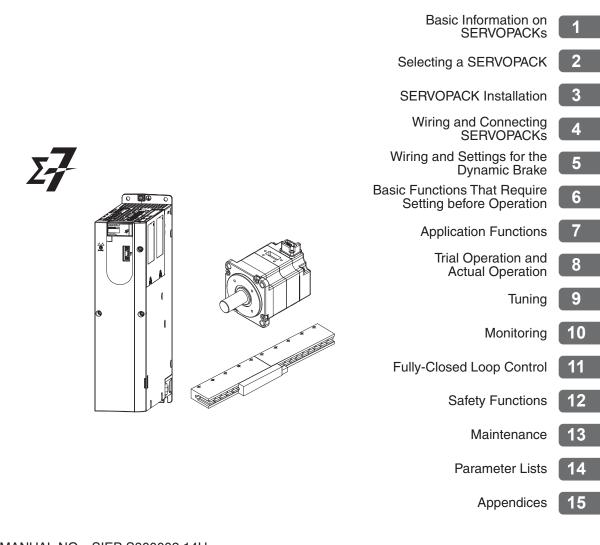
# YASKAWA

# $\Sigma$ -7-Series AC Servo Drive $\Sigma$ -7S SERVOPACK with 400 V-Input Power and MECHATROLINK-III Communications References RJ-45 Connectors Product Manual

Model: SGD7S-DDD30BDDDDD



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### About this Manual

This manual provides information required to select  $\Sigma$ -7S SERVOPACKs with MECHATROLINK-III Communications References and RJ-45 Connectors for  $\Sigma$ -7-Series AC Servo Drives, and to design, perform trial operation of, tune, operate, and maintain the Servo Drives.

Read and understand this manual to ensure correct usage of the  $\Sigma$ -7-Series AC Servo Drives.

Keep this manual in a safe place so that it can be referred to whenever necessary.

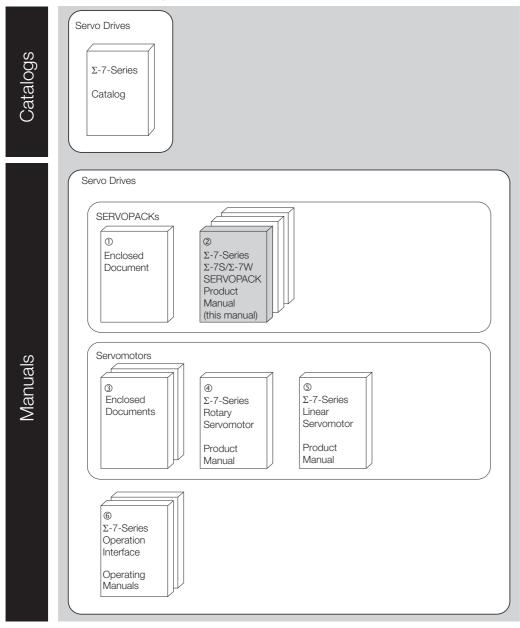
### Outline of Manual

The contents of the chapters of this manual are described in the following table. Refer to these chapters as required.

Chapter	Chapter Title	Contents
1	Basic Information on SERVOPACKs	Provides information required to select SERVOPACKs, such as SER- VOPACK models and combinations with Servomotors.
2	Selecting a SERVOPACK	Provides information required to select SERVOPACKs, such as specifications, block diagrams, dimensional drawings, and connection examples.
3	SERVOPACK Installation	Provides information on installing SERVOPACKs in the required loca- tions.
4	Wiring and Connecting SERVOPACKs	Provides information on wiring and connecting SERVOPACKs to power supplies and peripheral devices.
5	Wiring and Settings for the Dynamic BrakeProvides information about selecting the resistor, wiring, and settings when using the dynamic brake.	
6	Basic Functions That Require Set- ting before Operation	Describes the basic functions that must be set before you start Servo System operation. It also describes the setting methods.
7	Application Functions	Describes the application functions that you can set before you start Servo System operation. It also describes the setting methods.
8	Trial Operation and Actual Operation	Provides information on the flow and procedures for trial operation and convenient functions to use during trial operation.
9	Tuning	Provides information on the flow of tuning, details on tuning functions, and related operating procedures.
10	Monitoring	Provides information on monitoring SERVOPACK product information and SERVOPACK status.
11	Fully-Closed Loop Control	Provides detailed information on performing fully-closed loop control with the SERVOPACK.
12	Safety Functions	Provides detailed information on the safety functions of the SERVO- PACK.
13	Maintenance	Provides information on the meaning of, causes of, and corrections for alarms and warnings.
14	Parameter Lists	Provides information on the parameters.
15	Appendices	Provides information on interpreting panel displays and tables of corresponding SERVOPACK and SigmaWin+ function names.

### **Related Documents**

The relationships between the documents that are related to the Servo Drives are shown in the following figure. The numbers in the figure correspond to the numbers in the table on the following pages. Refer to these documents as required.



Classification	Document Name	Document No.	Description	
① Enclosed Document	$\Sigma$ -7-Series AC Servo Drive $\Sigma$ -7S SERVOPACK with 400 V-Input Power Safety Precautions	TOMP C710828 02	Provides detailed information for the safe usage of $\Sigma$ -7-Series SERVOPACKs.	
	$\Sigma$ -7-Series AC Servo Drive $\Sigma$ -7S SERVOPACK with 400 V-Input Power and EtherCAT (CoE) Communications References Product Manual	SIEP S800001 80		
② Σ-7-Series Σ-7S/Σ-7W	$\Sigma$ -7-Series AC Servo Drive $\Sigma$ -7S SERVOPACK with 400 V-Input Power and MECHATROLINK-III Communications References RJ-45 Connectors Product Manual	This manual (SIEP S800002 14)	Provide detailed information on selecting $\Sigma$ -7-Series SERVOPACKs and information on installing, con-	
SERVOPACK Product Manual	$\Sigma$ -7-Series AC Servo Drive $\Sigma$ -7W SERVOPACK with 400-V Input Power and EtherCAT (CoE) Communications References Product Manual	SIEP S800002 19	necting, setting, performing trial operation, tuning, monitoring, and maintaining the Servo Drives.	
	$\Sigma$ -7-Series AC Servo Drive $\Sigma$ -7W SERVOPACK with 400-V Input Power and MECHATROLINK-III Communications References RJ-45 Connectors Product Manual	SIEP S800002 20		
③ Enclosed Documents	AC Servo Drive Rotary Servomotor Safety Precautions	TOBP C230260 00	Provides detailed information for the safe usage of $\Sigma$ -7-Series Rotary Servomotors and Direct Drive Ser- vomotors.	
Enclosed Documents	AC Servomotor Linear $\Sigma$ Series Safety Precautions	TOBP C230800 00	Provides detailed information for the safe usage of $\Sigma$ -7-Series Linear Servomotors.	
<ul> <li>Φ</li> <li>Σ-7-Series</li> <li>Rotary Servomotor</li> <li>Product Manual</li> </ul>	Σ-7-Series AC Servo Drive Rotary Servomotor with 400 V-Input Power Product Manual	SIEP S800001 86	Provide detailed information on selecting, installing, and connecting	
© Σ-7-Series Linear Servomotor Product Manual	Σ-7-Series AC Servo Drive Linear Servomotor with 400 V-Input Power Product Manual	SIEP S800001 81	the $\Sigma$ -7-Series Servomotors.	
© Σ-7-Series	Σ-7-Series AC Servo Drive Digital Operator Operating Manual	SIEP S800001 33	Describes the operating proce- dures for a Digital Operator for a $\Sigma$ -7-Series Servo System.	
Operating Manuals	AC Servo Drive Engineering Tool SigmaWin+ Operation Manual	SIET S800001 34	Provides detailed operating proce- dures for the SigmaWin+ Engineer- ing Tool for a $\Sigma$ -7-Series Servo System.	

# **Using This Manual**

#### ◆ Technical Terms Used in This Manual

The following terms are used in this manual.

Term	Meaning
Servomotor	A $\Sigma$ -7-Series Rotary Servomotor or Linear Servomotor.
Rotary Servomotor	A $\Sigma$ -7-Series Rotary Servomotor (SGM7J, SGM7A, or SGM7G).
Linear Servomotor	A Σ-7-Series Linear Servomotor (SGLF or SGLT).
SERVOPACK	A $\Sigma$ -7-Series $\Sigma$ -7S servo amplifier with MECHATROLINK-III Communications References.
Servo Drive	The combination of a Servomotor and SERVOPACK.
Servo System	A servo control system that includes the combination of a Servo Drive with a host controller and peripheral devices.
servo ON	Supplying power to the motor.
servo OFF	Not supplying power to the motor.
base block (BB)	Shutting OFF the power supply to the motor by shutting OFF the base current to the power transistor in the SERVOPACK.
servo lock	A state in which the motor is stopped and is in a position loop with a position reference of 0.
Main Circuit Cable	One of the cables that connect to the main circuit terminals, including the Main Circuit Power Supply Cable, Control Power Supply Cable, and Servomotor Main Circuit Cable.
MECHATROLINK-III Communications Cable (RJ-45)	A MECHATROLINK-III Communications Cable for RJ-45 connectors.
SigmaWin+	The Engineering Tool for setting up and tuning Servo Drives or a computer in which the Engi- neering Tool is installed.

#### • Differences in Terms for Rotary Servomotors and Linear Servomotors

There are differences in the terms that are used for Rotary Servomotors and Linear Servomotors. This manual primarily describes Rotary Servomotors. If you are using a Linear Servomotor, you need to interpret the terms as given in the following table.

Rotary Servomotors	Linear Servomotors
torque	force
moment of inertia	mass
rotation	movement
forward rotation and reverse rotation	forward movement and reverse movement
CW and CCW pulse trains	forward and reverse pulse trains
rotary encoder	linear encoder
absolute rotary encoder	absolute linear encoder
incremental rotary encoder	incremental linear encoder
unit: min <sup>-1</sup>	unit: mm/s
unit: N·m	unit: N

### Notation Used in this Manual

#### Notation for Reverse Signals

The names of reverse signals (i.e., ones that are valid when low) are written with a forward slash (/) before the signal abbreviation.

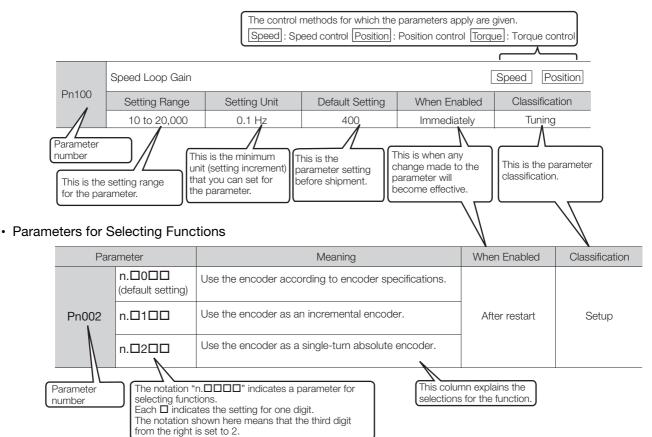
#### Notation Example

BK is written as /BK.

#### Notation for Parameters

The notation depends on whether the parameter requires a numeric setting (parameter for numeric setting) or requires the selection of a function (parameter for selecting functions).

#### Parameters for Numeric Settings



Notation Example

Notation Examples for Pn002

	Digit Notation		Numeric Value Notation	
n.0000	Notation	Meaning	Notation	Meaning
	Pn002 = n.□□□X	Indicates the first digit from the right in Pn002.	Pn002 = n.□□□1	Indicates that the first digit from the right in Pn002 is set to 1.
	Pn002 = n.□□X□	Indicates the second digit from the right in Pn002.	Pn002 = n.□□1□	Indicates that the second digit from the right in Pn002 is set to 1.
▶ ↓	Pn002 = n.□X□□	Indicates the third digit from the right in Pn002.	Pn002 = n.⊡1⊡⊡	Indicates that the third digit from the right in Pn002 is set to 1.
►	Pn002 = n.X□□□	Indicates the fourth digit from the right in Pn002.	Pn002 = n.1□□□	Indicates that the fourth digit from the right in Pn002 is set to 1.

### Engineering Tools Used in This Manual

This manual uses the interfaces of the SigmaWin+ for descriptions.

#### ♦ Trademarks

- QR code is a trademark of Denso Wave Inc.
- MECHATROLINK is a trademark of the MECHATROLINK Members Association.
- Other product names and company names are the trademarks or registered trademarks of the respective company. "TM" and the R mark do not appear with product or company names in this manual.

### Visual Aids

The following aids are used to indicate certain types of information for easier reference.



Indicates precautions or restrictions that must be observed. Also indicates alarm displays and other precautions that will not result in machine damage.



Indicates definitions of difficult terms or terms that have not been previously explained in this manual.



Indicates operating or setting examples.

Information Indicates supplemental information to deepen understanding or useful information.

# **Safety Precautions**

### Safety Information

To prevent personal injury and equipment damage in advance, the following signal words are used to indicate safety precautions in this document. The signal words are used to classify the hazards and the degree of damage or injury that may occur if a product is used incorrectly. Information marked as shown below is important for safety. Always read this information and heed the precautions that are provided.

### \Lambda DANGER

• Indicates precautions that, if not heeded, are likely to result in loss of life, serious injury, or fire.

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• Indicates precautions that, if not heeded, could result in loss of life, serious injury, or fire.

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• Indicates precautions that, if not heeded, could result in relatively serious or minor injury, or in fire.

# NOTICE

• Indicates precautions that, if not heeded, could result in property damage.

#### Safety Precautions That Must Always Be Observed

General Precautions

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- Read and understand this manual to ensure the safe usage of the product.
- Keep this manual in a safe, convenient place so that it can be referred to whenever necessary. Make sure that it is delivered to the final user of the product.
- Do not remove covers, cables, connectors, or optional devices while power is being supplied to the SERVOPACK.

There is a risk of electric shock, operational failure of the product, or burning.

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- Use a power supply with specifications (number of phases, voltage, frequency, and AC/DC type) that are appropriate for the product. There is a risk of burning, electric shock, or fire.
- Connect the ground terminals on the SERVOPACK and Servomotor to ground poles according to local electrical codes. (Connect to 10 Ω or less.) There is a risk of electric shock or fire.
- Do not attempt to disassemble, repair, or modify the product. There is a risk of fire or failure. The warranty is void for the product if you disassemble, repair, or modify it.

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- The SERVOPACK heat sinks, regenerative resistors, External Dynamic Brake Resistors, Servomotors, and other components can be very hot while power is ON or soon after the power is turned OFF. Implement safety measures, such as installing covers, so that hands and parts such as cables do not come into contact with hot components. There is a risk of burn injury.
- For a 24-VDC power supply, use a power supply device with double insulation or reinforced insulation.
  - There is a risk of electric shock.
- Do not damage, pull on, apply excessive force to, place heavy objects on, or pinch cables. There is a risk of failure, damage, or electric shock.
- The person who designs the system that uses the hard wire base block safety function must have a complete knowledge of the related safety standards and a complete understanding of the instructions in this document.
  - There is a risk of injury, product damage, or machine damage.
- Do not use the product in an environment that is subject to water, corrosive gases, or flammable gases, or near flammable materials.
   There is a risk of electric shock or fire.

- Do not attempt to use a SERVOPACK or Servomotor that is damaged or that has missing parts.
- Install external emergency stop circuits that shut OFF the power supply and stops operation immediately when an error occurs.
- In locations with poor power supply conditions, install the necessary protective devices (such as AC Reactors) to ensure that the input power is supplied within the specified voltage range. There is a risk of damage to the SERVOPACK.
- Use a Noise Filter to minimize the effects of electromagnetic interference. Electronic devices used near the SERVOPACK may be affected by electromagnetic interference.
- Always use a Servomotor and SERVOPACK in one of the specified combinations.
- Do not touch a SERVOPACK or Servomotor with wet hands. There is a risk of product failure.

#### Storage Precautions

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• Do not place an excessive load on the product during storage. (Follow all instructions on the packages.)

There is a risk of injury or damage.

### NOTICE

- Do not install or store the product in any of the following locations.
  - Locations that are subject to direct sunlight
  - · Locations that are subject to ambient temperatures that exceed product specifications
  - Locations that are subject to relative humidities that exceed product specifications
  - · Locations that are subject to condensation as the result of extreme changes in temperature
  - · Locations that are subject to corrosive or flammable gases
  - · Locations that are near flammable materials
  - · Locations that are subject to dust, salts, or iron powder
  - Locations that are subject to water, oil, or chemicals
  - · Locations that are subject to vibration or shock that exceeds product specifications
  - Locations that are subject to radiation
  - If you store or install the product in any of the above locations, the product may fail or be damaged.

#### Transportation Precautions

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- Transport the product in a way that is suitable to the mass of the product.
- Do not use the eyebolts on a SERVOPACK or Servomotor to move the machine. There is a risk of damage or injury.
- When you handle a SERVOPACK or Servomotor, be careful of sharp parts, such as the corners. There is a risk of injury.
- Do not place an excessive load on the product during transportation. (Follow all instructions on the packages.)
  - There is a risk of injury or damage.

- Do not hold onto the front cover or connectors when you move a SERVOPACK. There is a risk of the SERVOPACK falling.
- A SERVOPACK or Servomotor is a precision device. Do not drop it or subject it to strong shock. There is a risk of failure or damage.
- Do not subject connectors to shock. There is a risk of faulty connections or damage.
- If disinfectants or insecticides must be used to treat packing materials such as wooden frames, plywood, or pallets, the packing materials must be treated before the product is packaged, and methods other than fumigation must be used.

### Example: Heat treatment, where materials are kiln-dried to a core temperature of 56°C for 30 minutes or more.

If the electronic products, which include stand-alone products and products installed in machines, are packed with fumigated wooden materials, the electrical components may be greatly damaged by the gases or fumes resulting from the fumigation process. In particular, disinfectants containing halogen, which includes chlorine, fluorine, bromine, or iodine can contribute to the erosion of the capacitors.

• Do not overtighten the eyebolts on a SERVOPACK or Servomotor. If you use a tool to overtighten the eyebolts, the tapped holes may be damaged.

#### Installation Precautions

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- Install the Servomotor or SERVOPACK in a way that will support the mass given in technical documents.
- Install SERVOPACKs, Servomotors, regenerative resistors, and External Dynamic Brake Resistors on nonflammable materials.

Installation directly onto or near flammable materials may result in fire.

- Provide the specified clearances between the SERVOPACK and the control panel as well as with other devices.
  - There is a risk of fire or failure.
- Install the SERVOPACK in the specified orientation. There is a risk of fire or failure.
- Do not step on or place a heavy object on the product. There is a risk of failure, damage, or injury.
- Do not allow any foreign matter to enter the SERVOPACK or Servomotor. There is a risk of failure or fire.

- Do not install or store the product in any of the following locations.
  - Locations that are subject to direct sunlight
  - · Locations that are subject to ambient temperatures that exceed product specifications
  - Locations that are subject to relative humidities that exceed product specifications
  - Locations that are subject to condensation as the result of extreme changes in temperature
  - · Locations that are subject to corrosive or flammable gases
  - · Locations that are near flammable materials
  - · Locations that are subject to dust, salts, or iron powder
  - Locations that are subject to water, oil, or chemicals
  - · Locations that are subject to vibration or shock that exceeds product specifications
  - Locations that are subject to radiation
  - If you store or install the product in any of the above locations, the product may fail or be damaged.
- Use the product in an environment that is appropriate for the product specifications. If you use the product in an environment that exceeds product specifications, the product may fail or be damaged.
- A SERVOPACK or Servomotor is a precision device. Do not drop it or subject it to strong shock. There is a risk of failure or damage.
- Always install a SERVOPACK in a control panel.
- Do not allow any foreign matter to enter a SERVOPACK or a Servomotor with a Cooling Fan and do not cover the outlet from the Servomotor's cooling fan. There is a risk of failure.

#### Wiring Precautions

## **A** DANGER

• Do not change any wiring while power is being supplied. There is a risk of electric shock or injury.

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- Wiring and inspections must be performed only by qualified engineers. There is a risk of electric shock or product failure.
- Check all wiring and power supplies carefully.

Incorrect wiring or incorrect voltage application to the output circuits may cause short-circuit failures. If a short-circuit failure occurs as a result of any of these causes, the holding brake will not work. This could damage the machine or cause an accident that may result in death or injury.

- Connect the AC and DC power supplies to the specified SERVOPACK terminals.
  - Connect an AC power supply to the L1, L2, and L3 terminals on the SERVOPACK.
  - Connect a DC power supply to the B1 and  $\ominus$  2 terminals and the 24 V and 0 V terminals on the SERVOPACK.

There is a risk of failure or fire.

	Wait for at least six minutes after turning OFF the power supply (with a SERVOPACK for a 100 VAC input, wait for at least nine minutes) and then make sure that the CHARGE indicator is no lit before starting wiring or inspection work. Do not touch the power supply terminals while th CHARGE lamp is lit after turning OFF the power supply because high voltage may still remain the SERVOPACK. There is a risk of electric shock.
	Observe the precautions and instructions for wiring and trial operation precisely as described this document. Failures caused by incorrect wiring or incorrect voltage application in the brake circuit may cause the SERVOPACK to fail, damage the equipment, or cause an accident resulting in death or injury.
•	Check the wiring to be sure it has been performed correctly. Connectors and pin layouts are sometimes different for different models. Always confirm the pillayouts in technical documents for your model before operation. There is a risk of failure or malfunction.
	Connect wires to power supply terminals and motor connection terminals securely with the specified methods and tightening torque. Insufficient tightening may cause wires and terminal blocks to generate heat due to faulty contact possibly resulting in fire.
	Use shielded twisted-pair cables or screened unshielded multi-twisted-pair cables for I/O Sig nal Cables and Encoder Cables.
	The maximum wiring length is 10 m for Control Power Supply Cables (+24 V, 0 V), 3 m for I/O Signal Cables, and 50 m for Encoder Cables or Servomotor Main Circuit Cables.
•	<ul> <li>Observe the following precautions when wiring the SERVOPACK's main circuit terminals.</li> <li>Turn ON the power supply to the SERVOPACK only after all wiring, including the main circuit te nals, has been completed.</li> <li>If a connector is used for the main circuit terminals, remove the main circuit connector from the VOPACK before you wire it.</li> <li>Insert only one wire per insertion hole in the main circuit terminals.</li> <li>When you insert a wire, make sure that the conductor wire (e.g., whiskers) does not come into tact with adjacent wires.</li> </ul>
	Install molded-case circuit breakers and other safety measures to provide protection against short circuits in external wiring. There is a risk of fire or failure.

- Whenever possible, use the Cables specified by Yaskawa. If you use any other cables, confirm the rated current and application environment of your model and use the wiring materials specified by Yaskawa or equivalent materials.
- Securely tighten cable connector screws and lock mechanisms. Insufficient tightening may result in cable connectors falling off during operation.
- Do not bundle power lines (e.g., the Main Circuit Cable) and low-current lines (e.g., the I/O Signal Cables or Encoder Cables) together or run them through the same duct. If you do not place power lines and low-current lines in separate ducts, separate them by at least 30 cm. If the cables are too close to each other, malfunctions may occur due to noise affecting the low-current lines.
- Install a battery at either the host controller or on the Encoder Cable. If you install batteries both at the host controller and on the Encoder Cable at the same time, you will create a loop circuit between the batteries, resulting in a risk of damage or burning.
- When connecting a battery, connect the polarity correctly. There is a risk of battery rupture or encoder failure.
- If you use an External Regenerative Resistor or External Dynamic Brake Resistor, use cable ties, clamps, or other means to secure the resistor so that the connectors or terminal blocks inside the SERVOPACK will not be affected even if the resistor is subjected to vibration or shock. There is a risk of SERVOPACK damage.

#### Operation Precautions

### **WARNING**

• Before starting operation with a machine connected, change the settings of the switches and parameters to match the machine.

Unexpected machine operation, failure, or personal injury may occur if operation is started before appropriate settings are made.

- Do not radically change the settings of the parameters. There is a risk of unstable operation, machine damage, or injury.
- Install limit switches or stoppers at the ends of the moving parts of the machine to prevent unexpected accidents.

There is a risk of machine damage or injury.

- For trial operation, securely mount the Servomotor and disconnect it from the machine. There is a risk of injury.
- Forcing the motor to stop for overtravel is disabled when the Jog, Origin Search, or Easy FFT utility function is executed. Take necessary precautions. There is a risk of machine damage or injury.
- When an alarm occurs, the motor will coast to a stop or stop with the dynamic brake according to a setting in the SERVOPACK. The coasting distance will change with the moment of inertia of the load. Check the coasting distance during trial operation and implement suitable safety measures on the machine.
- Do not enter the machine's range of motion during operation. There is a risk of injury.
- Do not touch the moving parts of the Servomotor or machine during operation. There is a risk of injury.

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- Design the system to ensure safety even when problems, such as broken signal lines, occur. For example, the P-OT and N-OT signals are set in the default settings to operate on the safe side if a signal line breaks. Do not change the polarity of this type of signal.
- When overtravel occurs, the power supply to the motor is turned OFF and the brake is released. If you use the Servomotor to drive a vertical load, set the Servomotor to enter a zero-clamped state after the Servomotor stops. Also, install safety devices (such as an external brake or counterweight) to prevent the moving parts of the machine from falling.
- Always turn OFF the servo before you turn OFF the power supply. If you turn OFF the main circuit power supply or control power supply during operation before you turn OFF the servo, the Servomotor will stop as follows:
  - If you turn OFF the main circuit power supply during operation without turning OFF the servo, the Servomotor will stop abruptly with the dynamic brake.
  - If you turn OFF the control power supply without turning OFF the servo, the stopping method that is used by the Servomotor depends on the model of the SERVOPACK. For details, refer to the manual for the SERVOPACK.
  - If you use an External Dynamic Brake Resistor, the stopping method will be different from when you use built-in Dynamic Brake Resistor. For details, refer to the product manual for your SERVOPACK.
- Do not use the dynamic brake for any application other than an emergency stop. There is a risk of failure due to rapid deterioration of elements in the SERVOPACK and the risk of unexpected operation, machine damage, burning, or injury.

- When you adjust the gain during system commissioning, use a measuring instrument to monitor the torque waveform and speed waveform and confirm that there is no vibration. If a high gain causes vibration, the Servomotor will be damaged quickly.
- Do not frequently turn the power supply ON and OFF. After you have started actual operation, allow at least one hour between turning the power supply ON and OFF (as a guideline). Do not use the product in applications that require the power supply to be turned ON and OFF frequently.
  - The elements in the SERVOPACK will deteriorate quickly.
- An alarm or warning may occur if communications are performed with the host controller while the SigmaWin+ or Digital Operator is operating.
- If an alarm or warning occurs, it may interrupt the current process and stop the system.
- After you complete trial operation of the machine and facilities, use the SigmaWin+ to back up the settings of the SERVOPACK parameters. You can use them to reset the parameters after SERVOPACK replacement.

If you do not copy backed up parameter settings, normal operation may not be possible after a faulty SERVOPACK is replaced, possibly resulting in machine or equipment damage.

#### Maintenance and Inspection Precautions

### 🛕 DANGER

• Do not change any wiring while power is being supplied. There is a risk of electric shock or injury.

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• Wiring and inspections must be performed only by qualified engineers. There is a risk of electric shock or product failure.

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• Wait for at least six minutes after turning OFF the power supply (with a SERVOPACK for a 100-VAC input, wait for at least nine minutes) and then make sure that the CHARGE indicator is not lit before starting wiring or inspection work. Do not touch the power supply terminals while the CHARGE lamp is lit after turning OFF the power supply because high voltage may still remain in the SERVOPACK.

There is a risk of electric shock.

• Before you replace a SERVOPACK, back up the settings of the SERVOPACK parameters. Copy the backed up parameter settings to the new SERVOPACK and confirm that they were copied correctly.

If you do not copy backed up parameter settings or if the copy operation is not completed normally, normal operation may not be possible, possibly resulting in machine or equipment damage.

### NOTICE

 Discharge all static electricity from your body before you operate any of the buttons or switches inside the front cover of the SERVOPACK. There is a risk of equipment damage.

#### Troubleshooting Precautions

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• If the safety device (molded-case circuit breaker or fuse) installed in the power supply line operates, remove the cause before you supply power to the SERVOPACK again. If necessary, repair or replace the SERVOPACK, check the wiring, and remove the factor that caused the safety device to operate.

There is a risk of fire, electric shock, or injury.

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• The product may suddenly start to operate when the power supply is recovered after a momentary power interruption. Design the machine to ensure human safety when operation restarts. There is a risk of injury.

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- When an alarm occurs, remove the cause of the alarm and ensure safety. Then reset the alarm or turn the power supply OFF and ON again to restart operation. There is a risk of injury or machine damage.
- If the Servo ON signal is input to the SERVOPACK and an alarm is reset, the Servomotor may suddenly restart operation. Confirm that the servo is OFF and ensure safety before you reset an alarm.
  - There is a risk of injury or machine damage.
- Always insert a Magnetic Contactor in the line between the main circuit power supply and the main circuit power supply terminals on the SERVOPACK so that the power supply can be shut OFF at the main circuit power supply.
   If a Magnetic Contactor is not connected when the SERVOPACK fails, a large current may flow, possibly resulting in fire.
- If an alarm occurs, shut OFF the main circuit power supply. There is a risk of fire due to a Regenerative Resistor overheating as the result of regenerative transistor failure.
- Install a ground fault detector against overloads and short-circuiting or install a molded-case circuit breaker combined with a ground fault detector. There is a risk of SERVOPACK failure or fire if a ground fault occurs.
- The holding brake on a Servomotor will not ensure safety if there is the possibility that an external force (including gravity) may move the current position and create a hazardous situation when power is interrupted or an error occurs. If an external force may cause movement, install an external braking mechanism that ensures safety.

#### Disposal Precautions

• When disposing of the product, treat it as ordinary industrial waste. However, local ordinances and national laws must be observed. Implement all labeling and warnings as a final product as required.

#### General Precautions

- Figures provided in this document are typical examples or conceptual representations. There may be differences between them and actual wiring, circuits, and products.
- The products shown in illustrations in this document are sometimes shown without covers or protective guards. Always replace all covers and protective guards before you use the product.
- If you need a new copy of this document because it has been lost or damaged, contact your nearest Yaskawa representative or one of the offices listed on the back of this document.
- This document is subject to change without notice for product improvements, specifications changes, and improvements to the manual itself.
   We will update the document number of the document and issue revisions when changes are made.
- Any and all quality guarantees provided by Yaskawa are null and void if the customer modifies the product in any way. Yaskawa disavows any responsibility for damages or losses that are caused by modified products.

## Warranty

#### Details of Warranty

#### Warranty Period

The warranty period for a product that was purchased (hereinafter called the "delivered product") is one year from the time of delivery to the location specified by the customer or 18 months from the time of shipment from the Yaskawa factory, whichever is sooner.

#### Warranty Scope

Yaskawa shall replace or repair a defective product free of charge if a defect attributable to Yaskawa occurs during the above warranty period.

This warranty does not cover defects caused by the delivered product reaching the end of its service life and replacement of parts that require replacement or that have a limited service life.

This warranty does not cover failures that result from any of the following causes.

- Improper handling, abuse, or use in unsuitable conditions or in environments not described in product catalogs or manuals, or in any separately agreed-upon specifications
- · Causes not attributable to the delivered product itself
- Modifications or repairs not performed by Yaskawa
- Use of the delivered product in a manner in which it was not originally intended
- Causes that were not foreseeable with the scientific and technological understanding at the time
   of shipment from Yaskawa
- Events for which Yaskawa is not responsible, such as natural or human-made disasters

#### Limitations of Liability

- Yaskawa shall in no event be responsible for any damage or loss of opportunity to the customer that arises due to failure of the delivered product.
- Yaskawa shall not be responsible for any programs (including parameter settings) or the results of program execution of the programs provided by the user or by a third party for use with programmable Yaskawa products.
- The information described in product catalogs or manuals is provided for the purpose of the customer purchasing the appropriate product for the intended application. The use thereof does not guarantee that there are no infringements of intellectual property rights or other proprietary rights of Yaskawa or third parties, nor does it construe a license.
- Yaskawa shall not be responsible for any damage arising from infringements of intellectual property rights or other proprietary rights of third parties as a result of using the information described in catalogs or manuals.

### Suitability for Use

- It is the customer's responsibility to confirm conformity with any standards, codes, or regulations that apply if the Yaskawa product is used in combination with any other products.
- The customer must confirm that the Yaskawa product is suitable for the systems, machines, and equipment used by the customer.
- Consult with Yaskawa to determine whether use in the following applications is acceptable. If use in the application is acceptable, use the product with extra allowance in ratings and specifications, and provide safety measures to minimize hazards in the event of failure.
  - Outdoor use, use involving potential chemical contamination or electrical interference, or use in conditions or environments not described in product catalogs or manuals
  - Nuclear energy control systems, combustion systems, railroad systems, aviation systems, vehicle systems, medical equipment, amusement machines, and installations subject to separate industry or government regulations
  - Systems, machines, and equipment that may present a risk to life or property
  - Systems that require a high degree of reliability, such as systems that supply gas, water, or electricity, or systems that operate continuously 24 hours a day
  - Other systems that require a similar high degree of safety
- Never use the product for an application involving serious risk to life or property without first ensuring that the system is designed to secure the required level of safety with risk warnings and redundancy, and that the Yaskawa product is properly rated and installed.
- The circuit examples and other application examples described in product catalogs and manuals are for reference. Check the functionality and safety of the actual devices and equipment to be used before using the product.
- Read and understand all use prohibitions and precautions, and operate the Yaskawa product correctly to prevent accidental harm to third parties.

### Specifications Change

The names, specifications, appearance, and accessories of products in product catalogs and manuals may be changed at any time based on improvements and other reasons. The next editions of the revised catalogs or manuals will be published with updated code numbers. Consult with your Yaskawa representative to confirm the actual specifications before purchasing a product.

### Compliance with UL Standards, EU Directives, and Other Safety Standards

Certification marks for the standards for which the product has been certified by certification bodies are shown on nameplate. Products that do not have the marks are not certified for the standards.

#### North American Safety Standards (UL)

#### S Model UL Standards (UL File No.) Product UL 61800-5-1 (E147823), **SERVOPACKs** SGD7S CSA C22.2 No.274 UL 1004-1 • SGM7A Rotary • SGM7J UL 1004-6 Servomotors • SGM7G (E165827) SGLFW\* UL 1004-1 Linear • SGLFW2 UL 1004-6 Servomotors SGLTW\* (E165827)

\* Only products with derating specifications are in compliance with the UL Standards. Estimates are available for those products. Contact your Yaskawa representative for details.

#### European Directives



Product	Model	EU Directive	Harmonized Standards
		Machinery Directive 2006/42/EC	EN ISO13849-1: 2015
SERVOPACKs	SGD7S	EMC Directive 2014/30/EU	EN 55011 group 1, class A EN 61000-6-2 EN 61000-6-4 EN 61800-3 (Category C2, Second environment)
		Low Voltage Directive 2014/35/EU	EN 50178 EN 61800-5-1
		RoHS Directive 2011/65/EU	EN 50581
Rotary	• SGM7J • SGM7A • SGM7G	EMC Directive 2014/30/EU	EN 55011 group 1, class A EN 61000-6-2 EN 61000-6-4 EN 61800-3 (Category C2, Second environment)
Servomotors		Low Voltage Directive 2014/35/EU	EN 60034-1 EN 60034-5
		RoHS Directive 2011/65/EU	EN 50581
Linear	• SGLF* • SGLF□2 • SGLT*	EMC Directive 2014/30/EU	EN 55011 group 1, class A EN 61000-6-2 EN 61000-6-4 EN 61800-3 (Category C2, Second environment)
Servomotors		Low Voltage Directive 2014/35/EU	EN 60034-1
		RoHS Directive 2011/65/EU	EN 50581

\* For Moving Coils, only models with "-E" at the end of model numbers are certified.

Note: 1. We declared the CE Marking based on the harmonized standards in the above table.

These products are for industrial use. In home environments, these products may cause electromagnetic interference and additional noise reduction measures may be necessary.

### Safety Standards



Functional G Safety			
Product	Model	Safety Standards	Standards
	SGD7S	Safety of Machinery	EN ISO13849-1: 2015 IEC 60204-1
SERVOPACKs		Functional Safety	IEC 61508 series IEC 62061 IEC 61800-5-2
		EMC	IEC 61326-3-1

#### Safety Parameters

Item	Standards	Performa	ance Level
Safaty Integrity Lovel	IEC 61508	SIL3	
Safety Integrity Level	IEC 62061	SILCL3	
Mission Time	IEC 61508	10 years	20 years
Probability of Dangerous Failure per Hour	IEC 61508 IEC 62061	$PFH = 4.60 \times 10^{-9} [1/h]$ (4.60% of SIL3)	$PFH = 4.62 \times 10^{-9} [1/h]$ (4.62% of SIL3)
Performance Level	EN ISO 13849-1	PLe (Category 3)	·
Mean Time to Dangerous Failure of Each Channel EN ISO 13849-1 MTTFd: High			
Average Diagnostic Coverage	EN ISO 13849-1	DCavg: Medium	
Stop Category	IEC 60204-1	Stop category 0	
Safety Function	IEC 61800-5-2	STO	
Hardware Fault Tolerance	IEC 61508	HFT = 1	
Subsystem	IEC 61508	В	

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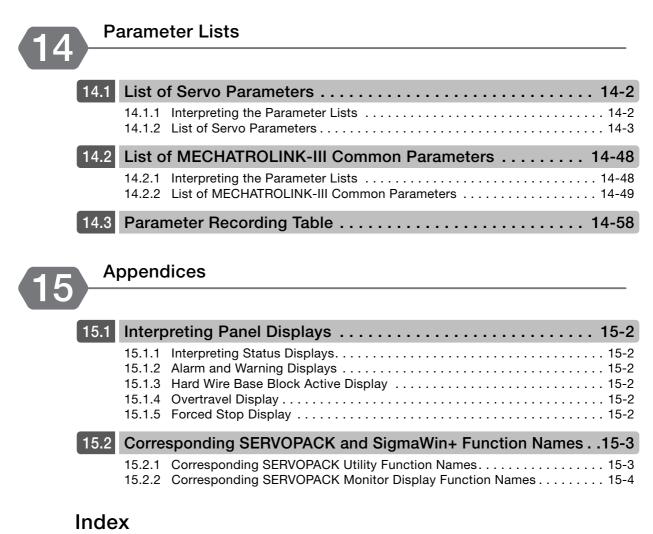
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**Revision History** 

# Basic Information on SERVOPACKs

This chapter provides information required to select SERVOPACKs, such as SERVOPACK models and combinations with Servomotors.

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### **1.1** The $\Sigma$ -7 Series

The  $\Sigma$ -7-series SERVOPACKs are designed for applications that require frequent high-speed and high-precision positioning. The SERVOPACK will make the most of machine performance in the shortest time possible, thus contributing to improving productivity.

These SERVOPACKs support ZONE outputs.

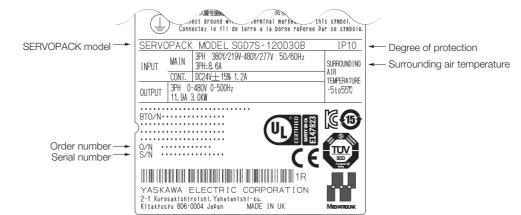
ZONE outputs are used to output signals during preset ranges of positions. You can use the ZONE outputs as triggers for operations related to positioning.

Refer to the following chapter for details on ZONE outputs.

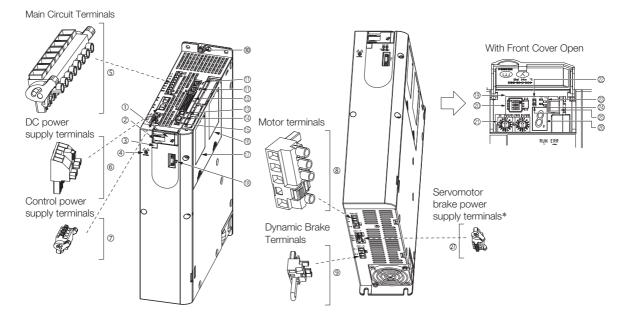
7.14 ZONE Outputs (FT64 Specification) on page 7-61

# 1.2 Interpreting the Nameplate

#### The following basic information is provided on the nameplate.







No.	Name	Description	Reference
1	Front Cover	-	-
2	Model	The model of the SERVOPACK.	page 1-6
3	QR Code	The QR code that is used by the MechatroCloud service.	-
4	CHARGE	Lit while the main circuit power is being supplied. Note: Even if you turn OFF the main circuit power supply, this indicator will be lit as long as the internal capacitor remains charged. Do not touch the main circuit or motor terminals while this indicator is lit. Doing so may result in electric shock.	-
5	Main Circuit Terminals	The terminals depend on the main circuit power supply input specifications of the SERVOPACK.	page 4-11
6	DC Power Supply Terminals	-	page 4-11
Ø	Control Power Supply Terminals	The connection terminals for the control power supply.	page 4-11
8	Servomotor Terminals (U, V, and W) and Ground Terminal (PE)	The connection terminals for the Servomotor Main Circuit Cable (power line).	page 4-19
9	Dynamic Brake Terminals	The connection terminals for a dynamic brake resistor.	page 4-11
10	Ground Terminal ()	The ground terminals to prevent electric shock. Always connect this terminal.	-
1	MECHATROLINK-III Com- munications Connector (CN6A and CN6B)	Connects to MECHATROLINK-III-compatible devices.	page 4-37
(12)	I/O Signal Connector (CN1)	Connects to sequence I/O signals.	page 4-28
13	Safety Connector (CN8)	Connects to a safety function device.	page 4-35
(4)	Encoder Connector (CN2)	<ul> <li>Rotary Servomotor: Connects to the encoder in the Servomotor.</li> <li>Linear Servomotor: Connects to a Serial Converter Unit or linear encoder.</li> </ul>	page 4-19
15	Computer Connector (CN7)	A USB connector to connect a computer.	page 4-38
16	Safety Option Module Con- nector	Connects to a Safety Option Module.	-
1	Feedback Option Module Connector	Connects to a Feedback Option Module.	_
18	Serial Communications Con- nector (CN3)	Connects to the Digital Operator.	page 4-38

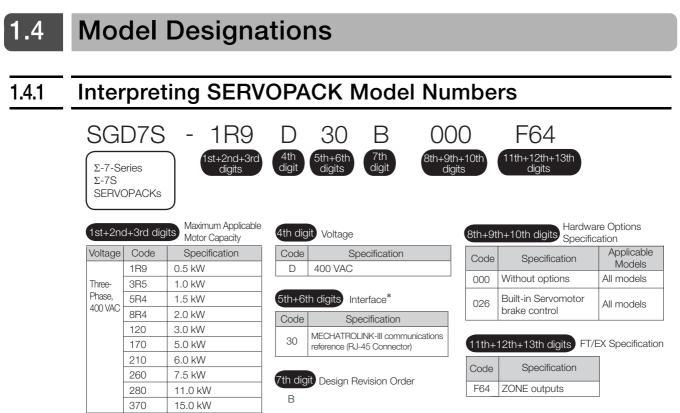
Continued on next page.

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			oriodo pago:
No.	Name	Description	Reference
19	Serial Number	_	—
20	DIP Switch (S3)	Used to set MECHATROLINK communications.	_
21	Rotary Switches (S1 and S2)	Used to set the MECHATROLINK station address.	page 6-12
22	PWR	Lights when the control power is being supplied.	_
23	CN	Not used.	_
24)	L1 and L2	not useu.	_
25	Analog Monitor Connector (CN5)	You can use a special cable (peripheral device) to monitor the motor speed, torque reference, or other values.	page 4-38
26	Panel Display	Displays the servo status with a seven-segment display.	_
Ø	Servomotor Brake Power Supply Terminals (CN117)*	Connect to the power supply for the Servomotor brake.	_

\* SERVOPACKs without built-in Servomotor brake control do not have these terminals.

1.4.1 Interpreting SERVOPACK Model Numbers



\* The same SERVOPACKs are used for both Rotary Servomotors and Linear Servomotors.

#### 1.4.2 Interpreting Servomotor Model Numbers

### 1.4.2 Interpreting Servomotor Model Numbers

This section outlines the model numbers of  $\Sigma$ -7-series Servomotors. Refer to the relevant manual in the following list for details.

Ω-7-Series Rotary Servomotor with 400 V-Input Power Product Manual (Manual No.: SIEP S800001 86)

Ω Σ-7-Series Linear Servomotor with 400 V-Input Power Product Manual (Manual No.: SIEP S800001 81)

### **Rotary Servomotors**

SGM		D 7 F 2 1 ard 4th 5th 6th 7th digit digit digit digit		
Series	Σ-7-Series Servomotors	1st+2nd digits Rated Output	5th digit Design Revision Order	
Code	Specifications	• SGM7J: 200 W to 1.5 kW		
SGM7J	Medium inertia, high speed	SGM7A: 200 W to 7.0 kW     SGM7G: 450 W to 15 kW     Gth digit Shaft End Specification		
SGM7A	Low inertia, high speed		<ul> <li>Straight without key</li> </ul>	
SGM7G	Medium inertia, low speed, high torque	<b>3rd digit</b> Power Supply Voltage	<ul> <li>Straight with key and tap</li> </ul>	
Jawra	Medium inertia, high speed, high torque	• 400 VAC		
		4th digit Serial Encoder Specification	7th digit Options	
		<ul><li> 24-bit absolute</li><li> 24-bit incremental</li></ul>	<ul><li>With holding brake</li><li>With dust seal</li></ul>	

### **Linear Servomotors**



Series Σ-7-Series Servomotors

Servomotor Type

Specification

Models with F-type iron core

Models with T-type iron core

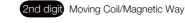
1st digit

Code

F

Т





Code	Specification	
W	Moving Coil	
W2	Moving Coil	
М	Magnetic Way	
M2		

#### 3rd digit on

The specifications for the 3rd digit on depend on the Servomotor type.

1.5.1 Combinations of Rotary Servomotors and SERVOPACKs

# **1.5** Combinations of SERVOPACKs and Servomotors

### 1.5.1 Combinations of Rotary Servomotors and SERVOPACKs

Rotary Servomotor Model		0 "	SERVOPACK Model	
		Capacity	SGD7S-	
SGM7J Models	SGM7J-02D□F	200 W	1000	
(Medium Inertia,	SGM7J-04D□F	400 W	- 1R9D	
High Speed), Rated motor speed:	SGM7J-08D□F	750 W	3R5D	
3,000 min <sup>-1</sup>	SGM7J-15D□F	1.5 kW	5R4D	
	SGM7A-02D□F	200 W	1000	
	SGM7A-04D□F	400 W	- 1R9D	
	SGM7A-08D□F	750 W	3R5D	
SGM7A Models	SGM7A-10D□F	1.0 kW	- 5R4D	
(Low Inertia,	SGM7A-15D□F	1.5 kW	- 3K4D	
High Speed),	SGM7A-20D□F	2.0 kW	8R4D	
Rated motor speed:	SGM7A-25D□F	2.5 kW	- 120D	
3,000 min⁻¹	SGM7A-30D□F	3.0 kW	1200	
	SGM7A-40D□F	4.0 kW	- 170D	
	SGM7A-50D□F	5.0 kW	1700	
	SGM7A-70D□F	7.0 kW	260D	
	SGM7G-05D□F	450 W	1R9D	
	SGM7G-09D□F	850 W	3R5D	
SGM7G Models	SGM7G-13D□F	1.3 kW	5R4D	
Standard Models	SGM7G-20D□F	1.8 kW	8R4D	
(Medium Inertia, Low Speed,	SGM7G-30D□F	2.9 kW	120D	
High Torque),	SGM7G-44D□F	4.4 kW	170D	
Rated motor speed:	SGM7G-55D□F	5.5 kW	210D	
1,500 min⁻¹	SGM7G-75D□F	7.5 kW	260D	
	SGM7G-1AD□F	11.0 kW	280D	
	SGM7G-1ED□F	15.0 kW	370D	
SGM7G Models	SGM7G-05D□R	450 W	3R5D	
High-speed Models	SGM7G-09D□R	850 W	5R4D	
(Medium Inertia, High	SGM7G-13D□R	1.3 kW	8R4D	
Speed, High Torque)	SGM7G-20D□R	1.8 kW	120D	
Rated motor speed: 1,500 min <sup>-1</sup>	SGM7G-30D□R	2.9 kW	170D	
1,000 11111	SGM7G-44D□R	4.4 kW	210D	

1.5.2 Combinations of Linear Servomotors and SERVOPACKs

# 1.5.2 Combinations of Linear Servomotors and SERVOPACKs

		Rated Force	Instantaneous	SERVOPACK Model
Linear Serv	omotor Model	[N]	Maximum Force [N]	SGD7S-
	SGLFW-35D120A	80	220	1R9D
	SGLFW-35D230A	160	440	1R9D
	SGLFW-50D200B	280	600	3R5D
	SGLFW-50D380B	FCO	1000	5040
	SGLFW-1ZD200B	560	1200	5R4D
	SGLFW-1ZD380B	1120	2400	120D
	SGLFW2-30D070A	45	135	1R9D
SGLF	SGLFW2-30D120A	90	270	1R9D
(Models with F-type Iron Cores)	SGLFW2-30D230A	180	540	1R9D
	SGLFW2-45D200A	280	840	3R5D
	SGLFW2-45D380A	560	1680	8R4D
	SGLFW2-90D200A			5R4D
	SGLFW2-90D380A	1120	3360	120D
	SGLFW2-90D560A	1680	5040	170D
	SGLFW2-1DD380A	1680	5040	170D
	SGLFW2-1DD560A	2520	7560	260D
	SGLTW-35D170H	300	600	3R5D
	SGLTW-35D320H	600	1200	8R4D
	SGLTW-40D400B	670	2600	120D
SGLT	SGLTW-40D600B	1000	4000	170D
(Models with T-type Iron Cores)	SGLTW-50D170H	450	900	3R5D
	SGLTW-50D320H	900	1800	8R4D
	SGLTW-80D400B	1300	5000	170D
	SGLTW-80D600B	2000	7500	260D

# 1.6 Functions

This section lists the functions provided by SERVOPACKs. Refer to the reference pages for details on the functions.

#### · Functions Related to the Machine

Function	Reference
Power Supply Type Settings for the Main Circuit and Control Circuit	page 6-13
Automatic Detection of Connected Motor	page 6-14
Motor Direction Setting	page 6-15
Linear Encoder Pitch Setting	page 6-16
Writing Linear Servomotor Parameters	page 6-17
Selecting the Phase Sequence for a Linear Servomotor	page 6-21
Polarity Sensor Setting	page 6-23
Polarity Detection	page 6-24
Overtravel Function and Settings	page 6-27
Holding Brake	page 6-32
Motor Stopping Methods for Servo OFF and Alarms	page 6-37
Resetting the Absolute Encoder	page 6-47
Setting the Origin of the Absolute Encoder	page 6-50
Setting the Regenerative Resistor Capacity	page 6-53
Operation for Momentary Power Interruptions	page 7-16
SEMI F47 Function	page 7-17
Setting the Motor Maximum Speed	page 7-19
Software Limits and Settings	page 7-27
Multiturn Limit Setting	page 7-38
Adjustment of Motor Current Detection Signal Offset	page 7-54
Forcing the Motor to Stop	page 7-58
Overheat Protection	page 7-68
Speed Ripple Compensation	page 9-60
Current Control Mode Selection	page 9-74
Current Gain Level Setting	page 9-74
Speed Detection Method Selection	page 9-75
Fully-Closed Loop Control	page 11-1
Safety Functions	page 12-1
External Latches	_

Function	Reference
Electronic Gear Settings	page 6-42
I/O Signal Allocations	page 7-4
ALM (Servo Alarm) Signal	page 7-8
/WARN (Warning) Signal	page 7-8
/TGON (Rotation Detection) Signal	page 7-9
/S-RDY (Servo Ready) Signal	page 7-10
/V-CMP (Speed Coincidence Detection) Signal	page 7-11
/COIN (Positioning Completion) Signal	page 7-12
/NEAR (Near) Signal	page 7-13
Speed Limit during Torque Control	page 7-14
/VLT (Speed Limit Detection) Signal	page 7-14
Encoder Divided Pulse Output	page 7-20
Selecting Torque Limits	page 7-28
Vibration Detection Level Initialization	page 7-50
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Replacing the Battery	page 13-3
Setting the Position Deviation Overflow Alarm Level	page 9-8

#### · Functions Related to the Host Controller

#### Functions to Achieve Optimum Motions

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Autotuning without a Host Reference	page 9-24
Autotuning with a Host Reference	page 9-35
Custom Tuning	page 9-42
Anti-Resonance Control Adjustment	page 9-51
Vibration Suppression	page 9-56
Gain Selection	page 9-66
Friction Compensation	page 9-70
Gravity Compensation	page 9-72
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Model Following Control	page 9-90
Compatible Adjustment Functions	page 9-93
Mechanical Analysis	page 9-97
Easy FFT	page 9-99

#### • Functions for Trial Operation during Setup

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Software Reset	page 7-47
Trial Operation for the Servomotor without a Load	page 8-7
Program Jogging	page 8-14
Origin Search	page 8-18
Test without a Motor	page 8-20
Monitoring Machine Operation Status and Signal Waveforms	page 10-6

Function	Reference
Write Prohibition Setting for Parameters	page 6-7
Initializing Parameter Settings	page 6-10
Automatic Detection of Connected Motor	page 6-14
Monitoring Product Information	page 10-2
Monitoring Product Life	page 10-2
Alarm History Display	page 13-44
Alarm Tracing	page 10-16

#### • Functions for Inspection and Maintenance

# Selecting a SERVOPACK

This chapter provides information required to select SERVOPACKs, such as specifications, block diagrams, dimensional drawings, and connection examples.

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	2.1.3	Specifications
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2.3	Exter	nal Dimensions 2-13
	2.3.1	Front Cover Dimensions and Connector Specifications
	2.3.2	SERVOPACK External Dimensions
2.4	Examples	of Standard Connections between SERVOPACKs and Peripheral Devices2-17

2.1.1 Ratings

# 2.1 Ratings and Specifications

This section gives the ratings and specifications of SERVOPACKs.

## 2.1.1 Ratings

### Three-Phase, 400 VAC

Ν	/lodel SGD7S	;-	1R9D	3R5D	5R4D	8R4D	120D	170D	210D	260D	280D	370D
Maximum Applicable Motor Capacity [kW]			0.5	1	1.5	2	3	5	6	7.5	11	15
Continuous (	Output Currer	nt [Arms]	1.9	3.5	5.4	8.4	11.9	16	20.8	25.7	28.1	37.2
Instantaneou rent [Arms]	is Maximum (	Output Cur-	5.5	8.5	14	21	28	42	55	65	70	85
Main Circuit	Power Supp	ly		Three-phase, 380 VAC to 480 VAC, -15% to +10%, 50 Hz/60 Hz								
	Input Curren	it [Arms]*	1.4	2.9	4.3	5.8	8.6	14.5	17.4	21.7	31.8	43.4
Control	Power Supp	ly					24 VDC	C±15%	)			
Control	Input Current [Arms]*			1.2					1.4		1.7	
Power Supp	ly Capacity [k	VA]*	1.1	2.3	3.5	4.5	7.1	11.7	12.4	14.4	21.9	30.6
	Main Circuit Power Loss [W]		19.4	30.3	62.8	90.1	137.7	188.7	188.4	228.5	278.2	389.8
Power Loss*	Control Circuit Power Loss [W]		21			22	28		32			
LUSS	Built-in Regenerative Resistor Power Loss [W]		14	14	28	28	28	36	(18	80)*	(24	0)*
	Total Power	Loss [W]	54.4	65.3	111.8	139.1	186.7	246.7	216.4	256.5	310.2	389.8
Regenera- tive Resis- tor	Built-In Regenera-	Resistance $[\Omega]$	75	75	75	43	43	27	_			
	tive Resis- tor	Capacity [W]	70	70	140	140	140	180	_			
	Minimum Allowable External Resistance [Ω]		75	75	75	43	43	27	18	18	14.25	14.25
Overvoltage Category												

\* This is the net value at the rated load.

### 540 VDC

Model SGD7S-			3R5D	5R4D	8R4D	120D	170D	210D	260D	280D	370D
Maximum Ap [kW]	pplicable Motor Capacity	0.5	1	1.5	2	3	5	6	7.5	11	15
Continuous (	Output Current [Arms]	1.9	3.5	5.4	8.4	11.9	16	20.8	25.7	28.1	37.2
Instantaneous Maximum Output Cur- rent [Arms]			8.5	14	21	28	42	55	65	70	85
Main Circuit	Power Supply		513 VDC to 648 VDC, -15% to +10%								
Main Circuit	Input Current [Arms]*	2	3.3	5.5	6.8	11	18	19.6	26.2	38.3	47.6
Control	Power Supply	24 VDC ±15%									
Control	Input Current [Arms]*	1.2						1.4		1	.7
Power Supp	ly Capacity [kVA]*	1.1	2.3	3.5	4.5	7.1	11.7	12.4	14.4	21.9	30.6
	Main Circuit Power Loss [W]	16.4	24.4	48.5	73.7	110.4	144.5	188.4	228.5	278.2	389.8
Power Loss*	Control Circuit Power Loss [W]			21			22	28		3	2
	Total Power Loss [W]	37.4	45.4	69.5	94.7	131.4	166.5	216.4	228.5	310.2	389.8
Overvoltage Category		III									

\* This is the net value at the rated load.

#### 2.1.2 SERVOPACK Overload Protection Characteristics

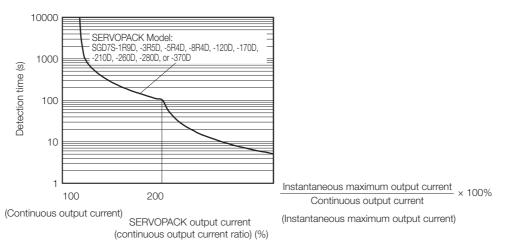
### 2.1.2 SERVOPACK Overload Protection Characteristics

The overload detection level is set for hot start conditions with a SERVOPACK surrounding air temperature of 55°C.

An overload alarm (A.710 or A.720) will occur if overload operation that exceeds the overload protection characteristics shown in the following diagram (i.e., operation on the right side of the applicable line) is performed.

The actual overload detection level will be the detection level of the connected SERVOPACK or Servomotor that has the lower overload protection characteristics.

In most cases, that will be the overload protection characteristics of the Servomotor.



Note: The above overload protection characteristics do not mean that you can perform continuous duty operation with an output of 100% or higher.

For a Yaskawa-specified combination of SERVOPACK and Servomotor, maintain the effective torque within the continuous duty zone of the torque-motor speed characteristic of the Servomotor.

2.1.3 Specifications

# 2.1.3 Specifications

	Item	Specification						
Drive Metho	d	IGBT-based PWM control, sine wave current drive						
	With Rotary Servomotor	Serial encoder: 24 bits (incremental encoder/absolute encoder)						
Feedback	With Linear Servomotor	<ul> <li>Absolute linear encoder (The signal resolution depends on the absolute linear encoder.)</li> <li>Incremental linear encoder (The signal resolution depends on the incremental linear encoder or Serial Converter Unit.)</li> </ul>						
	Surrounding Air Tem- perature <sup>*1</sup>	-5°C to 55°C However, the range for the SGD7S-370D is -5°C to 40°C. (With derating, usage is possible between 55°C and 60°C. For the SGD7S-370D, however, usage is possible between 40°C to 60°C.) Refer to the following section for derating specifications. 3.6 Derating Specifications on page 3-7						
	Storage Temperature	-20°C to 85°C						
	Surrounding Air Humidity	95% relative humidity max. (with no freezing or condensation)						
	Storage Humidity	95% relative humidity max. (with no freezing or condensation)						
Fouiroo	Vibration Resistance	4.9 m/s <sup>2</sup>						
Environ- mental	Shock Resistance	19.6 m/s <sup>2</sup>						
Conditions	Degree of Protection	IP10						
	Pollution Degree	<ul> <li>2</li> <li>Must be no corrosive or flammable gases.</li> <li>Must be no exposure to water, oil, or chemicals.</li> <li>Must be no dust, salts, or iron dust.</li> </ul>						
	Altitude	1,000 m max. (With derating, usage is possible between 1,000 m and 2,000 m.) Refer to the following section for derating specifications. 3.6 Derating Specifications on page 3-7						
	Others	Do not use the SERVOPACK in the following locations: Locations subject to static electricity noise, strong electromagnetic/magnetic fields, or radioactivity						
Applicable S	Standards	Refer to the following section for details. Compliance with UL Standards, EU Directives, and Other Safety Stan- dards on page xxi						
Mounting		Base-mounted						
	Speed Control Range	1:5000 (At the rated torque, the lower limit of the speed control range must not cause the Servomotor to stop.)						
		$\pm 0.01\%$ of rated speed max. (for a load fluctuation of 0% to 100%)						
	Coefficient of Speed	0% of rated speed max. (for a voltage fluctuation of ±10%)						
Perfor- mance	Fluctuation*2	$\pm$ 0.1% of rated speed max. (for a temperature fluctuation of 25°C $\pm$ 25°C)						
	Torque Control Preci- sion (Repeatability)	±1%						
	Soft Start Time Setting	0 s to 10 s (Can be set separately for acceleration and deceleration.)						

Continued on next page.

2.1.3 Specifications

Continued from previous page.

	Item		Specification					
	Encoder Div Pulse Outp		Phase A, phase B, phase C: Line-driver output Number of divided output pulses: Any setting is allowed.					
	Overheat Protection Input		Number of input points: 1 Input voltage range: 0 V to +5 V					
	Sequence Input Signals	Input Signals That Can Be Allo- cated	<ul> <li>Allowable voltage range: 24 VDC ±20%</li> <li>Number of input points: 7 (Input method: Sink inputs or source inputs)</li> <li>Input Signals</li> <li>/DEC (Origin Return Deceleration Switch) signal</li> <li>/EXT1 to /EXT3 (External Latch Input 1 to 3) signals</li> <li>P-OT (Forward Drive Prohibit) and N-OT (Reverse Drive Prohibit) signals</li> <li>/P-CL (Forward External Torque Limit) and /N-CL (Reverse External Torque Limit) signals</li> <li>FSTP (Forced Stop Input) signal</li> <li>/DBANS (Dynamic Brake Answer) signal*3</li> <li>A signal can be allocated and the positive and negative logic can be</li> </ul>					
I/O Signals		Fixed Output	changed. Allowable voltage range: 5 VDC to 30 VDC Number of output points: 1 (A photocoupler output (isolated) is used.) Output signal: ALM (Servo Alarm) signal					
I/O Signals	Sequence Output Signals	Output Signals That Can Be Allo- cated	Allowable voltage range: 5 VDC to 30 VDC Number of output points: 5 (A photocoupler output (isolated) is used.) Output Signals · /COIN (Positioning Completion) signal · /V-CMP (Speed Coincidence Detection) signal · /TGON (Rotation Detection) signal · /S-RDY (Servo Ready) signal · /CLT (Torque Limit Detection) signal · /VLT (Speed Limit Detection) signal · /VLT (Speed Limit Detection) signal · /VLT (Speed Limit Detection) signal · /WARN (Warning) signal · /NEAR (Near) signal · /DBON (Dynamic Brake Operation Request) signal <sup>*3*4</sup> · /ZONE0 (ZONE Signal 1 Output) signal · /ZONE1 (ZONE Signal 2 Output) signal · /ZONE3 (ZONE Signal 4 Output) signal · /ZONE3 (ZONE Signal 4 Output) signal · /nZONE (nZONE Output) signal A signal can be allocated and the positive and negative logic can be changed.					
	RS-422A Communi-	Inter- faces 1:N Commu-	Digital Operator (JUSP-OP05A-1-E) Up to N = 15 stations possible for RS-422A port					
Communi- cations	cations (CN3)	nications Axis Address Setting	Set with parameters.					
	USB	Interface	Personal computer (with SigmaWin+) The software version of the SigmaWin+ must be version 7.11 or highe					
	Communi- cations (CN7)	Commu- nications Standard	Conforms to USB2.0 standard (12 Mbps).					
Displays/Indicators			CHARGE, PWR, CN, L1, and L2 indicators, and one-digit seven-seg-					

Continued on next page.

#### 2.1.3 Specifications

Continued from previous page.

	Item	Specification					
	-	Specification					
MECHA-	Communications Pro- tocol	MECHATROLINK-III					
	Station Address Settings	03h to EFh (maximum number of slaves: 62) The rotary switches (S1 and S2) are used to set the station address.					
TROLINK-III Communi-	Transmission Speed	100 Mbps					
cations	Transmission Cycle	125 μs, 250 μs, 500 μs, 750 μs, 1.0 ms to 4.0 ms (multiples of 0.5 ms)					
	Number of Transmis- sion Bytes	32 or 48 bytes/station A DIP switch (S3) is used to select the number of transmission bytes.					
	Performance	Position, speed, or torque control with MECHATROLINK-III communi- cations					
Reference Method	Reference Input	MECHATROLINK-III commands (sequence, motion, data setting, data access, monitoring, adjustment, etc.)					
	Profile	MECHATROLINK-III standard servo profile					
MECHATROLINK-III Communica-		Rotary switch (S1 and S2) positions: 16					
tions Setting	Switches	Number of DIP switch (S3) pins: 4					
Analog Monitor (CN5)		Number of points: 2 Output voltage range: ±10 VDC (effective linearity range: ±8 V) Resolution: 16 bits Accuracy: ±20 mV (Typ) Maximum output current: ±10 mA Settling time (±1%): 1.2 ms (Typ)					
Dynamic Bra	ake (DB) <sup>*5</sup>	Activated when a servo alarm or overtravel (OT) occurs, or when the power supply to the main circuit or servo is OFF.					
Regenerative	e Processing	Built-in Refer to the catalog for details.					
Overtravel (OT) Prevention		Stopping with dynamic brake, deceleration to a stop, or coasting to a stop for the P-OT (Forward Drive Prohibit) or N-OT (Reverse Drive Prohibit) signal					
Protective Functions		Overcurrent, overvoltage, low voltage, overload, regeneration error, etc.					
Utility Functions		Gain adjustment, alarm history, jogging, origin search, etc.					
	Inputs	/HWBB1 and /HWBB2: Base block signals for Power Modules					
Safety	Output	EDM1: Monitors the status of built-in safety circuit (fixed output).					
Functions	Applicable Standards <sup>*6</sup>	ISO13849-1 PLe (category 3), IEC61508 SIL3					
Applicable C	ption Modules	Fully-closed Modules					

\*1. The applicable surrounding range cannot be increased by derating.

\*2. The coefficient of speed fluctuation for load fluctuation is defined as follows:

Coefficient of speed fluctuation =  $\frac{\text{No-load motor speed} - \text{Total-load motor speed}}{\text{Rated motor speed}} \times 100\%$ 

\*3. Usable only with SGD7S-210D, -260D, -280D, -370D SERVOPACKs.

\*4. The /DBON signal can be used as positive logic.

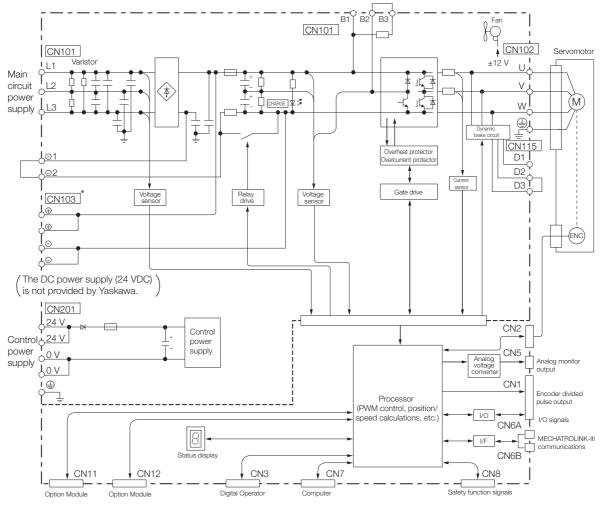
\*5. The SGD7S-210D, -260D, -280D, and -370D do not have a dynamic brake (DB). If a dynamic brake is necessary, create an external dynamic brake circuit.
 Refer to the following chapter for details on the dynamic brake.
 Chapter 5 Wiring and Settings for the Dynamic Brake

\*6. Always perform risk assessment for the system and confirm that the safety requirements are met.

# 2.2 Block Diagrams

This section provides a block diagram of the interior of the SERVOPACKs.

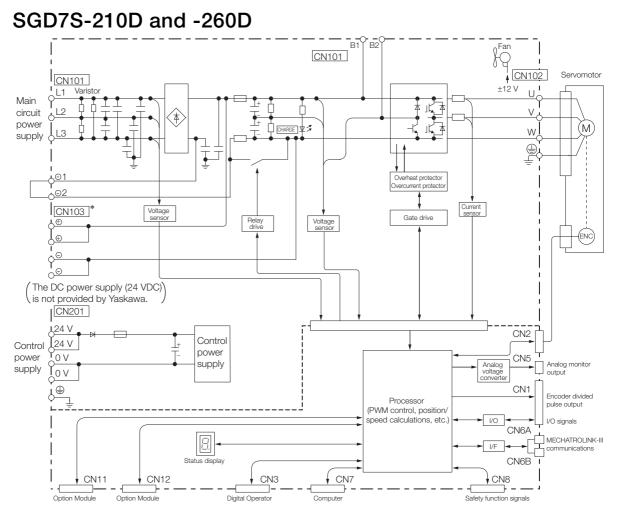
### 2.2.1 SERVOPACKs without Built-in Servomotor Brake Control



### SGD7S-1R9D, -3R5D, -5R4D, -8R4D, -120D, and -170D

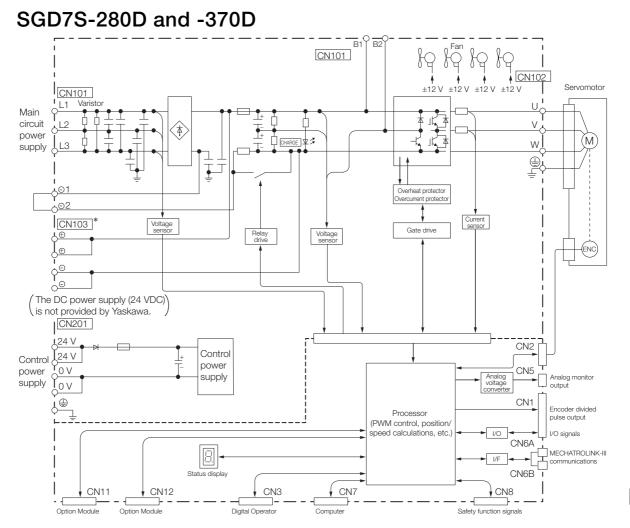
\* If using these terminals, contact your YASKAWA representative.

2.2.1 SERVOPACKs without Built-in Servomotor Brake Control



\* If using these terminals, contact your YASKAWA representative.

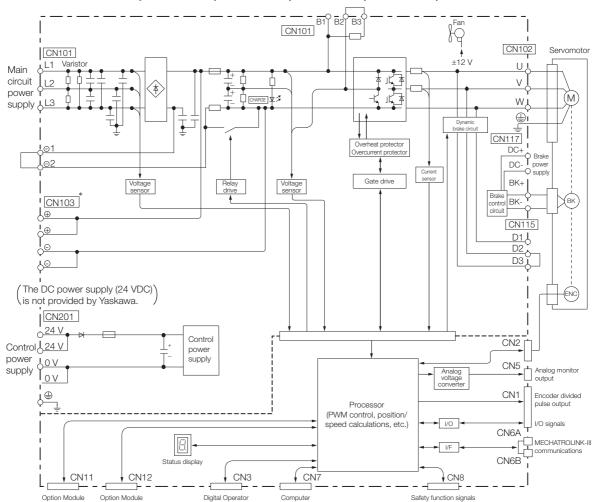
#### 2.2.1 SERVOPACKs without Built-in Servomotor Brake Control



\* If using these terminals, contact your YASKAWA representative.

2.2.2 SERVOPACKs with Built-in Servomotor Brake Control

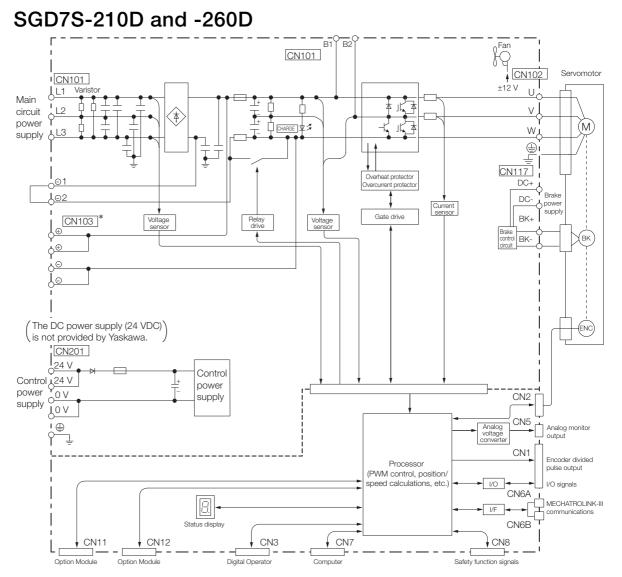
### 2.2.2 SERVOPACKs with Built-in Servomotor Brake Control



### SGD7S-1R9D, -3R5D, -5R4D, -8R4D, -120D, and -170D

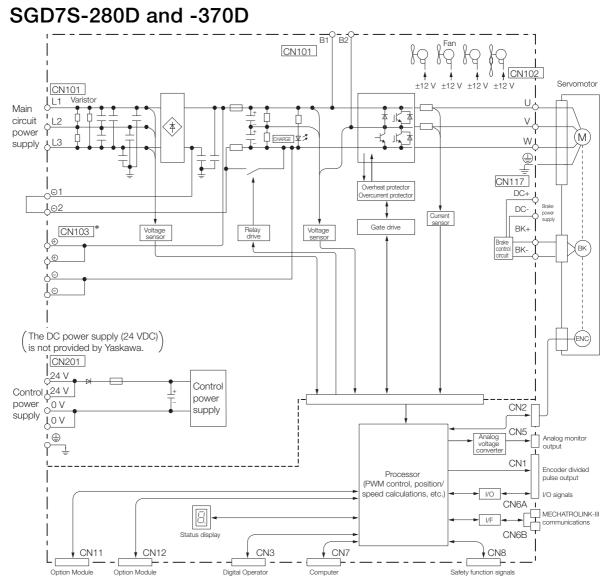
\* If using these terminals, contact your YASKAWA representative.

#### 2.2.2 SERVOPACKs with Built-in Servomotor Brake Control



\* If using these terminals, contact your YASKAWA representative.

2.2.2 SERVOPACKs with Built-in Servomotor Brake Control



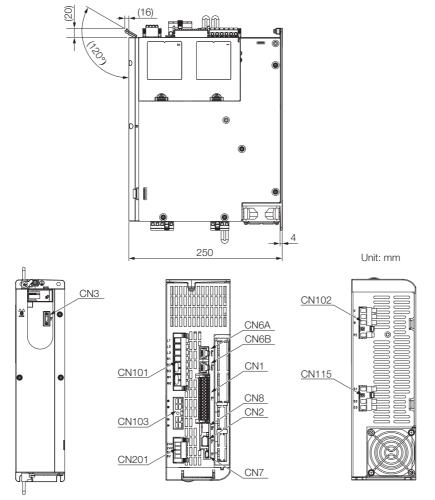
\* If using these terminals, contact your YASKAWA representative.

# 2.3 External Dimensions

### 2.3.1 Front Cover Dimensions and Connector Specifications

The front cover dimensions and panel connector section are the same for all models. Refer to the following figures and table.

#### Front Cover Dimensions and Connectors



#### Connector Specifications

Connector No.	Connector Model	Number of Pins	Manufacturer	SERVOPACK Model
CN1	DMC 1.5/15-G1F-3.5-LR-BK	30	Phoenix Contact	All models
CN2	3E106-0220KV	6	3M Japan Limited	All models
CN3	HDR-EC14LFDTN-SLD+	14	Honda Tsushin Kogyo Co., Ltd.	All models
CN6A/B	1-1734579-4	8	Tyco Electronics Japan G.K.	All models
CN7	2172034-1	5	Tyco Electronics Japan G.K.	All models
CN8	1903815-1	8	Tyco Electronics Japan G.K.	All models
CN101	BLZ 7.62HP/08/180LR SN BK BX PRT	8	Weidmüller Interface	SGD7S-1R9D to -170D
GNTUT	BUZ 10.16HP/07/180F AG BK BX LPR	0	GmbH & Co. KG	SGD7S-210D to -370D

Continued on next page.

#### 2.3.1 Front Cover Dimensions and Connector Specifications

			Continued from	previous page.
Connector No.	Connector Model	Number of Pins	Manufacturer	SERVOPACK Model
CN102	BLZ 7.62IT/04/180MF4 SN BK BX PRT	4	Weidmüller Interface	SGD7S-1R9D to -170D
CINTU2	BUZ 10.16IT/04/180MF4 AG BK BX LPR	4	GmbH & Co. KG	SGD7S-210D to -370D
CN103*	BVZ 7.62IT/04/180MF3 SN BK BX PRT	4	Weidmüller Interface	SGD7S-1R9D to -170D
CINTUS.	BUZ 10.16IT/04/180MF3 AG BK BX LPR	4	GmbH & Co. KG	SGD7S-210D to -370D
CN115	BLZ 7.62IT/03/180MF2 SN BK BX PRT	3	Weidmüller Interface	SGD7S-1R9D to -170D
ONTIO	None		GmbH & Co. KG	SGD7S-210D to -370D
CN201	BLF 5.08HC/04/180LR SN OR BX SO	4	Weidmüller Interface GmbH & Co. KG	All models

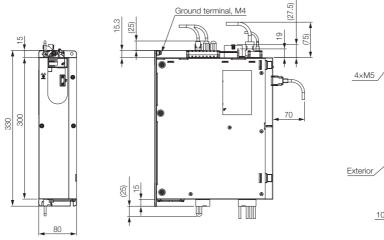
\* If using these terminals, contact your YASKAWA representative.

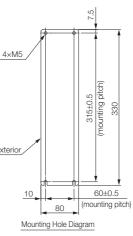
Note: The above connectors or their equivalents are used for the SERVOPACKs.

### 2.3.2 SERVOPACK External Dimensions

### **Base-mounted SERVOPACKs**

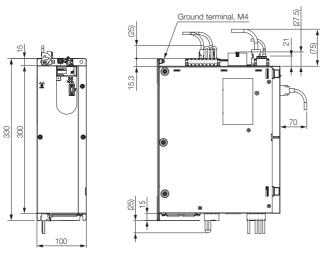
• Three-Phase, 400 VAC: SGD7S-1R9D, -3R5D, -5R4D, -8R4D, and -120D

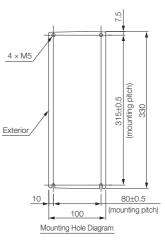




Approx. mass: SGD7S-1R9D, -3R5D, or -5R4D: 3.4 kg SGD7S-8R4D or -120D: 3.7 kg Unit: mm

• Three-Phase, 400 VAC: SGD7S-170D

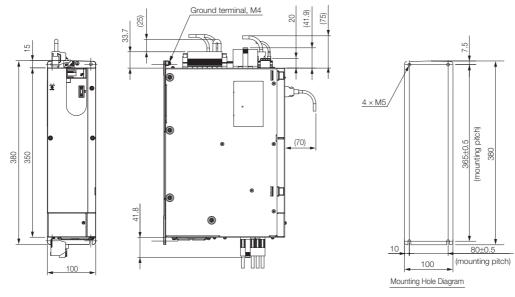




Approx. mass: 5.5 kg Unit: mm

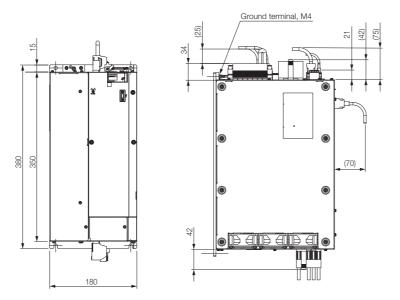
#### 2.3.2 SERVOPACK External Dimensions

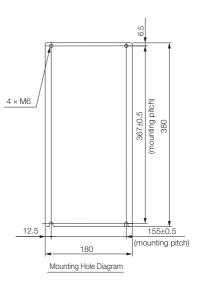
Three-Phase, 400 VAC: SGD7S-210D and -260D



Approx. mass: 7.0 kg Unit: mm

• Three-Phase, 400 VAC: SGD7S-280D and -370D

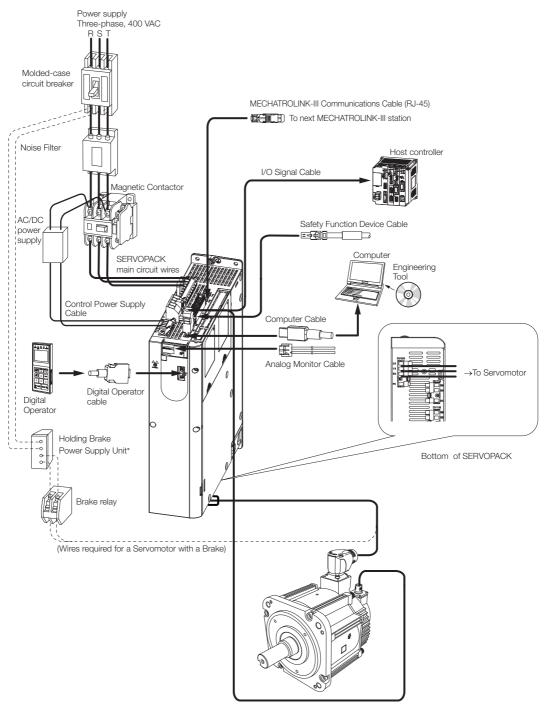




Approx. mass: 13.5 kg Unit: mm

#### Examples of Standard Connections between SERVOPACKs and Peripheral Devices 2.4

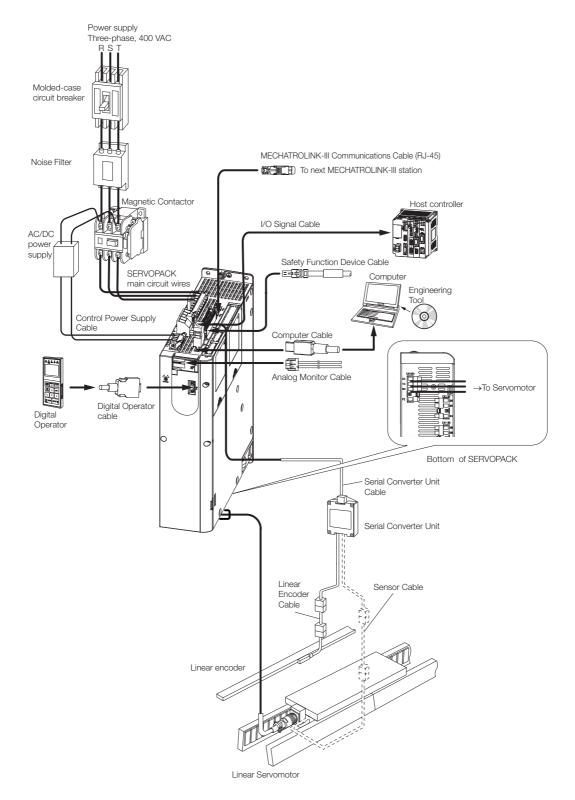




\* The power supply for the holding brake is not provided by Yaskawa. Select a power supply based on the holding

If you use a 24-V brake, install a separate power supply for the 24-VDC power supply from other power supplies, such as the one for the I/O signals of the CN1 connector. If the power supply is shared, the I/O signals may malfunction.

· Linear Servomotors



# SERVOPACK Installation

This chapter provides information on installing SERVO-PACKs in the required locations.

3.1	Installation Precautions						
3.2	Mounting Types and Orientation3-3						
3.3	Mounting Hole Dimensions						
3.4	Mour	nting Interval					
	3.4.1 3.4.2	Installing One SERVOPACK in a Control Panel3-5 Installing More Than One SERVOPACK in a Control Panel					
3.5	Moni	toring the Installation Environment 3-6					
3.6	Derat	ting Specifications					
3.7	EMC	Installation Conditions					

# 3.1 Installation Precautions

Refer to the following section for the ambient installation conditions. (2) 2.1.3 Specifications on page 2-4

#### Installation Near Sources of Heat

Implement measures to prevent temperature increases caused by radiant or convection heat from heat sources so that the ambient temperature of the SERVOPACK meets the ambient conditions.

#### Installation Near Sources of Vibration

Install a vibration absorber on the installation surface of the SERVOPACK so that the SERVO-PACK will not be subjected to vibration.

#### Other Precautions

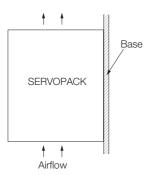
Do not install the SERVOPACK in a location subject to high temperatures, high humidity, water drops, cutting oil, excessive dust, excessive dirt, excessive iron powder, corrosive gasses, or radioactivity.

# 3.2 Mounting Types and Orientation

Only base-mounted SERVOPACKs are available. Mount the SERVOPACK vertically, as shown in the following figures.

Also, mount the SERVOPACK so that the front panel is facing toward the operator.

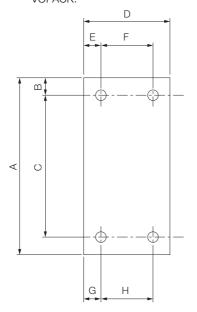
Note: Prepare four mounting holes for the SERVOPACK and mount it securely in the mounting holes. (The number of mounting holes depends on the capacity of the SERVOPACK.)



# 3.3 Mounting Hole Dimensions

Use mounting holes to securely mount the SERVOPACK to the mounting surface.

Note: To mount the SERVOPACK, you will need to prepare a screwdriver that is longer than the depth of the SER-VOPACK.



### Mounting Hole Dimensions

SERVOPACK Model				Screw	Number						
		А	В	С	D	Е	F	G	н	Size	of Screws
	1R9D, 3R5D, 5R4D, 8R4D, 120D	330	7.5	315±0.5	80	10	60±0.5	10	60±0.5	M5	4
SGD7S-	170D	330	7.5	315±0.5	100	10	80±0.5	10	80±0.5	M5	4
	210D, 260D	380	7.5	365±0.5	100	10	80±0.5	10	80±0.5	M5	4
	280D, 370D	380	6.5	367±0.5	180	12.5	155±0.5	12.5	155±0.5	M6	4

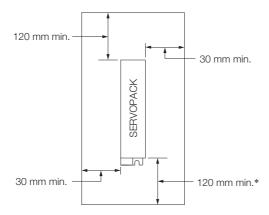
3.4.1 Installing One SERVOPACK in a Control Panel

# **Mounting Interval**

 $\bigcirc$ 

#### Installing One SERVOPACK in a Control Panel 3.4.1

Provide the following spaces around the SERVOPACK.

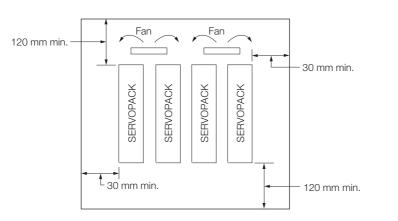


\* For this dimension, ignore items protruding from the main body of the SERVOPACK.

#### Installing More Than One SERVOPACK in a Control 3.4.2 Panel

Provide the following spaces around the SERVOPACK, and install a cooling fan in the control panel.

Install cooling fans above the SERVOPACKs so that hot spots do not occur around the SERVO-PACKs. Important



0	RVOPACK model	Cooling Fan Installation Conditions			
36		10 mm above SERVOPACK's Top Surface			
SGD7S-	1R9D, 3R5D, 5R4D, 8R4D, 120D, 170D, 210D, 260D, 280D, 370D	Air speed: 1.0 m/s min.			

# 3.5 Monitoring the Installation Environment

You can use the SERVOPACK Installation Environment Monitor parameter to check the operating conditions of the SERVOPACK in the installation environment.

You can check the SERVOPACK installation environment monitor with either of the following methods.

- Using the SigmaWin+: Life Monitor Installation Environment Monitor SERVOPACK
- Panel Operator or Digital Operator: Un025 (Installation Environment Monitor [%])

Implement one or more of the following actions if the monitor value exceeds 100%.

- Lower the surrounding temperature.
- Decrease the load.

Information The value of the SERVOPACK Installation Environment Monitor parameter will increase by about 10% for each 10°C increase in the ambient temperature.

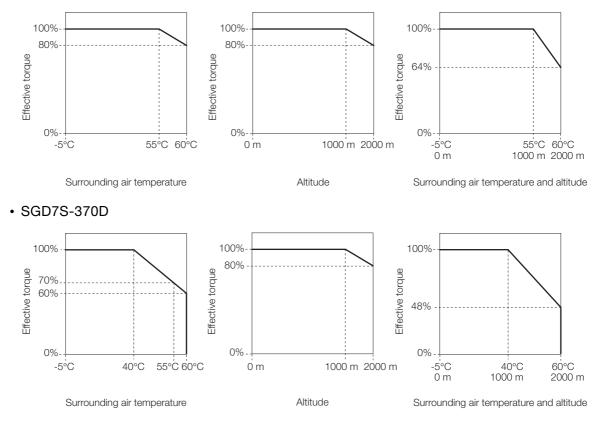


Always observe the surrounding air temperature given in the SERVOPACK environment conditions. Even if the monitor value is 100% or lower, you cannot use a SERVOPACK in a location that exceeds the specified surrounding air temperature.

# 3.6 Derating Specifications

If you use the SERVOPACK at a surrounding air temperature of 55°C to 60°C or at an altitude of 1,000 m to 2,000 m, you must apply the derating rates given in the following graphs.

• SGD7S-1R9D, 3R5D, 5R4D, 8R4D, 120D, 170D, 210D, 260D, and 280D

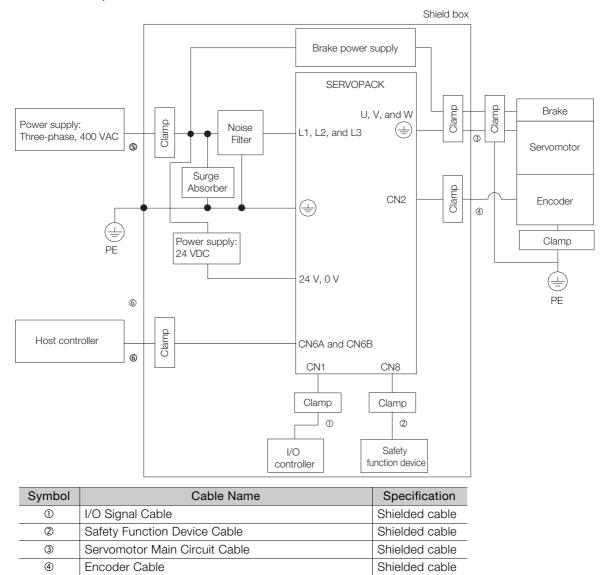


# 3.7 EMC Installation Conditions

This section gives the installation conditions that were used for EMC certification testing.

The EMC installation conditions that are given here are the conditions that were used to pass testing criteria at Yaskawa. The EMC level may change under other conditions, such as the actual installation structure and wiring conditions. These Yaskawa products are designed to be built into equipment. Therefore, you must implement EMC measures and confirm compliance for the final equipment.

The applicable standards are EN 55011 group 1 class A, EN 61000-6-2, EN 61000-6-4, and EN 61800-3 (category C2, second environment).



Shielded cable

Shielded cable

• Three-Phase, 400 VAC

5

6

Main Circuit Power Supply Cable

MECHATROLINK-III Communications Cable (RJ-45)

# Wiring and Connecting SERVOPACKs

This chapter provides information on wiring and connecting SERVOPACKs to power supplies and peripheral devices.

4.1	Wiring	g and Connecting SERVOPACKs 4-3
	4.1.1 4.1.2 4.1.3	General Precautions4-3Countermeasures against Noise4-5Grounding4-8
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4.1.1 General Precautions

# 4.1 Wiring and Connecting SERVOPACKs

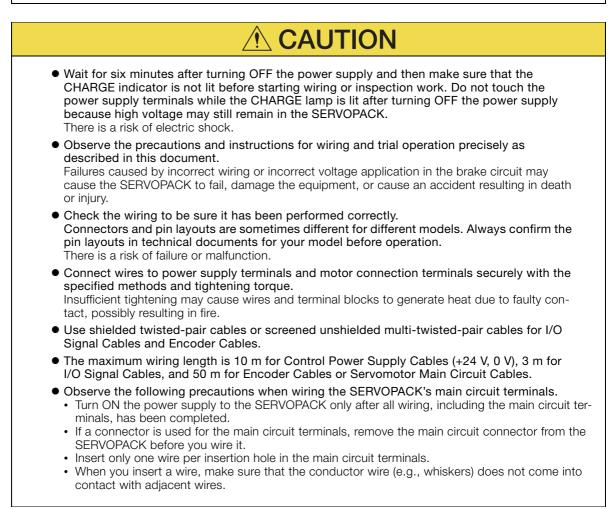
# 4.1.1 General Precautions

# 🚹 DANGER

• Do not change any wiring while power is being supplied. There is a risk of electric shock or injury.

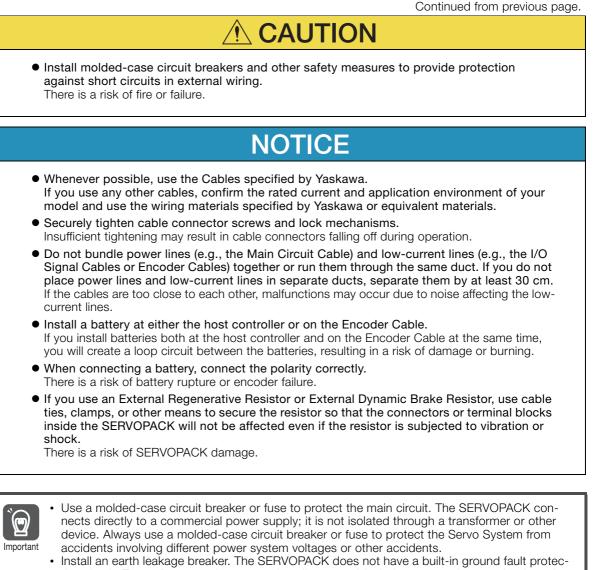
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- Wiring and inspections must be performed only by qualified engineers. There is a risk of electric shock or product failure.
- Check all wiring and power supplies carefully. Incorrect wiring or incorrect voltage application to the output circuits may cause short-circuit failures. If a short-circuit failure occurs as a result of any of these causes, the holding brake will not work. This could damage the machine or cause an accident that may result in death or injury.
- Connect the AC and DC power supplies to the specified SERVOPACK terminals.
  - Connect an AC power supply to the L1, L2, and L3 terminals on the SERVOPACK.
  - Connect a DC power supply to the B1 and  $\ominus$  2 terminals and the 24 V and 0 V terminals on the SERVOPACK.



Continued on next page.

#### 4.1.1 General Precautions



tive circuit. To configure a safer system, install a ground fault detector against overloads and short-circuiting, or install a ground fault detector combined with a molded-case circuit breaker. • Do not turn the power supply ON and OFF more than necessary.

- Do not use the SERVOPACK for applications that require the power supply to turn ON and OFF frequently. Such applications will cause elements in the SERVOPACK to deteriorate.
- After you have started actual operation, allow at least one hour between turning the power supply ON and OFF (as a guideline).

To ensure safe, stable application of the Servo System, observe the following precautions when wiring.

- Use the Cables specified by Yaskawa. Design and arrange the system so that each cable is as short as possible.
  - Refer to the catalog for information on the specified cables.
- The signal cable conductors are as thin as 0.2 mm<sup>2</sup> or 0.3 mm<sup>2</sup>. Do not subject them to excessive bending stress or tension.

4.1.2 Countermeasures against Noise

# 4.1.2 Countermeasures against Noise

The SERVOPACK is designed as an industrial device. It therefore provides no measures to prevent radio interference. The SERVOPACK uses high-speed switching elements in the main circuit. Therefore peripheral devices may be affected by switching noise.

If the equipment is to be used near private houses or if radio interference is a problem, take countermeasures against noise.

The SERVOPACK uses microprocessors. Therefore, it may be affected by switching noise from peripheral devices.

To prevent the noise from the SERVOPACK or the peripheral devices from causing malfunctions of any devices, take the following countermeasures against noise as required.

- Install the input reference device and Noise Filter as close to the SERVOPACK as possible.
- Always install a Surge Absorber for relays, solenoids, and Magnetic Contactor coils.
- Do not place the following cables in the same duct or bundle them together. Also, separate the cables from each other by at least 30 cm.

•Main Circuit Cables and I/O Signal Cables

- •Main Circuit Cables and Encoder Cables
- Do not share the power supply with an electric welder or electrical discharge machine. If the SERVOPACK is placed near a high-frequency generator, install Noise Filters on the input side on the Main Circuit Power Supply Cable and Control Power Supply Cable even if the same power supply is not shared with the high-frequency generator. Refer to the following section for information on connecting Noise Filters.
- *∎* Noise Filters on page 4-6
- Implement suitable grounding measures. Refer to the following section for information on grounding measures.

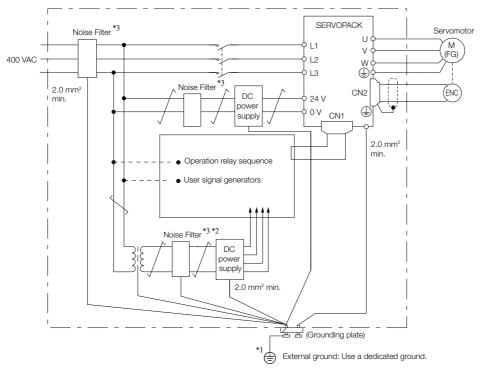
4.1.3 Grounding on page 4-8

Δ

4.1.2 Countermeasures against Noise

### **Noise Filters**

You must attach Noise Filters in appropriate places to protect the SERVOPACK from the adverse effects of noise. The following is an example of wiring for countermeasures against noise.



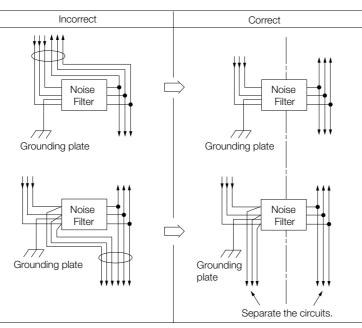
- \*1. For the ground wire, use a wire with a thickness of at least 2.0 mm<sup>2</sup> (preferably, flat braided copper wire).
- \*2. Whenever possible, use twisted-pair wires to wire all connections marked with  $\underline{\frown}$ .
- \*3. Refer to the following section for precautions when using Noise Filters.

4.1.2 Countermeasures against Noise

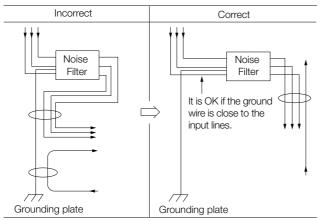
### **Noise Filter Wiring and Connection Precautions**

Always observe the following precautions when wiring or connecting Noise Filters.

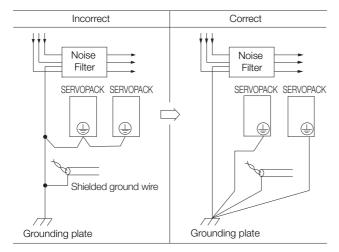
• Separate input lines from output lines. Do not place input lines and output lines in the same duct or bundle them together.



• Separate the Noise Filter ground wire from the output lines. Do not place the Noise Filter ground wire, output lines, and other signal lines in the same duct or bundle them together.



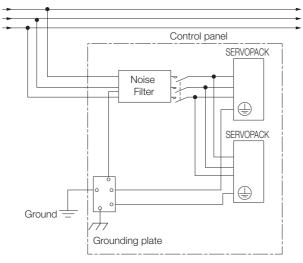
• Connect the Noise Filter ground wire directly to the grounding plate. Do not connect the Noise Filter ground wire to other ground wires.



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### 4.1.3 Grounding

• If a Noise Filter is located inside a control panel, first connect the Noise Filter ground wire and the ground wires from other devices inside the control panel to the grounding plate for the control panel, then ground the plate.



## 4.1.3 Grounding

Implement grounding measures as described in this section. Implementing suitable grounding measures will also help prevent malfunctions, which can be caused by noise.

Observe the following precautions when wiring the ground cable.

- Ground the SERVOPACK to a resistance of 10  $\Omega$  or less.
- · Be sure to ground at one point only.
- Ground the Servomotor directly if the Servomotor is insulated from the machine.

### Motor Frame Ground or Motor Ground

If you ground the Servomotor through the machine, switching noise current can flow from the main circuit of the SERVOPACK through the stray capacitance of the Servomotor. To prevent this, always connect the FG terminal of the Servomotor Main Circuit Cable connected to the Servomotor to the ground terminal () on the SERVOPACK. Also be sure to ground the ground terminal (). Always connect the shield wire of the Encoder Cable connected to the Servomotor to the connector case (shell).

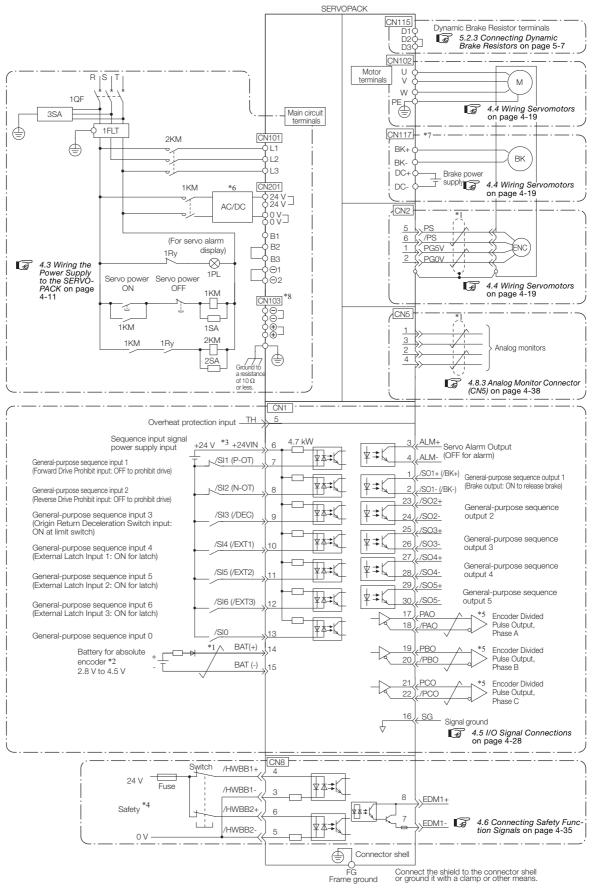
Ground both the Moving Coil and Magnetic Way of a Linear Servomotor.

### Noise on I/O Signal Cables

If noise enters the I/O Signal Cable, ground the shield of the I/O Signal Cable using a clamp or other means. If the Servomotor Main Circuit Cable is placed in a metal conduit, ground the conduit and its junction box. For all grounding, ground at one point only.

# 4.2 Basic Wiring Diagrams

This section provide the basic wiring diagrams. Refer to the reference sections given in the diagrams for details.



\*1.  $\checkmark$  represents twisted-pair wires.

- \*2. Connect these when using an absolute encoder. If the Encoder Cable with a Battery Case is connected, do not connect a backup battery.
- \*3. The 24-VDC power supply is not provided by Yaskawa. Use a 24-VDC power supply with double insulation or reinforced insulation.
- \*4. Refer to the following chapter if you use a safety function device.
  Chapter 12 Safety Functions
  If you do not use the safety function, insert the Safety Jumper Connector (provided as an accessory) into CN8 when you use the SERVOPACK.
- \*5. Always use line receivers to receive the output signals.
- \*6. Use an SELV-compliant power supply according to EN/IEC 60950-1 to input 24 VDC to the control power supply input terminals.
- \*7. The CN117 connector is used for SERVOPACKs with built-in Servomotor brake control. SERVOPACKs without built-in Servomotor brake control do not have the CN117 connector.
- \*8. If using these terminals, contact your YASKAWA representative.
- Note: 1. You can use parameters to change the functions allocated to the /DEC, P-OT, N-OT, /EXT1, /EXT2, and / EXT3 input signals and the /SO1, /SO2, /SO3, /SO4, and /SO5 output signals. Refer to the following section for details.

#### 7.1 I/O Signal Allocations on page 7-4

- If you use a 24-V brake, install a separate power supply for the 24-VDC power supply from other power supplies, such as the one for the I/O signals of the CN1 connector. If the power supply is shared, the I/O signals may malfunction.
- 3. Default settings are given in parentheses.

4.3.1 Terminal Symbols and Terminal Names

# 4.3 Wiring the Power Supply to the SERVOPACK

Refer to the catalog for information on cables and peripheral devices.

# 4.3.1 Terminal Symbols and Terminal Names

Use the main circuit connector on the SERVOPACK to wire the main circuit power supply and control circuit power supply to the SERVOPACK.

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• Wire all connections correctly according to the following table and specified reference information. There is a risk of SERVOPACK failure or fire if incorrect wiring is performed.

The SERVOPACKs have the following two types of main circuit power supply input specifications.

#### • Three-Phase, 400-VAC Power Supply Input

Terminal Symbols	Terminal Name	Specifications and Reference	
L1, L2, L3	Main circuit power sup- ply input terminals for AC power supply input	Three-phase, 380 VAC to 400 VAC, -15% to +10%, 50 Hz/60 Hz	
24 V	Control power supply	24 VDC, -15% to +15%	
0 V	terminals <sup>*1</sup>	0 VDC	
		4.3.5 Wiring Regenerative Resistors on page 4-18	
B1, B2, B3 <sup>*2</sup>	Regenerative Resistor terminal	If the internal Regenerative Resistor is insufficient, remove the lead or short bar between B2 and B3 and connect an External Regen- erative Resistor between B1 and B2. The External Regenerative Resistor is not included. Obtain it sepa- rately.	
	DC Reactor terminals for	4.3.6 Wiring Reactors for Harmonic Suppression on page 4-18	
⊖1, ⊖2	power supply harmonic suppression	These terminals are used to connect a DC Reactor for power sup- ply harmonic suppression or power factor improvement.	
$\Theta, \oplus$	-	None. (Do not connect anything to this terminal.)	
U, V, W, PE	Servomotor terminals	These are the Σ-7S connection terminals for the Servomotor Main Circuit Cable (power line). Note: Do not connect the PE terminal to anything other than a ground ter- minal.	
D1, D2, D3 <sup>*3</sup> Dynamic Brake Resistor terminals		<ul> <li>In the following cases, remove the lead or short bar between D2 and D3 and connect a Dynamic Brake Resistor between D1 and D2.</li> <li>To specify the brake torque when stopping with the dynamic brake</li> <li>To use a larger load moment of inertia than in the standard specifications</li> <li>The Dynamic Brake Resistor is not included. Obtain it separately.</li> </ul>	
DC+*5	Servomotor brake power	24 VDC	
DC-*5	supply terminals <sup>*4</sup>	0 VDC	
BK+, BK-*5	Servomotor brake termi- nals	Connect these terminals to the Servomotor's holding brake termi- nals. The holding brake terminals on the Servomotor do not have any polarity.	
	Ground terminal	The ground terminals to prevent electric shock. Always connect this terminal.	

\*1. Use an SELV-compliant power supply according to EN/IEC 60950-1 to input 24 VDC to the control power supply input terminals.

\*2. With the SGD7S-210D, -260D, -280D, or -370D, connect an External Regenerative Resistor between B1 and B2.

\*3. The SGD7S-210D, -260D, -280D, and -370D do not have the D1, D2, and D3 terminals.

\*4. Make sure you check the brake specifications of the Servomotor for the 24-VDC power supply input to the Servomotor brake power supply terminals.

\*5. SERVOPACKs without built-in Servomotor brake control do not have these terminals.

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#### 4.3.1 Terminal Symbols and Terminal Names

#### • DC Power Supply Input

Terminal Symbols	Terminal Name	Specifications and Reference		
24 V	Control power supply termi-	24 VDC, -15% to +15%		
0 V	nals <sup>*1</sup>	0 VDC		
B1 <sup>*2</sup>	Main circuit power supply	513 VDC to 648 VDC, -15% to +10%		
$\ominus 2^{*2}$	input terminals for DC power supply input	0 VDC		
L1, L2, L3, B2, B3, ⊖1, ⊖, ⊕	_	None. (Do not connect anything to these terminals.)		
U, V, W, PE	Servomotor terminals	These are the Σ-7S connection terminals for the Servomotor Main Circuit Cable (power line). Note: Do not connect the PE terminal to anything other than a ground terminal.		
D1, D2, D3 <sup>*3</sup>	Dynamic Brake Resistor ter- minals	<ul> <li>In the following cases, remove the lead or short bar between D2 and D3 and connect a Dynamic Brake Resistor between D1 and D2.</li> <li>To specify the brake torque when stopping with the dynamic brake</li> <li>To use a larger load moment of inertia than in the standard specifications</li> <li>The Dynamic Brake Resistor is not included. Obtain it separately.</li> </ul>		
DC+*5	Servomotor brake power	24 VDC		
DC-*5	supply terminals <sup>*4</sup>	0 VDC		
BK+, BK- <sup>*5</sup>	Servomotor brake terminals	Connect these terminals to the Servomotor's holding brake terminals. The holding brake terminals on the Servomotor do not have any polarity.		
Ground terminal This is the ground terminal to pre- connect this terminal.		This is the ground terminal to prevent electric shock. Always connect this terminal.		

\*1. Use an SELV-compliant power supply according to EN/IEC 60950-1 to input 24 VDC to the control power supply input terminals.

\*2. If using these terminals, contact your YASKAWA representative.

\*3. The SGD7S-210D, -260D, -280D, and -370D do not have the D1, D2, and D3 terminals.

\*4. Make sure you check the brake specifications of the Servomotor for the 24-VDC power supply input to the Servomotor brake power supply terminals.

\*5. SERVOPACKs without built-in Servomotor brake control do not have these terminals.

If you use a DC power supply input to the SERVOPACK, make sure to set parameter Pn001 to  $n.\Box 1 \Box \Box$  (DC power supply input supported) before inputting the power supply. Refer to the following section for details.

6.3 Power Supply Type Settings for the Main Circuit on page 6-13

# 4.3.2 Connector Wiring Procedure

• Required Items: Phillips or flat-blade screwdriver

SERVOPACK model SGD7S-	Terminal Symbols	Screwdriver Type	Screwdriver End Dimensions Thickness × Width [mm]	Wire Stripping Length [mm]
	L1, L2, L3, B1, B2, B3, -1, -2	Flat-blade		7
1R9D, 3R5D, 5R4D, 8R4D, 120D, 170D	U, V, W, PE	Phillips or flat-blade	0.6 × 3.5	7
	24 V, 0 V	Flat-blade		10
0100 0000 0000	L1, L2, L3, B1, B2, B3, -1, -2	Phillips or flat-blade	1.0 × 5.5	12
210D, 260D, 280D, 370D	U, V, W, PE	Phillips or flat-blade		12
	24 V, 0 V	Flat-blade		10

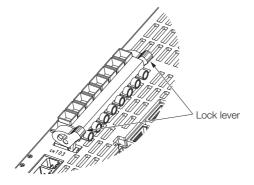
- 1. Prepare the connector that was provided with the SERVOPACK.
- 2. Remove the sheath from the wire to connect.

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3. Open the wire insertion hole on the terminal connector with the screwdriver.

Main Circuit Terminals and Motor Terminals	Control Power Supply Terminals
Insert the conductor of the wire into the wire inser- tion hole, insert the screwdriver into the screwdriver insertion hole, and tighten the screw.	Press the lever with a screwdriver or your fingertip and insert the conductor of the wire into the wire insertion hole. After you insert conductor, release the screwdriver or your fingertip.
Wire	Wire

- 4. Make all other connections in the same way.
- 5. When you have completed wiring, attach the connector to the SERVOPACK.
- 6. Press the connector all the way to the back and lock it with the lock lever.



4.3.3 Power ON Sequence

# 4.3.3 Power ON Sequence

Consider the following points when you design the power ON sequence.

• The ALM (Servo Alarm) signal is output for up to five seconds when the control power supply is turned ON. Take this into consideration when you design the power ON sequence, and turn ON the main circuit power supply to the SERVOPACK when the ALM signal is OFF (alarm cleared).

	Power ON	
Control power supply	OFF ON	
ALM (Servo Alarm) signal	Alarm	Alarm cleared.
Main circuit power supply	OFF	ON
/S_RDY (Servo Ready) signal	OFF	ON
SV_ON (Servo ON) command	Servo OFF	Servo ON
Motor power status	Power not supplied	. Power supplied.

- Information If the servo ON state cannot be achieved by inputting the Servo ON command (Enable Operation command), the /S\_RDY signal is not ON. Check the status of the /S\_RDY signal. Refer to the following section for details.
- Design the power ON sequence so that main circuit power supply is turned OFF when an ALM (Servo Alarm) signal is output.
- Make sure that the power supply specifications of all parts are suitable for the input power supply.
- Allow at least 1 s after the power supply is turned OFF before you turn it ON again.



Turn ON the control power supply and the main circuit power supply at the same time or turn ON the control power supply before the main circuit power supply. Turn OFF the main circuit power supply first, and then turn OFF the control power supply.

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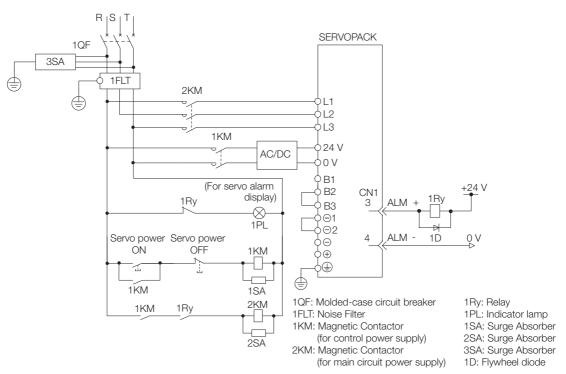
• Even after you turn OFF the power supply, a high residual voltage may still remain in the SERVOPACK. To prevent electric shock, do not touch the power supply terminals after you turn OFF the power. When the voltage is discharged, the CHARGE indicator will turn OFF. Make sure the CHARGE indicator is OFF before you start wiring or inspection work.

4.3.4 Power Supply Wiring Diagrams

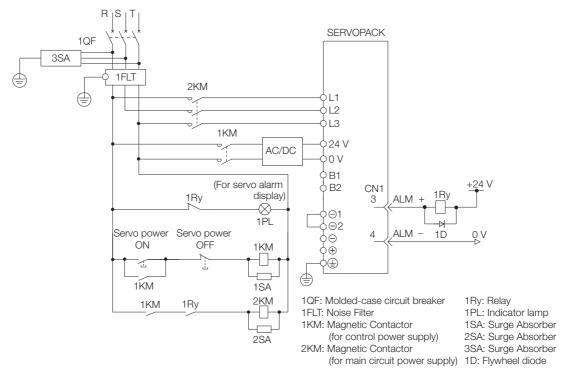
## 4.3.4 Power Supply Wiring Diagrams

### Using Only One SERVOPACK

• Wiring Example for Three-Phase, 400-VAC Power Supply Input: SGD7S-1R9D, -3R5D, -5R4D, -8R4D, -120D, and -170D

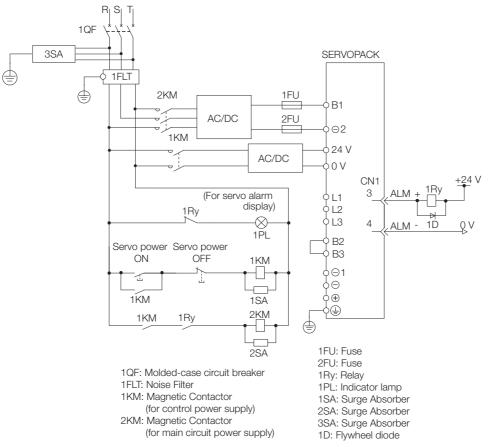


• Wiring Example for Three-Phase, 400-VAC Power Supply Input: SGD7S-210D, -260D, -280D, and -370D

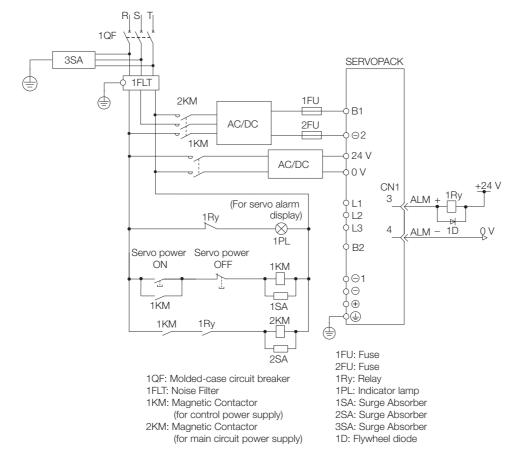


4.3.4 Power Supply Wiring Diagrams

 Wiring Example for DC Power Supply Input: SGD7S-1R9D, -3R5D, -5R4D, -8R4D, -120D, and -170D



• Wiring Example for DC Power Supply Input: SGD7S-210D, -260D, -280D, and -370D



4.3.4 Power Supply Wiring Diagrams

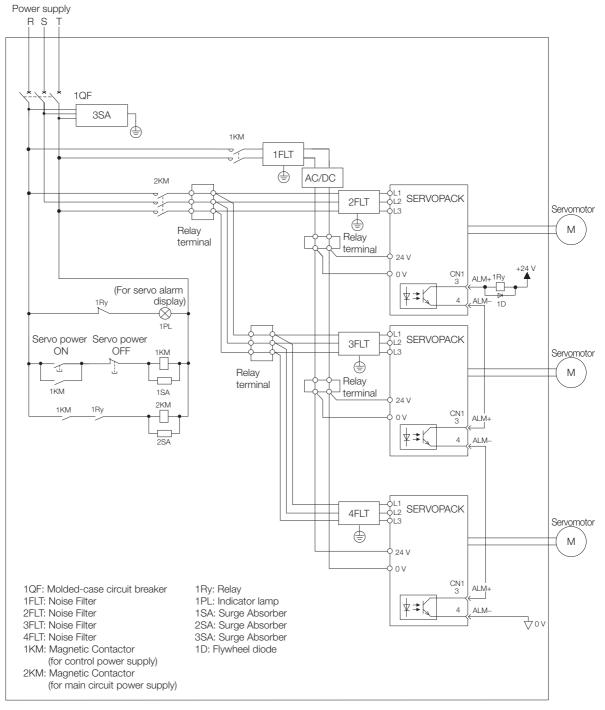
## Using More Than One SERVOPACK

Connect the ALM (Servo Alarm) output for these SERVOPACKs in series to operate the alarm detection relay (1RY).

When a SERVOPACK alarm is activated, the ALM output signal transistor turns OFF.

The following diagram shows the wiring to stop all of the Servomotors when there is an alarm for any one SERVOPACK.

More than one SERVOPACK can share a single Noise Filter. However, always select a Noise Filter that has a large enough capacity to handle the total power supply capacity of all the SERVOPACKs. Be sure to consider the load conditions.



To comply with UL/cUL standards, you must install a branch circuit protective device at the power supply input section to each SERVOPACK. Refer to the following document for details.  $\square$   $\Sigma$ -7-Series  $\Sigma$ -7S SERVOPACK with 400 V-Input Power Safety Precautions (Manual No.: TOMP C710828 02)

4.3.5 Wiring Regenerative Resistors

# 4.3.5 Wiring Regenerative Resistors

This section describes how to connect External Regenerative Resistors.

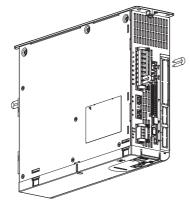
Refer to the catalog to select External Regenerative Resistors.



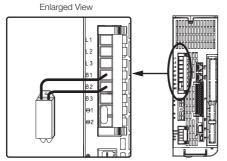
● Be sure to wire Regenerative Resistors correctly. Do not connect B1/⊕ and B2. Doing so may result in fire or damage to the Regenerative Resistor or SERVOPACK.

## **Connecting Regenerative Resistors**

1. Remove the wire connected between the B2 and B3 terminals.



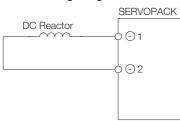
2. Connect the External Regenerative Resistor between the B1 and B2 terminals on the SERVOPACK.



 Set Pn600 (Regenerative Resistor Capacity) and Pn603 (Regenerative Resistor Resistance). Refer to the following section for details on the settings.
 6.18 Setting the Regenerative Resistor Capacity on page 6-53

# 4.3.6 Wiring Reactors for Harmonic Suppression

You can connect a reactor for harmonic suppression to the SERVOPACK when power supply harmonic suppression is required. Connection terminals  $\ominus 1$  and  $\ominus 2$  for a DC Reactor are connected when the SERVOPACK is shipped. Remove the lead wire and connect a DC Reactor as shown in the following diagram.



# 4.4 Wiring Servomotors

# 4.4.1 Terminal Symbols and Terminal Names

The SERVOPACK terminals or connectors that are required to connect the SERVOPACK to a Servomotor are given below.

Terminal/Connector Symbols	Terminal/Connector Name	Remarks
U, V, and W	Servomotor terminals	Refer to the following section for the wiring proce- dure. 3.2 Connector Wiring Procedure on page 4-13
PE	Ground terminal	-
CN2	Encoder connector	-

# 4.4.2 Pin Arrangement of Encoder Connector (CN2)

When early a notary convenience				
Pin No.	Signal Function			
1	PG5V	Encoder power supply +5 V		
2	PG0V	Encoder power supply 0 V		
3	BAT (+)*	Battery for absolute encoder (+)		
4	BAT (-)*	Battery for absolute encoder (-)		
5	PS	Serial data (+)		
6	/PS	Serial data (-)		
Shell	Shield	-		

### • When Using a Rotary Servomotor

\* You do not need to wire these pins for an incremental encoder.

#### • When Using a Linear Servomotor

Pin No.	Signal	Function	
1	PG5V	Linear encoder power supply +5 V	
2	PG0V	Linear encoder power supply 0 V	
3	-	– (Do not use.)	
4	-	– (Do not use.)	
5	PS	Serial data (+)	
6	/PS	Serial data (-)	
Shell	Shield	-	

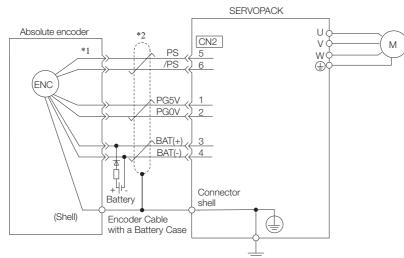
# 4.4.3 Wiring the SERVOPACK to the Encoder

# When Using an Absolute Encoder

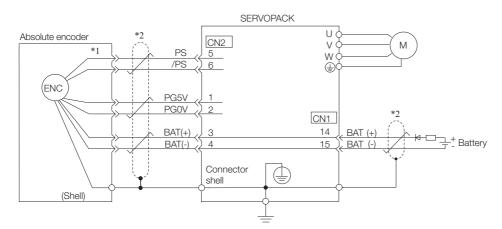
If you use an absolute encoder, use an Encoder Cable with a JUSP-BA01-E Battery Case or install a battery on the host controller.

Refer to the following section for the battery replacement procedure. *13.1.3 Replacing the Battery* on page 13-3

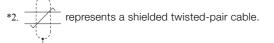
• Wiring Example When Using an Encoder Cable with a Battery Case



- \*1. The absolute encoder pin numbers for wiring the connector depend on the Servomotor that you use.
- \*2. represents a shielded twisted-pair cable.
- Wiring Example When Installing a Battery on the Host Controller

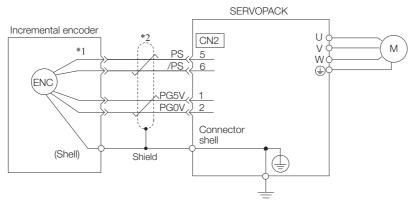


\*1. The absolute encoder pin numbers for wiring the connector depend on the Servomotor that you use.



Use the Encoder Cable with Refer to the catalog for detain Important • When Installing a Battery or	<ul> <li>When Installing a Battery on the Encoder Cable Use the Encoder Cable with a Battery Case that is specified by Yaskawa. Refer to the catalog for details.</li> <li>When Installing a Battery on the Host Controller Insert a diode near the battery to prevent reverse current flow.</li> </ul>			
Circuit Example	Required Component Specifications • Schottky Diode Reverse Voltage: $Vr \ge 40 V$ Forward Voltage: $Vf \le 0.37 V$ Reverse current: $Ir \le 5 \mu A$ Junction temperature: $Tj \ge 125^{\circ}C$	• Resistor Resistance: 22 $\Omega$ Tolerance: $\pm 5\%$ max. Rated power: 0.25 W min.		

# When Using an Incremental Encoder



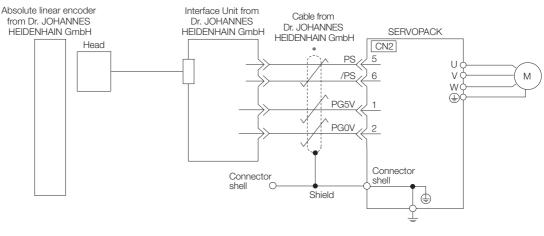
\*1. The incremental encoder pin numbers for wiring the connector depend on the Servomotor that you use.

\*2. represents a shielded twisted-pair cable.

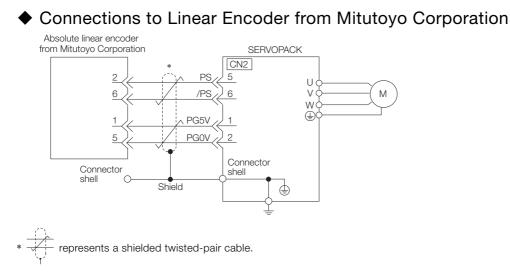
# When Using an Absolute Linear Encoder

The wiring depends on the manufacturer of the linear encoder.

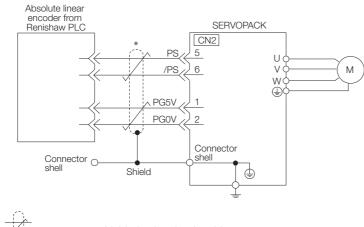
### Connections to Linear Encoder from Dr. JOHANNES HEIDENHAIN GmbH



represents a shielded twisted-pair cable.

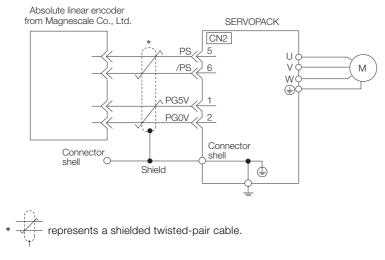


### Connections to Absolute Linear Encoder from Renishaw PLC

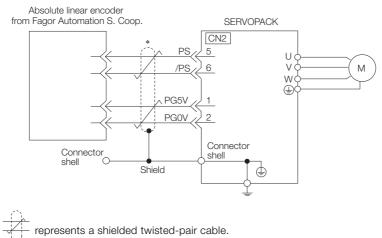


represents a shielded twisted-pair cable.

### Connections to Absolute Linear Encoder from Magnescale Co., Ltd.



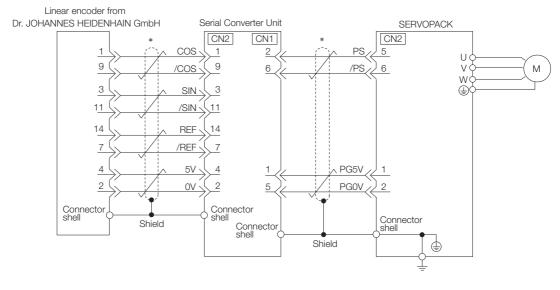
 Connections to Absolute Linear Encoder from Fagor Automation S. Coop.



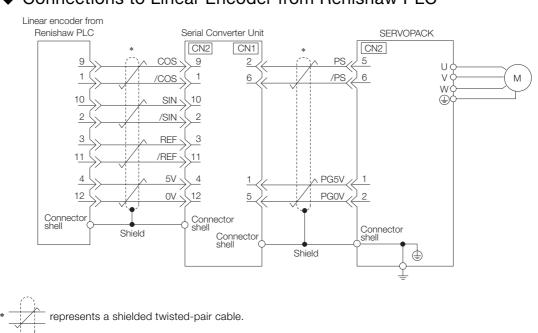
# When Using an Incremental Linear Encoder

The wiring depends on the manufacturer of the linear encoder.

 Connections to Linear Encoder from Dr. JOHANNES HEIDENHAIN GmbH

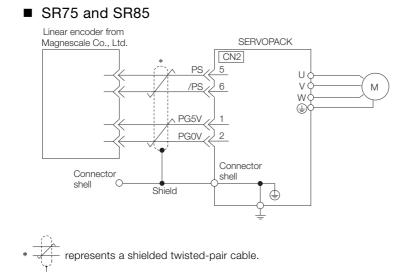


\* represents a shielded twisted-pair cable.



### ◆ Connections to Linear Encoder from Magnescale Co., Ltd.

If you use a linear encoder from Magnescale Co., Ltd., the wiring will depend on the model of the linear encoder.



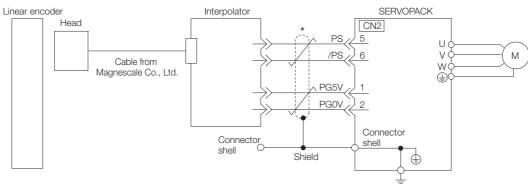
# Connections to Linear Encoder from Renishaw PLC

### SL700, SL710, SL720, SL730, and SQ10

• PL101-RY, MQ10-FLA, or MQ10-GLA Interpolator The following table gives the linear encoder and Interpolator combinations.

Linear Encoder Model	Interpolator Model
SL700, SL710, SL720, and SL730	PL101-RY*1
SQ10	MQ10-FLA*2
3010	MQ10-GLA*2

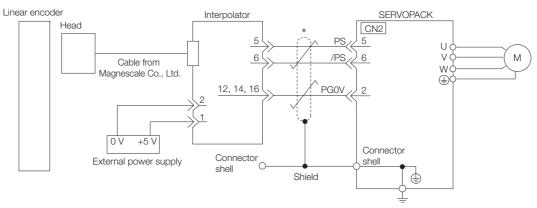
- \*1. This is the model of the Head with Interpolator.
- \*2. This is the model of the Interpolator.



\*  $\overbrace{\uparrow}^{\uparrow}$  represents a shielded twisted-pair cable.

### ■ SL700, SL710, SL720, and SL730

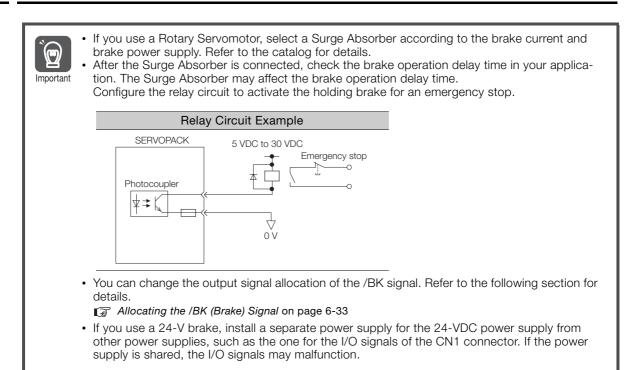
• MJ620-T13 Interpolator



\*  $\underbrace{}_{1}^{1}$  represents a shielded twisted-pair cable.

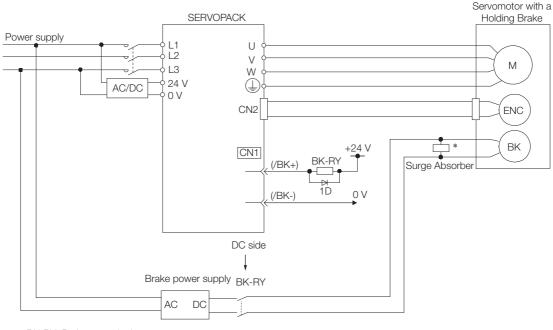
4.4.4 Wiring the SERVOPACK to the Holding Brake

# 4.4.4 Wiring the SERVOPACK to the Holding Brake



### SERVOPACKs without Built-in Servomotor Brake Control

A wiring example for SERVOPACKs without built-in Servomotor brake control is provided below.



BK-RY: Brake control relay 1D: Flywheel diode

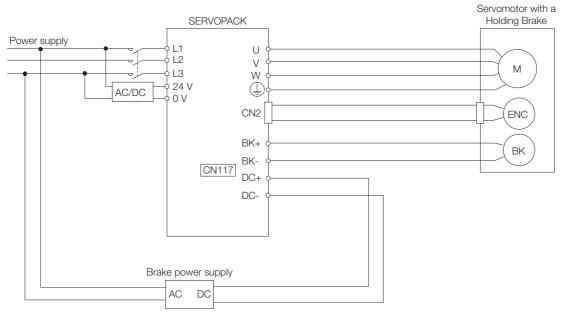
\* Install the Surge Absorber near the brake terminals on the Servomotor.

4.4.4 Wiring the SERVOPACK to the Holding Brake

# SERVOPACKs with Built-in Servomotor Brake Control

SERVOPACKs with built-in brake control contain a brake relay.

The wiring is different because of the built-in brake relays. The following figure shows a wiring example.



#### Connector Specifications

Connector No.	Model	Number of Pins	Manufacturer
CN117	BLF 5.08HC/04/180LR SN BK BX SO	4	Weidmüller Interface GmbH & Co. KG

### Built-in Brake Relay Specifications

The specifications of the built-in brake relay are as follows:

- Service life (number of operations): 30,000 operations
- Allowable number of operations: 30 operations per minute max.

4.5.1 I/O Signal Connector (CN1) Names and Functions

# 4.5 I/O Signal Connections

# 4.5.1 I/O Signal Connector (CN1) Names and Functions

The following table gives the pin numbers, names, and functions the I/O signal pins for the default settings.

## **Input Signals**

Default settings are given in parentheses.

Signal	Pin No.	Name	Function	Reference
/SI1* (P-OT)	7	General-purpose Sequence Input 1 (For- ward Drive Prohibit Input)	You can allocate the input signal to use with a parameter. (Stops Servomotor drive (to prevent over-	
/SI2* (N-OT)	8	General-purpose Sequence Input 2 (Reverse Drive Prohibit Input)	travel) when the moving part of the machine exceeds the range of move- ment.)	page 6-27
/SI3* (/DEC)	9	General-purpose Sequence Input 3 (Ori- gin Return Deceleration Switch Input)You can allocate the input signal to use with a parameter. (Connects the deceleration limit switch for origin return.)		-
/SI4* (/EXT1)	10	General-purpose Sequence Input 4 (Exter- nal Latch Input 1)		
/SI5* (/EXT2)	11	General-purpose Sequence Input 5 (Exter- nal Latch Input 2)	You can allocate the input signals to use with parameters. (Connect the external signals that latch the current feedback pulse counter.)	-
/SI6* (/EXT3)	12	General-purpose Sequence Input 6 (Exter- nal Latch Input 3)		
/SI0*	13	General-purpose Sequence Input 0 You can allocate the input signal to with a parameter. (Used for general-purpose input. Yo monitor this signal in the I/O monito of MECHATROLINK.)		_
+24VIN	6	Sequence Input Signal Power Supply Input	Inputs the sequence input signal power supply. Allowable voltage range: 24 VDC ±20% The 24-VDC power supply is not provided by Yaskawa.	-
BAT+	14	Battery for Absolute Encoder (+)	These are the pins to connect the abso- lute encoder backup battery.	
BAT-	15	Battery for Absolute Encoder (-)	Do not connect these pins if you use the Encoder Cable with a Battery Case.	_
ТН	5	Overheat ProtectionInputs the overheat protection signal from a Linear Servomotor or from a sensor attached to the machine		page 7-68

\* You can change the allocations. Refer to the following section for details.

7.1.1 Input Signal Allocations on page 7-4

Note: If forward drive prohibition or reverse drive prohibition is used, the SERVOPACK is stopped by software controls. If the application does not satisfy the safety requirements, add external safety circuits as required.

#### 4.5.1 I/O Signal Connector (CN1) Names and Functions

# **Output Signals**

Default settings are given in parentheses.

Signal	Pin No.	Name	Function	Reference
ALM+	3	Sonia Alarm Output	Turne OFF (opene) when an error is detected	page 7-8
ALM-	4	Servo Alarm Output	Turns OFF (opens) when an error is detected.	
/SO1+* (/BK+)	1	General-purpose Sequence Output 1	You can allocate the output signal to use with a parameter.	page 6-32
/SO1-* (/BK-)	2	(Brake Output)	(Controls the brake. The brake is released when the signal turns ON (closes).)	
/SO2+*	23	General-purpose		_
/SO2-*	24	Sequence Output 2		
/SO3+*	25	General-purpose	Used for general-purpose outputs. Set the parameters to allocate functions.	
/SO3-*	26	Sequence Output 3		
/SO4+*	27	General-purpose		
/SO4-*	28	Sequence Output 4		
/SO5+*	29	General-purpose		
/SO5-*	30	Sequence Output 5		
PAO	17	Encoder Divided Pulse		page 7-33 page 7-42
/PAO	18	Output, Phase A	Output the encoder divided pulse output signals with a 90° phase differential.	
PBO	19	Encoder Divided Pulse		
/PBO	20	Output, Phase B		
PCO	21	Encoder Divided Pulse	Outputs the origin signal once every encoder	
/PCO	22	Output, Phase C	rotation.	
SG	16	Signal ground	This is the 0-V signal for the control circuits.	-

 $\ast$  You can change the allocations. Refer to the following section for details.

(3 7.1.2 Output Signal Allocations on page 7-6

4.5.2 I/O Signal Connector (CN1) Pin Arrangement

# 4.5.2 I/O Signal Connector (CN1) Pin Arrangement

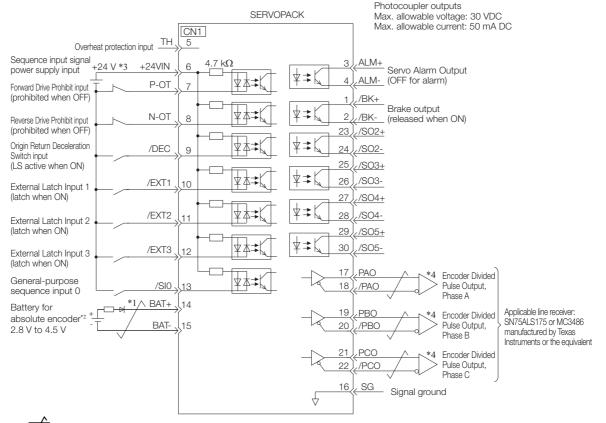
The following figure gives the pin arrangement of the of the I/O signal connector (CN1) for the default settings.

	No	Signal	Specification	No	Signal	Specification
Pin	15	PG BAT-	Battery for absolute encoder (-)	30	/SO5-	General-purpose sequence output 5
	14	PG BAT+	Battery for absolute encoder (+)	29	/SO5+	General-purpose sequence output 5
Pin 000 Pin 200	13	/SI0	General-purpose sequence input 0	28	/SO4-	General-purpose sequence output 4
2 17 17 Pin Pin	12	/SI6 (/EXT3)	General-purpose sequence input 6	27	/SO4+	General-purpose sequence output 4
1 16 Top View of I/O Signal Connector	11	/SI5 (/EXT2)	General-purpose sequence input 5	26	/SO3-	General-purpose sequence output 3
	10	/SI4 (/EXT1)	General-purpose sequence input 4	25	/SO3+	General-purpose sequence output 3
Side View of I/O	9	/SI3 (/DEC)	General-purpose sequence input 3	24	/SO2-	General-purpose sequence output 2
	8	/SI2 (N-OT)	General-purpose sequence input 2	23	/SO2+	General-purpose sequence output 2
Signal Connector	7	/SI1 (P-OT)	General-purpose sequence input 1	22	/PCO	Encoder divided pulse output, phase C
	6	+24VIN	Sequence input signal power supply input	21	PCO	Encoder divided pulse output, phase C
	5	тн	Overheat protection input	20	/PBO	Encoder divided pulse output, phase B
	4	ALM-	Servo alarm output	19	РВО	Encoder divided pulse output, phase B
	3	ALM+	Servo alarm output	18	/PAO	Encoder divided pulse output, phase A
	2	/SO1- (/BK-)	General-purpose sequence output 1	17	PAO	Encoder divided pulse output, phase A
	1	/SO1+ (/BK+)	General-purpose sequence output 1	16	SG	Signal ground

#### 4.5.3 I/O Signal Wiring Examples

# 4.5.3 I/O Signal Wiring Examples

## Using a Rotary Servomotor



- \*1.  $\overline{/}$  represents twisted-pair wires.
- \*2. Connect these when using an absolute encoder. If the Encoder Cable with a Battery Case is connected, do not connect a backup battery.
- \*3. The 24-VDC power supply is not provided by Yaskawa. Use a 24-VDC power supply with double insulation or reinforced insulation.
- \*4. Always use line receivers to receive the output signals.
- Note: 1. You can use parameters to change the functions allocated to the /DEC, P-OT, N-OT, /EXT1, /EXT2, and /EXT3 input signals and the /SO1, /SO2, /SO3, /SO4, and /SO5 output signals. Refer to the following section for details.

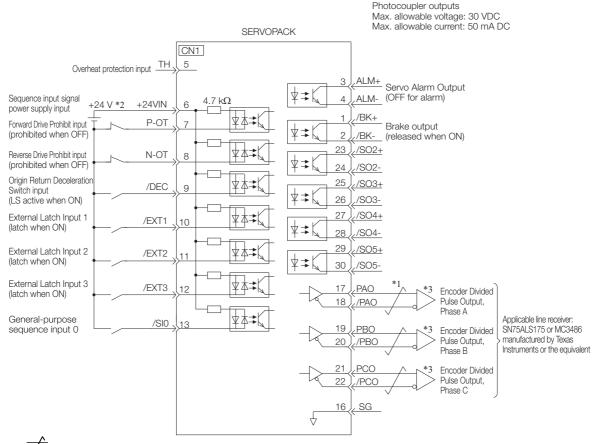
#### 7.1 I/O Signal Allocations on page 7-4

2. If you use a 24-V brake, install a separate power supply for the 24-VDC power supply from other power supplies, such as the one for the I/O signals of the CN1 connector.

If the power supply is shared, the I/O signals may malfunction.

4.5.3 I/O Signal Wiring Examples

# Using a Linear Servomotor



\*1. / represents twisted-pair wires.

\*2. The 24-VDC power supply is not provided by Yaskawa. Use a 24-VDC power supply with double insulation or reinforced insulation.

\*3. Always use line receivers to receive the output signals.

Note: 1. You can use parameters to change the functions allocated to the /DEC, P-OT, N-OT, /EXT1, /EXT2, and /EXT3 input signals and the /SO1, /SO2, /SO3, /SO4, and /SO5 output signals. Refer to the following section for details.

#### 7.1 I/O Signal Allocations on page 7-4

2. If you use a 24-V brake, install a separate power supply for the 24-VDC power supply from other power supplies, such as the one for the I/O signals of the CN1 connector. If the power supply is shared, the I/O signals may malfunction.

SERVOPACK

 $4.7~\mathrm{k}\Omega$ 

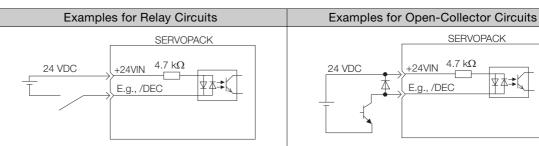
#### **I/O Circuits** 4.5.4

## **Sequence Input Circuits**

### Photocoupler Input Circuits

OFF

This section describes CN1 connector terminals 6 to 13.

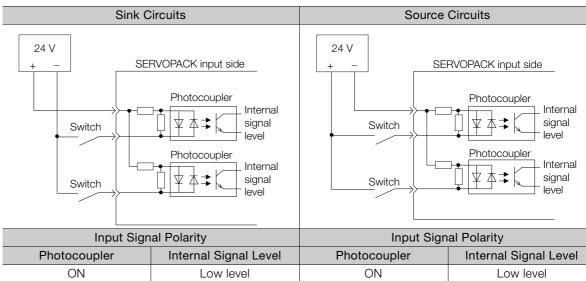


High level

Note: The 24-VDC external power supply capacity must be 50 mA minimum.

The SERVOPACK input circuits use bidirectional photocouplers. Select either a sink circuit or source circuit according to the specifications required by the machine.

Note: The connection examples in 4.5.3 I/O Signal Wiring Examples on page 4-31 are for sink circuit connections.



OFF

4

High level

0

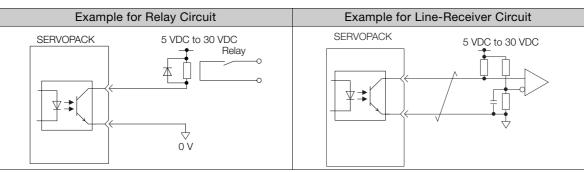
# **Sequence Output Circuits**

Incorrect wiring or incorrect voltage application to the output circuits may cause short-circuit failures.

If a short-circuit failure occurs as a result of any of these causes, the holding brake will not work. Important This could damage the machine or cause an accident that may result in death or injury.

### Photocoupler Output Circuits

Photocoupler output circuits are used for the ALM (Servo Alarm), /S-RDY (Servo Ready), and other sequence output signals. Connect a photocoupler output circuit to a relay or line-receiver circuit.



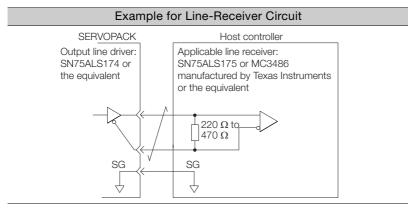
Note: The maximum allowable voltage and current range for photocoupler output circuits are as follows:

- Maximum allowable voltage: 30 VDC
- Current range: 5 mA to 50 mA DC

### Line-Driver Output Circuits

This section describes CN1 connector terminals 17-18 (Phase-A Signal), 19-20 (Phase-B Signal), and 21-22 (Phase-C Signal).

The serial data from the encoder is converted to two-phase (phases A and B) pulses. The resulting output signals (PAO, /PAO and PBO, /PBO), origin pulse signal (PCO and /PCO), and the absolute encoder position output signals (PSO and /PSO) are output with line-driver output circuits. Connect the line-driver output circuits to line-receiver circuits at the host controller.



4.6.1 Pin Arrangement of Safety Function Signals (CN8)

# 4.6 Connecting Safety Function Signals

This section describes the wiring required to use a safety function. Refer to the following chapter for details on the safety function. *Chapter 12 Safety Functions* 

# 4.6.1 Pin Arrangement of Safety Function Signals (CN8)

Pin No.	Signal	Name	Function		
1	-	– (Do not use these pins because they	are connected to internal circuite )		
2	-	- (Do not use these pins because they	are connected to internal circuits.)		
3	/HWBB1-	Hard Wire Base Block Input 1			
4	/HWBB1+	That whe base block input i	For a hard wire base block input. The base block (motor power turned OFF) is		
5	/HWBB2-	Hard Wire Rose Plack Input 2	in effect when the signal is OFF.		
6	/HWBB2+	Hard Wire Base Block Input 2			
7	EDM1-	External Device Monitor Output	Turns ON when the /HWBB1 and the /HWBB2 signals are input and the SEF VOPACK enters a base block state.		
8	EDM1+				

# 4.6.2 I/O Circuits

Important

For safety function signal connections, the input signal is the 0-V common and the output signal is a source output. This is opposite to other signals described in this manual.

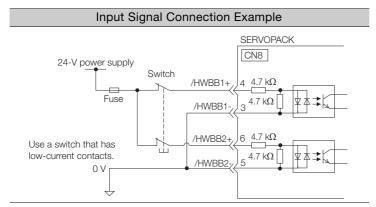
To avoid confusion, the ON and OFF status of signals for the safety function are defined as follows:

ON: The state in which the relay contacts are closed or the transistor is ON and current flows into the signal line.

OFF: The state in which the relay contacts are open or the transistor is OFF and no current flows into the signal line.

# Safety Input Circuits

Use a 0-V common to connect the safety function signals. You must connect redundant input signals.



### 4.6.2 I/O Circuits

### ◆ Input (HWBB) Signal Specifications

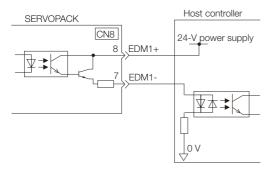
Туре	Signal	Connector Pin No.	Status	Meaning	
laguta	/HWBB1	CN8-4 CN8-3	ON (closed)	Does not activate the HWBB (normal operation).	
			OFF (open)	Activates the HWBB (motor current shut-OFF request).	
Inputs		CN8-6	ON (closed)	Does not activate the HWBB (normal operation).	
		/HWBB2	CN8-5	OFF (open)	Activates the HWBB (motor current shut-OFF request).

The input (HWBB) signals have the following electrical characteristics.

Item	Characteristics	Remarks
Internal Impedance	4.7 kΩ	-
Operating Voltage Range	+24 V ±20%	-
Maximum Delay Time	8 ms	Time from /HWBB1 and /HWBB2 signals turning OFF until HWBB is activated

# **Diagnostic Output Circuits**

The EDM1 output signal uses a source circuit. The following figure shows a connection example.



# EDM1 Output Signal Specifications

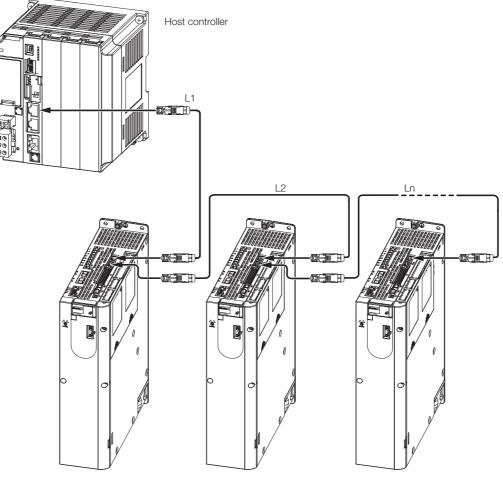
Туре	Signal	Pin No.	Output Status	Meaning
Output ED		CN8-8	ON	Both the /HWBB1 and /HWBB2 signals are operat- ing normally.
		CN8-7	OFF	The /HWBB1 signal, the /HWBB2 signal, or both are not operating.

The electrical characteristics of the EDM1 signal are as follows:

Item	Characteristics	Remarks
Maximum Allowable Voltage	30 VDC	-
Maximum Allowable Current	50 mA DC	-
Maximum ON Voltage Drop	1.0 V	Voltage between EDM1+ and EDM1- when current is 50 mA
Maximum Delay Time	8 ms	Time from a change in /HWBB1 or /HWBB2 until a change in EDM1

# 4.7 Connecting MECHATROLINK-III Communications Cables (RJ-45)

Connect the MECHATROLINK-III Communications Cables to the CN6A and CN6B connectors.



Note: The length of the cable between stations (L1, L2, ... Ln) must be 50 m or less.

Use the cables specified in the selection table for the MECHATROLINK-III Communications Cables (RJ-45). The maximum cable lengths are as follows:

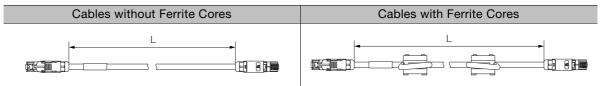
- Cables with Connectors on Both Ends and No Ferrite Cores: 30 m
- Cables with Connectors on Both Ends and Ferrite Cores: 50 m

# **Selection Table**

Туре	Length (L)	Order Number*	Inquiries
Cables with Connectors on Both Ends and No Ferrite Cores	0.2 m, 0.5 m, 1 m, 2 m, 3 m, 4 m, 5 m, 10 m, 20 m, and 30 m	JZSP-CM3RR00-□□-E (□□: 00P2/00P5/01/02/03/ 04/05/10/20/30)	Yaskawa Controls
Cables with Connectors on Both Ends and Ferrite Cores	10 m, 20 m, 30 m, and 50 m	JZSP-CM3RR01-□□-E (□□: 10/20/30/50)	Co., Ltd.

\* Replace the boxes ( $\Box\Box$ ) in the order number with the code for the cable length.

# **External Dimensions**



Λ

4.8.1 Serial Communications Connector (CN3)

## 4.8 Connecting the Other Connectors

## 4.8.1 Serial Communications Connector (CN3)

To use a Digital Operator or to connect a computer with an RS-422 cable, connect CN3 on the SERVOPACK.

Refer to the following manual for the operating procedures for the Digital Operator.  $\square \Sigma$ -7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)

## 4.8.2 Computer Connector (CN7)

To use the SigmaWin+ Engineering Tool, connect the computer on which the SigmaWin+ is installed to CN7 on the SERVOPACK.

Refer to the following manual for the operating procedures for the SigmaWin+.



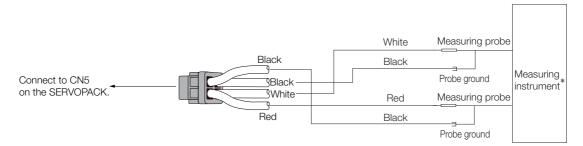
Use the Yaskawa-specified cables. Operation will not be dependable due to low noise resistance with any other cable.

Refer to the catalog for details on the Computer Cable.

## 4.8.3 Analog Monitor Connector (CN5)

To use an analog monitor, connect CN5 on the SERVOPACK.

• Wiring Example



\* The measuring instrument is not provided by Yaskawa.

Refer to the following section for information on the monitoring methods for an analog monitor. 10.3 Monitoring Machine Operation Status and Signal Waveforms on page 10-6

# Wiring and Settings for the Dynamic Brake

5

This chapter provides information on wiring and settings when using a dynamic brake with the SERVOPACK.

5.1	Introd	uction to the Dynamic Brake5-2
	5.1.1 5.1.2	SERVOPACK Models with a Built-In Dynamic Brake
5.2	SERVO	PACK Models with a Built-In Dynamic Brake5-3
	5.2.1 5.2.2 5.2.3 5.2.4	Using the Dynamic Brake
5.3	SERVO	PACK Models without a Built-In Dynamic Brake 5-10
	5.3.1 5.3.2 5.3.3 5.3.4	Using the Dynamic Brake
5.4	Coast	ing Distances for Dynamic Braking 5-18
	5.4.1 5.4.2	Coasting Distance during Dynamic Braking 5-18 Data for Calculating Coasting Distance 5-19

5.1.1 SERVOPACK Models with a Built-In Dynamic Brake

## 5.1 Introduction to the Dynamic Brake

Dynamic braking is a method in which the kinetic energy of the Servomotor is converted to electrical energy, and then this energy is consumed as thermal energy with a resistor to brake the motor.

The smaller the resistance of the Dynamic Brake Resistor, the faster the Servomotor can be stopped and the shorter the coasting distance will be. However, the larger the resistance of the Dynamic Brake Resistor, the more time will be required to stop the Servomotor and the longer the coasting distance will be.

Refer to the following section for details on the coasting distance. 5.4 Coasting Distances for Dynamic Braking on page 5-18



**Coasting Distance** 

During dynamic braking, the Servomotor rotates due to inertia until the electrical energy is consumed. The travel distance at this time is called the coasting distance.

Dynamic braking can be used when an alarm occurs, when the servo is turned OFF, during an emergency stop, and when overtravel occurs by setting  $Pn001 = n.\Box\Box\BoxX$  (Motor Stopping Method for Servo OFF and Group 1 Alarms) to 0 or 1.

Parameter		Meaning	When Enabled	Classification	
Pn001	n.□□□0 (default setting)	Stop the motor by applying the dynamic brake.			
	n.0001	Stop the motor by the applying dynamic brake and then release the dynamic brake.	After restart	Setup	
	n.0002	Coast the motor to a stop without the dynamic brake.			

SERVOPACKs are available as models with a built-in dynamic brake (SGD7S-1R9D to 170D) and models without a built-in dynamic brake (SGD7S-210D to 370D).

## 5.1.1 SERVOPACK Models with a Built-In Dynamic Brake

SGD7S-1R9D to 170D SERVOPACKs are equipped with the built-in circuit required to use the dynamic brake. A Dynamic Brake Resistor is not required when operating the SERVOPACK within its rated range. However, an External Dynamic Brake Resistor must be connected to the SERVOPACK to operate the SERVOPACK in the following manner.

- When specifying the brake torque when stopping with the dynamic brake.
- When operating with a load moment of inertia that exceeds the rating.

Refer to the following section for how to connect the Dynamic Brake Resistor to the SERVO-PACK.

5.2.3 Connecting Dynamic Brake Resistors on page 5-7

## 5.1.2 SERVOPACK Models without a Built-In Dynamic Brake

SGD7S-210D to 370D SERVOPACKs are not equipped with a built-in dynamic brake.

To use dynamic braking, you must select the Resistor, create the circuit, and set the parameters.

Refer to the following section for details on the dynamic brake circuit.

5.3.3 Wiring the Dynamic Brake Circuit on page 5-15

Refer to the following section for details on selecting the Dynamic Brake Resistor.

5.3.2 Selecting the Devices Required for the Dynamic Brake Circuit on page 5-12

Refer to the following section for details on parameter settings for the dynamic brake. 5.3.4 Parameter Settings for the Dynamic Brake Circuit on page 5-16

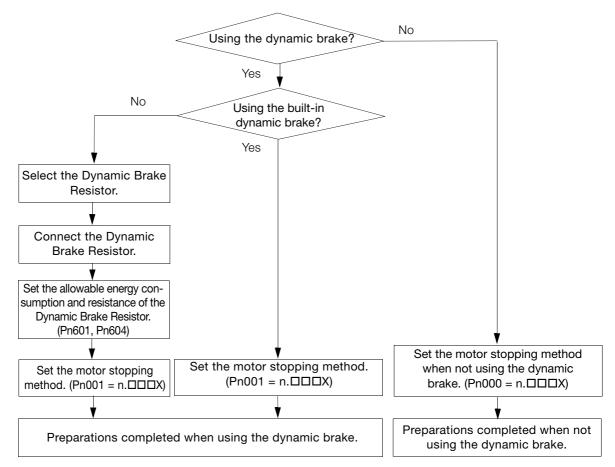
5.2.1 Using the Dynamic Brake

## 5.2 SERVOPACK Models with a Built-In Dynamic Brake

This section describes how to use the SERVOPACKs (SGD7S-1R9D to 170D) equipped with a built-in dynamic brake.

## 5.2.1 Using the Dynamic Brake

When using the SGD7S-1R9D to 170D, set up the SERVOPACK according to the following flowchart.



5.2.2 Selecting the Dynamic Brake Resistor

## Setting When Not Using Dynamic Braking

When not using dynamic braking, set  $Pn001 = n.\Box\Box\BoxX$  (Motor Stopping Method for Servo OFF and Group 1 Alarms) to 2.

Parameter		Meaning	When Enabled	Classification
Pn001	n.□□□0 (default setting)	Stop the motor by applying the dynamic brake.		Setup
	n.0001	Stop the motor by the applying dynamic brake and then release the dynamic brake.	After restart	
	n.0002	Coast the motor to a stop without the dynamic brake.		

## Setting When Using Dynamic Braking

When using dynamic braking, set  $Pn001 = n.\Box\Box\BoxX$  (Motor Stopping Method for Servo OFF and Group 1 Alarms) to 0 or 1.

You must complete the following items to use the dynamic brake.

- Selecting the Dynamic Brake Resistor 5.2.2 Selecting the Dynamic Brake Resistor on page 5-4
- Connecting the Dynamic Brake Resistor [] 5.2.3 Connecting Dynamic Brake Resistors on page 5-7
- Parameter Settings for the Dynamic Brake
   5.2.4 Setting the Energy Consumption and Resistance of the Dynamic Brake Resistor on page 5-9

Note: When using the dynamic brake built into the SERVOPACK, you do not need to connect a Dynamic Brake Resistor.

## 5.2.2 Selecting the Dynamic Brake Resistor

This section describes the selection of the Dynamic Brake Resistor.

To select the Dynamic Brake Resistor, you must calculate the resistance and energy consumption for the specifications of the machine.

## 

- Do not use dynamic braking for any application other than an emergency stop. There is a risk of failure due to rapid deterioration of elements in the SERVOPACK and the risk of unexpected operation, machine damage, burning, or injury.
- Use a Dynamic Brake Resistor matched to the specifications of the machine. There is a risk of unexpected operation, machine damage, burning, or injury.
- When using dynamic braking, implement suitable safety measures on the machine. There is a risk of unexpected operation, machine damage, burning, or injury.
- In situation where the motor will be rotated from the machine after it has been stopped, set the SERVOPACK to coast to stop instead of using dynamic braking. There is a risk of burning in the equipment, damage to the machine, or injury.

## Resistance

Based on the characteristic graphs of the Servomotor that will be used, you must determine the resistance that can satisfy the limit of instantaneous maximum brake torque.

## 

• Do not select a resistor with resistance less than the minimum allowable resistance. There is a risk of burning in the SERVOPACK or Servomotor, damage to the machine, or injury.

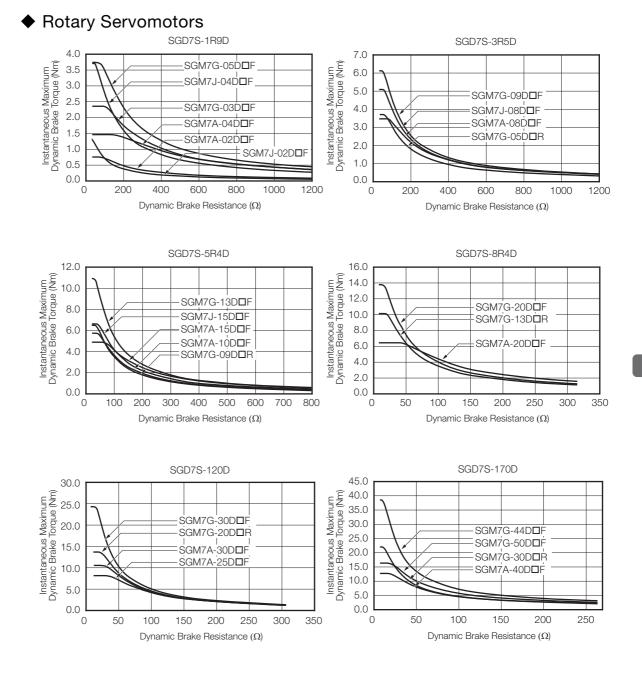
5.2.2 Selecting the Dynamic Brake Resistor

If it is not necessary to reduce the brake torque, select a Dynamic Brake Resistor with the following resistance.

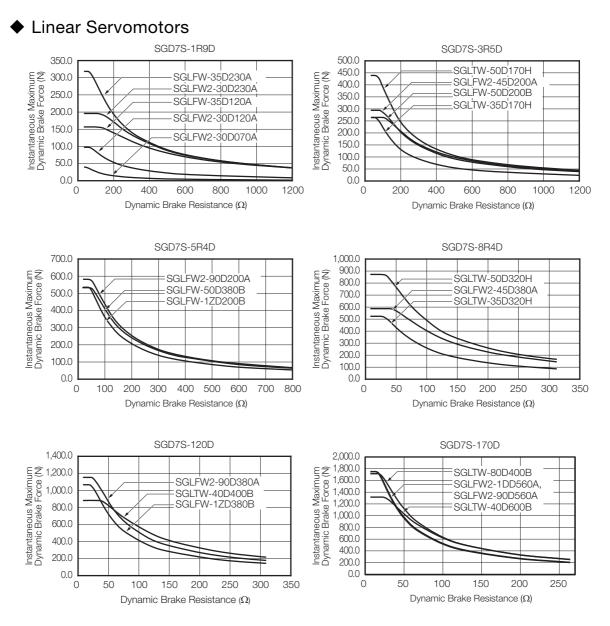
Мо	Minimum Allowable Resis- tance (±5%)	
	-1R9D, -3R5D	30 Ω
SGD7S	-5R4D	20 Ω
30073	-8R4D, -120D	7.8 Ω
	-170D	6.6 Ω

If it is necessary to reduce the brake torque, determine the resistance based on the characteristic graphs.

The following graphs show the relationship between the instantaneous maximum brake torque of the Servomotor and the resistance of the dynamic brake.



#### 5.2.2 Selecting the Dynamic Brake Resistor



#### Energy Consumption of the Dynamic Brake Resistor

Calculate the energy consumption required to stop the Servomotor using the Dynamic Brake Resistor.

To simplify the calculation of energy consumption, assume that all kinetic energy until the Servomotor stops is consumed by the Dynamic Brake Resistor and calculate energy consumption with the following formula.

Calculate energy consumption at the maximum value of kinetic energy of the Servomotor out of all anticipated operation patterns.

#### Rotary Servomotors

Energy consumption of Dynamic Brake Resistor:  ${\ensuremath{\scriptscriptstyle \mathsf{E}_{\mathsf{DB}}}}\left[J\right]$ 

Motor moment of inertia: J<sub>M</sub> [kg·m<sup>2</sup>]

Load moment of inertia: JL [kg·m<sup>2</sup>]

Motor speed before dynamic braking: N [min<sup>-1</sup>]

 $E_{DB} = 1/2 \times (J_M + J_L) \times (2\pi N/60)^2$ 

Note: Refer to the catalog or product manual of the Servomotor for details on the motor moment of inertia.

5.2.3 Connecting Dynamic Brake Resistors

#### Linear Servomotors

Energy consumption of Dynamic Brake Resistor:  ${\ensuremath{\scriptscriptstyle\mathsf{E}_{\text{DB}}}}[J]$ 

Moving Coil mass:  $M_M$  [kg]

Load mass:  $M_L$  [kg]

Movement speed before dynamic braking: V [m/s]

 $E_{DB} = 1/2 \times (M_M + M_L) \times V^2$ 

Note: Refer to the catalog or product manual of the Servomotor for details on the Moving Coil mass.

#### Specifications of the Dynamic Brake Resistor

Have the following specifications ready when purchasing the Dynamic Brake Resistor. In the blank cells of the table, write down the specifications of the Dynamic Brake Resistor that you are considering for purchase, and confirm these specifications with the manufacturer of the Resistor.

Item	Specification
Resistance (Ω)	
Energy consumption of resistor from dynamic braking (J)	
Number of operations of the dynamic brake (Number of times the dynamic brake will be used in the service life of the machine (reference data))	
Wire size	AWG14 (2.0 mm <sup>2</sup> ) to AWG18 (0.9 mm <sup>2</sup> )

## 5.2.3 Connecting Dynamic Brake Resistors

A connector or terminal block is used to wire a Dynamic Brake Resistor.

This section describes the connection of the Dynamic Brake Resistor to a SERVOPACK with a built-in dynamic brake (SGD7S-1R9D to 170D).

## **Terminal Symbols and Terminal Names**

## 

• Wire all connections correctly according to the following table.

There is a risk of SERVOPACK failure or fire if incorrect wiring is performed.

SERVOPACK Model	Terminal Symbols	Terminal Name	Specification
SGD7S-1R9D, -3R5D, -5R4D, -8R4D, -120D, -170D	D1, D2	Dynamic Brake Resis- tor terminals	These terminals are connected to an External Dynamic Brake Resistor.

Note: The SGD7S-210D to 370D are not equipped with a connection terminal for a Dynamic Brake Resistor.

## Connecting a Dynamic Brake Resistor



• Wire the Dynamic Brake Resistor correctly. Do not connect the following terminals directly to each other: D1 and D2.

There is a risk of burning in the SERVOPACK or Servomotor, damage to the machine, or injury.

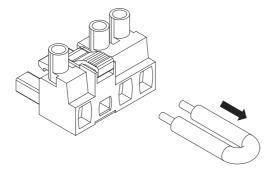
#### 5.2.3 Connecting Dynamic Brake Resistors



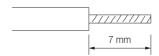
#### · Required Items

Required Item	Remarks
Phillips or flat-blade screwdriver	Commercially available screwdriver with a tip thickness of 0.6 mm and tip width of 3.5 mm

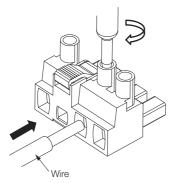
- 1. Prepare the connector that is provided with the SERVOPACK.
- 2. Remove the lead wire from between D2 and D3.



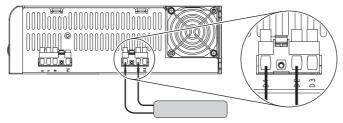
3. Remove the sheath from the wire to connect.



- 4. Open the wire insertion hole on the terminal connector with the screwdriver.
- 5. Insert the conductor of the wire into the wire insertion hole. After you insert the conductor, remove the screwdriver.



- 6. Connect the Dynamic Brake Resistor to the D1 and D2 terminals on the SERVOPACK.
  - Note: 1. The D1 and D2 are in the locations shown in the following figure. Do not connect anything to the D3 terminal.
    - 2. Terminal labels (D1 and D2) are provided on the Dynamic Brake Resistor connector.



5.2.4 Setting the Energy Consumption and Resistance of the Dynamic Brake Resistor

7. Set Pn601 (Dynamic Brake Resistor Allowable Energy Consumption) and Pn604 (Dynamic Brake Resistance).

Refer to the following section for details on the settings.

3-5.2.4 Setting the Energy Consumption and Resistance of the Dynamic Brake Resistor on page 5-9

# 5.2.4 Setting the Energy Consumption and Resistance of the Dynamic Brake Resistor

If an External Dynamic Brake Resistor is connected, you must set Pn601 (Dynamic Brake Resistor Allowable Energy Consumption) and Pn604 (Dynamic Brake Resistance).

## 

- If you connect an External Dynamic Brake Resistor, set Pn601 and Pn604 to suitable values. Failure to set these parameters will cause an A.730 alarm (Dynamic Brake Overload) to be detected incorrectly and can destroy the External Dynamic Brake Resistor, cause unintended operation during an emergency stop, cause damage to the machine, and cause burning or injury.
- When you select an External Dynamic Brake Resistor, make sure that it has a suitable energy consumption and resistance. There is a risk of personal injury or fire.

## 

 Mount Dynamic Brake Resistors only on nonflammable materials. Do not mount them on or near any flammable material.

There is a risk of fire.

	Dynamic Brake Res	sistor Allowable Ene	Speed Position Torque		
Pn601*1	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 65,535	10 J	0	After restart	Setup
	Dynamic Brake Resistance			Speed Position Torque	
Pn604*2	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 65,535	10 mΩ	0	After restart	Setup

\*1. SGD7S-210D to 370D SERVOPACKs require three Dynamic Brake Resistors. For this parameter setting, enter the total value of resistor capacity of the three resistors.

\*2. SGD7S-210D to 370D SERVOPACKs require three Dynamic Brake Resistors. For this parameter setting, enter the resistance of one Dynamic Brake Resistor multiplied by  $\sqrt{3}$ .

Set Pn601 to the capacity of the Dynamic Brake Resistor that you calculated when selecting the connected External Dynamic Brake Resistor or the capacity of the Resistor as reported by the manufacturer.

Refer to the following section for details on the energy consumption of the Dynamic Brake Resistor.

G ← Energy Consumption of the Dynamic Brake Resistor on page 5-6

5.3.1 Using the Dynamic Brake

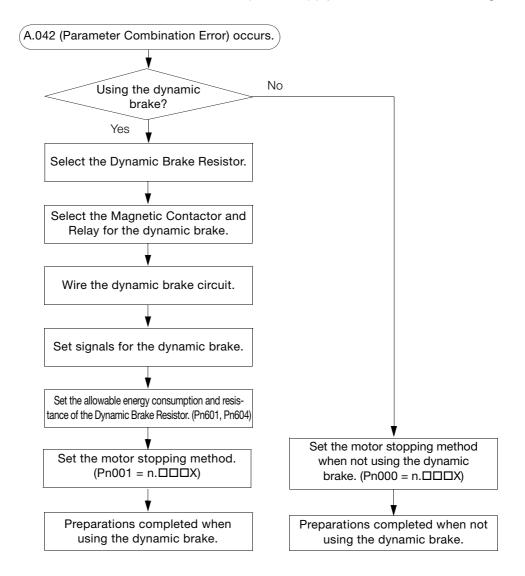
## 5.3 SERVOPACK Models without a Built-In Dynamic Brake

This section describes how to use the SERVOPACKs (SGD7S-210D to 370D) that are not equipped with a built-in dynamic brake.

### 5.3.1 Using the Dynamic Brake

The SGD7S-210D to 370D are not equipped with a built-in dynamic brake. When using the SGD7S-210D to 370D, set up the SERVOPACK according to the following flowchart.

With the SGD7S-210D to 370D, A.042 (Parameter Combination Error) will always occur when the power supply is first turned ON. This alarm occurs because the settings for the dynamic brake have not been configured. After you set the parameters according to the following flow-chart, the A.042 alarm will be reset when the power supply is turned OFF and ON again.



5.3.1 Using the Dynamic Brake

## Setting When Not Using Dynamic Braking

When not using dynamic braking, set  $Pn001 = n.\Box\Box\BoxX$  (Motor Stopping Method for Servo OFF and Group 1 Alarms) to 2.

The A.042 (Parameter Combination Error) alarm will be reset when you set  $Pn001 = n.\Box\Box\Box2$  (Coast to a stop) and turn the power supply OFF and ON again.

Parameter		Meaning	When Enabled	Classification	
	n.ロロロ0 (default setting)	Stop the motor by applying the dynamic brake.			
Pn001	n.0001	Stop the motor by the applying dynamic brake and then release the dynamic brake.		Setup	
	n.0002	Coast the motor to a stop without the dynamic brake.			

## Setting When Using Dynamic Braking

When using dynamic braking, set  $Pn001 = n.\Box\Box\BoxX$  (Motor Stopping Method for Servo OFF and Group 1 Alarms) to 0 or 1.

You must also create the dynamic brake circuit in order to perform dynamic braking. The A.042 (Parameter Combination Error) alarm will be reset when you turn the power supply OFF and ON again after the parameters for the dynamic brake circuit and stopping the Servomotor have been set.

You must complete the following items to use the dynamic brake.

- Selecting the Dynamic Brake Resistor 5.3.2 Selecting the Devices Required for the Dynamic Brake Circuit on page 5-12
- Creating the Dynamic Brake Circuit 5.3.3 Wiring the Dynamic Brake Circuit on page 5-15

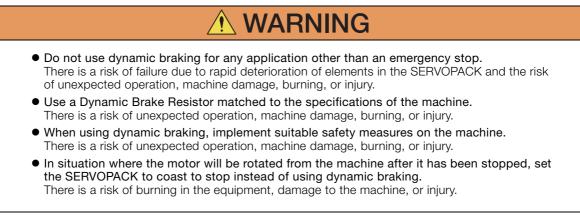
5.3.2 Selecting the Devices Required for the Dynamic Brake Circuit

## 5.3.2 Selecting the Devices Required for the Dynamic Brake Circuit

You must select the resistor, Magnetic Contactor, and relay to create the dynamic brake circuit.

### Selecting the Dynamic Brake Resistor

To select the Dynamic Brake Resistor, you must calculate the resistance and energy consumption for the specifications of the machine.



#### Resistance

Based on the characteristic graphs of the Servomotor that will be used, you must determine the resistance that can satisfy the limit of instantaneous maximum brake torque.



• Do not select a resistor with resistance less than the minimum allowable resistance. There is a risk of burning in the SERVOPACK or Servomotor, damage to the machine, or injury.

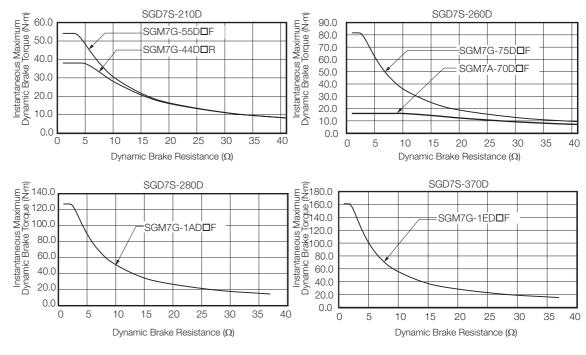
If it is not necessary to reduce the brake torque, select a Dynamic Brake Resistor with the following resistance. SGD7S-210D to 370D SERVOPACKs differ from SGD7S-1R9D to 170D in that three Dynamic Brake Resistors are required. Use resistors with the same resistance and capacity for the three Dynamic Brake Resistors. The following table gives the resistance per resistor.

Model		Minimum Allowable Resis- tance (±5%)	
SGD7S	-210D, -260D	1.1 Ω	
30073	-280D, -370D	0.95 Ω	

If it is necessary to reduce the brake torque, determine the resistance based on the characteristic graphs.

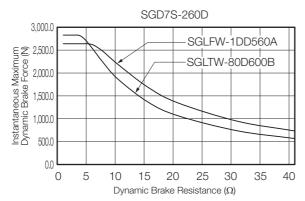
The following graphs show the relationship between the instantaneous maximum brake torque of the Servomotor and the resistance of the Dynamic Brake.

#### 5.3.2 Selecting the Devices Required for the Dynamic Brake Circuit



#### Rotary Servomotors





#### Energy Consumption of the Dynamic Brake Resistor

Calculate the energy consumption required to stop the Servomotor using the Dynamic Brake Resistor.

To simplify the calculation of energy consumption, assume that all kinetic energy until the Servomotor stops is consumed by the Dynamic Brake Resistor and calculate energy consumption with the following formula.

Calculate energy consumption at the maximum value of kinetic energy of the Servomotor out of all anticipated operation patterns.

#### Rotary Servomotors

Energy consumption of Dynamic Brake Resistor:  ${\ensuremath{\scriptscriptstyle \mathsf{E}_{\mathsf{DB}}}}\left[J\right]$ 

Motor moment of inertia: J<sub>M</sub> [kg·m<sup>2</sup>]

Load moment of inertia: JL [kg·m<sup>2</sup>]

Motor speed before dynamic braking: N [min<sup>-1</sup>]

 $E_{DB} = 1/2 \times (J_M + J_L) \times (2\pi N/60)^2$ 

Note: Refer to the catalog or product manual of the Servomotor for details on the motor moment of inertia.

#### 5.3.2 Selecting the Devices Required for the Dynamic Brake Circuit

#### Linear Servomotors

Energy consumption of Dynamic Brake Resistor:  ${\ensuremath{\scriptscriptstyle\mathsf{E}_{DB}}}[J]$ 

Moving Coil mass: M<sub>M</sub> [kg]

Load mass:  $M_L$  [kg]

Movement speed before dynamic braking: V [m/s]

 $E_{DB}=1/2\times(M_M+M_l)\times V^2$ 

Note: Refer to the catalog or product manual of the Servomotor for details on Moving Coil mass.

#### Specifications of the Dynamic Brake Resistor

Have the following specifications ready when purchasing the Dynamic Brake Resistor. In the blank cells of the table, write down the specifications of the Dynamic Brake Resistor that you are considering for purchase, and confirm these specifications with the manufacturer of the Resistor.

Item	Specification
Resistance ( $\Omega$ )	
Energy consumption of resistor from dynamic braking (J)*	
Number of operations of the dynamic brake (Number of times the dynamic brake will be used in the service life of the machine (reference data))	
Wire size	AWG14 (2.0 mm <sup>2</sup> ) to AWG18 (0.9 mm <sup>2</sup> )

\* SGD7S-210D to 370D SERVOPACKs require three Dynamic Brake Resistors. Therefore, the energy consumption required for one resistor will be one-third of the electrical energy that was calculated from the kinetic energy of the Servomotor.

## Selecting the Magnetic Contactor and Relay

The following table gives the Magnetic Contactor and relay that must be used to create the dynamic brake circuit.

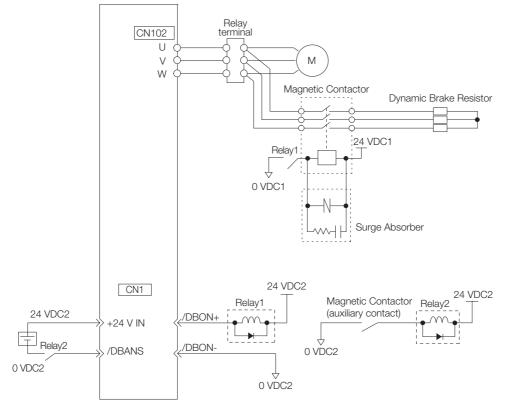
SERVOPACK Model SGD7S-	Part	Manufacturer	Manufacturer Model No.
	Magnetic Contactor	Mitsubishi Electric Cor- poration	BD-N65 (24 VDC)
210D, 260D, 280D, and	Relay	OMRON Corporation	G6B-4BND
370D		Panasonic Corporation	ERZV09D390
	Surge Absorber	Okaya Electric Indus- tries Co., Ltd.	XEB01010

## 5.3.3 Wiring the Dynamic Brake Circuit

This section shows how to wire the dynamic brake based on a wiring example that uses the recommended parts from the following section.

Selecting the Magnetic Contactor and Relay on page 5-14

The /DBON (Dynamic Brake Operation Request Output) and /DBANS (Dynamic Brake Answer Input) signals must be allocated to sequence I/O signal terminals.



- Note: 1. Separate the 24-VDC power supply for the Magnetic Contactor from the power supply for the I/O signals (CN1). If the same power supply is used, the I/O signals may malfunction.
  - 2. The recommended relay (G6B-4BND) is a terminal relay equipped with four mini-relays. A single relay can be used for Relay1 and Relay2 in the above diagram.

5.3.4 Parameter Settings for the Dynamic Brake Circuit

## 5.3.4 Parameter Settings for the Dynamic Brake Circuit

You must set the following parameters to create the dynamic brake circuit.

Item to Set	Parameter	Reference
Allocation of /DBON (Dynamic Brake Operation Request Output) signal	Pn51A = n.□□X□	page 5-16
Allocation of /DBANS (Dynamic Brake Answer Input) signal	Pn515 = n.□X□□	page 5-16
Selection of motor stopping method	Pn001	page 5-2
Energy consumption of the Dynamic Brake Resistor	Pn601	none E O
Resistance of Dynamic Brake Resistor	Pn604	page 5-9

## /DBON (Dynamic Brake Operation Request Output) Signal

The /DBON signal is the trigger signal for executing dynamic braking.

Create the sequence so that the Magnetic Contactor in the dynamic brake circuit is excited when the /DBON signal is turned ON.

If you allocate more than one signal to the same output connector pin, a logical OR of the signals is output. Set the /DBON signal so that it is not allocated to the same terminal as another output signal.
 If the /DBON signal is allocated to the same terminal as another output signal.

<sup>ant</sup> 2. If the /DBON signal is allocated to the same terminal as another output signal, the A.F32 (Dynamic Brake Operation Request Output Signal Setting Error) alarm will occur to prevent unexpected operation.

The /DBON signal is required to execute dynamic braking on SGD7S-210D to 370D SERVO-PACKs. On SERVOPACKs other than SGD7S-210D to 370D, the /DBON signal cannot be allocated.

Туре	Signal	Connector Pin No.	Signal Status	Meaning
Output	/DBON	Must be allocated.	ON (closed)	Execute dynamic braking.
Output	ulput 7060N Must be allocated.	OFF (open)	Do not execute dynamic braking.	

Note: Use  $Pn51A = n.\square\squareX\square$  (/DBON (Dynamic Brake Operation Request Output) Signal Allocation) to allocate the /DBON signal to a connector pin. Refer to the following section for details.

7.1.2 Output Signal Allocations on page 7-6

## /DBANS (Dynamic Brake Answer Input) Signal

The /DBANS signal is used to check the operating status of the Magnetic Contactor in the dynamic brake circuit.

Туре	Signal	Connector Pin No.	Signal Status	Meaning
loout	nout /DBANS Must be allocated		ON (closed)	Dynamic braking is not being executed.
Input /DBANS		OFF (open)	Dynamic braking is being executed.	

Note: Use Pn515 = n.  $\Box X \Box \Box$  (/DBANS (Dynamic Brake Answer Input) Signal Allocation) to allocate the /DBANS signal to a connector pin. Refer to the following section for details.

7.1.1 Input Signal Allocations on page 7-4

Always configure the parameter settings for the /DBANS and /DBON signals when using the External Dynamic Brake Resistor.

#### 5.3.4 Parameter Settings for the Dynamic Brake Circuit

### ♦ Operating Time of the Dynamic Brake

The operating time of the dynamic brake is the total value of the operating times of the relay and Magnetic Contactor.

The operating times of the selected parts are given in the following table.

Part	Model	Manufac- turer	Operating Time*	Sym- bol
Relay			Operating time: 10 ms or less (actual value: approx. 3 ms)	T <sub>R11</sub>
(DBRy1)	G6B-4BND	OMRON Corpora-	Operating time: 15 ms or less (actual value: approx. 4 ms)	T <sub>R12</sub>
Relay	GOD-4DIND	tion	Operating time: 10 ms or less (actual value: approx. 3 ms)	T <sub>R21</sub>
(DBRy2)			Operating time: 15 ms or less (actual value: approx. 4 ms)	T <sub>R22</sub>
Magnetic	BD-N65	Mitsubi- shi Elec-	Time from coil ON to main contact (normally closed) OFF: 68 ms to 92 ms	T <sub>C1</sub>
Contactor (DBKM)	(24 VDC)	tric	Time from coil OFF to main contact (normally closed) ON: 13 ms to 29 ms	T <sub>C2</sub>

#### Operating Times of Selected Parts

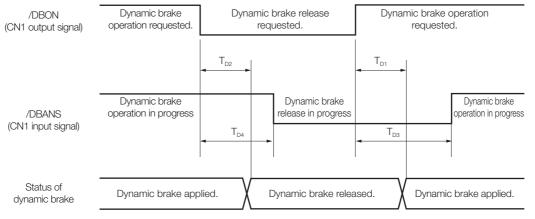
\* The operating time values are those listed in the manufacturers' catalogs. Refer to the materials from the manufacturers for details on the operating conditions.

#### ■ Dynamic Brake Operating Time

Sym- bol	Description	Operating Time
T <sub>D1</sub>	Time from when the /DBON signal is turned ON to when the Magnetic Contactor operates.	$T_{D1} = T_{R11} + T_{C2}$
T <sub>D2</sub>	Time from when the /DBON signal is turned OFF to when the Magnetic Contactor opens.	$T_{D2} = T_{R12} + T_{C1}$
T <sub>D3</sub>	Time from when the /DBON signal is turned ON to when the /DBANS signal turns ON.	$T_{D3} = T_{D1} + T_{R21}$
T <sub>D4</sub>	Time from when the /DBON signal is turned OFF to when the /DBANS signal turns OFF.	$T_{D4} = T_{D2} + T_{R22}$

#### Timing Chart

The SERVOPACK monitors the status of the /DBON and /DBANS signals. The A.F30 (Dynamic Brake Circuit Error) alarm will occur if a disagreement in the status of the /DBON and /DBANS signals occurs for 0.14 s or longer.



5.4.1 Coasting Distance during Dynamic Braking

## 5.4 Coasting Distances for Dynamic Braking

During dynamic braking, the motor rotates due to inertia until the electrical energy is consumed. The travel distance at this time is called the coasting distance.

This section provides a method for calculating the coasting distance.

## 5.4.1 Coasting Distance during Dynamic Braking

## 

• There will be a margin of error between the value calculated for the coasting distance and the actual distance. Therefore, evaluate the operation of the dynamic brake with the actual equipment or machine and confirm that the coasting distance is acceptable. There is a risk of machine damage or injury.

The coasting distance must be checked with the actual equipment, but it can be approximated with the following formulas.

### **Rotary Servomotors**

The coasting distance can be calculated with the following formula.

 $\theta = J\{\alpha(R_D + Zm)Nm_0 + (\beta \times N^3m_0) / (R_D + Zm)\} + (Nm_0/60) \times T_{D1} \times 360 \text{ [deg]}$ 

Calculate the coasting distance using the above formula based on the following conditions.

- θ [deg]: Coasting distance (mechanical angle)
- J [kgm<sup>2</sup>]: Moment of inertia (motor moment of inertia + load moment of inertia)
- $R_D$  [ $\Omega$ ]: Resistance of Dynamic Brake Resistor
- Nm<sub>0</sub> [min<sup>-1</sup>]: Motor speed before starting dynamic braking
- α, β: Coasting distance coefficients<sup>\*1</sup>
- Zm: Characteristic impedance<sup>\*1</sup>
- T<sub>D1</sub> [s]: Dynamic brake operating time<sup>\*2</sup>
- \*1. Refer to the following section for details on the coasting distance coefficients and characteristic impedance. 5.4.2 Data for Calculating Coasting Distance on page 5-19
- \*2. Refer to the following section for details on the dynamic brake operating time.

   *G* ◆ Operating Time of the Dynamic Brake on page 5-17

### **Linear Servomotors**

The coasting distance can be calculated with the following formula.

 $Lm = M\{\alpha(R_{D} + Zm)Vm_{0} + (\beta \times V^{3}m_{0}) / (R_{D} + Zm)\} + Vm_{0} \times T_{D1} [m]$ 

Calculate the coasting distance using the above formula based on the following conditions.

- Lm [m]: Coasting distance
- M [kg]: Conveyed mass (Moving Coil mass + load mass)
- $R_D [\Omega]$ : Resistance of Dynamic Brake Resistor
- Vm<sub>0</sub> [m/s]: Movement speed before starting dynamic braking
- α, β: Coasting distance coefficients<sup>\*1</sup>
- Zm: Characteristic impedance\*1
- T<sub>D1</sub> [s]: Dynamic brake operating time<sup>\*2</sup>
- \*1. Refer to the following section for details on the coasting distance coefficients and characteristic impedance.
- \*2. Refer to the following section for details on the dynamic brake operating time.

   *→* Operating Time of the Dynamic Brake on page 5-17

## 5.4.2 Data for Calculating Coasting Distance

This section provides the coasting distance coefficients and characteristic impedance required to calculate the coasting distance.

## **Coasting Distance Coefficients**

The following tables give the relationship between the Servomotor and coasting distance coefficients  $\alpha$  and  $\beta.$ 

Motor Type	SERVOPACK Model	Servomotor Model		Distance icients
			α	β [×10 <sup>-6</sup> ]
		SGM7G-03D <b>□</b> F	4.31	2027.37
		SGM7G-05D <b>□</b> F	3.56	980.46
	SGD7-1R9D	SGM7J-02D□F	48.85	588.19
	3007-1090	SGM7J-04D <b>□</b> F	11.15	317.05
		SGM7A-02D□F	33.65	2531.91
		SGM7A-04D <b>□</b> F	8.50	2710.91
		SGM7G-09D <b>□</b> F	3.52	366.36
	SGD7-3R5D	SGM7J-08D□F	7.61	244.05
	3007-300	SGM7A-08D□F	7.68	520.12
		SGM7G-05D <b>□</b> R	8.12	429.13
		SGM7A-15D□F	6.85	301.37
		SGM7G-13D <b>□</b> F	3.27	133.17
	SGD7S-5R4D	SGM7A-10D□F	9.05	168.32
		SGM7J-15D□F	8.07	143.11
		SGM7G-09D <b>□</b> R	8.24	146.05
Rotary Servomotors	SGD7S-8R4D	SGM7A-20D□F	7.46	153.86
HUIALY SELVOITIOLOIS		SGM7G-20D□F	4.65	55.13
		SGM7G-13D <b>□</b> R	8.72	53.98
		SGM7A-25D□F	7.87	92.05
	SGD7S-120D	SGM7A-30D□F	7.68	56.19
	36073-1200	SGM7G-30D <b>□</b> F	3.61	23.52
		SGM7G-20D <b>□</b> R	6.51	40.29
		SGM7A-40D□F	9.25	34.78
	SGD7S-170D	SGM7A-50D□F	7.11	26.74
	36073-1700	SGM7G-44D <b>□</b> F	2.80	11.68
		SGM7G-30D <b>□</b> R	6.91	14.88
	SCD75-210D	SGM7G-55D <b>□</b> F	3.20	5.21
	SGD7S-210D	SGM7G-44D <b>□</b> R	4.79	7.04
	SGD7S-260D	SGM7G-75D <b>□</b> F	2.83	2.59
	0010-20UD	SGM7A-70D <b>□</b> F	7.11	26.74
	SGD7S-280D	SGM7G-1AD <b>□</b> F	1.36	2.22
	SGD7S-370D	SGM7G-1ED <b>□</b> F	1.27	1.49

Continued on next page.

		Cor	ntinued from p	
Motor Type	SERVOPACK Model	Servomotor Model	Coasting Distance Coefficients	
			α	β [×10 <sup>-6</sup> ]
		SGLFW-35D120A	0.94	544.23
		SGLFW-35D230A	0.94	132.48
	SGD7-1R9D	SGLFW2-30D070A	15.62	487.67
		SGLFW2-30D120A	4.16	313.30
		SGLFW2-30D230A	1.04	313.30
		SGLFW-50D200B	0.95	183.90
	SGD7-3R5D	SGLTW-35D170H	1.75	100.60
		SGLTW-50D170H	0.74	87.00
	SGD7S-5R4D	SGLFW-50D380B	0.95	45.53
		SGLFW-1ZD200B	1.15	37.13
		SGLFW2-90D200A	0.73	49.83
Linear Servomotors	SGD7S-8R4D	SGLFW2-45D380A	0.93	38.73
		SGLTW-35D320H	1.75	25.57
		SGLTW-50D320H	0.74	22.18
		SGLFW-1ZD380B	1.15	9.28
	SGD7S-120D	SGLFW2-90D380A	0.73	12.46
		SGLTW-40D400B	0.45	34.53
		SGLFW2-90D560A	0.73	5.52
	SGD7S-170D	SGLFW2-1DD380A	0.65	6.18
	20012-110D	SGLTW-40D600B	0.45	15.86
		SGLTW-80D400B	0.46	9.17
	SGD7S-260D	SGLTW-80A600B	0.65	2.72
	JUD1 J-200D	SGLFW2-1DD560A	0.46	4.20

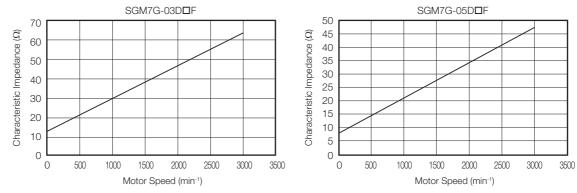
... .  $\sim$ 

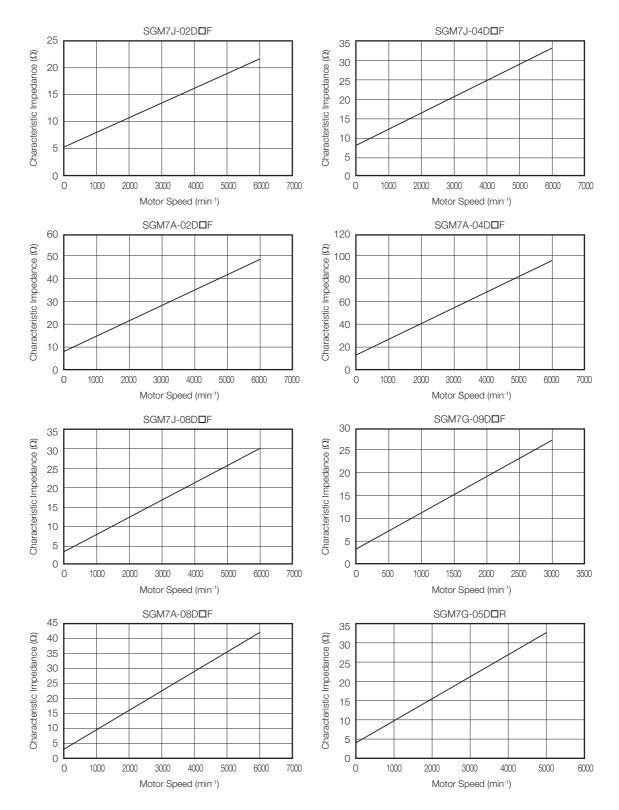
## **Characteristic Impedance**

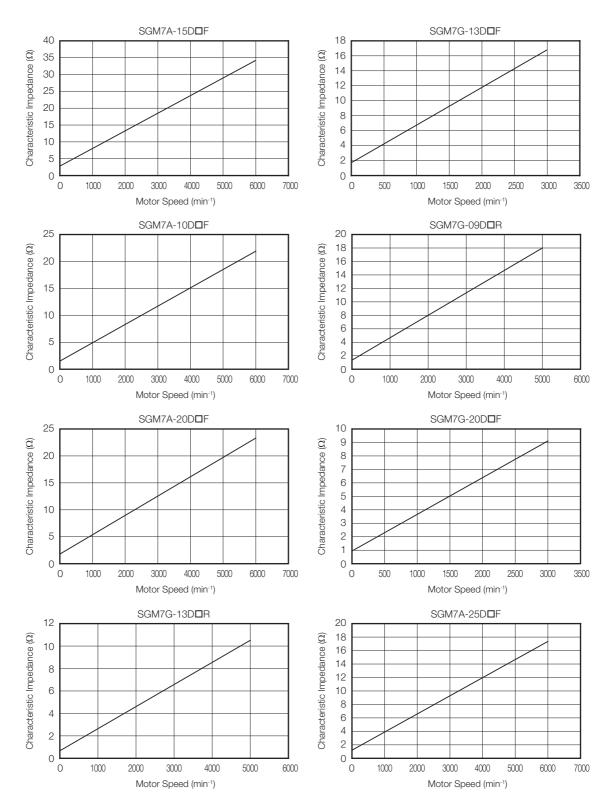
The following graphs give the relationship between the characteristic impedance and speed of the Servomotors.

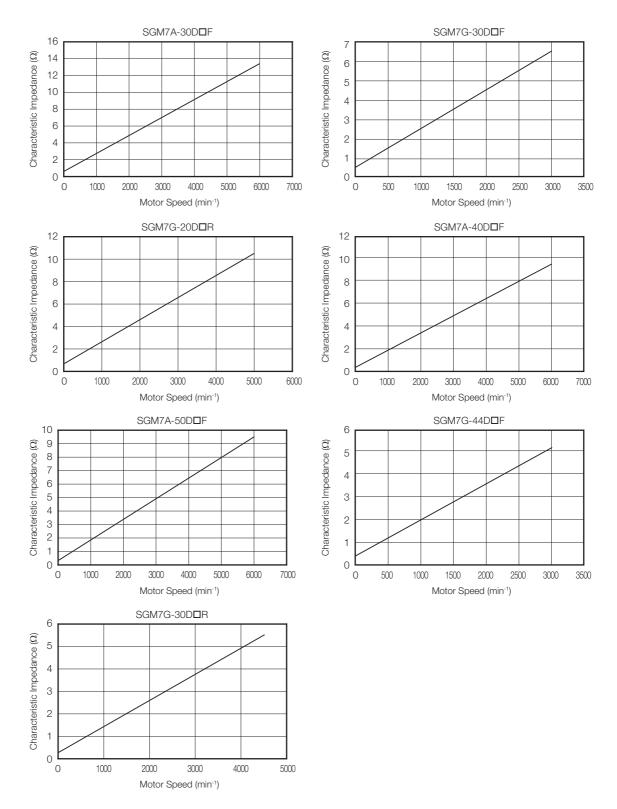
Refer to the graph of the Servomotor that will be used, and use characteristic impedance Zm from the speed before starting dynamic braking.

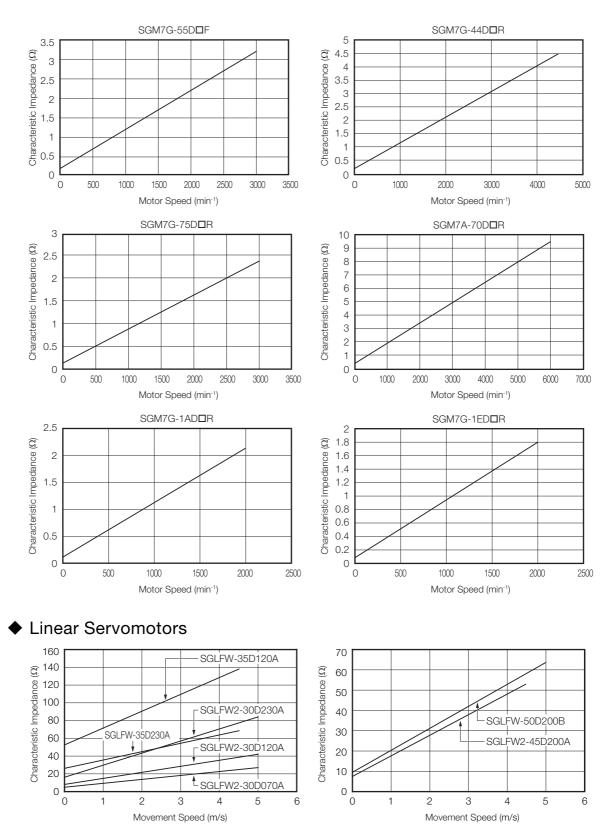
#### Rotary Servomotors

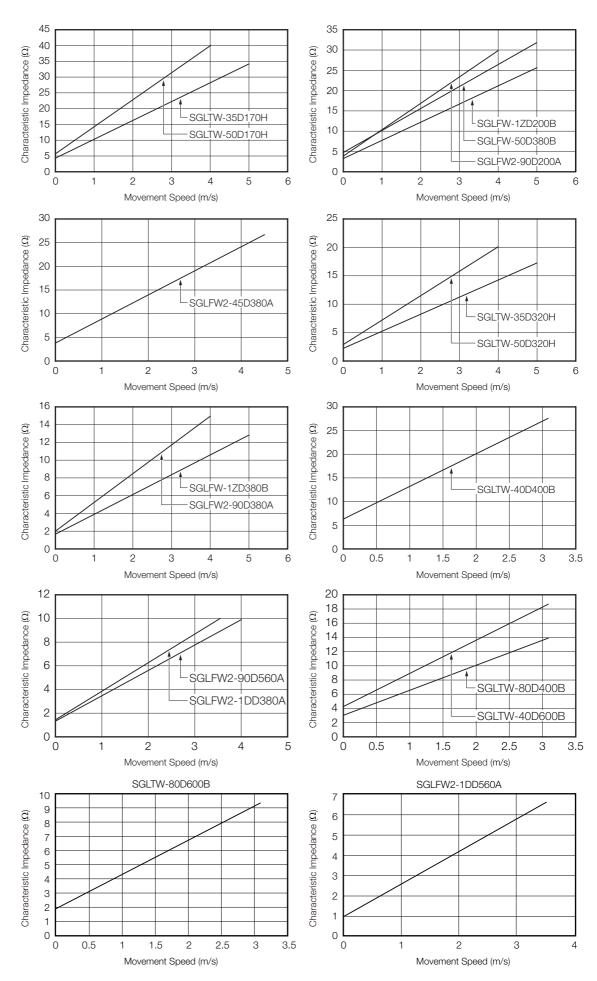












# Basic Functions That Require Setting before Operation

6

This chapter describes the basic functions that must be set before you start Servo System operation. It also describes the setting methods.

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6.1.1 Parameter Classification

## 6.1 Manipulating Parameters (Pn

This section describes the classifications, notation, and setting methods for the parameters given in this manual.

## 6.1.1 Parameter Classification

There are the following two types of SERVOPACK parameters.

Classification	Meaning
Setup Parameters	Parameters for the basic settings that are required for operation.
Tuning Parameters	Parameters that are used to adjust servo performance.

<b>Ì</b>	When you edit parameters with the SigmaWin+, setup parameters and tuning parameters are displayed. When you edit parameters with a Digital Operator, only setup parameters are displayed by default. To edit tuning parameters, set Pn00B to n.□□□1 (Display all parameters).				
	Parameter		Meaning	When Enabled	Classification
	n.□□□0 Pn00B (default setting)		Display only setup parameters.	After restart	Setup
	n.0001		Display all parameters.		
					L

The setting method for each type of parameter is described below.

### **Setup Parameters**

You can use the Digital Operator or SigmaWin+ to set the setup parameters individually.

Information We recommend that you use the Setup Wizard of the SigmaWin+ to easily set the required setup parameters by setting the operating methods, machine specifications, and I/O signals according to on-screen Wizard instructions.

Setup Wizard AXIS#00	
Servopack Selection SGD7S-R90A00A (100W)	Setting tems
Contraction	Servopack Selection / III Encoder Selection Servopack and motor selection: Confirm your motor model and Servopack model. In Online mode
Encoder Selection : 24bit absolute Fully-closed encoder : Do not use	(when the Servopack is connected), the models are automatically displayed. In Offline mode (when the Servopack is disconnected), the model numbers must be set manually.
Control Mode Selection	Control Mode Selection Control Mode Selection: Select a control mode such as Speed Control that uses analog voltage
Position control with pulse train references	reference and Position Control that uses pulse-train reference.
Reference Input Setting	Reference Input Setting
Reference Pulse Configuration : Sign + Pulse Electronic gear ratio : 64 / 1 Positioning Completed Width : 7 [reference u	Set the reference input specifications and other items in accordance with the connected machine and host controller.
	Motor Encoder Setting
Motor Encoder Setting	Configure the settings for the motor and encoder you use, such as encoder type, encoder output from the Servopack (encoder dividing pulse).
Output pulses : 2048 [P/rev] Absolute Encoder Usage : Uses absolute en Rotation (movement) direction setting : Stanc	-Motor Stop Method Selection
Motor Stop Method Selection	Set the motor stop method and whether or not to use brake at occurrence of alarm when the servo is off (motor power is off) or the when the overtravel limit is used (movable machine parts exceed the allowable range of motion and turn ON a limit switch).
Servo OFF, G1 alarm : Stop the motor by app Overtravel : Apply the dynamic brake or coa	
G2 alarm : Stops the motor by setting the spi	NO Signal Setting
VO Signal Setting	The I/O signal allocations for specified terminal numbers of the CN-1 connector can be changed from the standard allocation. I/O signal forced input and output are provided to check the wiring.
Input signal setting : Customize the allocation Output signal setting : Use the standard alloc	allSave/Write
al Save/Write	Check the allocated signals, and save the parameters in a file.
	Close

6.1.2 Notation for Parameters

## **Tuning Parameters**

Normally the user does not need to set the tuning parameters individually.

Use the various SigmaWin+ tuning functions to set the related tuning parameters to increase the response even further for the conditions of your machine. Refer to the following sections for details.

- 9.6 Autotuning without Host Reference on page 9-24
- 9.7 Autotuning with a Host Reference on page 9-35

3.8 Custom Tuning on page 9-42

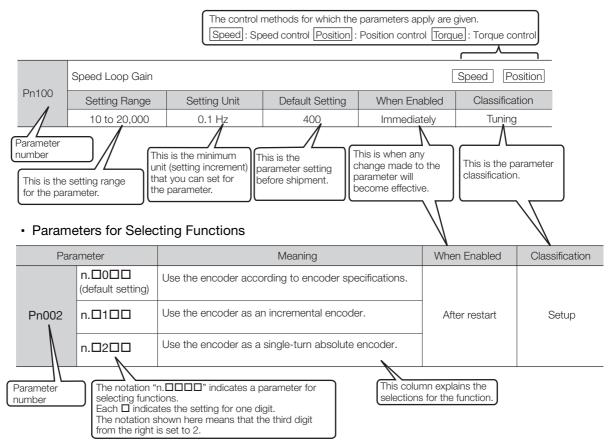
You can also set the tuning parameters individually to make adjustments. Refer to the following section for details.

3.13 Manual Tuning on page 9-82

## 6.1.2 Notation for Parameters

There are two types of notation used for parameters that depend on whether the parameter requires a numeric setting (parameter for numeric setting) or requires the selection of a function (parameter for selecting a function).

Parameters for Numeric Settings



6.1.3 Parameter Setting Methods

## 6.1.3 Parameter Setting Methods

You can use the SigmaWin+ or a Digital Operator to set parameters. Use the following procedure to set the parameters.

### Setting Parameters with the SigmaWin+

- 1. Click the 🔎 Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select Edit Parameters in the Menu Dialog Box. The Parameter Editing Dialog Box will be displayed.
- **3.** Click the cell of the parameter to edit. If the parameter to edit is not displayed in the Parameter Editing Dialog Box, click the ▲ or ▼ Button

to display the parameter to edit. YASKAWA SigmaWin+ Ver.7 • a × 0,0 70 01 n000.2 Reserved parameter (Do not chang ) : Reserved para 000.3 Rotary/Linear Startup Se : Start as a rota n001.0 Servo OFF or Alarm Group 1 Stopp : Stop the moto 001.1 el Stopping Meth : Apply the dyn : Input AC pow 001.3 Main Circuit Power Supply AC/DC Ir 001.3 Warning Code Output Selection : Output only al Speed/Position Control Option (T-R : Do not use Tn002.1 Torque Control Option (V-REF Ir ) : Do not use V-002.2 Absolute Encoder Usage : Uses a 002.3 External Encoder Usag : Do not use an 1006.0-1 Analog Monitor 1 Signal Selection 02 : Torque refer Reserved parameter (Do not chang 006.2 : Reserved para 006.3 rved parameter (Do not chang : Reserved para 007.0-1 Analog Monitor 2 Signal Si 0 : Motor spe 007.2 ed para eter (Do not cha 0 : Reserved para 007.3 Reserved parameter (Do not chang -) : Reserved para 0.80 Low Battery Voltage Alarm/Wa ) : Output alarm 008.1 Function Selection for Unde : Do not detect 008.2 Warning Detection Selecti 0 : Detect warnin Reserved parameter (Do not chang Reserved para 0 Reserved parameter (Do not chang : Reserved para

#### 4. Change the setting of the parameter.

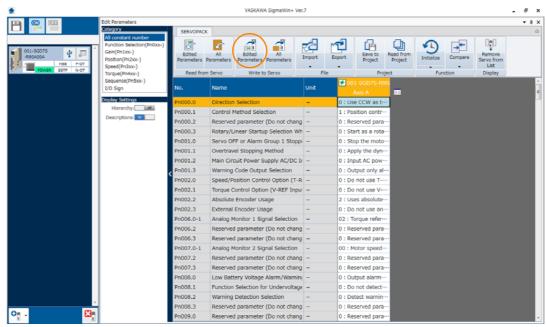
Information

- 1. For a parameter for a numeric setting, input the numeric setting.
- If the parameter requires selection of a function, select the function from the list of selections.

#### 5. Press the Enter Key.

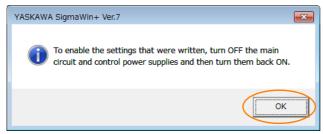
The background of the edited parameter cell will change to green.

#### 6.1.4 Write Prohibition Setting for Parameters



6. Select Edited Parameters in the Write to Servo Group.

- The edited parameters are written to the SERVOPACK and the backgrounds of the cells change to white.
- 7. Click the OK Button.



**8.** To enable changes to the settings, turn the power supply to the SERVOPACK OFF and ON again.

This concludes the procedure to set the parameters.

### Setting Parameters with a Digital Operator

Refer to the following manual for information on setting the parameters with a Digital Operator.  $\square \Sigma$ -7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)

## 6.1.4 Write Prohibition Setting for Parameters

You can prohibit writing parameters from the Digital Operator. Even if you do, you will still be able to change parameter settings from the SigmaWin+.

### Preparations

No preparations are required.

6.1.4 Write Prohibition Setting for Parameters

### **Applicable Tools**

The following table lists the tools that you can use to change the write prohibition setting and the applicable tool functions.

Tool	Function	Reference
Digital Operator	Fn010	Ω Σ-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Setup - Write Prohibited Setting	S Operating Procedure on page 6-8

### **Operating Procedure**

Use the following procedure to prohibit or permit writing parameter settings.

- 1. Click the 🔎 Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select Write Prohibition Setting in the Menu Dialog Box. The Write Prohibition Setting Dialog Box will be displayed.
- **3.** Press the ▼ or ▲ for the rightmost digit and set one of the following. 0000: Writing is permitted (default setting). 0001: Writing is prohibited.



#### 4. Click the Setting Button.



5. Click the OK Button.

The setting will be written to the SERVOPACK.

Write Pro	hibition Setting
Â	Write Prohibition Setting has changed. The setting will be enabled the next power ON.
	ОК

6. To enable the new setting, turn the power supply to the SERVOPACK OFF and ON again.

This concludes the procedure to prohibit or permit writing parameter settings.

## Restrictions

If you prohibit writing parameter settings, you will no longer be able to execute some functions. Refer to the following table.

	SigmaWin+		Digital Operator		
Button in Menu Dialog Box	SigmaWin+ Function Name	Fn No.	Utility Function Name	When Writ- ing Is Pro- hibited	Reference
	Origin Search <sup>*1</sup>	Fn003	Origin Search	Cannot be executed.	page 8-18
	Absolute Encoder Reset	Fn008	Reset Absolute Encoder	Cannot be executed.	page 6-48
	Adjusting the Analog Moni- tor Output	Fn00C	Adjust Analog Monitor Output Offset	Cannot be executed.	page 10-8
		Fn00D	Adjust Analog Monitor Output Gain	Cannot be executed.	page 10-8
	Motor Current Detection Offset Adjustment	Fn00E	Autotune Motor Current Detection Signal Offset	Cannot be executed.	- page 7-54
		Fn00F	Manually Adjust Motor Cur- rent Detection Signal Offset	Cannot be executed.	
Setup	Multiturn Limit Setting	Fn013	Multiturn Limit Setting after Multiturn Limit Disagreement Alarm	Cannot be executed.	page 7-39
	Reset Configuration Error of Option Module	Fn014	Reset Option Module Config- uration Error	Cannot be executed.	page 13-46
	Vibration Detection Level Initialization	Fn01B	Initialize Vibration Detection Level	Cannot be executed.	page 7-50
	Set Origin	Fn020	Set Absolute Linear Encoder Origin	Cannot be executed.	page 6-50
	Software Reset	Fn030	Software Reset	Can be executed.	page 7-47
	Polarity Detection	Fn080	Polarity Detection	Cannot be executed.	page 6-26
	Tuning-less Level Setting	Fn200	Tuning-less Level Setting	Cannot be executed.	page 9-16
	EasyFFT	Fn206	Easy FFT	Cannot be executed.	page 9-99
Parameters	Initialize <sup>*2</sup>	Fn005	Initialize Parameters	Cannot be executed.	page 6-10
Tuning	Autotuning without Refer- ence Input	Fn201	Advanced Autotuning with- out Reference	Cannot be executed.	page 9-24
	Autotuning with Reference Input	Fn202	Advanced Autotuning with Reference	Cannot be executed.	page 9-35
	Custom Tuning	Fn203	One-Parameter Tuning	Cannot be executed.	page 9-42
	Anti-Resonance Control Adjustment	Fn204	Adjust Anti-resonance Con- trol	Cannot be executed.	page 9-51
	Vibration Suppression	Fn205	Vibration Suppression	Cannot be executed.	page 9-56
Monitor	Product Information	Fn011	Display Servomotor Model	Can be executed.	page 10.0
		Fn012	Display Software Version	Can be executed.	page 10-2
		Fn01E	Display SERVOPACK and Servomotor IDs	Can be executed.	page 10-2
		Fn01F	Display Servomotor ID from Feedback Option Module	Can be executed.	page 10-2

Continued on next page.

#### 6.1.5 Initializing Parameter Settings

Continued from previous page.					
SigmaWin+		Digital Operator		When Writ-	
Button in Menu Dialog Box	SigmaWin+ Function Name	Fn No.	Utility Function Name		Reference
Test Opera-	Jogging	Fn002	Jog	Cannot be executed.	page 8-7
tion	Program Jogging	Fn004	Jog Program	Cannot be executed.	page 8-14
Alarm	Display Alarm	Fn000	Display Alarm History	Can be executed.	page 13-44
		Fn006	Clear Alarm History	Cannot be executed.	page 13-45
	Reset Motor Type Alarm	Fn021	Reset Motor Type Alarm	Cannot be executed.	page 6-14

\*1. Cannot be used when connecting a Linear Servomotor.

\*2. An Initialize Button will be displayed in the Parameter Editing Dialog Box.

## 6.1.5 Initializing Parameter Settings

You can return the parameters to their default settings.

This function will not initialize the settings of the parameters that are adjusted for the Fn00C, Fn00D, Fn00E, and Fn00F utility functions.



To enable the new settings, turn the power supply to the SERVOPACK OFF and ON again after you complete the operation.

### Preparations

Always check the following before you initialize the parameter settings.

- The parameters must not be write prohibited.
- The servo must be OFF.

## Applicable Tools

The following table lists the tools that you can use to initialize the parameter settings and the applicable tool functions.

Tool	Function	Reference
Digital Operator	Fn005	Ω Σ-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Parameters - Edit Parameters	Gerating Procedure on page 6-11

Continued from previous page.

**Operating Procedure** 

Use the following procedure to initialize the parameter settings.

- 1. Click the <u>I</u> Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- 2. Select Edit Parameters in the Menu Dialog Box. The Parameter Editing Dialog Box will be displayed.
- 3. Select any parameter of the axis to initialize.
- 4. Click the Initialize Button.

<b>a</b>			YASKAWA SigmaWin+ Ver.7			- 5 ×
	Edit Parameters					▼ Ģ ×
	Category	SERVOPACK				۵
0001-SV2 -020L2 U U HBB P-07 ROWER ESTP N-07	Speed(Pn3xx-)	Edited Parameters Pa Read from 1	rameters parameters parameters	Import Exp	Save to Project Project Function	Display
	Torque(Pn4xx-) Sequence(Pn5xx-)				✓ 0001-SV2-020L2	A
	I/O Sign	NO.	Name	Unit	Axis A	
	Mechatrolink(Pn8xx-) Common Parameters(PnAxx-)	Pn000.0	Direction Selection	-	0 : Use CCW as t···	
		Pn000.1	Reserved parameter (Do not chang	-	0 : Reserved para	
	Display Settings Hierarchy: on F		Reserved parameter (Do not chang		0 : Reserved para	
			Rotary/Linear Startup Selection Wh		0 : Start as a rota…	
		Pn001.0	Servo OFF or Alarm Group 1 Stoppi	-	0 : Stop the moto	
	< F	Pn001.1	Overtravel Stopping Method	-	1 : Decelerate the···	
	F	n001.2	Main Circuit Power Supply AC/DC Ir	-	0 : Input AC pow····	
	F	Pn001.3	Reserved parameter (Do not chang	-	0 : Reserved para…	
	F	n002.0	MECHATROLINK Command Position	-	1 : Use TLIM as t···	
	F	n002.1	Torque Control Option	-	1 : Use the speed…	
	F	n002.2	Absolute Encoder Usage	-	1 : Use the absol····	
	F	Pn002.3	External Encoder Usage	-	0 : Do not use an…	
	F	Pn006.0-1	Analog Monitor 1 Signal Selection	-	02 : Torque refer…	
	F	Pn006.2	Reserved parameter (Do not chang	-	0 : Reserved para…	
	F	n006.3	Reserved parameter (Do not chang	-	0 : Reserved para…	
	F	Pn007.0-1	Analog Monitor 2 Signal Selection	-	00 : Motor speed…	
	F	n007.2	Reserved parameter (Do not chang	-	0 : Reserved para…	
On - 10	F	Pn007.3	Reserved parameter (Do not chang	-	0 : Reserved para…	-

5. Click the OK Button.



Click the **Cancel** Button to cancel initialization. The Parameter Editing Dialog Box will return.

6. Click the OK Button.

YASKAWA SigmaWin+ Ver.7	×
Cautior	
Turn OFF the power supply. The settings will be applied the next t the power supply is turned ON.	ime
	ок

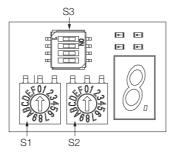
7. Turn the power supply to the SERVOPACK OFF and ON again after the parameter settings have been initialized.

This concludes the procedure to initialize the parameter settings.

6.2.1 Communications Settings

# 6.2 MECHATROLINK-III Communications Settings

The settings for MECHATROLINK-III communications are made with the DIP switch (S3). The station address is set using the rotary switches (S1 and S2).



### 6.2.1 Communications Settings

Use the DIP switch (S3) to make the communications settings.

Pin No.	Function		Setting		Default
FILLINO.	Function	1	2	Description	Setting
		OFF	OFF	Reserved. (Do not change.)	
1, 2	Sets the number of	ON	OFF	32 bytes	1: OFF
	transmission bytes.	OFF	ON	48 bytes	2: ON
		ON	ON	Reserved. (Do not change.)	
3	Reserved. (Do not change.)			OFF	
4	Reserved. (Do not change.)			OFF	
					·



• If you will use the MECHATROLINK-III standard servo profile, set the number of transmission bytes to either 32 or 48.

• To enable the new setting, turn the power supply to the SERVOPACK OFF and ON again after you change the communications switches (S1, S2, and S3).

### 6.2.2 Setting the Station Address

Use the rotary switches (S1 and S2) to set the station address.

Station Address	S1	S2
00h to 02h: Disabled (Do not set.)	0	0 to 2
03h (default setting)	0	3
04h	0	4
:	:	:
EFh	E	F
F0h to FFh: Disabled (Do not set.)	F	0 to F

# 6.3 Power Supply Type Settings for the Main Circuit

A SERVOPACK can operate on either an AC power supply input or DC power supply input to the main circuits. This section describes the settings related to the power supply.

Set Pn001 =  $n.\Box X \Box \Box$  (Main Circuit Power Supply AC/DC Input Selection) to specify whether to use an AC or DC power supply input for the main circuit power supply to the SERVOPACK.

If the setting of  $Pn001 = n.\Box X \Box \Box$  does not agree with the actual power supply input, an A.330 alarm (Main Circuit Power Supply Wiring Error) will occur.

Examples of When an A.330 Alarm (Main Circuit Power Supply Wiring Error) Occurs

Example

- A DC power supply is connected between the B1 and ⊝2 terminals, but an AC power supply input is specified (Pn001 = n.□0□□).
  - An AC power supply is input to the L1, L2, and L3 terminals, but a DC power supply is specified (Pn001 = n.□1□□).

Parameter		Meaning	When Enabled	Classification		
Pp001	n.□0□□ (default set- ting)	Use an AC power supply input.	After restart	Setup		
n	n.0100	Use a DC power supply input.				
<ul> <li>Con</li> <li>Con</li> <li>SEF</li> <li>There</li> <li>Alway the m</li> <li>If you</li> <li>n. □11</li> <li>equipr</li> <li>With a supply</li> <li>power</li> <li>Install</li> <li>The S</li> <li>with a</li> </ul>	nnect an AC p nnect a DC po RVOPACK. is a risk of fa ys specify a I nain circuit po input DC pow III), the SEF ment. a DC power s ly is turned O er supply is tu Il fuses on the Servomotor re a DC power s	DC power supply input (Pn001 = n.□1□□) t	on the SERVOPAG the 24 V and 0 V pefore you input I ut (i.e., without sett hay cause fire or d lectricity after the he SERVOPACK a shock.	CK. terminals on the DC power for ting Pn001 to amage to the main power fiter the SERVOPACK		

Refer to the following section for information on wiring the SERVOPACK. *4.3.4 Power Supply Wiring Diagrams* on page 4-15

# 6.4 Automatic Detection of Connected Motor

You can use a SERVOPACK to operate either a Rotary Servomotor or a Linear Servomotor.

If you connect the Servomotor encoder to the CN2 connector on the SERVOPACK, the SER-VOPACK will automatically determine which type of Servomotor is connected. Therefore, you normally do not need to specify the Servomotor type.

Information If an encoder is not connected, e.g., for a test without a motor, you can specify a Rotary Servomotor or a Linear Servomotor in Pn000 = n.X□□□ (Rotary/Linear Servomotor Startup Selection When Encoder Is Not Connected). If you specify either a Rotary or Linear Servomotor, only the parameters, monitors, alarms, and functions for the specified motor type will be enabled.

Parameter		Meaning	When Enabled	Classification
Pn000	n.0□□□ (default setting)	When an encoder is not connected, start as SERVOPACK for Rotary Servo- motor.	After restart	Setup
FIIUUU	n.1000	When an encoder is not connected, start as SERVOPACK for Linear Servo- motor.	Aller restart	Serup

# 6.5 Motor Direction Setting

You can reverse the direction of Servomotor rotation by changing the setting of  $Pn000 = n.\square\square\squareX$  (Direction Selection) without changing the polarity of the speed or position reference. This causes the rotation direction of the Servomotor to change, but the polarity of the signals, such as encoder output pulses, output from the SERVOPACK do not change. Set the appropriate direction for your system.

Refer to the following section for details on the encoder divided pulse output. 7.5 Encoder Divided Pulse Output on page 7-20

#### Rotary Servomotors

The default setting for forward rotation is counterclockwise (CCW) as viewed from the load end of the Servomotor.

	Parameter	Forward/Reverse Reference	Motor Direction and End	Motor Direction and Encoder Divided Pulse Outputs	
Pn000 n.□□□ <sup>-</sup> Use CW forward tion. (Reverse	n.□□□0 Use CCW as	Forward reference	CCW Torque reference	Encoder Divided Pulse Outputs PAO PBO Phase-B lead	P-OT (For- ward Drive Prohibit) signal
	direction. (default setting)	Reverse reference	Torque reference	Encoder Divided Pulse Outputs PAO Phase-A lead PBO	N-OT (Reverse Drive Prohibit) signal
	n.□□□1 Use CW as the forward direc-	Forward reference	+ Torque reference	Encoder Divided Pulse Outputs PAO PBO Phase-B lead	P-OT (For- ward Drive Prohibit)signal
	tion. (Reverse Rota- tion Mode)	Reverse reference	CCW Torque reference	Encoder Divided Pulse Outputs PAO Phase-A lead PBO	N-OT (Reverse Drive Prohibit) signal

Note: The trace waveforms of the SigmaWin+ are shown in the above table for the torque reference and motor speed diagrams. If you measure them on a measuring instrument, e.g., with an analog monitor, the polarity will be reversed.

#### • Linear Servomotors

Before you set this parameter, make sure that  $Pn080 = n.\Box\Box X\Box$  (Motor Phase Sequence Selection) is set correctly.

Parameter		Forward/Reverse Reference	Motor Moving Direction and Encoder Divided Pulse Outputs	Applicable Overtravel Signal (OT)	
		n.□□□0 Use the direc- tion in which the linear	Forward reference	Moves in the count-up direction. Hore speed Page Page Page Page Page Page Page Page	P-OT (For- ward Drive Prohibit) signal
		encoder counts up as the for- ward direction. (default setting)	Reverse reference	Moves in the count-down direction. Hore speed Page Proceeds and the proceds and the proceed	N-OT (Reverse Drive Prohibit) signal
	Pn000	n.□□□1 Use the direc- tion in which the linear encoder counts down as the forward direc- tion.	Forward reference	+       Force reference       Encoder Divided Pulse Outputs         Moves in the count-down direction.       Motor speed       PAO	P-OT (For- ward Drive Prohibit) signal
			Reverse reference	+       Force reference       Encoder Divided Pulse Outputs         Moves in the count-up direction.       Motor speed       PAO	N-OT (Reverse Drive Prohibit) signal

Note: The trace waveforms of the SigmaWin+ are shown in the above table for the force reference and motor speed diagrams. If you measure them on a measuring instrument, e.g., with an analog monitor, the polarity will be reversed.

Term

#### Setting the Linear Encoder Pitch 6.6

If you connect a linear encoder to the SERVOPACK through a Serial Converter Unit, you must set the scale pitch of the linear encoder in Pn282.

If a Serial Converter Unit is not connected, you do not need to set Pn282.

#### Serial Converter Unit

The Serial Converter Unit converts the signal from the linear encoder into a form that can be read by the SERVOPACK.

#### Scale Pitch

A linear encoder has a scale for measuring lengths (positions). The length of one division on this scale is the scale pitch.

	Linear Encoder Sc	ale Pitch		Speed Po	osition Force
Pn282	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 6,553,600	0.01 µm	0	After restart	Setup

You will not be able to control the Linear Servomotor if Pn282 is not set correctly. Check the above table and always set the correct value before you operate the Linear Servomotor.

Type of Linear Encoder	Manufacturer	Model	Serial Converter Unit Model	Linear Encoder Pitch [µm]	
		LIDA480	JZDP-H003-DDD-E	20	
Incremental	Dr. JOHANNES HEIDENHAIN GmbH		JZDP-J003-DD-E		
		LIF48□	JZDP-H003-DD-E	4	
		LIF40 <b>U</b>	JZDP-J003-DD-E	4	
	Renishaw PLC	RGH22B	JZDP-H005-DDD-E	20	
	Henishaw PLU	NGI 122D	JZDP-J005-DDD-E	20	

The first time you supply power to the SERVOPACK, the panel display on the front of the Servomotor will display an A.080 alarm (Linear Encoder Pitch Setting Error). The A.080 alarm is displayed because the setting of Pn282 has not been changed. The A.080 alarm will be cleared when you change the setting of Pn282 and then turn the power supply OFF and ON again.

#### Information

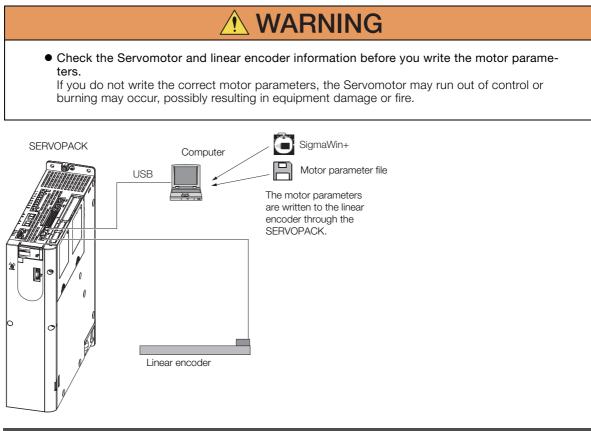
#### Linear Encoder Pitch

If you do not use a Serial Converter Unit, the linear encoder pitch is automatically set. It is not necessary to set Pn282. You can use the SigmaWin+ to check the linear encoder pitch that was automatically set. Refer to the following section for details.

2 10.1 Monitoring Product Information on page 10-2

# Writing Linear Servomotor Parameters

If you connect a linear encoder to the SERVOPACK without going through a Serial Converter Unit, you must use the SigmaWin+ to write the motor parameters to the linear encoder. The motor parameters contain the information that is required by the SERVOPACK to operate the Linear Servomotor.



Serial number information is not included in the motor parameters. You cannot use the monitor functions of the SERVOPACK to monitor the serial number. If you attempt to monitor the serial number, \*\*\*\*\*\*\*\* will be displayed. Important

### Precautions

- If the encoder parameters are not written to the linear encoder, an A.CAO alarm (Encoder Parameter Error) will occur. Consult the manufacturer of the linear encoder.
- If the motor parameters are not written to the linear encoder, an A.CAO alarm (Encoder Parameter Error) will not occur, but the following alarms will occur.
  - A.040 (Parameter Setting Error), A.041 (Encoder Output Pulse Setting Error),
  - A.050 (Combination Error), A.051 (Unsupported Device Alarm),
  - A.550 (Maximum Speed Setting Error), A.710 (Instantaneous Overload),
  - A.720 (Continuous Overload), and A.C90 (Encoder Communications Error)

### Applicable Tools

The following table lists the tools that you can use to write the parameters to the Linear Servomotor and the applicable tool functions.

Tool	Function	Reference		
Digital Operator	You cannot write Linear Servomotor parameters from the Digital Operator.			
SigmaWin+	Setup – Motor Parameter Scale Write	Gerating Procedure on page 6-18		

### **Operating Procedure**

Use the following procedure to write the motor parameters to the linear encoder.

- 1. Prepare the motor parameter file to write to the linear encoder.
- 2. Click the *P* Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **3.** Select Motor Parameter Scale Write in the Menu Dialog Box. The Motor Parameter Scale Write Dialog Box will be displayed.
- 4. Click the OK Button.

ſ	Motor parameter scale write
	This function rewrites data in the scale. If the data which does not suit the connected motor is rewritten, the motor may not work normally, resulting in motor overrun, etc., and it is very dangerous. Be sure that the data written in the scale suits the connected motor.
	OK Cacnel

Click the **Cancel** Button to cancel writing the motor parameters to the linear encoder. The Main Window will return.

If the write is completed normally, the Motor Parameter Scale Write - File Select Dialog Box will be displayed.

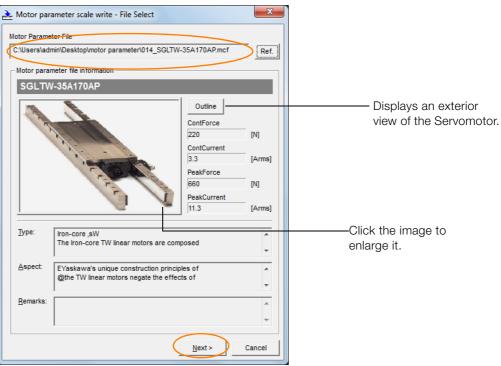
5. Click the Ref. Button.

otor Parameter File	
	Ref.
Motor parameter file information	
-1	

6. Select the motor parameter file that you prepared and click the Open Button.

🔾 🗢 🕌 🕨 motor parameter		
Organize 🔻 New folder	iii 🕶 🛄	
* Favorites	Date modified Type	5
Desktop 014_SGLTW-35A170AP.mcf	5/13/2015 7:39 PM MCF File	
Recent Places      Libraries     Nocuments		
I Music ■ Pictures Videos		
J Music	-	

7. Confirm that the motor parameter file information that is displayed is suitable for your Servomotor, and then click the **Next** Button.

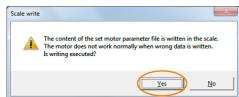


Click the **Cancel** Button to cancel writing the motor parameters to the linear encoder. The Main Window will return.

#### 8. Click the Write Button.

🚠 Motor par	ameter scale write - Scale write		×		
The motor parameter is written in the scale. Please confirm the motor which connects is corresponding to the following information.					
Motor para	meter file information				
SGLTW	/-35A170AP				
CARCE C		Outline ContForce 220 ContCurrent 3.3 PeakForce	[N] [Arms]		
	V S	660 PeakCurrent 11.3	[N] [Arms]		
<u>Т</u> уре:	Iron-core ,sW The Iron-core TW linear motors are com	posed	^ ~		
<u>A</u> spect:	EYaskawa's unique construction princip @the TW linear motors negate the effect		* •		
<u>R</u> emarks:			* *		
	< Back	Complete	Cancel		

#### 9. Click the Yes Button.



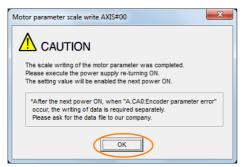
Click the **No** Button to cancel writing the motor parameters to the linear encoder.

If you click the Yes Button, writing the motor parameter scale will start.

#### 10. Click the Complete Button.

The motor par	ameter scale write - Scale write ameter is written in the scale. n the motor which connects is correspond information.	ding to	Write
Motor para	neter file information		
SGLTW	/-35A170AP		
CRACK!		Outline ContForce 220 ContCurrent 3.3 PeakForce 660 PeakCurrent 11.3	[N] [Arms] [N] [Arms]
<u>Т</u> уре:	Iron-core ,sW The Iron-core TW linear motors are com	posed	* *
<u>A</u> spect:	EYaskawa's unique construction princip @the TW linear motors negate the effect		* *
<u>R</u> emarks:			* *
	< Back	Complete	Cancel

11. Click the OK Button.



#### 12. Turn the power supply to the SERVOPACK OFF and ON again.

This concludes the procedure to write the motor parameters.

### Confirming If the Motor Parameters Have Been Written

After you write the motor parameters, you can use a monitor function to confirm that the motor parameters are in the encoder.

If the motor parameters have not been written, no information on the Servomotor will be displayed.

10.1 Monitoring Product Information on page 10-2

# 6.8 Selecting the Phase Sequence for a Linear Servomotor

You must select the phase sequence of the Linear Servomotor so that the forward direction of the Linear Servomotor is the same as the encoder's count-up direction.

Before you set the Linear Servomotor phase sequence (Pn080 =  $n.\Box\Box X\Box$ ), check the following items.

- Confirm that the signal from the linear encoder is being received normally.
- Make sure that the forward direction of the Linear Servomotor and the count-up direction of the linear encoder are in the same direction.



If you do not confirm the above items before you attempt to operate the Servomotor, the Servomotor may not operate or it may run out of control. Always confirm these items before you operate the motor.

### **Related Parameters**

Parameter		Meaning	When Enabled	Classification
Pn080	n.□□0□ (default setting)	Set a phase-A lead as a phase sequence of U, V, and W.	nd W. After restart Setup	
	n.0010	Set a phase-B lead as a phase sequence of U, V, and W.		

### **Operating Procedure**

Use the following procedure to select the phase sequence for a Linear Servomotor.

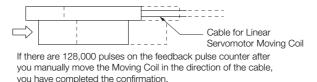
- **1.** Set Pn000 to n.  $\Box\Box\Box$  (Set a phase-A lead as a phase sequence of U, V, and W). This setting is to make following confirmation work easier to understand.
- 2. Select Monitor in the Menu Dialog Box.

The Operation Pane will be displayed so that you can check the feedback pulse counter. To check the feedback pulse counter with the Digital Operator, use Un00D (Feedback Pulse Counter).

**3.** Manually move the Moving Coil from one end to the other of the stroke and confirm that only the correct number of feedback pulses is returned.

If the correct number and only the correct number of pulses is returned, the signal is being received correctly from the linear encoder.

**Example** In this example, assume that a linear encoder with a scale pitch of 20  $\mu$ m and a resolution of 256 is used. If you manually move the Moving Coil 1 cm in the count-up direction of the linear encoder, the number of feedback pulses would be as follows: 1 cm/(20  $\mu$ m/256) = 128,000 pulses



Note: The actual monitor display will be offset by the error in the travel distance. There is no problem as long as the above value is close to the calculated value.

Information

If the correct value is not displayed for the feedback pulse counter, the following conditions may exist. Check the situation and correct any problems.

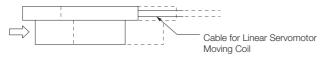
The linear encoder pitch is not correct.

If the scale pitch that is set in Pn282 does not agree with the actual scale pitch, the expected number of feedback pulses will not be returned. Check the specifications of the linear encoder.

- The linear encoder is not adjusted properly.
   If the linear encoder is not adjusted properly, the output signal level from the linear encoder will drop and the correct number of pulses will not be counted. Check the adjustment of the linear encoder. Contact the manufacturer of the linear encoder for details.
- There is a mistake in the wiring between the linear encoder and the Serial Converter Unit.

If the wiring is not correct, the correct number of pulses will not be counted. Correct the wiring.

4. Manually move the Moving Coil in the direction of the cable and check the value of the feedback pulse counter in the Operation Pane to confirm that it is counting up.



Manually move the Moving Coil in the direction of the cable.

- 5. If the feedback pulse counter counts up, set a phase-A lead as a phase sequence of U, V, and W (Pn080 = n.□□0□).
  If the feedback pulse counter counts down, set a phase-B lead as a phase sequence of U, V, and W (Pn080 = n.□□1□).
- 6. Turn the power supply to the SERVOPACK OFF and ON again.
- 7. If necessary, return  $Pn000 = n.\Box\Box\BoxX$  (Direction Selection) to its original setting.

This concludes the procedure to set the phase sequence of the Linear Servomotor.

# 6.9 Polarity Sensor Setting

The polarity sensor detects the polarity of the Servomotor. You must set a parameter to specify whether the Linear Servomotor that is connected to the SERVOPACK has a polarity sensor. Specify whether there is a polarity sensor in Pn080 =  $n.\square\square\squareX$  (Polarity Sensor Selection).

If the Linear Servomotor has a polarity sensor, set Pn080 to n.  $\Box\Box\Box$  (Use polarity sensor) (default setting).

If the Linear Servomotor does not have a polarity sensor, set Pn080 to n.  $\Box\Box\Box$  (Do not use polarity sensor). Turn the power supply OFF and ON again to enable the new setting.

Parameter		Meaning	When Enabled	Classification
Pn080	n.□□□0 (default setting)	Use polarity sensor.	After restart	Setup
	n.0001	Do not use polarity sensor.		

6.10.1 Restrictions

# 6.10 Polarity Detection

If you use a Linear Servomotor that does not have a polarity sensor, then you must detect the polarity.

Detecting the polarity means that the position of the electrical phase angle on the electrical angle coordinates of the Servomotor is detected. The SERVOPACK cannot control the Servomotor correctly unless it accurately knows the position of the electrical angle coordinate of the Servomotor.

The execution timing and execution method for polarity detection depend on the encoder specification as described in the following table.

Encoder Specification	Polarity Detection Execution Timing	Polarity Detection Execution Method
	Each time the control power supply to the SERVOPACK is turned ON	Use the SV_ON (Servo ON) com- mand.
Incremental encoder	(Even after you execute polarity detec- tion, the position of the polarity will be lost the next time the control power supply to the SERVOPACK is turned OFF.)	<ul> <li>Use the polarity detection function of the SigmaWin+.</li> <li>Execute the Fn080 (Polarity Detection) utility function from the Digital Opera- tor.</li> </ul>
	Only for initial setup, or after the SER- VOPACK, linear encoder, or Servomotor has been replaced	<ul> <li>Use the polarity detection function of the SigmaWin+.</li> <li>Execute the Fn080 (Polarity Detection) utility function from the Digital Opera-</li> </ul>
Absolute encoder	(The results of polarity detection is stored in the absolute encoder, so the polarity position is not lost when the control power supply is turned OFF.)	<ul> <li>Use Pn587 (Polarity Detection Execution Selection for Absolute Linear Encoder).</li> </ul>

Information If you use a Linear Servomotor that does not have a polarity sensor, you will not be able to turn ON the servo until polarity detection has been completed.

### 6.10.1 Restrictions

### **Assumed Conditions**

The Servomotor will move when you execute polarity detection. The following conditions must be met before you start.

- It must be OK to move the Moving Coil about 10 mm.
- (If polarity detection fails, the Moving Coil may move approximately 5 cm. The amount of movement depends on conditions.)
- The linear encoder pitch must be 100  $\mu m$  or less. (We recommend a pitch of 40  $\mu m$  or less for an incremental encoder.)
- As much as possible, the motor must not be subjected to an imbalanced external force. (We recommend 5% or less of the rated force.)
- The mass ratio must be 50x or less.
- The axis must be horizontal.
- There must be friction equivalent to a few percent of the rated force applied to the guides. (Air sliders cannot be used.)

### Preparations

Always check the following before you execute polarity detection.

- Not using a polarity sensor must be specified (Pn080 =  $n.\Box\Box\Box$ 1).
- The servo must be OFF.
- The main circuit power supply must be ON.
- There must be no hard wire base block (HWBB).
- There must be no alarms except for an A.C22 alarm (Phase Information Disagreement).
- The parameters must not be write prohibited. (This item applies only when using the SigmaWin+ or Digital Operator.)
- The test without a motor function must be disabled (Pn00C =  $n.\Box\Box\Box$ ).
- There must be no overtravel.
- If the motor parameters have been written or the origin of the absolute linear encoder has been set, the power supply to the SERVOPACK must be turned OFF and ON again after completion of the writing or setting operation.



1. Power is supplied to the Servomotor during polarity detection. Be careful not to get an electric shock. Also, the Moving Coil of the Linear Servomotor may greatly move during detection. Do not approach the moving parts of the Servomotor.

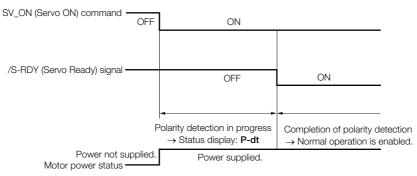
Polarity detection is affected by many factors.
 For example, polarity detection may fail if the mass ratio or friction is too large or the cable tension is too strong.

# 6.10.2 Using the SV\_ON (Servo ON) Command to Perform Polarity Detection

You can use the SV\_ON (Servo ON) command to perform polarity detection only with an incremental linear encoder.

Polarity detection will be performed when you turn the control power supply to the SERVO-PACK OFF and then ON again, and then send the SV\_ON (Servo ON) command. As soon as polarity detection is completed, the /S-RDY (Servo Ready) signal will turn ON.

Polarity detection will start simultaneously with execution of the SV\_ON (Servo ON) command. As soon as polarity detection is completed, the /S-RDY will turn ON and the servo will remain ON.



6.10.3 Using a Tool Function to Perform Polarity Detection

### 6.10.3 Using a Tool Function to Perform Polarity Detection

### Applicable Tools

The following table lists the tools that you can use to perform polarity detection and the applicable tool functions.

Tool	Function	Reference
Digital Operator	Fn080	Σ-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Setup - Polarity Detection	Gerating Procedure on page 6-26

### **Operating Procedure**

Use the following procedure to perform polarity detection.

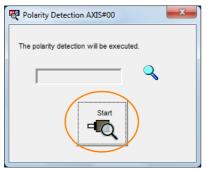
- 1. Click the 🔎 Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select Polarity Detection in the Menu Dialog Box. The Polarity Detection Dialog Box will be displayed.
- 3. Click the Continue Button.

Polarity Detection
During execution of this function, power will be supplied to the motor. Take care to avoid electric shock. The motor may move widely. Do not approach the motor movable parts.
Do you want to continue the polarity detection?
Continue

Click the Cancel Button to cancel polarity detection. The Main Window will return.

#### 4. Click the Start Button.

Polarity detection will be executed.



This concludes the polarity detection procedure.

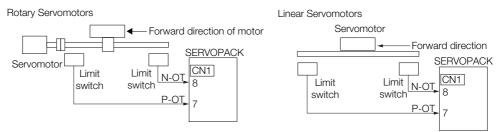
# 6.11 Overtravel and Related Settings

Overtravel is a function of the SERVOPACK that forces the Servomotor to stop in response to a signal input from a limit switch that is activated when a moving part of the machine exceeds the safe range of movement.

The overtravel signals include the P-OT (Forward Drive Prohibit) and the N-OT (Reverse Drive Prohibit) signals.

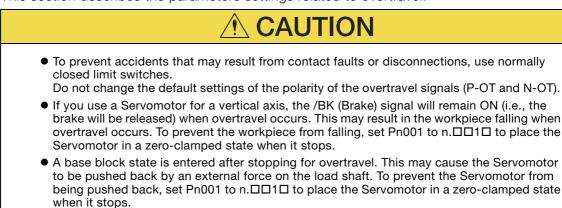
You use the P-OT and N-OT signals to stop the machine by installing limit switches at the positions where you want to stop the machine that is operated by the Servomotor.

A SERVOPACK wiring example is provided below.



Using the overtravel function is not necessary for rotating applications such as rotary tables and conveyors. No wiring for overtravel input signals is required.

This section describes the parameters settings related to overtravel.



### 6.11.1 Overtravel Signals

The overtravel signals include the P-OT (Forward Drive Prohibit) and the N-OT (Reverse Drive Prohibit) signals.

Туре	Signal	Connector Pin No.	Signal Status	Meaning
		OT CN1-7	ON	Forward drive is enabled (actual operation).
laput	P-OT		OFF	Forward drive is prohibited (forward overtravel).
Input		ON	Reverse drive is enabled (actual operation).	
	N-OT CN1-8		OFF	Reverse drive is prohibited (reverse overtravel).

You can operate the Servomotor in the opposite direction during overtravel by inputting a reference.

6.11.2 Setting to Enable/Disable Overtravel

### 6.11.2 Setting to Enable/Disable Overtravel

You can use  $Pn50A = n.X\square\square\square$  (P-OT (Forward Drive Prohibit) Signal Allocation) and  $Pn50B = n.\square\square\squareX$  (N-OT (Reverse Drive Prohibit) Signal Allocation) to enable and disable the overtravel function.

You do not need to wire the overtravel input signals if you are not going to use the overtravel function.

Parameter		Meaning	When Enabled	Classification
Pn50A	n.1□□□ (default setting)	- Land the P-OT (Forward Drive Prohibit) signal		
	n.8000	The reverse overtravel function is disabled. Forward drive is always enabled.	After restart	Catura
Pn50B	n.□□□2 (default setting)	The reverse overtravel function is enabled and the N-OT (Reverse Drive Prohibit) signal is input from CN1-8.	After restart	Setup
	n.0008	The reverse overtravel function is disabled. Reverse drive is always enabled.	1	

You can allocate the P-OT and N-OT signals to other connector pins. Refer to the following section for details.

7.1.1 Input Signal Allocations on page 7-4

### 6.11.3 Motor Stopping Method for Overtravel

You can set the stopping method of the Servomotor when overtravel occurs in Pn001 =  $n.\Box\BoxXX$  (Motor Stopping Method for Servo OFF and Group 1 Alarms and Overtravel Stopping Method).

Parameter		Motor Stopping Method <sup>*</sup>	Status after Stopping	When Enabled	Classification
	n.□□00 (default setting)	Dynamic brake			
n.□□01	,	Coasting			
	n.□□02	Coasting			Setup
Pn001	n.0010	Deceleration	Zero clamp	After restart	
r	n.0020	according to setting of Pn406	Coasting		
	n.🗆 🗆 3 🗆	Deceleration	Zero clamp	_	
	n.0040	according to setting of Pn30A	Coasting		

\* You cannot decelerate a Servomotor to a stop during torque control. For torque control, the Servomotor will be stopped with the dynamic braking or coast to a stop (according to the setting of Pn001 = n. DDX (Motor Stopping Method for Servo OFF and Group 1 Alarms)), and then the Servomotor will enter a coasting state.

Refer to the following section for information on stopping methods other than those for overtravel.

6.13.1 Stopping Method for Servo OFF on page 6-38

6.11.3 Motor Stopping Method for Overtravel

### Stopping the Servomotor by Setting Emergency Stop Torque

To stop the Servomotor by setting emergency stop torque, set Pn406 (Emergency Stop Torque).

If  $Pn001 = n.\Box\BoxX\Box$  is set to 1 or 2, the Servomotor will be decelerated to a stop using the torque set in Pn406 as the maximum torque.

The default setting is 800%. This setting is large enough to allow you to operate the Servomotor at the maximum torque. However, the maximum emergency stop torque that you can actually use is the maximum torque of the Servomotor.

	Emergency Stop Torque			Speed Position	
Pn406	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 800	1%*	800	Immediately	Setup

\* Set a percentage of the motor rated torque.

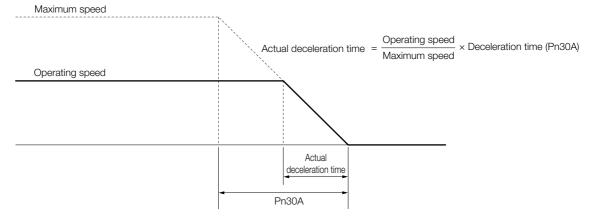
### Stopping the Servomotor by Setting the Deceleration Time

To specify the Servomotor deceleration time and use it to stop the Servomotor, set Pn30A (Deceleration Time for Servo OFF and Forced Stops).

	Deceleration Time for Servo OFF and Forced Stops			Speed Position	٦
Pn30A	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 ms	0	Immediately	Setup

If you set Pn30A to 0, the Servomotor will be stopped with a zero speed.

The deceleration time that you set in Pn30A is the time to decelerate the Servomotor from the maximum motor speed.



Important

6.11.4 Overtravel Warnings

### 6.11.4 Overtravel Warnings

You can set the system to detect an A.9A0 warning (Overtravel) if overtravel occurs while the servo is ON. This allows the SERVOPACK to notify the host controller with a warning even when the overtravel signal is input only momentarily. An alarm occurs only if overtravel occurs while the servo is ON. An overtravel warning will not be detected when the servo is OFF, even if overtravel occurs.

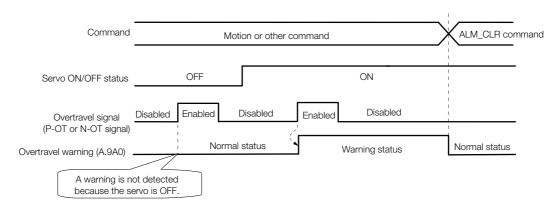
1. The occurrence of an A.9A0 warning will not stop the motor or have any affect on host controller motion operations. The next step (e.g., the next motion or command) can be executed even if an overtravel warning exists.

- However, depending on the processing specifications and programming for warnings in the host controller, operation may be affected when an overtravel warning occurs (e.g., motion may stop or not stop). Confirm the specifications and programming in the host controller.
- 2. When overtravel occurs, the SERVOPACK will perform stop processing for overtravel. Therefore, when an A.9A0 warning occurs, the Servomotor may not reach the target position specified by the host controller. Check the feedback position to make sure that the axis is stopped at a safe position.

The following parameter is set for this function.

Parameter		Meaning	When Enabled	Classification
Pn00D	n.0□□□ (default setting)	Do not detect overtravel warnings.	Immediately	Setup
	n.1000	Detect overtravel warnings.		

A timing chart for warning detection is provided below.



Information

- 1. Warnings are detected for overtravel in the same direction as the reference.
  - 2. Warnings are not detected for overtravel in the opposite direction from the reference. Example: A warning will not be output for a forward reference even if the N-OT signal turns ON.
  - 3. A warning can be detected in either the forward or reverse direction if there is no reference.
  - 4. A warning will not be detected when the servo is turned ON even if overtravel status exists.
  - 5. You can use the ALM\_CLR (Clear Alarms and Warnings) command to clear the warning regardless of the servo ON/OFF status and overtravel signal status.
  - 6. If you clear the warning with the ALM\_CLR (Clear Alarms and Warnings) command during overtravel status, a warning will not be detected again until the overtravel status is left.
  - 7. An overtravel warning will be detected even when the software limit has been detected.

#### 6.11.5 Overtravel Release Method Selection

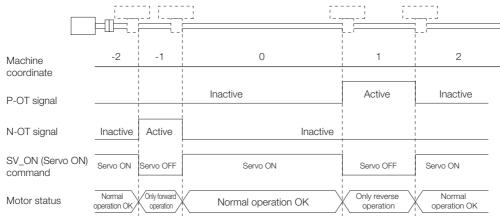
### 6.11.5 Overtravel Release Method Selection

You can set  $Pn022 = n.\Box\Box\BoxX$  (Overtravel Release Method Selection) to release overtravel. The motor will not be driven if there is overtravel in the same direction as the reference.

Parameter		Meaning	When Enabled	Classification
	n.□□□0 (default setting)	Overtravel exists while the P-OT or N-OT signal is being input.		
Pn022	n.0001	Overtravel exists while the P-OT or N-OT signal is input and the current position of the workpiece is separated* from the P-OT signal or N-OT signal.	After restart	Setup

\* Here, "separated" means a position that is further in the positive direction than the P-OT signal or a position that is further in the negative direction than the N-OT signal.

### When Pn022 Is Set to n. DDD0



### When Pn022 Is Set to n. DDD1

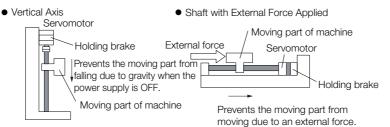
	 			ı 	1   
	јш <u>с</u>			<u> </u>         ,	
Machine coordinate	-2	-1	0		2
P-OT signal		     	Inactive	Active	Inactive
N-OT signal	Inactive	Active	Inactive	•       	
Ū				' 	 
SV_ON (Servo ON command	) Servo	OFF	Servo ON	Servo OFF	   
Motor status	Only forward operation		Normal operation OK	Only reverse operation	1 

6.12.1 Brake Operating Sequence

# 6.12 Holding Brake

A holding brake is used to hold the position of the moving part of the machine when the SER-VOPACK is turned OFF so that moving part does not move due to gravity or an external force. You can use the brake that is built into a Servomotor with a Brake, or you can provide one on the machine.

The holding brake is used in the following cases.





The brake built into a Servomotor with a Brake is a de-energization brake. It is used only to hold the Servomotor and cannot be used for braking. Use the holding brake only to hold a Servomotor that is already stopped.

### 6.12.1 Brake Operating Sequence

You must consider the brake release delay time and the brake operation delay time to determine the brake operation timing, as described below.

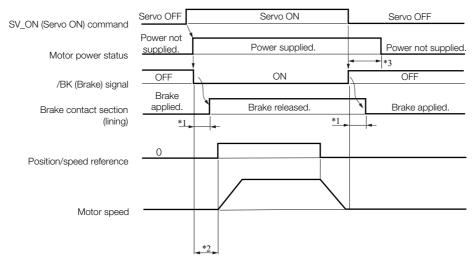


#### Brake Release Delay Time

The time from when the /BK (Brake) signal is turned ON until the brake is actually released.

#### Brake Operation Delay Time

The time from when the /BK (Brake) signal is turned OFF until the brake actually operates.



\*1. Rotary Servomotors: The brake delay times for Servomotors with Holding Brakes are given in the following table. The operation delay times in the following table are examples for when the power supply is switched on the DC side. You must evaluate the actual brake delay times on the actual equipment before using the application.

#### 6.12.2 /BK (Brake) Signal

Model	Voltage	Brake Release Delay Time [ms]	Brake Operation Delay Time [ms]	
SGM7J-02, -04		60		
SGM7J-08, -15		80	100	
SGM7A-02, -04	24 VDC	60	100	
SGM7A-08, -10		80		
SGM7A-15 to -25	24 VDC	170		
SGM7A-30 to -50		100	80	
SGM7G-05 to -20		100		
SGM7G-30, -44		170	100	

Linear Servomotors: The brake delay times depend on the brake that you use. Set the parameters related to /BK signal output timing according to the delay times for the brake that you will actually use.

- \*2. Before you output a reference from the host controller to the SERVOPACK, wait for at least 50 ms plus the brake release delay time after you send the SV\_ON command.
- \*3. Use the following parameters to set the timing of when the brake will operate and when the servo will be turned OFF.
  - Rotary Servomotors: Pn506 (Brake Reference-Servo OFF Delay Time), Pn507 (Brake Reference Output Speed Level), and Pn508 (Servo OFF-Brake Command Waiting Time) Linear Servomotors: Pn506 (Brake Reference-Servo OFF Delay Time), Pn508 (Servo OFF-Brake Command
  - Waiting Time), and Pn583 (Brake Reference Output Speed Level)
- Note: The brake operation delay time on SERVOPACKs with built-in Servomotor brake control is somewhat longer than the time required on SERVOPACKs without built-in Servomotor brake control. Consider the brake operation delay time when you design the system.

### Connection Examples

Refer to the following section for information on brake wiring. 3 4.4.4 Wiring the SERVOPACK to the Holding Brake on page 4-26

#### 6.12.2 /BK (Brake) Signal

The following settings are for the output signal that controls the brake. You can change the connector pin that is allocated. For details, refer to Allocating the /BK (Brake) Signal. The /BK signal is turned OFF (to operate the brake) when the servo is turned OFF or when an alarm is detected. You can adjust the timing of brake operation (i.e., the timing of turning OFF the /BK signal) with the servo OFF delay time (Pn506).

Туре	Signal	Connector Pin No.	Signal Status	Meaning
Output	/BK	CN1-1, CN1-2	ON (closed)	Releases the brake.
			OFF (open)	Activates the brake.

Information The /BK signal will remain ON during overtravel. The brake will not be applied.

### Allocating the /BK (Brake) Signal

Set the allocation for the /BK signal in Pn50F =  $n.\Box X \Box \Box$  (/BK (Brake Output) Signal Allocation).

Parameter		Connector Pin No.		Mooning	When	Classification
		+ Pin	- Pin	Meaning	Enabled	Classification
	n.🗆0🗆 🗆	-	-	The /BK signal is not used.	After restart	
	n.□1□□ (default setting)	CN1-1	CN1-2	The /BK signal is output from CN1-1 and CN1-2.		Setup
Pn50F	n.0200	CN1-23	CN1-24	The /BK signal is output from CN1-23 and CN1-24.		
	n.¤3¤¤	CN1-25	CN1-26	The /BK signal is output from CN1-25 and CN1-26.		

#### 6.12.3 Output Timing of /BK (Brake) Signal When the Servomotor Is Stopped



If you allocate more than one signal to the same output connector pin, a logical OR of the signals is output. Allocate the /BK signal to its own output connector pin, i.e., do not use the same output terminal for another signal.

For example, never allocate the /TGON (Rotation Detection) signal and /BK signal to the same output connector pin. If you did so, the /TGON signal would be turned ON by the falling speed on a vertical axis, and the brake would not operate.

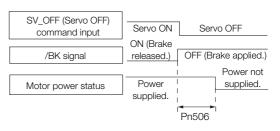
# 6.12.3 Output Timing of /BK (Brake) Signal When the Servomotor Is Stopped

When the Servomotor is stopped, the /BK signal turns OFF as soon as the SV\_OFF (Servo OFF) command is received. Use the servo OFF delay time (Pn506) to change the timing to turn OFF power supply to the motor after the SV\_OFF command is input.

	Brake Reference-Se	ervo OFF Delay Time	Speed Position	on Torque	
Pn506	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 50	10 ms	0*	Immediately	Setup

\* The default setting is 32 for a SERVOPACK with built-in Servomotor brake control.

• When the Servomotor is used to control a vertical axis, the machine moving part may move slightly due to gravity or an external force. You can eliminate this slight motion by setting the servo OFF delay time (Pn506) so that power supply to the motor is stopped after the brake is applied.



 This parameter sets the timing of stopping power supply to the Servomotor while the Servomotor is stopped.

Power supply to the Servomotor will be stopped immediately when an alarm occurs, regardless of the setting of this parameter. The machine moving part may move due to gravity or an external force before the brake is applied.

### 6.12.4 Output Timing of /BK (Brake) Signal When the Servomotor Is Operating

If an alarm occurs while the Servomotor is operating, the Servomotor will start stopping and the /BK signal will be turned OFF. You can adjust the timing of /BK signal output by setting the brake reference output speed level (Rotary Servomotors: Pn507, Linear Servomotors: Pn583) and the Servo OFF-Brake Command Waiting Time (Pn508).

Note: If zero-speed stopping is set as the stopping method for alarms, the setting of Pn506 (Brake Reference-Servo OFF Delay Time) is used after the motor stops.

Rotary Servomotors

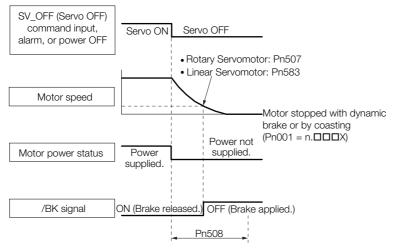
	Brake Reference O	utput Speed Level	Speed Position Torque		
Pn507	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 min <sup>-1</sup>	100	Immediately	Setup
	Servo OFF-Brake C	ommand Waiting Ti	Speed Position Torque		
Pn508	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
-	10 to 100	10 ms	50	Immediately	Setup

• Linear Servomotors

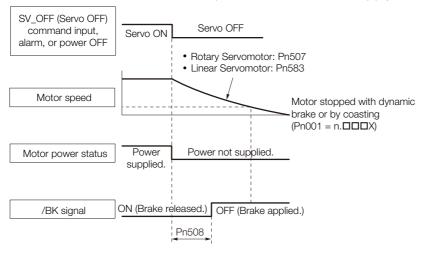
	Brake Reference Ou	tput Speed Level	Speed Position Force		
Pn583	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 mm/s	10	Immediately	Setup
	Servo OFF-Brake Command Waiting Time			Speed Positi	on Force
Pn508	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 100	10 ms	50	Immediately	Setup

The brake operates when either of the following conditions is satisfied:

• When the Motor Speed Goes below the Level Set in Pn507 for a Rotary Servomotor or in Pn583 for a Linear Servomotor after the Power Supply to the Motor Is Stopped



• When the Time Set In Pn508 Elapses after the Power Supply to the Motor Is Stopped





The Servomotor will be limited to its maximum speed even if the brake reference output speed level (Rotary Servomotor: Pn507, Linear Servomotor: Pn583) is higher than the maximum speed.

6.12.5 Built-in Brake Relay Usage Selection

### 6.12.5 Built-in Brake Relay Usage Selection

SERVOPACKs with built-in brake control contain a brake relay.

Set Pn023 =  $n.\Box\Box\BoxX$  (Built-in Brake Relay Usage Selection) to specify whether to use the built-in brake relays.

Parameter		Description	When Enabled	Classification
Pn023	n.□□□0 (default setting)	Use the built-in brake relays.	After restart	Setup
	n.0001	Do not use the built-in brake relays.		

# 6.13 Motor Stopping Methods for Servo OFF and Alarms

You can use the following methods to stop the Servomotor when the servo is turned OFF or an alarm occurs.

There are the following four stopping methods.

Motor Stopping Method	Meaning
Stopping by Applying the Dynamic Brake	The electric circuits are internally connected to stop the Servomotor quickly.
Coasting to a Stop	The motor stops naturally due to friction during operation.
Zero Clamping	The speed reference is set to 0 to stop the Servomotor quickly.
Decelerating to a Stop	Emergency stop torque is used to decelerate the motor to a stop.

There are the following three conditions after stopping.

Status after Stopping	Meaning
Dynamic Brake Applied	The electric circuits are internally connected to hold the Servomotor.
Coasting	The SERVOPACK does not control the Servomotor. (The machine will move in response to a force from the load.)
Zero Clamping	A position loop is created and the Servomotor remains stopped at a position reference of 0. (The current stop position is held.)

• The dynamic brake is used for emergency stops. The dynamic brake circuit will operate frequently if the power supply is turned ON and OFF or the servo is turned ON and OFF while a reference input is applied to start and stop the Servomotor. This may result in deterioration of the internal elements in the SERVOPACK. Use speed input references or position references to start and stop the Servomotor.

 If you turn OFF the main circuit power supply or control power supply during operation before you turn OFF the servo, the Servomotor stopping method depends on the SERVOPACK model as shown in the following table.

	Servomotor Stopping Method				
Condition	SGD7S-1R9D, -3R5D, -5R4D, -8R4D, -120D, or -170D	SGD7S-210D, -260D, -280D, or -370D			
Main circuit power supply turned OFF before turning OFF the servo	Stopping with dynamic brake	Coasting to a stop			
Control power supply turned OFF before turning OFF the servo	Stopping with dynamic brake				

Note: The SGD7S-210D, -260D, -280D, and -370D do not have a built-in dynamic brake. They will always coast to a stop. To perform dynamic braking, you must create the dynamic brake circuit. Refer to the following chapter for details on the dynamic brake circuit.

Chapter 5 Wiring and Settings for the Dynamic Brake

- If the Servomotor must be stopped by coasting rather than with the dynamic brake when the main circuit power supply or the control power supply is turned OFF before the servo is turned OFF, use a Servomotor that has the dynamic brake option.
- To minimize the coasting distance of the Servomotor to come to a stop when an alarm occurs, zero-speed stopping is the default method for alarms to which it is applicable. However, depending on the application, stopping with the dynamic brake may be more suitable than zero-speed stopping.

For example, when coupling two shafts (twin-drive operation), machine damage may occur if a zero-speed stopping alarm occurs for one of the coupled shafts and the other shaft stops with a dynamic brake. In such cases, change the stopping method to the dynamic brake.

6.13.1 Stopping Method for Servo OFF

### 6.13.1 Stopping Method for Servo OFF

Set the stopping method for when the servo is turned OFF in Pn001 =  $n.\Box\Box\BoxX$  (Motor Stopping Method for Servo OFF and Group 1 Alarms).

Parameter		Servomotor Stop- ping Method	Status after Servo- motor Stops	When Enabled	Classifi- cation
Pn001	n.□□□0 (default setting)	Dynamic brake *	Dynamic brake *	A (t	
	n.0001		Coasting	After restart	Setup
	n.0002	Coasting	Coasting		

\* The Servomotor will coast to a stop when the SERVOPACK is not equipped with a built-in Dynamic Brake Resistor or an External Dynamic Brake Resistor is not connected.

Note: If Pn001 is set to n. DDD (Stop the motor by applying the dynamic brake) and the Servomotor is stopped or operates at a low speed, braking force may not be generated, just like it is not generated for coasting to a stop.



When connecting an external dynamic brake circuit to SGD7S-210D, -260D, -280D, and -370D SERVOPACKs, set the /DBANS (Dynamic Brake Answer Input) and /DBON (Dynamic Brake Operation Request Output) signals regardless of the setting of Pn001 = n.  $\Box$   $\Box$   $\Box$  X. The A.F30 (Dynamic Brake Circuit Error) alarm will occur if the /DBANS and /DBON signals are not connected to I/O signal terminals.

### 6.13.2 Servomotor Stopping Method for Alarms

There are two types of alarms, group 1 (Gr. 1) alarms and group 2 (Gr. 2) alarms. A different parameter is used to set the stopping method for alarms for each alarm type.

Refer to the following section to see which alarms are in group 1 and which are in group 2. *13.2.1 List of Alarms* on page 13-5

### Motor Stopping Method for Group 1 Alarms

When a group 1 alarm occurs, the Servomotor will stop according to the setting of  $Pn001 = n.\Box\Box\BoxX$ . The default setting is to stop by applying the dynamic brake.

Refer to the following section for details. 6.13.1 Stopping Method for Servo OFF on page 6-38

6.13.2 Servomotor Stopping Method for Alarms

### Motor Stopping Method for Group 2 Alarms

When a group 2 alarm occurs, the Servomotor will stop according to the settings of the following three parameters. The default setting is for zero clamping.

- Pn001 = n. DDX (Motor Stopping Method for Servo OFF and Group 1 Alarms)
- Pn00A = n.□□□X (Motor Stopping Method for Group 2 Alarms)
- Pn00B = n. DDXD (Motor Stopping Method for Group 2 Alarms)

However, during torque control, the group 1 stopping method is always used. If you set Pn00B to n.  $\Box$   $\Box$   $\Box$   $\Box$  (Apply dynamic brake or coast Servomotor to a stop), you can use the same stopping method as group 1. If you are coordinating a number of Servomotors, you can use this stopping method to prevent machine damage that may result because of differences in the stopping method.

The following table shows the combinations of the parameter settings and the resulting stopping methods.

	Paramete	er	Servomotor	Status after	When	Classification
Pn00B	Pn00A	Pn001	Stopping Method	Servomotor Stops	Enabled	
n.□□0□ (default	afault - (default setting) Zero-speed stop-					
(default setting)	-	n.0001	ping	Coasting		
		n.□□□2				
		n.□□□0 (default setting)	Dynamic brake	Dynamic brake		
n.0010	-	n.0001		Coasting		
		n.0002	Coasting			
		n.□□□0 (default setting)	Dynamic brake	Dynamic brake	- After restart	Setup
	n.□□□0	n.□□□1		Coasting		
		n.0002	Coasting	Codoting		
	n.□□□1 (default setting)	n.□□□0 (default setting)		Dynamic brake		
		n.0001	Motor is deceler- ated using the torque set in	Coasting		
		n.0002				
n.0020		n.□□□0 (default setting)	Pn406 as the maximum torque.	Coasting		
n.uu2u	n.□□□2	n.□□□1				
		n.0002				
		n.□□□0 (default setting)		Dynamic brake		
	n.□□□3	n.0001		Coasting		
		n.🗆 🗆 🗠 2	Motor is deceler- ated according to	Coasting	_	
		n.□□□0 (default setting)	setting of Pn30A.			
	n.0004	n.0001		Coasting		
		n.□□□2				

Note: 1. The setting of Pn00A is ignored if Pn00B is set to n. DDD or n. DD1.

2. The setting of Pn00A = n.  $\Box$   $\Box$  X is enabled for position control and speed control. During torque control, the setting of Pn00A = n.  $\Box$   $\Box$  X will be ignored and only the setting of Pn001 = n.  $\Box$   $\Box$  X will be used.

3. Refer to the following section for details on Pn406 (Emergency Stop Torque). Stopping the Servomotor by Setting Emergency Stop Torque on page 6-29

4. Refer to the following section for details on Pn30A (Deceleration Time for Servo OFF and Forced Stops).

Stopping the Servomotor by Setting the Deceleration Time on page 6-29

6.14.1 Detection Timing for Overload Warnings (A.910)

# 6.14 Motor Overload Detection Level

The motor overload detection level is the threshold used to detect overload alarms and overload warnings when the Servomotor is subjected to a continuous load that exceeds the Servomotor ratings.

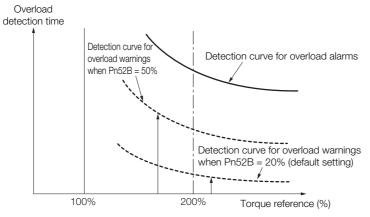
It is designed to prevent Servomotor overheating.

You can change the detection timing for A.910 warnings (Overload) and A.720 alarms (Continuous Overload). You cannot change the detection level for A.710 alarms (Instantaneous Overload).

# 6.14.1 Detection Timing for Overload Warnings (A.910)

With the default setting for overload warnings, an overload warning is detected in 20% of the time required to detect an overload alarm. You can change the time required to detect an overload warning by changing the setting of the overload warning level (Pn52B). You can increase safety by using overload warning detection as an overload protection function matched to the system.

The following graph shows an example of the detection of overload warnings when the overload warning level (Pn52B) is changed from 20% to 50%. An overload warning is detected in half of the time required to detect an overload alarm.



	Overload Warning L	evel	Speed Position	n Torque	
Pn52B	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 100 1%		20	Immediately	Setup

6.14.2 Detection Timing for Overload Alarms (A.720)

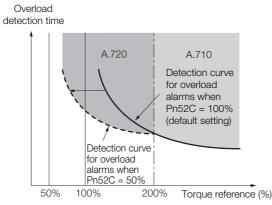
### 6.14.2 Detection Timing for Overload Alarms (A.720)

If Servomotor heat dissipation is insufficient (e.g., if the heat sink is too small), you can lower the overload alarm detection level to help prevent overheating.

To reduce the overload alarm detection level, change the setting of Pn52C (Base Current Derating at Motor Overload Detection).

	Base Current Derati	ng at Motor Overloa	Speed Position Torque		
Pn52C	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 100	1%	100	After restart	Setup

An A.720 alarm (Continuous Overload) can be detected earlier to protect the Servomotor from overloading.



Note: The gray areas in the above graph show where A.710 and A.720 alarms occur.

Refer to the relevant manual given below for a diagram that shows the relationships between the Servomotor heat dissipation conditions (heat sink size, surrounding air temperature, and derating). You can protect the Servomotor from overloads more effectively by setting this derating value in Pn52C.

Ω 2-7-Series Rotary Servomotor with 400 V-Input Power Product Manual (Manual No.: SIEP S800001 86)

Ω Σ-7-Series Linear Servomotor with 400 V-Input Power Product Manual (Manual No.: SIEP S800001 81)

# **Electronic Gear Settings**

The minimum unit of the position data that is used to move a load is called the reference unit. The reference unit is used to give travel amounts, not in pulses, but rather in distances or other physical units (such as  $\mu m$  or °) that are easier to understand.

The electronic gear is used to convert the travel distances that are specified in reference units to pulses, which are required for actual movements.

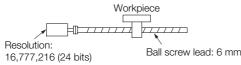
With the electronic gear, one reference unit is equal to the workpiece travel distance per reference pulse input to the SERVOPACK. In other words, if you use the SERVOPACK's electronic gear, pulses can be read as reference units.

Note: If you set an electronic gear in the host controller, normally set the electronic gear ratio in the SERVOPACK to

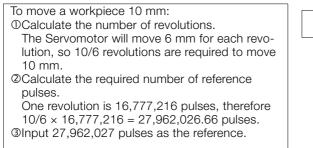
The difference between using and not using the electronic gear is shown below.

#### Rotary Servomotors

In this example, the following machine configuration is used to move the workpiece 10 mm.



When the Electronic Gear Is Not Used



Calculating the number of reference pulses for each reference is troublesome.

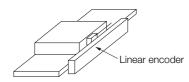
When the Electronic Gear Is Used

If you use reference units to move the workpiece when one reference unit is set to  $1 \, \mu m$ , the travel distance is 1 µm per pulse. To move the workpiece 10 mm  $(10,000 \ \mu m), \ 10,000 \ \div \ 1 =$ 10,000 pulses, so 10,000 pulses would be input.

Calculating the number of reference pulses for each reference is not necessary.

#### Linear Servomotors

In this example, the following machine configuration is used to move the load 10 mm. We'll assume that the resolution of the Serial Converter Unit is 256 and that the linear encoder pitch is 20 µm.



When the Electronic Gear Is Not Used

To move the load 10 mm:  $10 \times 1000 \div 20 \times 256 = 128,000$ pulses, so 128,000 pulses are input as the reference.

Calculating the number of reference pulses for each reference is troublesome.

To use reference units to move the load 10 mm: If we set the reference unit to 1  $\mu$ m, the travel distance is 1  $\mu$ m per pulse. To move the load 10 mm (10,000  $\mu$ m), 10,000/1 = 10,000 pulses, so 10,000 pulses would be input as the reference.

When the Electronic Gear Is Used

Calculating the number of reference pulses for each reference is not necessary.

### 6.15.1 Electronic Gear Ratio Settings

Set the electronic gear ratio using Pn20E and Pn210.

Important	<ul> <li>The setting range of the electronic gear depends on the setting of Pn040 = n.□□X□ (Encoder Resolution Compatibility Selection).</li> <li>Pn040 = n.□□0□ (Use the encoder resolution of the connected motor.) Set the electronic gear ratio within the following range.</li> <li>0.001 ≤ Electronic gear ratio (B/A) ≤ 64,000 If the electronic gear ratio is outside of this range, an A.040 alarm (Parameter Setting Error) will occur.</li> <li>Pn040 = n.□□1□ (Use a resolution of 20 bits when connected to an SGM7J, SGM7A, or SGM7G motor.) Set the electronic gear ratio within the following range.</li> <li>0.001 ≤ Electronic gear ratio (B/A) ≤ 4,000 If the electronic gear ratio within the following range.</li> <li>0.001 ≤ Electronic gear ratio within the following range.</li> <li>0.001 ≤ Electronic gear ratio (B/A) ≤ 4,000 If the electronic gear ratio is outside of this range, an A.040 alarm (Parameter Setting Error) will occur.</li> </ul>
-----------	---

	Electronic Gear Rati	o (Numerator)	Position			
Pn20E	Setting Range	Setting Unit	Default Setting	When Enabled Classific		
	1 to 1,073,741,824	1	16	After restart	Setup	
	Electronic Gear Ratio (Denominator)			Position		
Pn210	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	1 to 1,073,741,824	1	1	After restart	Setup	

### Calculating the Settings for the Electronic Gear Ratio

### Rotary Servomotors

If the gear ratio between the Servomotor shaft and the load is given as n/m, where n is the number of load rotations for m Servomotor shaft rotations, the settings for the electronic gear ratio can be calculated as follows:

Electronic gear ratio  $\frac{B}{A} = \frac{Pn20E}{Pn210} = \frac{Encoder resolution}{Travel distance per load shaft revolution (reference units)} \times \frac{m}{n}$ 

#### Encoder Resolution

You can check the encoder resolution in the Servomotor model number.

SGM7J, SGM7A, or SGM7G -

 Code	Specification	Encoder Resolution
7	24-bit multiturn absolute encoder	16,777,216
F	24-bit incremental encoder	16,777,216

6.15.1 Electronic Gear Ratio Settings

#### Linear Servomotors

You can calculate the settings for the electronic gear ratio with the following equation: When Not Using a Serial Converter Unit

Use the following formula if the linear encoder and SERVOPACK are connected directly or if a linear encoder that does not require a Serial Converter Unit is used.

Electronic gear ratio  $\frac{B}{A} = \frac{Pn20E}{Pn210} = \frac{Travel distance per reference unit (reference units) × Linear encoder resolution Linear encoder pitch (the value from the following table)$ 

When Using a Serial Converter Unit

Electronic gear ratio  $\frac{B}{A} = \frac{Pn20E}{Pn210} = \frac{Travel distance per reference unit (reference units) × Resolution of the Serial Converter Unit Linear encoder pitch (setting of Pn282)$ 

#### Feedback Resolution of Linear Encoder

The linear encoder pitches and resolutions are given in the following table. Calculate the electronic gear ratio using the values in the following table.

Type of Linear Encoder	Manufacturer	Linear Encoder Model	Linear Encoder Pitch [µm] <sup>*1</sup>	Model of Serial Con- verter Unit or Model of Interpolator	Resolution	Resolution
	Dr.	LIDA480	20	JZDP-H003- <b>DD</b> -E <sup>*2</sup>	256	0.078 μm
	JOHANNES		20	JZDP-J003-00-E*2	4,096	0.0049 µm
			4	JZDP-H003- <b>DD</b> -E <sup>*2</sup>	256	0.016 µm
	GmbH	LIF48	4	JZDP-J003-00-E*2	4,096	0.00098 µm
	Renishaw		00	JZDP-H005- <b>DDD</b> -E*2	256	0.078 µm
	PLC	RGH22B	20	JZDP-J005- <b>DDD</b> -E*2	4,096	0.0049 μm
Incre-		SR75-0000LF*5	80	_	8,192	0.0098 µm
mental		SR75-DDDDDMF	80	_	1,024	0.078 μm
		SR85-DDDDDLF*5	80	_	8,192	0.0098 µm
	Magnescale Co., Ltd.	SR85-DDDDDMF	80	_	1,024	0.078 µm
		SL700 <sup>*5</sup> , SL710 <sup>*5</sup> , SL720 <sup>*5,</sup> SL730 <sup>*5</sup>	800	PL101-RY*3	8,192	0.0977 μm
				MJ620-T13 <sup>*4</sup>		
		SQ10	400	MQ10-FLA <sup>*4</sup>	8,192	0.0488 µm
				MQ10-GLA*4		
		LIC4100 Series	20.48	EIB3391Y*4	4,096	0.005 μm
	Dr. JOHANNES		204.8	EIB3391Y <sup>*4</sup>	4,096	0.05 µm
		JOHANNES HEIDENHAIN	LIC2100 Series	409.6	EIB3391Y <sup>*4</sup>	4,096
	GmbH	LC115	40.96	EIB3381Y*4	4,096	0.01 µm
		LC415	40.96	EIB3391Y*4	4,096	0.01 µm
		ST781A/ST781AL	256	_	512	0.5 µm
Absolute		ST782A/ST782AL	256	_	512	0.5 µm
		ST783/ST783AL	51.2	_	512	0.1 μm
	Mitutoyo	ST784/ST784AL	51.2	_	512	0.1 μm
	Corporation	ST788A/ST788AL	51.2	-	512	0.1 µm
		ST789A/ST789AL	25.6	-	512	0.05 µm
		ST1381	5.12	-	512	0.01 µm
		ST1382	0.512	_	512	0.001 µm

Continued on next page.

#### 6.15.1 Electronic Gear Ratio Settings

Continued from previous page.

Type of Linear Encoder	Manufacturer	Linear Encoder Model	Linear Encoder Pitch [µm] <sup>*1</sup>	Model of Serial Con- verter Unit or Model of Interpolator	Resolution	Resolution
		EL36Y-0050F000	12.8	-	256	0.05 µm
		EL36Y-00100F000	25.6	_	256	0.1 µm
	Renishaw PLC	EL36Y-00500F000	128	-	256	0.5 µm
		RL36Y-00500000	12.8	_	256	0.05 μm
		RL36Y-0001000	0.256	-	256	0.001 µm
		SR77-0000LF*5	80	_	8,192	0.0098 µm
		SR77-DDDDDMF	80	_	1,024	0.078 µm
		SR87-0000LF*5	80	_	8,192	0.0098 µm
		SR87-DDDDDMF	80	_	1,024	0.078 μm
	Magnescale Co., Ltd.	SQ47/SQ57- SDF SQ47/SQ57- F	20.48	_	4,096	0.005 μm
Absolute		SQ47/SQ57- ADFDDD SQ47/SQ57- DDDFDFDDD	40.96	_	4,096	0.01 µm
		L2AK208	20	_	256	0.078 µm
		L2AK211	20	_	2,048	0.0098 µm
		LAK209	40	_	512	0.078 µm
	_	LAK212	40	_	4,096	0.0098 μm
	Fagor Automation S.	S2AK208	20	_	256	0.078 µm
	Coop.	SV2AK208	20	_	256	0.078 µm
		G2AK208	20	_	256	0.078 µm
		S2AK211	20	_	2,048	0.0098 µm
		SV2AK211	20	_	2,048	0.0098 µm
		G2AK211	20	_	2,048	0.0098 µm

\*1. These are reference values for setting SERVOPACK parameters. Contact the manufacturer for actual linear encoder scale pitches.

\*2. This is the model of the Serial Converter Unit.

\*3. This is the model of the Head with Interpolator.

\*4. This is the model of the Interpolator.

\*5. If you use an encoder pulse output with this linear encoder, the setting range of the encoder output resolution (Pn281) is restricted. Refer to the following section for details on the encoder output resolution (Pn281).
 7.5.2 Setting for the Encoder Divided Pulse Output on page 7-25

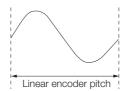
#### Information Resolution

You can calculate the resolution that is used inside the SERVOPACK (i.e., the travel distance per feedback pulse) with the following formula.

Resolution (travel distance per feedback pulse) =

Linear encoder pitch Resolution of Serial Converter Unit or linear encoder

The SERVOPACK uses feedback pulses as the unit to control a Servomotor.



Linear encoder pitch =Distance for one cycle of the analog voltage feedback signal from the linear encoder

6.15.2 Electronic Gear Ratio Setting Examples

### 6.15.2 Electronic Gear Ratio Setting Examples

Setting examples are provided in this section.

• Rotary Servomotors

Step	Description	Machine Configuration		
		Ball Screw	Rotary Table	Belt and Pulley
		Reference unit: 0.001 mm Load shaft Encoder: Ball screw lead: 24 bits 6 mm	Reference unit: 0.01° Gear ratio: 1/100 Load shaft Encoder: 24 bits	Reference unit: 0.005 mm Load shaft Gear ratio: Pulley dia.: 1/50 Fulley dia.: 100 mm Encoder: 24 bits
1	Machine Specifications	<ul> <li>Ball screw lead: 6 mm</li> <li>Gear ratio: 1/1</li> </ul>	<ul> <li>Rotation angle per revolution: 360°</li> <li>Gear ratio: 1/100</li> </ul>	<ul> <li>Pulley dia.: 100 mm (Pulley circumference: 314 mm)</li> <li>Gear ratio: 1/50</li> </ul>
2	Encoder Resolution	16,777,216 (24 bits)	16,777,216 (24 bits)	16,777,216 (24 bits)
3	Reference Unit	0.001 mm (1 μm)	0.01°	0.005 mm (5 μm)
4	Travel Distance per Load Shaft Revolution (Reference Units)	6 mm/0.001 mm = 6,000	360°/0.01° = 36,000	314 mm/0.005 mm = 62,800
5	Electronic Gear Ratio	$\frac{B}{A} = \frac{16,777,216}{6,000} \times \frac{1}{1}$	$\frac{B}{A} = \frac{16,777,216}{36,000} \times \frac{100}{1}$	$\frac{B}{A} = \frac{16,777,216}{62,800} \times \frac{50}{1}$
6	Parameters	Pn20E: 16,777,216	Pn20E: 167,772,160	Pn20E: 838,860,800
		Pn210: 6,000	Pn210: 3,600	Pn210: 62,800

Linear Servomotors

A setting example for a Serial Converter Unit resolution of 256 is given below.

		Machine Configuration	
Step	Description	Reference unit: 0.02 mm (20 µm) Forward direction	
1	Linear encoder pitch	0.02 mm (20 μm)	
2	Reference Unit	0.001 mm (1 μm)	
3	Electronic Gear Ratio	$\frac{B}{A} = \frac{1 (\mu m)}{20 (\mu m)} \times 256$	
4	Setting Parameters	Pn20E: 256 Pn210: 20	

## 6.16 Resetting the Absolute Encoder

In a system that uses an absolute encoder, the multiturn data must be reset at startup. An alarm related to the absolute encoder (A.810 or A.820) will occur when the absolute encoder must be reset, such as when the power supply is turned ON.

When you reset the absolute encoder, the multiturn data is reset and any alarms related to the absolute encoder are cleared.

Reset the absolute encoder in the following cases.

- When an A.810 alarm (Encoder Backup Alarm) occurs
- When an A.820 alarm (Encoder Checksum Alarm) occurs
- When starting the system for the first time
- · When you want to reset the multiturn data in the absolute encoder
- When the Servomotor has been replaced

## CAUTION

• The multiturn data will be reset to a value between -2 and +2 rotations when the absolute encoder is reset. The reference position of the machine system will change. Adjust the reference position in the host controller to the position that results from resetting the absolute encoder.

If the machine is started without adjusting the position in the host controller, unexpected operation may cause personal injury or damage to the machine.

#### Information

- The multiturn data will always be zero in the following cases. It is never necessary to reset the absolute encoder in these cases. An alarm related to the absolute encoder (A.810 or A.820) will not occur.
  - · When you use a single-turn absolute encoder
  - When the encoder is set to be used as a single-turn absolute encoder (Pn002 =  $n.\Box 2\Box \Box$ )

#### 6.16.1 Precautions on Resetting

- You cannot use the ALM\_CLR (Clear Alarm) command from the SERVOPACK to clear the A.810 alarm (Encoder Backup Alarm) or the A.820 alarm (Encoder Checksum Alarm). Always use the operation to reset the absolute encoder to clear these alarms.
- If an A.8 arm (Internal Encoder Monitoring Alarm) occurs, turn OFF the power supply to reset the alarm.

#### 6.16.2 Preparations

Always check the following before you reset an absolute encoder.

- The parameters must not be write prohibited.
- The servo must be OFF.

6.16.3 Applicable Tools

### 6.16.3 Applicable Tools

The following table lists the tools that you can use to reset the absolute encoder and the applicable tool functions.

Tool	Function	Reference
Digital Operator	Fn008	Σ-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Setup – Absolute Encoder Reset	6.16.4 Operating Procedure on page 6-48

Information

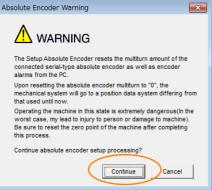
You can reset the absolute encoder using the MEM\_WR (Write Memory) command. Refer to the following manual for information on the MEM\_WR (Write Memory) command.

Σ-7-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

### 6.16.4 Operating Procedure

Use the following procedure to reset the absolute encoder.

- 1. Confirm that the servo is OFF.
- 2. Click the 🔎 Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **3.** Select Absolute Encoder Reset in the Menu Dialog Box. The Absolute Encoder Reset Dialog Box will be displayed.
- 4. Click the Continue Button.



Click the **Cancel** Button to cancel resetting the absolute encoder. The Main Window will return.

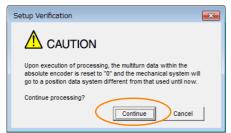
5. Click the Execute setting Button.

Absolute encoder - Setup AXIS#00	×
Perform absolute encoder setup under the following circumstances: 1. At first start-up of the machine 2. When an "encoder backup alarm" has been generated 3. After the Servopack power has been turned OFF and the encoder cable removed	
Absolute encoder setup can only be performed with the Restart power after setup processing is complete.	
Alarm name A.810 : Encoder Backup Alarm	
Execute setting	

The current alarm code and name will be displayed in the Alarm name Box.

6.16.4 Operating Procedure

6. Click the Continue Button.



Click the **Cancel** Button to cancel resetting the absolute encoder. The previous dialog box will return.

#### 7. Click the OK Button.

The absolute encoder will be reset.

#### When Resetting Fails

If you attempted to reset the absolute encoder when the servo was ON in the SERVOPACK, the following dialog box will be displayed and processing will be canceled.

Absolute encoder reset conditions error	
Servo ON now. Turn the Servo UFF when resetting the absolute encoder.	
ок	

Click the **OK** Button. The Main Window will return. Turn OFF the servo and repeat the procedure from step 1.

When Resetting Is Successful

The following dialog box will be displayed when the absolute encoder has been reset.

Completion Warning Message
Absolute Encoder reset processing has been performed. The Multiturn amount in the absolute encoder has been to "0". Be sure to reset the mechanical system to "0" after restarting power.
ОК

The Main Window will return.

**8.** To enable the change to the settings, turn the power supply to the SERVOPACK OFF and ON again.

This concludes the procedure to reset the absolute encoder.

6.17.1 Absolute Encoder Origin Offset

## 6.17 Setting the Origin of the Absolute Encoder

## 6.17.1 Absolute Encoder Origin Offset

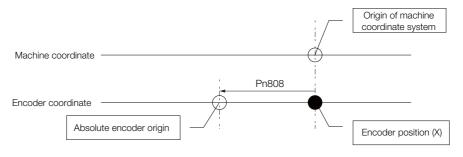
The origin offset of the absolute encoder is a correction that is used to set the origin of the machine coordinate system in addition to the origin of the absolute encoder. Set the offset between the absolute encoder origin and the machine coordinate system origin in Pn808 (Absolute Encoder Origin Offset).

After the SENS\_ON (Absolute Data Request) command is received, the position in the machine coordinate system (APOS) is set based on the absolute encoder position data and the setting of Pn808.

	Absolute Encoder C	rigin Offset	Position		
Pn808	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	-1,073,741,823 to 1,073,741,823	1 reference unit	0	Immediately	Setup

Example

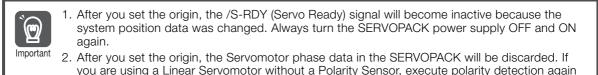
If the encoder position (X) is at the origin of the machine coordinate system (0), then Pn808 would be set to -X.



## 6.17.2 Setting the Origin of the Absolute Linear Encoder

You can set any position as the origin in the following Linear Encoders.

- Mitutoyo Corporation ABS ST780A Series or ST1300 Series Models: ABS ST78□A/ST78□AL/ST13□□
- Renishaw PLC EVOLUTE Series Models: EL36Y-DDDDDDDDD
- Renishaw PLC RESOLUTE Series Models: RL36Y-



## Preparations

Always check the following before you set the origin of an absolute encoder.

to save the Servomotor phase data in the SERVOPACK.

- The parameters must not be write prohibited.
- The servo must be OFF.

#### **Applicable Tools**

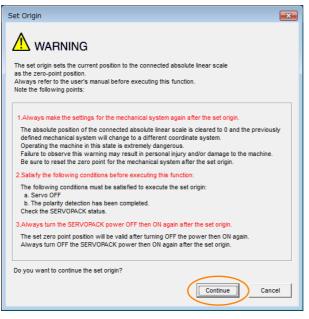
The following table lists the tools that you can use to set the origin of the absolute linear encoder and the applicable tool functions.

Tool	Function	Reference
Digital Operator	Fn020	Σ-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Setup - Set Origin	Gerating Procedure on page 6-51

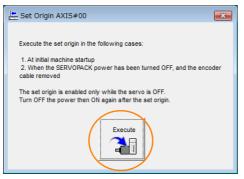
#### **Operating Procedure**

Use the following procedure to set the origin of an absolute linear encoder.

- 1. Click the 🔎 Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select Set Origin in the Menu Dialog Box. The Set Origin Dialog Box will be displayed.
- 3. Click the Continue Button.



4. Click the Execute Button.



6.17.2 Setting the Origin of the Absolute Linear Encoder

5. Click the Continue Button.



Click the **Cancel** Button to cancel setting the origin of the absolute linear encoder. The previous dialog box will return.

6. Click the OK Button.

Set Origin
Zero-point position setting has been executed. The movement amount saved in the encoder has been reset to 0 (zero). Always turn the power to the Servopack off and then on again after execution of this function.
When using a linear motor without a hall sensor, execute polarity detection after turning the power off and then on again
ОК

- 7. Turn the power supply to the SERVOPACK OFF and ON again.
- 8. If you use a Linear Servomotor that does not have a polarity sensor, perform polarity detection.

Refer to the following section for details on the polarity detection.

This concludes the procedure to set the origin of the absolute linear encoder.

## 6.18 Setting the Regenerative Resistor Capacity

The Regenerative Resistor consumes regenerative energy that is generated by the Servomotor, e.g., when the Servomotor decelerates.

If an External Regenerative Resistor is connected, you must set Pn600 (Regenerative Resistor Capacity) and Pn603 (Regenerative Resistance).

Note: When using the SERVOPACK's built-in regenerative resistor (not using an External Regenerative Resistor), use the default setting of 0 for Pn600 and Pn603.



- If you connect an External Regenerative Resistor, set Pn600 and Pn603 to suitable values. If a suitable value is not set, A.320 alarms (Regenerative Overload) will not be detected correctly, and the External Regenerative Resistor may be damaged or personal injury or fire may result.
- When you select an External Regenerative Resistor, make sure that it has a suitable capacity.

	Regenerative Resiste	or Capacity	Speed Position Torque		
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
Pn600	0 to SERVOPACK's maximum applica- ble motor capacity	10 W	0	Immediately	Setup
	Regenerative Resistance			Speed Position Torque	
Pn603	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 65,535	10 mΩ	0	Immediately	Setup

There is a risk of personal injury or fire.

Set the Regenerative Resistor capacity to a value that is consistent with the allowable capacity of the External Regenerative Resistor. The setting depends on the cooling conditions of the External Regenerative Resistor.

- For self-cooling (natural convection cooling): Set the parameter to a maximum 20% of the capacity (W) of the actually installed Regenerative Resistor.
- For forced-air cooling: Set the parameter to a maximum 50% of the capacity (W) of the actually installed Regenerative Resistor.

**Example** For a self-cooling 100-W External Regenerative Resistor, set Pn600 to 2 (×10 W) (100 W × 20% = 20 W).

Note: An A.320 alarm will be displayed if the setting is not suitable.



1. When an External Regenerative Resistor is used at the normal rated load ratio, the resistor temperature increases to between 200°C and 300°C. Always apply derating. Consult the manufacturer for the resistor's load characteristics.

2. For safety, use an External Regenerative Resistor with a thermoswitch.

# Application Functions

This chapter describes the application functions that you can set before you start Servo System operation. It also describes the setting methods.

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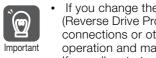
7.1.1 Input Signal Allocations

## I/O Signal Allocations

Functions are allocated to the pins on the I/O signal connector (CN1) in advance. You can change the allocations and the polarity for some of the connector pins. Function allocations and polarity settings are made with parameters.

This section describes the I/O signal allocations.

#### 7.1.1 Input Signal Allocations



If you change the default polarity settings for the P-OT (Forward Drive Prohibit) or N-OT (Reverse Drive Prohibit) signal, the overtravel function will not operate if there are signal line disconnections or other problems. If you must change the polarity of one of these signals, verify operation and make sure that no safety problems will exist.

• If you allocate two or more signals to the same input circuit, a logical OR of the inputs will be used and all of the allocated signals will operate accordingly. This may result in unexpected operation.

The input signals that you can allocate to the pins on the I/O signal connector (CN1) and the related parameters are given in the following table.

Input Signal	Input Signal Name	Parameter
P-OT	Forward Drive Prohibit	Pn50A = n.X□□□
N-OT	Reverse Drive Prohibit	Pn50B = n.□□□X
/P-CL	Forward External Torque Limit	Pn50B = n.□X□□
/N-CL	Reverse External Torque Limit	Pn50B = n.X□□□
/DEC	Origin Return Deceleration Switch Input	Pn511 = n.□□□X
/EXT1	External Latch Input 1	Pn511 = n.□□X□
/EXT2	External Latch Input 2	Pn511 = n.□X□□
/EXT3	External Latch Input 3	Pn511 = n.X□□□
/DBANS	Dynamic Brake Answer Input	Pn515 = n.□X□□
FSTP	Forced Stop	Pn516 = n.□□□X

#### Relationship between Parameter Settings, Allocated Pins, and Polarities

The following table shows the relationship between the input signal parameter settings, the pins on the I/O signal connector (CN1), and polarities.

Parameter Setting	Pin No.	Description	
0	13		
1	7	+24 V	
2	8		
3	9	A reverse signal (a signal with "/" before the signal abbreviation, such as the /	
4	10	P-CL signal) is active when the contacts are ON (closed).	
5	11	A signal that does not have "/" before the signal abbreviation (such as t OT signal) is active when the contacts are OFF (open).	
6	12		
7	-	The input signal is not allocated to a connector pin and it is always active. If the signal is processed on a signal edge, then it is always inactive.	
8	-	The input signal is not allocated to a connector pin and it is always inactive. Set the parameter to 8 if the signal is not used.	
9	13		
A	7		
В	8		
С	9	A reverse signal (a signal with "/" before the signal abbreviation, such as the /	
D	10	P-CL signal) is active when the contacts are OFF (open).	
E	11	A signal that does not have "/" before the signal abbreviation (such as the P- OT signal) is active when the contacts are ON (closed).	
F	12		

Note: 1. You cannot allocate the /EXT1 to /EXT3 (External Latch Inputs 1 to 3) signals to pins 10 to 12 on the I/O signal connector (CN1).

2. Refer to the following section for details on input signal parameter settings.

14.1.2 List of Servo Parameters on page 14-3

#### **Example of Changing Input Signal Allocations**

The following example shows reversing the P-OT (Forward Drive Prohibit) signal allocated to CN1-7 and the /DEC (Origin Return Deceleration Switch) signal allocated to CN1-9.

Pn50A = n.1□□1	Pn511 = n. <b>□□□</b> 3	Before change
$\downarrow$	$\downarrow$	

 $Pn50A = n.3\Box\Box1$   $Pn511 = n.\Box\Box\Box1$  After change

Refer to the following section for the parameter setting procedure. 6.1.3 Parameter Setting Methods on page 6-6

#### **Confirming Input Signals**

You can confirm the status of input signals on the I/O signal monitor. Refer to the following section for information on the I/O signal monitor.

7.1.2 Output Signal Allocations

## 7.1.2 Output Signal Allocations

You can allocate the desired output signals to pins 1, 2, and 23 to 30 on the I/O signal connector (CN1). You set the allocations in the following parameters: Pn50E, Pn50F, Pn510, Pn514, Pn51A, Pn53C, and Pn53D.

- The signals that are not detected are considered to be OFF. For example, the /COIN (Positioning Completion) signal is considered to be OFF during speed control.
- Reversing the polarity of the /BK (Brake) signal, i.e., changing it to positive logic, will prevent the holding brake from operating if its signal line is disconnected. If you must change the polarity of this signal, verify operation and make sure that no safety problems will exist.
  - If you allocate more than one signal to the same output circuit, a logical OR of the signals will be output.

Output signals are allocated as shown in the following table.

Refer to *Interpreting the Output Signal Allocation Tables* and change the allocations accordingly.

Interpreting the Output Signal Allocation Tables

These columns give the parameter settings to use. Signals are allocated to CN1 pins according to the settings.

Output Signal Name	Output Signals	CN1 Pin No.					Disabled
and Parameter		1 and 2	23 and 24	25 and 26	27 and 28	29 and 30	(Not Used)
Brake Pn50F = □X□□	/BK	1	2	3	4	5	0

7.1.2 Output Signal Allocations

	0.1.1		(	CN1 Pin No	).		Dischlard
Output Signal Name and Parameter	Output Signals	1 and 2	23 and 24	25 and 26	27 and 28	29 and 30	Disabled (Not Used)
Positioning Completion Pn50E = n.□□□X	/COIN	1	2	3	4	5	0 (default setting)
Speed Coincidence Detection Pn50E = n.□□X□	/V-CMP	1	2	3	4	5	0 (default setting)
Rotation Detection Pn50E = n.□X□□	/TGON	1	2	3	4	5	0 (default setting)
Servo Ready Pn50E = n.X□□□	/S-RDY	1	2	3	4	5	0 (default setting)
Torque Limit Detection Pn50F = n.□□□X	/CLT	1	2	3	4	5	0 (default setting)
Speed Limit Detection Pn50F = n.□□X□	/VLT	1	2	3	4	5	0 (default setting)
Brake Pn50F = n.□X□□	/BK	1 (default setting)	2	3	4	5	0
Warning Pn50F = n.X□□□	/WARN	1	2	3	4	5	0 (default setting)
Near Pn510 = n.□□□X	NEAR	1	2	3	4	5	0 (default setting)
Preventative Maintenance Pn514 = n.□X□□	/PM	1	2	3	4	5	0 (default setting)
Dynamic Brake Operation Request Pn51A = n.□□X□	/DBON	1	2	3	4	5	0 (default setting)
ZONE Table Entry 1 Pn53C = n.□□□X	/ZONE0	1	2	3	4	5	0 (default setting)
ZONE Table Entry 2 Pn53C = n.□□X□	/ZONE1	1	2	3	4	5	0 (default setting)
ZONE Table Entry 3 Pn53C = n.□X□□	/ZONE2	1	2	3	4	5	0 (default setting)
ZONE Table Entry 4 Pn53C = n.XDDD	/ZONE3	1	2	3	4	5	0 (default setting)
ZONE n Signal Pn53D = n.□□□X	/nZONE	1	2	3	4	5	0 (default setting)
Pn512 = n.□□□1	Reverse po CN1-1 an						
Pn512 = n.□□1□		polarity for CN1-23 nd CN1-24					0 (default setting)
Pn512 = n.□1□□	Reverse polarity for CN1-25 and		I CN1-26			The polarity is not reversed in the default	
Pn512 = n.1□□□	Reverse polarity for CN1-27 and CN1-2			-28		settings.	
Pn513 = n.□□□1		Reverse po	plarity for C	N1-29 and	I CN1-30		

7.1.3 ALM (Servo Alarm) Signal

#### **Example of Changing Output Signal Allocations**

The following example shows disabling the /COIN (Positioning Completion) signal allocated to CN1-25 and CN1-26 and allocating the /SRDY (Servo Ready) signal.

 $Pn50E = n.0 \square \square 3$  Before change

 $\downarrow$ 

 $Pn50E = n.3 \square \square 0$  After change

Refer to the following section for the parameter setting procedure. 6.1.3 Parameter Setting Methods on page 6-6

#### **Checking Output Signal Status**

You can confirm the status of output signals on the I/O signal monitor. Refer to the following section for information on the I/O signal monitor. 10.2.3 I/O Signal Monitor on page 10-5

## 7.1.3 ALM (Servo Alarm) Signal

This signal is output when the SERVOPACK detects an error.



Configure an external circuit so that this alarm output turns OFF the main circuit power supply to the SERVOPACK whenever an error occurs.

Туре	Signal	Connector Pin No.	Signal Status	Meaning
Output ALM		CN1-3 and CN1-4	ON (closed)	Normal SERVOPACK status
	ALIVI		OFF (open)	SERVOPACK alarm

#### Alarm Reset Methods

Refer to the following section for information on the alarm reset methods. 3.2.3 Resetting Alarms on page 13-43

### 7.1.4 /WARN (Warning) Signal

Both alarms and warnings are generated by the SERVOPACK. Alarms indicate errors in the SERVOPACK for which operation must be stopped immediately. Warnings indicate situations that may results in alarms but for which stopping operation is not yet necessary.

The /WARN (Warning) signal indicates that a condition exists that may result in an alarm.

Туре	Signal	Connector Pin No.	Signal Status	Meaning
Output /WARN		ON (closed)	Warning	
		Must be allocated.	OFF (open)	Normal status

Note: You must allocate the /WARN signal to use it. Use Pn50F = n.XDDD (/WARN (Warning Output) Signal Allocation) to allocate the signal to a connector pin. Refer to the following section for details.

7.1.2 Output Signal Allocations on page 7-6

#### /TGON (Rotation Detection) Signal 7.1.5

The /TGON signal indicates that the Servomotor is operating.

This signal is output when the shaft of the Servomotor rotates at the setting of Pn502 (Rotation Detection Level) or faster or the setting of Pn581 (Zero Speed Level) or faster.

Туре	Signal	Connector Pin No.	Signal Status	Servomotor	Meaning
Output /Te		Must be allocated.	Rotary Servomotors		The Servomotor is operating at the setting of Pn502 or faster.
			ON (closed)	Linear Servomotors	The Servomotor is operating at the setting of Pn581 or faster.
	/TGON			Rotary Servomotors	The Servomotor is operating at a speed that is slower than the setting of Pn502.
			OFF (open)	Linear Servomotors	The Servomotor is operating at a speed that is slower than the setting of Pn581.

Note: You must allocate the /TGON signal to use it. Use Pn50E = n. IXIII (/TGON (Rotation Detection Output) Signal Allocation) to allocate the signal to a connector pin. Refer to the following section for details.

#### 7.1.2 Output Signal Allocations on page 7-6

#### Setting the Rotation Detection Level

Use the following parameter to set the speed detection level at which to output the /TGON signal.

Rotary Servomotors

	Rotation Detection	Level	Speed Position Torque		
Pn502	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 10,000	1 min <sup>-1</sup>	20	Immediately	Setup

#### • Linear Servomotors

	Zero Speed Level		Speed Position	n Force	
Pn581	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 10,000	1 mm/s	20	Immediately	Setup

7.1.6 /S-RDY (Servo Ready) Signal

### 7.1.6 /S-RDY (Servo Ready) Signal

The /S-RDY (Servo Ready) signal turns ON when the SERVOPACK is ready to accept the SV\_ON (Servo ON) command.

The /S-RDY signal is turned ON under the following conditions.

- Main circuit power supply is ON.
- There is no hard wire base block state.
- There are no alarms.
- If an absolute encoder is used, the SENS\_ON (Turn ON Sensor) command has been input.
- If a Servomotor without a polarity sensor is used, polarity detection has been completed. \*
- If an absolute encoder is used, the output of the position data from the absolute encoder to the host controller must have been completed if the SENS\_ON (Turn ON Sensor) command is being input.
- \* Do not include this condition if the SV\_ON (Servo ON) command is input for the first time after the control power supply was turned ON. In that case, when the first SV\_ON command is input, polarity detection is started immediately and the /S-RDY signal turns ON at the completion of polarity detection.

Туре	Signal	Connector Pin No.	Signal Status	Meaning
Output	/S-RDY	Must be allocated.	ON (closed)	Ready to receive the SV_ON (Servo ON) com- mand.
Output			OFF (open)	Not ready to receive the SV_ON (Servo ON) command.

Note: 1. You must allocate the /S-RDY signal to use it. Use Pn50E = n.XDDD (/S-RDY (Servo Ready) Signal Allocation) to allocate the signal to a connector pin. Refer to the following section for details.

7.1.2 Output Signal Allocations on page 7-6

2. Refer to the following section for information on the hard wire base block and the /S-RDY signal.

7.1.7 /V-CMP (Speed Coincidence Detection) Signal

### 7.1.7 /V-CMP (Speed Coincidence Detection) Signal

The /V-CMP (Speed Coincidence Detection Output) signal is output when the Servomotor speed is the same as the reference speed. This signal is used, for example, to interlock the SERVOPACK and the host controller. You can use this output signal only during speed control.

The /V-CMP signal is described in the following table.

Туре	Signal	Connector Pin No.	Signal Status	Meaning
Output	Output /V-CMP	MP Must be allocated.	ON (closed)	The speed coincides.
	/ V-OIVIF		OFF (open)	The speed does not coincide.

Note: You must allocate the /V-CMP signal to use it. Use Pn50E = n.  $\Box \Box X \Box$  (/V-CMP (Speed Coincidence Detection Output) Signal Allocation) to allocate the signal to connector pins.

- Refer to the following section for details on allocations.
- 7.1.2 Output Signal Allocations on page 7-6

You can set the speed detection width for the /V-CMP signal in Pn503 (Speed Coincidence Detection Signal Output Width) for a Rotary Servomotor or in Pn582 (Speed Coincidence Detection Signal Output Width) for a Linear Servomotor.

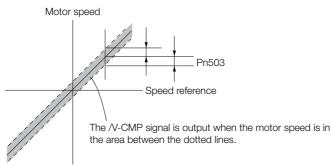
Rotary Servomotors

	Speed Coincidence	Detection Signal Ou	Speed		
Pn503	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 100	1 min <sup>-1</sup>	10	Immediately	Setup

The signal is output when the difference between the reference speed and motor speed is equal or less than the setting.



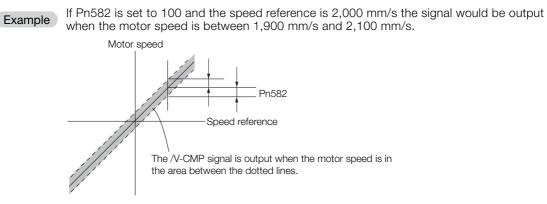
If Pn503 is set to 100 and the speed reference is 2,000 min<sup>-1</sup>, the signal would be output when the motor speed is between 1,900 min<sup>-1</sup> and 2,100 min<sup>-1</sup>.



• Linear Servomotors

	Speed Coincidence Detection Signal Output Width			Speed	
Pn582	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 100	1 mm/s	10	Immediately	Setup

The signal is output when the difference between the reference speed and motor speed is equal or less than the setting.



7.1.8 /COIN (Positioning Completion) Signal

## 7.1.8 /COIN (Positioning Completion) Signal

The /COIN (Positioning Completion) signal indicates that Servomotor positioning has been completed during position control.

The /COIN signal is output when the difference between the reference position output by the host controller and the current position of the Servomotor (i.e., the position deviation as given by the value of the deviation counter) is equal to or less than the setting of the positioning completed width (Pn522).

Use this signal to check the completion of positioning from the host controller.

Туре	Signal	Connector Pin No.	Signal Status	Meaning
Output /COIN		Must be allocated.	ON (closed)	Positioning has been completed.
		Must be allocated.	OFF (open)	Positioning has not been completed.

Note: You must allocate the /COIN signal to use it. Use Pn50E = n. 
X (/COIN (Positioning Completion Output) Signal Allocation) to allocate the signal to connector pins. Refer to the following section for details on allocations.

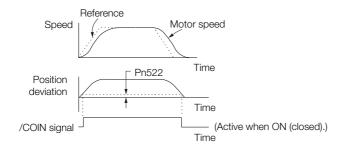
7.1.2 Output Signal Allocations on page 7-6

#### Setting the Positioning Completed Width

The /COIN signal is output when the difference between the reference position and the current position (i.e., the position deviation as given by the value of the deviation counter) is equal to or less than the setting of the positioning completed width (Pn522).

	Positioning Completed Width			Position	
Pn522	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 1,073,741,824	1 reference unit	7	Immediately	Setup

The setting of the positioning completed width has no effect on final positioning accuracy.



Note: If the parameter is set to a value that is too large, the /COIN signal may be output when the position deviation is low during a low-speed operation. If that occurs, reduce the setting until the signal is no longer output.

# Setting the Output Timing of the /COIN (Positioning Completion Output) Signal

You can add a reference input condition to the output conditions for the /COIN signal to change the signal output timing.

If the position deviation is always low and a narrow positioning completed width is used, change the setting of  $Pn207 = n.X \square \square \square$  (/COIN (Positioning Completion Output) Signal Output Timing) to change output timing for the /COIN signal.

Parameter		Description	When Enabled	Classification
	n.0□□□ (default setting)	Output the /COIN signal when the absolute value of the position deviation is the same or less than the setting of Pn522 (Positioning Completed Width).		
	n. 1000	Output the /COIN signal when the absolute value of the position deviation is the same or less than the setting of Pn522 (Positioning Completed Width) and the reference after the position reference filter is 0.	After restart	Setup
	n. 2000	Output the /COIN signal when the absolute value of the position deviation is the same or less than the setting of Pn522 (Positioning Completed Width) and the reference input is 0.		

### 7.1.9 /NEAR (Near) Signal

The /NEAR (Near) signal indicates when positioning completion is being approached.

The host controller receives the NEAR signal before it receives the /COIN (Positioning Completion) signal, it can start preparations for the operating sequence to use after positioning has been completed. This allows you to reduce the time required for operation when positioning is completed.

The NEAR signal is generally used in combination with the /COIN signal.

Туре	Signal	Connector Pin No.	Signal Status	Meaning
Output	/NEAR	Must be allocated.	ON (closed)	The Servomotor has reached a point near to positioning completion.
			OFF (open)	The Servomotor has not reached a point near to positioning completion.

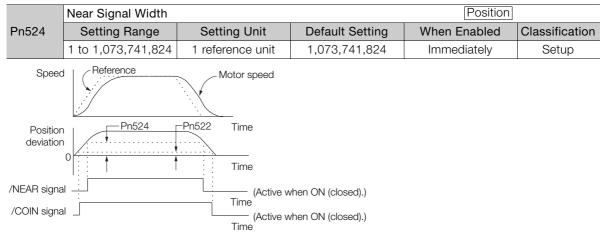
Note: You must allocate the /NEAR signal to use it. Use Pn510 = n.  $\Box \Box \Box X$  (/NEAR (Near) Signal Allocation) to allocate the signal to a connector pin. Refer to the following section for details.

7.1.2 Output Signal Allocations on page 7-6

7.1.10 Speed Limit during Torque Control

## /NEAR (Near) Signal Setting

You set the condition for outputting the /NEAR (Near) signal (i.e., the near signal width) in Pn524 (Near Signal Width). The /NEAR signal is output when the difference between the reference position and the current position (i.e., the position deviation as given by the value of the deviation counter) is equal to or less than the setting of the near signal width (Pn524).

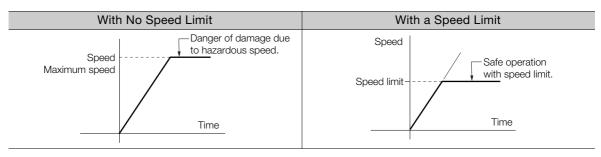


Note: Normally, set Pn524 to a value that is larger than the setting of Pn522 (Positioning Completed Width).

### 7.1.10 Speed Limit during Torque Control

You can limit the speed of the Servomotor to protect the machine.

When you use a Servomotor for torque control, the Servomotor is controlled to output the specified torque, but the motor speed is not controlled. Therefore, if a reference torque is input that is larger than the machine torque, the speed of the Servomotor may increase greatly. If that may occur, use this function to limit the speed.



Note: The actual limit of Servomotor speed depends on the load conditions on the Servomotor.

#### /VLT (Speed Limit Detection) Signal

The signal that is output when the motor speed is being limited by the speed limit is described in the following table.

Туре	Signal	Connector Pin No.	Signal Status	Meaning
Output /VL		Must be allocated.	ON (closed)	The Servomotor speed is being limited.
	/VLT		OFF (open)	The Servomotor speed is not being lim- ited.

Note: You must allocate the /VLT signal to use it. Use Pn50F = n.□□X□ (/VLT (Speed Limit Detection) Signal Allocation) to allocate the signal to a connector pin. Refer to the following section for details.

7.1.2 Output Signal Allocations on page 7-6

### Selecting the Speed Limit

The smaller of the external speed limit and internal speed limit will be used.

Parameter		Meaning	When Enabled	Classification
n.000	n.🗆 🗆 🗆	Reserved settings (Do not use.)		
Pn002	n.□□1□ (default setting)	Use the speed limit from the VLIM (Limit Speed for Torque Control) command as the speed limit. (Use external speed limiting.)	After restart	Setup

#### ◆ Internal Speed Limiting

Set the speed limit for the motor in Pn407 (Speed Limit during Torque Control) or Pn480 (Speed Limit during Force Control).

Also set  $Pn408 = n.\square\squareX\square$  (Speed Limit Selection) to specify using the maximum motor speed or the overspeed alarm detection speed as the speed limit. Select the overspeed alarm detection speed to limit the speed to the equivalent of the maximum motor speed.

F	Parameter	Meaning	When Enabled	Classification
Dp/08	n.□□0□ (default setting)	Use the smaller of the maximum motor speed and the setting of Pn407 or Pn480 as the speed limit.	After restart	Setup
Pn408	n.0010	Use the smaller of the overspeed alarm detec- tion speed and the setting of Pn407 or Pn480 as the speed limit.	Aller restart	

Note: If you are using a Rotary Servomotor, set Pn407 (Speed Limit during Torque Control). If you are using a Linear Servomotor, set Pn480 (Speed Limit during Force Control).

Rotary Servomotors

	Speed Limit during	Torque			
Pn407	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 min <sup>-1</sup>	10000	Immediately	Setup

#### Linear Servomotors

	Speed Limit during I	Force			
Pn480	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 mm/s	10000	Immediately	Setup

Note: If the parameter setting exceeds the maximum speed of the Servomotor, the Servomotor's maximum speed or the overspeed alarm detection speed will be used.

#### External Speed Limiting

The motor speed will be limited by VLIM (Limit Speed for Torque Control). Refer to the following manual for details.

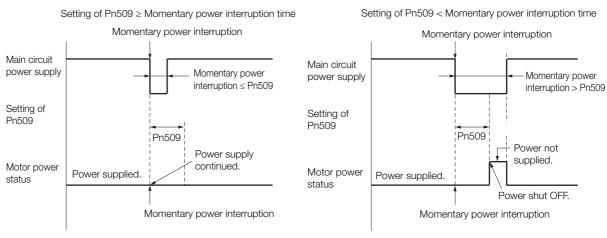
Σ-7-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

## 7.2 Operation for Momentary Power Interruptions

Even if the main power supply to the SERVOPACK is interrupted momentarily, power supply to the motor (servo ON status) will be maintained for the time set in Pn509 (Momentary Power Interruption Hold Time).

	Momentary Power Interruption Hold Time			Speed Positio	n Torque
Pn509	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	20 to 50,000	1 ms	20	Immediately	Setup

If the momentary power interruption time is equal to or less than the setting of Pn509, power supply to the motor will be continued. If it is longer than the setting, power supply to the motor will be stopped. Power will be supplied to the motor again when the main circuit power supply recovers.



- Information 1. If the momentary power interruption time exceeds the setting of Pn509, the /S-RDY (Servo Ready) signal will turn OFF.
  - 2. If uninterruptible power supplies are used for the control power supply and main circuit power supply, the SERVOPACK can withstand a power interruption that lasts longer than 50,000 ms.
  - 3. The holding time of the SERVOPACK control power supply is approximately 100 ms. If control operations become impossible during a momentary power interruption of the control power supply, the setting of Pn509 will be ignored and the same operation will be performed as for when the power supply is turned OFF normally.



The holding time of the main circuit power supply depends on the output from the SERVOPACK. If the load on the Servomotor is large and an A.410 alarm (Undervoltage) occurs, the setting of Pn509 will be ignored.

## 7.3 SEMI F47 Function

The SEMI F47 function detects an A.971 warning (Undervoltage) and limits the output current if the DC main circuit power supply voltage to the SERVOPACK drops to a specified value or lower because the power was momentarily interrupted or the main circuit power supply voltage was temporarily reduced.

This function complies with the SEMI F47 standards for semiconductor manufacturing equipment.

You can combine this function with the momentary power interruption hold time (Pn509) to allow the Servomotor to continue operating without stopping for an alarm or without recovery work even if the power supply voltage drops.

#### **Execution Sequence**

This function can be executed either with the host controller or with the SERVOPACK. Use  $Pn008 = n.\Box\Box X\Box$  (Function Selection for Undervoltage) to specify whether the function is executed by the host controller or by the SERVOPACK.

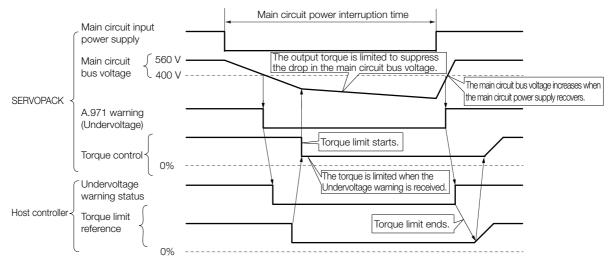
The default setting (Pn008 =  $n.\Box\Box0\Box$ ) disables detection of an A.971 warning (Undervoltage).

F	Parameter	Meaning	When Enabled	Classification
Pn008	n.□□0□ (default setting)	fault setting) Do not detect undervoltage warning.		Setup
	n.0010			
	n.0020	Detect undervoltage warning and limit torque with Pn424 and Pn425 (i.e., only in SERVOPACK).		

#### • Execution with the Host Controller (Pn008 = $n.\Box\Box1\Box$ )

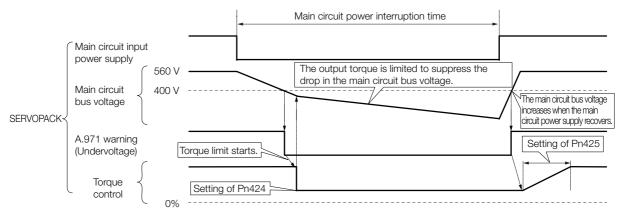
The host controller limits the torque in response to an A.971 warning (Undervoltage).

The host controller removes the torque limit after the Undervoltage warning is cleared.



#### ◆ Execution with the SERVOPACK (Pn008 = n.□□2□)

The torque is limited in the SERVOPACK in response to an Undervoltage warning. The SERVOPACK controls the torque limit for the set time after the Undervoltage warning is cleared.



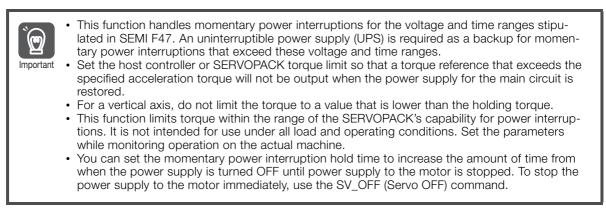
#### **Related Parameters**

The following parameters are related to the SEMI F47 function.

	Torque Limit at Main Circuit Voltage Drop			Speed Position Torque	
Pn424	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 100	1%*	50	Immediately	Setup
	Release Time for Torque Limit at Main Circuit Voltage Drop				n Torque
Pn425	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 1,000	1 ms	100	Immediately	Setup
	Momentary Power In	nterruption Hold Tim	Speed Position	n Torque	
Pn509	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	20 to 50,000	1 ms	20	Immediately	Setup

\* Set a percentage of the motor rated torque.

Note: If you will use the SEMI F47 function, set the time to 1,000 ms.



## 7.4 Setting the Motor Maximum Speed

You can set the maximum speed of the Servomotor with the following parameter. • Rotary Servomotors

	Maximum Motor Speed			Speed Posit	ion Torque
Pn316	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 65,535	1 min <sup>-1</sup>	10,000	After restart	Setup

Linear Servomotors

	Maximum Motor Speed			Speed Positi	on Force
Pn385	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 100	100 mm/s	50	After restart	Setup

You can achieve the following by lowering the maximum speed of the Servomotor.

• If the Servomotor speed exceeds the setting, an A.510 alarm (Overspeed) will occur.

With a Linear Servomotor, you can increase the upper limit for the setting of Pn281 (Encoder Output Resolution). Refer to the following section for details.
 7.5 Encoder Divided Pulse Output on page 7-20

Changing the setting of the parameter is effective in the following cases.

- To protect the machine by stopping machine operation with an alarm when the set speed is reached or exceeded
- To limit the speed so that the load is not driven beyond the allowable moment of inertia Refer to relevant manual from the following list for the relationship between the speed and the allowable moment of inertia.

Ω Σ-7-Series Rotary Servomotor with 400 V-Input Power Product Manual (Manual No.: SIEP S800001 86)

- Ω Σ-7-Series Linear Servomotor with 400 V-Input Power Product Manual (Manual No.: SIEP S800001 81)
- To increase the encoder output resolution and increase the position resolution managed by the host controller (for a Linear Servomotor)

## 7.5 Encoder Divided Pulse Output

The encoder divided pulse output is a signal that is output from the encoder and processed inside the SERVOPACK. It is then output externally in the form of two phase pulse signals (phases A and B) with a 90° phase differential. At the host controller, it is used as the position feedback.

The following table describes the signals and output phase forms.

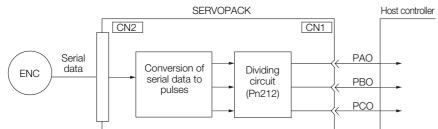
### 7.5.1 Encoder Divided Pulse Output Signals

Туре	Signal	Connector Pin No.	Name	Remarks	
Output	PAO	CN1-17	Encoder Divided Pulse Output,	Rotary Servomotors     These encoder divided pulse     output pins output the number	
	/PAO	CN1-18	Phase A	of pulses per Servomotor reso- lution that is set in Pn212 (Number of Encoder Output	
	PBO	CN1-19	_	Pulses). The phase difference between phase A and phase B is an electric angle of 90°.	
	/PBO	CN1-20	Encoder Divided Pulse Output, Phase B	<ul> <li>Linear Servomotors         These encoder divided pulse             output pins output pulses at the             resolution that is set in Pn281             (Encoder Output Resolution).             The phase difference between             phase A and phase B is an             electric angle of 90°.         </li> </ul>	
	PCO	CN1-21	Encoder Divided Pulse Output,	These pins output one pulse	
	/PCO	CN1-22	Phase C*	every Servomotor rotation.	

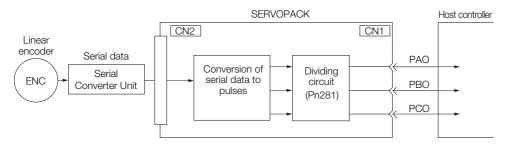
\* Refer to the following section for information on the origin within one encoder rotation.

If the two billowing occurrent intermation on the origin within one of occurrent to the origin within one occurrent to the origin within one occurrent to the origin within one of occurrent to the origin within one occurrent to the origin within origin to the origin within origin to the origi

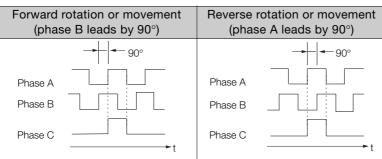
Rotary Servomotor



Linear Servomotors



### **Output Phase Forms**



Note: The pulse width of the origin within one encoder rotation depends on the setting of number of encoder output pulses (Pn212) or the encoder output resolution (Pn281). It is the same as the width of phase A. Even for reverse operation (Pn000 =  $n.\square\square\square$ 1), the output phase form is the same as shown above.



If you use the SERVOPACK's phase-C pulse output for an origin return, rotate the Servomotor two or more rotations before you start an origin return. If the Servomotor cannot be rotated two or more times, perform an origin return operation at a motor speed of 600 min<sup>-1</sup> or lower. If the motor speed is higher than 600 min<sup>-1</sup>, the phase-C pulse may not be output correctly.

### **Linear Encoder Application Precautions**

The following precautions apply to the encoder output pulses when an external linear encoder is used.

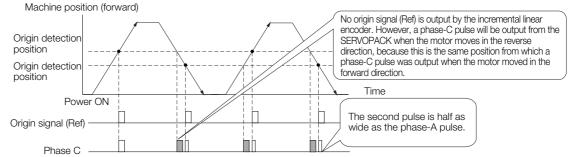
#### Relation between Renishaw PLC Incremental Linear Encoders and Encoder Output Pulse Signal from the SERVOPACK When Using a RGS20 Scale and RGH22B Sensor Head

The output position of the origin signal (Ref) will depend on the direction of movement for some models of incremental linear encoders from Renishaw PLC.

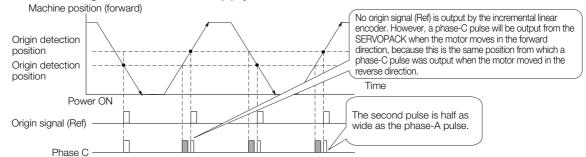
In that case, the phase-C pulse of the SERVOPACK is output at two positions.

For detailed specifications on the origin signal, refer to the manual for the Renishaw PLC incremental linear encoder.

When Passing the First Origin Signal (Ref) in the Forward Direction and Returning after Turning ON the Power Supply



## When Passing the First Origin Signal (Ref) in the Reverse Direction and Returning after Turning ON the Power Supply



#### Precautions When Using a Linear Incremental Encoder from Magnescale Co., Ltd.

#### Encoder Divided Phase-C Pulse Output Selection

You can also output the encoder's phase-C pulse for reverse movement. To do so, set Pn081 to n. DDD1.

Parameter		Meaning	When Enabled	Classification
Pn081	n.□□□0 (default setting)	Output phase-C pulses only in the forward direction.	After restart	Setup
111001	n.0001	Output phase-C pulses in both the forward and reverse directions.	Alter restart	Getup
Important	<ul> <li>If you set Pn0 tions), the wid pulse.</li> <li>There is a difference encoder's phae when Pn081 = when it is set</li> </ul>	Origin     Origin     I/8 linear encoder pitch	the forward and re r than the width of detection positior and, or phase-C la nly in the forward of	verse direc- the phase-A n for the tch between direction) and

Observe the following precaution if you set Pn081 to n.  $\Box\Box\Box$  (Output phase-C pulses only in the forward direction).

When a linear incremental encoder from Magnescale Co., Ltd. is used, the count direction of the encoder determines how the phase-C pulse (CN1-21 and CN1-22) is output.

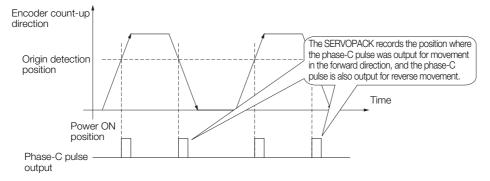
· · ·						
Encoder Model	Interpolator	Linear Encoder Pitch [µm]				
SL710		800				
SL720	PL101-RY MJ620-T13	800				
SL730	10020110	800				
	SR75	80				
	SR85	80				
SQ10	MQ10-FLA	400				
5010	MQ10-GLA	400				

Note: The count direction (up or down) of the linear encoder determines whether a phase-C pulse is output. The output of the pulse does not depend on the setting of the movement direction (Pn000 =  $n.\square\square\square$ ).

#### When First Passing the Origin Signal in the Forward Direction and Returning after Turning ON the Power Supply

The encoder's phase-C pulse (CN1-21 and CN1-22) is output when the origin detection position is passed for the first time in the forward direction after the power supply is turned ON.

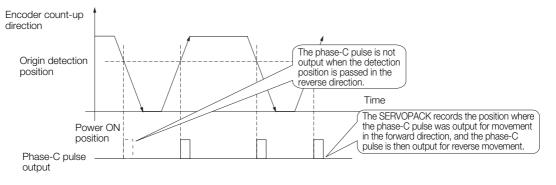
After that, the phase-C pulse is output whenever the origin detection position is passed in the forward or reverse direction.



#### When First Passing the Origin Signal in the Reverse Direction and Returning after Turning ON the Power Supply

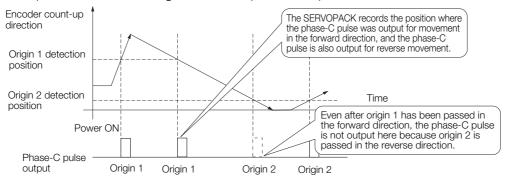
The encoder's phase-C pulse (CN1-19 and CN1-20) is not output when the origin detection position is passed for the first time in the reverse direction after the power supply is turned ON.

However, after the origin detection position is passed in the forward direction and the encoder's phase-C pulse is output, it will then also be output when the origin detection point is passed in the reverse direction.



## When Using a Linear Encoder with Multiple Origins and First Passing the Origin Position in the Forward Direction and Returning after Turning ON the Power Supply

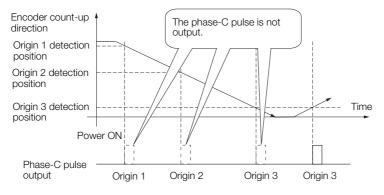
The encoder's phase-C pulse is output when the origin detection position is passed for the first time in the forward direction after the power supply is turned ON. After that, the phase-C pulse is output whenever the origin detection position is passed in the forward or reverse direction.



## When Using a Linear Encoder with Multiple Origins and First Passing the Origin Position in the Reverse Direction after Turning ON the Power Supply

The encoder's phase-C pulse is not output when the origin detection position is passed for the first time in the reverse direction after the power supply is turned ON.

However, after the origin detection position is passed in the forward direction and the encoder's phase-C pulse it output, it will then also be output when the origin detection point is passed in the reverse direction.



7.5.2 Setting for the Encoder Divided Pulse Output

#### 7.5.2 Setting for the Encoder Divided Pulse Output

This section describes the setting for the encoder divided pulse output for a Rotary Servomotor or Linear Servomotor.

# Encoder Divided Pulse Output When Using a Rotary Servomotor

If you will use a Rotary Servomotor, set the number of encoder output pulses (Pn212).

		Number of Encoder C	Speed Positic	nTorque		
Ρ	n212	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
		16 to 1,073,741,824	1 P/Rev	2,048	After restart	Setup

The number of pulses from the encoder per rotation are processed inside the SERVOPACK, divided by the setting of Pn212, and then output.

Set the number of encoder divided output pulses according to the system specifications of the machine or host controller.

The setting of the number of encoder output pulses is limited by the resolution of the encoder.

Setting of the Number of	Setting	Encoder Resolution	Upper Limit of Servomotor Speed for
Encoder Output Pulses [P/Rev]	Increment	24 bits	Set Number of Encoder Output
	morement	(16,777,216 pulses)	Pulses [min⁻¹]
16 to 16,384	1	0	6,000
16,386 to 32,768	2	0	3,000
32,772 to 65,536	4	0	1,500
65,544 to 131,072	8	0	750
131,088 to 262,144	16	0	375
262,176 to 524,288	32	0	187
524,352 to 1,048,576	64	0	93
1,048,704 to 2,097,152	128	0	46
2,097,408 to 4,194,304	256	0	23

Note: 1. The setting range of the number of encoder output pulses (Pn212) depends on the resolution of the Servomotor encoder. An A.041 alarm (Encoder Output Pulse Setting Error) will occur if the above setting conditions are not met.

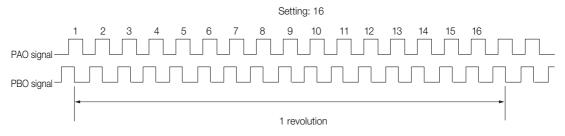
Correct setting example: Pn212 can be set to 25,000 [P/Rev].

Incorrect setting example: Pn212 cannot be set to 25,001 (P/Rev) because the setting increment in the above table is not used.

2. The upper limit of the pulse frequency is approximately 1.6 Mpps. The Servomotor speed will be limited if the setting of the number of encoder output pulses is too high.

An A.511 alarm (Encoder Output Pulse Overspeed) will occur if the upper limit of the motor speed is exceeded.

Output example: An output example is given below for the PAO (Encoder Pulse Output Phase A) signal and the PBO (Encoder Pulse Output Phase B) signal when Pn212 is set to 16 (16 pulses output per revolution).



7.5.2 Setting for the Encoder Divided Pulse Output

# Encoder Divided Pulse Output When Using a Linear Servomotor

If you will use a Linear Servomotor, set the encoder output resolution (Pn281).

	Encoder Output Resolution			Speed Posit	ion Force
Pn281	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 4,096	1 edge/pitch	20	After restart	Setup

Note: The maximum setting for the encoder output resolution is 4,096. Pulse output at a linear encoder resolution of 4,096 or higher is not possible.

Set the encoder output resolution for the encoder pulse output signals (PAO, /PAO, PBO, and /PBO) from the SERVOPACK to the host controller.

The number of feedback pulses per linear encoder pitch is divided by the setting of Pn281 (after multiplication by 4) inside the SERVOPACK and then the resulting number of pulses is output. Set the parameter according to the system specifications of the machine or host controller.

The setting range depends on the Servomotor's maximum speed (Pn385) and the Linear Encoder Scale Pitch (Pn282).\* You can calculate the upper limit of the setting of Pn281 with the following formula.

Upper limit of Pn281 =  $\frac{\text{Linear Encoder Pitch*/100}}{\text{Pn385}} \times 72$ 

\* The value depends on whether a Serial Converter Unit is used.

Using a Seria	al Converter Unit	Setting of Pn282	
ear encoder directly or wh	Serial Converter Unit (when the lin- and SERVOPACK are connected nen a linear encoder that does not ial Converter Unit is used)	The linear encoder pitch is automatically detected by the SERVO- PACK, so the setting of Pn282 is ignored. You can use the monitor functions of the SigmaWin+ to check the linear encoder pitch that was automatically detected.	
Information	When the linear encoder pitch is 4 $\mu$ m, the maximum motor speed is limited to 1 mm/s because of the maximum response frequency of the Serial Converter Unit. If the setting is out of range or does not satisfy the setting conditions, an A.041 alarm (Encoder Output Pulse Setting Error) will be output. If the motor speed exceeds the upper limit for the set encoder output resolution, an A.511 alarm (Encoder Output Pulse Overspeed) will be output. The upper limit of the encoder output resolution is restricted by the dividing specifications of the Serial Converter Unit.		
Example	(Pn385 = 50): Pn281 = 28 (edg	oder pitch of 20 μm and a maximum motor speed of 5 m/s ges/pitch) (edges/pitch) (An A.041 alarm would be output.)	
Example	Phase A Phase B	utput (5-pulse output) per linear encoder pitch)	

#### 7.6.1 Setting to Enable/Disable Software Limits

## 7.6 Software Limits

You can set limits in the software for machine movement that do not use the overtravel signals (P-OT and N-OT). If a software limit is exceeded, an emergency stop will be executed in the same way as it is for overtravel.

You must make the following settings to use the software limits.

- You must enable the software limit function.
- You must set the software limits.

### 7.6.1 Setting to Enable/Disable Software Limits

You can use  $Pn801 = n.\square\square\squareX$  (Software Limit Selection) to enable and disable the software limit function. One of following commands must be executed to define the origin of the machine coordinate system before the software limits will operate. Otherwise, the software limit function will not operate even if a software limit is exceeded.

- The ZRET command has been executed.
- The POS\_SET command has been executed with REFE set to 1.
- If an absolute encoder is used, the SENS\_ON (Turn ON Sensor) command must have been completed.

Parameter		Meaning	When Enabled	Classification
D-001	n.0000	Enable both forward and reverse soft- ware limits.		Setup
	n.0001	Disable forward software limit.	Immediately	
Pn801	n.🗆 🗆 🗠 2	Disable reverse software limit.		
	n.□□□3 (default setting)	Disable both forward and reverse soft- ware limits.		

## 7.6.2 Setting the Software Limits

Software limits are set in both the forward and reverse directions.

The reverse software limit must be less than the forward software limit to set a limit in each direction.

	Forward Software Limit			Position	
Pn804	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	-1,073,741,823 to 1,073,741,823	1 reference unit	1,073,741,823	Immediately	Setup
	Reverse Software Limit		Position		
Pn806	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	-1,073,741,823 to 1,073,741,823	1 reference unit	-1,073,741,823	Immediately	Setup

### 7.6.3 Software Limit Check for References

You can enable or disable software limit checks for commands that have target position references, such as POSING or INTERPOLATE. If the target position exceeds a software limit, a deceleration stop will be performed from the position set as the software limit.

Parameter		Meaning	When Enabled	Classification
Pn801	n.□0□□ (default setting)	Do not perform software limit checks for references.	Immediately	Setup
	n.0100	Perform software limit checks for references.	mmediately	

7.7.1 Internal Torque Limits

## 7.7 Selecting Torque Limits

You can limit the torque that is output by the Servomotor.

There are four different ways to limit the torque. These are described in the following table.

Limit Method	Outline	Control Method	Reference
Internal Torque Limits	The torque is always limited with the setting of a parameter.	Speed control, position control, or	7.7.1
External Torque Limits	The torque is limited with an input signal from the host computer.	torque control	7.7.2
Limiting Torque with TLIM Data in Commands <sup>*</sup>	The TLIM data in a command is used to set the required torque limits.	Speed control or position control	_
Torque Limiting with P_CL and N_CL in the Servo Command Output Signals (SVCMD_IO)*	The P_CL and N_CL signals in the servo command output signals (SVCMD_IO) are used to set the required limits.	Speed control or position control	_

\* Refer to the following manual for details.

Σ-7-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

Note: If you set a value that exceeds the maximum torque of the Servomotor, the torque will be limited to the maximum torque of the Servomotor.

## 7.7.1 Internal Torque Limits

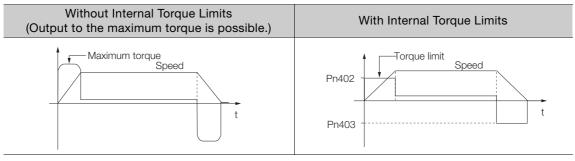
If you use internal torque limits, the maximum output torque will always be limited to the specified forward torque limit (Pn402) and reverse torque limit (Pn403).

Rotary Servomotors

	Forward Torque Limit			Speed Position Torque		
Pn402	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 800	1%*	800	Immediately	Setup	
	Reverse Torque Limit			Speed Position Torque		
Pn403	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 800	1%*	800	Immediately	Setup	

\* Set a percentage of the rated motor torque.

Note: If the setting of Pn402 or Pn403 is too low, the torque may be insufficient for acceleration or deceleration of the Servomotor.



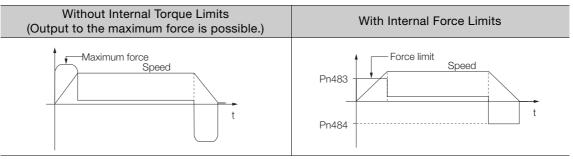
7.7.2 External Torque Limits

Linear Servomotors

	Forward Force Limit		Speed Position Force		
Pn483	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 800	1%*	30	Immediately	Setup
	Reverse Force Limit			Speed Position Force	
Pn484	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 800	1%*	30	Immediately	Setup

\* Set a percentage of the rated motor force.

Note: If the setting of Pn483 or Pn484 is too low, the force may be insufficient for acceleration or deceleration of the Servomotor.



#### 7.7.2 **External Torque Limits**

You can limit the torque only when required by the operating conditions of the machine by turning a signal ON and OFF.

You can use this for applications such as stopping on physical contact, or holding a workpiece with a robot.

#### External Torque Limit Reference Signals

The /P-CL (Forward External Torque Limit) and /N-CL (Reverse External Torque Limit) signals are used as the external torque limit reference signals. The /P-CL signal is used for the forward torque limit and the /N-CL signal is used for the reverse torque limit.

Туре	Signal	Connector Pin No.	Signal Status	Meaning
Input /P-CL	/P-CL	Must be allocated.	ON (closed)	Applies the forward external torque limit. The torque is limited to the smaller of the set- tings of Pn402 <sup>*1</sup> and Pn404.
			OFF (open)	Cancels the forward external torque limit. The torque is limited to the setting of Pn402 <sup>*1</sup> .
Input /N-CL	/N-CL	Must be allocated.	ON (closed)	Applies the reverse external torque limit. The torque is limited to the smaller of the set- tings of Pn403 <sup>*2</sup> and Pn404.
			OFF (open)	Cancels the reverse external torque limit. The torque is limited to the setting of Pn403 <sup>*2</sup> .

\*1. Pn483 is used for a Linear Servomotor.

\*2. Pn484 is used for a Linear Servomotor.

Note: You must allocate the /P-CL and /N-CL signals to use them. You can use the following parameters to allocate the signal to a terminal.

Pn50B = n.□X□□ (/P-CL (Forward External Torque Limit Input) Signal Allocation)
 Pn50B = n.X□□□ (/N-CL (Reverse External Torque Limit Input) Signal Allocation)

Refer to the following section for details.

7.1.1 Input Signal Allocations on page 7-4

7.7.2 External Torque Limits

### Setting the Torque Limits

The parameters that are related to setting the torque limits are given below.

Rotary Servomotors

If the setting of Pn402 (Forward Torque Limit), Pn403 (Reverse Torque Limit), Pn404 (Forward External Torque Limit), or Pn405 (Reverse External Torque Limit) is too low, the torque may be insufficient for acceleration or deceleration of the Servomotor.

	Forward Torque Lim	it		Speed Positio	Torque
Pn402	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 800	1%*	800	Immediately	Setup
	Reverse Torque Lim	it	Speed Positio	n Torque	
Pn403	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 800 1%*		800	Immediately	Setup
	Forward External To	rque Limit	Speed Position Torque		
Pn404	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 800	1%*	100	Immediately	Setup
	Reverse External To	rque Limit		Speed Positio	n Torque
Pn405	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 800	1%*	100	Immediately	Setup

\* Set a percentage of the rated motor torque.

Linear Servomotors

If the setting of Pn483 (Forward Force Limit), Pn484 (Reverse Force Limit), Pn404 (Forward External Force Limit), or Pn405 (Reverse External Force Limit) is too low, the force may be insufficient for acceleration or deceleration of the Servomotor.

	Forward Force Limit		Speed Positio	on Force	
Pn483	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 800	1%*	30	Immediately	Setup
	Reverse Force Limit		Speed Positio	on Force	
Pn484	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 800	1%*	30	Immediately	Setup
	Forward External Force Limit			Speed Positio	on Force
Pn404	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 800	1%*	100	Immediately	Setup
	Reverse External Fo	orce Limit		Speed Positio	on Force
Pn405	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 800	1%*	100	Immediately	Setup

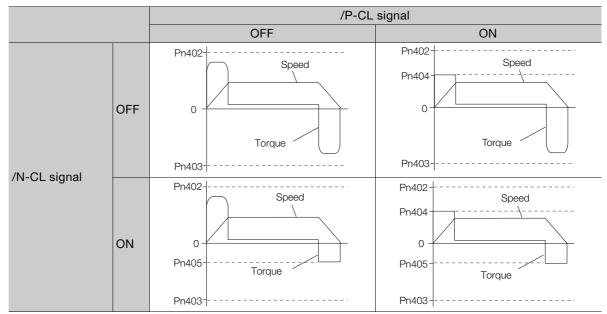
\* Set a percentage of the rated motor force.

## Changes in the Output Torque for External Torque Limits

The following table shows the changes in the output torque when the internal torque limit is set to 800%.

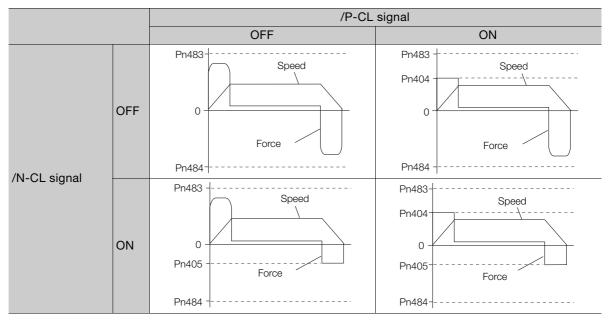
Rotary Servomotors

In this example, the Servomotor direction is set to  $Pn000 = n.\Box\Box\Box$  (Use CCW as the forward direction).



#### Linear Servomotors

In this example, the Servomotor direction is set to  $Pn000 = n.\Box\Box\Box\Box$  (Use the direction in which the linear encoder counts up as the forward direction).



7.7.3 /CLT (Torque Limit Detection) Signal

# 7.7.3 /CLT (Torque Limit Detection) Signal

This section describes the /CLT signal, which indicates the status of limiting the motor output torque.

Туре	Signal	Connector Pin No.	Signal Status	Meaning
Output /CLT		ON (closed)	The motor output torque is being limited.	
		Must be allocated.	OFF (open)	The motor output torque is not being limited.

Note: You must allocate the /CLT signal to use it. Use Pn50F = n.  $\Box \Box \Box X$  (/CLT (Torque Limit Detection Output) Signal Allocation) to allocate the signal to a connector pin. Refer to the following section for details.

7.1.2 Output Signal Allocations on page 7-6

# 7.8 Absolute Encoders

The absolute encoder records the current position of the stop position even when the power supply is OFF.

With a system that uses an absolute encoder, the host controller can monitor the current position. Therefore, it is not necessary to perform an origin return operation when the power supply to the system is turned ON.

There are three types of encoders for Rotary Servomotors. The usage of the encoder is specified in  $Pn002 = n.\Box X \Box \Box$ .

Refer to the following section for encoder models.

■ Encoder Resolution on page 6-43

#### · Parameter Settings When Using an Incremental Encoder

Parameter		Meaning	When Enabled	Classification
Pn002	n.□0□□ (default setting)	Use the encoder as an incremental encoder. A battery is not required.		
	n.□1□□ Use the encoder as an incremental encoder. A battery is not required.		After restart	Setup
	n.0200	Use the encoder as a single-turn absolute encoder. A battery is not required.	1	

#### · Parameter Settings When Using a Multiturn Absolute Encoder

Parameter		Meaning	When Enabled	Classification
	n.□0□□ (default setting)	Use the encoder as a multiturn absolute encoder. A battery is required.		
	n.□1□□ Use the encoder as an incremental encoder. A battery is not required.		After restart	Setup
	n.0200	Use the encoder as a single-turn absolute encoder. A battery is not required.		

# NOTICE

• Install a battery at either the host controller or on the Encoder Cable. If you install batteries both at the host controller and on the Encoder Cable at the same time, you will create a loop circuit between the batteries, resulting in a risk of damage or burning.

# 7.8.1 Connecting an Absolute Encoder

You can get the position data from the absolute encoder with MECHATROLINK communications. Therefore, it is not necessary to wire the PAO, PBO, and PCO (Encoder Divided Pulse Output) signals.

If they need to be wired, refer to the following section.

- $\overrightarrow{a}$  4.4.3 Wiring the SERVOPACK to the Encoder on page 4-20
- 4.5.3 I/O Signal Wiring Examples on page 4-31

7.8.2 Structure of the Position Data of the Absolute Encoder

## 7.8.2 Structure of the Position Data of the Absolute Encoder

The position data of the absolute encoder is the position coordinate from the origin of the absolute encoder.

The position data from the absolute encoder contains the following two items.

- The number of rotations from the origin of the encoder coordinate system (called the multiturn data)
- The position (number of pulses) within one rotation

The position data of the absolute encoder is as follows:

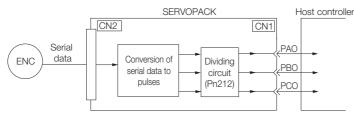
Position data of absolute encoder = Multiturn data  $\times$  Number of pulses within one encoder rotation (setting of Pn212)+ Position (number of pulses) within one rotation.

For a single-turn absolute encoder, the multiturn data is 0.

# 7.8.3 Output Ports for the Position Data from the Absolute Encoder

You can read the position data of the absolute encoder from the PAO, PBO, and PCO (Encoder Divided Pulse Output) signals.

The output method and timing for the position data of the absolute encoder are different in each case. A conceptual diagram of the connections of the PAO, PBO, and PCO (Encoder Divided Pulse Output) signals to the host controller is provided below.



Signal	Status	Signal Contents When Using an Absolute Encoder
PAO	First signal	Multiturn data position within one rotation (pulse train)
	During normal operation	Incremental pulses
PBO	First signal	Position within one rotation (pulse train)
FDU	During normal operation	Incremental pulses
PCO	Always	Origin pulse

The PAO (Encoder Divided Pulse Output) signal outputs the position data from the absolute encoder after the control power supply is turned ON. The SENS\_ON (Turn ON Sensor) command is used to output the position data from the absolute encoder.

The position data of the absolute encoder is the current stop position. The absolute encoder outputs the multiturn data with the specified protocol. The absolute encoder outputs the position within one rotation as a pulse train. It then outputs pulses as an incremental encoder (incremental operation status).

The host controller must have a reception circuit (e.g., UART) for the position data from the absolute encoder. The pulse counter at the host controller will not count pulses when the multiturn data (communications message) is input because only phase A is input. Counting starts from the position of the absolute encoder within one rotation.

The output circuits for the PAO, PBO, and PCO signals use line drivers. Refer to the following section for details on line drivers.

4.5.4 I/O Circuits on page 4-33

## 7.8.4 Reading the Position Data from the Absolute Encoder

The SENS\_ON (Turn ON Sensor) command is used to read the position data from the absolute encoder.

The sequence for using the SENS\_ON command to read the position data from the absolute encoder of a Rotary Servomotor is given below.

The multiturn data is sent according to the transmission specifications.

The position of the absolute encoder within one rotation is output as a pulse train.

Control power supply <sup>*1</sup> OFF				ON				
				ON				
Main circuit power supply OFF								
ALM signal								
		No alarm						
/S-RDY signal								
	OFF						ON	
SV_ON command							1	
	OFF						ON	
							1	
Motor power status				Power	not supplied	d.	Power supplied.	
SENS_ON command <sup>*1</sup>	OFF			ON			1 1 1 1	
PAO signal	Undefined.			Multiturn		on within one rotation	Incremental pulses	
				data	(incren	nental pulses)		
PBO signal	Undefined.			1		n within one rotation	Incremental pulses	
				1		nental pulses)		
	5 s max.	50 m	90 ms s typ.	Approx. 15 ms		T*2		//
	1 1	1	1	1	ms to 3 ms	5	1	

\*1. When you turn OFF the control power supply, input the SENS\_OFF command.

\*2. The pulse output time T for the position of the absolute encoder within one rotation depends on the setting of Pn212 (Number of Encoder Output Pulses). Refer to the following table.

Setting of Pn212	Calculation of the Pulse Output Speed for the Position of the Absolute Encoder within One Rotation	Calculation of the Pulse Output Time T for the Position of the Absolute Encoder within One Rotation
16 to 16,384	680 × Pn212/16,384 [kpps]	25 ms max.
16,386 to 32,768	680 × Pn212/32,768 [kpps]	50 ms max.
32,722 to 65,536	680 × Pn212/65,536 [kpps]	100 ms max.
65,544 to 131,072	680 × Pn212/131,072 [kpps]	200 ms max.
131,088 to 262,144	680 × Pn212/262,144 [kpps]	400 ms max.
262,176 to 524,288	680 × Pn212/524,288 [kpps]	800 ms max.
524,352 to 1,048,576	680 × Pn212/1,048,576 [kpps]	1,600 ms max.
1,048,704 to 2,097,152	680 × Pn212/2,097,152 [kpps]	3,200 ms max.
2,097,408 to 4,194,304	680 × Pn212/4194304 [kpps]	6,400 ms max.

7.8.5 Transmission Specifications

# 7.8.5 Transmission Specifications

The position data transmission specifications for the PAO (Encoder Divided Pulse Output) signal are given in the following table.

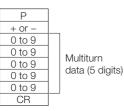
The PAO signal sends only the multiturn data.

Refer to the following section for the timing of sending the position data from the absolute encoder. 7.8.4 Reading the Position Data from the Absolute Encoder on page 7-35

Item	PAO signal
Synchronization Method	Start-stop synchronization (ASYNC)
Transmission Speed	9,600 bps
Start Bits	1 bit
Stop Bits	1 bit
Parity	Even
Character Code	ASCII, 7 bits
Data Format	Refer to Data Format of PAO Signal.
Data Output Period	Each time the SENS_ON command is input after the control power supply is turned ON

### Data Format of PAO Signal

As shown below, the message format consists of eight characters: "P," the sign, the 5-digit multiturn data, and "CR" (which indicates the end of the message).



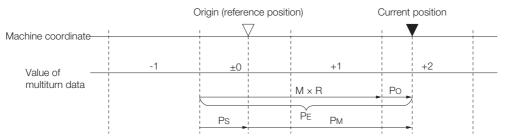
# 7.8.6 Calculating the Current Position in Machine Coordinates

When you reset the absolute encoder, the reset position becomes the reference position.

The host controller reads the coordinate Ps from the origin of the encoder coordinate system. The host controller must record the value of coordinate Ps.

This section describes the reference position in the machine coordinate system.

The method to calculate the coordinate value of the present position from the origin of the machine coordinate system is given below.



The current position  $\mathsf{P}_\mathsf{M}$  in the machine coordinate system is calculated as follows:

$$\begin{split} P_M &= P_E - P_S \\ P_E &= M \times R + P_O \\ P_S &= M_S \times R + P_S' \end{split}$$

#### 7.8.7 Alarm Output from Output Ports for the Position Data from the Absolute Encoder

Symbol	Meaning
P <sub>E</sub>	Position data for the current position of the absolute encoder
М	Current position of the multiturn data of the absolute encoder
Po	Position of the current position within one rotation
P <sub>S</sub>	Position data of the absolute encoder when absolute encoder was reset
M <sub>S</sub>	Multiturn data of the absolute encoder when absolute encoder was reset
P <sub>S</sub> '	Position of the absolute encoder within one rotation when absolute encoder was reset
P <sub>M</sub>	Current position in machine coordinate system
R	Pulses output per encoder rotation (value after dividing; setting of Pn212)

Note: The following formulas apply in Reverse Rotation Mode (Pn000 =  $n.\square\square\square1$ ).

$$P_{M} = P_{E} - P_{S}$$

$$P_{\rm E} = -M_{\rm S} \times R + P_{\rm O}$$
$$P_{\rm S} = M_{\rm S} \times R + P_{\rm S}'$$

Information 1. If you are using a Rotary Servomotor, you must reset the absolute encoder. Refer to the following section for information on resetting the absolute encoder.

6.16 Resetting the Absolute Encoder on page 6-47

2. You can set the origin to a different position from the reset position. Refer to the following section for information on the origin position offset.

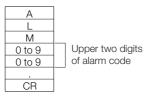
6.17 Setting the Origin of the Absolute Encoder on page 6-50

# 7.8.7 Alarm Output from Output Ports for the Position Data from the Absolute Encoder

Any alarm detected by the SERVOPACK is transmitted as alarm information to the host controller with the PAO (Encoder Divided Pulse Output) signal when the SENS\_ON (Turn ON Sensor) command turns OFF.

ALM signal		
Motor power status	Servo ON (Power supplied.)	Servo OFF (Power not supplied.)
Main circuit power supply	ON	OFF
Control power supply	ON	
SENS_ON command	ON	OFF
PAO signal		Alarm information

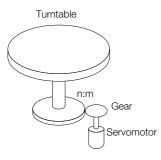
The data format of the alarm information is shown below.



7.8.8 Multiturn Limit Setting

## 7.8.8 Multiturn Limit Setting

The multiturn limit is used in position control for a turntable or other rotating body. For example, consider a machine that moves the turntable shown in the following diagram in only one direction.



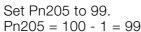
Because the turntable moves in only one direction, the upper limit to the number of rotations that can be counted by an absolute encoder will eventually be exceeded.

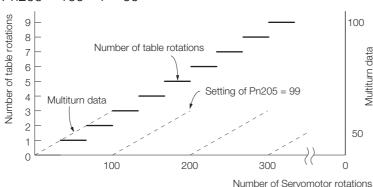
The multiturn limit is used in cases like this to prevent fractions from being produced by the integral ratio of the number of Servomotor rotations and the number of turntable rotations.

For a machine with a ratio of n:m between the number of Servomotor rotations and the number of turntable rotations, as shown above, the value of m minus 1 will be the setting for the multi-turn limit setting (Pn205).

Multiturn limit (Pn205) = m - 1

If m = 100 and n = 3 (i.e., the turntable rotates three times for each 100 Servomotor rotations), the relationship between the number of Servomotor rotations and the number of turntable rotations would be as shown below.





	Multiturn Limit		Speed Position Torque		
Pn205	Setting Range Setting Unit		Default Setting	When Enabled	Classification
	0 to 65,535	1 Rev	65,535	After restart	Setup

Note: This parameter is enabled when you use an absolute encoder.

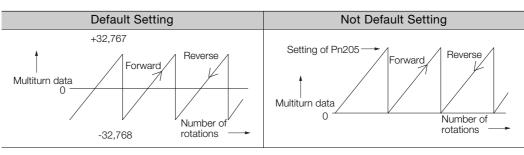
The data will change as shown below when this parameter is set to anything other than the default setting.

- If the Servomotor operates in the reverse direction when the multiturn data is 0, the multiturn data will change to the value set in Pn205.
- If the motor operates in the forward direction when the multiturn data is at the value set in Pn205, the multiturn data will change to 0.

Set Pn205 to one less than the desired multiturn data.

If you change the multiturn limit in Pn205, an A.CCO alarm (Multiturn Limit Disagreement) will be displayed because the setting disagrees with the value in the encoder. Refer to the following section for the procedure to change the multiturn limit settings in the encoder. 7.8.9 Multiturn Limit Disagreement Alarm (A.CCO) on page 7-39

7.8.9 Multiturn Limit Disagreement Alarm (A.CC0)



Information The multiturn data will always be 0 in the following cases. It is not necessary to reset the absolute encoder in these cases.

- When you use a single-turn absolute encoder
- When the encoder is set to be used as a single-turn absolute encoder (Pn002 =  $n.\Box 2\Box \Box$ ) Absolute encoder-related alarms (A.810 and A.820) will not occur.

# 7.8.9 Multiturn Limit Disagreement Alarm (A.CC0)

If you change the multiturn limit in Pn205 (Multiturn Limit), an A.CCO alarm (Multiturn Limit Disagreement) will be displayed because the setting disagrees with the value in the encoder.

Display	ay Name Meaning	
A.CC0	Multiturn Limit Disagreement	Different multiturn limits are set in the encoder and SERVO- PACK.

If this alarm is displayed, use the following procedure to change the multiturn limit in the encoder to the same value as the setting of Pn205.

### **Applicable Tools**

The following table lists the tools that you can use to set the multiturn limit and the applicable tool functions.

Tool	Function	Operating Procedure Reference
Digital Operator	Fn013	Ω Σ-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Setup - Multiturn Limit Setting	Generating Procedure on page 7-40

This setting can be made with the MEM\_WR (Write Memory) command. Refer to the following manual for information on the MEM\_WR (Write Memory) command.

Σ-7-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31) 7.8.9 Multiturn Limit Disagreement Alarm (A.CC0)

### **Operating Procedure**

Use the following procedure to adjust the multiturn limit setting.

- 1. Click the 🔎 Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select Multiturn Limit Setting in the Menu Dialog Box. The Multiturn Limit Setting Dialog Box will be displayed.
- 3. Click the Continue Button.

Multiturn Limit Setting
The position data is cleared when this function is used. Since the Multiturn (multiple rotations) limit is changed, the position data of the machine system is changed and it is very dangerous.
Do you want to continue the process?
Continue

Click the **Cancel** Button to cancel setting the multiturn limit. The Main Window will return.

4. Change the setting.

🕐 Multiturn Limit Setting AXIS#00					
Multiturn Limit Setting Change					
Pn205:Multiturn Limit					
65535 [Rev] 🕨 65535 [Rev]					
(0-65535)					
Writing into the Servopack					

- 5. Click the Writing into the Servopack Button.
- 6. Click the OK Button.

Multiturn Limit Setting
⚠
Multiturn limit value was changed. The following procedure is needed to operate with changing the Multiturn limit.
1. Close this function program.
<ol><li>"A.CC0.Multiturn Limit Disagreement" is occurred when the power of the Servopack (control) is cycled.</li></ol>
3. Select "Multiturn Limit Setting function" again.
<ol> <li>Set the Multiturn limit setting value to the servomotor according to the instruction of the screen.</li> </ol>
<ol> <li>Cycle power again Multiturn limit change is completed, through these procedures.</li> </ol>
ОК

#### 7.8.9 Multiturn Limit Disagreement Alarm (A.CC0)

7. Turn the power supply to the SERVOPACK OFF and ON again.

An A.CCO alarm (Multiturn Limit Disagreement) will occur because setting the multiturn limit in the Servomotor is not yet completed even though the setting has been changed in the SERVOPACK.

- 8. Display the Multiturn Limit Setting in the Menu Dialog Box.
- 9. Click the Continue Button.

🕐 Multiturn Limit Setting
The position data is cleared when this function is used. Since the Multiturn (multiple rotations) limit is changed, the position data of the machine system is changed and it is very dangerous.
Do you want to continue the process?
Continue

10. Click the Writing into the Motor Button.

🖲 Multiturn	Limit Setting	<b>—</b> ———————————————————————————————————	
Set the multiturn limit value to the servomotor.			
Pn205:Multiturn Limit			
1555	[ Rev ]	Re-Change	
Writing into the servomotor			

Click the **Re-change** Button to change the setting.

11. Click the OK Button.

Multiturn Limit Setting
Multiturn Limit Setting has been completed. Cycle (control) power. The operation can be done with the set multiturn limit from the next time when the power is turned on.
It is very dangerous to operate the machine in this state. Be sure to perform the original point re-setup of a machine system after power is turned on again.
ОК

This concludes the procedure to set the multiturn limit.

7.9.1 Connecting an Absolute Linear Encoder

# 7.9 Absolute Linear Encoders

The absolute linear encoder records the current position of the stop position even when the power supply is OFF.

With a system that uses an absolute linear encoder, the host controller can monitor the current position. Therefore, it is not necessary to perform an origin return operation when the power supply to the system is turned ON.

There are three types of linear encoders for Linear Servomotors. The usage of the linear encoder is specified in  $Pn002 = n.\Box X \Box \Box$ .

Refer to the following section for linear encoder models.

Feedback Resolution of Linear Encoder on page 6-44

#### · Parameter Settings When Using an Incremental Linear Encoder

Parameter		Meaning	When Enabled	Classification
Pn002	n.□0□□ (default setting)	Use the encoder as an incremental linear encoder.	After restart	Setup
	n.0100	Use the encoder as an incremental linear encoder.		

#### · Parameter Settings When Using an Absolute Linear Encoder

Parameter		Meaning	When Enabled	Classification
Pn002	n.□0□□ (default setting)	Use the encoder as an absolute linear encoder.	After restart	Setup
	n.🗆 1 🗆 🗆	Use the encoder as an incremental linear encoder.		

### 7.9.1 Connecting an Absolute Linear Encoder

You can get the position data from the absolute linear encoder with MECHATROLINK communications. Therefore, it is not necessary to wire the PAO, PBO, and PCO (Encoder Divided Pulse Output) signals.

If they need to be wired, refer to the following section.

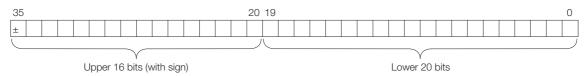
4.4.3 Wiring the SERVOPACK to the Encoder on page 4-20

31 4.5.3 I/O Signal Wiring Examples on page 4-31

# 7.9.2 Structure of the Position Data of the Absolute Linear Encoder

The position data of the absolute linear encoder is the distance (number of pulses) from the origin of the absolute linear encoder.

The position data is signed 36-bit data.



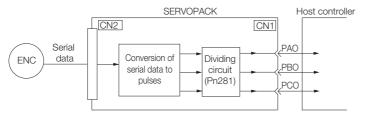
When the SERVOPACK sends the position data, it sends the upper 16-bit data (with sign) separately from the lower 20-bit data.

# 7.9.3 Output Ports for the Position Data from the Absolute Linear Encoder

You can read the position data of the absolute linear encoder from the PAO, PBO, and PCO (Encoder Divided Pulse Output) signals.

The output method and timing for the position data of the absolute linear encoder are different in each case.

A conceptual diagram of the connections of the PAO, PBO, and PCO (Encoder Divided Pulse Output) ports to the host controller is provided below.



Signal	Status	Signal Contents When Using an Absolute Linear Encoder
PAO	First signal	Upper 16-bit data (with sign) Lower 20-bit data (pulse train)
	During normal operation	Incremental pulses
PBO	First signal	Lower 20-bit data (pulse train)
	During normal operation	Incremental pulses
PCO	Always	Origin pulse

The PAO (Encoder Divided Pulse Output) signal outputs the position data from the absolute linear encoder after the control power supply is turned ON. The SENS\_ON (Turn ON Sensor) command is used to output the position data from the absolute linear encoder.

The position data of the absolute linear encoder is the current stop position. The absolute linear encoder outputs the upper 16-bit data (with sign) according to the specified protocol. The absolute encoder outputs the lower 20-bit data as a pulse train. It then outputs pulses as an incremental linear encoder (incremental operation status).

The host controller must have a reception circuit (e.g., UART) for the position data from the absolute linear encoder. The pulse counter at the host controller will not count pulses when the upper 16-bit data (with sign) (communications message) is input because only phase A is input.

The output circuits for the PAO, PBO, and PCO signals use line drivers. Refer to the following section for details on line drivers.

a.5.4 I/O Circuits on page 4-33

### 7.9.4 Reading the Position Data from the Absolute Linear Encoder

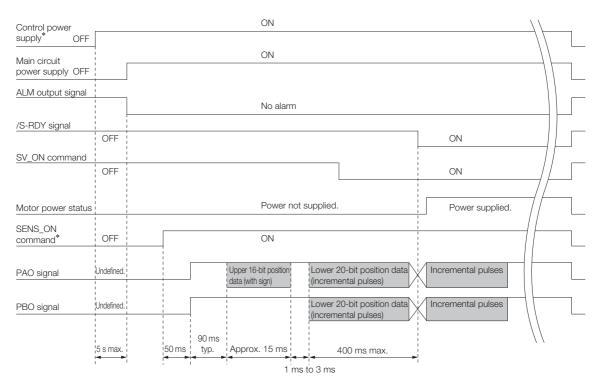
The SENS\_ON (Turn ON Sensor) command is used to read the position data from the absolute linear encoder.

The sequence for using the SENS\_ON command to read the position data from the absolute linear encoder of a Linear Servomotor is given below.

The upper 16-bit position data (with sign) are sent according to the transmission specifications.

The lower 20-bit data is output as a pulse train.

#### 7.9.5 Transmission Specifications



\* When you turn OFF the control power supply, input the SENS\_OFF command.

# 7.9.5 Transmission Specifications

The position data transmission specifications for the PAO (Encoder Divided Pulse Output) signal are given in the following table.

The PAO signal sends only the 16-bit data (with sign).

Refer to the following section for the timing of sending the position data from the absolute encoder.

Æ	7.9.4 Reading the Position Data from the Absolute Linear Encoder	on page 7-4	3
---	--	-------------	---

Item	PAO signal		
Synchronization Method	Start-stop synchronization (ASYNC)		
Transmission Speed	9,600 bps		
Start Bits	1 bit		
Stop Bits	1 bit		
Parity	Even		
Character Code	ASCII, 7 bits		
Data Format	Refer to Data Format of PAO Signal.		
Data Output Period	Each time the SENS_ON command is input after the control power supply is turned ON		

### Data Format of PAO Signal

As shown below, the message format consists of eight characters: "P," the sign, the 5-digit upper 15bit position data, and "CR" (which indicates the end of the message).



Upper 15 bits of position data

### 7.9.6 Calculating the Current Position in Machine Coordinates

With an absolute linear encoder, you must set the position of the origin (i.e., the origin of the machine coordinate system).

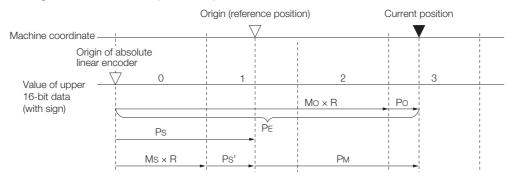
The host controller reads the coordinate from the origin of the encoder coordinate system. The host controller must record the value of this coordinate.

The method to calculate the coordinate value of the present position from the origin of the machine coordinate system is given below.

The position data from the absolute linear encoder is signed 36-bit data, but the upper 16 bits (with sign) and the lower 20 bits are output separately.

For the upper 16-bit data (with sign), the upper bits (16 bits, including the sign) of the current position after dividing by the setting of Pn281 are output with serial communications according to the transmission specifications.

For the lower 20-bit data, the lower bits (20 bits) of the current position after dividing by the setting of Pn281 are output as a pulse train.



The current position  $P_{M}$  in the machine coordinate system is calculated as follows:

 $P_{M} = P_{E} - P_{S}$  $P_{E} = M_{O} \times R + P_{O}$  $P_{S} = M_{S} \times R + P_{S}'$ 

Symbol	Meaning				
P <sub>E</sub>	Position data for the current position of the absolute linear encoder				
M <sub>O</sub> Upper 16 bits (with sign) of the position data for the current position of the absolute linear					
Po	Lower 20 bits of the position data for the current position of the absolute linear encoder				
P <sub>S</sub> Position data of the origin					
M <sub>S</sub> Upper 16 bits (with sign) of the position data of the origin					
P <sub>S</sub> '	Lower 20 bits of the position data of the origin				
P <sub>M</sub>	Current position in machine coordinate system				
R	1048576 (=2 <sup>20</sup> )				

Note: The above formulas also apply in reverse movement mode (Pn000 =  $n.\Box\Box\Box$ 1).

Information If you are using a Linear Servomotor, you do not need to reset the absolute linear encoder to define the origin. (Some absolute linear encoders also allow you to set any position as the origin.)

7.9.7 Alarm Output from the Output Ports for the Position Data from the Absolute Linear Encoder

# 7.9.7 Alarm Output from the Output Ports for the Position Data from the Absolute Linear Encoder

Any alarm detected by the SERVOPACK is transmitted as alarm information to the host controller with the PAO (Encoder Divided Pulse Output) signal when the SENS\_ON (Turn ON Sensor) command turns OFF.

ALM signal		]
Motor power status	Servo ON (Power supplied.)	Servo OFF (Power not supplied.)
Main circuit power supply	ON	OFF
Control power supply	ON	
SENS_ON comm	and ON	OFF
PAO signal		Alarm information

The data format of the alarm information is shown below.

А	
L	
М	
0 to 9	Upper two digits
0 to 9	of alarm code
CR	

# 7.10 Software Reset

You can reset the SERVOPACK internally with the software. A software reset is used when resetting alarms and changing the settings of parameters that normally require turning the power supply to the SERVOPACK OFF and ON again. This can be used to change those parameters without turning the power supply to the SERVOPACK OFF and ON again.

Information

- 1. Always confirm that the servo is OFF and that the Servomotor is stopped before you start a software reset.
  - 2. This function resets the SERVOPACK independently of the host controller. The SERVO-PACK carries out the same processing as when the power supply is turned ON and outputs the ALM (Servo Alarm) signal. The status of other output signals may be forcibly changed.
  - 3. When you execute a software reset, the SERVOPACK will not respond for approximately five seconds.

Before you execute a software reset, check the status of the SERVOPACK and Servomotor and make sure that no problems will occur.

### 7.10.1 Preparations

Always check the following before you perform a software reset.

- The servo must be OFF.
- The motor must be stopped.

## 7.10.2 Applicable Tools

The following table lists the tools that you can use to perform a software reset and the applicable tool functions.

Tool	Function	Operating Procedure Reference		
Digital Operator	Fn030	Σ-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)		
SigmaWin+	Setup - Software Reset	Terror 7.10.3 Operating Procedure on page 7-48		

7.10.3 Operating Procedure

# 7.10.3 Operating Procedure

There are the following two methods that you can use to perform a software reset.

- Direct connection to the SERVOPACK
- · Connection though a controller

The procedure for each method is given below.

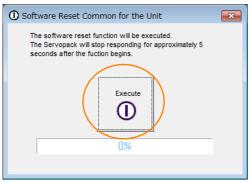
# Direct Connection to the SERVOPACK

- 1. Click the 🔎 Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- 2. Select Software Reset in the Menu Dialog Box. The Software Reset Dialog Box will be displayed.
- 3. Click the Execute Button.

Software Reset
The software reset function resets the Servopack by using software and re-calculates all settings including parameters. Be sure to carefully read the SigmaWin+ Operation Manual before executing this function. Special care must be taken for the following.
The Servopack will stop responding for approximately 5 seconds after the execution begins. Before executing this function, always check the Servopack and motor status to ensure safety.
Execute

Click the **Cancel** Button to cancel the software reset. The Main Window will return.

4. Click the Execute Button.



#### 5. Click the OK Button to end the software reset operation.

All settings including parameters will have been re-calculated. When you finish this operation, disconnect the SigmaWin+ from the SERVOPACK, and then connect it again.

Software Reset
The software reset function has been completed. All settings including parameters were re-calculated. Always reconnect the SigmaVVin+ to the Servopack after execution of this function.
ОК

This concludes the procedure to reset the software.

## Connection through a Controller

- 1. Click the 🔎 Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select Software Reset in the Menu Dialog Box. The Software Reset Dialog Box will be displayed.
- 3. Click the Execute Button.

Software Reset					
The software reset function resets the Servopack by using software and re-calculates all settings including parameters. Be sure to carefully read the SigmaWin+ Operation Manual before executing this function. Special care must be taken for the following.					
The Servopack will stop responding for approximately 5 seconds after the execution begins. Before executing this function, always check the Servopack and motor status to ensure safety.					
Execute					

Click the Cancel Button to cancel the software reset. The Main Window will return.

4. Select the Reset MECHATROLINK communication Check Box.

O Software Reset Common for the Unit						
The software reset function will be executed. The Servopack will stop responding for approximately 5 seconds after the fuction begins.						
Execute						
0%						
Reset MECHATROLINK communication After executing the software reset function, communications with the axis #5 will be reset.						

5. Click the Execute Button.



If you perform a software reset without resetting MECHATROLINK communications, a communications error will occur between the controller and SERVOPACK, and communications will no longer be possible.

Always select the **Reset MECHATROLINK communication** Check Box and reset MECHATROLINK communications as well.

#### 6. Click the OK Button.

All settings including parameters will have been re-calculated. When you finish this operation, disconnect the SigmaWin+ from the SERVOPACK, and then connect it again.

Software Rese	et 🔀
	JTION
All settings inc	reset function has been completed. luding parameters were re-calculated. Always
function.	SigmaWin+ to the Servopack after execution of this
	ОК

This concludes the procedure to reset the software.

#### 7.11.1 Preparations

# 7.11 Initializing the Vibration Detection Level

You can detect machine vibration during operation to automatically adjust the settings of Pn312 or Pn384 (Vibration Detection Level) to detect A.520 alarms (Vibration Alarm) and A.911 warnings (Vibration) more precisely.

This function detects specific vibration components in the Servomotor speed.

	Parameter		Meaning	When Enabled	Classification
	D-010	n.□□□0 (default setting)	Do not detect vibration.		Setup
Pn310	Pn310	n.0001	Output a warning (A.911) if vibration is detected.	Immediately	
		n.🗆 🗆 🗠 2	Output an alarm (A.520) if vibration is detected.		

If the vibration exceeds the detection level calculated with the following formula, an alarm or warning occurs according to Pn310 (Vibration Detection Selection).

Rotary Servomotors

Detection level = Vibration detection level (Pn312 [min-1]) × Vibration detection sensitivity (Pn311 [%])

100

• Linear Servomotors

Detection level = <u>
Vibration detection level (Pn384 [mm/s]) × Vibration detection sensitivity (Pn311 [%])</u> 100

Use this function only if A.520 or A.911 alarms are not output at the correct times when vibration is detected with the default vibration detection level (Pn312 or Pn384).

There will be discrepancies in the detection sensitivity for vibration alarms and warnings depending on the condition of your machine. If there is a discrepancy, use the above formula to adjust Pn311 (Vibration Detection Sensitivity).

	Vibration Detection Sensitivity			Speed Position	on Torque
Pn311	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	50 to 500	1%	100	Immediately	Tuning

Information 1. Vibration may not be detected because of unsuitable servo gains. Also, not all kinds of vibrations can be detected.

2. Set a suitable moment of inertia ratio (Pn103). An unsuitable setting may result in falsely detecting or not detecting vibration alarms or vibration warnings.

- 3. To use this function, you must input the actual references that will be used to operate your system.
- 4. Execute this function under the operating conditions for which you want to set the vibration detection level.
- 5. Execute this function while the Servomotor is operating at 10% of its maximum speed or faster.

### 7.11.1 Preparations

Always check the following before you initialize the vibration detection level.

- The parameters must not be write prohibited.
- The test without a motor function must be disabled (Pn00C =  $n.\Box\Box\Box$ ).

# 7.11.2 Applicable Tools

The following table lists the tools that you can use to initialize the vibration detection level and the applicable tool functions.

Tool	Function	Operating Procedure Reference
Digital Operator	Fn01B	Ω Σ-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Setup - Initialize Vibra- tion Detection Level	7.11.3 Operating Procedure on page 7-51

# 7.11.3 Operating Procedure

Use the following procedure to initialize the vibration detection level.

- 1. Click the 🔎 Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select Initialize Vibration Detection Level in the Menu Dialog Box. The Initialize Vibration Detection Level Dialog Box will be displayed.
- Select Pn311: Vibration Detection Sensitivity and Pn310: Vibration Detection Selections and then click the Detection Start Button. A setting execution standby mode will be entered.

Initialize Vibration Detection Level AXIS#00
Setting Condition
Pn311 : Vibration Detection Sensitivity (50 - 500)
100 - [%]
Pn310 : Vibration Detection Selections digit 0 Vibration Detection Selection
2 : Output an alarm (A.520) if vibration is detected.
Setting Result
Pn312 : Vibration Detection Level
50 [min-1] <b>(</b> min-1]

7

7-51

7.11.3 Operating Procedure

4. Click the Execute Button.

Initialize Vibration Detection Level AXIS#00
- Setting Condition
Pn311 : Vibration Detection Sensitivity (50 - 500)
100 [%]
Pn310 : Vibration Detection Selections digit 0 Vibration Detection Selection
2 : Output an alarm (A.520) if vibration is detected.
Execute
Setting Result
Pn312 : Vibration Detection Level
50 [min-1]

The newly set vibration detection level will be displayed and the value will be saved in the SERVO-PACK.

Initialize Vibration Detection Level AXIS#00 ■			
- Setting Condition			
Pn311 : Vibration Detection Sensitivity (50 - 500)			
100 . [%]			
Pn310 : Vibration Detection Selections digit 0 Vibration Detection Selection			
2 : Output an alarm (A.520) if vibration is detected.			
Setting Result			
Pn312 : Vibration Detection Level			
50 [min-1] <b>b</b> 50 [min-1]			
When vibration exceeds a detection level 50 [min-1], Alarm(A.520) is detected.			

This concludes the procedure to initialize the vibration detection level.

7.11.4 Related Parameters

# 7.11.4 Related Parameters

The following three items are given in the following table.

- Parameters Related to this Function
  - These are the parameters that are used or referenced when this function is executed.
- Changes during Function Execution Not allowed: The parameter cannot be changed using the SigmaWin+ or other tool while this function is being executed.

Allowed: The parameter can be changed using the SigmaWin+ or other tool while this function is being executed.

• Automatic Changes after Function Execution Yes: The parameter is automatically set or adjusted after execution of this function. No: The parameter is not automatically set or adjusted after execution of this function.

Parameter	Name	Setting Changes	Automatic Changes	
Pn311	Vibration Detection Sensitivity	Allowed	No	
Pn312	Vibration Detection Level	Not allowed	Yes	
Pn384	Vibration Detection Level	Not allowed	Yes	

7.12.1 Automatic Adjustment

# 7.12 Adjusting the Motor Current Detection Signal Offset

The motor current detection signal offset is used to reduce ripple in the torque. You can adjust the motor current detection signal offset either automatically or manually.

# 7.12.1 Automatic Adjustment

Perform this adjustment only if highly accurate adjustment is required to reduce torque ripple. It is normally not necessary to adjust this offset.



Execute the automatic offset adjustment if the torque ripple is too large when compared with other SERVOPACKs.

tion The offset does not use a parameter, so it will not change even if the parameter settings are initialized.

### Preparations

Always check the following before you automatically adjust the motor current detection signal offset.

- The parameters must not be write prohibited.
- The servo must be in ready status.
- The servo must be OFF.

## **Applicable Tools**

The following table lists the tools that you can use to automatically adjust the offset and the applicable tool functions.

Tool	Function	ion Operating Procedure Reference	
Digital Operator	Fn00E	Ω Σ-7-Series Digital Operator Operating Manual (document No. SIEP S800001 33)	
SigmaWin+	Setup - Adjust Offset - Adjust the Motor Current Detection Signal Offsets	S Operating Procedure on page 7-54	

### **Operating Procedure**

Use the following procedure to automatically adjust the motor current detection signal offset.

- 1. Click the 🔎 Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select Adjust the Motor Current Detection Signal Offsets in the Menu Dialog Box. The Adjust the Motor Current Detection Signal Offsets Dialog Box will be displayed.

Information

7.12.1 Automatic Adjustment

3. Click the Continue Button.



4. Click the Automatic Adjustment Tab in the Adjust the Motor Current Detection Signal Offsets Dialog Box.

S. Adjust the Motor Cu	urrent Detection Signal O 💌				
Automatic Adjustment Manual Adjustment					
U-phase Offset V-phase Offset	-73 ►				
Adjust					

#### 5. Click the Adjust Button.

The values that result from automatic adjustment will be displayed in the **New** Boxes.

Search Adjust the Motor Current Detection Signal O					
Automatic Adjustment Ma	anual Adjustment	_			
U-phase Offset -73 -74 V-phase Offset -63 -63					
Ajust					

This concludes the procedure to automatically adjust the motor current detection signal offset.

7.12.2 Manual Adjustment

# 7.12.2 Manual Adjustment

You can use this function if you automatically adjust the motor current detection signal offset and the torque ripple is still too large.

If the offset is incorrectly adjusted with this function, the Servomotor characteristics may be adversely affected.

- Observe the following precautions when you manually adjust the offset.
- Important Operate the Servomotor at a speed of approximately 100 min<sup>-1</sup>.
  - Adjust the offset while monitoring the torque reference with the analog monitor until the ripple is minimized.
  - Adjust the offsets for the phase-U current and phase-V current of the Servomotor so that they
    are balanced. Alternately adjust both offsets several times.

Information

The offset does not use a parameter, so it will not change even if the parameter settings are initialized.

# Preparations

Always check the following before you manually adjust the motor current detection signal offset.

• The parameters must not be write prohibited.

## Applicable Tools

The following table lists the tools that you can use to manually adjust the offset and the applicable tool functions.

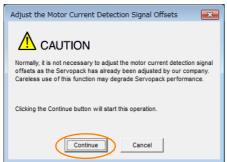
Tool	Function Operating Procedure Reference		
Digital Operator	Fn00F	Ω Σ-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)	
SigmaWin+	Setup - Adjust Offset - Adjust the Motor Current Detection Signal Offsets	Operating Procedure on page 7-56	

### **Operating Procedure**

Use the following procedure to manually adjust the motor current detection signal offset.

- 1. Operate the Servomotor at approximately 100 min<sup>-1</sup>.
- 2. Click the 🔎 Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **3.** Select Adjust the Motor Current Detection Signal Offsets in the Menu Dialog Box. The Adjust the Motor Current Detection Signal Offsets Dialog Box will be displayed.

#### 4. Click the Continue Button.



7.12.2 Manual Adjustment

5. Click the Manual Adjustment Tab in the Adjust the Motor Current Detection Signal Offsets Dialog Box.

2 Adjust the Motor Current Detection Signal O				
Automatic Adjustment Manual Adjustment				
Motor Current Detection Offset				
Channel U-phase 💌				
Offset +1 ()↑				

- 6. Set the Channel Box in the Motor Current Detection Offset Area to U-phase.
- **7.** Use the +1 and -1 Buttons to adjust the offset for phase U. Change the offset by about 10 in the direction that reduces the torque ripple. Adjustment range: -512 to +511
- 8. Set the Channel Box in the Motor Current Detection Offset Area to V-phase.
- 9. Use the +1 and -1 Buttons to adjust the offset for phase V. Change the offset by about 10 in the direction that reduces the torque ripple.
- **10.** Repeat steps 6 to 9 until the torque ripple cannot be decreased any further regardless of whether you increase or decrease the offsets.
- **11.** Reduce the amount by which you change the offsets each time and repeat steps 6 to 9.

This concludes the procedure to manually adjust the motor current detection signal offset.

7.13.1 FSTP (Forced Stop Input) Signal

# 7.13 Forcing the Motor to Stop

You can force the Servomotor to stop for a signal from the host controller or an external device.

To force the motor to stop, you must allocate the FSTP (Forced Stop Input) signal in Pn516 =  $n.\Box\Box\BoxX$ . You can specify one of the following stopping methods: dynamic brake (DB), coasting to a stop, or decelerating to a stop.

Note: Forcing the motor to stop is not designed to comply with any safety standard. In this respect, it is different from the hard wire base block (HWBB).

Information Panel Operator and Digital Operator Displays

When a forced stop is performed, the panel and the Digital Operator will display FSTP.



• To prevent accidents that may result from contact faults or disconnections, use a normally closed switch for the Forced Stop Input signal.

# 7.13.1 FSTP (Forced Stop Input) Signal

Classifica- tion	Signal	Connector Pin No.	Signal Status	Description
Input	FSTP	Must be allocated.	ON (closed)	Drive is enabled (normal operation).
			OFF (open)	The motor is stopped.

Note: You must allocate the FSTP signal to use it. Use Pn516 = n.□□□X (FSTP (Forced Stop Input) Signal Allocation) to allocate the FSTP signal to a connector pin. Refer to the following section for details.

7.1.1 Input Signal Allocations on page 7-4

# 7.13.2 Stopping Method Selection for Forced Stops

Use  $Pn00A = n.\square\squareX\square$  (Stopping Method for Forced Stops) to set the stopping method for forced stops.

Parameter		Description	When Enabled	Classifi- cation
n. <b>□</b> □0□		Apply the dynamic brake or coast the motor to a stop (use the stopping method set in $Pn001 = n.\Box\Box\BoxX$ ).		
n.□10 (default set- ting) Pn00A n.□20 n.□30	Decelerate the motor to a stop using the torque set in Pn406 as the maximum torque. Use the setting of Pn001 = $n.\Box\Box\BoxX$ for the status after stopping.			
	n.0020	Decelerate the motor to a stop using the torque set in Pn406 as the maximum torque and then let the motor coast.	After restart	Setup
	n.0030	Decelerate the motor to a stop using the deceleration time set in Pn30A. Use the setting of Pn001 = $n.\Box\Box\BoxX$ for the status after stopping.		
	n.0040	Decelerate the motor to a stop using the deceleration time set in Pn30A and then let the motor coast.		

Note: You cannot decelerate a Servomotor to a stop during torque control. For torque control, the Servomotor will be stopped with the dynamic braking or coast to a stop according to the setting of Pn001 = n.  $\Box \Box \Box X$  (Motor Stopping Method for Servo OFF and Group 1 Alarms).

7.13.2 Stopping Method Selection for Forced Stops

### Stopping the Servomotor by Setting Emergency Stop Torque (Pn406)

To stop the Servomotor by setting emergency stop torque, set Pn406 (Emergency Stop Torque).

If  $Pn00A = n.\Box\BoxX\Box$  is set to 1 or 2, the Servomotor will be decelerated to a stop using the torque set in Pn406 as the maximum torque.

The default setting is 800%. This setting is large enough to allow you to operate the Servomotor at the maximum torque. However, the maximum emergency stop torque that you can actually use is the maximum torque of the Servomotor.

	Emergency Stop To	rque	Speed Positio	n	
Pn406	Setting Range Setting Unit		Default Setting	When Enabled	Classification
	0 to 800	1%*	800	Immediately	Setup

\* Set a percentage of the motor rated torque.

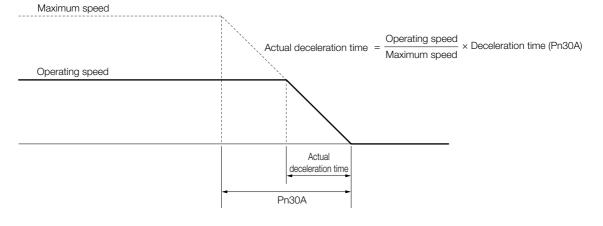
# Stopping the Servomotor by Setting the Deceleration Time for Servo OFF and Forced Stops (Pn30A)

To specify the Servomotor deceleration time and use it to stop the Servomotor, set Pn30A (Deceleration Time for Servo OFF and Forced Stops).

	Deceleration Time f	or Servo OFF and Fo	Speed Position	١	
Pn30A	Setting Range	Setting Unit Default Setting		When Enabled	Classification
	0 to 10,000	1 ms	0	Immediately	Setup

If you set Pn30A to 0, the Servomotor will be stopped with a zero speed.

The deceleration time that you set in Pn30A is the time to decelerate the Servomotor from the maximum motor speed.



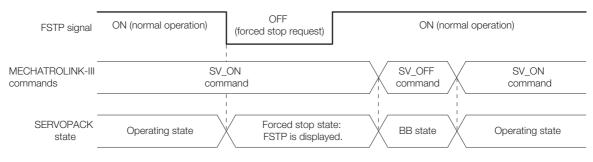
7.13.3 Resetting Method for Forced Stops

# 7.13.3 Resetting Method for Forced Stops

This section describes the reset methods that can be used after stopping operation for an FSTP (Forced Stop Input) signal.

If the FSTP (Forced Stop Input) signal is OFF and the SV\_ON (Servo ON) command is sent, the forced stop state will be maintained even after the FSTP signal is turned ON.

Send the SV\_OFF (Servo OFF) command to place the SERVOPACK in the base block (BB) state and then send the SV\_ON (Servo ON) command.



7.14.1 ZONE Table and ZONE Signals

# 7.14 ZONE Outputs (FT64 Specification)

You can use ZONE signals to output a ZONE number to indicate when the current value is within a registered zone.

The ZONE signals (/ZONE0 to /ZONE3) are assigned to output signals (/SO1 to /SO5) on CN1.

# 7.14.1 ZONE Table and ZONE Signals

You can register the desired zones in the ZONE table. The ZONE table consists of settings for the ZONE numbers (ZONE), ZONE N values (ZONE N), and ZONE P values (ZONE P). You can register up to 16 zones.

The ZONE numbers identify the registered zones.

ZONE N is the lower limit of the ZONE and ZONE P is the upper limit of the ZONE. The setting conditions for ZONE N and ZONE P are given in the following table.

Setting Range	Setting Unit	Default Setting	When Enabled
-2,147,483,648 to 2,147,483,647	Reference units	0	Immediately

The ZONE signals indicate the ZONE number. If the current value is within a zone registered in the ZONE table, the corresponding ZONE number is output on the ZONE signals.

	ZONE Table			ZONE	Signals	
ZONE Number (ID)	ZONE N [Reference units]	ZONE P [Reference units]	/ZONE3	/ZONE2	/ZONE1	/ZONE0
0	±nnnnnnnnn	±nnnnnnnnn	0	0	0	0
1	±nnnnnnnnn	±nnnnnnnnn	0	0	0	1
2	±nnnnnnnnn	±nnnnnnnnn	0	0	1	0
3	±nnnnnnnnn	±nnnnnnnnn	0	0	1	1
4	±nnnnnnnnn	±nnnnnnnnn	0	1	0	0
5	±nnnnnnnnn	±nnnnnnnnn	0	1	0	1
6	±nnnnnnnnn	±nnnnnnnnn	0	1	1	0
7	±nnnnnnnnn	±nnnnnnnnn	0	1	1	1
8	±nnnnnnnnn	±nnnnnnnnn	1	0	0	0
9	±nnnnnnnnn	±nnnnnnnnn	1	0	0	1
10	±nnnnnnnnn	±nnnnnnnnn	1	0	1	0
11	±nnnnnnnnn	±nnnnnnnnn	1	0	1	1
12	±nnnnnnnnn	±nnnnnnnnn	1	1	0	0
13	±nnnnnnnnn	±nnnnnnnnn	1	1	0	1
14	±nnnnnnnnn	±nnnnnnnnn	1	1	1	0
15	±nnnnnnnnn	±nnnnnnnnn	1	1	1	1

Note: 1: Signal is ON (active), 0: Signal is OFF (inactive).

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7.14.1 ZONE Table and ZONE Signals

## **ZONE Table Settings and ZONE Numbers**

The relationship between the ZONE table settings and the ZONE numbers is shown below.

• ZONE  $N \leq ZONE P$ 

The ZONE signals for the corresponding ZONE number is output if the current value is between ZONE N and ZONE P, inclusive (the shaded part in the following figure).



#### • ZONE P < ZONE N

The ZONE signals for the corresponding ZONE number is output if the current value is less than or equal to ZONE P or greater than or equal to ZONE N (the shaded parts in the following figure).



- Duplicated Settings in the ZONE Table The smaller ZONE number is output.
- ZONE N and ZONE P = 0 The ZONE number is disabled.
- When the Current Value Is Not In Any ZONE All of the ZONE signals will be OFF (0).

# 7.14.2 ZONE Table Settings

ZONE outputs can be used by sending the MEM\_WR (Write Memory) command. Set the addresses in the following table in the MEM\_WR (Write Memory) command.

Name	Address	Unit	Default Setting	Setting Range	Data Size (Bytes)
ZONE ID 0	F0040000h	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 1	F0040008h	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 2	F0040010h	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 3	F0040018h	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 4	F0040020h	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 5	F0040028h	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 6	F0040030h	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 7	F0040038h	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 8	F0040040h	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 9	F0040048h	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 10	F0040050h	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 11	F0040058h	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 12	F0040060h	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 13	F0040068h	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 14	F0040070h	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 15	F0040078h	Reference units	0	-2,147,483,648 to 2,147,483,647	4

• ZONE Table Forward Boundary Positions (ZONE P)

• ZONE Table Reverse Boundary Positions (ZONE N)

Name	Address	Unit	Default Setting	Setting Range	Data Size (Bytes)
ZONE ID 0	F0040004h	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 1	F004000Ch	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 2	F0040014h	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 3	F004001Ch	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 4	F0040024h	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 5	F004002Ch	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 6	F0040034h	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 7	F004003Ch	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 8	F0040044h	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 9	F004004Ch	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 10	F0040054h	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 11	F004005Ch	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 12	F0040064h	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 13	F004006Ch	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 14	F0040074h	Reference units	0	-2,147,483,648 to 2,147,483,647	4
ZONE ID 15	F004007Ch	Reference units	0	-2,147,483,648 to 2,147,483,647	4

#### 7.14.2 ZONE Table Settings

# Data Formats of the MEM\_WR (Write Memory) Command

The following table gives details and setting examples for the MEM\_WR (Write Memory) command.

### Data Formats

	n Which the Com- Can Be Executed	2 and 3	Command Classification	Common command	Asynchronous command		
Pro	cessing Time	-	Subcommand	Cannot	be used.		
Byte	MEM	I_WR		Contents			
Dyte	Command	Response		Contents			
0	1EH	1EH					
1	WDT	RWDT					
2	CMD_CTRL	CMD_STAT					
3			_				
4	Reserved.	Reserved.		address to write in th			
5	MODE/DATA TYPE	MODE/DATA TYPE	tual memory.	a size to write, and v			
6	SIZE	SIZE	<ul> <li>This command performs an adjustment operation t equivalent to the ADJ command of the MECHATROLINK-II-compatible profile.</li> <li>Confirm the completion of command execution by</li> </ul>				
7	UIZL	UIZE					
8			checking that $RCMD = MEM_WR$ (= 1Eh) and $CMD_STAT.CMDRDY = 1$ , and with ADDRESS,				
9	ADDRESS	ADDRESS	CMD_STAT.CMD MODE/DATA_TY	ADDRESS, SIZE,			
10							
11			In the following cases, an alarm occurs and the comman is not executed.				
12	-		<ul> <li>ADDRESS was or</li> </ul>	ut of range: CMD_A			
13	-		<ul> <li>MODE/DATA_TYPE was out of range: CMD_ALM = 9h (A.94B)</li> </ul>				
14	_			range: CMD_ALM =			
15	-		<ul> <li>The conditions for</li> </ul>	range: CMD_ALM = or Normal Mode (000			
16	_		fied: CMD_ALM =	= Ah (A.95A). r Initialize Parameter	$r_{\rm c}$ (1005b) wore pot		
17	_		satisfied: CMD A	LM = Ah (A.95A).	. ,		
18	_		The conditions for wore not satisfied	• The conditions for Absolute Encoder Reset (1008h) were not satisfied: CMD_ALM = Ah (A.95A).			
19	-		<ul> <li>The conditions for</li> </ul>	or Autotune Motor C	urrent Detection		
20	-		Signal Offset (100 CMD_ALM = Ah	DEh) were not satisfi (A.95A).	ed:		
21	DATA	DATA	<ul> <li>The conditions for</li> </ul>	òr Multiturn Limit Set	ting (1013h) were		
22	-			$D_ALM = Ah (A.95A)$ SigmaWin or Digita			
23	-			ALM = Ah (A.95A)	······		
24	-		Refer to the followi	ng manual for detail	S.		
26	-		$\square$ $\Sigma$ -7-Series MEC	CHATROLINK-III Com	munications Stan-		
27	4			file Command Manual EP S800001 31)	l		
28	-		,	· · · /			
29	-						
30	-						
31	-						

#### Command Parameters

This section describes the contents of MODE/DATA\_TYPE.

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
MODE				DAT	A_TYPE		

MODE = 1: Volatile memory, 2: Nonvolatile memory (Nonvolatile memory is used only for common parameters.)

DATA\_TYPE = 1: Byte, 2: Short, 3: Long, 4: Unsupported

SIZE: Number of data (Type is specified with DATA\_TYPE.) ADDRESS: First address DATA: Read data

7.14.3 ZONE Signals 1 to 4 Outputs (/ZONE0 to /ZONE3)

### • Example of ZONE Output Settings

An example of setting the ZONE table forward boundary position for ZONE ID 0 to 10,000 are given below.

Example

ADDRESS = F0040000H MODE/DATA\_TYPE = 0x13 SIZE = 0x01 DATA = 10000 Note: The current set value can also be read using the MEM\_RD command.

### Command Warnings

The following table describes the contents of CMD\_ALM in the MEM\_RD and MEM\_WR commands.

CMD_ALM	Displayed Code	Error				
		The first address accesses an address outside the defined area.				
	A.94A	Addresses that are reserved for common parameters or vendor specifications were specified.				
9h		ADDRESS is not a multiple of the size specified with DATA_TYPE.				
911	A.94B	MODE or DATA_TYPE are out of range.				
	A.94D	The first address is within the defined area, but the size specification resulted in accessing an address outside the defined area.				
		SIZE exceeded the data size of the command format.				

# 7.14.3 ZONE Signals 1 to 4 Outputs (/ZONE0 to /ZONE3)

The /ZONE0 to /ZONE3 signals indicate when the current value is within a zone registered in the ZONE table.

Туре	Signal	Connector Pin No.	Signal Status	Meaning
	/ZONE0	Must be allocated.	ON (closed)	The current value is within a zone in the ZONE table and / ZONE0 is active.
	ZUNLU	Must be allocated.	OFF (open)	The current value is not within a zone in the ZONE table or / ZONE0 is inactive.
	/ZONE1	Must be allocated.	ON (closed)	The current value is within a zone in the ZONE table and / ZONE1 is active.
		NUST DE ANOCATEU.	OFF (open)	The current value is not within a zone in the ZONE table or / ZONE1 is inactive.
Outputs	/ZONE2 /ZONE3	Must be allocated. Must be allocated.	ON (closed)	The current value is within a zone in the ZONE table and / ZONE2 is active.
			OFF (open)	The current value is not within a zone in the ZONE table or / ZONE2 is inactive.
			ON (closed)	The current value is within a zone in the ZONE table and / ZONE3 is active.
			OFF (open)	The current value is not within a zone in the ZONE table or / ZONE3 is inactive.

Note: You must allocate the /ZONE0 to /ZONE3 signals to use them. Use Pn53C (ZONE Output Signal Selections 1) to allocate them to connector pins. Refer to the following sections for details.

7.1.2 Output Signal Allocations on page 7-6

7.14.4 nZONE Signal Output

#### nZONE Signal Output 7.14.4

The /nZONE signal indicates when the current value is within a zone registered in the ZONE table.

Туре	Signal	Connector Pin No.	Signal Status	Meaning
Output	/nZONE	Must be allocated.	ON (closed)	The current value is within a zone registered in the ZONE table.
Output	/ILUNL	NUST DE ANOCATEU.	OFF (open)	The current value is not within a zone registered in the ZONE table.

Note: You must allocate the /nZONE signal to use it. Use Pn53D = n. DDX (/nZONE (ZONE n Signal Output) Signal Allocation) to allocate the signal to connector pins. Refer to the following sections for details.

The relationship between the ZONE table and /nZONE signal is shown in the following table.

ZONE Number (ID)	ZONE N [Reference Units]	ZONE P [Reference Units]	/nZONE
0	±nnnnnnnnn	±nnnnnnnnn	1
1	±nnnnnnnnn	±nnnnnnnnn	1
2	±nnnnnnnnn	±nnnnnnnnn	1
3	±nnnnnnnnn	±nnnnnnnnn	1
4	±nnnnnnnnn	±nnnnnnnnn	1
5	±nnnnnnnnn	±nnnnnnnnn	1
6	±nnnnnnnnn	±nnnnnnnnn	1
7	±nnnnnnnnn	±nnnnnnnnn	1
8	±nnnnnnnnn	±nnnnnnnnn	1
9	±nnnnnnnnn	±nnnnnnnnn	1
10	±nnnnnnnnn	±nnnnnnnnn	1
11	±nnnnnnnnn	±nnnnnnnnn	1
12	±nnnnnnnnn	±nnnnnnnnn	1
13	±nnnnnnnnn	±nnnnnnnnn	1
14	±nnnnnnnnn	±nnnnnnnnn	1
15	±nnnnnnnnn	±nnnnnnnnn	1

Note: The /nZONE signal will be 0 (OFF) if both ZONE N and ZONE P are zero.

7.14.5 ZONE Output Application Example

# 7.14.5 **ZONE** Output Application Example

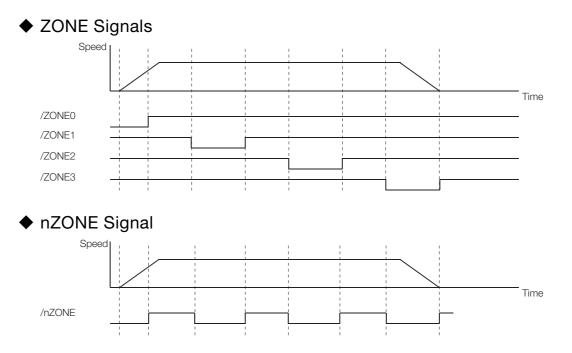
# Using the ZONE Outputs as Zone Signals

The ZONE signals are output when the current value is within a zone registered in the ZONE table. The relationship between the ZONE table and ZONE signals is shown in the following table.

ZONE Number (ID)	ZONE N	ZONE P
0	0	0
1	-1000	+1000
2	+99000	+101000
3	0	0
4	+199000	+201000
5	0	0
6	0	0
7	0	0
8	+299000	+301000
9	0	0
10	0	0
11	0	0
12	0	0
13	0	0
14	0	0
15	0	0

The ZONE table is given below.

The relationship between the operation pattern and ZONE signals is shown in the following diagrams.



7.15.1 Connecting the Overheat Protection Input (TH) Signal

# 7.15 Overheat Protection

Overheat protection detects an A.93B warning (Overheat Warning) and an A.862 alarm (Overheat Alarm) by monitoring the overheat protection input signal (TH) from a Yaskawa SGLFW2 Linear Servomotor or from a sensor attached to the machine.

SERVOPACKs with software version 0023 or higher support overheat protection.

When you use overheat protection, you must wire the overheat protection input (TH) signal and select overheat protection (Pn61A =  $n.\Box\Box\BoxX$ ).

# 7.15.1 Connecting the Overheat Protection Input (TH) Signal

To use overheat protection, you must connect an overheat protection input (TH) signal to the SERVOPACK. This section describes the connection methods for the overheat protection input (TH) signal.

### Using Overheat Protection in the Linear Servomotor

- If you use a Serial Converter Unit, connect the connector for the polarity sensor and thermostat cable of the Linear Servomotor to the Serial Converter Unit.
- If you do not use a Serial Converter Unit, connect the thermostat cable of the Linear Servomotor to CN1-5.

### Using Overheat Protection for the Machine

To use overheat protection for the machine, connect the overheat protection input (an analog voltage input) from the sensor mounted to the machine to the CN1-5.

### 7.15.2 Overheat Protection Selections

The overheat protection function is selected with  $Pn61A = n.\Box\Box\BoxX$  (Overheat Protection Selections).

Parameter		Meaning	When Enabled	Classifi- cation
	n.□□□0 (default set- ting)	Disable overheat protection.		Setup
Pn61A	n.0001	Use overheat protection in the Yaskawa Linear Servomo- tor.*	After restart	
	n.0002	Monitor a negative voltage input from a sensor attached to the machine and use overheat protection.		
	n. <b>DDD</b> 3	Monitor a positive voltage input from a sensor attached to		

\* The SGLFW2 is the only Yaskawa Linear Servomotor that supports this function.

# Using Overheat Protection in the Yaskawa Linear Servomotor

To use the overheat protection in a Yaskawa Linear Servomotor (SGLFW2), set Pn61A to n.DDD1.

An A.93B warning (Overheat Warning) will be detected if the overheat protection input (TH) signal from the Yaskawa SGLFW2 Linear Servomotor exceeds the warning temperature.

An A.862 alarm (Overheat Alarm) will be detected if the overheat protection input (TH) signal from the Yaskawa SGLFW2 Linear Servomotor exceeds the alarm temperature.

• If the overheat protection input signal line is disconnected or short-circuited, an A.862 alarm will occur.

• If you set Pn61A to n. DDD1 (Use overheat protection in the Yaskawa Linear Servomotor), the parameters in the Servomotor are enabled and the following parameters are disabled.

- Overheat Alarm Level (Pn61B)
- Overheat Warning Level (Pn61C)
- Overheat Alarm Filter Time (Pn61D)

# Monitoring the Machine's Temperature and Using Overheat Protection

Set Pn61A =  $n.\Box\Box\BoxX$  to 2 or 3 to use overheat protection for the machine.

Set the following parameters as required.

 $\bigcirc$ 

	Overheat Alarm Lev	el	Speed Positi	on Torque	
Pn61B	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 500	0.01 V	250	Immediately	Setup
	Overheat Warning L	evel		Speed Positi	on Torque
Pn61C	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 100	1%	100	Immediately	Setup
	Overheat Alarm Filte	er Time	Speed Positi	on Torque	
Pn61D	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 65,535	1 s	0	Immediately	Setup

• When Pn61A is set to n. DDD2, an A.862 alarm will occur if the overheat protection input signal line is disconnected or short-circuited.

• When Pn61A is set to n. DDD3, an A.862 alarm will not occur if the overheat protection input signal line is disconnected or short-circuited. To ensure safety, we recommend that you connect the external circuits so that you can use a negative voltage input for the overheat protection input (an analog voltage input).

# Trial Operation and Actual Operation

8

This chapter provides information on the flow and procedures for trial operation and convenient functions to use during trial operation.

8.1	Flow	of Trial Operation8-2
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8.1.1 Flow of Trial Operation for Rotary Servomotors

# 8.1 Flow of Trial Operation

# 8.1.1 Flow of Trial Operation for Rotary Servomotors

The procedure for trial operation is given below.

### • Preparations for Trial Operation

Step	Meaning	Reference
1	Installation Install the Servomotor and SERVOPACK according to the installation conditions. First, operation is checked with no load. Do not connect the Servomotor to the machine.	Chapter 3 SERVOPACK Installation
2	Wiring and Connections Wire and connect the SERVOPACK. First, Servomotor operation is checked without a load. Do not connect the CN1 connector on the SERVOPACK.	Chapter 4 Wiring and Connecting SERVOPACKs
3	Confirmations before Trial Operation	8.2 Inspections and Confirmations before Trial Operation on page 8-6
4	Power ON	-
5	Resetting the Absolute Encoder This step is necessary only for a Servomotor with an absolute encoder.	6.16 Resetting the Absolute Encoder on page 6-47

### 8.1.1 Flow of Trial Operation for Rotary Servomotors

### • Trial Operation

Step	Meaning	Reference
1	Trial Operation for the Servomotor without a Load To power supply Secure the motor flange to the machine. Do not connect the motor shaft to the load shaft.	8.3 Trial Operation for the Servomotor without a Load on page 8-7
2	Trial Operation with MECHATROLINK-III Communications CN6A, to host controller To power Supply CN1, to host controller Secure the motor flange to the machine. Do not connect the motor shaft to the load shaft.	8.4 Trial Operation with MECHATROLINK-III Communica- tions on page 8-10
3	Trial Operation with the Servomotor Con- nected to the Machine CN6A, to host controller To power CN1, to host controller Secure the motor flange to the machine, and connect the motor shaft to the load shaft with a coupling or other means.	8.5 Trial Operation with the Servomotor Connected to the Machine on page 8-12

8.1.2 Flow of Trial Operation for Linear Servomotors

# 8.1.2 Flow of Trial Operation for Linear Servomotors

The procedure for trial operation is given below.

### • Preparations for Trial Operation

Step	Meaning			Reference		
1	Installation Install the Servomotor and SERVOPACK according to the installation conditions. First, operation is checked with no load. Do not connect the Servomotor to the machine.		Chapter 3 SERVOPACK Installation			
2	Wiring and Connections Wire and connect the SERVOPACK. First, Servomotor operation is checked without a load. Do not connect the CN1 connector on the SERVOPACK.		Chapter 4 Wiring and Connecting SERVOPACKs			
3	Confirm	ations before Trial Ope	ration		spections and Confirmations before on page 8-6	ore Trial Operation
4	Power (	NC		-		
	Setting Parameters in the SERVOPACK           Step         No. of Parameter to         Description				Remarks	Reference
	5-1	Set Pn282	Linear Encoder Scale Pitch		Set this parameter only if you are using a Serial Con- verter Unit.	page 6-16
	5-2	-	Writing Parameters to the Linear Servo- motor		Set this parameter only if you are not using a Serial Converter Unit.	page 6-17
5	5-3	Pn080 = n.□□X□	Motor Phase Sequence Sel tion	ec-	-	page 6-21
	5-4	Pn080 = n. <b>□□□</b> X	Polarity Senso Selection	or	_	page 6-23
	5-5	-	Polarity Detec	tion	This step is necessary only for a Linear Servomotor without a Polarity Sensor.	page 6-24
	5-6	Pn50A = n.X□□□ and Pn50B = n.□□□X	Overtravel Signal Allocations		_	page 6-27
	5-7	Pn483, Pn484	Force Control		-	page 7-28
6	6 Setting the Origin of the Absolute Linear Encoder on page 6-50					

### 8.1.2 Flow of Trial Operation for Linear Servomotors

• Trial Operation

Step	Meaning	Reference
1	Trial Operation for the Servomotor without a Load	8.3 Trial Operation for the Servomotor without a Load on page 8-7
2	Trial Operation with MECHATROLINK-III Communications	8.4 Trial Operation with MECHATROLINK-III Communica- tions on page 8-10
3	Trial Operation with the Servomotor Con- nected to the Machine CN6A, to host controller To power supply CN1, to host controller	8.5 Trial Operation with the Servomotor Connected to the Machine on page 8-12

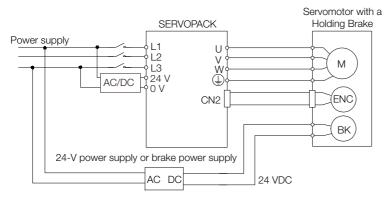
# 8.2 Inspections and Confirmations before Trial Operation

To ensure safe and correct trial operation, check the following items before you start trial operation.

- Make sure that the SERVOPACK and Servomotor are installed, wired, and connected correctly.
- Make sure that the correct power supply voltage is supplied to the SERVOPACK.
- Make sure that there are no loose parts in the Servomotor mounting.
- If you are using a Servomotor with an Oil Seal, make sure that the oil seal is not damaged. Also make sure that oil has been applied.
- If you are performing trial operation on a Servomotor that has been stored for a long period of time, make sure that all Servomotor inspection and maintenance procedures have been completed.

Refer to the manual for your Servomotor for Servomotor maintenance and inspection information.

• If you are using a Servomotor with a Holding Brake, make sure that the brake is released in advance. To release the brake, you must apply the specified voltage of 24 VDC to the brake. A circuit example for trial operation is provided below.



8.3.1 Preparations

# 8.3 Trial Operation for the Servomotor without a Load

You use jogging for trial operation of the Servomotor without a load.

Jogging is used to check the operation of the Servomotor without connecting the SERVOPACK to the host controller. The Servomotor is moved at the preset jogging speed.



• During jogging, the overtravel function is disabled. Consider the range of motion of your machine when you jog the Servomotor.

Ìmporta

The tuning-less function is enabled as the default setting. If the tuning-less function is enabled, gain may increase and vibrations may occur with no load. If vibrations occur, disable the tuning-less function (Pn170=n.□□□0).

# 8.3.1 Preparations

Always check the following before you execute jogging.

- The parameters must not be write prohibited.
- The main circuit power supply must be ON.
- There must be no alarms.
- There must be no hard wire base block (HWBB).
- The servo must be OFF.
- The jogging speed must be set considering the operating range of the machine. The jogging speed is set with the following parameters.
  - Rotary Servomotors

	Jogging Speed		Speed Po	osition Torque		
Pn304	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 10,000	1 min <sup>-1</sup>	500	Immediately	Setup	
	Soft Start Acceler	ation Time		Speed		
Pn305	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 10,000	1 ms	0	Immediately	Setup	
	Soft Start Deceler	ration Time		Speed		
Pn306	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 10,000	1 ms	0	Immediately	Setup	
Linear Ca				•		

Linear Servomotors

	Jogging Speed		Speed Position Force		
Pn383	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 mm/s	50	Immediately	Setup
	Soft Start Acceler	ation Time		Speed	
Pn305	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 ms	0	Immediately	Setup
	Soft Start Deceler	ation Time		Speed	
Pn306	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 ms	0	Immediately	Setup

8.3.2 Applicable Tools

# 8.3.2 Applicable Tools

The following table lists the tools that you can use to perform jogging and the applicable tool functions.

Tool	Function	Operating Procedure Reference
Digital Operator	Fn002	Ω-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Test Run - Jog	Gerating Procedure on page 8-8

# 8.3.3 Operating Procedure

Use the following procedure to jog the motor.

- 1. Click the 🔎 Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select JOG Operation in the Menu Dialog Box. The Jog Operation Dialog Box will be displayed.
- 3. Read the warnings and then click the OK Button.



4. Check the jogging speed and then click the Servo ON Button.

S JOG Operation AXIS#00
JOG Speed Setting
Pn304 : Jogging Speed
500 [min-1] Edit
Operation
Servo ON
Servo OFF
Forward Reverse
+• •

The display in the Operation Area will change to Servo ON.

Information To change the speed, click the Edit Button and enter the new speed.

8.3.3 Operating Procedure

5. Click the Forward Button or the Reverse Button.

Jogging will be performed only while you hold down the mouse button.

JOG Operation AXIS#00 JOG Speed Setting	<b></b>
Pn304 : Jogging Speed	[min-1] Edit
Operation	Servo OFF
Forward	Reverse

6. After you finish jogging, turn the power supply to the SERVOPACK OFF and ON again.

This concludes the jogging procedure.

# 8.4 Trial Operation with MECHATROLINK-III Communications

A trial operation example for MECHATROLINK-III communications is given below.

Refer to the following manual for command details.

Σ-7-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

1. Confirm that the wiring is correct, and then connect the I/O signal connector (CN1 connector).

Refer to the following chapter for details on wiring. *Chapter 4 Wiring and Connecting SERVOPACKs* 

#### 2. Turn ON the power supplies to the SERVOPACK and host controller.

If control power is being supplied correctly, the PWR indicator on the SERVOPACK will light. If main circuit power is being supplied correctly, the CHARGE indicator on the SERVOPACK will light. If communications are established, the L1 or L2 indicators, whichever one corresponds to the CN6A or CN6B connector where the MECHATROLINK-III cable is connected, will light. If the L1 or L2 indicator does not light, recheck the settings of MECHATROLINK-III setting switches (S1, S2, and S3) and then turn the power supply OFF and ON again.

#### 3. Send the CONNECT command from the host controller.

If the SERVOPACK correctly receives the CONNECT command, the CN indicator will light. If the CN indicator does not light, the settings of the CONNECT command are not correct. Correct the settings of the CONNECT command, and then send it from the host controller again.

#### 4. Confirm the product model with the ID\_RD command.

The SERVOPACK will return the product model (example: SGD7S-1R9D30B).

5. Set the following items, which are necessary for trial operation.

Setting	Reference	
Electronic Gear	6.15 Electronic Gear Settings on page 6-42	
Motor Direction	6.5 Motor Direction Setting on page 6-15	
Overtravel	6.11 Overtravel and Related Settings on page 6-27	

#### 6. Save the settings that you made in step 5.

If the settings are saved in the host controller, use the SVPRM\_WR command with the mode set to RAM to save them.

If the settings are saved in the SERVOPACK, use the SVPRM\_WR command with the mode set to non-volatile memory to save them.

7. Send the CONFIG command to enable the settings.

#### 8. Send the SENS\_ON command to obtain the position information (encoder ready).

#### 9. Send the SV\_ON command.

Servomotor operation will be enabled and the SERVOPACK will return 1 for SVON (power supplied to motor) in the status.

#### **10.** Operate the Servomotor at low speed.

Operating Example for a Positioning Command Command: POSING Command settings: Positioning position = 10,000 (If you are using an absolute encoder, add 10,000 to the present position), rapid traverse speed = 400.

### **11.** While operation is in progress for step 10, confirm the following items.

Confirmation Item	Reference
Confirm that the rotational direction of the Servomotor agrees with the forward or reverse reference. If they do not agree, cor- rect the rotation direction of the Servomo- tor.	6.5 Motor Direction Setting on page 6-15
Confirm that no abnormal vibration, noise, or temperature rise occurs. If any abnor- malities are found, implement corrections.	13.5 Troubleshooting Based on the Operation and Condi- tions of the Servomotor on page 13-59

Note: If the load machine is not sufficiently broken in before trial operation, the Servomotor may become overloaded.

8.5.1 Precautions

# 8.5 Trial Operation with the Servomotor Connected to the Machine

This section provides the procedure for trial operation with both the machine and Servomotor.

# 8.5.1 Precautions

# **WARNING**

• Operating mistakes that occur after the Servomotor is connected to the machine may not only damage the machine, but they may also cause accidents resulting in personal injury.



If you disabled the overtravel function for trial operation of the Servomotor without a load, enable the overtravel function (P-OT and N-OT signal) before you preform trial operation with the Servomotor connected to the machine in order to provide protection.

If you will use a holding brake, observe the following precautions during trial operation.

- Before you check the operation of the brake, implement measures to prevent vibration from being caused by the machine falling due to gravity or an external force.
- First check the Servomotor operation and brake operation with the Servomotor uncoupled from the machine. If no problems are found, connect the Servomotor to the machine and perform trial operation again.

Control the operation of the brake with the /BK (Brake) signal output from the SERVOPACK.

Refer to the following sections for information on wiring and the related parameter settings. 3 4.4.4 Wiring the SERVOPACK to the Holding Brake on page 4-26

5.12 Holding Brake on page 6-32



Failures caused by incorrect wiring or incorrect voltage application in the brake circuit may cause the SERVOPACK to fail, damage the SERVOPACK, damage the equipment, or cause an accident resulting in death or injury.

Observe the precautions and instructions for wiring and trial operation precisely as described in this manual.

# 8.5.2 Preparations

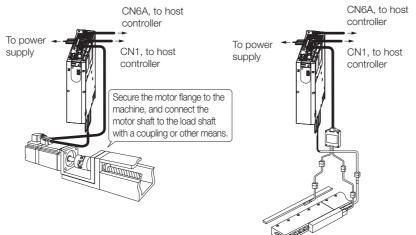
Always confirm the following before you perform the trial operation procedure for both the machine and Servomotor.

- Make sure that the procedure described in 8.4 Trial Operation with MECHATROLINK-III Communications on page 8-10 has been completed.
- Make sure that the SERVOPACK is connected correctly to both the host controller and the peripheral devices.
  - Safety Function Wiring
    - If you are not using the safety function, leave the Safety Jumper Connector (provided as an accessory with the SERVOPACK) connected to CN8.
    - If you are using the safety function, remove the Safety Jumper Connector from CN8 and connect the safety function device.
  - · Overtravel wiring
  - Brake wiring
  - Allocation of the /BK (Brake) signal to a pin on the I/O signal connector (CN1)
  - Emergency stop circuit wiring
  - Host controller wiring

8.5.3 Operating Procedure

# 8.5.3 Operating Procedure

- **1.** Enable the overtravel signals.
- 2. Make the settings for the protective functions, such as the safety function, overtravel, and the brake.
  - 4.6 Connecting Safety Function Signals on page 4-35
  - 6.11 Overtravel and Related Settings on page 6-27
  - 3 6.12 Holding Brake on page 6-32
- **3.** Turn OFF the power supplies to the SERVOPACK. The control power supply and main circuit power supply will turn OFF.
- 4. Couple the Servomotor to the machine.



- 5. Turn ON the power supplies to the machine and host controller and turn ON the control power supply and main circuit power supply to the SERVOPACK.
- 6. Check the protective functions, such overtravel and the brake, to confirm that they operate correctly.

Note: Enable activating an emergency stop so that the Servomotor can be stopped safely should an error occur during the remainder of the procedure.

- 7. Perform trial operation according to 8.4 Trial Operation with MECHATROLINK-III Communications on page 8-10 and confirm that the same results are obtained as when trial operation was performed on the Servomotor without a load.
- 8. If necessary, adjust the servo gain to improve the Servomotor response characteristics. The Servomotor and machine may not be broken in completely for the trial operation. Therefore, let the system run for a sufficient amount of time to ensure that it is properly broken in.
- 9. For future maintenance, save the parameter settings with one of the following methods.
  - Use the SigmaWin+ to save the parameters as a file.
  - Use the Parameter Copy Mode of the Digital Operator.
  - Record the settings manually.

This concludes the procedure for trial operation with both the machine and Servomotor.

# 8.6 Convenient Function to Use during Trial Operation

This section describes some convenient operations that you can use during trial operation. Use them as required.

### 8.6.1 Program Jogging

You can use program jogging to perform continuous operation with a preset operation pattern, travel distance, movement speed, acceleration/deceleration time, waiting time, and number of movements.

You can use this operation when you set up the system in the same way as for normal jogging to move the Servomotor without connecting it to the host controller in order to check Servomotor operation and execute simple positioning operations.

### Preparations

Always check the following before you execute program jogging.

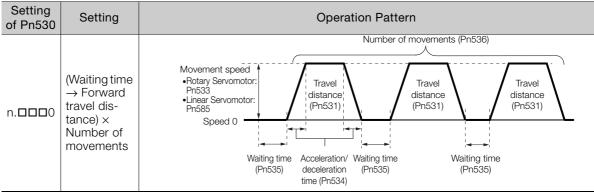
- The parameters must not be write prohibited.
- The main circuit power supply must be ON.
- There must be no alarms.
- There must be no hard wire base block (HWBB).
- The servo must be OFF.
- The range of machine motion and the safe movement speed of your machine must be considered when you set the travel distance and movement speed.
- There must be no overtravel.

# Additional Information

- You can use the functions that are applicable to position control. However, parameters related to motion control through MECHATROLINK communications (i.e., Pn800 and higher) are disabled.
- The overtravel function is enabled.

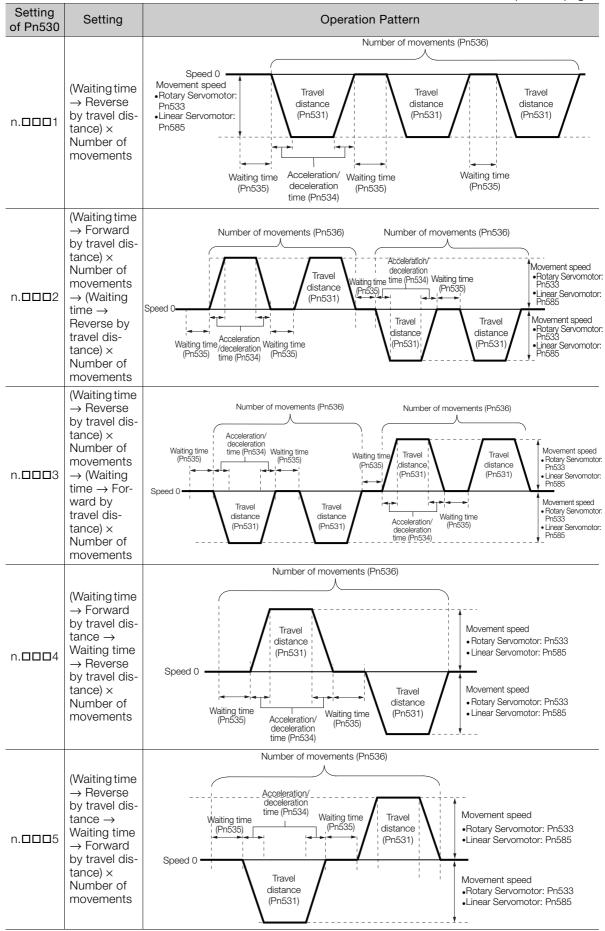
# **Program Jogging Operation Pattern**

An example of a program jogging operation pattern is given below. In this example, the Servomotor direction is set to  $Pn000 = n.\Box\Box\Box\Box$  (Use CCW as the forward direction).



Continued on next page.

Continued from previous page.



Information If Pn530 is set to n.  $\Box$   $\Box$   $\Box$ , n.  $\Box$   $\Box$   $\Box$ , n.  $\Box$   $\Box$   $\Box$ , or n.  $\Box$   $\Box$   $\Box$ , you can set Pn536 (Program Jogging Number of Movements) to 0 to perform infinite time operation. You cannot use infinite time operation if Pn530 is set to n.  $\Box$   $\Box$   $\Box$   $\Box$   $\Box$ . If you perform infinite time operation from the Digital Operator, press the **JOG/SVON** Key to turn OFF the servo to end infinite time operation.

### **Related Parameters**

Use the following parameters to set the program jogging operation pattern. Do not change the settings while the program jogging operation is being executed.

• Rotary Servomotors

	Program Jogging-R	elated Selections		Speed Posit	ion Torque	
Pn530	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0000 to 0005	_	0000	Immediately	Setup	
	Program Jogging Tr	avel Distance		Speed Posit	ion Torque	
Pn531	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	1 to 1,073,741,824	1 reference unit	32,768	Immediately	Setup	
	Program Jogging M	ovement Speed		Speed Po	sition Torque	
Pn533	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	1 to 10,000	1 min <sup>-1</sup>	500	Immediately	Setup	
	Program Jogging Acceleration/Deceleration Time			Speed Posit	Speed Position Torque	
Pn534	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	2 to 10,000	1 ms	100	Immediately	Setup	
	Program Jogging W	aiting Time		Speed Posit	ion Torque	
Pn535	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 10,000	1 ms	100	Immediately	Setup	
	Program Jogging N	Program Jogging Number of Movements		Speed Po	sition Torque	
Pn536	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 1,000	1	1	Immediately	Setup	

Linear Servomotors

	Program Jogging-R	elated Selections		Speed Pc	sition Force	
Pn530	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0000 to 0005	_	0000	Immediately	Setup	
	Program Jogging Tr	avel Distance		Speed Pc	sition Force	
Pn531	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	1 to 1,073,741,824	1 reference unit	32,768	Immediately	Setup	
	Program Jogging M	ovement Speed		Speed Pc	sition Force	
Pn585	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	1 to 10,000	1 mm/s	50	Immediately	Setup	
	Program Jogging Acceleration/Deceleration Time			Speed Pc	Speed Position Force	
Pn534	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	2 to 10,000	1 ms	100	Immediately	Setup	
	Program Jogging W	aiting Time		Speed Pc	sition Force	
Pn535	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 10,000	1 ms	100	Immediately	Setup	
	Program Jogging N	umber of Movemer	nts	Speed Pc	sition Force	
Pn536	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 1,000	1	1	Immediately	Setup	

# **Applicable Tools**

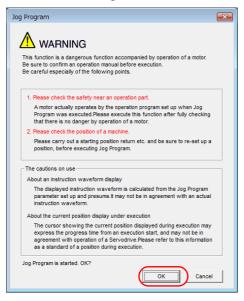
The following table lists the tools that you can use to perform program jogging and the applicable tool functions.

Tool	Function	Reference
Digital Operator	Fn004	Ω-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Test Run - Program JOG Operation	Gerating Procedure on page 8-17

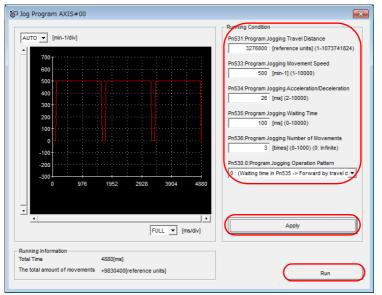
# **Operating Procedure**

Use the following procedure for a program jog operation.

- 1. Click the 🔎 Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- 2. Select JOG Program in the Menu Dialog Box. The Jog Program Dialog Box will be displayed.
- 3. Read the warnings and then click the OK Button.

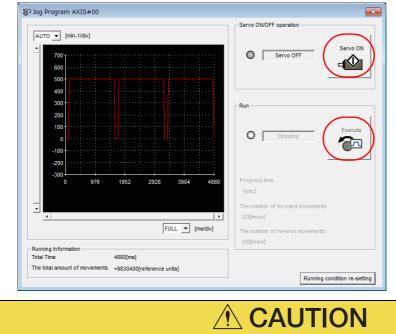


**4.** Set the operating conditions, click the **Apply** Button, and then click the **Run** Button. A graph of the operation pattern will be displayed.



#### 8.6.2 Origin Search

5. Click the Servo ON Button and then the Execute Button. The program jogging operation will be executed.



- Be aware of the following points if you cancel the program jogging operation while the Servomotor is operating.
  - If you cancel operation with the **Servo OFF** Button, the Servomotor will stop according to setting of the Servo OFF stopping method (Pn001 = n.□□□X).
  - If you cancel operation with the **Cancel** Button, the Servomotor will decelerate to a stop and then enter a zero-clamped state.

This concludes the program jogging procedure.

# 8.6.2 Origin Search

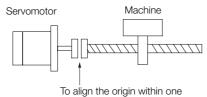
The origin search operation positions the motor to the origin within one rotation and the clamps it there.



• Make sure that the load is not coupled when you execute an origin search. The Forward Drive Prohibit (P-OT) signal and Reverse Drive Prohibit (N-OT) signal are disabled during an origin search.

Use an origin search when it is necessary to align the origin within one rotation with the machine origin. The following speeds are used for origin searches.

- Rotary Servomotors: 60 min<sup>-1</sup>
- Linear Servomotors: 15 mm/s



To align the origin within one rotation with the machine origin

8.6.2 Origin Search

### Preparations

Always check the following before you execute an origin search.

- The parameters must not be write prohibited.
- The main circuit power supply must be ON.
- There must be no alarms.
- There must be no hard wire base block (HWBB).
- The servo must be OFF.

### **Applicable Tools**

The following table lists the tools that you can use to perform an origin search and the applicable tool functions.

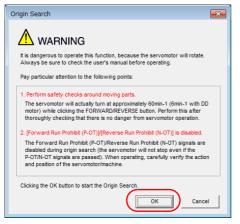
Tool	Function	Reference
Digital Operator	Fn003	Ω Σ-7-Series Digital Operator Operating Man- ual (Manual No.: SIEP S800001 33)
SigmaWin+*	Setup - Origin Search	Gerating Procedure on page 8-19

\* Cannot be used when connecting a Linear Servomotor.

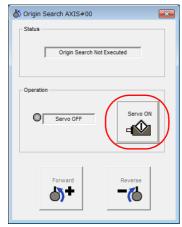
# **Operating Procedure**

Use the following procedure to perform an origin search.

- 1. Click the 🔎 Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- 2. Select Search Origin in the Menu Dialog Box. The Origin Search Dialog Box will be displayed.
- 3. Read the warnings and then click the OK Button.



4. Click the Servo ON Button.



#### 5. Click the Forward Button or the Reverse Button.

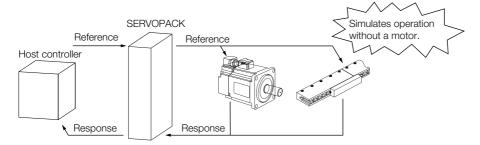
An origin search will be performed only while you hold down the mouse button. The motor will stop when the origin search has been completed.

🎳 Origin Search AXIS#00
Status Origin Search Not Executed
Operation Servo OFF
Forward

This concludes the origin search procedure.

### 8.6.3 Test without a Motor

A test without a motor is used to check the operation of the host controller and peripheral devices by simulating the operation of the Servomotor in the SERVOPACK, i.e., without actually operating a Servomotor. This test allows you to check wiring, debug the system, and verify parameters to shorten the time required for setup work and to prevent damage to the machine that may result from possible malfunctions. The operation of the Servomotor can be checked with this test regardless of whether the Servomotor is actually connected or not.



Use  $PnOOC = n.\Box\Box\BoxX$  to enable or disable the test without a motor.

F	Parameter Meaning		When Enabled	Classification
Pn00C	n.□□□0 (default setting)	Disable tests without a motor.	After restart	Setup
	n.□□□1	Enable tests without a motor.		

Information An asterisk is displayed on the status display of the Digital Operator while a test without a motor is being executed.

# Motor Information and Encoder Information

The motor and encoder information is used during tests without a motor. The source of the information depends on the device connection status.

Rotary Servomotor

Motor Connection Status	Information That Is Used	Source of Information	
Connected	Motor information <ul> <li>Rated motor speed</li> <li>Maximum motor speed</li> </ul>	Information in the Servomotor that is connected	
Connected	Encoder information <ul> <li>Encoder resolution</li> <li>Encoder type</li> </ul>		
Not connected	Motor information • Rated motor speed • Maximum motor speed	<ul> <li>Setting of Pn000 = n.X□□□ (Rotary/Linear Servomotor Startup Selection When Encoder Is Not Connected)</li> <li>Rated motor speed and maximum motor speed The values previously saved in the SERVOPACK wibe used for the rated motor speed and maximum motor speed.</li> <li>Use the motor displays (Un020: Rated Motor Speeand Un021: Maximum Motor Speed) to check the values.</li> </ul>	
	Encoder information <ul> <li>Encoder resolution</li> <li>Encoder type</li> </ul>	<ul> <li>Encoder resolution: Setting of Pn00C = n. \[\]X\[\]X\[ (Encoder Resolution for Tests without a Motor)</li> <li>Encoder type: Setting of Pn00C = n. \[\]X\[\]\([Encoder Type Selection for Tests without a Motor)</li> </ul>	

### If you use fully-closed loop control, the external encoder information is also used.

External Encoder Connection Status	Information That Is Used	Source of Information
Connected	External encoder infor- mation	Information in the external encoder that is con- nected
Not connected	<ul><li>Resolution</li><li>Encoder type</li></ul>	<ul><li>Resolution: 256</li><li>Encoder type: Incremental encoder</li></ul>

### Linear Servomotors

Motor Connection Status	Information That Is Used	Source of Information	
	Motor information	Information in the motor that is connected	
Connected	Linear encoder informa- tion • Resolution • Encoder pitch • Encoder type	Information in the linear encoder that is connected	
	Motor information	Setting of Pn000 = n.X□□□ (Rotary/Linear Servomotor Startup Selection When Encoder Is Not Connected)	
Not connected	Linear encoder informa- tion • Resolution • Encoder pitch • Encoder type	<ul> <li>Resolution: 256</li> <li>Encoder pitch: Setting of Pn282 (Linear Encoder Scale Pitch)</li> <li>Encoder type: Setting of Pn00C = n. IXIII (Encoder Type Selection for Tests without a Motor)</li> </ul>	

Related Parameters

Р	arameter	Me	eaning		When Enabled		Classification	
Pn000	n.0□□□ (default setting)		Then an encoder is not connected, start as ERVOPACK for Rotary Servomotor. After restart S			Setup		
111000	n.1000	When an encoder is not connected, start as SERVOPACK for Linear Servomotor.			Aller lestart		Gelup	
	Linear Encoder S	Scale Pitch			Speed	Posi	tion Force	
Pn282	Setting Range	Setting Unit	Default Setting	Whe	en Enabled	0	Classification	
	0 to 6,553,600	0.01 µm	0	Aft	ter restart		Setup	
P	arameter	rameter Meaning		When Enabled		Classification		
	n.□□0□ (default setting)	Use 13 bits as enco without a motor.	der resolution for te	sts				
	n.0010	Use 20 bits as enco without a motor.	der resolution for te	sts				
Pn00C	n.🗆 🗆 2 🗆	Use 22 bits as encoder resolution for tes without a motor.		r tests After restar		rt	Setup	
111000	n.🗆 🗆 3 🗆	Use 24 bits as encoder resolution for tests without a motor.		sts				
	n.□0□□ (default setting)	Use an incremental e a motor.	Use an incremental encoder for tests without a motor.					
	n.0100	Use an absolute encoder for tests without a motor.						

# Motor Position and Speed Responses

For a test without a motor, the following responses are simulated for references from the host controller according to the gain settings for position or speed control.

- Servomotor position
- Motor speed
- External encoder position

The load model will be for a rigid system with the moment of inertia ratio that is set in Pn103.

### Restrictions

The following functions cannot be used during the test without a motor.

- Regeneration and dynamic brake operation
- Brake output signal
- Items marked with "x" in the following utility function table

Button in Menu Dialog Box Dialog Box         SigmaWin+ Function Name         Fn No.         Utility Function Name         Motor Not Connected         Motor Connected         Reference           Origin Search <sup>11</sup> Absolute Encoder Preset         Fn003         Origin Search         O         page 8-18           Analog Monitor Out- put Adjustment         Fn000         Adjust Analog Monitor Output Offset Analog Monitor Out- put Adjustment         Fn000         Adjust Analog Monitor Output Gain         O         O         page 10-8           Motor Current Detec- tion Offset Adjust- ment         Fn000         Adjust Motor Offset         O         O         page 7-54           Parameter Write Pro- hibition Setting         Fn010         Write Prohibition Set- nal Offset         O         O         page 7-39           Reset Configuration Error of Option Mod- lie         Fn018         Multifurn Limit Setting after Multifurn Limit Setting         No         O         page 7-39           Reset Configuration Error of Option Mod- lie         Fn014         Reset Option Module Configuration Error         O         O         page 7-39           Reset Absolute Linear Encoder Origin         Fn018         Set Absolute Linear Encoder Origin         X         Q         page 7-39           Reset Absolute Linear Encoder Origin         Fn020         Set Absolute Linear Encoder Origin         X         Q<	S	SigmaWin+		Digital Operator	Execu	table?	
Absolute Encoder Reset         Fn008         Reset Absolute Encoder         ×         O         page 6-48           Analog Monitor Out- put Adjustment         Fn008         Reset Absolute Encoder         O         O         page 10-8           Analog Monitor Out- put Adjustment         Fn000         Adjust Analog Monitor Output Gain         O         O         page 10-8           Motor Current Detec- tion Offset Adjust- ment         Fn000         Autotune Motor Cur- rent Detection Signal Offset         ×         O         Page 7-54           Parameter Write Pro- hibition Setting         Fn001         Write Prohibition Set- ing         O         O         page 7-54           Reset Configuration Error of Option Mod- ule         Fn018         Multiturn Limit Setting after Multiturn Limit Disagreement Alarm         ×         O         page 7-50           Set Origin         Fn018         Initialize Vibration Detection Level         ×         ×         Page 6-50           Reset Motor Type Alarm         Fn028         Software Reset         O         O         page 7-50           Set Origin         Fn028         Software Reset         O         O         -           Reset Motor Type Alarm         Fn020         Software Reset         O         O         -           Software Reset         Fn02	Menu		Fn No.	Utility Function Name			Reference
Reset         FN008         Encoder         ×         O         page 6-48           Analog Monitor Out- put Adjustment         Fn000         Adjust Analog Monitor Output Gain         O         O         page 10-8           Motor Current Detec- tion Offset Adjust- ment         Fn000         Adjust Analog Monitor Output Gain         O         O         page 10-8           Motor Current Detec- tion Offset Adjust- ment         Fn000         Autotune Motor Cur- rent Detection Signal Offset         ×         O         O         page 7-54           Parameter Write Pro- hibition Setting         Fn010         Write Prohibition Set- ting         O         O         page 7-39           Multiturn Limit Setting         Fn018         Multiturn Limit Disagreement Alarm         X         O         page 7-50           Reset Oonfiguration Error of Option Mod- ule         Fn018         Initialize Vibration Detection Level         X         X         page 7-50           Set Origin         Fn028         Set Absolute Linear Encoder Origin         X         O         page 7-43           Alarm         Fn028         Set Motor Type Alarm         Fn028         Set Motor Type Encoder Origin         X         Q         page 7-50           Set Origin         Fn020         Software Reset         Fn030         Software Reset		Origin Search <sup>*1</sup>	Fn003	Origin Search	0	0	page 8-18
Analog Monitor Output AdjustmentPrioDCOutput OffseiOOpage 10-8Motor Current Detection Offset AdjustmentFn00DAdjust Analog Monitor Current Detection Signal OffsetOOpage 10-8Motor Current Detection Offset AdjustmentFn00DAutotune Motor Current Detection Signal OffsetXOpage 7-54Parameter Write Pro- hibition SettingFn01DWrite Prohibition Set- ting diret Multiturn Limit Setting after Multiturn Limit Setting after Multiturn Limit Disagreement AlarmOOpage 6-7Reset Configuration Error of Option Mod- uleFn014Reset Option Module Configuration Error of Option Module Configuration ErrorOOpage 7-50Set OriginFn020Set Absolute Linear Encoder OriginFn021Reset Motor Type AlarmO0page 6-50Reset Motor Type AlarmFn021Reset Motor Type AlarmOOpage 7-50Set OriginFn020Set Absolute Linear Encoder OriginXOpage 6-24Tuning-less Level SettingFn020Fn021Reset Motor Type AlarmOOpage 6-24ParameterInitialize*Fn020Software Reset AlarmOOpage 7-39ParameterInitialize**Fn020Software Reset AlarmOOpage 7-50Reset Motor Type AlarmFn021Reset Motor Type AlarmOO-Page 7-50Fn021Fn020Software Reset AlarmOOpage 6-			Fn008		×	0	page 6-48
SetupFn00DOutput GainOOpage 10-8Motor Current Detection Offset Adjust- mentFn00EAutotune Motor Cur- offset×Opage 7-54Parameter Write Pro- hibition SettingFn00FManually Adjust Motor Current Detection Signal offset×Opage 7-54Parameter Write Pro- hibition SettingFn010Write Prohibition Set- ingOOpage 7-39Multiturn Limit Setting Hibition SettingFn013Multiturn Limit Setting after Multiturn Limit×Opage 7-39Reset Configuration Error of Option Mod- uleFn014Reset Option Module Configuration ErrorOOpage 7-50Set OriginFn018Initialize Vibration Detection Level××page 7-50Set OriginFn020Set Absolute Linear Encoder Origin×Opage 6-50Reset Motor Type AlarmFn021Reset Motor Type AlarmOO-Polarity DetectionFn080Polarity Detection××page 9-16Easy FFTFn200Initialize ParametersOOpage 6-10ParameterInitialize**Fn005Initialize ParametersOOpage 9-35ParameterInitialize**Fn203One-ParametersOOpage 9-35ParameterInitialize**Fn203One-Parameter××page 9-35ParameterInitialize**Fn203One-Parameter Tuning××page 9-35			Fn00C	Adjust Analog Monitor Output Offset	0	0	page 10-8
Notor Current Detection OffsetFn00Erent Detection Signal Offset×OParameterMotor Current Detection Sig- nal Offset×Opage 7-54Fn00FFn00FFn010Write Prohibition Set- tingOOpage 6-7Nultiturn Limit SettingFn013Multiturn Limit Setting after Multiturn Limit×Opage 7-39Reset Configuration Error of Option Module UeFn014Reset Option Module Configuration ErrorOOpage 7-39Set OriginFn018Initialize Vibration Detection Level××page 7-50Set OriginFn019Initialize Vibration Detection Level×0page 7-50Set OriginFn020Set Absolute Linear Encoder Origin×0page 7-50Set OriginFn021Reset Motor Type AlarmO0-Software ResetFn030Software ResetO0-Software ResetFn030Software ResetO0page 7-47Polarity DetectionFn020Tuning-less Level Set- Ting××page 9-24Autor Uning without Host ReferenceFn200Initialize ParametersO0page 9-16FacameterInitialize ParametersOOPage 9-3524Tuning-less Level SettingFn203Advanced Autoruning without Reference××page 9-35ParameterInitialize ParametersOOOpage 9-35Tuning-less		put Adjustment	Fn00D		0	0	page 10-8
MentManually Adjust Motor Current Detection Sig- nal Offset×OParameter Write Pro- hibition SettingFn00FFn010Write Prohibition Set- tingOOpage 6-7Multiturn Limit SettingFn010Write Prohibition Set- tingOOpage 7-39Reset Configuration Error of Option Mod- uleFn014Reset Option Module Configuration ErrorOOpage 7-39Initializing the Vibra- tion Detection LevelFn01BInitialize Vibration Ercor of Option Module Configuration ErrorOOpage 7-50Set OriginFn020Set Absolute Linear Encoder Origin×Opage 6-50Reset Motor Type AlarmFn021Reset Motor Type AlarmOO-Software ResetFn020Software ResetOO-Software ResetFn020Tuning-less Level Set- ting××page 6-24Tuning-less Level SettingFn200Tuning-less Level Set- ting××page 9-99ParameterInitialize*2Fn050Initialize ParametersOOpage 9-99ParameterInitialize*2Fn050Initialize ParametersOOpage 9-24Autotuning without Host ReferenceFn201Advanced Autotuning with Reference××page 9-35TuningCustom TuningFn203One-Parameter Tuning××page 9-51TuningCustom TuningFn203One-Parameter Tuning×× <td></td> <td></td> <td>Fn00E</td> <td>rent Detection Signal</td> <td>×</td> <td>0</td> <td>222 7 54</td>			Fn00E	rent Detection Signal	×	0	222 7 54
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Adjust Anti-reso- nance ControlFn204Adjust Anti-resonance Control××page 9-51Vibration Suppres- sionFn205Vibration Suppression××page 9-56			Fn202		×	×	page 9-35
nance ControlFn204Control××page 9-51Vibration SuppressionFn205Vibration Suppression×××page 9-56	Tuning	Custom Tuning	Fn203	One-Parameter Tuning	×	×	page 9-42
sion Fn205 Vibration Suppression × × page 9-56			Fn204		×	×	page 9-51
			Fn205	Vibration Suppression			

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Continued on next page.

Continued from previous page.						
9	SigmaWin+		Digital Operator		Executable?	
Button in Menu Dialog Box	SigmaWin+ Function Name	Fn No.	Utility Function Name	Motor Not Connected	Motor Connected	Reference
		Fn011	Display Servomotor Model	0	0	page 10-2
		Fn012	Display Software Ver- sion	0	0	page 10-2
Monitoring	Product Information	Fn01E	Display SERVOPACK and Servomotor IDs	0	0	
		Fn01F	Display Servomotor ID from Feedback Option Module	0	0	page 10-2
Test Oper-	Jogging	Fn002	Jogging	0	0	page 8-7
ation	Program Jogging	Fn004	Program Jogging	0	0	page 8-14
Alarms	Alarm Display	Fn000	Display Alarm History	0	0	page 13-44
Alamis	Alarm Display	Fn006	Clear Alarm History	0	0	page 13-45

 $\ast 1.$  Cannot be used when connecting a Linear Servomotor.

 $\ensuremath{\ast}\xspace_2$  . An Initialize Button will be displayed in the Parameter Editing Dialog Box.

# 8.7 Operation Using MECHATROLINK-III Commands

Refer to the following manual for information on MECHATROLINK-III commands. Ω Σ-7-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

# Tuning

This chapter provides information on the flow of tuning, details on tuning functions, and related operating procedures.

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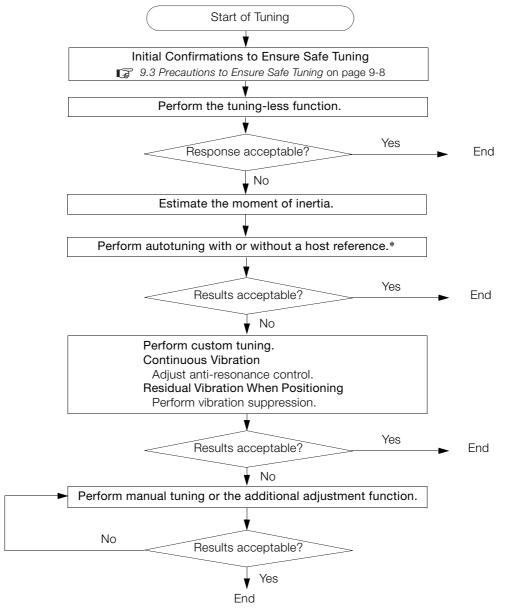
# 9.1 Overview and Flow of Tuning

Tuning is performed to optimize response by adjusting the servo gains in the SERVOPACK.

The servo gains are set using a combination of parameters, such as parameters for the speed loop gain, position loop gain, filters, friction compensation, and moment of inertia ratio. These parameters influence each other, so you must consider the balance between them.

The servo gains are set to stable settings by default. Use the various tuning functions to increase the response even further for the conditions of your machine.

The basic tuning procedure is shown in the following flowchart. Make suitable adjustments considering the conditions and operating requirements of your machine.



\* If possible, perform autotuning with a host reference.

If a host controller is not available, set an operation pattern that is as close as possible to the host reference and perform autotuning without a host reference.

If an operation pattern that is close to the host reference is not possible, perform autotuning with a host reference while performing program jogging.

9.1.1 Tuning Functions

# 9.1.1 Tuning Functions

Tuning Function	Outline	Applicable Con- trol Methods	Reference
Tuning-less Function	This automatic adjustment function is designed to enable stable operation without servo tuning. This function can be used to obtain a stable response regardless of the type of machine or changes in the load. You can use it with the default settings.	Speed control or position control	page 9-12
Moment of Inertia Estimation	The moment of inertia ratio is calculated by operat- ing the Servomotor a few times. The moment of inertia ratio that is calculated here is used in other tuning functions.	Speed control, position control, or torque control	page 9-16
Autotuning without Host Reference	<ul> <li>The following parameters are automatically adjusted in the internal references in the SERVO- PACK during automatic operation.</li> <li>Gains (e.g., position loop gain and speed loop gain)</li> <li>Filters (torque reference filter and notch filters)</li> <li>Friction compensation</li> <li>Anti-resonance control</li> <li>Vibration suppression</li> </ul>	Speed control or position control	page 9-24
Autotuning with Host Reference	<ul> <li>The following parameters are automatically adjusted with the position reference input from the host controller while the machine is in operation. You can use this function for fine-tuning after you perform autotuning without a host reference.</li> <li>Gains (e.g., position loop gain and speed loop gain)</li> <li>Filters (torque reference filter and notch filters)</li> <li>Friction compensation</li> <li>Anti-resonance control</li> <li>Vibration suppression</li> </ul>	Position control	page 9-35
Custom Tuning	<ul> <li>The following parameters are adjusted with the position reference or speed reference input from the host controller while the machine is in operation.</li> <li>Gains (e.g., position loop gain and speed loop gain)</li> <li>Filters (torque reference filter and notch filters)</li> <li>Friction compensation</li> <li>Anti-resonance control</li> </ul>	Speed control or position control	page 9-42
Anti-resonance Control Adjustment	This function effectively suppresses continuous vibration.	Speed control or position control	page 9-51
Vibration Suppression	This function effectively suppresses residual vibra- tion if it occurs when positioning.	Position control	page 9-56
Speed Ripple Com- pensation	This function reduces the ripple in the motor speed.	Speed control, position control, or torque control	page 9-60
Additional Adjustment Function	This function combines autotuning with custom tuning. You can use it to improve adjustment results.	Depends on the functions that you use.	page 9-66
Manual Tuning	You can manually adjust the servo gains to adjust the response.	Speed control, position control, or torque control	page 9-82

The following table provides an overview of the tuning functions.

9.1.2 Diagnostic Tool

# 9.1.2 Diagnostic Tool

You can use the following tools to measure the frequency characteristics of the machine and set notch filters.

Diagnostic Tool	Outline	Applicable Control Methods	Reference
Mechanical Analysis	The machine is subjected to vibration to detect resonance frequencies. The measurement results are displayed as waveforms or numeric data.	Speed control, position control, or torque control	page 9-97
Easy FFT	The machine is subjected to vibration to detect resonance frequencies. The measurement results are displayed only as numeric data.	Speed control, position control, or torque control	page 9-99

# 9.2 Monitoring Methods

You can use the data tracing function of the SigmaWin+ or the analog monitor signals of the SERVOPACK for monitoring. If you perform custom tuning or manual tuning, always use the above functions to monitor the machine operating status and SERVOPACK signal waveform while you adjust the servo gains.

Check the adjustment results with the following response waveforms.

• Position Control

Item	Unit		
ILCIII	Rotary Servomotor	Linear Servomotor	
Torque reference	%		
Feedback speed	min <sup>-1</sup>	mm/s	
Position reference speed	min <sup>-1</sup> mm/s		
Position deviation	Reference units		

### • Speed Control

Item	Unit		
ILEITI	Rotary Servomotor	Linear Servomotor	
Torque reference	%		
Feedback speed	min⁻¹	mm/s	
Reference speed	min <sup>-1</sup>	mm/s	

#### Torque Control

Item	Unit	
	Rotary Servomotor	Linear Servomotor
Torque reference	%	
Feedback speed	min <sup>-1</sup>	mm/s

9.3.1 Overtravel Settings

# **Precautions to Ensure Safe Tuning**

- CAUTION
- Observe the following precautions when you perform tuning.
  - Do not touch the rotating parts of the motor when the servo is ON.
  - · Before starting the Servomotor, make sure that an emergency stop can be performed at any time.
  - Make sure that trial operation has been successfully performed without any problems.
  - · Provide an appropriate stopping device on the machine to ensure safety.

Perform the following settings in a way that is suitable for tuning.

#### **Overtravel Settings** 9.3.1

Overtravel settings are made to force the Servomotor to stop for a signal input from a limit switch when a moving part of the machine exceeds the safe movement range.

Refer to the following section for details.

3 6.11 Overtravel and Related Settings on page 6-27

#### 9.3.2 **Torque Limit Settings**

You can limit the torque that is output by the Servomotor based on calculations of the torque required for machine operation. You can use torque limits to reduce the amount of shock applied to the machine when problems occur, such as collisions or interference. If the torque limit is lower than the torgue that is required for operation, overshooting or vibration may occur. Refer to the following section for details.

7.7 Selecting Torque Limits on page 7-28

#### Setting the Position Deviation Overflow Alarm Level 9.3.3

The position deviation overflow alarm is a protective function that is enabled when the SERVO-PACK is used in position control.

If the alarm level is set to a suitable value, the SERVOPACK will detect excessive position deviation and will stop the Servomotor if the Servomotor operation does not agree with the reference.

The position deviation is the difference between the position reference value and the actual position.

You can calculate the position deviation from the position loop gain (Pn102) and the motor speed with the following formula.

#### Rotary Servomotors

Motor speed [min<sup>-1</sup>] Encoder resolution<sup>\*1</sup> Pn210 Position deviation [reference units] × 60 Pn102 [0.1/s]/10 \*2, \*3 Pn20E

#### Linear Servomotors

Motor speed [mm/s] Resolution Pn210 Position deviation [reference units] =  $\frac{1}{Pn102 [0.1/s]/10^{*2,*3}} \times \frac{1}{Linear encoder pitch [\mum]/1,000} \times \frac{1}{Linear encoder pitch [\mum]/1,000}$ Pn20F

#### 9.3.3 Setting the Position Deviation Overflow Alarm Level

Position Deviation Overflow Alarm Level (Pn520) [setting unit: reference units]

#### Rotary Servomotors

 $Pn520 > \frac{Maximum motor speed [min<sup>-1</sup>]}{60} \times \frac{Encoder resolution<sup>*1</sup>}{Pn102 [0.1/s]/10^{*2, *3}} \times \frac{Pn210}{Pn20E} \times \frac{(1.2 \text{ to } 2)^{*4}}{Encoder model}$ 

#### · Linear Servomotors

D-500	Maximum motor speed [mm/s]	Resolution	$\times \frac{\text{Pn210}}{\text{m210}} \times (1.2 \text{ to } 2)^{*4}$
Pn520 >	Pn102 [0.1/s]/10 <sup>*2, *3</sup> ×	Linear encoder pitch [µm]/1,000	Pn20E (1.2 to 2)

\*1. Refer to the following section for details.

6.15 Electronic Gear Settings on page 6-42

- \*2. When model following control (Pn140 = n. 
  DDD1) is enabled, use the setting of Pn141 (Model Following Control Gain) instead of the setting of Pn102 (Position Loop Gain).
- \*3. To check the setting of Pn102 on the Digital Operator, change the parameter display setting to display all parameters (Pn00B = n.□□□1).
- \*4. The underlined coefficient "× (1.2 to 2)" adds a margin to prevent an A.d00 alarm (Position Deviation Overflow) from occurring too frequently.

If you set a value that satisfies the formula, an A.d00 alarm (Position Deviation Overflow) should not occur during normal operation.

If the Servomotor operation does not agree with the reference, position deviation will occur, an error will be detected, and the Servomotor will stop.

The following calculation example uses a Rotary Servomotor with a maximum motor speed of

6,000 and an encoder resolution of 16,777,216 (24 bits). Pn102 is set to 400.  $\frac{Pn210}{Pn20E} = \frac{1}{16}$ 

$$Pn520 = \frac{6,000}{60} \times \frac{16,777,216}{400/10} \times \frac{1}{16} \times 2$$
$$= 2,621,440 \times 2$$

= 5,242,880 (default setting of Pn520)

If the acceleration/deceleration rate required for the position reference exceeds the tracking capacity of the Servomotor, the tracking delay will increase and the position deviation will no longer satisfy the above formulas. If this occurs, lower the acceleration/deceleration rate so that the Servomotor can follow the position reference or increase the position deviation overflow alarm level.

### **Related Parameters**

	Position Deviation Overflow Alarm Level			Position	
Pn520	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 1,073,741,823	1 reference unit	5,242,880	Immediately	Setup
	Position Deviation Overflow Warning Level		Position		
Pn51E	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 100	1%	100	Immediately	Setup

### **Related Alarms**

Alarm Number	Alarm Name	Alarm Meaning
A.d00	Position Deviation Overflow	This alarm is displayed when the position deviation exceeds the set- ting of Pn520 (Position Deviation Overflow Alarm Level).

9.3.4 Vibration Detection Level Setting

### **Related Warnings**

Warning Number	Warning Name	Meaning
A.900	Position Deviation Overflow	This warning occurs if the position deviation exceeds the specified percentage (Pn520 $\times$ Pn51E/100).

## 9.3.4 Vibration Detection Level Setting

You can set the vibration detection level (Pn312) to more accurately detect A.520 alarms (Vibration Alarm) and A.911 warnings (Vibration) when vibration is detected during machine operation.

Set the initial vibration detection level to an appropriate value. Refer to the following section for details.

7.11 Initializing the Vibration Detection Level on page 7-50

# 9.3.5 Setting the Position Deviation Overflow Alarm Level at Servo ON

If the servo is turned ON when there is a large position deviation, the Servomotor will attempt to return to the original position to bring the position deviation to 0, which may create a hazardous situation. To prevent this, you can set a position deviation overflow alarm level at servo ON to restrict operation.

The related parameters and alarms are given in the following tables.

### **Related Parameters**

	Position Deviation Overflow Alarm Level at Servo ON			Position	
Pn526	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 1,073,741,823	1 reference unit	5,242,880	Immediately	Setup
	Position Deviation Overflow Warning Level at Servo ON			Posit	ion
Pn528	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 100	1%	100	Immediately	Setup

Rotary Servomotors

	Speed Limit Level at Servo ON			Position	
Pn529	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 min <sup>-1</sup>	10,000	Immediately	Setup

Linear Servomotors

	Speed Limit Level at Servo ON			Position	
Pn584	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 mm/s	10,000	Immediately	Setup

#### 9.3.5 Setting the Position Deviation Overflow Alarm Level at Servo ON

### **Related Alarms**

Alarm Number	Alarm Name	Alarm Meaning
A.d01	Position Deviation Overflow Alarm at Servo ON	This alarm occurs if the servo is turned ON after the position devia- tion exceeded the setting of Pn526 (Position Deviation Overflow Alarm Level at Servo ON) while the servo was OFF.
A.d02	Position Deviation Overflow Alarm for Speed Limit at Servo ON	If position deviation remains in the deviation counter, the setting of Pn529 or Pn584 (Speed Limit Level at Servo ON) will limit the speed when the servo is turned ON. This alarm occurs if a position reference is input and the setting of Pn520 (Position Deviation Overflow Alarm Level) is exceeded.

Refer to the following section for information on troubleshooting alarms. *13.2.3 Resetting Alarms* on page 13-43

### **Related Warnings**

Warning Number	Warning Name	Meaning
A.901	Position Deviation Overflow Warning at Servo ON	This warning occurs if the servo is turned ON while the position deviation exceeds the specified percentage (Pn526 × Pn528/100).

9.4.1 Application Restrictions

## .4 Tuning-less Function

The tuning-less function performs autotuning to obtain a stable response regardless of the type of machine or changes in the load. Autotuning is started when the servo is turned ON.

# 

- The tuning-less function is disabled during torque control.
- The Servomotor may momentarily emit a sound the first time the servo is turned ON after the Servomotor is connected to the machine. This sound is caused by setting the automatic notch filter. It does not indicate a problem. The sound will not be emitted from the next time the servo is turned ON.
- The Servomotor may vibrate if it exceeds the allowable load moment of inertia. If that occurs, set the tuning-less load level to 2 (Pn170 = n.2□□□) or reduce the Tuning-less Rigidity Level (Pn170 = n.□X□□).
- To ensure safety, make sure that you can perform an emergency stop at any time when you execute the tuning-less function.

## 9.4.1 Application Restrictions

The following application restrictions apply to the tuning-less function.

Function	Executable*	Remarks
Vibration Detection Level Initialization	0	-
Moment of Inertia Estimation	×	Disable the tuning-less function (Pn170 = $n.\Box\Box\Box$ 0) before you execute moment of inertia estimation.
Autotuning without Host Reference	×	Disable the tuning-less function (Pn170 = $n.\Box\Box\Box$ 0) before you execute autotuning without a host reference.
Autotuning with Host Reference	×	-
Custom Tuning	×	-
Anti-Resonance Control Adjustment	×	-
Vibration Suppression	×	-
Easy FFT	0	The tuning-less function is disabled while you execute Easy FFT and then it is enabled when Easy FFT has been completed.
Friction Compensation	×	-
Gain Selection	×	-
Mechanical Analysis	0	The tuning-less function is disabled while you execute mechanical analysis and then it is enabled when mechan- ical analysis has been completed.

\* O: Yes ×: No

The tuning-less function is enabled in the default settings. No specific procedure is required. You can use the following parameter to enable or disable the tuning-less function.

Parameter		Meaning	WhenEnabled	Classification
n.⊏ (de Pn170 n.⊏ (de	n.🗆 🗆 🗆 0	Disable tuning-less function.		
	n.□□□1 (default setting)	Enable tuning-less function.		Setup
	n.□□0□ (default setting)	Use for speed control.	After restart	
	n.0010	Use for speed control and use host controller for position control.		

When you enable the tuning-less function, you can select the tuning-less type. Normally, set Pn14F to  $n.\square\square2\square$  (Use tuning-less type 3) (default setting). If compatibility with previous models is required, set Pn14F to  $n.\square\square0\square$  (Use tuning-less type 1) or  $n.\square\square1\square$  (Use tuning-less type 2).

F	Parameter	Meaning	When Enabled	Classification
	n.🗆 🗆 🗆	Use tuning-less type 1.		
Pn14F	n.0010	Use tuning-less type 2. (The noise level is improved more than with tuning-less type 1.)	After restart	Tuning
	n.□□2□ (default setting)	Use tuning-less type 3.		

### **Tuning-less Level Settings**

If vibration or other problems occur, change the tuning-less levels. To change the tuning-less levels, use the SigmaWin+.

### Preparations

Always check the following before you set the tuning-less levels.

- The tuning-less function must be enabled (Pn170 =  $n.\Box\Box\Box$ 1).
- The test without a motor function must be disabled (Pn00C =  $n.\Box\Box\Box$ ).
- The Servomotor must be connected to the machine.

### ♦ Procedure

Use the following procedure to set the tuning-less levels.

In addition to the following procedure, you can also set the parameters directly. Refer to *Related Parameters*, below, for the parameters to set.

- 1. Click the <u>J</u> Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- 2. Select Response Level Setting in the Menu Dialog Box. The Tuning-less Level Setting-Adj Dialog Box will be displayed.

#### 9.4.3 Troubleshooting Alarms

# 3. Click the ▲ or ▼ Button to adjust the response level setting. Increase the response level setting to increase the response. Decrease the response level setting to suppress vibration.

The default response level setting is 4.

Response Level Setting	Description	Remarks
7	Response level: High	
6		You cannot select these levels if tuning-less type 1 or 2 (Pn14F = $n.\Box\Box\Box\Box$ or $n.\Box\Box\Box\Box$ ) is used.
5		
4 (default setting)		
3		
2		-
1	27	
0	Response level: Low	

#### 4. Click the Completed Button.

The adjustment results will be saved in the SERVOPACK.



Reset the tuning-less level to the default setting when removing the Servomotor from the machine. The Servomotor may vibrate if the tuning-less level is not reset and the servo is turned ON when the Servomotor has been removed from the machine.

### Related Parameters

#### Tuning-less Rigidity Level

If you use tuning-less type 1 or 2 (Pn14F =  $n.\square\square\square\square$  or  $n.\square\square\square\square$ ), set the tuning-less level to between 0 and 4 (Pn170 =  $n.\square\square\square\square$  to  $n.\square4\square\square$ ). Do not set the tuning-less level to between 5 and 7 (Pn170 =  $n.\square5\square\square$  to  $n.\square7\square\square$ ).

F	arameter	Description	When Enabled	Classification
	n.🗆0🗆 🗆	Tuning-less rigidity level 0 (low rigidity)		
	n.0100	Tuning-less rigidity level 1		
	n.0200	Tuning-less rigidity level 2		
	n.¤3¤¤	Tuning-less rigidity level 3		
Pn170	n.□4□□ (default setting)	Tuning-less rigidity level 4	Immediately	Setup
	n.¤5¤¤	Tuning-less rigidity level 5		
	n.¤6¤¤	Tuning-less rigidity level 6		
	n.0700	Tuning-less rigidity level 7 (high rigidity)		

#### Tuning-less Load Level

Р	arameter	Description	When Enabled	Classification
	n.0000	Tuning-less load level 0		
Pn170	n.1□□□ (default setting)	Tuning-less load level 1	Immediately Setup	
	n.2000	Tuning-less load level 2		

### 9.4.3 Troubleshooting Alarms

An A.521 alarm (Autotuning Alarm) will occur if a resonant sound occurs or if excessive vibration occurs during position control. If an alarm occurs, implement the following measures.

#### Resonant Sound

Decrease the setting of  $Pn170 = n.X \square \square \square$  or the setting of  $Pn170 = n.\square X \square \square$ .

• Excessive Vibration during Position Control Increase the setting of Pn170 = n.  $\Box X \Box \Box$  or decrease the setting of Pn170 = n.  $\Box X \Box \Box$ .

9.4.4 Parameters Disabled by Tuning-less Function

### 9.4.4 Parameters Disabled by Tuning-less Function

When the tuning-less function is enabled ( $Pn170 = n.\Box\Box\Box1$ ) (default setting), the parameters in the following table are disabled.

Item	Parameter Name	Parameter Number
	Speed Loop Gain Second Speed Loop Gain	Pn100 Pn104
Gain-Related Parameters	Speed Loop Integral Time Constant Second Speed Loop Integral Time Constant	Pn101 Pn105
	Position Loop Gain Second Position Loop Gain	Pn102 Pn106
	Moment of Inertia Ratio	Pn103
Advanced Control-Related	Friction Compensation Function Selection	Pn408 = n.X□□□
Parameters	Anti-Resonance Control Selection	Pn160= n.□□□X
Gain Selection-Related Parameters	Gain Switching Selection	Pn139= n.□□□X

The tuning-less function is disabled during torque control, Easy FFT, and mechanical analysis for a vertical axis. The gain-related parameters in the above table are enabled for torque control, Easy FFT, and mechanical analysis. Of these, Pn100, Pn103, and Pn104 are enabled for torque control.

## 9.4.5 Automatically Adjusted Function Setting

You can also automatically adjust notch filters.

Normally, set Pn460 to n. D1 DD (Adjust automatically) (default setting). Vibration is automatically detected and a notch filter is set.

Set Pn460 to n.  $\Box 0 \Box \Box$  (Do not adjust automatically) only if you do not change the setting of the notch filter before you execute the tuning-less function.

P	arameter	Meaning	When Enabled	Classification
Pn460	n.□0□□ Do not adjust the second stage notch filter automatically when the tuning-less function is enabled or during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.		Immediately	Tuning
1 11400	n.□1□□ (default setting)	Adjust the second stage notch filter automati- cally when the tuning-less function is enabled or during execution of autotuning without a host reference, autotuning with a host refer- ence, and custom tuning.	ininediately	Turning

### 9.4.6 Related Parameters

The following parameters are automatically adjusted when you execute the tuning-less function.

Do not manually change the settings of these parameters after you have enabled the tuningless function.

Parameter	Name	
Pn401	First Stage First Torque Reference Filter Time Constant	
Pn40C	Second Stage Notch Filter Frequency	
Pn40D	Second Stage Notch Filter Q Value	

9.5.1 Outline

# 9.5 Estimating the Moment of Inertia

This section describes how the moment of inertia is calculated.

The moment of inertia ratio that is calculated here is used in other tuning functions. You can also estimate the moment of inertia during autotuning without a host reference. Refer to the following section for the procedure.

9.6.4 Operating Procedure on page 9-26

### 9.5.1 Outline

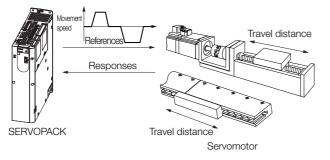
The moment of inertia during operation is automatically calculated by the SERVOPACK for round-trip (forward and reverse) operation. A reference from the host controller is not used.

The moment of inertia ratio (i.e., the ratio of the load moment of inertia to the motor moment of inertia) is a basic parameter for adjusting gains. It must be set as accurately as possible.

Although the load moment of inertia can be calculated from the weight and structure of the mechanisms, doing so is very troublesome and calculating it accurately can be very difficult with the complex mechanical structures that are used these days. With moment of inertia estimation, you can get an accurate load moment of inertia simply by operating the Servomotor in the actual system in forward and reverse a few times.

The Servomotor is operated with the following specifications.

- Maximum speed: ±1,000 min<sup>-1</sup> (can be changed)
- Acceleration rate: ±20,000 min<sup>-1</sup>/s (can be changed)
- Travel distance: ±2.5 rotations max. (can be changed)



Note: Execute moment of inertia estimation after jogging to a position that ensures a suitable range of motion.

## 9.5.2 Restrictions

The following restrictions apply to estimating the moment of inertia.

### Systems for which Execution Cannot Be Performed

- When the machine system can move only in one direction
- When the range of motion is 0.5 rotations or less

# Systems for Which Adjustments Cannot Be Made Accurately

- When a suitable range of motion is not possible
- When the moment of inertia changes within the set operating range
- When the machine has high dynamic friction
- When the rigidity of the machine is low and vibration occurs when positioning is performed
- When the position integration function is used

• When proportional control is used

Note: If you specify calculating the moment of inertia, an error will occur if V\_PPI in the servo command output signals (SVCMD\_IO) changes to specify the proportional action during moment of inertia estimation.

- When mode switching is used
  - Note: If you specify moment of inertia estimation, mode switching will be disabled and PI control will be used while the moment of inertia is being calculated. Mode switching will be enabled after moment of inertia estimation has been completed.
- · When speed feedforward or torque feedforward is input

### Preparations

Always check the following before you execute moment of inertia estimation.

- The main circuit power supply must be ON.
- There must be no overtravel.
- The servo must be OFF.
- The control method must not be set to torque control.
- The gain selection switch must be set to manual gain selection (Pn139 =  $n.\Box\Box\Box$ ).
- The first gains must be selected.
- The test without a motor function must be disabled (Pn00C =  $n.\Box\Box\Box$ ).
- There must be no alarms or warnings.
- There must be no hard wire base block (HWBB).
- The parameters must not be write prohibited.
- The tuning-less function must be disabled (Pn170 =  $n.\Box\Box\Box$ 0).

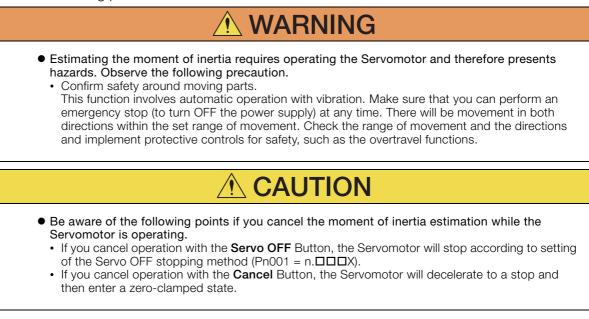
### 9.5.3 Applicable Tools

The following table lists the tools that you can use to estimate the moment of inertia and the applicable tool functions.

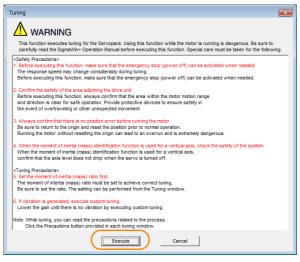
Tool	Function	Operating Procedure Reference	
Digital Operator	You cannot estimate the moment of inertia from the Digital Operator.		
SigmaWin+	Tuning - TuningI 39.5.4 Operating Procedure on page 9		

### 9.5.4 Operating Procedure

Use the following procedure to estimate the moment of inertia ratio.



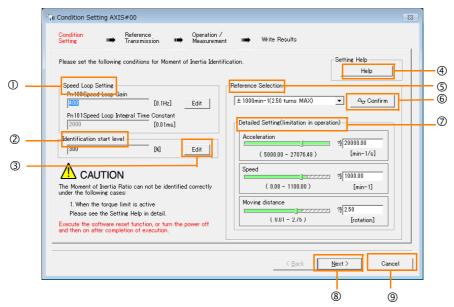
- 1. Click the <u>I</u> Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select Tuning in the Menu Dialog Box. The Tuning Dialog Box will be displayed. Click the **Cancel** Button to cancel tuning.
- 3. Click the Execute Button.



4. Click the Execute Button.

Tuning AXIS#00	<b>—</b> ×—
Set the moment of inertia (mass) ratio before executing autotuning.	Precautions
Moment of inertia (mass) ratio identification	
Ph 103 - Moreau of hertia Ratio	
100 % Edit	
Autotuning Reference input from host controller © Postion Reference Input No Reference Input	]
Advanced adjustment	Finish

5. Set the conditions as required.



#### ① Speed Loop Setting Area

Make the speed loop settings in this area.

If the speed loop response is too bad, it will not be possible to measure the moment of inertia ratio accurately.

The values for the speed loop response that are required for moment of inertia estimation are set for the default settings. It is normally not necessary to change these settings. If the default speed loop gain is too high for the machine (i.e., if vibration occurs), lower the setting. It is not necessary to increase the setting any farther.

#### 2 Identification Start Level Group

This is the setting of the moment of inertia calculation starting level.

If the load is large or the machine has low rigidity, the torgue limit may be applied, causing moment of inertia estimation to fail.

If that occurs, estimation may be possible if you double the setting of the start level. ③ Edit Buttons

Click the button to display a dialog box to change the settings related to the speed loop or estimation start level.

④ Help Button

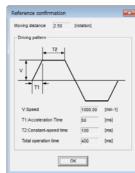
Click this button to display guidelines for setting the reference conditions. Make the following settings as required.

- Operate the Servomotor to measure the load moment of inertia of the machine in comparison with the rotor moment of inertia.
- Set the operation mode, reference pattern (maximum acceleration rate, maximum speed, and maximum travel distance), and speed loop-related parameters.
- · Correct measurement of the moment of inertia ratio may not be possible depending on the settings. Set suitable settings using the measurement results as reference.
- S Reference Selection Area
  - Either select the reference pattern for estimation processing from the box, or set the values in the **Detailed Setting** Group. Generally speaking, the larger the maximum acceleration rate is, the more accurate the moment of inertia estimation will be. Set the maximum acceleration range within the possible range of movement considering

the gear ratio, e.g., the pulley diameters or ball screw pitch.

#### 6 Confirm Button

Click this button to display the Reference Confirmation Dialog Box.



#### ⑦ Detailed Setting Area

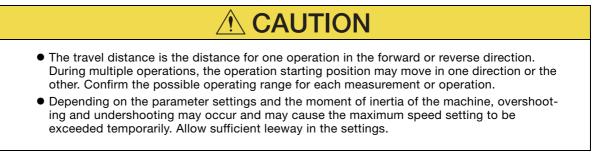
You can change the settings by moving the bars or directly inputting the settings to create the required reference pattern.

#### 8 Next Button

Click this button to display the Reference Transmission Dialog Box.

③ Cancel Button

Click this button to return to the Tuning Dialog Box.



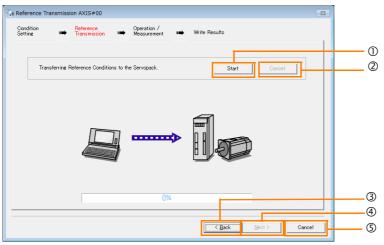
#### Information When Measurement Is Not Correct

Estimating the moment of inertia ratio cannot be performed correctly if the torque limit is activated. Adjust the limits or reduce the acceleration rate in the reference selection so that the torque limit is not activated.

#### 6. Click the Next Button.

The Reference Transmission Dialog Box will be displayed.

#### 7. Click the Start Button.



#### ① Start Button

The reference conditions will be transferred to the SERVOPACK. A progress bar will show the progress of the transfer.

#### 2 Cancel Button

The **Cancel** Button is enabled only while data is being transferred to the SERVOPACK. You cannot use it after the transfer has been completed.

#### ③ Back Button

This button returns you to the Condition Setting Dialog Box. It is disabled while data is being transferred.

④ Next Button

This button is enabled only when the data has been transferred correctly. You cannot use it if an error occurs or if you cancel the transfer before it is completed.

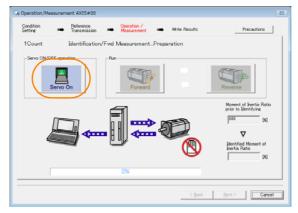
Click the **Next** Button to display the Operation/Measurement Dialog Box. (S Cancel Button

This button cancels processing and returns you to the Tuning Dialog Box.

#### 8. Click the Next Button.

The Operation/Measurement Dialog Box will be displayed.

#### 9. Click the Servo On Button.



#### 10. Click the Forward Button.

The shaft will rotate in the forward direction and the measurement will start. After the measurement and data transfer have been completed, the **Reverse** Button will be displayed in color.

#### 11. Click the Reverse Button.



The shaft will rotate in the reverse direction and the measurement will start. After the measurement and data transfer have been completed, the **Forward** Button will be displayed in color.

	easurement AXIS#00			
Condition Setting	Reference Transmission	Operation /     Measurement     Measurement	ite Results	Precautions
2Count	Identification	/Fwd MeasurementPrep. Cor	nplete	
-Servo ON/	OFF operation	Ra Forward	Re	Verse
		1.	pr	oment of Inertia Ratio ior to Identifying 800 [K] <b>V</b>
				Rentified Moment of Rentia Ratio 19 [M]
		100%		

#### 12. Repeat steps 9 to 11 until the Next Button is enabled.

Measurements are performed from 2 to 7 times and then verified. The number of measurements is displayed in upper left corner of the dialog box. A progress bar at the bottom of the dialog box will show the progress of the transfer each time.

13. When the measurements have been completed, click the Servo On Button to turn OFF the servo.

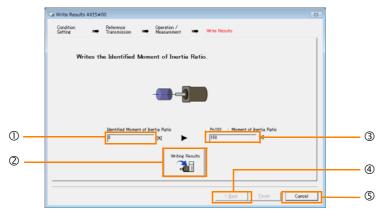
#### 14. Click the Next Button.

The Write Results Dialog Box will be displayed.

Information If you click the **Next** Button before you turn OFF the servo, the following Dialog Box will be displayed. Click the **OK** Button to turn OFF the servo.



15. Click the Writing Results Button.



① Identified Moment of Inertia Ratio Box

The moment of inertia ratio that was found with operation and measurements is displayed here.

2 Writing Results Button

If you click this button, Pn103 (Moment of Inertia Ratio) in the SERVOPACK is set to the value that is displayed for the identified moment of inertia ratio.

3 Pn103: Moment of Inertia Ratio Box

The value that is set for the parameter is displayed here.

After you click the **Writing Results** Button, the value that was found with operation and measurements will be displayed as the new setting.

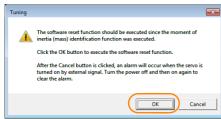
④ Back Button

This button is disabled.

S Cancel Button

This button will return you to the Tuning Dialog Box.

- 16. Confirm that the Identified Moment of Inertia Ratio Box and the Pn103: Moment of Inertia Ratio Box show the same value and then click the Finish Button.
- 17. Click the OK Button.



#### 18. Click the Execute Button.



If the setting of the moment of inertia ratio (Pn103) was changed, the new value will be saved and the Tuning Dialog Box will be displayed again.

This concludes the procedure to estimate the moment of inertia ratio.

9.6.1 Outline

# 9.6 Autotuning without Host Reference

This section describes autotuning without a host reference.

Important	<ul> <li>Autotuning without a host reference performs adjustments based on the setting of the speed loop gain (Pn100). Therefore, precise adjustments cannot be made if there is vibration when adjustments are started. Make adjustments after lowering the speed loop gain (Pn100) until vibration is eliminated.</li> <li>You cannot execute autotuning without a host reference if the tuning-less function is enabled (Pn170 = n. □□□1 (default setting)). Disable the tuning-less function (Pn170 = n. □□□0) before you execute autotuning without a host reference.</li> <li>If you change the machine load conditions or drive system after you execute autotuning without a host reference and then you execute autotuning without a host reference with moment of inertia estimation specified, use the following parameter settings. If you execute autotuning without a host reference for any other conditions, the machine may vibrate and may be damaged.</li> <li>Pn140 = n. □□□0 (Do not use model following control.)</li> <li>Pn160 = n. □□□0 (Do not use anti-resonance control.)</li> <li>Pn408 = n.00□0 (Disable friction compensation, first stage notch filter, and second stage notch filter.)</li> </ul>
	Note: If you are using the Digital Operator and the above parameters are not displayed, change the parameter display setting to display all parameters (Pn00B = n.□□□1) and then turn the power supply OFF and ON again.

## 9.6.1 Outline

For autotuning without a host reference, operation is automatically performed by the SERVO-PACK for round-trip (forward and reverse) operation to adjust for machine characteristics during operation. A reference from the host controller is not used.

The following items are adjusted automatically.

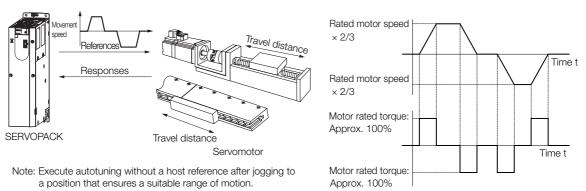
- Moment of inertia ratio
- · Gains (e.g., speed loop gain and position loop gain)
- Filters (torque reference filter and notch filters)
- Friction compensation
- Anti-resonance control
- Vibration suppression (only for mode 2 or 3)

Refer to the following section for details on the parameters that are adjusted. **9.6.7** *Related Parameters* on page 9-34

The Servomotor is operated with the following specifications.

Maximum Speed	Rated motor speed × $\frac{2}{3}$	
Acceleration Torque	Rated motor torque: Approx. 100% Note: The acceleration torque depends on the setting of the influence of the moment of inertia ratio (Pn103), machine friction, and external disturbance.	
Travel Distance	Rotary Servomotors	You can set the desired travel distance. The default setting is for a value equivalent to 3 Servomotor shaft rotations.
	Linear Servomotors	You can set the desired travel distance in increments of 1,000 reference units. (The default setting is for 90 mm.)

9.6.2 Restrictions



Example of Automatic Operation Pattern

## 

- Autotuning without a host reference requires operating the Servomotor and therefore presents hazards. Observe the following precaution.
- Confirm safety around moving parts. This function involves automatic operation with vibration. Make sure that you can perform an emergency stop (to turn OFF the power supply) at any time. There will be movement in both directions within the set range of movement. Check the range of movement and the directions and implement protective controls for safety, such as the overtravel functions.

### 9.6.2 Restrictions

The following restrictions apply to autotuning without a host reference.

If you cannot use autotuning without a host reference because of these restrictions, use autotuning with a host reference or custom tuning. Refer to the following sections for details.  $\Im$  9.7 Autotuning with a Host Reference on page 9-35

3.8 Custom Tuning on page 9-42

### Systems for Which Execution Cannot Be Performed

- · When the machine system can move only in one direction
- When the range of motion is 0.5 rotations or less

# Systems for Which Adjustments Cannot Be Made Accurately

- When a suitable range of motion is not possible
- When the moment of inertia changes within the set operating range
- When the machine has high friction
- When the rigidity of the machine is low and vibration occurs when positioning is performed
- When the position integration function is used
- When proportional control is used

Note: If you specify calculating the moment of inertia, an error will occur if V\_PPI in the servo command output signals (SVCMD\_IO) changes to specify the proportional action during moment of inertia estimation.

· When mode switching is used

Note: If you specify moment of inertia estimation, mode switching will be disabled and PI control will be used while the moment of inertia is being calculated. Mode switching will be enabled after moment of inertia estimation has been completed.

- When speed feedforward or torque feedforward is input
- When the positioning completed width (Pn522) is too narrow

9.6.3 Applicable Tools

### Preparations

Always check the following before you execute autotuning without a host reference.

- The main circuit power supply must be ON.
- There must be no overtravel.
- The servo must be OFF.
- The control method must not be set to torque control.
- The gain selection switch must be set to manual gain selection (Pn139 =  $n.\Box\Box\Box$ ).
- The first gains must be selected.
- The test without a motor function must be disabled (Pn00C =  $n.\Box\Box\Box$ ).
- There must be no alarms or warnings.
- There must be no hard wire base block (HWBB).
- The parameters must not be write prohibited.
- The tuning-less function must be disabled (Pn170 = n.□□□0), or the tuning-less function must be enabled (Pn170 = n.□□□1) and moment of inertia estimation must be specified.
- If you execute autotuning without a host reference during speed control, set the mode to 1.

Information • If you start autotuning without a host reference while the SERVOPACK is in speed control for mode 2 or 3, the SERVOPACK will change to position control automatically to perform autotuning without a host reference. The SERVOPACK will return to speed control after autotuning has been completed.

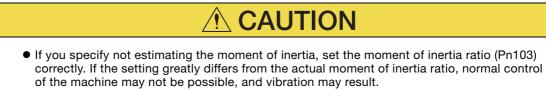
### 9.6.3 Applicable Tools

The following table lists the tools that you can use to perform autotuning without a host reference and the applicable tool functions.

Tool	Function	Operating Procedure Reference
Digital Operator	Fn201	Ω Σ-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Tuning - Tuning	3.6.4 Operating Procedure on page 9-26

### 9.6.4 Operating Procedure

Use the following procedure to perform autotuning without a host reference.



• If you are using an MP3000-series Controller for phase control, set the mode selection to 1. If 2 or 3 is selected for the mode, correct phase control may not be possible.

- **1.** Confirm that the moment of inertia ratio (Pn103) is set correctly.
- 2. Click the *P* Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **3.** Select Tuning in the Menu Dialog Box. The Tuning Dialog Box will be displayed. Click the **Cancel** Button to cancel tuning.
- 4. Click the Execute Button.

WARNING This function executes turing for the Servopack. Using this function while the motor is running is dangerous. Be sure to	
This function executes tuning for the Servopack. Using this function while the motor is running is dangerous. Be sure to	
carefully read the SigmaWin+ Operation Manual before executing this function. Special care must be taken for the following.	
-Safety Precautions> 1. Before executing this function, make sure that the emergency stop (power off) can be activated when needed. The response speed may change considerably during tuning. Before executing this function, make sure that the emergency stop (power off) can be activated when needed.	_
2. Confirm the safety of the area adjoining the drive unit. Before executing this function, always confirm that the area within the motor motion range and direction is clear for safe operation. Provide protective devices to ensure safety in the event of overtraveling or other unexpected movement.	
<ol> <li>Always confirm that there is no position error before running the motor.</li> <li>Be sure to return to the origin and reset the position proving logaration.</li> <li>Running the motor without resetting the origin can lead to an overrun and is extremely dangerous.</li> </ol>	
4. When the moment of inertia (mass) identification function is used for a vertical axis, check the safety of the system. When the moment of inertia (mass) identification function is used for a vertical axis, confirm that the axis level does not drop when the servo is turned off.	
<turning precautions=""> 5. Set the moment of inertia (mass) ratio first. The moment of interta (mass) ratio must be set to achieve correct tuning. Be sure to set the ratio. The setting can be performed from the Tuning window.</turning>	
<ol> <li>If vibration is generated, execute custom tuning.</li> <li>Lower the gain until there is no vibration by executing custom tuning.</li> </ol>	
Note: While tuning, you can read the precautions related to the process. Click the Precautions button provided in each tuning window.	
Execute	

5. Select the No Reference Input Option in the Autotuning Area and then click the Autotuning Button.

Tuning AXIS#00	×
Set the moment of inertia (mass) ratio before executing autotuning.	Precautions
Moment of inertia (mass) ratio identification	
Pn103 : Moment of Inertia Ratio	
Autotuning	
Postion Reference Input	
Advanced adjustment	Finish

Information

When the following dialog box is displayed, click the **OK** Button and then confirm that the correct moment of inertia ratio is set in Pn103 (Moment of Inertia Ratio).

Tuning
The moment of inertia (mass) ratio has never been changed from the default setting. Set a correct moment of inertia (mass) ratio in the Moment of Inertia (Mass) Setting window before starting luning. If an incorrect moment of inertia (mass) ratio is set, vibration may be generated during luning. Do you want to continue tuning?
Cancel

6. Set the conditions in the Switching the load moment of inertia (load mass) identification Box, the Mode selection Box, the Mechanism selection Box, and the Distance Box, and then click the Next Button.

8	Autotuning - Setting Conditions AXIS#00
-	Set conditions.
Ľ	Switching the load moment of intertia (load mass) identification
	1:A moment of inertia is not presumed.
Ē	Mode selection
	2:For positioning
	A gain adjustment specialized for positioning will be executed. In addition, the following automatic adjustments can be executed: Model following control, notch filter, anti-resonance control, and vibration suppression.
	Mechanism selection
	2:Ball screw mechanism or linear motor
	Executes adjustment suitable for relatively high-rigidity mechanism, such as a ball screw or linear motor. Select this type if there is no applicable mechanism.
-	Distance
	The moving range from the current value is specified.
1	786 X 1000 = 786000 [reference units]
	(-99990 - 99990)
	(Setting invalid range : -131 - 131) 3.0 [Rotation]
	Tuning parameters
	Start tuning using the default settings.
	Cancel
	Cancel
_	tance Box
et	tance Box the travel distance.
et	tance Box the travel distance.
et S	tance Box the travel distance. vement range: -99,990,000 to
et Sv	tance Box the travel distance. vement range: -99,990,000 to 9,990,000 [reference units]
et Sv 99 n	tance Box the travel distance. vement range: -99,990,000 to 9,990,000 [reference units] imum setting increment for travel dis-
et SV 92 n	tance Box the travel distance. vement range: -99,990,000 to 9,990,000 [reference units] imum setting increment for travel dis- ce: 1,000 [reference units]
et SV 92 n	tance Box the travel distance. vement range: -99,990,000 to 9,990,000 [reference units] imum setting increment for travel dis- ce: 1,000 [reference units]
	tance Box the travel distance. vement range: -99,990,000 to 9,990,000 [reference units] imum setting increment for travel dis- ce: 1,000 [reference units] gative values are for reverse operation
n n n	tance Box the travel distance. vement range: -99,990,000 to 9,990,000 [reference units] imum setting increment for travel dis- ce: 1,000 [reference units] gative values are for reverse operation I positive values are for forward opera-
	tance Box the travel distance. vement range: -99,990,000 to 9,990,000 [reference units] imum setting increment for travel dis- ce: 1,000 [reference units] gative values are for reverse operation I positive values are for forward opera- from the current position.
	tance Box the travel distance. vement range: -99,990,000 to 9,990,000 [reference units] imum setting increment for travel dis- ce: 1,000 [reference units] gative values are for reverse operation I positive values are for forward opera-
	tance Box the travel distance. vement range: -99,990,000 to 9,990,000 [reference units] imum setting increment for travel dis- ce: 1,000 [reference units] gative values are for reverse operation I positive values are for forward opera- from the current position. ault settings:
	tance Box the travel distance. vement range: -99,990,000 to 9,990,000 [reference units] imum setting increment for travel dis- ce: 1,000 [reference units] gative values are for reverse operation I positive values are for forward opera- from the current position. ault settings: otary Servomotors: Approx. 3 rotations
	tance Box the travel distance. vement range: -99,990,000 to 9,990,000 [reference units] imum setting increment for travel dis- ce: 1,000 [reference units] gative values are for reverse operation I positive values are for forward opera- from the current position. ault settings: otary Servomotors: Approx. 3 rotations near Servomotors: Approx 90 mm
et over in ne ed on ef at	tance Box the travel distance. vement range: -99,990,000 to 9,990,000 [reference units] imum setting increment for travel dis- ce: 1,000 [reference units] gative values are for reverse operation I positive values are for forward opera- from the current position. ault settings: otary Servomotors: Approx. 3 rotations

default distance setting. Rotary Servomotors: 0.5 rotations Linear Servomotors: 5 mm

ommend that you use approximately the

#### Switching the load moment of inertia (load mass) identification Box

Specify whether to estimate the moment of inertia. 0: A moment of inertia is presumed. (default setting) 1: A moment of inertia is not presumed.

#### Mode selection Box

Set the mode.		
Mode Selection	Description	
1: Standard	Standard gain adjustment is per- formed. In addition to gain adjust- ment, notch filters and anti-resonance control are automatically adjusted.	
2: For positioning	Tuning is performed for positioning applications. In addition to gain adjustment, model following control, notch filters, anti-resonance control, and vibration suppression are auto- matically adjusted.	
3: For positioning especially to pre- vent overshooting	Tuning is performed for positioning applications with emphasis on elimi- nating overshooting. In addition to gain adjustment, notch filters, anti- resonance control, and vibration sup- pression are automatically adjusted.	

#### Mechanism selection Box

Select the type according to the machine element to drive.

If there is noise or if the gain does not increase, better results may be obtained by changing the rigidity type. Select the type according to the following guidelines.

Mechanism Selection	Description
1: Belt mechanism	Tuning is performed for a mecha- nism with relatively low rigidity, e.g., a belt.
2: Ball screw mech- anism or linear motor	Tuning is performed for a mecha- nism with relatively high rigidity, e.g., a ball screw or Linear Servomotor. Use this setting if there is no other appropriate setting.
3: Rigid model	Tuning is performed for a mecha- nism with high rigidity, e.g., a rigid body system.

#### • Tuning parameters Box

Specify the parameters to use for tuning. If you select the **Start tuning using the default set-tings** Check Box, the tuning parameters will be returned to the default settings before tuning is started.

7. Click the Servo ON Button.

Autotuning - Automatic s	setting AXIS#00
Waiting for execution	Servo ON/OFF operation
measurement	Tuning
Gain search behaviour evaluation	Start tuning
	Mechanism selection
	2:Ball screw mechanism or linear motor
Notch filter	786000 [reference units]
Anti-res Adj Vib Suppress	3.0 [Rotation]
Precautions	< Back Finish Cancel

8. Click the Start tuning Button.

Image: Setting AxIS#00		
Waiting for execution	Servo ON/OFF operation Servo OFF	
Gain search behaviour evaluation	Tuning Start tuning	
Tuning completed	Mode selection 2:For positioning	
	Mechanism selection 2:Ball screw mechanism or linear motor	
Notch filter Anti-res Adj Vib Suppress	Distance         [reference units]           786000         [Rotation]	
Precautions	< Back Finish Cancel	

#### 9.6.5 Troubleshooting Problems in Autotuning without a Host Reference

9. Confirm safety around moving parts and click the Yes Button.



The Servomotor will start operating and tuning will be executed.

Vibration that occurs during tuning will be detected automatically and suitable settings will be made for that vibration. When the settings have been completed, the indicators for the functions that were used will light at the lower left of the dialog box.

Image: Setting AXIS#00         83		
Waiting for execution	Servo ON/OFF operation	
Oscillation level measurement		
	Cancel	
Gain search behaviour evaluation		
	<u></u>	
Tuning completed	Mode selection	
	2:For positioning	
	Mechanism selection	
	2:Ball screw mechanism or linear motor	
	Distance [reference units]	
Notch filter	10000	
Vib Suppress	3.0 [Rotation]	
-		
Precautions	< Back Finish Cancel	

#### 10. When tuning has been completed, click the Finish Button.

The results of tuning will be set in the parameters and you will return to the Tuning Dialog Box.

This concludes the procedure to perform autotuning without a host reference.

# 9.6.5 Troubleshooting Problems in Autotuning without a Host Reference

The following tables give the causes of and corrections for problems that may occur in autotuning without a host reference.

#### Autotuning without a Host Reference Was Not Performed

Possible Cause	Corrective Action
Main circuit power supply is OFF.	Turn ON the main circuit power supply.
An alarm or warning occurred.	Remove the cause of the alarm or warning.
Overtraveling occurred.	Remove the cause of overtraveling.
The second gains were selected with the gain selection.	Disable automatic gain switching.
The HWBB was activated.	Release the HWBB.
The setting of the travel distance is too small.	Set the travel distance again in step 6 of the proce- dure.
The settings for the tuning-less function are not correct.	<ul> <li>Disable the tuning-less function (Pn170 = n.□□□0).</li> <li>Enable the tuning-less function (Pn170 = n.□□□1) and specify moment of inertia estimation.</li> </ul>

#### When an Error Occurs during Execution of Autotuning without a Host Reference

Error	Possible Cause	Corrective Action
The gain adjustments were not successfully completed.	Machine vibration occurs or the posi- tioning completion signal is not stable when the Servomotor stops.	<ul> <li>Increase the setting of the positioning completed width (Pn522).</li> <li>Change the mode from 2 to 3.</li> <li>If machine vibration occurs, suppress the vibration with the anti-resonance control function and the vibration suppression function.</li> </ul>
An error occurred during calculation of the moment of inertia.	Refer to the following section for troubleshooting information.	
Positioning was not completed within approximately 10 sec- onds after position adjustment was com- pleted.	The positioning completed width is too narrow or proportional control is being used.	<ul> <li>Increase the setting of the positioning completed width (Pn522).</li> <li>Set V_PPI to 0 in the servo command output signals (SVCMD_IO).</li> </ul>

### When an Error Occurs during Calculation of Moment of Inertia

Possible Cause	Corrective Action
The SERVOPACK started calculating the moment of inertia but the calculation was not completed.	<ul><li>Increase the setting of the speed loop gain (Pn100).</li><li>Increase the stroke (travel distance).</li></ul>
The moment of inertia fluctuated greatly and did not converge within 10 tries.	Set Pn103 (Moment of Inertia Ratio) from the machine specifications and specify not estimating the moment of inertia.
Low-frequency vibration was detected.	Double the setting of moment of inertia calculation starting level (Pn324).
The torque limit was reached.	<ul> <li>If you are using the torque limit, increase the torque limit.</li> <li>Double the setting of moment of inertia calculation starting level (Pn324).</li> </ul>
The speed control section changed to proportional control during calculation of the moment of inertia, e.g., V_PPI in the servo command output signals (SVCMD_IO) was set to 1.	Use PI control when calculating the moment of inertia.

### ◆ Adjustment Results Are Not Satisfactory for Position Control

You may be able to improve the adjustment results by changing the settings of the positioning completed width (Pn522) and the electronic gear ratio (Pn20E/Pn210).

If satisfactory results are still not possible, adjust the overshoot detection level (Pn561). That may improve the adjustment results.

- Pn561 = 100% (default setting)
- This will allow tuning with overshooting that is equivalent to the positioning completed width. • Pn561 = 0%
  - This will allow tuning to be performed without overshooting within the positioning completed width, but the positioning completed width may be extended.

	Overshoot Detection Level			Speed Posit	ion Torque
Pn561	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 100	1%	100	Immediately	Setup

9.6.6 Automatically Adjusted Function Settings

### 9.6.6 Automatically Adjusted Function Settings

You can specify whether to automatically adjust the following functions during autotuning.

### Automatic Notch Filters

Normally, set Pn460 to n. D1DD (Adjust automatically) (default setting).

Vibration will be detected during autotuning without a host reference and a notch filter will be adjusted.

Set Pn460 to n.  $\Box 0 \Box \Box$  (Do not adjust automatically) only if you do not change the setting of the notch filter before you execute this function.

P	arameter	Function	When Enabled	Classification
Pn460	n.□□□0	Do not adjust the first stage notch filter auto- matically during execution of autotuning with- out a host reference, autotuning with a host reference, and custom tuning.	Immediately	Tuning
	n.□□□1 (default setting)	Adjust the first stage notch filter automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.		
	n.□0□□	Do not adjust the second stage notch filter automatically when the tuning-less function is enabled or during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.		
	n.□1□□ (default setting)	Adjust the second stage notch filter automati- cally when the tuning-less function is enabled or during execution of autotuning without a host reference, autotuning with a host refer- ence, and custom tuning.		

### Anti-Resonance Control Adjustment

This function reduces low vibration frequencies, for which the notch filters cannot be used.

Normally, set Pn160 to n. DD1D (Adjust automatically) (default setting).

Vibration will be detected during autotuning without a host reference and anti-resonance control will be automatically adjusted.

Parameter		Function	When Enabled	Classification
Pn160	n.□□0□	Do not adjust anti-resonance control automat- ically during execution of autotuning without a host reference, autotuning with a host refer- ence, and custom tuning.	Immediately	Turing
	n.□□1□ (default setting)	Adjust anti-resonance control automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.	ininediately	Tuning

### Vibration Suppression

You can use vibration suppression to suppress transitional vibration at a low frequency from 1 Hz to 100 Hz, which is generated mainly when the machine vibrates during positioning.

Normally, set Pn140 to n. D1DD (Adjust automatically) (default setting). Vibration will be detected during autotuning without a host reference and vibration suppression control will be automatically set.

Set  $Pn140 = n.\Box 0 \Box \Box$  (Do not adjust automatically) only if you do not change the settings for vibration suppression before you execute autotuning without a host reference.

Note: Autotuning without a host reference uses model following control. Therefore, it can be executed only if the mode is set to 2 or 3.

#### 9.6.6 Automatically Adjusted Function Settings

Parameter		Function	When Enabled	Classification
Dp140	n.	Do not adjust vibration suppression automati- cally during execution of autotuning without a host reference, autotuning with a host refer- ence, and custom tuning.	Immediately	Tuning
Pn140	n.⊡1⊡⊡ (default setting)	Adjust vibration suppression automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.	ininediately	Tuning

### Friction Compensation

Friction compensation compensates for changes in the following conditions.

- Changes in the viscous resistance of the lubricant, such as grease, on the sliding parts of the machine
- · Changes in the friction resistance resulting from variations in the machine assembly
- · Changes in the friction resistance due to aging

The conditions for applying friction compensation depend on the mode selection.

Mode Selection Settings	Friction Compensation	
1: Standard	Based on the setting of Pn408 = n.X□□□ (Friction Compensation Function Selection)*	
2: For position control	- Adjusted with friction compensation.	
3: For position control (emphasis on overshooting)		

Parameter		Function	When Enabled	Classification
Pn408	n. 0□□□ (default setting)	Disable friction compensation.	Immediately	Setup
	n. 1000	Enable friction compensation.		

\* Refer to the following section for details.

Required Parameter Settings on page 9-70

### Feedforward

If Pn140 is set to n.0 [10] (Do not use model following control and speed/torque feedforward together (default setting)) and tuning is performed with the mode selection set to 2 or 3, feed-forward (Pn109), the speed feedforward input (VFF), and the torque feedforward input (TFF) will be disabled.

To use the speed feedforward input (VFF), the torque feedforward input (TFF), and model following control from the host controller in the system, set Pn140 to n.1DDD (Use model following control and speed/torque feedforward together).

Parameter		Function	When Enabled	Classification
Pn140	n.0□□□ (default setting)	Do not use model following control and speed/torque feedforward together.	Immediately	Tuning
	n.1000	Use model following control and speed/torque feedforward together.	Intinediately	runnig

Refer to the following manual for information on the torque feedforward input (TFF) and the speed feedforward input (VFF).

Σ-7-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)



When model following control is used with the feedforward function, it is used to make optimum feedforward settings in the SERVOPACK. Therefore, model following control is not normally used together with either the speed feedforward input (VFF) or torque feedforward input (TFF) from the host controller. However, model following control can be used with the speed feedforward input (VFF) or torque feedforward input (TFF) if required. An unsuitable feedforward input may result in overshooting.

9.6.7 Related Parameters

### 9.6.7 Related Parameters

The following parameters are automatically adjusted or used as reference when you execute autotuning without a host reference.

Do not change the settings while autotuning without a host reference is being executed.

Parameter	Name	Automatic Changes
Pn100	Speed Loop Gain	Yes
Pn101	Speed Loop Integral Time Constant	Yes
Pn102	Position Loop Gain	Yes
Pn103	Moment of Inertia Ratio	Yes
Pn121	Friction Compensation Gain	Yes
Pn123	Friction Compensation Coefficient	Yes
Pn124	Friction Compensation Frequency Correction	No
Pn125	Friction Compensation Gain Correction	Yes
Pn401	First Stage First Torque Reference Filter Time Constant	Yes
Pn408	Torque-Related Function Selections	Yes
Pn409	First Stage Notch Filter Frequency	Yes
Pn40A	First Stage Notch Filter Q Value	Yes
Pn40C	Second Stage Notch Filter Frequency	Yes
Pn40D	Second Stage Notch Filter Q Value	Yes
Pn140	Model Following Control-Related Selections	Yes
Pn141	Model Following Control Gain	Yes
Pn142	Model Following Control Gain Correction	Yes
Pn143	Model Following Control Bias in the Forward Direction	Yes
Pn144	Model Following Control Bias in the Reverse Direction	Yes
Pn145	Vibration Suppression 1 Frequency A	Yes
Pn146	Vibration Suppression 1 Frequency B	Yes
Pn147	Model Following Control Speed Feedforward Compensation	Yes
Pn160	Anti-Resonance Control-Related Selections	Yes
Pn161	Anti-Resonance Frequency	Yes
Pn163	Anti-Resonance Damping Gain	Yes
Pn531	Program Jogging Travel Distance	No
Pn533	Program Jogging Movement Speed for Rotary Servomotor	No
Pn585	Program Jogging Movement Speed for Linear Servomotor	No
Pn534	Program Jogging Acceleration/Deceleration Time	No
Pn535	Program Jogging Waiting Time	No
Pn536	Program Jogging Number of Movements	No

Yes: The parameter is automatically set.

No: The parameter is not automatically set, but the setting is read during execution.

9.7.1 Outline

# 9.7 Autotuning with a Host Reference

This section describes autotuning with a host reference.



Autotuning with a host reference makes adjustments based on the set speed loop gain (Pn100). Therefore, precise adjustments cannot be made if there is vibration when adjustments are started. Make adjustments after lowering the speed loop gain (Pn100) until vibration is eliminated.

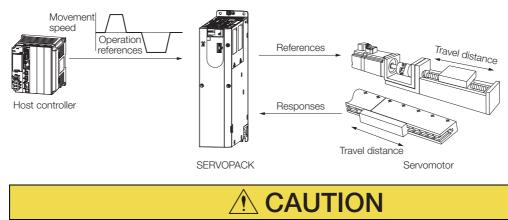
## 9.7.1 Outline

Autotuning with a host reference automatically makes optimum adjustments for operation references from the host controller.

The following items are adjusted automatically.

- · Gains (e.g., speed loop gain and position loop gain)
- Filters (torque reference filter and notch filters)
- Friction compensation
- Anti-resonance control
- Vibration suppression

Refer to the following section for details on the parameters that are adjusted. 9.7.7 Related Parameters on page 9-41



• Because autotuning with a host reference adjusts the SERVOPACK during automatic operation, vibration or overshooting may occur. To ensure safety, make sure that you can perform an emergency stop at any time.

#### 9.7.2 Restrictions

### 9.7.2 Restrictions

### Systems for Which Adjustments Cannot Be Made Accurately

Adjustments will not be made correctly for autotuning with a host reference in the following cases. Use custom tuning.

- When the travel distance for the reference from the host controller is equal to or lower than the setting of the positioning completed width (Pn522)
- Rotary Servomotors: When the movement speed for the reference from the host controller is equal to or lower than the setting of the rotation detection level (Pn502)
- Linear Servomotors: When the movement speed for the reference from the host controller is equal to or lower than the setting of the zero speed level (Pn581)
- When the time required to stop is 10 ms or less
- When the rigidity of the machine is low and vibration occurs when positioning is performed
- When the position integration function is used
- · When proportional control is used
- When mode switching is used
- When the positioning completed width (Pn522) is too narrow

Refer to the following sections for details on custom tuning.

3.8 Custom Tuning on page 9-42

### Preparations

Always check the following before you execute autotuning with a host reference.

- The servo must be in ready status.
- There must be no overtravel.
- The servo must be OFF.
- Position control must be selected if power is supplied to the motor (i.e., when the servo is ON).
- The gain selection switch must be set to manual gain selection (Pn139 =  $n.\Box\Box\Box$ ).
- The first gains must be selected.
- The test without a motor function must be disabled (Pn00C =  $n.\Box\Box\Box$ ).
- There must be no warnings.
- The tuning-less function must be disabled (Pn170 =  $n.\Box\Box\Box$ ).
- The parameters must not be write prohibited.

### 9.7.3 Applicable Tools

The following table lists the tools that you can use to perform autotuning with a host reference and the applicable tool functions.

Tool	Function	Operating Procedure Reference
Digital Operator	Fn202	Ω Σ-7-Series Digital Operator Operating Man- ual (Manual No.: SIEP S800001 33)
SigmaWin+	Tuning - Tuning	🕼 9.7.4 Operating Procedure on page 9-36

## 9.7.4 Operating Procedure

Use the following procedure to perform autotuning with a host reference.



• If you are using an MP3000-Series Controller for phase control, set the mode selection to 1. If 2 or 3 is selected for the mode, correct phase control may not be possible.

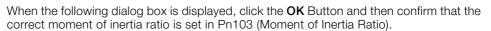
- **1.** Confirm that the moment of inertia ratio (Pn103) is set correctly.
- 2. Click the *P* Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **3.** Select Tuning in the Menu Dialog Box. The Tuning Dialog Box will be displayed. Click the **Cancel** Button to cancel tuning.
- 4. Click the Execute Button.

Tuning	×
This function executes tuning for the Servopack. Using this function while the motor is running is dangerous. Be sure to carefully read the SigmaWin+ Operation Manual before executing this function. Special care must be taken for the following.	
-Safety Precautions> 1. Before executing this function, make sure that the emergency stop (power off) can be activated when needed. The response speed may change considerably during tuning. Before executing this function, make sure that the emergency stop (power off) can be activated when needed.	_
2. Confirm the safety of the area adjoining the drive unit. Before executing this function, always confirm that the area within the motor motorn range and direction is clear for safe operation. Provide protective devices to ensure safety in the event of overtraveling or other unexpected movement.	
<ol> <li>Always confirm that there is no position error before running the notion:</li> <li>Be sare to return to the origin and reset the position information operation.</li> <li>Running the motor without resetting the origin can lead to an overrun and is extremely dangerous.</li> </ol>	
4. When the moment of inertia (mass) identification function is used for a vertical axis, check the safety of the system. When the moment of inertia (mass) identification function is used for a vertical axis, confirm that the axis level does not drop when the serve is turned off.	
<turning precautions=""> 5. Set he moment of inertia (mass) rato frst. The moment of inertia (mass) rato must be set to achieve correct tuning. Be sure to set the ratio. The setting can be performed from the Tuning window.</turning>	
<ol> <li>If vibration is generated, execute custom tuning.</li> <li>Lower the gain until there is no vibration by executing custom tuning.</li> </ol>	
Note: While tuning, you can read the precautions related to the process. Click the Precautions button provided in each tuning window.	
Execute	

5. Select the **Position reference input** Option in the **Autotuning** Area and then click the **Autotuning** Button.

Tuning AXIS#00	×
Set the moment of inertia (mass) ratio before executing autotuning.	Precautions
Moment of inertia (mass) ratio identification	
Pn103 : Moment of Inertia Ratio	
Execute.	
202 % Edit	
.↓	
Autotuning	
Reference input from host controller Position Reference Input	
C No Reference input	
Advanced adjustment	Finish

Information



Tuning
The moment of inertia (mass) ratio has never been changed from the default setting. Set a correct moment of inertia (mass) ratio in the Moment of Inertia (Mass) Setting window before starting funning. If an incorrect moment of inertia (mass) ratio is set, vibration may be generated during funning. Do you want to continue tuning?
Cancel

6. Set the conditions in the Mode selection Box and the Mechanism selection Box, and then click the Next Button.

If you select the **Start tuning using the default settings** Check Box in the **Tuning parameters** Area, the tuning parameters will be returned to the default settings before tuning is started.

Mode selection Box

	Set conditions.
[	Mode selection
	2:For positioning
	A gain adjustment specialized for positioning will be executed. In addition, the following automatic adjustments can be executed. Model following control, notch filter, anti-resonance control, and vibration suppression.
[	Mechanism selection
	2:Ball screw mechanism or linear motor
	Executes adjustment suitable for relatively high-rigidity mechanism, such as a ball screw or linear motor. Select this type if there is no applicable mechanism.
[	- Tuning parameters
	Start tuning using the default settings.
l	Lext > Cancel

• Tuning parameters Box Specify the parameters to use for tuning. If you select the Start tuning using the default settings Check Box, the tuning parameters will be returned to the default settings before tuning is started.

Set the mode.				
Mode Selection	Description			
1: Standard	Standard gain adjustment is per- formed. In addition to gain adjust- ment, notch filters and anti- resonance control are automatically adjusted.			
2: For positioning	Tuning is performed for positioning applications. In addition to gain adjustment, model following control, notch filters, anti-resonance control, and vibration suppression are auto- matically adjusted.			
3: For positioning especially to pre- vent overshooting	Tuning is performed for positioning applications with emphasis on elimi- nating overshooting. In addition to gain adjustment, notch filters, anti- resonance control, and vibration sup- pression are automatically adjusted.			

#### Mechanism selection Box

Select the type according to the machine element to drive.

If there is noise or if the gain does not increase, better results may be obtained by changing the rigidity type. Select the type according to the following guidelines.

Mechanism Selection	Description
1: Belt mechanism	Tuning is performed for a mecha- nism with relatively low rigidity, e.g., a belt.
2: Ball screw mechanism or linear motor	Tuning is performed for a mecha- nism with relatively high rigidity, e.g., a ball screw or Linear Servomotor. Use this setting if there is no other appropriate setting.
3: Rigid model	Tuning is performed for a mecha- nism with high rigidity, e.g., a rigid body system.

7. Click the Yes Button.



8. Input the correct moment of inertia ratio and click the Next Button.

🚏 Autotuning - Moment of Inertia Ratio Setting AXI 💌			
If Moment of Inertia Ratio is not correctly set, vibration may be generated.			
Is Moment of Inertia Ratio correctly set?			
Pn103 : Moment of Inertia Ratio (0 - 20000)			
[96]			
<back next=""> Cancel</back>			

**9.** First confirm safety around moving parts. Then turn ON the servo, enter a reference from the host controller, and click the **Start tuning** Button.

Autotuning - Automatic s	etting AXIS#00	×
Waiting for execution Oscillation level measurement Gain search behaviour evaluation	Tuning Turn the servo on, input the reference from the host controller, and then click the Start button.	
	Mode selection 2:For positioning	
Notch filter Anti-res Adj Vib Suppress	Mechanism selection 2:Ball screw mechanism or linear motor	
Precautions	< Back Finish Cancel	

10. Click the Yes Button.



Tuning will be executed.

Vibration that occurs during tuning will be detected automatically and suitable settings will be made for that vibration. When the settings have been completed, the indicators for the functions that were used will light at the lower left of the dialog box.

Autotuning - Automatic s	etting AXIS#00	8
Waiting for execution	Tuning Executing tuning (Input the reference.)	
Oscillation level measurement	Cancel	
Gain search behaviour evaluation		
Tuning completed	Mode selection	
	2:For positioning	
Notch filter	Mechanism selection	
Anti-res Adj Vib Suppress	2:Ball screw mechanism or linear motor	
Precautions	< Back Finish Cancel	

9.7.5 Troubleshooting Problems in Autotuning with a Host Reference

#### **11.** When tuning has been completed, click the **Finish** Button.

The results of tuning will be set in the parameters and you will return to the Tuning Dialog Box.

This concludes the procedure to perform autotuning with a host reference.

# 9.7.5 Troubleshooting Problems in Autotuning with a Host Reference

The following tables give the causes of and corrections for problems that may occur in autotuning with a host reference.

### Autotuning with a Host Reference Was Not Performed

Possible Cause	Corrective Action
Main circuit power supply is OFF.	Turn ON the main circuit power supply.
An alarm or warning occurred.	Remove the cause of the alarm or warning.
Overtraveling occurred.	Remove the cause of overtraveling.
The second gains were selected with the gain selection.	Disable automatic gain switching.
The HWBB was activated.	Release the HWBB.

### Troubleshooting Errors

Error	Possible Cause	Corrective Action
The gain adjustments were not successfully completed.	Machine vibration occurs or positioning completion is not stable when the Servomotor stops.	<ul> <li>Increase the setting of the positioning completed width (Pn522).</li> <li>Change the mode from 2 to 3.</li> <li>If machine vibration occurs, suppress the vibration with the anti-resonance control function and the vibration suppression function.</li> </ul>
Positioning was not completed within approximately 10 seconds after posi- tion adjustment was completed.	The positioning com- pleted width is too nar- row or proportional control is being used.	<ul> <li>Increase the setting of the positioning completed width (Pn522).</li> <li>Set V_PPI to 0 in the servo command output signals (SVCMD_IO).</li> </ul>

### Adjustment Results Are Not Satisfactory for Position Control

You may be able to improve the adjustment results by changing the settings of the positioning completed width (Pn522) and the electronic gear ratio (Pn20E/Pn210).

If satisfactory results are still not possible, adjust the overshoot detection level (Pn561). That may improve the adjustment results.

- Pn561 = 100% (default setting)
- This will allow tuning with overshooting that is equivalent to the positioning completed width. • Pn561 = 0%

This will allow tuning to be performed without overshooting within the positioning completed width, but the positioning completed width may be extended.

	Overshoot Detection	n Level		Speed Posit	ion Torque
Pn561	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 100	1%	100	Immediately	Setup

### 9.7.6 Automatically Adjusted Function Settings

These function settings are the same as for autotuning without a host reference. Refer to the following section.

3.6.6 Automatically Adjusted Function Settings on page 9-32

9.7.7 Related Parameters

### 9.7.7 Related Parameters

The following parameters are automatically adjusted or used as reference when you execute autotuning with a host reference.

Do not change the settings while autotuning with a host reference is being executed.

Parameter	Name	Automatic Changes
Pn100	Speed Loop Gain	Yes
Pn101	Speed Loop Integral Time Constant	Yes
Pn102	Position Loop Gain	Yes
Pn103	Moment of Inertia Ratio	No
Pn121	Friction Compensation Gain	Yes
Pn123	Friction Compensation Coefficient	Yes
Pn124	Friction Compensation Frequency Correction	No
Pn125	Friction Compensation Gain Correction	Yes
Pn401	First Stage First Torque Reference Filter Time Constant	Yes
Pn408	Torque-Related Function Selections	Yes
Pn409	First Stage Notch Filter Frequency	Yes
Pn40A	First Stage Notch Filter Q Value	Yes
Pn40C	Second Stage Notch Filter Frequency	Yes
Pn40D	Second Stage Notch Filter Q Value	Yes
Pn140	Model Following Control-Related Selections	Yes
Pn141	Model Following Control Gain	Yes
Pn142	Model Following Control Gain Correction	Yes
Pn143	Model Following Control Bias in the Forward Direction	Yes
Pn144	Model Following Control Bias in the Reverse Direction	Yes
Pn145	Vibration Suppression 1 Frequency A	Yes
Pn146	Vibration Suppression 1 Frequency B	Yes
Pn147	Model Following Control Speed Feedforward Compensation	Yes
Pn160	Anti-Resonance Control-Related Selections	Yes
Pn161	Anti-Resonance Frequency	Yes
Pn163	Anti-Resonance Damping Gain	Yes

Yes: The parameter is automatically set.

No: The parameter is not automatically set, but the setting is read during execution.

9.8.1 Outline

# 9.8 Custom Tuning

This section describes custom tuning.

### 9.8.1 Outline

You can use custom tuning to manually adjust the servo during operation using a speed or position reference input from the host controller. You can use it to fine-tune adjustments that were made with autotuning.

The following items are adjusted automatically.

- · Gains (e.g., speed loop gain and position loop gain)
- Filters (torque reference filter and notch filters)
- Friction compensation
- Anti-resonance control

Refer to the following section for details on the parameters that are adjusted. **9.8.7** *Related Parameters* on page 9-50

There are two adjustment methods that you can use for custom tuning.

 Tuning Mode 0 (Setting Servo Gains Giving Priority to Stability) or 1 (Setting Servo Gains Giving Priority to Good Response)

These modes allow you to set stable control conditions for multiple servo gains by manipulating only one tuning level. Automatic setting of notch filters and anti-resonance control is provided if vibration is detected. Manual anti-resonance control adjustment is also possible during custom tuning.

 Tuning Mode 2 (Setting Servo Gains Giving Priority to Position Control Applications) or 3 (Setting Servo Gains Giving Priority to Preventing Overshooting in Position Control Applications)

Two tuning levels are manipulated to reduce positioning time even further and set multiple servo gains.

Model following control is used to reduce the positioning time. If vibration is detected, notch filters and anti-resonance control are automatically adjusted, and friction compensation is automatically set. Manual anti-resonance control adjustment and vibration suppression are also possible during custom tuning.

# **A CAUTION**

• Vibration or overshooting may occur during custom tuning. To ensure safety, make sure that you can perform an emergency stop at any time.

### 9.8.2 Preparations

Always check the following before you execute custom tuning.

- The test without a motor function must be disabled (Pn00C =  $n.\Box\Box\Box$ ).
- The tuning-less function must be disabled (Pn170 =  $n.\Box\Box\Box$ ).
- If speed control is used, tuning mode 0 or 1 must be set.
- The parameters must not be write prohibited.

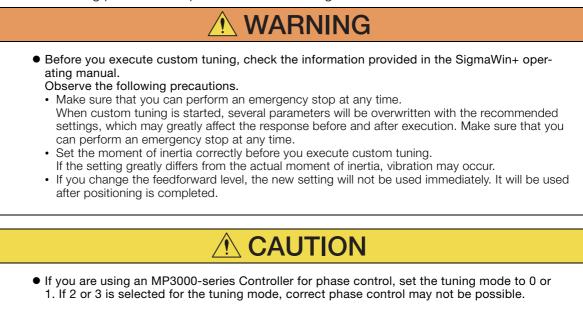
### 9.8.3 Applicable Tools

The following table lists the tools that you can use to perform custom tuning and the applicable tool functions.

Tool	Function	Operating Procedure Reference
Digital Operator	Fn203	Σ-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Tuning – Tuning	Jean Strate Stra

## 9.8.4 Operating Procedure

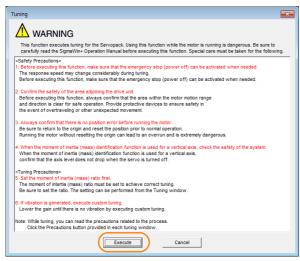
Use the following procedure to perform custom tuning.



- 1. Confirm that the moment of inertia ratio (Pn103) is set correctly.
- 2. Click the *P* Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **3.** Select Tuning in the Menu Dialog Box. The Tuning Dialog Box will be displayed. Click the **Cancel** Button to cancel tuning.

9.8.4 Operating Procedure

4. Click the Execute Button.



5. Click the Advanced adjustment Button.

Tuning AXIS#00
Set the moment of inertia (mass) ratio before Precautions
Moment of inertia (mass) ratio identification
Pn103 : Moment of Inertia Ratio
Execute
100 % Edit
Autotuning Reference input from host controller
Position Reference Input
Advanced adjustment Finish

Information

When the following dialog box is displayed, click the **OK** Button and then confirm that the correct moment of inertia ratio is set in Pn103 (Moment of Inertia Ratio).

Tuning
The moment of inertia (mass) ratio has never been changed from the default seting. Set a correct moment of inertia (mass) ratio in the Moment of Inertia (Mass) Setting window before starting turing. If an incorrect moment of inertia (mass) ratio is set, vibration may be generated during tuning. Do you want to continue tuning?
OK Cancel

6. Click the Custom tuning Button.

Tuning	- X
Click the button of the function to be execute	d.
Manually adjust gain and vibration.	
Suppress vibration by decreasing gain whe	en stopped.

7. Set the Tuning mode Box and Mechanism selection Box, and then click the Next Button.

Custom Tuning - Mode selection AXIS#00	Tuning mode Box	
Tuning mode	Mode Selection	Description
2:Set servo gains for positioning application.     O:Set servo gains with priority given to stability.     Overshoot will rarely occur since priority is given to stability. In addition     to gain adjustments, the notch filter and anti-resonance control (except     for torque (force) control) can be adjusted.     1:Set servo gains with priority given to response.	0: Set servo gains with priority given to stability.	This setting gives priority to stability and preventing overshooting. In addi- tion to gain adjustment, notch filters and anti-resonance control (except during torque control) are automatically adjusted.
Covershot may occur since priority is given to responsiveness. In addition to gain adjustments, the notch filter and anti-resonance control (except for torque (force) control) can be adjusted.	1: Set servo gains with priority given to response.	Overshooting may occur because pri- ority is given to response. In addition to gain adjustment, notch filters and anti- resonance control (except during torque control) are automatically adjusted.
Executes adjustment suitable for relatively high-rigidity mechanism, such as a ball screw or linear motor. Select this type if there is no applicable v	2: Set servo gains for positioning application.	Tuning is performed for positioning applications. In addition to gain adjust- ment, notch filters, anti-resonance control, and vibration suppression are adjusted.
Next > Cancel	3: Set servo gains especially to pre- vent overshooting during positioning application.	Tuning is performed for positioning applications with emphasis on elimi- nating overshooting. In addition to gain adjustment, notch filters, anti-reso- nance control, and vibration suppres- sion are adjusted.

#### Mechanism Selection Box

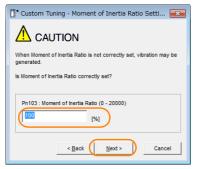
Select the type according to the machine element to drive.

If there is noise or if the gain does not increase, better results may be obtained by changing the rigidity type. Select the type according to the following guidelines.

Mechanism Selection	Description
1: Belt mechanism	Tuning is performed for a mechanism with relatively low rigidity, e.g., a belt.
2: Ball screw mechanism or Linear motor	Tuning is performed for a mechanism with relatively high rigidity, e.g., a ball screw or Linear Servomotor. Use this setting if there is no other appropriate setting.
3: Rigid body system	Tuning is performed for a mechanism with high rigidity, e.g., a rigid body system.

Information The tuning modes that you can select depend on the SERVOPACK setting.

8. If the moment of inertia ratio is not set correctly, correct the setting and then click the Next Button.



9.8.4 Operating Procedure

9. Turn ON the servo, enter a reference from the host controller, and then click the Start tuning Button.

Tuning Mode 0 or 1

Funing mode	0 : Set servo gains with priority given to stability.		Tuning mode	2 : Set servo gains for position
fechanism selection	2 : Ball screw mechanism or linear motor		Mechanism selection	2 : Ball screw mechanism or
Friction compensation	Enable		Friction compensation	Enable
Gain status	1 gain		Gain status	1 gain
Tuning level adjustment Setting the tuning level too high can cause vibration or abnormal	Tuning level and start the tuning. Tuning level	Start tuning	FF level adjustment	Tuning level Set the tuning level and st Feed forward level (FF)
Finish			FB level adjustment	Feedback level (FB)
	Auto-setting		overshooting disappears	Auto-setting
	Notch filter	Vib Detect	↓ ↓	Notch filter
	1 step inactive Cancel		$\sim$	1 step
	2 step inactive		Response level OK?	≥ 2 step
	Anti-res Ctrl Adj		No I Yes	Anti-res Ctrl Adj
	Anti-res Adj inactive Cancel	Anti-res Ctrl Adj	↓ ····	Anti-res Adj
Precautions	< Back To Autotuning Completed.	Cancel	Finish	Vib Suppression Frequency 1

#### Tuning Mode 2 or 3

Tuning mode	2 : Set servo gains for positioning application.	
Mechanism selection	2 : Ball screw mechanism or linear motor	
Friction compensation	Enable	
Gain status	1 gain	
	Tuning level	
	Set the tuning level and start the tuning. Feed forward level (FF)	
FF level adjustment		Start tuning
	I PRAM	
Increase until overshooting occurs.		
·	(1 - 2000)	
1	Feedback level (FB)	
<b>•</b>		
	1 68888	
FB level adjustment	<b>T T</b>	
Increase until	(1 - 2000)	
	(1 - 2000)	
Increase until	<u> </u>	Vib Detect
Increase until	Auto-setting Notch fiter	Vib Detect
Increase until	Auto-setting Notch filter	Vib Detect
Increase until overshooting disappears. Response level OK?	Auto-setting Notch fiter 1 step inactive 2 step inactive Cancel	Vib Detect
Increase until overshooting disappears. Response level OK?	Auto-setting Notch fitter 1 step	Vib Detect
Increase until overshooting disappears. Response level OK?	Auto-setting Notch fiter 1 step inactive 2 step inactive Cancel	
Response level OK?	Auto-setting Noto-fifter 1 step Cancel 2 step Nactive Cancel Anti-res Adj Anti-res Adj Cancel	Vib Detect
Increase until overshooting disappears. Response level OK?	Auto-setting Noto-filter 1 step inactive Cancel 2 step inactive Cancel	

#### **10.** Use the $\blacktriangle$ and $\blacktriangledown$ Buttons to change the tuning level.

Click the Back Button during tuning to restore the setting to its original value. The tuning level will return to the value from before when custom tuning was started.

#### Tuning Mode 0 or 1

Increase the tuning level until overshooting occurs.

	0 : Set servo gains with priority given to stability.		
Mechanism selection	2 : Ball screw mechanism or linear motor		
Friction compensation	Enable		
Gain status	1 gain		
Tuning level adjustmer Setting the tuning level too high can cause vibration or abnormal noise.	Tuning level Set he tuning level Tuning level	Back	
	J		
	Auto-setting Notch fiter Vibration not detected 1 step inactive Cancel	Vib Detect	

Tuning Mode 2 or 3

Increase the feedforward level until overshooting occurs and then increase the feedback level until overshooting is eliminated. Repeat these changes to make the adjustment.

Custom Tuning - Ad	lust AXIS#00	×
Tuning mode	2 : Set servo gains for positioning application.	
Mechanism selection	2 : Ball screw mechanism or linear motor	
Friction compensation	Enable	
Gain status	1 gain	
	Tuning level Set the tuning level. Feed forward level (FF)	
FF level adjustment		Back
Increase until overshooting occurs.		-
overshooting occurs.	(1 - 2000)	
↓	Feedback level (FB)	
FB level adjustment		
Increase until	(1 - 2000)	
overshooting disappears	Auto-setting	
↓ ↓	Notch filter Vibration not detected	Vib Detect
	1 step inactive Cancel	
Response level OK?	2 step inactive	-4
I Yes	Anti-res Ctrl Adj Vibration not detected	
<u> </u>	Anti-res Adj inactive Cancel	Anti-res Ctrl Adj
Finish	Vib Suppression	
	Frequency 1 inactive Cancel	Vib Suppress
Precautions	< Back To Autotuning Completed.	Cancel

Information

The new feedforward level will not be used until the positioning completed signal is output.

- 11. You can set the functions to suppress vibration (notch filters, automatic anti-resonance setting, anti-resonance control adjustment, and autotuning with a host reference) as required.
  - Refer to the following section for details.
  - Vibration Suppression Functions on page 9-48

**12.** When tuning has been completed, click the Completed Button. The values that were changed will be saved in the SERVOPACK and you will return to the Tuning Dialog Box.

Tuning mode	0 : Set servo gains with priority given to stability.
-	
Mechanism selection	2 : Ball screw mechanism or linear motor
Friction compensation	Enable
Gain status	1 gain
Tuning level adjustme Setting the tuning leve too high can cause vibration or abnormal noise.	
Finish	]
Finish	Auto-setting Noto fitter Vibration not detected Vib Detect
Finish	Notoh filter Vibration not detected
Finish	Notch filter Vibration not detected Vib Detect

This concludes the procedure to set up custom tuning.

9.8.4 Operating Procedure

### **Vibration Suppression Functions**

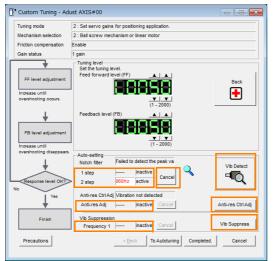
#### Notch Filters and Automatic Anti-resonance Setting

If the vibration frequency that occurs when you increase the servo gains is at 1,000 Hz or higher, notch filters are effective to suppress vibration. If the vibration is between 100 Hz and 1,000 Hz, anti-resonance control is effective.

#### Automatic Setting

To set vibration suppression automatically, use the parameters to enable notch filters and automatic anti-resonance control setting.

The notch filter frequency (stage 1 or 2) or anti-resonance control frequency that is effective for the vibration that was detected during tuning will be automatically set.



#### Auto-setting Cancel Buttons

The automatically set notch filter frequencies or the anti-resonance control frequencies may not always suppress vibration. Click the **Cancel** Button to reset the notch filter frequencies or the anti-resonance control frequencies to the values from just before these frequencies were set automatically.

When they are reset, vibration detection will start again.

• Vib Detect Button

While the notch filter or anti-resonance control adjustment automatic setting function is enabled, you can click the **Vib Detect** Button to manually detect vibration. When you click the **Vib Detect** Button, the SERVOPACK will detect vibration at that time, and set the notch filter frequency (stage 1 or 2) or anti-resonance control frequency that is effective for the detected vibration. You can also perform manual vibration detection even when the SERVOPACK does not detect vibration.

#### Anti-res Ctrl Adj Button

You can use the **Anti-res Ctrl Adj** Button to execute the anti-resonance control function if fine-tuning is required. Refer to the following section.

3.9 Anti-Resonance Control Adjustment on page 9-51

Vib Suppress Button

Click the **Vib Suppress** Button to suppress low and transient vibration (oscillation) of approximately 1 Hz to 100 Hz that occurs during positioning. Refer to the following section.

3.10 Vibration Suppression on page 9-56

#### Autotuning with a Host Reference

You can perform autotuning with a host reference. Refer to the following section for details. **9.7** Autotuning with a Host Reference on page 9-35

### 9.8.5 Automatically Adjusted Function Settings

You cannot use vibration suppression functions at the same time. Other automatic function settings are the same as for autotuning without a host reference. Refer to the following section.  $\square 2000 \pm 0.66$  Automatically Adjusted Function Settings on page 9-32

### 9.8.6 Tuning Example for Tuning Mode 2 or 3

Step	Measurement Display Examples	Operation
1	Position deviation Reference speed Positioning completion signal	The positioning time is measured after the moment of inertia ratio (Pn103) is set correctly. Tuning is completed if the specifications are met. The tuning results are saved in the SERVOPACK.
2		The positioning time will be reduced if the feedforward level is increased. Tuning is completed if the specifications are met. The tuning results are saved in the SERVOPACK. If overshooting occurs before the specifications are met, pro- ceed to step 3.
3		Overshooting will be reduced if the feedback level is increased. If the overshooting is eliminated, proceed to step 4.
4		The graph shows overshooting that occurred when the feed- forward level was increased even more after step 3. In this state, overshooting occurs, but the positioning settling time is shorter. Tuning is completed if the specifications are met. The tuning results are saved in the SERVOPACK. If over- shooting occurs before the specifications are met, repeat steps 3 and 4. If vibration occurs before the overshooting is eliminated, the vibration is suppressed with the notch filters and anti-reso- nance control.
5	-	The tuning results are saved in the SERVOPACK.

9.8.7 Related Parameters

### 9.8.7 Related Parameters

The following parameters are automatically adjusted or used as reference when you execute custom tuning.

Parameter	Name	Automatic Changes
Pn100	Speed Loop Gain	Yes
Pn101	Speed Loop Integral Time Constant	Yes
Pn102	Position Loop Gain	Yes
Pn103	Moment of Inertia Ratio	No
Pn121	Friction Compensation Gain	Yes
Pn123	Friction Compensation Coefficient	Yes
Pn124	Friction Compensation Frequency Correction	No
Pn125	Friction Compensation Gain Correction	Yes
Pn401	First Stage First Torque Reference Filter Time Constant	Yes
Pn408	Torque-Related Function Selections	Yes
Pn409	First Stage Notch Filter Frequency	Yes
Pn40A	First Stage Notch Filter Q Value	Yes
Pn40C	Second Stage Notch Filter Frequency	Yes
Pn40D	Second Stage Notch Filter Q Value	Yes
Pn140	Model Following Control-Related Selections	Yes
Pn141	Model Following Control Gain	Yes
Pn142	Model Following Control Gain Correction	Yes
Pn143	Model Following Control Bias in the Forward Direction	Yes
Pn144	Model Following Control Bias in the Reverse Direction	Yes
Pn145	Vibration Suppression 1 Frequency A	No
Pn146	Vibration Suppression 1 Frequency B	No
Pn147	Model Following Control Speed Feedforward Compensation	Yes
Pn160	Anti-Resonance Control-Related Selections	Yes
Pn161	Anti-Resonance Frequency	Yes
Pn163	Anti-Resonance Damping Gain	Yes

Do not change the settings while custom tuning is being executed.

Yes: The parameter is automatically set.

No: The parameter is not automatically set, but the setting is read during execution.

9.9.1 Outline

# 9.9 Anti-Resonance Control Adjustment

This section describes anti-resonance control.

### 9.9.1 Outline

Anti-resonance control increases the effectiveness of vibration suppression after custom tuning.

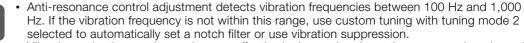
Anti-resonance control is effective for suppression of continuous vibration frequencies from 100 to 1,000 Hz that occur when the control gain is increased. Vibration can be eliminated by setting vibration frequencies through automatic detection or by manually setting them to adjust the damping gain. Input an operation reference and execute this anti-resonance control adjustment when there is vibration.

Anti-resonance control is automatically set by autotuning without a host reference or autotuning with a host reference. Use anti-resonance control adjustment only if fine-tuning is required or readjustment is required as a result of a failure to detect vibration.

Perform custom tuning if required to increase the response after performing anti-resonance control adjustment. If the control gain is increased, e.g., when custom tuning is performed, vibration may occur again. If that occurs, perform anti-resonance control adjustment again to fine-tune the parameters.

# 

- Related parameters will be set automatically when anti-resonance control adjustment is executed. This may greatly affect the response before and after execution. Make sure that you can perform an emergency stop at any time.
- Before you execute anti-resonance control adjustment, set the correct moment of inertia ratio (Pn103). If the setting greatly differs from the actual moment of inertia ratio, normal control of the machine may not be possible, and vibration may occur.



Vibration reduction can be made more effective by increasing the anti-resonance damping gain (Pn163), but the vibration may become larger if the damping gain is too high. Increase the damping gain by approximately 0% to 200% in 10% increments while checking the effect on vibration. If vibration reduction is still insufficient at a gain of 200%, cancel the setting, and lower the control gain by using a different method, such as custom tuning.

### 9.9.2 Preparations

0

Always check the following before you execute anti-resonance control adjustment.

- The tuning-less function must be disabled (Pn170 =  $n.\Box\Box\Box$ 0).
- The test without a motor function must be disabled (Pn00C =  $n.\square\square\square$ ).
- The control method must not be set to torque control.
- The parameters must not be write prohibited.

Tuning

9.9.3 Applicable Tools

### 9.9.3 Applicable Tools

The following table lists the tools that you can use to perform anti-resonance control adjustment and the applicable tool functions.

Tool	Function	Operating Procedure Reference
Digital Operator	Fn204	Ω Σ-7-Series Digital Operator Operating Man- ual (Manual No.: SIEP S800001 33)
SigmaWin+	Tuning - Tuning	🗊 9.9.4 Operating Procedure on page 9-52

#### 9.9.4 Operating Procedure

To execute anti-resonance control adjustment, an operation reference is input, and the adjustment is executed while vibration is occurring.

The following methods can be used to execute anti-resonance control adjustment.

- To automatically detect the vibration frequency
- To manually set the vibration frequency

Use the following procedure to perform anti-resonance control.

<ul> <li>Before you execute anti-resonance control adjustment, check the information provided in the SigmaWin+ operating manual. Observe the following precautions.</li> <li>Make sure that you can perform an emergency stop at any time. Parameters will be set automatically when anti-resonance control adjustment is executed. This may greatly affect the response before and after execution. Make sure that you can perform an emergency stop (to turn OFF the power supply) at any time.</li> <li>Set the moment of inertia correctly before you execute anti-resonance control adjustment. If the setting greatly differs from the actual moment of inertia, effective vibration reduction may not be possible.</li> <li>If you have already performed anti-resonance control adjustment and then you change the frequency, the current anti-resonance control effect may be lost. Caution is particularly required when automatically detecting the vibration frequency.</li> <li>If effective vibration reduction is not achieved even after you execute anti-resonance control adjustment, cancel the function and lower the control gain by using a different method, such as custom tuning.</li> <li>Perform custom tuning separately if required to increase the response after performing anti-resonance control adjustment. If the servo gain is increased, e.g., when custom tuning is performed, vibration may occur again. If that occurs, perform and lower control adjustment again to fine-tune the parameters.</li> </ul>

9.9.4 Operating Procedure

1. Perform steps 1 to 8 of the procedure for custom tuning. Refer to the following section for details.

9.8.4 Operating Procedure on page 9-43

2. Click the Anti-res Ctrl Adj Button.

The rest of the procedure depends on whether you know the vibration frequency.

Tuning mode	0 : Set servo gains with priority given to stability.		
Mechanism selection	2 : Ball screw mechanism or linear motor		
Friction compensation	Enable		
Gain status	1 gain		
Tuning level adjustmen Setting the tuning level to high can cause vibration or shormal noise.	Tuning level and start the tuning. Tuning level	ning	
	Auto-setting Notch filter Vib Det	ect	
	1 stepinactiveCancel		

**3.** If you do not know the vibration frequency, click the **Auto Detect** Button. If you know the vibration frequency, click the **Manual Set** Button.

To Automatically Detect the Vibration Frequency

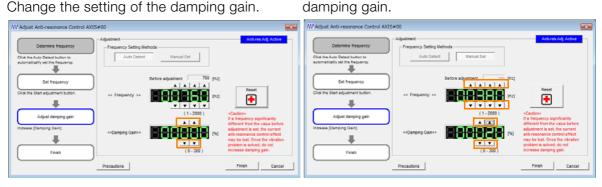
The frequency	will be	set.	
M Adjust Anti-resonance Control AXIS	#00		
Determine frequency Click the Auto Detect button to automatically set the frequency.	Adjustment		Anti-res Adj: Inactive
Set frequency Click the Start adjustment button.	« Frequency »	Before adjustment 760 [Hz]	Start adjustment
Adjust damping gain Increase (Damping Gain).	<«Damping Gain»»		«Caution» If a frequency significantly different from the value before adjustment is set, the current asti-resenance control effect may be lost. Once the vibration problem is solved, do not
Finish	Precautions	(0-300)	Increase damping gain.

To Manually Set the Vibration Frequency

Adjustment	thods	Anti-ret	Adj: Inactive
Auto Detect	Manual Set		
)	Before adjustment [Hz]	Start advant	nert
<< Frequency >>	89 <b>989</b> M	Q	
)	(1-2000)		
«Damping Gain»		anti-resonance o may be lost. Onc problem is solver	ontrol effect e the vibration I, do not
]	(0-300)	increase camping	A America
	Frequency Setting M     Auto Detect        <	Frequency Setting Methods     Auto Detect      Before adjustment     (rc)     (1.2000)     A A     (Ng)     (Ng)	

- 4. Click the Start adjustment Button.
- 5. Use the ▲ and ▼ Buttons in the Adjustment Area to change the settings. Click the **Reset** Button during tuning to restore the setting to its original value. The tuning level will return to the value from before when custom tuning was started.

To Automatically Detect the Vibration Frequency To Manually Set the Vibration Frequency Change the settings of the frequency and damping gain.



#### 9.9.5 Related Parameters

#### 6. When the adjustment has been completed, click the Finish Button.

The values that were changed will be saved in the SERVOPACK and you will return to the Tuning Dialog Box.

	Adjustment		Anti-res Adj Active
Determine frequency	- Frequency Setting M	ethods	
Click the Auto Detect button to automatically set the frequency.	Auto Detect	Manual Set	
Set frequency	ſ	Before adjustment 760 pig	a .
Click the Start adjustment button.	<< Frequency >>		t] Reset
		(1-2000)	«Caufion»
Adjust damping gain		(1-200) A	If a frequency significantly
Increase (Damping Gain).	«Damping Gain»»		different from the value before adjustment is set, the current anti-resonance control effect
Finah	<u>۱</u>	(0-300)	may be lost. Once the vibration problem is solved, do not increase damping gain.

This concludes the procedure to set up anti-resonance control.

#### 9.9.5 Related Parameters

The following parameters are automatically adjusted or used as reference when you execute anti-resonance control adjustment.

Do not change the settings while anti-resonance control adjustment is being executed.

Parameter	Name	Automatic Changes
Pn160	Anti-Resonance Control-Related Selections	Yes
Pn161	Anti-Resonance Frequency	Yes
Pn162	Anti-Resonance Gain Correction	No
Pn163	Anti-Resonance Damping Gain	Yes
Pn164	Anti-Resonance Filter Time Constant 1 Correction	No
Pn165	Anti-Resonance Filter Time Constant 2 Correction	No

Yes: The parameter is automatically set.

No: The parameter is not automatically set, but the setting is read during execution.

# 9.9.6 Suppressing Different Vibration Frequencies with Anti-resonance Control

When you use anti-resonance control and increase the control gain, for some mechanism, vibration can occur at a higher frequency than the frequency for which vibration was suppressed. If this occurs, you can suppress vibration for more than one frequency by adjusting Pn166 (Anti-Resonance Damping Gain 2).

Information

#### tion Guidelines for Vibration That Can Be Suppressed

- Anti-resonance frequency (Pn161): fa [Hz], Another vibration frequency that occurs when the control gain is increased: fb [Hz]
- Vibration frequencies: 100 Hz to 1,000 Hz
- Range of different vibration frequencies:  $1 < (fb/fa) \le 3$  to 4

### **Required Parameter Settings**

The following parameter settings are required to use anti-resonance control for more than one vibration frequency.

	Parameter	Description			Wher Enable	
n.□□□0 (default setting)		Do not use anti-resonance control.		After restar	Setun	
	n. D D I Use anti-resonance control.				Testai	
	Anti-Resonance Frequency Speed					n Torque
Pn161	Setting Range	Setting Unit	Default Setting	When Ena	abled	Classification
	10 to 20,000	0.1 Hz	1000	Immedia	ately	Tuning
	Anti-Resonance Ga	ain Correction		Speed	Positio	n Torque
Pn162	Setting Range	Setting Unit	Default Setting	When Ena	abled	Classification
	1 to 1,000	1%	100	Immedia	ately	Tuning
	Anti-Resonance Damping Gain Speed			Speed	Positio	n Torque
Pn163	Setting Range	Setting Unit	Default Setting	When Ena	abled	Classification
	0 to 300	1%	0	Immedia	,	Tuning
	Anti-Resonance Fi	ter Time Constant 1 C	orrection	Speed	Positio	n Torque
Pn164	Setting Range	Setting Unit	Default Setting	When Ena	abled	Classification
	-1,000 to 1,000	0.01 ms	0	Immedia	ately	Tuning
	Anti-Resonance Fi	ter Time Constant 2 C	orrection	Speed	Positio	n Torque
Pn165	Setting Range	Setting Unit	Default Setting	When Ena	abled	Classification
	-1,000 to 1,000	0.01 ms	0	Immedia	ately	Tuning
	Anti-Resonance Da	amping Gain 2		Speed	Positio	n Torque
Pn166	Setting Range	Setting Unit	Default Setting	When Ena	abled	Classification
	0 to 1,000	1%	0	Immedia	ately	Tuning

#### Adjustment Procedure for Suppressing Different Vibration Frequencies with Anti-resonance Control

Use the following procedure to make adjustments to suppress different vibration frequencies with anti-resonance control.

Step	Operation
1	Use the gain adjustment and anti-resonance control. Refer to the following section for details. 3.9.9.4 Operating Procedure on page 9-52
2	If there is vibration at a higher frequency than the vibration suppressed with anti-resonance control in step 1, adjust Pn166 (Anti-Resonance Damping Gain 2).
3	Adjust Pn166 (Anti-Resonance Damping Gain 2) while checking to see if vibration reduction is effective. To adjust Pn166 (Anti-Resonance Damping Gain 2), increase the setting by 10% at a time starting from the value that resulted in Pn163 (Anti-Resonance Damping Gain) from the adjustment in step 1.
4	If the vibration disappears, the adjustment is completed. However, if the vibration does not disappear even when you adjust Pn166 (Anti-Resonance Damping Gain 2), reduce the tuning level or feedback level until vibration does not occur.

9.10.1 Outline

# 9.10 Vibration Suppression

This section describes vibration suppression.

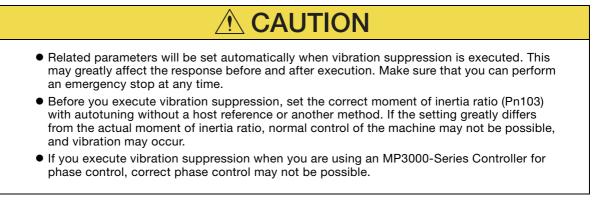
### 9.10.1 Outline

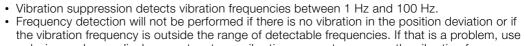
Important

You can use vibration suppression to suppress transient vibration at a low frequency from 1 Hz to 100 Hz, which is generated mainly when the machine vibrates during positioning. This is effective for vibration frequencies for which notch filters and anti-resonance control adjustment are not effective.

Vibration suppression is automatically set by autotuning without a host reference or autotuning with a host reference. Use vibration suppression only if fine-tuning is required or readjustment is required as a result of a failure to detect vibration. To execute vibration suppression, input an operation reference and execute the function when there is vibration.

Perform custom tuning if required to increase the response after performing vibration suppression.





a device such as a displacement meter or vibration sensor to measure the vibration frequency.If an automatically detected vibration frequency is not suppressed, the actual frequency and the detected frequency may be different. Fine-tune the detected frequency if necessary.

### **Items That Influence Performance**

If continuous vibration occurs while the Servomotor is stopping, vibration suppression cannot be used to suppress the vibration effectively. In this case, use anti-resonance control adjustment or custom tuning.

### **Detection of Vibration Frequencies**

Frequency detection may not be possible if vibration does not appear in the position deviation or the vibration that results from the position deviation is too small. You can adjust the detection sensitivity by changing the setting of the residual vibration detection width (Pn560), which is set as a percentage of the positioning completed width (Pn522). Perform the detection of vibration frequencies again after adjusting the setting of Pn560.

	Residual Vibration D	Detection Width		Posit	ion
Pn560	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 3,000	0.1%	400	Immediately	Setup

Note: As a guideline, change the setting 10% at a time. If the setting of this parameter is lowered, the detection sensitivity will be increased. Vibration may not be detected accurately if the setting is too small.

Information The vibration frequencies that are automatically detected may vary somewhat with each positioning operation. Perform positioning several times and make adjustments while checking the effect of vibration suppression.

#### 9.10.2 Preparations

Always check the following before you execute vibration suppression.

- Position control must be used.
- The tuning-less function must be disabled (Pn170 =  $n.\Box\Box\Box$ 0).
- The test without a motor function must be disabled (Pn00C =  $n.\Box\Box\Box$ ).
- The parameters must not be write prohibited.

#### 9.10.3 Applicable Tools

The following table lists the tools that you can use to perform vibration suppression and the applicable tool functions.

Tool	Function	Operating Procedure Reference
Digital Operator	Fn205	Ω Σ-7-Series Digital Operator Operating Man- ual (Manual No.: SIEP S800001 33)
SigmaWin+	Tuning - Tuning	3.10.4 Operating Procedure on page 9-57

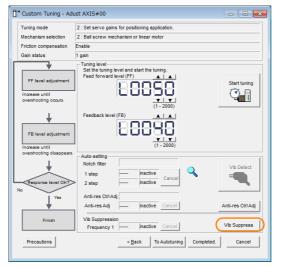
#### 9.10.4 Operating Procedure

Use the following procedure to perform vibration suppression.

1. Perform steps 1 to 8 of the procedure for custom tuning. Refer to the following section for details.

9.8.4 Operating Procedure on page 9-43

2. Click the Vib Suppress Button.



**3.** Click the Import Button or click ▲ and ▼ Button to manually adjust the set frequency. When you click the Import Button, the residual vibration frequency in the motor is read as the set frequency. (The frequency can be read only when the residual vibration frequency is between 1.0 and 100.0.)

#### 9.10.4 Operating Procedure



Frequency detection will not be performed if there is no vibration or if the vibration frequency is outside the range of detectable frequencies. If a vibration frequency is not detected, provide a means of measuring the vibration frequency.

Vibration Suppression AXIS	#00	×
Determine the frequency for setting. Click the Import battor Menual setting a site possible. The the frequency. Click the frequency. Click the Set battor bas battor finely adjust the frequency and the click adjust the frequency and the set battor agein.	Adjustment Residual Vibration Frequency Set frequency ( 1.0 - 100.0 )	Vb Suppression: Inactive
	Precautions	Finish Cancel

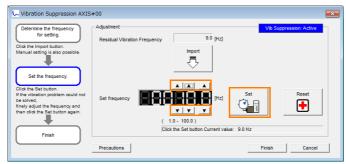
#### 4. Click the Set Button.



No settings related to vibration suppression are changed during operation. If the Servomotor does not stop within approximately 10 seconds after changing the setting, an update timeout will occur. The setting will be automatically returned to the previous value.

Vibration Suppression AXIS	#00	×
Cetermine the frequency for setting Click the Import button. Manual setting is also possible. Set the frequency. Click the Set button. If the Visition problem could not be solved. Timely adjust the frequency and	Adjustment Vib Suppression Active Residual Vibration Frequency 9.0 [H2] Import Set frequency Fre	
then dick the Set button again.	Current value: 9 0 Hz Precautions Finish Cancel	

If the vibration is not eliminated, use the  $\blacktriangle$  and  $\blacktriangledown$  Buttons for the set frequency to fine-tune the value and click the **Set** Button again.



Click the **Reset** Button during adjustment to restore the setting to its original value. The status from before when adjustment was started will be restored.

5. When the vibration has been eliminated, click the Finish Button. The updated value will be saved in the SERVOPACK.



Vibration suppression will be enabled in step 5. The Servomotor response, however, will change when the Servomotor comes to a stop with no reference input.

This concludes the procedure to set up vibration suppression.

### 9.10.5 Setting Combined Functions

You can also use the feedforward function when you execute vibration suppression.

In the default settings, feedforward (Pn109), the speed feedforward input (VFF), and the torque feedforward input (TFF) are disabled.

To use the speed feedforward input (VFF), the torque feedforward input (TFF), and model following control from the host controller in the system, set Pn140 to n.1 [] [] (Use model following control and speed/torque feedforward together).

	Parameter		Function	When Enabled	Classification
	Pn140	n.0□□□ (defaultsetting)	Do not use model following control and speed/torque feedforward together.	Immediately	Tuning
Pr	11140	n.1000	Use model following control and speed/ torque feedforward together.	Ininediately	runnig

Refer to the following manual for information on the torque feedforward input (TFF) and the speed feedforward input (VFF).

Σ-7-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

When model following control is used with the feedforward function, it is used to make optimum feedforward settings in the SERVOPACK. Therefore, model following control is not normally used together with either the speed feedforward input (VFF) or torque feedforward input (TFF) from the host controller. However, model following control can be used with the speed feedforward input (VFF) or torque feedforward input (TFF) if required. An unsuitable feedforward input may result in overshooting.

### 9.10.6 Related Parameters

The following parameters are automatically adjusted or used as reference when you execute vibration suppression.

Do not change the settings while vibration suppression is being executed.

Parameter	Name	Automatic Changes
Pn140	Model Following Control-Related Selections	Yes
Pn141	Model Following Control Gain	Yes
Pn142	Model Following Control Correction	No
Pn143	Model Following Control Bias in the Forward Direction	No
Pn144	Model Following Control Bias in the Reverse Direction	No
Pn145	Vibration Suppression 1 Frequency A	Yes
Pn146	Vibration Suppression 1 Frequency B	Yes
Pn147	Model Following Control Speed Feedforward Compensation	No
Pn14A	Vibration Suppression 2 Frequency	No
Pn14B	Vibration Suppression 2 Correction	No

Yes: The parameter is automatically set.

No: The parameter is not automatically set, but the setting is read during execution.

9.11.1 Outline

# 9.11 Speed Ripple Compensation

This section describes speed ripple compensation.

### 9.11.1 Outline

Speed ripple compensation reduces the amount of ripple in the motor speed due to torque ripple or cogging torque. You can enable speed ripple compensation to achieve smoother operation. To enable it, you must set up ripple compensation on the SigmaWin+.

# 

• Speed ripple compensation requires operating the Servomotor and therefore presents hazards. Observe the following precaution.

Confirm safety around moving parts.

This function involves automatic operation. Make sure that you can perform an emergency stop (to turn OFF the power supply) at any time.



- Execute speed ripple compensation only after adjusting the gains.
- Reset speed ripple compensation after you replace the Servomotor or SERVOPACK.

• Execute speed ripple compensation after jogging to a position that ensures a suitable range of motion.

### 9.11.2 Setting Up Speed Ripple Compensation

#### Restrictions

The following restrictions apply to the setup for speed ripple compensation.

Systems for Which Execution Cannot Be Performed

There are no restrictions.

#### Systems for Which Adjustments Cannot Be Made Accurately

Systems for which there is not a suitable range of motion

#### Preparations

Always check the following before you set up speed ripple compensation.

- The main circuit power supply must be ON.
- The servo must be OFF.
- There must be no alarms or warnings.
- There must be no hard wire base block (HWBB).
- The parameters must not be write prohibited.

9.11.2 Setting Up Speed Ripple Compensation

#### **Applicable Tools**

The following table lists the tools that you can use to set up speed ripple compensation and the applicable tool functions.

Tool	Function	Reference	
Digital Operator	You cannot set up speed ripple compensation from the Digital Operator.		
SigmaWin+	Solutions – Ripple Compensation		

#### **Operating Procedure**

Use the following procedure to set up speed ripple compensation.

- 1. Click the <u>I</u> Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- 2. Select Ripple Compensation in the Menu Dialog Box. The Ripple Compensation Dialog Box will be displayed.
- **3.** Click the **OK** Button.

Ripple Compensation
It is dangerous to operate this function, because the servomotor will rotate. Always be sure to check the user's manual before operating.
<ol> <li>Perform safety checks around moving parts.         While the operation button is being depressed, the servomotor will run at the JOG speed set. Execute after having confirmed that servomotor operation will present no danger.     </li> <li>[Forward Run Prohibit (P-OT))/[Reverse Run Prohibit (N-OT)] is disabled.         The Forward Run Prohibit (P-OT)//Reverse Run Prohibit (N-OT) signals are disabled during JOG operation (the servomotor will not stop even if the P-OT/N-OT signals are passed). When operating, carefully verify the action and position of the servomotor/machine.     </li> </ol>
Clicking the OK button to start the Ripple Compensation.

Information1. Click the Cancel Button to cancel ripple compensation. The Main Window will return.2. If write protection is set, the following dialog box will be displayed.



Click the **OK** Button to cancel write prohibition.

9.11.2 Setting Up Speed Ripple Compensation

4. Click the Edit Button.

	Writing Results	Verification	++ Confirm		- Measurement
	v pawj		l in be		Pr304 : Jogging Speed 500 [min-1] Edit Please execute by 100(min-1) or less.
4				····******	Servo DFF
2-				···-2	Forward Reverse
0= -1=				· · · • •	~ Writing Results
-2+ -3-					Write
-4 -5 -	0 60.0 120.0 180.0 2		420.0 480.0 540.0		
-		i mejnoj		÷	Confirm Reset Completed

5. Enter the jogging speed in the Input Value Box and click the OK Button.

Edit AXIS#00	<b>—X</b> —
Pn304 Jogging Speed	
Input value 500 min 1 (0 - 10000)	
ОК	Cancel

6. Click the Servo ON Button.

Kipple Compensation AXIS#00		
Measure	+ Confirm	
0	M R R	Pn304 : Jogging Speed
[dM]	[idiv]	500 [min-1] Edit
5	\$ 4	Servo OFF
2	3 	Forward
0 _1 _2	-1	Writing Results
.3		Write
-5 - 0.0 60.0 120.0 180.0 240.0 300.0 360.0 420 Time[m8]	.0 480.0 540.0 600.0 ▼	Confirm
E Before adjustment E After adjustment	[/div]	Reset Completed

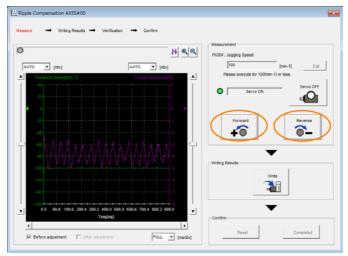
9.11.2 Setting Up Speed Ripple Compensation

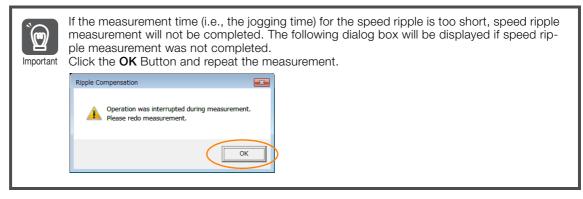
#### 7. Click the Forward Button or the Reverse Button.

Measurement operation is started.

The Servomotor shaft will rotate at the preset jogging speed while you hold down the **Forward** or **Reverse** Button and the speed ripple will be measured.

The feedback speed and torque reference graph will be displayed in the Ripple Compensation Dialog Box during jogging.





- 8. After speed ripple measurement has been completed, click the Write Button. The ripple compensation value will be written to the SERVOPACK.
- 9. After writing has been completed, click the OK Button.

Ripple Cor	mpensation	×
1	The Ripple Compensation value was written in. Please measure again and verify. If a verification result is good, please click the "Completed" button.	
	OK	

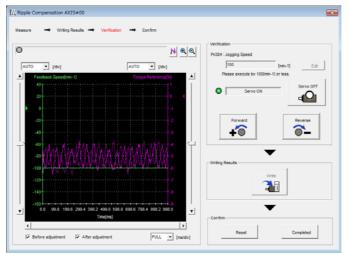
#### 9.11.3 Setting Parameters

#### 10. Click the Forward Button or the Reverse Button.

Verification operation is started.

The Servomotor shaft will rotate at the preset jogging speed while you hold down the **Forward** or **Reverse** Button.

The waveform with speed ripple compensation applied to it will be displayed.



11. If the verification results are OK, click the Finish Button.

Information To discard the setup results, click the Reset Button.

This concludes the setup for speed ripple compensation.

#### 9.11.3 Setting Parameters

The function is enabled when you perform the operating procedure on *Operating Procedure* on page 9-61. To cancel speed ripple compensation, use  $Pn423 = n.\square\square\square$  (Disable speed ripple compensation) to disable it.

Parameter		Description	When Enabled	Classifi- cation
Pn423	n.□□□0 (default setting)	Disable speed ripple compensation.	Immedi-	Setup
	n.0001	Enable speed ripple compensation.	ately	

If you enable speed ripple compensation, a compensation reference will be applied to reduce ripple even when stopped at a 0 speed reference. In speed control mode, this may result in the Servomotor moving slightly. To prevent this, set  $Pn423 = n.\Box X \Box \Box$  (Speed Ripple Compensation Enable Condition Selection) and Pn427 or Pn49F (Speed Ripple Compensation Enable Speed).

Parameter		Description	When Enabled	Classifi- cation
Pn423	n.0000 (default setting)	Speed reference	After restart	Setup
	n.0100	Motor Speed	Testart	

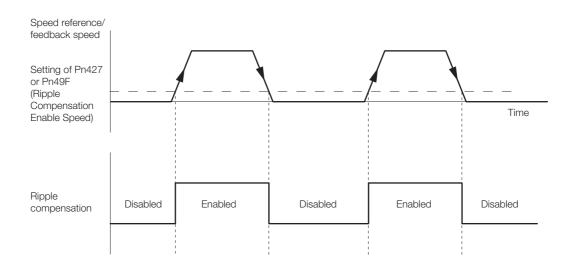
For Rotary Servomotors

	Speed Ripple Comp	ensation Enable Spe	ed	Speed Positic	Torque
Pn427	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 min <sup>-1</sup>	0	Immediately	Tuning

• For Linear Servomotors

	Speed Ripple Compensation Enable Speed			Speed Positio	n Torque
Pn49F	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 mm/s	0	Immediately	Tuning

9.11.3 Setting Parameters



#### **Speed Ripple Compensation Warnings**

The speed ripple compensation value is specific to each Servomotor. If you replace the Servomotor while speed ripple compensation is enabled, an A.942 warning (Speed Ripple Compensation Information Disagreement) will occur to warn you.

- You can use any of the following methods to clear A.942.
- Reset the speed ripple compensation value on the SigmaWin+.
- Disable speed ripple compensation (Pn423 =  $n.\Box\Box\Box$ ).
- Disable detection of A.942 (Pn423 =  $n.\Box\Box1\Box$ ).

Pa	rameter	Description	When Enabled	Classifi- cation
Pn423	n.□□0□ (default setting)	Detect A.942 alarms.	After restart	Setup
	n.0010	Do not detect A.942 alarms.		

# 9.12 Additional Adjustment Functions

This section describes the functions that you can use to make adjustments after you perform autotuning without a host reference, autotuning with a host reference, and custom tuning.

Function	Applicable Control Methods	Reference
Gain Switching	Position control, speed control, or torque control*	page 9-66
Friction Compensation	Position control or speed control	page 9-70
Current Control Mode Selection	Position control, speed control, or torque control	page 9-74
Current Gain Level Setting	Position control or speed control	page 9-74
Speed Detection Method Selection	Position control, speed control, or torque control	page 9-75
Backlash Compensation	Position Control	page 9-75

\* Automatic gain switching is enabled only for position control.

#### 9.12.1 Gain Switching

Two gain switching functions are available, manual selection and automatic switching. The manual switching function uses an external input signal to select the gains, and the automatic switching function changes the gains automatically.

You can use gain switching to shorten the positioning time by increasing the gains during positioning and suppressing vibration by decreasing the gains while stopping.

Parameter		Function	When Enabled	Classification
	n.ロロロ0 (default setting)	Use manual gain switching.	Immediately	Tuning
	n.□□□2	Use automatic gain switching pattern 1.		

Note:  $Pn139 = n.\square\square\square1$  is a reserved setting. Do not use this setting.

Refer to the following section for gain switching combinations.

Gain Switching Combinations on page 9-66

Refer to the following sections for information on manual and automatic gain switching. *Manual Gain Switching* on page 9-67 and *Automatic Gain Switching* on page 9-67

### **Gain Switching Combinations**

Selected Gains	Speed Loop Gain	Speed Loop Integral Time Constant	Position Loop Gain	Torque Refer- ence Filter	Model Fol- lowing Con- trol Gain	Model Follow- ing Control Correction	Friction Compensa- tion Gain
Gain Set- tings 1	Speed Loop Gain (Pn100)	Speed Loop Integral Time Constant (Pn101)	Position Loop Gain (Pn102)	First Stage First Torque Reference Fil- ter Time Con- stant (Pn401)	Model Fol- lowing Con- trol Gain* (Pn141)	Model Follow- ing Control Correction* (Pn142)	Friction Compensa- tion Gain (Pn121)
Gain Set- tings 2	Second Speed Loop Gain (Pn104)	Second Speed Loop Integral Time Constant (Pn105)	Second Position Loop Gain (Pn106)	First Stage Second Torque Refer- ence Filter Time Con- stant (Pn412)	Second Model Fol- lowing Con- trol Gain* (Pn148)	Second Model Following Control Gain Correction* (Pn149)	Second Friction Compensa- tion Gain (Pn122)

\* Gain switching for the model following control gain and the model following control gain correction is applicable only to manual gain switching.

To enable gain switching with these parameters, a gain switching input signal must be used and the following conditions must be met. If the conditions are not met, these parameters will not be changed even if the other parameters in the above table are changed.

There must be no reference.

• The motor must be stopped.

#### Manual Gain Switching

With manual gain switching, you use G-SEL in the servo command output signals (SVCMD\_IO) to change between gain settings 1 and gain settings 2.

Туре	Command Name	Value	Meaning
Input	G-SEL in the servo command output sig-		Changes the gain settings to gain settings 1.
Input	nals (SVCMD_IO)	1	Changes the gain settings to gain settings 2.

#### Automatic Gain Switching

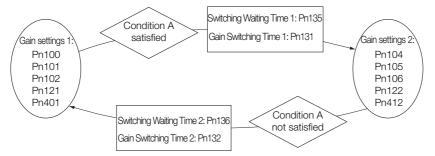
Automatic gain switching is enabled only for position control. The switching conditions are specified by using the following settings.

Parameter Switching Condition		Selected Gains	Switching Waiting Time	Switching Time	
Dp120	~ 0002	Condition A satisfied	Gain settings 1 to gain set- tings 2	Gain Switching Waiting Time 1 Pn135	Gain Switching Time 1 Pn131
	Condition A not satisfied	Gain settings 2 to gain set- tings 1	Gain Switching Waiting Time 2 Pn136	Gain Switching Time 2 Pn132	

Select one of the following settings for switching condition A.

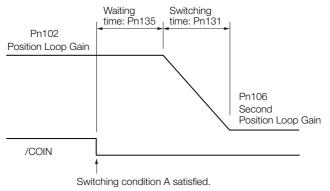
Parameter		Position Control Gain Switching Condition A	For Control Methods Other Than Position Control (No Switching)	When Enabled	Classification
	n.□□0□ (default setting)	/COIN (Positioning Com- pletion) signal ON	Gain settings 1 used.		
	n.0010	/COIN (Positioning Com- pletion) signal OFF	Gain settings 2 used.		
n.🗆 🗆 2 🗆	n.🗆 🗆 2 🗆	/NEAR (Near) signal ON	Gain settings 1 used.		
Pn139	n.🗆 🗆 3 🗆	/NEAR (Near) signal OFF	Gain settings 2 used.	Immediately	Tuning
	n.0040	Position reference filter output is 0 and position reference input is OFF.	Gain settings 1 used.		
	n.0050	Position reference input is ON.	Gain settings 2 used.		

Automatic Switching Pattern 1 (Pn139 =  $n.\Box\Box\Box$ 2)



#### Relationship between the Waiting Times and Switching Times for Gain Switching

In this example, an ON /COIN (Positioning Completion) signal is set as condition A for automatic gain switching. The position loop gain is changed from the value in Pn102 (Position Loop Gain) to the value in Pn106 (Second Position Loop Gain). When the /COIN signal turns ON, the switching operation begins after the waiting time (Pn135). The switching operation changes the position loop gain linearly from the gain set in Pn102 to the gain set in Pn106 over the switching time (Pn131).





Ation You can use gain switching for either PI control or I-P control (Pn10B =  $n.\Box\Box\Box\Box$  or  $\Box\Box$ 1 $\Box$ ).

#### **Related Parameters**

Image       Setting Range       Setting Unit       Default Setting       When Enabled       Classifi         10 to 20,000       0.1/s       400       Immediately       Tunit         First Stage First Torque Reference Filter Time Constant       Speed       Position       Torque	,
Speed Loop Integral Time ConstantSpeedPositionPn101Setting RangeSetting UnitDefault SettingWhen EnabledClassifi15 to 51,2000.01 ms2,000ImmediatelyTuniPosition Loop GainPositionPositionPositionPn102Setting RangeSetting UnitDefault SettingWhen EnabledClassifi10 to 20,0000.1/s400ImmediatelyTuniPn401Setting RangeSetting UnitDefault SettingWhen EnabledClassifi0 to 65,5350.01 ms100ImmediatelyTuniModel Following Control GainPositionPositionPositionPn141Setting RangeSetting UnitDefault SettingWhen EnabledClassifi10 to 20,0000.1/s500ImmediatelyTuniModel Following Control CorrectionPositionPositionPn142Setting RangeSetting UnitDefault SettingWhen EnabledClassifi10 to 2,0000.1%1,000ImmediatelyTuniPn124Setting RangeSetting UnitDefault SettingWhen EnabledClassifi10 to 1,0001%1,000ImmediatelyTuniPn104Setting RangeSetting UnitDefault SettingWhen EnabledClassifi10 to 1,0001%1,000ImmediatelyTuniSecond Speed Loop GainSpeedPositionTuniPn104Setting RangeSetting UnitDefault Setting </td <td>fication</td>	fication
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Interview         Interview <t< td=""><td></td></t<>	
Second Speed Loop Gain         Speed         Position           Pn104         Setting Range         Setting Unit         Default Setting         When Enabled         Classifi           10 to 20,000         0.1 Hz         400         Immediately         Turing	fication
Pn104         Setting Range         Setting Unit         Default Setting         When Enabled         Classifi           10 to 20,000         0.1 Hz         400         Immediately         Tunit	ning
10 to 20,000 0.1 Hz 400 Immediately Tuni	
	fication
Second Speed Loop Integral Time Constant Speed Position	ning
Pn105 Setting Range Setting Unit Default Setting When Enabled Classifi	fication
15 to 51,200 0.01 ms 2,000 Immediately Tuni	ning

Continued on next page.

Continued from previous page.

	Second Position Lo	op Gain		Posit	ion
Pn106	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 20,000	0.1/s	400	Immediately	Tuning
	First Stage Second	Torque Reference Fil	ter Time Constant	Speed Posit	ion Torque
Pn412	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 65,535	0.01 ms	100	Immediately	Tuning
	Second Model Follo	wing Control Gain		Posit	ion
Pn148	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 20,000	0.1/s	500	Immediately	Tuning
	Second Model Follo	wing Control Gain C	orrection	Posit	ion
Pn149	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	500 to 2,000	0.1%	1,000	Immediately	Tuning
	Second Friction Cor	npensation Gain		Speed Posit	ion
Pn122	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 1,000	1%	100	Immediately	Tuning

### Parameters Related to Automatic Gain Switching

	Gain Switching Time	e 1		Posit	ion
Pn131	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 65,535	1 ms	0	Immediately	Tuning
	Gain Switching Time	e 2		Posit	ion
Pn132	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 65,535	1 ms	0	Immediately	Tuning
	Gain Switching Wait	ting Time 1		Posit	ion
Pn135	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 65,535	1 ms	0	Immediately	Tuning
	Gain Switching Wait	ting Time 2		Posit	ion
Pn136	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 65,535	1 ms	0	Immediately	Tuning

#### **Related Monitoring**

• SigmaWin+

You can monitor gain switching with the status monitor or with tracing.

Analog Monitors

Parameter	Analog Monitor	Monitor Name	Output Value	Description
Pn006		Active Gain Monitor	1 V	Gain settings 1 are enabled.
Pn007	007 n.□□0B	Active Gain Monitor	2 V	Gain settings 2 are enabled.

Tuning

9.12.2 Friction Compensation

### 9.12.2 Friction Compensation

Friction compensation is used to compensate for viscous friction fluctuations and regular load fluctuations.

You can automatically adjust friction compensation with autotuning without a host reference, autotuning with a host reference, or custom tuning, or you can manually adjust it with the following procedure.

#### **Required Parameter Settings**

The following parameter settings are required to use friction compensation.

F	Parameter	Func	tion	When Enabled	Classification
Pn408	n.0□□□ (default setting)	Disable friction compensation.		Immediately	Setup
	n.1000	Enable friction compen	sation.		
	Friction Compension	sation Gain	Speed Posit	tion	
Pn121	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 1,000	1%	100	Immediately	Tuning
	Second Friction (	Compensation Gain		Speed Posit	tion
Pn122	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 1,000	1%	100	Immediately	Tuning
	Friction Compension	sation Coefficient	-	Speed Posit	tion
Pn123	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 100	1%	0	Immediately	Tuning
	Friction Compension	sation Frequency Corre	ction	Speed Posit	tion
Pn124	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	-10,000 to 10,00	0 0.1 Hz	0	Immediately	Tuning
	Friction Compension	sation Gain Correction		Speed Posit	tion
Pn125	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 1,000	1%	100	Immediately	Tuning

9.12.2 Friction Compensation

### **Operating Procedure for Friction Compensation**

Use the following procedure to perform friction compensation.



• Before you execute friction compensation, set the moment of inertia ratio (Pn103) as accurately as possible. If the setting greatly differs from the actual moment of inertia, vibration may occur.

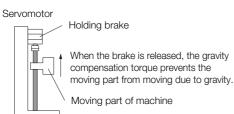
Step	Operation					
1	<ul> <li>Set the following parameters related to friction compensation to their default settings.</li> <li>Friction compensation gain (Pn121): 100</li> <li>Second friction compensation gain (Pn122): 100</li> <li>Friction compensation coefficient (Pn123): 0</li> <li>Friction compensation frequency correction (Pn124): 0</li> <li>Friction compensation gain correction (Pn125): 100</li> <li>Note: Always use the default settings for the friction compensation frequency correction (Pn124) and friction compensation gain correction (Pn125).</li> </ul>					
2	<ul> <li>Gradually increase the friction compensation coefficient (Pn123) to check the effect of friction compensation.</li> <li>Note: Usually, set the friction compensation coefficient (Pn123) to 95% or less. If the effect is insufficient, increase the friction compensation gain (Pn121) by 10% increments until vibration stops.</li> <li>Effect of Adjusted Parameters</li> <li>Pn121: Friction Compensation Gain and Pn122: Second Friction Compensation Gain These parameters set the response to external disturbances. The higher the setting is, the better the response will be. If the machine has a resonance frequency, however, vibration may occur if the setting is too high.</li> <li>Pn123: Friction Compensation Coefficient This parameter sets the effect of friction compensation. The higher the setting is, the more effective friction compensation will be. If the setting is too high, however, vibration will occur more easily. Usually, set the value to 95% or less.</li> </ul>					
3	Effect of Adjustments The following graphs show the response with and without adjustment. Poor response because of friction Position deviation High friction Before Friction Compensation After Friction Compensation Figure 200 Position reference speed After Friction Compensation					

9.12.3 Gravity Compensation

### 9.12.3 Gravity Compensation

When the Servomotor is used with a vertical axis, gravity compensation prevents the moving part from falling due to the machine's own weight when the brake is released.

SERVOPACKs with software version 0023 or higher support gravity compensation.



A timing chart for when the moving part is raised then lowered is provided below. Refer to the following section for details on brake operation timing.  $\bigcirc$  6.12.1 Brake Operating Sequence on page 6-32

SV_ON (Servo ON) command	Servo OFF	Servo ON Servo OFF
Motor power status	Power not supplied.	Power supplied. Power not supplied.
/BK (Brake) signal	OFF Brake	ON OFF
Brake contact section (lining)	applied.	Brake released. Brake applied.
Position/speed reference	0	
Motor speed	0	
Torque reference	0 Gravity compe	ensation torque (Pn476)

9.12.3 Gravity Compensation

#### **Required Parameter Settings**

The following parameter settings are required to use gravity compensation.

F	Parameter	Descr	iption	When Enabled	Classification
Pn475	n.□□□0 (default setting)	Disable gravity compensation.		After restart	Setup
	n.0001	Enable gravity compensation.			
Gravity Compensation Torque				Speed Posi	tion Torque
Pn476	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	-1,000 to 1,000	0.1%	0	Immediately	Tuning

#### **Operating Procedure for Gravity Compensation**

Use the following procedure to perform gravity compensation.

- 1. Set Pn475 to n. DDD1 (Enable gravity compensation).
- **2.** To enable changes to the settings, turn the power supply to the SERVOPACK OFF and ON again.
- **3.** Use SigmaWin+ or an analog monitor to find the torque reference value when the motor is stopped with the servo ON.
- 4. Set the torque reference value found in step 3 in Pn476 (Gravity Compensation Torque).
- 5. Turn the servo ON and OFF a few times and fine-tune Pn476 so that the moving part of the machine does not fall.

9.12.4 Current Control Mode Selection

### 9.12.4 Current Control Mode Selection

Current control mode selection reduces high-frequency noise while the Servomotor is being stopped.

Parameter		Meaning	When Enabled	Classification	
	n. 🗆 🗆 🗆	Use current control mode 1.			
Pn009	n. DD1D (default setting)	Use current control mode 2 (low noise).	After restart	Tuning	
	n. 🗆 🗆 2 🗆	Reserved setting (Do not use.)	*		



If current control mode 2 is selected, the load ratio may increase while the Servomotor is being stopped.

### 9.12.5 Current Gain Level Setting

You can set the current gain level to reduce noise by adjusting the parameter for current control inside the SERVOPACK according to the speed loop gain (Pn100). The noise level can be reduced by decreasing the current gain level (Pn13D) from its default setting of 2,000% (disabled). However, if the setting is decreased, the level of noise will be lowered, but the response characteristic of the SERVOPACK will also be reduced. Adjust the current gain level within the range that maintains the SERVOPACK response characteristic.

	Current Gain Level			Speed Posit	ion
Pn13D	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	100 to 2,000	1%	2,000	Immediately	Tuning



If the current gain level is changed, the response characteristic of the speed loop will also change. Servo tuning must therefore be performed again.

### 9.12.6 Speed Detection Method Selection

You can use the speed detection method selection to ensure smooth Servomotor speed changes during operation. To ensure smooth motor speed changes during operation, set Pn009 to  $n.\Box 1\Box \Box$  (Use speed detection 2).

With a Linear Servomotor, you can reduce the noise level of the running motor when the linear encoder scale pitch is large.

Parameter		Meaning	When Enabled	Classification
Pn009	n. □0□□ (default setting)	Use speed detection 1.	After restart	Tuning
	n. 🗆 1 🗆 🗆	Use speed detection 2.		



If the speed detection method is changed, the response characteristic of the speed loop will also change. Servo tuning must therefore be performed again.

### 9.12.7 Speed Feedback Filter

You can set a first order lag filter for the speed feedback in the speed loop. This ensures smooth changes in the feedback speed to reduce vibration. If a large value is set, it will increase the delay and make response slower.

	Speed Feedback Filter	Time Constant	Speed Position		
Pn308	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 65,535 (0.00 ms to 655.35 ms)	0.01 ms	0 (0.00 ms)	Immediately	Setup

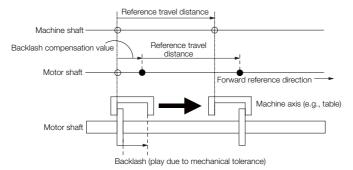
### 9.12.8 Backlash Compensation

#### Outline

If you drive a machine that has backlash, there will be deviation between the travel distance in the position reference that is managed by the host controller and the travel distance of the actual machine. Use backlash compensation to add the backlash compensation value to the position reference and use the result to drive the Servomotor. This will ensure that the travel distance of the actual machine will be the same as the travel distance in the host controller.

Note: 1. Backlash compensation can be used only with a Rotary Servomotor.

2. Backlash compensation can be used only for position control.



#### **Related Parameters**

Set the following parameters to use backlash compensation.

#### Backlash Compensation Direction

Set the direction in which to apply backlash compensation.

ŀ	Parameter	Meaning	When Enabled	Classification
Pn230	n. □□□0 (default setting)	Compensate forward references.	After restart	Setup
	n. DDD1 Compensate reverse references.			

#### Backlash Compensation Value

Set the amount of backlash compensation to add to the position reference. The amount is set in increments of 0.1 reference unit. However, when the amount is converted to encoder pulses, it is rounded off at the decimal point.

Example

When Pn231 = 6,553.6 [reference units] and electronic gear ratio (Pn20E/Pn210) = 4/1: 6,553.6 × 4 = 26,214.4 [pulses]

 $\Rightarrow$  The backlash compensation will be 26,214 encoder pulses.

	Backlash Compensation	า		Po	sition	
Pn231	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
111201	-500,000 to 500,000	0.1 reference units	0	Immediately	Setup	
Important	$Pn231 \le \frac{Pn210}{Pn20E} \times \frac{Maximum motor speed [min^*]}{60} \times Encoder resolution* \times 0.00025$					
	*Refer to the following section for the encoder resolution. I 6.15 Electronic Gear Settings on page 6-42 With fully-closed loop control, substitute the number of external encoder pulses per motor rotation for the encoder resolution in the above formula.					
	Example 1: Pn20E = 4, Pn210 = 1, Maximum motor speed = 6,000 [min <sup>-1</sup> ], and Encoder resolution = 16,777,216 (24 bits) $1/4 \times 6,000/60 \times 16,777,216 \times 0.00025 = 104,857.6$ [reference units] $\Rightarrow$ The backlash compensation will be limited to 104,857.6 reference units.					
	Example 2: Pn20E = 4, Pn210 = 1, Maximum motor speed = 6,000 [min <sup>-1</sup> ], Number of External Encoder Scale Pitches (Pn20A) = 500, and Use of the JZDP-H00 $\square$ -000 (signal resolution: 1/256): 1/4 × 6,000/60 × (500 × 256) × 0.00025 = 800.0 [reference units] $\Rightarrow$ The backlash compensation will be limited to 800.0 reference units.					
	Do not exceed the upp limit on the operation r			ion value. You can c	heck the upper	

#### Backlash Compensation Time Constant

You can set a time constant for a first order lag filter for the backlash compensation value (Pn231) that is added to the position reference.

If you set Pn233 (Backlash Compensation Time Constant) to 0, the first order lag filter is disabled.

	Backlash Compensation	n Time Constant	Position		
Pn233	Setting Range Setting Unit Default Setting			When Enabled	Classification
	0 to 65,535	0.01 ms	0	Immediately	Setup

Note: Changes to the settings are applied when there is no reference pulse input and the Servomotor is stopped. The current operation is not affected if the setting is changed during Servomotor operation.

#### **Related Monitoring**

You can monitor the following values on the operation monitor of the SigmaWin+.

Displayed Value	Setting Unit
Current Backlash Compensation Value	0.1 reference units
Backlash Compensation Value Setting Limit	0.1 reference units

#### **Compensation Operation**

This section describes the operation that is performed for backlash compensation.

Note: The following figures are for when backlash compensation is applied to references in the forward direction (Pn230 = n.  $\Box \Box \Box \Box$ ). The following monitor information is provided in the figures: TPOS (target position in the reference coordinate system), POS (reference position in the reference coordinate system), and APOS (feed-back position in the machine coordinate system). The monitor information includes the feedback position in machine coordinate system (APOS) and other feedback information.

The backlash compensation value is subtracted from the feedback positions in the monitor information, so it is not necessary for the host controller to consider the backlash compensation value.



• The encoder divided pulse output will output the number of encoder pulses for which driving was actually performed, including the backlash compensation value. If you use the encoder output pulses for position feedback at the host controller, you must consider the backlash compensation value.

#### Operation When the Servo Is ON

The backlash compensation value (Pn231) is added in the backlash compensation direction when the servo is ON (i.e., while power is supplied to the motor) and a reference is input in the same direction as the backlash compensation direction (Pn230.0 =  $n.\square\square\squareX$ ).

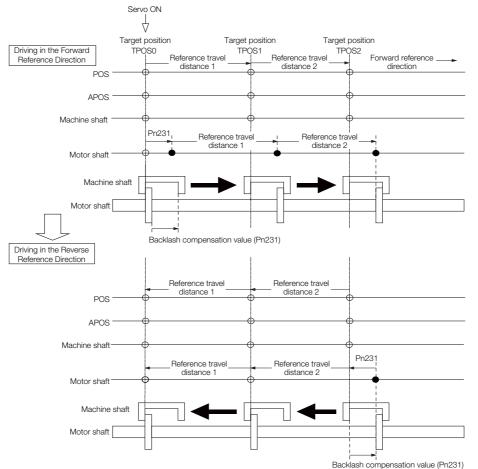
When there is a reference input in the direction opposite to the backlash compensation direction, the backlash compensation value is not added (i.e., backlash compensation is not performed).

The relationship between APOS and the motor shaft position is as follows:

- If a reference is input in the compensation direction: APOS = Motor shaft position Pn231
- If a reference is input in the direction opposite to the compensation direction: APOS = Motor shaft position

The following figure shows driving the Servomotor in the forward direction from target position TPOS0 to TPOS1 and then to TPOS2, and then returning from TPOS2 to TPOS1 and then to TPOS0.

Backlash compensation is applied when moving from TPOS0 to TPOS1, but not when moving from TPOS2 to TPOS1.



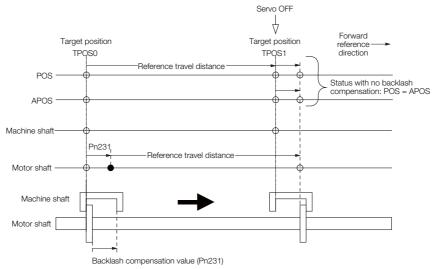
#### Operation When the Servo Is OFF

Backlash compensation is not applied when the servo is OFF (i.e., when power is not supplied to motor). Therefore, the reference position POS is moved by only the backlash compensation value.

The relationship between APOS and the motor shaft position is as follows:

• When servo is OFF: APOS = Servomotor shaft position

The following figure shows what happens when the servo is turned OFF after driving the Servomotor in the forward direction from target position TPOS0 to TPOS1. Backlash compensation is not applied when the servo is OFF. (The SERVOPACK manages the position data so that APOS and POS are the same.)



#### Operation When There Is Overtravel

When there is overtravel (i.e., when driving is prohibited due to an overtravel signal or software limit), the operation is the same as for when the servo is OFF ( $\blacklozenge$  Operation When the Servo Is OFF on page 9-79), i.e., backlash compensation is not applied.

#### Operation When Control Is Changed

Backlash compensation is performed only for position control.

Backlash compensation is not applied when position control is changed to any other control method.

Backlash compensation is applied in the same way as when the servo is ON ( Operation When the Servo Is ON on page 9-78) if any other control method is changed to position control.

#### **Related Monitoring**

You can monitor the following values on the operation monitor of the SigmaWin+.

Displayed Value	Unit	Specification
Input Reference Pulse Speed	min <sup>-1</sup>	Displays the input reference pulse speed before backlash compensation.
Position Deviation	Reference units	Displays the position deviation for the position reference after backlash compensation.
Input Reference Pulse Counter	Reference units	Displays the input reference pulse counter before back- lash compensation.
Feedback Pulse Counter	Encoder pulses	Displays the number of pulses from the actually driven motor encoder.
Fully-Closed Feedback Pulse Counter	External encoder resolution	Displays the number of pulses of the actually driven exter- nal encoder.
Feedback Pulse Counter	Reference units	Displays the number of pulses from the actually driven encoder in reference units.

9.12.8 Backlash Compensation

# **MECHATROLINK Monitor Information**

This section describes the information that is set for the MECHATROLINK monitor information (monitor 1, monitor 2, monitor 3, and monitor 4) and the backlash compensation operation.

Monitor Code	Abbreviation	Description	Unit	Remarks
0	POS	Reference position in the reference coordi- nate system (after the position reference filter)	Reference units	-
1	MPOS	Reference position	Reference units	_
2	PERR	Position deviation	Reference units	_
3	APOS	Feedback position in machine coordinate system	Reference units	Feedback position with the backlash com- pensation subtracted
4	LPOS	Feedback latch posi- tion in the machine coordinate system	Reference units	Feedback position with the backlash com- pensation subtracted
5	IPOS	Reference position in the reference coordi- nate system (before the position reference filter)	Reference units	-
6	TPOS	Target position in the reference coordinate system	Reference units	_
E	OMN1	Option monitor 1 (selected with Pn824)	-	-
F	OMN2	Option monitor 2 (selected with Pn825)	-	_

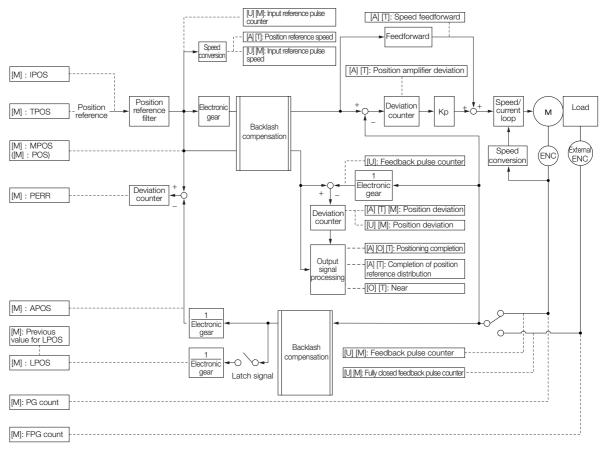
Para	ameter	Monitor Information	Output Unit	Remarks
	0003h	Position deviation (lower 32 bits)	Reference units	-
	0004h	Position deviation (upper 32 bits)	Reference units	-
	000Ah	PG count (lower 32 bits)	Reference units	Count value of the actually driven motor
	000Bh	PG count (upper 32 bits)	Reference units	encoder
	000Ch	FPG count (lower 32 bits)	Reference units	Count value of the actually driven external
	000Dh	FPG count (upper 32 bits)	Reference units	encoder
Pn824 Pn825	0017h	Input reference pulse speed	min <sup>-1</sup>	-
	0018h	Position deviation	Reference units	_
	001Ch	Input reference pulse counter	Reference units	_
	001Dh	Feedback pulse counter	Encoder pulses	-
	001Eh	Fully-closed feedback pulse counter	External encoder resolution	_
	0080h	Previous value of latched feedback posi- tion (LPOS)	Reference units	Feedback position with the backlash compensation subtracted

9.12.8 Backlash Compensation

## Related Monitoring Diagrams

The following symbols are used in the related monitoring diagrams.

- [A]: Analog monitor
- [U]: Monitor mode (Un monitor)
- [O]: Output signal
- [T]: Trace data
- [M]: MECHATROLINK monitor information



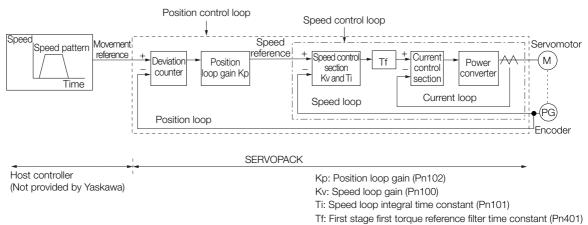
9.13.1 Tuning the Servo Gains

# 9.13 Manual Tuning

This section describes manual tuning.

# 9.13.1 Tuning the Servo Gains

## Servo Gains



In order to manually tune the servo gains, you must understand the configuration and characteristic of the SERVOPACK and adjust the servo gains individually. In most cases, if you greatly change any one parameter, you must adjust the other parameters again. To check the response characteristic, you must prepare a measuring instrument to monitor the output waveforms from the analog monitor.

The SERVOPACK has three feedback systems (the position loop, speed loop, and current loop), and the response characteristic must be increased more with the inner loops. If this relationship is not maintained, the response characteristic will suffer and vibration will occur more easily.

A sufficient response characteristic is ensured for the current loop. There is never a need for it to be adjusted by the user.

# Outline

You can use manual tuning to set the servo gains in the SERVOPACK to increase the response characteristic of the SERVOPACK. For example, you can reduce the positioning time for position control.

Use manual tuning in the following cases.

- When tuning with autotuning without a host reference or autotuning with a host reference does not achieve the desired results
- When you want to increase the servo gains higher than the gains that resulted from autotuning without a host reference or autotuning with a host reference
- · When you want to determine the servo gains and moment of inertia ratio yourself

You start manual tuning either from the default parameter settings or from the gain settings that resulted from autotuning without a host reference or autotuning with a host reference.

# **Applicable Tools**

You can monitor the servo gains with the SigmaWin+ or with the analog monitor.

# Precautions

Vibration may occur while you are tuning the servo gains. We recommend that you enable vibration alarms (Pn310 =  $n.\square\square\square$ ) to detect vibration. Refer to the following section for information on vibration detection.

7.11 Initializing the Vibration Detection Level on page 7-50

Vibration alarms are not detected for all vibration. Also, an emergency stop method is necessary to stop the machine safely when an alarm occurs. You must provide an emergency stop device and activate it immediately whenever vibration occurs.

# Tuning Procedure Example (for Position Control or Speed Control)

Step	Description
1	Adjust the first stage first torque reference filter time constant (Pn401) so that vibration does not occur.
2	Increase the Speed loop gain (Pn100) and reduce the speed loop integral time constant (Pn101) as far as possible within the range that does not cause machine vibration.
3	Repeat steps 1 and 2 and return the settings about 10% to 20% from the values that you set.
4	For position control, increase the position loop gain (Pn102) within the range that does not cause vibration.

Information If you greatly change any one servo gain parameter, you must adjust the other parameters again. Do not increase the setting of just one parameter. As a guideline, adjust the settings of the servo gains by approximately 5% each. As a rule, change the servo parameters in the following order.

- To Increase the Response Speed
- 1. Reduce the torque reference filter time constant.
- 2. Increase the speed loop gain.
- 3. Decrease the speed loop integral time constant.
- 4. Increase the position loop gain.
- To Reduce Response Speed and to Stop Vibration and Overshooting
- 1. Reduce the position loop gain.
- 2. Increase the speed loop integral time constant.
- 3. Decrease the speed loop gain.
- 4. Increase the torque filter time constant.

## Adjusted Servo Gains

You can set the following gains to adjust the response characteristic of the SERVOPACK.

- Pn100: Speed Loop Gain
- Pn101: Speed Loop Integral Time Constant
- Pn102: Position Loop Gain
- Pn401: First Stage First Torque Reference Filter Time Constant

## ♦ Position Loop Gain

The position loop gain determines the response characteristic of the position loop in the SER-VOPACK. If you can increase the setting of the position loop gain, the response characteristic will improve and the positioning time will be shortened. However, you normally cannot increase the position loop gain higher than the inherit vibration frequency of the machine system. Therefore, to increase the setting of the position loop gain, you must increase the rigidity of the machine to increase the inherit vibration frequency of the machine.

	Position Loop Gain		Position		
Pn102	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 20,000	0.1/s	400	Immediately	Tuning

#### 9.13.1 Tuning the Servo Gains

For machines for which a high position loop gain (Pn102) cannot be set, overflow alarms can Information occur during high-speed operation. If that is the case, you can increase the setting of the following parameter to increase the level for alarm detection.

Use the following condition as a guideline for determining the setting.

 $Pn520 \ge \frac{Maximum feed speed [reference units/s]}{2.0} \times 2.0$ Pn102 ÷ 10 (1/s)

If you use a position reference filter, transient deviation will increase due to the filter time constant. When you make the setting, consider deviation accumulation that may result from the filter.

	Position Deviation	Overflow Alarm	Position		
Pn520	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
111020	1 to 1,073,741,823	1 reference unit	5,242,880	Immediately	Setup

## Speed Loop Gain

This parameter determines the response characteristic of the speed loop. If the response characteristic of the speed loop is low, it becomes a delay factor for the position loop located outside of the speed loop. This will result in overshooting and vibration in the speed reference. Therefore, setting the speed loop gain as high as possible within the range that will not cause the machine system to vibrate will produce a stable Servo System with a good response characteristic.

	Speed Loop Gain			Speed Positi	on Torque
Pn100	Setting Range	Setting Unit	Default Setting	When Enabled	Classifica- tion
	10 to 20,000	0.1 Hz	400	Immediately	Tuning

Setting of Pn103 =  $\frac{\text{Load moment of inertia at motor shaft }(J_L)}{\text{Servomotor moment of inertia }(L_M)} \times 100(\%)$ 

The default setting of Pn103 (Moment of Inertia Ratio) is 100. Before you tune the servo, calculate the moment of inertia ratio with the above formula and set Pn103 to the calculation result.

	Moment of Inertia R	atio	0		on Torque
Pn103	Setting Range	Setting Unit	Default Setting	When Enabled	Classifica- tion
	0 to 20,000	1%	100	Immediately	Tuning

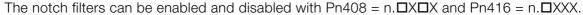
### Speed Loop Integral Time Constant

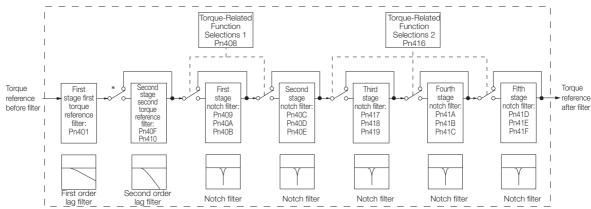
To enable response to even small inputs, the speed loop has an integral element. The integral element becomes a delay factor in the Servo System. If the time constant is set too high, overshooting will occur, positioning settling time will increase, and the response characteristic will suffer.

	Speed Loop Integral Time Constant			Speed Position	
Pn101	Setting Range	Setting Unit	Default Setting	When Enabled	Classifica- tion
	15 to 51,200	0.01 ms	2,000	Immediately	Tuning

### ◆ Torque Reference Filter

As shown in the following diagram, the torque reference filter contains a first order lag filter and notch filters arranged in series, and each filter operates independently.





\* The second stage second torque reference filter is disabled when Pn40F is set to 5,000 (default setting) and it is enabled when Pn40F is set to a value lower than 5,000.

### ■ Torque Reference Filter

If you suspect that machine vibration is being caused by the Servo Drive, try adjusting the torque reference filter time constant. This may stop the vibration. The lower the value, the better the control response characteristic will be, but there may be a limit depending on the machine conditions.

	First Stage First Torque Reference Filter Time Constant			Speed Posit	ion Torque
Pn401	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 65,535	0.01 ms	100	Immediately	Tuning
	Second Stage Second Torque Reference Filter Frequency		Speed Posit	ion Torque	
Pn40F	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	100 to 5,000	1 Hz	5000*	Immediately	Tuning
	Second Stage Seco	nd Torque Reference	e Filter Q Value	Speed Posit	ion Torque
Pn410	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	50 to 100	0.01	50	Immediately	Tuning

\* The filter is disabled if you set the parameter to 5,000.

#### Notch Filters

The notch filter can eliminate specific frequency elements generated by the vibration of sources such as resonance of the shaft of a ball screw.

The notch filter puts a notch in the gain curve at the specific vibration frequency (called the notch frequency). The frequency components near the notch frequency can be reduced or removed with a notch filter.

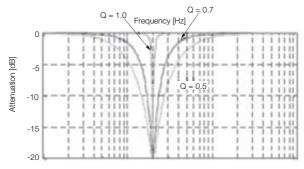
Notch filters are set with three parameters for the notch filter frequency, notch filter Q value, and notch filter depth. This section describes the notch filter Q value and notch filter depth.

#### Notch filter Q Value

The setting of the notch filter Q value determines the width of the frequencies that are filtered for the notch filter frequency. The width of the notch changes with the notch filter Q value. The larger the notch filter Q value is, the steeper the notch is and the narrower the width of frequencies that are filtered is.

#### 9.13.1 Tuning the Servo Gains

The notch filter frequency characteristics for different notch filter Q values are shown below.

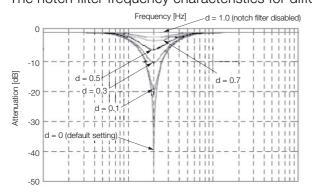


Note: The above notch filter frequency characteristics are based on calculated values and may be different from actual characteristics.

#### Notch Filter Depth

The setting of the notch filter depth determines the depth of the frequencies that are filtered for the notch filter frequency. The depth of the notch changes with the notch filter depth. The smaller the notch filter depth is, the deeper the notch is, increasing the effect of vibration suppression. However, if the value is too small, vibration can actually increase.

The notch filter is disabled if the notch filter depth, d, is set to 1.0 (i.e., if Pn419 is set to 1,000). The notch filter frequency characteristics for different notch filter depths are shown below.



Note: The above notch filter frequency characteristics are based on calculated values and may be different from actual characteristics.

You can enable or disable the notch filter with Pn408 and Pn416.

F	Parameter	Meaning	When Enabled	Classification
	n.□□□0 (default setting)	Disable first stage notch filter.		
Dn/08	n.0001	Enable first stage notch filter.		
Pn408	n.□0□□ (default setting)	Disable second stage notch filter.		
	n.0100	Enable second stage notch filter.	Immediately	Setup
	n.□□□0 (default setting)	Disable third stage notch filter.		
	n.0001	Enable third stage notch filter.		
Pn416	n.□□0□ (default setting)	Disable fourth stage notch filter.		
	n.0010	Enable fourth stage notch filter.		
	n.□0□□ (default setting)	Disable fifth stage notch filter.		
	n.🗆 1 🗆 🗆	Enable fifth stage notch filter.		

9.13.1 Tuning the Servo Gains

	First Stage Notch Fi	Iter Frequency	-	Speed Posit	ion Torque
Pn409	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	50 to 5,000	1 Hz	5,000	Immediately	Tuning
	First Stage Notch Fi	ilter Q Value		Speed Posit	ion Torque
Pn40A	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	50 to 1,000	0.01	70	Immediately	Tuning
	First Stage Notch Fi	ilter Depth		Speed Posit	ion Torque
Pn40B	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 1,000	0.001	0	Immediately	Tuning
	Second Stage Notc	h Filter Frequency		Speed Posit	ion Torque
Pn40C	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	50 to 5,000	1 Hz	5,000	Immediately	Tuning
	Second Stage Notc	h Filter Q Value		Speed Posit	ion Torque
Pn40D	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	50 to 1,000	0.01	70	Immediately	Tuning
	Second Stage Notc	h Filter Depth		Speed Posit	ion Torque
Pn40E	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 1,000	0.001	0	Immediately	Tuning
	Third Stage Notch F	ilter Frequency		Speed Posit	ion Torque
Pn417	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	50 to 5,000	1 Hz	5,000	Immediately	Tuning
	Third Stage Notch F	ilter Q Value		Speed Posit	ion Torque
Pn418	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	50 to 1,000	0.01	70	Immediately	Tuning
	Third Stage Notch F	ilter Depth		Speed Posit	ion Torque
Pn419	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 1,000	0.001	0	Immediately	Tuning
	Fourth Stage Notch	Filter Frequency		Speed Posit	ion Torque
Pn41A	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	50 to 5,000	1 Hz	5,000	Immediately	Tuning
	Fourth Stage Notch	Filter Q Value		Speed Posit	ion Torque
Pn41B	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	50 to 1,000	0.01	70	Immediately	Tuning
	Fourth Stage Notch	Filter Depth		Speed Posit	ion Torque
Pn41C	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 1,000	0.001	0	Immediately	Tuning
	Fifth Stage Notch Fi	ilter Frequency		Speed Posit	ion Torque
Pn41D	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	50 to 5,000	1 Hz	5,000	Immediately	Tuning
	Fifth Stage Notch Fi	ilter Q Value		Speed Posit	ion Torque
Pn41E	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	50 to 1,000	0.01	70	Immediately	Tuning
	Fifth Stage Notch Fi	ilter Depth		Speed Posit	ion Torque
Pn41F	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 1,000	0.001	0	Immediately	Tuning
					4

Set the machine vibration frequencies in the notch filter parameters.

Important	<ul> <li>Do not set notch filter frequencies (Pn409, Pn40C, Pn417, Pn41A, and Pn41D) that are close to the speed loop's response frequency. Set a frequency that is at least four times the speed loop gain (Pn100). (However, Pn103 (Moment of Inertia Ratio) must be set correctly. If the setting is not correct, vibration may occur and the machine may be damaged.</li> <li>Change the notch filter frequencies (Pn409, Pn40C, Pn417, Pn41A, and Pn41D) only while the Servomotor is stopped. Vibration may occur if a notch filter frequency is changed during operation.</li> </ul>
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## **Guidelines for Manually Tuning Servo Gains**

When you manually adjust the parameters, make sure that you completely understand the information in the product manual and use the following conditional expressions as guidelines. The appropriate values of the parameter settings are influenced by the machine specifications, so they cannot be determined universally. When you adjust the parameters, actually operate the machine and use the SigmaWin+ or analog monitor to monitor operating conditions. Even if the status is stable while the Servomotor is stopped, an unstable condition may occur when an operation reference is input. Therefore, input operation references and adjust the servo gains as you operate the Servomotor.

Stable gain: Settings that provide a good balance between parameters.

However, if the load moment of inertia is large and the machine system contains elements prone to vibration, you must sometimes use a setting that is somewhat higher to prevent the machine from vibrating.

Critical gain: Settings for which the parameters affect each other

Depending on the machine conditions, overshooting and vibration may occur and operation may not be stable. If the critical gain condition expressions are not met, operation will become more unstable, and there is a risk of abnormal motor shaft vibration and round-trip operation with a large amplitude. Always stay within the critical gain conditions.

If you use the torque reference filter, second torque reference filter, and notch filters together, the interference between the filters and the speed loop gain will be superimposed. Allow leeway in the adjustments.



The following adjusted value guidelines require that the setting of Pn103 (Moment of Inertia Ratio) is correctly set for the actual machine.

## • When $Pn10B = n.\Box\Box0\Box$ (PI Control)

Guidelines are given below for gain settings 1.

The same guidelines apply to gain settings 2 (Pn104, Pn105, Pn106, and Pn412).

- Speed Loop Gain (Pn100 [Hz]) and Position Loop Gain (Pn102 [/s]) Stable gain: Pn102 [/s]  $\leq 2\pi \times Pn100/4$  [Hz] Critical gain: Pn102 [/s]  $< 2\pi \times Pn100$  [Hz]
- Speed Loop Gain (Pn100 [Hz]) and Speed Loop Integral Time Constant (Pn101 [ms]) Stable gain: Pn101 [ms] ≥ 4,000/(2π × Pn100 [Hz]) Critical gain: Pn101 [ms] > 1,000/(2π × Pn100 [Hz])
- Speed Loop Gain (Pn100 [Hz]) and First Stage First Torque Reference Filter Time Constant (Pn401 [ms]) Stable gain: Pn401 [ms] ≤ 1,000/(2π × Pn100 [Hz] × 4) Critical gain: Pn401 [ms] < 1,000/(2π × Pn100 [Hz] × 1)</li>
- Speed Loop Gain (Pn100 [Hz]) and Second Stage Second Torque Reference Filter Frequency (Pn40F [Hz])
   Critical gain: Pn40F [Hz] > 4 × Pn100 [Hz]
   Note: Set the second stage second torque reference filter Q value (Pn410) to 0.70.
- Speed Loop Gain (Pn100 [Hz]) and First Stage Notch Filter Frequency (Pn409 [Hz]) (or Second Stage Notch Filter Frequency (Pn40C [Hz])) Critical gain: Pn409 [Hz] > 4 × Pn100 [Hz]
- Speed Loop Gain (Pn100 [Hz]) and Speed Feedback Filter Time Constant (Pn308 [ms]) Stable gain: Pn308 [ms]  $\leq$  1,000/( $2\pi \times$  Pn100 [Hz]  $\times$  4) Critical gain: Pn308 [ms] < 1,000/( $2\pi \times$  Pn100 [Hz]  $\times$  1)

## • When $Pn10B = n.\Box\Box1\Box$ (I-P Control)

Guidelines are given below for gain settings 1.

The same guidelines apply to gain settings 2 (Pn104, Pn105, Pn106, and Pn412).

For I-P control, the relationships between the speed loop integral time constant, speed loop gain, and position loop gain are different from the relationships for PI control. The relationship between other servo gains is the same as for PI control.

- Speed Loop Gain (Pn100 [Hz]) and Speed Loop Integral Time Constant (Pn101 [ms]) Stable gain: Pn100 [Hz] ≥ 320/Pn101 [ms]
- Position Loop Gain (Pn102 [/s]) and Speed Loop Integral Time Constant (Pn101 [ms]) Stable gain: Pn102 [/s] ≤ 320/Pn101 [ms]

### Information Selecting the Speed Loop Control Method (PI Control or I-P Control)

Usually, I-P control is effective for high-speed positioning and high-speed, high-precision processing applications. With I-P control, you can use a lower position loop gain than for PI control to reduce the positioning time and reduce arc radius reduction. However, if you can use mode switching to change to proportional control to achieve the desired application, then using PI control would be the normal choice.

### Decimal Points in Parameter Settings

For the SGD7S SERVOPACKs, decimal places are given for the settings of parameters on the Digital Operator, Panel Operator, and in the manual. For example with Pn100 (Speed Loop Gain), Pn100 = 40.0 is used to indicate a setting of 40.0 Hz. In the following adjusted value guidelines, the decimal places are also given.



Speed Loop Gain (Pn100 [Hz]) and Speed Loop Integral Time Constant (Pn101 [ms]) Stable gain: Pn101 [ms]  $\geq$  4,000/( $2\pi \times$  Pn100 [Hz]), therefore If Pn100 = 40.0 [Hz], then Pn101 = 4,000/( $2\pi \times$  40.0)  $\approx$  15.92 [ms].

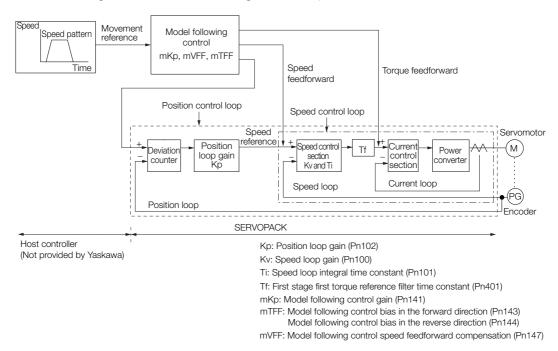
9.13.1 Tuning the Servo Gains

# **Model Following Control**

You can use model following control to improve response characteristic and shorten positioning time. You can use model following control only with position control.

Normally, the parameters that are used for model following control are automatically set along with the servo gains by executing autotuning or custom tuning. However, you must adjust them manually in the following cases.

- When the tuning results for autotuning or custom tuning are not acceptable
- When you want to increase the response characteristic higher than that achieved by the tuning results for autotuning or custom tuning
- · When you want to determine the servo gains and model following control parameters yourself



The block diagram for model following control is provided below.

## Manual Tuning Procedure

Use the following tuning procedure for using model following control.

Step	Description
1	Friction compensation must also be used. Set the friction compensation parameters. Refer to the following section for the setting procedure.
2	<ul> <li>Adjust the servo gains. Refer to the following section for an example procedure.</li> <li><i>Tuning Procedure Example (for Position Control or Speed Control)</i> on page 9-83</li> <li>Note: 1. Set the moment of inertia ratio (Pn103) as accurately as possible.</li> <li>2. Refer to the guidelines for manually tuning the servo gains and set a stable gain for the position loop gain (Pn102).</li> <li><i>Guidelines for Manually Tuning Servo Gains</i> on page 9-88</li> </ul>
3	Increase the model following control gain (Pn141) as much as possible within the range in which overshooting and vibration do not occur.
4	If overshooting occurs or if the response is different for forward and reverse operation, fine-tune model following control with the following settings: model following control bias in the forward direction (Pn143), model following control bias in the reverse direction (Pn144), and model following control speed feedforward compensation (Pn147).

### ◆ Related Parameters

Next we will describe the following parameters that are used for model following control.

- Pn140 (Model Following Control-Related Selections)
- Pn141 (Model Following Control Gain)
- Pn143 (Model Following Control Bias in the Forward Direction)
- Pn144 (Model Following Control Bias in the Reverse Direction)
- Pn147 (Model Following Control Speed Feedforward Compensation)

### Model Following Control-Related Selections

Set  $Pn140 = n.\Box\Box\BoxX$  to specify whether to use model following control.

If you use model following control with vibration suppression, set Pn140 to  $n.\Box\Box1\Box$  or Pn140 =  $n.\Box\Box2\Box$ . When you also perform vibration suppression, adjust vibration suppression with custom tuning in advance.

Note: If you use vibration suppression (Pn140 = n.  $\Box \Box \Box \Box$  or Pn140 = n.  $\Box \Box \Box \Box$ ), always set Pn140 to n.  $\Box \Box \Box \Box$  (Use model following control).

F	Parameter	Function	When Enabled	Classification
Pn140	n.□□□0 (default setting)	Do not use model following control.	Immediately	Tuning
	n.0001	Use model following control.		
	n.□□0□ (default setting)	Do not perform vibration suppression.		
	n.0010	Perform vibration suppression for a specific frequency.		
	n.0020	Perform vibration suppression for two specific frequencies.		

#### Model Following Control Gain

The model following control gain determines the response characteristic of the Servo System. If you increase the setting of the model following control gain, the response characteristic will improve and the positioning time will be shortened. The response characteristic of the Servo System is determined by this parameter, and not by Pn102 (Position Loop Gain).

	Model Following Control Gain			Position	
Pn141	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 20,000	0.1/s	500	Immediately	Tuning

Information For machines for which a high model following control gain cannot be set, the size of the position deviation in model following control will be determined by the setting of the model following control gain. For a machine with low rigidity, in which a high model following control gain cannot be set, position deviation overflow alarms may occur during high-speed operation. If that is the case, you can increase the setting of the following parameter to increase the level for alarm detection.

Use the following conditional expression for reference in determining the setting.

Pn 520  $\geq$  Maximum feed speed [reference units/s]  $\times$  2.0

Pn 141/10 [1/s]

Pn520	Position Deviation	Overflow Alarm	Position		
	Setting Range Setting Unit Defau		Default Setting	When Enabled	Classification
111020	1 to 1,073,741,823	1 reference unit	5,242,880	Immediately	Setup

9.13.1 Tuning the Servo Gains

# Model Following Control Bias in the Forward Direction and Model Following Control Bias in the Reverse Direction

If the response is different for forward and reverse operation, use the following parameters for fine-tuning.

If you decrease the settings, the response characteristic will be lowered but overshooting will be less likely to occur.

	Model Following Co	ontrol Bias in the Forv	Position		
Pn143	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	0.1%	1,000	Immediately	Tuning
	Model Following Co	ontrol Bias in the Rev	Position		
Pn144	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	0.1%	1,000	Immediately	Tuning

### Model Following Control Speed Feedforward Compensation

If overshooting occurs even after you adjust the model following control gain, model following control bias in the forward direction, and model following control bias in the reverse direction, you may be able to improve performance by setting the following parameter.

If you decrease the settings, the response characteristic will be lowered but overshooting will be less likely to occur.

	Model Following Co	ontrol Speed Feedfor	Position		
Pn147	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	0.1%	1,000	Immediately	Tuning

### ■ Model Following Control Type Selection

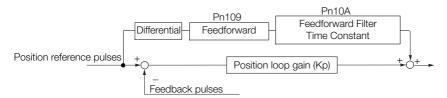
When you enable model following control, you can select the model following control type. Normally, set Pn14F to n. DDD1 (Use model following control type 2) (default setting). If compatibility with previous models is required, set Pn14F to n. DDD0 (Use model following control type 1).

Parameter		Meaning	When Enabled	Classification
	n.□□□0	Use model following control type 1.		
Pn14F	n.□□□1 (default setting)	Use model following control type 2.	After restart	Tuning

The compatible adjustment functions are used together with manual tuning. You can use these functions to improve adjustment results. These functions allow you to use the same functions as for  $\Sigma$ -III-Series SERVOPACKs to adjust  $\Sigma$ -7-Series SERVOPACKs.

# Feedforward

The feedforward function applies feedforward compensation to position control to shorten the positioning time.



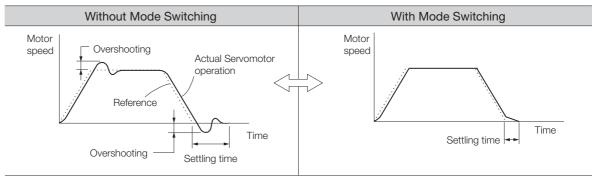
	Feedforward		Position			
Pn109	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 100	1%	0	Immediately	Tuning	
	Feedforward Filter Time Constant			Position		
Pn10A	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 6,400	0.01 ms	0	Immediately	Tuning	

Note: If you set the feedforward value too high, the machine may vibrate. As a guideline, use a setting of 80% or less.

# Mode Switching (Changing between Proportional and PI Control)

You can use mode switching to automatically change between proportional control and PI control.

Overshooting caused by acceleration and deceleration can be suppressed and the settling time can be reduced by setting the switching condition and switching levels.



**D** Tuning

## ♦ Related Parameters

Select the switching condition for mode switching with  $Pn10B = n.\Box\Box\BoxX$ .

Parameter		Mode Switching	Parameter That Sets the Level		When	Classification
ſ	arameter	Selection	Rotary Servomotor	Linear Servomotor	Enabled	Classification
	n.□□□0 (default setting)	Use the internal torque reference as the condition.	Pn <sup>-</sup>	10C	Immediately	
	n.0001	Use the speed ref- erence as the con- dition.	Pn10D	Pn181		
Pn10B	n.0002	Use the accelera- tion reference as the condition.	Pn10E	Pn182		Setup
	n.0003	Use the position deviation as the condition.	Pn	10F	Ť	
	n.0004	Do not use mode switching.	-	-		

### Parameters That Set the Switching Levels

Rotary Servomotors

	Mode Switching L	evel for Torque Ref	erence	Speed Position		
Pn10C	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 800	1%	200	Immediately	Tuning	
	Mode Switching L	evel for Speed Ref	erence	Speed	Position	
Pn10D	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 10,000	1 min⁻¹	0	Immediately	Tuning	
	Mode Switching Level for Acceleration			Speed Position		
Pn10E	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 30,000	1 min <sup>-1</sup> /s	0	Immediately	Tuning	
	Mode Switching L	evel for Position De	eviation	Position		
Pn10F	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 10,000	1 reference unit	0	Immediately	Tuning	

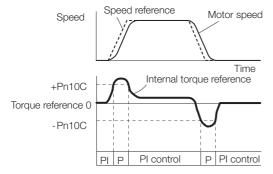
• Linear Servomotors

	Mode Switching L	evel for Force Refe	rence	Speed Position		
Pn10C	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 800	1%	200	Immediately	Tuning	
	Mode Switching L	evel for Speed Ref	erence	Speed	Position	
Pn181	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 10,000	1 mm/s	0	Immediately	Tuning	
	Mode Switching Level for Acceleration			Speed Position		
Pn182	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 30,000	1 mm/s <sup>2</sup>	0	Immediately	Tuning	
	Mode Switching L	evel for Position De	eviation	F	Position	
Pn10F	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 10.000	1 reference unit	0	Immediately	Tuning	

 Using the Internal Torque Reference as the Mode Switching Condition (Default Setting)

When the Internal torque reference equals or exceeds the torque set for the mode switching level for torque reference (Pn10C), the speed loop is changed to P control.

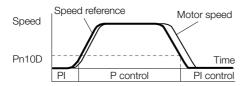
The default setting for the torque reference level is 200%.



#### ■ Using the Speed Reference as the Mode Switching Condition

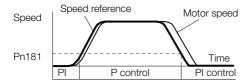
### Rotary Servomotors

When the speed reference equals or exceeds the speed set for the mode switching level for a speed reference (Pn10D), the speed loop is changed to P control.



Linear Servomotors

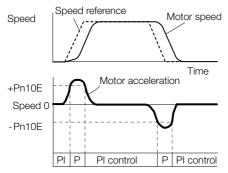
When the speed reference equals or exceeds the speed set for the mode switching level for a speed reference (Pn181), the speed loop is changed to P control.



### Using the Acceleration as the Mode Switching Condition

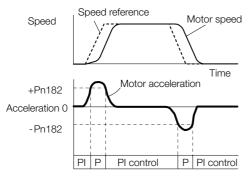
Rotary Servomotors

When the speed reference equals or exceeds the acceleration rate set for the mode switching level for acceleration (Pn10E), the speed loop is changed to P control.



• Linear Servomotors

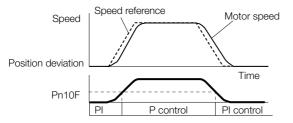
When the speed reference equals or exceeds the acceleration rate set for the mode switching level for acceleration (Pn182), the speed loop is changed to P control.



### ■ Using the Position Deviation as the Mode Switching Condition

When the position deviation equals or exceeds the value set for the mode switching level for position deviation (Pn10F), the speed loop is changed to P control.

This setting is enabled only for position control.



## **Position Integral**

The position integral is the integral function of the position loop. It is used for the electronic cams and electronic shafts when using the SERVOPACK with a Yaskawa MP3000-Series Machine Controller.

	Position Integral Time Constant			Position	
Pn11F	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 50,000	0.1 ms	0	Immediately	Tuning

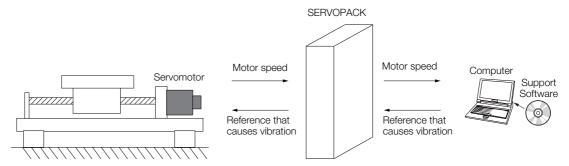
9.14.1 Mechanical Analysis

# 9.14 Diagnostic Tools

# 9.14.1 Mechanical Analysis

## Overview

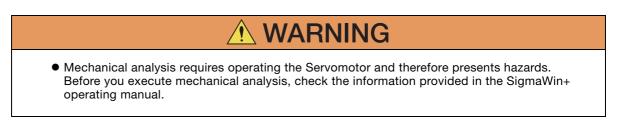
You can connect the SERVOPACK to a computer to measure the frequency characteristics of the machine. This allows you to measure the frequency characteristics of the machine without using a measuring instrument.



The Servomotor is used to cause machine vibration and then the speed frequency characteristics for the motor torque are measured. The measured frequency characteristics can be used to determine the machine resonance.

You determine the machine resonance for use in servo tuning and as reference for considering changes to the machine. The performance of the servo cannot be completely utilized depending on the rigidity of the machine. You may need to consider making changes to the machine. The information can also be used as reference for servo tuning to help you adjust parameters, such as the servo rigidity and torque filter time constant.

You can also use the information to set parameters, such as the notch filters.

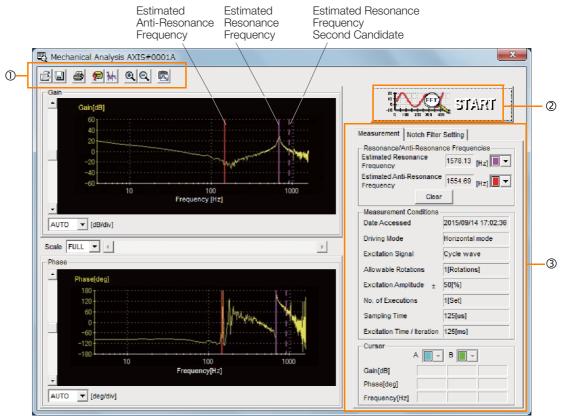


9.14.1 Mechanical Analysis

## **Frequency Characteristics**

The Servomotor is used to cause the machine to vibrate and the frequency characteristics from the torque to the motor speed are measured to determine the machine characteristics. For a normal machine, the resonance frequencies are clear when the frequency characteristics are plotted on graphs with the gain and phase (bode plots). The bode plots show the size (gain) of the response of the machine to which the torque is applied, and the phase delay (phase) in the response for each frequency. Also, the machine resonance frequency can be determined from the maximum frequency of the valleys (anti-resonance) and peaks (resonance) of the gain and the phase delay.

For a Servomotor without a load or for a rigid mechanism, the gain and phase change gradually in the bode plots.



- ① Toolbar
- ② START Button

Click the **START** Button to start analysis.

③ Measurement and Notch Filter Setting Tab Pages

Measurement Tab Page: Displays detailed information on the results of analysis.

Notch Filter Setting Tab Page: Displays the notch filter frequencies. You can set these values in the parameters.

The machine is made to vibrate and a resonance frequency is detected from the generated vibration to set notch filters according to the detected resonance frequencies. This is used to eliminate high-frequency vibration and noise.

During execution of Easy FFT, a frequency waveform reference is sent from the SERVOPACK to the Servomotor to automatically cause the shaft to rotate multiple times within 1/4th of a rotation, thus causing the machine to vibrate.

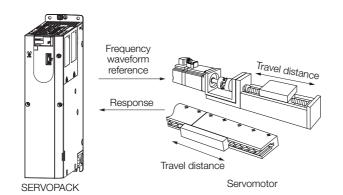
Execute Easy FFT after the servo is turned OFF if operation of the SERVOPACK results in high-frequency noise and vibration.

WARNING

 Never touch the Servomotor or machine during execution of Easy FFT. Doing so may result in injury.



• Use Easy FFT when the servo gain is low, such as in the initial stage of servo tuning. If you execute Easy FFT after you increase the gain, the machine may vibrate depending on the machine characteristics or gain balance.



Easy FFT is built into the SERVOPACK for compatibility with previous products. Normally use autotuning without a host reference for tuning.

# Preparations

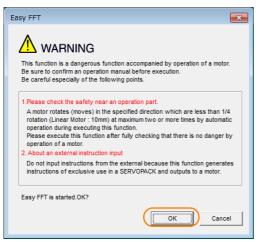
Always check the following before you execute Easy FFT.

- The parameters must not be write prohibited.
- The main circuit power supply must be ON.
- The test without a motor function must be disabled (Pn00C =  $n.\Box\Box\Box$ ).
- There must be no alarms.
- There must be no hard wire base block (HWBB).
- The servo must be OFF.
- There must be no overtravel.
- An external reference must not be input.

## **Operating Procedure**

Use the following procedure for Easy FFT.

- 1. Click the <u>I</u> Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- Select Easy FFT in the Menu Dialog Box. The Easy FFT Dialog Box will be displayed. Click the Cancel Button to cancel Easy FFT. You will return to the main window.
- 3. Click the OK Button.



4. Click the Servo ON Button.

Easy FFT AXIS#00	<b>—</b>
Servo ON/OFF operation	
Servo OFF	Servo ON
Measurement start / Stopping operation	
Measurement condition	
Stimulus signal Frequency	Start
Instruction amplitude 15 [%]	
(1 - 800) Rotation (moving) Forward 💌	~
Measurement result	
Detected resonance frequency	[Hz]
Optimal notch filter frequency	[Hz]
Notch filter selection	
	Measurement complete

 Select the instruction (reference) amplitude and the rotation direction in the Measurement condition Area, and then click the Start Button. The Servomotor shaft will rotate and measurements will start.

Easy FFT AXIS#		<b>—</b> ×
- Servo ON/OFF operat	ion	
Serv	ro ON	Servo OFF
- Measurement start / S	topping operation	
-Measurement condi	ion	
Stimulus signal	Frequency	start I
Instruction amplitude	15 🕂 [%]	
	(1 - 800)	
Rotation (moving) direction	Forward 💌	
-Measurement result -		
Detected resonanc	e frequency	[Hz]
Optimal notch filter	frequency	[Hz]
Notch filter selectio	n 📃	
		Measurement complete

When measurements have been completed, the measurement results will be displayed.

6. Check the results in the Measurement result Area and then click the Measurement complete Button.

Easy FFT AXIS#00	×
Servo ON/OFF operation	
Measurement start / Stopping operation Measurement condition Stimulus signal Frequency Instruction amplitude 15 • . [%] (1 - 800) Rotation (moving) Forward	Start C
Detected resonance frequency 502	[Hz]
Optimal notch filter frequency 502	[Hz]
Notch filter selection The 1st step	
	Measurement complete

7. Click the **Result Writing** Button if you want to set the measurement results in the parameters.

Easy FFT AXIS#00	×
Notch filter selection	
Pn408:Torque-Related Function Selections digit 0 Notch Filter Selection 1	
0:Disable first stage notch filter.	_
_	
1:Enable first stage notch filter.	_
,	
Notch filter frequency	
Pn409:First Stage Notch Filter Frequency	
5000 [Hz] <b>5</b> 02 [Hz]	
· · · · · · · · · · · · · · · · · · ·	
Please click a button, when you reflect a measurement result in User Param	ieter.
and the second se	
Result Writing	

This concludes the procedure to set up Easy FFT.

## **Related Parameters**

The following parameters are automatically adjusted or used as reference when you execute Easy FFT.

Do not change the settings of these parameters during execution of Easy FFT.

Parameter	Name	Automatic Changes
Pn408	Torque-Related Function Selections	Yes
Pn409	First Stage Notch Filter Frequency	Yes
Pn40A	First Stage Notch Filter Q Value	No
Pn40C	Second Stage Notch Filter Frequency	Yes
Pn40D	Second Stage Notch Filter Q Value	No
Pn456	Sweep Torque Reference Amplitude	No

Yes: The parameter is automatically set.

No: The parameter is not automatically set, but the setting is read during execution.

# Monitoring

This chapter provides information on monitoring SERVO-PACK product information and SERVOPACK status. (10)

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10.1.1 Items That You Can Monitor

# **10.1 Monitoring Product Information**

# 10.1.1 Items That You Can Monitor

Monitor Items					
Information on SERVOPACKs	<ul> <li>Model/Type</li> <li>Serial Number</li> <li>Manufacturing Date</li> <li>Software version (SW Ver.)</li> <li>Remarks</li> </ul>				
Information on Servomotors	<ul> <li>Model/Type</li> <li>Serial Number</li> <li>Manufacturing Date</li> <li>Remarks</li> </ul>				
Information on Encoders	<ul> <li>Model/Type</li> <li>Serial Number</li> <li>Manufacturing Date</li> <li>Software version (SW Ver.)</li> <li>Remarks</li> </ul>				

# 10.1.2 Operating Procedures

Use the following procedure to display the Servo Drive product information.

• Select *Read Product Information* in the Menu Dialog Box of the SigmaWin+. The Read Product Information Window will be displayed.

Product Information	Export				
- 0001-SGD7W-1R6A20A			<del>70</del>		
SERVOPACK	Model/Type	Serial Number	Manufacturing Date	SW Ver.	Remarks
SERVOPACK	SGD7W-1R6A20A (MECHATROLINK-III interface multi a)		2015.10	F021	[Specification] : Standard
Motor	Model/Type	Number	Manufacturing Date	SW Ver.	Remarks
Motor	SGM7J-02A7A21	20131204	2013.12		[Resolution] : 16777216 [Pulse/rev]
Encoder	UTTAI-B24RH		2013.12	0001	[Encoder type] : absolute
Motor 2	SGMAV-02A3A21	R13092-361-DK500	2010.05		[Resolution] : 1048576 [Pulse/rev]
Encoder	UTTAH-B20DG	K247-B0AF14J8	2010.04	0004	[Encoder type] : absolute

Information

With the Digital Operator, you can use Fn011, Fn012, and Fn01E to monitor this information. Refer to the following manual for the differences in the monitor items compared with the SigmaWin+.

Ω Σ-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)

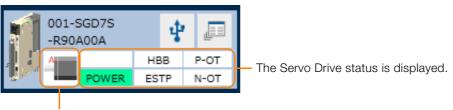
10.2.1 Servo Drive Status

# 10.2 Monitoring SERVOPACK Status

# 10.2.1 Servo Drive Status

Use the following procedure to display the Servo Drive status.

• Start the SigmaWin+. The Servo Drive status will be automatically displayed when you go online with a SERVOPACK.



The Servomotor type is displayed.

# 10.2.2 Monitoring Status and Operations

# Items That You Can Monitor

The items that you can monitor on the Status Monitor Window and Motion Monitor Window are listed below.

Status Monitor Window

Monitor Items						
<ul> <li>Main Circuit</li> <li>Encoder (PGRDY)</li> <li>Motor Power (Request</li> <li>Motor Power ON</li> <li>Dynamic Brake (DB)</li> <li>Rotation (Movement) Direction</li> <li>Mode Switch</li> <li>Speed Reference (V-R</li> <li>Torque Reference (T-R</li> <li>Position Reference (PULS)</li> <li>Position Reference Direction</li> <li>Surge Current Limiting Resistor Short Relay</li> <li>Regenerative Error Detection</li> <li>AC Power ON</li> <li>Overcurrent</li> <li>Origin Not Passed</li> </ul>	Status		Output Signal Status	<ul> <li>ALM (Servo Alarm Output Signal)</li> <li>/COIN (Positioning Com- pletion Output Signal)</li> <li>/V-CMP (Speed Coinci- dence Detection Output Signal)</li> <li>/TGON (Rotation Detec- tion Output Signal)</li> <li>/S-RDY (Servo Ready Out- put Signal)</li> <li>/CLT (Torque Limit Detec- tion Output Signal)</li> <li>/CLT (Speed Limit Detec- tion Output Signal)</li> <li>/VLT (Speed Limit Detec- tion Output Signal)</li> <li>/WARN (Warning Output Signal)</li> <li>/MEAR (Near Output Sig- nal)</li> <li>PAO (Encoder Divided Pulse Output Phase A Sig- nal)</li> <li>PEO (Encoder Divided Pulse Output Phase B Sig- nal)</li> <li>PCO (Encoder Divided Pulse Output Phase C Sig- nal)</li> <li>/PM (Preventative Mainte- nance Output Signal)</li> <li>/DBON (Dynamic Brake Operation Request Output Signal)</li> </ul>		

### 10.2.2 Monitoring Status and Operations

#### Motion Monitor Window

Monitor Items					
Current Alarm State	Power Consumption				
<ul> <li>Motor Speed</li> </ul>	Consumed Power				
<ul> <li>Speed Reference</li> </ul>	<ul> <li>Cumulative Power Consumption</li> </ul>				
<ul> <li>Internal Torque Reference</li> </ul>	<ul> <li>DB Resistor Consumption Power</li> </ul>				
<ul> <li>Angle of Rotation 1 (number of</li> </ul>	<ul> <li>Absolute Encoder Multiturn Data</li> </ul>				
encoder pulses from origin within one	<ul> <li>Absolute Encoder Position within One Rota-</li> </ul>				
encoder rotation)	tion				
Angle of Rotation 2 (angle from origin	Absolute Encoder (Lower)				
within one encoder rotation)	Absolute Encoder (Upper)				
<ul> <li>Input Reference Pulse Speed</li> </ul>	Reference Pulse Counter				
Deviation Counter (Position Deviation)	<ul> <li>Feedback Pulse Counter</li> </ul>				
Cumulative Load	<ul> <li>Fully Closed Feedback Pulse Counter</li> </ul>				
<ul> <li>Regenerative Load</li> </ul>	Total Operating Time				

## **Operating Procedure**

Use the following procedure to display the Motion Monitor and Status Monitor for the SERVO-PACK.

- Select *Monitor* in the SigmaWin+ Menu Dialog Box.
  - The Operation Pane and Status Pane will be displayed in the Monitor Window.

<b>A</b>			YASK	AWA SigmaWin	+ Ver.7	
	Monitor					
	Operation					
	Control	1/F 🗸	Item 🗸	Unit	0001-SV2- Axis A	
0001-SV2 -020L2 +BBB P-OT	POSI SPO TRQ	Common	Mctor rotating speed	min-1	0	
POWER ESTP N-OT	590	Common	Speed reference	min-1	0	
	POS SPO TRQ	Common	Input reference pulse speed	min-1	0	
	POS SPO TRO	Common	Position error amount	reference ur	0	
	POS SPO TRQ	Common	Accumulated load ratio	%	0	
	POS SPO TRO	Common	Regenerative load ratio	%	0	
	POS SPO TRO	Common	Power consumed by DB resi	%	0	
	POS SPO TRO	Common	Current Alarm State	-	Normal	
	Status 1/0					
	Status 1/O Status					
	Status	I/F 🗸	Item 🗸		0001-SV2- Axis A	
	Status		Item 🗸	ON(ALL)		
	Status Control	Common		ON(ALL) -	Axis A	
	Status Control POS SPO TRO POS SPO TRO	Common	Dynamic Brake (DB)	ON(ALL) - -	Axis A ON	
	Status Control Pos SP0 180 Pos SP0 180 Pos	Common Common	Dynamic Brake (DB) Origin not Passed	-	Axis A ON OFF	
	Status Control Pos SP0 180 Pos SP0 180 Pos	Common Common Common Common	Dynamic Brake (DB) Origin not Passed /COIN	-	Axis A ON OFF OFF	
	Status Control Pos SP0 TE0 Pos SP0 TE0 Pos SP0 Pos SP0 TE0	Common Common Common Common Common	Dynamic Brake (DB) Origin not Passed /COIN /V-CMP	-	Axis A ON OFF OFF OFF	
	Status Control Pos SP0 TE0 Pos SP0 TE0 Pos SP0 Pos SP0 TE0	Common Common Common Common Common	Dynamic Brake (DB) Origin not Passed /COIN /V-CMP /S-RDY		Axis A ON OFF OFF OFF OFF	

Information

You can flexibly change the contents that are displayed in the Monitor Window. Refer to the following manual for details.

C Engineering Tool SigmaWin+ Operation Manual (Manual No.: SIET S800001 34)

# 10.2.3 I/O Signal Monitor

Use the following procedure to check I/O signals.

- 1. Click the <u>I</u> Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- 2. Select Wiring Check in the Menu Dialog Box. The Wiring Check Dialog Box will be displayed.
- 3. Click the Monitor Mode Button.

Wiring check AXIS#00			×
Model SGD75-R	IOA2OA Monitor Forced Ou		Hi Lo Forced Hi Forced Lo
CN1-13 - 88 - CN1-7 - 98 -	7		
CN1-8 - HI - CN1-9 /DEC HI Deceleration Limit Switc	PAO Output OFI PBO Output ON PCO Output OFI		CN1-17,18 CN1-19,20 CN1-21,22
CN1-10 /EXT1 HI No EXT1 Interrupt Requ		H BK	CN1-1,2 CN1-23,24
CN1-12 /EXT3 He Ni EXT3 Interrupt Requ	e Alarm Generatio		CN1-25,26 CN1-3,4
Input signal status	Out	put signal s	tatus

Information

You can also use the above window to check wiring.

- Checking Input Signal Wiring
- Change the signal status at the host controller. If the input signal status on the window changes accordingly, then the wiring is correct.Checking Output Signal Wiring
  - Click the **Force Output Mode** Button. This will force the output signal status to change. If the signal status at the host controller changes accordingly, then the wiring is correct. You cannot use the **Force Output Mode** Button while the servo is ON.

10.3.1 Items That You Can Monitor

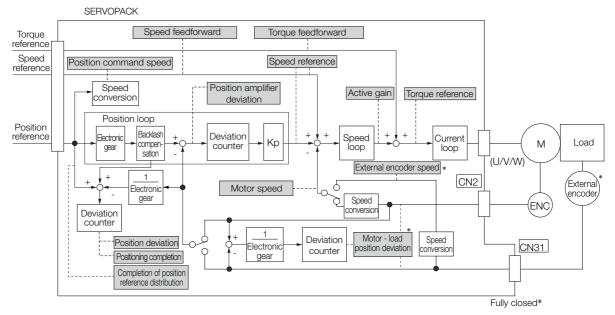
# **10.3** Monitoring Machine Operation Status and Signal Waveforms

To monitor waveforms, use the SigmaWin+ trace function or a measuring instrument, such as a memory recorder.

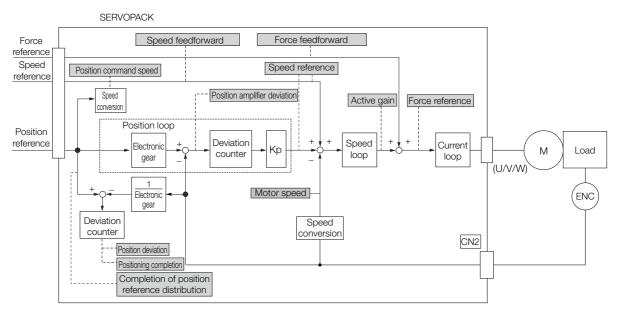
# 10.3.1 Items That You Can Monitor

You can use the SigmaWin+ or a measuring instrument to monitor the shaded items in the following block diagram.





- \* This speed is available when fully-closed loop control is being used.
- Linear Servomotors



# 10.3.2 Using the SigmaWin+

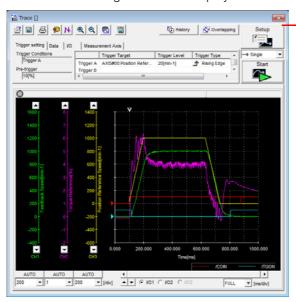
This section describes how to trace data and I/O with the SigmaWin+.

Refer to the following manual for detailed operating procedures for the SigmaWin+.

C Engineering Tool SigmaWin+ Operation Manual (Manual No.: SIET S800001 34)

# **Operating Procedure**

- 1. Click the <u>I</u> Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- 2. Select Trace in the Menu Dialog Box. The Trace Dialog Box will be displayed.



Click this button to display the Trace Setting Dialog Box shown below, and set the data to trace and the trace conditions.



# **Trace Objects**

You can trace the following items.

Data Tracing

Trace Objects		
<ul> <li>Torque Reference</li> <li>Feedback Speed</li> <li>Reference Speed</li> <li>Position Reference Speed</li> <li>Position Error (Deviation)</li> <li>Position Amplifier Error (Deviation)</li> </ul>	<ul> <li>Motor - Load Position Deviation</li> <li>Speed Feedforward</li> <li>Torque Feedforward</li> <li>Effective (Active) Gain</li> <li>Main Circuit DC Voltage</li> <li>External Encoder Speed</li> <li>Control Mode</li> </ul>	

#### • I/O Tracing

	Trace Objects			
Input Signals	<ul> <li>P-OT (Forward Drive Prohibit Input Signal)</li> <li>N-OT (Reverse Drive Prohibit Input Signal)</li> <li>/P-CL (Forward External Torque/Force Limit Input Signal)</li> <li>/N-CL (Reverse External Torque/Force Limit Input Signal)</li> <li>/G-SEL (Gain Selection Input Signal)</li> <li>/P-DET (Polarity Detection Input Signal)</li> <li>/DEC (Origin Return Deceleration Switch Input Signal)</li> <li>/EXT1 (External Latch Input 1 Signal)</li> <li>/EXT2 (External Latch Input 2 Signal)</li> <li>/EXT3 (External Latch Input 3 Signal)</li> <li>FSTP (Forced Stop Input Signal)</li> <li>SEN (Absolute Data Request Input Signal)</li> <li>/HWBB1 (Hard Wire Base Block Input 1 Signal)</li> <li>/HWBB2 (Hard Wire Base Block Input 2 Signal)</li> <li>/DBANS (Dynamic Brake Answer Input Signal)</li> </ul>	Output Signals	<ul> <li>ALM (Servo Alarm Output Signal)</li> <li>/COIN (Positioning Completion Output Signal)</li> <li>/V-CMP (Speed Coincidence Detection Output Signal)</li> <li>/TGON (Rotation Detection Output Sig- nal)</li> <li>/S-RDY (Servo Ready Output Signal)</li> <li>/CLT (Torque Limit Detection Output Sig- nal)</li> <li>/VLT (Speed Limit Detection Output Sig- nal)</li> <li>/VLT (Speed Limit Detection Output Sig- nal)</li> <li>/WARN (Warning Output Signal)</li> <li>/WARN (Warning Output Signal)</li> <li>/NEAR (Near Output Signal)</li> <li>/NEAR (Near Output Signal)</li> <li>PAO (Encoder Divided Pulse Output Phase A Signal)</li> <li>PBO (Encoder Divided Pulse Output Phase B Signal)</li> <li>PCO (Encoder Divided Pulse Output Phase C Signal)</li> <li>/DBON (Dynamic Brake Operation Request Output Signal)</li> <li>ACON (Main Circuit ON Signal)</li> <li>PDETCMP (Polarity Detection Com- pleted Signal)</li> <li>DEN (Position Reference Distribution</li> </ul>	
			Completed Signal) <ul> <li>PSET (Positioning Completion Output Signal)</li> <li>CMDRDY (Command Ready Signal)</li> </ul>	

# 10.3.3 Using the Analog Monitors

Connect a measuring instrument, such as a memory recorder, to the analog monitor connector (CN5) on the SERVOPACK to monitor analog signal waveforms. The measuring instrument is not provided by Yaskawa.

Refer to the following section for details on the connection. (37) 4.8.3 Analog Monitor Connector (CN5) on page 4-38

## Setting the Monitor Object

Use  $Pn006 = n.\Box \Box XX$  and  $Pn007 = n.\Box \Box XX$  (Analog Monitor 1 and 2 Signal Selections) to set the items to monitor.

Line Color	Signal	Parameter Setting
White	Analog monitor 1	Pn006 = n.□□XX
Red	Analog monitor 2	Pn007 = n.□□XX
Black (2 lines)	GND	-

Parameter		Description			
Par	ameter	Monitor Signal	Output Unit	Remarks	
	n.□□00 (default setting of Pn007)	Motor Speed	<ul> <li>Rotary Servomotor: 1 V/1,000 min<sup>-1</sup></li> <li>Linear Servomotor: 1 V/1,000 mm/s</li> </ul>	_	
	n.□□01	Speed Reference	<ul> <li>Rotary Servomotor:1 V/1,000 min<sup>-1</sup></li> <li>Linear Servomotor:1 V/1,000 mm/s</li> </ul>	_	
	n.□□02 (default setting of Pn006)	Torque Reference	1 V/100% rated torque	_	
	n.□□03	Position Deviation	0.05 V/Reference unit	0 V for speed or torque control	
	n.□□04	Position Amplifier Devi- ation	0.05 V/encoder pulse unit	Position deviation after electronic gear conversion	
	n.□□05	Position Command Speed	<ul> <li>Rotary Servomotor:1 V/1,000 min<sup>-1</sup></li> <li>Linear Servomotor:1 V/1,000 mm/s</li> </ul>	-	
Pn006 or	n.□□06	Reserved parameter (Do not change.)	-	-	
Pn007	n.□□07	Motor - Load Position Deviation	0.01 V/Reference unit	_	
	n.□□08	Positioning Completion	Positioning completed: 5 V Positioning not completed: 0 V	Completion is indi- cated by the output voltage.	
	n.□□09	Speed Feedforward	<ul> <li>Rotary Servomotor:1 V/1,000 min<sup>-1</sup></li> <li>Linear Servomotor:1 V/1,000 mm/s</li> </ul>	-	
	n.□□0A	Torque Feedforward	1 V/100% rated torque	_	
	n.ロロ0B	Active Gain*	1st gain: 1 V 2nd gain: 2 V	The gain that is active is indicated by the output voltage.	
	n.□□0C	Completion of Position Reference Distribution	Distribution completed: 5 V Distribution not completed: 0 V	Completion is indi- cated by the output voltage.	
	n.□□0D	External Encoder Speed	1 V/1,000 min <sup>-1</sup>	Value calculated at the motor shaft	
	n.□□10	Main Circuit DC Voltage	1 V/100 V (main circuit DC voltage)	_	

\* Refer to the following section for details.

## Changing the Monitor Factor and Offset

You can change the monitor factors and offsets for the output voltages for analog monitor 1 and analog monitor 2. The relationships to the output voltages are as follows:

Analog monitor 1 $= (-1) \times -$ output voltage	Analog Monitor 1 Signal Selection (Pn006 = n.□□XX) <sup>×</sup>	Analog Monitor 1 Magnification (Pn552) <sup>+</sup>	Analog Monitor 1 Offset Voltage (Pn550)	
Analog monitor 2 $=$ (-1) $\times$ output voltage	Analog Monitor 2 Signal × Selection (Pn007 = n.□□XX)	Analog Monitor 2 <sub>+</sub> Magnification (Pn553)	Analog Monitor 2 Offset Voltage (Pn551)	}

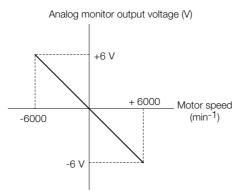
The following parameters are set.

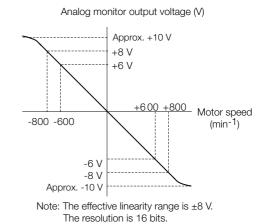
	Analog Monitor 1 Offset Voltage			Speed	osition Torque
Pn550	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	-10,000 to 10,000	0.1 V	0	Immediately	Setup
	Analog Monitor 2 Of	fset Voltage		Speed	osition Torque
Pn551	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	-10,000 to 10,000	0.1 V	0	Immediately	Setup
	Analog Monitor 1 Ma	agnification		Speed	osition Torque
Pn552	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	-10,000 to 10,000	×0.01	100	Immediately	Setup
	Analog Monitor 2 Ma	agnification		Speed	osition Torque
Pn553	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	-10,000 to 10,000	×0.01	100	Immediately	Setup

Example

• Example for Setting the Item to Monitor to the Motor Speed (Pn006 = n.□□00) When Pn552 = 100 (Setting Unit:  $\times 0.01$ )

When Pn552 = 1,000 (Setting Unit: ×0.01)





Adjusting the Analog Monitor Output

You can manually adjust the offset and gain for the analog monitor outputs for the torque reference monitor and motor speed monitor.

The offset is adjusted to compensate for offset in the zero point caused by output voltage drift or noise in the monitoring system.

The gain is adjusted to match the sensitivity of the measuring system.

The offset and gain are adjusted at the factory. You normally do not need to adjust them.

### ◆ Adjustment Example

An example of adjusting the output of the motor speed monitor is provided below.

Offset Adju	stment	Gain Adju	stment
Analog monitor output	voltage t adjustment Motor speed	Analog monitor output	Gain adjustment 000 [min <sup>-1</sup> ]
Item	Specification	Item	Specification
Offset Adjustment Range	-2.4 V to 2.4 V	Gain Adjustment Range	100 ±50%
Adjustment Unit	18.9 mV/LSB	Adjustment Unit	0.4%/LSB
		<ul> <li>The gain adjustment range is made using a 100% ou put value (gain adjustment of 0) as the reference valu with an adjustment range of 50% to 150%.</li> <li>A setting example is given below.</li> <li>Setting the Adjustment Value to -125 100 + (-125 × 0.4) = 50 [%] Therefore, the monitor output voltage goes to 50% of the original value.</li> <li>Setting the Adjustment Value to 125 100 + (125 × 0.4) = 150 [%] Therefore, the monitor output voltage goes to 150% of the original value.</li> </ul>	

Information • The adjustment values do not use parameters, so they will not change even if the parameter settings are initialized.

- Adjust the offset with the measuring instrument connected so that the analog monitor output value goes to zero. The following setting example achieves a zero output.
  - While power is not supplied to the Servomotor, set the monitor signal to the torque reference.
  - In speed control, set the monitor signal to the position deviation.

## Preparations

Always check the following before you adjust the analog monitor output.

• The parameters must not be write prohibited.

### ♦ Applicable Tools

You can use the following tools to adjust analog monitor outputs. The function that is used is given for each tool.

Offset Adjustment

Tool	Function	Operating Procedure Reference
Digital Operator	Fn00C	Ω-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Setup - Analog Monitor Out- put Adjustment	

• Gain Adjustment

Tool	Function	Operating Procedure Reference
Digital Operator	Fn00D	Ω Σ-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Setup - Analog Monitor Out- put Adjustment	

### Operating Procedure

Use the following procedure to adjust the analog monitor output.

- 1. Click the <u>I</u> Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select Adjust the Analog Monitor Output in the Menu Dialog Box. The Adjust the Analog Monitor Output Dialog Box will be displayed.
- 3. Click the Zero Adjustment or Gain Adjustment Tab.

Search Adjust the Analog Monitor Output AXIS#00
Zero Adjustment Gain Adjustment
Channel CH1
0 -1 Qt
Monitor Signal Torque reference (1 V/100% rated to

**4.** While watching the analog monitor, use the +1 and -1 Buttons to adjust the offset. There are two channels: CH1 and CH2. If necessary, click the down arrow on the **Channel** Box and select the channel.

Search Adjust the Analog Monitor Output AXIS#00
Zero Adjustment Gain Adjustment
Analog Monitor Output Offset
Channel CH1
Offset
Monitor Signal Torque reference (1 V/100% rated to

This concludes adjusting the analog monitor output.

# **10.4 Monitoring Product Life**

# 10.4.1 Items That You Can Monitor

Monitor Item	Description
SERVOPACK Installation Envi- ronment	<ul> <li>The operating status of the SERVOPACK in terms of the installation environment is displayed. Implement one or more of the following actions if the monitor value exceeds 100%.</li> <li>Lower the surrounding temperature.</li> <li>Decrease the load.</li> </ul>
Servomotor Installation Environ- ment	<ul> <li>The operating status of the SERVOPACK in terms of the installation environment is displayed. Implement one or more of the following actions if the monitor value exceeds 100%.</li> <li>Lower the surrounding temperature.</li> <li>Decrease the load.</li> </ul>
Built-in Fan Service Life Predic-	The unused status of the SERVOPACK is treated as the 100% value. The value decreases each time the main circuit power supply is turned ON and each time the servo is turned OFF. Use a monitor value of 0% as a guideline for the replacement period. Refer to the following section for part replacement guidelines.
tion	13.1.2 Guidelines for Part Replacement on page 13-2
Capacitor Service Life Predic-	The unused status of the SERVOPACK is treated as the 100% value. The value decreases each time the main circuit power supply is turned ON and each time the servo is turned OFF. Use a monitor value of 0% as a guideline for the replacement period. Refer to the following section for part replacement guidelines.
tion	13.1.2 Guidelines for Part Replacement on page 13-2
Surge Prevention Circuit Ser- vice Life Prediction	The unused status of the SERVOPACK is treated as the 100% value. The value decreases each time the main circuit power supply is turned ON and each time the servo is turned OFF. Use a monitor value of 0% as a guideline for the replacement period. Refer to the following section for part replacement guidelines.
Dynamic Brake Circuit Service	The unused status of the SERVOPACK is treated as the 100% value. The value decreases each time the main circuit power supply is turned ON and each time the servo is turned OFF. Use a monitor value of 0% as a guideline for the replacement period. Refer to the following section for part replacement guidelines.
Life Prediction	13.1.2 Guidelines for Part Replacement on page 13-2
Built-in Brake Relay Service Life	The unused status of the built-in brake relay is treated as the 100% value. The value decreases based on the number of operations of the built-in brake relay. Use a monitor value of 0% as a guideline for the replacement period. Refer to the following section for part replacement guidelines.
Prediction	13.1.2 Guidelines for Part Replacement on page 13-2

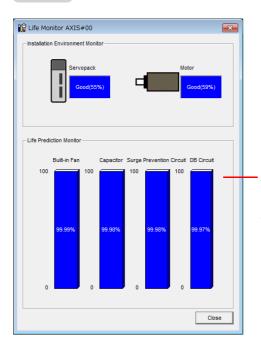
10.4.2 Operating Procedure

### 10.4.2 Operating Procedure

Use the following procedure to display the installation environment and service life prediction monitor dialog boxes.

- 1. Click the <u>I</u> Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select Life Monitor in the Menu Dialog Box. The Life Monitor Dialog Box will be displayed.

Information With the Digital Operator, you can use Un025 to Un02A to monitor this information.



A value of 100% indicates that the SERVOPACK has not yet been used. The percentage decreases as the SERVOPACK is used and reaches 0% when it is time to replace the SERVOPACK.

### 10.4.3 Preventative Maintenance

- You can use the following functions for preventative maintenance.
- Preventative maintenance warnings
- /PM (Preventative Maintenance Output) signal

The SERVOPACK can notify the host controller when it is time to replace any of the main parts.

### **Preventative Maintenance Warning**

An A.9b0 warning (Preventative Maintenance Warning) is detected when any of the following service life prediction values drops to 10% or less: SERVOPACK built-in fan life, capacitor life, inrush current limiting circuit life, dynamic brake circuit life, and built-in brake relay life. You can change the setting of Pn00F =  $n.\square\square\square\squareX$  to enable or disable these warnings.

Pa	Parameter Description		When Enabled	Classifi- cation
Pn00F	n.□□□0 (default setting)	Do not detect preventative maintenance warnings.	After restart	Setup
	n.0001	Detect preventative maintenance warnings.		

Note: Service life prediction of the built-in brake relay is performed as preventative maintenance for SERVOPACKs with built-in Servomotor brake control only when Pn023 is set to n.  $\Box \Box \Box \Box$ .

### /PM (Preventative Maintenance Output) Signal

The /PM (Preventative Maintenance Output) signal is output when any of the following service life prediction values reaches 10% or less: SERVOPACK built-in fan life, capacitor life, inrush current limiting circuit life, dynamic brake circuit life, and built-in brake relay life. The /PM (Preventative Maintenance Output) signal must be allocated.

Even if detection of preventive maintenance warnings is disabled (Pn00F =  $n.\Box\Box\Box$ ), the /PM signal will still be output as long as it is allocated.

Classifi- cation	Signal	Connector Pin No.	Signal Status	Description
Outout	/PM	Must be allocated.	ON (closed)	One of the following service life prediction values reached 10% or less: SERVOPACK built-in fan life, capacitor life, inrush current limiting circuit life, dynamic brake circuit life, and built-in brake relay life.
Output		Must De anocateu.	OFF (open)	All of the following service life prediction values are greater than 10%: SERVOPACK built-in fan life, capacitor life, inrush current limiting circuit life, dynamic brake circuit life, and built-in brake relay life.

Note: You must allocate the /PM signal to use it. Use Pn514 = n.□X□□ (/PM (Preventative Maintenance Output) Signal Allocation) to allocate the signal to connector pins. Refer to the following section for details. *7.1.2 Output Signal Allocations* on page 7-6 Monitoring

10.5.1 Data for Which Alarm Tracing Is Performed

# 10.5 Alarm Tracing

Alarm tracing records data in the SERVOPACK from before and after an alarm occurs. This data helps you to isolate the cause of the alarm.

You can display the data recorded in the SERVOPACK as a trace waveform on the SigmaWin+.

Information
Alarms that occur when the power supply is turned ON are not recorded.
Alarms that occur during the recording of alarm trace data are not recorded.

- · Alarms that occur while utility functions are being executed are not recorded.

#### 10.5.1 Data for Which Alarm Tracing Is Performed

Two types of data are recorded for alarm tracing: numeric data and I/O signal ON/OFF data.

Numeric Data	ON/OFF Data
Torque reference	ALM
Feedback speed	Servo ON command (/S-ON)
Reference speed	Proportional control command (/P-CON)
Position reference speed	Forward torque command (/P-CL)
Position deviation	Reverse torque command (/N-CL)
Motor-load position deviation	G-SEL1 signal (/G-SEL1)
Main circuit bus voltage	ACON

#### Applicable Tools 10.5.2

The following table lists the tools that you can use to perform alarm tracing and the applicable tool functions.

Tool	Function Operating Procedure Reference				
Digital Operator	You cannot display alarm tracing data from the Digital Operator.				
SigmaWin+	Alarm - Alarm Tracing	☐ Engineering Tool SigmaWin+ Operation Manual (Manual No.: SIET S800001 34)			

# Fully-Closed Loop Control

This chapter provides detailed information on performing fully-closed loop control with the SERVOPACK.

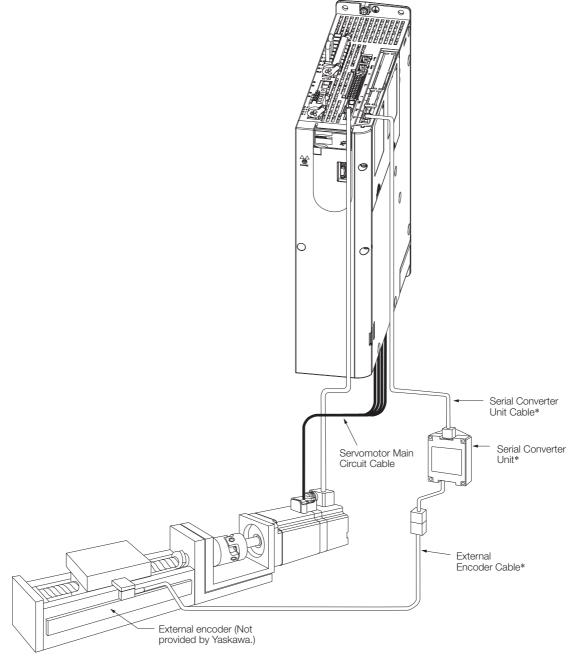
(11)

11.1	Fully-	Closed System 11-2
11.2	SERV	OPACK Commissioning Procedure11-3
11.3	Parame	eter Settings for Fully-Closed Loop Control 11-5
	11.3.1	Control Block Diagram for Fully-Closed Loop Control
	11.3.2	Setting the Motor Direction and the Machine Movement Direction
	11.3.3	Setting the Number of External Encoder Scale Pitches
	11.3.4	Setting the PAO, PBO, and PCO (Encoder Divided Pulse Output) Signals 11-7
	11.3.5	External Absolute Encoder Data Reception Sequence
	11.3.6	Electronic Gear Setting 11-8
	11.3.7	Alarm Detection Settings 11-9
	11.3.8	Analog Monitor Signal Settings 11-10
	11.3.9	Setting to Use an External Encoder for Speed Feedback

# 11.1 Fully-Closed System

With a fully-closed system, an externally installed encoder is used to detect the position of the controlled machine and the machine's position information is fed back to the SERVOPACK. High-precision positioning is possible because the actual machine position is fed back directly. With a fully-closed system, looseness or twisting of mechanical parts may cause vibration or oscillation, resulting in unstable positioning.

The following figure shows an example of the system configuration.



\* The connected devices and cables depend on the type of external linear encoder that is used.

Note: Refer to the following section for details on connections that are not shown above, such as connections to power supplies and peripheral devices.

2.4 Examples of Standard Connections between SERVOPACKs and Peripheral Devices on page 2-17

# **11.2 SERVOPACK Commissioning Procedure**

First, confirm that the SERVOPACK operates correctly with semi-closed loop control, and then confirm that it operates correctly with fully-closed loop control.

The commissioning procedure for the SERVOPACK for fully-closed loop control is given below.

Step	Description	Operation	Required Parameter Settings	Con- trolling Device
1	Check operation of the entire sequence with semi-closed loop control and without a load. Items to Check • Power supply circuit wiring • Servomotor wiring • Wiring of I/O signal lines from the host con- troller • Servomotor rotation direction, motor speed, and multiturn data • Operation of safety mechanisms, such as the brakes and the overtravel mechanisms	<ul> <li>Set the parameters so that the SERVOPACK operates correctly in semi-closed loop control without a load and check the following points. Set Pn002 to n.0□□□ to specify semi-closed loop control.</li> <li>Are there any errors in the SER-VOPACK?</li> <li>Does jogging function correctly when you operate the SERVO-PACK without a load?</li> <li>Do the I/O signals turn ON and OFF correctly?</li> <li>Is power supplied to the Servo-motor when the SV_ON (Servo ON) command is sent from the host controller?</li> <li>Does the Servomotor operate correctly when a position reference is input by the host controller?</li> </ul>	<ul> <li>Pn000 (Basic Function Selections 0)</li> <li>Pn001 (Application Function Selections 1)</li> <li>Pn002 = n.X□□□ (External Encoder Usage)</li> <li>Pn20E (Electronic Gear Ratio (Numerator))</li> <li>Pn210 (Electronic Gear Ratio (Denominator))</li> <li>Pn50A, Pn50B, Pn511, and Pn516 (Input Signal Selections)</li> <li>Pn50E, Pn50F, Pn510, Pn514, Pn53C, and Pn53D (Output Signal Selections)</li> </ul>	SERVO- PACK or host con- troller
2	Check operation with the Servomotor connected to the machine with semi-closed loop control. Items to Check • Initial response of the system connected to the machine • Movement direction, travel distance, and movement speed as specified by the refer- ences from the host controller	Connect the Servomotor to the machine. Set the moment of inertia ratio in Pn103 using autotuning without a host reference. Check that the machine's move- ment direction, travel distance, and movement speed agree with the references from the host controller.	Pn103 (Moment of Inertia Ratio)	Host con- troller
3	Check the external encoder. Items to Check Is the signal from the external encoder received correctly?	<ul> <li>Set the parameters related to fully-closed loop control and move the machine with your hand without turning ON the power supply to the Servomotor. Check the following status with the Digital Operator or SigmaWin+.</li> <li>Does the fully-closed feedback pulse counter count up when the Servomotor moves in the forward direction?</li> <li>Is the travel distance of the machine visually about the same as the amount counted by the fully-closed feedback pulse counter?</li> <li>Note: The unit for the fully-closed feedback pulse, which is equivalent to the external encoder sine wave pitch.</li> </ul>	<ul> <li>Pn002 = n.X□□□ (External Encoder Usage)</li> <li>Pn20A (Number of External Encoder Scale Pitches)</li> <li>Pn20E (Electronic Gear Ratio (Numerator))</li> <li>Pn210 (Electronic Gear Ratio (Denominator))</li> <li>Pn281 (Encoder Output Resolution)</li> <li>Pn51B (Motor-Load Position Deviation Over- flow Detection Level)</li> <li>Pn522 (Positioning Completed Width)</li> <li>Pn52A (Multiplier per Fully-closed Rotation)</li> </ul>	-

Continued on next page.

#### Continued from previous page.

Step	Description	Operation	Required Parameter Settings	Con- trolling Device	
4	Perform a program jog- ging operation. Items to Check Does the fully-closed system operate correctly for the SERVOPACK without a load?	Perform a program jogging opera- tion and confirm that the travel dis- tance is the same as the reference value in Pn531. When you perform program jog- ging, start from a low speed and gradually increase the speed.	Pn530 to Pn536 (program jogging-related parame- ters)	SERVO- PACK	
5	Operate the SERVO- PACK. Items to Check Does the fully-closed system operate correctly, including the host con- troller?	Input a position reference and con- firm that the SERVOPACK oper- ates correctly. Start from a low speed and gradu- ally increase the speed.	_	Host con- troller	

11.3.1 Control Block Diagram for Fully-Closed Loop Control

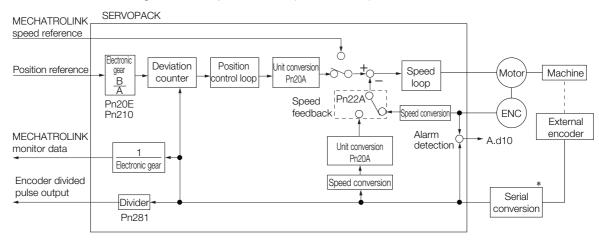
# 11.3 Parameter Settings for Fully-Closed Loop Control

Parameter to Set	Setting	Position Control	Speed Control	Torque Control	Reference
Pn000 = n.□□□X	Motor direction		$\checkmark$	$\checkmark$	
Pn002 = n.X□□□	External encoder usage method		$\checkmark$	$\checkmark$	page 11-6
Pn20A	Number of external encoder scale pitches		$\checkmark$	$\checkmark$	page 11-7
Pn281	Encoder divided pulse output signals (PAO, PBO, and PCO) from the SERVO- PACK	$\checkmark$	$\checkmark$	$\checkmark$	page 11-7
_	External absolute encoder data reception sequence		$\checkmark$	$\checkmark$	page 7-43
Pn20E and Pn210	Electronic gear ratio		-	-	page 6-42
Pn51B	Motor-load position deviation overflow detection level	$\checkmark$	_	-	page 11-9
Pn52A	Multiplier per fully-closed rotation		_	-	
Pn006/Pn007	Analog monitor signal		$\checkmark$	$\checkmark$	page 11-10
Pn22A = n.X□□□	Speed feedback method during fully- closed loop control		-	-	page 11-10

This section describes the parameter settings that are related to fully-closed loop control.

### 11.3.1 Control Block Diagram for Fully-Closed Loop Control

The control block diagram for fully-closed loop control is provided below.



\* The connected device depends on the type of external encoder.

Note: You can use either an incremental or an absolute encoder. If you use an absolute encoder, set Pn002 to n.  $\Box 1 \Box \Box$  (Use the absolute encoder as an incremental encoder).

11.3.2 Setting the Motor Direction and the Machine Movement Direction

# 11.3.2 Setting the Motor Direction and the Machine Movement Direction

You must set the motor direction and the machine movement direction. To perform fully-closed loop control, you must set the motor rotation direction with both  $Pn000 = n.\square\square\squareX$  (Direction Selection) and  $Pn002 = n.X\square\square\square$  (External Encoder Usage).

Parameter		Pn002 = n.XDDD (External Encoder Usage)				
		n.1000		n.3□□□		
		Reference direction	Forward reference	Reverse reference	Forward reference	Reverse reference
Pn000 =n.□□□X (Direction Selection)	n.□□□0	Motor direction	CCW	CW	CCW	CW
		External encoder	Forward movement	Reverse movement	Reverse movement	Forward movement
	n.0001	Reference direction	Forward reference	Reverse reference	Forward reference	Reverse reference
		Motor direction	CW	CCW	CW	CCW
		External encoder	Reverse movement	Forward movement	Forward movement	Reverse movement

• Phase B leads in the divided pulses for a forward reference regardless of the setting of Pn000 =  $n.\Box\Box\BoxX$ .

• Forward direction: The direction in which the pulses are counted up.

• Reverse direction: The direction in which the pulses are counted down.

### **Related Parameters**

#### ♦ Pn000 = n.□□□X

Refer to the following section for details. 6.5 Motor Direction Setting on page 6-15

### ◆ Pn002 = n.X□□□

When you perform fully-closed loop control, set Pn002 to n.1

Pa	arameter	Name	Meaning	When Enabled	Classifi- cation
	n.0□□□ (default set- ting)		Do not use an external encoder.		
Pn002	n.1000	External Encoder Usage	External encoder moves in forward direction for CCW motor rotation.	After restart	Setup
	n.2000		Reserved parameter (Do not change.)		
	n.3000		External encoder moves in reverse direction for CCW motor rotation.		
	n.4000		Reserved parameter (Do not change.)		

Information

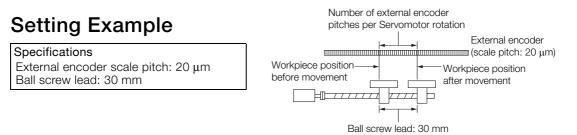
Determine the setting of  $Pn002 = n.X \square \square \square$  as described below.

- Set Pn000 to n. DD (Use the direction in which the linear encoder counts up as the forward direction) and set Pn002 to n.1DD (The external encoder moves in the forward direction for CCW motor rotation).
- Manually rotate the motor shaft counterclockwise.
- If the fully-closed feedback pulse counter counts up, do not change the setting of Pn002 (Pn002 = n.1□□□).
- If the fully-closed feedback pulse counter counts down, set Pn002 to n.3

#### 11.3.3 Setting the Number of External Encoder Scale Pitches

#### Setting the Number of External Encoder Scale Pitches 11.3.3

Set the number of external encoder scale pitches per Servomotor rotation in Pn20A.



If the external encoder is connected directly to the Servomotor, the setting will be 1,500 (30 mm/0.02 mm = 1,500).

Note: 1. If there is a fraction, round off the digits below the decimal point.

2. If the number of external encoder scale pitches per Servomotor rotation is not an integer, there will be deviation in the position loop gain (Kp), feedforward, and position reference speed monitor. This is not relevant for the position loop and it therefore does not interfere with the position accuracy.

### **Related Parameters**

	Number of Externa	I Encoder Scale Pito	ches	Posi	tion
Pn20A	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
FIIZUA	4 to 1,048,576	1 scale pitch/revo- lution	32,768	After restart	Setup

#### 11.3.4 Setting the PAO, PBO, and PCO (Encoder Divided Pulse Output) Signals

Set the position resolution in Pn281 (Encoder Output Resolution). Enter the number of phase A and phase B edges for the setting.

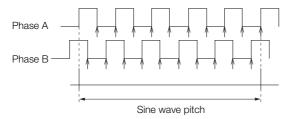
### Setting Example

Specifications External encoder scale pitch: 20 µm Ball screw lead: 30 mm Speed:1,600 mm/s

If a single pulse (multiplied by 4) is output for 1  $\mu$ m, the setting would be 20.

If a single pulse (multiplied by 4) is output for 0.5  $\mu$ m, the setting would be 40.

The encoder divided pulse output would have the following waveform if the setting is 20.



"1" indicates the edge positions. In this example, the set value is 20 and therefore the number of edges is 20.

Note: The upper limit of the encoder signal output frequency (multiplied by 4) is 6.4 Mpps. Do not set a value that would cause the output to exceed 6.4 Mpps.

If the output exceeds the upper limit, an A.511 alarm (Encoder Output Pulse Overspeed) will be output.

11.3.5 External Absolute Encoder Data Reception Sequence

Example If the setting is 20 and the speed is 1,600 mm/s, the output frequency would be 1.6 Mpps 1600 mm/s

$$\frac{1000 \text{ mm/s}}{0.001 \text{ mm}} = 1,600,000 = 1.6 \text{ Mpps}$$

Because 1.6 Mpps is less than 6.4 Mpps, this setting can be used.

### **Related Parameters**

	Encoder Output Re	solution		Positio	on
Pn281	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 4,096	1 edge/pitch	20	After restart	Setup

Note: The maximum setting for the encoder output resolution is 4,096. If the resolution of the external encoder exceeds 4,096, pulse output will no longer be possible at the resolu-

If the resolution of the external encoder exceeds 4,096, pulse output will no longer be possible at the resolution given in *Feedback Resolution of Linear Encoder* on page 6-44.

### 11.3.5 External Absolute Encoder Data Reception Sequence

Refer to the following section for details.

7.9.4 Reading the Position Data from the Absolute Linear Encoder on page 7-43

With fully-closed loop control, the same sequence as for a Linear Servomotor is used.

### 11.3.6 Electronic Gear Setting

Refer to the following section for details.

6.15 Electronic Gear Settings on page 6-42

With fully-closed loop control, the same setting as for a Linear Servomotor is used.

11.3.7 Alarm Detection Settings

### 11.3.7 Alarm Detection Settings

This section describes the alarm detection settings (Pn51B and Pn52A).

# Pn51B (Motor-Load Position Deviation Overflow Detection Level)

This setting is used to detect the difference between the feedback position of the Servomotor encoder and the feedback load position of the external encoder for fully-closed loop control. If the detected difference exceeds the setting, an A.d10 alarm (Motor-Load Position Deviation Overflow) will be output.

	Motor-Load Positio	n Deviation Overflo	Position		
Pn51B	Setting Range	Setting Unit	Default Setting	When Enabled	Classifica- tion
	0 to 1,073,741,824	1 reference unit	1000	Immediately	Setup

Note: If you set this parameter to 0, A.d10 alarms will not be output and the machine may be damaged.

### Pn52A (Multiplier per Fully-closed Rotation)

Set the coefficient of the deviation between the Servomotor and the external encoder per motor rotation.

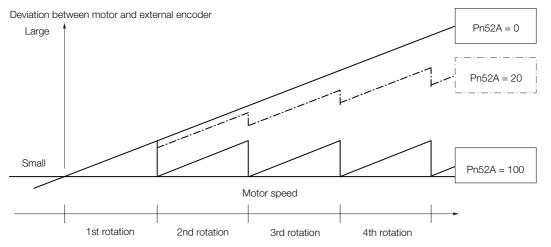
This setting can be used to prevent the Servomotor from running out of control due to damage to the external encoder or to detect belt slippage.

### Setting Example

Increase the value if the belt slips or is twisted excessively.

If this parameter is set to 0, the external encoder value will be read as it is.

If you use the default setting of 20, the second rotation will start with the deviation for the first Servomotor rotation multiplied by 0.8.



### Related Parameters

	Multiplier per Fully-	closed Rotation		Posi	tion
Pn52A	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 100	1%	20	Immediately	Setup

11.3.8 Analog Monitor Signal Settings

### 11.3.8 Analog Monitor Signal Settings

You can monitor the position deviation between the Servomotor and load with an analog monitor.

Para	ameter	Name	Meaning	When Enabled	Classifi- cation
Pn006	n.ロロ07	Analog Monitor 1 Signal Selection	Position deviation between motor and load (output unit: 0.01 V/reference unit).	Immedi-	Cotus
Pn007	n.□□07	Analog Monitor 2 Signal Selection	Position deviation between motor and load (output unit: 0.01 V/reference unit).	ately	Setup

### 11.3.9 Setting to Use an External Encoder for Speed Feedback

For fully-closed loop control, you normally set a parameter to specify using the motor encoder speed (Pn22A =  $n.0\square\square\square$ ).

If you will use a high-resolution external encoder, set the parameter to specify using the speed of the external encoder (Pn22A =  $n.1\square\square\square$ ).

Parameter		Meaning	When Enabled	Classification
Pn22A	n.0□□□ (default set- ting)	Use motor encoder speed.	After restart	Setup
	n.1000	Use external encoder speed.		

Note: This parameter cannot be used if Pn002 is set to n.0 [[] (Do not use external encoder).

# **Safety Functions**

This chapter provides detailed information on the safety functions of the SERVOPACK.

(12)

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12.1.1 Safety Functions

## **12.1 Introduction to the Safety Functions**

### 12.1.1 Safety Functions

Safety functions are built into the SERVOPACK to reduce the risks associated with using the machine by protecting workers from the hazards of moving machine parts and otherwise increasing the safety of machine operation.

Especially when working in hazardous areas inside guards, such as for machine maintenance, the safety function can be used to avoid hazardous moving machine parts.

Refer to the following section for information on the safety function and safety parameters. *Compliance with UL Standards, EU Directives, and Other Safety Standards* on page xxi



Products that display the TÜV mark on the nameplate have met the safety standards.

### 12.1.2 Precautions for Safety Functions

#### WARNING To confirm that the HWBB function satisfies the safety requirements of the system, you must conduct a risk assessment of the system. Incorrect use of the safety function may cause injury. • The Servomotor will move if there is an external force (e.g., gravity on a vertical axis) even when the HWBB function is operating. Use a separate means, such as a mechanical brake, that satisfies the safety requirements. Incorrect use of the safety function may cause injury. • While the HWBB function is operating, the Servomotor may move within an electric angle of 180° or less as a result of a SERVOPACK failure. Use the HWBB function for an application only after confirming that movement of the Servomotor will not result in a hazardous condition. Incorrect use of the safety function may cause injury. • The dynamic brake and the brake signal are not safety-related elements. You must design the system so that SERVOPACK failures will not cause a hazardous condition while the HWBB function is operating. Incorrect use of the safety function may cause injury. • Connect devices that satisfy the safety standards for the signals for safety functions. Incorrect use of the safety function may cause injury. The HWBB function does not shut OFF the power to the SERVOPACK or electrically isolate it. Implement measures to shut OFF the power supply to the SERVOPACK before you perform maintenance on it. There is a risk of electric shock. Use an SELV-compliant power supply according to EN/IEC 60950-1 to input 24 VDC to the control power supply input terminals. If you use a power supply that is not SELV compliant, safety functions may be lost if the power

supply fails, which may result in machine damage or injury.

12-2

# 12.2 Hard Wire Base Block (HWBB)

A hard wire base block (abbreviated as HWBB) is a safety function that is designed to shut OFF the current to the motor with a hardwired circuit.

The drive signals to the Power Module that controls the motor current are controlled by the circuits that are independently connected to the two input signal channels to turn OFF the Power Module and shut OFF the motor current.

For safety function signal connections, the input signal is the 0-V common and the output signal is a source output.

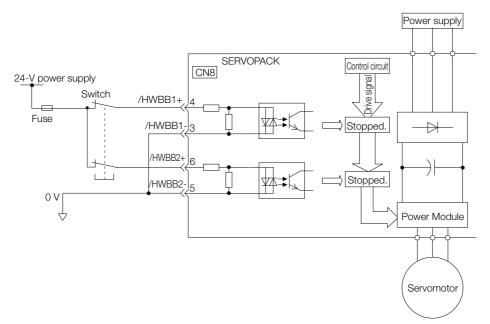
This is opposite to other signals described in this manual.

To avoid confusion, the ON and OFF status of signals for the safety function are defined as follows:

ON: The state in which the relay contacts are closed or the transistor is ON and current flows into the signal line.

OFF: The state in which the relay contacts are open or the transistor is OFF and no current flows into the signal line.

The input signal uses the 0-V common. The following figure shows a connection example.



12.2.1 Risk Assessment

### 12.2.1 Risk Assessment

When using the HWBB, you must perform a risk assessment of the Servo System in advance to confirm that the safety level of the standards is satisfied. Refer to the following section for details on the standards.

G Compliance with UL Standards, EU Directives, and Other Safety Standards on page xxi

Note: To meet performance level e (PLe) in EN ISO 13849-1 and SIL3 in IEC 61508, the EDM1 signal must be monitored by the host controller. If the EDM1 signal is not monitored by the host controller, the level will be safety performance level c (PLc) and SIL1.

The following hazards exist even when the HWBB is operating. These hazards must be included in the risk assessment.

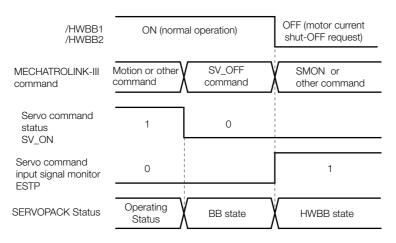
- The Servomotor will move if an external force is applied to it (for example, gravity on a vertical axis). Implement measures to hold the Servomotor, such as installing a separate mechanical brake.
- If a failure occurs such as a Power Module failure, the Servomotor may move within an electric angle of 180°. Ensure safety even if the Servomotor moves.
  - The rotational angle or travel distance depends on the type of Servomotor as follows:
  - Rotary Servomotor: 1/6 rotation max. (rotational angle calculated at the motor shaft)
  - Linear Servomotor: 50 mm max.
- The HWBB does not shut OFF the power to the SERVOPACK or electrically isolate it. Implement measures to shut OFF the power supply to the SERVOPACK before you perform maintenance on it.

#### 12.2.2 Hard Wire Base Block (HWBB) State

### 12.2.2 Hard Wire Base Block (HWBB) State

The SERVOPACK will be in the following state if the HWBB operates. If the /HWBB1 or /HWBB2 signal turns OFF, the HWBB will operate and the SERVOPACK will enter a HWBB state.

#### • When HWBB Operates after Servo OFF (Power Not Supplied to Motor)



#### • When HWBB Operates While Power Is Supplied to Servomotor

/HWBB1 <sub>C</sub> /HWBB2	N (normal operation)	OFF (motor current shut-OFF request)
MECHATROLINK-III command	Motion or other command	SMON or other command
Servo command status SV_ON	1	0
Servo command input signal monitor ESTP	0	1
SERVOPACK Status	Operating Status	HWBB state

12.2.3 Resetting the HWBB State

### 12.2.3 Resetting the HWBB State

Normally, after the SV\_OFF (Servo OFF: 32h) command is received and power is no longer supplied to the Servomotor, the /HWBB1 and /HWBB2 signals will turn OFF and the SERVOPACK will enter the HWBB state. If you turn ON the /HWBB1 and /HWBB2 signals in this state, the SERVOPACK will enter a base block (BB) state and will be ready to acknowledge the SV\_ON (Servo ON: 31h) command.

/HWBB1 /HWBB2 -	OFF (motor current shut-OFF request)	ON (normal	l operation)
MECHATROLINK-III command	SMON or other command		SV_ON command
Servo command status SV_ON -	0		1
- Servo command input signal monitor ESTP	1	0	0
SERVO- PACK Status	HWBB state	BB state	Operating Status

If the /HWBB1 and /HWBB2 signals are OFF and the SV\_ON (Servo ON: 31h) command is received, the HWBB state will be maintained even after the /HWBB1 and /HWBB2 signals are turned ON. Send the SV\_OFF (Servo OFF: 32h) command to place the SERVOPACK in the BB state and then send the SV\_ON (Servo ON: 31h) command.

/HWBB1 /HWBB2	OFF (motor current shut-OFF request)	ON (normal operat	ion)
MECHATROLINK-III command	SV_ON command	SV_OFF command	SV_ON command
Servo command status SV_ON	0	0	1
Servo command input signal monitor ESTP	1	0	0
SERVOPACK Status	HWBB state	BB state	Operating Status

Note: If the SERVOPACK is placed in the BB state while the main circuit power supply is OFF, the HWBB state will be maintained until the SV\_OFF (Servo OFF: 32h) command is received.

### 12.2.4 Related Commands

If the /HWBB1 or /HWBB2 signal turns OFF and the HWBB operates, the ESTP bit in the servo command input signal monitor (SVCMD\_IO) will change to 1. The host controller can monitor this bit to determine the status.

If the state changes to the HWBB state during the execution of the next motion command, a command warning occurs. If a warning occurs, clear the alarm to return to normal operating status. After stopping or canceling the motion command, using the sequence of commands to return to the HWBB status is recommended.

Applicable Motion Commands
SV_ON (Servo ON)
INTERPOLATE (Interpolating)
POSING (Positioning)
FEED (Constant Speed Feed)
EX_FEED (External Input Feed Command)
EX_POSING (External Input Positioning)
ZRET (Origin Return)

### 12.2.5 Detecting Errors in HWBB Signal

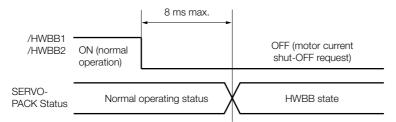
If only the /HWBB1 or the /HWBB2 signal is input, an A.Eb1 alarm (Safety Function Signal Input Timing Error) will occur unless the other signal is input within 10 seconds. This makes it possible to detect failures, such as disconnection of an HWBB signal.

### 

• The A.Eb1 alarm (Safety Function Signal Input Timing Error) is not a safety-related element. Keep this in mind when you design the system.

### 12.2.6 HWBB Input Signal Specifications

If an HWBB is requested by turning OFF the two HWBB input signal channels (/HWBB1 and /HWBB2), the power supply to the Servomotor will be turned OFF within 8 ms.



Note: 1. The OFF status is not recognized if the OFF interval of the /HWBB1 or /HWBB2 signal is 0.5 ms or shorter. 2. You can check the status of the input signals by using monitor displays. Refer to the following section for details.

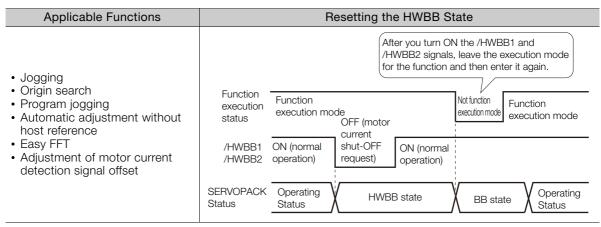
3 10.2.3 I/O Signal Monitor on page 10-5

12.2.7 Operation without a Host Controller

### 12.2.7 Operation without a Host Controller

The HWBB will operate even for operation without a host controller.

However, if the HWBB operates during execution of the following functions, leave the execution mode for the function and then enter it again to restart operation. Operation will not be restarted simply by turning OFF the /HWBB1 and /HWBB2 signals.

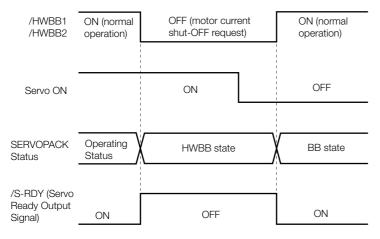


### 12.2.8 /S-RDY (Servo Ready Output) Signal

The SV\_ON (Servo ON: 31h) command will not be acknowledged in the HWBB state. Therefore, the Servo Ready Output Signal will turn OFF.

The Servo Ready Output Signal will turn ON if both the /HWBB1 and /HWBB2 signals are ON and the servo is turned OFF (BB state).

An example is provided below for when the main circuit power supply is ON and the SENS\_ON (Turn Sensor ON) command is input when there is no servo alarm. (An absolute encoder is used in this example.)



12.2.9 /BK (Brake Output) Signal

### 12.2.9 /BK (Brake Output) Signal

If the HWBB operates when the /HWBB1 or /HWBB2 signal is OFF, the /BK (Brake) signal will turn OFF. At that time, the setting in Pn506 (Brake Reference - Servo OFF Delay Time) will be disabled. Therefore, the Servomotor may be moved by external force until the actual brake becomes effective after the /BK signal turns OFF.



• The brake signal is not a safety-related element. You must design the system so that a hazardous condition does not occur even if the brake signal fails in the HWBB state. Also, if a Servomotor with a Brake is used, keep in mind that the brake in the Servomotor is used only to prevent the moving part from being moved by gravity or an external force and it cannot be used to stop the Servomotor.

### 12.2.10 Stopping Methods

If the /HWBB1 or /HWBB2 signal turns OFF and the HWBB operates, the Servomotor will stop according to the stop mode that is set for stopping the Servomotor when the servo turns OFF (Pn001 =  $n.\square\square\squareX$ ). However, if the dynamic brake is enabled (Pn001 =  $n.\square\square\square0$  or  $n.\square\square\square1$ ), observe the following precautions.



- The dynamic brake is not a safety-related element. You must design the system so that a hazardous condition does not occur even if the Servomotor coasts to a stop in the HWBB state. Normally, we recommend that you use a sequence that returns to the HWBB state after stopping for a reference.
- If the application frequently uses the HWBB, stopping with the dynamic brake may result in the deterioration of elements in the SERVOPACK. To prevent internal elements from deteriorating, use a sequence in which the HWBB state is returned to after the Servomotor has come to a stop.

# 12.2.11 ALM (Servo Alarm) Signal

The ALM (Servo Alarm) signal is not output in the HWBB state.

12.3.1 EDM1 Output Signal Specifications

## 12.3 EDM1 (External Device Monitor)

The EDM1 (External Device Monitor) signal is used to monitor failures in the HWBB. Connect the monitor signal as a feedback signal, e.g., to the Safety Unit.

Note: To meet performance level e (PLe) in EN ISO 13849-1 and SIL3 in IEC 61508, the EDM1 signal must be monitored by the host controller. If the EDM1 signal is not monitored by the host controller, the level will be safety performance level c (PLc) and SIL1.

#### • Failure Detection Signal for EDM1 Signal

The relationship between the EDM1, /HWBB1, and /HWBB2 signals is shown below.

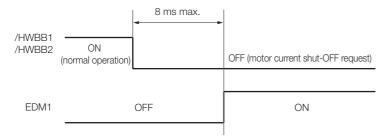
Detection of failures in the EDM1 signal circuit can be achieved by using the status of the /HWBB1, /HWBB2, and EDM1 signals in the following table. A failure can be detected by checking the failure status, e.g., when the power supply is turned ON.

Signal		Lo	gic	
/HWBB1	ON	ON	OFF	OFF
/HWBB2	ON	OFF	ON	OFF
EDM1	OFF	OFF	OFF	ON

• The EDM1 signal is not a safety output. Use it only for monitoring for failures.

### 12.3.1 EDM1 Output Signal Specifications

If an HWBB is requested by turning OFF the two HWBB input signal channels (/HWBB1 and /HWBB2) when the safety function is operating normally, the EDM1 output signal will be turned ON within 8 ms.



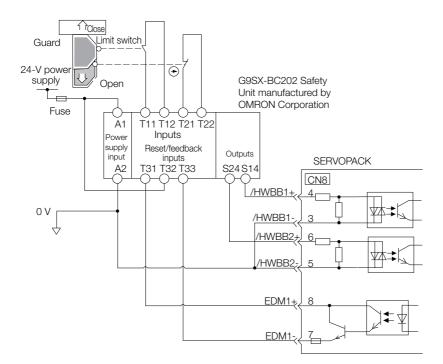
12.4.1 Connection Example

# **12.4 Applications Examples for Safety Functions**

This section provides examples of using the safety functions.

### 12.4.1 Connection Example

In the following example, a Safety Unit is used and the HWBB operates when the guard is opened.



When the guard is opened, both the /HWBB1 and the /HWBB2 signals turn OFF, and the EDM1 signal turns ON. Because the feedback circuit is ON while the guard is closed, the Safety Unit is reset, the /HWBB1 and the / HWBB2 signals turn ON, and the operation is enabled.

Note: The EDM1 signal is used as a source output. Connect the EDM1 so that the current flows from EMD1+ to EMD1-.

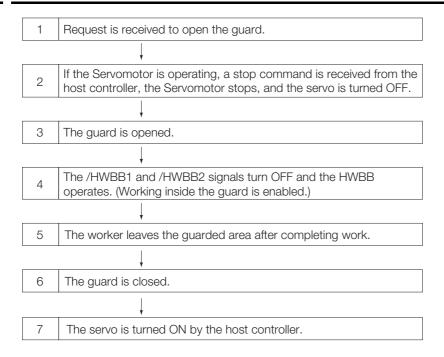
### 12.4.2 Failure Detection Method

If a failure occurs (e.g., the /HWBB1 or the /HWBB2 signal remains ON), the Safety Unit is not reset when the guard is closed because the EDM1 signal remains OFF. Therefore starting is not possible and a failure is detected.

In this case the following must be considered: an error in the external device, disconnection of the external wiring, short-circuiting in the external wiring, or a failure in the SERVOPACK. Find the cause and correct the problem.

12.4.3 Procedure

### 12.4.3 Procedure



# 12.5 Validating Safety Functions

When you commission the system or perform maintenance or SERVOPACK replacement, you must always perform the following validation test on the HWBB function after completing the wiring. (It is recommended that you keep the confirmation results as a record.)

- When the /HWBB1 and /HWBB2 signals turn OFF, confirm that the Digital Operator displays **Hbb** and that the Servomotor does not operate.
- Monitor the ON/OFF status of the /HWBB1 and /HWBB2 signals. If the ON/OFF status of the signals do not coincide with the display, the following must be considered: an error in the external device, disconnection of the external wiring, short-circuiting in the external wiring, or a failure in the SERVOPACK. Find the cause and correct the problem.

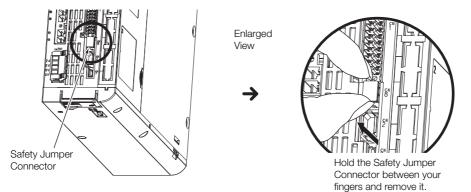
Refer to the following sections for details on the monitor. 10.2.3 I/O Signal Monitor on page 10-5

• Confirm that the EDM1 signal is OFF while in normal operation by using the feedback circuit input display of the connected device.

# 12.6 Connecting a Safety Function Device

Use the following procedure to connect a safety function device.

1. Remove the Safety Jumper Connector from the connector for the safety function device (CN8).



- 2. Connect the safety function device to the connector for the safety function device (CN8).
- Note: If you do not connect a safety function device, leave the Safety Jumper Connector connected to the connector for the safety function device (CN8). If the SERVOPACK is used without the Safety Jumper Connector connected to CN8, no current will be supplied to the Servomotor and no motor torque will be output. In this case, **Hbb** will be displayed on the Digital Operator.

# Maintenance

(13)

This chapter provides information on the meaning of, causes of, and corrections for alarms and warnings.

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13.1.1 Inspections

## **13.1** Inspections and Part Replacement

This section describes inspections and part replacement for SERVOPACKs.

### 13.1.1 Inspections

Perform the inspections given in the following table at least once every year for the SERVO-PACK. Daily inspections are not required.

Item	Frequency	Inspection	Correction
Exterior	At least once a year	Check for dust, dirt, and oil on the surfaces.	Clean with compressed air or a cloth.
Loose Screws		Check for loose terminal block and connector screws and for other loose parts.	Tighten any loose screws or other loose parts.

### 13.1.2 Guidelines for Part Replacement

The following electric or electronic parts are subject to mechanical wear or deterioration over time. Use one of the following methods to check the standard replacement period.

- Use the service life prediction function of the SERVOPACK. Refer to the following section for information on service life predictions.
   10.4 Monitoring Product Life on page 10-13
- Use the following table.

Part	Standard Replace- ment Period	Remarks		
Cooling Fan	4 years to 5 years	The standard replacement periods given on the left are for		
Electrolytic Capacitor	10 years	<ul> <li>the following operating conditions.</li> <li>Surrounding air temperature: Annual average of 30°C</li> <li>Load factor: 80% max.</li> <li>Operation rate: 20 hours/day max.</li> </ul>		
Inrush Current Limit- ing Circuit Relay	100,000 power ON operations	Power ON frequency: Once an hour		
Battery	3 years without power supplied	Surrounding temperature without power supplied: 20°C		
Built-in Brake Relay*	30,000 operations	Allowable number of operations: 30 operations per minute max.		

\* Only SERVOPACKs with built-in Servomotor brake control have a built-in brake relay.

When any standard replacement period is close to expiring, contact your Yaskawa representative. After an examination of the part in question, we will determine whether the part should be replaced.



The parameters of any SERVOPACKs that are sent to Yaskawa for part replacement are reset to the factory settings before they are returned to you. Always keep a record of the parameter settings. And, always confirm that the parameters are properly set before starting operation.

### 13.1.3 Replacing the Battery

If the battery voltage drops to approximately 2.7 V or less, an A.830 alarm (Encoder Battery Alarm) or an A.930 warning (Absolute Encoder Battery Error) will be displayed.

If this alarm or warning is displayed, the battery must be replaced. Refer to the following section for the battery replacement procedure.

### **Battery Alarm/Warning Selection**

Whether to display an alarm or a warning is determined by the setting of  $Pn008 = n.\Box\Box\BoxX$  (Low Battery Voltage Alarm/Warning Selection).

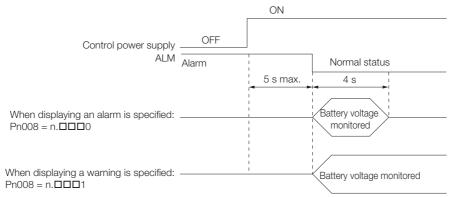
Parameter		Meaning	When Enabled	Classification
Pn008	n.□□□0 (default setting)	Output alarm (A.830) for low battery voltage.	After restart	Setup
	n.0001	Output warning (A.930) for low battery voltage.		

• Pn008 = n.□□□0

• The ALM (Servo Alarm) signal is output for up to five seconds when the control power supply is turned ON, and then the battery voltage is monitored for four seconds. No alarm will be displayed even if the battery voltage drops below the specified value after these four seconds.

• Pn008 = n.□□□1

The ALM (Servo Alarm) signal is output for up to five seconds when the control power supply is turned ON, and then the battery voltage is monitored continuously.



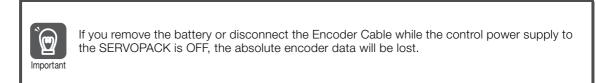
### **Battery Replacement Procedure**

- When Installing a Battery on the Host Controller
- 1. Turn ON only the control power supply to the SERVOPACK.
- 2. Remove the old battery and mount a new battery.
- **3.** Turn OFF the control power supply to the SERVOPACK to clear the A.830 alarm (Encoder Battery Alarm).
- 4. Turn ON the control power supply to the SERVOPACK again.
- 5. Make sure that the alarm has been cleared and that the SERVOPACK operates normally.

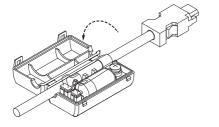
#### 13.1.3 Replacing the Battery

#### When Using an Encoder Cable with a Battery Case

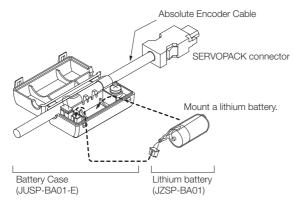
1. Turn ON only the control power supply to the SERVOPACK.



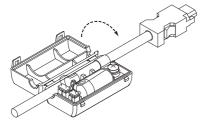
2. Open the cover of the Battery Case.



3. Remove the old battery and mount a new battery.



4. Close the cover of the Battery Case.



- **5.** Turn OFF the power supply to the SERVOPACK to clear the A.830 alarm (Encoder Battery Alarm).
- 6. Turn ON the power supply to the SERVOPACK.
- 7. Make sure that the alarm has been cleared and that the SERVOPACK operates normally.

# 13.2 Alarm Displays

If an error occurs in the SERVOPACK, an alarm number will be displayed on the panel display. However, if DD-DD appears on the panel display, the display will indicate a SERVOPACK system error. Replace the SERVOPACK.

If there is an alarm, the display will change in the following order.

Example: Alarm A.E60

$$\overset{\text{Status}}{\longrightarrow} \text{Not lit.} \longrightarrow H, \longrightarrow \text{Not lit.} \xrightarrow{} E \longrightarrow \text{Not lit.} \longrightarrow D \longrightarrow \text{Not lit.} \xrightarrow{} D \longrightarrow \text{Not lit.}$$

This section provides a list of the alarms that may occur and the causes of and corrections for those alarms.

### 13.2.1 List of Alarms

The list of alarms gives the alarm name, alarm meaning, alarm stopping method, and alarm reset possibility in order of the alarm numbers.

### Servomotor Stopping Method for Alarms

Refer to the following section for information on the stopping method for alarms. 6.13.2 Servomotor Stopping Method for Alarms on page 6-38

### Alarm Reset Possibility

Yes: You can use an alarm reset to clear the alarm. However, this assumes that the cause of the alarm has been removed.

No: You cannot clear the alarm.

### List of Alarms

Alarm Number	Alarm Name	Alarm Meaning	Servo- motor Stop- ping Method	Alarm Reset Possi- ble?
A.020	Parameter Checksum Error	There is an error in the parameter data in the SERVOPACK.	Gr.1	No
A.021	Parameter Format Error	There is an error in the parameter data format in the SERVOPACK.	Gr.1	No
A.022	System Checksum Error	There is an error in the parameter data in the SERVOPACK.	Gr.1	No
A.024	System Alarm	An internal program error occurred in the SER- VOPACK.	Gr.1	No
A.025	System Alarm	An internal program error occurred in the SER- VOPACK.	Gr.1	No
A.030	Main Circuit Detector Error	There is an error in the detection data for the main circuit.	Gr.1	Yes
A.040	Parameter Setting Error	A parameter setting is outside of the setting range.	Gr.1	No
A.041	Encoder Output Pulse Setting Error	The setting of Pn212 (Number of Encoder Output Pulses) or Pn281 (Encoder Output Resolution) is outside of the setting range or does not satisfy the setting conditions.	Gr.1	No

Continued on next page.

Servo-Alarm motor Alarm Reset Alarm Name Alarm Meaning Stop-Possi-Number ping ble? Method Parameter Combination The combination of some parameters exceeds A.042 Gr.1 No the setting range. Frror Semi-Closed/Fully-Closed The settings of the Option Module and Pn002 = A.044 Loop Control Parameter n.XDDD (External Encoder Usage) do not Gr 1 No Setting Error match. There is an error in the bank members or bank A.04A Parameter Setting Error 2 Gr.1 No data settings. The capacities of the SERVOPACK and Servomo-A.050 Combination Frror Gr. 1 Yes tor do not match. **Unsupported Device** A.051 An unsupported device was connected. Gr.1 No Alarm Motor Type Change The connected motor is a different type of motor A.070 Gr.1 No Detected from the previously connected motor. Linear Encoder Pitch Set-The setting of Pn282 (Linear Encoder Scale Pitch) A.080 Gr.1 No tina Error has not been changed from the default setting. The SV\_ON (Servo ON) command was sent from Invalid Servo ON Com-A.0b0 the host controller after a utility function that turns Gr.1 Yes mand Alarm ON the Servomotor was executed. An overcurrent flowed through the power transis-A.100 **Overcurrent Detected** Gr.1 No tor or the heat sink overheated. Motor Overcurrent The current to the motor exceeded the allowable A.101 Gr.1 No Detected current. Built-in Brake Relay Error A.231 The built-in brake relay malfunctioned. Gr.1 No Alarm Built-in Brake Relay Life The number of built-in brake relay operations A.232 Gr.1 No Alarm exceeded the service life of the relay. A.300 **Regeneration Error** There is an error related to regeneration. Gr.1 Yes A.320 A regenerative overload occurred. **Regenerative Overload** Gr.2 Yes • The AC power supply input setting or DC power Main Circuit Power Supply A.330 supply input setting is not correct. Gr.1 Yes Wiring Error • The power supply wiring is not correct. A.400 Overvoltage The main circuit DC voltage is too high. Gr.1 Yes A.410 Undervoltage The main circuit DC voltage is too low. Gr.2 Yes Main-Circuit Capacitor The capacitor in the main circuit has deteriorated A.450 Gr.1 No Overvoltage or is faulty. A.510 Gr.1 Overspeed The motor exceeded the maximum speed. Yes · Rotary Servomotor: The pulse output speed for the setting of Pn212 (Number of Encoder Out-**Encoder Output Pulse** put Pulses) was exceeded. A.511 Gr.1 Yes Overspeed · Linear Servomotor: The motor speed upper limit for the setting of Pn281 (Encoder Output Resolution) was exceeded. Abnormal oscillation was detected in the motor A.520 Vibration Alarm Gr.1 Yes speed. Vibration was detected during autotuning for the A.521 Autotuning Alarm Gr.1 Yes tuning-less function. Maximum Speed Setting The setting of Pn385 (Maximum Motor Speed) is A.550 Gr.1 Yes greater than the maximum motor speed. Error The Servomotor was operating for several sec-A.710 Instantaneous Overload onds to several tens of seconds under a torque Gr 2 Yes that largely exceeded the rating. The Servomotor was operating continuously A.720 Continuous Overload Gr.1 Yes under a torgue that exceeded the rating.

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Alarm Number	Alarm Name	Alarm Meaning	Servo- motor Stop- ping Method	Alarm Reset Possi- ble?
A.730 A.731	Dynamic Brake Overload	When the dynamic brake was applied, the rota- tional or linear kinetic energy exceeded the capacity of the Dynamic Brake Resistor.	Gr.1	Yes
A.740	Inrush Current Limiting Resistor Overload	The main circuit power supply was frequently turned ON and OFF.	Gr.1	Yes
A.7A1	Internal Temperature Error 1 (Control Board Tempera- ture Error)	The surrounding temperature of the control PCB is abnormal.	Gr.2	Yes
A.7A2	Internal Temperature Error 2 (Power Board Tempera- ture Error)	The surrounding temperature of the power PCB is abnormal.	Gr.2	Yes
A.7A3	Internal Temperature Sen- sor Error	An error occurred in the temperature sensor cir- cuit.	Gr.2	No
A.7A4	Power Transistor Over- heated (Abnormal power transistor temperature.)	The temperature of the power transistor is abnormal.	Gr.2	No
A.7Ab	SERVOPACK Built-in Fan Stopped	The fan inside the SERVOPACK stopped.	Gr.1	Yes
A.810	Encoder Backup Alarm	The power supplies to the encoder all failed and the position data was lost.	Gr.1	No
A.820	Encoder Checksum Alarm	There is an error in the checksum results for encoder memory.	Gr.1	No
A.830	Encoder Battery Alarm	The battery voltage was lower than the specified level after the control power supply was turned ON.	Gr.1	Yes
A.840	Encoder Data Alarm	There is an internal data error in the encoder.	Gr.1	No
A.850	Encoder Overspeed	The encoder was operating at high speed when the power was turned ON.	Gr.1	No
A.860	Encoder Overheated	The internal temperature of encoder is too high.	Gr.1	No
A.861	Motor Overheated	The internal temperature of motor is too high.	Gr.1	No
A.862	Overheat Alarm	The input voltage (temperature) for the overheat protection input (TH) signal exceeded the setting of Pn61B (Overheat Alarm Level).	Gr.1	Yes
A.890	Encoder Scale Error	A failure occurred in the linear encoder.	Gr.1	No
A.891	Encoder Module Error	An error occurred in the linear encoder.	Gr.1	No
A.8A0	External Encoder Error	An error occurred in the external encoder.	Gr.1	Yes
A.8A1	External Encoder Module Error	An error occurred in the Serial Converter Unit.	Gr.1	Yes
A.8A2	External Incremental Encoder Sensor Error	An error occurred in the external encoder.	Gr.1	Yes
A.8A3	External Absolute Encoder Position Error	An error occurred in the position data of the external encoder.	Gr.1	Yes
A.8A5	External Encoder Over- speed	An overspeed error occurred in the external encoder.	Gr.1	Yes
A.8A6	External Encoder Over- heated	An overheating error occurred in the external encoder.	Gr.1	Yes
A.b33	Current Detection Error 3	An error occurred in the current detection circuit.	Gr.1	No
A.b6A	MECHATROLINK Commu- nications ASIC Error 1	ASIC error 1 occurred in MECHATROLINK com- munications.	Gr.1	No
A.b6b	MECHATROLINK Commu- nications ASIC Error 2	ASIC error 2 occurred in MECHATROLINK com- munications.	Gr.2	No

Continued on next page.

Servo-Alarm motor Alarm Reset Alarm Name Alarm Meaning Stop-Possi-Number ping ble? Method Internal program error 0 occurred in the SERVO-A.bF0 System Alarm 0 Gr.1 No PACK. Internal program error 1 occurred in the SERVO-A.bF1 Gr.1 No System Alarm 1 PACK. Internal program error 2 occurred in the SERVO-A.bF2 Gr.1 System Alarm 2 No PACK. Internal program error 3 occurred in the SERVO-A.bF3 System Alarm 3 Gr.1 No PACK. Internal program error 4 occurred in the SERVO-A.bF4 System Alarm 4 Gr.1 No PACK. Internal program error 5 occurred in the SERVO-A.bF5 System Alarm 5 Gr 1 No PACK. Internal program error 6 occurred in the SERVO-A.bF6 System Alarm 6 Gr.1 No PACK. Internal program error 7 occurred in the SERVO-A.bF7 System Alarm 7 Gr.1 No PACK. Internal program error 8 occurred in the SERVO-A.bF8 System Alarm 8 Gr.1 No PACK. A.C10 Servomotor Out of Control The Servomotor ran out of control. Gr.1 Yes A.C20 Phase Detection Error The detection of the phase is not correct. Gr.1 No A.C21 An error occurred in the polarity sensor. Polarity Sensor Error Gr.1 No Phase Information Dis-A.C22 The phase information does not match. Gr. 1 No agreement A.C50 Polarity Detection Failure The polarity detection failed. Gr.1 Nο **Overtravel Detected** The overtravel signal was detected during polarity A.C51 Gr.1 Yes during Polarity Detection detection. Polarity Detection Not The servo was turned ON before the polarity was A.C52 Gr.1 Yes Completed detected. Out of Range of Motion for The travel distance exceeded the setting of A.C53 Gr.1 No Pn48E (Polarity Detection Range). Polarity Detection Polarity Detection Failure A.C54 The polarity detection failed. Gr.1 No 2 Encoder Clear Error or The multiturn data for the absolute encoder was A.C80 Multiturn Limit Setting Gr.1 No not correctly cleared or set. Error Encoder Communications Communications between the encoder and SER-A.C90 Gr.1 No VOPACK is not possible. Frror **Encoder Communications** An error occurred in calculating the position data A.C91 **Position Data Acceleration** Gr.1 No of the encoder. Rate Error **Encoder Communications** An error occurred in the communications timer A.C92 Gr.1 No Timer Error between the encoder and SERVOPACK. A.CA0 Encoder Parameter Error The parameters in the encoder are corrupted. Gr.1 No The contents of communications with the A.Cb0 Encoder Echoback Error Gr 1 No encoder are incorrect. Multiturn Limit Disagree-Different multiturn limits have been set in the A.CC0 Gr.1 No ment encoder and the SERVOPACK. **Reception Failed Error in** Receiving data from the Feedback Option Mod-A.CF1 Feedback Option Module Gr.1 No ule failed. Communications

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Alarm Number	Alarm Name	Alarm Meaning	Servo- motor Stop- ping Method	Alarm Reset Possi- ble?
A.CF2	Timer Stopped Error in Feedback Option Module Communications	An error occurred in the timer for communica- tions with the Feedback Option Module.	Gr.1	No
A.d00	Position Deviation Over- flow	The setting of Pn520 (Position Deviation Overflow Alarm Level) was exceeded by the position deviation while the servo was ON.	Gr.1	Yes
A.d01	Position Deviation Over- flow Alarm at Servo ON	The servo was turned ON after the position devi- ation exceeded the setting of Pn526 (Position Deviation Overflow Alarm Level at Servo ON) while the servo was OFF.	Gr.1	Yes
A.d02	Position Deviation Over- flow Alarm for Speed Limit at Servo ON	If position deviation remains in the deviation counter, the setting of Pn529 or Pn584 (Speed Limit Level at Servo ON) limits the speed when the servo is turned ON. This alarm occurs if a position reference is input and the setting of Pn520 (Position Deviation Overflow Alarm Level) is exceeded before the limit is cleared.	Gr.2	Yes
A.d10	Motor-Load Position Devi- ation Overflow	There was too much position deviation between the motor and load during fully-closed loop con- trol.	Gr.2	Yes
A.d30	Position Data Overflow	The position feedback data exceeded ±1,879,048,192.	Gr.1	No
A.E02	MECHATROLINK Internal Synchronization Error 1	A synchronization error occurred during MECHATROLINK communications with the SER- VOPACK.	Gr.1	Yes
A.E40	MECHATROLINK Trans- mission Cycle Setting Error	The setting of the MECHATROLINK communica- tions transmission cycle is not correct.	Gr.2	Yes
A.E41	MECHATROLINK Commu- nications Data Size Set- ting Error	The setting of the MECHATROLINK communica- tions data size is not correct.	Gr.2	Yes
A.E42	MECHATROLINK Station Address Setting Error	The setting of the MECHATROLINK station address is not correct.	Gr.2	No
A.E50*	MECHATROLINK Syn- chronization Error	A synchronization error occurred during MECHATROLINK communications.	Gr.2	Yes
A.E51	MECHATROLINK Syn- chronization Failed	Synchronization failed during MECHATROLINK communications.	Gr.2	Yes
A.E60*	Reception Error in MECHATROLINK Commu- nications	Communications errors occurred continuously during MECHATROLINK communications.	Gr.2	Yes
A.E61	Synchronization Interval Error in MECHATROLINK Transmission Cycle	An error occurred in the transmission cycle during MECHATROLINK communications.	Gr.2	Yes
A.E63	MECHATROLINK Syn- chronization Frame Not Received	Synchronization frames were continuously not received during MECHATROLINK communica- tions.	Gr.2	Yes
A.E72	Feedback Option Module Detection Failure	Detection of the Feedback Option Module failed.	Gr.1	No
A.Eb1	Safety Function Signal Input Timing Error	An error occurred in the input timing of the safety function signal.	Gr.1	No
A.EC8	Gate Drive Error 1	An error occurred in the gate drive circuit.	Gr.1	No
A.EC9	Gate Drive Error 2	An error occurred in the gate drive circuit.	Gr.1	No
A.Ed1	Command Execution Tim- eout	A timeout error occurred for a MECHATROLINK command.	Gr.2	Yes

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13.2.1 List of Alarms

Continued from previous page. Servo-Alarm motor Alarm Reset Alarm Name Alarm Meaning Stop-Number Possiping ble? Method The voltage was low for more than one second Power Supply Line Open A.F10 for phase R, S, or T when the main power supply Yes Gr.2 Phase was ON. **Dynamic Brake Circuit** A.F30 An error occurred in the dynamic brake circuit. Gr.2 Yes Error Dynamic Brake Operation An error occurred in the settings related to the A.F32 Request Output Signal Gr.1 No Dynamic Brake Operation Request Output signal. Setting Error FL-1\* FL-2\* FL-3\* An internal program error occurred in the SER-System Alarm No FL-4\* VOPACK. FL-5\* FL-6\* Digital Operator Commu-CPF00 Communications were not possible between the nications Error 1 Digital Operator (model: JUSP-OP05A-1-E) and No \_ Digital Operator Commuthe SERVOPACK (e.g., a CPU error occurred). CPF01 nications Error 2

\* These alarms are not stored in the alarm history. They are only displayed on the panel display.

The causes of and corrections for the alarms are given in the following table. Contact your Yaskawa representative if you cannot solve a problem with the correction given in the table.

Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
	The power supply voltage suddenly dropped.	Measure the power supply voltage.	Set the power supply volt- age within the specified range, and initialize the parameter settings.	page 6-10
	The power supply was shut OFF while writing parameter set- tings.	Check the timing of shutting OFF the power supply.	Initialize the parameter settings and then set the parameters again.	
<b>A.020:</b> Parameter	The number of times that parameters were written exceeded the limit.	Check to see if the parameters were fre- quently changed from the host controller.	The SERVOPACK may be faulty. Replace the SER- VOPACK. Reconsider the method for writing the parame- ters.	-
Checksum Error (There is an error in the parameter data in the SER- VOPACK.)	A malfunction was caused by noise from the AC power supply, ground, static elec- tricity, or other source.	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, noise may be the cause.	Implement countermea- sures against noise.	page 4-5
	Gas, water drops, or cutting oil entered the SERVOPACK and caused failure of the internal components.	Check the installation conditions.	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-
	A failure occurred in the SERVOPACK.	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may have failed.	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-
A.021: Parameter For- mat Error (There is an error in the parameter data format in the	The software version of the SERVOPACK that caused the alarm is older than the soft- ware version of the parameters specified to write.	Read the product infor- mation to see if the soft- ware versions are the same. If they are differ- ent, it could be the cause of the alarm.	Write the parameters from another SERVOPACK with the same model and the same software version, and then turn the power OFF and ON again.	page 10-2
SERVOPACK.)	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-
	The power supply voltage suddenly dropped.	Measure the power supply voltage.	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-
A.022: System Check- sum Error (There is an error	The power supply was shut OFF while setting a utility func- tion.	Check the timing of shutting OFF the power supply.	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-
in the parameter data in the SER- VOPACK.)	A failure occurred in the SERVOPACK.	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may have failed.	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Continued from pro	Reference
A.024: System Alarm (An internal pro- gram error occurred in the SERVOPACK.)	A failure occurred in the SERVOPACK.	_	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-
A.025: System Alarm (An internal pro- gram error occurred in the SERVOPACK.)	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-
A.030: Main Circuit Detector Error	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-
	The SERVOPACK and Servomotor capaci- ties do not match each other.	Check the combination of the SERVOPACK and Servomotor capacities.	Select a proper combina- tion of SERVOPACK and Servomotor capacities.	page 1-8
A.040: Parameter Set-	The motor parameter file was not written to the linear encoder. (This applies only when not using a Serial Converter Unit.)	Check to see if the motor parameter file was written to the lin- ear encoder.	Write the motor parame- ter file to the linear encoder.	page 6-17
ting Error (A parameter set- ting is outside of	A failure occurred in the SERVOPACK.	_	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-
the setting range.)	A parameter setting is outside of the setting range.	Check the setting ranges of the parame- ters that have been changed.	Set the parameters to val- ues within the setting ranges.	-
	The electronic gear ratio is outside of the setting range.	Check the electronic gear ratio. The ratio must be within the fol- lowing range: 0.001 < (Pn20E/Pn210) < 64,000.	Set the electronic gear ratio in the following range: 0.001 < (Pn20E/ Pn210) < 64,000.	page 6-43
<b>A.041:</b> Encoder Output Pulse Setting Error	The setting of Pn212 (Number of Encoder Output Pulses) or Pn281 (Encoder Out- put Resolution) is out- side of the setting range or does not sat- isfy the setting condi- tions.	Check the setting of Pn212 or Pn281.	Set Pn212 or Pn281 to an appropriate value.	page 7-20

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
	The speed of program jogging went below the setting range when the electronic gear ratio (Pn20E/ Pn210) or the Servo- motor was changed.	Check to see if the detection conditions <sup>*1</sup> are satisfied.	Decrease the setting of the electronic gear ratio (Pn20E/Pn210).	page 6-43
	The speed of program jogging went below the setting range when Pn533 or Pn585 (Program Jogging Movement Speed) was changed.	Check to see if the detection conditions <sup>*1</sup> are satisfied.	Increase the setting of Pn533 or Pn585.	page 8-14
A.042: Parameter Com-	The movement speed of advanced autotun- ing went below the setting range when the electronic gear ratio (Pn20E/ Pn210) or the Servomotor was changed.	Check to see if the detection conditions <sup>*2</sup> are satisfied.	Decrease the setting of the electronic gear ratio (Pn20E/Pn210).	page 6-43
bination Error	The combination of Pn001 = $n.\square\square\squareX$ (Motor Stopping Method for Servo OFF and Group 1 Alarms), Pn601 (Dynamic Brake Resistor Allow- able Energy Con- sumption), and PN604 (Dynamic Brake Resistance) is wrong, or the settings of those parameters are wrong.	Check Pn001 = n.□□□X, Pn601, and Pn604.	<ul> <li>When Not Using a Dynamic Brake</li> <li>Set Pn001 = n. \\DD X to 2 (Coast the motor to a stop without the dynamic brake).</li> <li>Set Pn601 and Pn604 to 0.</li> <li>When Using a Dynamic Brake</li> <li>Set Pn001 = n. \DD X to 0 (Stop the motor by applying the dynamic brake) or 1 (Stop the motor by applying the dynamic brake and then release the dynamic brake).</li> <li>Set Pn601 and Pn604 according to the specifi- cations of the resistor.</li> </ul>	page 5-9
A.044: Semi-Closed/ Fully-Closed Loop Control Parameter Setting Error	The setting of the Fully-closed Module does not match the setting of Pn002 = n.X□□□ (External Encoder Usage).	Check the setting of Pn002 = $n.X\square\square\square$ .	Make sure that the setting of the Fully-closed Mod- ule agrees with the setting of Pn002 = $n.X\square\square\square$ .	page 11-6
A.04A: Parameter Set-	For 4-byte parameter bank members, there are two consecutive members with nothing registered.	-	Change the number of bytes for bank members to an appropriate value.	-
ting Error 2	The total amount of bank data exceeds 64 (Pn900 × Pn901 > 64).	_	Reduce the total amount of bank data to 64 or less. Continued o	-

Maintenance

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
A.050: Combination Error (The capacities of the SERVOPACK and Servomotor	The SERVOPACK and Servomotor capaci- ties do not match each other.	Confirm that the follow- ing condition is met: $1/4 \le$ (Servomotor capacity/SERVOPACK capacity) $\le 4$	Select a proper combina- tion of the SERVOPACK and Servomotor capaci- ties.	page 1-8
	A failure occurred in the encoder.	Replace the encoder and check to see if the alarm still occurs.	Replace the Servomotor or encoder.	_
do not match.)	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-
A.051:	The motor parameter file was not written to the linear encoder. (This applies only when not using a Serial Converter Unit.)	Check to see if the motor parameter file was written to the lin- ear encoder.	Write the motor parame- ter file to the linear encoder.	page 6-17
Unsupported Device Alarm	An unsupported Serial Converter Unit or encoder (e.g., an external encoder) is connected to the SERVOPACK.	Check the product combination specifica-tions.	Change to a correct com- bination of models.	-
A.070: Motor Type Change Detected (The connected	A Rotary Servomotor was removed and a Linear Servomotor was connected.	_	Set the parameters for a Linear Servomotor and reset the motor type alarm. Then, turn the power supply to the SER- VOPACK OFF and ON again.	page 13-48
motor is a differ- ent type of motor from the previ- ously connected motor.)	A Linear Servomotor was removed and a Rotary Servomotor was connected.	_	Set the parameters for a Rotary Servomotor and reset the motor type alarm. Then, turn the power supply to the SER- VOPACK OFF and ON again.	page 13-48
A.080: Linear Encoder Pitch Setting Error	The setting of Pn282 (Linear Encoder Scale Pitch) has not been changed from the default setting.	Check the setting of Pn282.	Correct the setting of Pn282.	page 6-16
A.0b0: Invalid Servo ON Command Alarm	The SV_ON (Servo ON) command was sent from the host controller after a util- ity function that turns ON the Servomotor was executed.	-	Turn the power supply to the SERVOPACK OFF and ON again. Or, execute a software reset.	page 7-47

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
	The Main Circuit Cable is not wired correctly or there is faulty contact.	Check the wiring.	Correct the wiring.	
	There is a short-circuit or ground fault in a Main Circuit Cable.	Check for short-circuits across Servomotor phases U, V, and W, or between the ground and Servomotor phases U, V, and W.	The cable may be short- circuited. Replace the cable.	
A.100: Overcurrent	There is a short-circuit or ground fault inside the Servomotor.	Check for short-circuits across Servomotor phases U, V, and W, or between the ground and Servomotor phases U, V, or W.	The Servomotor may be faulty. Replace the Servo- motor.	page 4-19
Detected (An overcurrent flowed through the power tran- sistor or the heat sink overheated.)	There is a short-circuit or ground fault inside the SERVOPACK.	Check for short-circuits across the Servomotor connection terminals U, V, and W on the SER- VOPACK, or between the ground and termi- nals U, V, or W.	The SERVOPACK may be faulty. Replace the SER- VOPACK.	
	The Regenerative Resistor is not wired correctly or there is faulty contact.	Check the wiring.	Correct the wiring.	page 4-18
	The dynamic brake (DB, emergency stop executed from the SERVOPACK) was frequently activated, or a DB overload alarm occurred.	Check the power con- sumed by the DB resis- tor to see how frequently the DB is being used. Or, check the alarm display to see if a DB overload alarm (A.730 or A.731) has occurred.	Change the SERVOPACK model, operating meth- ods, or the mechanisms so that the dynamic brake does not need to be used so frequently.	-

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
	The regenerative pro- cessing capacity was exceeded.	Check the regenerative load ratio in the Sig- maWin+ Motion Monitor Tab Page to see how frequently the Regener- ative Resistor is being used.	Recheck the operating conditions and load.	*3
A.100: Overcurrent	The SERVOPACK regenerative resis- tance is too small.	Check the regenerative load ratio in the Sig- maWin+ Motion Monitor Tab Page to see how frequently the Regener- ative Resistor is being used.	Change the regenerative resistance to a value larger than the SERVO- PACK minimum allowable resistance.	*3
Detected (An overcurrent flowed through the power tran- sistor or the heat sink overheated.)	A heavy load was applied while the Ser- vomotor was stopped or running at a low speed.	Check to see if the operating conditions exceed Servo Drive specifications.	Reduce the load applied to the Servomotor. Or, increase the operating speed.	-
	A malfunction was caused by noise.	Improve the noise envi- ronment, e.g. by improving the wiring or installation conditions, and check to see if the alarm still occurs.	Implement countermea- sures against noise, such as correct wiring of the FG. Use an FG wire size equivalent to the SERVO- PACK's main circuit wire size.	-
	A failure occurred in the SERVOPACK.	-	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-

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Alarm Number	Continued from previous pag			
Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
	The Main Circuit Cable is not wired correctly or there is faulty contact.	Check the wiring.	Correct the wiring.	
	There is a short-circuit or ground fault in a Main Circuit Cable.	Check for short-circuits across cable phases U, V, and W, or between the ground and cable phases U, V, and W.	The cable may be short- circuited. Replace the cable.	
	There is a short-circuit or ground fault inside the Servomotor.	Check for short-circuits across Servomotor phases U, V, and W, or between the ground and Servomotor phases U, V, or W.	The Servomotor may be faulty. Replace the Servo- motor.	page 4-19
A.101: Motor Overcur- rent Detected (The current to the motor exceeded the	There is a short-circuit or ground fault inside the SERVOPACK.	Check for short-circuits across the Servomotor connection terminals U, V, and W on the SER- VOPACK, or between the ground and termi- nals U, V, or W.	The SERVOPACK may be faulty. Replace the SER- VOPACK.	
allowable cur- rent.)	A heavy load was applied while the Ser- vomotor was stopped or running at a low speed.	Check to see if the operating conditions exceed Servo Drive specifications.	Reduce the load applied to the Servomotor. Or, increase the operating speed.	-
	A malfunction was caused by noise.	Improve the noise envi- ronment, e.g. by improving the wiring or installation conditions, and check to see if the alarm still occurs.	Implement countermea- sures against noise, such as correct wiring of the FG. Use an FG wire size equivalent to the SERVO- PACK's main circuit wire size.	-
	A failure occurred in the SERVOPACK.	-	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
	The brake power sup- ply wiring is wrong, disconnected, or bro- ken.	Check the brake power supply wiring.	Wire the brake power supply correctly.	-
A.231: Built-in Brake Relay Error Alarm	A malfunction was caused by noise.	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, noise may be the cause.	Implement countermea- sures against noise.	-
	The built-in brake relay failed.	-	Replace the part. Con- tact your Yaskawa repre- sentative for replacement.	-
A.232: Built-in Brake Relay Life Alarm	The service life of the built-in brake relay was exceeded.	_	Replace the part. Con- tact your Yaskawa repre- sentative for replacement.	-

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
A 200:	When using the built- in regenerative resis- tor, the jumper between the regener- ative resistor terminals (B2 and B3) was removed from one of the following SERVO- PACKs: SGD7S -1R9D, -3R5D, -5R4D, -8R4D, -120D, or -170D	Check to see if the jumper is connected between power supply terminals B2 and B3. <sup>*4</sup>	Correctly connect a jumper.	page 4-18
A.300: Regeneration Error	The External Regener- ative Resistor is not wired correctly, or was removed or discon- nected.	Check the wiring of the External Regenerative Resistor. <sup>*4</sup>	Correct the wiring of the External Regenerative Resistor.	
	A failure occurred in the SERVOPACK.	_	While the main circuit power supply is OFF, turn the control power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVO- PACK may be faulty. Replace the SERVO- PACK.	_
	The power supply voltage exceeded the specified range.	Measure the power supply voltage.	Set the power supply volt- age within the specified range.	-
	The external regener- ative resistance value or Regenerative Resistor capacity is too small, or there has been a continuous regeneration state.	Check the operating conditions or the capacity using the Sig- maJunmaSize+ Capac- ity Selection Software or other means.	Change the regenerative resistance value or capac- ity. Reconsider the operating conditions using the Sig- maJunmaSize+ Capacity Selection Software or other means.	*3
	There was a continu- ous regeneration state because a negative load was continu- ously applied.	Check the load applied to the Servomotor during operation.	Reconsider the system including the servo, machine, and operating conditions.	_
<b>A.320:</b> Regenerative Overload	The setting of Pn600 (Regenerative Resis- tor Capacity) is smaller than the capacity of the Exter- nal Regenerative Resistor.	Check to see if a Regenerative Resistor is connected and check the setting of Pn600.	Correct the setting of Pn600.	page 6-53
	The setting of Pn603 (Regenerative Resis- tance) is smaller than the capacity of the External Regenerative Resistor.	Check to see if a Regenerative Resistor is connected and check the setting of Pn603.	Correct the setting of Pn603.	page 6-53
	The external regener- ative resistance is too high.	Check the regenerative resistance.	Change the regenerative resistance to a correct value or use an External Regenerative Resistor of an appropriate capacity.	*3
	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
<b>A.330:</b> Main Circuit	The Regenerative Resistor was discon- nected when the SERVOPACK power supply voltage was high.	Measure the resistance of the Regenerative Resistor using a mea- suring instrument.	If you are using the Regenerative Resistor built into the SERVO- PACK, replace the SER- VOPACK. If you are using an Exter- nal Regenerative Resis- tor, replace the External Regenerative Resistor.	-
Power Supply Wiring Error (Detected when the main circuit power supply is	DC power was sup- plied when an AC power supply input was specified in the settings.	Check the power sup- ply to see if it is a DC power supply.	Correct the power supply setting to match the actual power supply.	2000 C 50
turned ON.)	AC power was sup- plied when a DC power supply input was specified in the settings.	Check the power sup- ply to see if it is an AC power supply.	Correct the power supply setting to match the actual power supply.	- page 6-53
	A failure occurred in the SERVOPACK.	_	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-
	The power supply voltage exceeded the specified range.	Measure the power supply voltage.	Set the AC/DC power supply voltage within the specified range.	_
	The power supply is not stable or was influenced by a light- ning surge.	Measure the power supply voltage.	Improve the power sup- ply conditions, install a Surge Absorber, and then turn the power supply OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SER- VOPACK.	-
A.400: Overvoltage (Detected in the	The voltage for AC power supply was too high during accelera- tion or deceleration.	Check the power sup- ply voltage and the speed and torque during operation.	Set the AC power supply voltage within the speci- fied range.	-
main circuit power supply section of the SERVOPACK.)	The external regener- ative resistance is too high for the operating conditions.	Check the operating conditions and the regenerative resistance.	Select a regenerative resistance value that is appropriate for the oper- ating conditions and load.	*3
	The moment of inertia ratio or mass ratio exceeded the allow- able value.	Check to see if the moment of inertia ratio or mass ratio is within the allowable range.	Increase the deceleration time, or reduce the load.	-
	A failure occurred in the SERVOPACK.	_	While the main circuit power supply is OFF, turn the control power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVO- PACK may be faulty. Replace the SERVO- PACK.	-

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Alarm Number:	Continued from previous page			
Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
A.410: Undervoltage (Detected in the main circuit power supply	The power supply voltage went below the specified range.	Measure the power supply voltage.	Set the power supply volt- age within the specified range.	-
	The power supply voltage dropped during operation.	Measure the power supply voltage.	Increase the power supply capacity.	-
	A momentary power interruption occurred.	Measure the power supply voltage.	If you have changed the setting of Pn509 (Momen- tary Power Interruption Hold Time), decrease the setting.	page 7-16
section of the SERVOPACK.)	The SERVOPACK fuse is blown out.	-	Replace the SERVO- PACK and connect a Reactor to the DC Reac- tor terminals ( $\ominus$ 1 and $\ominus$ 2) on the SERVOPACK.	-
	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	_
A.450: Main-Circuit Capacitor Over- voltage (The capacitor in the main circuit has deteriorated or is faulty.)	A failure occurred in the SERVOPACK.	_	Replace the SERVO- PACK.	-
	The order of phases U, V, and W in the motor wiring is not correct.	Check the wiring of the Servomotor.	Make sure that the Servo- motor is correctly wired.	-
A.510: Overspeed (The motor	A reference value that exceeded the over- speed detection level was input.	Check the input refer- ence.	Reduce the reference value. Or, adjust the gain.	
exceeded the maximum speed.)	The motor exceeded the maximum speed.	Check the waveform of the motor speed.	Reduce the speed refer- ence input gain and adjust the servo gain. Or, reconsider the operating conditions.	_
	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-
A.511:	The encoder output pulse frequency exceeded the limit.	Check the encoder out- put pulse setting.	Decrease the setting of Pn212 (Number of Encoder Output Pulses) or Pn281 (Encoder Out- put Resolution).	page 7-25
Encoder Output Pulse Overspeed	The encoder output pulse frequency exceeded the limit because the motor speed was too high.	Check the encoder out- put pulse setting and the motor speed.	Reduce the motor speed. Continued o	-

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
<b>A.520:</b> Vibration Alarm	Abnormal oscillation was detected in the motor speed.	Check for abnormal motor noise, and check the speed and torque waveforms during oper- ation.	Reduce the motor speed. Or, reduce the setting of Pn100 (Speed Loop Gain).	page 9-82
	The setting of Pn103 (Moment of Inertia Ratio) is greater than the actual moment of inertia or was greatly changed.	Check the moment of inertia ratio or mass ratio.	Set Pn103 (Moment of Inertia Ratio) to an appro- priate value.	page 9-16
	The vibration detec- tion level (Pn312 or Pn384) is not suitable.	Check that the vibra- tion detection level (Pn312 or Pn384) is suitable.	Set a suitable vibration detection level (Pn312 or Pn384).	page 7-50
A.521: Autotuning Alarm (Vibration was detected while executing the custom tuning,	The Servomotor vibrated considerably while performing the tuning-less function.	Check the waveform of the motor speed.	Reduce the load so that the moment of inertia ratio is within the allowable value. Or increase the load level or reduce the rigidity level in the tuning- less level settings.	page 9-13
Easy FFT, or the tuning-less func- tion.)	The Servomotor vibrated considerably while performing cus- tom tuning or Easy FFT.	Check the waveform of the motor speed.	Check the operating pro- cedure of corresponding function and implement corrections.	page 9-42, page 9-99
A.550: Maximum Speed Setting Error	The setting of Pn385 (Maximum Motor Speed) is greater than the maximum speed.	Check the setting of Pn385, and the upper limits of the maximum motor speed setting and the encoder output resolution setting.	Set Pn385 to a value that does not exceed the max- imum motor speed.	page 7-19
	The wiring is not cor- rect or there is a faulty contact in the motor or encoder wiring.	Check the wiring.	Make sure that the Servo- motor and encoder are correctly wired.	page 4-19
	Operation was per- formed that exceeded the overload protec- tion characteristics.	Check the motor over- load characteristics and Run command.	Reconsider the load and operating conditions. Or, increase the motor capacity.	-
A.710: Instantaneous Overload A.720: Continuous Overload	An excessive load was applied during operation because the Servomotor was not driven due to mechanical problems.	Check the operation reference and motor speed.	Correct the mechanical problem.	-
	There is an error in the setting of Pn282 (Lin- ear Encoder Scale Pitch).	Check the setting of Pn282.	Correct the setting of Pn282.	page 6-16
	There is an error in the setting of $Pn080 =$ n. $\Box\Box$ X $\Box$ (Motor Phase Sequence Selection).	Check the setting of Pn080 = $n.\Box\Box X\Box$ .	Set Pn080 = n.□□X□ to an appropriate value.	page 6-21
	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-

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Alarm Number:				
Alarm Name	Possible Cause	Confirmation	Correction	Reference
A.730 and	The Servomotor was rotated by an external force.	Check the operation status.	Implement measures to ensure that the motor will not be rotated by an external force.	-
A.731: Dynamic Brake Overload (An excessive power consump- tion by the dynamic brake was detected.)	When the Servomo- tor was stopped with the dynamic brake, the rotational or linear kinetic energy exceeded the capac- ity of the dynamic brake resistor.	Check the power con- sumed by the DB resis- tor to see how frequently the DB is being used.	<ul> <li>Reconsider the following:</li> <li>Reduce the Servomotor command speed.</li> <li>Decrease the moment of inertia ratio or mass ratio.</li> <li>Reduce the frequency of stopping with the dynamic brake.</li> </ul>	-
	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	_
A.740: Inrush Current Limiting Resistor Overload (The main circuit power supply was frequently	The allowable fre- quency of the inrush current limiting resis- tor was exceeded when the main circuit power supply was turned ON and OFF.	_	Reduce the frequency of turning the main circuit power supply ON and OFF.	-
turned ON and OFF.)	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	_
	The surrounding tem- perature is too high.	Check the surrounding temperature using a thermostat. Or, check the operating status with the SERVOPACK installation environment monitor.	Decrease the surround- ing temperature by improving the SERVO- PACK installation condi- tions.	page 3-6
A.7A1:	An overload alarm was reset by turning OFF the power sup- ply too many times.	Check the alarm display to see if there is an overload alarm.	Change the method for resetting the alarm.	-
Internal Tempera- ture Error 1 (Control Board Temperature Error)	There was an exces- sive load or operation was performed that exceeded the regen- erative processing capacity.	Use the accumulated load ratio to check the load during operation, and use the regenera- tive load ratio to check the regenerative pro- cessing capacity.	Reconsider the load and operating conditions.	-
	The SERVOPACK installation orientation is not correct or there is insufficient space around the SERVO- PACK.	Check the SERVOPACK installation conditions.	Install the SERVOPACK according to specifica- tions.	page 3-3, page 3-5
	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK. Continued o	-

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
	The surrounding tem- perature is too high.	Check the surrounding temperature using a thermostat. Or, check the operating status with the SERVOPACK installation environment monitor.	Decrease the surround- ing temperature by improving the SERVO- PACK installation condi- tions.	page 3-6
4 740	An overload alarm was reset by turning OFF the power sup- ply too many times.	Check the alarm display to see if there is an overload alarm.	Change the method for resetting the alarm.	-
A.7A2: Internal Tempera- ture Error 2 (Power Board Temperature Error)	There was an exces- sive load or operation was performed that exceeded the regen- erative processing capacity.	Use the accumulated load ratio to check the load during operation, and use the regenera- tive load ratio to check the regenerative pro- cessing capacity.	Reconsider the load and operating conditions.	-
	The SERVOPACK installation orientation is not correct or there is insufficient space around the SERVO- PACK.	Check the SERVOPACK installation conditions.	Install the SERVOPACK according to specifica- tions.	page 3-3, page 3-5
	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-
A.7A3: Internal Tempera- ture Sensor Error (An error occurred in the temperature sen- sor circuit.)	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-
	The surrounding tem- perature is too high.	Check the surrounding temperature using a thermostat. Or, check the operating status with the SERVOPACK installation environment monitor.	Decrease the surround- ing temperature by improving the SERVO- PACK installation condi- tions.	page 3-6
A 7A 4.	An overload alarm was reset by turning OFF the power sup- ply too many times.	Check the alarm display to see if there is an overload alarm.	Change the method for resetting the alarm.	-
A.7A4: Power Transistor Overheated (Abnormal power transistor tem- perature.)	There was an exces- sive load or operation was performed that exceeded the regen- erative processing capacity.	Use the accumulated load ratio to check the load during operation, and use the regenera- tive load ratio to check the regenerative pro- cessing capacity.	Reconsider the load and operating conditions.	-
	The SERVOPACK installation orientation is not correct or there is insufficient space around the SERVO- PACK.	Check the SERVOPACK installation conditions.	Install the SERVOPACK according to specifica- tions.	page 3-3, page 3-5
	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
A.7Ab: SERVOPACK Built-in Fan Stopped	The fan inside the SERVOPACK stopped.	Check for foreign matter inside the SERVOPACK.	Remove foreign matter from the SERVOPACK. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SER- VOPACK.	-
	The power to the absolute encoder was turned ON for the first time.	Check to see if the power supply was turned ON for the first time.	Set up the encoder.	
A.810:	The Encoder Cable was disconnected and then connected again.	Check to see if the power supply was turned ON for the first time.	Check the encoder con- nection and set up the encoder.	page 6-47
Encoder Backup Alarm (Detected at the encoder, but only when an abso- lute encoder is used.)	Power is not being supplied both from the control power supply (+5 V) from the SERVOPACK and from the battery power supply.	Check the encoder connector battery and the connector status.	Replace the battery or implement similar mea- sures to supply power to the encoder, and set up the encoder.	
	A failure occurred in the absolute encoder.	_	If the alarm still occurs after setting up the encoder again, replace the Servomotor.	-
	A failure occurred in the SERVOPACK.	_	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-
A.820: Encoder Check- sum Alarm (Detected at the encoder.)	A failure occurred in the encoder.	_	<ul> <li>When Using an Absolute Encoder</li> <li>Set up the encoder again.</li> <li>If the alarm still occurs, the Servomotor may be faulty. Replace the Servomotor.</li> <li>When Using a Singleturn Absolute Encoder or Incremental Encoder</li> <li>The Servomotor may be faulty. Replace the Servomotor.</li> <li>The linear encoder may be faulty. Replace the linear encoder.</li> </ul>	page 6-47
	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-
A.830: Encoder Battery Alarm (The absolute encoder battery voltage was lower	The battery connec- tion is faulty or a bat- tery is not connected.	Check the battery con- nection.	Correct the battery con- nection.	page 4-20
	The battery voltage is lower than the specified value (2.7 V).	Measure the battery voltage.	Replace the battery.	page 13-3
than the speci- fied level.)	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
	The encoder malfunc- tioned.	_	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the Servomotor or linear encoder may be faulty. Replace the Servo- motor or linear encoder.	-
	An error occurred in reading data from the linear encoder.	_	The linear encoder is not mounted within an appro- priate tolerance. Correct the mounting of the linear encoder.	-
A.840: Encoder Data Alarm (Detected at the encoder.)	Excessive speed occurred in the linear encoder.	-	Control the motor speed within the range specified by the linear encoder manufacturer and then turn ON the control power supply.	-
	The encoder malfunc- tioned due to noise.	-	Correct the wiring around the encoder by separating the Encoder Cable from the Servomotor Main Cir- cuit Cable or by ground- ing the encoder.	-
	The polarity sensor is not wired correctly.	Check the wiring of the polarity sensor.	Correct the wiring of the polarity sensor.	-
	The polarity sensor failed.	-	Replace the polarity sen- sor.	-
	Rotary Servomotor: The Servomotor speed was 200 min <sup>-1</sup> or higher when the control power supply was turned ON.	Check the motor speed when the power supply is turned ON.	Reduce the Servomotor speed to a value less than 200 min <sup>-1</sup> , and turn ON the control power supply.	_
A.850: Encoder Over- speed (Detected at the	Linear Servomotor: The Servomotor exceeded the speci- fied speed when the control power supply was turned ON.	Check the motor speed when the power supply is turned ON.	Control the motor speed within the range specified by the linear encoder manufacturer and then turn ON the control power supply.	-
the control power supply is turned ON.)	A failure occurred in the encoder.	_	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the Servomotor or linear encoder may be faulty. Replace the Servo- motor or linear encoder.	-
	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK. Continued o	-

Maintenance

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
	The surrounding air temperature around the Servomotor is too high.	Measure the surround- ing air temperature around the Servomotor.	Reduce the surrounding air temperature of the Servomotor to 40°C or less.	-
A.860: Encoder Over-	The Servomotor load is greater than the rated load.	Use the accumulated load ratio to check the load.	Operate the Servo Drive so that the motor load remains within the speci- fied range.	page 10-3
heated (Detected when a Rotary Servomo- tor or absolute linear encoder is connected.) (Detected at the encoder.)	A failure occurred in the encoder.	_	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the Servomotor or absolute linear encoder may be faulty. Replace the Servomotor or absolute linear encoder.	-
	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
	The surrounding tem- perature around the Servomotor is too high.	Measure the surround- ing temperature around the Servomotor.	Reduce the surrounding air temperature of the Servomotor to 40° or less.	-
A.861: Motor Over- heated	The motor load is greater than the rated load.	Check the load with the accumulated load ratio on the Motion Monitor Tab Page on the Sig- maWin+.	Operate the Servo Drive so that the motor load remains within the speci- fied range.	page 10-3
	A failure occurred in the Serial Converter Unit.	_	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the Serial Con- verter Unit may be faulty. Replace the Serial Con- verter Unit.	-
	A failure occurred in the SERVOPACK.	-	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
	The surrounding tem- perature is too high.	Check the surrounding temperature using a thermometer.	Lower the surrounding temperature by improving the installation conditions of the Linear Servomotor or the machine.	-
	The overheat protec- tion input signal line is disconnected or short-circuited.	Check the input voltage with the overheat pro- tection input information on the Motion Monitor Tab Page on the Sig- maWin+.	Repair the line for the overheat protection input signal.	-
A.862:	An overload alarm was reset by turning OFF the power sup- ply too many times.	Check the alarm display to see if there is an overload alarm.	Change the method for resetting the alarm.	-
Overheat Alarm	Operation was per- formed under an excessive load.	Use the accumulated load ratio to check the load during operation.	Reconsider the load and operating conditions.	-
	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SERVOPACK.	-
	The temperature detection circuit in the Linear Servomotor is faulty or the sensor attached to the machine is faulty.	_	The temperature detec- tion circuit in the Linear Servomotor may be faulty or the sensor attached to the machine may be faulty. Replace the Linear Servomotor or repair the sensor attached to the machine.	_
A.890: Encoder Scale Error	A failure occurred in the linear encoder.	-	The linear encoder may be faulty. Replace the linear encoder.	-
A.891: Encoder Module Error	A failure occurred in the linear encoder.	-	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the linear encoder may be faulty. Replace the linear encoder.	-
<b>A.8A0:</b> External Encoder Error	Setting the origin of the absolute linear encoder failed because the motor moved.	Before you set the ori- gin, use the fully-closed feedback pulse counter to confirm that the motor is not moving.	The motor must be stopped while setting the origin position.	page 6-50
	A failure occurred in the external encoder.	-	Replace the external encoder.	-
A.8A1:	A failure occurred in the external encoder.	-	Replace the external encoder.	-
External Encoder Module Error	A failure occurred in the Serial Converter Unit.	_	Replace the Serial Con- verter Unit.	-
A.8A2: External Incre- mental Encoder Sensor Error	A failure occurred in the external encoder.	_	Replace the external encoder.	-
A.8A3: External Abso- lute Encoder Position Error	A failure occurred in the external absolute encoder.	-	The external absolute encoder may be faulty. Refer to the encoder manufacturer's instruc- tion manual for correc- tions.	-

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Alarm Number:	Possible Cause	Confirmation	Continued from pro	Reference
Alarm Name	Possible Cause	Confirmation	Correction	Reference
A.8A5: External Encoder Overspeed	An overspeed error was detected in the external encoder.	Check the maximum speed of the external encoder.	Keep the external encoder below its maxi- mum speed.	-
A.8A6: External Encoder Overheated	An overheating error was detected in the external encoder.	_	Replace the external encoder.	-
A.b33: Current Detec- tion Error 3	A failure occurred in the current detection circuit.	_	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
A.b6A: MECHATROLINK Communications ASIC Error 1	There is a fault in the SERVOPACK MECHATROLINK communications sec- tion.	_	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
A.b6b: MECHATROLINK Communications ASIC Error 2	A malfunction occurred in the MECHATROLINK communications sec- tion due to noise.	_	<ul> <li>Implement the following countermeasures against noise.</li> <li>Check the MECHA-TROLINK Communications Cable and FG wiring.</li> <li>Attach a ferrite core to the MECHATROLINK Communications Cable.</li> </ul>	-
	There is a fault in the SERVOPACK MECHATROLINK communications sec- tion.	_	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
<b>A.bF0:</b> System Alarm 0	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
A.bF1: System Alarm 1	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
<b>A.bF2:</b> System Alarm 2	A failure occurred in the SERVOPACK.	-	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
A.bF3: System Alarm 3	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
<b>A.bF4:</b> System Alarm 4	A failure occurred in the SERVOPACK.	-	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
<b>A.bF5:</b> System Alarm 5	A failure occurred in the SERVOPACK.	-	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
A.bF6: System Alarm 6	A failure occurred in the SERVOPACK.	-	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
A.bF7: System Alarm 7	A failure occurred in the SERVOPACK.	-	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
A.bF8: System Alarm 8	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
	The order of phases U, V, and W in the motor wiring is not correct.	Check the Servomotor wiring.	Make sure that the Servo- motor is correctly wired.	-
A.C10:	There is an error in the setting of Pn080 = n.□□X□ (Motor Phase Sequence Selection).	Check the setting of Pn080 = $n.\Box\BoxX\Box$ .	Set Pn080 = n.□□X□ to an appropriate value.	page 6-21
Servomotor Out of Control (Detected when the servo is turned ON.)	A failure occurred in the encoder.	_	If the motor wiring is cor- rect and an alarm still occurs after turning the power supply OFF and ON again, the Servomotor or linear encoder may be faulty. Replace the Servo- motor or linear encoder.	-
	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	- n next page.

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
	The linear encoder signal level is too low.	Check the voltage of the linear encoder sig- nal.	Fine-tune the mounting of the scale head. Or, replace the linear encoder.	-
<b>A.C20:</b> Phase Detection Error	The count-up direc- tion of the linear encoder does not match the forward direction of the Mov- ing Coil in the motor.	Check the setting of Pn080 = $n.\square\squareX\square$ (Motor Phase Sequence Selection). Check the installation orientation for the linear encoder and Moving Coil.	Change the setting of Pn080 = $n.\Box\Box X\Box$ . Correctly reinstall the linear encoder or Moving Coil.	page 6-21
	The polarity sensor signal is being affected by noise.	_	Correct the FG wiring. Implement countermea- sures against noise for the polarity sensor wiring.	-
	The setting of Pn282 (Linear Encoder Scale Pitch) is not correct.	Check the setting of Pn282 (Linear Encoder Scale Pitch).	Check the specifications of the linear encoder and set a correct value.	page 6-16
A.C21: Polarity Sensor Error	The polarity sensor is protruding from the Magnetic Way of the motor.	Check the polarity sen- sor.	Correctly reinstall the Moving Coil or Magnetic Way of the motor.	-
	The polarity sensor is not wired correctly.	Check the wiring of the polarity sensor.	Correct the wiring of the polarity sensor.	-
	The polarity sensor failed.	-	Replace the polarity sen- sor.	-
A.C22: Phase Informa- tion Disagree- ment	The SERVOPACK phase information is different from the lin- ear encoder phase information.	-	Perform polarity detec- tion.	page 6-26

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
	The parameter set- tings are not correct.	Check the linear encoder specifications and feedback signal status.	The settings of Pn282 (Linear Encoder Scale Pitch) and Pn080 = n.□□X□ (Motor Phase Sequence Selection) may not match the installa- tion. Set the parameters to correct values.	page 6-16, page 6-21
	There is noise on the scale signal.	Check to make sure that the frame grounds of the Serial Converter Unit and Servomotor are connected to the FG terminal on the SER- VOPACK and that the FG terminal on the SER- VOPACK is connected to the frame ground on the power supply. And, confirm that the shield is properly pro- cessed on the Linear Encoder Cable. Check to see if the detection reference is repeatedly output in one direction.	Implement appropriate countermeasures against noise for the Linear Encoder Cable.	-
A.C50: Polarity Detec- tion Failure	An external force was applied to the Moving Coil of the motor.	_	The polarity cannot be properly detected if the detection reference is 0 and the speed feedback is not 0 because of an external force, such as cable tension, applied to the Moving Coil. Imple- ment measures to reduce the external force so that the speed feedback goes to 0. If the external force cannot be reduced, increase the setting of Pn481 (Polarity Detection Speed Loop Gain).	_
	The linear encoder resolution is too low.	Check the linear encoder scale pitch to see if it is within 100 μm.	If the linear encoder scale pitch is 100 μm or higher, the SERVOPACK cannot detect the correct speed feedback. Use a linear encoder scale pitch with higher resolution. (We rec- ommend a pitch of 40 μm or less.) Or, increase the setting of Pn485 (Polarity Detection Reference Speed). However, increasing the setting of Pn485 will increase the Servomotor movement range that is required for polarity detection.	_

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
A.C51: Overtravel Detected during Polarity Detection	The overtravel signal was detected during polarity detection.	Check the overtravel position.	Wire the overtravel sig- nals. Execute polarity detection at a position where an overtravel sig- nal would not be detected.	page 4-31
A.C52: Polarity Detec- tion Not Com- pleted	The servo was turned ON when using an absolute linear encoder, Pn587 was set to n. DDD (Do not detect polarity), and the polarity had not been detected.	_	When using an absolute linear encoder, set Pn587 to n.	-
A.C53: Out of Range of Motion for Polar- ity Detection	The travel distance exceeded the setting of Pn48E (Polarity Detection Range) in the middle of detec- tion.	_	Increase the setting of Pn48E (Polarity Detection Range). Or, increase the setting of Pn481 (Polarity Detection Speed Loop Gain).	-
A.C54: Polarity Detec- tion Failure 2	An external force was applied to the Servo- motor.	_	Increase the setting of Pn495 (Polarity Detection Confirmation Force Refer- ence). Increase the setting of Pn498 (Polarity Detec- tion Allowable Error Range). Increasing the allowable error will also increase the motor tem- perature.	-
A.C80: Encoder Clear	A failure occurred in the encoder.		Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the Servomotor or linear encoder may be faulty. Replace the Servo- motor or linear encoder.	_
Error or Multiturn Limit Setting Error	A failure occurred in the SERVOPACK.	-	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference	
	There is a faulty con- tact in the connector or the connector is not wired correctly for the encoder.	Check the condition of the encoder connector.	Reconnect the encoder connector and check the encoder wiring.	page 4-19	
	There is a cable dis- connection or short- circuit in the encoder. Or, the cable imped- ance is outside the specified values.	Check the condition of the Encoder Cable.	Use the Encoder Cable within the specified specifications.	-	
A.C90: Encoder Commu- nications Error	One of the following has occurred: corro- sion caused by improper tempera- ture, humidity, or gas, a short-circuit caused by entry of water drops or cutting oil, or faulty contact in con- nector caused by vibration.	Check the operating environment.	Improve the operating environmental, and replace the cable. If the alarm still occurs, replace the SERVOPACK.	page 3-2	
	A malfunction was caused by noise.	_	Correct the wiring around the encoder by separating the Encoder Cable from the Servomotor Main Cir- cuit Cable or by ground- ing the encoder.	page 4-5	
	A failure occurred in the SERVOPACK.	_	Connect the Servomotor to another SERVOPACK, and turn ON the control power supply. If no alarm occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-	
A.C91: Encoder Commu- nications Posi- tion Data Acceleration Rate Error	Noise entered on the signal lines because the Encoder Cable is bent or the sheath is damaged.	Check the condition of the Encoder Cable and connectors.	Check the Encoder Cable to see if it is installed correctly.	page 4-8	
	The Encoder Cable is bundled with a high- current line or installed near a high- current line.	Check the installation condition of the Encoder Cable.	Confirm that there is no surge voltage on the Encoder Cable.	-	
	There is variation in the FG potential because of the influ- ence of machines on the Servomotor side, such as a welder.	Check the installation condition of the Encoder Cable.	Properly ground the machine to separate it from the FG of the encoder.	-	

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Alarm Number: **Possible Cause** Confirmation Correction Reference Alarm Name Noise entered on the Implement countermeasignal line from the sures against noise for the page 4-5 encoder. encoder wiring. Reduce machine vibra-Excessive vibration or Check the operating tion. shock was applied to conditions. Correctly install the Serthe encoder. vomotor or linear encoder. Turn the power supply to A.C92: the SERVOPACK OFF and Encoder Commu-ON again. If an alarm still A failure occurred in nications Timer occurs, the Servomotor or \_ the encoder. Error linear encoder may be faulty. Replace the Servomotor or linear encoder. Turn the power supply to the SERVOPACK OFF and A failure occurred in ON again. If an alarm still occurs, the SERVOPACK the SERVOPACK. may be faulty. Replace the SERVOPACK. Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still A failure occurred in occurs, the Servomotor or the encoder. linear encoder may be faulty. Replace the Servo-A.CA0: Encoder Paramemotor or linear encoder. ter Error Turn the power supply to the SERVOPACK OFF and A failure occurred in ON again. If an alarm still the SERVOPACK. occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
	The encoder is wired incorrectly or there is faulty contact.	Check the wiring of the encoder.	Make sure that the encoder is correctly wired.	page 4-19
	The specifications of the Encoder Cable are not correct and noise entered on it.	-	Use a shielded twisted- pair wire cable or a screened twisted-pair cable with conductors of at least 0.12 mm <sup>2</sup> .	-
	The Encoder Cable is too long and noise entered on it.	-	<ul> <li>Rotary Servomotors: The Encoder Cable wir- ing distance must be 50 m max.</li> <li>Linear Servomotors: The Encoder Cable wir- ing distance must be 20 m max.</li> </ul>	-
A.Cb0: Encoder Echo- back Error	There is variation in the FG potential because of the influ- ence of machines on the Servomotor side, such as a welder.	Check the condition of the Encoder Cable and connectors.	Properly ground the machine to separate it from the FG of the encoder.	-
	Excessive vibration or shock was applied to the encoder.	Check the operating conditions.	Reduce machine vibra- tion. Correctly install the Ser- vomotor or linear encoder.	-
	A failure occurred in the encoder.	_	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the Servomotor or linear encoder may be faulty. Replace the Servo- motor or linear encoder.	_
	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
A.CC0: Multiturn Limit	The multiturn limit of the encoder is differ- ent from that of the SERVOPACK. Or, the multiturn limit of the SERVOPACK has been changed.	Check the setting of Pn205 in the SERVO- PACK.	Change the setting if the alarm occurs.	page 7-39
Multiturn Limit Disagreement	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK. Continued o	-

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
	The cable between the Serial Converter Unit and SERVOPACK is not wired correctly or there is a faulty contact.	Check the wiring of the external encoder.	Correctly wire the cable between the Serial Con- verter Unit and SERVO- PACK.	page 4-21
A.CF1: Reception Failed Error in Feed- back Option	A specified cable is not being used between Serial Con- verter Unit and SER- VOPACK.	Check the wiring speci- fications of the external encoder.	Use a specified cable.	-
Module Commu- nications	The cable between the Serial Converter Unit and SERVOPACK is too long.	Measure the length of the cable that connects the Serial Converter Unit.	The length of the cable between the Serial Con- verter Unit and SERVO- PACK must be 20 m or less.	_
	The sheath on cable between the Serial Converter Unit and SERVOPACK is bro- ken.	Check the cable that connects the Serial Converter Unit.	Replace the cable between the Serial Con- verter Unit and SERVO- PACK.	-
A.CF2: Timer Stopped Error in Feed-	Noise entered the cable between the Serial Converter Unit and SERVOPACK.	_	Correct the wiring around the Serial Converter Unit, e.g., separate I/O signal lines from the Main Circuit Cables or ground.	-
back Option Module Commu- nications	A failure occurred in the Serial Converter Unit.	_	Replace the Serial Con- verter Unit.	-
	A failure occurred in the SERVOPACK.	-	Replace the SERVO- PACK.	-
	The Servomotor U, V, and W wiring is not correct.	Check the wiring of the Servomotor's Main Cir- cuit Cables.	Make sure that there are no faulty contacts in the wiring for the Servomotor and encoder.	-
	The position com- mand speed is too fast.	Reduce the position command speed and try operating the SER- VOPACK.	Reduce the position refer- ence speed or the refer- ence acceleration rate, or reconsider the electronic gear ratio.	page 6-43
A.d00: Position Devia- tion Overflow (The setting of Pn520 (Position Deviation Over- flow Alarm Level) was exceeded by the position devi- ation while the	The acceleration of the position reference is too high.	Reduce the reference acceleration and try operating the SERVO- PACK.	Reduce the acceleration of the position reference using a MECHATROLINK command. Or, smooth the position reference accel- eration by selecting the position reference filter (ACCFIL) using a MECHATROLINK com- mand.	_
ation while the servo was ON.)	The setting of Pn520 (Position Deviation Overflow Alarm Level) is too low for the operating conditions.	Check Pn520 (Position Deviation Overflow Alarm Level) to see if it is set to an appropriate value.	Optimize the setting of Pn520.	page 9-8
	A failure occurred in the SERVOPACK.	-	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
A.d01: Position Devia- tion Overflow Alarm at Servo ON	The servo was turned ON after the position deviation exceeded the setting of Pn526 (Position Deviation Overflow Alarm Level at Servo ON) while the servo was OFF.	Check the position deviation while the servo is OFF.	Optimize the setting of Pn526 (Position Deviation Overflow Alarm Level at Servo ON).	
A.d02: Position Devia- tion Overflow Alarm for Speed Limit at Servo ON	If position deviation remains in the devia- tion counter, the set- ting of Pn529 or Pn584 (Speed Limit Level at Servo ON) limits the speed when the servo is turned ON. This alarm occurs if a position reference is input and the set- ting of Pn520 (Posi- tion Deviation Overflow Alarm Level) is exceeded.		Optimize the setting of Pn520 (Position Deviation Overflow Alarm Level). Or, adjust the setting of Pn529 or Pn584 (Speed Limit Level at Servo ON).	page 9-8
A.d10: Motor-Load Posi- tion Deviation Overflow	The motor direction and external encoder installation orientation are backward.	Check the motor direc- tion and the external encoder installation ori- entation.	Install the external encoder in the opposite direction, or change the setting of Pn002 = n.X□□□ (External Encoder Usage) to reverse the direction.	page 11-6
Overnow	There is an error in the connection between the load (e.g., stage) and external encoder coupling.	Check the coupling of the external encoder.	Check the mechanical coupling.	-
A.d30: Position Data Overflow	The position data exceeded ±1,879,048,192.	Check the input refer- ence pulse counter.	Reconsider the operating specifications.	-
A.E02:	The MECHATROLINK transmission cycle fluctuated.	_	Remove the cause of transmission cycle fluctu- ation at the host control- ler.	-
MECHATROLINK Internal Synchro- nization Error 1	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
A.E40: MECHATROLINK Transmission Cycle Setting Error	The setting of MECHATROLINK transmission cycle is outside of the speci- fied range.	Check the setting of the MECHATROLINK trans- mission cycle.	Set the MECHATROLINK transmission cycle to an appropriate value.	-
A.E41: MECHATROLINK Communications Data Size Setting Error	The number of trans- mission bytes set on DIP switch S3 is not correct.	Check the MECHATROLINK com- munications data size of the host controller.	Reset DIP switch S3 to change the number of transmission bytes to an appropriate value.	page 6-12

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
A.E42: MECHATROLINK Station Address Setting Error	The station address is outside of the setting range.	Check rotary switches S1 and S2 to see if the station address is between 03 and EF.	Check the setting of the station address of the host controller, and reset rotary switches S1 and S2 to change the address to an appropriate value between 03 and EF.	
	Two or more stations on the communica- tions network have the same address.	Check to see if two or more stations on the communications net- work have the same address.	Check the setting of the station address of the host controller, and reset rotary switches S1 and S2 to change the address to an appropriate value between 03 and EF.	page 6-12
A.E50 <sup>*5</sup> :	The WDT data in the host controller was not updated normally.	Check to see if the WDT data is being updated at the host controller.	Correctly update the WDT data at the host controller.	-
MECHATROLINK Synchronization Error	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	_
A.E51: MECHATROLINK Synchronization Failed	The WDT data at the host controller was not updated correctly at the start of syn- chronous communi- cations, so synchronous commu- nications could not be started.	Check to see if the WDT data is being updated in the host controller.	Correctly update the WDT data at the host controller.	_
	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	_
	MECHATROLINK wir- ing is not correct.	Check the MECHATROLINK wir- ing.	Correct the MECHATROLINK Com- munications Cable wiring. Correctly connect the ter- minator.	-
A.E60 <sup>*5</sup> : Reception Error in MECHATROLINK Communications	A MECHATROLINK data reception error occurred due to noise.	_	Implement countermea- sures against noise. (Check the MECHATROLINK Com- munications Cable and FG wiring, and implement measures such as attach- ing a ferrite core to the MECHATROLINK Com- munications Cable.)	-
	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	_

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
A.E61: Synchronization	The MECHATROLINK transmission cycle fluctuated.	Check the setting of the MECHATROLINK trans- mission cycle.	Remove the cause of transmission cycle fluctu- ation at the host control- ler.	-
Interval Error in MECHATROLINK Transmission Cycle	A failure occurred in the SERVOPACK.	-	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
	MECHATROLINK wir- ing is not correct.	Check the Servomotor wiring.	Correct the MECHATROLINK Com- munications Cable wiring.	-
A.E63: MECHATROLINK Synchronization Frame Not Received	A MECHATROLINK data reception error occurred due to noise.	_	Implement countermea- sures against noise. (Check the MECHATROLINK Com- munications Cable and FG wiring, and implement measures such as attach- ing a ferrite core to the MECHATROLINK Com- munications Cable.)	-
	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
	There is a faulty con- nection between the SERVOPACK and the Feedback Option Module.	Check the connection between the SERVO- PACK and the Feed- back Option Module.	Correctly connect the Feedback Option Module.	-
A.E72: Feedback Option Module Detec- tion Failure	The Feedback Option Module was discon- nected.	_	Reset the Option Module configuration error and turn the power supply to the SERVOPACK OFF and ON again.	page 13-46
	A failure occurred in the Feedback Option Module.	-	Replace the Feedback Option Module.	-
	A failure occurred in the SERVOPACK.	-	Replace the SERVO- PACK.	-
A.Eb1: Safety Function Signal Input Tim- ing Error	The delay between activation of the /HWBB1 and /HWBB2 input sig- nals for the HWBB was ten second or longer.	Measure the time delay between the /HWBB1 and /HWBB2 signals.	The output signal circuits or devices for /HWBB1 and /HWBB2 or the SER- VOPACK input signal cir- cuits may be faulty. Alternatively, the input sig- nal cables may be discon- nected. Check to see if any of these items are faulty or have been dis- connected.	_
	A failure occurred in the SERVOPACK.	-	Replace the SERVO- PACK.	-

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
A.EC8: Gate Drive Error 1 (An error occurred in the gate drive circuit.) A.EC9: Gate Drive Error 2 (An error occurred in the	A failure occurred in the SERVOPACK.	-	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
gate drive circuit.)				
		Check the motor status when the command is executed.	Execute the SV_ON or SENS_ON command only when the motor is not operating.	-
A.Ed1: Command Exe- cution Timeout	A timeout error occurred for a MECHATROLINK command.	<ul> <li>For fully-closed loop control, check the status of the external encoder when the command is exe- cuted.</li> <li>For other types of control, check the status of the linear encoder when the command is exe- cuted.</li> </ul>	Execute the SENS_ON command only when an external encoder (e.g., a linear encoder) is con- nected.	-
A.F10:	The three-phase power supply wiring is not correct.	Check the power sup- ply wiring.	Make sure that the power supply is correctly wired.	page 4-11
Power Supply Line Open Phase (The voltage was low for more than one second for phase R, S, or T when the main power supply was ON.)	The three-phase power supply is unbalanced.	Measure the voltage for each phase of the three-phase power sup- ply.	Balance the power sup- ply by changing phases.	-
	A failure occurred in the SERVOPACK.	-	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-

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Alarm Number: Continued from previous page				
Alarm Name	Possible Cause	Confirmation	Correction	Reference
	The relay or Magnetic Contactor used in the dynamic brake circuit failed.	<ul> <li>Check to see if the relay works.</li> <li>Check to see if the contacts in the Magnetic Contactor have welded together.</li> </ul>	The relay or Magnetic Contactor may be faulty. Replace the relay or Mag- netic Contactor.	_
	The operating time of the relay or Magnetic Contactor used in the dynamic brake circuit was excessive.	Check to see if the operating time of the relay and Magnetic Contactor contacts (open to closed, closed to open) is less than 140 ms.	Replace the relay or Mag- netic Contactor with a component that has an operating time less than 140 ms. (Recommended: Less than 130 ms)	-
4 500	The cable used in the dynamic brake circuit is broken.	Check to see if the cable used in the dynamic brake circuit is broken.	Replace the broken cable.	-
A.F30: Dynamic Brake Circuit Error (An error occurred in the	Dynamic brake circuit wiring is not correct.	Check the wiring of the relay and Magnetic Contactor used in the dynamic brake circuit.	Wire the relay and Mag- netic Contactor correctly.	-
dynamic brake circuit.)	There is a mistake in the allocation setting for the /DBANS (Dynamic Brake	Check the terminal that was allocated the / DBANS signal and the setting of Pn515 = n. $\Box X \Box \Box$ (/DBANS (Dynamic Brake Answer Input) Signal Allocation).	<ul> <li>Wire the terminal that was allocated the / DBANS signal correctly.</li> <li>Set Pn515 = n. \[DXDD] x \[DD] x</li> </ul>	_
	Answer Input) signal.	Check the operation of the Magnetic Contac- tor's auxiliary contacts and the logic of the / DBANS signal.	Correct the operation of the magnetic contactor's auxiliary contacts and the logic of the /DBANS sig- nal to be consistent.	-
	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVO- PACK.	_
A.F32: Dynamic Brake Operation Request Output Signal Setting Error (An error occurred in the pottinge related to	The /DBON (Dynamic Brake Operation Request Output) sig- nal and another out- put signal are both allocated to the same CN1 output signal ter- minal.	Check the parameters related to output signals (Pn50E to Pn510, Pn514, Pn53C, and Pn53D).	Set the parameters related to output signals (Pn50E to Pn510, Pn514, Pn53C, and Pn53D) cor- rectly so that the /DBON signal and another output signal are not allocated to the same CN1 output sig- nal terminal.	_
settings related to the Dynamic Brake Operation Request Output signal.)	The /DBON (Dynamic Brake Operation Request Output) sig- nal is being used with the polarity reversed.	Check the related parameters (Pn512 and Pn513) that change the polarity of the /DBON signal.	Set the polarity of the / DBON signal correctly with Pn512 and Pn513.	-

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
FL-1*5: System Alarm FL-2*5: System Alarm FL-3*5: System Alarm FL-4*5: System Alarm FL-5*5: System Alarm FL-6*5: System Alarm	A failure occurred in the SERVOPACK.		Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	_
CPF00: Digital Operator	There is a faulty con- tact between the Digi- tal Operator and the SERVOPACK.	Check the connector contact.	Disconnect the connec- tor and insert it again. Or, replace the cable.	_
Communications Error 1	A malfunction was caused by noise.	_	Keep the Digital Operator or the cable away from sources of noise.	-
CPF01: Digital Operator Communications	A failure occurred in the Digital Operator.	_	Disconnect the Digital Operator and then con- nect it again. If an alarm still occurs, the Digital Operator may be faulty. Replace the Digital Oper- ator.	-
Error 2	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-

If either of the following conditions is detected, an alarm will occur. • Pn533 [min<sup>-1</sup>] ×  $\frac{\text{Encoder resolution}}{6 \times 10^5} \le \frac{\text{Pn20E}}{\text{Pn210}}$ Pn20E • Maximum motor speed [min<sup>-1</sup>] ×  $\frac{\text{Encoder resolution}}{\text{Approx. } 3.66 \times 10^{12}} \ge \frac{\text{Pn20E}}{\text{Pn210}}$  Linear Servomotor If either of the following conditions is detected, an alarm will occur.  $\frac{\text{Pn585 [mm/s]}}{10} \times \frac{\text{Resolution of Serial Converter Unit}}{10} \leq \frac{\text{Pn20E}}{\text{Pn210}}$ Linear encoder pitch [µm] 10 • \_\_\_\_

Pn385 [100 mm/s]	~	Resolution of Serial Converter Unit		Pn20E
Linear encoder pitch [µm]	~	Approx. 6.10 ×10 <sup>5</sup>	2	Pn210

<ul> <li>*2. Detection Conditions</li> <li>• Rotary Servomotor If either of the following conditions is detected, an alarm will occur.</li> </ul>	
• Rated motor speed [min <sup>-1</sup> ] $\times 1/3 \times \frac{\text{Encoder resolution}}{6 \times 10^5} \leq \frac{\text{Pn20E}}{\text{Pn210}}$	
• Maximum motor speed [min <sup>-1</sup> ] × $\frac{\text{Encoder resolution}}{\text{Approx. } 3.66 \times 10^{12}} \ge \frac{\text{Pn20E}}{\text{Pn210}}$	
<ul> <li>Linear Servomotor If either of the following conditions is detected, an alarm will occur.</li> </ul>	
$\label{eq:rescaled} \begin{array}{c} \begin{tabular}{c} \mbox{Rated motor speed [mm/s] $\times $1/3$} \\ \hline \mbox{Linear encoder pitch [$\mu$m]} \end{tabular} $\times$ $ \begin{tabular}{c} \mbox{Resolution of Serial Converter Unit} \\ \mbox{10} \end{tabular} \end{tabular}$	≤ Pn20E Pn210
$\label{eq:rescaled} \begin{array}{c} \label{eq:rescaled} \begin{tabular}{c} \label{eq:rescaled} & \label{eq:rescaled} \end{tabular} & \label{eq:rescaled} \begin{tabular}{c} \label{eq:rescaled} & \label{eq:rescaled} \end{tabular} \\ \begin{tabular}{c} \label{eq:rescaled} & \label{eq:rescaled} \end{tabular} & \label{eq:rescaled} \begin{tabular}{c} \label{eq:rescaled} & \label{eq:rescaled} \end{tabular} \\ \begin{tabular}{c} \label{eq:rescaled} & \label{eq:rescaled} \end{tabular} \\ \begin{tabular}{c} \label{eq:rescaled} \label{eq:rescaled} & \label{eq:rescaled} \end{tabular} \\ \begin{tabular}{c} \label{eq:rescaled} \label{eq:rescaled} & \label{eq:rescaled} \label{eq:rescaled} \\ \begin{tabular}{c} \label{eq:rescaled} \label{eq:rescaled} \label{eq:rescaled} \label{eq:rescaled} \\ \label{eq:rescaled} \label{eq:rescaled} \label{eq:rescaled} \label{eq:rescaled} \label{eq:rescaled} \\ \label{eq:rescaled} eq:r$	≥ <u>Pn20E</u> Pn210

- \*3. Refer to the following manual for details.

   Ω Σ-7-Series Peripheral Device Selection Manual (Manual No.: SIEP S800001 32)
- \*4. The SERVOPACK will fail if the External Regenerative Resistor or Regenerative Resistor Unit is connected while the jumper is connected between the B2 and B3 terminals.
- \*5. These alarms are not stored in the alarm history. They are only displayed on the panel display.

# 13.2.3 Resetting Alarms

If there is an ALM (Servo Alarm) signal, use one of the following methods to reset the alarm after eliminating the cause of the alarm.



Be sure to eliminate the cause of an alarm before you reset the alarm. If you reset the alarm and continue operation without eliminating the cause of the alarm, it may

#### result in damage to the equipment or fire.

# Resetting Alarms by Sending the ALM\_CLR (Clear Warning or Alarm) Command

Refer to the following manual for details.

Σ-7-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

# **Resetting Alarms Using the Digital Operator**

Press the **ALARM RESET** Key on the Digital Operator. Refer to the following manual for details on resetting alarms.

~~~  $\Sigma$ -7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)

13.2.4 Displaying the Alarm History

# 13.2.4 Displaying the Alarm History

The alarm history displays up to the last ten alarms that have occurred in the SERVOPACK.

Note: The following alarms are not displayed in the alarm history: A.E50 (MECHATROLINK Synchronization Error), A.E60 (Reception Error in MECHATROLINK Communications), and FL-1 to FL-5.

## Preparations

No preparations are required.

# **Applicable Tools**

The following table lists the tools that you can use to display the alarm history and the applicable tool functions.

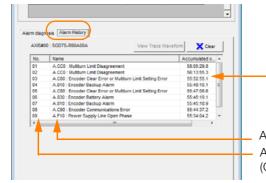
| Tool             | Function              | Reference                                                                     |
|------------------|-----------------------|-------------------------------------------------------------------------------|
| Digital Operator | Fn000                 | Σ-7-Series Digital Operator Operating Manual<br>(Manual No.: SIEP S800001 33) |
| SigmaWin+        | Alarm – Display Alarm | Operating Procedure on page 13-44                                             |

# **Operating Procedure**

Use the following procedure to display the alarm history.

- 1. Click the <u>J</u> Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- 2. Select Display Alarm in the Menu Dialog Box. The Alarm Display Dialog Box will be displayed.
- 3. Click the Alarm History Tab.

The following display will appear and you can check the alarms that occurred in the past.



Accumulated operation time Total operation time to the point at which the alarm occurred is displayed in increments of 100 ms from when the control power supply and main circuit power supply turned ON. For 24-hour, 365-day operation, measurements are possible for approximately 13 years. Alarm number: Alarm name Alarms in order of occurrence (Older alarms have higher numbers.)

Information

- 1. If the same alarm occurs consecutively within one hour, it is not saved in the alarm history. If it occurs after an hour or more, it is saved.
  - 2. You can clear the alarm history by clicking the **Clear** Button. The alarm history is not cleared when alarms are reset or when the SERVOPACK main circuit power is turned OFF.

This concludes the procedure to display the alarm history.

# 13.2.5 Clearing the Alarm History

You can clear the alarm history that is recorded in the SERVOPACK.

The alarm history is not cleared when alarms are reset or when the SERVOPACK main circuit power is turned OFF. You must perform the following procedure.

## Preparations

Always check the following before you clear the alarm history.

• The parameters must not be write prohibited.

# **Applicable Tools**

The following table lists the tools that you can use to clear the alarm history and the applicable tool functions.

| Tool             | Function              | Reference                                                                       |
|------------------|-----------------------|---------------------------------------------------------------------------------|
| Digital Operator | Fn006                 | C Σ-7-Series Digital Operator Operating Manual<br>(Manual No.: SIEP S800001 33) |
| SigmaWin+        | Alarm – Display Alarm | Operating Procedure on page 13-45                                               |

# **Operating Procedure**

Use the following procedure to reset the alarm history.

1. Click the <u>I</u> Servo Drive Button in the workspace of the Main Window of the SigmaWin+.

•

- 2. Select Display Alarm in the Menu Dialog Box. The Alarm Display Dialog Box will be displayed.
- 3. Click the Alarm History Tab.
- 4. Click the Clear Button.

| Alarm diagnose                  |                                                              |                            |               |   |
|---------------------------------|--------------------------------------------------------------|----------------------------|---------------|---|
| AXIS#00 : SGD7S-R90A00A View Tr |                                                              | View Trace Wavef           | orm           | r |
| No.                             | Name                                                         |                            | Accumulated o |   |
| 01                              | A.CC0 : Multiturn Limit Disagreement                         |                            | 58:05:29.8    |   |
| 02                              | A.CC0 : Multiturn Limit Disagreement                         |                            | 56:13:55.3    |   |
| 03                              | A.C80 : Encoder Clear Error or Multiturn Limit Setting Error |                            | 55:52:55.1    | 1 |
| 04                              | A.810 : Encoder Backup Alarm                                 |                            | 55:48:10.1    | Ξ |
| 05                              | A.C80 : Encoder Clear Error or Mul                           | titurn Limit Setting Error | 55:47:08.6    | 1 |
| 06                              | A.830 : Encoder Battery Alarm                                |                            | 55:45:19.1    | 1 |
| 07                              | A.810 : Encoder Backup Alarm                                 |                            | 55:45:18.9    | 1 |
| 08                              | A.C90 : Encoder Communications Error                         |                            | 55:44:37.2    | 1 |
| 09                              | A.F10 : Power Supply Line Open Phase                         |                            | 55:34:04.2    |   |
| 1                               | III                                                          |                            | •             |   |

This concludes the procedure to reset the alarm history.

13.2.6 Resetting Alarms Detected in Option Modules

### 13.2.6 Resetting Alarms Detected in Option Modules

If any Option Modules are attached to the SERVOPACK, the SERVOPACK detects the presence and models of the connected Option Modules. If it finds any errors, it outputs alarms.

You can delete those alarms with this operation.

- **Information** This operation is the only way to reset alarms for Option Modules. The alarms are not reset when you reset other alarms or when you turn OFF the power supply to the SERVOPACK.
  - Always remove the cause of an alarm before you reset the alarm.

#### Preparations

Always check the following before you clear an alarm detected in an Option Module.

The parameters must not be write prohibited.

#### **Applicable Tools**

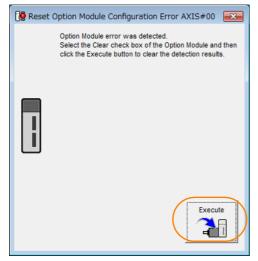
The following table lists the tools that you can use to reset Option Module configuration errors and the applicable tool functions.

| Tool             | Function                                           | Reference                                                                   |
|------------------|----------------------------------------------------|-----------------------------------------------------------------------------|
| Digital Operator | Fn014                                              | CT-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33) |
| SigmaWin+        | Setup – Reset Option Module<br>Configuration Error | C Operating Procedure on page 13-46                                         |

#### **Operating Procedure**

Use the following procedure to reset alarms detected in Option Modules.

- 1. Click the <u>I</u> Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select Reset Option Module Configuration Error in the Menu Dialog Box. The Reset Option Module Configuration Error Dialog Box will be displayed.
- 3. Select the Clear Check Box for the Option Modules from which to clear alarms and the click the Execute Button.

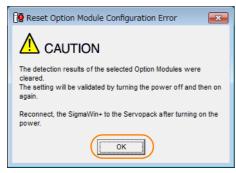


13.2.6 Resetting Alarms Detected in Option Modules

4. Click the OK Button.



5. Click the OK Button.



6. Turn the power supply to the SERVOPACK OFF and ON again.

This concludes the procedure to reset alarms detected in Option Modules.

13.2.7 Resetting Motor Type Alarms

## 13.2.7 Resetting Motor Type Alarms

The SERVOPACK automatically determines the type of Servomotor that is connected to it. If the type of Servomotor that is connected is changed, an A.070 alarm (Motor Type Change Detected) will occur the next time the SERVOPACK is started. If an A.070 alarm occurs, you must set the parameters to match the new type of Servomotor.

An A.070 alarm is reset by executing the Reset Motor Type Alarm utility function.

- Information 1. This utility function is the only way to reset an A.070 alarm (Motor Type Change Detected). The errors are not reset when you reset alarms or turn OFF the power supply to the SER-VOPACK.
  - 2. If an A.070 alarm occurs, first set the parameters according to the newly connected Servomotor type and then execute the Reset Motor Type Alarm utility function.

#### Preparations

Always check the following before you reset a motor type alarm.

• The parameters must not be write prohibited.

#### Applicable Tools

The following table lists the tools that you can use to clear the motor type alarm and the applicable tool functions.

| Tool             | Function                          | Reference                                                                                                                         |
|------------------|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Digital Operator | Fn021                             | $\bigcap_{\text{(Manual No.: SIEP S800001 33)}} \Sigma$ -7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33) |
| SigmaWin+        | Alarm – Reset Motor Type<br>Alarm | Operating Procedure on page 13-48                                                                                                 |

#### **Operating Procedure**

Use the following procedure to reset Motor Type alarm.

- 1. Click the <u>I</u> Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select Reset Motor Type Alarm in the Menu Dialog Box. The Reset Motor Type Alarm Dialog Box will be displayed.
- **3.** Click the Clear Button. The alarm will be cleared.

This concludes the procedure to reset Motor Type alarms.

# 13.3 Warning Displays

If a warning occurs in the SERVOPACK, a warning number will be displayed on the panel display. Warnings are displayed to warn you before an alarm occurs.

This section provides a list of warnings and the causes of and corrections for warnings.

## 13.3.1 List of Warnings

The list of warnings gives the warning name and warning meaning in order of the warning numbers.

| Warning<br>Number | Warning Name                                                              | Meaning                                                                                                                                                                                                    | Resetting             |
|-------------------|---------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| A.900             | Position Deviation<br>Overflow                                            | The position deviation exceeded the percentage set with the following formula: (Pn520 × Pn51E/100)                                                                                                         | Required.             |
| A.901             | Position Deviation<br>Overflow Alarm at<br>Servo ON                       | The position deviation when the servo was turned ON exceeded the percentage set with the following formula: (Pn526 × Pn528/100)                                                                            | Required.             |
| A.910             | Overload                                                                  | This warning occurs before an overload alarm (A.710 or A.720) occurs. If the warning is ignored and operation is continued, an alarm may occur.                                                            | Required.             |
| A.911             | Vibration                                                                 | Abnormal vibration was detected during motor opera-<br>tion. The detection level is the same as A.520. Set<br>whether to output an alarm or a warning by setting<br>Pn310 (Vibration Detection Selection). | Required.             |
| A.912             | Internal Temperature<br>Warning 1 (Control<br>Board Temperature<br>Error) | The surrounding temperature of the control PCB is abnormal.                                                                                                                                                | Required.             |
| A.913             | Internal Temperature<br>Warning 2 (Power<br>Board Temperature<br>Error)   | The surrounding temperature of the power PCB is abnormal.                                                                                                                                                  | Required.             |
| A.920             | Regenerative Overload                                                     | This warning occurs before an A.320 alarm (Regenera-<br>tive Overload) occurs. If the warning is ignored and<br>operation is continued, an alarm may occur.                                                | Required.             |
| A.921             | Dynamic Brake Over-<br>load                                               | This warning occurs before an A.731 alarm (Dynamic Brake Overload) occurs. If the warning is ignored and operation is continued, an alarm may occur.                                                       | Required.             |
| A.923             | SERVOPACK Built-in<br>Fan Stopped                                         | The fan inside the SERVOPACK stopped.                                                                                                                                                                      | Required.             |
| A.930             | Absolute Encoder Bat-<br>tery Error                                       | This warning occurs when the voltage of absolute encoder's battery is low.                                                                                                                                 | Required.             |
| A.93B             | Overheat Warning                                                          | The input voltage (temperature) for the overheat protec-<br>tion input (TH) signal exceeded the setting of Pn61C<br>(Overheat Warning Level).                                                              | Required.             |
| A.942             | Speed Ripple Com-<br>pensation Information<br>Disagreement                | The speed ripple compensation information stored in<br>the encoder does not agree with the speed ripple com-<br>pensation information stored in the SERVOPACK.                                             | Required.             |
| A.94A             | Data Setting Warning 1<br>(Parameter Number<br>Error)                     | There is an error in the parameter number for a Data Setting Warning 1 (Parameter Number) command.                                                                                                         | Automatically reset.* |
| A.94b             | Data Setting Warning 2<br>(Out of Range)                                  | The command data is out of range.                                                                                                                                                                          | Automatically reset.* |
| A.94C             | Data Setting Warning 3<br>(Calculation Error)                             | A calculation error was detected.                                                                                                                                                                          | Automatically reset.* |

13.3.1 List of Warnings

Continued from previous page.

| Warning<br>Number | Warning Name                                               | Meaning                                                                                                                                            | Resetting             |
|-------------------|------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| A.94d             | Data Setting Warning 4<br>(Parameter Size)                 | The data sizes do not match.                                                                                                                       | Automatically reset.* |
| A.94E             | Data Setting Warning 5<br>(Latch Mode Error)               | A Latch Mode error was detected.                                                                                                                   | Required.             |
| A.95A             | Command Warning 1<br>(Unsatisfied Com-<br>mand Conditions) | A command was sent when the conditions for sending a command were not satisfied.                                                                   | Automatically reset.* |
| A.95b             | Command Warning 2<br>(Unsupported Com-<br>mand)            | An unsupported command was sent.                                                                                                                   | Automatically reset.* |
| A.95d             | Command Warning 4<br>(Command Interfer-<br>ence)           | There was command interference, particularly latch command interference.                                                                           | Automatically reset.* |
| A.95E             | Command Warning 5<br>(Subcommand Not<br>Possible)          | The subcommand and main command interfere with each other.                                                                                         | Automatically reset.* |
| A.95F             | Command Warning 6<br>(Undefined Command)                   | An undefined command was sent.                                                                                                                     | Automatically reset.* |
| A.960             | MECHATROLINK<br>Communications<br>Warning                  | A communications error occurred during MECHATROLINK communications.                                                                                | Required.             |
| A.971             | Undervoltage                                               | This warning occurs before an A.410 alarm (Undervolt-<br>age) occurs. If the warning is ignored and operation is<br>continued, an alarm may occur. | Required.             |
| A.97A             | Command Warning 7<br>(Phase Error)                         | A command that cannot be executed in the current phase was sent.                                                                                   | Automatically reset.* |
| A.97b             | Data Clamp Out of<br>Range                                 | The set command data was clamped to the minimum or maximum value of the allowable setting range.                                                   | Automatically reset.* |
| A.9A0             | Overtravel                                                 | Overtravel was detected while the servo was ON.                                                                                                    | Required.             |
| A.9b0             | Preventative Mainte-<br>nance Warning                      | One of the consumable parts has reached the end of its service life.                                                                               | Required.             |

\* If using the commands for the MECHATROLINK-III standard servo profile, the warning will automatically be cleared after the correct command is received. If you use MECHATROLINK-II-compatible profile commands, send an ALM\_CLR (Clear Warning or Alarm) command to clear the warning.

Note: Use Pn008 = n.□X□□ (Warning Detection Selection) to control warning detection. However, the following warnings are not affected by the setting of Pn008 = n.□X□□ and other parameter settings are required in addition to Pn008 = n.□X□□.

| Warning                           | Parameters That Must Be Set to Select Warning Detection                                                                                           | Reference  |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| A.911                             | $Pn310 = n.\Box\Box\BoxX$ (Vibration Detection Selection)                                                                                         | page 7-50  |
| A.923                             | $_{-}$ (Not affected by the setting of Pn008 = n.□X□□.)                                                                                           | _          |
| A.930                             | Pn008 = n.                                                                                                                                        | page 13-3  |
| A.942                             | Pn423 = n. DIXI (Speed Ripple Compensation Information Dis-<br>agreement Warning Detection Selection)                                             | page 9-60  |
| A.94A to A.960 and A.97A to A.97b | Pn800=n.□□X□ (Warning Check Masks)                                                                                                                | page 14-3  |
| A.971                             | Pn008 = $n.\Box \Box X \Box$ (Function Selection for Undervoltage)<br>(Not affected by the setting of Pn008 = $n.\Box X \Box \Box$ .)             | page 7-17  |
| A.9A0                             | Pn00D = $n.X\square\square\square$ (Overtravel Warning Detection Selection) (Not affected by the setting of Pn008 = $n.\squareX\square\square$ .) | page 6-30  |
| A.9b0                             | Pn00F = n.                                                                                                                                        | page 10-15 |

The causes of and corrections for the warnings are given in the following table. Contact your Yaskawa representative if you cannot solve a problem with the correction given in the table.

| Warning Number:<br>Warning Name                               | Possible Cause                                                                                                                                             | Confirmation                                                                                                                   | Correction                                                                                                                                                                                                                                   | Reference |
|---------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|                                                               | The Servomotor<br>U, V, and W wiring<br>is not correct.                                                                                                    | Check the wiring of the<br>Servomotor's Main Cir-<br>cuit Cables.                                                              | Make sure that there are no faulty connections in the wiring for the Servomotor and encoder.                                                                                                                                                 | -         |
|                                                               | A SERVOPACK gain is too low.                                                                                                                               | Check the SERVO-<br>PACK gains.                                                                                                | Increase the servo gain,<br>e.g., by using autotuning<br>without a host reference.                                                                                                                                                           | page 9-24 |
| A.900:<br>Position Deviation<br>Overflow                      | The acceleration<br>of the position ref-<br>erence is too high.                                                                                            | Reduce the reference<br>acceleration and try<br>operating the SERVO-<br>PACK.                                                  | Reduce the acceleration of<br>the position reference using<br>a MECHATROLINK com-<br>mand. Or, smooth the posi-<br>tion reference acceleration<br>by selecting the position<br>reference filter (ACCFIL)<br>using a MECHATROLINK<br>command. | -         |
|                                                               | The excessive<br>position deviation<br>alarm level (Pn520<br>× Pn51E/100) is<br>too low for the<br>operating condi-<br>tions.                              | Check excessive posi-<br>tion deviation alarm<br>level (Pn520 × Pn51E/<br>100) to see if it is set to<br>an appropriate value. | Optimize the settings of<br>Pn520 and Pn51E.                                                                                                                                                                                                 | page 9-8  |
|                                                               | A failure occurred<br>in the SERVO-<br>PACK.                                                                                                               | _                                                                                                                              | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the SERVOPACK<br>may be faulty. Replace the<br>SERVOPACK.                                                                                        | -         |
| A.901:<br>Position Deviation<br>Overflow Alarm at<br>Servo ON | The position devi-<br>ation when the<br>servo was turned<br>ON exceeded the<br>percentage set<br>with the following<br>formula:<br>(Pn526 × Pn528/<br>100) | -                                                                                                                              | Optimize the setting of<br>Pn528 (Position Deviation<br>Overflow Warning Level at<br>Servo ON).                                                                                                                                              | -         |

Continued from previous page.

| Warning Number:<br>Warning Name                                          | Possible Cause                                                                                                                                | Confirmation                                                                                             | Correction                                                                     | Reference |
|--------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|-----------|
|                                                                          | The wiring is not<br>correct or there is<br>a faulty contact in<br>the motor or<br>encoder wiring.                                            | Check the wiring.                                                                                        | Make sure that the Servo-<br>motor and encoder are cor-<br>rectly wired.       | -         |
|                                                                          | Operation was<br>performed that<br>exceeded the<br>overload protec-<br>tion characteris-<br>tics.                                             | Check the motor over-<br>load characteristics and<br>Run command.                                        | Reconsider the load and operating conditions. Or, increase the motor capacity. | -         |
| A.910:<br>Overload (warning<br>before an A.710 or<br>A.720 alarm occurs) | An excessive load<br>was applied<br>during operation<br>because the Ser-<br>vomotor was not<br>driven because of<br>mechanical prob-<br>lems. | Check the operation<br>reference and motor<br>speed.                                                     | Remove the mechanical problem.                                                 | -         |
|                                                                          | The overload<br>warning level<br>(Pn52B) is not<br>suitable.                                                                                  | Check that the overload<br>warning level (Pn52B) is<br>suitable.                                         | Set a suitable overload warning level (Pn52B).                                 | page 6-40 |
|                                                                          | A failure occurred<br>in the SERVO-<br>PACK.                                                                                                  | -                                                                                                        | The SERVOPACK may be faulty. Replace the SERVO-<br>PACK.                       | -         |
|                                                                          | Abnormal vibra-<br>tion was detected<br>during motor<br>operation.                                                                            | Check for abnormal<br>motor noise, and check<br>the speed and torque<br>waveforms during oper-<br>ation. | Reduce the motor speed.<br>Or, reduce the servo gain<br>with custom tuning.    | page 9-42 |
| A.911:<br>Vibration                                                      | The setting of<br>Pn103 (Moment of<br>Inertia Ratio) is<br>greater than the<br>actual moment of<br>inertia or was<br>greatly changed.         | Check the moment of inertia ratio or mass ratio.                                                         | Set Pn103 (Moment of Iner-<br>tia Ratio) to an appropriate<br>value.           | page 9-16 |
|                                                                          | The vibration<br>detection level<br>(Pn312 or Pn384)<br>is not suitable.                                                                      | Check that the vibration detection level (Pn312 or Pn384) is suitable.                                   | Set a suitable vibration<br>detection level (Pn312 or<br>Pn384).               | page 7-50 |

Continued from previous page.

| Warning Number:                                                                         | Possible Cause                                                                                                                     | Confirmation                                                                                                                                                                | Correction                                                                                          | Reference             |
|-----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-----------------------|
| Warning Name                                                                            | 1 USSIDIE Uduse                                                                                                                    |                                                                                                                                                                             | Consection                                                                                          | nererence             |
|                                                                                         | The surrounding temperature is too high.                                                                                           | Check the surrounding<br>temperature using a<br>thermostat. Or, check<br>the operating status<br>with the SERVOPACK<br>installation environ-<br>ment monitor.               | Decrease the surrounding<br>temperature by improving<br>the SERVOPACK installa-<br>tion conditions. | page 3-6              |
|                                                                                         | An overload alarm<br>was reset by turn-<br>ing OFF the power<br>supply too many<br>times.                                          | Check the alarm display<br>to see if there is an<br>overload alarm.                                                                                                         | Change the method for resetting the alarm.                                                          | -                     |
| A.912:<br>Internal Tempera-<br>ture Warning 1<br>(Control Board Tem-<br>perature Error) | There was an<br>excessive load or<br>operation was<br>performed that<br>exceeded the<br>regenerative pro-<br>cessing capacity.     | Use the accumulated<br>load ratio to check the<br>load during operation,<br>and use the regenera-<br>tive load ratio to check<br>the regenerative pro-<br>cessing capacity. | Reconsider the load and operating conditions.                                                       | -                     |
|                                                                                         | The SERVOPACK<br>installation orien-<br>tation is not cor-<br>rect or there is<br>insufficient space<br>around the SER-<br>VOPACK. | Check the SERVO-<br>PACK installation con-<br>ditions.                                                                                                                      | Install the SERVOPACK according to specifications.                                                  | page 3-3,<br>page 3-5 |
|                                                                                         | A failure occurred<br>in the SERVO-<br>PACK.                                                                                       | _                                                                                                                                                                           | The SERVOPACK may be faulty. Replace the SERVO-<br>PACK.                                            | -                     |
|                                                                                         | The surrounding<br>temperature is too<br>high.                                                                                     | Check the surrounding<br>temperature using a<br>thermostat. Or, check<br>the operating status<br>with the SERVOPACK<br>installation environ-<br>ment monitor.               | Decrease the surrounding<br>temperature by improving<br>the SERVOPACK installa-<br>tion conditions. | page 3-6              |
|                                                                                         | An overload alarm<br>was reset by turn-<br>ing OFF the power<br>supply too many<br>times.                                          | Check the alarm display<br>to see if there is an<br>overload alarm.                                                                                                         | Change the method for resetting the alarm.                                                          | -                     |
| A.913:<br>Internal Tempera-<br>ture Warning 2<br>(Power Board Tem-<br>perature Error)   | There was an<br>excessive load or<br>operation was<br>performed that<br>exceeded the<br>regenerative pro-<br>cessing capacity.     | Use the accumulated<br>load ratio to check the<br>load during operation,<br>and use the regenera-<br>tive load ratio to check<br>the regenerative pro-<br>cessing capacity. | Reconsider the load and operating conditions.                                                       | -                     |
|                                                                                         | The SERVOPACK<br>installation orien-<br>tation is not cor-<br>rect or there is<br>insufficient space<br>around the SER-<br>VOPACK. | Check the SERVO-<br>PACK installation con-<br>ditions.                                                                                                                      | Install the SERVOPACK according to specifications.                                                  | page 3-3,<br>page 3-5 |
|                                                                                         | A failure occurred<br>in the SERVO-<br>PACK.                                                                                       | -                                                                                                                                                                           | The SERVOPACK may be faulty. Replace the SERVO-<br>PACK.                                            | -                     |

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| Warning Number:<br>Warning Name                                                                                                                                      | Possible Cause                                                                                                                                                                                            | Confirmation                                                                                                                              | Correction                                                                                                                                                                                                                               | Reference |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|                                                                                                                                                                      | The power supply voltage exceeded the specified range.                                                                                                                                                    | Measure the power supply voltage.                                                                                                         | Set the power supply volt-<br>age within the specified<br>range.                                                                                                                                                                         | _         |
| <b>A.920:</b><br>Regenerative Over-<br>load (warning before<br>an A.320 alarm<br>occurs)                                                                             | There is insuffi-<br>cient external<br>regenerative resis-<br>tance, Regenera-<br>tive Resistor<br>capacity, or SER-<br>VOPACK capac-<br>ity, or there has<br>been a continuous<br>regeneration<br>state. | Check the operating<br>conditions or the<br>capacity using the Sig-<br>maJunmaSize+ Capac-<br>ity Selection Software<br>or another means. | Change the regenerative<br>resistance value, regenera-<br>tive resistance capacity, or<br>SERVOPACK capacity.<br>Reconsider the operating<br>conditions using the Sigma-<br>JunmaSize+ Capacity<br>Selection Software or other<br>means. | -         |
|                                                                                                                                                                      | There was a con-<br>tinuous regenera-<br>tion state because<br>a negative load<br>was continuously<br>applied.                                                                                            | Check the load applied<br>to the Servomotor<br>during operation.                                                                          | Reconsider the system<br>including the servo,<br>machine, and operating<br>conditions.                                                                                                                                                   | -         |
|                                                                                                                                                                      | The Servomotor<br>was rotated by an<br>external force.                                                                                                                                                    | Check the operation status.                                                                                                               | Implement measures to<br>ensure that the motor will<br>not be rotated by an exter-<br>nal force.                                                                                                                                         | -         |
| A.921:<br>Dynamic Brake<br>Overload (warning<br>before an A.731<br>alarm occurs)                                                                                     | When the Servo-<br>motor was<br>stopped with the<br>dynamic brake,<br>the rotational or<br>linear kinetic<br>energy exceeded<br>the capacity of the<br>Dynamic Brake<br>Resistor.                         | Check the power con-<br>sumed by the DB resis-<br>tor to see how<br>frequently the DB is<br>being used.                                   | <ul> <li>Reconsider the following:</li> <li>Reduce the Servomotor command speed.</li> <li>Decrease the moment of inertia or mass.</li> <li>Reduce the frequency of stopping with the dynamic brake.</li> </ul>                           | -         |
|                                                                                                                                                                      | A failure occurred<br>in the SERVO-<br>PACK.                                                                                                                                                              | -                                                                                                                                         | The SERVOPACK may be faulty. Replace the SERVO-<br>PACK.                                                                                                                                                                                 | -         |
| A.923:<br>SERVOPACK Built-<br>in Fan Stopped                                                                                                                         | The fan inside the<br>SERVOPACK<br>stopped.                                                                                                                                                               | Check for foreign mat-<br>ter inside the SERVO-<br>PACK.                                                                                  | Remove foreign matter from<br>the SERVOPACK. If an<br>alarm still occurs, the SER-<br>VOPACK may be faulty.<br>Replace the SERVOPACK.                                                                                                    | -         |
| A.930:<br>Absolute Encoder<br>Battery Error (The<br>absolute encoder<br>battery voltage was<br>lower than the spec-<br>ified level.) (Detected<br>only when an abso- | The battery con-<br>nection is faulty or<br>a battery is not<br>connected.                                                                                                                                | Check the battery con-<br>nection.                                                                                                        | Correct the battery connec-<br>tion.                                                                                                                                                                                                     | page 4-20 |
|                                                                                                                                                                      | The battery volt-<br>age is lower than<br>the specified value<br>(2.7 V).                                                                                                                                 | Measure the battery voltage.                                                                                                              | Replace the battery.                                                                                                                                                                                                                     | page 13-3 |
| lute encoder is con-<br>nected.)                                                                                                                                     | A failure occurred<br>in the SERVO-<br>PACK.                                                                                                                                                              | -                                                                                                                                         | The SERVOPACK may be faulty. Replace the SERVO-<br>PACK.                                                                                                                                                                                 | -         |

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|------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Warning Number:<br>Warning Name                                        | Possible Cause                                                                                                                            | Confirmation                                                       | Correction                                                                                                                                                                                                                         | Reference      |
|                                                                        | The surrounding<br>temperature is too<br>high.                                                                                            | Check the surrounding temperature using a thermostat.              | Lower the surrounding tem-<br>perature by improving the<br>installation conditions of the<br>Linear Servomotor or the<br>machine.                                                                                                  | -              |
|                                                                        | Operation was<br>performed under<br>an excessive load.                                                                                    | Use the accumulated load ratio to check the load during operation. | Reconsider the load and operating conditions.                                                                                                                                                                                      | -              |
| A.93B:<br>Overheat Warning                                             | A failure occurred<br>in the SERVO-<br>PACK.                                                                                              | -                                                                  | The SERVOPACK may be faulty. Replace the SERVO-<br>PACK.                                                                                                                                                                           | -              |
|                                                                        | The temperature<br>detection circuit in<br>the Linear Servo-<br>motor is faulty or<br>the sensor<br>attached to the<br>machine is faulty. | _                                                                  | The temperature detection<br>circuit in the Linear Servo-<br>motor may be faulty or the<br>sensor attached to the<br>machine may be faulty.<br>Replace the Linear Servo-<br>motor or repair the sensor<br>attached to the machine. | -              |
|                                                                        | The speed ripple                                                                                                                          | -                                                                  | Reset the speed ripple<br>compensation value on the<br>SigmaWin+.                                                                                                                                                                  | page 9-60      |
| A.942:<br>Speed Ripple Com-<br>pensation Informa-<br>tion Disagreement | compensation<br>information stored<br>in the encoder<br>does not agree<br>with the speed<br>ripple compensa-                              | _                                                                  | Set Pn423 to n. <b>D</b> 1 <b>D</b> (Do not detect A.942 alarms).<br>However, changing the setting may increase the speed ripple.                                                                                                  | page 9-60      |
|                                                                        | tion information<br>stored in the SER-<br>VOPACK.                                                                                         | _                                                                  | Set Pn423 to n. DDD<br>(Disable speed ripple com-<br>pensation). However,<br>changing the setting may<br>increase the speed ripple.                                                                                                | page 9-60      |
| A.94A:<br>Data Setting Warn-<br>ing 1 (Parameter<br>Number Error)      | An invalid param-<br>eter number was<br>used.                                                                                             | Check the command that caused the warn-ing.                        | Use the correct parameter number.                                                                                                                                                                                                  | page 13-<br>58 |
| A.94b:<br>Data Setting Warn-<br>ing 2 (Out of Range)                   | The set com-<br>mand data was<br>clamped to the<br>minimum or maxi-<br>mum value of the<br>setting range.                                 | Check the command<br>that caused the warn-<br>ing.                 | Set the parameter within the setting range.                                                                                                                                                                                        | page 13-<br>58 |
| A.94C:<br>Data Setting Warn-<br>ing 3 (Calculation<br>Error)           | The calculation result of the set-<br>ting is not correct.                                                                                | Check the command that caused the warn-ing.                        | Set the parameter within the setting range.                                                                                                                                                                                        | page 13-<br>58 |
| A.94d:<br>Data Setting Warn-<br>ing 4 (Parameter<br>Size)              | The parameter<br>size set in the<br>command is not<br>correct.                                                                            | Check the command that caused the warn-ing.                        | Set the correct parameter size.                                                                                                                                                                                                    | page 13-<br>58 |
| A.94E:<br>Data Setting Warn-<br>ing 5 (Latch Mode<br>Error)            | A Latch Mode<br>error was<br>detected.                                                                                                    | Check the command that caused the warn-ing.                        | Change the setting of<br>Pn850 or the LT_MOD data<br>for the LTMOD_ON com-<br>mand sent by the host con-<br>troller to an appropriate<br>value.<br>(The applies when using the<br>MECHATROLINK-II-com-<br>patible profile.)        | page 13-<br>58 |

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| Warning Number:                                                      | Possible Cause                                                                                   | Confirmation                                       | Continued from pre                                                                                                                                                                                                                                                                   | Reference      |
|----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Warning Name                                                         | Possible Cause                                                                                   | Commation                                          | Correction                                                                                                                                                                                                                                                                           | Reference      |
| A.95A:<br>Command Warning<br>1 (Unsatisfied Com-<br>mand Conditions) | The command conditions are not satisfied.                                                        | Check the command<br>that caused the warn-<br>ing. | Send the command after the command conditions are satisfied.                                                                                                                                                                                                                         | page 13-<br>58 |
| A.95b:<br>Command Warning<br>2 (Unsupported<br>Command)              | An unsupported command was received.                                                             | Check the command that caused the warn-<br>ing.    | Do not send unsupported commands.                                                                                                                                                                                                                                                    | page 13-<br>58 |
| A.95d:<br>Command Warning<br>4 (Command Inter-<br>ference)           | The command<br>sending condi-<br>tions for latch-<br>related com-<br>mands was not<br>satisfied. | Check the command that caused the warn-ing.        | Send the command after the command conditions are satisfied.                                                                                                                                                                                                                         | page 13-<br>58 |
| A.95E:<br>Command Warning<br>5 (Subcommand<br>Not Possible)          | The command<br>sending condi-<br>tions for subcom-<br>mands was not<br>satisfied.                | Check the command<br>that caused the warn-<br>ing. | Send the command after the conditions are satisfied.                                                                                                                                                                                                                                 | page 13-<br>58 |
| A.95F:<br>Command Warning<br>6 (Undefined Com-<br>mand)              | An undefined command was sent.                                                                   | Check the command that caused the warn-<br>ing.    | Do not send undefined commands.                                                                                                                                                                                                                                                      | page 13-<br>58 |
|                                                                      | The<br>MECHATROLINK<br>Communications<br>Cable is not wired<br>correctly.                        | Check the wiring condi-<br>tions.                  | Correct the<br>MECHATROLINK Commu-<br>nications Cable wiring.                                                                                                                                                                                                                        | page 4-37      |
| A.960:<br>MECHATROLINK<br>Communications<br>Warning                  | A<br>MECHATROLINK<br>data reception<br>error occurred<br>due to noise.                           | Confirm the installation conditions.               | <ul> <li>Implement the following countermeasures against noise.</li> <li>Check the MECHATROLINK Communications Cable and FG wiring and implement countermeasures to prevent noise from entering.</li> <li>Attach a ferrite core to the MECHATROLINK Communications Cable.</li> </ul> | _              |
|                                                                      | A failure occurred<br>in the SERVO-<br>PACK.                                                     | -                                                  | The SERVOPACK may be faulty. Replace the SERVO-<br>PACK.                                                                                                                                                                                                                             | -              |
|                                                                      | For a 400-V SER-<br>VOPACK, the AC<br>power supply volt-<br>age dropped<br>below 280 V.          | Measure the power supply voltage.                  | Set the power supply volt-<br>age within the specified range.                                                                                                                                                                                                                        | -              |
| A 071.                                                               | The power supply voltage dropped during operation.                                               | Measure the power supply voltage.                  | Increase the power supply capacity.                                                                                                                                                                                                                                                  | -              |
| A.971:<br>Undervoltage                                               | A momentary<br>power interrup-<br>tion occurred.                                                 | Measure the power supply voltage.                  | If you have changed the<br>setting of Pn509 (Momen-<br>tary Power Interruption Hold<br>Time), decrease the setting.                                                                                                                                                                  | page 7-16      |
|                                                                      | The SERVOPACK fuse is blown out.                                                                 | -                                                  | Replace the SERVOPACK and connect a Reactor.                                                                                                                                                                                                                                         | page 4-18      |
|                                                                      | A failure occurred<br>in the SERVO-<br>PACK.                                                     | -                                                  | The SERVOPACK may be faulty. Replace the SERVO-<br>PACK.                                                                                                                                                                                                                             | _              |
|                                                                      | -                                                                                                | ·                                                  |                                                                                                                                                                                                                                                                                      |                |

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|                                                                |                                                                                                           |                                                                         | Continued from pre                                                                                                                                                                                                                                                                                                                                                                                                 | vious page.    |
|----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Warning Number:<br>Warning Name                                | Possible Cause                                                                                            | Confirmation                                                            | Correction                                                                                                                                                                                                                                                                                                                                                                                                         | Reference      |
| <b>A.97A:</b><br>Command Warning<br>7 (Phase Error)            | A command that<br>cannot be exe-<br>cuted in the cur-<br>rent phase was<br>sent.                          | -                                                                       | Send the command after the command conditions are satisfied.                                                                                                                                                                                                                                                                                                                                                       | -              |
| <b>A.97b:</b><br>Data Clamp Out of<br>Range                    | The set com-<br>mand data was<br>clamped to the<br>minimum or maxi-<br>mum value of the<br>setting range. | _                                                                       | Set the command data within the setting ranges.                                                                                                                                                                                                                                                                                                                                                                    | -              |
| A.9A0:<br>Overtravel (Over-<br>travel status was<br>detected.) | Overtravel was<br>detected while the<br>servo was ON.                                                     | Check the status of the overtravel signals on the input signal monitor. | <ul> <li>Even if an overtravel signal<br/>is not shown by the input<br/>signal monitor, momentary<br/>overtravel may have been<br/>detected. Take the following<br/>precautions.</li> <li>Do not specify move-<br/>ments that would cause<br/>overtravel from the host<br/>controller.</li> <li>Check the wiring of the<br/>overtravel signals.</li> <li>Implement countermea-<br/>sures against noise.</li> </ul> | page 6-30      |
| A.9b0:<br>Preventative Mainte-<br>nance Warning                | One of the con-<br>sumable parts has<br>reached the end<br>of its service life.                           | -                                                                       | Replace the part. Contact your Yaskawa representa-<br>tive for replacement.                                                                                                                                                                                                                                                                                                                                        | page 10-<br>15 |

## **13.4** Monitoring Communications Data during Alarms or Warnings

You can monitor the command data that is received when an alarm or warning occurs, such as a data setting warning  $(A.94\Box)$  or a command warning  $(A.95\Box)$  by using the following parameters. The following is an example of the data when an alarm or warning has occurred in the normal state.

Command Data during Alarms and Warnings: Pn890 to Pn8A6 Response Data during Alarms and Warnings: Pn8A8 to Pn8BE

| Command Byte | Command Data Storage When an Alarm or Warning Occurs |                    |  |
|--------------|------------------------------------------------------|--------------------|--|
| Sequence     | CMD                                                  | RSP                |  |
| 0            | Pn890 = n.□□□□□□XX                                   | Pn8A8 = n.00000XX  |  |
| 1            | Pn890 = n.□□□□XX□□                                   | Pn8A8 = n.DDDDXXDD |  |
| 2            | Pn890 = n.□□XX□□□□                                   | Pn8A8 = n.DDXXDDDD |  |
| 3            | Pn890 = n.XX□□□□□□                                   | Pn8A8 = n.XXDDDDDD |  |
| 4 to 7       | Pn892                                                | Pn8AA              |  |
| 8 to 11      | Pn894                                                | Pn8AC              |  |
| 12 to 15     | Pn896                                                | Pn8AE              |  |
| 16 to 19     | Pn898                                                | Pn8B0              |  |
| 20 to 23     | Pn89A                                                | Pn8B2              |  |
| 24 to 27     | Pn89C                                                | Pn8B4              |  |
| 28 to 31     | Pn89E                                                | Pn8B6              |  |
| 32 to 35     | Pn8A0                                                | Pn8B8              |  |
| 36 to 39     | Pn8A2                                                | Pn8BA              |  |
| 40 to 43     | Pn8A4                                                | Pn8BC              |  |
| 44 to 47     | Pn8A6                                                | Pn8BE              |  |

Note: 1. Data is stored in little endian byte order and displayed in the hexadecimal.

2. Refer to the following manual for command details.

Ω Σ-7-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

# **13.5** Troubleshooting Based on the Operation and Conditions of the Servomotor

This section provides troubleshooting based on the operation and conditions of the Servomotor, including causes and corrections.

| Problem                         | Possible Cause                                                                                                          | Confirmation                                                                                             | Correction                                                                                                                                                                               | Reference               |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
|                                 | The control power supply is not turned ON.                                                                              | Measure the voltage<br>between control power<br>supply terminals.                                        | Turn OFF the Servo<br>System. Correct the<br>wiring so that the con-<br>trol power supply is<br>turned ON.                                                                               | -                       |
|                                 | The main circuit power sup-<br>ply is not turned ON.                                                                    | Measure the voltage<br>across the main circuit<br>power input terminals.                                 | Turn OFF the Servo<br>System. Correct the<br>wiring so that the main<br>circuit power supply is<br>turned ON.                                                                            | -                       |
|                                 | The I/O signal connector<br>(CN1) pins are not wired cor-<br>rectly or are disconnected.                                | Turn OFF the Servo Sys-<br>tem. Check the wiring<br>condition of the I/O signal<br>connector (CN1) pins. | Correct the wiring of<br>the I/O signal connec-<br>tor (CN1) pins.                                                                                                                       | page 4-28,<br>page 10-5 |
|                                 | The wiring for the Servomo-<br>tor Main Circuit Cables or<br>Encoder Cable is discon-<br>nected.                        | Check the wiring condi-<br>tions.                                                                        | Turn OFF the Servo<br>System. Wire the cable<br>correctly.                                                                                                                               | _                       |
|                                 | There is an overload on the Servomotor.                                                                                 | Operate the Servomotor<br>with no load and check<br>the load status.                                     | Turn OFF the Servo<br>System. Reduce the<br>load or replace the Ser-<br>vomotor with a Servo-<br>motor with a larger<br>capacity.                                                        | -                       |
| Servomotor<br>Does Not<br>Start | The type of encoder that is being used does not agree with the setting of $Pn002 = n.\Box X \Box \Box$ (Encoder Usage). | Check the type of the encoder that is being used and the setting of $Pn002 = n.\Box X \Box \Box$ .       | Set Pn002 = $n.\Box X \Box \Box$<br>according to the type of<br>the encoder that is<br>being used.                                                                                       | page 7-33               |
|                                 | There is a mistake in the<br>input signal allocations<br>(Pn50A, Pn50B, Pn511, and<br>Pn516).                           | Check the input signal<br>allocations (Pn50A,<br>Pn50B, Pn511, and<br>Pn516).                            | Correctly allocate the<br>input signals (Pn50A,<br>Pn50B, Pn511, and<br>Pn516).                                                                                                          | page 7-4,<br>page 10-5  |
|                                 | The SV_ON command was not sent.                                                                                         | Check the commands sent from the host con-<br>troller.                                                   | Send the SV_ON com-<br>mand from the host controller.                                                                                                                                    | -                       |
|                                 | The SENS_ON (Turn ON Sensor) command was not sent.                                                                      | Check the commands sent from the host con-<br>troller.                                                   | Send the commands to the SERVOPACK in the correct sequence.                                                                                                                              | -                       |
|                                 | The P-OT (Forward Drive<br>Prohibit) or N-OT (Reverse<br>Drive Prohibit) signal is still<br>OFF.                        | Check the P-OT and N-<br>OT signals.                                                                     | Turn ON the P-OT and N-OT signals.                                                                                                                                                       | page 10-5               |
|                                 | The safety input signals<br>(/HWBB1 or /HWBB2) were<br>not turned ON.                                                   | Check the /HWBB1 and<br>/HWBB2 input signals.                                                            | Turn ON the /HWBB1<br>and /HWBB2 input sig-<br>nals. If you are not<br>using the safety func-<br>tion, connect the Safety<br>Jumper Connector<br>(provided as an acces-<br>sory) to CN8. | page 10-5               |

Continued on next page.

|                                    |                                                                                                                    |                                                                                                                                                                                                 | Continued from pre                                                                                                                                                                                        |           |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Problem                            | Possible Cause                                                                                                     | Confirmation                                                                                                                                                                                    | Correction                                                                                                                                                                                                | Reference |
|                                    | The FSTP (Forced Stop<br>Input) signal is still OFF.                                                               | Check the FSTP signal.                                                                                                                                                                          | <ul> <li>Turn ON the FSTP signal.</li> <li>If you will not use the function to force the motor to stop, set Pn516 = n. DDX (FSTP (Forced Stop Input) Signal Allocation) to disable the signal.</li> </ul> | page 10-5 |
| Servomotor<br>Does Not             | A failure occurred in the SER-<br>VOPACK.                                                                          | -                                                                                                                                                                                               | Turn OFF the Servo<br>System. Replace the<br>SERVOPACK.                                                                                                                                                   | -         |
| Start                              |                                                                                                                    | Check the setting of<br>Pn080 =n.□□□X (Polar-<br>ity Sensor Selection).                                                                                                                         | Correct the parameter setting.                                                                                                                                                                            | page 6-23 |
|                                    | The polarity detection was not executed.                                                                           | Check the inputs to the<br>SV_ON (Servo ON) com-<br>mand.                                                                                                                                       | <ul> <li>If you are using an incremental linear encoder, send the SV_ON command from the host controller.</li> <li>If you are using an absolute linear encoder, execute polarity detection.</li> </ul>    | page 6-24 |
|                                    | There is a mistake in the Ser-<br>vomotor wiring.                                                                  | Turn OFF the Servo Sys-<br>tem. Check the wiring.                                                                                                                                               | Wire the Servomotor correctly.                                                                                                                                                                            | -         |
|                                    | There is a mistake in the wir-<br>ing of the encoder or Serial<br>Converter Unit.                                  | Turn OFF the Servo Sys-<br>tem. Check the wiring.                                                                                                                                               | Wire the Serial Con-<br>verter Unit correctly.                                                                                                                                                            | -         |
|                                    | There is a mistake in the lin-<br>ear encoder wiring.                                                              | Turn OFF the Servo Sys-<br>tem. Check the wiring.                                                                                                                                               | Wire the cable cor-<br>rectly.                                                                                                                                                                            | -         |
| Servomotor<br>Moves<br>Instanta-   | The setting of Pn282 (Linear Encoder Scale Pitch) is not correct.                                                  | Check the setting of Pn282.                                                                                                                                                                     | Correct the setting of Pn282.                                                                                                                                                                             | page 6-16 |
| neously,<br>and Then<br>Stops      | The count-up direction of the linear encoder does not match the forward direction of the Moving Coil in the motor. | Check the directions.                                                                                                                                                                           | Change the setting of<br>Pn080 = $n.\square\squareX\square$<br>(Motor Phase<br>Sequence Selection).<br>Place the linear<br>encoder and motor in<br>the same direction.                                    | page 6-21 |
|                                    | Polarity detection was not performed correctly.                                                                    | Check to see if electrical<br>angle 2 (electrical angle<br>from polarity origin) at any<br>position is between ±10°.                                                                            | Correct the settings for<br>the polarity detection-<br>related parameters.                                                                                                                                | -         |
| Servomotor<br>Speed Is<br>Unstable | There is a faulty connection in the Servomotor wiring.                                                             | The connector connec-<br>tions for the power line<br>(U, V, and W phases) and<br>the encoder or Serial<br>Converter Unit may be<br>unstable. Turn OFF the<br>Servo System. Check the<br>wiring. | Tighten any loose ter-<br>minals or connectors<br>and correct the wiring.                                                                                                                                 | -         |

|                                                         | Continued from previous                                                                                            |                                                                                                                                                                                                                                                       |                                                                                                                                                                   |           |  |
|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--|
| Problem                                                 | Possible Cause                                                                                                     | Confirmation                                                                                                                                                                                                                                          | Correction                                                                                                                                                        | Reference |  |
|                                                         | A failure occurred in the SER-<br>VOPACK.                                                                          | -                                                                                                                                                                                                                                                     | Turn OFF the Servo<br>System. Replace the<br>SERVOPACK.                                                                                                           | -         |  |
| Servomotor<br>Moves with-<br>out a Refer-<br>ence Input | The count-up direction of the linear encoder does not match the forward direction of the Moving Coil in the motor. | Check the directions.                                                                                                                                                                                                                                 | Change the setting of<br>Pn080 = $n.\Box\Box X\Box$<br>(Motor Phase<br>Sequence Selection).<br>Match the linear<br>encoder direction and<br>Servomotor direction. | page 6-21 |  |
|                                                         | Polarity detection was not performed correctly.                                                                    | Check to see if electrical<br>angle 2 (electrical angle<br>from polarity origin) at any<br>position is between ±10°.                                                                                                                                  | Correct the settings for<br>the polarity detection-<br>related parameters.                                                                                        | -         |  |
| Dynamic<br>Brake Does<br>Not Operate                    | The setting of Pn001 =<br>n.                                                                                       | Check the setting of Pn001 = $n.\Box\Box\BoxX$ .                                                                                                                                                                                                      | Set Pn001 = n.□□□X<br>correctly.                                                                                                                                  | -         |  |
|                                                         | The Dynamic Brake Resistor is disconnected.                                                                        | Check the moment of<br>inertia, motor speed, and<br>dynamic brake frequency<br>of use. If the moment of<br>inertia, motor speed, or<br>dynamic brake frequency<br>of use is excessive, the<br>dynamic brake resis-<br>tance may be discon-<br>nected. | Turn OFF the Servo<br>System. Replace the<br>SERVOPACK. To pre-<br>vent disconnection,<br>reduce the load.                                                        | _         |  |
|                                                         | There was a failure in the dynamic brake drive circuit.                                                            | -                                                                                                                                                                                                                                                     | There is a defective<br>component in the<br>dynamic brake circuit.<br>Turn OFF the Servo<br>System. Replace the<br>SERVOPACK.                                     | -         |  |

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Continued on next page.

| Problem                              | Possible Cause                                                                                                 | Confirmation                                                                                                                                                                                                                                                 | Continued from pre                                                                                                                                                                                                                                                                                                                                                                         | Reference  |
|--------------------------------------|----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| FIUDIEIII                            | FOSSIBle Cause                                                                                                 | Commation                                                                                                                                                                                                                                                    | Reduce the load so                                                                                                                                                                                                                                                                                                                                                                         | neielelice |
|                                      | The Servomotor vibrated considerably while perform-<br>ing the tuning-less function with the default settings. | Check the waveform of the motor speed.                                                                                                                                                                                                                       | that the moment of<br>inertia ratio or mass<br>ratio is within the allow-<br>able value, or increase<br>the load level or reduce<br>the rigidity level in the<br>tuning-less level set-<br>tings.<br>If the situation is not<br>improved, disable the<br>tuning-less function<br>(i.e., set Pn170 to<br>n.□□□0) and execute<br>autotuning either with<br>or without a host refer-<br>ence. | page 9-12  |
|                                      |                                                                                                                | Turn OFF the Servo Sys-<br>tem. Check to see if there<br>are any loose mounting<br>screws.                                                                                                                                                                   | Tighten the mounting screws.                                                                                                                                                                                                                                                                                                                                                               | -          |
|                                      | The machine mounting is not secure.                                                                            | Turn OFF the Servo Sys-<br>tem. Check to see if there<br>is misalignment in the<br>coupling.                                                                                                                                                                 | Align the coupling.                                                                                                                                                                                                                                                                                                                                                                        | -          |
| A har a war a l                      |                                                                                                                | Turn OFF the Servo Sys-<br>tem. Check to see if the<br>coupling is balanced.                                                                                                                                                                                 | Balance the coupling.                                                                                                                                                                                                                                                                                                                                                                      | -          |
| Abnormal<br>Noise from<br>Servomotor | The bearings are defective.                                                                                    | Turn OFF the Servo Sys-<br>tem. Check for noise and<br>vibration around the bear-<br>ings.                                                                                                                                                                   | Replace the Servomo-<br>tor.                                                                                                                                                                                                                                                                                                                                                               | -          |
|                                      | There is a vibration source at the driven machine.                                                             | Turn OFF the Servo Sys-<br>tem. Check for any for-<br>eign matter, damage, or<br>deformation in the<br>machine's moving parts.                                                                                                                               | Consult with the machine manufacturer.                                                                                                                                                                                                                                                                                                                                                     | _          |
|                                      | Noise interference occurred<br>because of incorrect I/O Sig-<br>nal Cable specifications.                      | Turn OFF the Servo Sys-<br>tem. Check the I/O Signal<br>Cables to see if they sat-<br>isfy specifications. Use<br>shielded twisted-pair<br>cables or screened<br>twisted-pair cables with<br>conductors of at least<br>0.12 mm <sup>2</sup> (stranded wire). | Use cables that satisfy the specifications.                                                                                                                                                                                                                                                                                                                                                | -          |
|                                      | Noise interference occurred because an I/O Signal Cable is too long.                                           | Turn OFF the Servo Sys-<br>tem. Check the lengths of<br>the I/O Signal Cables.                                                                                                                                                                               | The I/O Signal Cables<br>must be no longer than<br>3 m.                                                                                                                                                                                                                                                                                                                                    | -          |
|                                      | Noise interference occurred<br>because of incorrect Encoder<br>Cable specifications.                           | Turn OFF the Servo Sys-<br>tem. Check the Encoder<br>Cable to see if it satisfies<br>specifications. Use<br>shielded twisted-pair<br>cables or screened<br>twisted-pair cables with<br>conductors of at least<br>0.12 mm <sup>2</sup> (stranded wire).       | Use cables that satisfy the specifications.                                                                                                                                                                                                                                                                                                                                                | -          |

|                                      | Continued from previous pa                                                                                                        |                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                        |           |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Problem                              | Possible Cause                                                                                                                    | Confirmation                                                                                                                                                                                                                                                                                                    | Correction                                                                                                                                                                                                                                                                                                             | Reference |
|                                      | Noise interference occurred<br>because the Encoder Cable<br>is too long.                                                          | Turn OFF the Servo Sys-<br>tem. Check the length of<br>the Encoder Cable.                                                                                                                                                                                                                                       | <ul> <li>Rotary Servomotors:<br/>The Encoder Cable<br/>length must be 50 m<br/>max.</li> <li>Linear Servomotors:<br/>Make sure that the<br/>Serial Converter Unit<br/>cable is no longer<br/>than 20 m and that<br/>the Linear Encoder<br/>Cable and the Sensor<br/>Cable are no longer<br/>than 15 m each.</li> </ul> | -         |
|                                      | Noise interference occurred because the Encoder Cable is damaged.                                                                 | Turn OFF the Servo Sys-<br>tem. Check the Encoder<br>Cable to see if it is<br>pinched or the sheath is<br>damaged.                                                                                                                                                                                              | Replace the Encoder<br>Cable and correct the<br>cable installation envi-<br>ronment.                                                                                                                                                                                                                                   | -         |
|                                      | The Encoder Cable was sub-<br>jected to excessive noise interference.                                                             | Turn OFF the Servo Sys-<br>tem. Check to see if the<br>Encoder Cable is bundled<br>with a high-current line or<br>installed near a high-cur-<br>rent line.                                                                                                                                                      | Correct the cable lay-<br>out so that no surge is<br>applied by high-current<br>lines.                                                                                                                                                                                                                                 | -         |
| Abnormal<br>Noise from<br>Servomotor | There is variation in the FG<br>potential because of the<br>influence of machines on the<br>Servomotor side, such as a<br>welder. | Turn OFF the Servo Sys-<br>tem. Check to see if the<br>machines are correctly<br>grounded.                                                                                                                                                                                                                      | Properly ground the machines to separate them from the FG of the encoder.                                                                                                                                                                                                                                              | -         |
| Convenience                          | There is a SERVOPACK pulse counting error due to noise.                                                                           | Check to see if there is<br>noise interference on the<br>signal line from the<br>encoder.                                                                                                                                                                                                                       | Turn OFF the Servo<br>System. Implement<br>countermeasures<br>against noise for the<br>encoder wiring.                                                                                                                                                                                                                 | -         |
|                                      | The encoder was subjected to excessive vibration or shock.                                                                        | Turn OFF the Servo Sys-<br>tem. Check to see if<br>vibration from the<br>machine occurred. Check<br>the Servomotor installa-<br>tion (mounting surface<br>precision, securing state,<br>and alignment).<br>Check the linear encoder<br>installation (mounting sur-<br>face precision and secur-<br>ing method). | Reduce machine vibra-<br>tion. Improve the<br>mounting state of the<br>Servomotor or linear<br>encoder.                                                                                                                                                                                                                | -         |
|                                      | A failure occurred in the encoder.                                                                                                |                                                                                                                                                                                                                                                                                                                 | Turn OFF the Servo<br>System. Replace the<br>Servomotor.                                                                                                                                                                                                                                                               | -         |
|                                      | A failure occurred in the Serial Converter Unit.                                                                                  | -                                                                                                                                                                                                                                                                                                               | Turn OFF the Servo<br>System. Replace the<br>Serial Converter Unit.                                                                                                                                                                                                                                                    | -         |
|                                      | A failure occurred in the linear encoder.                                                                                         | -                                                                                                                                                                                                                                                                                                               | Turn OFF the Servo<br>System. Replace the<br>linear encoder.                                                                                                                                                                                                                                                           | -         |

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|                                                      |                                                                                             |                                                                           | Continued from pre                                   | vious page. |
|------------------------------------------------------|---------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|------------------------------------------------------|-------------|
| Problem                                              | Possible Cause                                                                              | Confirmation                                                              | Correction                                           | Reference   |
|                                                      | The servo gains are not bal-<br>anced.                                                      | Check to see if the servo gains have been cor-<br>rectly tuned.           | Perform autotuning without a host reference.         | page 9-24   |
| Servomotor                                           | The setting of Pn100 (Speed Loop Gain) is too high.                                         | Check the setting of<br>Pn100.<br>The default setting is Kv =<br>40.0 Hz. | Set Pn100 to an appro-<br>priate value.              | -           |
| Vibrates at<br>Frequency<br>of Approx.<br>200 to 400 | The setting of Pn102 (Posi-<br>tion Loop Gain) is too high.                                 | Check the setting of<br>Pn102.<br>The default setting is Kp<br>= 40.0/s.  | Set Pn102 to an appro-<br>priate value.              | -           |
| 200 to 400<br>Hz.                                    | The setting of Pn101 (Speed<br>Loop Integral Time Con-<br>stant) is not appropriate.        | Check the setting of<br>Pn101.<br>The default setting is Ti =<br>20.0 ms. | Set Pn101 to an appro-<br>priate value.              | -           |
|                                                      | The setting of Pn103<br>(Moment of Inertia Ratio or<br>Mass Ratio) is not appropri-<br>ate. | Check the setting of Pn103.                                               | Set Pn103 to an appro-<br>priate value.              | -           |
|                                                      | The servo gains are not bal-<br>anced.                                                      | Check to see if the servo gains have been cor-<br>rectly tuned.           | Perform autotuning<br>without a host refer-<br>ence. | page 9-24   |
|                                                      | The setting of Pn100 (Speed Loop Gain) is too high.                                         | Check the setting of<br>Pn100.<br>The default setting is Kv =<br>40.0 Hz. | Set Pn100 to an appro-<br>priate value.              | -           |
| Large Motor<br>Speed                                 | The setting of Pn102 (Posi-<br>tion Loop Gain) is too high.                                 | Check the setting of<br>Pn102.<br>The default setting is Kp<br>= 40.0/s.  | Set Pn102 to an appro-<br>priate value.              | -           |
| Overshoot<br>on Starting<br>and Stop-<br>ping        | The setting of Pn101 (Speed<br>Loop Integral Time Con-<br>stant) is not appropriate.        | Check the setting of<br>Pn101.<br>The default setting is Ti =<br>20.0 ms. | Set Pn101 to an appro-<br>priate value.              | -           |
|                                                      | The setting of Pn103<br>(Moment of Inertia Ratio or<br>Mass Ratio) is not appropri-<br>ate. | Check the setting of Pn103.                                               | Set Pn103 to an appro-<br>priate value.              | -           |
|                                                      | The torque reference is saturated.                                                          | Check the waveform of the torque reference.                               | Use the mode switch.                                 | -           |
|                                                      | The force limits (Pn483 and Pn484) are set to the default values.                           | The default values of the force limits and Pn483 = 30% and Pn484 = 30%.   | Set Pn483 and Pn484 to appropriate values.           | page 7-28   |

|                                                                                 |                                                                                                                                   |                                                                                                                                                                                                                                                                                                                 | Continued from pre                                                                                                                                                                                                                                                                                                     | vious page. |
|---------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Problem                                                                         | Possible Cause                                                                                                                    | Confirmation                                                                                                                                                                                                                                                                                                    | Correction                                                                                                                                                                                                                                                                                                             | Reference   |
|                                                                                 | Noise interference occurred<br>because of incorrect Encoder<br>Cable specifications.                                              | Turn OFF the Servo Sys-<br>tem. Check the Encoder<br>Cable to see if it satisfies<br>specifications. Use<br>shielded twisted-pair<br>cables or screened<br>twisted-pair cables with<br>conductors of at least<br>0.12 mm <sup>2</sup> (stranded wire).                                                          | Use cables that satisfy the specifications.                                                                                                                                                                                                                                                                            | -           |
|                                                                                 | Noise interference occurred<br>because the Encoder Cable<br>is too long.                                                          | Turn OFF the Servo Sys-<br>tem. Check the length of<br>the Encoder Cable.                                                                                                                                                                                                                                       | <ul> <li>Rotary Servomotors:<br/>The Encoder Cable<br/>length must be 50 m<br/>max.</li> <li>Linear Servomotors:<br/>Make sure that the<br/>Serial Converter Unit<br/>cable is no longer<br/>than 20 m and that<br/>the Linear Encoder<br/>Cable and the Sensor<br/>Cable are no longer<br/>than 15 m each.</li> </ul> | -           |
| Absolute<br>Encoder<br>Position<br>Deviation<br>Error (The                      | Noise interference occurred because the Encoder Cable is damaged.                                                                 | Turn OFF the Servo Sys-<br>tem. Check the Encoder<br>Cable to see if it is<br>pinched or the sheath is<br>damaged.                                                                                                                                                                                              | Replace the Encoder<br>Cable and correct the<br>cable installation envi-<br>ronment.                                                                                                                                                                                                                                   | -           |
| position<br>that was<br>saved in the<br>host con-<br>troller when               | The Encoder Cable was sub-<br>jected to excessive noise interference.                                                             | Turn OFF the Servo Sys-<br>tem. Check to see if the<br>Encoder Cable is bundled<br>with a high-current line or<br>installed near a high-cur-<br>rent line.                                                                                                                                                      | Correct the cable lay-<br>out so that no surge is<br>applied by high-current<br>lines.                                                                                                                                                                                                                                 | -           |
| the power<br>was turned<br>OFF is dif-<br>ferent from<br>the posi-<br>tion when | There is variation in the FG<br>potential because of the<br>influence of machines on the<br>Servomotor side, such as a<br>welder. | Turn OFF the Servo Sys-<br>tem. Check to see if the<br>machines are correctly<br>grounded.                                                                                                                                                                                                                      | Properly ground the machines to separate them from the FG of the encoder.                                                                                                                                                                                                                                              | -           |
| the power<br>was next<br>turned ON.)                                            | There is a SERVOPACK pulse counting error due to noise.                                                                           | Turn OFF the Servo Sys-<br>tem. Check to see if there<br>is noise interference on<br>the I/O signal line from<br>the encoder or Serial<br>Converter Unit.                                                                                                                                                       | Implement counter-<br>measures against noise<br>for the encoder or<br>Serial Converter Unit<br>wiring.                                                                                                                                                                                                                 | -           |
|                                                                                 | The encoder was subjected to excessive vibration or shock.                                                                        | Turn OFF the Servo Sys-<br>tem. Check to see if<br>vibration from the<br>machine occurred.<br>Check the Servomotor<br>installation (mounting sur-<br>face precision, securing<br>state, and alignment).<br>Check the linear encoder<br>installation (mounting sur-<br>face precision and secur-<br>ing method). | Reduce machine vibra-<br>tion. Improve the<br>mounting state of the<br>Servomotor or linear<br>encoder.                                                                                                                                                                                                                | -           |
|                                                                                 | A failure occurred in the encoder.                                                                                                | -                                                                                                                                                                                                                                                                                                               | Turn OFF the Servo<br>System. Replace the<br>Servomotor or linear<br>encoder.                                                                                                                                                                                                                                          | -           |
|                                                                                 | A failure occurred in the SER-<br>VOPACK.                                                                                         | _                                                                                                                                                                                                                                                                                                               | Turn OFF the Servo<br>System. Replace the<br>SERVOPACK.                                                                                                                                                                                                                                                                | -           |

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| Continued from previous p                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                |                                                                                                                                                              | vious page. |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Problem                                                                                                                                                                                                                 | Possible Cause                                                                                                                                                                                                                                                                                                                                                                                             | Confirmation                                                                                                   | Correction                                                                                                                                                   | Reference   |
| Absolute<br>Encoder<br>Position                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                            | Check the error detec-<br>tion section of the host controller.                                                 | Correct the error detec-<br>tion section of the host controller.                                                                                             | -           |
| Deviation<br>Error (The<br>position<br>that was<br>saved in the<br>host con-<br>troller when<br>the power<br>was turned<br>OFF is dif-<br>ferent from<br>the posi-<br>tion when<br>the power<br>was next<br>turned ON.) | Host controller multiturn data<br>or absolute encoder position<br>data reading error                                                                                                                                                                                                                                                                                                                       | Check to see if the host controller is executing data parity checks.                                           | Perform parity checks<br>for the multiturn data or<br>absolute encoder posi-<br>tion data.                                                                   | -           |
|                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                            | Check for noise interfer-<br>ence in the cable<br>between the SERVO-<br>PACK and the host con-<br>troller.     | Implement counter-<br>measures against noise<br>and then perform parity<br>checks again for the<br>multiturn data or abso-<br>lute encoder position<br>data. | _           |
|                                                                                                                                                                                                                         | The P-OT/N-OT (Forward<br>Drive Prohibit or Reverse<br>Drive Prohibit) signal was<br>input.<br>The P-OT/N-OT (Forward<br>Drive Prohibit or Reverse<br>Drive Prohibit) signal mal-<br>functioned.<br>There is a mistake in the allo-<br>cation of the P-OT or N-OT<br>(Forward Drive Prohibit or<br>Reverse Drive Prohibit or<br>Reverse Drive Prohibit) sig-<br>nal in Pn50A = n.XDDD or<br>Pn50B = n.DDX. | Check the external power supply (+24 V) voltage for the input signals.                                         | Correct the external<br>power supply (+24 V)<br>voltage for the input<br>signals.                                                                            | -           |
|                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                            | Check the operating con-<br>dition of the overtravel<br>limit switches.                                        | Make sure that the overtravel limit switches operate correctly.                                                                                              | -           |
|                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                            | Check the wiring of the overtravel limit switches.                                                             | Correct the wiring of the overtravel limit switches.                                                                                                         | page 6-27   |
|                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                            | Check the settings of the overtravel input signal allocations (Pn50A/Pn50B).                                   | Set the parameters to correct values.                                                                                                                        | page 6-27   |
|                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                            | Check for fluctuation in<br>the external power supply<br>(+24 V) voltage for the<br>input signals.             | Eliminate fluctuation<br>from the external power<br>supply (+24 V) voltage<br>for the input signals.                                                         | -           |
| Overtravel                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                            | Check to see if the opera-<br>tion of the overtravel limit<br>switches is unstable.                            | Stabilize the operating condition of the over-<br>travel limit switches.                                                                                     | -           |
| Occurred                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                            | Check the wiring of the<br>overtravel limit switches<br>(e.g., check for cable<br>damage and loose<br>screws). | Correct the wiring of the overtravel limit switches.                                                                                                         | -           |
|                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                            | Check to see if the P-OT signal is allocated in Pn50A = $n.X\Box\Box\Box$ .                                    | If another signal is allo-<br>cated in Pn50A<br>=n.X□□□, allocate the<br>P-OT signal instead.                                                                |             |
|                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                            | Check to see if the N-OT signal is allocated in Pn50B = $n.\square\square\squareX$ .                           | If another signal is allo-<br>cated in Pn50B<br>=n.□□□X, allocate the<br>N-OT signal instead.                                                                | page 6-27   |
|                                                                                                                                                                                                                         | The selection of the Servo-                                                                                                                                                                                                                                                                                                                                                                                | Check the servo OFF<br>stopping method set in<br>Pn001 = $n.\Box\BoxX$ or<br>Pn001 = $n.\Box\BoxX\Box$ .       | Select a Servomotor<br>stopping method other<br>than coasting to a stop.                                                                                     |             |
|                                                                                                                                                                                                                         | motor stopping method is not correct.                                                                                                                                                                                                                                                                                                                                                                      | Check the torque control stopping method set in Pn001 = $n.\Box\BoxX$ or Pn001 = $n.\Box\BoxX\Box$ .           | Select a Servomotor stopping method other than coasting to a stop.                                                                                           | page 6-28   |

| <b></b>                            | <b>D</b>                                                                                                                          |                                                                                                                                                                                                                                                                                                                 | Continued from pre                                                                                                                                                                                                                                                                                                     |           |
|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Problem                            | Possible Cause                                                                                                                    | Confirmation                                                                                                                                                                                                                                                                                                    | Correction                                                                                                                                                                                                                                                                                                             | Reference |
| Improper<br>Stop Posi-<br>tion for | The limit switch position and dog length are not appropriate.                                                                     | -                                                                                                                                                                                                                                                                                                               | Install the limit switch at the appropriate position.                                                                                                                                                                                                                                                                  | -         |
| Overtravel<br>(OT) Signal          | The overtravel limit switch position is too close for the coasting distance.                                                      | _                                                                                                                                                                                                                                                                                                               | Install the overtravel limit switch at the appropriate position.                                                                                                                                                                                                                                                       | _         |
|                                    | Noise interference occurred<br>because of incorrect Encoder<br>Cable specifications.                                              | Turn OFF the Servo Sys-<br>tem. Check the Encoder<br>Cable to see if it satisfies<br>specifications. Use<br>shielded twisted-pair<br>cables or screened<br>twisted-pair cables with<br>conductors of at least<br>0.12 mm <sup>2</sup> (stranded wire).                                                          | Use cables that satisfy the specifications.                                                                                                                                                                                                                                                                            | -         |
|                                    | Noise interference occurred<br>because the Encoder Cable<br>is too long.                                                          | Turn OFF the Servo Sys-<br>tem. Check the length of<br>the Encoder Cable.                                                                                                                                                                                                                                       | <ul> <li>Rotary Servomotors:<br/>The Encoder Cable<br/>length must be 50 m<br/>max.</li> <li>Linear Servomotors:<br/>Make sure that the<br/>Serial Converter Unit<br/>cable is no longer<br/>than 20 m and that<br/>the Linear Encoder<br/>Cable and the Sensor<br/>Cable are no longer<br/>than 15 m each.</li> </ul> | -         |
| Position                           | Noise interference occurred because the Encoder Cable is damaged.                                                                 | Turn OFF the Servo Sys-<br>tem. Check the Encoder<br>Cable to see if it is<br>pinched or the sheath is<br>damaged.                                                                                                                                                                                              | Replace the Encoder<br>Cable and correct the<br>cable installation envi-<br>ronment.                                                                                                                                                                                                                                   | -         |
| Deviation<br>(without<br>Alarm)    | The Encoder Cable was sub-<br>jected to excessive noise<br>interference.                                                          | Turn OFF the Servo Sys-<br>tem. Check to see if the<br>Encoder Cable is bundled<br>with a high-current line or<br>installed near a high-cur-<br>rent line.                                                                                                                                                      | Correct the cable lay-<br>out so that no surge is<br>applied by high-current<br>lines.                                                                                                                                                                                                                                 | -         |
|                                    | There is variation in the FG<br>potential because of the<br>influence of machines on the<br>Servomotor side, such as a<br>welder. | Turn OFF the Servo Sys-<br>tem. Check to see if the<br>machines are correctly<br>grounded.                                                                                                                                                                                                                      | Properly ground the machines to separate them from the FG of the encoder.                                                                                                                                                                                                                                              | _         |
|                                    | There is a SERVOPACK pulse counting error due to noise.                                                                           | Turn OFF the Servo Sys-<br>tem. Check to see if there<br>is noise interference on<br>the I/O signal line from<br>the encoder or Serial<br>Converter Unit.                                                                                                                                                       | Implement counter-<br>measures against noise<br>for the encoder wiring<br>or Serial Converter Unit<br>wiring.                                                                                                                                                                                                          | -         |
|                                    | The encoder was subjected to excessive vibration or shock.                                                                        | Turn OFF the Servo Sys-<br>tem. Check to see if<br>vibration from the<br>machine occurred.<br>Check the Servomotor<br>installation (mounting sur-<br>face precision, securing<br>state, and alignment).<br>Check the linear encoder<br>installation (mounting sur-<br>face precision and secur-<br>ing method). | Reduce machine vibra-<br>tion. Improve the<br>mounting state of the<br>Servomotor or linear<br>encoder.                                                                                                                                                                                                                | -         |

|                                   |                                                                                           |                                                                                                                                                                                                                                                              | Continued from pre                                                                                                                                      | vious page. |
|-----------------------------------|-------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Problem                           | Possible Cause                                                                            | Confirmation                                                                                                                                                                                                                                                 | Correction                                                                                                                                              | Reference   |
| Position<br>Deviation<br>(without | The coupling between the machine and Servomotor is not suitable.                          | Turn OFF the Servo Sys-<br>tem. Check to see if posi-<br>tion offset occurs at the<br>coupling between<br>machine and Servomotor.                                                                                                                            | Correctly secure the coupling between the machine and Servomotor.                                                                                       | -           |
|                                   | Noise interference occurred<br>because of incorrect I/O Sig-<br>nal Cable specifications. | Turn OFF the Servo Sys-<br>tem. Check the I/O Signal<br>Cables to see if they sat-<br>isfy specifications. Use<br>shielded twisted-pair<br>cables or screened<br>twisted-pair cables with<br>conductors of at least<br>0.12 mm <sup>2</sup> (stranded wire). | Use cables that satisfy the specifications.                                                                                                             | -           |
| Alarm)                            | Noise interference occurred<br>because an I/O Signal Cable<br>is too long.                | Turn OFF the Servo Sys-<br>tem. Check the lengths of<br>the I/O Signal Cables.                                                                                                                                                                               | The I/O Signal Cables<br>must be no longer than<br>3 m.                                                                                                 | -           |
|                                   | An encoder fault occurred.<br>(The pulse count does not<br>change.)                       | _                                                                                                                                                                                                                                                            | Turn OFF the Servo<br>System. Replace the<br>Servomotor or linear<br>encoder.                                                                           | -           |
|                                   | A failure occurred in the SER-<br>VOPACK.                                                 | _                                                                                                                                                                                                                                                            | Turn OFF the Servo<br>System. Replace the<br>SERVOPACK.                                                                                                 | -           |
|                                   | The surrounding air tempera-<br>ture is too high.                                         | Measure the surrounding<br>air temperature around<br>the Servomotor.                                                                                                                                                                                         | Reduce the surround-<br>ing air temperature to<br>40°C or less.                                                                                         | -           |
|                                   | The surface of the Servomo-<br>tor is dirty.                                              | Turn OFF the Servo Sys-<br>tem. Visually check the<br>surface for dirt.                                                                                                                                                                                      | Clean dirt, dust, and oil from the surface.                                                                                                             | -           |
| Servomotor<br>Overheated          | There is an overload on the Servomotor.                                                   | Check the load status with a monitor.                                                                                                                                                                                                                        | If the Servomotor is<br>overloaded, reduce the<br>load or replace the<br>Servo Drive with a<br>SERVOPACK and Ser-<br>vomotor with larger<br>capacities. | -           |
|                                   | Polarity detection was not performed correctly.                                           | Check to see if electrical<br>angle 2 (electrical angle<br>from polarity origin) at any<br>position is between ±10°.                                                                                                                                         | Correct the settings for<br>the polarity detection-<br>related parameters.                                                                              | -           |

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# **Parameter Lists**

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This chapter provides information on the parameters.

# (14)

14.1.1 Interpreting the Parameter Lists

# 14.1 List of Servo Parameters

## 14.1.1 Interpreting the Parameter Lists

|                  |         |                         |                                                           |                                                                                                                                                                         |                                                                                     |                 |                    |                                     | fter one c<br>s turned (<br>hand is se                   | of the<br>OFF<br>ent. |                |
|------------------|---------|-------------------------|-----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------|--------------------|-------------------------------------|----------------------------------------------------------|-----------------------|----------------|
| Parameter<br>No. | Size    | 1                       | lame                                                      |                                                                                                                                                                         | Setting<br>Range                                                                    | Setting<br>Unit | Default<br>Setting | Applica-<br>ble Motors              | Whr n<br>Enabled                                         | Classi-<br>fication   | Refer-<br>ence |
|                  | 2       | Basic Funct             | tion Selection                                            | ons 0                                                                                                                                                                   | 0000h to<br>10B1h                                                                   | -               | 0000h              | All                                 | After restart                                            | Setup                 | -              |
|                  |         | Servo<br>provio<br>• To | omotor and<br>ded for both<br>op row: For<br>ottom row: F | Linear<br>n.<br>Rotary<br>For Lin<br><b>Direc</b>                                                                                                                       | in the paramete<br>Servomotor, in<br>Servomotors<br>ear Servomotor<br>tion Sel tion | formation is    | y   • 8            | Setup<br>Tuning<br>er to the follow | wing two class<br>ving section for<br>eter Classificatio | details.              |                |
| D 000            |         | n.000X                  | 0                                                         | Use (<br>Use t                                                                                                                                                          | CCW as the for<br>he direction in<br>direction.                                     | orward dire     |                    | oder counts                         | up as the for-                                           |                       |                |
| Pn000            |         |                         | 1                                                         | Use CW as the forward direction. (Reverse Rotation Mode)<br>Use the direction in which the linear encoder counts down as the forward direction. (Reverse Movement Mode) |                                                                                     |                 |                    |                                     |                                                          | page 6                | -15            |
| • <u>M2</u>      | Parar   | meters that are va      | lid only for a N                                          | 1ECHAT                                                                                                                                                                  | lid only for a spe<br>ROLINK-II-compat<br>ROLINK-III standar                        | ible profile.   |                    |                                     |                                                          |                       |                |
|                  | _ · · · |                         | ,                                                         |                                                                                                                                                                         | ervomotor Sta                                                                       | · · /           |                    | Encoder Is N                        | ot Connected                                             | Referen               | nce            |
|                  |         |                         |                                                           |                                                                                                                                                                         | When an encoder is not connected, start as SERVOPACK for Rotary Servomotor.         |                 |                    |                                     |                                                          |                       |                |
|                  |         | n.X000                  | 0                                                         | Rotar                                                                                                                                                                   |                                                                                     |                 |                    |                                     |                                                          | page 6                | -14            |

#### List of Servo Parameters 14.1.2

The following table lists the parameters.

Note: Do not change the following parameters from their default settings. • Reserved parameters

- Parameters not given in this manualParameters that are not valid for the Servomotor that you are using, as given in the parameter table

| Parameter<br>No. | Size | N                     | ame          | Setting<br>Range                                                                                                                                                       | Setting<br>Unit                                                | Default<br>Setting                          | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |
|------------------|------|-----------------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|---------------------------------------------|----------------------|------------------|---------------------|----------------|
|                  | 2    | Basic Fund<br>tions 0 | ction Selec- | 0000h to<br>10B1h                                                                                                                                                      | -                                                              | 0000h                                       | All                  | After<br>restart | Setup               | -              |
| Pn000            |      | n.000X                | Movemer<br>0 | Direction Selection<br>at Direction Select<br>Use CCW as the f<br>Use the direction<br>ward direction.<br>Use CW as the for<br>Use the direction<br>forward direction. | ion<br>forward dir<br>in which th<br>rward dire<br>in which th | ne linear er<br>ction. (Rev<br>ne linear er | erse Rotation        | Mode)            | page (              |                |
|                  |      | n.🗆🗆 X 🗆              | Reserved     | parameter (Do no                                                                                                                                                       | ot change                                                      | .)                                          |                      |                  |                     |                |
|                  |      | n.¤X¤¤                | Reserved     | parameter (Do no                                                                                                                                                       | ot change                                                      | .)                                          |                      |                  |                     |                |
|                  | Ī    |                       | Rotary/Lin   | near Servomotor                                                                                                                                                        | Startup Se                                                     | election W                                  | hen Encoder          | Is Not Con-      | Refere              | ence           |
|                  |      | n.X000                |              | When an encoder<br>Rotary Servomoto                                                                                                                                    |                                                                | nected, st                                  | art as SERVC         | PACK for         | Dogo (              | 2 1 4          |
|                  |      |                       |              | When an encoder<br>ear Servomotor.                                                                                                                                     | is not cor                                                     | nected, st                                  | art as SERVC         | PACK for Lin     | - page (            | 0-14           |
|                  | -    |                       |              |                                                                                                                                                                        |                                                                |                                             |                      |                  | I                   |                |

Continued on next page.

| Parameter<br>No. | Size | N                         | ame      |                                                                                                                     | Setting<br>Range                                     | Setting<br>Unit         | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |  |  |  |  |
|------------------|------|---------------------------|----------|---------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|-------------------------|--------------------|----------------------|------------------|---------------------|----------------|--|--|--|--|
|                  | 2    | Application<br>Selections |          |                                                                                                                     | 0000h to<br>1142h                                    | -                       | 0000h              | All                  | After<br>restart | Setup               | _              |  |  |  |  |
|                  |      |                           | Motor St | ίασο                                                                                                                | ng Method fo                                         | r Servo Ol              | F and Gro          | oup 1 Alarms         |                  | Refere              | ence           |  |  |  |  |
|                  |      |                           | 0        |                                                                                                                     | o the motor by                                       |                         |                    | •                    |                  |                     |                |  |  |  |  |
|                  |      | n.DDDX                    | 1        |                                                                                                                     | o the motor by<br>dynamic brake                      |                         | ing dynam          | ic brake and         | then release     | ease page 6         |                |  |  |  |  |
|                  |      |                           | 2        | Coa                                                                                                                 | ist the motor t                                      | o a stop w              | vithout the        | dynamic brak         | ке.              |                     |                |  |  |  |  |
|                  |      |                           | Overtrav | el St                                                                                                               | opping Metho                                         | d                       |                    |                      |                  | Refere              | ence           |  |  |  |  |
|                  |      | n.00X0                    | 0        |                                                                                                                     | ly the dynamic ping method                           |                         |                    |                      | op (use the      |                     |                |  |  |  |  |
|                  |      |                           | 1        | Decelerate the motor to a stop using the torque set in Pn406 as the maximum torque and then servo-lock the motor.   |                                                      |                         |                    |                      |                  |                     |                |  |  |  |  |
| Pn001            |      |                           | 2        | Decelerate the motor to a stop using the torque set in Pn406 as<br>the maximum torque and then let the motor coast. |                                                      |                         |                    |                      |                  |                     | 8-28           |  |  |  |  |
|                  |      |                           | 3        | Decelerate the motor to a stop using the deceleration time set in Pn30A and then servo-lock the motor.              |                                                      |                         |                    |                      |                  |                     |                |  |  |  |  |
|                  |      |                           | 4        | Decelerate the motor to a stop using the deceleration time set in Pn30A and then let the motor coast.               |                                                      |                         |                    |                      |                  |                     |                |  |  |  |  |
|                  |      |                           | Main Cir | cuit I                                                                                                              | Power Supply                                         | AC/DC In                | put Select         | tion                 |                  | Refere              | ence           |  |  |  |  |
|                  |      |                           | 0        |                                                                                                                     | ut AC power as<br>L3 terminals (                     |                         |                    |                      | ng the L1, L2    | ,                   |                |  |  |  |  |
|                  |      | n.□X□□                    | 1        | and                                                                                                                 | ut DC power as $\ominus$ 2 terminals verter or the s | s or the B <sup>-</sup> | 1 and ⊖ 2          | 11.2                 |                  | page 6              | 8-13           |  |  |  |  |
|                  |      | n.XDDD                    | Reserve  | d par                                                                                                               | ameter (Do no                                        | ot change               | )                  |                      |                  |                     |                |  |  |  |  |
|                  |      |                           | •        |                                                                                                                     |                                                      |                         |                    |                      |                  |                     |                |  |  |  |  |

Continued from previous page.

| Parameter<br>No. | Size                             | Ν                        | lame             | Setting<br>Range                     | Setting<br>Unit                   | Default<br>Setting | Applicable<br>Motors | When<br>Enabled      | Classi-<br>fication | Refer<br>ence |
|------------------|----------------------------------|--------------------------|------------------|--------------------------------------|-----------------------------------|--------------------|----------------------|----------------------|---------------------|---------------|
|                  | 2                                | Applicatio<br>Selections | n Function<br>2  | 0000h to<br>4213h                    | -                                 | 0011h              | -                    | After<br>restart     | Setup               | _             |
|                  |                                  |                          | MECHAT<br>Option | ROLINK Commar                        | nd Positior                       | and Spee           | ed Control           | Applicable<br>Motors | Refere              | ence          |
|                  |                                  |                          | 0                | Reserved setting                     | (Do not us                        | e.)                |                      |                      |                     |               |
|                  |                                  | n.🗆🗆 🗆 X                 | 1                | Use TLIM as the                      | torque limit                      |                    |                      |                      |                     |               |
|                  |                                  |                          | 2                | Reserved setting                     | (Do not us                        | e.)                |                      | All                  | *1                  |               |
|                  |                                  |                          | 3                | Use P_TLIM or N<br>P_CL or N_CL in   |                                   |                    |                      |                      |                     |               |
|                  |                                  |                          | Torque C         | ontrol Option                        |                                   |                    |                      | Applicable<br>Motors | Refere              | ence          |
|                  |                                  | n.🗆🗆 X 🗆                 | 0                | Reserved setting                     |                                   |                    |                      |                      |                     |               |
|                  |                                  |                          | 1                | Use the speed lin speed limit.       | All                               | *1                 |                      |                      |                     |               |
| Pn002            |                                  |                          | Encoder Usage    |                                      |                                   |                    |                      | Applicable<br>Motors | Refere              | ence          |
|                  |                                  | n.¤X¤¤                   | 0                | Use the encoder tions.               | All                               |                    |                      |                      |                     |               |
|                  |                                  |                          | 1                | Use the encoder                      | as an incre                       | emental en         | coder.               | page                 |                     | 7-33          |
|                  |                                  |                          | 2                | Use the encoder encoder.             | lute                              | Rotary             |                      |                      |                     |               |
|                  |                                  |                          | External         | Encoder Usage                        |                                   |                    |                      | Applicable<br>Motors | Refere              | ence          |
|                  |                                  |                          | 0                | Do not use an ex                     | ternal enco                       | oder.              |                      |                      |                     |               |
|                  |                                  | n.XDDD                   | 1                | The external enco<br>tion for CCW mo |                                   |                    | ward direc-          |                      |                     |               |
|                  |                                  |                          | 2                | Reserved setting                     | (Do not us                        | e.)                |                      | Rotary               | page <sup>-</sup>   | 11-6          |
|                  |                                  |                          | 3                | The external enco<br>tion for CCW mo | coder moves in the reverse direc- |                    |                      |                      |                     |               |
|                  | 4 Reserved setting (Do not use.) |                          |                  |                                      |                                   |                    |                      |                      | 1                   |               |

Continued on next page.

| Parameter<br>No. | Size | N                         | ame                                 | Setting<br>Range                                                                                     | Setting<br>Unit | Default<br>Setting  | Applicable<br>Motors         | When<br>Enabled  | Classi-<br>fication | Refer        |  |  |
|------------------|------|---------------------------|-------------------------------------|------------------------------------------------------------------------------------------------------|-----------------|---------------------|------------------------------|------------------|---------------------|--------------|--|--|
|                  | 2    | Application<br>Selections | n Function<br>6                     | 0000h to<br>105Fh                                                                                    | -               | 0002h               | All                          | Immedi-<br>ately | Setup               | page<br>10-8 |  |  |
|                  | _    |                           |                                     |                                                                                                      |                 |                     |                              |                  |                     |              |  |  |
|                  |      |                           | Analog Mo                           | onitor 1 Signal Se                                                                                   | election        |                     |                              |                  |                     |              |  |  |
|                  |      |                           | 00                                  | Motor speed (1                                                                                       | V/1,000 m       | nin <sup>-1</sup> ) |                              |                  |                     |              |  |  |
|                  |      |                           |                                     | Motor speed (1                                                                                       | V/1,000 m       | nm/s)               |                              |                  |                     |              |  |  |
|                  |      |                           | 01                                  | Speed reference                                                                                      | e (1 V/1,00     | )0 min⁻¹)           |                              |                  |                     |              |  |  |
|                  |      |                           | 01                                  | Speed reference (1 V/1,000 mm/s)                                                                     |                 |                     |                              |                  |                     |              |  |  |
|                  |      |                           | 02                                  | Torque reference (1 V/100% rated torque)                                                             |                 |                     |                              |                  |                     |              |  |  |
|                  |      |                           | 02                                  | Force reference (1 V/100% rated force)                                                               |                 |                     |                              |                  |                     |              |  |  |
|                  |      |                           | 03                                  | Position deviation                                                                                   | on (0.05 V/     | reference           | unit)                        |                  |                     |              |  |  |
|                  |      |                           |                                     | Position amplifie                                                                                    | er deviation    | n (after eleo       | ctronic gear) (              | 0.05 V/encc      | der pulse           | unit)        |  |  |
|                  |      |                           | 04                                  | Position amplifie pulse unit)                                                                        | er deviation    | n (after elec       | ctronic gear) (              | 0.05 V/linea     | r encoder           |              |  |  |
|                  |      |                           | 05                                  | Position referen                                                                                     | ce speed (      | 1 V/1,000           | min⁻¹)                       |                  |                     |              |  |  |
|                  |      |                           | 03                                  | Position reference speed (1 V/1,000 min <sup>-1</sup> )<br>Position reference speed (1 V/1,000 mm/s) |                 |                     |                              |                  |                     |              |  |  |
|                  |      |                           | 06                                  | Reserved setting (Do not use.)                                                                       |                 |                     |                              |                  |                     |              |  |  |
| Pn006            |      | n.🗆🗆 XX                   | 07                                  | Load-motor pos                                                                                       | sition devia    | ation (0.01         | V/reference u                | nit)             |                     |              |  |  |
|                  |      |                           | 08                                  | Positioning com<br>pleted: 0 V)                                                                      | pletion (po     | ositioning c        | completed: 5                 | V, positioning   | g not com           | -            |  |  |
|                  |      |                           | 09                                  | Speed feedforward (1 V/1,000 min <sup>-1</sup> )                                                     |                 |                     |                              |                  |                     |              |  |  |
|                  |      |                           | 03                                  | Speed feedforw                                                                                       | ard (1 V/1      | ,000 mm/s           | :)                           |                  |                     |              |  |  |
|                  |      |                           | 0A                                  | Torque feedforw                                                                                      | ard (1 V/1      | 00% rated           | torque)                      |                  |                     |              |  |  |
|                  |      |                           | UA                                  | Force feedforwa                                                                                      | urd (1 V/10     | 0% rated t          | orce)                        |                  |                     |              |  |  |
|                  |      |                           | 0B                                  | Active gain (1st                                                                                     | gain: 1 V,      | 2nd gain: 2         | 2 V)                         |                  |                     |              |  |  |
|                  |      |                           | 0C                                  | Completion of p<br>pleted: 0 V)                                                                      | osition ref     | erence dis          | tribution (com               | pleted: 5 V,     | not com-            |              |  |  |
|                  |      |                           | 0D                                  | External encode                                                                                      | r speed (1      | V/1,000 r           | nin <sup>-1</sup> : value at | the motor s      | haft)               |              |  |  |
|                  |      |                           | 0E                                  | Reserved setting                                                                                     | g (Do not i     | use.)               |                              |                  |                     |              |  |  |
|                  |      |                           | 0F                                  | Reserved setting                                                                                     | g (Do not i     | use.)               |                              |                  |                     |              |  |  |
|                  |      |                           | 10                                  | Main circuit DC                                                                                      | voltage         |                     |                              |                  |                     |              |  |  |
|                  |      |                           | 11 to 5F                            | Reserved setting                                                                                     | gs (Do not      | use.)               |                              |                  |                     |              |  |  |
|                  |      | n.¤X¤¤                    | Reserved                            | parameter (Do no                                                                                     | ot change       | .)                  |                              |                  |                     |              |  |  |
|                  |      | n.XDDD                    | Reserved parameter (Do not change.) |                                                                                                      |                 |                     |                              |                  |                     |              |  |  |

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| Parameter<br>No.  | Size | N                         | lame                                                    | Setting<br>Range                                                                         | Setting<br>Unit | Default<br>Setting     | Applicable<br>Motors         | When<br>Enabled  | Classi-<br>fication | Reference   |  |
|-------------------|------|---------------------------|---------------------------------------------------------|------------------------------------------------------------------------------------------|-----------------|------------------------|------------------------------|------------------|---------------------|-------------|--|
|                   | 2    | Application<br>Selections |                                                         | 0000h to<br>105Fh                                                                        | -               | 0000h                  | All                          | Immedi-<br>ately | Setup               | pag<br>10-8 |  |
|                   |      |                           |                                                         |                                                                                          |                 |                        |                              |                  |                     | _           |  |
|                   |      |                           | Analog Mo                                               | nitor 2 Signal Se                                                                        | lection         |                        |                              |                  |                     |             |  |
|                   |      |                           | 00                                                      | Motor speed (1                                                                           |                 | ,                      |                              |                  |                     |             |  |
|                   |      |                           |                                                         | Motor speed (1                                                                           | V/1,000 m       | ım/s)                  |                              |                  |                     |             |  |
|                   |      |                           | 01                                                      | Speed reference                                                                          | e (1 V/1,00     | )0 min <sup>-1</sup> ) |                              |                  |                     |             |  |
|                   |      |                           |                                                         | Speed reference                                                                          | e (1 V/1,00     | )0 mm/s)               |                              |                  |                     |             |  |
|                   |      |                           | 02                                                      | Torque reference                                                                         | e (1 V/100      | % rated to             | orque)                       |                  |                     |             |  |
|                   |      |                           |                                                         | Force reference (1 V/100% rated force) Position deviation (0.05 V/reference unit)        |                 |                        |                              |                  |                     |             |  |
|                   |      |                           | 03                                                      |                                                                                          |                 |                        | ,                            |                  |                     |             |  |
|                   |      |                           |                                                         | Position amplifie                                                                        | r deviatior     | n (after ele           | ctronic gear) (              | 0.05 V/enco      | der pulse           | unit)       |  |
|                   |      |                           | 04                                                      | Position amplifie<br>pulse unit)                                                         | r deviatior     | n (after eleo          | ctronic gear) (              | 0.05 V/linea     | r encoder           |             |  |
|                   |      | 05                        | Position reference speed (1 V/1,000 min <sup>-1</sup> ) |                                                                                          |                 |                        |                              |                  |                     |             |  |
|                   |      |                           | 00                                                      | Position reference speed (1 V/1,000 mm/s)                                                |                 |                        |                              |                  |                     |             |  |
|                   |      | n.🗆🗆XX                    | 06                                                      | Reserved setting (Do not use.)                                                           |                 |                        |                              |                  |                     |             |  |
| <sup>2</sup> n007 |      |                           | 07                                                      | Load-motor position deviation (0.01 V/reference unit)                                    |                 |                        |                              |                  |                     |             |  |
|                   |      |                           | 08                                                      | Positioning completion (positioning completed: 5 V, positioning not com-<br>pleted: 0 V) |                 |                        |                              |                  |                     |             |  |
|                   |      |                           | 09                                                      | Speed feedforward (1 V/1,000 min <sup>-1</sup> )                                         |                 |                        |                              |                  |                     |             |  |
|                   |      |                           | 09                                                      | Speed feedforw                                                                           | ard (1 V/1      | ,000 mm/s              | 3)                           |                  |                     |             |  |
|                   |      |                           | 0A                                                      | Torque feedforw                                                                          | ard (1 V/1      | 00% rated              | l torque)                    |                  |                     |             |  |
|                   |      |                           | UA                                                      | Force feedforwa                                                                          | rd (1 V/10      | 0% rated t             | force)                       |                  |                     |             |  |
|                   |      |                           | 0B                                                      | Active gain (1st                                                                         | gain: 1 V,      | 2nd gain: 2            | 2 V)                         |                  |                     |             |  |
|                   |      |                           | 0C                                                      | Completion of p<br>pleted: 0 V)                                                          | osition ref     | erence dis             | tribution (com               | pleted: 5 V,     | not com-            |             |  |
|                   |      |                           | 0D                                                      | External encode                                                                          | r speed (1      | V/1,000 r              | min <sup>-1</sup> : value at | the motor s      | haft)               |             |  |
|                   |      |                           | 0E                                                      | Reserved setting                                                                         | g (Do not i     | use.)                  |                              |                  |                     |             |  |
|                   |      |                           | 0F                                                      | Reserved setting                                                                         | g (Do not i     | use.)                  |                              |                  |                     |             |  |
|                   |      |                           | 10                                                      | Main circuit DC                                                                          | voltage         |                        |                              |                  |                     |             |  |
|                   |      |                           | 11 to 5F                                                | Reserved setting                                                                         | gs (Do not      | use.)                  |                              |                  |                     |             |  |
|                   |      | n.¤X¤¤                    | Reserved                                                | parameter (Do no                                                                         | ot change.      | .)                     |                              |                  |                     |             |  |
|                   |      | n.XDDD                    | Reserved                                                | parameter (Do no                                                                         | ot change.      | .)                     |                              |                  |                     |             |  |

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|------------------|------|------------------------------------------------------------------------------------------------|-------------------------------------|--------------------------------------------|-----------------|--------------------|----------------------|------------------|---------------------|---------------|--|--|--|--|--|
| Parameter<br>No. | Size | N                                                                                              | lame                                | Setting<br>Range                           | Setting<br>Unit | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer<br>ence |  |  |  |  |  |
|                  | 2    | Application<br>Selections                                                                      |                                     | 0000h to<br>7121h                          | -               | 4000h              | Rotary               | After<br>restart | Setup               | -             |  |  |  |  |  |
|                  |      |                                                                                                |                                     |                                            |                 |                    |                      |                  |                     |               |  |  |  |  |  |
|                  |      |                                                                                                |                                     | ery Voltage Alarm                          | v               |                    |                      |                  | page 13-2           |               |  |  |  |  |  |
|                  |      | n.DDDX                                                                                         | 0                                   | Output alarm (A.8                          | '               | ,                  | 0                    |                  |                     |               |  |  |  |  |  |
|                  |      |                                                                                                | 1                                   | Output warning (                           | 4.930) for l    | ow battery         | voltage.             |                  | 1                   |               |  |  |  |  |  |
|                  |      |                                                                                                | Function                            | Selection for Unc                          | lervoltage      |                    |                      |                  | Refere              | ence          |  |  |  |  |  |
| Pn008            |      |                                                                                                | 0                                   | Do not detect un                           | dervoltage.     |                    |                      |                  |                     |               |  |  |  |  |  |
| FIIUUO           |      | n.🗆🗆 X 🗆                                                                                       | 1                                   | Detect undervolta                          | age warning     | g and limit        | torque at hos        | t controller.    | page /-             |               |  |  |  |  |  |
|                  |      | 2 Detect undervoltage warning and limit torque with Pn424 and Pn425 (i.e., only in SERVOPACK). |                                     |                                            |                 |                    |                      |                  |                     |               |  |  |  |  |  |
|                  |      |                                                                                                | Warning                             | Varning Detection Selection                |                 |                    |                      |                  |                     |               |  |  |  |  |  |
|                  |      | n.¤X¤¤                                                                                         | 0                                   |                                            |                 |                    |                      |                  |                     |               |  |  |  |  |  |
|                  |      |                                                                                                | 1                                   | 1 Do not detect warnings except for A.971. |                 |                    |                      |                  |                     |               |  |  |  |  |  |
|                  |      | n.XDDD                                                                                         | Reserved parameter (Do not change.) |                                            |                 |                    |                      |                  |                     |               |  |  |  |  |  |
|                  |      |                                                                                                |                                     |                                            |                 |                    |                      |                  |                     |               |  |  |  |  |  |
|                  | 2    | Application<br>Selections                                                                      | n Function<br>9                     | 0000h to<br>0121h                          | -               | 0010h              | All                  | After<br>restart | Tuning              | -             |  |  |  |  |  |
|                  |      |                                                                                                |                                     |                                            |                 |                    |                      |                  |                     |               |  |  |  |  |  |
|                  |      | n.DDDX                                                                                         | Reserved                            | parameter (Do n                            | ot change.      | )                  |                      |                  |                     |               |  |  |  |  |  |
|                  | li   |                                                                                                | Current C                           | Control Mode Sele                          | ection          |                    |                      |                  | Refere              | nce           |  |  |  |  |  |
|                  |      |                                                                                                | 0                                   | Use current contr                          |                 |                    |                      |                  |                     | 1100          |  |  |  |  |  |
| Pn009            |      | n.🗆🗆 X 🗆                                                                                       | 1                                   | Use current contr                          |                 |                    |                      |                  | page 9              | 9-74          |  |  |  |  |  |
| 111000           |      |                                                                                                | 2                                   | Reserved setting                           | (Do not use     | e.)                |                      |                  |                     |               |  |  |  |  |  |
|                  | 1    |                                                                                                | Speed De                            | etection Method S                          | Selection       |                    |                      |                  | Refere              | nce           |  |  |  |  |  |
|                  |      | n.¤X¤¤                                                                                         | 0 Use speed detection 1.            |                                            |                 |                    |                      |                  |                     |               |  |  |  |  |  |
|                  |      |                                                                                                | 1 Use speed detection 2.            |                                            |                 |                    |                      |                  | — page 9            | 1-15          |  |  |  |  |  |
|                  |      |                                                                                                | 1                                   | Use speed detect                           | ion 2.          |                    |                      |                  |                     |               |  |  |  |  |  |
|                  |      | n.X000                                                                                         |                                     | Use speed detect                           |                 | )                  |                      |                  |                     |               |  |  |  |  |  |

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|                  |      |                           |                                                                                                         |                                                           |                            |                             | Con                              | tinued from                | n previou           | s page.        |  |  |  |
|------------------|------|---------------------------|---------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|----------------------------|-----------------------------|----------------------------------|----------------------------|---------------------|----------------|--|--|--|
| Parameter<br>No. | Size | N                         | ame                                                                                                     | Setting<br>Range                                          | Setting<br>Unit            | Default<br>Setting          | Applicable<br>Motors             | When<br>Enabled            | Classi-<br>fication | Refer-<br>ence |  |  |  |
|                  | 2    | Application<br>Selections |                                                                                                         | 0000h to<br>1044h                                         | -                          | 0001h                       | All                              | After<br>restart           | Setup               | -              |  |  |  |
|                  |      | L                         |                                                                                                         |                                                           | L                          | L                           |                                  |                            |                     | I              |  |  |  |
|                  |      |                           | Motor Sto                                                                                               | oping Method fo                                           | r Group 2                  | Alarms                      |                                  |                            | Refer               | ence           |  |  |  |
|                  |      |                           |                                                                                                         | Apply the dynami<br>topping method                        |                            |                             |                                  | op (use the                |                     |                |  |  |  |
|                  |      |                           | 1 t                                                                                                     | Decelerate the mo<br>he maximum toro                      | otor to a s<br>que. Use tl | top using t                 | the torque set                   |                            |                     |                |  |  |  |
|                  |      | n.□□□X                    |                                                                                                         | Decelerate the mo                                         |                            |                             |                                  | in Pn406 as                | page                | 6-39           |  |  |  |
|                  |      |                           | 3 F                                                                                                     | Decelerate the mo<br>Pn30A. Use the s                     |                            |                             |                                  |                            |                     |                |  |  |  |
|                  |      |                           |                                                                                                         | Decelerate the mo<br>Pn30A and then l                     |                            |                             | he deceleration                  | on time set ir             | ١                   |                |  |  |  |
| Pn00A            |      |                           | Stopping I                                                                                              | Aethod for Force                                          | ed Stops                   |                             |                                  |                            | Refer               | ence           |  |  |  |
|                  |      |                           |                                                                                                         | Apply the dynami<br>topping method                        |                            |                             |                                  | op (use the                |                     |                |  |  |  |
|                  |      |                           | 1 t                                                                                                     | Decelerate the mo<br>he maximum toro<br>tatus after stopp | que. Use tl                | top using t<br>ne setting ( | the torque set<br>of Pn001 = n.I | in Pn406 as<br>□□□X for th | ie                  |                |  |  |  |
|                  |      | n.00X0                    | 2 [                                                                                                     | Decelerate the mo                                         | otor to a s                |                             |                                  | in Pn406 as                | page                | 7-58           |  |  |  |
|                  |      |                           | 3 F                                                                                                     | Decelerate the mo<br>Pn30A. Use the s<br>topping.         |                            |                             |                                  |                            | after               |                |  |  |  |
|                  |      |                           | 4 Decelerate the motor to a stop using the deceleration time set in Pn30A and then let the motor coast. |                                                           |                            |                             |                                  |                            |                     |                |  |  |  |
|                  |      | n.¤X¤¤                    | Reserved                                                                                                | parameter (Do no                                          | ot change                  | .)                          |                                  |                            |                     |                |  |  |  |
|                  |      | n.X000                    | Reserved                                                                                                | parameter (Do no                                          | ot change                  | .)                          |                                  |                            |                     |                |  |  |  |
|                  |      |                           |                                                                                                         | V                                                         |                            | ,                           |                                  |                            |                     |                |  |  |  |
|                  | 2    | Application<br>Selections |                                                                                                         | 0000h to<br>1121h                                         | _                          | 0000h                       | All                              | After<br>restart           | Setup               | _              |  |  |  |
|                  |      |                           |                                                                                                         |                                                           |                            |                             |                                  |                            |                     |                |  |  |  |
|                  |      |                           | Operator Pa                                                                                             | arameter Display                                          | Selection                  | ı                           |                                  |                            | Refere              | nce            |  |  |  |
|                  |      | n.000X                    |                                                                                                         | splay only setup                                          | •                          | rs.                         |                                  |                            | page 6              | 5-4            |  |  |  |
|                  |      |                           | 1 Di                                                                                                    | splay all paramet                                         | ers.                       |                             |                                  |                            | 1 0                 |                |  |  |  |
| Pn00B            |      |                           |                                                                                                         | ping Method for                                           | •                          |                             |                                  |                            | Refere              | nce            |  |  |  |
|                  |      | n.00X0                    |                                                                                                         | top the motor by                                          | Ũ                          | •                           |                                  |                            | _                   |                |  |  |  |
|                  |      |                           |                                                                                                         | oply the dynamic<br>opping method s                       |                            |                             |                                  | p (use the                 | page 6              | -39            |  |  |  |
|                  |      |                           | 2 S                                                                                                     | et the stopping n                                         | nethod wit                 | h Pn00A =                   | = n.□□□X.                        |                            |                     |                |  |  |  |
|                  |      | n.OXOO                    | Reserved p                                                                                              | arameter (Do no                                           | t change.)                 | 1                           |                                  |                            |                     |                |  |  |  |
|                  |      | n.X000                    | Reserved p                                                                                              | arameter (Do no                                           | t change.)                 |                             |                                  |                            |                     |                |  |  |  |
|                  |      |                           |                                                                                                         |                                                           |                            |                             |                                  |                            |                     |                |  |  |  |

|                  |                                            |                                                        |                                                                                                                      | -                                                                |                                                                                        |                                                                        | Con                  | tinued fror           | n previou:          | s paye         |  |
|------------------|--------------------------------------------|--------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|----------------------------------------------------------------------------------------|------------------------------------------------------------------------|----------------------|-----------------------|---------------------|----------------|--|
| Parameter<br>No. | Size                                       | N                                                      | ame                                                                                                                  | Setting<br>Range                                                 | Setting<br>Unit                                                                        | Default<br>Setting                                                     | Applicable<br>Motors | When<br>Enabled       | Classi-<br>fication | Refer-<br>ence |  |
|                  | 2                                          | Application<br>Selections                              | n Function<br>C                                                                                                      | 0000h to<br>0131h                                                | -                                                                                      | 0000h                                                                  | -                    | After<br>restart      | Setup               | page<br>8-20   |  |
|                  |                                            |                                                        |                                                                                                                      |                                                                  |                                                                                        |                                                                        |                      |                       |                     |                |  |
|                  |                                            |                                                        | Function S                                                                                                           | Selection for Test                                               | without a                                                                              | Motor                                                                  |                      |                       | Applical<br>Motor   |                |  |
|                  |                                            | n.□□□X                                                 |                                                                                                                      | Disable tests with<br>Enable tests with                          |                                                                                        |                                                                        |                      |                       | All                 |                |  |
|                  |                                            |                                                        | Encoder F                                                                                                            | Resolution for Tes                                               | ts without                                                                             | a Motor                                                                |                      |                       | Applical<br>Motor   | ble<br>s       |  |
| Pn00C            |                                            | n.¤¤X¤                                                 |                                                                                                                      | Use 13 bits.                                                     |                                                                                        |                                                                        |                      |                       | -                   |                |  |
|                  |                                            | 11.00/0                                                |                                                                                                                      | Use 20 bits.<br>Use 22 bits.                                     |                                                                                        |                                                                        |                      |                       | Rotary              | /              |  |
|                  |                                            |                                                        |                                                                                                                      | Use 24 bits.                                                     |                                                                                        |                                                                        |                      |                       | -                   |                |  |
|                  |                                            |                                                        | Encoder T                                                                                                            | ype Selection for                                                | Tests wit                                                                              | hout a Mo                                                              | tor                  |                       | Applical<br>Motor   |                |  |
|                  |                                            | n.¤X¤¤                                                 | -                                                                                                                    | Use an increment                                                 | al encoder                                                                             | :                                                                      |                      |                       | All                 |                |  |
|                  |                                            |                                                        | 1                                                                                                                    | Use an absolute e                                                | ncoder.                                                                                |                                                                        |                      |                       | ,                   |                |  |
|                  |                                            | n.X000                                                 | Reserved                                                                                                             | parameter (Do no                                                 | ot change                                                                              | .)                                                                     |                      |                       |                     |                |  |
|                  | 2                                          | Application<br>Selections                              |                                                                                                                      | 0000h to<br>1001h                                                | _                                                                                      | 0000h                                                                  | All                  | After<br>restart      | Setup               | page<br>6-30   |  |
|                  |                                            |                                                        |                                                                                                                      |                                                                  |                                                                                        |                                                                        |                      |                       |                     |                |  |
|                  | n.□□□X Reserved parameter (Do not change.) |                                                        |                                                                                                                      |                                                                  |                                                                                        |                                                                        |                      |                       |                     |                |  |
| Pn00D            |                                            | n.00X0                                                 | Reserved                                                                                                             | parameter (Do no                                                 | ot change                                                                              | )                                                                      |                      |                       |                     |                |  |
|                  |                                            | n.¤X¤¤                                                 | Reserved                                                                                                             | parameter (Do no                                                 | ot change                                                                              | )                                                                      |                      |                       |                     |                |  |
|                  |                                            |                                                        | 1                                                                                                                    |                                                                  |                                                                                        |                                                                        |                      |                       |                     |                |  |
|                  |                                            |                                                        | Overtrave                                                                                                            | Warning Detecti                                                  | on Select                                                                              | ion                                                                    |                      |                       |                     |                |  |
|                  |                                            | n.XDDD                                                 | 0                                                                                                                    | Do not detect ove                                                | rtravel wa                                                                             |                                                                        |                      |                       |                     |                |  |
|                  |                                            | n.X000                                                 | 0                                                                                                                    | -                                                                | rtravel wa                                                                             |                                                                        |                      |                       |                     |                |  |
| Pn00E            | 2                                          | n.XDDD<br>Reserved p<br>(Do not cha                    | 0 1                                                                                                                  | Do not detect ove                                                | rtravel wa                                                                             |                                                                        | All                  |                       |                     |                |  |
| Pn00E            | 2                                          | Reserved p                                             | 0 1<br>1 1<br>Darameter<br>ange.)<br>n Function                                                                      | Do not detect ove                                                | rtravel wa                                                                             | rnings.                                                                | All                  | –<br>After<br>restart | -<br>Setup          |                |  |
| Pn00E            |                                            | Reserved p<br>(Do not cha                              | 0 1<br>1 1<br>Darameter<br>ange.)<br>n Function                                                                      | Do not detect ove<br>Detect overtravel                           | rtravel wa<br>warnings.                                                                | rnings.<br>0000h                                                       |                      | After                 |                     | -              |  |
| Pn00E            |                                            | Reserved p<br>(Do not cha                              | 0  <br>1  <br>Darameter<br>ange.)<br>n Function<br>F                                                                 | Do not detect ove<br>Detect overtravel                           | rtravel wa<br>warnings.<br>–<br>–                                                      | rnings.<br>0000h<br>0000h                                              |                      | After                 |                     | <br>           |  |
| Pn00E            |                                            | Reserved p<br>(Do not cha                              | 0 1<br>1 Darameter<br>ange.)<br>n Function<br>F<br>Preventati                                                        | Do not detect ove<br>Detect overtravel<br>–<br>0000h to<br>2011h | rtravel wa<br>warnings.<br>–<br>–<br>Warning S                                         | 0000h<br>0000h<br>0000h                                                | All                  | After                 | Setup<br>Reference  |                |  |
| Pn00E<br>Pn00F   |                                            | Reserved p<br>(Do not cha<br>Application<br>Selections | 0 1<br>Darameter<br>ange.)<br>n Function<br>F<br>Preventati<br>0 Dr                                                  | Do not detect over<br>Detect overtravel                          | rtravel wa<br>warnings.<br>–<br>–<br>Warning S<br>entative m                           | 0000h<br>0000h<br>0000h<br>election<br>aintenance                      | All                  | After                 | Setup               |                |  |
|                  |                                            | Reserved p<br>(Do not cha<br>Application<br>Selections | 0     1       1     1       Darameter ange.)       n Function       F       Preventati       0     Du       1     Du | Do not detect over<br>Detect overtravel                          | rtravel wa<br>warnings.<br>–<br>–<br>Warning S<br>entative maintena                    | rnings.<br>0000h<br>0000h<br>election<br>aintenance<br>nce warnin      | All                  | After                 | Setup<br>Reference  |                |  |
|                  | 2                                          | Reserved p<br>(Do not cha<br>Application<br>Selections | 0 1<br>1 1<br>Darameter<br>ange.)<br>n Function<br>F<br>Preventati<br>0 Do<br>1 Do<br>Reserved                       | Do not detect over<br>Detect overtravel                          | rtravel wa<br>warnings.<br>–<br>–<br>Warning S<br>entative ma<br>maintena<br>ot change | rnings.<br>0000h<br>0000h<br>eelection<br>aintenance<br>nce warnin     | All                  | After                 | Setup<br>Reference  |                |  |
|                  | 2                                          | Reserved p<br>(Do not cha<br>Application<br>Selections | 0  <br>1  <br>parameter<br>ange.)<br>h Function<br>F<br>Preventati<br>0 Dr<br>1 Dr<br>Reserved                       | Do not detect over<br>Detect overtravel                          | rtravel wa<br>warnings.<br>–<br>–<br>Warning S<br>entative ma<br>maintena<br>ot change | rnings.<br>0000h<br>0000h<br>election<br>aintenance<br>nce warnin<br>) | All                  | After                 | Setup<br>Reference  |                |  |
|                  | 2                                          | Reserved p<br>(Do not cha<br>Application<br>Selections | 0  <br>1  <br>parameter<br>ange.)<br>h Function<br>F<br>Preventati<br>0 Dr<br>1 Dr<br>Reserved                       | Do not detect over<br>Detect overtravel                          | rtravel wa<br>warnings.<br>–<br>–<br>Warning S<br>entative ma<br>maintena<br>ot change | rnings.<br>0000h<br>0000h<br>election<br>aintenance<br>nce warnin<br>) | All                  | After                 | Setup<br>Reference  |                |  |

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|                  |      |                           |                      | Continued fro                                                             |                       |                    |                      |                  |                     | s page.        |  |  |
|------------------|------|---------------------------|----------------------|---------------------------------------------------------------------------|-----------------------|--------------------|----------------------|------------------|---------------------|----------------|--|--|
| Parameter<br>No. | Size | 1                         | Name                 | Setting<br>Range                                                          | Setting<br>Unit       | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |  |  |
|                  | 2    | Application<br>Selections | n Function           | 0000h to<br>0011h                                                         | _                     | 0000h              | All                  | After<br>restart | Setup               | _              |  |  |
|                  |      | Ocidetion                 | 5 22                 | 001111                                                                    |                       |                    |                      | TOStart          |                     |                |  |  |
|                  | -    |                           | Our and the second L |                                                                           | O al a ati a m        |                    |                      |                  | Deferre             |                |  |  |
|                  |      |                           |                      | lelease Method                                                            |                       |                    |                      | ing input        | Refere              | nce            |  |  |
|                  | r    | n.000X                    |                      | ertravel exists w<br>ertravel exists w                                    |                       |                    | 0                    | •                | _                   |                |  |  |
| Pn022            |      |                           | 1 cu                 | rrent position of<br>or N-OT signal.                                      | the workp             | iece is sep        | parated from t       | he P-OT sig      | - page 6            | 5-31           |  |  |
|                  | r    | n.00X0                    | Reserved pa          | arameter (Do no                                                           | t change.)            |                    |                      |                  |                     |                |  |  |
|                  | r    | n.0X00                    | Reserved pa          | arameter (Do no                                                           | t change.)            |                    |                      |                  |                     |                |  |  |
|                  | r    | n.XDDD                    | Reserved pa          | arameter (Do no                                                           | t change.)            |                    |                      |                  |                     |                |  |  |
|                  | 2    | Application<br>Selections | n Function<br>s 23   | 0000h to<br>0001h                                                         | -                     | 0000h              | All                  | After<br>restart | Setup               | _              |  |  |
|                  | _    |                           |                      |                                                                           | l                     |                    |                      |                  |                     |                |  |  |
|                  |      |                           | 1                    | ke Relay Usage                                                            |                       | Reference          |                      |                  |                     |                |  |  |
|                  |      | n.🗆 🗆 🗆 X                 |                      | 0 Use the built-in brake relay.<br>1 Do not use the built-in brake relay. |                       |                    |                      |                  |                     |                |  |  |
| Pn023            |      |                           | 1 D                  | o not use the bu                                                          | built-in brake relay. |                    |                      |                  |                     |                |  |  |
|                  |      | n.DDXD                    | Reserved p           | arameter (Do no                                                           | ot change             | .)                 |                      |                  |                     |                |  |  |
|                  |      | n.¤X¤¤                    | Reserved p           | arameter (Do no                                                           | ot change             | )                  |                      |                  |                     |                |  |  |
|                  |      | n.XDDD                    | Reserved p           | Reserved parameter (Do not change.)                                       |                       |                    |                      |                  |                     |                |  |  |
| Pn040            | 2    | Reserved                  | parameter (Do        | 0000h to                                                                  | _                     | 0000h              | _                    | _                | _                   | _              |  |  |
|                  |      | not chang<br>Applicatio   | n Function           | 2111h<br>0000h to                                                         |                       | 00001-             | Linner               | After            | Oature              |                |  |  |
|                  | 2    | Selections                |                      | 1111h                                                                     | -                     | 0000h              | Linear               | restart          | Setup               | _              |  |  |
|                  |      |                           | Polarity Sen         | sor Selection                                                             |                       |                    |                      |                  | Refere              | nce            |  |  |
|                  | r    | n.DDDX                    | 0 Us                 | e polarity senso                                                          | r.                    |                    |                      |                  | — page 6            | 202            |  |  |
|                  |      |                           | 1 Do                 | not use polarity                                                          | / sensor.             |                    |                      |                  | page c              | -20            |  |  |
|                  |      |                           |                      | e Sequence Sel                                                            |                       |                    |                      |                  | Refere              | nce            |  |  |
| Pn080            | r    |                           |                      | t a phase-A lead                                                          | -                     |                    |                      |                  | page 6              | 6-21           |  |  |
|                  |      |                           | 1 Se                 | t a phase-B lead                                                          | d as a pha            | se sequen          | ce of U, V, an       | d W.             |                     |                |  |  |
|                  | r    | n.0X00                    | Reserved pa          | arameter (Do no                                                           | t change.)            | I                  |                      |                  |                     |                |  |  |
|                  |      |                           | Calculation          | Method for Max                                                            | imum Spe              | ed or End          | oder Output          | Pulses           | Refere              | ence           |  |  |
|                  | r    | n.X000                    |                      | Iculate the enco<br>eed.                                                  | der outpu             | t pulse set        | ting for a fixed     | d maximum        |                     |                |  |  |
|                  |      |                           | 0                    | Iculate the maxi                                                          | itout pulse           | page <sup>-</sup>  | 15-4                 |                  |                     |                |  |  |

Continued on next page.

|                  |      |                           |                                                |                                            |                 | Contract Setting Setting Default Applicat |                      |                   |                     |               |  |  |
|------------------|------|---------------------------|------------------------------------------------|--------------------------------------------|-----------------|-------------------------------------------|----------------------|-------------------|---------------------|---------------|--|--|
| Parameter<br>No. | Size | N                         | ame                                            | Setting<br>Range                           | Setting<br>Unit | Default<br>Setting                        | Applicable<br>Motors | When<br>Enabled   | Classi-<br>fication | Refer<br>ence |  |  |
|                  | 2    | Application<br>Selections |                                                | 0000h to<br>1111h                          | _               | 0000h                                     | All                  | After<br>restart  | Setup               | page<br>7-22  |  |  |
|                  |      |                           |                                                |                                            |                 |                                           | II                   |                   |                     |               |  |  |
|                  |      |                           |                                                | Pulse Output Sele                          |                 | in the few                                |                      |                   |                     |               |  |  |
|                  |      | n.□□□X                    | -                                              | Output phase-C p<br>Output phase-C p       | ,               |                                           |                      | rse direction     | าร.                 |               |  |  |
| Pn081            |      | n.00X0                    |                                                | parameter (Do no                           |                 |                                           |                      |                   |                     |               |  |  |
|                  |      | n.0X00                    | Reserved                                       | parameter (Do no                           | ot change.      | )                                         |                      |                   |                     |               |  |  |
|                  |      | n.X000                    | Reserved                                       | parameter (Do no                           | ot change.      | )                                         |                      |                   |                     |               |  |  |
|                  | -    |                           |                                                |                                            |                 | ,                                         |                      |                   |                     |               |  |  |
| Pn100            | 2    | Speed Loc                 | op Gain                                        | 10 to 20,000                               | 0.1 Hz          | 400                                       | All                  | Immedi-<br>ately  | Tuning              | page<br>9-82  |  |  |
| Pn101            | 2    | Speed Loc<br>Time Cons    |                                                | 15 to 51,200                               | 0.01 ms         | 2000                                      | All                  | Immedi-<br>ately  | Tuning              | page<br>9-82  |  |  |
| Pn102            | 2    | Position Lo               | oop Gain                                       | 10 to 20,000                               | 0.1/s           | 400                                       | All                  | Immedi-<br>ately  | Tuning              | page<br>9-82  |  |  |
| Pn103            | 2    | Moment of                 | f Inertia Rat                                  | io 0 to 20,000                             | 1%              | 100                                       | All                  | Immedi-<br>ately  | Tuning              | page<br>9-82  |  |  |
| Pn104            | 2    | Second Sp<br>Gain         | beed Loop                                      | 10 to 20,000                               | 0.1 Hz          | 400                                       | All                  | Immedi-<br>ately  | Tuning              | page<br>9-66  |  |  |
| Pn105            | 2    | Second Sp<br>Integral Tir |                                                | 15 to 51,200                               | 0.01 ms         | 2000                                      | All                  | Immedi-<br>ately  | Tuning              | page<br>9-66  |  |  |
| Pn106            | 2    | Second Po<br>Gain         | Integral Time Constant<br>Second Position Loop |                                            | 0.1/s           | 400                                       | All                  | Immedi-<br>ately  | Tuning              | page<br>9-66  |  |  |
| Pn109            | 2    | Feedforwa                 | -                                              | 0 to 100                                   | 1%              | 0                                         | All                  | Immedi-<br>ately  | Tuning              | page<br>9-93  |  |  |
| Pn10A            | 2    | Feedforwa<br>Constant     | rd Filter Tin                                  | ne 0 to 6,400                              | 0.01 ms         | 0                                         | All                  | Immedi-<br>ately  | Tuning              | page<br>9-93  |  |  |
|                  | 2    | Gain Applie<br>tions      | cation Sele                                    | c- 0000h to<br>5334h                       | _               | 0000h                                     | All                  | -                 | Setup               | _             |  |  |
|                  | _    |                           | 1                                              |                                            |                 |                                           |                      |                   |                     |               |  |  |
|                  |      |                           | Mode Sw                                        | itching Selection                          |                 |                                           |                      | When<br>Enabled   | d Refere            | ence          |  |  |
|                  |      |                           |                                                | Use the internal to<br>(level setting: Pn1 |                 | ence as th                                | e condition          |                   |                     |               |  |  |
|                  |      |                           |                                                | Use the speed ref<br>ting: Pn10D).         | erence as       | the condit                                | ion (level set-      |                   |                     |               |  |  |
|                  |      | n.000X                    |                                                | Use the speed ref<br>ting: Pn181).         | erence as       | the condit                                | ion (level set-      |                   |                     |               |  |  |
|                  |      |                           |                                                | Use the accelerat setting: Pn10E).         | ion referen     | ce as the                                 | condition (leve      | I Immedi<br>ately | - page §            | 9-94          |  |  |
| Pn10B            |      |                           |                                                | Use the accelerat setting: Pn182).         | ion referen     | ce as the                                 | condition (leve      | I                 |                     |               |  |  |
|                  |      |                           |                                                | Use the position of ting: Pn10F).          | deviation a     | s the conc                                | lition (level set-   | -                 |                     |               |  |  |
|                  |      |                           | 4                                              | Do not use mode                            | switching.      |                                           |                      | 1                 |                     |               |  |  |
|                  |      |                           | Speed Lo                                       | op Control Metho                           | od              |                                           |                      | When<br>Enabled   | Refere              | ence          |  |  |
|                  |      | n.🗆🗆 X 🗆                  | 0                                              | PI control                                 |                 |                                           |                      |                   |                     |               |  |  |
|                  |      |                           |                                                | I-P control                                |                 |                                           |                      | After<br>restart  | page §              | 9-89          |  |  |
|                  |      |                           | 2 and 3                                        | Reserved settings                          | (Do not u       | se.)                                      |                      |                   |                     |               |  |  |
|                  |      | n.🗆X🗆                     | Reserved                                       | parameter (Do no                           | ot change.      | )                                         |                      |                   |                     |               |  |  |
|                  |      |                           |                                                |                                            |                 |                                           |                      |                   |                     |               |  |  |

|                  |      | Continued from previous page                   |                      |                          |                    |                      |                  |                     | s page.                       |
|------------------|------|------------------------------------------------|----------------------|--------------------------|--------------------|----------------------|------------------|---------------------|-------------------------------|
| Parameter<br>No. | Size | Name                                           | Setting<br>Range     | Setting<br>Unit          | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence                |
| Pn10C            | 2    | Mode Switching Level<br>for Torque Reference   | 0 to 800             | 1%                       | 200                | All                  | Immedi-<br>ately | Tuning              | page<br>9-94                  |
| Pn10D            | 2    | Mode Switching Level<br>for Speed Reference    | 0 to 10,000          | 1 min <sup>-1</sup>      | 0                  | Rotary               | Immedi-<br>ately | Tuning              | page<br>9-94                  |
| Pn10E            | 2    | Mode Switching Level<br>for Acceleration       | 0 to 30,000          | 1 min <sup>-1</sup> /s   | 0                  | Rotary               | Immedi-<br>ately | Tuning              | page<br>9-94                  |
| Pn10F            | 2    | Mode Switching Level<br>for Position Deviation | 0 to 10,000          | 1 refer-<br>ence<br>unit | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>9-94                  |
| Pn11F            | 2    | Position Integral Time<br>Constant             | 0 to 50,000          | 0.1 ms                   | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>9-96                  |
| Pn121            | 2    | Friction Compensation<br>Gain                  | 10 to 1,000          | 1%                       | 100                | All                  | Immedi-<br>ately | Tuning              | page<br>9-66,<br>page<br>9-70 |
| Pn122            | 2    | Second Friction Com-<br>pensation Gain         | 10 to 1,000          | 1%                       | 100                | All                  | Immedi-<br>ately | Tuning              | page<br>9-66,<br>page<br>9-70 |
| Pn123            | 2    | Friction Compensation<br>Coefficient           | 0 to 100             | 1%                       | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>9-70                  |
| Pn124            | 2    | Friction Compensation<br>Frequency Correction  | -10,000 to<br>10,000 | 0.1 Hz                   | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>9-70                  |
| Pn125            | 2    | Friction Compensation<br>Gain Correction       | 1 to 1,000           | 1%                       | 100                | All                  | Immedi-<br>ately | Tuning              | page<br>9-70                  |
| Pn131            | 2    | Gain Switching Time 1                          | 0 to 65,535          | 1 ms                     | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>9-66                  |
| Pn132            | 2    | Gain Switching Time 2                          | 0 to 65,535          | 1 ms                     | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>9-66                  |
| Pn135            | 2    | Gain Switching Waiting<br>Time 1               | 0 to 65,535          | 1 ms                     | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>9-66                  |
| Pn136            | 2    | Gain Switching Waiting<br>Time 2               | 0 to 65,535          | 1 ms                     | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>9-66                  |
|                  | 2    | Automatic Gain Switch-<br>ing Selections 1     | 0000h to<br>0052h    | -                        | 0000h              | All                  | Immedi-<br>ately | Tuning              | page<br>9-66                  |
|                  |      |                                                |                      |                          |                    |                      |                  |                     |                               |

|       |                                            | Gain S     | ain Switching Selection                                                                                                                                                                                                                                                                    |  |  |  |  |  |  |  |
|-------|--------------------------------------------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|--|
| Pn139 |                                            | 0          | Use manual gain switching.<br>The gain is switched manually with G-SEL in the servo command output sig-<br>nals (SVCMD_IO).                                                                                                                                                                |  |  |  |  |  |  |  |
|       | n.□□□X                                     | 1          | Reserved setting (Do not use.)                                                                                                                                                                                                                                                             |  |  |  |  |  |  |  |
|       |                                            | 2          | Use automatic gain switching pattern 1.<br>The gain is switched automatically from the first gain to the second gain when<br>switching condition A is satisfied. The gain is switched automatically from the<br>second gain to the first gain when switching condition A is not satisfied. |  |  |  |  |  |  |  |
|       |                                            | Gain Sv    | vitching Condition A                                                                                                                                                                                                                                                                       |  |  |  |  |  |  |  |
|       |                                            | 0          | /COIN (Positioning Completion Output) signal turns ON.                                                                                                                                                                                                                                     |  |  |  |  |  |  |  |
|       |                                            | 1          | /COIN (Positioning Completion Output) signal turns OFF.                                                                                                                                                                                                                                    |  |  |  |  |  |  |  |
|       | n.□□X□                                     | 2          | /NEAR (Near Output) signal turns ON.                                                                                                                                                                                                                                                       |  |  |  |  |  |  |  |
|       |                                            | 3          | /NEAR (Near Output) signal turns OFF.                                                                                                                                                                                                                                                      |  |  |  |  |  |  |  |
|       |                                            | 4          | Position reference filter output is 0 and position reference input is OFF.                                                                                                                                                                                                                 |  |  |  |  |  |  |  |
|       |                                            | 5          | Position reference input is ON.                                                                                                                                                                                                                                                            |  |  |  |  |  |  |  |
|       | n.□X□□ Reserved parameter (Do not change.) |            |                                                                                                                                                                                                                                                                                            |  |  |  |  |  |  |  |
|       | n.XDDD Reserved parameter (Do not change.) |            |                                                                                                                                                                                                                                                                                            |  |  |  |  |  |  |  |
|       |                                            |            |                                                                                                                                                                                                                                                                                            |  |  |  |  |  |  |  |
| Pn13D | 2 Current                                  | Gain Level | 100 to 2,0001%2000AllImmediatelyTuningpage9-74                                                                                                                                                                                                                                             |  |  |  |  |  |  |  |
|       | L.                                         |            | Continued on next page.                                                                                                                                                                                                                                                                    |  |  |  |  |  |  |  |

Parameter Lists

|                  |      |                             | Continue                      |                                                            |                 |                            |                                   |                           |                     | s page.        |
|------------------|------|-----------------------------|-------------------------------|------------------------------------------------------------|-----------------|----------------------------|-----------------------------------|---------------------------|---------------------|----------------|
| Parameter<br>No. | Size | N                           | ame                           | Setting<br>Range                                           | Setting<br>Unit | Default<br>Setting         | Applicable<br>Motors              | When<br>Enabled           | Classi-<br>fication | Refer-<br>ence |
|                  | 2    | Model Folle<br>trol-Related | owing Con-<br>d Selections    | 0000h to<br>1121h                                          | -               | 0100h                      | All                               | Immedi-<br>ately          | Tuning              | -              |
|                  |      |                             |                               |                                                            | 1               | 1                          | 1                                 | L                         | 1                   |                |
|                  |      |                             | Model Foll                    | owing Control S                                            | election        |                            |                                   |                           | Referen             | ice            |
|                  |      | n.DDDX                      | 0 Dc                          | not use model f                                            | ollowing c      | ontrol.                    |                                   |                           | page 9-             | 90             |
|                  |      |                             | 1 Us                          | e model following                                          | g control.      |                            |                                   |                           | page o              |                |
|                  |      |                             | Vibration S                   | uppression Sele                                            | ection          |                            |                                   |                           | Referen             | ce             |
|                  |      | n.DDXD                      | 0 Dc                          | not perform vibr                                           | ation supp      | pression.                  |                                   |                           |                     |                |
|                  |      |                             |                               | rform vibration s                                          |                 |                            |                                   |                           | page 9-             | 90             |
|                  |      |                             | 2 Pe                          | rform vibration s                                          | uppressior      | n for two s                | pecific freque                    | ncies.                    |                     |                |
| Pn140            |      |                             | Vibration S                   | uppression Adju                                            | stment S        | election                   |                                   |                           | Referen             | ce             |
|                  |      | n.¤X¤¤                      | 0 ti                          | o not adjust vibr<br>on of autotuning<br>ost reference, ar | without a       | host refere                |                                   |                           |                     | 20             |
|                  |      |                             | 1 a                           | djust vibration su<br>utotuning withou<br>rence, and custo | t a host re     | n automatio<br>eference, a | cally during ex<br>utotuning with | ecution of<br>a host ref- | - page 9-           |                |
|                  |      |                             | Speed Fee                     | dforward (VFF)/                                            | Forque Fe       | edforward                  | (TFF) Selecti                     | on                        | Referen             | се             |
|                  |      | n.X000                      |                               | o not use model<br>vard together.                          | following       | control an                 | d speed/torqu                     | ue feedfor-               | - page 9-           | 22             |
|                  |      |                             |                               | lse model followi<br>ogether.                              | ng control      | and speed                  | d/torque feed                     | forward                   | page 9-             |                |
|                  |      | 1                           |                               |                                                            | 1               | T                          | 1                                 | [                         | 1                   |                |
| Pn141            | 2    | trol Gain                   | owing Con-                    | 10 to 20,000                                               | 0.1/s           | 500                        | All                               | Immedi-<br>ately          | Tuning              | page<br>9-90   |
| Pn142            | 2    | Model Folle<br>trol Gain C  | owing Con-<br>orrection       | 500 to 2,000                                               | 0.1%            | 1000                       | All                               | Immedi-<br>ately          | Tuning              | page<br>9-66   |
| Pn143            | 2    |                             | owing Con-<br>the Forward     | 0 to 10,000                                                | 0.1%            | 1000                       | All                               | Immedi-<br>ately          | Tuning              | page<br>9-90   |
| Pn144            | 2    |                             | owing Con-<br>the Reverse     | 0 to 10,000                                                | 0.1%            | 1000                       | All                               | Immedi-<br>ately          | Tuning              | page<br>9-90   |
| Pn145            | 2    | Vibration S<br>Frequency    | Suppression<br>A              | <sup>1</sup> 10 to 2,500                                   | 0.1 Hz          | 500                        | All                               | Immedi-<br>ately          | Tuning              | page<br>9-59   |
| Pn146            | 2    | Vibration S<br>Frequency    | Suppression<br>B              | <sup>1</sup> 10 to 2,500                                   | 0.1 Hz          | 700                        | All                               | Immedi-<br>ately          | Tuning              | page<br>9-59   |
| Pn147            | 2    |                             | owing Con-<br>Feedforward     | 0 to 10,000                                                | 0.1%            | 1000                       | All                               | Immedi-<br>ately          | Tuning              | page<br>9-90   |
| Pn148            | 2    | Second Mo<br>ing Contro     | odel Follow-<br>I Gain        | 10 to 20,000                                               | 0.1/s           | 500                        | All                               | Immedi-<br>ately          | Tuning              | page<br>9-66   |
| Pn149            | 2    |                             | odel Follow-<br>I Gain Correc | c- 500 to 2,000                                            | 0.1%            | 1000                       | All                               | Immedi-<br>ately          | Tuning              | page<br>9-66   |
| Pn14A            | 2    | Vibration S<br>Frequency    | Suppression                   | <sup>2</sup> 10 to 2,000                                   | 0.1 Hz          | 800                        | All                               | Immedi-<br>ately          | Tuning              | page<br>9-59   |
| Pn14B            | 2    | Vibration S<br>Correction   | Suppression                   | <sup>2</sup> 10 to 1,000                                   | 1%              | 100                        | All                               | Immedi-<br>ately          | Tuning              | page<br>9-59   |

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|                  |                                            |                                    | Continued from             |                                                                                                                                         |                 |                                                              |                      |                  | · · · · · · · · · · · · · · · · · · · |                |  |
|------------------|--------------------------------------------|------------------------------------|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------------------------------------------------------|----------------------|------------------|---------------------------------------|----------------|--|
| Parameter<br>No. | Size                                       | N                                  | ame                        | Setting<br>Range                                                                                                                        | Setting<br>Unit | Default<br>Setting                                           | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication                   | Refer-<br>ence |  |
|                  | 2                                          | Control-Re<br>tions                | lated Selec-               | 0000h to<br>0021h                                                                                                                       | -               | 0021h                                                        | All                  | After<br>restart | Tuning                                | Ι              |  |
|                  |                                            |                                    |                            |                                                                                                                                         |                 |                                                              |                      |                  |                                       |                |  |
|                  |                                            |                                    | Model Follov               | ving Control Ty                                                                                                                         | pe Select       | ion                                                          |                      |                  | Refere                                | ence           |  |
|                  |                                            | n.🗆🗆 🗆 X                           | 0 Use                      | e model followi                                                                                                                         | ng control      | type 1.                                                      |                      |                  | page 9                                | 2-02           |  |
|                  | -                                          |                                    | 1 Use                      | e model followi                                                                                                                         | ng control      | type 2.                                                      |                      |                  | page                                  |                |  |
| Pn14F            |                                            |                                    | Tuning-less                | Type Selection                                                                                                                          |                 |                                                              |                      |                  | Refere                                | ence           |  |
|                  |                                            | n.DDXD                             |                            | e tuning-less ty                                                                                                                        |                 |                                                              |                      |                  |                                       |                |  |
|                  |                                            |                                    |                            | Use tuning-less type 2.                                                                                                                 |                 |                                                              |                      |                  |                                       |                |  |
|                  |                                            |                                    | 2 Use tuning-less type 3.  |                                                                                                                                         |                 |                                                              |                      |                  |                                       |                |  |
|                  | n.□X□□ Reserved parameter (Do not change.) |                                    |                            |                                                                                                                                         |                 |                                                              |                      |                  |                                       |                |  |
|                  |                                            | n.XDDD                             | Reserved pa                | rameter (Do no                                                                                                                          | ot change.      | )                                                            |                      |                  |                                       |                |  |
|                  |                                            |                                    |                            |                                                                                                                                         |                 |                                                              |                      |                  |                                       |                |  |
|                  | 2                                          |                                    | ance Con-<br>d Selections  | 0000h to<br>0011h                                                                                                                       | -               | 0010h                                                        | All                  | Immedi-<br>ately | Tuning                                | -              |  |
|                  |                                            | ·                                  |                            |                                                                                                                                         |                 |                                                              |                      |                  |                                       |                |  |
|                  | 1                                          |                                    | Anti-Resonal               | nce Control Se                                                                                                                          | election        |                                                              |                      |                  | Refere                                | ence           |  |
|                  |                                            | n.🗆🗆 🛛 X                           | 0 Do                       | not use anti-re                                                                                                                         | sonance c       | ontrol.                                                      |                      |                  |                                       |                |  |
|                  |                                            |                                    | 1 Use                      | e anti-resonanc                                                                                                                         | e control.      |                                                              |                      |                  | page §                                | 9-51           |  |
|                  | 1                                          |                                    | Anti-Resonal               | nce Control Ad                                                                                                                          | ljustment       | Selection                                                    |                      |                  | Refere                                | ence           |  |
| Pn160            |                                            |                                    | Do                         | Do not adjust anti-resonance control automatically during execu-<br>tion of autotuning without a host reference, autotuning with a host |                 |                                                              |                      |                  |                                       |                |  |
|                  |                                            | n.🗆🗆 X 🗆                           |                            | erence, and cus                                                                                                                         |                 |                                                              | nce, autotum         | ng with a no:    |                                       | 0.00           |  |
|                  |                                            |                                    |                            | just anti-resona                                                                                                                        |                 |                                                              |                      |                  | page 9                                | 9-32           |  |
|                  |                                            |                                    |                            | cotuning withou<br>ce, and custom                                                                                                       |                 | t a host reference, autotuning with a host refer-<br>tuning. |                      |                  |                                       |                |  |
|                  | 1                                          | n.¤X¤¤                             | Reserved pa                | rameter (Do no                                                                                                                          | ot change.      | )                                                            |                      |                  |                                       |                |  |
|                  |                                            | n.XDDD                             | Reserved pa                | rameter (Do no                                                                                                                          | ot change.      | )                                                            |                      |                  |                                       |                |  |
|                  |                                            |                                    |                            |                                                                                                                                         |                 | /                                                            |                      |                  |                                       |                |  |
| Pn161            | 2                                          | Anti-Resor<br>quency               | ance Fre-                  | 10 to 20,000                                                                                                                            | 0.1 Hz          | 1000                                                         | All                  | Immedi-<br>ately | Tuning                                | page<br>9-51   |  |
| Pn162            | 2                                          | Anti-Resor<br>Correction           |                            | 1 to 1,000                                                                                                                              | 1%              | 100                                                          | All                  | Immedi-<br>ately | Tuning                                | page<br>9-51   |  |
| Pn163            | 2                                          | Anti-Resor<br>ing Gain             | ance Damp-                 | 0 to 300                                                                                                                                | 1%              | 0                                                            | All                  | Immedi-<br>ately | Tuning                                | page<br>9-51   |  |
| Pn164            | 2                                          | Anti-Resor<br>Time Cons<br>rection | ance Filter<br>tant 1 Cor- | -1,000 to<br>1,000                                                                                                                      | 0.01 ms         | 0                                                            | All                  | Immedi-<br>ately | Tuning                                | page<br>9-51   |  |
|                  | 1                                          | Anti-Resor                         | nance Filter               | -1,000 to                                                                                                                               |                 |                                                              | A 11                 | Immedi-          | - ·                                   | page           |  |
| Pn165            | 2                                          |                                    | tant 2 Cor-                | 1,000 10                                                                                                                                | 0.01 ms         | 0                                                            | All                  | ately            | Tuning                                | 9-51           |  |

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|                  |      |                            |                          |                                                        |                                      |                           | Cor                  | tinued from      | n previou            | s page.        |
|------------------|------|----------------------------|--------------------------|--------------------------------------------------------|--------------------------------------|---------------------------|----------------------|------------------|----------------------|----------------|
| Parameter<br>No. | Size | N                          | ame                      | Setting<br>Range                                       | Setting<br>Unit                      | Default<br>Setting        | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication  | Refer-<br>ence |
|                  | 2    | Tuning-less<br>Related Se  |                          | 0000h to<br>2711h                                      | -                                    | 1401h                     | All                  | _                | Setup                | page<br>9-12   |
|                  |      |                            |                          |                                                        | 1                                    | I                         |                      |                  |                      | I              |
|                  |      |                            | Tuning-less              | Selection                                              |                                      |                           |                      |                  | Whe<br>Enab          |                |
|                  |      | n.🗆 🗆 🗆 X                  |                          | able tuning-les                                        |                                      | •                         |                      |                  | Afte                 |                |
|                  |      |                            | 1 En                     | able tuning-less                                       | s function.                          |                           |                      |                  | Whe                  |                |
|                  |      | n.00X0                     | Speed Contr              |                                                        |                                      |                           |                      |                  | Enab                 |                |
| Pn170            |      |                            |                          | e for speed cor<br>e for speed cor                     |                                      | se host co                | ntroller for po      | sition contro    | Afte<br>I. resta     |                |
|                  |      |                            | Rigidity Leve            | el                                                     |                                      |                           |                      |                  | _Whe                 |                |
|                  |      | n.¤X¤¤                     |                          |                                                        |                                      |                           |                      |                  | Enab<br>Imme<br>atel | edi-           |
|                  |      |                            |                          | to 7 Set the rigidity level.                           |                                      |                           |                      |                  |                      |                |
|                  |      | n.XOOO                     | Tuning-less              | Load Level                                             |                                      |                           |                      |                  | Whe<br>Enab          |                |
|                  |      |                            | 0 to 2 Se                | t the load level                                       | for the tun                          | ing-less fu               | nction.              |                  | Imme<br>atel         |                |
|                  |      |                            | - Information and        | 1                                                      |                                      |                           |                      | 1                |                      |                |
| Pn181            | 2    | for Speed                  |                          | 0 to 10,000                                            | 1 mm/s                               | 0                         | Linear               | Immedi-<br>ately | Tuning               | page<br>9-94   |
| Pn182            | 2    | for Acceler                | ching Level<br>ation     | 0 to 30,000                                            | 1 mm/s <sup>2</sup>                  | 0                         | Linear               | Immedi-<br>ately | Tuning               | page<br>9-94   |
| Pn205            | 2    | Multiturn L                | imit                     | 0 to 65,535                                            | 1 rev                                | 65535                     | Rotary               | After<br>restart | Setup                | page<br>7-38   |
|                  | 2    | Position Co<br>tion Select | ontrol Func-<br>ions     | 0000h to<br>2210h                                      | -                                    | 0010h                     | All                  | After<br>restart | Setup                | -              |
|                  |      |                            |                          |                                                        |                                      |                           |                      |                  |                      |                |
|                  |      | n.🗆🗆 🗆 X                   | Reserved pa              | rameter (Do no                                         | ot change.                           | .)                        |                      |                  |                      |                |
|                  |      | n.DDXD                     | Reserved pa              | rameter (Do no                                         | ot change.                           | .)                        |                      |                  |                      |                |
|                  |      | n.¤X¤¤                     | Reserved pa              | rameter (Do no                                         | ot change.                           | )                         |                      |                  |                      |                |
| Pn207            |      |                            | /COIN (Posit             | ioning Comple                                          | tion Outp                            | ut) Signal                | Output Timin         | g                | Refe                 |                |
|                  |      |                            | 0 sar                    | tput when the a<br>me or less than<br>dth).            |                                      |                           |                      |                  |                      |                |
|                  |      | n.XDDD                     | Ou<br>1 or               | tput when the a<br>less than the se<br>d the reference | etting of Pi                         | n522 (Posi                | tioning Comp         | leted Width)     | page                 | 7-13           |
|                  |      |                            | Ou<br>2 or               | tput when the a<br>less than the se<br>d the reference | absolute v<br>etting of Pi           | alue of the<br>n522 (Posi | position erro        | r is the same    |                      |                |
|                  |      | 1                          |                          | 1                                                      |                                      | 1                         | 1                    | 1                |                      |                |
| Pn20A            | 4    | Number of<br>Encoder S     | External<br>cale Pitches | 4 to<br>1,048,576                                      | 1 scale<br>pitch/<br>revolu-<br>tion | 32768                     | Rotary               | After<br>restart | Setup                | page<br>11-7   |
| Pn20E            | 4    | Electronic<br>(Numerato    | Gear Ratio               | 1 to<br>1,073,741,824                                  | 1                                    | 16                        | All                  | After<br>restart | Setup                | page<br>6-43   |
| Pn210            | 4    | Electronic<br>(Denomina    | Gear Ratio               | 1 to<br>1,073,741,824                                  | 1                                    | 1                         | All                  | After<br>restart | Setup                | page<br>6-43   |
| Pn212            | 4    | Number of<br>Output Pul    | Encoder                  | 16 to<br>1,073,741,824                                 | 1 P/Rev                              | 2048                      | Rotary               | After<br>restart | Setup                | page<br>7-25   |
|                  |      |                            | 000                      | 1,010,141,024                                          | 1                                    |                           |                      |                  |                      | ,-20           |

| _                |                                            |                                      |                                  | _                                                               | -                              |                    |                      | tinued from      | · ·                 |                |  |  |
|------------------|--------------------------------------------|--------------------------------------|----------------------------------|-----------------------------------------------------------------|--------------------------------|--------------------|----------------------|------------------|---------------------|----------------|--|--|
| Parameter<br>No. | Size                                       | Na                                   | me                               | Setting<br>Range                                                | Setting<br>Unit                | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |  |  |
|                  | 2                                          | Fully-closed<br>Selections           | Control                          | 0000h to<br>1003h                                               | -                              | 0000h              | Rotary               | After<br>restart | Setup               | page<br>11-10  |  |  |
|                  |                                            | 1                                    |                                  |                                                                 |                                |                    |                      |                  |                     |                |  |  |
|                  |                                            | n.000X                               | Reserved par                     | rameter (Do no                                                  | ot change.                     | )                  |                      |                  |                     |                |  |  |
| Pn22A            |                                            | n.DDXD                               | Reserved par                     | ameter (Do no                                                   | ot change.                     | )                  |                      |                  |                     |                |  |  |
| 1 11227 (        |                                            | n.¤X¤¤                               | Reserved par                     | ameter (Do no                                                   | ot change.                     | )                  |                      |                  |                     |                |  |  |
|                  |                                            | -                                    | -                                | losed Control Speed Feedback Selection Use motor encoder speed. |                                |                    |                      |                  |                     |                |  |  |
|                  |                                            | n.X000                               |                                  | e motor encode<br>e external enco                               | •                              |                    |                      |                  |                     |                |  |  |
|                  | _                                          |                                      |                                  |                                                                 |                                |                    |                      |                  | i                   |                |  |  |
|                  | 2                                          | Position Cor<br>sion Functio         | ntrol Expan-<br>on Selections    | 0000h to<br>0001h                                               | -                              | 0000h              | All                  | After<br>restart | Setup               | page<br>9-76   |  |  |
|                  |                                            |                                      |                                  |                                                                 |                                |                    |                      |                  |                     |                |  |  |
|                  |                                            |                                      | Backlash Cor                     | mpensation Di                                                   | rection                        |                    |                      |                  |                     |                |  |  |
|                  |                                            | n.DDDX                               | 0 Compensate forward references. |                                                                 |                                |                    |                      |                  |                     |                |  |  |
| Pn230            |                                            |                                      |                                  | npensate reve                                                   |                                |                    |                      |                  |                     |                |  |  |
|                  |                                            | n.□□X□                               |                                  |                                                                 |                                |                    |                      |                  |                     |                |  |  |
|                  | n.□X□□ Reserved parameter (Do not change.) |                                      |                                  |                                                                 |                                |                    |                      |                  |                     |                |  |  |
|                  |                                            | n.XDDD                               | Reserved par                     | ameter (Do no                                                   | ot change.                     | )                  |                      |                  |                     |                |  |  |
|                  |                                            | 1                                    |                                  |                                                                 |                                |                    |                      |                  |                     |                |  |  |
| Pn231            | 4                                          | Backlash Co                          | ompensation                      | -500,000 to<br>500,000                                          | 0.1 ref-<br>erence<br>units    | 0                  | All                  | Immedi-<br>ately | Setup               | page<br>9-76   |  |  |
| Pn233            | 2                                          | Backlash Co<br>tion Time Co          |                                  | 0 to 65,535                                                     | 0.01 ms                        | 0                  | All                  | Immedi-<br>ately | Setup               | page<br>9-77   |  |  |
| Pn281            | 2                                          | Encoder Ou<br>tion                   | tput Resolu-                     | 1 to 4,096                                                      | 1 edge/<br>pitch               | 20                 | All                  | After<br>restart | Setup               | page<br>7-26   |  |  |
| Pn282            | 4                                          | Linear Enco<br>Pitch                 | der Scale                        | 0 to<br>6,553,600                                               | 0.01<br>μm                     | 0                  | Linear               | After<br>restart | Setup               | page<br>6-16   |  |  |
| Pn304            | 2                                          | Jogging Spe                          | eed                              | 0 to 10,000                                                     | Rotary:<br>1 min <sup>-1</sup> | 500                | Rotary               | Immedi-<br>ately | Setup               | page<br>8-7    |  |  |
| Pn305            | 2                                          | Soft Start Ad<br>Time                | cceleration                      | 0 to 10,000                                                     | 1 ms                           | 0                  | All                  | Immedi-<br>ately | Setup               | *1             |  |  |
| Pn306            | 2                                          | Soft Start De<br>Time                | eceleration                      | 0 to 10,000                                                     | 1 ms                           | 0                  | All                  | Immedi-<br>ately | Setup               | *1             |  |  |
| Pn308            | 2                                          | Speed Feed<br>Time Consta            |                                  | 0 to 65,535                                                     | 0.01 ms                        | 0                  | All                  | Immedi-<br>ately | Setup               | page<br>9-89   |  |  |
| Pn30A            | 2                                          | Deceleration<br>Servo OFF a<br>Stops |                                  | 0 to 10,000                                                     | 1 ms                           | 0                  | All                  | Immedi-<br>ately | Setup               | page<br>6-29   |  |  |
| Pn30C            | 2                                          | Speed Feed<br>Average Mo<br>Time     |                                  | 0 to 5,100                                                      | 0.1 ms                         | 0                  | All                  | Immedi-<br>ately | Setup               | -              |  |  |

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|------------------|------|--------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|---------------------|--------------------|----------------------|------------------|---------------------|----------------|--|
| Parameter<br>No. | Size | Name                                                                                                                                 | Setting<br>Range                                     | Setting<br>Unit     | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |  |
|                  | 2    | Vibration Detection<br>Selections                                                                                                    | 0000h to<br>0002h                                    | -                   | 0000h              | All                  | Immedi-<br>ately | Setup               | page<br>7-50   |  |
| Pn310            |      | 0         Do           1         Ou           2         Ou           n.□□X□         Reserved pa           n.□X□□         Reserved pa | 1 Output a warning (A.911) if vibration is detected. |                     |                    |                      |                  |                     |                |  |
|                  |      | Vibration Detection Sen-                                                                                                             |                                                      |                     |                    |                      | Immedi-          |                     | 0000           |  |
| Pn311            | 2    | sitivity                                                                                                                             | 50 to 500                                            | 1%                  | 100                | All                  | ately            | Tuning              | page<br>7-50   |  |
| Pn312            | 2    | Vibration Detection<br>Level                                                                                                         | 0 to 5,000                                           | 1 min <sup>-1</sup> | 50                 | Rotary               | Immedi-<br>ately | Tuning              | page<br>7-50   |  |
| Pn316            | 2    | Maximum Motor Speed                                                                                                                  | 0 to 65,535                                          | 1 min <sup>-1</sup> | 10000              | Rotary               | After<br>restart | Setup               | page<br>7-19   |  |
| Pn324            | 2    | Moment of Inertia Cal-<br>culation Starting Level                                                                                    | 0 to 20,000                                          | 1%                  | 300                | All                  | Immedi-<br>ately | Setup               | page<br>9-31   |  |
| Pn383            | 2    | Jogging Speed                                                                                                                        | 0 to 10,000                                          | 1 mm/s              | 50                 | Linear               | Immedi-<br>ately | Setup               | page<br>8-7    |  |
| Pn384            | 2    | Vibration Detection<br>Level                                                                                                         | 0 to 5,000                                           | 1 mm/s              | 10                 | Linear               | Immedi-<br>ately | Tuning              | page<br>7-50   |  |
| Pn385            | 2    | Maximum Motor Speed                                                                                                                  | 1 to 100                                             | 100<br>mm/s         | 50                 | Linear               | After<br>restart | Setup               | page<br>7-19   |  |
| Pn401            | 2    | First Stage First Torque<br>Reference Filter Time<br>Constant                                                                        | 0 to 65,535                                          | 0.01 ms             | 100                | All                  | Immedi-<br>ately | Tuning              | page<br>9-85   |  |
| Pn402            | 2    | Forward Torque Limit                                                                                                                 | 0 to 800                                             | 1%*2                | 800                | Rotary               | Immedi-<br>ately | Setup               | page<br>7-28   |  |
| Pn403            | 2    | Reverse Torque Limit                                                                                                                 | 0 to 800                                             | 1% <sup>*2</sup>    | 800                | Rotary               | Immedi-<br>ately | Setup               | page<br>7-28   |  |
| Pn404            | 2    | Forward External Torque<br>Limit                                                                                                     | 0 to 800                                             | 1%*2                | 100                | All                  | Immedi-<br>ately | Setup               | page<br>7-29   |  |
| Pn405            | 2    | Reverse External Torque<br>Limit                                                                                                     | 0 to 800                                             | 1%*2                | 100                | All                  | Immedi-<br>ately | Setup               | page<br>7-29   |  |
| Pn406            | 2    | Emergency Stop Torque                                                                                                                | 0 to 800                                             | 1% <sup>*2</sup>    | 800                | All                  | Immedi-<br>ately | Setup               | page<br>6-29   |  |
| Pn407            | 2    | Speed Limit during<br>Torque Control                                                                                                 | 0 to 10,000                                          | 1 min <sup>-1</sup> | 10000              | Rotary               | Immedi-<br>ately | Setup               | page<br>7-15   |  |

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|                  |      |                                        |                                          |         |                                     |                 |                    | 0011                 | inued from         | i previou                  | s puge         |
|------------------|------|----------------------------------------|------------------------------------------|---------|-------------------------------------|-----------------|--------------------|----------------------|--------------------|----------------------------|----------------|
| Parameter<br>No. | Size | N                                      | ame                                      |         | Setting<br>Range                    | Setting<br>Unit | Default<br>Setting | Applicable<br>Motors | When<br>Enabled    | Classi-<br>fication        | Refer-<br>ence |
|                  | 2    | Torque-Rel<br>tion Selecti             |                                          |         | 0000h to<br>1111h                   | -               | 0000h              | All                  | -                  | Setup                      | -              |
|                  |      |                                        |                                          |         |                                     |                 |                    |                      |                    |                            |                |
|                  |      | /                                      | Notch Filt                               | er S    | Selection 1                         |                 |                    |                      | When<br>Enabled    | Refere                     | ence           |
|                  |      | n.000X                                 |                                          |         | able first stage<br>ble first stage |                 |                    |                      | Immedi-<br>ately   | - page 9                   | 9-85           |
|                  |      |                                        | 1                                        | Ena     | Die III'st stage                    |                 | •                  |                      | ,                  |                            |                |
|                  |      |                                        | Speed Lir                                | nit S   | Selection                           |                 |                    |                      | When<br>Enabled    | Refere                     | ence           |
|                  |      |                                        | 0                                        | sett    | the smaller of ing of Pn407 a       | is the spe      | ed limit.          |                      |                    |                            |                |
|                  |      | n.🗆🗆 X 🗆                               |                                          |         | the smaller of ing of Pn480 a       |                 |                    | speed and the        | e After            | After<br>restart page 7-15 |                |
| Pn408            |      |                                        | 1                                        | spe     | the smaller of<br>ed and the set    | ting of Pn      | 407 as the         | speed limit.         | restart            |                            |                |
|                  |      |                                        |                                          |         | the smaller of<br>ed and the set    |                 |                    |                      |                    |                            |                |
|                  |      |                                        | Notch Filt                               | er S    | Selection 2                         |                 |                    |                      | When<br>Enabled    | Refere                     | ence           |
|                  |      | n.¤X¤¤                                 | 0                                        |         | able second st<br>ble second sta    | 0               |                    |                      | Immedi-<br>ately   | page §                     | 9-85           |
|                  |      |                                        | Friction Compensation Function Selection |         |                                     |                 |                    |                      |                    | Refere                     | ence           |
|                  |      | n.XDDD                                 | 0                                        | Disa    | able friction co                    | mpensatic       | n.                 |                      | Enableo<br>Immedi- |                            | . 70           |
|                  |      |                                        | 1                                        | Ena     | ble friction cor                    | npensatio       | า.                 |                      | ately              | page (                     | 9-70           |
|                  |      | First Stage                            | Notch Filte                              | ar      |                                     |                 |                    |                      | Immedi-            |                            | nade           |
| Pn409            | 2    | Frequency                              |                                          |         | 50 to 5,000                         | 1 Hz            | 5000               | All                  | ately              | Tuning                     | page<br>9-85   |
| Pn40A            | 2    | First Stage<br>Q Value                 | Notch Filte                              | er      | 50 to 1,000                         | 0.01            | 70                 | All                  | Immedi-<br>ately   | Tuning                     | page<br>9-85   |
| Pn40B            | 2    | First Stage<br>Depth                   | Notch Filte                              | ər      | 0 to 1,000                          | 0.001           | 0                  | All                  | Immedi-<br>ately   | Tuning                     | page<br>9-85   |
| Pn40C            | 2    | Second Sta<br>ter Frequer              |                                          | Fil-    | 50 to 5,000                         | 1 Hz            | 5000               | All                  | Immedi-<br>ately   | Tuning                     | page<br>9-85   |
| Pn40D            | 2    | Second Sta<br>ter Q Value              |                                          | Fil-    | 50 to 1,000                         | 0.01            | 70                 | All                  | Immedi-<br>ately   | Tuning                     | page<br>9-85   |
| Pn40E            | 2    | Second Sta<br>ter Depth                | age Notch                                | Fil-    | 0 to 1,000                          | 0.001           | 0                  | All                  | Immedi-<br>ately   | Tuning                     | page<br>9-85   |
| Pn40F            | 2    | Second Sta<br>Torque Ref<br>Frequency  |                                          |         | 100 to 5,000                        | 1 Hz            | 5000               | All                  | Immedi-<br>ately   | Tuning                     | page<br>9-85   |
| Pn410            | 2    | Second Sta<br>Torque Ref<br>Q Value    | age Secono<br>erence Filte               | d<br>ər | 50 to 100                           | 0.01            | 50                 | All                  | Immedi-<br>ately   | Tuning                     | page<br>9-85   |
| Pn412            | 2    | First Stage<br>Torque Ref<br>Time Cons | erence Filte                             | ər      | 0 to 65,535                         | 0.01 ms         | 100                | All                  | Immedi-<br>ately   | Tuning                     | page<br>9-66   |
|                  | I    |                                        |                                          |         |                                     | 1               |                    | 1                    |                    | I                          | 1              |

Continued on next page.

| No.         Ö         Name         Range         Unit         Setting         Motors         Enabled         Inclining         Enabled         Inclining         Enabled         Inclining         Enabled         Inclining         Enabled         Inclining         Enabled         Inclining         Enable         Inclining         Inclining         Enable         Inclining         Inclining <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>tinued from</th> <th></th> <th></th>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |      |                           |                     |        |                  |                  |            |             | tinued from      |        |                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|---------------------------|---------------------|--------|------------------|------------------|------------|-------------|------------------|--------|----------------|
| 2         tion Selections 2         1111n         C         Could         All         ately         Select         9-67           Pn416         Notch Filter Selection 3         0         Disable third stage notch filter.         1         Enable third stage notch filter.           Pn416         0         Disable third stage notch filter.         1         Enable third stage notch filter.           Pn417         2         Third Stage Notch filter Selection 5         0         Disable filter selection 6           Pn417         2         Third Stage Notch filter         50 to 5,000         1 Hz         5000         All         Immedi-<br>ately         Tuning         949           Pn418         2         Third Stage Notch Filter         50 to 5,000         1 Hz         5000         All         Immedi-<br>ately         Tuning         949           Pn418         2         Third Stage Notch Filter         50 to 5,000         1 Hz         5000         All         Immedi-<br>ately         Tuning         949           Pn418         2         Fourth Stage Notch Filter         50 to 5,000         1 Hz         5000         All         Immedi-<br>ately         Tuning         949           Pn418         2         Fourth Stage Notch Filter         50 to 1,000         0.01 </th <th></th> <th>Size</th> <th>N</th> <th>ame</th> <th></th> <th>0</th> <th>0</th> <th></th> <th>•••</th> <th></th> <th></th> <th>Refer-<br/>ence</th>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        | Size | N                         | ame                 |        | 0                | 0                |            | •••         |                  |        | Refer-<br>ence |
| Pn416         n_DDDX         0         Disable third stage notch filter.           n_DDX         0         Disable third stage notch filter.           n_DDX         0         Disable courth stage notch filter.           n_DDX         0         Disable filter Selection 6           n_DDXD         0         Disable filter selection 5           n_DDXD         0         Disable filter selection 6           n_DDXD         0         Disable filter.           n_DDXD         Reserved parameter (Do not change.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        | 2    | Torque-Rel<br>tion Select | ated Func<br>ions 2 | -      |                  | -                | 0000h      | All         |                  | Setup  | page<br>9-87   |
| Pn416         n_DDEX         0         Disable third stage notch filter.           n_DIXD         0         Disable third stage notch filter.           n_DIXD         0         Disable foruth stage notch filter.           n_DIXD         0         Disable foruth stage notch filter.           n_DIXDD         0         Disable fifth stage notch filter.           n_DIXDD         0         Disable fifth stage notch filter.           n_DIXDD         0         Disable fifth stage notch filter.           n_DIXDD         Reserved parameter (Do not change.)           Pn418         2         Third Stage Notch Filter         60 to 5,000         1 Hz         5000         All         Immedi-<br>stafy         Tuning         0925           Pn418         2         Third Stage Notch Filter         60 to 1,000         0.01         70         All         Immedi-<br>stafy         Tuning         0925           Pn418         2         Foruf Stage Notch Filter         60 to 1,000         0.01         70         All         Immedi-<br>stafy         Tuning         0925           Pn418         2         Foruf Stage Notch Filter         60 to 1,000         0.01         70         All         Immedi-<br>stafy         Tuning         0925         0925         0925                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        | -    |                           | Notch Fil           | Iter S | Selection 3      |                  |            |             |                  |        | _              |
| Pn416         Notch Filter Selection 4           n.□DXU         Notch Filter Selection 5           n.DXDD         Notch Filter Selection 5           n.DXDD         0         Disable fifth stage notch filter.           n.DXDD         0         Disable fifth stage notch filter.           n.DXDD         0         Disable fifth stage notch filter.           n.DXDD         Reserved parameter (Do not change.)           Pn417         2         Third Stage Notch Filter         50 to 5,000         1 Hz         5000         All         Immedia         Tuning         969.7           Pn418         2         Third Stage Notch Filter         50 to 1,000         0.01         70         All         Immedia         Tuning         969.7           Pn418         2         Third Stage Notch Filter         50 to 1,000         0.01         70         All         Immedia         Tuning         969.7           Pn418         2         Fourth Stage Notch Filter         50 to 1,000         0.01         70         All         Immedia         Tuning         969.7           Pn416         2         Fourth Stage Notch Filter         50 to 5,000         1 Hz         5000         All         Immedia         Tuning         969.7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |        |      | n.DDDX                    |                     |        |                  | e notch filt     | er.        |             |                  |        |                |
| Pn416         n.IIIXII         0         Disable fourth stage notch filter.           1         Enable fourth stage notch filter.         1         Enable fourth stage notch filter.           0         Disable filter Selection 5         1         Enable filter Selection 5           1         Enable filter Selection 5         1         Enable filter Selection 5           1         Enable filter Selection 5         1         Enable filter Selection 5           Pn417         2         Third Stage Notch Filter         50 to 5,000         1 Hz         5000         All         Immedi-<br>ately         Tuning         Page           Pn418         2         Third Stage Notch Filter         50 to 5,000         1 Hz         5000         All         Immedi-<br>ately         Tuning         Page           Pn418         2         Fourth Stage Notch Filter         0 to 1,000         0.01         70         All         Immedi-<br>ately         Tuning         Page           Pn418         2         Fourth Stage Notch Filter         50 to 5,000         1 Hz         5000         All         Immedi-<br>ately         Tuning         Page           Pn410         2         Fulth Stage Notch Filter         50 to 1,000         0.01         70         All         Immedi-<br>ately                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |        |      |                           | 1                   | Ena    | able third stage | notch filte      | er.        |             |                  |        |                |
| Pn412         0         Disable fourth stage notch filter.           n.DXDD         0         Disable fourth stage notch filter.           n.DXDD         0         Disable fifth stage notch filter.           n.XDDD         0         Disable fifth stage notch filter.           n.XDDD         Reserved parameter (Do not change.)           Pn417         2         Third Stage Notch Filter         50 to 5,000         1 Hz         5000         All         Immedi-<br>table         Tuning         Page           Pn418         2         Third Stage Notch Filter         50 to 1,000         0.01         70         All         Immedi-<br>table         Tuning         Page           Pn418         2         Third Stage Notch Filter         50 to 1,000         0.01         70         All         Immedi-<br>table         Tuning         Page           Pn418         2         Fourth Stage Notch Filter         50 to 5,000         1 Hz         5000         All         Immedi-<br>table         Tuning         Page           Pn418         2         Fourth Stage Notch Filter         50 to 5,000         1 Hz         5000         All         Immedi-<br>table         Tuning         Page           Pn418         2         Fourth Stage Notch Filter         50 to 5,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | D= 416 |      |                           | Notch Fil           | Iter S | Selection 4      |                  |            |             |                  |        |                |
| Notch Filter Selection 5         O         Disable fifth stage notch filter.           1         Enable fifth stage notch filter.         1         Enable fifth stage notch filter.           n.XUDD         Reserved parameter (Do not change.)         Immedi-<br>table         Tuning         page<br>page           Pn417         2         Third Stage Notch Filter<br>O Value         50 to 5,000         1 Hz         5000         All         Immedi-<br>ately         Tuning         page<br>page           Pn418         2         Third Stage Notch Filter         50 to 5,000         1 Hz         5000         All         Immedi-<br>ately         Tuning         page           Pn419         2         Third Stage Notch Filter         0 to 1,000         0.01         0         All         Immedi-<br>ately         Tuning         page           Pn419         2         Fourth Stage Notch Filter         0 to 1,000         0.01         70         All         Immedi-<br>ately         Tuning         page           Pn410         2         Fourth Stage Notch Filter         50 to 5,000         1 Hz         5000         All         Immedi-<br>ately         Tuning         page           Pn410         2         Fifth Stage Notch Filter         50 to 1,000         0.01         70         All         Imm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | F11410 |      | n.DDXD                    |                     |        | ,                | ,                |            |             |                  |        |                |
| Image: state in the intermediation of the intermediatic intermediation of the intermediation of the intermedi |        |      |                           |                     |        |                  |                  |            |             |                  |        |                |
| I         Enable fifth stage notch filter.           nXUDD         Reserved parameter (Do not change.)           Pn417         2         Third Stage Notch Filter<br>Frequency         50 to 5,000         1 Hz         5000         All         Immedi-<br>ately         Tuning         9895<br>9895           Pn418         2         Third Stage Notch Filter<br>O Value         50 to 1,000         0.01         70         All         Immedi-<br>ately         Tuning         9895<br>995           Pn418         2         Third Stage Notch Filter         0 to 1,000         0.001         0         All         Immedi-<br>ately         Tuning         9895<br>995           Pn418         2         Fourth Stage Notch Filter         50 to 5,000         1 Hz         5000         All         Immedi-<br>ately         Tuning         989<br>995           Pn410         2         Fourth Stage Notch Filter         50 to 1,000         0.01         0         All         Immedi-<br>ately         Tuning         989<br>995           Pn410         2         Fifth Stage Notch Filter         50 to 1,000         0.01         0         All         Immedi-<br>ately         Tuning         989<br>995           Pn41E         2         Fifth Stage Notch Filter         50 to 1,000         0.01         0         All                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |      | n.¤X¤¤                    |                     |        |                  | notch filte      | er.        |             |                  |        |                |
| Pn417         2         Third Stage Notch Filter<br>Frequency         50 to 5,000         1 Hz         5000         All         Immedi-<br>ately         Tuning         Page<br>9-97           Pn418         2         Third Stage Notch Filter<br>Depth         50 to 1,000         0.01         70         All         Immedi-<br>ately         Tuning         Page<br>9-97           Pn419         2         Third Stage Notch Filter<br>Depth         0 to 1,000         0.001         0         All         Immedi-<br>ately         Tuning         Page<br>9-97           Pn418         2         Fourth Stage Notch Filter<br>For Quality         50 to 5,000         1 Hz         5000         All         Immedi-<br>ter Quality         Tuning         Page<br>9-97           Pn410         2         Fourth Stage Notch Filter<br>for Ophth         50 to 5,000         1 Hz         5000         All         Immedi-<br>ter Quality         Tuning         Page<br>9-97           Pn41D         2         Fifth Stage Notch Filter<br>for Ophth         50 to 5,000         1 Hz         5000         All         Immedi-<br>tately         Tuning         Page<br>9-97           Pn41E         2         Fifth Stage Notch Filter<br>O to 1,000         0.01         0         All         Immedi-<br>tately         Tuning         Page<br>9-97           2         Speed R                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |      |                           | 1                   |        | 0                |                  |            |             |                  |        |                |
| PriA         2         Frequency         30 10 5,000         1 H2         3000         All         ately         Iulting         9-87           Pn418         2         Third Stage Notch Filter<br>Depth         50 to 1,000         0.01         70         All         Immedi-<br>ately         Tuning         Page           Pn419         2         Third Stage Notch Filter<br>Depth         0 to 1,000         0.001         0         All         Immedi-<br>ately         Tuning         Page           Pn418         2         Fourth Stage Notch Filt-<br>ter Frequency         50 to 1,000         0.01         70         All         Immedi-<br>ately         Tuning         Page           Pn418         2         Fourth Stage Notch Filt-<br>ter C Value         50 to 1,000         0.01         70         All         Immedi-<br>ately         Tuning         Page           Pn410         2         Fifth Stage Notch Filt-<br>G Value         50 to 1,000         0.01         70         All         Immedi-<br>ately         Tuning         Page           Pn411         2         Fifth Stage Notch Filt-<br>G Value         50 to 1,000         0.01         70         All         Immedi-<br>ately         Tuning         Page           Pn411         2         Fifth Stage Notch Filter<br>Q Value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |        |      | n.X000                    | Reserved            | d pai  | rameter (Do no   | ot change.       | .)         |             |                  |        |                |
| PriA         2         Frequency         30 10 5,000         1 H2         3000         All         ately         Iulting         9-87           Pn418         2         Third Stage Notch Filter<br>Depth         50 to 1,000         0.01         70         All         Immedi-<br>ately         Tuning         Page           Pn419         2         Third Stage Notch Filter<br>Depth         0 to 1,000         0.001         0         All         Immedi-<br>ately         Tuning         Page           Pn418         2         Fourth Stage Notch Filt-<br>ter Frequency         50 to 1,000         0.01         70         All         Immedi-<br>ately         Tuning         Page           Pn418         2         Fourth Stage Notch Filt-<br>ter C Value         50 to 1,000         0.01         70         All         Immedi-<br>ately         Tuning         Page           Pn410         2         Fifth Stage Notch Filt-<br>G Value         50 to 1,000         0.01         70         All         Immedi-<br>ately         Tuning         Page           Pn411         2         Fifth Stage Notch Filt-<br>G Value         50 to 1,000         0.01         70         All         Immedi-<br>ately         Tuning         Page           Pn411         2         Fifth Stage Notch Filter<br>Q Value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |        |      |                           |                     |        |                  |                  |            |             |                  |        |                |
| Prime         2         Q Value         So to 1,000         0.01         7.0         All         ately         Ithing         9-87           Pn419         2         Third Stage Notch File         0 to 1,000         0.001         0         All         Immediately         Tuning         Page           Pn418         2         Fourth Stage Notch File         50 to 1,000         0.01         70         All         Immediately         Tuning         Page           Pn418         2         Fourth Stage Notch File         50 to 1,000         0.01         70         All         Immediately         Tuning         Page           Pn418         2         Fourth Stage Notch File         50 to 1,000         0.01         70         All         Immediately         Tuning         Page           Pn410         2         Fifth Stage Notch Filer         50 to 1,000         0.01         70         All         Immediately         Tuning         Page           Pn412         2         Fifth Stage Notch Filer         50 to 1,000         0.01         70         All         Immediately         Tuning         Page           Pn415         2         Fifth Stage Notch Filer         50 to 1,000         0.001         0         All                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Pn417  | 2    |                           |                     | lter   | 50 to 5,000      | 1 Hz             | 5000       | All         |                  | Tuning | page<br>9-87   |
| Print 19         2         Depth         Otto 1,000         0.001         O         All         ately         full limitedi-<br>ately         Tuning         9-87           Pn41A         2         Fourth Stage Notch Fil-<br>ter Prequency         50 to 5,000         1 Hz         5000         All         Immedi-<br>ately         Tuning         9-87           Pn41B         2         Fourth Stage Notch Fil-<br>ter O value         50 to 1,000         0.01         70         All         Immedi-<br>ately         Tuning         9-87           Pn41C         2         Fourth Stage Notch Fil-<br>ter Depth         0 to 1,000         0.001         0         All         Immedi-<br>ately         Tuning         9-87           Pn41D         2         Fifth Stage Notch Filter<br>Q Value         50 to 5,000         1 Hz         5000         All         Immedi-<br>ately         Tuning         9-87           Pn41E         2         Fifth Stage Notch Filter<br>Q Value         50 to 1,000         0.01         70         All         Immedi-<br>ately         Tuning         9-87           Pn41F         2         Fifth Stage Notch Filter<br>Q Value         50 to 1,000         0.001         0         All         Immedi-<br>ately         Tuning         9-86           Pn426         Speed Ripple Compensati                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Pn418  | 2    |                           | e Notch Fi          | lter   | 50 to 1,000      | 0.01             | 70         | All         |                  | Tuning | page<br>9-87   |
| Print N         2         ter Frequency         S0.0 3,000         I H2         S0.00         All         ately         Itim g         9-57           Pn41B         2         Fourth Stage Notch Fil-<br>ter Q Value         50 to 1,000         0.01         70         All         Immedi-<br>ately         Tuning         9-57           Pn41C         2         Fourth Stage Notch Fil-<br>re Depth         0 to 1,000         0.001         0         All         Immedi-<br>ately         Tuning         9-57           Pn41D         2         Fifth Stage Notch Filter<br>Prequency         50 to 5,000         1 Hz         5000         All         Immedi-<br>ately         Tuning         9-57           Pn41E         2         Fifth Stage Notch Filter<br>Q Value         50 to 1,000         0.01         70         All         Immedi-<br>ately         Tuning         9-367           Pn41E         2         Fifth Stage Notch Filter         0 to 1,000         0.01         70         All         Immedi-<br>ately         Tuning         9-367           Pn41E         2         Fifth Stage Notch Filter         0 to 1,000         0.001         0         All         Immedi-<br>ately         Tuning         9-367           2         Speed Ripple Compensation Function Selection         Menan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Pn419  | 2    |                           | e Notch Fi          | lter   | 0 to 1,000       | 0.001            | 0          | All         |                  | Tuning | page<br>9-87   |
| Prime         2         ter Q Value         Solid 1,000         0.01         7.0         All         ately         fulling         9-87           Pn41C         2         Fourth Stage Notch Filter<br>ter Depth         0 to 1,000         0.001         0         All         Immedi-<br>ately         Tuning         9-87           Pn41D         2         Fifth Stage Notch Filter<br>Frequency         50 to 5,000         1 Hz         5000         All         Immedi-<br>ately         Tuning         9-87           Pn41E         2         Fifth Stage Notch Filter<br>Q Value         50 to 1,000         0.01         70         All         Immedi-<br>ately         Tuning         9-87           Pn41E         2         Fifth Stage Notch Filter<br>Q Value         50 to 1,000         0.01         70         All         Immedi-<br>ately         Tuning         9-87           Pn41F         2         Fifth Stage Notch Filter<br>Depth         0 to 1,000         0.001         0         All         Immedi-<br>ately         Tuning         9-87           Pn41F         2         Speed Ripple Compensation Function Selection         When<br>Enabled           n         Speed Ripple Compensation Information Disagreement Warning Detec-<br>in Selection         When<br>Enabled           n                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Pn41A  | 2    |                           |                     | -il-   | 50 to 5,000      | 1 Hz             | 5000       | All         |                  | Tuning | page<br>9-87   |
| Print       2       ter Depth       0       0       All       ately       Itiling       9-87         Pn41D       2       Fifth Stage Notch Filter<br>O Value       50 to 5,000       1 Hz       5000       All       Immedi-<br>ately       Tuning       9-87         Pn41E       2       Fifth Stage Notch Filter<br>O Value       50 to 1,000       0.01       70       All       Immedi-<br>ately       Tuning       9-87         Pn41E       2       Fifth Stage Notch Filter<br>O Value       50 to 1,000       0.01       70       All       Immedi-<br>ately       Tuning       9-87         Pn41F       2       Fifth Stage Notch Filter<br>Depth       0 to 1,000       0.01       0       All       Immedi-<br>ately       Tuning       9-87         Pn41F       2       Speed Ripple Compen-<br>sation Selections       0000h to<br>1111h       -       0000h       Rotary       -       Setup       Page<br>9-64         Pn423       Speed Ripple Compensation Function Selection       When<br>Enabled         Immedi-<br>1       Enable speed ripple compensation.       Immedi-<br>ately       Mune<br>Enabled         Immedi-<br>1       Do not detect A.942 alarms.       After<br>restart       After<br>restart         Immedi-<br>1       Speed Ripple Compensation Enable Condition Selection <t< td=""><td>Pn41B</td><td>2</td><td></td><td></td><td>=il-</td><td>50 to 1,000</td><td>0.01</td><td>70</td><td>All</td><td></td><td>Tuning</td><td>page<br/>9-87</td></t<>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Pn41B  | 2    |                           |                     | =il-   | 50 to 1,000      | 0.01             | 70         | All         |                  | Tuning | page<br>9-87   |
| Print D       2       Frequency       So to 3,000       1 H2       So to 3,000       All       ately       Idning       6-87         Pn41E       2       G Value       Fifth Stage Notch Filter<br>Depth       50 to 1,000       0.01       70       All       Immedi-<br>ately       Tuning       9-87         Pn41F       2       Fifth Stage Notch Filter<br>Depth       0 to 1,000       0.01       0       All       Immedi-<br>ately       Tuning       9-86         2       Speed Ripple Compen-<br>sation Selections       0000h to<br>1111h       -       0000h       Rotary       -       Setup       Page<br>9-86         Pn423       N       Speed Ripple Compensation Function Selection       When<br>Enabled       Immedi-<br>ately       Immedi-<br>ately       Immedi-<br>ately       Immedi-<br>ately         Pn423       N       Speed Ripple Compensation Function Selection       When<br>Enabled       Immedi-<br>ately       Immedi-<br>ately       Vhen<br>Enabled         N       D       Detect A.942 alarms.       After<br>restart       After<br>restart       After<br>restart         N       Speed Ripple Compensation Enable Condition Selection       When<br>Enabled       After<br>restart       After<br>restart         N       N       Do not detect A.942 alarms.       After<br>restart       After<br>restart       Af                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Pn41C  | 2    | Fourth Star<br>ter Depth  | ge Notch I          | =il-   | 0 to 1,000       | 0.001            | 0          | All         |                  | Tuning | page<br>9-87   |
| Pn41E       2       Q Value       So to 1,000       0.01       70       All       ately       Iuling       9-87         Pn41F       2       Fifth Stage Notch Filter<br>Depth       0 to 1,000       0.001       0       All       Immedi-<br>ately       Tuning       page<br>9-84         2       Speed Ripple Compen-<br>sation Selections       0000h to<br>1111h       -       0000h       Rotary       -       Setup       Page<br>9-64         N       Immedi-<br>sation Selections       0       Disable speed ripple compensation.       Immedi-<br>ately       Immedi-<br>ately       Immedi-<br>ately         Pn423       Speed Ripple Compensation Function Selection       Ø       Disable speed ripple compensation.       Immedi-<br>ately         N       Immedi-<br>1       Enable speed ripple compensation.       Immedi-<br>ately       Immedi-<br>ately         N       Immedi-<br>1       Do not detect A.942 alarms.       After<br>restart       After<br>restart         N       Speed Ripple Compensation Enable Condition Selection       When<br>Enabled         N       Speed Ripple Compensation Enable Condition Selection       When<br>Enabled         N       Immedi-<br>1       Motor speed       After<br>restart         N       Release Time for Torque<br>2       O to 100       1%²       So       All       Immedi-                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Pn41D  | 2    |                           |                     | er     | 50 to 5,000      | 1 Hz             | 5000       | All         |                  | Tuning | page<br>9-87   |
| Pn411       2       Depth       Oto 1,000       Oto 1,000       Oto 1,000       Oto 1,000       Oto 1,000       All       ately       Idning       9-8c         2       Speed Ripple Compen-<br>sation Selections       0000h to<br>1111h       -       0000h       Rotary       -       Setup       Page<br>9-64         Pn423       Speed Ripple Compensation Function Selection       When<br>Enabled         0       Disable speed ripple compensation.       Immedi-<br>ately       Immedi-<br>ately         Pn423       Speed Ripple Compensation Information Disagreement Warning Detec-<br>tion Selection       When<br>Enabled         0       Detect A.942 alarms.       After<br>restart         0       Detect A.942 alarms.       After<br>restart         0       Speed Ripple Compensation Enable Condition Selection       When<br>Enabled         0       Speed reference       After<br>restart         1       Do not detect A.942 alarms.       After<br>restart         N.IDDD       Reserved parameter (Do not change.)       After<br>restart         Pn424       2       Torque Limit at Main Cir-<br>cuit Voltage Drop       0 to 100       1%*2       50       All       Immedi-<br>ately       Setup       Page<br>7-18         Pn425       2       Release Time for Torque       0 to 1000       1 ms <t< td=""><td>Pn41E</td><td>2</td><td></td><td>Notch Filt</td><td>er</td><td>50 to 1,000</td><td>0.01</td><td>70</td><td>All</td><td></td><td>Tuning</td><td>page<br/>9-87</td></t<>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Pn41E  | 2    |                           | Notch Filt          | er     | 50 to 1,000      | 0.01             | 70         | All         |                  | Tuning | page<br>9-87   |
| Pn423       2       Speed Ripple Compensation Function Selection       When Enabled         N.□□□X       0       Disable speed ripple compensation.       Immediately         N.□□X□       Speed Ripple Compensation Information Disagreement Warning Detection       When Enabled         N.□□X□       Speed Ripple Compensation Information Disagreement Warning Detection       When Enabled         N.□□X□       Speed Ripple Compensation Information Disagreement Warning Detection       When Enabled         0       Detect A.942 alarms.       After restart         1       Do not detect A.942 alarms.       After restart         0       Speed Ripple Compensation Enable Condition Selection       When Enabled         0       Speed Ripple Compensation Enable Condition Selection       After restart         n.□X□□       Speed reference       After restart         n.X□□□       Reserved parameter (Do not change.)       After restart         Pn424       2       Torque Limit at Main Cir-<br>cuit Voltage Drop       0 to 100       1%*2       50       All       Immediately       Setup 718         Pn425       2       Release Time for Torque       0 to 1000       1 ms       100       All       Immediately       Setup 718                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Pn41F  | 2    |                           | Notch Filt          | er     | 0 to 1,000       | 0.001            | 0          | All         |                  | Tuning | page<br>9-86   |
| Pn423       Speed Ripple Compensation Function Selection       Enabled         n.□□X□       0       Disable speed ripple compensation.       Immediately         n.□□X□       Speed Ripple Compensation Information Disagreement Warning Detection       When Enabled         n.□□X□       0       Detect A.942 alarms.       After restart         1       Do not detect A.942 alarms.       After restart         1       Do not detect A.942 alarms.       After restart         0       Speed Ripple Compensation Enable Condition Selection       When Enabled         0       Speed reference       After restart         1       Motor speed       After restart         n.□X□□       Reserved parameter (Do not change.)       After restart         Pn424       2       Torque Limit at Main Cir- (Do not change.)       0 to 100       1%*2       50       All       Immediately       Setup       Page         Pn425       2       Limit at Main Cir- (Do not 100)       1 ms       100       All       Immediately       Setup       Page                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        | 2    |                           |                     | en-    |                  | _                | 0000h      | Rotary      | -                | Setup  | page<br>9-64   |
| Pn423       Speed Ripple Compensation Function Selection       Enabled         n.□□X□       0       Disable speed ripple compensation.       Immediately         n.□□X□       Speed Ripple Compensation Information Disagreement Warning Detection       When Enabled         n.□□X□       0       Detect A.942 alarms.       After restart         1       Do not detect A.942 alarms.       After restart         1       Do not detect A.942 alarms.       After restart         0       Speed Ripple Compensation Enable Condition Selection       When Enabled         0       Speed Ripple Compensation Enable Condition Selection       After restart         n.□X□□       Speed Ripple Compensation Enable Condition Selection       After restart         n.X□□□       Reserved parameter (Do not change.)       After restart         n.X□□□       Reserved parameter (Do not change.)       After restart         Pn424       2       Torque Limit at Main Cir Ot to 100       1%*2       50       All       Immediately       Setup       Page         Pn425       2       Unit at Main Cir Ot to 1000       1 ms       100       All       Immediately       Setup       Page                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |      |                           |                     |        |                  |                  |            |             |                  |        |                |
| Pn423       Immediately       Immediately         N.IIIXII       Speed Ripple Compensation Information Disagreement Warning Detection       When Enabled         0       Detect A.942 alarms.       After restart         1       Do not detect A.942 alarms.       After restart         1       Motor speed       After restart                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |      |                           | Speed R             | ipple  | Compensatio      | on Functio       | n Selectio | 'n          |                  |        |                |
| Pn423       Image: A market of the production of the producting productingeneous of the producting production of the                  |        |      | n.□□□X                    | -                   |        | 1 11             |                  |            |             |                  |        |                |
| Pn423       Image: tion Selection       Enabled         0       Detect A.942 alarms.       After restart         1       Do not detect A.942 alarms.       After restart         Image: number of the selection of the se                                                                                                                                             |        |      |                           | 1                   | Ena    | able speed ripp  | le comper        | nsation.   |             |                  | ale    | y              |
| n.IIIXII       0       Detect A.942 alarms.       After restart         1       Do not detect A.942 alarms.       After restart         n.IIXIII       Speed Ripple Compensation Enable Condition Selection       When Enabled         0       Speed reference       After restart         1       Motor speed       After restart         n.IIXIIII       Reserved parameter (Do not change.)       After restart         Pn424       2       Torque Limit at Main Cir- cuit Voltage Drop       0 to 100       1%*2       50       All       Immediately       Setup       Page         Pn425       2       Release Time for Torque       0 to 1 000       1 ms       100       All       Immediately       Setup       Page                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Pn423  |      |                           |                     |        |                  | on Informa       | tion Disag | reement War | ning Detec-      |        |                |
| Image: Speed Ripple Compensation Enable Condition Selection       When Enabled         0       Speed reference       After         1       Motor speed       After         n.XDDD       Reserved parameter (Do not change.)       After         Pn424       2       Torque Limit at Main Cir-<br>cuit Voltage Drop       0 to 100       1%*2       50       All       Immedi-<br>ately       Setup       page<br>7-18         Pn425       2       Release Time for Torque<br>Limit at Main Circuit       0 to 1 000       1 ms       100       All       Immedi-<br>setup       Setup       page                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 111420 |      | n.DDXD                    | 0                   | Det    | ect A.942 aları  | ns.              |            |             |                  |        |                |
| Pn424       2       Torque Limit at Main Cir-<br>cuit Voltage Drop       0 to 100       1%*2       50       All       Immedi-<br>ately       Setup<br>7-18       page<br>7-18         Pn425       2       Release Time for Torque<br>Limit at Main Circuit       0 to 1000       1 ms       100       All       Immedi-<br>ately       Setup       page<br>7-18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |      |                           | 1                   | Do     | not detect A.9   | 42 alarms        |            |             |                  | resta  | art            |
| Image: Decision of the speed reference       After restart         1       Motor speed       After restart         n.X□□□       Reserved parameter (Do not change.)       Image: Comparison of the speed reference         Pn424       2       Torque Limit at Main Cir-<br>cuit Voltage Drop       0 to 100       1%*2       50       All       Immedi-<br>ately       Setup       page         Pn425       2       Release Time for Torque<br>Limit at Main Circuit       0 to 1 000       1 ms       100       All       Immedi-<br>ately       Setup       page                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |        |      |                           | Speed R             | ipple  | Compensatio      | on Enable        | Condition  | Selection   |                  | -      |                |
| Pn424       2       Torque Limit at Main Cir-<br>cuit Voltage Drop       0 to 100       1%*2       50       All       Immedi-<br>ately       Setup       page<br>7-18         Pn425       2       Release Time for Torque<br>Limit at Main Circuit       0 to 1000       1 ms       100       All       Immedi-<br>ately       Setup       page<br>7-18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |        |      |                           | -                   | •      |                  |                  |            |             |                  |        |                |
| Pn424     2     Torque Limit at Main Cir-<br>cuit Voltage Drop     0 to 100     1%*2     50     All     Immedi-<br>ately     Setup     page<br>7-18       Pn425     2     Limit at Main Circuit     0 to 1 000     1 ms     100     All     Immedi-<br>ately     Setup     page                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |      |                           |                     |        | •                |                  |            |             |                  | Testa  |                |
| Prid24     2     cuit Voltage Drop     0 to 1 000     1% -     50     All     ately     Setup     7-18       Prid25     2     Limit at Main Circuit     0 to 1 000     1 ms     100     All     Immedi-     Setup     page                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |      | n.XDDD                    | Reserved            | d pai  | rameter (Do no   | ot change.       | .)         |             |                  |        |                |
| Pn425 2 Limit at Main Circuit 0 to 1 000 1 ms 100 All Immedi- Setup Page                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Pn424  | 2    | cuit Voltage              | e Drop              |        | 0 to 100         | 1% <sup>*2</sup> | 50         | All         |                  | Setup  | page<br>7-18   |
| Voltage Drop                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Pn425  | 2    | Limit at Ma               | ain Circuit         | que    | 0 to 1,000       | 1 ms             | 100        | All         | Immedi-<br>ately | Setup  | page<br>7-18   |

|                  |      |                                          |                                        |                                                                                                                            |                                                                       |                                                        | Con                                                                | tinued from                                         | n previou           | s page.                       |  |  |  |
|------------------|------|------------------------------------------|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------------------------|-----------------------------------------------------|---------------------|-------------------------------|--|--|--|
| Parameter<br>No. | Size | N                                        | ame                                    | Setting<br>Range                                                                                                           | Setting<br>Unit                                                       | Default<br>Setting                                     | Applicable<br>Motors                                               | When<br>Enabled                                     | Classi-<br>fication | Refer-<br>ence                |  |  |  |
| Pn426            | 2    | Torque Fee<br>Average M<br>Time          |                                        | 0 to 5,100                                                                                                                 | 0.1 ms                                                                | 0                                                      | All                                                                | Immedi-<br>ately                                    | Setup               | _                             |  |  |  |
| Pn427            | 2    | Speed Rip<br>sation Enal                 | ple Compen-<br>ble Speed               | 0 to 10,000                                                                                                                | 1 min <sup>-1</sup>                                                   | 0                                                      | Rotary                                                             | Immedi-<br>ately                                    | Tuning              | page<br>9-64                  |  |  |  |
| Pn456            | 2    | Sweep Tor<br>ence Ampl                   | que Refer-<br>itude                    | 1 to 800                                                                                                                   | 1%                                                                    | 15                                                     | All                                                                | Immedi-<br>ately                                    | Tuning              | page<br>9-102                 |  |  |  |
|                  | 2    | Notch Filte<br>Selections                | r Adjustment<br>1                      | 0000h to<br>0101h                                                                                                          | -                                                                     | 0101h                                                  | All                                                                | Immedi-<br>ately                                    | Tuning              | page<br>9-15,<br>page<br>9-32 |  |  |  |
|                  | Ī    |                                          | Notch Filter A                         | Adjustment Se                                                                                                              | lection 1                                                             |                                                        |                                                                    |                                                     |                     |                               |  |  |  |
|                  |      | n.DDDX                                   |                                        | not adjust the ing without a h                                                                                             |                                                                       |                                                        |                                                                    |                                                     |                     |                               |  |  |  |
| B 400            |      |                                          |                                        | ust the first sta<br>nout a host refe                                                                                      |                                                                       |                                                        |                                                                    |                                                     |                     |                               |  |  |  |
| Pn460            |      | n.🗆 🗆 X 🗆                                | Reserved par                           | rved parameter (Do not change.)                                                                                            |                                                                       |                                                        |                                                                    |                                                     |                     |                               |  |  |  |
|                  |      | n.0X00                                   | 0 Do<br>fund<br>auto<br>Adji<br>1 tion | Adjustment Se<br>not adjust the<br>ction is enabled<br>otuning with a<br>ust the second<br>is enabled or<br>otuning with a | second sta<br>d or during<br>host refere<br>l stage not<br>during exe | execution<br>ence, and<br>ch filter au<br>ecution of a | of autotuning<br>custom tuning<br>itomatically w<br>autotuning wit | y without a h<br>y.<br>hen the tunir<br>hout a host | ost referer         | nce,                          |  |  |  |
|                  |      | n.XOOO                                   | Reserved par                           | rameter (Do no                                                                                                             | ot change.                                                            | )                                                      |                                                                    |                                                     |                     |                               |  |  |  |
|                  | 2    | Gravity Co<br>Related Se                 | mpensation-<br>lections                | 0000h to<br>0001h                                                                                                          | -                                                                     | 0000h                                                  | All                                                                | After<br>restart                                    | Setup               | page<br>9-72                  |  |  |  |
| Pn475            |      | n.000X                                   | 0 Disa                                 | ensation Selec<br>able gravity co<br>able gravity cor                                                                      | mpensatic                                                             |                                                        |                                                                    |                                                     |                     |                               |  |  |  |
|                  |      | n.DDXD                                   | Reserved para                          | ameter (Do not                                                                                                             | change.)                                                              |                                                        |                                                                    |                                                     |                     |                               |  |  |  |
|                  | -    | n.X000                                   |                                        | ameter (Do not<br>ameter (Do not                                                                                           | 0,                                                                    |                                                        |                                                                    |                                                     |                     |                               |  |  |  |
| Pn476            | 2    | Gravity Cor<br>Torque                    | mpensation                             | -1,000 to<br>1,000                                                                                                         | 0.1%                                                                  | 0                                                      | All                                                                | Immedi-<br>ately                                    | Tuning              | page<br>9-72                  |  |  |  |
| Pn480            | 2    | Speed Lim<br>Force Cont                  | it during<br>trol                      | 0 to 10,000                                                                                                                | 1 mm/s                                                                | 10000                                                  | Linear                                                             | Immedi-<br>ately                                    | Setup               | page<br>7-15                  |  |  |  |
| Pn481            | 2    | Polarity De<br>Speed Loo                 | p Gain                                 | 10 to 20,000                                                                                                               | 0.1 Hz                                                                | 400                                                    | Linear                                                             | Immedi-<br>ately                                    | Tuning              | -                             |  |  |  |
| Pn482            | 2    | Polarity De<br>Speed Loo<br>Time Cons    | p Integral                             | 15 to 51,200                                                                                                               | 0.01 ms                                                               | 3000                                                   | Linear                                                             | Immedi-<br>ately                                    | Tuning              | _                             |  |  |  |
| Pn483            | 2    | Forward Fo                               | orce Limit                             | 0 to 800                                                                                                                   | 1%*2                                                                  | 30                                                     | Linear                                                             | Immedi-<br>ately                                    | Setup               | page<br>7-28                  |  |  |  |
| Pn484            | 2    | Reverse Fo                               | orce Limit                             | 0 to 800                                                                                                                   | 1% <sup>*2</sup>                                                      | 30                                                     | Linear                                                             | Immedi-<br>ately                                    | Setup               | page<br>7-28                  |  |  |  |
| Pn485            | 2    | ence Spee                                |                                        | 0 to 100                                                                                                                   | 1 mm/s                                                                | 20                                                     | Linear                                                             | Immedi-<br>ately                                    | Tuning              | Ι                             |  |  |  |
| Pn486            | 2    | Polarity De<br>ence Accel<br>Deceleratio |                                        | 0 to 100                                                                                                                   | 1 ms                                                                  | 25                                                     | Linear                                                             | Immedi-<br>ately                                    | Tuning              | _                             |  |  |  |

Pr

14.1.2 List of Servo Parameters

|      |                                                                                             | tinued from                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | n previou                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| Size | Name                                                                                        | Setting<br>Range                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Setting<br>Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Applicable<br>Motors                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | When<br>Enabled                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 2    | Polarity Detection Con-<br>stant Speed Time                                                 | 0 to 300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1 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| 2    | Momentary Power Inter-<br>ruption Hold Time                                                 | 20 to 50,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1 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| 2    | Input Signal Selections                                                                     | 0000h to<br>FFF2h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | - 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      Polarity Detection Constant Speed Time       0 to 300         2       Polarity Detection Reference Waiting Time       50 to 500         2       Polarity Detection Image       1 to 65,535         2       Polarity Detection Load Level       0 to 20,000         2       Polarity Detection Confirmation Force Reference       0 to 200         2       Polarity Detection Allowable Error Range       0 to 10,000         2       Speed Ripple Compensation Enable Speed       0 to 10,000         2       Rotation Detection Level       1 to 10,000         2       Speed Coincidence Detection Signal Output Width       0 to 50         2       Brake Reference-Servo OFF Delay Time       0 to 10,000         2       Brake Reference Out-put Speed Level       0 to 10,000         2       Servo OFF-Brake Command Waiting Time       10 to 100         2       Momentary Power Interruption Hold Time       20 to 50,000         2       Input Signal Selections       00000h to FFF2h         1       Reserved parameter (Do no for FFF2h         n.□□X□       Reserved parameter (Do no for FFF2h         n.□□X□       Reserved parameter (Do no for FFF2h         n.□□X□       Reserved parameter (Do no for FFF2h         0       Enable forward drive       1 <td>2       Polarity Detection Constant Speed Time       0 to 300       1 ms         2       Polarity Detection Reference Waiting Time       50 to 500       1 ms         2       Polarity Detection Load Level       1 to 65,535       1 mm         2       Polarity Detection Load Level       0 to 20,000       1%         2       Polarity Detection Confirmation Force Reference       0 to 200       1%         2       Polarity Detection Allow-able Error Range       0 to 10,000       1 mm/s         2       Polarity Detection Level       0 to 10,000       1 mm/s         2       Speed Ripple Compensation Enable Speed       0 to 100,000       1 mm/s         2       Rotation Detection Level       1 to 10,000       1 min<sup>-1</sup>         2       Speed Coincidence Detection Signal Output Width       0 to 100       1 min<sup>-1</sup>         2       Brake Reference-Servo Of to 50       10 ms       10 ms         2       Brake Reference Output Speed Level       0 to 10,000       1 min<sup>-1</sup>         2       Servo OFF-Brake Command Waiting Time       10 to 100       10 ms         2       Momentary Power Inter-ruption Hold Time       20 to 50,000       1 ms         2       Input Signal Selections       00000h to FFF2h       -         1</td> <td>2       Polarity Detection Constant Speed Time       0 to 300       1 ms       0         2       Polarity Detection Reference Waiting Time       50 to 500       1 ms       100         2       Polarity Detection Range       1 to 65,535       1 mm       100         2       Polarity Detection Load Level       0 to 20,000       1%       100         2       Polarity Detection Confirmation Force Reference       0 to 200       1%       100         2       Polarity Detection Allow-able Error Range       0 to 10,000       1 mm/s       0         2       Speed Ripple Compensation Enable Speed       0 to 100,000       1 min<sup>-1</sup>       20         2       Rotation Detection Level       1 to 10,000       1 min<sup>-1</sup>       10         2       Speed Coincidence Detection Signal Output Width       0 to 100       1 min<sup>-1</sup>       10         2       Brake Reference-Servo<br/>OFF-Delay Time       0 to 10,000       1 min<sup>-1</sup>       100         2       Brake Reference Out-<br/>wit Speed Level       0 to 10,000       1 min<sup>-1</sup>       100         2       Brake Reference Out-<br/>mand Waiting Time       10 to 100       10 ms       50         2       Momentary Power Inter-<br/>ruption Hold Time       20 to 50,000       1 ms       20</td> <td>Name         Setting<br/>Range         Setting<br/>Unit         Default<br/>Setting<br/>Unit         Applicable<br/>Motors           2         Polarity Detection Con-<br/>stant Speed Time         0 to 300         1 ms         0         Linear           2         Polarity Detection Refer-<br/>ence Waiting Time         50 to 500         1 ms         100         Linear           2         Polarity Detection<br/>Range         1 to 65,535         1 mm         100         Linear           2         Polarity Detection Load<br/>Level         0 to 20,000         1%         100         Linear           2         Polarity Detection Con-<br/>firmation Force Refer-<br/>ence         0 to 200         1%         100         Linear           2         Polarity Detection Allow-<br/>able Error Range         0 to 10,000         1 mm/s         0         Linear           2         Rotation Detection Level         1 to 10,000         1 min<sup>-1</sup>         20         Rotary           2         Rotation Detection Signal Output<br/>Width         0 to 100         1 min<sup>-1</sup>         100         Rotary           2         Brake Reference-Servo<br/>OFF Delay Time         0 to 10,000         1 min<sup>-1</sup>         100         Rotary           2         Brake Reference Out-<br/>put Speed Level         0 to 10,000         1 min<sup>-1</sup>         100         Rotar</td> <td>BO       Name       Setting<br/>Range       Default<br/>Unit       Default<br/>Setting       Applicable<br/>Motors       When<br/>Enabled         2       Polarity Detection Con-<br/>stant Speed Time       0 to 300       1 ms       0       Linear       Immedi-<br/>ately         2       Polarity Detection Refer-<br/>ence Waiting Time       50 to 500       1 ms       100       Linear       Immedi-<br/>ately         2       Polarity Detection Load<br/>Level       1 to 65,535       1 mm       10       Linear       Immedi-<br/>ately         2       Polarity Detection Load<br/>Level       0 to 20,000       1%       100       Linear       Immedi-<br/>ately         2       Polarity Detection Con-<br/>firmation Force Refer-<br/>ence       0 to 200       1%       100       Linear       Immedi-<br/>ately         2       Polarity Detection Allow-<br/>ance       0 to 10,000       1 mm/s       0       Linear       Immedi-<br/>ately         2       Rotation Detection Level       1 to 10,000       1 min<sup>-1</sup>       20       Rotary       Immedi-<br/>ately         2       Rotation Detection Level       0 to 100       1 min<sup>-1</sup>       10       Rotary       Immedi-<br/>ately         2       Brake Reference-Servo<br/>OFF Delay Time       0 to 10,000       1 min<sup>-1</sup>       100       Rotary       Immedi-<br/>ately      &lt;</td> <td>2       Polarity Detection Constant Speed Time       0 to 300       1 ms       0       Linear       Immediately       Tuning         2       Polarity Detection Reference Waiting Time       50 to 500       1 ms       100       Linear       Immediately       Tuning         2       Polarity Detection Reference Waiting Time       50 to 500       1 ms       100       Linear       Immediately       Tuning         2       Polarity Detection Load       0 to 20,000       1%       100       Linear       Immediately       Tuning         2       Polarity Detection Load       0 to 20,000       1%       100       Linear       Immediately       Tuning         2       Polarity Detection Allow-<br/>ence       0 to 200       1%       100       Linear       Immediately       Tuning         2       Polarity Detection Allow-<br/>ence       0 to 10,000       1 mm/s       0       Linear       Immediately       Tuning         2       Rotation Detection Level       1 to 10,000       1 min-1       20       Rotary       Immediately       Tuning         2       Break Reference-Servo       0 to 100       1 min-1       10       Rotary       Immediately       Setup         2       Brake Reference Out-<br/>put Speed Level</td> | 2       Polarity Detection Constant Speed Time       0 to 300       1 ms         2       Polarity Detection Reference Waiting Time       50 to 500       1 ms         2       Polarity Detection Load Level       1 to 65,535       1 mm         2       Polarity Detection Load Level       0 to 20,000       1%         2       Polarity Detection Confirmation Force Reference       0 to 200       1%         2       Polarity Detection Allow-able Error Range       0 to 10,000       1 mm/s         2       Polarity Detection Level       0 to 10,000       1 mm/s         2       Speed Ripple Compensation Enable Speed       0 to 100,000       1 mm/s         2       Rotation Detection Level       1 to 10,000       1 min <sup>-1</sup> 2       Speed Coincidence Detection Signal Output Width       0 to 100       1 min <sup>-1</sup> 2       Brake Reference-Servo Of to 50       10 ms       10 ms         2       Brake Reference Output Speed Level       0 to 10,000       1 min <sup>-1</sup> 2       Servo OFF-Brake Command Waiting Time       10 to 100       10 ms         2       Momentary Power Inter-ruption Hold Time       20 to 50,000       1 ms         2       Input Signal Selections       00000h to FFF2h       -         1 | 2       Polarity Detection Constant Speed Time       0 to 300       1 ms       0         2       Polarity Detection Reference Waiting Time       50 to 500       1 ms       100         2       Polarity Detection Range       1 to 65,535       1 mm       100         2       Polarity Detection Load Level       0 to 20,000       1%       100         2       Polarity Detection Confirmation Force Reference       0 to 200       1%       100         2       Polarity Detection Allow-able Error Range       0 to 10,000       1 mm/s       0         2       Speed Ripple Compensation Enable Speed       0 to 100,000       1 min <sup>-1</sup> 20         2       Rotation Detection Level       1 to 10,000       1 min <sup>-1</sup> 10         2       Speed Coincidence Detection Signal Output Width       0 to 100       1 min <sup>-1</sup> 10         2       Brake Reference-Servo<br>OFF-Delay Time       0 to 10,000       1 min <sup>-1</sup> 100         2       Brake Reference Out-<br>wit Speed Level       0 to 10,000       1 min <sup>-1</sup> 100         2       Brake Reference Out-<br>mand Waiting Time       10 to 100       10 ms       50         2       Momentary Power Inter-<br>ruption Hold Time       20 to 50,000       1 ms       20 | Name         Setting<br>Range         Setting<br>Unit         Default<br>Setting<br>Unit         Applicable<br>Motors           2         Polarity Detection Con-<br>stant Speed Time         0 to 300         1 ms         0         Linear           2         Polarity Detection Refer-<br>ence Waiting Time         50 to 500         1 ms         100         Linear           2         Polarity Detection<br>Range         1 to 65,535         1 mm         100         Linear           2         Polarity Detection Load<br>Level         0 to 20,000         1%         100         Linear           2         Polarity Detection Con-<br>firmation Force Refer-<br>ence         0 to 200         1%         100         Linear           2         Polarity Detection Allow-<br>able Error Range         0 to 10,000         1 mm/s         0         Linear           2         Rotation Detection Level         1 to 10,000         1 min <sup>-1</sup> 20         Rotary           2         Rotation Detection Signal Output<br>Width         0 to 100         1 min <sup>-1</sup> 100         Rotary           2         Brake Reference-Servo<br>OFF Delay Time         0 to 10,000         1 min <sup>-1</sup> 100         Rotary           2         Brake Reference Out-<br>put Speed Level         0 to 10,000         1 min <sup>-1</sup> 100         Rotar | BO       Name       Setting<br>Range       Default<br>Unit       Default<br>Setting       Applicable<br>Motors       When<br>Enabled         2       Polarity Detection Con-<br>stant Speed Time       0 to 300       1 ms       0       Linear       Immedi-<br>ately         2       Polarity Detection Refer-<br>ence Waiting Time       50 to 500       1 ms       100       Linear       Immedi-<br>ately         2       Polarity Detection Load<br>Level       1 to 65,535       1 mm       10       Linear       Immedi-<br>ately         2       Polarity Detection Load<br>Level       0 to 20,000       1%       100       Linear       Immedi-<br>ately         2       Polarity Detection Con-<br>firmation Force Refer-<br>ence       0 to 200       1%       100       Linear       Immedi-<br>ately         2       Polarity Detection Allow-<br>ance       0 to 10,000       1 mm/s       0       Linear       Immedi-<br>ately         2       Rotation Detection Level       1 to 10,000       1 min <sup>-1</sup> 20       Rotary       Immedi-<br>ately         2       Rotation Detection Level       0 to 100       1 min <sup>-1</sup> 10       Rotary       Immedi-<br>ately         2       Brake Reference-Servo<br>OFF Delay Time       0 to 10,000       1 min <sup>-1</sup> 100       Rotary       Immedi-<br>ately      < | 2       Polarity Detection Constant Speed Time       0 to 300       1 ms       0       Linear       Immediately       Tuning         2       Polarity Detection Reference Waiting Time       50 to 500       1 ms       100       Linear       Immediately       Tuning         2       Polarity Detection Reference Waiting Time       50 to 500       1 ms       100       Linear       Immediately       Tuning         2       Polarity Detection Load       0 to 20,000       1%       100       Linear       Immediately       Tuning         2       Polarity Detection Load       0 to 20,000       1%       100       Linear       Immediately       Tuning         2       Polarity Detection Allow-<br>ence       0 to 200       1%       100       Linear       Immediately       Tuning         2       Polarity Detection Allow-<br>ence       0 to 10,000       1 mm/s       0       Linear       Immediately       Tuning         2       Rotation Detection Level       1 to 10,000       1 min-1       20       Rotary       Immediately       Tuning         2       Break Reference-Servo       0 to 100       1 min-1       10       Rotary       Immediately       Setup         2       Brake Reference Out-<br>put Speed Level |

| n.¤X¤¤ | Rese | rved parameter (Do not change.)                               |           |
|--------|------|---------------------------------------------------------------|-----------|
|        | P-OT | (Forward Drive Prohibit) Signal Allocation                    | Reference |
|        | 0    | Enable forward drive when CN1-13 input signal is ON (closed). |           |
|        | 1    | Enable forward drive when CN1-7 input signal is ON (closed).  |           |
|        | 2    | Enable forward drive when CN1-8 input signal is ON (closed).  |           |
|        | 3    | Enable forward drive when CN1-9 input signal is ON (closed).  |           |
|        | 4    | Enable forward drive when CN1-10 input signal is ON (closed). |           |
|        | 5    | Enable forward drive when CN1-11 input signal is ON (closed). |           |
|        | 6    | Enable forward drive when CN1-12 input signal is ON (closed). |           |
| n.XDDD | 7    | Set the signal to always prohibit forward drive.              | nogo 6    |
|        | 8    | Set the signal to always enable forward drive.                | page 6-   |
|        | 9    | Enable forward drive when CN1-13 input signal is OFF (open).  |           |
|        | А    | Enable forward drive when CN1-7 input signal is OFF (open).   |           |
|        | В    | Enable forward drive when CN1-8 input signal is OFF (open).   |           |
|        | С    | Enable forward drive when CN1-9 input signal is OFF (open).   |           |
|        | D    | Enable forward drive when CN1-10 input signal is OFF (open).  |           |
|        | E    | Enable forward drive when CN1-11 input signal is OFF (open).  |           |
|        | F    | Enable forward drive when CN1-12 input signal is OFF (open).  |           |

Continued from previous page.

| arameter | Size | N                | ame                                                      | Setting                                                                                                                                                                                                             | Setting                                                                                                                                                             | Default                                                                                                                                                                   | Applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | When<br>Enabled  | Classi-  | Refe |  |
|----------|------|------------------|----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|----------|------|--|
| No.      |      | Input Sign       | al Salaction                                             | Range                                                                                                                                                                                                               | Unit                                                                                                                                                                | Setting                                                                                                                                                                   | Motors                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                  | fication | enc  |  |
|          | 2    | Input Signa<br>2 | al Selection                                             | s 0000h to<br>FFFFh                                                                                                                                                                                                 | -                                                                                                                                                                   | 8882h                                                                                                                                                                     | All                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | After<br>restart | Setup    | -    |  |
|          |      |                  |                                                          |                                                                                                                                                                                                                     |                                                                                                                                                                     |                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                  |          |      |  |
|          |      |                  | N-OT (Re                                                 | verse Drive Prohi                                                                                                                                                                                                   | bit) Signal                                                                                                                                                         | Allocation                                                                                                                                                                | I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                  | Refer    | ence |  |
|          |      |                  | 0                                                        | Enable reverse dr                                                                                                                                                                                                   | ive when (                                                                                                                                                          | CN1-13 inp                                                                                                                                                                | ut signal is O                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | N (closed).      |          |      |  |
|          |      |                  | 1                                                        | Enable reverse dr                                                                                                                                                                                                   | ive when (                                                                                                                                                          | CN1-7 inpu                                                                                                                                                                | t signal is ON                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | l (closed).      |          |      |  |
|          |      |                  | 2                                                        | Enable reverse dr                                                                                                                                                                                                   | ive when (                                                                                                                                                          | CN1-8 inpu                                                                                                                                                                | t signal is ON                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | l (closed).      |          |      |  |
|          |      |                  | 3                                                        | Enable reverse dr                                                                                                                                                                                                   |                                                                                                                                                                     |                                                                                                                                                                           | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | , ,              |          |      |  |
|          |      |                  | 4                                                        | Enable reverse dr                                                                                                                                                                                                   |                                                                                                                                                                     |                                                                                                                                                                           | 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | , ,              |          |      |  |
|          |      |                  | 5                                                        | Enable reverse dr                                                                                                                                                                                                   |                                                                                                                                                                     |                                                                                                                                                                           | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                  |          |      |  |
|          |      |                  | 6                                                        | Enable reverse dr                                                                                                                                                                                                   |                                                                                                                                                                     |                                                                                                                                                                           | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | N (closed).      |          |      |  |
|          |      | n.🗆 🗆 🗆 X        | 7                                                        | Set the signal to a                                                                                                                                                                                                 |                                                                                                                                                                     |                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                  | — page   | 6-28 |  |
|          |      |                  | 8                                                        | Set the signal to a<br>Enable reverse dr                                                                                                                                                                            |                                                                                                                                                                     |                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | FF (open)        | _        |      |  |
|          |      |                  | A                                                        | Enable reverse dr                                                                                                                                                                                                   |                                                                                                                                                                     |                                                                                                                                                                           | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | ,                |          |      |  |
|          |      |                  | B                                                        | Enable reverse dr                                                                                                                                                                                                   |                                                                                                                                                                     |                                                                                                                                                                           | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | ,                |          |      |  |
|          |      |                  | C                                                        | Enable reverse dr                                                                                                                                                                                                   |                                                                                                                                                                     |                                                                                                                                                                           | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                  |          |      |  |
|          |      |                  | D                                                        | Enable reverse dr                                                                                                                                                                                                   |                                                                                                                                                                     |                                                                                                                                                                           | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | ,                |          |      |  |
|          |      |                  | E                                                        | Enable reverse dr                                                                                                                                                                                                   |                                                                                                                                                                     |                                                                                                                                                                           | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | ,                |          |      |  |
|          |      |                  | F                                                        | Enable reverse dr                                                                                                                                                                                                   | ive when (                                                                                                                                                          | CN1-12 inp                                                                                                                                                                | ut signal is O                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | FF (open).       |          |      |  |
|          |      | n.DDXD           | Reserved                                                 |                                                                                                                                                                                                                     |                                                                                                                                                                     |                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                  |          |      |  |
| 150B     | H    |                  | +                                                        | rward External To                                                                                                                                                                                                   |                                                                                                                                                                     | ,                                                                                                                                                                         | nal Allocatio                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | n                | Refer    | ence |  |
|          |      |                  | 0                                                        | Active when CN1                                                                                                                                                                                                     |                                                                                                                                                                     |                                                                                                                                                                           | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                  |          |      |  |
|          |      |                  | 1                                                        | Active when CN1                                                                                                                                                                                                     |                                                                                                                                                                     | -                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                  |          |      |  |
|          |      |                  | 2                                                        | Active when CN1                                                                                                                                                                                                     |                                                                                                                                                                     | <b>,</b>                                                                                                                                                                  | , ,                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |          |      |  |
|          |      |                  | -                                                        | Active when CNI1                                                                                                                                                                                                    |                                                                                                                                                                     | -                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                  |          |      |  |
|          |      |                  | 3                                                        | Active when ON I                                                                                                                                                                                                    | -9 input sig                                                                                                                                                        | gnal is ON                                                                                                                                                                | (closed).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  |          |      |  |
|          |      |                  | 3                                                        | Active when CN1                                                                                                                                                                                                     |                                                                                                                                                                     | -                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                  |          |      |  |
|          |      |                  |                                                          |                                                                                                                                                                                                                     | -10 input s                                                                                                                                                         | signal is ON                                                                                                                                                              | I (closed).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  |          |      |  |
|          |      |                  | 4                                                        | Active when CN1                                                                                                                                                                                                     | -10 input s<br>-11 input s                                                                                                                                          | signal is ON<br>signal is ON                                                                                                                                              | l (closed).<br>l (closed).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                  |          |      |  |
|          |      | n.0X00           | 4<br>5                                                   | Active when CN1<br>Active when CN1                                                                                                                                                                                  | -10 input s<br>-11 input s<br>-12 input s                                                                                                                           | signal is ON<br>signal is ON                                                                                                                                              | l (closed).<br>l (closed).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                  |          | 7-29 |  |
|          |      | n.¤X¤¤           | 4<br>5<br>6                                              | Active when CN1<br>Active when CN1<br>Active when CN1                                                                                                                                                               | -10 input s<br>-11 input s<br>-12 input s<br>lys active.                                                                                                            | signal is ON<br>signal is ON<br>signal is ON                                                                                                                              | l (closed).<br>l (closed).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                  | page     | 7-29 |  |
|          |      | n.DXDD           | 4<br>5<br>6<br>7                                         | Active when CN1<br>Active when CN1<br>Active when CN1<br>The signal is alwa                                                                                                                                         | -10 input s<br>-11 input s<br>-12 input s<br>ys active.<br>ys inactive                                                                                              | signal is ON<br>signal is ON<br>signal is ON                                                                                                                              | V (closed).<br>V (closed).<br>V (closed).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  | page     | 7-29 |  |
|          |      | n.0X00           | 4<br>5<br>6<br>7<br>8                                    | Active when CN1<br>Active when CN1<br>Active when CN1<br>The signal is alwa<br>The signal is alwa<br>Active when CN1<br>Active when CN1                                                                             | -10 input s<br>-11 input s<br>-12 input s<br>ys active.<br>ys inactive<br>-13 input s<br>-7 input sig                                                               | signal is ON<br>signal is ON<br>signal is ON<br>n.<br>signal is OFF<br>gnal is OFF                                                                                        | V (closed).<br>V (closed).<br>V (closed).<br>F (open).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                  | page     | 7-29 |  |
|          |      | n.¤X¤¤           | 4<br>5<br>6<br>7<br>8<br>9<br>A<br>B                     | Active when CN1<br>Active when CN1<br>Active when CN1<br>The signal is alwa<br>The signal is alwa<br>Active when CN1<br>Active when CN1<br>Active when CN1                                                          | -10 input s<br>-11 input s<br>-12 input s<br>ys active.<br>ys inactive<br>-13 input s<br>-7 input sig<br>-8 input sig                                               | ignal is ON<br>ignal is ON<br>ignal is ON                                                                                                                                 | V (closed).<br>V (closed).<br>V (closed).<br>F (open).<br>Gopen).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                  | page     | 7-29 |  |
|          |      | n.0X00           | 4<br>5<br>6<br>7<br>8<br>9<br>A<br>B<br>C                | Active when CN1<br>Active when CN1<br>Active when CN1<br>The signal is alwa<br>The signal is alwa<br>Active when CN1<br>Active when CN1<br>Active when CN1                                                          | -10 input s<br>-11 input s<br>-12 input s<br>ys active.<br>ys inactive<br>-13 input s<br>-7 input sig<br>-8 input sig<br>-9 input sig                               | signal is ON<br>signal is ON<br>signal is ON<br>signal is OF<br>gnal is OFF<br>gnal is OFF                                                                                | V (closed).<br>V (clo |                  | page     | 7-29 |  |
|          |      | n.0X00           | 4<br>5<br>6<br>7<br>8<br>9<br>A<br>B<br>C<br>D           | Active when CN1<br>Active when CN1<br>Active when CN1<br>The signal is alwa<br>The signal is alwa<br>Active when CN1<br>Active when CN1<br>Active when CN1<br>Active when CN1                                       | -10 input s<br>-11 input s<br>-12 input s<br>ys active.<br>ys inactive<br>-13 input s<br>-7 input sig<br>-8 input sig<br>-9 input sig<br>-10 input s                | signal is ON<br>signal is ON<br>signal is ON<br>signal is OF<br>gnal is OFF<br>gnal is OFF<br>gnal is OFF                                                                 | J (closed).<br>J (closed).<br>J (closed).<br>F (open).<br>(open).<br>G (open).<br>F (open).<br>F (open).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                  | page     | 7-29 |  |
|          |      | n.0X00           | 4<br>5<br>6<br>7<br>8<br>9<br>A<br>B<br>C<br>D<br>E      | Active when CN1<br>Active when CN1<br>Active when CN1<br>The signal is alwa<br>The signal is alwa<br>Active when CN1<br>Active when CN1<br>Active when CN1<br>Active when CN1<br>Active when CN1<br>Active when CN1 | -10 input s<br>-11 input s<br>-12 input s<br>ys active.<br>-13 input s<br>-7 input sig<br>-8 input sig<br>-9 input sig<br>-10 input s                               | signal is ON<br>signal is ON<br>signal is ON<br>signal is OF<br>gnal is OFF<br>gnal is OFF<br>gnal is OFF<br>gnal is OFF<br>signal is OF                                  | V (closed).<br>V (clo |                  | page     | 7-29 |  |
|          |      | n.□X□□           | 4<br>5<br>6<br>7<br>8<br>9<br>A<br>B<br>C<br>D<br>E<br>F | Active when CN1<br>Active when CN1<br>Active when CN1<br>The signal is alwa<br>The signal is alwa<br>Active when CN1<br>Active when CN1<br>Active when CN1<br>Active when CN1<br>Active when CN1<br>Active when CN1 | -10 input s<br>-11 input s<br>-12 input s<br>ys active.<br>-13 input s<br>-7 input sig<br>-8 input sig<br>-9 input sig<br>-10 input s<br>-11 input s                | signal is ON<br>signal is ON<br>signal is ON<br>signal is OF<br>gnal is OFF<br>gnal is OFF<br>gnal is OFF<br>signal is OF<br>signal is OF<br>signal is OF                 | J (closed).<br>J (closed).<br>J (closed).<br>J (closed).<br>F (open).<br>G (open).<br>F (open).<br>F (open).<br>F (open).<br>F (open).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                  |          |      |  |
|          |      | n.0X00           | 4<br>5<br>6<br>7<br>8<br>9<br>A<br>B<br>C<br>D<br>E<br>F | Active when CN1<br>Active when CN1<br>Active when CN1<br>The signal is alwa<br>The signal is alwa<br>Active when CN1<br>Active when CN1<br>Active when CN1<br>Active when CN1<br>Active when CN1<br>Active when CN1 | -10 input s<br>-11 input s<br>-12 input s<br>ys active.<br>-13 input s<br>-7 input sig<br>-8 input sig<br>-9 input sig<br>-10 input s<br>-11 input s<br>-12 input s | signal is ON<br>signal is ON<br>signal is ON<br>signal is OF<br>gnal is OFF<br>gnal is OFF<br>gnal is OFF<br>signal is OF<br>signal is OF<br>signal is OF<br>signal is OF | <ul> <li>I (closed).</li> <li>I (closed).</li> <li>I (closed).</li> <li>I (closed).</li> <li>I (closed).</li> <li>I (closed).</li> <li>I (closen).</li> <li>I (open).</li> <li>I (open).</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                  | page     |      |  |

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|------------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-----------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|---------------------|------------------------------|--|--|
| Parameter<br>No. | Size | N                                                                                                                                                                            | lame                                                                          |                                                                             | Setting<br>Range                                                                                                                                                                                                                                      | Setting<br>Unit                                                                                                                                | Default<br>Setting                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Applicable<br>Motors                                                                                  | When<br>Enabled                                                               | Classi-<br>fication | Refei<br>ence                |  |  |
|                  | 2    | Output Sig<br>tions 1                                                                                                                                                        | ınal Selec-                                                                   |                                                                             | 0000h to<br>6666h                                                                                                                                                                                                                                     | -                                                                                                                                              | 0000h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | All                                                                                                   | After<br>restart                                                              | Setup               | -                            |  |  |
|                  |      |                                                                                                                                                                              | /COIN (P                                                                      | ositi                                                                       | oning Comple                                                                                                                                                                                                                                          | tion Outp                                                                                                                                      | ut) Signal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Allocation                                                                                            |                                                                               | Refere              | ence                         |  |  |
|                  |      |                                                                                                                                                                              | 0                                                                             |                                                                             | abled (the abov                                                                                                                                                                                                                                       |                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                       |                                                                               |                     |                              |  |  |
|                  |      |                                                                                                                                                                              | 1                                                                             | Out                                                                         | put the signal i                                                                                                                                                                                                                                      | from the C                                                                                                                                     | N1-1 or C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | N1-2 output                                                                                           | terminal.                                                                     |                     |                              |  |  |
|                  |      | n.🗆🗆 🗆 X                                                                                                                                                                     | 2                                                                             |                                                                             | put the signal i                                                                                                                                                                                                                                      |                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                       |                                                                               |                     |                              |  |  |
|                  |      |                                                                                                                                                                              | 3                                                                             |                                                                             | put the signal                                                                                                                                                                                                                                        |                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                       |                                                                               | page 7-12           |                              |  |  |
|                  |      |                                                                                                                                                                              | 4                                                                             |                                                                             | put the signal                                                                                                                                                                                                                                        |                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                       |                                                                               |                     |                              |  |  |
|                  |      |                                                                                                                                                                              | 5                                                                             |                                                                             | put the signal i                                                                                                                                                                                                                                      |                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | CINT-30 OUTP                                                                                          | ut terminai.                                                                  |                     | _                            |  |  |
| Pn50E            |      | 6 Reserved setting (Do not use.) /V-CMP (Speed Coincidence Detection Output) Signal Allocation                                                                               |                                                                               |                                                                             |                                                                                                                                                                                                                                                       |                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                       |                                                                               |                     |                              |  |  |
|                  |      |                                                                                                                                                                              | /V-CMP (                                                                      | •••                                                                         |                                                                                                                                                                                                                                                       |                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                       | Refere                                                                        | ence                |                              |  |  |
|                  |      | n.□□X□                                                                                                                                                                       | 0 to 6                                                                        | The allocations are the same as the /COIN (Positioning Comple               |                                                                                                                                                                                                                                                       |                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                       |                                                                               |                     |                              |  |  |
|                  |      |                                                                                                                                                                              | /TGON (F                                                                      |                                                                             | Refere                                                                                                                                                                                                                                                | ence                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                       |                                                                               |                     |                              |  |  |
|                  |      | n.□X□□       /TGON (Rotation Detection Output) Signal Allocation         0 to 6       The allocations are the same as the /COIN (Positioning Completion) signal allocations. |                                                                               |                                                                             |                                                                                                                                                                                                                                                       |                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                       |                                                                               |                     |                              |  |  |
|                  |      |                                                                                                                                                                              | /S-RDY (                                                                      | Serv                                                                        | o Ready) Sign                                                                                                                                                                                                                                         | al Allocat                                                                                                                                     | ion                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                       |                                                                               | Refere              | ence                         |  |  |
|                  |      | n.XDDD                                                                                                                                                                       | 0 to 6                                                                        |                                                                             | allocations are<br>signal allocati                                                                                                                                                                                                                    |                                                                                                                                                | e as the /C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | OIN (Position                                                                                         | ing Comple-                                                                   | page                | 7-10                         |  |  |
|                  |      |                                                                                                                                                                              |                                                                               |                                                                             |                                                                                                                                                                                                                                                       |                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                       |                                                                               |                     |                              |  |  |
|                  | 2    | Output Sig<br>tions 2                                                                                                                                                        | inal Selec-                                                                   |                                                                             | 0000h to<br>6666h                                                                                                                                                                                                                                     | _                                                                                                                                              | 0100h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | All                                                                                                   | After<br>restart                                                              | Setup               | -                            |  |  |
|                  |      |                                                                                                                                                                              | /CLT (Torque Limit Detection Output) Signal Allocation                        |                                                                             |                                                                                                                                                                                                                                                       |                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                       |                                                                               |                     |                              |  |  |
|                  |      |                                                                                                                                                                              | /CLT (Tor                                                                     |                                                                             | Limit Dotoctio                                                                                                                                                                                                                                        |                                                                                                                                                | Signal All                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | ocation                                                                                               |                                                                               | Pofor               |                              |  |  |
|                  |      |                                                                                                                                                                              | <u> </u>                                                                      | •                                                                           |                                                                                                                                                                                                                                                       | . ,                                                                                                                                            | •                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                       |                                                                               | Refere              | ence                         |  |  |
|                  |      |                                                                                                                                                                              | 0                                                                             | Disa                                                                        | abled (the abov                                                                                                                                                                                                                                       | /e signal c                                                                                                                                    | utput is no                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | ot used).                                                                                             | terminal.                                                                     | Refere              | ence                         |  |  |
|                  |      |                                                                                                                                                                              | <u> </u>                                                                      | Disa<br>Out                                                                 |                                                                                                                                                                                                                                                       | ve signal c<br>from the C                                                                                                                      | utput is no<br>N1-1 or C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ot used).<br>N1-2 output                                                                              |                                                                               | Refere              | ence                         |  |  |
|                  |      | n.000X                                                                                                                                                                       | 0                                                                             | Disa<br>Out<br>Out                                                          | abled (the above<br>put the signal                                                                                                                                                                                                                    | ve signal c<br>from the C<br>from the C                                                                                                        | output is no<br>N1-1 or C<br>N1-23 or                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | ot used).<br>N1-2 output<br>CN1-24 outp                                                               | ut terminal.                                                                  | Page                |                              |  |  |
|                  |      | n.000X                                                                                                                                                                       | 0<br>1<br>2                                                                   | Disa<br>Out<br>Out<br>Out                                                   | abled (the above<br>put the signal f<br>put the signal f                                                                                                                                                                                              | ve signal c<br>from the C<br>from the C<br>from the C                                                                                          | utput is no<br>N1-1 or C<br>N1-23 or<br>N1-25 or                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | ot used).<br>N1-2 output<br>CN1-24 outp<br>CN1-26 outp                                                | ut terminal.<br>ut terminal.                                                  |                     |                              |  |  |
|                  |      | n.000X                                                                                                                                                                       | 0<br>1<br>2<br>3                                                              | Disa<br>Out<br>Out<br>Out                                                   | abled (the above<br>put the signal<br>put the signal<br>put the signal                                                                                                                                                                                | ve signal c<br>from the C<br>from the C<br>from the C<br>from the C                                                                            | utput is no<br>2N1-1 or C<br>2N1-23 or<br>2N1-25 or<br>2N1-27 or                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | ot used).<br>N1-2 output<br>CN1-24 outp<br>CN1-26 outp<br>CN1-28 outp                                 | ut terminal.<br>ut terminal.<br>ut terminal.                                  |                     |                              |  |  |
| Pn50F            |      | n.DDDX                                                                                                                                                                       | 0<br>1<br>2<br>3<br>4                                                         | Disa<br>Out<br>Out<br>Out<br>Out                                            | abled (the above<br>put the signal<br>put the signal<br>put the signal<br>put the signal                                                                                                                                                              | ve signal c<br>from the C<br>from the C<br>from the C<br>from the C<br>from the C                                                              | 2011 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ot used).<br>N1-2 output<br>CN1-24 outp<br>CN1-26 outp<br>CN1-28 outp                                 | ut terminal.<br>ut terminal.<br>ut terminal.                                  |                     |                              |  |  |
| Pn50F            |      | n.000X                                                                                                                                                                       | 0<br>1<br>2<br>3<br>4<br>5<br>6                                               | Disa<br>Out<br>Out<br>Out<br>Out<br>Res                                     | abled (the above<br>put the signal<br>put the signal<br>put the signal<br>put the signal<br>put the signal                                                                                                                                            | ve signal c<br>from the C<br>from the C<br>from the C<br>from the C<br>from the C<br>Do not us                                                 | utput is no<br>N1-1 or C<br>N1-23 or<br>N1-25 or<br>N1-27 or<br>N1-29 or<br>e.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | ot used).<br>N1-2 output<br>CN1-24 outp<br>CN1-26 outp<br>CN1-28 outp                                 | ut terminal.<br>ut terminal.<br>ut terminal.                                  |                     | 7-32                         |  |  |
| Pn50F            |      | n.000X                                                                                                                                                                       | 0<br>1<br>2<br>3<br>4<br>5<br>6                                               | Disa<br>Out<br>Out<br>Out<br>Out<br>Out<br>Res<br>eed L                     | abled (the above<br>put the signal<br>put the signal<br>put the signal<br>put the signal<br>put the signal<br>erved setting (                                                                                                                         | ve signal c<br>from the C<br>from the C<br>from the C<br>from the C<br>Do not us<br>n) Signal <i>i</i><br>e the same                           | CN1-1 or C<br>CN1-1 or C<br>CN1-23 or<br>CN1-25 or<br>CN1-27 or<br>CN1-29 or<br>e.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | ot used).<br>N1-2 output<br>CN1-24 outp<br>CN1-26 outp<br>CN1-28 outp<br>CN1-30 outp                  | ut terminal.<br>ut terminal.<br>ut terminal.<br>ut terminal.                  | page                | 7-32<br>ence                 |  |  |
| Pn50F            |      | n.===X=                                                                                                                                                                      | 0<br>1<br>2<br>3<br>4<br>5<br>6<br>VLT (Spe<br>0 to 6                         | Disa<br>Out<br>Out<br>Out<br>Out<br>Out<br>Res<br>eed I<br>The<br>Out       | abled (the above<br>put the signal in<br>put the signal in<br>erved setting (<br><b></b>                                                                          | ve signal c<br>from the C<br>from the C<br>from the C<br>from the C<br>from the C<br>Do not us<br>n) Signal <i>i</i><br>e the same<br>cations. | CN1-1 or C<br>CN1-1 or C<br>CN1-23 or<br>CN1-25 or<br>CN1-27 or<br>CN1-29 or<br>e.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | ot used).<br>N1-2 output<br>CN1-24 outp<br>CN1-26 outp<br>CN1-28 outp<br>CN1-30 outp                  | ut terminal.<br>ut terminal.<br>ut terminal.<br>ut terminal.                  | page                | 7-32<br>ence                 |  |  |
| Pn50F            |      |                                                                                                                                                                              | 0<br>1<br>2<br>3<br>4<br>5<br>6<br>VLT (Spe<br>0 to 6                         | Disacon<br>Out<br>Out<br>Out<br>Out<br>Out<br>Ress<br>eed I<br>The<br>Out   | abled (the above<br>put the signal in<br>put the signal in<br>put the signal in<br>put the signal in<br>put the signal in<br>erved setting (<br><b>Limit Detection</b><br>allocations are<br>put) signal alloc                                        | ve signal c<br>from the C<br>from the C<br>from the C<br>from the C<br>Do not us<br><b>n) Signal</b> <i>i</i><br>e the same<br>cations.        | citization of the second secon | ot used).<br>N1-2 output<br>CN1-24 outp<br>CN1-26 outp<br>CN1-28 outp<br>CN1-30 outp<br>LT (Torque Li | ut terminal.<br>ut terminal.<br>ut terminal.<br>ut terminal.<br>mit Detection | Refere              | 7-32<br>ence<br>7-14         |  |  |
| Pn50F            |      | n.===X=                                                                                                                                                                      | 0<br>1<br>2<br>3<br>4<br>5<br>6<br>/VLT (Spe<br>0 to 6<br>/BK (Brak<br>0 to 6 | Disa<br>Outi<br>Outi<br>Outi<br>Outi<br>Outi<br>Res<br>eed I<br>The<br>Outi | abled (the above<br>put the signal in<br>put the signal in<br>erved setting (<br><b>Limit Detection</b><br>allocations are<br>put) signal allo<br>allocations are | ve signal c<br>from the C<br>from the C<br>from the C<br>from the C<br>from the C<br>Do not us<br>n) Signal /<br>e the same<br>cations.        | utput is no<br>N1-1 or C<br>N1-23 or<br>N1-25 or<br>N1-27 or<br>N1-29 or<br>e.)<br>Allocation<br>e as the /C<br>e as the /C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | ot used).<br>N1-2 output<br>CN1-24 outp<br>CN1-26 outp<br>CN1-28 outp<br>CN1-30 outp<br>LT (Torque Li | ut terminal.<br>ut terminal.<br>ut terminal.<br>ut terminal.<br>mit Detection | Refere              | 7-32<br>ence<br>7-14<br>ence |  |  |

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| Parameter<br>No. | Size | N                          | ame                                         |                                  | Setting<br>Range                                                                                                                               | Setting<br>Unit                                                                   | Default<br>Setting                                                             | Applicable<br>Motors                                          | When<br>Enabled                              | Classi-<br>fication | Refer-<br>ence |
|------------------|------|----------------------------|---------------------------------------------|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------|---------------------------------------------------------------|----------------------------------------------|---------------------|----------------|
|                  | 2    | Output Sig<br>tions 3      | nal Selec-                                  | -                                | 0000h to<br>0666h                                                                                                                              | -                                                                                 | 0000h                                                                          | All                                                           | After<br>restart                             | Setup               | -              |
| Pn510            |      | n.□□□X                     | /NEAR (I<br>0<br>1<br>2<br>3<br>4<br>5<br>6 | Disa<br>Out<br>Out<br>Out<br>Out | Output) Signa<br>abled (the abov<br>put the signal<br>put the signal<br>put the signal<br>put the signal<br>put the signal<br>served setting ( | ve signal c<br>from the C<br>from the C<br>from the C<br>from the C<br>from the C | output is no<br>CN1-1 or C<br>CN1-23 or<br>CN1-25 or<br>CN1-27 or<br>CN1-29 or | N1-2 output 1<br>CN1-24 outpu<br>CN1-26 outpu<br>CN1-28 outpu | ut terminal.<br>ut terminal.<br>ut terminal. | page                |                |
|                  | I    | n.00X0<br>n.0X00<br>n.X000 | Reserve                                     | d pai                            | rameter (Do no<br>rameter (Do no<br>rameter (Do no                                                                                             | ot change.                                                                        | .)                                                                             |                                                               |                                              |                     |                |

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| Devenuela        | -    |                 |                                                                           | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Outline         | Def: 1             |                      | Continued from Continued from Setting Setting Default Applicable When ( |                     |              |  |  |  |  |
|------------------|------|-----------------|---------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------------|----------------------|-------------------------------------------------------------------------|---------------------|--------------|--|--|--|--|
| Parameter<br>No. | Size | N               | lame                                                                      | Setting<br>Range                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Setting<br>Unit | Default<br>Setting | Applicable<br>Motors | When<br>Enabled                                                         | Classi-<br>fication | Refe<br>ence |  |  |  |  |
|                  | 2    | Input Sign<br>5 | al Selectio                                                               | ns 0000h to<br>FFFFh                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | -               | 6543h              | All                  | After<br>restart                                                        | Setup               | pag<br>7-4   |  |  |  |  |
|                  |      | n.□□□X          | /DEC (O)<br>0<br>1<br>2<br>3<br>4<br>5<br>6<br>7<br>8<br>9<br>A<br>B<br>C | FFFFhP0004311Allres/DEC (Origin Return Deceleration Switch Input) Signal Allocation0Active when CN1-13 input signal is ON (closed).1Active when CN1-7 input signal is ON (closed).2Active when CN1-8 input signal is ON (closed).3Active when CN1-9 input signal is ON (closed).4Active when CN1-10 input signal is ON (closed).5Active when CN1-11 input signal is ON (closed).6Active when CN1-12 input signal is ON (closed).7The signal is always active.8The signal is always inactive.9Active when CN1-13 input signal is OFF (open).AActive when CN1-7 input signal is OFF (open).BActive when CN1-8 input signal is OFF (open). |                 |                    |                      |                                                                         |                     |              |  |  |  |  |
| Pn511            |      |                 | E<br>F                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                    |                      |                                                                         |                     |              |  |  |  |  |
|                  |      |                 |                                                                           | ternal Latch Inpu                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | , 0             |                    | ו                    |                                                                         |                     |              |  |  |  |  |
|                  |      |                 | 0 to 3                                                                    | The signal is alware<br>Active when CN1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ,               |                    | l (closed)           |                                                                         |                     |              |  |  |  |  |
|                  |      |                 | 5                                                                         | Active when CN1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | •               | 0                  | . ,                  |                                                                         |                     |              |  |  |  |  |
|                  |      | n.🗆 🗆 X 🗆       | 6                                                                         | Active when CN1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 | -                  |                      |                                                                         |                     |              |  |  |  |  |
|                  |      |                 | D                                                                         | Active when CN1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | •               | •                  | , ,                  |                                                                         |                     |              |  |  |  |  |
|                  |      |                 | E                                                                         | Active when CN1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 | 0                  | ,                    |                                                                         |                     |              |  |  |  |  |
|                  |      |                 | F                                                                         | Active when CN1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 | -                  |                      |                                                                         |                     |              |  |  |  |  |
|                  |      |                 | 7 to C                                                                    | The signal is always                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | iys inactive    |                    |                      |                                                                         |                     |              |  |  |  |  |
|                  |      |                 | /EXT2 (E                                                                  | kternal Latch Inpu                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | ıt 2) Signa     | Allocation         | า                    |                                                                         |                     |              |  |  |  |  |
|                  |      | n.¤X¤¤          | 0 to F                                                                    | The allocations al cations.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | re the same     | e as the /E        | XT1 (External        | Latch Input                                                             | 1) signal a         | allo-        |  |  |  |  |
|                  |      |                 | /EXT3 (E                                                                  | kternal Latch Inpu                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | ıt 3) Signa     | Allocation         | 1                    |                                                                         |                     |              |  |  |  |  |
|                  |      | n.XDDD          | 0 to F                                                                    | The allocations an cations.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | re the same     | e as the /E        | XT1 (External        | Latch Input                                                             | 1) signal a         | allo-        |  |  |  |  |

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|                  |      |                        |                                        |                                                        |                                                                                                                                       |                                                                                                |                                                                                                    | 00                                                                      | itinued from                                | n previou           | s page        |  |  |
|------------------|------|------------------------|----------------------------------------|--------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|---------------------------------------------|---------------------|---------------|--|--|
| Parameter<br>No. | Size |                        | Name                                   |                                                        | Setting<br>Range                                                                                                                      | Setting<br>Unit                                                                                | Default<br>Setting                                                                                 | Applicable<br>Motors                                                    | When<br>Enabled                             | Classi-<br>fication | Refer<br>ence |  |  |
|                  | 2    | Output Sig<br>Settings | gnal Invers                            | se                                                     | 0000h to<br>1111h                                                                                                                     | -                                                                                              | 0000h                                                                                              | All                                                                     | After<br>restart                            | Setup               | page<br>7-6   |  |  |
|                  |      |                        | Output \$                              | Signa                                                  | I Inversion for                                                                                                                       | CN1-1 ar                                                                                       | nd CN1-2                                                                                           | Terminals                                                               |                                             |                     |               |  |  |
|                  |      | n.🗆 🗆 🗆 X              | 0                                      | The                                                    | signal is not ir                                                                                                                      | nverted.                                                                                       |                                                                                                    |                                                                         |                                             |                     |               |  |  |
|                  |      |                        | 1                                      | The                                                    | signal is inver                                                                                                                       | ted.                                                                                           |                                                                                                    |                                                                         |                                             |                     |               |  |  |
|                  |      |                        | -                                      | -                                                      | I Inversion for                                                                                                                       |                                                                                                | and CN1-2                                                                                          | 4 Terminals                                                             |                                             |                     |               |  |  |
| Pn512            |      | n.🗆🗆 X 🗆               | 0                                      |                                                        | signal is not in                                                                                                                      |                                                                                                |                                                                                                    |                                                                         |                                             |                     |               |  |  |
| 111012           |      |                        | 1                                      | The                                                    | signal is inver                                                                                                                       | ted.                                                                                           |                                                                                                    |                                                                         |                                             |                     |               |  |  |
|                  |      |                        | Output                                 | Signa                                                  | I Inversion for                                                                                                                       | CN1-25 a                                                                                       | and CN1-2                                                                                          | 6 Terminals                                                             |                                             |                     |               |  |  |
|                  |      | n.¤X¤¤                 | 0                                      | The                                                    | signal is not ir                                                                                                                      | nverted.                                                                                       |                                                                                                    |                                                                         |                                             |                     |               |  |  |
|                  |      |                        | 1                                      | The                                                    | signal is inver                                                                                                                       | ted.                                                                                           |                                                                                                    |                                                                         |                                             |                     |               |  |  |
|                  |      |                        | -                                      |                                                        | I Inversion for                                                                                                                       |                                                                                                | and CN1-2                                                                                          | 8 Terminals                                                             |                                             |                     |               |  |  |
|                  |      | n.X□□□                 | 0                                      | _                                                      | signal is not in signal is inver                                                                                                      |                                                                                                |                                                                                                    |                                                                         |                                             |                     |               |  |  |
|                  |      |                        |                                        | THE                                                    | Signal is inver                                                                                                                       | leu.                                                                                           |                                                                                                    |                                                                         |                                             |                     |               |  |  |
|                  |      | Output Ci              | anal Invara                            |                                                        | 0000h to                                                                                                                              |                                                                                                |                                                                                                    |                                                                         | After                                       |                     |               |  |  |
|                  | 2    | Settings 2             | gnal Invers                            | se                                                     | 0000h to<br>0011h                                                                                                                     | -                                                                                              | 0000h                                                                                              | All                                                                     | After<br>restart                            | Setup               | _             |  |  |
|                  |      |                        |                                        |                                                        |                                                                                                                                       |                                                                                                |                                                                                                    |                                                                         |                                             |                     |               |  |  |
|                  | L    |                        | Output S                               | ignal                                                  | Inversion for (                                                                                                                       | CN1-29 ar                                                                                      | nd CN1-30                                                                                          | ) Terminals                                                             |                                             | Refere              | ence          |  |  |
|                  | r    | n.000X                 | 0 T                                    | The sig                                                | gnal is not inve                                                                                                                      | erted.                                                                                         |                                                                                                    |                                                                         |                                             | page                | 7.0           |  |  |
| Pn513            |      |                        | 1 The signal is inverted.              |                                                        |                                                                                                                                       |                                                                                                |                                                                                                    |                                                                         |                                             |                     |               |  |  |
|                  | r    | n.00X0                 | Reserved                               | l para                                                 | meter (Do not                                                                                                                         | change.)                                                                                       |                                                                                                    |                                                                         |                                             |                     |               |  |  |
|                  | r    | 1.0X00                 | Reserved                               | l para                                                 | rameter (Do not change.)                                                                                                              |                                                                                                |                                                                                                    |                                                                         |                                             |                     |               |  |  |
|                  | r    | n.X000                 | Reserved                               | l para                                                 | meter (Do not                                                                                                                         | change.)                                                                                       |                                                                                                    |                                                                         |                                             |                     |               |  |  |
|                  | 2    | Output Sig<br>tions 4  | gnal Selec                             | -                                                      | 0000h to<br>0666h                                                                                                                     | _                                                                                              | 0000h                                                                                              | All                                                                     | After<br>restart                            | Setup               | -             |  |  |
|                  | -    | 1.000X                 | Reserved                               | d para                                                 | meter (Do not                                                                                                                         | t change.)                                                                                     |                                                                                                    |                                                                         |                                             |                     |               |  |  |
|                  |      |                        |                                        |                                                        |                                                                                                                                       |                                                                                                |                                                                                                    |                                                                         |                                             |                     |               |  |  |
|                  |      |                        | Reserved                               | n.□□X□ Reserved parameter (Do not change.)             |                                                                                                                                       |                                                                                                |                                                                                                    |                                                                         |                                             |                     |               |  |  |
|                  |      | n.00X0                 |                                        |                                                        | •                                                                                                                                     | 0,                                                                                             |                                                                                                    |                                                                         |                                             |                     |               |  |  |
|                  |      | n.□□X□                 | /PM (Pre                               | venta                                                  | tive Maintena                                                                                                                         | nce Outpu                                                                                      | ıt) Signal A                                                                                       |                                                                         |                                             | Refere              | ence          |  |  |
| Pn514            |      | n.00X0                 | /PM (Pret                              | venta<br>Disal                                         | tive Maintena<br>bled (the above                                                                                                      | nce Outpu<br>e signal ou                                                                       | <b>it) Signal A</b><br>itput is not                                                                | used).                                                                  |                                             | Refere              | ence          |  |  |
| Pn514            |      | n.00X0                 | /PM (Pre-<br>0<br>1                    | venta<br>Disal<br>Outp                                 | tive Maintena<br>bled (the above<br>ut the signal fr                                                                                  | nce Outpu<br>e signal ou<br>rom the Cl                                                         | <b>it) Signal A</b><br>itput is not<br>N1-1 or CN                                                  | : used).<br>N1-2 output te                                              |                                             | Refere              | ence          |  |  |
| Pn514            |      | n.00X0                 | /PM (Pre<br>0<br>1<br>2                | venta<br>Disal<br>Outp<br>Outp                         | tive Maintenan<br>bled (the above<br>ut the signal fr<br>ut the signal fr                                                             | nce Outpu<br>e signal ou<br>rom the CI<br>rom the CI                                           | <b>it) Signal A</b><br>itput is not<br>N1-1 or CN<br>N1-23 or C                                    | : used).<br>J1-2 output te<br>N1-24 outpu                               | t terminal.                                 |                     |               |  |  |
| Pn514            |      |                        | /PM (Pre<br>0<br>1<br>2<br>3           | venta<br>Disal<br>Outp<br>Outp<br>Outp                 | tive Maintenar<br>oled (the above<br>ut the signal fr<br>ut the signal fr<br>ut the signal fr                                         | nce Outpute<br>signal outpute<br>from the CI<br>from the CI                                    | <b>It) Signal A</b><br>Itput is not<br>N1-1 or CN<br>N1-23 or C<br>N1-25 or C                      | : used).<br>11-2 output te<br>N1-24 outpu<br>N1-26 outpu                | t terminal.<br>t terminal.                  | Refere              |               |  |  |
| Pn514            |      |                        | /PM (Pre<br>0<br>1<br>2<br>3<br>4      | venta<br>Disal<br>Outp<br>Outp<br>Outp<br>Outp         | tive Maintenar<br>bled (the above<br>ut the signal fr<br>ut the signal fr<br>ut the signal fr<br>ut the signal fr                     | nce Outpute<br>e signal out<br>rom the Cl<br>rom the Cl<br>rom the Cl<br>rom the Cl            | <b>It) Signal A</b><br>Itput is not<br>N1-1 or CN<br>N1-23 or C<br>N1-25 or C<br>N1-27 or C        | : used).<br>J1-2 output te<br>N1-24 outpu<br>N1-26 outpu<br>N1-28 outpu | t terminal.<br>It terminal.<br>It terminal. |                     |               |  |  |
| Pn514            |      |                        | /PM (Pre<br>0<br>1<br>2<br>3<br>4<br>5 | venta<br>Disal<br>Outp<br>Outp<br>Outp<br>Outp<br>Outp | tive Maintenan<br>oled (the above<br>ut the signal fr<br>ut the signal fr<br>ut the signal fr<br>ut the signal fr<br>ut the signal fr | nce Outpu<br>e signal ou<br>rom the CI<br>rom the CI<br>rom the CI<br>rom the CI<br>rom the CI | It) Signal A<br>Itput is not<br>N1-1 or CN<br>N1-23 or C<br>N1-25 or C<br>N1-27 or C<br>N1-29 or C | : used).<br>J1-2 output te<br>N1-24 outpu<br>N1-26 outpu<br>N1-28 outpu | t terminal.<br>It terminal.<br>It terminal. |                     |               |  |  |
| Pn514            |      |                        | /PM (Pre<br>0<br>1<br>2<br>3<br>4      | venta<br>Disal<br>Outp<br>Outp<br>Outp<br>Outp<br>Outp | tive Maintenar<br>bled (the above<br>ut the signal fr<br>ut the signal fr<br>ut the signal fr<br>ut the signal fr                     | nce Outpu<br>e signal ou<br>rom the CI<br>rom the CI<br>rom the CI<br>rom the CI<br>rom the CI | It) Signal A<br>Itput is not<br>N1-1 or CN<br>N1-23 or C<br>N1-25 or C<br>N1-27 or C<br>N1-29 or C | : used).<br>J1-2 output te<br>N1-24 outpu<br>N1-26 outpu<br>N1-28 outpu | t terminal.<br>It terminal.<br>It terminal. |                     |               |  |  |

Parameter Lists

| Parameter<br>No. | Size | N                | lame          | Setting<br>Range                  | Setting<br>Unit | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refe<br>ence |
|------------------|------|------------------|---------------|-----------------------------------|-----------------|--------------------|----------------------|------------------|---------------------|--------------|
|                  | 2    | Input Signa<br>6 | al Selections | 0000h to<br>FFFFh                 | -               | 8888h              | All                  | After<br>restart | Setup               | _            |
|                  |      | n.□□□X           | Reserved p    | arameter (Do no                   | ot change.      | .)                 |                      |                  |                     |              |
|                  |      | n.DDXD           | Reserved p    | arameter (Do no                   | ot change       | .)                 |                      |                  |                     |              |
|                  |      |                  | /DBANS (D     | /namic Brake A                    | nswer Inp       | ut) Signal         | Allocation           |                  |                     |              |
|                  |      |                  |               | Detect DB circui<br>signal is ON. | t error whe     | en CN1-13          | input signal is      | s ON (closed     | ) while /DE         | BON          |
|                  |      |                  | · · ·         | Detect DB circui<br>signal is ON. |                 |                    | 1 0                  |                  |                     |              |
|                  |      |                  |               | Detect DB circui<br>signal is ON. | t error whe     | en CN1-8 i         | nput signal is       | ON (closed)      | while /DE           | ION          |
|                  |      |                  |               | Detect DB circui<br>signal is ON. | t error whe     | en CN1-9 i         | nput signal is       | ON (closed)      | while /DE           | ON           |
|                  |      |                  |               | Detect DB circui<br>signal is ON. | t error whe     | en CN1-10          | input signal is      | s ON (closed     | ) while /DE         | BON          |
|                  |      |                  |               | Detect DB circui<br>signal is ON. | t error whe     | en CN1-11          | input signal is      | SON (closed      | ) while /DE         | BON          |
| n515             |      |                  |               | Detect DB circui<br>signal is ON. | t error whe     | en CN1-12          | input signal is      | s ON (closed     | ) while /DE         | BON          |
|                  |      | n.¤X¤¤           | 7             | Disable DB circu                  | it error de     | tection usi        | ng the /DBAN         | IS signal.       |                     |              |
|                  |      |                  | 8 1           | Disable DB circu                  | it error de     | tection usi        | ng the /DBAN         | IS signal.       |                     |              |
|                  |      |                  |               | Detect DB circui<br>signal is ON. | t error whe     | en CN1-13          | input signal i       | s OFF (open)     | ) while /DE         | BON          |
|                  |      |                  | A             | Detect DB circui<br>signal is ON. | t error whe     | en CN1-7 i         | nput signal is       | OFF (open)       | while /DB           | ON           |
|                  |      |                  |               | Detect DB circui<br>signal is ON. | t error whe     | en CN1-8 i         | nput signal is       | OFF (open)       | while /DB           | ON           |
|                  |      |                  |               | Detect DB circui<br>signal is ON. | t error whe     | en CN1-9 i         | nput signal is       | OFF (open)       | while /DB           | ON           |
|                  |      |                  |               | Detect DB circui<br>signal is ON. | t error whe     | en CN1-10          | input signal i       | s OFF (open)     | ) while /DE         | BON          |
|                  |      |                  |               | Detect DB circui<br>signal is ON. | t error whe     | en CN1-11          | input signal i       | s OFF (open)     | ) while /DE         | BON          |
|                  |      |                  |               | Detect DB circui<br>signal is ON. | t error whe     | en CN1-12          | input signal i       | s OFF (open)     | ) while /DE         | BON          |
|                  |      | n.XDDD           | Reserved p    | arameter (Do no                   | ot change       | .)                 |                      |                  |                     |              |

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|                         |      |                                                         | Continued from                                                                                                                                                   |                                                                                                                                                                                                                                               |                                                                                                              |                                                                                      |                                                                                            |                                                                                 | ·                   |                             |
|-------------------------|------|---------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|---------------------|-----------------------------|
| Parameter<br>No.        | Size | 1                                                       | lame                                                                                                                                                             | Setting<br>Range                                                                                                                                                                                                                              | Setting<br>Unit                                                                                              | Default<br>Setting                                                                   | Applicable<br>Motors                                                                       | When<br>Enabled                                                                 | Classi-<br>fication | Refer<br>ence               |
|                         | 2    | Input Sigr<br>7                                         | al Selections                                                                                                                                                    | 0000h to<br>FFFFh                                                                                                                                                                                                                             | _                                                                                                            | 8888h                                                                                | All                                                                                        | After<br>restart                                                                | Setup               | I                           |
| Pn516                   |      |                                                         | FSTP (Forc         0         1         2         3         4         5         6         7         8         9         A         B         C         D         E |                                                                                                                                                                                                                                               |                                                                                                              |                                                                                      |                                                                                            |                                                                                 |                     | -<br>58                     |
|                         | 1.5  | n.0X00                                                  | Reserved p                                                                                                                                                       | arameter (Do not<br>arameter (Do not                                                                                                                                                                                                          | ζ,                                                                                                           |                                                                                      |                                                                                            |                                                                                 |                     |                             |
|                         | 2    | Output Signations 8                                     | gnal Selec-                                                                                                                                                      | 0000h to<br>0060h                                                                                                                                                                                                                             | _<br>ot change                                                                                               | 0000h                                                                                | All                                                                                        | After<br>restart                                                                | Setup               | page<br>7-4                 |
| Pn51A                   |      |                                                         | /DBON (D                                                                                                                                                         |                                                                                                                                                                                                                                               |                                                                                                              |                                                                                      |                                                                                            |                                                                                 |                     |                             |
| Pn51A                   |      | n.00X0                                                  | 0<br>1<br>2<br>3<br>4<br>5<br>6                                                                                                                                  | Disabled (the abo<br>Output the signa<br>Output the signa<br>Output the signa<br>Output the signa<br>Output the signa                                                                                                                         | ove signal<br>I from the<br>I from the<br>I from the<br>I from the<br>I from the                             | output is r<br>CN1-1 or<br>CN1-23 o<br>CN1-25 o<br>CN1-27 o<br>CN1-29 o              | CN1-2 outpur<br>CN1-24 out<br>CN1-26 out<br>CN1-28 out                                     | t terminal.<br>put terminal.<br>put terminal.<br>put terminal.                  |                     |                             |
| Pn51A                   |      | n                                                       | 0<br>1<br>2<br>3<br>4<br>5<br>6<br>Reserved                                                                                                                      | Disabled (the abo<br>Output the signa<br>Output the signa<br>Output the signa<br>Output the signa                                                                                                                                             | ove signal<br>I from the<br>I from the<br>I from the<br>I from the<br>I from the<br>(Do not u<br>t change.   | output is r<br>CN1-1 or<br>CN1-23 o<br>CN1-25 o<br>CN1-27 o<br>CN1-29 o<br>se.)      | not used).<br>CN1-2 outpur<br>r CN1-24 out<br>r CN1-26 out<br>r CN1-28 out                 | t terminal.<br>put terminal.<br>put terminal.<br>put terminal.                  |                     |                             |
|                         | 4    | n.0X00                                                  | 0<br>1<br>2<br>3<br>4<br>5<br>6<br>Reserved<br>Reserved<br>ad Position<br>Overflow                                                                               | Disabled (the abo<br>Output the signa<br>Output the signa<br>Output the signa<br>Output the signa<br>Output the signa<br>Reserved setting                                                                                                     | ove signal<br>I from the<br>I from the<br>I from the<br>I from the<br>I from the<br>(Do not u<br>t change.   | output is r<br>CN1-1 or<br>CN1-23 o<br>CN1-25 o<br>CN1-27 o<br>CN1-29 o<br>se.)      | not used).<br>CN1-2 outpur<br>r CN1-24 out<br>r CN1-26 out<br>r CN1-28 out                 | t terminal.<br>put terminal.<br>put terminal.<br>put terminal.                  | Setup               | page<br>11-9                |
| Pn51A<br>Pn51B<br>Pn51E | 4    | n.□X□□<br>n.X□□□<br>Motor-Loa<br>Deviation<br>Detection | 0<br>1<br>2<br>3<br>4<br>5<br>6<br>Reserved<br>Reserved<br>Ad Position<br>Overflow<br>Level<br>Deviation Ove                                                     | Disabled (the abi<br>Output the signa<br>Output the signa<br>Output the signa<br>Output the signa<br>Output the signa<br>Reserved setting<br>Darameter (Do no<br>Darameter (Do no<br>Darameter (Do no<br>Darameter (Do no<br>Darameter (Do no | Dive signal<br>I from the<br>I from the<br>I from the<br>I from the<br>(Do not u<br>ot change.<br>Di change. | output is r<br>CN1-1 or<br>CN1-23 o<br>CN1-25 o<br>CN1-27 o<br>CN1-29 o<br>se.)<br>) | not used).<br>CN1-2 outpur<br>r CN1-24 out<br>r CN1-26 out<br>r CN1-28 out<br>r CN1-30 out | t terminal.<br>put terminal.<br>put terminal.<br>put terminal.<br>put terminal. | Setup               | page<br>11-9<br>page<br>9-9 |

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| <u>.</u>         | Continued from previous page. |                                        |                                        |                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                |                    |                      |                  |                     |                |
|------------------|-------------------------------|----------------------------------------|----------------------------------------|----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|--------------------|----------------------|------------------|---------------------|----------------|
| Parameter<br>No. | Size                          | Na                                     | ame                                    |                                                                                                                | Setting<br>Range                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Setting<br>Unit                | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |
| Pn522            | 4                             | Positioning<br>Width                   | Complete                               | ed                                                                                                             | 0 to<br>1,073,741,824                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1 refer-<br>ence<br>unit       | 7                  | All                  | Immedi-<br>ately | Setup               | page<br>7-12   |
| Pn524            | 4                             | Near Signa                             | l Width                                |                                                                                                                | 1 to<br>1,073,741,824                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1 refer-<br>ence<br>unit       | 107374<br>1824     | All                  | Immedi-<br>ately | Setup               | page<br>7-14   |
| Pn526            | 4                             | Position De<br>flow Alarm<br>Servo ON  |                                        | /er-                                                                                                           | 1 to<br>1,073,741,823                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1 refer-<br>ence<br>unit       | 5242880            | All                  | Immedi-<br>ately | Setup               | page<br>9-10   |
| Pn528            | 2                             | Position De<br>flow Warnir<br>Servo ON |                                        |                                                                                                                | 10 to 100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1%                             | 100                | All                  | Immedi-<br>ately | Setup               | page<br>9-10   |
| Pn529            | 2                             | Speed Limi<br>Servo ON                 | t Level at                             |                                                                                                                | 0 to 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1 min <sup>-1</sup>            | 10000              | Rotary               | Immedi-<br>ately | Setup               | page<br>9-10   |
| Pn52A            | 2                             | Multiplier p<br>closed Rot             |                                        |                                                                                                                | 0 to 100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1%                             | 20                 | Rotary               | Immedi-<br>ately | Tuning              | page<br>11-9   |
| Pn52B            | 2                             | Overload V                             | /arning Le                             | vel                                                                                                            | 1 to 100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1%                             | 20                 | All                  | Immedi-<br>ately | Setup               | page<br>6-40   |
| Pn52C            | 2                             | Base Curre<br>at Motor O<br>Detection  |                                        | g                                                                                                              | 10 to 100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1%                             | 100                | All                  | After<br>restart | Setup               | page<br>6-41   |
|                  | 2                             |                                        | Program Jogging-<br>Related Selections |                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | -                              | 0000h              | All                  | Immedi-<br>ately | Setup               | page<br>8-14   |
|                  |                               |                                        |                                        |                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                |                    |                      |                  |                     |                |
|                  |                               |                                        | Program                                | Jog                                                                                                            | ging Operatior                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | n Pattern                      |                    |                      |                  |                     |                |
|                  |                               | 0                                      |                                        | Waiting time in Pn535 $\rightarrow$ Forward by travel distance in Pn531) $\times$ Number of novements in Pn536 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                |                    |                      |                  |                     |                |
|                  |                               |                                        | 1                                      | mo                                                                                                             | aiting time in Pn535 $\rightarrow$ Reverse by travel distance in Pn531) $\times$ Number of overnents in Pn536                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                |                    |                      |                  |                     |                |
|                  |                               |                                        | 2                                      | mo<br>(Wa                                                                                                      | aiting time in Pr<br>vements in Pn5<br>aiting time in Pr<br>vements in Pn5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 536<br>1535 → Re               | -                  |                      |                  |                     |                |
| Pn530            | ľ                             | n.000X                                 | 3                                      | mo<br>(Wa                                                                                                      | aiting time in Provinsion of the provinsi of the provinsion of the provinsion of the | ,                              |                    |                      |                  |                     |                |
|                  |                               |                                        | 4                                      |                                                                                                                | aiting time in Pr<br>Pn535 → Rever<br>536                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                |                    |                      |                  |                     |                |
|                  |                               |                                        | 5                                      |                                                                                                                | aiting time in Pn<br>Pn535 → Forwa<br>536                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                |                    |                      |                  |                     |                |
|                  | I                             | n.00X0                                 | Reserved                               | d pa                                                                                                           | rameter (Do no                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ot change.                     | )                  |                      |                  |                     |                |
|                  | 1                             | n.OXOO                                 | Reserved                               | d pa                                                                                                           | rameter (Do no                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ot change.                     | )                  |                      |                  |                     |                |
|                  | I                             | n.XDDD                                 | Reserved                               | d pa                                                                                                           | rameter (Do no                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ot change.                     | )                  |                      |                  |                     |                |
|                  |                               |                                        |                                        |                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                |                    |                      |                  |                     |                |
| Pn531            | 4                             | Program Jo<br>Distance                 | ogging Tra                             | vel                                                                                                            | 1 to<br>1,073,741,824                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1 refer-<br>ence<br>unit       | 32768              | All                  | Immedi-<br>ately | Setup               | page<br>8-14   |
| Pn533            | 2                             | Program Jo<br>ment Spee                |                                        | ve-                                                                                                            | 1 to 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Rotary:<br>1 min <sup>-1</sup> | 500                | Rotary               | Immedi-<br>ately | Setup               | page<br>8-14   |
| Pn534            | 2                             | Program Jo<br>eration/Deo<br>Time      |                                        | cel-                                                                                                           | 2 to 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1 ms                           | 100                | All                  | Immedi-<br>ately | Setup               | page<br>8-14   |
|                  |                               |                                        |                                        |                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                |                    |                      |                  |                     |                |
| Pn535            | 2                             | Program Jo<br>ing Time                 | ogging Wa                              | uit-                                                                                                           | 0 to 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1 ms                           | 100                | All                  | Immedi-<br>ately | Setup               | page<br>8-14   |

Continued from previous page.

|                  |      |                         |                 |                                                                                                                                  |                 |                    | Cor                  | tinued from              | n previou           | s page                       |  |  |
|------------------|------|-------------------------|-----------------|----------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------------|----------------------|--------------------------|---------------------|------------------------------|--|--|
| Parameter<br>No. | Size | N                       | lame            | Setting<br>Range                                                                                                                 | Setting<br>Unit | Default<br>Setting | Applicable<br>Motors | When<br>Enabled          | Classi-<br>fication | Refer-<br>ence               |  |  |
|                  | 2    | ZONE Out<br>Selections  | put Signal<br>1 | 0000h to<br>6666h                                                                                                                | -               | 0000h              | All                  | After<br>restart         | Setup               | -                            |  |  |
|                  |      |                         | ZONE Table      | Entry 1 (/ZONE                                                                                                                   | E0) Signal      | Allocation         | 1                    |                          | Refere              | ence                         |  |  |
|                  |      |                         | 0 Di            | sabled (the abo <sup>,</sup>                                                                                                     | ve signal c     | output is no       | ot used).            |                          |                     |                              |  |  |
|                  |      |                         | 1 Ou            | utput the signal                                                                                                                 | from the C      | CN1-1 or C         | N1-2 output          | terminal.                |                     |                              |  |  |
|                  |      | n.🗆 🗆 🗆 X               |                 | utput the signal                                                                                                                 |                 |                    |                      |                          |                     |                              |  |  |
|                  |      |                         |                 | utput the signal                                                                                                                 |                 |                    | •                    |                          | page                | 7-65                         |  |  |
|                  |      |                         |                 | utput the signal                                                                                                                 |                 |                    |                      |                          |                     |                              |  |  |
|                  |      |                         |                 | utput the signal                                                                                                                 |                 |                    | CN1-30 outp          | ut terminai.             |                     |                              |  |  |
| Pn53C            |      |                         | 6 Re            | eserved setting (                                                                                                                | (Do not us      | e.)                |                      |                          |                     |                              |  |  |
|                  |      |                         | ZONE Table      | Entry 2 (/ZONE                                                                                                                   | E1) Signal      | Allocation         | 1                    |                          | Refere              | ence                         |  |  |
|                  |      | n.□□X□                  |                 | e allocations arong a locations.                                                                                                 |                 | e as the /Z        | ONE0 (ZONE           | Table Entry              | 1) page             | page 7-65                    |  |  |
|                  |      |                         | ZONE Table      | ZONE Table Entry 3 (/ZONE2) Signal Allocation                                                                                    |                 |                    |                      |                          |                     |                              |  |  |
|                  |      | n.¤X¤¤                  |                 | e allocations arong a locations.                                                                                                 |                 | e as the /Z        | ONE0 (ZONE           | Table Entry              | 1) page             | 7-65                         |  |  |
|                  |      |                         | ZONE Table      | NE Table Entry 4 (/ZONE3) Signal Allocation                                                                                      |                 |                    |                      |                          |                     |                              |  |  |
|                  |      | n.XDDD                  |                 | e allocations ar                                                                                                                 |                 | e as the /Z        | ONE0 (ZONE           | Table Entry <sup>-</sup> | 1) page             | 7-65                         |  |  |
|                  |      |                         | SIQ             | gnal allocations.                                                                                                                |                 |                    |                      |                          |                     |                              |  |  |
|                  | 2    | ZONE Out<br>Selections  |                 | 0000h to<br>0006h                                                                                                                | _               | 0000h              | All                  | After<br>restart         | Setup               | -                            |  |  |
|                  |      |                         |                 |                                                                                                                                  |                 |                    |                      |                          |                     |                              |  |  |
|                  |      |                         | i i             | NE n Signal Ou                                                                                                                   | . , .           |                    |                      |                          | Refere              | ence                         |  |  |
|                  |      |                         |                 | sabled (the abo                                                                                                                  | Ŭ               |                    | ,                    | torminal                 |                     |                              |  |  |
|                  |      |                         |                 | 1 Output the signal from the CN1-1 or CN1-2 output terminal.                                                                     |                 |                    |                      |                          |                     |                              |  |  |
|                  |      | n.🗆🗆 🗆 X                |                 | 2 Output the signal from the CN1-23 or CN1-24 output terminal.<br>3 Output the signal from the CN1-25 or CN1-26 output terminal. |                 |                    |                      |                          |                     |                              |  |  |
| Pn53D            |      |                         |                 |                                                                                                                                  |                 |                    | -                    |                          | page                | 00                           |  |  |
| 21153D           |      |                         |                 |                                                                                                                                  |                 |                    |                      |                          |                     |                              |  |  |
|                  |      |                         |                 | eserved setting (                                                                                                                |                 |                    |                      |                          |                     |                              |  |  |
|                  |      | n.DDXD                  | Reserved p      | arameter (Do no                                                                                                                  | ot change       | )                  |                      |                          |                     |                              |  |  |
|                  |      |                         |                 |                                                                                                                                  |                 |                    |                      |                          |                     |                              |  |  |
|                  |      | n.¤X¤¤                  | Reserved pa     | arameter (Do no                                                                                                                  | ot change.      | .)                 |                      |                          |                     |                              |  |  |
|                  |      | n.XDDD                  | Reserved pa     | arameter (Do no                                                                                                                  | ot change       | .)                 |                      |                          |                     |                              |  |  |
|                  |      |                         |                 |                                                                                                                                  |                 |                    |                      |                          |                     |                              |  |  |
| Pn550            | 2    | Analog Mo<br>Voltage    | onitor 1 Offset | -10,000 to<br>10,000                                                                                                             | 0.1 V           | 0                  | All                  | Immedi-<br>ately         | Setup               | page<br>10-1                 |  |  |
| Pn551            | 2    | Voltage                 | onitor 2 Offset | 10,000                                                                                                                           | 0.1 V           | 0                  | All                  | Immedi-<br>ately         | Setup               | page<br>10-1                 |  |  |
| Pn552            | 2    | nification              | onitor 1 Mag-   | -10,000 to<br>10,000                                                                                                             | × 0.01          | 100                | All                  | Immedi-<br>ately         | Setup               | page<br>10-1                 |  |  |
| Pn553            | 2    | nification              | onitor 2 Mag-   | -10,000 to<br>10,000                                                                                                             | × 0.01          | 100                | All                  | Immedi-<br>ately         | Setup               | page<br>10-1                 |  |  |
| Pn55A            | 2    | Monitor Ur              |                 | 1 to 1,440                                                                                                                       | 1 min           | 1                  | All                  | Immedi-<br>ately         | Setup               | -                            |  |  |
| Pn560            | 2    | Residual V<br>Detection |                 | 1 to 3,000                                                                                                                       | 0.1%            | 400                | All                  | Immedi-<br>ately         | Setup               | page<br>9-56                 |  |  |
| Pn561            | 2    | Overshoot<br>Level      | Detection       | 0 to 100                                                                                                                         | 1%              | 100                | All                  | Immedi-<br>ately         | Setup               | page<br>9-31<br>page<br>9-40 |  |  |
| Pn581            | 2    | Zero Spee               | d Level         | 1 to 10,000                                                                                                                      | 1 mm/s          | 20                 | Linear               | Immedi-<br>ately         | Setup               | page<br>7-9                  |  |  |
|                  |      |                         |                 |                                                                                                                                  |                 |                    |                      | Cantinus                 | بمصحب مام           | +                            |  |  |

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14-31

|                     |                                                            |                                      |                                          |                                                 |                      |                    | Con                  | tinued fron      | n previou           | s page.        |  |  |  |  |
|---------------------|------------------------------------------------------------|--------------------------------------|------------------------------------------|-------------------------------------------------|----------------------|--------------------|----------------------|------------------|---------------------|----------------|--|--|--|--|
| Parameter<br>No.    | Size                                                       | N                                    | ame                                      | Setting<br>Range                                | Setting<br>Unit      | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |  |  |  |  |
| Pn582               | 2                                                          | Speed Coi<br>Detection S<br>Width    | ncidence<br>Signal Output                | 0 to 100                                        | 1 mm/s               | 10                 | Linear               | Immedi-<br>ately | Setup               | page<br>7-11   |  |  |  |  |
| Pn583               | 2                                                          | Brake Refe<br>put Speed              | erence Out-<br>Level                     | 0 to 10,000                                     | 1 mm/s               | 10                 | Linear               | Immedi-<br>ately | Setup               | page<br>6-32   |  |  |  |  |
| Pn584               | 2                                                          | Speed Lim<br>Servo ON                | it Level at                              | 0 to 10,000                                     | 1 mm/s               | 10000              | Linear               | Immedi-<br>ately | Setup               | page<br>9-10   |  |  |  |  |
| Pn585               | 2                                                          | Program J<br>ment Spee               | ogging Move<br>d                         | 1 to 10,000                                     | 1 mm/s               | 50                 | Linear               | Immedi-<br>ately | Setup               | page<br>8-14   |  |  |  |  |
| Pn586               | 2                                                          | Motor Run<br>Ratio                   | ning Cooling                             | 0 to 100                                        | 1%/<br>Max.<br>speed | 0                  | Linear               | Immedi-<br>ately | Setup               | -              |  |  |  |  |
|                     | 2                                                          |                                      | tection<br>Selection for<br>inear Encode | 0000h to<br>0001h                               | _                    | 0000h              | Linear               | Immedi-<br>ately | Setup               | -              |  |  |  |  |
|                     | _                                                          |                                      | T                                        |                                                 |                      |                    |                      |                  | 1                   |                |  |  |  |  |
|                     |                                                            |                                      |                                          | Detection Selection for Absolute Linear Encoder |                      |                    |                      |                  |                     | nce            |  |  |  |  |
| D. 507              |                                                            | n.🗆🗆 🗆 X                             |                                          | not detect polar                                |                      | page 6-            | -24                  |                  |                     |                |  |  |  |  |
| Pn587               |                                                            |                                      | 1 Det                                    | ect polarity.                                   |                      |                    |                      | <u> </u>         |                     |                |  |  |  |  |
|                     |                                                            | n.🗆 🗆 X 🗆                            | Reserved p                               | arameter (Do no                                 | ot change.           | )                  |                      |                  |                     |                |  |  |  |  |
|                     |                                                            | n.¤X¤¤                               |                                          |                                                 |                      |                    |                      |                  |                     |                |  |  |  |  |
|                     |                                                            | n.XDDD                               | XDDD Reserved parameter (Do not change.) |                                                 |                      |                    |                      |                  |                     |                |  |  |  |  |
|                     | -                                                          |                                      |                                          |                                                 |                      |                    |                      |                  |                     |                |  |  |  |  |
| Pn600               | 2                                                          | Regenerati<br>Capacity*4             | ve Resistor                              | Depends on model. <sup>*5</sup>                 | 10 W                 | 0                  | All                  | Immedi-<br>ately | Setup               | page<br>6-53   |  |  |  |  |
| Pn601*6             | 2                                                          | Dynamic B<br>tor Allowat<br>Consumpt |                                          | 0 to 65,535                                     | 10 J                 | 0                  | All                  | After<br>restart | Setup               | page<br>6-53   |  |  |  |  |
| Pn603               | 2                                                          | Regenerati<br>tance                  | ve Resis-                                | 0 to 65,535                                     | 10 m $\Omega$        | 0                  | All                  | Immedi-<br>ately | Setup               | page<br>6-53   |  |  |  |  |
| Pn604 <sup>*7</sup> | 2                                                          | Dynamic E<br>tance                   | rake Resis-                              | 0 to 65,535                                     | 10 mΩ                | 0                  | All                  | After<br>restart | Setup               | page<br>6-53   |  |  |  |  |
|                     | 2                                                          | Overheat F<br>Selections             | Protection                               | 0000h to<br>0003h                               | -                    | 0000h              | All                  | After<br>restart | Setup               | page<br>7-68   |  |  |  |  |
|                     |                                                            |                                      |                                          |                                                 |                      |                    |                      |                  |                     |                |  |  |  |  |
|                     |                                                            |                                      | Overheat Pr                              | otection Select                                 | ions                 |                    |                      |                  |                     |                |  |  |  |  |
|                     |                                                            |                                      |                                          | sable overheat p                                |                      |                    |                      |                  |                     |                |  |  |  |  |
|                     |                                                            | n.000X                               |                                          | se overheat prot                                |                      |                    |                      |                  |                     |                |  |  |  |  |
| Pn61A               |                                                            |                                      |                                          | onitor a negative<br>e overheat prote           |                      | nput from a        | a sensor attac       | hed to the r     | nachine ar          | ıd             |  |  |  |  |
| PhotA               |                                                            |                                      | <sub>з</sub> М                           | onitor a positive<br>e overheat prote           | voltage in           | put from a         | sensor attacl        | ned to the m     | achine an           | d              |  |  |  |  |
|                     | I                                                          | n.00X0                               | Reserved p                               | arameter (Do no                                 | ot change.           | )                  |                      |                  |                     |                |  |  |  |  |
|                     | 1                                                          | n.OXOO                               | Reserved p                               | arameter (Do no                                 | ot change.           | )                  |                      |                  |                     |                |  |  |  |  |
|                     | n.XDDD Reserved parameter (Do not change.)                 |                                      |                                          |                                                 |                      |                    |                      |                  |                     |                |  |  |  |  |
| Pn61B*9             | 2                                                          | Overheat A                           | larm Level                               | 0 to 500                                        | 0.01 V               | 250                | All                  | Immedi-<br>ately | Setup               | page<br>7-68   |  |  |  |  |
| Pn61C*9             | 2                                                          | Overheat V                           | Varning Leve                             | 0 to 100                                        | 1%                   | 100                | All                  | Immedi-<br>ately | Setup               | page<br>7-68   |  |  |  |  |
| Pn61D*9             | 2                                                          | Overheat A<br>Time                   | larm Filter                              | 0 to 65,535                                     | 1 s                  | 0                  | All                  | Immedi-<br>ately | Setup               | page<br>7-68   |  |  |  |  |
|                     | 2     Time     0.10 obj,535     1.5     0     All     atel |                                      |                                          |                                                 |                      |                    |                      |                  |                     |                |  |  |  |  |

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|                  |      |                                      |                                                                             | Continued from previous                                                             |                          |                    |                      |                  |                     | s page.        |  |  |  |
|------------------|------|--------------------------------------|-----------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------|--------------------|----------------------|------------------|---------------------|----------------|--|--|--|
| Parameter<br>No. | Size | N                                    | ame                                                                         | Setting<br>Range                                                                    | Setting<br>Unit          | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |  |  |  |
|                  | 2    |                                      | ations Con-                                                                 | 0000h to                                                                            | _                        | 1040h              | All                  | Immedi-          | Setup               | -              |  |  |  |
|                  |      | trols                                |                                                                             | 1FF3h                                                                               |                          | 101011             | 7.01                 | ately            | Cottap              |                |  |  |  |
|                  |      |                                      | MECHATR                                                                     | LINK Commun                                                                         | ications (               | heck Mas           | k for Debugo         | ina              |                     |                |  |  |  |
|                  |      |                                      |                                                                             | not mask.                                                                           |                          |                    |                      | ,9               |                     |                |  |  |  |
|                  |      |                                      |                                                                             | ore MECHATRO                                                                        | I INK com                | nunication         | s errors (A.Ff       | 30).             |                     | -              |  |  |  |
|                  |      | n.🗆🗆 🗆 X                             |                                                                             | ore WDT errors (                                                                    |                          |                    |                      |                  |                     | _              |  |  |  |
|                  |      |                                      | ع اgn                                                                       | ore both MECHA                                                                      | , ,                      | communic           | cations errors       | (A.E60) and      | WDT                 | _              |  |  |  |
|                  |      |                                      |                                                                             | eck Masks                                                                           |                          |                    |                      |                  |                     | i              |  |  |  |
|                  |      |                                      | Ŭ                                                                           | not mask.                                                                           |                          |                    |                      |                  |                     | -              |  |  |  |
|                  |      |                                      | 1 Ign                                                                       | ore data setting                                                                    | warnings (               | A.94 <b>□</b> ).   |                      |                  |                     | _              |  |  |  |
|                  |      |                                      | 2 Ign                                                                       | ore command w                                                                       | arnings (A               | .95□).             |                      |                  |                     | _              |  |  |  |
|                  |      |                                      | 3 Ign                                                                       | ore both A.94                                                                       | and A.95                 | J warnings         | 3.                   |                  |                     | _              |  |  |  |
|                  |      |                                      | 4 Ign                                                                       |                                                                                     |                          |                    |                      |                  |                     |                |  |  |  |
| Pn800            |      |                                      | 5 Ign                                                                       | ore both A.94                                                                       | and A.96 <b>E</b>        | J warnings         | 8.                   |                  |                     | -              |  |  |  |
| 1 11000          |      |                                      | 6 Ign                                                                       | ore both A.95                                                                       | and A.96 <b>E</b>        | J warnings         | 8.                   |                  |                     | -              |  |  |  |
|                  |      | n.🗆🗆 X 🗆                             | 7 Ign                                                                       |                                                                                     |                          |                    |                      |                  |                     |                |  |  |  |
|                  |      |                                      | 8 Ign                                                                       |                                                                                     |                          |                    |                      |                  |                     |                |  |  |  |
|                  |      |                                      | 9 Ignore A.94 <sup>II</sup> , A.97A, and A.97b warnings.                    |                                                                                     |                          |                    |                      |                  |                     |                |  |  |  |
|                  |      |                                      | A Ign                                                                       |                                                                                     |                          |                    |                      |                  |                     |                |  |  |  |
|                  |      |                                      | B Ign                                                                       | B Ignore A.94 <sup>,</sup> A.95 <sup>,</sup> A.97A, and A.97b warnings.             |                          |                    |                      |                  |                     |                |  |  |  |
|                  |      |                                      | C Ignore A.96 <sup>II</sup> , A.97A, and A.97b warnings.                    |                                                                                     |                          |                    |                      |                  |                     |                |  |  |  |
|                  |      | -                                    | D Ign                                                                       | D Ignore A.94 <sup>,</sup> A.96 <sup>,</sup> A.97A, and A.97 <sup>b</sup> warnings. |                          |                    |                      |                  |                     |                |  |  |  |
|                  |      |                                      | E Ignore A.95 <sup>□</sup> , A.96 <sup>□</sup> , A.97A, and A.97b warnings. |                                                                                     |                          |                    |                      |                  |                     |                |  |  |  |
|                  |      |                                      | F Ign                                                                       | ore A.94 <b>□</b> , A.95                                                            | □, A.96□                 | , A.97A, a         | nd A.97b war         | nings.           |                     | _              |  |  |  |
|                  |      | n.¤X¤¤                               | Reserved p                                                                  | arameter (Do no                                                                     | ot change                | .)                 |                      |                  |                     |                |  |  |  |
|                  |      | n.XDDD                               | Automatic                                                                   | Narning Clear S                                                                     | election f               | or Debugg          | $ing^{*10}$          |                  |                     |                |  |  |  |
|                  |      | M3 *10                               | 0 Ret                                                                       | ain warnings for                                                                    | debuggin                 | g.                 |                      |                  |                     | _              |  |  |  |
|                  |      |                                      | 1 Aut                                                                       | omatically clear                                                                    | warnings (               | MECHATE            | OLINK-III spe        | ecification).    |                     | _              |  |  |  |
|                  | 2    | Application<br>Selections<br>Limits) | Function<br>6 (Software                                                     | 0000h to<br>0103h                                                                   | _                        | 0003h              | All                  | Immedi-<br>ately | Setup               | page<br>7-27   |  |  |  |
|                  |      |                                      | Software L                                                                  | mit Selection                                                                       |                          |                    |                      |                  |                     |                |  |  |  |
|                  |      |                                      | 0 Ena                                                                       | ble both forward                                                                    | d and reve               | rse softwa         | re limits.           |                  |                     | -              |  |  |  |
|                  |      | n.🗆🗆 🗆 X                             | 1 Dis                                                                       | able forward sof                                                                    | tware limit              |                    |                      |                  |                     | -              |  |  |  |
|                  |      |                                      | 2 Dis                                                                       | able reverse soft                                                                   | ware limit.              |                    |                      |                  |                     | -              |  |  |  |
| Pn801            |      |                                      | 3 Dis                                                                       | able both forwar                                                                    | d and reve               | erse softwa        | are limits.          |                  |                     | _              |  |  |  |
|                  |      | n.🗆 🗆 X 🗆                            | Reserved p                                                                  | arameter (Do no                                                                     | ot change                | .)                 |                      |                  |                     | [              |  |  |  |
|                  |      |                                      | Software L                                                                  | mit Check for R                                                                     | eferences                |                    |                      |                  |                     |                |  |  |  |
|                  |      | n.¤X¤¤                               |                                                                             | not perform soft                                                                    |                          |                    | references.          |                  |                     |                |  |  |  |
|                  |      |                                      |                                                                             | form software lir                                                                   |                          |                    |                      |                  |                     | _              |  |  |  |
|                  |      |                                      |                                                                             |                                                                                     |                          |                    |                      |                  |                     | -              |  |  |  |
|                  |      | n.XOOO                               | Reserved p                                                                  | arameter (Do no                                                                     | or change                | .)                 |                      |                  |                     |                |  |  |  |
| Pn803            | 2    | Origin Ran                           | ge                                                                          | 0 to 250                                                                            | 1 refer-<br>ence<br>unit | 10                 | All                  | Immedi-<br>ately | Setup               | *1             |  |  |  |
|                  | L    |                                      |                                                                             |                                                                                     | Grift                    |                    |                      | L                | I                   | L              |  |  |  |

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Parameter Lists

|                            | Continued from previous |                                              |                              |                                       |                                                  |                    |                      |                                 |                     | s page.        |
|----------------------------|-------------------------|----------------------------------------------|------------------------------|---------------------------------------|--------------------------------------------------|--------------------|----------------------|---------------------------------|---------------------|----------------|
| Parameter<br>No.           | Size                    | N                                            | ame                          | Setting<br>Range                      | Setting<br>Unit                                  | Default<br>Setting | Applicable<br>Motors | When<br>Enabled                 | Classi-<br>fication | Refer-<br>ence |
| Pn804                      | 4                       | Forward So                                   | oftware Limit                | -1,073,741,823<br>to<br>1,073,741,823 | 1 refer-<br>ence<br>unit                         | 107374<br>1823     | All                  | Immedi-<br>ately                | Setup               | page<br>7-27   |
| Pn806                      | 4                       | Reverse So                                   | oftware Limit                | -1,073,741,823<br>to<br>1,073,741,823 | 1 refer-<br>ence<br>unit                         | -10737<br>41823    | All                  | Immedi-<br>ately                | Setup               | page<br>7-27   |
| Pn808                      | 4                       | Absolute E<br>Offset                         | ncoder Origin                | -1,073,741,823<br>to<br>1,073,741,823 | 1 refer-<br>ence<br>unit                         | 0                  | All                  | Immedi-<br>ately <sup>*11</sup> | Setup               | page<br>6-50   |
| Pn80A                      | 2                       | First Stage<br>eration Co                    | Linear Accel-<br>nstant      | 1 to 65,535                           | 10,000<br>refer-<br>ence<br>units/s <sup>2</sup> | 100                | All                  | Immedi-<br>ately <sup>*12</sup> | Setup               | *1             |
| Pn80B                      | 2                       | Second Stage Linear<br>Acceleration Constant |                              | 1 to 65,535                           | 10,000<br>refer-<br>ence<br>units/s <sup>2</sup> | 100                | All                  | Immedi-<br>ately <sup>*12</sup> | Setup               | *1             |
| Pn80C                      | 2                       | Acceleration<br>Switching                    | on Constant<br>Speed         | 0 to 65,535                           | 100 ref-<br>erence<br>units/s                    | 0                  | All                  | Immedi-<br>ately <sup>*12</sup> | Setup               | *1             |
| Pn80D                      | 2                       | First Stage<br>Deceleratio                   | Linear<br>on Constant        | 1 to 65,535                           | 10,000<br>refer-<br>ence<br>units/s <sup>2</sup> | 100                | All                  | Immedi-<br>ately <sup>*12</sup> | Setup               | *1             |
| Pn80E                      | 2                       | Second St<br>Deceleratio                     | age Linear<br>on Constant    | 1 to 65,535                           | 10,000<br>refer-<br>ence<br>units/s <sup>2</sup> | 100                | All                  | Immedi-<br>ately <sup>*12</sup> | Setup               | *1             |
| Pn80F                      | 2                       | Deceleration                                 | on Constant<br>Speed         | 0 to 65,535                           | 100 ref-<br>erence<br>units/s                    | 0                  | All                  | Immedi-<br>ately <sup>*12</sup> | Setup               | *1             |
| Pn810                      | 2                       |                                              | al Accelera-<br>eration Bias | 0 to 65,535                           | 100 ref-<br>erence<br>units/s                    | 0                  | All                  | Immedi-<br>ately <sup>*13</sup> | Setup               | *1             |
| Pn811                      | 2                       |                                              | al Accelera-<br>eration Time | 0 to 5,100                            | 0.1 ms                                           | 0                  | All                  | Immedi-<br>ately <sup>*13</sup> | Setup               | *1             |
| Pn812                      | 2                       | Movement<br>Time                             | Average                      | 0 to 5,100                            | 0.1 ms                                           | 0                  | All                  | Immedi-<br>ately *13            | Setup               | *1             |
| Pn814                      | 4                       | External Po<br>Final Trave                   |                              | -1,073,741,823<br>to<br>1,073,741,823 | 1 refer-<br>ence<br>unit                         | 100                | All                  | Immedi-<br>ately                | Setup               | *1             |
|                            | 2                       | Origin Retu<br>tings                         | ırn Mode Set-                | 0000h to<br>0001h                     | -                                                | 0000h              | All                  | Immedi-<br>ately                | Setup               | *14            |
| Pn816<br>M2 <sup>*15</sup> |                         | n.000X                                       | 1 Retur                      | n in forward di<br>n in reverse dir   | rection.                                         |                    |                      |                                 |                     | -              |
|                            |                         | n.DDXD                                       | Reserved par                 | rameter (Do no                        | ot change.                                       | )                  |                      |                                 |                     |                |
|                            | 1                       | n.¤X¤¤                                       | Reserved par                 | rameter (Do no                        | ot change.                                       | )                  |                      |                                 |                     |                |
|                            | I                       | n.XOOO                                       | Reserved par                 | rameter (Do no                        | ot change.                                       | )                  |                      |                                 |                     |                |
| Pn817<br>*16               | 2                       | Origin App<br>1                              | roach Speed                  | 0 to 65,535                           | 100 ref-<br>erence<br>units/s                    | 50                 | All                  | Immedi-<br>ately <sup>*12</sup> | Setup               | *1             |
| Pn818<br>*17               | 2                       | Origin App<br>2                              | roach Speed                  | 0 to 65,535                           | 100 ref-<br>erence<br>units/s                    | 5                  | All                  | Immedi-<br>ately <sup>*12</sup> | Setup               | *1             |
| Pn819                      | 4                       | Final Trave<br>Origin Retu                   | l Distance for<br>urn        | -1,073,741,823<br>to<br>1,073,741,823 | 1 refer-<br>ence<br>unit                         | 100                | All                  | Immedi-<br>ately                | Setup               | *1             |

|                  |      |                           |                                                                                   |                      |                  |                    |                      | itinued fron     | n previou           | s page.        |
|------------------|------|---------------------------|-----------------------------------------------------------------------------------|----------------------|------------------|--------------------|----------------------|------------------|---------------------|----------------|
| Parameter<br>No. | Size | N                         | ame                                                                               | Setting<br>Range     | Setting<br>Unit  | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |
|                  | 2    | Input Signa<br>Selections | al Monitor                                                                        | 0000h to<br>7777h    | -                | 0000h              | All                  | Immedi-<br>ately | Setup               | *14            |
|                  |      |                           |                                                                                   |                      |                  |                    |                      |                  |                     | _              |
|                  |      |                           | IO12 Signal I                                                                     | Mapping              |                  |                    |                      |                  |                     |                |
|                  |      |                           |                                                                                   | ot map.              |                  |                    |                      |                  |                     | _              |
|                  |      |                           | 1 Moni                                                                            | tor CN1-13 inp       | ut termina       | Ι.                 |                      |                  |                     | _              |
|                  |      |                           | 2 Moni                                                                            | tor CN1-7 inpu       | t terminal.      |                    |                      |                  |                     | _              |
|                  |      | n.🗆🗆🛛 X                   | 3 Moni                                                                            | tor CN1-8 inpu       | t terminal.      |                    |                      |                  |                     | _              |
|                  |      |                           | 4 Moni                                                                            | tor CN1-9 inpu       | t terminal.      |                    |                      |                  |                     | _              |
| Pn81E            |      |                           | 5 Moni                                                                            | tor CN1-10 inp       | ut termina       | l.                 |                      |                  |                     | _              |
| M2 *15           |      |                           | 6 Moni                                                                            | tor CN1-11 inp       | ut termina       | l.                 |                      |                  |                     | _              |
|                  |      |                           | 7 Moni                                                                            | tor CN1-12 inp       | ut termina       | l.                 |                      |                  |                     | _              |
|                  |      |                           | IO13 Signal Mapping                                                               |                      |                  |                    |                      |                  |                     |                |
|                  |      | n.□□X□                    | DXD         0 to 7         The mappings are the same as the IO12 signal mappings. |                      |                  |                    |                      |                  |                     |                |
|                  |      |                           | IO14 Signal I                                                                     | Vapping              |                  |                    |                      |                  |                     |                |
|                  |      | n.¤X¤¤                    |                                                                                   | nappings are tl      | ne same a        | s the IO12         | signal mappi         | ngs.             |                     | _              |
|                  |      | X                         | IO15 Signal I                                                                     | Vapping              |                  |                    |                      |                  |                     |                |
|                  |      | n.XDDD                    | 0 to 7 The r                                                                      | mappings are tl      | ne same a        | s the IO12         | signal mappi         | ngs.             |                     | -              |
|                  |      |                           |                                                                                   |                      |                  |                    |                      |                  |                     |                |
|                  | 2    | Command tions             | Data Alloca-                                                                      | 0000h to<br>1111h    | -                | 0010h              | All                  | After<br>restart | Setup               | *14            |
|                  |      |                           |                                                                                   | 1                    |                  |                    | I                    | I                |                     |                |
|                  |      |                           | Option Field                                                                      | Allocation           |                  |                    |                      |                  |                     |                |
|                  |      | n.🗆 🗆 🗆 X                 |                                                                                   | ole option field     | allocation.      |                    |                      |                  |                     | -              |
| D 045            |      |                           |                                                                                   | le option field a    |                  |                    |                      |                  |                     | -              |
| Pn81F<br>M2 *15  |      |                           | Position Con                                                                      | trol Command         | TFF/TLIM         | 1 Allocatio        | n                    |                  |                     |                |
|                  |      | n.🗆🗆 X 🗆                  |                                                                                   | ole allocation.      |                  |                    |                      |                  |                     | -              |
|                  |      |                           | 1 Enab                                                                            | le allocation.       |                  |                    |                      |                  |                     | -              |
|                  |      | n.¤X¤¤                    | Reserved par                                                                      | rameter (Do no       | ot change.       | )                  |                      |                  |                     | Ī              |
|                  |      | n.XDDD                    | Reserved par                                                                      | rameter (Do no       | ot change.       | )                  |                      |                  |                     | Ī              |
|                  |      |                           |                                                                                   | (                    |                  | ,                  |                      |                  |                     | -              |
| D=000            | 4    | Fam. c.d.l                |                                                                                   | -2,147,483,648       | 1 refer-         | 0                  | A.!!                 | Immedi-          | Onto                |                |
| Pn820            | 4    | Forward La                | atching Area                                                                      | to<br>2,147,483,647  | ence<br>unit     | 0                  | All                  | ately            | Setup               | *1             |
|                  | 1    | 1                         |                                                                                   | 0 1 47 400 040       | 1 rofor          |                    |                      |                  |                     |                |
| Pn822            | 4    | Povoroo L c               | atching Area                                                                      | -2,147,483,648<br>to | 1 refer-<br>ence | 0                  | All                  | Immedi-          | Setup               | *1             |

Continued on next page.

|                  |      |                              |                                                                        |                                             |                           |                    | Cor                  | ntinued fro      | om previou          | s page         |  |  |
|------------------|------|------------------------------|------------------------------------------------------------------------|---------------------------------------------|---------------------------|--------------------|----------------------|------------------|---------------------|----------------|--|--|
| Parameter<br>No. | Size |                              | Name                                                                   | Setting<br>Range                            | Setting<br>Unit           | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |  |  |
|                  | 2    | Option M<br>tion             | Ionitor 1 Selec-                                                       | 0000h to<br>FFFFh                           | _                         | 0000h              | _                    | Immedi-<br>ately | Setup               | *1             |  |  |
|                  |      | Setting<br>igh-Speed<br>000h | Monitor Region                                                         |                                             | Monitor<br>speed det      | ection spe         | ed]                  |                  | oplicable M         | otors          |  |  |
|                  | 0    | 001h                         | Speed reference                                                        | e [1000000h/c                               | overspeed                 | detection          | speed]               |                  | All                 |                |  |  |
|                  | 0    | 002h                         | Torque [100000                                                         | 00h/maximum                                 | torque]                   |                    |                      |                  | All                 |                |  |  |
|                  | 0    | 003h                         | Position deviati                                                       | on (lower 32 b                              | its) [refere              | nce units]         |                      |                  | All                 |                |  |  |
|                  | 0    | 004h                         | Position deviati                                                       | on (upper 32 k                              | oits) [refere             | ence units]        |                      |                  | All                 |                |  |  |
|                  | 0    | 00Ah                         | Encoder count                                                          | (lower 32 bits)                             | [reference                | e units]           |                      |                  | All                 |                |  |  |
|                  | 0    | 00Bh                         | Encoder count                                                          | (upper 32 bits                              | ) [referenc               | e units]           |                      |                  | All                 |                |  |  |
|                  | 0    | 00Ch                         | FPG count (low                                                         | ver 32 bits) [ref                           | erence un                 | ts]                |                      |                  | All                 |                |  |  |
|                  | 0    | 00Dh                         | FPG count (up)                                                         | per 32 bits) [ref                           | ference un                | its]               |                      |                  | All                 |                |  |  |
|                  | L    | ow-Speed                     | Monitor Regior                                                         | ı                                           |                           |                    |                      | 1                |                     |                |  |  |
|                  | 0    | 010h                         | Un000: Motor s                                                         | speed [min <sup>-1</sup> ]                  |                           |                    |                      |                  | All                 |                |  |  |
|                  | 0    | 011h                         | Un001: Speed                                                           | Reference [mir                              | ר <sup>-1</sup> ]         |                    |                      |                  | All                 |                |  |  |
|                  | 0    | 012h                         | Un002: Torque                                                          | Reference [%]                               |                           |                    |                      |                  | All                 |                |  |  |
|                  | 0    | 013h                         | Un003: Rotatio<br>Number of enc<br>displayed in de                     | nal Angle 1 [er<br>oder pulses fro<br>cimal | ncoder pul<br>om origin v | vithin one e       | encoder rotat        | ion              | All                 |                |  |  |
|                  |      |                              | Un003: Rotatio<br>Linear encoder<br>Un004: Rotatio<br>Electrical angle | pulses from th<br>nal Angle 2 [de           | ne polarity<br>eg]        |                    | layed in decii       | mal              |                     |                |  |  |
| Pn824<br>M3 *10  | 0    | 014h                         | Un004: Electric<br>Electrical angle                                    | al Angle 2 [de                              | ]<br>]                    |                    |                      |                  | - All               |                |  |  |
| WIO              | 0    | 015h                         | Un005: Input S                                                         | ignal Monitor                               |                           |                    |                      |                  | All                 |                |  |  |
|                  | 0    | 016h                         | Un006: Output                                                          | Signal Monito                               | r                         |                    |                      |                  | All                 |                |  |  |
|                  | 0    | 017h                         | Un007: Input R                                                         | eference Spee                               | ed [min <sup>-1</sup> ]   |                    |                      |                  | All                 |                |  |  |
|                  | 0    | 018h                         | Un008: Positio                                                         | n Deviation [ref                            | ference un                | its]               |                      |                  | All                 |                |  |  |
|                  | 0    | 019h                         | Un009: Accum                                                           | ulated Load Ra                              | atio [%]                  |                    |                      |                  | All                 |                |  |  |
|                  | 0    | 01Ah                         | Un00A: Regene                                                          | erative Load R                              | atio [%]                  |                    |                      |                  | All                 |                |  |  |
|                  | 0    | 01Bh                         | Un00B: Dynam                                                           | ic Brake Resis                              | tor Power                 | Consump            | tion [%]             |                  | All                 |                |  |  |
|                  | 0    | 01Ch                         | Un00C: Input F                                                         | Reference Pulse                             | e Counter                 | [reference         | units]               |                  | All                 |                |  |  |
|                  | 0    | 01Dh                         | Un00D: Feedba                                                          | ack Pulse Cou                               | nter [enco                | der pulses         |                      |                  | All                 |                |  |  |
|                  | 0    | 01Eh                         | Un00E: Fully-cl<br>resolution]                                         | osed Loop Fee                               | edback Pu                 | lse Counte         | er [external er      | icoder           | Rotary              |                |  |  |
|                  | 0    | 023h                         | Initial multiturn                                                      | data [Rev]                                  |                           |                    |                      |                  | Rotary              |                |  |  |
|                  | 0    | 024h                         | Initial increment                                                      | tal data [pulses                            | 6]                        |                    |                      |                  | Rotary              |                |  |  |
|                  | 0    | 025h                         | Initial absolute                                                       | position data (                             | lower 32 b                | oits) [pulses      | 5]                   |                  | Linear              |                |  |  |
|                  | 0    | 026h                         | Initial absolute                                                       | position data (                             | upper 32 I                | oits) [pulse       | s]                   |                  | Linear              |                |  |  |
|                  | 0    | 040h                         | Un025: SERVC                                                           | PACK Installat                              | ion Enviro                | nment Mo           | nitor                |                  | All                 |                |  |  |
|                  | 0    | 041h                         | Un026: Servon                                                          | notor Installatic                           | n Environi                | ment Moni          | tor                  |                  | All                 |                |  |  |
|                  | 0    | 042h                         | Un027: Built-in                                                        | Fan Remainin                                | g Life Rati               | 0                  |                      |                  | All                 |                |  |  |
|                  |      | 043h                         | Un028: Capaci                                                          |                                             | -                         |                    |                      |                  | All                 |                |  |  |
|                  |      | 044h                         | Un029: Surge I                                                         |                                             |                           | ning Life R        | atio                 |                  | All                 |                |  |  |
|                  |      | 045h                         | Un02A: Dynam                                                           |                                             |                           | -                  |                      |                  | All                 |                |  |  |
|                  |      | 046h                         | Un032: Instant                                                         |                                             |                           |                    |                      |                  | All                 |                |  |  |
|                  |      | 0401<br>047h                 | Un033: Power                                                           |                                             |                           |                    |                      |                  | All                 |                |  |  |
|                  |      | 04711<br>048h                | Un034: Cumula                                                          |                                             | neumotio                  | <u>ר</u>           |                      |                  | All                 |                |  |  |
|                  |      | 048h                         | Un036: Built-in                                                        |                                             | •                         |                    |                      |                  | All                 |                |  |  |

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| Parameter<br>No. | Size | N                                            | lame                             | Setting<br>Range  | Setting<br>Unit                                  | Default<br>Setting | Applicable<br>Motors | -    | /hen<br>abled               | Classi-<br>fication | Refer-<br>ence |
|------------------|------|----------------------------------------------|----------------------------------|-------------------|--------------------------------------------------|--------------------|----------------------|------|-----------------------------|---------------------|----------------|
|                  |      | Setting                                      |                                  |                   | Monitor                                          |                    |                      |      | Applic                      | able Mot            | ors            |
|                  |      | Communica                                    | ations Module                    | Only              |                                                  |                    |                      |      |                             |                     |                |
|                  | -    | 0080h                                        | Previous value<br>units]         | e of latched fee  | dback po:                                        | sition (LPC        | S1) [reference       | e    |                             | All                 |                |
| Pn824<br>M3 *10  | -    | 0081h                                        | Previous value<br>units]         | e of latched fee  | dback po:                                        | sition (LPC        | S2) [referenc        | e    |                             | All                 |                |
|                  | -    | 0084h                                        | Continuous La                    | atch Status (EX   | (STATUS)                                         |                    |                      |      |                             | All                 |                |
|                  |      | All Areas                                    |                                  |                   |                                                  |                    |                      |      |                             |                     |                |
|                  | -    | Other values Reserved settings (Do not use.) |                                  |                   |                                                  |                    | All                  |      |                             |                     |                |
|                  | -    |                                              | 1                                |                   |                                                  |                    |                      |      |                             |                     |                |
|                  | 2    | Option Mo<br>tion                            | onitor 2 Selec-                  | 0000h to<br>FFFFh | -                                                | 0000h              | All                  |      | medi-<br>ately              | Setup               | *1             |
| D= 005           |      |                                              |                                  |                   |                                                  |                    |                      |      |                             |                     |                |
| Pn825            | -    | 0000h to<br>0084h                            | The settings                     | are the same      | as those fo                                      | or the Opti        | on Monitor 1         | Sele | ction.                      |                     | _              |
|                  |      |                                              |                                  |                   |                                                  |                    |                      |      |                             |                     |                |
| Pn827            | 2    | Linear Deo<br>Constant                       | celeration<br>1 for Stopping     | 1 to 65,535       | 10,000<br>refer-<br>ence<br>units/s <sup>2</sup> | 100                | All                  |      | medi-<br>əly <sup>*12</sup> | Setup               | *1             |
| Pn829            | 2    | SVOFF Wa<br>SVOFF at<br>to Stop)             | aiting Time (for<br>Deceleration | 0 to 65,535       | 10 ms                                            | 0                  | All                  |      | medi-<br>əly <sup>*12</sup> | Setup               | *1             |
|                  |      |                                              |                                  |                   |                                                  |                    |                      | С    | ontinue                     | d on nex            | t page         |

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|                  |      |                 |            |                                    |                                   |                 |                    | Con                  | itinued fron     | n previou           | s page.        |  |  |
|------------------|------|-----------------|------------|------------------------------------|-----------------------------------|-----------------|--------------------|----------------------|------------------|---------------------|----------------|--|--|
| Parameter<br>No. | Size | N               | lame       |                                    | Setting<br>Range                  | Setting<br>Unit | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |  |  |
|                  | 2    | Option Fie<br>1 | ld Allocat | ions                               | 0000h to<br>1E1Eh                 | -               | 1813h              | All                  | After<br>restart | Setup               | *14            |  |  |
|                  |      |                 |            |                                    |                                   |                 |                    |                      |                  |                     |                |  |  |
|                  |      |                 | ACCFIL     | . Alloc                            | ation (Option)                    |                 |                    |                      |                  |                     |                |  |  |
|                  |      |                 | 0          | Alloca                             | ate bits 0 and                    | 1 to ACCF       | ΊL.                |                      |                  |                     |                |  |  |
|                  |      |                 | 1          | Alloca                             | ate bits 1 and 2                  | 2 to ACCF       | ΊL.                |                      |                  |                     |                |  |  |
|                  |      |                 | 2          | Alloca                             | ate bits 2 and 3                  | 3 to ACCF       | IL.                |                      |                  |                     |                |  |  |
|                  |      |                 | 3          | Alloca                             | llocate bits 3 and 4 to ACCFIL.   |                 |                    |                      |                  |                     |                |  |  |
|                  |      |                 | 4          | Alloca                             | Allocate bits 4 and 5 to ACCFIL.  |                 |                    |                      |                  |                     |                |  |  |
|                  |      |                 | 5          | Alloca                             | Allocate bits 5 and 6 to ACCFIL.  |                 |                    |                      |                  |                     |                |  |  |
|                  |      | n.DDDX          | 6          | Alloca                             | ate bits 6 and                    | 7 to ACCF       | ΊL.                |                      |                  |                     | _              |  |  |
|                  |      |                 | 7          | Alloca                             | Allocate bits 7 and 8 to ACCFIL.  |                 |                    |                      |                  |                     |                |  |  |
|                  |      |                 | 8          | Alloca                             | Allocate bits 8 and 9 to ACCFIL.  |                 |                    |                      |                  |                     |                |  |  |
|                  |      |                 | 9          |                                    | Allocate bits 9 and 10 to ACCFIL. |                 |                    |                      |                  |                     |                |  |  |
| Pn82A            |      |                 | A          | Allocate bits 10 and 11 to ACCFIL. |                                   |                 |                    |                      |                  |                     |                |  |  |
| M2 *15           |      |                 | В          |                                    | ate bits 11 and                   |                 | -                  |                      |                  |                     |                |  |  |
|                  |      |                 | С          |                                    | ate bits 12 and                   |                 | -                  |                      |                  |                     | _              |  |  |
|                  |      |                 | D          |                                    | ate bits 13 and                   |                 |                    |                      |                  |                     | _              |  |  |
|                  |      |                 | E          | Alloca                             | ate bits 14 and                   | 15 to AC        | CFIL.              |                      |                  |                     |                |  |  |
|                  |      |                 | ACCFIL     | Alloc                              | ation Enable/I                    | Disable Se      | election           |                      |                  |                     |                |  |  |
|                  |      | n.🗆🗆 X 🗆        | 0          | Disab                              | le ACCFIL allo                    | cation.         |                    |                      |                  |                     |                |  |  |
|                  |      |                 | 1          | Enabl                              | e ACCFIL allo                     | cation.         |                    |                      |                  |                     | _              |  |  |
|                  | -    |                 |            |                                    |                                   |                 |                    |                      |                  |                     | _              |  |  |
|                  |      | n.🗆X🗆           |            |                                    | ation (Option)                    |                 |                    |                      |                  |                     |                |  |  |
|                  |      |                 | 0 to E     | The s                              | ettings are the                   | same as         | tor the AC         | CFIL allocatio       | ns.              |                     |                |  |  |
|                  |      |                 | G_SEL      | Alloca                             | tion Enable/D                     | isable Se       | ection             |                      |                  |                     |                |  |  |
|                  |      | n. XDDD         | 0          | Disab                              | Disable G_SEL allocation.         |                 |                    |                      |                  |                     |                |  |  |
|                  |      |                 | 1          | Enabl                              | e G_SEL alloc                     | ation.          |                    |                      |                  |                     |                |  |  |
|                  |      |                 |            |                                    |                                   |                 |                    |                      |                  |                     |                |  |  |
|                  |      |                 |            |                                    |                                   |                 |                    |                      |                  |                     |                |  |  |

|                   |      |            |                 |                                      |                 |                    | Con                  | itinued fron     | n previou           | s page.        |
|-------------------|------|------------|-----------------|--------------------------------------|-----------------|--------------------|----------------------|------------------|---------------------|----------------|
| Parameter<br>No.  | Size | Ν          | Jame            | Setting<br>Range                     | Setting<br>Unit | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |
|                   | 2    | Option Fie | eld Allocations | 0000h to<br>1F1Fh                    | -               | 1D1Ch              | All                  | After<br>restart | Setup               | *14            |
|                   |      | 2          |                 |                                      |                 |                    |                      | rootart          |                     |                |
|                   |      |            | V_PPI Allocat   | ion (Ontion)                         |                 |                    |                      |                  |                     |                |
|                   |      |            |                 | ate bit 0 to V_F                     | PPI.            |                    |                      |                  |                     |                |
|                   |      |            |                 | ate bit 1 to V_F                     |                 |                    |                      |                  |                     |                |
|                   |      |            |                 |                                      |                 |                    |                      |                  |                     | _              |
|                   |      |            | 3 Alloca        | ate bit 3 to V_F                     | PPI.            |                    |                      |                  |                     | _              |
|                   |      |            | 4 Alloca        | ate bit 4 to V_F                     | PPI.            |                    |                      |                  |                     | _              |
|                   |      |            | 5 Alloca        | ate bit 5 to V_F                     | PPI.            |                    |                      |                  |                     | _              |
|                   |      |            |                 | ate bit 6 to V_F                     |                 |                    |                      |                  |                     | _              |
|                   |      | n.🗆🗆 🛛 X   |                 | ate bit 7 to V_F                     |                 |                    |                      |                  |                     | _              |
|                   |      |            |                 | ate bit 8 to V_F                     |                 |                    |                      |                  |                     | _              |
|                   |      |            |                 | ate bit 9 to V_F                     |                 |                    |                      |                  |                     | _              |
| Pn82B             |      |            |                 | ate bit 10 to $V_{-}$                |                 |                    |                      |                  |                     | _              |
| M2 <sup>*15</sup> |      |            |                 | ate bit 11 to V_<br>ate bit 12 to V_ |                 |                    |                      |                  |                     |                |
|                   |      |            |                 | ate bit 12 to $V_{-}$                |                 |                    |                      |                  |                     | _              |
|                   |      |            |                 | ate bit 14 to V                      | -               |                    |                      |                  |                     | _              |
|                   |      |            |                 | ate bit 15 to V                      | -               |                    |                      |                  |                     | _              |
|                   |      |            |                 |                                      |                 |                    |                      |                  |                     | -              |
|                   |      |            | _               | ion Enable/Di                        |                 | ection             |                      |                  |                     |                |
|                   |      | n.□□X□     |                 | le V_PPI alloca                      |                 |                    |                      |                  |                     | _              |
|                   |      |            | I Ellap         |                                      |                 |                    |                      |                  |                     | _              |
|                   |      |            | P_PI_CLR All    | ocation (Optic                       | on)             |                    |                      |                  |                     |                |
|                   |      | n.¤X¤¤     | 0 to F The s    | ettings are the                      | same as         | for the V_F        | PPI allocations      | 3.               |                     | -              |
|                   |      |            |                 |                                      |                 |                    |                      |                  |                     | _              |
|                   |      |            | P_PI_CLR All    |                                      |                 | Selection          |                      |                  |                     |                |
|                   |      | n.XDDD     |                 | le P_PI_CLR a                        |                 |                    |                      |                  |                     |                |
|                   |      |            | 1 Enab          | e P_PI_CLR a                         | liocation.      |                    |                      |                  |                     | _              |
|                   |      |            |                 |                                      |                 |                    |                      |                  |                     |                |
|                   | 2    |            | d Allocations   | 0000h to                             | _               | 1F1Eh              | All                  | After            | Setup               | *14            |
|                   |      | 3          |                 | 1F1Fh                                |                 |                    |                      | restart          |                     |                |
|                   |      |            |                 |                                      |                 |                    |                      |                  |                     | -              |
|                   |      | n.🗆🗆 🗆 X   | P_CL Allocat    |                                      |                 | for the \/ [       |                      |                  |                     |                |
|                   |      |            | 0 to F The s    | ettings are the                      | same as         | for the V_F        | PPI allocations      | 3.               |                     | _              |
|                   |      |            | P_CL Allocat    | on Fnable/Dis                        | sable Sele      | ction              |                      |                  |                     |                |
|                   |      | n.🗆🗆 X 🗆   |                 | le P_CL alloca                       |                 |                    |                      |                  |                     |                |
| Pn82C             |      |            |                 | e P_CL alloca                        |                 |                    |                      |                  |                     | _              |
| M2 *15            |      |            |                 |                                      |                 |                    |                      |                  |                     | _              |
|                   |      | n.¤X¤¤     | N_CL Allocat    |                                      |                 |                    |                      |                  |                     |                |
|                   |      |            | 0 to F The s    | ettings are the                      | same as         | for the V_F        | PPI allocations      | ŝ.               |                     |                |
|                   |      |            |                 | <b>_</b>                             |                 |                    |                      |                  |                     |                |
|                   |      |            | N_CL Allocat    |                                      |                 | ction              |                      |                  |                     |                |
|                   |      | n.XDDD     |                 | le N_CL alloca                       |                 |                    |                      |                  |                     | _              |
|                   |      |            | 1 Enab          | e N_CL alloca                        | uon.            |                    |                      |                  |                     | -              |
|                   |      |            |                 |                                      |                 |                    |                      | 0 1              | d on nov            |                |

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|------------------|------|-----------------|-------------|--------------------------------------------------------------------------|-------------------|-----------------|--------------------|----------------------|------------------|---------------------|----------------|--|
| Parameter<br>No. | Size | N               | lame        |                                                                          | Setting<br>Range  | Setting<br>Unit | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |  |
|                  | 2    | Option Fie<br>4 | ld Allocati | ons                                                                      | 0000h to<br>1F1Ch | -               | 0000h              | All                  | After<br>restart | Setup               | *14            |  |
|                  |      |                 |             |                                                                          |                   |                 |                    |                      |                  |                     |                |  |
|                  |      |                 | BANK_S      | SEL1                                                                     | Allocation (Op    | otion)          |                    |                      |                  |                     |                |  |
|                  |      |                 | 0           | Alloca                                                                   | ate bits 0 to 3   | to BANK_        | SEL1.              |                      |                  |                     |                |  |
|                  |      |                 |             |                                                                          | ate bits 1 to 4   |                 |                    |                      |                  |                     | _              |  |
|                  |      |                 |             |                                                                          | ate bits 2 to 5   | -               |                    |                      |                  |                     |                |  |
|                  |      |                 |             |                                                                          | ate bits 3 to 6   |                 |                    |                      |                  |                     |                |  |
|                  |      |                 |             |                                                                          | ate bits 4 to 7   | -               |                    |                      |                  |                     | _              |  |
|                  |      | n.🗆 🗆 🗆 X       |             |                                                                          | ate bits 5 to 8   |                 |                    |                      |                  |                     |                |  |
|                  |      |                 |             |                                                                          | ate bits 6 to 9   |                 |                    |                      |                  |                     | _              |  |
|                  |      |                 |             | Allocate bits 7 to 10 to BANK_SEL1. Allocate bits 8 to 11 to BANK SEL1.  |                   |                 |                    |                      |                  |                     |                |  |
|                  |      |                 |             |                                                                          |                   |                 |                    |                      |                  |                     | _              |  |
| Pn82D            |      |                 |             | Allocate bits 9 to 12 to BANK_SEL1. Allocate bits 10 to 13 to BANK SEL1. |                   |                 |                    |                      |                  |                     |                |  |
| M2 *15           |      |                 |             |                                                                          | ate bits 10 to 1  |                 | -                  |                      |                  |                     | _              |  |
|                  |      |                 |             |                                                                          | ate bits 12 to 1  |                 | -                  |                      |                  |                     | _              |  |
|                  |      |                 |             |                                                                          |                   |                 |                    |                      |                  |                     | -              |  |
|                  |      |                 | _           |                                                                          | Allocation Ena    |                 |                    | on                   |                  |                     |                |  |
|                  |      | n.DDXD          |             |                                                                          | IE BANK_SEL       |                 |                    |                      |                  |                     | _              |  |
|                  |      |                 | 1           | Enabi                                                                    | e BANK_SEL1       | allocation      | 1.                 |                      |                  |                     | _              |  |
|                  |      | n.0X00          | -           |                                                                          | Allocation (Op    |                 |                    |                      |                  |                     |                |  |
|                  |      |                 | 0 to F      | The s                                                                    | ettings are the   | same as         | for the V_F        | PPI allocations      | 3.               |                     | _              |  |
|                  |      |                 | LT_DISA     | ABLE Allocation Enable/Disable Selection                                 |                   |                 |                    |                      |                  |                     |                |  |
|                  |      | n.XDDD          | 0           | Disable LT_DISABLE allocation.                                           |                   |                 |                    |                      |                  |                     |                |  |
|                  |      |                 | 1           | Enable LT_DISABLE allocation.                                            |                   |                 |                    |                      |                  |                     |                |  |
|                  |      |                 |             |                                                                          |                   |                 |                    |                      |                  |                     |                |  |
|                  |      |                 |             |                                                                          |                   |                 |                    |                      |                  |                     |                |  |

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|------------------|------|---------------------------|------------------------------|--------------------------------------|------------------------------|--------------------|----------------------|---------------------------------|---------------------|----------------|
| Parameter<br>No. | Size | ١                         | lame                         | Setting<br>Range                     | Setting<br>Unit              | Default<br>Setting | Applicable<br>Motors | When<br>Enabled                 | Classi-<br>fication | Refer-<br>ence |
|                  | 2    | Option Fie<br>5           | eld Allocations              | 0000h to<br>1D1Fh                    | -                            | 0000h              | All                  | After<br>restart                | Setup               | *14            |
|                  |      |                           | -                            |                                      |                              |                    |                      |                                 |                     | -              |
|                  |      | n.🗆 🗆 🗆 X                 | Reserved par                 | rameter (Do no                       | ot change.                   | )                  |                      |                                 |                     | _              |
|                  |      | n.🗆 🗆 X 🗆                 | Reserved par                 | rameter (Do no                       | ot change.                   | )                  |                      |                                 |                     |                |
|                  |      |                           |                              | _ Allocation (O                      | . ,                          |                    |                      |                                 |                     |                |
|                  |      |                           |                              | ate bits 0 to 2                      |                              |                    |                      |                                 |                     | _              |
|                  |      |                           |                              | ate bits 1 to 3<br>ate bits 2 to 4   | -                            |                    |                      |                                 |                     | _              |
|                  |      |                           |                              | ate bits 2 to 4                      |                              |                    |                      |                                 |                     | _              |
|                  |      |                           |                              | ate bits 4 to 6                      | _                            |                    |                      |                                 |                     | _              |
| Pn82E            |      |                           | 5 Alloca                     | ate bits 5 to 7                      | to OUT_SI                    | GNAL.              |                      |                                 |                     |                |
| M2 *15           |      | n.¤X¤¤                    | 6 Alloca                     | ate bits 6 to 8                      | to OUT_SI                    | GNAL.              |                      |                                 |                     | _              |
|                  |      |                           |                              | ate bits 7 to 9                      | _                            |                    |                      |                                 |                     |                |
|                  |      |                           |                              | ate bits 8 to 10                     |                              |                    |                      |                                 |                     | _              |
|                  |      |                           |                              | ate bits 9 to 11<br>ate bits 10 to 1 |                              |                    |                      |                                 |                     |                |
|                  |      |                           |                              | ate bits 10 to 1<br>ate bits 11 to 1 | -                            | -                  |                      |                                 |                     | -              |
|                  |      |                           |                              | ate bits 12 to 1                     |                              |                    |                      |                                 |                     | _              |
|                  |      |                           |                              | ate bits 13 to 1                     |                              |                    |                      |                                 |                     | _              |
|                  |      |                           | OUT SIGNAL                   | _ Allocation Er                      | able/Disa                    | hle Select         | ion                  |                                 |                     |                |
|                  |      | n.XDDD                    |                              | ble OUT_SIGN                         |                              |                    |                      |                                 |                     | -              |
|                  |      |                           |                              | le OUT_SIGNA                         |                              |                    |                      |                                 |                     | _              |
|                  |      |                           |                              |                                      |                              |                    |                      |                                 |                     | _              |
|                  | 0    | Mation Co                 | ttingg                       | 0000h to                             |                              | 0000h              | A 11                 | After                           | Catura              | *1             |
|                  | 2    | Motion Se                 | attings                      | 0001h                                | -                            | 0000h              | All                  | restart                         | Setup               | *1             |
|                  |      |                           |                              |                                      |                              |                    |                      |                                 |                     |                |
|                  |      |                           | Linear Accel                 | eration/Decele                       | ration Cou                   | etant Sol          | action               |                                 |                     |                |
|                  |      |                           |                              | Pn80A to Pn80                        |                              |                    |                      | 334 to Pn84                     | 0 are               |                |
|                  |      | n.🗆🗆🗆 X                   | 0 ignor                      |                                      |                              | <b>v</b>           | J                    |                                 |                     | _              |
| Pn833            |      |                           | 1 Use Fignor                 | Pn834 to Pn84<br>ed.)                | 0. (The se                   | ttings of P        | n80A to Pn80         | F and Pn82                      | 7 are               |                |
|                  |      |                           |                              |                                      | + ohongo                     | <u>۱</u>           |                      |                                 |                     | -              |
|                  |      | n.□□X□                    | Reserved par                 | rameter (Do no                       | ot change.                   | )                  |                      |                                 |                     |                |
|                  |      | n.¤X¤¤                    | Reserved par                 | rameter (Do no                       | ot change.                   | )                  |                      |                                 |                     |                |
|                  |      | n.XDDD                    | Reserved par                 | rameter (Do no                       | ot change.                   | )                  |                      |                                 |                     | [              |
|                  |      |                           |                              |                                      |                              |                    |                      |                                 |                     | _              |
|                  |      |                           |                              |                                      | 10,000                       |                    |                      |                                 |                     |                |
| Pn834            | 4    | First Stage<br>eration Co | e Linear Accel-              | 1 to<br>20,971,520                   | refer-<br>ence               | 100                | All                  | Immedi-<br>ately <sup>*12</sup> | Setup               | *1             |
|                  | L    |                           |                              | 20,011,020                           | units/s <sup>2</sup>         |                    |                      | atery                           |                     |                |
|                  |      | Second C                  | tago Lipcor                  | 1 +0                                 | 10,000<br>refer-             |                    |                      | Immedi-                         |                     |                |
| Pn836            | 4    |                           | tage Linear<br>on Constant 2 | 1 to<br>20,971,520                   | ence                         | 100                | All                  | ately *12                       | Setup               | *1             |
|                  |      |                           |                              |                                      | units/s <sup>2</sup>         |                    |                      |                                 |                     |                |
| Pn838            | 4    | Accelerati<br>Switching   | on Constant                  | 0 to<br>2,097,152,000                | 1 refer-<br>ence             | 0                  | All                  | Immedi-<br>ately <sup>*12</sup> | Setup               | *1             |
|                  |      | Switching                 | opeeu 2                      | 2,007,102,000                        | unit/s                       |                    |                      | alely                           |                     |                |
| Dn82A            | 4    | First Stage               | e Linear                     | 1 to                                 | 10,000<br>refer-             | 100                | All                  | Immedi-                         | Satura              | *1             |
| Pn83A            | 4    | Decelerati                | on Constant 2                | 20,971,520                           | ence<br>units/s <sup>2</sup> | 100                | All                  | ately *12                       | Setup               | ~1             |
|                  |      |                           |                              |                                      | units/S-                     |                    |                      |                                 |                     |                |

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|                  |      | -                                      |                                                              |                                                                                    |                                                                                                                                                                       |                                                        |                    | Cor                  | tinued fron                     | n previou           | s page.                    |
|------------------|------|----------------------------------------|--------------------------------------------------------------|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|--------------------|----------------------|---------------------------------|---------------------|----------------------------|
| Parameter<br>No. | Size | N                                      | ame                                                          |                                                                                    | Setting<br>Range                                                                                                                                                      | Setting<br>Unit                                        | Default<br>Setting | Applicable<br>Motors | When<br>Enabled                 | Classi-<br>fication | Refer-<br>ence             |
| Pn83C            | 4    | Second Sta<br>Deceleratio              |                                                              |                                                                                    | 1 to<br>20,971,520                                                                                                                                                    | 10,000<br>refer-<br>ence<br>units/s <sup>2</sup>       | 100                | All                  | Immedi-<br>ately <sup>*12</sup> | Setup               | *1                         |
| Pn83E            | 4    | Deceleration                           |                                                              |                                                                                    | 0 to<br>2,097,152,000                                                                                                                                                 | 1 refer-<br>ence<br>unit/s                             | 0                  | All                  | Immedi-<br>ately <sup>*12</sup> | Setup               | *1                         |
| Pn840            | 4    | Linear Dec<br>Constant 2               |                                                              |                                                                                    | 1 to<br>20,971,520                                                                                                                                                    | 10,000<br>refer-<br>ence<br>units/s <sup>2</sup>       | 100                | All                  | Immedi-<br>ately *12            | Setup               | *1                         |
| Pn842<br>*16     | 4    | Second Or<br>Approach S                |                                                              |                                                                                    | 0 to<br>20,971,520                                                                                                                                                    | 100 ref-<br>erence<br>units/s                          | 0                  | All                  | Immedi-<br>ately <sup>*12</sup> | Setup               | *1                         |
| Pn844<br>*17     | 4    | Second Or<br>Approach \$               |                                                              |                                                                                    | 0 to<br>20,971,520                                                                                                                                                    | 100 ref-<br>erence<br>units/s                          | 0                  | All                  | Immedi-<br>ately <sup>*12</sup> | Setup               | *1                         |
| Pn846            | 2    | POSING C<br>Scurve Acc<br>Deceleration | celeratio                                                    |                                                                                    | 0 to 50                                                                                                                                                               | 1%                                                     | 0                  | All                  | Immedi-<br>ately <sup>*12</sup> | Setup               | _                          |
| Pn850            | 2    | Number of<br>Sequences                 |                                                              |                                                                                    | 0 to 8                                                                                                                                                                | _                                                      | 0                  | All                  | Immedi-<br>ately                | Setup               | *1                         |
| Pn851            | 2    | Continuous<br>Sequence                 |                                                              |                                                                                    | 0 to 255                                                                                                                                                              | _                                                      | 0                  | All                  | Immedi-<br>ately                | Setup               | *1                         |
|                  | 2    | Latch Sequence Settings                | uence 1                                                      | to 4                                                                               | 0000h to<br>3333h                                                                                                                                                     | -                                                      | 0000h              | All                  | Immedi-<br>ately                | Setup               | *1                         |
| Pn852            |      | n.000X<br>n.00X0<br>n.0X00             | 0<br>1<br>2<br>3<br>Latch \$<br>0 to 3<br>Latch \$<br>0 to 3 | Phas<br>EXT1<br>EXT2<br>EXT3<br>Seque<br>The s<br>tion.<br>Seque<br>The s<br>tion. | nce 1 Signal S<br>e C<br>signal<br>signal<br>signal<br>nce 2 Signal S<br>settings are the<br>nce 3 Signal S<br>settings are the<br>nce 4 Signal S<br>settings are the | election<br>same as<br>election<br>same as<br>election | those for t        | he Latch Seq         | uence 1 Sigr                    | nal Selec-          | -<br>-<br>-<br>-<br>-<br>- |

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| Deveneter        |      |                       |                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                       |                                                                    |                     |                            |
|------------------|------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|---------------------|----------------------------|
| Parameter<br>No. | Size | N                     | lame                                                                                                                                                                                                                                                                                                                                                                            | Setting<br>Range                                                                                                                                                                                                                                                                                      | Setting<br>Unit                                                                                                                                                                                                                          | Default<br>Setting                                                                                                                                                                                                                     | Applicable<br>Motors                                                                                                                                                                                                                  | When<br>Enabled                                                    | Classi-<br>fication | Refer<br>ence              |
|                  | 2    | Latch Seq<br>Settings | uence 5 to 8                                                                                                                                                                                                                                                                                                                                                                    | 3 0000h to<br>3333h                                                                                                                                                                                                                                                                                   | -                                                                                                                                                                                                                                        | 0000h                                                                                                                                                                                                                                  | All                                                                                                                                                                                                                                   | Immedi-<br>ately                                                   | Setup               | *1                         |
|                  |      |                       |                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                          | 1                                                                                                                                                                                                                                      | 1                                                                                                                                                                                                                                     | I                                                                  |                     |                            |
|                  |      |                       | Latch Seq                                                                                                                                                                                                                                                                                                                                                                       | uence 5 Signal S                                                                                                                                                                                                                                                                                      | Selection                                                                                                                                                                                                                                |                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                       |                                                                    |                     |                            |
|                  |      |                       | 0 Pł                                                                                                                                                                                                                                                                                                                                                                            | ase C                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                       |                                                                    |                     | _                          |
|                  |      | n.🗆🗆 🛛 X              | 1 E>                                                                                                                                                                                                                                                                                                                                                                            | (T1 signal                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                       |                                                                    |                     | _                          |
|                  |      |                       |                                                                                                                                                                                                                                                                                                                                                                                 | (T2 signal                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                       |                                                                    |                     | _                          |
|                  |      |                       | 3 E>                                                                                                                                                                                                                                                                                                                                                                            | (T3 signal                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                       |                                                                    |                     | _                          |
| Pn853            |      |                       | Latch Seq                                                                                                                                                                                                                                                                                                                                                                       | uence 6 Signal S                                                                                                                                                                                                                                                                                      | election                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                       |                                                                    |                     |                            |
|                  |      | n.□□X□                | 0 to 3 Th                                                                                                                                                                                                                                                                                                                                                                       | e settings are the<br>n.                                                                                                                                                                                                                                                                              | e same as                                                                                                                                                                                                                                | those for t                                                                                                                                                                                                                            | he Latch Seq                                                                                                                                                                                                                          | uence 5 Sigr                                                       | nal Selec-          | _                          |
|                  |      |                       | Latch Seq                                                                                                                                                                                                                                                                                                                                                                       | uence 7 Signal S                                                                                                                                                                                                                                                                                      | election                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                       |                                                                    |                     |                            |
|                  |      | n.¤X¤¤                | 0 to 3 Th                                                                                                                                                                                                                                                                                                                                                                       | e settings are the<br>n.                                                                                                                                                                                                                                                                              | e same as                                                                                                                                                                                                                                | those for t                                                                                                                                                                                                                            | he Latch Seq                                                                                                                                                                                                                          | uence 5 Sigr                                                       | nal Selec-          | _                          |
|                  |      |                       | Latch Sec                                                                                                                                                                                                                                                                                                                                                                       | uence 8 Signal S                                                                                                                                                                                                                                                                                      | election                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                       |                                                                    |                     |                            |
|                  |      | n.X000                | -                                                                                                                                                                                                                                                                                                                                                                               | e settings are the                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                          | those for t                                                                                                                                                                                                                            | he Latch Seq                                                                                                                                                                                                                          | uence 5 Sigr                                                       | nal Selec-          | -                          |
|                  | 2    | Monitor Al            | D Input Sign                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                       | Immedi-                                                            |                     | *1                         |
|                  |      |                       |                                                                                                                                                                                                                                                                                                                                                                                 | 1717h                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                          | 0000h                                                                                                                                                                                                                                  | All                                                                                                                                                                                                                                   | ately                                                              | Setup               | -                          |
|                  |      |                       | Input Sign                                                                                                                                                                                                                                                                                                                                                                      | al Monitor Alloca                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                          | N1-13 (SV                                                                                                                                                                                                                              | /CMD_IO)                                                                                                                                                                                                                              |                                                                    |                     |                            |
|                  |      |                       | Input Sign                                                                                                                                                                                                                                                                                                                                                                      | al Monitor Alloca                                                                                                                                                                                                                                                                                     | STS1) to C                                                                                                                                                                                                                               | N1-13 (SV<br>N1-13 inp                                                                                                                                                                                                                 | CMD_IO)<br>ut signal mor                                                                                                                                                                                                              | itor.                                                              |                     |                            |
|                  |      |                       | Input Sign<br>0 Al<br>1 Al                                                                                                                                                                                                                                                                                                                                                      | al Monitor Alloca<br>ocate bit 24 (IO_<br>ocate bit 25 (IO_                                                                                                                                                                                                                                           | STS1) to C<br>STS2) to C                                                                                                                                                                                                                 | N1-13 (SV<br>N1-13 inp<br>N1-13 inp                                                                                                                                                                                                    | CMD_IO)<br>ut signal mor<br>ut signal mor                                                                                                                                                                                             | iitor.<br>iitor.                                                   |                     |                            |
|                  |      |                       | Input Sign0Al1Al2Al                                                                                                                                                                                                                                                                                                                                                             | al Monitor Alloca<br>ocate bit 24 (IO_<br>ocate bit 25 (IO_<br>ocate bit 26 (IO_                                                                                                                                                                                                                      | STS1) to C<br>STS2) to C<br>STS3) to C                                                                                                                                                                                                   | N1-13 (SV<br>2N1-13 inp<br>2N1-13 inp<br>2N1-13 inp                                                                                                                                                                                    | CMD_IO)<br>ut signal mor<br>ut signal mor<br>ut signal mor                                                                                                                                                                            | iitor.<br>iitor.<br>iitor.                                         |                     |                            |
|                  |      | n.000X                | Input Sign0Al1Al2Al3Al                                                                                                                                                                                                                                                                                                                                                          | al Monitor Alloca<br>ocate bit 24 (IO_<br>ocate bit 25 (IO_<br>ocate bit 26 (IO_<br>ocate bit 27 (IO_                                                                                                                                                                                                 | STS1) to C<br>STS2) to C<br>STS3) to C<br>STS4) to C                                                                                                                                                                                     | N1-13 (SV<br>CN1-13 inp<br>CN1-13 inp<br>CN1-13 inp<br>CN1-13 inp                                                                                                                                                                      | CMD_IO)<br>ut signal mor<br>ut signal mor<br>ut signal mor<br>ut signal mor                                                                                                                                                           | itor.<br>iitor.<br>iitor.<br>iitor.                                |                     | -                          |
|                  |      |                       | Input Sign0Al1Al2Al3Al4Al                                                                                                                                                                                                                                                                                                                                                       | al Monitor Alloca<br>ocate bit 24 (IO_<br>ocate bit 25 (IO_<br>ocate bit 26 (IO_<br>ocate bit 27 (IO_<br>ocate bit 28 (IO_                                                                                                                                                                            | STS1) to C<br>STS2) to C<br>STS3) to C<br>STS4) to C<br>STS5) to C                                                                                                                                                                       | N1-13 (SV<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp                                                                                                                                                | CMD_IO)<br>ut signal mor<br>ut signal mor<br>ut signal mor<br>ut signal mor<br>ut signal mor                                                                                                                                          | itor.<br>iitor.<br>iitor.<br>iitor.<br>iitor.                      |                     |                            |
|                  |      |                       | Input Sign0Al1Al2Al3Al4Al5Al                                                                                                                                                                                                                                                                                                                                                    | al Monitor Alloca<br>ocate bit 24 (IO_1<br>ocate bit 25 (IO_1<br>ocate bit 26 (IO_1<br>ocate bit 26 (IO_2<br>ocate bit 28 (IO_2)<br>ocate bit 28 (IO_2)                                                                                                                                               | STS1) to C<br>STS2) to C<br>STS3) to C<br>STS4) to C<br>STS5) to C<br>STS5) to C                                                                                                                                                         | N1-13 (SV<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp                                                                                                                                                | CMD_IO)<br>ut signal mor<br>ut signal mor<br>ut signal mor<br>ut signal mor<br>ut signal mor<br>ut signal mor                                                                                                                         | itor.<br>iitor.<br>iitor.<br>iitor.<br>iitor.<br>iitor.            |                     | -<br>-<br>-<br>-           |
| Pn860            |      |                       | Input Sign           0         Al           1         Al           2         Al           3         Al           4         Al           5         Al           6         Al                                                                                                                                                                                                     | al Monitor Alloca<br>ocate bit 24 (IO_<br>ocate bit 25 (IO_<br>ocate bit 26 (IO_<br>ocate bit 27 (IO_<br>ocate bit 28 (IO_                                                                                                                                                                            | STS1) to C<br>STS2) to C<br>STS3) to C<br>STS4) to C<br>STS5) to C<br>STS6) to C<br>STS6) to C                                                                                                                                           | N1-13 (SV<br>CN1-13 inp<br>CN1-13 inp<br>CN1-13 inp<br>CN1-13 inp<br>CN1-13 inp<br>CN1-13 inp<br>CN1-13 inp                                                                                                                            | CMD_IO)<br>ut signal mor<br>ut signal mor<br>ut signal mor<br>ut signal mor<br>ut signal mor<br>ut signal mor<br>ut signal mor                                                                                                        | itor.<br>iitor.<br>iitor.<br>iitor.<br>iitor.<br>iitor.<br>iitor.  |                     | -<br>-<br>-<br>-<br>-      |
|                  |      |                       | Input Sign           0         Al           1         Al           2         Al           3         Al           4         Al           5         Al           6         Al           7         Al                                                                                                                                                                              | al Monitor Alloca<br>ocate bit 24 (IO_<br>ocate bit 25 (IO_<br>ocate bit 26 (IO_<br>ocate bit 27 (IO_<br>ocate bit 27 (IO_<br>ocate bit 28 (IO_<br>ocate bit 29 (IO_<br>ocate bit 30 (IO_                                                                                                             | STS1) to C<br>STS2) to C<br>STS3) to C<br>STS4) to C<br>STS5) to C<br>STS6) to C<br>STS6) to C<br>STS7) to C<br>STS8) to C                                                                                                               | N1-13 (SV<br>CN1-13 inp<br>CN1-13 inp<br>CN1-13 inp<br>CN1-13 inp<br>CN1-13 inp<br>CN1-13 inp<br>CN1-13 inp<br>CN1-13 inp                                                                                                              | CMD_IO)<br>ut signal mor<br>ut signal mor                                                                                       | itor.<br>iitor.<br>iitor.<br>iitor.<br>iitor.<br>iitor.<br>iitor.  |                     | -<br>-<br>-<br>-<br>-      |
|                  |      |                       | Input Sign           0         Al           1         Al           2         Al           3         Al           4         Al           5         Al           6         Al           7         Al                                                                                                                                                                              | al Monitor Alloca<br>ocate bit 24 (IO_<br>ocate bit 25 (IO_<br>ocate bit 26 (IO_<br>ocate bit 27 (IO_<br>ocate bit 28 (IO_<br>ocate bit 28 (IO_<br>ocate bit 29 (IO_<br>ocate bit 30 (IO_<br>ocate bit 31 (IO_                                                                                        | STS1) to C<br>STS2) to C<br>STS3) to C<br>STS4) to C<br>STS5) to C<br>STS6) to C<br>STS6) to C<br>STS7) to C<br>STS8) to C<br>STS8) to C                                                                                                 | N1-13 (SV<br>2N1-13 inp<br>2N1-13 inp<br>2N1-13 inp<br>2N1-13 inp<br>2N1-13 inp<br>2N1-13 inp<br>2N1-13 inp<br>2N1-13 inp<br>2N1-13 inp                                                                                                | CMD_IO)<br>ut signal mor<br>ut signal mor                                                                      | itor.<br>iitor.<br>iitor.<br>iitor.<br>iitor.<br>iitor.<br>iitor.  |                     | -                          |
|                  |      | n.000X                | Input Sign           0         Al           1         Al           2         Al           3         Al           4         Al           5         Al           6         Al           7         Al           CN1-13         Im           0         Di                                                                                                                           | al Monitor Alloca<br>ocate bit 24 (IO_<br>ocate bit 25 (IO_<br>ocate bit 26 (IO_<br>ocate bit 27 (IO_<br>ocate bit 28 (IO_<br>ocate bit 28 (IO_<br>ocate bit 29 (IO_<br>ocate bit 30 (IO_<br>ocate bit 31 (IO_<br>put Signal Monit                                                                    | STS1) to C<br>STS2) to C<br>STS3) to C<br>STS4) to C<br>STS5) to C<br>STS5) to C<br>STS6) to C<br>STS7) to C<br>STS8) to C<br>or Enable,<br>or CN1-13                                                                                    | N1-13 (SV<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>V1-13 inp<br><b>/Disable S</b><br>input sign                                                                      | CMD_IO)<br>ut signal mor<br>ut signal mor<br>election<br>al monitor.                                                            | itor.<br>iitor.<br>iitor.<br>iitor.<br>iitor.<br>iitor.<br>iitor.  |                     | -<br>-<br>-<br>-<br>-<br>- |
|                  |      | n.□□□X                | Input Sign           0         Al           1         Al           2         Al           3         Al           4         Al           5         Al           6         Al           7         Al           0         Di           1         D           1         Al                                                                                                          | al Monitor Alloca<br>ocate bit 24 (IO_<br>ocate bit 25 (IO_<br>ocate bit 26 (IO_<br>ocate bit 26 (IO_<br>ocate bit 27 (IO_<br>ocate bit 28 (IO_<br>ocate bit 29 (IO_<br>ocate bit 30 (IO_<br>ocate bit 31 (IO_<br>put Signal Monit<br>sable allocation for                                            | STS1) to C<br>STS2) to C<br>STS3) to C<br>STS4) to C<br>STS5) to C<br>STS6) to C<br>STS6) to C<br>STS7) to C<br>STS8) to C<br>or Enable,<br>or CN1-13<br>r CN1-13                                                                        | N1-13 (SV<br>CN1-13 inp<br>CN1-13 inp            | CMD_IO)<br>ut signal mor<br>ut signal mor<br>election<br>al monitor.                                                            | itor.<br>iitor.<br>iitor.<br>iitor.<br>iitor.<br>iitor.<br>iitor.  |                     |                            |
|                  |      | n.000X                | Input Sign           0         Al           1         Al           2         Al           3         Al           4         Al           5         Al           6         Al           7         Al           0         Di           1         Er                                                                                                                                | al Monitor Alloca<br>ocate bit 24 (IO_5<br>ocate bit 25 (IO_5<br>ocate bit 26 (IO_5<br>ocate bit 26 (IO_5<br>ocate bit 27 (IO_5<br>ocate bit 28 (IO_5<br>ocate bit 29 (IO_5<br>ocate bit 30 (IO_5<br>ocate bit 31 (IO_5<br>put Signal Monit<br>sable allocation for                                   | STS1) to C<br>STS2) to C<br>STS3) to C<br>STS4) to C<br>STS5) to C<br>STS5) to C<br>STS6) to C<br>STS7) to C<br>STS8) to C<br>or Enable,<br>or CN1-13<br>r CN1-13<br>ation for C                                                         | N1-13 (SV<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>input signa                                                                                          | CMD_IO)<br>ut signal mor<br>ut signal mor<br>ut signal mor<br>ut signal mor<br>ut signal mor<br>ut signal mor<br>ut signal mor<br>election<br>al monitor.<br>CMD_IO)                                                                  | iitor.<br>iitor.<br>iitor.<br>iitor.<br>iitor.<br>iitor.<br>iitor. |                     |                            |
|                  |      | n                     | Input Sign           0         Al           1         Al           2         Al           3         Al           4         Al           5         Al           6         Al           7         Al           0         Di           1         Er           0         Di           1         Er                                                                                  | al Monitor Alloca<br>ocate bit 24 (IO_<br>ocate bit 25 (IO_<br>ocate bit 26 (IO_<br>ocate bit 26 (IO_<br>ocate bit 27 (IO_<br>ocate bit 28 (IO_<br>ocate bit 29 (IO_<br>ocate bit 30 (IO_<br>ocate bit 30 (IO_<br>put Signal Monit<br>sable allocation for<br>al Monitor Alloca                       | STS1) to C<br>STS2) to C<br>STS3) to C<br>STS4) to C<br>STS5) to C<br>STS5) to C<br>STS6) to C<br>STS7) to C<br>STS7) to C<br>STS8) to C<br>or Enable,<br>or CN1-13<br>r CN1-13<br>tion for C<br>e same as                               | N1-13 (SV<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>V <b>Disable S</b><br>input sign<br>input sign<br>the CN1-1                                          | CMD_IO)<br>ut signal mor<br>ut signal mor<br>ut signal mor<br>ut signal mor<br>ut signal mor<br>ut signal mor<br>ut signal mor<br>election<br>al monitor.<br>CMD_IO)<br>3 allocations.                                                | iitor.<br>iitor.<br>iitor.<br>iitor.<br>iitor.<br>iitor.<br>iitor. |                     |                            |
|                  |      | n.□□□X                | Input Sign           0         Al           1         Al           2         Al           3         Al           4         Al           5         Al           6         Al           7         Al           0         Di           1         Er           Input Sign         0 to 7           0 to 7         Th           CN1-7         Input Sign           0 to 7         Th | al Monitor Alloca<br>ocate bit 24 (IO_<br>ocate bit 25 (IO_<br>ocate bit 26 (IO_<br>ocate bit 26 (IO_<br>ocate bit 27 (IO_<br>ocate bit 28 (IO_<br>ocate bit 29 (IO_<br>ocate bit 30 (IO_<br>ocate bit 31 (IO_<br>put Signal Monit<br>sable allocation for<br>al Monitor Alloca<br>e settings are the | STS1) to C<br>STS2) to C<br>STS3) to C<br>STS4) to C<br>STS5) to C<br>STS6) to C<br>STS6) to C<br>STS7) to C<br>STS7) to C<br>STS8) to C<br>or Enable,<br>or CN1-13<br>r CN1-13<br>ation for C<br>e same as<br>r Enable/[<br>or CN1-7 in | N1-13 (SV<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br><b>(Disable S</b><br>input signa<br><b>N1-7 (SVC</b><br>the CN1-1<br><b>Disable Se</b><br>nput signa | CMD_IO)<br>ut signal mor<br>ut signal mor<br>al monitor.<br>CMD_IO)<br>3 allocations.<br>lection<br>I monitor. | iitor.<br>iitor.<br>iitor.<br>iitor.<br>iitor.<br>iitor.<br>iitor. |                     |                            |

|                            |      |                                              |                                                                 |                 |                    | Con                  | tinued fron      | n previou:          | s page.        |
|----------------------------|------|----------------------------------------------|-----------------------------------------------------------------|-----------------|--------------------|----------------------|------------------|---------------------|----------------|
| Parameter<br>No.           | Size | Name                                         | Setting<br>Range                                                | Setting<br>Unit | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |
|                            | 2    | SVCMD_IO Input Sign<br>Monitor Allocations 2 | al 0000h to<br>1717h                                            | -               | 0000h              | All                  | Immedi-<br>ately | Setup               | *1             |
|                            |      | n.DDDX Input Sign                            | al Monitor Alloca                                               |                 | ,                  | _ ,                  |                  |                     |                |
| Pn861<br>M3 *10            |      | n. <b>DDXD</b> 0 Di                          | ut Signal Monito<br>sable allocation fo<br>able allocation fo   | or CN1-8 i      | nput signal        | l monitor.           |                  |                     | -              |
|                            |      |                                              | al Monitor Alloca<br>e settings are the                         |                 |                    |                      |                  |                     | _              |
|                            |      | n.XDDD 0 Di                                  | ut Signal Monito<br>sable allocation for<br>able allocation for | or CN1-9 i      | nput signal        | l monitor.           |                  |                     | -              |
|                            | 2    | SVCMD_IO Input Sign<br>Monitor Allocations 3 | al 0000h to 1717h                                               | -               | 0000h              | All                  | Immedi-<br>ately | Setup               | *1             |
|                            |      |                                              | al Monitor Alloca<br>e settings are the                         |                 | ,                  | _ ,                  |                  |                     |                |
| Pn862<br>M3 *10            |      | n. <b>DDXD</b> 0 Di                          | put Signal Monit<br>sable allocation for<br>able allocation for | or CN1-10       | input sign         | al monitor.          |                  |                     | -              |
|                            |      |                                              | al Monitor Alloca<br>e settings are the                         |                 |                    | ,                    |                  |                     | _              |
|                            |      | n.X <b>DDD</b> 0 Di                          | put Signal Monit<br>sable allocation fo<br>able allocation fo   | or CN1-11       | input sign         | al monitor.          |                  |                     | -              |
|                            | 2    | SVCMD_IO Input Sign<br>Monitor Allocations 4 | al 0000h to<br>1717h                                            | _               | 0000h              | All                  | Immedi-<br>ately | Setup               | *1             |
|                            |      |                                              | al Monitor Alloca<br>e settings are the                         |                 |                    |                      |                  |                     |                |
| Pn863<br>M3 <sup>*10</sup> |      | n. <b>DDXD</b> 0 Di                          | put Signal Monit<br>sable allocation fo<br>able allocation fo   | or CN1-12       | input sign         | al monitor.          |                  |                     | -              |
|                            |      | n.□X□□ Reserved                              | parameter (Do no                                                | ot change       | )                  |                      |                  |                     | I              |
|                            |      | n.XDDD Reserved                              | parameter (Do no                                                | ot change       | )                  |                      |                  |                     | I              |
|                            |      |                                              |                                                                 |                 |                    |                      | 0                | d on nev            |                |

Continued from previous page.

|                            |      |                              |                                |                                      |                        |                    | Con                  | itinued fron     | n previou           | s page.        |
|----------------------------|------|------------------------------|--------------------------------|--------------------------------------|------------------------|--------------------|----------------------|------------------|---------------------|----------------|
| Parameter<br>No.           | Size | N                            | ame                            | Setting<br>Range                     | Setting<br>Unit        | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |
|                            | 2    | SVCMD_IC<br>nal Monitor<br>1 | ) Output Sig-<br>r Allocations | 0000h to<br>1717h                    | _                      | 0000h              | All                  | Immedi-<br>ately | Setup               | *1             |
|                            |      |                              |                                |                                      |                        |                    |                      |                  |                     | _              |
|                            |      |                              |                                | I Monitor Allo                       |                        |                    |                      |                  |                     |                |
|                            |      |                              |                                | ate bit 24 (IO_9                     |                        |                    | . 0                  |                  |                     | _              |
|                            |      |                              |                                | ate bit 25 (IO_S<br>ate bit 26 (IO_S |                        |                    |                      |                  |                     | -              |
|                            |      | n.DDDX                       |                                | ate bit 26 (IO_3<br>ate bit 27 (IO_3 | ,                      |                    | 1 0                  |                  |                     | _              |
|                            |      |                              |                                | ate bit 27 (IO_3<br>ate bit 28 (IO_3 | ,                      |                    |                      |                  |                     | -              |
|                            |      |                              |                                | ate bit 20 (IO_0                     |                        |                    |                      |                  |                     | _              |
| Pn868                      |      |                              |                                | ate bit 20 (10_0                     | ,                      |                    |                      |                  |                     | -              |
| M3 *10                     |      |                              |                                | ate bit 31 (IO_8                     |                        |                    |                      |                  |                     | _              |
|                            |      |                              |                                |                                      |                        |                    |                      |                  |                     | -              |
|                            |      |                              |                                | 2 Output Signa                       |                        |                    |                      |                  |                     |                |
|                            |      | n.🗆🗆 X 🗆                     |                                | ble allocation fo                    |                        |                    | 0                    |                  |                     | _              |
|                            |      |                              | 1 Enab                         | le allocation fo                     | r CN1-1/C              | N1-2 outp          | ut signal mor        | nitor.           |                     | _              |
|                            |      |                              | Output Signa                   | I Monitor Allo                       | cation for             | CN1-23 a           | nd CN1-24 (S         | SVCMD_IO)        |                     |                |
|                            |      | n.¤X¤¤                       | 0 to 7 The s                   | settings are the                     | same as                | the CN1-1          | /CN1-2 alloca        | ations.          |                     | -              |
|                            |      |                              | CN1-23/CN1                     | -24 Output Sig                       | onal Moni <sup>.</sup> | tor Enable         | /Disable Sele        | ection           |                     |                |
|                            |      | n.XDDD                       |                                | le allocation fo                     | -                      |                    |                      |                  |                     | -              |
|                            |      |                              | 1 Enab                         | le allocation fo                     | r CN1-23/              | CN1-24 oi          | utput signal m       | nonitor.         |                     | -              |
|                            |      |                              |                                |                                      |                        |                    |                      |                  |                     | _              |
|                            | 2    | SVCMD_IC<br>nal Monitor<br>2 | ) Output Sig-<br>r Allocations | 0000h to<br>1717h                    | -                      | 0000h              | All                  | Immedi-<br>ately | Setup               | *1             |
|                            |      |                              |                                |                                      |                        |                    |                      |                  |                     |                |
|                            |      |                              | 0.1.0                          |                                      |                        | 014 05 -           |                      |                  |                     | -              |
|                            |      | n.🗆🗆 🗆 X                     |                                | I Monitor Allo                       |                        |                    |                      |                  |                     | _              |
|                            |      |                              | 0 to 7 The s                   | settings are the                     | same as                | the CNT-T          | /CINT-2 alloca       | allons.          |                     | _              |
|                            |      |                              | CN1-25/CN1                     | -26 Output Sig                       | gnal Moni <sup>.</sup> | tor Enable         | /Disable Sele        | ection           |                     |                |
| Pn869<br>M3 <sup>*10</sup> |      | n.🗆🗆 X 🗆                     |                                | le allocation fo                     |                        |                    |                      |                  |                     | _              |
| IVI3                       |      |                              | 1 Enab                         | le allocation fo                     | r CN1-25/              | CN1-26 oi          | utput signal m       | nonitor.         |                     | _              |
|                            |      |                              | Output Signa                   | I Monitor Allo                       | cation for             | CN1-27 a           | nd CN1-28 (S         | SVCMD_IO)        |                     |                |
|                            |      | n.¤X¤¤                       | 0 to 7 The s                   | ettings are the                      | same as                | the CN1-1          | /CN1-2 alloca        | ations.          |                     | _              |
|                            |      |                              | CN1-27/CN1                     | -28 Output Sig                       | nal Moni               | for Enable         | /Disable Sele        | ection           |                     | _              |
|                            |      | n.XDDD                       | -                              | ble allocation fo                    | -                      |                    |                      |                  |                     |                |
|                            |      |                              |                                | le allocation fo                     |                        |                    |                      |                  |                     | _              |
|                            |      |                              | Linab                          |                                      | - UNI 21/              | 5111 20 00         | arpar oignaí H       |                  |                     | _              |
|                            |      |                              |                                |                                      |                        |                    |                      |                  |                     |                |

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|                            |      |                        |                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1                                        |                          |                      | tinued fron      | n previou           | s page.        |
|----------------------------|------|------------------------|---------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|--------------------------|----------------------|------------------|---------------------|----------------|
| Parameter<br>No.           | Size |                        | Name                                                                | Setting<br>Range                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Setting<br>Unit                          | Default<br>Setting       | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |
|                            | 2    |                        | O Output Sig-<br>or Allocations                                     | 0000h to<br>1717h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | -                                        | 0000h                    | All                  | Immedi-<br>ately | Setup               | *1             |
| Dasca                      |      | n.000X                 |                                                                     | al Monitor Alloo<br>settings are the                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                          |                          |                      | _ ,              |                     | _              |
| Pn86A<br>M3 <sup>*10</sup> |      | n.00X0                 | 0 Disat                                                             | -30 Output Signal Signa | or CN1-29,                               | /CN1-30 o                | utput signal r       | nonitor.         |                     | -              |
|                            |      | n.¤X¤¤                 | Reserved par                                                        | rameter (Do no                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ot change.                               | )                        |                      |                  |                     |                |
|                            |      | n.XDDD                 | Reserved par                                                        | rameter (Do no                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ot change                                | )                        |                      |                  |                     | I              |
| Pn880                      | 2    |                        | ddress Moni-<br>aintenance,<br>)                                    | 03h to<br>EFh                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | _                                        | _                        | All                  | _                | Setup               | page<br>6-12   |
| Pn881                      | 2    | Count Mo               | mission Byte<br>pnitor [bytes]<br>enance, read                      | 17, 32, 48                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | -                                        | -                        | All                  | -                | Setup               | page<br>6-12   |
| Pn882                      | 2    | ting Moni              | sion Cycle Set-<br>tor [× 0.25 μs]<br>enance, read                  | Oh to FFFFh                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | -                                        | _                        | All                  | -                | Setup               | page<br>6-12   |
| Pn883                      | 2    | Setting M<br>mission c | ications Cycle<br>lonitor [trans-<br>ycles] (for<br>nce, read only) | 0 to 32                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | _                                        | _                        | All                  | -                | Setup               | page<br>6-12   |
|                            | 2    | Commun<br>trols 2      | ications Con-                                                       | 0000h to<br>0001h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | -                                        | 0000h                    | All                  | Immedi-<br>ately | Setup               | *1             |
| Pn884<br>M3 *10            |      | X.                     | 0 MECH                                                              | in the status s<br>ATROLINK cor<br>the holding bra                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | et by the E<br>mmunication<br>ake when a | BRK_ON of ons error of o | r BRK_OFF c          | ommand wh        |                     | Jrs.           |
|                            |      | .0X00                  | Reserved para                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                          |                          |                      |                  |                     |                |
|                            |      | .X000                  | Reserved para                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                          |                          |                      |                  |                     |                |
| Pn88A                      | 2    | Monitor                | ROLINK<br>Error Counter<br>enance, read                             | 0 to 65,535                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | _                                        | 0                        | All                  | _                | Setup               | _              |
| Pn890 to<br>Pn8A6          | 4    | tor during             | d Data Moni-<br>9 Alarm/Warn-<br>enance, read                       | Oh to<br>FFFFFFFFh                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | _                                        | Oh                       | All                  | _                | Setup               | page<br>13-58  |
| Pn8A8 to<br>Pn8BE          | 4    | during Ala             | e Data Monitor<br>arm/Warning<br>enance, read                       | Oh to<br>FFFFFFFFh                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | _                                        | Oh                       | All                  | _                | Setup               | page<br>13-58  |
| Pn900                      | 2    | Number o<br>Banks      | of Parameter                                                        | 0 to 16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | -                                        | 0                        | All                  | After<br>restart | Setup               | *1             |
| Pn901                      | 2    | Number o<br>Bank Mer   | of Parameter<br>mbers                                               | 0 to 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | -                                        | 0                        | All                  | After<br>restart | Setup               | *1             |
| Pn902 to<br>Pn910          | 2    | Paramete<br>ber Defini | er Bank Mem-<br>ition                                               | 0000h to<br>08FFh                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | -                                        | 0000h                    | All                  | After<br>restart | Setup               | *1             |
|                            |      |                        |                                                                     | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1                                        | 1                        | 1                    | 1                | 1                   | 1              |

Continued from previous page.

| Parameter<br>No.  | Size | Name                                                         | Setting<br>Range  | Setting<br>Unit | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |
|-------------------|------|--------------------------------------------------------------|-------------------|-----------------|--------------------|----------------------|------------------|---------------------|----------------|
| Pn920 to<br>Pn95F | 2    | Parameter Bank Data<br>(Not saved in nonvolatile<br>memory.) | 0000h to<br>FFFFh | _               | 0000h              | All                  | Immedi-<br>ately | Setup               | *1             |

\*1. Refer to the following manual for details.

Ω Σ-7-Series AC Servo Drive MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

\*2. Set a percentage of the motor rated torque.

\*3. The default setting is 32 for a SERVOPACK with built-in Servomotor brake control.

- \*4. Normally set this parameter to 0. If you use an External Regenerative Resistor, set the capacity (W) of the External Regenerative Resistor.
- \*5. The upper limit is the maximum output capacity (W) of the SERVOPACK.
- \*6. SGD7S-210D to 370D SERVOPACKs require three Dynamic Brake Resistors. For this parameter setting, enter the total value of resistor capacity of the three resistors.
- \*7. SGD7S-210D to 370D SERVOPACKs require three Dynamic Brake Resistors. For this parameter setting, enter the resistance of one Dynamic Brake Resistor multiplied by  $\sqrt{3}$ .
- \*8. The SGLFW2 is the only Yaskawa Linear Servomotor that supports this function.
- \*9. Enabled only when Pn61A is set to n. DDD2 or n. DDD3.
- \*10.This parameter is valid only when the MECHATROLINK-III standard servo profile is used.
- \*11. The parameter setting is enabled after SENS\_ON command execution is completed.
- \*12.Change the setting when the reference is stopped (i.e., while DEN is set to 1). If you change the setting during operation, the reference output will be affected.
- \*13. The settings are updated only if the reference is stopped (i.e., only if DEN is set to 1).
- \*14.Refer to the following manual for details.
- Ω Σ-7-Series AC Servo Drive MECHATROLINK-II Communications Command Manual (Manual No.: SIEP S800001 30)

\*15.This parameter is valid only when the MECHATROLINK-II-compatible profile is used.

- \*16.The setting of Pn842 is valid while Pn817 is set to 0.
- \*17.The setting of Pn844 is valid while Pn818 is set to 0.

#### 14.2.1 Interpreting the Parameter Lists

# 14.2 List of MECHATROLINK-III Common Parameters

## 14.2.1 Interpreting the Parameter Lists

- The types of Servomotors to which the parameter applies.
- All: The parameter is used for both Rotary Servomotors and Linear Servomotors.
  Rotary: The parameter is used for only Rotary Servomotors.
- Linear: The parameter is used for only Linear Servomotors.
- Rotary Servomotor terms are used for parameters that are

applicable to all Servomotors. If you are using a Linear Servomotor, you need to interpret the terms accordingly. Refer to the following section for details.

| Parameter<br>No. | Size | Name            | Setting<br>Range      | Setting Unit<br>[Resolution] | Defaunt<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication |
|------------------|------|-----------------|-----------------------|------------------------------|--------------------|----------------------|------------------|---------------------|
| 61<br>PnAC2      | 4    | Speed Loop Gain | 1,000 to<br>2,000,000 | 0.001 Hz<br>[0.1 Hz]         | 40000              | All                  | Immedi-<br>ately | Tuning              |

You can set the parameter in increments of the setting unit. However, if a unit is given in square brackets,

.

Indicates when a change to the

"After restart" indicates parameters

that will be effective after one of the

• The power supply is turned OFF

The CONFIG command is sent.

• A software reset is executed.

parameter will be effective.

following is executed.

and ON again.

the setting is automatically converted to the

resolution given in the square brackets.

14.2.2 List of MECHATROLINK-III Common Parameters

### 14.2.2 List of MECHATROLINK-III Common Parameters

The following table lists the common MECHATROLINK-III parameters. These common parameters are used to make settings from the host controller via MECHATROLINK communications. Do not change the settings with the Digital Operator or any other device.

| Parameter<br>No. | Size               | Name                                                           |  | Setting Range                         | Setting Unit<br>[Resolution] | Default<br>Setting | Applicable<br>Motors | When<br>Enabled                | Classi-<br>fication |  |
|------------------|--------------------|----------------------------------------------------------------|--|---------------------------------------|------------------------------|--------------------|----------------------|--------------------------------|---------------------|--|
|                  | 4                  | Encoder Type Selec-<br>tion (read only)                        |  | Oh to 1h                              | -                            | -                  | All                  | _                              |                     |  |
| 01               |                    | 0000h Absolute encoder                                         |  |                                       |                              |                    |                      |                                |                     |  |
| PnA02            |                    | 00001h                                                         |  | Incremental encoder                   |                              |                    |                      |                                |                     |  |
|                  |                    |                                                                |  |                                       |                              |                    |                      |                                |                     |  |
|                  | 4                  | Motor Type Selection<br>(read only)     Oh to 1h     -     All |  |                                       |                              |                    |                      | _                              |                     |  |
| 02               |                    |                                                                |  |                                       |                              |                    |                      |                                |                     |  |
| PnA04            |                    | 0000h Rotary Servomotor                                        |  |                                       |                              |                    |                      |                                |                     |  |
|                  |                    | 0001h Linear Servomotor                                        |  |                                       |                              |                    |                      |                                |                     |  |
|                  |                    | 1                                                              |  |                                       | T                            |                    |                      | T                              |                     |  |
|                  | 4                  | Semi-close<br>closed Sele<br>(read only)                       |  | 0h to 1h                              | _                            | _                  | All                  | _                              |                     |  |
| 03               |                    |                                                                |  |                                       |                              |                    |                      |                                |                     |  |
| PnA06            | 0000h Semi-closed  |                                                                |  |                                       |                              |                    |                      |                                | latio               |  |
|                  | 0001h Fully-closed |                                                                |  |                                       |                              |                    |                      |                                | inform              |  |
| 04<br>PnA08      | 4                  | Rated Motor Speed (read only)                                  |  | Oh to<br>FFFFFFFh                     | 1 min <sup>-1</sup>          | -                  | All                  | _                              | Device information  |  |
| 05<br>PnA0A      | 4                  | Maximum Output<br>Speed (read only)                            |  | Oh to<br>FFFFFFFh                     | 1 min <sup>-1</sup>          | -                  | All                  | -                              |                     |  |
| 06<br>PnA0C      | 4                  | Speed Multiplier<br>(read only)                                |  | -1,073,741,823<br>to<br>1,073,741,823 | -                            | -                  | All                  | _                              |                     |  |
| 07<br>PnA0E      | 4                  | Rated Torque<br>(read only)                                    |  | Oh to<br>FFFFFFFh                     | 1 N∙m                        | -                  | All                  | -                              |                     |  |
| 08<br>PnA10      | 4                  | Maximum Output<br>Torque (read only)                           |  | Oh to<br>FFFFFFFh                     | 1 N∙m                        | -                  | All                  | -                              |                     |  |
| 09<br>PnA12      | 4                  | Torque Multiplier<br>(read only)                               |  | -1,073,741,823<br>to<br>1,073,741,823 | -                            | -                  | All                  | _                              |                     |  |
| 0A<br>PnA14      | 4                  | Resolution<br>(read only)                                      |  | Oh to<br>FFFFFFFh                     | 1 pulse/rev                  | -                  | Rotary               | -                              |                     |  |
| 0B<br>PnA16      | 4                  | Scale Pitch                                                    |  | 0 to 65,536,000                       | 1 nm<br>[0.01 μm]            | 0                  | Linear               | After<br>restart <sup>*1</sup> |                     |  |
| 0C<br>PnA18      | 4                  | Pulses per Scale<br>Pitch (read only)                          |  | Oh to<br>FFFFFFFh                     | 1 pulse/<br>pitch            | -                  | Linear               | _                              |                     |  |

Continued on next page.

| Size Name Setting Bange                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |       |      |                                                                                                                    |                     | -                     |                  | (     | Continued fr | rom previo | us page.            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------|--------------------------------------------------------------------------------------------------------------------|---------------------|-----------------------|------------------|-------|--------------|------------|---------------------|
| PnA42         4         INUmeratory         1,073,741,824         -         16         All         restart           22         PnA44         4         Electronic Gear Ratio         1,073,741,824         -         1         All         Instant           23         PnA46         4         Absolute Encoder         1,073,741,823         1         reference         0         All         Immediation           24         Absolute Encoder         1,073,741,823         1         reference         0         All         Immediation           25         Multifum Umit         0 to 65,535         1         Rev         65535         Retary         After           81 0         P-OT (0: Enabled, 1: Disabled)         Immediation         Immediation         Immediation         Immediation           81 3         Reserved.         Bit 4         P-SOT (0: Disabled, 1: Enabled)         Immediation         Immediation         Immediation           26         A         Envard Software         1,073,741,823         Immediation         Immediation         Immediation           81 3         Reserved, Baserved.         Immediation         Immediation         Immediation         Immediation         Immediation           PnA4C         4                                                                                                                                                                                                    |       | Size | Nam                                                                                                                | е                   | Setting Range         |                  |       |              | -          | Classi-<br>fication |
| PnA44         *         (Donominator)         1,073,741,824         -         1         I         Immediate           23         PnA46         4         Absolute Encoder         -1,073,741,823         1 reference         0         All         immedi-<br>atte/*i           24         Multitum Limit<br>Setting         0 to 65,535         1 Rev         65535         Rotary         After<br>restart           25         Bit 0         P-OT (0: Enabled, 1: Disabled)         -         0000h         All         After<br>restart           25         Bit 2         Reserved.         -         -         0000h         All         Miter<br>restart           26         Bit 3         Reserved.         -         -         0000h         All         Immedi-<br>attely           27         Bit 6 to 31         Reserved.         -         -         0         All         Immedi-<br>attely           27         A         Reserved parameter<br>(Do not change)         -         -         0         All         Immedi-<br>attely           27         PnA46         4         Reserved parameter<br>(Do not change)         -         -         0         All         Immedi-<br>attely           28         4         Reverse Software<br>(Donth All         <                                                                                                                                                                                           |       | 4    |                                                                                                                    |                     | 1 to<br>1,073,741,824 | _                | 16    | All          |            |                     |
| PnA46         4         Absolute Proven         Treference         0         All         mitteon         atter/n         atter/n           24         Multitum Limit         0 to 65.535         1 Rev         65535         Potary         After mestart           4         Multitum Limit         0 to 65.535         1 Rev         65535         Potary         After mestart           4         Limit Setting         0 h to 33h         -         0000h         All         After mestart           25         Bit 0         P-OT (0: Enabled, 1: Disabled)         Bit 1         N-OT (0: Disabled, 1: Disabled)         Bit 2         Reserved.           Bit 4         P-SOT (0: Disabled, 1: Enabled)         Bit 5         N-SOT (0: Disabled, 1: Enabled)         Immediately           26         4         Forward Software         -1.073,741,823         1 reference         10737418         All         Immediately           27         PnA4E         4         Reserved parameter         -         -         0         All         Immediately           28         PnA52         4         Reverse Software         -1.073,741,823         1 reference         -1073741         All         Immediately           29         PnA52         4         Rev                                                                                                                                                                                               |       | 4    |                                                                                                                    |                     | 1 to<br>1,073,741,824 | _                | 1     | All          |            |                     |
| PnA48         4         Setting         D10 B5,335         1 Hev         d5335         Holary         restart           4         Limit Setting         0h to 33h         -         0000h         All         After<br>restart           25         PnA4A         Bit 0         P-OT (0: Enabled, 1: Disabled)         -         -         -         0000h         All         After<br>restart           25         PnA4A         Bit 1         N-OT (0: Enabled, 1: Disabled)         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -                                                                                                                                                                                                                                                                                                           |       | 4    |                                                                                                                    |                     | to                    |                  | 0     | All          |            |                     |
| 4         Limit Setting         On to 33n         -         0000n         All         restart           25         Bit 0         P-OT (0: Enabled, 1: Disabled)         -         0000n         All         restart           25         Bit 1         N-OT (0: Enabled, 1: Disabled)         -         -         0000n         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -                                                                                                                                                                                                                                                                                                                                 |       | 4    |                                                                                                                    | nit                 | 0 to 65,535           | 1 Rev            | 65535 | Rotary       |            |                     |
| Bits 6 to 31         Reserved.           26<br>PnA4C         4         Forward Software<br>Limit         -1,073,741,823         1 reference<br>unit         10737418         All         Immedi-<br>ately           27<br>PnA4E         4         Reserved parameter<br>(Do not change.)         -         -         0         All         Immedi-<br>ately           28<br>PnA50         4         Reverse Software<br>(Do not change.)         -         -         0         All         Immedi-<br>ately           29<br>PnA52         4         Reserved parameter<br>(Do not change.)         -         -         0         All         Immedi-<br>ately           29<br>PnA52         4         Speed Unit<br>Selection*2         0h to 4h         -         0h         All         Immedi-<br>ately           4         Speed Unit<br>Selection*2         0h to 4h         -         0h         All         After<br>restart           41<br>PnA82         Speed Base Unit<br>Selection*2         0000h         Reference units/s<br>0000h         -         0         All         After<br>restart           42<br>PnA84         4         Speed Base Unit<br>Selection         -3 to 3         -         0         All         After<br>restart           43         Speed Dist         0h         0h         -         0h         All                                                                                                                               |       | 4    | Limit Setting                                                                                                      | )                   | 0h to 33h             | _                | 0000h | All          |            | _                   |
| Bits 6 to 31         Reserved.           26<br>PnA4C         4         Forward Software<br>Limit         -1,073,741,823<br>1,073,741,823         1 reference<br>unit         10737418<br>23         All         Immedi-<br>ately           27<br>PnA4E         4         Reserved parameter<br>(Do not change.)         -         -         0         All         Immedi-<br>ately           28<br>PnA52         4         Reverse Software<br>(Do not change.)         -1,073,741,823<br>1,073,741,823         1 reference<br>unit         -1073741<br>823         All         Immedi-<br>ately           29<br>PnA52         4         Reserved parameter<br>(Do not change.)         -         -         0         All         Immedi-<br>ately           29<br>PnA52         4         Speed Unit<br>Selection*2         0h to 4h         -         0h         All         After<br>restart           4         Speed Unit<br>Selection*2         0h to 4h         -         0h         All         After<br>restart           41<br>PnA82         Speed Base Unit<br>Selection*4         Speed Maximum motor speed/40000000h*4         -         0         All         After<br>restart           42<br>PnA84         4         Speed Dase Unit<br>Selection         -         0         All         After<br>restart           43<br>Bra48         4         Speed Unit<br>Selection         0h         -<                                                              | 25    |      | Bit 1                                                                                                              | N-01                | (0: Enabled, 1: D     | ,                |       |              |            | ifications          |
| Bits 6 to 31         Reserved.           26<br>PnA4C         4         Forward Software<br>Limit         -1,073,741,823<br>1,073,741,823         1 reference<br>unit         10737418<br>23         All         Immedi-<br>ately           27<br>PnA4E         4         Reserved parameter<br>(Do not change.)         -         -         0         All         Immedi-<br>ately           28<br>PnA50         4         Reverse Software<br>(Do not change.)         -         -         0         All         Immedi-<br>ately           29<br>PnA52         4         Reserved parameter<br>(Do not change.)         -         -         0         All         Immedi-<br>ately           29<br>PnA52         4         Speed Unit<br>Selection*2         0h to 4h         -         0h         All         After<br>restart           4         Speed Unit<br>Selection*2         0h to 4h         -         0h         All         After<br>restart           41<br>PnA82         Speed Base Unit<br>Selection***4<br>PnA84         Speed Base Unit<br>Selection (41 PnA82)<br>× 10*)         -         0         All         After<br>restart           42<br>PnA84         4         Speed Unit<br>selection (41 PnA82)<br>× 10*)         -         0         All         After<br>restart           43<br>PnA86         4         Speed Unit<br>selection         0h         0h         -                                                                           |       |      |                                                                                                                    |                     |                       |                  |       |              |            | bec                 |
| Bits 6 to 31         Reserved.           26<br>PnA4C         4         Forward Software<br>Limit         -1,073,741,823<br>1,073,741,823         1 reference<br>unit         10737418<br>23         All         Immedi-<br>ately           27<br>PnA4E         4         Reserved parameter<br>(Do not change.)         -         -         0         All         Immedi-<br>ately           28<br>PnA50         4         Reverse Software<br>(Do not change.)         -         -         0         All         Immedi-<br>ately           29<br>PnA52         4         Reserved parameter<br>(Do not change.)         -         -         0         All         Immedi-<br>ately           29<br>PnA52         4         Speed Unit<br>Selection*2         0h to 4h         -         0h         All         After<br>restart           4         Speed Unit<br>Selection*2         0h to 4h         -         0h         All         After<br>restart           41<br>PnA82         Speed Base Unit<br>Selection***4<br>PnA84         Speed Base Unit<br>Selection (41 PnA82)<br>× 10*)         -         0         All         After<br>restart           42<br>PnA84         4         Speed Unit<br>selection (41 PnA82)<br>× 10*)         -         0         All         After<br>restart           43<br>PnA86         4         Speed Unit<br>selection         0h         0h         -                                                                           |       |      |                                                                                                                    |                     |                       | Enabled)         |       |              |            | le s                |
| Bits 6 to 31         Reserved.           26<br>PnA4C         4         Forward Software<br>Limit         -1,073,741,823<br>1,073,741,823         1 reference<br>unit         10737418<br>23         All         Immedi-<br>ately           27<br>PnA4E         4         Reserved parameter<br>(Do not change.)         -         -         0         All         Immedi-<br>ately           28<br>PnA50         4         Reverse Software<br>(Do not change.)         -         -         0         All         Immedi-<br>ately           29<br>PnA52         4         Reserved parameter<br>(Do not change.)         -         -         0         All         Immedi-<br>ately           29<br>PnA52         4         Speed Unit<br>Selection*2         0h to 4h         -         0h         All         After<br>restart           4         Speed Unit<br>Selection*2         0h to 4h         -         0h         All         After<br>restart           41<br>PnA82         Speed Base Unit<br>Selection***4<br>PnA84         Speed Base Unit<br>Selection (41 PnA82)<br>× 10*)         -         0         All         After<br>restart           42<br>PnA84         4         Speed Unit<br>selection (41 PnA82)<br>× 10*)         -         0         All         After<br>restart           43<br>PnA86         4         Speed Unit<br>selection         0h         0h         -                                                                           |       |      |                                                                                                                    |                     |                       | ,                |       |              |            | chir                |
| 26<br>PnA4C         4         Forward Software<br>Limit         -1,073,741,823<br>to<br>1,073,741,823         1 reference<br>unit         10737418<br>23         All         Immedi-<br>ately           27<br>PnA4E         4         Reserved parameter<br>to not change.)         -         -         0         All         Immedi-<br>ately           28<br>PnA50         4         Reverse Software<br>Limit         -1,073,741,823         1 reference<br>unit         -1073741         All         Immedi-<br>ately           29<br>PnA52         4         Reserved parameter<br>(Do not change.)         -         -         0         All         Immedi-<br>ately           29<br>PnA52         4         Reserved parameter<br>(Do not change.)         -         -         0         All         Immedi-<br>ately           4         Speed Unit<br>Selection <sup>2</sup> 0h to 4h         -         0h         All         After<br>restart           41<br>PnA82         Speed Unit<br>Selection <sup>15, 44</sup><br>(South Value of n<br>from the following<br>from the following<br>selection (41 PnA82)<br>× 10')         -         0         All         After<br>restart           41<br>PnA84         4         Speed Unit<br>Selection '3, 44<br>Speed Unit<br>selection (41 PnA82)<br>× 10')         -         0         All         After<br>restart           43<br>PnA86         4         Speed Unit<br>Selection         0h         -         0h |       |      | -                                                                                                                  |                     |                       | Lilabled)        |       |              |            | Ma                  |
| 20         4         Environ 301 Wate         to<br>1,073,741,823         Interference         1073,7418         All         Interference         Interfer                                                                                         |       |      | Dits 0 t0 01                                                                                                       | 11636               |                       |                  |       |              |            |                     |
| PnA4E         4         Coord parameter<br>(Do not change.)         -         -         0         All         Instance<br>ately           28<br>PnA50         4         Reverse Software<br>Limit         -1,073,741,823<br>to<br>1,073,741,823         1 reference<br>unit         -1073741<br>823         All         Immedi-<br>ately           29<br>PnA52         4         Reserved parameter<br>(Do not change.)         -         -         0         All         Immedi-<br>ately           4         Speed Unit<br>Selection*2         0h to 4h         -         0h         All         After<br>restart           4         Speed Unit<br>Selection*2         0h to 4h         -         0h         All         After<br>restart           000h         Reference units/s<br>000h         Reference units/s<br>000h         -         0h         All         After<br>restart           000h         Reference units/s<br>000h         Maximum motor speed/40000000h*4         -         0h         All         After<br>restart           42<br>PnA84         4         Speed Base Unit<br>Selection (41 PnA82)<br>× 10°)         -3 to 3         -         0         All         After<br>restart           4         Position Unit<br>Selection         0h         -         0h         All         After<br>restart                                                                                                                                           |       | 4    |                                                                                                                    | ftware              | to                    |                  |       | All          |            | -                   |
| 20         4         Reverse software         to         Interference         For Strain         All         Interference         ately           29         PnA52         4         Reserved parameter<br>(Do not change.)         -         -         0         All         Immedi-<br>ately           4         Speed Unit<br>Selection*2         0h to 4h         -         0h         All         Affer<br>restart           41         Speed Unit<br>Selection*2         0h to 4h         -         0h         All         Affer<br>restart           0000h         Reference units/s         -         0h         All         Affer<br>restart           0001h         Reference units/s         -         0h         All         Affer<br>restart           0002h         Percentage (%) of rated speed*3         -         0         All         Affer<br>restart           0004h         Maximum motor speed/40000000h*4         -         -         0         All         After<br>restart           42         Speed Base Unit<br>Selection *3.*4         -3 to 3         -         0         All         After<br>restart           43         Position Unit<br>Selection         0h         -         0h         All         After<br>restart                                                                                                                                                                                                                   |       | 4    |                                                                                                                    |                     | -                     | -                | 0     | All          |            |                     |
| PnA52         4         IDenote change.)         -         -         0         All         Instein           4         Speed Unit<br>Selection*2         0h to 4h         -         0h         All         After<br>restart           41         PnA82         4         Speed Unit<br>Selection*2         0h to 4h         -         0h         All         After<br>restart           41         PnA82         0000h         Reference units/s         -         0h         All         After<br>restart           0002h         Percentage (%) of rated speed*3         -         0003h         min <sup>-1*3</sup> -         0004h         Maximum motor speed/40000000h*4         -         -         All         After<br>restart         -         -         0         All         After<br>restart                                                                                                                                                                               |       | 4    |                                                                                                                    | ftware              | to                    |                  |       | All          |            |                     |
| 41         Selection*2         0h to 4h         -         0h         All         restart           41         PnA82         000h         Reference units/s                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |       | 4    | Reserved pa<br>(Do not cha                                                                                         | arameter<br>nge.)   | -                     | -                | 0     | All          |            |                     |
| 41<br>PnA82       0001h       Reference units/min         0002h       Percentage (%) of rated speed*3         0003h       min <sup>-1*3</sup> 0004h       Maximum motor speed/4000000h*4         42       Speed Base Unit         Selection* <sup>3,*4</sup><br>(Set the value of n<br>from the following<br>formula: Speed unit<br>selection (41 PnA82)<br>× 10 <sup>n</sup> )       -3 to 3       -       0       All       After<br>restart         43       PnA86       -       0h       All       After<br>restart       -       -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |       | 4    | Speed Unit<br>Selection <sup>*2</sup>                                                                              |                     | Oh to 4h              | -                | Oh    | All          |            |                     |
| 41<br>PnA82       0001h       Reference units/min         0002h       Percentage (%) of rated speed*3         0003h       min <sup>-1*3</sup> 0004h       Maximum motor speed/4000000h*4         42       Speed Base Unit         Selection* <sup>3,*4</sup><br>(Set the value of n<br>from the following<br>formula: Speed unit<br>selection (41 PnA82)<br>× 10 <sup>n</sup> )       -3 to 3       -       0       All       After<br>restart         43       PnA86       -       0h       All       After<br>restart       -       -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |       |      |                                                                                                                    |                     |                       |                  |       |              |            |                     |
| PnA82       O002h       Percentage (%) of rated speed*3       Speed speed*3       Speed*3 </td <td></td> <td></td> <td>0000h</td> <td>Reference</td> <td>e units/s</td> <td></td> <td></td> <td></td> <td></td> <td></td>                                     |       |      | 0000h                                                                                                              | Reference           | e units/s             |                  |       |              |            |                     |
| 42<br>PnA84     4     Speed Base Unit<br>Selection*3,*4<br>(Set the value of n<br>from the following<br>formula: Speed unit<br>selection (41 PnA82)<br>× 10 <sup>n</sup> )     -3 to 3     -     0     All     After<br>restart       43<br>PnA86     4     Position Unit<br>Selection     0h     -     0h     All     After<br>restart                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |       |      | 0001h                                                                                                              | Reference           | e units/min           |                  |       |              |            |                     |
| 42       Speed Base Unit<br>Selection*3.*4<br>(Set the value of n<br>from the following<br>formula: Speed unit<br>selection (41 PnA82)<br>× 10 <sup>n</sup> )       -3 to 3       -       0       All       After<br>restart         43       4       Position Unit<br>Selection       0h       -       0h       All       After<br>restart                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | PnA82 |      | 0002h                                                                                                              | Percenta            | ge (%) of rated spe   | ed <sup>*3</sup> |       |              |            |                     |
| 42       A       Speed Base Unit<br>Selection* <sup>3,*4</sup><br>(Set the value of n<br>from the following<br>formula: Speed unit<br>selection (41 PnA82)<br>× 10 <sup>n</sup> )       -3 to 3       -       O       All       After<br>restart         43       A       Position Unit<br>Selection       Oh       -       Oh       All       After<br>restart                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |       |      | 0003h                                                                                                              | min <sup>-1*3</sup> |                       |                  |       |              |            |                     |
| 42     4     from the following formula: Speed unit selection (41 PnA82) × 10 <sup>n</sup> )     -3 to 3     -     0     All     After restart       4     Position Unit Selection     0h     -     0h     All     After restart                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |       |      | 0004h                                                                                                              | Maximum             | n motor speed/400     | )00000h*4        |       |              |            |                     |
| 42     4     from the following formula: Speed unit selection (41 PnA82) × 10 <sup>n</sup> )     -3 to 3     -     0     All     After restart       4     Position Unit Selection     0h     -     0h     All     After restart                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |       |      | 1                                                                                                                  |                     |                       |                  |       |              |            | sɓL                 |
| × 10°)     Image: Selection       4     Position Unit<br>Selection     Oh         43                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |       | 4    | Selection <sup>*3, *4</sup><br>(Set the value of n<br>from the following -3 to 3 - 0 All re<br>formula: Speed unit |                     |                       |                  |       |              |            | Unit settir         |
| 4 Selection Un – Un All restart<br>43<br>Pa A 86                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |       |      | × 10 <sup>n</sup> )                                                                                                |                     |                       |                  |       | •            | After      | -                   |
| Dn 496                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 40    | 4    |                                                                                                                    | L                   | Oh                    | -                | Oh    | All          |            | _                   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |       |      | 0000h                                                                                                              | Reference           | e units               |                  |       |              |            |                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |       |      |                                                                                                                    |                     |                       |                  |       |              |            |                     |

Continued from previous page.

| Parameter   |      |                                                                                                                                                               |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                     |                                                                                                                                            |                             |                      |                  |
|-------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|----------------------|------------------|
| No.         | Size | Nar                                                                                                                                                           | ne                                                                                                                                                                                                                                       | Setting Range                                                                                                                                                                                                                                                                       | Setting Unit<br>[Resolution]                                                                                                               | Default<br>Setting          | Applicable<br>Motors | When<br>Enabled  |
| 44<br>PnA88 | 4    | Position Ba<br>Selection<br>(Set the val<br>from the fo<br>formula: Po<br>selection (4<br>$\times$ 10 <sup>n</sup> )                                          | ue of n<br>llowing<br>sition unit                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                     | _                                                                                                                                          | 0                           | All                  | After<br>restart |
|             | 4    | Acceleratio<br>Selection                                                                                                                                      | n Unit                                                                                                                                                                                                                                   | Oh                                                                                                                                                                                                                                                                                  | _                                                                                                                                          | Oh                          | All                  | After<br>restart |
| 45          |      |                                                                                                                                                               |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                     |                                                                                                                                            |                             |                      |                  |
| PnA8A       |      | 0000h                                                                                                                                                         | Referenc                                                                                                                                                                                                                                 | e units/s <sup>2</sup>                                                                                                                                                                                                                                                              |                                                                                                                                            |                             |                      |                  |
| 46<br>PnA8C | 4    | Acceleratio<br>Unit Selecti<br>(Set the val<br>from the fo<br>formula: Ac<br>unit selectio<br>PnA8A) × 1                                                      | ion<br>ue of n<br>llowing<br>celeration<br>on (45                                                                                                                                                                                        | 4 to 6                                                                                                                                                                                                                                                                              | _                                                                                                                                          | 4                           | All                  | After<br>restart |
|             | 4    | Torque Unit<br>Selection                                                                                                                                      | t                                                                                                                                                                                                                                        | 1h to 2h                                                                                                                                                                                                                                                                            | -                                                                                                                                          | 1h                          | All                  | After<br>restart |
| 47<br>PnA8E |      | 0001h<br>0002h                                                                                                                                                |                                                                                                                                                                                                                                          | age (%) of rated toro<br>n torque/40000000                                                                                                                                                                                                                                          |                                                                                                                                            |                             |                      |                  |
| 48<br>PnA90 | 4    | Torque Base Unit<br>Selection <sup>*5</sup><br>(Set the value of n<br>from the following<br>formula: Torque unit<br>selection (47 PnA8E)<br>$\times 10^{n}$ ) |                                                                                                                                                                                                                                          | -5 to 0                                                                                                                                                                                                                                                                             | _                                                                                                                                          | 0                           | All                  | After<br>restart |
|             | 4    | Supported tems (read                                                                                                                                          | Unit Sys-<br>only)                                                                                                                                                                                                                       | -                                                                                                                                                                                                                                                                                   | -                                                                                                                                          | 0601011F<br>h               | All                  | _                |
|             |      | Speed Unit                                                                                                                                                    |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                     |                                                                                                                                            |                             |                      |                  |
|             |      |                                                                                                                                                               | .0                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                     |                                                                                                                                            |                             |                      |                  |
|             |      |                                                                                                                                                               | R                                                                                                                                                                                                                                        | eference units/s (1:                                                                                                                                                                                                                                                                | Enabled)                                                                                                                                   |                             |                      |                  |
|             |      | Bit 0<br>Bit 1                                                                                                                                                |                                                                                                                                                                                                                                          | eference units/s (1:<br>eference units/min                                                                                                                                                                                                                                          |                                                                                                                                            |                             |                      |                  |
|             |      | Bit 0                                                                                                                                                         | R                                                                                                                                                                                                                                        | eference units/min                                                                                                                                                                                                                                                                  | (1: Enabled)                                                                                                                               | Enabled)                    |                      |                  |
|             |      | Bit 0<br>Bit 1<br>Bit 2                                                                                                                                       | R                                                                                                                                                                                                                                        | eference units/min<br>ercentage (%) of rat                                                                                                                                                                                                                                          | (1: Enabled)<br>ed speed (1: E                                                                                                             | nabled)                     |                      |                  |
|             |      | Bit 0<br>Bit 1                                                                                                                                                | R<br>P<br>m                                                                                                                                                                                                                              | eference units/min                                                                                                                                                                                                                                                                  | (1: Enabled)<br>ed speed (1: E<br>ed)                                                                                                      |                             |                      |                  |
|             |      | Bit 0<br>Bit 1<br>Bit 2<br>Bit 3                                                                                                                              | R<br>P<br>m<br>M                                                                                                                                                                                                                         | eference units/min<br>ercentage (%) of rat<br>in <sup>-1</sup> (rpm) (1: Enable                                                                                                                                                                                                     | (1: Enabled)<br>ed speed (1: E<br>ed)<br>ed/4000000h (                                                                                     |                             |                      |                  |
|             |      | Bit 0<br>Bit 1<br>Bit 2<br>Bit 3<br>Bit 4                                                                                                                     | R<br>P<br>m<br>M<br>R                                                                                                                                                                                                                    | eference units/min<br>ercentage (%) of rat<br>in <sup>-1</sup> (rpm) (1: Enable<br>laximum motor spe                                                                                                                                                                                | (1: Enabled)<br>ed speed (1: E<br>ed)<br>ed/4000000h (                                                                                     |                             |                      |                  |
| 49          |      | Bit 0           Bit 1           Bit 2           Bit 3           Bit 4           Bits 5 to 7                                                                   | R<br>P<br>M<br>M<br>R<br>hits                                                                                                                                                                                                            | eference units/min<br>ercentage (%) of rat<br>in <sup>-1</sup> (rpm) (1: Enable<br>laximum motor spe                                                                                                                                                                                | 1: Enabled)<br>ed speed (1: E<br>ed)<br>ed/4000000h (<br>d).                                                                               |                             |                      |                  |
|             |      | Bit 0<br>Bit 1<br>Bit 2<br>Bit 3<br>Bit 4<br>Bits 5 to 7<br>Position Ur                                                                                       | R<br>P<br>M<br>M<br>R<br>nits                                                                                                                                                                                                            | eference units/min<br>ercentage (%) of rat<br>in <sup>-1</sup> (rpm) (1: Enable<br>laximum motor spe<br>eserved (0: Disable                                                                                                                                                         | 1: Enabled)<br>ed speed (1: E<br>ed)<br>ed/4000000h (<br>d).<br>nabled)                                                                    |                             |                      |                  |
|             |      | Bit 0Bit 1Bit 2Bit 3Bit 4Bits 5 to 7Position UrBit 8                                                                                                          | R<br>P<br>M<br>M<br>R<br>nits<br>R                                                                                                                                                                                                       | eference units/min (<br>ercentage (%) of rat<br>in <sup>-1</sup> (rpm) (1: Enable<br>laximum motor spe<br>eserved (0: Disable<br>eference units (1: E                                                                                                                               | 1: Enabled)<br>ed speed (1: E<br>ed)<br>ed/4000000h (<br>d).<br>nabled)                                                                    |                             |                      |                  |
|             |      | Bit 0<br>Bit 1<br>Bit 2<br>Bit 3<br>Bit 4<br>Bits 5 to 7<br>Position Ur<br>Bit 8<br>Bits 9 to 15                                                              | R<br>P<br>M<br>M<br>N<br>M<br>N<br>M<br>N<br>M<br>N<br>M<br>N<br>M<br>M<br>M<br>M<br>M<br>M<br>M<br>M                                                                                                                                    | eference units/min (<br>ercentage (%) of rat<br>in <sup>-1</sup> (rpm) (1: Enable<br>laximum motor spe<br>eserved (0: Disable<br>eference units (1: E                                                                                                                               | 1: Enabled)<br>ed speed (1: E<br>ed)<br>ed/4000000h (<br>d).<br>nabled)<br>d).                                                             |                             |                      |                  |
|             |      | Bit 0Bit 1Bit 2Bit 3Bit 4Bits 5 to 7Position UrBit 8Bits 9 to 18Acceleration                                                                                  | R<br>P<br>m<br>M<br>R<br>nits<br>R<br>5 R<br>n Units                                                                                                                                                                                     | eference units/min<br>ercentage (%) of rat<br>in <sup>-1</sup> (rpm) (1: Enable<br>laximum motor spec-<br>eserved (0: Disable<br>eference units (1: E<br>eserved (0: Disable                                                                                                        | 1: Enabled)<br>ed speed (1: E<br>ed)<br>ed/4000000h (<br>d).<br>nabled)<br>d).<br>: Enabled)                                               | 1: Enabled)                 | peed) (0: Disa       | bled)            |
|             |      | Bit 0Bit 1Bit 2Bit 3Bit 4Bits 5 to 7Position UrBit 8Bits 9 to 15AccelerationBit 16                                                                            | R<br>P<br>M<br>M<br>M<br>R<br>nits<br>R<br>5 R<br>n Units<br>R<br>M<br>M                                                                                                                                                                 | eference units/min (<br>ercentage (%) of rat<br>in <sup>-1</sup> (rpm) (1: Enable<br>laximum motor spe-<br>eserved (0: Disable<br>eference units (1: E<br>eserved (0: Disable<br>eference units/s <sup>2</sup> (1<br>is (acceleration time                                          | 1: Enabled)<br>ed speed (1: E<br>ed)<br>ed/4000000h (<br>d).<br>nabled)<br>d).<br>: Enabled)<br>e required to re                           | 1: Enabled)                 | peed) (0: Disa       | bled)            |
|             |      | Bit 0Bit 1Bit 2Bit 3Bit 4Bits 5 to 7Position UrBit 8Bits 9 to 15AccelerationBit 16Bit 17Bits 18 to 2                                                          | R<br>M<br>M<br>Nits<br>R<br>S<br>R<br>N Units<br>R<br>R<br>23 R                                                                                                                                                                          | eference units/min<br>ercentage (%) of rat<br>in <sup>-1</sup> (rpm) (1: Enable<br>laximum motor spe<br>eserved (0: Disable<br>eference units (1: E<br>eserved (0: Disable<br>eference units/s <sup>2</sup> (1                                                                      | 1: Enabled)<br>ed speed (1: E<br>ed)<br>ed/4000000h (<br>d).<br>nabled)<br>d).<br>: Enabled)<br>e required to re                           | 1: Enabled)                 | peed) (0: Disa       | bled)            |
|             |      | Bit 0<br>Bit 1<br>Bit 2<br>Bit 3<br>Bit 4<br>Bits 5 to 7<br>Position Ur<br>Bit 8<br>Bits 9 to 15<br>Acceleratio<br>Bit 16<br>Bit 17                           | R<br>P<br>M<br>M<br>M<br>R<br>M<br>M<br>S<br>S<br>R<br>R<br>S<br>R<br>R<br>M<br>23<br>R                                                                                                                                                  | eference units/min (<br>ercentage (%) of rat<br>in <sup>-1</sup> (rpm) (1: Enable<br>laximum motor spe-<br>eserved (0: Disable<br>eference units (1: E<br>eserved (0: Disable<br>eference units/s <sup>2</sup> (1<br>is (acceleration time                                          | 1: Enabled)<br>ed speed (1: E<br>ed)<br>ed/4000000h (<br>d).<br>nabled)<br>d).<br>: Enabled)<br>e required to re                           | 1: Enabled)                 | peed) (0: Disa       | bled)            |
| 49<br>PnA92 |      | Bit 0Bit 1Bit 2Bit 3Bit 4Bits 5 to 7Position UrBit 8Bits 9 to 15AccelerationBit 16Bit 17Bits 18 to 2Torque UnitBit 24                                         | R           P           m           M           R           5           N           Constraints           R           M           So           R           M           So           R           M           23           R           Lts | eference units/min<br>ercentage (%) of rat<br>in <sup>-1</sup> (rpm) (1: Enable<br>laximum motor spe-<br>eserved (0: Disable<br>eference units (1: E<br>eserved (0: Disable<br>eference units/s <sup>2</sup> (1<br>is (acceleration time<br>eserved (0: Disable<br>•m (0: Disabled) | 1: Enabled)<br>ed speed (1: E<br>ed)<br>ed/4000000h (<br>d).<br>nabled)<br>d).<br>: Enabled)<br>e required to re<br>d).                    | 1: Enabled)<br>ach rated sp | peed) (0: Disa       | bled)            |
|             |      | Bit 0Bit 1Bit 2Bit 3Bit 4Bits 5 to 7Position UrBit 8Bits 9 to 18AcceleratioBit 16Bit 17Bits 18 to 2Torque Unit                                                | R           P           m           M           R           5           R           n Units           R           23           R           1s           N           P                                                                    | eference units/min<br>ercentage (%) of rat<br>in <sup>-1</sup> (rpm) (1: Enable<br>laximum motor spece<br>eserved (0: Disable<br>eference units (1: E<br>eserved (0: Disable<br>eference units/s <sup>2</sup> (1<br>is (acceleration time<br>eserved (0: Disable                    | 1: Enabled)<br>ed speed (1: E<br>ed)<br>ed/4000000h (<br>d).<br>nabled)<br>d).<br>: Enabled)<br>e required to re<br>d).<br>ed torque (1: E | 1: Enabled)<br>ach rated sp | peed) (0: Disa       | bled)            |

Parameter Lists

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| Parameter        | Size | Nar                                       | ne                                                           | Setting Range         | Setting Unit                       | Default                                         | Applicable | When             | Class  |
|------------------|------|-------------------------------------------|--------------------------------------------------------------|-----------------------|------------------------------------|-------------------------------------------------|------------|------------------|--------|
| <u>No.</u><br>61 |      |                                           |                                                              |                       | [Resolution]                       | Setting                                         | Motors     | Enabled          | ficati |
| o I<br>PnAC2     | 4    | Speed Loo                                 | p Gain                                                       | 1,000 to<br>2,000,000 | 0.001 Hz<br>[0.1 Hz]               | 40000                                           | All        | Immedi-<br>ately |        |
| 62               | 4    | Speed Loo                                 | p Integral                                                   | 150 to 512,000        | 1 µs                               | 20000                                           | All        | Immedi-          |        |
| PnAC4            | -    | Time Cons                                 | tant                                                         | ,                     | [0.01 ms]                          | 20000                                           | 7 41       | ately            | -      |
| 63<br>PnAC6      | 4    | Position Lo                               | oop Gain                                                     | 1,000 to<br>2,000,000 | 0.001/s<br>[0.1/s]                 | 40000                                           | All        | Immedi-<br>ately |        |
| 64               | 4    | Feedforwa                                 | rd Com-                                                      | 0 to 100              | 1%                                 | 0                                               | All        | Immedi-          |        |
| PnAC8            | -    | pensation                                 |                                                              | 010100                |                                    | 0                                               |            | ately            | -      |
| 65<br>PnACA      | 4    | Position Lo<br>gral Time C                |                                                              | 0 to 5,000,000        | 1 μs<br>[0.1 ms]                   | 0                                               | All        | Immedi-<br>ately |        |
| 66               | 4    | Positioning                               |                                                              | 0 to                  | 1 reference                        | 7                                               | All        | Immedi-          |        |
| PnACC            | •    | pleted Wid                                | th                                                           | 1,073,741,824         | unit                               |                                                 | ,          | ately            | -      |
| 67<br>PnACE      | 4    | Near Signa                                | l Width                                                      | 1 to<br>1,073,741,824 | 1 reference<br>unit                | 10737418<br>24                                  | All        | Immedi-<br>ately |        |
| 81               | 4    | Exponentia                                |                                                              | 0.1.510.000           | 1 µs                               | 0                                               | A.II.      | Immedi-          |        |
| PnB02            | 4    | ation/Dece<br>Time Cons                   |                                                              | 0 to 510,000          | [0.1 ms]                           | 0                                               | All        | ately*6          |        |
| 82               | 4    | Movement                                  | Average                                                      | 0 to 510,000          | 1 μs                               | 0                                               | All        | Immedi-          |        |
| PnB04            |      | Time                                      |                                                              | -1,073,741,823        | [0.1 ms]                           |                                                 |            | ately*6          | -      |
| 83<br>PnB06      | 4    | External Po<br>Final Trave                |                                                              | to                    | 1 reference<br>unit                | 100                                             | All        | Immedi-<br>ately |        |
|                  |      |                                           |                                                              | 1,073,741,823         |                                    | × 5,000h                                        |            |                  | -      |
| 84               |      | Origin App                                | roach                                                        | 0h to                 |                                    | reference<br>units/s                            |            | Immedi-          |        |
| PnB08            | 4    | Speed                                     | roach                                                        | 3FFFFFFh              | 10 <sup>-3</sup> min <sup>-1</sup> | con-                                            | All        | ately            |        |
|                  |      |                                           |                                                              |                       |                                    | verted to<br>10 <sup>-3</sup> min <sup>-1</sup> |            |                  |        |
|                  |      |                                           |                                                              |                       |                                    | × 500h<br>reference                             |            |                  |        |
| 85               | 4    | Origin Retu                               | ırn Creep                                                    | Oh to                 | 10 <sup>-3</sup> min <sup>-1</sup> | units/s                                         | All        | Immedi-          | Tuning |
| PnB0A            | -    | Speed                                     |                                                              | 3FFFFFFh              | 10 11111                           | con-<br>verted to                               | 7 41       | ately            | Г      |
|                  |      |                                           |                                                              |                       |                                    | 10 <sup>-3</sup> min <sup>-1</sup>              |            |                  | _      |
| 86<br>PnB0C      | 4    | Final Travel<br>for Origin F              |                                                              | -1,073,741,823<br>to  | 1 reference<br>unit                | 100                                             | All        | Immedi-<br>atelv |        |
| FIIBUC           |      | 0                                         |                                                              | 1,073,741,823         | Unit                               |                                                 |            | ,                | -      |
|                  | 4    | Fixed Moni<br>tion 1                      | tor Selec-                                                   | 0h to Fh              | -                                  | 1h                                              | All        | Immedi-<br>ately |        |
|                  |      |                                           |                                                              |                       |                                    |                                                 |            |                  |        |
|                  |      | 0000h                                     | APOS                                                         |                       |                                    |                                                 |            |                  |        |
|                  |      | 0001h                                     | CPOS                                                         |                       |                                    |                                                 |            |                  |        |
|                  |      | 0002h                                     | PERR                                                         |                       |                                    |                                                 |            |                  |        |
|                  |      | 0003h                                     | LPOS1                                                        |                       |                                    |                                                 |            |                  |        |
|                  |      | 0004h                                     | LPOS2                                                        |                       |                                    |                                                 |            |                  |        |
|                  |      | 0005h                                     | FSPD                                                         |                       |                                    |                                                 |            |                  |        |
| 87               |      | 0006h                                     | CSPD                                                         |                       |                                    |                                                 |            |                  |        |
| PnB0E            |      | 0007h                                     | TRQ                                                          |                       |                                    |                                                 |            |                  |        |
|                  |      | 0008h                                     | ALARM                                                        |                       |                                    |                                                 |            |                  |        |
|                  |      | 0009h                                     | MPOS                                                         |                       |                                    |                                                 |            |                  |        |
|                  |      | 000Ah                                     | Reserved                                                     | (undefined value).    |                                    |                                                 |            |                  |        |
|                  |      | 000Bh                                     | Reserved                                                     | (undefined value).    |                                    |                                                 |            |                  |        |
|                  |      | 000Ch                                     |                                                              | ommon monitor 1)      |                                    |                                                 |            |                  |        |
|                  |      | 000Dh                                     |                                                              | ommon monitor 2)      |                                    |                                                 |            |                  |        |
|                  |      | -                                         |                                                              |                       |                                    |                                                 |            |                  |        |
|                  |      |                                           |                                                              | , ,                   |                                    |                                                 |            |                  |        |
|                  |      | 0008h<br>0009h<br>000Ah<br>000Bh<br>000Ch | ALARM<br>MPOS<br>Reserved<br>CMN1 (co<br>CMN2 (co<br>OMN1 (o | (undefined value).    |                                    |                                                 |            |                  |        |

| Parameter<br>No. | Size | Nan                   | ne         | Setting Range     | Setting Unit<br>[Resolution] | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication        |
|------------------|------|-----------------------|------------|-------------------|------------------------------|--------------------|----------------------|------------------|----------------------------|
|                  | 4    | Fixed Monit<br>tion 2 | tor Selec- | Oh to Fh          | -                            | Oh                 | All                  | Immedi-<br>ately | -                          |
| 88<br>PnB10      |      | 0000h to<br>000Fh     | The settin | gs are the same a | s those for Fixe             | ed Monitor S       | Selection 1.         |                  | Command-related parameters |

Continued from previous page.

|                  |      |                       |                                                                                                                          |                                                                                                      |                                          |                    | Continued fr                           |                  |                            |
|------------------|------|-----------------------|--------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|------------------------------------------|--------------------|----------------------------------------|------------------|----------------------------|
| Parameter<br>No. | Size | Nar                   | ne                                                                                                                       | Setting Range                                                                                        | e Setting Unit<br>[Resolution]           | Default<br>Setting | Applicable<br>Motors                   | When<br>Enabled  | Classi<br>ficatio          |
|                  | 4    | SEL_MON<br>Monitor Se | (CMN1)                                                                                                                   | 0h to 9h                                                                                             | -                                        | Oh                 | All                                    | Immedi-<br>ately |                            |
|                  |      |                       |                                                                                                                          |                                                                                                      |                                          |                    |                                        | atery            |                            |
|                  |      | 00001                 | TD00 (1)                                                                                                                 |                                                                                                      |                                          |                    |                                        |                  |                            |
|                  |      | 0000h                 |                                                                                                                          |                                                                                                      | reference coordina                       |                    |                                        |                  |                            |
|                  |      | 0001h                 |                                                                                                                          | •                                                                                                    | in reference coord                       | -                  | ,                                      |                  |                            |
|                  |      | 0002h                 |                                                                                                                          |                                                                                                      | in POS_SET (Set                          | Coordinate         | System) con                            | imand)           |                            |
|                  |      | 0003h                 |                                                                                                                          | get speed)<br>(speed limit)                                                                          |                                          |                    |                                        |                  |                            |
|                  |      | 0004h<br>0005h        | -                                                                                                                        | (torque limit)                                                                                       |                                          |                    |                                        |                  |                            |
|                  |      | 000511                | _                                                                                                                        | ,                                                                                                    | perating status)                         |                    |                                        |                  |                            |
|                  |      |                       | Byte 1: C<br>00h: Pha<br>01h: Pha<br>02h: Pha<br>03h: Pha<br>Byte 2: C<br>00h: Pos<br>01h: Spo<br>02h: Tor<br>Byte 3: Ro | ase 1<br>ase 2<br>ase 3<br>urrent control n<br>sition control mo<br>eed control mo<br>que control mo | node<br>ode<br>de<br>de                  |                    |                                        |                  |                            |
|                  |      |                       | Bit                                                                                                                      | Name                                                                                                 | Description                              | Value              | Settin                                 | a                |                            |
|                  |      | 0006h                 |                                                                                                                          |                                                                                                      | Processing status                        | s for 0            | Latch dete<br>not yet pro<br>cessed.   | ction            | ers                        |
| 89               |      |                       | Bit 0                                                                                                                    | LT_RDY1                                                                                              | LT_REQ1 in SVC<br>D_CTRL region          |                    | Processing<br>detection i<br>progress. |                  | Command-related parameters |
| PnB12            |      |                       | Bit 1                                                                                                                    | LT_RDY1                                                                                              | Processing status<br>latch detection for | or                 | Latch dete<br>not yet pro<br>cessed.   |                  | d-related                  |
|                  |      |                       |                                                                                                                          |                                                                                                      | LT_REQ2 in SVC<br>D_CTRL region          | M-<br>1            | Processing<br>detection i<br>progress. |                  | ommano                     |
|                  |      |                       | Bits 2                                                                                                                   |                                                                                                      |                                          | 0                  | Phase C                                |                  | 0                          |
|                  |      |                       |                                                                                                                          |                                                                                                      |                                          | 1                  | External in signal 1                   |                  |                            |
|                  |      |                       | and 3                                                                                                                    | LT_SEL1R                                                                                             | Latch signal                             | 2                  | External in signal 2                   |                  |                            |
|                  |      |                       |                                                                                                                          |                                                                                                      |                                          | 3                  | External in signal 3                   | put              |                            |
|                  |      |                       |                                                                                                                          |                                                                                                      |                                          | 0                  | Phase C                                |                  |                            |
|                  |      |                       |                                                                                                                          |                                                                                                      |                                          | 1                  | External in signal 1                   | put              |                            |
|                  |      |                       | Bits 4<br>and 5                                                                                                          | LT_SEL2R                                                                                             | Latch signal                             | 2                  | External in signal 2                   |                  |                            |
|                  |      |                       |                                                                                                                          |                                                                                                      |                                          | 3                  | External in signal 3                   | put              |                            |
|                  |      |                       | Bit 6                                                                                                                    | Reserved (0                                                                                          | ).                                       |                    |                                        |                  |                            |
|                  |      | 0007h                 | Reserved                                                                                                                 | •                                                                                                    |                                          |                    |                                        |                  |                            |
|                  |      | 0008h                 | INIT_PGP                                                                                                                 | OS (Low)                                                                                             | Lower 32 bits<br>verted to 64-b          | pit position i     | reference dat                          | а                |                            |
|                  |      | 0009h                 | INIT_PGP                                                                                                                 | OS (High)                                                                                            | Upper 32 bits verted to 64-b             |                    |                                        |                  |                            |

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Continued from previous page.

| Parameter<br>No. | Size | Name                                                                     | Setting Range                                                                                                                                                                                                                                                                     | Setting Unit<br>[Resolution]                                                                   | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication        |
|------------------|------|--------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|--------------------|----------------------|------------------|----------------------------|
|                  | 4    | SEL_MON (CMN2<br>Monitor Selection                                       | 2 Oh to 9h                                                                                                                                                                                                                                                                        | -                                                                                              | Oh                 | All                  | Immedi-<br>ately | _                          |
| 8A<br>PnB14      |      | 0000h to<br>0009h The set                                                |                                                                                                                                                                                                                                                                                   |                                                                                                |                    |                      |                  |                            |
| 8B<br>PnB16      | 4    | Origin Detection<br>Width                                                | 0 to 250                                                                                                                                                                                                                                                                          | 1 reference<br>unit                                                                            | 10                 | All                  | Immedi-<br>ately |                            |
| 8C<br>PnB18      | 4    | Forward Torque Li                                                        | mit 0 to 800                                                                                                                                                                                                                                                                      | 1%                                                                                             | 100                | All                  | Immedi-<br>ately |                            |
| 8D<br>PnB1A      | 4    | Reverse Torque Li                                                        | mit 0 to 800                                                                                                                                                                                                                                                                      | 1%                                                                                             | 100                | All                  | Immedi-<br>ately |                            |
| 8E<br>PnB1C      | 4    | Zero Speed Detec<br>tion Range                                           | - 1,000 to<br>10,000,000                                                                                                                                                                                                                                                          | 10 <sup>-3</sup> min <sup>-1</sup>                                                             | 20000              | All                  | Immedi-<br>ately |                            |
| 8F<br>PnB1E      | 4    | Speed Coincidence<br>Signal Detection<br>Width                           | e 0 to 100,000                                                                                                                                                                                                                                                                    | 10 <sup>-3</sup> min <sup>-1</sup>                                                             | 10000              | All                  | Immedi-<br>ately | ameters                    |
|                  | 4    | Servo Command<br>Control Field Enab<br>Disable Selections<br>(read only) |                                                                                                                                                                                                                                                                                   | _                                                                                              | 0FFF3F3F<br>h      | All                  | _                | elated par                 |
| 90<br>PnB20      |      |                                                                          | CMD_PAUSE (1: Er<br>CMD_CANCEL (1: I<br>STOP_MODE (1: Er<br>ACCFIL (1: Enabled<br>Reserved (0: Disabl<br>LT_REQ1 (1: Enable<br>LT_SEL1 (1: Enable<br>LT_SEL2 (1: Enable<br>Reserved (0: Disabl<br>SEL_MON1 (1: Ena<br>SEL_MON2 (1: Ena<br>SEL_MON3 (1: Ena<br>Reserved (0: Disabl | Enabled)<br>nabled)<br>)<br>ed).<br>ed).<br>ed)<br>d)<br>d)<br>ed).<br>bled)<br>bled)<br>bled) | n                  |                      |                  | Command-related parameters |

Continued on next page.

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| No.         Size         Name         Setting Hange         [Resolution]         Setting         Motors         Enabled         fication           4         Servo Status Field<br>Selections (read<br>only)         -         -         0FFF3F33         All         -         0FF57F3         All         All         All                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                 |      |                                    |                         |                |                  | Continued fr | rom previou | us page.            |  |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|------|------------------------------------|-------------------------|----------------|------------------|--------------|-------------|---------------------|--|--|
| 4         Enable/Disable<br>only         -         -         0FF75733<br>h         All         -           91<br>PnB22         Bit 0         CMD_PAUSE_CMP (1: Enabled)         -         -         0FF75733<br>h         All         -           91<br>PnB22         Bit 0         CMD_PAUSE_CMP (1: Enabled)         -         -         0FF75733<br>h         All         -           91<br>PnB22         Bit 1         CMD_CANCEL_CMP (1: Enabled)         -         -         -         0FF75733<br>h         All         -           91<br>PnB22         Bit 1         CMD_CANCEL_CMP (1: Enabled)         -         -         -         0FF75733<br>h         All         -           91<br>PnB22         Bit 2 and 3         Reserved (0: Disabled).         -         -         -         0FF75733<br>h         All         -         -         0F757573<br>h         All         -         -         0F757573<br>h         Bit 3         -         -         0F757573<br>h         All         -         -         0F757573<br>h         Bit 3         -         -         -         0F757573<br>h         All         -         -         -         Disber 200 20 20 20 20 20 20 20 20 20 20 20 20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                 | Size | Name                               | Setting Range           |                |                  |              | -           | Classi-<br>fication |  |  |
| 91<br>PnB22         Bit 1         CMD_CANCEL_CMP (1: Enabled)           Bit 2 and 3         Reserved (0: Disabled).           Bits 4 and 5         ACCFL (1: Enabled)           Bits 6 and 7         Reserved (0: Disabled).           Bits 8         L_CMP1 (1: Enabled)           Bit 9         L_OMP2 (1: Enabled)           Bit 10         POS_RDY (1: Enabled)           Bit 11         PON (1: Enabled)           Bit 12         M_RDY (1: Enabled)           Bits 24 to 23         SEL_MON1 (1: Enabled)           Bits 24 to 23         SEL_MON2 (1: Enabled)           Bits 26 to 31         Reserved (0: Disabled).           Bits 26 to 31         Reserved (0: Disabled).           Bit 4         V_PPI (1: Enabled)           Bit 4         V_PPI (1: Enabled)           Bit 6         P_OL(1: Enabled)           Bit 7         N_OL (1: Enabled)           Bit 8         G_SEL (1: Enabled)           Bit 8         G_SEL (1: Enabled)           Bit 7         N_OL (1: Enabled)           Bit 7         N_OL (1:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                 | 4    | Enable/Disable<br>Selections (read | -                       | -              |                  | All          | _           |                     |  |  |
| 91<br>PnB22         Bit 1         CMD_CANCEL_CMP (1: Enabled)           Bit 2 and 3         Reserved (0: Disabled).         Bits 4 and 5         ACCFL (1: Enabled)           Bits 6 and 7         Reserved (0: Disabled).         Bits 6 and 7         Reserved (0: Disabled).           Bit 8         L_CMP1 (1: Enabled)         Bits 6         Bit 9         L_CMP2 (1: Enabled)           Bit 10         POS_RDY (1: Enabled)         Bit 11         PON (1: Enabled)         Bit 12           Bit 11         PON (1: Enabled)         Bit 13         SV_ON (1: Enabled)         Bit 13           Bit 12         M_RDY (1: Enabled)         Bit 13         SV_ON (1: Enabled)         Bit 14           Bits 14 and 15         Reserved (0: Disabled).         Bits 24 to 27         SEL_MON2 (1: Enabled)         Bits 24 to 27         SEL_MON2 (1: Enabled)           Bits 28 to 31         Reserved (0: Disabled).         Bits 28 to 31         Reserved (0: Disabled).         Bit 4         -           Bits 20 to 3         Reserved (0: Disabled).         Bit 4         -         01FF01F0         All         -           92         PnB24         Bit 5         P_PPI (1: Enabled)         Bit 4         -         01FF01F0         All         -           92         Bit 6         P_CL (1: Enabled)         Bi                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |      |                                    |                         |                |                  |              |             |                     |  |  |
| 91<br>PnB22         Bit 2 and 3         Reserved (0: Disabled).         Image: Comparison of the second of th |                                                                                                                 |      | Bit 0                              | CMD_PAUSE_CMP           | (1: Enabled)   |                  |              |             |                     |  |  |
| 91<br>PnB22         Bits 4 and 5         ACCFIL (1: Enabled)         Image: Second (0: Disabled), Second (0: Disabled), Second (0: Disabled), Second (0: Disabled), Second (0: Disabled)         Second (0: Disabled), Second (0: Disa          |                                                                                                                 |      | Bit 1                              | CMD_CANCEL_CMI          | P (1: Enabled) |                  |              |             |                     |  |  |
| 91<br>PnB22         Bits 6 and 7         Reserved (0: Disabled).         Image: Constraint of the second of t |                                                                                                                 |      | Bit 2 and 3                        | Reserved (0: Disable    | ed).           |                  |              |             |                     |  |  |
| 91<br>PnB22         Bit 8         L_CMP1 (1: Enabled)           Bit 9         L_CMP2 (1: Enabled)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |      | Bits 4 and 5                       | ACCFIL (1: Enabled)     |                |                  |              |             |                     |  |  |
| 91<br>PnB22         Bit 9         L_CMP2 (1: Enabled)           Bit 10         POS_RDY (1: Enabled)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                 |      | Bits 6 and 7                       | Reserved (0: Disabled). |                |                  |              |             |                     |  |  |
| PnB22         Bit 9         L_CMP2 (1: Enabled)           Bit 10         POS_RDY (1: Enabled)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 01                                                                                                              |      | Bit 8                              | L_CMP1 (1: Enabled      | d)             |                  |              |             |                     |  |  |
| Bit 10         POS_RDY (1: Enabled)           Bit 11         PON (1: Enabled)           Bit 12         M_RDY (1: Enabled)           Bit 12         M_RDY (1: Enabled)           Bit 13         SV_ON (1: Enabled)           Bit 14 and 15         Reserved (0: Disabled).           Bits 14 and 15         Reserved (0: Disabled)           Bits 20 to 23         SEL_MON3 (1: Enabled)           Bits 24 to 27         SEL_MON3 (1: Enabled)           Bits 28 to 31         Reserved (0: Disabled).           Bits 28 to 31         Reserved (0: Disabled).           Bit 4         0.1FF01F0           All         -           Bit 4         V_PPI (1: Enabled)           Bit 4         V_PPI (1: Enabled)           Bit 5         P_PPI (1: Enabled)           Bit 6         PCL (1: Enabled)           Bit 7         N_CL (1: Enabled)           Bit 8         G_SEL (0: Disabled).           Bit 8         G_SEL (0: Disabled).           Bit 9 to 11         G_SEL (0: Disabled).           Bit 12 to 15         Reserved (0: Disabled).           Bit 12 to 15         Reserved (0: Disabled).           Bit 12 to 15         Reserved (0: Disabled).           Bits 16 to 19         BANK_SEL (1: Enabled)<                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                 |      | Bit 9                              | L_CMP2 (1: Enabled      | (k             |                  |              |             |                     |  |  |
| Bit 12         M_RDY (1: Enabled)           Bit 13         SV_ON (1: Enabled)           Bits 14 and 15         Reserved (0: Disabled).           Bits 14 and 15         Reserved (0: Disabled).           Bits 16 to 19         SEL_MON1 (1: Enabled)           Bits 20 to 23         SEL_MON2 (1: Enabled)           Bits 24 to 27         SEL_MON3 (1: Enabled)           Bits 28 to 31         Reserved (0: Disabled).           Its 20 to 3         Reserved (0: Disabled).           Bits 0 to 3         Reserved (0: Disabled).           Bit 4         V_PPI (1: Enabled)           Bit 5         P_PPI (1: Enabled)           Bit 6         P_CL (1: Enabled)           Bit 7         N_CL (1: Enabled)           Bit 8         G_SEL (1: Enabled)           Bit 9 to 11         G_SEL (0: Disabled).           Bits 12 to 15         Reserved (0: Disabled).           Bits 20 to 24         SO1 to                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                 |      | Bit 10                             | POS_RDY (1: Enable      | ed)            |                  |              |             |                     |  |  |
| Bit 13         SV_ON (1: Enabled)         seguration         Seguration <th <="" colspan="2" td=""><td></td><td></td><td>Bit 11</td><td>PON (1: Enabled)</td><td></td><td></td><td></td><td></td><td></td></th>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <td></td> <td></td> <td>Bit 11</td> <td>PON (1: Enabled)</td> <td></td> <td></td> <td></td> <td></td> <td></td> |      |                                    |                         | Bit 11         | PON (1: Enabled) |              |             |                     |  |  |
| 92         Bits 0 to 3         Reserved (0: Disabled).           Bit 4         V_PPI (1: Enabled)           Bit 5         P_PPI (1: Enabled)           Bit 6         P_CL (1: Enabled)           Bit 7         N_CL (1: Enabled)           Bit 8         G_SEL (1: Enabled)           Bits 9 to 11         G_SEL (0: Disabled).           Bits 12 to 15         Reserved (0: Disabled).           Bits 16 to 19         BANK_SEL (1: Enabled)           Bits 20 to 24         SO1 to SO5 (1: Enabled)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                 |      |                                    | - ,                     |                |                  |              |             |                     |  |  |
| Bits 0 to 3         Reserved (0: Disabled).           Bit 4         V_PPI (1: Enabled)           Bit 5         P_PPI (1: Enabled)           Bit 6         P_CL (1: Enabled)           Bit 7         N_CL (1: Enabled)           Bit 8         G_SEL (1: Enabled)           Bits 9 to 11         G_SEL (0: Disabled).           Bits 12 to 15         Reserved (0: Disabled).           Bits 16 to 19         BANK_SEL (1: Enabled)           Bits 20 to 24         SO1 to SO5 (1: Enabled)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                 |      | Bit 13                             | SV_ON (1: Enabled)      |                |                  |              |             |                     |  |  |
| Bits 0 to 3         Reserved (0: Disabled).           Bit 4         V_PPI (1: Enabled)           Bit 5         P_PPI (1: Enabled)           Bit 6         P_CL (1: Enabled)           Bit 7         N_CL (1: Enabled)           Bit 8         G_SEL (1: Enabled)           Bits 9 to 11         G_SEL (0: Disabled).           Bits 12 to 15         Reserved (0: Disabled).           Bits 16 to 19         BANK_SEL (1: Enabled)           Bits 20 to 24         SO1 to SO5 (1: Enabled)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                 |      | Bits 14 and 15                     | Reserved (0: Disable    | ed).           |                  |              |             | ame                 |  |  |
| 92         Bits 0 to 3         Reserved (0: Disabled).           Bit 4         V_PPI (1: Enabled)           Bit 5         P_PPI (1: Enabled)           Bit 6         P_CL (1: Enabled)           Bit 7         N_CL (1: Enabled)           Bit 8         G_SEL (1: Enabled)           Bits 9 to 11         G_SEL (0: Disabled).           Bits 12 to 15         Reserved (0: Disabled).           Bits 16 to 19         BANK_SEL (1: Enabled)           Bits 20 to 24         SO1 to SO5 (1: Enabled)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                 |      |                                    | SEL_MON1 (1: Enab       | oled)          |                  |              |             | oara                |  |  |
| 92         Bits 0 to 3         Reserved (0: Disabled).           Bit 4         V_PPI (1: Enabled)           Bit 5         P_PPI (1: Enabled)           Bit 6         P_CL (1: Enabled)           Bit 7         N_CL (1: Enabled)           Bit 8         G_SEL (1: Enabled)           Bits 9 to 11         G_SEL (0: Disabled).           Bits 12 to 15         Reserved (0: Disabled).           Bits 16 to 19         BANK_SEL (1: Enabled)           Bits 20 to 24         SO1 to SO5 (1: Enabled)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                 |      | -                                  | _ ``                    | ,              |                  |              |             | ed                  |  |  |
| 92         Bits 0 to 3         Reserved (0: Disabled).           Bit 4         V_PPI (1: Enabled)           Bit 5         P_PPI (1: Enabled)           Bit 6         P_CL (1: Enabled)           Bit 7         N_CL (1: Enabled)           Bit 8         G_SEL (1: Enabled)           Bits 9 to 11         G_SEL (0: Disabled).           Bits 12 to 15         Reserved (0: Disabled).           Bits 16 to 19         BANK_SEL (1: Enabled)           Bits 20 to 24         SO1 to SO5 (1: Enabled)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                 |      |                                    |                         |                |                  |              |             | elat                |  |  |
| 92         Bits 0 to 3         Reserved (0: Disabled).           Bit 4         V_PPI (1: Enabled)           Bit 5         P_PPI (1: Enabled)           Bit 6         P_CL (1: Enabled)           Bit 7         N_CL (1: Enabled)           Bit 8         G_SEL (1: Enabled)           Bits 9 to 11         G_SEL (0: Disabled).           Bits 12 to 15         Reserved (0: Disabled).           Bits 16 to 19         BANK_SEL (1: Enabled)           Bits 20 to 24         SO1 to SO5 (1: Enabled)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                 |      | Bits 28 to 31                      | Reserved (0: Disable    | ed).           |                  |              |             | nd-r                |  |  |
| 92<br>PnB24Bit 4V_PPI (1: Enabled)<br>Bit 5P_PPI (1: Enabled)<br>Bit 6Bit 6P_CL (1: Enabled)Bit 7N_CL (1: Enabled)<br>Bit 8Bit 8G_SEL (1: Enabled)<br>Bits 9 to 11Bits 9 to 11G_SEL (0: Disabled)<br>Bits 12 to 15Bits 12 to 15Reserved (0: Disabled).<br>Bits 16 to 19Bits 20 to 24SO1 to SO5 (1: Enabled)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                 | 4    | Disable Selections                 | _                       | -              |                  | All          | _           | Comma               |  |  |
| 92<br>PnB24Bit 4V_PPI (1: Enabled)<br>Bit 5P_PPI (1: Enabled)<br>Bit 6Bit 6P_CL (1: Enabled)Bit 7N_CL (1: Enabled)<br>Bit 8Bit 8G_SEL (1: Enabled)<br>Bits 9 to 11Bits 9 to 11G_SEL (0: Disabled)<br>Bits 12 to 15Bits 12 to 15Reserved (0: Disabled).<br>Bits 16 to 19Bits 20 to 24SO1 to SO5 (1: Enabled)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                 |      | Dite 0 to 0                        | Deserved (0, Disable    |                |                  |              |             |                     |  |  |
| Bit 5         P_PPI (1: Enabled)           Bit 6         P_CL (1: Enabled)           Bit 7         N_CL (1: Enabled)           Bit 8         G_SEL (1: Enabled)           Bits 9 to 11         G_SEL (0: Disabled)           Bits 12 to 15         Reserved (0: Disabled).           Bits 16 to 19         BANK_SEL (1: Enabled)           Bits 20 to 24         SO1 to SO5 (1: Enabled)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                 |      |                                    |                         | eu).           |                  |              |             |                     |  |  |
| 92         Bit 6         P_CL (1: Enabled)           Bit 7         N_CL (1: Enabled)           Bit 8         G_SEL (1: Enabled)           Bits 9 to 11         G_SEL (0: Disabled)           Bits 12 to 15         Reserved (0: Disabled).           Bits 16 to 19         BANK_SEL (1: Enabled)           Bits 20 to 24         SO1 to SO5 (1: Enabled)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                 |      | -                                  | = ( ,                   |                |                  |              |             |                     |  |  |
| 92         PnB24         Bit 7       N_CL (1: Enabled)         Bit 8       G_SEL (1: Enabled)         Bits 9 to 11       G_SEL (0: Disabled)         Bits 12 to 15       Reserved (0: Disabled).         Bits 16 to 19       BANK_SEL (1: Enabled)         Bits 20 to 24       SO1 to SO5 (1: Enabled)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                 |      | -                                  |                         |                |                  |              |             |                     |  |  |
| Bit 8       G_SEL (1: Enabled)         Bits 9 to 11       G_SEL (0: Disabled)         Bits 12 to 15       Reserved (0: Disabled).         Bits 16 to 19       BANK_SEL (1: Enabled)         Bits 20 to 24       SO1 to SO5 (1: Enabled)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                 |      |                                    | - , ,                   |                |                  |              |             |                     |  |  |
| Bits 9 to 11G_SEL (0: Disabled)Bits 12 to 15Reserved (0: Disabled).Bits 16 to 19BANK_SEL (1: Enabled)Bits 20 to 24SO1 to SO5 (1: Enabled)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | PNB24                                                                                                           |      |                                    |                         |                |                  |              |             |                     |  |  |
| Bits 12 to 15Reserved (0: Disabled).Bits 16 to 19BANK_SEL (1: Enabled)Bits 20 to 24SO1 to SO5 (1: Enabled)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                 |      |                                    | - , ,                   |                |                  |              |             |                     |  |  |
| Bits 16 to 19BANK_SEL (1: Enabled)Bits 20 to 24SO1 to SO5 (1: Enabled)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                 |      |                                    | . ,                     |                |                  |              |             |                     |  |  |
| Bits 20 to 24 SO1 to SO5 (1: Enabled)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                 |      |                                    |                         | ,              |                  |              |             |                     |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                 |      |                                    | _ 、                     | ,              |                  |              |             |                     |  |  |
| Bits 25 to 31 Reserved (0: Disabled).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                 |      | Bits 25 to 31                      | Reserved (0: Disable    | ed).           |                  |              |             |                     |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                 |      |                                    |                         |                |                  |              |             |                     |  |  |

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| Parameter<br>No. | Size | Name                                                 | Setting Range                          | Setting Unit<br>[Resolution] | Default<br>Setting | Applicable<br>Motors | When<br>Enabled | Classi-<br>fication        |  |
|------------------|------|------------------------------------------------------|----------------------------------------|------------------------------|--------------------|----------------------|-----------------|----------------------------|--|
|                  | 4    | Input Bit Enable/Di<br>able Selections (rea<br>only) |                                        | -                            | FF0FFEFE<br>h      | All                  | _               |                            |  |
|                  |      |                                                      |                                        |                              |                    |                      |                 |                            |  |
|                  |      | Bit 0                                                | Reserved (0: Disab                     | led).                        |                    |                      |                 |                            |  |
|                  |      | Bit 1                                                | DEC (1: Enabled)                       |                              |                    |                      |                 |                            |  |
|                  |      | Bit 2                                                | P-OT (1: Enabled)                      |                              |                    |                      |                 |                            |  |
|                  |      | Bit 3                                                | N-OT (1: Enabled)                      |                              |                    |                      |                 |                            |  |
|                  |      | Bit 4                                                | EXT1 (1: Enabled)                      |                              |                    |                      |                 |                            |  |
|                  |      | Bit 5<br>Bit 6                                       | EXT2 (1: Enabled)<br>EXT3 (1: Enabled) |                              |                    |                      |                 | Ś                          |  |
|                  |      | Bit 7                                                | ESTP (1: Enabled)                      |                              |                    |                      |                 |                            |  |
|                  |      | Bit 8                                                | Reserved (0: Disab                     | led)                         |                    |                      |                 | ram                        |  |
|                  |      | Bit 9                                                | BRK ON (1: Enable                      |                              |                    |                      |                 | l pa                       |  |
| 93<br>PnB26      |      | Bit 10                                               | P-SOT (1: Enabled)                     | ,                            |                    |                      |                 | atec                       |  |
| PIIB20           |      | Bit 11                                               | N-SOT (1: Enabled                      |                              |                    |                      |                 | -rel                       |  |
|                  |      | Bit 12                                               | DEN (1: Enabled)                       | ,                            |                    |                      |                 | and                        |  |
|                  |      | Bit 13                                               | NEAR (1: Enabled)                      |                              |                    |                      |                 | Command-related parameters |  |
|                  |      | Bit 14                                               | PSET (1: Enabled)                      |                              |                    |                      |                 | Co                         |  |
|                  |      | Bit 15                                               | ZPOINT (1: Enable                      | d)                           |                    |                      |                 |                            |  |
|                  |      | Bit 16                                               | T_LIM (1: Enabled)                     |                              |                    |                      |                 |                            |  |
|                  |      | Bit 17                                               | V_LIM (1: Enabled)                     |                              |                    |                      |                 |                            |  |
|                  |      | Bit 18                                               | V_CMP (1: Enabled                      | 1)                           |                    |                      |                 |                            |  |
|                  |      | Bit 19                                               | ZSPD (1: Enabled)                      |                              |                    |                      |                 |                            |  |
|                  |      | Bits 20 to 23                                        | Reserved (0: Disab                     | led).                        |                    |                      |                 |                            |  |
|                  |      | Bits 24 to 31                                        | IO_STS1 to IO_STS                      | 8 (1: Enabled)               |                    |                      |                 |                            |  |

Continued from previous page.

\*1. The parameter setting is enabled after SENS\_ON command execution is completed.

\*2. When using fully-closed loop control, set the reference units/s.

\*3. If you set the Speed Unit Selection (parameter 41) to either 0002h or 0003h, set the Speed Base Unit Selection (parameter 42) to a number between -3 and 0.

\*4. If you set the Speed Unit Selection (parameter 41) to 0004h, set the Speed Base Unit Selection (parameter 42) to 0.

\*5. If you set the Torque Unit Selection (parameter 47) to 0002h, set the Torque Base Unit Selection (parameter 48) to 0.

\*6. Change the setting when the reference is stopped (i.e., while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

# 14.3 Parameter Recording Table

Use the following table to record the settings of the parameters.

| Parameter<br>No. | Default Setting | Name                                          | When<br>Enabled |
|------------------|-----------------|-----------------------------------------------|-----------------|
| Pn000            | 0000h           | Basic Function Selections 0                   | After restart   |
| Pn001            | 0000h           | Application Function Selec-<br>tions 1        | After restart   |
| Pn002            | 0011h           | Application Function Selec-<br>tions 2        | After restart   |
| Pn006            | 0002h           | Application Function Selec-<br>tions 6        | Immediately     |
| Pn007            | 0000h           | Application Function Selec-<br>tions 7        | Immediately     |
| Pn008            | 4000h           | Application Function Selec-<br>tions 8        | After restart   |
| Pn009            | 0010h           | Application Function Selec-<br>tions 9        | After restart   |
| Pn00A            | 0001h           | Application Function Selec-<br>tions A        | After restart   |
| Pn00B            | 0000h           | Application Function Selec-<br>tions B        | After restart   |
| Pn00C            | 0000h           | Application Function Selec-<br>tions C        | After restart   |
| Pn00D            | 0000h           | Application Function Selec-<br>tions D        | After restart   |
| Pn00F            | 0000h           | Application Function Selec-<br>tions F        | After restart   |
| Pn022            | 0000h           | Application Function Selec-<br>tions 22       | After restart   |
| Pn023            | 0000h           | Application Function Selec-<br>tion 23        | After restart   |
| Pn040            | 0000h           | Reserved parameter                            | _               |
| Pn080            | 0000h           | Application Function Selec-<br>tions 80       | After restart   |
| Pn081            | 0000h           | Application Function Selec-<br>tions 81       | After restart   |
| Pn100            | 400             | Speed Loop Gain                               | Immediately     |
| Pn101            | 2000            | Speed Loop Integral Time<br>Constant          | Immediately     |
| Pn102            | 400             | Position Loop Gain                            | Immediately     |
| Pn103            | 100             | Moment of Inertia Ratio                       | Immediately     |
| Pn104            | 400             | Second Speed Loop Gain                        | Immediately     |
| Pn105            | 2000            | Second Speed Loop Inte-<br>gral Time Constant | Immediately     |
| Pn106            | 400             | Second Position Loop Gain                     | Immediately     |
| Pn109            | 0               | Feedforward                                   | Immediately     |
| Pn10A            | 0               | Feedforward Filter Time<br>Constant           | Immediately     |
| Pn10B            | 0000h           | Gain Application Selections                   | *1              |
| Pn10C            | 200             | Mode Switching Level for<br>Torque Reference  | Immediately     |
| Pn10D            | 0               | Mode Switching Level for<br>Speed Reference   | Immediately     |
| Pn10E            | 0               | Mode Switching Level for<br>Acceleration      | Immediately     |

| Davassata        |                 |                                                                | 1 0             |
|------------------|-----------------|----------------------------------------------------------------|-----------------|
| Parameter<br>No. | Default Setting | Name                                                           | When<br>Enabled |
| Pn10F            | 0               | Mode Switching Level for<br>Position Deviation                 | Immediately     |
| Pn11F            | 0               | Position Integral Time Con-<br>stant                           | Immediately     |
| Pn121            | 100             | Friction Compensation Gain                                     | Immediately     |
| Pn122            | 100             | Second Friction Compen-<br>sation Gain                         | Immediately     |
| Pn123            | 0               | Friction Compensation<br>Coefficient                           | Immediately     |
| Pn124            | 0               | Friction Compensation Fre-<br>quency Correction                | Immediately     |
| Pn125            | 100             | Friction Compensation Gain<br>Correction                       | Immediately     |
| Pn131            | 0               | Gain Switching Time 1                                          | Immediately     |
| Pn132            | 0               | Gain Switching Time 2                                          | Immediately     |
| Pn135            | 0               | Gain Switching Waiting<br>Time 1                               | Immediately     |
| Pn136            | 0               | Gain Switching Waiting<br>Time 2                               | Immediately     |
| Pn139            | 0000h           | Automatic Gain Switching<br>Selections 1                       | Immediately     |
| Pn13D            | 2000            | Current Gain Level                                             | Immediately     |
| Pn140            | 0100h           | Model Following Control-<br>Related Selections                 | Immediately     |
| Pn141            | 500             | Model Following Control<br>Gain                                | Immediately     |
| Pn142            | 1000            | Model Following Control<br>Gain Correction                     | Immediately     |
| Pn143            | 1000            | Model Following Control<br>Bias in the Forward Direc-<br>tion  | Immediately     |
| Pn144            | 1000            | Model Following Control<br>Bias in the Reverse Direc-<br>tion  | Immediately     |
| Pn145            | 500             | Vibration Suppression 1<br>Frequency A                         | Immediately     |
| Pn146            | 700             | Vibration Suppression 1<br>Frequency B                         | Immediately     |
| Pn147            | 1000            | Model Following Control<br>Speed Feedforward Com-<br>pensation | Immediately     |
| Pn148            | 500             | Second Model Following<br>Control Gain                         | Immediately     |
| Pn149            | 1000            | Second Model Following<br>Control Gain Correction              | Immediately     |
| Pn14A            | 800             | Vibration Suppression 2<br>Frequency                           | Immediately     |
| Pn14B            | 100             | Vibration Suppression 2<br>Correction                          | Immediately     |
| Pn14F            | 0021h           | Control-Related Selections                                     | After restart   |
| Pn160            | 0010h           | Anti-Resonance Control-<br>Related Selections                  | Immediately     |
| Pn161            | 1000            | Anti-Resonance Frequency                                       | Immediately     |
| Pn162            | 100             | Anti-Resonance Gain Cor-<br>rection                            | Immediately     |

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|                  |                 | Continued from p                                    | previous page.  |
|------------------|-----------------|-----------------------------------------------------|-----------------|
| Parameter<br>No. | Default Setting | Name                                                | When<br>Enabled |
| Pn163            | 0               | Anti-Resonance Damping<br>Gain                      | Immediately     |
| Pn164            | 0               | Anti-Resonance Filter Time<br>Constant 1 Correction | Immediately     |
| Pn165            | 0               | Anti-Resonance Filter Time<br>Constant 2 Correction | Immediately     |
| Pn166            | 0               | Anti-Resonance Damping<br>Gain 2                    | Immediately     |
| Pn170            | 1401h           | Tuning-less Function-<br>Related Selections         | *1              |
| Pn181            | 0               | Mode Switching Level for<br>Speed Reference         | Immediately     |
| Pn182            | 0               | Mode Switching Level for<br>Acceleration            | Immediately     |
| Pn205            | 65535           | Multiturn Limit                                     | After restart   |
| Pn207            | 0010h           | Position Control Function<br>Selections             | After restart   |
| Pn20A            | 32768           | Number of External<br>Encoder Scale Pitches         | After restart   |
| Pn20E            | 16              | Electronic Gear Ratio<br>(Numerator)                | After restart   |
| Pn210            | 1               | Electronic Gear Ratio<br>(Denominator)              | After restart   |
| Pn212            | 2048            | Number of Encoder Output<br>Pulses                  | After restart   |
| Pn22A            | 0000h           | Fully-closed Control Selec-<br>tions                | After restart   |
| Pn230            | 0000h           | Position Control Expansion<br>Function Selections   | After restart   |
| Pn231            | 0               | Backlash Compensation                               | Immediately     |
| Pn233            | 0               | Backlash Compensation<br>Time Constant              | Immediately     |
| Pn281            | 20              | Encoder Output Resolution                           | After restart   |
| Pn282            | 0               | Linear Encoder Scale Pitch                          | After restart   |
| Pn304            | 500             | Jogging Speed                                       | Immediately     |
| Pn305            | 0               | Soft Start Acceleration<br>Time                     | Immediately     |
| Pn306            | 0               | Soft Start Deceleration<br>Time                     | Immediately     |
| Pn308            | 0               | Speed Feedback Filter<br>Time Constant              | Immediately     |
| Pn30A            | 0               | Deceleration Time for Servo<br>OFF and Forced Stops | Immediately     |
| Pn30C            | 0               | Speed Feedforward Aver-<br>age Movement Time        | Immediately     |
| Pn310            | 0000h           | Vibration Detection Selec-<br>tions                 | Immediately     |
| Pn311            | 100             | Vibration Detection Sensi-<br>tivity                | Immediately     |
| Pn312            | 50              | Vibration Detection Level                           | Immediately     |
| Pn316            | 10000           | Maximum Motor Speed                                 | After restart   |
| Pn324            | 300             | Moment of Inertia Calcula-<br>tion Starting Level   | Immediately     |
| Pn383            | 50              | Jogging Speed                                       | Immediately     |
| Pn384            | 10              | Vibration Detection Level                           | Immediately     |
|                  |                 |                                                     |                 |

|                  |                 | Continued from p                                                 | , ,             |
|------------------|-----------------|------------------------------------------------------------------|-----------------|
| Parameter<br>No. | Default Setting | Name                                                             | When<br>Enabled |
| Pn385            | 50              | Maximum Motor Speed                                              | After restart   |
| Pn401            | 100             | First Stage First Torque<br>Reference Filter Time Con-<br>stant  | Immediately     |
| Pn402            | 800             | Forward Torque Limit                                             | Immediately     |
| Pn403            | 800             | Reverse Torque Limit                                             | Immediately     |
| Pn404            | 100             | Forward External Torque<br>Limit                                 | Immediately     |
| Pn405            | 100             | Reverse External Torque<br>Limit                                 | Immediately     |
| Pn406            | 800             | Emergency Stop Torque                                            | Immediately     |
| Pn407            | 10000           | Speed Limit during Torque<br>Control                             | Immediately     |
| Pn408            | 0000h           | Torque-Related Function<br>Selections                            | *1              |
| Pn409            | 5000            | First Stage Notch Filter Fre-<br>quency                          | Immediately     |
| Pn40A            | 70              | First Stage Notch Filter Q<br>Value                              | Immediately     |
| Pn40B            | 0               | First Stage Notch Filter<br>Depth                                | Immediately     |
| Pn40C            | 5000            | Second Stage Notch Filter<br>Frequency                           | Immediately     |
| Pn40D            | 70              | Second Stage Notch Filter<br>Q Value                             | Immediately     |
| Pn40E            | 0               | Second Stage Notch Filter<br>Depth                               | Immediately     |
| Pn40F            | 5000            | Second Stage Second<br>Torque Reference Filter Fre-<br>quency    | Immediately     |
| Pn410            | 50              | Second Stage Second<br>Torque Reference Filter Q<br>Value        | Immediately     |
| Pn412            | 100             | First Stage Second Torque<br>Reference Filter Time Con-<br>stant | Immediately     |
| Pn416            | 0000h           | Torque-Related Function<br>Selections 2                          | Immediately     |
| Pn417            | 5000            | Third Stage Notch Filter<br>Frequency                            | Immediately     |
| Pn418            | 70              | Third Stage Notch Filter Q<br>Value                              | Immediately     |
| Pn419            | 0               | Third Stage Notch Filter<br>Depth                                | Immediately     |
| Pn41A            | 5000            | Fourth Stage Notch Filter<br>Frequency                           | Immediately     |
| Pn41B            | 70              | Fourth Stage Notch Filter Q<br>Value                             | Immediately     |
| Pn41C            | 0               | Fourth Stage Notch Filter<br>Depth                               | Immediately     |
| Pn41D            | 5000            | Fifth Stage Notch Filter Fre-<br>quency                          | Immediately     |
| Pn41E            | 70              | Fifth Stage Notch Filter Q<br>Value                              | Immediately     |
| Pn41F            | 0               | Fifth Stage Notch Filter<br>Depth                                | Immediately     |

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| Parameter<br>No. | Default Setting | Name                                                                  | When<br>Enabled |
|------------------|-----------------|-----------------------------------------------------------------------|-----------------|
| Pn423            | 0000h           | Speed Ripple Compensa-<br>tion Selections                             | *1              |
| Pn424            | 50              | Torque Limit at Main Circuit<br>Voltage Drop                          | Immediately     |
| Pn425            | 100             | Release Time for Torque<br>Limit at Main Circuit Voltage<br>Drop      | Immediately     |
| Pn426            | 0               | Torque Feedforward Aver-<br>age Movement Time                         | Immediately     |
| Pn427            | 0               | Speed Ripple Compensa-<br>tion Enable Speed                           | Immediately     |
| Pn456            | 15              | Sweep Torque Reference<br>Amplitude                                   | Immediately     |
| Pn460            | 0101h           | Notch Filter Adjustment<br>Selections 1                               | Immediately     |
| Pn475            | 0000h           | Gravity Compensation-<br>Related Selections                           | After restart   |
| Pn476            | 0               | Gravity Compensation<br>Torque                                        | Immediately     |
| Pn480            | 10000           | Speed Limit during Force<br>Control                                   | Immediately     |
| Pn481            | 400             | Polarity Detection Speed<br>Loop Gain                                 | Immediately     |
| Pn482 3000       |                 | Polarity Detection Speed<br>Loop Integral Time Con-<br>stant          | Immediately     |
| Pn483            | 30              | Forward Force Limit                                                   | Immediately     |
| Pn484            | 30              | Reverse Force Limit                                                   | Immediately     |
| Pn485            | 20              | Polarity Detection Refer-<br>ence Speed                               | Immediately     |
| Pn486            | 25              | Polarity Detection Refer-<br>ence Acceleration/Deceler-<br>ation Time | Immediately     |
| Pn487            | 0               | Polarity Detection Con-<br>stant Speed Time                           | Immediately     |
| Pn488            | 100             | Polarity Detection Refer-<br>ence Waiting Time                        | Immediately     |
| Pn48E            | 10              | Polarity Detection Range                                              | Immediately     |
| Pn490            | 100             | Polarity Detection Load<br>Level                                      | Immediately     |
| Pn495            | 100             | Polarity Detection Confir-<br>mation Force Reference                  | Immediately     |
| Pn498            | 10              | Polarity Detection Allowable<br>Error Range                           | Immediately     |
| Pn49F            | 0               | Speed Ripple Compensa-<br>tion Enable Speed                           | Immediately     |
| Pn502            | 20              | Rotation Detection Level                                              | Immediately     |
| Pn503            | 10              | Speed Coincidence Detec-<br>tion Signal Output Width                  | Immediately     |
| Pn506            | 0               | Brake Reference-Servo<br>OFF Delay Time                               | Immediately     |
| Pn507            | 100             | Brake Reference Output<br>Speed Level                                 | Immediately     |
| Pn508            | 50              | Servo OFF-Brake Com-<br>mand Waiting Time                             | Immediately     |

| Parameter<br>No. | Default Setting | Name                                                           | When<br>Enabled |
|------------------|-----------------|----------------------------------------------------------------|-----------------|
| No.<br>Pn509     | 20              | Momentary Power Interrup-<br>tion Hold Time                    | Immediately     |
| Pn50A            | 1881h           | Input Signal Selections 1                                      | After restart   |
| Pn50B            | 8882h           | Input Signal Selections 2                                      | After restart   |
| Pn50E            | 0000h           | Output Signal Selections 1                                     | After restart   |
| Pn50F            | 0100h           | Output Signal Selections 2                                     | After restart   |
| Pn510            | 0000h           | Output Signal Selections 3                                     | After restart   |
| Pn511            | 6543h           | Input Signal Selections 5                                      | After restart   |
| Pn512            | 0000h           | Output Signal Inverse Set-<br>tings                            | After restart   |
| Pn513            | 0000h           | Output Signal Inverse Set-<br>tings 2                          | After restart   |
| Pn514            | 0000h           | Output Signal Selections 4                                     | After restart   |
| Pn515            | 8888h           | Input Signal Selections 6                                      | After restart   |
| Pn516            | 8888h           | Input Signal Selections 7                                      | After restart   |
| Pn51A            | 0000h           | Output Signal Selections 8                                     | After restart   |
| Pn51B            | 1000            | Motor-Load Position Devia-<br>tion Overflow Detection<br>Level | Immediately     |
| Pn51E            | 100             | Position Deviation Over-<br>flow Warning Level                 | Immediately     |
| Pn520            | 5242880         | Position Deviation Over-<br>flow Alarm Level                   | Immediately     |
| Pn522            | 7               | Positioning Completed<br>Width                                 | Immediately     |
| Pn524            | 1073741824      | Near Signal Width                                              | Immediately     |
| Pn526            | 5242880         | Position Deviation Over-<br>flow Alarm Level at Servo<br>ON    | Immediately     |
| Pn528 100        |                 | Position Deviation Over-<br>flow Warning Level at Servo<br>ON  | Immediately     |
| Pn529            | 10000           | Speed Limit Level at Servo<br>ON                               | Immediately     |
| Pn52A            | 20              | Multiplier per Fully-closed<br>Rotation                        | Immediately     |
| Pn52B            | 20              | Overload Warning Level                                         | Immediately     |
| Pn52C            | 100             | Base Current Derating at<br>Motor Overload Detection           | After restart   |
| Pn530            | 0000h           | Program Jogging-Related Selections                             | Immediately     |
| Pn531            | 32768           | Program Jogging Travel<br>Distance                             | Immediately     |
| Pn533            | 500             | Program Jogging Move-<br>ment Speed                            | Immediately     |
| Pn534            | 100             | Program Jogging Accelera-<br>tion/Deceleration Time            | Immediately     |
| Pn535            | 100             | Program Jogging Waiting<br>Time                                | Immediately     |
| Pn536            | 1               | Program Jogging Number<br>of Movements                         | Immediately     |
| Pn53C            | 0000h           | ZONE Output Signal Selec-<br>tions 1                           | After restart   |
| Pn53D            | 0000h           | ZONE Output Signal Selec-<br>tions 2                           | After restart   |

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|                  |                 | Continued from p                                                           |                                |  |
|------------------|-----------------|----------------------------------------------------------------------------|--------------------------------|--|
| Parameter<br>No. | Default Setting | Name                                                                       | When<br>Enabled                |  |
| Pn550            | 0               | Analog Monitor 1 Offset<br>Voltage                                         | Immediately                    |  |
| Pn551            | 0               | Analog Monitor 2 Offset<br>Voltage                                         | Immediately                    |  |
| Pn552            | 100             | Analog Monitor 1 Magnifi-<br>cation                                        | Immediately                    |  |
| Pn553            | 100             | Analog Monitor 2 Magnifi-<br>cation                                        | Immediately                    |  |
| Pn55A            | 1               | Power Consumption Moni-<br>tor Unit Time                                   | Immediately                    |  |
| Pn560            | 400             | Residual Vibration Detec-<br>tion Width                                    | Immediately                    |  |
| Pn561            | 100             | Overshoot Detection Level                                                  | Immediately                    |  |
| Pn581            | 20              | Zero Speed Level                                                           | Immediately                    |  |
| Pn582            | 10              | Speed Coincidence Detec-<br>tion Signal Output Width                       | Immediately                    |  |
| Pn583            | 10              | Brake Reference Output<br>Speed Level                                      | Immediately                    |  |
| Pn584            | 10000           | Speed Limit Level at Servo<br>ON                                           | Immediately                    |  |
| Pn585            | 50              | Program Jogging Move-<br>ment Speed                                        | Immediately                    |  |
| Pn586            | 0               | Motor Running Cooling<br>Ratio                                             | Immediately                    |  |
| Pn587            | 0000h           | Polarity Detection Execu-<br>tion Selection for Absolute<br>Linear Encoder | Immediately                    |  |
| Pn600            | 0               | Regenerative Resistor<br>Capacity                                          | Immediately                    |  |
| <b>Pn601</b> 0   |                 | Dynamic Brake Resistor<br>Allowable Energy Con-<br>sumption                | After restart                  |  |
| Pn603            | 0               | Regenerative Resistance                                                    | Immediately                    |  |
| Pn604            | 0               | Dynamic Brake Resistance                                                   | After restart                  |  |
| Pn61A            | 0000h           | Overheat Protection Selec-<br>tions                                        | After restart                  |  |
| Pn61B            | 250             | Overheat Alarm Level                                                       | Immediately                    |  |
| Pn61C            | 100             | Overheat Warning Level                                                     | Immediately                    |  |
| Pn61D            | 0               | Overheat Alarm Filter Time                                                 | Immediately                    |  |
| Pn800            | 1040h           | Communications Controls                                                    | Immediately                    |  |
| Pn801            | 0003h           | Application Function Selec-<br>tions 6 (Software Limits)                   | Immediately                    |  |
| Pn803            | 10              | Origin Range                                                               | Immediately                    |  |
| Pn804            | 1073741823      | Forward Software Limit                                                     | Immediately                    |  |
| Pn806            | -1073741823     | Reverse Software Limit                                                     | Immediately                    |  |
| Pn808            | 0               | Absolute Encoder Origin<br>Offset                                          | Immedi-<br>ately <sup>*2</sup> |  |
| Pn80A            | 100             | First Stage Linear Accelera-<br>tion Constant                              | Immedi-<br>ately <sup>*3</sup> |  |
| Pn80B            | 100             | Second Stage Linear<br>Acceleration Constant                               | Immedi-<br>ately <sup>*3</sup> |  |
| Pn80C            | 0               | Acceleration Constant<br>Switching Speed                                   | Immedi-<br>ately <sup>*3</sup> |  |
|                  | <b>.</b>        |                                                                            | ·                              |  |

| Parameter | Default Setting | Name                                                         | When                           |
|-----------|-----------------|--------------------------------------------------------------|--------------------------------|
| No.       |                 |                                                              | Enabled<br>Immedi-             |
| Pn80D     | 100             | First Stage Linear Decelera-<br>tion Constant                | ately*3                        |
| Pn80E     | 100             | Second Stage Linear<br>Deceleration Constant                 | Immedi-<br>ately <sup>*3</sup> |
| Pn80F     | 0               | Deceleration Constant<br>Switching Speed                     | Immedi-<br>ately <sup>*3</sup> |
| Pn810     | 0               | Exponential Acceleration/<br>Deceleration Bias               | Immedi-<br>ately <sup>*3</sup> |
| Pn811     | 0               | Exponential Acceleration/<br>Deceleration Time Constant      | Immedi-<br>ately <sup>*3</sup> |
| Pn812     | 0               | Movement Average Time                                        | Immedi-<br>ately <sup>*3</sup> |
| Pn814     | 100             | External Positioning Final<br>Travel Distance                | Immedi-<br>ately <sup>*3</sup> |
| Pn816     | 0000h           | Origin Return Mode Set-<br>tings                             | Immedi-<br>ately <sup>*3</sup> |
| Pn817     | 50              | Origin Approach Speed 1                                      | Immedi-<br>ately <sup>*3</sup> |
| Pn818     | 5               | Origin Approach Speed 2                                      | Immedi-<br>ately <sup>*3</sup> |
| Pn819     | 100             | Final Travel Distance for<br>Origin Return                   | Immedi-<br>ately <sup>*3</sup> |
| Pn81E     | 0000h           | Input Signal Monitor Selec-<br>tions                         | Immediately                    |
| Pn81F     | 0010h           | Command Data Allocations                                     | After restart                  |
| Pn820     | 0               | Forward Latching Area                                        | Immediately                    |
| Pn822     | 0               | Reverse Latching Area                                        | Immediately                    |
| Pn824     | 0000h           | Option Monitor 1 Selection                                   | Immediately                    |
| Pn825     | 0000h           | Option Monitor 2 Selection                                   | Immediately                    |
| Pn827 100 |                 | Linear Deceleration Con-<br>stant 1 for Stopping             | Immedi-<br>ately <sup>*3</sup> |
| Pn829     | 0               | SVOFF Waiting Time (for<br>SVOFF at Deceleration to<br>Stop) | Immediately                    |
| Pn82A     | 1813h           | Option Field Allocations 1                                   | After restart                  |
| Pn82B     | 1D1Ch           | Option Field Allocations 2                                   | After restart                  |
| Pn82C     | 1F1Eh           | Option Field Allocations 3                                   | After restart                  |
| Pn82D     | 0000h           | Option Field Allocations 4                                   | After restart                  |
| Pn82E     | 0000h           | Option Field Allocations 5                                   | After restart                  |
| Pn833     | 0000h           | Motion Settings                                              | After restart                  |
| Pn834     | 100             | First Stage Linear Accelera-<br>tion Constant 2              | Immedi-<br>ately <sup>*3</sup> |
| Pn836     | 100             | Second Stage Linear<br>Acceleration Constant 2               | Immedi-<br>ately <sup>*3</sup> |
| Pn838     | 0               | Acceleration Constant<br>Switching Speed 2                   | Immedi-<br>ately <sup>*3</sup> |
| Pn83A     | 100             | First Stage Linear Decelera-<br>tion Constant 2              | Immedi-<br>ately <sup>*3</sup> |
| Pn83C     | 100             | Second Stage Linear<br>Deceleration Constant 2               | Immedi-<br>ately <sup>*3</sup> |
| Pn83E     | 0               | Deceleration Constant<br>Switching Speed 2                   | Immedi-<br>ately <sup>*3</sup> |

Parameter Lists

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When Parameter **Default Setting** Name No. Enabled Immedi-Linear Deceleration Con-Pn840 100 stant 2 for Stopping ately\*3 Immedi-Second Origin Approach Pn842 0 Speed 1 ately\*3 Immedi-Second Origin Approach Pn844 0 Speed 2 ately\*3 **POSING Command Scurve** Immedi-Pn846 0 Acceleration/Deceleration ately\*3 Rate Number of Latch Pn850 0 Immediately Sequences Continuous Latch Pn851 0 Immediately Sequence Count Latch Sequence 1 to 4 Set-Pn852 0000h Immediately tings Latch Sequence 5 to 8 Set-Pn853 0000h Immediately tings SVCMD\_IO Input Signal Pn860 0000h Immediately Monitor Allocations 1 SVCMD\_IO Input Signal Pn861 0000h Immediately Monitor Allocations 2 SVCMD\_IO Input Signal Pn862 0000h Immediately Monitor Allocations 3 SVCMD\_IO Input Signal Pn863 0000h Immediately Monitor Allocations 4 SVCMD IO Output Signal Pn868 0000h Immediately Monitor Allocations 1 SVCMD\_IO Output Signal Pn869 0000h Immediately Monitor Allocations 2 SVCMD\_IO Output Signal Pn86A 0000h Immediately Monitor Allocations 3 Station Address Monitor Pn880 (for maintenance, read only) Set Transmission Byte Pn881 Count Monitor [bytes] (for \_ maintenance, read only) Transmission Cycle Setting Pn882 Monitor  $[\times 0.25 \ \mu s]$  (for maintenance, read only) Communications Cycle Setting Monitor [transmis-Pn883 sion cycles] (for maintenance, read only) Pn884 0000h Communications Controls 2 Immediately **MECHATROLINK Receive** Pn88A 0 Error Counter Monitor (for maintenance, read only) Command Data Monitor Pn890 to Oh during Alarm/Warning (for Pn8A6 maintenance, read only) Response Data Monitor Pn8A8 to during Alarm/Warning (for Oh Pn8BE maintenance, read only) Number of Parameter Pn900 0 After restart Banks Number of Parameter Bank Pn901 0 After restart Members

Continued from previous page.

| Parameter<br>No.  | Default Setting | Name                                                           | When<br>Enabled                |
|-------------------|-----------------|----------------------------------------------------------------|--------------------------------|
| Pn902 to<br>Pn910 | 0000h           | Parameter Bank Member<br>Definition                            |                                |
| Pn920 to<br>Pn95F | 0000h           | Parameter Bank Data (Not<br>saved in nonvolatile mem-<br>ory.) | Immediately                    |
| 01<br>PnA02       | _               | Encoder Type Selection<br>(read only)                          | -                              |
| 02<br>PnA04       | _               | Motor Type Selection<br>(read only)                            | -                              |
| 03<br>PnA06       | _               | Semi-closed/Fully-closed<br>Selection (read only)              | -                              |
| 04<br>PnA08       | _               | Rated Motor Speed<br>(read only)                               | -                              |
| 05<br>PnA0A       | _               | Maximum Output Speed<br>(read only)                            | -                              |
| 06<br>PnA0C       | _               | Speed Multiplier (read only)                                   | -                              |
| 07<br>PnA0E       | _               | Rated Torque (read only)                                       | -                              |
| 08<br>PnA10       | _               | Maximum Output Torque<br>(read only)                           | -                              |
| 09<br>PnA12       | _               | Torque Multiplier (read only)                                  | -                              |
| 0A<br>PnA14       | _               | Resolution (read only)                                         | -                              |
| 0B<br>PnA16       | 0               | Scale Pitch                                                    | After restart                  |
| 0C<br>PnA18       | _               | Pulses per Scale Pitch<br>(read only)                          | -                              |
| 21<br>PnA42       | 16              | Electronic Gear Ratio<br>(Numerator)                           | After restart                  |
| 22<br>PnA44       | 1               | Electronic Gear Ratio<br>(Denominator)                         | After restart                  |
| 23<br>PnA46       | 0               | Absolute Encoder Origin<br>Offset                              | Immedi-<br>ately <sup>*2</sup> |
| 24<br>PnA48       | 65535           | Multiturn Limit Setting                                        | After restart                  |
| 25<br>PnA4A       | 0000h           | Limit Setting                                                  | After restart                  |
| 26<br>PnA4C       | 1073741823      | Forward Software Limit                                         | Immediately                    |
| 27<br>PnA4E       | 0               | Reserved (Do not change.)                                      | Immediately                    |
| 28<br>PnA50       | -1073741823     | Reverse Software Limit                                         | Immediately                    |
| 29<br>PnA52       | 0               | Reserved (Do not change.)                                      | Immediately                    |
| 41<br>PnA82       | Oh              | Speed Unit Selection                                           | After restart                  |
| 42<br>PnA84       | 0               | Speed Base Unit Selection                                      | After restart                  |
| 43<br>PnA86       | Oh              | Position Unit Selection                                        | After restart                  |

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|                  |                                                                                  | Continued from p                                        | previous page.                 |
|------------------|----------------------------------------------------------------------------------|---------------------------------------------------------|--------------------------------|
| Parameter<br>No. | Default Setting                                                                  | Name                                                    | When<br>Enabled                |
| 44<br>PnA88      | 0                                                                                | Position Base Unit Selec-<br>tion                       | After restart                  |
| 45<br>PnA8A      | Oh                                                                               | Acceleration Unit Selection                             | After restart                  |
| 46<br>PnA8C      | 4                                                                                | Acceleration Base Unit<br>Selection                     | After restart                  |
| 47<br>PnA8E      | 1h                                                                               | Torque Unit Selection                                   | After restart                  |
| 48<br>PnA90      | 0                                                                                | Torque Base Unit Selection                              | After restart                  |
| 49<br>PnA92      | 0601011Fh                                                                        | Supported Unit Systems<br>(read only)                   | _                              |
| 61<br>PnAC2      | 40000                                                                            | Speed Loop Gain                                         | Immediately                    |
| 62<br>PnAC4      | 20000                                                                            | Speed Loop Integral Time<br>Constant                    | Immediately                    |
| 63<br>PnAC6      | 40000                                                                            | Position Loop Gain                                      | Immediately                    |
| 64<br>PnAC8      | 0                                                                                | Feedforward Compensation                                | Immediately                    |
| 65<br>PnACA      | 0                                                                                | Position Loop Integral Time<br>Constant                 | Immediately                    |
| 66<br>PnACC      | 7                                                                                | Positioning Completed<br>Width                          | Immediately                    |
| 67<br>PnACE      | 1073741824                                                                       | Near Signal Width                                       | Immediately                    |
| 81<br>PnB02      | 0                                                                                | Exponential Acceleration/<br>Deceleration Time Constant | Immedi-<br>ately <sup>*3</sup> |
| 82<br>PnB04      | 0                                                                                | Movement Average Time                                   | Immedi-<br>ately <sup>*3</sup> |
| 83<br>PnB06      | 100                                                                              | External Positioning Final<br>Travel Distance           | Immediately                    |
| 84<br>PnB08      | × 5,000h reference<br>units/s converted to<br>10 <sup>-3</sup> min <sup>-1</sup> | Origin Approach Speed                                   | Immediately                    |
| 85<br>PnB0A      | × 500h reference<br>units/s converted to<br>10 <sup>-3</sup> min <sup>-1</sup>   | Origin Return Creep Speed                               | Immediately                    |
| 86<br>PnB0C      | 100                                                                              | Final Travel Distance for<br>Origin Return              | Immediately                    |
| 87<br>PnB0E      | 1h                                                                               | Fixed Monitor Selection 1                               | Immediately                    |
| 88<br>PnB10      | Oh                                                                               | Fixed Monitor Selection 2                               | Immediately                    |
| 89<br>PnB12      | Oh                                                                               | SEL_MON (CMN1) Monitor<br>Selection 1                   | Immediately                    |
| 8A<br>PnB14      | Oh                                                                               | SEL_MON (CMN2) Monitor<br>Selection 2                   | Immediately                    |
| 8B<br>PnB16      | 10                                                                               | Origin Detection Width                                  | Immediately                    |
| 8C<br>PnB18      | 100                                                                              | Forward Torque Limit                                    | Immediately                    |
| 8D<br>PnB1A      | 100 Reverse Torque Limit                                                         |                                                         | Immediately                    |

|                       |                 |                                                                           | 1               |
|-----------------------|-----------------|---------------------------------------------------------------------------|-----------------|
| Parameter<br>No.      | Default Setting | Name                                                                      | When<br>Enabled |
| 8E<br>PnB1C           | 20000           | Zero Speed Detection<br>Range                                             | Immediately     |
| 8F 10000 PnB1E        |                 | Speed Coincidence Signal<br>Detection Width                               | Immediately     |
| 90<br>PnB20           | 0FFF3F3Fh       | Servo Command Control<br>Field Enable/Disable Selec-<br>tions (read only) | _               |
| 91<br>PnB22           | 0FFF3F33h       | Servo Status Field Enable/<br>Disable Selections (read<br>only)           | _               |
| 92<br>PnB24 01FF01F0h |                 | Output Bit Enable/Disable<br>Selections (read only)                       | _               |
| 93<br>PnB26           | FF0FFEFEh       | Input Bit Enable/Disable<br>Selections (read only)                        | _               |

\*1. The enable timing depends on the digit that is changed. Refer to the following section for details. *14.1 List of Servo Parameters* on page 14-2

\*2. The parameter setting is enabled after SENS\_ON command execution is completed.
\*3. Change the setting when the reference is stopped (i.e., while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

# Appendices

The appendix provides information on interpreting panel displays, and tables of corresponding SERVOPACK and SigmaWin+ function names.

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| 15.1 | Interpreting Panel Displays15-2 |                                                                                                                                                    |  |  |
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15.1.1 Interpreting Status Displays

# **15.1 Interpreting Panel Displays**

You can check the Servo Drive status on the panel display of the SERVOPACK. Also, if an alarm or warning occurs, the alarm or warning number will be displayed.

# 15.1.1 Interpreting Status Displays

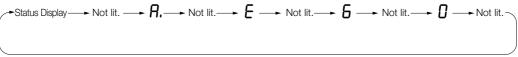
The status is displayed as described below.

| Display | Meaning                                                                                                                                                                                                                                        | Display | Meaning                                                                           |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-----------------------------------------------------------------------------------|
|         | /TGON (Rotation Detection) Signal Display<br>Lit if the Servomotor speed is higher than the<br>setting of Pn502 or Pn581 and not lit if the<br>speed is lower than the setting. (The default set-<br>ting is 20 min <sup>-1</sup> or 20 mm/s.) |         | Reference Input Display<br>Lit while a reference is being input.                  |
| 8       | Base Block Display<br>Lit during the base block state (servo OFF). Not<br>lit while the servo is ON.                                                                                                                                           | ₿,      | Control Power Supply ON Display<br>Lit while the control power is being supplied. |

# 15.1.2 Alarm and Warning Displays

If there is an alarm or warning, the display will change in the following order.

Example: Alarm A.E60



# 15.1.3 Hard Wire Base Block Active Display

If a hard wire base block (HWBB) is active, the display will change in the following order.

→Status Display—→ Not lit. —→ H —→ Not lit. —→ b —→ Not lit. —→ b, —→ Not lit.-

# 15.1.4 Overtravel Display

If overtravel has occurred, the display will change in the following order.

● Forward Overtravel (P-OT)
 ● Reverse Overtravel (N-OT)
 ● Status Display → P → n
 ● Status Display → P → n

# 15.1.5 Forced Stop Display

During a forced stop, the following display will appear.

Status 
$$\longrightarrow$$
 Not lit.  $\longrightarrow F \longrightarrow$  Not lit.  $\longrightarrow 5 \longrightarrow$  Not lit.  $\longrightarrow E \longrightarrow$  Not lit.  $\longrightarrow P \longrightarrow$  Not lit.  $\longrightarrow Y$ 

15.2.1 Corresponding SERVOPACK Utility Function Names

# 15.2 Corresponding SERVOPACK and SigmaWin+ Function Names

This section gives the names and numbers of the utility functions and monitor display functions used by the SERVOPACKs and the names used by the SigmaWin+.

# 15.2.1 Corresponding SERVOPACK Utility Function Names

|                                 | SigmaWin+                                    |        | SERVOPACK                                                        |
|---------------------------------|----------------------------------------------|--------|------------------------------------------------------------------|
| Button in<br>Menu<br>Dialog Box | Function Name                                | Fn No. | Function Name                                                    |
|                                 | Origin Search                                | Fn003  | Origin Search                                                    |
|                                 | Absolute Encoder Reset                       | Fn008  | Reset Absolute Encoder                                           |
|                                 | Adjust the Analog Monitor Output             | Fn00C  | Adjust Analog Monitor Output Offset                              |
|                                 | Adjust the Analog Monitor Output             | Fn00D  | Adjust Analog Monitor Output Gain                                |
|                                 | Adjust the Motor Current Detec-              | Fn00E  | Autotune Motor Current Detection Signal Offset                   |
|                                 | tion Signal Offsets                          | Fn00F  | Manually Adjust Motor Current Detection Signal<br>Offset         |
|                                 | Multiturn Limit Setting                      | Fn013  | Multiturn Limit Setting after Multiturn Limit Disagreement Alarm |
| Setup                           | Reset Option Module Configura-<br>tion Error | Fn014  | Reset Option Module Configuration Error                          |
|                                 | Initialize Vibration Detection Level         | Fn01B  | Initialize Vibration Detection Level                             |
|                                 | Set Origin                                   | Fn020  | Set Absolute Linear Encoder Origin                               |
|                                 | Reset Motor Type Alarm                       | Fn021  | Reset Motor Type Alarm                                           |
|                                 | Software Reset                               | Fn030  | Software Reset                                                   |
|                                 | Polarity Detection                           | Fn080  | Polarity Detection                                               |
|                                 | Tuning-less Level Setting                    | Fn200  | Tuning-less Level Setting                                        |
|                                 | Easy FFT                                     | Fn206  | Easy FFT                                                         |
|                                 | Initialize                                   | Fn005  | Initializing Parameters                                          |
| Parameters                      | Write Prohibition Setting                    | Fn010  | Write Prohibition Setting                                        |
|                                 | Setup Wizard                                 | -      | -                                                                |
|                                 | Autotuning without Host Refer-<br>ence       | Fn201  | Advanced Autotuning without Reference                            |
|                                 | Autotuning with Host Reference               | Fn202  | Advanced Autotuning with Reference                               |
| Tuning                          | Custom Tuning                                | Fn203  | One-Parameter Tuning                                             |
|                                 | Adjust Anti-resonance Control                | Fn204  | Adjust Anti-resonance Control                                    |
|                                 | Vibration Suppression                        | Fn205  | Vibration Suppression                                            |
|                                 | Moment of Inertia Estimation                 | -      | -                                                                |
|                                 |                                              | Fn011  | Display Servomotor Model                                         |
|                                 |                                              | Fn012  | Display Software Version                                         |
| Monitoring                      | Product Information                          | Fn01E  | Display SERVOPACK and Servomotor IDs                             |
|                                 |                                              | Fn01F  | Display Servomotor ID from Feedback Option<br>Module             |
| Test Opera-                     | Jog                                          | Fn002  | Jog                                                              |
| tion                            | Jog Program                                  | Fn004  | Jog Program                                                      |
| Alarms                          |                                              | Fn000  | Display Alarm History                                            |
|                                 | Alarm Display                                | Fn006  | Clear Alarm History                                              |
| Solutions                       | Mechanical Analysis                          | -      | -                                                                |

15.2.2 Corresponding SERVOPACK Monitor Display Function Names

# 15.2.2 Corresponding SERVOPACK Monitor Display Function Names

| SigmaWin+ S                     |                                                                                                                                                                                                                                                                                                         | SERVOPACK |                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Button in<br>Menu<br>Dialog Box | Name [Unit]                                                                                                                                                                                                                                                                                             | Un No.    | Name [Unit]                                                                                                                                                                                                                                                                                                                               |
|                                 | Motor Speed [min <sup>-1</sup> ]                                                                                                                                                                                                                                                                        | Un000     | Motor Speed [min <sup>-1</sup> ]                                                                                                                                                                                                                                                                                                          |
|                                 | Speed Reference [min <sup>-1</sup> ]                                                                                                                                                                                                                                                                    | Un001     | Speed Reference [min <sup>-1</sup> ]                                                                                                                                                                                                                                                                                                      |
|                                 | Torque Reference [%]                                                                                                                                                                                                                                                                                    | Un002     | Torque Reference [%]<br>(percentage of rated torque)                                                                                                                                                                                                                                                                                      |
|                                 | <ul> <li>Rotary Servomotors:<br/>Rotational Angle 1 [encoder<br/>pulses]<br/>(number of encoder pulses from<br/>origin within one encoder rotation)</li> <li>Linear Servomotors:<br/>Electrical Angle 1 [linear encoder<br/>pulses]<br/>(linear encoder pulses from the<br/>polarity origin)</li> </ul> | Un003     | <ul> <li>Rotary Servomotors:<br/>Rotational Angle 1 [encoder pulses]<br/>(number of encoder pulses from origin within<br/>one encoder rotation displayed in decimal)</li> <li>Linear Servomotors:<br/>Electrical Angle 1 [linear encoder pulses]<br/>(linear encoder pulses from the polarity origin<br/>displayed in decimal)</li> </ul> |
|                                 | <ul> <li>Rotary Servomotors:<br/>Rotational Angle 2 [deg]<br/>(electrical angle from origin within<br/>one encoder rotation)</li> <li>Linear Servomotors:<br/>Electrical Angle 2 [deg]<br/>(electrical angle from polarity ori-<br/>gin)</li> </ul>                                                     | Un004     | <ul> <li>Rotary Servomotors:<br/>Rotational Angle 2 [deg]<br/>(electrical angle from polarity origin)</li> <li>Linear Servomotors:<br/>Electrical Angle 2 [deg]<br/>(electrical angle from polarity origin)</li> </ul>                                                                                                                    |
|                                 | Input Reference Pulse Speed [min <sup>-1</sup> ]                                                                                                                                                                                                                                                        | Un007     | Input Reference Pulse Speed [min <sup>-1</sup> ]<br>(displayed only during position control)                                                                                                                                                                                                                                              |
| Motion                          | Position Deviation [reference units]                                                                                                                                                                                                                                                                    | Un008     | Position Error Amount [reference units]<br>(displayed only during position control)                                                                                                                                                                                                                                                       |
| Monitor                         | Accumulated Load Ratio [%]                                                                                                                                                                                                                                                                              | Un009     | Accumulated Load Ratio [%]<br>(percentage of rated torque: effective torque in<br>cycles of 10 seconds)                                                                                                                                                                                                                                   |
|                                 | Regenerative Load Ratio [%]                                                                                                                                                                                                                                                                             | Un00A     | Regenerative Load Ratio [%]<br>(percentage of processable regenerative<br>power: regenerative power consumption in<br>cycles of 10 seconds)                                                                                                                                                                                               |
|                                 | Input Reference Pulse Counter [ref-<br>erence units]                                                                                                                                                                                                                                                    | Un00C     | Input Reference Pulse Counter [reference units]                                                                                                                                                                                                                                                                                           |
|                                 | Feedback Pulse Counter [encoder pulses]                                                                                                                                                                                                                                                                 | Un00D     | Feedback Pulse Counter [encoder pulses]                                                                                                                                                                                                                                                                                                   |
|                                 | Fully-closed Loop Feedback Pulse<br>Counter [external encoder resolu-<br>tion]                                                                                                                                                                                                                          | Un00E     | Fully-closed Loop Feedback Pulse Counter<br>[external encoder resolution]                                                                                                                                                                                                                                                                 |
|                                 | Upper Limit Setting of Motor Maxi-<br>mum Speed/Upper Limit Setting of<br>Encoder Output Resolution                                                                                                                                                                                                     | Un010*1   | Upper Limit Setting of Motor Maximum Speed/<br>Upper Limit Setting of Encoder Output Resolu-<br>tion                                                                                                                                                                                                                                      |
|                                 | Total Operation Time [100 ms]                                                                                                                                                                                                                                                                           | Un012     | Total Operation Time [100 ms]                                                                                                                                                                                                                                                                                                             |
|                                 | Feedback Pulse Counter [reference units]                                                                                                                                                                                                                                                                | Un013     | Feedback Pulse Counter [reference units]                                                                                                                                                                                                                                                                                                  |
|                                 | Overheat Protection Input [0.01 V]                                                                                                                                                                                                                                                                      | Un02F     | Overheat Protection Input [0.01 V]                                                                                                                                                                                                                                                                                                        |
|                                 | Current Backlash Compensation<br>Value [0.1 reference units]                                                                                                                                                                                                                                            | Un030     | Current Backlash Compensation Value [0.1 reference units]                                                                                                                                                                                                                                                                                 |
|                                 | Backlash Compensation Value Set-<br>ting Limit [0.1 reference units]                                                                                                                                                                                                                                    | Un031     | Backlash Compensation Value Setting Limit<br>[0.1 reference units]                                                                                                                                                                                                                                                                        |

#### 15.2.2 Corresponding SERVOPACK Monitor Display Function Names

Continued from previous page

|                                 | Continued from previous SigmaWin+ SERVOPACK                              |         |                                                                                                                                 |
|---------------------------------|--------------------------------------------------------------------------|---------|---------------------------------------------------------------------------------------------------------------------------------|
| Button in<br>Menu<br>Dialog Box | Name [Unit]                                                              | Un No.  | Name [Unit]                                                                                                                     |
|                                 | Power Consumption [W]                                                    | Un032   | Power Consumption [W]                                                                                                           |
|                                 | Consumed Power [0.001 Wh]                                                | Un033   | Consumed Power [0.001 Wh]                                                                                                       |
|                                 | Cumulative Power Consumption [Wh]                                        | Un034   | Cumulative Power Consumption [Wh]                                                                                               |
| Motion                          | Energy Consumption of the Dynamic<br>Brake Resistor [%]                  | Un03B   | Dynamic Brake Resistor energy consumption<br>[%] (Percentage of Pn601 (Dynamic Brake<br>Resistor Allowable Energy Consumption)) |
| Monitor                         | Absolute Encoder Multiturn Data                                          | Un040   | Absolute Encoder Multiturn Data                                                                                                 |
|                                 | Position within One Rotation of<br>Absolute Encoder [encoder pulses]     | Un041   | Position within One Rotation of Absolute<br>Encoder [encoder pulses]                                                            |
|                                 | Lower Bits of Absolute Encoder<br>Position [encoder pulses]              | Un042   | Lower Bits of Absolute Encoder Position [encoder pulses]                                                                        |
|                                 | Upper Bits of Absolute Encoder<br>Position [encoder pulses]              | Un043   | Upper Bits of Absolute Encoder Position [encoder pulses]                                                                        |
|                                 | Polarity Sensor Signal Monitor                                           | Un011   | Polarity Sensor Signal Monitor                                                                                                  |
| Status<br>Monitor               | Active Gain Monitor                                                      | Un014   | Effective Gain Monitor (gain settings 1 = 1, gain settings 2 = 2)                                                               |
|                                 | Safety I/O Signal Monitor                                                | Un015   | Safety I/O Signal Monitor                                                                                                       |
| Input Sig-<br>nal Moni-<br>tor  | Input Signal Monitor                                                     | Un005   | Input Signal Monitor                                                                                                            |
| Output<br>Signal<br>Monitor     | Output Signal Monitor                                                    | Un006   | Output Signal Monitor                                                                                                           |
|                                 | Installation Environment Monitor –<br>SERVOPACK                          | Un025   | SERVOPACK Installation Environment Monitor [%]                                                                                  |
|                                 | Installation Environment Monitor –<br>Servomotor <sup>*2</sup>           | Un026*2 | Servomotor Installation Environment Monitor [%]                                                                                 |
| Contine                         | Service Life Prediction Monitor –<br>Built-in Fan                        | Un027   | Built-in Fan Remaining Life Ratio [%]                                                                                           |
| Service<br>Life Moni-<br>tor    | Service Life Prediction Monitor –<br>Capacitor                           | Un028   | Capacitor Remaining Life Ratio [%]                                                                                              |
|                                 | Service Life Prediction Monitor –<br>Surge Prevention Circuit            | Un029   | Surge Prevention Circuit Remaining Life Ratio [%]                                                                               |
|                                 | Service Life Prediction Monitor –<br>Dynamic Brake Circuit <sup>*3</sup> | Un02A*3 | Dynamic Brake Circuit Remaining Life Ratio [%]                                                                                  |
|                                 | Service Life Prediction Monitor –<br>Built-in Brake Relay                | Un036   | Built-in Brake Relay Remaining Life Ratio [%]                                                                                   |
| Product<br>Informa-             | Motor – Resolution                                                       | Un084   | Linear Encoder Pitch (Scale pitch = Un084 $\times$ 10 <sup>Un085</sup> [pm])                                                    |
| tion                            |                                                                          | Un085   | Linear Encoder Pitch Exponent (Scale pitch = Un084 × 10 <sup>Un085</sup> [pm])                                                  |
|                                 | _                                                                        | Un020   | Rated Motor Speed [min-1]                                                                                                       |
|                                 |                                                                          |         |                                                                                                                                 |

\*1. You can use Un010 to monitor the upper limit setting for the maximum motor speed or the upper limit setting for the encoder output resolution.

You can monitor the upper limit of the encoder output resolution setting (Pn281) for the current maximum motor speed setting (Pn385), or you can monitor the upper limit of the maximum motor speed setting for the current Select which signal to monitor with Pn080 =  $n.X \square \square$  (Calculation Method for Maximum Speed or Encoder Output Pulses).

If Pn080 = n.0 | | | | , the encoder output resolution (Pn281) that can be set is displayed.
If Pn080 = n.1 | | | | | , the maximum motor speed (Pn385) that can be set is displayed in mm/s.

\*2. This applies to the following motors. The display will show 0 for all other models.

SGM7J, SGM7A, and SGM7G

\*3. With SGD7S-210D, -260D, -280D, and -370D SERVOPACKs, you cannot check the remaining life ratio with the Service Life Prediction Monitor and Un02A because these SERVOPACKs are not equipped with a built-in dynamic brake circuit.

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# $\langle$ Index angle

#### Symbols

| /ВК                                          | 6 00  |
|----------------------------------------------|-------|
| /BK (Brake) signal                           |       |
|                                              |       |
| /CLT                                         |       |
| /CLT (Torque Limit Detection) signal         |       |
| /COIN                                        | 7-12  |
| /COIN (Positioning Completion) signal        | 7-12  |
| /HWBB1                                       | 4-36  |
| /HWBB2                                       | 4-36  |
| /N-CL                                        | 7-29  |
| /N-CL (Reverse External Torque Limit) signal | 7-29  |
| /NEAR                                        | 7-13  |
| /NEAR (Near) signal                          | 7-13  |
| /P-CL                                        | 7-29  |
| /P-CL (Forward External Torque Limit) signal | 7-29  |
| /S-RDY                                       | 7-10  |
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