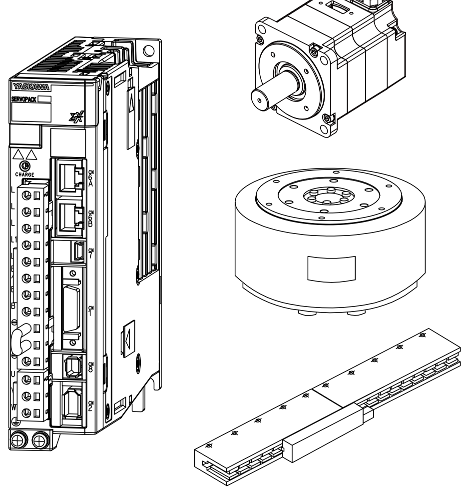
YASKAWA

Σ-X-Series AC Servo Drive

Σ-XS SERVOPACK with MECHATROLINK-4/III Communications References

Product Manual

Model: SGDXS-□□□□40□



MANUAL NO. SIEP C710812 01E

Table of Contents

i

Preface and General Precautions

i.1 About this Manual

This manual provides information required to select Σ-XS SERVOPACKs MECHATROLINK-4/III communications references for Σ-X-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 Σ-X-series AC servo drives. Keep this manual in a safe place so that it can be referred to whenever necessary.

i.2 Target Readers

This manual is intended for the following readers who are assumed to possess knowledge about the fundamentals of servo drives and electric/electronic circuits.

- Readers who wish to deepen their knowledge of SERVOPACK products
- Personnel in charge of selecting products for equipment
- Designers of applications for SERVOPACKs and servomotors in various types of equipment
- Personnel who maintain equipment
- Designers of FA systems

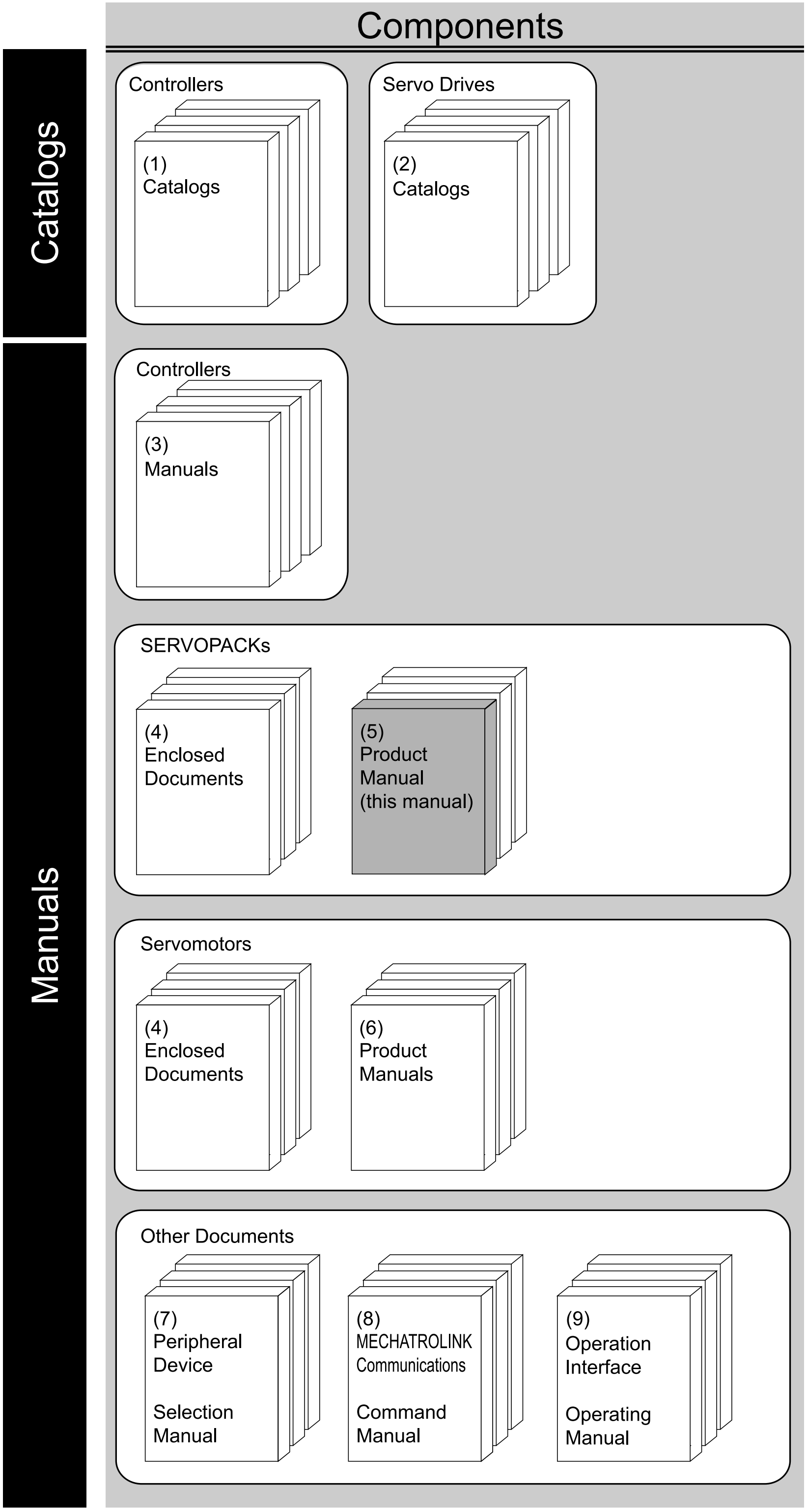
i.3 Outline of Manual

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 SERVOPACK 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 locations.
4	Wiring and Connecting SERVOPACKs	Provides information on wiring and connecting SERVOPACKs to power supplies and peripheral devices.
5	Basic Functions That Require Setting before Operation	Describes the basic functions that must be set before you start servo system operation. It also describes the setting methods.
6	Application Functions	Describes the application functions that you can set before you start servo system operation. It also describes the setting methods.
7	Trial Operation and Actual Operation	Provides information on the flow and procedures for trial operation and convenient functions to use during trial operation.
8	Tuning	Provides information on the flow of tuning, details on tuning functions, and related operating procedures.
9	Monitoring	Provides information on monitoring SERVOPACK product information and SERVOPACK status.
10	Fully-Closed Loop Control	Provides detailed information on performing fully-closed loop control with the SERVOPACK.
11	Σ-LINK II Function	Provides detailed information on the Σ-LINK II functions of the SERVOPACK.
12	Safety Functions	Provides detailed information on the safety functions of the SERVOPACK.
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 LED indicators and panel displays and tables of corresponding SERVOPACK and SigmaWin+ function names.

i.4 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.



i.4.1 Related Documents

(1) Machine Controllers Catalogs

You can check for products related to YASKAWA machine controllers. Refer to these documents as required.

(2) Servo Drives Catalogs

Document Name	Document No.	Description
AC Servo Drives Sigma-X Series	KAEP C710812 03	Provides detailed information on Σ-X-series AC servo drives, including features and specifications.

(3) Machine Controllers Manuals

The machine controller to use depends on the SERVOPACK that is used. Refer to the manual for the machine controller as required.

(4) Enclosed Documents

Document Name	Document No.	Description
Σ-X-Series AC Servo Drive Σ-XS/Σ-XW SERVOPACK Safety Precautions	TOMP C710812 00	Provides detailed information for the safe usage of Σ-X-series SERVOPACKs.
Σ-X-Series AC Servo Drive Σ-XT SERVOPACK Safety Precautions	TOMP C710812 16	
Σ-X-Series AC Servo Drive Σ-LINK II Sensor Hub Instructions	TOMP C710812 06	Provides detailed information for the safe usage of the Σ-LINK II sensor hub, as well as specifications, installation, and connection information.
Σ-X-Series AC Servo Drive Σ-LINK II Booster Unit Instructions	TOMP C710812 08	Provides detailed information for the safe usage of the Σ-LINK II booster unit, as well as specifications, installation, and connection information.
Σ-V-Series/Σ-V-Series for Large-Capacity Models/Σ-7-Series/Σ-X-Series Installation Guide Fully-closed Module	TOBP C720829 03	Provides detailed procedures for installing the fully-closed module in a SERVOPACK.
AC Servo Drive Rotary Servomotor Safety Precautions	TOBP C230260 00	Provides detailed information for the safe usage of rotary servomotors and direct drive servomotors.

(5) SERVOPACK Product Manuals

Document Name	Document No.	Description
Σ-X-Series AC Servo Drive Σ-XS SERVOPACK with MECHATROLINK-4/III Communications References Product Manual	SIEP C710812 01	Provide detailed information on selecting Σ-X-series Σ-XS or Σ-XW SERVOPACKs; installing, connecting, setting, testing in trial operation, tuning, monitoring, and maintaining servo drives; and other information.
Σ-X-Series AC Servo Drive Σ-XS SERVOPACK with EtherCAT Communications References Product Manual	SIEP C710812 02	Provide detailed information on selecting Σ-X-series Σ-XS or Σ-XW SERVOPACKs; installing, connecting, setting, testing in trial operation, tuning, monitoring, and maintaining servo drives; and other information.
Σ-X-Series AC Servo Drive Σ-XS SERVOPACK with Analog Voltage/Pulse Train References Product Manual	SIEP C710812 03	Provide detailed information on selecting Σ-X-series Σ-XS or Σ-XW SERVOPACKs; installing, connecting, setting, testing in trial operation, tuning, monitoring, and maintaining servo drives; and other information.
Σ-X-Series AC Servo Drive Σ-XW SERVOPACK with MECHATROLINK-4/III Communications References Product Manual	SIEP C710812 04	Provide detailed information on selecting Σ-X-series Σ-XS or Σ-XW SERVOPACKs; installing, connecting, setting, testing in trial operation, tuning, monitoring, and maintaining servo drives; and other information.
Σ-X-Series AC Servo Drive Σ-XW SERVOPACK with EtherCAT Communications References Product Manual	SIEP C710812 05	Provide detailed information on selecting Σ-X-series Σ-XS or Σ-XW SERVOPACKs; installing, connecting, setting, testing in trial operation, tuning, monitoring, and maintaining servo drives; and other information.
Σ-X-Series AC Servo Drive Σ-XT SERVOPACK with MECHATROLINK-4/III Communications References Product Manual	SIEP C710812 16	Provide detailed information on selecting Σ-X-series Σ-XT SERVOPACKs; installing, connecting, setting, testing in trial operation, tuning, monitoring, and maintaining servo drives; and other information.
Σ-X-Series AC Servo Drive Σ-XT SERVOPACK with EtherCAT Communications References Product Manual	SIEP C710812 17	Provide detailed information on selecting Σ-X-series Σ-XT SERVOPACKs; installing, connecting, setting, testing in trial operation, tuning, monitoring, and maintaining servo drives; and other information.
Σ-X-Series AC Servo Drive Σ-XW/Σ-XT SERVOPACK Hardware Option Specifications HWBB Function Product Manual	SIEP C710812 13	Provides information on servo drives equipped with the HWBB safety function (SGDXW-□□□□40□1000, SGDXW-□□□□A0□1000, SGDXT-□□□□40□1000, and SGDXT-□□□□A0□1000)). The differences in specifications from SERVOPACKs not equipped with the HWBB are given in this manual.
Σ-X-Series AC Servo Drive Σ-XS/Σ-XW/Σ-XT SERVOPACK Hardware Option Specifications Dynamic Brake Product Manual	SIEP C710812 14	Provides information on Σ-X-series AC servo drives (SGDX□-□□□□□□□0020) with the dynamic brake option. The differences in specifications from SERVOPACKs without the dynamic brake option are given in this manual.

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<table>
<tr><th>Document Name</th><th>Document No.</th><th>Description</th></tr>
<tr><td>Σ-X-Series AC Servo Drive
Σ-XS/Σ-XW SERVOPACK
with MECHATROLINK-4/III Communications References
FT Specification
for Gantry Applications
Product Manual</td><td>SIEP C710812 19</td><td rowspan="2">Provide information on the gantry application function and torque/force assistance in the Σ-X-series Σ-XS/Σ-XW SERVOPACK.</td></tr>
<tr><td>Σ-X-Series AC Servo Drive
Σ-XS/Σ-XW SERVOPACK
with EtherCAT Communications References
FT Specification
for Gantry Applications
Product Manual</td><td>SIEP C710812 20</td></tr>
<tr><td>Σ-X-Series AC Servo Drive
Σ-XS SERVOPACK
with MECHATROLINK-4/III Communications References
FT Specification
for Press and Injection Molding Applications
Product Manual</td><td>SIEP C710812 22</td><td rowspan="2">Provide information on the press and injection molding function in the Σ-X-series Σ-XS SERVOPACK.</td></tr>
<tr><td>Σ-X-Series AC Servo Drive
Σ-XS SERVOPACK
with EtherCAT Communications References
FT Specification
for Press and Injection Molding Applications
Product Manual</td><td>SIEP C710812 23</td></tr>
<tr><td>Σ-X-Series AC Servo Drive
Σ-XS SERVOPACK
with FT Specification
Customized Sensing Data Function Option
Product Manual</td><td>SIEP C710812 18</td><td>Provides information on the customized sensing data function in the Σ-X-series Σ-XS SERVOPACK.</td></tr>
<tr><td>Σ-X-Series AC Servo Drive
Σ-XS SERVOPACK
with FT Specification
Customized Sensing Data Function Option (with Custom Motion Function)
Product Manual</td><td>SIEP C710812 21</td><td>Provides information on the customized sensing data function (with custom motion function) in the Σ-X-series Σ-XS SERVOPACK.</td></tr>
</table>

(6) Servomotor Product Manuals

Document Name	Document No.	Description
Σ-X-Series AC Servo Drive Rotary Servomotor Product Manual	SIEP C230210 00	Provides detailed information on selecting, installing, and connecting the Σ-X-series servomotors.

(7) Peripheral Device Selection Manual

Document Name	Document No.	Description
Σ-X-Series AC Servo Drive Peripheral Device Selection Manual	SIEP C710812 12	Provides the following information in detail for Σ-X-series servo systems. • Cables: Models, dimensions, wiring materials, connector models, and connection specifications • Peripheral devices: Models, specifications, diagrams, and selection (calculation) methods

(8) MECHATROLINK Communications Command Manuals

Document Name	Document No.	Description
Σ-7/Σ-X-Series AC Servo Drive MECHATROLINK-III Communications Standard Servo Profile Command Manual	SIEP S800001 31	Provides detailed information on the MECHATROLINK-III communications standard servo profile commands that are used for a Σ-7/Σ-X-series servo system.
Σ-7/Σ-X-Series AC Servo Drive MECHATROLINK-4 Communications Standard Servo Profile Command Manual	SIEP S800002 32	Provides detailed information on the MECHATROLINK-4 communications standard servo profile commands that are used for a Σ-7/Σ-X-series servo system.

(9) Operation Interface Operating Manuals

Document Name	Document No.	Description
System Integrated Engineering Tool MPE720 Ver.7 User's Manual	SIEP C880761 03	Describes in detail how to operate MPE720 version 7.
Σ-7/Σ-X-Series AC Servo Drive Digital Operator Operating Manual	SIEP S800001 33	Describes the operating procedures for a digital operator for a Σ-7/Σ-X-series servo system.
AC Servo Drive Engineering Tool SigmaWin+ Operation Manual	SIET S800001 34	Provides detailed operating procedures for the SigmaWin+ engineering tool for a Σ-7/Σ-X series servo system.

i.5 Using This Manual

i.5.1 Technical Terms Used in This Manual

The following terms are used in this manual.

Term	Meaning
servomotor	A generic term for a rotary servomotor or linear servomotor that can be driven by this SERVOPACK.
rotary servomotor	A generic term used for a Σ-X-series or Σ-7-series rotary servomotor (SGMXJ, SGMXA, SGMXP, SGMXG, SGM7M) or a Σ-7-series direct drive servomotor (SGM7D, SGM7E, SGM7F). The descriptions will specify when direct drive servomotors are excluded.
linear servomotor	A generic term used for a Σ-7-series linear servomotor (SGLG, SGLF, SGLT).
SERVOPACK	A Σ-X-series Σ-XS servo amplifier with MECHATROLINK-4/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.
SigmaWin+	The engineering tool for setting up and tuning servo drives or a computer in which the engineering tool is installed.

i.5.2 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 Servomotor	Linear Servomotor
torque	force
moment of inertia	mass
rotation	movement
forward rotation and reverse rotation	forward movement and reverse movement
CW + 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^{-1}	unit: mm/s
unit: N·m	unit: N

i.5.3 Notation Used in this Manual

(1) 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.

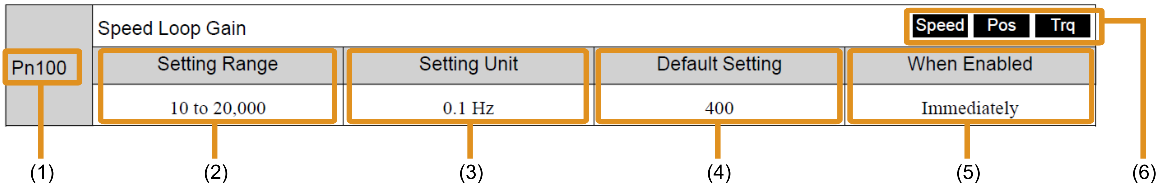
Notation Example

$\overline{\mathrm{BK}}$ is written as /BK.

(2) Notation for Parameters

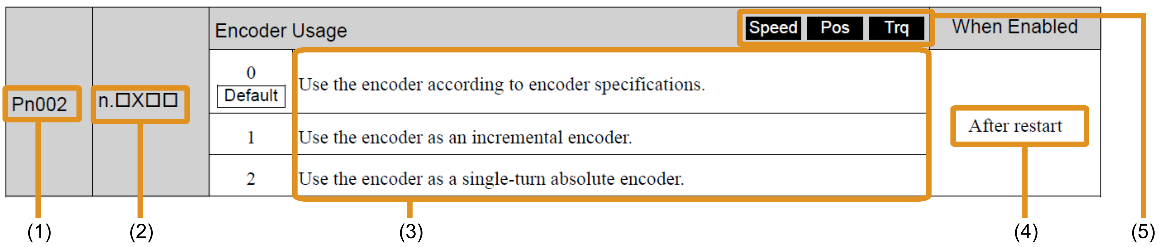
The notation depends on whether the parameter requires a numeric setting (parameter for numeric setting) or requires the selection of a function (parameter for selecting functions).

(a) Parameters for Numeric Settings



No.	Description
(1)	Parameter number
(2)	This is the setting range for the parameter.
(3)	This is the setting unit (setting increment) that you can set for the parameter.
(4)	This is the parameter setting before shipment.
(5)	This is when any change made to the parameter will become effective.
(6)	The control methods for which the parameters apply are given. Speed: A parameter that can be used in speed control. Pos: A parameter that can be used in position control. Trq: A parameter that can be used in torque control. "Torque" is used even for linear servomotor parameters. Grayed-out icons (Speed, Pos, Trq) indicate parameters that cannot be used in the corresponding control method.

(b) Parameters for Selecting Functions



<table>
<tr><th>No.</th><th>Description</th></tr>
<tr><td>(1)</td><td>Parameter number</td></tr>
<tr><td>(2)</td><td>The notation “n.□□□□” indicates a parameter for selecting functions. The digit shown as "X" is the content being explained in this parameter.
Notation Example
n. 0 0 0 0
Notation Examples for Pn002
<table>
<tr><th colspan="2">Digit Notation</th><th colspan="2">Numeric Value Notation</th></tr>
<tr><th>Notation</th><th>Meaning</th><th>Notation</th><th>Meaning</th></tr>
<tr><td>Pn002 = n.□□□X</td><td>Indicates the first digit from the right in Pn002.</td><td>Pn002 = n.□□□1</td><td>Indicates that the first digit from the right in Pn002 is set to 1.</td></tr>
<tr><td>Pn002 = n.□□X□</td><td>Indicates the second digit from the right in Pn002.</td><td>Pn002 = n.□□1□</td><td>Indicates that the second digit from the right in Pn002 is set to 1.</td></tr>
<tr><td>Pn002 = n.□X□□</td><td>Indicates the third digit from the right in Pn002.</td><td>Pn002 = n.□1□□</td><td>Indicates that the third digit from the right in Pn002 is set to 1.</td></tr>
<tr><td>Pn002 = n.X□□□</td><td>Indicates the fourth digit from the right in Pn002.</td><td>Pn002 = n.1□□□</td><td>Indicates that the fourth digit from the right in Pn002 is set to 1.</td></tr>
</table></td></tr>
<tr><td>(3)</td><td>This column explains the selections for the function.
In the above example, the first line gives an explanation of when Pn002 = n.□0□□ is set.</td></tr>
<tr><td>(4)</td><td>This is when any change made to the parameter will become effective.</td></tr>
<tr><td>(5)</td><td>The control methods for which the parameters apply are given.
Speed: A parameter that can be used in speed control.
Pos: A parameter that can be used in position control.
Trq: A parameter that can be used in torque control. "Torque" is used even for linear servomotor parameters.
Grayed-out icons (Speed, Pos, Trq) indicate parameters that cannot be used in the corresponding control method.</td></tr>
</table>

i.5.4 Engineering Tools Used in This Manual

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

The interfaces and procedures contained in this manual are currently in development and may differ from the actual specifications.

i.5.5 Trademarks

- QR code is a trademark of Denso Wave Inc.
- MECHATROLINK is a trademark of the MECHATROLINK Members Association.
- Σ-LINK is a trademark of the MECHATROLINK Members Association.
- Other product names and company names are the trademarks or registered trademarks of their respective companies. “TM” and the ® mark do not appear with product or company names in this manual.

i.5.6 Visual Aids

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

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

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

Information Indicates supplemental information to deepen understanding or useful information.

i.6 Safety Precautions

i.6.1 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.

DANGER

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

WARNING

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

CAUTION

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.

i.6.2 Safety Precautions That Must Always Be Observed

(1) General Precautions

DANGER

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.

⚠ WARNING

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 (100 Ω max).

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.

⚠ CAUTION

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 burning.

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 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 place the product in locations where it is subject to water, corrosive gases, flammable gases, potentially explosive atmospheres, or near flammable materials.

There is a risk of electric shock or fire.

NOTICE

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 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.

(2) Storage Precautions

⚠ CAUTION

Do not place an excessive load on the product. (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 surrounding 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.

(3) Transportation Precautions

⚠ CAUTION

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. (Follow all instructions on the packages.)

There is a risk of injury or damage.

NOTICE

Do not hold onto the front cover or connectors when you move a SERVOPACK.

There is a risk of the SERVOPACK falling.

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.

NOTICE

If disinfectants or insecticides must be used to treat packing materials such as wooden frames, plywood, or pallets, use a method other than fumigation. For example, use heat sterilization (core temperature of 56°C or higher for 30 minutes or longer). Treat the packing materials before the product is packaged instead of using a method that treats the entire packaged product.

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.

(4) Installation Precautions

⚠ CAUTION

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.

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 surrounding 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.

NOTICE

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.

(5) Wiring Precautions

⚠ DANGER

Do not change any wiring while power is being supplied.

There is a risk of electric shock or injury.

⚠ WARNING

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. There is also a risk that some parts damaged by the short-circuit failure may fall from the SERVOPACK.

Connect the AC or DC power supplies to the specified SERVOPACK terminals.

- **Connect an AC power supply to the L1, L2, and L3 terminals and the L1C and L2C terminals on the SERVOPACK.**
- **Connect a DC power supply to the B1/⊕ and ⊖ 2 terminals and the L1C and L2C terminals on the SERVOPACK.**

There is a risk of failure or fire.

If you use a SERVOPACK with the dynamic brake hardware option, connect an external dynamic brake resistor that is suitable for the machine and equipment specifications to the specified terminals.

There is a risk of unexpected operation, machine damage, burning, or injury when an emergency stop is performed.

⚠ CAUTION

Wait for at least 20 minutes (or 100 minutes when using DC power supply input) after turning OFF the power and then make sure that the CHARGE indicator is not lit before starting wiring or inspection work. Do not touch the main circuit terminals while the CHARGE indicator is lit because high voltage may still remain in the SERVOPACK even after turning OFF the power.

There is a risk of electric shock.

Observe the precautions and instructions for wiring and trial operation precisely as described in 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.

⚠ CAUTION

Check the wiring to be sure it has been performed correctly. Connectors and pin layouts are sometimes different for different models. Always confirm the pin layouts in technical documents for your model before operation.

There is a risk of failure or malfunction.

Connect wires to main circuit 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 signal cables and encoder cables.

The maximum wiring length is 3 m for I/O signal cables and 50 m for servomotor main circuit cables and encoder cables.

Observe the following precautions when wiring the SERVOPACK's main circuit terminals.

- **Turn ON the power to the SERVOPACK only after all wiring, including the main circuit terminals, has been completed.**
- **If a connector is used for the main circuit terminals, remove the main circuit connector from the SERVOPACK before you wire it.**
- **Insert only one wire per insertion hole in the main circuit terminals.**
- **When you insert a wire, make sure that the conductor wire (e.g., whiskers) does not come into contact with adjacent wires and cause a short-circuit.**

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.

NOTICE

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 connector screws and lock mechanisms.

Insufficient tightening may result in 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.

(6) 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 servomotor will coast to a stop or stop with the dynamic brake according to the SERVOPACK option and settings. The coasting distance will change with the moment of inertia of the load and the external dynamic brake resistance. 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.

Perform the correct operation with the servomotor connected to the machine.

There is a risk of machine damage or personal injury.

⚠ CAUTION

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 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.

⚠ CAUTION

Always turn OFF the servo before you turn OFF the power. If you turn OFF the main circuit power or control power during operation before you turn OFF the servo, the servomotor will stop as follows:

- **If you turn OFF the main circuit power during operation without turning OFF the servo, the servomotor will stop abruptly with the dynamic brake.**
- **If you turn OFF the control power 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 a SERVOPACK with the dynamic brake hardware option, the servomotor stopping methods will be different from the stopping methods used without the option or with other hardware options.**

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.

NOTICE

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 ON and OFF. After you have started actual operation, allow at least one hour between turning the power ON and OFF (as a guideline). Do not use the product in applications that require the power 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.

(7) Maintenance and Inspection Precautions

⚠ DANGER

Do not change any wiring while power is being supplied.

There is a risk of electric shock or injury.

⚠ WARNING

Wiring and inspections must be performed only by qualified engineers.

There is a risk of electric shock or product failure.

⚠ CAUTION

Wait for at least 20 minutes (or 100 minutes when using DC power supply input) after turning OFF the power and then make sure that the CHARGE indicator is not lit before starting wiring or inspection work. Do not touch the main circuit terminals while the CHARGE indicator is lit because high voltage may still remain in the SERVOPACK even after turning OFF the power.

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 correctly, 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.

(8) Troubleshooting Precautions

⚠ DANGER

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.

⚠ WARNING

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.

⚠ CAUTION

When an alarm occurs, remove the cause of the alarm and ensure safety. Then reset the alarm or turn the power 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 terminals on the SERVOPACK so that the power 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 continuously, possibly resulting in fire.

⚠ CAUTION

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.

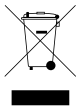
Install a ground fault detector against overloads and short-circuiting or install a molded-case circuit breaker combined with a ground fault detector.

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.

(9) Disposal Precautions

- Correctly discard the product as stipulated by regional, local, and municipal laws and regulations. Be sure to include these contents in all labelling and warning notifications on the final product as necessary.



(10) General Precautions

- Figures provided in this manual 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 manual are sometimes shown with their covers or protective guards removed to illustrate detail. Always replace all covers and protective guards before you use the product.
- If you need a new copy of this manual because it has been lost or damaged, contact your nearest Yaskawa representative or one of the offices listed on the back of this manual.
- This manual is subject to change without notice for product improvements, specifications changes, and improvements to the manual itself. We will update the manual number of the manual 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.

i.7 Warranty

i.7.1 Details of Warranty

(1) 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.

(2) 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

i.7.2 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.

i.7.3 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.

i.7.4 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.

i.8 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.

Refer to the servomotor manual for compliant standards of servomotors.

i.8.1 North American Safety Standards (UL)

Product	Model	North American Safety Standards (UL File No.)
SERVOPACK	SGDXS	UL 61800-5-1 (E147823), CSA C22.2 No.274

i.8.2 EU Directives

Product	Model	EU Directives	Harmonized Standards
SERVOPACK	SGDXS	Machinery Directive 2006/42/EC	EN 62061 EN 61800-5-2
		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 61800-5-1
		RoHS Directive 2011/65/EU (EU)2015/863	EN IEC 63000
		WEEE Directive 2012/19/EU	–

Note:

- We declared the CE Marking based on the harmonized standards in the above table. These products complied with the corresponding IEC standards. Refer to the declaration of conformity for details.
- These products are for industrial use. In home environments, these products may cause electromagnetic interference and additional noise reduction measures may be necessary.

i.8.3 Safety Standards

Product	Model	Standards
SERVOPACK	SGDXS	EN ISO13849-1:2015 EN 62061 EN 61800-5-2 EN 61000-6-7 EN 61326-3-1 EN 61508 series

Note:

These products complied with the corresponding IEC standards. Refer to the declaration of conformity for details.

- Safety Parameters

Item	Standards	Performance Level
Safety Integrity Level	IEC 61508	SIL3
	IEC 62061	SILCL3
Mission Time	EN ISO 13849-1	20 years
Probability of Dangerous Failure per Hour	IEC 61508 IEC 62061	PFH = 8.57×10^{-9} [1/h] (8.57% of SIL3)
Performance Level	EN ISO 13849-1	PL e (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	B

Note:

Mission time is a parameter used in the statistic calculation required by functional safety standards. Mission time is not related to the warranty period.

1

Basic Information on SERVOPACKs

This chapter provides information required to select SERVOPACKs, such as SERVOPACK model numbers and combinations with servomotors.

1.1 The Σ-X Series

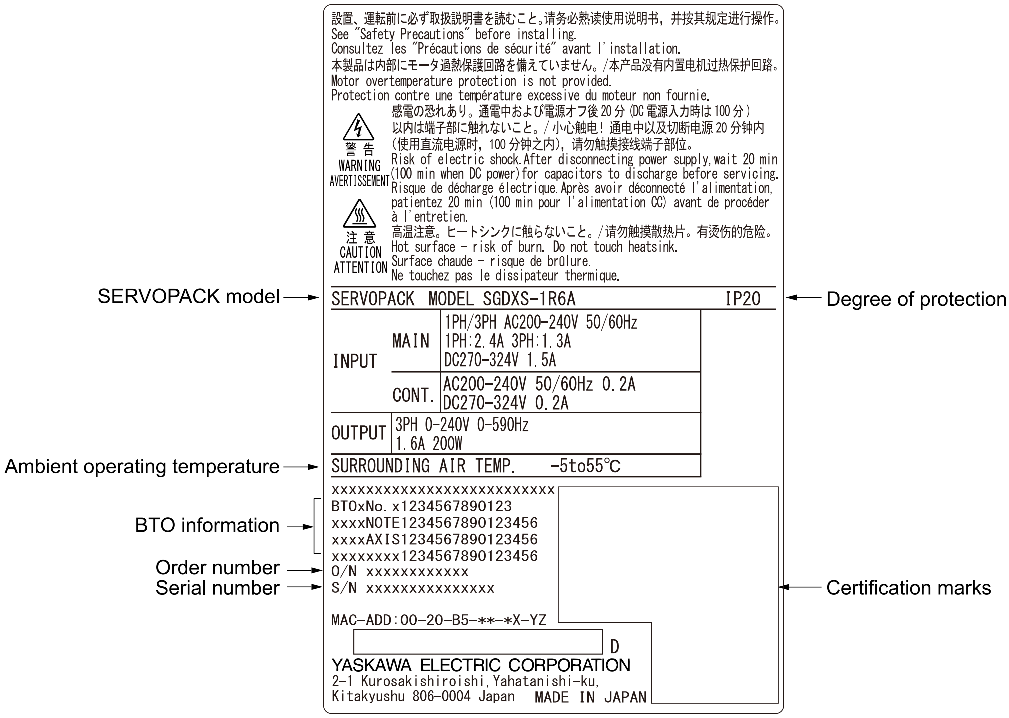
The Σ-X-series SERVOPACKs are designed for applications that require frequent high-speed and high-precision positioning. The SERVOPACK will make the most of machine performance in the shortest time possible, thus contributing to improving productivity.

Σ-X-series SERVOPACKs are available in the three models shown below.

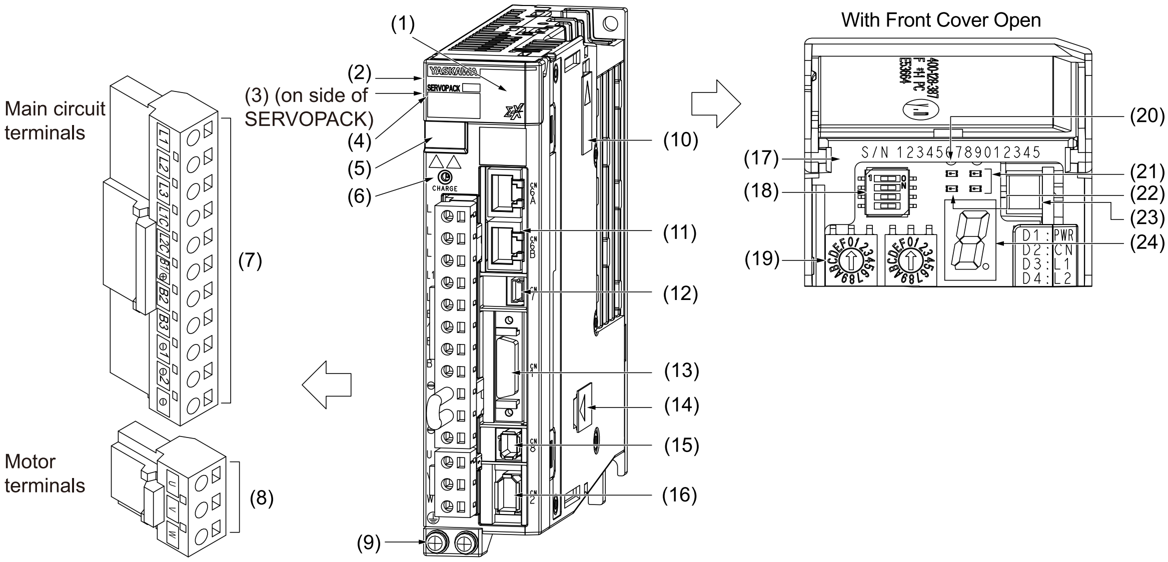
Model Name	Description
Σ-XS	Single-axis SERVOPACKs
Σ-XW	Two-axis SERVOPACKs
Σ-XT	Three-axis SERVOPACKs

1.2 Interpreting the Nameplate

The following basic information is provided on the nameplate.



1.3 Part Names



Code	Name	Description	Reference
(1)	Front Cover	–	–
(2)	Input Voltage	–	–
(3)	Nameplate	Indicates the SERVOPACK model and ratings.	47
(4)	Model	The model of the SERVOPACK.	50
(5)	QR Code	The QR code that is used by the MechatroCloud service.	–
(6)	CHARGE	Lits 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. There is a risk of electric shock.	–
(7)	Main Circuit Terminals	The terminals depend on the main circuit power supply input specifications of the SERVOPACK.	109
(8)	Servomotor Terminals (U, V, and W)	The connection terminals for the servomotor main circuit cable (power line).	121
(9)	Ground Terminal (⏚)	The ground terminals to prevent electric shock. Always connect this terminal.	–
(10)	Safety Option Module Connector (CN11)	Connects to a safety option module (currently in development).	–
(11)	MECHATROLINK Communications Input Connectors (Input: CN6A, Output: CN6B)	Connects to MECHATROLINK-4/MECHATROLINK-III-compatible devices.	140
(12)	Personal Computer Connector (CN7)	A USB connector to connect a personal computer. The digital operator can also be connected.	141 , 142
(13)	I/O Signal Connector (CN1)	Connects to sequence I/O signals.	131
(14)	Feedback Option Module Connector (CN12)	Connects to a feedback option module.	–
(15)	Safety Connector (CN8)	Connects to a safety function device.	138

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Code	Name	Description	Reference
(16)	Encoder Cable Connector (CN2)	This connector is used for the following purposes. • Rotary servomotor: Connects to the encoder in the servomotor. • Linear servomotor: Connects to the serial converter unit or linear encoder. • Connects to Σ-LINK II-compatible sensors and the Σ-LINK II sensor hub.	121
(17)	Serial Number	–	–
(18)	DIP Switch (S3)	• Used to switch between MECHATROLINK-III and MECHATROLINK-4 communications. • Used to set the number of transmission bytes in MECHATROLINK-III communications.	156
(19)	Rotary Switches (S1 and S2)	Used to set the MECHATROLINK station address.	
(20)	PWR	Lits while the control power is being supplied.	830
(21)	L1, L2	Lits during MECHATROLINK communications.	
(22)	CN	Lits when the CONNECT (Request for Establishing Connection) command is received correctly.	
(23)	Analog Monitor Connector (CN5)	You can use a special cable (peripheral device) to monitor the motor speed, torque reference, or other values.	143
(24)	Panel Display	Displays the servo status with a seven-segment LED.	831

1.4 Interpreting Model Numbers

1.4.1 Interpreting SERVOPACK Model Numbers

SGDXS	-	R70	A	40	A	0001	00	B
Σ-X-Series Σ-XS model		1st+2nd+3rd digits	4th digit	5th+6th digits	7th digit	8th+9th+10th+11th digits	12th+13th digits	14th digit

1st+2nd+3rd digits Maximum Applicable Motor Capacity

Voltage	Code	Specification
Three-Phase, 200 VAC	R70*1	0.05 kW
	R90*1	0.1 kW
	1R6*1	0.2 kW
	2R8*1	0.4 kW
	3R8	0.5 kW
	5R5*1	0.75 kW
	7R6	1.0 kW
	120*2	1.5 kW
	180	2.0 kW
	200	3.0 kW
	330	5.0 kW
	470	6.0 kW
	550	7.5 kW
	590	11 kW
	780	15 kW

4th digit Voltage

Code	Specification
A	200 VAC

5th+6th digits Interface*3

Code	Specification
40	MECHATROLINK-4/III communications reference

7th digit Design Revision Order

A

8th+9th+10th+11th digits Hardware Options Specification

Code	Specification	Applicable Models
None	Without options	All models
0000		
0001	Rack-mounted	SGDXS-R70A to -330A
	Duct-ventilated	SGDXS-470A to -780A
0002	Varnished	All models
0008	Single-phase, 200-VAC power supply input	SGDXS-120A
0020*4	No dynamic brake	SGDXS-R70A to -2R8A
	External dynamic brake resistor	SGDXS-3R8A to -780A

12th+13th digits FT Specification

Code	Specification
None	None
00	

14th digit BTO Specification (under development)

Code	Specification
None	None
B	BTO specification

*1 You can use these models with either a single-phase or three-phase input.
*2 A model with a single-phase, 200-VAC power supply input is available as a hardware option specification. (model: SGDXS-120A40A0008)
*3 The same SERVOPACKs are used for both rotary servomotors and linear servomotors.
*4 Refer to the following manual for details.

Σ-X-Series Σ-XS/Σ-XW/Σ-XT SERVOPACK with Dynamic Brake Hardware Option Specifications Product Manual (Manual No.: SIEP C710812 14)

1.4.2 Interpreting Servomotor Model Numbers

This section outlines the model numbers of servomotors that can be combined with a Σ-X-series SERVOPACK. Refer to the relevant manual in the following list for details.

Σ-X-series Rotary Servomotor Product Manual (Manual No.: SIEP C230210 00)

Σ-7-series Rotary Servomotor Product Manual (Manual No.: SIEP S800001 36)

Σ-7-series Linear Servomotor Product Manual (Manual No.: SIEP S800001 37)

Σ-7-Series Direct Drive Servomotor Product Manual (Manual No.: SIEP S800001 38)

(1) Rotary Servomotors

SGM□□ - 01 A U A 2 1 A 1

Series, 1st+2nd digits, 3rd digit, 4th digit, 5th digit, 6th digit, 7th digit, 8th digit, 9th digit

Series

Σ-X Series Servomotors

Code	Specification
SGMXJ	Medium inertia, high speed
SGMXA	Low inertia, high speed
SGMXP	Medium inertia, flat
SGMXG	Medium inertia, low speed, high torque

Σ-7 Series Servomotors

Code	Specification
SGM7M	Low inertia, ultra-small capacity

1st+2nd digits Rated Output

3rd digit Power Supply Voltage
- 200 VAC
- 24 VDC/48 VDC

4th digit Serial Encoder Specification
- 20-bit absolute encoder
- 26-bit batteryless absolute encoder
- 26-bit absolute encoder

5th digit Design Revision Order

6th digit Shaft End Specification
- Straight without key
- Straight with tap
- Straight with key and tap
- Straight with flat seat
- With two flat seats

7th digit Option Specification
- With 24-V holding brake
- With oil seal

8th digit Destination

A

9th digit Ancillary Specification

Code	Specification
1	Standard
2	Σ-7 compatible

(2) Direct Drive Servomotors

SGM□□ - 02 B 3 C 1 1

Series, 1st+2nd digits, 3rd digit, 4th digit, 5th digit, 6th digit, 7th digit

Series Σ-7 Series Servomotors

Code	Specification
SGM7D	With core outer rotor
SGM7E	Small capacity, coreless inner rotor
SGM7F	Small capacity,with core inner rotor
	Medium capacity, with core inner rotor

1st+2nd digits Rated Torque

3rd digit Servomotor Outer Diameter

4th digit Serial Encoder Specification

5th digit Design Revision Order

6th digit Flange Specification
- Cable drawn to load side
- Cable drawn to non-load side

7th digit Option Specification
- High mechanical precision

Basic Information on SERVOPACKs

1

(3) Linear Servomotors

SGL □ □ - 30 A 050 C P □

Series | 1st digit | 2nd digit | 3rd digit on

Series Σ-7 Series Servomotors

1st digit Servomotor Type

Code	Specification
G	Coreless models
F	Models with F-type iron core
T	Models with T-type iron core

2nd digit Moving Coil/Magnetic Way

Code	Specification
W	Moving coil
W2	
M	Magnetic way
M2	

3rd digit on

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

1.5 Combinations of SERVOPACKs and Servomotors

1.5.1 Combinations of Rotary Servomotors and SERVOPACKs

Rotary Servomotor Model		Capacity	SERVOPACK Model SGDXS-
SGMXJ (Medium Inertia, Small Capacity) 3000 min^{-1}	SGMXJ-A5A	50 W	R70A
	SGMXJ-01A	100 W	R90A
	SGMXJ-C2A	150 W	1R6A
	SGMXJ-02A	200 W	
	SGMXJ-04A	400 W	2R8A
	SGMXJ-06A	600 W	5R5A
	SGMXJ-08A	750 W	
SGMXA (Low Inertia, Small Capacity) 3000 min^{-1}	SGMXA-A5A	50 W	R70A
	SGMXA-01A	100 W	R90A
	SGMXA-C2A	150 W	1R6A
	SGMXA-02A	200 W	
	SGMXA-04A	400 W	2R8A
	SGMXA-06A	600 W	5R5A
	SGMXA-08A	750 W	
	SGMXA-10A	1.0 kW	120A
	SGMXA-15A	1.5 kW	
	SGMXA-20A	2.0 kW	180A
	SGMXA-25A	2.5 kW	200A
	SGMXA-30A	3.0 kW	
	SGMXA-40A	4.0 kW	330A
	SGMXA-50A	5.0 kW	
	SGMXA-70A	7.0 kW	550A
SGMXP (Medium Inertia, Flat) 3000 min^{-1}	SGMXP-01A	100 W	R90A
	SGMXP-02A	200 W	2R8A
	SGMXP-04A	400 W	
	SGMXP-08A	750 W	5R5A
	SGMXP-15A	1.5 kW	120A

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Rotary Servomotor Model		Capacity	SERVOPACK Model SGDXS-
SGMXG (Medium Inertia, Medium Capacity) 1500 min^{-1}	SGMXG-03A	300 W	3R8A
	SGMXG-05A	450 W	
	SGMXG-09A	850 W	7R6A (120A) *1
	SGMXG-13A	1.3 kW	120A (180A) *1
	SGMXG-20A	1.8 kW	180A (200A) *1
	SGMXG-30A	2.9 kW *2	330A (470A) *1
	SGMXG-44A	4.4 kW	330A (550A) *1
	SGMXG-55A	5.5 kW	470A (780A) *1
	SGMXG-75A	7.5 kW	550A
	SGMXG-1AA	11 kW	590A
	SGMXG-1EA	15 kW	780A
SGM7M (Low Inertia, Ultra-small Capacity) 3000 min^{-1}	SGM7M-A1A	11 W	R90A
	SGM7M-A2A	22 W	
	SGM7M-A3A	33 W	1R6A

*1 To increase the instantaneous maximum torque, use the SERVOPACK with the model number given inside the parentheses. Refer to the following manual for the instantaneous maximum torque of each SERVOPACK.

Σ-X-Series Rotary Servomotor Product Manual (Manual No.: SIEP C230210 00)

*2 2.4 kW when using the servomotor with a SGDXS-200A SERVOPACK.

1.5.2 Combinations of Direct Drive Servomotors and SERVOPACKs

Direct Drive Servomotor Model		Rated Torque N·m	Instantaneous Maximum Torque N·m	SERVOPACK Model SGDXS-
SGM7D (With Core, Outer Rotor)	SGM7D-30F	30.0	50.0	120A
	SGM7D-58F	58.0	100	
	SGM7D-90F	90.0	150	
	SGM7D-1AF	110	200	
	SGM7D-01G	1.30	4.00	2R8A
	SGM7D-05G	5.00	6.00	
	SGM7D-08G	8.00	15.0	120A
	SGM7D-18G	18.0	30.0	
	SGM7D-24G	24.0	45.0	
	SGM7D-34G	34.0	60.0	
	SGM7D-45G	45.0	75.0	
	SGM7D-03H	3.00	4.00	2R8A
SGM7D (With Core, Outer Rotor)	SGM7D-28I	28.0	50.0	120A
	SGM7D-70I	70.0	100	
	SGM7D-1ZI	100	150	
	SGM7D-1CI	130	200	
	SGM7D-2BI	220	300	
	SGM7D-2DI	240	400	
	SGM7D-06J	6.00	8.00	
	SGM7D-09J	9.00	15.0	
	SGM7D-18J	18.0	30.0	
	SGM7D-20J	20.0	45.0	
	SGM7D-38J	38.0	60.0	
	SGM7D-02K	2.06	5.00	2R8A
	SGM7D-06K	6.00	10.0	
	SGM7D-08K	8.00	15.0	
	SGM7D-06L	6.00	10.0	
	SGM7D-12L	12.0	20.0	
	SGM7D-30L	30.0	40.0	120A

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Basic Information on SERVOPACKs

1

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Direct Drive Servomotor Model		Rated Torque N·m	Instantaneous Maximum Torque N·m	SERVOPACK Model SGDXS-
SGM7E (Small Capacity, Coreless, Inner Rotor)	SGM7E-02B	2	6	2R8A
	SGM7E-05B	5	15	
	SGM7E-07B	7	21	
	SGM7E-04C	4	12	
	SGM7E-10C	10	30	
	SGM7E-14C	14	42	
	SGM7E-08D	8	24	
	SGM7E-17D	17	51	
	SGM7E-25D	25	75	
	SGM7E-16E	16	48	5R5A
	SGM7E-35E	35	105	
SGM7F (Small Capacity, With Core, Inner Rotor)	SGM7F-02A	2	6	2R8A
	SGM7F-05A	5	15	
	SGM7F-07A	7	21	
	SGM7F-04B	4	12	
	SGM7F-10B	10	30	
	SGM7F-14B	14	42	5R5A
	SGM7F-08C	8	24	2R8A
	SGM7F-17C	17	51	5R5A
	SGM7F-25C	25	75	7R6A
	SGM7F-16D	16	48	5R5A
	SGM7F-35D	35	105	7R6A *1, 120A
SGM7F (Medium Capacity, With Core, Inner Rotor)	SGM7F-45M	45	135	7R6A
	SGM7F-80M	80	240	120A
	SGM7F-80N	80	240	
	SGM7F-1AM	110	330	180A
	SGM7F-1EN	150	450	200A
	SGM7F-2ZN	200	600	

*1 For this combination, use the following derated values for the rated output and rated rotation speed.

- Rated output: 1000 W
- Rated rotation speed: 270 min^{-1}

1.5.3 Combinations of Linear Servomotors and SERVOPACKs

Linear Servomotor Model		Rated Force N	Instantaneous Maximum Force N	SERVOPACK Model SGDXS-
SGLG (Coreless) Used with Standard-Force Magnetic Way	SGLGW-30A050C	12.5	40	R70A
	SGLGW-30A080C	25	80	R90A
	SGLGW-40A140C	47	140	
	SGLGW-40A253C	93	280	1R6A
	SGLGW-40A365C	140	420	2R8A
	SGLGW-60A140C	70	220	1R6A
	SGLGW-60A253C	140	440	2R8A
	SGLGW-60A365C	210	660	5R5A
	SGLGW-90A200C	325	1300	120A
	SGLGW-90A370C	550	2200	180A
	SGLGW-90A535C	750	3000	200A
SGLG (Coreless) Used with High-Force Magnetic Way	SGLGW-40A140C	57	230	1R6A
	SGLGW-40A253C	114	460	2R8A
	SGLGW-40A365C	171	690	3R8A
	SGLGW-60A140C	85	360	1R6A
	SGLGW-60A253C	170	720	3R8A
	SGLGW-60A365C	255	1080	7R6A
SGLF (With F-type Iron Cores)	SGLFW2-30A070A	45	135	1R6A
	SGLFW2-30A120A	90	270	
	SGLFW2-30A230A *1	180	540	3R8A
		170	500	2R8A
	SGLFW2-45A200A	280	840	5R5A
	SGLFW2-45A380A *1	560	1680	180A
			1500	120A
	SGLFW2-90A200A□1	560	1680	
	SGLFW2-90A200A□L	896	1680	
	SGLFW2-90A380A	1120	3360	200A
	SGLFW2-90A560A	1680	5040	330A
	SGLFW2-1DA380A	1680	5040	200A
	SGLFW2-1DA560A	2520	7560	330A

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Linear Servomotor Model		Rated Force N	Instantaneous Maximum Force N	SERVOPACK Model SGDXS-
SGLT (With T-type Iron Cores)	SGLTW-20A170A	130	380	3R8A
	SGLTW-20A320A	250	760	7R6A
	SGLTW-20A460A	380	1140	120A
	SGLTW-35A170A	220	660	5R5A
	SGLTW-35A170H	300	600	
	SGLTW-35A320A	440	1320	120A
	SGLTW-35A320H	600	1200	
	SGLTW-35A460A	670	2000	180A
	SGLTW-40A400B	670	2600	
	SGLTW-40A600B	1000	4000	330A
	SGLTW-50A170H	450	900	5R5A
	SGLTW-50A320H	900	1800	120A
	SGLTW-80A400B	1300	5000	330A
	SGLTW-80A600B	2000	7500	550A

*1 The force depends on the SERVOPACK that is used with the servomotor.

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
Setting the Power Supply Type for the Main Circuit and Control Circuit	158
Automatic Detection of Connected Motor	160
Setting the Motor Direction	161
Setting the Linear Encoder Pitch	163
Writing the Linear Servomotor Parameters	164
Selecting the Phase Sequence for a Linear Servomotor	168
Setting the Polarity Sensor	170
Polarity Detection	171
Overtravel Function and Settings	174
Holding Brake	179
Motor Stopping Methods for Servo OFF and Alarms	183
Resetting the Absolute Encoder	194
Setting the Origin of the Absolute Encoder	197
Setting the Regenerative Resistor Capacity	200
Operation for Momentary Power Interruptions	223
SEMI F47 Function	224
Setting the Maximum Motor Speed	226
Software Limits and Settings	234
Setting the Multiturn Limit	244
Adjusting the Motor Current Detection Signal Offset	260
Forcing the Motor to Stop	264
Overheat Protection	267
Triggers at Preset Positions	270
Specifying Output Status When a Host Communications Error Occurs	278
Speed Ripple Compensation	387
Selecting the Current Control Mode	419
Setting the Current Gain Level	419
Selecting the Speed Detection Method	419
Fully-Closed Loop Control	479
Σ-LINK II Function	493
Safety Function	523
External Latches	–

- Functions Related to the Host Controller

Function	Reference
MECHATROLINK-4/III Communications Switching	156
Electronic Gear Setting	188
Allocating the I/O Signal	208
ALM (Servo Alarm Output) Signal	215
/WARN (Warning Output) Signal	216
/TGON (Rotation Detection Output) Signal	216
/S-RDY (Servo Ready Output) Signal	217
/V-CMP (Speed Coincidence Detection Output) Signal	217
/COIN (Positioning Completion Output) Signal	219
/NEAR (Near Output) Signal	220
Speed Limit during Torque Control	221
/VLT (Speed Limit Detection Output) Signal	221
Encoder Divided Pulse Output	227
Selecting Torque Limits	235
Initializing the Vibration Detection Level	257
Setting the Position Deviation Overflow Alarm Level	314
Alarm Reset	574
Replacing the Battery	539

- Functions to Achieve Optimum Motions

Function	Reference
Tuning-less Function	318
Autotuning without a Host Reference	344
Autotuning with a Host Reference	357
Custom Tuning	366
Anti-Resonance Control Adjustment	375
Vibration Suppression	382
Load Fluctuation Compensation Control	409
Gain Switching	412
Friction Compensation	416
Gravity Compensation	417
Output Torque Compensation	418
Backlash Compensation	420
Model Following Control	434
Compatible Adjustment Functions	437
Mechanical Analysis	442
Easy FFT	443

- Functions for Trial Operation during Setup

Function	Reference
Software Reset	254
Trial Operation for the Servomotor without a Load	287
Program JOG Operation	294
Origin Search	299
Test without a Motor	301
Monitoring Machine Operation Status and Signal Waveforms	460

- Functions for Inspection and Maintenance

Function	Reference
Write Prohibition Setting for Parameters	151
Initializing Parameter Settings	154
Automatic Detection of Connected Motor	160
Monitoring Product Information	450
Monitoring Product Life	467
Error Detection Setting	471
Displaying the Alarm History	575
Alarm Tracing	470

2

Selecting a SERVOPACK

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

2.1 Ratings and Specifications

This section gives the ratings and specifications of SERVOPACKs.

2.1.1 Ratings

(1) Three-Phase, 200 VAC

Model SGDXS-			R70A	R90A	1R6A	2R8A	3R8A	5R5A	7R6A	120A	180A	200A	330A
Maximum Applicable Motor Capacity [kW]			0.05	0.1	0.2	0.4	0.5	0.75	1.0	1.5	2.0	3.0	5.0
Continuous Output Current [Arms]			0.66	0.91	1.6	2.8	3.8	5.5	7.6	11.6	18.5	19.6	32.9
Instantaneous Maximum Output Current [Arms]			2.1	3.2	5.9	9.3	11	16.9	17	28	42	56	84
Main Circuit	Power Supply		200 VAC to 240 VAC, -15% to +10%, 50 Hz/60 Hz										
	Input Current [Arms] *1		0.4	0.8	1.3	2.5	3.0	4.1	5.7	7.3	10	15	25
Control	Power Supply		200 VAC to 240 VAC, -15% to +10%, 50 Hz/60 Hz										
	Input Current [Arms] *1		0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.25	0.25	0.3
Power Supply Capacity [kVA] *1			0.2	0.3	0.5	1.0	1.3	1.6	2.3	3.2	4.0	5.9	7.5
Power Loss *1	Main Circuit Power Loss [W]		5.0	7.0	11.9	22.5	28.5	38.9	49.2	72.6	104.2	114.2	226.6
	Control Circuit Power Loss [W]		12	12	12	12	14	14	14	15	16	16	19
	Total Power Loss [W]		17.0	19.0	23.9	34.5	42.5	52.9	63.2	87.6	120.2	130.2	245.6
Regenerative Resistor	Built-In Regenerative Resistor	Resistance [Ω]	–	–	–	–	35	35	35	20	12	10	6
		Capacity [W]	–	–	–	–	60	60	60	60	60	60	180
		Allowable Power Consumption [W]	–	–	–	–	15	15	15	30	30	30	36
	Minimum Allowable External Resistance [Ω]		40	40	40	40	35	35	35	20	12	10	6
Overvoltage Category			III										

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

Model SGDXS-		470A	550A	590A	780A
Maximum Applicable Motor Capacity [kW]		6.0	7.5	11	15
Continuous Output Current [Arms]		46.9	54.7	58.6	78.0
Instantaneous Maximum Output Current [Arms]		110	130	140	170
Main Circuit	Power Supply	200 VAC to 240 VAC, -15% to +10%, 50 Hz/60 Hz			
	Input Current [Arms] *1	29	37	54	73
Control	Power Supply	200 VAC to 240 VAC, -15% to +10%, 50 Hz/60 Hz			
	Input Current [Arms] *1	0.3	0.3	0.4	0.4
Power Supply Capacity [kVA] *1		10.7	14.6	21.7	29.6
Power Loss *1	Main Circuit Power Loss [W]	271.7	326.9	365.3	501.4
	Control Circuit Power Loss [W]	21	21	28	28
	Total Power Loss [W]	292.7	347.9	393.3	529.4
External Regenerative Resistor Unit	Resistance [Ω]	5 *2	3.13 *1	3.13 *3	3.13 *3
	Capacity [W]	880 *2	1760 *3	1760 *3	1760 *3
	Allowable Power Consumption [W]	180 *2	350 *3	350 *3	350 *3
	Minimum Allowable External Resistance [Ω]	5	2.9	2.9	2.9
Overvoltage Category		III			

*1 This is the net value at the rated load.
*2 This value is for the optional JUSP-RA29-E regenerative resistor unit.
*3 This value is for the optional JUSP-RA05-E regenerative resistor unit.

(2) Single-Phase, 200 VAC

Model SGDXS-		R70A	R90A	1R6A	2R8A	5R5A	120A
Maximum Applicable Motor Capacity [kW]		0.05	0.1	0.2	0.4	0.75	1.5
Continuous Output Current [Arms]		0.66	0.91	1.6	2.8	5.5	11.6
Instantaneous Maximum Output Current [Arms]		2.1	3.2	5.9	9.3	16.9	28
Main Circuit	Power Supply	200 VAC to 240 VAC, -15% to +10%, 50 Hz/60 Hz					
	Input Current [Arms] *1	0.8	1.6	2.4	5.0	8.7	16 *2
Control	Power Supply	200 VAC to 240 VAC, -15% to +10%, 50 Hz/60 Hz					
	Input Current [Arms] *1	0.2	0.2	0.2	0.2	0.2	0.2
Power Supply Capacity [kVA] *1		0.2	0.3	0.6	1.2	1.9	4.0
Power Loss *1	Main Circuit Power Loss [W]	5.0	7.1	12.1	23.7	39.2	72.6
	Control Circuit Power Loss [W]	12	12	12	12	14	15
	Total Power Loss [W]	17.0	19.1	24.1	35.7	53.2	87.6

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Model SGDXS-			R70A	R90A	1R6A	2R8A	5R5A	120A
Regenerative Resistor	Built-In Regenerative Resistor	Resistance [Ω]	–	–	–	–	35	20
		Capacity [W]	–	–	–	–	60	60
		Allowable Power Consumption [W]	–	–	–	–	15	30
	Minimum Allowable External Resistance [Ω]		40	40	40	40	35	20
Overvoltage Category			III					

*1 This is the net value at the rated load.
*2 Derate to 12 Arms for UL certification.

(3) 270 VDC

Model SGDXS-		R70A	R90A	1R6A	2R8A	3R8A	5R5A	7R6A	120A
Maximum Applicable Motor Capacity [kW]		0.05	0.1	0.2	0.4	0.5	0.75	1.0	1.5
Continuous Output Current [Arms]		0.66	0.91	1.6	2.8	3.8	5.5	7.6	11.6
Instantaneous Maximum Output Current [Arms]		2.1	3.2	5.9	9.3	11.0	16.9	17.0	28.0
Main Circuit	Power Supply	270 VDC to 324 VDC, -15% to +10%							
	Input Current [Arms] *1	0.5	1.0	1.5	3.0	3.8	4.9	6.9	11
Control	Power Supply	270 VDC to 324 VDC, -15% to +10%							
	Input Current [Arms] *1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Power Supply Capacity [kVA] *1		0.2	0.3	0.6	1	1.4	1.6	2.3	3.2
Power Loss *1	Main Circuit Power Loss [W]	4.4	5.9	9.8	17.5	23.0	30.7	38.7	55.8
	Control Circuit Power Loss [W]	12	12	12	12	14	14	14	15
	Total Power Loss [W]	16.4	17.9	21.8	29.5	37.0	44.7	52.7	70.8
Overvoltage Category		III							

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

Model SGDXS-		180A	200A	330A	470A	550A	590A	780A
Maximum Applicable Motor Capacity [kW]		2.0	3.0	5.0	6.0	7.5	11.0	15.0
Continuous Output Current [Arms]		18.5	19.6	32.9	46.9	54.7	58.6	78.0
Instantaneous Maximum Output Current [Arms]		42.0	56.0	84.0	110	130	140	170
Main Circuit	Power Supply	270 VDC to 324 VDC, -15% to +10%						
	Input Current [Arms] *1	14	20	34	36	48	68	92
Control	Power Supply	270 VDC to 324 VDC, -15% to +10%						
	Input Current [Arms] *1	0.25	0.25	0.3	0.3	0.3	0.4	0.4
Power Supply Capacity [kVA] *1		4.0	5.9	7.5	10.7	14.6	21.7	29.6

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Model SGDXS-		180A	200A	330A	470A	550A	590A	780A
Power Loss *1	Main Circuit Power Loss [W]	82.7	83.5	146.2	211.6	255.3	243.6	343.4
	Control Circuit Power Loss [W]	16	16	19	21	21	28	28
	Total Power Loss [W]	98.7	99.5	165.2	232.6	276.3	271.6	371.4
Overvoltage Category		III						

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

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.

A.710 or A.720 (an overload alarm) 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.

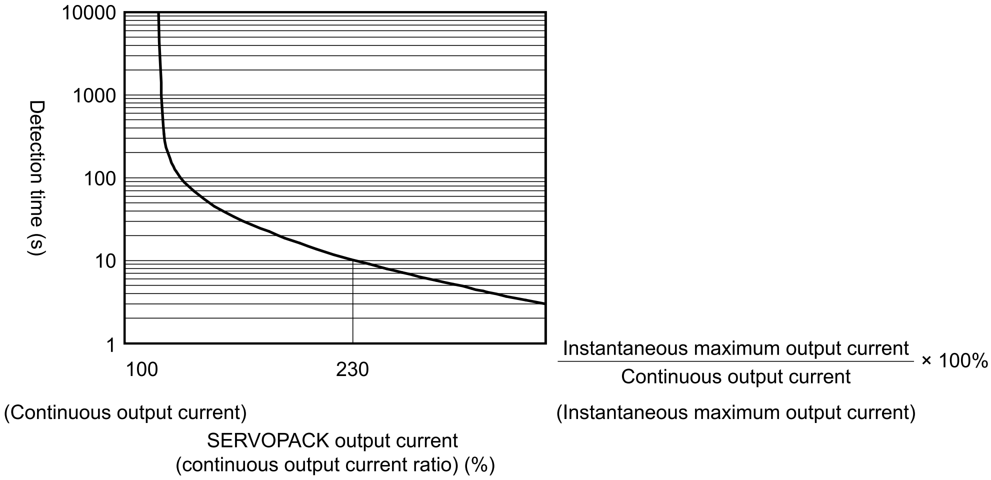

Figure 2.1 SGDXS-R70A, -R90A, -1R6A, -2R8A

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.
- This overload protection function is not a protection function related to speed. This product does not have a built-in thermal memory hold function.

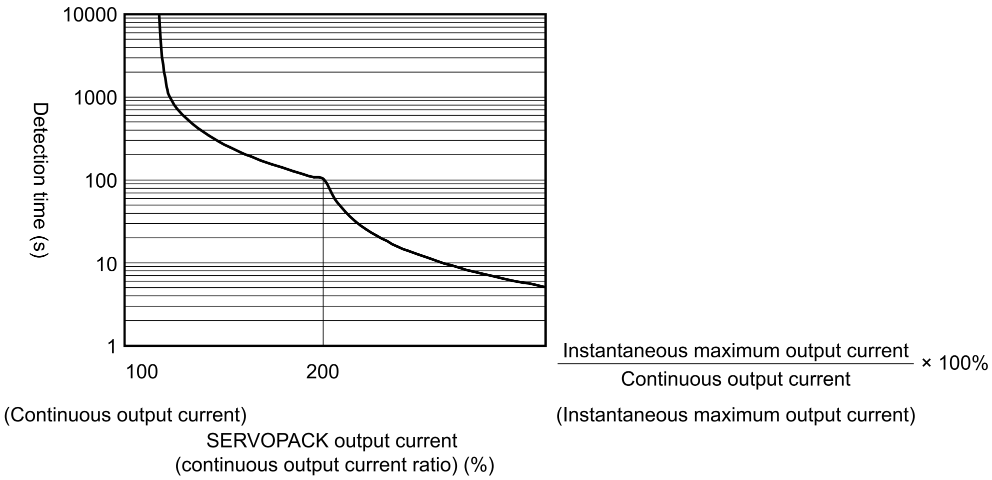

Figure 2.2 SGDXS-3R8A, -5R5A, -7R6A, -120A, -180A, -200A, -330A, -470A, -550A, -590A, -780A

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.
- This overload protection function is not a protection function related to speed. This product does not have a built-in thermal memory hold function.

2.1.3 Specification

(1) Environmental Conditions

Item	Specification
Surrounding Air Temperature	-5°C to 55°C (With derating, usage is possible between 55°C and 60°C.) Refer to the following section for derating specifications. ☞ *3.6 Derating Specifications on page 95*
Storage Temperature *1	-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)
Vibration Resistance	When there is continuous vibration: 10 Hz to 55 Hz, acceleration amplitude 5.9 m/s^2 (0.6G)
Impact Resistance	19.6 m/s^2
Degree of Protection	IP20: Models SGDXS-R70A, -R90A, -1R6A, -2R8A, -3R8A, -5R5A, -7R6A, -120A IP10: Models SGDXS-180A, -200A, -330A, -470A, -550A, -590A, -780A
Pollution Degree	2 • Must be no corrosive or flammable gases. • Must be no exposure to water, oil, or chemicals. • Must be no dust, salts, or iron dust.
Altitude *1	1000 m max. (With derating, usage is possible between 1000 m and 2000 m.) Refer to the following section for derating specifications. ☞ *3.6 Derating Specifications on page 95*
Others	Do not use the SERVOPACK in the following locations: Locations subject to static electricity noise, strong electro-magnetic/magnetic fields, or radioactivity

*1 If you combine a Σ-X-series SERVOPACK with a Σ-V-series option module, the following Σ-V-series SERVOPACKs specifications must be used: a surrounding air temperature of 0°C to 55°C and an altitude of 1000 m max. Also, the applicable surrounding range cannot be increased by derating.

(2) I/O Signals

Item		Specification
Encoder Divided Pulse Output		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
Outputs for Triggers at Preset Positions		Number of output points: 3 (output method: a line driver output) Output signals: High-Speed Output Signal for Triggers at Preset Positions 1 to 3 (HSO1 to 3) **Note:** Normal Output Signal for Triggers at Preset Positions 1 to 3 (/NSO1 to 3) are used by allocating the signals to sequence output signals.
Sequence Input Signals	Input Signals That Can Be Allocated	Allowable voltage range: 24 VDC ±20% Number of input points: 7 (input method: sink inputs or source inputs)
		Input signals: • P-OT (Forward Drive Prohibit Input) and N-OT (Reverse Drive Prohibit Input) signals • /P-CL (Forward External Torque Limit Input) and /N-CL (Reverse External Torque Limit Input) signals • /DEC (Origin Return Deceleration Switch Input) signal • /EXT1 to /EXT3 (External Latch Input 1 to 3) signals • FSTP (Forced Stop Input) signal A signal can be allocated and the positive and negative logic can be changed.
Sequence Output Signals	Fixed Output	Allowable voltage range: 5 VDC to 30 VDC Number of output points: 1 (output method: a photocoupler output (isolated))
		Output signal: ALM (Servo Alarm Output) signal
	Output Signals That Can Be Allocated	Allowable voltage range: 5 VDC to 30 VDC Number of output points: 3 (output method: a photocoupler output (isolated))
		Output signals: • /COIN (Positioning Completion Output) signal • /V-CMP (Speed Coincidence Detection Output) signal • /TGON (Rotation Detection Output) signal • /S-RDY (Servo Ready Output) Signal • /CLT (Torque Limit Detection Output) signal • /VLT (Speed Limit Detection Output) signal • /BK (Brake Output) signal • /WARN (Warning Output) signal • /NEAR (Near Output) signal • /NSO1 to 3 (Normal Output for Triggers at Preset Positions 1 to 3) signals A signal can be allocated and the positive and negative logic can be changed.

(3) Function

Item			Specification
Communications	USB Communications (CN7)	Interfaces	Personal computer (with SigmaWin+), digital operator (JUSP-OP07A-E)
		Communications Standard	Conforms to USB2.0 standard (12 Mbps).
Displays/Indicators			CHARGE, PWR, CN, L1, L2, and one-digit seven-segment LED

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Continued from previous page.

Item		Specification
MECHATROLINK-4 Communications *1	Communications Protocol	MECHATROLINK-4
	Station Address Settings	01h to FFh (maximum number of slaves: 127) The rotary switches (S1 and S2) are used to set the station address.
	Transmission Speed	100 Mbps
	Transmission Cycle *2	62.5 µs, 125 µs, 250 µs, 500 µs, 750 µs, 1.0 ms to 4.0 ms (multiples of 0.5 ms)
	Number of Transmission Bytes	16 to 80 bytes/station
Reference Methods for MECHATROLINK-4 Communications	Performance	Position, speed, or torque control with MECHATROLINK-4 communications
	Reference Input	MECHATROLINK-4 commands (sequence, motion, data setting, data access, monitoring, adjustment, etc.)
	Profile	MECHATROLINK-4 standard servo profile MECHATROLINK-III standard servo profile
MECHATROLINK-III Communications *1	Communications Protocol	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.
	Transmission Speed	100 Mbps
	Transmission Cycle	125 µs, 250 µs, 500 µs, 750 µs, 1.0 ms to 4.0 ms (multiples of 0.5 ms)
	Number of Transmission Bytes	32 or 48 bytes/station A DIP switch (S3) is used to select the transmission bytes.
Reference Methods for MECHATROLINK-III Communications	Performance	Position, speed, or torque control with MECHATROLINK-III communications
	Reference Input	MECHATROLINK-III commands (sequence, motion, data setting, data access, monitoring, adjustment, etc.)
	Profile	MECHATROLINK-III standard servo profile
MECHATROLINK-4 and MECHATROLINK-III Communications Setting Switches		Rotary switch (S1 and S2) positions: 16
		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
Dynamic Brake (DB)		Activated when a servo alarm or overtravel (OT) occurs, or when the power to the main circuit or servo is OFF.
Regenerative Processing		Built-in (An external resistor must be connected to the SGDXS-470A to -780A.)
Overtravel (OT) Prevention		Stopping with dynamic brake, deceleration to a stop, or coasting to a stop for the P-OT (Forward Drive Prohibit Input) or N-OT (Reverse Drive Prohibit Input) signal
Protective Functions		Overcurrent, overvoltage, undervoltage, overload, regeneration error, etc.
Utility Functions		Gain tuning, alarm history, jogging operation, origin search, etc.

Continued on next page.

Continued from previous page.

Item		Specification
Safety Functions	Inputs	/HWBB1 and /HWBB2: Base block signals for power modules
	Output	EDM1: Monitors the status of built-in safety circuit (fixed output). *3
	Applicable Standards *4	ISO13849-1 PLe (Category 3) and IEC61508 SIL3

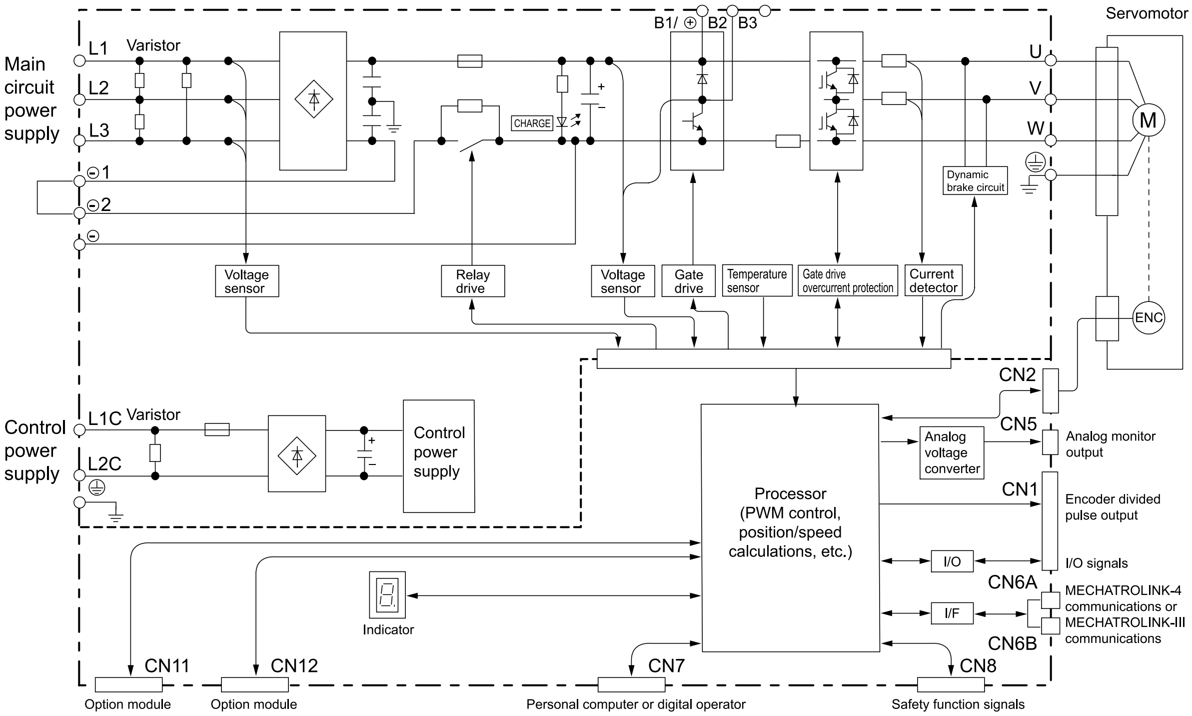
*1 Use the DIP switch S3 to switch the communications protocol. Refer to the following section for details.
☞ *5.2 MECHATROLINK Communications Settings on page 156*
*2 Multiple transmission cycles are supported.
*3 Whether or not you use the EDM1 signal does not affect the performance level of safety parameters.
*4 Always perform risk assessment for the system and confirm that the safety requirements are met.

(4) Option

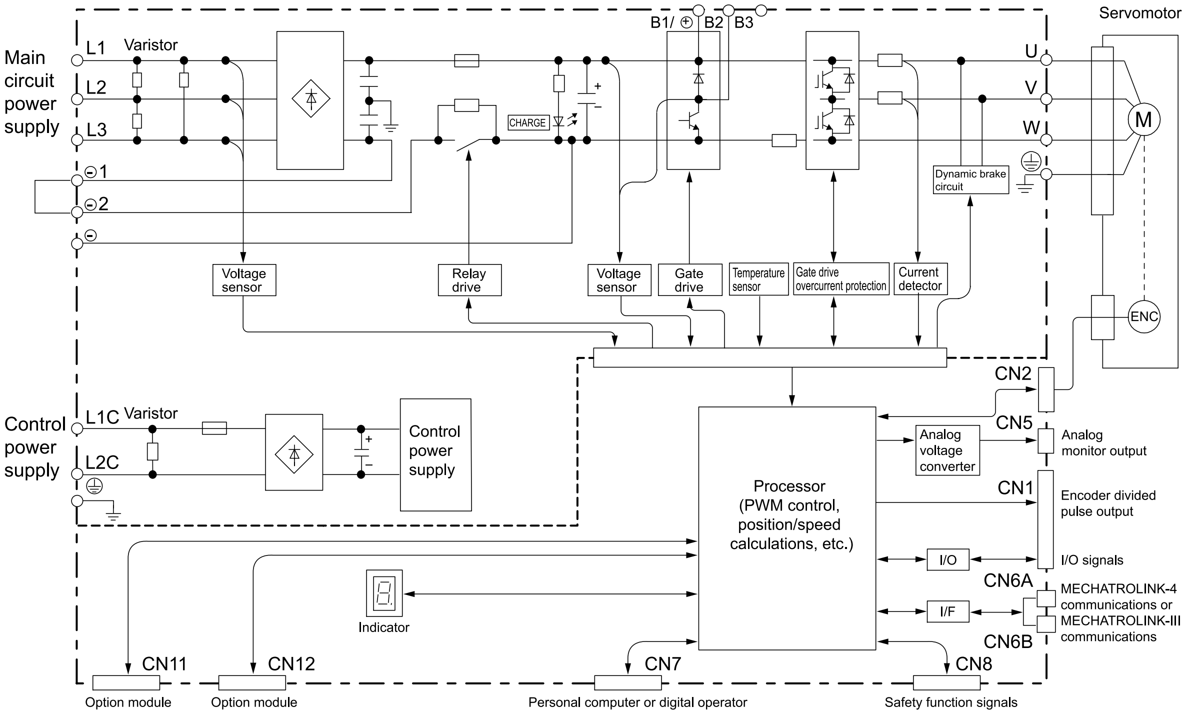
Item	Specification
Applicable Option Modules	Fully-closed module

2.2 Block Diagrams

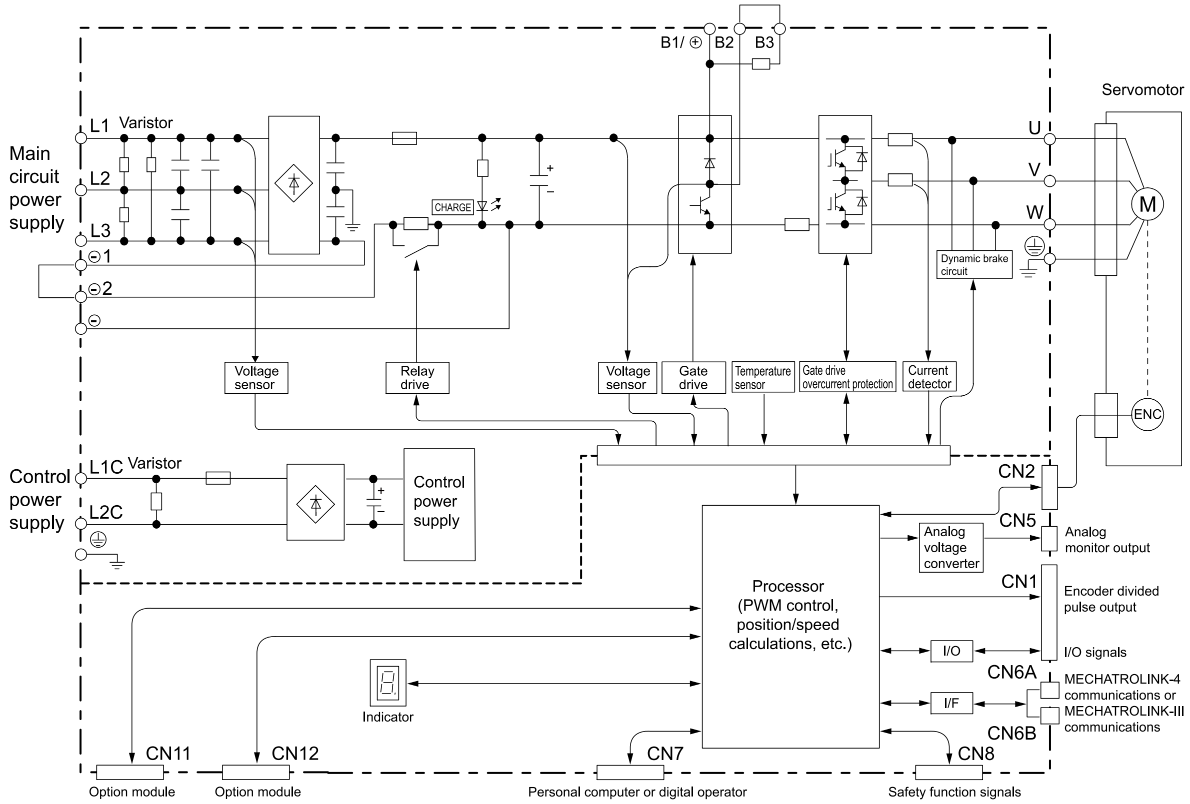
2.2.1 SGDXS-R70A, -R90A, -1R6A



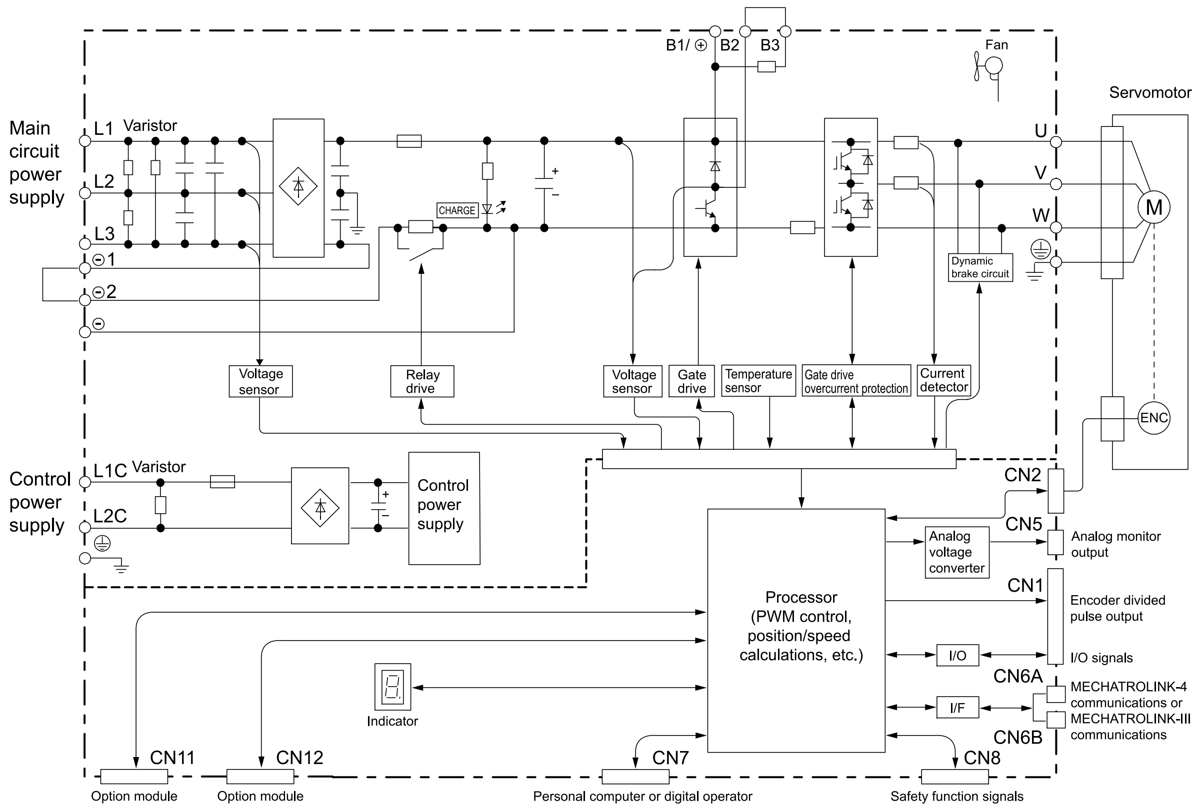
2.2.2 SGDXS-2R8A



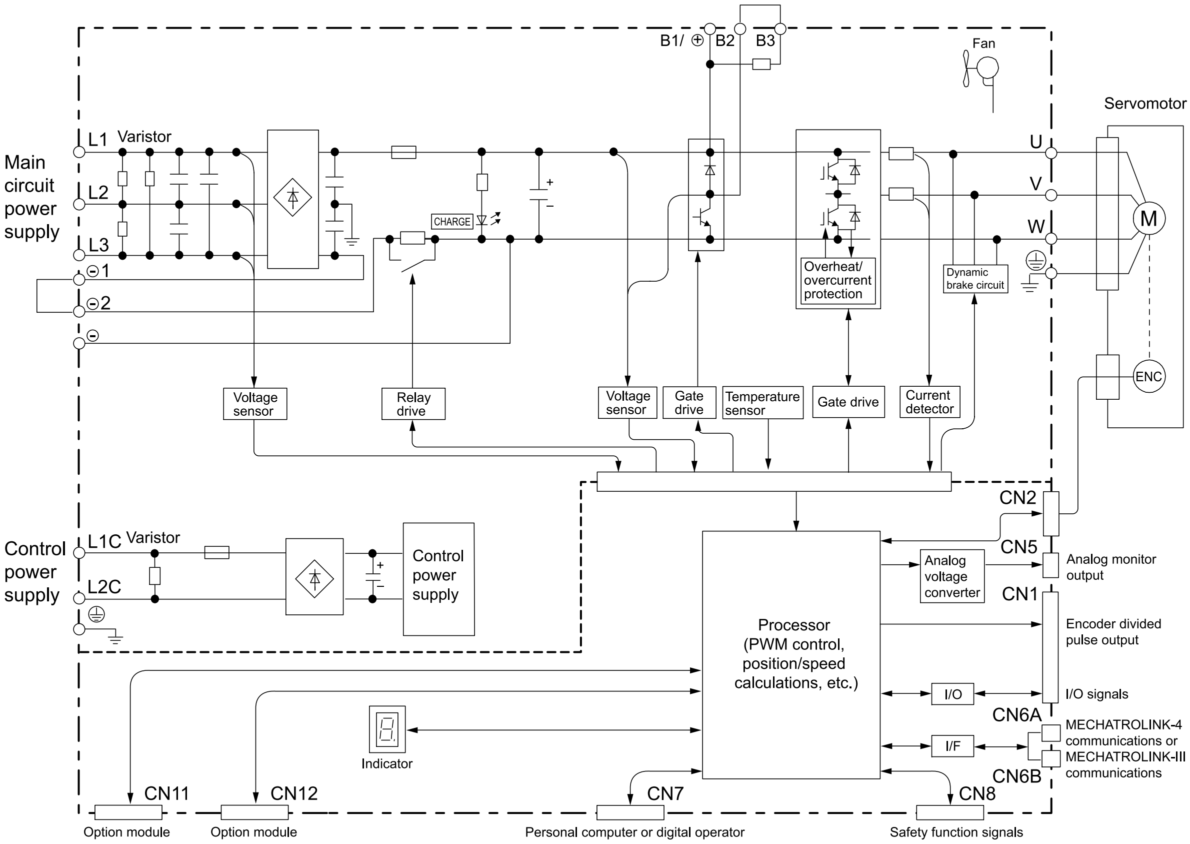
2.2.3 SGDXS-3R8A



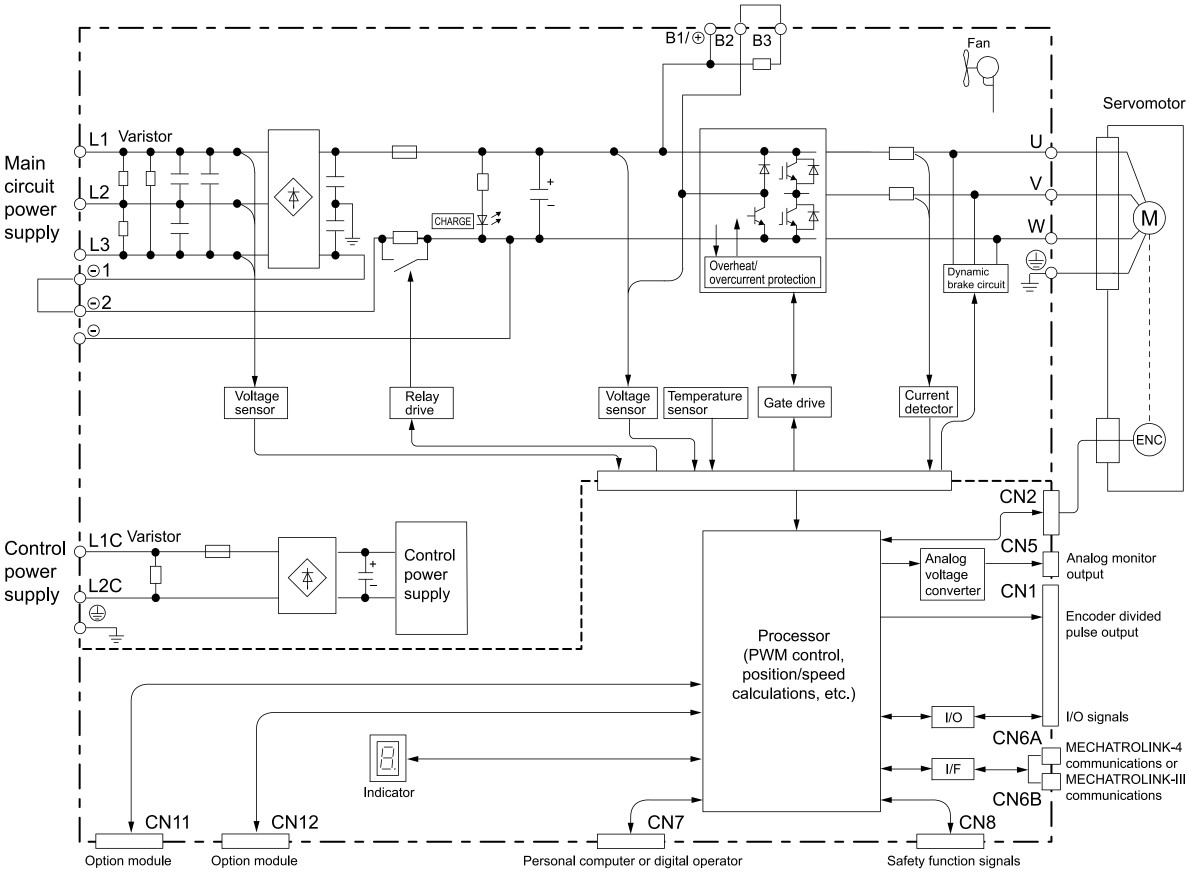
2.2.4 SGDXS-5R5A, -7R6A



2.2.5 SGDXS-120A



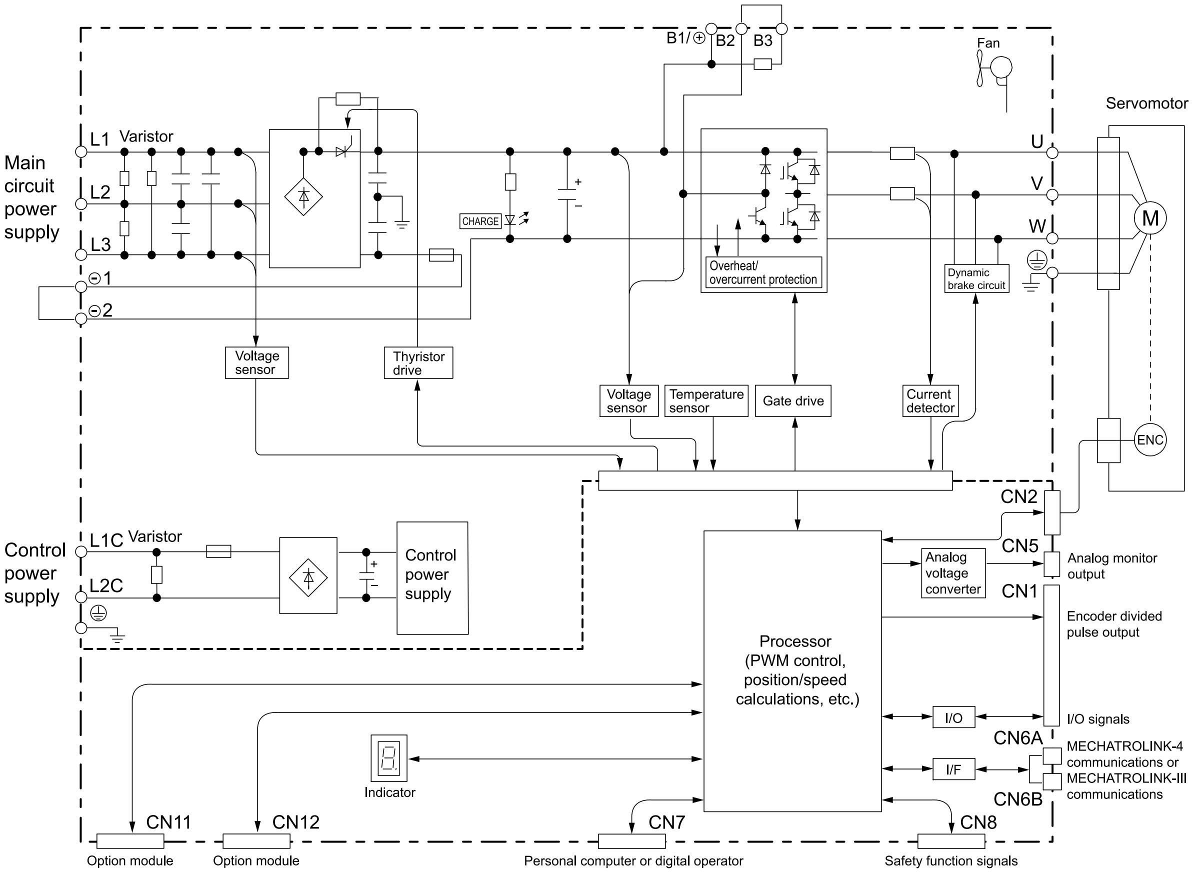
2.2.6 SGDXS-180A, -200A



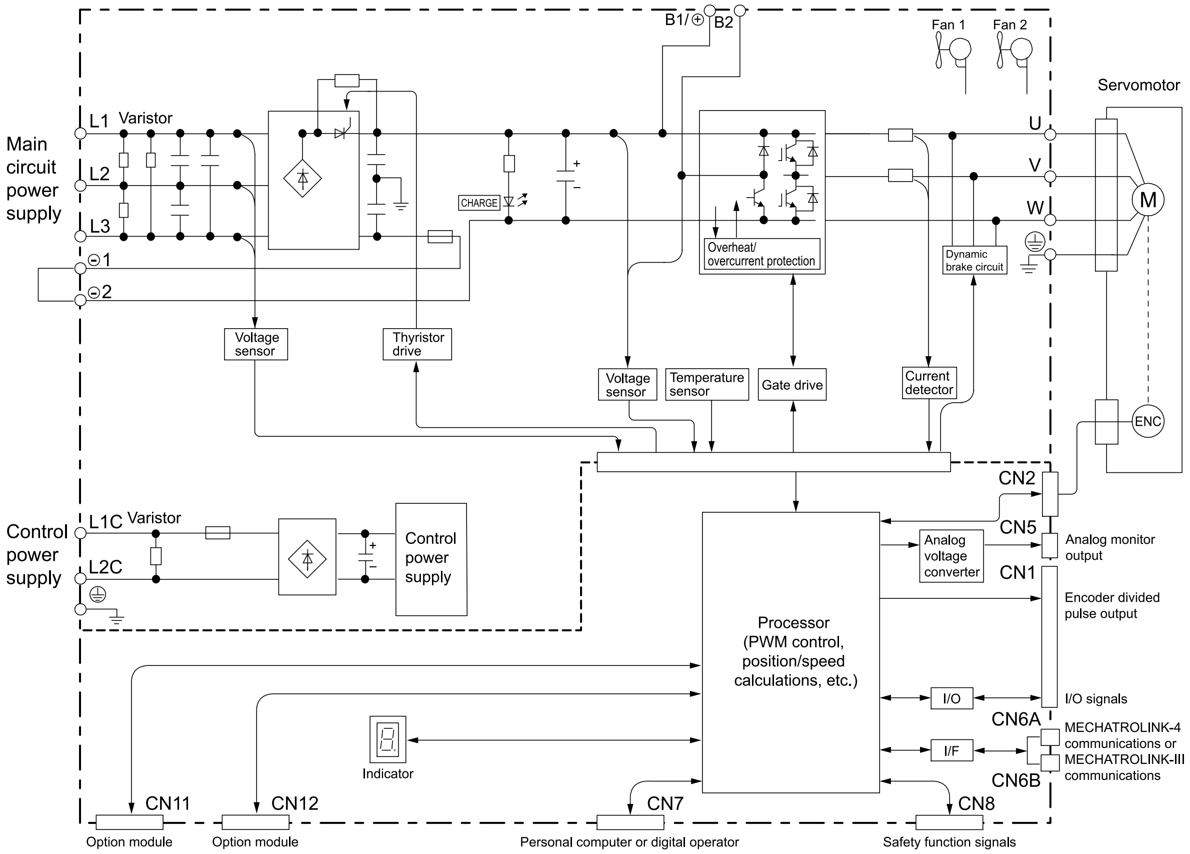
Selecting a SERVOPACK

2

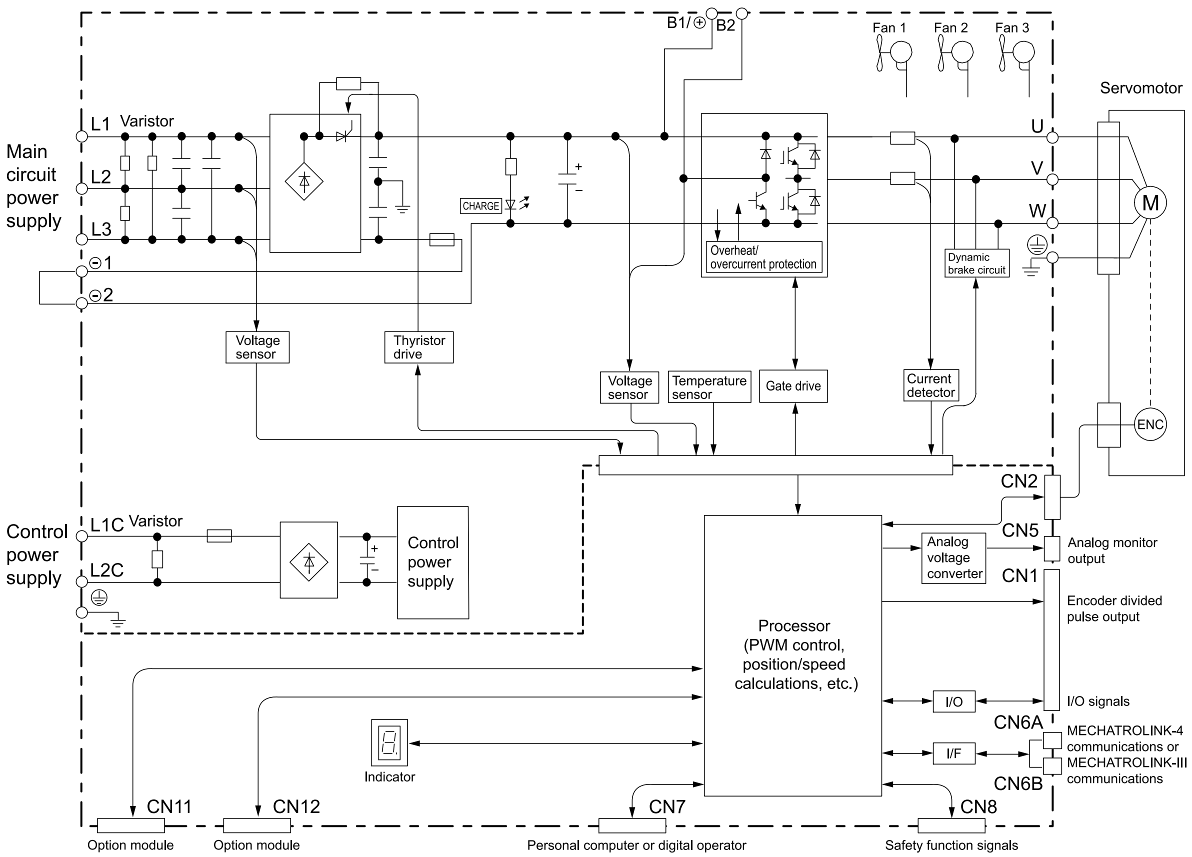
2.2.7 SGDXS-330A



2.2.8 SGDXS-470A, -550A



2.2.9 SGDXS-590A, -780A

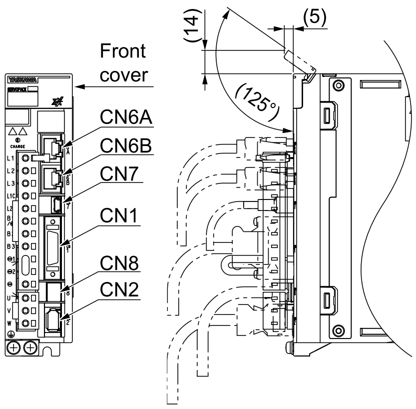


2.3 External Dimensions

2.3.1 Front Cover Dimensions and Connector Specifications

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

(1) Front Cover Dimensions



(2) Connector Specifications

Connector No.	Model	Number of Pins	Manufacturer
CN1	10226-59A3MB	26	3M Japan Limited
CN2	53984-0681	6	Molex Japan Co., Ltd.
CN6A/B	3-1734579-4	8	Tyco Electronics Japan G.K.
CN7	2342993-1	5	Tyco Electronics Japan G.K.
CN8	2294415-1	8	Tyco Electronics Japan G.K.

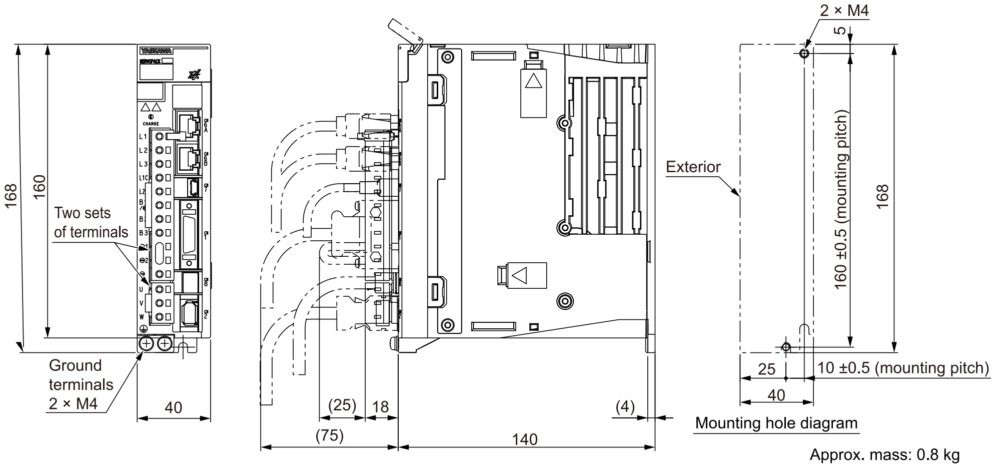
Note:

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

2.3.2 SERVOPACK External Dimensions

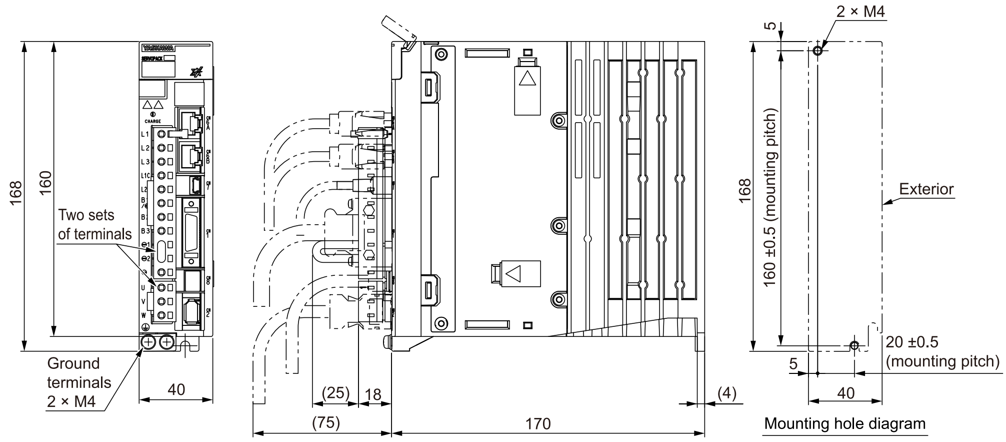
(1) Base-mounted SERVOPACKs

(a) SGDXS-R70A, -R90A, -1R6A



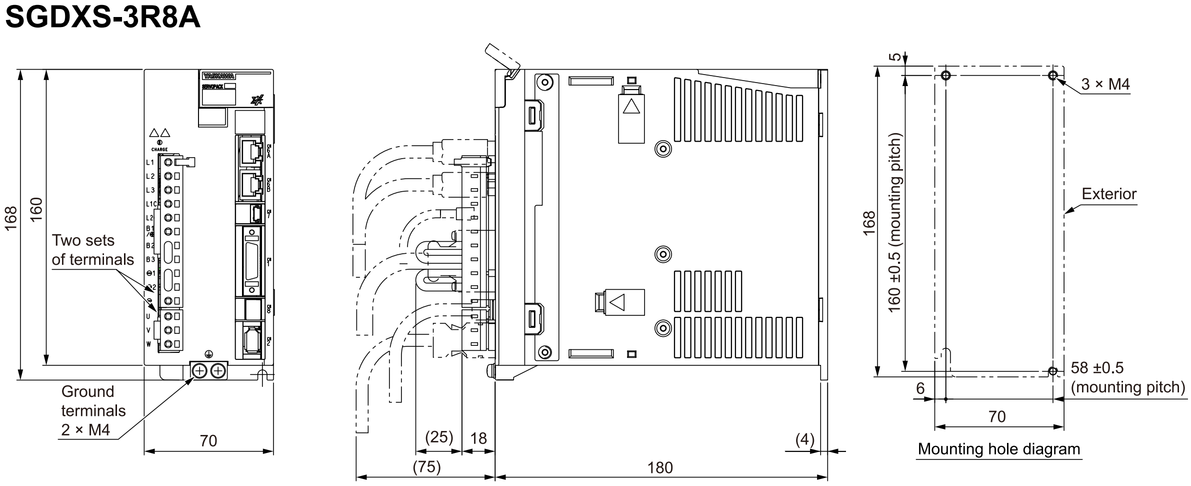
Approx. mass: 0.8 kg
Unit: mm

(b) SGDXS-2R8A



Approx. mass: 1.1 kg
Unit: mm

(c) SGDXS-3R8A

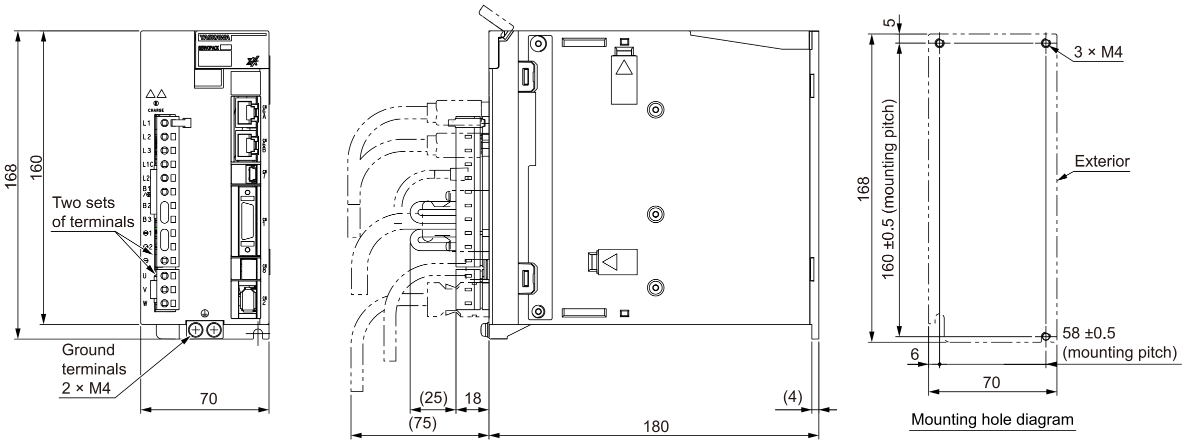


Approx. mass: 1.7 kg
Unit: mm

Selecting a SERVOPACK

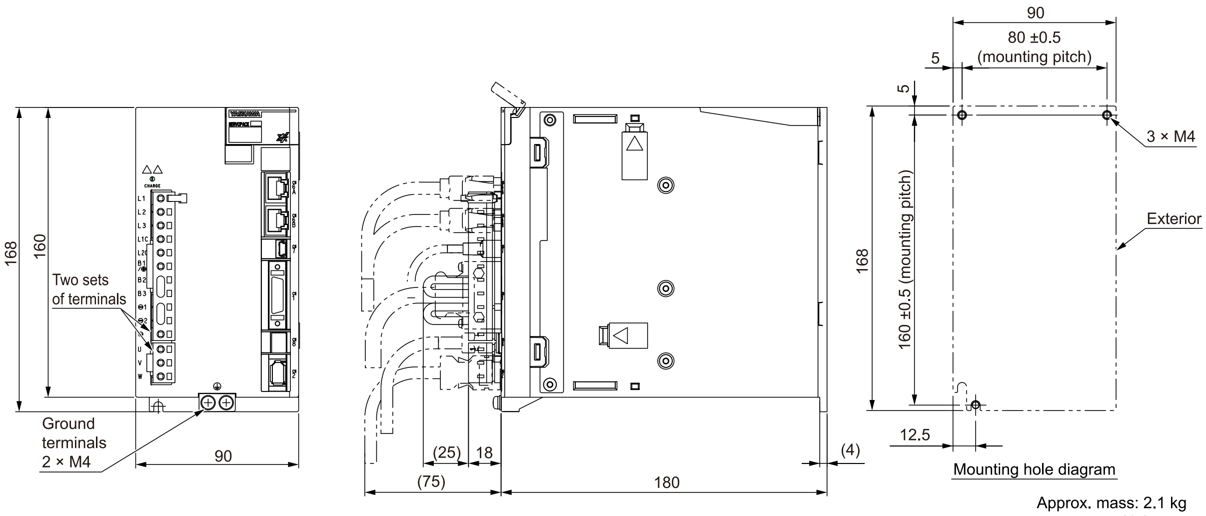
2

(d) SGDXS-5R5A, -7R6A



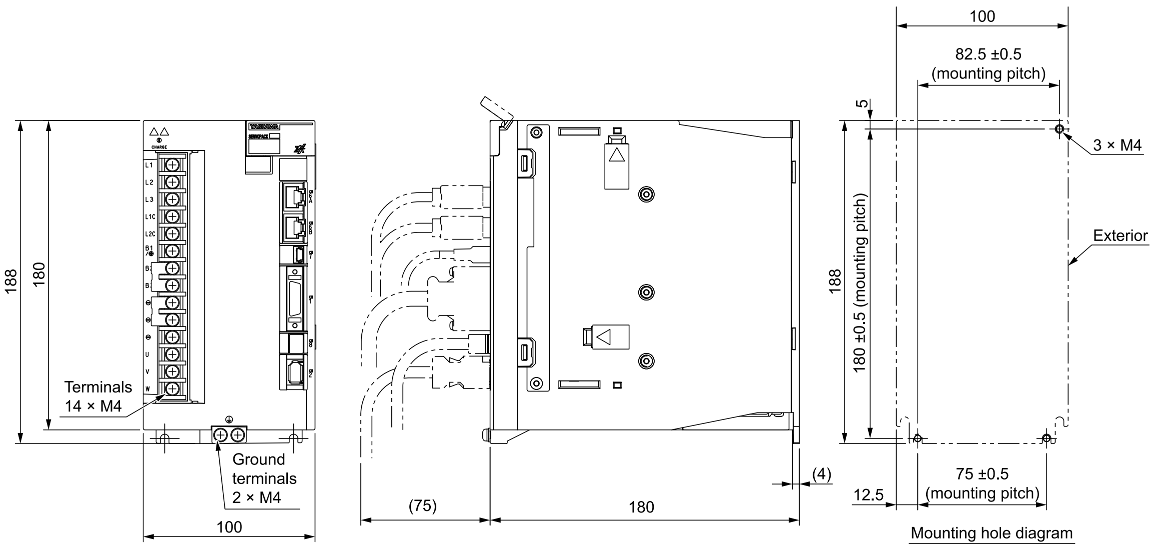
Approx. mass: 1.6 kg
Unit: mm

(e) SGDXS-120A



Approx. mass: 2.1 kg
Unit: mm

(f) SGDXS-180A, -200A

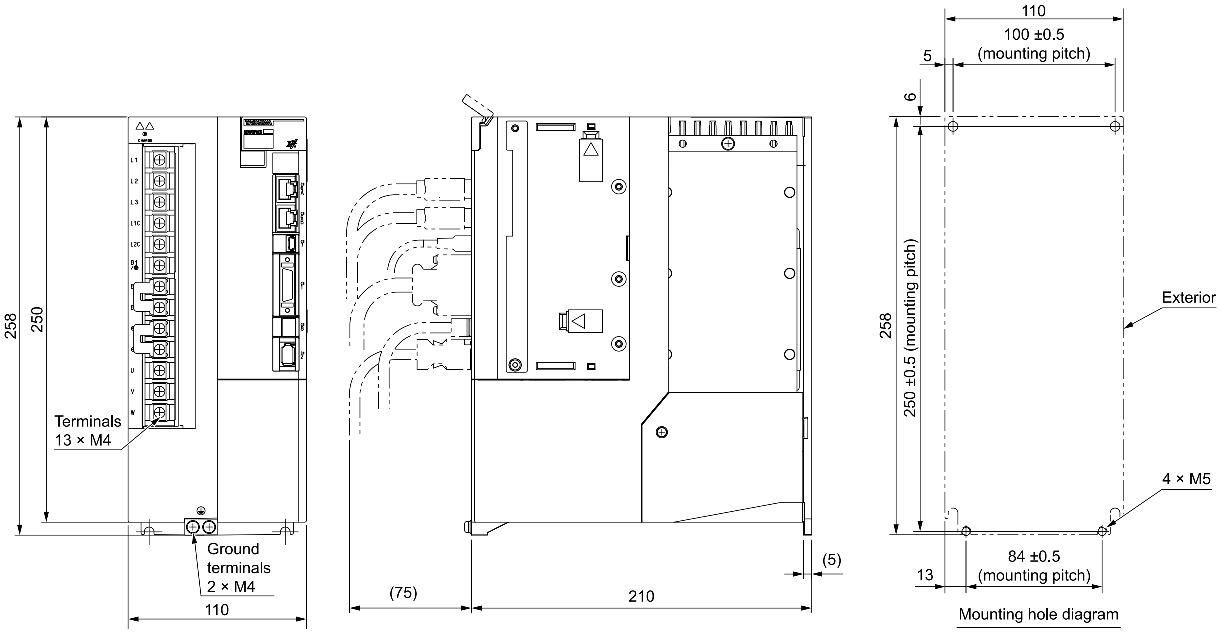


Approx. mass: 2.8 kg
Unit: mm

Note:

These drawings show the SERVOPACK with the terminal cover removed.

(g) SGDXS-330A

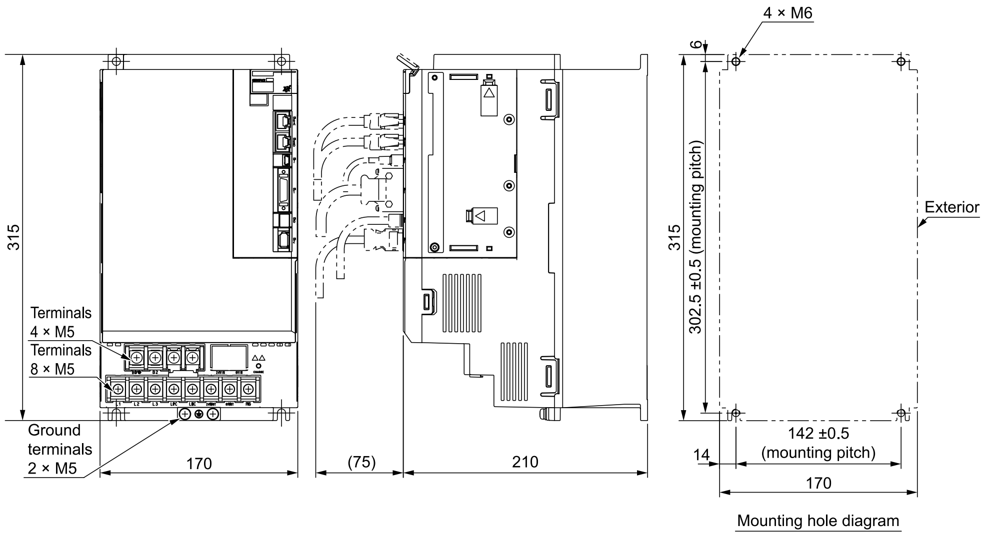


Approx. mass: 4.4 kg
Unit: mm

Note:

These drawings show the SERVOPACK with the terminal cover removed.

(h) SGDXS-470A, -550A

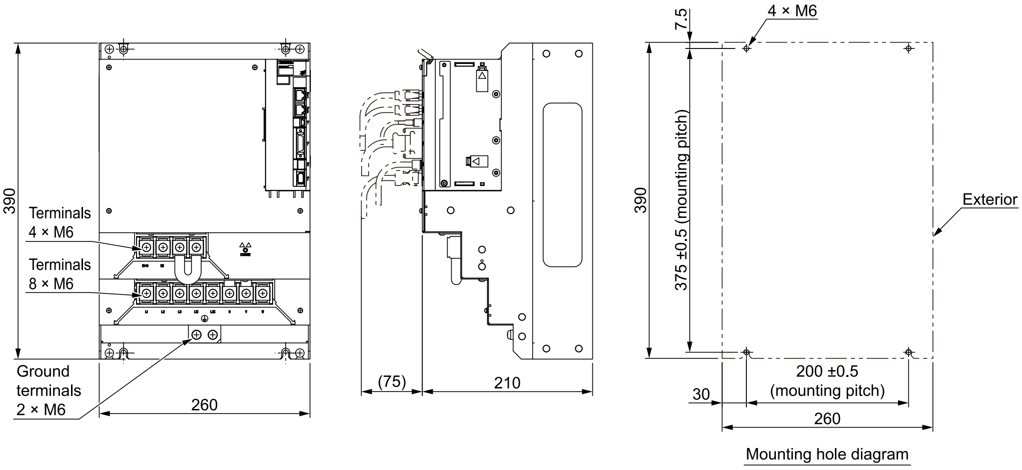


Approx. mass: 9.0 kg
Unit: mm

Selecting a SERVOPACK

2

(i) SGDXS-590A, -780A

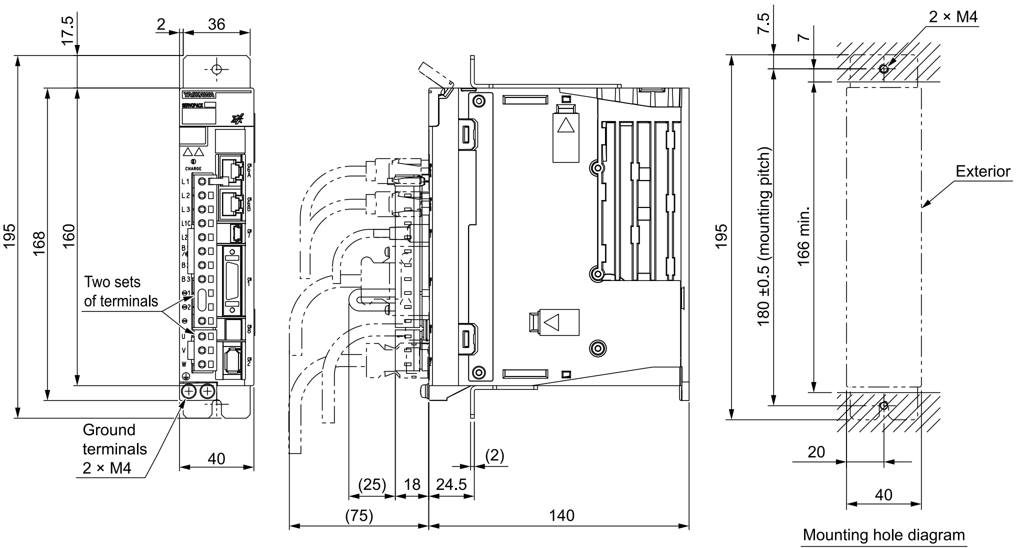


Approx. mass: 16 kg
Unit: mm

(2) Rack-mounted SERVOPACKs

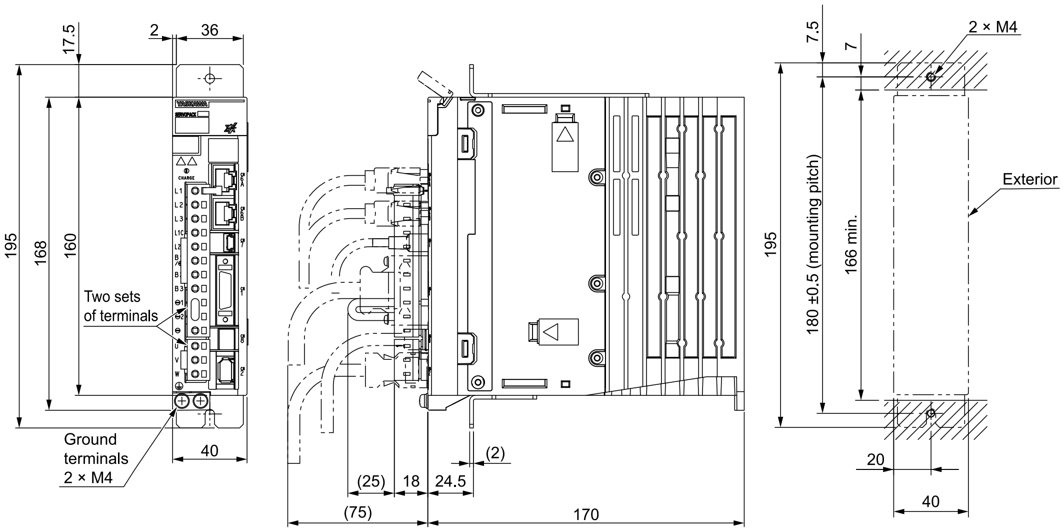
Hardware Option Code: 0001

(a) SGDXS-R70A, -R90A, -1R6A



Approx. mass: 0.9 kg
Unit: mm

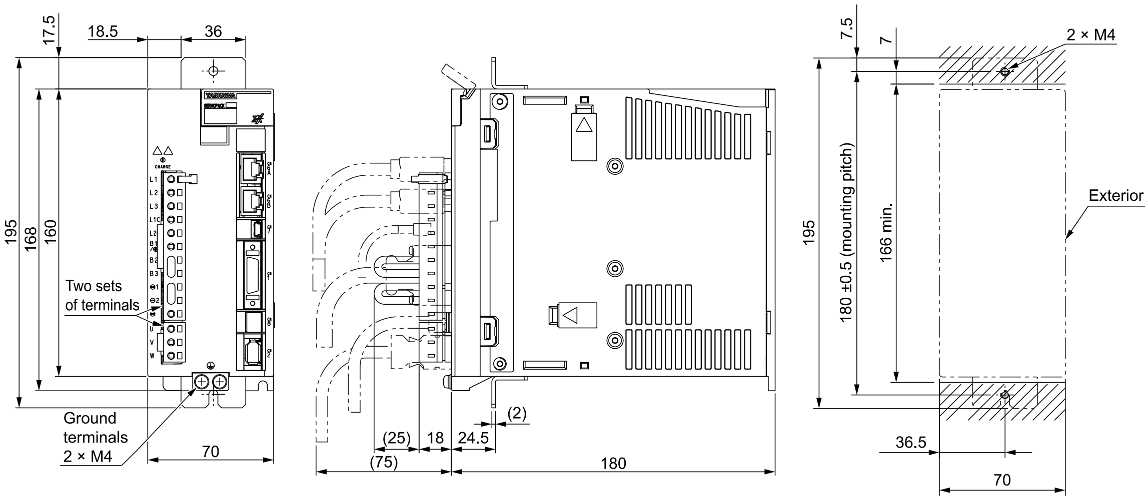
(b) SGDXS-2R8A



Mounting hole diagram

Approx. mass: 1.1 kg
Unit: mm

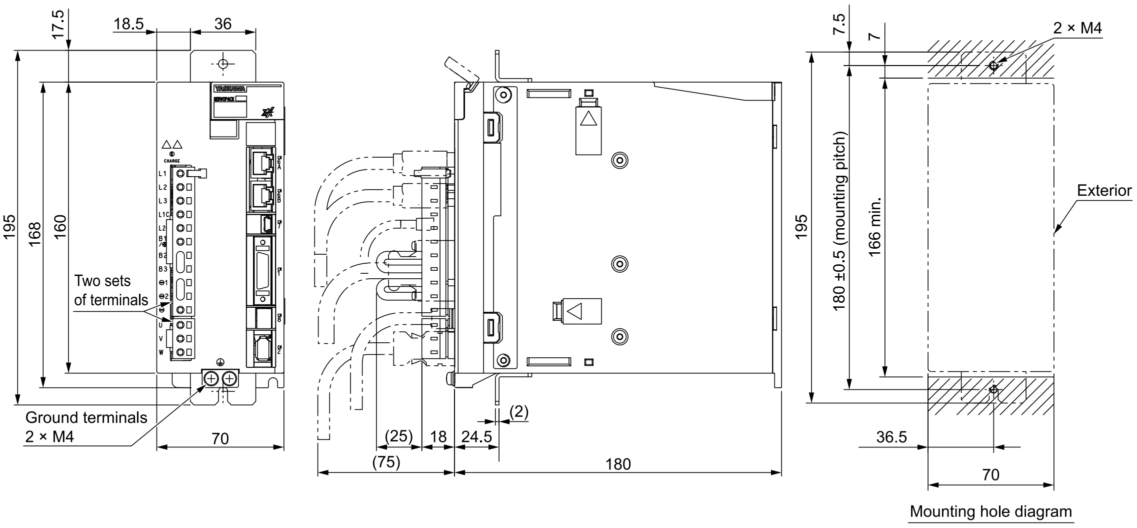
(c) SGDXS-3R8A



Mounting hole diagram

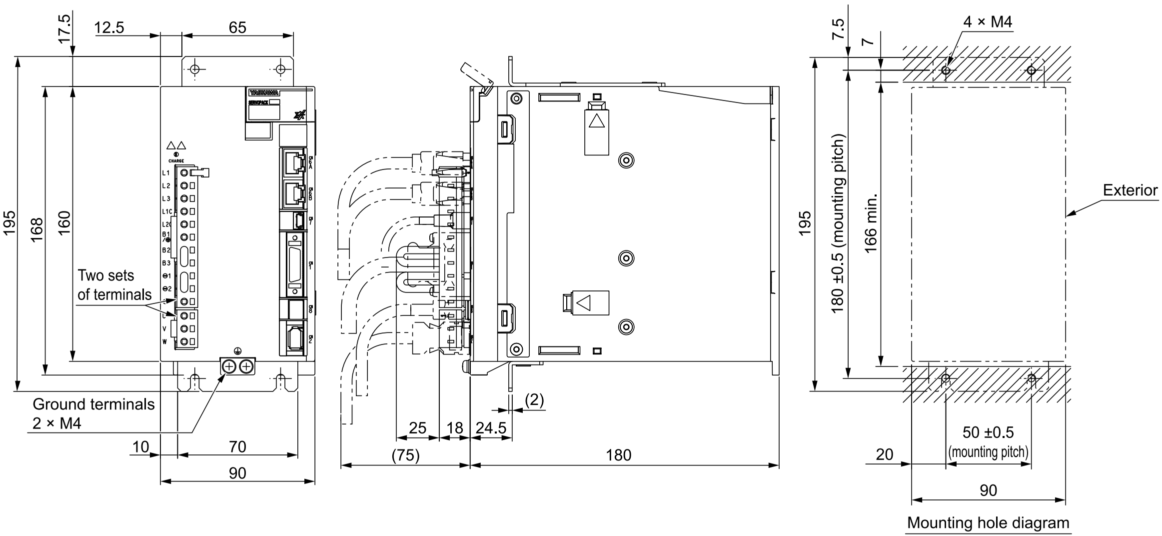
Approx. mass: 1.7 kg
Unit: mm

(d) SGDXS-5R5A, -7R6A



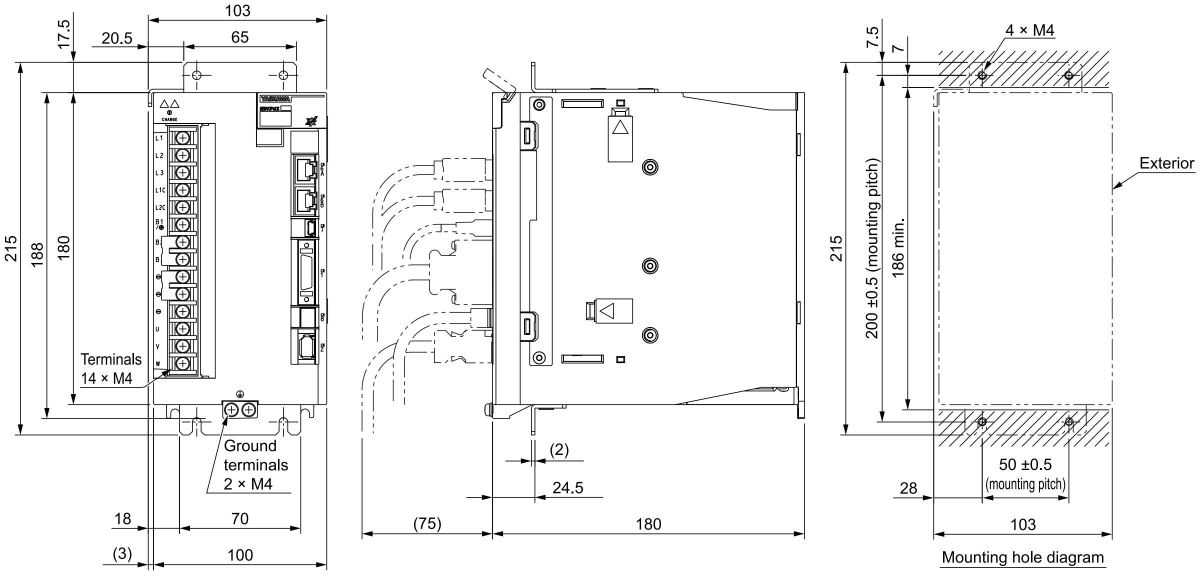
Approx. mass: 1.7 kg
Unit: mm

(e) SGDXS-120A



Approx. mass: 2.2 kg
Unit: mm

(f) SGDXS-180A, -200A

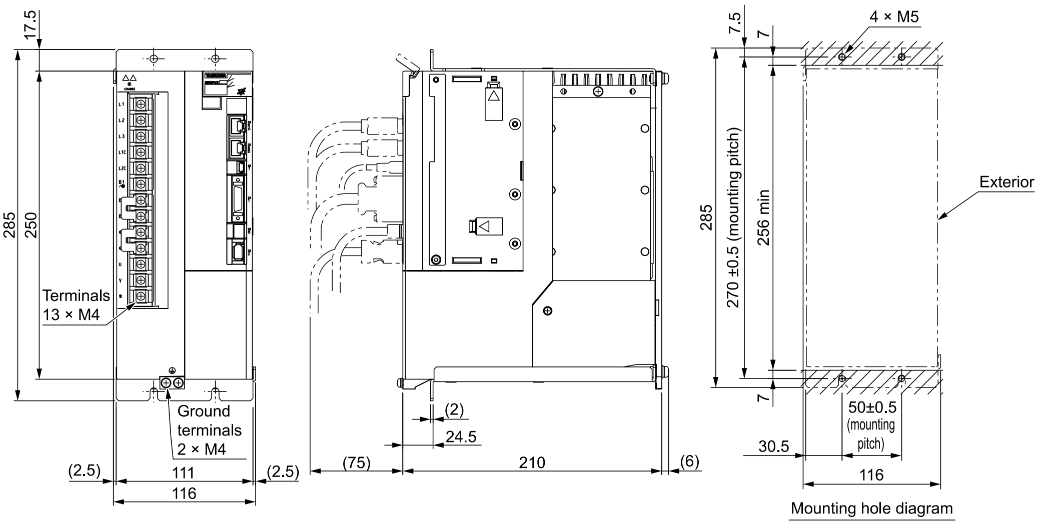


Approx. mass: 2.9 kg
Unit: mm

Note:

These drawings show the SERVOPACK with the terminal cover removed.

(g) SGDXS-330A



Approx. mass: 4.9 kg
Unit: mm

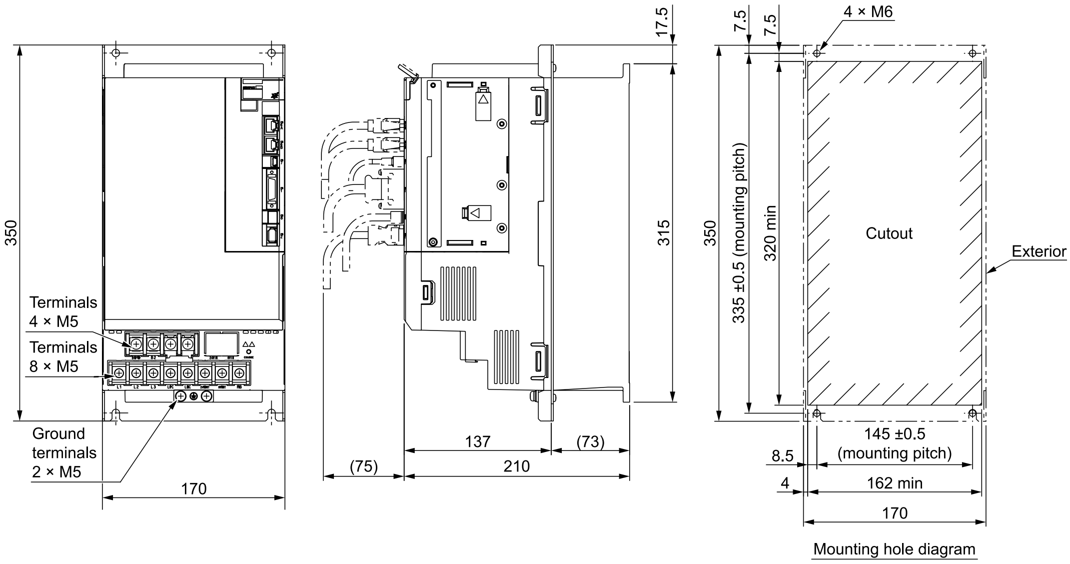
Note:

These drawings show the SERVOPACK with the terminal cover removed.

(3) Duct-ventilated SERVOPACKs

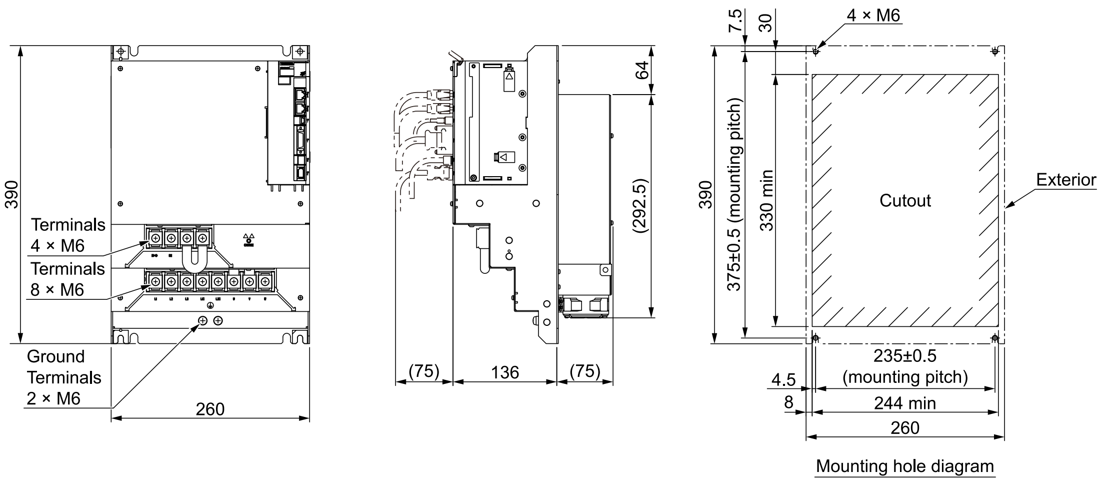
Hardware Option Code: 0001

(a) SGDXS-470A, -550A



Approx. mass: 9.0 kg
Unit: mm

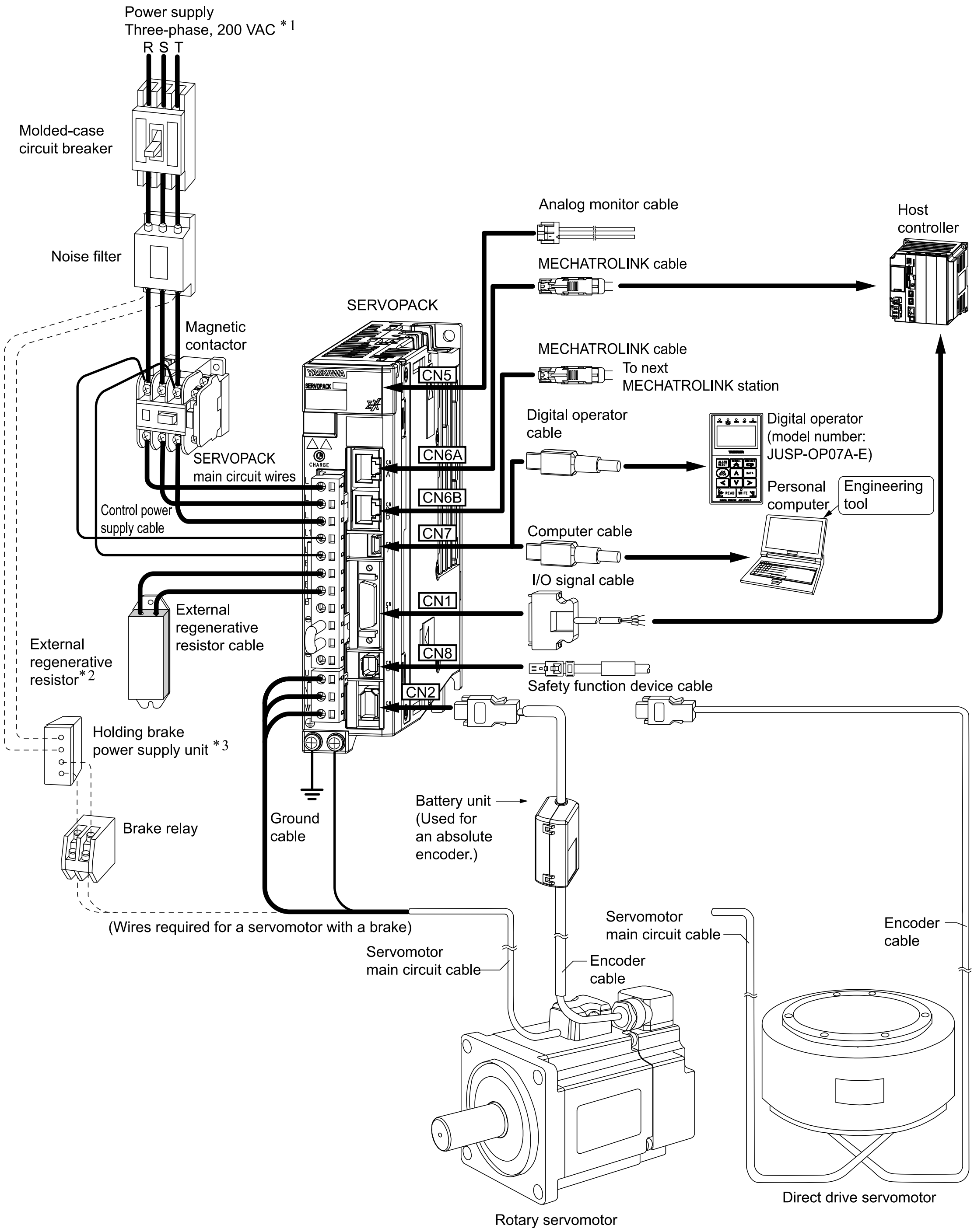
(b) SGDXS-590A, -780A



Approx. mass: 15 kg
Unit: mm

2.4 Examples of Standard Connections between SERVOPACKs and Peripheral Devices

2.4.1 Rotary Servomotor

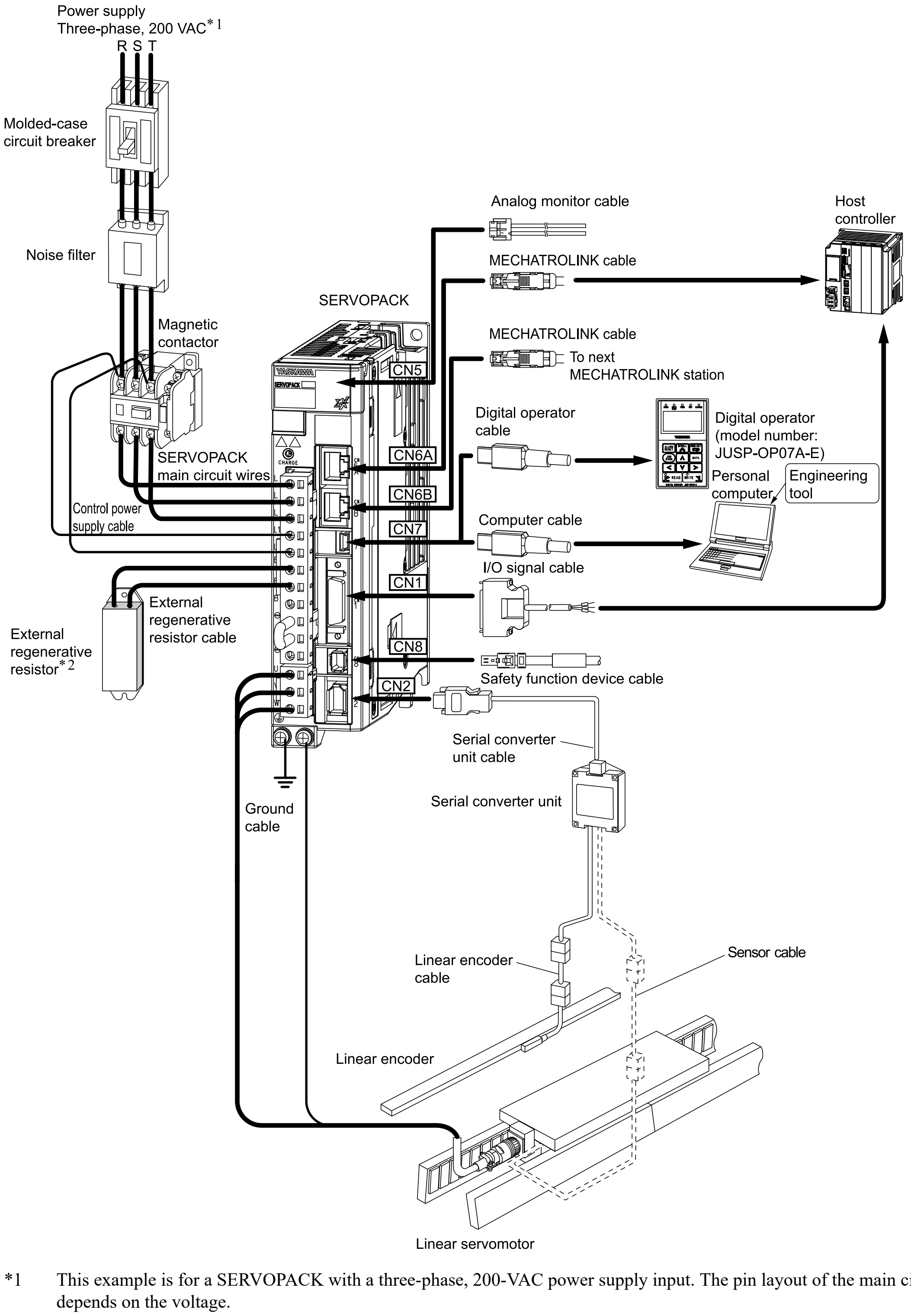


*1 This example is for a SERVOPACK with a three-phase, 200-VAC power supply input. The pin layout of the main circuit connector depends on the voltage.

*2 External regenerative resistors are not provided by Yaskawa.

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

2.4.2 Linear Servomotor



*1 This example is for a SERVOPACK with a three-phase, 200-VAC power supply input. The pin layout of the main circuit connector depends on the voltage.
*2 External regenerative resistors are not provided by Yaskawa.

3

SERVOPACK Installation

This chapter provides information on installing SERVOPACKs in the required locations.

3.1 Installation Precautions

Refer to the following section for the surrounding installation conditions.

☞ *2.1.3 Specification on page 68*

- Installation Near Sources of Heat
  Implement measures to prevent temperature increases caused by radiant or convection heat from heat sources so that the surrounding temperature of the SERVOPACK meets the surrounding conditions.
- Installation Near Sources of Vibration
  Install a vibration absorber on the installation surface of the SERVOPACK so that the SERVOPACK will not be subjected to vibration.
- Others
  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

The SERVOPACKs come in the following mounting types: base-mounted, rack-mounted, and duct-ventilated types.

Applicable SERVOPACK models for each mounting type are listed below.

Mounting Type	SERVOPACK Model: SGDXS-
Base-mounted SERVOPACK	All models
Rack-mounted SERVOPACK	R70A, R90A, 1R6A, 2R8A, 3R8A, 5R5A, 7R6A, 120A, 180A, 200A, 330A
Duct-ventilated SERVOPACK	470A, 550A, 590A, 780A

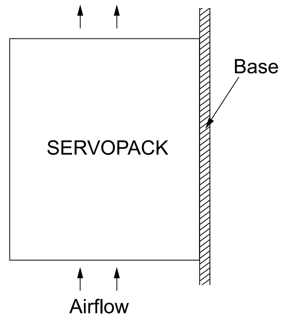
Regardless of the mounting type, mount the SERVOPACK vertically, as shown in the following figures.

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

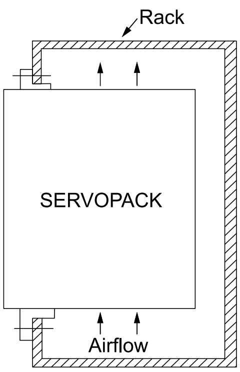
Note:

Prepare two to 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.)

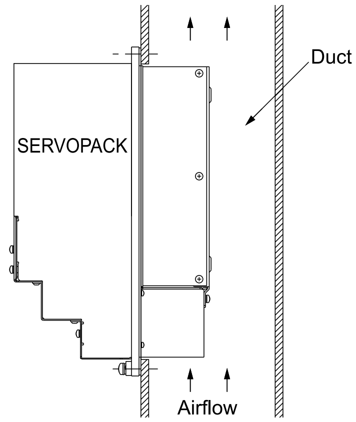
- Base-mounted SERVOPACK



- Rack-mounted SERVOPACK



- Duct-ventilated SERVOPACK

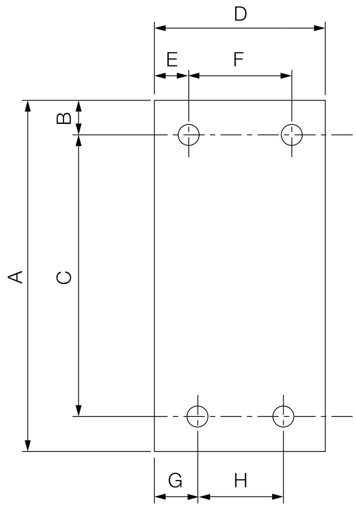


3.3 Mounting Hole Dimensions

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

Note:

To mount the SERVOPACK, prepare a screwdriver that is longer than the depth of the SERVOPACK.



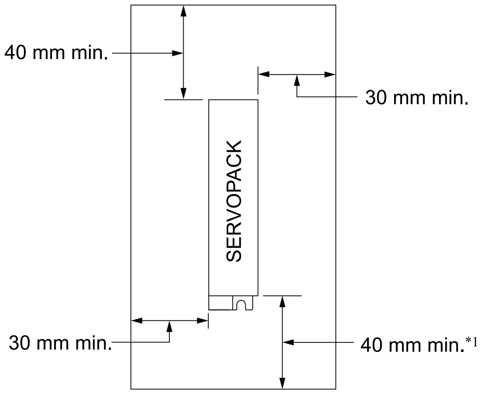
3.3.1 Σ-X-series Mounting Hole Dimensions

SERVOPACK Model SGDXS-	Dimensions (mm)								Screw Size	Number of Screws
	A	B	C	D	E	F	G	H		
R70A, R90A, 1R6A	168	5	160±0.5	40	35	–	25	–	M4	2
2R8A	168	5	160±0.5	40	5	–	25	–	M4	2
3R8A, 5R5A, or 7R6A	168	5	160±0.5	70	6	58±0.5	64	–	M4	3
120A, 120A□□□0008	168	5	160±0.5	90	5	80±0.5	12.5	–	M4	3
180A, 200A	188	5	180±0.5	100	95	–	12.5	75±0.5	M4	3
330A	258	6	250±0.5	110	5	100±0.5	13	84±0.5	M5	4
470A, 550A	315	6	302.5±0.5	170	14	142±0.5	14	142±0.5	M6	4
590A, 780A	390	7.5	375±0.5	260	30	200±0.5	30	200±0.5	M6	4

3.4 Mounting Interval

3.4.1 Installing One SERVOPACK in a Control Panel

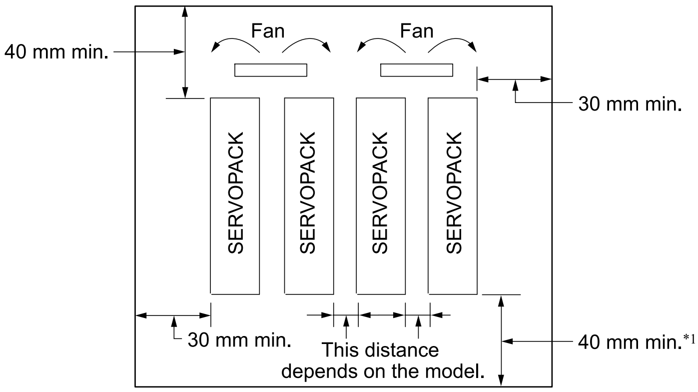
Provide the following spaces around the SERVOPACK.



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

3.4.2 Installing More Than One SERVOPACK in a Control Panel

When multiple SERVOPACKs are installed close together in a enclosed space, the surrounding temperature of the SERVOPACKs may locally exceed the surrounding air temperature range, and air circulation due to natural convection may be insufficient. In this case, you must take measures to disperse the localized hot spots, such as using fans. When using fans, install them as shown below.



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

The space required on the right side of a SERVOPACK (when looking at the SERVOPACK from the front) depends on the SERVOPACK models. Refer to the following table.

SERVOPACK Model		Space on Right Side	Cooling Fan Installation Conditions
			10 mm above SERVOPACK's Top Surface
SGDXS-	R70A, R90A, 1R6A, 2R8A, 3R8A, 5R5A, 7R6A	1 mm min.	Air speed: 0.5 m/s min.
	120A, 180A, 200A, 330A, 470A, 550A, 590A, 780A	10 mm min.	Air speed: 0.5 m/s min.

Note:

When option modules are mounted on SERVOPACKs, the SERVOPACK installation conditions will depend on the option modules that are mounted. For details, refer to the manual for option module.

3.5 Monitoring the Installation Environment

You can use the SERVOPACK Installation Environment Monitor 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]
- Using a 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.
- Increase the spacing between SERVOPACKs.
- Make the air around the SERVOPACK circulate by convection.

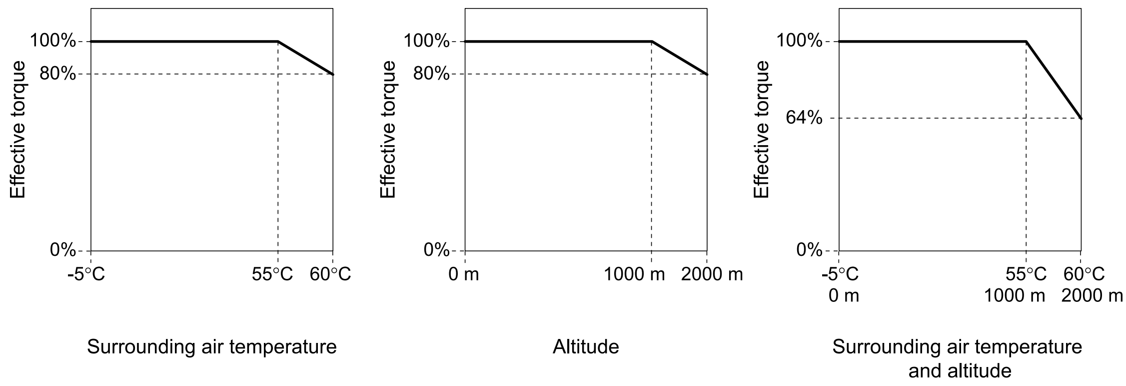
Information: The value of the SERVOPACK Installation Environment Monitor will increase by about 10% for each 10°C increase in the surrounding temperature.

Important: 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.

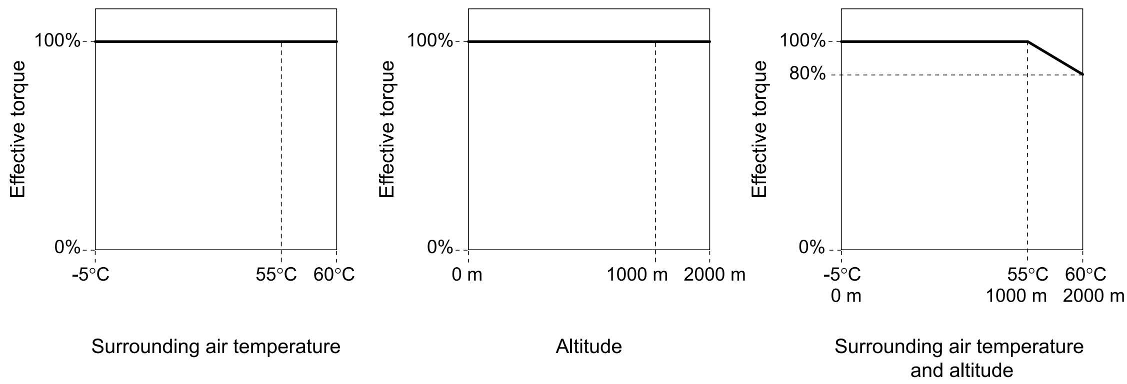
3.6 Derating Specifications

If you use the SERVOPACK at a surrounding air temperature of 55°C to 60°C or at an altitude of 1000 m to 2000 m, you must apply the derating rates given in the following graphs.

3.6.1 SGDXS-R70A, -R90A, -1R6A, -2R8A



3.6.2 SGDXS-3R8A, -5R5A, -7R6A, -120A, -180A, -200A, -330A, -470A, -550A, -590A, -780A



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).

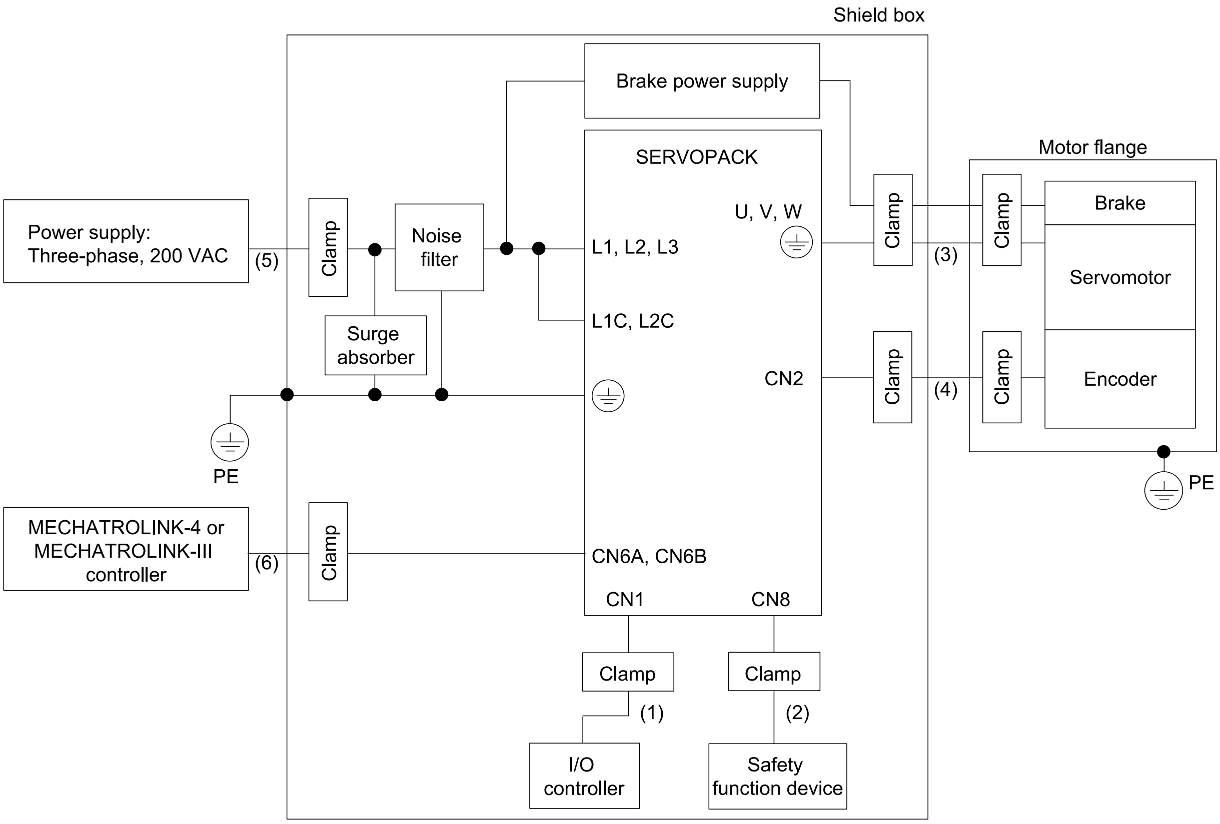
WARNING

In a domestic environment, this product may cause radio interference in which case supplementary mitigation measures may be required.

CAUTION

This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

3.7.1 Three-Phase, 200 VAC



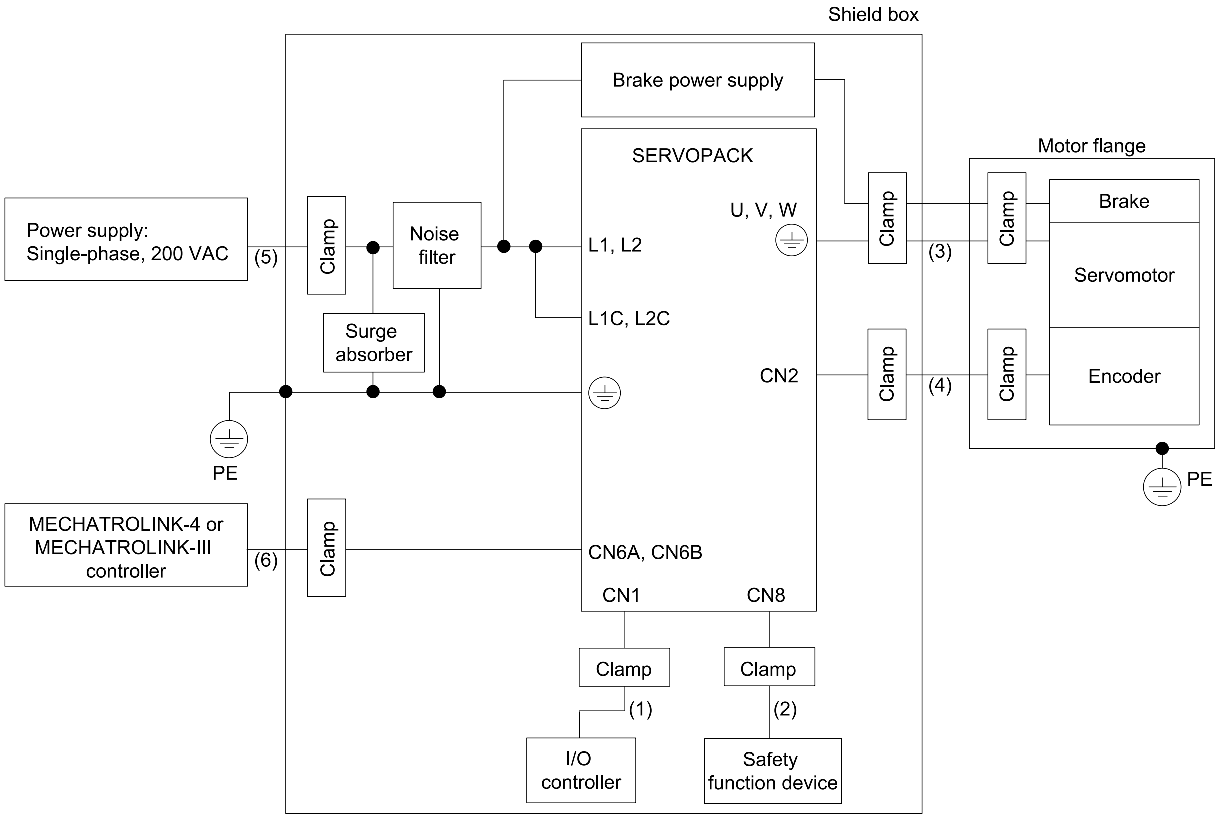
No.	Cable Name	Specification
(1)	I/O signal cable	Shield wire
(2)	Safety function device cable	Shield wire
(3)	Servomotor main circuit cable	Shield wire
(4)	Encoder cable	Shield wire

Continued on next page.

Continued from previous page.

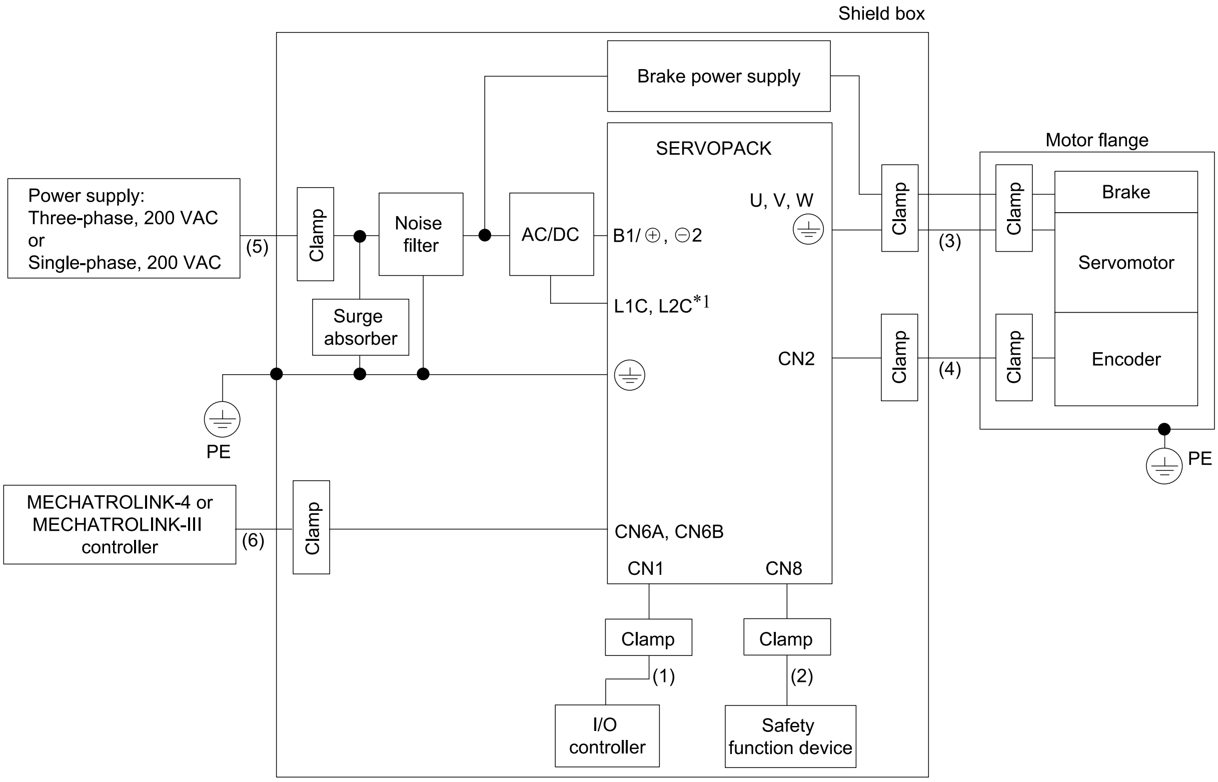
No.	Cable Name	Specification
(5)	Main circuit power cable	Shield wire
(6)	MECHATROLINK-4 or MECHATROLINK-III cable	Shield wire

3.7.2 Single-Phase, 200 VAC



No.	Cable Name	Specification
(1)	I/O signal cable	Shield wire
(2)	Safety function device cable	Shield wire
(3)	Servomotor main circuit cable	Shield wire
(4)	Encoder cable	Shield wire
(5)	Main circuit power cable	Shield wire
(6)	MECHATROLINK-4 or MECHATROLINK-III cable	Shield wire

3.7.3 270 VDC



*1 You can also use a single-phase 200-VAC power supply instead of a 270-VDC power supply for input to the L1C and L2C control power supply terminals.

Code	Cable Name	Specification
(1)	I/O signal cable	Shield wire
(2)	Safety function device cable	Shield wire
(3)	Servomotor main circuit cable	Shield wire
(4)	Encoder cable	Shield wire
(5)	Main circuit power cable	Shield wire
(6)	MECHATROLINK-4 or MECHATROLINK-III cable	Shield wire

4

Wiring and Connecting SERVOPACKs

Provides information on wiring and connecting SERVOPACKs to power supplies and peripheral devices.

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.

⚠ WARNING

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. There is also a risk that some parts damaged by the short-circuit failure may fall from the SERVOPACK.

Connect the AC or DC power supplies to the specified SERVOPACK terminals.

- **Connect an AC power supply to the L1, L2, and L3 terminals and the L1C and L2C terminals on the SERVOPACK.**
- **Connect a DC power supply to the B1/⊕ and ⊖ 2 terminals and the L1C and L2C terminals on the SERVOPACK.**

There is a risk of failure or fire.

If you use a SERVOPACK with the dynamic brake hardware option, connect an external dynamic brake resistor that is suitable for the machine and equipment specifications to the specified terminals.

There is a risk of unexpected operation, machine damage, burning, or injury when an emergency stop is performed.

⚠ CAUTION

Wait for at least 20 minutes (or 100 minutes when using DC power supply input) after turning OFF the power and then make sure that the CHARGE indicator is not lit before starting wiring or inspection work. Do not touch the main circuit terminals while the CHARGE indicator is lit because high voltage may still remain in the SERVOPACK even after turning OFF the power.

There is a risk of electric shock.

Observe the precautions and instructions for wiring and trial operation precisely as described in 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 pin layouts in technical documents for your model before operation.

There is a risk of failure or malfunction.

Connect wires to main circuit 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.

⚠ CAUTION

Use shielded twisted-pair cables or screened unshielded multi-twisted-pair cables for I/O signal cables and encoder cables.

The maximum wiring length is 3 m for I/O signal cables and 50 m for servomotor main circuit cables and encoder cables.

Observe the following precautions when wiring the SERVOPACK's main circuit terminals.
- **Turn ON the power to the SERVOPACK only after all wiring, including the main circuit terminals, has been completed.**
- **If a connector is used for the main circuit terminals, remove the main circuit connector from the SERVOPACK before you wire it.**
- **Insert only one wire per insertion hole in the main circuit terminals.**
- **When you insert a wire, make sure that the conductor wire (e.g., whiskers) does not come into contact with adjacent wires and cause a short-circuit.**

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.

NOTICE

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 connector screws and lock mechanisms.

Insufficient tightening may result in 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.

Important

- Use a molded-case circuit breaker or fuse to protect the main circuit.
  The SERVOPACK connects directly to a commercial power supply; it is not isolated through a transformer or other device. Always use a molded-case circuit breaker or fuse to protect the servo system from accidents involving different power system voltages or other accidents.
- Install an earth leakage breaker.
  The SERVOPACK does not have a built-in ground fault protective 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 ON and OFF more than necessary.
  - Do not use the SERVOPACK for applications that require the power to be turned 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 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 following manual or catalog for information on the specified cables.

  Σ-X-Series Catalog (Catalog No.: KAEP C710812 03)

  Σ-X-Series Peripheral Device Selection Manual (Manual No.: SIEP C710812 12)
- The signal cable conductors are as thin as 0.2 mm^2 or 0.3 mm^2. Do not subject them to excessive bending stress or tension.

4.1.2 Countermeasures against Noise

> **Important**
>
> 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.

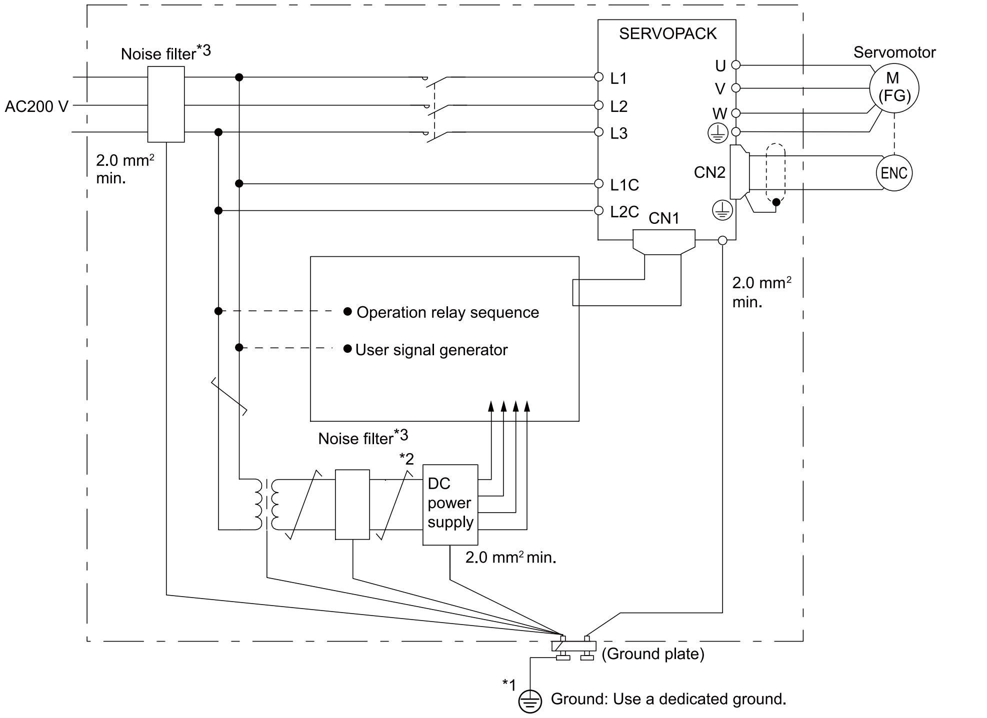
To prevent the noise from the SERVOPACK or the peripheral devices from causing malfunctions of any devices, take the following countermeasures against noise as required.

- 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.
  ☞ *(1) Noise Filters on page 103*
- Implement suitable grounding measures. Refer to the following section for information on grounding measures.
  ☞ *4.1.3 Grounding on page 105*

(1) 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 2 (preferably, flat braided copper wire).

*2 Whenever possible, use twisted-pair wires to wire all connections marked with this symbol.

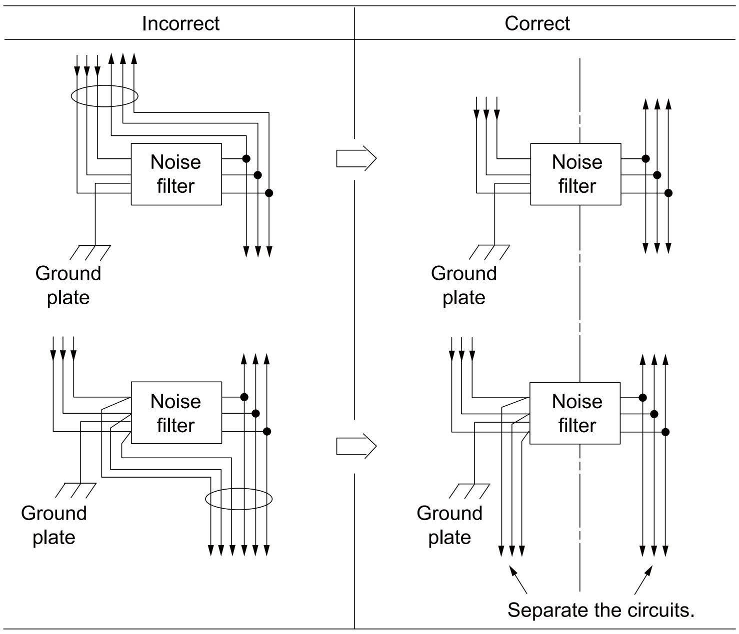
*3 Refer to the following section for precautions when using noise filters.

☞ *(2) Noise Filter Wiring and Connection Precautions on page 104*

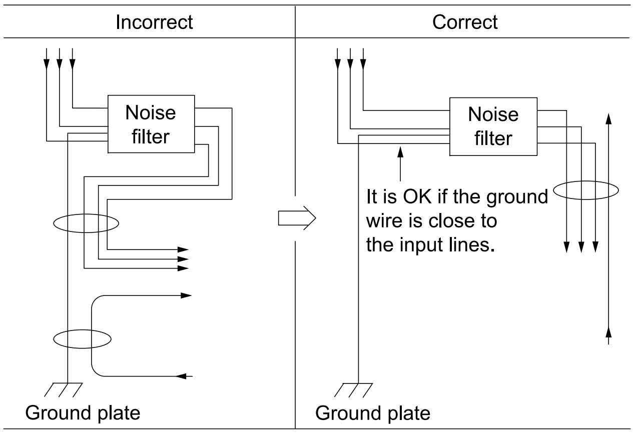
(2) Noise Filter Wiring and Connection Precautions

Always observe the following precautions when wiring or connecting noise filters.

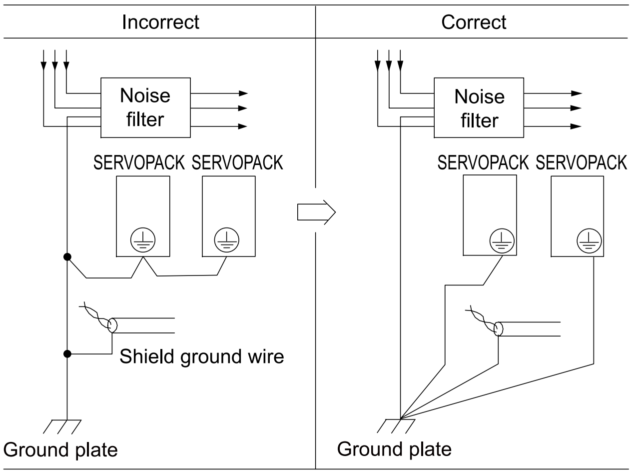
- Separate input lines from output lines. Do not place input lines and output lines in the same duct or bundle them together.



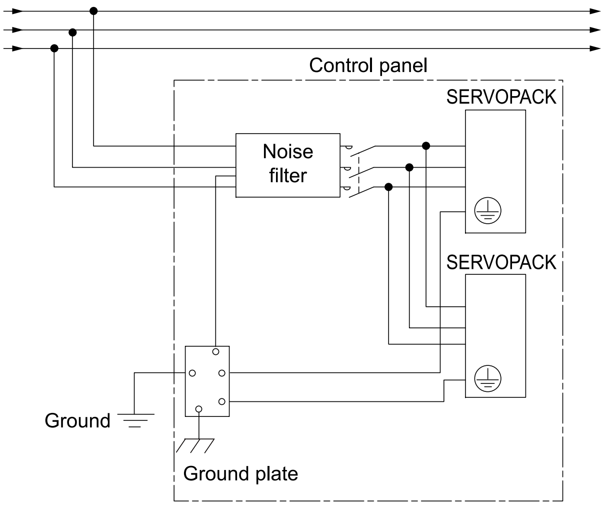
- Separate the noise filter ground wire from the output lines. Do not place the noise filter ground wire, output lines, and other signal lines in the same duct or bundle them together.



- Connect the noise filter ground wire directly to the grounding plate. Do not connect the noise filter ground wire to other ground wires.



- 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 100 Ω or less.
- Be sure to ground at one point only.
- Ground the servomotor directly if the servomotor is insulated from the machine.

(1) 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).

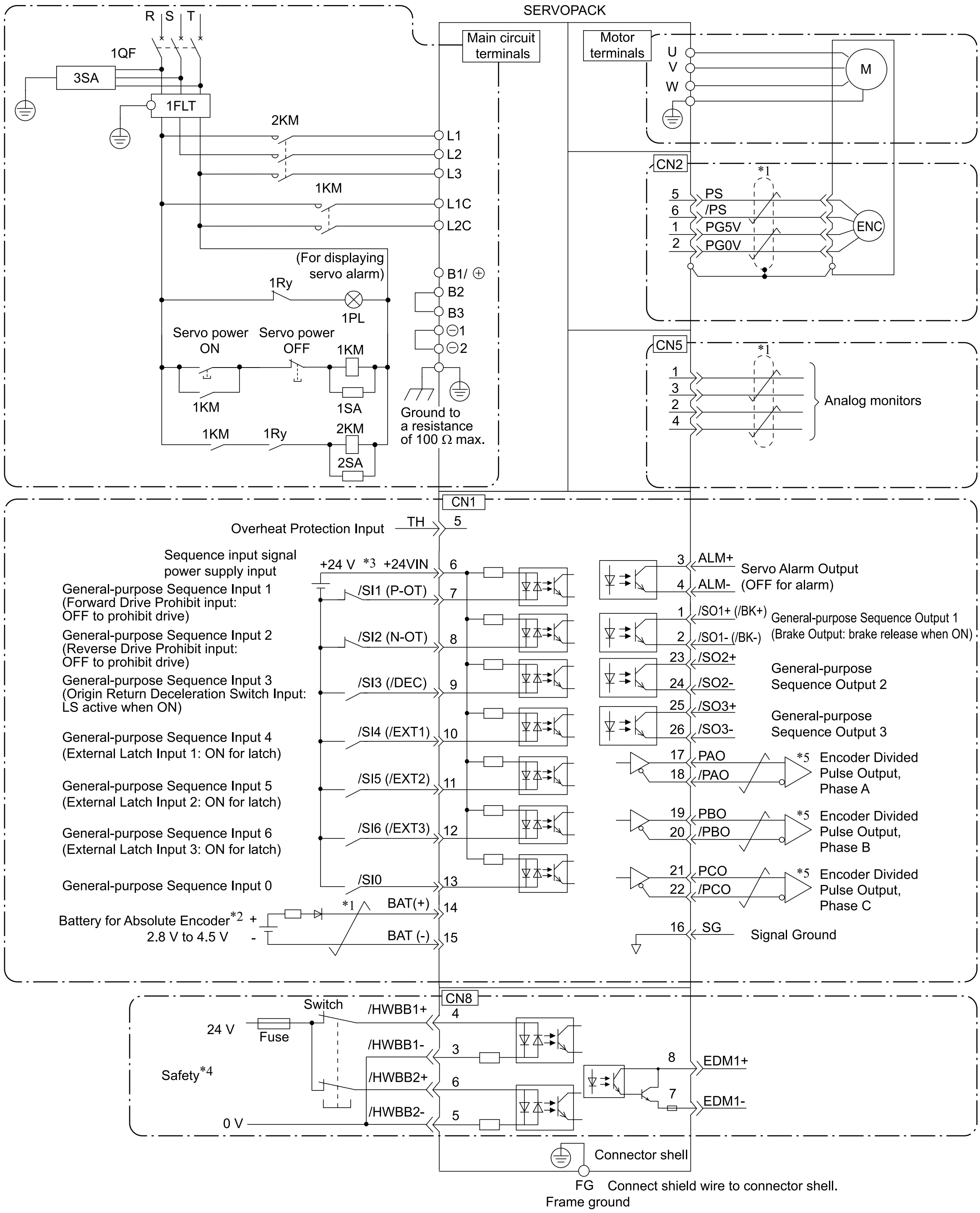
Ground both the moving coil and magnetic way of a linear servomotor.

(2) Noise on I/O Signal Cables

If noise enters the I/O signal cable, connect the shield of the I/O signal cable to the connector shell to ground it. 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.



*1 represents twisted-pair wires.
*2 Connect these when using an absolute encoder. If the encoder cable with a battery unit 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.
☞ *4.6 Connecting Safety Function Signals on page 138*
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.

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, and /SO3 output signals. Refer to the following section for details.
   ☞ *6.1 Changing Allocations of I/O Signals on page 208*
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.
3. Default settings are given in parentheses.

Refer to the reference sections given in the diagrams for details.

Item	Reference
Main circuit terminals	*4.3 Wiring the Power Supply to the SERVOPACK on page 109*
Motor terminals	*4.4 Wiring Servomotors on page 121*
CN1	*4.5 I/O Signal Connections on page 131*
CN2	*4.4 Wiring Servomotors on page 121*
CN5	*4.10 Using the Analog Monitors on page 143*
CN8	*4.6 Connecting Safety Function Signals on page 138*

4.3 Wiring the Power Supply to the SERVOPACK

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

Σ-X-Series Catalog (Catalog No.: KAEP C710812 03)

Σ-X-Series Peripheral Device Selection Manual (Manual No.: SIEP C710812 12)

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.

CAUTION

Wire all connections correctly according to the following table and the reference information.

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

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

- Three-phase, 200-VAC power supply input
- Single-phase, 200-VAC power supply input
- DC power supply input

Information A single-phase AC power supply or a DC power supply can be connected to the control power supply terminals.

(1) Three-Phase, 200-VAC Power Supply Input

Terminal Symbols	Terminal Name	Specifications and Reference	
L1, L2, L3	Main circuit power input terminals for AC power input	Three-phase, 200 VAC to 240 VAC, -15% to +10%, 50 Hz/60 Hz	
L1C, L2C	Control power supply terminals	AC power supply	Single-phase, 200 VAC to 240 VAC, -15% to +10%, 50 Hz/60 Hz
		DC power supply	L1C: 270 VDC to 324 VDC, -15% to +10%, L2C: 0 VDC or L2C: 270 VDC to 324 VDC, -15% to +10%, L1C: 0 VDC
B1/⊕, B2, B3	Regenerative resistor terminals	4.3.5 Wiring Regenerative Resistors on page 117	
		For SGDXS-R70A, -R90A, -1R6A, -2R8A If the regenerative capacity is insufficient, connect an external regenerative resistor between B1/⊕and B2. The external regenerative resistor is not included. Obtain it separately.	
		For SGDXS-3R8A,- 5R5A, -7R6A, -120A, -180A, -200A, -330A If the internal regenerative resistor is insufficient, remove the jumper (lead or short bar) between B2 and B3 and connect an external regenerative resistor between B1/⊕ and B2. The external regenerative resistor is not included. Obtain it separately.	
		For SGDXS-470A, -550A, -590A, -780A Connect a regenerative resistor unit between B1/⊕ and B2. Obtain a regenerative resistor unit separately. These models do not have a B3 terminal.	
⊖1,⊖2	DC reactor terminals	4.3.6 Wiring Reactors for Harmonic Suppression on page 119	
		These terminals are used to connect a DC reactor for harmonic suppression.	

Continued on next page.

Continued from previous page.

Terminal Symbols	Terminal Name	Specifications and Reference
⊖	–	None. (Do not connect anything to this terminal.) **Note:** SGDXS-330A to -780A do not have a ⊖ terminal.

(2) Single-Phase, 200-VAC Power Supply Input

<table>
<tr><th>Terminal Symbols</th><th>Terminal Name</th><th colspan="2">Specifications and Reference</th></tr>
<tr><td>L1, L2</td><td>Main circuit power input terminals for AC power input</td><td colspan="2">Single-phase, 200 VAC to 240 VAC, -15% to +10%, 50 Hz/60 Hz</td></tr>
<tr><td rowspan="2">L1C, L2C</td><td rowspan="2">Control power supply terminals</td><td>AC power supply</td><td>Single-phase, 200 VAC to 240 VAC, -15% to +10%, 50 Hz/60 Hz</td></tr>
<tr><td>DC power supply</td><td>L1C: 270 VDC to 324 VDC, -15% to +10%, L2C: 0 VDC
or
L2C: 270 VDC to 324 VDC, -15% to +10%, L1C: 0 VDC</td></tr>
<tr><td rowspan="3">B1/⊕, B2, B3</td><td rowspan="3">Regenerative resistor terminals</td><td colspan="2">☞ 4.3.5 Wiring Regenerative Resistors on page 117</td></tr>
<tr><td colspan="2">For SGDXS-R70A, -R90A, -1R6A, -2R8A
If the regenerative capacity is insufficient, connect an external regenerative resistor between B1/⊕and B2. The external regenerative resistor is not included. Obtain it separately.</td></tr>
<tr><td colspan="2">For SGDXS-5R5A, -120A□□□0008
If the internal regenerative resistor is insufficient, remove the jumper (lead) between B2 and B3 and connect an external regenerative resistor between B1/⊕ and B2. The external regenerative resistor is not included. Obtain it separately.</td></tr>
<tr><td rowspan="2">⊖1,⊖2</td><td rowspan="2">DC reactor terminals</td><td colspan="2">☞ 4.3.6 Wiring Reactors for Harmonic Suppression on page 119</td></tr>
<tr><td colspan="2">These terminals are to connect a DC reactor for power supply harmonic suppression.</td></tr>
<tr><td>L3,⊖</td><td>–</td><td colspan="2">None. (Do not connect anything to this terminal.)</td></tr>
</table>

You can use a single-phase, 200-VAC power supply input with the following models.

- SGDXS-R70A, -R90A, -1R6A, -2R8A, -5R5A

If you use a single-phase, 200-VAC power supply input for the SERVOPACK's main circuit power supply, set parameter Pn00B to n.□1□□ (use a three-phase power supply input as a single-phase power supply input). Refer to the following section for details.

☞ *5.3.2 Single-phase AC Power Supply Input/Three-phase AC Power Supply Input Setting on page 159*

Information You do not need to change the setting of Pn00B to n.□1□□ (use a three-phase power supply input as a single-phase power supply input) for a SERVOPACK with a single-phase 200-VAC power supply input (model numbers: SGDXS-120A□□□0008).

(3) DC Power Supply Input

<table>
<tr><th>Terminal Symbols</th><th>Terminal Name</th><th colspan="2">Specifications and Reference</th></tr>
<tr><td rowspan="2">L1C, L2C</td><td rowspan="2">Control power supply terminals</td><td>AC power supply</td><td>Single-phase, 200 VAC to 240 VAC, -15% to +10%, 50 Hz/60 Hz</td></tr>
<tr><td>DC power supply</td><td>L1C: 270 VDC to 324 VDC, -15% to +10%, L2C: 0 VDC
or
L2C: 270 VDC to 324 VDC, -15% to +10%, L1C: 0 VDC</td></tr>
<tr><td>B1/⊕</td><td rowspan="2">Main circuit power supply input terminals for DC power supply input</td><td colspan="2">270 VDC to 324 VDC, -15% to +10%</td></tr>
<tr><td>⊖2</td><td colspan="2">0 VDC</td></tr>
</table>

Continued on next page.

Continued from previous page.

Terminal Symbols	Terminal Name	Specifications and Reference
L1, L2, L3, B2, B3,⊖1,⊖	–	None. (Do not connect anything to this terminal.) **Note:** • SGDXS-470A to -780A do not have a B3 terminal. • SGDXS-330A to -780A do not have a ⊖ terminal.

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

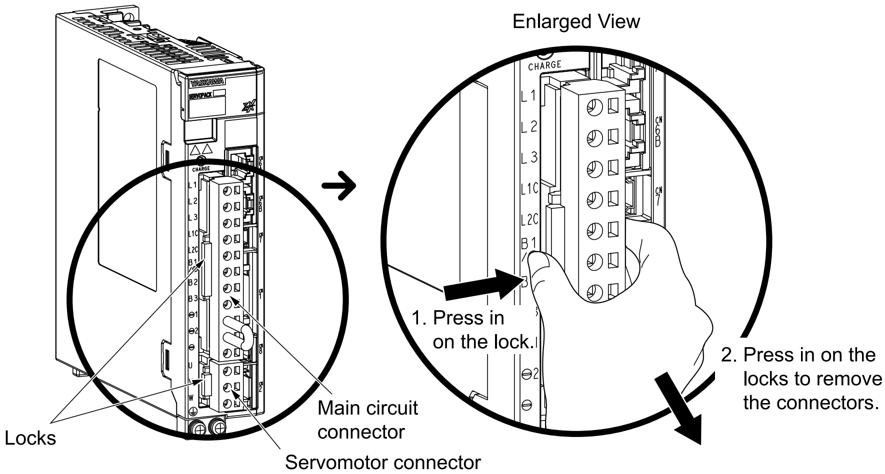
☞ *5.3.1 AC Power Supply Input/DC Power Supply Input Setting on page 158*

4.3.2 Wiring Procedure for Main Circuit Connector

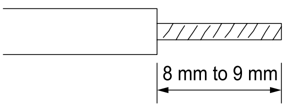
• Required Items

Required Items	Remarks
Spring Opener or Flatblade Screwdriver	– Spring opener SERVOPACK accessory (You can also use model 1981045-1 from Tyco Electronics Japan G.K.)
	– Flat-blade screwdriver Commercially available screwdriver with tip width of 3.0 mm to 3.5 mm

1. **Remove the main circuit connector and motor connector from the SERVOPACK.**



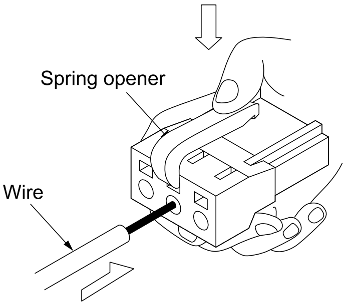
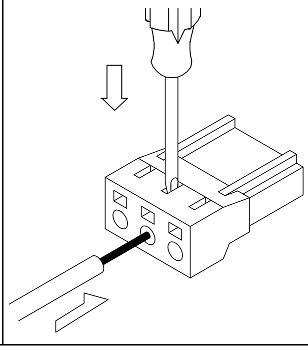
2. **Remove the sheath from the wire to connect.**



Wiring and Connecting SERVOPACKs

4

3. **Open the wire insertion hole on the terminal connector with the tool. here are the following two ways to open the insertion hole. Use either method.**

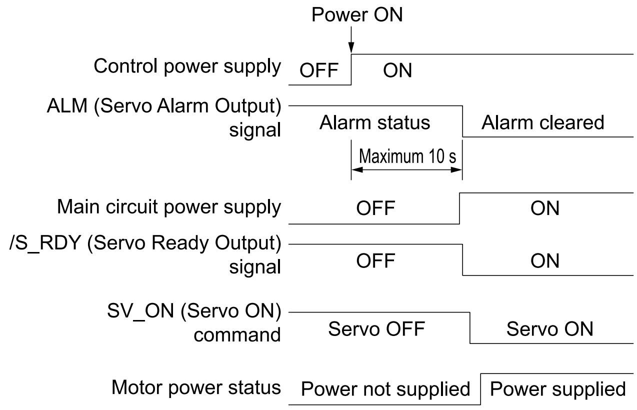
Using a Spring Opener	Using a Flat- blade Screwdriver
Open the insertion hole with the spring opener as shown in the figure. 	Firmly insert a flat-blade screwdriver into the screwdriver insertion hole to open the wire insertion hole. 

4. **Insert the conductor into the wire insertion hole. Then, remove the spring opener or flat-blade screwdriver.**
5. **Make all other connections in the same way.**
6. **When you have completed wiring, attach the connectors to the SERVOPACK.**

4.3.3 Power ON Sequence

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

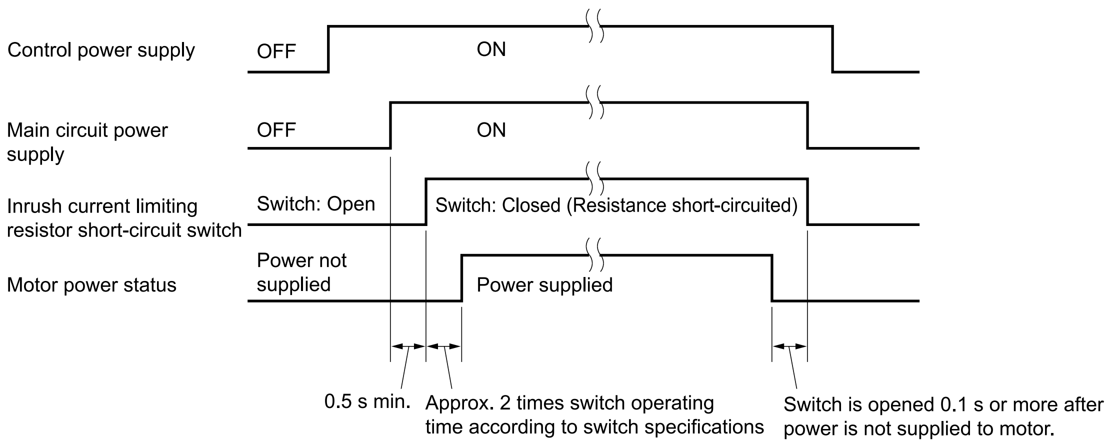
- The ALM (Servo Alarm Output) signal is output for up to ten seconds when the control power is turned ON. Take this into consideration when you design the power ON sequence, and turn ON the main circuit power to the SERVOPACK when the ALM signal is OFF (alarm cleared).



Information If the servo ON state cannot be achieved by inputting the SV_ON (Servo ON) command, the /S_RDY signal is not ON. Check the status of the /S_RDY signal. Refer to the following section for details.

☞ *6.1.8 /S-RDY (Servo Ready Output) Signal on page 217*

- If you use a DC power supply input with any of the following SERVOPACKs, use the power ON sequence shown below: SGDXS-330A, -470A, -550A, -590A, -780A.



- Design the power ON sequence so that main circuit power is turned OFF when an ALM (Servo Alarm Output) 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 is turned OFF before you turn it ON again.

Important

Turn ON the control power before the main circuit power or turn ON the control power and the main circuit power at the same time.

Turn OFF the main circuit power first, and then turn OFF the control power.

⚠ CAUTION

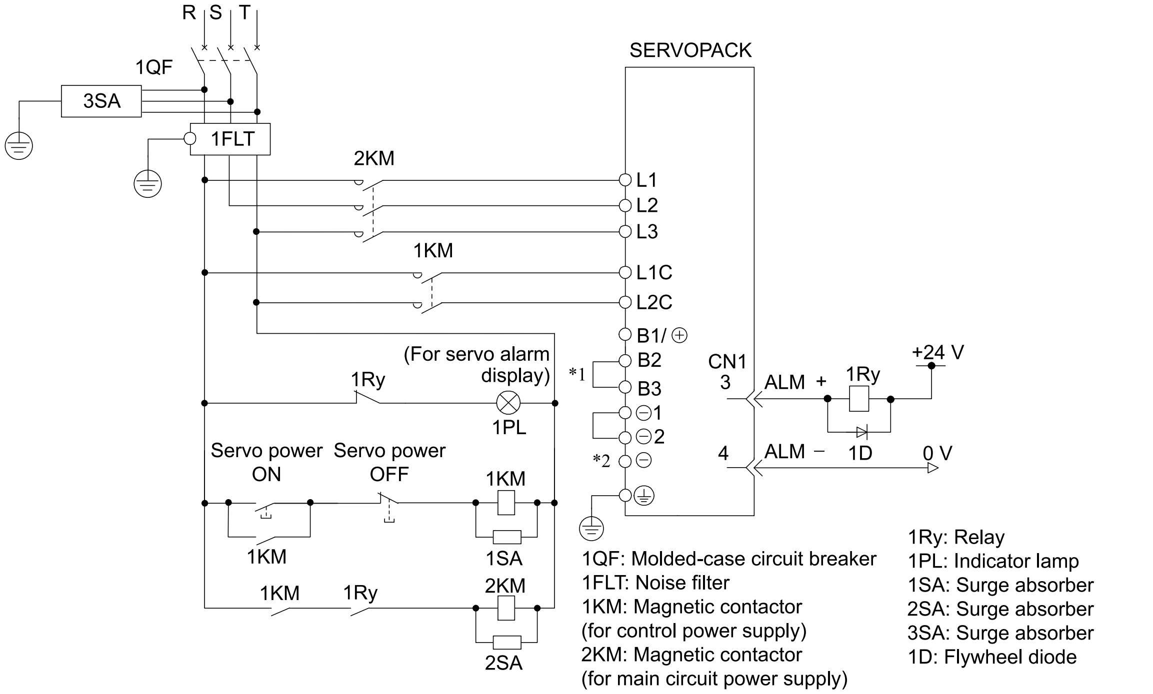
Wait for at least 20 minutes (or 100 minutes when using DC power supply input) after turning OFF the power and then make sure that the CHARGE indicator is not lit before starting wiring or inspection work. Do not touch the main circuit terminals while the CHARGE indicator is lit because high voltage may still remain in the SERVOPACK even after turning OFF the power.

There is a risk of electric shock.

4.3.4 Power Supply Wiring Diagrams

(1) Using Only One SERVOPACK

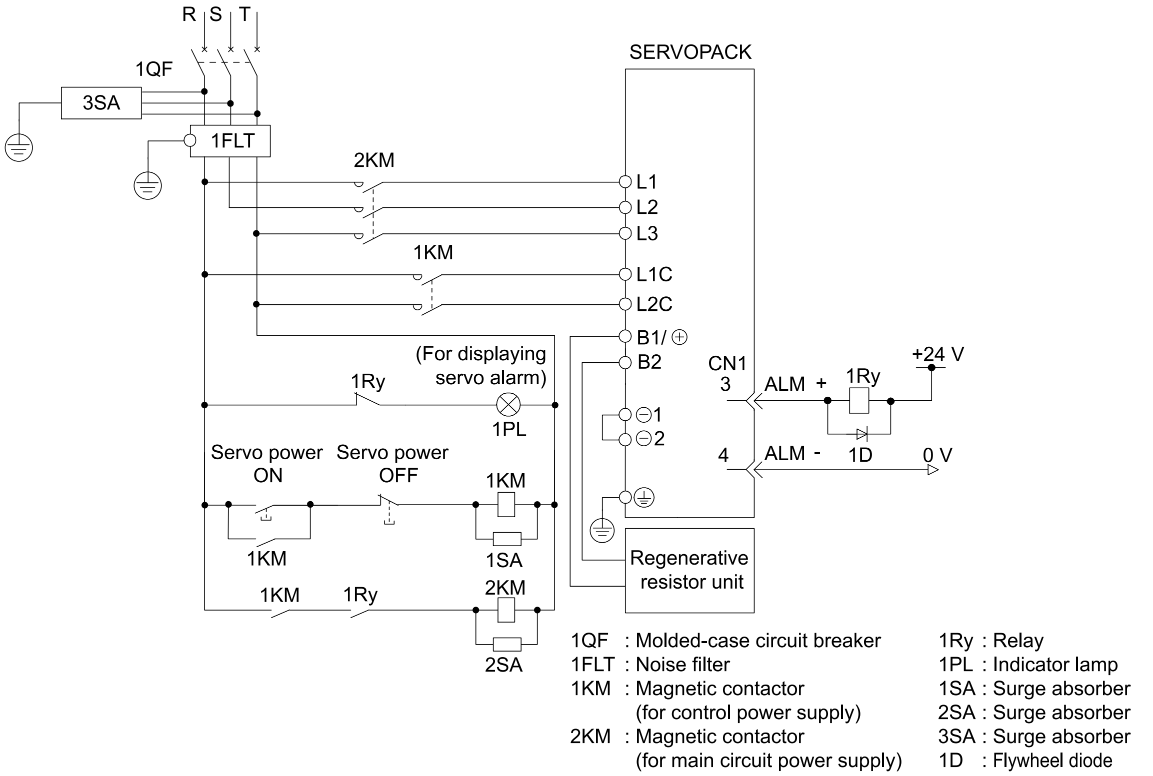
(a) Wiring Example for Three-Phase, 200 VAC Power Supply Input: SGDXS-R70A, -1R6A, -2R8A, -3R8A, -5R5A, -7R6A, -120A, -180A, -200A, -330A



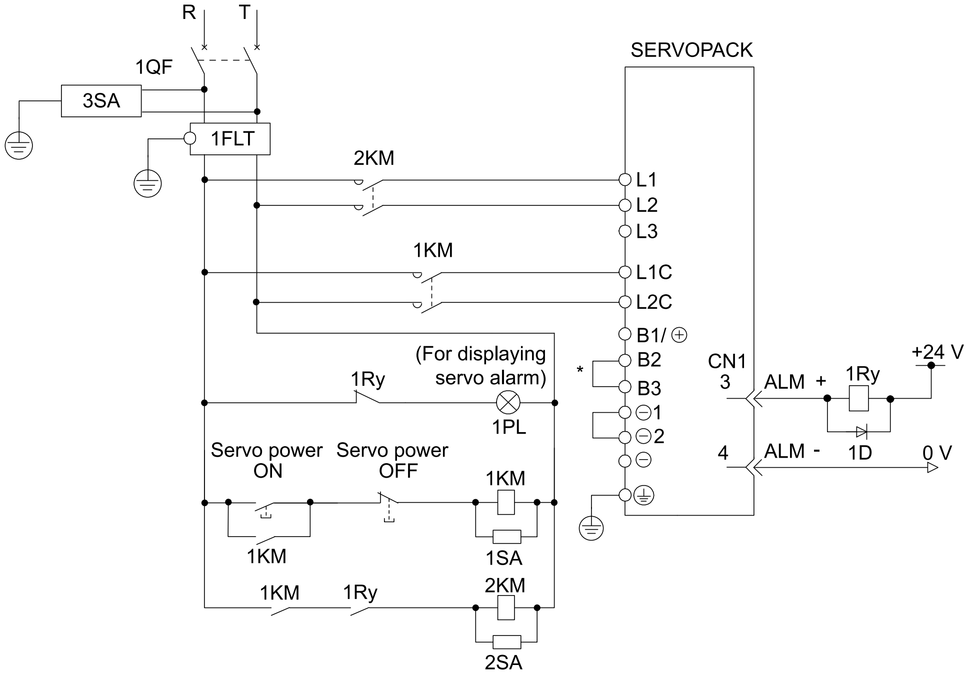
*1 You do not have to connect B2 and B3 for the following models: SGDXS-R70A, -R90A, -1R6A, -2R8A. Do not connect them.

*2 A SGDXS-330A SERVOPACK does not have a ⊖terminal.

(b) Wiring Example for Three-Phase, 200 VAC Power Supply Input: SGDXS-470A, -550A, -590A, -780A



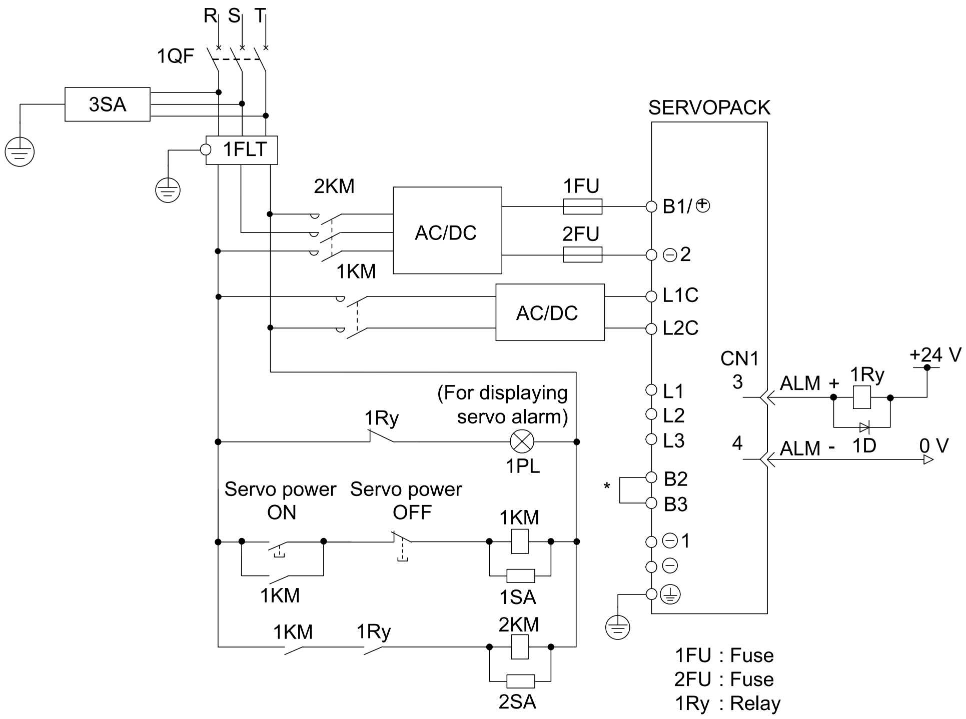
(c) Wiring Example for Single-Phase, 200-VAC Power Supply Input



1QF : Molded-case circuit breaker
1FLT : Noise filter
1KM : Magnetic contactor (for control power supply)
2KM : Magnetic contactor (for main circuit power supply)
1Ry : Relay
1PL : Indicator lamp
1SA : Surge absorber
2SA : Surge absorber
3SA : Surge absorber
1D : Flywheel diode

*1 You do not have to connect B2 and B3 for the following models: SGDXS-R70A, -R90A, -1R6A, -2R8A. Do not connect them.

(d) Wiring Example for DC Power Supply Input: SGDXS-R70A, -R90A, -1R6A, -2R8A, -3R8A, -5R5A, -7R6A, -120A, -180A, -200A



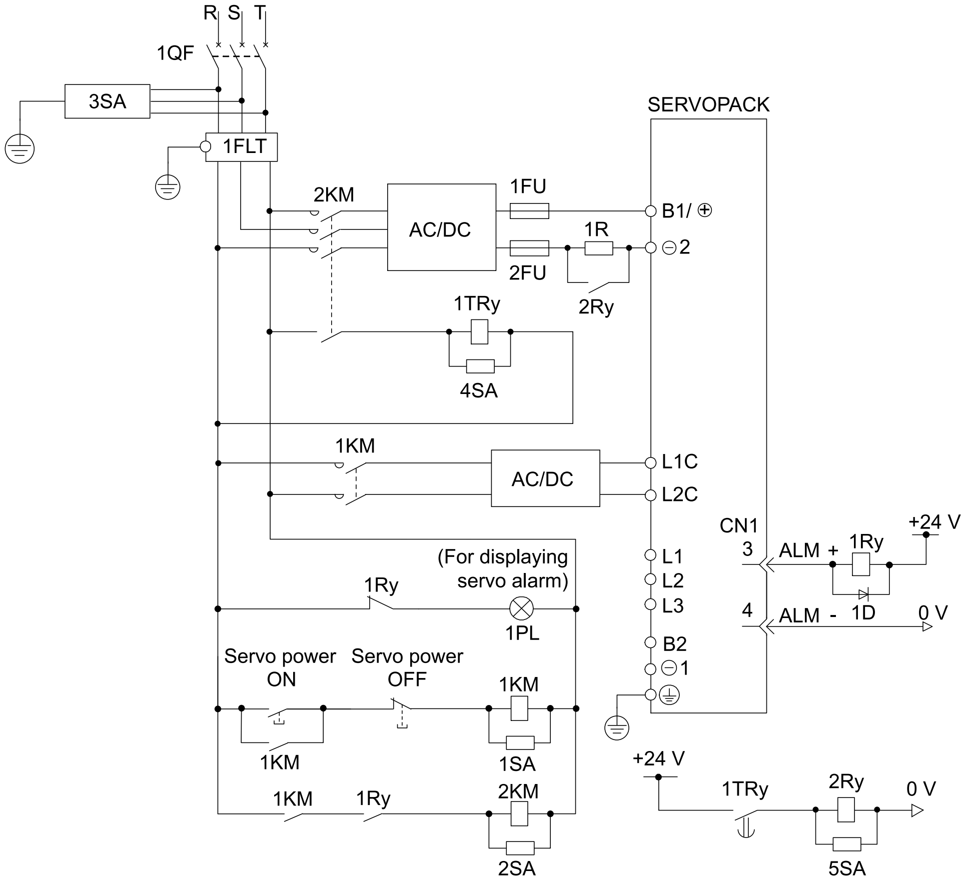
1QF : Molded-case circuit breaker
1FLT : Noise filter
1KM : Magnetic contactor (for control power supply)
2KM : Magnetic contactor (for main circuit power supply)
1FU : Fuse
2FU : Fuse
1Ry : Relay
1PL : Indicator lamp
1SA : Surge absorber
2SA : Surge absorber
3SA : Surge absorber
1D : Flywheel diode

*1 You do not have to connect B2 and B3 for the following models: SGDXS-R70A，-R90A，-1R6A，and -2R8A. Do not connect them.

Wiring and Connecting SERVOPACKs

4

(e) Wiring Example for DC Power Supply Input: SGDXS-330A, -470A, -550A, -590A, -780A



1QF : Molded-case circuit breaker
1FLT : Noise filter
1KM : Magnetic contactor (for control power supply)
2KM : Magnetic contactor
(for main circuit power supply, auxiliary contact)
1FU : Fuse, positive side
2FU : Fuse, negative side
1Ry : Relay
2Ry : Relay (for inrush current suppression resistor short)
1TRy : Timer relay
1PL : Indicator lamp

1SA : Surge absorber
2SA : Surge absorber
3SA : Surge absorber
4SA : Surge absorber
5SA : Surge absorber
1D : Flywheel diode
1R : External inrush current suppression resistor

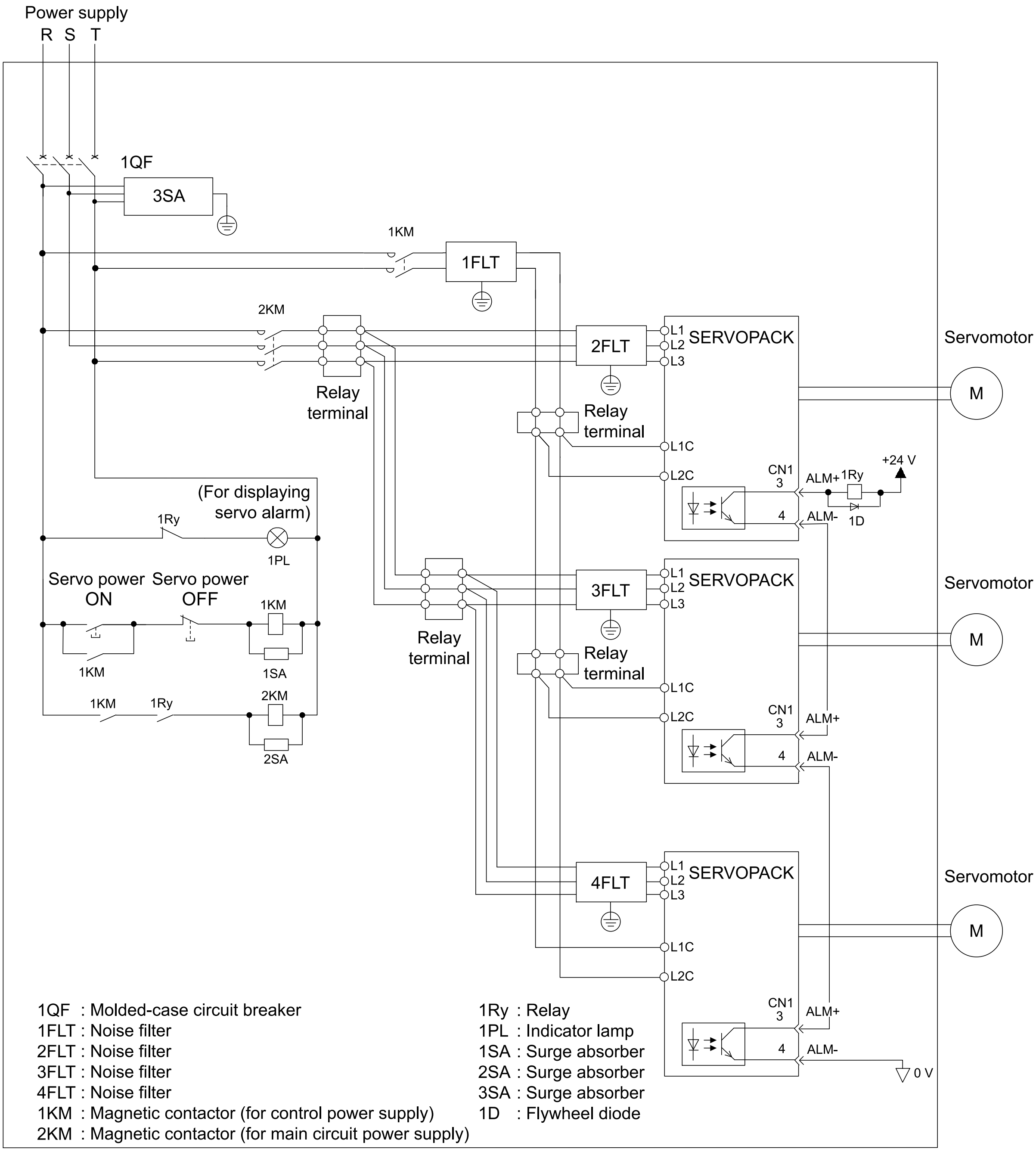
(2) Using More Than One SERVOPACK

Connect the ALM (Servo Alarm Output) signal 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 manual for details.

Σ-X-Series Σ-XS/Σ-XW SERVOPACK Safety Precautions (Manual No.: TOMP C710812 00)

4.3.5 Wiring Regenerative Resistors

This section describes how to connect external regenerative resistors.

Refer to the following manual to select external regenerative resistors.

Σ-X-Series Peripheral Device Selection Manual (Manual No.: SIEP C710812 12)

⚠ WARNING

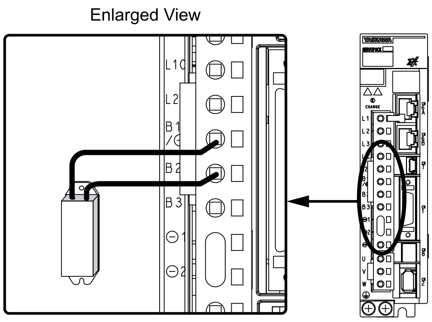
Be sure to wire regenerative resistors correctly. Do not connect B1/ ⊕and B2.

Doing so may result in fire or damage to the regenerative resistor or SERVOPACK.

(1) Connecting Regenerative Resistors

(a) SERVOPACK Models SGDXS-R70A, -R90A, -1R6A, and -2R8A,

1. **Connect the external regenerative resistor between the B1/⊕ and B2 terminals on the SERVOPACK.**



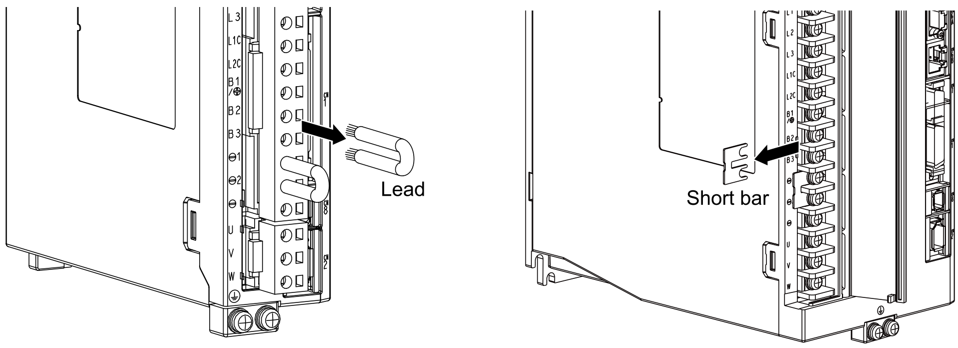
2. **Set Pn600 (Regenerative Resistor Capacity) and the Pn603 (Regenerative Resistance).**

   Refer to the following section for details on the settings.

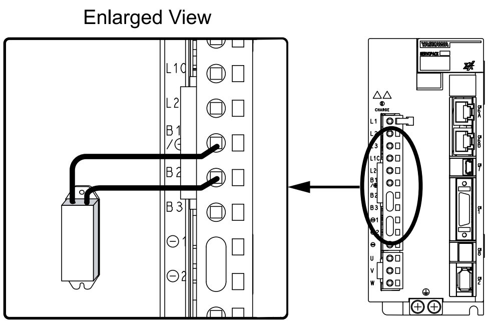
   ☞ *5.18 Setting the Regenerative Resistor Capacity on page 200*

(b) SERVOPACK Models SGDXS-3R8A, -5R5A, -7R6A, -120A, -180A, -200A, -330A

1. **Remove the jumper (lead or short bar) from between the B2 and B3 terminals on the SERVOPACK.**



2. **Connect the external regenerative resistor between the B1/⊕ and B2 terminals.**



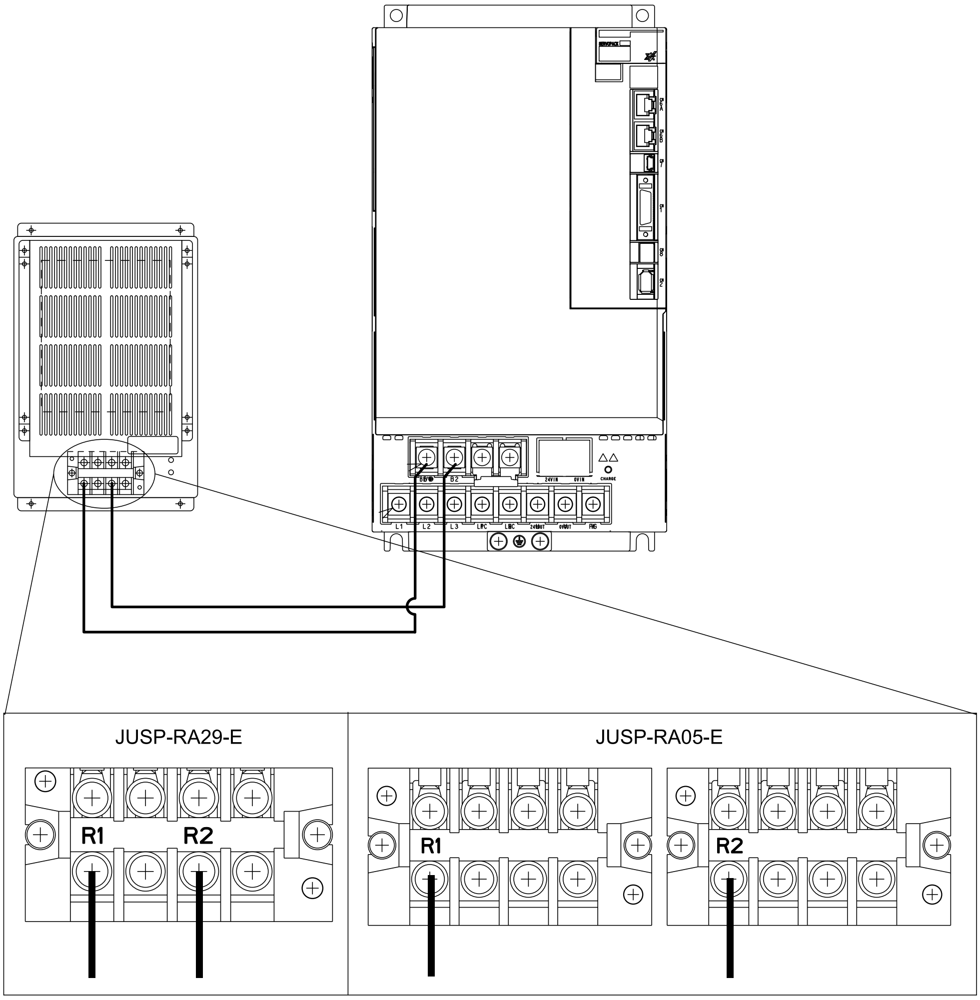
3. **Set Pn600 (Regenerative Resistor Capacity) and Pn603 (Regenerative Resistance).**

   Refer to the following section for details on the settings.

   ☞ *5.18 Setting the Regenerative Resistor Capacity on page 200*

(c) SERVOPACK Models SGDXS-470A, -550A, -590A, and -780A

1. **Connect the R1 and R2 terminals on the regenerative resistor unit to the B1/⊕ and B2 terminals on the SERVOPACK.**



2. **Set Pn600 (Regenerative Resistor Capacity) and Pn603 (Regenerative Resistance) as required.**
   - When using the Yaskawa-recommended regenerative resistor unit, use the default settings for Pn600 and Pn603.
   - If you use any other external regenerative resistor, set Pn600 and Pn603 according to the specifications of the regenerative resistor.

   Refer to the following section for details on the settings.

   ☞ *5.18 Setting the Regenerative Resistor Capacity on page 200*

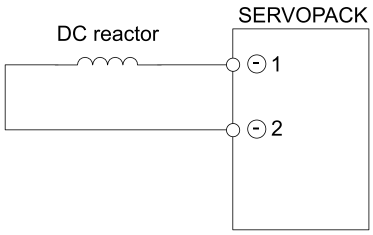
4.3.6 Wiring Reactors for Harmonic Suppression

You can connect a reactor for harmonic suppression to the SERVOPACK when harmonic suppression is required. Refer to the following manual for details on reactors for harmonic reactors.

📖 Σ-X-Series Peripheral Device Selection Manual (Manual No.: SIEP C710812 12)

Refer to the following figures to connect reactors.

< SERVOPACK with Three-Phase, 200-VAC Power Supply Input >



Note:

1. Connection terminals ⊖1 and ⊖2 for a DC reactor are connected when the SERVOPACK is shipped. Remove the lead wire and connect a DC reactor.
2. Reactors are optional products. (Purchase them separately.)

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, W	Servomotor terminals	Refer to the following section for the wiring procedure. ☞ *4.3.2 Wiring Procedure for Main Circuit Connector on page 111*
⏚	Ground terminal	-
CN2	Encoder connector	-

4.4.2 Pin Layout of Connector for Encoder Cables (CN2)

(1) When Using a Rotary Servomotor

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

*1 No wiring is required for an incremental encoder or a batteryless absolute encoder.

(2) When Using a Direct Drive Servomotor

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

(3) 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

(1) When Using an Absolute Encoder

If you use an absolute encoder but not a booster unit, use one of the following methods to wire the devices.

- Use the encoder cable included with the JUSP-BA01-E battery unit.
- Install a battery on the host controller.

If you use a booster unit and an absolute encoder, use the encoder cable included with the JUSP-BA01-E battery unit.

Refer to the following section for the battery replacement procedure.

☞ *13.1.3 Replacing the Battery on page 539*

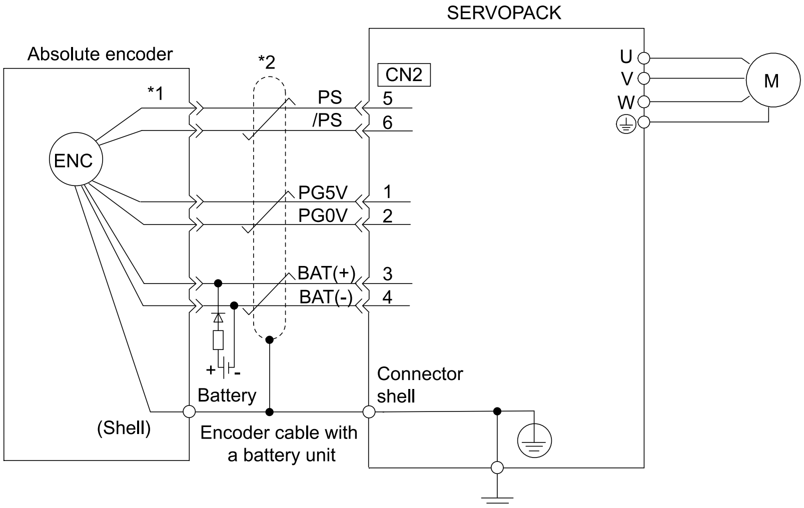


Figure 4.1 Wiring Example When Using an Encoder Cable with a Battery Unit

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

*2 indicates shielded twisted-pair cable.

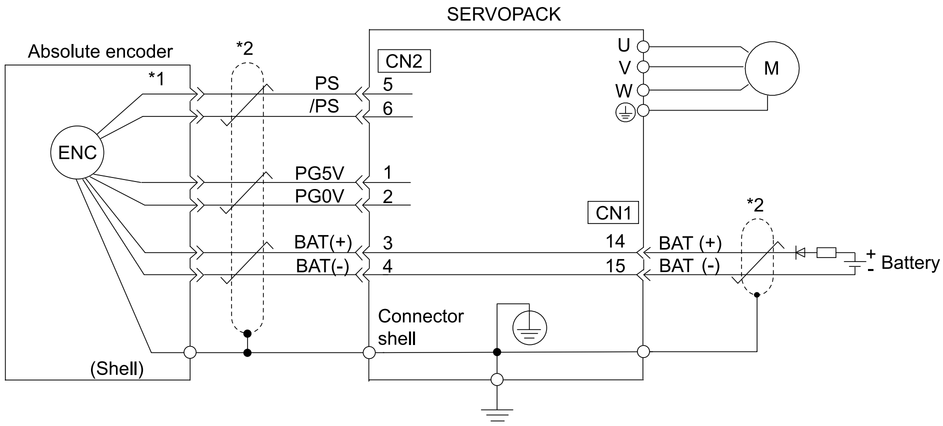


Figure 4.2 Wiring Example When Installing a Battery on the Host Controller

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

*2 indicates shielded twisted-pair cable.

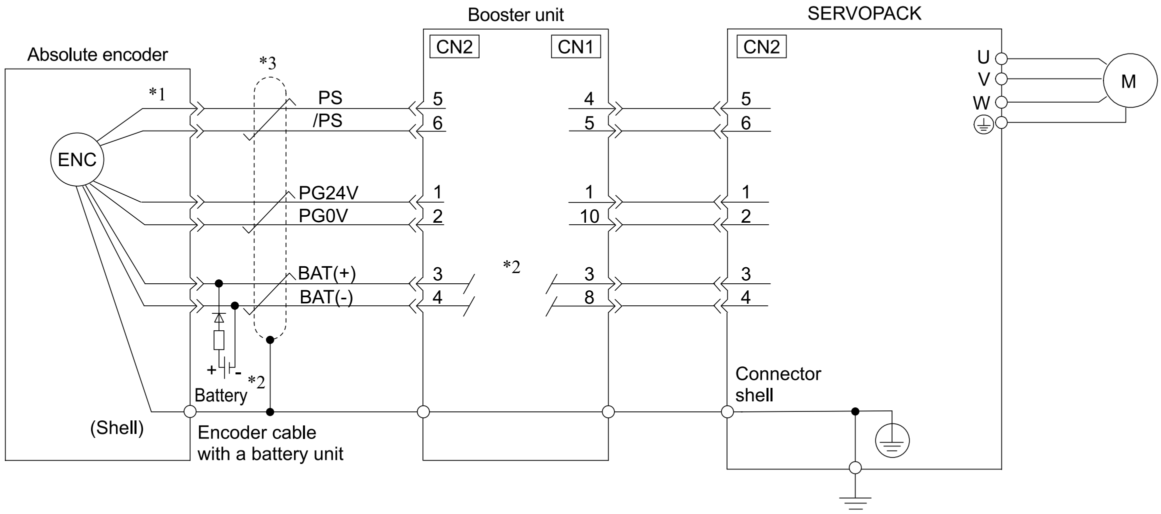


Figure 4.3 Wiring Example When Using a Booster Unit and Absolute Encoder

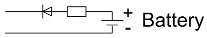
*1 The absolute encoder pin numbers for wiring the connector depend on the servomotor that you use.

*2 CN1-3 and CN2-3 as well as CN1-8 and CN2-4 on the booster unit are not connected internally. For this reason, connect the battery to the encoder as shown in the figure when you use a booster unit and an absolute encoder.

*3 indicates shielded twisted-pair cable.

Important

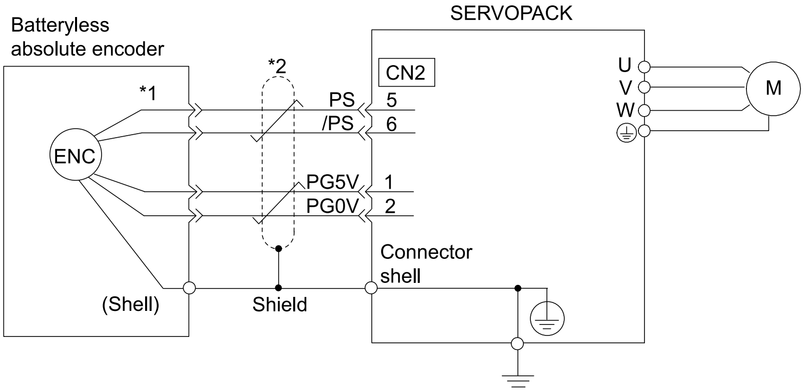
- When Installing a Battery on the Encoder Cable
  Use the encoder cable with a battery unit that is specified by Yaskawa.
  Refer to the following manual for details.
  Σ-X-Series Peripheral Device Selection Manual (Manual No.: SIEP C710812 12)
- When Installing a Battery on the Host Controller
  Insert a diode near the battery to prevent reverse current flow.
  <Circuit Example>



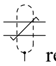
Required Component Specifications

- Schottky Diode
  Reverse voltage: Vr ≧ 40 V
  Forward voltage: Vf ≦ 0.37 V
  Reverse current: Ir ≦ 5 μA
  Junction temperature: Tj ≧ 125°C
- Resistor
  Resistance: 22 Ω
  Tolerance: ±5% max.
  Rated power: 0.25 W min.

(2) When Using a Batteryless Absolute Encoder



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

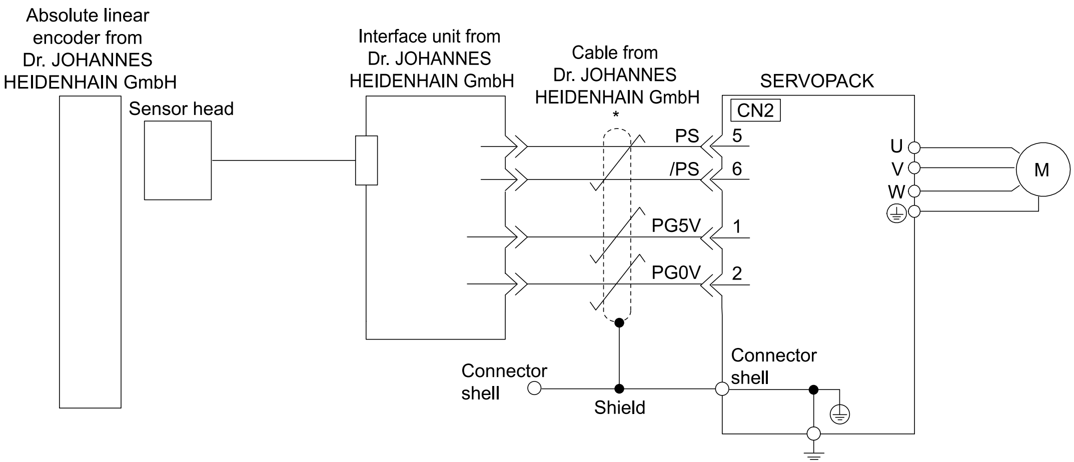
*2  represents a shielded twisted-pair cable.

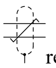
(3) When Using an Absolute Linear Encoder

The wiring depends on the manufacturer of the linear encoder.

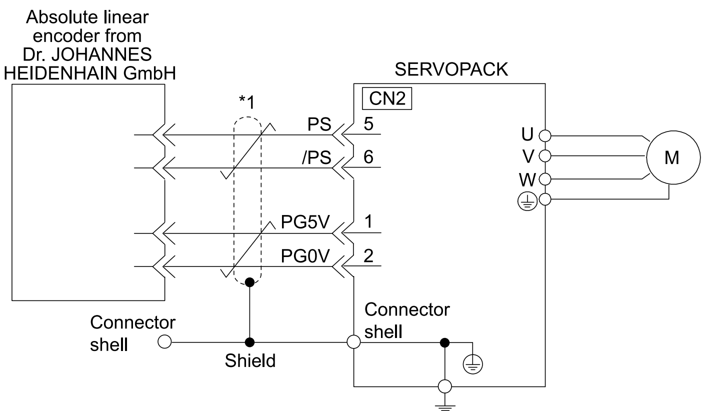
(a) Connections to Linear encoder from Dr. JOHANNES HEIDENHAIN GmbH

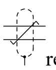
◆ LC115, LC415



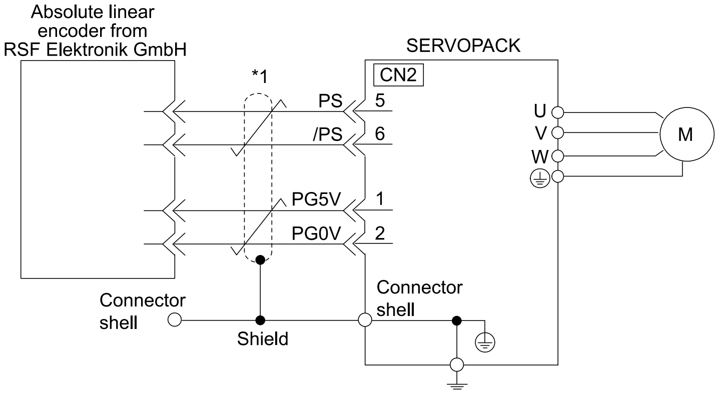
*1  represents a shielded twisted-pair cable.

◆ LIC4190 Series and LIC2190 Series



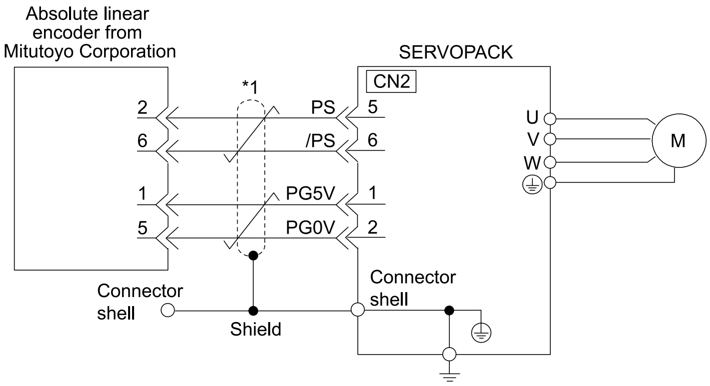
*1  represents a shielded twisted-pair cable.

(b) Connections to Linear Encoder from RSF Elektronik GmbH



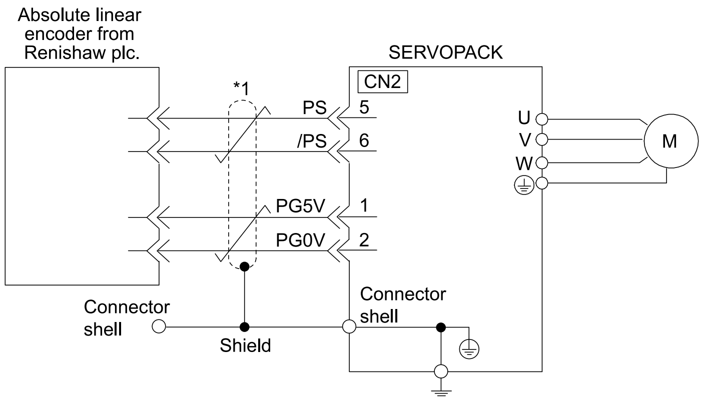
*1 represents a shielded twisted-pair cable.

(c) Connections to Absolute Linear Encoder from Mitutoyo Corporation



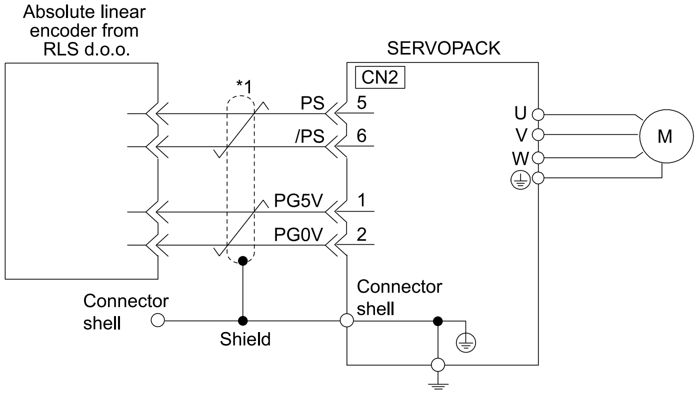
*1 represents a shielded twisted-pair cable.

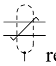
(d) Connections to Absolute Linear Encoder from Renishaw PLC



*1 represents a shielded twisted-pair cable.

(e) Connections to Linear Encoder from RLS d.o.o.



*1  represents a shielded twisted-pair cable.

(f) Connections to Absolute Linear Encoder from Magnescale Co., Ltd.

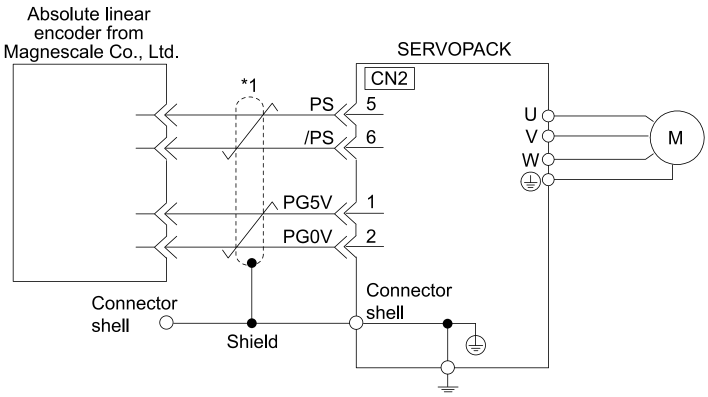
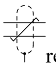
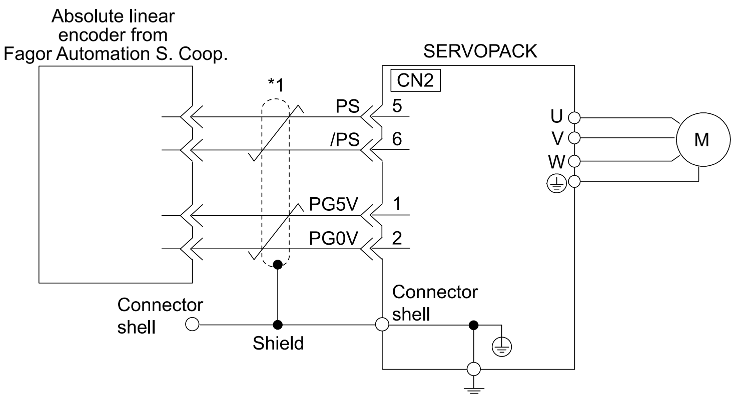
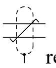


Figure 4.4 SR77, SR87, SQ47, and SQ57

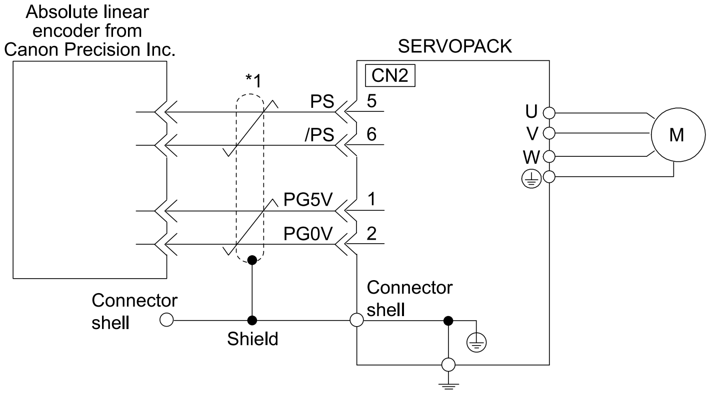
*1  represents a shielded twisted-pair cable.

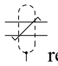
(g) Connections to Linear Encoder from Fagor Automation S. Coop.



*1  represents a shielded twisted-pair cable.

(h) Connections to Absolute Linear Encoder from Canon Precision Inc.

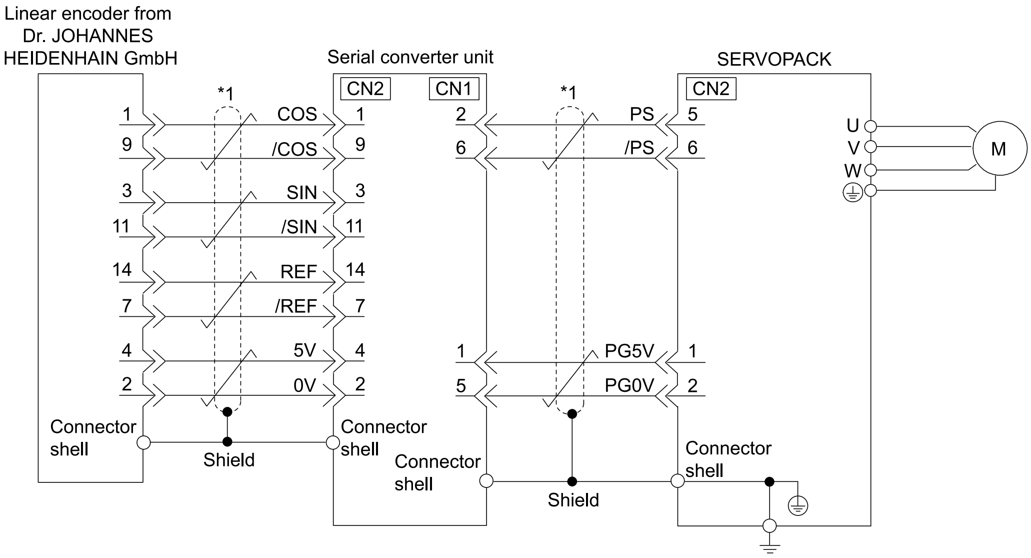


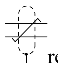
*1  represents a shielded twisted-pair cable.

(4) When Using an Incremental Linear Encoder

The wiring depends on the manufacturer of the linear encoder.

(a) Connections to Linear Encoder from Dr. JOHANNES HEIDENHAIN GmbH



*1  represents a shielded twisted-pair cable.

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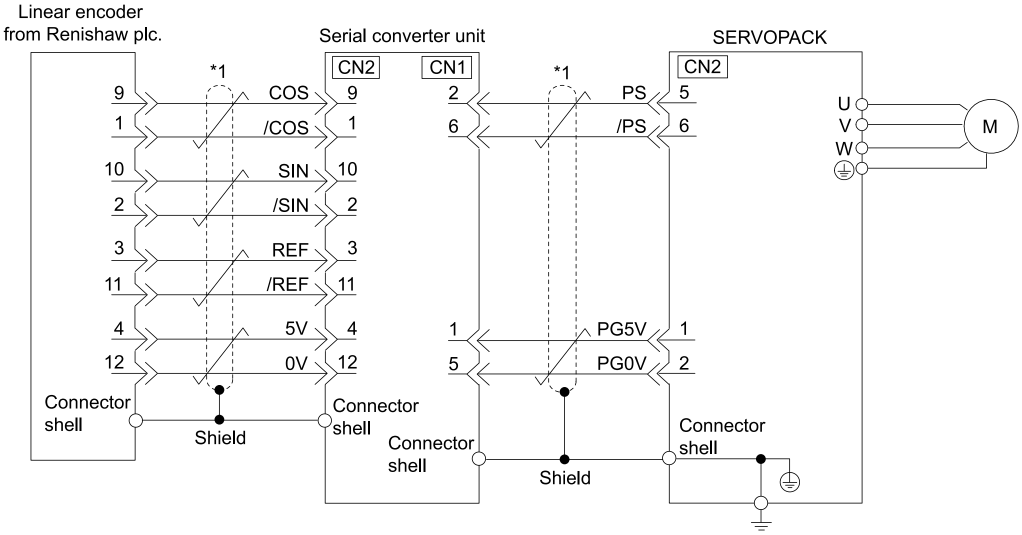
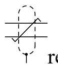
(b) Connections to Linear Encoder from Renishaw PLC

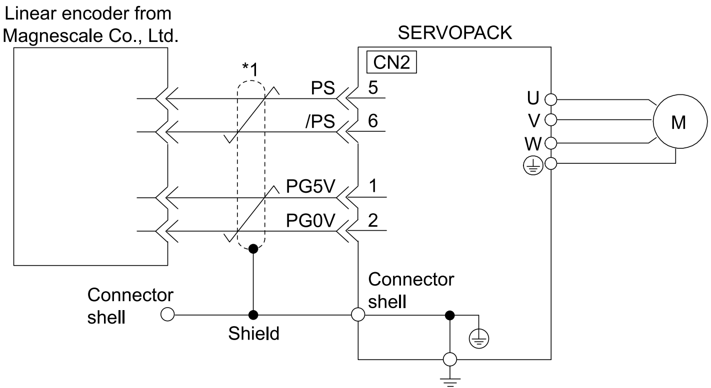


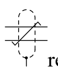
*1  represents a shielded twisted-pair cable.

(c) 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.

◆ SR75 and SR85



*1  represents a shielded twisted-pair cable.

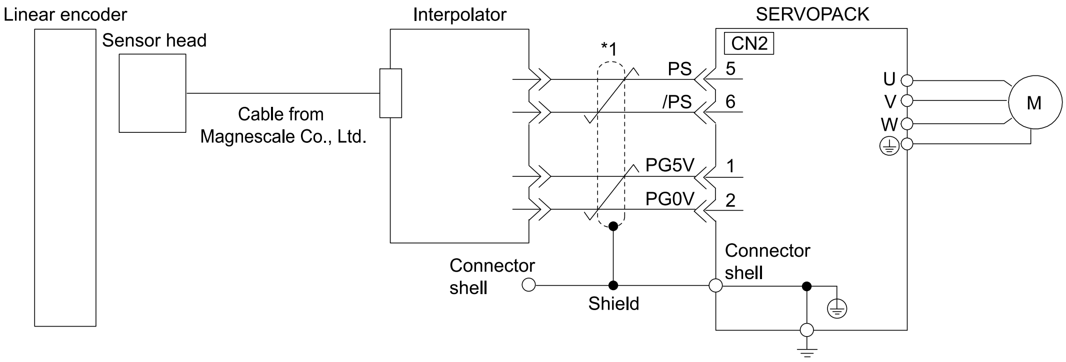
◆ SL700, SL710, SL720, SL730, SQ10

- 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
	MQ10-GLA *2

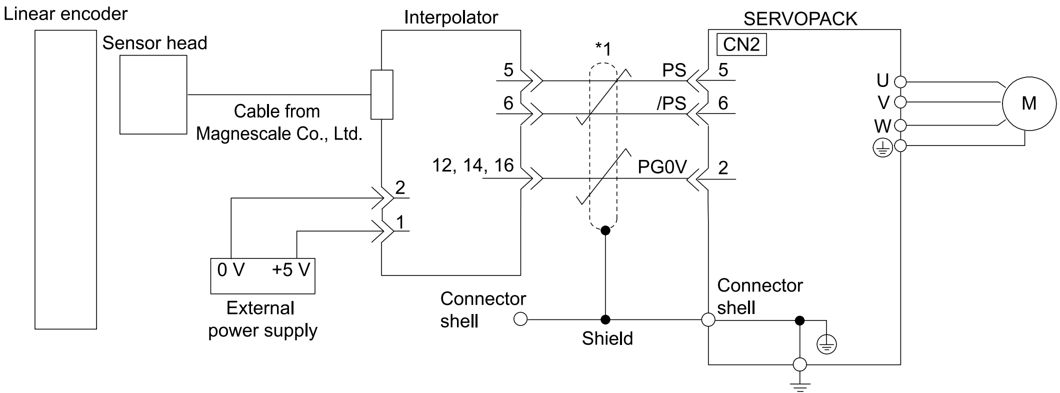
*1 This is the model of the sensor head with interpolator.
*2 This is the model of the interpolator.



*1 represents a shielded twisted-pair cable.

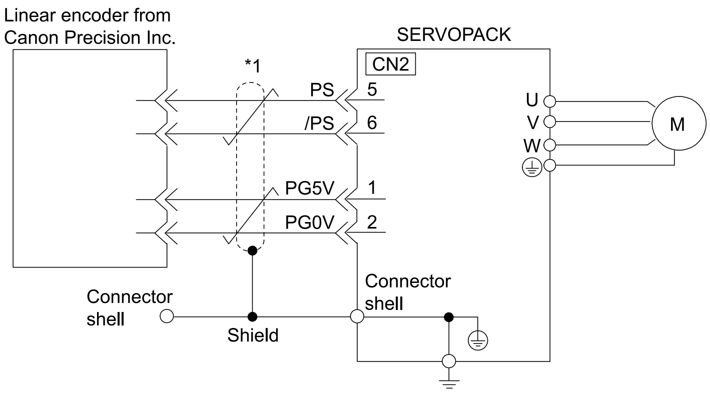
◆ SL700, SL710, SL720, and SL730

- MJ620-T13 Interpolator



*1 represents a shielded twisted-pair cable.

(d) Connections to Linear Encoder from Canon Precision Inc.



*1 represents a shielded twisted-pair cable.

4.4.4 Wiring the SERVOPACK to the Holding Brake

Important

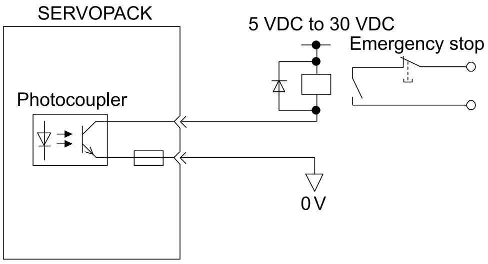
- If you use a rotary servomotor, select a surge absorber according to the brake current and brake power supply. Refer to the relevant manual in the following list for details.

  Σ-X-series Peripheral Device Selection Manual (Manual No.: SIEP C710812 12)

- After the surge absorber is connected, check the brake operation delay time in your application. The surge absorber may affect the brake operation delay time.

  Configure the relay circuit to activate the holding brake for an emergency stop.

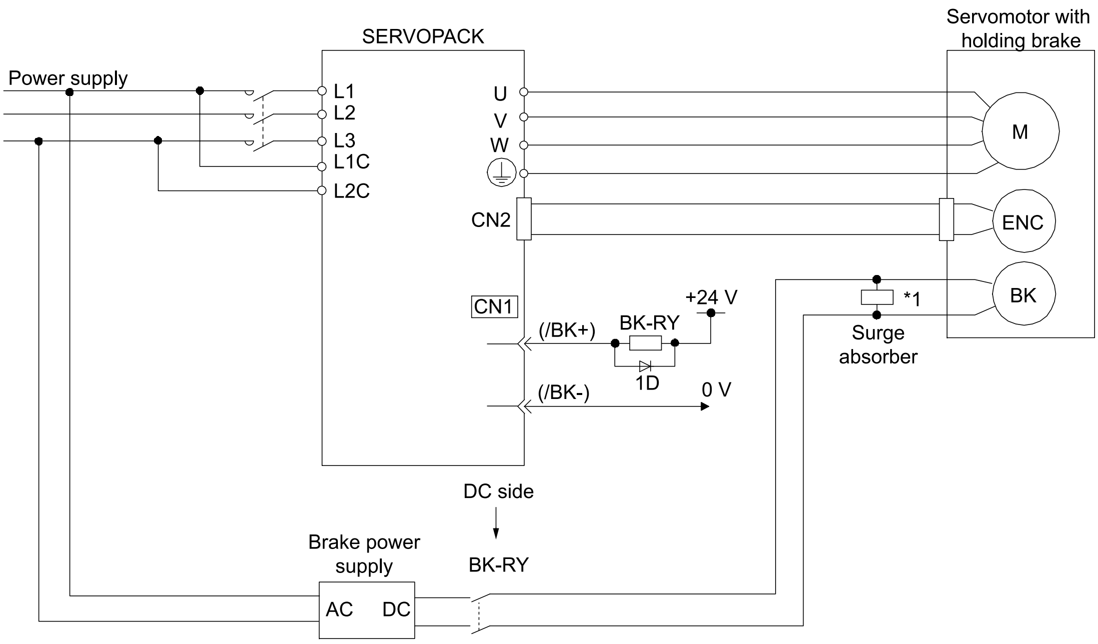
  < Relay Circuit Example >



- You can change the output signal allocation of the /BK signal. Refer to the following section for details.

  5.12.2 /BK (Brake Output) Signal on page 180

- 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.



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

*1 Install the surge absorber near the brake terminals on the servomotor.

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.

(1) Input Signals

Default settings are given in parentheses.

Signal	Pin No.	Name	Function	Reference Page
/SI1 *1 (P-OT)	7	General-Purpose Sequence Input 1 (Forward Drive Prohibit Input)	You can allocate the input signal to use with a parameter. (Stops servomotor drive (to prevent over-travel when the moving part of the machine exceeds the range of movement.)	174
/SI2 *1 (N-OT)	8	General-Purpose Sequence Input 2 (Reverse Drive Prohibit Input)		
/SI3 *1 (/DEC *2)	9	General-Purpose Sequence Input 3 (Origin Return Deceleration Switch Input)	You can allocate the input signal to use with a parameter. (Connects the deceleration limit switch for origin return.)	–
/SI4 *1 (/EXT1 *2)	10	General-Purpose Sequence Input 4 (External Latch Input 1)	You can allocate the input signal to use with a parameter. (Connect the external signals that latch the current feedback pulse counter.)	–
/SI5 *1 (/EXT2 *2)	11	General-Purpose Sequence Input 5 (External Latch Input 2)		
/SI6 *1 (/EXT3 *2)	12	General-Purpose Sequence Input 6 (External Latch Input 3)		
/SI0 *1	13	General-Purpose Sequence Input 0	You can allocate the input signal to use with a parameter. (Used for general-purpose input.) You can monitor this signal in the I/O monitor field 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.	135
BAT+	14	Battery for Absolute Encoder (+)	These are the pins to connect the absolute encoder backup battery. **Note:** • Do not connect these pins if you use the encoder cable with a battery unit. • Do not connect these pins if you use a booster unit. Always use an encoder cable with a battery unit to connect the booster unit and absolute encoder.	121
BAT-	15	Battery for Absolute Encoder (-)		
TH	5	Overheat Protection Input	Inputs the overheat protection signal from a linear servomotor or from a sensor attached to the machine.	267

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

☞ *6.1.3 Input Signal Allocations on page 210*

*2 For details on usage, refer to the following manuals that correspond to the communications references being used.

Σ-7/Σ-X-Series MECHATROLINK-4 Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800002 32)

Σ-7/Σ-X-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

The /DEC (Origin Return Deceleration Switch Input) signal is equivalent to the ZRET (Origin Return) command. The /EXT1 to /EXT3 (External Latch Inputs 1 to 3) signals are equivalent to EXT1 to EXT3 of SVCMD_IN.
This is SVCMD_IO and not SVCMD_IN when using MECHATROLINK-III communications.

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.

(2) Output Signals

Default settings are given in parentheses.

Signal	Pin No.	Name	Function	Reference Page
ALM+	3	Servo Alarm Output	Turns OFF (opens) when an error is detected.	215
ALM-	4			
/SO1+ (/BK+)	1	General-Purpose Sequence Output 1 (Brake Output) *1, *2	You can allocate the output signal to use with a parameter. (Controls the brake. The brake is released when the signal turns ON (closes).)	179
/SO1- (/BK-)	2			
/SO2+	23	General-Purpose Sequence Output 2 *1, *2	Used for general-purpose outputs. Set the parameters to allocate functions.	–
/SO2-	24			
/SO3+	25	General-Purpose Sequence Output 3 *1, *2		
/SO3-	26			
PAO	17	Encoder Divided Pulse Output, Phase A *3	Output the encoder divided pulse output signals with a 90° phase differential.	240, 249
/PAO	18			
PBO	19	Encoder Divided Pulse Output, Phase B *3		
/PBO	20			
PCO	21	Encoder Divided Pulse Output, Phase C *3	Outputs the origin signal once every encoder rotation.	
/PCO	22			
SG	16	Signal Ground	This is the 0-V signal for the control circuits.	–
FG	Shell	Frame Ground	Connected to the frame ground if the shield of the I/O signal cable is connected to the connector shell.	–

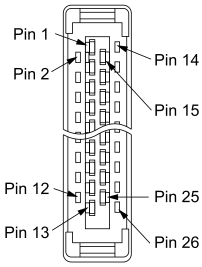
*1 You can change the allocations. Refer to the following section for details.
☞ *6.1.4 Output Signal Allocations on page 213*

*2 When triggers at preset positions is enabled, the normal outputs for triggers at preset positions are used. The output signals for triggers at preset positions are output using logical OR. This allows other output signals to also be allocated to the same terminals. Refer to the following section for details on the selections of triggers at preset positions.
☞ *(a) Triggers at Preset Positions Function Selection on page 273*

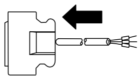
*3 When triggers at preset positions is enabled, the high-speed outputs for triggers at preset positions are used. In this case, encoder divided pulses are not output. Refer to the following section for details on the selections of triggers at preset positions.
☞ *(a) Triggers at Preset Positions Function Selection on page 273*

4.5.2 I/O Signal Connector (CN1) Pin Layout

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



The illustration to the left and the following table are from the direction of the following arrow without the connector shell attached.



2	/SO1- (/BK-)	General-Purpose Sequence Output 1	1	/SO1+ (/BK+)	General-Purpose Sequence Output 1	15	BAT-	Battery for Absolute Encoder (-)	14	BAT+	Battery for Absolute Encoder (+)
4	ALM-	Servo Alarm Output	3	ALM+	Servo Alarm Output	17	PAO	Encoder Divided Pulse Output, Phase A	16	SG	Signal Ground
6	+24VIN	Sequence Input Signal Power Supply Input	5	TH	Overheat Protection Input	19	PBO	Encoder Divided Pulse Output, Phase B	18	/PAO	Encoder Divided Pulse Output, Phase A
8	/SI2 (N-OT)	General-Purpose Sequence Input 2	7	/SI1 (P-OT)	General-Purpose Sequence Input 1	21	PCO	Encoder Divided Pulse Output, Phase C	20	/PBO	Encoder Divided Pulse Output, Phase B
10	/SI4 (/EXT1)	General-Purpose Sequence Input 4	9	/SI3 (/DEC)	General-Purpose Sequence Input 3	23	/SO2+	General-Purpose Sequence Output 2	22	/PCO	Encoder Divided Pulse Output, Phase C
12	/SI6 (/EXT3)	General-Purpose Sequence Input 6	11	/SI5 (/EXT2)	General-Purpose Sequence Input 5	25	/SO3+	General-Purpose Sequence Output 3	24	/SO2-	General-Purpose Sequence Output 2
–	–	–	13	/SI0	General-Purpose Sequence Input 0	–	–	–	26	/SO3-	General-Purpose Sequence Output 3

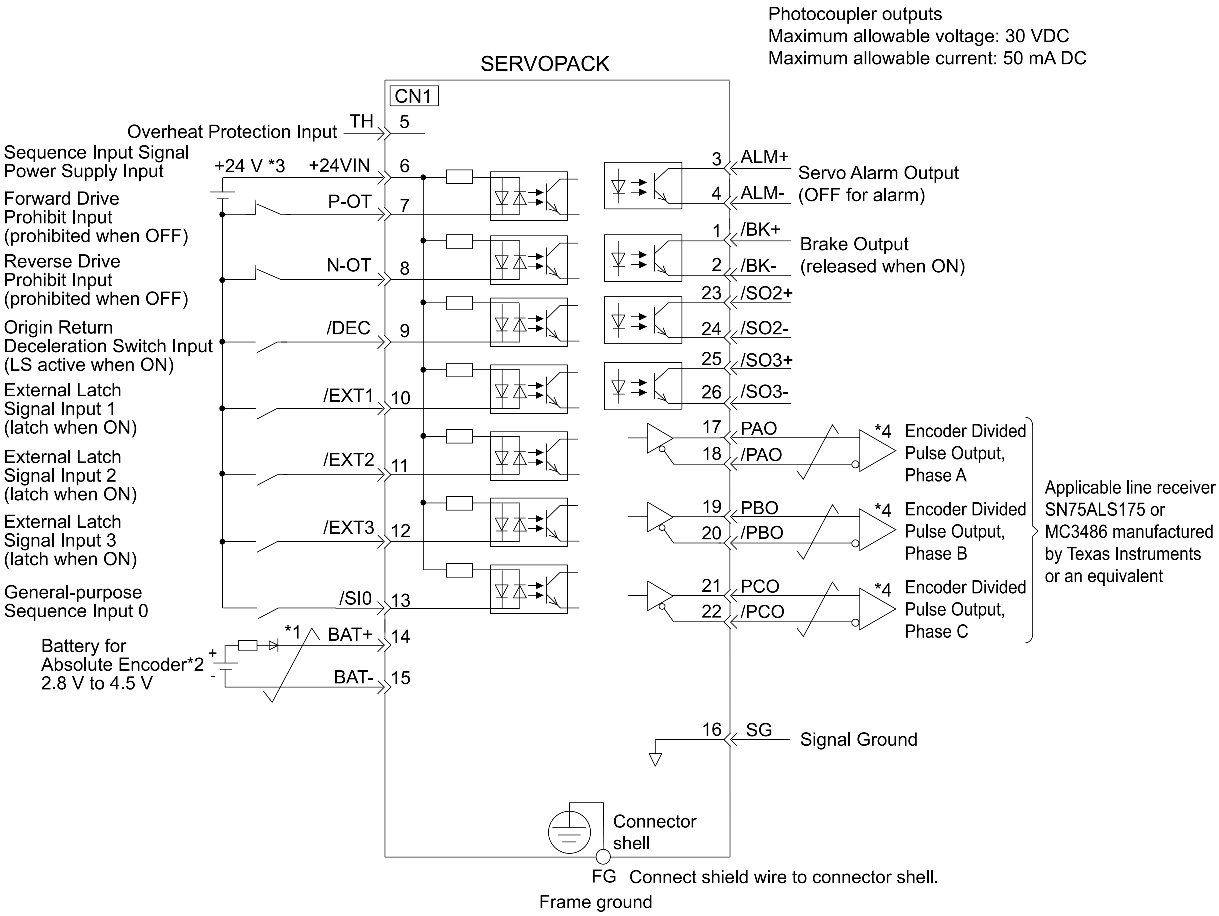
Note:

When using triggers at preset positions, the signals for CN1-17 to CN1-22 differ from those listed above. Refer to the following section for details.

☞ *6.15.2 I/O Signal Connector (CN1) Pin Layout on page 271*

4.5.3 I/O Signal Wiring Examples

(1) When Using a Rotary Servomotor

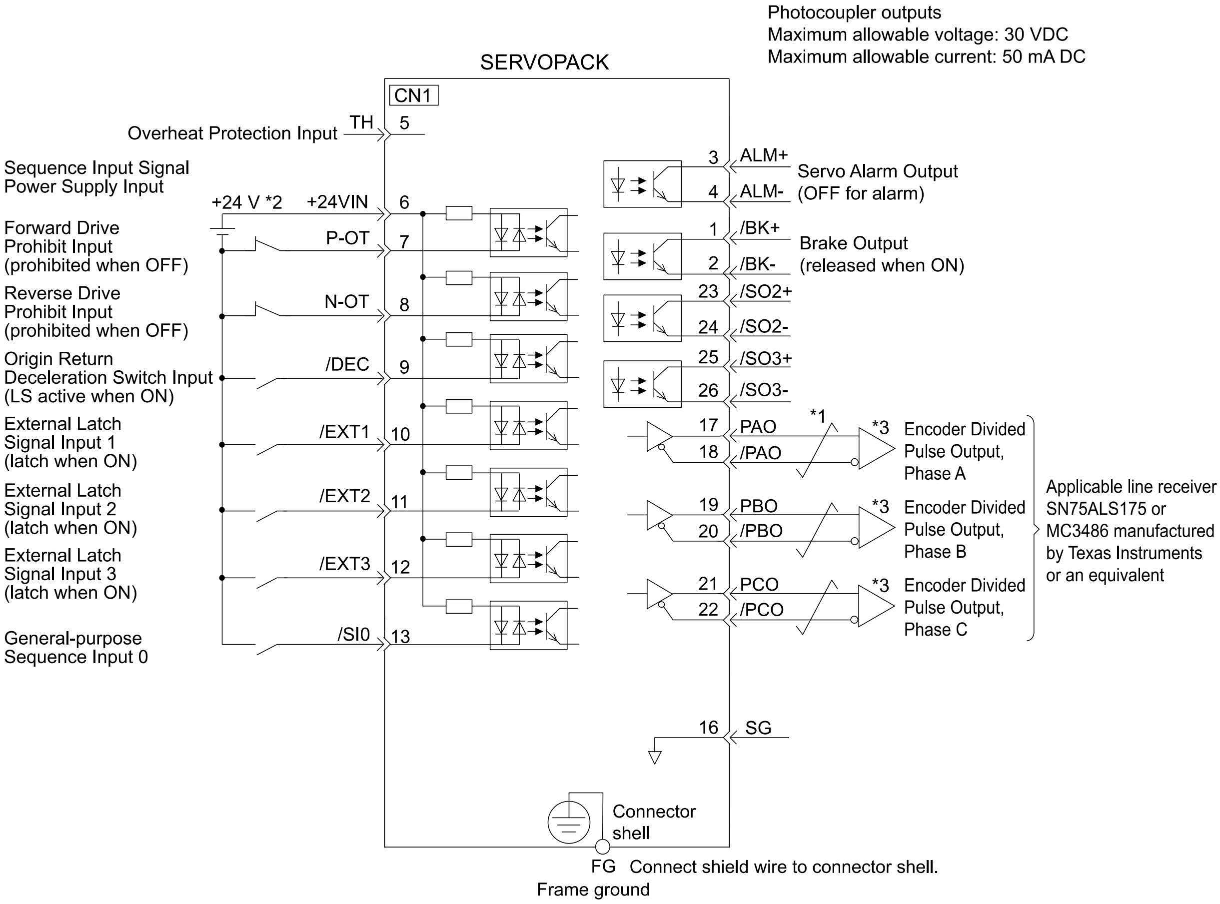


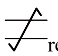
*1 represents twisted-pair wires.
*2 Connect these when using an absolute encoder. If the encoder cable with a battery unit is connected, do not connect a backup battery.
*3 The 24-VDC power supply is not provided by Yaskawa. Use a 24-VDC power supply with double insulation or reinforced insulation.
*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, and /SO3 output signals. Refer to the following section for details.
   ☞ *6.1 Changing Allocations of I/O Signals on page 208*
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.

(2) When 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:

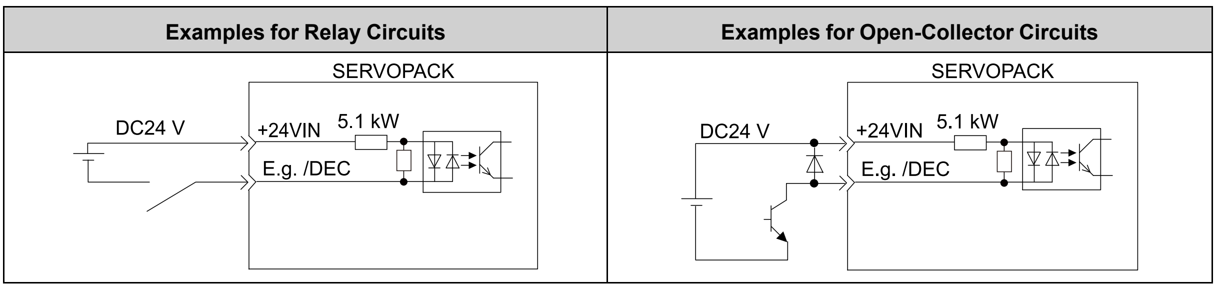
1. You can use parameters to change the functions allocated to the /DEC, P-OT, N-OT, /EXT1, /EXT2, and /EXT3 input signals and the /SO1, /SO2, and /SO3 output signals. Refer to the following section for details.
   ☞ *6.1 Changing Allocations of I/O Signals on page 208*
2. If you use a 24-V brake, install 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.

4.5.4 I/O Circuits

(1) Sequence Input Circuits

(a) Photocoupler Input Circuits

This section describes CN1 connector terminals 6 to 13.



Note:

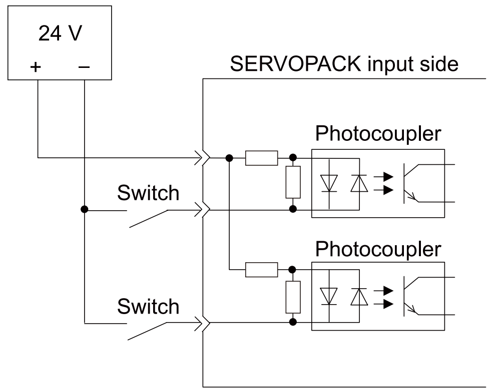
For the external power supply (24 VDC), use a power supply with a capacity of 50 mA or higher.

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

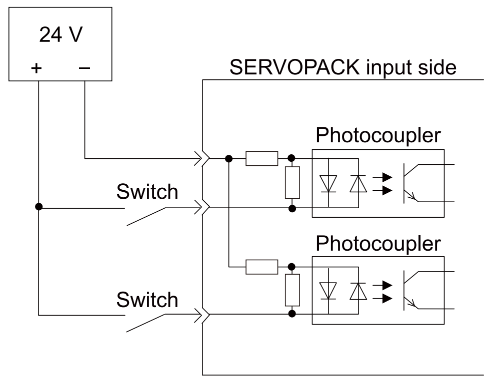
Note:

The connection examples in *4.5.3 I/O Signal Wiring Examples on page 134* are for sink circuit connections.

<table>
<tr><th colspan="2">Sink Circuits</th><th colspan="2">Source Circuits</th></tr>
<tr><td colspan="2">



</td><td colspan="2">



</td></tr>
<tr><td colspan="2">Input signal status</td><td colspan="2">Input signal status</td></tr>
<tr><td>Switch</td><td>Photocoupler</td><td>Switch</td><td>Photocoupler</td></tr>
<tr><td>Close</td><td>ON</td><td>Close</td><td>ON</td></tr>
<tr><td>Open</td><td>OFF</td><td>Open</td><td>OFF</td></tr>
</table>

(2) Sequence Output Circuits

Important

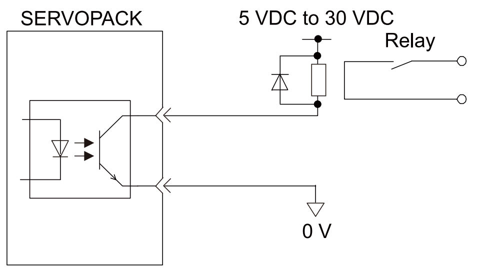
Incorrect wiring or incorrect voltage application to the output circuits may cause short-circuit failures.

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.

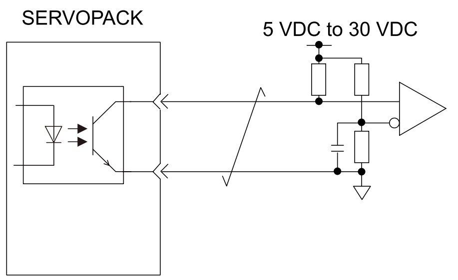
(a) Photocoupler Output Circuits

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

<table>
<tr><th>Examples for Relay Circuits</th><th>Example for Line Receiver Circuit</th></tr>
<tr><td>



</td><td>



</td></tr>
</table>

Note:

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

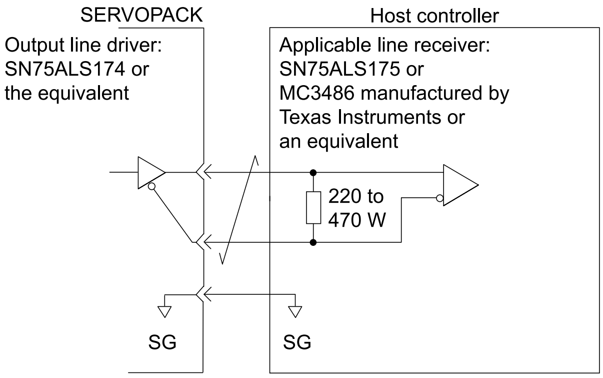
- Maximum allowable voltage: 30 VDC
- Current range: 5 mA to 50 mA DC

(b) 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, PBO, and /PBO), origin pulse signal (PCO and /PCO) are output with line-driver output circuits. Connect the line-driver output circuits to line-receiver circuits at the host controller.

<Example for Line-Receiver Circuit>


SERVOPACK
Output line driver:
SN75ALS174 or
the equivalent
Host controller
Applicable line receiver:
SN75ALS175 or
MC3486 manufactured by
Texas Instruments or
an equivalent
220 to
470 W
SG
SG

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.

☞ *12 Safety Functions on page 523*

4.6.1 Pin Layout of Safety Function Signals (CN8)

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

Whether or not you use the EDM1 signal does not affect the performance level of safety parameters.

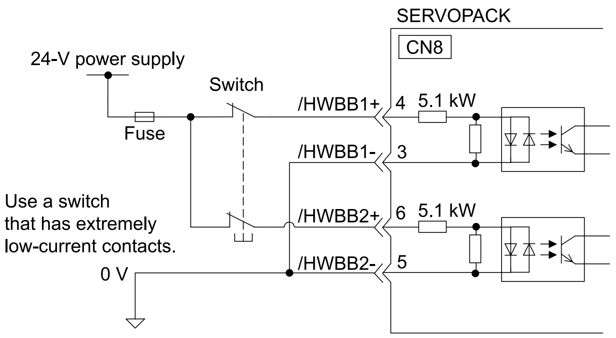
4.6.2 I/O Circuits

> **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.

(1) Safety Input Circuits

Use a 0-V common to connect the Safety Function signals. You must connect redundant input signals.

< Input Signal Connection Example >



(a) Input (HWBB) Signal Specifications

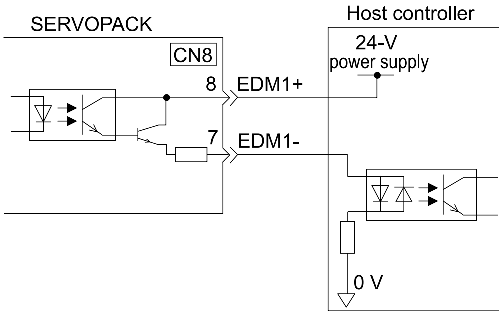
Type	Signal	Connector Pin No.	Status	Meaning
Input	/HWBB1	CN8-4 CN8-3	ON (closed)	Does not activate the HWBB (normal operation).
			OFF (open)	Activates the HWBB (motor current interruption request).
	/HWBB2	CN8-6 CN8-5	ON (closed)	Does not activate the HWBB (normal operation).
			OFF (open)	Activates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

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

Item	Characteristics	Remarks
Internal Impedance	5.1 kΩ	–
Allowable Voltage Range	+24 V± 20%	For the 24-V power supply, use an SELV power supply.
Response Time	4 ms	Time from /HWBB1 and /HWBB2 signals turning OFF until HWBB is activated

(2) Diagnostic Output Circuits

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



(a) EDM1 Output Signal Specifications

Type	Signal	Connector Pin No.	Status	Meaning
Output	EDM1	CN8-8 CN8-7	ON	Both the /HWBB1 and /HWBB2 signals are operating normally.
			OFF	The /HWBB1 signal, the /HWBB2 signal, or both are not operating.

The electrical characteristics of the EDM1 signal are as follows:

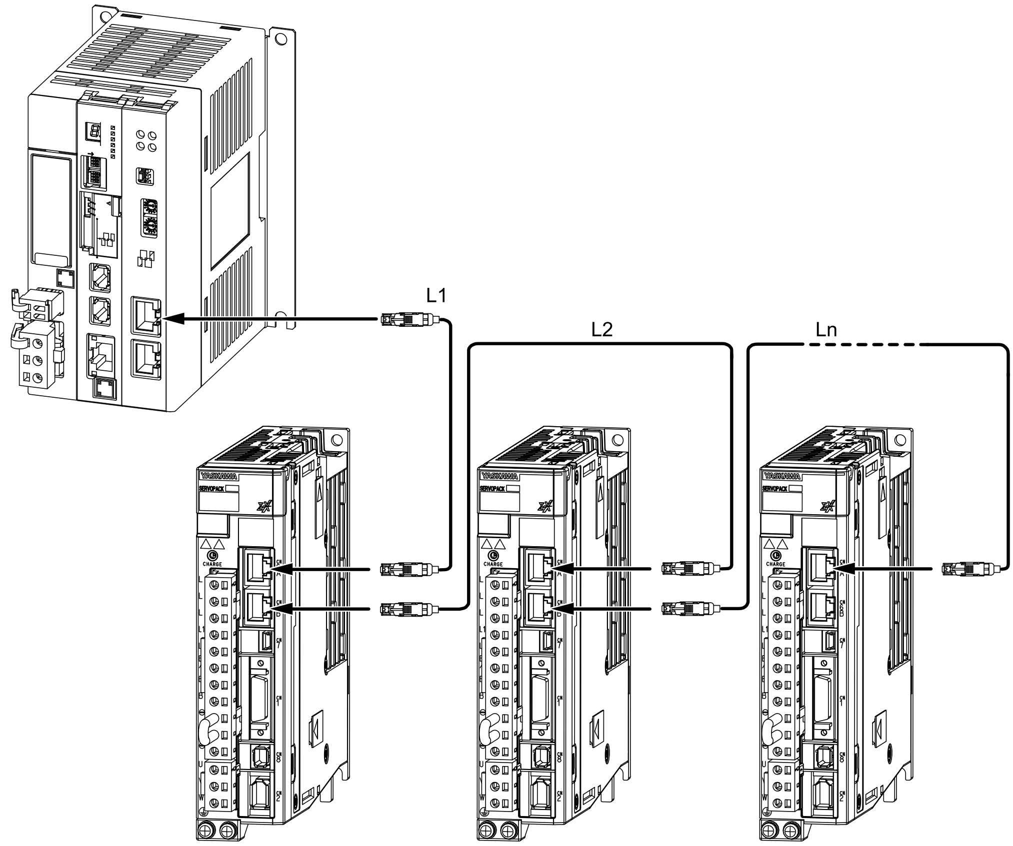
Item	Characteristics	Remarks
Maximum Allowable Voltage	30 VDC	–
Maximum Allowable Current	50 mA DC	–
Maximum ON Voltage Drop	1.0 V	Voltage between EDM1+ and EDM1- when current is 50 mA
Response Time	4 ms	Time from a change in /HWBB1 or /HWBB2 until a change in EDM1

Wiring and Connecting SERVOPACKs

4

4.7 Connecting MECHATROLINK Cables

Connect the MECHATROLINK-4 or MECHATROLINK-III cables to the CN6A and CN6B connectors.



Note:

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

4.8 Connecting the SigmaWin+

To connect a computer on which the SigmaWin+ is installed, connect CN7 on the SERVOPACK.

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

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

Engineering Tool SigmaWin+ Operation Manual (Manual No.: SIET S800001 34)

Information When using MECHATROLINK-4 communications, you can also connect the computer on which the SigmaWin+ is installed to CN6A. However, IP communications must be configured when CN6A is connected. Pn030, Pn032, and Pn034 are used for these settings. Details on the settings are shown below.

Parameter	Ethernet IP Address		Speed Pos Trq	
Pn030	Setting Range	Setting Unit	Default Setting	When Enabled
	00000000h to FFFFFFFFh	–	C0A80101h	After restart

Parameter	Ethernet Subnet Mask		Speed Pos Trq	
Pn032	Setting Range	Setting Unit	Default Setting	When Enabled
	00000000h to FFFFFFFFh	–	FFFFFF00h	After restart

Parameter	Ethernet Default Gateway		Speed Pos Trq	
Pn034	Setting Range	Setting Unit	Default Setting	When Enabled
	00000000h to FFFFFFFFh	–	00000000h	After restart

The relationship between parameter settings and the IP address is shown below. The subnet mask and default gateway are also the same. Substitute the relevant parameter numbers in the following figure.

IP Address (Decimal)	□□□.	□□□.	□□□.	□□□.
Parameter Setting (Hexadecimal)	Fourth byte of Pn030	Third byte of Pn030	Second byte of Pn030	First byte of Pn030

For example, to set the IP address to 192.168.1.2, the setting of Pn030 is as follows:

IP Address (Decimal)	192.	168.	1.	2.
Value of Decimal IP Address Converted to Hexadecimal	C0	A8	01	02
Setting of Pn030	Pn030= C0A80102h			

Information When using MECHATROLINK-III communications, CN6A cannot be used, even if the computer on which the Sigma-Win+ is installed is connected to CN6A. Switch to MECHATROLINK-4 communications or connect CN7 on the SERVOPACK.

Refer to the following section for details on switching between MECHATROLINK-4 communications and MECHA-TROLINK-III communications.

☞ *5.2 MECHATROLINK Communications Settings on page 156*

4.9 Connecting a Digital Operator

To use a digital operator, connect CN7 on the SERVOPACK.

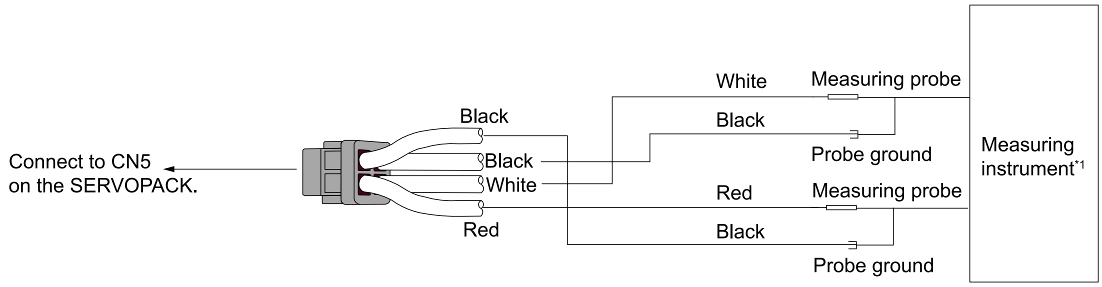
Refer to the following manual for the operating procedures for the digital operator.

Σ-7-/Σ-X-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)

4.10 Using the Analog Monitors

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

- Wiring Example



*1 The measuring instrument is not provided by Yaskawa.

Refer to the following section for information on the monitoring methods for an analog monitor.

☞ *9.3 Monitoring Machine Operation Status and Signal Waveforms on page 460*

5

Basic Functions That Require Setting before Operation

Describes the basic functions that must be set before you start servo system operation. It also describes the setting methods.

5.1 Parameter (Pn□□□) Operations

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

5.1.1 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.

Important

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
Pn00B	n.□□□X	Operator Parameter Display Selection (Speed Pos Trq)		When Enabled
		0 [Default]	Display only setup parameters.	After restart
		1	Display all parameters.	

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

(1) 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.

(2) 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 section for details.

☞ *8.7 Autotuning without a Host Reference on page 344*
☞ *8.8 Autotuning with a Host Reference on page 357*
☞ *8.9 Custom Tuning on page 366*

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

☞ *8.15 Manual Tuning on page 427*

5.1.2 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).

(1) Parameters for Numeric Settings

	Speed Loop Gain			Speed Pos Trq
Pn100	Setting Range	Setting Unit	Default Setting	When Enabled
	10 to 20,000	0.1 Hz	400	Immediately

(1) (2) (3) (4) (5) (6)

No.	Description
(1)	Parameter number
(2)	This is the setting range for the parameter.
(3)	This is the setting unit (setting increment) that you can set for the parameter.
(4)	This is the parameter setting before shipment.
(5)	This is when any change made to the parameter will become effective.
(6)	The control methods for which the parameters apply are given. Speed: A parameter that can be used in speed control. Pos: A parameter that can be used in position control. Trq: A parameter that can be used in torque control. "Torque" is used even for linear servomotor parameters. Grayed-out icons (Speed, Pos, Trq) indicate parameters that cannot be used in the corresponding control method.

(2) Parameters for Selecting Functions

		Encoder Usage	Speed Pos Trq	When Enabled
Pn002	n.□X□□	0 Default	Use the encoder according to encoder specifications.	After restart
		1	Use the encoder as an incremental encoder.	
		2	Use the encoder as a single-turn absolute encoder.	

(1) (2) (3) (4) (5)

<table>
<tr><th>No.</th><th>Description</th></tr>
<tr><td>(1)</td><td>Parameter number</td></tr>
<tr><td>(2)</td><td>The notation “n.□□□□” indicates a parameter for selecting functions. The digit shown as "X" is the content being explained in this parameter.
Notation Example
Notation Examples for Pn002
n. 0 0 0 0
<table>
<tr><th colspan="2">Digit Notation</th><th colspan="2">Numeric Value Notation</th></tr>
<tr><th>Notation</th><th>Meaning</th><th>Notation</th><th>Meaning</th></tr>
<tr><td>Pn002 = n.□□□X</td><td>Indicates the first digit from the right in Pn002.</td><td>Pn002 = n.□□□1</td><td>Indicates that the first digit from the right in Pn002 is set to 1.</td></tr>
<tr><td>Pn002 = n.□□X□</td><td>Indicates the second digit from the right in Pn002.</td><td>Pn002 = n.□□1□</td><td>Indicates that the second digit from the right in Pn002 is set to 1.</td></tr>
<tr><td>Pn002 = n.□X□□</td><td>Indicates the third digit from the right in Pn002.</td><td>Pn002 = n.□1□□</td><td>Indicates that the third digit from the right in Pn002 is set to 1.</td></tr>
<tr><td>Pn002 = n.X□□□</td><td>Indicates the fourth digit from the right in Pn002.</td><td>Pn002 = n.1□□□</td><td>Indicates that the fourth digit from the right in Pn002 is set to 1.</td></tr>
</table></td></tr>
<tr><td>(3)</td><td>This column explains the selections for the function.
In the above example, the first line gives an explanation of when Pn002 = n.□0□□ is set.</td></tr>
</table>

Continued on next page.

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No.	Description
(4)	This is when any change made to the parameter will become effective.
(5)	The control methods for which the parameters apply are given. Speed: A parameter that can be used in speed control. Pos: A parameter that can be used in position control. Trq: A parameter that can be used in torque control. "Torque" is used even for linear servomotor parameters. Grayed-out icons (Speed, Pos, Trq) indicate parameters that cannot be used in the corresponding control method.

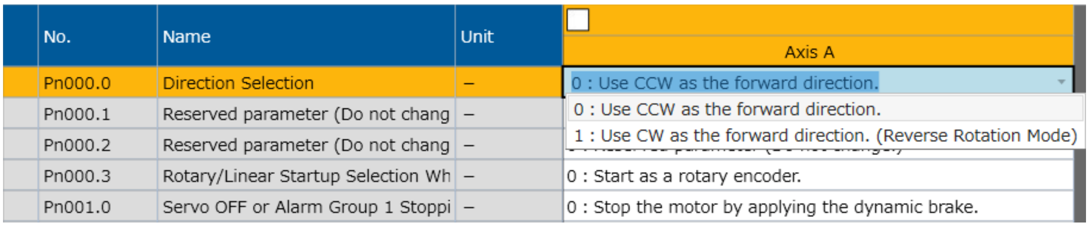
5.1.3 Parameter Setting Methods

You can use the SigmaWin+ or a digital operator to set parameters.

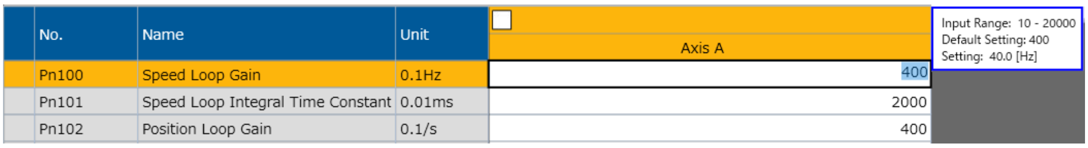
Use the following procedure to set the parameters.

(1) Setting Parameters with the SigmaWin+

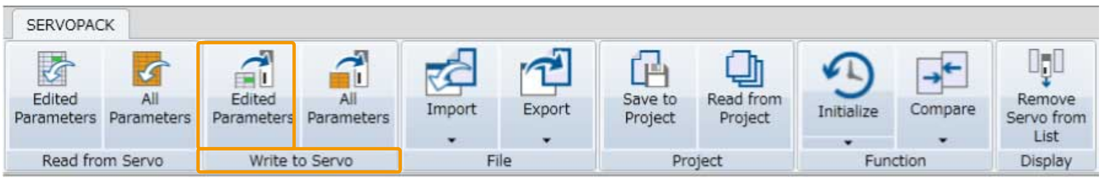
1. **Click the [ ] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**
2. **Click [Edit Parameters] in the [Menu] window.**
   The [Edit Parameters] window will be displayed.
3. **Double-click the cell with the setting of the parameter to change.**
   - Parameters for Numeric Settings



   - Parameters for Selecting Functions

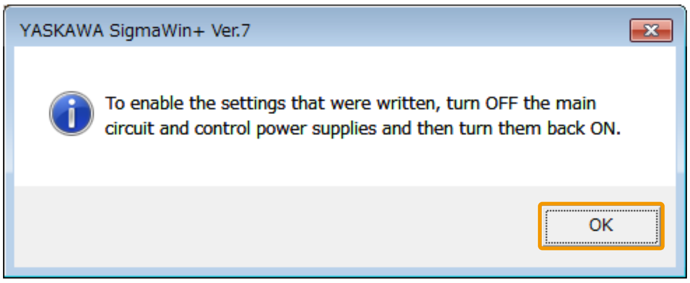


4. **Change the setting of the parameter.**
5. **Press the [Enter] key.**
   The background of the edited parameter cell will change to green.
6. **Click [Edited Parameters] in the [Write to Servo] group.**



   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 to the SERVOPACK OFF and ON again.**

This concludes the procedure to set the parameters.

(2) Setting Parameters with a Digital Operator

Refer to the following manual for information on setting the parameters with a digital operator.

Σ-7/Σ-X-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)

5.1.4 Write Prohibition Setting

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

(1) Preparations

No preparations are required.

(2) Applicable Tools

The following table lists the tools that you can use to change the Write Prohibition Setting for parameters.

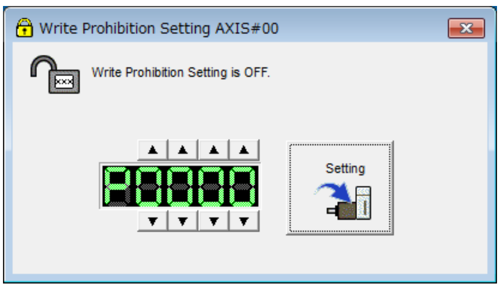
Tool	Fn No./Function Name	Reference
Digital Operator	Fn010	Σ-7/Σ-X-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	[Others] – [Write Prohibition Setting]	*(3) Operating Procedure on page 151*

(3) Operating Procedure

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

1. **Click the [ ] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**
2. **Click [Write Prohibition Setting] in the [Menu] window.**

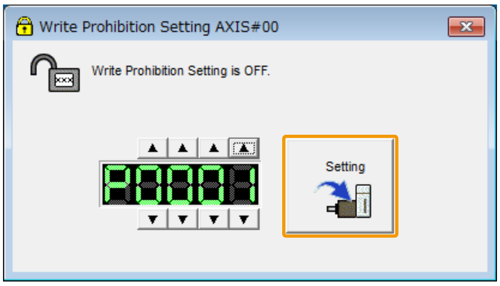
   The [Write Prohibition Setting] window will be displayed.
3. **Press the [ ], [ ] for the rightmost digit and set one of the following.**



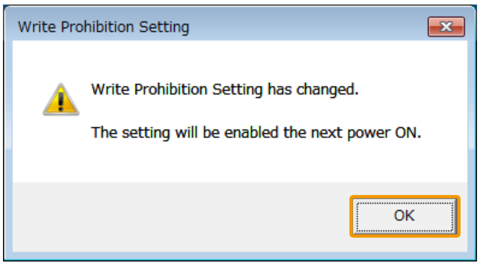
0000: Writing is permitted (default setting).

0001: Writing is prohibited.

4. **Click the [Setting] button.**



5. **Click the [OK] button.**



The setting will be written to the SERVOPACK.

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

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

(4) 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		When Writing Is Prohibited	Reference
Button in Menu Window	**SigmaWin+ Function Name**	**Fn No.**	**Utility Function Name**		
Basic Functions	Initialize *1	**Fn005**	Initialize Parameters	Cannot be executed.	☞ *5.1.5 Initialize Parameters on page 154*
	Software Reset	**Fn030**	Software Reset	Can be executed.	☞ *6.10 Software Reset on page 254*
	Product Information	**Fn011**	Display Servomotor Model	Can be executed.	☞ *9.1 Monitoring Product Information on page 450*
		Fn012	Display Software Version	Can be executed.	
		Fn01E	Display SERVOPACK and Servomotor IDs	Can be executed.	
		Fn01F	Display Servomotor ID from Feedback Option Module	Can be executed.	
Encoder Setting	Reset Absolute Encoder	**Fn008**	Reset Absolute Encoder	Cannot be executed.	☞ *5.16 Resetting the Absolute Encoder on page 194*
	Multi-turn Limit Setup	**Fn013**	Multiturn Limit Setting after Multiturn Limit Disagreement Alarm	Cannot be executed.	☞ *6.8.9 A.CC0 (Multiturn Limit Disagreement Alarm) on page 246*
	Search Origin *2	**Fn003**	Origin Search	Cannot be executed.	☞ *7.6.2 Origin Search on page 299*
	Zero Point Position Setting	**Fn020**	Set Absolute Linear Encoder Origin	Cannot be executed.	☞ *5.17 Setting the Origin of the Absolute Encoder on page 197*
	Polarity Detection	**Fn080**	Polarity Detection	Cannot be executed.	☞ *5.10 Polarity Detection on page 171*
Trouble-shooting	Display Alarm	**Fn000**	Display Alarm History	Can be executed.	☞ *13.2.4 Displaying the Alarm History on page 575*
		Fn006	Clear Alarm History	Cannot be executed.	☞ *13.2.5 Clearing the Alarm History on page 577*
		Fn014	Reset Option Module Configuration Error	Cannot be executed.	☞ *13.2.6 Resetting Option Module Configuration Error on page 578*
	Reset Motor Type Alarm	**Fn021**	Reset Motor Type Alarm	Cannot be executed.	☞ *13.2.7 Resetting Motor Type Alarms on page 579*
Operation	Jog	**Fn002**	Jog	Cannot be executed.	☞ *7.3 Trial Operation for the Servomotor without a Load on page 287*
	Program JOG Operation	**Fn004**	Jog Program	Cannot be executed.	☞ *7.6.1 Program Jogging on page 294*
Tuning	Tuning - Autotuning without Host Reference	**Fn201**	Advanced Autotuning without Reference	Cannot be executed.	☞ *8.7 Autotuning without a Host Reference on page 344*
	Tuning - Autotuning with Host Reference	**Fn202**	Advanced Autotuning with Reference	Cannot be executed.	☞ *8.8 Autotuning with a Host Reference on page 357*
	Tuning - Custom Tuning	**Fn203**	One-Parameter Tuning	Cannot be executed.	☞ *8.9 Custom Tuning on page 366*
	Tuning - Custom Tuning - Adjust Anti-resonance Control	**Fn204**	Adjust Anti-resonance Control	Cannot be executed.	☞ *8.10 Anti-Resonance Control Adjustment on page 375*
	Tuning - Custom Tuning - Vibration Suppression	**Fn205**	Vibration Suppression	Cannot be executed.	☞ *8.11 Vibration Suppression on page 382*
	Response Level Setting	**Fn200**	Tuning-less Level Setting	Cannot be executed.	☞ *8.4 Tuning-less Function on page 318*

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SigmaWin+		Digital Operator		When Writing Is Prohibited	Reference
Button in Menu Window	**SigmaWin+ Function Name**	**Fn No.**	**Utility Function Name**		
Diagnostic	Easy FFT	**Fn206**	Easy FFT	Cannot be executed.	☞ *8.16.2 Easy FFT on page 443*
Others	Adjust the Analog Monitor Output	**Fn00C**	Adjust Analog Monitor Output Offset	Cannot be executed.	☞ *9.3.3 Using the Analog Monitors on page 462*
		Fn00D	Adjust Analog Monitor Output Gain	Cannot be executed.	
	Adjust the Motor Current Detection Signal Offsets	**Fn00E**	Autotune Motor Current Detection Signal Offset	Cannot be executed.	☞ *6.12 Adjusting the Motor Current Detection Signal Offset on page 260*
		Fn00F	Manually Adjust Motor Current Detection Signal Offset	Cannot be executed.	
	Initialize Vibration Detection Level	**Fn01B**	Initialize Vibration Detection Level	Cannot be executed.	☞ *6.11 Vibration Detection Level Initialization on page 257*
	Write Prohibited Setting	**Fn010**	Write Prohibition Setting	Can be executed.	☞ *5.1.4 Write Prohibition Setting on page 151*

*1 An [Initialize] button will be displayed in the [Edit Parameters] window.
*2 Cannot be used when connecting a linear servomotor.

5.1.5 Initialize Parameters

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.

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

(1) Preparations

Always check the following before you initialize the parameter settings.

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

(2) Applicable Tools

The following table lists the tools that you can use to initialize the parameter settings.

Tool	Fn No./Function Name	Reference
Digital Operator	Fn005	Σ-7/Σ-X Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	[Basic Functions] – [Edit Parameters]	☞ *(3) Operating Procedure on page 154*

(3) Operating Procedure

Use the following procedure to initialize the parameter settings.

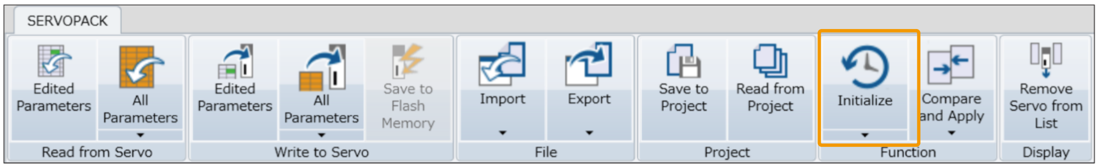
1. **Click the [ ] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**

2. **Click [Edit Parameters] in the [Menu] window.**

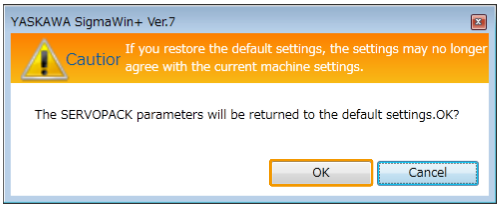
   The [Edit Parameters] window will be displayed.

3. **Select any parameter of the axis to initialize.**

4. **Click [Initialize] in [Function] group.**

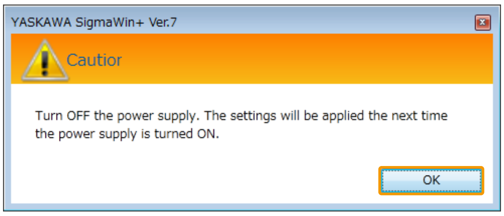


5. **Click the [OK] button.**



   Click the [Cancel] button to cancel initialization. The [Edit Parameters] window will return.

6. **Click the [OK] button.**



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

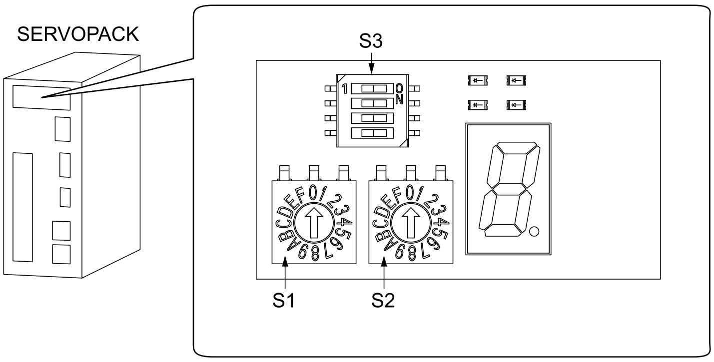
This concludes the procedure to initialize the parameter settings.

5.2 MECHATROLINK Communications Settings

This SERVOPACK can use MECHATROLINK-4 communications and MECHATROLINK-III communications. MECHATROLINK communications requires the following three types of settings.

Setting Item	Setting Location		Reference
	MECHATROLINK-4 Communications	MECHATROLINK-III Communications	
Communications Protocol Setting	Pin 3 on DIP switch (S3)		☞ *5.2.1 DIP Switch (S3) Settings on page 156*
Number of Transmission Bytes Setting	Host controller	Pin 1 and 2 on DIP switch (S3)	
Station Address Setting	Rotary switches (S1 and S2)		☞ *5.2.2 Rotary Switch (S1 and S2) Settings on page 157*

Details on the switches used for the settings are given next.



5.2.1 DIP Switch (S3) Settings

The DIP switch (S3) settings are shown in the following table.

Pin No.	Default Setting	Function	Setting
1	OFF	• When using MECHATROLINK-4 communications: Reserved for system. (Do not change.) *1 • When using MECHATROLINK-III communications: Sets the number of transmission bytes. Refer to the following table for details on the settings.	
2	ON		
3	ON	Selects the communications protocol.	ON: Use MECHATROLINK-4 communications. OFF: Use MECHATROLINK-III communications.
4	OFF	Reserved for system. (Do not change.)	

Details on the settings of pins 1 and 2 on DIP switch (S3) when using MECHATROLINK-III communications are shown in the following table.

Pin No.		Setting
1	2	
OFF	OFF	Reserved for system. (Do not change.)
ON	OFF	32 bytes
OFF	ON	48 bytes Default
ON	ON	Reserved for system. (Do not change.)

*1 Set the number of transmission bytes from the host controller when using MECHATROLINK-4 communications.

Important

To enable the new setting, turn the power to the SERVOPACK OFF and ON again after you change the DIP switch (S3) .

5.2.2 Rotary Switch (S1 and S2) Settings

Use the rotary switches (S1 and S2) to set the station address. The setting range depends on the communications references being used (MECHATROLINK-4 or MECHATROLINK-III).

Important

- To enable the new setting, turn the power to the SERVOPACK OFF and ON again after you change the rotary switches (S1 and S2) .
- When the power is turned ON, the value of the set station address will be displayed on the panel display. Refer to the following section for details.
  ☞ *15.2.2 Interpreting the Station Address Display on page 831*

(1) MECHATROLINK-4 Communications

Station Address	S1	S2
00h: Station address set from the host controller.	0	0
01h	0	1
02h	0	2
03h Default	0	3
:	:	:
FEh	F	E
FFh	F	F

(2) MECHATROLINK-III Communications

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

5.3 Power Supply Type Settings for the Main Circuit and Control Circuit

A SERVOPACK can be operated on either an AC power supply input or DC power supply input to the main and control circuits. If you select an AC power supply input, you can operate the SERVOPACK on either a single-phase power supply input or a three-phase power supply input. This section describes the settings related to the power supplies.

5.3.1 AC Power Supply Input/DC Power Supply Input Setting

Set Pn001 = n.□X□□ (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.□X□□ 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

- A DC power supply was input between the B1/⊕ - ⊖2 terminals when Pn001 is set to n.□0□□ (set to use an AC power supply).
- An AC power supply was input to the L1, L2, and L3 terminals when Pn001 is set to n.□1□□ (set to use a DC power supply).

Pn001	n.□X□□	Main Circuit Power Supply AC/DC Input Selection	Speed Pos Trq	When Enabled
		0 Default	Input AC power as the main circuit power supply using the L1, L2, and L3 terminals (do not use shared converter).	After restart
		1	Input DC as the main circuit power supply using the B1/⊕, ⊖2 terminals or the B1 and ⊖2 terminals (use an external converter or the shared converter).	

⚠ WARNING

Connect the AC or DC power supplies to the specified SERVOPACK terminals.

- **Connect an AC power supply to the L1, L2, and L3 terminals and the L1C and L2C terminals on the SERVOPACK.**
- **Connect a DC power supply to the B1/⊕ and ⊖ 2 terminals and the L1C and L2C terminals on the SERVOPACK.**

There is a risk of failure or fire.

Always specify a DC power supply Pn001 = n.□1□□ (DC power supply input) before you input for the main circuit power supply.

If you input without specifying a DC power supply Pn001 = n.□1□□ (DC power supply input), the SERVOPACK's internal elements may burn and may cause fire or damage to the equipment.

Install fuses on the power supply line if you use DC power.

The servomotor returns regenerative energy to the power supply. If you use a SERVOPACK with a DC power supply input, regenerative energy is not processed. Process the regenerative energy at the power supply.

If you use a DC power supply input with any of the following SERVOPACKs, externally connect an inrush current limiting circuit and use the power ON and OFF sequences recommended by Yaskawa: SGDXS-330A, -470A, -550A, -590A, -780A.

There is a risk of equipment damage.

⚠ CAUTION

Wait for at least 20 minutes (or 100 minutes when using DC power supply input) after turning OFF the power and then make sure that the CHARGE indicator is not lit before starting wiring or inspection work. Do not touch the main circuit terminals while the CHARGE indicator is lit because high voltage may still remain in the SERVOPACK even after turning OFF the power.

There is a risk of electric shock.

Refer to the following section for information on wiring the SERVOPACK.

☞ *4.3.4 Power Supply Wiring Diagrams on page 114*

5.3.2 Single-phase AC Power Supply Input/Three-phase AC Power Supply Input Setting

Some models of three-phase 200-VAC SERVOPACKs can also operate on a single-phase 200-VAC power supply.

You can use a single-phase, 200-VAC power supply input with the following models.

- SGDXS-R70A, -R90A, -1R6A, -2R8A, -5R5A

If you use a single-phase, 200-VAC power supply input for the SERVOPACK's main circuit power supply, set parameter Pn00B to n.□1□□ (use a three-phase power supply input as a single-phase power supply input).

Information: You do not need to change the setting of Pn00B to n.□1□□ (use a three-phase power supply input as a single-phase power supply input) for a SERVOPACK with a single-phase 200-VAC power supply input (model numbers: SGDXS-120A□□□0008).

Pn00B	n.□X□□	Power Input Selection for Three-phase SERVOPACK	Speed Pos Trq	When Enabled
		0 Default	Use a three-phase power supply input.	After restart
		1	Use a three-phase power supply input as a single-phase power supply input.	

Important

1. If you use a single-phase power supply input without setting Pn00B to n.□1□□ (use a three-phase power supply input as a single-phase power supply input), an A.F10 alarm (Power Supply Line Open Phase) will occur.
2. Not all SERVOPACKs can be run on a single-phase AC power supply input. If you connect a single-phase AC power supply input to a SERVOPACK that does not support single-phase power, an A.F10 alarm (Power Supply Line Open Phase) will occur.
3. If you use a single-phase 200-VAC power supply input, the torque-rotation speed characteristic of the servomotor will not be the same as for a three-phase AC power supply input. Decide whether to use a single-phase or three-phase AC power supply input after checking the characteristics given in the servomotor manual or catalog.

Refer to the following section for information on wiring a single-phase AC power supply input to the SERVOPACK.

☞ *(c) Wiring Example for Single-Phase, 200-VAC Power Supply Input on page 115*

5.4 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 SERVOPACK 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.

Pn000	n.X□□□	Rotary/Linear Servomotor Startup Selection When Encoder Is Not Connected (Speed Pos Trq)		When Enabled
		0 (Default)	When an encoder is not connected, start as SERVOPACK for rotary servomotor.	After restart
		1	When an encoder is not connected, start as SERVOPACK for linear servomotor.	

5.5 Motor Direction Setting

You can change the direction of servomotor rotation without changing the polarity of the speed or position reference by setting Pn000 to n.□□□X (Rotation Direction Selection).

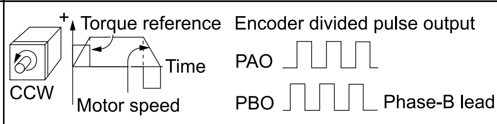
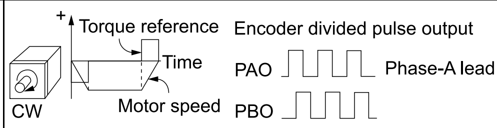
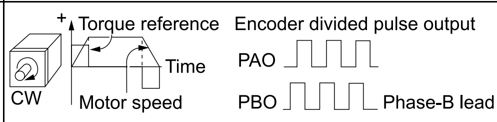
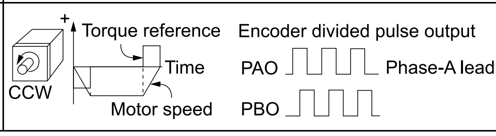
This causes the rotation direction of the servomotor to change, but the polarity of the signals, such as encoder divided pulse output, output from the SERVOPACK do not change. Set the appropriate direction for your system.

Refer to the following section for details on the encoder divided pulse output.

☞ *6.5 Encoder Divided Pulse Output on page 227*

5.5.1 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 Encoder Divided Pulse Outputs	Applicable Overtravel Signal (OT)
Pn000	n.□□□0 Use CCW as the forward direction. (default setting)	Forward reference		P-OT (Forward Drive Prohibit Input) Signal
		Reverse reference		N-OT (Reverse Drive Prohibit Input) Signal
	n.□□□1 Use CW as the forward direction. (Reverse Rotation Mode)	Forward reference		P-OT (Forward Drive Prohibit Input) Signal
		Reverse reference		N-OT (Reverse Drive Prohibit Input) Signal

Note:

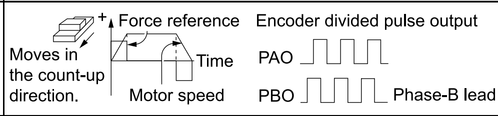
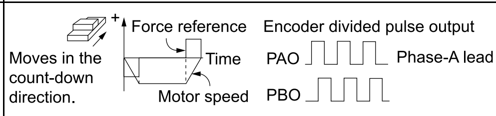
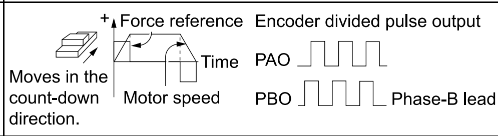
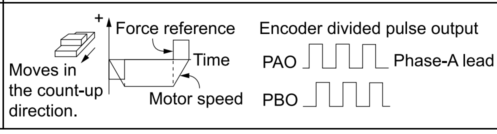
The trace waveforms of the SigmaWin+ are shown in the above table for the torque reference and motor speed diagrams. If you measure them on a measuring instrument, e.g., with an analog monitor, the polarity will be reversed.

5.5.2 Linear Servomotors

Important

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

☞ *5.8 Selecting the Phase Sequence for a Linear Servomotor on page 168*

Parameter		Forward/ Reverse Reference	Motor Direction and Encoder Divided Pulse Outputs	Applicable Overtravel Signal (OT)
Pn000	n.□□□0 Use the direction in which the linear encoder counts up as the forward direction. (default setting)	Forward reference		P-OT (Forward Drive Prohibit Input) Signal
		Reverse reference		N-OT (Reverse Drive Prohibit Input) Signal
	n.□□□1 Use the direction in which the linear encoder counts up as the reverse direction.	Forward reference		P-OT (Forward Drive Prohibit Input) Signal
		Reverse reference		N-OT (Reverse Drive Prohibit Input) 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.

5.6 Setting the Linear Encoder Pitch

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, the setting of Pn282 will be invalid.

Term

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.

Pn282	Linear Encoder Scale Pitch			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 6553600	0.01 μm	0	After restart

You will not be able to control the linear servomotor if Pn282 is not set correctly. Check the following 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 Scale Pitch [μm]
Incremental	Heidenhain Corporation	LIDA48□	JZDP-H003-□□□-E	20
			JZDP-J003-□□□-E	
		LIF48□	JZDP-H003-□□□-E	4
			JZDP-J003-□□□-E	
	Renishaw PLC	RGH22B	JZDP-H005-□□□-E	20
			JZDP-J005-□□□-E	

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 OFF and ON again.

Information **Linear Encoder Scale Pitch**

If you do not use a serial converter unit, the linear encoder pitch is automatically set, and the setting of Pn282 will be invalid. Refer to the following sections for details.

☞
◆ *Feedback Resolution of Linear Encoder: Incremental Linear Encoder on page 190*

☞
◆ *Feedback Resolution of Linear Encoder: Absolute Linear Encoder on page 190*

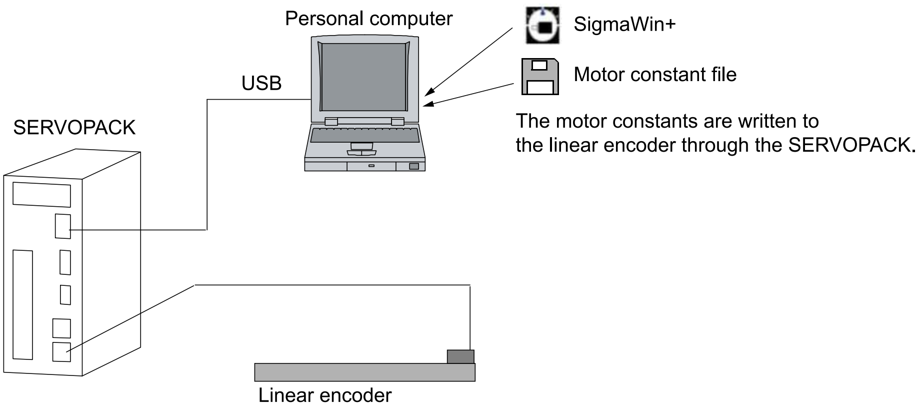
5.7 Writing Linear Servomotor Parameters

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 constants to the linear encoder. The motor constants contain the information that is required by the SERVOPACK to operate the linear servomotor.

WARNING

Check if the servomotor and linear encoder information to write is correct.

There is a risk of the servomotor running out of control, device damage, personal injury, and fire by writing incorrect motor constants.



Important

Serial number information is not included in the motor constants. 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.

5.7.1 Precautions

- If the encoder parameters are not written to the linear encoder, an A.CA0 alarm (Encoder Parameter Error) will occur. Consult the manufacturer of the linear encoder.
- If the motor constants are not written to the linear encoder, an A.CA0 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 Motor Speed Setting Error), A.710 (Instantaneous Overload), A.720 (Continuous Overload), and A.C90 (Encoder Communications Error)

5.7.2 Applicable Tools

The following table lists the tools that you can use to write the parameters to the linear servomotor.

Tool	Fn No./Function Name	Reference
Digital Operator	You cannot write linear servomotor parameters from the digital operator.	
SigmaWin+	[Encoder Setting] – [Motor Parameter Scale Write]	☞ *5.7.3 Operating Procedure on page 164*

5.7.3 Operating Procedure

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

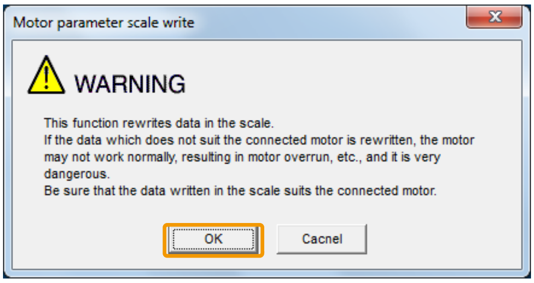
1. **Prepare the motor constant file to write to the linear encoder.**

2. **Click the [] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**

3. **Select [Motor Parameter Scale Write] in the [Menu] window.**

   The [Motor Parameter Scale Write] window will be displayed.

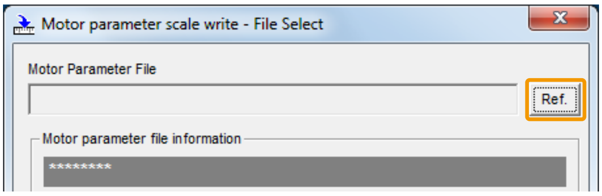
4. **Click the [OK] button.**



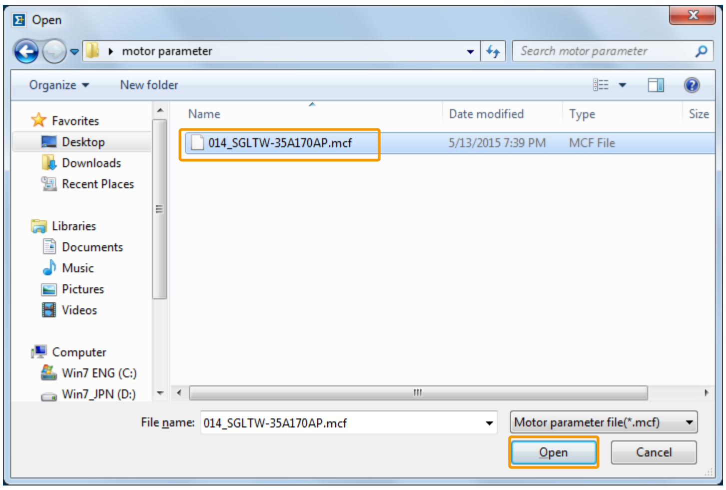
   Click the [Cancel] button to cancel writing the motor constant scale to the linear encoder. The Main Window will return.

   If the write is completed normally, the [Motor Parameter Scale Write - File Select] window will be displayed.

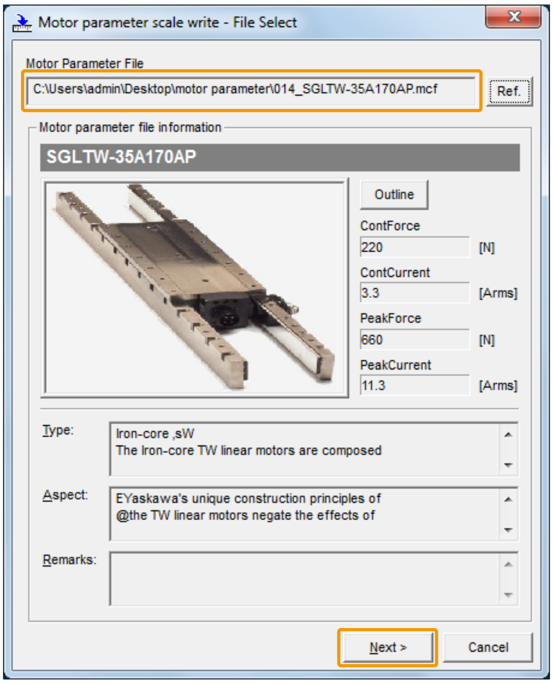
5. **Click the [Ref.] button.**



6. **Select the motor constant file that you prepared and click the [Open] button.**



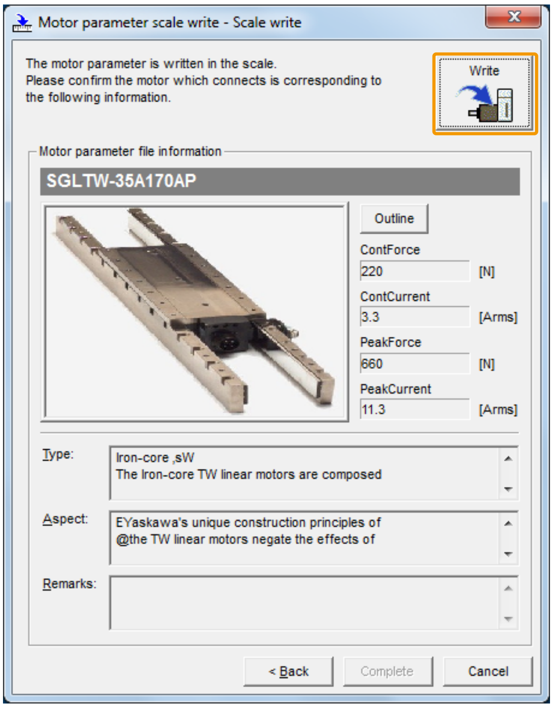
7. **Confirm that the motor constant file information that is displayed is suitable for your servomotor, and then click the [Next] button.**



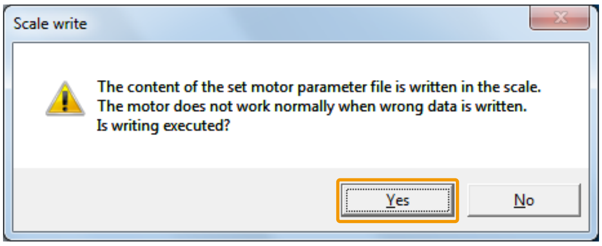
Information • Click the [Outline] button to display the dimensional drawing.
• Click the image of the servomotor to enlarge the view.

Click the [Cancel] button to cancel writing the motor constant scale to the linear encoder. The Main Window will return.

8. **Click the [Write] button.**

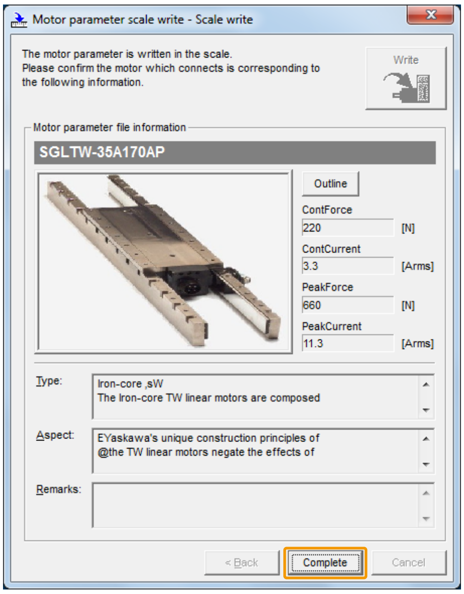


9. **Click the [Yes] button.**

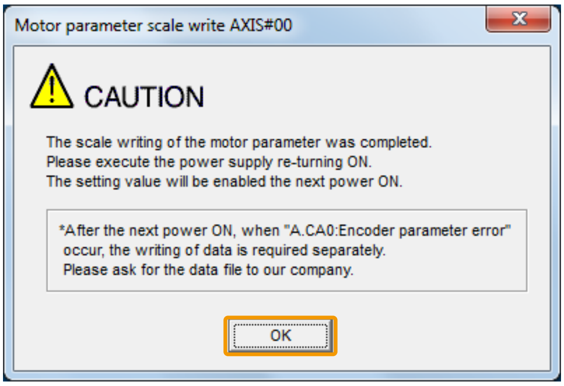


Click the [No] button to cancel writing the motor constant scale to the linear encoder.
If you click the [Yes] button, writing the motor constant scale will start.

10. **Click the [Complete] button.**



11. **Click the [OK] button.**



12. **Turn the power to the SERVOPACK OFF and ON again.**

This concludes the procedure to write the motor constants.

5.7.4 Confirming If the Motor Constants Have Been Written

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

If the motor constants have not been written, no information on the servomotor will be displayed.

☞ *9.1 Monitoring Product Information on page 450*

5.8 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. This is accomplished with the setting that synchronizes the position and direction of the servomotor and encoder.

Before you set Pn080 to n.□□X□ (Motor Phase Sequence Selection), 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.

Important

- 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 servomotor.
- To set Pn000 to n.□□□X (Direction Selection), first set Pn080 to n.□□X□ explained here, and then set Pn000 to n.□□□X.
- If you changed the setting of Pn080 = n.□□X□ (Motor Phase Sequence Selection) when using an absolute encoder, always detect the polarity afterward. If you change the setting of Pn080 = n.□□X□ after the polarity is detected, A.C10 (Servomotor Out of Control) will occur.

5.8.1 Related Parameters

		Motor Phase Sequence Selection	Speed Pos Trq	When Enabled
Pn080	n.□□X□	0 Default	Set a phase-A lead as a phase sequence of U, V, and W.	After restart
		1	Set a phase-B lead as a phase sequence of U, V, and W.	

5.8.2 Operating Procedure

Use the following procedure to select the phase sequence for a linear servomotor.

1. **Set Pn000 to n.□□□0 (use the direction in which the linear encoder counts up as the forward direction).**

   This setting is to make following confirmation work easier to understand.

2. **Click [Monitor] in the [Menu] window.**

   The [Operation] window will be displayed so that you can check the feedback pulse counter.

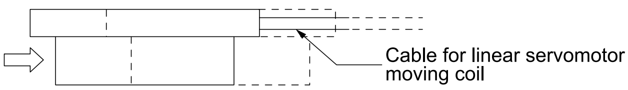
   To check the feedback pulse counter with the digital operator, use Un00D (Feedback Pulse Counter).

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.

   Setting Example

   In this example, assume that a linear encoder with a scale pitch of 20 μm 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 μm/256) = 128000 pulses



If the value on the feedback pulse counter is 128000 pulses after you manually moved the linear servomotor in the direction of the cable, confirmation is complete.

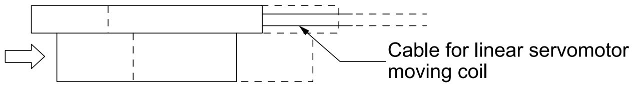
Note:

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] window to confirm that it is counting up.**



Manually move the linear servomotor in the direction of the cable.

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

This concludes the procedure to set the phase sequence of the linear servomotor.

5.9 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.□□□X (Polarity Sensor Selection).

If the linear servomotor has a polarity sensor, set Pn080 to n.□□□0 (use polarity sensor) (default setting).

If the linear servomotor does not have a polarity sensor, set Pn080 to n.□□□1 (do not use polarity sensor). Turn the power OFF and ON again to enable the new setting.

		Polarity Sensor Selection Speed Pos Trq		When Enabled
Pn080	n.□□□X	0 Default	Use polarity sensor.	After restart
		1	Do not use polarity sensor.	

Information: If you set Pn080 to n.□□□0 (use polarity sensor) and the linear servomotor that is connected to the SERVOPACK does not have a polarity sensor, an A.C21 alarm (Polarity Sensor Error) will occur when you turn the power OFF and ON again.

5.10 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
Incremental encoder	Each time the control power to the SERVOPACK is turned ON (Even after you execute polarity detection, the position of the polarity will be lost the next time the control power to the SERVOPACK is turned OFF.)	• Use the SV_ON (Servo ON) command. • Use the polarity detection function of the SigmaWin +. • Execute the Fn080 (Polarity Detection) utility function from the digital operator.
Absolute encoder	Only for initial setup, or after the SERVOPACK, linear encoder, or servomotor has been replaced (The results of polarity detection is stored in the absolute encoder, so the polarity position is not lost when the control power is turned OFF.)	• Use the polarity detection function of the SigmaWin +. • Execute the Fn080 (Polarity Detection) utility function from the digital operator. • Use Pn587 (Polarity Detection Execution Selection for Absolute Linear Encoder).

Important

If you changed the setting of Pn080 = n.□□X□ (Motor Phase Sequence Selection) when using an absolute encoder, always detect the polarity afterward. If you change the setting of Pn080 = n.□□X□ after the polarity is detected, A.C10 (Servomotor Out of Control) will occur.

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.

5.10.1 Restrictions

(1) 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 µm or less. (We recommend a pitch of 40 µm 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.)

(2) Preparations

Always check the following before you execute polarity detection.

- Pn080 must be set to n.□□□1 (do not use polarity sensor).
- The servo must be OFF.
- The main circuit power 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.)
- Pn00C must be set to n.□□□0 (test without a motor function is disabled).
- There must be no overtravel.
- If the motor constants have been written or the origin of the absolute linear encoder has been set, the power to the SERVOPACK must be turned OFF and ON again after completion of the writing or setting operation.

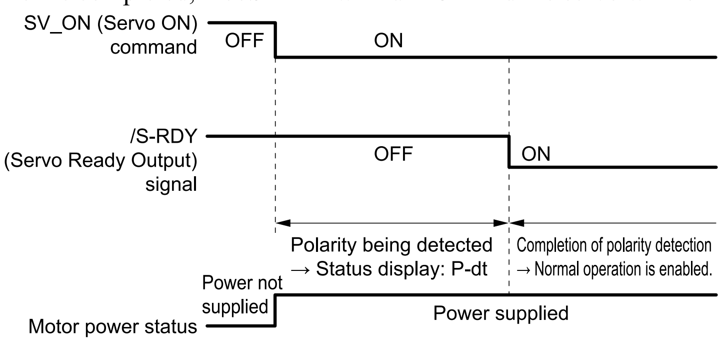
Important
- Power is supplied to the servomotor during polarity detection. Be careful not to get an electric shock. Also, the moving coil of the linear servomotor may greatly move during detection. Do not approach the moving parts of the servomotor.
- Polarity detection is affected by many factors. For example, polarity detection may fail if the mass ratio or friction is too large or the cable tension is too strong.

5.10.2 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 to the SERVOPACK OFF and then ON again, and then send the SV_ON command. As soon as polarity detection is completed, the /S-RDY (Servo Ready Output) signal will turn ON.

Polarity detection will start simultaneously with execution of the SV_ON command. As soon as polarity detection is completed, the /S-RDY will turn ON and the servo will remain ON.



5.10.3 Using a Tool Function to Perform Polarity Detection

(1) Applicable Tools

The following table lists the tools that you can use to perform polarity detection.

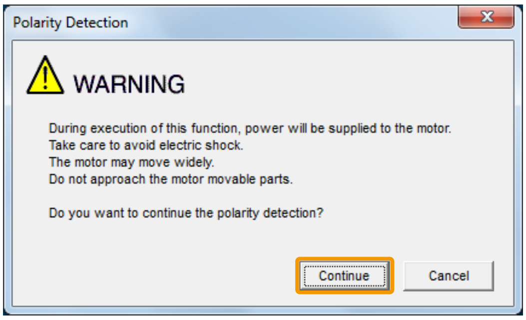
Tool	Fn No./Function Name	Reference
Digital Operator	Fn080	Σ-7/Σ-X-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	[Encoder Setting] – [Polarity Detection]	☞ *(2) Operating Procedure on page 172*

(2) Operating Procedure

Use the following procedure to perform polarity detection.

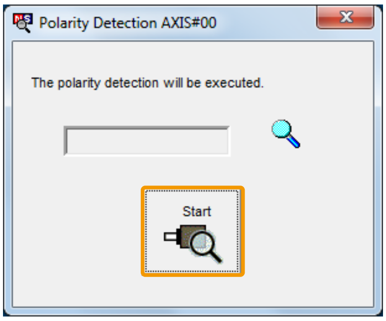
1. **Click the [ ] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**
2. **Click [Polarity Detection] in the [Menu] window.**

   The [Polarity Detection] window will be displayed.
3. **Click the [Continue] button.**



   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.

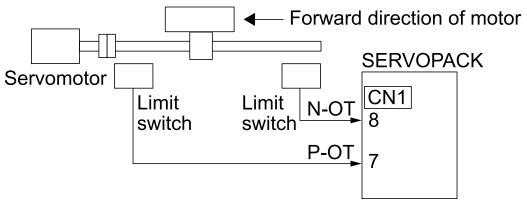
5.11 Overtravel and Related Settings

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.

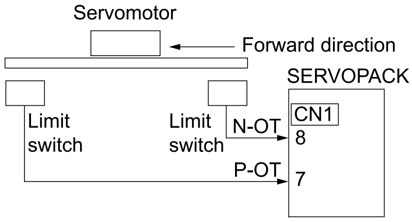
The overtravel signals include the P-OT (Forward Drive Prohibit Input) and the N-OT (Reverse Drive Prohibit Input) signals. You use the P-OT and N-OT signals to stop the machine by installing limit switches at the positions where you want to stop the machine that is operated by the servomotor.

A SERVOPACK wiring example is provided below.

Rotary Servomotors



Linear Servomotors



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.

⚠ CAUTION

To prevent accidents that may result from poor contact or disconnections, use normally closed limit switches. Do not change the default settings of the polarity of the overtravel signals (P-OT and N-OT).

If you use a servomotor for a vertical axis, the /BK (Brake Output) signal will remain ON (i.e., the brake will be released) when overtravel occurs. This may result in the workpiece falling when overtravel occurs. To prevent the workpiece from falling, set Pn001 to n.□□1□ to place the servomotor in a zero-clamped state when it stops.

A base block state is entered after stopping for overtravel. This may cause the servomotor to be pushed back by an external force on the load shaft. To prevent the servomotor from being pushed back, set Pn001 to n.□□1□ to place the servomotor in a zero-clamped state when it stops.

5.11.1 Overtravel Signals

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

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

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

5.11.2 Setting to Enable/Disable Overtravel

Enable and disable overtravel by setting parameters.

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

The parameters to use for the settings depend on the allocation method as shown below.

Allocation Method	Parameter to Use
Σ-7S-compatible I/O Signal Allocation	• Pn50A = n.□□□1 (use Sigma-7S-compatible I/O signal allocations) • Pn50A = n.X□□□ (P-OT (Forward Drive Prohibit Input) Signal Allocation) • Pn50B = n.□□□X (N-OT (Reverse Drive Prohibit Input) Signal Allocation)
Σ-LINK II Input Signal Allocation	• Pn50A = n.□□□2 (use Σ-LINK II input signal allocations) • Pn590 (P-OT (Forward Drive Prohibit Input) Signal Allocation) • Pn591 (N-OT (Reverse Drive Prohibit Input) Signal Allocation)

Refer to the following section for details on allocations.

☞ *6.1.2 I/O Signal Allocations on page 210*

After you allocate the signals with the parameter settings given above, set bit 0 and bit 1 of MECHATROLINK common parameter 25 PnA4A to 0 (P-OT and N-OT limit settings = Enabled) to enable the overtravel function.

5.11.3 Motor Stopping Method for Overtravel

You can set the stopping method of the servomotor when overtravel occurs in Pn001 = n.□□XX (Motor Stopping Method for Servo OFF and Group 1 Alarms and Overtravel Stopping Method).

Parameter		Motor Stopping Method *1	Status after Stopping	When Enabled
Pn001	**n.□□00 (default setting)**	Dynamic brake	Coasting	After restart
	n.□□01			
	n.□□02	Coasting		
	n.□□1□	Deceleration according to setting of Pn406	Zero clamp	
	n.□□2□		Coasting	
	n.□□3□	Deceleration according to setting of Pn30A	Zero clamp	
	n.□□4□		Coasting	

*1 You cannot decelerate a servomotor to a stop during torque control. The servomotor will be stopped with the dynamic braking or coast to a stop (according to the setting of Pn001 = n.□□□X (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.

☞ *5.13 Motor Stopping Methods for Servo OFF and Alarms on page 183*

(1) 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.□□X□ 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 instantaneous maximum torque. However, the maximum emergency stop torque that you can actually use is the instantaneous maximum torque of the servomotor.

Pn406	Emergency Stop Torque			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 800	1%	800	Immediately

Note:
The setting unit is a percentage of the motor rated torque.

(2) Stopping the Servomotor by Setting the Deceleration Time

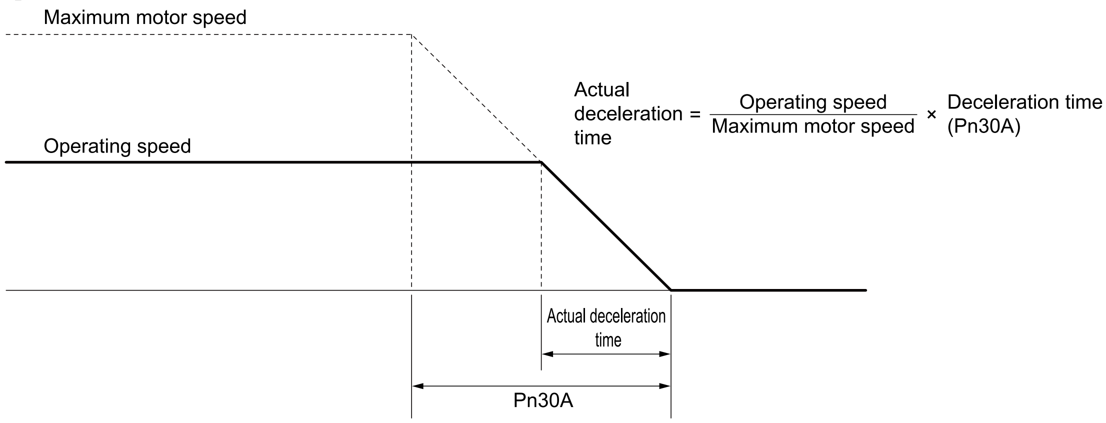
To specify the servomotor deceleration time and use it to stop the servomotor, set Pn30A (Deceleration Time for Servo OFF and Forced Stops).

The maximum torque value when stopping is the value set in Pn406 (Emergency Stop Torque).

Pn30A	Deceleration Time for Servo OFF and Forced Stops			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 12000	1 ms	0	Immediately

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.



5.11.4 Overtravel Alarms

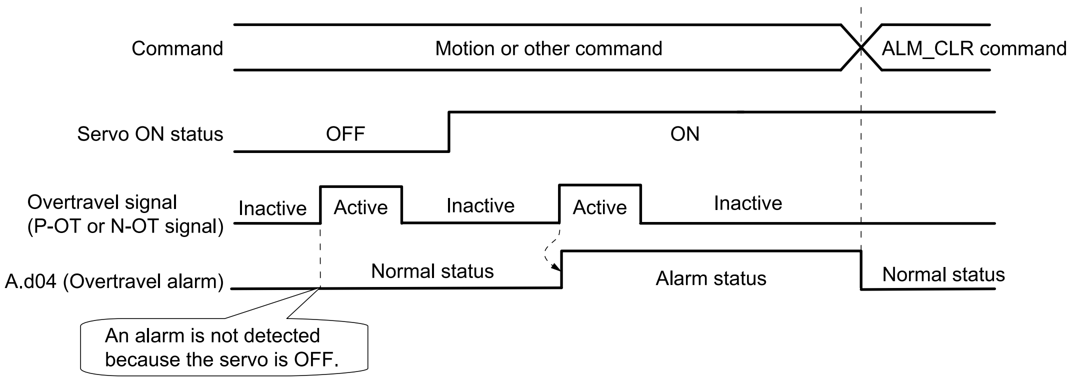
You can set the system to detect an A.d04 alarm (Overtravel) if overtravel occurs while the servo is ON. This function activates an alarm and stops the servomotor when the overtravel signal is input. An alarm occurs only if overtravel occurs while the servo is ON. An overtravel alarm will not be detected when the servo is OFF, even if overtravel occurs.

Note:
If the overtravel alarm is enabled, homing using a limit switch cannot be performed.

The following parameter is set for this function.

Pn00D	n.X□□□	Overtravel Warning Detection Selection	Speed Pos Trq	When Enabled
		0 Default	Do not detect overtravel warnings.	After restart
		1	Detect overtravel warnings.	
		2	Detect overtravel alarms.	

A timing chart for alarm detection is provided below.



Information
- Alarms are detected for overtravel in the same direction as the reference.
- Alarms are not detected for overtravel in the opposite direction from the reference.
  Example: An alarm will not be output for a forward reference even if the N-OT signal turns ON.
- If the travel command is 0, an alarm will be detected with overtravel in either the forward or reverse direction.
- An alarm will not be detected when the servo is turned ON even if overtravel status exists.
- If software limits are enabled, an alarm will be detected in the same manner as overtravel if a software limit status exists.

5.11.5 Overtravel Warnings

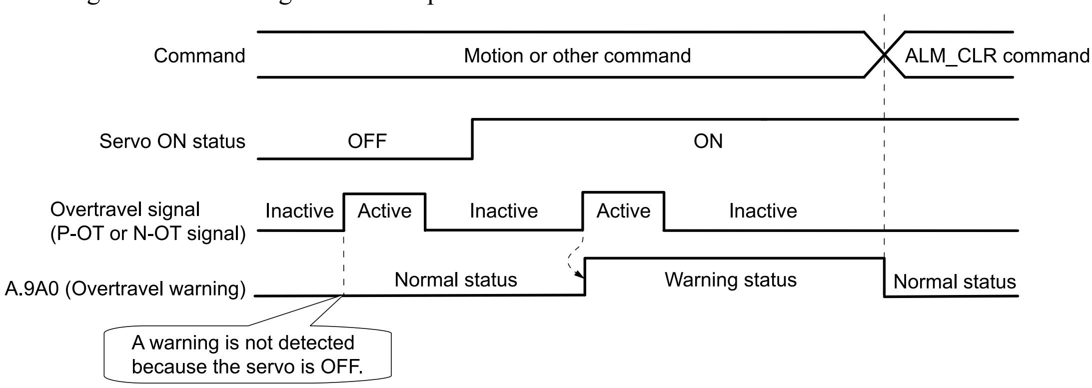
You can set the system to detect an A.9A0 warning (Overtravel) if overtravel occurs while the servo is ON. This allows the SERVOPACK to notify the host controller with a warning even when the overtravel signal is input only momentarily. An alarm occurs only if overtravel occurs while the servo is ON.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

Important
- 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.
- 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.

Pn00D	n.X□□□	Overtravel Warning Detection Selection (Speed, Pos, Trq)		When Enabled
		0 Default	Do not detect overtravel warnings.	After restart
		1	Detect overtravel warnings.	
		2	Detect overtravel alarms.	

A timing chart for warning detection is provided below.



Information

- Warnings are detected for overtravel in the same direction as the reference.
- 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.
- If the travel command is 0, a warning will be detected with overtravel in either the forward or reverse direction.
- A warning will not be detected when the servo is turned ON even if overtravel status exists.
- You can use the an ALM_CLR (Clear Alarms and Warnings) command to clear the warning regardless of the servo ON/OFF status and overtravel signal status.
- If you clear the warning with the an ALM_CLR (Clear Alarms and Warnings) command during overtravel status, a warning will not be detected again until the overtravel status is left.
- An overtravel warning will be detected even when the software limit has been detected.

5.11.6 Behavior Selection after Overtravel Release

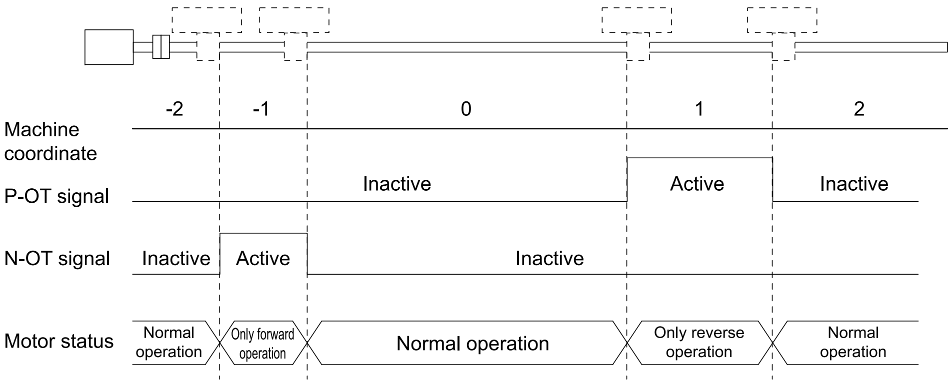
The servomotor is stopped when overtravel occurs. In the overtravel state, movement is possible in the direction opposite to the previous direction of movement.

However, the servomotor may stop by overrunning the overtravel limit switch depending on the stopping method. In this case, the servomotor will not be in the overtravel state and normal operation is possible again when you turn ON the servo. Therefore, operation is also possible that exceeds the area in which movement is allowed, which may cause damage to the machine or other accidents.

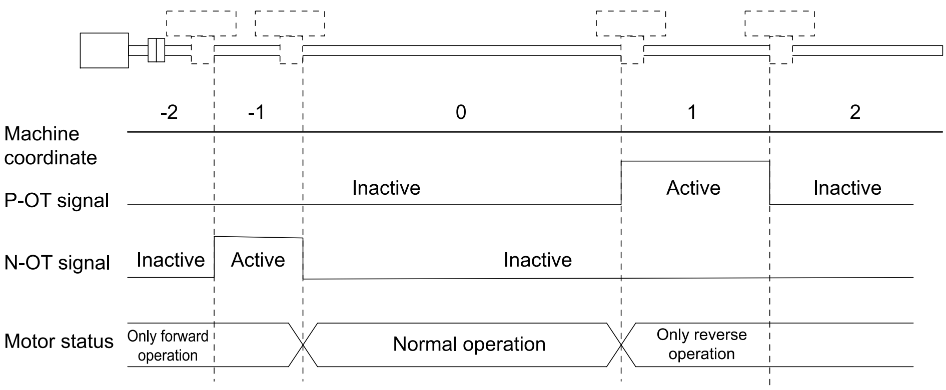
To avoid this, you can limit the movement direction when the OT signal is turned OFF (limit switch was overrun) after overtravel occurs by setting Pn022 to n.□□□1.

Pn022	n.□□□X	Overtravel Release Method Selection	Speed Pos Trq	When Enabled
		0 Default	Overtravel exists while the P-OT or N-OT signal is being input.	After restart
		1	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.	

(1) When Pn022 is set to n.□□□0



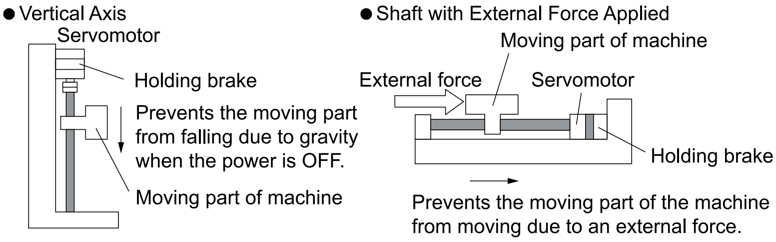
(2) When Pn022 is set to n.□□□1



5.12 Holding Brake

A holding brake is used to hold the position of the moving part of the machine when the SERVOPACK 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.



Important

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.

5.12.1 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.

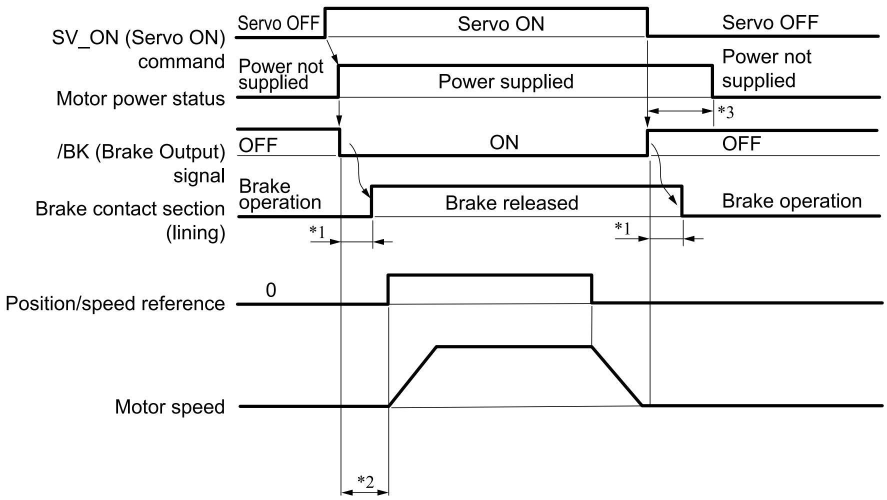
Term

Brake Release Delay Time :

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

Brake Operation Delay Time :

The time from when the /BK (Brake Output) 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 is switched on the DC side. You must evaluate the actual brake delay times on the actual equipment before using the application.

<table>
<tr><th>Model</th><th>Voltage</th><th>Brake Release Delay Time [ms]</th><th>Brake Operation Delay Time [ms]</th></tr>
<tr><td>SGMXJ-A5 to -04</td><td rowspan="14">24 VDC</td><td>60</td><td rowspan="4">100</td></tr>
<tr><td>SGMXJ-06, -08</td><td>80</td></tr>
<tr><td>SGMXA-A5 to -04</td><td>60</td></tr>
<tr><td>SGMXA-06 to -10</td><td>80</td></tr>
<tr><td>SGMXA-15 to -25</td><td>170</td><td rowspan="2">80</td></tr>
<tr><td>SGMXA-30 to -70</td><td>100</td></tr>
<tr><td>SGMXP-01</td><td>20</td><td rowspan="3">100</td></tr>
<tr><td>SGMXP-02, -04</td><td>40</td></tr>
<tr><td>SGMXP-08, -15</td><td>20</td></tr>
<tr><td>SGMXG-03 to -20</td><td>100</td><td>80</td></tr>
<tr><td>SGMXG-30 to -44</td><td rowspan="2">170</td><td>100</td></tr>
<tr><td>SGMXG-55 to -1A</td><td rowspan="2">80</td></tr>
<tr><td>SGMXG-1E</td><td>250</td></tr>
<tr><td>SGM7M-A1 to -A3</td><td>60</td><td>100</td></tr>
</table>

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 (Servo 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)

(1) Connection Example

Refer to the following section for information on brake wiring.

☞ *4.4.4 Wiring the SERVOPACK to the Holding Brake on page 130*

5.12.2 /BK (Brake Output) Signal

The following settings are for the output signal that controls the brake.

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 setting of Pn506 (Servo OFF Delay Time).

Type	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.

Note:
You can change the allocation of the /BK signal. To change the allocation, the parameters that you use depend on the allocation method.

Allocation Method	Parameter to Use
Σ-7S-compatible I/O Signal Allocation	• Pn50A = n.□□□1 (use Σ-7S-compatible I/O signal allocations) • Pn50F = n.X□□□ (/WARN (Warning Output) Signal Allocation)
Σ-LINK II Input Signal Allocation	• Pn50A = n.□□□2 (use Σ-LINK II input signal allocations) • Pn5B7 (/WARN (Warning Output) Signal Allocation)

Refer to the following section for details.
☞ *6.1.4 Output Signal Allocations on page 213*

Important

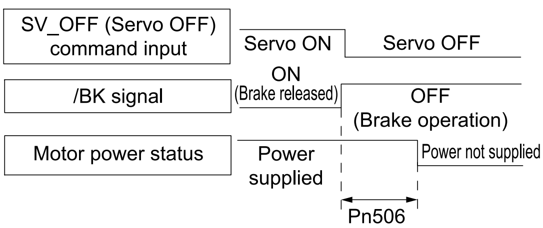
If you allocate more than one signal to the same output connector pin, a logical OR of the signals is output. Allocate the BK signal to its own output connector pin, i.e., do not use the same output terminal for another signal. For example, never allocate the /TGON (Rotation Detection Output) signal 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.

5.12.3 Output Timing of /BK (Brake Output) 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 Pn506 (Servo OFF Delay Time) to change the timing to turn OFF power to the motor after the SV_OFF command is input.

Pn506	Brake Reference-Servo OFF Delay Time			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 50	10 ms	0	Immediately

- 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 Pn506 (Servo OFF Delay Time) so that power to the motor is stopped after the brake is applied.
- This parameter sets the timing of stopping power to the servomotor while the servomotor is stopped.



Important

Power 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.

5.12.4 Output Timing of /BK (Brake Output) 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 Pn508 (Servo OFF-Brake Command Waiting Time) and either Pn507 (Rotary Servomotor Brake Reference Output Speed Level) or Pn583 (Linear Servomotor Brake Reference Output Speed Level).

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

Pn507	Brake Reference Output Speed Level			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 10000	1 min^{-1}	100	Immediately

Pn508	Servo OFF-Brake Command Waiting Time			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	10 to 100	10 ms	50	Immediately

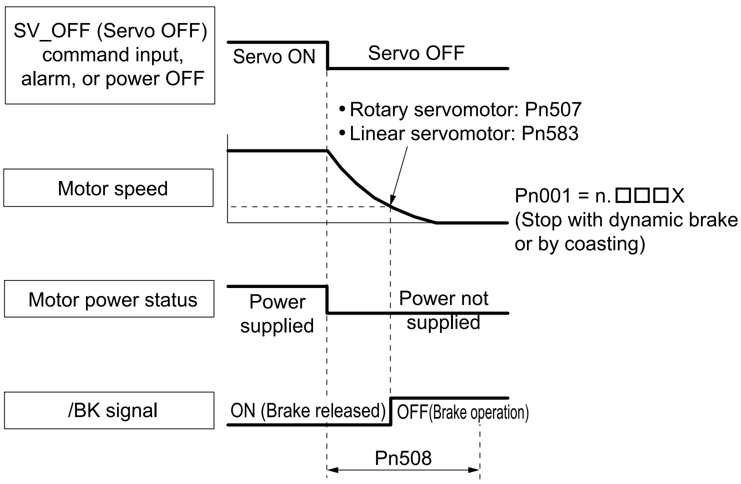
- Linear Servomotors

Pn583	Brake Reference Output Speed Level			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 10000	1 mm/s	10	Immediately

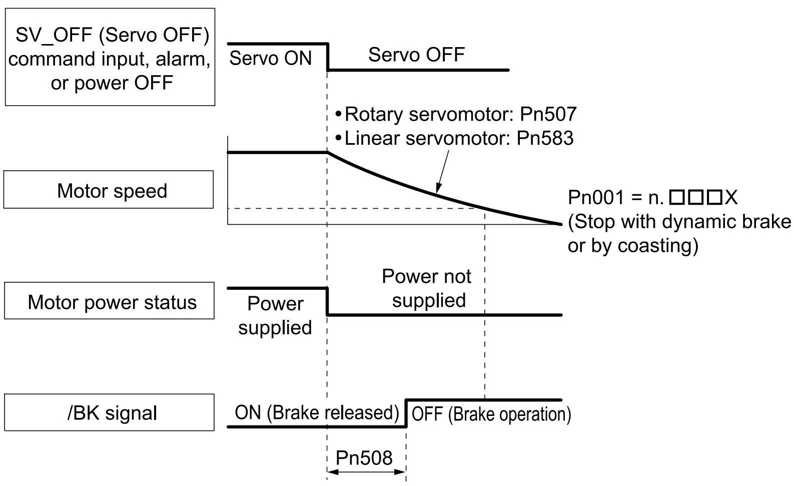
Pn508	Servo OFF-Brake Command Waiting Time			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	10 to 100	10 ms	50	Immediately

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 to the Motor Is Stopped



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



Important

The servomotor will be limited to its maximum speed even if a value higher than its maximum speed is set in Pn507 (Rotary Servomotor Brake Reference Output Speed Level) or Pn583 (Linear Servomotor Brake Reference Output Speed Level).

5.13 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-speed Stopping	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.)

Important

- The dynamic brake is used for emergency stops. The dynamic brake circuit will operate frequently if the power 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 or control power during operation before you turn OFF the servo, the servomotor stopping method depends on the SERVOPACK model as shown in the following table.

<table>
<tr><th rowspan="2">Condition</th><th colspan="2">Servomotor Stopping Method</th></tr>
<tr><th>For SGDXS-R70A, -1R6A, -2R8A, -3R8A, -5R5A, -7R6A, -120A, -180A, and -200A</th><th>SGDXS-330A, -470A, -550A, -590A, -780A</th></tr>
<tr><td>Main circuit power turned OFF before turning OFF the servo</td><td colspan="2">Stopping with dynamic brake</td></tr>
<tr><td>Control power turned OFF before turning OFF the servo</td><td>Stopping with dynamic brake</td><td>Coasting to a Stop</td></tr>
</table>

- If the servomotor must be stopped by coasting rather than with the dynamic brake when the main circuit power or the control power is turned OFF before the servo is turned OFF, use a SERVOPACK with 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.

5.13.1 Stopping Method for Servo OFF

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

<table>
<tr><th colspan="2">Parameter</th><th>Servomotor Stopping Method</th><th>Status after Servomotor Stops</th><th>When Enabled</th></tr>
<tr><td rowspan="3">Pn001</td><td>n.□□□0
(default setting)</td><td rowspan="2">Dynamic brake *1</td><td>Dynamic brake *1</td><td rowspan="3">After restart</td></tr>
<tr><td>n.□□□1</td><td>Coasting</td></tr>
<tr><td>n.□□□2</td><td>Coasting</td><td>Coasting</td></tr>
</table>

*1 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.□□□0 (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.

5.13.2 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 542*

(1) Motor Stopping Method for Group 1 Alarms

When a group 1 alarm occurs, the servomotor will stop according to the setting of Pn001 = n.□□□X. The default setting is to stop by applying the dynamic brake.

Refer to the following section for details.

☞ *5.13.1 Stopping Method for Servo OFF on page 183*

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

Parameter			Servomotor Stopping Method	Status after Servomotor Stops	When Enabled
Pn00B	Pn00A	Pn001			
n.□□0□ (default setting)	–	n.□□□0 (default setting)	Zero-speed stopping	Dynamic brake	After restart
		n.□□□1		Coasting	
		n.□□□2			
n.□□1□	–	n.□□□0 (default setting)	Dynamic brake	Dynamic brake	
		n.□□□1		Coasting	
		n.□□□2	Coasting		
n.□□2□	n.□□□0	n.□□□0 (default setting)	Dynamic brake	Dynamic brake	
		n.□□□1		Coasting	
		n.□□□2	Coasting		
	n.□□□1 (default setting)	n.□□□0 (default setting)	Motor is decelerated using the torque set in Pn406 as the maximum torque.	Dynamic brake	
		n.□□□1		Coasting	
		n.□□□2			
	n.□□□2	n.□□□0 (default setting)		Coasting	
		n.□□□1			
		n.□□□2			
	n.□□□3	n.□□□0 (default setting)	Motor is decelerated according to setting of Pn30A.	Dynamic brake	
		n.□□□1		Coasting	
		n.□□□2			
	n.□□□4	n.□□□0 (default setting)		Coasting	
		n.□□□1			
		n.□□□2			

Note:

1. The setting of Pn00A is ignored if Pn00B is set to n.□□0□ or n.□□1□.
2. The setting of Pn00A = n.□□□X is enabled for position control and speed control. During torque control, the setting of Pn00A = n.□□□X will be ignored and only the setting of Pn001 = n.□□□X will be used.
3. Refer to the following section for details on Pn406 (Emergency Stop Torque).
   ☞ *(1) Stopping the Servomotor by Setting Emergency Stop Torque on page 175*
4. Refer to the following section for details on Pn30A (Deceleration Time for Servo OFF and Forced Stops).
   ☞ *(2) Stopping the Servomotor by Setting the Deceleration Time on page 176*

5.14 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.

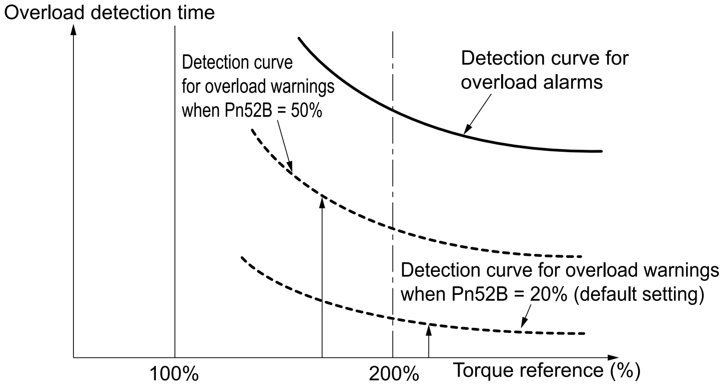
It is designed to prevent servomotor overheating.

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).

5.14.1 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 Pn52B (Overload Warning Level). 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 setting of Pn52B (Overload Warning Level) is changed from 20% to 50%. An overload warning is detected in half of the time required to detect an overload alarm.



Pn52B	Overload Warning Level			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	1 to 100	1%	20	After restart

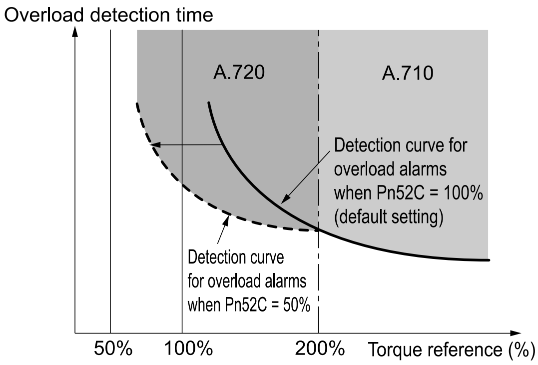
5.14.2 Detection Timing for Overload Alarms (A.720)

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).

Pn52C	Base Current Derating at Motor Overload Detection			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	10 to 100	1%	100	After restart

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.

Σ-X-Series Rotary Servomotor Product Manual (Manual No.: SIEP C230210 00)

Σ-7-Series Linear Servomotor Product Manual (Manual No.: SIEP S800001 37)

Σ-7-Series Direct Drive Servomotor Product Manual (Manual No.: SIEP S800001 38)

5.15 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 μm or °) that are easier to understand.

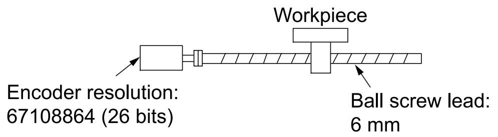
The electronic gear is used to convert the travel distances that are specified in reference units to pulses, which are required for actual movements.

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.

> **Important**
> If you set an electronic gear in the host controller, normally set the electronic gear ratio in the SERVOPACK to 1:1.

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

To move a workpiece 10 mm:
(1) Calculate the number of rotations.
The servomotor will move 6 mm for each rotation, so 10/6 rotations are required to move 10 mm.
(2) Calculate the required number of reference pulses.
One rotation is 67108864 pulses.
Therefore, "10/6 × 67108864 = 111848106.66... pulses"
(3) Input 111848107 pulses as the reference.

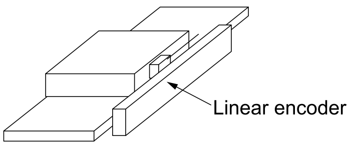
Calculating the number of reference pulses for each reference is necessary. = Troublesome

When the Electronic Gear Is Used

If you use reference units to move the workpiece 10 mm, when the reference unit is set to 1 μm, the travel amount is 1 μm per pulse.
To move the workpiece 10 mm (10000 μm), 10000 ÷ 1 = 10000 pulses, so 10000 pulses would be input.

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

- 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 × 1000 ÷ 20 × 256 = 128000 pulses,
so 128000 pulses is input as the reference.

Calculating the number of reference pulses for each reference is necessary. = Troublesome

When the Electronic Gear Is Used

To move the load 10 mm using reference units:
When the reference unit is set to 1 μm, the travel amount is 1 μm per pulse.
To move the load 10 mm (10000 μm),
10000/1 = 10000 pulses, so 10000 pulses is input as the reference.

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

5.15.1 Electronic Gear Ratio Settings

Set the electronic gear ratio using Pn20E and Pn210.

Important

- Set the electronic gear ratio within the following range.
  0.001 ≤ Electronic gear ratio (B/A) ≤ 64000
  If the electronic gear ratio is outside of this range, an A.040 alarm (Parameter Setting Error) will occur.
  If the electronic gear ratio in the device configuration exceeds this setting range, set Pn21D.
- When Pn21D is set to n.□□□1 (enable encoder resolution compatibility), the servomotor operates with the encoder bit count set by Pn21D = n.□□X□ (encoder resolution compatibility: bit count selection) instead of the encoder bit count in the servomotor specifications.
  Refer to the following section for details on the Pn21D.
  ☞ *5.19.2 Setting the Encoder Resolution Compatibility Selection on page 203*

	Electronic Gear Ratio (Numerator) Speed **Pos** Trq			
Pn20E	Setting Range	Setting Unit	Default Setting	When Enabled
	1 to 1073741824	–	64	After restart
	Electronic Gear Ratio (Denominator) Speed **Pos** Trq			
Pn210	Setting Range	Setting Unit	Default Setting	When Enabled
	1 to 1073741824	–	1	After restart

(1) Calculating the Settings for the Electronic Gear Ratio

(a) 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:

$$\text{Electronic gear ratio } \frac{B}{A} = \frac{\text{Pn20E}}{\text{Pn210}} = \frac{\text{Encoder resolution}}{\text{Travel amount per load shaft rotation (reference unit)}} \times \frac{m}{n}$$

◆ Encoder Resolution

You can check the encoder resolution in the servomotor model number and with Pn21D = n.□□X□.

- When Pn21D is set to n.□□□0 (disable encoder bit count compatibility)
  You can check the encoder resolution in the servomotor model number. The encoder resolutions are given next.

Servomotor Model	Code for ■ in Interpreting Servomotor Model Number	Specification	Encoder Resolution
SGMXJ-□□□■□□□□□ SGMXA-□□□■□□□□□ SGMXP-□□□■□□□□□ SGMXG-□□□■□□□□□	U	26 bits (absolute encoder)	67108864
	W	26 bits (batteryless absolute encoder)	
SGM7M-□□□■□□□□□	3	20 bits (absolute encoder)	1048576
SGM7D-□□□■□□□□□ SGM7E-□□□■□□□□□ SGM7E-□□□■□□□□□	7	24 bits (multiturn absolute encoder)	16777216
	F	24 bits (incremental encoder)	

Information With fully-closed loop control, the number of external encoder pulses per motor rotation is the encoder resolution.

- When Pn21D is set to n.□□□1 (enable encoder bit count compatibility)
  Calculate the encoder resolution with "$2^{\text{Number of bits set in Pn21D = n.□□X□}}$".

		Encoder Resolution Compatibility: Resolution Selection **Speed** **Pos** Trq		When Enabled
Pn21D	n.□□X□	4	Operate as 20-bit encoder.	After restart
		6	Operate as 22-bit encoder.	
		8 (Default)	Operate as 24-bit encoder.	
		A	Operate as 26-bit encoder.	
		Other values	Reserved (Do not use.)	

Basic Functions That Require Setting before Operation 5

Refer to the following section for details on Pn21D.

☞ *5.19.2 Setting the Encoder Resolution Compatibility Selection on page 203*

(b) Linear Servomotors

You can calculate the settings for the electronic gear ratio with the following equation:

- When Not Using a Serial Converter Unit

$$\text{Electronic gear ratio } \frac{B}{A} = \frac{\text{Pn20E}}{\text{Pn210}} = \frac{\text{Travel amount per reference unit (reference units)} \times \text{Number of divisions of the linear encoder}}{\text{Linear encoder scale pitch (setting in the following table)}}$$

- When Using a Serial Converter Unit

$$\text{Electronic gear ratio } \frac{B}{A} = \frac{\text{Pn20E}}{\text{Pn210}} = \frac{\text{Travel amount per reference unit (reference units)} \times \text{Number of divisions of the serial converter unit}}{\text{Linear encoder scale pitch (setting of Pn282)}}$$

◆ Feedback Resolution of Linear Encoder: Incremental Linear Encoder

The incremental linear encoder scale pitches and resolutions are given in the following table.

Calculate the electronic gear ratio using the values in the following table.

Manufacturer	Linear Encoder Model	Linear Encoder Scale Pitch [μm] *1	Relay Device between SERVOPACK and Linear Encoder	Resolution	Resolution
Dr. JOHANNES HEIDENHAIN GmbH	LIDA48□	20	JZDP-H003-□□□-E *2	256	0.078 μm
			JZDP-J003-□□□-E *2	4096	0.0049 μm
	LIF48□	4	JZDP-H003-□□□-E *2	256	0.016 μm
			JZDP-J003-□□□-E *2	4096	0.00098 μm
Renishaw PLC	RGH22B	20	JZDP-H005-□□□-E *2	256	0.078 μm
			JZDP-J005-□□□-E *2	4096	0.0049 μm
Magnescale Co., Ltd.	SR75-□□□□□LF *3	80	–	8192	0.0098 μm
	SR75-□□□□□MF	80	–	1024	0.078 μm
	SR85-□□□□□LF *3	80	–	8192	0.0098 μm
	SR85-□□□□□MF	80	–	1024	0.078 μm
	SL700 *3, SL710 *3, SL720 *3, SL730 *3	800	PL101-RY *4	8192	0.0977 μm
			MJ620-T13 *5		
	SQ10	400	MQ10-FLA *5	8192	0.0488 μm
			MQ10-GLA *5		
Canon Precision Inc.	PH03-36110	128	–	2048	0.0625 μm
	PH03-36120	128	–	2048	0.0625 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 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).
☞ *6.5.2 Setting for the Encoder Divided Pulse Output on page 231*
*4 This is the model of the head with interpolator.
*5 This is the model of the interpolator.

◆ Feedback Resolution of Linear Encoder: Absolute Linear Encoder

The absolute linear encoder scale pitches and resolutions are given in the following table.

Calculate the electronic gear ratio using the values in the following table.

Manufacturer	Linear Encoder Model	Linear Encoder Scale Pitch [μm] *1	Relay Device between SERVOPACK and Linear Encoder	Resolution	Resolution
Dr. JOHANNES HEIDENHAIN GmbH	LIC4190 Series	40.96	–	4096	0.01 μm
		20.48	–	4096	0.005 μm
		4.096	–	4096	0.001 μm
	LIC2190 Series	409.6	–	4096	0.1 μm
		204.8	–	4096	0.05 μm
	LC115	40.96	EIB3391Y *2	4096	0.01 μm
	LC415	40.96	EIB3391Y *2	4096	0.01 μm
RSF Elektronik GmbH	MC15Y Series	409.6	–	4096	0.1 μm
		204.8	–	4096	0.05 μm
Mitutoyo Corporation	ST781A/ST781AL	256	–	512	0.5 μm
	ST782A/ST782AL	256	–	512	0.5 μm
	ST783/ST783AL	51.2	–	512	0.1 μm
	ST784/ST784AL	51.2	–	512	0.1 μm
	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
Renishaw PLC	EL36Y□□050F□□□	12.8	–	256	0.05 μm
	EL36Y□□100F□□□	25.6	–	256	0.1 μm
	EL36Y□□500F□□□	128	–	256	0.5 μm
	RL36Y□□050□□□□	12.8	–	256	0.05 μm
	RL36Y□□001□□□□	0.256	–	256	0.001 μm
RLS d.o.o.	LA11YA Series	2000	–	2048	0.9765 μm
		2000	–	4096	0.4882 μm
		2000	–	8192	0.2441 μm
Magnescale Co., Ltd.	SR77-□□□□□LF *3	80	–	8192	0.0098 μm
	SR77-□□□□□MF	80	–	1024	0.078 μm
	SR87-□□□□□LF *3	80	–	8192	0.0098 μm
	SR87-□□□□□MF	80	–	1024	0.078 μm
	SQ47/SQ57-□□□□□SF□□□□ SQ47/SQ57-□□□□□TF□□□	20.48	–	4096	0.005 μm
	SQ47/SQ57-□□□□□AF□□□ SQ47/SQ57-□□□□□FF□□□	40.96	–	4096	0.01 μm

Continued on next page.

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Manufacturer	Linear Encoder Model	Linear Encoder Scale Pitch [μm] *1	Relay Device between SERVOPACK and Linear Encoder	Resolution	Resolution
Fagor Automation S. Coop.	L2AK208	20	–	256	0.078 μm
	L2AK211	20	–	2048	0.0098 μm
	LAK209	40	–	512	0.078 μm
	LAK212	40	–	4096	0.0098 μm
	S2AK208	20	–	256	0.078 μm
	SV2AK208	20	–	256	0.078 μm
	G2AK208	20	–	256	0.078 μm
	S2AK211	20	–	2048	0.0098 μm
	SV2AK211	20	–	2048	0.0098 μm
	G2AK211	20	–	2048	0.0098 μm
Canon Precision Inc.	PH03-36E00	128	–	2048	0.0625 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 interpolator.
*3 If you use an encoder pulse output with this linear encoder, the setting range of Pn281 (Encoder Output Resolution) is restricted. Refer to the following section for details on Pn281 (Encoder Output Resolution).

☞ *6.5.2 Setting for the Encoder Divided Pulse Output on page 231*

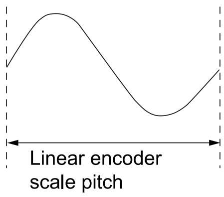
Information

Resolution

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

$$\text{Resolution (travel amount per feedback pulse)} = \frac{\text{Linear encoder scale pitch}}{\text{Number of divisions of serial converter unit or linear encoder}}$$

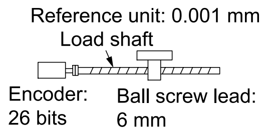
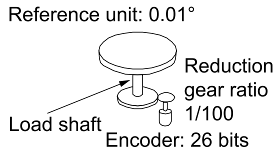
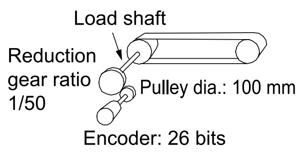
The SERVOPACK uses feedback pulses as the unit to control a servomotor.



5.15.2 Electronic Gear Ratio Setting Examples

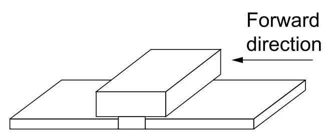
Setting examples are provided in this section.

(1) Rotary Servomotors

Step	Description	Machine Configuration		
		Ball Screw	Rotary Table	Belt and Pulley
				
1	Machine Specifications	• Ball screw lead: 6 mm • Gear ratio: 1/1	• Rotational angle per revolution: 360° • Gear ratio: 1/100	• Pulley dia.: 100 mm (pulley circumference: 314 mm) • Gear ratio: 1/50
2	Encoder Resolution	67108864 (26 bits)	16777216 (24 bits) **Note:** Use Pn21D (Encoder Resolution Setting) to use 67108864 (26 bits) as 16777216 (24 bits).	16777216 (24 bits) **Note:** Use Pn21D (Encoder Resolution Setting) to use 67108864 (26 bits) as 16777216 (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 = 6000	360°/0.01° = 36000	314 mm/0.005 mm = 62800
5	Electronic Gear Ratio	$\frac{B}{A} = \frac{67108864}{6000} \times \frac{1}{1}$	$\frac{B}{A} = \frac{16777216}{36000} \times \frac{100}{1}$	$\frac{B}{A} = \frac{16777216}{62800} \times \frac{50}{1}$
6	Parameter	• Pn20E = 67108864 • Pn210 = 6000 • Pn21D = n.□□□0	• Pn20E = 167772160 • Pn210 = 3600 • Pn21D = n.□□81	• Pn20E = 838860800 • Pn210 = 62800 • Pn21D = n.□□81

(2) Linear Servomotors

A setting example for a Serial Converter Unit resolution of 256 is given below.

Step	Description	Machine Configuration
		Ball Screw
		Reference unit: 0.02 mm (20 μm) 
1	Linear Encoder Scale 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	Parameter	Pn20E: 256
		Pn210: 20

Basic Functions That Require Setting before Operation

5

5.16 Resetting the Absolute Encoder

In a system that uses an absolute encoder, the multiturn data must be reset at startup. An A.810 or A.820 alarm (alarm related to the absolute encoder) will occur when the absolute encoder must be reset, such as when the power 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

⚠ WARNING

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

1. The multiturn data will always be zero in the following cases. It is never necessary to reset the absolute encoder in these cases. An A.810 or A.820 alarm (alarm related to the absolute encoder) will not occur.
   - When you use a single-turn absolute encoder
   - When Pn002 is set to n.□2□□ (use the encoder as a single-turn absolute encoder)
2. If a batteryless absolute encoder is used, an A.810 alarm (Encoder Backup Alarm) will occur the first time the power is turned ON. After you reset the absolute encoder, the A.810 alarm will no longer occur.

5.16.1 Precautions on Resetting

- You cannot use the an 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□□ alarm (internal encoder monitoring alarm) occurs, turn OFF the power to reset the alarm.

5.16.2 Preparations

Always check the following before you reset an absolute encoder.

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

5.16.3 Applicable Tools

The following table lists the tools that you can use to reset the absolute encoder.

Tool	Fn No./Function Name	Reference
Digital Operator	Fn008	📖 Σ-7/Σ-X-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	[Encoder Setting] – [Reset Absolute Encoder]	☞ *5.16.4 Operating Procedure on page 195*

Information You can reset the absolute encoder using the MEM_WR (Write Memory) command. For the MEM_WR command, refer to the following manual that corresponds to the communications references being used.

Σ-7/Σ-X-Series MECHATROLINK-4 Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800002 32)

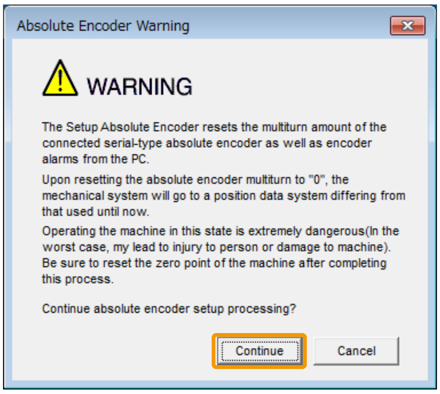
Σ-7/Σ-X-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

5.16.4 Operating Procedure

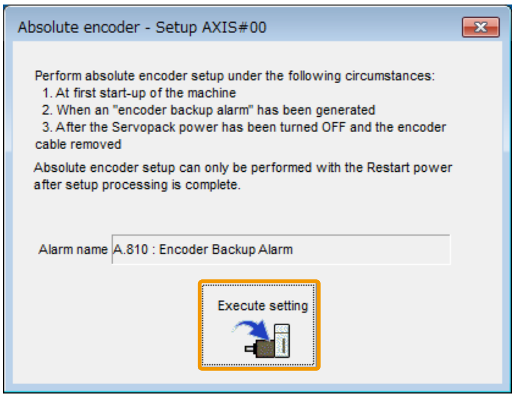
Use the following procedure to reset the absolute encoder.

1. **Confirm that the servo is OFF.**
2. **Click the [] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**
3. **Click [Reset Absolute Encoder] in the [Menu] window.**

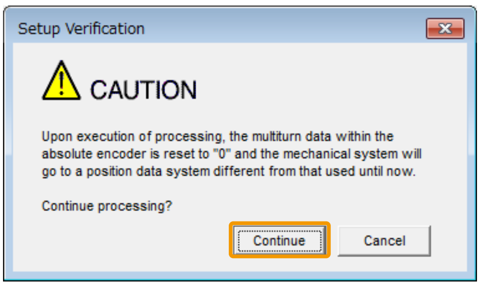
   The [Absolute Encoder Reset] window will be displayed.
4. **Click the [Continue] button.**



   Click the [Cancel] button to cancel resetting the absolute encoder. The Main Window will return.
5. **Click the [Execute setting] button.**



   The current alarm code and name will be displayed in the [Alarm name] box.
6. **Click the [Continue] button.**



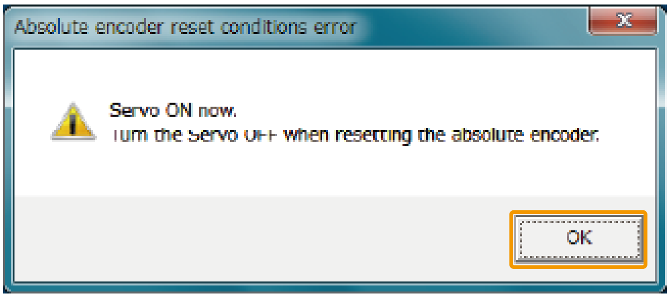
   Click the [Cancel] button to cancel resetting the absolute encoder. The previous window will return.

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 message dialog box will be displayed and processing will be canceled.



   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 message dialog box will be displayed when the absolute encoder has been reset.

   The Main Window will return.

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

This concludes the procedure to reset the absolute encoder.

5.17 Setting the Origin of the Absolute Encoder

5.17.1 Absolute Encoder Origin Offset

NOTICE

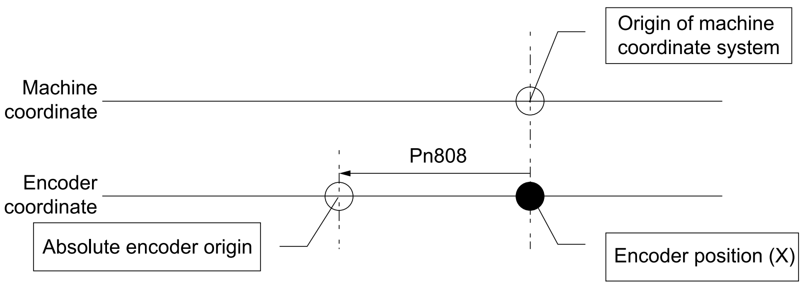
This parameter is set from the host controller. For details when the host controller is an MP3000 controller, refer to the motion control manual.

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 (Turn Sensor ON) command by the MECHATROLINK communications is received, the position in the machine coordinate system (APOS) is set based on the absolute encoder position data and the setting of Pn808.

Pn808	Absolute Encoder Origin Offset			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	-1073741823 to 1073741823	1 reference unit	0	Immediately

If the encoder position (X) is at the origin of the machine coordinate system (0), then Pn808 would be set to "-X."



5.17.2 Setting the Origin of the Absolute Linear Encoder

You can set any position as the origin in the following linear encoders.

- Dr. JOHANNES HEIDENHAIN GmbH
  LIC4190 Series or LIC2190 Series
- RSF Elektronik GmbH
  MC15Y Series
- Mitutoyo Corporation
  ABS ST780A Series or ST1300 Series
  Models: ABS ST78□A/ST78□AL/ST13□□
- Renishaw PLC
  EVOLUTE Series
  Models: EL36Y□□□□□□□□□□
- Renishaw PLC
  RESOLUTE Series
  Models: RL36Y□□□□□□□□□□
- Canon Precision Inc.
  Model: PH03-36E00

Important

- After you set the origin, the /S-RDY (Servo Ready Output) signal will become inactive because the system position data was changed. Always turn the SERVOPACK power OFF and ON again.
- After you set the origin, the servomotor phase data in the SERVOPACK will be discarded. If you are using a linear servomotor without a polarity sensor, execute polarity detection again to save the servomotor phase data in the SERVOPACK.

(1) Preparations

Always check the following before you set the origin of an absolute linear encoder.

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

(2) Applicable Tools

The following table lists the tools that you can use to set the origin of the absolute linear encoder.

Tool	Fn No./Function Name	Reference
Digital Operator	Fn020	Σ-7/Σ-X-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	[Encoder Setting] – [Zero Point Position Setting]	☞ *(3) Operating Procedure on page 198*

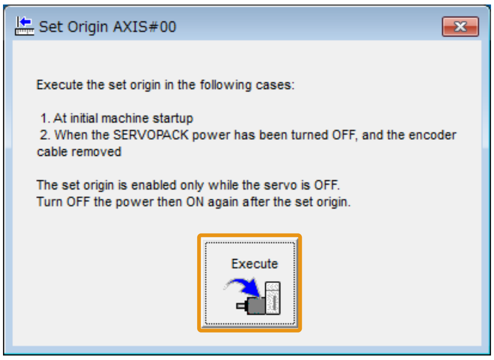
(3) Operating Procedure

Use the following procedure to set the origin of an absolute linear encoder.

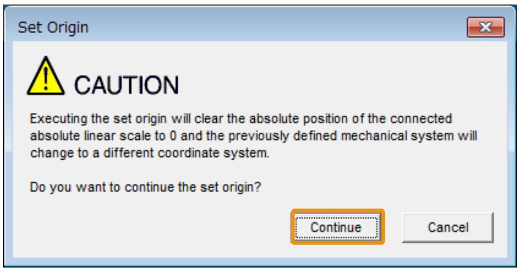
1. **Click the [ ] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**
2. **Click [Zero Point Position Setting] in the [Menu] window.**

   The [Set Origin] window will be displayed.
3. **Click the [Continue] button.**

4. **Click the [Execute] button.**

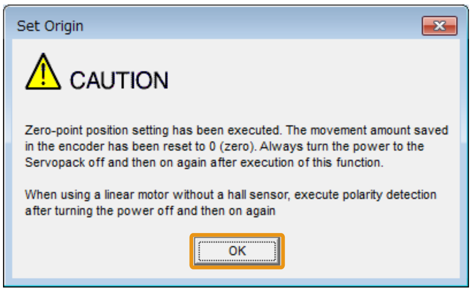


5. **Click the [Continue] button.**



Click the [Cancel] button to cancel setting the origin of the absolute linear encoder. The previous window will return.

6. **Click the [OK] button.**



7. **Turn the power 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.

   ☞ *5.10 Polarity Detection on page 171*

This concludes the procedure to set the origin of the absolute linear encoder.

5.18 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).

Refer to the following manual to select the capacity of a regenerative resistor.

Σ-X-Series Peripheral Device Selection Manual (Manual No.: SIEP C710812 12)

WARNING

If you use an external regenerative resistor, set Pn600 and Pn603 to suitable values.

If you set an unsuitable value, A.320 alarms (Regenerative Overload) cannot be detected correctly, and the external regenerative resistor may suffer a wire break or personal injury or fire may result.

Use an regenerative resistor with a suitable capacity for the external regenerative resistor.

If you use an external regenerative resistor with an unsuitable capacity, personal injury or fire may result.

Pn600	Regenerative Resistor Capacity (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to SERVOPACK's maximum applicable motor capacity	10 W	0	Immediately

Pn603	Regenerative Resistance (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 65535	10 mΩ	0	Immediately

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.

Note:

1. To use the SERVOPACK's built-in regenerative resistor or Yaskawa's regenerative resistor unit, set Pn600 to 0.
2. An A.320 alarm will be displayed if the setting is not suitable.

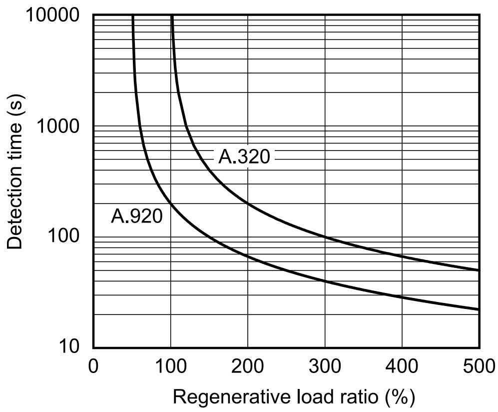
Example

For a self-cooling 100-W external regenerative resistor, set Pn600 (Regenerative Resistor Capacity) to 2 (×10 W) (100 W × 20% = 20 W).

Important

- 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.
- For safety, use an external regenerative resistor with a thermoswitch.

A.320 (Regenerative Overload) and A.920 (Regenerative Overload) alarms are detected by the following overload protection characteristics.



The regenerative load ratio differs on whether the regenerative resistor is built-in or external as described next.

- When the regenerative resistor is built-in: Permissible power consumption [W] of the built-in regenerative resistor is detected as regenerative load ratio 100%
- When the regenerative resistor is external: Setting of Pn600 is detected as regenerative load ratio 100%

Refer to the following section for the permissible power consumption of the built-in regenerative resistor.

☞ *2.1.1 Ratings on page 64*

You can use the [Operation] monitor in the SigmaWin+ to check the regenerative load ratio. Refer to the following section for details.

☞ *9.2.2 Operation Monitor, Status Monitor, and I/O Monitor on page 452*

5.19 Σ-V/Σ-7 Compatible Function and Settings

The Σ-V/Σ-7 compatible function allows you to easily replace a Σ-V/Σ-7-Series SERVOPACK with a Σ-X-Series SERVOPACK in an existing servo system.

5.19.1 Σ-X/Σ-7 Compatibility Mode Settings

As long as MECHATROLINK communications are used to communicate between the SERVOPACK and the host controller, the Σ-X-Series SERVOPACK can be used in the same way as the replaced Σ-V/Σ-7-Series SERVOPACK.

Important

- If you replace a Σ-V/Σ-7-Series SERVOPACK with a Σ-X-Series SERVOPACK, you must also replace the previous servomotor with a servomotor that is compatible with the Σ-X-Series SERVOPACK. You cannot use a Σ-V/Σ-7-Series servomotor even if you use the Σ-V/Σ-7 compatible function.
- Pn040 = n.□□□X (Σ-X/Σ-7 Compatibility Mode Selection) does not guarantee compatibility at the same level of performance. When applying this mode, you must evaluate performance on the machine.

If you use MECHATROLINK-4 communications to communicate with a Σ-X-Series SERVOPACK as if it were a Σ-7-Series SERVOPACK. set Pn040 to n.□□□2.

If you use MECHATROLINK-III communications to communicate with a Σ-X-Series SERVOPACK as if it were a Σ-7-Series SERVOPACK, set Pn040 to n.□□□2. If you use a Σ-X-Series SERVOPACK to communicate as if it were a Σ-V-Series SERVOPACK, set Pn040 to n.□□□1.

Information Refer to the following section for details on switching between MECHATROLINK-4 communications and MECHATROLINK-III communications.

☞ *5.2 MECHATROLINK Communications Settings on page 156*

- MECHATROLINK-4 Communications

Pn040	n.□□□X	Σ-X/Σ-7 Compatibility Mode Selection Speed Pos Trq		When Enabled
		0 Default	Perform Sigma-X communications.	After restart
		1	Reserved (Do not use.)	
		2	Perform Sigma-7 communications.	

- MECHATROLINK-III Communications

Pn040	n.□□□X	Σ-X/Σ-7 Compatibility Mode Selection Speed Pos Trq		When Enabled
		0 Default	Perform Sigma-X communications.	After restart
		1	Perform Sigma-V communications.	
		2	Perform Sigma-7 communications.	

When Pn040 is set to n.□□□1 or n.□□□2, the device code of the device ID read with the ID_RD (Read ID) command is the same as a Σ-7- or Σ-V-series SERVOPACK.

The Pn040 settings and the device codes when set to those values are shown below.

- MECHATROLINK-4 Communications

Setting of Pn040	Device code	Remarks
n.□□□0	02290000H	Σ-X device code.
n.□□□1	–	Pn040= n.□□□1 is a reserved setting.
n.□□□2	02250006H	Σ-7 device code.

• MECHATROLINK-III Communications

Setting of Pn040	Device code	Remarks
n.□□□0	02290000H	Σ-X device code.
n.□□□1	02200000H	Σ-V device code.
n.□□□2	02250000H	Σ-7 device code.

For the IR_RD command, refer to the following manual that corresponds to the communications references being used.

Σ-7/Σ-X-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

Σ-7/Σ-X-Series MECHATROLINK-4 Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800002 32)

5.19.2 Setting the Encoder Resolution Compatibility Selection

When a Σ-X rotary servomotor is connected to a Σ-X-Series SERVOPACK, the servomotor can be operated with an encoder resolution that differs from the servomotor specifications.

First set Pn21D to n.□□□1 (enable encoder resolution compatibility), and then set the encoder resolution in Pn21D = n.□□X□.

> Important
>
> After setting the parameters, check the details of the settings again. If this settings are incorrect, unexpected machine operation, failure, or personal injury may occur.

Parameter	Digit	Setting	Description	When Enabled
Pn21D	n.□□□X	Encoder Resolution Compatibility Selection (Speed, Pos, Trq)		When Enabled
		0 (Default)	Disable encoder resolution compatibility.	After restart
		1	Enable encoder resolution compatibility.	
Pn21D	n.□□X□	Encoder Resolution Compatibility: Resolution Selection (Speed, Pos, Trq)		When Enabled
		4	Operate as 20-bit encoder.	After restart
		6	Operate as 22-bit encoder.	
		8 (Default)	Operate as 24-bit encoder.	
		A	Operate as 26-bit encoder.	
		Other values	Reserved (Do not use.)	

(1) Restrictions

Encoder bit count compatibility cannot be used when any of the following conditions apply.

- When fully-closed loop control is being used.
- When the bit count of the encoder in the connected servomotor is less than the bit count selected in Pn21D = n.□□X□.
- When a linear servomotor is connected.
- When the encoder resolution of the connected servomotor is not 2^n.

6

Application Functions

Describes the application functions that you can set before you start servo system operation. It also describes the setting methods.

6.1 Changing Allocations of I/O Signals

I/O signals 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 signals. Signal allocations and polarity settings are made with the SigmaWin+ or parameters.

Information
Refer to the following section for the default settings of the I/O signal connector (CN1) and pin numbers for which allocations can be changed.
☞ *4.5.1 I/O Signal Connector (CN1) Names and Functions on page 131*

6.1.1 Changing Allocations of I/O Signals

Use the following procedure to change the signals allocated to pins on the I/O signal connector (CN1) and the polarity of the signals.

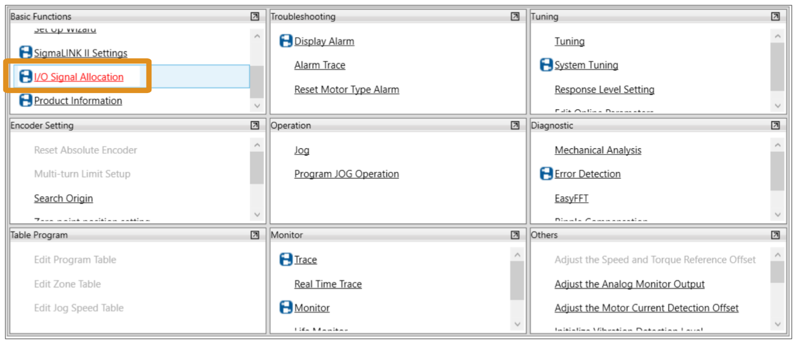
Information
This section gives the procedure using the SigmaWin+. Signal allocations and polarity can also be set with parameters. Refer to the following section for details.
☞ *6.1.3 Input Signal Allocations on page 210*
☞ *6.1.4 Output Signal Allocations on page 213*

Important
If you use Σ-LINK II, you must also set the peripheral devices in addition to the I/O signal allocations. Refer to the following chapter instead of this procedure if you use Σ-LINK II.
☞ *11 Σ-LINK II Function on page 493*

1. **Click the [ ] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**

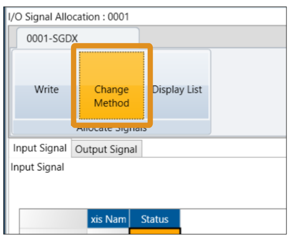
   The [Menu] window will be displayed.

2. **Click [I/O Signal Allocation] in the [Basic Functions] area.**



   The [I/O Signal Allocation] window will be displayed.

3. **Click [Change Method].**

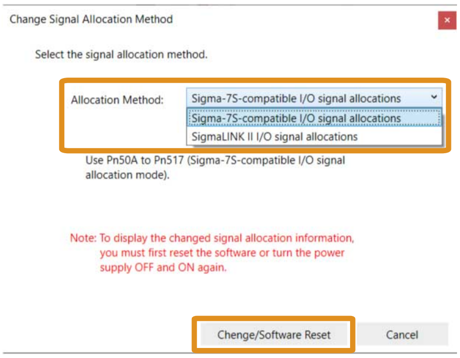


   The [Change Signal Allocation Method] window will be displayed.

4. **Select the allocation methods and click the [Change/Software Reset] button.**

   Refer to the following sections for details on allocation methods.

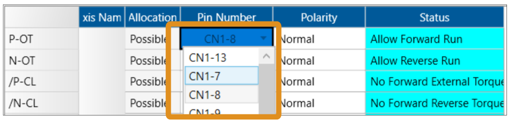
   ☞ *6.1.2 I/O Signal Allocations on page 210*



The software will be reset to change the set allocation methods. The [I/O Signal Allocation] dialog box will return when the software is reset.

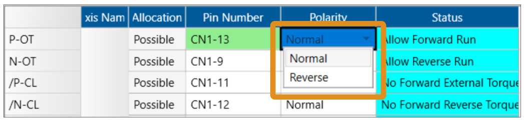
5. **Click the [Input Signal] tab or [Output Signal] tab for the signal allocations to change.**

6. **Double-click the [Pin Number] cell on the row of the signal with the allocation to change, select the pin number, and then press the [Enter] key.**



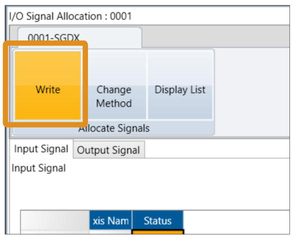
The background of the cell with the changed signal allocation will change to green.

7. **Double-click the [Polarity] cell on the row of the signal with the polarity to change, select the polarity, and then press the [Enter] key.**



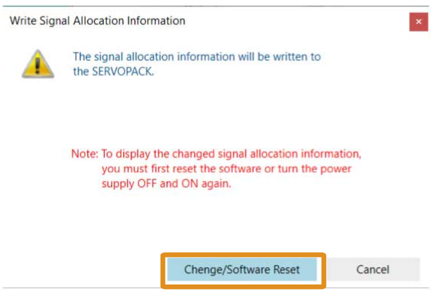
The background of the cell with the changed polarity will change to green.

8. **Click [Write].**



The [Write Signal Allocation Information] dialog box will be displayed.

9. **Click the [Change/Software Reset] button.**



The software will be reset, the changes to the I/O signal allocations and polarities will be applied, and the backgrounds of the cell will return to white.

This concludes the procedure.

6.1.2 I/O Signal Allocations

There are the following two methods to allocate I/O signals.

Allocation Method	Description	Reference
Σ-7S-compatible I/O Signal Allocations	Use Pn50A to Pn516 to allocate pin numbers to I/O signals.	• Input Signals *(1) Σ-7S-Compatible Input Signal Allocations on page 210* • Output Signals *(1) Σ-7S-Compatible Output Signal Allocations on page 213*
Σ-LINK II Input Signal Allocations	• When the Σ-LINK II Is Not Used Use Pn590 to Pn5BC to allocate pin numbers to I/O signals. • When the Σ-LINK II Is Used Use Pn590 to Pn5BC to allocate pin numbers or communications data to input signals.	• Input Signals *(2) Σ-LINK II Input Signal Allocations on page 211* • Output Signals *(2) Σ-LINK II Input Signal Allocations on page 214*

Information When Σ-LINK II is not used, "Σ-7S-compatible I/O Signal Allocations" and "Σ-LINK II-compatible I/O Signal Allocations" differ only in the parameters used to allocate I/O signals. The signals and pin numbers to allocate are the same for both methods.

Specify the allocation method to use in Pn50A = n.□□□X (Input Signal Allocation Mode).

		Input Signal Allocation Mode (Speed, Pos, Trq)		When Enabled
Pn50A	n.□□□X	0	Reserved (Do not use.)	After restart
		1 [Default]	Use Pn50A to Pn516 (Sigma-7S-compatible I/O signal allocation mode).	
		2	Use Pn590 to Pn5BC (SigmaLINK II input signal allocation mode).	

You can also use MECHATROLINK commands to force output signals. Refer to the following section for details.

(3) Forcing Outputs with MECHATROLINK Commands on page 215

6.1.3 Input Signal Allocations

This section describes the parameters used to change allocations and the relationship between pin numbers and polarity by allocation method of input signals.

Important
- If you change the default polarity settings for the P-OT (Forward Drive Prohibit Input), or N-OT (Reverse Drive Prohibit Input) signal, the main circuit power will not be turned OFF and 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.

(1) Σ-7S-Compatible Input Signal Allocations

The parameters used to change allocations of I/O signals are shown in the following table.

Signal		Parameter
P-OT	Forward Drive Prohibit Input	Pn50A = n.X□□□
N-OT	Reverse Drive Prohibit Input	Pn50B = n.□□□X
/P-CL	Forward External Torque Limit Input	Pn50B = n.□X□□
/N-CL	Reverse External Torque Limit Input	Pn50B = n.X□□□
/DEC	Origin Return Deceleration Switch Input	Pn511 = n.□□□X

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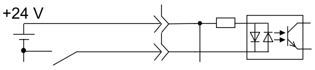
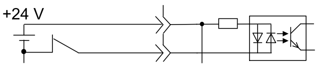
Signal		Parameter
/EXT1	External Latch Input 1	Pn511 = n.□□X□
/EXT2	External Latch Input 2	Pn511 = n.□X□□
/EXT3	External Latch Input 3	Pn511 = n.X□□□
FSTP	Forced Stop Input	Pn516 = n.□□□X

(a) 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.

<table>
<tr><th>Parameter Setting</th><th>Pin No.</th><th>Description</th></tr>
<tr><td>0</td><td>CN1-13 *1</td><td rowspan="7">
A reverse signal (a signal with “/” before the signal abbreviation, such as the / P-CL signal) is active when the contacts are ON (closed).
A signal that does not have “/” before the signal abbreviation (such as the P-OT signal) is active when the contacts are OFF (open).</td></tr>
<tr><td>1</td><td>CN1-7 *1</td></tr>
<tr><td>2</td><td>CN1-8 *1</td></tr>
<tr><td>3</td><td>CN1-9 *1</td></tr>
<tr><td>4</td><td>CN1-10</td></tr>
<tr><td>5</td><td>CN1-11</td></tr>
<tr><td>6</td><td>CN1-12</td></tr>
<tr><td>7</td><td>–</td><td>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.</td></tr>
<tr><td>8</td><td>–</td><td>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.</td></tr>
<tr><td>9</td><td>CN1-13 *1</td><td rowspan="7">
A reverse signal (a signal with “/” before the signal abbreviation, such as the / P-CL signal) is active when the contacts are OFF (open).
A signal that does not have “/” before the signal abbreviation (such as the P-OT signal) is active when the contacts are ON (closed).</td></tr>
<tr><td>A</td><td>CN1-7 *1</td></tr>
<tr><td>B</td><td>CN1-8 *1</td></tr>
<tr><td>C</td><td>CN1-9 *1</td></tr>
<tr><td>D</td><td>CN1-10</td></tr>
<tr><td>E</td><td>CN1-11</td></tr>
<tr><td>F</td><td>CN1-12</td></tr>
</table>

*1 Cannot be set if Pn511 = n.□□X□ (/EXT1 (External Latch Input 1) Signal Allocation), Pn511 = n.□X□□ (/EXT2 (External Latch Input 2) Signal Allocation), and Pn511 = n.X□□□ (/EXT3 (External Latch Input 3) Signal Allocation).

< Example 1 >

When Pn50A is set to n.5□□□, the P-OT (Forward Drive Prohibit Input) signal is active (enable forward drive) when CN1-11 is ON (open).

< Example 2 >

When Pn50A is set to n.8□□□, the P-OT (Forward Drive Prohibit Input) signal is always inactive.

(2) Σ-LINK II Input Signal Allocations

The parameters used to change allocations of input signals are shown in the following table.

Signal		Parameter
P-OT	Forward Drive Prohibit Input	Pn590
N-OT	Reverse Drive Prohibit Input	Pn591
/P-CL	Forward External Torque Limit Input	Pn598
/N-CL	Reverse External Torque Limit Input	Pn599

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Signal		Parameter
/DEC	Origin Return Deceleration Switch Input	Pn592
/EXT1	External Latch Input 1	Pn593
/EXT2	External Latch Input 2	Pn594
/EXT3	External Latch Input 3	Pn595
FSTP	Forced Stop Input	Pn597

(a) Relationship between Parameter Settings and Allocated Pin Numbers

The following table shows the relationship between the input signal parameter settings and the pin numbers on the I/O signal connector (CN1).

Parameter Setting	Description
n.□007 *1	Allocate the signal to CN1-7.
n.□008 *1	Allocate the signal to CN1-8.
n.□009 *1	Allocate the signal to CN1-9.
n.□010	Allocate the signal to CN1-10.
n.□011	Allocate the signal to CN1-11.
n.□012	Allocate the signal to CN1-12.
n.□013	Allocate the signal to CN1-13.
n.□100	Allocate the signal to SigmaLINK II Sequence Input 0.
n.□101	Allocate the signal to SigmaLINK II Sequence Input 1.
n.□102	Allocate the signal to SigmaLINK II Sequence Input 2.
n.□103	Allocate the signal to SigmaLINK II Sequence Input 3.
n.□104	Allocate the signal to SigmaLINK II Sequence Input 4.
n.□105	Allocate the signal to SigmaLINK II Sequence Input 5.
n.□106	Allocate the signal to SigmaLINK II Sequence Input 6.
n.□107	Allocate the signal to SigmaLINK II Sequence Input 7.

*1 Cannot be set for Pn593 (/EXT1 (External Latch Input 1) Signal Allocation), Pn594 (/EXT2 (External Latch Input 2) Signal Allocation), and Pn595 (/EXT3 (External Latch Input 3) Signal Allocation).

Important

If you will not use Σ-LINK II, always set n.□0□□ (allocate signal to CN1-□). If you set n.□1□□ (allocate the signal to SigmaLINK II Sequence Input □), the signal input will not function.

(b) Relationship between Parameter Settings and Polarities

The following table shows the relationship between the input signal parameter settings and polarities.

Parameter Setting	Description
n.0□□□	The signal is always inactive.
n.1□□□	Active when input signal is ON (closed).
n.2□□□	Active when input signal is OFF (open).
n.3□□□	The signal is always active.

6.1.4 Output Signal Allocations

This section describes the parameters used to change allocations and the relationship between pin numbers and polarity by allocation method of output signals.

Important
- The signals that are not detected are considered to be OFF. For example, the /COIN (Positioning Completion Output) signal is considered to be OFF during speed control.
- Reversing the polarity of the /BK (Brake Output) 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.

(1) Σ-7S-Compatible Output Signal Allocations

The parameters used to change allocations of I/O signals are shown in the following table.

Signal		Parameter
/COIN	Positioning Completion Output	Pn50E = n.□□□X
/V-CMP	Speed Coincidence Detection Output	Pn50E = n.□□X□
/TGON	Rotation Detection Output	Pn50E = n.□X□□
/S-RDY	Servo Ready Output	Pn50E = n.X□□□
/CLT	Torque Limit Detection Output	Pn50F = n.□□□X
/VLT	Speed Limit Detection Output	Pn50F = n.□□X□
/BK	Brake Output	Pn50F = n.□X□□
/WARN	Warning Output	Pn50F = n.X□□□
/NEAR	Near Output	Pn510 = n.□□□X
/PM	Preventative Maintenance Output	Pn514 = n.□X□□

(a) Relationship between Parameter Settings and Allocated Pin Numbers

The following table shows the relationship between the output signal parameter settings and the pin numbers on the I/O signal connector (CN1).

Parameter Setting	Description
0	Disable (signal output is not used)
1	Output the allocated signal from the CN1-1 or CN1-2 output terminal.
2	Output the allocated signal from the CN1-23 or CN1-24 output terminal.
3	Output the allocated signal from the CN1-25 or CN1-26 output terminal.
4 to 6	Reserved (Do not use.)

(b) Output Signal Polarity Switching

The polarity of the output signal is switched using Pn512.

Pn512	n.□□□X	Output Signal Inversion for CN1-1 and CN1-2 Terminals (Speed Pos Trq)		When Enabled
		0 Default	The signal is not inverted.	After restart
		1	The signal is inverted.	
Pn512	n.□□X□	Output Signal Inversion for CN1-23 and CN1-24 Terminals (Speed Pos Trq)		When Enabled
		0 Default	The signal is not inverted.	After restart
		1	The signal is inverted.	

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Application Functions 6

Continued from previous page.

Pn512	n.□X□□	Output Signal Inversion for CN1-25 and CN1-26 Terminals Speed Pos Trq		When Enabled
		0 Default	The signal is not inverted.	After restart
		1	The signal is inverted.	

(2) Σ-LINK II Input Signal Allocations

The parameters used to change allocations of output signals are shown in the following table.

Signal		Parameter
/COIN	Positioning Completion Output	Pn5B0
/V-CMP	Speed Coincidence Detection Output	Pn5B1
/TGON	Rotation Detection Output	Pn5B2
/S-RDY	Servo Ready Output	Pn5B3
/CLT	Torque Limit Detection Output	Pn5B4
/VLT	Speed Limit Detection Output	Pn5B5
/BK	Brake Output	Pn5B6
/WARN	Warning Output	Pn5B7
/NEAR	Near Output	Pn5B8
/PM	Preventative Maintenance Output	Pn5BC

(a) Relationship between Parameter Settings and Allocated Pin Numbers

The following table shows the relationship between the output signal parameter settings and the pin numbers on the I/O signal connector (CN1).

Parameter Setting	Description
n.□000	Disable (the signal output is not used).
n.□023	Allocate the signal to CN1-23.
n.□025	Allocate the signal to CN1-25.
n.□027	Allocate the signal to CN1-27.
n.□029	Allocate the signal to CN1-29.
n.□031	Allocate the signal to CN1-31.

Important

When the polarity setting is "n.1□□ (output the signal)" or "n.2□□ (invert the signal and output it)", make sure to allocate the signal to a pin number on CN1. If you do not allocate the signal to a pin number, A.040 (Parameter Setting Error) will occur.

(b) Relationship between Parameter Settings and Polarities

The following table shows the relationship between the input signal parameter settings and polarities.

Parameter Setting	Description
n.0□□□	Disable (the signal output is not used).
n.1□□□	Output the signal.
n.2□□□	Invert the signal and output it.

Important

When the polarity setting is n.1□□ (output the signal) or n.2□□ (invert the signal and output it), make sure to allocate the signal to a pin number on CN1. If you do not allocate the signal to a pin number, A.040 (Parameter Setting Error) will occur.

(3) Forcing Outputs with MECHATROLINK Commands

You can use the MECHATROLINK command SVCMD_OUT *1 to force output on general-purpose sequence output 1 (SO1) to general-purpose sequence output 3 (SO3).

Use Pn56A = n.□XXX to set the output signal reference method for SO1 to SO3.

Parameter			Description	When Enabled
Pn56A	n.□□□X	SO1 Output Signal Reference Method Selection	Speed Pos Trq	When Enabled
		0	Reserved (Do not use.)	After restart
		1 Default	Output OR of parameter-assigned SO1 signal and signal set by SVCMD_OUT.	
		2	Output signal set by SCVMD_OUT to SLO1.	
Pn56A	n.□□X□	SO2 Output Signal Reference Method Selection	Speed Pos Trq	When Enabled
		0	Reserved (Do not use.)	After restart
		1 Default	Output OR of parameter-assigned SO2 signal and signal set by SVCMD_OUT.	
		2	Output signal set by SCVMD_OUT to SLO2.	
Pn56A	n.□X□□	SO3 Output Signal Reference Method Selection	Speed Pos Trq	When Enabled
		0	Reserved (Do not use.)	After restart
		1 Default	Output OR of parameter-assigned SO3 signal and signal set by SVCMD_OUT.	
		2	Output signal set by SCVMD_OUT to SLO3.	

For example, if Pn56A is set to n.□□□1, a logical OR of the /BK signal and the signal set with SVCMD_OUT *1 will be output.

Important

To output only the signal that is set with SVCMD_OUT *1 on SO1 to SO3, disable the signal that is allocated to CN1 (i.e., set it to not use the signal).

*1 Field name of MECHATROLINK-4 command. This is SVCMD_IO when using MECHATROLINK-III commands. For details, refer to the following manual that corresponds to the communications references being used.

Σ-7/Σ-X-Series MECHATROLINK-4 Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800002 32)

Σ-7/Σ-X-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

If you use Σ-LINK II, you can use this function to force the DO signal from the sensor hub with a command from the host controller. Refer to the following section for details.

☞ *11 Σ-LINK II Function on page 493*

6.1.5 ALM (Servo Alarm Output) Signal

This signal is output when the SERVOPACK detects an error.

Important

Configure an external circuit so that this alarm output turns OFF the main circuit power supply to the SERVOPACK whenever an error occurs.

Type	Signal	Connector Pin No.	Signal Status	Meaning
Output	ALM	CN1-3 and CN1-4	ON (closed)	Normal SERVOPACK status
			OFF (open)	SERVOPACK alarm

(1) Alarm Reset Methods

Refer to the following section for information on the alarm reset methods.

☞ *13.2.3 Alarm Reset on page 574*

6.1.6 /WARN (Warning Output) 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 Output) signal indicates that a condition exists that may result in an alarm.

Type	Signal	Connector Pin No.	Signal Status	Meaning
Output	/WARN	Must be allocated.	ON (closed)	Warning
			OFF (open)	Normal status

Note:

You must allocate the /WARN signal to use it. The parameters that you use depend on the allocation method.

Allocation Method	Parameter to Use
Σ-7S-compatible I/O Signal Allocations	• Pn50A = n.□□□1 (Σ-7S-Compatible I/O Signal Allocations) • Pn50F = n.X□□□ (/WARN (Warning Output) Signal Allocation)
Σ-LINK II Input Allocations	• Pn50A= n.□□□2 (Σ-LINK II Input Allocations) • Pn5B7 (/WARN (Warning Output) Signal Allocation)

Refer to the following section for details.

☞ *6.1.4 Output Signal Allocations on page 213*

6.1.7 /TGON (Rotation Detection Output) Signal

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.

Type	Signal	Connector Pin No.	Signal Status	Servomotor	Meaning
Output	/TGON	Must be allocated.	ON (closed)	Rotary servomotor	The servomotor is operating at the setting of Pn502 or faster.
				Linear servomotor	The Servomotor is operating at the setting of Pn581 or faster.
			OFF (open)	Rotary servomotor	The servomotor is operating at a speed that is slower than the setting of Pn502.
				Linear servomotor	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. The parameters that you use depend on the allocation method.

Allocation Method	Parameter to Use
Σ-7S-compatible I/O Signal Allocations	• Pn50A = n.□□□1 (Σ-7S-compatible I/O Signal Allocations) • Pn50E = n.□X□□ (/TGON (Rotation Detection Output) Signal Allocation)
Σ-LINK II Input Signal Allocations	• Pn50A = n.□□□2 (Σ-LINK II Input Allocation) • Pn5B2 (/TGON (Rotation Detection Output) Signal Allocation)

Refer to the following section for details.

☞ *6.1.4 Output Signal Allocations on page 213*

(1) Setting the Rotation Detection Level

Use the following parameter to set the speed detection level at which to output the /TGON signal.

- Rotary Servomotors

Pn502	Rotation Detection Level Speed Pos Trq			
	Setting Range	Setting Unit	Default Setting	When Enabled
	1 to 10000	1 min-1	20	Immediately

- Linear Servomotors

Pn581	Zero Speed Level Speed Pos Trq			
	Setting Range	Setting Unit	Default Setting	When Enabled
	1 to 10000	1 mm/s	20	Immediately

6.1.8 /S-RDY (Servo Ready Output) Signal

The /S-RDY (Servo Ready Output) 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 is ON.
- There is no hard wire base block state.
- There are no alarms.
- There is no forced stop state (= the Forced Stop Input (FSTP) signal is ON).
- 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 *1.
- 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.

*1 Do not include this condition if the SV_ON (Servo ON) command is input for the first time after the control power 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.

Type	Signal	Connector Pin No.	Signal Status	Meaning
Output	/S-RDY	Must be allocated.	ON (closed)	Ready to receive the SV_ON (Servo ON) command.
			OFF (open)	Not ready to receive the SV_ON (Servo ON) command.

Note:

• You must allocate the /S-RDY signal to use it. The parameters that you use depend on the allocation method.

Allocation Method	Parameter to Use
Σ-7S-compatible I/O Signal Allocations	– Pn50A = n.□□□1 (Σ-7S-compatible I/O Signal Allocations) – Pn50E = n.X□□□ (/S-RDY (Servo Ready Output) Signal Allocations)
Σ-LINK II Input Signal Allocations	– Pn50A = n.□□□2 (use Σ-LINK II input signal allocations) – Pn5B3 (/S-RDY (Servo Ready Output) Signal Allocations)

Refer to the following section for details.

☞ *6.1.4 Output Signal Allocations on page 213*

• Refer to the following section for information on the hard wire base block and the /S-RDY signal.

☞ *12.2.8 /S-RDY (Servo Ready Output) Signal on page 529*

6.1.9 /V-CMP (Speed Coincidence Detection Output) 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.

Type	Signal	Connector Pin No.	Signal Status	Meaning
Output	/V-CMP	Must be allocated.	ON (closed)	The speed coincides.
			OFF (open)	The speed does not coincide.

Note:
You must allocate the /V-CMP signal to use it. The parameters that you use depend on the allocation method.

Allocation Method	Parameter to Use
Σ-7S-compatible I/O Signal Allocations	• Pn50A = n.□□□1 (Σ-7S-Compatible I/O Signal Allocations) • Pn50E = n.□□X□ (/V-CMP (Speed Coincidence Detection Output) Signal Allocation)
Σ-LINK II Input Allocations	• Pn50A= n.□□□2 (Σ-LINK II Input Allocations) • Pn5B1 (/V-CMP (Speed Coincidence Detection Output) Signal Allocation)

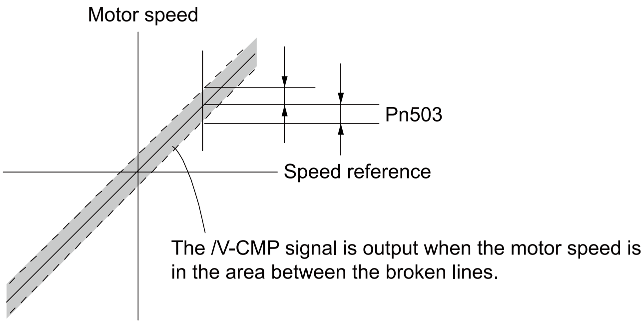
Refer to the following section for details.
☞ *6.1.4 Output Signal Allocations on page 213*

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

Pn503	Speed Coincidence Detection Signal Output Width			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 100	1 min-1	10	Immediately

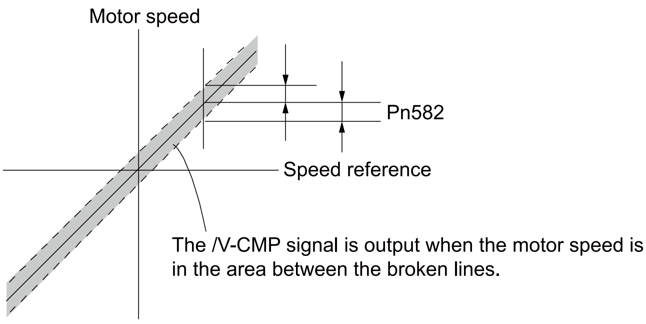
The signal is output when the difference between the reference speed and motor speed is equal or less than the setting.
For example, if Pn503 is set to 100 and the speed reference is 2000 min-1, the signal would be output when the motor speed is between 1900 min-1 and 2100 min-1.



- Linear Servomotors

Pn582	Speed Coincidence Detection Signal Output Width			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 100	1 mm/s	10	Immediately

The signal is output when the difference between the reference speed and motor speed is equal or less than the setting.
For example, if Pn582 is set to 100 and the speed reference is 2000 mm/s, the signal would be output when the motor speed is between 1900 mm/s and 2100 mm/s.



6.1.10 /COIN (Positioning Completion Output) Signal

The /COIN (Positioning Completion Output) 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 Pn522 (Positioning Completed Width).

Use this signal to check the completion of positioning from the host controller.

Type	Signal	Connector Pin No.	Signal Status	Meaning
Output	/COIN	Must be allocated.	ON (closed)	Positioning has been completed.
			OFF (open)	Positioning has not been completed.

Note:

You must allocate the /COIN signal to use it. The parameters that you use depend on the allocation method.

Allocation Method	Parameter to Use
Σ-7S-Compatible I/O Signal Allocations	• Pn50A = n.□□□1 (Σ-7S-Compatible I/O Signal Allocations) • Pn50E = n.□□□X (/COIN (Positioning Completion Output) Signal Allocation)
Σ-LINK II Input Allocations	• Pn50A = n.□□□2 (Σ-LINK II Input Allocation) • Pn5B0 (/COIN (Positioning Completion Output) Signal Allocation)

For details, refer to the following section.

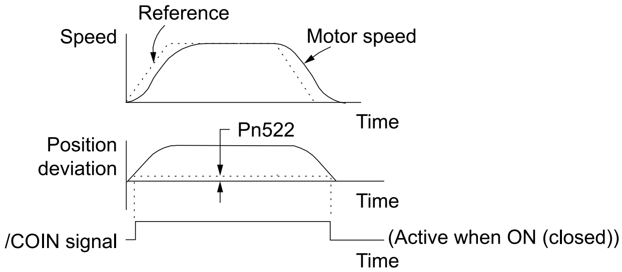
☞ *6.1.4 Output Signal Allocations on page 213*

(1) 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 Pn522 (Positioning Completed Width).

Pn522	In-position Range			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 1073741824	1 reference unit	7	Immediately

The setting of this parameter 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.

(2) 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□□□ (/COIN (Positioning Completion Output) Signal Output Timing) to change output timing for the /COIN signal.

Pn207	n.X□□□	/COIN (Positioning Completion Output) Signal Output Timing	Speed Pos Trq	When Enabled
		0 Default	Output when the absolute value of the position deviation is the same or less than the setting of Pn522 (Positioning Completed Width).	After restart
		1	Output when the absolute value of the position error is the same or less than the setting of Pn522 (Positioning Completed Width) and the reference after the position reference filter is 0.	
		2	Output when the absolute value of the position error is the same or less than the setting of Pn522 (Positioning Completed Width) and the reference input is 0.	

6.1.11 /NEAR (Near Output) Signal

The /NEAR (Near Output) signal indicates when positioning completion is being approached.

The host controller receives the NEAR signal before it receives the /COIN (Positioning Completion Output) 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.

Type	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. The parameters that you use depend on the allocation method.

Allocation Method	Parameter to Use
Σ-7S-compatible I/O Signal Allocations	• Pn50A = n.□□□1 (Σ-7S-Compatible I/O Signal Allocations) • Pn50E = n.□□□X (/NEAR (Near Output) Signal Allocation)
Σ-LINK II Input Allocations	• Pn50A= n.□□□2 (Σ-LINK II Input Allocations) • Pn5B8 (/NEAR (Near Output) Signal Allocation)

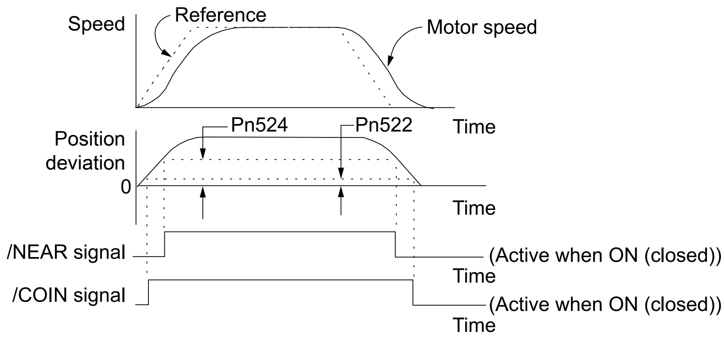
Refer to the following section for details.

☞ *6.1.4 Output Signal Allocations on page 213*

(1) Setting /NEAR (Near) Signal

You set the condition for outputting the /NEAR (Near Output) 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 Pn524.

Pn524	Near Signal Width (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	1 to 1073741824	1 reference unit	1073741824	Immediately



Note:

Normally, set Pn524 to a value that is larger than the setting of Pn522 (Positioning Completed Width).

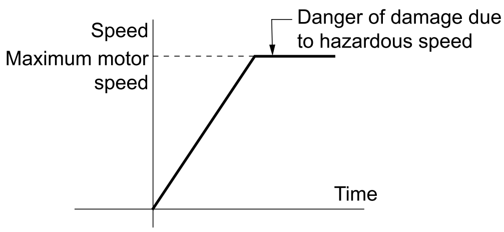
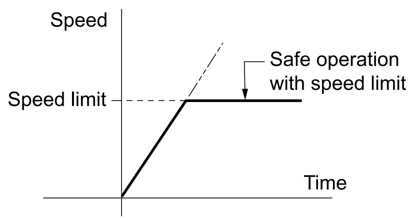
6.1.12 Speed Limit during Torque Control

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.

Without Speed Limit	With a Speed Limit
	

(1) /VLT (Speed Limit Detection Output) signal

The signal that is output when the motor speed is being limited by the speed limit is described in the following table.

Type	Signal	Connector Pin No.	Signal Status	Meaning
Output	/VLT	Must be allocated.	ON (closed)	The servomotor speed is being limited.
			OFF (open)	The servomotor speed is not being limited.

Note:

You must allocate the /VLT signal to use it. The parameters that you use depend on the allocation method.

Allocation Method	Parameter to Use
Σ-7S-compatible I/O Signal Allocations	• Pn50A = n.□□□1 (Σ-7S-Compatible I/O Signal Allocations) • Pn50F = n.□□X□ (/VLT (Speed Limit Detection Output) Signal Allocation)
Σ-LINK II Input Allocations	• Pn50A= n.□□□2 (Σ-LINK II Input Allocations) • Pn5B5 (/VLT (Speed Limit Detection Output) Signal Allocation)

Refer to the following section for details.

☞ *6.1.4 Output Signal Allocations on page 213*

(2) Selecting the Speed Limit

The smaller of the external speed limit and internal speed limit will be used.

Parameter		Meaning		When Enabled
Pn002	n.□□X□	Torque Control Option (Speed Pos Trq)		When Enabled
		0	Reserved (Do not use.)	After restart
		1 Default	Use the speed limit for torque control (VLIM) as the speed limit.	

(3) 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.□□X□ (Speed Limit Selection) to specify using the maximum motor speed or the overspeed alarm detection speed as the speed limit.

Use caution as the definition of maximum motor speed depends on your servomotor.

- Rotary servomotor: The maximum rotation speed listed in the ratings table of the servomotor.
  Refer to the following document for the ratings table of the servomotor.
  Σ-X-Series Catalog (Catalog No.: KAEP C710812 03)
- Linear servomotor: The setting of Pn385 (Maximum Motor Speed).

The overspeed alarm detection speed is appropriately 1.1-times the maximum motor speed.

Parameter		Meaning		When Enabled
Pn408	n.□□X□	Speed Limit Selection (Speed Pos Trq)		When Enabled
		0 Default	Use the smaller of the maximum motor speed and the setting of Pn407 as the speed limit. Use the smaller of the maximum motor speed and the setting of Pn480 as the speed limit.	After restart
		1	Use the smaller of the overspeed alarm detection speed and the setting of Pn407 as the speed limit. Use the smaller of the overspeed alarm detection speed and the setting of Pn480 as the speed limit.	

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

Pn407	Speed Limit during Torque Control (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 10000	1 min-1	10000	Immediately

- Linear Servomotors

Pn480	Speed Limit during Force Control (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 10000	1 mm/s	10000	Immediately

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.

(4) External Speed Limiting

The motor speed will be limited by VLIM (Limit Speed for Torque Control). For details, refer to the following manual that corresponds to the communications references being used.

Σ-7/Σ-X-Series MECHATROLINK-4 Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800002 32)

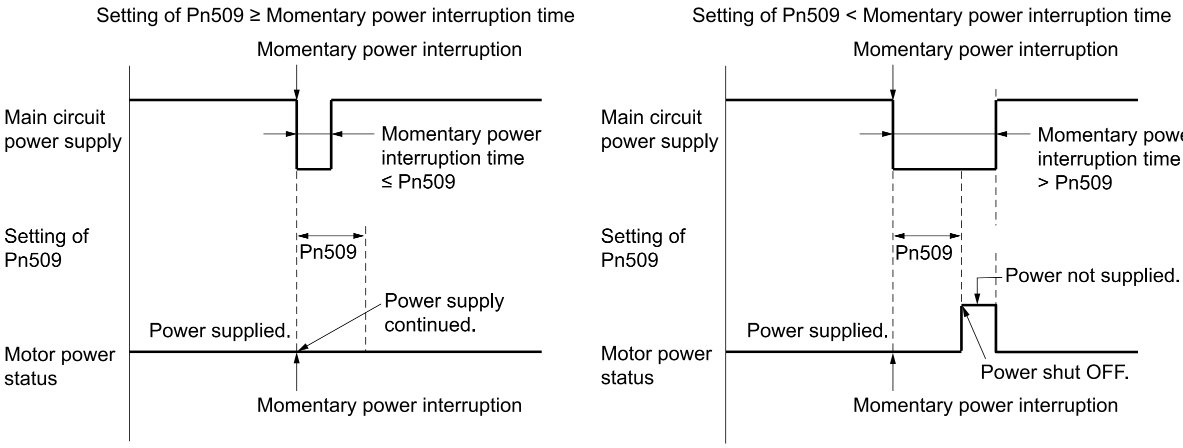
Σ-7/Σ-X-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

6.2 Operation for Momentary Power Interruptions

Even if the main power to the SERVOPACK is interrupted momentarily, power to the motor (servo ON status) will be maintained for the time set in Pn509 (Momentary Power Interruption Hold Time).

Pn509	Momentary Power Interruption Hold Time (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	20 to 50000	1 ms	20	Immediately

If the momentary power interruption time is equal to or less than the setting of Pn509, power to the motor will be continued. If it is longer than the setting, power to the motor will be stopped. Power will be supplied to the motor again when the main circuit power supply recovers.



Information
- If the momentary power interruption time exceeds the setting of Pn509, the /S-RDY (Servo Ready Output) signal will turn OFF.
- 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 50000 ms.
- 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 is turned OFF normally.
- The detection delay time for main circuit power OFF is approximately 16 ms. Therefore, the actual time that power will continue being supplied to the motor will increase from the setting of Pn509 by the amount of the detection delay time.

Important

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.

6.3 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 setting of Pn509 (Momentary Power Interruption Hold Time) to allow the servomotor to continue operating without stopping for an alarm or without recovery work even if the power supply voltage drops.

6.3.1 Execution Sequence

This function can be executed either with the host controller or with the SERVOPACK. Use Pn008 = n.□□X□ (Function Selection for Undervoltage) to specify whether the function is executed by the host controller or by the SERVOPACK.

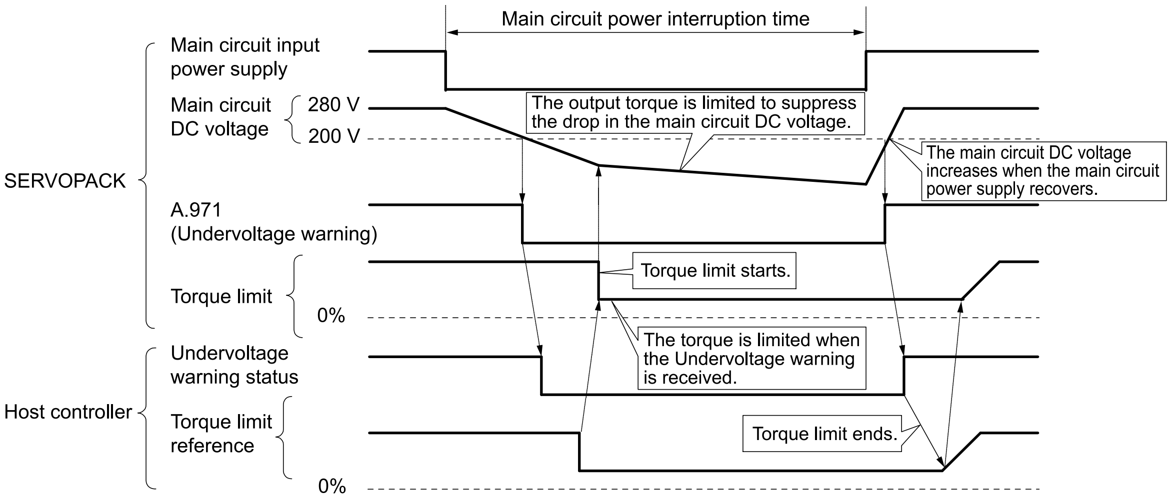
The default setting is Pn008 = n.□□0□ (do not detect undervoltage warning).

		Function Selection for Undervoltage	Speed Pos Trq	When Enabled
Pn008	n.□□X□	0 Default	Do not detect undervoltage.	After restart
		1	Detect undervoltage warning and limit torque at host controller.	
		2	Detect undervoltage warning and limit torque with Pn424 and Pn425 (i.e., only in SERVOPACK).	

(1) When Pn008 is set to n.□□1□ (Execution with the Host Controller)

The host controller limits the torque in response to an A.971 warning (Undervoltage).

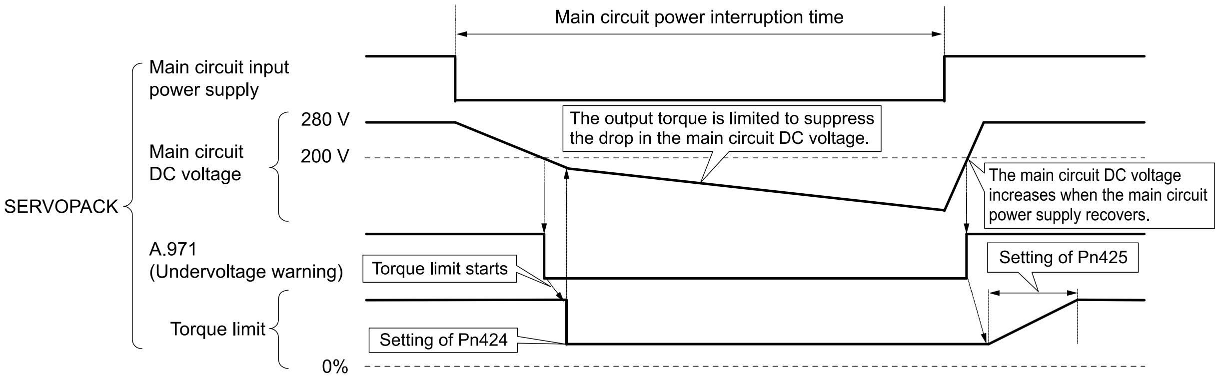
The host controller removes the torque limit after the Undervoltage warning is cleared.



(2) When Pn008 is set to n.□□2□ (Execution with the SERVOPACK)

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.



6.3.2 Related Parameters

The following parameters are related to the SEMI F47 function.

Parameter				
Pn424	Torque Limit at Main Circuit Voltage Drop (Speed, Pos, Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 100	1%	50	Immediately
Pn425	Release Time for Torque Limit at Main Circuit Voltage Drop (Speed, Pos, Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 1000	1 ms	100	Immediately
Pn509	Momentary Power Interruption Hold Time (Speed, Pos, Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	20 to 50000	1 ms	20	Immediately

Note:
1. The setting unit for Pn424 (Torque Limit at Main Circuit Voltage Drop) is set as percentage of the motor rated torque.
2. If you will use the SEMI F47 function, set the time to 1000 ms.

Important

- This function handles momentary power interruptions for the voltage and time ranges stipulated in SEMI F47. An uninterruptible power supply (UPS) is required as a backup for momentary power interruptions that exceed these voltage and time ranges.
- Set the host controller or SERVOPACK torque limit so that a torque reference that exceeds the specified acceleration torque will not be output when the power supply for the main circuit is restored.
- For a vertical axis, do not limit the torque to a value that is lower than the holding torque.
- This function limits torque within the range of the SERVOPACK's capability for power interruptions. It is not intended for use under all load and operating conditions. Set the parameters while monitoring operation on the actual machine.
- You can set the momentary power interruption hold time to increase the amount of time from when the power is turned OFF until power to the motor is stopped.
  To stop the power to the motor immediately, use the SV_OFF (Servo OFF) command.

6.4 Setting the Maximum Motor Speed

You can set the maximum speed of the servomotor with the following parameter.

- Rotary Servomotors

Pn316	Maximum Motor Speed			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 65535	1 min^{-1}	10000	After restart

- Linear Servomotors

Pn385	Maximum Motor Speed			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	1 to 100	100 mm/s	50	After restart

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.
  ☞ *6.5 Encoder Divided Pulse Output on page 227*

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 driven beyond the allowable moment load of inertia
  Refer to relevant manual from the following list for the relationship between the speed and the allowable moment of load inertia.
  - Σ-X-Series Rotary Servomotor Product Manual (Manual No.: SIEP C230210 00)
  - Σ-7-Series Direct Drive Servomotor Product Manual (Manual No.: SIEP S800001 38)
  - Σ-7-Series Linear Servomotor Product Manual (Manual No.: SIEP S800001 37)
- To increase the encoder output resolution and increase the position resolution managed by the host controller (for a linear servomotor)

6.5 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.

Note:

If Pn660 is set to n.1□□□ (enable triggers at preset positions), encoder divided pulses are not output.

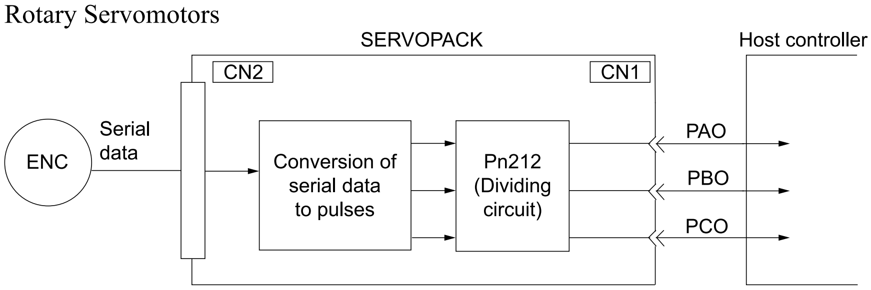
6.5.1 Encoder Divided Pulse Output Signals

Type	Signal	Connector Pin No.	Name	Meaning
Output	PAO	CN1-17	Encoder Divided Pulse Output, Phase A	• Rotary Servomotors These encoder divided pulse output pins output the number of pulses per servomotor resolution that is set in Pn212 (Number of Encoder Output Pulses). The phase difference between phase A and phase B is an electric angle of 90°. • 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°.
	/PAO	CN1-18		
	PBO	CN1-19	Encoder Divided Pulse Output, Phase B	
	/PBO	CN1-20		
	PCO	CN1-21	Encoder Divided Pulse Output, Phase C *1	These pins output one pulse every servomotor rotation.
	/PCO	CN1-22		

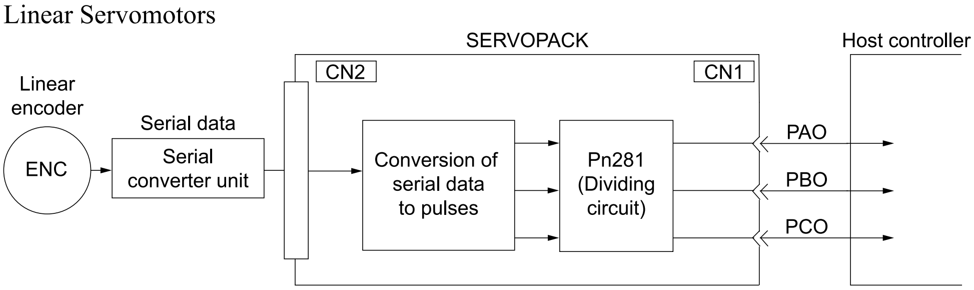
*1 Refer to the following section for information on the origin within one encoder rotation.

☞ *(a) Relation between Renishaw PLC Incremental Linear Encoders and Encoder Output Pulse Signal from the SERVOPACK When Using a RGS20 Scale and RGH22B Sensor Head on page 228*

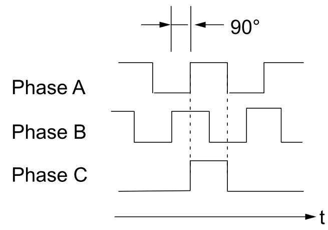
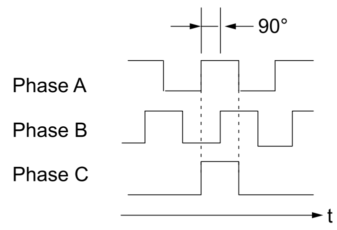
- Rotary Servomotors



- Linear Servomotors



(1) Output Phase Forms

Forward Rotation or Movement (phase B leads by 90°)	Reverse Rotation or Movement (phase A leads by 90°)
	

Note:

The pulse width of the origin within one encoder rotation depends on the setting of Pn212 (Number of Encoder Output Pulses) or Pn281 (Encoder Output Resolution). It is the same as the width of phase A.

Even for Pn000 = n.□□□1 (reverse operation), the output phase form is the same as shown above.

Important

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^{-1} or lower. If the motor speed is higher than 600 min^{-1}, the phase-C pulse may not be output correctly.

(2) Linear Encoder Application Precautions

The following precautions apply to the encoder output pulses when an external linear encoder is used.

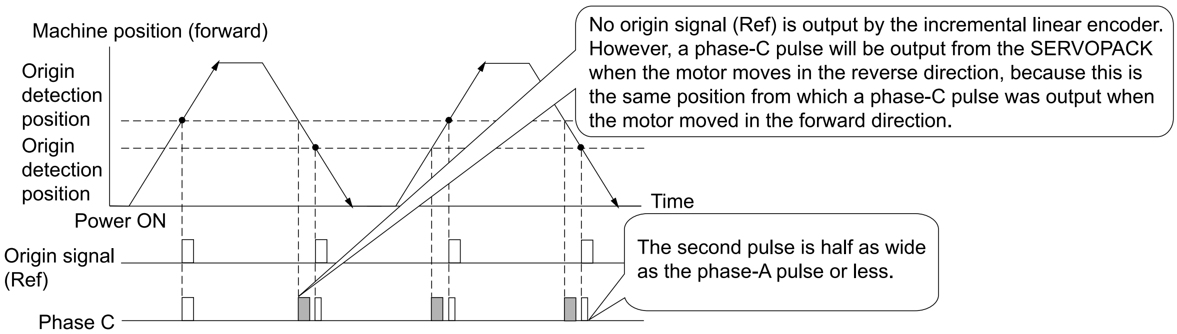
(a) Relation between Renishaw PLC Incremental Linear Encoders and Encoder Output Pulse Signal from the SERVOPACK When Using a RGS20 Scale and RGH22B Sensor Head

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.

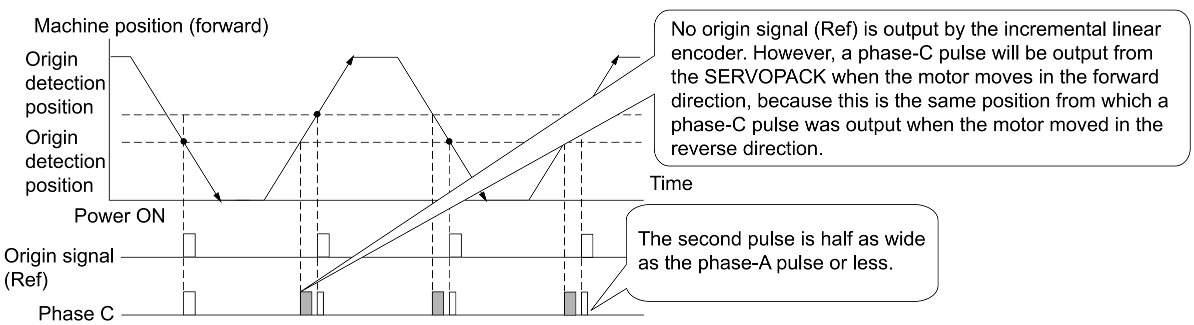
In that case, the phase-C pulse of the SERVOPACK is output at two positions.

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



◆ When Passing the First Origin Signal (Ref) in the Reverse Direction and Returning after Turning ON the Power



(b) Precautions When Using a Linear Incremental Encoder from Magnescale Co., Ltd.

◆ Encoder Divided Phase-C Pulse Output Selection

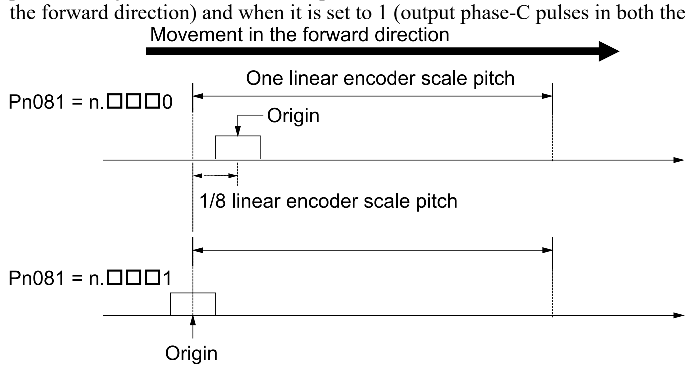
You can also output the encoder's phase-C pulse for reverse movement. To do so, set Pn081 to n.□□□1.

Pn081	n.□□□X	Phase-C Pulse Output Selection	Speed Pos Trq	When Enabled
		0 Default	Output phase-C pulses only in the forward direction.	After restart
		1	Output phase-C pulses in both the forward and reverse directions.	

Important

Precautions on Setting Pn081 = n.□□□X (Phase-C Pulse Output Selection)

- If you set Pn081 to n.□□□1 (output phase-C pulses in both the forward and reverse directions), the width of the phase-C pulse output may be narrower than the width of the phase-A pulse.
- There is a difference of 1/8th of the scale pitch in the phase-C detection position for the encoder's phase-C pulse output position, origin return command, or phase-C latch between when Pn081 = n.□□□X set to 0 (output phase-C pulses only in the forward direction) and when it is set to 1 (output phase-C pulses in both the forward and reverse directions).



Observe the following precaution if you set Pn081 to n.□□□0 (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.

Note:

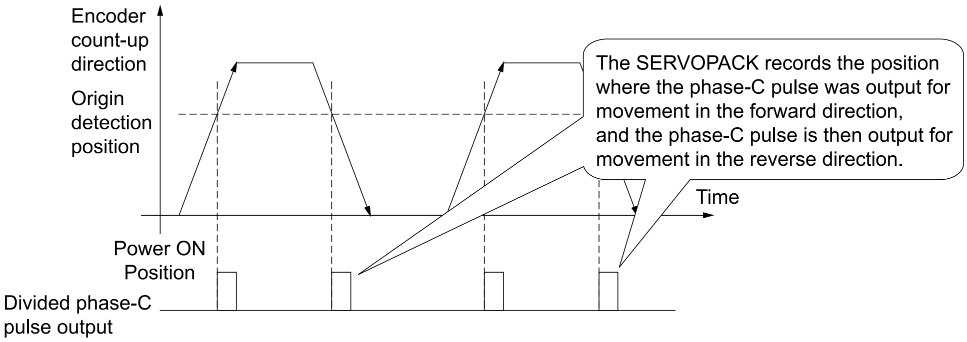
The count direction (up or down) of the linear encoder determines whether a phase-C pulse is output. The output of the pulse does not depend on the setting of Pn000 = n.□□□1 (Reverse Movement Mode).

Encoder Model	Interpolator	Linear Encoder Scale Pitch [μm]
SL710	PL101-RY MJ620-T13	800
SL720		800
SL730		800
SR75		80
SR85		80
SQ10	MQ10-FLA	400
	MQ10-GLA	

◆ When First Passing the Origin Signal in the Forward Direction and Returning after Turning ON the Power

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 is turned ON.

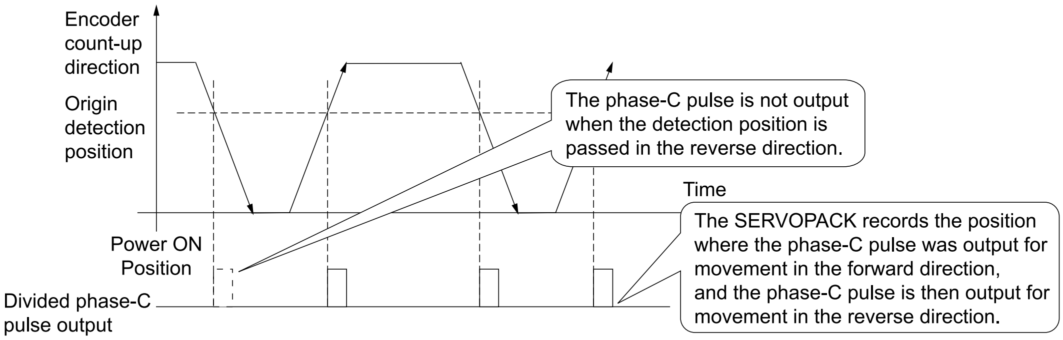
After that, the phase-C pulse is output whenever the origin detection position is passed in the forward or reverse direction.



◆ When First Passing the Origin Signal in the Reverse Direction and Returning after Turning ON the Power

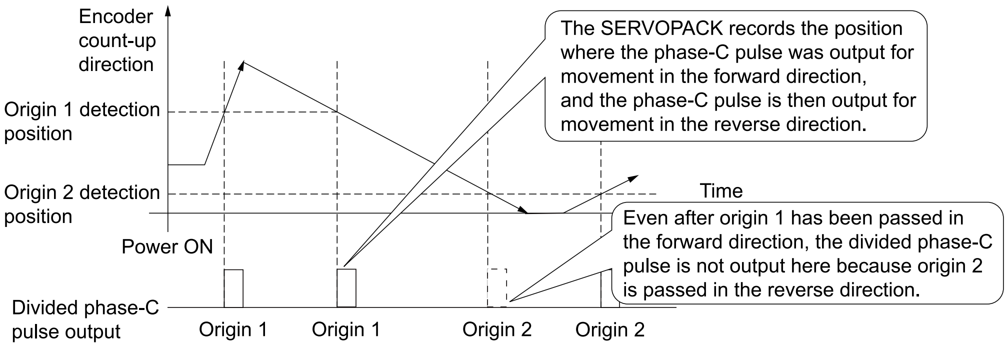
The encoder's phase-C pulse (CN1-21 and CN1-22) is not output when the origin detection position is passed for the first time in the reverse direction after the power is turned ON.

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

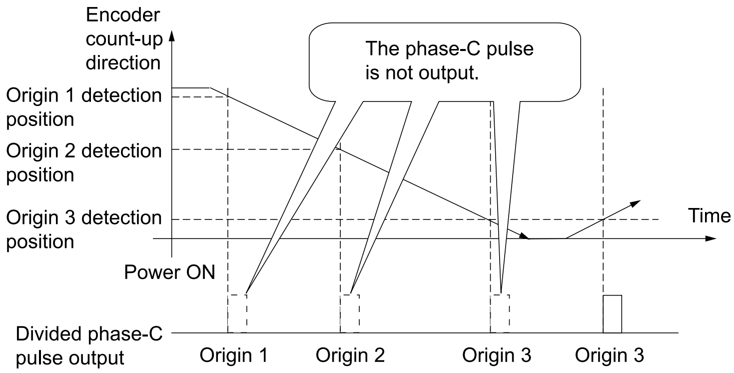
The encoder’s phase-C pulse is output when the origin detection position is passed for the first time in the forward direction after the power is turned ON. After that, the phase-C pulse is output whenever the origin detection position is passed in the forward or reverse direction.



◆ When Using a Linear Encoder with Multiple Origins and First Passing the Origin Position in the Reverse Direction after Turning ON the Power

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 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.



6.5.2 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.

(1) Encoder Divided Pulse Output When Using a Rotary Servomotor

If you will use a rotary servomotor, set Pn212 (Number of Encoder Output Pulses).

Pn212	Number of Encoder Output Pulses			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	16 to 1073741824	1 P/Rev	2048	After restart

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.

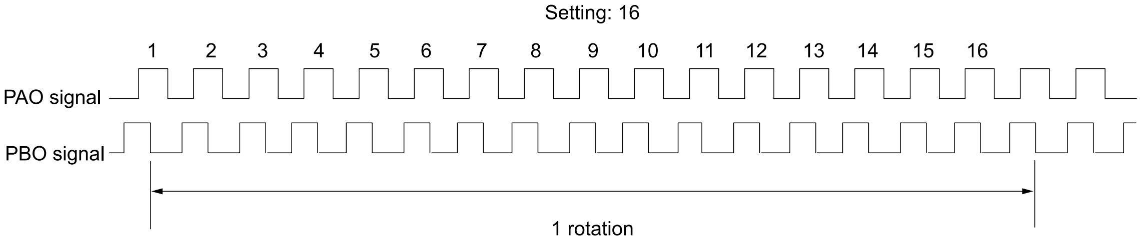
Setting of the Number of Encoder Output Pulses [P/Rev]	Setting Increment	Encoder Resolution				Upper Limit of Servomotor Speed for Set Number of Encoder Output Pulses [min^{-1}]
		20 bits (1048576 pulses)	22 bits (4194304 pulses)	24 bits (16777216 pulses)	26 bits (67108864 pulses)	
16 to 8192	1	○	○	○	○	7000
8193 to 16384	1	○	○	○	○	6000
16386 to 32768	2	○	○	○	○	3000
32772 to 65536	4	○	○	○	○	1500
65544 to 131072	8	○	○	○	○	750
131088 to 262144	16	○	○	○	○	375
262176 to 524288	32	–	○	○	○	187
524352 to 1048576	64	–	○	○	○	93
1048704 to 2097152	128	–	–	○ *1	○	46
2097408 to 4194304	256	–	–	○ *1	○	23

*1 You can use the encoder as an incremental encoder only.

Note:

1. The setting range of Pn212 (Number of Encoder Output Pulses) 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 25000 [P/Rev].
   Incorrect setting example: Pn212 cannot be set to 25001 (P/Rev) because the setting increment in the above table is not used and A.041 alarm would will occur.
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).



(2) Encoder Divided Pulse Output When Using a Linear Servomotor

If you will use a linear servomotor, set Pn281 (Encoder Output Resolution).

Pn281	Encoder Output Resolution			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	1 to 4096	1 edge/pitch	20	After restart

Note:

- The maximum setting for the encoder output resolution is 4096. If the resolution of the external encoder exceeds 4096, pulse output will no longer be possible at the resolution given in the following section.
  ☞ ◆ *Feedback Resolution of Linear Encoder: Incremental Linear Encoder on page 190*
  ☞ ◆ *Feedback Resolution of Linear Encoder: Absolute Linear Encoder on page 190*
- If the setting of Pn281 exceeds the number of divisions of the external encoder, A.041 (Encoder Output Pulse Setting Error) will be output.

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 scale pitch *1 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 Pn385 (Maximum Motor Speed) and Pn282 (Linear Encoder Scale Pitch) *1 of the servomotor. You can calculate the upper limit of the setting of Pn281 with the following formula.

$$\text{Upper limit of Pn281} = \frac{\text{Linear encoder scale pitch}^{*1}/100}{\text{Pn385}} \times 72$$

*1 The value depends on whether a serial converter unit is used.

Using a Serial Converter Unit	Setting of Pn282
Not Using a Serial Converter Unit (when the linear encoder and SERVOPACK are connected directly or when a linear encoder that does not require a serial converter unit is used)	The linear encoder scale pitch is automatically detected by the SERVOPACK, so the setting of Pn282 is ignored.

Information When the linear encoder scale pitch is 4 µm, the maximum motor speed is limited to 1 m/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.

<Setting Example>

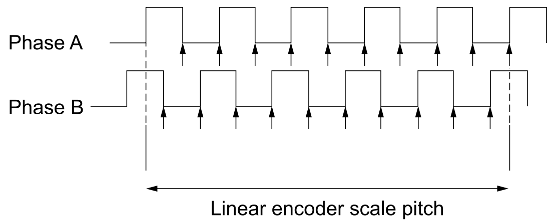
When the linear encoder scale pitch is 20 µm and the maximum motor speed is 5 m/s (Pn385 = 50).

Correct setting: Pn281 = 28 (edges/pitch)

Incorrect setting: Pn281 = 29 (edges/pitch) (An A.041 alarm would will occur.)

<Pulse Output Example>

When Pn281 = 20 (20-edge output (5-pulse output) per linear encoder scale pitch)



6.6 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.

6.6.1 Setting to Enable/Disable Software Limits

You can use Pn801= n.□□□X (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 (Zero Point Return) command has been executed.
- The POS_SET (Set Coordinates) command has been executed with REFE set to 1.
- If an absolute encoder is used, the SENS_ON (Turn Sensor ON) command must have been completed.

			Software Limits (Speed / Pos / Trq)	When Enabled
Pn801	n.□□□X	0	Enable both forward and reverse software limits.	Immediately
		1	Disable forward software limit.	
		2	Disable reverse software limit.	
		3 (Default)	Disable both forward and reverse software limits.	

6.6.2 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 (Speed / Pos / Trq)			
Pn804	Setting Range	Setting Unit	Default Setting	When Enabled
	-1073741823 to 1073741823	1 reference unit	1073741823	Immediately

	Reverse Software Limit (Speed / Pos / Trq)			
Pn806	Setting Range	Setting Unit	Default Setting	When Enabled
	-1073741823 to 1073741823	1 reference unit	-1073741823	Immediately

6.6.3 Software Limit Check for References

You can enable or disable software limit checks for commands that have target position references, such as POSING (Positioning) command or INTERPOLATE (Interpolation Feed) command. If the target position exceeds a software limit, a deceleration stop will be performed from the position set as the software limit.

			Software Limit Check for References (Speed / Pos / Trq)	When Enabled
Pn801	n.□X□□	0 (Default)	Do not perform software limit checks for references.	Immediately
		1	Perform software limit checks for references.	

6.7 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 torque control	☞ *6.7.1 Internal Torque Limits on page 235*
External Torque Limits	The torque is limited with an input signal from the host computer.	Speed control, position control, or torque control	☞ *6.7.2 External Torque Limits on page 236*
Limiting Torque with TLIM Data in MECHATROLINK Commands *1	The TLIM data is used to set the required torque limits.	Speed control or position control	–
Limiting Torque with P_CL and N_CL in the MECHATROLINK Command SVCMD_OUT *2 *1	The torque is limited by using P_CL and N_CL in SVCMD_OUT *2.	Speed control or position control	–

*1 For details, refer to the following manual that corresponds to the communications references being used.

Σ-7/Σ-X-Series MECHATROLINK-4 Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800002 32)

Σ-7/Σ-X-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

*2 Field name of MECHATROLINK-4 command. This is SVCMD_IO when using MECHATROLINK-III commands.

Note:

If you set a value that exceeds the instantaneous maximum torque of the servomotor, the torque will be limited to the instantaneous maximum torque of the servomotor.

6.7.1 Internal Torque Limits

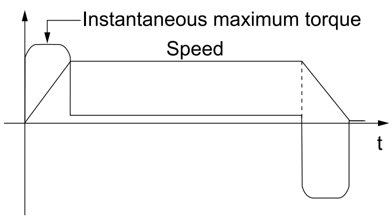
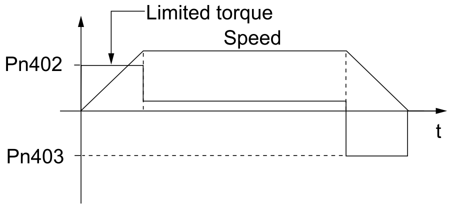
If you use internal torque limits, the maximum output torque will always be limited to the setting of Pn402 (Forward Torque Limit) and Pn403 (Reverse Torque Limit).

(1) Rotary Servomotors

Parameter	Name			Control Methods
Pn402	Forward Torque Limit			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 800	1%	800	Immediately
Pn403	Reverse Torque Limit			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 800	1%	800	Immediately

Note:

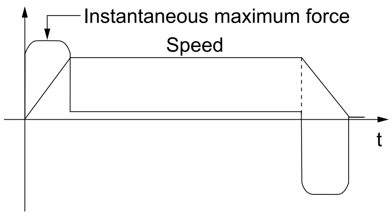
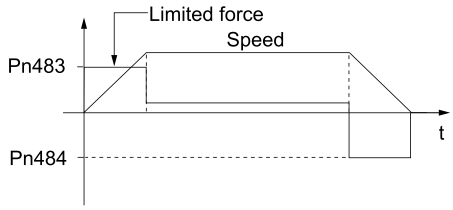
- The setting unit is a percentage of the motor rated torque.
- If the setting of Pn402 or Pn403 is too low, the torque may be insufficient for acceleration or deceleration of the servomotor.

Without Internal Torque Limits (Output to the instantaneous maximum torque is possible.)	With Internal Torque Limits
	

(2) Linear Servomotors

Pn483	Forward Force Limit			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 800	1%	30	Immediately
Pn484	Reverse Force Limit			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 800	1%	30	Immediately

Note:
- The setting unit is a percentage of the motor rated force.
- If the setting of Pn483 or Pn484 is too low, the force may be insufficient for acceleration or deceleration of the servomotor.

Without Internal Force Limits (Output to the instantaneous maximum force is possible.)	With Internal Force Limits
	

6.7.2 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.

(1) External Torque Limit Reference Signals

The /P-CL (Forward External Torque Limit Input) and /N-CL (Reverse External Torque Limit Input) 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.

Type	Signal	Connector Pin No.	Signal Status	Meaning
Input	/P-CL	Must be allocated.	ON (closed)	Applies the forward external torque limit. The torque is limited to the smaller of the settings of Pn402 *1 and Pn404.
			OFF (open)	Cancels the forward external torque limit. The torque is limited to the setting of Pn402 *1.
	/N-CL	Must be allocated.	ON (closed)	Applies the reverse external torque limit. The torque is limited to the smaller of the settings of Pn403 *1 and Pn405.
			OFF (open)	Cancels the reverse external torque limit. The torque is limited to the setting of Pn403 *1.

*1 Pn483 is used for a linear servomotor.
*2 Pn484 is used for a linear servomotor.

Note:

You must allocate the /P-CL signal and /N- CL signal to use them. The parameters that you use depend on the allocation method.

Allocation Method	Parameter to Use
Σ-7S-compatible I/O Signal Allocations	• Pn50A = n.□□□1 (Σ-7S-compatible I/O Signal Allocations) • Pn50B = n.□X□□ (/P-CL (Forward External Torque Limit Input) Signal Allocation) • Pn50B = n.X□□□ (/N-CL (Reverse External Torque Limit Input) Signal Allocation)
Σ-LINK II Input Signal Allocations	• Pn50A = n.□□□2 (use Σ-LINK II input signal allocations) • Pn598 (/P-CL (Forward External Torque Limit Input) Signal Allocations) • Pn599 (/N-CL (Reverse External Torque Limit Input) Signal Allocations)

Refer to the following section for details.

☞ *6.1.3 Input Signal Allocations on page 210*

(2) Torque Limit Settings

The parameters that are related to setting the torque limits are given below.

(a) 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.

Pn402	Forward Torque Limit			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 800	1%	800	Immediately
Pn403	Reverse Torque Limit			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 800	1%	800	Immediately
Pn404	Forward External Torque Limit			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 800	1%	100	Immediately
Pn405	Reverse External Torque Limit			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 800	1%	100	Immediately

Note:

The setting unit is a percentage of the motor rated torque.

(b) 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.

Pn483	Forward Force Limit			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 800	1%	30	Immediately
Pn484	Reverse Force Limit			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 800	1%	30	Immediately

Continued on next page.

Application Functions

6

Continued from previous page.

<table>
<tr><td rowspan="3">Pn404</td><td colspan="4">Forward External Torque Limit   Speed Pos Trq</td></tr>
<tr><td>Setting Range</td><td>Setting Unit</td><td>Default Setting</td><td>When Enabled</td></tr>
<tr><td>0 to 800</td><td>1%</td><td>100</td><td>Immediately</td></tr>
<tr><td rowspan="3">Pn405</td><td colspan="4">Reverse External Torque Limit   Speed Pos Trq</td></tr>
<tr><td>Setting Range</td><td>Setting Unit</td><td>Default Setting</td><td>When Enabled</td></tr>
<tr><td>0 to 800</td><td>1%</td><td>100</td><td>Immediately</td></tr>
</table>

Note:

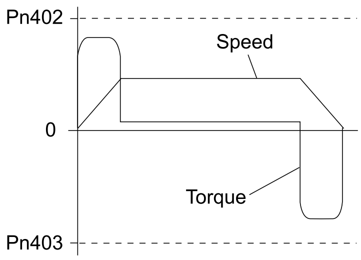
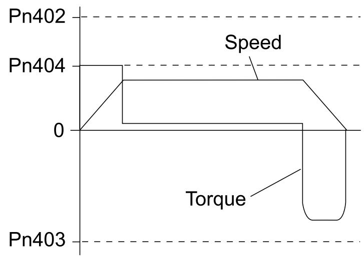
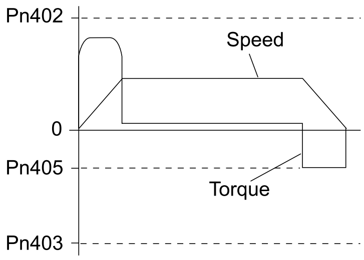
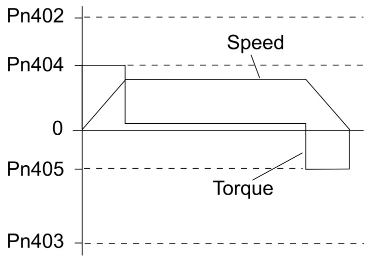
The setting unit is a percentage of the motor rated force.

(3) 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%.

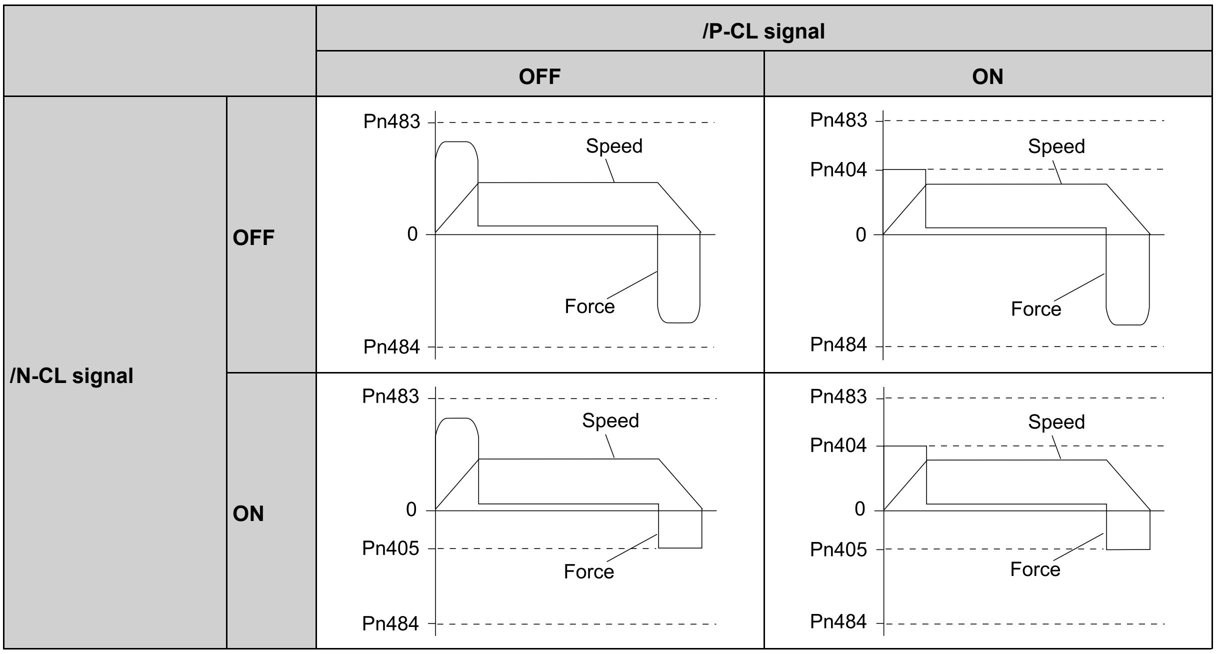
(a) Rotary Servomotors

In this example, the servomotor direction is set to Pn000 = n.□□□0 (use CCW as the forward direction).

<table>
<tr><td colspan="2" rowspan="2"></td><td colspan="2">**/P-CL signal**</td></tr>
<tr><td>**OFF**</td><td>**ON**</td></tr>
<tr><td rowspan="2">**/N-CL signal**</td><td>**OFF**</td><td>
</td><td>
</td></tr>
<tr><td>**ON**</td><td>
</td><td>
</td></tr>
</table>

(b) Linear Servomotors

In this example, the servomotor direction is set to Pn000 = n.□□□0 (use the direction in which the linear encoder counts up as the forward direction).



6.7.3 /CLT (Torque Limit Detection Output) Signal

This section describes the /CLT signal, which indicates the status of limiting the motor output torque.

Type	Signal	Connector Pin No.	Signal Status	Meaning
Output	/CLT	Must be allocated.	ON (closed)	The motor output torque is being limited.
			OFF (open)	The motor output torque is not being limited.

Note:
You must allocate the /CLT signal to use it. The parameters that you use depend on the allocation method.

Allocation Method	Parameter to Use
Σ-7S-compatible I/O Signal Allocation	• Pn50A = n.□□□1 (use Sigma-7S-compatible I/O signal allocations) • Pn50F = n.□□□X (/CLT (Torque Limit Detection Output) Signal Allocation)
Σ-LINK II Input Allocations	• Pn50A= n.□□□2 (use SigmaLINK II input allocations) • Pn5B4 (/CLT (Torque Limit Detection Output) Signal Allocation)

Refer to the following section for details.

☞ *6.1.4 Output Signal Allocations on page 213*

6.8 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 to the system is turned ON.

There are four types of encoders for rotary servomotors. The usage of the encoder is specified in Pn002 = n.□X□□.

Information Σ-X SERVOPACKs can be connected to absolute encoders only. However, an absolute encoder can also be used as an incremental encoder by setting Pn002 to n.□X□□.

Refer to the following section for encoder models.

☞ ◆ *Encoder Resolution on page 189*

- Parameter Settings When Using an Incremental Encoder

Parameter		Meaning	When Enabled
Pn002	**n.□0□□ (default setting)**	Use the encoder as an incremental encoder. A battery is not required.	After restart
	n.□1□□	Use the encoder as an incremental encoder. A battery is not required.	
	n.□2□□	Use the encoder as a single-turn absolute encoder. A battery is not required.	

- Parameter Settings When Using a Single-Turn Absolute Encoder

Parameter		Meaning	When Enabled
Pn002	**n.□0□□ (default setting)**	Use the encoder as a single-turn absolute encoder. A battery is not required.	After restart
	n.□1□□	Use the encoder as an incremental encoder. A battery is not required.	
	n.□2□□	Use the encoder as a single-turn absolute encoder. A battery is not required.	

- Parameter Settings When Using a Multiturn Absolute Encoder

Parameter		Meaning	When Enabled
Pn002	**n.□0□□ (default setting)**	Use the encoder as a multiturn absolute encoder. A battery is required.	After restart
	n.□1□□	Use the encoder as an incremental encoder. A battery is not required.	
	n.□2□□	Use the encoder as a single-turn absolute encoder. A battery is not required.	

- Parameter Settings When Using a Batteryless Multiturn Absolute Encoder

Parameter		Meaning	When Enabled
Pn002	**n.□0□□ (default setting)**	Use the encoder as a multiturn absolute encoder. A battery is not required.	After restart
	n.□1□□	Use the encoder as an incremental encoder. A battery is not required.	
	n.□2□□	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.

6.8.1 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.

☞ *4.4.3 Wiring the SERVOPACK to the Encoder on page 122*
☞ *4.5.3 I/O Signal Wiring Examples on page 134*

6.8.2 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 × Number of pulses within one encoder rotation (setting of Pn212) + Position (number of pulses) within one rotation

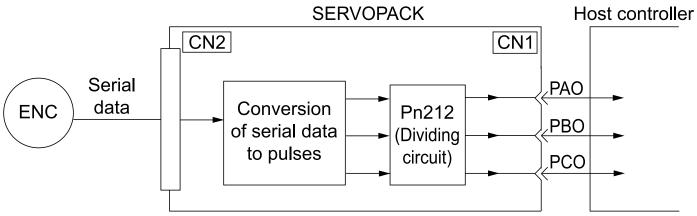
For a single-turn absolute encoder, the multiturn data is 0.

6.8.3 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)
	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 is turned ON.

The SENS_ON (Turn Sensor ON) 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 135*

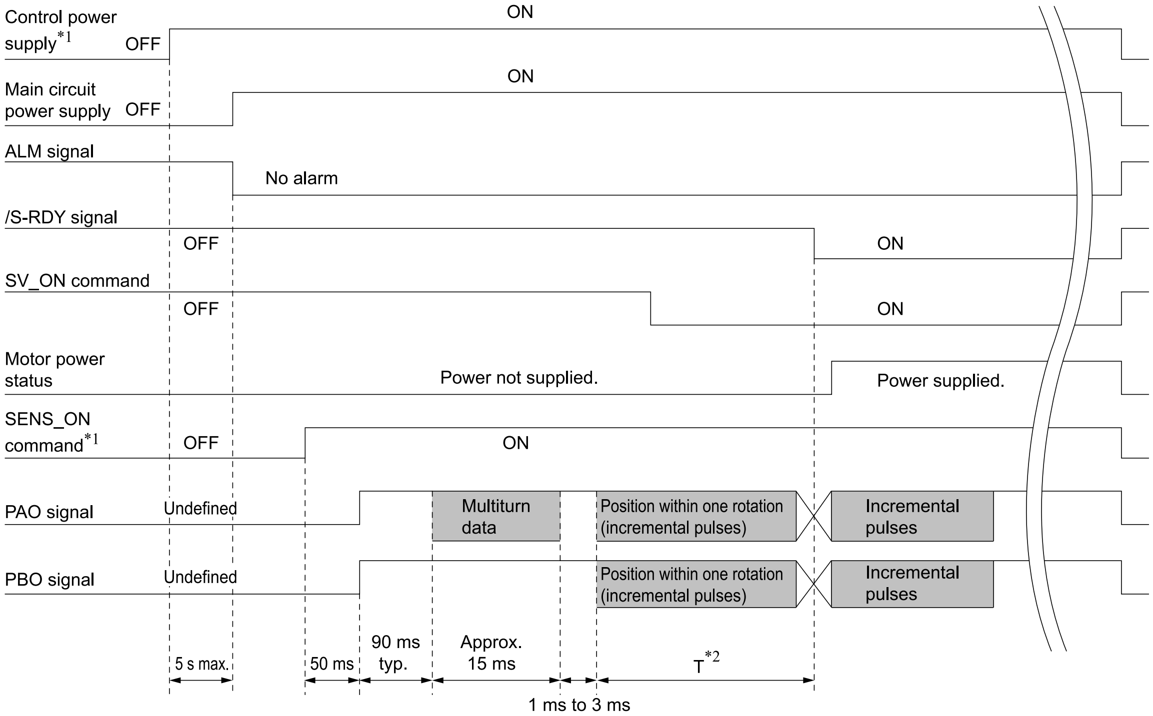
6.8.4 Reading the Position Data from the Absolute Encoder

The SENS_ON (Turn Sensor ON) 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.



*1 When you turn OFF the control power, input the SENS_OFF (Turn Sensor 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 16384	680 × Pn212 / 16384 [kpps]	25 ms max.
16386 to 32768	680 × Pn212 / 32768 [kpps]	50 ms max.
32722 to 65536	680 × Pn212 / 65536 [kpps]	100 ms max.
65544 to 131072	680 × Pn212 / 131072 [kpps]	200 ms max.
131088 to 262144	680 × Pn212 / 262144 [kpps]	400 ms max.
262176 to 524288	680 × Pn212 / 524288 [kpps]	800 ms max.
524352 to 1048576	680 × Pn212 / 1048576 [kpps]	1600 ms max.

6.8.5 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.

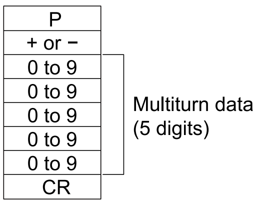
Refer to the following section for the timing of sending the position data from the absolute encoder.

☞ *6.8.4 Reading the Position Data from the Absolute Encoder on page 242*

Item	PAO Signal
Synchronization Method	Start-stop synchronization (ASYNC)
Transmission Speed	9600 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 Cycle	Each time the SENS_ON (Turn Sensor ON) command is input after the control power is turned ON

(1) 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).



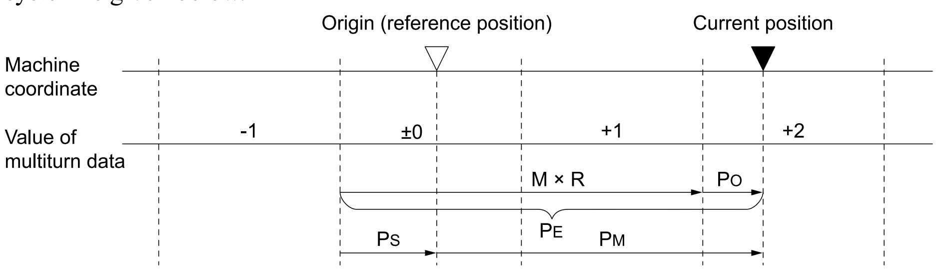
6.8.6 Calculating the Current Position in Machine Coordinates

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 P_M in the machine coordinate system is calculated as follows:

$P_M = P_E - P_S$

$P_E = M \times R + P_O$

$P_S = M_S \times R + P_S'$

Symbol	Meaning
P_E	Position data for the current position of the absolute encoder
M	Current position of the multiturn data of the absolute encoder
P_O	Position of the current position within one rotation
P_S	Position data of the absolute encoder when absolute encoder was reset
M_S	Multiturn data of the absolute encoder when absolute encoder was reset
P_S'	Position of the absolute encoder within one rotation when absolute encoder was reset
P_M	Current position in machine coordinate system
R	Pulse output for one encoder rotation

Note:

The calculations for Pn000 = n.□□□1 (reverse rotation mode) are given below.

$P_M = P_E - P_S$

$P_E = -M \times R + P_O$

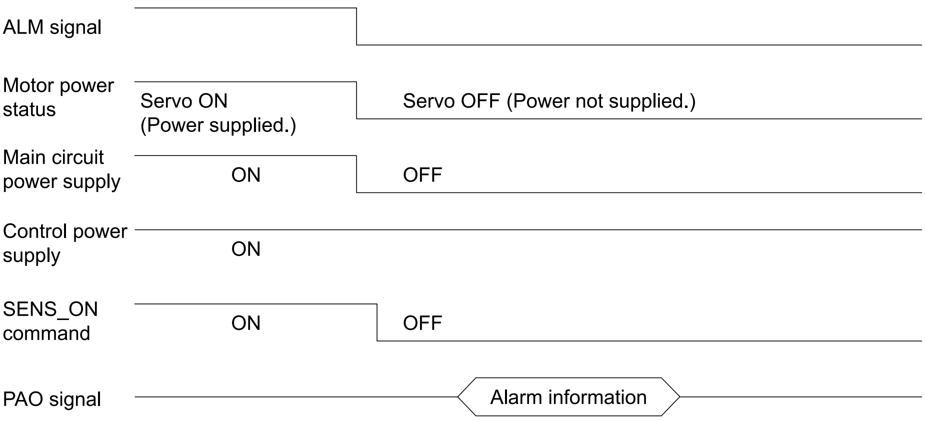
$P_S = M_S \times R + P_S'$

Information

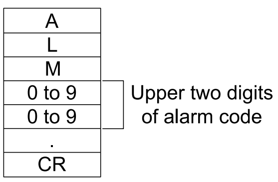
1. If you are using a rotary servomotor, you must reset the absolute encoder. Refer to the following section for information on resetting the absolute encoder.
   ☞ *5.16 Resetting the Absolute Encoder on page 194*
2. You can set the origin to a different position from the reset position. Refer to the following section for information on the origin position offset.
   ☞ *5.17 Setting the Origin of the Absolute Encoder on page 197*

6.8.7 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 Sensor ON) command turns OFF.



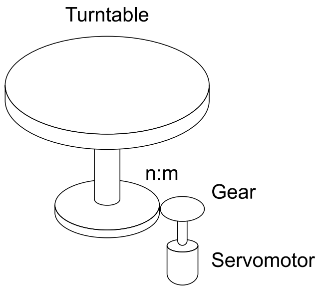
The data format of the alarm information is shown below.



6.8.8 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 revolutions.

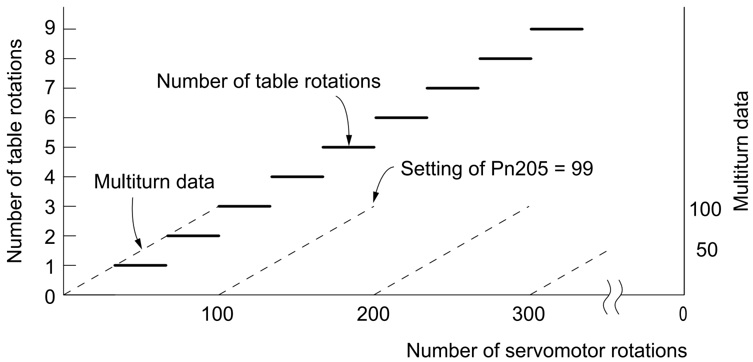
For a machine with a ratio of n:m between the number of servomotor rotations and the number of turntable rotations, as shown above, the value of m minus 1 will be the setting of Pn205 (Multiturn Limit).

Pn205 (Multiturn Limit) = 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.

Set Pn205 to 99.

Pn205 = 100 – 1 = 99



<table>
<tr><td rowspan="3">Pn205</td><td colspan="4">Multiturn Limit   Speed Pos Trq</td></tr>
<tr><td>Setting Range</td><td>Setting Unit</td><td>Default Setting</td><td>When Enabled</td></tr>
<tr><td>0 to 65535</td><td>1 rev</td><td>65535</td><td>After restart</td></tr>
</table>

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.

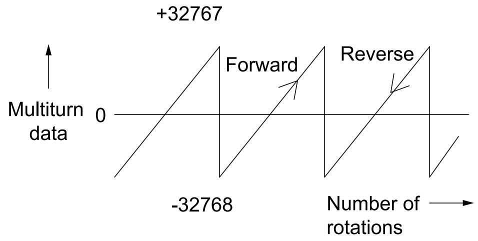
- If the servomotor operates in the reverse direction when the multiturn data is 0, the multiturn data will change to the value set in Pn205.
- If the servomotor operates in the forward direction when the multiturn data is at the value set in Pn205, the multiturn data will change to 0.

Set Pn205 to one less than the desired multiturn data.

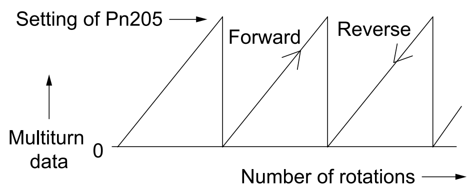
If you change the setting of Pn205, an A.CC0 alarm (Multiturn Limit Disagreement) will be displayed because the setting disagrees with the value in the encoder. Refer to the following section for the procedure to change the multiturn limit settings in the encoder.

☞ *6.8.9 A.CC0 (Multiturn Limit Disagreement Alarm) on page 246*

Default Setting



Not Default Setting



Information
The multiturn data will always be zero in the following cases. It is never necessary to reset the absolute encoder in these cases.
- When you use a single-turn absolute encoder
- When Pn002 is set to n.□2□□ (use the encoder as a single-turn absolute encoder)

A.810 and A.820 (alarms related to the absolute encoder) will also not occur.

6.8.9 A.CC0 (Multiturn Limit Disagreement Alarm)

If you change the multiturn limit in Pn205 (Multiturn Limit), an A.CC0 alarm (Multiturn Limit Disagreement) will be displayed because the setting disagrees with the value in the encoder.

Display	Name	Meaning
A.CC0	Multiturn Limit Disagreement	Different multiturn limits are set in the encoder and SERVOPACK.

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.

(1) Applicable Tools

The following table lists the tools that you can use to set the multiturn limit.

Tool	Fn No./Function Name	Operating Procedure Reference
Digital Operator	Fn013	Σ-7/Σ-X-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	[Encoder Setting] – [Multiturn Limit Setup]	*(2) Operating Procedure on page 246*

This setting can be made with the MEM_WR (Write Memory) command. For details on the MEM_WR command, refer to the following manual that corresponds to the communications references being used.

Σ-7/Σ-X-Series MECHATROLINK-4 Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800002 32)

Σ-7/Σ-X-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

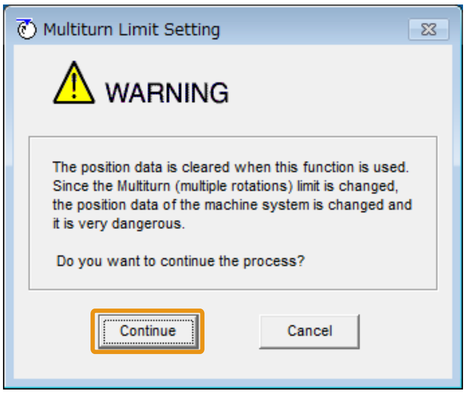
(2) Operating Procedure

Use the following procedure to adjust the multiturn limit setting.

1. **Click the [ ] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**
2. **Click [Multi-turn Limit Setup] in the [Menu] window.**

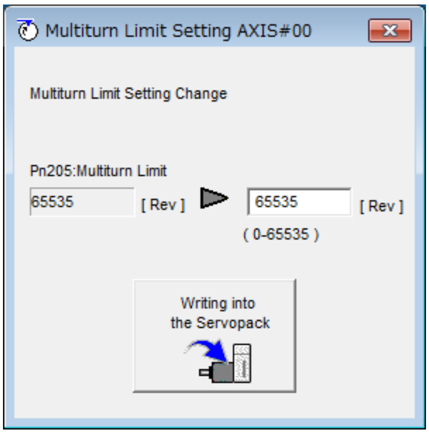
   The [Multiturn Limit Setting] window will be displayed.

3. **Click the [Continue] button.**

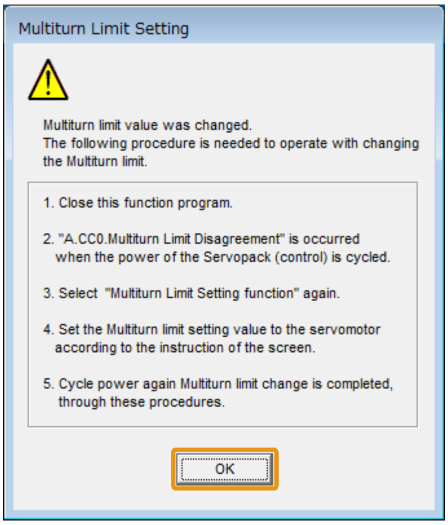


Click the [Cancel] button to cancel setting the multiturn limit.
The Main Window will return.

4. **Change the setting.**



5. **Click the [Writing into the Servopack] button.**
6. **Click the [OK] button.**

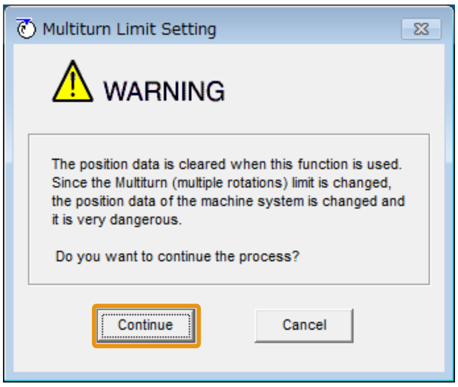


7. **Turn the power to the SERVOPACK OFF and ON again.**

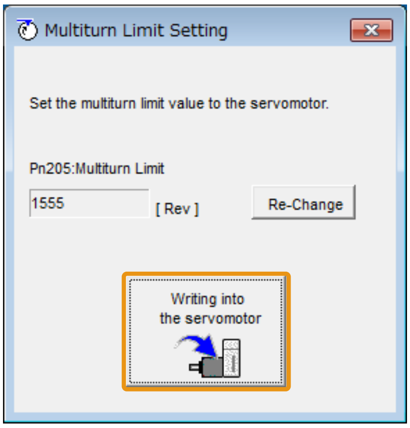
An A.CC0 alarm (Multiturn Limit Disagreement) will occur because setting the multiturn limit in the servomotor is not yet completed even though the setting has been changed in the SERVOPACK.

8. **Click [Multi-turn Limit Setup] in the [Menu] window.**

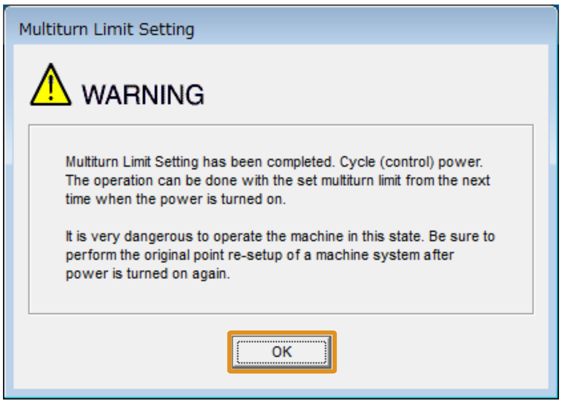
9. **Click the [Continue] button.**



10. **Click the [Writing into the servomotor] button.**



11. **Click the [OK] button.**



This concludes the procedure to set the multiturn limit.

6.9 Absolute Linear Encoders

The absolute linear encoder records the current position of the stop position even when the power 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 to the system is turned ON.

There are two types of linear encoders for linear servomotors. The usage of the linear encoder is specified in Pn002 = n.□X□□.

Refer to the following section for linear encoder models.

☞ ◆ *Feedback Resolution of Linear Encoder: Incremental Linear Encoder on page 190*

☞ ◆ *Feedback Resolution of Linear Encoder: Absolute Linear Encoder on page 190*

- Parameter Settings When Using an Incremental Linear Encoder

Parameter		Meaning	When Enabled
Pn002	**n.□0□□ (default setting)**	Use the encoder as an incremental linear encoder.	After restart
	n.□1□□	Use the encoder as an incremental linear encoder.	

- Parameter Settings When Using an Absolute Linear Encoder

Parameter		Meaning	When Enabled
Pn002	**n.□0□□ (default setting)**	Use the encoder as an absolute linear encoder.	After restart
	n.□1□□	Use the encoder as an incremental linear encoder.	

6.9.1 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.

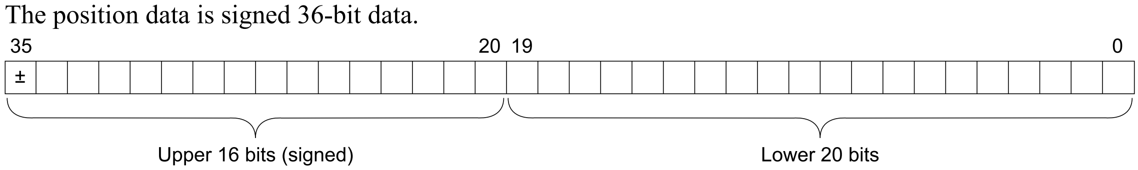
☞ *4.4.3 Wiring the SERVOPACK to the Encoder on page 122*

☞ *4.5.3 I/O Signal Wiring Examples on page 134*

6.9.2 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.



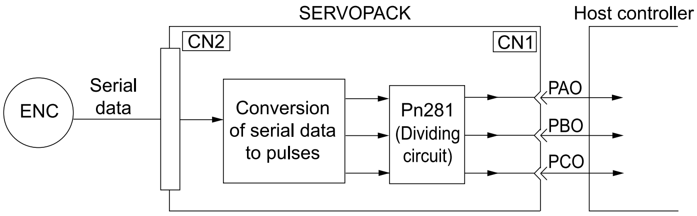
When the SERVOPACK sends the position data, it sends the upper 16-bit data (with sign) separately from the lower 20-bit data.

6.9.3 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 is turned ON.

The SENS_ON (Turn Sensor ON) 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 linear 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.

☞ *4.5.4 I/O Circuits on page 135*

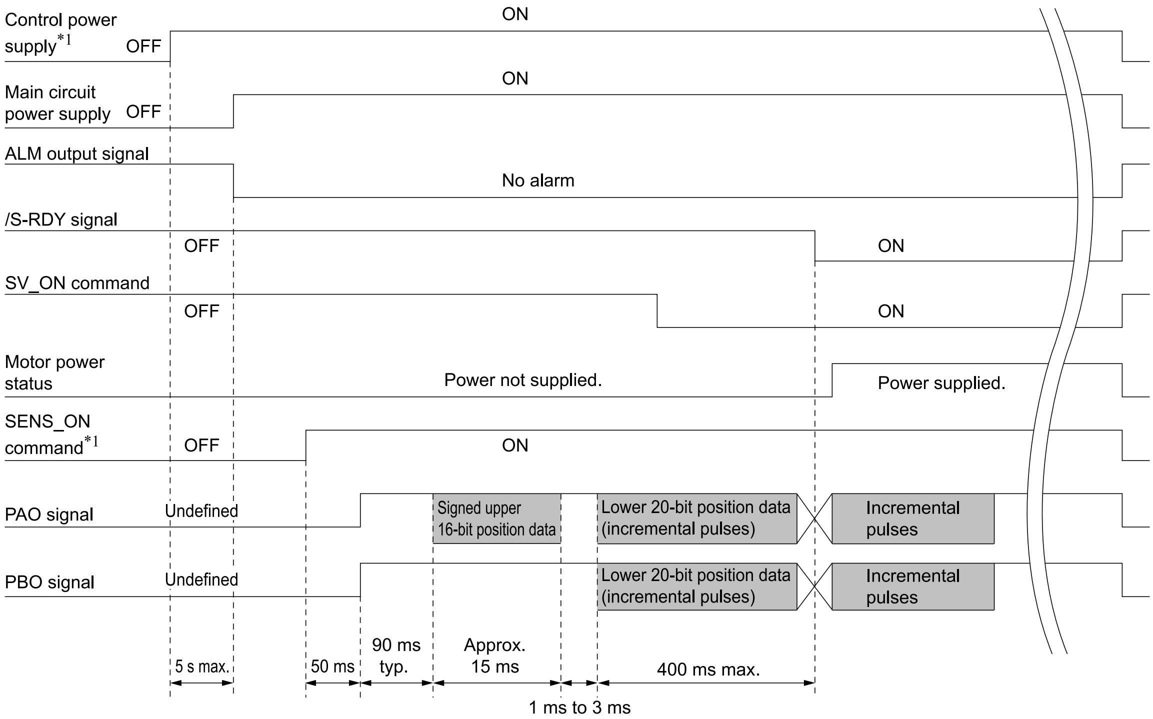
6.9.4 Reading the Position Data from the Absolute Linear Encoder

The SENS_ON (Turn Sensor ON) 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.



*1 When you turn OFF the control power, input the SENS_OFF (Turn Sensor OFF) command.

6.9.5 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).

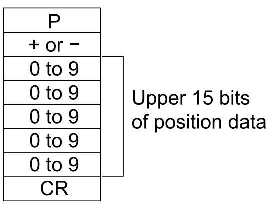
Refer to the following section for the timing of sending the position data from the absolute encoder.

☞ *6.9.4 Reading the Position Data from the Absolute Linear Encoder on page 250*

Item	PAO Signal
Synchronization Method	Start-stop synchronization (ASYNC)
Transmission Speed	9600 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 Cycle	Each time the SENS_ON (Turn Sensor ON) command is input after the control power is turned ON

(1) Data Format of PAO Signal

As shown below, the message format consists of eight characters: “P,” the sign, the 5-digit upper 15-bit position data, and “CR” (which indicates the end of the message).



6.9.6 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).

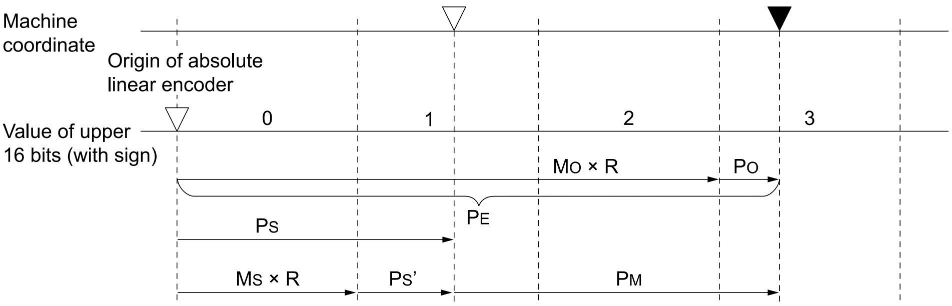
The host controller reads the coordinate from the origin of the encoder coordinate system. The host controller must record the value of this coordinate.

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_E	Position data for the current position of the absolute linear encoder
M_O	Upper 16 bits (with sign) of the position data for the current position of the absolute linear encoder
P_O	Lower 20 bits of the position data for the current position of the absolute linear encoder
P_S	Position data of the origin
M_S	Upper 16 bits (with sign) of the position data of the origin
P_S'	Lower 20 bits of the position data of the origin
P_M	Current position in machine coordinate system
R	1048576 (= 2^{20})

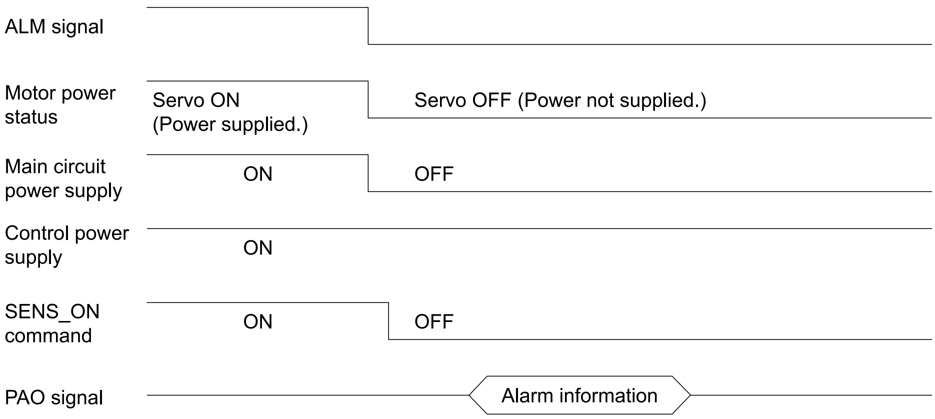
Note:

The above calculations are also used for Pn000 = n.□□□1 (reverse movement mode).

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.)

6.9.7 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 Sensor ON) command turns OFF.



The data format of the alarm information is shown below.

A	
L	
M	
0 to 9	Upper two digits of alarm code
0 to 9	
.	
CR	

6.10 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 to the SERVOPACK OFF and ON again. This can be used to change those parameters without turning the power to the SERVOPACK OFF and ON again.

Information
- Always confirm that the servo is OFF and servomotor is stopped before you start a software reset.
- This function resets the SERVOPACK independently of the host controller. The SERVOPACK carries out the same processing as when the power is turned ON and outputs the ALM (Servo Alarm Output) signal. The status of other output signals may be forcibly changed.
- 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.

6.10.1 Preparations

Always check the following before you perform a software reset.

- The servo must be OFF.
- The motor must be stopped.

6.10.2 Applicable Tools

The following table lists the tools that you can use to perform a software reset.

Tool	Fn No./Function Name	Operating Procedure Reference
Digital Operator	Fn030	Σ-7/Σ-X-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	[Basic Functions] – [Software Reset]	*6.10.3 Operating Procedure on page 254*

6.10.3 Operating Procedure

There are the following two methods that you can use to perform a software reset.

- Direct Connection to the SERVOPACK
- Connection through a Controller

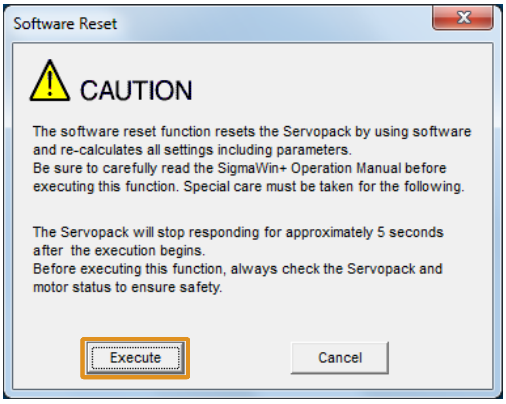
The procedure for each method is given below.

(1) Direct Connection to the SERVOPACK

1. **Click the [] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**
2. **Select [Software Reset] in the [Menu] dialog box.**

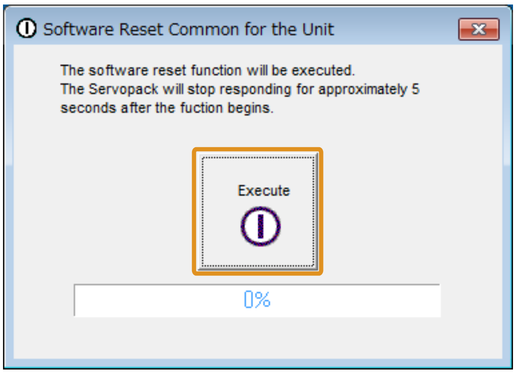
   The [Software Reset] dialog box will be displayed.

3. **Click the [Execute] button.**



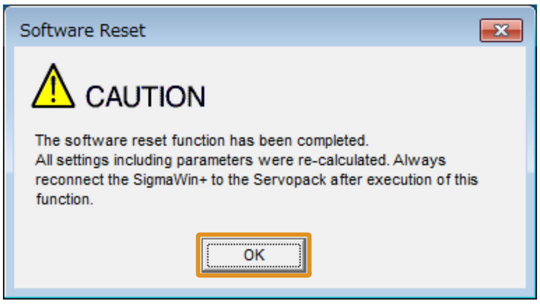
Click the [Cancel] button to cancel the software reset. The Main Window will return.

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.



This concludes the procedure to reset the software.

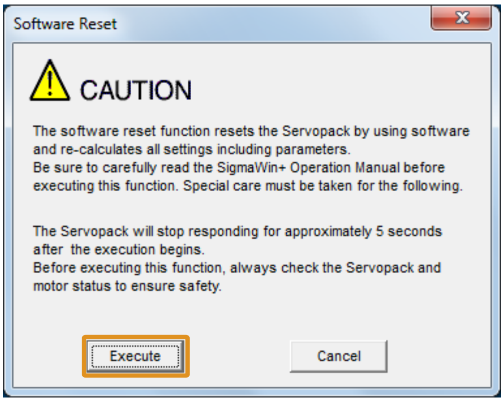
(2) Connection through a Controller

1. **Click the [] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**

2. **Select [Software Reset] in the [Menu] dialog box.**

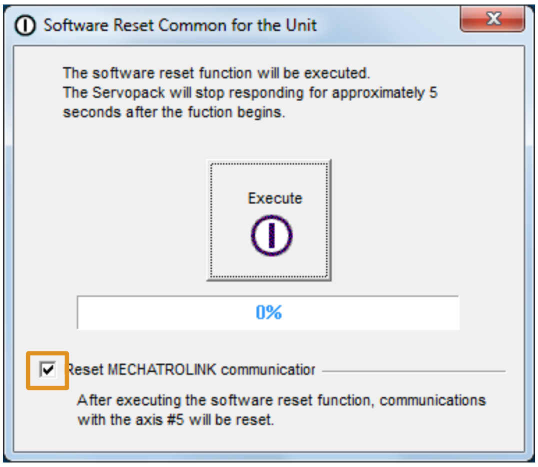
The [Software Reset] dialog box will be displayed.

3. **Click the [Execute] button.**



Click the [Cancel] button to cancel the software reset. The Main Window will return.

4. **Select the [Reset MECHATROLINK communication] check box.**

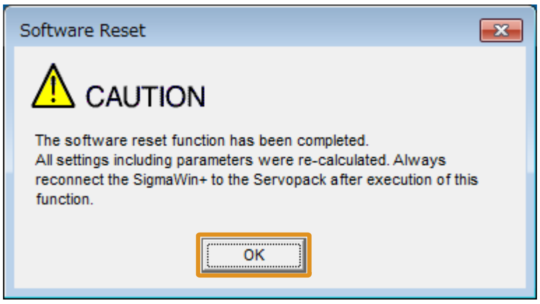


5. **Click the [Execute] button.**

> Important
>
> 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.



This concludes the procedure to reset the software.

6.11 Vibration Detection Level Initialization

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.

Pn310	n.□□□X	Vibration Detection Selection (Speed Pos Trq)		When Enabled
		0 Default	Do not detect vibration.	Immediately
		1	Output a warning (A.911) if vibration is detected.	
		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

$$\text{Detection level} = \frac{\text{Pn312 [min}^{-1}\text{] (Vibration detection level)} \times \text{Pn311 [\%] (Vibration detection sensitivity)}}{100}$$

- Linear Servomotors

$$\text{Detection level} = \frac{\text{Pn384 [mm/s] (Vibration detection level)} \times \text{Pn311 [\%] (Vibration detection sensitivity)}}{100}$$

Use this function only if A.520 or A.911 alarms are not output at the correct timing when vibration is detected with the default setting of Pn312 or Pn384 (Vibration Detection Level).

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 the setting of Pn311 (Vibration Detection Sensitivity).

Pn311	Vibration Detection Sensitivity (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	50 to 500	1%	100	Immediately

Information
- Vibration may not be detected because of unsuitable servo gains. Also, not all kinds of vibrations can be detected.
- Set a suitable value to Pn103 (Moment of Inertia Ratio). An unsuitable setting may result in falsely detecting or not detecting vibration alarms or vibration warnings.
- To use this function, you must input the actual references that will be used to operate your system.
- Execute this function under the operating conditions for which you want to set the vibration detection level.
- Execute this function while the servomotor is operating at 10% of its maximum speed or faster.

6.11.1 Preparations

Always check the following before you initialize the vibration detection level.

- The parameters must not be write prohibited.
- Pn00C must be set to n.□□□0 (Function Selection for Test without a Motor is disabled).

6.11.2 Applicable Tools

The following table lists the tools that you can use to initialize the vibration detection level.

Tool	Fn No./Function Name	Operating Procedure Reference
Digital Operator	Fn01B	Σ-7/Σ-X-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	[Others] – [Initialize Vibration Detection Level]	*6.11.3 Operating Procedure on page 258*

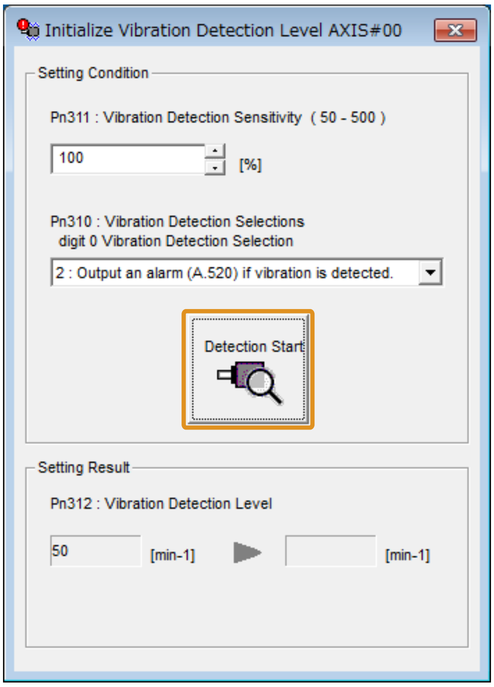
6.11.3 Operating Procedure

Use the following procedure to initialize the vibration detection level.

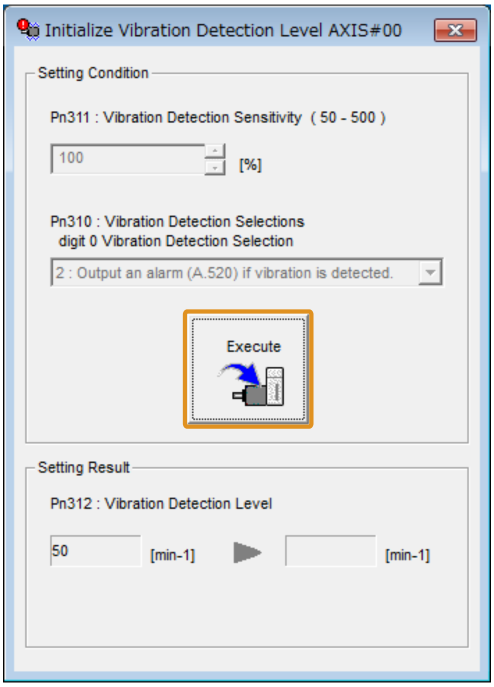
1. **Click the [] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**
2. **Select [Initialize Vibration Detection Level] in the [Menu] window.**

   The [Initialize Vibration Detection Level] window will be displayed.
3. **Select [Pn311: Vibration Detection Sensitivity] and [Pn310: Vibration Detection Selections] and then click the [Detection Start] button.**

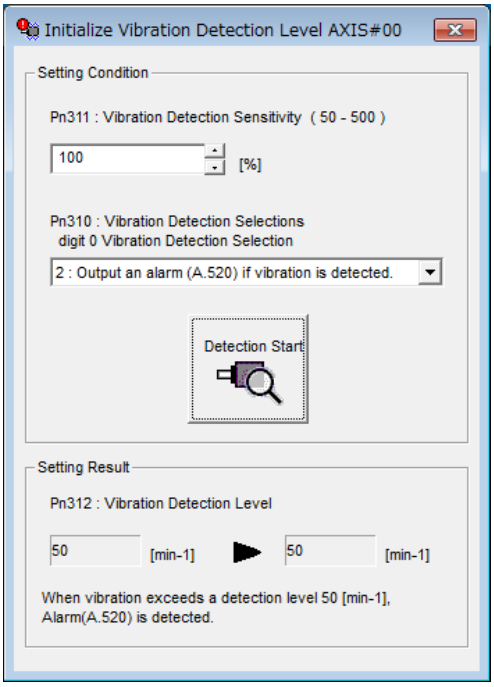
   A setting execution standby mode will be entered.



4. **Click the [Execute] button.**



The newly set vibration detection level will be displayed and the value will be saved in the SERVOPACK.



This concludes the procedure to initialize the vibration detection level.

6.11.4 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

6.12 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.

6.12.1 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.

Important

Execute the automatic offset adjustment if the torque ripple is too large when compared with other SERVOPACKs.

Information The offset does not use a parameter, so it will not change even if the parameter settings are initialized.

(1) Preparations

Always check the following before you automatically adjust the motor current detection signal offset.

- The main circuit power must be ON.
- The servo must be OFF.
- The servomotor must be stopped.
- There must be no hard wire base block (HWBB).
- The parameters must not be write prohibited.

(2) Applicable Tools

The following table lists the tools that you can use to perform automatic tuning.

Tool	Fn No./Function Name	Operating Procedure Reference
Digital Operator	Fn00E	Σ-7/Σ-X-series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	[Others] –[Adjust the Motor Current Detection Signal Offsets]	☞ *(3) Operating Procedure on page 260*

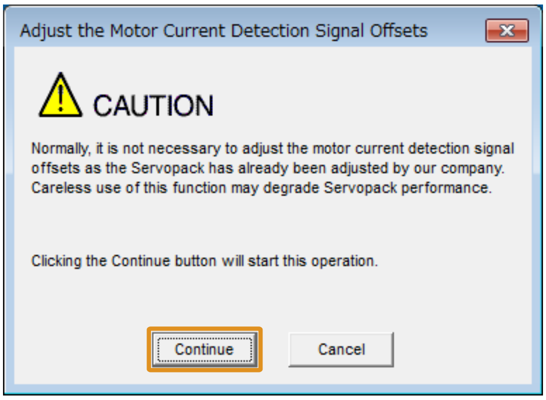
(3) Operating Procedure

Use the following procedure to automatically adjust the motor current detection signal offset.

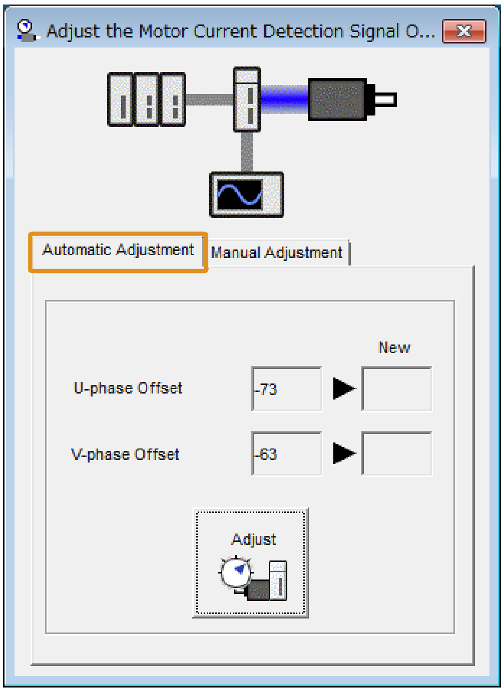
1. **Click the [ ] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**
2. **Click [Adjust the Motor Current Detection Signal Offsets] in the [Menu] window.**

   The [Adjust the Motor Current Detection Signal Offsets] window will be displayed.

3. **Click the [Continue] button.**

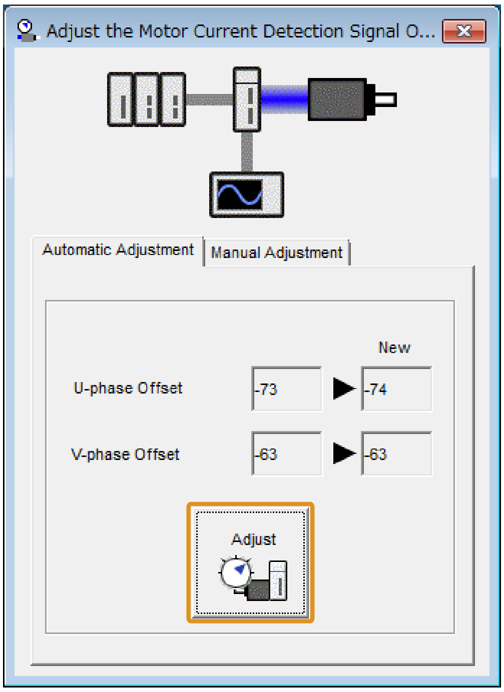


4. **Click the [Automatic Adjustment] tab in the [Adjust the Motor Current Detection Signal Offsets] window.**



5. **Click the [Adjust] button.**

The values that result from automatic adjustment will be displayed in the [New] boxes.



This concludes the procedure to automatically adjust the motor current detection signal offset.

6.12.2 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.

> **Important**
> 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.
> - Operate the servomotor at a speed of approximately 100 min^{-1}.
> - 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.

(1) Preparations

Always check the following before you manually adjust the motor current detection signal offset.

- The parameters must not be write prohibited.

(2) Applicable Tools

The following table lists the tools that you can use to perform manual tuning.

Tool	Fn No./Function Name	Operating Procedure Reference
Digital Operator	Fn00F	Σ-7/Σ-X-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	[Others] –[Adjust the Motor Current Detection Signal Offsets]	*(3) Operating Procedure on page 262*

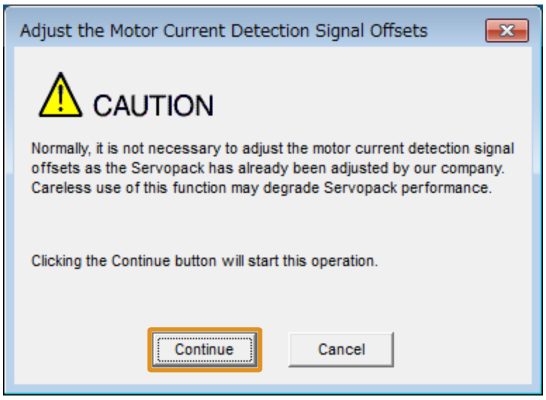
(3) Operating Procedure

Use the following procedure to manually adjust the motor current detection signal offset.

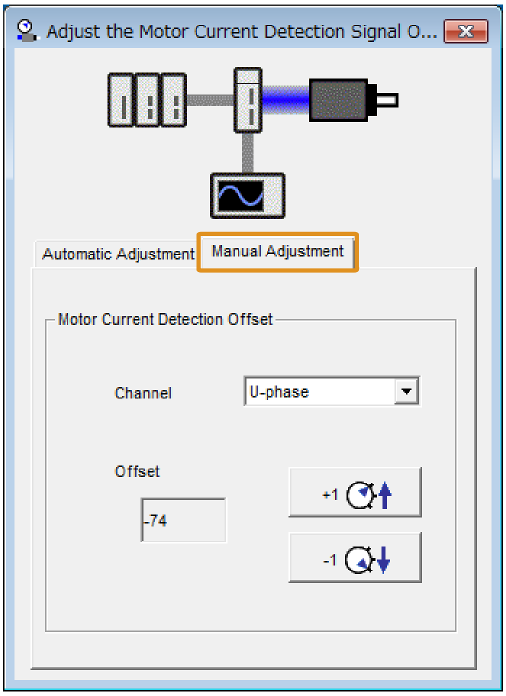
1. **Operate the servomotor at approximately 100 min^{-1}.**

2. **Click the [ ] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**
3. **Click [Adjust the Motor Current Detection Signal Offsets] in the [Menu] window.**

   The [Adjust the Motor Current Detection Signal Offsets] window will be displayed.
4. **Click the [Continue] button.**



5. **Click the [Manual Adjustment] tab in the [Adjust the Motor Current Detection Signal Offsets] window.**



6. **Set the [Channel] in the [Motor Current Detection Offset] 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] in the [Motor Current Detection Offset] 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.

6.13 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 set Pn516 to n.□□□X (FSTP (Forced Stop Input) Signal Allocation). 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 Display and Digital Operator Display**

When a forced stop is performed, the panel and the digital operator will display “FSTP.”

CAUTION

To prevent accidents that may result from contact faults or disconnections, use a normally closed switch for the Forced Stop Input signal.

6.13.1 FSTP (Forced Stop Input) Signal

Type	Signal	Connector Pin No.	Signal Status	Meaning
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. The parameters that you use depend on the allocation method.

Allocation Method	Parameter to Use
Σ-7S-compatible I/O Signal Allocation	• Pn50A = n.□□□1 (use Sigma-7S-compatible I/O signal allocations) • Pn516 = n.□□□X (FSTP (Forced Stop Input) Signal Allocation)
Σ-LINK II Input Allocations	• Pn50A= n.□□□2 (use SigmaLINK II input allocations) • Pn597 (FSTP (Forced Stop Input) Signal Allocation)

Refer to the following section for details.

☞ *6.1.3 Input Signal Allocations on page 210*

6.13.2 Stopping Method Selection for Forced Stops

Use Pn00A = n.□□X□ (Stopping Method for Forced Stops) to set the stopping method for forced stops.

		Stopping Method for Forced Stops (Speed Pos Trq)		When Enabled
Pn00A	n.□□X□	0 (Default)	Apply the dynamic brake or coast the motor to a stop (use the stopping method set in Pn001 = n.□□□X).	After restart
		1	Decelerate the motor to a stop using the torque set in Pn406 as the maximum torque. Use the setting of Pn001 = n.□□□X for the status after stopping.	
		2	Decelerate the motor to a stop using the torque set in Pn406 as the maximum torque and then let the motor coast.	
		3	Decelerate the motor to a stop using the deceleration time set in Pn30A. Use the setting of Pn001 = n.□□□X for the status after stopping.	
		4	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. The servomotor will be stopped with the dynamic braking or coast to a stop according to the setting of Pn001 = n.□□□X (Motor Stopping Method for Servo OFF and Group 1 Alarms).

(1) Stopping the Servomotor by Setting Pn406 (Emergency Stop Torque)

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

If Pn00A = n.□□X□ 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 instantaneous maximum torque. However, the maximum emergency stop torque that you can actually use is the instantaneous maximum torque of the servomotor.

Pn406	Emergency Stop Torque (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 800	1%	800	Immediately

Note:

The setting unit is a percentage of the motor rated torque.

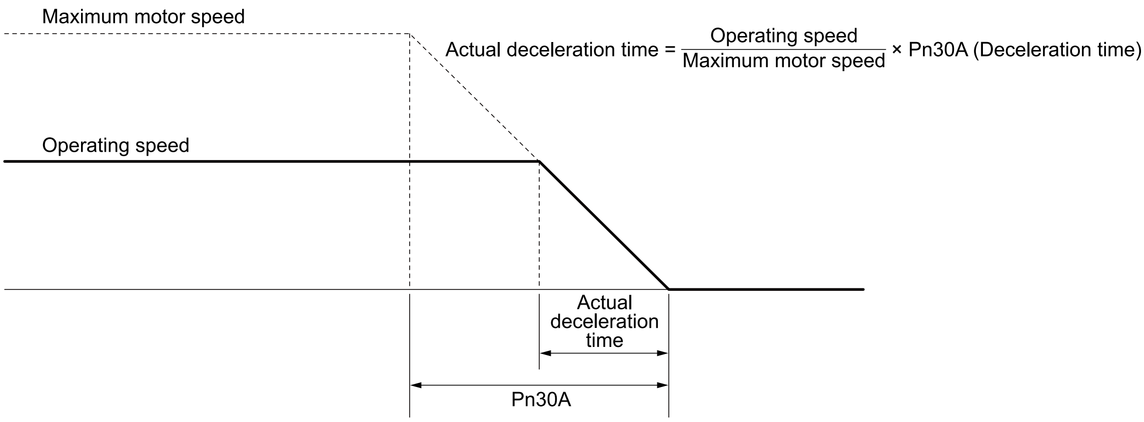
(2) Stopping the Servomotor by Setting Pn30A (Deceleration Time for Servo OFF and Forced Stops)

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

Pn30A	Deceleration Time for Servo OFF and Forced Stops (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 12000	1 ms	0	Immediately

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.

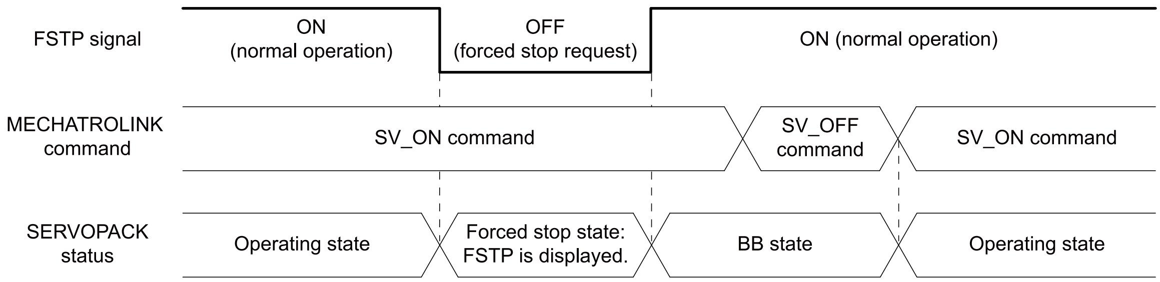


6.13.3 Resetting Method for Forced Stops

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 again.


FSTP signal
ON
(normal operation)
OFF
(forced stop request)
ON (normal operation)
MECHATROLINK command
SV_ON command
SV_OFF command
SV_ON command
SERVOPACK status
Operating state
Forced stop state: FSTP is displayed.
BB state
Operating state

6.14 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 from a Yaskawa SGLFW2 linear servomotor or from a sensor attached to the machine.

When you use overheat protection, you must wire the TH (Overheat Protection Input) signal and set Pn61A to n.□□□X (Overheat Protection Selection).

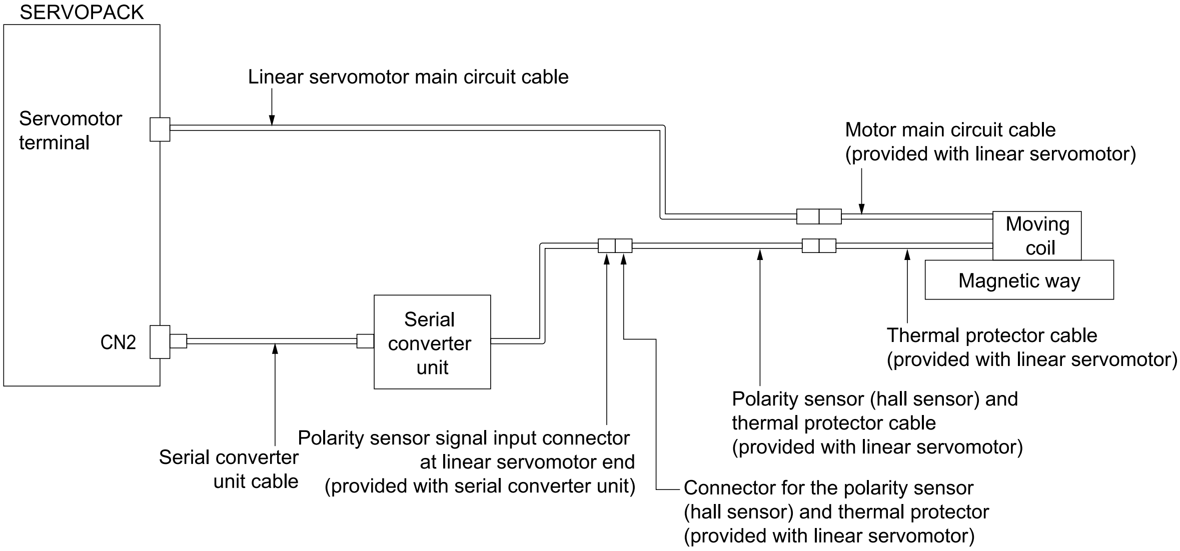
6.14.1 Connecting the Overheat Protection Input (TH) Signal

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.

(1) Using Overheat Protection in the Linear Servomotor

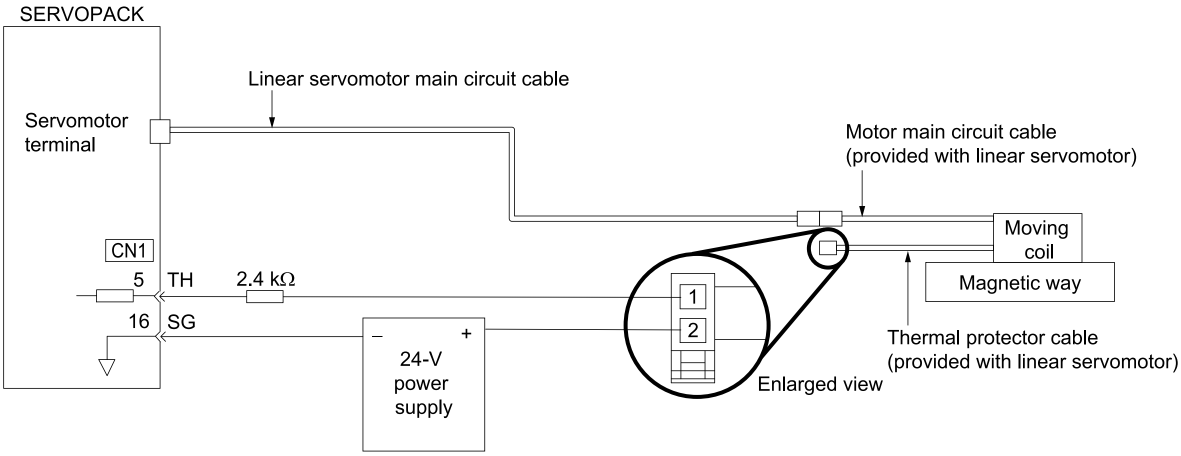
(a) When Using a Serial Converter Unit

Connect the connector for the polarity sensor (hall sensor) and thermal protector of the linear servomotor to the serial converter unit.



(b) When Not Using a Serial Converter Unit

Connect the thermal protector cable of the linear servomotor to CN1-5 on the SERVOPACK. The following figure shows a wiring example.



Application Functions

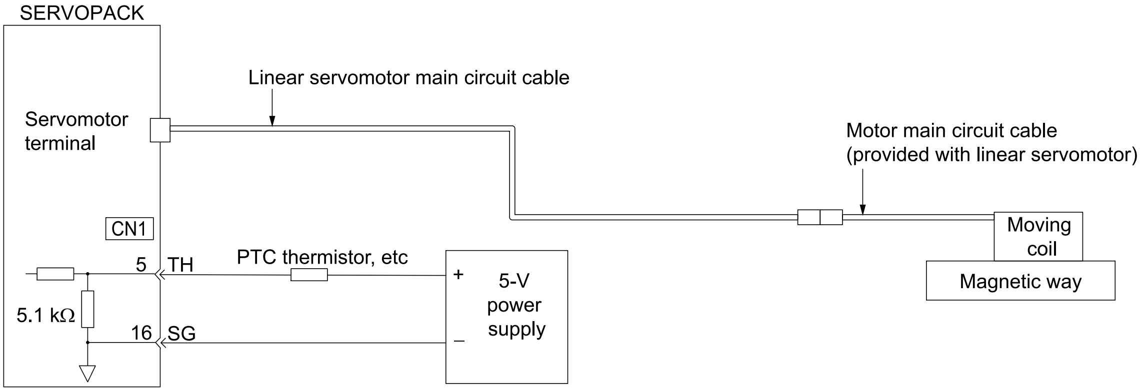
6

Important

- The thermal protector signal from the linear servomotor must be input to the host controller. This example shows the connection to the SERVOPACK. The thermal protector signal is closed when the temperature is normal and open when the thermal protector is activated. Do not exceed 3 A or 30 V.
- The recommended length of the thermal protector cable is 15 m maximum.
- The 24-V power supply and 24-kΩ resistor are not provided by Yaskawa. Use a 0.3 W or greater 24-V power supply, and use a 0.2 W or greater 24-kΩ resistor.
- Be sure to connect the positive and negative sides of the power supply correctly. Otherwise there is a risk of SERVOPACK failure.

(2) 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 on the SERVOPACK. The following figure shows a wiring example.



The equation when wired as shown in the above wiring example is as follows:

Input voltage = 5 V × 5.1 kΩ/(5.1 kΩ + thermistor resistance)

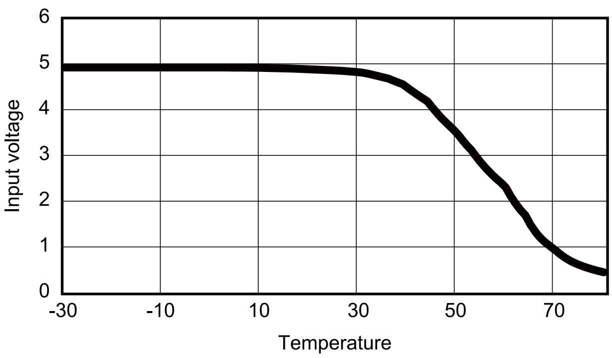
When an NTC thermistor is used, the input voltage increases because the thermistor resistance decreases when the temperature increases. The voltage input when an NTC thermistor is being used is called "positive voltage input" in this manual.

When a PTC thermistor is used, the input voltage decreases because the thermistor resistance increases when the temperature increases. The voltage input when a PTC thermistor is being used is called "negative voltage input" in this manual.

You must consider the following three elements for the detection error of overheat protection.

- SERVOPACK detection accuracy: ±5% (= 4.5 V maximum)
- Variations in the external 5-V power supply
- Variations in thermistor resistance

The following graph shows an example of the relationship between PTC thermistor input voltage and temperature.



Important

- The 5-V power supply is not provided by Yaskawa.
- The customer is responsible for adjusting the detection level.
- Be sure to connect the positive and negative sides of the power supply correctly. Otherwise there is a risk of SERVOPACK failure.

6.14.2 Overheat Protection Selections

The overheat protection function is selected with Pn61A = n.□□□X (Overheat Protection Selections).

		Overheat Protection Selections (Speed Pos Trq)		When Enabled
Pn61A	n.□□□X	0 Default	Disable overheat protection.	After restart
		1	Use overheat protection in the Yaskawa linear servomotor.	
		2	Monitor a negative voltage input from a sensor attached to the machine and use overheat protection.	
		3	Monitor a positive voltage input from a sensor attached to the machine and use overheat protection.	

Important

The SGLFW2 is the only Yaskawa linear servomotor that supports this function.

(1) Using Overheat Protection in the Yaskawa Linear Servomotor

To use the overheat protection in the Yaskawa linear servomotor (SGLFW2), set Pn61A to n.□□□1.

An A.93B warning (Overheat Warning) will be detected if the TH (Overheat Protection Input) signal from the Yaskawa SGLFW2 linear servomotor exceeds the warning temperature.

An A.862 alarm (Overheat Alarm) will be detected if the TH (Overheat Protection Input) signal from the Yaskawa SGLFW2 linear servomotor exceeds the alarm temperature.

Important

1. If the overheat protection input signal line is disconnected or short-circuited, an A.862 alarm (Overheat Alarm) will occur.
2. If you set Pn61A to n.□□□1 (use overheat protection in the Yaskawa linear servomotor), the parameters in the servomotor are enabled and the following parameters are disabled.
   - Pn61B (Overheat Alarm Level)
   - Pn61C (Overheat Warning Level)
   - Pn61D (Overheat Alarm Filter Time)

(2) Monitoring the Machine's Temperature and Using Overheat Protection

Set Pn61A = n.□□□X to 2 or 3 to use overheat protection for the machine.

Set the following parameters as required.

Pn61B	Overheat Alarm Level (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 500	0.01 V	250	Immediately
Pn61C	Overheat Warning Level (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 100	1%	100	Immediately
Pn61D	Overheat Alarm Filter Time (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 65535	1 s	0	Immediately

Important

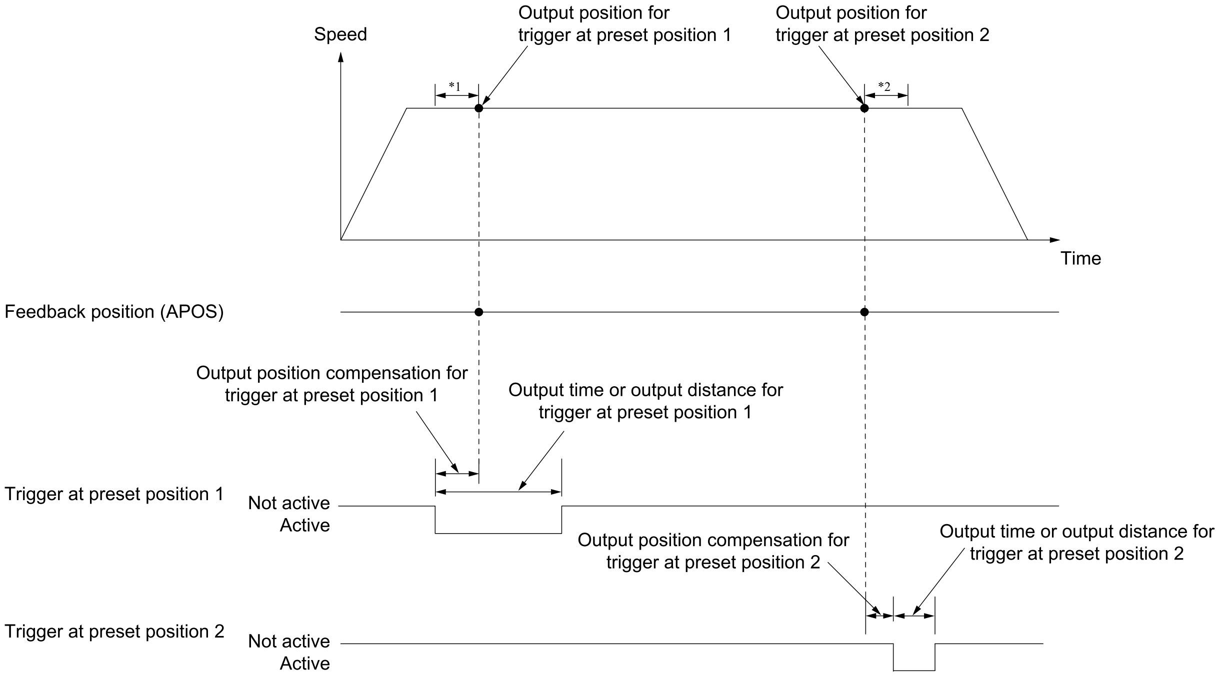
1. When Pn61A is set to n.□□□2, an A.862 alarm (Overheat Alarm) will occur if the overheat protection input signal line is disconnected or short-circuited.
2. When Pn61A is set to n.□□□3, an A862 alarm will not occur if the overheat protection input signal line is disconnected or short-circuited. To 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).
3. Set Pn61B to a value that matches the actually measured level of the connected sensor.
   Additionally, when Pn61B is set to a value of 450 (= 4.5 V) or higher, the detection error of the overheat alarm/warning will increase. For this reason, we recommend setting a value less than 450 (= 4.5 V).

6.15 Triggers at Preset Positions

6.15.1 Outline

Triggers at preset positions are signals that are output when a moving part of a machine passes preset reference positions. You can use this function to set signal outputs for up to 32 positions.

The following image shows the operation of triggers at preset positions.



*1 For triggers at preset positions to function, the speed must be constant for at least 250 µs before the machine passes a preset position.

*2 When you set the output width of a signal output at a preset position as a distance, use a distance that does not exceed the point where deceleration of the constant speed starts.

> Important
>
> The function is enabled by performing one of the following steps.
>
> **<Absolute Encoder>**
>
> Send the Turn Sensor ON command (SENS_ON: 23h) from the host controller.
>
> **<Incremental Encoder>**
>
> - Send the Zero Point Return command (ZRET: 3Ah) from the host controller.
> - Use the Set Coordinates command (POS_SET: 20h) from the host controller to set a reference point (REFE = 1).
>
> Refer to the following manuals for details on the commands.
>
> Σ-7/Σ-X-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)
>
> Σ-7/Σ-X-Series MECHATROLINK-4 Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800002 32)

You can use both high-speed outputs that output signals from line drivers and normal outputs that output signals from photocouplers for triggers at preset positions. They can also be used together.

Output circuit specifications for the line-driver and photocoupler output are given below.

(1) Line-Driver Output Specifications

Compared with a photocoupler, a line driver is capable of more precise output, and it is suitable for applications with no margin for output signal delays or variations.

Item	Specification
Number of Output Position Settings	32
Range of Output Position Settings	-2147483648 to 2147483647 reference units

Continued on next page.

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Item	Specification
Outputs for Triggers at Preset Positions	Triggers at preset positions are allocated to output signals /PAO, /PBO, and /PCO on CN1.
Output Time Setting Range	0 to 32767000 μs
Output Distance Setting Range	0 to 2147483647 reference units
Output Position Compensation Range	-2147483648 to 2147483647 reference units
Signal Output Delay Time	ON to OFF: 1 μs or less, OFF to ON: 1 μs or less
Signal Output Variation	At constant speed of 1000000 [reference unit/sec] or greater: 5 μs max. *1, *2

*1 The accuracy of high-speed output signals for triggers at preset positions is reduced during acceleration, deceleration, and low-speed operation.

*2 This value is when a Σ-X-series rotary servomotor is connected.

(2) Photocoupler Output Specifications

Item	Specification
Number of Output Position Settings	32
Range of Output Position Settings	-2147483648 to 2147483647 reference units
Outputs for Triggers at Preset Positions	Triggers at preset positions are allocated to output signals /SO1, /SO2, and /SO3 on CN1.
Output Time Setting Range	0 to 32767000 μs
Output Distance Setting Range	0 to 2147483647 reference units
Output Position Compensation Range	-2147483648 to 2147483647 reference units
Signal Output Delay Time	ON to OFF: 2 ms or less, OFF to ON: 1 ms or less
Signal Output Variation	250 μs max.

(3) Restrictions

The triggers at preset positions output signals will not be output when the host controller is not connected because this function is allocated to SO1 to SO3.

Refer to the following section for details.

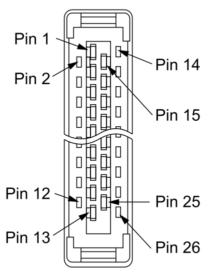
☞ *6.16 Specifying Output Status When a Host Communications Error Occurs on page 278*

6.15.2 I/O Signal Connector (CN1) Pin Layout

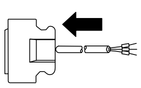
The following figure gives the pin layout of the I/O signal connector (CN1) when using triggers at preset positions.

For the high-speed outputs for triggers at preset positions, allocate and wire High-Speed Output Signal for Triggers at Preset Positions 1 to 3 to CN1-17 to CN1-22.

For the normal outputs for triggers at preset positions, allocate and wire Normal Output Signal for Triggers at Preset Positions 1 to 3 to CN1-1, CN1-2, or CN1-23 to CN1-26.



The illustration to the left and the following table are from the direction of the following arrow without the connector shell attached.



2	/SO1- (/BK-) *1	Normal Output for Triggers at Preset Positions 1 (Brake Output)	1	/SO1+ (/BK+) *1	Normal Output for Triggers at Preset Positions 1 (Brake Output)	15	BAT-	Battery for Absolute Encoder (-)	14	BAT+	Battery for Absolute Encoder (+)
4	ALM-	Servo Alarm Output	3	ALM+	Servo Alarm Output	17	PAO *2 (HSO1)	High-Speed Output for Triggers at Preset Positions 1	16	SG	Signal Ground
6	+24VIN	Sequence Input Signal Power Supply Input	5	TH	Overheat Protection Input	19	PBO *2 (HSO2)	High-Speed Output for Triggers at Preset Positions 2	18	/PAO *2 (/HSO1)	High-Speed Output for Triggers at Preset Positions 1
8	/SI2 (N-OT)	General-Purpose Sequence Input 2	7	/SI1 (P-OT)	General-Purpose Sequence Input 1	21	PCO *2 (HSO3)	High-Speed Output for Triggers at Preset Positions 3	20	/PBO *2 (/HSO2)	High-Speed Output for Triggers at Preset Positions 2
10	/SI4 (/EXT1)	General-Purpose Sequence Input 4	9	/SI3 (/DEC)	General-Purpose Sequence Input 3	23	/SO2+ *1	Normal Output for Triggers at Preset Positions 2	22	/PCO *2 (/HSO3)	High-Speed Output for Triggers at Preset Positions 3
12	/SI6 (/EXT3)	General-Purpose Sequence Input 6	11	/SI5 (/EXT2)	General-Purpose Sequence Input 5	25	/SO3+ *1	Normal Output for Triggers at Preset Positions 3	24	/SO2- *1	Normal Output for Triggers at Preset Positions 2
–	–	–	13	/SI0	General-Purpose Sequence Input 0	–	–	–	26	/SO3- *1	Normal Output for Triggers at Preset Positions 3

*1 When Pn660 is set to n.1□□□ (enable triggers at preset positions), the normal outputs for triggers at preset positions are used. The output signals for triggers at preset positions are output using logical OR. This allows other output signals to also be allocated to the same terminals.

*2 When Pn660 is set to n.1□□□ (enable triggers at preset positions), the high-speed outputs for triggers at preset positions are used. Encoder divided pulses are not output.

6.15.3 Procedure to Use Triggers at Preset Positions

The following table gives the steps to use triggers at preset positions.

Step		Item	Reference
1		Parameter Settings	–
	1-1	Set Pn50A to n.□□□2 (use Pn590 to Pn5BC (Sigma-LINK II input signal allocation mode)). **Note:** If Pn50A is not set to n.□□□2, A.042 (Parameter Combination Error) will occur.	☞ *(c) Input Signal Allocation Mode Setting on page 273*
	1-2	Set Pn590 to Pn5BC (SigmaLINK II input signal allocation mode).	☞ *14.2 List of Servo Parameters: MECHATROLINK-4 Communications References on page 603*
	1-3	Set the signal polarity with Pn5D7 (Output Signal Inversion for Triggers at Preset Positions). Information: You can use bit 30 (FOUT_STOP) of the MECHATROLINK command SVCMD_OUT *1 to forcibly stop the triggers at preset positions output signals. This allows triggers at preset positions to be paused when necessary, such as during an origin return operation. *2	☞ *(e) Inverse Settings for Output Signals for Triggers at Preset Positions on page 274*
	1-4	Set Pn660 = n.□□□X (Output Unit Setting).	☞ *(b) Output Unit Setting on page 273*
	1-5	Set Pn660 to n.1□□□ (enable triggers at preset positions).	☞ *(a) Triggers at Preset Positions Function Selection on page 273*

Continued on next page.

Continued from previous page.

Step		Item	Reference
2		Turn the power to the SERVOPACK OFF and ON again.	–
3		Edit the triggers at preset positions table in the SigmaWin+. Information You can also use the MECHATROLINK command MEM_WR to configure the triggers at preset positions table. *2	(2) Configuring the Triggers at Preset Positions Table on page 274 (3) Details on the Triggers at Preset Positions Table on page 276
	3-1	Set the output position in reference units.	
	3-2	Set the axis number, output terminal selection, passing direction selection, and encoder selection with the output function selection.	
	3-3	If Pn660 is set to n.□□□0, set the signal output width in the output distance of the triggers at preset positions table as a time in μs.	
	3-4	If Pn660 is set to n.□□□1, set the signal output width in the output time of the triggers at preset positions table as a distance in reference units.	
	3-5	Set the output position compensation as a distance in reference units.	
	3-6	Save the triggers at preset positions table to flash memory.	
4		Operate the servomotor from the host controller. When the moving part of the machine passes a preset position, a trigger at preset position signal will be output.	–

*1 Field name of MECHATROLINK-4 command. This is SVCMD_IO when using MECHATROLINK-III commands.
*2 For details on settings configured by using commands, refer to the following manual that corresponds to the communications references being used.

Σ-7/Σ-X-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

Σ-7/Σ-X-Series MECHATROLINK-4 Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800002 32)

(1) Parameter Settings

(a) Triggers at Preset Positions Function Selection

Select the triggers at preset positions function with Pn660 = n.X□□□ (Triggers at Preset Positions Selections).

Parameter		Meaning		When Enabled
Pn660	n.X□□□	Triggers at Preset Positions Selections (Speed Pos Trq)		
		0 (Default)	Disable triggers at preset positions.	After restart
		1	Enable triggers at preset positions.	
		2	Reserved (Do not use.)	

(b) Output Unit Setting

Set the output width of the preset position output signals to time [μs] or distance [reference units] with Pn660 = n.□□□X (Output Unit Setting).

Parameter		Meaning		When Enabled
Pn660	n.□□□X	Output Unit Setting (Speed Pos Trq)		
		0 (Default)	Set the signal output width as a time [μs].	After restart
		1	Set the signal output width as a distance [reference units].	

(c) Input Signal Allocation Mode Setting

Set the input signal allocation mode to Pn50A = n.□□□2 (use Pn590 to Pn5BC (Sigma-LINK II input signal allocation mode)).

Note:

If Pn50A is not set to n.□□□2, A.042 (Parameter Combination Error) will occur.

Parameter		Setting	Meaning	When Enabled
Pn50A	n.□□□X	Input Signal Allocation Mode (Speed, Pos, Trq)		When Enabled
		0	Reserved (Do not use.)	After restart
		1 Default	Use Pn50A to Pn516 (Sigma-7S-compatible I/O signal allocation mode).	
		2	Use Pn590 to Pn5BC (SigmaLINK II input signal allocation mode).	

(d) Signal Allocations

Set the signal allocations with Pn590 to Pn5BC (SigmaLINK II input signal allocation mode).

Refer to the following sections for details on the parameters.

☞ *14.2 List of Servo Parameters: MECHATROLINK-4 Communications References on page 603*

(e) Inverse Settings for Output Signals for Triggers at Preset Positions

The output signals for triggers at preset positions can be inverted with Pn5D7 (Output Signal Inversion for Triggers at Preset Positions).

Parameter		Setting	Meaning	When Enabled
Pn5D7	n.□□□X	High-Speed Output Signal Inverse Settings for Triggers at Preset Positions (Speed, Pos, Trq)		When Enabled
		0 Default	The signal is not inverted.	After restart
		1	Invert CN1-17, -18 (PAO) and output it.	
		2	Invert CN1-19, -20 (PBO) and output it.	
		3	Invert CN1-17, -18 (PAO) and CN1-19, -20 (PBO) and output them.	
		4	Invert CN1-21, -22 (PCO) and output it.	
		5	Invert CN1-17, -18 (PAO) and CN1-21, -22 (PCO) and output them.	
		6	Invert CN1-19, -20 (PBO) and CN1-21, -22 (PCO) and output them.	
		7	Invert CN1-17, -18 (PAO), CN1-19, -20 (PBO), and CN1-21, -22 (PCO) and output them.	
Pn5D7	n.□□X□	Normal Output Signal Inverse Settings for Triggers at Preset Positions 1 (Speed, Pos, Trq)		When Enabled
		0 Default	The signal is not inverted.	After restart
		1	Invert CN1-1, -2 (SO1) and output it.	
		2	Invert CN1-23, -24 (SO2) and output it.	
		3	Invert CN1-1, -2 (SO1) and CN1-23, -24 (SO2) and output them.	
		4	Invert CN1-25, -26 (SO3) and output it.	
		5	Invert CN1-1, -2 (SO1) and CN1-25, -26 (SO3) and output them.	
		6	Invert CN1-23, -24 (SO2) and CN1-25, -26 (SO3) and output them.	
		7	Invert CN1-1, -2 (SO1), CN1-23, -24 (SO2), and CN1-25, -26 (SO3) and output them.	

Note:

The output signals for triggers at preset positions are output using OR circuits. This allows other signals set with Pn5B0 to Pn5BC to be allocated to SO1 to SO3. Be careful when setting the output signals.

(2) Configuring the Triggers at Preset Positions Table

This section provides the procedure to configure the triggers at preset positions table from the SigmaWin+.

The flow of operation from making settings for triggers at preset positions through writing data to the SERVOPACK is described. Refer to the following manual for details on editing tables on the SigmaWin+.

Engineering Tool SigmaWin+ Operation Manual (Manual No.: SIET S800001 34)

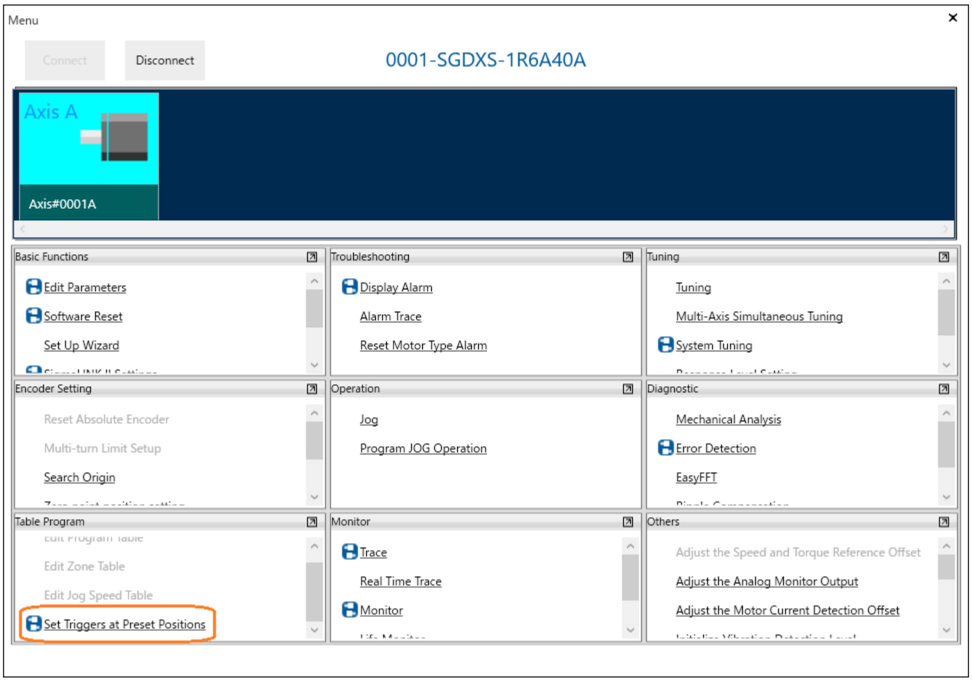
Information You can also use the MECHATROLINK command MEM_WR to configure the triggers at preset positions table. For details on settings configured by using commands, refer to the following manual that corresponds to the communications references being used.

📖 Σ-7/Σ-X-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

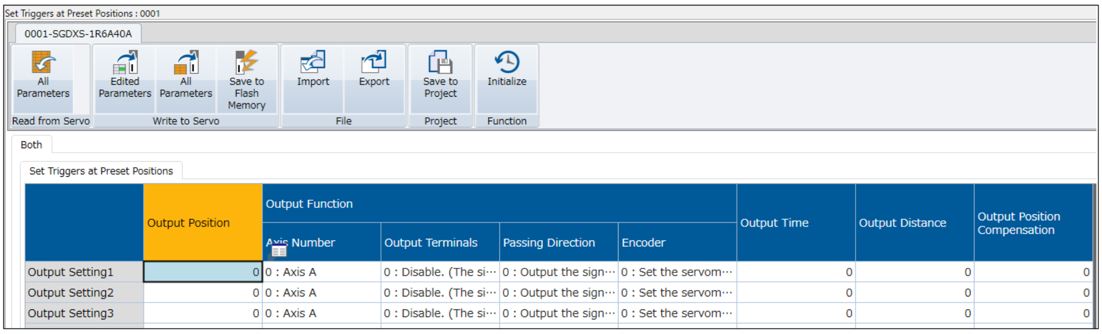
📖 Σ-7/Σ-X-Series MECHATROLINK-4 Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800002 32)

1. **Click the [] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**

2. **Select [Set Triggers at Preset Positions] in [Table Program].**



The [Set Triggers at Preset Positions] dialog box will be displayed.



3. **Set the items for the Output Setting 1 to 32 to use.**

   Refer to the following section for details on the settings.

   ☞ *(3) Details on the Triggers at Preset Positions Table on page 276*

4. **After the settings are completed, click the [All Parameters] button.**

   The edited data will be written to the volatile memory in the SERVOPACK.

5. **Click the [Save to Flash Memory] button.**

   The edited data will be written to the non-volatile memory in the SERVOPACK.

   Note:

   When you write edited data to the SERVOPACK, you must save it to flash memory. If the data is not saved to flash memory, the edited data will be erased from memory when the power to the SERVOPACK is turned OFF.

This concludes the procedure to configure the triggers at preset positions table.

(3) Details on the Triggers at Preset Positions Table

Important

The polarity of the output signals for triggers at preset positions can be inverted with Pn5D7 (Output Signal Inversion for Triggers at Preset Positions). Check the settings of Pn5D7 when allocating the output signals for triggers at preset positions.

The details of the triggers at preset positions table are shown below.

	(a)	(b)	(c)	(d)	(e)
Name	Output Position	Output Function	Output Time	Output Distance	Output Position Compensation
Output Setting 1					
Output Setting 2					
Output Setting 3					
:					
Output Setting 32					

(a) Output Position

Set the reference position for outputting a signal for the trigger at the preset position.

Size	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
4	-2147483648 to 2147483647	Reference unit *1	0	Immediately	Setup

*1 When an external encoder is selected in the output function (third digit), the setting unit is the external encoder resolution.

(b) Output Function

Select the axis number, output terminals, signal logic, and passing direction to use for the trigger at the preset position.

Size	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
4	00000000h to 000112A2h	Reference unit	00000000h	*1	Setup

*1 The passing direction (second digit) is enabled immediately after it is changed. The other digits are enabled after the power is turned OFF and ON again or after the parameters are recalculated.

Digit	Name	Setting	Description
0	Axis No.	0	Set the axis number to 0.
1	Output Terminal Selection	0	Disable. (The signal is not output.)
		1	Output HSO1 (High-Speed Output Signal for Triggers at Preset Positions 1) signal from the PAO terminal.
		2	Output HSO2 (High-Speed Output Signal for Triggers at Preset Positions 2) signal from the PBO terminal.
		3	Output HSO3 (High-Speed Output Signal for Triggers at Preset Positions 3) signal from the PCO terminal.
		4	Output /NSO1 (Normal Output Signal for Triggers at Preset Positions 1) signal from the /SO1 terminal.
		5	Output /NSO2 (Normal Output Signal for Triggers at Preset Positions 2) signal from the /SO2 terminal.
		6	Output /NSO3 (Normal Output Signal for Triggers at Preset Positions 3) signal from the /SO3 terminal.
		7 to F	Disable. (The signal is not output.)

Continued on next page.

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Digit	Name	Setting	Description
2	Passing Direction Selection	0	Output the signal at the preset position during forward movement.
		1	Output the signal at the preset position during reverse movement.
		2	Output the signal at the preset position during forward or reverse movement.
3	Encoder Selection	0 *1	Set the servomotor encoder position as the reference.
		1	Set the external encoder monitor position as the reference.
4 to 7	Reserved (Do not change.)		

*1 When Pn002 is set to n.1□□□ (the external encoder moves in the forward direction for CCW motor rotation) or n.3□□□ (the external encoder moves in the reverse direction for CCW motor rotation), the signal can be output at the position of the fully-closed encoder by setting the encoder selection value to 0.

(c) Output Time

Set the output time of the preset position signal output. This is valid when Pn660 is set to n.□□□0 (set the signal output width as a time [µs]).

Size	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
4	0 to 32767000	1 µs	0	Immediately	Setup

(d) Output Distance

Set the output width of the output signals for triggers at preset positions as distance. This is valid when Pn660 is set to n.□□□1 (set the signal output width as a distance [reference units]).

Size	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
4	0 to 2147483647	Reference unit	0	Immediately	Setup

(e) Output Position Compensation

Set the compensation distance in reference units from the reference position set in the output position setting.

Size	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
4	-2147483648 to 2147483647	Reference unit	0	Immediately	Setup

6.16 Specifying Output Status When a Host Communications Error Occurs

The function to specify the output status when a host communications error occurs allows the status of the general-purpose output signals *2 on the CN1 connector of the SERVOPACK to be selected when an alarm related to a MECHATROLINK communications error *1 occurs.

With MECHATROLINK communications, you can control the general-purpose output signals on the CN1 connector of the SERVOPACK from the host controller. However, when a MECHATROLINK communications error occurs, such as a disconnected communications cable, the host controller loses the ability to control the signals and the SERVOPACK will no longer receive the references correctly.

Use this function to select the status of the outputs when references are no longer received from the host controller.

*1 An alarm related to a MECHATROLINK communications error refers to the following alarms.

Alarm Number	Alarm Name
A.E02	MECHATROLINK Internal Synchronization Error 1
A.E50	MECHATROLINK Synchronization Error
A.E51	MECHATROLINK Synchronization Failed
A.E60	Reception Error in MECHATROLINK Communications
A.E61	Synchronization Interval Error in MECHATROLINK Transmission Cycle
A.E63	MECHATROLINK Synchronization Frame Not Received
A.E43	MECHATROLINK Communications Setting Error

*2 Applicable signals: SO1 to SO3 (CN1-1, -2, and -23 to -26)
The above signals are photocoupler output circuits that are opened with OFF and closed with ON. Refer to the following section for details.
☞ *(a) Photocoupler Output Circuits on page 136*

6.16.1 Function Selections for Specifying Output Status When a Host Communications Error Occurs

Select whether to use the function to specify the output status when a host communications error occurs in Pn55C (Specifying Output Status At a Host Comms Error Switch).

Select the output statuses in Pn55D (Specifying Output Status When a Host Comms Error Occurs) for when the function is enabled.

Pn55C	n.□□□X	Specifying Output Status When a Host Communications Error Occurs Function Selection		Speed Pos Trq	When Enabled
		0	Disable the function to specify the output status when a host communications error occurs.		After restart
		1 Default	Enable the function to specify the output status when a host communications error occurs.		

Pn55D	Specifying Output Status When a Host Comms Error Occurs Speed Pos Trq			
	Setting Range	Setting Unit	Default Setting	When Enabled
	0000h to 001Fh	–	0000h	After restart

Parameter		Meaning
Pn55D	Bit 0	Use the SO1 output (0: OFF when a host communications error occurs, 1: ON when a host communications occurs)
Pn55D	Bit 1	Use the SO2 output (0: OFF when a host communications error occurs, 1: ON when a host communications occurs)

Continued on next page.

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Parameter		Meaning
Pn55D	Bit 2	Use the SO3 output (0: OFF when a host communications error occurs, 1: ON when a host communications occurs)
Pn55D	Bits 3 to 15	Reserved (Do not use.)

6.16.2 Precautions

- If signals are allocated to SO1 to SO3 (= Pn50E, Pn50F, Pn510 (Output Signal Selections 1 to 3), the signals will be output by using the logical OR of the statuses of those signals and the selection statuses of this function.
- The signals will be output according to the settings of this function when the control power is turned ON and the host controller is not connected. Configure the circuits to be on the safe side when the control power supply is interrupted.
- The signals will be output according to the settings of the host controller when the control power is turned ON and the host controller is connected.
- The signals will be output according to the settings of this function when an alarm related to MECHATRO-LINK communications is active.
- The signals will be output according to the settings of the host controller when an alarm related to MECHA-TROLINK communications is not active.

7

Trial Operation and Actual Operation

Provides information on the flow and procedures for trial operation and convenient functions to use during trial operation.

7.1 Flow of Trial Operation

7.1.1 Flow of Trial Operation for Rotary Servomotors

The procedure for trial operation is given below.

(1) Preparations for Trial Operation

1. **Installation**

   Install the servomotor and SERVOPACK according to the conditions.

   First, operation is checked with no load. Do not connect the servomotor to the machine.

   ☞ *3 SERVOPACK Installation on page 89*

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.

   ☞ *4 Wiring and Connecting SERVOPACKs on page 99*

3. **Confirmations before Trial Operation**

   ☞ *7.2 Inspections and Confirmations before Trial Operation on page 286*

4. **Power ON**

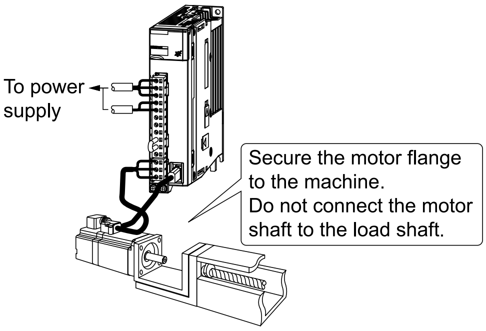
5. **Resetting the Absolute Encoder**

   This step is necessary only for a servomotor with an absolute encoder.

   ☞ *5.16 Resetting the Absolute Encoder on page 194*

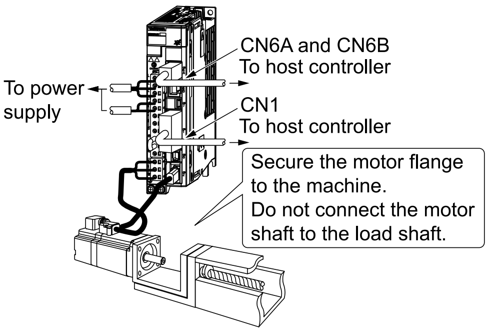
(2) Trial Operation

1. **Trial Operation for the Servomotor without a Load**



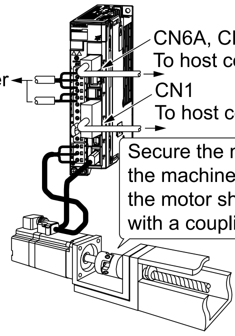
   ☞ *7.3 Trial Operation for the Servomotor without a Load on page 287*

2. **Trial Operation with MECHATROLINK Communications**



   ☞ *7.4 Trial Operation with MECHATROLINK Communications on page 290*

3. **Trial Operation with the Servomotor Connected to the Machine**



☞ *7.5 Trial Operation with the Servomotor Connected to the Machine on page 292*

7.1.2 Flow of Trial Operation for Linear Servomotors

The procedure for trial operation is given below.

(1) Preparations for Trial Operation

1. **Installation**

   Install the servomotor and SERVOPACK according to the conditions.

   First, operation is checked with no load. Do not connect the servomotor to the machine.

   ☞ *3 SERVOPACK Installation on page 89*

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.

   ☞ *4 Wiring and Connecting SERVOPACKs on page 99*

3. **Confirmations before Trial Operation**

   ☞ *7.2 Inspections and Confirmations before Trial Operation on page 286*

4. **Power ON**

5. **Setting Parameters in the SERVOPACK**

Step	No. of Parameter to Set	Description	Remarks	Reference
5-1	Pn282	Linear Encoder Scale Pitch	Set this parameter only if you are using a serial converter unit.	☞ *5.6 Setting the Linear Encoder Pitch on page 163*
5-2	–	Writing Parameters to the Linear Servomotor	Set this parameter only if you are not using a serial converter unit.	☞ *5.7 Writing Linear Servomotor Parameters on page 164*
5-3	Pn080 = n.□□X□.	Motor Phase Sequence Selection	–	☞ *5.8 Selecting the Phase Sequence for a Linear Servomotor on page 168*
5-4	Pn080 = n.□□□X	Polarity Sensor Selection	–	☞ *5.9 Polarity Sensor Setting on page 170*

Continued on next page.

Continued from previous page.

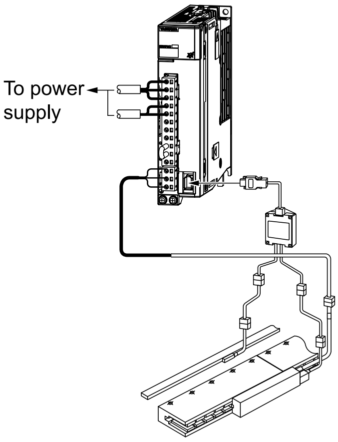
Step	No. of Parameter to Set	Description	Remarks	Reference
5-5	–	Polarity Detection	This step is necessary only for a linear servomotor with a polarity sensor.	☞ *5.10 Polarity Detection on page 171*
5-6	• Pn50A = n.X□□□ and Pn50B = n.□□□X or • Pn590 and Pn591	Overtravel Signal Allocations	–	☞ *5.1-1 Overtravel and Related Settings on page 174*
5-7	Pn483, Pn484	Force Control	–	☞ *6.7.1 Internal Torque Limits on page 235*

6. **Setting the Origin of the Absolute Linear Encoder**

   ☞ *5.17.2 Setting the Origin of the Absolute Linear Encoder on page 197*

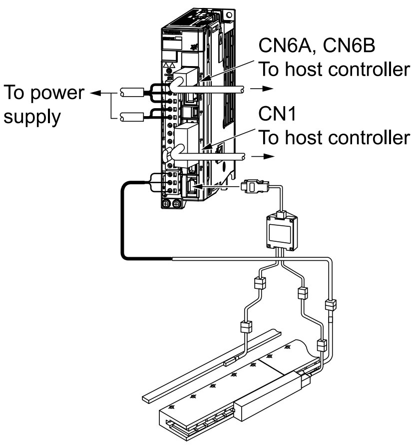
(2) Trial Operation

1. **Trial Operation for the Servomotor without a Load**



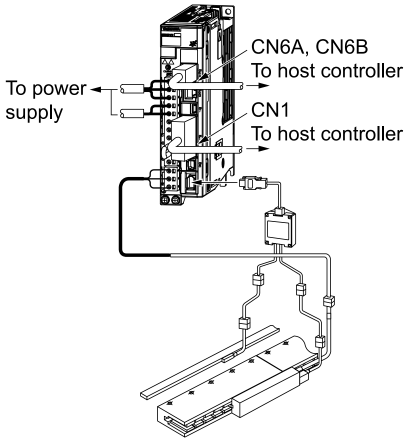
☞ *7.3 Trial Operation for the Servomotor without a Load on page 287*

2. **Trial Operation with MECHATROLINK Communications**



☞ *7.4 Trial Operation with MECHATROLINK Communications on page 290*

3. **Trial Operation with the Servomotor Connected to the Machine**

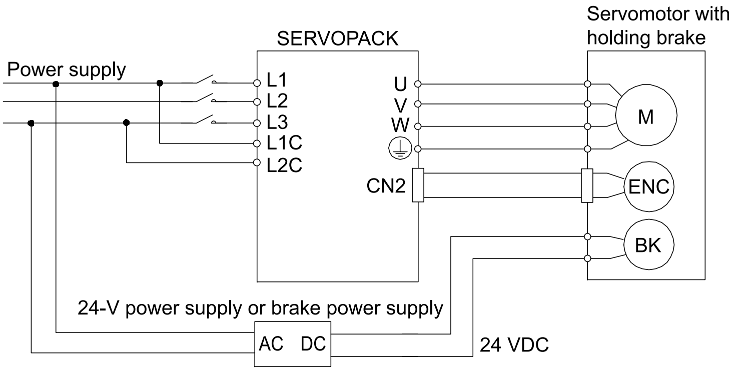


☞ *7.5 Trial Operation with the Servomotor Connected to the Machine on page 292*

7.2 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.



7.3 Trial Operation for the Servomotor without a Load

You use jogging operation for trial operation of the servomotor without a load.

Jogging operation 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.

⚠ CAUTION

During jogging operation, the overtravel function is disabled. Consider the range of motion of your machine when you jog the servomotor.

Important: The tuning-less function is enabled as the default setting. When the tuning-less function is enabled, gain will increase and vibration may occur if the servomotor is operated with no load. If vibration occurs, set Pn170 = n.□□□0 (disable the tuning-less function).

7.3.1 Preparations

Always check the following before you execute jogging.

- The parameters must not be write prohibited.
- The main circuit power 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

Parameter	Setting Range	Setting Unit	Default Setting	When Enabled
Pn304 Jogging Speed (Speed, Pos, Trq)	0 to 10000	Rotary: 1 min^{-1} Direct Drive: 0.1 min^{-1}	500	Immediately
Pn305 Soft Start Acceleration Time (Speed)	0 to 12000	1 ms	0	Immediately
Pn306 Soft Start Deceleration Time (Speed)	0 to 12000	1 ms	0	Immediately

– Linear Servomotors

Parameter	Setting Range	Setting Unit	Default Setting	When Enabled
Pn383 Jogging Speed (Speed, Pos, Trq)	0 to 10000	1 mm/s	50	Immediately
Pn305 Soft Start Acceleration Time (Speed)	0 to 12000	1 ms	0	Immediately
Pn306 Soft Start Deceleration Time (Speed)	0 to 12000	1 ms	0	Immediately

7.3.2 Applicable Tools

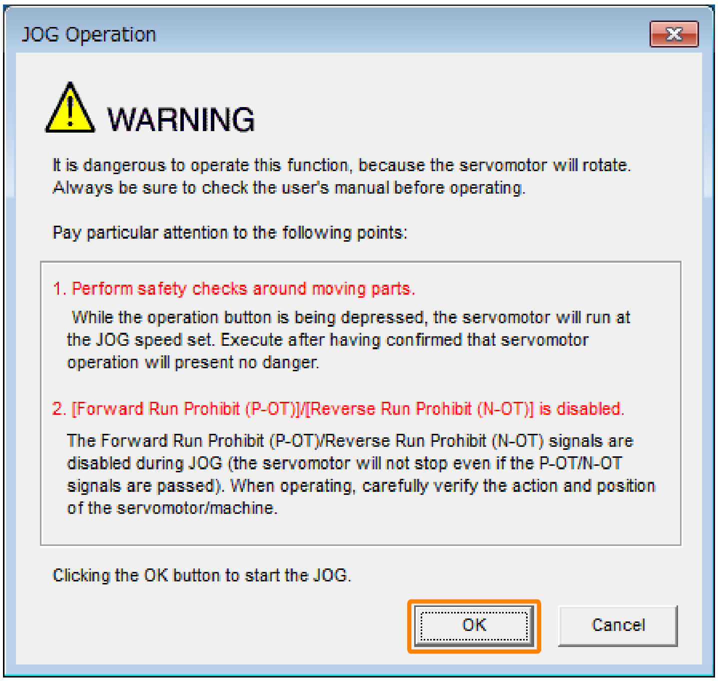
The following table lists the tools that you can use to perform jogging.

Tool	Fn No./Function Name	Reference
Digital Operator	Fn002	Σ-7/Σ-X series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	[Operation] - [Jog]	*7.3.3 Operating Procedure on page 288*

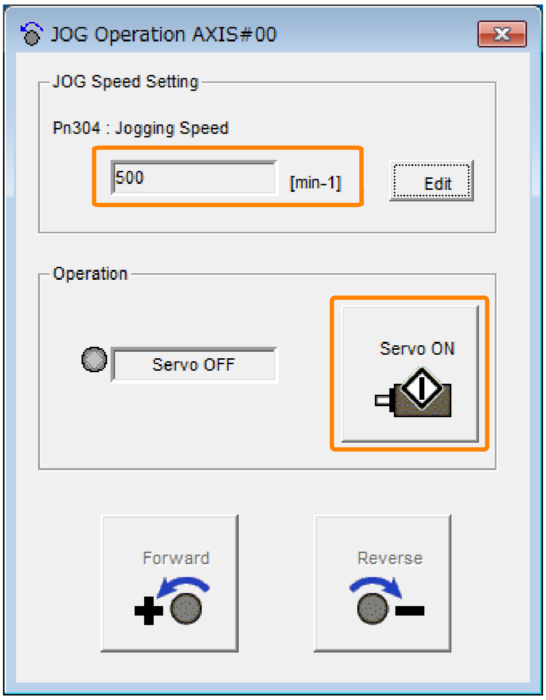
7.3.3 Operating Procedure

Use the following procedure to jog the motor.

1. **Click the [ ] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**
2. **Click [Jog] in the [Menu] window.**
   The [Jog Operation] window will be displayed.
3. **Read the warnings and then click the [OK] button.**



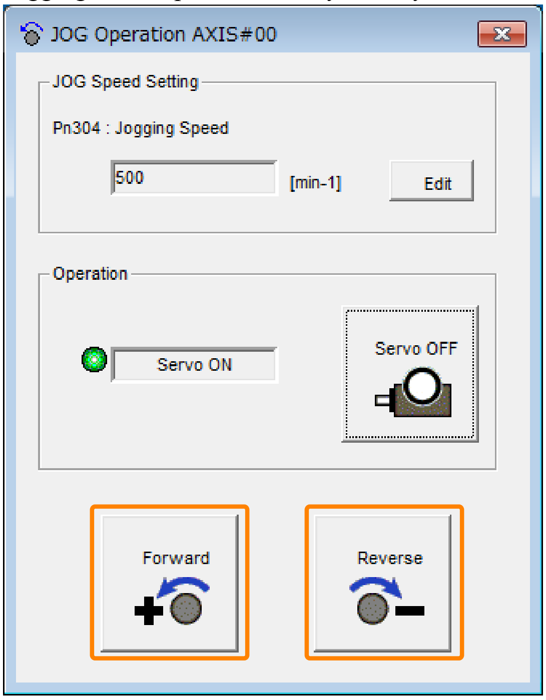
4. **Check the jogging speed and then click the [Servo ON] button.**



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.

5. **Click the [Forward] button or the [Reverse] button.**
Jogging will be performed only while you hold down the mouse button.



6. **Turn the power to the SERVOPACK OFF and ON again after you finish jogging.**

This concludes the jogging procedure.

7.4 Trial Operation with MECHATROLINK Communications

A trial operation example for MECHATROLINK communications is given below.

For details on the commands, refer to the following manual that corresponds to the communications references being used.

Σ-7/Σ-X-Series MECHATROLINK-4 Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800002 32)

Σ-7/Σ-X-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.

   ☞ *4 Wiring and Connecting SERVOPACKs on page 99*

2. **Turn ON the powers 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 cable is connected, will light.

   If the L1 or L2 indicator does not light, check the MECHATROLINK communications settings and correct the settings if necessary. Refer to the following section for details on the MECHATROLINK communications settings.

   ☞ *5.2 MECHATROLINK Communications Settings on page 156*

   If the settings were corrected, turn the SERVOPACK power OFF and ON again.

3. **Send the CONNECT (Request for Establishing Connection) 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 (Read ID) command.**

   The SERVOPACK will return the product model (example: SGDXS-R90A40A).

5. **Set the following items, which are necessary for trial operation.**

Setting	Reference
Setting the Electronic Gear	☞ *5.15 Electronic Gear Settings on page 188*
Motor Direction	☞ *5.5 Motor Direction Setting on page 161*
Overtravel	☞ *5.11 Overtravel and Related Settings on page 174*

6. **Save the settings that you made in step 5.**

   To save the settings to the host controller, use the SVPRM_WR (Write Servo Parameter) command and MODE = 00h (write common parameters to RAM area) or MODE = 10h (write device parameters to RAM area).

   To save the settings to the SERVOPACK, use the SVPRM_WR (Write Servo Parameter) command and MODE = 01h (write common parameters to non-volatile memory area) or MODE = 11h (write device parameters to non-volatile memory area).

7. **Send the CONFIG (Device Setup Request) command to enable the settings.**

8. **Send the SENS_ON (Turn Sensor ON) command to obtain the position information (encoder ready).**

9. **Send the SV_ON (Servo 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 (Positioning)

Command settings: Positioning position = 10000 (If you are using an absolute encoder, add + 10000 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, correct the rotation direction of the servomotor.	☞ *5.5 Motor Direction Setting on page 161*
Confirm that no abnormal vibration, noise, or temperature rise occurs. If any abnormalities are found, implement corrections.	☞ *13.5 Troubleshooting Based on the Operation and Conditions of the Servomotor on page 591*

Note:

If the load machine is not sufficiently broken in before trial operation, the servomotor may become overloaded.

7.5 Trial Operation with the Servomotor Connected to the Machine

This section provides the procedure for trial operation with both the machine and servomotor.

7.5.1 Precautions

⚠ WARNING

Perform the correct operation with the servomotor connected to the machine.

There is a risk of machine damage or personal injury.

Important

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 the machine from falling due to gravity and to prevent vibration from being caused by 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 Output) signal from the SERVOPACK.

Refer to the following sections for information on wiring and the related parameter settings.

☞ *4.4.4 Wiring the SERVOPACK to the Holding Brake on page 130*

☞ *5.12 Holding Brake on page 179*

Important

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.

7.5.2 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 the following has been completed.
  ☞ *7.4 Trial Operation with MECHATROLINK Communications on page 290*
- 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

7.5.3 Operating Procedure

1. **Enable the overtravel signals.**

   ☞ *5.11.2 Setting to Enable/Disable Overtravel on page 175*

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 138*

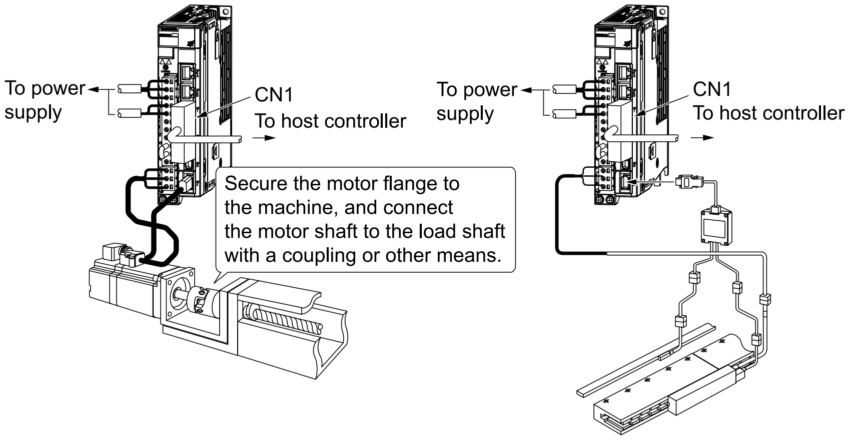
   ☞ *5.11 Overtravel and Related Settings on page 174*

   ☞ *5.12 Holding Brake on page 179*

3. **Turn OFF the power to the SERVOPACK.**

   The control power and main circuit power will turn OFF.

4. **Couple the servomotor to the machine.**



5. **Turn ON the power to the machine and host controller and turn ON the control power and main circuit power to the SERVOPACK.**

6. **Check the protective functions, such as 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 the following and confirm that the same results are obtained as when trial operation was performed on the servomotor without a load.**

   ☞ *7.4 Trial Operation with MECHATROLINK Communications on page 290*

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.
   - Record the settings manually.

This concludes the procedure for trial operation with both the machine and servomotor.

7.6 Convenient Function to Use during Trial Operation

This section describes some convenient operations that you can use during trial operation.

Use them as required.

7.6.1 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.

(1) Preparations

Always check the following before you execute program jogging.

- The parameters must not be write prohibited.
- The main circuit power 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 travel speed of your machine must be considered when you set the travel distance and travel speed.
- There must be no overtravel.
- The settings of the electronic gear ratio (Pn20E/Pn210), Pn533 or Pn585 (Program Jogging Movement Speed), and Pn385 (Maximum Motor Speed) must not satisfy either of the conditional expressions shown below.
  If either of these conditional expressions is satisfied, an A.042 (Parameter Combination Error) will occur.

– Rotary Servomotors

$$\cdot\ \text{Pn533 [min}^{-1}] \times \frac{\text{Encoder resolution}}{6 \times 10^5} \leq \frac{\text{Pn20E}}{\text{Pn210}}$$

$$\cdot\ \text{Maximum motor speed [min}^{-1}] \times \frac{\text{Encoder resolution}}{\text{Approx. } 3.66 \times 10^{12}} \geq \frac{\text{Pn20E}}{\text{Pn210}}$$

Information Refer to the following section for details on the encoder resolution.

☞
◆ *Encoder Resolution on page 189*

– Linear Servomotors

$$\cdot\ \frac{\text{Pn585 [mm/s]}}{\text{Linear encoder scale pitch [}\mu\text{m]}} \times \frac{\text{Number of divisions of the serial converter unit}}{10} \leq \frac{\text{Pn20E}}{\text{Pn210}}$$

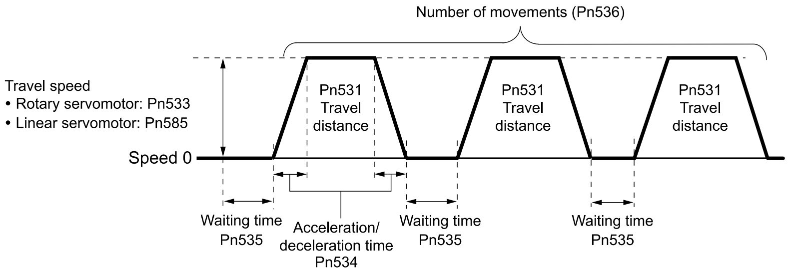
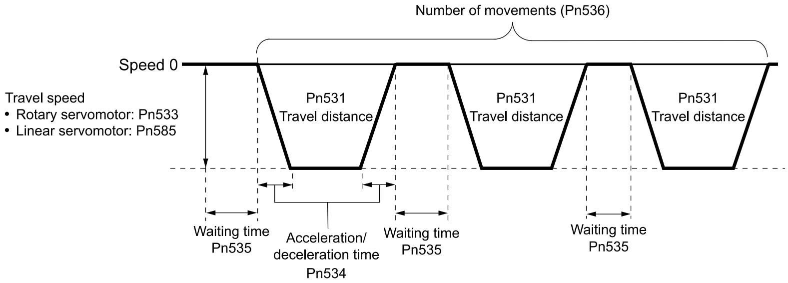
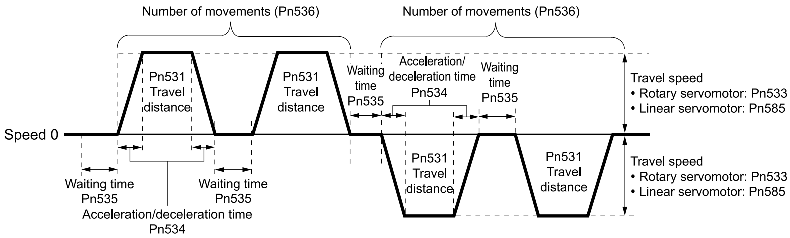
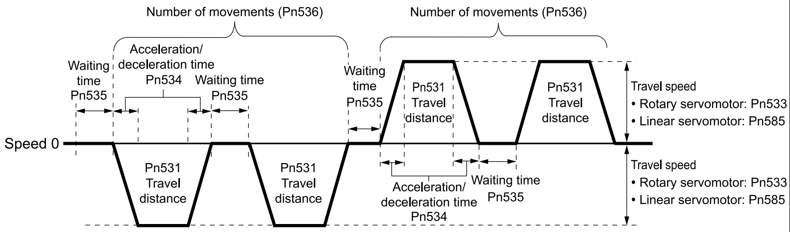
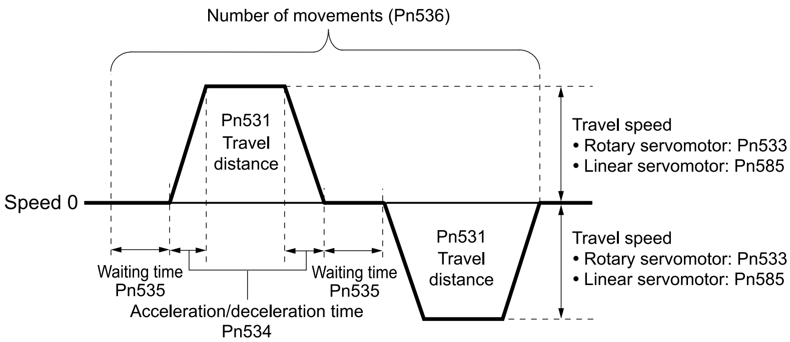
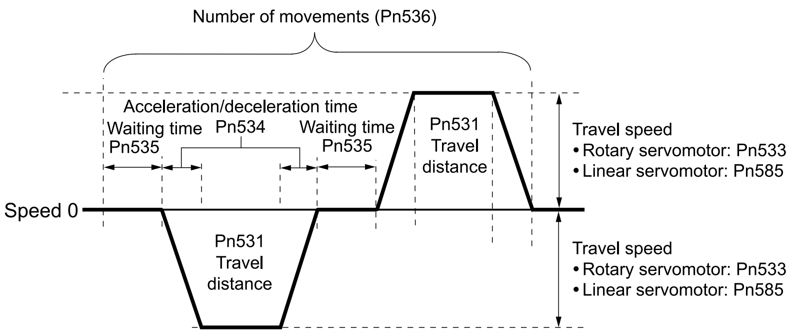
$$\cdot\ \frac{\text{Pn385 [100 mm/s]}}{\text{Linear encoder scale pitch [}\mu\text{m]}} \times \frac{\text{Number of divisions of the serial converter unit}}{\text{Approx. } 6.10 \times 10^5} \geq \frac{\text{Pn20E}}{\text{Pn210}}$$

(2) 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.

(3) Program Jogging Operation Pattern

An example of a program jogging operation pattern is given below. In this example, the motor rotation direction is set to Pn000 = n.□□□0 (use CCW as the forward direction).

Setting of Pn530	Setting	Operation Pattern
n.□□□0	(Waiting time → Forward by travel distance) × Number of movements	
n.□□□1	(Waiting time → Reverse by travel distance) × Number of movements	
n.□□□2	(Waiting time → Forward by travel distance) × Number of movements → (Waiting time → Reverse by travel distance) × Number of movements	
n.□□□3	(Waiting time → Reverse by travel distance) × Number of movements → (Waiting time → Forward by travel distance) × Number of movements	
n.□□□4	(Waiting time → Forward by travel distance → Waiting time → Reverse by travel distance) × Number of movements	
n.□□□5	(Waiting time → Reverse by travel distance → Waiting time → Forward by travel distance) × Number of movements	

Information If Pn530 is set to n.□□□0, n.□□□1, n.□□□4, or n.□□□5, 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 n.□□□2 or n.□□□3.

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.

(4) 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.

(a) Rotary Servomotors

		Program Jogging Operation Pattern (Speed Pos Trq)		When Enabled
Pn530	n.□□□X	0 Default	(Waiting time in Pn535 → Forward by travel distance in Pn531) × Number of movements in Pn536	Immediately
		1	(Waiting time in Pn535 → Reverse by travel distance in Pn531) × Number of movements in Pn536	
		2	(Waiting time in Pn535 → Forward by travel distance in Pn531) × Number of movements in Pn536 (Waiting time in Pn535 → Reverse by travel distance in Pn531) × Number of movements in Pn536	
		3	(Waiting time in Pn535 → Reverse by travel distance in Pn531) × Number of movements in Pn536 (Waiting time in Pn535 → Forward by travel distance in Pn531) × Number of movements in Pn536	
		4	(Waiting time in Pn535 → Forward by travel distance in Pn531 → Waiting time in Pn535 → Reverse by travel distance in Pn531) × Number of movements in Pn536	
		5	(Waiting time in Pn535 → Reverse by travel distance in Pn531 → Waiting time in Pn535 → Forward by travel distance in Pn531) × Number of movements in Pn536	

	Program Jogging Travel Distance (Speed Pos Trq)			
Pn531	Setting Range	Setting Unit	Default Setting	When Enabled
	1 to 1073741824	1 reference unit	32768	Immediately

	Program Jogging Movement Speed (Speed Pos Trq)			
Pn533	Setting Range	Setting Unit	Default Setting	When Enabled
	1 to 10000	Rotary: 1 min^{-1} Direct Drive: 0.1 min^{-1}	500	Immediately

	Program Jogging Acceleration/Deceleration Time (Speed Pos Trq)			
Pn534	Setting Range	Setting Unit	Default Setting	When Enabled
	2 to 10000	1 ms	100	Immediately

	Program Jogging Waiting Time (Speed Pos Trq)			
Pn535	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 10000	1 ms	100	Immediately

	Program Jogging Number of Movements (Speed Pos Trq)			
Pn536	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 1000	1 time	1	Immediately

(b) Linear Servomotors

Parameter			Meaning	When Enabled
Pn530	n.□□□X		Program Jogging Operation Pattern (Speed, Pos, Trq)	When Enabled
		0 (Default)	(Waiting time in Pn535 → Forward by travel distance in Pn531) × Number of movements in Pn536	Immediately
		1	(Waiting time in Pn535 → Reverse by travel distance in Pn531) × Number of movements in Pn536	
		2	(Waiting time in Pn535 → Forward by travel distance in Pn531) × Number of movements in Pn536 (Waiting time in Pn535 → Reverse by travel distance in Pn531) × Number of movements in Pn536	
		3	(Waiting time in Pn535 → Reverse by travel distance in Pn531) × Number of movements in Pn536 (Waiting time in Pn535 → Forward by travel distance in Pn531) × Number of movements in Pn536	
		4	(Waiting time in Pn535 → Forward by travel distance in Pn531 → Waiting time in Pn535 → Reverse by travel distance in Pn531) × Number of movements in Pn536	
		5	(Waiting time in Pn535 → Reverse by travel distance in Pn531 → Waiting time in Pn535 → Forward by travel distance in Pn531) × Number of movements in Pn536	

Parameter	Setting Range	Setting Unit	Default Setting	When Enabled
Pn531	Program Jogging Travel Distance (Speed, Pos, Trq)			
	1 to 1073741824	1 reference unit	32768	Immediately
Pn585	Program Jogging Movement Speed (Speed, Pos, Trq)			
	1 to 10000	1 mm/s	50	Immediately
Pn534	Program Jogging Acceleration/Deceleration Time (Speed, Pos, Trq)			
	2 to 10000	1 ms	100	Immediately
Pn535	Program Jogging Waiting Time (Speed, Pos, Trq)			
	0 to 10000	1 ms	100	Immediately
Pn536	Program Jogging Number of Movements (Speed, Pos, Trq)			
	0 to 1000	1 time	1	Immediately

(5) Applicable Tools

The following table lists the tools that you can use to perform program jogging.

Tool	Fn No./Function Name	Reference
Digital Operator	Fn004	Σ-7/Σ-X series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	[Operation] - [Program JOG Operation]	*(6) Operating Procedure on page 297*

(6) Operating Procedure

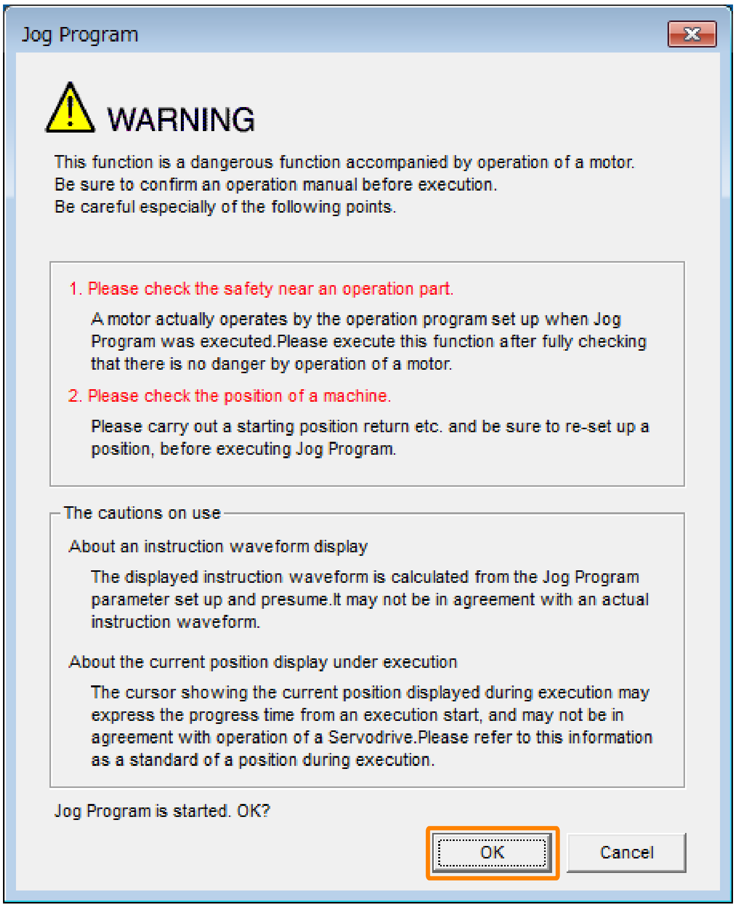
Use the following procedure for program jogging.

1. **Click the [ ] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**

2. **Click [Jog Program] in the [Menu] window.**

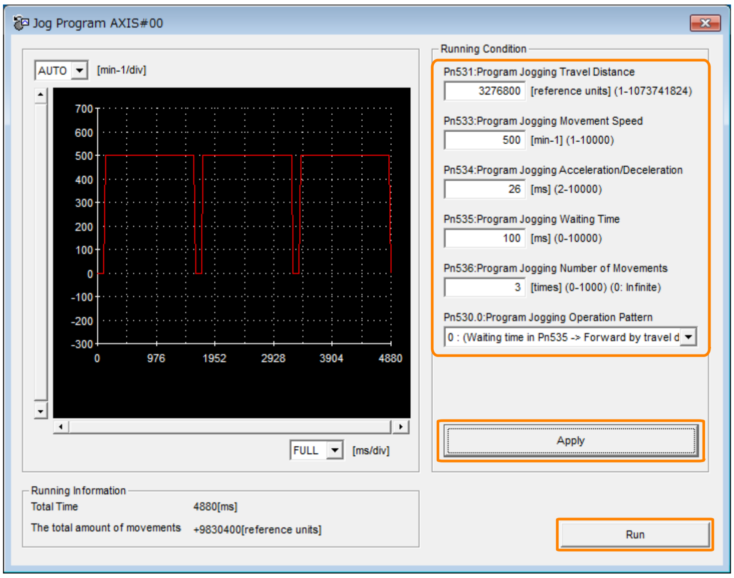
   The [Jog Program] window will be displayed.

3. **Read the warnings and then click the [OK] button.**

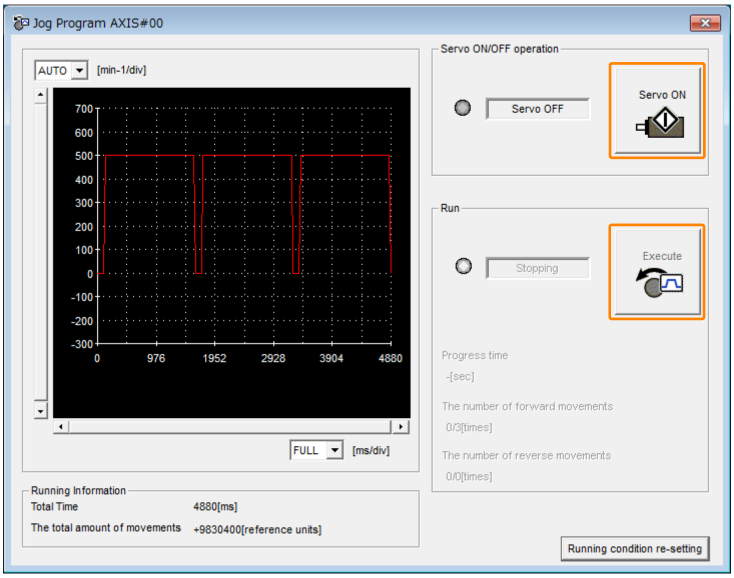


4. **Set the operating conditions, click the [Apply] button, and then click the [Run] button.**

   A graph of the operation pattern will be displayed.



5. **Click the [Servo ON] button and then the [Execute] button. The program jogging operation will be executed.**



Important	The stopping method if you cancel the program jogging operation while the servomotor is operating is given below. • If you cancel operation with the [Servo OFF] button, the servomotor will stop according to the setting of Pn001 = n.□□□X (Motor Stopping Method for Servo OFF). • 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.

7.6.2 Origin Search

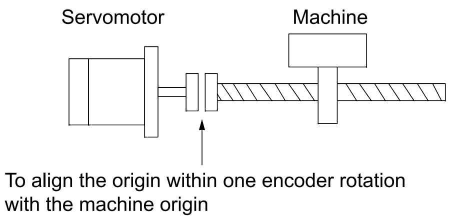
The origin search operation positions the motor to the origin within one rotation and then clamps it there.

The overtravel function is disabled during an origin search.

⚠ CAUTION
Make sure that the load is not coupled when you execute an origin search. Since the P-OT (Forward Drive Prohibit Input) signal and N-OT (Reverse Drive Prohibit Input) signal are disabled during an origin search, the machine may be damaged by exceeding its movement limits.

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^{-1}
- Direct drive servomotors: 6 min^{-1}
- Linear servomotors: 15 mm/s



(1) Preparations

Always check the following before you execute an origin search.

- The load must not be coupled.
- The parameters must not be write prohibited.
- The main circuit power must be ON.
- There must be no alarms.
- There must be no hard wire base block (HWBB).
- The servo must be OFF.

(2) Applicable Tools

The following table lists the tools that you can use to perform origin search.

Tool	Fn No./Function Name	Reference
Digital Operator	Fn003	Σ-7/Σ-X series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+ *1	[Encoder Setting] - [Origin Search]	☞ *(3) Operating Procedure on page 300*

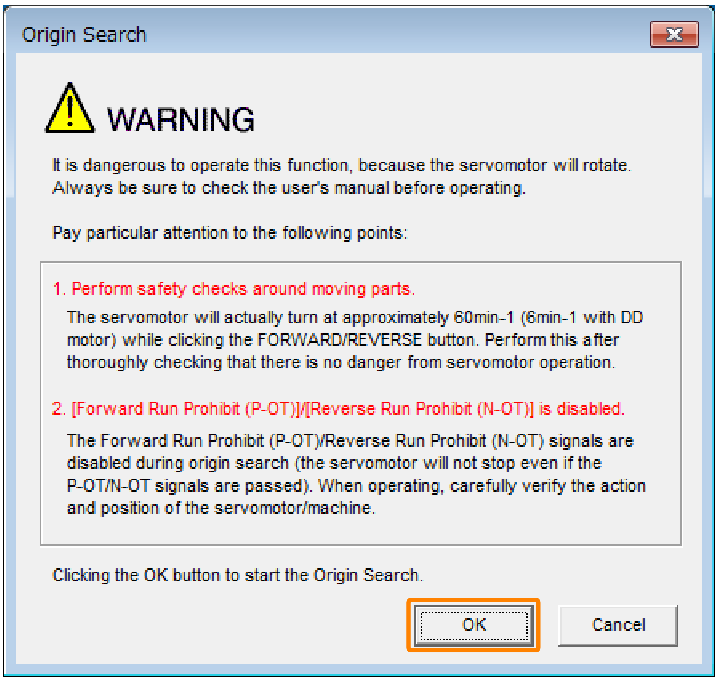
*1 Cannot be used when connecting a linear servomotor.

(3) Operating Procedure

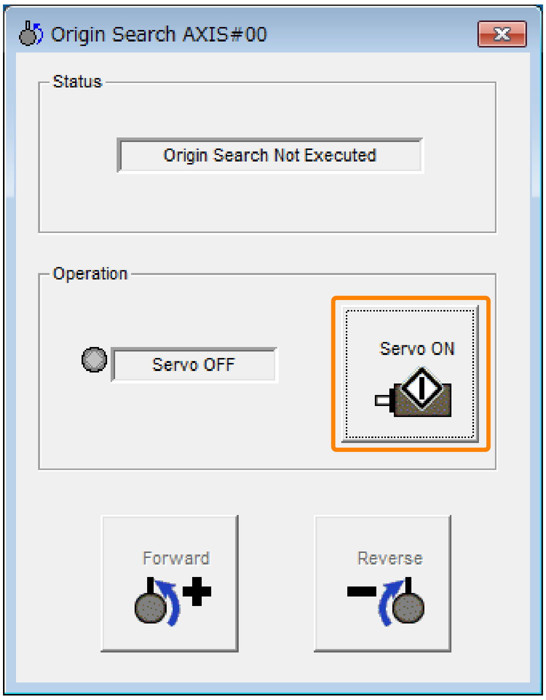
Use the following procedure to perform an origin search.

1. **Click the [ ] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**
2. **Click [Origin Search] in the [Menu] window.**

   The [Origin Search] window will be displayed.
3. **Read the warnings and then click the [OK] button.**

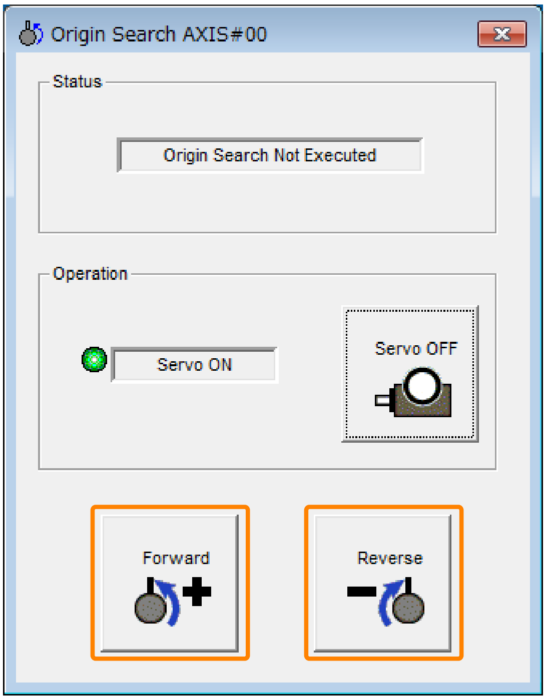


4. **Click the [Servo ON] button.**



5. **Click the [Forward] button or the [Reverse] button.**

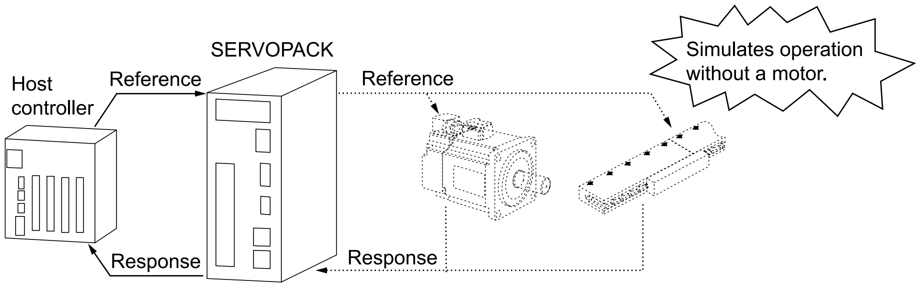
An origin search will be performed only while you hold down the mouse button. The motor will stop when the origin search has been completed.



This concludes the origin search procedure.

7.6.3 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 Pn00C = n.□□□X to enable or disable the test without a motor.

Pn00C	n.□□□X	Function Selection for Test without a Motor (Speed Pos Trq)		When Enabled
		0 Default	Disable tests without a motor.	After restart
		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.

(1) 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 connection status.

(a) Rotary Servomotors

Motor Connection Status	Information That Is Used	Source of Information
Connected	Motor information • Motor rated speed • Maximum motor speed	Information in the servomotor that is connected
	Encoder information • Encoder resolution • Encoder type	
Not connected	Motor information • Motor rated speed • Maximum motor speed	• Setting of Pn000 = n.X□□□ (Rotary/Linear Servomotor Startup Selection When Encoder Is Not Connected) • Motor rated speed and maximum motor speed The values previously saved in the SERVOPACK will be used for the motor rated speed and maximum motor speed. Use the motor displays (Un020: Motor Rated Speed and Un021: Maximum Motor Speed) to check the values.
	Encoder information • Encoder resolution • Encoder type	• Encoder resolution: Setting of Pn00C = n.□□X□ (Encoder Resolution for Tests without a Motor) • Encoder type: Setting of Pn00C = n.□X□□ (Encoder Type Selection for Tests without a Motor)

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 number of divisions • External encoder type	Information in the external encoder that is connected
Not connected		Because you do not connect an external encoder to the SERVPOACK, the following values will always be displayed. • Number of divisions: 256 • Encoder type: Incremental encoder

(b) Linear Servomotor

Motor Connection Status	Information That Is Used	Source of Information
Connected	Motor information	Information in the motor that is connected
	Linear encoder information • Number of divisions • Encoder scale pitch • Encoder type	Information in the linear encoder that is connected
Not connected	Motor information	Setting of Pn000 = n.X□□□ (Rotary/Linear Servomotor Startup Selection When Encoder Is Not Connected)
	Encoder information • Number of divisions • Encoder scale pitch • Encoder type	• Number of divisions: 256 • Encoder scale pitch: Setting of Pn282 (Linear Encoder Scale Pitch) • Encoder type: Setting of Pn00C = n.□X□□ (Encoder Type Selection for Tests without a Motor)

(c) Related Parameters

Parameter		Meaning		When Enabled
Pn000	n.X□□□	Rotary/Linear Servomotor Startup Selection When Encoder Is Not Connected (Speed Pos Trq)		When Enabled
		0 Default	When an encoder is not connected, start as SERVOPACK for rotary servomotor.	After restart
		1	When an encoder is not connected, start as SERVOPACK for linear servomotor.	

Pn282	Linear Encoder Scale Pitch (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 6553600	0.01 μm	0	After restart

Parameter		Meaning		When Enabled
Pn00C	n.□□X□	Encoder Resolution for Tests without a Motor (Speed Pos Trq)		When Enabled
		0	Use 13 bits.	After restart
		1	Use 20 bits.	
		2	Use 22 bits.	
		3	Use 24 bits.	
		4 Default	Use 26 bits.	
Pn00C	n.□X□□	Encoder Type Selection for Tests without a Motor (Speed Pos Trq)		When Enabled
		0 Default	Use an incremental encoder.	After restart
		1	Use an absolute encoder.	

(2) 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.

- Motor 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.

(3) Restrictions

The following functions cannot be used during the test without a motor.

- Regeneration and dynamic brake operation
- Brake output signal
- Items marked with “×” in the following utility function table

SigmaWin+		Digital Operator		Executable?		Reference
Button in Menu Window	SigmaWin+ Function Name	Fn No.	Utility Function Name	Motor Not Connected	Motor Connected	
Basic Functions	Initialize *1	Fn005	Initialize Parameters	○	○	☞ *5.1.5 Initialize Parameters on page 154*
	Software Reset	Fn030	Software Reset	○	○	☞ *6.10 Software Reset on page 254*
	Product Information	Fn011	Display Servomotor Model	○	○	☞ *9.1 Monitoring Product Information on page 450*
		Fn012	Display Software Version	○	○	
		Fn01E	Display SERVOPACK and Servomotor IDs	○	○	
		Fn01F	Display Servomotor ID from Feedback Option Module	○	○	
Encoder Setting	Reset Absolute Encoder	Fn008	Reset Absolute Encoder	×	○	☞ *5.16 Resetting the Absolute Encoder on page 194*
	Multiturn Limit Setting	Fn013	Multiturn Limit Setting after Multiturn Limit Disagreement Alarm	×	○	☞ *6.8.9 A.CC0 (Multiturn Limit Disagreement Alarm) on page 246*
	Origin Search	Fn003	Origin Search	○	○	☞ *7.6.2 Origin Search on page 299*
	Set Origin	Fn020	Set Absolute Linear Encoder Origin	×	○	☞ *5.17 Setting the Origin of the Absolute Encoder on page 197*
	Polarity Detection	Fn080	Polarity Detection	×	×	☞ *5.10 Polarity Detection on page 171*
Trouble-shooting	Display Alarm	Fn000	Display Alarm History	○	○	☞ *13.2.4 Displaying the Alarm History on page 575*
		Fn006	Clear Alarm History	○	○	☞ *13.2.5 Clearing the Alarm History on page 577*
		Fn014	Reset Option Module Configuration Error	○	○	☞ *13.2.6 Resetting Option Module Configuration Error on page 578*
	Reset Motor Type Alarm	Fn021	Reset Motor Type Alarm	○	○	☞ *13.2.7 Resetting Motor Type Alarms on page 579*
Operation	Jog	Fn002	Jog	○	○	☞ *7.3 Trial Operation for the Servomotor without a Load on page 287*
	Program JOG Operation	Fn004	Jog Program	○	○	☞ *7.6.1 Program Jogging on page 294*

Continued on next page.

Continued from previous page.

SigmaWin+		Digital Operator		Executable?		Reference
Button in Menu Window	SigmaWin+ Function Name	Fn No.	Utility Function Name	Motor Not Connected	Motor Connected	
Tuning	Tuning - Autotuning without Host Reference	Fn201	Advanced Autotuning without Reference	×	×	*8.7 Autotuning without a Host Reference on page 344*
	Tuning - Autotuning with Host Reference	Fn202	Advanced Autotuning with Reference	×	×	*8.8 Autotuning with a Host Reference on page 357*
	Tuning - Custom Tuning	Fn203	One-Parameter Tuning	×	×	*8.9 Custom Tuning on page 366*
	Tuning - Custom Tuning - Adjust Anti-resonance Control	Fn204	Adjust Anti-resonance Control	×	×	*8.10 Anti-Resonance Control Adjustment on page 375*
	Tuning - Custom Tuning - Vibration Suppression	Fn205	Vibration Suppression	×	×	*8.11 Vibration Suppression on page 382*
	Response Level Setting	Fn200	Tuning-less Level Setting	×	×	*8.4 Tuning-less Function on page 318*
Diagnostic	Easy FFT	Fn206	Easy FFT	×	×	*8.16.2 Easy FFT on page 443*
Others	Adjust the Analog Monitor Output	Fn00C	Adjust Analog Monitor Output Offset	○	○	*9.3.3 Using the Analog Monitors on page 462*
		Fn00D	Adjust Analog Monitor Output Gain	○	○	
	Adjust the Motor Current Detection Offsets	Fn00E	Autotune Motor Current Detection Signal Offset	×	○	*6.12 Adjusting the Motor Current Detection Signal Offset on page 260*
		Fn00F	Manually Adjust Motor Current Detection Signal Offset	×	○	
	Initialize Vibration Detection Level	Fn01B	Initialize Vibration Detection Level	×	×	*6.11 Vibration Detection Level Initialization on page 257*
	Write Prohibited Setting	Fn010	Write Prohibition Setting	○	○	*5.1.4 Write Prohibition Setting on page 151*

*1 An [Initialize] button will be displayed in the [Edit Parameters] window.

7.7 Operation Using MECHATROLINK Commands

For details on the commands, refer to the following manuals that corresponds to the communications references being used.

Σ-7/Σ-X-series MECHATROLINK-4 Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800002 32)

Σ-7/Σ-X-series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

⚠ CAUTION

Do not operate the SERVOPACK using the SigmaWin+ or the digital operator while the MECHATROLINK-4 network is being reset.

There is a risk of failure or malfunction.

8

Tuning

This chapter provides information on the flow of tuning, details on tuning functions, and related operating procedures.

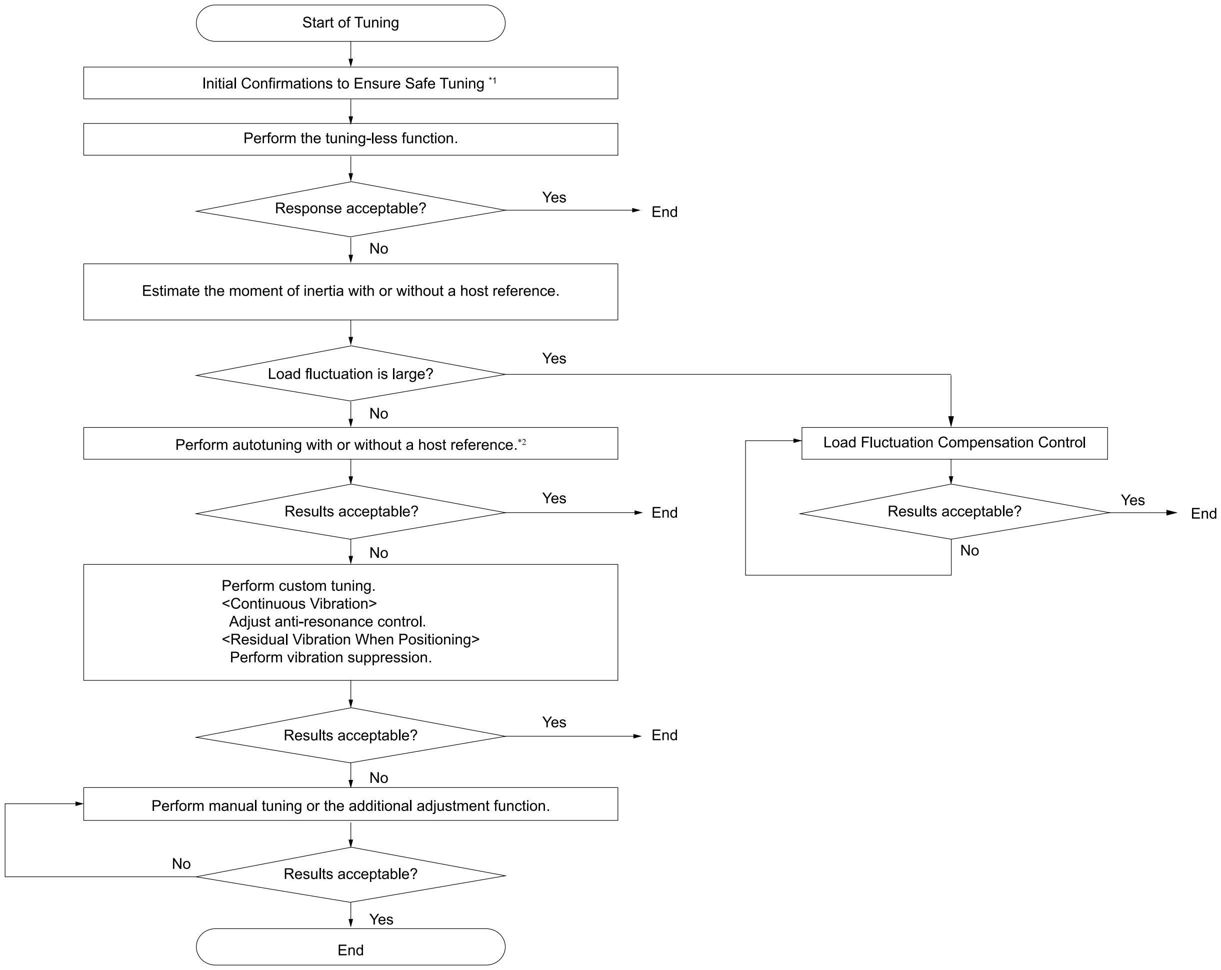
8.1 Overview and Flow of Tuning

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.



*1 Refer to the following section for details.
☞ *8.3 Precautions to Ensure Safe Tuning on page 314*

*2 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.

8.1.1 Tuning Functions

The following table provides an overview of the tuning functions.

Tuning Function	Outline	Applicable Control 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	☞ *8.4 Tuning-less Function on page 318*
Moment of Inertia Estimation without a Host Reference	The moment of inertia during operation is automatically calculated by the SERVOPACK for round-trip operation. A reference from the host controller is not used. The moment of inertia ratio that is calculated here is used in other tuning functions.	Speed control, position control, or torque control	☞ *8.5 Moment of Inertia Estimation without a Host Reference on page 323*
Moment of Inertia Estimation with a Host Reference	The load moment of inertia is estimated from operation by reference (position control) from the host controller. The moment of inertia ratio that is calculated here is used in other tuning functions.	Speed control, position control, or torque control	☞ *8.6 Moment of Inertia Estimation with a Host Reference on page 341*
Autotuning without a Host Reference	The following parameters are automatically adjusted in the internal references in the SERVOPACK during automatic operation. • Gains (e.g., position loop gain and speed loop gain) • Filters (torque reference filter and notch filters) • Friction compensation • Anti-resonance control • Vibration suppression	Speed control or position control	☞ *8.7 Autotuning without a Host Reference on page 344*
Autotuning with a Host Reference	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. • Gains (e.g., position loop gain and speed loop gain) • Filters (torque reference filter and notch filters) • Friction compensation • Anti-resonance control • Vibration suppression	Position control	☞ *8.8 Autotuning with a Host Reference on page 357*
Custom Tuning	The following parameters are adjusted with the position reference or speed reference input from the host controller while the machine is in operation. • Gains (e.g., position loop gain and speed loop gain) • Filters (torque reference filter and notch filters) • Friction compensation • Anti-resonance control	Speed control or position control	☞ *8.9 Custom Tuning on page 366*
Anti-Resonance Control Adjustment	This function effectively suppresses continuous vibration.	Speed control or position control	☞ *8.10 Anti-Resonance Control Adjustment on page 375*
Vibration Suppression	This function effectively suppresses residual vibration if it occurs when positioning.	Position control	☞ *8.11 Vibration Suppression on page 382*
Load Fluctuation Compensation Control	This function is used to control fluctuations in response for applications where the load (moment of inertia) fluctuates greatly.	Position control, speed control, or torque control	☞ *8.13 Load Fluctuation Compensation Control on page 409*
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.	☞ *8.14 Additional Adjustment Functions on page 412*
Manual Tuning	You can manually adjust the servo gains to adjust the response.	Speed control, position control, or torque control	☞ *8.15 Manual Tuning on page 427*

8.1.2 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	☞ *8.16.1 Mechanical Analysis on page 442*
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	☞ *8.16.2 Easy FFT on page 443*

8.2 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	
	Rotary Servomotor	Linear Servomotor
Torque reference	%	
Feedback speed	min^{-1}	mm/s
Position reference speed	min^{-1}	mm/s
Position deviation	Reference units	

- Speed Control

Item	Unit	
	Rotary Servomotor	Linear Servomotor
Torque reference	%	
Feedback speed	min^{-1}	mm/s
Reference speed	min^{-1}	mm/s

- Torque Control

Item	Unit	
	Rotary Servomotor	Linear Servomotor
Torque reference	%	
Feedback speed	min^{-1}	mm/s

8.3 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.**

There is a risk of machine damage or injury.

Perform the following settings in a way that is suitable for tuning.

8.3.1 Overtravel Settings

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.

☞ *5.11 Overtravel and Related Settings on page 174*

8.3.2 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 torque that is required for operation, overshooting or vibration may occur.

Refer to the following section for details.

☞ *6.7 Selecting Torque Limits on page 235*

8.3.3 Setting the Position Deviation Overflow Alarm Level

The position deviation overflow alarm is a protective function that is enabled when the SERVOPACK 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 setting of Pn102 (Position Loop Gain) and the motor speed with the following formula.

- Rotary Servomotors

$$\text{Position deviation [reference units]} = \frac{\text{Motor speed [min}^{-1}]}{60} \times \frac{\text{Encoder resolution}^{*1}}{\text{Pn102 [0.1/s]}/10^{*2,*3}} \times \frac{\text{Pn210}}{\text{Pn20E}}$$

- Linear Servomotors

$$\text{Position deviation [reference units]} = \frac{\text{Motor speed [mm/s]}}{\text{Pn102 [0.1/s]}/10^{*2,*3}} \times \frac{\text{Number of divisions}}{\text{Linear encoder scale pitch [}\mu\text{m]}/1000} \times \frac{\text{Pn210}}{\text{Pn20E}}$$

Pn520 (Position Deviation Overflow Alarm Level) [setting unit: reference units]

- Rotary Servomotors

$$\text{Pn520} > \frac{\text{Maximum motor speed [min}^{-1}]}{60} \times \frac{\text{Encoder resolution}^{*1}}{\text{Pn102 [0.1/s]/10}^{*2,*3}} \times \frac{\text{Pn210}}{\text{Pn20E}} \times \underline{\underline{(1.2 \text{ to } 2)^{*4}}}$$

- Linear Servomotors

$$\text{Pn520} > \frac{\text{Maximum motor speed [mm/s]}}{\text{Pn102 [0.1/s]/10}^{*2,*3}} \times \frac{\text{Number of divisions}}{\text{Linear encoder pitch [}\mu\text{m] /1000}} \times \frac{\text{Pn210}}{\text{Pn20E}} \times \underline{\underline{(1.2 \text{ to } 2)^{*4}}}$$

*1 Refer to the following section for details.
☞ *5.15 Electronic Gear Settings on page 188*
*2 When Pn140 is set to n.□□□1 (use model following control), 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, set Pn00B to n.□□□1 (display all parameters).
*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 7000 and an encoder resolution of 67108864 (26 bits). Pn102 is set to 400. $\frac{\text{Pn210}}{\text{Pn20E}} = \frac{1}{64}$

$$\text{Pn520} = \frac{7000}{60} \times \frac{67108864}{400/10} \times \frac{1}{64} \times 2$$

$$= 3058347 \times 2$$

$$= 6116694$$

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.

(1) Related Parameters

Parameter	Setting Range	Setting Unit	Default Setting	When Enabled
Pn520	Position Deviation Overflow Alarm Level (Speed / **Pos** / Trq)			
	1 to 1073741823	1 reference unit	6116694	Immediately
Pn51E	Position Deviation Overflow Warning Level (Speed / **Pos** / Trq)			
	10 to 100	1%	100	Immediately

(2) Related Alarms

Alarm Number	Alarm Name	Alarm Meaning
A.d00	Position Deviation Overflow	The setting of Pn520 (Position Deviation Overflow Alarm Level) was exceeded by the position deviation while the servo was ON.

(3) Related Warnings

Warning Number	Warning Name	Warning Meaning
A.900	Position Deviation Overflow	The position deviation exceeded the percentage set with the following formula: (Pn520 × Pn51E/100)

8.3.4 Vibration Detection Level Setting

You can set Pn312 (Vibration Detection Level) 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.

☞ *6.11 Vibration Detection Level Initialization on page 257*

8.3.5 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.

(1) Related Parameters

Pn526	Position Deviation Overflow Alarm Level at Servo ON (Speed / Pos / Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	1 to 1073741823	1 reference unit	6116694	Immediately
Pn528	Position Deviation Overflow Warning Level at Servo ON (Speed / Pos / Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	10 to 100	1%	100	Immediately

• Rotary Servomotors

Pn529	Speed Limit Level at Servo ON (Speed / Pos / Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 10000	1 min^{-1}	10000	Immediately

• Linear Servomotors

Pn584	Speed Limit Level at Servo ON (Speed / Pos / Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 10000	1 mm/s	10000	Immediately

(2) Related Alarms

Alarm Number	Alarm Name	Alarm Meaning
A.d01	Position Deviation 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.
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) limits the speed when the servo is turned ON. This alarm occurs if position reference is input and the setting of Pn520 (Position Deviation Overflow Alarm Level) is exceeded before the limit is cleared.

Refer to the following section for information on troubleshooting alarms.

☞ *13.2.3 Alarm Reset on page 574*

(3) Related Warnings

Warning Number	Warning Name	Warning Meaning
A.901	Position Deviation Overflow Alarm at Servo ON	The position deviation when the servo was turned ON exceeded the percentage set with the following formula: (Pn526 × Pn528/100)

8.4 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.

⚠ CAUTION

To ensure safety, make sure that you can perform an emergency stop at any time when you change the tuning-less level and change the tuning-less type.

Important

The servomotor may vibrate if it exceeds the allowable load moment of inertia. If that occurs, set Pn170 to n.2□□□ (set the load level for the tuning-less function to 2) or reduce the setting of Pn170 = n.□X□□ (Rigidity Level).

Information

- The tuning-less function is disabled during torque control.
- The servomotor may momentarily emit a sound or vibrate 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. Depending on the mechanism, the automatic notch filter may not be set to an appropriate frequency. If this sound or vibration continues, set Pn460 to n.□0□□ (do not adjust automatically) and manually set a function to suppress vibration (e.g., a notch filter). Refer to the following section for the settings of functions that are automatically adjusted.
  ☞ *8.4.5 Automatically Adjusted Function Setting on page 321*

8.4.1 Application Restrictions

The following application restrictions apply to the tuning-less function.

Function	Executable? *1	Remarks
Vibration Detection Level Initialization	○	–
Moment of Inertia Estimation	×	Set Pn170 to n.□□□0 (disable the tuning-less function) before you execute moment of inertia estimation.
Autotuning without a Host Reference	×	Set Pn170 to n.□□□0 (disable the tuning-less function) before you execute autotuning without a host reference. *2
Autotuning with a Host Reference	×	–
Custom Tuning	×	–
Anti-Resonance Control Adjustment	×	–
Vibration Suppression	×	–
Load Fluctuation Compensation	×	Set Pn170 to n.□□□0 (disable the tuning-less function), turn the power OFF and then ON again, and then set Pn173 to n.□□□1 (enable load fluctuation compensation).
EasyFFT	○	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 Switching	×	–
Mechanical Analysis	○	The tuning-less function is disabled while you execute mechanical analysis and then it is enabled when mechanical analysis has been completed.

*1 ○: Yes ×: No

*2 To execute this function from the digital operator, set Jcalc = ON (estimate moment of inertia) [default setting] on the Fn201 (Advanced Autotuning without Reference) setting display of the digital operator when Pn170 = n.□□□1 (enable the tuning-less function) [default setting], and then autotuning without a host reference can be executed.
Refer to the following manual for the operating procedures for the digital operator.
Σ-7/Σ-X-series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)

8.4.2 Operating Procedure

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.

				When Enabled
Pn170	n.□□□X	Tuning-less Selection	Speed Pos Trq	When Enabled
		0	Disable tuning-less function.	After restart
		1 Default	Enable tuning-less function.	
Pn170	n.□□X□	Speed Control Method	Speed Pos Trq	When Enabled
		0 Default	Use for speed control.	After restart
		1	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.□□3□ (use tuning-less type 4) (default setting). If you set Pn14F to n.□□3□, load level correction will be switched automatically.

If you require compatibility with previous products, use one of the following settings.

- Pn14F= n.□□0□ (use tuning-less type 1)
- Pn14F= n.□□1□ (use tuning-less type 2)
- Pn14F= n.□□2□ (use tuning-less type 3)

If you set the parameter to one of the above settings, load level correction will not be switched automatically.

Information: Automatic switching of load level correction is used to automatically switch Pn170 = n.X□□□ (Tuning-less Load Level) according to the load. Automatic switching of load level correction is used to execute tuning automatically so that the SERVOPACK can handle a load up to 100-times that of the normal load.

				When Enabled
Pn14F	n.□□X□	Tuning-less Type Selection	Speed Pos Trq	When Enabled
		0	Use tuning-less type 1.	After restart
		1	Use tuning-less type 2.	
		2	Use tuning-less type 3.	
		3 Default	Use tuning-less type 4.	

(1) Tuning-less Level Settings

If vibration or other problems occur, change the tuning-less levels. To change the tuning-less levels, use the SigmaWin+.

(a) Preparations

Always check the following before you set the tuning-less levels.

- Pn170 must be set to n.□□□1 (Tuning-less Selection is enabled).
- Pn00C must be set to n.□□□0 (Function Selection for Test without a Motor is disabled).
- The servomotor must be connected to the machine.

(b) Procedure

Use the following procedure to set the tuning-less levels.

Information: This section gives the procedure using the SigmaWin+, but the tuning-less levels can also be set with parameters. Refer to the following sections for details on the parameters to set.

☞ *(c) Related Parameters on page 320*

1. **Click the [ ] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**
2. **Select [Response Level Setting] in the [Menu] window.**

   The [Turning-less Level Setting-Adj] window will be displayed.

3. **Click the [▲] or [▼] button to adjust the turning-less level setting. Increase the turning-less level setting to increase the response. Decrease the turning-less level setting to suppress vibration.**

The default response level setting is 4.

Tuning-less Rigidity Level	Description	Remarks
7	Response level: High	These levels cannot be selected if Pn14F is set to n.□□0□ or n.□□1□ (use tuning-less type 1 or 2).
6		
5		
4 (default setting)		–
3		
2		
1		
0	Response level: Low	

4. **Click the [Completed] button.**

The adjustment results will be saved in the SERVOPACK.

> **Important**
> If the servomotor will be removed from the machine, always reset the tuning-less levels back to the default settings. If you turn ON the servo when the servomotor has been removed from the machine without resetting the default settings, there is a risk of servomotor vibration.

(c) Related Parameters

◆ Tuning-less Rigidity Level

If Pn14F is set to n.□□0□ or n.□□1□ (use tuning-less type 1 or 2), set Pn170 to n.□0□□ to n.□4□□ (tuning-less level 0 to 4). Do not set Pn170 to n.□5□□ to n.□7□□ (tuning-less level 5 to 7).

Information Tuning-less level 0 is the lowest response level, and then levels increase up to the largest response level at tuning-less level 7.

Pn170	n.□X□□	Tuning-less Level (Speed Pos Trq)		When Enabled
		0	Set the tuning-less level to 0.	Immediately
		1	Set the tuning-less level to 1.	
		2	Set the tuning-less level to 2.	
		3	Set the tuning-less level to 3.	
		4 Default	Set the tuning-less level to 4.	
		5	Set the tuning-less level to 5.	
		6	Set the tuning-less level to 6.	
		7	Set the tuning-less level to 7.	

◆ Tuning-less Load Level

Pn170	n.X□□□	Tuning-less Load Level (Speed Pos Trq)		When Enabled
		0	Set the tuning-less load level to 0.	Immediately
		1 Default	Set the tuning-less load level to 1.	
		2	Set the tuning-less load level to 2.	

8.4.3 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□□□ or Pn170 = n.□X□□.
- Excessive Vibration during Position Control
  Increase the setting of Pn170 = n.X□□□ or decrease the setting of Pn170 = n.□X□□.

8.4.4 Parameters Disabled by Tuning-less Function

When Pn170 is set to n.□□□1 (the tuning-less function is enabled) (default setting), the parameters in the following table are disabled.

Parameter Name	Parameter Number
Speed Loop Gain Second Speed Loop Gain	Pn100 Pn104
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
Friction Compensation Function Selection	Pn408 = n.X□□□
Anti-Resonance Control Selection	Pn160 = n.□□□X
Gain Switching Selection	Pn139 = n.□□□X

The tuning-less function is disabled during torque control, Easy FFT, and mechanical analysis for a vertical axis. In addition, Pn100, Pn104, Pn101, Pn105, Pn102, Pn106, and Pn103 in the above table are enabled for torque control, Easy FFT, and mechanical analysis for a vertical axis. Of these, only Pn100, Pn103, and Pn104 are enabled for torque control.

8.4.5 Automatically Adjusted Function Setting

You can also automatically adjust notch filters.

Normally, set Pn460 to n.□1□□ (adjust automatically) (default setting). Vibration is automatically detected and a notch filter is set.

Set Pn460 to n.□0□□ (do not adjust automatically) only if you do not change the setting of the notch filter before you execute this function.

<table>
<tr><td rowspan="3">Pn460</td><td rowspan="3">n.□X□□</td><td colspan="2">Notch Filter Adjustment Selection 2 Speed Pos Trq</td><td>When Enabled</td></tr>
<tr><td>0</td><td>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.</td><td rowspan="2">Immediately</td></tr>
<tr><td>1
Default</td><td>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.</td></tr>
</table>

8.4.6 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 tuning-less function.

Parameter	Name
Pn401	First Stage First Torque Reference Filter Time Constant
Pn40A	First Stage Notch Filter Q Value
Pn40C	Second Stage Notch Filter Frequency
Pn40D	Second Stage Notch Filter Q Value

8.5 Moment of Inertia Estimation without a Host Reference

This section describes how the moment of inertia without a host reference 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.

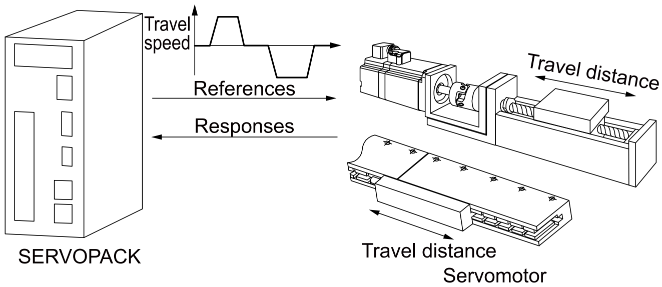
☞ *8.7.4 Operating Procedure on page 346*

8.5.1 Outline

The moment of inertia during operation is automatically calculated by the SERVOPACK for round-trip 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 this function, you can estimate load moment of inertia with good accuracy.



Note:
Execute this function after jogging to a position that ensures a suitable range of motion.

8.5.2 Restrictions

The following restrictions apply to estimating the moment of inertia without a host reference.

(1) Systems for which Execution Cannot Be Performed

- When the machine system can move only in one direction
- When the range of motion is greater than 0.25 rotations and less than or equal to 0.5 rotations

(2) 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 P control is used

  Note:

  If you specify calculating the moment of inertia, an error will occur if V_PPI in MECHATROLINK command 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

(3) Preparations

Always check the following before you execute moment of inertia estimation without a host reference.

- The main circuit power 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 switching selection must be Pn139 = n.□□□0 (automatic gain switching is disabled).
- The gain 1 must be selected.
- Pn00C must be set to n.□□□0 (Function Selection for Test without a Motor is disabled).
- Pn170 must be set to n.□□□0 (tuning-less function is disabled).
- Pn173 must be set to n.□□□0 (a load fluctuation compensation control is disabled).
- There must be no alarms or warnings.
- There must be no hard wire base block (HWBB).
- The parameters must not be write prohibited.

8.5.3 Applicable Tools

The following table lists the tools that you can use to estimate the moment of inertia without a host reference.

Tool	Fn No./Function Name	Operating Procedure Reference
Digital Operator	You cannot estimate the moment of inertia without a host reference from the digital operator.	
SigmaWin+	[Tuning] - [Tuning]	☞ *8.5.4 Operating Procedure on page 325*

8.5.4 Operating Procedure

⚠ WARNING

Moment of inertia estimation is a measurement function that actually drives the machine and therefore presents hazards. Observe the following precautions.

- **Confirm safety around moving parts.**
- **This function involves automatic reciprocating operation. 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 measures for safety, such as the overtravel functions.**

Important

The stopping method if you cancel the moment of inertia estimation without a host reference is given below.

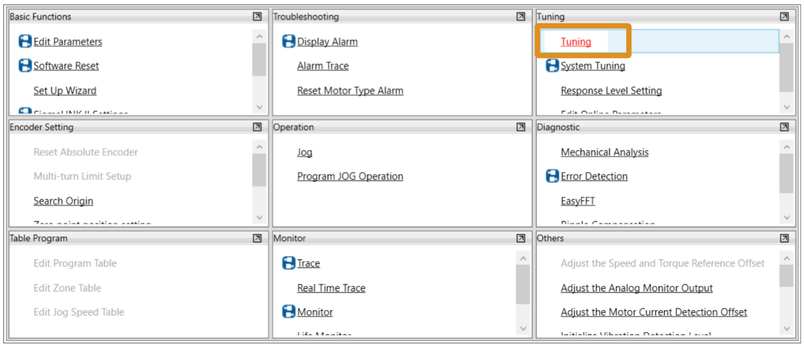
- If you cancel operation with the [Servo OFF] button, the servomotor will stop according to the setting of Pn001 = n.□□□X (Motor Stopping Method for Servo OFF).
- If you cancel operation with the [Cancel] button, the servomotor will decelerate to a stop and then enter a zero-clamped state.

Use the following procedure to estimate the moment of inertia without a host reference.

1. **Click the [ ] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**

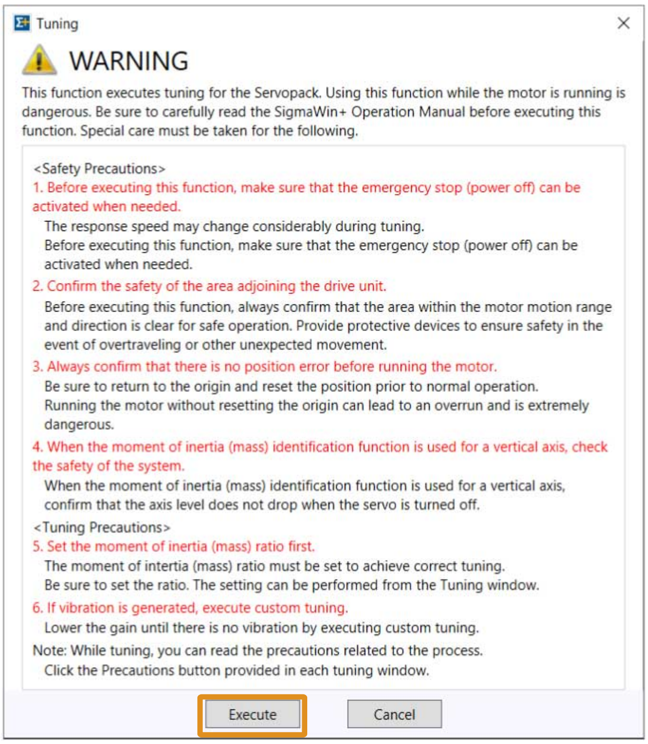
   The [Menu] window will be displayed.

2. **Click [Tuning] in the [Tuning] area.**



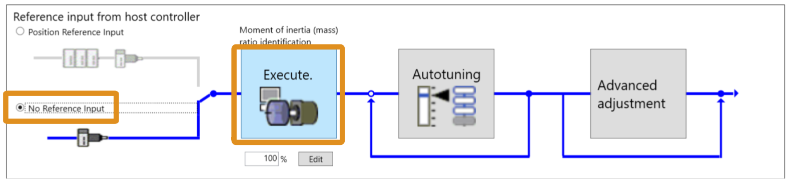
   The [Tuning] window will be displayed.

3. **Click the [Execute] button.**



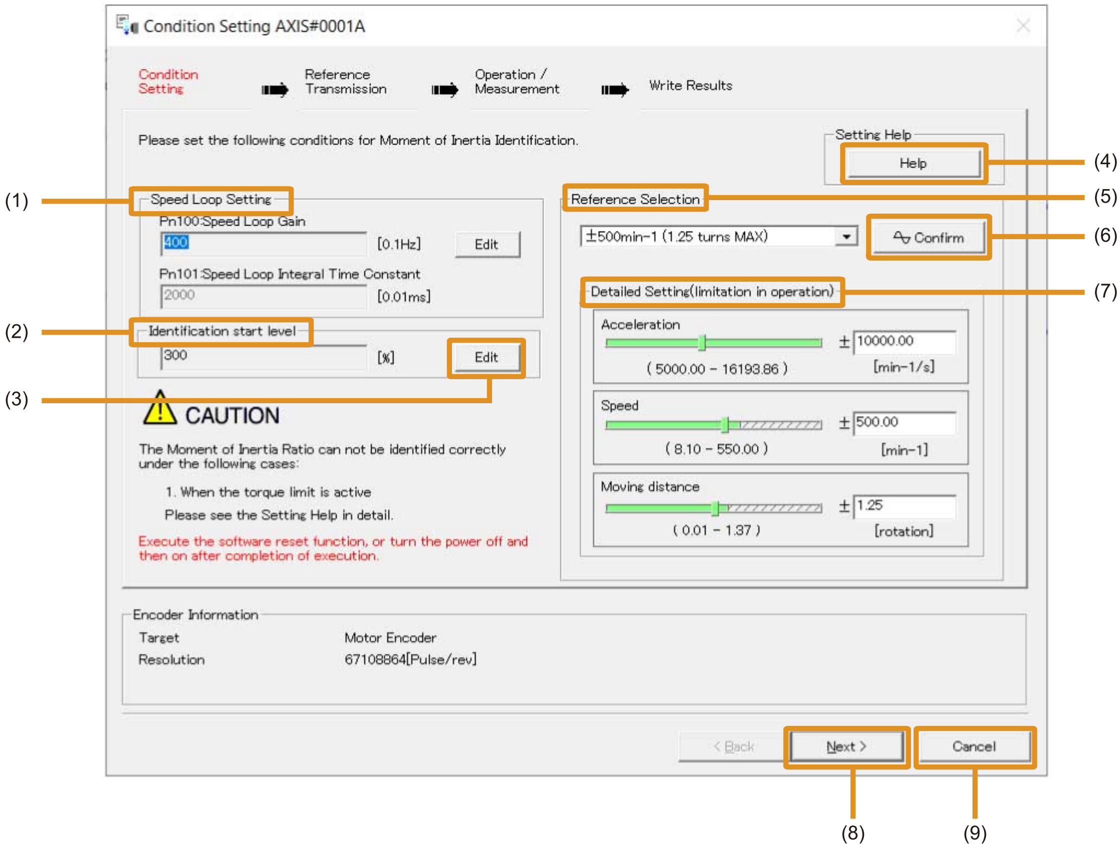
The [Tuning] window will be displayed.

4. **Under [Reference input from host controller], select [No Reference Input], and then click the [Execute] button.**



The [Condition Setting] window will be displayed.

5. **Set the conditions as required.**



No.	Item	Meaning
(1)	[Speed Loop Setting]	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. A suitable value is set to perform the moment of inertia estimation. 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]	This is the setting of the moment of inertia calculation starting level. If the load is large or the machine has low rigidity, the torque 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] button	Click the button to display a window 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.
(5)	[Reference Selection]	Either select the reference pattern for estimation processing from the box, or set the values in the [Detailed Setting]. 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.

Continued on next page.

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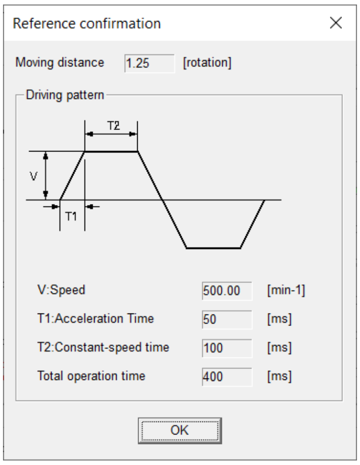
No.	Item	Meaning
(6)	[Confirm] button	Click this button to display the [Reference Confirmation] window. 
(7)	[Detailed Setting]	You can change the settings by moving the bars or directly inputting the settings to create the required reference pattern.
(8)	[Next] button	Click this button to display the [Reference Transmission] window.
(9)	[Cancel] button	Click this button to return to the [Tuning] window.

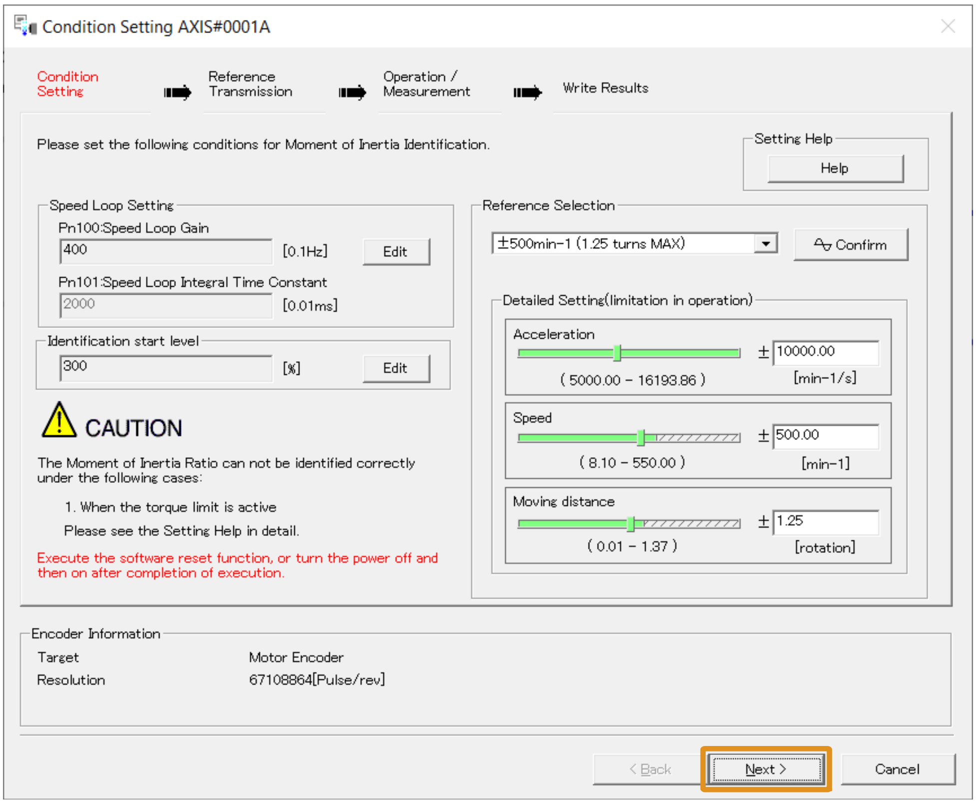
Important

- The travel distance is the distance for one operation in the forward or reverse direction. During multiple operations, the operation starting position may move in one direction or the other. Confirm the possible operating range for each measurement or operation.
- Depending on the parameter settings and the moment of inertia of the machine, overshooting may occur and may cause the maximum speed setting to be exceeded temporarily. Allow sufficient leeway in the settings.

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.



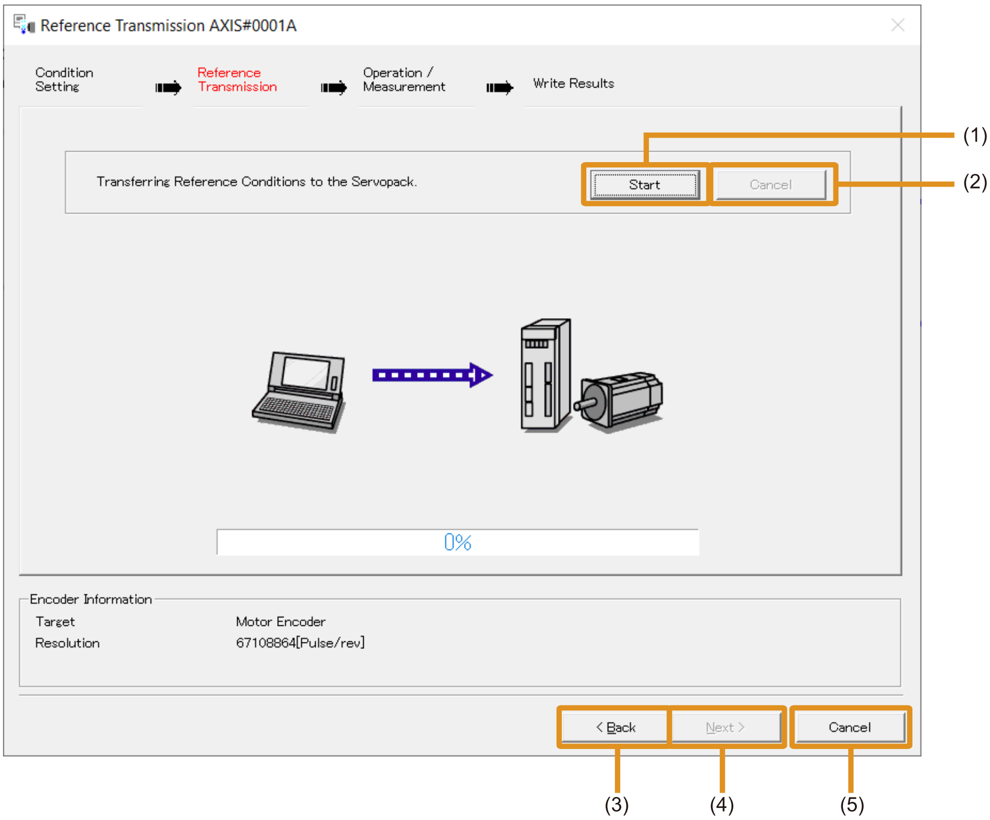
The procedure after this step depends on the travel distance. If any of the following apply, proceed to the next step.

- The travel distance of a rotary servomotor is 0.25 rotations or more.
- The travel distance of a direct drive servomotors is 0.04 rotations or more.
- The travel distance of a linear servomotor is 2.5 mm or more.

If none of the above apply, refer to the following section.

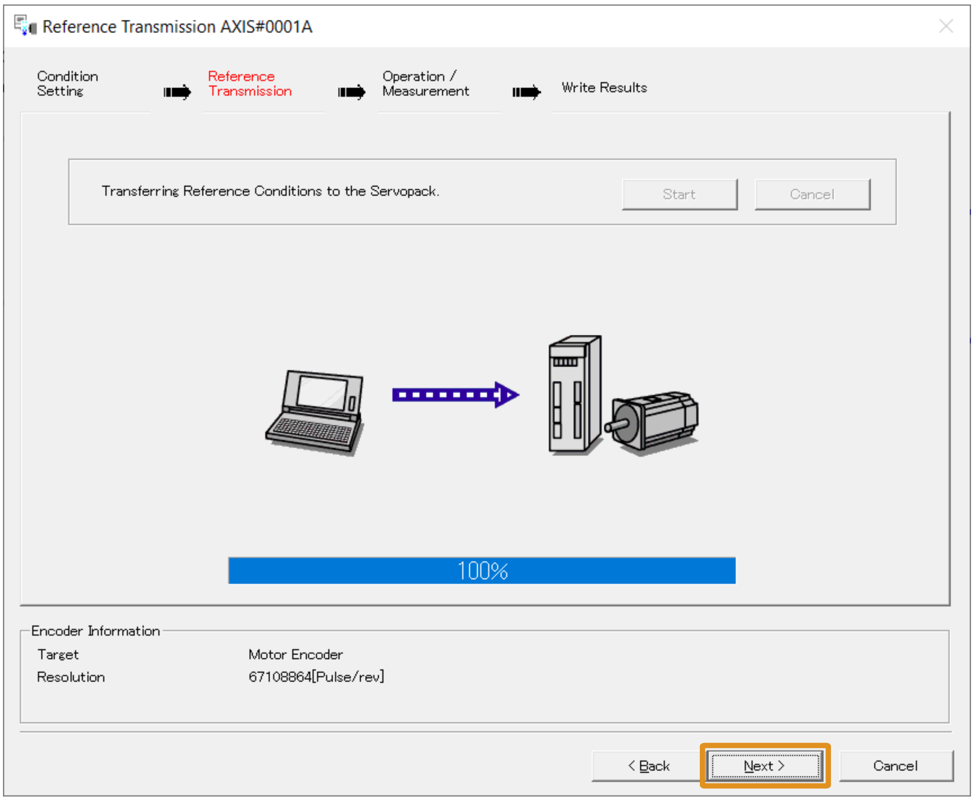
☞ *(1) Moment of Inertia Estimation without a Host Reference When Travel Distance Is Short on page 335*

7. **Click the [Start] button.**



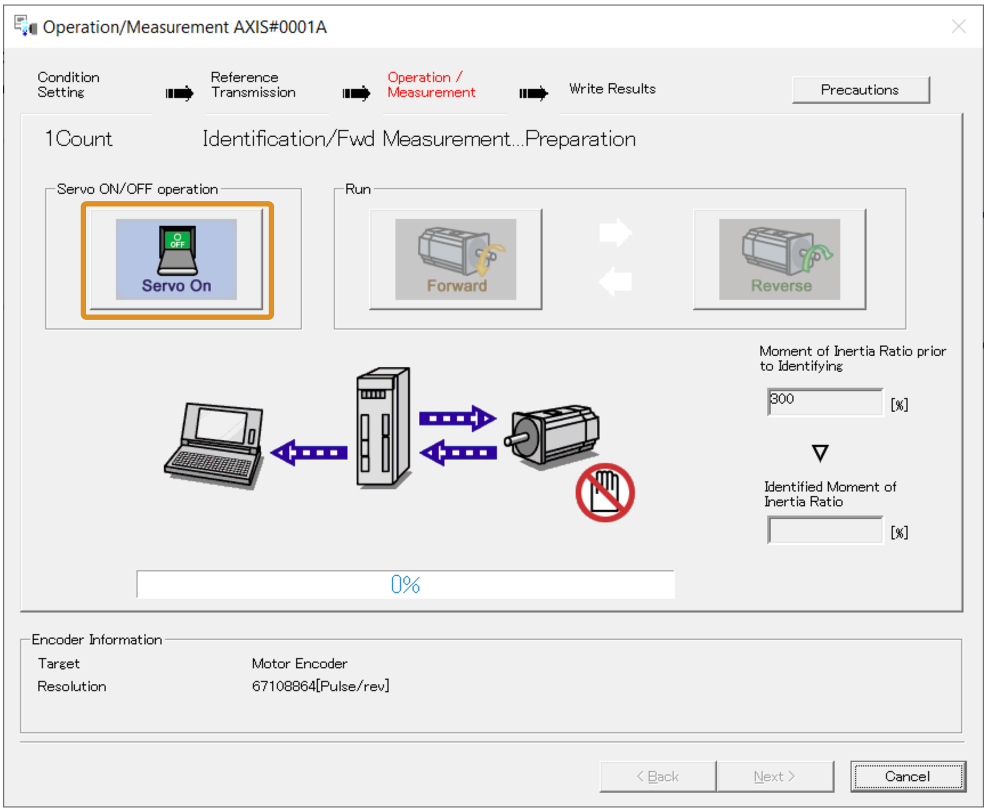
No.	Item	Meaning
(1)	[Start] button	The reference conditions will be transferred to the SERVOPACK. A progress bar will show the progress of the transfer.
(2)	[Cancel] button	The [Cancel] button is enabled only while data is being transferred to the SERVOPACK. You cannot use it after the transfer has been completed.
(3)	[Back] button	This button returns you to the [Condition Setting] window. 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] window.
(5)	[Cancel] button	This button cancels processing and returns you to the [Tuning] window.

8. **Click the [Next] button.**

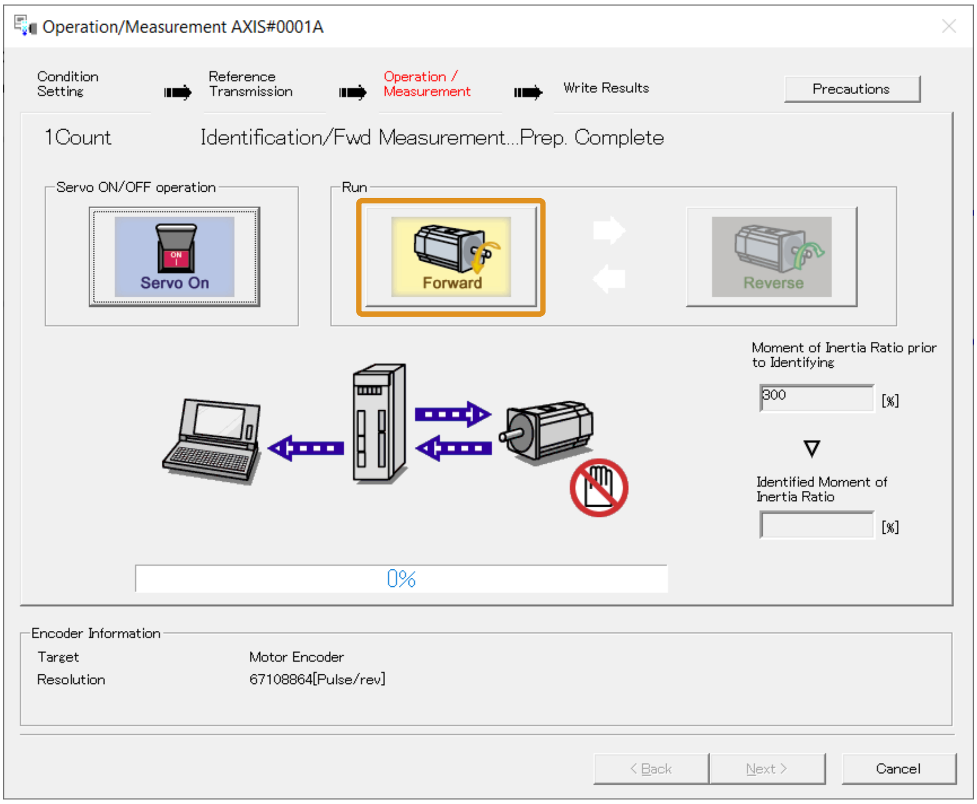


The [Operation/Measurement] window will be displayed.

9. **Click the [Servo On] button.**

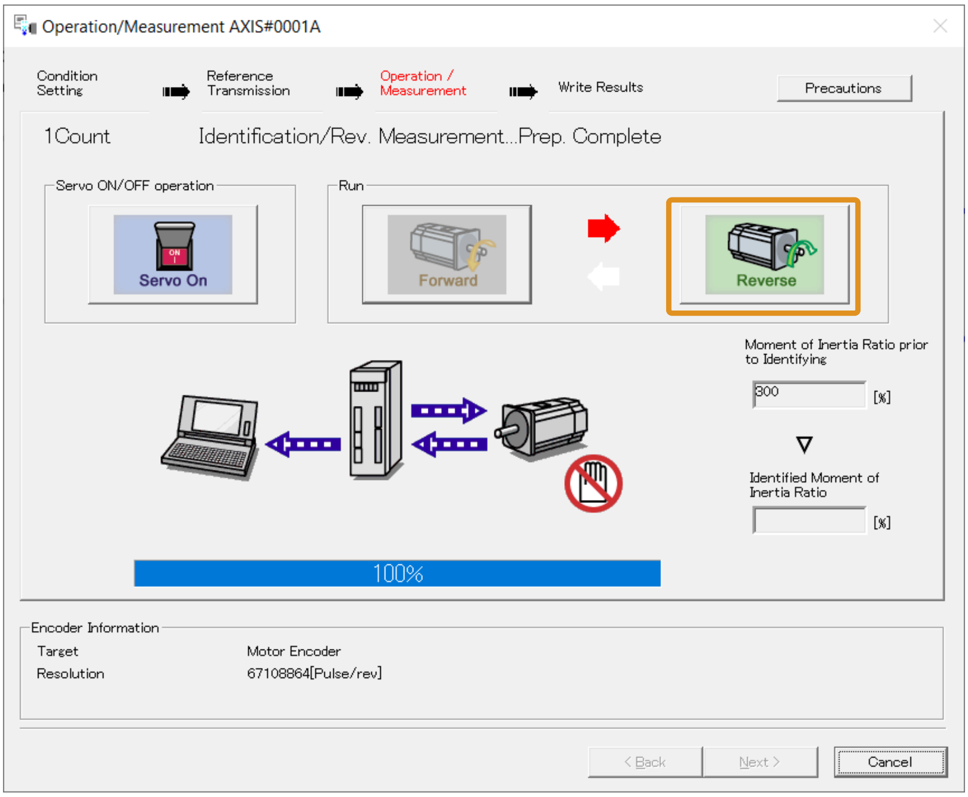


10. **Click the [Forward] button.**



The servomotor 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.

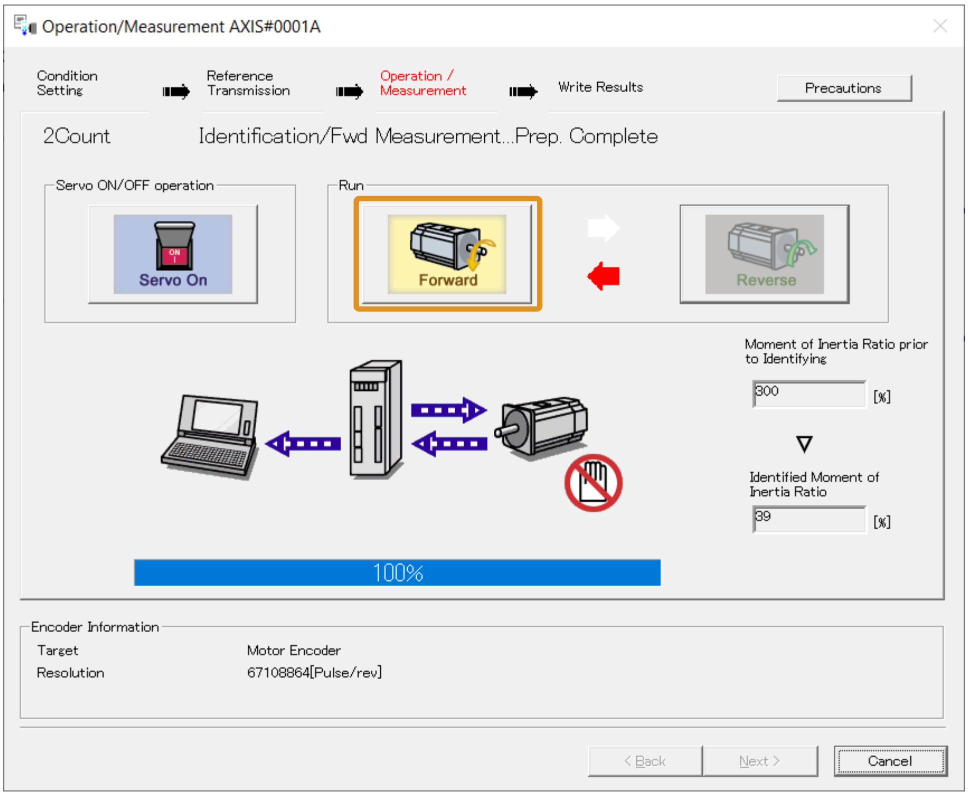
11. **Click the [Reverse] button.**



The servomotor 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.

Tuning

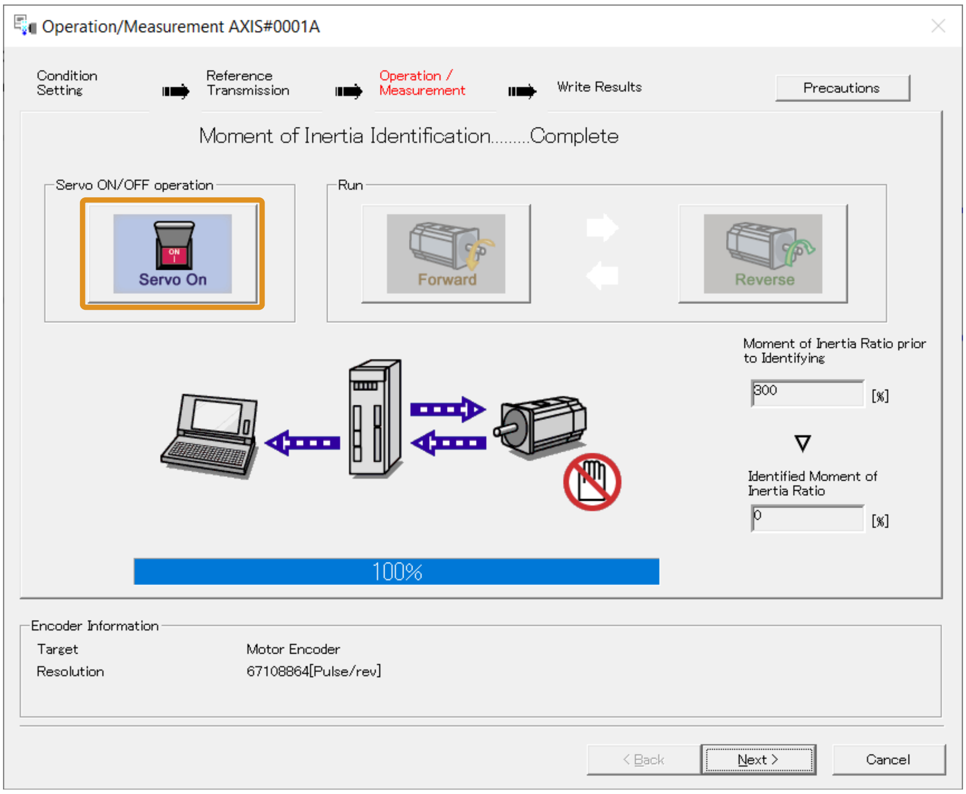
8



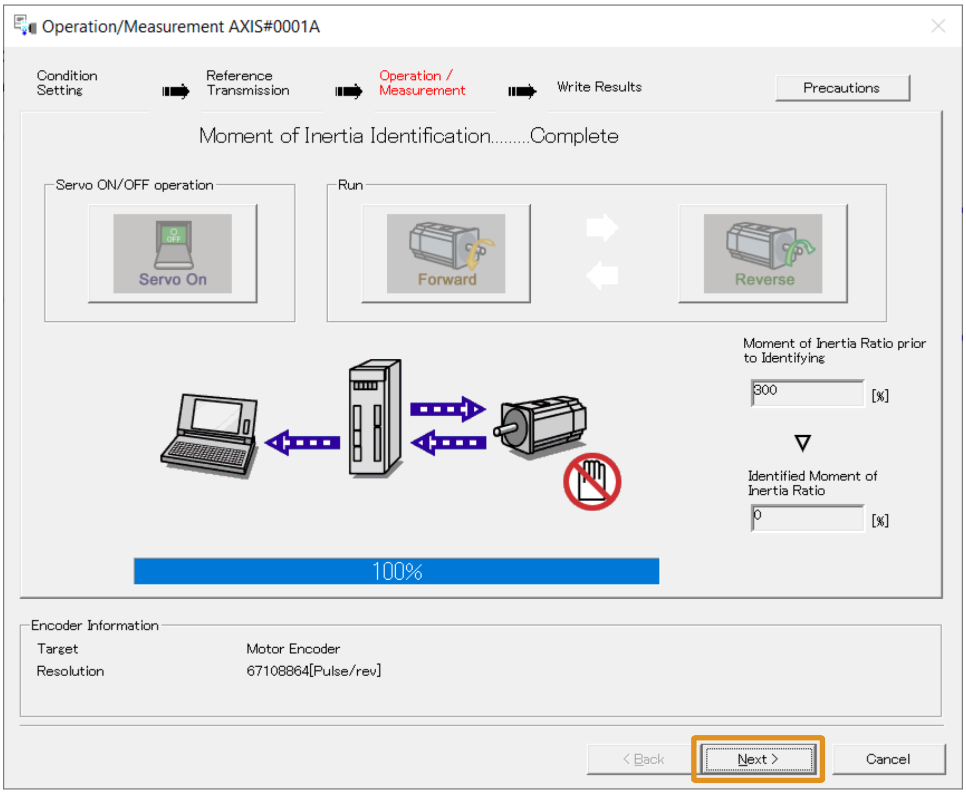
12. **Repeat steps 10 to 11 until the [Next] button is enabled.**

    Measurements are performed from 2 to 7 times and then verified. The number of measurements is displayed in upper left corner of the window. A progress bar at the bottom of the window 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.**

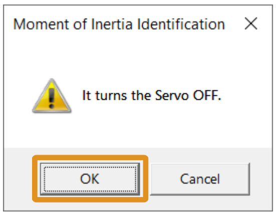


14. **Click the [Next] button.**



The [Write Results] window will be displayed.

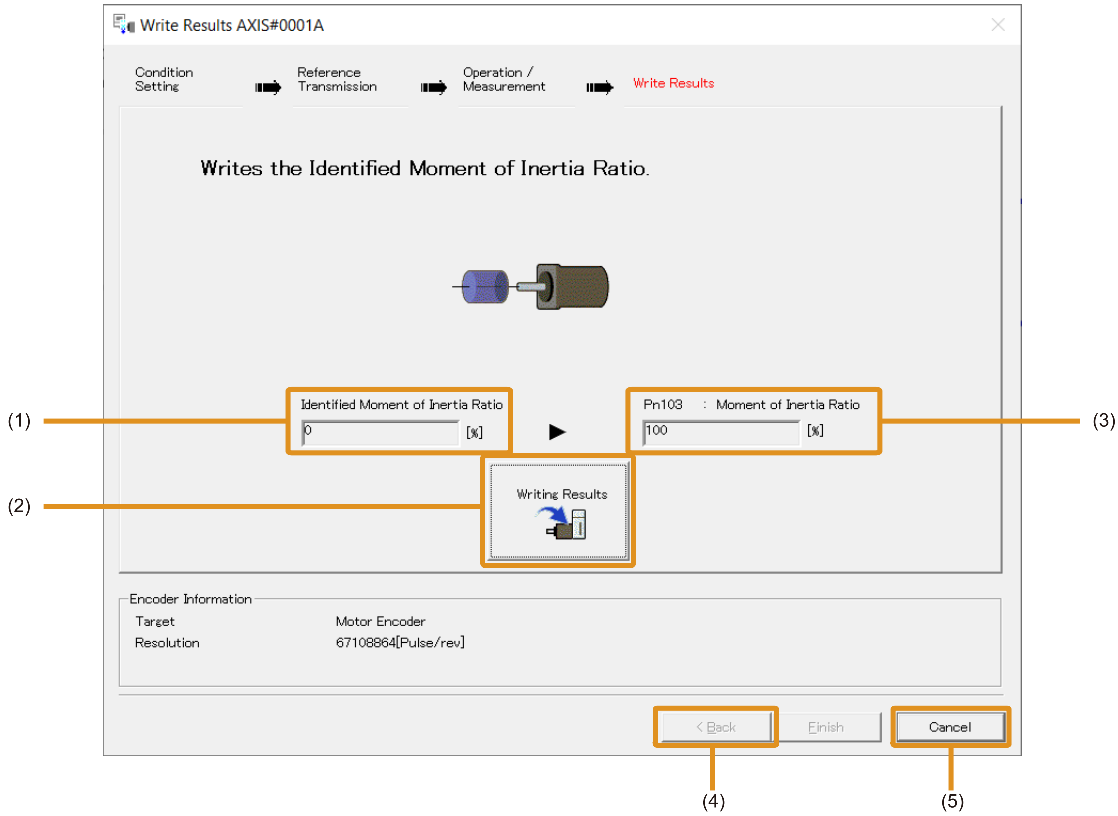
Information If you click the [Next] button before you turn OFF the servo, the following message dialog box will be displayed. Click the [OK] button to turn OFF the servo.



Tuning

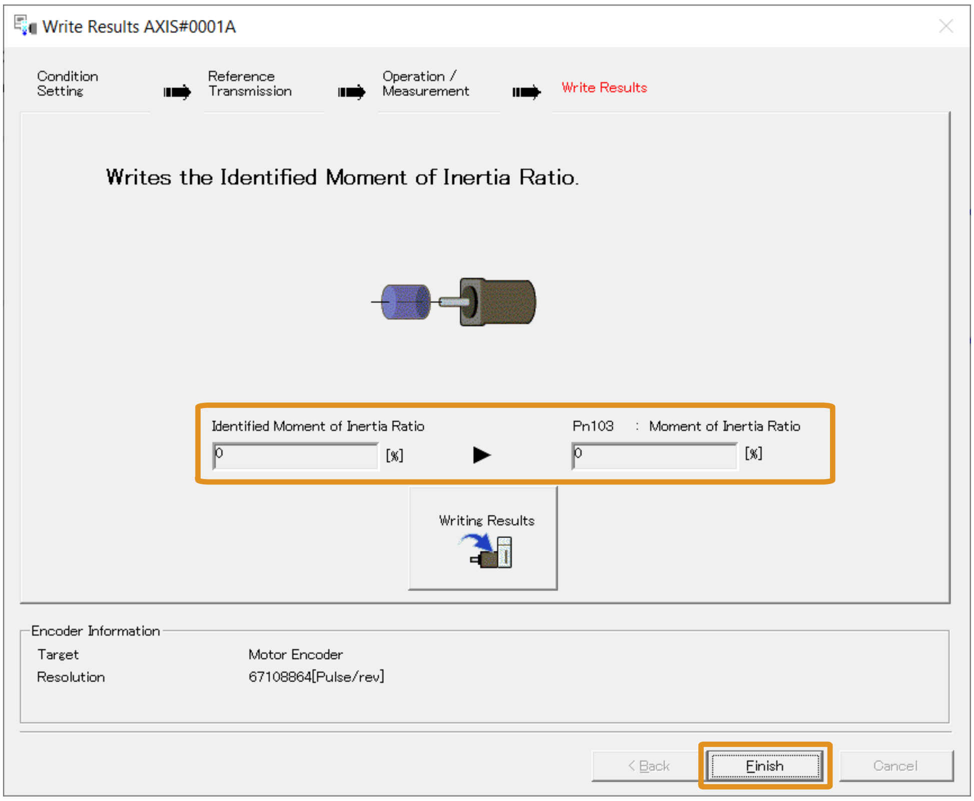
8

15. **Click the [Writing Results] button.**



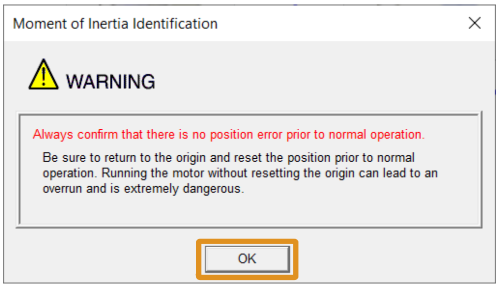
No.	Item	Meaning
(1)	[Identified Moment of Inertia Ratio]	The moment of inertia ratio that was found with operation and measurements is displayed here.
(2)	[Writing Results] button	If you click this button, Pn103 (Moment of Inertia Ratio) in the SERVOPACK is set to the value that is displayed for the identified moment of inertia ratio.
(3)	[Pn103: Moment of Inertia Ratio]	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.
(5)	[Cancel] button	You will return to the [Tuning] window.

16. **Confirm that the [Identified Moment of Inertia Ratio] and the [Pn103: Moment of Inertia Ratio] show the same value and then click the [Finish] button.**



The message dialog box will be displayed.

17. **Click the [OK] button.**



If the setting of Pn103 (Moment of Inertia Ratio) was changed, the new value will be saved and the [Tuning] window will be displayed again.

This concludes the procedure to estimate the moment of inertia ratio without a host reference.

(1) Moment of Inertia Estimation without a Host Reference When Travel Distance Is Short

Use the following procedure to estimate the moment of inertia without a host reference when any of the following apply to the travel distance.

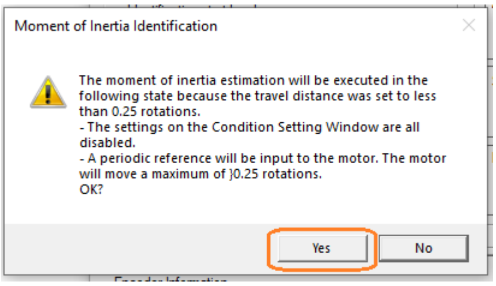
- The travel distance of a rotary servomotor is less than 0.25 rotations.
- The travel distance of a direct drive servomotors is less than 0.04 rotations.
- The travel distance of a linear servomotor is less than 2.5 mm.

Note:

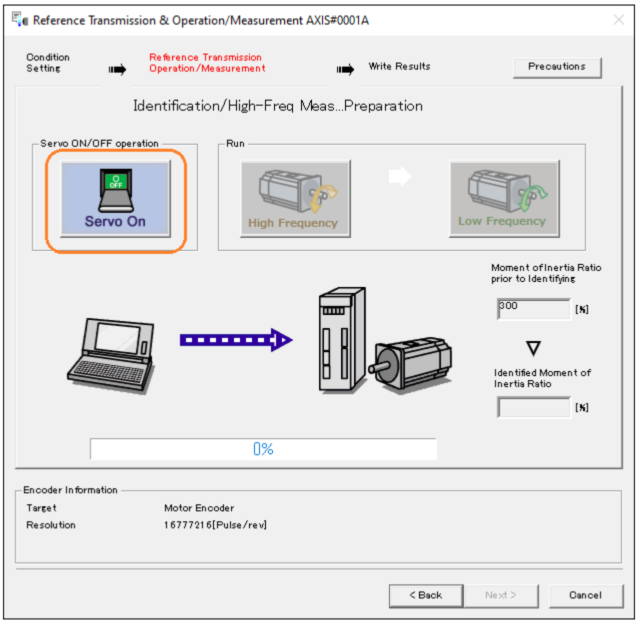
This section does not contain the complete procedure to estimate moment of inertia without a host reference. Refer to the following section before using this procedure.

☞ *8.5.4 Operating Procedure on page 325*

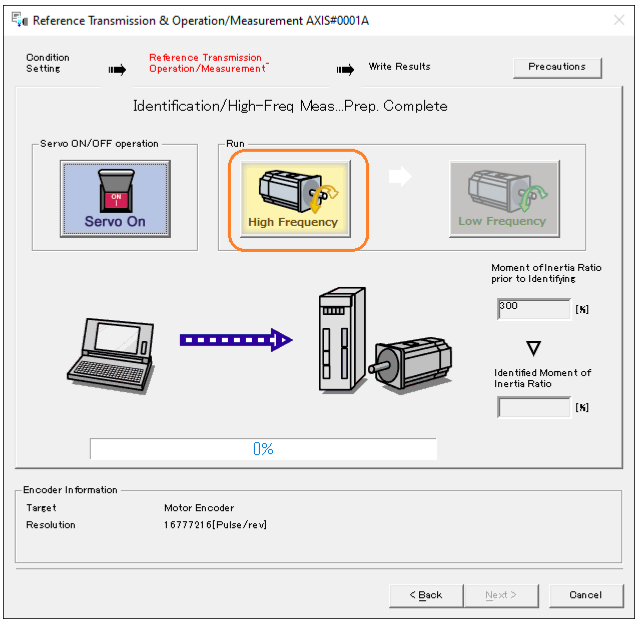
1. **Click the [Yes] button.**



2. **Click the [Servo On] button.**



3. **Click the [High Frequency] button.**

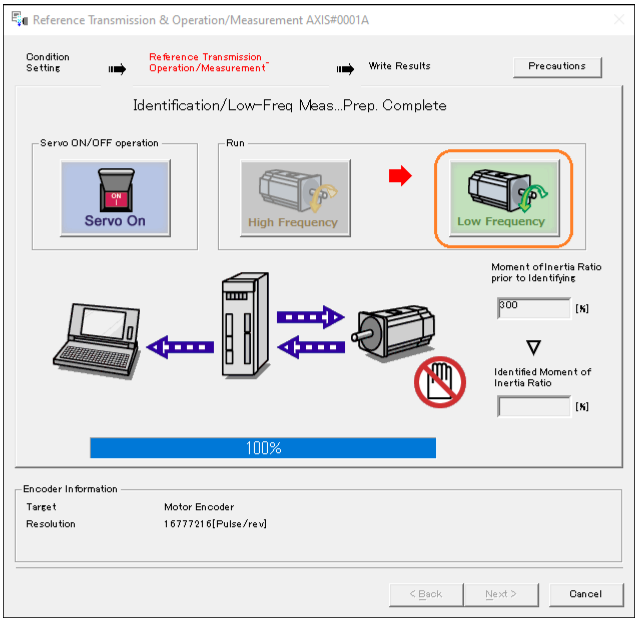


The servomotor shaft will rotate and measurements will start. After the measurement and data transfer have been completed, the [Low Frequency] button will be displayed in color.

Information

- The servomotor shaft will rotate only a maximum of 0.25 rotations (0.04 rotations for a direct drive servomotor) at one time.
- The servomotor may not operate as configured because it will operate at a constant frequency.
- Noise may occur during operation.

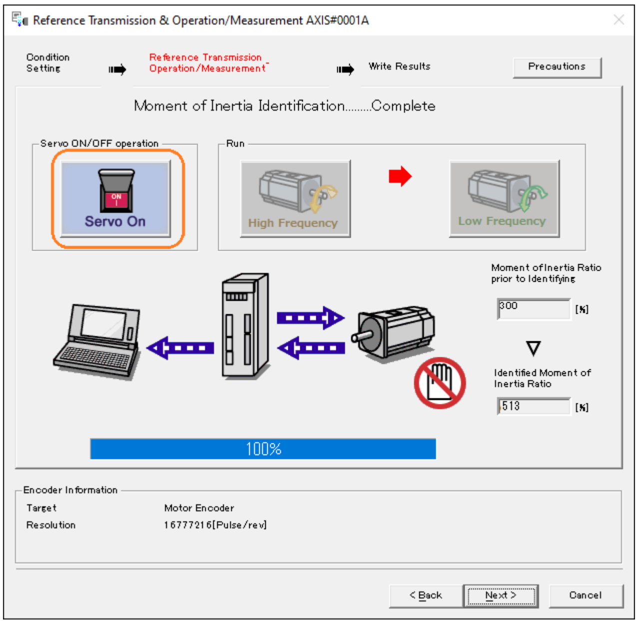
4. **Click the [Low Frequency] button.**



The servomotor shaft will rotate and measurements will start. After the measurement and data transfer have been completed, the [Next] button will be enabled.

Information
- The servomotor shaft will rotate only a maximum of 0.25 rotations (0.04 rotations for a direct drive servomotor) at one time.
- The servomotor may not operate as configured because it will operate at a constant frequency.
- Noise may occur during operation.

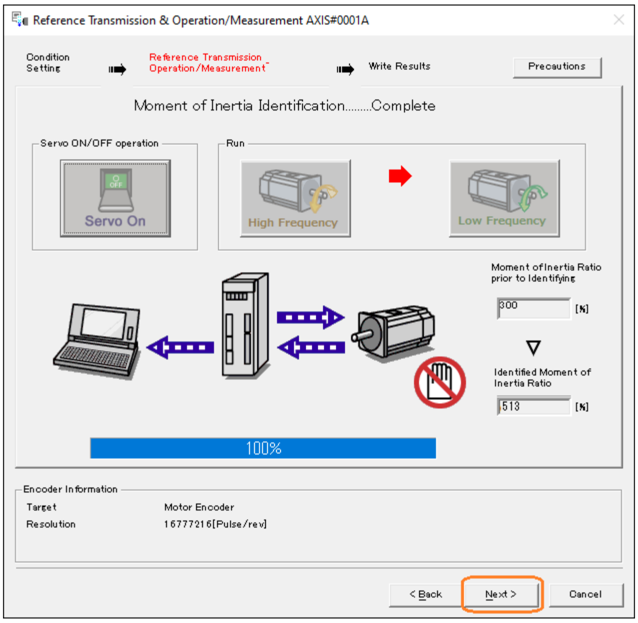
5. **When the measurements have been completed, click the [Servo On] button to turn OFF the servo.**



Tuning

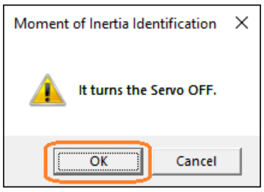
8

6. **Click the [Next] button.**

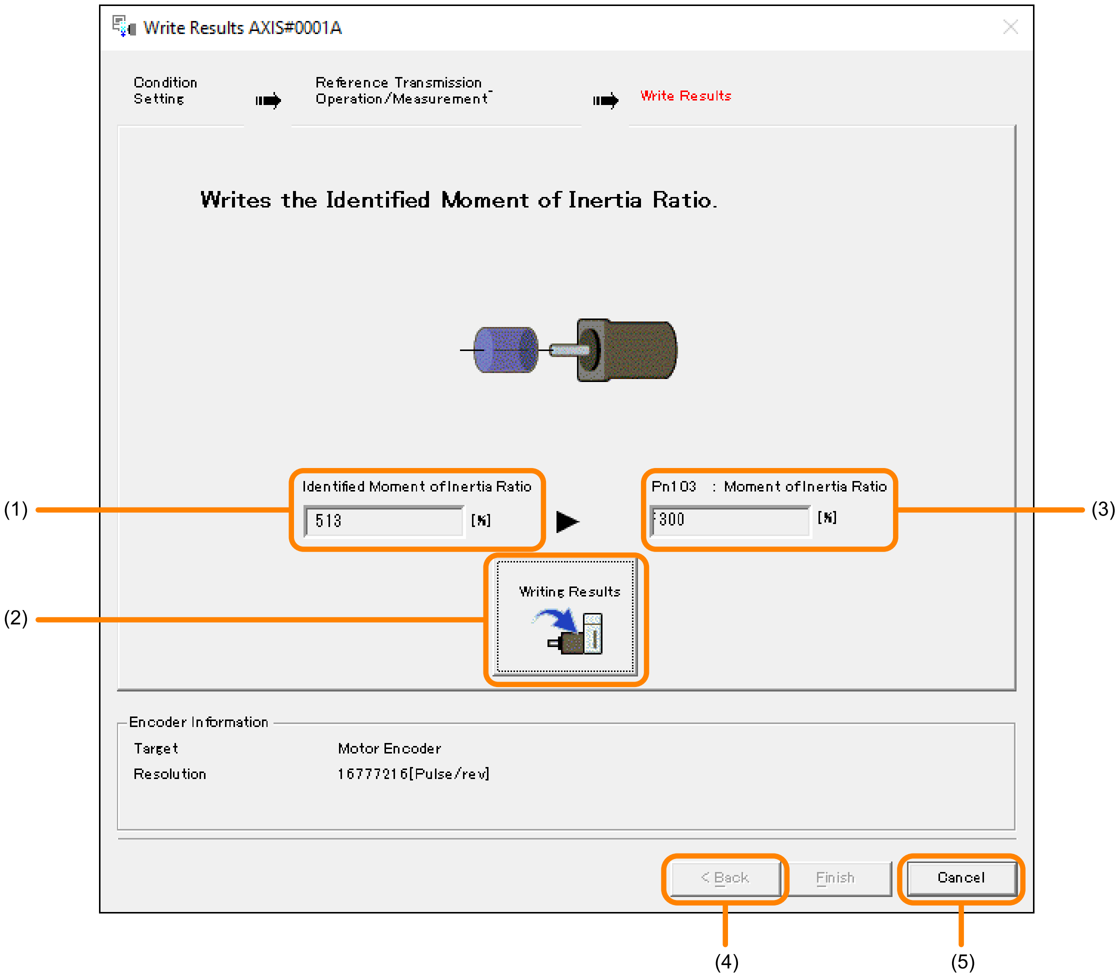


The [Write Results] window will be displayed.

Information If you click the [Next] button before you turn OFF the servo, the following message dialog box will be displayed. Click the [OK] button to turn OFF the servo.

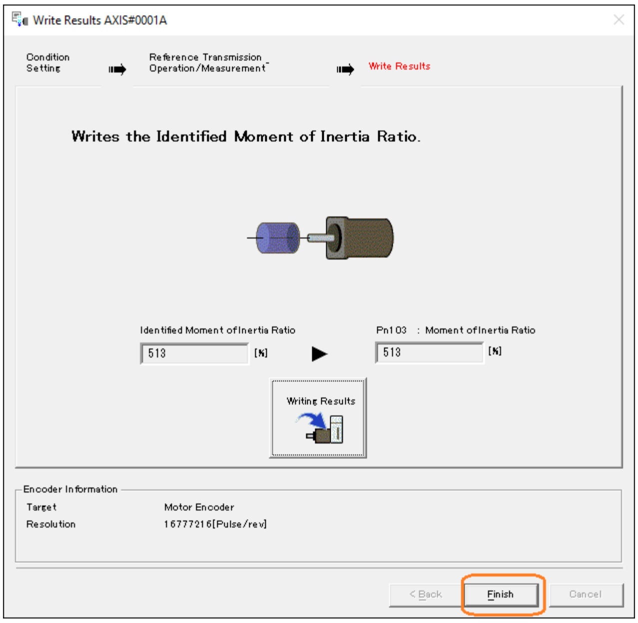


7. **Click the [Writing Results] button.**



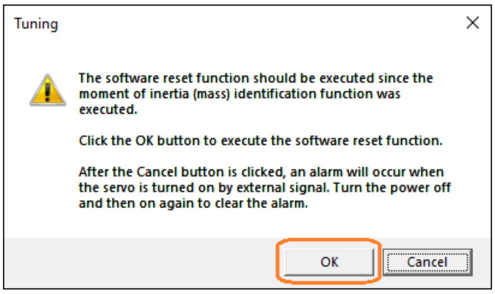
No.	Item	Meaning
(1)	[Identified Moment of Inertia Ratio]	The moment of inertia ratio that was found with operation and measurements is displayed here.
(2)	[Writing Results] button	If you click this button, Pn103 (Moment of Inertia Ratio) in the SERVOPACK is set to the value that is displayed for the identified moment of inertia ratio.
(3)	[Pn103: Moment of Inertia Ratio]	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.
(5)	[Cancel] button	You will return to the [Tuning] window.

8. **Confirm that the [Identified Moment of Inertia Ratio] and the [Pn103: Moment of Inertia Ratio] show the same value and then click the [Finish] button.**

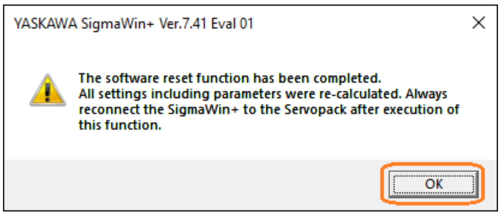


The message dialog box will be displayed.

9. **Click the [OK] button.**



10. **Click the [OK] button.**



This concludes the procedure to estimate the moment of inertia ratio without a host reference when the travel distance is short.

8.6 Moment of Inertia Estimation with a Host Reference

This section describes how the moment of inertia with a host reference is calculated.

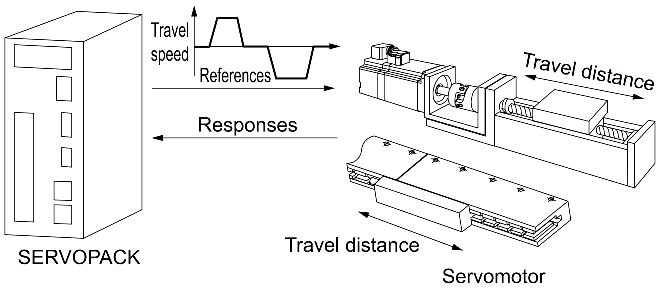
The moment of inertia ratio that is calculated here is used in other tuning functions.

8.6.1 Outline

The load moment of inertia is estimated from operation by reference (position control) from the host controller. This function is called real-time moment of inertia estimation.

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, calculating it accurately can be very difficult with the complex mechanical structures that are used these days. With this function, you can estimate load moment of inertia with good accuracy.



Note:

Execute this function after jogging to a position that ensures a suitable range of motion.

8.6.2 Restrictions

The following restrictions apply to estimating the moment of inertia with a host reference.

(1) Systems for which Execution Cannot Be Performed

- When the operating time is shorter than 200 ms
- For low speed operations

(2) Systems for Which Adjustments Cannot Be Made Accurately

- When a suitable range of motion is not possible
- When the machine has high dynamic friction

(3) Preparations

Always check the following before you execute moment of inertia estimation with a host reference.

- The main circuit power must be ON.
- There must be no overtravel.
- The servo must be OFF.
- The control method must not be set to torque control.
- Pn00C must be set to n.□□□0 (Function Selection for Test without a Motor is disabled).
- There must be no alarms or warnings.
- There must be no hard wire base block (HWBB).
- The parameters must not be write prohibited.

8.6.3 Applicable Tools

The following table lists the tools that you can use to estimate the moment of inertia with a host reference.

Tool	Fn No./Function Name	Operating Procedure Reference
Digital Operator	You cannot estimate the moment of inertia with a host reference from the digital operator.	
SigmaWin+	[Tuning] - [Tuning]	☞ *8.6.4 Operating Procedure on page 342*

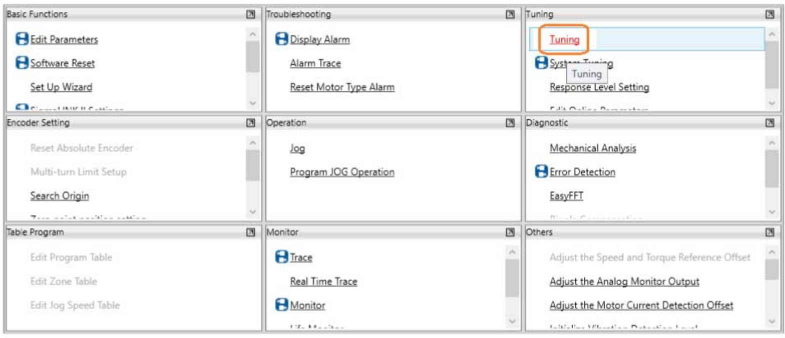
8.6.4 Operating Procedure

Use the following procedure to estimate the moment of inertia with a host reference.

1. **Click the [] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**

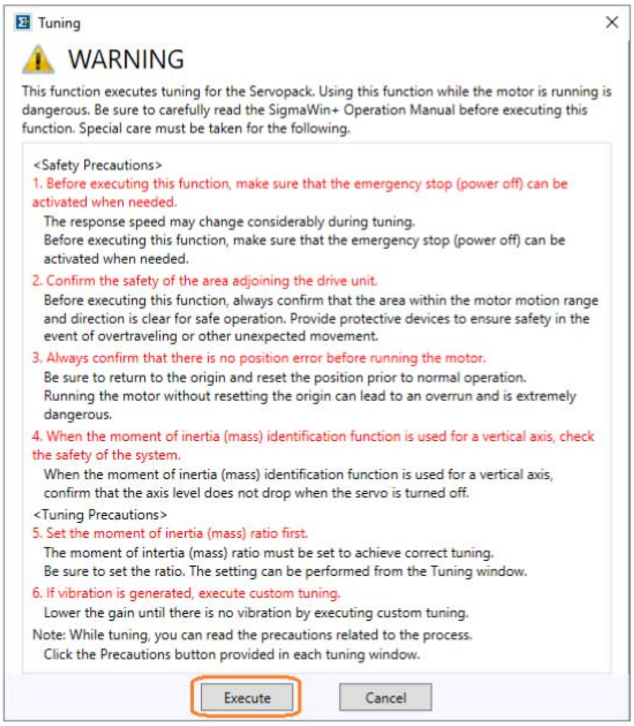
   The [Menu] window will be displayed.

2. **Click [Tuning] in the [Tuning] area.**



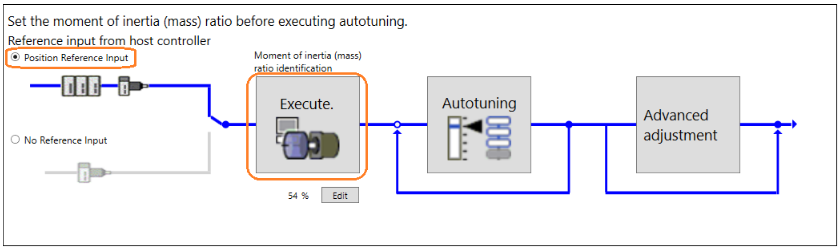
   The [Tuning] window will be displayed.

3. **Click the [Execute] button.**



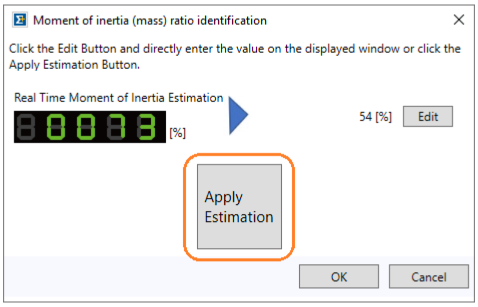
   The [Tuning] window will be displayed.

4. **Under [Reference input from host controller], select [Position Reference Input], and then click the [Execute] button.**

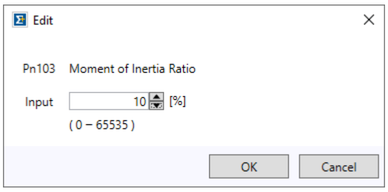


The [Moment of inertia (mass) ratio identification] window will be displayed.

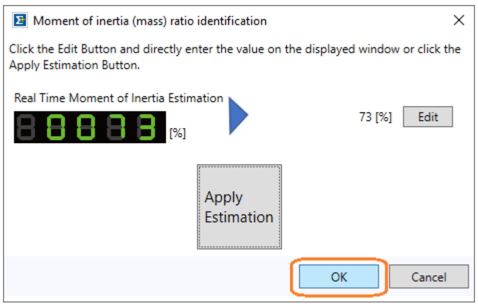
5. **If you click the [Apply Estimation] button, the estimated value of the real-time moment of inertia will be applied to the settings area.**



Information Click the [Edit] button to display the [Edit] window on which you can manually enter the value. Set the value and click the [OK] button.



6. **Click the [OK] button.**



This concludes the procedure to estimate the moment of inertia ratio with a host reference.

Tuning

8

8.7 Autotuning without a Host Reference

This section describes autotuning without a host reference.

Important

- Autotuning without a host reference performs adjustments based on the setting of Pn100 (Speed Loop Gain). Therefore, precise adjustments cannot be made if there is vibration when adjustments are started. Make adjustments after lowering the setting of Pn100 (Speed Loop Gain) until vibration is eliminated.
- You cannot execute autotuning without a host reference if Pn170 is set to n.□□□1 (enable tuning-less function)(default setting). Set Pn170 to n.□□□0 (disable the tuning-less function) before you execute autotuning without a host reference.
- You cannot execute autotuning without a host reference if Pn173 is set to n.□□□1 (enable load fluctuation compensation control). Set Pn173 to n.□□□0 (disable load fluctuation compensation control) before you execute autotuning without a host reference.
- 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.
  Pn140 = n.□□□0 (do not use model following control)
  Pn160 = n.□□□0 (do not use anti-resonance control)
  Pn408 = n.00□0 (disable friction compensation, first stage notch filter, and second stage notch filter)

  Note:

  If you are using the digital operator and the above parameters are not displayed, set Pn00B to n.□□□1 (display all parameters) and then turn the power OFF and ON again.

8.7.1 Outline

For autotuning without a host reference, operation is automatically performed by the SERVOPACK 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.

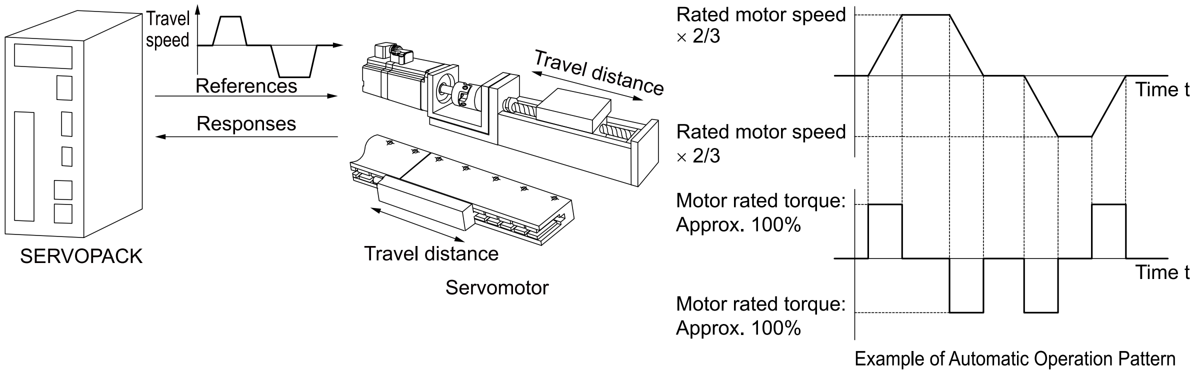
- Moment of inertia ratio
- Gains (e.g., speed loop gain and position loop gain)
- Filters (torque reference filter and notch filters)
- Friction compensation
- Anti-resonance control
- Vibration suppression (only for mode 2 or 3)

Refer to the following section for details on the parameters that are adjusted.

☞ *8.7.7 Related Parameters on page 355*

The servomotor is operated with the following specifications.

Maximum Motor Speed	Rated motor speed × 2/3	
Acceleration Torque	Rated motor torque: Approx. 100% **Note:** The acceleration torque depends on the setting of Pn103 (Moment of Inertia Ratio), and the influences of 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.
	Direct Drive Servomotors	You can set the desired travel distance. The default setting is for a value equivalent to 0.3 rotations.
	Linear Servomotors	You can set the desired travel distance in increments of 1000 reference units. The default setting is for 90 mm.



Note:

Execute this function after jogging to a position that ensures a suitable range of motion.

⚠ WARNING

Autotuning without a host reference is a measurement function that actually drives the machine and therefore presents hazards. Observe the following precautions.

- **Confirm safety around moving parts.**
- **This function involves automatic reciprocating operation. 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 measures for safety, such as the overtravel functions.**

8.7.2 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 section for details.

☞ *8.8 Autotuning with a Host Reference on page 357*

☞ *8.9 Custom Tuning on page 366*

(1) 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

(2) 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 P control is used

  Note:

  If you specify calculating the moment of inertia, an error will occur if V_PPI in MECHATROLINK command 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 setting of Pn522 (Positioning Completed Width) is too small

(3) Preparations

Always check the following before you execute autotuning without a host reference.

- The main circuit power 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 switching selection must be Pn139 = n.□□□0 (automatic gain switching is disabled).
- The gain 1 must be selected.
- Pn00C must be set to n.□□□0 (Function Selection for Test without a Motor is disabled).
- Pn173 must be set to n.□□□0 (a load fluctuation compensation control is disabled).
- There must be no alarms or warnings.
- There must be no hard wire base block (HWBB).
- The parameters must not be write prohibited.
- Moment of inertia estimation must be specified when Pn170 is set to n.□□□0 (tuning-less function is disabled) or Pn170 is set to n.□□□1 (tuning-less function is enabled) (default setting).
- 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.

- The settings of the electronic gear ratio (Pn20E/Pn210), Pn533 or Pn585 (Program Jogging Movement Speed), and Pn385 (Maximum Motor Speed) must not satisfy either of the conditional expressions shown below.
  If either of these conditional expressions is satisfied, an A.042 (Parameter Combination Error) will occur.

  – Rotary Servomotors

  $$\cdot\ \text{Pn533 [min}^{-1}\text{]} \times \frac{\text{Encoder resolution}}{6 \times 10^5} \leq \frac{\text{Pn20E}}{\text{Pn210}}$$

  $$\cdot\ \text{Maximum motor speed [min}^{-1}\text{]} \times \frac{\text{Encoder resolution}}{\text{Approx. } 3.66 \times 10^{12}} \geq \frac{\text{Pn20E}}{\text{Pn210}}$$

  Information Refer to the following section for details on the encoder resolution.

  ☞ ◆ *Encoder Resolution on page 189*

  – Linear Servomotors

  $$\cdot\ \frac{\text{Pn585 [mm/s]}}{\text{Linear encoder scale pitch [}\mu\text{m]}} \times \frac{\text{Number of divisions of the serial converter unit}}{10} \leq \frac{\text{Pn20E}}{\text{Pn210}}$$

  $$\cdot\ \frac{\text{Pn385 [100 mm/s]}}{\text{Linear encoder scale pitch [}\mu\text{m]}} \times \frac{\text{Number of divisions of the serial converter unit}}{\text{Approx. } 6.10 \times 10^5} \geq \frac{\text{Pn20E}}{\text{Pn210}}$$

8.7.3 Applicable Tools

The following table lists the tools that you can use to perform autotuning without a host reference.

Tool	Fn No./Function Name	Operating Procedure Reference
Digital Operator	Fn201	📖 Σ-7/Σ-X-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	[Tuning] - [Tuning]	☞ *8.7.4 Operating Procedure on page 346*

8.7.4 Operating Procedure

Use the following procedure to perform autotuning without a host reference.

⚠ CAUTION

If you specify not estimating the moment of inertia, set Pn103 (Moment of Inertia Ratio) correctly.

If the setting greatly differs from the actual moment of inertia ratio, normal control of the machine may not be possible, and vibration may result.

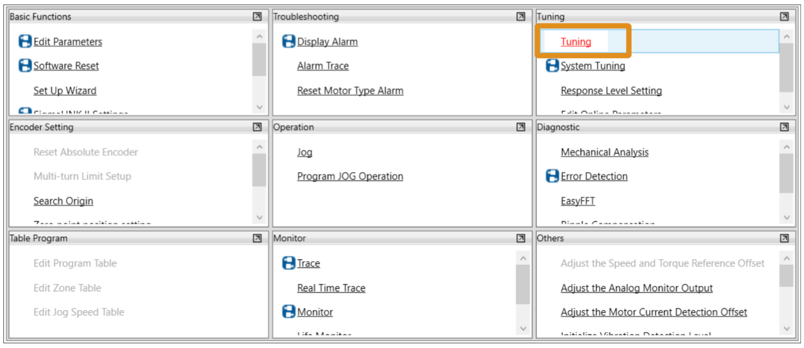
NOTICE

If you are using an MP3000-Series Controller for phase control, set the mode selection to 1.

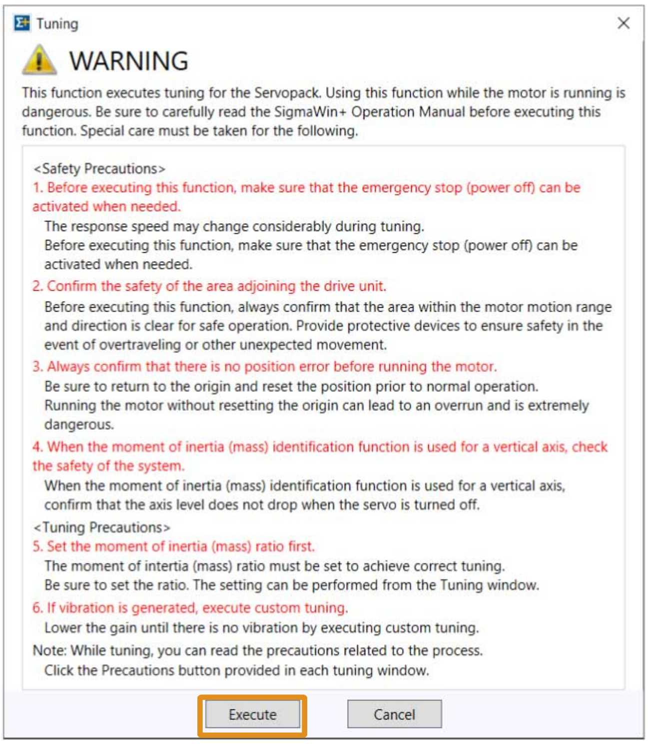
If 2 or 3 is selected for the mode, correct phase control may not be possible.

1. **Confirm that the value of Pn103 (Moment of Inertia Ratio) is set correctly.**
2. **Click the [ ] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**

   The [Menu] window will be displayed.
3. **Click [Tuning] in the [Tuning] area.**



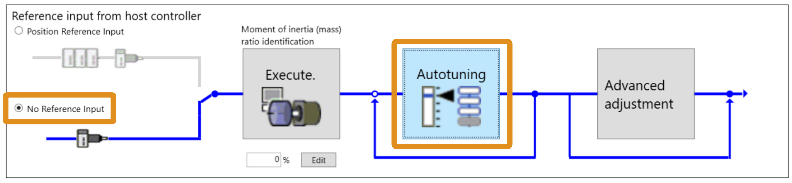
   The [Tuning] window will be displayed.
4. **Click the [Execute] button.**



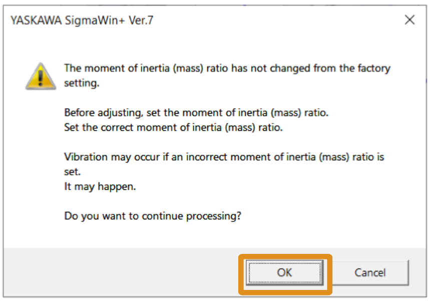
Tuning

8

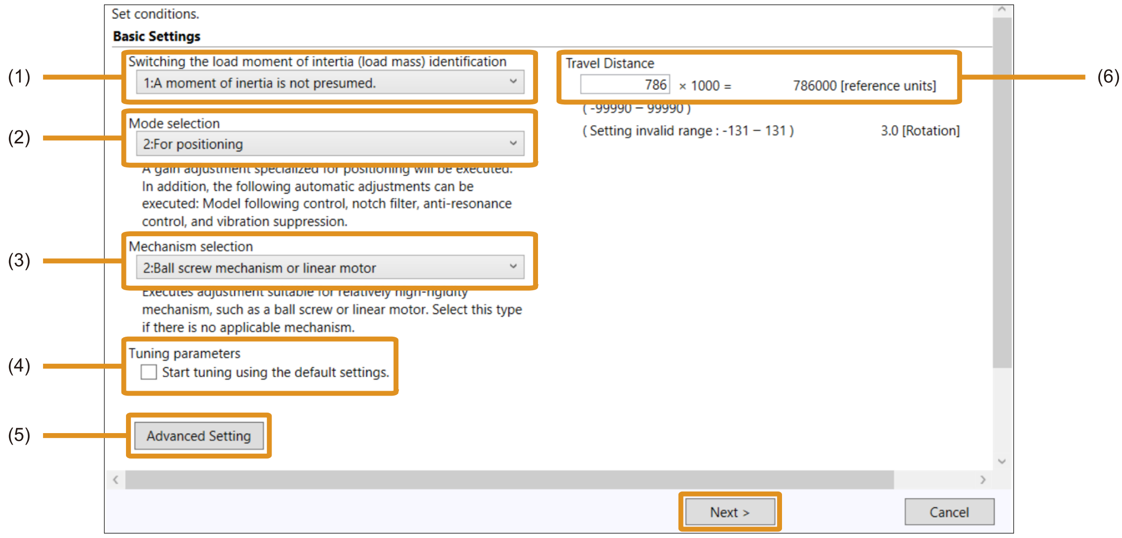
5. **Click [No Reference Input] in [Reference input from host controller] and then click the [Autotuning] button.**



Information When the following message dialog box is displayed, click the [OK] button and then confirm that Pn103 (Moment of Inertia Ratio) is set correctly.



6. **Set the conditions and click the [Next] button.**



No.	Item	Meaning
(1)	[Switching the load moment of inertia (load mass) identification]	Specify whether to estimate the moment of inertia.
(2)	[Mode selection]	Set the mode. For details on the options, refer to the explanations on the window.
(3)	[Mechanism selection]	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. For details on the options, refer to the explanations on the window.
(4)	[Tuning parameters]	Specify the parameters to use for tuning. If you select [Start tuning using the default settings], the tuning parameters will be returned to the default settings before tuning is started.

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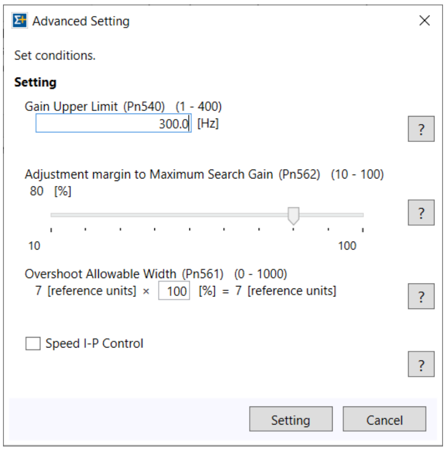
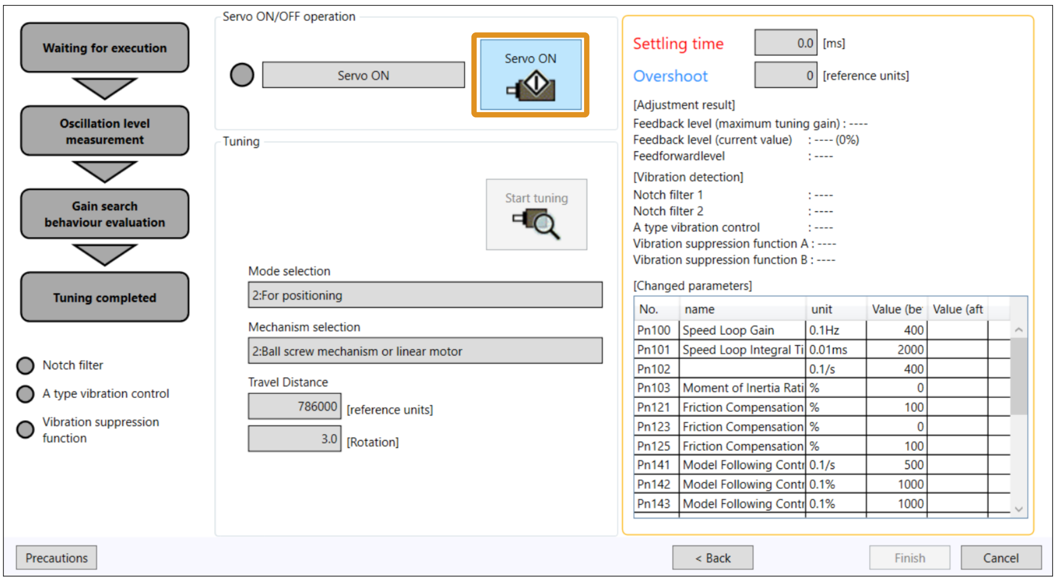
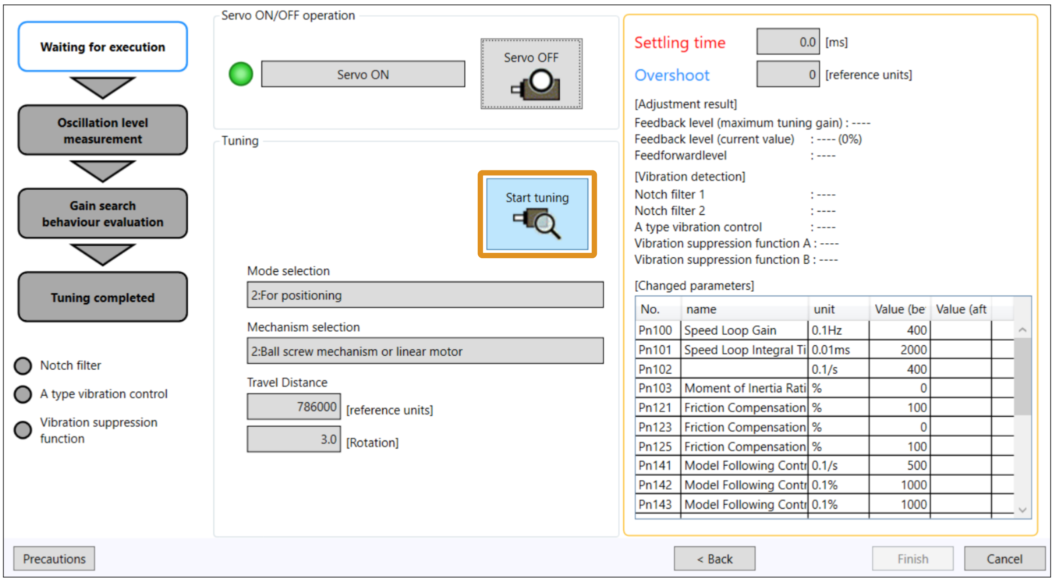
No.	Item	Meaning
(5)	[Advanced Setting] button	Click this button to display the [Advanced Setting] window on which you can set the details of tuning conditions. Configure detailed tuning conditions in the following cases: • To tune a higher response than the tuning results • When tuning fails with a large amount of overshoot • To tune with speed I-P control 
(6)	[Travel Distance]	Set the travel distance. Movement range: -99990000 to +99990000 [reference units] Minimum setting increment for travel distance: 1000 [reference units] Negative values are for reverse operation and positive values are for forward operation from the current position. Default settings: Rotary servomotors: Approx. 3 rotations Direct drive servomotors: Approx. 0.3 rotations Linear servomotors: Approx. 90 mm Set the distance to the following values or higher. To ensure tuning precision, we recommend that you use approximately the default distance setting. Rotary servomotors: 0.5 rotations Direct drive servomotors: 0.05 rotations Linear servomotors: 5 mm

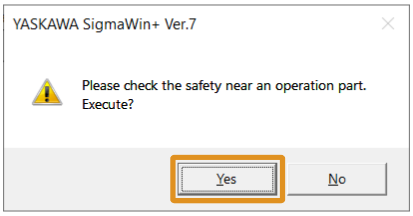
7. **Click the [Servo ON] button.**



8. **Click the [Start tuning] button.**

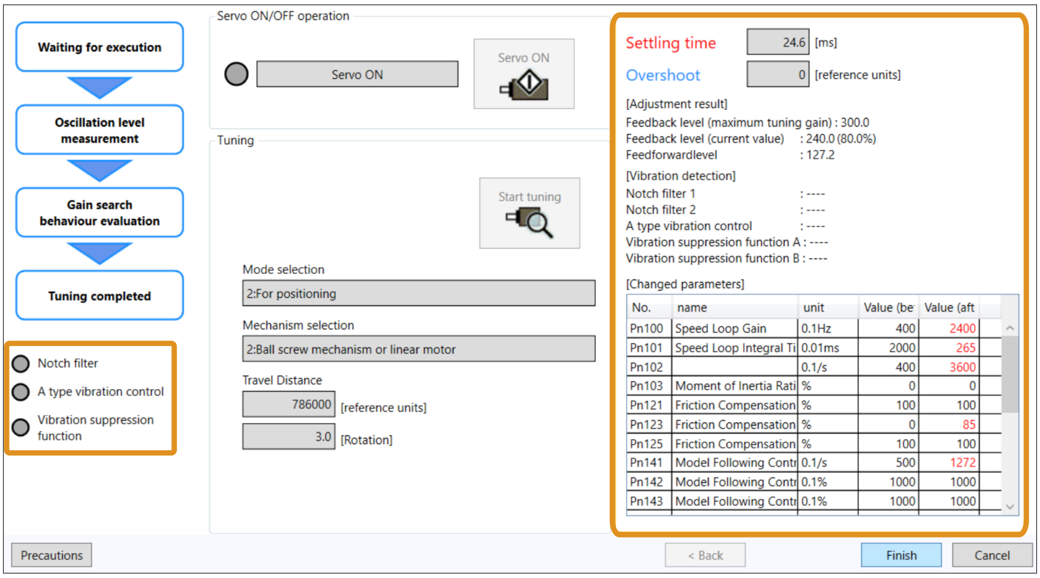


9. **Confirm safety around moving parts and click the [Yes] button.**



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. The content to set will be displayed on the right side of the window. When the settings have been completed, the indicators for the functions that were used will light at the lower left of the window.



Details on the content to set are shown below.

Item	Meaning
[Settling time]	Displays the settling time by the tuning results.
[Overshoot]	Displays the maximum overshoot by the tuning results.

Continued on next page.

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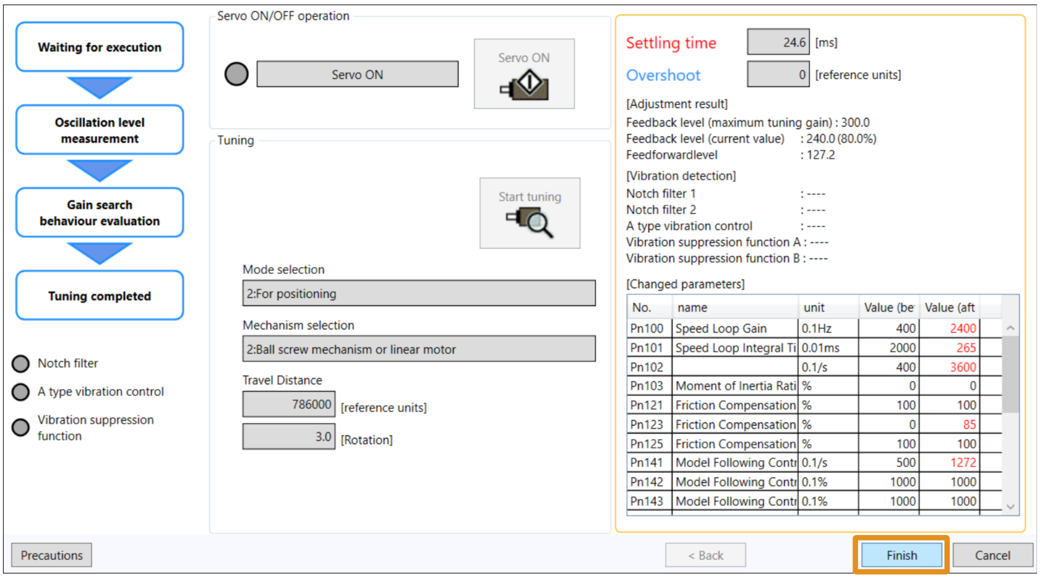
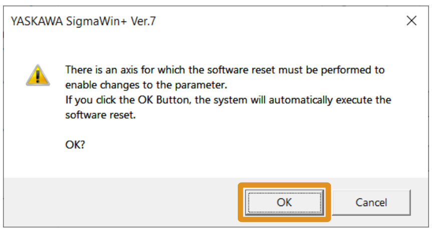
Item	Meaning
[Feedback level (maximum tuning gain)]	Displays the maximum value of Pn100 (Speed Loop Gain) during tuning.
[Feedback level (current value)]	Displays the value of Pn100 (Speed Loop Gain) after tuning. The number in parentheses is the percentage of adjusting maximum gain.
[Feedforward level]	Displays the value of Pn141 (Model Following Control Gain) after tuning.
[Notch filter 1] [Notch filter 2]	Displays the frequencies set by the notch filters. "——" is displayed if not set.
[A type vibration control]	Displays the frequency set by anti-resonance control. "——" is displayed if not set.
[Vibration suppression function A] [Vibration suppression function B]	Displays the frequencies set by vibration suppression. "——" is displayed if not set.

10. **When tuning has been completed, click the [Finish] button.**



The message dialog box will be displayed.

11. **Click the [OK] button.**



The software will be reset, the results of tuning will be set in the parameters, and you will return to the [Tuning] window.

This concludes the procedure to perform autotuning without a host reference.

8.7.5 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.

(1) Autotuning without a Host Reference Was Not Performed

Possible Cause	Corrective Action
Main circuit power is OFF.	Turn ON the main circuit power.
An alarm or warning occurred.	Remove the cause of the alarm or warning.
Overtraveling occurred.	Remove the cause of overtraveling.
The gain 2 was 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 procedure.
The settings for the tuning-less function are not correct.	• Set Pn170 to n.□□□0 (disable the tuning-less function). • Set Pn170 to n.□□□1 (enable the tuning-less function) and specify moment of inertia estimation.

(2) 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 positioning completion signal is not stable when the servomotor stops.	• On the [Detailed Setting] window, increase the setting of Pn561 (Overshoot Detection Level). • Increase the setting of Pn522 (Positioning Completed Width). • On the [Detailed Setting] window, decrease the setting of Pn562 (Setting Gain Ratio). • Change the mode from 2 to 3. • If machine vibration occurs, suppress the vibration with the anti-resonance control adjustment and the vibration suppression function.
An error occurred during calculation of the moment of inertia.	Refer to the following section for troubleshooting information. ☞ *(3) When an Error Occurs during Calculation of Moment of Inertia on page 352*	
Positioning was not completed within approximately 10 seconds after position adjustment was completed.	The positioning completed width is too narrow or proportional control is being used.	• Increase the setting of Pn522 (Positioning Completed Width). • Set V_PPI to 0 in MECHATROLINK commands.

(3) 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.	• Increase the setting of Pn100 (Speed Loop Gain). • Increase the stroke (travel distance).
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 Pn324 (Moment of Inertia Calculation Starting Level).
The torque limit was reached.	• If you are using the torque limit, increase the torque limit. • Double the setting of Pn324 (Moment of Inertia Calculation Starting Level).
The speed control section changed to proportional control during calculation of the moment of inertia, e.g., V_PPI was set to 1 in MECHATROLINK command.	Use PI control when calculating the moment of inertia.

(4) Adjustment Results Are Not Satisfactory for Position Control

Configuring parameters as shown below may improve the adjustment results.

- Change Pn522 (Positioning Completed Width) and Pn20E/Pn210 (Electronic Gear Ratio).

- Adjust Pn561 (Overshoot Detection Level).
  You can change these parameters on the [Adjustment Settings] window. Details on the settings of Pn561 are shown below.

Setting of Pn561	Meaning
0% to 99%	This will allow tuning to be performed without overshooting within the positioning completed width, but the positioning completed width may be extended.
100% (default setting)	This will allow tuning with overshooting that is equivalent to the positioning completed width.
101% to 1000%	The settings that allow overshooting to exceed the positioning completed width. Adjust Pn561 (Overshoot Detection Level) without changing the positioning completed width. Increase this setting when high responsiveness is required even if overshooting increases.

- Increase the upper limits for tuning.
  However, the changes in these settings are valid only when the tuning results are Pn100 = 2400 [0.1 Hz] (speed loop gain = 240 Hz) and Pn141 = 6000 [0.1/s] (model following control gain = 600/s). If you increase the upper limits of tuning at this time, you may be able to further decrease the settling time.
  You can change the upper limits of tuning on the [Detailed Setting] window. Set the parameters as shown below.
  – Pn540 = 3000 [0.1 Hz] or higher (maximum search gain = 300 Hz [default setting] or higher)
  – Pn562 = 80 [%] or higher (setting gain ratio = 80% [default setting] or higher)

8.7.6 Automatically Adjusted Function Setting

You can specify whether to automatically adjust the following functions during autotuning.

(1) Automatic Notch Filters

Normally, set Pn460 to n.□1□□ (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.□0□□ (do not adjust automatically) only if you do not change the setting of the notch filter before you execute this function.

<table>
<tr><td rowspan="3">Pn460</td><td rowspan="3">n.□□□X</td><td colspan="2">Notch Filter Adjustment Selection 1 Speed Pos Trq</td><td>When Enabled</td></tr>
<tr><td>0</td><td>Do not adjust the first stage notch filter automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.</td><td rowspan="2">Immediately</td></tr>
<tr><td>1
Default</td><td>Adjust the first stage notch filter automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.</td></tr>
<tr><td rowspan="3">Pn460</td><td rowspan="3">n.□X□□</td><td colspan="2">Notch Filter Adjustment Selection 2 Speed Pos Trq</td><td>When Enabled</td></tr>
<tr><td>0</td><td>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.</td><td rowspan="2">Immediately</td></tr>
<tr><td>1
Default</td><td>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.</td></tr>
</table>

(2) Anti-Resonance Control Adjustment

This function reduces low vibration frequencies, for which the notch filters cannot be used.

Normally, set Pn160 to n.□□1□ (adjust automatically) (default setting).

Vibration will be detected during autotuning without a host reference and anti-resonance control will be automatically adjusted.

Pn160	n.□□X□	Anti-Resonance Control Adjustment Selection Speed Pos Trq		When Enabled
		0	Do not adjust anti-resonance control automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.	Immediately
		1 Default	Adjust anti-resonance control automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.	

(3) 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.□1□□ (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.□0□□ (do not adjust automatically) only if you do not change the settings for vibration suppression before you execute this function.

Note:

This function uses model following control. Therefore, it can be executed only if the mode is set to 2 or 3.

Pn140	n.□X□□	Vibration Suppression Adjustment Selection Speed Pos Trq		When Enabled
		0	Do not adjust vibration suppression automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.	Immediately
		1 Default	Adjust vibration suppression automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.	

(4) 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) *1
2. Priority to settling time	Adjusted with friction compensation.
3: Priority to overshoot control	

Pn408	n.X□□□	Friction Compensation Function Selection Speed Pos Trq		When Enabled
		0 Default	Disable friction compensation.	Immediately
		1	Enable friction compensation.	

*1 Refer to the following section for details.
☞ *(1) Required Parameter Settings on page 416*

(5) Feedforward

If Pn140 is set to n.0□□□ (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, the setting of Pn109 (Feedforward), the speed feedforward input, and the torque feedforward input will be disabled.

To use the speed feedforward input, the torque feedforward input, 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).

Pn140	n.X□□□	Speed Feedforward (VFF)/Torque Feedforward (TFF) Selection — Speed Pos Trq		When Enabled
		0 Default	Do not use model following control and speed/torque feedforward together.	Immediately
		1	Use model following control and speed/torque feedforward together.	

For information on the torque feedforward input (TFF) and the speed feedforward input (VFF), refer to the following manual that corresponds to the communications references being used.

Σ-7/Σ-X-Series MECHATROINK-4 Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800002 32)

Σ-7/Σ-X-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

Important

When model following control is used with this 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 or torque feedforward input from the host controller. However, model following control can be used with the speed feedforward input or torque feedforward input if required. An unsuitable feedforward input may result in overshooting.

8.7.7 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
Pn14F = n.□□□X	Model Following Control Type Selection	Yes
Pn160	Anti-Resonance Control-Related Selections	Yes

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Parameter	Name	Automatic Changes
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.

8.8 Autotuning with a Host Reference

This section describes autotuning with a host reference.

> **Important** Autotuning with a host reference makes adjustments based on the setting of Pn100 (Speed Loop Gain). Therefore, precise adjustments cannot be made if there is vibration when adjustments are started. Make adjustments after lowering the setting of Pn100 (Speed Loop Gain) until vibration is eliminated.

8.8.1 Outline

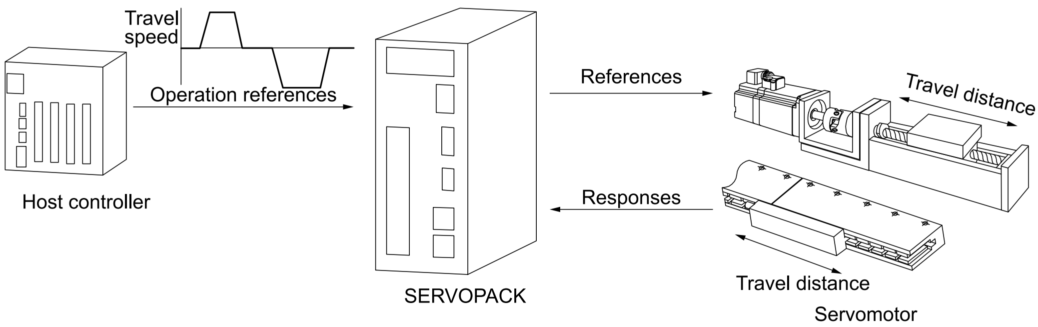
Autotuning with a host reference automatically makes optimum adjustments for operation references from the host controller.

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.

☞ *8.8.7 Related Parameters on page 364*



> **⚠ CAUTION**
>
> **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 when you execute this function.**

8.8.2 Restrictions

(1) 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 Pn522 (Positioning Completed Width).
- Rotary Servomotors: When the movement speed for the reference from the host controller is equal to or lower than the setting of Pn502 (Rotation Detection Level)
- Linear Servomotors: When the movement speed for the reference from the host controller is equal to or lower than the setting of Pn581 (Zero Speed Level)
- 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 P control is used
- When mode switching is used
- When the setting of Pn522 (Positioning Completed Width) is too small

Refer to the following sections for details on custom tuning.

☞ *8.9 Custom Tuning on page 366*

(2) 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 switching selection must be Pn139 = n.□□□0 (automatic gain switching is disabled).
- The gain 1 must be selected.
- Pn00C must be set to n.□□□0 (Function Selection for Test without a Motor is disabled).
- Pn170 must be set to n.□□□0 (Tuning-less Selection is disabled).
- Pn173 must be set to n.□□□0 (a load fluctuation compensation control is disabled).
- There must be no warnings.
- The parameters must not be write prohibited.

8.8.3 Applicable Tools

The following table lists the tools that you can use to perform autotuning with a host reference.

Tool	Fn No./Function Name	Operating Procedure Reference
Digital Operator	Fn202	Σ-7/Σ-X-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	[Tuning] - [Tuning]	☞ *8.8.4 Operating Procedure on page 358*

8.8.4 Operating Procedure

Use the following procedure to perform autotuning with a host reference.

NOTICE

If you are using an MP3000-Series Controller for phase control, set the mode selection to 1.

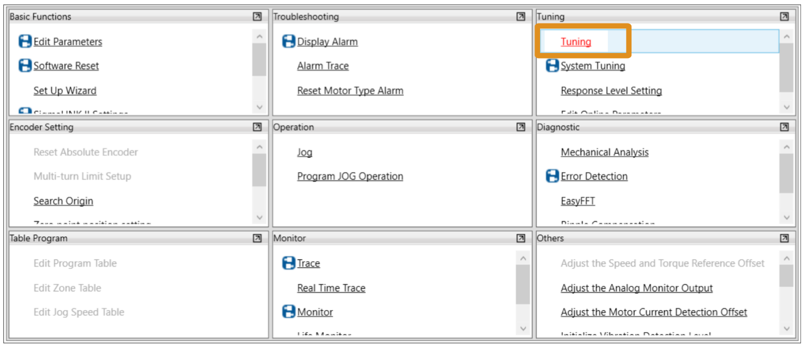
If 2 or 3 is selected for the mode, correct phase control may not be possible.

1. **Confirm that the value of Pn103 (Moment of Inertia Ratio) is set correctly.**

2. **Click the [ ] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**

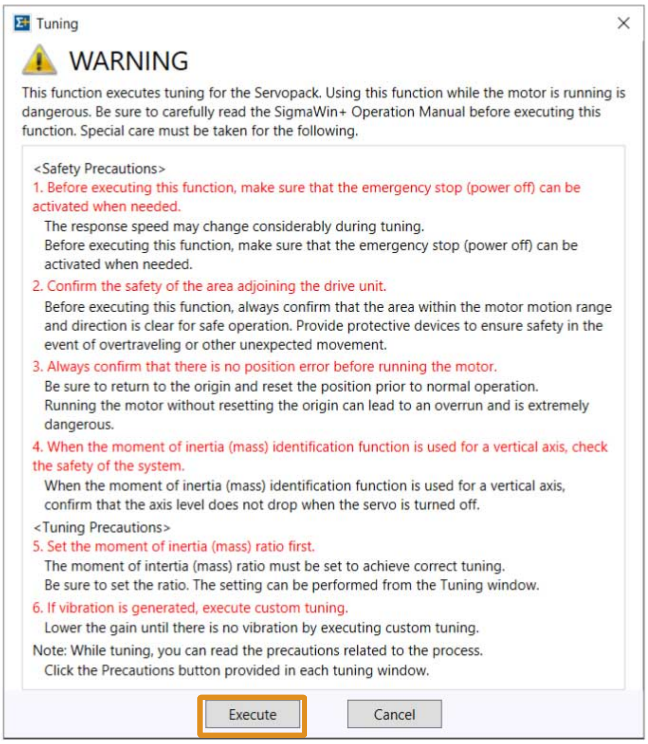
   The [Menu] window will be displayed.

3. **Click [Tuning] in the [Tuning] area.**

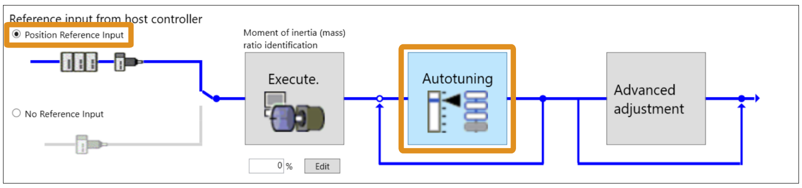


   The [Tuning] window will be displayed.

4. **Read the warnings and then click the [Execute] button.**



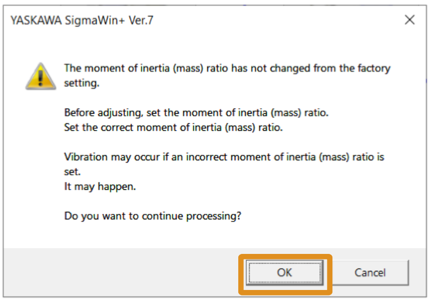
5. **Click [Position Reference Input] in [Reference input from host controller] and then click the [Autotuning] button.**



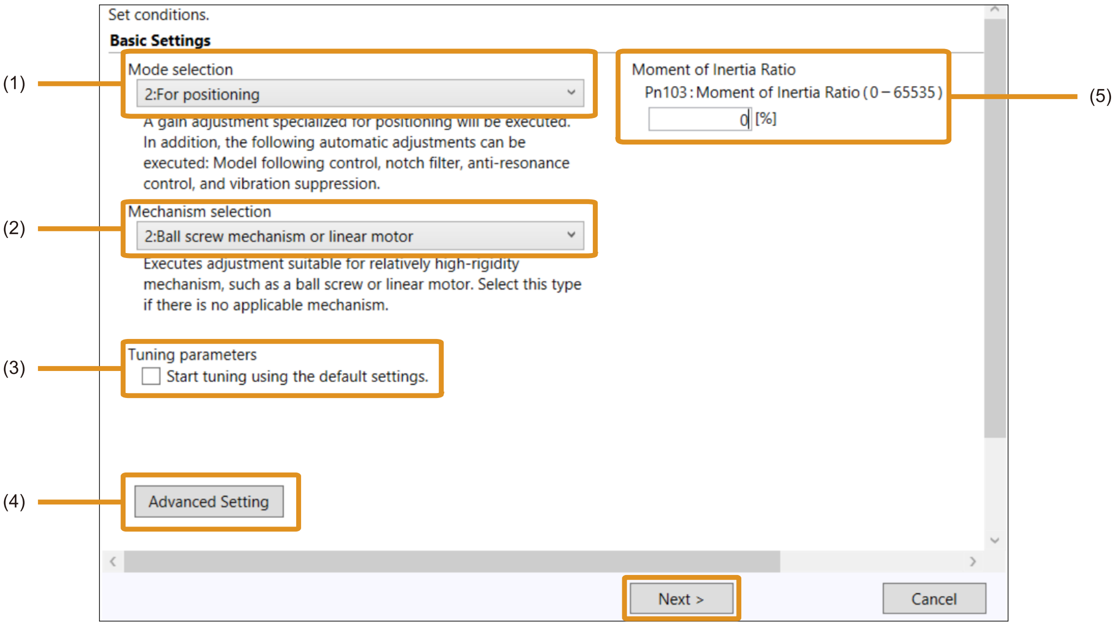
Tuning

8

Information When the following message dialog box is displayed, click the [OK] button and then confirm that Pn103 (Moment of Inertia Ratio) is set correctly.



6. **Set the conditions and click the [Next] button.**



No.	Item	Meaning
(1)	[Mode selection]	Set the mode. For details on the options, refer to the explanations on the window.
(2)	[Mechanism selection]	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. For details on the options, refer to the explanations on the window.
(3)	[Tuning parameters]	Specify the parameters to use for tuning. If you select [Start tuning using the default settings], the tuning parameters will be returned to the default settings before tuning is started.

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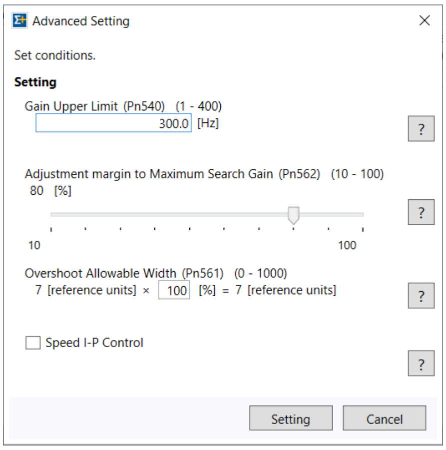
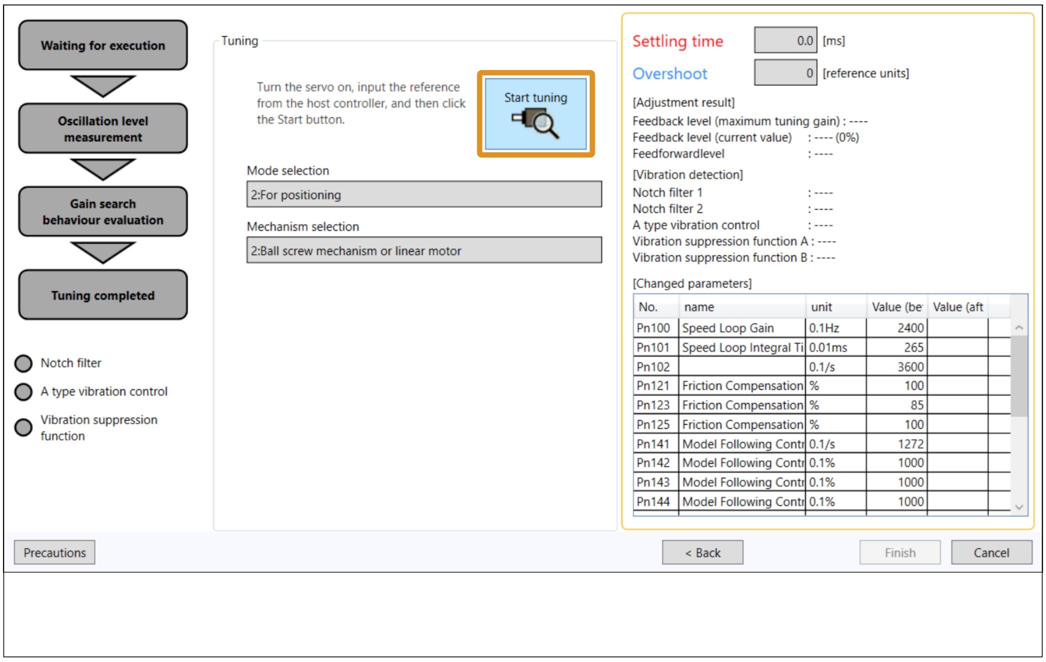
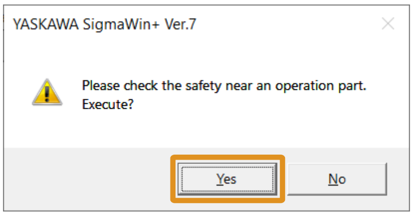
No.	Item	Meaning
(4)	[Advanced Setting] button	Click this button to display the [Advanced Setting] window on which you can set the details of tuning conditions. Configure detailed tuning conditions in the following cases: • To tune a higher response than the tuning results • When tuning fails with a large amount of overshoot • To tune with speed I-P control 
(5)	[Moment of Inertia Ratio]	Change the settings as required.

7. **Turn ON the servo, enter a reference from the host controller, and then click the [Start tuning] button.**

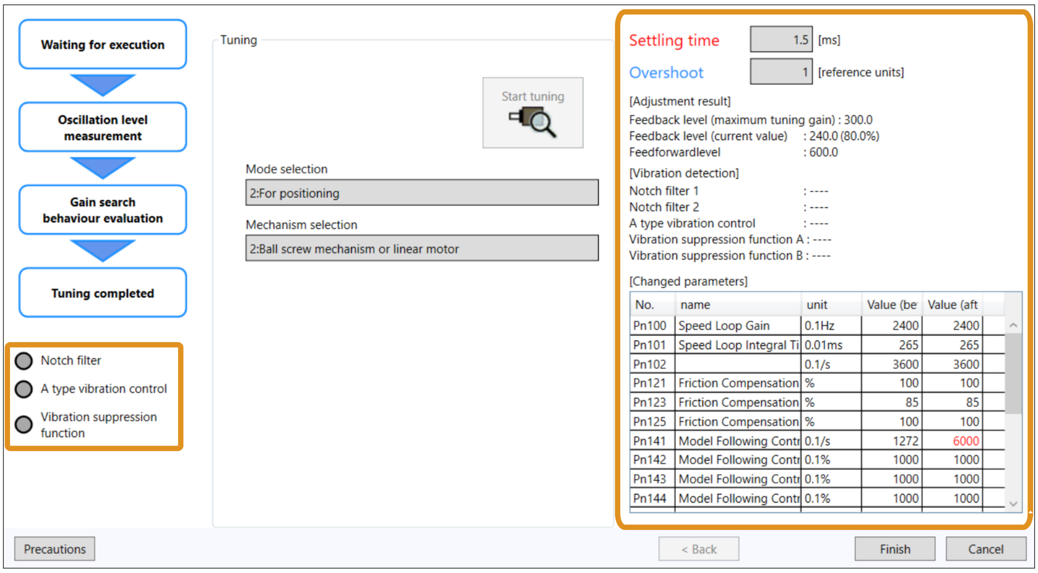


8. **Confirm safety around moving parts and click the [Yes] button.**



Tuning will be executed.

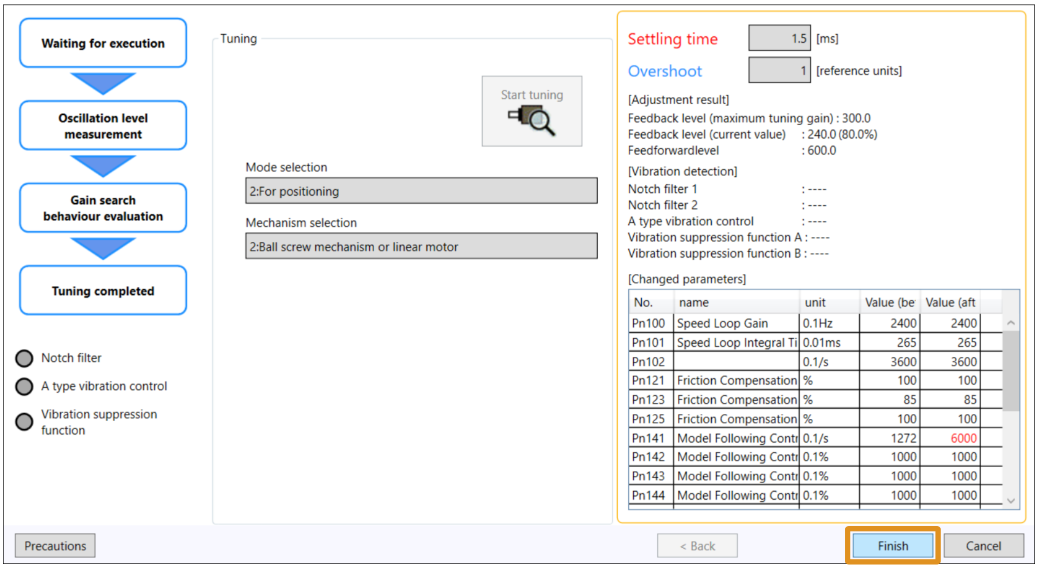
Vibration that occurs during tuning will be detected automatically and suitable settings will be made for that vibration. The content to set will be displayed on the right side of the window. When the settings have been completed, the indicators for the functions that were used will light at the lower left of the window.



Details on the content to set are shown below.

Item	Meaning
[Settling time]	Displays the settling time by the tuning results.
[Overshoot]	Displays the maximum overshoot by the tuning results.
[Feedback level (maximum tuning gain)]	Displays the maximum value of Pn100 (Speed Loop Gain) during tuning.
[Feedback level (current value)]	Displays the value of Pn100 (Speed Loop Gain) after tuning. The number in parentheses is the percentage of adjusting maximum gain.
[Feedforward level]	Displays the value of Pn141 (Model Following Control Gain) after tuning.
[Notch filter 1] [Notch filter 2]	Displays the frequencies set by the notch filters. "——" is displayed if not set.
[A type vibration control]	Displays the frequency set by anti-resonance control. "——" is displayed if not set.
[Vibration suppression function A] [Vibration suppression function B]	Displays the frequencies set by vibration suppression. "——" is displayed if not set.

9. **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] window.

This concludes the procedure to perform autotuning with a host reference.

8.8.5 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.

(1) Autotuning with a Host Reference Was Not Performed

Possible Cause	Corrective Action
Main circuit power is OFF.	Turn ON the main circuit power.
An alarm or warning occurred.	Remove the cause of the alarm or warning.
Overtraveling occurred.	Remove the cause of overtraveling.
The gain 2 was selected with the gain selection.	Disable automatic gain switching.
The HWBB was activated.	Release the HWBB.

(2) Troubleshooting Errors

Error	Possible Cause	Corrective Action
The gain adjustments were not successfully completed.	Machine vibration occurs or the positioning completion signal is not stable when the servomotor stops.	• On the [Detailed Setting] window, increase the setting of Pn561 (Overshoot Detection Level). • Increase the setting of Pn522 (Positioning Completed Width). • On the [Detailed Setting] window, decrease the setting of Pn562 (Setting Gain Ratio). • Change the mode from 2 to 3. • If machine vibration occurs, suppress the vibration with the anti-resonance control adjustment and the vibration suppression function.
Positioning was not completed within approximately 10 seconds after position adjustment was completed.	The positioning completed width is too narrow or proportional control is being used.	• Increase the setting of Pn522 (Positioning Completed Width). • Set V_PPI to 0 in MECHATROLINK commands.

(3) Adjustment Results Are Not Satisfactory for Position Control

Configuring parameters as shown below may improve the adjustment results.

- Change Pn522 (Positioning Completed Width) and Pn20E/Pn210 (Electronic Gear Ratio).
- Adjust Pn561 (Overshoot Detection Level).
  You can change these parameters on the [Adjustment Settings] window. Details on the settings of Pn561 are shown below.

Setting of Pn561	Meaning
0% to 99%	This will allow tuning to be performed without overshooting within the positioning completed width, but the positioning completed width may be extended.
100% (default setting)	This will allow tuning with overshooting that is equivalent to the positioning completed width.
101% to 1000%	The settings that allow overshooting to exceed the positioning completed width. Adjust Pn561 (Overshoot Detection Level) without changing the positioning completed width. Increase this setting when high responsiveness is required even if overshooting increases.

- Increase the upper limits for tuning.
  However, the changes in these settings are valid only when the tuning results are Pn100 = 2400 [0.1 Hz] (speed loop gain = 240 Hz) and Pn141 = 6000 [0.1/s] (model following control gain = 600/s). If you increase the upper limits of tuning at this time, you may be able to further decrease the settling time.
  You can change the upper limits of tuning on the [Detailed Setting] window. Set the parameters as shown below.
  - Pn540 = 3000 [0.1 Hz] or higher (maximum search gain = 300 Hz [default setting] or higher)
  - Pn562 = 80 [%] or higher (setting gain ratio = 80% [default setting] or higher)

8.8.6 Automatically Adjusted Function Setting

These function settings are the same as for autotuning without a host reference. Refer to the following section.

☞ *8.7.6 Automatically Adjusted Function Setting on page 353*

8.8.7 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
Pn14F = n.□□□X	Model Following Control Type Selection	Yes

Continued on next page.

Continued from previous page.

Parameter	Name	Automatic Changes
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.

8.9 Custom Tuning

This section describes custom tuning.

8.9.1 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, position loop gain, load fluctuation compensation response level)
- 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.

☞ *8.9.7 Related Parameters on page 373*

There are three adjustment methods that you can use for custom tuning.

Tuning Mode		Adjusting Method
0	Set servo gains with priority given to stability.	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.
1	Set servo gains with priority given to response.	
2	Set servo gains for positioning application.	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.
3	Set servo gains especially to prevent overshooting during positioning application.	
6	Set servo gains for application with large load fluctuations.	Load fluctuation compensation control is performed to suppress the variations in settling time that occur when the load fluctuates. In addition to gain adjustment, automatic setting of notch filters and anti-resonance control is provided.

CAUTION

Vibration or overshooting may occur during custom tuning. To ensure safety, make sure that you can perform an emergency stop at any time when you execute this function.

8.9.2 Preparations

Always check the following before you execute custom tuning.

- Pn00C must be set to n.□□□0 (Function Selection for Test without a Motor is disabled).
- Pn170 must be set to n.□□□0 (Tuning-less Selection is disabled).
- If speed control is used, tuning mode 0 or 1 must be set.
- The parameters must not be write prohibited.

8.9.3 Applicable Tools

The following table lists the tools that you can use to perform custom tuning.

Tool	Fn No./Function Name	Operating Procedure Reference
Digital Operator	Fn203	🕮 Σ-7/Σ-X-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	[Tuning] - [Tuning]	☞ *8.9.4 Operating Procedure on page 367*

8.9.4 Operating Procedure

Use the following procedure to perform custom tuning.

⚠ CAUTION

Before you execute custom tuning, check the information provided in the SigmaWin+ operating manual. Observe the following precautions.

- **Make sure that you can perform an emergency stop at any time when you execute this function. When custom tuning is started, several parameters will be overwritten with the recommended settings, which may greatly affect the response before and after execution. Make sure that you can perform an emergency stop at any time.**
- **Set the moment of inertia correctly before you execute this function. If the setting greatly differs from the actual moment of inertia, vibration may occur.**
- **If you change the feedforward level, the new setting will not be used immediately. It will be used after positioning is completed.**

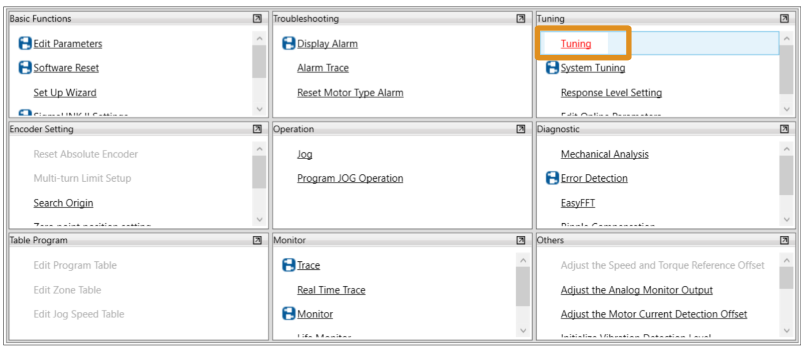
NOTICE

If you are using an MP3000-series controller for phase control, set the tuning mode to 0 or 1.

If 2 or 3 is selected for the tuning mode, correct phase control may not be possible.

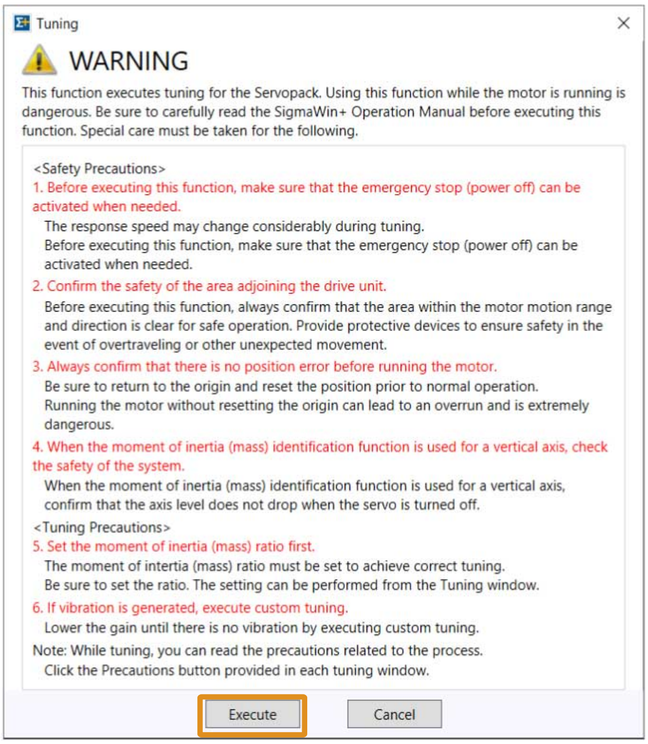
1. **Confirm that the value of Pn103 (Moment of Inertia Ratio) is set correctly.**
2. **Click the [ ] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**

   The [Menu] window will be displayed.
3. **Click [Tuning] in the [Tuning] area.**

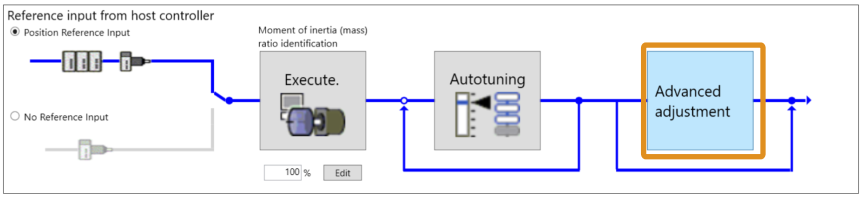


The [Tuning] window will be displayed.

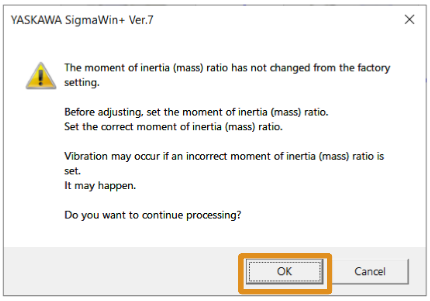
4. **Click the [Execute] button.**



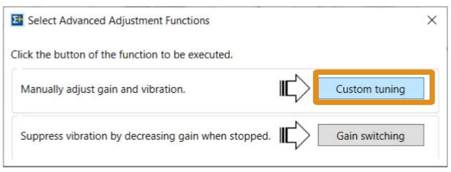
5. **Click the [Advanced adjustment] button.**



Information When the following message dialog box is displayed, click the [OK] button and then confirm that Pn103 (Moment of Inertia Ratio) is set correctly.

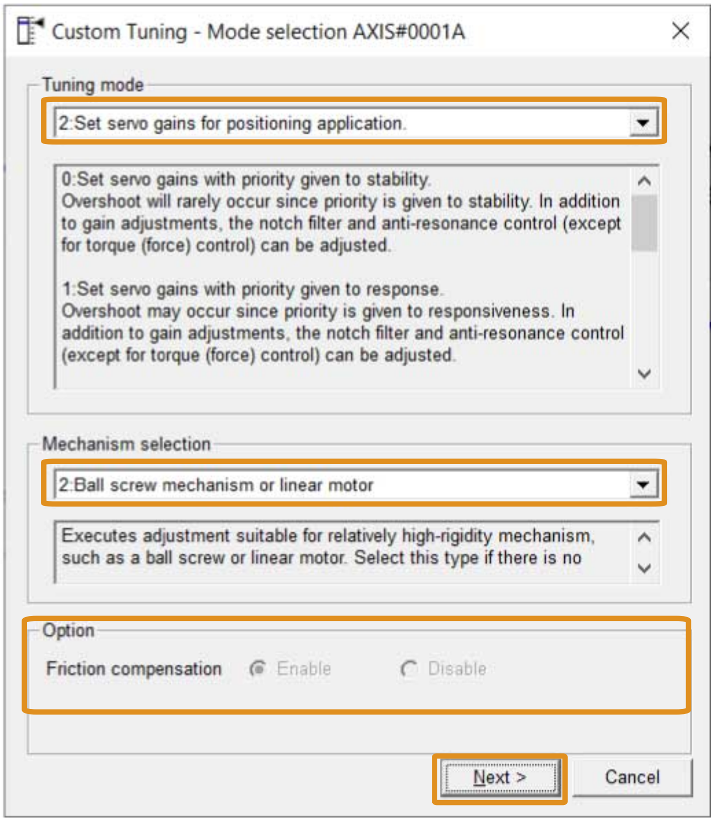


6. **Click the [Custom tuning] button.**



The [Custom Tuning] window will be displayed.

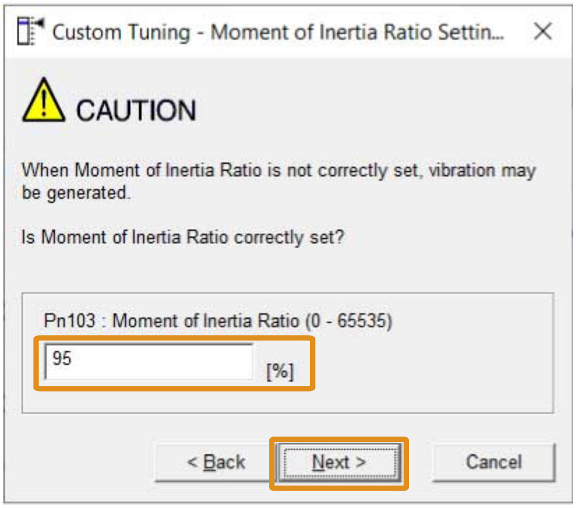
7. **Select [Tuning mode], [Mechanism selection], and [Option], and then click the [Next] button.**



For details on [Tuning mode] and [Mechanism selection], refer to the explanations on the above window.

The content displayed in [Option] changes according the selection of [Tuning mode].

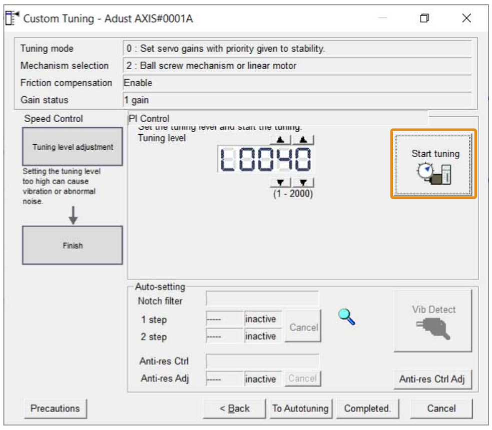
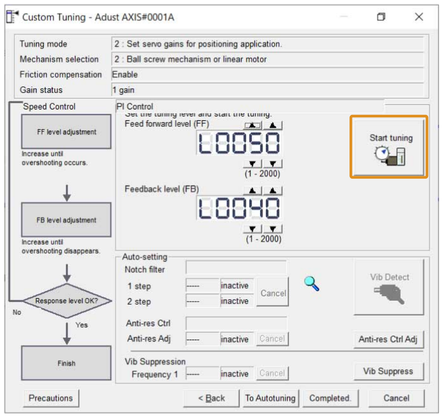
8. **If the moment of inertia ratio is not set correctly, correct the setting and then click the [Next] button.**



Tuning

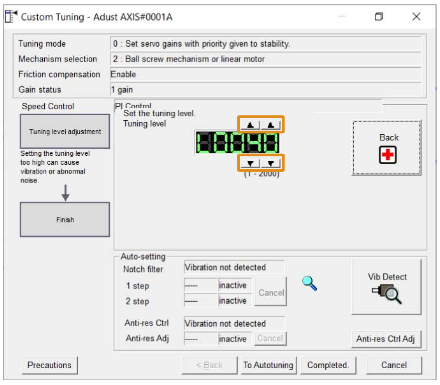
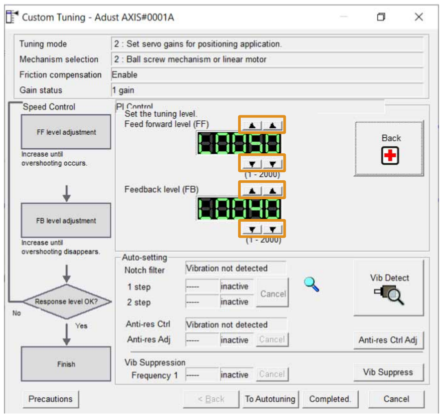
8

9. **Turn ON the servo, enter a reference from the host controller, and then click the [Start tuning] button.**

Tuning Mode 0 or 1 or 6	Tuning Mode 2 or 3
	

10. **Use the [▲] and [▼] 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.

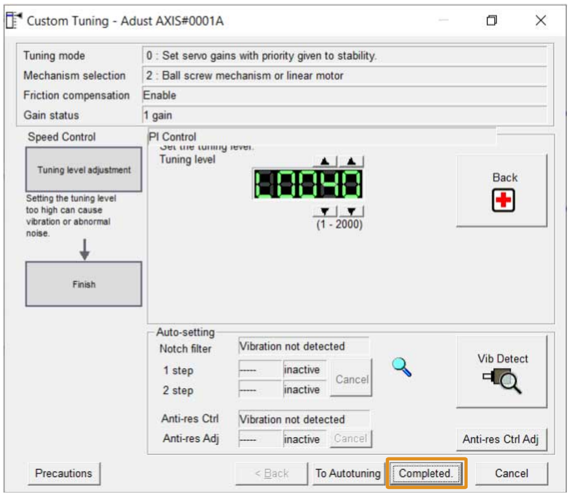
Tuning Mode 0 or 1 or 6	Tuning Mode 2 or 3
Increase the tuning level until overshooting occurs. 	Increase the feedforward level until overshooting occurs and then increase the feedback level until overshooting is eliminated. Repeat these changes to make the adjustment. The new feedforward level will not be used until the positioning completed signal is output. 

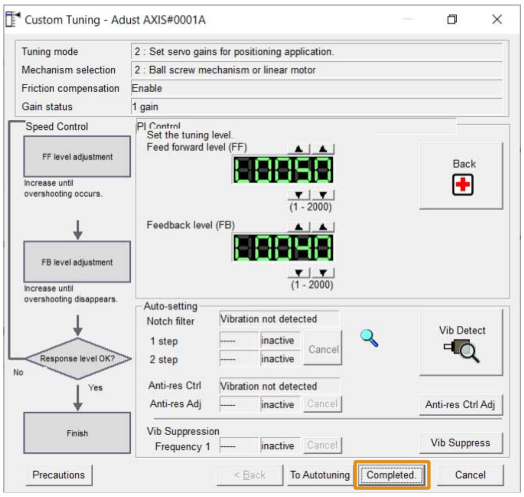
11. **You can set the functions to suppress vibration (notch filters, automatic anti-resonance control setting, anti-resonance control adjustment, and autotuning with a host reference) as required.**

Refer to the following section for details.

☞ *(1) Vibration Suppression Functions on page 371*

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] window.

This concludes the procedure to set up custom tuning.

(1) Vibration Suppression Functions

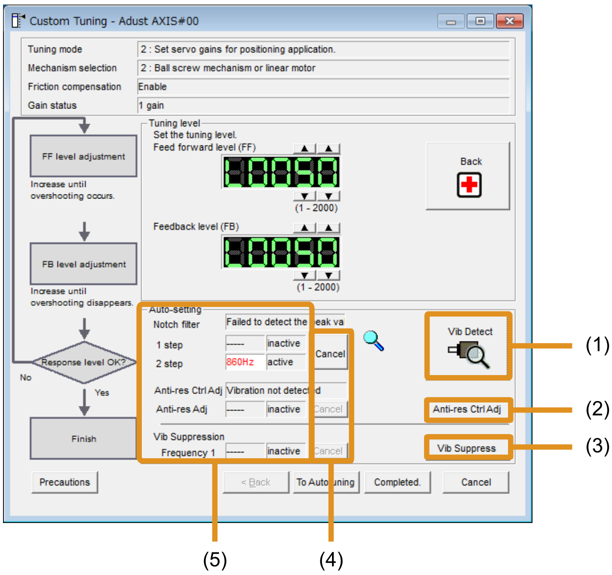
(a) Notch Filters and Automatic Anti-resonance Control Setting

If the vibration frequency that occurs when you increase the servo gains is at 1000 Hz or higher, notch filters are effective to suppress vibration. If the vibration is between 100 Hz and 1000 Hz, anti-resonance control is effective.

(b) 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.



No.	Item	Meaning
(1)	[Vib Detect] button	While the notch filter or automatic anti-resonance control 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.
(2)	[Anti-res Ctrl Adj] button	You can use the [Anti-res Ctrl Adj] button to execute the anti-resonance control adjustment if fine-tuning is required. Refer to the following section. ☞ *8.10 Anti-Resonance Control Adjustment on page 375*
(3)	[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. ☞ *8.11 Vibration Suppression on page 382*
(4)	[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.
(5)	[Auto-setting]	The usage status and frequencies of the automatically set notch filter, anti-resonance control, and vibration suppression are displayed here.

(c) Autotuning with a Host Reference

You can perform autotuning with a host reference. Refer to the following section for details.

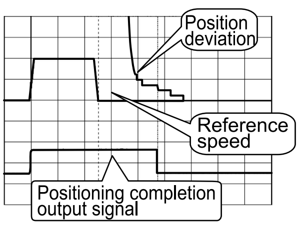
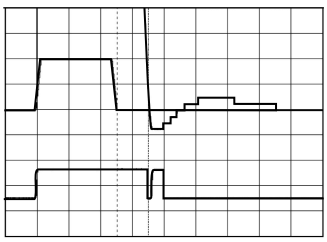
☞ *8.8 Autotuning with a Host Reference on page 357*

8.9.5 Automatically Adjusted Function Setting

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.

☞ *8.7.6 Automatically Adjusted Function Setting on page 353*

8.9.6 Tuning Example for Tuning Mode 2 or 3

Step	Measurement Display Examples	Operation
1		The positioning time is measured after Pn103 (Moment of Inertia Ratio) 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, proceed to step 3.

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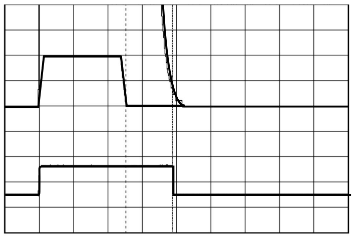
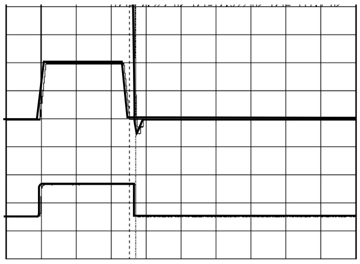
Step	Measurement Display Examples	Operation
3		Overshooting will be reduced if the feedback level is increased. If the overshooting is eliminated, proceed to step 4.
4		The graph shows overshooting that occurred when the feedforward level was increased even more after step 3. In this state, overshooting 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 overshooting 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-resonance control.
5	–	The tuning results are saved in the SERVOPACK.

8.9.7 Related Parameters

The following parameters are automatically adjusted or used as reference when you execute custom tuning. Do not change the settings while custom tuning 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	No

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Parameter	Name	Automatic Changes
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
Pn173	Load Fluctuation Compensation Control-Related Selections	Yes
Pn174	Load Fluctuation Compensation Control Response Level	Yes

Yes: The parameter is automatically set.

No: The parameter is not automatically set, but the setting is read during execution.

8.10 Anti-Resonance Control Adjustment

This section describes anti-resonance control.

8.10.1 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 1000 Hz that occur when the servo 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 function when there is vibration.

This function is automatically set by autotuning without a host reference or autotuning with a host reference. Use this function 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 executing this function. If the servo gain is increased, e.g., when custom tuning is performed, vibration may occur again. If that occurs, execute this function again to fine-tune the parameters.

⚠ CAUTION

Related parameters will be set automatically when this function 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 this function, set Pn103 (Moment of Inertia Ratio) correctly. If the setting greatly differs from the actual moment of inertia ratio, normal control of the machine may not be possible, and vibration may result.

Important

- This function detects vibration frequencies between 100 Hz and 1000 Hz. If the vibration frequency is not within this range, use custom tuning with tuning mode 2 selected to automatically set a notch filter or use vibration suppression.
- Vibration reduction can be made more effective by increasing the setting of Pn163 (Anti-Resonance Damping Gain), 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 servo gain by using a different method, such as custom tuning.

8.10.2 Preparations

Always check the following before you execute anti-resonance control adjustment.

- Pn170 must be set to n.□□□0 (Tuning-less Selection is disabled).
- Pn00C must be set to n.□□□0 (Function Selection for Test without a Motor is disabled).
- The control method must not be set to torque control.
- The parameters must not be write prohibited.

8.10.3 Applicable Tools

The following table lists the tools that you can use to perform anti-resonance control adjustment.

Tool	Fn No./Function Name	Operating Procedure Reference
Digital Operator	Fn204	Σ-7/Σ-X-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	[Tuning] - [Tuning]	*8.10.4 Operating Procedure on page 376*

8.10.4 Operating Procedure

To execute this function, an operation reference is input, and the adjustment is executed while vibration is occurring.

The following methods can be used to execute this function.

- To automatically detect the vibration frequency
- To manually set the vibration frequency

Use the following procedure to perform anti-resonance control.

⚠ CAUTION

Before you execute anti-resonance control adjustment, check the information provided in the SigmaWin+ operating manual. Observe the following precautions.

- **Make sure that you can perform an emergency stop at any time when you execute this function. Parameters will be set automatically when this function 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) at any time.**

Important

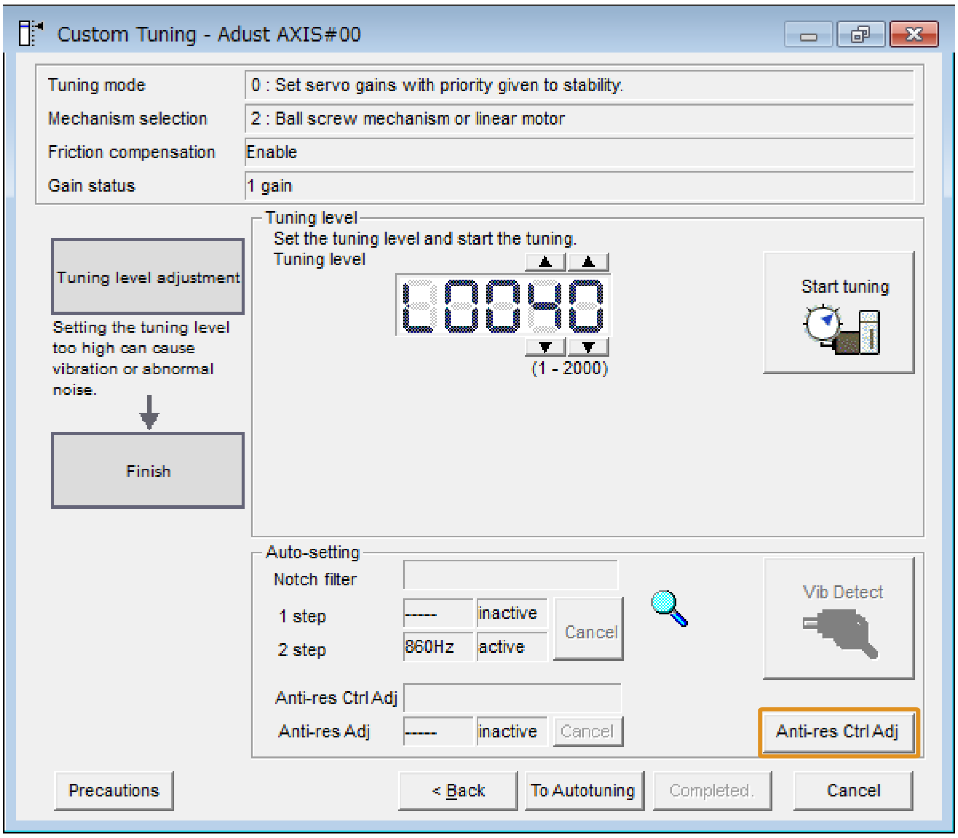
- Set the moment of inertia correctly before you execute this function.
  If the setting greatly differs from the actual moment of inertia, effective vibration reduction may not be possible.
- If you have already performed anti-resonance control adjustment and then you change the vibration frequency, the current anti-resonance control effect may be lost. Caution is particularly required when automatically detecting the vibration frequency.
- If effective vibration reduction is not achieved even after you execute this function, cancel the function and lower the servo gain by using a different method, such as custom tuning.
- Perform custom tuning separately if required to increase the response after executing this function.
  If the servo gain is increased, e.g., when custom tuning is performed, vibration may occur again. If that occurs, execute this function again to fine-tune the parameters.

1. **Perform steps 1 to 9 of the procedure for custom tuning. Refer to the following section for details.**

   ☞ *8.9.4 Operating Procedure on page 367*

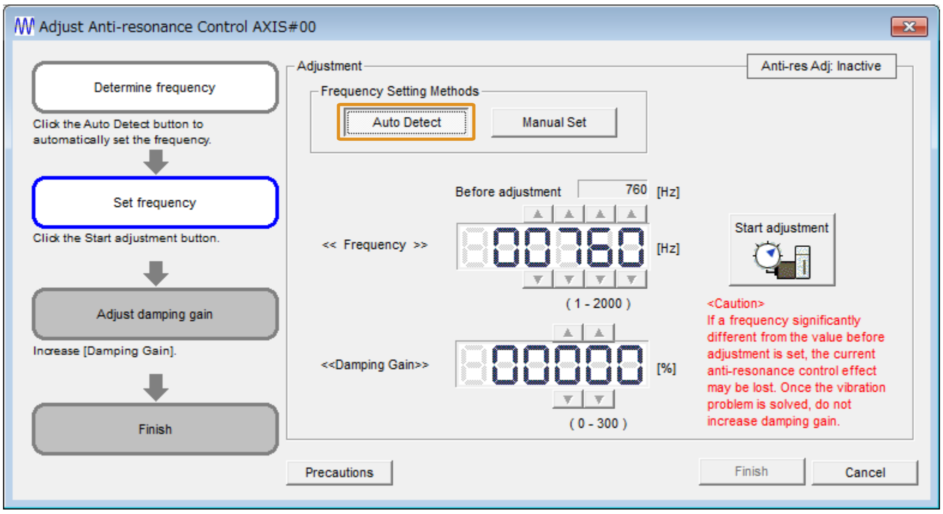
2. **Click the [Anti-res Ctrl Adj] button.**

   The rest of the procedure depends on whether you know the vibration frequency.

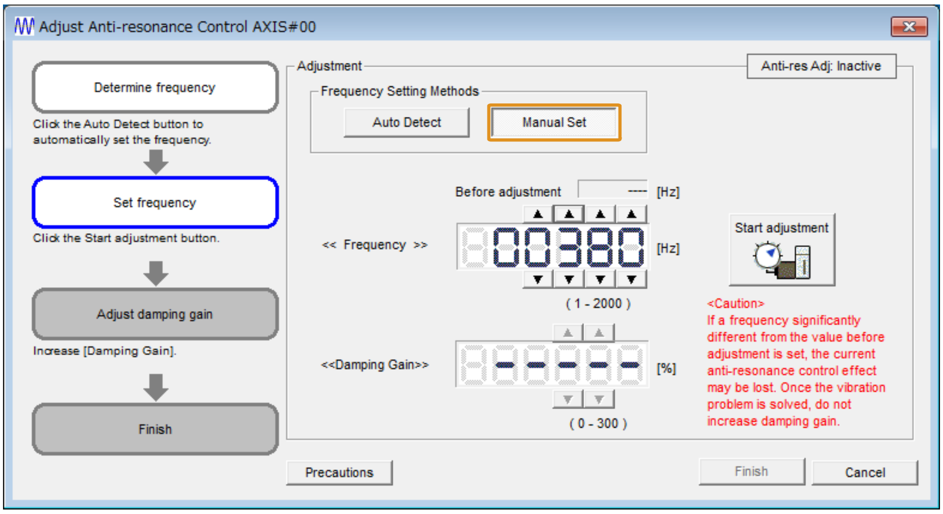

Custom Tuning - Adust AXIS#00
Tuning mode
0 : Set servo gains with priority given to stability.
Mechanism selection
2 : Ball screw mechanism or linear motor
Friction compensation
Enable
Gain status
1 gain
Tuning level
Set the tuning level and start the tuning.
Tuning level
(1 - 2000)
Start tuning
Tuning level adjustment
Setting the tuning level too high can cause vibration or abnormal noise.
Finish
Auto-setting
Notch filter
1 step
-----
inactive
2 step
860Hz
active
Cancel
Vib Detect
Anti-res Ctrl Adj
Anti-res Adj
-----
inactive
Cancel
Anti-res Ctrl Adj
Precautions
< Back
To Autotuning
Completed.
Cancel

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.



   - To manually set the vibration frequency

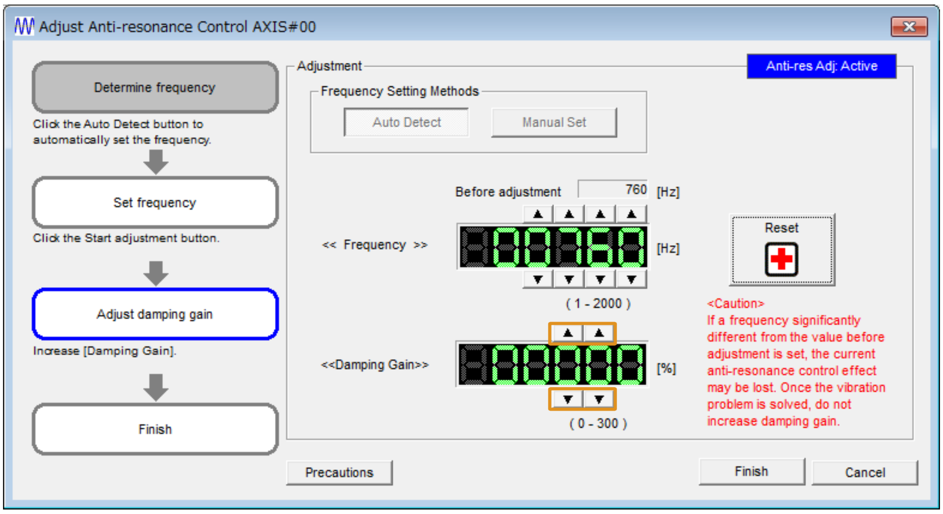


4. **Click the [Start adjustment] button.**

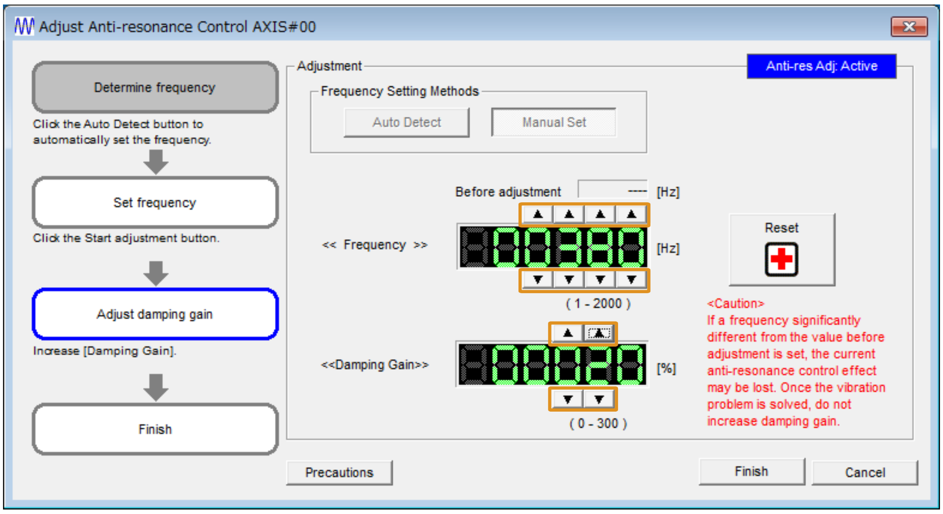
5. **Use the [▲] and [▼] buttons in [Adjustment] to change the settings.**

   Click the [Reset] button during tuning to restore the setting to its original value. The status from before when adjustment was started will be restored.

- To automatically detect the vibration frequency
  Change the setting of the damping gain.

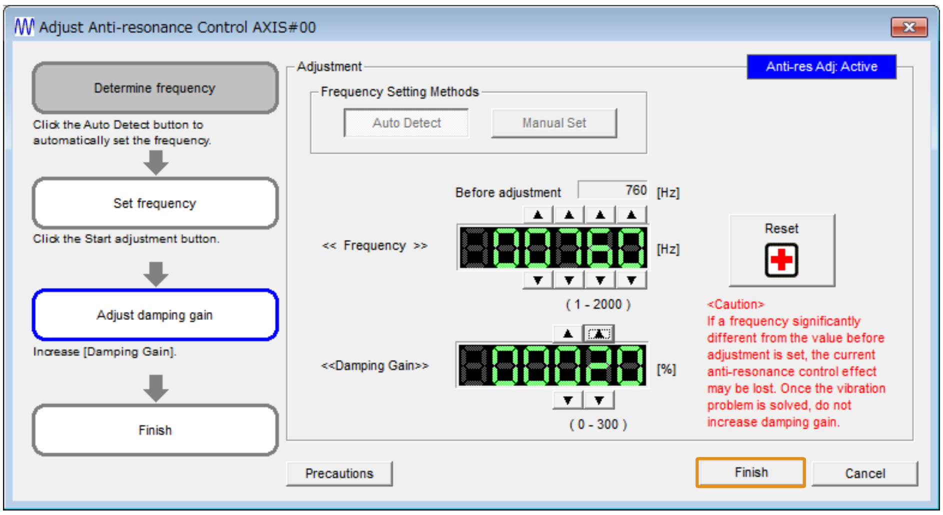


- To manually set the vibration frequency
  Change the settings of the frequency and damping gain.



6. **When tuning 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] window.



This concludes the procedure to set up anti-resonance control.

8.10.5 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	Yes

Yes: The parameter is automatically set.

No: The parameter is not automatically set, but the setting is read during execution.

8.10.6 Suppressing Different Vibration Frequencies with Anti-resonance Control

When you use anti-resonance control and increase the servo 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 Guidelines for Vibration That Can Be Suppressed

Pn161 (Anti-Resonance Frequency): fa [Hz], another vibration frequency that occurs when the servo gain is increased: fb [Hz]

- Vibration frequencies: 100 Hz to 1000 Hz
- Range of different vibration frequencies: $1 < (fb/fa) \leq 3$ to 4

(1) Required Parameter Settings

The following parameter settings are required to use anti-resonance control for more than one vibration frequency.

			Anti-Resonance Control Selection (Speed Pos Trq)	When Enabled
Pn160	n.□□□X	0 Default	Do not use anti-resonance control.	Immediately
		1	Use anti-resonance control.	

	Anti-Resonance Frequency (Speed Pos Trq)			
Pn161	Setting Range	Setting Unit	Default Setting	When Enabled
	10 to 20000	0.1 Hz	1000	Immediately
	Anti-Resonance Gain Correction (Speed Pos Trq)			
Pn162	Setting Range	Setting Unit	Default Setting	When Enabled
	1 to 1000	1%	100	Immediately
	Anti-Resonance Damping Gain (Speed Pos Trq)			
Pn163	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 300	1%	0	Immediately

Continued on next page.

Continued from previous page.

Pn164	Anti-Resonance Filter Time Constant 1 Correction			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	-1000 to 1000	0.01 ms	0	Immediately
Pn165	Anti-Resonance Filter Time Constant 2 Correction			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	-1000 to 1000	0.01 ms	0	Immediately
Pn166	Anti-Resonance Damping Gain 2			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 1000	1%	0	Immediately

(2) 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. ☞ *8.10.4 Operating Procedure on page 376*
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). If there is vibration at a lower frequency than the vibration suppressed with anti-resonance control in step 1, return to step 1, set Pn161 (Anti-Resonance Frequency) to the lower vibration frequency, and adjust Pn163 (Anti-Resonance Damping Gain) again. Then 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.

8.11 Vibration Suppression

This section describes vibration suppression.

8.11.1 Outline

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.

This function is automatically set by autotuning without a host reference or autotuning with a host reference. Use this function only if fine-tuning is required or readjustment is required as a result of a failure to detect vibration. To execute this function, input an operation reference and execute the function when there is vibration.

Perform custom tuning if required to increase the response after executing this function.

⚠ CAUTION

Related parameters will be set automatically when this function 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 this function, set Pn103 (Moment of Inertia Ratio) correctly. If the setting greatly differs from the actual moment of inertia ratio, normal control of the machine may not be possible, and vibration may result.

NOTICE

If you execute vibration suppression when you are using an MP3000-series controller for phase control, correct phase control may not be possible.

Important

- This function detects vibration frequencies between 1 Hz and 100 Hz.
- Frequency detection will not be performed if there is no vibration in the position deviation or if the vibration frequency is outside the range of detectable frequencies. If that is a problem, use 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.

(1) 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.

(2) 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 Pn560 (Residual Vibration Detection Width), which is set as a percentage of the setting of Pn522 (Positioning Completed Width). Perform the detection of vibration frequencies again after adjusting the setting of Pn560.

Pn560	Residual Vibration Detection Width			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	1 to 3000	0.1%	400	Immediately

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.

8.11.2 Preparations

Always check the following before you execute vibration suppression.

- Position control must be used.
- Pn170 must be set to n.□□□0 (Tuning-less Selection is disabled).
- Pn00C must be set to n.□□□0 (Function Selection for Test without a Motor is disabled).
- The parameters must not be write prohibited.

8.11.3 Applicable Tools

The following table lists the tools that you can use to perform vibration suppression.

Tool	Fn No./Function Name	Operating Procedure Reference
Digital Operator	Fn205	Σ-7/Σ-X-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	[Tuning] - [Tuning]	☞ *8.11.4 Operating Procedure on page 383*

8.11.4 Operating Procedure

Use the following procedure to perform vibration suppression.

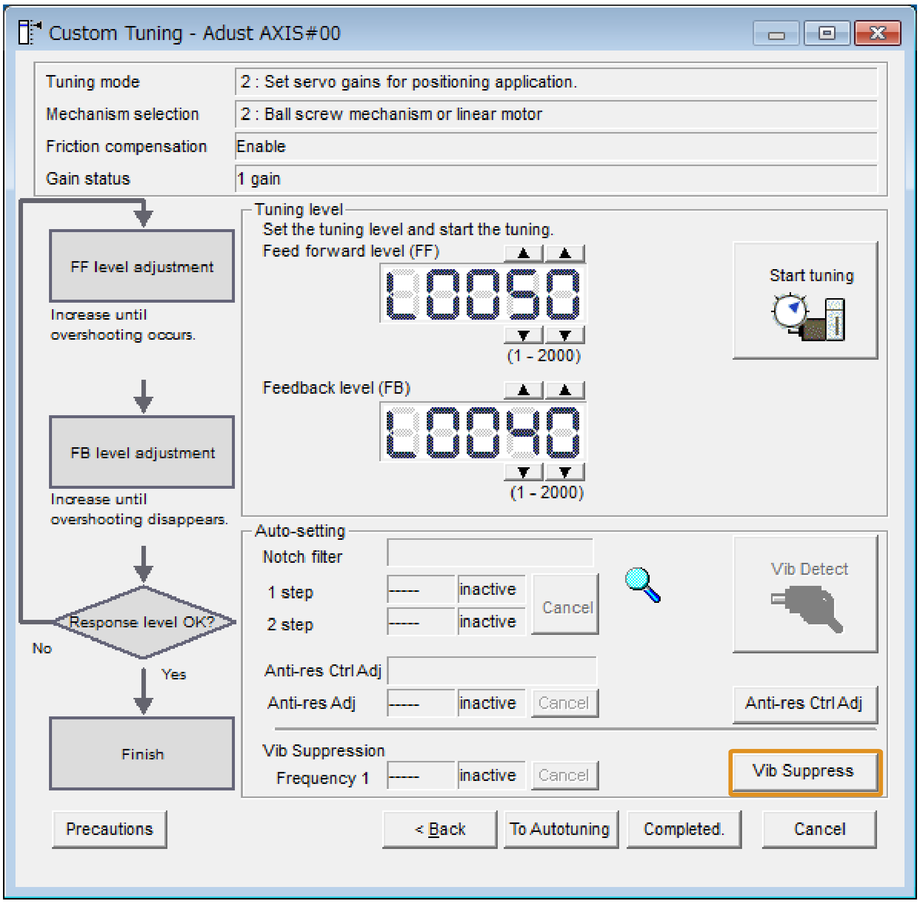
1. **Perform steps 1 to 9 of the procedure for custom tuning. Refer to the following section for details.**

   ☞ *8.9.4 Operating Procedure on page 367*

Tuning

8

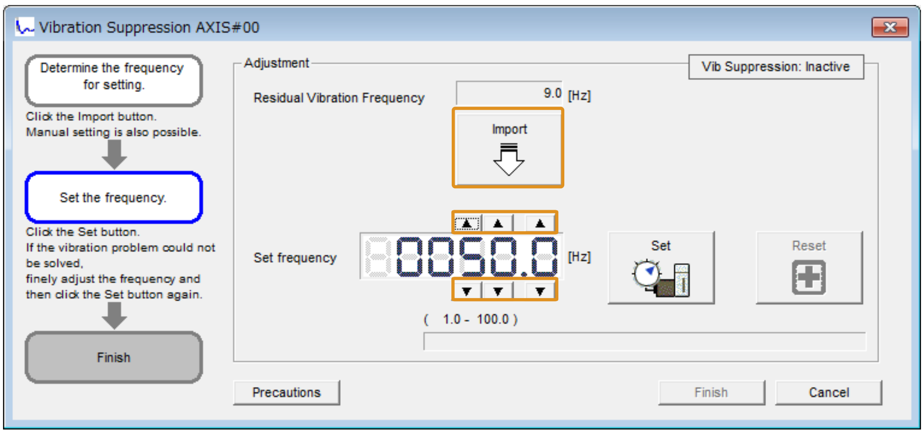
2. **Click the [Vib Suppress] button.**



3. **Click the [Import] button or click the [▲] and [▼] buttons to manually adjust the set frequency.**

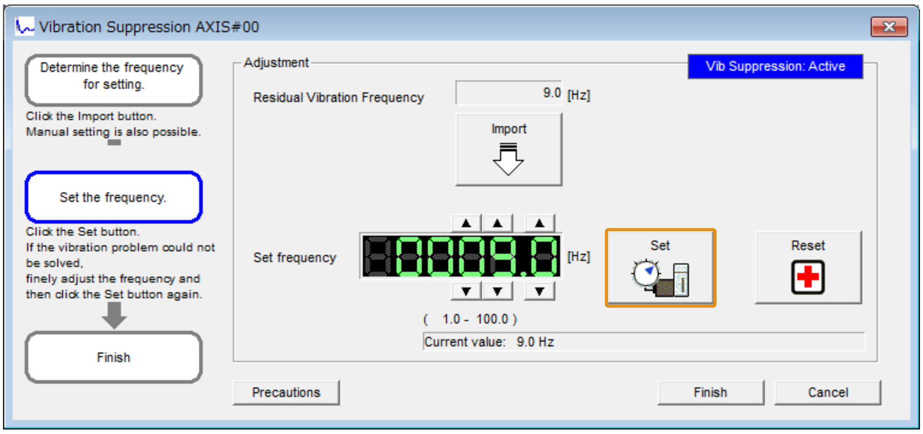
When you click the [Import] button, the residual vibration frequency in the servomotor is read as the set frequency. (The frequency can be read only when the residual vibration frequency is between 1.0 and 100.0.)

> **Important**
>
> 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.

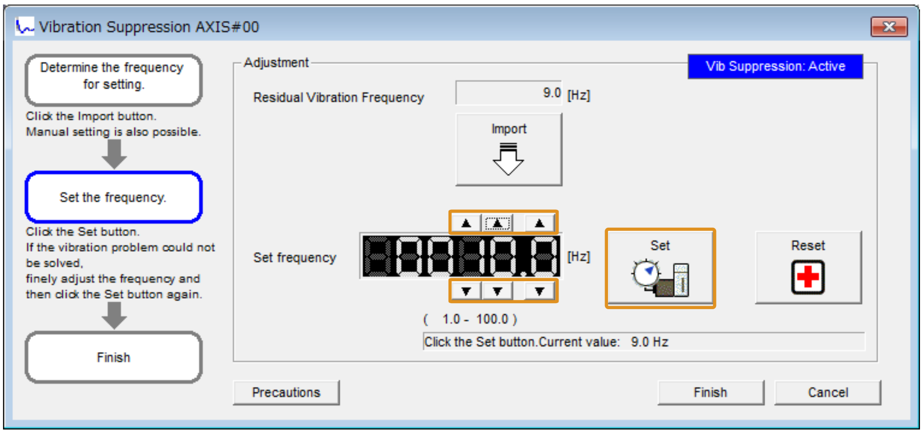


4. **Click the [Set] button.**

> **Important**
>
> 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.



If the vibration is not eliminated, use the [▲] and [▼] buttons for the set frequency to fine-tune the value and click the [Set] button again.



Click the [Reset] button during tuning 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.

> **Important**
> Vibration suppression will be enabled in step 5. The motor response, however, will change when the servomotor comes to a stop with no reference input.

This concludes the procedure to set up vibration suppression.

8.11.5 Setting Combined Functions

You can also use the feedforward function when you execute vibration suppression.

In the default settings, Pn109 (Feedforward), the speed feedforward input, and the torque feedforward input are disabled.

To use the speed feedforward input, the torque feedforward input, 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).

Pn140	n.X□□□	Speed Feedforward (VFF)/Torque Feedforward (TFF) Selection (Speed, Pos, Trq)		When Enabled
		0 [Default]	Do not use model following control and speed/torque feedforward together.	Immediately
		1	Use model following control and speed/torque feedforward together.	

For information on the torque feedforward input (TFF) and the speed feedforward input (VFF), refer to the following manual that corresponds to the communications references being used.

Σ-7/Σ-X-Series MECHATROLINK-4 Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800002 32)

Σ-7/Σ-X-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

Important

When model following control is used with this 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 or torque feedforward input from the host controller. However, model following control can be used with the speed feedforward input or torque feedforward input if required. An unsuitable feedforward input may result in overshooting.

8.11.6 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 Gain 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.

8.12 Speed Ripple Compensation

This section describes speed ripple compensation.

8.12.1 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. You do not need to perform any setup procedures to enable this function when a Σ-X-series rotary servomotor is connected to the SERVOPACK. If any other servomotor is connected to the SERVOPACK, perform the setup procedure with [Ripple Compensation] in the SigmaWin+.

⚠ WARNING

Speed ripple compensation setup is a tuning function that actually drives the machine and therefore presents hazards. Observe the following precautions.

- **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.**

Important

Execute this function only after adjusting the gains.
- If the servomotor or SERVOPACK is replaced after this function is set up in the SigmaWin+, set up this function again.
- Execute speed ripple compensation after jogging to a position that ensures a suitable range of motion.

8.12.2 Speed Ripple Compensation when a Rotary Servomotor Is Connected

The following two methods are available to enable speed ripple compensation when a rotary servomotor is connected.

- Using the default adjustment value saved to the servomotor
- Using the user adjustment value set up with the SigmaWin+

(1) Using the Default Adjustment Value

This function enables speed ripple compensation by using the default adjustment value that is saved to the servomotor when shipped from the factory.

When a servomotor that supports the default adjustment value is connected to the SERVOPACK, this function can be enabled without performing any setup procedures with the SigmaWin+.

Pn423	n.□□□X	Speed Ripple Compensation Function Selection (Speed, Pos, Trq)		When Enabled
		0	Do not execute speed ripple compensation.	Immediately
		1	Execute speed ripple compensation using the value adjusted by the user.	
		2 (Default)	Execute speed ripple compensation using the default adjustment value.	

Information

When a servomotor that does not support the default adjustment value is connected to the SERVOPACK, this function will not be enabled even if Pn423 is set to n.□□□2 (execute speed ripple compensation using the default adjustment value).

If the servomotor is replaced when Pn423 is set to n.□□□2 (execute speed ripple compensation using the default adjustment value), the SERVOPACK will execute this function using the default adjustment value of the servomotor that was newly connected. As a result, A.942 (Speed Ripple Compensation Information Disagreement) will not occur.

(a) Restrictions

Only Σ-X-series rotary servomotors support the default adjustment value.

(b) Operating Procedure

Speed ripple compensation is enabled simply by connecting a servomotor that supports the default adjustment value.

This is because the default setting of the SERVOPACK is Pn423 = n.□□□2 (execute speed ripple compensation using the default adjustment value).

(2) Using the User Adjustment Value Set Up with the SigmaWin+

Speed ripple information analyzed in the SigmaWin+ can be saved to the SERVOPACK as the user adjustment value and used for speed ripple compensation.

Set up this function in the SigmaWin+ when you connect a servomotor that does not support the default adjustment value.

Information The default adjustment value saved to the servomotor and the user adjustment value set up in the SigmaWin+ are saved to separate locations in memory.

This allows you to switch between the default adjustment value and user adjustment value. The previous adjustment value will not disappear.

(a) Restrictions

The following restrictions apply to the setup for speed ripple compensation when a rotary servomotor is connected.

◆ 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
- Equipment that is affected by other axes (e.g., gantry equipment)

◆ Preparations

Always check the following before you set up speed ripple compensation.

- The main circuit power 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.
- There must be no impact from other axes.

(b) Applicable Tools

The following table lists the tools that you can set up speed ripple compensation.

Tool	Fn No./Function Name	Reference
Digital Operator	You cannot set up speed ripple compensation from the Digital Operator.	
SigmaWin+	[Diagnostic] - [Ripple Compensation]	☞ *(c) Operating Procedure on page 388*

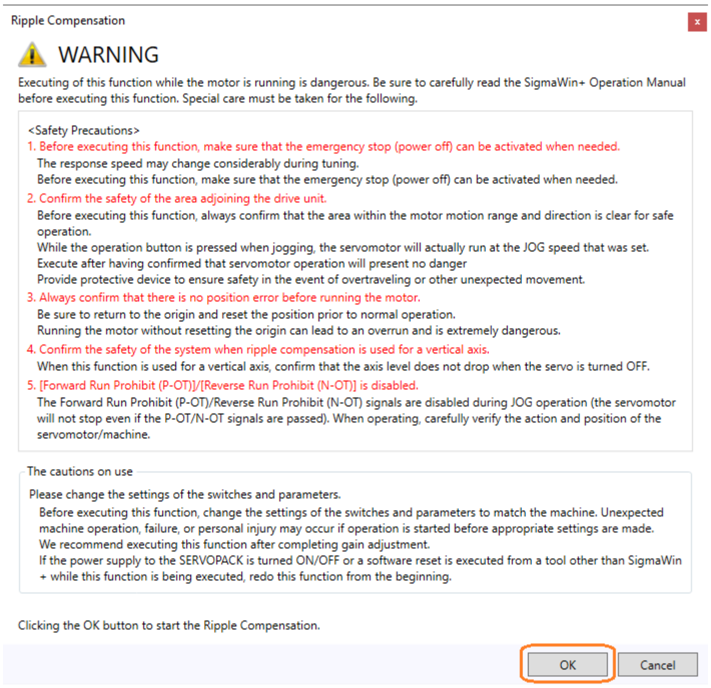
(c) Operating Procedure

Use the following procedure to set up speed ripple compensation.

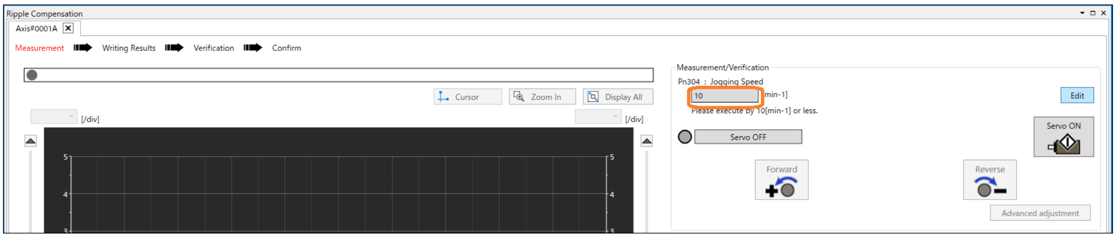
1. **Click the [] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**
2. **Select [Ripple Compensation] in the [Menu] dialog box.**

   The [Ripple Compensation] dialog box will be displayed.

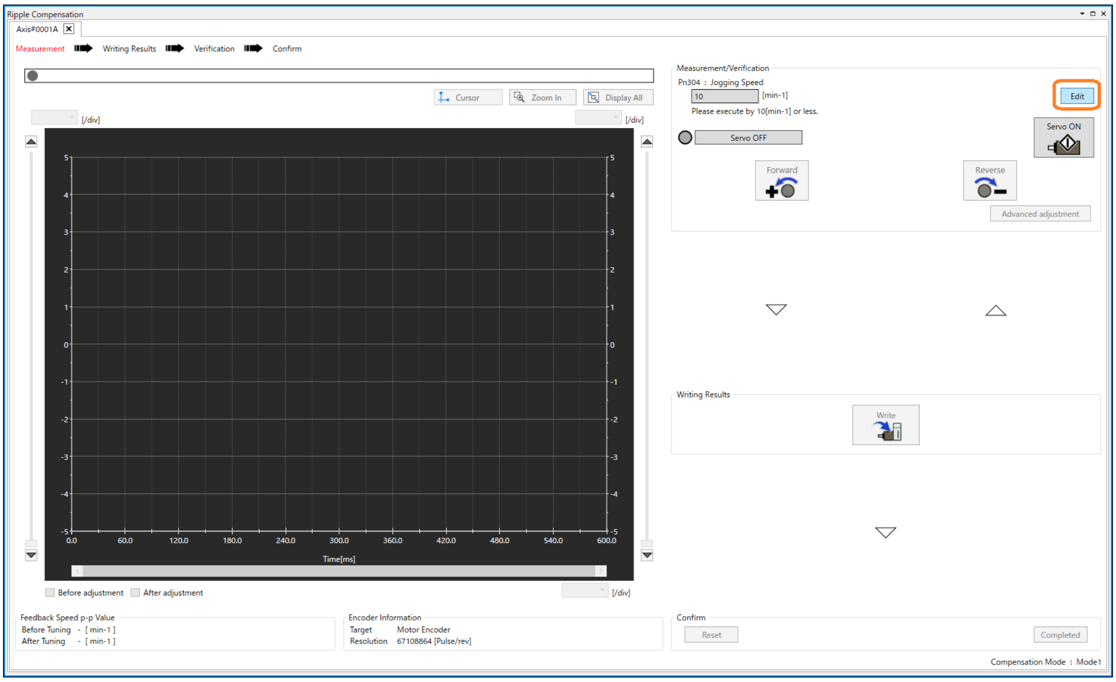
3. **Read the warnings and then click the [OK] button.**



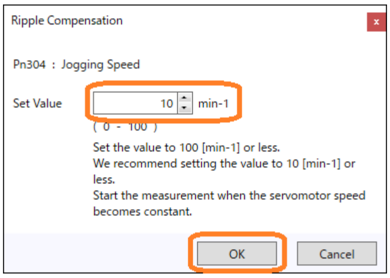
A jogging speed for the speed ripple measurement will be automatically set.



4. **Check the jogging speed. If the jogging speed that was set is OK, proceed to step 6. To change the jogging speed, click the [Edit] button.**

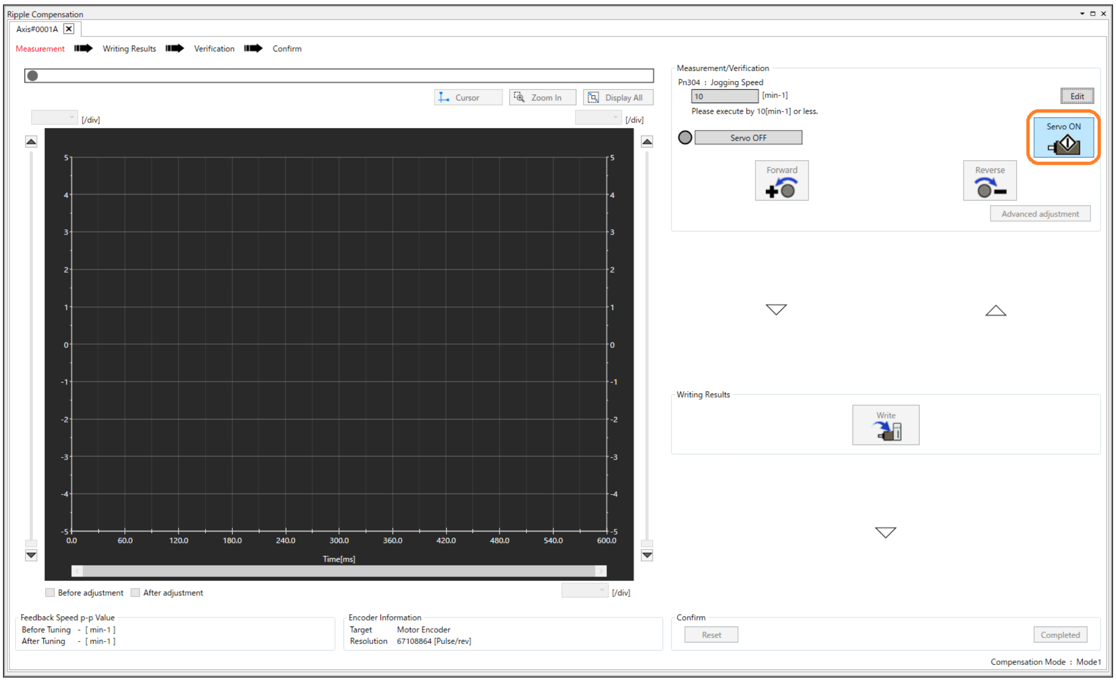


5. **Enter the jogging speed in [Set Value] and click the [OK] button.**

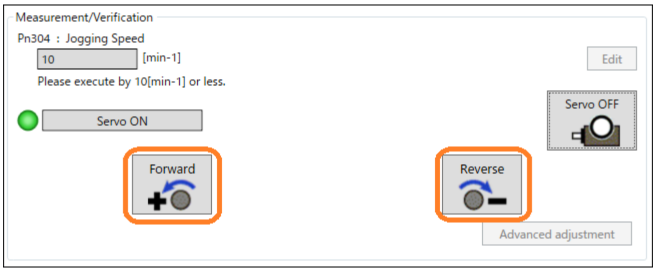


The Main Window will return.

6. **Confirm safety around moving parts and click the [Servo ON] button.**



7. **Click and hold the [Forward] button or the [Reverse] button.**

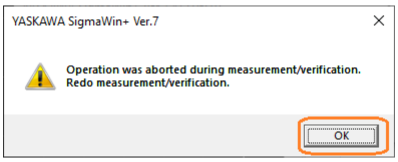


The servomotor shaft will rotate at the preset jogging speed while you hold down the [Forward] or [Reverse] button and the speed ripple will be measured.

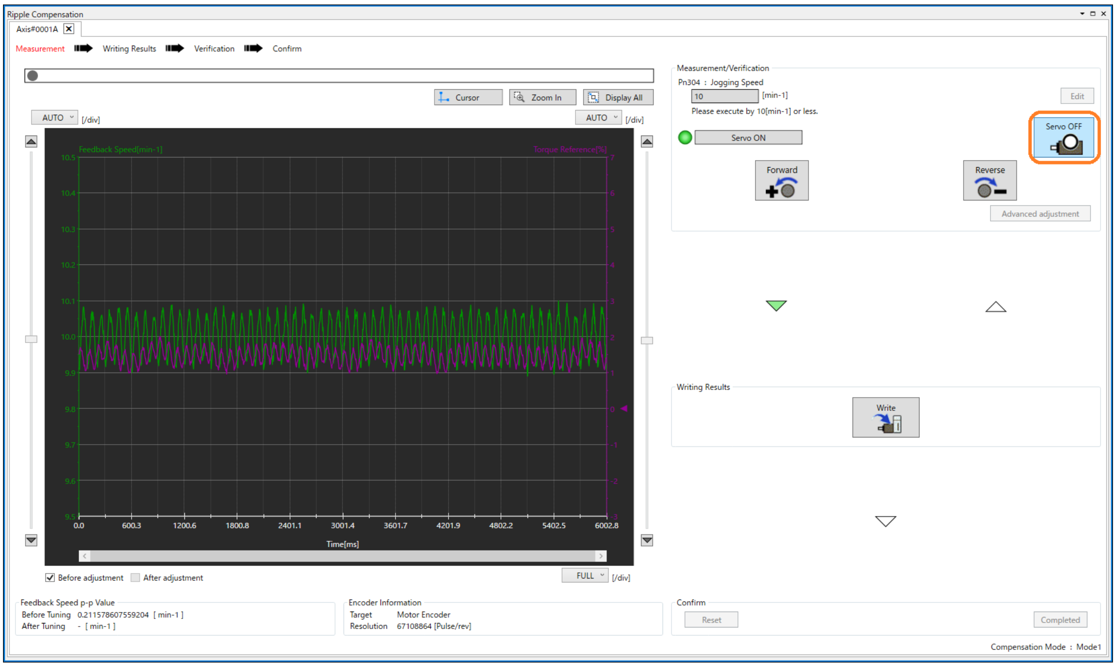
After the speed ripple measurement has completed, the feedback speed and torque reference waveform during jogging will be displayed in the graph area.

Information If you stop pressing the [Forward] button or the [Reverse] button before the measurement has completed, the following message dialog box will be displayed.

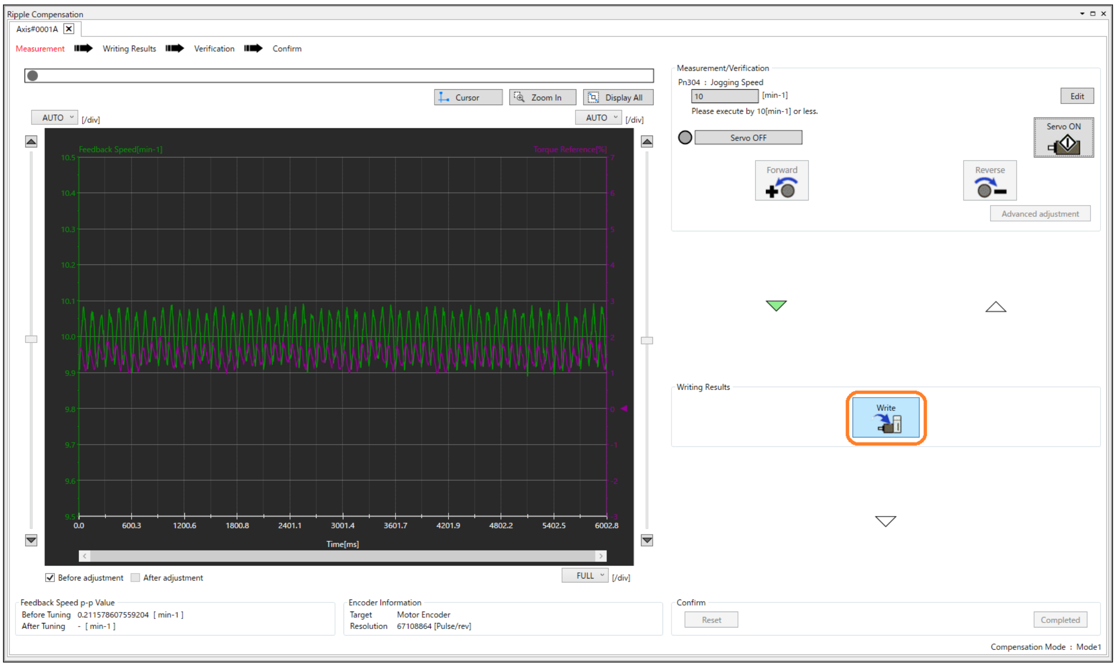
Click the [OK] button and repeat the measurement.



8. **After speed ripple measurement has been completed, click the [Servo OFF] button.**

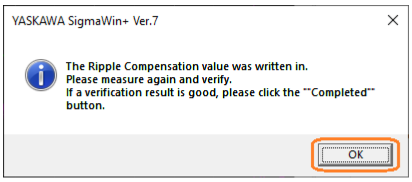


9. **Click the [Write] button.**

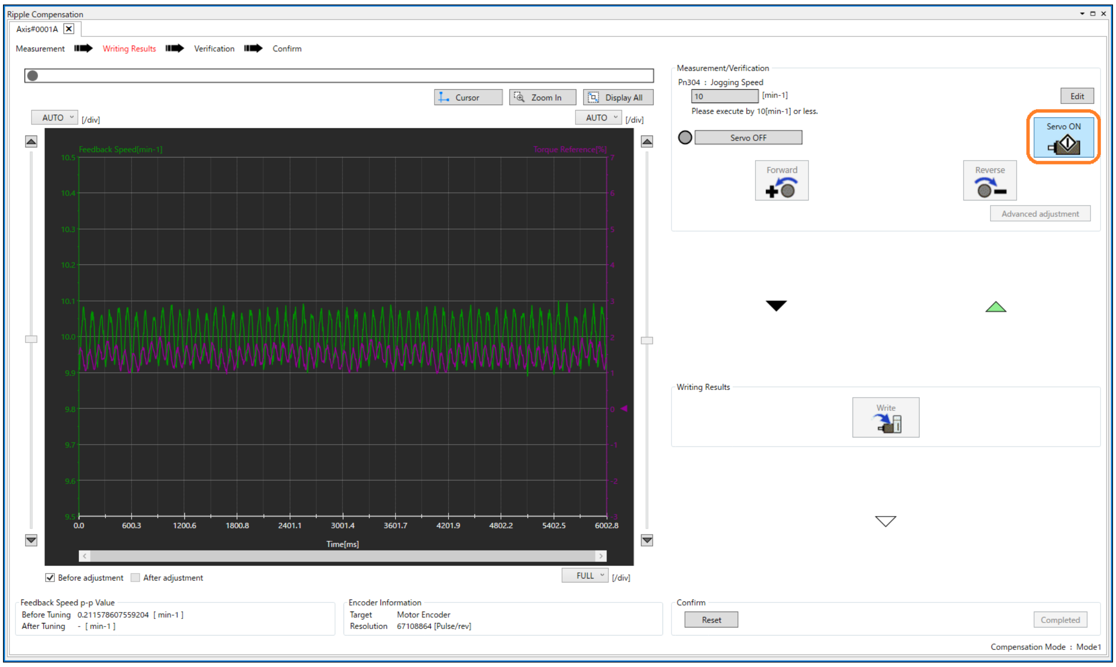


The ripple compensation value will be written to the SERVOPACK.

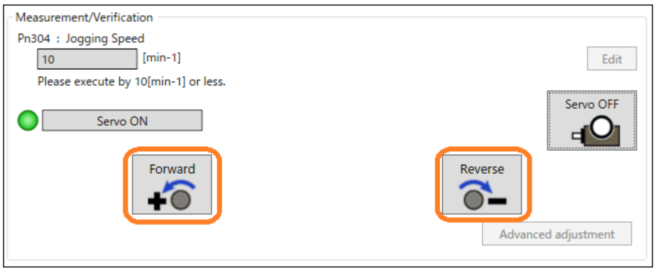
10. **After writing has been completed, click the [OK] button.**



11. **Click the [Servo ON] button.**



12. **Click and hold the [Forward] button or the [Reverse] button.**



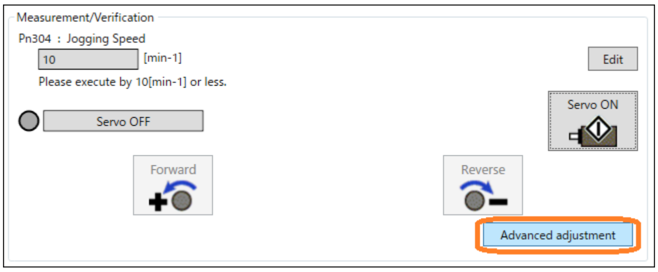
The servomotor shaft will rotate at the preset jogging speed while you hold down the [Forward] or [Reverse] button and the speed ripple will be measured.

The waveform during verification operation with speed ripple compensation applied to it will be displayed overlapping in the graph area.

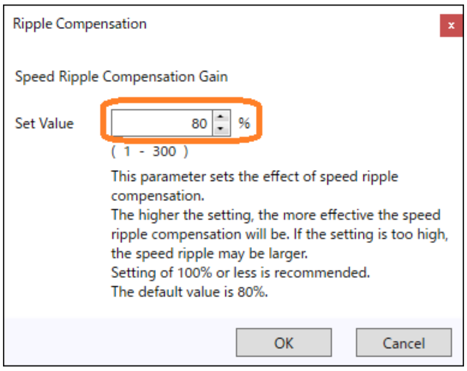
13. **If you obtained satisfactory results in the verification of speed ripple compensation, first click the [Servo OFF] button, and then click the [Completed] button.**

The tuning results will be set for the parameters and the [Ripple Compensation] window will close.

Information
- To increase the effect of the speed ripple compensation, click the [Advanced adjustment] button. You can change the speed ripple compensation gain.



We recommend setting the speed ripple compensation gain to 100% or less because speed ripple may grow larger if the gain setting is too high.



- To discard the setup results and perform setup again, click the [Reset] button and redo the measurement from step 3.

This concludes the setup for speed ripple compensation.

8.12.3 Speed Ripple Compensation when a Linear Servomotor Is Connected

When a linear servomotor is connected to the SERVOPACK, you must complete the setup procedure in the SigmaWin+ to enable speed ripple compensation.

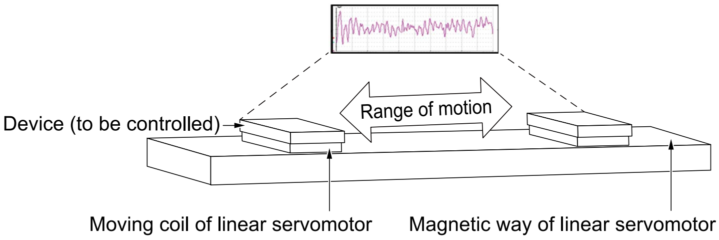
Set the range of motion (start point and end point) with the setup procedure in the SigmaWin+. Speed ripple compensation is enabled in this range of motion.

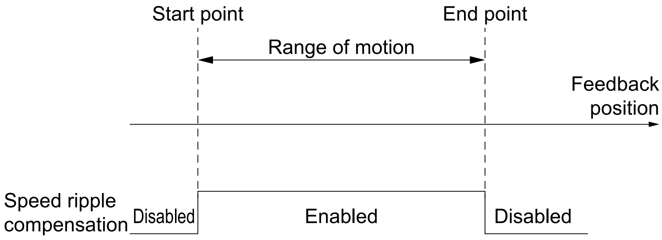
Important
- This function is enabled in the range of motion set during the setup procedure. Speed ripple may increase outside the range of motion.
- If the speed ripple measurement range exceeds 2.5 m, the compensation effect may diminish. If the effect is insufficient, make the speed ripple measurement range narrower.

The timing at which speed ripple compensation is enabled depends on your encoder.

Type of Encoder		When Speed Ripple Compensation Is Enabled
Absolute linear encoder		After power ON
Incremental linear encoder	One of the following: • Multiple Origin Signal (Ref) outputs in range of motion • No Origin Signal (Ref) outputs in range of motion	After power ON
	Only one Origin Signal (Ref) outputs in range of motion	After power ON and after Origin Signal (Ref) is detected

The speed ripple is compensated based on the speed ripple information in the set range of motion.





(1) Restrictions

The following restrictions apply to the setup for speed ripple compensation when a linear servomotor is connected.

(a) Systems for Which Adjustments Cannot Be Made Accurately

- Systems for which there is not a suitable range of motion
- Equipment that is affected by other axes (e.g., gantry equipment)

(b) Preparations

Always check the following before you set up speed ripple compensation.

- The main circuit power 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.
- There must be no impact from other axes.

In addition, if you are using an incremental encoder that has one output position for the Origin Signal (Ref), check the following items.

- Speed ripple compensation must not be executed between when the power is turned ON and when the Origin Signal (Ref) is detected.
  When the power is turned ON, execute the origin return operation and confirm that the Speed Ripple Compensation in Progress monitor is ON before starting normal operation.

(2) Applicable Tools

The following table lists the tools that you can set up speed ripple compensation.

Tool	Fn No./Function Name	Reference
Digital Operator	You cannot set up speed ripple compensation from the Digital Operator.	
SigmaWin+	[Diagnostic] - [Ripple Compensation]	☞ *(3) Operating Procedure on page 394*

(3) Operating Procedure

Use the following procedure to set up speed ripple compensation when a linear servomotor is connected.

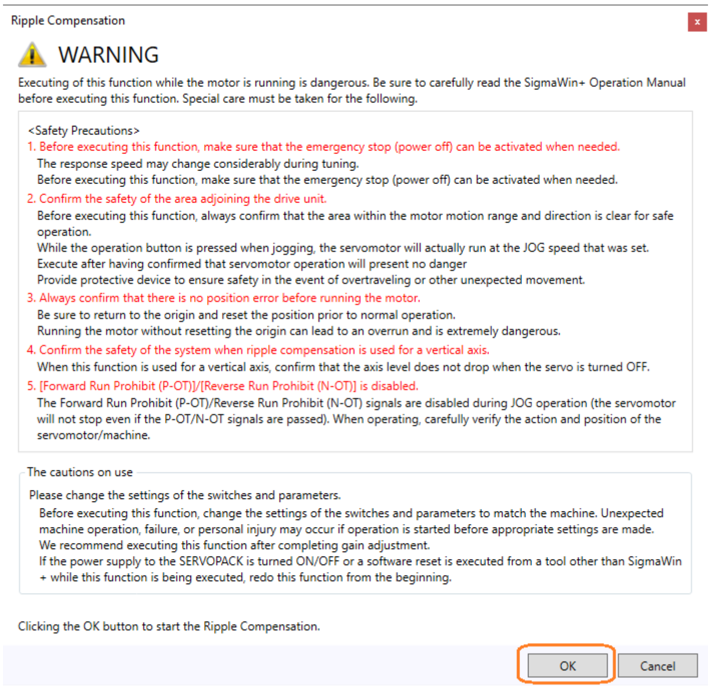
1. Set the range of motion and check operation.
2. Perform measurement operation.
3. Perform verification operation.

(a) Setting the Range of Motion/Checking Operation

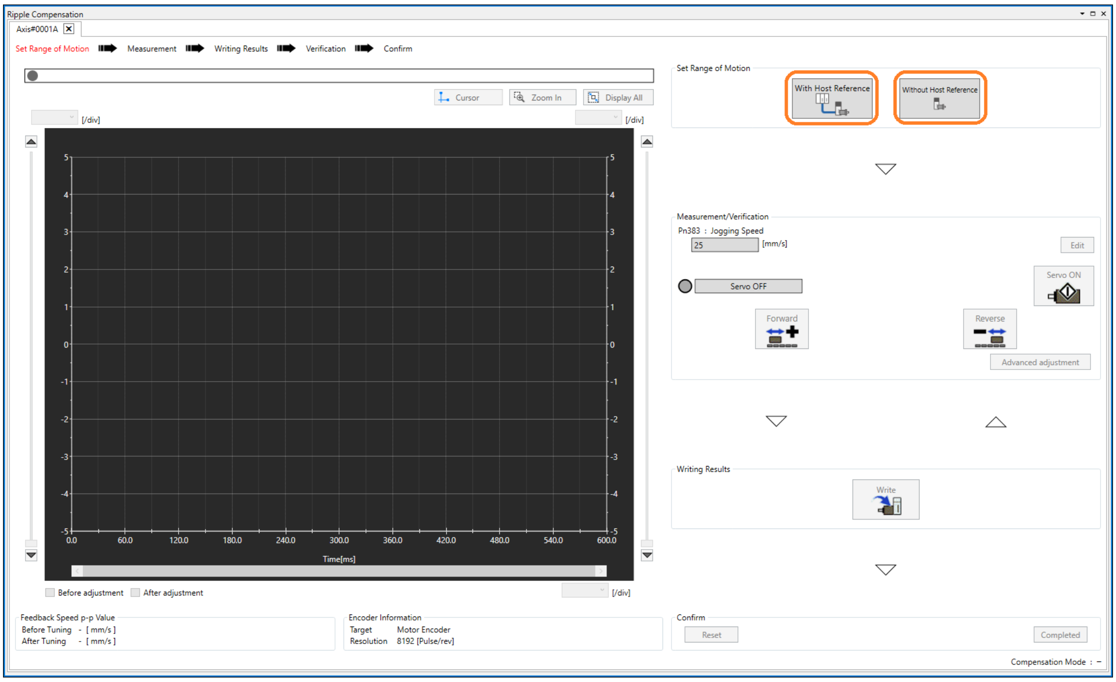
Use the following procedure to set the range of motion and check operation.

1. **Click the [] button for the servo drive 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. **Read the warnings and then click the [OK] button.**

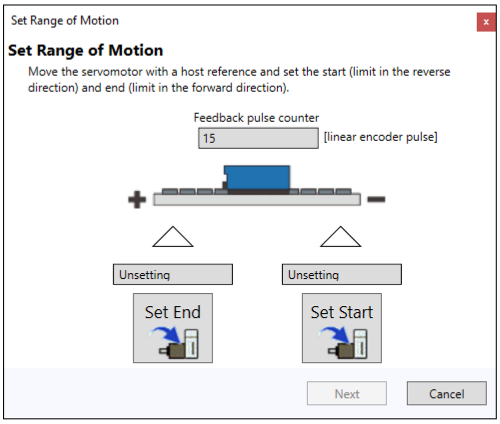


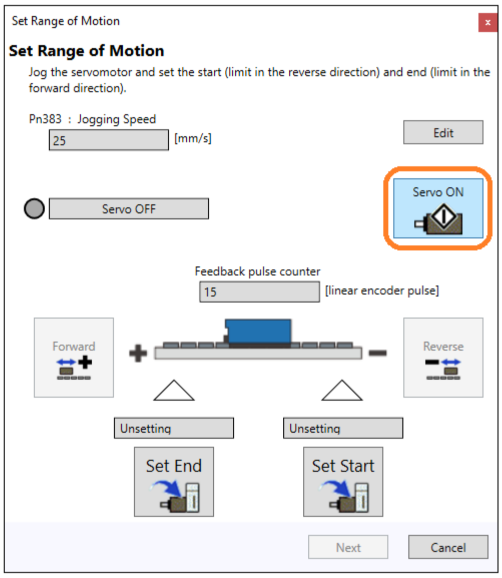
4. **Click one of the following buttons according to the reference method to use when setting the range of motion.**
   - To set the range of motion with a reference from the host controller: Click the [With Host Reference] button.
   - To set the range of motion by jogging: Click the [Without Host Reference] button.



The [Set Range of Motion] window will be displayed.

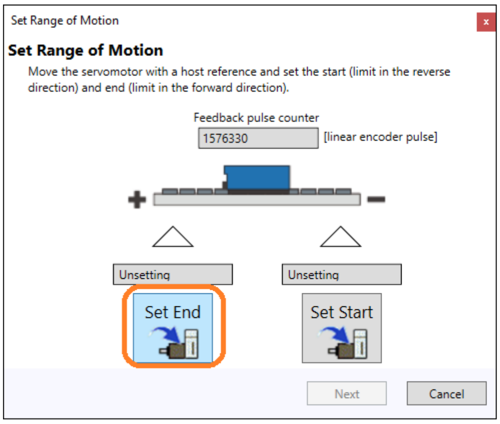
5. **Confirm safety around moving parts and turn ON the servo with one of the following methods according to the reference method.**
   - If [With Host Reference] was selected in step 4: Turn ON the servo from the host controller.
   - If [Without Host Reference] was selected in step 4: Click the [Servo ON] button.

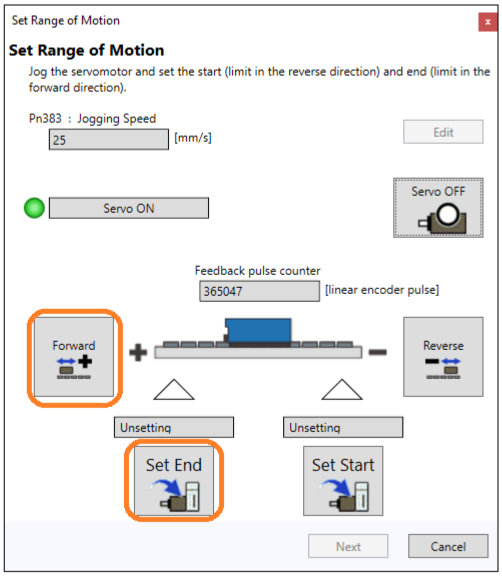




6. **Move the linear servomotor in the forward direction with one of the following methods according to the reference method. Click the [Set End] button when the linear servomotor has moved to the position to set as the end of the range of motion in the forward direction.**
   - If [With Host Reference] was selected in step 4: Move the linear servomotor from the host controller.
   - If [Without Host Reference] was selected in step 4: Click and hold the [Forward] button.

> **Important**
> - Speed ripple may worsen outside the range of motion set during setup.
> - If you are using an incremental encoder that has one output position for the Origin Signal (Ref), set the range of motion so that it includes that output position.
> - Speed ripple may worse if you are using an incremental encoder that has multiple output positions for the Origin Signal (Ref) and the set range of motion includes only one of those output positions. Set the range of motion so that it includes multiple output positions for the Origin Signal (Ref).
> - Set the end point at a sufficient distance from the limit switch to prevent overtravel for occurring.



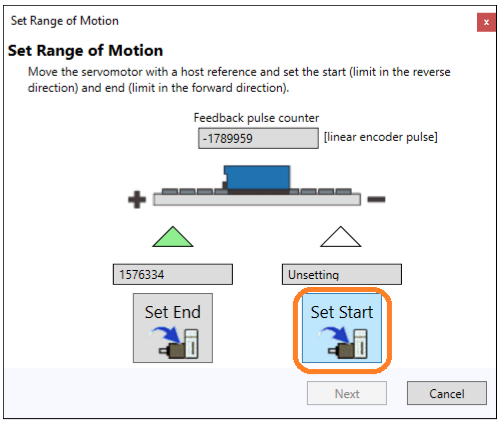


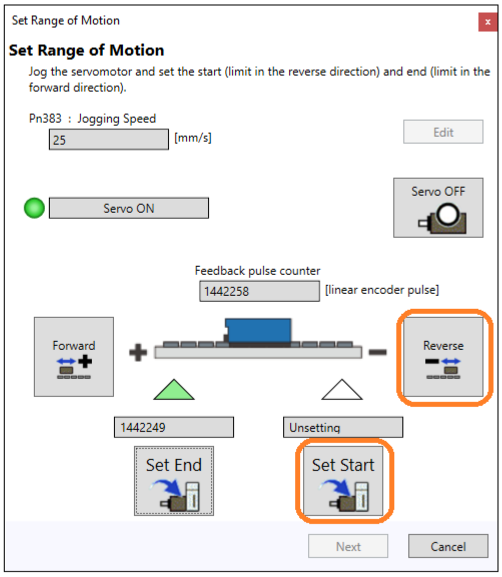
7. **Move the linear servomotor in the reverse direction with one of the following methods according to the reference method. Click the [Set Start] button when the linear**

servomotor has moved to the position to set as the end of the range of motion in the reverse direction.

- If [With Host Reference] was selected in step 4: Move the linear servomotor from the host controller.
- If [Without Host Reference] was selected in step 4: Click and hold the [Reverse] button.

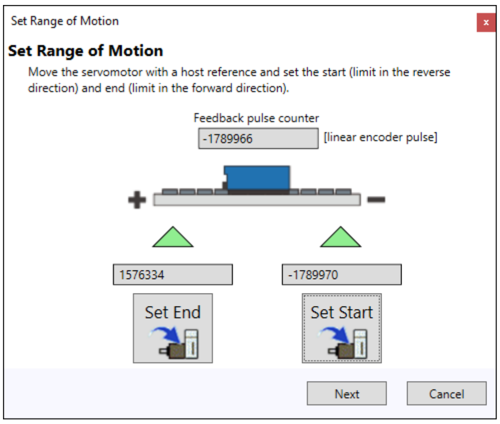
> Important
>
> - Speed ripple may worsen outside the range of motion set during setup.
> - If you are using an incremental encoder that has one output position for the Origin Signal (Ref), set the range of motion so that it includes that output position.
> - Speed ripple may worse if you are using an incremental encoder that has multiple output positions for the Origin Signal (Ref) and the set range of motion includes only one of those output positions. Set the range of motion so that it includes multiple output positions for the Origin Signal (Ref).
> - Set the end point at a sufficient distance from the limit switch to prevent overtravel for occurring.

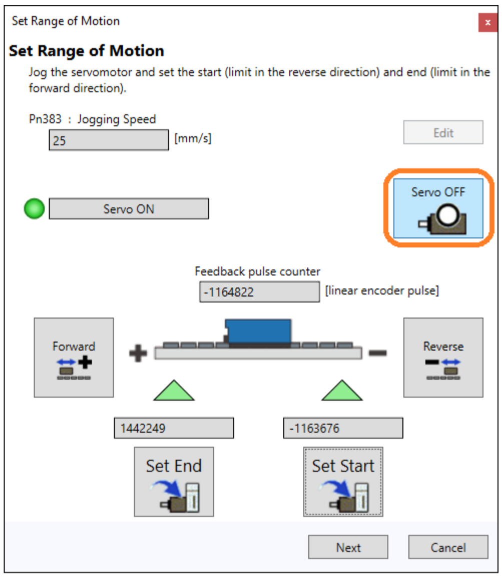




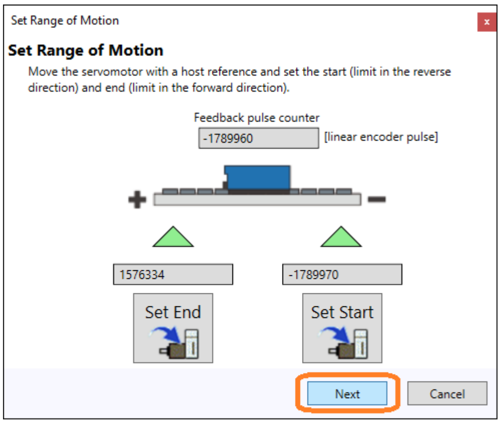
8. **Turn OFF the servo with one of the following methods according to the reference method.**

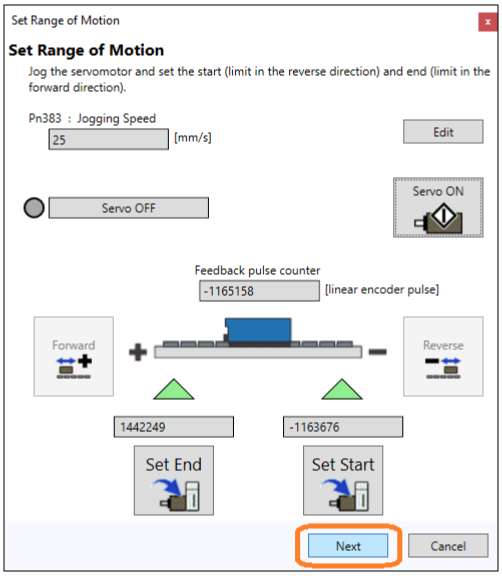
- If [With Host Reference] was selected in step 4: Turn OFF the servo from the host controller.
- If [Without Host Reference] was selected in step 4: Click the [Servo OFF] button.



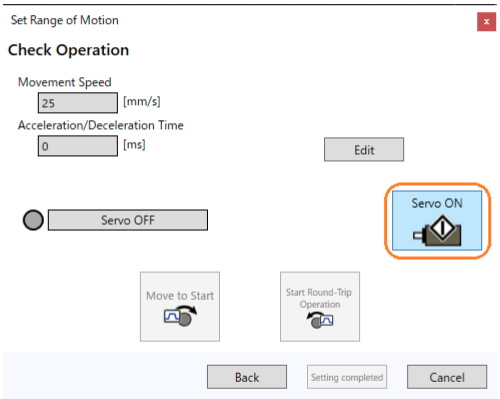


9. **Click the [Next] button.**

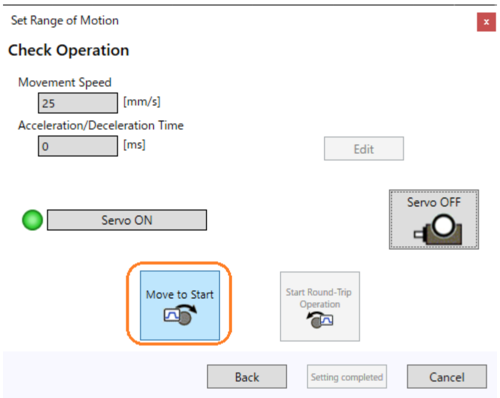




10. **Perform trial operation to check for problems in the range of motion that was set. Confirm safety around moving parts and click the [Servo ON] button.**

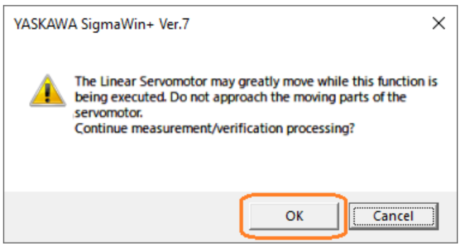


11. **Click the [Move to Start] button.**



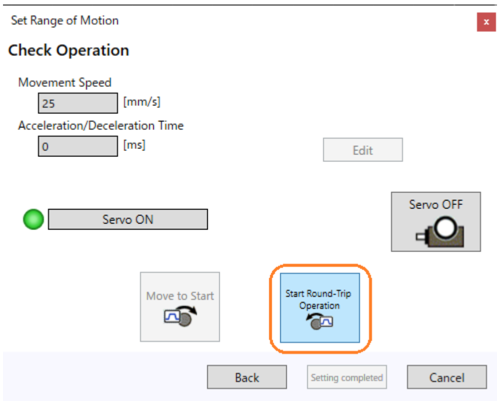
The message dialog box will be displayed.

12. **Confirm the contents of the message and click the [OK] button.**



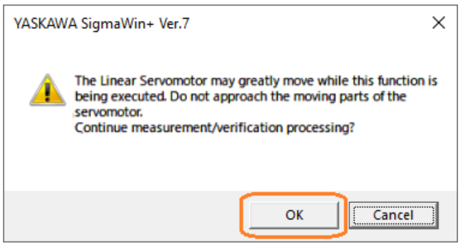
The linear servomotor will move to the start point that was set.

13. **Click the [Start Round-Trip Operation] button.**



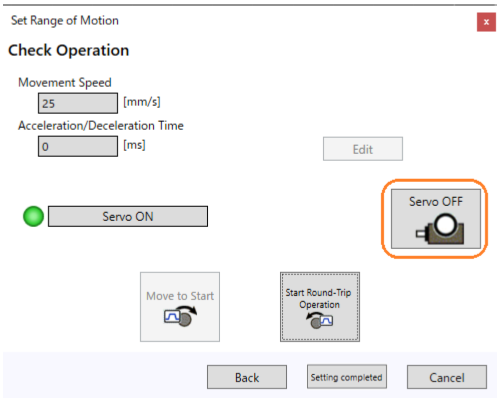
The message dialog box will be displayed.

14. **Confirm the contents of the message and click the [OK] button.**

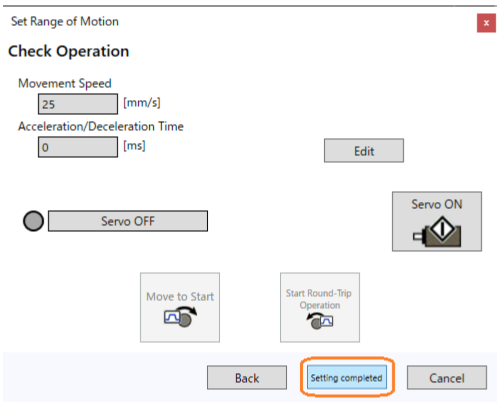


The linear servomotor will perform round-trip operation in the range of motion that was set.

15. **Click the [Servo OFF] button.**

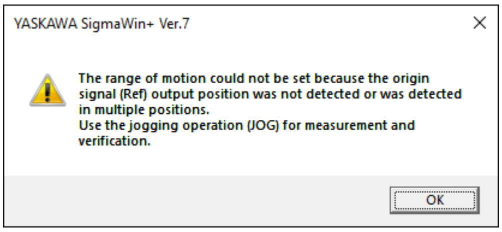


16. **Click the [Setting completed] button.**



The [Ripple Compensation] window will return.

Information Click the [Setting completed] button and the following message dialog box may be displayed.



This dialog box will be displayed in the following cases.

• Output of the Origin Signal (Ref) cannot be confirmed when using an increment encoder

• Multiple output positions of Origin Signal (Ref) were confirmed

When this dialog box is displayed, you must measure and verify the range of motion by jogging the servomotor. The operating procedure is the same as starting from step 4 in the operating procedure for speed ripple compensation when a rotary servomotor is connected. Refer to the following section and complete the procedure.

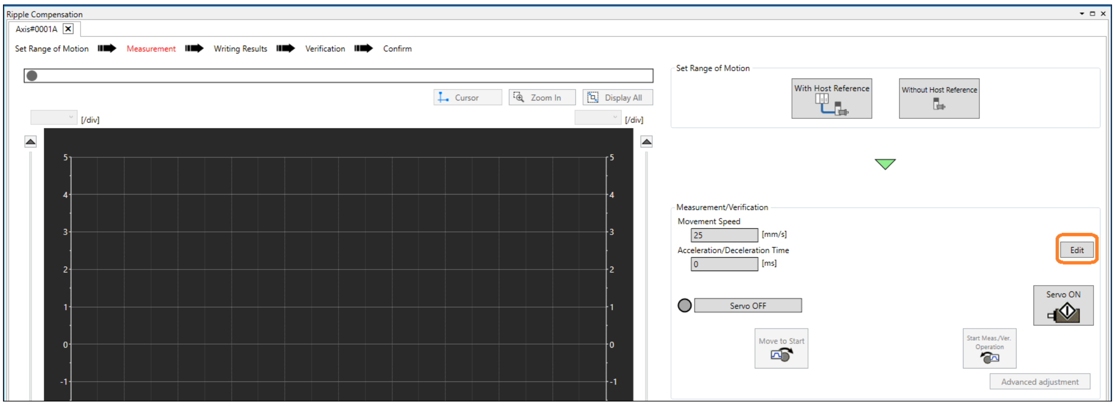
☞ *(c) Operating Procedure on page 388*

This concludes the procedure to set the range of motion and check operation.

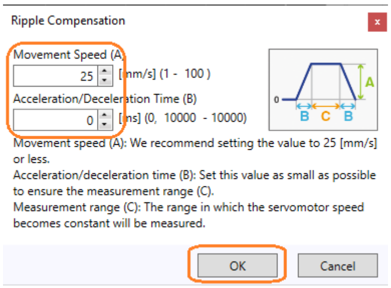
(b) Measurement Operation

Use the following procedure to perform measurement operation.

1. **Check the values for travel speed and acceleration/deceleration time. If you will not change the values, proceed to step 3. To change the travel speed and acceleration/ deceleration time, click the [Edit] button.**

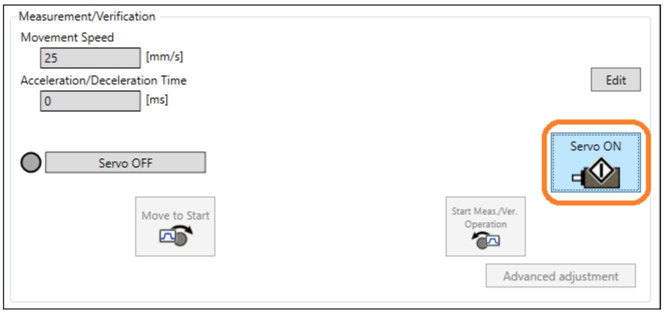


2. **Enter the operating conditions in [Movement Speed (A)] and [Acceleration/Deceleration Time (B)], and then click the [OK] button.**

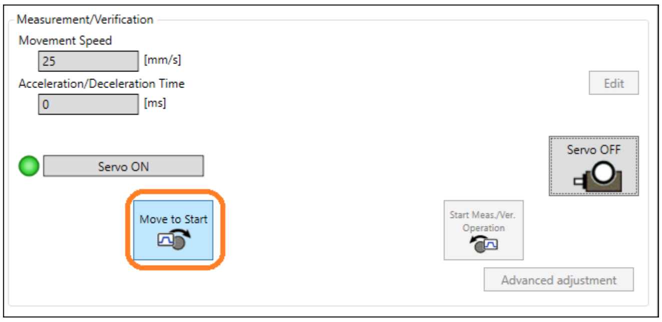


The Main Window will return.

3. **Confirm safety around moving parts and click the [Servo ON] button.**

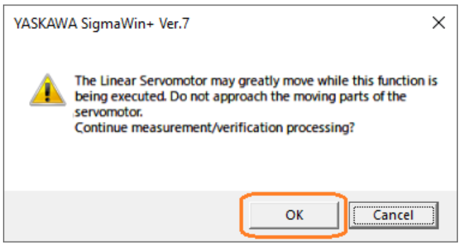


4. **Click the [Move to Start] button.**



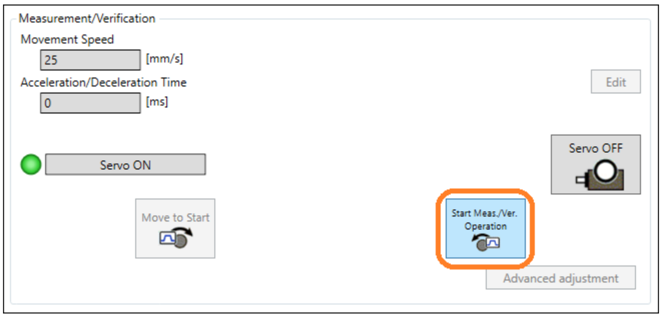
The message dialog box will be displayed.

5. **Confirm the contents of the message and click the [OK] button.**



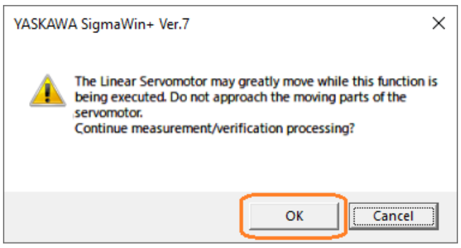
The linear servomotor will move to the start point that was set.

6. **Click the [Start Meas./Ver. Operation] button.**



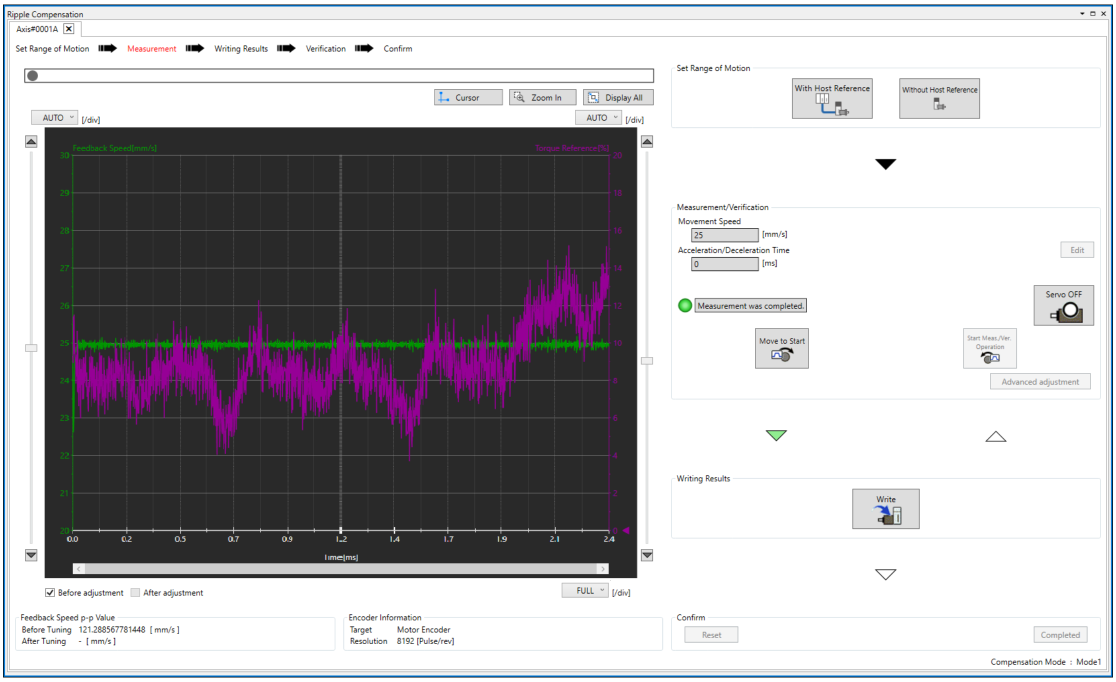
The message dialog box will be displayed.

7. **Confirm the contents of the message and click the [OK] button.**

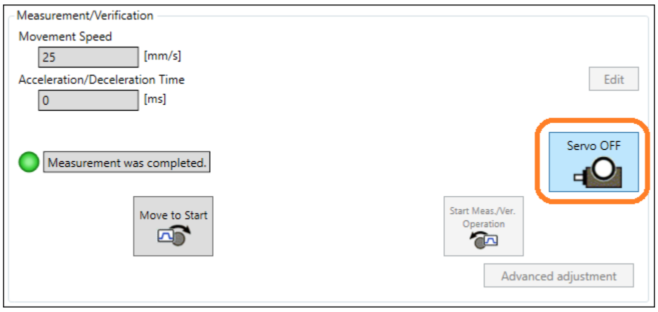


The linear servomotor will move to the end point that was set and speed ripple will be measured.

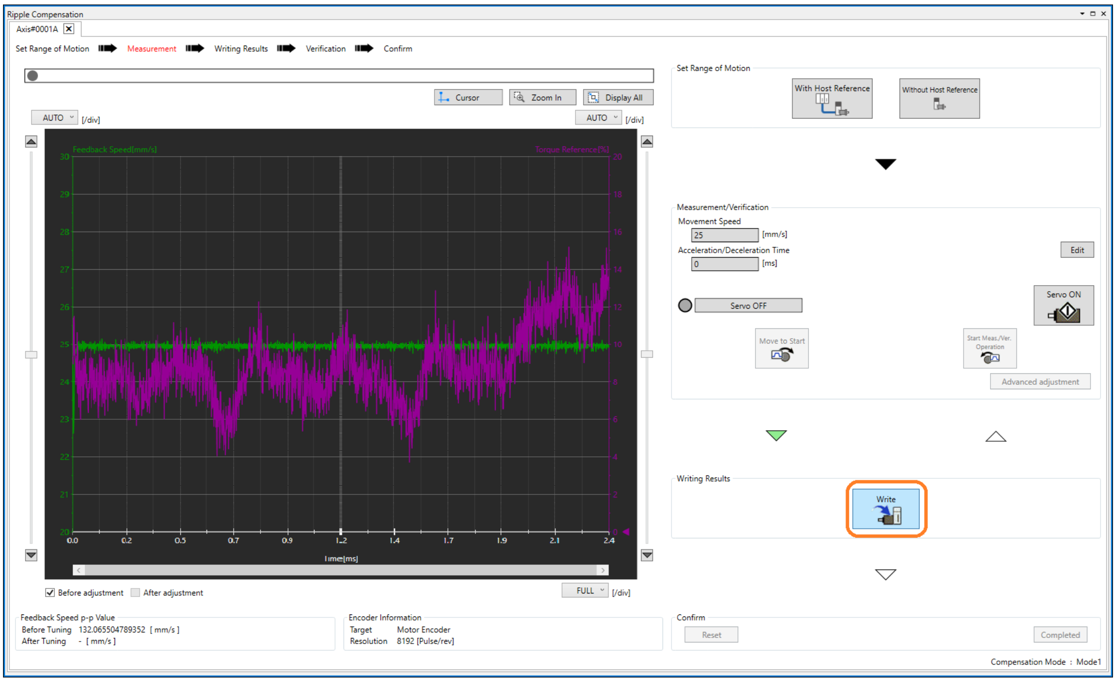
After the speed ripple measurement has completed, the feedback speed and torque reference waveform during measurement operation will be displayed in the graph area.



8. **After speed ripple measurement has been completed, click the [Servo OFF] button.**

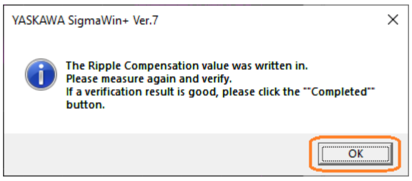


9. **Click the [Write] button.**



The ripple compensation value will be written to the SERVOPACK.

10. **Click the [OK] button.**

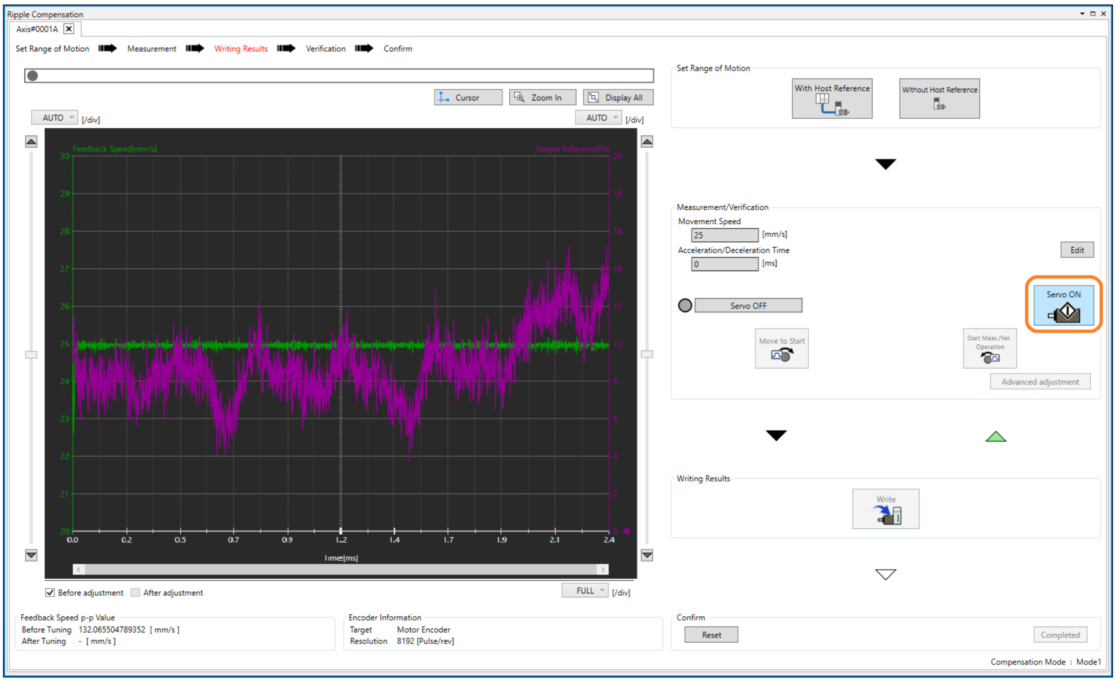


This concludes the measurement operation procedure.

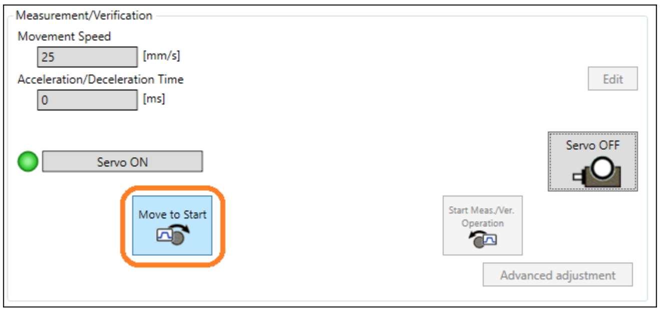
(c) Verification Operation

Use the following procedure to perform verification operation.

1. **Click the [Servo ON] button.**

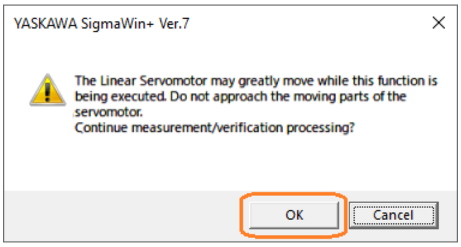


2. **Click the [Move to Start] button.**



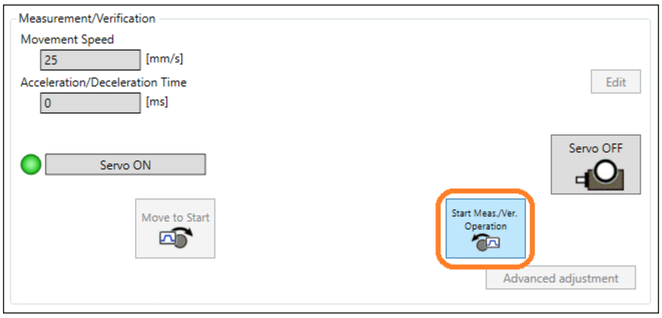
The message dialog box will be displayed.

3. **Confirm the contents of the message and click the [OK] button.**



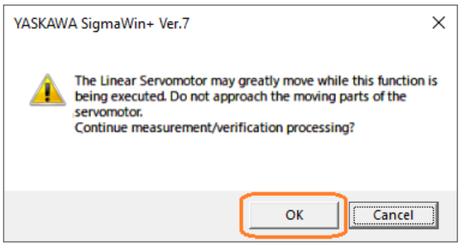
The linear servomotor will move to the start point that was set.

4. **Click the [Start Meas./Ver. Operation] button.**



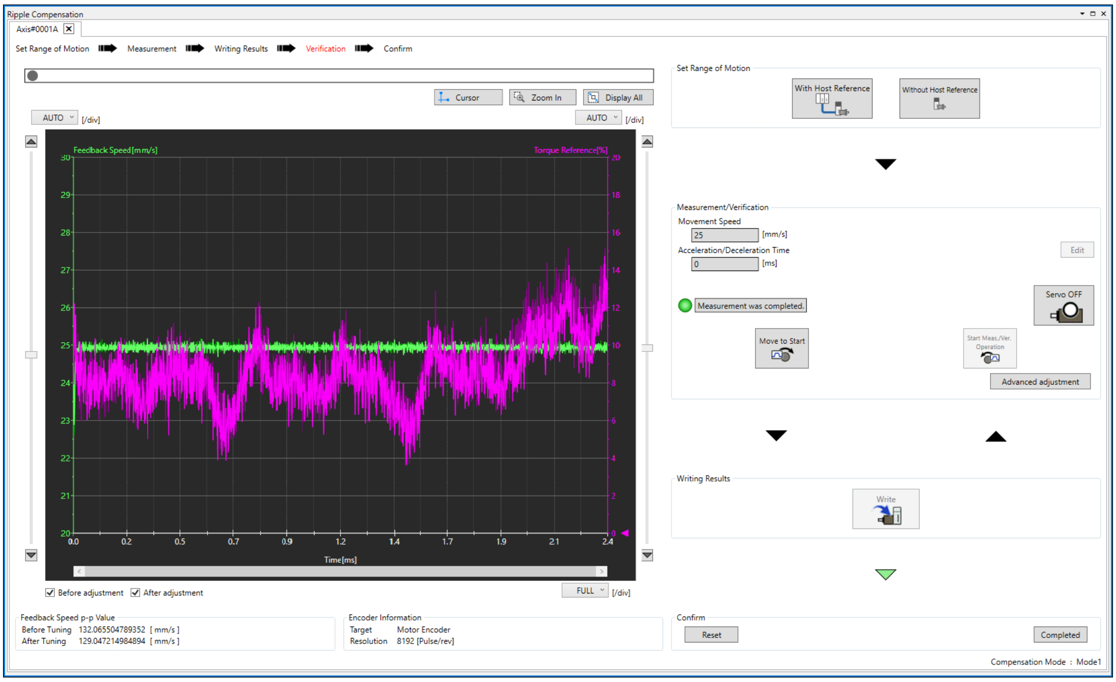
The message dialog box will be displayed.

5. **Confirm the contents of the message and click the [OK] button.**

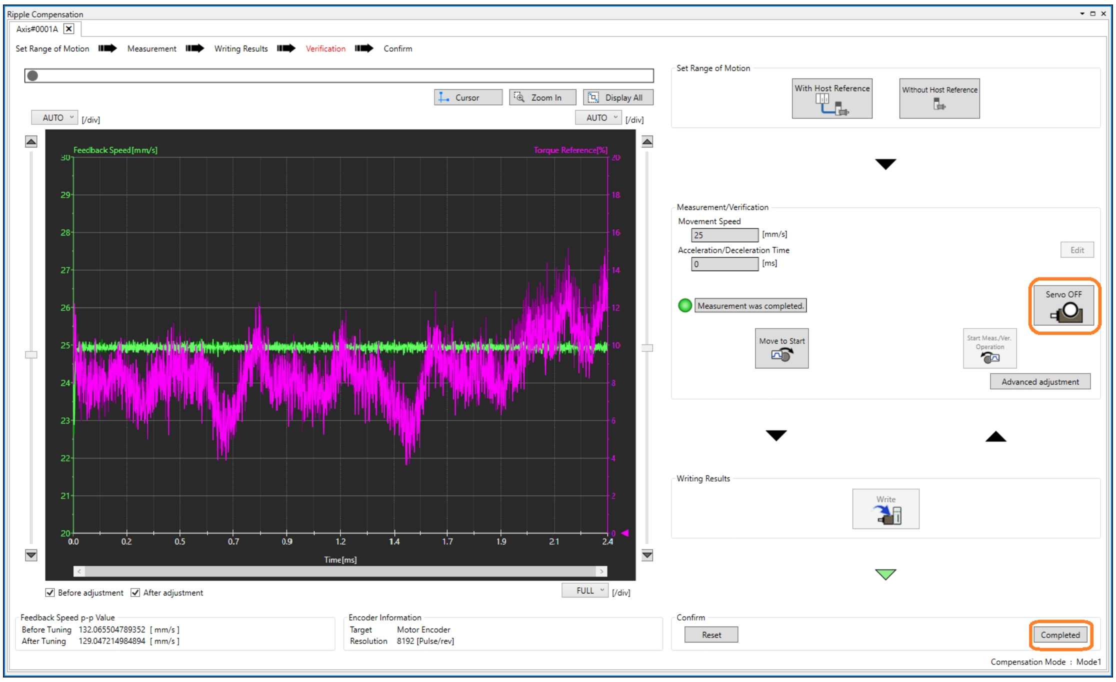


The linear servomotor will move to the end point that was set.

The waveform during verification operation with speed ripple compensation applied to it will be displayed overlapping in the graph area.

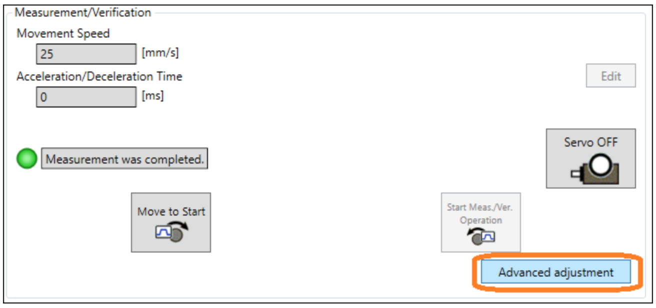


6. **If you obtained satisfactory results in the verification of speed ripple compensation, first click the [Servo OFF] button, and then click the [Completed] button.**

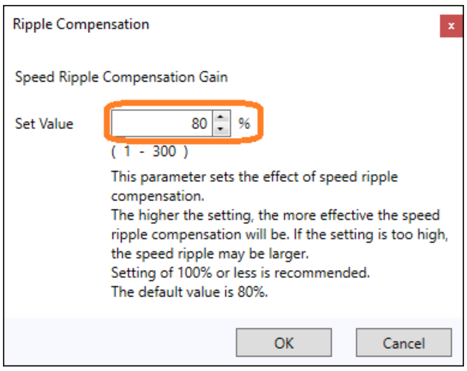


Information

- To increase the effect of the speed ripple compensation, click the [Advanced adjustment] button. You can change the speed ripple compensation gain.



We recommend setting the speed ripple compensation gain to 100% or less because speed ripple may grow larger if the gain setting is too high.



- If there was a problem, click the [Reset] button and redo the settings from "*(a) Setting the Range of Motion/Checking Operation on page 395*".

This concludes the setup for speed ripple compensation.

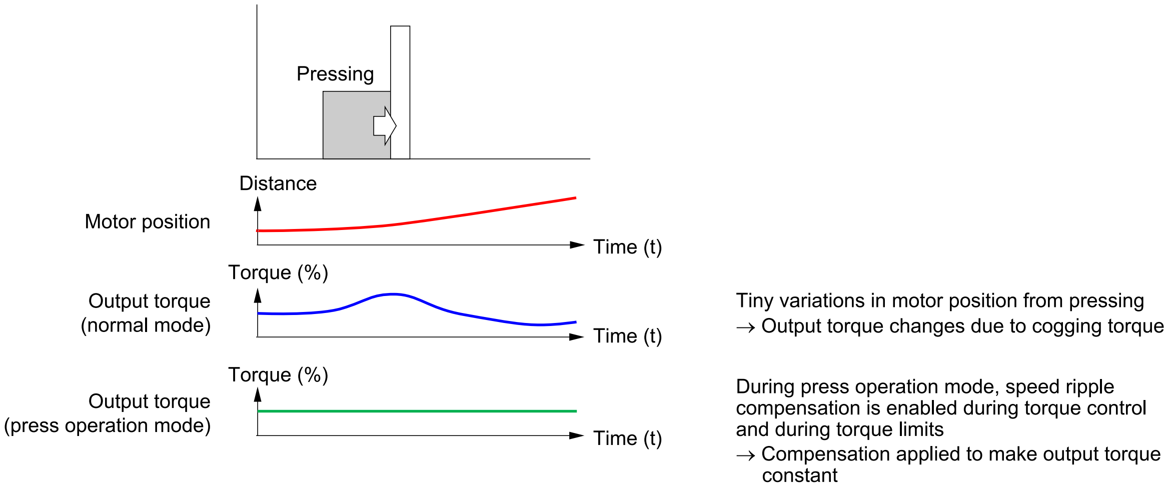
8.12.4 Speed Ripple Compensation during Torque Control Mode and during Torque Limits

Speed ripple compensation during torque control mode and speed ripple compensation during torque limits are disabled by default.

To enable speed ripple compensation during torque control mode and speed ripple compensation during torque limits, use the following procedure to enable press operation mode.

Information During press operation mode, the torque reference monitor and trace waveform may change depending on the speed ripple compensation value, even if a constant torque reference is input.
Even when press operation mode is set, speed ripple will not be compensated in such a way as to exceed the maximum torque that can be output by the servomotor and SERVOPACK.

Pn423	n.X□□□	Speed Ripple Compensation Function Operation Mode Selection Speed Pos Trq		When Enabled
		0 Default	Execute speed ripple compensation in normal mode.	After restart
		1	Execute speed ripple compensation in press operation mode.	
		2	Reserved (Do not use.)	
		3	Reserved (Do not use.)	



(1) Operating Procedure

Use the following procedure to execute speed ripple compensation in press operation mode.

1. **Perform setup for speed ripple compensation.**

   Refer to the following sections for details.

   ☞ *(c) Operating Procedure on page 388*

   ☞ *(3) Operating Procedure on page 394*

2. **Set Pn423 to n.1□□□ (execute speed ripple compensation in press operation mode).**

3. **Turn the power to the SERVOPACK OFF and ON again.**
   Press operation mode will be enabled.

This concludes the procedure to execute speed ripple compensation in press operation mode.

8.12.5 Parameter Settings

The default setting for speed ripple compensation is Pn423 = n.□□□2 (execute speed ripple compensation using the default adjustment value). If you set up the function using the SigmaWin+, Pn423 will be set to n.□□□1 (execute speed ripple compensation using the user adjustment value). To disable speed ripple compensation, set Pn423 to n.□□□0 (disable speed ripple compensation) to disable the function.

Note:

If Easy FFT is enabled, speed ripple compensation will be forcibly disabled.

Pn423	n.□□□X	Speed Ripple Compensation Function Selection (Speed, Pos, Trq)		When Enabled
		0	Do not execute speed ripple compensation.	Immediately
		1	Execute speed ripple compensation using the value adjusted by the user.	
		2 Default	Execute speed ripple compensation using the default adjustment value.	

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 to n.□X□□ (Speed Ripple Compensation Enable Condition Selection) and Pn427 or Pn49F (Speed Ripple Compensation Enable Speed).

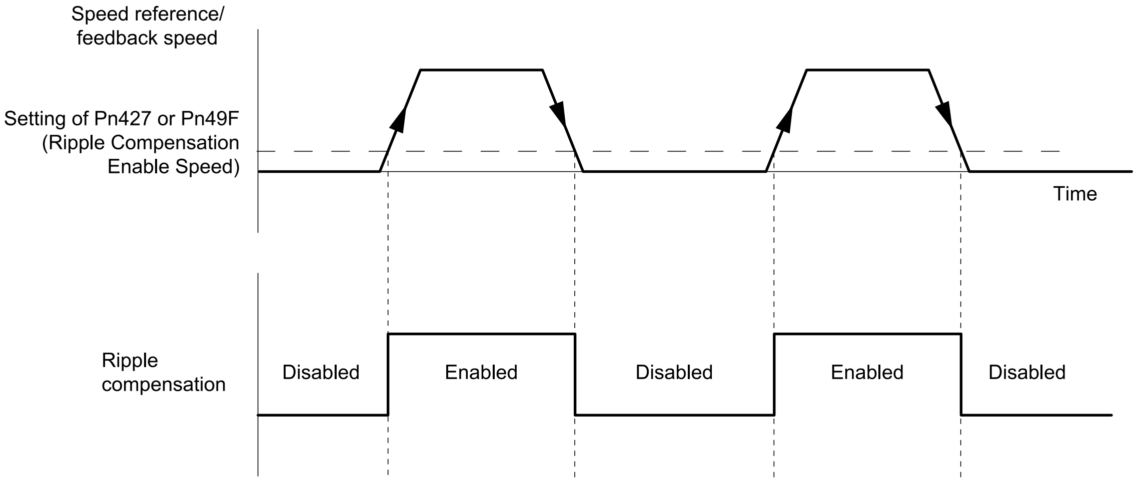
Pn423	n.□X□□	Speed Ripple Compensation Enable Condition Selection (Speed, Pos, Trq)		When Enabled
		0 Default	Speed Reference	After restart
		1	Motor Speed	

- Rotary Servomotors

Pn427	Speed Ripple Compensation Enable Speed (Speed, Pos, Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 10000	1 min^{-1}	0	Immediately

- Linear Servomotors

Pn49F	Speed Ripple Compensation Enable Speed (Linear) (Speed, Pos, Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 10000	1 mm/s	0	Immediately



(1) Speed Ripple Compensation Warnings

The speed ripple compensation value is specific to each servomotor. If you replace the servomotor while speed ripple compensation using the user adjustment value is enabled, A.942 (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+.
- Set Pn423 to n.□□□0 (disable speed ripple compensation).
- Set Pn423 to n.□□□2 (execute speed ripple compensation using the default adjustment value).
- Set Pn423 to n.□□1□ (disable detection of A.942).

Information **Information on A.942 When a Linear Servomotor Is Replaced**

A.942 may not occur when a linear servomotor or a linear encoder is replaced. When these devices are replaced, be sure to set up this function again in the SigmaWin+.

Pn423	n.□□□X	Speed Ripple Compensation Function Selection (Speed Pos Trq)		When Enabled
		0	Do not execute speed ripple compensation.	Immediately
		1	Execute speed ripple compensation using the value adjusted by the user.	
		2 Default	Execute speed ripple compensation using the default adjustment value.	
Pn423	n.□□X□	Speed Ripple Compensation Information Disagreement Warning Detection Selection (Speed Pos Trq)		When Enabled
		0 Default	Detect A.942 alarms.	After restart
		1	Do not detect A.942 alarms.	

(2) Press Operation Mode for Speed Ripple Compensation

To enable speed ripple compensation during torque control mode and during torque limits, set Pn423 to n.1□□□.

Pn423	n.X□□□	Speed Ripple Compensation Function Operation Mode Selection (Speed Pos Trq)		When Enabled
		0 Default	Execute speed ripple compensation in normal mode.	After restart
		1	Execute speed ripple compensation in press operation mode.	
		2	Reserved (Do not use.)	
		3	Reserved (Do not use.)	

8.13 Load Fluctuation Compensation Control

This section describes load fluctuation compensation control.

8.13.1 Outline

Load fluctuation compensation control is used to control fluctuations in response for applications where the load (moment of inertia) fluctuates greatly due to the operating status and posture of the machine, such as robots and transfer equipment.

Load fluctuation compensation control implements operation that suppresses variations in settling time when the load fluctuates ±500% in relation to the set moment of inertia ratio (Pn103) (e.g., if Pn103 is 2000%, between 1500% and 2500%).

This function can be combined with notch filters, anti-resonance control, and model following control.

To use this function, set Pn173 to n.□□□1 (enable load fluctuation compensation control).

Important
- For a machine with low rigidity, such as a machine that vibrates at 100 Hz or less, the variation in settling time may not fall to within 10 ms or less.
- If combined with model following control, overshooting may increase.

8.13.2 Application Restrictions

The restrictions for load fluctuation compensation control are given below.

- Load fluctuation compensation control cannot be used during torque control.
- This function cannot be combined with I-P control or friction compensation.
- Load fluctuation compensation control cannot be used if the encoder resolution is 13 bits or less.

8.13.3 Preparations

Always check the following before you execute load fluctuation compensation control.

- The test without a motor function must be disabled (Pn00C = n.□□□0).
- The tuning-less function must be disabled (Pn170 = n.□□□0).
- The parameters must not be write prohibited.

8.13.4 Required Parameter Settings

The following parameter settings are required to use load fluctuation compensation control.

			Load Fluctuation Compensation Control Selection (Speed Pos Trq)	When Enabled
Pn173	n.□□□X	0 Default	Do not use load fluctuation compensation control.	Immediately
		1	Use load fluctuation compensation control.	

Pn103	Moment of Inertia Ratio (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 65535	1%	100	Immediately

Tuning

8

Pn174	Load Fluctuation Compensation Control Response Level			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	10 to 20000	0.1	400	Immediately

8.13.5 Operating Procedure

Use the following procedure to perform load fluctuation compensation control.

1. **If Pn170 is set to n.□□□1 (enable tuning-less function), change Pn170 to n.□□□0 (disable tuning-less function), and then turn the SERVOPACK power OFF and ON again.**
2. **Set Pn173 to n.□□□1 (use load fluctuation compensation control).**
3. **Execute various operations so the load increases to the maximum and decreases to the minimum and monitor the moment of inertia ratio.**

   You can use the [Operation] monitor in the SigmaWin+ to check the identified moment of inertia ratio. Refer to the following section for details.

   ☞ *9.2.2 Operation Monitor, Status Monitor, and I/O Monitor on page 452*
4. **Identify the minimum and maximum of the moment of inertia ratio, and set the median value of those two to Pn103 (Moment of Inertia Ratio).**

   Note:

   The fluctuation range of the moment of inertia that can be compensated by this function is ±500%.
5. **Input the references for normal operation from the host controller and operate the servomotor.**
6. **While checking the response with the tracing function, increase Pn174 (Load Fluctuation Compensation Control Response Level). If vibration or residual vibration when stopped increases, set and adjust vibration suppression, such as anti-resonance control and the notch filters. If vibration cannot be sufficiently suppressed with the vibration suppression adjustments, lower Pn174 to a level at which vibration can be tolerated, and then end the adjustments.**

This concludes the procedure to set up load fluctuation compensation control.

8.13.6 Parameters Disabled by a Load Fluctuation Compensation Control

When Pn173 is set to n.□□□1 (when load fluctuation compensation control is enabled), the parameters in the following table are disabled.

Parameter Name	Parameter Number
Speed Loop Gain Second Speed Loop Gain	Pn100 Pn104
Speed Loop Integral Time Constant Second Speed Loop Integral Time Constant	Pn101 Pn105
Position Loop Gain Second Position Loop Gain	Pn102 Pn106
Speed Loop Control Method	Pn10B = n.□□X□
Friction Compensation Function Selection	Pn408 = n.X□□□
Gain Switching Selection	Pn139 = n.□□□X

Load fluctuation compensation control is disabled during torque control, EasyFFT, and mechanical analysis for a vertical axis. In addition, Pn100, Pn104, Pn101, Pn105, Pn102, and Pn106 in the above table are enabled for torque control, EasyFFT, and mechanical analysis for a vertical axis. Of these, only Pn100 and Pn104 are enabled for torque control.

8.14 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 *1	☞ 8.14.1 Gain Switching on page 412
Friction Compensation	Position control or speed control	☞ 8.14.2 Friction Compensation on page 416
Gravity Compensation	Position control, speed control, or torque control	☞ 8.14.3 Gravity Compensation on page 417
Output Torque Compensation	Position control, speed control, or torque control	☞ 8.14.4 Output Torque Compensation on page 418
Current Control Mode Selection	Position control, speed control, or torque control	☞ 8.14.5 Current Control Mode Selection on page 419
Current Gain Level Setting	Position control or speed control	☞ 8.14.6 Current Gain Level Setting on page 419
Speed Detection Method Selection	Position control, speed control, or torque control	☞ 8.14.7 Speed Detection Method Selection on page 419
Speed Feedback Filter	Position control or speed control	☞ 8.14.8 Speed Feedback Filter on page 420
Backlash Compensation	Position control	☞ 8.14.9 Backlash Compensation on page 420

*1 Automatic gain switching is enabled only for position control.

8.14.1 Gain Switching

Two gain switching functions are available, manual switching 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.

		Gain Switching Selection (Speed, Pos, Trq)		When Enabled
Pn139	n.□□□X	0 Default	Manual Gain Switching The gain is switched manually with G-SEL in SVCMD_IO.	Immediately
		1	Reserved (Do not use.)	
		2	Use automatic gain switching pattern 1. The gain settings 1 switch automatically to 2 when switching condition A is satisfied. The gain settings 2 switch automatically to 1 when switching condition A is not satisfied.	

Note:
n.□□□1 is a reserved setting. Do not use this setting.

Refer to the following section for gain switching combinations.

☞ *(1) Gain Switching Combinations on page 413*

Refer to the following sections for information on manual and automatic gain switching.

☞ *(2) Manual Gain Switching on page 413*

☞ *(3) Automatic Gain Switching on page 413*

(1) Gain Switching Combinations

Selected Gains	Speed Loop Gain	Speed Loop Integral Time Constant	Position Loop Gain	Torque Reference Filter	Model Following Control Gain	Model Following Control Gain Correction	Friction Compensation Gain
Gain 1	Pn100 (Speed Loop Gain)	Pn101 (Speed Loop Integral Time Constant)	Pn102 (Position Loop Gain)	Pn401 (First Stage First Torque Reference Filter Time Constant)	Pn141 (Model Following Control Gain) *1	Pn142 (Model Following Control Gain Correction) *1	Pn121 (Friction Compensation Gain)
Gain 2	Pn104 (Second Speed Loop Gain)	Pn105 (Second Speed Loop Integral Time Constant)	Pn106 (Second Position Loop Gain)	Pn412 (First Stage Second Torque Reference Filter Time Constant)	Pn148 (Second Model Following Control Gain) *1	Pn149 (Second Model Following Control Gain Correction) *1	Pn122 (Second Friction Compensation Gain)

*1 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.

(2) Manual Gain Switching

With manual gain switching, you use the MECHATROLINK command G-SEL to change between gain 1 and gain 2.

Type	Command Name	Value	Description
Input	G-SEL	0	Changes the gain settings to gain 1.
		1	Changes the gain settings to gain 2.

(3) 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
Pn139	n.□□□2	Condition A satisfied	Gain 1 to gain 2	Gain Switching Waiting Time 1 Pn135	Gain Switching Time 1 Pn131
		Condition A not satisfied	Gain 2 to gain 1	Gain Switching Waiting Time 2 Pn136	Gain Switching Time 2 Pn132

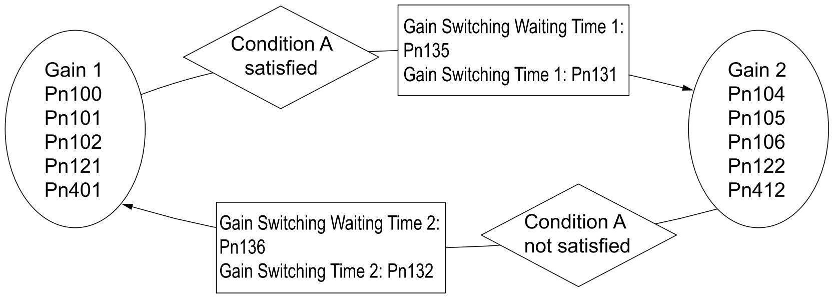
Select one of the following settings for switching condition A.

Parameter		Position Control Gain Switching Condition A	For Control Methods Other Than Position Control (No Switching)	When Enabled
Pn139	n.□□0□ (default setting)	/COIN (Positioning Completion) signal ON	Gain 1 used.	Immediately
	n.□□1□	/COIN (Positioning Completion) signal OFF	Gain 2 used.	
	n.□□2□	/NEAR (Near) signal ON	Gain 1 used.	
	n.□□3□	/NEAR (Near) signal OFF	Gain 2 used.	
	n.□□4□	Position reference filter output is 0 and position reference input is OFF.	Gain 1 used.	
	n.□□5□	Position reference input is ON.	Gain 2 used.	

Tuning

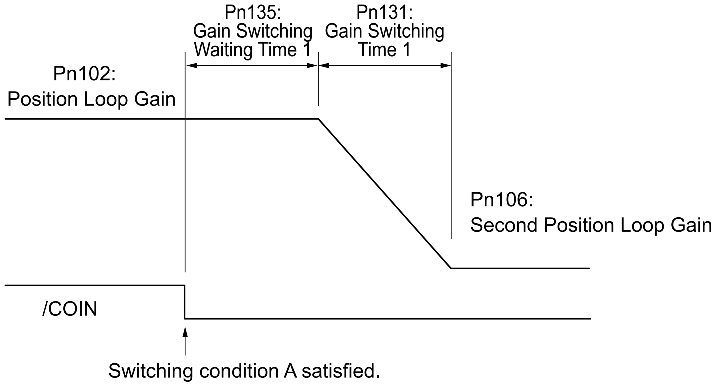
8

Pn139 = n.□□□2 (use automatic gain switching pattern 1)



(a) Relationship between the Waiting Times and Switching Times for Gain Switching

In this example, an ON /COIN (Positioning Completion Input) 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 Pn135 (Gain Switching Waiting Time 1). The switching operation changes the position loop gain linearly from the gain set in Pn102 to the gain set in Pn106 over Pn131 (Gain Switching Time 1).



Information: Gain switching can be performed when Pn10B is set to n.□□0□ or n.□□1□ (Speed Loop Control Method is PI control or I-P control).

(4) Related Parameters

Pn100	Speed Loop Gain			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	10 to 20000	0.1 Hz	400	Immediately

Pn101	Speed Loop Integral Time Constant			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	15 to 51200	0.01 ms	2000	Immediately

Pn102	Position Loop Gain			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	10 to 20000	0.1/s	400	Immediately

Pn401	First Stage First Torque Reference Filter Time Constant			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 65535	0.01 ms	100	Immediately

Pn141	Model Following Control Gain			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	10 to 20000	0.1/s	500	Immediately

Pn142	Model Following Control Gain Correction			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	500 to 2000	0.1%	1000	Immediately

Continued on next page.

Continued from previous page.

Pn121	Friction Compensation Gain			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	10 to 1000	1%	100	Immediately
Pn104	Second Speed Loop Gain			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	10 to 20000	0.1 Hz	400	Immediately
Pn105	Second Speed Loop Integral Time Constant			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	15 to 51200	0.01 ms	2000	Immediately
Pn106	Second Position Loop Gain			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	10 to 20000	0.1/s	400	Immediately
Pn412	First Stage Second Torque Reference Filter Time Constant			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 65535	0.01 ms	100	Immediately
Pn148	Second Model Following Control Gain			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	10 to 20000	0.1/s	500	Immediately
Pn149	Second Model Following Control Gain Correction			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	500 to 2000	0.1%	1000	Immediately
Pn122	Second Friction Compensation Gain			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	10 to 1000	1%	100	Immediately

(5) Parameters Related to Automatic Gain Switching

Pn131	Gain Switching Time 1			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 65535	1 ms	0	Immediately
Pn132	Gain Switching Time 2			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 65535	1 ms	0	Immediately
Pn135	Gain Switching Waiting Time 1			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 65535	1 ms	0	Immediately
Pn136	Gain Switching Waiting Time 2			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 65535	1 ms	0	Immediately

(6) Related Monitoring

- SigmaWin+
  You can monitor gain switching with the status monitor or with tracing.
- Analog Monitor

Parameter	Analog Monitor	Monitor Name	Output Value	Meaning
Pn006 Pn007	n.□□0B	Active Gain Monitor	1 V	Gain 1 is enabled.
			2 V	Gain 2 is enabled.

8.14.2 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.

(1) Required Parameter Settings

The following parameter settings are required to use friction compensation.

Parameter		Friction Compensation Function Selection (Speed Pos Trq)		When Enabled
Pn408	n.X□□□	0 Default	Disable friction compensation.	Immediately
		1	Enable friction compensation.	

Parameter	Friction Compensation Gain (Speed Pos Trq)			
Pn121	Setting Range	Setting Unit	Default Setting	When Enabled
	10 to 1000	1%	100	Immediately

Parameter	Second Friction Compensation Gain (Speed Pos Trq)			
Pn122	Setting Range	Setting Unit	Default Setting	When Enabled
	10 to 1000	1%	100	Immediately

Parameter	Friction Compensation Coefficient (Speed Pos Trq)			
Pn123	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 100	1%	0	Immediately

Parameter	Friction Compensation Frequency Correction (Speed Pos Trq)			
Pn124	Setting Range	Setting Unit	Default Setting	When Enabled
	-10000 to 10000	0.1 Hz	0	Immediately

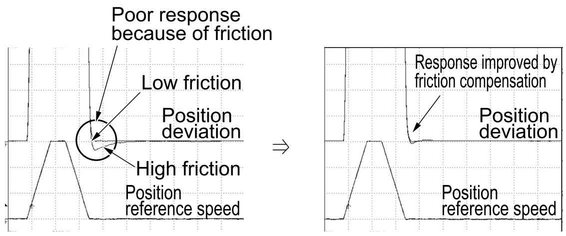
Parameter	Friction Compensation Gain Correction (Speed Pos Trq)			
Pn125	Setting Range	Setting Unit	Default Setting	When Enabled
	1 to 1000	1%	100	Immediately

(2) Operating Procedure for Friction Compensation

Use the following procedure to perform friction compensation.

⚠ CAUTION

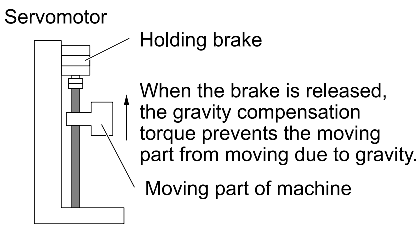
Before you execute this function, set Pn103 (Moment of Inertia Ratio) correctly. If the setting greatly differs from the actual moment of inertia ratio, normal control of the machine may not be possible, and vibration may result.

<table>
<tr><th>Step</th><th>Operation</th></tr>
<tr><td>1</td><td>Set the following parameters related to friction compensation to their default settings.
Pn121 (Friction Compensation Gain) → default setting: 100
Pn122 (Second Friction Compensation Gain) → default setting: 100
Pn123 (Friction Compensation Coefficient) → default setting: 0
Pn124 (Friction Compensation Frequency Correction) → default setting: 0
Pn125 (Friction Compensation Gain Correction) → default setting: 100
Note:
Always use the default settings for Pn124 (Friction Compensation Frequency Correction) and Pn125 (Friction Compensation Gain Correction).</td></tr>
<tr><td>2</td><td>Gradually increase the setting of Pn123 (Friction Compensation Coefficient) to check the effect of friction compensation.
Note:
Usually, set Pn123 (Friction Compensation Coefficient) to 95% or less.
If the effect is insufficient, increase the setting of Pn121 (Friction Compensation Gain) by 10% increments until vibration stops.
Effect of Adjusted Parameters
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.
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.</td></tr>
<tr><td>3</td><td>Effect of Adjustments
The following graphs show the response with and without adjustment.


Before Friction Compensation   After Friction Compensation</td></tr>
</table>

8.14.3 Gravity Compensation

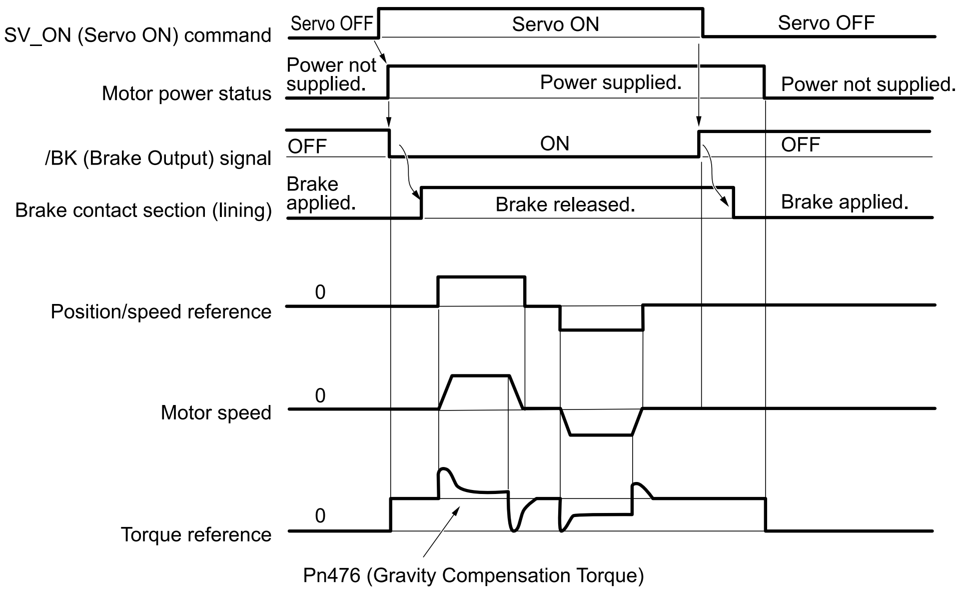
When the servomotor is used with a vertical axis, gravity compensation prevents the moving part from falling due to the machine's own weight when the brake is released.



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.

☞ *5.12.1 Brake Operating Sequence on page 179*



(1) Required Parameter Settings

The following parameter settings are required to use gravity compensation.

Pn475	n.□□□X	Gravity Compensation Selection (Speed, Pos, Trq)		When Enabled
		0 (Default)	Disable gravity compensation.	After restart
		1	Enable gravity compensation.	

Pn476	Gravity Compensation Torque (Speed, Pos, Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	-1000 to 1000	0.1%	0	Immediately

(2) Operating Procedure for Gravity Compensation

Use the following procedure to perform gravity compensation.

1. **Set Pn475 to n.□□□1 (enable gravity compensation).**
2. **To enable changes to the settings, turn the power 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.**

8.14.4 Output Torque Compensation

Output torque compensation is used to compensate the offset from the torque reference for output torque.

Output torque may become offset from the reference value due to motor temperature and load status, and this offset can be reduced with compensation.

This function is enabled by default. To disable this function, set Pn428 to n.□□□0 (disable output torque compensation).

Parameter		Output Torque Compensation Function Selection (Speed Pos Trq)		When Enabled
Pn428	n.□□□X	0	Disable output torque compensation.	After restart
		1 Default	Enable output torque compensation.	

8.14.5 Current Control Mode Selection

Current control mode selection reduces noise while the servomotor is being stopped and during high-speed rotation.

To use this function, set Pn009 to n.□□2□ (current control mode 2), Pn009 to n.□□3□ (current control mode 3), or Pn009 to n.□□4□ (current control mode 4).

Parameter		Current Control Mode Selection (Speed Pos Trq)		When Enabled
Pn009	n.□□X□	0	Use current control mode 1.	After restart
		1	• SERVOPACK Models SGDXS-R70A, -R90A, -1R6A, -2R8A, - 3R8A, -5R5A, -7R6A: Use current control mode 1. • SERVOPACK Models SGDXS-120A, -180A, -200A, -330A, -470A, -550A, -590A, -780A: Use current control mode 2. (For noise reduction when the motor is stopped)	
		2	Use current control mode 2. (For noise reduction when the motor is stopped)	
		3	Use current control mode 3. (For noise reduction when the motor is operating at high speed)	
		4 Default	Use current control mode 4. (For noise reduction when the motor is stopped and operating at high speed)	

8.14.6 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 setting of Pn100 (Speed Loop Gain). The noise level can be reduced by decreasing the setting of Pn13D (Current Gain Level) from its default setting of 2000% (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.

Pn13D	Current Gain Level (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	100 to 2000	1%	2000	Immediately

> **Important**
> If the current gain level is changed, the response characteristic of the speed loop will also change. Servo tuning must therefore be performed again.

8.14.7 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.□1□□ (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.

Pn009	n.□X□□	Speed Detection Method Selection Speed Pos Trq		When Enabled
		0 Default	Use speed detection 1.	After restart
		1	Use speed detection 2.	

Important: If the speed detection method is changed, the response characteristic of the speed loop will also change. Servo tuning must therefore be performed again.

8.14.8 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.

Pn308	Speed Feedback Filter Time Constant Speed Pos Trq			
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 65535	0.01 ms	0	Immediately

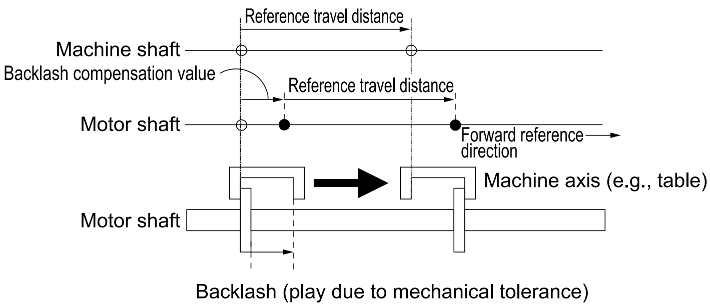
8.14.9 Backlash Compensation

(1) 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:

- This function can be used only with a rotary servomotor.
- This function can be used only for position control.
- This function is disabled while a utility function is executing. However, this function is always enabled while autotuning with a host reference is executing.



(2) Related Parameters

Set the following parameters to use backlash compensation.

(a) Backlash Compensation Direction

Set the direction in which to apply backlash compensation.

Pn230	n.□□□X	Backlash Compensation Direction	Speed Pos Trq	When Enabled
		0 Default	Compensate forward references.	After restart
		1	Compensate reverse references.	

(b) 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 units. However, when the amount is converted to encoder pulses, it is rounded off at the decimal point.

Information When Pn231 = 6553.6 [reference units] and Pn20E/Pn210 (Electronic Gear Ratio) = 64/1:
6553.6 × 64 = 419430.4 [pulses]
⇒ The backlash compensation will be 419430 encoder pulses.

Pn231	Backlash Compensation Value			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	-500000 to 500000	0.1 reference unit	0	Immediately

Important

- The backlash compensation value is restricted by the following formula. Backlash compensation is not performed if this condition is not met.

$$\text{Pn231} \leq \frac{\text{Pn210}}{\text{Pn20E}} \times \frac{\text{Maximum motor speed [min}^{-1}]}{60} \times \text{Encoder resolution}^{*1} \times 0.00025$$

*1 Refer to the following section for the encoder resolution.
☞ *5.15 Electronic Gear Settings on page 188*

Example 1:
Pn20E = 64, Pn210 = 1, Maximum motor speed = 7000 [min-1], and Encoder resolution = 67108864 (26 bits):
1/64 × 7000/60 × 67108864 × 0.00025 = 30583.4 [reference units]
⇒ The backlash compensation will be limited to 30583.4 reference units.
Example 2:
Pn20E = 4, Pn210 = 1, Maximum motor speed = 7000 [min-1], Pn20A (Number of External Encoder Scale Pitches) = 500, and Use of the JZDP-H00□-000 (signal resolution: 1/256):
1/4 × 7000/60 × (500 × 256) × 0.00025 = 933.3 [reference units]
⇒ The backlash compensation will be limited to 933.3 reference units.

- Do not exceed the upper limit of the backlash compensation value. You can check the upper limit on the operation monitor of the SigmaWin+.
- The sign for backlash compensation depends on the setting of Pn230 (Backlash Compensation Direction). Specifically, if Pn231 is set to a positive value when Pn230 is set to n.□□□1 (compensate reverse references), then backlash is compensated in the reverse direction. The relationship between each setting and the direction of backlash compensation is shown below.

Setting of Pn230	Setting of Pn231	Backlash Compensation Direction
n.□□□1 (compensate reverse references)	Positive value	Reverse
	Negative value	Forward
n.□□□0 (compensate forward references)	Positive value	Forward
	Negative value	Reverse

(c) Backlash Compensation Time Constant

You can set a time constant for a first order lag filter for the setting of Pn231 (Backlash Compensation) that is added to the position reference.

If you set Pn233 (Backlash Compensation Time Constant) to 0, the first order lag filter is disabled.

Pn233	Backlash Compensation Time Constant			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 65535	0.01 ms	0	Immediately

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.

Tuning 8

(3) Related Monitoring

You can monitor the following values on the operation monitor of the SigmaWin+.

Displayed Value	Unit
Current Backlash Compensation Value	0.1 reference units
Backlash Compensation Value Setting Limit	0.1 reference units

(4) Compensation Operation

This section describes the operation that is performed for backlash compensation.

Note:

The following figures are for when backlash compensation direction is set to Pn230 = n.□□□0 (compensate forward references). 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 (feedback 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.

Important

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 divided pulse output for position feedback at the host controller, you must consider the backlash compensation value.

(a) Operation When the Servo Is ON

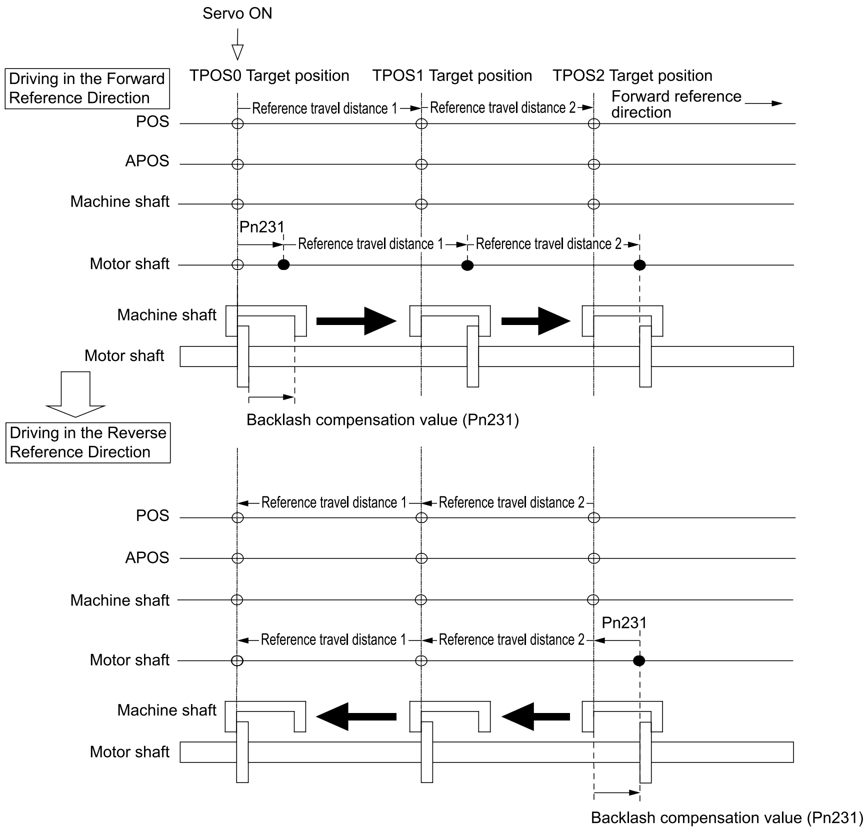
Pn231 (Backlash Compensation Value) is added in the backlash compensation direction when the servo is ON (i. e., while power is supplied to the motor) and a reference is input in the same direction as Pn230 = n.□□□X (backlash compensation direction). When there is a reference input in the direction opposite 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 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.



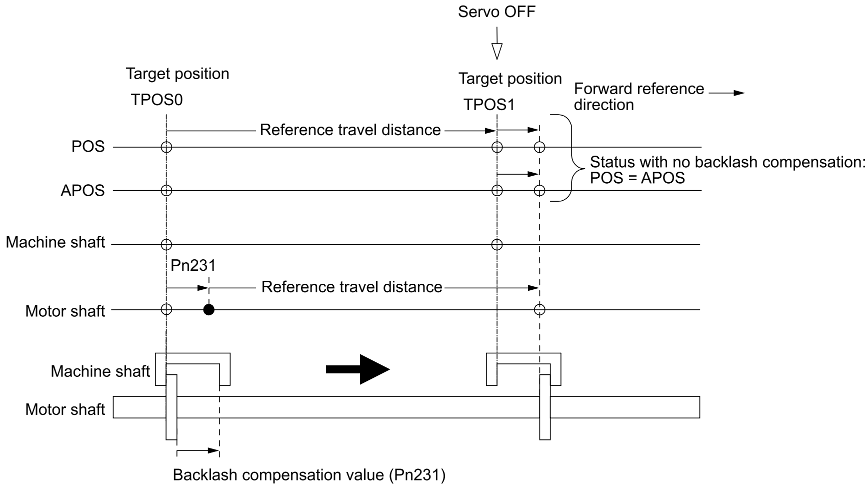
(b) Operation When the Servo Is OFF

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.)



(c) 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, i.e., backlash compensation is not applied.

Refer to the following section for information when the servo is OFF.

☞ *(b) Operation When the Servo Is OFF on page 423*

Tuning

8

(d) 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 if any other control method is changed to position control.

Refer to the following section for information on the same compensation as when the servo is ON.

☞ *(a) Operation When the Servo Is ON on page 422*

(5) Related Monitoring

You can monitor the following values on the operation monitor of the SigmaWin+.

Displayed Value	Unit	Specification
Input Reference Pulse Speed	min^{-1}	Displays the input reference pulse speed after 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 after backlash 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 external encoder.
Feedback Pulse Counter	Reference units	Displays the number of pulses from the actually driven encoder in reference units.

(6) MECHATROLINK Monitor Information

This section describes the information that is set for the MECHATROLINK MONITOR 1 to 4 and the backlash compensation operation.

- MECHATROLINK-III Communications

Monitor Code	Code	Description	Unit	Remarks
0	POS	Reference position in reference coordinate 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 compensation subtracted
4	LPOS	Feedback latch position in the machine coordinate system	Reference units	Feedback position with the backlash compensation subtracted
5	IPOS	Reference position in reference coordinate system (before 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)	–	–

- MECHATROLINK-4 Communications

Selection Code	Monitor Name	Description	Unit	Remarks
00h	APOS	Feedback position	Reference units	Current position of the servomotor
01h	CPOS	Reference position	Reference units	Reference position after acceleration/deceleration filter
02h	PERR	Position deviation	Reference units	Position deviation of control loop
03h	LPOS1	Latched position 1	Reference units	Motor position 1 when latched by latch signal
04h	LPOS2	Latched position 2	Reference units	Motor position 2 when latched by latch signal
05h	FSPD	Feedback speed	Reference units	–
06h	CSPD	Reference speed	Reference units	–
07h	TRQ	Torque (force) reference	Reference units	Reference torque (force) to motor
08h	ALARM	Detailed information on the current alarm	–	Current alarm or warning If an alarm occurs after a warning occurs, the alarm is displayed.
09h	MPOS	Reference position	Reference units	Input reference position of position control loop MPOS = APOS + PERR
0Ah	–	Reserved.	–	–
0Bh	–	Reserved.	–	–
0Ch	CMN1	Common monitor 1	–	Select the monitor data specified by common parameter 89.
0Dh	CMN2	Common monitor 2	–	Select the monitor data specified by common parameter 8A.
0Eh	OMN1	Option monitor 1	–	
0Fh	OMN2	Option monitor 2	–	
10h	TPOS	Target position in the reference coordinate system	Reference units	–
11h	IPOS	Reference position in reference coordinate system	Reference units	–
12h	POS_OFST	Offset set in POS_SET (Set Coordinate System) command	–	–
13h	TSPD	Target speed	Reference units	–
14h	SPD_LIM	Speed limit value	Reference units	–
15h	TRQ_LIM	Torque limit value	Reference units	–
16h	SV_STAT	Servo actual operating status	–	–
20h to 7Fh	–	Reserved.	–	–
80h to FFh	Vendor-specific monitor information			

Parameter		Monitor Information	Output Unit	Remarks
Pn824 Pn825	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 encoder
	000Bh	PG count (upper 32 bits)	Reference units	
	000Ch	FPG count (lower 32 bits)	Reference units	Count value of the actually driven external encoder
	000Dh	FPG count (upper 32 bits)	Reference units	
	0017h	Input reference pulse speed	min^{-1}	–
	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 feed-back position (LPOS)	Encoder pulses	Feedback position with the backlash compen-sation subtracted

(a) Related Monitoring Diagrams

The following symbols are used in the related monitoring diagrams.

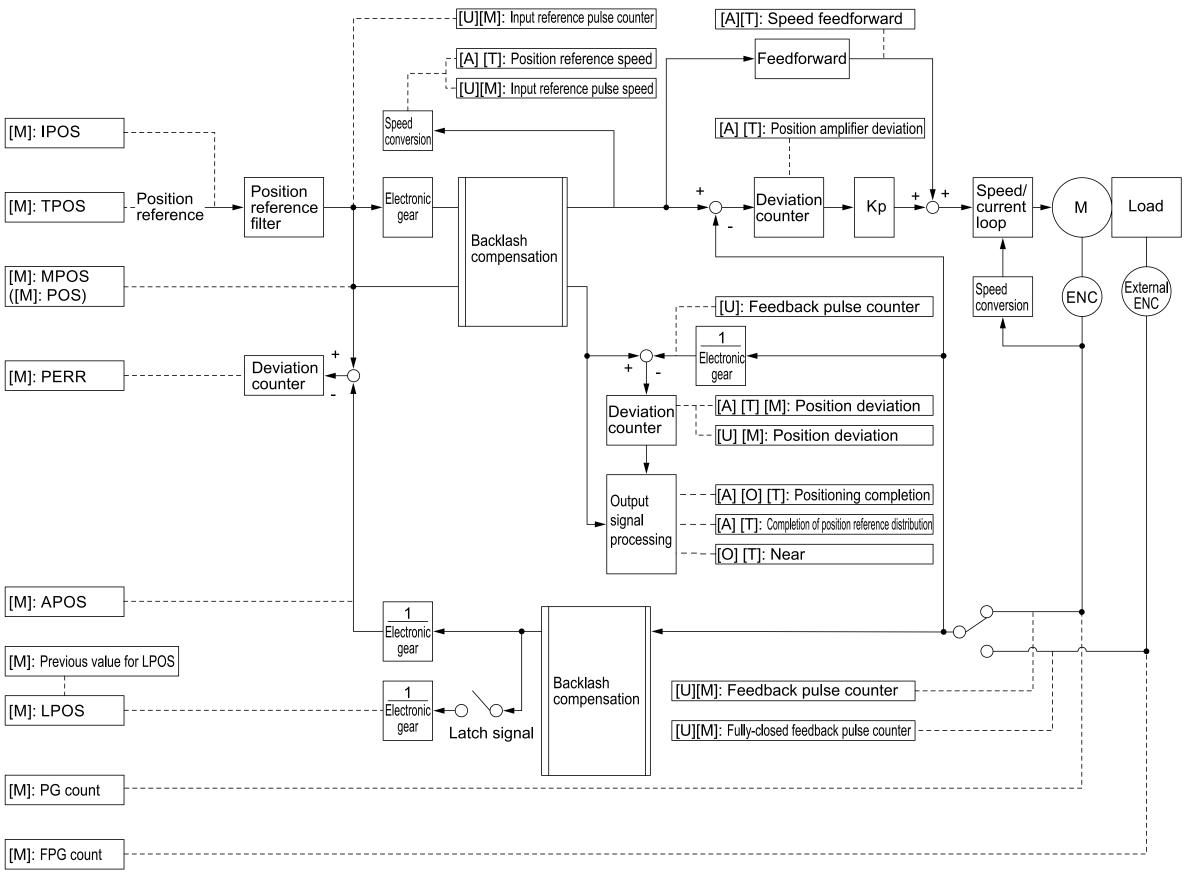
[A]: Analog monitor

[U]: Monitor mode (Un monitor)

[O]: Output signal

[T]: Trace data

[M]: MECHATROLINK monitor information



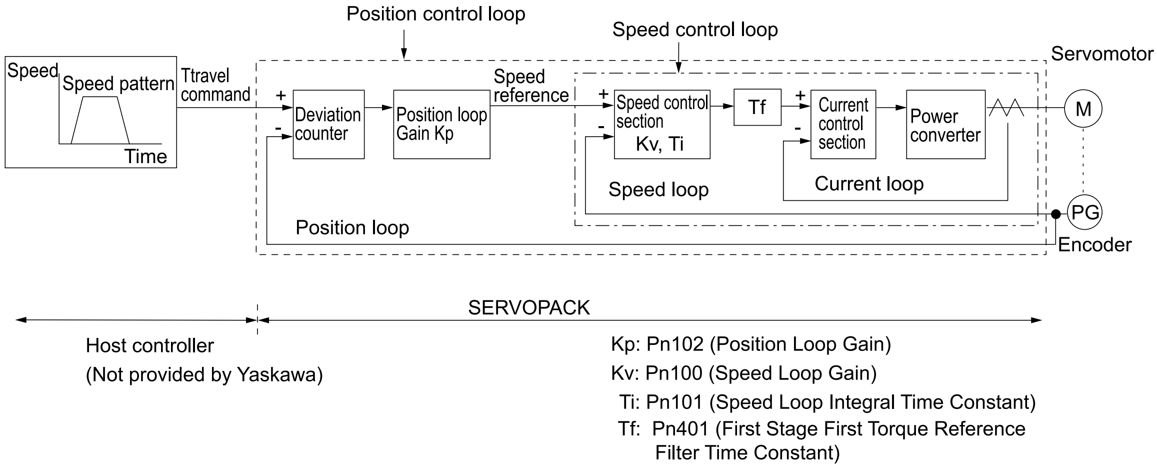
The monitor display and the actual position may be offset ±1 reference unit due to calculation processing. This is an error in the display. It does not mean a position deviation has occurred.

8.15 Manual Tuning

This section describes manual tuning.

8.15.1 Tuning the Servo Gains

(1) 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.

(2) 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.

(3) Applicable Tools

You can monitor the servo gains with the SigmaWin+ or with the analog monitor.

(4) Precautions

Vibration may occur while you are tuning the servo gains. We recommend that you set Pn310 to n.□□□2 (output an alarm (A.520) if vibration is detected). Refer to the following section for information on vibration detection.

☞ *6.11 Vibration Detection Level Initialization on page 257*

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.

(5) Tuning Procedure Example (for Position Control or Speed Control)

Step	Description
1	Adjust the setting of Pn401 (First Stage First Torque Reference Filter Time Constant) so that vibration does not occur.
2	Increase the setting of Pn100 (Speed Loop Gain) and reduce the setting of Pn101 (Speed Loop Integral Time Constant) 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 setting of Pn102 (Position Loop Gain) 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.

(6) Adjusted Servo Gains

You can set the following gains to adjust the response characteristic of the SERVOPACK.

Parameter No.	Name	Reference
Pn100	Speed Loop Gain	☞ *(b) Speed Loop Gain on page 429*
Pn101	Speed Loop Integral Time Constant	☞ *(c) Speed Loop Integral Time Constant on page 429*
Pn102	Position Loop Gain	☞ *(a) Position Loop Gain on page 428*
Pn401	First Stage First Torque Reference Filter Time Constant	☞ *(d) Torque Reference Filter on page 429*

(a) Position Loop Gain

The position loop gain determines the response characteristic of the position loop in the SERVOPACK. 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.

Pn102	Position Loop Gain Speed **Pos** Trq			
	Setting Range	Setting Unit	Default Setting	When Enabled
	10 to 20000	0.1/s	400	Immediately

Information For machines for which Pn102 (Position Loop Gain) cannot be set to a high value, the A.d00 alarm (Position Deviation Overflow) 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 condition as a guideline for determining the setting.

$$\text{Pn520} \geq \frac{\text{Maximum feed speed [reference units/s]}}{\text{Pn102} \div 10\ \text{(1/s)}} \times 2.0$$

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.

Pn520	Position Deviation Overflow Alarm Level			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	1 to 1073741823	1 reference unit	6116694	Immediately

(b) 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.

Pn100	Speed Loop Gain			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	10 to 20000	0.1 Hz	400	Immediately

$$\text{Setting of Pn103} = \frac{\text{Load moment of inertia at motor shaft } (J_L)}{\text{Servomotor moment of inertia } (L_M)} \times 100\ (\%)$$

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.

Pn103	Moment of Inertia Ratio			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 65535	1%	100	Immediately

(c) Speed Loop Integral Time Constant

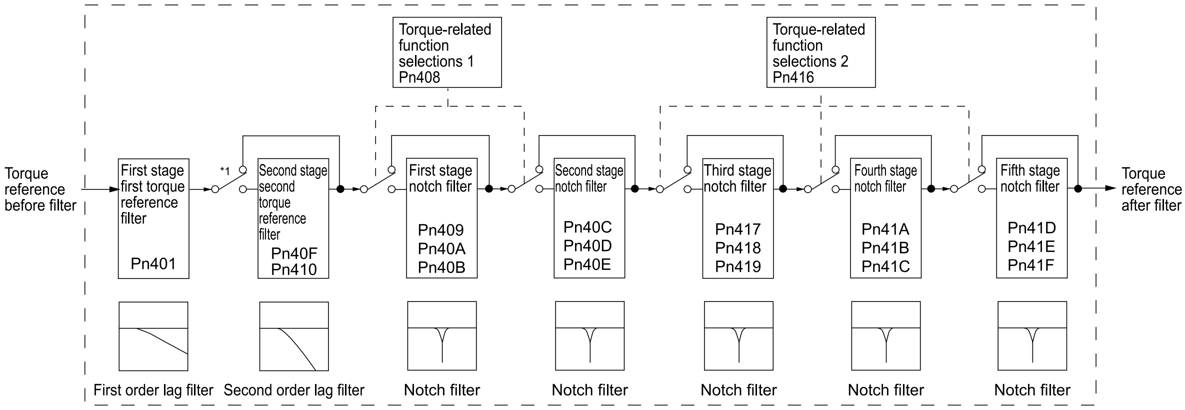
To enable response to even small inputs, the speed loop has an integral element. The integral element becomes a delay factor in the servo system. If the time constant is set too high, overshooting will occur, positioning settling time will increase, and the response characteristic will suffer.

Pn101	Speed Loop Integral Time Constant			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	15 to 51200	0.01 ms	2000	Immediately

(d) 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 notch filters can be enabled and disabled with Pn408 = n.□X□X and Pn416 = n.□XXX.



*1 The second stage second torque reference filter is disabled when Pn40F is set to 5000 (default setting) and it is enabled when Pn40F is set to a value lower than 5000.

◆ 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.

Pn401	First Stage First Torque Reference Filter Time Constant			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 65535	0.01 ms	100	Immediately
Pn40F	Second Stage Second Torque Reference Filter Frequency			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	100 to 5000	1 Hz	5000	Immediately
Pn410	Second Stage Second Torque Reference Filter Q Value			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	50 to 100	0.01	50	Immediately

Note:

The filter is disabled if you set Pn40F to 5000.

◆ 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.

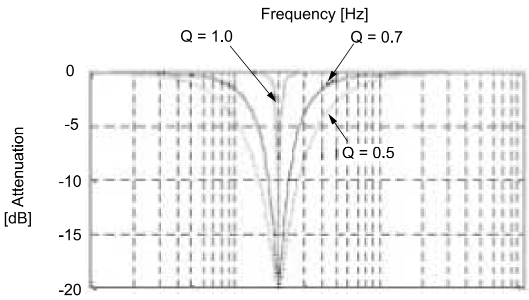
The notch filter puts a notch in the gain curve at the specific vibration frequency (called the notch frequency). The frequency components near the notch frequency can be reduced or removed with a notch filter.

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 frequencies (width of the notch) changes with the notch filter Q value. The larger the notch filter Q value is, the narrower the width of frequencies that are filtered is (the steeper the notch is).

The notch filter frequency characteristics for different notch filter Q values are shown below.



Note:

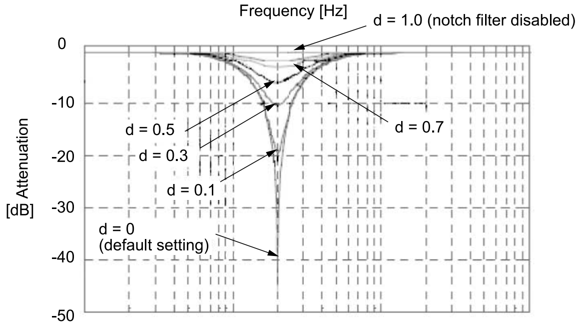
The above notch filter frequency characteristics are based on calculated values and may be different from actual characteristics.

◆ 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 1000).

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.

Parameter		Meaning		When Enabled
Pn408	n.□□□X	Notch Filter Selection 1 (Speed Pos Trq)		When Enabled
		0 Default	Disable first stage notch filter.	Immediately
		1	Enable first stage notch filter.	
Pn408	n.□X□□	Notch Filter Selection 2 (Speed Pos Trq)		When Enabled
		0 Default	Disable second stage notch filter.	Immediately
		1	Enable second stage notch filter.	
Pn416	n.□□□X	Notch Filter Selection 3 (Speed Pos Trq)		When Enabled
		0 Default	Disable third stage notch filter.	Immediately
		1	Enable third stage notch filter.	
Pn416	n.□□X□	Notch Filter Selection 4 (Speed Pos Trq)		When Enabled
		0 Default	Disable fourth stage notch filter.	Immediately
		1	Enable fourth stage notch filter.	
Pn416	n.□X□□	Notch Filter Selection 5 (Speed Pos Trq)		When Enabled
		0 Default	Disable fifth stage notch filter.	Immediately
		1	Enable fifth stage notch filter.	

Set the machine vibration frequencies in the notch filter parameters.

Pn409	First Stage Notch Filter Frequency			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	10 to 5000	1 Hz	5000	Immediately
Pn40A	First Stage Notch Filter Q Value			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	50 to 1000	0.01	70	Immediately
Pn40B	First Stage Notch Filter Depth			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 1000	0.001	0	Immediately
Pn40C	Second Stage Notch Filter Frequency			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	10 to 5000	1 Hz	5000	Immediately
Pn40D	Second Stage Notch Filter Q Value			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	50 to 1000	0.01	70	Immediately
Pn40E	Second Stage Notch Filter Depth			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 1000	0.001	0	Immediately
Pn417	Third Stage Notch Filter Frequency			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	10 to 5000	1 Hz	5000	Immediately
Pn418	Third Stage Notch Filter Q Value			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	50 to 1000	0.01	70	Immediately
Pn419	Third Stage Notch Filter Depth			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 1000	0.001	0	Immediately
Pn41A	Fourth Stage Notch Filter Frequency			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	10 to 5000	1 Hz	5000	Immediately
Pn41B	Fourth Stage Notch Filter Q Value			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	50 to 1000	0.01	70	Immediately
Pn41C	Fourth Stage Notch Filter Depth			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 1000	0.001	0	Immediately
Pn41D	Fifth Stage Notch Filter Frequency			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	10 to 5000	1 Hz	5000	Immediately
Pn41E	Fifth Stage Notch Filter Q Value			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	50 to 1000	0.01	70	Immediately

Continued on next page.

Continued from previous page.

Pn41F	Fifth Stage Notch Filter Depth			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 1000	0.001	0	Immediately

Important

- Do not set Pn409, Pn40C, Pn417, Pn41A, and Pn41D (notch filter frequencies) that are close to the speed loop's response frequency. Set a frequency that is at least four times the setting of Pn100 (Speed Loop Gain). (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.
- Change the settings of Pn409, Pn40C, Pn417, Pn41A, and Pn41D (notch filter frequencies) only while the servomotor is stopped. Vibration may occur if a notch filter frequency is changed during operation.

(7) 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 motor 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.

Adjustment Value for Manual Tuning	Description
Stable Value	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 Value	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.

Important

The following adjusted value guidelines require that the setting of Pn103 (Moment of Inertia Ratio) is correctly set for the actual machine.

Term

P control :

Proportional control.

PI control :

Proportional - integral control.

I-P control :

Proportional - integral control in which the proportional operation works for the controlled variable only and the integral operation works for the control deviation only.

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.

(a) When Pn10B = n.□□0□ (PI Control)

Guidelines are given below for gain 1.

The same guidelines apply to gain 2 (Pn104, Pn105, Pn106, and Pn412).

- Pn100 (Speed Loop Gain) [Hz] and Pn102 (Position Loop Gain) [/s]
  Stable gain: Pn102 [/s] ≤ 2π × Pn100/4 [Hz]
  Critical gain: Pn102 [/s] < 2π × Pn100 [Hz]
- Pn100 (Speed Loop Gain) [Hz] and Pn101 (Speed Loop Integral Time Constant) [ms]
  Stable gain: Pn101 [ms] ≥ 4000/(2π × Pn100 [Hz])
  Critical gain: Pn101 [ms] > 1000/(2π × Pn100 [Hz])
- Pn100 (Speed Loop Gain) [Hz] and Pn401 (First Stage First Torque Reference Filter Time Constant) [ms]
  Stable gain: Pn401 [ms] ≤ 1000/(2π × Pn100 [Hz] × 4)
  Critical gain: Pn401 [ms] < 1000/(2π × Pn100 [Hz] × 1)
- Pn100 (Speed Loop Gain) [Hz] and Pn40F (Second Stage Second Torque Reference Filter Frequency) [Hz]
  Critical gain: Pn40F [Hz] > 4 × Pn100 [Hz]

  Note:

  Set Pn410 (Second Stage Second Torque Reference Filter Q Value) to 0.70.
- Pn100 (Speed Loop Gain) [Hz] and Pn409 (First Stage Notch Filter Frequency) [Hz] (or Pn40C (Second Stage Notch Filter Frequency) [Hz])
  Critical gain: Pn409 [Hz] > 4 × Pn100 [Hz]
- Pn100 (Speed Loop Gain) [Hz] and Pn308 (Speed Feedback Filter Time Constant) [ms]
  Stable gain: Pn308 [ms] ≤ 1000/(2π × Pn100 [Hz] × 4)
  Critical gain: Pn308 [ms] < 1000/(2π × Pn100 [Hz] × 1)

(b) When Pn10B = n.□□1□ (I-P Control)

Guidelines are given below for gain 1.

The same guidelines apply to gain 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.

- Pn100 (Speed Loop Gain) [Hz] and Pn101 (Speed Loop Integral Time Constant) [ms]
  Stable gain: Pn100 [Hz] ≥ 320/Pn101 [ms]
- Pn102 (Position Loop Gain) [/s] and Pn101 (Speed Loop Integral Time Constant) [ms]
  Stable gain: Pn102 [/s] ≤ 320/Pn101 [ms]

(c) Decimal Points in Parameter Settings

For the 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.

Information
Pn100 (Speed Loop Gain) [Hz] and Pn101 (Speed Loop Integral Time Constant) [ms]
Stable gain: Pn101 [ms] ≥ 4000/(2π × Pn100 [Hz])
If Pn100 = 40.0 [Hz], then Pn101 = 4000/(2π × 40.0) ≈ 15.92 [ms].

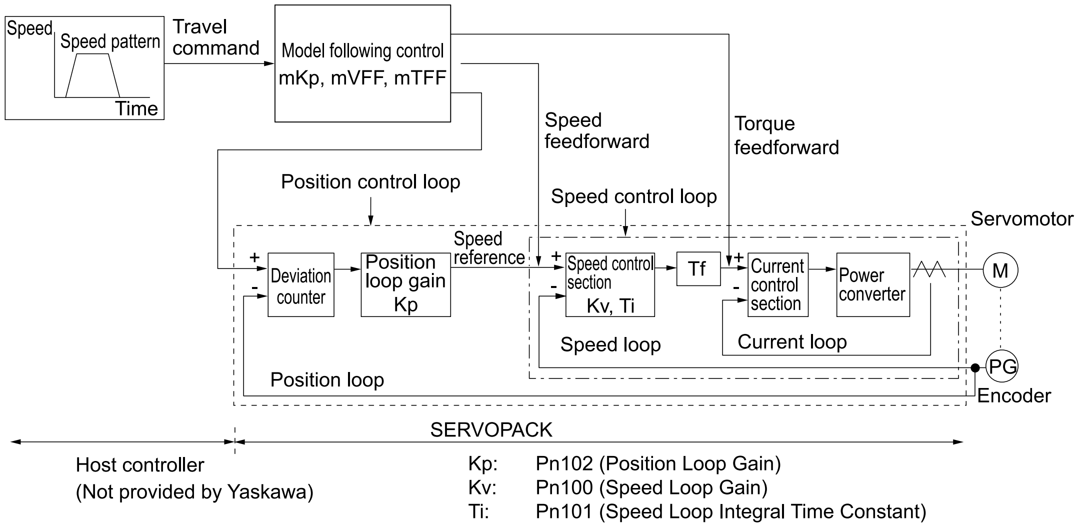
(8) Model Following Control

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.



Kp:	Pn102 (Position Loop Gain)
Kv:	Pn100 (Speed Loop Gain)
Ti:	Pn101 (Speed Loop Integral Time Constant)
Tf:	Pn401 (First Stage First Torque Reference Filter Time Constant)
mKp:	Pn141 (Model Following Control Gain)
mTFF:	Pn143 (Model Following Control Bias in the Forward Direction)
	Pn144 (Model Following Control Bias in the Reverse Direction)
mVFF:	Pn147 (Model Following Control Speed Feedforward Compensation)

(a) 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. ☞ *8.14.2 Friction Compensation on page 416*
2	Adjust the servo gains. Refer to the following section for an example procedure. ☞ *(5) Tuning Procedure Example (for Position Control or Speed Control) on page 428* **Note:** 1. Set Pn103 (Moment of Inertia Ratio) as accurately as possible. 2. Refer to the guidelines for manually tuning the servo gains and set a stable value to Pn102 (Position Loop Gain). ☞ *(7) Guidelines for Manually Tuning Servo Gains on page 433*
3	Increase the setting of Pn141 (Model Following Control Gain) 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: Pn143 (Model Following Control Bias in the Forward Direction), Pn144 (Model Following Control Bias in the Reverse Direction), and Pn147 (Model Following Control Speed Feedforward Compensation).

(b) 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.□□□X to specify whether to use model following control.

If you use model following control with vibration suppression, set Pn140 to n.□□1□ or Pn140 = n.□□2□. When you also perform vibration suppression, adjust vibration suppression with custom tuning in advance.

Note:

If you set Pn140 to n.□□1□ or n.□□2□ (use vibration suppression), always set Pn140 to n.□□□1 (use model following control).

Parameter		Meaning		When Enabled
Pn140	n.□□□X	Model Following Control Selection (Speed Pos Trq)		When Enabled
		0 Default	Do not use model following control.	Immediately
		1	Use model following control.	
Pn140	n.□□X□	Vibration Suppression Selection (Speed Pos Trq)		When Enabled
		0 Default	Do not perform vibration suppression.	Immediately
		1	Perform vibration suppression for a specific frequency.	
		2	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).

Pn141	Model Following Control Gain (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	10 to 20000	0.1/s	500	Immediately

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.

$$\text{Pn520} \geq \frac{\text{Maximum feed speed [reference units/s]}}{\text{Pn141/10 [1/s]}} \times 2.0$$

Pn520	Position Deviation Overflow Alarm Level (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	1 to 1073741823	1 reference unit	6116694	Immediately

◆ 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.

Pn143	Model Following Control Bias in the Forward Direction (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 10000	0.1%	1000	Immediately
Pn144	Model Following Control Bias in the Reverse Direction (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 10000	0.1%	1000	Immediately

◆ 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.

Pn147	Model Following Control Speed Feedforward Compensation (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 10000	0.1%	1000	Immediately

◆ Model Following Control Type Selection

When you enable model following control, you can select the model following control type. Normally, set Pn14F to n.□□□0 (use overshoot control type for model following control.model) (default setting). To further increase responsiveness, set Pn14F to n.□□□1 (response emphasis type for model following control).

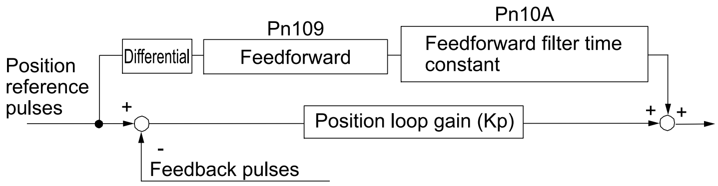
Pn14F	n.□□□X	Model Following Control Type Selection (Speed Pos Trq)		When Enabled
		0 Default	Use overshoot control type for model following control.	After restart
		1	Use response emphasis type for model following control.	

8.15.2 Compatible Adjustment Functions

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 Σ-III-series SERVOPACKs to adjust Σ-X-series SERVOPACKs.

(1) Feedforward

The feedforward function applies feedforward compensation to position control to shorten the positioning time.



Pn109	Feedforward (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 100	1%	0	Immediately
Pn10A	Feedforward Filter Time Constant (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 6400	0.01 ms	0	Immediately

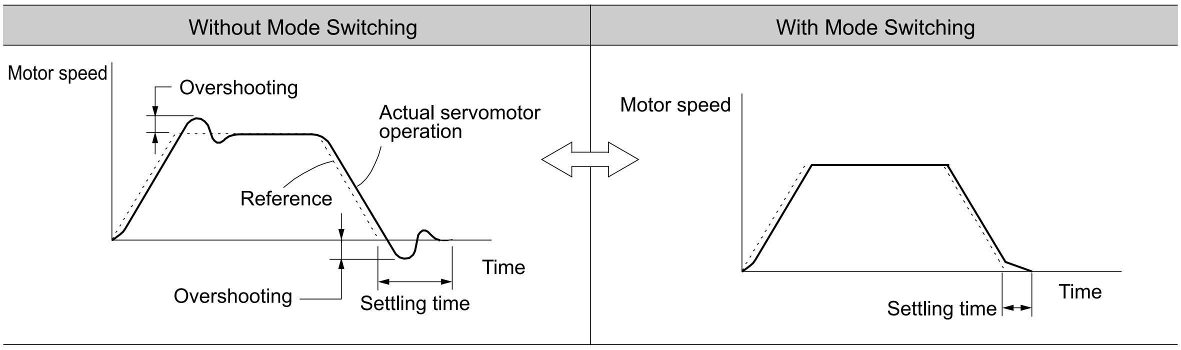
Note:

If you set the feedforward value too high, the machine may vibrate. As a guideline, use a setting of 80% or less.

(2) Mode Switching (Changing between P and PI Control)

You can use mode switching to automatically change between P 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.



(a) Related Parameters

Select the switching condition for mode switching with Pn10B = n.□□□X.

Parameter		Mode Switching Selection	Parameter That Sets the Level		When Enabled
			Rotary Servomotor	Linear Servomotor	
Pn10B	n.□□□0 (default setting)	Use the internal torque reference as the condition.	Pn10C		Immediately
	n.□□□1	Use the speed reference as the condition.	Pn10D	Pn181	
	n.□□□2	Use the acceleration as the condition.	Pn10E	Pn182	
	n.□□□3	Use the position deviation as the condition.	Pn10F		
	n.□□□4	Do not use mode switching.	–		

◆ Parameters That Set the Switching Levels

- Rotary Servomotors

Pn10C	Mode Switching Level for Torque Reference			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 800	1%	200	Immediately

Pn10D	Mode Switching Level for Speed Reference			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 10000	1 min^{-1}	0	Immediately

Pn10E	Mode Switching Level for Acceleration			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 30000	1 min^{-1}/s	0	Immediately

Pn10F	Mode Switching Level for Position Deviation			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 10000	1 reference unit	0	Immediately

- Linear Servomotors

Pn10C	Mode Switching Level for Torque Reference			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 800	1%	200	Immediately

Pn181	Mode Switching Level for Speed Reference			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 10000	1 mm/s	0	Immediately

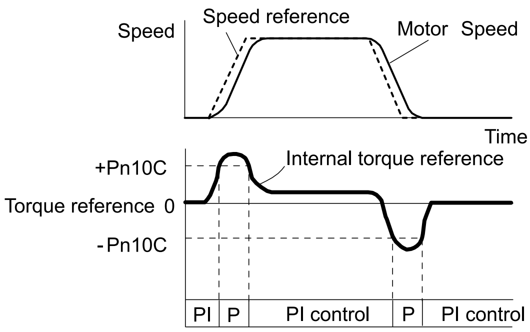
Pn182	Mode Switching Level for Acceleration			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 30000	1 mm/s^2	0	Immediately

Pn10F	Mode Switching Level for Position Deviation			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 10000	1 reference unit	0	Immediately

◆ Using the Internal Torque Reference as the Mode Switching Condition (Default Setting)

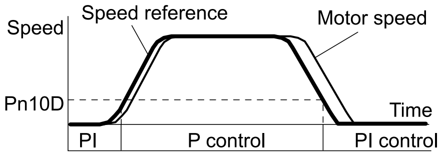
When the internal torque reference equals or exceeds the torque set for Pn10C (Mode Switching Level for Torque Reference), the speed loop is changed to P control.

The default setting for the torque reference level is 200%.

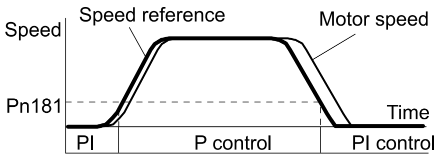


◆ Using the Speed Reference as the Mode Switching Condition

- Rotary Servomotors
  When the speed reference equals or exceeds the speed set for Pn10D (Mode Switching Level for Speed Reference), the speed loop is changed to P control.

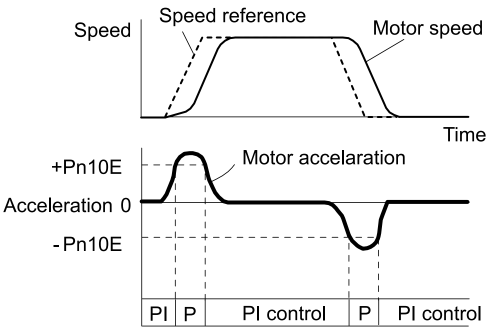


- Linear Servomotors
  When the speed reference equals or exceeds the speed set for Pn181 (Mode Switching Level for Speed Reference), the speed loop is changed to P control.

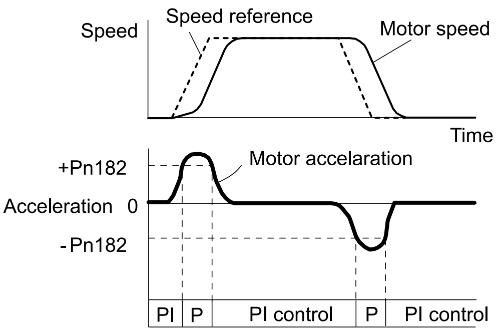


◆ Using the Acceleration as the Mode Switching Condition

- Rotary Servomotors
  When the speed reference equals or exceeds the acceleration rate set for Pn10E (Mode Switching Level for Position Deviation), the speed loop is changed to P control.



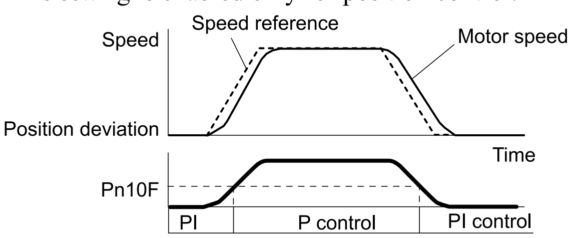
- Linear Servomotors
  When the speed reference equals or exceeds the acceleration rate set for Pn182 (Mode Switching Level for Acceleration), the speed loop is changed to P control.



◆ Using the Position Deviation as the Mode Switching Condition

When the position deviation equals or exceeds the value set for Pn10F (Mode Switching Level for Position Deviation), the speed loop is changed to P control.

This setting is enabled only for position control.



(3) 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.

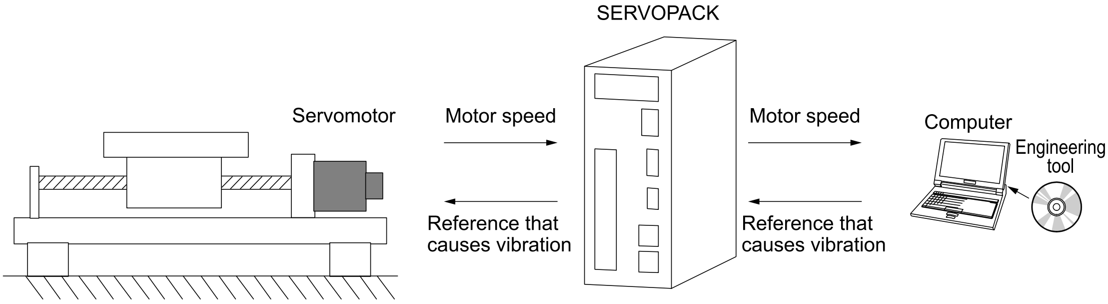
Pn11F	Position Integral Time Constant			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 50000	0.1 ms	0	Immediately

8.16 Diagnostic Tool

8.16.1 Mechanical Analysis

(1) 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.

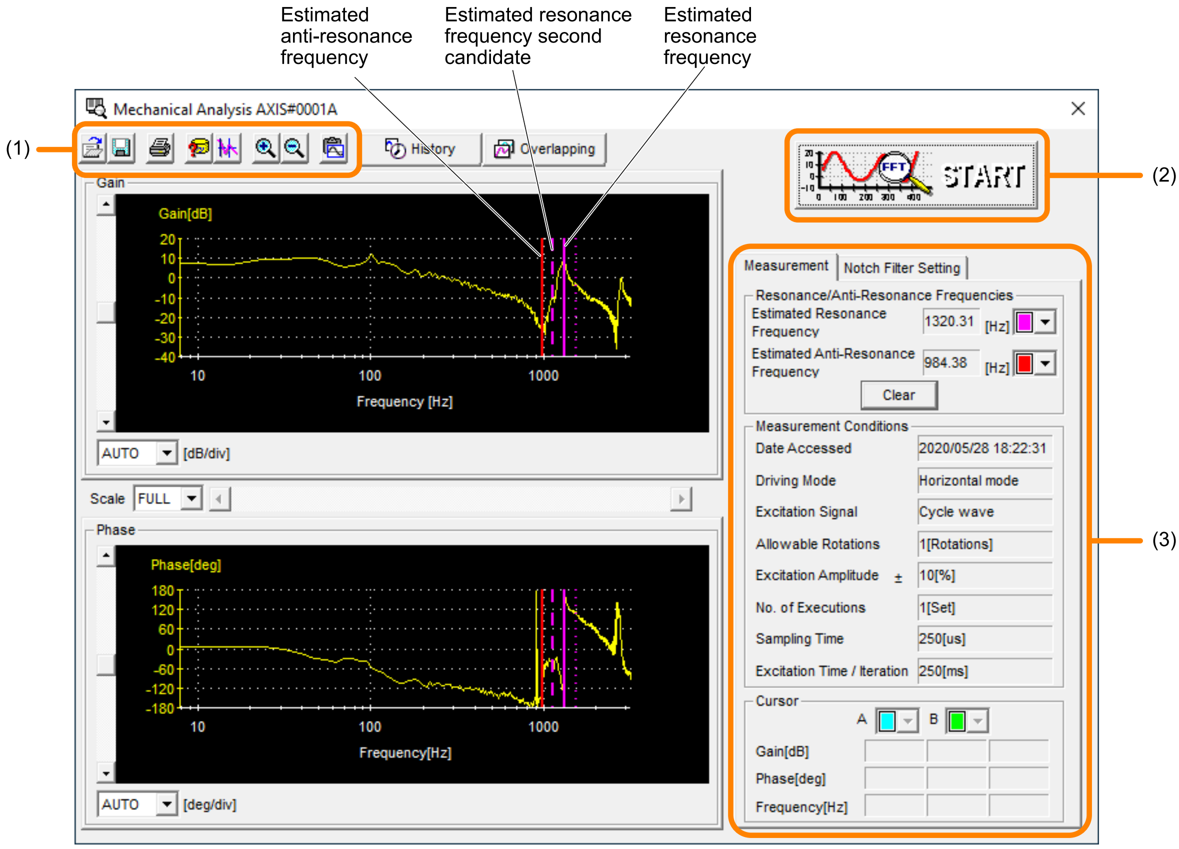
WARNING

Mechanical analysis is a measurement function that actually drives the machine and therefore presents hazards. Before you execute mechanical analysis, check the information provided in the SigmaWin+ operating manual.

(2) Frequency Characteristics

The motor 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.



No.	Item	Meaning
(1)	Toolbar	-
(2)	[START] button	Click the [START] button to start analysis.
(3)	[Measurement] tab and [Notch Filter Setting] tab	[Measurement] tab: Displays detailed information on the results of analysis. [Notch Filter Setting] tab: Displays the notch filter frequencies. You can set these values in the parameters.

8.16.2 Easy FFT

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 this function after the servo is turned OFF if operation of the SERVOPACK results in high frequency noise and vibration.

⚠ WARNING

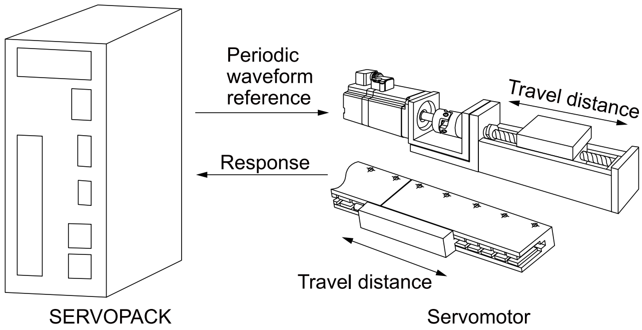
Never touch the servomotor or machine during execution of Easy FFT.

There is a risk of injury.

⚠ CAUTION

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.



This function is built into the SERVOPACK for compatibility with previous products. Normally use autotuning without a host reference for tuning.

(1) Preparations

Always check the following before you execute Easy FFT.

- The parameters must not be write prohibited.
- The main circuit power must be ON.
- Pn00C must be set to n.□□□0 (Function Selection for Test without a Motor is disabled).
- 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.

(2) Applicable Tools

The following table lists the tools that you can use to perform EasyFFT.

Tool	Fn No./Function Name	Operating Procedure Reference
Digital Operator	Fn206	Σ-7/Σ-X-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	[Diagnostic] – [Easy FFT]	*(3) Operating Procedure on page 444*

(3) Operating Procedure

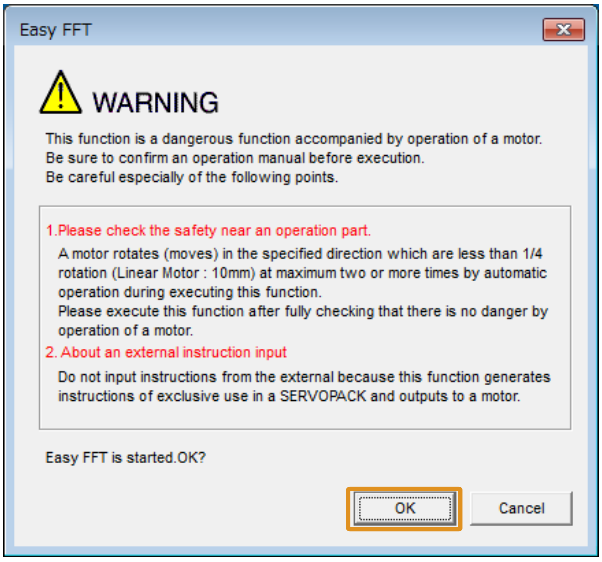
Use the following procedure for Easy FFT.

1. **Click the [ ] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**
2. **Click [Easy FFT] in the [Menu] window.**

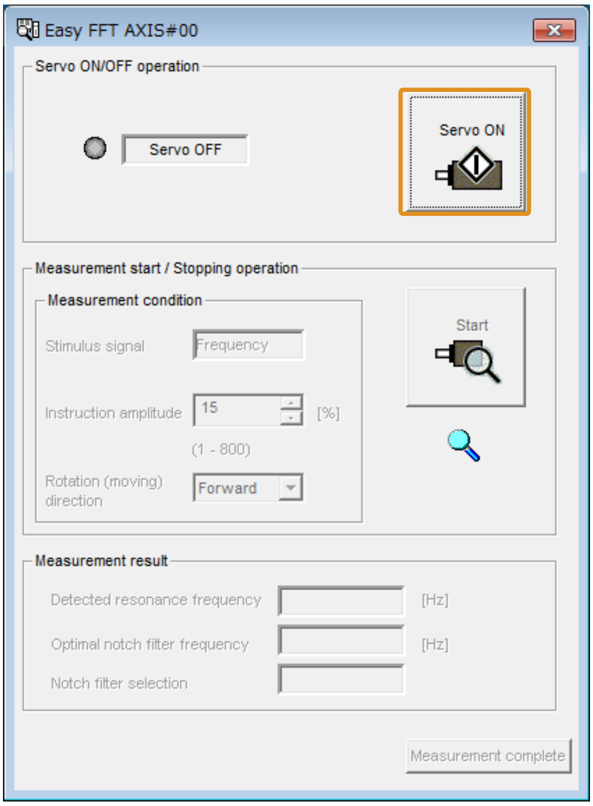
   The [Easy FFT] window will be displayed.

   Click the [Cancel] button to cancel Easy FFT. The Main Window will return.

3. **Click the [OK] button.**

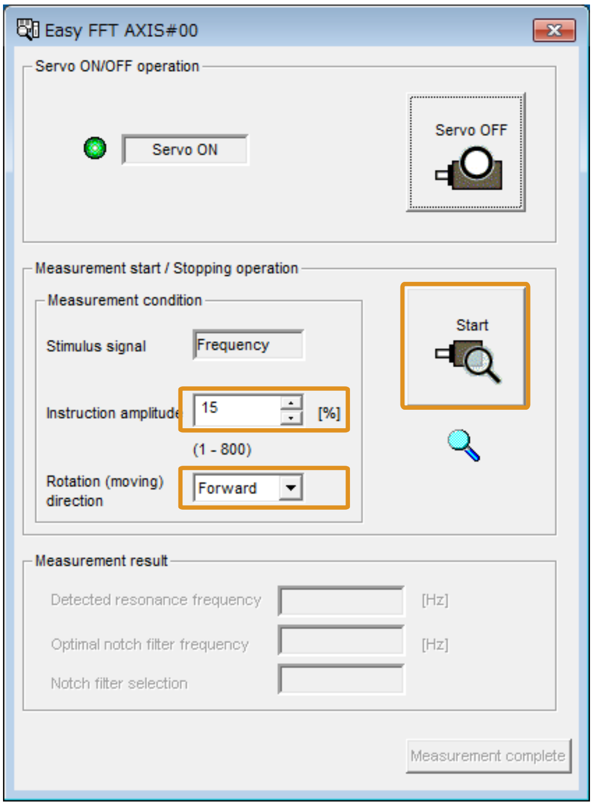


4. **Click the [Servo ON] button.**



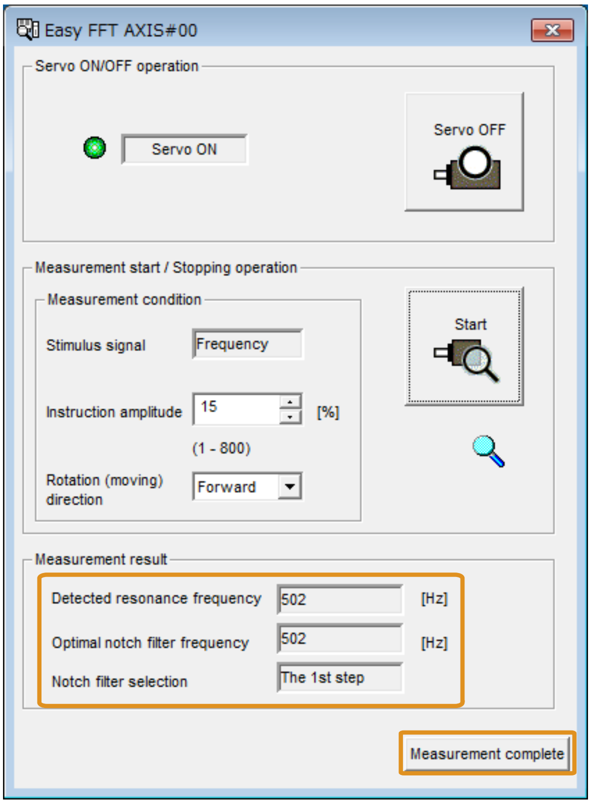
5. **Select [instruction amplitude] and [Rotation (moving) direction] in [Measurement condition], and then click the [Start] button.**

The servomotor shaft will rotate and measurements will start.

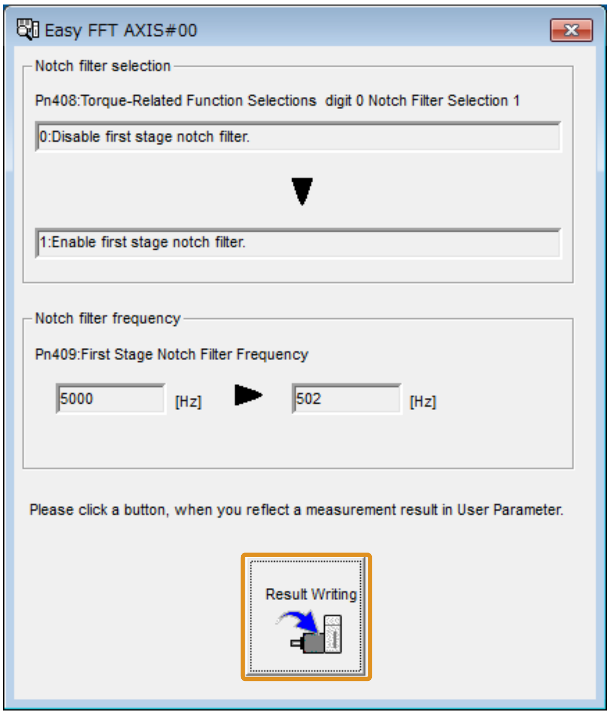


When measurements have been completed, the measurement results will be displayed.

6. **Check the results in [Measurement result] and then click the [Measurement complete] button.**



7. **Click the [Result Writing] button if you want to set the measurement results in the parameters.**



This concludes the procedure to set up Easy FFT.

(4) 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.

9

Monitoring

This chapter provides information on monitoring SERVOPACK product information and SERVOPACK status.

9.1 Monitoring Product Information

9.1.1 Items That You Can Monitor

The items that you can monitor in the [Product Information] window of the SigmaWin+ are listed below.

Monitor Items	
Information on SERVOPACKs	• Model/Type • Serial Number • Manufacturing Date • Software version (SW Ver.) • Remarks
Information on Servomotors	• Model/Type • Serial Number • Manufacturing Date • Remarks
Information on Encoders	• Model/Type • Serial Number • Manufacturing Date • Software version (SW Ver.) • Remarks
Information on Option Modules	• Model/Type • Serial Number • Manufacturing Date • Software version (SW Ver.) • Remarks

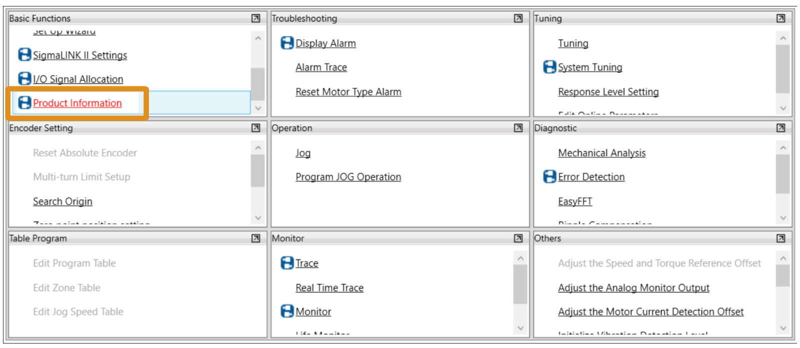
9.1.2 Operating Procedure

Use the following procedure to display the servo drive information.

1. **Click the [] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**

   The [Menu] window will be displayed.

2. **Click [Product Information] in the [Basic Functions] area.**



   The [Read Product Information] window will be displayed.

Read Product Information

Product Information	Export				
− 0001-SGDXS-R90A	QR Code				
SERVOPACK	Model/Type	Serial Number	Manufacturing Date	SW Ver.	Remarks
SERVOPACK	SGDXS-R90A				[Specification] : Standard
Motor	Model/Type	Number	Manufacturing Date	SW Ver.	Remarks
1 Motor	SGMXJ-02AUA21A1				[Resolution] : 67108864 [Pulse [Encoder type] : absolute
Encoder	UTTAI-B26AX				
Feedback Option Module	Model/Type	Serial Number	Manufacturing Date	SW Ver.	Remarks
Option Module					[Specification] : Standard [Resolution] : 8388608 [Pulse/ [Encoder type] : incremental
Motor					
Encoder	JZDP-Z001-000				

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+.

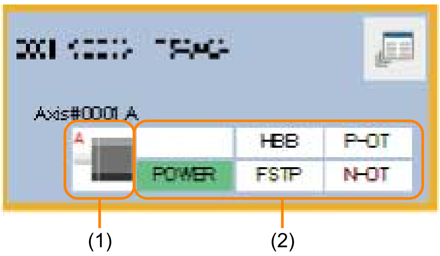
Σ-7-/Σ-X-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)

9.2 Monitoring SERVOPACK Status

9.2.1 Servo Drive Information

Use the following procedure to display the servo drive Information.

- Start the SigmaWin+. The servo drive status will be automatically displayed when you go online with a SERVOPACK.



Symbol	Description
(1)	The servomotor type is displayed.
(2)	The servo drive status is displayed.

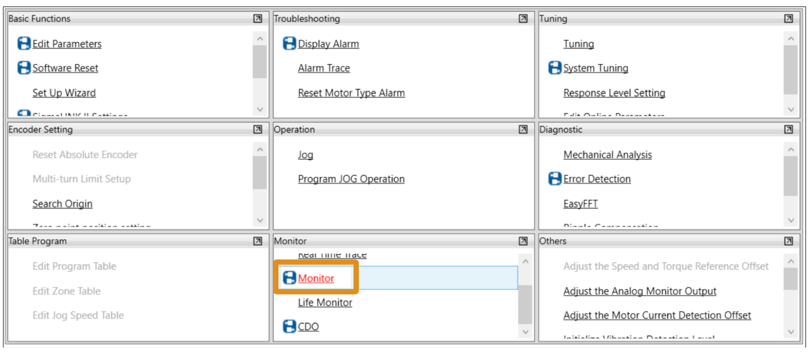
9.2.2 Operation Monitor, Status Monitor, and I/O Monitor

(1) Operating Procedure

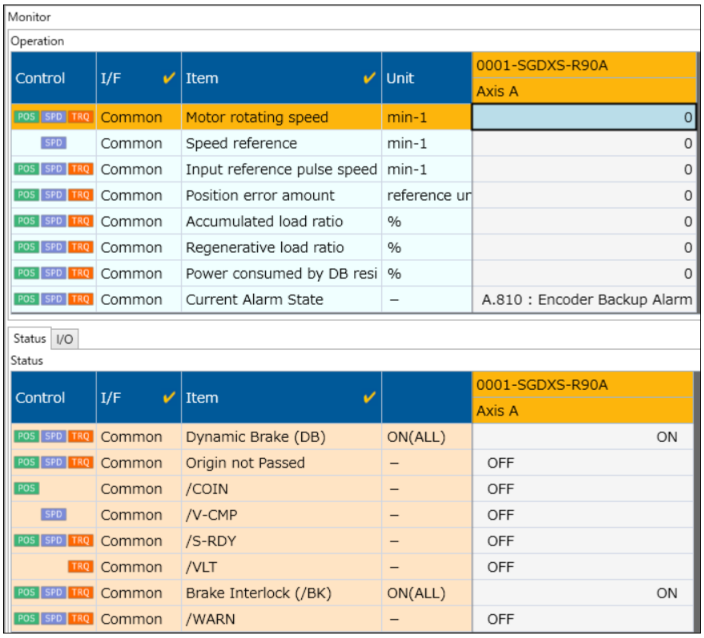
1. **Click the [ ] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**

   The [Menu] window will be displayed.

2. **Click [Monitor] in the [Monitor] area.**



[Operation], [Status], and [I/O] will be displayed in the [Monitor] window.



Information You can flexibly change the contents that are displayed in the [Monitor] window. Refer to the following manual for details.

Engineering Tool SigmaWin+ Operation Manual (Manual No.: SIET S800001 34)

(2) Items That You Can Monitor

The items that you can monitor in the [Operation] window, [Status] window, and [I/O] window are listed below.

(a) [Operation] Window

Important: The margins that can be monitored are the margins for the operating limits of the SERVOPACK and servomotor. However, these margins provide no guarantees about the long-term reliability of the product.

Monitor Items	Description	Setting Unit
Motor Speed	Displays the current motor speed.	min^{-1}
Speed Reference	Displays the current speed reference value.	min^{-1}
Torque Reference	Displays the current torque reference value.	%
Angle of Rotation 1 (number of encoder pulses from origin within one encoder rotation)	Displays the number of pulses that the encoder has rotated (moved) from the origin.	pulse
Angle of Rotation 2 (electrical angle from origin within one encoder rotation)	Displays the angle that the encoder has rotated (moved) from the origin.	deg
Input Reference Pulse Speed	Displays the speed reference value by pulse reference input.	min^{-1}
Deviation Counter (Position Deviation)	Displays the position deviation during position control.	reference unit
Cumulative Load	Displays the effective value in a 10-second cycle with rated torque as 100%.	%
Regenerative Load	Displays the effective value in a 10-second cycle with the processable power in the regenerative resistor as 100%.	%
DB Resistor Consumption Power	Displays the effective value in a 10-second cycle with the processable power in the dynamic brake resistor as 100%.	%

Continued on next page.

Continued from previous page.

Monitor Items	Description	Setting Unit
Input Reference Pulse Counter	Displays the counter value of the pulse reference input.	reference unit
Feedback Pulse Counter	Displays the number of pulses that were fed back to the SERVOPACK from the encoder.	pulse
Fully Closed Feedback Pulse Counter	Displays the number of pulses that were fed back to the SERVOPACK from the external encoder used in fully-closed loop control.	External encoder resolution
Upper Limit Setting of Motor Maximum Speed/ Upper Limit Setting of Encoder Output Resolution	Displays the upper limit value of the maximum motor speed setting or the encoder resolution setting.	–
Total Operating Time	Displays the cumulative time that the control and main circuit power supplies of the SERVO-PACK were turned ON.	100 ms
Main Circuit DC Voltage	Displays the current main circuit voltage of the SERVOPACK.	V
Overheat Protection Input	Displays the voltage input by the Overheat Protection Input (TH) signal.	0.01 V
Current Backlash Com-pensation Value	Displays the backlash compensation value.	0.1 refer-ence unit
Backlash Compensation Value Setting Limit	Displays the upper limit of the backlash compensation value setting.	0.1 refer-ence unit
Power Consumption	Displays the power consumption of the SERVOPACK.	W
Consumed Power	Displays the power consumption of the SERVOPACK.	0.001 Wh
Cumulative Power Consumption	Displays the cumulative power consumption of the SERVOPACK from power ON.	Wh
Absolute Encoder Multi-turn Data	Displays the current multiturn data of the absolute encoder.	–
Absolute Encoder Position within One Rotation	Displays the position information within one rotation of the absolute encoder.	Pulse
Lower Bits of Absolute Encoder Position	Displays the current position information (lower bits) of the absolute encoder.	pulse
Upper Bits of Absolute Encoder Position	Displays the current position information (upper bits) of the absolute encoder.	pulse
Current Alarm State	Displays the currently active alarm.	–
Feedback Position (APOS)	Displays the feedback position (APOS) in MECHATROLINK communications.	reference unit
Current Reference Posi-tion (CPOS)	Displays the current reference position (CPOS) in MECHATROLINK communications.	reference unit
Position Error (PERR)	Displays the position error (PERR) in MECHATROLINK communications.	reference unit
Latched Position 1 (LPOS1)	Displays feedback latched position 1 (LPOS1) in MECHATROLINK communications.	reference unit
Latched Position 2 (LPOS2)	Displays feedback latched position 2 (LPOS2) in MECHATROLINK communications.	reference unit
Feedback Speed (FSPD)	Displays the feedback speed (FSPD) in MECHATROLINK communications.	min^{-1}
Current Position Refer-ence Speed (CSPD)	Displays the current position reference speed (CSPD) in MECHATROLINK communications.	min^{-1}
Target Position in Refer-ence Coordinate System (TPOS)	Displays the target position in the reference coordinate system (TPOS) in MECHATROLINK communications.	reference unit
Torque Limit (TRQ_LIM)	Displays the torque limit value (TRQ_LIM) in MECHATROLINK communications.	%
Speed Limit (SPD_LIM)	Displays the speed limit (SPD_LIM) in MECHATROLINK communications.	min^{-1}

Continued on next page.

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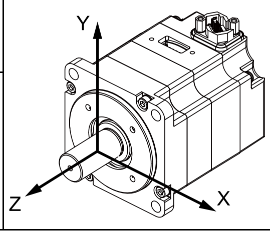
Monitor Items	Description	Setting Unit
Estimated Vibration	Displays the estimated value of vibration by analyzing the vibration component from servomotor response.	min^{-1}
Maximum Value of Amplitude of Estimated Vibration	Displays the maximum value of estimated vibration from power ON.	min^{-1}
Estimated External Disturbance Torque	Displays the estimated value of disturbance by analyzing the disturbance component from motor response.	%
Maximum Value of Estimated External Disturbance Torque	Displays the maximum value of estimated external disturbance torque from power ON.	%
Minimum Value of Estimated External Disturbance Torque	Displays the minimum value of estimated external disturbance torque from power ON.	%
Identified Moment of Inertia Ratio	Displays the result of estimating the load moment of inertia during SERVOPACK operation.	%
Maximum Identified Moment of Inertia Ratio	Displays the maximum value of the identified moment of inertia ratio from power ON.	%
Minimum Identified Moment of Inertia Ratio	Displays the minimum value of the identified moment of inertia ratio from power ON.	%
Number of MECHATROLINK Communications Errors	Displays the total number of MECHATROLINK communications errors from when the power was turned ON.	Time
Number of Serial Encoder Communications Errors	Displays the total number of serial encoder communications errors from when the power was turned ON.	Time
Settling Time	Displays the time from the position reference distribution completed (DEN) signal to the rise in the positioning completion (/COIN or PSET) signal.	0.1 ms
Maximum Settling Time	Displays the maximum value of the settling time from power ON.	0.1 ms
Amount of Overshoot	Displays the maximum value of position deviation overshooting by analyzing the positioning status in the servo.	reference unit
Maximum Amount of Overshoot	Displays the maximum value of the amount of overshoot from power ON.	reference unit
Residual Vibration Frequency	Displays the residual vibration (shaking in a short cycle by machine stand vibration) frequency by analyzing the positioning status in the servo.	0.1 Hz
Maximum Value of Accumulated Load Ratio	Displays the maximum value of Un009 (Accumulated Load Ratio).	%
Margin until Overload	Displays the margin until A.710 (Instantaneous Overload) or A.720 (Continuous Overload) is detected. If the margin until overload drops below 0%, A.710 (Instantaneous Overload) or A.720 (Continuous Overload) is detected.	0.01%
Margin until Regenerative Overload	Displays the margin until A.320 (Regenerative Overload) is detected. If the margin until regenerative overload drops below 0%, A.320 (Regenerative Overload) is detected.	0.01%
Margin until Overvoltage	Displays the margin until A.400 (Overvoltage) is detected. If the margin until overvoltage drops below 0 V, A.400 (Overvoltage) is detected.	V
Margin until Undervoltage	Displays the margin until A.410 (Undervoltage) is detected. If the margin until undervoltage drops below 0 V, A.410 (Undervoltage) is detected.	V
Temperature Margin until SERVOPACK Overheats	Displays the margin until A.7A1 (Internal Temperature Error 1) or A.7A2 (Internal Temperature Error 2) is detected. If the temperature margin until the SERVOPACK overheats drops below 0°C, A.7A1 (Internal Temperature Error 1) or A.7A2 (Internal Temperature Error 2) is detected.	°C
Temperature Margin until Servomotor Overheats	Displays the margin until A.860 (Encoder Overheated) is detected. If the temperature margin drops below 0°C, A.860 (Encoder Overheated) is detected.	°C

Continued on next page.

Continued from previous page.

<table>
<tr><th>Monitor Items</th><th colspan="2">Description</th><th>Setting Unit</th></tr>
<tr><td>Encoder Power Supplied Time</td><td colspan="2">Displays the cumulative time that power was supplied to the encoder.</td><td>100 ms</td></tr>
<tr><td>Encoder Power Supply Voltage</td><td colspan="2">Displays the power supply voltage supplied to the encoder.
A guildeline for the normal value is given next.
• Standard specification servomotor: 3.9 V or higher
• Σ-7-compatible specification servomotor: 4.5 V to 5.5 V</td><td>0.1 V</td></tr>
<tr><td>Encoder Battery Voltage</td><td colspan="2">Displays the voltage of the battery for the absolute encoder.
If the voltage drops below 2.7 V, A.930 (Low Battery Voltage) occurs.</td><td>0.1 V</td></tr>
<tr><td>Motor Total Number of Rotations</td><td colspan="2">Displays the total number of rotations that the motor rotated since it was shipped from the factory.
The value is incremented even if the motor does not complete one rotation.</td><td>100 rev</td></tr>
<tr><td>Maintenance Prediction Monitor - Bearings</td><td colspan="2">Displays the prediction value for when to perform maintenance on the servomotor bearings.
The prediction value is displayed with the unused status of the servomotor treated as 100%, and the value decreases according to the total number of rotations of the motor. Use a monitor value of 0% as a guideline for the maintenance period.</td><td>%</td></tr>
<tr><td>Maintenance Prediction Monitor - Oil Seal</td><td colspan="2">Displays the prediction value for when to perform maintenance on the servomotor oil seal.
The prediction value is displayed with the unused status of the servomotor treated as 100%, and the value decreases according to the total number of rotations of the motor. Use a monitor value of 0% as a guideline for the maintenance period.</td><td>%</td></tr>
<tr><td>Motor Vibration in X-Axis Direction</td><td>Displays the vibration in the X-axis direction of the accelerometer built into the servomotor.
The refresh cycle is 1 ms.</td><td rowspan="3">The following figure shows the X-axis, Y-axis, and Z-axis directions of vibration in the motor. Vibration in the direction of the arrow is a positive value, and the opposite direction is a negative value.
</td><td>0.0001 G (Resolution: 0.0625 G)</td></tr>
<tr><td>Motor Vibration in Y-Axis Direction</td><td>Displays the vibration in the Y-axis direction of the accelerometer built into the servomotor.
The refresh cycle is 1 ms.</td><td>0.0001 G (Resolution: 0.0625 G)</td></tr>
<tr><td>Motor Vibration in Z-Axis Direction</td><td>Displays the vibration in the Z-axis direction of the accelerometer built into the servomotor.
The refresh cycle is 1 ms.</td><td>0.0001 G (Resolution: 0.0625 G)</td></tr>
<tr><td>Motor Vibration XYZ Composite Value</td><td colspan="2">Displays the composite value of vibration in the X-axis, Y-axis, and Z-axis directions of the motor.
The refresh cycle is 1 ms.</td><td>0.0001 G (Resolution: 0.0625 G)</td></tr>
<tr><td>Maximum Motor Vibration</td><td colspan="2">Displays the maximum value of the motor vibration XYZ composite value from power ON.</td><td>0.0001 G (Resolution: 0.0625 G)</td></tr>
<tr><td>Σ-LINK II Response Data 1 to 8</td><td colspan="2">Displays the values of input signals for devices connected over Σ-LINK II.</td><td>–</td></tr>
<tr><td>Σ-LINK II Command Data 1 to 4</td><td colspan="2">Displays the values of output signals for devices connected over Σ-LINK II.</td><td>–</td></tr>
<tr><td>Σ-LINK II Sequence Input Signal Monitor</td><td colspan="2">Displays the status of a signal when a Σ-LINK II input signal is allocated to a SERVOPACK function.</td><td>–</td></tr>
<tr><td>Σ-LINK II Sequence Output Signal Monitor</td><td colspan="2">Displays the status of a signal when a Σ-LINK II output signal is allocated to a SERVOPACK function.</td><td>–</td></tr>
<tr><td>Σ-LINK II Data Status</td><td colspan="2">Displays the status related to Σ-LINK II data.</td><td>–</td></tr>
<tr><td>Command Data Monitor during Alarm/Warning (0 to 79 bytes)</td><td colspan="2">Displays the command data when an alarm or warning occurs in MECHATROLINK communications.</td><td>–</td></tr>
<tr><td>Response Data Monitor during Alarm/Warning (0 to 79 bytes)</td><td colspan="2">Displays the response data when an alarm or warning occurs in MECHATROLINK communications.</td><td>–</td></tr>
</table>

(b) [Status] Window

Monitor Items	
• Active Gain Monitor	• Alarm Reset (/ALM-RST)
• Safety Input Signal Monitor 1 (/HWBB1)	• Torque Limit (P-CL)
• Safety Input Signal Monitor 2 (/HWBB2)	• Torque Limit (/N-CL)
• Main Circuit	• Encoder (SEN)
• Encoder (PGRDY)	• Gain Selection (/G-SEL)
• Motor Power (Request)	• Forced Stop Input (FSTP)
• Motor Power ON	• Deceleration Limit Switch Input Signal (/DEC)
• Dynamic Brake (DB)	• External Latch Input Signal (/EXT1)
• Rotation Direction	• External Latch Input Signal (/EXT2)
• Mode Switch	• External Latch Input Signal (/EXT3)
• Speed Reference (V-Ref)	• Servo Alarm (ALM)
• Torque Reference (T-Ref)	• Positioning (/COIN)
• Position Reference (PULS)	• Speed Coincidence (/V-CMP)
• Position Reference Direction	• Motor Rotation (/TGON)
• AC Power ON	• Servo Ready (/S-RDY)
• Surge Current Limiting Resistor Short Relay	• Torque Limit (/CLT)
• Regenerative Transistor	• Speed Limit (/VLT)
• Regenerative Error Detection	• Brake Interlock (BK)
• Overcurrent	• Warning (/WARN)
• Origin Not Passed	• Positioning Near (/NEAR)
• Polarity Detection	• Divided Pulse Output A (PAO)
• Polarity Identification Completed	• Divided Pulse Output B (PBO)
• Speed Ripple Compensation in Progress	• Divided Pulse Output C (PCO)
• Servo ON (/S-ON)	• Preventative Maintenance (/PM)
• P Control (/P-CON)	• External Trace Input
• Overtravel (P-OT)	
• Overtravel (N-OT)	

(c) [I/O] Window

Monitor Items	
Input Signal Status	**Output Signal Status**
• P-OT (Forward Drive Prohibit Input) Signal	• ALM (Servo Alarm Output) Signal
• N-OT (Reverse Drive Prohibit Input) Signal	• /COIN (Positioning Completion Output) Signal
• /P-CL (Forward External Torque Limit Input) Signal	• /V-CMP (Speed Coincidence Detection Output) Signal
• /N-CL (Reverse External Torque Limit Input) Signal	• /TGON (Rotation Detection Output) Signal
• /G-SEL (Gain Selection Input) Signal	• /S-RDY (Servo Ready Output) Signal
• /P-DET (Polarity Detection Input) Signal	• /CLT (Torque Limit Detection Output) Signal
• /DEC (Origin Return Deceleration Switch Input) Signal	• /VLT (Speed Limit Detection Output) Signal
• /EXT1 (External Latch Input 1) Signal	• /BK (Brake Output) Signal
• /EXT2 (External Latch Input 2) Signal	• /WARN (Warning Output) Signal
• /EXT3 (External Latch Input 3) Signal	• /NEAR (Near Output) Signal
• FSTP (Forced Stop Input) Signal	• PAO (Encoder Divided Pulse Output Phase A) Signal
• Σ-LINK II Sequence Input Signal Monitor	• PBO (Encoder Divided Pulse Output Phase B) Signal
	• PCO (Encoder Divided Pulse Output Phase C) Signal
	• /PM (Preventative Maintenance Output) Signal
	• Σ-LINK II Sequence Output Signal Monitor

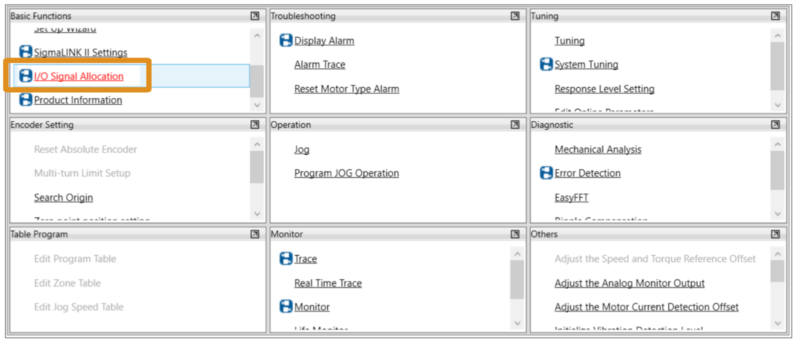
9.2.3 I/O Signals Status Monitor

Use the following procedure to check the status of the I/O signals.

1. **Click the [ ] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**

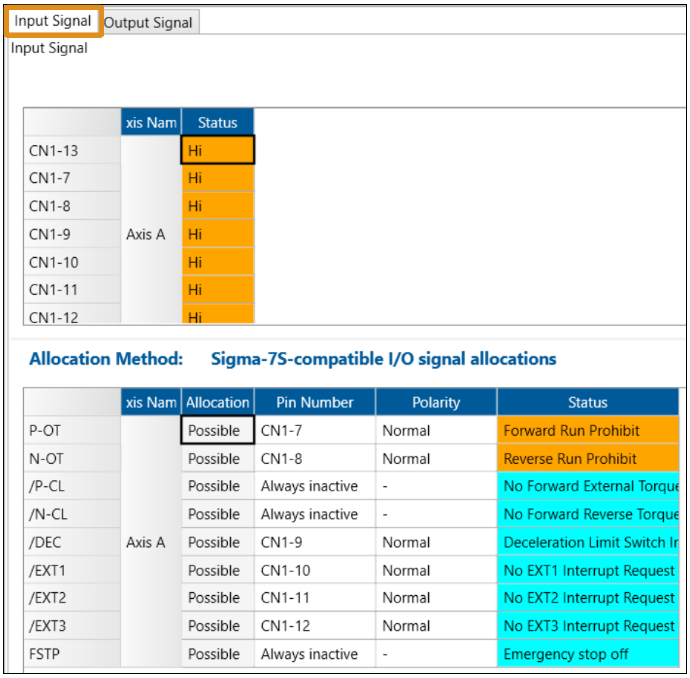
   The [Menu] window will be displayed.

2. **Click [I/O Signal Allocation] in the [Basic Functions] area.**

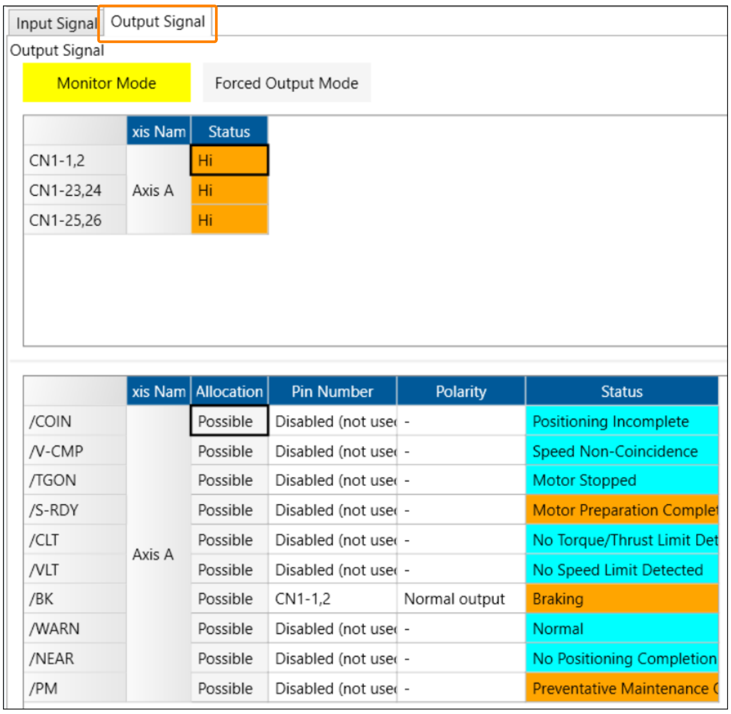


The [I/O Signal Allocation] window will be displayed.

3. **Click the [Input Signal] tab to check the status of input signals.**



4. **Click the [Output Signal] tab to check the status of output signals.**



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 [Forced 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 [Forced Output Mode] button while the servo is ON.

Refer to the following manual for details.

📖 Engineering Tool SigmaWin+ Operation Manual (Manual No.: SIET S800001 34)

9.2.4 MECHATROLINK Communications Settings Monitor: When Using MECHATROLINK-4 Communications Only

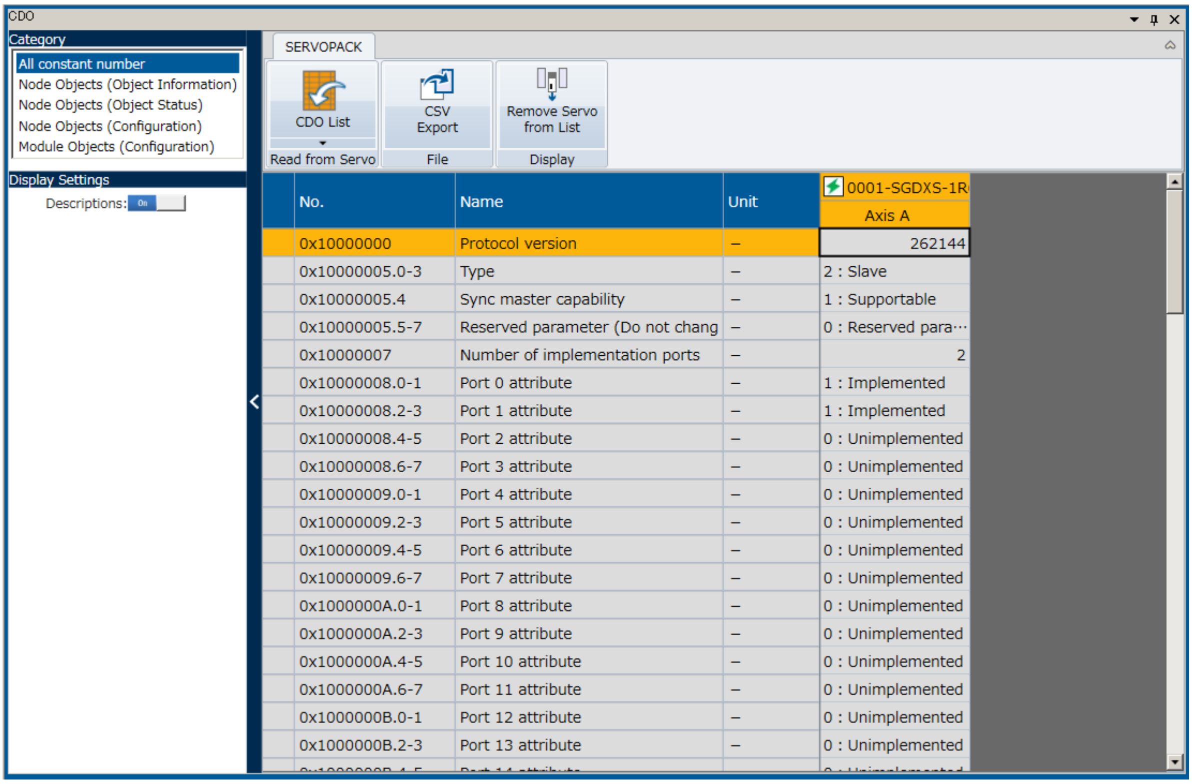
This monitor is for maintenance from the host controller.

Use the following procedure to check the MECHATROLINK communications settings set in the SERVOPACK from the host controller.

- Click [CDO] in the [Menu] window in the SigmaWin+.
  On the [CDO] window, a CDO list similar to the following will be displayed.

Information
- This CDO list is an example. The actual CDO list will differ.
- In the SigmaWin+, the MECHATROLINK communications settings are represented as CDOs (Communication Data Objects). Refer to the following manual issued by the MECHATROLINK Members Association for details on CDOs.

📖 MECHATROLINK-4 Protocol User's Manual (Manual No.: MMATDEP040)



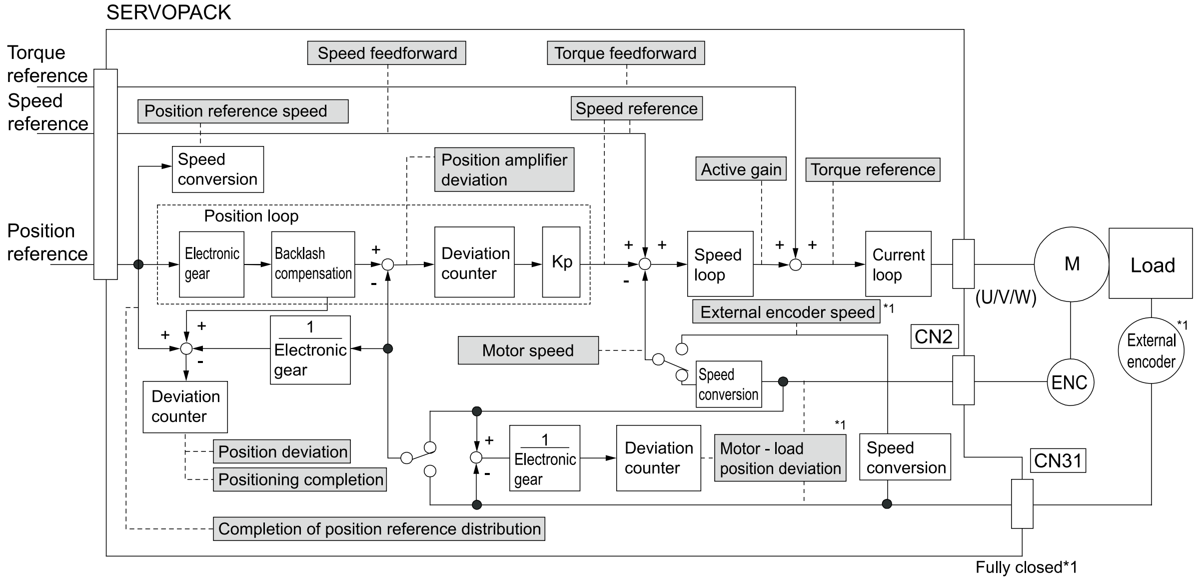
9.3 Monitoring Machine Operation Status and Signal Waveforms

To monitor waveforms, use the SigmaWin+ trace function or a measuring instrument.

9.3.1 Items That You Can Monitor

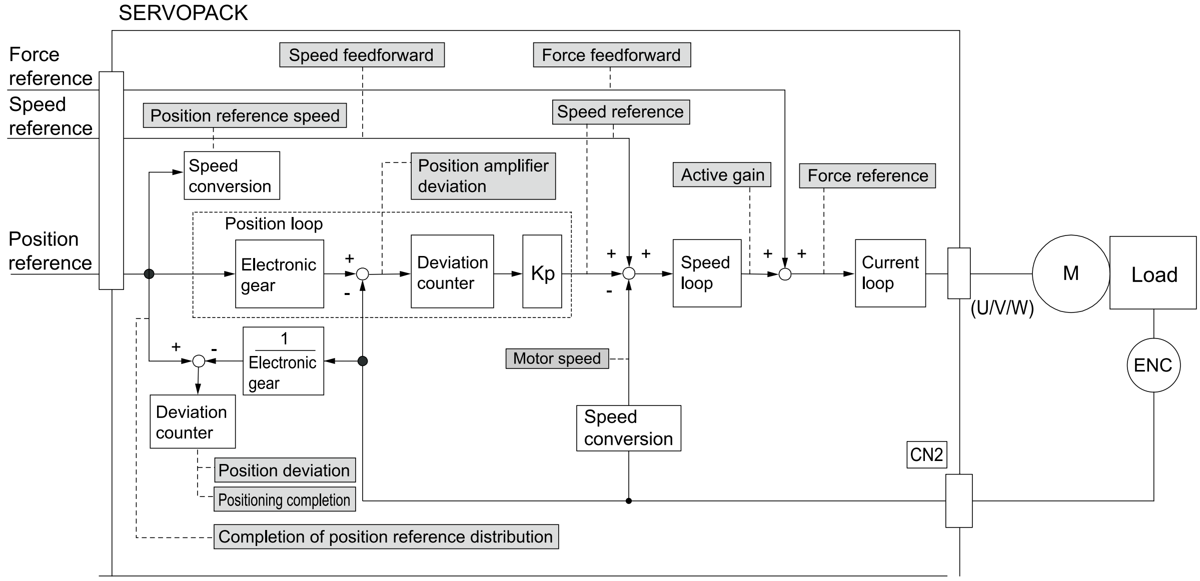
You can use the SigmaWin+ or a measuring instrument to monitor the shaded items in the following block diagram.

- Rotary Servomotors



*1 Enabled when fully-closed loop control is being used.

- Linear Servomotors



9.3.2 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+.

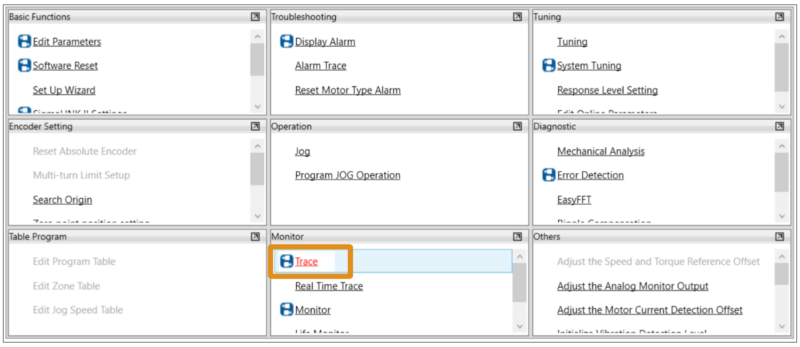
Engineering Tool SigmaWin+ Operation Manual (Manual No.: SIET S800001 34)

(1) Operating Procedure

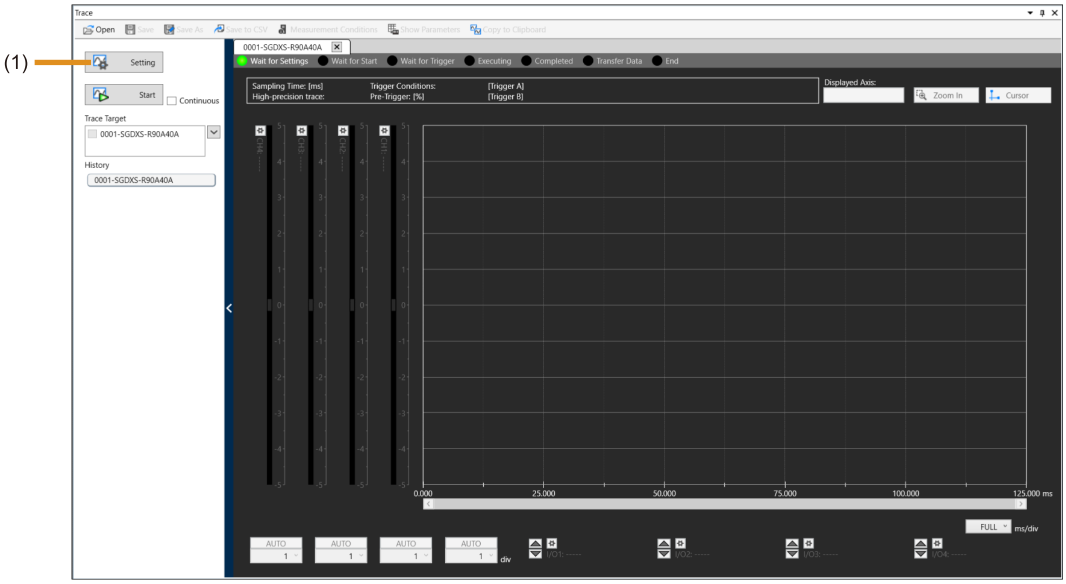
1. **Click the [] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**

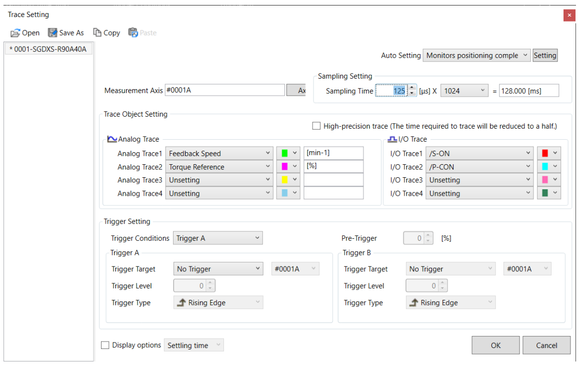
   The [Menu] window will be displayed.

2. **Click [Trace] in the [Monitor] area.**



The [Trace] window will be displayed.



No.	Meaning
(1)	Click this button to display the [Trace Setting] window shown below, and set the data to trace and the trace conditions. 

(2) Trace Objects

You can trace the following items.

(a) Data Tracing

Trace Objects	
• Feedback Speed • Torque Reference • Reference Speed • Position Reference Speed • Position Error (Deviation) • Position Amplifier Error (Deviation) • Motor - Load Position Deviation • Speed Feedforward • Torque Feedforward • Effective (Active) Gain • Main Circuit DC Voltage • External Encoder Speed • Estimated Vibration • Estimated External Disturbance Torque • Number of Serial Encoder Communications Errors • Number of MECHATROLINK Communications Errors	• Σ-LINK II Response Data 1 to 8 • Σ-LINK II Command Data 1 to 4 • Margin until Regenerative Overload • Margin until Overload • Temperature Margin until SERVOPACK Overheats • Temperature Margin until Servomotor Overheats • Margin until Undervoltage • Margin until Overvoltage • Identified Moment of Inertia Ratio • Motor Vibration in X-Axis Direction • Motor Vibration in Y-Axis Direction • Motor Vibration in Z-Axis Direction • Motor Vibration XYZ Composite Value • Current Reference

(b) I/O Tracing

Trace Objects	
Input Signals	**Output Signals**
• /S-ON (Servo ON Input) Signal • /P-CON (Proportional Control Input) Signal • P-OT (Forward Drive Prohibit Input) Signal • N-OT (Reverse Drive Prohibit Input) Signal • /ALM-RST (Alarm Reset Input) Signal • /P-CL (Forward External Torque Limit Input) Signal • /N-CL (Reverse External Torque Limit Input) Signal • /G-SEL (Gain Selection Input) Signal • /P-DET (Polarity Detection Input) Signal • /DEC (Origin Return Deceleration Switch Input) Signal • /EXT1 (External Latch Input 1) Signal • /EXT2 (External Latch Input 2) Signal • /EXT3 (External Latch Input 3) Signal • FSTP (Forced Stop Input) Signal • /HWBB1 (Hard Wire Base Block Input 1) Signal • /HWBB2 (Hard Wire Base Block Input 2) Signal • Σ-LINK II Sequence Input 0 to 7	• ALM (Servo Alarm Output) Signal • /COIN (Positioning Completion Output) Signal • /V-CMP (Speed Coincidence Detection Output) Signal • /TGON (Rotation Detection Output) Signal • /S-RDY (Servo Ready Output) Signal • /CLT (Torque Limit Detection Output) Signal • /VLT (Speed Limit Detection Output) Signal • /BK (Brake Output) Signal • /WARN (Warning Output) Signal • /NEAR (Near Output) Signal • PAO (Encoder Divided Pulse Output Phase A) Signal • PBO (Encoder Divided Pulse Output Phase B) Signal • PCO (Encoder Divided Pulse Output Phase C) Signal • ACON (Main Circuit ON) Signal • PDETCMP (Polarity Detection Completed) Signal • DEN (Position Reference Distribution Completed) Signal • PSET (Positioning Completion Output) Signal • EXT_TRC (External Trace Input) Signal *1 • CMDRDY (Command Ready) Signal *1 • Σ-LINK II Sequence Output 1 to 4 • High-Speed Output Signal for Trigger at Preset Position 1 to 3 (/HSO1 to 3) • Normal Output Signal for Trigger at Preset Position 1 to 3 (/NSO1 to 3)

*1 For details, refer to the following manual that corresponds to the communications references being used.

Σ-7/Σ-X-Series MECHATROLINK-4 Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800002 32)

Σ-7/Σ-X-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

9.3.3 Using the Analog Monitors

Connect a measuring instrument 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.

☞ *4.10 Using the Analog Monitors on page 143*

(1) Setting the Monitor Object

Use Pn006 = n.□□XX and Pn007 = n.□□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	–

Pn006 Pn007	**Analog Monitor 1 Signal Selection** **Analog Monitor 2 Signal Selection** (Speed Pos Trq)				When Enabled
	Description	**Monitor Signal**	**Output Unit**	**Remarks**	
	n.□□00 [Default setting of Pn007]	Motor Speed	• Rotary servomotor: 1 V/1000 min^{-1} • Linear servomotor: 1 V/1000 mm/s	–	Immediately
	n.□□01	Speed Reference	• Rotary servomotor: 1 V/1000 min^{-1} • Linear servomotor: 1 V/1000 mm/s	–	
	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 Deviation	0.05 V/encoder pulse unit	Position deviation after electronic gear conversion	
	n.□□05	Position Command Speed	• Rotary servomotor: 1 V/1000 min^{-1} • Linear servomotor: 1 V/1000 mm/s	–	
	n.□□06	Reserved (Do not use.)	–	–	
	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 indicated by the output voltage.	
	n.□□09	Speed Feedforward	• Rotary servomotor: 1 V/1000 min^{-1} • Linear servomotor: 1 V/1000 mm/s	–	
	n.□□0A	Torque Feedforward	1 V/100% rated torque	–	
	n.□□0B	Active Gain *1	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 indicated by the output voltage.	
	n.□□0D	External Encoder Speed	1 V/1000 min^{-1}	Value calculated at the motor shaft	
	n.□□10	Main Circuit DC Voltage	1 V/100 V (main circuit DC voltage)	–	

*1 Refer to the following section for details.
☞ *8.14.1 Gain Switching on page 412*

(2) 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 output voltage = (-1) × {Pn006 = n.□□XX (Analog Monitor 1 Signal Selection) × Pn552 (Analog Monitor 1 Magnification) + Pn550 (Analog Monitor 1 Offset Voltage)}

Analog monitor 2 output voltage = (-1) × {Pn007 = n.□□XX (Analog Monitor 2 Signal Selection) × Pn553 (Analog Monitor 2 Magnification) + Pn551 (Analog Monitor 2 Offset Voltage)}

The following parameters are set.

Pn550	Analog Monitor 1 Offset Voltage			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	-10000 to 10000	0.1 V	0	Immediately

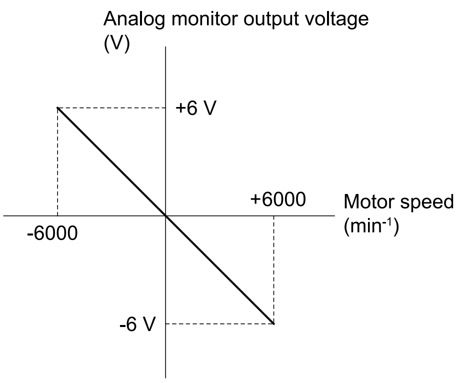
Pn551	Analog Monitor 2 Offset Voltage			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	-10000 to 10000	0.1 V	0	Immediately

Pn552	Analog Monitor 1 Magnification			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	-10000 to 10000	× 0.01	100	Immediately

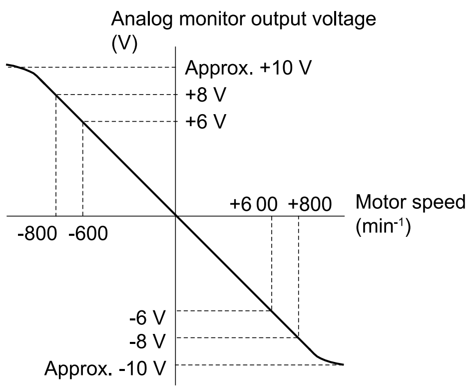
Pn553	Analog Monitor 2 Magnification			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	-10000 to 10000	× 0.01	100	Immediately

Example: To set the monitor item to Pn006 = n.□□00 (Motor Speed)

When Pn552 = 100 (Setting unit: ×0.01)



When Pn552 = 1000 (Setting unit: ×0.01)



Note: The valid linearity range is ±8 V.
The resolution is 16 bits.

(3) 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.

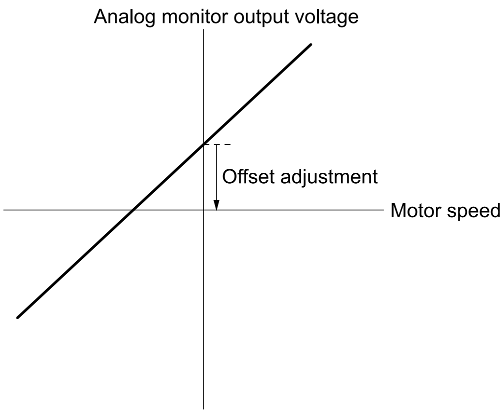
The gain is adjusted to match the sensitivity of the measuring system.

The offset and gain are adjusted at the factory. You normally do not need to adjust them.

(4) Adjustment Example

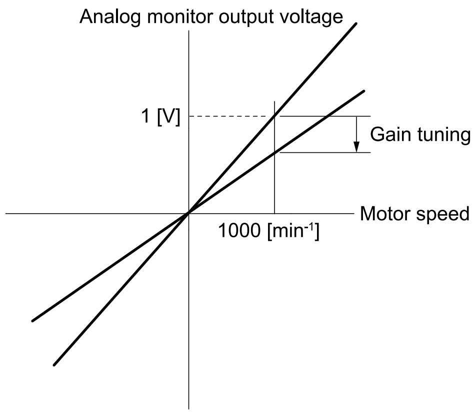
An example of adjusting the output of the motor speed monitor is provided below.

Offset Adjustment



Item	Specification
Offset Adjustment Range	-2.4 V to 2.4 V
Adjustment Unit	18.9 mV/LSB

Gain Adjustment



Item	Specification
Gain Adjustment Range	100 ±50%
Adjustment Unit	0.4%/LSB

The gain adjustment range is made using a 100% output value (gain adjustment of 0) as the reference value with an adjustment range of 50% to 150%. A setting example is given below.

- Setting the Adjustment Value to -125
  $100 + (-125 \times 0.4) = 50$ [%]
  Therefore, the monitor output voltage goes to 50% of the original value.
- Setting the Adjustment Value to 125
  $100 + (125 \times 0.4) = 150$ [%]
  Therefore, the monitor output voltage goes to 150% of the original value.

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.

(5) Preparations

Always check the following before you adjust the analog monitor output.

- The parameters must not be write prohibited.

(6) Applicable Tools

The following table lists the tools that you can use to perform analog monitor output tuning.

- Offset Adjustment

Tool	Fn No./Function Name	Reference
Digital Operator	Fn00C	Σ-7-/Σ-X-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	[Others] - [Adjusting the Analog Monitor Output]	*(7) Operating Procedure on page 465*

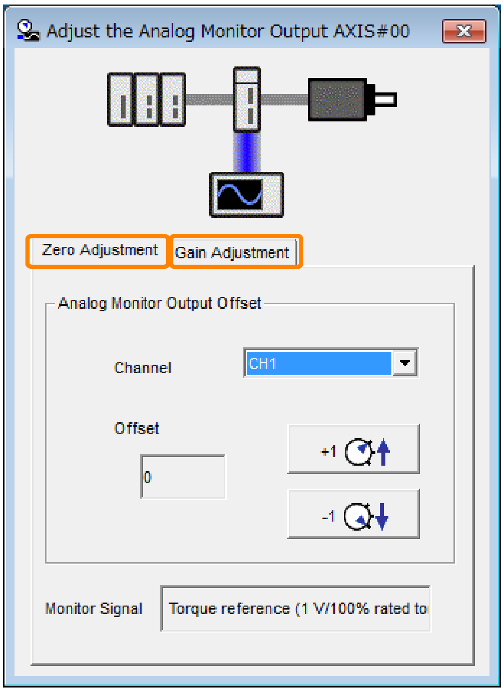
- Gain Adjustment

Tool	Fn No./Function Name	Reference
Digital Operator	Fn00D	Σ-7-/Σ-X-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	[Others] - [Adjusting the Analog Monitor Output]	*(7) Operating Procedure on page 465*

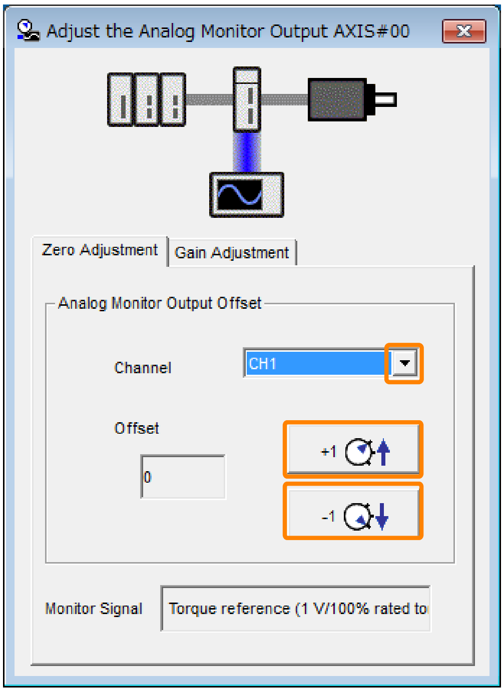
(7) Operating Procedure

Use the following procedure to adjust the analog monitor output.

1. **Click the [] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**
2. **Click [Adjust the Analog Monitor Output] in the [Menu] window.**
   The [Adjust the Analog Monitor Output] window will be displayed.
3. **Click the [Zero Adjustment] or [Gain Adjustment] tab.**



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] and select the channel.



This concludes adjusting the analog monitor output.

9.4 Monitoring Product Life

9.4.1 Items That You Can Monitor

Monitor Items	Description
SERVOPACK Installation Environment	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%. • Lower the surrounding temperature. • Decrease the load.
Servomotor Installation Environment	
Built-in Fan Service 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. ☞ *13.1.2 Guidelines for Part Replacement on page 539*
Capacitor Service Life Prediction	
Inrush Current Prevention Circuit Service 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. ☞ *13.1.2 Guidelines for Part Replacement on page 539*
Dynamic Brake Circuit Service Life Prediction	
Maintenance Prediction of Bearings	The prediction value is displayed with the unused status of the servomotor treated as 100%, and the value decreases according to the total number of rotations of the motor. Use a monitor value of 0% as a guideline for the maintenance period. The prediction value is calculated from the standard service life time for motor parts and the motor total number of rotations when the motor has rotated continuously at the rated speed. (The standard service life of the bearings is 20,000 hours. The service life depends on the actual usage conditions and environment.) Example: Servomotor with a rated speed of 3000 min^{-1} Rated speed 3000 [min^{-1}] × 60 [min] × 20000 [hours] = 3600 × 10^6 [revolutions] Maintenance prediction monitor: bearings [%] = (1 - (Current total number of rotations / 3600 × 10^6)) × 100 Refer to the following manual for details on the service life of motor parts. Σ-X-Series Rotary Servomotor Product Manual (Manual No.: SIEP C230210 00)
Maintenance Prediction of Oil Seal	The prediction value is displayed with the unused status of the servomotor treated as 100%, and the value decreases according to the total number of rotations of the motor. Use a monitor value of 0% as a guideline for the maintenance period. The prediction value is calculated from the standard service life time for motor parts and the motor total number of rotations when the motor has rotated continuously at the rated speed. (The standard service life of the oil seal is 5,000 hours. The service life depends on the actual usage conditions and environment.) Example: Servomotor with a rated speed of 3000 min^{-1} Rated speed 3000 [min^{-1}] × 60 [min] × 5000 [hours] = 900 × 10^6 [revolutions] Maintenance prediction monitor: oil seal [%] = (1 - (Current total number of rotations / 900 × 10^6)) × 100 Refer to the following manual for details on the service life of motor parts. Σ-X-Series Rotary Servomotor Product Manual (Manual No.: SIEP C230210 00)

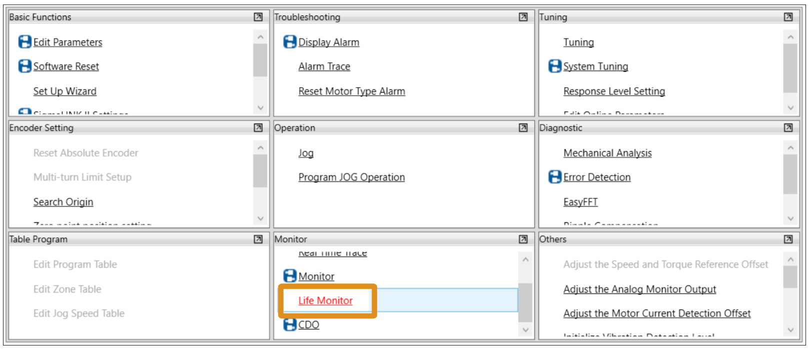
9.4.2 Operating Procedure

Use the following procedure to monitor the installation environment, service life predictions, and maintenance predictions.

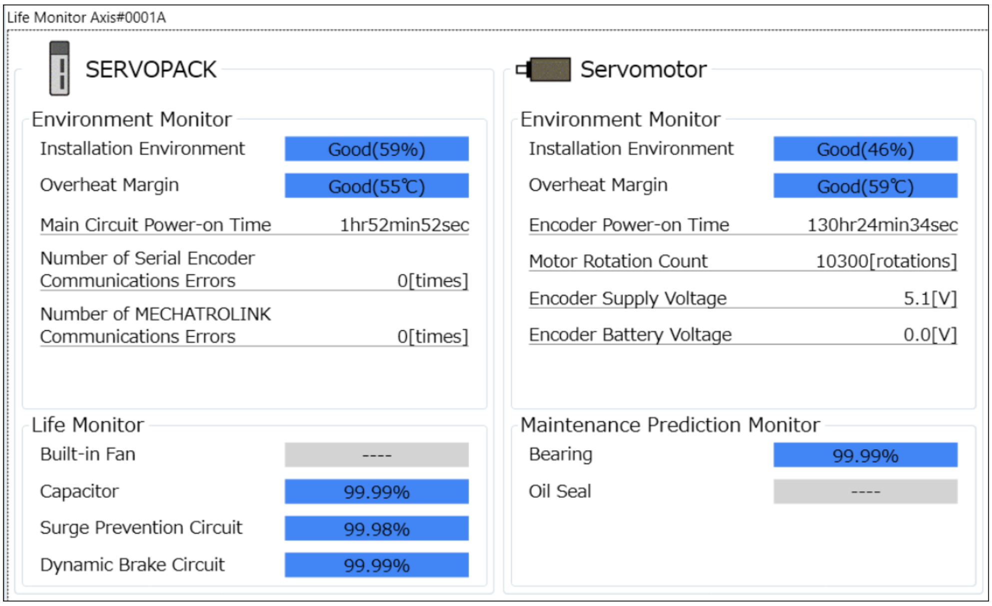
1. **Click the [ ] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**

   The [Menu] window will be displayed.

2. **Click [Life Monitor] in the [Monitor] area.**



The [Life Monitor] window will be displayed.



Information With the digital operator, you can use Un025 to Un02A, Un183 to Un188 to monitor this information.

9.4.3 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 and when the service life of bearings and oil seals are reached.

(1) Preventative Maintenance Warning

(a) SERVOPACK Preventative Maintenance Warning

An A.9b0 warning (SERVOPACK 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 prevention circuit life, and dynamic brake circuit life. You can change the setting of Pn00F = n.□□□X to enable or disable the SERVOPACK preventative maintenance warning.

Pn00F	n.□□□X	SERVOPACK Preventative Maintenance Warning Selection Speed Pos Trq		When Enabled
		0 Default	Do not detect SERVOPACK preventative maintenance warnings.	After restart
		1	Detect SERVOPACK preventative maintenance warnings.	

(b) Servomotor Preventative Maintenance Warning

For bearings and oil seals, which are consumable parts in the servomotor, an A.9b1 (Servomotor Preventative Maintenance Warning) is detected when one of the maintenance prediction values becomes 10% or lower. Use this warning as a guideline for when to perform maintenance.

You can change the setting of Pn00F = n.□□X□ to enable or disable the servomotor preventative maintenance warning.

Pn00F	n.□□X□	Servomotor Preventative Maintenance Warning Selection Speed Pos Trq		When Enabled
		0 Default	Do not detect servomotor preventative maintenance warnings.	After restart
		1	Detect servomotor preventative maintenance warnings.	

(2) /PM (Preventative Maintenance Output) Signal

The /PM (Preventative Maintenance Output) signal is output when any of the following service life prediction items reaches 10% or less.

- SERVOPACK fan service life prediction
- SERVOPACK capacitor service life prediction
- SERVOPACK inrush current prevention circuit service life prediction
- SERVOPACK dynamic brake circuit service life prediction
- Servomotor maintenance prediction of bearings
- Servomotor maintenance prediction of oil seal

Even if Pn00F is set to n.□□□0 (do not detect SERVOPACK preventative maintenance warnings) or Pn00F is set to n.□□0□ (do not detect servomotor preventative maintenance warnings), the /PM signal will still be output as long as it is allocated.

Classification	Signal	Connector Pin No.	Signal Status	Description
Output	/PM	Must be allocated.	ON (closed)	A service life prediction item has reached 10% or less.
			OFF (open)	All service life prediction items are greater than 10%.

Note:
You must allocate the /PM signal to use it. The parameters that you use depend on the allocation method.

Allocation Method	Parameter to Use
Σ-7S-compatible I/O Signal Allocation	• Pn50A = n.□□□1 (Σ-7S-compatible I/O Signal Allocations) • Pn514 = n.□X□□ (/PM (Preventative Maintenance Output) Signal Allocation)
Σ-LINK II Input Signal Allocation	• Pn50A = n.□□□2 (use Σ-LINK II input signal allocations) • Pn5BC (/PM (Preventative Maintenance Output) Signal Allocation)

Refer to the following section for details.

☞ *6.1.4 Output Signal Allocations on page 213*

9.5 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.

9.5.1 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 • Feedback speed • Reference speed • Position command speed • Position deviation • Motor-load position deviation • Main circuit DC voltage	• ALM • Servo ON command (/S-ON) • Proportional control command (/P-CON) • Forward torque command (/P-CL) • Reverse torque command (/N-CL) • G-SEL1 signal (/G-SEL1) • ACON

9.5.2 Applicable Tools

The following table lists the tools that you can use to perform alarm tracing.

Tool	Fn No./Function Name	Reference
Digital Operator	You cannot display alarm tracing data from the digital operator.	
SigmaWin+	[Troubleshooting] - [Alarm Trace]	Engineering Tool SigmaWin+ Operation Manual (Manual No.: SIET S800001 34)

9.6 Error Detection Setting

9.6.1 Outline

Error detection is a function that compares the values of normal operating characteristics saved to the SERVOPACK in advance with the actual values during operation to judge errors. You can use this function to detect deterioration and failures in machines and equipment and to detect defective products. The detected results can be checked from the host controller.

The following table gives the steps to execute error detection and references for each step.

Step	Item	Reference
1	Preparing Trace Data for Sample Data	☞ *9.6.2 Preparing Trace Data to Create Sample Data on page 471*
2	Creating Sample Data and Setting the Error Judgment Baseline	☞ *9.6.3 Creating Sample Data and Setting the Error Judgment Baseline on page 472*
3	Executing Error Detection	☞ *9.6.4 Executing Error Detection on page 476*

Information: Error detection is performed by calculating the Mahalanobis distance of each sampling point from sample data saved to the SERVOPACK in advance and trace data obtained during operation. For the Mahalanobis distance of each sampling point, A.905 (Error Detection Warning) will occur when the number of points that exceed the judgment level registered in advance is greater than or equal to the number of error detection points. You can select up to two trace targets for calculating the Mahalanobis distance.

Term

Sample Data :

Sample data is the data set saved to the SERVOPACK in advance for error detection processing. The sample data is created by calculating the mean value and distribution value in waveform sample points from multiple waveforms when the SERVOPACK performed the same operation.

Mahalanobis Distance :

The Mahalanobis distance is an index that expresses the degree to which the operating values deviate from the sample data. The greater the Mahalanobis distance, the more the operating values are deviating from the sample data.

9.6.2 Preparing Trace Data to Create Sample Data

Prepare the trace data to create sample data.

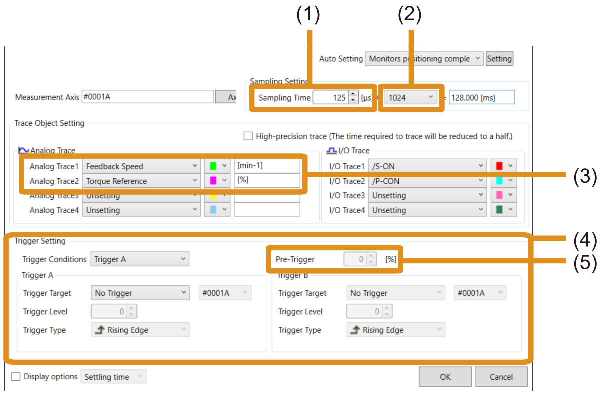
Perform tracing using the same procedure as normal tracing and obtain multiple items of trace data (std file).

Important

If the SERVOPACK software version is 0007 or later, use the SigmaWin+ Ver. 7.42 or later to use error detection.

Important

Be careful of the following settings when acquiring trace data.



No.	Setting
(1)	Make this the same as the sampling time.
(2)	Set to “1024”.
(3)	Set analog trace 1 and analog trace 2 to the data for error detection (trace targets with which to calculate the Mahalanobis distance).
(4)	Make this the same as the trigger settings.
(5)	Set the pre-trigger to 0.

9.6.3 Creating Sample Data and Setting the Error Judgment Baseline

1. **Check if the trace data is finished being prepared, and check if the trace data (std file) is saved to the same computer.**

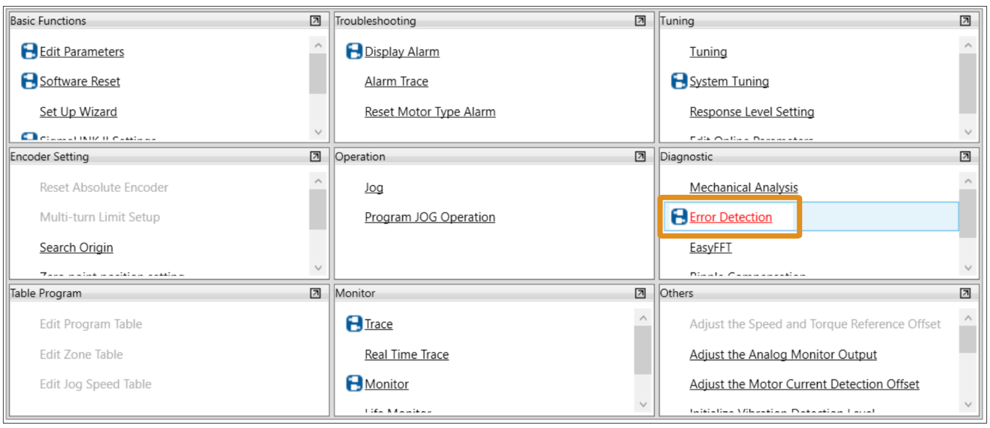
   Refer to the following section for details on preparing the trace data.

   ☞ *9.6.2 Preparing Trace Data to Create Sample Data on page 471*

2. **Click the [ ] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**

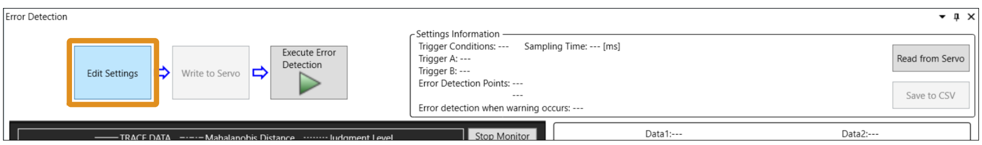
   The [Menu] window will be displayed.

3. **Click [Error Detection] in the [Diagnostic] area.**



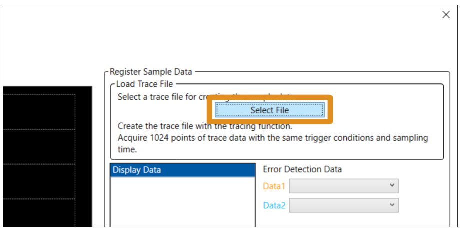
   The [Error Detection] window will be displayed.

4. **Click the [Edit Settings] button.**



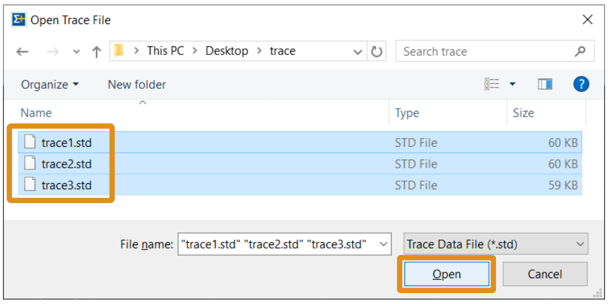
The [Edit Error Detection Settings] window will be displayed.

5. **Click the [Select File] button.**



The [Open Trace File] window will be displayed.

6. **Select the prepared trace data (std file), and then click the [Open] button.**

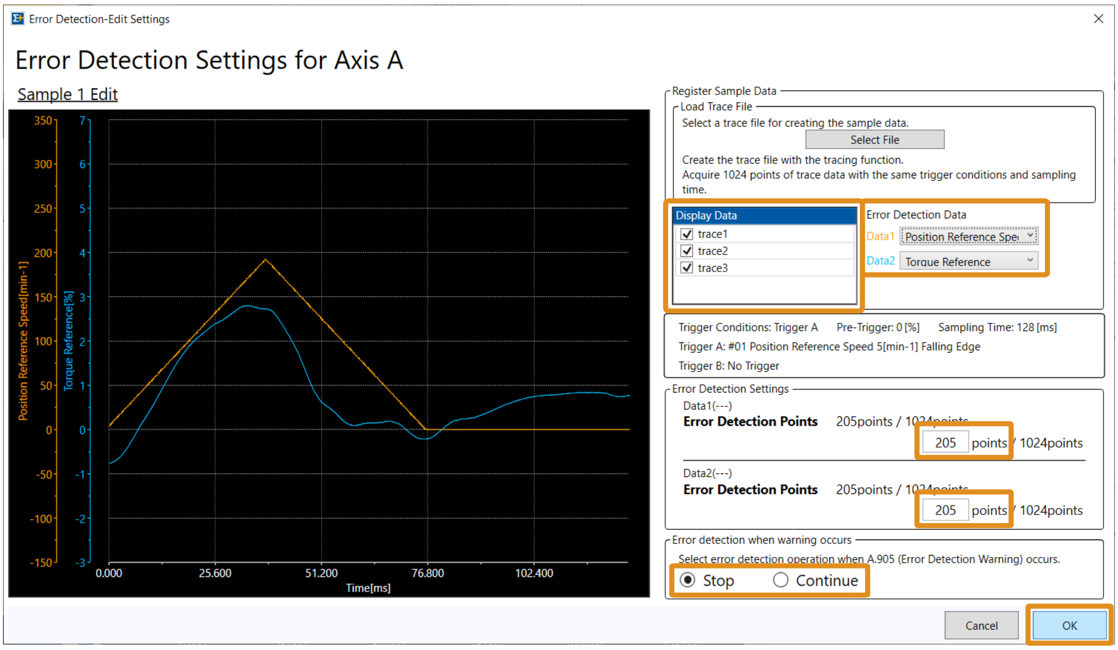


Information You can select multiple files by using the [Shift] key and [Ctrl] key while selecting files.

The selected files will be displayed on the [Error Detection-Edit Settings] window.

7. **Configure the following settings, and then click the [OK] button.**

- Select the check boxes for the data to use to create the sample data.
- Set the data to use for error detection in [Data 1] and [Data 2].
- Set the number of error detection points.
  Set whether to trigger A.905 when a difference of the number of points is detected for the sample data. If the setting is low, the odds of A.905 being triggered will increase. If the setting is 1024, A.905 will no longer be triggered.
  The number of error detection points can be changed when using error detection. The appropriate setting will depend on the device and usage conditions, so adjust the setting while actually using error detection.
- Select the error detection trace execution setting.

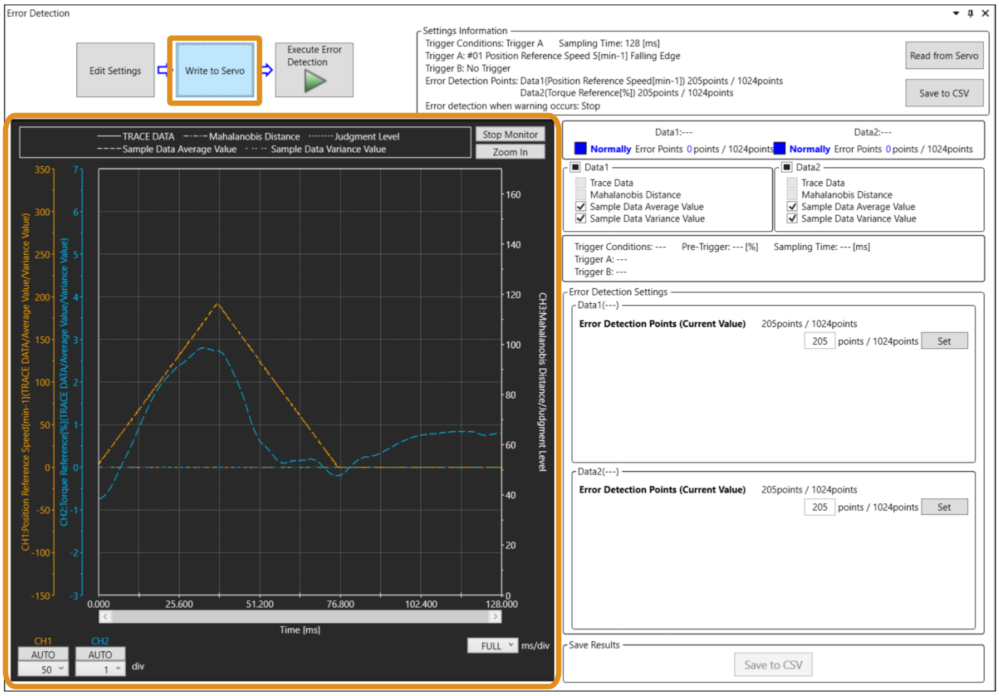


The average and dispersion values of the sample data will be displayed on the [Error Detection] window.

Information You can also set the error detection trace execution setting with the parameter. The following table gives details on the parameter to set.

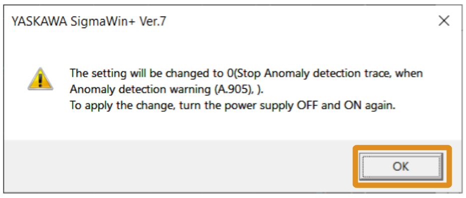
		Execution Selection when Error Detection Warning (Speed, Pos, Trq)		When Enabled
Pn5C3	n.□□X□	0 Default	Stop error detection when A.905 (Error Detection Warning) occurs.	After restart
		1	Do not stop error detection when A.905 (Error Detection Warning) occurs.	

8. **Check the waveforms of the sample data, and then click [Write to Servo] button.**



The message dialog box will be displayed.

9. **Click the [OK] button.**



The displayed sample data will be written to the SERVOPACK.

10. **To enable the sample data saved to the SERVOPACK, turn the power to the SERVOPACK OFF and ON again.**

Information To edit the sample data, click the [Edit Settings] button. The [Edit Error Detection Settings] window will be displayed, and you can change the settings.

This concludes the procedure to create sample data. Next, use error detection. Refer to the following section for details.

☞ *9.6.4 Executing Error Detection on page 476*

(1) Related Parameters

The following section describes the setting procedure using the SigmaWin+.

☞ *9.6.3 Creating Sample Data and Setting the Error Judgment Baseline on page 472*

You can also configure these settings with SERVOPACK parameters. The parameters related to the settings are shown next.

Information The number of error detection points and the error judgment levels can be set with parameters.
The error detection data cannot be set with parameters. Use the SigmaWin+ to set the error detection data.
You cannot use the SigmaWin+ to set the error judgment levels. You can use only the parameters to set the error judgment levels.

(a) Number of Error Detection Points

Pn5C4	Error Detection Sample Data Set 1 Warning Level 1			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 10000	0.01%	2000	Immediately

Pn5C6	Error Detection Sample Data Set 1 Warning Level 2			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 10000	0.01%	2000	Immediately

Pn5C8	Error Detection Sample Data Set 2 Warning Level 1			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 10000	0.01%	2000	Immediately

Pn5CA	Error Detection Sample Data Set 2 Warning Level 2			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 10000	0.01%	2000	Immediately

Information In the SigmaWin+, set error detection points, but with parameters, set error rate (level).
For example, to set the level for the torque reference data of sample data 1, configure the settings as shown below.

1. For [Error Detection Data: Data 1] in the SigmaWin+, set the torque reference data.
2. In Pn5C4 (Error Detection Sample Data Set 1 Warning Level 1), set the error rate for reference data.
   For example, to trigger A.905 when the error rate is 30%, set Pn5C4 to 3000.
   Or to no longer trigger A.905, set Pn5C4 to 10000.

(b) Error Judgment Level

It is normally not necessary to change the error judgment level, but it can be changed with parameters. The error judgment level cannot be changed in the SigmaWin+. The following table lists the related parameters for changing the error judgment level.

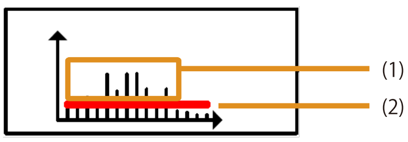
Pn5C5	Error Detection Sample Data Set 1 Judgment Level 1			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 10000	–	1520	Immediately

Pn5C7	Error Detection Sample Data Set 1 Judgment Level 2			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 10000	–	1520	Immediately

Pn5C9	Error Detection Sample Data Set 2 Judgment Level 1			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 10000	–	1520	Immediately

Pn5CB	Error Detection Sample Data Set 2 Judgment Level 2			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 10000	–	1520	Immediately

The following table shows the relationship between the Mahalanobis distance and the parameters to set.



No.	Description	Parameter to Set
(1)	Set what percentage the judgment level should be exceeded in order to trigger A.905. This percentage is called the error rate, which can be calculated with the following equation. Error rate [%] = Number of samples that exceed the judgment level [count] / Number of samples of trace data [count]	Pn5C4 Pn5C6 Pn5C8 Pn5CA
(2)	Set the judgment level at which an error is judged. It is normally not necessary to change these settings from the default values.	Pn5C5 Pn5C7 Pn5C9 Pn5CB

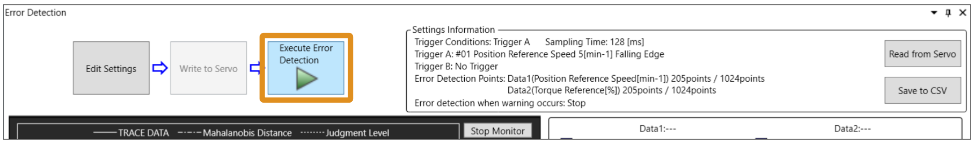
9.6.4 Executing Error Detection

This section describes how to use error detection.

Information Refer to the following section for the preparations to use error detection.

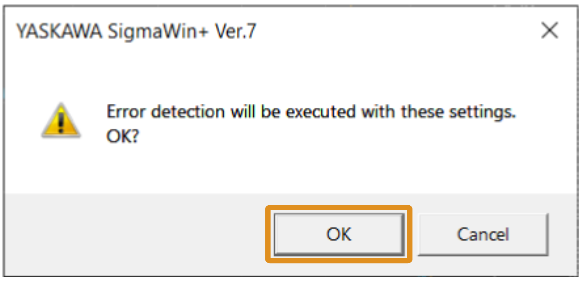
☞ *9.6.3 Creating Sample Data and Setting the Error Judgment Baseline on page 472*

1. **Click the [Execute Error Detection] button in the SigmaWin+.**



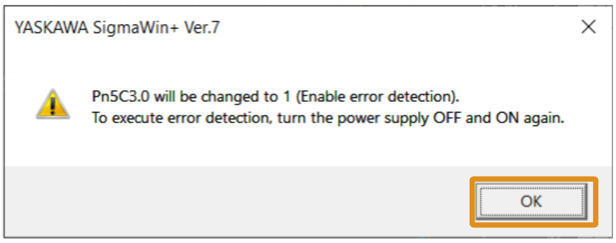
The message dialog box will be displayed.

2. **Click the [OK] button.**



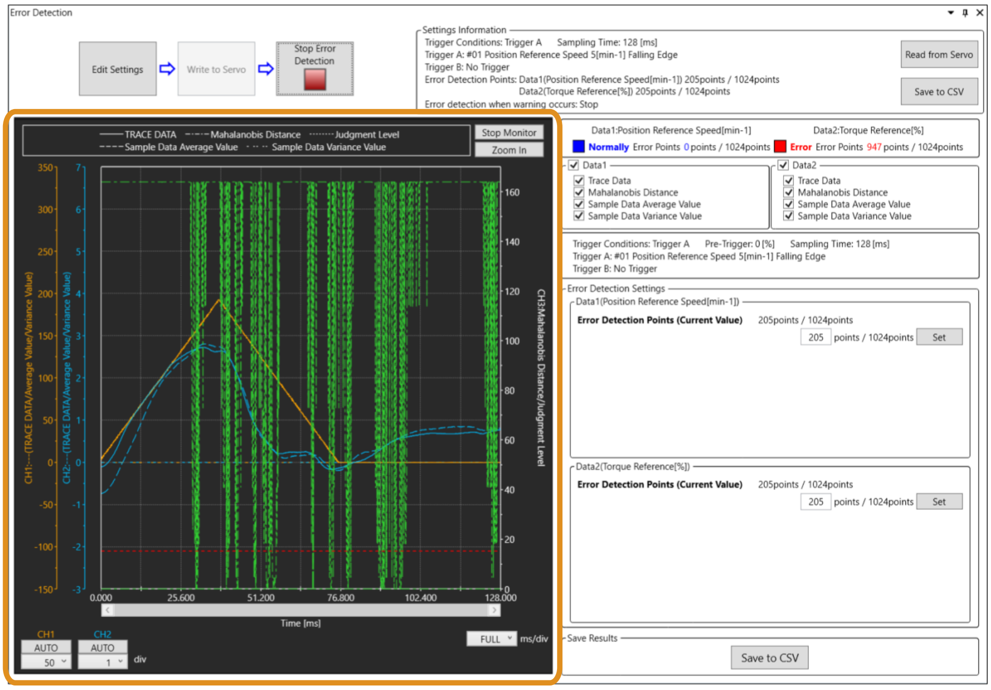
Another message dialog box will be displayed.

3. **Click the [OK] button.**



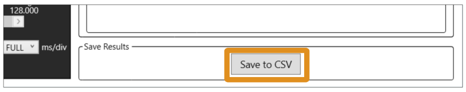
4. **Turn the power to the SERVOPACK OFF and ON again.**
5. **Run the machine and equipment as you would normally.**

The sample data and running trace data will be displayed.



When an error is detected according to the set conditions and content, A.905 (Error Detection Warning) will occur.

Click the [Save to CSV] button to save the on-screen data to a CSV file.



(1) Restrictions

- If the SERVOPACK software version is 0007 or later, use the SigmaWin+ Ver. 7.42 or later to use error detection.
- You cannot execute utility functions at the same time as error detection. Error detection will stop if you execute the following utility functions.

SigmaWin+		Digital Operator		Reference
Button in [Menu] Window	**SigmaWin+ Function Name**	**Fn No.**	**Utility Function Name**	
Monitor	Trace	–	–	☞ *9.3 Monitoring Machine Operation Status and Signal Waveforms on page 460*
Tuning	Tuning - Moment of Inertia Ratio Settings - Execute	–	–	☞ *8.5 Moment of Inertia Estimation without a Host Reference on page 323*
Diagnostic	Mechanical Analysis	–	–	☞ *8.16.1 Mechanical Analysis on page 442*

10

Fully-Closed Loop Control

Provides detailed information on performing fully-closed loop control with the SERVOPACK.

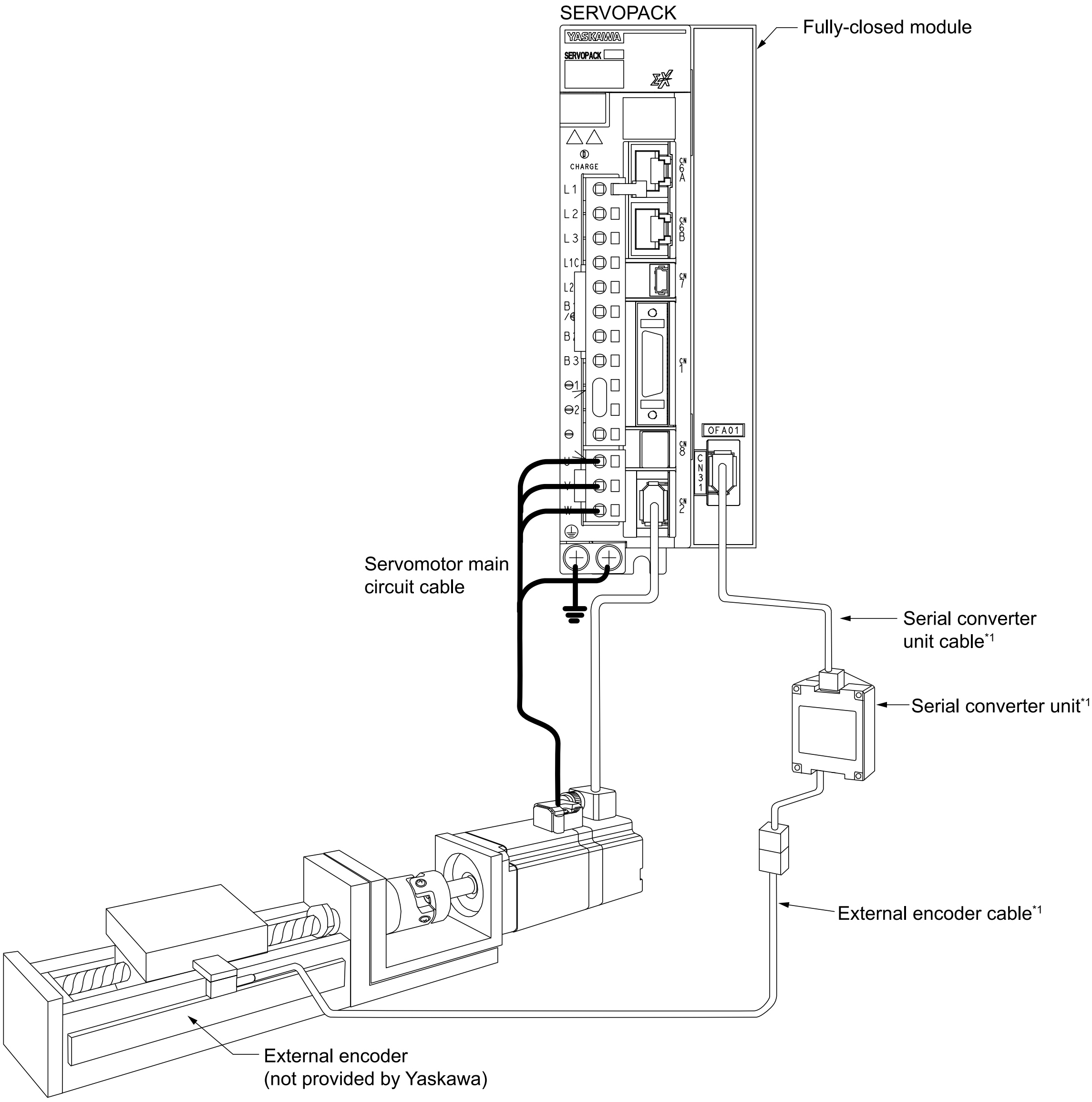
10.1 Fully-Closed System

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.

Refer to the following manual for details on fully-closed modules.

Σ-X-Series Peripheral Device Selection Manual (Manual No.: SIEP C710812 12)

The following figure shows an example of the system configuration.



*1 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 87*

10.2 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	Controlling 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 • Encoder wiring • Wiring of I/O signal lines from the host controller • Servomotor rotation direction, motor speed, and multiturn data • Operation of safety mechanisms, such as the holding brakes and the overtravel mechanisms	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□□□ (do not use an external encoder) to specify semi-closed loop control. • Are there any errors in the SERVOPACK? • Does jogging operation function correctly when you operate the SERVOPACK without a load? • Do the I/O signals turn ON and OFF correctly? • Is power supplied to the servomotor when the SV_ON (Servo ON) command is sent from the host controller? • Does the servomotor operate correctly when a position reference is input by the host controller?	• Pn000 (Basic Function Selections 0) • Pn001 (Application Function Selections 1) • Pn002 = n.X□□□ (External Encoder Usage) • Pn20E (Electronic Gear Ratio (Numerator)) • Pn210 (Electronic Gear Ratio (Denominator)) • Pn50A to Pn516 or Pn50A, Pn590 to Pn5BC (Input Signal Selections)	SERVOPACK or host controller
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 references 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 movement direction, travel distance, and movement speed agree with the references from the host controller.	Pn103 (Moment of Inertia Ratio)	Host controller
3	Check the external encoder. Items to Check Is the signal from the external encoder received correctly?	Set the parameters related to fully-closed loop control and move the machine with your hand without turning ON the power to the servomotor. Check the following status with the digital operator or SigmaWin+. • Does the fully-closed feedback pulse counter count up when the servomotor moves in the forward direction? • Is the travel distance of the machine visually about the same as the amount counted by the fully-closed feedback pulse counter? **Note:** The unit for the fully-closed feedback pulse counter is pulses, which is equivalent to the external encoder sine wave pitch.	• Pn002 = n.X□□□ (External Encoder Usage) • Pn20A (Number of External Encoder Scale Pitches) • Pn20E (Electronic Gear Ratio (Numerator)) • Pn210 (Electronic Gear Ratio (Denominator)) • Pn281 (Encoder Output Resolution) • Pn51B (Motor-Load Position Deviation Overflow Detection Level) • Pn522 (Positioning Completed Width) • Pn52A (Multiplier per Fully-closed Rotation)	–

Continued on next page.

Continued from previous page.

Step	Description	Operation	Required Parameter Settings	Controlling Device
4	Perform a program jogging. Items to Check Does the fully-closed system operate correctly for the SERVOPACK without a load?	Perform a program jogging and confirm that the travel distance is the same as the reference value in Pn531 (Program Jogging Travel Distance). When you perform program jogging, start from a low speed and gradually increase the speed.	Pn530 to Pn536 (program jogging-related parameters)	SERVOPACK
5	Operate the SERVOPACK. Items to Check Does the fully-closed system operate correctly, including the host controller?	Input a position reference and confirm that the SERVOPACK operates correctly. Start from a low speed and gradually increase the speed.	–	Host controller

10.3 Parameter Settings for Fully-Closed Loop Control

10.3.1 Parameters to Set and Reference Information

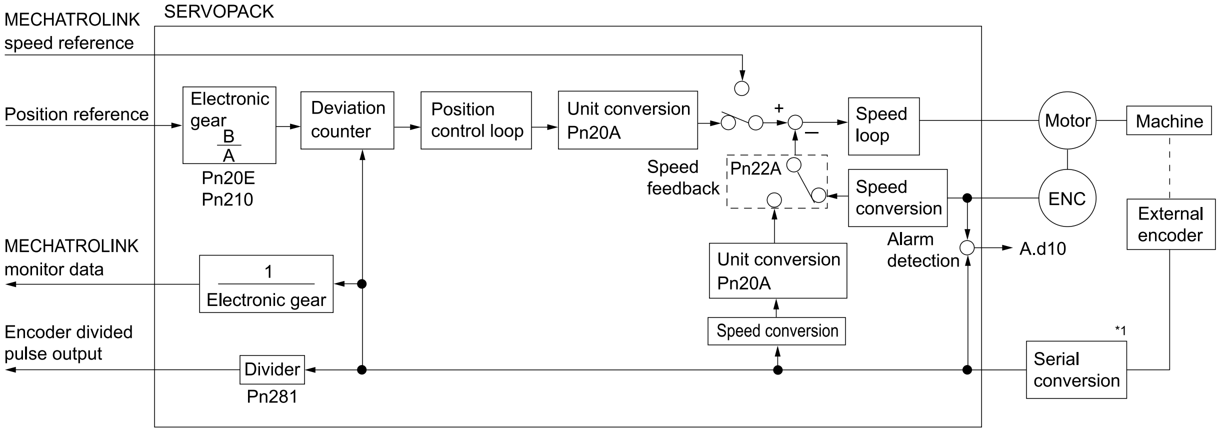
This section describes the parameter settings that are related to fully-closed loop control.

Parameter to Set	Setting	Availability *1			Reference
		Position Control	Speed Control	Torque Control	
Pn000 = n.□□□X	Motor rotation direction	○	○	○	☞ *10.3.3 Setting the Motor Rotation Direction and the Machine Movement Direction on page 484*
Pn002 = n.X□□□	External encoder usage method	○	○	○	
Pn20A	Number of external encoder scale pitches	○	○	○	☞ *10.3.4 Setting the Number of External Encoder Scale Pitches on page 485*
Pn281	PAO, PBO, and PCO (Encoder Divided Pulse Output) signals from the SERVOPACK	○	○	○	☞ *10.3.5 Setting the PAO, PBO, and PCO (Encoder Divided Pulse Output) Signals on page 485*
–	External absolute encoder data reception sequence	○	○	○	☞ *6.9.4 Reading the Position Data from the Absolute Linear Encoder on page 250*
Pn20E or Pn210	Electronic gear ratio	○	–	–	☞ *5.15 Electronic Gear Settings on page 188*
Pn51B	Motor-load position deviation overflow detection level	○	–	–	☞ *10.3.8 Alarm Detection Settings on page 487*
Pn52A	Multiplier per fully-closed rotation	○	–	–	
Pn006/Pn007	Analog monitor signal	○	○	○	☞ *10.3.9 Analog Monitor Signal Settings on page 487*
Pn22A = n.X□□□	Speed feedback method during fully-closed loop control	○	–	–	☞ *10.3.10 Setting to Use an External Encoder for Speed Feedback on page 489*

*1 ○: Can be set, –: Cannot be set

10.3.2 Control Block Diagram for Fully-Closed Loop Control

The control block diagram for fully-closed loop control is provided below.



*1 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.□1□□ (use the absolute encoder as an incremental encoder).

10.3.3 Setting the Motor Rotation Direction and the Machine Movement Direction

You must set the motor rotation direction and the machine movement direction. To perform fully-closed loop control, you must set the motor rotation direction with both Pn000 = n.□□□X (Rotation Direction Selection) and Pn002 = n.X□□□ (External Encoder Usage).

Parameter			Pn002 = n.X□□□ (External Encoder Usage)			
			n.1□□□		**n.3□□□**	
Pn000 = n.□□□X (Motor Direction Selection)	**n.□□□0**	Reference direction	Forward reference	Reverse reference	Forward reference	Reverse reference
		Motor rotation direction	CCW	CW	CCW	CW
		External encoder	Forward movement	Reverse movement	Reverse movement	Forward movement
	n.□□□1	Reference direction	Forward reference	Reverse reference	Forward reference	Reverse reference
		Motor rotation 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.□□□X.
- Forward direction: The direction in which the pulses are counted up.
- Reverse direction: The direction in which the pulses are counted down.

(1) Related Parameters

- Pn000 = n.□□□X
  Refer to the following section for details.
  ☞ *5.5 Motor Direction Setting on page 161*
- Pn002 = n.X□□□
  When you perform fully-closed loop control, set Pn002 to n.1□□□ or n.3□□□.

		External Encoder Usage (Speed / Pos / Trq)		When Enabled
Pn002	n.X□□□	0 Default	Do not use an external encoder.	After restart
		1	The external encoder moves in the forward direction for CCW motor rotation.	
		2	Reserved (Do not use.)	
		3	The external encoder moves in the reverse direction for CCW motor rotation.	
		4	Reserved (Do not use.)	

Information Determine the setting of Pn002 = n.X□□□ as described below.

1. Set Pn000 to n.□□□0 (use the direction in which the linear encoder counts up as the forward direction) and set Pn002 to n.1□□□ (the external encoder moves in the forward direction for CCW motor rotation).
2. Manually rotate the motor shaft counterclockwise.
3. 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□□□.

10.3.4 Setting the Number of External Encoder Scale Pitches

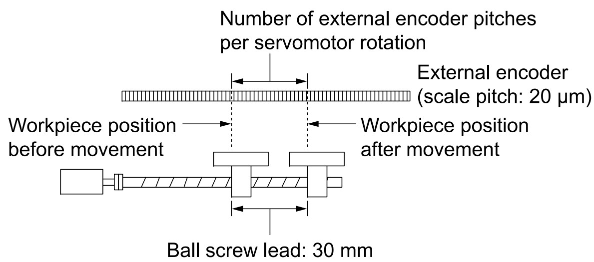
Set the number of external encoder scale pitches per servomotor rotation in Pn20A.

(1) Setting Example

Specifications

- External encoder scale pitch: 20 μm
- Ball screw lead: 30 mm

If the external encoder is connected directly to the servomotor, the setting will be 1500 (30 mm/0.02 mm = 1500).



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.

(2) Related Parameters

Pn20A	Number of External Encoder Scale Pitches (Speed / Pos / Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	4 to 1048576	1 scale pitch/revolution	32768	After restart

10.3.5 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.

(1) Setting Example

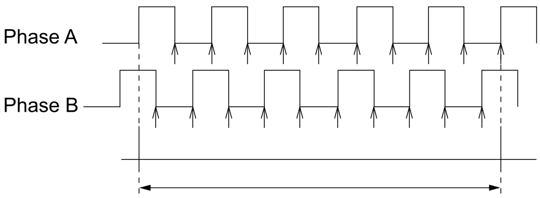
Specifications

- External encoder scale pitch: 20 μm
- Ball screw lead: 30 mm
- Speed:1600 mm/s

If a single pulse (multiplied by 4) is output for 1 μm, the setting would be 20.

If a single pulse (multiplied by 4) is output for 0.5 μm, the setting would be 40.

The encoder divided pulse output would have the following waveform if the setting is 20.



"↑" 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.

Information If the setting is 20 and the speed is 1600 mm/s, the output frequency would be 1600 mm/s /0.001 mm = 1600000 = 1.6 Mpps.

Because 1.6 Mpps is less than 6.4 Mpps, this setting can be used.

(2) Related Parameters

Pn281	Encoder Output Resolution			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	1 to 4096	1 edge/pitch	20	After restart

Note:

- The maximum setting for the encoder output resolution is 4096. If the resolution of the external encoder exceeds 4096, pulse output will no longer be possible at the resolution given in the following section.
  ☞ ◆ *Feedback Resolution of Linear Encoder: Incremental Linear Encoder on page 190*
  ☞ ◆ *Feedback Resolution of Linear Encoder: Absolute Linear Encoder on page 190*
- If the setting of Pn281 exceeds the resolution of the external encoder, an A.041 alarm (Encoder Output Pulse Setting Error) will be output.

10.3.6 External Absolute Encoder Data Reception Sequence

Refer to the following sections for details.

☞ *6.9.4 Reading the Position Data from the Absolute Linear Encoder on page 250*

With fully-closed loop control, the same sequence as for a linear servomotor is used.

10.3.7 Electronic Gear Settings

Refer to the following section for details.

☞ *5.15 Electronic Gear Settings on page 188*

With fully-closed loop control, the same setting as for a linear servomotor is used.

10.3.8 Alarm Detection Settings

This section describes the parameters related to alarm detection settings (Pn51B and Pn52A).

(1) 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.

Pn51B	Motor-Load Position Deviation Overflow Detection Level			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 1073741824	1 reference unit	1000	Immediately

Note:
If you set this parameter to 0, A.d10 alarms will not be output and the machine may be damaged.

(2) Pn52A (Multiplier per Fully-closed Rotation)

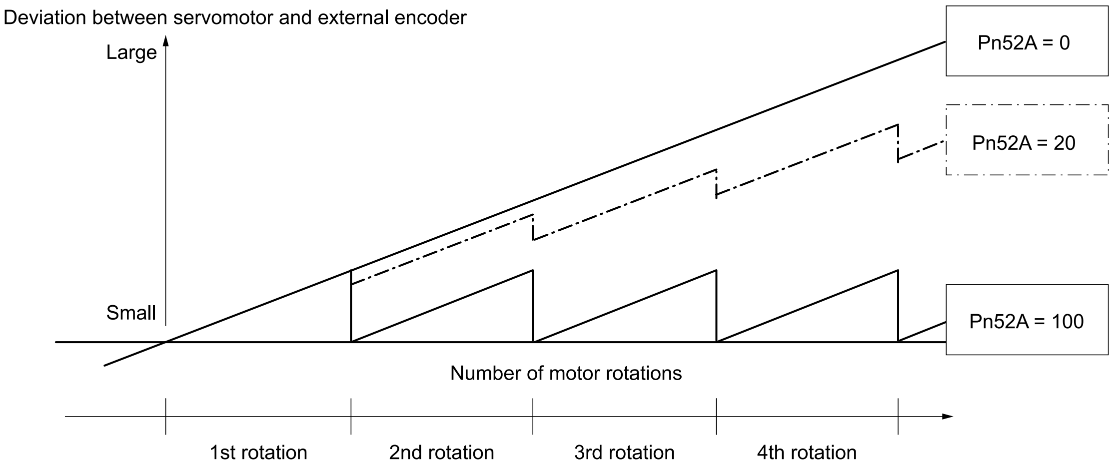
Set the coefficient of the deviation between the servomotor and the external encoder per servomotor rotation. This setting can be used to prevent the servomotor from running out of control due to damage to the external encoder or to detect belt slippage.

(a) 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 motor rotation multiplied by 0.8.



(b) Related Parameters

Pn52A	Multiplier per Fully-closed Rotation			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0 to 100	1%	20	Immediately

10.3.9 Analog Monitor Signal Settings

You can monitor the position deviation between the servomotor and load with an analog monitor.

		Analog Monitor 1 Signal Selection Speed Pos Trq		When Enabled
Pn006	n.□□XX	00	Motor speed (1 V/1000 min^{-1}) Motor speed (1 V/1000 mm/s)	Immediately
		01	Speed reference (1 V/1000 min^{-1}) Speed reference (1 V/1000 mm/s)	
		02 Default	Torque reference (1 V/100% rated torque) Force reference (1 V/100% rated force)	
		03	Position deviation (0.05 V/reference unit)	
		04	Position amplifier deviation (after electronic gear) (0.05 V/encoder pulse unit) Position amplifier deviation (after electronic gear) (0.05 V/linear encoder pulse unit)	
		05	Position reference speed (1 V/1000 min^{-1}) Position reference speed (1 V/1000 mm/s)	
		06	Reserved (Do not use.)	
		07	Position deviation between motor and load (0.01 V/reference unit)	
		08	Positioning completion (positioning completed: 5 V, positioning not completed: 0 V)	
		09	Speed feedforward (1 V/1000 min^{-1}) Speed feedforward (1 V/1000 mm/s)	
		0A	Torque feedforward (1 V/100% rated torque) Force feedforward (1 V/100% rated force)	
		0B	Active gain (gain 1: 1 V, gain 2: 2 V) 2 V)	
		0C	Completion of position reference distribution (completed: 5 V, not completed: 0 V)	
		0D	External encoder speed (1 V/1000 min^{-1}: value at the motor shaft)	
		0E	Reserved (Do not use.)	
		0F	Reserved (Do not use.)	
		10	Main circuit DC voltage	
		11 to 5F	Reserved (Do not use.)	

Pn007	n.□□XX	Analog Monitor 2 Signal Selection (Speed, Pos, Trq)		When Enabled
		00 Default	Motor speed (1 V/1000 min^{-1}) Motor speed (1 V/1000 mm/s)	Immediately
		01	Speed reference (1 V/1000 min^{-1}) Speed reference (1 V/1000 mm/s)	
		02	Torque reference (1 V/100% rated torque) Force reference (1 V/100% rated force)	
		03	Position deviation (0.05 V/reference unit)	
		04	Position amplifier deviation (after electronic gear) (0.05 V/encoder pulse unit) Position amplifier deviation (after electronic gear) (0.05 V/linear encoder pulse unit)	
		05	Position reference speed (1 V/1000 min^{-1}) Position reference speed (1 V/1000 mm/s)	
		06	Reserved (Do not use.)	
		07	Position deviation between motor and load (0.01 V/reference unit)	
		08	Positioning completion (positioning completed: 5 V, positioning not completed: 0 V)	
		09	Speed feedforward (1 V/1000 min^{-1}) Speed feedforward (1 V/1000 mm/s)	
		0A	Torque feedforward (1 V/100% rated torque) Force feedforward (1 V/100% rated force)	
		0B	Active gain (gain 1: 1 V, gain 2: 2 V) 2 V)	
		0C	Completion of position reference distribution (completed: 5 V, not completed: 0 V)	
		0D	External encoder speed (1 V/1000 min^{-1}: value at the motor shaft)	
		0E	Reserved (Do not use.)	
		0F	Reserved (Do not use.)	
		10	Main circuit DC voltage	
		11 to 5F	Reserved (Do not use.)	

10.3.10 Setting to Use an External Encoder for Speed Feedback

For fully-closed loop control, you normally set Pn22A to n.0□□□ (use motor encoder speed). If you will use a direct drive servomotor and a high-resolution external encoder, set Pn22A to n.1□□□ (use external encoder speed).

Pn22A	n.X□□□	Fully-closed Control Speed Feedback Selection (Speed, Pos, Trq)		When Enabled
		0 Default	Use motor encoder speed.	After restart
		1	Use external encoder speed.	

Note:

This parameter cannot be used if Pn002 is set to n.0□□□ (do not use external encoder).

10.4 Monitoring an External Encoder

You can monitor the current value of an external encoder attached to a machine without creating a fully-closed loop.

A dual encoder system with an encoder in the rotary servomotor and an external encoder attached to the machine is used, but only the encoder in the rotary servomotor is used in the control loop.

The external encoder is used only to monitor the current position of the machine.

10.4.1 Option Module Required for Monitoring

A fully-closed module (SGDV-OFA01A) is required to use this function. Refer to the following manual for detailed information on installation.

Σ-V-Series/Σ-V-Series for Large-Capacity Models/Σ-7-Series/Σ-X-Series Installation Guide Fully-closed Module (Manual No.: TOBP C720829 03)

10.4.2 Related Parameters

The parameter for using the external encoder as the current value monitor of the machine is shown below.

		External Encoder Monitor Usage Speed Pos Trq		When Enabled
Pn00E	n.X□□□	0 Default	Do not use an external encoder monitor.	After restart
		1	Use CCW as the forward direction.	
		2	Reserved (Do not use.)	
		3	Use CW as the forward direction.	
		4	Reserved (Do not use.)	

Fully-closed loop control is not used, so set Pn002 to n.0□□□ (do not use external encoder).

10.4.3 Monitoring the Current Value of the External Encoder from the Host Controller

To check the current value of the external encoder from the host controller, set one of the following parameters.

Item	Required Parameter Settings	
MECHATROLINK-III Communications	Pn824, Pn825	
MECHATROLINK-4 Communications	SERVOPACK parameters	Pn824, Pn825
	MECHATROLINK common parameters	E0 PnBC0 to E7 PnBCE *1

*1 These parameters are not available when using MECHATROLINK-III communications. You can set these parameters when using MECHATROLINK-4 communications only.

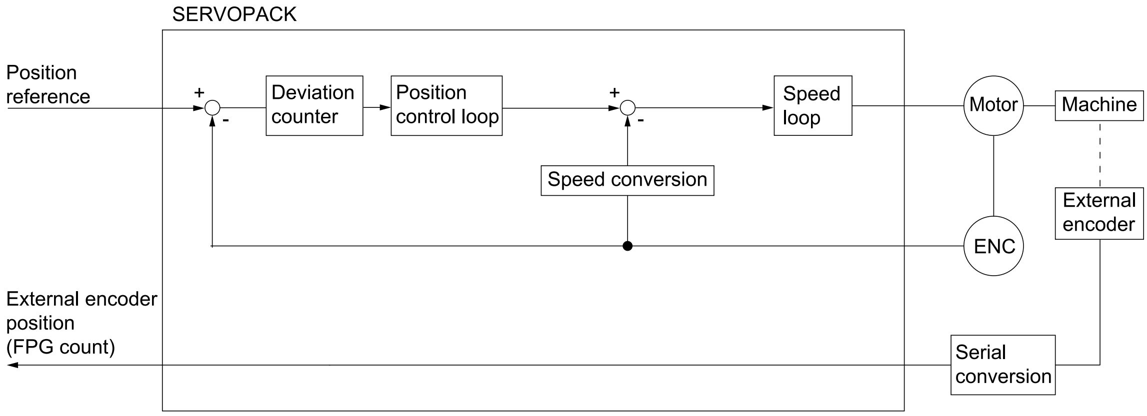
The setting will depend on the parameter that is used as shown below.

Setting of Pn824, Pn825	Settings of E0 PnBC0 to E7 PnBCE	Meaning
000Ch	005Ch	FPG count (lower 32 bits) [external encoder resolution]
000Dh	005Dh	FPG count (upper 32 bits) [external encoder resolution]

Information When you monitor the current value of the external encoder, the unit for the displayed numeric value is [external encoder resolution] and not [reference unit].

10.4.4 Block Diagrams

A simple block diagram is given below to provide an overall image of monitoring an external encoder.



11

Σ-LINK II Function

Provides detailed information on the Σ-LINK II functions of the SERVOPACK.

11.1 Outline

Σ-LINK II is a protocol used for communications between the SERVOPACK and encoder.

The Σ-X Series now allows you to connect multiple devices to the SERVOPACK.

In addition to the encoder, you can also connected sensors and I/O devices installed on the machine end. You can also use a Yaskawa sensor hub (model number: JUSP-SL2H□) to connect devices that do not support Σ-LINK II to the SERVOPACK.

The SERVOPACK collects data from the devices. This collected data can be monitored by the host controller and allocated to signals and used for SERVOPACK functions.

You may need to perform configuration using the SigmaWin+ to enable Σ-LINK II. You may also need to configure settings to monitor the data of connected devices and to configure settings to allocate signals to SERVOPACK functions.

11.2 Devices That Support Σ-LINK II

The following table lists devices that support Σ-LINK II.

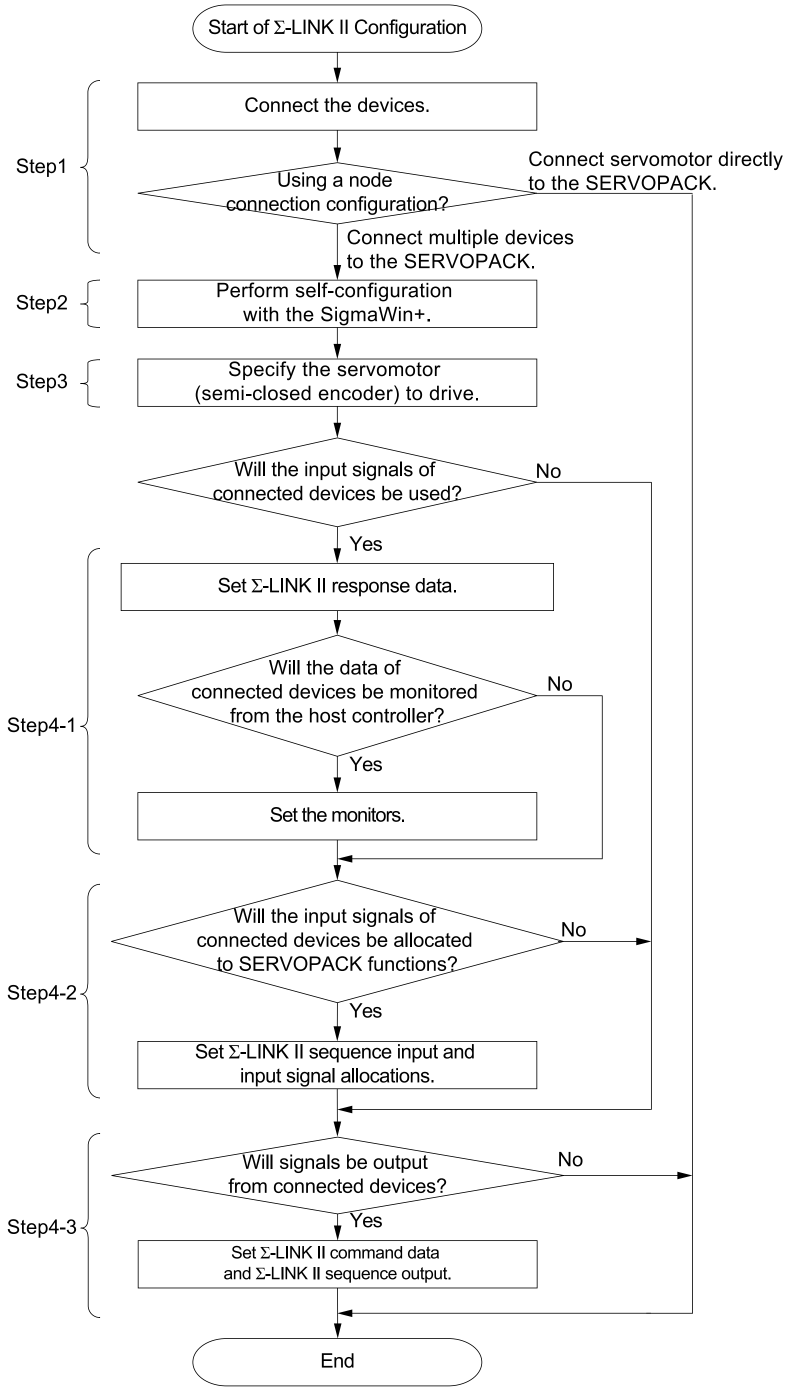
Classification	Product	Product Name	Model
Encoder	Servomotor (Semi-closed encoder)	Σ-X-series rotary servomotors Ancillary specification: Standard	SGMX□-□□□□□□□□1
	External Encoder *1 (Fully-closed encoder)	–	–
I/O Device	Sensor hub	Σ-LINK II sensor hub	JUSP-SL2H□

*1 Currently in development

> **Important**
> Σ-X-series rotary servomotors (model: SGMX□-□□□□□□□□2) with Σ-7 compatibility cannot use Σ-LINK II.

11.3 Procedure to Use Σ-LINK II

The following table gives the flow and references to use Σ-LINK II.



Step	Item	Reference
1	Connecting Devices to the SERVOPACK	☞ *11.2 Devices That Support Σ-LINK II on page 495* ☞ *11.4 Connecting Devices to the SERVOPACK on page 498*
2	Performing Self-Configuration with the SigmaWin+	☞ *11.5 Performing Self-Configuration on page 499*
3	Specifying the Servomotor (Semi-Closed Encoder) to Drive	☞ *11.6 Specifying the Servomotor (Semi-Closed Encoder) to Drive on page 504*
4	Configuring the Σ-LINK II Data Settings	–
4-1	Monitoring the Input Signals of Connected Devices	☞ *11.7.1 Monitoring the Input Signals of Connected Devices with the SigmaWin+ on page 506* ☞ *11.7.2 Monitoring the Input Signals of Connected Devices from the Host Controller on page 509*
4-2	Allocating Input Signals of Connected Devices to SERVOPACK Functions and Using those Signals Information This function can be used only when a digital I/O type sensor hub is connected.	☞ *11.7.3 Allocating Input Signals of Connected Devices to SERVOPACK Functions and Using those Signals on page 512*
4-3	Outputting Signals from Connected Devices	☞ *11.7.4 Configuring Settings to Output Signals from Connected Devices on page 517*

Term

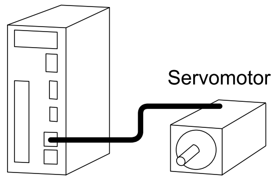
Self-configuration :

Self-configuration is a function that automatically identifies the devices connected over Σ-LINK II. Perform self-configuration from the SigmaWin+. You must perform self-configuration only when you connect multiple devices to the SERVOPACK.

11.4 Connecting Devices to the SERVOPACK

This section describes about when using a direction connection between the SERVOPACK and servomotor and when connecting multiple devices to the SERVOPACK.

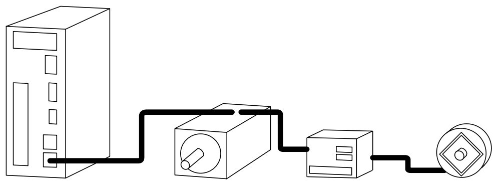
11.4.1 Using a Direct Connection between the SERVOPACK and Servomotor

Equipment Configuration	Remarks
	Setup is not required to enable Σ-LINK II.

11.4.2 Connecting Multiple Devices to the SERVOPACK

You can connect a maximum of three Σ-LINK-II-compatible devices to the SERVOPACK, but only two of those connections can be devices that detect position (e.g., a servomotor and external encoder).

> **Important**
> There are limitations on the maximum cable length when connecting multiple devices to the SERVOPACK. Refer to the following manual for details.
> Σ-X-Series Peripheral Device Selection Manual (Manual No.: SIEP C710812 12)

Equipment Configuration	Remarks
	• Setup is required to enable Σ-LINK II. Refer to the following section for details on the settings. ☞ *11.5 Performing Self-Configuration on page 499* • Devices can be connected in any order.

11.5 Performing Self-Configuration

Perform self-configuration to identify the devices connected over Σ-LINK II. Use the SigmaWin+ to perform self-configuration. When you perform self-configuration, the connected devices will be automatically identified and those results will be saved in the SERVOPACK.

If a node or connection configuration is detected after restart that differs from the saved results, A.Cd4 (Sigma-LINK II Node Change Detected) will occur.

Information
- If you change the configuration of devices connected over Σ-LINK II after the self-configuration results are saved, execute self-configuration again or discard the self-configuration data. To discard the self-configuration data, click the [Discard Settings] button on the [SigmaLINK II Settings] window.
- If you use a direct connection between the SERVOPACK and servomotor, self-configuration is not required. However, if you switch to a direct connection between the SERVOPACK and servomotor after the self-configuration results are saved, execute self-configuration again or discard the self-configuration results data.
- When you connect a sensor hub, additional setup procedures are required. After you configure these settings, perform procedures shown in the following section.
  ☞ *11.7.3 Allocating Input Signals of Connected Devices to SERVOPACK Functions and Using those Signals on page 512*
  ☞ *11.7.4 Configuring Settings to Output Signals from Connected Devices on page 517*
- If the node detection time is short, a timeout may occur and the correct results may not be obtained. In this case, increase the setting of Pn589 (SigmaLINK II Node Detection Time).

11.5.1 Preparations

Always check the following before you perform Σ-LINK II configuration.

- Utility functions must not be running.
  Refer to the following section for details on utility functions.
  ☞ *15.3.1 Corresponding SERVOPACK Utility Function Names on page 833*
- The servo must not be ON.

11.5.2 Applicable Tools

The following table lists the tools that you can use to perform Σ-LINK II configuration.

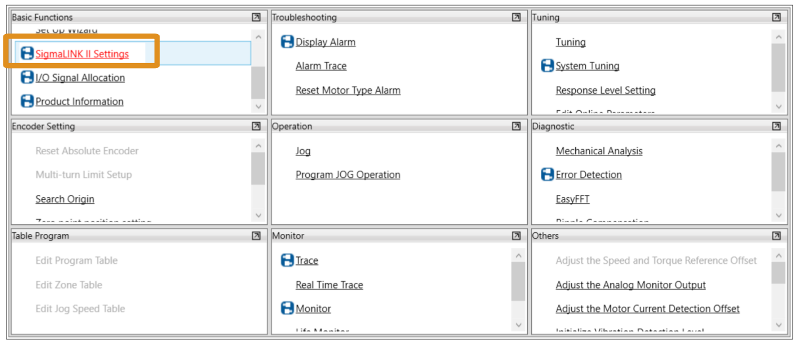
Tool	Fn No./Function Name	Reference
Digital Operator	You cannot perform Σ-LINK II configuration from the digital operator.	
SigmaWin+	[Σ-LINK II Setting]	🕮 Engineering Tool SigmaWin+ Operation Manual (Manual No.: SIET S800001 34)

11.5.3 Operating Procedure

This section gives the operation procedure for Σ-LINK II self-configuration.

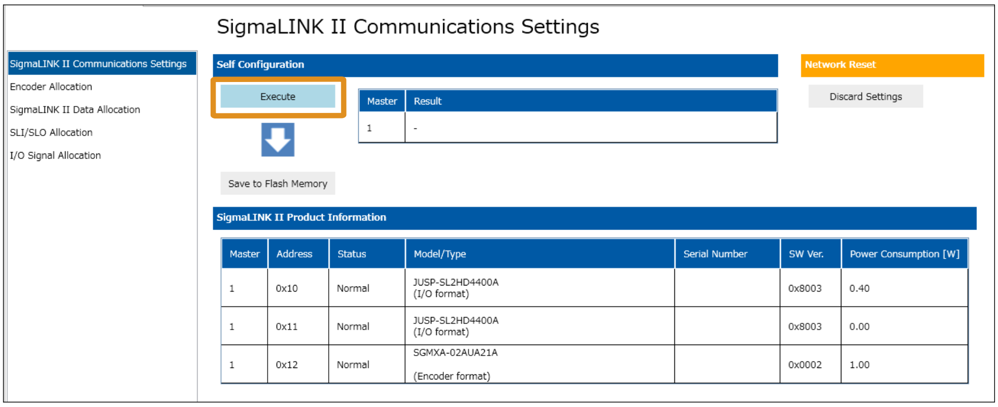
1. **First connect all Σ-LINK II devices, and then start an online connection to the SERVOPACK with the SigmaWin+.**
2. **Click the [] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**
   The [Menu] window will be displayed.

3. **Click [SigmaLINK II Setting] in the [Basic Functions] area.**



The [SigmaLINK II Communications Settings] window will be displayed.

4. **Click the [Execute] button.**

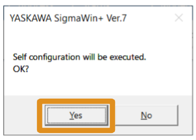


Information
- Click the [Discard Settings] button to discard the self-configuration results.
- If an error code is displayed, refer to the following section.

☞ *11.5.4 Troubleshooting If an Error Code Is Displayed on page 501*

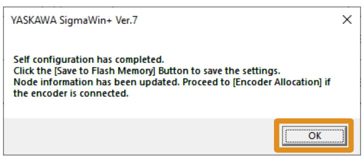
The message dialog box will be displayed.

5. **Click the [Yes] button.**



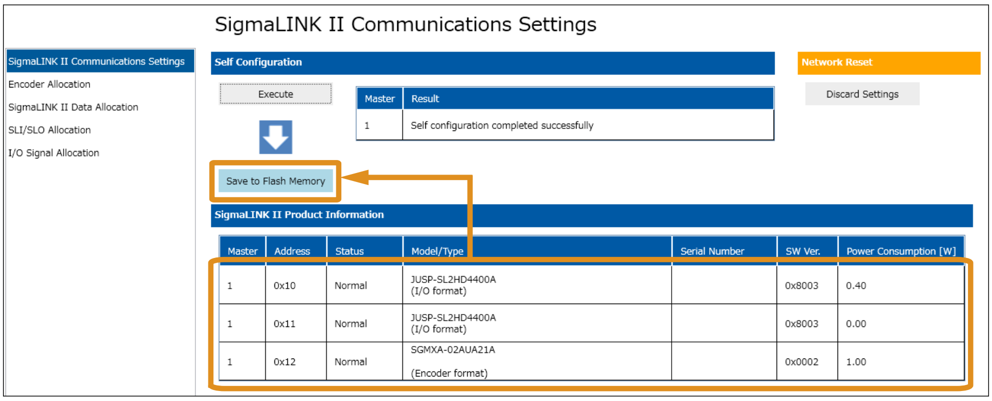
Another dialog box will be displayed.

6. **Click the [OK] button.**



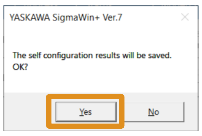
The devices connected to CN2 will be automatically detected, and the connected device information will be displayed at the bottom of the window.

7. **Check the information that was automatically detected. If there are no problems with the information, click the [Save to Flash Memory] button.**



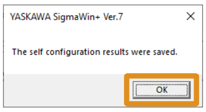
The message dialog box will be displayed.

8. **Click the [Yes] button.**



Another dialog box will be displayed.

9. **Click the [OK] button.**



The self-configuration results will be saved in the SERVOPACK.

This concludes the procedure.

11.5.4 Troubleshooting If an Error Code Is Displayed

If an error code is displayed when starting the [SigmaLINK II Communications Settings] window in the Sigma-Win+ or when Σ-LINK II self-configuration was executed, resolve the error based on the following information.

Error Code	Item	Possible Cause	Confirmation	Correction
0x0011	Node Combination Error	The SERVOPACK exceeded the upper limit of Σ-LINK II nodes that can be connected.	Check the number of nodes that can be connected. For the number of nodes that can be connected, refer to Peripheral Device Selection Manual (Manual No.: SIEP C710812 12).	Review the device configuration and set it to the number of nodes that can be connected.
		The content saved in the configuration and the content detected in node detection are different.	Check the content that was saved with self-configuration and the actual device connections.	If the actual device configuration is correct, execute self-configuration again. If the content that was saved with self-configuration is correct, change the actual device configuration to match the saved content.
		A sensor hub is connected that exceeds the number of connections supported by the SERVOPACK.	Check the total number of sensor hub connections.	Keep the total number of sensor hub connections to within two nodes.
0x0013	Excessive Total Power Consumption	The total power consumption of the nodes connected to one connector exceeded 3.5 W.	Check the total power consumption of the nodes connected to one connector.	• Use a booster unit. • Review the connection configuration so that total power consumption does not exceed the specified value. For the connection configuration, refer to Peripheral Device Selection Manual (Manual No.: SIEP C710812 12).

Continued on next page.

Continued from previous page.

Error Code	Item	Possible Cause	Confirmation	Correction
0x0070	Slave Communications Error	A timeout occurred while detecting nodes.	Compare the number of detected nodes displayed on the window and the actual number of connected nodes.	If the number of detected nodes displayed on the window is lower than the actual number of connected nodes, make the set value for Pn589 (Σ-LINK II Node Detection Time) larger, turn the power OFF and ON, and execute self-configuration again.
		There is a faulty contact in the connector or the connector is not wired correctly for the encoder cable.	Check the condition of the connector for encoder cable.	Reconnect the connector for encoder cable and check the encoder wiring.
		There is a cable disconnection or shortcircuit in the encoder. Or, the cable impedance is outside the specified values.	Check the condition of the encoder cable.	Use the encoder cable within the specified specifications.
		The power supplied to nodes is insufficient due to the voltage drop from the length of the cable.	Check if the length of each cable is within the specified cable length. For the specified cable lengths, refer to Peripheral Device Selection Manual (Manual No.: SIEP C710812 12).	• Use a booster unit. • Change the length of each cable to the specified cable length.
		One of the following has occurred: corrosion caused by improper temperature, humidity, or gas, a short-circuit caused by entry of water drops or cutting oil, or faulty contact in connector caused by vibration.	Check the operating environment.	Improve the operating environment, and replace the cable. If the alarm still occurs, replace the SERVOPACK.
		A malfunction was caused by noise.	–	Correct the wiring around the encoder by separating the encoder cable from the servomotor main circuit cable or by grounding the encoder.
		A failure occurred in the SERVOPACK.	–	If normal communications are possible after replacing the SERVOPACK with a different SERVOPACK, the SERVOPACK may be faulty. Replace the SERVOPACK.
0xFFFF	System Error	A system error occurred in the SERVOPACK.	–	If normal communications are possible after replacing the SERVOPACK with a different SERVOPACK, the SERVOPACK may be faulty. Replace the SERVOPACK.

11.6 Specifying the Servomotor (Semi-Closed Encoder) to Drive

The SERVOPACK cannot determine which device at what node address to drive by executing self-configuration only. For this reason, you must specify the node address of the servomotor for the SERVOPACK to drive and save that node address in the SERVOPACK.

You will use the SigmaWin+ to configure these settings.

Term

Node Address :

A node address is a unique number that identifies a device connected over Σ-LINK II.

Important

If you do not set the node address of the servomotor (semi-closed encoder) to drive correctly, an A.C90 alarm (Encoder Communications Error) will occur.

Information

You can also use parameters to specify the servomotor (semi-closed encoder) to drive. The following table lists the related parameters.

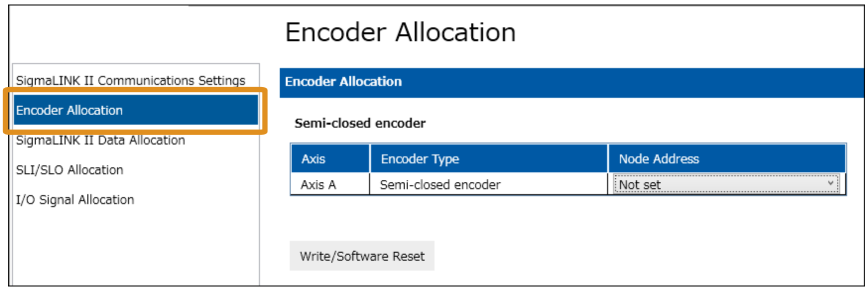
Pn0DA	n.□□XX	Node Address	Speed Pos Trq	When Enabled
		00 to 1E	Select an encoder with a node address between 00h and 1Eh.	After restart

For example, set Pn0DA to 0012h for Node 3.

11.6.1 Operating Procedure

Use the following procedure to specify the motor (semi-closed encoder) to drive.

1. **Click [Encoder Allocation] on the [SigmaLINK II Settings] window.**

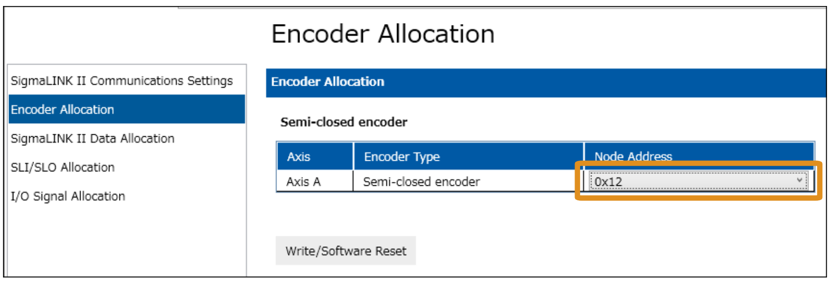


The display of the [SigmaLINK II Communications Settings] area will be changed.

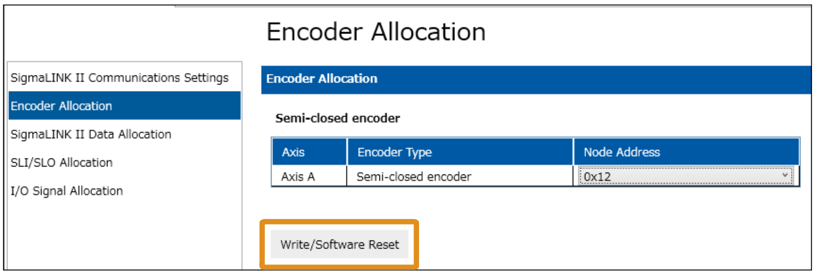
2. **Set the node address of the servomotor to be driven by the SERVOPACK.**

Refer to the following section for details on node address.

☞ *11.6 Specifying the Servomotor (Semi-Closed Encoder) to Drive on page 504*

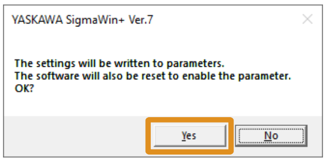


3. **Click the [Write/Software Reset] button.**



The message dialog box will be displayed.

4. **Click the [Yes] button.**



After the software is reset, the node address of the motor to be driven by the SERVOPACK will be saved to the SERVOPACK and another message dialog box will be displayed.

5. **Click the [OK] button.**

This concludes the procedure.

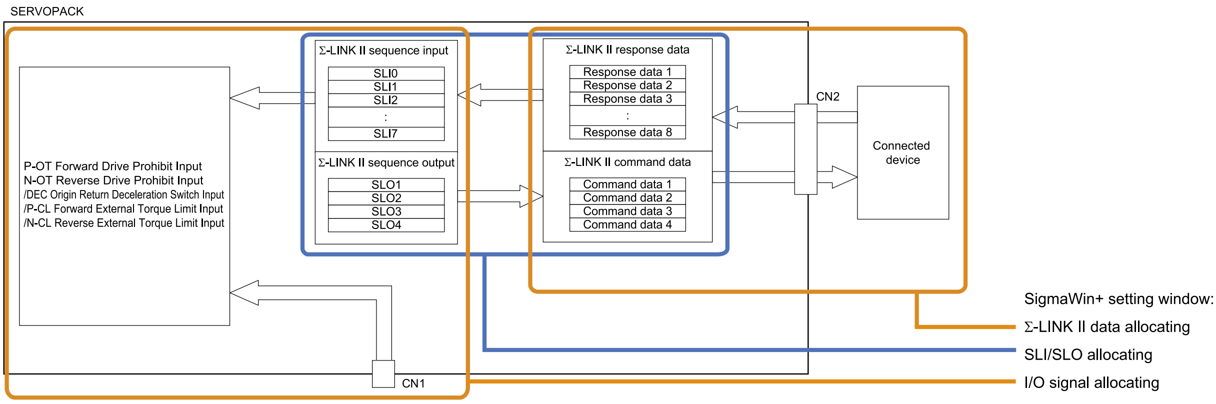
11.7 Configuring the Σ-LINK II Data Settings

You can accomplish the following by using Σ-LINK II functions.

- Monitoring the Input Signals of Connected Devices
- Allocating Input Signals of Connected Devices to SERVOPACK Functions and Using those Signals
- Outputting Signals from Connected Devices

To accomplish this, the Σ-LINK II data input from Σ-LINK II peripheral devices or output to Σ-LINK II peripheral devices must be associated with data inside the SERVOPACK. You will use the SigmaWin+ to configure these settings.

The following figure shows an image of the content to set.



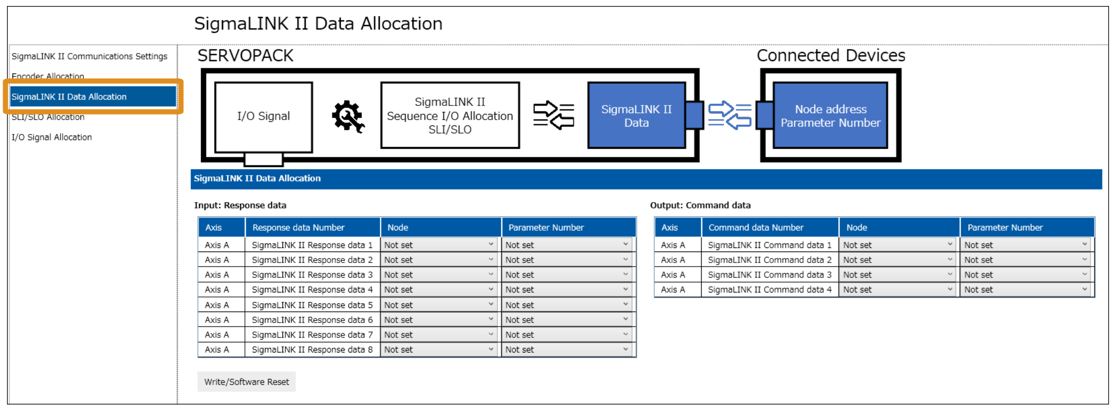
11.7.1 Monitoring the Input Signals of Connected Devices with the SigmaWin+

This section describes how to monitor the signals input to devices connected over Σ-LINK II with the SigmaWin +.

You can check the signals input to devices connected over Σ-LINK II as Σ-LINK II Response Data 1 to 8 with the monitor and trace functions in the SigmaWin+.

Use the SigmaWin+ to configure monitor settings for the input signals of devices connected over Σ-LINK II.

1. **Click [SigmaLINK II Data Allocation] on the [SigmaLINK II Settings] window.**

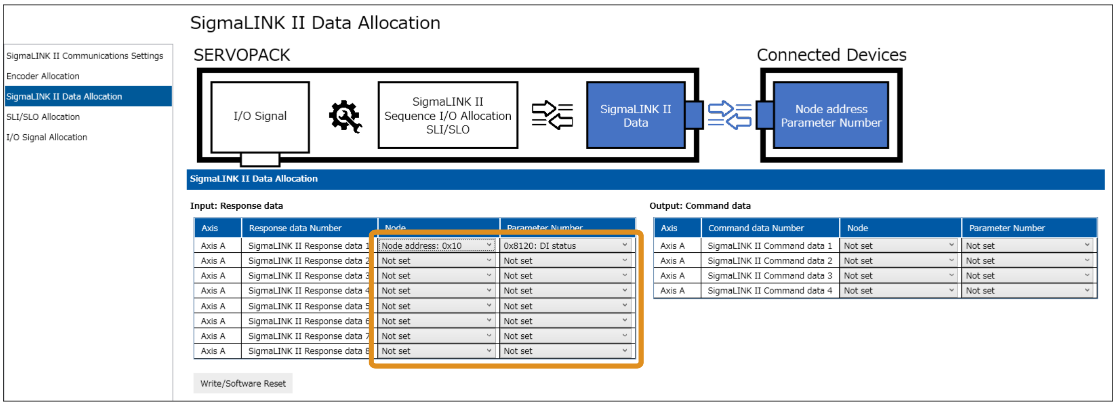


The display of the [SigmaLINK II Communications Settings] area will be changed.

2. **Under [Input: Response Data], set [Node] and [Parameter Number] for the [Response Data Number] to allocate.**

Information For the parameter number, refer to the device documentation. Refer to the following manual if you use a Yaskawa sensor hub.

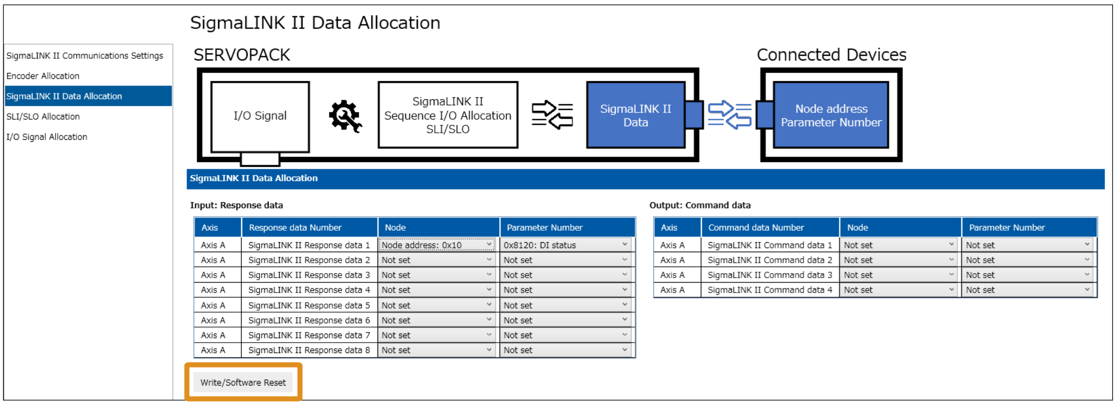
Σ-X-Series Σ-LINK II Sensor Hub Instructions (Manual No.: TOMP C710812 06)



Information You can also set [Output: Command Data] at the same time. Refer to the following section for details.

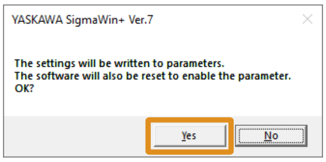
☞ 11.7.4 Configuring Settings to Output Signals from Connected Devices on page 517

3. **Click the [Write/Software Reset] button.**



The message dialog box will be displayed.

4. **Click the [Yes] button.**



After the software is reset, the content that was set will be saved to the SERVOPACK and another message dialog box will be displayed.

5. **Click the [OK] button.**

This concludes the procedure.

Information
- Refer to the following section for details on checking input signals with the SigmaWin+ monitors.
  ☞ 9.2.2 Operation Monitor, Status Monitor, and I/O Monitor on page 452
- The input signals of connected devices can also be checked from the host controller. To check input signals from the host controller, configure the settings described here, and then configure the settings shown in the following section.
  ☞ 11.7.2 Monitoring the Input Signals of Connected Devices from the Host Controller on page 509

(1) Related Parameters

You can also use parameters to configure the settings to monitor the signals input to devices connected over Σ-LINK II with the SigmaWin+. The related parameters are shown next.

Information If you use the SigmaWin+ to configure the settings, these parameters will be automatically set.

To use parameters, set Pn050 to Pn05E. The settings of Pn050 to Pn05E are shown below.

Digit	Description	Remarks
n.□□□□XXXX	Parameter number (0000h to FFFFh)	This setting determines the breakdown of the response data (32 bits). The values are determined by each device.
n. XXXX□□□□	Node address (0010h to 001Eh)	A unique number assigned to each connected device. This value is automatically set during self-configuration.

Example: To Check the Input Signals of the Yaskawa Sensor Hub DI Signals (Parameter Number: 8120) in Σ-LINK II Response Data 1

- In Pn050 = n.□□□□XXXX (SigmaLINK II Response Data Selections 1 = Parameter Number), set the parameter number of the sensor hub DI signals to 8120.
- In Pn050 = n.XXXX□□□□ (SigmaLINK II Response Data Selections 1 = Node Address), set the node address of the sensor hub that was assigned in self-configuration.

Information For the parameter number, refer to the device documentation. Refer to the following manual if you use a Yaskawa sensor hub.

Σ-X-Series Σ-LINK II Sensor Hub Instructions (Manual No.: TOMP C710812 06)

When you configure the above settings, you can check the input signals of the sensor hub with bit 8 to 11 in Σ-LINK II Response Data 1.

Bit	Bit 31 to Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7 to Bit 0
Bit Information	Reserved	Information of sensor hub channel 4	Information of sensor hub channel 3	Information of sensor hub channel 2	Information of sensor hub channel 1	Reserved

The following table gives details on the related parameters.

Parameter	Name / Setting Range	Setting Unit	Default Setting	When Enabled
Pn050	SigmaLINK II Response Data Selection 1 (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	00000000h to FF7EFFFFh	–	00000000h	After restart
Pn052	SigmaLINK II Response Data Selection 2 (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	00000000h to FF7EFFFFh	–	00000000h	After restart
Pn054	SigmaLINK II Response Data Selection 3 (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	00000000h to FF7EFFFFh	–	00000000h	After restart
Pn056	SigmaLINK II Response Data Selection 4 (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	00000000h to FF7EFFFFh	–	00000000h	After restart
Pn058	SigmaLINK II Response Data Selection 5 (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	00000000h to FF7EFFFFh	–	00000000h	After restart
Pn05A	SigmaLINK II Response Data Selection 6 (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	00000000h to FF7EFFFFh	–	00000000h	After restart
Pn05C	SigmaLINK II Response Data Selection 7 (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	00000000h to FF7EFFFFh	–	00000000h	After restart
Pn05E	SigmaLINK II Response Data Selection 8 (Speed Pos Trq)			
	Setting Range	Setting Unit	Default Setting	When Enabled
	00000000h to FF7EFFFFh	–	00000000h	After restart

11.7.2 Monitoring the Input Signals of Connected Devices from the Host Controller

To check input signals from the host controller, configure the settings shown in "*11.7.1 Monitoring the Input Signals of Connected Devices with the SigmaWin+ on page 506*", and then set one of the following parameters.

Item	Required Parameter Settings		
MECHATROLINK-III Communications	Pn824, Pn825		
MECHATROLINK-4 Communications	SERVOPACK parameters		Pn824, Pn825
	MECHATROLINK common parameters		A0 PnB40 to D7 PnBAE *1
			E0 PnBC0 to E7 PnBCE *1

*1 These parameters are not available when using MECHATROLINK-III communications. You can set these parameters when using MECHATROLINK-4 communications only.

(1) Setting Pn824, Pn825

Details on Pn824 and Pn825 are shown below.

Pn824	Option Monitor 1 Selection			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0000h to FFFFh	–	0000h	Immediately
Pn825	Option Monitor 2 Selection			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0000h to FFFFh	–	0000h	Immediately

Set Pn824 to Pn825 to one of the following values.

Setting	Meaning
0200h	Σ-LINK II response data 1
0201h	Σ-LINK II response data 2
0202h	Σ-LINK II response data 3
0203h	Σ-LINK II response data 4
0204h	Σ-LINK II response data 5
0205h	Σ-LINK II response data 6
0206h	Σ-LINK II response data 7
0207h	Σ-LINK II response data 8
0210h	Σ-LINK II command data 1
0211h	Σ-LINK II command data 2
0212h	Σ-LINK II command data 3
0213h	Σ-LINK II command data 4
0240h	Σ-LINK II data status information

(2) Setting A0 PnB40 to D7 PnBAE

Details on A0 PnB40 to D7 PnBAE are shown below.

Information These parameters are not available when using MECHATROLINK-III communications. You can set these parameters when using MECHATROLINK-4 communications only.

A0 PnB40 to AB PnB56	CPRM_SEL_CMDP1 to 12 Allocation Setting			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0000h to FFFFh	–	0000h	After restart
B0 PnB60 to BB PnB76	CPRM_SEL_CMDV1 to 12 Allocation Setting			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0000h to FFFFh	–	0000h	After restart
C0 PnB80 to CB PnB96	CPRM_SEL_CMDT1 to 12 Allocation Setting			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0000h to FFFFh	–	0000h	After restart
D0 PnBA0 to D7 PnBAE	CPRM_SEL_CMD1 to 8 Allocation Setting			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0000h to FFFFh	–	0000h	After restart

Set A0 PnB40 to D7 PnBAE to one of the following values.

Set Value	Meaning
0260h	Σ-LINK II command data 1
0261h	Σ-LINK II command data 2
0262h	Σ-LINK II command data 3
0263h	Σ-LINK II command data 4

(3) Setting E0 PnBC0 to E7 PnBCE

Details on E0 PnBC0 to E7 Pn8CE are shown below.

Information These parameters are not available when using MECHATROLINK-III communications. You can set these parameters when using MECHATROLINK-4 communications only.

E0 PnBC0	CPRM_SEL_MON3 Allocation Setting			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0000h to FFFFh	–	0000h	Immediately
E1 PnBC2	CPRM_SEL_MON4 Allocation Setting			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0000h to FFFFh	–	0000h	Immediately
E2 PnBC4	CPRM_SEL_MON5 Allocation Setting			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0000h to FFFFh	–	0000h	Immediately
E3 PnBC6	CPRM_SEL_MON6 Allocation Setting			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0000h to FFFFh	–	0000h	Immediately
E4 PnBC8	CPRM_SEL_MON7 Allocation Setting			Speed Pos Trq
	Setting Range	Setting Unit	Default Setting	When Enabled
	0000h to FFFFh	–	0000h	Immediately

Continued on next page.

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E5 PnBCA	**CPRM_SEL_MON8 Allocation Setting** Speed Pos Trq			
	Setting Range	**Setting Unit**	**Default Setting**	**When Enabled**
	0000h to FFFFh	–	0000h	Immediately
E6 PnBCC	**CPRM_SEL_MON9 Allocation Setting** Speed Pos Trq			
	Setting Range	**Setting Unit**	**Default Setting**	**When Enabled**
	0000h to FFFFh	–	0000h	Immediately
E7 PnBCE	**CPRM_SEL_MON10 Allocation Setting** Speed Pos Trq			
	Setting Range	**Setting Unit**	**Default Setting**	**When Enabled**
	0000h to FFFFh	–	0000h	Immediately

Set PnBC0 to PnBCE to one of the following values.

Setting	Meaning
0250h	Σ-LINK II response data 1
0251h	Σ-LINK II response data 2
0252h	Σ-LINK II response data 3
0253h	Σ-LINK II response data 4
0254h	Σ-LINK II response data 5
0255h	Σ-LINK II response data 6
0256h	Σ-LINK II response data 7
0257h	Σ-LINK II response data 8
0260h	Σ-LINK II command data 1
0261h	Σ-LINK II command data 2
0262h	Σ-LINK II command data 3
0263h	Σ-LINK II command data 4
0290h	Σ-LINK II Data Status Information

(4) Interpreting Monitor Content for Σ-LINK II Data Status Information

When monitoring Σ-LINK II data status information, the information for each bit is shown in the following table.

Bit	Meaning	Meaning
Bit 0	Σ-LINK II response data 1 status	0: Data disabled 1: Data enabled
Bit 1	Σ-LINK II response data 2 status	
Bit 2	Σ-LINK II response data 3 status	
Bit 3	Σ-LINK II response data 4 status	
Bit 4	Σ-LINK II response data 5 status	
Bit 5	Σ-LINK II response data 6 status	
Bit 6	Σ-LINK II response data 7 status	
Bit 7	Σ-LINK II response data 8 status	
Bit 8	Σ-LINK II command data 1 status	0: Data disabled 1: Data enabled
Bit 9	Σ-LINK II command data 2 status	
Bit 10	Σ-LINK II command data 3 status	
Bit 11	Σ-LINK II command data 4 status	
Bit 12 to Bit 15	Reserved.	–

Continued on next page.

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Bit	Meaning	Meaning
Bit 16	Error status of the device associated with Σ-LINK II response data 1	0: Normal 1: Alarm or warning
Bit 17	Error status of the device associated with Σ-LINK II response data 2	
Bit 18	Error status of the device associated with Σ-LINK II response data 3	
Bit 19	Error status of the device associated with Σ-LINK II response data 4	
Bit 20	Error status of the device associated with Σ-LINK II response data 5	
Bit 21	Error status of the device associated with Σ-LINK II response data 6	
Bit 22	Error status of the device associated with Σ-LINK II response data 7	
Bit 23	Error status of the device associated with Σ-LINK II response data 8	
Bit 24	Error status of the device associated with Σ-LINK II command data 1	0: Normal 1: Alarm or warning
Bit 25	Error status of the device associated with Σ-LINK II command data 2	
Bit 26	Error status of the device associated with Σ-LINK II command data 3	
Bit 27	Error status of the device associated with Σ-LINK II command data 4	
Bit 28 to Bit 31	Reserved.	–

11.7.3 Allocating Input Signals of Connected Devices to SERVOPACK Functions and Using those Signals

The signals input to devices connected over Σ-LINK II can be used by allocating them to functions related to SERVOPACK input signals. The signals that can be allocated are given in the following table.

Information This function can be used only when a digital I/O type sensor hub is connected.

Signal	
P-OT	Forward Drive Prohibit Input Signal
N-OT	Reverse Drive Prohibit iInput Signal
/DEC	Origin Return Deceleration Switch Input Signal
/P-CL	Forward External Torque Limit Input Signal
/N-CL	Reverse External Torque Limit Input Signal

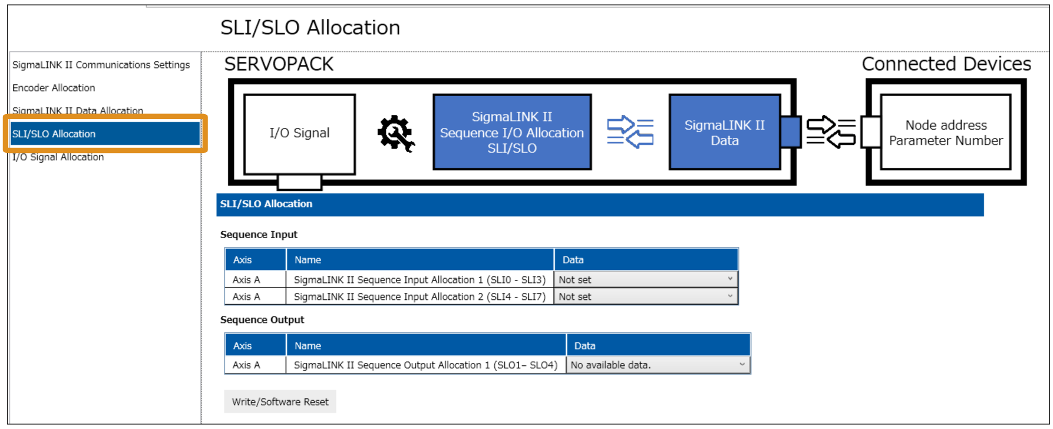
The setting procedure for the SigmaWin+ is shown next.

1. **Check if the Σ-LINK II data allocation settings have been completed.**

   Refer to the following section for details.

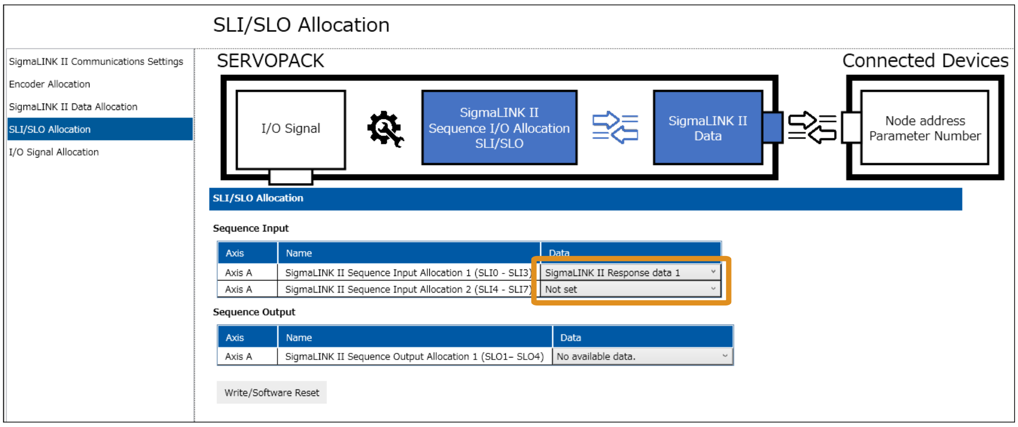
   ☞ *11.7.1 Monitoring the Input Signals of Connected Devices with the SigmaWin+ on page 506*

2. **Click [SLI/SLO Allocation] on the [SigmaLINK II Settings] window.**

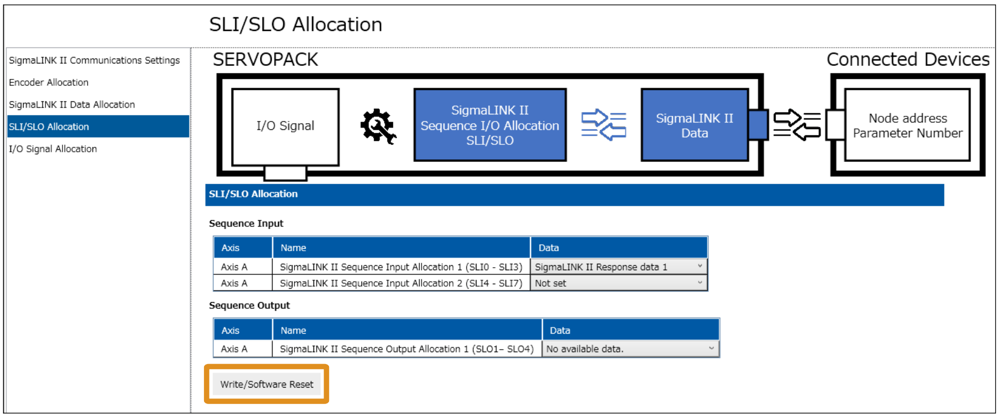


The display of the [SigmaLINK II Communications Settings] area will be changed.

3. **Under [Sequence Input], select the Σ-LINK II data to allocate.**

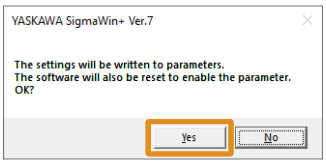


4. **Click the [Write/Software Reset] button.**



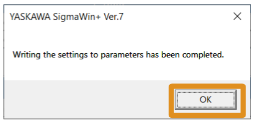
The message dialog box will be displayed.

5. **Click the [Yes] button.**



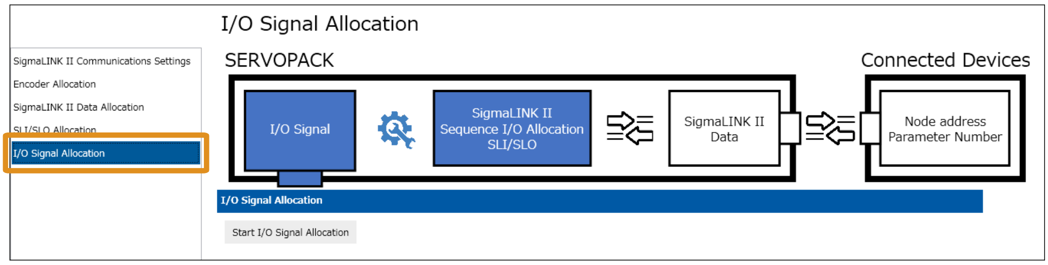
After the software is reset, the content that was set will be saved to the SERVOPACK and another message dialog box will be displayed.

6. **Click the [OK] button.**



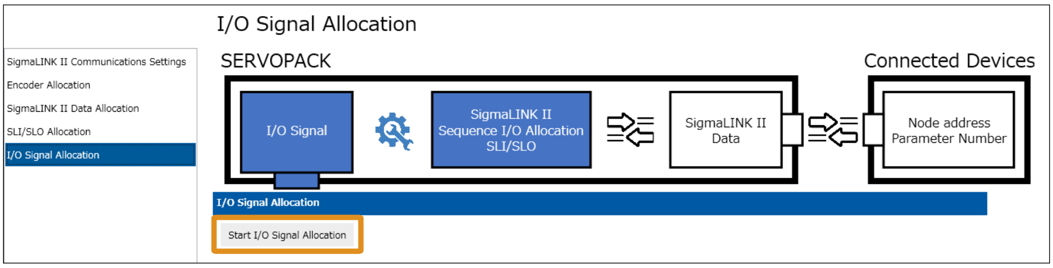
Close the message dialog box. You will return to the [SigmaLINK II Settings] window.

7. **Click [I/O Signal Allocation] on the [SigmaLINK II Settings] window.**



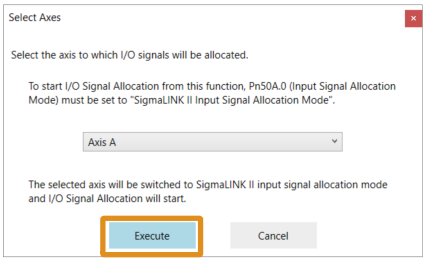
The display of the [SigmaLINK II Communications Settings] area will be changed.

8. **Click the [Start I/O Signal Allocation] button.**



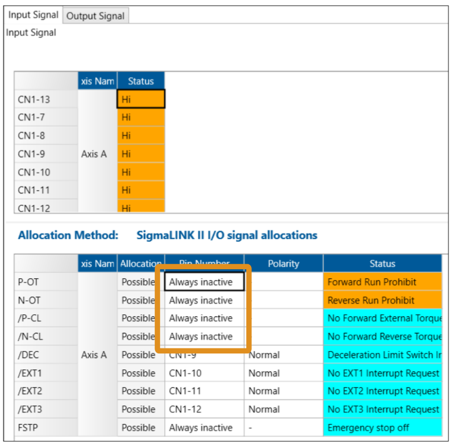
The [Select Axis] window will be displayed.

9. **Click the [Execute] button.**



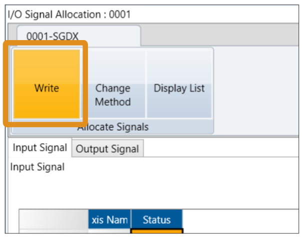
The [I/O Signal Allocation] window will be displayed.

10. **Double-click the [Pin Number] cell of the signal to allocate, select sequence input number that was allocated in step 3, and then press the [Enter] key.**



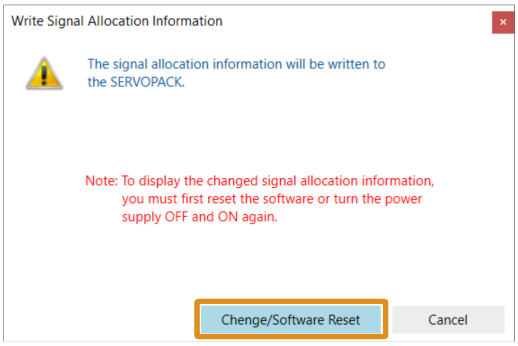
11. **Use the same operation to set [Polarity] as required.**

12. **Click [Write].**



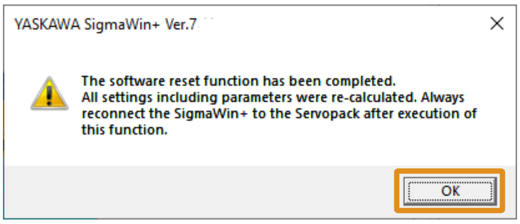
The [Write Signal Allocation Information] dialog box will be displayed.

13. **Click the [Change/Software Reset] button.**



The software will be reset, the content that was set will be applied, and another message dialog box will be displayed.

14. **Click the [OK] button.**



This concludes the procedure.

(1) Related Parameters

You can also use parameters to configure the settings to allocate input signals of connected devices to SERVOPACK functions and to use those signals. The related parameters are shown next.

Information If you use the SigmaWin+ to configure the settings, these parameters will be automatically set.

(a) SLI Allocations

To set the SLI allocations using parameters, allocate Σ-LINK II Response Data 1 to 8 to Pn0B1 (SigmaLINK II Sequence Allocation 1) and Pn0B2 (SigmaLINK II Sequence Allocation 2).

Four bits of continuous data from the bit specified by Pn0B1 = n.XX□□ are allocated as SLI0 to SLI3. Pn0B2 is also allocated as SLI4 to SLI7 in the same manner.

- Pn0B1: Σ-LINK II Sequence Input Allocation 1

Pn0B1	n.□□XX	SigmaLINK II Response Data Selection	Speed Pos Trq	When Enabled
		00 Default	Disable (data is not set to the SigmaLINK II sequence input).	After restart
		01	Allocate SigmaLINK II Response Data 1 to the SigmaLINK II sequence input.	
		02	Allocate SigmaLINK II Response Data 2 to the SigmaLINK II sequence input.	
		03	Allocate SigmaLINK II Response Data 3 to the SigmaLINK II sequence input.	
		04	Allocate SigmaLINK II Response Data 4 to the SigmaLINK II sequence input.	
		05	Allocate SigmaLINK II Response Data 5 to the SigmaLINK II sequence input.	
		06	Allocate SigmaLINK II Response Data 6 to the SigmaLINK II sequence input.	
		07	Allocate SigmaLINK II Response Data 7 to the SigmaLINK II sequence input.	
		08	Allocate SigmaLINK II Response Data 8 to the SigmaLINK II sequence input.	
Pn0B1	n.XX□□	SigmaLINK II Sequence Input Allocation Start Position Selection	Speed Pos Trq	When Enabled
		00 to 20	Specify the allocation start bit to the SigmaLINK II sequence input.	After restart

- Pn0B2: Σ-LINK II Sequence Input Allocation 2
  The setting procedure is the same as Pn0B1.

> **Important**
> If you allocated Σ-LINK II response data to Σ-LINK II sequence inputs, A.Cd7 (SigmaLINK II I/O Device Communications Error) and A.Cd8 (SigmaLINK II I/O Device Status Error) will occur regardless of the setting of Pn0DD (SigmaLINK II I/O Device Error Detection Selection).

(b) I/O Signal Allocation

To set the I/O signal allocations using parameters, allocate the Σ-LINK II sequence inputs (SLI0 to SLI7) to SERVOPACK functions.

First, set Pn50A to n.□□□2 (use Pn590 to Pn5BC (SigmaLINK II input signal allocation mode)).

Pn50A	n.□□□X	Input Signal Allocation Mode	Speed Pos Trq	When Enabled
		0	Reserved (Do not use.)	After restart
		1 Default	Use Pn50A to Pn516 (Sigma-7S-compatible I/O signal allocation mode).	
		2	Use Pn590 to Pn5BC (SigmaLINK II input signal allocation mode).	

Next, set the settings of the signals to input from the Σ-LINK II connected device to □1□□□ (allocate the signal to SIgmaLINK II Sequence Input □).

Set the settings of the signals to input from the I/O signal connector (CN1) to □0□□ (allocate signal to CN1-□).

Refer to the following section for the parameters and settings used to set the signals.

☞ *(2) Σ-LINK II Input Signal Allocations on page 211*

Finally, set the signals to output from the I/O signal connector (CN1).

Refer to the following section for the parameters and settings used to set the signals.

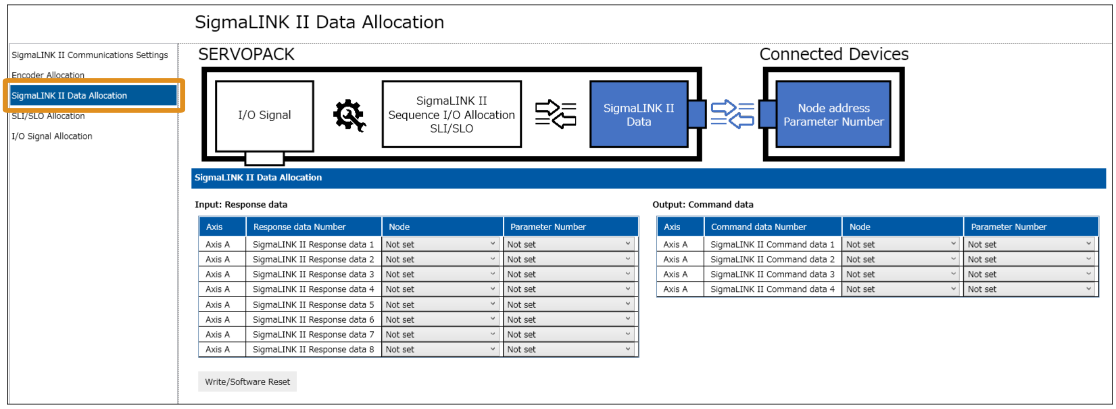
☞ *(2) Σ-LINK II Input Signal Allocations on page 214*

11.7.4 Configuring Settings to Output Signals from Connected Devices

Use the following setting procedure to output a signal to a device connected over Σ-LINK II. When you configure these settings, you can check the signals to output as Σ-LINK II Command Data 1 to 4 with the monitor and trace functions in the SigmaWin+.

You will use the SigmaWin+ to configure these settings.

1. **Click [SigmaLINK II Data Allocation] on the [SigmaLINK II Settings] window.**

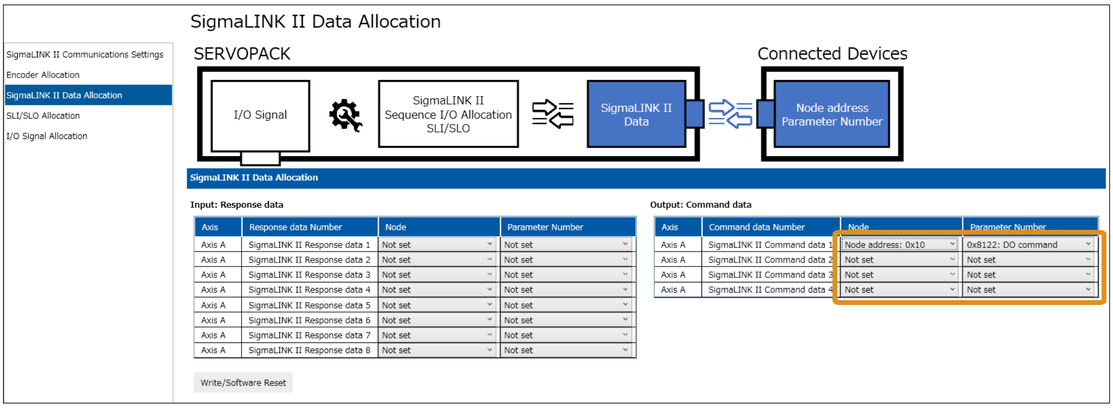


The display of the [SigmaLINK II Communications Settings] area will be changed.

2. **Under [Output: Command Data], set [Node] and [Parameter Number] for the [Command Data Number] to allocate.**

Information: For the parameter number, refer to the device documentation. Refer to the following manual if you use a Yaskawa sensor hub.

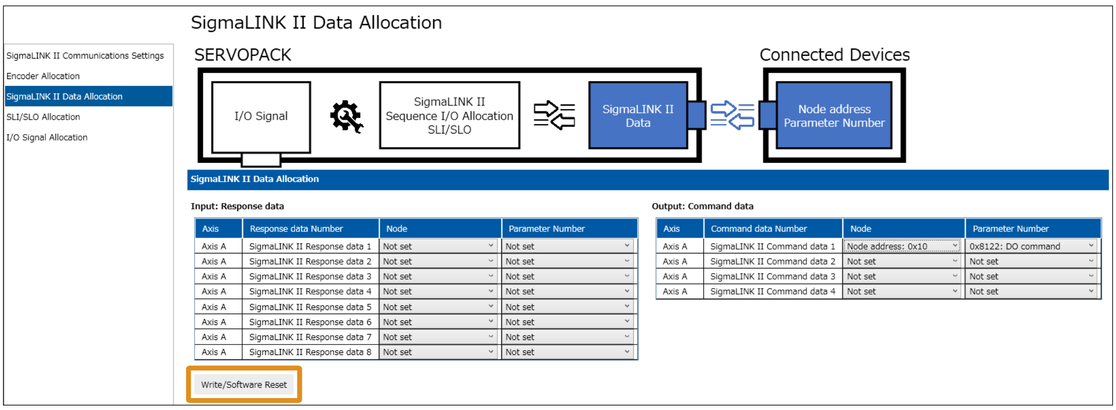
Σ-X-Series Σ-LINK II Sensor Hub Instructions (Manual No.: TOMP C710812 06)



Information: You can also set [Input: Response Data] at the same time. Refer to the following section for details.

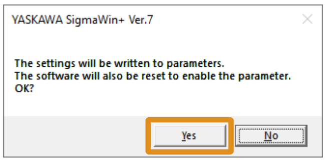
☞ *11.7.1 Monitoring the Input Signals of Connected Devices with the SigmaWin+ on page 506*

3. **Click the [Write/Software Reset] button.**



The message dialog box will be displayed.

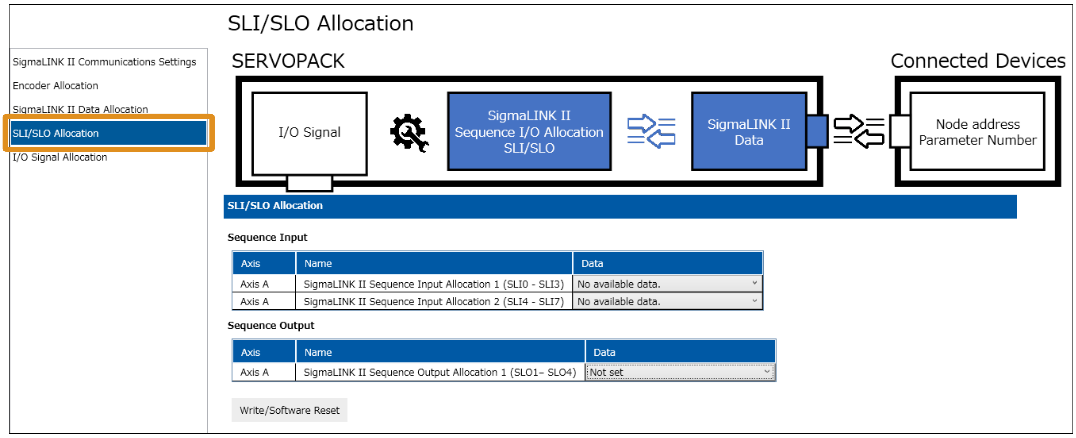
4. **Click the [Yes] button.**



After the software is reset, the content that was set will be saved to the SERVOPACK and another message dialog box will be displayed.

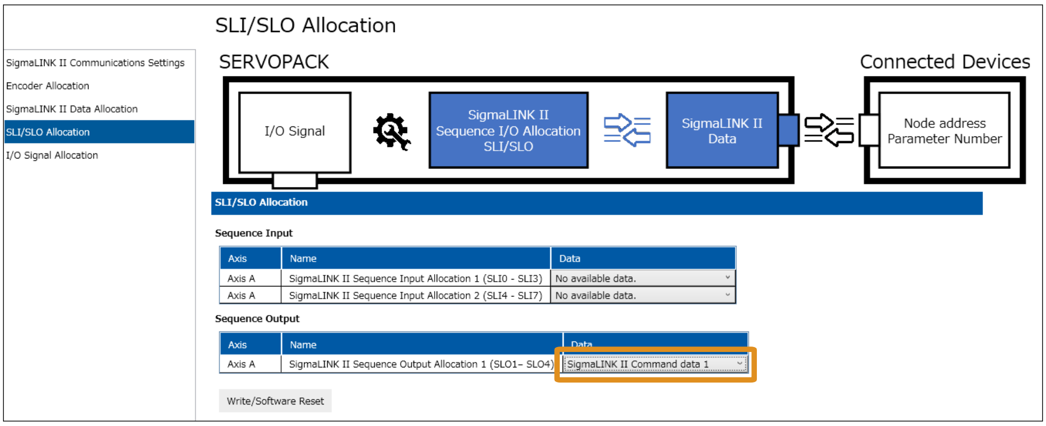
5. **Click the [OK] button.**

6. **Click [SLI/SLO Allocation] on the [SigmaLINK II Settings] window.**

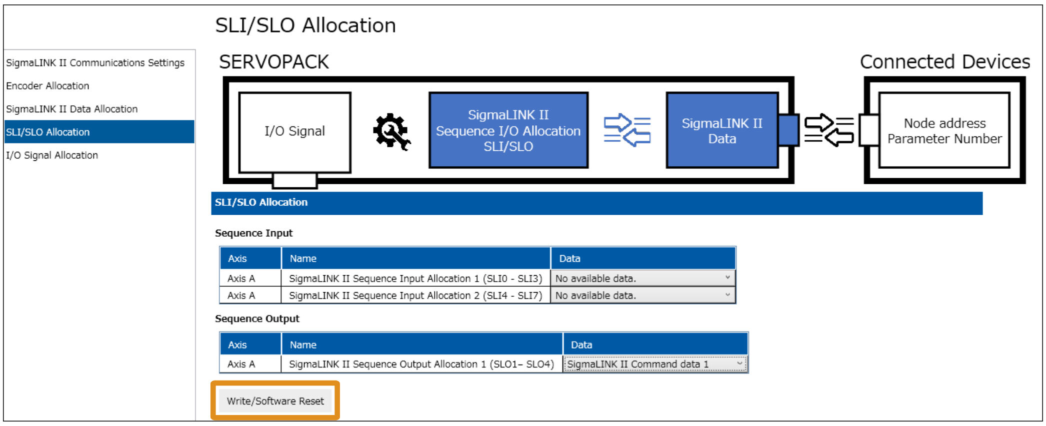


The display of the [SigmaLINK II Communications Settings] area will be changed.

7. **Under [Sequence Output], select the Σ-LINK II data to allocate.**

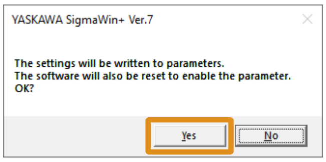


8. **Click the [Write/Software Reset] button.**



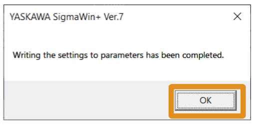
The message dialog box will be displayed.

9. **Click the [Yes] button.**



After the software is reset, the content that was set will be saved to the SERVOPACK and another message dialog box will be displayed.

10. **Click the [OK] button.**



This concludes the procedure.

Information The signals to output from connected devices can also be checked from the host controller. To check input signals from the host controller, configure the settings described here, and then configure the settings shown in the following section.

☞ *11.7.2 Monitoring the Input Signals of Connected Devices from the Host Controller on page 509*

(1) Related Parameters

You can also use parameters to configure the settings to output signals from connected devices. The related parameters are shown next.

Information If you use the SigmaWin+ to configure the settings, these parameters will be automatically set.

(a) SLO Allocations

Assign the Σ-LINK II command data bits to the Σ-LINK II sequence outputs (SLO1 to SLO4).

Four bits of continuous data from the bit specified by Pn0B5 = n.XX□□ are allocated as SLO1 to SLO4.

Pn0B5	n.□□XX	SigmaLINK II Command Data Selection	Speed Pos Trq	When Enabled
		00 Default	Disable (data is not set to the SigmaLINK II sequence output).	After restart
		01	Allocate SigmaLINK II Command Data 1 to the SigmaLINK II sequence output.	
		02	Allocate SigmaLINK II Command Data 2 to the SigmaLINK II sequence output.	
		03	Allocate SigmaLINK II Command Data 3 to the SigmaLINK II sequence output.	
		04	Allocate SigmaLINK II Command Data 4 to the SigmaLINK II sequence output.	
Pn0B5	n.XX□□	SigmaLINK II Sequence Output Allocation Start Position Selection	Speed Pos Trq	When Enabled
		00 to 20	Specify the allocation start bit to the SigmaLINK II sequence output.	After restart

Important: If you allocated Σ-LINK II response data to Σ-LINK II sequence inputs, A.Cd7 (SigmaLINK II I/O Device Communications Error) and A.Cd8 (SigmaLINK II I/O Device Status Error) will occur regardless of the setting of Pn0DD (SigmaLINK II I/O Device Error Detection Selection).

SLO1 to SLO4 are assigned to bits 20 to 23 of SVCMD_OUT *1.

SVCMD_OUT *1	Name	
Bit 20	SLO1	Σ-LINK II Sequence Output 1
Bit 21	SLO2	Σ-LINK II Sequence Output 2
Bit 22	SLO3	Σ-LINK II Sequence Output 3
Bit 23	SLO4	Σ-LINK II Sequence Output 4

*1 Field name of MECHATROLINK-4 command. This is SVCMD_IO when using MECHATROLINK-III commands.

Use Pn56A (Output Signal Reference Method Selections 1) for the signal output settings of SLO1 to SLO4.

Pn56A	n.□□□X	SO1 Output Signal Reference Method Selection	Speed Pos Trq	When Enabled
		0	Reserved (Do not use.)	After restart
		1 Default	Output OR of parameter-assigned SO1 signal and signal set by SVCMD_OUT.	
		2	Output signal set by SCVMD_OUT to SLO1.	
Pn56A	n.□□X□	SO2 Output Signal Reference Method Selection	Speed Pos Trq	When Enabled
		0	Reserved (Do not use.)	After restart
		1 Default	Output OR of parameter-assigned SO2 signal and signal set by SVCMD_OUT.	
		2	Output signal set by SCVMD_OUT to SLO2.	
Pn56A	n.□X□□	SO3 Output Signal Reference Method Selection	Speed Pos Trq	When Enabled
		0	Reserved (Do not use.)	After restart
		1 Default	Output OR of parameter-assigned SO3 signal and signal set by SVCMD_OUT.	
		2	Output signal set by SCVMD_OUT to SLO3.	
Pn56A	n.X□□□	SLO4 Output Signal Reference Method Selection	Speed Pos Trq	When Enabled
		0	Reserved (Do not use.)	After restart
		1 Default	Do not output signal to SLO4.	
		2	Output signal set by SCVMD_OUT to SLO4.	

(b) Allocating Σ-LINK II Data

To set Σ-LINK II allocations using parameters, use Pn090 to Pn094 to set information about the connected devices from which to output signals. The settings of Pn090 to Pn094 are shown below.

Digit	Description	Remarks
n.□□□□XXXX	Parameter number (0000h to FFFFh)	This setting determines the breakdown of the response data (32 bits). The values are determined by each device.
n.XXXX□□□□	Node address (0010h to 001Eh)	A unique number assigned to each connected device. This value is automatically set during self-configuration.

Example: To Output the Σ-LINK II Command Data 1 Signals to Yaskawa Sensor Hub DO Signals (Parameter Number: 8122)

- In Pn090 = n.□□□□8122 (SigmaLINK II Command Data Selections 1 = Parameter Number), set the parameter number of the output destination sensor hub DO signals to 8122.
- In Pn090 = n.XXXX□□□□ (SigmaLINK II Command Data Selections 1 = Node Address), set the node address of the sensor hub that was assigned in self-configuration.

Information For the parameter number, refer to the device documentation. Refer to the following manual if you use a Yaskawa sensor hub.

Σ-X-Series Σ-LINK II Sensor Hub Instructions (Manual No.: TOMP C710812 06)

When you configure the above settings, you can check the output signals with bit 1 to 4 on the sensor hub.

Bit	Bit 31 to Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Bit Information	Reserved	Information of sensor hub channel 4	Information of sensor hub channel 3	Information of sensor hub channel 2	Information of sensor hub channel 1

The following table gives details on the related parameters.

Parameter	Setting Range	Setting Unit	Default Setting	When Enabled
Pn090 SigmaLINK II Command Data Selection 1 (Speed Pos Trq)	00000000h to FF7EFFFFh	–	00000000h	After restart
Pn092 SigmaLINK II Command Data Selection 2 (Speed Pos Trq)	00000000h to FF7EFFFFh	–	00000000h	After restart
Pn094 SigmaLINK II Command Data Selection 3 (Speed Pos Trq)	00000000h to FF7EFFFFh	–	00000000h	After restart
Pn096 SigmaLINK II Command Data Selection 4 (Speed Pos Trq)	00000000h to FF7EFFFFh	–	00000000h	After restart

Σ-LINK II Function

11

11.8 Changing Detection Conditions of Alarms Related to Σ-LINK II

You can change the detection conditions for certain alarms related to Σ-LINK II by setting the relevant parameters.

11.8.1 Connected Node Change Detection Condition

When a node or connection configuration is detected after restart that differs from the saved self-configuration results, A.Cd4 (SigmaLINK II Node Change Detected) will occur.

Set the detection conditions at this time with Pn0DC = n.□□□X.

Pn0DC	n.□□□X	Connected Node Change Detection Condition (Speed, Pos, Trq)		When Enabled
		0 Default	Set vendor ID and product ID as conditions.	After restart
		1	Set vendor ID, product ID, and serial number as conditions.	
		2	Set vendor ID, product ID, and product version as conditions.	
		3	Set vendor ID, product ID, product version, and serial number as conditions.	

11.8.2 Σ-LINK II I/O Device Error Detection Selection

You can select the detection method for Σ-LINK II I/O device errors by setting Pn0DD (SigmaLINK II I/O Device Error Detection Selection).

Parameter		Description		When Enabled
Pn0DD	n.□□□X	SigmaLINK II I/O Device Communications Check Mask (Speed, Pos, Trq)		When Enabled
		0 Default	Set SigmaLINK II slave communications error as an alarm (A.Cd7).	After restart
		1	Set SigmaLINK II slave communications error as a warning (A.932).	
		2	Do not detect the SigmaLINK II slave communications error.	
Pn0DD	n.□X□□	SigmaLINK II I/O Device Status Check Mask (Speed, Pos, Trq)		When Enabled
		0	A.Cd8 occurs when the alarm or warning signal is received from the SigmaLINK II slave.	After restart
		1 Default	A.Cd8 occurs when the alarm signal is received from the SigmaLINK II slave and A.933 occurs when the warning signal is received.	
		2	A.933 occurs when the alarm or warning signal is received from the SigmaLINK II slave.	
		3	Do not detect the SigmaLINK II slave status error.	

Note:

If you allocated Σ-LINK II I/O response data to Σ-LINK II sequence inputs, A.Cd7 (SigmaLINK II I/O Device Communications Error) and A.Cd8 (SigmaLINK II I/O Device Status Error) will occur regardless of the setting of Pn0DD.

12

Safety Functions

This chapter provides detailed information on the Safety Functions of the SERVOPACK.

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.

☞ *i.8 Compliance with UL Standards, EU Directives, and Other Safety Standards on page 42*

Important

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 motor 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 motor 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 to the SERVOPACK before you perform maintenance on it.

There is a risk of electric shock.

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 servomotor 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.

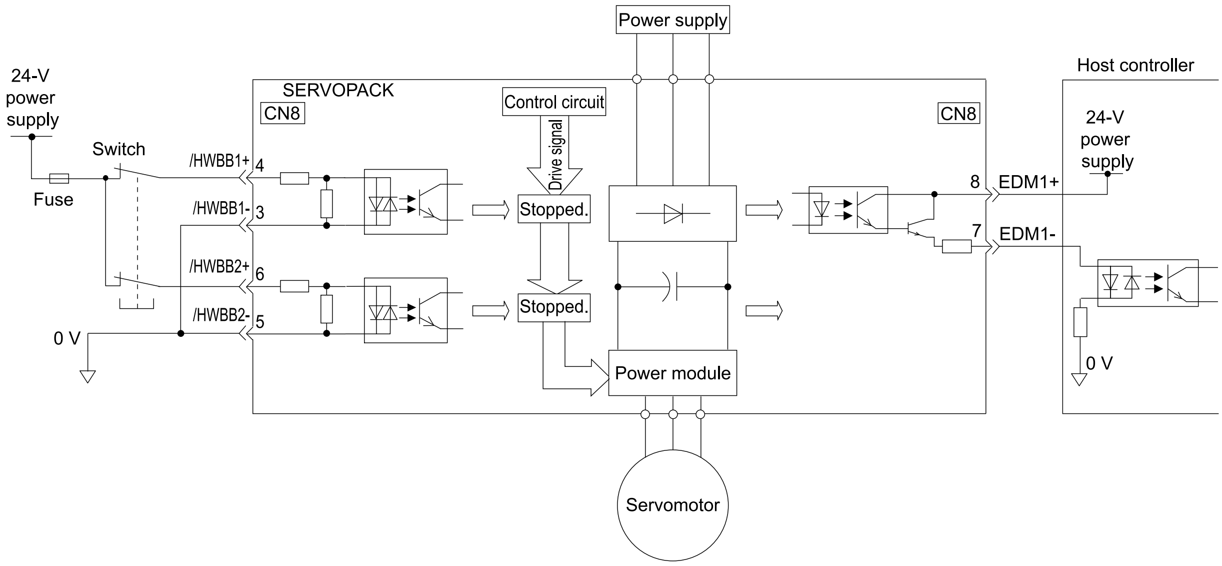
Refer to the following section for connection specification for signals.

☞ *4.6 Connecting Safety Function Signals on page 138*

Important

- Connect the Safety Function input signals (/HWBB1 and /HWBB2) as sink inputs when viewed from the SERVOPACK side. Make the connections this way because a safe failure will occur if the /HWBB1 and /HWBB2 signals are connected to 0 V. This differs from the wiring example for other input signals described in "*4.5.3 I/O Signal Wiring Examples on page 134*".
  The ON and OFF status of signals for the Safety Function are also 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.
- For the 24-V power supply, use an SELV power supply.

The following figure shows a connection example.



Whether or not you use the EDM1 signal does not affect the performance level of safety parameters.

You can use the EDM1 signal if the system requires it, such as when a Σ-X SERVOPACK is replacing a Σ-7 SERVOPACK in the system.

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.

☞ *i.8 Compliance with UL Standards, EU Directives, and Other Safety Standards on page 42*

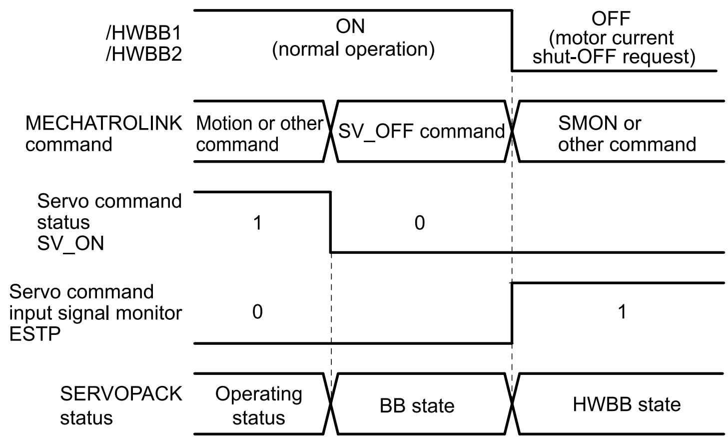
The following hazards exist even when the HWBB is operating. These hazards must be included in the risk assessment.

- 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)
  – Direct drive servomotor: 1/20 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 to the SERVOPACK before you perform maintenance on it.

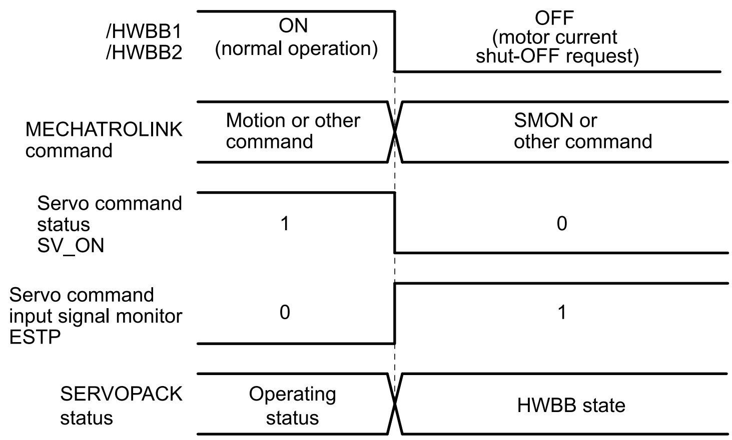
12.2.2 Hard Wire Base Block (HWBB) State

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)



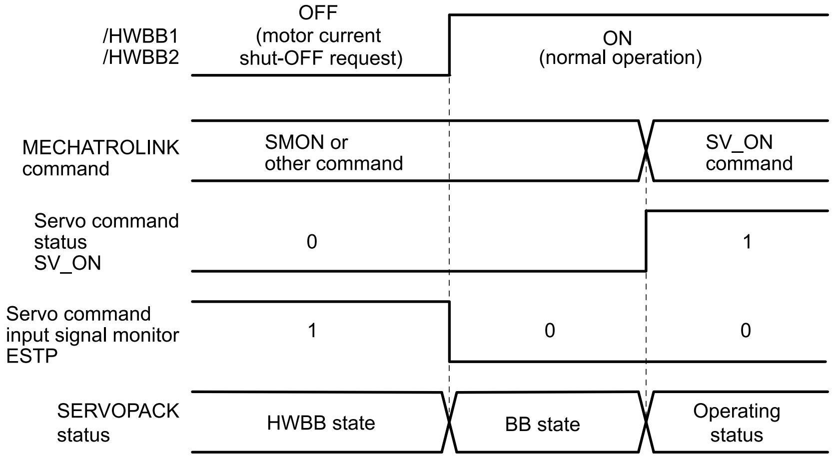
· When HWBB Operates While Power Is Supplied to Motor



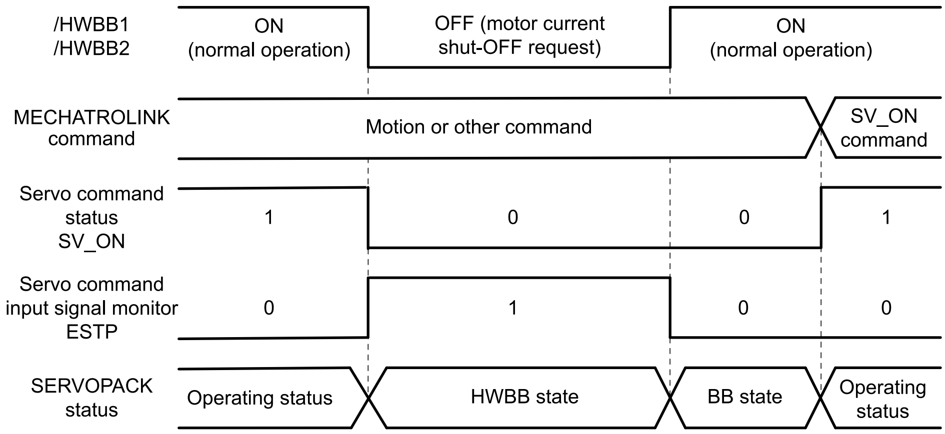
12.2.3 Resetting the HWBB State

Normally, after the SV_OFF (Servo OFF) command is sent 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) command.



If the SERVOPACK enters the HWBB state while power is supplied to the motor, turn ON the /HWBB1 and /HWBB2 signals, and then send the SV_ON (Servo ON) command to restore the normal operating status.



If the SERVOPACK enters the HWBB state while the SV_ON (Servo ON) command is being sent, turn ON the /HWBB1 and /HWBB2 signals, and then send any command other than the SV_ON (Servo ON) command, such as the SV_OFF (Servo OFF) command. Next, send the SV_ON (Servo ON) command again to restore the normal operating status.

12.2.4 Related Commands

If the /HWBB1 or /HWBB2 signal turns OFF and the HWBB operates, the ESTP bit in the MECHATROLINK command SVCMD_IN *1 will change to 1. The host controller can monitor this bit to determine the status.

*1 Field name of MECHATROLINK-4 communications. SVCMD_IO for MECHATROLINK-III communications.

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. Using the sequence of commands to return to the HWBB status after stopping or canceling the motion command 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

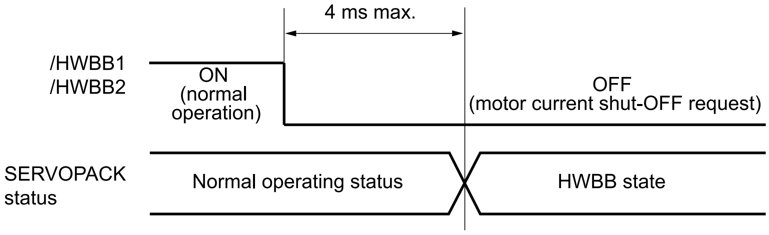
If only the /HWBB1 or the /HWBB2 signal is input, an A.Eb1 alarm (Safety Function Signal Input Timing Error) will occur unless the other signal is input within 10 seconds. This makes it possible to detect failures, such as disconnection of an HWBB signal. If the A.Eb1 alarm occurs, check the wiring.

⚠ CAUTION

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 to the servomotor will be turned OFF within 4 ms.



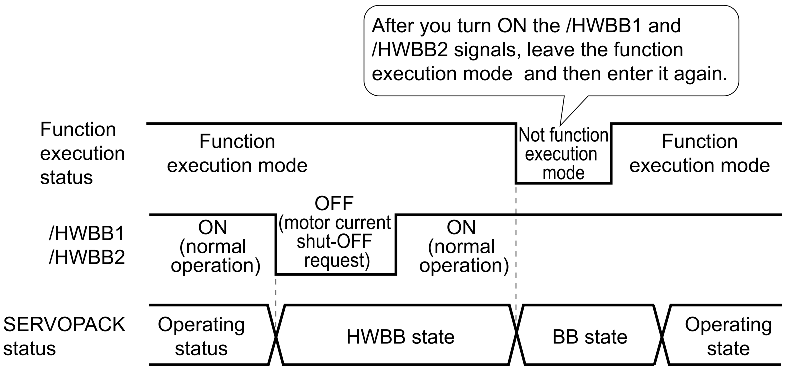
Note:

- The OFF status is not recognized if the OFF interval of the /HWBB1 or /HWBB2 signal is 0.5 ms or shorter. However, in certain situations, such as when you input test pulses and you do not want the HWBB function to respond, make the interval between OFF intervals (i.e., the ON interval) 0.5 ms or longer. The reason for this is that the OFF status may be recognized if a signal repeatedly turns OFF even though the OFF interval is 0.5 ms or shorter.
- You can check the status of the input signals by using monitor displays.

12.2.7 Operation without a Host Controller

The HWBB will operate even for operation without a host controller.

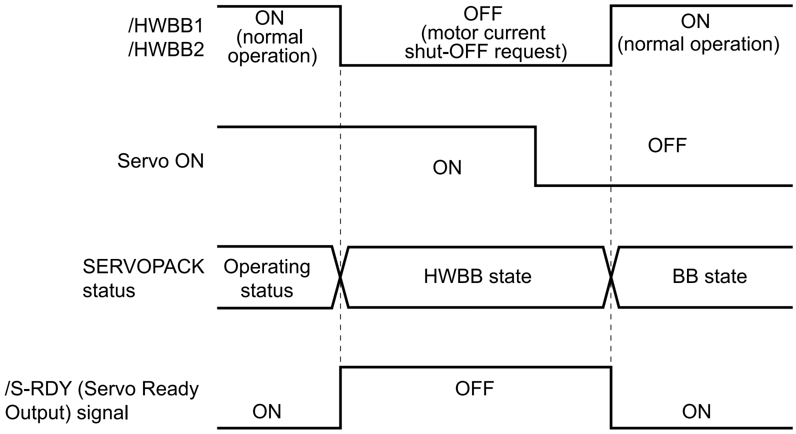
However, if the HWBB operates during execution of the following functions, leave the execution mode for the function and then enter it again to restart operation. Operation will not be restarted simply by turning ON the /HWBB1 and /HWBB2 signals.

Applicable Functions	Resetting the HWBB State
• Jog • Origin Search • Jog Program • Autotuning without Host Reference • Easy FFT • Adjust the Motor Current Detection Signal Offsets	

12.2.8 /S-RDY (Servo Ready Output) Signal

The SV_ON (Servo ON) 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 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

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.

⚠ CAUTION

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 Pn001 = n.□□□X (Motor Stopping Method for Servo OFF). However, if you set Pn001 = n.□□□0 or n.□□□1 (stop the motor by applying the dynamic brake), observe the following precautions.

⚠ CAUTION

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 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.

Whether or not you use the EDM1 signal does not affect the performance level of safety parameters.

You can use the EDM1 signal if the system requires it, such as when a Σ-X SERVOPACK is replacing a Σ-7 SERVOPACK in the system.

- 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 is turned ON.

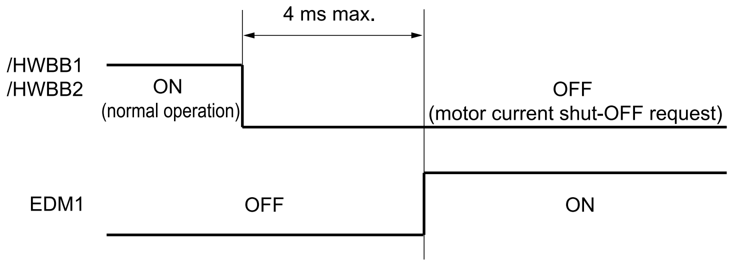
Signal	Logic			
/HWBB1	ON	ON	OFF	OFF
/HWBB2	ON	OFF	ON	OFF
EDM1	OFF	OFF	OFF	ON

⚠ WARNING

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 4 ms.



Safety Functions

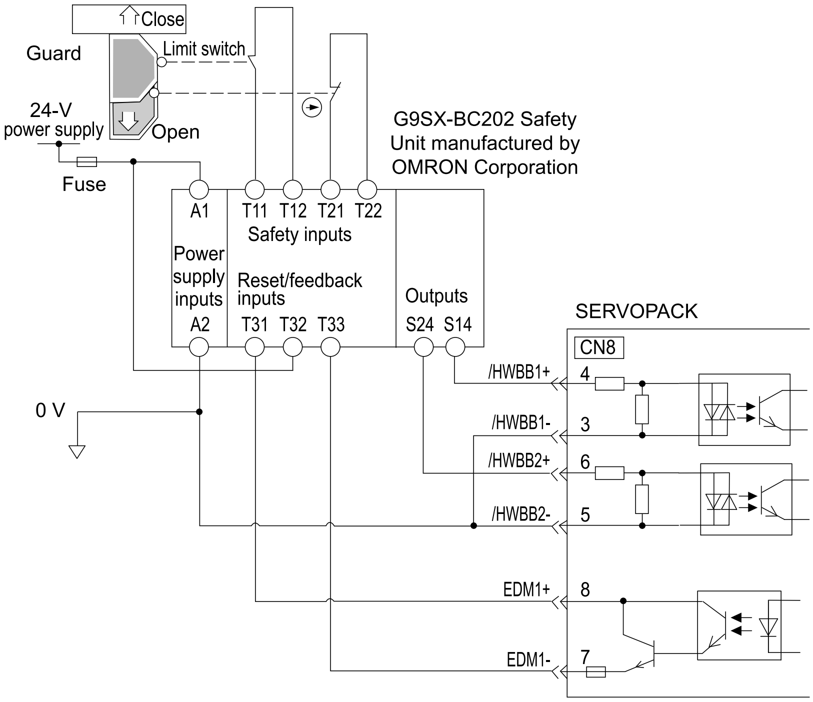
12

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 /HWBB2 signals turn OFF and the EDM1 signal turns ON, and this turns ON the feedback inputs and resets the safety unit. When the guard is closed from this state, the /HWBB1 and /HWBB2 signals turn ON and the SERVOPACK can be reset from the HWBB state.

Note:

The EDM1 signal is used as a source output. Refer to the following section for information on making the connection to the host controller.

☞ *(2) Diagnostic Output Circuits on page 139*

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 an error 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

1	Request is received to open the guard.
2	If the servomotor is operating, a stop command is received from the host controller, the servomotor stops, and the servo is turned OFF.
3	The guard is opened.
4	The /HWBB1 and /HWBB2 signals turn OFF and the HWBB operates. (Working inside the guard is enabled.)
5	The worker leaves the guarded area after completing work.
6	The guard is closed.
7	The servo is turned ON by the host controller.

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 panel display or digital operator displays Hbb and that the servomotor does not operate.
  If the display does not show Hbb, check the ON/OFF status of the /HWBB1 and /HWBB2 signals.
- 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.
- If you use the EDM1 signal, confirm that the EDM1 signal is OFF while in normal operation by using the feedback circuit input display of the connected device.
  (Whether or not you use the EDM1 signal does not affect the performance level of safety parameters.)

Information

You can use the [Status] monitor in the SigmaWin+ to check the ON/OFF status of the /HWBB1 and /HWBB2 signals. Refer to the following section for details.

☞ *9.2.2 Operation Monitor, Status Monitor, and I/O Monitor on page 452*

The /HWBB1 and /HWBB2 signals can also be traced using the trace function in the SigmaWin+. Refer to the following section for details.

☞ *9.3 Monitoring Machine Operation Status and Signal Waveforms on page 460*

Important

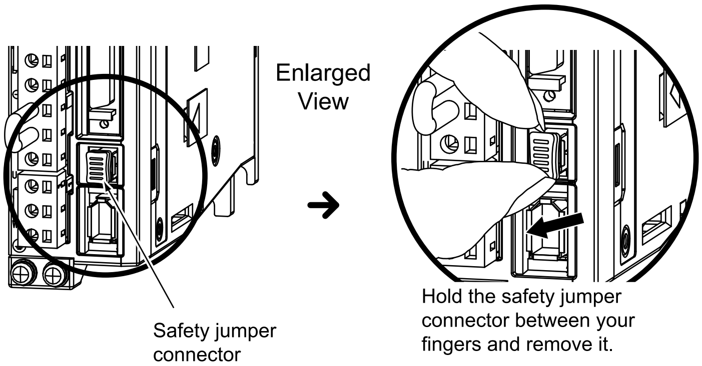
If the following states occur, check if the cause is on the SERVOPACK end.
- When the /HWBB1 and /HWBB2 signals are turned OFF, the panel display or digital operator does not display Hbb.
- When the /HWBB1 and /HWBB2 signals are turned OFF, the EDM1 signal does not turn ON.

If the cause is found on the SERVOPACK end, the SERVOPACK may be faulty.

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 panel display or digital operator.

13

Maintenance

This chapter provides information on the meaning of, causes of, and corrections for alarms and warnings.

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 SERVOPACK. Daily inspections are not required.

Maintenance of the safety functions are not required, but regular maintenance is recommended

Item	Frequency	Inspection	Correction
Exterior	At least once a year	Check for dust, dirt, and oil on the surfaces.	Clean with pressurized air or a cloth.
Loose Screws		Check for loose terminal block and connector mounting 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.
  ☞ *9.4 Monitoring Product Life on page 467*
- Use the following table.

Part	Standard Replacement Period	Remarks
Cooling Fan	4 years to 5 years	The standard replacement periods given on the left are for the following operating conditions. – Surrounding air temperature: Annual average of 30°C – Load factor: 80% max. – Operation rate: 20 hours/day max.
Electrolytic Capacitor	10 years	
Relays	100000 power ON operations	Power ON frequency: Once an hour
Battery	3 years without power supplied	Surrounding temperature without power supplied: 20°C

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.

Important

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.

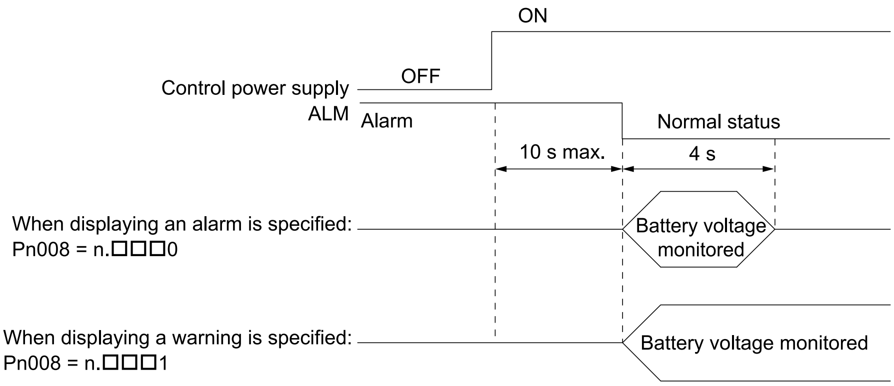
☞ *(2) Battery Replacement Procedure on page 540*

(1) Battery Alarm/Warning Selection

Whether to display an alarm or a warning is determined by the setting of Pn008 = n.□□□X (Low Battery Voltage Alarm/Warning Selection).

		Low Battery Voltage Alarm/Warning Selection Speed Pos Trq		When Enabled
Pn008	n.□□□X	0 Default	Output alarm (A.830) for low battery voltage.	After restart
		1	Output warning (A.930) for low battery voltage.	

- Pn008 = n.□□□0
  The ALM (Servo Alarm Output) signal is output for up to 10 seconds when the control power 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 Output) signal is output for up to 10 seconds when the control power is turned ON, and then the battery voltage is monitored continuously.



(2) Battery Replacement Procedure

(a) When Installing a Battery on the Host Controller

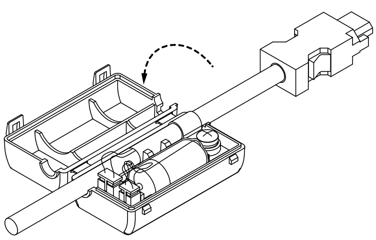
1. **Turn ON only the control power to the SERVOPACK.**
2. **Remove the old battery and mount a new battery.**
3. **Turn OFF the control power to the SERVOPACK to clear the A.830 alarm (Encoder Battery Alarm).**
4. **Turn ON the control power to the SERVOPACK again.**
5. **Make sure that the alarm has been cleared and that the SERVOPACK operates normally.**

(b) When Using an Encoder Cable with a Battery Unit

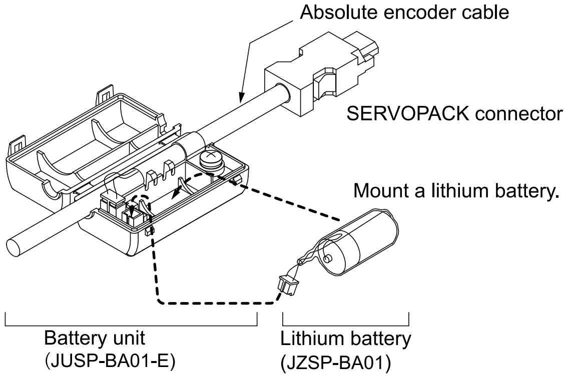
1. **Turn ON only the control power to the SERVOPACK.**

> Important
> If you remove the battery or disconnect the encoder cable while the control power to the SERVOPACK is OFF, the absolute encoder data will be lost.

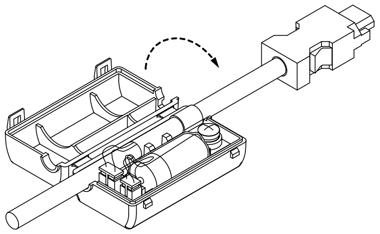
2. **Open the cover of the battery unit.**



3. **Remove the old battery and mount a new battery.**



4. **Close the cover of the battery unit.**



5. **Turn OFF the power to the SERVOPACK to clear the A.830 alarm (Encoder Battery Alarm).**
6. **Turn ON the power 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 no alarm number appears on the panel display, this indicates a SERVOPACK system error. Replace the SERVOPACK.

If there is an alarm, the display will change in the following order.

Example: Alarm A.E60

Status Display → Not lit. → A. → Not lit. → E → Not lit. → 6 → Not lit. → 0 → 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.

(1) Servomotor Stopping Method for Alarms

Refer to the following section for information on the stopping method for alarms.

☞ *5.13.2 Servomotor Stopping Method for Alarms on page 184*

(2) 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.

(3) List of Alarms

The following table lists the alarms.

Information: Alarm numbers A.E50, A.E60, and FL-1 to FL-7 are not stored in the alarm history. They are only displayed on the panel display.

Alarm Number	Alarm Name	Alarm Meaning	Servomotor Stopping Method	Alarm Reset Possibility
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 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 SERVOPACK.	Gr.1	No
A.025	System Alarm	An internal program error occurred in the SERVOPACK.	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
A.042	Parameter Combination Error	The combination of some parameters exceeds the setting range.	Gr.1	No
A.044	Semi-Closed/Fully-Closed Loop Control Parameter Setting Error	The settings of parameters related to semi-closed/fully-closed loop control do not match.	Gr.1	No

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Alarm Number	Alarm Name	Alarm Meaning	Servomotor Stopping Method	Alarm Reset Possibility
A.046	SigmaLINK II Command/ Response Parameter Setting Error	An error was detected in the SigmaLINK II response data or SigmaLINK II command data settings.	Gr.1	No
A.04A	Parameter Setting Error 2	There is an error in the bank members, bank data, or speed unit settings.	Gr.1	No
A.050	Combination Error	The capacities of the SERVOPACK and servomotor do not match.	Gr.1	Yes
A.051	Unsupported Device Alarm	An unsupported device was connected.	Gr.1	No
A.070	Motor Type Change Detected	The connected motor is a different type of motor from the previously connected motor.	Gr.1	No
A.080	Linear Encoder Pitch Setting Error	The setting of Pn282 (Linear Encoder Scale Pitch) has not been changed from the default setting.	Gr.1	No
A.0b0	Invalid Servo ON Command Alarm	The SV_ON (Servo ON) command was sent from the host controller after a utility function that turns ON the servomotor was executed..	Gr.1	Yes
A.100	Overcurrent Detected	An overcurrent flowed through the power transistor or the heat sink overheated.	Gr.1	No
A.101	Motor Overcurrent Detected	The current to the motor exceeded the allowable current.	Gr.1	No
A.102	Motor Overcurrent Detected 2	The current to the motor exceeded the allowable current.	Gr.1	No
A.300	Regeneration Error	There is an error related to regeneration.	Gr.1	Yes
A.320	Regenerative Overload	A regenerative overload occurred.	Gr.2	Yes
A.330	Main Circuit Power Supply Wiring Error	• The AC power supply input setting or DC power supply input setting is not correct. • The power supply wiring is not correct.	Gr.1	Yes
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
A.510	Overspeed	The motor exceeded the maximum speed.	Gr.1	Yes
A.511	Encoder Output Pulse Overspeed	• The pulse output speed for the setting of Pn212 (Number of Encoder Output Pulses) was exceeded. (Rotary Servomotor) • The motor speed upper limit for the setting of Pn281 (Encoder Output Resolution) was exceeded. (Linear Servomotor)	Gr.1	Yes
A.520	Vibration Alarm	Abnormal oscillation was detected in the motor speed.	Gr.1	Yes
A.521	Autotuning Alarm	Vibration was detected during autotuning for the tuning- less function.	Gr.1	Yes
A.550	Maximum Motor Speed Setting Error	The setting of Pn385 (Maximum Motor Speed) is greater than the maximum motor speed.	Gr.1	Yes
A.710	Instantaneous Overload	The servomotor was operating for several seconds to several tens of seconds under a torque that largely exceeded the rating.	Gr.2	Yes
A.720	Continuous Overload	The servomotor was operating continuously under a torque that exceeded the rating.	Gr.1	Yes
A.730	Dynamic Brake Overload	When the dynamic brake was applied, the rotational or linear kinetic energy exceeded the capacity of the dynamic brake resistor.	Gr.1	Yes
A.731	Dynamic Brake Overload	When the dynamic brake was applied, the rotational 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 was frequently turned ON and OFF.	Gr.1	Yes

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Alarm Number	Alarm Name	Alarm Meaning	Servomotor Stopping Method	Alarm Reset Possibility
A.7A1	Internal Temperature Error 1 (Control Board Temperature Error)	The surrounding temperature of the control board is abnormal.	Gr.2	Yes
A.7A2	Internal Temperature Error 2 (Power Board Temperature Error)	The surrounding temperature of the power board is abnormal.	Gr.2	Yes
A.7A3	Internal Temperature Sensor Error	An error occurred in the temperature sensor circuit.	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 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 Overspeed	An overspeed error occurred in the external encoder.	Gr.1	Yes
A.8A6	External Encoder Overheated	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 Communications ASIC Error 1	ASIC error 1 occurred in MECHATROLINK communications.	Gr.1	No
A.b6b	MECHATROLINK Communications ASIC Error 2	ASIC error 2 occurred in MECHATROLINK communications.	Gr.2	No
A.bE2	Firmware error	A firmware error occurred in the SERVOPACK.	Gr.1	No
A.bF0	System Alarm 0	Internal program error 0 occurred in the SERVOPACK.	Gr.1	No
A.bF1	System Alarm 1	Internal program error 1 occurred in the SERVOPACK.	Gr.1	No
A.bF2	System Alarm 2	Internal program error 2 occurred in the SERVOPACK.	Gr.1	No
A.bF3	System Alarm 3	Internal program error 3 occurred in the SERVOPACK.	Gr.1	No
A.bF4	System Alarm 4	Internal program error 4 occurred in the SERVOPACK.	Gr.1	No
A.bF5	System Alarm 5	Internal program error 5 occurred in the SERVOPACK.	Gr.1	No
A.bF6	System Alarm 6	Internal program error 6 occurred in the SERVOPACK.	Gr.1	No

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Alarm Number	Alarm Name	Alarm Meaning	Servomotor Stopping Method	Alarm Reset Possibility
A.bF7	System Alarm 7	Internal program error 7 occurred in the SERVOPACK.	Gr.1	No
A.bF8	System Alarm 8	Internal program error 8 occurred in the SERVOPACK.	Gr.1	No
A.bFd	System Alarm D	An internal program error D occurred in the SERVOPACK.	Gr.1	No
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	Polarity Sensor Error	An error occurred in the polarity sensor.	Gr.1	No
A.C22	Phase Information Disagreement	The phase information does not match.	Gr.1	No
A.C50	Polarity Detection Failure	The polarity detection failed.	Gr.1	No
A.C51	Overtravel Detected during Polarity Detection	The overtravel signal was detected during polarity detection.	Gr.1	Yes
A.C52	Polarity Detection Not Completed	The servo was turned ON before the polarity was detected.	Gr.1	Yes
A.C53	Out of Range of Motion for Polarity Detection	The travel distance exceeded the setting of Pn48E (Polarity Detection Range).	Gr.1	No
A.C54	Polarity Detection Failure 2	The polarity detection failed.	Gr.1	No
A.C80	Encoder Clear Error or Multiturn Limit Setting Error	The multiturn data for the absolute encoder was not correctly cleared or set.	Gr.1	No
A.C90	Encoder Communications Error	Communications between the encoder and SERVOPACK is not possible.	Gr.1	No
A.C91	Encoder Communications Position Data Acceleration Rate Error	An error occurred in calculating the position data of the encoder.	Gr.1	No
A.C92	Encoder Communications Timer Error	An error occurred in the communications timer between the encoder and SERVOPACK.	Gr.1	No
A.CA0	Encoder Parameter Error	The parameters in the encoder are corrupted.	Gr.1	No
A.Cb0	Encoder Echoback Error	The contents of communications with the encoder are incorrect.	Gr.1	No
A.CC0	Multiturn Limit Disagreement	Different multiturn limits have been set in the encoder and the SERVOPACK.	Gr.1	No
A.Cd1	SigmaLINK II Node Configuration Error	A configuration that cannot be connected with SigmaLINK II was detected.	Gr.1	No
A.Cd2	SigmaLINK II Power Supply Short-Circuit Detected	An error occurred in the power system of the SigmaLINK II connection.	Gr.1	No
A.Cd3	SigmaLINK II Configuration Data Checksum Error	Saving the configuration data failed.	Gr.1	No
A.Cd4	SigmaLINK II Node Change Detected	The content saved in the configuration and the content detected in node detection are different.	Gr.1	No
A.Cd7	SigmaLINK II I/O Device Communications Error	An error occurred in communications with the SigmaLINK II I/O device.	Gr.2	No
A.Cd8	SigmaLINK II I/O Device Status Error	The SigmaLINK II I/O device detected an error.	Gr.2	No
A.CF1	Reception Failed Error in External Encoder	Communications between the external encoder and SERVOPACK is not possible.	Gr.1	No
A.CF2	Timer Stopped Error in External Encoder	An error occurred in the communications timer between the external encoder and SERVOPACK.	Gr.1	No
A.d00	Position Deviation Overflow	The setting of Pn520 (Position Deviation Overflow Alarm Level) was exceeded by the position deviation.	Gr.1	Yes

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Alarm Number	Alarm Name	Alarm Meaning	Servomotor Stopping Method	Alarm Reset Possibility
A.d01	Position Deviation 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.	Gr.1	Yes
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) limits the speed when the servo is turned ON. This alarm occurs if 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.d04	Overtravel Alarm	Overtravel was detected while the servo was ON.	Gr.1	Yes
A.d10	Motor-Load Position Deviation Overflow	There was too much position deviation between the motor and load during fully-closed loop control.	Gr.2	Yes
A.d30	Position Data Overflow	The position feedback data exceeded ±1879048192.	Gr.1	No
A.E00	MECHATROLINK Initialization Timeout Error 1	Communications initialization failed between the servo control module and the MECHATROLINK communications module.	Gr.2	Yes
A.E02	MECHATROLINK Internal Synchronization Error 1	A synchronization error occurred during MECHATROLINK communications with the SERVOPACK.	Gr.1	Yes
A.E40	MECHATROLINK Transmission Cycle Setting Error	The setting of the MECHATROLINK communications transmission cycle is not correct.	Gr.2	Yes
A.E41	MECHATROLINK Communications Data Size Setting Error (This alarm can occur when using MECHATROLINK-III communications.)	The setting of the MECHATROLINK communications data size is not correct.	Gr.2	Yes
A.E42	MECHATROLINK Station Address Setting Error(This alarm can occur when using MECHATROLINK-III communications.)	The setting of the MECHATROLINK station address is not correct.	Gr.2	No
A.E43	MECHATROLINK Communications Setting Error(This alarm can occur when using MECHATROLINK-4 communications.)	There is an error in the MECHATROLINK communications settings.	Gr.2	Yes
A.E50	MECHATROLINK Synchronization Error	A synchronization error occurred during MECHATROLINK communications.	Gr.2	Yes
A.E51	MECHATROLINK Synchronization Failed	Synchronization failed during MECHATROLINK communications.	Gr.2	Yes
A.E60	Reception Error in MECHATROLINK Communications	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 Synchronization Frame Not Received	Synchronization frames were continuously not received during MECHATROLINK communications.	Gr.2	Yes
A.E72	Feedback Option Module Detection Failure	Detection of the feedback option module failed.	Gr.1	No
A.EA0	MECHATROLINK Initialization Timeout Error 2	Communications initialization failed between the servo control module and the MECHATROLINK communications module.	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 Timeout	A timeout error occurred for a MECHATROLINK command.	Gr.2	Yes

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Alarm Number	Alarm Name	Alarm Meaning	Servomotor Stopping Method	Alarm Reset Possibility
A.F10	Power Supply Line Open Phase	The voltage was low for more than one second for phase R, S, or T when the main power was ON.	Gr.2	Yes
FL-1	System Alarm	An internal program error occurred in the SERVOPACK.	-	No
FL-2	System Alarm	An internal program error occurred in the SERVOPACK.	-	No
FL-3	System Alarm	An internal program error occurred in the SERVOPACK.	-	No
FL-4	System Alarm	An internal program error occurred in the SERVOPACK.	-	No
FL-5	System Alarm	An internal program error occurred in the SERVOPACK.	-	No
FL-6	System Alarm	An internal program error occurred in the SERVOPACK.	-	No
FL-7	System Alarm	An internal program error occurred in the SERVOPACK.	-	No
CPF00	Digital Operator Communications Error 1	Communications were not possible between the digital operator and the SERVOPACK.	-	No
CPF01	Digital Operator Communications Error 2	Communications were not possible between the digital operator and the SERVOPACK.	-	No

13.2.2 Troubleshooting Alarms

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.

◆ A.020:Parameter Checksum Error

Possible Cause	Confirmation	Correction	Reference
The power supply voltage suddenly dropped.	Measure the power supply voltage.	Set the power supply voltage within the specified range, and initialize the parameter settings.	154
The power was shut OFF while writing parameter settings.	Check the timing of shutting OFF the power.	Initialize the parameter settings and then set the parameters again.	154
The number of times that parameters were written exceeded the limit.	Check to see if the parameters were frequently changed from the host controller.	The SERVOPACK may be faulty. Replace the SERVOPACK. Reconsider the method for writing the parameters.	–
A malfunction was caused by noise from the AC power supply, ground, static electricity, or other source.	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, noise may be the cause.	Implement countermeasures against noise.	103
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 SERVOPACK.	–
A failure occurred in the SERVOPACK.	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may have failed.	The SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.021:Parameter Format Error

Possible Cause	Confirmation	Correction	Reference
The software version of the SERVOPACK that caused the alarm is older than the software version of the parameters specified to write.	Read the product information to see if the software versions are the same. If they are different, 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.	450
A failure occurred in the SERVOPACK.	–	The SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.022:System Checksum Error

Possible Cause	Confirmation	Correction	Reference
The power supply voltage suddenly dropped.	Measure the power supply voltage.	The SERVOPACK may be faulty. Replace the SERVOPACK.	–
The power was shut OFF while setting a utility function.	Check the timing of shutting OFF the power.	The SERVOPACK may be faulty. Replace the SERVOPACK.	–
A failure occurred in the SERVOPACK.	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may have failed.	The SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.024:System Alarm
A.025:System Alarm
A.030:Main Circuit Detector Error

Possible Cause	Confirmation	Correction	Reference
A failure occurred in the SERVOPACK.	–	The SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.040:Parameter Setting Error

Possible Cause	Confirmation	Correction	Reference
The SERVOPACK and servomotor capacities do not match each other.	Check the combination of the SERVOPACK and servomotor capacities.	Select a proper combination of SERVOPACK and servomotor capacities.	53
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 linear encoder.	Write the motor parameter file to the linear encoder.	164
A failure occurred in the SERVOPACK.	–	The SERVOPACK may be faulty. Replace the SERVOPACK.	–
A parameter setting is outside of the setting range.	Check the setting ranges of the parameters that have been changed.	Set the parameters to values within the setting ranges.	200
The electronic gear ratio is outside of the setting range.	Check the electronic gear ratio. The ratio must be within the following range: 0.001 < (Pn20E/Pn210) < 64000.	Set the electronic gear ratio in the following range: 0.001 < (Pn20E/ Pn210) < 64000.	188
A pin number or sequence input number that does not exist on the SERVOPACK was allocated in Pn590 to Pn5BC = n.□XXX (Allocated Pin Number). (An alarm will not occur, however, if the signal is disabled.)	Check the setting of Pn590 to Pn5BC = n.□XXX.	Set a pin number or sequence input number that exists in Pn590 to Pn5BC = n.□XXX.	211

◆ A.041:Encoder Output Pulse Setting Error

Possible Cause	Confirmation	Correction	Reference
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.	Check the setting of Pn212 or Pn281.	Set Pn212 or Pn281 to an appropriate value.	231

◆ A.042:Parameter Combination Error

Possible Cause	Confirmation	Correction	Reference
The speed of program jogging went below the setting range when the electronic gear ratio (Pn20E/ Pn210) or the servomotor was changed.	Check if the setting of the electronic gear ratio (Pn20E/Pn210) satisfies the conditions given in the preparations for program jogging.	Decrease the setting of the electronic gear ratio (Pn20E/Pn210).	294
The speed of program jogging went below the setting range when Pn533 or Pn585 (Program Jogging Movement Speed) was changed.	Check if the setting of Pn533 or Pn585 satisfies the conditions given in the preparations for program jogging.	Increase the setting of Pn533 or Pn585.	294
The travel speed during autotuning without a host reference went below the setting range when the electronic gear ratio (Pn20E/ Pn210) or the servomotor was changed.	Check if the setting of the electronic gear ratio (Pn20E/Pn210) satisfies the conditions given in the preparations for autotuning without a host reference.	Decrease the setting of the electronic gear ratio (Pn20E/Pn210).	346
Triggers at preset positions are enabled, but the allocations of the input signal allocation mode settings are not correct.	Check the settings of Pn660 = n.X□□□ (Triggers at Preset Positions Selections) and Pn50A = n.□□□X (Input Signal Allocation Mode).	Set Pn660 to n.1□□□ (enable triggers at preset positions), and set Pn50A to n.□□□2 (use Pn590 to Pn5BC (Sigma-LINK II input signal allocation mode)).	–

◆ A.044:Semi-Closed/Fully-Closed Loop Control Parameter Setting Error

Possible Cause	Confirmation	Correction	Reference
The node specified by Pn0DA or Pn0DB does not exist.	Check if the setting for Pn0DA or Pn0DB is the node address of the connected device.	Set Pn0DA and Pn0DB to appropriate values.	504
An unsupported serial converter unit, encoder, or external encoder was specified by Pn0DA.	Check if the connected serial converter unit, encoder, or external encoder is a supported model.	Connect a supported serial converter unit, encoder, or external encoder.	504
A serial converter unit, encoder, or external encoder was specified by Pn0DA.	Check the node address set in Pn0DA.	Set the node address of a servomotor in Pn0DA.	504
A servomotor was specified by Pn0DB.	Check the node address set in Pn0DB.	Set the node address of a serial converter unit, encoder, or external encoder in Pn0DB (a servomotor cannot be used as an external encoder).	504
An I/O device was specified by Pn0DA or Pn0DB.	Check the node address set in Pn0DA and Pn0DB.	Set the node address of a servomotor in Pn0DA, and set the node address of a serial converter unit, encoder, or external encoder in Pn0DB.	504
The same node was specified in Pn0DA and Pn0DB.	Check if Pn0DA and Pn0DB are the same value.	Set Pn0DA and Pn0DB to different values.	504
The setting of Pn002 = n.X□□□ (External Encoder Usage) and the device status do not match.	Check the setting of Pn002 = n.X□□□.	Make sure that the setting of Pn002 = n.X□□□ agrees with the device status.	484

◆ A.046:SigmaLINK II Command/Response Parameter Setting Error

Possible Cause	Confirmation	Correction	Reference
Slave parameters specified by Pn050 to Pn05E and Pn090 to Pn096 (Sigma-LINK II Response Data Selection 1 to 8/SigmaLINK II Command Data Selection 1 to 4) do not exist.	Check the parameter numbers set in Pn050 to Pn05E and Pn090 to Pn096.	Refer to the I/O device manual and set the correct values.	–

◆ A.04A:Parameter Setting Error 2

Possible Cause	Confirmation	Correction	Reference
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.	–
It may not be possible to calculate the speed reference correctly when maximum motor speed > rated motor speed and PnA82 (Speed Unit) = 2.	–	Decrease the setting of PnA82.	–

◆ A.050:Combination Error

Possible Cause	Confirmation	Correction	Reference
The SERVOPACK and servomotor capacities do not match each other.	Confirm that the following condition is met: 1/4 ≤ (Servomotor capacity/SERVOPACK capacity) ≤ 4	Select a proper combination of the SERVOPACK and servomotor capacities.	53
A failure occurred in the encoder.	Replace the encoder and check to see if the alarm still occurs.	Replace the servomotor or encoder.	–
A failure occurred in the SERVOPACK.	–	The SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.051:Unsupported Device Alarm

Possible Cause	Confirmation	Correction	Reference
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 linear encoder.	Write the motor parameter file to the linear encoder.	164
An unsupported serial converter unit or encoder (e.g., an external encoder) is connected to the SERVOPACK.	Check the product combination specifications.	Change to a correct combination of models.	–

◆ A.070:Motor Type Change Detected

Possible Cause	Confirmation	Correction	Reference
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 to the SERVOPACK OFF and ON again.	579
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 to the SERVOPACK OFF and ON again.	579
The node specified by Pn0DA was changed from rotary servomotor to linear servomotor.	Check the setting of Pn0DA.	Change Pn0DA to the setting for a linear servomotor and reset the motor type alarm. Then, turn the power to the SERVOPACK OFF and ON again.	504, 579
The node specified by Pn0DA was changed from linear servomotor to rotary servomotor.	Check the setting of Pn0DA.	Change Pn0DA to the setting for a rotary servomotor and reset the motor type alarm. Then, turn the power to the SERVOPACK OFF and ON again.	504, 579

◆ A.080:Linear Encoder Pitch Setting Error

Possible Cause	Confirmation	Correction	Reference
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.	163

◆ A.0b0:Invalid Servo ON Command Alarm

Possible Cause	Confirmation	Correction	Reference
The SV_ON (Servo ON) command was sent from the host controller after a utility function that turns ON the servomotor was executed.	–	Turn the power to the SERVOPACK OFF and ON again. Or, execute a software reset.	254

◆ A.100:Overcurrent Detected

Possible Cause	Confirmation	Correction	Reference
The main circuit cable is not wired correctly or there is faulty contact.	Check the wiring.	Correct the wiring.	121
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 shortcircuited. Replace the cable.	121
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 servomotor.	121
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 SERVOPACK, or between the ground and terminals U, V, or W.	The SERVOPACK may be faulty. Replace the SERVOPACK.	121
The regenerative resistor is not wired correctly or there is faulty contact.	Check the wiring.	Correct the wiring.	121
The dynamic brake (DB, emergency stop executed from the SERVOPACK) was frequently activated, or a DB overload alarm occurred.	Check the power consumed by the DB resistor to see how frequently the DB is being used. Or, check the alarm display to see if an A.730 or A.731 alarm (Dynamic Brake Overload) has occurred.	Change the SERVOPACK model, operating methods, or the mechanisms so that the dynamic brake does not need to be used so frequently.	–
The regenerative processing capacity was exceeded.	Check the regenerative load ratio in the operation monitor of the SigmaWin+ to see how frequently the regenerative resistor is being used.	Recheck the operating conditions and load.	200
The SERVOPACK regenerative resistance is too small.	Check the regenerative load ratio in the operation monitor of the SigmaWin+ to see how frequently the regenerative resistor is being used.	Change the regenerative resistance to a value larger than the SERVOPACK minimum allowable resistance.	200
A heavy load was applied while the servomotor 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 environment, e.g. by improving the wiring or installation conditions, and check to see if the alarm still occurs.	Implement countermeasures against noise, such as correct wiring of the FG. Use an FG wire size equivalent to the SERVOPACK's main circuit wire size.	–
A failure occurred in the SERVOPACK.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.101:Motor Overcurrent Detected A.102:Motor Overcurrent Detected 2

Possible Cause	Confirmation	Correction	Reference
The main circuit cable is not wired correctly or there is faulty contact.	Check the wiring.	Correct the wiring.	121
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 shortcircuited. Replace the cable.	121
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 servomotor.	121
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 SERVOPACK, or between the ground and terminals U, V, or W.	The SERVOPACK may be faulty. Replace the SERVOPACK.	121
A heavy load was applied while the servomotor 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 environment, e.g. by improving the wiring or installation conditions, and check to see if the alarm still occurs.	Implement countermeasures against noise, such as correct wiring of the FG. Use an FG wire size equivalent to the SERVOPACK's main circuit wire size.	–
A failure occurred in the SERVOPACK.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–
Pn43D (Reserved parameter) is set to anything other than the default setting.	–	Initialize the parameter settings.	–

◆ A.300:Regeneration Error

Possible Cause	Confirmation	Correction	Reference
When using the built-in regenerative resistor, the jumper between the regenerative resistor terminals (B2 and B3) was removed from one of the following SERVOPACKs: SGDXS-3R8A, -5R5A, -7R6A, -120A, -180A, -200A, or -330A.	Confirm to see if the jumper is connected between main circuit terminals B2 and B3.	Correctly connect a jumper.	117
The external regenerative resistor or regenerative resistor unit is not wired correctly, or was removed or disconnected.	Check the wiring of the external regenerative resistor or regenerative resistor unit.	Remove the jumper between B2 and B3, and correctly wire the external regenerative resistor or regenerative resistor unit.	117
Pn600 (Regenerative Resistor Capacity) is not set to 0 and an external regenerative resistor is not connected to one of the following SERVOPACKs: SGDXS-R70A, -R90A,-1R6A, or -2R8A.	Check to see if an external regenerative resistor is connected and check the setting of Pn600.	Connect an external regenerative resistor, or set Pn600 (Regenerative Resistor Capacity) to 0 (setting unit: ×10 W) if no regenerative resistor is required.	200
An external regenerative resistor is not connected to one of the following SERVOPACKs: SGDXS-470A, -550A, -590A, or -780A.	Check to see if an external regenerative resistor or regenerative resistor unit is connected and check the setting of Pn600.	Connect an external regenerative resistor and set Pn600 to an appropriate value. Or connect a regenerative resistor unit and set Pn600 (Regenerative Resistor Capacity) to 0 (setting unit: 10 W).	200
A failure occurred in the SERVOPACK.	–	While the main circuit power is OFF, turn the control power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.320:Regenerative Overload

Possible Cause	Confirmation	Correction	Reference
The power supply voltage exceeded the specified range.	Measure the power supply voltage.	Set the power supply voltage within the specified range.	–
The external regenerative resistance value or regenerative resistor capacity is too small, or there has been a continuous regeneration state.	Check the operating conditions or the capacity.	Change the regenerative resistance value or capacity. Reconsider the operating conditions.	200
There was a continuous regeneration state because a negative load was continuously applied.	Check the load applied to the servomotor during operation.	Reconsider the system including the servo, machine, and operating conditions.	–
The setting of Pn600 (Regenerative Resistor Capacity) is smaller than the capacity of the external regenerative resistor.	Check to see if a regenerative resistor is connected and check the setting of Pn600.	Correct the setting of Pn600.	200
The setting of Pn603 (Regenerative Resistance) 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.	200
The external regenerative 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.	200
A failure occurred in the SERVOPACK.	–	The SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.330:Main Circuit Power Supply Wiring Error

Possible Cause	Confirmation	Correction	Reference
The regenerative resistor was disconnected when the SERVOPACK power supply voltage was high.	Measure the resistance of the regenerative resistor using a measuring instrument.	If you are using the regenerative resistor built into the SERVOPACK, replace the SERVOPACK. If you are using an external regenerative resistor, replace the external regenerative resistor.	–
DC power was supplied when an AC power supply input was specified in the settings.	Check the power supply to see if it is a DC power supply.	Correct the power supply setting to match the actual power supply.	158
AC power was supplied when a DC power supply input was specified in the settings.	Check the power supply to see if it is an AC power supply.	Correct the power supply setting to match the actual power supply.	158
Pn600 (Regenerative Resistor Capacity) is not set to 0 and an external regenerative resistor is not connected to one of the following SERVOPACKs: SGDXS-R70A, -R90A,-1R6A, or -2R8A.	Check to see if an external regenerative resistor is connected and check the setting of Pn600.	Connect an external regenerative resistor, or if an external regenerative resistor is not required, set Pn600 to 0.	117 , 200
A failure occurred in the SERVOPACK.	–	The SERVOPACK may be faulty. Replace the SERVOPACK.	–

Maintenance

13

◆ A.400:Overvoltage

Possible Cause	Confirmation	Correction	Reference
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 lightning surge.	Measure the power supply voltage.	Improve the power supply conditions, install a surge absorber, and then turn the power OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–
The voltage for AC power supply was too high during acceleration or deceleration.	Check the power supply voltage and the speed and torque during operation.	Set the AC power supply voltage within the specified range.	–
The external regenerative 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 operating conditions and load.	200
The load moment of inertia ratio or mass ratio exceeded the allowable 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 is OFF, turn the control power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.410:Undervoltage

Possible Cause	Confirmation	Correction	Reference
The power supply voltage went below the specified range.	Measure the power supply voltage.	Set the power supply voltage 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 (Momentary Power Interruption Hold Time), decrease the setting.	223
The SERVOPACK fuse is blown out.	–	Replace the SERVOPACK and connect a reactor to the DC reactor terminals (⊖1, ⊖2) on the SERVOPACK.	–
A failure occurred in the SERVOPACK.	–	The SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.510:Overspeed

Possible Cause	Confirmation	Correction	Reference
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 servomotor is correctly wired.	–
A reference value that exceeded the overspeed detection level was input.	Check the input reference.	Reduce the reference value. Or, adjust the gain.	–
The motor exceeded the maximum speed.	Check the waveform of the motor speed.	Reduce the speed reference 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 SERVOPACK.	–

◆ A.511:Encoder Output Pulse Overspeed

Possible Cause	Confirmation	Correction	Reference
The encoder output pulse frequency exceeded the limit.	Check the encoder output pulse setting.	Decrease the setting of Pn212 (Number of Encoder Output Pulses) or Pn281 (Encoder Output Resolution).	231
The encoder output pulse frequency exceeded the limit because the motor speed was too high.	Check the encoder output pulse setting and the motor speed.	Reduce the motor speed.	–

◆ A.520:Vibration Alarm

Possible Cause	Confirmation	Correction	Reference
Abnormal oscillation was detected in the motor speed.	Check for abnormal motor noise, and check the speed and torque waveforms during operation.	Reduce the motor speed. Or, reduce the setting of Pn100 (Speed Loop Gain).	427
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 appropriate value.	323
The setting of Pn312 or Pn384 (Vibration Detection Level) is not suitable.	Check that the setting of Pn312 or Pn384 (Vibration Detection Level) is suitable.	Set Pn312 or Pn384 (Vibration Detection Level) to an appropriate value.	257

◆ A.521:Autotuning Alarm

Possible Cause	Confirmation	Correction	Reference
The servomotor vibrated considerably while performing the tuning-less function.	Check the waveform of the motor speed.	Reduce the load so that the load moment of inertia ratio is within the allowable value. Or increase the load level or reduce the response level in the tuning-less level settings.	319
The servomotor vibrated considerably while performing custom tuning or Easy FFT.	Check the waveform of the motor speed.	Check the operating procedure of corresponding function and implement corrections.	366 , 443

◆ A.550:Maximum Motor Speed Setting Error

Possible Cause	Confirmation	Correction	Reference
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 maximum motor speed.	226

◆ A.710:Instantaneous Overload A.720:Continuous Overload

Possible Cause	Confirmation	Correction	Reference
The wiring is not correct or there is a faulty connection in the motor or encoder wiring.	Check the wiring.	Make sure that the servomotor and encoder are correctly wired.	121
Operation was performed that exceeded the overload protection characteristics.	Check the motor overload characteristics and operation reference.	Reconsider the load and operating conditions. Or, increase the motor capacity.	–
An excessive load was applied during operation because the servomotor was not driven due to mechanical problems.	Check the operation reference and motor speed.	Remove the mechanical problem.	–
There is an error in the setting of Pn282 (Linear Encoder Scale Pitch).	Check the setting of Pn282.	Set Pn282 to an appropriate value.	163
There is an error in the setting of Pn080 = n.□□X□ (Motor Phase Sequence Selection).	Check the setting of Pn080 = n.□□X□.	Set Pn080 = n.□□X□ to an appropriate value.	168
A failure occurred in the SERVOPACK.	–	The SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.730:Dynamic Brake Overload A.731:Dynamic Brake Overload

Possible Cause	Confirmation	Correction	Reference
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.	–
When the servomotor was stopped with the dynamic brake, the rotational or linear kinetic energy exceeded the capacity of the dynamic brake resistor.	Check the power consumed by the DB resistor to see how frequently the DB is being used.	Reconsider the following: • Reduce the servomotor command speed. • Decrease the moment of inertia ratio or mass ratio. • Reduce the frequency of stopping with the dynamic brake.	–
A failure occurred in the SERVOPACK.	–	The SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.740:Inrush Current Limiting Resistor Overload

Possible Cause	Confirmation	Correction	Reference
The allowable frequency of the inrush current limiting resistor was exceeded when the main circuit power was turned ON and OFF.	–	Reduce the frequency of turning the main circuit power ON and OFF.	–
A failure occurred in the SERVOPACK.	–	The SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.7A1:Internal Temperature Error 1 (Control Board Temperature Error) A.7A2:Internal Temperature Error 2 (Power Board Temperature Error)

Possible Cause	Confirmation	Correction	Reference
The surrounding temperature is too high.	Check the surrounding temperature using a thermometer. Or, check the operating status with the SERVOPACK installation environment monitor.	Decrease the surrounding temperature by improving the SERVOPACK installation conditions.	94
An overload alarm was reset by turning OFF the power too many times.	Check the alarm display to see if there is an overload alarm.	Change the method for resetting the alarm.	–
There was an excessive load or operation was performed that exceeded the regenerative processing capacity.	Check the load during operation with [Cumulative Load] and check the regenerative capacity with [Regenerative Load] on the operation monitor of the SigmaWin+.	Reconsider the load and operating conditions.	–
The SERVOPACK installation orientation is not correct or there is insufficient space around the SERVOPACK.	Check the SERVOPACK installation conditions.	Install the SERVOPACK according to specifications.	91 , 93
A failure occurred in the SERVOPACK.	–	The SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.7A3:Internal Temperature Sensor Error

Possible Cause	Confirmation	Correction	Reference
A failure occurred in the SERVOPACK.	–	The SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.7Ab:SERVOPACK Built-in Fan Stopped

Possible Cause	Confirmation	Correction	Reference
The fan inside the SERVOPACK stopped.	Check for foreign matter inside the SERVOPACK.	Remove foreign matter from the SERVOPACK. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.810:Encoder Backup Alarm

Possible Cause	Confirmation	Correction	Reference
The power to the absolute encoder was turned ON for the first time.	Check to see if the power was turned ON for the first time.	Set up the encoder.	194
The encoder cable was disconnected and then connected again.	Check to see if the power was turned ON for the first time.	Check the encoder connection and set up the encoder.	194
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 measures to supply power to the encoder, and set up the encoder.	194
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 SERVOPACK.	–

◆ A.820:Encoder Checksum Alarm

Possible Cause	Confirmation	Correction	Reference
A failure occurred in the encoder.	–	• When Using an Absolute Encoder Set up the encoder again. If the alarm still occurs, the servomotor may be faulty. Replace the servomotor. • When Using a Singleturn Absolute Encoder or Incremental Encoder – The servomotor may be faulty. Replace the servomotor. – The linear encoder may be faulty. Replace the linear encoder.	194
A failure occurred in the SERVOPACK.	–	The SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.830:Encoder Battery Alarm

Possible Cause	Confirmation	Correction	Reference
The battery connection is faulty or a battery is not connected.	Check the battery connection.	Correct the battery connection.	122
The battery voltage is lower than the specified value (2.7 V).	Measure the battery voltage.	Replace the battery.	539
A failure occurred in the SERVOPACK.	–	The SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.840:Encoder Data Alarm

Possible Cause	Confirmation	Correction	Reference
The encoder malfunctioned.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the servomotor or linear encoder may be faulty. Replace the servomotor or linear encoder.	–
An error occurred in reading data from the linear encoder.	–	The linear encoder is not mounted within an appropriate tolerance. Correct the mounting of the linear 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.	–
The encoder malfunctioned due to noise.	–	Correct the wiring around the encoder by separating the encoder cable from the servomotor main circuit cable or by grounding 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 sensor.	–

◆ A.850:Encoder Overspeed

Possible Cause	Confirmation	Correction	Reference
Rotary Servomotor: The servomotor speed was 200 min^{-1} or higher when the control power was turned ON.	Check the motor speed when the power is turned ON.	Reduce the servomotor speed to a value less than 200 min^{-1}, and turn ON the control power.	–
Linear Servomotor: The servomotor exceeded the specified speed when the control power was turned ON.	Check the motor speed when the power is turned ON.	Control the motor speed within the range specified by the linear encoder manufacturer and then turn ON the control power.	–
A failure occurred in the encoder.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the servomotor or linear encoder may be faulty. Replace the servomotor or linear encoder.	–
A failure occurred in the SERVOPACK.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.860:Encoder Overheated

Possible Cause	Confirmation	Correction	Reference
The surrounding temperature around the servomotor is too high.	Measure the surrounding temperature around the servomotor.	Reduce the surrounding temperature of the servomotor to 40°C or less.	–
The servomotor load is greater than the rated load.	Check the load with the [Cumulative Load] on the operation monitor of the SigmaWin+.	Operate the servo drive so that the motor load remains within the specified range.	452
A failure occurred in the encoder.	–	Turn the power to the SERVOPACK OFF and ON again. If the 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 to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.861:Motor Overheated

Possible Cause	Confirmation	Correction	Reference
The surrounding temperature around the servomotor is too high.	Measure the surrounding temperature around the servomotor.	Reduce the surrounding temperature of the servomotor to 40°C or less.	–
The servomotor load is greater than the rated load.	Check the load with the [Cumulative Load] on the operation monitor of the SigmaWin+.	Operate the servo drive so that the motor load remains within the specified range.	452
A failure occurred in the serial converter unit.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the serial converter unit may be faulty. Replace the serial converter unit.	–
A failure occurred in the SERVOPACK.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.862:Overheat Alarm

Possible Cause	Confirmation	Correction	Reference
The surrounding temperature 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 protection input signal line is disconnected or short-circuited.	Check the input voltage with the overheat protection input information on the operation monitor of the SigmaWin+.	Repair the line for the overheat protection input signal.	–
An overload alarm was reset by turning OFF the power too many times.	Check the alarm display to see if there is an overload alarm.	Change the method for resetting the alarm.	–
Operation was performed under an excessive load.	Check the load with the [Cumulative Load] on the operation monitor of the SigmaWin+.	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 detection 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

Possible Cause	Confirmation	Correction	Reference
A failure occurred in the linear encoder.	–	The linear encoder may be faulty. Replace the linear encoder.	–

◆ A.891:Encoder Module Error

Possible Cause	Confirmation	Correction	Reference
A failure occurred in the linear encoder.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the linear encoder may be faulty. Replace the linear encoder.	–

◆ A.8A0:External Encoder Error

Possible Cause	Confirmation	Correction	Reference
Setting the origin of the absolute linear encoder failed because the motor moved.	Before you set the origin, 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.	197
A failure occurred in the external encoder.	–	Replace the external encoder.	–

◆ A.8A1:External Encoder Module Error

Possible Cause	Confirmation	Correction	Reference
A failure occurred in the external encoder.	–	Replace the external encoder.	–
A failure occurred in the serial converter unit.	–	Replace the serial converter unit.	–

◆ A.8A2:External Incremental Encoder Sensor Error

Possible Cause	Confirmation	Correction	Reference
A failure occurred in the external encoder.	–	Replace the external encoder.	–

◆ A.8A3:External Absolute Encoder Position Error

Possible Cause	Confirmation	Correction	Reference
A failure occurred in the external absolute encoder.	–	The external absolute encoder may be faulty. Refer to the encoder manufacturer's instruction manual for corrections.	–

◆ A.8A5:External Encoder Overspeed

Possible Cause	Confirmation	Correction	Reference
An overspeed error was detected in the external encoder.	Check the maximum speed of the external encoder.	Keep the external encoder below its maximum speed.	–

◆ A.8A6:External Encoder Overheated

Possible Cause	Confirmation	Correction	Reference
An overheating error was detected in the external encoder.	–	Replace the external encoder.	–

◆ A.b33:Current Detection Error 3

Possible Cause	Confirmation	Correction	Reference
A failure occurred in the current detection circuit.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.b6A:MECHATROLINK Communications ASIC Error 1

Possible Cause	Confirmation	Correction	Reference
There is a fault in the SERVOPACK MECHATROLINK communications section.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.b6b:MECHATROLINK Communications ASIC Error 2

Possible Cause	Confirmation	Correction	Reference
A malfunction occurred in the MECHATROLINK communications section due to noise.	–	Implement the following countermeasures against noise. • Check the MECHATROLINK communications cable and FG wiring. • Attach a ferrite core to the MECHATROLINK communications cable.	–
There is a fault in the SERVOPACK MECHATROLINK communications section.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.bE2:Firmware error
A.bF0:System Alarm 0
A.bF1:System Alarm 1
A.bF2:System Alarm 2
A.bF3:System Alarm 3
A.bF4:System Alarm 4
A.bF5:System Alarm 5
A.bF6:System Alarm 6
A.bF7:System Alarm 7
A.bF8:System Alarm 8
A.bFd:System Alarm D

Possible Cause	Confirmation	Correction	Reference
A failure occurred in the SERVOPACK.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.C10:Servomotor Out of Control

Possible Cause	Confirmation	Correction	Reference
The order of phases U, V, and W in the motor wiring is not correct.	Check the servomotor wiring.	Make sure that the servomotor is correctly wired.	–
There is an error in the setting of Pn080 = n.□□X□ (Motor Phase Sequence Selection).	Check the setting of Pn080 = n.□□X□.	Set Pn080 = n.□□X□ to an appropriate value.	168
When using an absolute encoder, the setting of Pn080 = n.□□X□ (Motor Phase Sequence Selection) was changed after polarity detection was executed.	–	Execute polarity detection again.	171
A failure occurred in the encoder.	–	If the motor wiring is correct and an alarm still occurs after turning the power OFF and ON again, the servomotor or linear encoder may be faulty. Replace the servomotor or linear encoder.	–
A failure occurred in the SERVOPACK.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.C20:Phase Detection Error

Possible Cause	Confirmation	Correction	Reference
The linear encoder signal level is too low.	Check the voltage of the linear encoder signal.	Fine-tune the mounting of the scale sensor head. Or, replace the linear encoder.	–
The count-up direction of the linear encoder does not match the forward direction of the moving coil in the motor.	Check the setting of Pn080 = n.□□X□ (Motor Phase Sequence Selection). Check the installation orientation for the linear encoder and moving coil.	Change the setting of Pn080 = n.□□X□. Correctly reinstall the linear encoder or moving coil.	168
The polarity sensor signal is being affected by noise.	–	Correct the FG wiring. Implement countermeasures 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.	163

◆ A.C21:Polarity Sensor Error

Possible Cause	Confirmation	Correction	Reference
The polarity sensor is protruding from the magnetic way of the motor.	Check the polarity sensor.	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 sensor.	–

◆ A.C22:Phase Information Disagreement

Possible Cause	Confirmation	Correction	Reference
The SERVOPACK phase information is different from the linear encoder phase information.	–	Perform polarity detection.	172

◆ A.C50:Polarity Detection Failure

Possible Cause	Confirmation	Correction	Reference
The parameter settings 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 installation. Set the parameters to correct values.	163,168
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 SERVOPACK and that the FG terminal on the SERVOPACK is connected to the frame ground on the power supply. And, confirm that the shield is properly processed 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.	–
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. Implement 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 recommend 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.	–

◆ A.C51:Overtravel Detected during Polarity Detection

Possible Cause	Confirmation	Correction	Reference
The overtravel signal was detected during polarity detection.	Check the overtravel position.	Wire the overtravel signals. Execute polarity detection at a position where an overtravel signal would not be detected.	134

◆ A.C52:Polarity Detection Not Completed

Possible Cause	Confirmation	Correction	Reference
The servo was turned ON when using an absolute linear encoder, Pn587 was set to n.□□□0 (do not detect polarity), and the polarity had not been detected.	–	When using an absolute linear encoder, set Pn587 to n.□□□1 (detect polarity).	–

◆ A.C53:Out of Range of Motion for Polarity Detection

Possible Cause	Confirmation	Correction	Reference
The travel distance exceeded the setting of Pn48E (Polarity Detection Range) in the middle of detection.	–	Increase the setting of Pn48E (Polarity Detection Range). Or, increase the setting of Pn481 (Polarity Detection Speed Loop Gain).	–

◆ A.C54:Polarity Detection Failure 2

Possible Cause	Confirmation	Correction	Reference
An external force was applied to the servomotor.	–	Increase the setting of Pn495 (Polarity Detection Confirmation Force Reference). Increase the setting of Pn498 (Polarity Detection Allowable Error Range). Increasing the allowable error will also increase the motor temperature.	–

◆ A.C80:Encoder Clear Error or Multiturn Limit Setting Error

Possible Cause	Confirmation	Correction	Reference
A failure occurred in the encoder.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the servomotor or linear encoder may be faulty. Replace the servomotor or linear encoder.	–
A failure occurred in the SERVOPACK.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.C90:Encoder Communications Error

Possible Cause	Confirmation	Correction	Reference
The content saved in the configuration and the content detected in node detection are different when SigmaLINK II was used.	Check the content that was saved with self-configuration and the actual device connections.	If the actual device configuration is correct, execute self-configuration again. If the content that was saved with self-configuration is correct, change the actual device configuration to match the saved content.	499
There is a faulty contact in the connector or the connector is not wired correctly for the encoder cable.	Check the condition of the connector for encoder cable.	Reconnect the connector for encoder cable and check the encoder wiring.	121
There is a cable disconnection or short-circuit in the encoder. Or, the cable impedance is outside the specified values.	Check the condition of the encoder cable.	Use the encoder cable within the specified specifications.	–
One of the following has occurred: corrosion caused by improper temperature, humidity, or gas, a short-circuit caused by entry of water drops or cutting oil, or faulty contact in connector caused by vibration.	Check the operating environment.	Improve the operating environment, and replace the cable. If the alarm still occurs, replace the SERVOPACK.	90
A malfunction was caused by noise.	–	Correct the wiring around the encoder by separating the encoder cable from the servomotor main circuit cable or by grounding the encoder.	103
A failure occurred in the SERVOPACK.	–	If the alarm does not occur when the servomotor is connected to a different SERVOPACK and the control power is supplied, the SERVOPACK may be faulty. Replace the SERVOPACK.	–
Pn0D8 (Reserved parameter) is set to anything other than the default setting. (This alarm can occur when using MECHATROLINK-III communications.)	–	Initialize the parameter settings.	–

◆ A.C91:Encoder Communications Position Data Acceleration Rate Error

Possible Cause	Confirmation	Correction	Reference
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.	105
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 influence 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.	–

◆ A.C92:Encoder Communications Timer Error

Possible Cause	Confirmation	Correction	Reference
Noise entered on the signal line from the encoder.	–	Implement countermeasures against noise for the encoder wiring.	103
Excessive vibration or shock was applied to the encoder.	Check the operating conditions.	Reduce machine vibration. Correctly install the servomotor or linear encoder.	–
A failure occurred in the encoder.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the servomotor or linear encoder may be faulty. Replace the servomotor or linear encoder.	–
A failure occurred in the SERVOPACK.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.CA0:Encoder Parameter Error

Possible Cause	Confirmation	Correction	Reference
A failure occurred in the encoder.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the servomotor or linear encoder may be faulty. Replace the servomotor or linear encoder.	–
A failure occurred in the SERVOPACK.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.Cb0:Encoder Echoback Error

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.	121
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 ^{2}.	–
The encoder cable is too long and noise entered on it.	–	• Rotary Servomotors: The encoder cable wiring distance must be 50 m max. • Linear Servomotors: The encoder cable wiring distance must be 20 m max.	–
There is variation in the FG potential because of the influence 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 vibration. Correctly install the servomotor or linear encoder.	–
A failure occurred in the encoder.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the servomotor or linear encoder may be faulty. Replace the servomotor or linear encoder.	–
A failure occurred in the SERVOPACK.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.CC0:Multiturn Limit Disagreement

Possible Cause	Confirmation	Correction	Reference
When using a direct drive servomotor, the setting of Pn205 (Multiturn Limit) does not agree with the encoder.	Check the setting of Pn205.	Correct the setting of Pn205 (0 to 65535).	246
The multiturn limit of the encoder is different from that of the SERVOPACK. Or, the multiturn limit of the SERVOPACK has been changed.	Check the setting of Pn205 (Multiturn Limit).	Change the setting if the alarm occurs.	246
A failure occurred in the SERVOPACK.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.Cd1:SigmaLINK II Node Configuration Error

Possible Cause	Confirmation	Correction	Reference
Nodes that are compatible and incompatible with SigmaLINK II are connected.	Check if nodes that are compatible and incompatible with SigmaLINK II are connected.	Make all of the connected nodes either compatible or incompatible with SigmaLINK II.	498
Four or more nodes are connected.	Check the number of connected servomotors, external encoders, and I/O devices.	Connect no more than a total of three servomotors, external encoders, and I/O devices.	498
Two or more servomotors are connected.	Check the number of servomotors that are connected.	Connect one servomotor.	498
Two or more external encoders are connected.	Check the number of external encoders that are connected.	Connect one external encoder.	498

◆ A.Cd2:SigmaLINK II Power Supply Short-Circuit Detected

Possible Cause	Confirmation	Correction	Reference
The CN2 power supply is short-circuited.	Check the condition of the encoder cable.	Disconnect the connected node and check if the alarm occurs. If the alarm occurs even when the connected node is disconnected, replace the encoder cable. If the alarm still occurs, replace the connected node or SERVOPACK.	–

◆ A.Cd3:SigmaLINK II Configuration Data Checksum Error

Possible Cause	Confirmation	Correction	Reference
Saving the configuration data failed.	–	Execute SigmaLINK II self-configuration again and save the settings.	499
The SigmaLINK II configuration data saved in nonvolatile memory is damaged.	–	Execute SigmaLINK II self-configuration again and save the settings.	499

◆ A.Cd4:SigmaLINK II Node Change Detected

Possible Cause	Confirmation	Correction	Reference
The content saved in the configuration and the content detected in node detection are different.	Check the content that was saved with self-configuration and the actual device connections.	If the actual device configuration is correct, execute self-configuration again. If the content that was saved with self-configuration is correct, change the actual device configuration to match the saved content.	499
Detection of the node failed.	–	Execute SigmaLINK II self-configuration again and save the settings.	499

◆ A.Cd7:SigmaLINK II I/O Device Communications Error

Possible Cause	Confirmation	Correction	Reference
There is a faulty contact in the connector or the connector is not wired correctly for the encoder cable.	Check the connection and condition of the encoder cable.	• Correctly connect the encoder cable. • Replace the encoder cable.	–
There is a cable disconnection or short-circuit in the encoder. Or, the cable impedance is outside the specified values.	Check the condition of the encoder cable.	Use the encoder cable within the specified specifications.	–
One of the following has occurred: corrosion caused by improper temperature, humidity, or gas, a short-circuit caused by entry of water drops or cutting oil, or faulty contact in connector caused by vibration.	Check the operating environment.	Improve the operating environment, and replace the cable. If the alarm still occurs, replace the SERVOPACK.	90
A malfunction was caused by noise.	–	Correct the wiring around the encoder by separating the encoder cable from the servomotor main circuit cable or by grounding the encoder.	103
A failure occurred in the SERVOPACK.	–	If the alarm does not occur when the I/O device is connected to a different SERVOPACK and the control power is supplied, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.Cd8:SigmaLINK II I/O Device Status Error

Possible Cause	Confirmation	Correction	Reference
The I/O device detected a warning.	Check the alarm code by reading the I/O device alarm in the SigmaWin+.	Take corrective action according to the I/O device manual.	–

◆ A.CF1:Reception Failed Error in External Encoder

Possible Cause	Confirmation	Correction	Reference
The content saved in the configuration and the content detected in node detection are different when SigmaLINK II was used.	Check the content that was saved with self-configuration and the actual device connections.	If the actual device configuration is correct, execute self-configuration again. If the content that was saved with self-configuration is correct, change the actual device configuration to match the saved content.	499
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 converter unit and SERVOPACK.	127
A specified cable is not being used between serial converter unit and SERVOPACK.	Check the wiring specifications of the external encoder.	Use a specified cable.	–
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 converter unit and SERVOPACK must be 20 m or less.	–
The sheath on cable between the serial converter unit and SERVOPACK is broken.	Check the cable that connects the serial converter unit.	Replace the cable between the serial converter unit and SERVOPACK.	–

◆ A.CF2:Timer Stopped Error in External Encoder

Possible Cause	Confirmation	Correction	Reference
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.	–
A failure occurred in the serial converter unit.	–	Replace the serial converter unit.	–
A failure occurred in the SERVOPACK.	–	Replace the SERVOPACK.	–

◆ A.d00:Position Deviation Overflow

Possible Cause	Confirmation	Correction	Reference
The servomotor U, V, and W wiring is not correct.	Check the wiring of the servomotor main circuit cables.	Make sure that there are no faulty contacts in the wiring for the servomotor and encoder.	–
The position reference speed is too fast.	Reduce the position reference speed and try operating the SERVOPACK.	Reduce the position reference speed or the reference acceleration rate, or reconsider the electronic gear ratio.	188
The acceleration of the position reference is too high.	Reduce the reference acceleration and try operating the SERVOPACK.	Reduce the acceleration of the position reference using a MECHATROLINK command. Or, smooth the position reference acceleration by selecting the position reference filter (ACCFIL) using a MECHATROLINK command.	–
The setting of Pn520 (Position Deviation Overflow Alarm Level) is too low for the operating conditions.	Check the setting of Pn520 (Position Deviation Overflow Alarm Level) to see if it is set to an appropriate value.	Optimize the setting of Pn520.	314
A failure occurred in the SERVOPACK.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.d01:Position Deviation Overflow Alarm at Servo ON

Possible Cause	Confirmation	Correction	Reference
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).	314

◆ A.d02:Position Deviation Overflow Alarm for Speed Limit at Servo ON

Possible Cause	Confirmation	Correction	Reference
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.	–	Optimize the setting of Pn520 (Position Deviation Overflow Alarm Level). Or, set Pn529 or Pn584 (Speed Limit Level at Servo ON) to an appropriate value.	314

◆ A.d04:Overtravel Alarm

Possible Cause	Confirmation	Correction	Reference
Overtravel was detected while the servo was ON.	Check the status of the overtravel signals on the input signal monitor.	• Review the references from the host controller so that the moving parts of the machine do not exceed the overtravel range and software limits. • Check the wiring of the overtravel signals. • Implement countermeasures against noise.	176

◆ A.d10:Motor-Load Position Deviation Overflow

Possible Cause	Confirmation	Correction	Reference
The motor direction and external encoder installation orientation are backward.	Check the motor direction and the external encoder installation orientation.	Install the external encoder in the opposite direction, or change the setting of Pn002 = n.X□□□ (External Encoder Usage) to reverse the direction.	484
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

Possible Cause	Confirmation	Correction	Reference
The position data exceeded ±1879048192.	Check the input reference pulse counter.	Reconsider the operating specifications.	–

◆ A.E00:MECHATROLINK Initialization Timeout Error 1

Possible Cause	Confirmation	Correction	Reference
A failure occurred in the SERVOPACK.	–	Replace the SERVOPACK.	–

◆ A.E02:MECHATROLINK Internal Synchronization Error 1

Possible Cause	Confirmation	Correction	Reference
The MECHATROLINK transmission cycle fluctuated.	–	Remove the cause of transmission cycle fluctuation at the host controller.	–
A failure occurred in the SERVOPACK.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.E40:MECHATROLINK Transmission Cycle Setting Error

Possible Cause	Confirmation	Correction	Reference
The setting of MECHATROLINK transmission cycle is outside of the specified range.	Check the setting of the MECHATROLINK transmission cycle.	Set the MECHATROLINK transmission cycle to an appropriate value.	–

◆ A.E41:MECHATROLINK Communications Data Size Setting Error(This alarm can occur when using MECHATROLINK-III communications.)

Possible Cause	Confirmation	Correction	Reference
The number of transmission bytes set on DIP switch S3 is not correct.	Check the MECHATROLINK communications data size of the host controller.	Reset DIP switch S3 to change the number of transmission bytes to an appropriate value.	156

◆ A.E42:MECHATROLINK Station Address Setting Error(This alarm can occur when using MECHATROLINK-III communications.)

Possible Cause	Confirmation	Correction	Reference
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.	156
Two or more stations on the communications network have the same address.	Check to see if two or more stations on the communications network 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.	156

◆ A.E43:MECHATROLINK Communications Setting Error(This alarm can occur when using MECHATROLINK-4 communications.)

Possible Cause	Confirmation	Correction	Reference
MECHATROLINK communications settings that were set from the host controller are not correct.	Read the MECHATROLINK communications settings that were set from the host controller.	Reconsider the host controller communications settings.	–

◆ A.E50:MECHATROLINK Synchronization Error

Possible Cause	Confirmation	Correction	Reference
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.	–
A failure occurred in the SERVOPACK.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.E51:MECHATROLINK Synchronization Failed

Possible Cause	Confirmation	Correction	Reference
The WDT data at the host controller was not updated correctly at the start of synchronous communications, so synchronous communications could not be started.	Check to see if the WDT data is being updated at the host controller.	Correctly update the WDT data at the host controller.	–
A failure occurred in the SERVOPACK.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.E60:Reception Error in MECHATROLINK Communications

Possible Cause	Confirmation	Correction	Reference
MECHATROLINK wiring is not correct.	Check the MECHATROLINK wiring.	Correct the MECHATROLINK cable wiring.	–
A MECHATROLINK data reception error occurred due to noise.	–	Implement countermeasures against noise. (Check the MECHATROLINK cable and FG wiring, and implement measures such as attaching a ferrite core to the MECHATROLINK cable.)	–
A failure occurred in the SERVOPACK.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.E61:Synchronization Interval Error in MECHATROLINK Transmission Cycle

Possible Cause	Confirmation	Correction	Reference
The MECHATROLINK transmission cycle fluctuated.	Check the setting of the MECHATROLINK transmission cycle.	Remove the cause of transmission cycle fluctuation at the host controller.	–
A failure occurred in the SERVOPACK.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.E63:MECHATROLINK Synchronization Frame Not Received

Possible Cause	Confirmation	Correction	Reference
MECHATROLINK wiring is not correct.	Check the MECHATROLINK wiring.	Correct the MECHATROLINK cable wiring.	–
A MECHATROLINK data reception error occurred due to noise.	–	Implement countermeasures against noise. (Check the MECHATROLINK cable and FG wiring, and implement measures such as attaching a ferrite core to the MECHATROLINK cable.)	–
A failure occurred in the SERVOPACK.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.E72:Feedback Option Module Detection Failure

Possible Cause	Confirmation	Correction	Reference
There is a faulty connection between the SERVOPACK and the feedback option module.	Check the connection between the SERVOPACK and the feedback option module.	Correctly connect the feedback option module.	–
The feedback option module was disconnected.	–	Reset the option module configuration error and turn the power to the SERVOPACK OFF and ON again.	578
A failure occurred in the feedback option module.	–	Replace the feedback option module.	–
A failure occurred in the SERVOPACK.	–	Replace the SERVOPACK.	–

◆ A.EA0:MECHATROLINK Initialization Timeout Error 2

Possible Cause	Confirmation	Correction	Reference
A failure occurred in the SERVOPACK.	–	Repair or replace the SERVOPACK.	–

◆ A.Eb1:Safety Function Signal Input Timing Error

Possible Cause	Confirmation	Correction	Reference
The delay between activation of the /HWBB1 and /HWBB2 input signals 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 SERVOPACK input signal circuits may be faulty. Alternatively, the input signal cables may be disconnected. Check to see if any of these items are faulty or have been disconnected.	–
A failure occurred in the SERVOPACK.	–	Replace the SERVOPACK.	–

◆ A.EC8:Gate Drive Error 1
A.EC9:Gate Drive Error 2

Possible Cause	Confirmation	Correction	Reference
A failure occurred in the SERVOPACK.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.Ed1:Command Execution Timeout

Possible Cause	Confirmation	Correction	Reference
A timeout error occurred for a MECHATROLINK command.	Check the motor status when the command is executed.	Execute the SV_ON (Servo ON) command or SENS_ON (Turn Sensor ON) command only when the motor is not operating.	–
A timeout error occurred for a MECHATROLINK command.	• For fully-closed loop control, check the status of the external encoder when the command is executed. • For other types of control, check the status of the linear encoder when the command is executed.	Execute the SENS_ON (Turn Sensor ON) command only when an external encoder (e.g., a linear encoder) is connected.	–

◆ A.F10:Power Supply Line Open Phase

Possible Cause	Confirmation	Correction	Reference
The three-phase power supply wiring is not correct.	Check the power supply wiring.	Make sure that the power supply is correctly wired.	109
The three-phase power supply is unbalanced.	Measure the voltage for each phase of the three-phase power supply.	Balance the power supply by changing phases.	–
A single-phase AC power supply was input without specifying Pn00B = n.□1□□ (Single-phase AC Power Supply Input).	Check the power supply and the parameter setting.	Match the parameter setting to the power supply.	109
A failure occurred in the SERVOPACK.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ FL-1:System Alarm
FL-2:System Alarm
FL-3:System Alarm
FL-4:System Alarm
FL-5:System Alarm
FL-6:System Alarm
FL-7:System Alarm

Possible Cause	Confirmation	Correction	Reference
A failure occurred in the SERVOPACK.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ CPF00:Digital Operator Communications Error 1

Possible Cause	Confirmation	Correction	Reference
There is a faulty connection between the digital operator and the SERVOPACK.	Check the connector contact.	Disconnect the connector and insert it again. Or, replace the cable.	–
A malfunction was caused by noise.	–	Keep the digital operator or the cable away from sources of noise.	–

◆ CPF01:Digital Operator Communications Error 2

Possible Cause	Confirmation	Correction	Reference
A failure occurred in the digital operator.	–	Disconnect the digital operator and then connect it again. If the alarm still occurs, the digital operator may be faulty. Replace the digital operator.	–
A failure occurred in the SERVOPACK.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–
A malfunction was caused by noise.	–	Keep the digital operator or the cable away from sources of noise.	–

13.2.3 Alarm Reset

If there is an ALM (Servo Alarm Output) signal, use one of the following methods to reset the alarm after eliminating the cause of the alarm.

> **Important**
> 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.

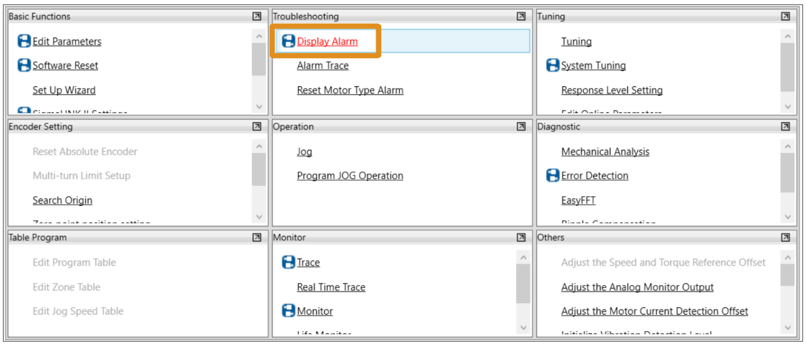
(1) Resetting Alarms with the SigmaWin+

Use the following procedure to reset alarms with the SigmaWin+.

1. **Click the [] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**

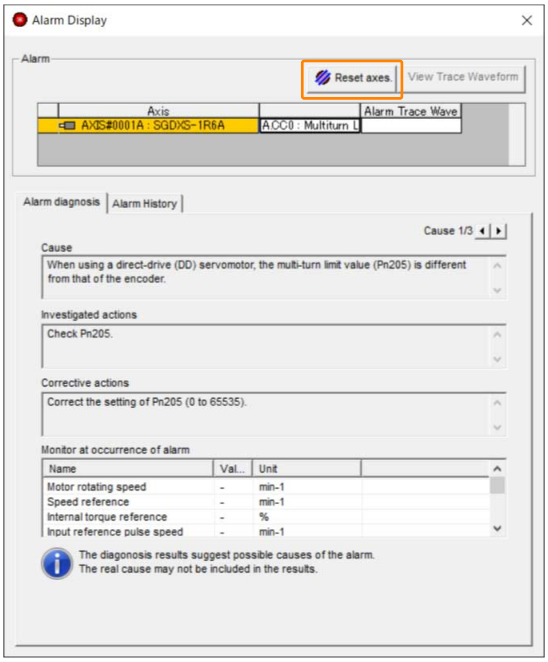
   The [Menu] window will be displayed.

2. **Click [Display Alarm] in the [Troubleshooting] area.**



   The [Alarm Display] window will be displayed.

3. **Click the [Reset axes] button.**



The alarm will be reset, and the alarm display will be cleared.

This concludes the procedure to reset alarms.

(2) Resetting Alarms by Sending the ALM_CLR (Clear Alarm/Warning State) Command

For details, refer to the following manual that corresponds to the communications references being used.

📖 Σ-7/Σ-X-Series MECHATROLINK-4 Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800002 32)

📖 Σ-7/Σ-X-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

(3) 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.

📖 Σ-7/Σ-X-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)

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-7.

(1) Preparations

No preparations are required.

(2) Applicable Tools

The following table lists the tools that you can use to display the alarm history.

Tool	Fn No./Function Name	Reference
Digital Operator	Fn000	📖 Σ-7/Σ-X-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	[Troubleshooting] – [Display Alarm]	☞ *(3) Operating Procedure on page 576*

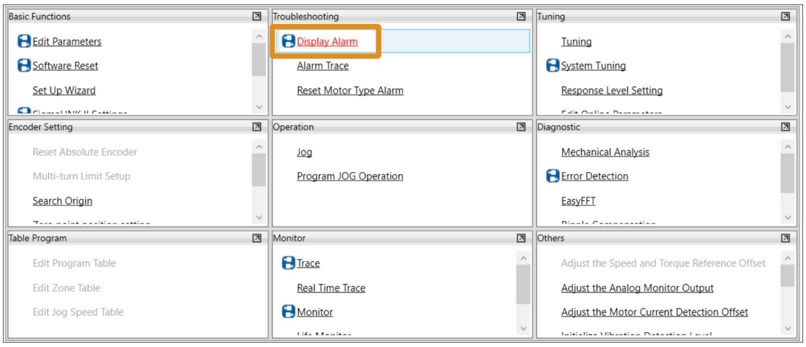
(3) Operating Procedure

Use the following procedure to display the alarm history.

1. **Click the [] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**

   The [Menu] window will be displayed.

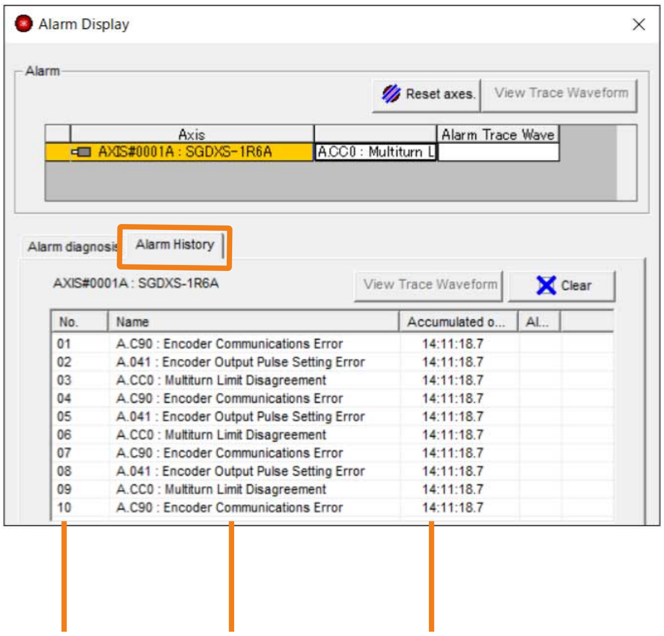
2. **Click [Display Alarm] in the [Troubleshooting] area.**



   The [Alarm Display] window will be displayed.

3. **Click the [Alarm History] tab.**

   The following window will appear and you can check the alarms that occurred in the past.



(1) (2) (3)

Code	Item	Meaning
(1)	No.	Alarms in order of occurrence (Older alarms have higher numbers.)
(2)	Name	Alarm number, alarm name
(3)	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 and main circuit power turned ON. For 24-hour, 365-day operation, measurements are possible for approximately 13 years.

Information
- 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.
- 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.

(1) Preparations

Always check the following before you clear the alarm history.

- The parameters must not be write prohibited.

(2) Applicable Tools

The following table lists the tools that you can use to clear the alarm history.

Tool	Fn No./Function Name	Reference
Digital Operator	Fn006	Σ-7/Σ-X-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	[Troubleshooting] – [Display Alarm]	*(3) Operating Procedure on page 577*

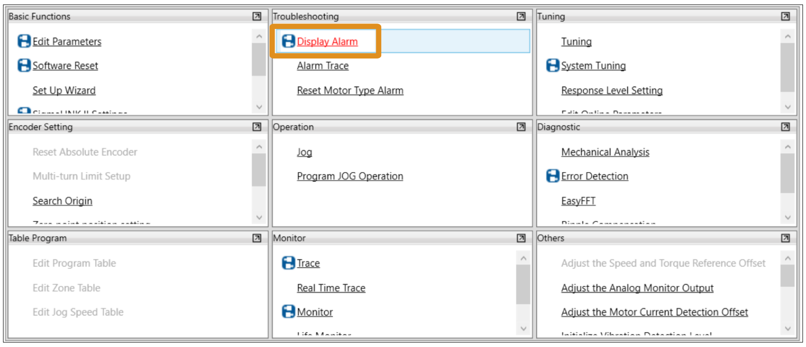
(3) Operating Procedure

Use the following procedure to clear the alarm history.

1. **Click the [ ] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**

   The [Menu] window will be displayed.

2. **Click [Display Alarm] in the [Troubleshooting] area.**

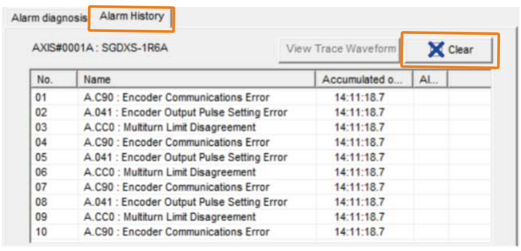


   The [Alarm Display] window will be displayed.

3. **Click the [Alarm History] tab.**

4. **Click the [Clear] button.**

   The alarm history will be cleared.



This concludes the procedure to clear the alarm history.

Maintenance

13

13.2.6 Resetting Option Module Configuration Error

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 to the SERVOPACK.

Always remove the cause of an alarm before you reset the alarm.

(1) Preparations

Always check the following before you clear an alarm detected in an option module.

- The parameters must not be write prohibited.

(2) Applicable Tools

The following table lists the tools that you can use to reset option module configuration errors.

Tool	Fn No./Function Name	Reference
Digital Operator	Fn014	Σ-7/Σ-X-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	[Troubleshooting] – [Display Alarm]	☞ *(3) Operating Procedure on page 578*

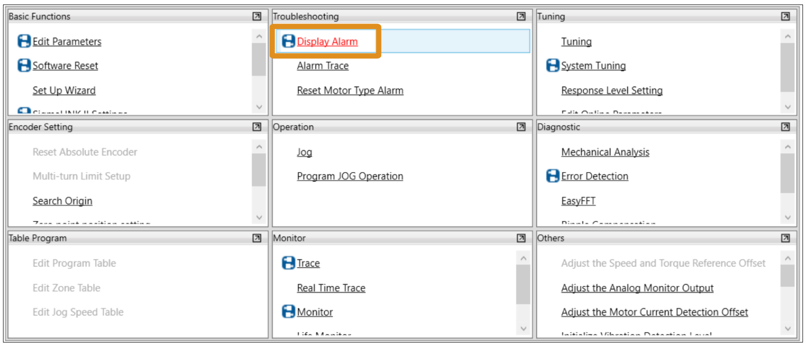
(3) Operating Procedure

Use the following procedure to reset alarms detected in option modules.

1. **Click the [] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**

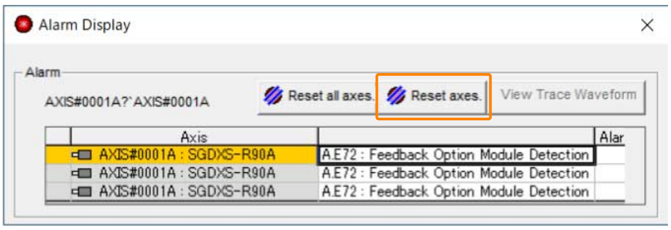
   The [Menu] window will be displayed.

2. **Click [Display Alarm] in the [Troubleshooting] area.**



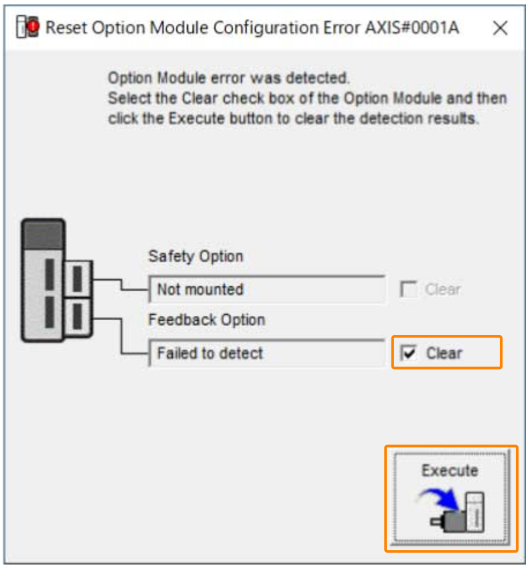
   The [Alarm Display] window will be displayed.

3. **Click the [Reset axes] button.**

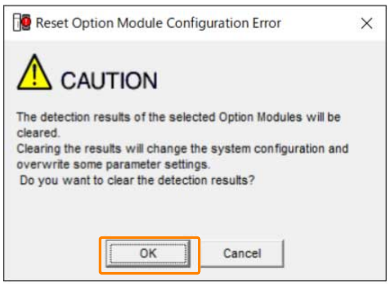


   The [Reset Option Module Configuration Error] window will be displayed.

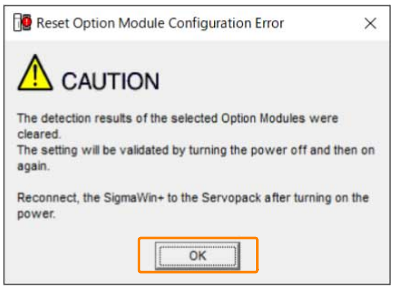
4. **Select the [Clear] check box for the option module for which to reset the alarm and then click the [Execute] button.**



5. **Read the precaution and then click the [OK] button.**



6. **Read the precaution and then click the [OK] button.**



7. **Turn the power 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

The SERVOPACK automatically determines the type of servomotor that is connected to it. If the type of servomotor that is connected is changed, 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
- 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 to the SERVOPACK.
- 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.

(1) Preparations

Always check the following before you reset a motor type alarm.

- The parameters must not be write prohibited.

(2) Applicable Tools

The following table lists the tools that you can use to reset the motor type alarms.

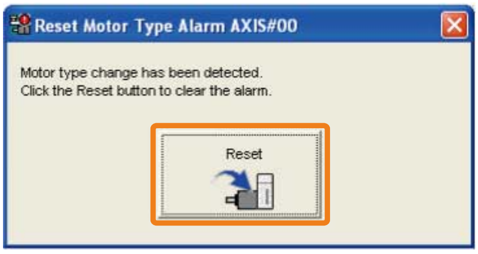
Tool	Fn No./Function Name	Reference
Digital Operator	Fn021	Σ-7/Σ-X-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	[Troubleshooting] - [Reset Motor Type Alarm]	*(3) Operating Procedure on page 580*

(3) Operating Procedure

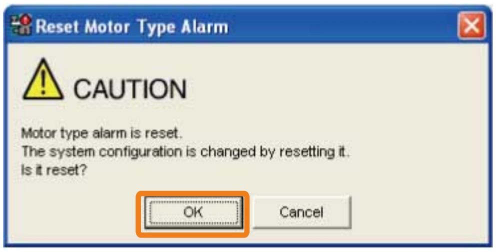
Use the following procedure to reset motor type alarm.

1. **Click the [] button for the servo drive in the workspace of the Main Window of the SigmaWin+.**
2. **Click the [Reset Motor Type Alarm] in the [Menu] window.**

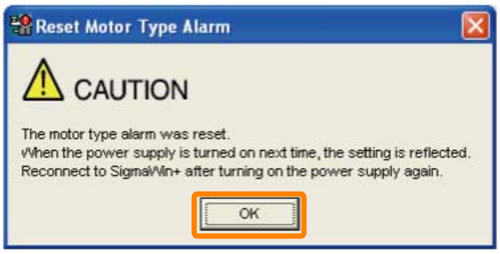
   The [Reset Motor Type Alarm] window will be displayed.
3. **Click the [Reset] button.**



4. **Read the precaution and then click the [OK] button.**



5. **Read the precaution and then click the [OK] button.**



6. **Turn the power to the SERVOPACK OFF and ON again.**

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.

Certain warnings are reset with the SigmaWin+ and other warnings are automatically reset when a normal command is received. To reset a warning with the SigmaWin+, first eliminate the cause of the warning and then reset it. The reset procedure is the same as an alarm reset. Refer to the following section.

☞ *(1) Resetting Alarms with the SigmaWin+ on page 574*

This section provides a list of warnings and the causes of and corrections for warnings.

13.3.1 Warnings Table

The list of warnings gives the warning name and warning meaning in order of the warning numbers.

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 Number	Parameters That Must Be Set to Select Warning Detection	Reference
A.911	Pn310 = n.□□□X (Vibration Detection Selection)	257
A.923	– (Not affected by the setting of Pn008 = n.□X□□.)	–
A.930	Pn008 = n.□□□X (Low Battery Voltage Alarm/Warning Selection)	539
A.932	Pn0DD = n.□□□X (SigmaLINK II I/O Device Communications Check Mask)	522
A.933	Pn0DD = n.□X□□ (SigmaLINK II I/O Device Status Check Mask)	522
A.94A to A.960, A.97A to A.97F	Pn800=n.□□X□ (Warning Check Masks)	686, 603
A.971	Pn008 = n.□□X□ (Function Selection for Undervoltage) (Not affected by the setting of Pn008 = n.□X□□.)	224
A.9A0	Pn00D = n.X□□□ (Overtravel Warning Detection Selection) (Not affected by the setting of Pn008 = n.□X□□.)	177
A.9b0	Pn00F = n.□□□X (SERVOPACK Preventative Maintenance Warning Selection)	468
A.9b1	Pn00F = n.□□X□ (Servomotor Preventative Maintenance Warning Selection)	

Warning Number	Warning Name	Warning Meaning	Resetting
A.900	Position Deviation Overflow	The position deviation exceeded the percentage set with the following formula: (Pn520 × Pn51E/100)	Required.
A.901	Position Deviation Overflow Alarm at Servo ON	The position deviation when the servo was turned ON exceeded the percentage set with the following formula: (Pn526 × Pn528/100)	Required.
A.905	Error Detection Warning	An error was detected in error detection.	Required.
A.910	Overload	This warning occurs before an A.710 or A.720 alarm (overload) occurs. If the warning is ignored and operation is continued, an alarm may occur.	Required.
A.911	Vibration	Abnormal vibration was detected during motor operation. The detection level is the same as A.520. Set whether to output an alarm or a warning by setting Pn310 (Vibration Detection Selections).	Required.
A.912	Internal Temperature Warning 1 (Control Board Temperature Error)	The surrounding temperature of the control board is abnormal.	Required.

Continued on next page.

Maintenance

13

Continued from previous page.

Warning Number	Warning Name	Warning Meaning	Resetting
A.913	Internal Temperature Warning 2 (Power Board Temperature Error)	The surrounding temperature of the power board is abnormal.	Required.
A.920	Regenerative Overload	This warning occurs before an A.320 alarm (Regenerative Overload) occurs. If the warning is ignored and operation is continued, an alarm may occur.	Required.
A.923	SERVOPACK Built- Fan Stopped	The fan inside the SERVOPACK stopped.	Required.
A.930	Absolute Encoder Battery Error	This warning occurs when the voltage of absolute encoder's battery is low.	Required.
A.932	SigmaLINK II I/O Device Communications Warning	An error occurred in communications with the SigmaLINK II I/O device.	Required.
A.933	SigmaLINK II I/O Device Status Warning	The SigmaLINK II I/O device detected an error.	Required.
A.93b	Overheat Warning	The input voltage (temperature) of the overheat protection input (TH) signal exceeded the setting of Pn61C (Overheat Warning Level).	Required.
A.942	Speed Ripple Compensation Information Disagreement	The speed ripple compensation information stored in the encoder does not agree with the speed ripple compensation information stored in the SERVOPACK.	Required.
A.94A	Data Setting Warning 1 (Parameter Number 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 (Out of Range)	The command data is out of range.	Automatically reset.
A.94d	Data Setting Warning 4 (Parameter Size)	The data sizes do not match.	Automatically reset.
A.94E	Data Setting Warning 5 (Latch Mode Error)	A latch mode error was detected.	Required.
A.95A	Command Warning 1 (Unsatisfied Command Conditions)	A command was sent when the conditions for sending a command were not satisfied.	Automatically reset.
A.95b	Command Warning 2 (Unsupported Command)	An unsupported command was sent.	Automatically reset.
A.95d	Command Warning 4 (Command Interference)	There was command interference, particularly latch command interference.	Automatically reset.
A.95E	Command Warning 5 (Subcommand Not Possible)	The subcommand and main command interfere with each other.	Automatically reset.
A.95F	Command Warning 6 (Undefined Command)	An undefined command was sent.	Automatically reset.
A.960	MECHATROLINK Communications Warning	A communications error occurred during MECHATROLINK communications.	Required.
A.971	Undervoltage	This warning occurs before an A.410 alarm (Undervoltage) occurs. If the warning is ignored and operation is continued, an alarm may occur.	Required.
A.97A	Command Warning 7 (Phase Error)	A command that cannot be executed in the current phase was sent.	Automatically reset.
A.97b	Data Clamp Out of Range	The set command data was clamped to the minimum or maximum value of the allowable setting range.	Automatically reset.
A.97E	MECHATROLINK Communications Settings Not Configured Warning(This alarm can occur when using MECHATROLINK-4 communications.)	The host controller attempted to start communications when the MECHATROLINK communications settings were not configured.	Required.

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Warning Number	Warning Name	Warning Meaning	Resetting
A.97F	MECHATROLINK Communications Setting Warning(This alarm can occur when using MECHATROLINK-4 communications.)	A MECHATROLINK communications setting does not match the servo profile specifications.	Required.
A.9A0	Overtravel	Overtravel was detected while the servo was ON.	Required.
A.9b0	SERVOPACK Preventative Maintenance Warning	One of the consumable parts of the SERVOPACK has reached the end of its service life.	Required.
A.9b1	Servomotor Preventative Maintenance Warning	One of the consumable parts of the servomotor has reached the time when maintenance is needed.	Required.

13.3.2 Troubleshooting Warnings

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.

◆ A.900:Position Deviation Overflow

Possible Cause	Confirmation	Correction	Reference
The servomotor U, V, and W wiring is not correct.	Check the wiring of the servomotor main circuit cables.	Make sure that there are no faulty contacts in the wiring for the servomotor and encoder.	–
A SERVOPACK gain is too low.	Check the SERVOPACK gains.	Increase the servo gain, e.g., by using autotuning without a host reference.	344
The acceleration of the position reference is too high.	Reduce the reference acceleration and try operating the SERVOPACK.	Reduce the acceleration of the position reference using a MECHATROLINK command. Or, smooth the position reference acceleration by selecting the position reference filter (ACCFIL) using a MECHATROLINK command.	–
The excessive position deviation alarm level (Pn520 × Pn51E/100) is too low for the operating conditions.	Check excessive position deviation alarm level (Pn520 × Pn51E/100) to see if it is set to an appropriate value.	Optimize the settings of Pn520 and Pn51E.	314
A failure occurred in the SERVOPACK.	–	Turn the power to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.901:Position Deviation Overflow Alarm at Servo ON

Possible Cause	Confirmation	Correction	Reference
The position deviation when the servo was turned ON exceeded the percentage set with the following formula: (Pn526 × Pn528/100)	–	Optimize the setting of Pn528 (Position Deviation Overflow Warning Level at Servo ON).	–

◆ A.905:Error Detection Warning

Possible Cause	Confirmation	Correction	Reference
A behavior was detected that differs greatly from the sample data in error detection tracing.	Check the error detection tracing waveform and error rate.	Check if an error has occurred on the equipment. Reconsider Pn5C4 (Error Detection Sample Data Set 1 Warning Level 1) and Pn5C5 (Error Detection Sample Data Set 1 Judgment Level 1).	–
The correct sample data is not saved.	Check if the SigmaWin+ is Ver. 7.42 or higher.	First upgrade to the SigmaWin+ Ver. 7.42 or higher, and then create the sample data again.	471

◆ A.910:Overload

Possible Cause	Confirmation	Correction	Reference
The wiring is not correct or there is a faulty connection in the motor or encoder wiring.	Check the wiring.	Make sure that the servomotor and encoder are correctly wired.	–
Operation was performed that exceeded the overload protection characteristics.	Check the motor overload characteristics and operation reference.	Reconsider the load and operating conditions. Or, increase the motor capacity.	–
An excessive load was applied during operation because the servomotor was not driven due to mechanical problems.	Check the operation reference and motor speed.	Remove the mechanical problem.	–
The setting of Pn52B (Overload Warning Level) is not suitable.	Check that the setting of Pn52B (Overload Warning Level) is suitable.	Set Pn52B (Overload Warning Level) to an appropriate value.	186
A failure occurred in the SERVOPACK.	–	The SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.911:Vibration

Possible Cause	Confirmation	Correction	Reference
Abnormal vibration was detected during motor operation.	Check for abnormal motor noise, and check the speed and torque waveforms during operation.	Reduce the motor speed. Or, reduce the servo gain with custom tuning.	366
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 appropriate value.	323
The setting of Pn312 or Pn384 (Vibration Detection Level) is not suitable.	Check that the setting of Pn312 or Pn384 (Vibration Detection Level) is suitable.	Set Pn312 or Pn384 (Vibration Detection Level) to an appropriate value.	257

◆ A.912:Internal Temperature Warning 1 (Control Board Temperature Error) A.913:Internal Temperature Warning 2 (Power Board Temperature Error)

Possible Cause	Confirmation	Correction	Reference
The surrounding temperature is too high.	Check the surrounding temperature using a thermometer. Or, check the operating status with the SERVOPACK installation environment monitor.	Decrease the surrounding temperature by improving the SERVOPACK installation conditions.	94
An overload alarm was reset by turning OFF the power too many times.	Check the alarm display to see if there is an overload alarm.	Change the method for resetting the alarm.	–
There was an excessive load or operation was performed that exceeded the regenerative processing capacity.	Check the load during operation with [Cumulative Load] and check the regenerative capacity with [Regenerative Load] on the operation monitor of the SigmaWin+.	Reconsider the load and operating conditions.	–
The SERVOPACK installation orientation is not correct or there is insufficient space around the SERVOPACK.	Check the SERVOPACK installation conditions.	Install the SERVOPACK according to specifications.	91, 93
A failure occurred in the SERVOPACK.	–	The SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.920:Regenerative Overload

Possible Cause	Confirmation	Correction	Reference
The power supply voltage exceeded the specified range.	Measure the power supply voltage.	Set the power supply voltage within the specified range.	–
There is insufficient external regenerative resistance, regenerative resistor capacity, or SERVOPACK capacity, or there has been a continuous regeneration state.	Check the operating conditions or the capacity.	Change the regenerative resistance value, regenerative resistance capacity, or SERVOPACK capacity. Reconsider the operating conditions.	–
There was a continuous regeneration state because a negative load was continuously applied.	Check the load applied to the servomotor during operation.	Reconsider the system including the servo, machine, and operating conditions.	–

◆ A.923:SERVOPACK Built- Fan Stopped

Possible Cause	Confirmation	Correction	Reference
The fan inside the SERVOPACK stopped.	Check for foreign matter inside the SERVOPACK.	Remove foreign matter from the SERVOPACK. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.930:Absolute Encoder Battery Error

Possible Cause	Confirmation	Correction	Reference
The battery connection is faulty or a battery is not connected.	Check the battery connection.	Correct the battery connection.	122
The battery voltage is lower than the specified value (2.7 V).	Measure the battery voltage.	Replace the battery.	539
A failure occurred in the SERVOPACK.	–	The SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.932:SigmaLINK II I/O Device Communications Warning

Possible Cause	Confirmation	Correction	Reference
There is a faulty contact in the connector or the connector is not wired correctly for the encoder cable.	Check the condition of the encoder cable.	Replace the encoder cable.	–
There is a cable disconnection or short-circuit in the encoder. Or, the cable impedance is outside the specified values.	Check the condition of the encoder cable.	Use the encoder cable within the specified specifications.	–
One of the following has occurred: corrosion caused by improper temperature, humidity, or gas, a short-circuit caused by entry of water drops or cutting oil, or faulty contact in connector caused by vibration.	Check the operating environment.	Improve the operating environment, and replace the cable. If the alarm still occurs, replace the SERVOPACK.	–
A malfunction was caused by noise.	–	Correct the wiring around the encoder by separating the encoder cable from the servomotor main circuit cable or by grounding the encoder.	–
A failure occurred in the SERVOPACK.	–	If the alarm does not occur when the I/O device is connected to a different SERVOPACK and the control power is supplied, the SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.933:SigmaLINK II I/O Device Status Warning

Possible Cause	Confirmation	Correction	Reference
The I/O device detected a warning.	Check the alarm code by reading the I/O device alarm in the SigmaWin+.	Take corrective action according to the I/O device manual.	–

◆ A.93b:Overheat Warning

Possible Cause	Confirmation	Correction	Reference
The surrounding temperature 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.	–
Operation was performed under an excessive load.	Check the load with the [Cumulative Load] on the operation monitor of the SigmaWin+.	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 detection 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.942:Speed Ripple Compensation Information Disagreement

Possible Cause	Confirmation	Correction	Reference
The speed ripple compensation information stored in the encoder does not agree with the speed ripple compensation information stored in the SERVOPACK.	–	Reset the speed ripple compensation value on the SigmaWin+.	387
The speed ripple compensation information stored in the encoder does not agree with the speed ripple compensation information stored in the SERVOPACK.	–	Set Pn423 to n.□□□2 (execute speed ripple compensation using the default adjustment value). However, changing this setting may increase the speed ripple when using a Σ-X rotary servomotor.	387
The speed ripple compensation information stored in the encoder does not agree with the speed ripple compensation information stored in the SERVOPACK.	–	Set Pn423 to n.□□1□ (do not detect A.942 alarms) . However, changing this setting may increase the speed ripple.	387
The speed ripple compensation information stored in the encoder does not agree with the speed ripple compensation information stored in the SERVOPACK.	–	Set Pn423 to n.□□□0 (disable speed ripple compensation). However, changing this setting may increase the speed ripple.	387

◆ A.94A:Data Setting Warning 1 (Parameter Number Error)

Possible Cause	Confirmation	Correction	Reference
An invalid parameter number was used.	Check the command that caused the warning.	Use the correct parameter number.	590

◆ A.94b:Data Setting Warning 2 (Out of Range)

Possible Cause	Confirmation	Correction	Reference
The set command data was out of the setting range.	Check the command that caused the warning.	Set the parameter within the setting range.	590

◆ A.94d:Data Setting Warning 4 (Parameter Size)

Possible Cause	Confirmation	Correction	Reference
The parameter size set in the command is not correct.	Check the command that caused the warning.	Set the correct parameter size.	590

◆ A.94E:Data Setting Warning 5 (Latch Mode Error)

Possible Cause	Confirmation	Correction	Reference
A latch mode error was detected.	Check the command that caused the warning.	Change the setting of Pn850 or the LT_MOD data for the LTMOD_ON command sent by the host controller to an appropriate value.	590

◆ A.95A:Command Warning 1 (Unsatisfied Command Conditions)

Possible Cause	Confirmation	Correction	Reference
The command conditions are not satisfied.	Check the command that caused the warning.	Send the command after the command conditions are satisfied.	590

◆ A.95b:Command Warning 2 (Unsupported Command)

Possible Cause	Confirmation	Correction	Reference
An unsupported command was received.	Check the command that caused the warning.	Do not send unsupported commands.	590

◆ A.95d:Command Warning 4 (Command Interference)

Possible Cause	Confirmation	Correction	Reference
The command sending conditions for latch-related commands was not satisfied.	Check the command that caused the warning.	Send the command after the conditions are satisfied.	590

◆ A.95E:Command Warning 5 (Subcommand Not Possible)

Possible Cause	Confirmation	Correction	Reference
The command sending conditions for subcommands was not satisfied.	Check the command that caused the warning.	Send the command after the conditions are satisfied.	590

◆ A.95F:Command Warning 6 (Undefined Command)

Possible Cause	Confirmation	Correction	Reference
An undefined command was sent.	Check the command that caused the warning.	Do not send undefined commands.	590

◆ A.960:MECHATROLINK Communications Warning

Possible Cause	Confirmation	Correction	Reference
The MECHATROLINK cable is not wired correctly.	Check the wiring conditions.	Correct the MECHATROLINK cable wiring.	140
A MECHATROLINK data reception error occurred due to noise.	Check the installation conditions.	Implement the following countermeasures against noise. • Check the MECHATROLINK cable and FG wiring and implement countermeasures to prevent noise from entering. • Attach a ferrite core to the MECHATROLINK cable.	–
A failure occurred in the SERVOPACK.	–	The SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.971:Undervoltage

Possible Cause	Confirmation	Correction	Reference
For a 200-V SERVOPACK, the AC power supply voltage dropped below 140 V.	Measure the power supply voltage.	Set the power supply voltage 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 (Momentary Power Interruption Hold Time), decrease the setting.	223
The SERVOPACK fuse is blown out.	–	Replace the SERVOPACK and connect a reactor.	119
A failure occurred in the SERVOPACK.	–	The SERVOPACK may be faulty. Replace the SERVOPACK.	–

◆ A.97A:Command Warning 7 (Phase Error)

Possible Cause	Confirmation	Correction	Reference
A command that cannot be executed in the current phase was sent.	–	Send the command after the conditions are satisfied.	–

◆ A.97b:Data Clamp Out of Range

Possible Cause	Confirmation	Correction	Reference
The set command data was out of the setting range.	–	Set the command data within the setting ranges.	–

◆ A.97E:MECHATROLINK Communications Settings Not Configured Warning

Possible Cause	Confirmation	Correction	Reference
The host controller attempted to start communications when the MECHATROLINK communications settings were not configured.	Check if the MECHATROLINK connection configuration settings on the host controller differ from the actual connection configuration.	Configure the MECHATROLINK connection configuration settings on the host controller again. Start the host controller after the power to the SERVOPACK is turned ON and the SERVOPACK has started.	–
The host controller attempted to start communications when the MECHATROLINK communications settings were not configured.	Check if the power to the SERVOPACK is turned ON after MECHATROLINK communications initialization is completed on the host controller.	First turn ON the power to the SERVOPACK, and then execute MECHATROLINK communications initialization on the host controller.	–

◆ A.97F:MECHATROLINK Communications Setting Warning

Possible Cause	Confirmation	Correction	Reference
The setting value for the number of transmission bytes is not a multiple of four.	Check if the number of transmission bytes in the communications settings on the host controller is correct.	Set the number of transmission bytes in the communications settings on the host controller again as a multiple of four.	–
The setting value for the number of transmission bytes is less than 16 bytes or greater than 80 bytes.	Check if the number of transmission bytes in the communications settings on the host controller is correct.	Set the number of transmission bytes in the communications settings on the host controller again to between 16 bytes and 80 bytes.	–
The transmission cycle setting is a setting that is not supported by the product specifications.	Check if the transmission cycle in the communications settings on the host controller is correct.	Set the transmission cycle again to a value within the following setting range from the host controller. 62.5 μs, 125 μs, 250 μs, 500 μs, 750 μs, 1.0 ms to 4.0 ms (multiple of 0.5 ms)	–
Reading the MECHATROLINK communications settings failed.	–	Check the address and data size of the MECHATROLINK communications settings to read.	–

◆ A.9A0:Overtravel

Possible Cause	Confirmation	Correction	Reference
Overtravel was detected while the servo was ON.	Check the status of the overtravel signals on the input signal monitor.	Even if an overtravel signal is not shown by the input signal monitor, momentary overtravel may have been detected. Take the following precautions. • Do not specify movements that would cause overtravel from the host controller. • Check the wiring of the overtravel signals. • Implement countermeasures against noise.	177

◆ A.9b0:SERVOPACK Preventative Maintenance Warning

Possible Cause	Confirmation	Correction	Reference
One of the consumable parts of the SERVOPACK has reached the end of its service life.	–	Replace the part. Contact your Yaskawa representative for replacement.	468

◆ A.9b1:Servomotor Preventative Maintenance Warning

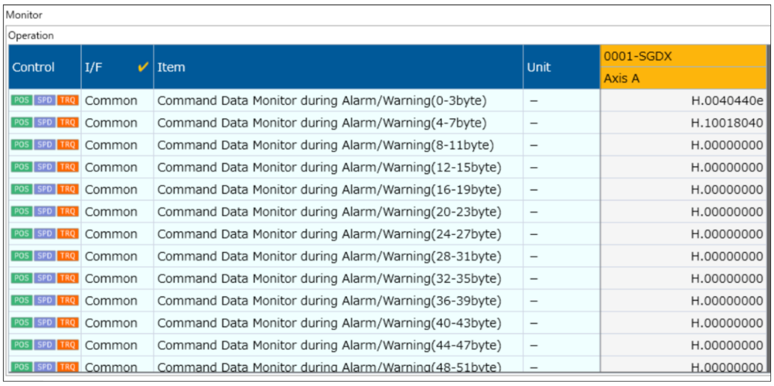
Possible Cause	Confirmation	Correction	Reference
One of the consumable parts of the servomotor has reached the time when maintenance is needed.	–	Replace the part. Contact your Yaskawa representative for replacement.	468

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.94□ (Data Setting Warning) or A.95□ (Command Warning) with the [Operation] window in the SigmaWin+.

Refer to the following section for details on the operation procedure.

☞ *(1) Operating Procedure on page 452*



Monitor

Operation

Control	I/F	Item	Unit	0001-SGDX Axis A
POS SPD TRQ	Common	Command Data Monitor during Alarm/Warning(0-3byte)	–	H.0040440e
POS SPD TRQ	Common	Command Data Monitor during Alarm/Warning(4-7byte)	–	H.10018040
POS SPD TRQ	Common	Command Data Monitor during Alarm/Warning(8-11byte)	–	H.00000000
POS SPD TRQ	Common	Command Data Monitor during Alarm/Warning(12-15byte)	–	H.00000000
POS SPD TRQ	Common	Command Data Monitor during Alarm/Warning(16-19byte)	–	H.00000000
POS SPD TRQ	Common	Command Data Monitor during Alarm/Warning(20-23byte)	–	H.00000000
POS SPD TRQ	Common	Command Data Monitor during Alarm/Warning(24-27byte)	–	H.00000000
POS SPD TRQ	Common	Command Data Monitor during Alarm/Warning(28-31byte)	–	H.00000000
POS SPD TRQ	Common	Command Data Monitor during Alarm/Warning(32-35byte)	–	H.00000000
POS SPD TRQ	Common	Command Data Monitor during Alarm/Warning(36-39byte)	–	H.00000000
POS SPD TRQ	Common	Command Data Monitor during Alarm/Warning(40-43byte)	–	H.00000000
POS SPD TRQ	Common	Command Data Monitor during Alarm/Warning(44-47byte)	–	H.00000000
POS SPD TRQ	Common	Command Data Monitor during Alarm/Warning(48-51byte)	–	H.00000000

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.

13.5.1 Servomotor Does Not Start

Possible Cause	Confirmation	Correction	Reference
There is a mistake in the wiring of the MECHATROLINK cable.	Check if the L1 and L2 LED indicators are lit.	Turn OFF the power to the servo system. Correct the MECHATROLINK cable wiring.	140
MECHATROLINK Cyclic Communications Did Not Start	Check if the CN6A LED indicator is lit.	Use the correct procedure to configure the communications settings from the host controller.	–
The control power is not turned ON.	Measure the voltage between control power supply terminals.	Turn OFF the power to the servo system. Correct the wiring so that the control power is turned ON.	–
The main circuit power is not turned ON.	Measure the voltage between the main circuit power input terminals.	Turn OFF the power to the servo system. Correct the wiring so that the main circuit power is turned ON.	–
The I/O signal connector (CN1) pins are not wired correctly or are disconnected.	Turn OFF the power to the servo system. Check the wiring condition of the I/O signal connector (CN1) pins.	Correct the wiring of the I/O signal connector (CN1) pins.	131,457
The wiring servomotor main circuit cables or encoder cable is disconnected.	Check the wiring conditions.	Turn OFF the power to the servo system. Wire the cable correctly.	–
There is an overload on the servomotor.	Operate the servomotor with no load and check the load status.	Turn OFF the power to the servo system. Reduce the load or replace the servomotor with a servomotor with a larger capacity.	–
The type of encoder that is being used does not agree with the setting of Pn002 = n.□X□□ (Encoder Usage).	Check the type of the encoder that is being used and the setting of Pn002 = n.□X□□.	Set Pn002 = n.□X□□ according to the type of the encoder that is being used.	240
There is a mistake in the input signal allocations.	Check the allocations of the input signals. • Pn50A, Pn50B, Pn511, Pn516 or • Pn50A, Pn590 to Pn599	Correctly allocate the input signals.	210,457
The SV_ON (Servo ON) command was not sent.	Check the commands sent from the host controller.	Send the SV_ON (Servo ON) command from the host controller.	–
The SENS_ON (Turn Sensor ON) command was not sent.	Check the commands sent from the host controller.	Send the commands to the SERVOPACK in the correct sequence.	–
The P-OT (Forward Drive Prohibit Input) or N-OT (Reverse Drive Prohibit Input) signal is still OFF.	Check the P-OT and N-OT signals.	Turn ON the P-OT and N-OT signals.	457
The safety input signals (/HWBB1 or /HWBB2) are still OFF.	Check the /HWBB1 and /HWBB2 input signals.	Turn ON the /HWBB1 and /HWBB2 input signals. If you are not using the safety function, connect the safety jumper connector (provided as an accessory) to CN8.	457
		Validate the safety functions.	534

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Possible Cause	Confirmation	Correction	Reference
The FSTP (Forced Stop Input) signal is still OFF.	Check the FSTP signal.	• Turn ON the FSTP signal. • If you will not use the function to force the motor to stop, set Pn516 = n.□□□X (FSTP (Forced Stop Input) Signal Allocation) to disable the signal.	457
A failure occurred in the SERVOPACK.	–	Turn OFF the power to the servo system. Replace the SERVOPACK.	–
The polarity detection was not executed.	Check the setting of Pn080 = n.□□□X (Polarity Sensor Selection).	Correct the parameter setting.	170
	Check the inputs to the SV_ON (Servo ON) command.	• If you are using an incremental linear encoder, send the SV_ON (Servo ON) command from the host controller. • If you are using an absolute linear encoder, execute polarity detection.	171

13.5.2 Servomotor Moves Instantaneously, and Then Stops

Possible Cause	Confirmation	Correction	Reference
There is a mistake in the servomotor wiring.	Turn OFF the power to the servo system. Check the wiring.	Wire the cable correctly.	–
There is a mistake in the wiring of the encoder or serial converter unit.	Turn OFF the power to the servo system. Check the wiring.	Wire the cable correctly.	–
There is a mistake in the linear encoder wiring.	Turn OFF the power to the servo system. Check the wiring.	Wire the cable correctly.	–
The setting of Pn282 (Linear Encoder Scale Pitch) is not correct.	Check the setting of Pn282.	Correct the setting of Pn282.	163
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 Pn080 = n.□□X□ (Motor Phase Sequence Selection). Place the linear encoder and motor in the same direction.	168
Polarity detection was not performed correctly.	Check to see if electrical angle 2 (electrical angle from polarity origin) at any position is between ±10°.	Correct the settings for the polarity detection-related parameters.	–

13.5.3 Servomotor Speed Is Unstable

Possible Cause	Confirmation	Correction	Reference
There is a faulty connection in the servomotor wiring.	The connector connections for the power line (U, V, and W phases) and the encoder or serial converter unit may be unstable. Turn OFF the power to the servo system. Check the wiring.	Tighten any loose terminals or connectors and correct the wiring.	–

13.5.4 Servomotor Moves without a Reference Input

Possible Cause	Confirmation	Correction	Reference
A failure occurred in the SERVOPACK.	–	Turn OFF the power to the servo system. Replace the SERVOPACK.	–
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 Pn080 = n.□□X□ (Motor Phase Sequence Selection). Match the linear encoder direction and servomotor direction.	168
Polarity detection was not performed correctly.	Check to see if electrical angle 2 (electrical angle from polarity origin) at any position is between ±10°.	Correct the settings for the polarity detection-related parameters.	–

13.5.5 Dynamic Brake Does Not Operate

Possible Cause	Confirmation	Correction	Reference
The setting of Pn001 = n.□□□X (Motor Stopping Method for Servo OFF and Group 1 Alarms) is not suitable.	Check the setting of Pn001 = n.□□□X.	Correct the setting of Pn001 = n.□□□X.	–
The dynamic brake resistor is disconnected.	Check the moment of inertia, motor speed, and dynamic brake frequency of use. If the moment of inertia, motor speed, or dynamic brake frequency of use is excessive, the dynamic brake resistor may be disconnected.	Turn OFF the power to the servo system. Replace the SERVOPACK. To prevent disconnection, reduce the load.	–
There was a failure in the dynamic brake drive circuit.	–	There is a defective component in the dynamic brake circuit. Turn OFF the power to the servo system. Replace the SERVOPACK.	–

13.5.6 Abnormal Noise from Servomotor

Possible Cause	Confirmation	Correction	Reference
The servomotor vibrated considerably while performing the tuning-less function with the default settings.	Check the waveform of the motor speed.	Reduce the load so that the load moment of inertia ratio or mass ratio is within the allowable value, or increase the load level or reduce the response level in the tuning-less level settings. If the situation is not improved, set Pn170 = n.□□□0 (disable the tuning-less function) and execute autotuning either with or without a host reference.	318
The machine mounting is not secure.	Turn OFF the power to the servo system. Check the servomotor installation.	Tighten the mounting screws.	–
	Turn OFF the power to the servo system. Check to see if there is misalignment in the coupling.	Align the coupling.	–
	Turn OFF the power to the servo system. Check to see if the coupling is balanced.	Balance the coupling.	–
The bearings are defective.	Turn OFF the power to the servo system. Check for noise and vibration around the bearings.	Replace the servomotor.	–

Continued on next page.

Continued from previous page.

Possible Cause	Confirmation	Correction	Reference
There is a vibration source at the driven machine.	Turn OFF the power to the servo system. Check for any foreign matter, damage, or deformation in the machine's moving parts.	Consult with the machine manufacturer.	–
Noise interference occurred because of incorrect I/O signal cable specifications.	Turn OFF the power to the servo system. Check the I/O signal cables to see if they satisfy specifications. Use a shielded twisted-pair wire cable or a screened twisted-pair cable with conductors of at least 0.12 mm^2.	Use cables that satisfy the specifications.	–
Noise interference occurred because an I/O signal cable is too long.	Turn OFF the power to the servo system. Check the lengths of the I/O signal cables.	The I/O signal cables must be no longer than 3 m.	–
Noise interference occurred because of incorrect encoder cable specifications.	Turn OFF the power to the servo system. Check the encoder cable to see if it satisfies specifications. Use a shielded twisted-pair wire cable or a screened twisted-pair cable with conductors of at least 0.12 mm^2.	Use cables that satisfy the specifications.	–
Noise interference occurred because the encoder cable is too long.	Turn OFF the power to the servo system. Check the length of the encoder cable.	• Rotary servomotors: The encoder cable length must be 50 m max. • Linear servomotors: Make sure that the serial converter unit cable is no longer than 20 m and that the linear encoder cable and the sensor cable are no longer than 15 m each.	–
Noise interference occurred because the encoder cable is damaged.	Turn OFF the power to the servo system. Check the encoder cable to see if it is pinched or the sheath is damaged.	Replace the encoder cable and correct the cable installation environment.	–
The encoder cable was subjected to excessive noise interference.	Turn OFF the power to the servo system. Check to see if the encoder cable is bundled with a power line or installed near a power line.	Correct the cable layout so that no surge is applied by power line.	–
There is variation in the FG potential because of the influence of machines on the servomotor side, such as a welder.	Turn OFF the power to the servo system. Check to see if the machines are correctly grounded.	Properly ground the machines to separate them from the FG of the encoder.	–
There is a SERVOPACK pulse counting error due to noise.	Check to see if there is noise interference on the signal line from the encoder.	Turn OFF the power to the servo system. Implement countermeasures against noise for the encoder wiring.	–
The encoder was subjected to excessive vibration or shock.	Turn OFF the power to the servo system. Check to see if vibration from the machine occurred. Check the servomotor installation (mounting surface precision, securing state, and alignment). Check the linear encoder installation (mounting surface precision and securing method).	Reduce machine vibration. Improve the mounting state of the servomotor or linear encoder.	–
A failure occurred in the encoder.	–	Turn OFF the power to the servo system. Replace the servomotor.	–
A failure occurred in the serial converter unit.	–	Turn OFF the power to the servo system. Replace the serial converter unit.	–
A failure occurred in the linear encoder.	–	Turn OFF the power to the servo system. Replace the linear encoder.	–

13.5.7 Servomotor Vibrates at Frequency of Approx. 200 to 400 Hz.

Possible Cause	Confirmation	Correction	Reference
The servo gains are not balanced.	Check to see if the servo gains have been correctly tuned.	Perform autotuning without a host reference.	344
The setting of Pn100 (Speed Loop Gain) is too high.	Check the setting of Pn100 (Speed Loop Gain). The default setting is Kv = 40.0 Hz.	Set Pn100 (Speed Loop Gain) to an appropriate value.	–
The setting of Pn102 (Position Loop Gain) is too high.	Check the setting of Pn102 (Position Loop Gain). The default setting is Kp = 40.0/s.	Set Pn102 (Position Loop Gain) to an appropriate value.	–
The setting of Pn101 (Speed Loop Integral Time Constant) is not appropriate.	Check the setting of Pn101 (Speed Loop Integral Time Constant). The default setting is Ti = 20.0 ms.	Set Pn101 (Speed Loop Integral Time Constant) to an appropriate value.	–
The setting of Pn103 (Moment of Inertia Ratio) is not appropriate.	Check the setting of Pn103 (Moment of Inertia Ratio).	Set Pn103 (Moment of Inertia Ratio) to an appropriate value.	–

13.5.8 Large Motor Speed on Starting and Stopping

Possible Cause	Confirmation	Correction	Reference
The servo gains are not balanced.	Check to see if the servo gains have been correctly tuned.	Perform autotuning without a host reference.	344
The setting of Pn100 (Speed Loop Gain) is too high.	Check the setting of Pn100 (Speed Loop Gain). The default setting is Kv = 40.0 Hz.	Set Pn100 (Speed Loop Gain) to an appropriate value.	–
The setting of Pn102 (Position Loop Gain) is too high.	Check the setting of Pn102 (Position Loop Gain). The default setting is Kp = 40.0/s.	Set Pn102 (Position Loop Gain) to an appropriate value.	–
The setting of Pn101 (Speed Loop Integral Time Constant) is not appropriate.	Check the setting of Pn101 (Speed Loop Integral Time Constant). The default setting is Ti = 20.0 ms.	Set Pn101 (Speed Loop Integral Time Constant) to an appropriate value.	–
The setting of Pn103 (Moment of Inertia Ratio) is not appropriate.	Check the setting of Pn103 (Moment of Inertia Ratio).	Set Pn103 (Moment of Inertia Ratio) to an appropriate value.	–
The torque reference is saturated.	Check the waveform of the torque reference.	Use the mode switching.	–
Pn483 (Forward Force Limit) and Pn484 (Reverse Force Limit) are set to the default values.	Force limits: Default settings Pn483 = 30% Pn484 = 30%	Set Pn483 (Forward Force Limit) and Pn484 (Reverse Force Limit) to appropriate values.	235

13.5.9 Absolute Encoder Position Deviation Error (The position that was saved in the host controller when the power was turned OFF is different from the position when the power was next turned ON.)

Possible Cause	Confirmation	Correction	Reference
Noise interference occurred because of incorrect encoder cable specifications.	Turn OFF the power to the servo system. Check the encoder cable to see if it satisfies specifications. Use a shielded twisted-pair wire cable or a screened twisted-pair cable with conductors of at least 0.12 mm^2.	Use cables that satisfy the specifications.	–
Noise interference occurred because the encoder cable is too long.	Turn OFF the power to the servo system. Check the length of the encoder cable.	• Rotary servomotors: The encoder cable length must be 50 m max. • Linear servomotors: Make sure that the serial converter unit cable is no longer than 20 m and that the linear encoder cable and the sensor cable are no longer than 15 m each.	–
Noise interference occurred because the encoder cable is damaged.	Turn OFF the power to the servo system. Check the encoder cable to see if it is pinched or the sheath is damaged.	Replace the encoder cable and correct the cable installation environment.	–
The encoder cable was subjected to excessive noise interference.	Turn OFF the power to the servo system. Check to see if the encoder cable is bundled with a power line or installed near a power line.	Correct the cable layout so that no surge is applied by power line.	–
There is variation in the FG potential because of the influence of machines on the servomotor side, such as a welder.	Turn OFF the power to the servo system. Check to see if the machines are correctly 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 power to the servo system. Check to see if there is noise interference on the signal line from the encoder or serial converter unit.	Implement countermeasures against noise for the encoder or serial converter unit wiring.	–
The encoder was subjected to excessive vibration or shock.	Turn OFF the power to the servo system. Check to see if vibration from the machine occurred. Check the servomotor installation (mounting surface precision, securing state, and alignment). Check the linear encoder installation (mounting surface precision and securing method).	Reduce machine vibration. Improve the mounting state of the servomotor or linear encoder.	–
A failure occurred in the encoder.	–	Turn OFF the power to the servo system. Replace the servomotor or linear encoder.	–
A failure occurred in the SERVOPACK.	–	Turn OFF the power to the servo system. Replace the SERVOPACK.	–
Host controller multiturn data or absolute encoder position data reading error	Check the error detection section of the host controller.	Correct the error detection section of the host controller.	–
	Check to see if the host controller is executing data parity checks.	Perform parity checks for the multiturn data or absolute encoder position data.	–
	Check for noise interference in the cable between the SERVOPACK and the host controller.	Implement countermeasures against noise and then perform parity checks again for the multiturn data or absolute encoder position data.	–

13.5.10 Overtravel Occurred

Possible Cause	Confirmation	Correction	Reference
The P-OT/N-OT (Forward Drive Prohibit Input or Reverse Drive Prohibit Input) signal was input.	Check the external power supply (+24 V) voltage for the input signals.	Correct the external power supply (+24 V) voltage for the input signals.	–
	Check the operating condition of the overtravel 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.	174
	Check the settings of the overtravel input signal allocation (Pn50A/Pn50B or Pn590/Pn591).	Set the parameters to correct values.	174
The P-OT/N-OT (Forward Drive Prohibit Input or Reverse Drive Prohibit Input) signal malfunctioned.	Check for fluctuation in the external power supply (+24 V) voltage for the input signals.	Eliminate fluctuation from the external power supply (+24 V) voltage for the input signals.	–
	Check to see if the operation of the overtravel limit switches is unstable.	Stabilize the operating condition of the overtravel limit switches.	–
	Check the wiring of the overtravel limit switches (e.g., check for cable damage and loose screws).	Correct the wiring of the overtravel limit switches.	–
There is a mistake in the allocation of the P-OT/N-OT (Forward Drive Prohibit Input or Reverse Drive Prohibit Input).	Check if the SERVOPACK is configured in one of the following ways: • Pn50A = n.□□□1 (use Sigma-7S-compatible I/O signal allocations) and the P-OT signal is allocated to CN1 with Pn50A = n.X□□□. • Pn50A = n.□□□2 (use SigmaLINK II input signal allocation) and the P-OT signal is allocated to CN1 with Pn590.	Set the parameters to correct values.	174
	Check if the SERVOPACK is configured in one of the following ways: • Pn50A = n.□□□1 (use Sigma-7S-compatible I/O signal allocations) and the N-OT signal is allocated to CN1 with Pn50B = n.□□□X. • Pn50A = n.□□□2 (use SigmaLINK II input signal allocation) and the N-OT signal is allocated to CN1 with Pn591.	Set the parameters to correct values.	
The selection of the servomotor stopping method is not correct.	Check the servo OFF stopping method set in Pn001 = n.□□□X or Pn001 = n.□□X□.	Select a servomotor stopping method other than coasting to a stop.	175
	Check the torque control stopping method set in Pn001 = n.□□□X or Pn001 = n.□□X□.	Select a servomotor stopping method other than coasting to a stop.	

13.5.11 Improper Stop Position for Overtravel (OT) Signal

Possible Cause	Confirmation	Correction	Reference
The limit switch position and dog length are not appropriate.	–	Install the limit switch at the appropriate position.	–
The overtravel limit switch position is too close for the coasting distance.	–	Install the overtravel limit switch at the appropriate position.	–

Maintenance

13

13.5.12 Position Deviation (without Alarm)

Possible Cause	Confirmation	Correction	Reference
Noise interference occurred because of incorrect encoder cable specifications.	Turn OFF the power to the servo system. Check the encoder cable to see if it satisfies specifications. Use a shielded twisted-pair wire cable or a screened twisted-pair cable with conductors of at least 0.12 mm^2.	Use cables that satisfy the specifications.	–
Noise interference occurred because the encoder cable is too long.	Turn OFF the power to the servo system. Check the length of the encoder cable.	• Rotary servomotors: The encoder cable length must be 50 m max. • Linear servomotors: Make sure that the serial converter unit cable is no longer than 20 m and that the linear encoder cable and the sensor cable are no longer than 15 m each.	–
Noise interference occurred because the encoder cable is damaged.	Turn OFF the power to the servo system. Check the encoder cable to see if it is pinched or the sheath is damaged.	Replace the encoder cable and correct the cable installation environment.	–
The encoder cable was subjected to excessive noise interference.	Turn OFF the power to the servo system. Check to see if the encoder cable is bundled with a power line or installed near a power line.	Correct the cable layout so that no surge is applied by power line.	–
There is variation in the FG potential because of the influence of machines on the servomotor side, such as a welder.	Turn OFF the power to the servo system. Check to see if the machines are correctly 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 power to the servo system. Check to see if there is noise interference on the signal line from the encoder or serial converter unit.	Implement countermeasures against noise for the encoder wiring or serial converter unit wiring.	–
The encoder was subjected to excessive vibration or shock.	Turn OFF the power to the servo system. Check to see if vibration from the machine occurred. Check the servomotor installation (mounting surface precision, securing state, and alignment). Check the linear encoder installation (mounting surface precision and securing method).	Reduce machine vibration. Improve the mounting state of the servomotor or linear encoder.	–
The coupling between the machine and servomotor not suitable.	Turn OFF the power to the servo system. Check to see if position offset occurs at the coupling between machine and servomotor.	Correctly secure the coupling between the machine and servomotor.	–
Noise interference occurred because of incorrect I/O signal cable specifications.	Turn OFF the power to the servo system. Check the I/O signal cables to see if they satisfy specifications. Use a shielded twisted-pair wire cable or a screened twisted-pair cable with conductors of at least 0.12 mm^2.	Use cables that satisfy the specifications.	–
Noise interference occurred because an I/O signal cable is too long.	Turn OFF the power to the servo system. Check the lengths of the I/O signal cables.	The I/O signal cables must be no longer than 3 m.	–
An encoder fault occurred. (The pulse count does not change.)	–	Turn OFF the power to the servo system. Replace the servomotor or linear encoder.	–
A failure occurred in the SERVOPACK.	–	Turn OFF the power to the servo system. Replace the SERVOPACK.	–

13.5.13 Servomotor Overheated

Possible Cause	Confirmation	Correction	Reference
The surrounding temperature is too high.	Measure the surrounding temperature around the servomotor.	Reduce the surrounding temperature to 40°C or less.	–
The surface of the servomotor is dirty.	Turn OFF the power to the servo system. Visually check the surface for dirt.	Clean dirt, dust, and oil from the surface.	–
There is an overload on the servomotor.	Check the load status with a monitor.	If the servomotor is overloaded, reduce the load or replace the servo drive with a SERVOPACK and servomotor with larger capacities.	–
Polarity detection was not performed correctly.	Check to see if electrical angle 2 (electrical angle from polarity origin) at any position is between ±10°.	Correct the settings for the polarity detection-related parameters.	–

14

Parameter Lists

Provides information on the parameters.

14.1 Servo Parameters: Interpreting the Parameter Lists

(1) (2) (3)

◆ Pn000: Basic Function Selections 0

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 10B1h	–	0000h	All	After restart	Setup	–

Digit	Meaning		Reference
n.□□□X	Rotation Direction Selection Movement Direction Selection	Speed Pos Trq	–
0 Default	Use CCW as the forward direction. Use the direction in which the linear encoder counts up as the forward direction.		145
1	Use CW as the forward direction. (Reverse Rotation Mode) Use the direction in which the linear encoder counts down as the forward direction. (Reverse Movement Mode)		145
n.□□X□	Reserved (Do not change.)		–

(4) (5)

No.	Item	Meaning
(1)	Applicable Motors	Indicates 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. If this item differs by digit, it is added to the digit table. 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 sections for details. ☞ *i.5.2 Differences in Terms for Rotary Servomotors and Linear Servomotors on page 26*
(2)	When Enabled	Indicates when a change to the parameter will be effective. “After restart” indicates parameters that will be effective after one of the following is executed. • The power is turned OFF and ON again. • The CONFIG (Device setup request) command is sent. • A software reset is executed. If this item differs by digit, it is added to the digit table.
(3)	Classification	There are the following two classifications. • Setup • Tuning Refer to the following sections for details. ☞ *5.1.1 Parameter Classification on page 148*
(4)	Digit Name and Setting Description	If there are differences in the parameters for rotary servomotor and linear servomotor, information is provided for both. • Top row: For rotary servomotors • Bottom row: For linear servomotors
(5)	Control Mode	Speed: A parameter that can be used in speed control. Pos: A parameter that can be used in position control. Trq: A parameter that can be used in torque control. "Torque" is used even for linear servomotor parameters. Grayed-out icons (Speed, Pos, Trq) indicate parameters that cannot be used in the corresponding control method. For parameters for numeric settings, this item is added next to the parameter name. For parameters for selecting functions, this item is added to each digit in the table.

14.2 List of Servo Parameters: MECHATROLINK-4 Communications References

The following table lists the parameters.

Note:

Do not change the following parameters from their default settings.

- Reserved parameters
- Parameters not given in this manual
- Parameters that are not valid for the servomotor that you are using, as given in the parameter table

◆ Pn000: Basic Function Selections 0

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 10B1h	–	0000h	All	After restart	Setup	–

Digit	Meaning		Reference
n.□□□X	Rotation Direction Selection Movement Direction Selection	Speed Pos Trq	–
0 Default	Use CCW as the forward direction. Use the direction in which the linear encoder counts up as the forward direction.		161
1	Use CW as the forward direction. (Reverse Rotation Mode) Use the direction in which the linear encoder counts down as the forward direction. (Reverse Movement Mode)		161
n.□□X□	Reserved (Do not change.)		–
n.□X□□	Reserved (Do not change.)		–
n.X□□□	Rotary/Linear Servomotor Startup Selection When Encoder Is Not Connected	Speed Pos Trq	–
0 Default	When an encoder is not connected, start as SERVOPACK for rotary servomotor.		160
1	When an encoder is not connected, start as SERVOPACK for linear servomotor.		160

◆ Pn001: Application Function Selections 1

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1142h	–	0000h	All	After restart	Setup	–

Digit	Meaning	Reference
n.□□□X	Motor Stopping Method for Servo OFF and Group 1 Alarms Speed Pos Trq	–
0 Default	Stop the motor by applying the dynamic brake.	183
1	Stop the motor by the applying dynamic brake and then release the dynamic brake.	183
2	Coast the motor to a stop without the dynamic brake.	183
n.□□X□	Overtravel Stopping Method Speed Pos Trq	–
0 Default	Apply the dynamic brake or coast the motor to a stop (use the stopping method set in Pn001 = n.□□□X).	175
1	Decelerate the motor to a stop using the torque set in Pn406 as the maximum torque and then servo-lock the motor.	175
2	Decelerate the motor to a stop using the torque set in Pn406 as the maximum torque and then let the motor coast.	175
3	Decelerate the motor to a stop using the deceleration time set in Pn30A and then servo-lock the motor.	175
4	Decelerate the motor to a stop using the deceleration time set in Pn30A and then let the motor coast.	175
n.□X□□	Main Circuit Power Supply AC/DC Input Selection Speed Pos Trq	–
0 Default	Input AC power as the main circuit power supply using the L1, L2, and L3 terminals (do not use shared converter).	158
1	Input DC as the main circuit power supply using the B1/⊕, ⊖2 terminals or the B1 and ⊖2 terminals (use an external converter or the shared converter).	158
n.X□□□	Reserved (Do not change.)	–

◆ Pn002: Application Function Selections 2

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 4213h	–	0011h	–	After restart	Setup	–

Digit	Meaning	Applicable Motors	Reference
n.□□□X	MECHATROLINK Command Position and Speed Control Option Speed Pos Trq	–	–
0	Reserved (Do not use.)	All	–
1 Default	Use TLIM as the torque limit.	All	–
2	Reserved (Do not use.)	All	–
3	Reserved (Do not use.)	All	–
n.□□X□	Torque Control Option Speed Pos Trq	–	–
0	Reserved (Do not use.)	All	–
1 Default	Use the speed limit for torque control (VLIM) as the speed limit.	All	–
n.□X□□	Encoder Usage Speed Pos Trq	–	–
0 Default	Use the encoder according to encoder specifications.	All	240
1	Use the encoder as an incremental encoder.	All	240
2	Use the encoder as a single-turn absolute encoder.	Rotary	240
n.X□□□	External Encoder Usage Speed Pos Trq	–	–
0 Default	Do not use an external encoder.	Rotary	485
1	The external encoder moves in the forward direction for CCW motor rotation.	Rotary	485
2	Reserved (Do not use.)	Rotary	485
3	The external encoder moves in the reverse direction for CCW motor rotation.	Rotary	485
4	Reserved (Do not use.)	Rotary	485

◆ Pn006: Application Function Selections 6

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 105Fh	–	0002h	All	Immediately	Setup	463

Digit	Meaning
n.□□XX	Analog Monitor 1 Signal Selection Speed Pos Trq
00	Motor speed (1 V/1000 min^{-1})
	Motor speed (1 V/1000 mm/s)
01	Speed reference (1 V/1000 min^{-1})
	Speed reference (1 V/1000 mm/s)
02 Default	Torque reference (1 V/100% rated torque)
	Force reference (1 V/100% rated force)
03	Position deviation (0.05 V/reference unit)
04	Position amplifier deviation (after electronic gear) (0.05 V/encoder pulse unit)
	Position amplifier deviation (after electronic gear) (0.05 V/linear encoder pulse unit)
05	Position reference speed (1 V/1000 min^{-1})
	Position reference speed (1 V/1000 mm/s)
06	Reserved (Do not use.)
07	Position deviation between motor and load (0.01 V/reference unit)
08	Positioning completion (positioning completed: 5 V, positioning not completed: 0 V)
09	Speed feedforward (1 V/1000 min^{-1})
	Speed feedforward (1 V/1000 mm/s)
0A	Torque feedforward (1 V/100% rated torque)
	Force feedforward (1 V/100% rated force)
0B	Active gain (gain 1: 1 V, gain 2: 2 V) 2 V)
0C	Completion of position reference distribution (completed: 5 V, not completed: 0 V)
0D	External encoder speed (1 V/1000 min^{-1}: value at the motor shaft)
0E	Reserved (Do not use.)
0F	Reserved (Do not use.)
10	Main circuit DC voltage
11 to 5F	Reserved (Do not use.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn007: Application Function Selections 7

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 105Fh	–	0000h	All	Immediately	Setup	463

Digit	Meaning
n.□□XX	Analog Monitor 2 Signal Selection (Speed Pos Trq)
00 Default	Motor speed (1 V/1000 min^{-1})
	Motor speed (1 V/1000 mm/s)
01	Speed reference (1 V/1000 min^{-1})
	Speed reference (1 V/1000 mm/s)
02	Torque reference (1 V/100% rated torque)
	Force reference (1 V/100% rated force)
03	Position deviation (0.05 V/reference unit)
04	Position amplifier deviation (after electronic gear) (0.05 V/encoder pulse unit)
	Position amplifier deviation (after electronic gear) (0.05 V/linear encoder pulse unit)
05	Position reference speed (1 V/1000 min^{-1})
	Position reference speed (1 V/1000 mm/s)
06	Reserved (Do not use.)
07	Position deviation between motor and load (0.01 V/reference unit)
08	Positioning completion (positioning completed: 5 V, positioning not completed: 0 V)
09	Speed feedforward (1 V/1000 min^{-1})
	Speed feedforward (1 V/1000 mm/s)
0A	Torque feedforward (1 V/100% rated torque)
	Force feedforward (1 V/100% rated force)
0B	Active gain (gain 1: 1 V, gain 2: 2 V) 2 V)
0C	Completion of position reference distribution (completed: 5 V, not completed: 0 V)
0D	External encoder speed (1 V/1000 min^{-1}: value at the motor shaft)
0E	Reserved (Do not use.)
0F	Reserved (Do not use.)
10	Main circuit DC voltage
11 to 5F	Reserved (Do not use.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn008: Application Function Selections 8

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 7121h	–	4000h	Rotary	After restart	Setup	–

Digit	Meaning	Reference
n.□□□X	Low Battery Voltage Alarm/Warning Selection (Speed Pos Trq)	–
0 Default	Output alarm (A.830) for low battery voltage.	540
1	Output warning (A.930) for low battery voltage.	540
n.□□X□	Function Selection for Undervoltage (Speed Pos Trq)	–
0 Default	Do not detect undervoltage.	224
1	Detect undervoltage warning and limit torque at host controller.	224
2	Detect undervoltage warning and limit torque with Pn424 and Pn425 (i.e., only in SERVOPACK).	224
n.□X□□	Warning Detection Selection (Speed Pos Trq)	–
0 Default	Detect warnings.	581
1	Do not detect warnings except for A.971.	581
n.X□□□	Reserved (Do not change.)	–

◆ Pn009: Application Function Selections 9

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0141h	–	0040h	All	After restart	Tuning	–

Digit	Meaning	Reference
n.□□□X	Reserved (Do not change.)	–
n.□□X□	Current Control Mode Selection (Speed Pos Trq)	–
0	Use current control mode 1.	419
1	• SERVOPACK Models SGDXS-R70A, -R90A, -1R6A, -2R8A, - 3R8A, -5R5A, -7R6A: Use current control mode 1. • SERVOPACK Models SGDXS-120A, -180A, -200A, -330A, -470A, -550A, -590A, -780A: Use current control mode 2. (For noise reduction when the motor is stopped)	419
2	Use current control mode 2. (For noise reduction when the motor is stopped)	419
3	Use current control mode 3. (For noise reduction when the motor is operating at high speed)	419
4 Default	Use current control mode 4. (For noise reduction when the motor is stopped and operating at high speed)	419
n.□X□□	Speed Detection Method Selection (Speed Pos Trq)	–
0 Default	Use speed detection 1.	419
1	Use speed detection 2.	419
n.X□□□	Reserved (Do not change.)	–

◆ Pn00A: Application Function Selections A

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1244h	–	0001h	All	After restart	Setup	–

Digit	Meaning	Reference
n.□□□X	Motor Stopping Method for Group 2 Alarms Speed Pos Trq	–
0	Apply the dynamic brake or coast the motor to a stop (use the stopping method set in Pn001 = n.□□□X).	184
1 Default	Decelerate the motor to a stop using the torque set in Pn406 as the maximum torque. Use the setting of Pn001 = n.□□□X for the status after stopping.	184
2	Decelerate the motor to a stop using the torque set in Pn406 as the maximum torque and then let the motor coast.	184
3	Decelerate the motor to a stop using the deceleration time set in Pn30A. Use the setting of Pn001 = n.□□□X for the status after stopping.	184
4	Decelerate the motor to a stop using the deceleration time set in Pn30A and then let the motor coast.	184
n.□□X□	Stopping Method for Forced Stops Speed Pos Trq	–
0 Default	Apply the dynamic brake or coast the motor to a stop (use the stopping method set in Pn001 = n.□□□X).	264
1	Decelerate the motor to a stop using the torque set in Pn406 as the maximum torque. Use the setting of Pn001 = n.□□□X for the status after stopping.	264
2	Decelerate the motor to a stop using the torque set in Pn406 as the maximum torque and then let the motor coast.	264
3	Decelerate the motor to a stop using the deceleration time set in Pn30A. Use the setting of Pn001 = n.□□□X for the status after stopping.	264
4	Decelerate the motor to a stop using the deceleration time set in Pn30A and then let the motor coast.	264
n.□X□□	Reserved (Do not change.)	–
n.X□□□	Reserved (Do not change.)	–

◆ Pn00B: Application Function Selections B

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1121h	–	0000h	All	After restart	Setup	–

Digit	Meaning	Reference
n.□□□X	Operator Parameter Display Selection Speed Pos Trq	–
0 Default	Display only setup parameters.	148
1	Display all parameters.	148
n.□□X□	Motor Stopping Method for Group 2 Alarms Speed Pos Trq	–
0 Default	Stop the motor by setting the speed reference to 0.	184
1	Apply the dynamic brake or coast the motor to a stop (use the stopping method set in Pn001 = n.□□□X).	184
2	Set the stopping method with Pn00A = n.□□□X.	184
n.□X□□	Power Input Selection for Three-phase SERVOPACK Speed Pos Trq	–
0 Default	Use a three-phase power supply input.	159
1	Use a three-phase power supply input as a single-phase power supply input.	159
n.X□□□	Reserved (Do not change.)	–

◆ Pn00C: Application Function Selections C

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0141h	–	0040h	–	After restart	Setup	301

Digit	Meaning	Applicable Motors
n.□□□X	Function Selection for Test without a Motor (Speed, Pos, Trq)	–
0 Default	Disable tests without a motor.	All
1	Enable tests without a motor.	All
n.□□X□	Encoder Resolution for Tests without a Motor (Speed, Pos, Trq)	–
0	Use 13 bits.	Rotary
1	Use 20 bits.	Rotary
2	Use 22 bits.	Rotary
3	Use 24 bits.	Rotary
4 Default	Use 26 bits.	Rotary
n.□X□□	Encoder Type Selection for Tests without a Motor (Speed, Pos, Trq)	–
0 Default	Use an incremental encoder.	All
1	Use an absolute encoder.	All
n.X□□□	Reserved (Do not change.)	–

◆ Pn00D: Application Function Selections D

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2001h	–	0000h	All	After restart	Setup	177

Digit	Meaning
n.□□□X	Reserved (Do not change.)
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Overtravel Warning Detection Selection (Speed, Pos, Trq)
0 Default	Do not detect overtravel warnings.
1	Detect overtravel warnings.
2	Detect overtravel alarms.

◆ Pn00E: Application Function Selections E

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0000h to 4001h	–	0000h	All	After restart	Setup	490

Digit	Meaning
n.□□□X	Reserved (Do not change.)
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	External Encoder Monitor Usage Speed Pos Trq
0 Default	Do not use an external encoder monitor.
1	Use CCW as the forward direction.
2	Reserved (Do not use.)
3	Use CW as the forward direction.
4	Reserved (Do not use.)

◆ Pn00F: Application Function Selections F

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0000h to 2021h	–	0000h	All	After restart	Setup	–

Digit	Meaning	Refer-ence
n.□□□X	SERVOPACK Preventative Maintenance Warning Selection Speed Pos Trq	–
0 Default	Do not detect SERVOPACK preventative maintenance warnings.	468
1	Detect SERVOPACK preventative maintenance warnings.	468
n.□□X□	Servomotor Preventative Maintenance Warning Selection Speed Pos Trq	–
0 Default	Do not detect servomotor preventative maintenance warnings.	469
1	Detect servomotor preventative maintenance warnings.	469
n.□X□□	Reserved (Do not change.)	–
n.X□□□	Reserved (Do not change.)	–

◆ Pn021: Reserved (Do not change.) Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	–	–	0000h	All	–	–	–

◆ Pn022: Application Function Selections 22

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0011h	–	0000h	All	After restart	Setup	178

Digit	Meaning
n.□□□X	Overtravel Release Method Selection Speed Pos Trq
0 Default	Overtravel exists while the P-OT or N-OT signal is being input.
1	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.
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn02F: Application Function Selections 2F

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0002h	–	0000h	All	After restart	Setup	–

Digit	Meaning
n.□□□X	Selection of Capacitor Discharge Mode When Main Circuit Power OFF Speed Pos Trq
0 Default	• SGDXS-R70A to -200A : Do not perform rapid discharge. • SGDXS-330A to -780A : Perform rapid discharge.
1	Perform rapid discharge.
2	Reserved (Do not use.)
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn030: Ethernet IP Address

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	00000000h to FFFFFFFFh	–	C0A80101h	All	After restart	Setup	141

◆ Pn032: Ethernet Subnet Mask

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	00000000h to FFFFFFFFh	–	FFFFFF00h	All	After restart	Setup	141

◆ Pn034: Ethernet Default Gateway

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	00000000h to FFFFFFFFh	–	00000000h	All	After restart	Setup	141

◆ Pn040: Sigma-V/Sigma-7 Compatible Function Switch

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2112h	–	0000h	All	After restart	Setup	–

Digit	Meaning
n.□□□X	Σ-X/Σ-7 Compatibility Mode Selection Speed Pos Trq
0 Default	Perform Sigma-X communications.
1	Reserved (Do not use.)
2	Perform Sigma-7 communications.
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn050: SigmaLINK II Response Data Selection 1

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	00000000h to FF7EFFFFh	–	00000000h	All	After restart	Setup	506

Digit	Meaning
n.□□□□XXXX	Parameter Number (0000h to FFFFh)
n.□□XX□□□□	Node Address (10h to 1Eh)
n.XX□□□□□□	Reserved.

◆ Pn052: SigmaLINK II Response Data Selection 2

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	00000000h to FF7EFFFFh	–	00000000h	All	After restart	Setup	506

Digit	Meaning
n.□□□□XXXX	Parameter Number (0000h to FFFFh)
n.□□XX□□□□	Node Address (10h to 1Eh)
n.XX□□□□□□	Reserved.

◆ Pn054: SigmaLINK II Response Data Selection 3

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	00000000h to FF7EFFFFh	–	00000000h	All	After restart	Setup	506

Digit	Meaning
n.□□□□XXXX	Parameter Number (0000h to FFFFh)
n.□□XX□□□□	Node Address (10h to 1Eh)
n.XX□□□□□□	Reserved.

◆ Pn056: SigmaLINK II Response Data Selection 4

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	00000000h to FF7EFFFFh	–	00000000h	All	After restart	Setup	506

Digit	Meaning
n.□□□□XXXX	Parameter Number (0000h to FFFFh)
n.□□XX□□□□	Node Address (10h to 1Eh)
n.XX□□□□□□	Reserved.

◆ Pn058: SigmaLINK II Response Data Selection 5

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	00000000h to FF7EFFFFh	–	00000000h	All	After restart	Setup	506

Digit	Meaning
n.□□□□XXXX	Parameter Number (0000h to FFFFh)
n.□□XX□□□□	Node Address (10h to 1Eh)
n.XX□□□□□□	Reserved.

◆ Pn05A: SigmaLINK II Response Data Selection 6

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	00000000h to FF7EFFFFh	–	00000000h	All	After restart	Setup	506

Digit	Meaning
n.□□□□XXXX	Parameter Number (0000h to FFFFh)
n.□□XX□□□□	Node Address (10h to 1Eh)
n.XX□□□□□□	Reserved.

◆ Pn05C: SigmaLINK II Response Data Selection 7

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	00000000h to FF7EFFFFh	–	00000000h	All	After restart	Setup	506

Digit	Meaning
n.□□□□XXXX	Parameter Number (0000h to FFFFh)
n.□□XX□□□□	Node Address (10h to 1Eh)
n.XX□□□□□□	Reserved.

◆ Pn05E: SigmaLINK II Response Data Selection 8

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	00000000h to FF7EFFFFh	–	00000000h	All	After restart	Setup	506

Digit	Meaning
n.□□□□XXXX	Parameter Number (0000h to FFFFh)
n.□□XX□□□□	Node Address (10h to 1Eh)
n.XX□□□□□□	Reserved.

◆ Pn080: Application Function Selections 80

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1111h	–	0000h	Linear	After restart	Setup	–

Digit	Meaning	Reference
n.□□□X	Polarity Sensor Selection (Speed Pos Trq)	–
0 Default	Use polarity sensor.	170
1	Do not use polarity sensor.	170
n.□□X□	Motor Phase Sequence Selection (Speed Pos Trq)	–
0 Default	Set a phase-A lead as a phase sequence of U, V, and W.	168
1	Set a phase-B lead as a phase sequence of U, V, and W.	168
n.□X□□	Reserved (Do not change.)	–
n.X□□□	Calculation Method for Maximum Speed or Encoder Output Pulses (Speed Pos Trq)	–
0 Default	Calculate the encoder output pulse setting for a fixed maximum motor speed.	834
1	Calculate the maximum motor speed for a fixed encoder output pulse setting.	834

◆ Pn081: Application Function Selections 81

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1111h	–	0000h	All	After restart	Setup	229

Digit	Meaning
n.□□□X	Phase-C Pulse Output Selection (Speed Pos Trq)
0 Default	Output phase-C pulses only in the forward direction.
1	Output phase-C pulses in both the forward and reverse directions.
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn090: SigmaLINK II Command Data Selection 1

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	00000000h to FF7EFFFFh	–	00000000h	All	After restart	Setup	517

Digit	Meaning
n.□□□□XXXX	Parameter Number (0000h to FFFFh)
n.□□XX□□□□	Node Address (10h to 1Eh)
n.XX□□□□□□	Reserved.

◆ Pn092: SigmaLINK II Command Data Selection 2

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	00000000h to FF7EFFFFh	–	00000000h	All	After restart	Setup	517

Digit	Meaning
n.□□□□XXXX	Parameter Number (0000h to FFFFh)
n.□□XX□□□□	Node Address (10h to 1Eh)
n.XX□□□□□□	Reserved.

◆ Pn094: SigmaLINK II Command Data Selection 3

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	00000000h to FF7EFFFFh	–	00000000h	All	After restart	Setup	517

Digit	Meaning
n.□□□□XXXX	Parameter Number (0000h to FFFFh)
n.□□XX□□□□	Node Address (10h to 1Eh)
n.XX□□□□□□	Reserved.

◆ Pn096: SigmaLINK II Command Data Selection 4

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	00000000h to FF7EFFFFh	–	00000000h	All	After restart	Setup	517

Digit	Meaning
n.□□□□XXXX	Parameter Number (0000h to FFFFh)
n.□□XX□□□□	Node Address (10h to 1Eh)
n.XX□□□□□□	Reserved.

◆ Pn0B1: SigmaLINK II Sequence Input Allocation 1

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to FFFFh	–	0000h	All	After restart	Setup	515

Digit	Meaning
n.□□XX	SigmaLINK II Response Data Selection — Speed Pos Trq
00 Default	Disable (data is not set to the SigmaLINK II sequence input).
01	Allocate SigmaLINK II Response Data 1 to the SigmaLINK II sequence input.
02	Allocate SigmaLINK II Response Data 2 to the SigmaLINK II sequence input.
03	Allocate SigmaLINK II Response Data 3 to the SigmaLINK II sequence input.
04	Allocate SigmaLINK II Response Data 4 to the SigmaLINK II sequence input.
05	Allocate SigmaLINK II Response Data 5 to the SigmaLINK II sequence input.
06	Allocate SigmaLINK II Response Data 6 to the SigmaLINK II sequence input.
07	Allocate SigmaLINK II Response Data 7 to the SigmaLINK II sequence input.
08	Allocate SigmaLINK II Response Data 8 to the SigmaLINK II sequence input.
n.XX□□	SigmaLINK II Sequence Input Allocation Start Position Selection — Speed Pos Trq
00 to 20	Specify the allocation start bit to the SigmaLINK II sequence input.

◆ Pn0B2: SigmaLINK II Sequence Input Allocation 2

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to FFFFh	–	0000h	All	After restart	Setup	515

Digit	Meaning
n.□□XX	SigmaLINK II Response Data Selection — Speed Pos Trq
00 Default	Disable (data is not set to the SigmaLINK II sequence input).
01	Allocate SigmaLINK II Response Data 1 to the SigmaLINK II sequence input.
02	Allocate SigmaLINK II Response Data 2 to the SigmaLINK II sequence input.
03	Allocate SigmaLINK II Response Data 3 to the SigmaLINK II sequence input.
04	Allocate SigmaLINK II Response Data 4 to the SigmaLINK II sequence input.
05	Allocate SigmaLINK II Response Data 5 to the SigmaLINK II sequence input.
06	Allocate SigmaLINK II Response Data 6 to the SigmaLINK II sequence input.
07	Allocate SigmaLINK II Response Data 7 to the SigmaLINK II sequence input.
08	Allocate SigmaLINK II Response Data 8 to the SigmaLINK II sequence input.
n.XX□□	SigmaLINK II Sequence Input Allocation Start Position Selection — Speed Pos Trq
00 to 20	Specify the allocation start bit to the SigmaLINK II sequence input.

◆ Pn0B5: SigmaLINK II Sequence Output Allocation 1

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0000h to FFFFh	–	0000h	All	After restart	Setup	517

Digit	Meaning
n.□□XX	SigmaLINK II Command Data Selection Speed Pos Trq
00 Default	Disable (data is not set to the SigmaLINK II sequence output).
01	Allocate SigmaLINK II Command Data 1 to the SigmaLINK II sequence output.
02	Allocate SigmaLINK II Command Data 2 to the SigmaLINK II sequence output.
03	Allocate SigmaLINK II Command Data 3 to the SigmaLINK II sequence output.
04	Allocate SigmaLINK II Command Data 4 to the SigmaLINK II sequence output.
n.XX□□	SigmaLINK II Sequence Output Allocation Start Position Selection Speed Pos Trq
00 to 20	Specify the allocation start bit to the SigmaLINK II sequence output.

◆ Pn0DA: SigmaLINK II Semi-closed Encoder Selection

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0000h to 011Eh	–	0000h	All	After restart	Setup	504

Digit	Meaning
n.□□XX	Node Address Speed Pos Trq
00 to 1E	Select an encoder with a node address between 00h and 1Eh.
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn0DB: SigmaLINK II Fully-closed Encoder Selection

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0000h to 011Eh	–	0101h	All	After restart	Setup	–

Digit	Meaning
n.□□XX	Node Address Speed Pos Trq
00 to 1E	Select an encoder with a node address between 00h and 1Eh.
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn0DC: SigmaLINK II Node Change Detection Condition Selection

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0003h	–	0000h	All	After restart	Setup	–

Digit	Meaning
n.□□□X	Connected Node Change Detection Condition (Speed Pos Trq)
0 Default	Set vendor ID and product ID as conditions.
1	Set vendor ID, product ID, and serial number as conditions.
2	Set vendor ID, product ID, and product version as conditions.
3	Set vendor ID, product ID, product version, and serial number as conditions.
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn0DD: SigmaLINK II I/O Device Error Detection Selection

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to F4F2h	–	0110h	All	After restart	Setup	–

Digit	Meaning
n.□□□X	SigmaLINK II I/O Device Communications Check Mask (Speed Pos Trq)
0 Default	Set SigmaLINK II slave communications error as an alarm (A.Cd7).
1	Set SigmaLINK II slave communications error as a warning (A.932).
2	Do not detect the SigmaLINK II slave communications error.
n.□□X□	Reserved (Do not change.)
n.□X□□	SigmaLINK II I/O Device Status Check Mask (Speed Pos Trq)
0	A.Cd8 occurs when the alarm or warning signal is received from the SigmaLINK II slave.
1 Default	A.Cd8 occurs when the alarm signal is received from the SigmaLINK II slave and A.933 occurs when the warning signal is received.
2	A.933 occurs when the alarm or warning signal is received from the SigmaLINK II slave.
3	Do not detect the SigmaLINK II slave status error.
n.X□□□	Reserved (Do not change.)

◆ Pn100: Speed Loop Gain

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 20000	0.1 Hz	400	All	Immediately	Tuning	427

◆ Pn101: Speed Loop Integral Time Constant

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	15 to 51200	0.01 ms	2000	All	Immediately	Tuning	427

◆ Pn102: Position Loop Gain

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 20000	0.1/s	400	All	Immediately	Tuning	427

◆ Pn103: Moment of Inertia Ratio

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 65535	1%	100	All	Immediately	Tuning	427

◆ Pn104: Second Speed Loop Gain

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	10 to 20000	0.1 Hz	400	All	Immediately	Tuning	412

◆ Pn105: Second Speed Loop Integral Time Constant

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	15 to 51200	0.01 ms	2000	All	Immediately	Tuning	412

◆ Pn106: Second Position Loop Gain

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	10 to 20000	0.1/s	400	All	Immediately	Tuning	412

◆ Pn109: Feedforward

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 100	1%	0	All	Immediately	Tuning	437

◆ Pn10A: Feedforward Filter Time Constant

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 6400	0.01 ms	0	All	Immediately	Tuning	437

◆ Pn10B: Gain Application Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 5334h	–	0000h	All	–	Setup	–

Digit	Meaning	When Enabled	Reference
n.□□□X	Mode Switching Selection (Speed, Pos)	–	–
0 (Default)	Use the internal torque reference as the condition (level setting: Pn10C).	Immediately	438
1	Use the speed reference as the condition (level setting: Pn10D). Use the speed reference as the condition (level setting: Pn181).	Immediately	438
2	Use the acceleration reference as the condition (level setting: Pn10E). Use the acceleration reference as the condition (level setting: Pn182).	Immediately	438
3	Use the position deviation as the condition (level setting: Pn10F).	Immediately	438
4	Do not use mode switching.	Immediately	438
n.□□X□	Speed Loop Control Method (Speed, Pos)	–	–
0 (Default)	PI control	After restart	433
1	I-P control	After restart	433
2, 3	Reserved (Do not use.)	After restart	433
n.□X□□	Reserved (Do not change.)	–	–
n.X□□□	Reserved (Do not change.)	–	–

◆ Pn10C: Mode Switching Level for Torque Reference

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 800	1%	200	All	Immediately	Tuning	438

◆ Pn10D: Mode Switching Level for Speed Reference

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10000	1 min^{-1}	0	Rotary	Immediately	Tuning	438

◆ Pn10E: Mode Switching Level for Acceleration

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 30000	1 min^{-1}/s	0	Rotary	Immediately	Tuning	438

◆ Pn10F: Mode Switching Level for Position Deviation

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10000	1 reference unit	0	All	Immediately	Tuning	438

◆ Pn11F: Position Integral Time Constant

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 50000	0.1 ms	0	All	Immediately	Tuning	441

◆ Pn121: Friction Compensation Gain

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 1000	1%	100	All	Immediately	Tuning	412, 354

◆ Pn122: Second Friction Compensation Gain

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 1000	1%	100	All	Immediately	Tuning	412, 354

◆ Pn123: Friction Compensation Coefficient

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 100	1%	0	All	Immediately	Tuning	354

◆ Pn124: Friction Compensation Frequency Correction

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	-10000 to 10000	0.1 Hz	0	All	Immediately	Tuning	354

◆ Pn125: Friction Compensation Gain Correction

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	1 to 1000	1%	100	All	Immediately	Tuning	354

◆ Pn131: Gain Switching Time 1

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65535	1 ms	0	All	Immediately	Tuning	412

◆ Pn132: Gain Switching Time 2

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65535	1 ms	0	All	Immediately	Tuning	412

◆ Pn135: Gain Switching Waiting Time 1

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65535	1 ms	0	All	Immediately	Tuning	412

◆ Pn136: Gain Switching Waiting Time 2

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65535	1 ms	0	All	Immediately	Tuning	412

◆ Pn139: Automatic Gain Switching Selections 1

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0052h	–	0000h	All	Immediately	Tuning	412

Digit	Meaning
n.□□□X	Gain Switching Selection Speed Pos Trq
0 Default	Manual Gain Switching The gain is switched manually with G-SEL in SVCMD_IO.
1	Reserved (Do not use.)
2	Use automatic gain switching pattern 1. The gain settings 1 switch automatically to 2 when switching condition A is satisfied. The gain settings 2 switch automatically to 1 when switching condition A is not satisfied.
n.□□X□	Gain Switching Condition A Speed Pos Trq
0 Default	/COIN (Positioning Completion Output) signal turns ON.
1	/COIN (Positioning Completion Output) signal turns OFF.
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 (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn13D: Current Gain Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	100 to 2000	1%	2000	All	Immediately	Tuning	419

Parameter Lists

14

◆ Pn140: Model Following Control-Related Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1121h	–	0100h	All	Immediately	Tuning	–

Digit	Meaning	Reference
n.□□□X	Model Following Control Selection (Speed Pos Trq)	–
0 Default	Do not use model following control.	434
1	Use model following control.	434
n.□□X□	Vibration Suppression Selection (Speed Pos Trq)	–
0 Default	Do not perform vibration suppression.	434
1	Perform vibration suppression for a specific frequency.	434
2	Perform vibration suppression for two specific frequencies.	434
n.□X□□	Vibration Suppression Adjustment Selection (Speed Pos Trq)	–
0	Do not adjust vibration suppression automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.	354
1 Default	Adjust vibration suppression automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.	354
n.X□□□	Speed Feedforward (VFF)/Torque Feedforward (TFF) Selection (Speed Pos Trq)	–
0 Default	Do not use model following control and speed/torque feedforward together.	354, 385
1	Use model following control and speed/torque feedforward together.	354, 385

◆ Pn141: Model Following Control Gain

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 20000	0.1/s	500	All	Immediately	Tuning	434

◆ Pn142: Model Following Control Gain Correction

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	500 to 2000	0.1%	1000	All	Immediately	Tuning	412

◆ Pn143: Model Following Control Bias in the Forward Direction

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10000	0.1%	1000	All	Immediately	Tuning	434

◆ Pn144: Model Following Control Bias in the Reverse Direction

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10000	0.1%	1000	All	Immediately	Tuning	434

◆ Pn145: Vibration Suppression 1 Frequency A

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 2500	0.1 Hz	500	All	Immediately	Tuning	386

◆ Pn146: Vibration Suppression 1 Frequency B

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 2500	0.1 Hz	700	All	Immediately	Tuning	386

◆ Pn147: Model Following Control Speed Feedforward Compensation

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10000	0.1%	1000	All	Immediately	Tuning	434

◆ Pn148: Second Model Following Control Gain

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 20000	0.1/s	500	All	Immediately	Tuning	412

◆ Pn149: Second Model Following Control Gain Correction

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	500 to 2000	0.1%	1000	All	Immediately	Tuning	412

◆ Pn14A: Vibration Suppression 2 Frequency

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 2000	0.1 Hz	800	All	Immediately	Tuning	386

◆ Pn14B: Vibration Suppression 2 Correction

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 1000	1%	100	All	Immediately	Tuning	386

◆ Pn14F: Control-Related Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0031h	–	0030h	All	After restart	Tuning	–

Digit	Meaning	Reference
n.□□□X	Model Following Control Type Selection Speed Pos Trq	–
0 Default	Use overshoot control type for model following control.	437
1	Use response emphasis type for model following control.	437
n.□□X□	Tuning-less Type Selection Speed Pos Trq	–
0	Use tuning-less type 1.	319
1	Use tuning-less type 2.	319
2	Use tuning-less type 3.	319
3 Default	Use tuning-less type 4.	319
n.□X□□	Reserved (Do not change.)	–
n.X□□□	Reserved (Do not change.)	–

◆ Pn160: Anti-Resonance Control-Related Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0011h	–	0010h	All	Immediately	Tuning	–

Digit	Meaning	Reference
n.□□□X	Anti-Resonance Control Selection Speed Pos Trq	–
0 Default	Do not use anti-resonance control.	375
1	Use anti-resonance control.	375
n.□□X□	Anti-Resonance Control Adjustment Selection Speed Pos Trq	–
0	Do not adjust anti-resonance control automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.	353
1 Default	Adjust anti-resonance control automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.	353
n.□X□□	Reserved (Do not change.)	–
n.X□□□	Reserved (Do not change.)	–

◆ Pn161: Anti-Resonance Frequency

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 20000	0.1 Hz	1000	All	Immediately	Tuning	375

◆ Pn162: Anti-Resonance Gain Correction

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	1 to 1000	1%	100	All	Immediately	Tuning	375

◆ Pn163: Anti-Resonance Damping Gain

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 300	1%	0	All	Immediately	Tuning	375

◆ Pn164: Anti-Resonance Filter Time Constant 1 Correction

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	-1000 to 1000	0.01 ms	0	All	Immediately	Tuning	375

◆ Pn165: Anti-Resonance Filter Time Constant 2 Correction

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	-1000 to 1000	0.01 ms	0	All	Immediately	Tuning	375

◆ Pn166: Anti-Resonance Damping Gain 2

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 1000	1%	0	All	Immediately	Tuning	380

◆ Pn170: Tuning-less Function-Related Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2711h	–	1401h	All	–	Setup	318

Digit	Meaning	When Enabled
n.□□□X	Tuning-less Selection (Speed Pos Trq)	–
0	Disable tuning-less function.	After restart
1 Default	Enable tuning-less function.	After restart
n.□□X□	Speed Control Method (Speed Pos Trq)	–
0 Default	Use for speed control.	After restart
1	Use for speed control and use host controller for position control.	After restart
n.□X□□	Tuning-less Level (Speed Pos Trq)	–
0	Set the tuning-less level to 0.	Immediately
1	Set the tuning-less level to 1.	Immediately
2	Set the tuning-less level to 2.	Immediately
3	Set the tuning-less level to 3.	Immediately
4 Default	Set the tuning-less level to 4.	Immediately
5	Set the tuning-less level to 5.	Immediately
6	Set the tuning-less level to 6.	Immediately
7	Set the tuning-less level to 7.	Immediately
n.X□□□	Tuning-less Load Level (Speed Pos Trq)	–
0	Set the tuning-less load level to 0.	Immediately
1 Default	Set the tuning-less load level to 1.	Immediately
2	Set the tuning-less load level to 2.	Immediately

◆ Pn173: Load Fluctuation Compensation Control-Related Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0001h	–	0000h	All	Immediately	Setup	409

Digit	Meaning
n.□□□X	Load Fluctuation Compensation Control Selection (Speed Pos Trq)
0 Default	Do not use load fluctuation compensation control.
1	Use load fluctuation compensation control.
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn174: Load Fluctuation Compensation Control Response Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 20000	0.1	400	All	Immediately	Tuning	409

◆ Pn181: Mode Switching Level for Speed Reference

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10000	1 mm/s	0	Linear	Immediately	Tuning	438

◆ Pn182: Mode Switching Level for Acceleration

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 30000	1 mm/s^2	0	Linear	Immediately	Tuning	438

◆ Pn205: Multiturn Limit

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65535	1 rev	65535	Rotary	After restart	Setup	244

◆ Pn207: Position Control Function Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2210h	–	0010h	All	After restart	Setup	219

Digit	Meaning
n.□□□X	Reserved (Do not change.)
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	/COIN (Positioning Completion Output) Signal Output Timing Speed Pos Trq
0 Default	Output when the absolute value of the position deviation is the same or less than the setting of Pn522 (Positioning Completed Width).
1	Output when the absolute value of the position error is the same or less than the setting of Pn522 (Positioning Completed Width) and the reference after the position reference filter is 0.
2	Output when the absolute value of the position error is the same or less than the setting of Pn522 (Positioning Completed Width) and the reference input is 0.

◆ Pn20A: Number of External Encoder Scale Pitches

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	4 to 1048576	1 scale pitch/ revolution	32768	Rotary	After restart	Setup	485

◆ Pn20E: Electronic Gear Ratio (Numerator)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	1 to 1073741824	–	64	All	After restart	Setup	188

◆ Pn210: Electronic Gear Ratio (Denominator)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	1 to 1073741824	–	1	All	After restart	Setup	188

◆ Pn212: Number of Encoder Output Pulses

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	16 to 1073741824	1 P/Rev	2048	Rotary	After restart	Setup	231

◆ Pn21D: Encoder Resolution Setting

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 00A1h	–	0080h	Rotary	After restart	Setup	203

Digit	Meaning
n.□□□X	Encoder Resolution Compatibility Selection (Speed Pos Trq)
0 Default	Disable encoder resolution compatibility.
1	Enable encoder resolution compatibility.
n.□□X□	Encoder Resolution Compatibility: Resolution Selection (Speed Pos Trq)
4	Operate as 20-bit encoder.
6	Operate as 22-bit encoder.
8 Default	Operate as 24-bit encoder.
A	Operate as 26-bit encoder.
Other values	Reserved (Do not use.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn22A: Fully-closed Control Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1003h	–	0000h	Rotary	After restart	Setup	489

Digit	Meaning
n.□□□X	Reserved (Do not change.)
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Fully-closed Control Speed Feedback Selection (Speed Pos Trq)
0 Default	Use motor encoder speed.
1	Use external encoder speed.

◆ Pn230: Position Control Expansion Function Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0001h	–	0000h	All	After restart	Setup	420

Digit	Meaning
n.□□□X	Backlash Compensation Direction (Speed Pos Trq)
0 (Default)	Compensate forward references.
1	Compensate reverse references.
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn231: Backlash Compensation Value

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	-500000 to 500000	0.1 reference unit	0	All	Immediately	Setup	421

◆ Pn233: Backlash Compensation Time Constant

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65535	0.01 ms	0	All	Immediately	Setup	421

◆ Pn281: Encoder Output Resolution

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	1 to 4096	1 edge/pitch	20	All	After restart	Setup	232

◆ Pn282: Linear Encoder Scale Pitch

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	0 to 6553600	0.01 μm	0	Linear	After restart	Setup	163

◆ Pn304: Jogging Speed

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10000	Rotary: 1 min^{-1} Direct Drive: 0.1 min^{-1}	500	Rotary	Immediately	Setup	287

◆ Pn305: Soft Start Acceleration Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 12000	1 ms	0	All	Immediately	Setup	–

◆ Pn306: Soft Start Deceleration Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 12000	1 ms	0	All	Immediately	Setup	–

◆ Pn308: Speed Feedback Filter Time Constant

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65535	0.01 ms	0	All	Immediately	Setup	420

◆ Pn30A: Deceleration Time for Servo OFF and Forced Stops

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 12000	1 ms	0	All	Immediately	Setup	176

◆ Pn30C: Speed Feedforward Average Movement Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 5100	0.1 ms	0	All	Immediately	Setup	–

◆ Pn310: Vibration Detection Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0002h	–	0000h	All	Immediately	Setup	257

Digit	Meaning
n.□□□X	Vibration Detection Selection (Speed Pos Trq)
0 Default	Do not detect vibration.
1	Output a warning (A.911) if vibration is detected.
2	Output an alarm (A.520) if vibration is detected.
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn311: Vibration Detection Sensitivity

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	50 to 500	1%	100	All	Immediately	Tuning	257

◆ Pn312: Vibration Detection Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 5000	1 min^{-1}	50	Rotary	Immediately	Tuning	257

◆ Pn316: Maximum Motor Speed

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65535	1 min^{-1}	10000	Rotary	After restart	Setup	226

◆ Pn324: Moment of Inertia Calculation Starting Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 20000	1%	300	All	Immediately	Setup	352

◆ Pn383: Jogging Speed

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10000	1 mm/s	50	Linear	Immediately	Setup	287

◆ Pn384: Vibration Detection Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 5000	1 mm/s	10	Linear	Immediately	Tuning	257

◆ Pn385: Maximum Motor Speed

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	1 to 100	100 mm/s	50	Linear	After restart	Setup	226

◆ Pn401: First Stage First Torque Reference Filter Time Constant

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65535	0.01 ms	100	All	Immediately	Tuning	429

◆ Pn402: Forward Torque Limit

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 800	1%	800	Rotary	Immediately	Setup	235

Note:

The setting is a percentage of the motor rated torque.

◆ Pn403: Reverse Torque Limit

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 800	1%	800	Rotary	Immediately	Setup	235

Note:

The setting is a percentage of the motor rated torque.

◆ Pn404: Forward External Torque Limit

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 800	1%	100	All	Immediately	Setup	236

Note:

The setting is a percentage of the motor rated torque.

◆ Pn405: Reverse External Torque Limit

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 800	1%	100	All	Immediately	Setup	236

Note:

The setting is a percentage of the motor rated torque.

◆ Pn406: Emergency Stop Torque

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 800	1%	800	All	Immediately	Setup	175

Note:

The setting is a percentage of the motor rated torque.

◆ Pn407: Speed Limit during Torque Control

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 10000	1 min^{-1}	10000	Rotary	Immediately	Setup	221

◆ Pn408: Torque-Related Function Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0000h to 1111h	–	0000h	All	–	Setup	–

Digit	Meaning	When Enabled	Refer-ence
n.□□□X	Notch Filter Selection 1 (Speed Pos Trq)	–	–
0 Default	Disable first stage notch filter.	Immediately	429
1	Enable first stage notch filter.	Immediately	429
n.□□X□	Speed Limit Selection (Speed Pos Trq)	–	–
0 Default	Use the smaller of the maximum motor speed and the setting of Pn407 as the speed limit. Use the smaller of the maximum motor speed and the setting of Pn480 as the speed limit.	After restart	222
1	Use the smaller of the overspeed alarm detection speed and the setting of Pn407 as the speed limit. Use the smaller of the overspeed alarm detection speed and the setting of Pn480 as the speed limit.	After restart	222
n.□X□□	Notch Filter Selection 2 (Speed Pos Trq)	–	–
0 Default	Disable second stage notch filter.	Immediately	429
1	Enable second stage notch filter.	Immediately	429
n.X□□□	Friction Compensation Function Selection (Speed Pos Trq)	–	–
0 Default	Disable friction compensation.	Immediately	416
1	Enable friction compensation.	Immediately	416

◆ Pn409: First Stage Notch Filter Frequency

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	10 to 5000	1 Hz	5000	All	Immediately	Tuning	429

◆ Pn40A: First Stage Notch Filter Q Value

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	50 to 1000	0.01	70	All	Immediately	Tuning	429

◆ Pn40B: First Stage Notch Filter Depth

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 1000	0.001	0	All	Immediately	Tuning	429

◆ Pn40C: Second Stage Notch Filter Frequency

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	10 to 5000	1 Hz	5000	All	Immediately	Tuning	429

◆ Pn40D: Second Stage Notch Filter Q Value

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	50 to 1000	0.01	70	All	Immediately	Tuning	429

◆ Pn40E: Second Stage Notch Filter Depth

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 1000	0.001	0	All	Immediately	Tuning	429

◆ Pn40F: Second Stage Second Torque Reference Filter Frequency

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	100 to 5000	1 Hz	5000	All	Immediately	Tuning	429

◆ Pn410: Second Stage Second Torque Reference Filter Q Value

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	50 to 100	0.01	50	All	Immediately	Tuning	429

◆ Pn412: First Stage Second Torque Reference Filter Time Constant

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 65535	0.01 ms	100	All	Immediately	Tuning	412

◆ Pn416: Torque-Related Function Selections 2

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1111h	–	0000h	All	Immediately	Setup	430

Digit	Meaning
n.□□□X	Notch Filter Selection 3 — Speed Pos Trq
0 Default	Disable third stage notch filter.
1	Enable third stage notch filter.
n.□□X□	Notch Filter Selection 4 — Speed Pos Trq
0 Default	Disable fourth stage notch filter.
1	Enable fourth stage notch filter.
n.□X□□	Notch Filter Selection 5 — Speed Pos Trq
0 Default	Disable fifth stage notch filter.
1	Enable fifth stage notch filter.
n.X□□□	Reserved (Do not change.)

◆ Pn417: Third Stage Notch Filter Frequency

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 5000	1 Hz	5000	All	Immediately	Tuning	430

◆ Pn418: Third Stage Notch Filter Q Value

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	50 to 1000	0.01	70	All	Immediately	Tuning	430

◆ Pn419: Third Stage Notch Filter Depth

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 1000	0.001	0	All	Immediately	Tuning	430

◆ Pn41A: Fourth Stage Notch Filter Frequency

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 5000	1 Hz	5000	All	Immediately	Tuning	430

◆ Pn41B: Fourth Stage Notch Filter Q Value

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	50 to 1000	0.01	70	All	Immediately	Tuning	430

◆ Pn41C: Fourth Stage Notch Filter Depth

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 1000	0.001	0	All	Immediately	Tuning	430

◆ Pn41D: Fifth Stage Notch Filter Frequency

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 5000	1 Hz	5000	All	Immediately	Tuning	430

◆ Pn41E: Fifth Stage Notch Filter Q Value

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	50 to 1000	0.01	70	All	Immediately	Tuning	430

◆ Pn41F: Fifth Stage Notch Filter Depth

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 1000	0.001	0	All	Immediately	Tuning	430

◆ Pn423: Speed Ripple Compensation Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000H to 1112h	–	0002h	–	–	Setup	406

Digit	Meaning	Applicable Motors	When Enabled
n.□□□X	Speed Ripple Compensation Function Selection Speed Pos Trq	–	–
0	Do not execute speed ripple compensation.	Rotary	Immediately
1	Execute speed ripple compensation using the value adjusted by the user.	Rotary	Immediately
2 Default	Execute speed ripple compensation using the default adjustment value.	Rotary	Immediately
n.□□X□	Speed Ripple Compensation Information Disagreement Warning Detection Selection Speed Pos Trq	–	–
0 Default	Detect A.942 alarms.	Rotary	After restart
1	Do not detect A.942 alarms.	Rotary	After restart
n.□X□□	Speed Ripple Compensation Enable Condition Selection Speed Pos Trq	–	–
0 Default	Speed Reference	Rotary	After restart
1	Motor Speed	Rotary	After restart
n.X□□□	Speed Ripple Compensation Function Operation Mode Selection Speed Pos Trq	–	–
0 Default	Execute speed ripple compensation in normal mode.	All	After restart
1	Execute speed ripple compensation in press operation mode.	All	After restart
2	Reserved (Do not use.)	All	After restart
3	Reserved (Do not use.)	All	After restart

◆ Pn424: Torque Limit at Main Circuit Voltage Drop

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 100	1%	50	All	Immediately	Setup	225

Note:

The setting is a percentage of the motor rated torque.

◆ Pn425: Release Time for Torque Limit at Main Circuit Voltage Drop

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 1000	1 ms	100	All	Immediately	Setup	225

◆ Pn426: Torque Feedforward Average Movement Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 5100	0.1 ms	0	All	Immediately	Setup	–

◆ Pn427: Speed Ripple Compensation Enable Speed

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10000	1 min^{-1}	0	Rotary	Immediately	Tuning	406

◆ Pn428: Output Torque Compensation Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0001h	–	0001h	All	After restart	Setup	418

Digit	Meaning
n.□□□X	Output Torque Compensation Function Selection (Speed Pos Trq)
0	Disable output torque compensation.
1 Default	Enable output torque compensation.
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn43D: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	10000	All	–	–	–

◆ Pn456: Sweep Torque Reference Amplitude

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	1 to 800	1%	15	All	Immediately	Tuning	447

◆ Pn460: Notch Filter Adjustment Selections 1

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0101h	–	0101h	All	Immediately	Tuning	321, 353

Digit	Meaning
n.□□□X	Notch Filter Adjustment Selection 1 (Speed Pos Trq)
0	Do not adjust the first stage notch filter automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.
1 Default	Adjust the first stage notch filter automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.
n.□□X□	Reserved (Do not change.)
n.□X□□	Notch Filter Adjustment Selection 2 (Speed Pos Trq)
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.
1 Default	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.X□□□	Reserved (Do not change.)

◆ Pn475: Gravity Compensation-Related Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0001h	–	0000h	All	After restart	Setup	417

Digit	Meaning
n.□□□X	Gravity Compensation Selection (Speed Pos Trq)
0 Default	Disable gravity compensation.
1	Enable gravity compensation.
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn476: Gravity Compensation Torque

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	-1000 to 1000	0.1%	0	All	Immediately	Tuning	417

◆ Pn480: Speed Limit during Force Control

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10000	1 mm/s	10000	Linear	Immediately	Setup	222

◆ Pn481: Polarity Detection Speed Loop Gain

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 20000	0.1 Hz	400	Linear	Immediately	Tuning	–

◆ Pn482: Polarity Detection Speed Loop Integral Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	15 to 51200	0.01 ms	3000	Linear	Immediately	Tuning	–

◆ Pn483: Forward Force Limit

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 800	1%	30	Linear	Immediately	Setup	235

Note:

The setting is a percentage of the motor rated torque.

◆ Pn484: Reverse Force Limit

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 800	1%	30	Linear	Immediately	Setup	235

Note:

The setting is a percentage of the motor rated torque.

◆ Pn485: Polarity Detection Reference Speed

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 100	1 mm/s	20	Linear	Immediately	Tuning	–

◆ Pn486: Polarity Detection Reference Acceleration/Deceleration Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 100	1 ms	25	Linear	Immediately	Tuning	–

◆ Pn487: Polarity Detection Constant Speed Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 300	1 ms	0	Linear	Immediately	Tuning	–

◆ Pn488: Polarity Detection Reference Waiting Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	50 to 500	1 ms	100	Linear	Immediately	Tuning	–

◆ Pn48E: Polarity Detection Range

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	1 to 65535	1 mm	10	Linear	Immediately	Tuning	–

◆ Pn490: Polarity Detection Load Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 20000	1%	100	Linear	Immediately	Tuning	–

◆ Pn495: Polarity Detection Confirmation Force Reference

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 200	1%	100	Linear	Immediately	Tuning	–

◆ Pn498: Polarity Detection Allowable Error Range

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 30	1 deg	10	Linear	Immediately	Tuning	–

◆ Pn49F: Speed Ripple Compensation Enable Speed (Linear)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10000	1 mm/s	0	Linear	Immediately	Tuning	406

◆ Pn502: Rotation Detection Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	1 to 10000	1 min^{-1}	20	Rotary	Immediately	Setup	216

◆ Pn503: Speed Coincidence Detection Signal Output Width

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 100	1 min^{-1}	10	Rotary	Immediately	Setup	217

◆ Pn506: Brake Reference-Servo OFF Delay Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 50	10 ms	0	All	Immediately	Setup	179

◆ Pn507: Brake Reference Output Speed Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10000	1 min^{-1}	100	Rotary	Immediately	Setup	179

◆ Pn508: Servo OFF-Brake Command Waiting Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 100	10 ms	50	All	Immediately	Setup	179

◆ Pn509: Momentary Power Interruption Hold Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	20 to 50000	1 ms	20	All	Immediately	Setup	223

◆ Pn50A: Input Signal Selections 1

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to FFF2h	–	1881h	All	After restart	Setup	–

Digit	Meaning	Reference
n.□□□X	Input Signal Allocation Mode Speed Pos Trq	–
0	Reserved (Do not use.)	210
1 Default	Use Pn50A to Pn516 (Sigma-7S-compatible I/O signal allocation mode).	210
2	Use Pn590 to Pn5BC (SigmaLINK II input signal allocation mode).	210
n.□□X□	Reserved (Do not change.)	–
n.□X□□	Reserved (Do not change.)	–
n.X□□□	P-OT (Forward Drive Prohibit Input) Signal Allocation Speed Pos Trq	–
0	Enable forward drive when CN1-13 input signal is ON (closed).	175
1 Default	Enable forward drive when CN1-7 input signal is ON (closed).	175
2	Enable forward drive when CN1-8 input signal is ON (closed).	175
3	Enable forward drive when CN1-9 input signal is ON (closed).	175
4	Enable forward drive when CN1-10 input signal is ON (closed).	175
5	Enable forward drive when CN1-11 input signal is ON (closed).	175
6	Enable forward drive when CN1-12 input signal is ON (closed).	175
7	Set the signal to always prohibit forward drive.	175
8	Set the signal to always enable forward drive.	175
9	Enable forward drive when CN1-13 input signal is OFF (open).	175
A	Enable forward drive when CN1-7 input signal is OFF (open).	175
B	Enable forward drive when CN1-8 input signal is OFF (open).	175
C	Enable forward drive when CN1-9 input signal is OFF (open).	175
D	Enable forward drive when CN1-10 input signal is OFF (open).	175
E	Enable forward drive when CN1-11 input signal is OFF (open).	175
F	Enable forward drive when CN1-12 input signal is OFF (open).	175

◆ Pn50B: Input Signal Selections 2

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to FFFFh	–	8882h	All	After restart	Setup	–

Digit	Meaning	Reference
n.□□□X	N-OT (Reverse Drive Prohibit Input) Signal Allocation Speed Pos Trq	–
0	Enable reverse drive when CN1-13 input signal is ON (closed).	175
1	Enable reverse drive when CN1-7 input signal is ON (closed).	175
2 Default	Enable reverse drive when CN1-8 input signal is ON (closed).	175
3	Enable reverse drive when CN1-9 input signal is ON (closed).	175
4	Enable reverse drive when CN1-10 input signal is ON (closed).	175
5	Enable reverse drive when CN1-11 input signal is ON (closed).	175
6	Enable reverse drive when CN1-12 input signal is ON (closed).	175
7	Set the signal to always prohibit reverse drive.	175
8	Set the signal to always enable reverse drive.	175
9	Enable reverse drive when CN1-13 input signal is OFF (open).	175
A	Enable reverse drive when CN1-7 input signal is OFF (open).	175
B	Enable reverse drive when CN1-8 input signal is OFF (open).	175
C	Enable reverse drive when CN1-9 input signal is OFF (open).	175
D	Enable reverse drive when CN1-10 input signal is OFF (open).	175
E	Enable reverse drive when CN1-11 input signal is OFF (open).	175
F	Enable reverse drive when CN1-12 input signal is OFF (open).	175
n.□□X□	Reserved (Do not change.)	–
n.□X□□	/P-CL (Forward External Torque Limit Input) Signal Allocation Speed Pos Trq	–
0	Active when CN1-13 input signal is ON (closed).	236
1	Active when CN1-7 input signal is ON (closed).	236
2	Active when CN1-8 input signal is ON (closed).	236
3	Active when CN1-9 input signal is ON (closed).	236
4	Active when CN1-10 input signal is ON (closed).	236
5	Active when CN1-11 input signal is ON (closed).	236
6	Active when CN1-12 input signal is ON (closed).	236
7	The signal is always active.	236
8 Default	The signal is always inactive.	236
9	Active when CN1-13 input signal is OFF (open).	236
A	Active when CN1-7 input signal is OFF (open).	236
B	Active when CN1-8 input signal is OFF (open).	236
C	Active when CN1-9 input signal is OFF (open).	236
D	Active when CN1-10 input signal is OFF (open).	236
E	Active when CN1-11 input signal is OFF (open).	236
F	Active when CN1-12 input signal is OFF (open).	236
n.X□□□	/N-CL (Reverse External Torque Limit Input) Signal Allocation Speed Pos Trq	–
0 to F	The allocations are the same as the /P-CL (Forward External Torque Limit Input) signal allocations.	236

◆ Pn50E: Output Signal Selections 1

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 6666h	–	0000h	All	After restart	Setup	–

Digit	Meaning	Reference
n.□□□X	/COIN (Positioning Completion Output) Signal Allocation Speed Pos Trq	–
0 Default	Disabled (the above signal output is not used).	219
1	Output the signal from the CN1-1 or CN1-2 output terminal.	219
2	Output the signal from the CN1-23 or CN1-24 output terminal.	219
3	Output the signal from the CN1-25 or CN1-26 output terminal.	219
4	Reserved (Do not use.)	219
5	Reserved (Do not use.)	219
6	Reserved (Do not use.)	219
Other values	Disabled (the above signal output is not used).	219
n.□□X□	/V-CMP (Speed Coincidence Detection Output) Signal Allocation Speed Pos Trq	–
0 to 6	The allocations are the same as the /COIN (Positioning Completion Output) signal allocations.	217
n.□X□□	/TGON (Rotation Detection Output) Signal Allocation Speed Pos Trq	–
0 to 6	The allocations are the same as the /COIN (Positioning Completion Output) signal allocations.	216
n.X□□□	/S-RDY (Servo Ready Output) Signal Allocation Speed Pos Trq	–
0 to 6	The allocations are the same as the /COIN (Positioning Completion Output) signal allocations.	217

◆ Pn50F: Output Signal Selections 2

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 6666h	–	0100h	All	After restart	Setup	–

Digit	Meaning	Reference
n.□□□X	/CLT (Torque Limit Detection Output) Signal Allocation Speed Pos Trq	–
0 Default	Disabled (the above signal output is not used).	239
1	Output the signal from the CN1-1 or CN1-2 output terminal.	239
2	Output the signal from the CN1-23 or CN1-24 output terminal.	239
3	Output the signal from the CN1-25 or CN1-26 output terminal.	239
4	Reserved (Do not use.)	239
5	Reserved (Do not use.)	239
6	Reserved (Do not use.)	239
Other values	Disabled (the above signal output is not used).	239
n.□□X□	/VLT (Speed Limit Detection Output) Signal Allocation Speed Pos Trq	–
0 to 6	The allocations are the same as the /CLT (Torque Limit Detection Output) signal allocations.	221
n.□X□□	/BK (Brake Output) Signal Allocation Speed Pos Trq	–
0 to 6	The allocations are the same as the /CLT (Torque Limit Detection Output) signal allocations.	180
n.X□□□	/WARN (Warning Output) Signal Allocation Speed Pos Trq	–
0 to 6	The allocations are the same as the /CLT (Torque Limit Detection Output) signal allocations.	216

◆ Pn510: Output Signal Selections 3

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0666h	–	0000h	All	After restart	Setup	220

Digit	Meaning
n.□□□X	/NEAR (Near Output) Signal Allocation Speed Pos Trq
0 Default	Disabled (the above signal output is not used).
1	Output the signal from the CN1-1 or CN1-2 output terminal.
2	Output the signal from the CN1-23 or CN1-24 output terminal.
3	Output the signal from the CN1-25 or CN1-26 output terminal.
4	Reserved (Do not use.)
5	Reserved (Do not use.)
6	Reserved (Do not use.)
Other values	Disabled (the above signal output is not used).
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn511: Input Signal Selections 5

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to FFFFh	–	6543h	All	After restart	Setup	210

Digit	Meaning
n.□□□X	/DEC (Origin Return Deceleration Switch Input) Signal Allocation Speed Pos Trq
0	Active when CN1-13 input signal is ON (closed).
1	Active when CN1-7 input signal is ON (closed).
2	Active when CN1-8 input signal is ON (closed).
3 Default	Active when CN1-9 input signal is ON (closed).
4	Active when CN1-10 input signal is ON (closed).
5	Active when CN1-11 input signal is ON (closed).
6	Active when CN1-12 input signal is ON (closed).
7	The signal is always active.
8	The signal is always inactive.
9	Active when CN1-13 input signal is OFF (open).
A	Active when CN1-7 input signal is OFF (open).
B	Active when CN1-8 input signal is OFF (open).
C	Active when CN1-9 input signal is OFF (open).
D	Active when CN1-10 input signal is OFF (open).
E	Active when CN1-11 input signal is OFF (open).
F	Active when CN1-12 input signal is OFF (open).
n.□□X□	/EXT1 (External Latch Input 1) Signal Allocation Speed Pos Trq
0 to 3	The signal is always inactive.
4 Default	Active when CN1-10 input signal is ON (closed).
5	Active when CN1-11 input signal is ON (closed).
6	Active when CN1-12 input signal is ON (closed).
7 to C	The signal is always inactive.
D	Active when CN1-10 input signal is OFF (open).
E	Active when CN1-11 input signal is OFF (open).
F	Active when CN1-12 input signal is OFF (open).
n.□X□□	/EXT2 (External Latch Input 2) Signal Allocation Speed Pos Trq
0 to F	The allocations are the same as the /EXT1 (External Latch Input 1) signal allocations.
n.X□□□	/EXT3 (External Latch Input 3) Signal Allocation Speed Pos Trq
0 to F	The allocations are the same as the /EXT1 (External Latch Input 1) signal allocations.

◆ Pn512: Output Signal Inverse Settings

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0000h to 1111h	–	0000h	All	After restart	Setup	213

Digit	Meaning
n.□□□X	Output Signal Inversion for CN1-1 and CN1-2 Terminals Speed Pos Trq
0 Default	The signal is not inverted.
1	The signal is inverted.
n.□□X□	Output Signal Inversion for CN1-23 and CN1-24 Terminals Speed Pos Trq
0 Default	The signal is not inverted.
1	The signal is inverted.
n.□X□□	Output Signal Inversion for CN1-25 and CN1-26 Terminals Speed Pos Trq
0 Default	The signal is not inverted.
1	The signal is inverted.
n.X□□□	Reserved (Do not change.)

◆ Pn514: Output Signal Selections 4

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0000h to 0666h	–	0000h	All	After restart	Setup	469

Digit	Meaning
n.□□□X	Reserved (Do not change.)
n.□□X□	Reserved (Do not change.)
n.□X□□	/PM (Preventative Maintenance Output) Signal Allocation Speed Pos Trq
0 Default	Disabled (the above signal output is not used).
1	Output the signal from the CN1-1 or CN1-2 output terminal.
2	Output the signal from the CN1-23 or CN1-24 output terminal.
3	Output the signal from the CN1-25 or CN1-26 output terminal.
4	Reserved (Do not use.)
5	Reserved (Do not use.)
6	Reserved (Do not use.)
Other values	Disabled (the above signal output is not used).
n.X□□□	Reserved (Do not change.)

◆ Pn516: Input Signal Selections 7

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to FFFFh	–	8888h	All	After restart	Setup	264

Digit	Meaning
n.□□□X	FSTP (Forced Stop Input) Signal Allocation Speed Pos Trq
0	Enable drive when CN1-13 input signal is ON (closed).
1	Enable drive when CN1-7 input signal is ON (closed).
2	Enable drive when CN1-8 input signal is ON (closed).
3	Enable drive when CN1-9 input signal is ON (closed).
4	Enable drive when CN1-10 input signal is ON (closed).
5	Enable drive when CN1-11 input signal is ON (closed).
6	Enable drive when CN1-12 input signal is ON (closed).
7	Set the signal to always prohibit drive (always force the motor to stop).
8 Default	Set the signal to always enable drive (always disable forcing the motor to stop).
9	Enable drive when CN1-13 input signal is OFF (open).
A	Enable drive when CN1-7 input signal is OFF (open).
B	Enable drive when CN1-8 input signal is OFF (open).
C	Enable drive when CN1-9 input signal is OFF (open).
D	Enable drive when CN1-10 input signal is OFF (open).
E	Enable drive when CN1-11 input signal is OFF (open).
F	Enable drive when CN1-12 input signal is OFF (open).
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn518: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
–	–	–	–	All	–	–	–

◆ Pn51B: Motor-Load Position Deviation Overflow Detection Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	0 to 1073741824	1 reference unit	1000	Rotary	Immediately	Setup	487

◆ Pn51E: Position Deviation Overflow Warning Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 100	1%	100	All	Immediately	Setup	315

◆ Pn520: Position Deviation Overflow Alarm Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	1 to 1073741823	1 reference unit	6116694	All	Immediately	Setup	314, 436

◆ Pn522: In-position Range

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	0 to 1073741824	1 reference unit	7	All	Immediately	Setup	219

◆ Pn524: Near Signal Width

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	1 to 1073741824	1 reference unit	1073741824	All	Immediately	Setup	220

◆ Pn526: Position Deviation Overflow Alarm Level at Servo ON

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	1 to 1073741823	1 reference unit	6116694	All	Immediately	Setup	316

◆ Pn528: Position Deviation Overflow Warning Level at Servo ON

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 100	1%	100	All	Immediately	Setup	316

◆ Pn529: Speed Limit Level at Servo ON

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10000	1 min^{-1}	10000	Rotary	Immediately	Setup	316

◆ Pn52A: Multiplier per Fully-closed Rotation

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 100	1%	20	Rotary	Immediately	Tuning	487

◆ Pn52B: Overload Warning Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	1 to 100	1%	20	All	After restart	Setup	186

◆ Pn52C: Base Current Derating at Motor Overload Detection

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 100	1%	100	All	After restart	Setup	186

◆ Pn530: Program Jogging-Related Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0005h	–	0000h	All	Immediately	Setup	294

Digit	Meaning
n.□□□X	Program Jogging Operation Pattern (Speed, Pos, Trq)
0 Default	(Waiting time in Pn535 → Forward by travel distance in Pn531) × Number of movements in Pn536
1	(Waiting time in Pn535 → Reverse by travel distance in Pn531) × Number of movements in Pn536
2	(Waiting time in Pn535 → Forward by travel distance in Pn531) × Number of movements in Pn536 (Waiting time in Pn535 → Reverse by travel distance in Pn531) × Number of movements in Pn536
3	(Waiting time in Pn535 → Reverse by travel distance in Pn531) × Number of movements in Pn536 (Waiting time in Pn535 → Forward by travel distance in Pn531) × Number of movements in Pn536
4	(Waiting time in Pn535 → Forward by travel distance in Pn531 → Waiting time in Pn535 → Reverse by travel distance in Pn531) × Number of movements in Pn536
5	(Waiting time in Pn535 → Reverse by travel distance in Pn531 → Waiting time in Pn535 → Forward by travel distance in Pn531) × Number of movements in Pn536
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn531: Program Jogging Travel Distance

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	1 to 1073741824	1 reference unit	32768	All	Immediately	Setup	294

◆ Pn533: Program Jogging Movement Speed

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	1 to 10000	Rotary: 1 min^{-1} Direct Drive: 0.1 min^{-1}	500	Rotary	Immediately	Setup	294

◆ Pn534: Program Jogging Acceleration/Deceleration Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	2 to 10000	1 ms	100	All	Immediately	Setup	294

◆ Pn535: Program Jogging Waiting Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10000	1 ms	100	All	Immediately	Setup	294

◆ Pn536: Program Jogging Number of Movements

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 1000	1 time	1	All	Immediately	Setup	294

◆ Pn540: Maximum Search Gain

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 4000	0.1 Hz	3000	All	Immediately	Tuning	–

◆ Pn550: Analog Monitor 1 Offset Voltage

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	-10000 to 10000	0.1 V	0	All	Immediately	Setup	464

◆ Pn551: Analog Monitor 2 Offset Voltage

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	-10000 to 10000	0.1 V	0	All	Immediately	Setup	464

◆ Pn552: Analog Monitor 1 Magnification

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	-10000 to 10000	× 0.01	100	All	Immediately	Setup	464

◆ Pn553: Analog Monitor 2 Magnification

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	-10000 to 10000	× 0.01	100	All	Immediately	Setup	464

◆ Pn55A: Power Consumption Monitor Unit Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	1 to 1440	1 min	1	All	Immediately	Setup	–

◆ Pn55C: Specifying Output Status At a Host Comms Error Switch

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0001h	–	0001h	All	After restart	Setup	278

Digit	Meaning
n.□□□X	Specifying Output Status When a Host Communications Error Occurs Function Selection (Speed Pos Trq)
0	Disable the function to specify the output status when a host communications error occurs.
1 Default	Enable the function to specify the output status when a host communications error occurs.
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn55D: Specifying Output Status When a Host Comms Error Occurs

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 001Fh	–	0000h	All	After restart	Setup	278

Bit	Meaning
Bit 0	Use the SO1 output (0: OFF when a host communications error occurs, 1: ON when a host communications occurs)
Bit 1	Use the SO2 output (0: OFF when a host communications error occurs, 1: ON when a host communications occurs)
Bit 2	Use the SO3 output (0: OFF when a host communications error occurs, 1: ON when a host communications occurs)
Bits 3 to 15	Reserved (Do not use.)

◆ Pn560: Residual Vibration Detection Width

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	1 to 3000	0.1%	400	All	Immediately	Setup	382

◆ Pn561: Overshoot Detection Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 1000	1%	100	All	Immediately	Setup	352, 363

◆ Pn562: Setting Gain Ratio

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 100	1%	80	All	Immediately	Tuning	352, 363

◆ Pn56A: Output Signal Reference Method Selections 1

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2222h	–	1111h	All	After restart	Setup	215

Digit	Meaning
n.□□□X	SO1 Output Signal Reference Method Selection Speed Pos Trq
0	Reserved (Do not use.)
1 Default	Output OR of parameter-assigned SO1 signal and signal set by SVCMD_OUT.
2	Output signal set by SCVMD_OUT to SLO1.
n.□□X□	SO2 Output Signal Reference Method Selection Speed Pos Trq
0	Reserved (Do not use.)
1 Default	Output OR of parameter-assigned SO2 signal and signal set by SVCMD_OUT.
2	Output signal set by SCVMD_OUT to SLO2.
n.□X□□	SO3 Output Signal Reference Method Selection Speed Pos Trq
0	Reserved (Do not use.)
1 Default	Output OR of parameter-assigned SO3 signal and signal set by SVCMD_OUT.
2	Output signal set by SCVMD_OUT to SLO3.
n.X□□□	SLO4 Output Signal Reference Method Selection Speed Pos Trq
0	Reserved (Do not use.)
1 Default	Do not output signal to SLO4.
2	Output signal set by SCVMD_OUT to SLO4.

◆ Pn56B: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	0001h	All	–	–	–

◆ Pn581: Zero Speed Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	1 to 10000	1 mm/s	20	Linear	Immediately	Setup	216

◆ Pn582: Speed Coincidence Detection Signal Output Width

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 100	1 mm/s	10	Linear	Immediately	Setup	217

◆ Pn583: Brake Reference Output Speed Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10000	1 mm/s	10	Linear	Immediately	Setup	179

◆ Pn584: Speed Limit Level at Servo ON

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10000	1 mm/s	10000	Linear	Immediately	Setup	316

◆ Pn585: Program Jogging Movement Speed

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	1 to 10000	1 mm/s	50	Linear	Immediately	Setup	294

◆ Pn586: Motor Running Cooling Ratio

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 100	1% / Maximum Motor Speed	0	Linear	Immediately	Setup	–

◆ Pn587: Polarity Detection Execution Selection for Absolute Linear Encoder

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0001h	–	0000h	Linear	Immediately	Setup	171

Digit	Meaning
n.□□□X	Polarity Detection Selection for Absolute Linear Encoder (Speed Pos Trq)
0 Default	Do not detect polarity.
1	Detect polarity.
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn589: SigmaLINK II Node Detection Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	100 to 10000	1 ms	1500	All	After restart	Setup	–

◆ Pn590: P-OT (Forward Drive Prohibit Input) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 3149h	–	1007h	All	After restart	Setup	175, 211

Digit	Meaning
n.□XXX	Allocated Pin Number (Speed, Pos, Trq)
007 Default	Allocate the signal to CN1-7.
008	Allocate the signal to CN1-8.
009	Allocate the signal to CN1-9.
010	Allocate the signal to CN1-10.
011	Allocate the signal to CN1-11.
012	Allocate the signal to CN1-12.
013	Allocate the signal to CN1-13.
100	Allocate the signal to SigmaLINK II Sequence Input 0.
101	Allocate the signal to SigmaLINK II Sequence Input 1.
102	Allocate the signal to SigmaLINK II Sequence Input 2.
103	Allocate the signal to SigmaLINK II Sequence Input 3.
104	Allocate the signal to SigmaLINK II Sequence Input 4.
105	Allocate the signal to SigmaLINK II Sequence Input 5.
106	Allocate the signal to SigmaLINK II Sequence Input 6.
107	Allocate the signal to SigmaLINK II Sequence Input 7.
Other values	Set the signal to always enable forward drive.
n.X□□□	Polarity Selection (Speed, Pos, Trq)
0	Set the signal to always enable forward drive.
1 Default	Active when input signal is ON (closed).
2	Active when input signal is OFF (open).
3	Set the signal to always prohibit forward drive.

◆ Pn591: N-OT (Reverse Drive Prohibit Input) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0000h to 3149h	–	1008h	All	After restart	Setup	175, 211

Digit	Meaning
n.□XXX	Allocated Pin Number (Speed Pos Trq)
007	Allocate the signal to CN1-7.
008 Default	Allocate the signal to CN1-8.
009	Allocate the signal to CN1-9.
010	Allocate the signal to CN1-10.
011	Allocate the signal to CN1-11.
012	Allocate the signal to CN1-12.
013	Allocate the signal to CN1-13.
100	Allocate the signal to SigmaLINK II Sequence Input 0.
101	Allocate the signal to SigmaLINK II Sequence Input 1.
102	Allocate the signal to SigmaLINK II Sequence Input 2.
103	Allocate the signal to SigmaLINK II Sequence Input 3.
104	Allocate the signal to SigmaLINK II Sequence Input 4.
105	Allocate the signal to SigmaLINK II Sequence Input 5.
106	Allocate the signal to SigmaLINK II Sequence Input 6.
107	Allocate the signal to SigmaLINK II Sequence Input 7.
Other values	Set the signal to always enable reverse drive.
n.X□□□	Polarity Selection (Speed Pos Trq)
0	Set the signal to always enable reverse drive.
1 Default	Active when input signal is ON (closed).
2	Active when input signal is OFF (open).
3	Set the signal to always prohibit reverse drive.

◆ Pn592: /DEC (Origin Return Deceleration Switch Input) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 3149h	–	1009h	All	After restart	Setup	–

Digit	Meaning
n.□XXX	Allocated Pin Number Speed Pos Trq
007	Allocate the signal to CN1-7.
008	Allocate the signal to CN1-8.
009 Default	Allocate the signal to CN1-9.
010	Allocate the signal to CN1-10.
011	Allocate the signal to CN1-11.
012	Allocate the signal to CN1-12.
013	Allocate the signal to CN1-13.
100	Allocate the signal to SigmaLINK II Sequence Input 0.
101	Allocate the signal to SigmaLINK II Sequence Input 1.
102	Allocate the signal to SigmaLINK II Sequence Input 2.
103	Allocate the signal to SigmaLINK II Sequence Input 3.
104	Allocate the signal to SigmaLINK II Sequence Input 4.
105	Allocate the signal to SigmaLINK II Sequence Input 5.
106	Allocate the signal to SigmaLINK II Sequence Input 6.
107	Allocate the signal to SigmaLINK II Sequence Input 7.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection Speed Pos Trq
0	The signal is always inactive.
1 Default	Active when input signal is ON (closed).
2	Active when input signal is OFF (open).
3	The signal is always active.

◆ Pn593: /EXT1 (External Latch Input 1) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2149h	–	1010h	All	After restart	Setup	–

Digit	Meaning
n.□XXX	Allocated Pin Number Speed Pos Trq
010 Default	Allocate the signal to CN1-10.
011	Allocate the signal to CN1-11.
012	Allocate the signal to CN1-12.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection Speed Pos Trq
0	The signal is always inactive.
1 Default	Active when input signal is ON (closed).
2	Active when input signal is OFF (open).

◆ Pn594: /EXT2 (External Latch Input 2) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2149h	–	1011h	All	After restart	Setup	–

Digit	Meaning
n.□XXX	Allocated Pin Number (Speed, Pos, Trq)
010	Allocate the signal to CN1-10.
011 Default	Allocate the signal to CN1-11.
012	Allocate the signal to CN1-12.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection (Speed, Pos, Trq)
0	The signal is always inactive.
1 Default	Active when input signal is ON (closed).
2	Active when input signal is OFF (open).

◆ Pn595: /EXT3 (External Latch Input 3) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2149h	–	1012h	All	After restart	Setup	–

Digit	Meaning
n.□XXX	Allocated Pin Number (Speed, Pos, Trq)
010	Allocate the signal to CN1-10.
011	Allocate the signal to CN1-11.
012 Default	Allocate the signal to CN1-12.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection (Speed, Pos, Trq)
0	The signal is always inactive.
1 Default	Active when input signal is ON (closed).
2	Active when input signal is OFF (open).

◆ Pn597: FSTP (Forced Stop Input) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 3049h	–	0000h	All	After restart	Setup	264

Digit	Meaning
n.□XXX	Allocated Pin Number Speed Pos Trq
007	Allocate the signal to CN1-7.
008	Allocate the signal to CN1-8.
009	Allocate the signal to CN1-9.
010	Allocate the signal to CN1-10.
011	Allocate the signal to CN1-11.
012	Allocate the signal to CN1-12.
013	Allocate the signal to CN1-13.
Other values	Set the signal to always enable drive (always disable forcing the motor to stop).
n.X□□□	Polarity Selection Speed Pos Trq
0 Default	Set the signal to always enable drive (always disable forcing the motor to stop).
1	Enable drive when the input signal is ON (closed).
2	Enable drive when the input signal is OFF (open).
3	Set the signal to always prohibit drive (always force the motor to stop).

◆ Pn598: /P-CL (Forward External Torque Limit Input) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 3149h	–	0000h	All	After restart	Setup	211, 236

Digit	Meaning
n.□XXX	Allocated Pin Number (Speed, Pos, Trq)
000 Default	The signal is always inactive.
007	Allocate the signal to CN1-7.
008	Allocate the signal to CN1-8.
009	Allocate the signal to CN1-9.
010	Allocate the signal to CN1-10.
011	Allocate the signal to CN1-11.
012	Allocate the signal to CN1-12.
013	Allocate the signal to CN1-13.
100	Allocate the signal to SigmaLINK II Sequence Input 0.
101	Allocate the signal to SigmaLINK II Sequence Input 1.
102	Allocate the signal to SigmaLINK II Sequence Input 2.
103	Allocate the signal to SigmaLINK II Sequence Input 3.
104	Allocate the signal to SigmaLINK II Sequence Input 4.
105	Allocate the signal to SigmaLINK II Sequence Input 5.
106	Allocate the signal to SigmaLINK II Sequence Input 6.
107	Allocate the signal to SigmaLINK II Sequence Input 7.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection (Speed, Pos, Trq)
0 Default	The signal is always inactive.
1	Active when input signal is ON (closed).
2	Active when input signal is OFF (open).
3	The signal is always active.

◆ Pn599: /N-CL (Reverse External Torque Limit Input) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 3149h	–	0000h	All	After restart	Setup	211, 236

Digit	Meaning
n.□XXX	Allocated Pin Number (Speed, Pos, Trq)
000 Default	The signal is always inactive.
007	Allocate the signal to CN1-7.
008	Allocate the signal to CN1-8.
009	Allocate the signal to CN1-9.
010	Allocate the signal to CN1-10.
011	Allocate the signal to CN1-11.
012	Allocate the signal to CN1-12.
013	Allocate the signal to CN1-13.
100	Allocate the signal to SigmaLINK II Sequence Input 0.
101	Allocate the signal to SigmaLINK II Sequence Input 1.
102	Allocate the signal to SigmaLINK II Sequence Input 2.
103	Allocate the signal to SigmaLINK II Sequence Input 3.
104	Allocate the signal to SigmaLINK II Sequence Input 4.
105	Allocate the signal to SigmaLINK II Sequence Input 5.
106	Allocate the signal to SigmaLINK II Sequence Input 6.
107	Allocate the signal to SigmaLINK II Sequence Input 7.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection (Speed, Pos, Trq)
0 Default	The signal is always inactive.
1	Active when input signal is ON (closed).
2	Active when input signal is OFF (open).
3	The signal is always active.

◆ Pn5B0: /COIN (Positioning Completion Output) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2039h	–	0000h	All	After restart	Setup	214, 219

Digit	Meaning
n.□XXX	Allocated Pin Number (Speed Pos Trq)
001	Allocate the signal to CN1-1.
023	Allocate the signal to CN1-23.
025	Allocate the signal to CN1-25.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection (Speed Pos Trq)
0 Default	The signal is always inactive.
1	Output the above signal.
2	Invert the above signal and output it.

◆ Pn5B1: /V-CMP (Speed Coincidence Detection Output) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2039h	–	0000h	All	After restart	Setup	214, 217

Digit	Meaning
n.□XXX	Allocated Pin Number (Speed Pos Trq)
001	Allocate the signal to CN1-1.
023	Allocate the signal to CN1-23.
025	Allocate the signal to CN1-25.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection (Speed Pos Trq)
0 Default	The signal is always inactive.
1	Output the above signal.
2	Invert the above signal and output it.

◆ Pn5B2: /TGON (Rotation Detection Output) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2039h	–	0000h	All	After restart	Setup	214, 216

Digit	Meaning
n.□XXX	Allocated Pin Number Speed Pos Trq
001	Allocate the signal to CN1-1.
023	Allocate the signal to CN1-23.
025	Allocate the signal to CN1-25.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection Speed Pos Trq
0 Default	The signal is always inactive.
1	Output the above signal.
2	Invert the above signal and output it.

◆ Pn5B3: /S-RDY (Servo Ready Output) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2039h	–	0000h	All	After restart	Setup	214, 217

Digit	Meaning
n.□XXX	Allocated Pin Number Speed Pos Trq
001	Allocate the signal to CN1-1.
023	Allocate the signal to CN1-23.
025	Allocate the signal to CN1-25.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection Speed Pos Trq
0 Default	The signal is always inactive.
1	Output the above signal.
2	Invert the above signal and output it.

◆ Pn5B4: /CLT (Torque Limit Detection Output) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2039h	–	0000h	All	After restart	Setup	214, 239

Digit	Meaning
n.□XXX	Allocated Pin Number (Speed, Pos, Trq)
001	Allocate the signal to CN1-1.
023	Allocate the signal to CN1-23.
025	Allocate the signal to CN1-25.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection (Speed, Pos, Trq)
0 Default	The signal is always inactive.
1	Output the above signal.
2	Invert the above signal and output it.

◆ Pn5B5: /VLT (Speed Limit Detection Output) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2039h	–	0000h	All	After restart	Setup	214, 221

Digit	Meaning
n.□XXX	Allocated Pin Number (Speed, Pos, Trq)
001	Allocate the signal to CN1-1.
023	Allocate the signal to CN1-23.
025	Allocate the signal to CN1-25.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection (Speed, Pos, Trq)
0 Default	The signal is always inactive.
1	Output the above signal.
2	Invert the above signal and output it.

◆ Pn5B6: /BK (Brake Output) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2039h	–	1001h	All	After restart	Setup	180, 214

Digit	Meaning
n.□XXX	Allocated Pin Number (Speed, Pos, Trq)
001 Default	Allocate the signal to CN1-1.
023	Allocate the signal to CN1-23.
025	Allocate the signal to CN1-25.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection (Speed, Pos, Trq)
0	The signal is always inactive.
1 Default	Output the above signal.
2	Invert the above signal and output it.

◆ Pn5B7: /WARN (Warning Output) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2039h	–	0000h	All	After restart	Setup	214, 216

Digit	Meaning
n.□XXX	Allocated Pin Number (Speed, Pos, Trq)
001	Allocate the signal to CN1-1.
023	Allocate the signal to CN1-23.
025	Allocate the signal to CN1-25.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection (Speed, Pos, Trq)
0 Default	The signal is always inactive.
1	Output the above signal.
2	Invert the above signal and output it.

◆ Pn5B8: /NEAR (Near Output) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2039h	–	0000h	All	After restart	Setup	214, 220

Digit	Meaning
n.□XXX	Allocated Pin Number (Speed Pos Trq)
001	Allocate the signal to CN1-1.
023	Allocate the signal to CN1-23.
025	Allocate the signal to CN1-25.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection (Speed Pos Trq)
0 [Default]	The signal is always inactive.
1	Output the above signal.
2	Invert the above signal and output it.

◆ Pn5BC: /PM (Preventative Maintenance Output) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2039h	–	0000h	All	After restart	Setup	469

Digit	Meaning
n.□XXX	Allocated Pin Number (Speed Pos Trq)
001	Allocate the signal to CN1-1.
023	Allocate the signal to CN1-23.
025	Allocate the signal to CN1-25.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection (Speed Pos Trq)
0 [Default]	The signal is always inactive.
1	Output the above signal.
2	Invert the above signal and output it.

◆ Pn5C3: Error Detection Setting

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0011h	–	0000h	All	After restart	Setup	476

Digit	Meaning
n.□□□X	Error Detection Selections Speed Pos Trq
0 Default	Disable error detection.
1	Enable error detection.
n.□□X□	Execution Selection when Error Detection Warning Speed Pos Trq
0 Default	Stop error detection when A.905 (Error Detection Warning) occurs.
1	Do not stop error detection when A.905 (Error Detection Warning) occurs.
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn5C4: Error Detection Sample Data Set 1 Warning Level 1

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10000	0.01%	2000	All	Immediately	Setup	476

◆ Pn5C5: Error Detection Sample Data Set 1 Judgment Level 1

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10000	–	1520	All	Immediately	Setup	476

◆ Pn5C6: Error Detection Sample Data Set 1 Warning Level 2

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10000	0.01%	2000	All	Immediately	Setup	476

◆ Pn5C7: Error Detection Sample Data Set 1 Judgment Level 2

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10000	–	1520	All	Immediately	Setup	476

◆ Pn5C8: Error Detection Sample Data Set 2 Warning Level 1

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10000	0.01%	2000	All	Immediately	Setup	476

◆ Pn5C9: Error Detection Sample Data Set 2 Judgment Level 1

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10000	–	1520	All	Immediately	Setup	476

◆ Pn5CA: Error Detection Sample Data Set 2 Warning Level 2

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10000	0.01%	2000	All	Immediately	Setup	476

◆ Pn5CB: Error Detection Sample Data Set 2 Judgment Level 2

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 10000	–	1520	All	Immediately	Setup	476

◆ Pn5D7: Output Signal Inversion for Triggers at Preset Positions

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0000H to 01F7h	–	0000h	All	After restart	Setup	–

Digit	Meaning
n.□□□X	High-Speed Output Signal Inverse Settings for Triggers at Preset Positions Speed Pos Trq
0 Default	The signal is not inverted.
1	Invert CN1-17, -18 (PAO) and output it.
2	Invert CN1-19, -20 (PBO) and output it.
3	Invert CN1-17, -18 (PAO) and CN1-19, -20 (PBO) and output them.
4	Invert CN1-21, -22 (PCO) and output it.
5	Invert CN1-17, -18 (PAO) and CN1-21, -22 (PCO) and output them.
6	Invert CN1-19, -20 (PBO) and CN1-21, -22 (PCO) and output them.
7	Invert CN1-17, -18 (PAO), CN1-19, -20 (PBO), and CN1-21, -22 (PCO) and output them.
n.□□X□	Normal Output Signal Inverse Settings for Triggers at Preset Positions 1 Speed Pos Trq
0 Default	The signal is not inverted.
1	Invert CN1-1, -2 (SO1) and output it.
2	Invert CN1-23, -24 (SO2) and output it.
3	Invert CN1-1, -2 (SO1) and CN1-23, -24 (SO2) and output them.
4	Invert CN1-25, -26 (SO3) and output it.
5	Invert CN1-1, -2 (SO1) and CN1-25, -26 (SO3) and output them.
6	Invert CN1-23, -24 (SO2) and CN1-25, -26 (SO3) and output them.
7	Invert CN1-1, -2 (SO1), CN1-23, -24 (SO2), and CN1-25, -26 (SO3) and output them.
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn600: Regenerative Resistor Capacity

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to SERVOPACK's maximum applicable motor capacity	10 W	0	All	Immediately	Setup	200

◆ Pn601: Dynamic Brake Resistor Allowable Energy Consumption

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 65535	10 J	0	All	After restart	Setup	–

◆ Pn603: Regenerative Resistance

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65535	10 mΩ	0	All	Immediately	Setup	200

◆ Pn604: Dynamic Brake Resistance

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65535	10 mΩ	0	All	After restart	Setup	–

◆ Pn61A: Overheat Protection Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0003h	–	0000h	Linear	After restart	Setup	267

Digit	Meaning
n.□□□X	Overheat Protection Selections (Speed Pos Trq)
0 (Default)	Disable overheat protection.
1	Use overheat protection in the Yaskawa linear servomotor.
2	Monitor a negative voltage input from a sensor attached to the machine and use overheat protection.
3	Monitor a positive voltage input from a sensor attached to the machine and use overheat protection.
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn61B: Overheat Alarm Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 500	0.01 V	250	All	Immediately	Setup	269

Note:
Valid only when Pn61A is set to n.□□□2 or n.□□□3 (enable overheat protection).

◆ Pn61C: Overheat Warning Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 100	1%	100	All	Immediately	Setup	269

Note:
Valid only when Pn61A is set to n.□□□2 or n.□□□3 (enable overheat protection).

◆ Pn61D: Overheat Alarm Filter Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65535	1 s	0	All	Immediately	Setup	269

Note:
Valid only when Pn61A is set to n.□□□2 or n.□□□3 (enable overheat protection).

◆ Pn621: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
–	–	–	–	All	–	–	–

◆ Pn622: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
–	–	–	–	All	–	–	–

◆ Pn623: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
–	–	–	–	All	–	–	–

◆ Pn624: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
–	–	–	–	All	–	–	–

◆ Pn625: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
–	–	–	–	All	–	–	–

◆ Pn626: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
–	–	–	–	All	–	–	–

◆ Pn627: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
–	–	–	–	All	–	–	–

◆ Pn628: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
–	–	–	–	All	–	–	–

◆ Pn660: Triggers at Preset Positions Switch

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer- ence
2	0000h to 2011h	–	0000h	All	After restart	Setup	–

Digit	Meaning
n.□□□X	Output Unit Setting Speed Pos Trq
0 Default	Set the signal output width as a time [μs].
1	Set the signal output width as a distance [reference units].
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Triggers at Preset Positions Selections Speed Pos Trq
0 Default	Disable triggers at preset positions.
1	Enable triggers at preset positions.
2	Reserved (Do not use.)

◆ Pn800: Communications Controls

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1FF3h	–	1040h	All	Immediately	Setup	–

Digit	Meaning
n.□□□X	MECHATROLINK Communications Check Mask for Debugging (Speed Pos Trq)
0 Default	Do not mask.
1	Ignore A.E60 (MECHATROLINK communications error).
2	Ignore A.E50 (WDT errors).
3	Ignore both A.E60 (MECHATROLINK communications errors) and A.E50 (WDT errors).
n.□□X□	Warning Check Masks (Speed Pos Trq)
0	Do not mask.
1	Ignore A.94□ (data setting warnings).
2	Ignore A.95□ (command warnings).
3	Ignore both A.94□ and A.95□ warnings.
4 Default	Ignore A.96□ (communications warnings).
5	Ignore both A.94□ and A.96□ warnings.
6	Ignore both A.95□ and A.96□ warnings.
7	Ignore A.94□, A.95□, and A.96□ warnings.
8	Ignore A.97□ (data setting warnings).
9	Ignore both A.94□ and A.97□ warnings.
A	Ignore both A.95□ and A.97□ warnings.
B	Ignore A.94□, A.95□, and A.97□ warnings.
C	Ignore both A.96□ and A.97□ warnings.
D	Ignore A.94□, A.96□, and A.97□ warnings.
E	Ignore A.95□, A.96□, and A.97□ warnings.
F	Ignore A.94□, A.95□, A.96□, and A.97□ warnings.
n.□X□□	Reserved (Do not change.)
n.X□□□	Automatic Warning Clear Selection for Debugging (Speed Pos Trq)
0	Retain warnings for debugging.
1 Default	Automatically clear warnings (MECHATROLINK-4 specification).

Parameter Lists

14

◆ Pn801: Application Function Selections 6 (Software Limits)

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0103h	–	0003h	All	Immediately	Setup	234

Digit	Meaning
n.□□□X	Software Limits (Speed, Pos, Trq)
0	Enable both forward and reverse software limits.
1	Disable forward software limit.
2	Disable reverse software limit.
3 Default	Disable both forward and reverse software limits.
n.□□X□	Reserved (Do not change.)
n.□X□□	Software Limit Check for References (Speed, Pos, Trq)
0 Default	Do not perform software limit checks for references.
1	Perform software limit checks for references.
n.X□□□	Reserved (Do not change.)

◆ Pn803: Origin Range

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 250	1 reference unit	10	All	Immediately	Setup	–

◆ Pn804: Forward Software Limit

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	-1073741823 to 1073741823	1 reference unit	1073741823	All	Immediately	Setup	234

◆ Pn806: Reverse Software Limit

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	-1073741823 to 1073741823	1 reference unit	-1073741823	All	Immediately	Setup	234

◆ Pn808: Absolute Encoder Origin Offset

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	-1073741823 to 1073741823	1 reference unit	0	All	Immediately	Setup	197

Note:

Enabled after SENS_ON command execution is completed.

◆ Pn80A: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	100	All	–	–	–

◆ Pn80B: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	100	All	–	–	–

◆ Pn80C: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	0	All	–	–	–

◆ Pn80D: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	100	All	–	–	–

◆ Pn80E: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	100	All	–	–	–

◆ Pn80F: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	0	All	–	–	–

◆ Pn810: Exponential Acceleration/ Deceleration Bias

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65535	100 reference units/s	0	All	Immediately	Setup	–

Note:

The value is updated only when the reference is stopped (DEN = 1).

◆ Pn811: Exponential Acceleration/Deceleration Time Constant

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 5100	0.1 ms	0	All	Immediately	Setup	–

Note:

The value is updated only when the reference is stopped (DEN = 1).

◆ Pn812: Movement Average Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 5100	0.1 ms	0	All	Immediately	Setup	–

Note:

The value is updated only when the reference is stopped (DEN = 1).

◆ Pn814: External Positioning Final Travel Distance

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
4	-1073741823 to 1073741823	1 reference unit	100	All	Immediately	Setup	–

◆ Pn816: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	–	–	0000h	All	–	–	–

◆ Pn817: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	–	–	0	All	–	–	–

◆ Pn818: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	–	–	0	All	–	–	–

◆ Pn819: Final Travel Distance for Origin Return

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
4	-1073741823 to 1073741823	1 reference unit	100	All	Immediately	Setup	–

◆ Pn81E: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	–	–	0000h	All	–	–	–

◆ Pn81F: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	–	–	0010h	All	–	–	–

◆ Pn820: Forward Latching Area

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
4	-2147483648 to 2147483647	1 reference unit	0	All	Immediately	Setup	–

◆ Pn822: Reverse Latching Area

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
4	-2147483648 to 2147483647	1 reference unit	0	All	Immediately	Setup	–

◆ Pn824: Option Monitor 1 Selection

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to FFFFh	–	0000h	–	Immediately	Setup	–

- High-Speed Monitor Region

Set Value	Meaning	Applicable Motors
0000h Default	Motor speed [overspeed detection speed / 1000000h]	All
0001h	Speed reference [overspeed detection speed / 1000000h]	All
0002h	Torque [maximum torque] / 1000000h]	All
0003h	Position deviation (lower 32 bits) [reference units]	All
0004h	Position deviation (upper 32 bits) [reference units]	All
000Ah	PG count (lower 32 bits) [reference units]	All
000Bh	PG count (upper 32 bits) [reference units]	All
000Ch	FPG count (lower 32 bits) [reference units]	All
000Dh	FPG count (upper 32 bits) [reference units]	All
0055h	Estimated Vibration [overspeed detection speed / 1000000h]	All
0056h	Estimated External Disturbance Torque [maximum torque / 1000000h]	All
0113h	File Upload Counter	All
0114h	File Upload Data	All
0115h	Error Detection Trace Counter	All
0116h	Error Detection Trace Error Rate	All
0200h	SigmaLINK II Response Data 1	All
0201h	SigmaLINK II Response Data 2	All
0202h	SigmaLINK II Response Data 3	All
0203h	SigmaLINK II Response Data 4	All
0204h	SigmaLINK II Response Data 5	All
0205h	SigmaLINK II Response Data 6	All
0206h	SigmaLINK II Response Data 7	All
0207h	SigmaLINK II Response Data 8	All
0210h	SigmaLINK II Command Data 1	All
0211h	SigmaLINK II Command Data 2	All
0212h	SigmaLINK II Command Data 3	All
0213h	SigmaLINK II Command Data 4	All
0240h	Σ-LINK II Data Status Information	All

- Low-Speed Monitor Region

Set Value	Meaning	Applicable Motors
0010h	Un000: Motor Speed [min^{-1}]	All
0011h	Un001: Speed Reference [min^{-1}]	All
0012h	Un002: Torque Reference [%]	All

Set Value	Meaning	Applicable Motors
0013h	Un003: Rotational Angle 1 [encoder pulses] Number of encoder pulses from origin within one encoder rotation displayed in decimal	All
	Un003: Electrical Angle 1 [linear encoder pulses] Linear encoder pulses from the polarity origin displayed in decimal	
0014h	Un004: Rotational Angle 2 [deg] Electrical angle from polarity origin	All
	Un004: Electrical Angle 2 [deg] Electrical angle from polarity origin	
0015h	Un005: Input Signal Monitor	All
0016h	Un006: Output Signal Monitor	All
0017h	Un007: Input Reference Pulse Speed [min^{-1}]	All
0018h	Un008: Position Deviation [reference units]	All
0019h	Un009: Accumulated Load Ratio [%]	All
001Ah	Un00A: Regenerative Load Ratio [%]	All
001Bh	Un00B: Dynamic Brake Resistor Power Consumption [%]	All
001Ch	Un00C: Input Reference Pulse Counter [reference units]	All
001Dh	Un00D: Feedback Pulse Counter [encoder pulses]	All
001Eh	Un00E: Fully-closed Loop Feedback Pulse Counter [external encoder resolution]	Rotary
0025h	Initial absolute position data (lower 32 bits) [pulses]	Linear
0026h	Initial absolute position data (upper 32 bits) [pulses]	Linear
0040h	Un025: SERVOPACK Installation Environment Monitor	All
0041h	Un026: Servomotor Installation Environment Monitor	All
0042h	Un027: Built-in Fan Remaining Life Ratio	All
0043h	Un028: Capacitor Remaining Life Ratio	All
0044h	Un029: Surge Prevention Circuit Remaining Life Ratio	All
0045h	Un02A: Dynamic Brake Circuit Remaining Life Ratio	All
0046h	Un032: Instantaneous Power	All
0047h	Un033: Power Consumption	All
0048h	Un034: Cumulative Power Consumption	All
004Dh	Un173: Temperature Margin until SERVOPACK Overheats	All
0058h	Un13C: Margin until Regenerative Overload	All
005Ah	Un13E: Margin until Undervoltage	All
005Bh	Un13F: Margin until Overvoltage	All
0060h	Un023: Main Circuit DC Voltage	All
0070h	Un078: Maximum Value of Amplitude of Estimated Vibration [min^{-1}]	All
0071h	Un07A: Maximum Value of Estimated External Disturbance Torque [%]	All
0072h	Un07B: Minimum Value of Estimated External Disturbance Torque [%]	All
0073h	Un147: Number of MECHATROLINK Communications Errors [times]	All
0074h	Un104: Number of Serial Encoder Communications Errors [times]	All
0075h	Un105: Settling Time [0.1 ms]	All
0076h	Un106: Amount of Overshoot [reference units]	All
0077h	Un107: Residual Vibration Frequency [0.1 Hz]	All

Set Value	Meaning	Applicable Motors
0079h	Un174: Temperature Margin until Servomotor Overheats [°C]	All
007Ah	Un145: Maximum Value of Accumulated Load Ratio [%]	All
007Bh	Un14E: Margin until Overload [0.01 %]	All
007Ch	Un07C: Identified Moment of Inertia Ratio	All
007Eh	Un108: Maximum Settling Time [0.1ms]	All
007Fh	Un109: Maximum Amount of Overshoot [reference units]	All
0104h	Un177: Encoder Power Supplied Time	Rotary
0106h	Un17A: Encoder Power Supply Voltage	Rotary
0107h	Un17B: Encoder Battery Voltage	Rotary
010Ch	Un181: Motor Total Number of Rotations	Rotary
010Dh	Un183: Maintenance Prediction Monitor - Bearings	Rotary
010Eh	Un184: Maintenance Prediction Monitor - Oil Seal	Rotary
0126h	Un190: Motor Vibration in X-Axis Direction	Rotary
0127h	Un191: Motor Vibration in Y-Axis Direction	Rotary
0128h	Un192: Motor Vibration in Z-Axis Direction	Rotary
0129h	Un193: Motor Vibration XYZ Composite Value	Rotary
012Ah	Un194: Maximum Motor Vibration	Rotary

- Low-Speed Monitor Region (Communications Module Only)

Set Value	Meaning	Applicable Motors
0080h	Previous value of latched feedback position (LPOS1) [reference units]	All
0081h	Previous value of latched feedback position (LPOS2) [reference units]	All
0084h	Continuous Latch Status (EX STATUS)	All

- All Areas

Set Value	Meaning	Applicable Motors
Other values	Reserved (Do not use.)	All

◆ Pn825: Option Monitor 2 Selection

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to FFFFh	–	0000h	–	Immediately	Setup	–

Set Value	Meaning
0000h to FFFFh	The settings are the same as those for the Option Monitor 1 Selection.

Parameter Lists

14

◆ Pn827: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	–	–	100	All	–	–	–

◆ Pn829: SVOFF Waiting Time (for SVOFF at Deceleration to Stop)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 65535	10 ms	0	All	Immediately	Setup	–

Note:

Change the setting when the reference is stopped (while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

◆ Pn82A: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	–	–	1813h	All	–	–	–

◆ Pn82B: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	–	–	1D1Ch	All	–	–	–

◆ Pn82C: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	–	–	1F1Eh	All	–	–	–

◆ Pn82D: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	–	–	0000h	All	–	–	–

◆ Pn82E: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	–	–	0000h	All	–	–	–

◆ Pn833: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	–	–	0001h	All	–	–	–

◆ Pn834: First Stage Linear Acceleration Constant

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
4	1 to 4294967295	10000 reference units/s^2	100	All	Immediately	Setup	–

Note:

Change the setting when the reference is stopped (while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

◆ Pn836: Second Stage Linear Acceleration Constant

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
4	1 to 4294967295	10000 reference units/s^2	100	All	Immediately	Setup	–

Note:

Change the setting when the reference is stopped (while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

◆ Pn838: Acceleration Constant Switching Speed

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
4	0 to 2097152000	1 reference unit/s	0	All	Immediately	Setup	–

Note:

Change the setting when the reference is stopped (while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

◆ Pn83A: First Stage Linear Deceleration Constant

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
4	1 to 4294967295	10000 reference units/s^2	100	All	Immediately	Setup	–

Note:

Change the setting when the reference is stopped (while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

◆ Pn83C: Second Stage Linear Deceleration Constant

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
4	1 to 4294967295	10000 reference units/s^2	100	All	Immediately	Setup	–

Note:

Change the setting when the reference is stopped (while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

◆ Pn83E: Deceleration Constant Switching Speed

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
4	0 to 2097152000	1 reference unit/s	0	All	Immediately	Setup	–

Note:

Change the setting when the reference is stopped (while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

◆ Pn840: Linear Deceleration Constant for Stopping

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
4	1 to 4294967295	10000 reference units/s^2	100	All	Immediately	Setup	–

Note:

Change the setting when the reference is stopped (while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

◆ Pn842: Origin Approach Speed 1

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	0 to 20971520	100 reference units/s	50	All	Immediately	Setup	–

Note:

Change the setting when the reference is stopped (while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

◆ Pn844: Origin Approach Speed 2

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	0 to 20971520	100 reference units/s	5	All	Immediately	Setup	–

Note:

Change the setting when the reference is stopped (while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

◆ Pn846: POSING Command S-curve Acceleration/Deceleration Rate

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 50	1%	0	All	Immediately	Setup	–

Note:

Change the setting when the reference is stopped (while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

◆ Pn850: Number of Latch Sequences

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 8	–	0	All	Immediately	Setup	–

◆ Pn851: Continuous Latch Sequence Count

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 255	–	0	All	Immediately	Setup	–

◆ Pn852: Latch Sequence 1 to 4 Settings

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 3333h	–	0000h	All	Immediately	Setup	–

Digit	Meaning
n.□□□X	Latch Sequence 1 Signal Selection (Speed Pos Trq)
0 (Default)	Phase C
1	EXT1 signal
2	EXT2 signal
3	EXT3 signal
n.□□X□	Latch Sequence 2 Signal Selection (Speed Pos Trq)
0 to 3	The settings are the same as those for the Latch Sequence 1 Signal Selection.
n.□X□□	Latch Sequence 3 Signal Selection (Speed Pos Trq)
0 to 3	The settings are the same as those for the Latch Sequence 1 Signal Selection.
n.X□□□	Latch Sequence 4 Signal Selection (Speed Pos Trq)
0 to 3	The settings are the same as those for the Latch Sequence 1 Signal Selection.

◆ Pn853: Latch Sequence 5 to 8 Settings

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0000h to 3333h	–	0000h	All	Immediately	Setup	–

Digit	Meaning
n.□□□X	Latch Sequence 5 Signal Selection (Speed Pos Trq)
0 Default	Phase C
1	EXT1 signal
2	EXT2 signal
3	EXT3 signal
n.□□X□	Latch Sequence 6 Signal Selection (Speed Pos Trq)
0 to 3	The settings are the same as those for the Latch Sequence 5 Signal Selection.
n.□X□□	Latch Sequence 7 Signal Selection (Speed Pos Trq)
0 to 3	The settings are the same as those for the Latch Sequence 5 Signal Selection.
n.X□□□	Latch Sequence 8 Signal Selection (Speed Pos Trq)
0 to 3	The settings are the same as those for the Latch Sequence 5 Signal Selection.

◆ Pn860: SVCMD_IN Input Signal Monitor Allocations 1

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0000h to 1717h	–	0000h	All	Immediately	Setup	–

Digit	Meaning
n.□□□X	Input Signal Monitor Allocation for CN1-13 (SVCMD_IN) (Speed Pos Trq)
0 Default	Allocate bit 24 (IO_STS1) to CN1-13 input signal monitor.
1	Allocate bit 25 (IO_STS2) to CN1-13 input signal monitor.
2	Allocate bit 26 (IO_STS3) to CN1-13 input signal monitor.
3	Allocate bit 27 (IO_STS4) to CN1-13 input signal monitor.
4	Allocate bit 28 (IO_STS5) to CN1-13 input signal monitor.
5	Allocate bit 29 (IO_STS6) to CN1-13 input signal monitor.
6	Allocate bit 30 (IO_STS7) to CN1-13 input signal monitor.
7	Allocate bit 31 (IO_STS8) to CN1-13 input signal monitor.
n.□□X□	CN1-13 Input Signal Monitor Enable/Disable Selection (Speed Pos Trq)
0 Default	Disable allocation for CN1-13 input signal monitor.
1	Enable allocation for CN1-13 input signal monitor.
n.□X□□	Input Signal Monitor Allocation for CN1-7 (SVCMD_IN) (Speed Pos Trq)
0 to 7	The settings are the same as the CN1-13 allocations.
n.X□□□	CN1-7 Input Signal Monitor Enable/Disable Selection (Speed Pos Trq)
0 Default	Disable allocation for CN1-7 input signal monitor.
1	Enable allocation for CN1-7 input signal monitor.

◆ Pn861: SVCMD_IN Input Signal Monitor Allocations 2

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1717h	–	0000h	All	Immediately	Setup	–

Digit	Meaning
n.□□□X	Input Signal Monitor Allocation for CN1-8 (SVCMD_IN) Speed Pos Trq
0 to 7	The settings are the same as the CN1-13 allocations.
n.□□X□	CN1-8 Input Signal Monitor Enable/Disable Selection Speed Pos Trq
0 Default	Disable allocation for CN1-8 input signal monitor.
1	Enable allocation for CN1-8 input signal monitor.
n.□X□□	Input Signal Monitor Allocation for CN1-9 (SVCMD_IN) Speed Pos Trq
0 to 7	The settings are the same as the CN1-13 allocations.
n.X□□□	CN1-9 Input Signal Monitor Enable/Disable Selection Speed Pos Trq
0 Default	Disable allocation for CN1-9 input signal monitor.
1	Enable allocation for CN1-9 input signal monitor.

◆ Pn862: SVCMD_IN Input Signal Monitor Allocations 3

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1717h	–	0000h	All	Immediately	Setup	–

Digit	Meaning
n.□□□X	Input Signal Monitor Allocation for CN1-10 (SVCMD_IN) Speed Pos Trq
0 to 7	The settings are the same as the CN1-13 allocations.
n.□□X□	CN1-10 Input Signal Monitor Enable/Disable Selection Speed Pos Trq
0 Default	Disable allocation for CN1-10 input signal monitor.
1	Enable allocation for CN1-10 input signal monitor.
n.□X□□	Input Signal Monitor Allocation for CN1-11 (SVCMD_IN) Speed Pos Trq
0 to 7	The settings are the same as the CN1-13 allocations.
n.X□□□	CN1-11 Input Signal Monitor Enable/Disable Selection Speed Pos Trq
0 Default	Disable allocation for CN1-11 input signal monitor.
1	Enable allocation for CN1-11 input signal monitor.

◆ Pn863: SVCMD_IN Input Signal Monitor Allocations 4

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1717h	–	0000h	All	Immediately	Setup	–

Digit	Meaning
n.□□□X	Input Signal Monitor Allocation for CN1-12 (SVCMD_IN) Speed Pos Trq
0 to 7	The settings are the same as the CN1-13 allocations.
n.□□X□	CN1-12 Input Signal Monitor Enable/Disable Selection Speed Pos Trq
0 Default	Disable allocation for CN1-12 input signal monitor.
1	Enable allocation for CN1-12 input signal monitor.
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn868: SVCMD_IN Output Signal Monitor Allocations 1

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1717h	–	0000h	All	Immediately	Setup	–

Digit	Meaning
n.□□□X	Output Signal Monitor Allocation for CN1-1 and CN1-2 (SVCMD_IN) Speed Pos Trq
0 Default	Allocate bit 24 (IO_STS1) to CN1-1/CN1-2 output signal monitor.
1	Allocate bit 25 (IO_STS2) to CN1-1/CN1-2 output signal monitor.
2	Allocate bit 26 (IO_STS3) to CN1-1/CN1-2 output signal monitor.
3	Allocate bit 27 (IO_STS4) to CN1-1/CN1-2 output signal monitor.
4	Allocate bit 28 (IO_STS5) to CN1-1/CN1-2 output signal monitor.
5	Allocate bit 29 (IO_STS6) to CN1-1/CN1-2 output signal monitor.
6	Allocate bit 30 (IO_STS7) to CN1-1/CN1-2 output signal monitor.
7	Allocate bit 31 (IO_STS8) to CN1-1/CN1-2 output signal monitor.
n.□□X□	CN1-1/CN1-2 Output Signal Monitor Enable/Disable Selection Speed Pos Trq
0 Default	Disable allocation for CN1-1/CN1-2 output signal monitor.
1	Enable allocation for CN1-1/CN1-2 output signal monitor.
n.□X□□	Output Signal Monitor Allocation for CN1-23 and CN1-24 (SVCMD_IN) Speed Pos Trq
0 to 7	The settings are the same as the CN1-1/CN1-2 allocations.
n.X□□□	CN1-23/CN1-24 Output Signal Monitor Enable/Disable Selection Speed Pos Trq
0 Default	Disable allocation for CN1-23/CN1-24 output signal monitor.
1	Enable allocation for CN1-23/CN1-24 output signal monitor.

◆ Pn869: SVCMD_IN Output Signal Monitor Allocations 2

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0000h to 1717h	–	0000h	All	Immediately	Setup	–

Digit	Meaning
n.□□□X	Output Signal Monitor Allocation for CN1-25 and CN1-26 (SVCMD_IN) Speed Pos Trq
0 to 7	The settings are the same as the CN1-1/CN1-2 allocations.
n.□□X□	CN1-25/CN1-26 Output Signal Monitor Enable/Disable Selection Speed Pos Trq
0 Default	Disable allocation for CN1-25/CN1-26 output signal monitor.
1	Enable allocation for CN1-25/CN1-26 output signal monitor.
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn880: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	–	–	–	All	–	–	–

◆ Pn881: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	–	–	–	All	–	–	–

◆ Pn882: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	–	–	–	All	–	–	–

◆ Pn883: Communications Cycle Setting Monitor [transmission cycles] (for maintenance, read only)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 32	–	–	All	–	Setup	–

◆ Pn884: Communications Controls 2

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0000h to 0001h	–	0000h	All	Immediately	Setup	–

Digit	Meaning
n.□□□X	MECHATROLINK Communications Error Holding Brake Signal Setting Speed Pos Trq
0 Default	Maintain the status set by the BRK_ON or BRK_OFF command when a MECHATROLINK communications error occurs.
1	Apply the holding brake when a MECHATROLINK communications error occurs.
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn885: Reserved (Do not change.)

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	–	–	0000h	All	–	–	–

◆ Pn886: S-curve Maximum Acceleration/Deceleration Rate

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
4	1h to FFFFFFFFh	–	FFFFFFFFh	All	Immediately	Setup	–

◆ Pn88A: MECHATROLINK Receive Error Counter Monitor (for maintenance, read only)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 65535	–	0	All	–	Setup	–

14.3 List of Servo Parameters: MECHATROLINK-III Communications References

The following table lists the parameters.

Note:

Do not change the following parameters from their default settings.

- Reserved parameters
- Parameters not given in this manual
- Parameters that are not valid for the servomotor that you are using, as given in the parameter table

◆ Pn000: Basic Function Selections 0

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 10B1h	–	0000h	All	After restart	Setup	–

Digit	Meaning		Reference
n.□□□X	Rotation Direction Selection Movement Direction Selection	Speed Pos Trq	–
0 Default	Use CCW as the forward direction. Use the direction in which the linear encoder counts up as the forward direction.		161
1	Use CW as the forward direction. (Reverse Rotation Mode) Use the direction in which the linear encoder counts down as the forward direction. (Reverse Movement Mode)		161
n.□□X□	Reserved (Do not change.)		–
n.□X□□	Reserved (Do not change.)		–
n.X□□□	Rotary/Linear Servomotor Startup Selection When Encoder Is Not Connected	Speed Pos Trq	–
0 Default	When an encoder is not connected, start as SERVOPACK for rotary servomotor.		160
1	When an encoder is not connected, start as SERVOPACK for linear servomotor.		160

◆ Pn001: Application Function Selections 1

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1142h	–	0000h	All	After restart	Setup	–

Digit	Meaning	Reference
n.□□□X	Motor Stopping Method for Servo OFF and Group 1 Alarms Speed Pos Trq	–
0 Default	Stop the motor by applying the dynamic brake.	183
1	Stop the motor by the applying dynamic brake and then release the dynamic brake.	183
2	Coast the motor to a stop without the dynamic brake.	183
n.□□X□	Overtravel Stopping Method Speed Pos Trq	–
0 Default	Apply the dynamic brake or coast the motor to a stop (use the stopping method set in Pn001 = n.□□□X).	175
1	Decelerate the motor to a stop using the torque set in Pn406 as the maximum torque and then servo-lock the motor.	175
2	Decelerate the motor to a stop using the torque set in Pn406 as the maximum torque and then let the motor coast.	175
3	Decelerate the motor to a stop using the deceleration time set in Pn30A and then servo-lock the motor.	175
4	Decelerate the motor to a stop using the deceleration time set in Pn30A and then let the motor coast.	175
n.□X□□	Main Circuit Power Supply AC/DC Input Selection Speed Pos Trq	–
0 Default	Input AC power as the main circuit power supply using the L1, L2, and L3 terminals (do not use shared converter).	158
1	Input DC as the main circuit power supply using the B1/⊕, ⊖2 terminals or the B1 and ⊖2 terminals (use an external converter or the shared converter).	158
n.X□□□	Reserved (Do not change.)	–

Parameter Lists

14

◆ Pn002: Application Function Selections 2

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 4213h	–	0011h	–	After restart	Setup	–

Digit	Meaning	Applicable Motors	Reference
n.□□□X	MECHATROLINK Command Position and Speed Control Option Speed Pos Trq	–	–
0	Reserved (Do not use.)	All	–
1 Default	Use TLIM as the torque limit.	All	–
2	Reserved (Do not use.)	All	–
3	Reserved (Do not use.)	All	–
n.□□X□	Torque Control Option Speed Pos Trq	–	–
0	Reserved (Do not use.)	All	–
1 Default	Use the speed limit for torque control (VLIM) as the speed limit.	All	–
n.□X□□	Encoder Usage Speed Pos Trq	–	–
0 Default	Use the encoder according to encoder specifications.	All	240
1	Use the encoder as an incremental encoder.	All	240
2	Use the encoder as a single-turn absolute encoder.	Rotary	240
n.X□□□	External Encoder Usage Speed Pos Trq	–	–
0 Default	Do not use an external encoder.	Rotary	485
1	The external encoder moves in the forward direction for CCW motor rotation.	Rotary	485
2	Reserved (Do not use.)	Rotary	485
3	The external encoder moves in the reverse direction for CCW motor rotation.	Rotary	485
4	Reserved (Do not use.)	Rotary	485

◆ Pn006: Application Function Selections 6

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 105Fh	–	0002h	All	Immediately	Setup	463

Digit	Meaning
n.□□XX	Analog Monitor 1 Signal Selection (Speed, Pos, Trq)
00	Motor speed (1 V/1000 min^{-1})
	Motor speed (1 V/1000 mm/s)
01	Speed reference (1 V/1000 min^{-1})
	Speed reference (1 V/1000 mm/s)
02 Default	Torque reference (1 V/100% rated torque)
	Force reference (1 V/100% rated force)
03	Position deviation (0.05 V/reference unit)
04	Position amplifier deviation (after electronic gear) (0.05 V/encoder pulse unit)
	Position amplifier deviation (after electronic gear) (0.05 V/linear encoder pulse unit)
05	Position reference speed (1 V/1000 min^{-1})
	Position reference speed (1 V/1000 mm/s)
06	Reserved (Do not use.)
07	Position deviation between motor and load (0.01 V/reference unit)
08	Positioning completion (positioning completed: 5 V, positioning not completed: 0 V)
09	Speed feedforward (1 V/1000 min^{-1})
	Speed feedforward (1 V/1000 mm/s)
0A	Torque feedforward (1 V/100% rated torque)
	Force feedforward (1 V/100% rated force)
0B	Active gain (gain 1: 1 V, gain 2: 2 V) 2 V)
0C	Completion of position reference distribution (completed: 5 V, not completed: 0 V)
0D	External encoder speed (1 V/1000 min^{-1}: value at the motor shaft)
0E	Reserved (Do not use.)
0F	Reserved (Do not use.)
10	Main circuit DC voltage
11 to 5F	Reserved (Do not use.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn007: Application Function Selections 7

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 105Fh	–	0000h	All	Immediately	Setup	463

Digit	Meaning
n.□□XX	Analog Monitor 2 Signal Selection Speed Pos Trq
00 Default	Motor speed (1 V/1000 min^{-1})
	Motor speed (1 V/1000 mm/s)
01	Speed reference (1 V/1000 min^{-1})
	Speed reference (1 V/1000 mm/s)
02	Torque reference (1 V/100% rated torque)
	Force reference (1 V/100% rated force)
03	Position deviation (0.05 V/reference unit)
04	Position amplifier deviation (after electronic gear) (0.05 V/encoder pulse unit)
	Position amplifier deviation (after electronic gear) (0.05 V/linear encoder pulse unit)
05	Position reference speed (1 V/1000 min^{-1})
	Position reference speed (1 V/1000 mm/s)
06	Reserved (Do not use.)
07	Position deviation between motor and load (0.01 V/reference unit)
08	Positioning completion (positioning completed: 5 V, positioning not completed: 0 V)
09	Speed feedforward (1 V/1000 min^{-1})
	Speed feedforward (1 V/1000 mm/s)
0A	Torque feedforward (1 V/100% rated torque)
	Force feedforward (1 V/100% rated force)
0B	Active gain (gain 1: 1 V, gain 2: 2 V) 2 V)
0C	Completion of position reference distribution (completed: 5 V, not completed: 0 V)
0D	External encoder speed (1 V/1000 min^{-1}: value at the motor shaft)
0E	Reserved (Do not use.)
0F	Reserved (Do not use.)
10	Main circuit DC voltage
11 to 5F	Reserved (Do not use.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn008: Application Function Selections 8

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 7121h	–	4000h	Rotary	After restart	Setup	–

Digit	Meaning	Reference
n.□□□X	Low Battery Voltage Alarm/Warning Selection (Speed Pos Trq)	–
0 Default	Output alarm (A.830) for low battery voltage.	540
1	Output warning (A.930) for low battery voltage.	540
n.□□X□	Function Selection for Undervoltage (Speed Pos Trq)	–
0 Default	Do not detect undervoltage warning.	224
1	Detect undervoltage warning and limit torque at host controller.	224
2	Detect undervoltage warning and limit torque with Pn424 and Pn425 (i.e., only in SERVOPACK).	224
n.□X□□	Warning Detection Selection (Speed Pos Trq)	–
0 Default	Detect warnings.	581
1	Do not detect warnings except for A.971.	581
n.X□□□	Reserved (Do not change.)	–

◆ Pn009: Application Function Selections 9

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0141h	–	0040h	All	After restart	Tuning	–

Digit	Meaning	Reference
n.□□□X	Reserved (Do not change.)	–
n.□□X□	Current Control Mode Selection (Speed Pos Trq)	–
0	Use current control mode 1.	419
1	• SERVOPACK Models SGDXS-R70A, -R90A, -1R6A, -2R8A, - 3R8A, -5R5A, -7R6A: Use current control mode 1. • SERVOPACK Models SGDXS-120A, -180A, -200A, -330A, -470A, -550A, -590A, -780A: Use current control mode 2. (For noise reduction when the motor is stopped)	419
2	Use current control mode 2. (For noise reduction when the motor is stopped)	419
3	Use current control mode 3. (For noise reduction when the motor is operating at high speed)	419
4 Default	Use current control mode 4. (For noise reduction when the motor is stopped and operating at high speed)	419
n.□X□□	Speed Detection Method Selection (Speed Pos Trq)	–
0 Default	Use speed detection 1.	419
1	Use speed detection 2.	419
n.X□□□	Reserved (Do not change.)	–

◆ Pn00A: Application Function Selections A

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1244h	–	0001h	All	After restart	Setup	–

Digit	Meaning	Reference
n.□□□X	Motor Stopping Method for Group 2 Alarms (Speed Pos Trq)	–
0	Apply the dynamic brake or coast the motor to a stop (use the stopping method set in Pn001 = n.□□□X).	184
1 Default	Decelerate the motor to a stop using the torque set in Pn406 as the maximum torque. Use the setting of Pn001 = n.□□□X for the status after stopping.	184
2	Decelerate the motor to a stop using the torque set in Pn406 as the maximum torque and then let the motor coast.	184
3	Decelerate the motor to a stop using the deceleration time set in Pn30A. Use the setting of Pn001 = n.□□□X for the status after stopping.	184
4	Decelerate the motor to a stop using the deceleration time set in Pn30A and then let the motor coast.	184
n.□□X□	Stopping Method for Forced Stops (Speed Pos Trq)	–
0 Default	Apply the dynamic brake or coast the motor to a stop (use the stopping method set in Pn001 = n.□□□X).	264
1	Decelerate the motor to a stop using the torque set in Pn406 as the maximum torque. Use the setting of Pn001 = n.□□□X for the status after stopping.	264
2	Decelerate the motor to a stop using the torque set in Pn406 as the maximum torque and then let the motor coast.	264
3	Decelerate the motor to a stop using the deceleration time set in Pn30A. Use the setting of Pn001 = n.□□□X for the status after stopping.	264
4	Decelerate the motor to a stop using the deceleration time set in Pn30A and then let the motor coast.	264
n.□X□□	Reserved (Do not change.)	–
n.X□□□	Reserved (Do not change.)	–

◆ Pn00B: Application Function Selections B

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1121h	–	0000h	All	After restart	Setup	–

Digit	Meaning	Reference
n.□□□X	Operator Parameter Display Selection (Speed Pos Trq)	–
0 Default	Display only setup parameters.	148
1	Display all parameters.	148
n.□□X□	Motor Stopping Method for Group 2 Alarms (Speed Pos Trq)	–
0 Default	Stop the motor by setting the speed reference to 0.	184
1	Apply the dynamic brake or coast the motor to a stop (use the stopping method set in Pn001 = n.□□□X).	184
2	Set the stopping method with Pn00A = n.□□□X.	184
n.□X□□	Power Input Selection for Three-phase SERVOPACK (Speed Pos Trq)	–
0 Default	Use a three-phase power supply input.	159
1	Use a three-phase power supply input as a single-phase power supply input.	159
n.X□□□	Reserved (Do not change.)	–

◆ Pn00C: Application Function Selections C

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0141h	–	0040h	–	After restart	Setup	301

Digit	Meaning	Applicable Motors
n.□□□X	Function Selection for Test without a Motor (Speed, Pos, Trq)	–
0 (Default)	Disable tests without a motor.	All
1	Enable tests without a motor.	All
n.□□X□	Encoder Resolution for Tests without a Motor (Speed, Pos, Trq)	–
0	Use 13 bits.	Rotary
1	Use 20 bits.	Rotary
2	Use 22 bits.	Rotary
3	Use 24 bits.	Rotary
4 (Default)	Use 26 bits.	Rotary
n.□X□□	Encoder Type Selection for Tests without a Motor (Speed, Pos, Trq)	–
0 (Default)	Use an incremental encoder.	All
1	Use an absolute encoder.	All
n.X□□□	Reserved (Do not change.)	–

◆ Pn00D: Application Function Selections D

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2001h	–	0000h	All	After restart	Setup	177

Digit	Meaning
n.□□□X	Reserved (Do not change.)
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Overtravel Warning Detection Selection (Speed, Pos, Trq)
0 (Default)	Do not detect overtravel warnings.
1	Detect overtravel warnings.
2	Detect overtravel alarms.

Parameter Lists

14

◆ Pn00E: Application Function Selections E

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 4001h	–	0000h	All	After restart	Setup	490

Digit	Meaning
n.□□□X	Reserved (Do not change.)
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	External Encoder Monitor Usage Speed Pos Trq
0 Default	Do not use an external encoder monitor.
1	Use CCW as the forward direction.
2	Reserved (Do not use.)
3	Use CW as the forward direction.
4	Reserved (Do not use.)

◆ Pn00F: Application Function Selections F

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2021h	–	0000h	All	After restart	Setup	–

Digit	Meaning	Reference
n.□□□X	SERVOPACK Preventative Maintenance Warning Selection Speed Pos Trq	–
0 Default	Do not detect SERVOPACK preventative maintenance warnings.	468
1	Detect SERVOPACK preventative maintenance warnings.	468
n.□□X□	Servomotor Preventative Maintenance Warning Selection Speed Pos Trq	–
0 Default	Do not detect servomotor preventative maintenance warnings.	469
1	Detect servomotor preventative maintenance warnings.	469
n.□X□□	Reserved (Do not change.)	–
n.X□□□	Reserved (Do not change.)	–

◆ Pn021: Reserved (Do not change.) Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	0000h	All	–	–	–

◆ Pn022: Application Function Selections 22

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0011h	–	0000h	All	After restart	Setup	178

Digit	Meaning
n.□□□X	Overtravel Release Method Selection (Speed Pos Trq)
0 Default	Overtravel exists while the P-OT or N-OT signal is being input.
1	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.
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn02F: Application Function Selections 2F

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0002h	–	0000h	All	After restart	Setup	–

Digit	Meaning
n.□□□X	Selection of Capacitor Discharge Mode When Main Circuit Power OFF (Speed Pos Trq)
0 Default	• SGDXS-R70A to -200A : Do not perform rapid discharge. • SGDXS-330A to -780A : Perform rapid discharge.
1	Perform rapid discharge.
2	Reserved (Do not use.)
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn040: Sigma-V/Sigma-7 Compatible Function Switch

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2112h	–	0000h	All	After restart	Setup	–

Digit	Meaning
n.□□□X	Σ-X/Σ-7 Compatibility Mode Selection (Speed Pos Trq)
0 Default	Perform Sigma-X communications.
1	Perform Sigma-V communications.
2	Perform Sigma-7 communications.
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn050: SigmaLINK II Response Data Selection 1

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	00000000h to FF7EFFFFh	–	00000000h	All	After restart	Setup	506

Digit	Meaning
n.□□□□XXXX	Parameter Number (0000h to FFFFh)
n.□□XX□□□□	Node Address (10h to 1Eh)
n.XX□□□□□□	Reserved.

◆ Pn052: SigmaLINK II Response Data Selection 2

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	00000000h to FF7EFFFFh	–	00000000h	All	After restart	Setup	506

Digit	Meaning
n.□□□□XXXX	Parameter Number (0000h to FFFFh)
n.□□XX□□□□	Node Address (10h to 1Eh)
n.XX□□□□□□	Reserved.

◆ Pn054: SigmaLINK II Response Data Selection 3

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	00000000h to FF7EFFFFh	–	00000000h	All	After restart	Setup	506

Digit	Meaning
n.□□□□XXXX	Parameter Number (0000h to FFFFh)
n.□□XX□□□□	Node Address (10h to 1Eh)
n.XX□□□□□□	Reserved.

◆ Pn056: SigmaLINK II Response Data Selection 4

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	00000000h to FF7EFFFFh	–	00000000h	All	After restart	Setup	506

Digit	Meaning
n.□□□□XXXX	Parameter Number (0000h to FFFFh)
n.□□XX□□□□	Node Address (10h to 1Eh)
n.XX□□□□□□	Reserved.

◆ Pn058: SigmaLINK II Response Data Selection 5

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	00000000h to FF7EFFFFh	–	00000000h	All	After restart	Setup	506

Digit	Meaning
n.□□□□XXXX	Parameter Number (0000h to FFFFh)
n.□□XX□□□□	Node Address (10h to 1Eh)
n.XX□□□□□□	Reserved.

◆ Pn05A: SigmaLINK II Response Data Selection 6

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	00000000h to FF7EFFFFh	–	00000000h	All	After restart	Setup	506

Digit	Meaning
n.□□□□XXXX	Parameter Number (0000h to FFFFh)
n.□□XX□□□□	Node Address (10h to 1Eh)
n.XX□□□□□□	Reserved.

◆ Pn05C: SigmaLINK II Response Data Selection 7

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	00000000h to FF7EFFFFh	–	00000000h	All	After restart	Setup	506

Digit	Meaning
n.□□□□XXXX	Parameter Number (0000h to FFFFh)
n.□□XX□□□□	Node Address (10h to 1Eh)
n.XX□□□□□□	Reserved.

◆ Pn05E: SigmaLINK II Response Data Selection 8

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	00000000h to FF7EFFFFh	–	00000000h	All	After restart	Setup	506

Digit	Meaning
n.□□□□XXXX	Parameter Number (0000h to FFFFh)
n.□□XX□□□□	Node Address (10h to 1Eh)
n.XX□□□□□□	Reserved.

◆ Pn080: Application Function Selections 80

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1111h	–	0000h	Linear	After restart	Setup	–

Digit	Meaning	Reference
n.□□□X	Polarity Sensor Selection Speed Pos Trq	–
0 Default	Use polarity sensor.	170
1	Do not use polarity sensor.	170
n.□□X□	Motor Phase Sequence Selection Speed Pos Trq	–
0 Default	Set a phase-A lead as a phase sequence of U, V, and W.	168
1	Set a phase-B lead as a phase sequence of U, V, and W.	168
n.□X□□	Reserved (Do not change.)	–
n.X□□□	Calculation Method for Maximum Speed or Encoder Output Pulses Speed Pos Trq	–
0 Default	Calculate the encoder output pulse setting for a fixed maximum motor speed.	834
1	Calculate the maximum motor speed for a fixed encoder output pulse setting.	834

◆ Pn081: Application Function Selections 81

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1111h	–	0000h	All	After restart	Setup	229

Digit	Meaning
n.□□□X	Phase-C Pulse Output Selection Speed Pos Trq
0 Default	Output phase-C pulses only in the forward direction.
1	Output phase-C pulses in both the forward and reverse directions.
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn090: SigmaLINK II Command Data Selection 1 Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	00000000h to FF7EFFFFh	–	00000000h	All	After restart	Setup	517

Digit	Meaning
n.□□□□XXXX	Parameter Number (0000h to FFFFh)
n.□□XX□□□□	Node Address (10h to 1Eh)
n.XX□□□□□□	Reserved.

◆ Pn092: SigmaLINK II Command Data Selection 2

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	00000000h to FF7EFFFFh	–	00000000h	All	After restart	Setup	517

Digit	Meaning
n.□□□□XXXX	Parameter Number (0000h to FFFFh)
n.□□XX□□□□	Node Address (10h to 1Eh)
n.XX□□□□□□	Reserved.

◆ Pn094: SigmaLINK II Command Data Selection 3

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	00000000h to FF7EFFFFh	–	00000000h	All	After restart	Setup	517

Digit	Meaning
n.□□□□XXXX	Parameter Number (0000h to FFFFh)
n.□□XX□□□□	Node Address (10h to 1Eh)
n.XX□□□□□□	Reserved.

◆ Pn096: SigmaLINK II Command Data Selection 4

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	00000000h to FF7EFFFFh	–	00000000h	All	After restart	Setup	517

Digit	Meaning
n.□□□□XXXX	Parameter Number (0000h to FFFFh)
n.□□XX□□□□	Node Address (10h to 1Eh)
n.XX□□□□□□	Reserved.

◆ Pn0B1: SigmaLINK II Sequence Input Allocation 1

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to FFFFh	–	0000h	All	After restart	Setup	515

Digit	Meaning
n.□□XX	SigmaLINK II Response Data Selection (Speed Pos Trq)
00 Default	Disable (data is not set to the SigmaLINK II sequence input).
01	Allocate SigmaLINK II Response Data 1 to the SigmaLINK II sequence input.
02	Allocate SigmaLINK II Response Data 2 to the SigmaLINK II sequence input.
03	Allocate SigmaLINK II Response Data 3 to the SigmaLINK II sequence input.
04	Allocate SigmaLINK II Response Data 4 to the SigmaLINK II sequence input.
05	Allocate SigmaLINK II Response Data 5 to the SigmaLINK II sequence input.
06	Allocate SigmaLINK II Response Data 6 to the SigmaLINK II sequence input.
07	Allocate SigmaLINK II Response Data 7 to the SigmaLINK II sequence input.
08	Allocate SigmaLINK II Response Data 8 to the SigmaLINK II sequence input.
n.XX□□	SigmaLINK II Sequence Input Allocation Start Position Selection (Speed Pos Trq)
00 to 20	Specify the allocation start bit to the SigmaLINK II sequence input.

◆ Pn0B2: SigmaLINK II Sequence Input Allocation 2

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to FFFFh	–	0000h	All	After restart	Setup	515

Digit	Meaning
n.□□XX	SigmaLINK II Response Data Selection (Speed Pos Trq)
00 Default	Disable (data is not set to the SigmaLINK II sequence input).
01	Allocate SigmaLINK II Response Data 1 to the SigmaLINK II sequence input.
02	Allocate SigmaLINK II Response Data 2 to the SigmaLINK II sequence input.
03	Allocate SigmaLINK II Response Data 3 to the SigmaLINK II sequence input.
04	Allocate SigmaLINK II Response Data 4 to the SigmaLINK II sequence input.
05	Allocate SigmaLINK II Response Data 5 to the SigmaLINK II sequence input.
06	Allocate SigmaLINK II Response Data 6 to the SigmaLINK II sequence input.
07	Allocate SigmaLINK II Response Data 7 to the SigmaLINK II sequence input.
08	Allocate SigmaLINK II Response Data 8 to the SigmaLINK II sequence input.
n.XX□□	SigmaLINK II Sequence Input Allocation Start Position Selection (Speed Pos Trq)
00 to 20	Specify the allocation start bit to the SigmaLINK II sequence input.

◆ Pn0B5: SigmaLINK II Sequence Output Allocation 1

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to FFFFh	–	0000h	All	After restart	Setup	517

Digit	Meaning
n.□□XX	SigmaLINK II Command Data Selection Speed Pos Trq
00 Default	Disable (data is not set to the SigmaLINK II sequence output).
01	Allocate SigmaLINK II Command Data 1 to the SigmaLINK II sequence output.
02	Allocate SigmaLINK II Command Data 2 to the SigmaLINK II sequence output.
03	Allocate SigmaLINK II Command Data 3 to the SigmaLINK II sequence output.
04	Allocate SigmaLINK II Command Data 4 to the SigmaLINK II sequence output.
n.XX□□	SigmaLINK II Sequence Output Allocation Start Position Selection Speed Pos Trq
00 to 20	Specify the allocation start bit to the SigmaLINK II sequence output.

◆ Pn0D8: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	0000h	All	–	–	–

◆ Pn0D9: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	0000h	All	–	–	–

◆ Pn0DA: SigmaLINK II Semi-closed Encoder Selection

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 011Eh	–	0000h	All	After restart	Setup	504

Digit	Meaning
n.□□XX	Node Address Speed Pos Trq
00 to 1E	Select an encoder with a node address between 00h and 1Eh.
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn0DB: SigmaLINK II Fully-closed Encoder Selection

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 011Eh	–	0101h	All	After restart	Setup	–

Digit	Meaning
n.□□XX	Node Address Speed Pos Trq
00 to 1E	Select an encoder with a node address between 00h and 1Eh.
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn0DC: SigmaLINK II Node Change Detection Condition Selection

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0003h	–	0000h	All	After restart	Setup	–

Digit	Meaning
n.□□□X	Connected Node Change Detection Condition (Speed, Pos, Trq)
0 Default	Set vendor ID and product ID as conditions.
1	Set vendor ID, product ID, and serial number as conditions.
2	Set vendor ID, product ID, and product version as conditions.
3	Set vendor ID, product ID, product version, and serial number as conditions.
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn0DD: SigmaLINK II I/O Device Error Detection Selection

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to F4F2h	–	0110h	All	After restart	Setup	–

Digit	Meaning
n.□□□X	SigmaLINK II I/O Device Communications Check Mask (Speed, Pos, Trq)
0 Default	Set SigmaLINK II slave communications error as an alarm (A.Cd7).
1	Set SigmaLINK II slave communications error as a warning (A.932).
2	Do not detect the SigmaLINK II slave communications error.
n.□□X□	Reserved (Do not change.)
n.□X□□	SigmaLINK II I/O Device Status Check Mask (Speed, Pos, Trq)
0	A.Cd8 occurs when the alarm or warning signal is received from the SigmaLINK II slave.
1 Default	A.Cd8 occurs when the alarm signal is received from the SigmaLINK II slave and A.933 occurs when the warning signal is received.
2	A.933 occurs when the alarm or warning signal is received from the SigmaLINK II slave.
3	Do not detect the SigmaLINK II slave status error.
n.X□□□	Reserved (Do not change.)

◆ Pn100: Speed Loop Gain

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 20,000	0.1 Hz	400	All	Immediately	Tuning	427

◆ Pn101: Speed Loop Integral Time Constant

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	15 to 51,200	0.01 ms	2000	All	Immediately	Tuning	427

◆ Pn102: Position Loop Gain

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 20,000	0.1/s	400	All	Immediately	Tuning	427

◆ Pn103: Moment of Inertia Ratio

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 65,535	1%	100	All	Immediately	Tuning	427

◆ Pn104: Second Speed Loop Gain

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	10 to 20,000	0.1 Hz	400	All	Immediately	Tuning	412

◆ Pn105: Second Speed Loop Integral Time Constant

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	15 to 51,200	0.01 ms	2000	All	Immediately	Tuning	412

◆ Pn106: Second Position Loop Gain

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	10 to 20,000	0.1/s	400	All	Immediately	Tuning	412

◆ Pn109: Feedforward

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 100	1%	0	All	Immediately	Tuning	437

◆ Pn10A: Feedforward Filter Time Constant

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 6,400	0.01 ms	0	All	Immediately	Tuning	437

◆ Pn10B: Gain Application Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 5334h	–	0000h	All	–	Setup	–

Digit	Meaning	When Enabled	Reference
n.□□□X	Mode Switching Selection (Speed Pos Trq)	–	–
0 Default	Use the internal torque reference as the condition (level setting: Pn10C).	Immediately	438
1	Use the speed reference as the condition (level setting: Pn10D). Use the speed reference as the condition (level setting: Pn181).	Immediately	438
2	Use the acceleration reference as the condition (level setting: Pn10E). Use the acceleration reference as the condition (level setting: Pn182).	Immediately	438
3	Use the position deviation as the condition (level setting: Pn10F).	Immediately	438
4	Do not use mode switching.	Immediately	438
n.□□X□	Speed Loop Control Method (Speed Pos Trq)	–	–
0 Default	PI control	After restart	433
1	I-P control	After restart	433
2, 3	Reserved (Do not use.)	After restart	433
n.□X□□	Reserved (Do not change.)	–	–
n.X□□□	Reserved (Do not change.)	–	–

◆ Pn10C: Mode Switching Level for Torque Reference

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 800	1%	200	All	Immediately	Tuning	438

◆ Pn10D: Mode Switching Level for Speed Reference

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10,000	1 min^{-1}	0	Rotary	Immediately	Tuning	438

◆ Pn10E: Mode Switching Level for Acceleration

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 30,000	1 min^{-1}/s	0	Rotary	Immediately	Tuning	438

◆ Pn10F: Mode Switching Level for Position Deviation

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10,000	1 reference unit	0	All	Immediately	Tuning	438

◆ Pn11F: Position Integral Time Constant

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 50000	0.1 ms	0	All	Immediately	Tuning	441

◆ Pn121: Friction Compensation Gain

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 1000	1%	100	All	Immediately	Tuning	412, 354

◆ Pn122: Second Friction Compensation Gain

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 1000	1%	100	All	Immediately	Tuning	412, 354

◆ Pn123: Friction Compensation Coefficient

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 100	1%	0	All	Immediately	Tuning	354

◆ Pn124: Friction Compensation Frequency Correction

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	-10,000 to 10,000	0.1 Hz	0	All	Immediately	Tuning	354

◆ Pn125: Friction Compensation Gain Correction

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	1 to 1000	1%	100	All	Immediately	Tuning	354

◆ Pn131: Gain Switching Time 1

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65,535	1 ms	0	All	Immediately	Tuning	412

◆ Pn132: Gain Switching Time 2

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65,535	1 ms	0	All	Immediately	Tuning	412

◆ Pn135: Gain Switching Waiting Time 1

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65,535	1 ms	0	All	Immediately	Tuning	412

◆ Pn136: Gain Switching Waiting Time 2

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65,535	1 ms	0	All	Immediately	Tuning	412

◆ Pn139: Automatic Gain Switching Selections 1

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0000h to 0052h	–	0000h	All	Immediately	Tuning	412

Digit	Meaning
n.□□□X	Gain Switching Selection Speed Pos Trq
0 Default	Manual Gain Switching The gain is switched manually with G-SEL in SVCMD_IO.
1	Reserved (Do not use.)
2	Use automatic gain switching pattern 1. The gain settings 1 switch automatically to 2 when switching condition A is satisfied. The gain settings 2 switch automatically to 1 when switching condition A is not satisfied.
n.□□X□	Gain Switching Condition A Speed Pos Trq
0 Default	/COIN (Positioning Completion Output) signal turns ON.
1	/COIN (Positioning Completion Output) signal turns OFF.
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 (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn13D: Current Gain Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	100 to 2,000	1%	2000	All	Immediately	Tuning	419

◆ Pn140: Model Following Control-Related Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1121h	–	0100h	All	Immediately	Tuning	–

Digit	Meaning	Reference
n.□□□X	Model Following Control Selection (Speed Pos Trq)	–
0 Default	Do not use model following control.	434
1	Use model following control.	434
n.□□X□	Vibration Suppression Selection (Speed Pos Trq)	–
0 Default	Do not perform vibration suppression.	434
1	Perform vibration suppression for a specific frequency.	434
2	Perform vibration suppression for two specific frequencies.	434
n.□X□□	Vibration Suppression Adjustment Selection (Speed Pos Trq)	–
0	Do not adjust vibration suppression automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.	354
1 Default	Adjust vibration suppression automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.	354
n.X□□□	Speed Feedforward (VFF)/Torque Feedforward (TFF) Selection (Speed Pos Trq)	–
0 Default	Do not use model following control and speed/torque feedforward together.	354, 385
1	Use model following control and speed/torque feedforward together.	354, 385

◆ Pn141: Model Following Control Gain

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 20,000	0.1/s	500	All	Immediately	Tuning	434

◆ Pn142: Model Following Control Gain Correction

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	500 to 2,000	0.1%	1000	All	Immediately	Tuning	412

◆ Pn143: Model Following Control Bias in the Forward Direction

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10,000	0.1%	1000	All	Immediately	Tuning	434

◆ Pn144: Model Following Control Bias in the Reverse Direction

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10,000	0.1%	1000	All	Immediately	Tuning	434

◆ Pn145: Vibration Suppression 1 Frequency A

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 2,500	0.1 Hz	500	All	Immediately	Tuning	386

◆ Pn146: Vibration Suppression 1 Frequency B

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 2,500	0.1 Hz	700	All	Immediately	Tuning	386

◆ Pn147: Model Following Control Speed Feedforward Compensation

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10,000	0.1%	1000	All	Immediately	Tuning	434

◆ Pn148: Second Model Following Control Gain

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 20,000	0.1/s	500	All	Immediately	Tuning	412

◆ Pn149: Second Model Following Control Gain Correction

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	500 to 2,000	0.1%	1000	All	Immediately	Tuning	412

◆ Pn14A: Vibration Suppression 2 Frequency

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 2000	0.1 Hz	800	All	Immediately	Tuning	386

◆ Pn14B: Vibration Suppression 2 Correction

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 1000	1%	100	All	Immediately	Tuning	386

◆ Pn14F: Control-Related Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0031h	–	0030h	All	After restart	Tuning	–

Digit	Meaning	Reference
n.□□□X	Model Following Control Type Selection Speed Pos Trq	–
0 Default	Use overshoot control type for model following control.	437
1	Use response emphasis type for model following control.	437
n.□□X□	Tuning-less Type Selection Speed Pos Trq	–
0	Use tuning-less type 1.	319
1	Use tuning-less type 2.	319
2	Use tuning-less type 3.	319
3 Default	Use tuning-less type 4.	319
n.□X□□	Reserved (Do not change.)	–
n.X□□□	Reserved (Do not change.)	–

◆ Pn160: Anti-Resonance Control-Related Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0011h	–	0010h	All	Immediately	Tuning	–

Digit	Meaning	Reference
n.□□□X	Anti-Resonance Control Selection Speed Pos Trq	–
0 Default	Do not use anti-resonance control.	375
1	Use anti-resonance control.	375
n.□□X□	Anti-Resonance Control Adjustment Selection Speed Pos Trq	–
0	Do not adjust anti-resonance control automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.	353
1 Default	Adjust anti-resonance control automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.	353
n.□X□□	Reserved (Do not change.)	–
n.X□□□	Reserved (Do not change.)	–

◆ Pn161: Anti-Resonance Frequency

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 20,000	0.1 Hz	1000	All	Immediately	Tuning	375

◆ Pn162: Anti-Resonance Gain Correction

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	1 to 1000	1%	100	All	Immediately	Tuning	375

◆ Pn163: Anti-Resonance Damping Gain

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 300	1%	0	All	Immediately	Tuning	375

◆ Pn164: Anti-Resonance Filter Time Constant 1 Correction

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	-1,000 to 1,000	0.01 ms	0	All	Immediately	Tuning	375

◆ Pn165: Anti-Resonance Filter Time Constant 2 Correction

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	-1,000 to 1,000	0.01 ms	0	All	Immediately	Tuning	375

◆ Pn166: Anti-Resonance Damping Gain 2

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 1,000	1%	0	All	Immediately	Tuning	380

◆ Pn170: Tuning-less Function-Related Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2711h	–	1401h	All	–	Setup	318

Digit	Meaning	When Enabled
n.□□□X	Tuning-less Selection Speed Pos Trq	–
0	Disable tuning-less function.	After restart
1 Default	Enable tuning-less function.	After restart
n.□□X□	Speed Control Method Speed Pos Trq	–
0 Default	Use for speed control.	After restart
1	Use for speed control and use host controller for position control.	After restart
n.□X□□	Tuning-less Level Speed Pos Trq	–
0	Set the tuning-less level to 0.	Immediately
1	Set the tuning-less level to 1.	Immediately
2	Set the tuning-less level to 2.	Immediately
3	Set the tuning-less level to 3.	Immediately
4 Default	Set the tuning-less level to 4.	Immediately
5	Set the tuning-less level to 5.	Immediately
6	Set the tuning-less level to 6.	Immediately
7	Set the tuning-less level to 7.	Immediately
n.X□□□	Tuning-less Load Level Speed Pos Trq	–
0	Set the tuning-less load level to 0.	Immediately
1 Default	Set the tuning-less load level to 1.	Immediately
2	Set the tuning-less load level to 2.	Immediately

◆ Pn173: Load Fluctuation Compensation Control-Related Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0001h	–	0000h	All	Immediately	Setup	409

Digit	Meaning
n.□□□X	Load Fluctuation Compensation Control Selection Speed Pos Trq
0 Default	Do not use load fluctuation compensation control.
1	Use load fluctuation compensation control.
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn174: Load Fluctuation Compensation Control Response Level Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 20,000	0.1	400	All	Immediately	Tuning	409

◆ Pn181: Mode Switching Level for Speed Reference

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10,000	1 mm/s	0	Linear	Immediately	Tuning	438

◆ Pn182: Mode Switching Level for Acceleration

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 30,000	1 mm/s^2	0	Linear	Immediately	Tuning	438

◆ Pn205: Multiturn Limit

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65,535	1 rev	65535	Rotary	After restart	Setup	244

◆ Pn207: Position Control Function Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2210h	–	0010h	All	After restart	Setup	219

Digit	Meaning
n.□□□X	Reserved (Do not change.)
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	/COIN (Positioning Completion Output) Signal Output Timing Speed Pos Trq
0 Default	Output when the absolute value of the position deviation is the same or less than the setting of Pn522 (Positioning Completed Width).
1	Output when the absolute value of the position error is the same or less than the setting of Pn522 (Positioning Completed Width) and the reference after the position reference filter is 0.
2	Output when the absolute value of the position error is the same or less than the setting of Pn522 (Positioning Completed Width) and the reference input is 0.

◆ Pn20A: Number of External Encoder Scale Pitches

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	4 to 1,048,576	1 scale pitch/revolution	32768	Rotary	After restart	Setup	485

◆ Pn20E: Electronic Gear Ratio (Numerator)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	1 to 1073741824	–	64	All	After restart	Setup	188

◆ Pn210: Electronic Gear Ratio (Denominator)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	1 to 1073741824	–	1	All	After restart	Setup	188

◆ Pn212: Number of Encoder Output Pulses

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
4	16 to 1073741824	1 P/Rev	2048	Rotary	After restart	Setup	231

◆ Pn21D: Encoder Resolution Setting

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0000h to 00A1h	–	0080h	Rotary	After restart	Setup	203

Digit	Meaning
n.□□□X	Encoder Resolution Compatibility Selection (Speed Pos Trq)
0 Default	Disable encoder resolution compatibility.
1	Enable encoder resolution compatibility.
n.□□X□	Encoder Resolution Compatibility: Resolution Selection (Speed Pos Trq)
4	Operate as 20-bit encoder.
6	Operate as 22-bit encoder.
8 Default	Operate as 24-bit encoder.
A	Operate as 26-bit encoder.
Other values	Reserved (Do not use.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn22A: Fully-closed Control Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0000h to 1003h	–	0000h	Rotary	After restart	Setup	489

Digit	Meaning
n.□□□X	Reserved (Do not change.)
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Fully-closed Control Speed Feedback Selection (Speed Pos Trq)
0 Default	Use motor encoder speed.
1	Use external encoder speed.

◆ Pn230: Position Control Expansion Function Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0001h	–	0000h	All	After restart	Setup	420

Digit	Meaning
n.□□□X	Backlash Compensation Direction (Speed Pos Trq)
0 Default	Compensate forward references.
1	Compensate reverse references.
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn231: Backlash Compensation Value

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	-500,000 to 500,000	0.1 reference unit	0	All	Immediately	Setup	421

◆ Pn233: Backlash Compensation Time Constant

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65,535	0.01 ms	0	All	Immediately	Setup	421

◆ Pn281: Encoder Output Resolution

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	1 to 4,096	1 edge/pitch	20	All	After restart	Setup	232

◆ Pn282: Linear Encoder Scale Pitch

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	0 to 6553600	0.01 μm	0	Linear	After restart	Setup	163

◆ Pn304: Jogging Speed

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10,000	Rotary: 1 min^{-1} Direct Drive: 0.1 min^{-1}	500	Rotary	Immediately	Setup	287

◆ Pn305: Soft Start Acceleration Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 12000	1 ms	0	All	Immediately	Setup	–

◆ Pn306: Soft Start Deceleration Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 12000	1 ms	0	All	Immediately	Setup	–

◆ Pn308: Speed Feedback Filter Time Constant

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65,535	0.01 ms	0	All	Immediately	Setup	420

◆ Pn30A: Deceleration Time for Servo OFF and Forced Stops

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 12000	1 ms	0	All	Immediately	Setup	176

◆ Pn30C: Speed Feedforward Average Movement Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 5,100	0.1 ms	0	All	Immediately	Setup	–

◆ Pn310: Vibration Detection Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0002h	–	0000h	All	Immediately	Setup	257

Digit	Meaning
n.□□□X	Vibration Detection Selection (Speed Pos Trq)
0 Default	Do not detect vibration.
1	Output a warning (A.911) if vibration is detected.
2	Output an alarm (A.520) if vibration is detected.
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn311: Vibration Detection Sensitivity

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	50 to 500	1%	100	All	Immediately	Tuning	257

◆ Pn312: Vibration Detection Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 5,000	1 min^{-1}	50	Rotary	Immediately	Tuning	257

◆ Pn316: Maximum Motor Speed

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65,535	1 min^{-1}	10000	Rotary	After restart	Setup	226

◆ Pn324: Moment of Inertia Calculation Starting Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 20000	1%	300	All	Immediately	Setup	352

◆ Pn383: Jogging Speed

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 10,000	1 mm/s	50	Linear	Immediately	Setup	287

◆ Pn384: Vibration Detection Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 5,000	1 mm/s	10	Linear	Immediately	Tuning	257

◆ Pn385: Maximum Motor Speed

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	1 to 100	100 mm/s	50	Linear	After restart	Setup	226

◆ Pn401: First Stage First Torque Reference Filter Time Constant

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 65,535	0.01 ms	100	All	Immediately	Tuning	429

◆ Pn402: Forward Torque Limit

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 800	1%	800	Rotary	Immediately	Setup	235

Note:

The setting is a percentage of the motor rated torque.

◆ Pn403: Reverse Torque Limit

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 800	1%	800	Rotary	Immediately	Setup	235

Note:

The setting is a percentage of the motor rated torque.

◆ Pn404: Forward External Torque Limit

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 800	1%	100	All	Immediately	Setup	236

Note:

The setting is a percentage of the motor rated torque.

◆ Pn405: Reverse External Torque Limit

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 800	1%	100	All	Immediately	Setup	236

Note:

The setting is a percentage of the motor rated torque.

◆ Pn406: Emergency Stop Torque

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 800	1%	800	All	Immediately	Setup	175

Note:

The setting is a percentage of the motor rated torque.

◆ Pn407: Speed Limit during Torque Control

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10,000	1 min^{-1}	10000	Rotary	Immediately	Setup	221

◆ Pn408: Torque-Related Function Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1111h	–	0000h	All	–	Setup	–

Digit	Meaning	When Enabled	Reference
n.□□□X	Notch Filter Selection 1 (Speed Pos Trq)	–	–
0 Default	Disable first stage notch filter.	Immediately	429
1	Enable first stage notch filter.	Immediately	429
n.□□X□	Speed Limit Selection (Speed Pos Trq)	–	–
0 Default	Use the smaller of the maximum motor speed and the setting of Pn407 as the speed limit. Use the smaller of the maximum motor speed and the setting of Pn480 as the speed limit.	After restart	222
1	Use the smaller of the overspeed alarm detection speed and the setting of Pn407 as the speed limit. Use the smaller of the overspeed alarm detection speed and the setting of Pn480 as the speed limit.	After restart	222
n.□X□□	Notch Filter Selection 2 (Speed Pos Trq)	–	–
0 Default	Disable second stage notch filter.	Immediately	429
1	Enable second stage notch filter.	Immediately	429
n.X□□□	Friction Compensation Function Selection (Speed Pos Trq)	–	–
0 Default	Disable friction compensation.	Immediately	416
1	Enable friction compensation.	Immediately	416

◆ Pn409: First Stage Notch Filter Frequency

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 5,000	1 Hz	5000	All	Immediately	Tuning	429

◆ Pn40A: First Stage Notch Filter Q Value

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	50 to 1,000	0.01	70	All	Immediately	Tuning	429

◆ Pn40B: First Stage Notch Filter Depth

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 1,000	0.001	0	All	Immediately	Tuning	429

◆ Pn40C: Second Stage Notch Filter Frequency

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 5,000	1 Hz	5000	All	Immediately	Tuning	429

◆ Pn40D: Second Stage Notch Filter Q Value

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	50 to 1,000	0.01	70	All	Immediately	Tuning	429

◆ Pn40E: Second Stage Notch Filter Depth

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 1,000	0.001	0	All	Immediately	Tuning	429

◆ Pn40F: Second Stage Second Torque Reference Filter Frequency

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	100 to 5,000	1 Hz	5000	All	Immediately	Tuning	429

◆ Pn410: Second Stage Second Torque Reference Filter Q Value

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	50 to 100	0.01	50	All	Immediately	Tuning	429

◆ Pn412: First Stage Second Torque Reference Filter Time Constant

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65,535	0.01 ms	100	All	Immediately	Tuning	412

◆ Pn416: Torque-Related Function Selections 2

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1111h	–	0000h	All	Immediately	Setup	430

Digit	Meaning
n.□□□X	Notch Filter Selection 3 Speed Pos Trq
0 Default	Disable third stage notch filter.
1	Enable third stage notch filter.
n.□□X□	Notch Filter Selection 4 Speed Pos Trq
0 Default	Disable fourth stage notch filter.
1	Enable fourth stage notch filter.
n.□X□□	Notch Filter Selection 5 Speed Pos Trq
0 Default	Disable fifth stage notch filter.
1	Enable fifth stage notch filter.
n.X□□□	Reserved (Do not change.)

◆ Pn417: Third Stage Notch Filter Frequency

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 5,000	1 Hz	5000	All	Immediately	Tuning	430

◆ Pn418: Third Stage Notch Filter Q Value

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	50 to 1,000	0.01	70	All	Immediately	Tuning	430

◆ Pn419: Third Stage Notch Filter Depth

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 1,000	0.001	0	All	Immediately	Tuning	430

◆ Pn41A: Fourth Stage Notch Filter Frequency

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 5,000	1 Hz	5000	All	Immediately	Tuning	430

◆ Pn41B: Fourth Stage Notch Filter Q Value

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	50 to 1,000	0.01	70	All	Immediately	Tuning	430

◆ Pn41C: Fourth Stage Notch Filter Depth

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 1,000	0.001	0	All	Immediately	Tuning	430

◆ Pn41D: Fifth Stage Notch Filter Frequency

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 5,000	1 Hz	5000	All	Immediately	Tuning	430

◆ Pn41E: Fifth Stage Notch Filter Q Value

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	50 to 1,000	0.01	70	All	Immediately	Tuning	430

◆ Pn41F: Fifth Stage Notch Filter Depth

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 1,000	0.001	0	All	Immediately	Tuning	430

◆ Pn423: Speed Ripple Compensation Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000H to 1112h	–	0002h	–	–	Setup	406

Digit	Meaning	Applicable Motors	When Enabled
n.□□□X	Speed Ripple Compensation Function Selection (Speed Pos Trq)	–	–
0	Do not execute speed ripple compensation.	Rotary	Immediately
1	Execute speed ripple compensation using the value adjusted by the user.	Rotary	Immediately
2 Default	Execute speed ripple compensation using the default adjustment value.	Rotary	Immediately
n.□□X□	Speed Ripple Compensation Information Disagreement Warning Detection Selection (Speed Pos Trq)	–	–
0	Detect A.942 alarms.	Rotary	After restart
1	Do not detect A.942 alarms.	Rotary	After restart
n.□X□□	Speed Ripple Compensation Enable Condition Selection (Speed Pos Trq)	–	–
0	Speed Reference	Rotary	After restart
1	Motor Speed	Rotary	After restart
n.X□□□	Speed Ripple Compensation Function Operation Mode Selection (Speed Pos Trq)	–	–
0 Default	Execute speed ripple compensation in normal mode.	All	After restart
1	Execute speed ripple compensation in press operation mode.	All	After restart
2	Reserved (Do not use.)	All	After restart
3	Reserved (Do not use.)	All	After restart

◆ Pn424: Torque Limit at Main Circuit Voltage Drop

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 100	1%	50	All	Immediately	Setup	225

Note:

The setting is a percentage of the motor rated torque.

◆ Pn425: Release Time for Torque Limit at Main Circuit Voltage Drop

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 1,000	1 ms	100	All	Immediately	Setup	225

◆ Pn426: Torque Feedforward Average Movement Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 5,100	0.1 ms	0	All	Immediately	Setup	–

◆ Pn427: Speed Ripple Compensation Enable Speed

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10,000	1 min^{-1}	0	Rotary	Immediately	Tuning	406

◆ Pn428: Output Torque Compensation Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0001h	–	0001h	All	After restart	Setup	418

Digit	Meaning
n.□□□X	Output Torque Compensation Function Selection (Speed Pos Trq)
0	Disable output torque compensation.
1 Default	Enable output torque compensation.
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn43A: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	10000	All	–	–	–

◆ Pn43B: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	10000	All	–	–	–

◆ Pn43C: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	10000	All	–	–	–

◆ Pn43D: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	10000	All	–	–	–

◆ Pn456: Sweep Torque Reference Amplitude

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	1 to 800	1%	15	All	Immediately	Tuning	447

◆ Pn460: Notch Filter Adjustment Selections 1

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0101h	–	0101h	All	Immediately	Tuning	321, 353

Digit	Meaning
n.□□□X	Notch Filter Adjustment Selection 1 (Speed Pos Trq)
0	Do not adjust the first stage notch filter automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.
1 Default	Adjust the first stage notch filter automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.
n.□□X□	Reserved (Do not change.)
n.□X□□	Notch Filter Adjustment Selection 2 (Speed Pos Trq)
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.
1 Default	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.X□□□	Reserved (Do not change.)

◆ Pn475: Gravity Compensation-Related Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0001h	–	0000h	All	After restart	Setup	417

Digit	Meaning
n.□□□X	Gravity Compensation Selection (Speed Pos Trq)
0 Default	Disable gravity compensation.
1	Enable gravity compensation.
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn476: Gravity Compensation Torque

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	-1,000 to 1,000	0.1%	0	All	Immediately	Tuning	417

◆ Pn480: Speed Limit during Force Control

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10,000	1 mm/s	10000	Linear	Immediately	Setup	222

◆ Pn481: Polarity Detection Speed Loop Gain

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	10 to 20,000	0.1 Hz	400	Linear	Immediately	Tuning	–

◆ Pn482: Polarity Detection Speed Loop Integral Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	15 to 51,200	0.01 ms	3000	Linear	Immediately	Tuning	–

◆ Pn483: Forward Force Limit

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 800	1%	30	Linear	Immediately	Setup	235

Note:

The setting is a percentage of the motor rated torque.

◆ Pn484: Reverse Force Limit

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 800	1%	30	Linear	Immediately	Setup	235

Note:

The setting is a percentage of the motor rated torque.

◆ Pn485: Polarity Detection Reference Speed

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 100	1 mm/s	20	Linear	Immediately	Tuning	–

◆ Pn486: Polarity Detection Reference Acceleration/Deceleration Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 100	1 ms	25	Linear	Immediately	Tuning	–

◆ Pn487: Polarity Detection Constant Speed Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 300	1 ms	0	Linear	Immediately	Tuning	–

◆ Pn488: Polarity Detection Reference Waiting Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	50 to 500	1 ms	100	Linear	Immediately	Tuning	–

◆ Pn48E: Polarity Detection Range

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	1 to 65535	1 mm	10	Linear	Immediately	Tuning	–

◆ Pn490: Polarity Detection Load Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 20000	1%	100	Linear	Immediately	Tuning	–

◆ Pn495: Polarity Detection Confirmation Force Reference

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 200	1%	100	Linear	Immediately	Tuning	–

◆ Pn498: Polarity Detection Allowable Error Range

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 30	1 deg	10	Linear	Immediately	Tuning	–

◆ Pn49F: Speed Ripple Compensation Enable Speed (Linear)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10,000	1 mm/s	0	Linear	Immediately	Tuning	406

◆ Pn502: Rotation Detection Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	1 to 10,000	1 min^{-1}	20	Rotary	Immediately	Setup	216

◆ Pn503: Speed Coincidence Detection Signal Output Width

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 100	1 min^{-1}	10	Rotary	Immediately	Setup	217

◆ Pn506: Brake Reference-Servo OFF Delay Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 50	10 ms	0	All	Immediately	Setup	179

◆ Pn507: Brake Reference Output Speed Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10,000	1 min^{-1}	100	Rotary	Immediately	Setup	179

◆ Pn508: Servo OFF-Brake Command Waiting Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 100	10 ms	50	All	Immediately	Setup	179

◆ Pn509: Momentary Power Interruption Hold Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	20 to 50,000	1 ms	20	All	Immediately	Setup	223

◆ Pn50A: Input Signal Selections 1

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to FFF2h	–	1881h	All	After restart	Setup	–

Digit	Meaning	Reference
n.□□□X	Input Signal Allocation Mode Speed Pos Trq	–
0	Reserved (Do not use.)	210
1 Default	Use Pn50A to Pn516 (Sigma-7S-compatible I/O signal allocation mode).	210
2	Use Pn590 to Pn5BC (SigmaLINK II input signal allocation mode).	210
n.□□X□	Reserved (Do not change.)	–
n.□X□□	Reserved (Do not change.)	–
n.X□□□	P-OT (Forward Drive Prohibit Input) Signal Allocation Speed Pos Trq	–
0	Enable forward drive when CN1-13 input signal is ON (closed).	175
1 Default	Enable forward drive when CN1-7 input signal is ON (closed).	175
2	Enable forward drive when CN1-8 input signal is ON (closed).	175
3	Enable forward drive when CN1-9 input signal is ON (closed).	175
4	Enable forward drive when CN1-10 input signal is ON (closed).	175
5	Enable forward drive when CN1-11 input signal is ON (closed).	175
6	Enable forward drive when CN1-12 input signal is ON (closed).	175
7	Set the signal to always prohibit forward drive.	175
8	Set the signal to always enable forward drive.	175
9	Enable forward drive when CN1-13 input signal is OFF (open).	175
A	Enable forward drive when CN1-7 input signal is OFF (open).	175
B	Enable forward drive when CN1-8 input signal is OFF (open).	175
C	Enable forward drive when CN1-9 input signal is OFF (open).	175
D	Enable forward drive when CN1-10 input signal is OFF (open).	175
E	Enable forward drive when CN1-11 input signal is OFF (open).	175
F	Enable forward drive when CN1-12 input signal is OFF (open).	175

◆ Pn50B: Input Signal Selections 2

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to FFFFh	–	8882h	All	After restart	Setup	–

Digit	Meaning	Reference
n.□□□X	N-OT (Reverse Drive Prohibit Input) Signal Allocation Speed Pos Trq	–
0	Enable reverse drive when CN1-13 input signal is ON (closed).	175
1	Enable reverse drive when CN1-7 input signal is ON (closed).	175
2 Default	Enable reverse drive when CN1-8 input signal is ON (closed).	175
3	Enable reverse drive when CN1-9 input signal is ON (closed).	175
4	Enable reverse drive when CN1-10 input signal is ON (closed).	175
5	Enable reverse drive when CN1-11 input signal is ON (closed).	175
6	Enable reverse drive when CN1-12 input signal is ON (closed).	175
7	Set the signal to always prohibit reverse drive.	175
8	Set the signal to always enable reverse drive.	175
9	Enable reverse drive when CN1-13 input signal is OFF (open).	175
A	Enable reverse drive when CN1-7 input signal is OFF (open).	175
B	Enable reverse drive when CN1-8 input signal is OFF (open).	175
C	Enable reverse drive when CN1-9 input signal is OFF (open).	175
D	Enable reverse drive when CN1-10 input signal is OFF (open).	175
E	Enable reverse drive when CN1-11 input signal is OFF (open).	175
F	Enable reverse drive when CN1-12 input signal is OFF (open).	175
n.□□X□	Reserved (Do not change.)	–
n.□X□□	/P-CL (Forward External Torque Limit Input) Signal Allocation Speed Pos Trq	–
0	Active when CN1-13 input signal is ON (closed).	236
1	Active when CN1-7 input signal is ON (closed).	236
2	Active when CN1-8 input signal is ON (closed).	236
3	Active when CN1-9 input signal is ON (closed).	236
4	Active when CN1-10 input signal is ON (closed).	236
5	Active when CN1-11 input signal is ON (closed).	236
6	Active when CN1-12 input signal is ON (closed).	236
7	The signal is always active.	236
8 Default	The signal is always inactive.	236
9	Active when CN1-13 input signal is OFF (open).	236
A	Active when CN1-7 input signal is OFF (open).	236
B	Active when CN1-8 input signal is OFF (open).	236
C	Active when CN1-9 input signal is OFF (open).	236
D	Active when CN1-10 input signal is OFF (open).	236
E	Active when CN1-11 input signal is OFF (open).	236
F	Active when CN1-12 input signal is OFF (open).	236
n.X□□□	/N-CL (Reverse External Torque Limit Input) Signal Allocation Speed Pos Trq	–
0 to F	The allocations are the same as the /P-CL (Forward External Torque Limit Input) signal allocations.	236

◆ Pn50E: Output Signal Selections 1

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 6666h	–	0000h	All	After restart	Setup	–

Digit	Meaning	Reference
n.□□□X	/COIN (Positioning Completion Output) Signal Allocation Speed Pos Trq	–
0 Default	Disabled (the above signal output is not used).	219
1	Output the signal from the CN1-1 or CN1-2 output terminal.	219
2	Output the signal from the CN1-23 or CN1-24 output terminal.	219
3	Output the signal from the CN1-25 or CN1-26 output terminal.	219
4	Reserved (Do not use.)	219
5	Reserved (Do not use.)	219
6	Reserved (Do not use.)	219
Other values	Disabled (the above signal output is not used).	219
n.□□X□	/V-CMP (Speed Coincidence Detection Output) Signal Allocation Speed Pos Trq	–
0 to 6	The allocations are the same as the /COIN (Positioning Completion Output) signal allocations.	217
n.□X□□	/TGON (Rotation Detection Output) Signal Allocation Speed Pos Trq	–
0 to 6	The allocations are the same as the /COIN (Positioning Completion Output) signal allocations.	216
n.X□□□	/S-RDY (Servo Ready Output) Signal Allocation Speed Pos Trq	–
0 to 6	The allocations are the same as the /COIN (Positioning Completion Output) signal allocations.	217

◆ Pn50F: Output Signal Selections 2

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 6666h	–	0100h	All	After restart	Setup	–

Digit	Meaning	Reference
n.□□□X	/CLT (Torque Limit Detection Output) Signal Allocation Speed Pos Trq	–
0 Default	Disabled (the above signal output is not used).	239
1	Output the signal from the CN1-1 or CN1-2 output terminal.	239
2	Output the signal from the CN1-23 or CN1-24 output terminal.	239
3	Output the signal from the CN1-25 or CN1-26 output terminal.	239
4	Reserved (Do not use.)	239
5	Reserved (Do not use.)	239
6	Reserved (Do not use.)	239
Other values	Disabled (the above signal output is not used).	239
n.□□X□	/VLT (Speed Limit Detection Output) Signal Allocation Speed Pos Trq	–
0 to 6	The allocations are the same as the /CLT (Torque Limit Detection Output) signal allocations.	221
n.□X□□	/BK (Brake Output) Signal Allocation Speed Pos Trq	–
0 to 6	The allocations are the same as the /CLT (Torque Limit Detection Output) signal allocations.	180
n.X□□□	/WARN (Warning Output) Signal Allocation Speed Pos Trq	–
0 to 6	The allocations are the same as the /CLT (Torque Limit Detection Output) signal allocations.	216

◆ Pn510: Output Signal Selections 3

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0666h	–	0000h	All	After restart	Setup	220

Digit	Meaning
n.□□□X	/NEAR (Near Output) Signal Allocation Speed Pos Trq
0 Default	Disabled (the above signal output is not used).
1	Output the signal from the CN1-1 or CN1-2 output terminal.
2	Output the signal from the CN1-23 or CN1-24 output terminal.
3	Output the signal from the CN1-25 or CN1-26 output terminal.
4	Reserved (Do not use.)
5	Reserved (Do not use.)
6	Reserved (Do not use.)
Other values	Disabled (the above signal output is not used).
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

Parameter Lists

14

◆ Pn511: Input Signal Selections 5

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to FFFFh	–	6543h	All	After restart	Setup	210

Digit	Meaning
n.□□□X	/DEC (Origin Return Deceleration Switch Input) Signal Allocation Speed Pos Trq
0	Active when CN1-13 input signal is ON (closed).
1	Active when CN1-7 input signal is ON (closed).
2	Active when CN1-8 input signal is ON (closed).
3 Default	Active when CN1-9 input signal is ON (closed).
4	Active when CN1-10 input signal is ON (closed).
5	Active when CN1-11 input signal is ON (closed).
6	Active when CN1-12 input signal is ON (closed).
7	The signal is always active.
8	The signal is always inactive.
9	Active when CN1-13 input signal is OFF (open).
A	Active when CN1-7 input signal is OFF (open).
B	Active when CN1-8 input signal is OFF (open).
C	Active when CN1-9 input signal is OFF (open).
D	Active when CN1-10 input signal is OFF (open).
E	Active when CN1-11 input signal is OFF (open).
F	Active when CN1-12 input signal is OFF (open).
n.□□X□	/EXT1 (External Latch Input 1) Signal Allocation Speed Pos Trq
0 to 3	The signal is always inactive.
4 Default	Active when CN1-10 input signal is ON (closed).
5	Active when CN1-11 input signal is ON (closed).
6	Active when CN1-12 input signal is ON (closed).
7 to C	The signal is always inactive.
D	Active when CN1-10 input signal is OFF (open).
E	Active when CN1-11 input signal is OFF (open).
F	Active when CN1-12 input signal is OFF (open).
n.□X□□	/EXT2 (External Latch Input 2) Signal Allocation Speed Pos Trq
0 to F	The allocations are the same as the /EXT1 (External Latch Input 1) signal allocations.
n.X□□□	/EXT3 (External Latch Input 3) Signal Allocation Speed Pos Trq
0 to F	The allocations are the same as the /EXT1 (External Latch Input 1) signal allocations.

◆ Pn512: Output Signal Inverse Settings

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1111h	–	0000h	All	After restart	Setup	213

Digit	Meaning
n.□□□X	Output Signal Inversion for CN1-1 and CN1-2 Terminals Speed Pos Trq
0 Default	The signal is not inverted.
1	The signal is inverted.
n.□□X□	Output Signal Inversion for CN1-23 and CN1-24 Terminals Speed Pos Trq
0 Default	The signal is not inverted.
1	The signal is inverted.
n.□X□□	Output Signal Inversion for CN1-25 and CN1-26 Terminals Speed Pos Trq
0 Default	The signal is not inverted.
1	The signal is inverted.
n.X□□□	Reserved (Do not change.)

◆ Pn514: Output Signal Selections 4

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0666h	–	0000h	All	After restart	Setup	469

Digit	Meaning
n.□□□X	Reserved (Do not change.)
n.□□X□	Reserved (Do not change.)
n.□X□□	/PM (Preventative Maintenance Output) Signal Allocation Speed Pos Trq
0 Default	Disabled (the above signal output is not used).
1	Output the signal from the CN1-1 or CN1-2 output terminal.
2	Output the signal from the CN1-23 or CN1-24 output terminal.
3	Output the signal from the CN1-25 or CN1-26 output terminal.
4	Reserved (Do not use.)
5	Reserved (Do not use.)
6	Reserved (Do not use.)
Other values	Disabled (the above signal output is not used).
n.X□□□	Reserved (Do not change.)

◆ Pn516: Input Signal Selections 7

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to FFFFh	–	8888h	All	After restart	Setup	264

Digit	Meaning
n.□□□X	FSTP (Forced Stop Input) Signal Allocation Speed Pos Trq
0	Enable drive when CN1-13 input signal is ON (closed).
1	Enable drive when CN1-7 input signal is ON (closed).
2	Enable drive when CN1-8 input signal is ON (closed).
3	Enable drive when CN1-9 input signal is ON (closed).
4	Enable drive when CN1-10 input signal is ON (closed).
5	Enable drive when CN1-11 input signal is ON (closed).
6	Enable drive when CN1-12 input signal is ON (closed).
7	Set the signal to always prohibit drive (always force the motor to stop).
8 Default	Set the signal to always enable drive (always disable forcing the motor to stop).
9	Enable drive when CN1-13 input signal is OFF (open).
A	Enable drive when CN1-7 input signal is OFF (open).
B	Enable drive when CN1-8 input signal is OFF (open).
C	Enable drive when CN1-9 input signal is OFF (open).
D	Enable drive when CN1-10 input signal is OFF (open).
E	Enable drive when CN1-11 input signal is OFF (open).
F	Enable drive when CN1-12 input signal is OFF (open).
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn518: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
–	-	-	-	All	-	-	–

◆ Pn51B: Motor-Load Position Deviation Overflow Detection Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	0 to 1073741824	1 reference unit	1000	Rotary	Immediately	Setup	487

◆ Pn51E: Position Deviation Overflow Warning Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 100	1%	100	All	Immediately	Setup	315

◆ Pn520: Position Deviation Overflow Alarm Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	1 to 1073741823	1 reference unit	6116694	All	Immediately	Setup	314, 436

◆ Pn522: In-position Range

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
4	0 to 1073741824	1 reference unit	7	All	Immediately	Setup	219

◆ Pn524: Near Signal Width

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
4	1 to 1073741824	1 reference unit	1073741824	All	Immediately	Setup	220

◆ Pn526: Position Deviation Overflow Alarm Level at Servo ON

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
4	1 to 1073741823	1 reference unit	6116694	All	Immediately	Setup	316

◆ Pn528: Position Deviation Overflow Warning Level at Servo ON

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	10 to 100	1%	100	All	Immediately	Setup	316

◆ Pn529: Speed Limit Level at Servo ON

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 10,000	1 min^{-1}	10000	Rotary	Immediately	Setup	316

◆ Pn52A: Multiplier per Fully-closed Rotation

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 100	1%	20	Rotary	Immediately	Tuning	487

◆ Pn52B: Overload Warning Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	1 to 100	1%	20	All	After restart	Setup	186

◆ Pn52C: Base Current Derating at Motor Overload Detection

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	10 to 100	1%	100	All	After restart	Setup	186

◆ Pn530: Program Jogging-Related Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0005h	–	0000h	All	Immediately	Setup	294

Digit	Meaning
n.□□□X	Program Jogging Operation Pattern (Speed, Pos, Trq)
0 Default	(Waiting time in Pn535 → Forward by travel distance in Pn531) × Number of movements in Pn536
1	(Waiting time in Pn535 → Reverse by travel distance in Pn531) × Number of movements in Pn536
2	(Waiting time in Pn535 → Forward by travel distance in Pn531) × Number of movements in Pn536 (Waiting time in Pn535 → Reverse by travel distance in Pn531) × Number of movements in Pn536
3	(Waiting time in Pn535 → Reverse by travel distance in Pn531) × Number of movements in Pn536 (Waiting time in Pn535 → Forward by travel distance in Pn531) × Number of movements in Pn536
4	(Waiting time in Pn535 → Forward by travel distance in Pn531 → Waiting time in Pn535 → Reverse by travel distance in Pn531) × Number of movements in Pn536
5	(Waiting time in Pn535 → Reverse by travel distance in Pn531 → Waiting time in Pn535 → Forward by travel distance in Pn531) × Number of movements in Pn536
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn531: Program Jogging Travel Distance

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	1 to 1073741824	1 reference unit	32768	All	Immediately	Setup	294

◆ Pn533: Program Jogging Movement Speed

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	1 to 10,000	Rotary: 1 min^{-1} Direct Drive: 0.1 min^{-1}	500	Rotary	Immediately	Setup	294

◆ Pn534: Program Jogging Acceleration/Deceleration Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	2 to 10,000	1 ms	100	All	Immediately	Setup	294

◆ Pn535: Program Jogging Waiting Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10,000	1 ms	100	All	Immediately	Setup	294

◆ Pn536: Program Jogging Number of Movements

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 1,000	1 time	1	All	Immediately	Setup	294

◆ Pn540: Maximum Search Gain

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	10 to 4000	0.1 Hz	3000	All	Immediately	Tuning	–

◆ Pn550: Analog Monitor 1 Offset Voltage

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	-10,000 to 10,000	0.1 V	0	All	Immediately	Setup	464

◆ Pn551: Analog Monitor 2 Offset Voltage

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	-10,000 to 10,000	0.1 V	0	All	Immediately	Setup	464

◆ Pn552: Analog Monitor 1 Magnification

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	-10,000 to 10,000	× 0.01	100	All	Immediately	Setup	464

◆ Pn553: Analog Monitor 2 Magnification

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	-10,000 to 10,000	× 0.01	100	All	Immediately	Setup	464

◆ Pn55A: Power Consumption Monitor Unit Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	1 to 1440	1 min	1	All	Immediately	Setup	–

◆ Pn55C: Specifying Output Status At a Host Comms Error Switch

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0001h	–	0001h	All	After restart	Setup	278

Digit	Meaning
n.□□□X	Specifying Output Status When a Host Communications Error Occurs Function Selection (Speed Pos Trq)
0	Disable the function to specify the output status when a host communications error occurs.
1 Default	Enable the function to specify the output status when a host communications error occurs.
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn55D: Specifying Output Status When a Host Comms Error Occurs

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0000h to 001Fh	–	0000h	All	After restart	Setup	278

Bit	Meaning
Bit 0	Use the SO1 output (0: OFF when a host communications error occurs, 1: ON when a host communications occurs)
Bit 1	Use the SO2 output (0: OFF when a host communications error occurs, 1: ON when a host communications occurs)
Bit 2	Use the SO3 output (0: OFF when a host communications error occurs, 1: ON when a host communications occurs)
Bits 3 to 15	Reserved (Do not use.)

◆ Pn560: Residual Vibration Detection Width

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	1 to 3000	0.1%	400	All	Immediately	Setup	382

◆ Pn561: Overshoot Detection Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 1,000	1%	100	All	Immediately	Setup	352, 363

◆ Pn562: Setting Gain Ratio

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	10 to 100	1%	80	All	Immediately	Tuning	352, 363

◆ Pn56A: Output Signal Reference Method Selections 1

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2222h	–	1111h	All	After restart	Setup	215

Digit	Meaning
n.□□□X	SO1 Output Signal Reference Method Selection (Speed Pos Trq)
0	Reserved (Do not use.)
1 Default	Output OR of parameter-assigned SO1 signal and signal set by SVCMD_IO.
2	Output signal set by SCVMD_IO to SLO1.
n.□□X□	SO2 Output Signal Reference Method Selection (Speed Pos Trq)
0	Reserved (Do not use.)
1 Default	Output OR of parameter-assigned SO2 signal and signal set by SVCMD_IO.
2	Output signal set by SCVMD_IO to SLO2.
n.□X□□	SO3 Output Signal Reference Method Selection (Speed Pos Trq)
0	Reserved (Do not use.)
1 Default	Output OR of parameter-assigned SO3 signal and signal set by SVCMD_IO.
2	Output signal set by SCVMD_IO to SLO3.
n.X□□□	SLO4 Output Signal Reference Method Selection (Speed Pos Trq)
0	Reserved (Do not use.)
1 Default	Do not output signal to SLO4.
2	Output signal set by SCVMD_IO to SOL4.

◆ Pn56B: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	0001h	All	–	–	–

◆ Pn581: Zero Speed Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	1 to 10,000	1 mm/s	20	Linear	Immediately	Setup	216

◆ Pn582: Speed Coincidence Detection Signal Output Width

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 100	1 mm/s	10	Linear	Immediately	Setup	217

◆ Pn583: Brake Reference Output Speed Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10,000	1 mm/s	10	Linear	Immediately	Setup	179

◆ Pn584: Speed Limit Level at Servo ON

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10,000	1 mm/s	10000	Linear	Immediately	Setup	316

◆ Pn585: Program Jogging Movement Speed

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	1 to 10,000	1 mm/s	50	Linear	Immediately	Setup	294

◆ Pn586: Motor Running Cooling Ratio

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 100	1% / Maximum Motor Speed	0	Linear	Immediately	Setup	–

◆ Pn587: Polarity Detection Execution Selection for Absolute Linear Encoder

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0001h	–	0000h	Linear	Immediately	Setup	171

Digit	Meaning
n.□□□X	Polarity Detection Selection for Absolute Linear Encoder (Speed Pos Trq)
0 Default	Do not detect polarity.
1	Detect polarity.
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn589: SigmaLINK II Node Detection Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	100 to 10,000	1 ms	1500	All	After restart	Setup	–

◆ Pn590: P-OT (Forward Drive Prohibit Input) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 3149h	–	1007h	All	After restart	Setup	175, 211

Digit	Meaning
n.□XXX	Allocated Pin Number (Speed Pos Trq)
007 Default	Allocate the signal to CN1-7.
008	Allocate the signal to CN1-8.
009	Allocate the signal to CN1-9.
010	Allocate the signal to CN1-10.
011	Allocate the signal to CN1-11.
012	Allocate the signal to CN1-12.
013	Allocate the signal to CN1-13.
100	Allocate the signal to Σ-LINK II Sequence Input 0.
101	Allocate the signal to Σ-LINK II Sequence Input 1.
102	Allocate the signal to Σ-LINK II Sequence Input 2.
103	Allocate the signal to Σ-LINK II Sequence Input 3.
104	Allocate the signal to Σ-LINK II Sequence Input 4.
105	Allocate the signal to Σ-LINK II Sequence Input 5.
106	Allocate the signal to Σ-LINK II Sequence Input 6.
107	Allocate the signal to SigmaLINK II Sequence Input 7.
Other values	Set the signal to always enable forward drive.
n.X□□□	Polarity Selection (Speed Pos Trq)
0	Set the signal to always enable forward drive.
1 Default	Active when input signal is ON (closed).
2	Active when input signal is OFF (open).
3	Set the signal to always prohibit forward drive.

Parameter Lists

14

◆ Pn591: N-OT (Reverse Drive Prohibit Input) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 3149h	–	1008h	All	After restart	Setup	175, 211

Digit	Meaning
n.□XXX	Allocated Pin Number (Speed, Pos, Trq)
007	Allocate the signal to CN1-7.
008 Default	Allocate the signal to CN1-8.
009	Allocate the signal to CN1-9.
010	Allocate the signal to CN1-10.
011	Allocate the signal to CN1-11.
012	Allocate the signal to CN1-12.
013	Allocate the signal to CN1-13.
100	Allocate the signal to Σ-LINK II Sequence Input 0.
101	Allocate the signal to Σ-LINK II Sequence Input 1.
102	Allocate the signal to Σ-LINK II Sequence Input 2.
103	Allocate the signal to Σ-LINK II Sequence Input 3.
104	Allocate the signal to Σ-LINK II Sequence Input 4.
105	Allocate the signal to Σ-LINK II Sequence Input 5.
106	Allocate the signal to Σ-LINK II Sequence Input 6.
107	Allocate the signal to SigmaLINK II Sequence Input 7.
Other values	Set the signal to always enable reverse drive.
n.X□□□	Polarity Selection (Speed, Pos, Trq)
0	Set the signal to always enable reverse drive.
1 Default	Active when input signal is ON (closed).
2	Active when input signal is OFF (open).
3	Set the signal to always prohibit reverse drive.

◆ Pn592: /DEC (Origin Return Deceleration Switch Input) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0000h to 3149h	–	1009h	All	After restart	Setup	–

Digit	Meaning
n.□XXX	Allocated Pin Number Speed Pos Trq
007	Allocate the signal to CN1-7.
008	Allocate the signal to CN1-8.
009 Default	Allocate the signal to CN1-9.
010	Allocate the signal to CN1-10.
011	Allocate the signal to CN1-11.
012	Allocate the signal to CN1-12.
013	Allocate the signal to CN1-13.
100	Allocate the signal to Σ-LINK II Sequence Input 0.
101	Allocate the signal to Σ-LINK II Sequence Input 1.
102	Allocate the signal to Σ-LINK II Sequence Input 2.
103	Allocate the signal to Σ-LINK II Sequence Input 3.
104	Allocate the signal to Σ-LINK II Sequence Input 4.
105	Allocate the signal to Σ-LINK II Sequence Input 5.
106	Allocate the signal to Σ-LINK II Sequence Input 6.
107	Allocate the signal to SigmaLINK II Sequence Input 7.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection Speed Pos Trq
0	The signal is always inactive.
1 Default	Active when input signal is ON (closed).
2	Active when input signal is OFF (open).
3	The signal is always active.

◆ Pn593: /EXT1 (External Latch Input 1) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0000h to 2149h	–	1010h	All	After restart	Setup	–

Digit	Meaning
n.□XXX	Allocated Pin Number Speed Pos Trq
010 Default	Allocate the signal to CN1-10.
011	Allocate the signal to CN1-11.
012	Allocate the signal to CN1-12.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection Speed Pos Trq
0	The signal is always inactive.
1 Default	Active when input signal is ON (closed).
2	Active when input signal is OFF (open).

Parameter Lists 14

◆ Pn594: /EXT2 (External Latch Input 2) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2149h	–	1011h	All	After restart	Setup	–

Digit	Meaning
n.□XXX	Allocated Pin Number (Speed, Pos, Trq)
010	Allocate the signal to CN1-10.
011 Default	Allocate the signal to CN1-11.
012	Allocate the signal to CN1-12.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection (Speed, Pos, Trq)
0	The signal is always inactive.
1 Default	Active when input signal is ON (closed).
2	Active when input signal is OFF (open).

◆ Pn595: /EXT3 (External Latch Input 3) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2149h	–	1012h	All	After restart	Setup	–

Digit	Meaning
n.□XXX	Allocated Pin Number (Speed, Pos, Trq)
010	Allocate the signal to CN1-10.
011	Allocate the signal to CN1-11.
012 Default	Allocate the signal to CN1-12.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection (Speed, Pos, Trq)
0	The signal is always inactive.
1 Default	Active when input signal is ON (closed).
2	Active when input signal is OFF (open).

◆ Pn597: FSTP (Forced Stop Input) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 3049h	–	0000h	All	After restart	Setup	264

Digit	Meaning
n.□XXX	Allocated Pin Number Speed Pos Trq
007	Allocate the signal to CN1-7.
008	Allocate the signal to CN1-8.
009	Allocate the signal to CN1-9.
010	Allocate the signal to CN1-10.
011	Allocate the signal to CN1-11.
012	Allocate the signal to CN1-12.
013	Allocate the signal to CN1-13.
Other values	Set the signal to always enable drive (always disable forcing the motor to stop).
n.X□□□	Polarity Selection Speed Pos Trq
0 Default	Set the signal to always enable drive (always disable forcing the motor to stop).
1	Enable drive when the input signal is ON (closed).
2	Enable drive when the input signal is OFF (open).
3	Set the signal to always prohibit drive (always force the motor to stop).

◆ Pn598: /P-CL (Forward External Torque Limit Input) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 3149h	–	0000h	All	After restart	Setup	211, 236

Digit	Meaning
n.□XXX	Allocated Pin Number Speed Pos Trq
000 Default	The signal is always inactive.
007	Allocate the signal to CN1-7.
008	Allocate the signal to CN1-8.
009	Allocate the signal to CN1-9.
010	Allocate the signal to CN1-10.
011	Allocate the signal to CN1-11.
012	Allocate the signal to CN1-12.
013	Allocate the signal to CN1-13.
100	Allocate the signal to Σ-LINK II Sequence Input 0.
101	Allocate the signal to Σ-LINK II Sequence Input 1.
102	Allocate the signal to Σ-LINK II Sequence Input 2.
103	Allocate the signal to Σ-LINK II Sequence Input 3.
104	Allocate the signal to Σ-LINK II Sequence Input 4.
105	Allocate the signal to Σ-LINK II Sequence Input 5.
106	Allocate the signal to Σ-LINK II Sequence Input 6.
107	Allocate the signal to SigmaLINK II Sequence Input 7.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection Speed Pos Trq
0 Default	The signal is always inactive.
1	Active when input signal is ON (closed).
2	Active when input signal is OFF (open).
3	The signal is always active.

◆ Pn599: /N-CL (Reverse External Torque Limit Input) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 3149h	–	0000h	All	After restart	Setup	211, 236

Digit	Meaning
n.□XXX	Allocated Pin Number (Speed, Pos, Trq)
000 (Default)	The signal is always inactive.
007	Allocate the signal to CN1-7.
008	Allocate the signal to CN1-8.
009	Allocate the signal to CN1-9.
010	Allocate the signal to CN1-10.
011	Allocate the signal to CN1-11.
012	Allocate the signal to CN1-12.
013	Allocate the signal to CN1-13.
100	Allocate the signal to Σ-LINK II Sequence Input 0.
101	Allocate the signal to Σ-LINK II Sequence Input 1.
102	Allocate the signal to Σ-LINK II Sequence Input 2.
103	Allocate the signal to Σ-LINK II Sequence Input 3.
104	Allocate the signal to Σ-LINK II Sequence Input 4.
105	Allocate the signal to Σ-LINK II Sequence Input 5.
106	Allocate the signal to Σ-LINK II Sequence Input 6.
107	Allocate the signal to Σ-LINK II Sequence Input 7.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection (Speed, Pos, Trq)
0 (Default)	The signal is always inactive.
1	Active when input signal is ON (closed).
2	Active when input signal is OFF (open).
3	The signal is always active.

◆ Pn5B0: /COIN (Positioning Completion Output) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2039h	–	0000h	All	After restart	Setup	214, 219

Digit	Meaning
n.□XXX	Allocated Pin Number Speed Pos Trq
001	Allocate the signal to CN1-1.
023	Allocate the signal to CN1-23.
025	Allocate the signal to CN1-25.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection Speed Pos Trq
0 Default	The signal is always inactive.
1	Output the above signal.
2	Invert the above signal and output it.

◆ Pn5B1: /V-CMP (Speed Coincidence Detection Output) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2039h	–	0000h	All	After restart	Setup	214, 217

Digit	Meaning
n.□XXX	Allocated Pin Number Speed Pos Trq
001	Allocate the signal to CN1-1.
023	Allocate the signal to CN1-23.
025	Allocate the signal to CN1-25.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection Speed Pos Trq
0 Default	The signal is always inactive.
1	Output the above signal.
2	Invert the above signal and output it.

◆ Pn5B2: /TGON (Rotation Detection Output) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2039h	–	0000h	All	After restart	Setup	–

Digit	Meaning	Reference
n.□XXX	Allocated Pin Number Speed Pos Trq	–
001	Allocate the signal to CN1-1.	214, 216
023	Allocate the signal to CN1-23.	214, 216
025	Allocate the signal to CN1-25.	214, 216
Other values	The signal is always inactive.	214, 216
n.X□□□	Polarity Selection Speed Pos Trq	–
0 Default	The signal is always inactive.	216, 214
1	Output the above signal.	216, 214
2	Invert the above signal and output it.	216, 214

◆ Pn5B3: /S-RDY (Servo Ready Output) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2039h	–	0000h	All	After restart	Setup	214, 217

Digit	Meaning
n.□XXX	Allocated Pin Number Speed Pos Trq
001	Allocate the signal to CN1-1.
023	Allocate the signal to CN1-23.
025	Allocate the signal to CN1-25.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection Speed Pos Trq
0 Default	The signal is always inactive.
1	Output the above signal.
2	Invert the above signal and output it.

◆ Pn5B4: /CLT (Torque Limit Detection Output) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2039h	–	0000h	All	After restart	Setup	214, 239

Digit	Meaning
n.□XXX	Allocated Pin Number (Speed, Pos, Trq)
001	Allocate the signal to CN1-1.
023	Allocate the signal to CN1-23.
025	Allocate the signal to CN1-25.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection (Speed, Pos, Trq)
0 Default	The signal is always inactive.
1	Output the above signal.
2	Invert the above signal and output it.

◆ Pn5B5: /VLT (Speed Limit Detection Output) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2039h	–	0000h	All	After restart	Setup	214, 221

Digit	Meaning
n.□XXX	Allocated Pin Number (Speed, Pos, Trq)
001	Allocate the signal to CN1-1.
023	Allocate the signal to CN1-23.
025	Allocate the signal to CN1-25.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection (Speed, Pos, Trq)
0 Default	The signal is always inactive.
1	Output the above signal.
2	Invert the above signal and output it.

◆ Pn5B6: /BK (Brake Output) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2039h	–	1001h	All	After restart	Setup	180, 214

Digit	Meaning
n.□XXX	Allocated Pin Number (Speed Pos Trq)
001 Default	Allocate the signal to CN1-1.
023	Allocate the signal to CN1-23.
025	Allocate the signal to CN1-25.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection (Speed Pos Trq)
0	The signal is always inactive.
1 Default	Output the above signal.
2	Invert the above signal and output it.

◆ Pn5B7: /WARN (Warning Output) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2039h	–	0000h	All	After restart	Setup	214, 216

Digit	Meaning
n.□XXX	Allocated Pin Number (Speed Pos Trq)
001	Allocate the signal to CN1-1.
023	Allocate the signal to CN1-23.
025	Allocate the signal to CN1-25.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection (Speed Pos Trq)
0 Default	The signal is always inactive.
1	Output the above signal.
2	Invert the above signal and output it.

◆ Pn5B8: /NEAR (Near Output) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2039h	–	0000h	All	After restart	Setup	214, 220

Digit	Meaning
n.□XXX	Allocated Pin Number Speed Pos Trq
001	Allocate the signal to CN1-1.
023	Allocate the signal to CN1-23.
025	Allocate the signal to CN1-25.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection Speed Pos Trq
0 Default	The signal is always inactive.
1	Output the above signal.
2	Invert the above signal and output it.

◆ Pn5BC: /PM (Preventative Maintenance Output) Signal Allocation

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 2039h	–	0000h	All	After restart	Setup	469

Digit	Meaning
n.□XXX	Allocated Pin Number Speed Pos Trq
001	Allocate the signal to CN1-1.
023	Allocate the signal to CN1-23.
025	Allocate the signal to CN1-25.
Other values	The signal is always inactive.
n.X□□□	Polarity Selection Speed Pos Trq
0 Default	The signal is always inactive.
1	Output the above signal.
2	Invert the above signal and output it.

◆ Pn5C3: Error Detection Setting

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0011h	–	0000h	All	After restart	Setup	476

Digit	Meaning
n.□□□X	Error Detection Selections (Speed Pos Trq)
0 (Default)	Disable error detection.
1	Enable error detection.
n.□□X□	Execution Selection when Error Detection Warning (Speed Pos Trq)
0 (Default)	Stop error detection when A.905 (Error Detection Warning) occurs.
1	Do not stop error detection when A.905 (Error Detection Warning) occurs.
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn5C4: Error Detection Sample Data Set 1 Warning Level 1

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10,000	0.01%	2000	All	Immediately	Setup	476

◆ Pn5C5: Error Detection Sample Data Set 1 Judgment Level 1

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10,000	–	1520	All	Immediately	Setup	476

◆ Pn5C6: Error Detection Sample Data Set 1 Warning Level 2

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10,000	0.01%	2000	All	Immediately	Setup	476

◆ Pn5C7: Error Detection Sample Data Set 1 Judgment Level 2

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10,000	–	1520	All	Immediately	Setup	476

◆ Pn5C8: Error Detection Sample Data Set 2 Warning Level 1

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10,000	0.01%	2000	All	Immediately	Setup	476

◆ Pn5C9: Error Detection Sample Data Set 2 Judgment Level 1

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10,000	–	1520	All	Immediately	Setup	476

◆ Pn5CA: Error Detection Sample Data Set 2 Warning Level 2

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10,000	0.01%	2000	All	Immediately	Setup	476

◆ Pn5CB: Error Detection Sample Data Set 2 Judgment Level 2

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 10,000	–	1520	All	Immediately	Setup	476

◆ Pn5D7: Output Signal Inversion for Triggers at Preset Positions

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000H to 01F7h	–	0000h	All	After restart	Setup	–

Digit	Meaning
n.□□□X	High-Speed Output Signal Inverse Settings for Triggers at Preset Positions Speed Pos Trq
0 Default	The signal is not inverted.
1	Invert CN1-17, -18 (PAO) and output it.
2	Invert CN1-19, -20 (PBO) and output it.
3	Invert CN1-17, -18 (PAO) and CN1-19, -20 (PBO) and output them.
4	Invert CN1-21, -22 (PCO) and output it.
5	Invert CN1-17, -18 (PAO) and CN1-21, -22 (PCO) and output them.
6	Invert CN1-19, -20 (PBO) and CN1-21, -22 (PCO) and output them.
7	Invert CN1-17, -18 (PAO), CN1-19, -20 (PBO), and CN1-21, -22 (PCO) and output them.
n.□□X□	Normal Output Signal Inverse Settings for Triggers at Preset Positions 1 Speed Pos Trq
0 Default	The signal is not inverted.
1	Invert CN1-1, -2 (SO1) and output it.
2	Invert CN1-23, -24 (SO2) and output it.
3	Invert CN1-1, -2 (SO1) and CN1-23, -24 (SO2) and output them.
4	Invert CN1-25, -26 (SO3) and output it.
5	Invert CN1-1, -2 (SO1) and CN1-25, -26 (SO3) and output them.
6	Invert CN1-23, -24 (SO2) and CN1-25, -26 (SO3) and output them.
7	Invert CN1-1, -2 (SO1), CN1-23, -24 (SO2), and CN1-25, -26 (SO3) and output them.
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn600: Regenerative Resistor Capacity

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to SERVOPACK's maximum applicable motor capacity	10 W	0	All	Immediately	Setup	200

◆ Pn601: Dynamic Brake Resistor Allowable Energy Consumption

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65,535	10 J	0	All	After restart	Setup	–

◆ Pn603: Regenerative Resistance

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65,535	10 mΩ	0	All	Immediately	Setup	200

◆ Pn604: Dynamic Brake Resistance

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65,535	10 mΩ	0	All	After restart	Setup	–

◆ Pn61A: Overheat Protection Selections

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0003h	–	0000h	Linear	After restart	Setup	267

Digit	Meaning
n.□□□X	Overheat Protection Selections (Speed Pos Trq)
0 Default	Disable overheat protection.
1	Use overheat protection in the Yaskawa linear servomotor.
2	Monitor a negative voltage input from a sensor attached to the machine and use overheat protection.
3	Monitor a positive voltage input from a sensor attached to the machine and use overheat protection.
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn61B: Overheat Alarm Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 500	0.01 V	250	All	Immediately	Setup	269

Note:

Valid only when Pn61A is set to n.□□□2 or n.□□□3 (enable overheat protection).

◆ Pn61C: Overheat Warning Level

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 100	1%	100	All	Immediately	Setup	269

Note:

Valid only when Pn61A is set to n.□□□2 or n.□□□3 (enable overheat protection).

◆ Pn61D: Overheat Alarm Filter Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65,535	1 s	0	All	Immediately	Setup	269

Note:

Valid only when Pn61A is set to n.□□□2 or n.□□□3 (enable overheat protection).

◆ Pn621: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
–	–	–	–	All	–	–	–

◆ Pn622: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
–	–	–	–	All	–	–	–

◆ Pn623: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
–	–	–	–	All	–	–	–

◆ Pn624: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
–	–	–	–	All	–	–	–

◆ Pn625: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
–	–	–	–	All	–	–	–

◆ Pn626: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
–	–	–	–	All	–	–	–

◆ Pn627: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
–	–	–	–	All	–	–	–

◆ Pn628: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
–	–	–	–	All	–	–	–

◆ Pn660: Triggers at Preset Positions Switch

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0000h to 2011h	–	0000h	All	After restart	Setup	–

Digit	Meaning
n.□□□X	Output Unit Setting Speed Pos Trq
0 Default	Set the signal output width as a time [µs].
1	Set the signal output width as a distance [reference units].
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Triggers at Preset Positions Selections Speed Pos Trq
0 Default	Disable triggers at preset positions.
1	Enable triggers at preset positions.
2	Reserved (Do not use.)

◆ Pn800: Communications Controls

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1FF3h	–	1040h	All	Immediately	Setup	–

Digit	Meaning
n.□□□X	MECHATROLINK Communications Check Mask for Debugging Speed Pos Trq
0 Default	Do not mask.
1	Ignore A.E60 (MECHATROLINK communications error).
2	Ignore A.E50 (WDT errors).
3	Ignore both A.E60 (MECHATROLINK communications errors) and A.E50 (WDT errors).
n.□□X□	Warning Check Masks Speed Pos Trq
0	Do not mask.
1	Ignore A.94□ (data setting warnings).
2	Ignore A.95□ (command warnings).
3	Ignore both A.94□ and A.95□ warnings.
4 Default	Ignore A.96□ (communications warnings).
5	Ignore both A.94□ and A.96□ warnings.
6	Ignore both A.95□ and A.96□ warnings.
7	Ignore A.94□, A.95□, and A.96□ warnings.
8	Ignore A.97□ (data setting warnings).
9	Ignore both A.94□ and A.97□ warnings.
A	Ignore both A.95□ and A.97□ warnings.
B	Ignore A.94□, A.95□, and A.97□ warnings.
C	Ignore both A.96□ and A.97□ warnings.
D	Ignore A.94□, A.96□, and A.97□ warnings.
E	Ignore A.95□, A.96□, and A.97□ warnings.
F	Ignore A.94□, A.95□, A.96□, and A.97□ warnings.
n.□X□□	Reserved (Do not change.)
n.X□□□	Automatic Warning Clear Selection for Debugging Speed Pos Trq
0	Retain warnings for debugging.
1 Default	Automatically clear warnings (MECHATROLINK-III specification).

◆ Pn801: Application Function Selections 6 (Software Limits)

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0103h	–	0003h	All	Immediately	Setup	234

Digit	Meaning
n.□□□X	Software Limits (Speed, Pos, Trq)
0	Enable both forward and reverse software limits.
1	Disable forward software limit.
2	Disable reverse software limit.
3 (Default)	Disable both forward and reverse software limits.
n.□□X□	Reserved (Do not change.)
n.□X□□	Software Limit Check for References (Speed, Pos, Trq)
0 (Default)	Do not perform software limit checks for references.
1	Perform software limit checks for references.
n.X□□□	Reserved (Do not change.)

◆ Pn803: Origin Range

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 250	1 reference unit	10	All	Immediately	Setup	–

◆ Pn804: Forward Software Limit

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	-1073741823 to 1073741823	1 reference unit	1073741823	All	Immediately	Setup	234

◆ Pn806: Reverse Software Limit

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	-1073741823 to 1073741823	1 reference unit	-1073741823	All	Immediately	Setup	234

◆ Pn808: Absolute Encoder Origin Offset

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	-1073741823 to 1073741823	1 reference unit	0	All	Immediately	Setup	197

Note:

Enabled after SENS_ON command execution is completed.

◆ Pn80A: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	100	All	–	Setup	–

◆ Pn80B: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	100	All	Immediately	Setup	–

◆ Pn80C: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	0	All	Immediately	Setup	–

◆ Pn80D: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	100	All	Immediately	Setup	–

◆ Pn80E: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	100	All	Immediately	Setup	–

◆ Pn80F: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	0	All	Immediately	Setup	–

◆ Pn810: Exponential Acceleration/ Deceleration Bias

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65,535	100 reference units/s	0	All	Immediately	Setup	–

Note:

The value is updated only when the reference is stopped (DEN = 1).

◆ Pn811: Exponential Function Acceleration/Deceleration Time Constant

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 5,100	0.1 ms	0	All	Immediately	Setup	–

Note:

The value is updated only when the reference is stopped (DEN = 1).

◆ Pn812: Movement Average Time

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 5,100	0.1 ms	0	All	Immediately	Setup	–

Note:

The value is updated only when the reference is stopped (DEN = 1).

◆ Pn814: External Positioning Final Travel Distance

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	-1073741823 to 1073741823	1 reference unit	100	All	Immediately	Setup	–

◆ Pn816: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	0000h	All	–	Setup	–

◆ Pn817: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	0	All	Immediately	Setup	–

◆ Pn818: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	0	All	Immediately	Setup	–

◆ Pn819: Final Travel for Zero Point Return

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	-1073741823 to 1073741823	1 reference unit	100	All	Immediately	Setup	–

◆ Pn81E: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	0000h	All	–	Setup	–

◆ Pn81F: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	0010h	All	–	Setup	–

◆ Pn820: Forward Latching Area

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	-2147483648 to 2147483647	1 reference unit	0	All	Immediately	Setup	–

◆ Pn822: Reverse Latching Area

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	-2147483648 to 2147483647	1 reference unit	0	All	Immediately	Setup	–

◆ Pn824: Option Monitor 1 Selection

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to FFFFh	–	0000h	–	Immediately	Setup	–

- High-Speed Monitor Region

Set Value	Meaning	Applicable Motors
0000h Default	Motor speed [overspeed detection speed / 1000000h]	All
0001h	Speed reference [overspeed detection speed / 1000000h]	All
0002h	Torque [maximum torque] / 1000000h]	All
0003h	Position deviation (lower 32 bits) [reference units]	All
0004h	Position deviation (upper 32 bits) [reference units]	All
000Ah	PG count (lower 32 bits) [reference units]	All
000Bh	PG count (upper 32 bits) [reference units]	All
000Ch	FPG count (lower 32 bits) [reference units]	All
000Dh	FPG count (upper 32 bits) [reference units]	All
0055h	Estimated Vibration [overspeed detection speed / 1000000h]	All
0056h	Estimated External Disturbance Torque [maximum torque / 1000000h]	All
0113h	File Upload Counter	All
0114h	File Upload Data	All
0115h	Error Detection Trace Counter	All
0116h	Error Detection Trace Error Rate	All
0200h	SigmaLINK II Response Data 1	All
0201h	SigmaLINK II Response Data 2	All
0202h	SigmaLINK II Response Data 3	All
0203h	SigmaLINK II Response Data 4	All
0204h	SigmaLINK II Response Data 5	All
0205h	SigmaLINK II Response Data 6	All
0206h	SigmaLINK II Response Data 7	All
0207h	SigmaLINK II Response Data 8	All
0210h	SigmaLINK II Command Data 1	All
0211h	SigmaLINK II Command Data 2	All
0212h	SigmaLINK II Command Data 3	All
0213h	SigmaLINK II Command Data 4	All
0240h	SigmaLINK II Data Status Information	All

- Low-Speed Monitor Region

Set Value	Meaning	Applicable Motors
0010h	Un000: Motor Speed [min^{-1}]	All
0011h	Un001: Speed Reference [min^{-1}]	All
0012h	Un002: Torque Reference [%]	All

Set Value	Meaning	Applicable Motors
0013h	Un003: Rotational Angle 1 [encoder pulses] Number of encoder pulses from origin within one encoder rotation displayed in decimal	All
	Un003: Electrical Angle 1 [linear encoder pulses] Linear encoder pulses from the polarity origin displayed in decimal	
0014h	Un004: Rotational Angle 2 [deg] Electrical angle from polarity origin	All
	Un004: Electrical Angle 2 [deg] Electrical angle from polarity origin	
0015h	Un005: Input Signal Monitor	All
0016h	Un006: Output Signal Monitor	All
0017h	Un007: Input Reference Pulse Speed [min^{-1}]	All
0018h	Un008: Position Deviation [reference units]	All
0019h	Un009: Accumulated Load Ratio [%]	All
001Ah	Un00A: Regenerative Load Ratio [%]	All
001Bh	Un00B: Dynamic Brake Resistor Power Consumption [%]	All
001Ch	Un00C: Input Reference Pulse Counter [reference units]	All
001Dh	Un00D: Feedback Pulse Counter [encoder pulses]	All
001Eh	Un00E: Fully-closed Loop Feedback Pulse Counter [external encoder resolution]	Rotary
0025h	Initial absolute position data (lower 32 bits) [pulses]	Linear
0026h	Initial absolute position data (upper 32 bits) [pulses]	Linear
0040h	Un025: SERVOPACK Installation Environment Monitor	All
0041h	Un026: Servomotor Installation Environment Monitor	All
0042h	Un027: Built-in Fan Remaining Life Ratio	All
0043h	Un028: Capacitor Remaining Life Ratio	All
0044h	Un029: Surge Prevention Circuit Remaining Life Ratio	All
0045h	Un02A: Dynamic Brake Circuit Remaining Life Ratio	All
0046h	Un032: Instantaneous Power	All
0047h	Un033: Power Consumption	All
0048h	Un034: Cumulative Power Consumption	All
004Dh	Un173: Temperature Margin until SERVOPACK Overheats	All
0058h	Un13C: Margin until Regenerative Overload	All
005Ah	Un13E: Margin until Undervoltage	All
005Bh	Un13F: Margin until Overvoltage	All
0060h	Un023: Main Circuit DC Voltage	All
0070h	Un078: Maximum Value of Amplitude of Estimated Vibration [min^{-1}]	All
0071h	Un07A: Maximum Value of Estimated External Disturbance Torque [%]	All
0072h	Un07B: Minimum Value of Estimated External Disturbance Torque [%]	All
0073h	Un147: Number of MECHATROLINK Communications Errors [times]	All
0074h	Un104: Number of Serial Encoder Communications Errors [times]	All
0075h	Un105: Settling Time [0.1 ms]	All
0076h	Un106: Amount of Overshoot [reference units]	All
0077h	Un107: Residual Vibration Frequency [0.1 Hz]	All

Set Value	Meaning	Applicable Motors
0079h	Un174: Temperature Margin until Servomotor Overheats [°C]	All
007Ah	Un145: Maximum Value of Accumulated Load Ratio [%]	All
007Bh	Un14E: Margin until Overload [0.01 %]	All
007Ch	Un07C: Identified Moment of Inertia Ratio	All
007Eh	Un108: Maximum Settling Time [0.1ms]	All
007Fh	Un109: Maximum Amount of Overshoot [reference units]	All
0104h	Un177: Encoder Power Supplied Time	Rotary
0106h	Un17A: Encoder Power Supply Voltage	Rotary
0107h	Un17B: Encoder Battery Voltage	Rotary
010Ch	Un181: Motor Total Number of Rotations	Rotary
010Dh	Un183: Maintenance Prediction Monitor - Bearings	Rotary
010Eh	Un184: Maintenance Prediction Monitor - Oil Seal	Rotary
0126h	Un190: Motor Vibration in X-Axis Direction	Rotary
0127h	Un191: Motor Vibration in Y-Axis Direction	Rotary
0128h	Un192: Motor Vibration in Z-Axis Direction	Rotary
0129h	Un193: Motor Vibration XYZ Composite Value	Rotary
012Ah	Un194: Maximum Motor Vibration	Rotary

- Low-Speed Monitor Region (Communications Module Only)

Set Value	Meaning	Applicable Motors
0080h	Previous value of latched feedback position (LPOS1) [reference units]	All
0081h	Previous value of latched feedback position (LPOS2) [reference units]	All
0084h	Continuous Latch Status (EX STATUS)	All

- All Areas

Set Value	Meaning	Applicable Motors
Other values	Reserved (Do not use.)	All

◆ Pn825: Option Monitor 2 Selection

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0000h to FFFFh	–	0000h	–	Immediately	Setup	–

Set Value	Meaning
0000h to FFFFh	The settings are the same as those for the Option Monitor 1 Selection.

◆ Pn827: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	–	–	100	All	–	Setup	–

◆ Pn829: SVOFF Waiting Time (for SVOFF at Deceleration to Stop)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65,535	10 ms	0	All	Immediately	Setup	–

Note:

Change the setting when the reference is stopped (while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

◆ Pn82A: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	1813h	All	–	Setup	–

◆ Pn82B: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	1D1Ch	All	–	Setup	–

◆ Pn82C: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	1F1Eh	All	–	Setup	–

◆ Pn82D: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	0000h	All	–	Setup	–

◆ Pn82E: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	0000h	All	–	Setup	–

◆ Pn833: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	0001h	All	–	–	–

◆ Pn834: First Stage Linear Acceleration Constant 2

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	1 to 4294967295	10000 reference units/s^2	100	All	Immediately	Setup	–

Note:

Change the setting when the reference is stopped (while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

◆ Pn836: Second Stage Linear Acceleration Constant 2

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
4	1 to 4294967295	10000 reference units/s^2	100	All	Immediately	Setup	–

Note:

Change the setting when the reference is stopped (while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

◆ Pn838: Acceleration Constant Switching Speed 2

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
4	0 to 2097152000	1 reference unit/s	0	All	Immediately	Setup	–

Note:

Change the setting when the reference is stopped (while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

◆ Pn83A: First Stage Linear Deceleration Constant 2

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
4	1 to 4294967295	10000 reference units/s^2	100	All	Immediately	Setup	–

Note:

Change the setting when the reference is stopped (while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

◆ Pn83C: Second Stage Linear Deceleration Constant 2

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
4	1 to 4294967295	10000 reference units/s^2	100	All	Immediately	Setup	–

Note:

Change the setting when the reference is stopped (while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

◆ Pn83E: Deceleration Constant Switching Speed 2

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
4	0 to 2097152000	1 reference unit/s	0	All	Immediately	Setup	–

Note:

Change the setting when the reference is stopped (while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

◆ Pn840: Linear Deceleration Constant 2 for Stopping

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
4	1 to 4294967295	10000 reference units/s^2	100	All	Immediately	Setup	–

Note:

Change the setting when the reference is stopped (while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

◆ Pn842: Second Origin Approach Speed 1

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
4	0 to 20971520	100 reference units/s	50	All	Immediately	Setup	–

Note:

Change the setting when the reference is stopped (while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

◆ Pn844: Second Origin Approach Speed 2

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
4	0 to 20971520	100 reference units/s	5	All	Immediately	Setup	–

Note:

Change the setting when the reference is stopped (while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

◆ Pn846: POSING Command S-curve Acceleration/Deceleration Rate

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 50	1%	0	All	Immediately	Setup	–

Note:

Change the setting when the reference is stopped (while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

◆ Pn850: Number of Latch Sequences

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 8	–	0	All	Immediately	Setup	–

◆ Pn851: Continuous Latch Sequence Count

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0 to 255	–	0	All	Immediately	Setup	–

◆ Pn852: Latch Sequence 1 to 4 Settings

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Refer-ence
2	0000h to 3333h	–	0000h	All	Immediately	Setup	–

Digit	Meaning
n.□□□X	Latch Sequence 1 Signal Selection Speed Pos Trq
0 Default	Phase C
1	EXT1 signal
2	EXT2 signal
3	EXT3 signal
n.□□X□	Latch Sequence 2 Signal Selection Speed Pos Trq
0 to 3	The settings are the same as those for the Latch Sequence 1 Signal Selection.
n.□X□□	Latch Sequence 3 Signal Selection Speed Pos Trq
0 to 3	The settings are the same as those for the Latch Sequence 1 Signal Selection.
n.X□□□	Latch Sequence 4 Signal Selection Speed Pos Trq
0 to 3	The settings are the same as those for the Latch Sequence 1 Signal Selection.

◆ Pn853: Latch Sequence 5 to 8 Settings

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 3333h	–	0000h	All	Immediately	Setup	–

Digit	Meaning
n.□□□X	Latch Sequence 5 Signal Selection Speed Pos Trq
0 Default	Phase C
1	EXT1 signal
2	EXT2 signal
3	EXT3 signal
n.□□X□	Latch Sequence 6 Signal Selection Speed Pos Trq
0 to 3	The settings are the same as those for the Latch Sequence 5 Signal Selection.
n.□X□□	Latch Sequence 7 Signal Selection Speed Pos Trq
0 to 3	The settings are the same as those for the Latch Sequence 5 Signal Selection.
n.X□□□	Latch Sequence 8 Signal Selection Speed Pos Trq
0 to 3	The settings are the same as those for the Latch Sequence 5 Signal Selection.

◆ Pn860: SVCMD_IO Input Signal Monitor Allocations 1

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1717h	–	0000h	All	Immediately	Setup	–

Digit	Meaning
n.□□□X	Input Signal Monitor Allocation for CN1-13 (SVCMD_IO) Speed Pos Trq
0 Default	Allocate bit 24 (IO_STS1) to CN1-13 input signal monitor.
1	Allocate bit 25 (IO_STS2) to CN1-13 input signal monitor.
2	Allocate bit 26 (IO_STS3) to CN1-13 input signal monitor.
3	Allocate bit 27 (IO_STS4) to CN1-13 input signal monitor.
4	Allocate bit 28 (IO_STS5) to CN1-13 input signal monitor.
5	Allocate bit 29 (IO_STS6) to CN1-13 input signal monitor.
6	Allocate bit 30 (IO_STS7) to CN1-13 input signal monitor.
7	Allocate bit 31 (IO_STS8) to CN1-13 input signal monitor.
n.□□X□	CN1-13 Input Signal Monitor Enable/Disable Selection Speed Pos Trq
0 Default	Disable allocation for CN1-13 input signal monitor.
1	Enable allocation for CN1-13 input signal monitor.
n.□X□□	Input Signal Monitor Allocation for CN1-7 (SVCMD_IO) Speed Pos Trq
0 to 7	The settings are the same as the CN1-13 allocations.
n.X□□□	CN1-7 Input Signal Monitor Enable/Disable Selection Speed Pos Trq
0 Default	Disable allocation for CN1-7 input signal monitor.
1	Enable allocation for CN1-7 input signal monitor.

◆ Pn861: SVCMD_IO Input Signal Monitor Allocations 2

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1717h	–	0000h	All	Immediately	Setup	–

Digit	Meaning
n.□□□X	Input Signal Monitor Allocation for CN1-8 (SVCMD_IO) Speed Pos Trq
0 to 7	The settings are the same as the CN1-13 allocations.
n.□□X□	CN1-8 Input Signal Monitor Enable/Disable Selection Speed Pos Trq
0 Default	Disable allocation for CN1-8 input signal monitor.
1	Enable allocation for CN1-8 input signal monitor.
n.□X□□	Input Signal Monitor Allocation for CN1-9 (SVCMD_IO) Speed Pos Trq
0 to 7	The settings are the same as the CN1-13 allocations.
n.X□□□	CN1-9 Input Signal Monitor Enable/Disable Selection Speed Pos Trq
0 Default	Disable allocation for CN1-9 input signal monitor.
1	Enable allocation for CN1-9 input signal monitor.

◆ Pn862: SVCMD_IO Input Signal Monitor Allocations 3

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1717h	–	0000h	All	Immediately	Setup	–

Digit	Meaning
n.□□□X	Input Signal Monitor Allocation for CN1-10 (SVCMD_IO) Speed Pos Trq
0 to 7	The settings are the same as the CN1-13 allocations.
n.□□X□	CN1-10 Input Signal Monitor Enable/Disable Selection Speed Pos Trq
0 Default	Disable allocation for CN1-10 input signal monitor.
1	Enable allocation for CN1-10 input signal monitor.
n.□X□□	Input Signal Monitor Allocation for CN1-11 (SVCMD_IO) Speed Pos Trq
0 to 7	The settings are the same as the CN1-13 allocations.
n.X□□□	CN1-11 Input Signal Monitor Enable/Disable Selection Speed Pos Trq
0 Default	Disable allocation for CN1-11 input signal monitor.
1	Enable allocation for CN1-11 input signal monitor.

Parameter Lists

14

◆ Pn863: SVCMD_IO Input Signal Monitor Allocations 4

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1717h	–	0000h	All	Immediately	Setup	–

Digit	Meaning
n.□□□X	Input Signal Monitor Allocation for CN1-12 (SVCMD_IO) Speed Pos Trq
0 to 7	The settings are the same as the CN1-13 allocations.
n.□□X□	CN1-12 Input Signal Monitor Enable/Disable Selection Speed Pos Trq
0 Default	Disable allocation for CN1-12 input signal monitor.
1	Enable allocation for CN1-12 input signal monitor.
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn868: SVCMD_IO Output Signal Monitor Allocations 1

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1717h	–	0000h	All	Immediately	Setup	–

Digit	Meaning
n.□□□X	Output Signal Monitor Allocation for CN1-1 and CN1-2 (SVCMD_IO) Speed Pos Trq
0 Default	Allocate bit 24 (IO_STS1) to CN1-1/CN1-2 output signal monitor.
1	Allocate bit 25 (IO_STS2) to CN1-1/CN1-2 output signal monitor.
2	Allocate bit 26 (IO_STS3) to CN1-1/CN1-2 output signal monitor.
3	Allocate bit 27 (IO_STS4) to CN1-1/CN1-2 output signal monitor.
4	Allocate bit 28 (IO_STS5) to CN1-1/CN1-2 output signal monitor.
5	Allocate bit 29 (IO_STS6) to CN1-1/CN1-2 output signal monitor.
6	Allocate bit 30 (IO_STS7) to CN1-1/CN1-2 output signal monitor.
7	Allocate bit 31 (IO_STS8) to CN1-1/CN1-2 output signal monitor.
n.□□X□	CN1-1/CN1-2 Output Signal Monitor Enable/Disable Selection Speed Pos Trq
0 Default	Disable allocation for CN1-1/CN1-2 output signal monitor.
1	Enable allocation for CN1-1/CN1-2 output signal monitor.
n.□X□□	Output Signal Monitor Allocation for CN1-23 and CN1-24 (SVCMD_IO) Speed Pos Trq
0 to 7	The settings are the same as the CN1-1/CN1-2 allocations.
n.X□□□	CN1-23/CN1-24 Output Signal Monitor Enable/Disable Selection Speed Pos Trq
0 Default	Disable allocation for CN1-23/CN1-24 output signal monitor.
1	Enable allocation for CN1-23/CN1-24 output signal monitor.

◆ Pn869: SVCMD_IO Output Signal Monitor Allocations 2

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 1717h	–	0000h	All	Immediately	Setup	–

Digit	Meaning
n.□□□X	Output Signal Monitor Allocation for CN1-25 and CN1-26 (SVCMD_IO) Speed Pos Trq
0 to 7	The settings are the same as the CN1-1/CN1-2 allocations.
n.□□X□	CN1-25/CN1-26 Output Signal Monitor Enable/Disable Selection Speed Pos Trq
0 Default	Disable allocation for CN1-25/CN1-26 output signal monitor.
1	Enable allocation for CN1-25/CN1-26 output signal monitor.
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn879: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	–	–	0300h	All	–	–	–

◆ Pn880: Station Address Monitor (for maintenance, read only)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	03h to FFh	–	–	All	–	Setup	–

◆ Pn881: Set Transmission Byte Count Monitor [bytes] (for maintenance, read only)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	17, 32, 48	–	–	All	–	Setup	–

◆ Pn882: Transmission Cycle Setting Monitor [× 0.25 μs] (for maintenance, read only)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0h to FFFFh	–	–	All	–	Setup	–

◆ Pn883: Communications Cycle Setting Monitor [transmission cycles] (for maintenance, read only)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 32	–	–	All	–	Setup	–

◆ Pn884: Communications Controls 2

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0000h to 0001h	–	0000h	All	Immediately	Setup	–

Digit	Meaning
n.□□□X	MECHATROLINK Communications Error Holding Brake Signal Setting (Speed Pos Trq)
0 Default	Maintain the status set by the BRK_ON or BRK_OFF command when a MECHATROLINK communications error occurs.
1	Apply the holding brake when a MECHATROLINK communications error occurs.
n.□□X□	Reserved (Do not change.)
n.□X□□	Reserved (Do not change.)
n.X□□□	Reserved (Do not change.)

◆ Pn886: S-curve Maximum Acceleration/Deceleration Rate

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	1h to FFFFFFFFh	–	FFFFFFFFh	All	Immediately	Setup	–

◆ Pn88A: MECHATROLINK Receive Error Counter Monitor (for maintenance, read only)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
2	0 to 65,535	–	0	All	–	Setup	–

◆ PnA1A: Reserved (Do not change.)

Speed Pos Trq

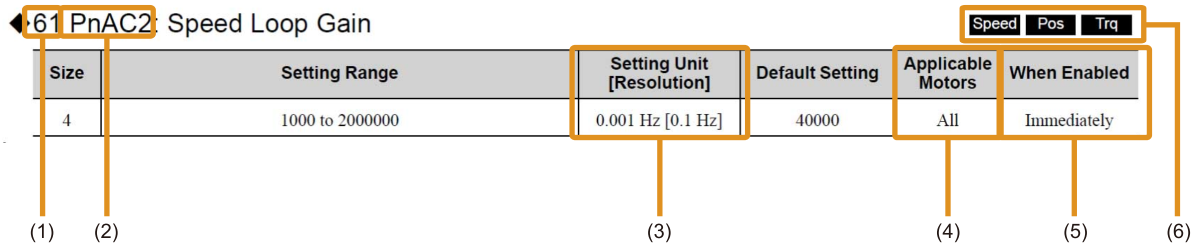
Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	–	–	64	All	–	–	–

◆ PnB42to PnBD0: Reserved (Do not change.)

Speed Pos Trq

Size	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
4	–	–	0	All	–	–	–

14.4 MECHATROLINK Common Parameters: Interpreting the Parameter Lists



No.	Item	Meaning
(1)	Common Parameter Number	A parameter with a common number that is not dependent on a device defined in the MECHATROLINK-4 standard servo profile or the MECHATROLINK-III standard servo profile. You can use a common parameter to read and set a parameter without using the parameter number and name specific to a device.
(2)	Device Parameter Number	A parameter number that is specific to this SERVOPACK.
(3)	Setting Unit	You can set the parameter in increments of the setting unit. However, if a unit is given in square brackets, the setting is automatically converted to the resolution given in the square brackets.
(4)	Applicable Motors	Indicates 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 sections for details. ☞ *i.5.2 Differences in Terms for Rotary Servomotors and Linear Servomotors on page 26*
(5)	When Enabled	Indicates when a change to the parameter will be effective. “After restart” indicates parameters that will be effective after one of the following is executed. • The power is turned OFF and ON again. • The CONFIG command is sent. • A software reset is executed.
(6)	Control Mode	Speed: A parameter that can be used in speed control. Pos: A parameter that can be used in position control. Trq: A parameter that can be used in torque control. "Torque" is used even for linear servomotor parameters. Grayed-out icons (Speed, Pos, Trq) indicate parameters that cannot be used in the corresponding control method.

14.5 List of MECHATROLINK Common Parameters : MECHATROLINK-4 Communications References

The following table lists the common MECHATROLINK-4 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.

◆ 01 PnA02: Encoder Type (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h, 1h	–	–	All	–

Set Value	Meaning
0000h	Absolute encoder
0001h	Incremental encoder

◆ 02 PnA04: Motor Type (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h, 1h	–	–	All	–

Set Value	Meaning
0000h	Rotary servomotor
0001h	Linear servomotor

◆ 03 PnA06: Semi-closed/Fully-closed Type (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h, 1h	–	–	All	–

Set Value	Meaning
0000h	Semi-closed
0001h	Fully-closed

◆ 04 PnA08: Rated Speed (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h to FFFFFFFFh	10^{PnA0C} min^{-1}	–	All	–

◆ 05 PnA0A: Maximum Output Speed (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h to FFFFFFFFh	10^{PnA0C} min^{-1}	–	All	–

◆ 06 PnA0C: Speed Multiplier (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	-1073741823 to 1073741823	–	–	All	–

◆ 07 PnA0E: Rated Torque (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h to FFFFFFFFh	10^{PnA12} N·m	–	All	–

◆ 08 PnA10: Maximum Output Torque (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h to FFFFFFFFh	10^{PnA12} N·m	–	All	–

◆ 09 PnA12: Torque Multiplier (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	-1073741823 to 1073741823	–	–	All	–

◆ 0A PnA14: Resolution (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h to FFFFFFFFh	1 pulse/rev	–	Rotary	–

◆ 0B PnA16: Linear Scale Pitch

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0 to 65536000	1 nm [0.01 μm]	0	Linear	After restart

◆ 0C PnA18: Pulses per Scale Pitch (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h to FFFFFFFFh	1 pulse/ pitch	–	Linear	–

◆ 21 PnA42: Electronic Gear Ratio (Numerator)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	1 to 1073741824	–	64	All	After restart

◆ 22 PnA44: Electronic Gear Ratio (Denominator)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	1 to 1073741824	–	1	All	After restart

◆ 23 PnA46: Absolute Encoder Origin Offset

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	-1073741823 to 1073741823	1 reference unit	0	All	Immediately

Note:

The parameter setting is enabled after SENS_ON command execution is completed.

◆ 24 PnA48: Multiturn Limit

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0 to 65,535	1 Rev	65535	Rotary	After restart

Parameter Lists

14

◆ 25 PnA4A: Limit Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h to 33h	–	0000h	All	After restart

Bit	Meaning
Bit 0	P-OT (0: Enabled, 1: Disabled)
Bit 1	N-OT (0: Enabled, 1: Disabled)
Bit 2	Reserved.
Bit 3	Reserved.
Bit 4	P-SOT (0: Disabled, 1: Enabled)
Bit 5	N-SOT (0: Disabled, 1: Enabled)
Bits 6 to 31	Reserved.

◆ 26 PnA4C: Forward Software Limit

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	-1073741823 to 1073741823	1 reference unit	1073741823	All	Immediately

◆ 27 PnA4E: Reserved by System

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	–	–	0	All	Immediately

◆ 28 PnA50: Reverse Software Limit

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	-1073741823 to 1073741823	1 reference unit	-1073741823	All	Immediately

◆ 29 PnA52: Reserved by System

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	–	–	0	All	Immediately

◆ 41 PnA82: Speed Unit

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h to 4h	–	0h	All	After restart

Set Value	Meaning
0000h	Reference units/s
0001h	Reference units/min
0002h	Percentage (%) of rated speed
0003h	min^{-1}
0004h	Maximum motor speed/40000000h

Note:

- When using fully-closed loop control, set 0000h: reference units/s.
- If you set this parameter to 0002h, adjust the common parameter 42 PnA84 (Speed Base Unit) to satisfy the following formula:
  1.28 × Rated speed [min^{-1}] × 10^{PnA84} < Maximum speed [min^{-1}]
- If you set this parameter to either 0002h or 0003h, set the common parameter 42 PnA84 (Speed Base Unit) to a number between -3 and 0.
- If you set this parameter to 0004h, set the common parameter 42 PnA84 (Speed Base Unit) to 0.

◆ 42 PnA84: Speed Base Unit (Set the value of n from the following formula: Speed unit (41 PnA82) × is 10^n.)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	-3 to 3	–	0	All	After restart

Note:

- If you set common parameter 41 PnA82 (Speed Unit) to 0002h, set this parameter to satisfy the following formula:
  1.28 × Rated speed [min^{-1}] × 10^{PnA84} < Maximum speed [min^{-1}]
- If you set common parameter 41 PnA82 (Speed Unit) to either 0002h or 0003h, set this parameter to a number between -3 and 0.
- If you set common parameter 41 PnA82 (Speed Unit) to 0004h, set this parameter to 0.

◆ 43 PnA86: Position Unit

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h	–	0h	All	After restart

Set Value	Meaning
0000h	Reference units

◆ 44 PnA88: Position Base Unit (Set the value of n from the following formula: Position unit (43 PnA86) × is 10^n)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0	–	0	All	After restart

◆ 45 PnA8A: Acceleration Unit

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h	–	0h	All	After restart

Set Value	Meaning
0000h	Reference unit/s^2

◆ 46 PnA8C: Acceleration Base Unit (Set the value of n from the following formula: Acceleration unit (45 PnA8A) × 10^n.)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	4 to 6	–	4	All	After restart

◆ 47 PnA8E: Torque Unit

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	1h, 2h	–	1h	All	After restart

Set Value	Meaning
0001h	Percentage (%) of rated torque
0002h	Maximum torque/40000000h

Note:

- If you set this parameter to 0001h, adjust the common parameter 48 PnA90 (Torque Base Unit) to satisfy the following formula:
  128 × 10^{PnA90} < Maximum torque [%]
- If you set this parameter to 0002h, set the common parameter 48 PnA90 (Torque Base Unit) to 0.

◆ 48 PnA90: Torque Base Unit (Set the value of n from the following formula: Torque unit (47 PnA8E) × is 10^n.)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	-5 to 0	–	0	All	After restart

Note:

- If you set common parameter 47 PnA8E (Torque Unit) to 0001h, set this parameter to satisfy the following formula:
  128×10^{PnA90} < Maximum torque [%]
- If you set common parameter 47 PnA8E (Torque Unit) to 0002h, set this parameter to 0.

◆ 49 PnA92: Supported Unit (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	–	–	0601011Fh	All	–

Bit	Meaning
Speed Units	
Bit 0	Reference units/s (1: Enabled)
Bit 1	Reference units/min (1: Enabled)
Bit 2	Percentage (%) of rated speed (1: Enabled)
Bit 3	min^{-1} (rpm) (1: Enabled)
Bit 4	Maximum motor speed/4000000h (1: Enabled)
Bits 5 to 7	Reserved (0: Disabled).
Position Units	
Bit 8	Reference units (1: Enabled)
Bits 9 to 15	Reserved (0: Disabled).
Acceleration Units	
Bit 16	Reference unit/s^2 (1: Enabled)
Bit 17	ms (acceleration time required to reach rated speed) (0: Disabled)
Bits 18 to 23	Reserved (0: Disabled).
Torque Units	
Bit 24	N·m (0: Disabled)
Bit 25	Percentage (%) of rated torque (1: Enabled)
Bit 26	Maximum torque/40000000h (1: Enabled)
Bits 27 to 31	Reserved (0: Disabled).

◆ 61 PnAC2: Speed Loop Gain

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	1000 to 2000000	0.001 Hz [0.1 Hz]	40000	All	Immediately

◆ 62 PnAC4: Speed Loop Integral Time Constant

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	150 to 512000	1 μs [0.01 ms]	20000	All	Immediately

◆ 63 PnAC6: Position Loop Gain

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	1000 to 2000000	0.001/s [0.1/s]	40000	All	Immediately

◆ 64 PnAC8: Feed Forward Compensation

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0 to 100	1%	0	All	Immediately

◆ 65 PnACA: Position Loop Integral Time Constant

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0 to 5000000	1 μs [0.1 ms]	0	All	Immediately

◆ 66 PnACC: In-position Range

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0 to 1073741824	1 reference unit	7	All	Immediately

◆ 67 PnACE: Near-position Range

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	1 to 1073741824	1 reference unit	1073741824	All	Immediately

◆ 81 PnB02: Exponential Function Acceleration/Deceleration Time Constant

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0 to 510000	1 μs [0.1 ms]	0	All	Immediately

Note:

Change the setting when the reference is stopped (while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

◆ 82 PnB04: Movement Average Time

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0 to 510000	1 μs [0.1 ms]	0	All	Immediately

Note:

Change the setting when the reference is stopped (while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

◆ 83 PnB06: Final Travel for External Input Positioning

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	-1073741823 to 1073741823	1 reference unit	100	All	Immediately

◆ 84 PnB08: Zero Point Return Approach Speed

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h to 3FFFFFFFh	10^{-3} min^{-1}	× 5000h reference units/s converted to 10^{-3} min^{-1}	All	Immediately

◆ 85 PnB0A: Zero Point Return Creep Speed

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h to 3FFFFFFFh	10^{-3} min^{-1}	× 500h reference units/s converted to 10^{-3} min^{-1}	All	Immediately

◆ 86 PnB0C: Final Travel for Zero Point Return

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	-1073741823 to 1073741823	1 reference unit	100	All	Immediately

◆ 87 PnB0E: Monitor Select 1

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0001h	All	Immediately

Set Value	Meaning
0000h	APOS
0001h Default	CPOS
0002h	PERR
0003h	LPOS1
0004h	LPOS2
0005h	FSPD
0006h	CSPD
0007h	TRQ
0008h	ALARM
0009h	MPOS
000Ah	Reserved (undefined value).
000Bh	Reserved (undefined value).
000Ch	CMN1 (common monitor 1)
000Dh	CMN2 (common monitor 2)
000Eh	OMN1 (optional monitor 1)
000Fh	OMN2 (optional monitor 2)
0010h	TPOS
0011h	IPOS
0012h	POS_OFST
0013h	TSPD
0014h	SPD_LIM
0015h	TRQ_LIM
0016h	SV_STAT
0018h	INIT_PGPOS (Low)
0019h	INIT_PGPOS (High)
001Ah	ERR_STS
0050h	Motor speed [overspeed detection speed / 1000000h]
0051h	Speed reference [overspeed detection speed / 1000000h]
0052h	Torque [maximum torque] / 1000000h]
0053h	Position deviation (lower 32 bits) [reference units]
0054h	Position deviation (upper 32 bits) [reference units]
005Ah	PG count (lower 32 bits) [reference units]
005Bh	PG count (upper 32 bits) [reference units]
005Ch	FPG count (lower 32 bits) [reference units]
005Dh	FPG count (upper 32 bits) [reference units]
0060h	Un000: Motor Speed [min^{-1}]
0061h	Un001: Speed Reference [min^{-1}]
0062h	Un002: Torque Reference [%]

Set Value	Meaning
0063h	Un003: Rotational Angle 1 [encoder pulses] Number of encoder pulses from origin within one encoder rotation displayed in decimal
	Un003: Electrical Angle 1 [linear encoder pulses] Linear encoder pulses from the polarity origin displayed in decimal
0064h	Un004: Rotational Angle 2 [deg] Electrical angle from polarity origin
	Un004: Electrical Angle 2 [deg] Electrical angle from polarity origin
0065h	Un005: Input Signal Monitor
0066h	Un006: Output Signal Monitor
0067h	Un007: Input Reference Pulse Speed [$\min^{-1}$]
0068h	Un008: Position Deviation [reference units]
0069h	Un009: Accumulated Load Ratio [%]
006Ah	Un00A: Regenerative Load Ratio [%]
006Bh	Un00B: Dynamic Brake Resistor Power Consumption [%]
006Ch	Un00C: Input Reference Pulse Counter [reference units]
006Dh	Un00D: Feedback Pulse Counter [encoder pulses]
006Eh	Un00E: Fully-closed Loop Feedback Pulse Counter [external encoder resolution]
0073h	Initial multiturn data [Rev]
0074h	Initial incremental data [pulses]
0075h	Initial absolute position data (lower 32 bits) [pulses]
0076h	Initial absolute position data (upper 32 bits) [pulses]
0090h	Un025: SERVOPACK Installation Environment Monitor
0091h	Un026: Servomotor Installation Environment Monitor
0092h	Un027: Built-in Fan Remaining Life Ratio
0093h	Un028: Capacitor Remaining Life Ratio
0094h	Un029: Surge Prevention Circuit Remaining Life Ratio
0095h	Un02A: Dynamic Brake Circuit Remaining Life Ratio
0096h	Un032: Instantaneous Power
0097h	Un033: Power Consumption
0098h	Un034: Cumulative Power Consumption
009Dh	Un173: Temperature Margin until SERVOPACK Overheats
00A5h	Estimated Vibration [overspeed detection speed / 1000000h]
00A6h	Estimated External Disturbance Torque [maximum torque / 1000000h]
00A8h	Un13C: Margin until Regenerative Overload
00AAh	Un13E: Margin until Undervoltage
00ABh	Un13F: Margin until Overvoltage
00B0h	Un023: Main Circuit DC Voltage
00C0h	Un078: Maximum Value of Amplitude of Estimated Vibration [$\min^{-1}$]
00C1h	Un07A: Maximum Value of Estimated External Disturbance Torque [%]
00C2h	Un07B: Minimum Value of Estimated External Disturbance Torque [%]
00C3h	Un147: Number of MECHATROLINK Communications Errors [times]
00C4h	Un104: Number of Serial Encoder Communications Errors [times]

Set Value	Meaning
00C5h	Un105: Settling Time [0.1 ms]
00C6h	Un106: Amount of Overshoot [reference units]
00C7h	Un107: Residual Vibration Frequency [0.1 Hz]
00C9h	Un174: Temperature Margin until Servomotor Overheats [°C]
00CAh	Un145: Maximum Value of Accumulated Load Ratio [%]
00CBh	Un14E: Margin until Overload [0.01 %]
00CCh	Un07C: Identified Moment of Inertia Ratio
00CEh	Un108: Maximum Settling Time
00CFh	Un109: Maximum Amount of Overshoot
00D0h	Previous value of latched feedback position (LPOS1) [reference units]
00D1h	Previous value of latched feedback position (LPOS2) [reference units]
00D4h	Continuous Latch Status (EX STATUS)
0154h	Un177: Encoder Power Supplied Time
0156h	Un17A: Encoder Power Supply Voltage
0157h	Un17B: Encoder Battery Voltage
015Ch	Un181: Motor Total Number of Rotations
015Dh	Un183: Maintenance Prediction Monitor - Bearings
015Eh	Un184: Maintenance Prediction Monitor - Oil Seal
0163h	File Upload Counter
0164h	File Upload Data
0165h	Error Detection Trace Counter
0166h	Error Detection Trace Error Rate
0176h	Un190: Motor Vibration in X-Axis Direction
0177h	Un191: Motor Vibration in Y-Axis Direction
0178h	Un192: Motor Vibration in Z-Axis Direction
0179h	Un193: Motor Vibration XYZ Composite Value
017Ah	Un194: Maximum Motor Vibration
0250h	SigmaLINK II Response Data 1
0251h	SigmaLINK II Response Data 2
0252h	SigmaLINK II Response Data 3
0253h	SigmaLINK II Response Data 4
0254h	SigmaLINK II Response Data 5
0255h	SigmaLINK II Response Data 6
0256h	SigmaLINK II Response Data 7
0257h	SigmaLINK II Response Data 8
0260h	SigmaLINK II Command Data 1
0261h	SigmaLINK II Command Data 2
0262h	SigmaLINK II Command Data 3
0263h	SigmaLINK II Command Data 4
0290h	SigmaLINK II Data Status Information
Other values	Reserved (Do not use.)

◆ 88 PnB10: Monitor Select 2

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	Immediately

Set Value	Meaning
0000h to FFFFh	The settings are the same as those for Monitor Select 1.

◆ 89 PnB12: Monitor Select for SEL_MON1 (CMN1)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h to Ah	–	0h	All	Immediately

Set Value	Meaning
0000h	TPOS (target position in reference coordinate system)
0001h	IPOS (reference position in reference coordinate system)
0002h	POS_OFFSET (offset set in POS_SET (Set Coordinate System) command)
0003h	TSPD (target speed)
0004h	SPD_LIM (speed limit)
0005h	TRQ_LIM (torque limit)
0006h	SV_STAT (servo actual operating status) Monitor Description • Byte 1: Current communications phase – 00h: Phase 0 – 01h: Phase 1 – 02h: Phase 2 – 03h: Phase 3 • Byte 2: Current control mode – 00h: Position control mode – 01h: Speed control mode – 02h: Torque control mode • Byte 3: Reserved • Byte 4: Expansion signal monitor – Bit 0: LT_RDY1: Processing status for latch detection for LT_REQ1 in SVCMD_CTRL region (0: Latch detection not yet processed. 1: Processing latch detection in progress.) – Bit 1: LT_RDY1: Processing status for latch detection for LT_REQ2 in SVCMD_CTRL region (0: Latch detection not yet processed. 1: Processing latch detection in progress.) – Bits 2 and 3: LT_SEL1R: Latch signal (0: Phase C, 1: External input signal 1, 2: External input signal 2, external input signal 3) – Bits 4 and 5: LT_SEL2R: Latch signal (0: Phase C, 1: External input signal 1, 2: External input signal 2, external input signal 3) – Bit 6: Reserved (0).
0007h	Reserved.
0008h	INIT_PGPOS (Low) Lower 32 bits of initial encoder position converted to 64-bit position reference data
0009h	INIT_PGPOS (High) Upper 32 bits of initial encoder position converted to 64-bit position reference data
000Ah	ERR_STS Error status read from communications ASIC

◆ 8A PnB14: Monitor Select for SEL_MON2 (CMN2)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h to Ah	–	0h	All	Immediately

Set Value	Meaning
0000h to 000Ah	The settings are the same as those for SEL_MON Monitor Selection 1.

◆ 8B PnB16: Zero Point Detection Range

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0 to 250	1 reference unit	10	All	Immediately

◆ 8C PnB18: Forward Torque Limit

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0 to 800	1%	100	All	Immediately

◆ 8D PnB1A: Reverse Torque Limit

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0 to 800	1%	100	All	Immediately

◆ 8E PnB1C: Zero Speed Detection Range

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	1000 to 10000000	10^{-3} min^{-1}	20000	All	Immediately

◆ 8F PnB1E: Speed Match Signal Detection Range

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0 to 100000	10^{-3} min^{-1}	10000	All	Immediately

◆ 90 PnB20: SVCMD_ CTRL bit Enabled/Disabled (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	–	–	FFFF3F3Fh	All	–

Bit	Meaning
Bit 0	CMD_PAUSE (1: Enabled)
Bit 1	CMD_CANCEL (1: Enabled)
Bits 2, 3	STOP_MODE (1: Enabled)
Bits 4, 5	ACCFIL (1: Enabled)
Bits 6, 7	Reserved (0: Disabled).
Bit 8	LT_REQ1 (1: Enabled)
Bit 9	LT_REQ2 (1: Enabled)
Bits 10, 11	LT_SEL1 (1: Enabled)
Bits 12, 13	LT_SEL2 (1: Enabled)
Bits 14, 15	Reserved (0: Disabled).
Bits 16 to 19	SEL_MON1 (1: Enabled)
Bits 20 to 23	SEL_MON2 (1: Enabled)
Bits 24 to 31	SEL_MON3 (1: Enabled)

◆ 91 PnB22: SVCMD_ STAT bit Enabled/Disabled (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	–	–	FFFF3F33h	All	–

Bit	Meaning
Bit 0	CMD_PAUSE_CMP (1: Enabled)
Bit 1	CMD_CANCEL_CMP (1: Enabled)
Bits 2, 3	Reserved (0: Disabled).
Bits 4, 5	ACCFIL (1: Enabled)
Bits 6, 7	Reserved (0: Disabled).
Bit 8	L_CMP1 (1: Enabled)
Bit 9	L_CMP2 (1: Enabled)
Bit 10	POS_RDY (1: Enabled)
Bit 11	PON (1: Enabled)
Bit 12	M_RDY (1: Enabled)
Bit 13	SV_ON (1: Enabled)
Bits 14, 15	Reserved (0: Disabled).
Bits 16 to 19	SEL_MON1 (1: Enabled)
Bits 20 to 23	SEL_MON2 (1: Enabled)
Bits 24 to 31	SEL_MON3 (1: Enabled)

◆ 92 PnB24: I/O Bit Enabled/Disabled (Output) (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	–	–	88FF01F0h	All	–

Bit	Meaning
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 22	SO1 to SO3 (1: Enabled)
Bits 23 to 30	Reserved (0: Disabled).
Bit 31	EXT_TRC (1: Enabled)

◆ 93 PnB26: I/O Bit Enabled/Disabled (Input) (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	–	–	FF0FFEFEh	All	–

Bit	Meaning
Bit 0	Reserved (0: Disabled).
Bit 1	DEC (1: Enabled)
Bit 2	P-OT (1: Enabled)
Bit 3	N-OT (1: Enabled)
Bit 4	EXT1 (1: Enabled)
Bit 5	EXT2 (1: Enabled)
Bit 6	EXT3 (1: Enabled)
Bit 7	ESTP (1: Enabled)
Bit 8	Reserved (0: Disabled).
Bit 9	BRK_ON (1: Enabled)
Bit 10	P-SOT (1: Enabled)
Bit 11	N-SOT (1: Enabled)
Bit 12	DEN (1: Enabled)
Bit 13	NEAR (1: Enabled)
Bit 14	PSET (1: Enabled)
Bit 15	ZPOINT (1: Enabled)
Bit 16	T_LIM (1: Enabled)
Bit 17	V_LIM (1: Enabled)
Bit 18	V_CMP (1: Enabled)
Bit 19	ZSPD (1: Enabled)
Bits 20 to 23	Reserved (0: Disabled).
Bits 24 to 31	IO_STS1 to IO_STS8 (1: Enabled)

◆ 94 PnB28: Selectable Command Values (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	–	–	7Eh	All	–

Bit	Meaning
Bit 0	Reserved (0: Disabled).
Bit 1	ACCR (1: Supported)
Bit 2	DECR (1: Supported)
Bit 3	VFF (1: Supported)
Bit 4	TFF (1: Supported)
Bit 5	VLIM (1: Supported)
Bit 6	TLIM (1: Supported)
Bits 7 to 31	Reserved (0).

◆ A0 PnB40: CPRM_SEL_CMDP1 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h	Disabled (no allocation setting)
0001h	ACCR
0002h	DECR
0003h	VFF
0004h	TFF
0005h	VLIM
0006h	TLIM
0007h to 008Fh	Reserved.
0090h	Triggers at Preset Positions Table 1 Output Position Settings
0091h	Triggers at Preset Positions Table 2 Output Position Settings
0092h	Triggers at Preset Positions Table 3 Output Position Settings
0093h	Triggers at Preset Positions Table 4 Output Position Settings
0094h	Triggers at Preset Positions Table 5 Output Position Settings
0095h	Triggers at Preset Positions Table 6 Output Position Settings
0096h to 025Fh	Reserved.
0260h	SigmaLINK II Command Data 1
0261h	SigmaLINK II Command Data 2
0262h	SigmaLINK II Command Data 3
0263h	SigmaLINK II Command Data 4
0264h to FFFFh	Reserved.

◆ A1 PnB42: CPRM_SEL_CMDP2 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ A2 PnB44: CPRM_SEL_CMDP3 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ A3 PnB46: CPRM_SEL_CMDP4 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ A4 PnB48: CPRM_SEL_CMDP5 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ A5 PnB4A: CPRM_SEL_CMDP6 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ A6 PnB4C: CPRM_SEL_CMDP7 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ A7 PnB4E: CPRM_SEL_CMDP8 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ A8 PnB50: CPRM_SEL_CMDP9 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ A9 PnB52: CPRM_SEL_CMDP10 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ AA PnB54: CPRM_SEL_CMDP11 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ AB PnB56: CPRM_SEL_CMDP12 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ B0 PnB60: CPRM_SEL_CMDV1 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ B1 PnB62: CPRM_SEL_CMDV2 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ B2 PnB64: CPRM_SEL_CMDV3 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ B3 PnB66: CPRM_SEL_CMDV4 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ B4 PnB68: CPRM_SEL_CMDV5 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ B5 PnB6A: CPRM_SEL_CMDV6 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ B6 PnB6C: CPRM_SEL_CMDV7 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ B7 PnB6E: CPRM_SEL_CMDV8 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ B8 PnB70: CPRM_SEL_CMDV9 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ B9 PnB72: CPRM_SEL_CMDV10 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ BA PnB74: CPRM_SEL_CMDV11 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ BB PnB76: CPRM_SEL_CMDV12 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ C0 PnB80: CPRM_SEL_CMDT1 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ C1 PnB82: CPRM_SEL_CMDT2 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ C2 PnB84: CPRM_SEL_CMDT3 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ C3 PnB86: CPRM_SEL_CMDT4 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ C4 PnB88: CPRM_SEL_CMDT5 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ C5 PnB8A: CPRM_SEL_CMDT6 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ C6 PnB8C: CPRM_SEL_CMDT7 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ C7 PnB8E: CPRM_SEL_CMDT8 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ C8 PnB90: CPRM_SEL_CMDT9 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ C9 PnB92: CPRM_SEL_CMDT10 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ CA PnB94: CPRM_SEL_CMDT11 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ CB PnB96: CPRM_SEL_CMDT12 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ D0 PnBA0: CPRM_SEL_CMD1 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ D1 PnBA2: CPRM_SEL_CMD2 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ D2 PnBA4: CPRM_SEL_CMD3 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ D3 PnBA6: CPRM_SEL_CMD4 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ D4 PnBA8: CPRM_SEL_CMD5 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ D5 PnBAA: CPRM_SEL_CMD6 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ D6 PnBAC: CPRM_SEL_CMD7 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ D7 PnBAE: CPRM_SEL_CMD8 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	After restart

Set Value	Meaning
0000h to FFFFh	Same as common parameter A0 PnB40.

◆ E0 PnBC0: CPRM_SEL_MON3 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	Immediately

Set Value	Meaning
0000h to FFFFh	Same as common parameter 87 PnB0E.

◆ E1 PnBC2: CPRM_SEL_MON4 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	Immediately

Set Value	Meaning
0000h to FFFFh	Same as common parameter 87 PnB0E.

◆ E2 PnBC4: CPRM_SEL_MON5 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	Immediately

Set Value	Meaning
0000h to FFFFh	Same as common parameter 87 PnB0E.

◆ E3 PnBC6: CPRM_SEL_MON6 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	Immediately

Set Value	Meaning
0000h to FFFFh	Same as common parameter 87 PnB0E.

◆ E4 PnBC8: CPRM_SEL_MON7 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	Immediately

Set Value	Meaning
0000h to FFFFh	Same as common parameter 87 PnB0E.

◆ E5 PnBCA: CPRM_SEL_MON8 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	Immediately

Set Value	Meaning
0000h to FFFFh	Same as common parameter 87 PnB0E.

◆ E6 PnBCC: CPRM_SEL_MON9 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	Immediately

Set Value	Meaning
0000h to FFFFh	Same as common parameter 87 PnB0E.

◆ E7 PnBCE: CPRM_SEL_MON10 Allocation Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	Immediately

Set Value	Meaning
0000h to FFFFh	Same as common parameter 87 PnB0E.

14.6 List of MECHATROLINK Common Parameters: MECHATROLINK-III Communications References

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.

◆ 01 PnA02: Encoder Type (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h, 1h	–	–	All	–

Set Value	Meaning
0000h	Absolute encoder
0001h	Incremental encoder

◆ 02 PnA04: Motor Type (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h, 1h	–	–	All	–

Set Value	Meaning
0000h	Rotary servomotor
0001h	Linear servomotor

◆ 03 PnA06: Semi-closed/Fully-closed Type (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h, 1h	–	–	All	–

Set Value	Meaning
0000h	Semi-closed
0001h	Fully-closed

◆ 04 PnA08: Rated Speed (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h to FFFFFFFFh	10^{PnA0C} min^{-1}	–	All	–

◆ 05 PnA0A: Maximum Output Speed (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h to FFFFFFFFh	10^{PnA0C} min^{-1}	–	All	–

◆ 06 PnA0C: Speed Multiplier (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	-1073741823 to 1073741823	–	–	All	–

◆ 07 PnA0E: Rated Torque (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h to FFFFFFFFh	10^{PnA12} N·m	–	All	–

◆ 08 PnA10: Maximum Output Torque (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h to FFFFFFFFh	10^{PnA12} N·m	–	All	–

◆ 09 PnA12: Torque Multiplier (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	-1073741823 to 1073741823	–	–	All	–

◆ 0A PnA14: Resolution (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h to FFFFFFFFh	1 pulse/rev	–	Rotary	–

◆ 0B PnA16: Linear Scale Pitch

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0 to 65536000	1 nm [0.01 μm]	0	Linear	After restart

◆ 0C PnA18: Pulses per Scale Pitch (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h to FFFFFFFFh	1 pulse/ pitch	–	Linear	–

◆ 21 PnA42: Electronic Gear Ratio (Numerator)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	1 to 1073741824	–	64	All	After restart

◆ 22 PnA44: Electronic Gear Ratio (Denominator)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	1 to 1073741824	–	1	All	After restart

◆ 23 PnA46: Absolute Encoder Origin Offset

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	-1073741823 to 1073741823	1 reference unit	0	All	Immediately

Note:

The parameter setting is enabled after SENS_ON command execution is completed.

◆ 24 PnA48: Multiturn Limit

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0 to 65,535	1 Rev	65535	Rotary	After restart

◆ 25 PnA4A: Limit Setting

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h to 33h	–	0000h	All	After restart

Bit	Meaning
Bit 0	P-OT (0: Enabled, 1: Disabled)
Bit 1	N-OT (0: Enabled, 1: Disabled)
Bit 2	Reserved.
Bit 3	Reserved.
Bit 4	P-SOT (0: Disabled, 1: Enabled)
Bit 5	N-SOT (0: Disabled, 1: Enabled)
Bits 6 to 31	Reserved.

◆ 26 PnA4C: Forward Software Limit

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	-1073741823 to 1073741823	1 reference unit	1073741823	All	Immediately

◆ 27 PnA4E: Reserved by System

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	–	–	0	All	Immediately

◆ 28 PnA50: Reverse Software Limit

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	-1073741823 to 1073741823	1 reference unit	-1073741823	All	Immediately

◆ 29 PnA52: Reserved by System

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	–	–	0	All	Immediately

◆ 41 PnA82: Speed Unit

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h to 4h	–	0h	All	After restart

Set Value	Meaning
0000h	Reference units/s
0001h	Reference units/min
0002h	Percentage (%) of rated speed
0003h	min^{-1}
0004h	Maximum motor speed/40000000h

Note:

- When using fully-closed loop control, set 0000h: reference units/s.
- If you set this parameter to 0002h, adjust the common parameter 42 PnA84 (Speed Base Unit) to satisfy the following formula:
  1.28 × Rated speed [min^{-1}] × 10^{PnA84} < Maximum speed [min^{-1}]
- If you set this parameter to either 0002h or 0003h, set the common parameter 42 PnA84 (Speed Base Unit) to a number between -3 and 0.
- If you set this parameter to 0004h, set the common parameter 42 PnA84 (Speed Base Unit) to 0.

◆ 42 PnA84: Speed Base Unit (Set the value of n from the following formula: Speed unit (41 PnA82) × is 10^n.)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	-3 to 3	–	0	All	After restart

Note:

- If you set common parameter 41 PnA82 (Speed Unit) to 0002h, set this parameter to satisfy the following formula: 1.28 × Rated speed [min^{-1}] × 10^{PnA84} < Maximum speed [min^{-1}]
- If you set common parameter 41 PnA82 (Speed Unit) to either 0002h or 0003h, set this parameter to a number between -3 and 0.
- If you set common parameter 41 PnA82 (Speed Unit) to 0004h, set this parameter to 0.

◆ 43 PnA86: Position Unit

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h	–	0h	All	After restart

Set Value	Meaning
0000h	Reference units

◆ 44 PnA88: Position Base Unit (Set the value of n from the following formula: Position unit (43 PnA86) × is 10^n)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0	–	0	All	After restart

◆ 45 PnA8A: Acceleration Unit

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h	–	0h	All	After restart

Set Value	Meaning
0000h	Reference unit/s^2

◆ 46 PnA8C: Acceleration Base Unit (Set the value of n from the following formula: Acceleration unit (45 PnA8A) × 10^n.)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	4 to 6	–	4	All	After restart

◆ 47 PnA8E: Torque Unit

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	1h, 2h	–	1h	All	After restart

Set Value	Meaning
0001h	Percentage (%) of rated torque
0002h	Maximum torque/40000000h

Note:

- If you set this parameter to 0001h, adjust the common parameter 48 PnA90 (Torque Base Unit) to satisfy the following formula: 128 × 10^{PnA90} < Maximum torque [%]
- If you set this parameter to 0002h, set the common parameter 48 PnA90 (Torque Base Unit) to 0.

◆ 48 PnA90: Torque Base Unit (Set the value of n from the following formula: Torque unit (47 PnA8E) × is 10^n.)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	-5 to 0	–	0	All	After restart

Note:

- If you set common parameter 47 PnA8E (Torque Unit) to 0001h, set this parameter to satisfy the following formula: 128×10^{PnA90} < Maximum torque [%]
- If you set common parameter 47 PnA8E (Torque Unit) to 0002h, set this parameter to 0.

◆ 49 PnA92: Supported Unit (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	–	–	0601011Fh	All	–

Bit	Meaning
Speed Units	
Bit 0	Reference units/s (1: Enabled)
Bit 1	Reference units/min (1: Enabled)
Bit 2	Percentage (%) of rated speed (1: Enabled)
Bit 3	min^{-1} (rpm) (1: Enabled)
Bit 4	Maximum motor speed/4000000h (1: Enabled)
Bits 5 to 7	Reserved (0: Disabled).
Position Units	
Bit 8	Reference units (1: Enabled)
Bits 9 to 15	Reserved (0: Disabled).
Acceleration Units	
Bit 16	Reference unit/s^2 (1: Enabled)
Bit 17	ms (acceleration time required to reach rated speed) (0: Disabled)
Bits 18 to 23	Reserved (0: Disabled).
Torque Units	
Bit 24	N·m (0: Disabled)
Bit 25	Percentage (%) of rated torque (1: Enabled)
Bit 26	Maximum torque/40000000h (1: Enabled)
Bits 27 to 31	Reserved (0: Disabled).

◆ 61 PnAC2: Speed Loop Gain

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	1000 to 2000000	0.001 Hz [0.1 Hz]	40000	All	Immediately

◆ 62 PnAC4: Speed Loop Integral Time Constant

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	150 to 512000	1 μs [0.01 ms]	20000	All	Immediately

◆ 63 PnAC6: Position Loop Gain

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	1000 to 2000000	0.001/s [0.1/s]	40000	All	Immediately

◆ 64 PnAC8: Feed Forward Compensation

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0 to 100	1%	0	All	Immediately

◆ 65 PnACA: Position Loop Integral Time Constant

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0 to 5000000	1 μs [0.1 ms]	0	All	Immediately

◆ 66 PnACC: In-position Range

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0 to 1073741824	1 reference unit	7	All	Immediately

◆ 67 PnACE: Near-position Range

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	1 to 1073741824	1 reference unit	1073741824	All	Immediately

◆ 81 PnB02: Exponential Function Acceleration/Deceleration Time Constant

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0 to 510000	1 μs [0.1 ms]	0	All	Immediately

Note:

Change the setting when the reference is stopped (while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

◆ 82 PnB04: Movement Average Time

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0 to 510000	1 μs [0.1 ms]	0	All	Immediately

Note:

Change the setting when the reference is stopped (while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

◆ 83 PnB06: Final Travel for External Input Positioning

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	-1073741823 to 1073741823	1 reference unit	100	All	Immediately

◆ 84 PnB08: Zero Point Return Approach Speed

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h to 3FFFFFFFh	10^{-3} min^{-1}	× 5000h reference units/s converted to 10^{-3} min^{-1}	All	Immediately

◆ 85 PnB0A: Zero Point Return Creep Speed

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h to 3FFFFFFFh	10^{-3} min^{-1}	× 500h reference units/s converted to 10^{-3} min^{-1}	All	Immediately

◆ 86 PnB0C: Final Travel for Zero Point Return

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	-1073741823 to 1073741823	1 reference unit	100	All	Immediately

◆ 87 PnB0E: Monitor Select 1

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0001h	All	Immediately

Set Value	Meaning
0000h	APOS
0001h Default	CPOS
0002h	PERR
0003h	LPOS1
0004h	LPOS2
0005h	FSPD
0006h	CSPD
0007h	TRQ
0008h	ALARM
0009h	MPOS
000Ah	Reserved (undefined value).
000Bh	Reserved (undefined value).
000Ch	CMN1 (common monitor 1)
000Dh	CMN2 (common monitor 2)
000Eh	OMN1 (optional monitor 1)
000Fh	OMN2 (optional monitor 2)
Other values	Reserved (Do not use.)

◆ 88 PnB10: Monitor Select 2

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0000h to FFFFh	–	0000h	All	Immediately

Set Value	Meaning
0000h to FFFFh	The settings are the same as those for Monitor Select 1.

◆ 89 PnB12: Monitor Select for SEL_MON1 (CMN1)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h to Ah	–	0h	All	Immediately

Set Value	Meaning
0000h	TPOS (target position in reference coordinate system)
0001h	IPOS (reference position in reference coordinate system)
0002h	POS_OFFSET (offset set in POS_SET (Set Coordinate System) command)
0003h	TSPD (target speed)
0004h	SPD_LIM (speed limit)
0005h	TRQ_LIM (torque limit)
0006h	SV_STAT (servo actual operating status) Monitor Description • Byte 1: Current communications phase – 00h: Phase 0 – 01h: Phase 1 – 02h: Phase 2 – 03h: Phase 3 • Byte 2: Current control mode – 00h: Position control mode – 01h: Speed control mode – 02h: Torque control mode • Byte 3: Reserved • Byte 4: Expansion signal monitor – Bit 0: LT_RDY1: Processing status for latch detection for LT_REQ1 in SVCMD_CTRL region (0: Latch detection not yet processed. 1: Processing latch detection in progress.) – Bit 1: LT_RDY1: Processing status for latch detection for LT_REQ2 in SVCMD_CTRL region (0: Latch detection not yet processed. 1: Processing latch detection in progress.) – Bits 2 and 3: LT_SEL1R: Latch signal (0: Phase C, 1: External input signal 1, 2: External input signal 2, external input signal 3) – Bits 4 and 5: LT_SEL2R: Latch signal (0: Phase C, 1: External input signal 1, 2: External input signal 2, external input signal 3) – Bit 6: Reserved (0).
0007h	Reserved.
0008h	INIT_PGPOS (Low) Lower 32 bits of initial encoder position converted to 64-bit position reference data
0009h	INIT_PGPOS (High) Upper 32 bits of initial encoder position converted to 64-bit position reference data
000Ah	Reserved.

◆ 8A PnB14: Monitor Select for SEL_MON2 (CMN2)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0h to Ah	–	0h	All	Immediately

Set Value	Meaning
0000h to 000Ah	The settings are the same as those for SEL_MON Monitor Selection 1.

◆ 8B PnB16: Zero Point Detection Range

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0 to 250	1 reference unit	10	All	Immediately

◆ 8C PnB18: Forward Torque Limit

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0 to 800	1%	100	All	Immediately

◆ 8D PnB1A: Reverse Torque Limit

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0 to 800	1%	100	All	Immediately

◆ 8E PnB1C: Zero Speed Detection Range

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	1000 to 10000000	10^{-3} min^{-1}	20000	All	Immediately

◆ 8F PnB1E: Speed Match Signal Detection Range

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	0 to 100000	10^{-3} min^{-1}	10000	All	Immediately

◆ 90 PnB20: SVCMD_ CTRL bit Enabled/Disabled (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	–	–	0FFF3F3Fh	All	–

Bit	Meaning
Bit 0	CMD_PAUSE (1: Enabled)
Bit 1	CMD_CANCEL (1: Enabled)
Bits 2, 3	STOP_MODE (1: Enabled)
Bits 4, 5	ACCFIL (1: Enabled)
Bits 6, 7	Reserved (0: Disabled).
Bit 8	LT_REQ1 (1: Enabled)
Bit 9	LT_REQ2 (1: Enabled)
Bits 10, 11	LT_SEL1 (1: Enabled)
Bits 12, 13	LT_SEL2 (1: Enabled)
Bits 14, 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).

◆ 91 PnB22: SVCMD_ STAT bit Enabled/Disabled (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	–	–	0FFF3F33h	All	–

Bit	Meaning
Bit 0	CMD_PAUSE_CMP (1: Enabled)
Bit 1	CMD_CANCEL_CMP (1: Enabled)
Bits 2, 3	Reserved (0: Disabled).
Bits 4, 5	ACCFIL (1: Enabled)
Bits 6, 7	Reserved (0: Disabled).
Bit 8	L_CMP1 (1: Enabled)
Bit 9	L_CMP2 (1: Enabled)
Bit 10	POS_RDY (1: Enabled)
Bit 11	PON (1: Enabled)
Bit 12	M_RDY (1: Enabled)
Bit 13	SV_ON (1: Enabled)
Bits 14, 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).

◆ 92 PnB24: I/O Bit Enabled/Disabled (Output) (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	–	–	88FF01F0h	All	–

Bit	Meaning
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 22	SO1 to SO3 (1: Enabled)
Bits 23 to 30	Reserved (0: Disabled).
Bit 31	EXT_TRC (1: Enabled)

◆ 93 PnB26: I/O Bit Enabled/Disabled (Input) (read only)

Speed Pos Trq

Size	Setting Range	Setting Unit [Resolution]	Default Setting	Applicable Motors	When Enabled
4	–	–	FF0FFEFEh	All	–

Bit	Meaning
Bit 0	Reserved (0: Disabled).
Bit 1	DEC (1: Enabled)
Bit 2	P-OT (1: Enabled)
Bit 3	N-OT (1: Enabled)
Bit 4	EXT1 (1: Enabled)
Bit 5	EXT2 (1: Enabled)
Bit 6	EXT3 (1: Enabled)
Bit 7	ESTP (1: Enabled)
Bit 8	Reserved (0: Disabled).
Bit 9	BRK_ON (1: Enabled)
Bit 10	P-SOT (1: Enabled)
Bit 11	N-SOT (1: Enabled)
Bit 12	DEN (1: Enabled)
Bit 13	NEAR (1: Enabled)
Bit 14	PSET (1: Enabled)
Bit 15	ZPOINT (1: Enabled)
Bit 16	T_LIM (1: Enabled)
Bit 17	V_LIM (1: Enabled)
Bit 18	V_CMP (1: Enabled)
Bit 19	ZSPD (1: Enabled)
Bits 20 to 23	Reserved (0: Disabled).
Bits 24 to 31	IO_STS1 to IO_STS8 (1: Enabled)

14.7 Parameter Recording Table: MECHATROLINK-4 Communications References

Use the following table to record the settings of the parameters.

Parameter No.	Default Setting						Name	When Enabled
Pn000	0000h						Basic Function Selections 0	After restart
Pn001	0000h						Application Function Selections 1	After restart
Pn002	0011h						Application Function Selections 2	After restart
Pn006	0002h						Application Function Selections 6	Immediately
Pn007	0000h						Application Function Selections 7	Immediately
Pn008	4000h						Application Function Selections 8	After restart
Pn009	0040h						Application Function Selections 9	After restart
Pn00A	0001h						Application Function Selections A	After restart
Pn00B	0000h						Application Function Selections B	After restart
Pn00C	0040h						Application Function Selections C	After restart
Pn00D	0000h						Application Function Selections D	After restart
Pn00E	0000h						Application Function Selections E	After restart
Pn00F	0000h						Application Function Selections F	After restart
Pn021	0000h						Reserved (Do not change.)	–
Pn022	0000h						Application Function Selections 22	After restart
Pn02F	0000h						Application Function Selections 2F	After restart
Pn030	C0A80101-h						Ethernet IP Address	After restart
Pn032	FFFFFF00-h						Ethernet Subnet Mask	After restart
Pn034	00000000h						Ethernet Default Gateway	After restart
Pn040	0000h						Sigma-V/Sigma-7 Compatible Function Switch	After restart
Pn050	00000000h						SigmaLINK II Response Data Selection 1	After restart
Pn052	00000000h						SigmaLINK II Response Data Selection 2	After restart
Pn054	00000000h						SigmaLINK II Response Data Selection 3	After restart
Pn056	00000000h						SigmaLINK II Response Data Selection 4	After restart
Pn058	00000000h						SigmaLINK II Response Data Selection 5	After restart
Pn05A	00000000h						SigmaLINK II Response Data Selection 6	After restart
Pn05C	00000000h						SigmaLINK II Response Data Selection 7	After restart
Pn05E	00000000h						SigmaLINK II Response Data Selection 8	After restart
Pn080	0000h						Application Function Selections 80	After restart
Pn081	0000h						Application Function Selections 81	After restart

Continued on next page.

Continued from previous page.

Parameter No.	Default Setting						Name	When Enabled
Pn090	00000000h						SigmaLINK II Command Data Selection 1	After restart
Pn092	00000000h						SigmaLINK II Command Data Selection 2	After restart
Pn094	00000000h						SigmaLINK II Command Data Selection 3	After restart
Pn096	00000000h						SigmaLINK II Command Data Selection 4	After restart
Pn0B1	0000h						SigmaLINK II Sequence Input Allocation 1	After restart
Pn0B2	0000h						SigmaLINK II Sequence Input Allocation 2	After restart
Pn0B5	0000h						SigmaLINK II Sequence Output Allocation 1	After restart
Pn0DA	0000h						SigmaLINK II Semi-closed Encoder Selection	After restart
Pn0DB	0101h						SigmaLINK II Fully-closed Encoder Selection	After restart
Pn0DC	0000h						SigmaLINK II Node Change Detection Condition Selection	After restart
Pn0DD	0110h						SigmaLINK II I/O Device Error Detection Selection	After restart
Pn100	400						Speed Loop Gain	Immediately
Pn101	2000						Speed Loop Integral Time 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 Integral Time Constant	Immediately
Pn106	400						Second Position Loop Gain	Immediately
Pn109	0						Feedforward	Immediately
Pn10A	0						Feedforward Filter Time Constant	Immediately
Pn10B	0000h						Gain Application Selections	–
Pn10C	200						Mode Switching Level for Torque Reference	Immediately
Pn10D	0						Mode Switching Level for Speed Reference	Immediately
Pn10E	0						Mode Switching Level for Acceleration	Immediately
Pn10F	0						Mode Switching Level for Position Deviation	Immediately
Pn11F	0						Position Integral Time Constant	Immediately
Pn121	100						Friction Compensation Gain	Immediately
Pn122	100						Second Friction Compensation Gain	Immediately
Pn123	0						Friction Compensation Coefficient	Immediately
Pn124	0						Friction Compensation Frequency Correction	Immediately

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Parameter No.	Default Setting						Name	When Enabled
Pn125	100						Friction Compensation Gain Correction	Immediately
Pn131	0						Gain Switching Time 1	Immediately
Pn132	0						Gain Switching Time 2	Immediately
Pn135	0						Gain Switching Waiting Time 1	Immediately
Pn136	0						Gain Switching Waiting Time 2	Immediately
Pn139	0000h						Automatic Gain Switching Selections 1	Immediately
Pn13D	2000						Current Gain Level	Immediately
Pn140	0100h						Model Following Control-Related Selections	Immediately
Pn141	500						Model Following Control Gain	Immediately
Pn142	1000						Model Following Control Gain Correction	Immediately
Pn143	1000						Model Following Control Bias in the Forward Direction	Immediately
Pn144	1000						Model Following Control Bias in the Reverse Direction	Immediately
Pn145	500						Vibration Suppression 1 Frequency A	Immediately
Pn146	700						Vibration Suppression 1 Frequency B	Immediately
Pn147	1000						Model Following Control Speed Feedforward Compensation	Immediately
Pn148	500						Second Model Following Control Gain	Immediately
Pn149	1000						Second Model Following Control Gain Correction	Immediately
Pn14A	800						Vibration Suppression 2 Frequency	Immediately
Pn14B	100						Vibration Suppression 2 Correction	Immediately
Pn14F	0030h						Control-Related Selections	After restart
Pn160	0010h						Anti-Resonance Control-Related Selections	Immediately
Pn161	1000						Anti-Resonance Frequency	Immediately
Pn162	100						Anti-Resonance Gain Correction	Immediately
Pn163	0						Anti-Resonance Damping Gain	Immediately
Pn164	0						Anti-Resonance Filter Time Constant 1 Correction	Immediately
Pn165	0						Anti-Resonance Filter Time Constant 2 Correction	Immediately
Pn166	0						Anti-Resonance Damping Gain 2	Immediately
Pn170	1401h						Tuning-less Function-Related Selections	–
Pn173	0000h						Load Fluctuation Compensation Control-Related Selections	Immediately
Pn174	400						Load Fluctuation Compensation Control Response Level	Immediately
Pn181	0						Mode Switching Level for Speed Reference	Immediately

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Parameter No.	Default Setting						Name	When Enabled
Pn182	0						Mode Switching Level for Acceleration	Immediately
Pn205	65535						Multiturn Limit	After restart
Pn207	0010h						Position Control Function Selections	After restart
Pn20A	32768						Number of External Encoder Scale Pitches	After restart
Pn20E	64						Electronic Gear Ratio (Numerator)	After restart
Pn210	1						Electronic Gear Ratio (Denominator)	After restart
Pn212	2048						Number of Encoder Output Pulses	After restart
Pn21D	0080h						Encoder Resolution Setting	After restart
Pn22A	0000h						Fully-closed Control Selections	After restart
Pn230	0000h						Position Control Expansion Function Selections	After restart
Pn231	0						Backlash Compensation Value	Immediately
Pn233	0						Backlash Compensation 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 Time	Immediately
Pn306	0						Soft Start Deceleration Time	Immediately
Pn308	0						Speed Feedback Filter Time Constant	Immediately
Pn30A	0						Deceleration Time for Servo OFF and Forced Stops	Immediately
Pn30C	0						Speed Feedforward Average Movement Time	Immediately
Pn310	0000h						Vibration Detection Selections	Immediately
Pn311	100						Vibration Detection Sensitivity	Immediately
Pn312	50						Vibration Detection Level	Immediately
Pn316	10000						Maximum Motor Speed	After restart
Pn324	300						Moment of Inertia Calculation Starting Level	Immediately
Pn383	50						Jogging Speed	Immediately
Pn384	10						Vibration Detection Level	Immediately
Pn385	50						Maximum Motor Speed	After restart
Pn401	100						First Stage First Torque Reference Filter Time Constant	Immediately
Pn402	800						Forward Torque Limit	Immediately
Pn403	800						Reverse Torque Limit	Immediately
Pn404	100						Forward External Torque Limit	Immediately
Pn405	100						Reverse External Torque Limit	Immediately
Pn406	800						Emergency Stop Torque	Immediately
Pn407	10000						Speed Limit during Torque Control	Immediately
Pn408	0000h						Torque-Related Function Selections	–

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Parameter No.	Default Setting						Name	When Enabled
Pn409	5000						First Stage Notch Filter Frequency	Immediately
Pn40A	70						First Stage Notch Filter Q Value	Immediately
Pn40B	0						First Stage Notch Filter Depth	Immediately
Pn40C	5000						Second Stage Notch Filter Frequency	Immediately
Pn40D	70						Second Stage Notch Filter Q Value	Immediately
Pn40E	0						Second Stage Notch Filter Depth	Immediately
Pn40F	5000						Second Stage Second Torque Reference Filter Frequency	Immediately
Pn410	50						Second Stage Second Torque Reference Filter Q Value	Immediately
Pn412	100						First Stage Second Torque Reference Filter Time Constant	Immediately
Pn416	0000h						Torque-Related Function Selections 2	Immediately
Pn417	5000						Third Stage Notch Filter Frequency	Immediately
Pn418	70						Third Stage Notch Filter Q Value	Immediately
Pn419	0						Third Stage Notch Filter Depth	Immediately
Pn41A	5000						Fourth Stage Notch Filter Frequency	Immediately
Pn41B	70						Fourth Stage Notch Filter Q Value	Immediately
Pn41C	0						Fourth Stage Notch Filter Depth	Immediately
Pn41D	5000						Fifth Stage Notch Filter Frequency	Immediately
Pn41E	70						Fifth Stage Notch Filter Q Value	Immediately
Pn41F	0						Fifth Stage Notch Filter Depth	Immediately
Pn423	0002h						Speed Ripple Compensation Selections	–
Pn424	50						Torque Limit at Main Circuit Voltage Drop	Immediately
Pn425	100						Release Time for Torque Limit at Main Circuit Voltage Drop	Immediately
Pn426	0						Torque Feedforward Average Movement Time	Immediately
Pn427	0						Speed Ripple Compensation Enable Speed	Immediately
Pn428	0001h						Output Torque Compensation Selections	After restart
Pn43D	10000						Reserved (Do not change.)	–
Pn456	15						Sweep Torque Reference Amplitude	Immediately
Pn460	0101h						Notch Filter Adjustment Selections 1	Immediately
Pn475	0000h						Gravity Compensation-Related Selections	After restart
Pn476	0						Gravity Compensation Torque	Immediately
Pn480	10000						Speed Limit during Force Control	Immediately
Pn481	400						Polarity Detection Speed Loop Gain	Immediately
Pn482	3000						Polarity Detection Speed Loop Integral Time	Immediately
Pn483	30						Forward Force Limit	Immediately

Continued on next page.

Continued from previous page.

Parameter No.	Default Setting						Name	When Enabled
Pn484	30						Reverse Force Limit	Immediately
Pn485	20						Polarity Detection Reference Speed	Immediately
Pn486	25						Polarity Detection Reference Acceleration/Deceleration Time	Immediately
Pn487	0						Polarity Detection Constant Speed Time	Immediately
Pn488	100						Polarity Detection Reference Waiting Time	Immediately
Pn48E	10						Polarity Detection Range	Immediately
Pn490	100						Polarity Detection Load Level	Immediately
Pn495	100						Polarity Detection Confirmation Force Reference	Immediately
Pn498	10						Polarity Detection Allowable Error Range	Immediately
Pn49F	0						Speed Ripple Compensation Enable Speed (Linear)	Immediately
Pn502	20						Rotation Detection Level	Immediately
Pn503	10						Speed Coincidence Detection Signal Output Width	Immediately
Pn506	0						Brake Reference-Servo OFF Delay Time	Immediately
Pn507	100						Brake Reference Output Speed Level	Immediately
Pn508	50						Servo OFF-Brake Command Waiting Time	Immediately
Pn509	20						Momentary Power Interruption 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 Settings	After restart
Pn514	0000h						Output Signal Selections 4	After restart
Pn516	8888h						Input Signal Selections 7	After restart
Pn518	–						Reserved (Do not change.)	–
Pn51B	1000						Motor-Load Position Deviation Overflow Detection Level	Immediately
Pn51E	100						Position Deviation Overflow Warning Level	Immediately
Pn520	6116694						Position Deviation Overflow Alarm Level	Immediately
Pn522	7						In-position Range	Immediately
Pn524	1073741824						Near Signal Width	Immediately
Pn526	6116694						Position Deviation Overflow Alarm Level at Servo ON	Immediately

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Continued from previous page.

Parameter No.	Default Setting						Name	When Enabled
Pn528	100						Position Deviation Overflow Warning Level at Servo ON	Immediately
Pn529	10000						Speed Limit Level at Servo ON	Immediately
Pn52A	20						Multiplier per Fully-closed Rotation	Immediately
Pn52B	20						Overload Warning Level	After restart
Pn52C	100						Base Current Derating at Motor Overload Detection	After restart
Pn530	0000h						Program Jogging-Related Selections	Immediately
Pn531	32768						Program Jogging Travel Distance	Immediately
Pn533	500						Program Jogging Movement Speed	Immediately
Pn534	100						Program Jogging Acceleration/Deceleration Time	Immediately
Pn535	100						Program Jogging Waiting Time	Immediately
Pn536	1						Program Jogging Number of Movements	Immediately
Pn540	3000						Maximum Search Gain	Immediately
Pn550	0						Analog Monitor 1 Offset Voltage	Immediately
Pn551	0						Analog Monitor 2 Offset Voltage	Immediately
Pn552	100						Analog Monitor 1 Magnification	Immediately
Pn553	100						Analog Monitor 2 Magnification	Immediately
Pn55A	1						Power Consumption Monitor Unit Time	Immediately
Pn55C	0001h						Specifying Output Status At a Host Comms Error Switch	After restart
Pn55D	0000h						Specifying Output Status When a Host Comms Error Occurs	After restart
Pn560	400						Residual Vibration Detection Width	Immediately
Pn561	100						Overshoot Detection Level	Immediately
Pn562	80						Setting Gain Ratio	Immediately
Pn56A	1111h						Output Signal Reference Method Selections 1	After restart
Pn56B	0001h						Reserved (Do not change.)	–
Pn581	20						Zero Speed Level	Immediately
Pn582	10						Speed Coincidence Detection Signal Output Width	Immediately
Pn583	10						Brake Reference Output Speed Level	Immediately
Pn584	10000						Speed Limit Level at Servo ON	Immediately
Pn585	50						Program Jogging Movement Speed	Immediately
Pn586	0						Motor Running Cooling Ratio	Immediately
Pn587	0000h						Polarity Detection Execution Selection for Absolute Linear Encoder	Immediately
Pn589	1500						SigmaLINK II Node Detection Time	After restart
Pn590	1007h						P-OT (Forward Drive Prohibit Input) Signal Allocation	After restart

Continued on next page.

Continued from previous page.

Parameter No.	Default Setting						Name	When Enabled
Pn591	1008h						N-OT (Reverse Drive Prohibit Input) Signal Allocation	After restart
Pn592	1009h						/DEC (Origin Return Deceleration Switch Input) Signal Allocation	After restart
Pn593	1010h						/EXT1 (External Latch Input 1) Signal Allocation	After restart
Pn594	1011h						/EXT2 (External Latch Input 2) Signal Allocation	After restart
Pn595	1012h						/EXT3 (External Latch Input 3) Signal Allocation	After restart
Pn597	0000h						FSTP (Forced Stop Input) Signal Allocation	After restart
Pn598	0000h						/P-CL (Forward External Torque Limit Input) Signal Allocation	After restart
Pn599	0000h						/N-CL (Reverse External Torque Limit Input) Signal Allocation	After restart
Pn5B0	0000h						/COIN (Positioning Completion Output) Signal Allocation	After restart
Pn5B1	0000h						/V-CMP (Speed Coincidence Detection Output) Signal Allocation	After restart
Pn5B2	0000h						/TGON (Rotation Detection Output) Signal Allocation	After restart
Pn5B3	0000h						/S-RDY (Servo Ready Output) Signal Allocation	After restart
Pn5B4	0000h						/CLT (Torque Limit Detection Output) Signal Allocation	After restart
Pn5B5	0000h						/VLT (Speed Limit Detection Output) Signal Allocation	After restart
Pn5B6	1001h						/BK (Brake Output) Signal Allocation	After restart
Pn5B7	0000h						/WARN (Warning Output) Signal Allocation	After restart
Pn5B8	0000h						/NEAR (Near Output) Signal Allocation	After restart
Pn5BC	0000h						/PM (Preventative Maintenance Output) Signal Allocation	After restart
Pn5C3	0000h						Error Detection Setting	After restart
Pn5C4	2000						Error Detection Sample Data Set 1 Warning Level 1	Immediately
Pn5C5	1520						Error Detection Sample Data Set 1 Judgment Level 1	Immediately
Pn5C6	2000						Error Detection Sample Data Set 1 Warning Level 2	Immediately
Pn5C7	1520						Error Detection Sample Data Set 1 Judgment Level 2	Immediately
Pn5C8	2000						Error Detection Sample Data Set 2 Warning Level 1	Immediately
Pn5C9	1520						Error Detection Sample Data Set 2 Judgment Level 1	Immediately
Pn5CA	2000						Error Detection Sample Data Set 2 Warning Level 2	Immediately

Continued on next page.

Continued from previous page.

Parameter No.	Default Setting						Name	When Enabled
Pn5CB	1520						Error Detection Sample Data Set 2 Judgment Level 2	Immediately
Pn5D7	0000h						Output Signal Inversion for Triggers at Preset Positions	After restart
Pn600	0						Regenerative Resistor Capacity	Immediately
Pn601	0						Dynamic Brake Resistor Allowable Energy Consumption	After restart
Pn603	0						Regenerative Resistance	Immediately
Pn604	0						Dynamic Brake Resistance	After restart
Pn61A	0000h						Overheat Protection Selections	After restart
Pn61B	250						Overheat Alarm Level	Immediately
Pn61C	100						Overheat Warning Level	Immediately
Pn61D	0						Overheat Alarm Filter Time	Immediately
Pn621	–						Reserved (Do not change.)	–
Pn622	–						Reserved (Do not change.)	–
Pn623	–						Reserved (Do not change.)	–
Pn624	–						Reserved (Do not change.)	–
Pn625	–						Reserved (Do not change.)	–
Pn626	–						Reserved (Do not change.)	–
Pn627	–						Reserved (Do not change.)	–
Pn628	–						Reserved (Do not change.)	–
Pn660	0000h						Triggers at Preset Positions Switch	After restart
Pn800	1040h						Communications Controls	Immediately
Pn801	0003h						Application Function Selections 6 (Software Limits)	Immediately
Pn803	10						Origin Range	Immediately
Pn804	10737418-23						Forward Software Limit	Immediately
Pn806	-10737418-23						Reverse Software Limit	Immediately
Pn808	0						Absolute Encoder Origin Offset	Immediately
Pn80A	100						Reserved (Do not change.)	–
Pn80B	100						Reserved (Do not change.)	–
Pn80C	0						Reserved (Do not change.)	–
Pn80D	100						Reserved (Do not change.)	–
Pn80E	100						Reserved (Do not change.)	–
Pn80F	0						Reserved (Do not change.)	–
Pn810	0						Exponential Acceleration/ Deceleration Bias	Immediately
Pn811	0						Exponential Acceleration/Deceleration Time Constant	Immediately
Pn812	0						Movement Average Time	Immediately
Pn814	100						External Positioning Final Travel Distance	Immediately

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Parameter No.	Default Setting						Name	When Enabled
Pn816	0000h						Reserved (Do not change.)	–
Pn817	0						Reserved (Do not change.)	–
Pn818	0						Reserved (Do not change.)	–
Pn819	100						Final Travel Distance for Origin Return	Immediately
Pn81E	0000h						Reserved (Do not change.)	–
Pn81F	0010h						Reserved (Do not change.)	–
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						Reserved (Do not change.)	–
Pn829	0						SVOFF Waiting Time (for SVOFF at Deceleration to Stop)	Immediately
Pn82A	1813h						Reserved (Do not change.)	–
Pn82B	1D1Ch						Reserved (Do not change.)	–
Pn82C	1F1Eh						Reserved (Do not change.)	–
Pn82D	0000h						Reserved (Do not change.)	–
Pn82E	0000h						Reserved (Do not change.)	–
Pn833	0001h						Reserved (Do not change.)	–
Pn834	100						First Stage Linear Acceleration Constant	Immediately
Pn836	100						Second Stage Linear Acceleration Constant	Immediately
Pn838	0						Acceleration Constant Switching Speed	Immediately
Pn83A	100						First Stage Linear Deceleration Constant	Immediately
Pn83C	100						Second Stage Linear Deceleration Constant	Immediately
Pn83E	0						Deceleration Constant Switching Speed	Immediately
Pn840	100						Linear Deceleration Constant for Stopping	Immediately
Pn842	50						Origin Approach Speed 1	Immediately
Pn844	5						Origin Approach Speed 2	Immediately
Pn846	0						POSING Command S-curve Acceleration/Deceleration Rate	Immediately
Pn850	0						Number of Latch Sequences	Immediately
Pn851	0						Continuous Latch Sequence Count	Immediately
Pn852	0000h						Latch Sequence 1 to 4 Settings	Immediately
Pn853	0000h						Latch Sequence 5 to 8 Settings	Immediately
Pn860	0000h						SVCMD_IN Input Signal Monitor Allocations 1	Immediately

Continued on next page.

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Parameter No.	Default Setting						Name	When Enabled
Pn861	0000h						SVCMD_IN Input Signal Monitor Allocations 2	Immediately
Pn862	0000h						SVCMD_IN Input Signal Monitor Allocations 3	Immediately
Pn863	0000h						SVCMD_IN Input Signal Monitor Allocations 4	Immediately
Pn868	0000h						SVCMD_IN Output Signal Monitor Allocations 1	Immediately
Pn869	0000h						SVCMD_IN Output Signal Monitor Allocations 2	Immediately
Pn880	–						Reserved (Do not change.)	–
Pn881	–						Reserved (Do not change.)	–
Pn882	–						Reserved (Do not change.)	–
Pn883	–						Communications Cycle Setting Monitor [transmission cycles] (for maintenance, read only)	–
Pn884	0000h						Communications Controls 2	Immediately
Pn885	0000h						Reserved (Do not change.)	–
Pn886	FFFFFFFF-h						S-curve Maximum Acceleration/ Deceleration Rate	Immediately
Pn88A	0						MECHATROLINK Receive Error Counter Monitor (for maintenance, read only)	–

14.8 Parameter Recording Table: MECHATROLINK- III Communications References

Use the following table to record the settings of the parameters.

Parameter No.	Default Setting						Name	When Enabled
Pn000	0000h						Basic Function Selections 0	After restart
Pn001	0000h						Application Function Selections 1	After restart
Pn002	0011h						Application Function Selections 2	After restart
Pn006	0002h						Application Function Selections 6	Immediately
Pn007	0000h						Application Function Selections 7	Immediately
Pn008	4000h						Application Function Selections 8	After restart
Pn009	0040h						Application Function Selections 9	After restart
Pn00A	0001h						Application Function Selections A	After restart
Pn00B	0000h						Application Function Selections B	After restart
Pn00C	0040h						Application Function Selections C	After restart
Pn00D	0000h						Application Function Selections D	After restart
Pn00E	0000h						Application Function Selections E	After restart
Pn00F	0000h						Application Function Selections F	After restart
Pn021	0000h						Reserved (Do not change.)	–
Pn022	0000h						Application Function Selections 22	After restart
Pn02F	0000h						Application Function Selections 2F	After restart
Pn040	0000h						Sigma-V/Sigma-7 Compatible Function Switch	After restart
Pn050	00000000h						SigmaLINK II Response Data Selection 1	After restart
Pn052	00000000h						SigmaLINK II Response Data Selection 2	After restart
Pn054	00000000h						SigmaLINK II Response Data Selection 3	After restart
Pn056	00000000h						SigmaLINK II Response Data Selection 4	After restart
Pn058	00000000h						SigmaLINK II Response Data Selection 5	After restart
Pn05A	00000000h						SigmaLINK II Response Data Selection 6	After restart
Pn05C	00000000h						SigmaLINK II Response Data Selection 7	After restart
Pn05E	00000000h						SigmaLINK II Response Data Selection 8	After restart
Pn080	0000h						Application Function Selections 80	After restart
Pn081	0000h						Application Function Selections 81	After restart
Pn090	00000000h						SigmaLINK II Command Data Selection 1	After restart
Pn092	00000000h						SigmaLINK II Command Data Selection 2	After restart
Pn094	00000000h						SigmaLINK II Command Data Selection 3	After restart

Continued on next page.

Continued from previous page.

Parameter No.	Default Setting						Name	When Enabled
Pn096	00000000h						SigmaLINK II Command Data Selection 4	After restart
Pn0B1	0000h						SigmaLINK II Sequence Input Allocation 1	After restart
Pn0B2	0000h						SigmaLINK II Sequence Input Allocation 2	After restart
Pn0B5	0000h						SigmaLINK II Sequence Output Allocation 1	After restart
Pn0D8	0000h						Reserved (Do not change.)	–
Pn0D9	0000h						Reserved (Do not change.)	–
Pn0DA	0000h						SigmaLINK II Semi-closed Encoder Selection	After restart
Pn0DB	0101h						SigmaLINK II Fully-closed Encoder Selection	After restart
Pn0DC	0000h						SigmaLINK II Node Change Detection Condition Selection	After restart
Pn0DD	0110h						SigmaLINK II I/O Device Error Detection Selection	After restart
Pn100	400						Speed Loop Gain	Immediately
Pn101	2000						Speed Loop Integral Time 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 Integral Time Constant	Immediately
Pn106	400						Second Position Loop Gain	Immediately
Pn109	0						Feedforward	Immediately
Pn10A	0						Feedforward Filter Time Constant	Immediately
Pn10B	0000h						Gain Application Selections	–
Pn10C	200						Mode Switching Level for Torque Reference	Immediately
Pn10D	0						Mode Switching Level for Speed Reference	Immediately
Pn10E	0						Mode Switching Level for Acceleration	Immediately
Pn10F	0						Mode Switching Level for Position Deviation	Immediately
Pn11F	0						Position Integral Time Constant	Immediately
Pn121	100						Friction Compensation Gain	Immediately
Pn122	100						Second Friction Compensation Gain	Immediately
Pn123	0						Friction Compensation Coefficient	Immediately
Pn124	0						Friction Compensation Frequency Correction	Immediately
Pn125	100						Friction Compensation Gain Correction	Immediately
Pn131	0						Gain Switching Time 1	Immediately
Pn132	0						Gain Switching Time 2	Immediately

Continued on next page.

Continued from previous page.

Parameter No.	Default Setting						Name	When Enabled
Pn135	0						Gain Switching Waiting Time 1	Immediately
Pn136	0						Gain Switching Waiting Time 2	Immediately
Pn139	0000h						Automatic Gain Switching Selections 1	Immediately
Pn13D	2000						Current Gain Level	Immediately
Pn140	0100h						Model Following Control-Related Selections	Immediately
Pn141	500						Model Following Control Gain	Immediately
Pn142	1000						Model Following Control Gain Correction	Immediately
Pn143	1000						Model Following Control Bias in the Forward Direction	Immediately
Pn144	1000						Model Following Control Bias in the Reverse Direction	Immediately
Pn145	500						Vibration Suppression 1 Frequency A	Immediately
Pn146	700						Vibration Suppression 1 Frequency B	Immediately
Pn147	1000						Model Following Control Speed Feedforward Compensation	Immediately
Pn148	500						Second Model Following Control Gain	Immediately
Pn149	1000						Second Model Following Control Gain Correction	Immediately
Pn14A	800						Vibration Suppression 2 Frequency	Immediately
Pn14B	100						Vibration Suppression 2 Correction	Immediately
Pn14F	0030h						Control-Related Selections	After restart
Pn160	0010h						Anti-Resonance Control-Related Selections	Immediately
Pn161	1000						Anti-Resonance Frequency	Immediately
Pn162	100						Anti-Resonance Gain Correction	Immediately
Pn163	0						Anti-Resonance Damping Gain	Immediately
Pn164	0						Anti-Resonance Filter Time Constant 1 Correction	Immediately
Pn165	0						Anti-Resonance Filter Time Constant 2 Correction	Immediately
Pn166	0						Anti-Resonance Damping Gain 2	Immediately
Pn170	1401h						Tuning-less Function-Related Selections	–
Pn173	0000h						Load Fluctuation Compensation Control-Related Selections	Immediately
Pn174	400						Load Fluctuation Compensation Control Response Level	Immediately
Pn181	0						Mode Switching Level for Speed Reference	Immediately
Pn182	0						Mode Switching Level for Acceleration	Immediately
Pn205	65535						Multiturn Limit	After restart
Pn207	0010h						Position Control Function Selections	After restart

Continued on next page.

Continued from previous page.

Parameter No.	Default Setting						Name	When Enabled
Pn20A	32768						Number of External Encoder Scale Pitches	After restart
Pn20E	64						Electronic Gear Ratio (Numerator)	After restart
Pn210	1						Electronic Gear Ratio (Denominator)	After restart
Pn212	2048						Number of Encoder Output Pulses	After restart
Pn21D	0080h						Encoder Resolution Setting	After restart
Pn22A	0000h						Fully-closed Control Selections	After restart
Pn230	0000h						Position Control Expansion Function Selections	After restart
Pn231	0						Backlash Compensation Value	Immediately
Pn233	0						Backlash Compensation 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 Time	Immediately
Pn306	0						Soft Start Deceleration Time	Immediately
Pn308	0						Speed Feedback Filter Time Constant	Immediately
Pn30A	0						Deceleration Time for Servo OFF and Forced Stops	Immediately
Pn30C	0						Speed Feedforward Average Movement Time	Immediately
Pn310	0000h						Vibration Detection Selections	Immediately
Pn311	100						Vibration Detection Sensitivity	Immediately
Pn312	50						Vibration Detection Level	Immediately
Pn316	10000						Maximum Motor Speed	After restart
Pn324	300						Moment of Inertia Calculation Starting Level	Immediately
Pn383	50						Jogging Speed	Immediately
Pn384	10						Vibration Detection Level	Immediately
Pn385	50						Maximum Motor Speed	After restart
Pn401	100						First Stage First Torque Reference Filter Time Constant	Immediately
Pn402	800						Forward Torque Limit	Immediately
Pn403	800						Reverse Torque Limit	Immediately
Pn404	100						Forward External Torque Limit	Immediately
Pn405	100						Reverse External Torque Limit	Immediately
Pn406	800						Emergency Stop Torque	Immediately
Pn407	10000						Speed Limit during Torque Control	Immediately
Pn408	0000h						Torque-Related Function Selections	–
Pn409	5000						First Stage Notch Filter Frequency	Immediately
Pn40A	70						First Stage Notch Filter Q Value	Immediately
Pn40B	0						First Stage Notch Filter Depth	Immediately

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Parameter No.	Default Setting						Name	When Enabled
Pn40C	5000						Second Stage Notch Filter Frequency	Immediately
Pn40D	70						Second Stage Notch Filter Q Value	Immediately
Pn40E	0						Second Stage Notch Filter Depth	Immediately
Pn40F	5000						Second Stage Second Torque Reference Filter Frequency	Immediately
Pn410	50						Second Stage Second Torque Reference Filter Q Value	Immediately
Pn412	100						First Stage Second Torque Reference Filter Time Constant	Immediately
Pn416	0000h						Torque-Related Function Selections 2	Immediately
Pn417	5000						Third Stage Notch Filter Frequency	Immediately
Pn418	70						Third Stage Notch Filter Q Value	Immediately
Pn419	0						Third Stage Notch Filter Depth	Immediately
Pn41A	5000						Fourth Stage Notch Filter Frequency	Immediately
Pn41B	70						Fourth Stage Notch Filter Q Value	Immediately
Pn41C	0						Fourth Stage Notch Filter Depth	Immediately
Pn41D	5000						Fifth Stage Notch Filter Frequency	Immediately
Pn41E	70						Fifth Stage Notch Filter Q Value	Immediately
Pn41F	0						Fifth Stage Notch Filter Depth	Immediately
Pn423	0002h						Speed Ripple Compensation Selections	–
Pn424	50						Torque Limit at Main Circuit Voltage Drop	Immediately
Pn425	100						Release Time for Torque Limit at Main Circuit Voltage Drop	Immediately
Pn426	0						Torque Feedforward Average Movement Time	Immediately
Pn427	0						Speed Ripple Compensation Enable Speed	Immediately
Pn428	0001h						Output Torque Compensation Selections	After restart
Pn43A	10000						Reserved (Do not change.)	–
Pn43B	10000						Reserved (Do not change.)	–
Pn43C	10000						Reserved (Do not change.)	–
Pn43D	10000						Reserved (Do not change.)	–
Pn456	15						Sweep Torque Reference Amplitude	Immediately
Pn460	0101h						Notch Filter Adjustment Selections 1	Immediately
Pn475	0000h						Gravity Compensation-Related Selections	After restart
Pn476	0						Gravity Compensation Torque	Immediately
Pn480	10000						Speed Limit during Force Control	Immediately
Pn481	400						Polarity Detection Speed Loop Gain	Immediately
Pn482	3000						Polarity Detection Speed Loop Integral Time	Immediately
Pn483	30						Forward Force Limit	Immediately

Continued on next page.

Continued from previous page.

Parameter No.	Default Setting						Name	When Enabled
Pn484	30						Reverse Force Limit	Immediately
Pn485	20						Polarity Detection Reference Speed	Immediately
Pn486	25						Polarity Detection Reference Accel-eration/Deceleration Time	Immediately
Pn487	0						Polarity Detection Constant Speed Time	Immediately
Pn488	100						Polarity Detection Reference Waiting Time	Immediately
Pn48E	10						Polarity Detection Range	Immediately
Pn490	100						Polarity Detection Load Level	Immediately
Pn495	100						Polarity Detection Confirmation Force Reference	Immediately
Pn498	10						Polarity Detection Allowable Error Range	Immediately
Pn49F	0						Speed Ripple Compensation Enable Speed (Linear)	Immediately
Pn502	20						Rotation Detection Level	Immediately
Pn503	10						Speed Coincidence Detection Signal Output Width	Immediately
Pn506	0						Brake Reference-Servo OFF Delay Time	Immediately
Pn507	100						Brake Reference Output Speed Level	Immediately
Pn508	50						Servo OFF-Brake Command Waiting Time	Immediately
Pn509	20						Momentary Power Interruption 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 Settings	After restart
Pn514	0000h						Output Signal Selections 4	After restart
Pn516	8888h						Input Signal Selections 7	After restart
Pn518	-						Reserved (Do not change.)	-
Pn51B	1000						Motor-Load Position Deviation Over-flow Detection Level	Immediately
Pn51E	100						Position Deviation Overflow Warning Level	Immediately
Pn520	6116694						Position Deviation Overflow Alarm Level	Immediately
Pn522	7						In-position Range	Immediately
Pn524	10737418-24						Near Signal Width	Immediately
Pn526	6116694						Position Deviation Overflow Alarm Level at Servo ON	Immediately

Continued on next page.

Continued from previous page.

Parameter No.	Default Setting						Name	When Enabled
Pn528	100						Position Deviation Overflow Warning Level at Servo ON	Immediately
Pn529	10000						Speed Limit Level at Servo ON	Immediately
Pn52A	20						Multiplier per Fully-closed Rotation	Immediately
Pn52B	20						Overload Warning Level	After restart
Pn52C	100						Base Current Derating at Motor Overload Detection	After restart
Pn530	0000h						Program Jogging-Related Selections	Immediately
Pn531	32768						Program Jogging Travel Distance	Immediately
Pn533	500						Program Jogging Movement Speed	Immediately
Pn534	100						Program Jogging Acceleration/Deceleration Time	Immediately
Pn535	100						Program Jogging Waiting Time	Immediately
Pn536	1						Program Jogging Number of Movements	Immediately
Pn540	3000						Maximum Search Gain	Immediately
Pn550	0						Analog Monitor 1 Offset Voltage	Immediately
Pn551	0						Analog Monitor 2 Offset Voltage	Immediately
Pn552	100						Analog Monitor 1 Magnification	Immediately
Pn553	100						Analog Monitor 2 Magnification	Immediately
Pn55A	1						Power Consumption Monitor Unit Time	Immediately
Pn55C	0001h						Specifying Output Status At a Host Comms Error Switch	After restart
Pn55D	0000h						Specifying Output Status When a Host Comms Error Occurs	After restart
Pn560	400						Residual Vibration Detection Width	Immediately
Pn561	100						Overshoot Detection Level	Immediately
Pn562	80						Setting Gain Ratio	Immediately
Pn56A	1111h						Output Signal Reference Method Selections 1	After restart
Pn56B	0001h						Reserved (Do not change.)	–
Pn581	20						Zero Speed Level	Immediately
Pn582	10						Speed Coincidence Detection Signal Output Width	Immediately
Pn583	10						Brake Reference Output Speed Level	Immediately
Pn584	10000						Speed Limit Level at Servo ON	Immediately
Pn585	50						Program Jogging Movement Speed	Immediately
Pn586	0						Motor Running Cooling Ratio	Immediately
Pn587	0000h						Polarity Detection Execution Selection for Absolute Linear Encoder	Immediately
Pn589	1500						SigmaLINK II Node Detection Time	After restart
Pn590	1007h						P-OT (Forward Drive Prohibit Input) Signal Allocation	After restart

Continued on next page.

Continued from previous page.

Parameter No.	Default Setting						Name	When Enabled
Pn591	1008h						N-OT (Reverse Drive Prohibit Input) Signal Allocation	After restart
Pn592	1009h						/DEC (Origin Return Deceleration Switch Input) Signal Allocation	After restart
Pn593	1010h						/EXT1 (External Latch Input 1) Signal Allocation	After restart
Pn594	1011h						/EXT2 (External Latch Input 2) Signal Allocation	After restart
Pn595	1012h						/EXT3 (External Latch Input 3) Signal Allocation	After restart
Pn597	0000h						FSTP (Forced Stop Input) Signal Allocation	After restart
Pn598	0000h						/P-CL (Forward External Torque Limit Input) Signal Allocation	After restart
Pn599	0000h						/N-CL (Reverse External Torque Limit Input) Signal Allocation	After restart
Pn5B0	0000h						/COIN (Positioning Completion Output) Signal Allocation	After restart
Pn5B1	0000h						/V-CMP (Speed Coincidence Detection Output) Signal Allocation	After restart
Pn5B2	0000h						/TGON (Rotation Detection Output) Signal Allocation	After restart
Pn5B3	0000h						/S-RDY (Servo Ready Output) Signal Allocation	After restart
Pn5B4	0000h						/CLT (Torque Limit Detection Output) Signal Allocation	After restart
Pn5B5	0000h						/VLT (Speed Limit Detection Output) Signal Allocation	After restart
Pn5B6	1001h						/BK (Brake Output) Signal Allocation	After restart
Pn5B7	0000h						/WARN (Warning Output) Signal Allocation	After restart
Pn5B8	0000h						/NEAR (Near Output) Signal Allocation	After restart
Pn5BC	0000h						/PM (Preventative Maintenance Output) Signal Allocation	After restart
Pn5C3	0000h						Error Detection Setting	After restart
Pn5C4	2000						Error Detection Sample Data Set 1 Warning Level 1	Immediately
Pn5C5	1520						Error Detection Sample Data Set 1 Judgment Level 1	Immediately
Pn5C6	2000						Error Detection Sample Data Set 1 Warning Level 2	Immediately
Pn5C7	1520						Error Detection Sample Data Set 1 Judgment Level 2	Immediately
Pn5C8	2000						Error Detection Sample Data Set 2 Warning Level 1	Immediately
Pn5C9	1520						Error Detection Sample Data Set 2 Judgment Level 1	Immediately
Pn5CA	2000						Error Detection Sample Data Set 2 Warning Level 2	Immediately

Continued on next page.

Continued from previous page.

Parameter No.	Default Setting						Name	When Enabled
Pn5CB	1520						Error Detection Sample Data Set 2 Judgment Level 2	Immediately
Pn5D7	0000h						Output Signal Inversion for Triggers at Preset Positions	After restart
Pn600	0						Regenerative Resistor Capacity	Immediately
Pn601	0						Dynamic Brake Resistor Allowable Energy Consumption	After restart
Pn603	0						Regenerative Resistance	Immediately
Pn604	0						Dynamic Brake Resistance	After restart
Pn61A	0000h						Overheat Protection Selections	After restart
Pn61B	250						Overheat Alarm Level	Immediately
Pn61C	100						Overheat Warning Level	Immediately
Pn61D	0						Overheat Alarm Filter Time	Immediately
Pn621	–						Reserved (Do not change.)	–
Pn622	–						Reserved (Do not change.)	–
Pn623	–						Reserved (Do not change.)	–
Pn624	–						Reserved (Do not change.)	–
Pn625	–						Reserved (Do not change.)	–
Pn626	–						Reserved (Do not change.)	–
Pn627	–						Reserved (Do not change.)	–
Pn628	–						Reserved (Do not change.)	–
Pn660	0000h						Triggers at Preset Positions Switch	After restart
Pn800	1040h						Communications Controls	Immediately
Pn801	0003h						Application Function Selections 6 (Software Limits)	Immediately
Pn803	10						Origin Range	Immediately
Pn804	10737418-23						Forward Software Limit	Immediately
Pn806	-10737418-23						Reverse Software Limit	Immediately
Pn808	0						Absolute Encoder Origin Offset	Immediately
Pn80A	100						Reserved (Do not change.)	–
Pn80B	100						Reserved (Do not change.)	Immediately
Pn80C	0						Reserved (Do not change.)	Immediately
Pn80D	100						Reserved (Do not change.)	Immediately
Pn80E	100						Reserved (Do not change.)	Immediately
Pn80F	0						Reserved (Do not change.)	Immediately
Pn810	0						Exponential Acceleration/ Deceleration Bias	Immediately
Pn811	0						Exponential Function Acceleration/ Deceleration Time Constant	Immediately
Pn812	0						Movement Average Time	Immediately
Pn814	100						External Positioning Final Travel Distance	Immediately

Continued on next page.

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Parameter No.	Default Setting						Name	When Enabled
Pn816	0000h						Reserved (Do not change.)	–
Pn817	0						Reserved (Do not change.)	Immediately
Pn818	0						Reserved (Do not change.)	Immediately
Pn819	100						Final Travel for Zero Point Return	Immediately
Pn81E	0000h						Reserved (Do not change.)	–
Pn81F	0010h						Reserved (Do not change.)	–
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						Reserved (Do not change.)	–
Pn829	0						SVOFF Waiting Time (for SVOFF at Deceleration to Stop)	Immediately
Pn82A	1813h						Reserved (Do not change.)	–
Pn82B	1D1Ch						Reserved (Do not change.)	–
Pn82C	1F1Eh						Reserved (Do not change.)	–
Pn82D	0000h						Reserved (Do not change.)	–
Pn82E	0000h						Reserved (Do not change.)	–
Pn833	0001h						Reserved (Do not change.)	–
Pn834	100						First Stage Linear Acceleration Constant 2	Immediately
Pn836	100						Second Stage Linear Acceleration Constant 2	Immediately
Pn838	0						Acceleration Constant Switching Speed 2	Immediately
Pn83A	100						First Stage Linear Deceleration Constant 2	Immediately
Pn83C	100						Second Stage Linear Deceleration Constant 2	Immediately
Pn83E	0						Deceleration Constant Switching Speed 2	Immediately
Pn840	100						Linear Deceleration Constant 2 for Stopping	Immediately
Pn842	50						Second Origin Approach Speed 1	Immediately
Pn844	5						Second Origin Approach Speed 2	Immediately
Pn846	0						POSING Command S-curve Acceleration/Deceleration Rate	Immediately
Pn850	0						Number of Latch Sequences	Immediately
Pn851	0						Continuous Latch Sequence Count	Immediately
Pn852	0000h						Latch Sequence 1 to 4 Settings	Immediately
Pn853	0000h						Latch Sequence 5 to 8 Settings	Immediately
Pn860	0000h						SVCMD_IO Input Signal Monitor Allocations 1	Immediately
Pn861	0000h						SVCMD_IO Input Signal Monitor Allocations 2	Immediately

Continued on next page.

Continued from previous page.

Parameter No.	Default Setting						Name	When Enabled
Pn862	0000h						SVCMD_IO Input Signal Monitor Allocations 3	Immediately
Pn863	0000h						SVCMD_IO Input Signal Monitor Allocations 4	Immediately
Pn868	0000h						SVCMD_IO Output Signal Monitor Allocations 1	Immediately
Pn869	0000h						SVCMD_IO Output Signal Monitor Allocations 2	Immediately
Pn879	0300h						Reserved (Do not change.)	–
Pn880	–						Station Address Monitor (for maintenance, read only)	–
Pn881	–						Set Transmission Byte Count Monitor [bytes] (for maintenance, read only)	–
Pn882	–						Transmission Cycle Setting Monitor [× 0.25 μs] (for maintenance, read only)	–
Pn883	–						Communications Cycle Setting Monitor [transmission cycles] (for maintenance, read only)	–
Pn884	0000h						Communications Controls 2	Immediately
Pn886	FFFFFFFF-h						S-curve Maximum Acceleration/ Deceleration Rate	Immediately
Pn88A	0						MECHATROLINK Receive Error Counter Monitor (for maintenance, read only)	–
PnA1A	64						Reserved (Do not change.)	–
PnB42to PnBD0	0						Reserved (Do not change.)	–

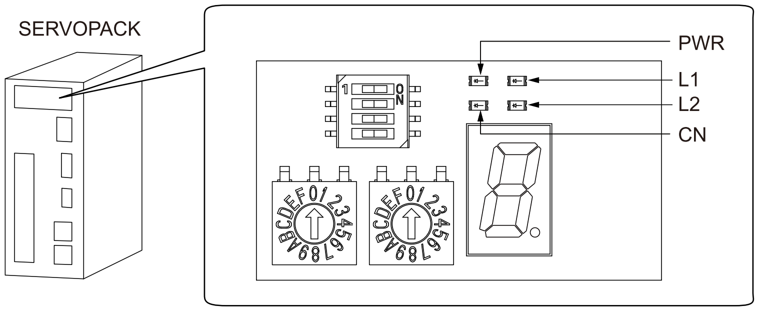
15

Appendices

Provides information on interpreting LED indicators and panel displays and tables of corresponding SERVOPACK and SigmaWin+ function names.

15.1 Interpreting LED Displays

This diagram shows details of the MECHATROLINK communications LED indicators.



LED	Description
PWR	Lit while the control power is being supplied normally.
L1 L2	When communications in the data link layer have started, these LEDs are lit. The L1 LED indicates the status of the communication port at the CN6A connector and the L2 LED that at the CN6B connector. Lit: In normal communication Unlit: Communication not in progress due to disconnected cable, etc.
CN	When the connection in the application layer has been established, this LED is lit. Lit: Connection completed state Unit: Connection uncompleted state

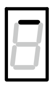
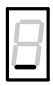
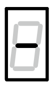
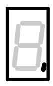
15.2 Interpreting Panel Displays

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.

> **Important**
>
> If the displayed characters cannot be recognized, turn the SERVOPACK power OFF and ON again.
> If this does not resolve the problem, check the items shown below.
> - Check the input signals on the [Status] monitor of the SigmaWin+.
>   Refer to the following section for details.
>   ☞ *(1) Operating Procedure on page 452*
> - Check if anything around the SERVOPACK is generating noise.
>
> If the problem is still not resolved after checking the above items, the SERVOPACK may be faulty.

15.2.1 Interpreting Status Displays

The status is displayed as described below.

Display	Description	Display	Description
	**/TGON (Rotation Detection Output) Signal Display** Lit if the servomotor speed is higher than the setting of Pn502 or Pn581 and not lit if the speed is lower than the setting. (The default setting is 20 min^{-1} or 20 mm/s.)		**Reference Input Display** Lit while a reference is being input.
	**Base Block Display** Lit during the base block state (servo OFF). Not lit while the servo is ON.		**Control Power Supply ON Display** Lit while the control power is being supplied.

15.2.2 Interpreting the Station Address Display

When the SERVOPACK power is turned ON, the station address will be displayed one character at a time as shown below. Each character will be lit for 0.35 s, and then the next character will be displayed.

Example: When the station address set to 03h

r. → 0 → 3.

15.2.3 Alarm and Warning Displays

If there is an alarm or warning, the display will change in the following order.

Example: Alarm A.020

Status Display → Not lit. → A. → Not lit. → 0 → Not lit. → 2 → Not lit. → 0 → Not lit.

15.2.4 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.

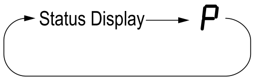
Appendices

15

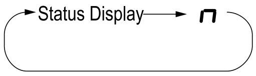
15.2.5 Overtravel Display

If overtravel has occurred, the display will change in the following order.

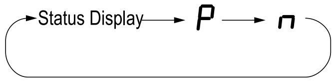
① Forward Overtravel (P-OT)



② Reverse Overtravel (N-OT)

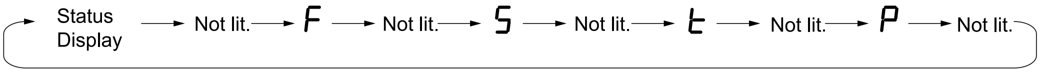


③ Forward and Reverse Overtravel



15.2.6 Forced Stop Display

During a forced stop, the following display will appear.



15.3 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+.

15.3.1 Corresponding SERVOPACK Utility Function Names

SigmaWin+		SERVOPACK	
Button in [Menu] Window	**Function Name**	**Fn No.**	**Function Name**
Basic Functions	Initialize	Fn005	Initialize Parameters
	Software Reset	Fn030	Software Reset
	Setup Wizard	–	–
	I/O Signal Allocation	–	–
	Product Information	Fn011	Display Servomotor Model
		Fn012	Display Software Version
		Fn01E	Display SERVOPACK and Servomotor IDs
		Fn01F	Display Servomotor ID from Feedback Option Module
Encoder Setting	Reset Absolute Encoder	Fn008	Reset Absolute Encoder
	Multi-turn Limit Setup	Fn013	Multiturn Limit Setting after A.CC0 (Multiturn Limit Disagreement) Alarm
	Search Origin	Fn003	Origin Search
	Zero Point Position Setting	Fn020	Set Absolute Linear Encoder Origin
	Polarity Detection	Fn080	Polarity Detection
	Motor Parameter Scale Write	–	–
Troubleshooting	Display Alarm	Fn000	Display Alarm History
		Fn006	Clear Alarm History
		Fn014	Reset Option Module Configuration Error
	Alarm Trace	–	–
	Reset Motor Type Alarm	Fn021	Reset Motor Type Alarm
Operation	Jog	Fn002	Jog
	Program JOG Operation	Fn004	Jog Program
Monitor	Trace	–	–
	Real Time Trace	–	–
	Monitor	–	–
	Life Monitor	–	–

Continued on next page.

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SigmaWin+		SERVOPACK	
Button in [Menu] Window	Function Name	Fn No.	Function Name
Tuning	Tuning - Autotuning without Host Reference	Fn201	Advanced Autotuning without Reference
	Tuning - Autotuning with Host Reference	Fn202	Advanced Autotuning with Reference
	Tuning - Custom Tuning	Fn203	One-Parameter Tuning
	Tuning - Custom Tuning - Adjust Anti-resonance Control	Fn204	Adjust Anti-resonance Control
	Tuning - Custom Tuning - Vibration Suppression	Fn205	Vibration Suppression
	System Tuning	–	–
	Response Level Setting	Fn200	Tuning-less Level Setting
	Edit Online Parameters	–	–
Diagnostic	Mechanical Analysis	–	–
	Easy FFT	Fn206	Easy FFT
	Ripple Compensation	–	–
	Online Vibration Monitor	–	–
Others	Adjust the Analog Monitor Output	Fn00C	Adjust Analog Monitor Output Offset
		Fn00D	Adjust Analog Monitor Output Gain
	Adjust the Motor Current Detection Signal Offsets	Fn00E	Autotune Motor Current Detection Signal Offset
		Fn00F	Manually Adjust Motor Current Detection Signal Offset
	Initialize Vibration Detection Level	Fn01B	Initialize Vibration Detection Level
	Parameter Converter	–	–
	SERVOPACK Axis Name Setting	–	–
	Write Prohibited Setting	Fn010	Write Prohibition Setting
	Motor Parameter SERVOPACK Write	–	–

15.3.2 Corresponding SERVOPACK Monitor Display Function Names

SigmaWin+ Button in [Menu] Window: [Monitor] - [Operation]	SERVOPACK	
Name [Unit]	Un No.	Name [Unit]
Motor Speed [min^{-1}]	Un000	Motor Speed [min^{-1}]
Speed Reference [min^{-1}]	Un001	Speed Reference [min^{-1}]
Torque Reference [%]	Un002	Torque Reference [%] (percentage of rated torque)
• Rotary servomotors: Rotational Angle 1 [encoder pulses] (number of encoder pulses from origin within one encoder rotation) • Linear servomotors: Electrical Angle 1 [linear encoder pulses] (linear encoder pulses from the polarity origin)	Un003	• Rotary servomotors: Rotational Angle 1 [encoder pulses] (number of encoder pulses from origin within one encoder rotation displayed in decimal) • Linear servomotors: Electrical Angle 1 [linear encoder pulses] (linear encoder pulses from the polarity origin displayed in decimal)

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SigmaWin+ Button in [Menu] Window: [Monitor] - [Operation]	SERVOPACK	
Name [Unit]	Un No.	Name [Unit]
• Rotary servomotors: Rotational Angle 2 [deg] (electrical angle from origin within one encoder rotation) • Linear servomotors: Electrical Angle 2 [deg] (electrical angle from polarity origin)	Un004	• Rotary servomotors: Rotational Angle 2 [deg] (electrical angle from polarity origin) • Linear servomotors: Electrical Angle 2 [deg] (electrical angle from polarity origin)
Input Reference Pulse Speed [min^{-1}]	Un007	Input Reference Pulse Speed [min^{-1}] (displayed only during position control)
Position Deviation [reference units]	Un008	Position Deviation [reference units] (displayed only during position control)
Accumulated Load Ratio [%]	Un009	Accumulated Load Ratio [%] (percentage of rated torque: effective torque in cycles of 10 seconds)
Regenerative Load Ratio [%]	Un00A	Regenerative Load Ratio [%] (percentage of processable regenerative power: regenerative power consumption in cycles of 10 seconds)
Dynamic Brake Resistor Power Consumption [%]	Un00B	Dynamic Brake Resistor Power Consumption [%] (percentage of processable power at DB activation: displayed in cycles of 10 seconds)
Input Reference Pulse Counter [reference units]	Un00C	Input Reference Pulse Counter [reference units]
Feedback Pulse Counter [encoder pulses]	Un00D	Feedback Pulse Counter [encoder pulses]
Fully-closed Loop Feedback Pulse Counter [external encoder resolution]	Un00E	Fully-closed Loop Feedback Pulse Counter [external encoder resolution]
Upper Limit Setting of Motor Maximum Speed/Upper Limit Setting of Encoder Output Resolution	Un010 *1	Upper Limit Setting of Motor Maximum Speed/Upper Limit Setting of Encoder Output Resolution
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 Value [0.1 reference units]	Un030	Current Backlash Compensation Value [0.1 reference units]
Backlash Compensation Value Setting Limit [0.1 reference units]	Un031	Backlash Compensation Value Setting Limit [0.1 reference units]
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]
Absolute Encoder Multiturn Data	Un040	Absolute Encoder Multiturn Data
Position within One Rotation of Absolute Encoder [encoder pulses]	Un041	Position within One Rotation of Absolute Encoder [encoder pulses]
Lower Bits of Absolute Encoder Position [encoder pulses]	Un042	Lower Bits of Absolute Encoder Position [encoder pulses]
Upper Bits of Absolute Encoder Position [encoder pulses]	Un043	Upper Bits of Absolute Encoder Position [encoder pulses]
Lower Bits of External Absolute Encoder Position [encoder pulses]	Un054	Lower Bits of External Absolute Encoder Position [encoder pulses]
Upper Bits of External Absolute Encoder Position [encoder pulses]	Un055	Upper Bits of External Absolute Encoder Position [encoder pulses]
Maximum Value of Amplitude of Estimated Vibration [min^{-1}]	Un078	Maximum Value of Amplitude of Estimated Vibration [min^{-1}]
Estimated External Disturbance Torque [%]	Un079	Estimated External Disturbance Torque [%]

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SigmaWin+ Button in [Menu] Window: [Monitor] - [Operation]	SERVOPACK	
Name [Unit]	Un No.	Name [Unit]
Maximum Value of Estimated External Disturbance Torque [%]	Un07A	Maximum Value of Estimated External Disturbance Torque [%]
Minimum Value of Estimated External Disturbance Torque [%]	Un07B	Minimum Value of Estimated External Disturbance Torque [%]
Identified Moment of Inertia Ratio [%]	Un07C	Identified Moment of Inertia Ratio [%]
Maximum Identified Moment of Inertia Ratio [%]	Un088	Maximum Identified Moment of Inertia Ratio [%]
Minimum Identified Moment of Inertia Ratio [%]	Un089	Minimum Identified Moment of Inertia Ratio [%]
Number of Serial Encoder Communications Errors [times]	Un104	Number of Serial Encoder Communications Errors [times]
Settling Time [0.1 ms]	Un105	Settling Time [0.1 ms]
Amount of Overshoot [reference units]	Un106	Amount of Overshoot [reference units]
Residual Vibration Frequency [0.1 Hz]	Un107	Residual Vibration Frequency [0.1 Hz]
Maximum Settling Time [0.1 ms]	Un108	Maximum Settling Time [0.1 ms]
Maximum Amount of Overshoot [reference units]	Un109	Maximum Amount of Overshoot [reference units]
Estimated Vibration [min^{-1}]	Un10C	Estimated Vibration [min^{-1}]
Margin until Regenerative Overload [0.01%]	Un13C	Margin until Regenerative Overload [0.01%]
Margin until Undervoltage [V]	Un13E	Margin until Undervoltage [V]
Margin until Overvoltage [V]	Un13F	Margin until Overvoltage [V]
Maximum Value of Accumulated Load Ratio [%]	Un145	Maximum Value of Accumulated Load Ratio [%]
Number of MECHATROLINK Communications Errors [times]	Un147	Number of MECHATROLINK Communications Errors [times]
Margin until Overload [0.01 %]	Un14E	Margin until Overload [0.01 %]
Temperature Margin until SERVOPACK Overheats [°C]	Un173	Temperature Margin until SERVOPACK Overheats [°C]
Temperature Margin until Servomotor Overheats [°C]	Un174	Temperature Margin until Servomotor Overheats [°C]
Encoder Power Supplied Time [100 ms]	Un177	Encoder Power Supplied Time [100 ms]
Encoder Power Supply Voltage [0.01 V]	Un17A	Encoder Power Supply Voltage [0.01 V]
Encoder Battery Voltage [0.1 V]	Un17B	Encoder Battery Voltage [0.1 V]
Motor Total Number of Rotations [100 rev]	Un181	Motor Total Number of Rotations [100 rev]
Maintenance Prediction Monitor - Bearings	Un183	Maintenance Prediction Monitor - Bearings
Maintenance Prediction Monitor - Oil Seal	Un184	Maintenance Prediction Monitor - Oil Seal
Motor Vibration in X-Axis Direction [0.0001 G]	Un190	Motor Vibration in X-Axis Direction [0.0001 G]
Motor Vibration in Y-Axis Direction [0.0001 G]	Un191	Motor Vibration in Y-Axis Direction [0.0001 G]
Motor Vibration in Z-Axis Direction [0.0001 G]	Un192	Motor Vibration in Z-Axis Direction [0.0001 G]
Motor Vibration XYZ Composite Value [0.0001 G]	Un193	Motor Vibration XYZ Composite Value [0.0001 G]
Maximum Motor Vibration [0.0001 G]	Un194	Maximum Motor Vibration [0.0001 G]
Σ-LINK II Response Data 1	Un1A0	Σ-LINK II Response Data 1
Σ-LINK II Response Data 2	Un1A1	Σ-LINK II Response Data 2
Σ-LINK II Response Data 3	Un1A2	Σ-LINK II Response Data 3
Σ-LINK II Response Data 4	Un1A3	Σ-LINK II Response Data 4
Σ-LINK II Response Data 5	Un1A4	Σ-LINK II Response Data 5
Σ-LINK II Response Data 6	Un1A5	Σ-LINK II Response Data 6

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SigmaWin+ Button in [Menu] Window: [Monitor] - [Operation]	SERVOPACK	
Name [Unit]	**Un No.**	**Name [Unit]**
Σ-LINK II Response Data 7	Un1A6	Σ-LINK II Response Data 7
Σ-LINK II Response Data 8	Un1A7	Σ-LINK II Response Data 8
Σ-LINK II Command Data 1	Un1C0	Σ-LINK II Command Data 1
Σ-LINK II Command Data 2	Un1C1	Σ-LINK II Command Data 2
Σ-LINK II Command Data 3	Un1C2	Σ-LINK II Command Data 3
Σ-LINK II Command Data 4	Un1C3	Σ-LINK II Command Data 4
Σ-LINK II Data Status	Un1CC	Σ-LINK II Data Status
Σ-LINK II Data Status	Un1CD	Σ-LINK II Data Status
Σ-LINK II Data Status	Un1CE	Σ-LINK II Data Status
Σ-LINK II Data Status	Un1CF	Σ-LINK II Data Status

*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 Pn281 (Encoder Output Resolution) for the current Pn385 (Maximum Motor Speed), or you can monitor the upper limit of the maximum motor speed setting for the current encoder output resolution setting.
Select which signal to monitor with Pn080 = n.X□□□ (Calculation Method for Maximum Speed or Encoder Output Pulses).

- If Pn080 = n.0□□□, Pn281 (Encoder Output Resolution) that can be set is displayed.
- If Pn080 = n.1□□□, Pn385 (Maximum Motor Speed) that can be set is displayed in mm/s.

SigmaWin+ Button in [Menu] Window: [Monitor] - [Status]	SERVOPACK	
Name [Unit]	**Un No.**	**Name [Unit]**
Active Gain Monitor	Un014	Active Gain Monitor (gain settings 1 = 1, gain settings 2 = 2)
Safety I/O Signal Monitor	Un015	Safety I/O Signal Monitor

SigmaWin+ Button in [Menu] Window: [Monitor] - [I/O]	SERVOPACK	
Name [Unit]	**Un No.**	**Name [Unit]**
Input Signal Monitor	Un005	Input Signal Monitor
Output Signal Monitor	Un006	Output Signal Monitor
Σ-LINK II Sequence Input Signal Monitor	Un1C8	Σ-LINK II Sequence Input Signal Monitor
Σ-LINK II Sequence Output Signal Monitor	Un1CA	Σ-LINK II Sequence Output Signal Monitor

SigmaWin+ Button in [Menu] Window: [Service Life]	SERVOPACK	
Name [Unit]	**Un No.**	**Name [Unit]**
Installation Environment Monitor − SERVOPACK	Un025	SERVOPACK Installation Environment Monitor [%]
Installation Environment Monitor − Servomotor *1	Un026	Servomotor Installation Environment Monitor [%]
Service Life Prediction Monitor − Built-in Fan	Un027	Built-in Fan Remaining Life Ratio [%]
Service Life Prediction Monitor − Capacitor	Un028	Capacitor Remaining Life Ratio [%]
Service Life Prediction Monitor − Surge Prevention Circuit	Un029	Surge Prevention Circuit Remaining Life Ratio [%]
Service Life Prediction Monitor − Dynamic Brake Circuit	Un02A	Dynamic Brake Circuit Remaining Life Ratio [%]
Maintenance Prediction Monitor - Bearings	Un183	Maintenance Prediction Monitor - Bearings
Maintenance Prediction Monitor - Oil Seal	Un184	Maintenance Prediction Monitor - Oil Seal

*1 This applies to the following motors. The display will show 0 for all other models.

- SGMXJ, SGMXA, SGMXP, SGMXG, SGM7M, SGM7D, SGM7E, SGM7F

SigmaWin+ Button in [Menu] Window: [Product Information]	SERVOPACK	
Name [Unit]	**Un No.**	**Name [Unit]**
Motor − Resolution	Un084	Linear Encoder Pitch (Scale pitch = Un084 × 10^{Un085} [pm])
	Un085	Linear Encoder Pitch Exponent (Scale pitch = Un084 × 10^{Un085} [pm])

SigmaWin+ Button in [Menu] Window: [Trace]	SERVOPACK	
Name [Unit]	**Un No.**	**Name [Unit]**
Main Circuit DC Voltage	Un023	Main Circuit DC Voltage

The following Un numbers are not displayed as monitors in SigmaWin+.

SERVOPACK	
Un No.	**Name [Unit]**
Un011	Polarity Sensor Signal Monitor
Un020	Motor Rated Speed [min^{-1}]
Un021	Maximum Motor Speed [min^{-1}]

Index

T

V

W

Z

Revision History

The date of publication, revision code, revision number, and web revision number are given at the bottom right of the back cover. Refer to the following example.

Revision number

Revision code

Web revision number

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Date of Publication	Rev. Code	Rev. No.	Web Rev. No.	Section	Revised Contents
February 2023	E	<4>	0	Chapter 6	Addition: Information on the function to specify the output status when a host communications error occurs
				8.8.5	Deletion: Operating procedure for multi-axis simultaneous tuning
				All chapters	Partly revised.
				Back cover	Revision: Address
April 2022	D	<3>	0	All chapters	Addition: Information on SGDXS-590A, and -780A
					Addition: Information on SGMXA-15 to -70, SGMXP, SGMXG-03, -05, -1A, -1E, and SGM7M
					Partly revised.
December 2021	C	<2>	0	5.11.4	Addition: Overtravel alarms
				6.15	Addition: Triggers at preset positions
				8.5.4	Addition: When the travel distance is less than 0.25 rotations (2.5 mm for a linear servomotor)
				8.8.5	Addition: Operating procedure for multi-axis simultaneous tuning
				8.12	Addition: Speed ripple compensation
				11.8	Addition: Changing detection conditions of alarms related to Σ-LINK II
				All chapters	Partly revised.
August 2021	B	<1>	0	All chapters	Addition: Information on SGDXS-330A, -470A, -550A
					Addition: Information on SGMXG-30A, -44A, -55A, -75A
					Partly revised.
April 2021	A	<0>	0	–	First edition

Σ-X-Series AC Servo Drive

Σ-XS SERVOPACK with MECHATROLINK-4/III Communications References

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YASKAWA

YASKAWA ELECTRIC CORPORATION

In the event that the end user of this product is to be the military and said product is to be employed in any weapons systems or the manufacture thereof, the export will fall under the relevant regulations as stipulated in the Foreign Exchange and Foreign Trade Regulations. Therefore, be sure to follow all procedures and submit all relevant documentation according to any and all rules, regulations and laws that may apply.

Specifications are subject to change without notice for ongoing product modifications and improvements.

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