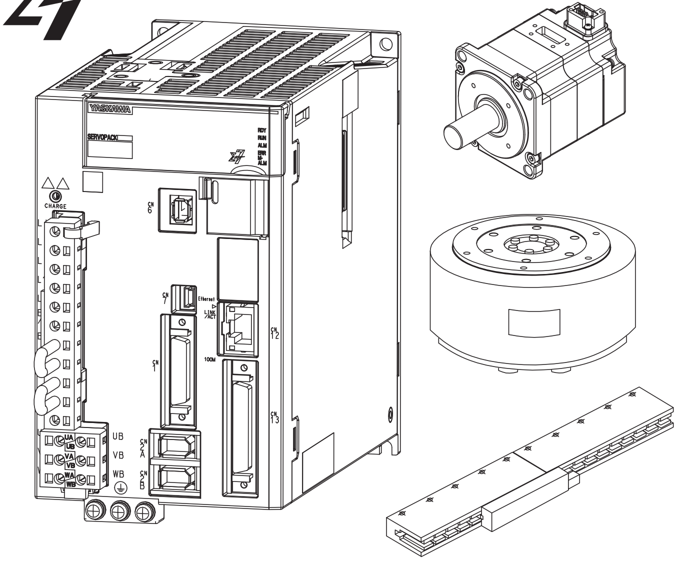
YASKAWA

Σ-7-Series AC Servo Drive

Σ-7C SERVOPACK

Product Manual

Model: SGD7C-□□□AMAA□□□



MANUAL NO. SIEP S800002 04D

About this Manual

This manual provides information required to select Σ-7C SERVOPACKs for Σ-7-Series AC Servo Drives, and to design, perform trial operation of, tune, operate, and maintain the Servo Drives.

Read this manual carefully to ensure the correct usage of Σ-7-Series AC Servo Drives.

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

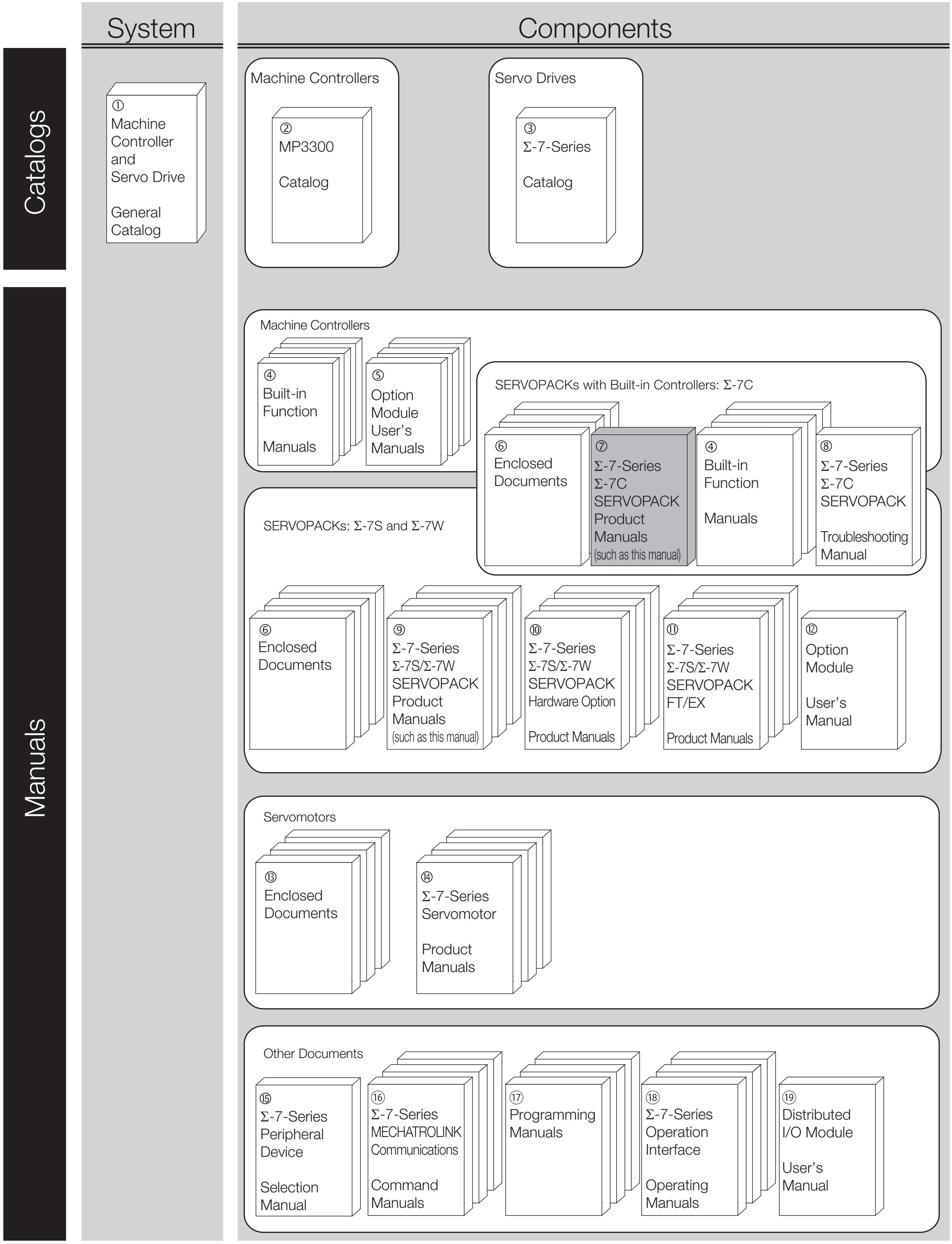
Outline of Manual

The contents of the chapters of this manual are described in the following table. First-time users of a SERVOPACK should perform operations in the sequence given in this manual.

Chapter	Chapter Title	Contents
1	Basic Information on SERVOPACKs	Provides an overview of the SERVOPACKs and gives the SERVOPACK specifications.
2	Installation	Provides information on installing SERVOPACKs in the required locations.
3	Wiring and Connections	Provides information on wiring and connecting SERVOPACKs to power supplies and peripheral devices.
4	Preparations	Describes the Engineering Tool and the SERVOPACK setting procedures that are necessary to make device-specific settings.
5	Device-Specific Settings	Describes the procedure for making device-specific settings for the Servo Drive.
6	Trial Operation	Describes the flow of and operating procedures for trial operation.
7	Creating User Programs	Describes how to create user programs for the Controller Section.
8	Tuning	Describes the flow of tuning with SigmaWin+ and provides details on tuning functions and related operating procedures.
9	Monitoring	Provides information on monitoring SERVOPACK product information and SERVOPACK status.
10	Maintenance	Describes inspections and parts replacement.
11	Parameter Lists	Provides information on the parameters.
12	Functions of the Controller Section	Describes the functions of the Controller Section.

Related Documents

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



Classification	Document Name	Document No.	Description
① Machine Controller and Servo Drive General Catalog	Machine Controller and AC Servo Drive Solutions Catalog	KAEP S800001 22	Describes the features and application examples for combinations of MP3000-Series Machine Controllers and Σ-7-Series AC Servo Drives.
② MP3300 Catalog	Machine Controller MP3300	KAEP C880725 03	Provides detailed information on MP3300 Machine Controllers, including features and specifications.
③ Σ-7-Series Catalog	AC Servo Drives Σ-7 Series	KAEP S800001 23	Provides detailed information on Σ-7-Series AC Servo Drives, including features and specifications.
④ Built-in Function Manuals	Σ-7-Series AC Servo Drive Σ-7C SERVOPACK Motion Control User's Manual	SIEP S800002 03	Provides detailed information on the specifications, system configuration, and application methods of the Motion Control Function Modules (SVD, SVC4, and SVR4) for Σ-7-Series Σ-7C SERVOPACKs.
	Machine Controller MP3000 Series Communications User's Manual	SIEP C880725 12	Provides detailed information on the specifications, system configuration, and communications connection methods for the Ethernet communications that are used with MP3000-Series Machine Controllers and Σ-7-Series Σ-7C SERVOPACKs.
⑤ Option Module User's Manuals	Machine Controller MP2000 Series Communication Module User's Manual	SIEP C880700 04	Provide detailed information on the specifications and communications methods for the Communications Modules that can be mounted to MP3000-Series Machine Controllers and Σ-7-Series Σ-7C SERVOPACKs.
	Machine Controller MP2000 Series 262IF-01 FL-net Communication Module User's Manual	SIEP C880700 36	
	Machine Controller MP2000 Series 263IF-01 EtherNet/IP Communication Module User's Manual	SIEP C880700 39	
	Machine Controller MP2000 Series I/O Module User's Manual	SIEP C880700 34	Provide detailed information on the specifications and communications methods for the I/O Modules that can be mounted to MP3000-Series Machine Controllers and Σ-7-Series Σ-7C SERVOPACKs.
	Machine Controller MP2000 Series Analog Input/Analog Output Module AI-01/AO-01 User's Manual	SIEP C880700 26	
	Machine Controller MP2000 Series Counter Module CNTR-01 User's Manual	SIEP C880700 27	

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Classification	Document Name	Document No.	Description
⑥ Enclosed Documents	Σ-7-Series AC Servo Drive Σ-7S and Σ-7W SERVOPACK Safety Precautions	TOMP C710828 00	Provides detailed information for the safe usage of Σ-7-Series SERVOPACKs.
	Σ-V-Series/Σ-V-Series for Large-Capacity Models/ Σ-7-Series Safety Precautions Option Module	TOBP C720829 00	Provides detailed information for the safe usage of Option Modules.
	Σ-V-Series/Σ-V-Series for Large-Capacity Models/ Σ-7-Series Installation Guide Command Option Module	TOBP C720829 01	Provides detailed procedures for installing the Command Option Module in a SERVOPACK.
	Σ-V-Series/Σ-V-Series for Large-Capacity Models/ Σ-7-Series Installation Guide Fully-closed Module	TOBP C720829 03	Provides detailed procedures for installing the Fully-closed Module in a SERVOPACK.
	Σ-V-Series/Σ-V-Series for Large-Capacity Models/ Σ-7-Series Installation Guide Safety Module	TOBP C720829 06	Provides detailed procedures for installing the Safety Module in a SERVOPACK.
	Σ-V-Series/Σ-V-Series for Large-Capacity Models/ Σ-7-Series Installation Guide INDEXER Module	TOBP C720829 02	Provides detailed procedures for installing the INDEXER Module in a SERVOPACK.
	Σ-V-Series/Σ-V-Series for Large-Capacity Models/ Σ-7-Series Installation Guide DeviceNet Module	TOBP C720829 07	Provides detailed procedures for installing the DeviceNet Module in a SERVOPACK.
⑦ Σ-7-Series Σ-7C SERVOPACK Product Manual	Σ-7-Series AC Servo Drive Σ-7C SERVOPACK Product Manual	This manual (SIEP S800002 04)	Provides detailed information on selecting Σ-7-Series Σ-7C SERVOPACKs; installing, connecting, setting, testing in trial operation, and tuning Servo Drives; writing, monitoring, and maintaining programs; and other information.
⑧ Σ-7-Series Σ-7C SERVOPACK Troubleshooting Manual	Σ-7-Series AC Servo Drive Σ-7C SERVOPACK Troubleshooting Manual	SIEP S800002 07	Provides detailed troubleshooting information for Σ-7-Series Σ-7C SERVOPACKs.

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Classification	Document Name	Document No.	Description
⑨ Σ-7-Series Σ-7S/Σ-7W SERVOPACK Product Manuals	Σ-7-Series AC Servo Drive Σ-7S SERVOPACK with MECHATROLINK-III Communications References Product Manual	SIEP S800001 28	Provide detailed information on selecting Σ-7-Series SERVOPACKs and information on installing, connecting, setting, performing trial operation for, tuning, monitoring, and maintaining the Servo Drives.
	Σ-7-Series AC Servo Drive Σ-7S SERVOPACK with MECHATROLINK-II Communications References Product Manual	SIEP S800001 27	
	Σ-7-Series AC Servo Drive Σ-7S SERVOPACK with Analog Voltage/Pulse Train References Product Manual	SIEP S800001 26	
	Σ-7-Series AC Servo Drive Σ-7S SERVOPACK Command Option Attachable Type with INDEXER Module Product Manual	SIEP S800001 64	
	Σ-7-Series AC Servo Drive Σ-7S SERVOPACK Command Option Attachable Type with DeviceNet Module Product Manual	SIEP S800001 70	
	Σ-7-Series AC Servo Drive Σ-7W SERVOPACK with MECHATROLINK-III Communications References Product Manual	SIEP S800001 29	
⑩ Σ-7-Series Σ-7S/Σ-7W SERVOPACK with Hardware Option Specifications Product Manuals	Σ-7-Series AC Servo Drive Σ-7S/Σ-7W SERVOPACK with Hardware Option Specifications Dynamic Brake Product Manual	SIEP S800001 73	Provide detailed information on Hardware Options for Σ-7-Series SERVOPACKs.
	Σ-7-Series AC Servo Drive Σ-7W/Σ-7C SERVOPACK with Hardware Option Specifications HWBB Function Product Manual	SIEP S800001 72	

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Classification	Document Name	Document No.	Description
⑪ Σ-7-Series Σ-7S/Σ-7W SERVOPACK FT/EX Product Manuals	Σ-7-Series AC Servo Drive Σ-7S SERVOPACK with FT/EX Specification for Indexing Application Product Manual	SIEP S800001 84	Provide detailed information on the FT/EX Option for Σ-7-Series SERVOPACKs.
	Σ-7-Series AC Servo Drive Σ-7S SERVOPACK with FT/EX Specification for Tracking Application Product Manual	SIEP S800001 89	
	Σ-7-Series AC Servo Drive Σ-7S SERVOPACK with FT/EX Specification for Application with Special Motor, SGM7D Motor Product Manual	SIEP S800001 91	
	Σ-7-Series AC Servo Drive Σ-7S SERVOPACK with FT/EX Specification for Press and Injection Molding Application Product Manual	SIEP S800001 94	
	Σ-7-Series AC Servo Drive Σ-7S SERVOPACK with FT/EX Specification for Transfer and Alignment Application Product Manual	SIEP S800001 95	
	Σ-7-Series AC Servo Drive Σ-7S SERVOPACK with FT/EX Specification for Torque/Force Assistance for Conveyance Application Product Manual	SIEP S800002 09	
	Σ-7-Series AC Servo Drive Σ-7S SERVOPACK with FT/EX Specification for Cutting Application Feed Shaft Motor Product Manual	SIEP S800002 10	
	Σ-7-Series AC Servo Drive Σ-7S SERVOPACK with FT/EX Specification for Three-Point Latching for Conveyance Application Product Manual	SIEP S800002 17	
	Σ-7-Series AC Servo Drive Σ-7S SERVOPACK with FT/EX Specification for Semi-/Fully-Closed Loop Control Online Switching for Conveyance Application Product Manual	SIEP S800002 27	
	Σ-7-Series AC Servo Drive Σ-7W SERVOPACK with FT/EX Specification for Gantry Applications Product Manual	SIEP S800002 29	

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Classification	Document Name	Document No.	Description
⑫ Option Module User's Manual	AC Servo Drives Σ-V Series/Σ-V Series for Large-Capacity Models/ Σ-7 Series User's Manual Safety Module	SIEP C720829 06	Provides details information required for the design and maintenance of a Safety Module.
⑬ Enclosed Documents	AC Servo Drive Rotary Servomotor Safety Precautions	TOBP C230260 00	Provides detailed information for the safe usage of Rotary Servomotors and Direct Drive Servomotors.
	AC Servomotor Linear Σ Series Safety Precautions	TOBP C230800 00	Provides detailed information for the safe usage of Linear Servomotors.
⑭ Σ-7-Series Servomotor Product Manuals	Σ-7-Series AC Servo Drive Rotary Servomotor Product Manual	SIEP S800001 36	Provide detailed information on selecting, installing, and connecting the Σ-7-Series Servomotors.
	Σ-7-Series AC Servo Drive Linear Servomotor Product Manual	SIEP S800001 37	
	Σ-7-Series AC Servo Drive Direct Drive Servomotor Product Manual	SIEP S800001 38	
⑮ Σ-7-Series Peripheral Device Selection Manual	Σ-7-Series AC Servo Drive Peripheral Device Selection Manual	SIEP S800001 32	Provides the following information in detail for Σ-7-Series Servo Systems. • Cables: Models, dimensions, wiring materials, connector models, and connection specifications • Peripheral devices: Models, specifications, diagrams, and selection (calculation) methods
⑯ Σ-7-Series MECHATROLINK Communications Command Manuals	Σ-7-Series AC Servo Drive MECHATROLINK-II Communications Command Manual	SIEP S800001 30	Provides detailed information on the MECHATROLINK-II communications commands that are used for a Σ-7-Series Servo System.
	Σ-7-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-Series Servo System.

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Classification	Document Name	Document No.	Description
⑰ Programming Manuals	Machine Controller MP3000 Series Ladder Programming Manual	SIEP C880725 13	Provides detailed information on the ladder programming specifications and instructions for MP3000-Series Machine Controllers and Σ-7-Series Σ-7C SERVOPACKs.
	Machine Controller MP3000 Series Motion Programming Manual	SIEP C880725 14	Provides detailed information on the motion programming and sequence programming specifications and instructions for MP3000-Series Machine Controllers and Σ-7-Series Σ-7C SERVOPACKs.
⑱ Σ-7-Series Operation Interface Operating Manuals	Machine Controller MP2000/MP3000 Series Engineering Tool MPE720 Version 7 User's Manual	SIEP C880761 03	Describes in detail how to operate MPE720 version 7.
	Σ-7-Series AC Servo Drive Digital Operator Operating Manual	SIEP S800001 33	Describes the operating procedures for a Digital Operator for a Σ-7-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-Series Servo System.
⑲ Distributed I/O Module User's Manual	MECHATROLINK-III Compatible I/O Module User's Manual	SIEP C880781 04	Describes the functions, specifications, operating methods, and MECHATROLINK-III communications for the Remote I/O Modules for MP2000/MP3000-Series Machine Controllers.

Using this Manual

◆ Technical Terms Used in This Manual

The following terms are used in this manual.

Term	Meaning
Servomotor	A Σ-7-Series Rotary Servomotor, Direct Drive Servomotor, or Linear Servomotor.
Rotary Servomotor	A generic term used for a Σ-7-Series Rotary Servomotor (SGMMV, SGM7J, SGM7A, SGM7P, or SGM7G) or a Direct Drive Servomotor (SGM7E, SGM7F, SGMCV or SGMCS). 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, or SGLT).
SERVOPACK	A Σ-7-Series Σ-7C Servo Amplifier.
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.
MPE720	The Engineering Tool or a personal computer running the Engineering Tool
PLC	A Programmable Logic Controller.
Servo Section	The part of a Σ-7C SERVOPACK that provides servo functionality.
Controller Section	The part of a Σ-7C SERVOPACK that provides controller functionality.
CPU	The CPU built into the Controller Section of a Σ-7C SERVOPACK.
Motion Control Function Module	The SVD, SVC4, or SVR4 Function Modules in the Controller Section of the SERVOPACK.
SVD	A Motion Control Function Module for the two axes of a Σ-7C SERVOPACK that connects to the Controller Section and Servo Section of the Σ-7C SERVOPACK through a bus.
SVC4	A Motion Control Function Module that uses MECHATROLINK-III communications to communicate with MECHATROLINK-III slave devices.
Communications Function Module	The Function Module in the 218IFD built into the CPU.

◆ Differences in Terms for Rotary Servomotors and Linear Servomotors

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

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

◆ Notation Used in this Manual

■ Notation for Reverse Signals

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

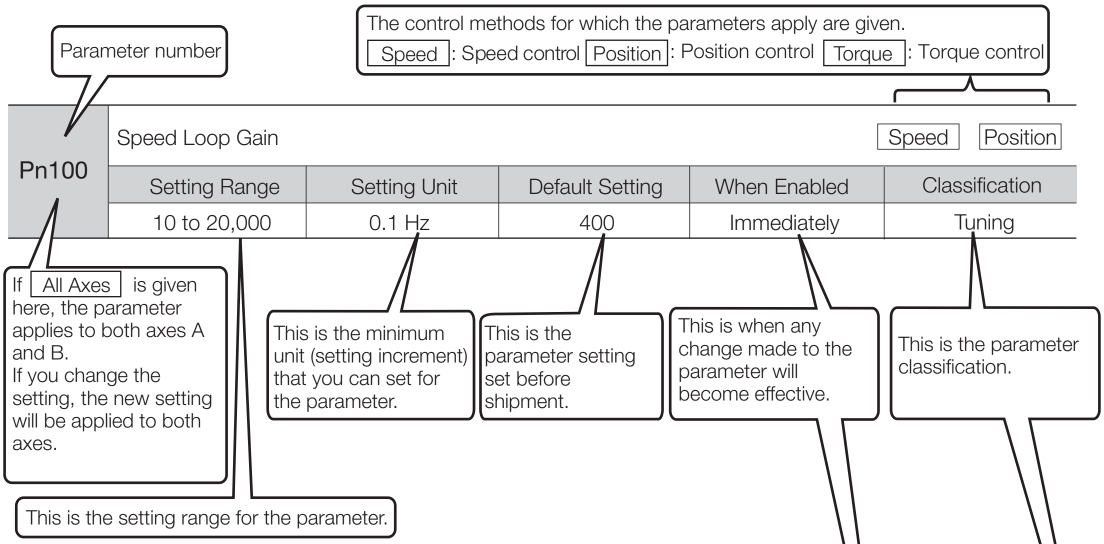
Notation Example

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

■ Notation for Parameters

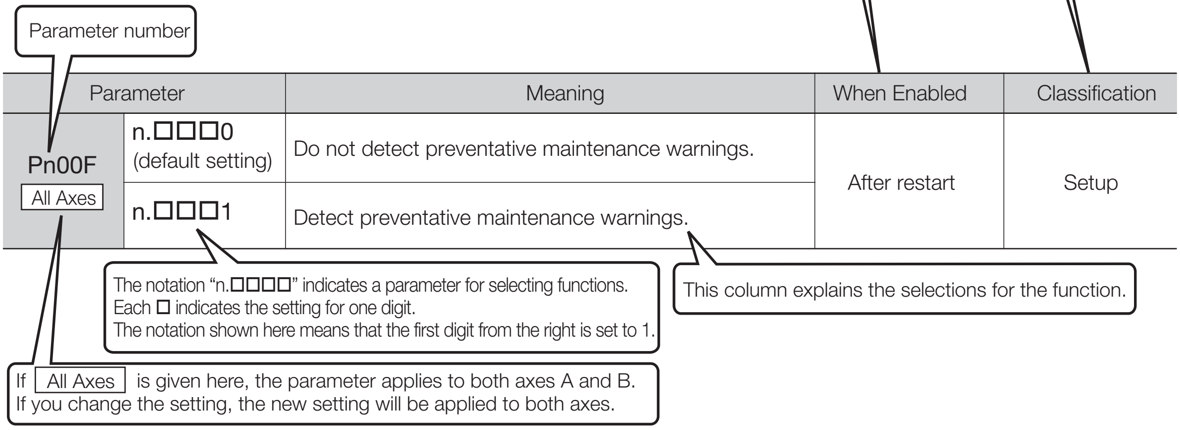
The notation depends on whether the parameter requires a numeric setting (parameter for numeric setting) or requires the selection of a function (parameter for selecting functions).

- Parameters for Numeric Settings



Pn100	Speed Loop Gain			Speed Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 20,000	0.1 Hz	400	Immediately	Tuning

- Parameters for Selecting Functions



Parameter		Meaning	When Enabled	Classification
Pn00F All Axes	n.□□□0 (default setting)	Do not detect preventative maintenance warnings.	After restart	Setup
	n.□□□1	Detect preventative maintenance warnings.		

Notation Example

Notation Examples for Pn002

n.0 0 0 0

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

◆ Engineering Tools Used in This Manual

This manual uses the interfaces of the MPE720 and SigmaWin+ for descriptions.

◆ Trademarks

- QR code is a trademark of Denso Wave Inc.
- MECHATROLINK is a trademark of the MECHATROLINK Members Association.
- DeviceNet is a registered trademark of the ODVA (Open DeviceNet Vendors Association).
- PROFIBUS is a trademark of the PROFIBUS User Organization.
- Ethernet is a registered trademark of the Xerox Corporation.
- Other product names and company names are the trademarks or registered trademarks of the respective company. “TM” and the ® mark do not appear with product or company names in this manual.

◆ Visual Aids

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

Important

Indicates precautions or restrictions that must be observed.
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.

Example Indicates operating or setting examples.

Information Indicates supplemental information to deepen understanding or useful information.

Safety Precautions

◆ Safety Information

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

⚠ 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.

◆ Safety Precautions That Must Always Be Observed

■ General Precautions

⚠ DANGER

- Read and understand this manual to ensure the safe usage of the SERVOPACK.
- 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 SERVOPACK.
- 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 SERVOPACK, or burning.

⚠ WARNING

- Use a power supply with specifications (number of phases, voltage, frequency, and AC/DC type) that are appropriate for the SERVOPACK.
  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 or less for a SERVOPACK with a 100-VAC or 200-VAC power supply, and 10 Ω or less for a SERVOPACK with a 400-VAC power supply).
  There is a risk of electric shock or fire.
- Do not attempt to disassemble, repair, or modify the SERVOPACK.
  There is a risk of fire or malfunction.
  The warranty is void for the SERVOPACK if you disassemble, repair, or modify it.
- The installation must be suitable and it must be performed only by an experienced technician.
  There is a risk of electric shock or injury.
- Before connecting the machine and starting operation, make sure that an emergency stop procedure has been provided and is working correctly.
  There is a risk of injury.
- Do not touch anything inside the SERVOPACK.
  There is a risk of electric shock.

⚠ 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 burn injury.
- For a 24-VDC power supply, use a power supply device with double insulation or reinforced insulation.
  There is a risk of electric shock.
- Do not damage, pull on, apply excessive force to, place heavy objects on, or pinch the cables.
  There is a risk of failure, damage, or electric shock.
- Never use the SERVOPACK in locations subject to water, corrosive atmospheres, or flammable gas, or near flammable objects.
  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 supply and stop 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 SERVOPACK failure.

■ Storage Precautions

⚠ CAUTION

- Do not place an excessive load on the SERVOPACK during storage. (Follow all instructions on the packages.)
  There is a risk of injury or damage.

NOTICE

- Do not install or store the SERVOPACK in any of the following locations.
  - Locations that are subject to direct sunlight
  - Locations that are subject to ambient temperatures that exceed SERVOPACK specifications
  - Locations that are subject to relative humidities that exceed SERVOPACK 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 SERVOPACK specifications
  - Locations near devices that generate strong magnetic fields
  - Locations that are subject to radiation

  If you store or install the SERVOPACK in any of the above locations, the SERVOPACK may fail or be damaged.

■ Transportation Precautions

⚠ CAUTION

- Transport the SERVOPACK in a way that is suitable to the mass of the SERVOPACK.
- 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.
  Doing so may result in injury.
- Do not place an excessive load on the SERVOPACK during transportation. (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.
- The 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.
- Never subject the SERVOPACK to an atmosphere containing halogen (fluorine, chlorine, bromine, or iodine) during transportation.
  There is a risk of failure or damage.
- If disinfectants or insecticides must be used to treat packing materials such as wooden frames, pallets, or plywood, the packing materials must be treated before the SERVOPACK is packaged, and methods other than fumigation must be used.
  Example: Heat treatment, where materials are kiln-dried to a core temperature of 56°C for 30 minutes or more.
  If the electronic products, which include stand-alone products and products installed in machines, are packed with fumigated wooden materials, the electrical components may be greatly damaged by the gases or fumes resulting from the fumigation process. In particular, disinfectants containing halogen, which includes chlorine, fluorine, bromine, or iodine can contribute to the erosion of the capacitors.
- Do not overtighten the eyebolts on a SERVOPACK or Servomotor.
  If you use a tool to overtighten the eyebolts, the tapped holes may be damaged.

■ Installation Precautions

⚠ CAUTION

- Install the SERVOPACK or Servomotor 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 SERVOPACK.
  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 SERVOPACK in any of the following locations.**
  - Locations that are subject to direct sunlight
  - Locations that are subject to ambient temperatures that exceed SERVOPACK specifications
  - Locations that are subject to relative humidities that exceed SERVOPACK 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 SERVOPACK specifications
  - Locations near devices that generate strong magnetic fields
  - Locations that are subject to radiation

  If you store or install the SERVOPACK in any of the above locations, the SERVOPACK may fail or be damaged.
- **Use the SERVOPACK in an environment that is appropriate for the SERVOPACK specifications.**
  If you use the SERVOPACK in an environment that exceeds SERVOPACK specifications, the SERVOPACK may fail or be damaged.
- **The 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 foreign objects to enter a SERVOPACK or a Servomotor with a Cooling Fan and do not cover the inlet or outlet of the Servomotor's cooling fan.**
  There is a risk of failure.
- **Never install the SERVOPACK in an atmosphere containing halogen (fluorine, chlorine, bromine, or iodine).**
  There is a risk of failure or damage.

■ 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 SERVOPACK failure.
- **Check all wiring and power supplies carefully.**
  Incorrect wiring or incorrect voltage application to the output circuits may cause short-circuit failures. If a short-circuit failure occurs as a result of any of these causes, the holding brake will not work. This could damage the machine or cause an accident that may result in death or injury.
- **Connect the AC 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

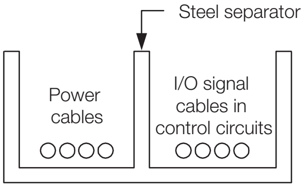
- Wait for at least six minutes after turning OFF the power supply and then make sure that the CHARGE indicator is not lit before starting wiring or inspection work. Do not touch the power supply terminals while the CHARGE lamp is lit because high voltage may still remain in the SERVOPACK even after turning OFF the power supply.
  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 SERVOPACK failure or malfunction.
- Connect wires to power supply terminals and motor connection terminals securely with the specified methods and tightening torque.
  Insufficient tightening may cause wires and terminal blocks to generate heat due to faulty contact, possibly resulting in fire.
- Use shielded twisted-pair cables or shielded 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 Encoder Cables or Servomotor Main Circuit Cables.
- Observe the following precautions when wiring the SERVOPACK's main circuit terminals.
  - Turn ON the power supply 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.
- In places with poor power supply conditions, ensure that the input power is supplied within the specified voltage range.
  There is a risk of equipment damage.
- Provide sufficient shielding when using the SERVOPACK in the following locations.
  - Locations that are subject to noise, such as from static electricity
  - Locations that are subject to strong electromagnetic or magnetic fields
  - Locations that are subject to radiation
  - Locations that are near power lines

  There is a risk of equipment damage.

⚠ CAUTION

- **Configure the circuits to turn ON the control power supply to the SERVOPACK before the 24-V I/O power supply.**
  If the control power supply to the SERVOPACK is turned ON after the external power supply, e.g., the 24-V I/O power supply, the outputs from the SERVOPACK may momentarily turn ON when the power supply to the SERVOPACK turns ON. This can result in unexpected operation that may cause injury or device damage.
- **Provide emergency stop circuits, interlock circuits, limit circuits, and any other required safety measures in control circuits outside of the SERVOPACK.**
  There is a risk of injury or device damage.
- **If you use MECHATROLINK I/O Modules, use the establishment of MECHATROLINK communications as an interlock output condition.**
  There is a risk of device damage.
- **Select the I/O signal wires for external wiring to connect the SERVOPACK to external devices based on the following criteria:**
  - Mechanical strength
  - Noise interference
  - Wiring distance
  - Signal voltage
- **Separate the I/O signal cables for control circuits from the power cables both inside and outside the control panel to reduce the influence of noise from the power cables.**
  If the I/O signal lines and power lines are not separated properly, malfunction may occur.

Example of Separated Cables



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 cable connector lock screws and lock mechanisms.**
  Insufficient tightening may result in cable connectors falling off during operation.
- **Do not bundle power lines (e.g., the Main Circuit Cable) and low-current lines (e.g., the I/O Signal Cables or Encoder Cables) together or run them through the same duct. If you do not place power lines and low-current lines in separate ducts, separate them by at least 30 cm.**
  If the cables are too close to each other, malfunctions may occur due to noise affecting the low-current lines.
- **Install a battery at either the host controller or on the Encoder Cable.**
  If you install batteries both at the host controller and on the Encoder Cable at the same time, you will create a loop circuit between the batteries, resulting in a risk of damage or burning.
- **When connecting a battery, connect the polarity correctly.**
  There is a risk of battery rupture or encoder failure.

■ 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 resistance of the External Dynamic Brake Resistor. 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.

⚠ CAUTION

- **Design the system to ensure safety even when problems, such as signal line disconnection, occur.**
  For example, the P-OT and N-OT signals are set in the default settings to operate on the safe side if there is a signal line disconnection. Do not change the polarity of this type of signal.
- **When overtravel occurs, the power supply to the motor is turned OFF and the brake is released. If you use the Servomotor to drive in a vertical direction, set the Servomotor to enter a zero-clamped state after the Servomotor stops. Also, install safety devices (such as an external brake or counterweight) to prevent the moving parts of the machine from falling.**
- **Always turn OFF the servo before you turn OFF the power supply. If you turn OFF the main circuit power supply or control power supply during operation before you turn OFF the servo, the Servomotor will stop as follows:**
  - If you turn OFF the main circuit power supply during operation without turning OFF the servo, the Servomotor will stop abruptly with the dynamic brake.
  - If you turn OFF the control power supply without turning OFF the servo, the stopping method that is used by the Servomotor depends on the model of the SERVOPACK. For details, refer to the manual for the SERVOPACK.
  - If you use 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. For details, refer to the following manual.

    📖 Σ-7-Series Σ-7S/Σ-7W SERVOPACK with Dynamic Brake Hardware Option Specifications Product Manual (Manual No.: SIEP S800001 73)
- **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.
- **Implement interlock signals and other safety circuits external to the SERVOPACK to ensure safety in the overall system even if the following conditions occur.**
  - SERVOPACK failure or errors caused by external factors
  - Shutdown of operation due to SERVOPACK detection of an error in self-diagnosis and the subsequent turning OFF or holding of output signals
  - Holding of the ON or OFF status of outputs from the SERVOPACK due to fusing or burning of output relays or damage to output transistors
  - Voltage drops from overloads or short-circuits in the 24-V output from the SERVOPACK and the subsequent inability to output signals
  - Unexpected outputs due to errors in the power supply, I/O, or memory that cannot be detected by the SERVOPACK through self-diagnosis.

  There is a risk of injury, device damage, or burning.
- **Observe the setting methods that are given in the manual for the following parameters.**
  - Parameters for absolute position detection when the axis type is set to a finite-length axis
  - Parameters for simple absolute infinite-length position control when the axis type is set to an infinite-length axis

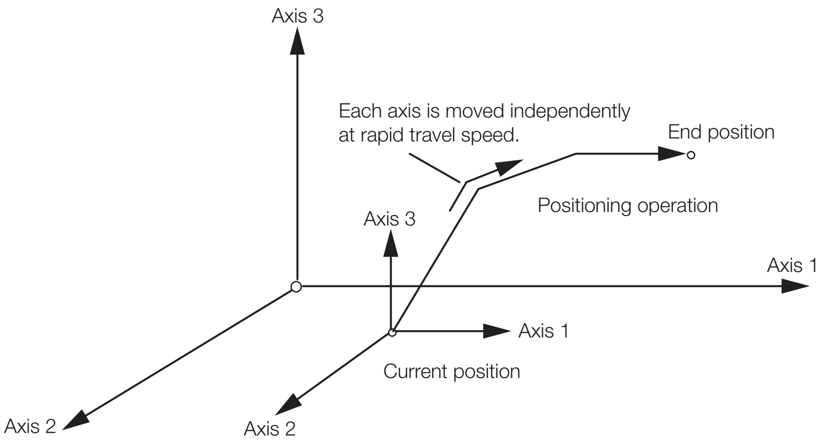
    📖 Σ-7-Series Σ-7C SERVOPACK Motion Control User's Manual (Manual No.: SIEP S800002 03)

  If any other methods are used, offset in the current position when the power supply is turned OFF and ON again may result in device damage.
- **OL□□□48 (Zero Point Position Offset in Machine Coordinate System) is always valid when the axis type is set to a finite-length axis. Do not change the setting of OL□□□48 while the machine is operating.**
  There is a risk of machine damage or an accident.

⚠ CAUTION

- Always check to confirm the paths of axes when any of the following axis movement instructions are used in programs to ensure that the system operates safely.
  - Positioning (MOV)
  - Linear Interpolation (MVS)
  - Circular Interpolation (MCC or MCW)
  - Helical Interpolation (MCC or MCW)
  - Set-Time Positioning (MVT)
  - Linear Interpolation with Skip Function (SKP)
  - Zero Point Return (ZRN)
  - External Positioning (EXM)

Example

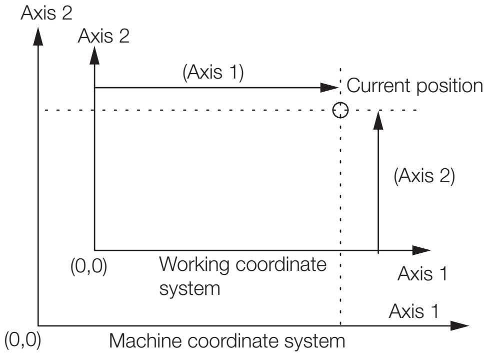


Example of Basic Path for Positioning (MOV) Instructions

There is a risk of injury or device damage.

- The travel path for the Positioning (MOV) instructions will not necessarily be a straight line. Check to confirm the paths of the axis when this instruction is used in programs to ensure that the system operates safely.
  There is a risk of injury or device damage.
- The Linear Interpolation (MVS) instruction can be used on both linear axes and rotary axes. However, if a rotary axis is included, the linear interpolation path will not necessarily be a straight line. Check to confirm the paths of the axis when this instruction is used in programs to ensure that the system operates safely.
  There is a risk of injury or device damage.
- The linear interpolation for the Helical Interpolation (MCW and MCC) instructions can be used for both linear axes and rotary axes. However, depending on how the linear axis is taken, the path of helical interpolation will not be a helix. Check to confirm the paths of the axis when this instruction is used in programs to ensure that the system operates safely.
  There is a risk of injury or device damage.
- Unexpected operation may occur if the following coordinate instructions are specified incorrectly: Always confirm that the following instructions are specified correctly before you begin operation.
  - Absolute Mode (ABS)
  - Incremental Mode (INC)
  - Current Position Set (POS)

Example



Example of Working Coordinate System Created with the Set Current Position (POS) Instruction

There is a risk of injury or device damage.

⚠ CAUTION

- The Move on Machine Coordinates (MVM) instruction temporarily performs positioning to a coordinate position in the machine coordinate system. Therefore, unexpected operation may occur if the instruction is executed without confirming the origin position in the machine coordinate system first. When you use the MVM instruction, always confirm that the machine origin is in the correct position before you begin operation.
  There is a risk of injury or device damage.

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 supply ON and OFF. After you have started normal operation, allow at least one hour between turning the power supply ON and OFF (as a guideline).
  Do not use the SERVOPACK in applications that require the power supply to be turned ON and OFF frequently.
  The elements in the SERVOPACK will deteriorate quickly.
- An alarm or warning may occur if axis movement instructions are executed from the Controller Section during MPE720 or SigmaWin+ operation.
  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 MPE720 or the SigmaWin+ to create a backup file 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, which could result in machine or equipment damage.

■ Maintenance and Inspection Precautions

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

- Wait for at least six minutes after turning OFF the power supply and then make sure that the CHARGE indicator is not lit before starting wiring or inspection work. Do not touch the power supply terminals while the CHARGE lamp is lit because high voltage may still remain in the SERVOPACK even after turning OFF the power supply.
  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.
- Do not attempt to disassemble or repair the SERVOPACK.
  There is a risk of electric shock, injury, or device damage.

NOTICE

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

■ Troubleshooting Precautions

⚠ 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 SERVOPACK may suddenly restart 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 supply OFF and ON again to restart operation.
  There is a risk of injury or machine damage.
- If the Servo ON signal is input to the SERVOPACK and an alarm is reset, the Servomotor may suddenly restart operation. Confirm that the servo is OFF and ensure safety before you reset an alarm.
  There is a risk of injury or machine damage.
- Always insert a magnetic contactor in the line between the main circuit power supply and the main circuit power supply terminals on the SERVOPACK so that the power supply can be shut OFF at the main circuit power supply.
  If a magnetic contactor is not connected when the SERVOPACK fails, a large current may flow continuously, possibly resulting in fire.
- If an alarm occurs, shut OFF the main circuit power supply.
  There is a risk of fire due to a regenerative resistor overheating as the result of regenerative transistor failure.
- Install an earth leakage breaker against overloads and short-circuiting or install a molded-case circuit breaker combined with an earth leakage breaker against ground faults.
  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 (such as gravity) may move the current position and create a hazardous situation when power is interrupted or an error occurs. If an external force may cause movement, install an external braking mechanism that ensures safety.

■ Disposal Precautions

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

■ Other 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 SERVOPACK in any way. Yaskawa disavows any responsibility for damages or losses that are caused by modified SERVOPACKs.

Warranty

◆ Details of Warranty

■ Warranty Period

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

■ Warranty Scope

Yaskawa shall replace or repair a defective product free of charge if a defect attributable to Yaskawa occurs during the above warranty period.
This warranty does not cover defects caused by the delivered product reaching the end of its service life and replacement of parts that require replacement or that have a limited service life.

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

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

◆ Limitations of Liability

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

◆ Suitability for Use

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

◆ Specifications Change

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

Compliance with UL Standards and EU Directives

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

◆ North American Safety Standards (UL)

Product	Model	North American Safety Standards (UL File No.)
SERVOPACKs	SGD7C	UL 61800-5-1 (E147823) CSA C22.2 No.274
Rotary Servomotors	• SGM7A • SGM7J • SGM7P • SGM7G • SGMMV	UL 1004-1 UL 1004-6 (E165827)
Direct Drive Servomotors	• SGM7E • SGM7F-□□A, -□□B, -□□C, -□□D (Small-Capacity Servomotors with Cores) • SGMCV • SGMCS-□□B, -□□C, -□□D, -□□E (Small-Capacity, Coreless Servomotors)	UL 1004-1 UL 1004-6 (E165827)
Linear Servomotors	• SGLGW* • SGLFW* • SGLFW2 • SGLTW*	UL 1004-1 UL 1004-6 (E165827)

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

◆ EU Directives

Product	Model	EU Directive	Harmonized Standards
SERVOPACKs	SGD7C	EMC Directive 2014/30/EU	EN 55011 group 1, class A EN 61000-6-2 EN 61000-6-4 EN 61800-3 (Category C2, Second environment)
		Low Voltage Directive 2014/35/EU	EN 50178 EN 61800-5-1
		RoHS Directive 2011/65/EU	EN 50581
Rotary Servomotors	SGMMV	EMC Directive 2004/108/EC	EN 55011 group 1, class A EN 61000-6-2 EN 61800-3 (Category C2, Second environment)
		Low Voltage Directive 2006/95/EC	EN 60034-1 EN 60034-5
		RoHS Directive 2011/65/EU	EN 50581
	• SGM7J • SGM7A • SGM7P • SGM7G	EMC Directive 2014/30/EU	EN 55011 group 1, class A EN 61000-6-2 EN 61000-6-4 EN 61800-3 (Category C2, Second environment)
		Low Voltage Directive 2014/35/EU	EN 60034-1 EN 60034-5
		RoHS Directive 2011/65/EU	EN 50581
Direct Drive Servomotors	• SGM7E • SGM7F • SGMCV • SGMCS-□□B, -□□C, -□□D, and -□□E (Small-Capacity, Coreless Servomotors)	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 60034-1 EN 60034-5
		RoHS Directive 2011/65/EU	EN 50581
Linear Servomotors	• SGLG* • SGLF* • SGLF□2 • SGLT*	EMC Directive 2014/30/EU	EN 55011 group 1, class A EN 61000-6-2 EN 61000-6-4 EN 61800-3 (Category C2, Second environment)
		Low Voltage Directive 2014/35/EU	EN 60034-1
		RoHS Directive 2011/65/EU	EN 50581

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

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

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

Contents

1 Basic Information on SERVOPACKs

2 Installation

3 Wiring and Connections

4 Preparations

5 Device-Specific Settings

6 Trial Operation

7 Creating User Programs

8 Tuning

9 Monitoring

10 Maintenance

11 Parameter Lists

12 Functions of the Controller Section

Basic Information on SERVOPACKs

This chapter provides an overview of the SERVOPACKs and gives the SERVOPACK specifications.

1.1 The Σ-7-Series Σ-7C SERVOPACKs

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

The following three types of Σ-7-Series SERVOPACKs are available.

Type	Description
Σ-7S	Single-Axis SERVOPACKs
Σ-7W	Two-Axis SERVOPACKs
Σ-7C	Two-Axis SERVOPACKs with Built-in Controllers

Information In this manual, the axes are called axis A and axis B.
However, they are displayed as **axis 1**, **axis 2**, **AXIS#00**, or **AXIS#01** on the Engineering Tool.

The features of the Σ-7C SERVOPACK are described below.

■ Space-Saving Systems

- A Two-Axis SERVOPACK and Controller Section are combined in a single unit.
- You can configure systems with up to six axes (two internal axes and four external axes connected through MECHATROLINK-III).
- Standard features for device control, such as I/O ports and Ethernet ports, enable building PLC-free small-scale device systems.
- You can install Optional Units to use MP2000-Series Option Modules to expand functionality.

■ Equipment Modularization

- Use the Σ-7C SERVOPACKs to modularize equipment and configure systems with distributed controls.
  This reduces software design work when modifying or changing parts of a manufacturing line.

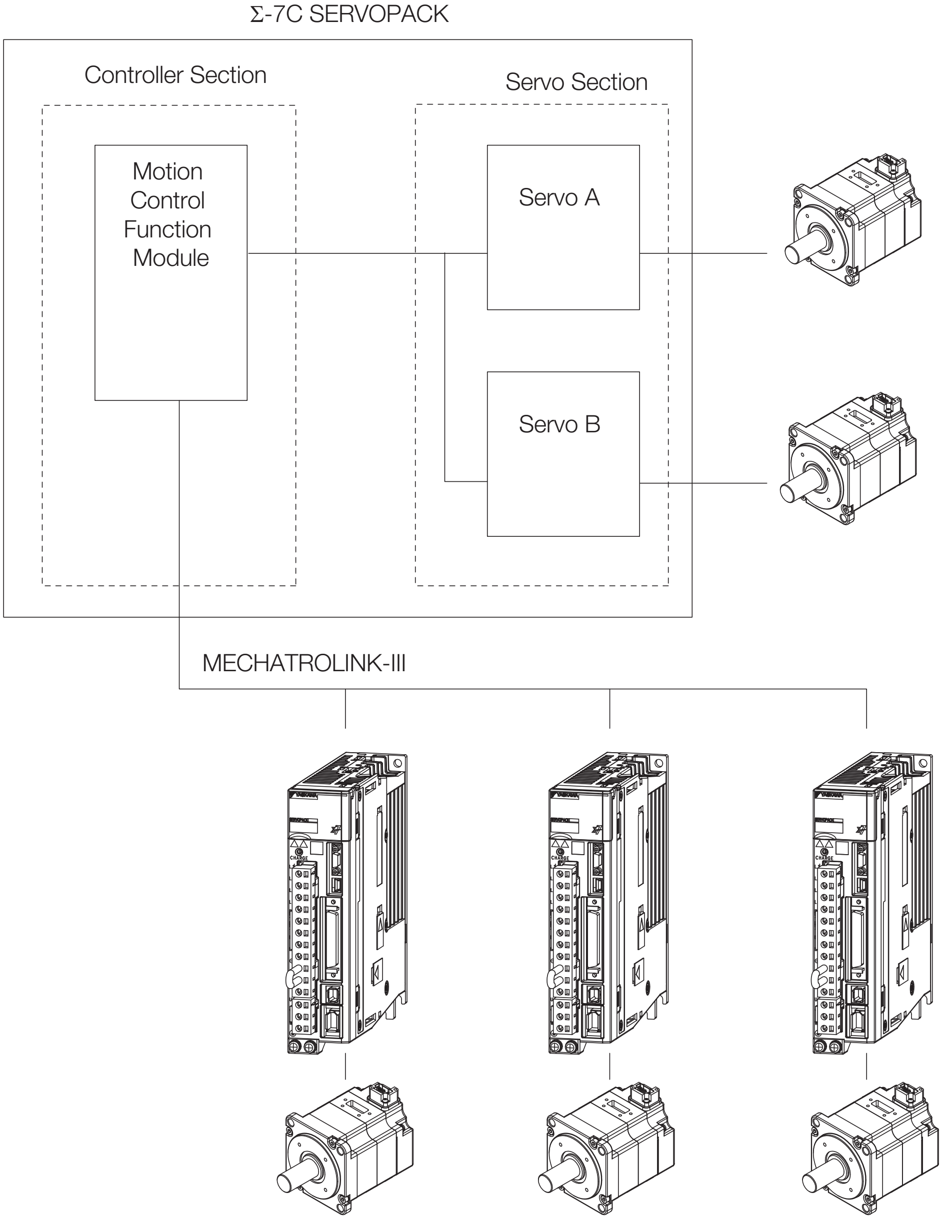
■ High-Speed Response

- A speed frequency response of 3.1 kHz has been achieved.
- High-speed I/O (Controller Section) is provided.

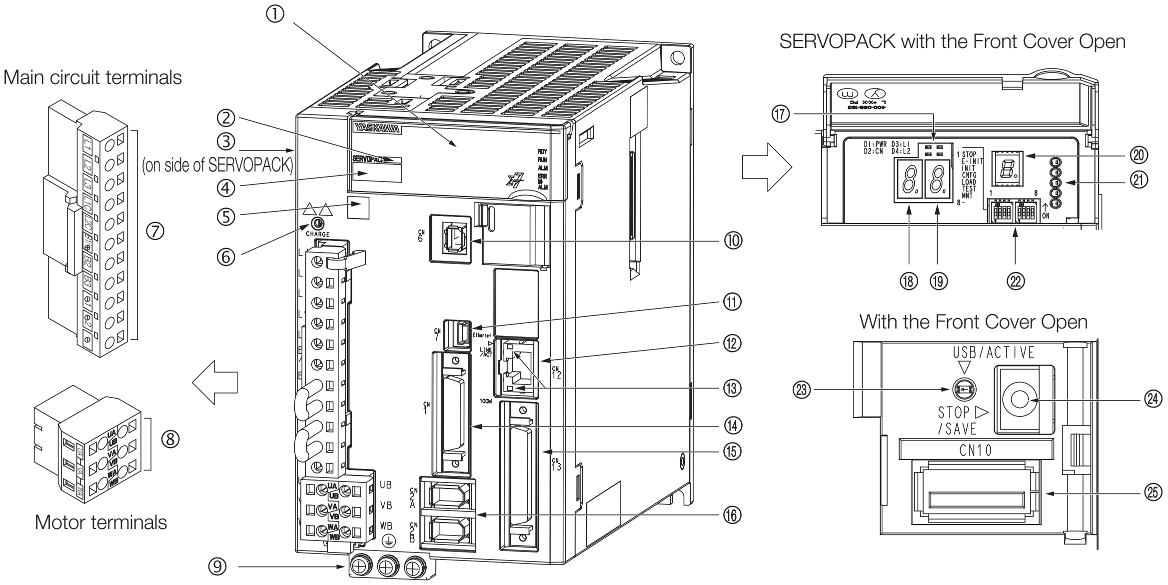
■ Easier Maintenance

- The battery-free Controller Section eliminates the need for regular battery replacement and reduces costs.
- Protection has been improved for outputs from the Controller Section.

A conceptual diagram of an Σ-7C SERVOPACK is provided below.



1.2 Part Names



No.	Name	Description	Reference
①	Front Cover	–	–
②	Input Voltage	–	–
③	Nameplate	Indicates the SERVOPACK model and ratings.	page 1-7
④	Model	The model of the SERVOPACK.	page 1-8
⑤	QR Code	The QR code that is used by the MechatroCloud service.	–
⑥	CHARGE	Lit while the main circuit power is being supplied. Note: Even if you turn OFF the main circuit power supply, this indicator will be lit as long as the internal capacitor remains charged. Do not touch the main circuit or motor terminals while this indicator is lit. Doing so may result in electric shock.	page 1-30
⑦	Main Circuit Terminals	The terminals depend on the main circuit power supply input specifications of the SERVOPACK.	page 3-27
⑧	Servomotor Terminals (Axis A: UA, VA, and WA; Axis B: UB, VB, and WB)	These terminals are used to connect the main circuit cable (power line) to the Servomotor.	page 3-13
⑨	Ground Terminal(⏚)	The ground terminal helps prevent electric shock. Always connect this terminal.	–
⑩	MECHATROLINK-III Communications Connector (CN6)	Connects to MECHATROLINK-III-compatible devices.	page 3-46
⑪	Computer Connector (CN7)	A USB connector to connect a computer.	page 3-47
⑫	Ethernet Connector (CN12)	Connects to devices that support Ethernet communications.	page 3-48
⑬	Ethernet Status Indicators	Show the status of Ethernet communications.	page 1-33
⑭	I/O Signal Connector (CN1)	Connects the Servo Section sequence I/O signals.	page 3-36
⑮	I/O Signal Connector (CN13)	Connects the Controller Section sequence I/O signals.	page 3-43
⑯	Encoder Connectors (Axis A: CN2A, Axis B: CN2B)	• Rotary Servomotor: Connects to the encoder in the Servomotor. • Linear Servomotor: Connects to a Serial Converter Unit or linear encoder.	page 3-13
⑰	Servo Section Indicators	Show the status of the control power supply.	page 1-30

Continued on next page.

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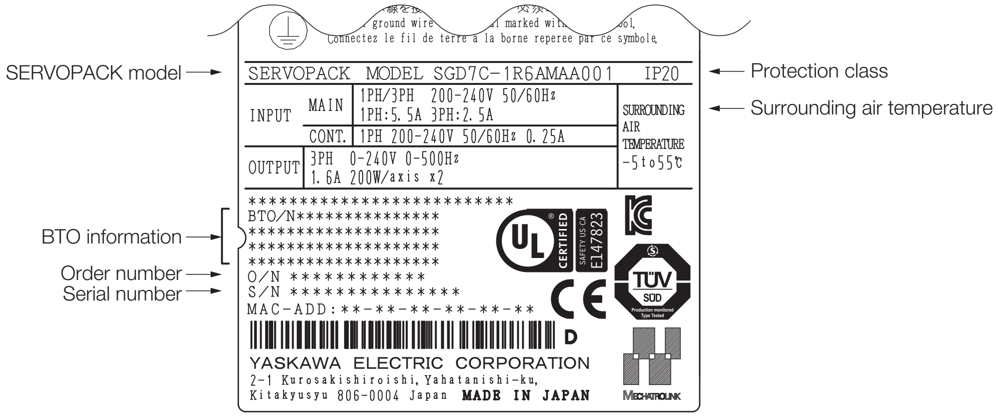
No.	Name	Description	Reference
⑱	Servo Section Display for Axis A	Displays the servo status with a seven-segment display.	page 1-30
⑲	Servo Section Display for Axis B		
⑳	Controller Section Displays	Show the execution or error status of the CPU.	page 1-33
㉑	Controller Section Status Indicators	Show the status of the CPU.	page 1-32
㉒	DIP Switches: Mode Switches	Primarily used to set the operating mode of the CPU.	page 1-34
㉓	USB Status Indicator	Show the status of USB memory.	page 1-32
㉔	STOP/SAVE Switch	Use this switch when removing USB memory or batch-saving data to USB memory.	page 1-35
㉕	USB Connector (CN10)	Connects to USB memory.	page 3-47

1.3 Interpreting the Nameplate

The following basic information is provided on the nameplate.



1.4 Model Designations

1.4.1 Interpreting SERVOPACK Model Numbers

SGD7C - 1R6 A MA A 001

Σ-7-Series
Σ-7C SERVOPACKs

1st+2nd+3rd digits | 4th digit | 5th+6th digits | 7th digit | 8th+9th+10th digits

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

Voltage	Code	Specification
Three-Phase, 200 VAC	1R6*1	0.2 kW
	2R8*1	0.4 kW
	5R5*1,*2	0.75 kW
	7R6	1.0 kW

4th digit Voltage

Code	Specification
A	200 VAC

5th+6th digits Interface*3

Code	Specification
MA	Bus connection references

7th digit Design Revision Order

A

8th+9th+10th digits Hardware Option Specification

Code	Specification	Applicable Models
None	Without options	All models
000		
001	Rack-mounted	
002	Varnished	
020*4	No dynamic brake	SGD7C- 1R6A to -2R8A
	External dynamic brake resistor	SGD7C- 5R5A to -7R6A
700*5	HWBB option	All models

*1. You can use these models with either a single-phase or three-phase input.

*2. If you use the Servomotor with a single-phase 200-VAC power supply input, derate the load ratio to 65%. An example is given below.
If the load ratio of the first axis is 90%, use a load ratio of 40% for the second axis so that average load ratio for both axes is 65%.
((90% + 40%)/2 = 65%)

*3. The same interface is used for both Rotary Servomotors and Linear Servomotors.

*4. Refer to the following manual for details.
Σ-7-Series Σ-7S/Σ-7W SERVOPACK with Hardware Option Specifications Dynamic Brake Product Manual (Manual No.: SIEP S800001 73)

*5. Refer to the following manual for details.
Σ-7-Series Σ-7W SERVOPACK with Hardware Option Specifications HWBB Function Product Manual (Manual No.: SIEP S800001 72)

1.4.2 Interpreting Servomotor Model Numbers

This section outlines the model numbers of Σ-7-Series Servomotors. Refer to the following manuals for details.

📖 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)

Rotary Servomotors

SGM□□	-	01	A	F	A	2	1
Series		1st+2nd digits	3rd digit	4th digit	5th digit	6th digit	7th digit

Series Σ-7-Series Servomotors

Code	Specification
SGMMV	Low inertia, ultra-small capacity
SGM7J	Medium inertia, high speed
SGM7A	Low inertia, high speed
SGM7G	Medium inertia, low speed, high torque
SGM7P	Medium inertia, flat

1st+2nd digits Rated Output

3rd digit Power Supply Voltage

- 200 VAC

4th digit Serial Encoder Specification

- 17-bit absolute encoder
- 24-bit absolute encoder
- 24-bit incremental encoder

5th digit Design Revision Order

6th digit Shaft End Specification

- Straight
- With key and tap
- With two flat seats

7th digit Option Specification

- With 24-V holding brake
- With oil seal

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
SGM7E	Small capacity, coreless inner rotor
SGM7F	Small capacity,with core inner rotor
	Medium capacity, with core inner rotor
SGMCV	Small capacity, with core inner rotor
SGMCS	Small capacity, coreless 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

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 Ratings and Specifications

This section gives the ratings and specifications of SERVOPACKs.

1.5.1 Ratings

Three-Phase, 200 VAC

SGD7C-			1R6A	2R8A	5R5A	7R6A
Maximum Applicable Motor Capacity per Axis [kW]			0.2	0.4	0.75	1.0
Continuous Output Current per Axis [Arms]			1.6	2.8	5.5	7.6
Instantaneous Maximum Output Current per Axis [Arms]			5.9	9.3	16.9	17.0
Main Circuit	Power Supply		200 VAC to 240 VAC, -15% to +10%, 50 Hz/60 Hz			
	Input Current [Arms]*		2.5	4.7	7.8	11
Control	Power Supply		200 VAC to 240 VAC, -15% to +10%, 50 Hz/60 Hz			
	Input Current [Arms]*		0.25	0.25	0.25	0.25
Power Supply Capacity [kVA]*			1.0	1.9	3.2	4.5
Power Loss*	Main Circuit Power Loss [W]		24.0	43.3	78.9	94.2
	Control Circuit Power Loss [W]		17	17	17	17
	Built-in Regenerative Resistor Power Loss [W]		8	8	16	16
	Total Power Loss [W]		49.0	68.3	111.9	127.2
Regenera-tive Resistor	Built-In Regenerative Resistor	Resistance [Ω]	40	40	12	12
		Capacity [W]	40	40	60	60
	Minimum Allowable External Resistance [Ω]		40	40	12	12
Overvoltage Category			III			

* This is the net value at the rated load.

Single-Phase, 200 VAC

SGD7C-			1R6A	2R8A	5R5A[*1]
Maximum Applicable Motor Capacity per Axis [kW]			0.2	0.4	0.75
Continuous Output Current per Axis [Arms]			1.6	2.8	5.5
Instantaneous Maximum Output Current per Axis [Arms]			5.9	9.3	16.9
Main Circuit	Power Supply		200 VAC to 240 VAC, -15% to +10%, 50 Hz/60 Hz		
	Input Current [Arms]*		5.5	11	12
Control	Power Supply		200 VAC to 240 VAC, -15% to +10%, 50 Hz/60 Hz		
	Input Current [Arms]*		0.25	0.25	0.25
Power Supply Capacity [kVA]*			1.3	2.4	2.7
Power Loss[*2]	Main Circuit Power Loss [W]		24.1	43.6	54.1
	Control Circuit Power Loss [W]		17	17	17
	Built-in Regenerative Resistor Power Loss [W]		8	8	16
	Total Power Loss [W]		49.1	68.6	87.1
Regenera-tive Resistor	Built-In Regenerative Resistor	Resistance [Ω]	40	40	12
		Capacity [W]	40	40	60
	Minimum Allowable External Resistance [Ω]		40	40	12
Overvoltage Category			III		

[1] If you use the SGD7C-5R5A with a single-phase 200-VAC power supply input, derate the load ratio to 65%. An example is given below.
If the load ratio of the first axis is 90%, use a load ratio of 40% for the second axis so that average load ratio for both axes is 65%.
((90% + 40%)/2 = 65%)

[2] This is the net value at the rated load. However, a load ratio of 65% was used for the SGD7C-5R5A.

270 VDC

Model SGD7C-		1R6A	2R8A	5R5A	7R6A
Maximum Applicable Motor Capacity per Axis [kW]		0.2	0.4	0.75	1.0
Continuous Output Current per Axis [Arms]		1.6	2.8	5.5	7.6
Instantaneous Maximum Output Current per Axis [Arms]		5.9	9.3	16.9	17.0
Main Circuit	Power Supply	270 VDC to 324 VDC, -15% to +10%			
	Input Current [Arms]*	3.0	5.8	9.7	14
Control	Power Supply	270 VDC to 324 VDC, -15% to +10%			
	Input Current [Arms]*	0.25	0.25	0.25	0.25
Power Supply Capacity [kVA]*		1.2	2	3.2	4.6
Power Loss*	Main Circuit Power Loss [W]	18.7	33.3	58.4	73.7
	Control Circuit Power Loss [W]	17	17	17	17
	Total Power Loss [W]	35.7	50.3	75.4	90.7
Overvoltage Category		III			

* This is the net value at the rated load.

1.5.2 SERVOPACK Overload Protection Characteristics

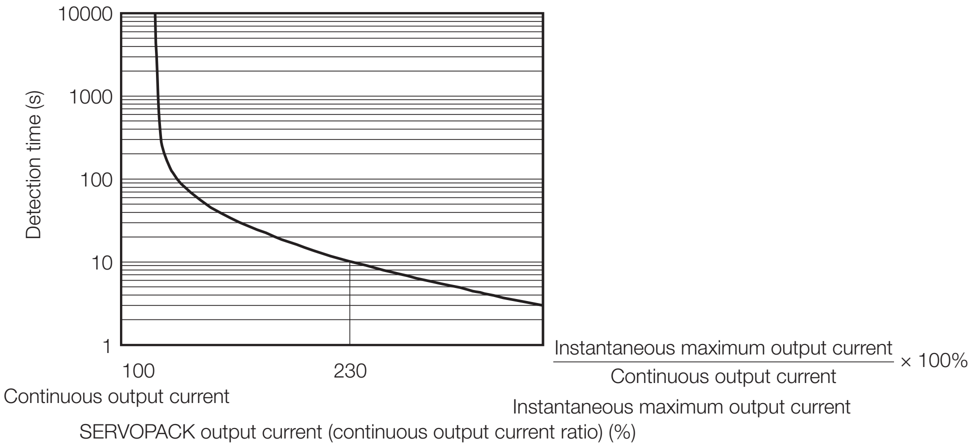
The overload detection level is set for hot start conditions with a SERVOPACK surrounding air temperature of 55°C.

An A.710 alarm (Instantaneous Overload) or A.720 alarm (Continuous Overload) 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.

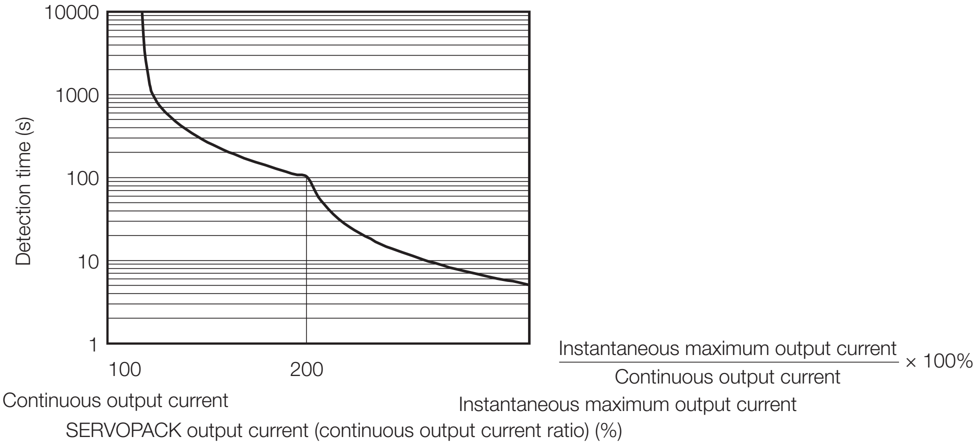
In most cases, that will be the overload protection characteristics of the Servomotor.

- SGD7C-1R6, -2R8



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.

- SGD7C-5R5, -7R6



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.

1.5.3 General Specifications

Item		Specification
Control Method		IGBT-based PWM control, sine wave current drive
Feedback	With Rotary Servomotor	Serial encoder: 17 bits (absolute encoder) 20 bits or 24 bits (incremental encoder/absolute encoder) 22 bits (absolute encoder)
	With Linear Servomotor	• Absolute linear encoder (The signal resolution depends on the absolute linear encoder.) • Incremental linear encoder (The signal resolution depends on the incremental linear encoder or Serial Converter Unit.)
Environmental Conditions	Surrounding Air Temperature	0°C to 55°C
	Storage Temperature	-20°C to 85°C
	Surrounding Air Humidity	10% to 95% relative humidity (with no freezing or condensation)
	Storage Humidity	10% to 95% relative humidity (with no freezing or condensation)
	Vibration Resistance	4.9 m/s^2
	Shock Resistance	19.6 m/s^2
	Protection Class	IP20
	Pollution Degree	2 • Must be no corrosive or flammable gases. • Must be no exposure to water, oil, or chemicals. • Must be no excessive dust, salts, or iron dust.
	Altitude	1,000 m max. Note: With derating, usage is possible between 1,000 m and 2,000 m. Refer to the following section for the derating specifications. ☞ *2.6 Derating Specifications* on page 2-7
	Power Frequency Magnetic Field	30 A/m (50 Hz/60 Hz), IEC 61000-4-8, Level 4
	Others	Must be no exposure to electrostatic noise or radiation.
Applicable Standards		Refer to the following section for details. ☞ *Compliance with UL Standards and EU Directives* on page xxix
Mounting		Base-mounted or rack-mounted

1.5.4 Servo Section Specifications

Item			Specification
Performance	Speed Control Range		1:5000 (At the rated torque, the lower limit of the speed control range must not cause the Servomotor to stop.)
	Coefficient of Speed Fluctuation*		±0.01% of rated speed max. (for a load fluctuation of 0% to 100%)
			0% of rated speed max. (for a voltage fluctuation of ±10%)
			±0.1% of rated speed max. (for a temperature fluctuation of 25°C ±25°C)
	Torque Control Precision (Repeatability)		±1%
	Soft Start Time Setting		0 s to 10 s (Can be set separately for acceleration and deceleration.)
I/O Signals	Linear Servomotor Overheat Protection Input		Number of input points: 2 Input voltage range (0 V to 5 V)
	Sequence Input Signals	Input Signals That Can Be Allocated	Allowable voltage range: 24 VDC ±20% Number of input points: 12
			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) and /N-CL (Reverse External Torque Limit) signals • /DEC (Origin Return Deceleration Switch) 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 Outputs	Allowable voltage range: 5 VDC to 30 VDC Number of output points: 2 Output signal: ALM (Servo Alarm Output) signal
		Output Signals That Can Be Allocated	Allowable voltage range: 5 VDC to 30 VDC Number of outputs points: 5 (Photocoupler outputs (isolated) are used.)
			Output Signals: • /COIN (Positioning Completion) signal • /V-CMP (Speed Coincidence Detection) signal • /TGON (Rotation Detection) signal • /S-RDY (Servo Ready) signal • /CLT (Torque Limit Detection) signal • /VLT (Speed Limit Detection) signal • /BK (Brake) signal • /WARN (Warning) signal • /NEAR (Near) signal A signal can be allocated and the positive and negative logic can be changed.
Communications	USB Communications (CN7)	Interface	Personal computer (with SigmaWin+)
		Communications Standard	Conforms to USB2.0 standard (12 Mbps).
Displays/Indicators			CHARGE and PWR indicators, and two, one-digit seven-segment displays
Reference Method			Reference with built-in controller
Dynamic Brake (DB)			Activated when a servo alarm or overtravel (OT) occurs, or when the power supply to the main circuit or servo is OFF.
Regenerative Processing			Built-in
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

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Item	Specification
Protective Functions	Overcurrent, overvoltage, undervoltage, overload, regeneration error, etc.
Utility Functions	Gain adjustment, alarm history, jogging, origin search, etc.
Applicable Option Modules	None

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

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

1.5.5 Controller Section Specifications

This section provides the specifications of the Controller Section.

Hardware Specifications

Item	Specification
Flash Memory	Capacity: 24 MB (15 MB of user memory)
SDRAM	Capacity: 256 MB
MRAM	Capacity: 4 MB
Calendar	Seconds, minutes, hour, day, week, month, year, day of week, and timing
Ethernet	One port, 10Base-T or 100Base-TX
MECHATROLINK	• MECHATROLINK-III, 1 circuit with 1 port • Master
USB	• USB 2.0, Type A host, 1 port • Compatible devices: USB storage
Indicators and Displays	• Seven-segment display • Status indicators • USB Status Indicator • Ethernet status indicators
Switches	• DIP switches: Mode switches • STOP/SAVE switch
Connectors	• MECHATROLINK-III connector (CN6) • USB connector (CN10) • Ethernet connector (CN12) • Controller Section I/O connector (CN13)

Performance Specifications

Item		Specification	Remarks
System Configuration	Number of Mountable Option Modules	1	Install the Optional Unit to mount an Option Module.
Number of Controlled Axes	SVC4	4 axes 1 circuit	Circuit number selected from 1 to 16.
	SVD	2 axes	Circuit number selected from 1 to 16.
	SVR4	4 axes 1 circuit	Circuit number selected from 1 to 16.
	Maximum Number of Controlled Axes	6 axes	–

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Item		Specification	Remarks
Scan Time Settings	H Scan	0.5 ms to 32.0 ms (in 0.25-ms increments)	Refer to the following section for details. ☞ *4.3.5 Setting the Scan Times* on page 4-43
	L Scan	2.0 ms to 300 ms (in 0.5-ms increments)	–
	H Scan Default	4 ms	–
	L Scan Default	200 ms	–
Peripheral Devices	Calendar	Supported.	–
	Communications Interface	Ethernet	–
	USB	Supported.	–
Memory Capacity	DRAM	256 MB with ECC	–
	MRAM	4 MB	Up to 1 MB can be used to back up table data.
	Program Capacity	15 MB	Total capacity including definition data, ladder programs, table data, etc.
Ladder Programs	Number of Startup Drawings (DWG.A)	64	Number of steps per drawing: 4,000
	Number of Interrupt Drawings (DWG.I)	64	
	Number of High-Speed Scan Drawings (DWG.H)	1000	
	Number of Low-Speed Scan Drawings (DWG.L)	2000	
	Number of User Function Drawings	2000	
Motion Programs	Number of Programs	512	Total of all programs listed below: • Motion main programs • Motion subprograms • Sequence main programs • Sequence subprograms
	Number of Groups	16	–
	Number of Tasks	32	–
	Number of Nesting Levels for IF Instructions	8	–
	Number of Nesting Levels for MSEE Instructions	8	–
	Number of Parallel Forks Per Task	8	Select from the following four options: • Main: 4 forks, Sub: 2 forks • Main: 8 forks • Main: 2 forks, Sub: 4 forks • Sub: 8 forks
	Number of Simultaneously Controlled Axes Per Task	10 axes	–

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Item			Specification	Remarks
Registers	S Registers		64 Kwords	–
	M Registers		1 Mword	–
	G Registers		2 Mwords	–
	I/O Registers		64 Kwords	–
	Motion Registers		32 Kwords	–
	C Registers		16 Kwords	–
	# Registers		16 Kwords	–
	D Registers		16 Kwords	–
Data Types	Bit (B)		Supported.	0 or 1
	Integer (W)		Supported.	-32,768 to 32,767
	Double-Length Integer (L)		Supported.	-2,147,483,648 to 2,147,483,647
	Quadruple-Length Integer (Q)		Supported.	-9,223,372,036,854,775,808 to 9,223,372,036,854,775,807
	Single-Precision Real Number (F)		Supported.	± (1.175E-38 to 3.402E+38) or 0
	Double-Precision Real Number (D)		Supported.	±(2.225E-308 to 1.798E+308) or 0
	Addresses (A)		Supported.	0 to 16,777,214
Index Registers	Subscript i		Supported.	Special registers for offsetting addresses. Subscripts i and j function identically.
	Subscript j		Supported.	
	Array Registers		Supported.	Used to handle registers as arrays.
Data Tracing	Number of Groups		4	–
	Trace Memory		256 Kwords total in 4 groups	–
	Traceable Data Points		16 points per group	–
	Trigger Types		>, <, =, <>, >=, <= and differential detection of the above conditions	–
Data Logging	Number of Groups		4	–
	Log Storage Location		Built-in RAM disk or USB memory device	–
	Log File Formats		CSV file format or binary file format	–
	Data Logging Points		64 points per group	–
	Number of Log Files	Built-in RAM Disk	1 to 4,000	–
		USB Memory	1 to 32,767 or unlimited	The ultimate upper limit is 10,000 files even if unlimited is selected.
	Trigger Types		>, <, =, <>, >=, <=	–
Compatibility with MP2000-Series Option Modules			Refer to the following section for details. ☞ *1.12 Installable Option Modules* on page 1-41	

Communications Function Module Specifications

Item			Specification	Remarks
Abbreviation			218IFD	
Common Items	Transmission Interface		10Base-T/100Base-TX	–
	Number of Communications Ports (Connectors)		1	–
	Transmission Protocols		TCP/UDP/IP/ARP/ICMP/IGMP	–
Ethernet Communications	Maximum Number of Communications Connections		20 + 2 (I/O message communications)	–
	Maximum Number of Communications Channels		10 + 2 (I/O message communications)	–
	Automatic Reception		Supported.	Not supported for no-protocol communications.
	Maximum Number of Automatic Reception Connections		10	–
	Automatic Reception Status Monitor		Supported.	–
	Maximum Size of Message Communications	MEMOBUS	Write: 100 words Read: 125 words	–
		Extended MEMOBUS	Write: 2,043 words Read: 2,044 words	–
		MELSEC (A-Compatible 1E)	Write: 256 words Read: 256 words	–
		MELSEC (QnA-Compatible 3E)	Write: 960 words Read: 960 words	–
		MODBUS/TCP	Write: 100 words Read: 125 words	–
		OMRON	Write: 996 words Read: 999 words	–
		TOYOPUC	Write: 1,022 words	–
		No-protocol	Write: 2,046 words	–
	Maximum Size of I/O Message Communications	MEMOBUS	Write: 100 words Read: 125 words	–
		Extended MEMOBUS	Write: 1,024 words Read: 1,024 words	–
		MELSEC (A-Compatible 1E)	Write: 256 words Read: 256 words	–
		MELSEC (QnA-Compatible 3E)	Write: 256 words Read: 256 words	–
		MODBUS/TCP	Write: 100 words Read: 125 words	–
		OMRON	Write: 996 words Read: 999 words	–
		Execution Conditions	You can select controls (start/stop) from a ladder program.	–
		Execution Status Monitor	Supported.	–
	MotomanSync-MP		Supported.	–
	FTP Server		Supported.	–
	FTP Client		Supported.	–
	Receive Buffer Mode Selection for No-protocol Communications		Supported.	–
	Engineering Tools	Communications Platform	Ethernet	–
		Controller Searches	Supported.	–
		Supported Engineering Tools	MPE720 version 7 and SigmaWin+ version 7	–

Motion Control Function Module Specifications

Module	Item		Specification
SVD	Number of Controlled Axes[*1]		2
	Reference Update Cycle (High-Speed Scan Cycle Performed by the CPU)		500 μs to 32.0 ms
	Register Ranges		Registers for two axes are assigned from the registers for each circuit. Refer to the following manual for details. 📖 **Σ-7-Series Σ-7C SERVOPACK Motion Control User's Manual (Manual No.: SIEP S800002 03)**
SVC4	Number of Controlled Axes[*1]		4
	Reference Update Cycle (High-Speed Scan Cycle Performed by the CPU)		500 μs to 32.0 ms
	Register Ranges		Registers for four axes are assigned from the registers for each circuit. Refer to the following manuals for details. 📖 **Σ-7-Series Σ-7C SERVOPACK Motion Control User's Manual (Manual No.: SIEP S800002 03)**
	MECHATROLINK-III communications	Communications Interface	Master
		Communications Cycle (Reference Update Cycle)	500 μs to 32.0 ms
		Transmission Cycle[*2]	125 μs, 250 μs, 500 μs, or 1 ms
		Communications Cable	MECHATROLINK-III Communications Cable
		Maximum Number of Connectable Stations	8
		Topology	Cascade connections, star connections, or mixed star-cascade connections
		Terminating Resistance	Not required.
		Connectable Slave Devices	SERVOPACKs, Stepping Motor Drivers, Inverters, I/O Modules, and Machine Controllers that support MECHATROLINK-III communications
		Supported Profiles	MECHATROLINK-III Servo Standard, MECHATROLINK-III I/O Standard, MECHATROLINK-III Inverter Standard, and MECHATROLINK-III Stepping Motor Standard
SVR4	Number of Controlled Axes[*1]		4
	Reference Update Cycle (High-Speed Scan Cycle Performed by the CPU)		500 μs to 32.0 ms
	Register Ranges		Registers for four axes are assigned from the registers for each circuit. Refer to the following manuals for details. 📖 **Σ-7-Series Σ-7C SERVOPACK Motion Control User's Manual (Manual No.: SIEP S800002 03)**

*1. A maximum of six axes can be controlled with the Motion Control Function Module in a Σ-7C SERVOPACK. Do not control more than a total of six axes with one Motion Control Function Module.

*2. The transmission cycle is the cycle in which the SVC4 and the slave devices perform communications on the MECHATROLINIK-III transmission path.

M-EXECUTOR Function Module Specifications

◆ Registerable Programs

Program Type		Number of Registered Programs
Motion Programs		32*
Sequence Programs	Startup	1
	Interrupt	Not possible.
	H scan	32*
	L scan	32*

* The combined total of motion programs and sequence programs must not exceed 32.

◆ Program Control Methods

You can use the following control methods for the programs that are registered in the M-EXECUTOR:

Item	Motion Programs	Sequence Programs
Execution Method	Sequential execution	Startup: Event execution H scan: Scan execution L scan: Scan execution
System Work	The same number is used for the definition number and system work number. Definition No. / System Work Number No.1 / 1 No.2 / 2 ⋮ / ⋮ No.32 / 32	
Program Designation Method	Direct designation or indirect designation	Direct designation
Program Execution Method	Register the program in the definitions and start execution by turning ON the start signal.	Execution is started when the program is registered in the definitions.
Interpolation Override Setting	Supported.	Not supported.
I/O Link Definitions	Supported.	Not supported.
Motion Program Status Reporting in S Registers	Supported.	
Number of Parallel Forks	Up to 8 Main: 4 forks, Sub: 2 forks Main: 8 forks Main: 2 forks, Sub:4 forks Sub: 8 forks	No forks
Error Diagram Execution When an Operation Error Occurs	Supported.	

USB Memory Specifications

Item	Specification	Remarks
Supported Media	USB memory device	Refer to the following section for details. ☞ *Recommended USB Memory Device* on page 1-21
Applicable FAT	FAT16/32	–
Maximum Number of Nested Directories	10	–
File Information	Last update time-stamp supported.	Uses the calendar in the Controller Section. Refer to the following section for details. ☞ *12.4 Calendar* on page 12-30
Maximum Length for File Name and Directory Names	256 characters	–
Current Directory Function	16	–
Maximum Number of Simultaneously Open Files	16	–
Formatting	Not supported.	Use a formatted USB memory device.

◆ Recommended USB Memory Device

The following USB memory device is recommended. It can be purchased from Yaskawa.

Model	Specification	Manufacturer
SFU24096D1BP1TO-C-QT-111-CAP	4-GB USB memory	Swissbit Japan Inc.

IO16 Function Module Specifications

The following table gives the specifications of the IO16 Function Module. There are 16 digital inputs and 16 digital outputs in the IO16 Function Module.

Item	Specification	
Digital Inputs	Number of Inputs	16
	Input Method	Sink/source
	Isolation Method	Photocouplers
	Input Voltage	24 VDC ±20%
	Input Current	5 mA (typical)
	ON Voltage/Current	15 V min./2 mA min.
	OFF Voltage/Current	5 V max./1 mA max.
	ON/OFF Time	0.01 ms + Digital filter setting
	Digital Filter Setting	0 to 65,535 μs
	Number of Commons	2 (8 points per common)
	Others	DI_00 is also used for interrupt signals. DI_01 is also used as the pulse latch input.
Digital Outputs	Number of Outputs	16
	Output Method	Transistor open-collector sink outputs
	Isolation Method	Photocouplers
	Output Voltage	24 VDC (20 V to 30 V)
	Output Current	50 mA max.
	Leakage Current When OFF	0.1 mA max.
	ON/OFF Time	0.01 μs (for output current of 85 mA)
	Number of Commons	2 (8 points per common)
	Output Protection	Thermistor (automatic recovery after blow out)
	Others	DO_00 is also used as the Match Output.

Counter Function Module Specifications

The following table gives the specifications of Counter Function Module. The Counter Function Module uses a pulse input on one channel.

Item	Specification	
Pulse Input	Number of Inputs	1 (phase A, B, or Z input)
	Input Circuits	Phases A and B: 5-V differential input, not isolated, maximum frequency: 4 MHz Phase Z: 5-V, 12-V, or 24-V photocoupler input, maximum frequency: 500 kHz
	Input Modes	Phases A and B, sign, and incrementing/decrementing
	Latch Input	Pulses are latched for phase Z or DI_01. Response Times for Phase-Z Input ON: 1 μs max. OFF: 1 μs max. Response Times for DI_01 Input ON: 60 μs max. OFF: 0.5 ms max.
	Other Functions	Match detection, counter preset and clear, electronic gear conversion, and phase-C (phase-Z) digital filter

System Register Specifications

This section shows the overall structure of the system registers.

Register Addresses	Contents	Reference
SW00000 to SW00029	System Service Registers	*12.10 System Service Registers* on page 12-78
SW00030 to SW00049	System Status	Σ-7-Series Σ-7C SERVOPACK Troubleshooting Manual (Manual No.: SIEP S800002 07)
SW00050 to SW00079	System Error Status	
SW00080 to SW00089	User Operation Error Status	
SW00090 to SW00103	System Service Execution Status	
SW00104 to SW00109	Reserved.	
SW00110 to SW00189	Detailed User Operation Error Status	
SW00190 to SW00199	Reserved.	
SW00200 to SW00503	System I/O Error Status	
SW00504 and SW00505	Reserved.	
SW00506 and SW00507	Security Status	
SW00508 to SW00649	Reserved.	
SW00650 to SW00667	USB-Related System Status	
SW00668 to SW00693	Reserved.	
SW00694 to SW00697	Message Relaying Status	
SW00698 to SW00789	Interrupt Status	
SW00790 to SW00799	Reserved.	
SW00800 to SW01095	Module Information	
SW01096 to SW02687	Reserved.	
SW02688 to SW03199	PROFINET Controller (266IF-01) IOPS Status	
SW03200 to SW05119	Motion Program Information	
SW05120 to SW05247	Used by the system (system memory read).	
SW05248 to SW08191	Reserved.	
SW08192 to SW09215	Expansion Motion Program Information	

Continued on next page.

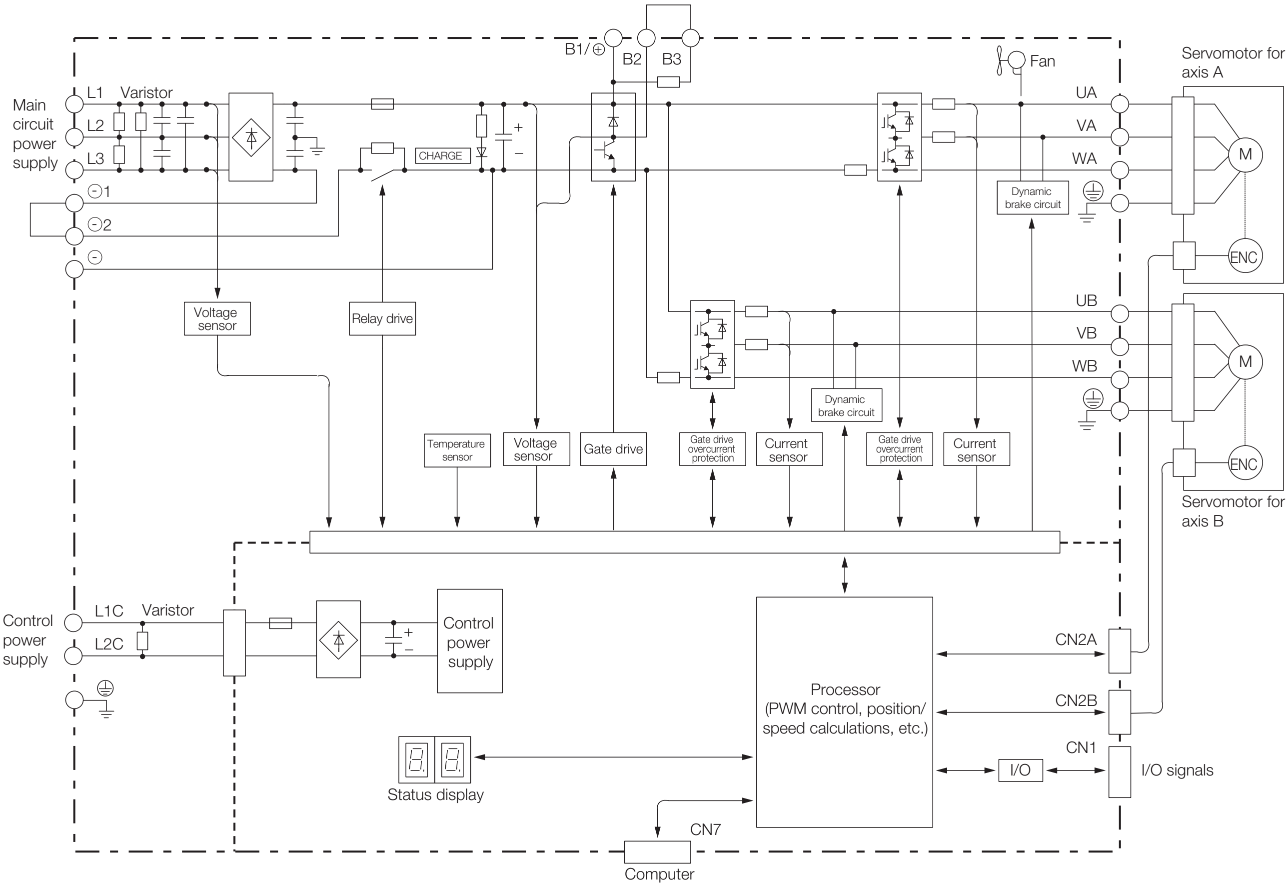
Continued from previous page.

Register Addresses	Contents	Reference
SW09216 to SW09559	Reserved.	Σ-7-Series Σ-7C SERVOPACK Troubleshooting Manual (Manual No.: SIEP S800002 07)
SW09560 to SW10627	Expansion System I/O Error Status	
SW10628 to SW13699	Reserved.	
SW13700 to SW14259	Expanded Unit and Module Information	
SW14260 to SW15997	Reserved.	
SW15998 to SW16011	Expansion System Service Execution Status	
SW16012 to SW16199	Reserved.	
SW16200 to SW17999	Alarm History Information	
SW18000 to SW19999	Reserved.	
SW20000 to SW22063	Product Information	
SW22064 to SW23999	Reserved.	
SW24000 to SW24321	Data Logging Execution Status	
SW24322 to SW24999	Reserved.	
SW24400 to SW24719	FTP Client Status and Controls	
SW25000 to SW25671	Automatic Reception Status for Ethernet Communications	
SW25672 to SW27599	Reserved.	
SW27600 to SW29775	Maintenance Monitor	
SW29776 to SW65534	Reserved.	

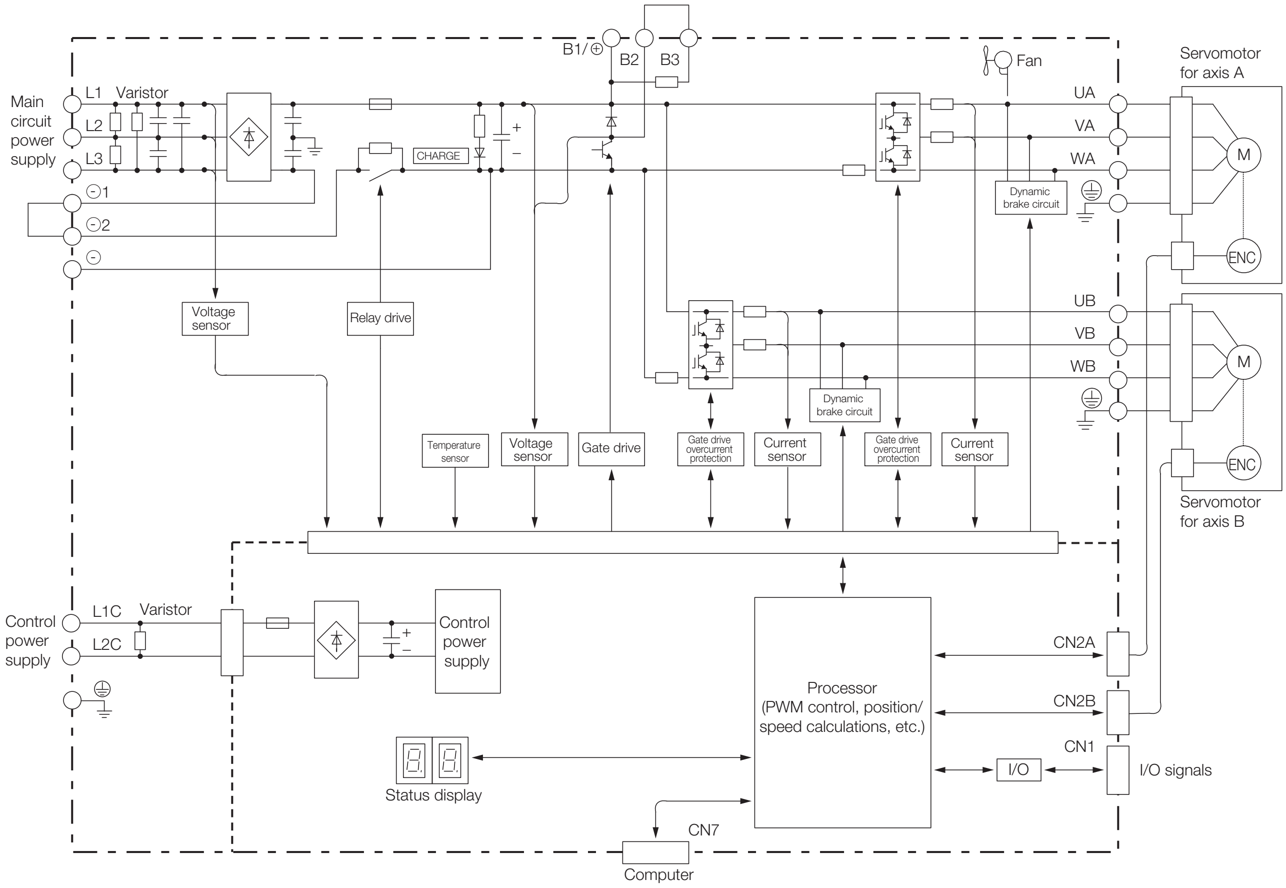
1.6 Block Diagrams

Internal block diagrams for the Servo Section are provided below.

1.6.1 SGD7C-1R6A and -2R8A



1.6.2 SGD7C-5R5A and -7R6A

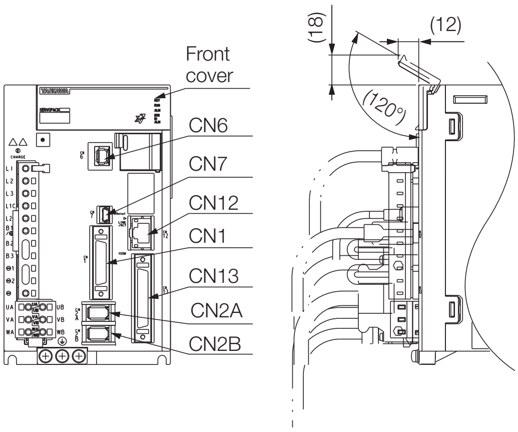


1.7 External Dimensions

1.7.1 Front Cover Dimensions and Connector Specifications

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

- Front Cover Dimensions



- Connector Specifications

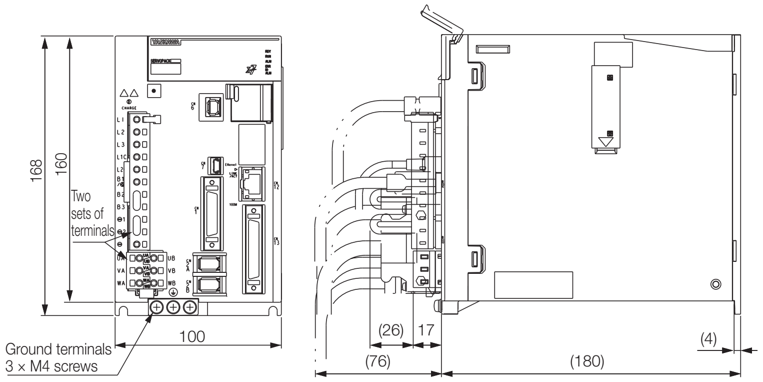
Connector No.	Model	Number of Pins	Manufacturer
CN1	10236-59A3MB	36	3M Japan Limited
CN2A, CN2B	3E106-2230KV	6	3M Japan Limited
CN6	1981386-1	8	Tyco Electronics Japan G.K.
CN7	2172034-1	5	Tyco Electronics Japan G.K.
CN12	26-51024KB13-1	8	UDE Corp.
CN13	10250-52A3PL	50	3M Japan Limited

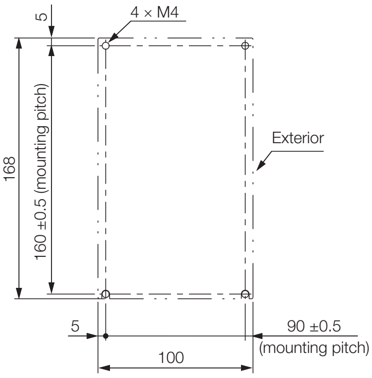
Note: The above connectors or their equivalents are used for the SERVOPACKs.

1.7.2 SERVOPACK External Dimensions

Base-Mounted SERVOPACKs

- Three-phase, 200 VAC: SGD7C-1R6A and -2R8A

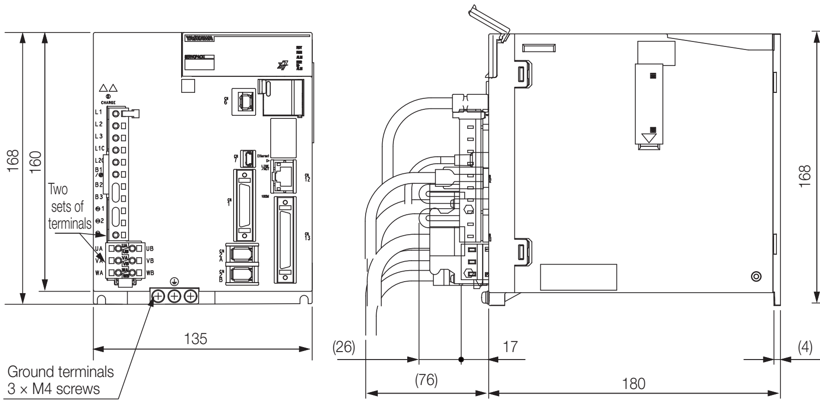


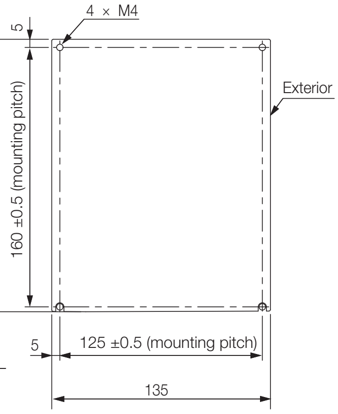


Mounting Hole Diagram

Approx. mass: 2.0 kg
Unit: mm

- Three-phase, 200 VAC: SGD7C-5R5A and -7R6A





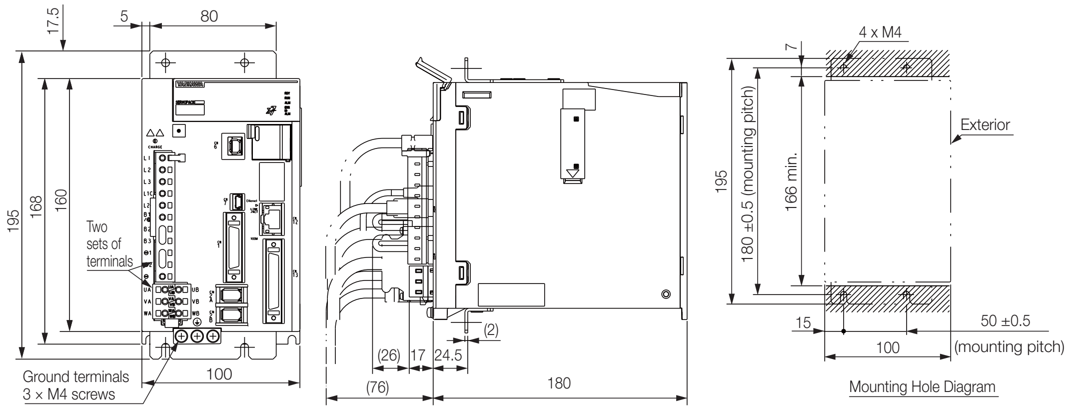
Mounting Hole Diagram

Approx. mass: 2.8 kg
Unit: mm

Rack-Mounted SERVOPACKs

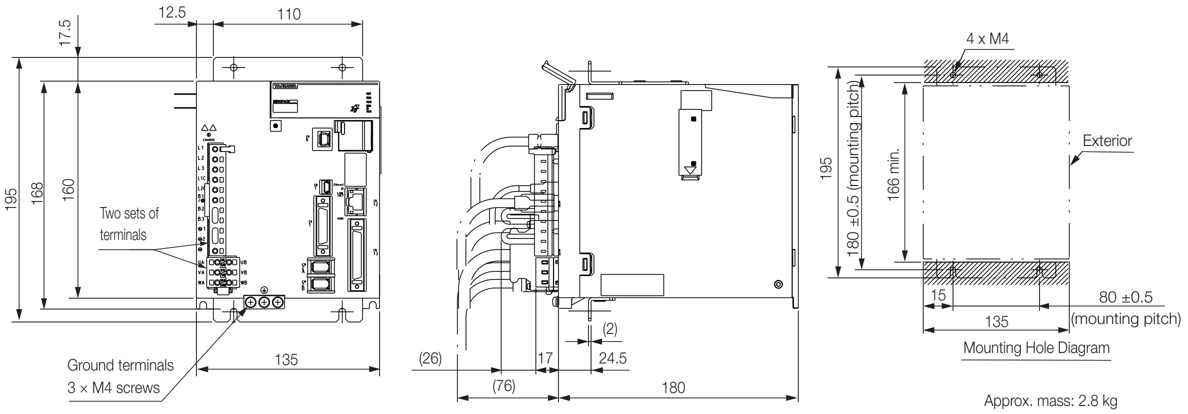
Hardware Option Code: 001

- Three-phase, 200 VAC: SGD7C-1R6A and -2R8A



Approx. mass: 2.0 kg
Unit: mm

- Three-phase, 200 VAC: SGD7C-5R5A and -7R6A



Approx. mass: 2.8 kg
Unit: mm

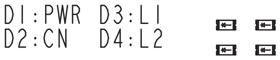
1.8 Interpreting the Displays and Indicators

This section describes how to interpret the displays and the indicators on the SERVOPACK.

1.8.1 Servo Section

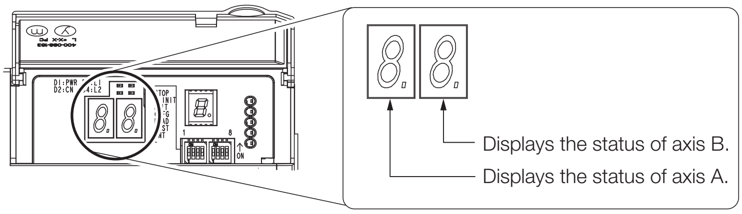
Servo Section Indicators

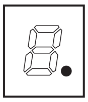
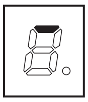
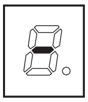
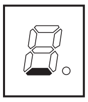
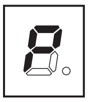
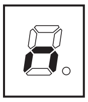
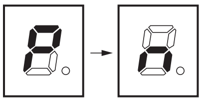
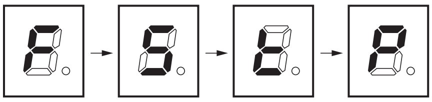
The indicators on the Servo Section give the status of the main circuit power supply and the control power supply.

Indicator	Indicator Name	Color	Status When Lit
	CHARGE	Orange	The main circuit power supply is ON.
	PWR	Green	The control power supply is ON.
	CN	–	Not used.
	L1	Green	MECHATROLINK-III communications are in progress.
	L2	–	Not used.

Servo Section Displays

There are two displays on the Servo Section. These displays give the status of axes A and B connected to the SERVOPACK. The left display gives the status of axis A, and the right display gives the status of axis B.



Color	Display	Description and Status
Red		Lit: The control power supply is ON.
		Status of the /TGON (Rotation Detection Output) Signal • Lit: The Servomotor speed is faster than the specified value. • Not lit: The Servomotor speed is slower than the specified value. Set the specified value of the Servomotor speed in Pn502 or Pn581. The default setting is 20 min^{-1} or 20 mm/s.
		Base Block State • Lit: Base block is active (servo OFF state). • Not lit: Servo is ON.
		Lit: There is a reference input.
		Forward overtravel occurred.
		Reverse overtravel occurred.
		Forward and reverse overtravel occurred.
		The motor was forced to stop.
	A three-digit number will be displayed after E. or A..	Refer to the following manual for details on alarm and warning status. 📖 Σ-7-Series Σ-7C SERVOPACK Troubleshooting Manual (Manual No.: SIEP S800002 07)

1.8.2 Controller Section

Controller Section Indicators

There are three types of indicators on the Controller Section.

◆ Status Indicators

These indicators show the status of the CPU.

- ▯ RDY
- ▯ RUN
- ▯ ALM
- ▯ ERR
- ▯ M-ALM

Indicator Name	Color	Status When Lit*
RDY	Green	Operation is normal.
RUN	Green	A user program is being executed.
ALM	Red	An alarm occurred.
ERR	Red	An error occurred.
M-ALM	Red	An error occurred with one of the servo axes: • Warnings • Alarm • Command error end status

* Refer to the following manual for details.
📖 Σ-7-Series Σ-7C SERVOPACK Troubleshooting Manual (Manual No.: SIEP S800002 07)

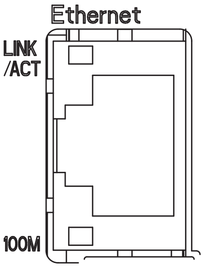
◆ USB Status Indicator

This indicator shows the status of USB memory.

Indicator Name	Indicator Status	Description	Status
USB ACTIVE	▯ Not lit.	No USB memory device	No USB memory device has been inserted yet, or the USB memory device is ready to be removed.
	▮ Lit blue	USB memory device inserted	A USB memory device is inserted.
	▮ Flashing blue	Accessing USB memory	The USB memory is being accessed.

◆ Ethernet Status Indicators

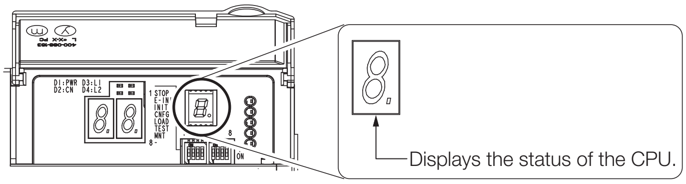
These indicators show the status of Ethernet communications.

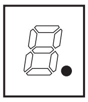
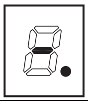
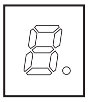
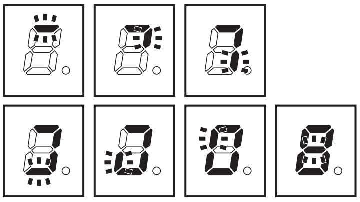
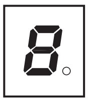


Indicator Name	Color	Status When Not Lit, Lit, or Flashing
LINK/ACT	Yellow	Lit: Ethernet link established. Flashing: Ethernet communications activity.
100M	Green	Not lit: 10 M connection Lit: 100 M connection

Controller Section Displays

Show the execution or error status of the CPU.



Color	Display	Description	Status
Red		Initializing (The RDY status indicator is not lit.)	The CPU started normally after the power was turned ON or after the system was reset.
		Normal operation (The RDY status indicator is lit.)	Operation is normal.
		CPU stopped	The CPU is stopped.
		USB memory batch transfer	Save/load is being started.
			Save/load is in progress.
			Save or load is completed. After 2 seconds, the display will indicate the status of the CPU.
	A three-digit number will be displayed after CE. or CA..	A system error occurred.	Error Refer to the following manual for details. 📖 Σ-7-Series Σ-7C SERVOPACK Troubleshooting Manual (Manual No.: SIEP S800002 07)
		An alarm occurred.	

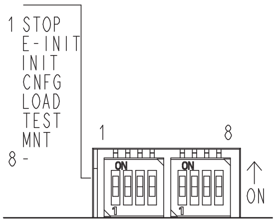
1.9 Interpreting Switch Labels

This section describes how to interpret the switch labels on the SERVOPACK.

There are two types of switches in the Controller Section.

DIP Switches: Mode Switches

These switches are primarily used to set the operating mode of the CPU.

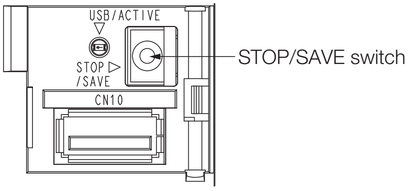


Switch Name	Status	Operating Mode	Default	Remarks
STOP	ON	Stops the user programs.	OFF	Turn ON the pin to stop execution of the user programs.
	OFF	Executes the user programs.		
E-INIT	ON	Sets the default IP address.	OFF	If this pin is set to ON, the IP address is set to 192.168.1.1. If this pin is set to OFF, the IP address for the definition that is stored in flash memory is used. If there is no definition stored in flash memory, the IP address is set to 192.168.1.1.
	OFF	Does not set the default IP address.		
INIT	ON	Resets memory.	OFF	If this pin is set to ON, the data stored in the RAM will be deleted. Turn OFF the pin to execute the programs that are stored in the flash memory.
	OFF	Normal operation		
CNFG	ON	Configuration Mode	OFF	Turn ON the pin to perform self configuration. Turn OFF the pin to operate according to the definitions that are stored in the flash memory.
	OFF	Normal operation		
LOAD	ON	Loads data.	OFF	Turn ON the pin and then turn ON the power to batch load data from the USB memory to the CPU. Refer to the following section for details. ☞ *12.2 USB Memory* on page 12-17
	OFF	Does not load data.		
TEST	ON	Reserved.	OFF	Keep this pin OFF at all times.
	OFF	Normal operation		
MNT	ON	Reserved.	OFF	Keep this pin OFF at all times.
	OFF	Normal operation		
–	ON	Reserved.	OFF	–
	OFF	Normal operation		

STOP/SAVE Switch

Use this switch when you remove the USB memory device or batch-save data to the USB memory.

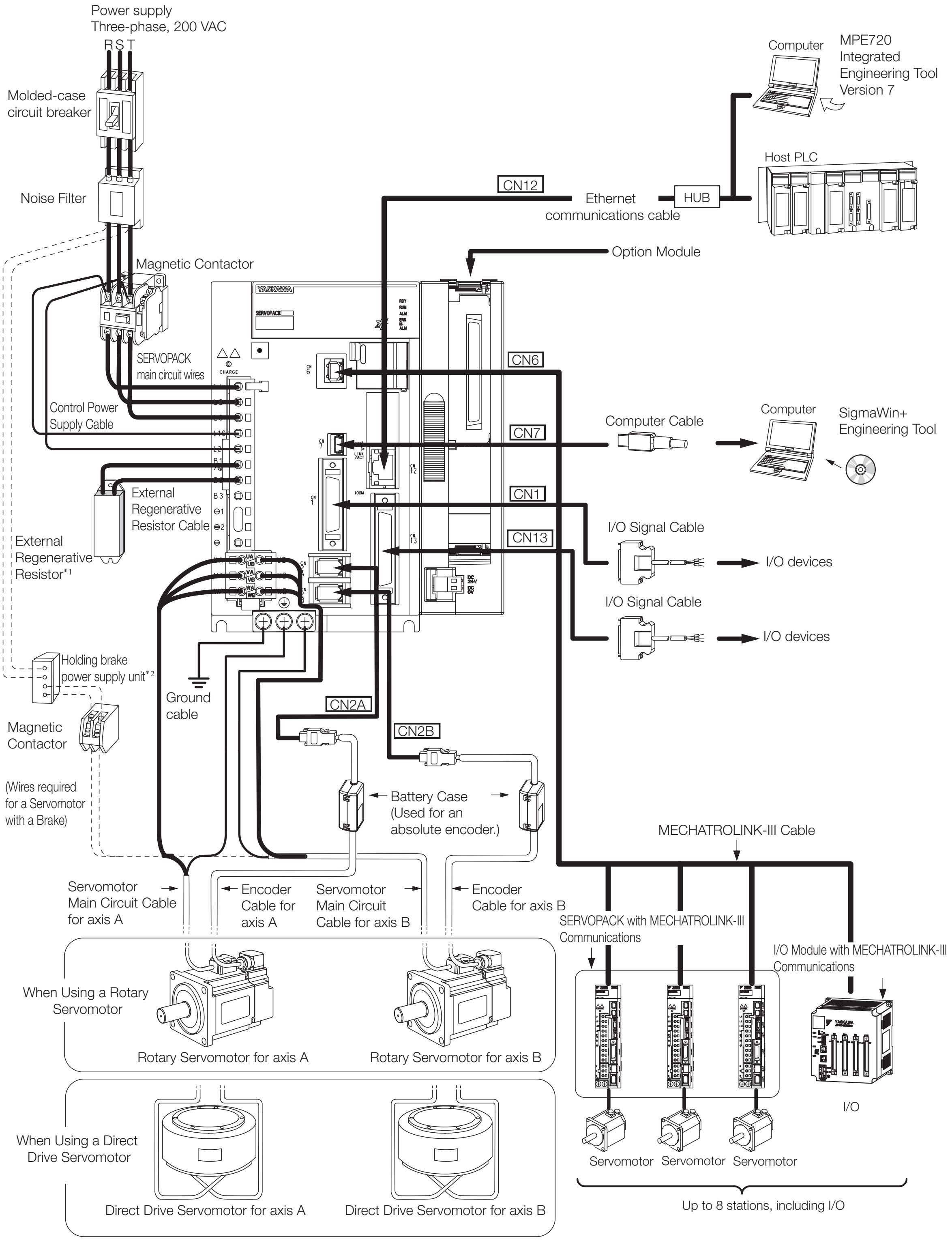
With the Cover Open



- Lightly press this switch to prepare the USB memory device for removal. The USB memory device can be safely removed when the USB status indicator changes from flashing to not lit.
- Press and hold this switch for at least 2 seconds to save all of the data to the USB memory. The display will show the progress of saving.

1.10 Examples of Standard Connections between SERVOPACKs and Peripheral Devices

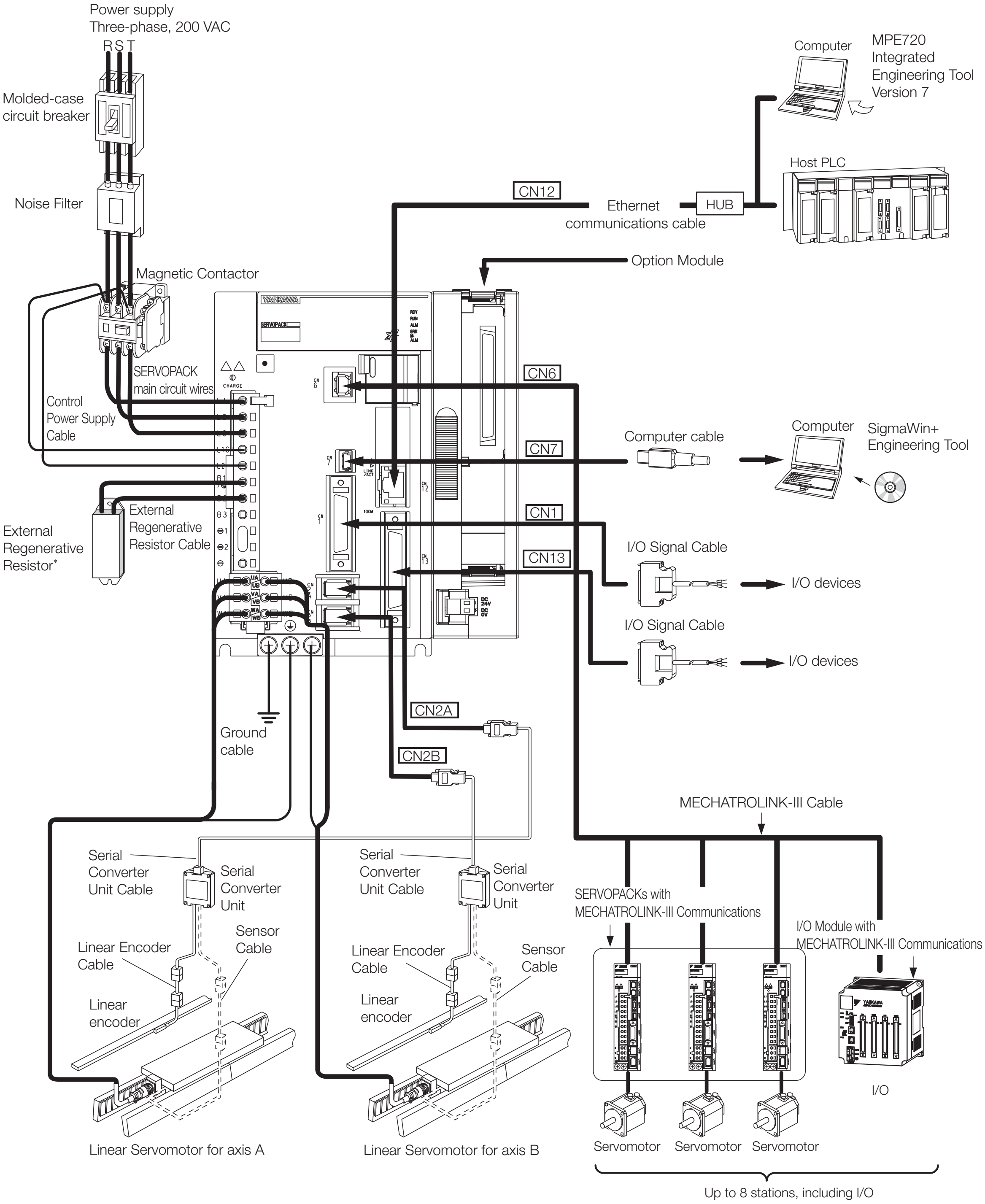
- Rotary Servomotors



[1] External Regenerative Resistors are not provided by Yaskawa.

[2] 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 or CN13 connector. If the power supply is shared, the I/O signals may malfunction.

- Linear Servomotors



* External Regenerative Resistors are not provided by Yaskawa.

1.11 Combinations of SERVOPACKs and Servomotors

1.11.1 Combinations of Rotary Servomotors and SERVOPACKs

Rotary Servomotor Model		Capacity	SERVOPACK Model
			SGD7C-
SGMMV (Low Inertia, Ultra-small Capacity) 3000 min^{-1}	SGMMV-A1A	10 W	1R6A*, 2R8A*
	SGMMV-A2A	20 W	
	SGMMV-A3A	30 W	1R6A, 2R8A*
SGM7J (Medium Inertia, Small Capacity) 3000 min^{-1}	SGM7J-A5A	50 W	1R6A*, 2R8A*
	SGM7J-01A	100 W	
	SGM7J-C2A	150 W	1R6A, 2R8A*
	SGM7J-02A	200 W	
	SGM7J-04A	400 W	2R8A, 5R5A*, 7R6A*
	SGM7J-06A	600 W	5R5A, 7R6A
	SGM7J-08A	750 W	
SGM7A (Low Inertia, Small Capacity) 3000 min^{-1}	SGM7A-A5A	50 W	1R6A*, 2R8A*
	SGM7A-01A	100 W	
	SGM7A-C2A	150 W	1R6A, 2R8A*
	SGM7A-02A	200 W	
	SGM7A-04A	400 W	2R8A, 5R5A*, 7R6A*
	SGM7A-06A	600 W	5R5A, 7R6A
	SGM7A-08A	750 W	
SGM7P (Medium Inertia, Flat) 3000 min^{-1}	SGM7P-01A	100 W	1R6A*, 2R8A*
	SGM7P-02A	200 W	2R8A, 5R5A*, 7R6A*
	SGM7P-04A	400 W	
	SGM7P-08A	750 W	5R5A, 7R6A
SGM7G (Medium Inertia, Medium Capacity) 1500 min^{-1}	SGM7G-03A	300 W	5R5A*, 7R6A*
	SGM7G-05A	450 W	
	SGM7G-09A	850 W	7R6A

* If you use this combination, performance may not be as good, e.g., the control gain may not increase, in comparison with using a Σ-7S SERVOPACK.

1.11.2 Combinations of Direct Drive Servomotors and SERVOPACKs

Direct Drive Servomotor Model		Rated Torque [N·m]	Instantaneous Maximum Torque [N·m]	SERVOPACK Model
				SGD7C-
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-04B	4	12	2R8A
	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*
SGM7F (Medium Capacity, With Core, Inner Rotor)	SGM7F-45M	45	135	7R6A
SGMCV (Small Capacity, With Core, Inner Rotor)	SGMCV-04B	4	12	2R8A
	SGMCV-10B	10	30	
	SGMCV-14B	14	42	5R5A
	SGMCV-08C	8	24	2R8A
	SGMCV-17C	17	51	5R5A
	SGMCV-25C	25	75	7R6A
	SGMCV-16D	16	48	5R5A
	SGMCV-35D	35	105	7R6A*
SGMCS (Small Capacity, Coreless, Inner Rotor)	SGMCS-02B	2	6	2R8A
	SGMCS-05B	5	15	
	SGMCS-07B	7	21	
	SGMCS-04C	4	12	
	SGMCS-10C	10	30	
	SGMCS-14C	14	42	
	SGMCS-08D	8	24	
	SGMCS-17D	17	51	
	SGMCS-25D	25	75	
	SGMCS-16E	16	48	5R5A
	SGMCS-35E	35	105	
SGMCS (Medium Capacity, With Core, Inner Rotor)	SGMCS-45M	45	135	7R6A

* Use derated values for this combination. Refer to the following catalog for information on derating values.
📖 AC Servo Drives Σ-7 Series (Manual No.: KAEP S800001 23)

1.11.3 Combinations of Linear Servomotors and SERVOPACKs

Linear Servomotor Model		Rated Force [N]	Instantaneous Maximum Force [N]	SERVOPACK Models
				SGD7C-
SGLG (Coreless Models), Used with Standard-Force Magnetic Way	SGLGW-30A050C	12.5	40	1R6A
	SGLGW-30A080C	25	80	
	SGLGW-40A140C	47	140	
	SGLGW-40A253C	93	280	
	SGLGW-40A365C	140	420	2R8A
	SGLGW-60A140C	70	220	1R6A
	SGLGW-60A253C	140	440	2R8A
	SGLGW-60A365C	210	660	5R5A
SGLG (Coreless Models), Used with High-Force Magnetic Way	SGLGW-40A140C	57	230	1R6A
	SGLGW-40A253C	114	460	2R8A
	SGLGW-40A365C	171	690	5R5A
	SGLGW-60A140C	85	360	1R6A
	SGLGW-60A253C	170	720	5R5A
	SGLGW-60A365C	255	1080	7R6A
SGLF (Models with F-type Iron Cores)	SGLFW-20A090A	25	86	1R6A
	SGLFW-20A120A	40	125	
	SGLFW-35A120A	80	220	
	SGLFW-35A230A	160	440	5R5A
	SGLFW-50A200B	280	600	
	SGLFW2-30A070A	45	135	1R6A
	SGLFW2-30A120A	90	270	
	SGLFW2-30A230A*	180	540	–
		170	500	2R8A
	SGLFW2-45A200A	280	840	5R5A
SGLT (Models with T-type Iron Cores)	SGLTW-20A170A	130	380	5R5A
	SGLTW-20A320A	250	760	7R6A
	SGLTW-20A460A	380	1140	–
	SGLTW-35A170A	220	660	5R5A
	SGLTW-35A170H	300	600	
	SGLTW-50A170H	450	900	

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

1.12 Installable Option Modules

You can connect an Option Unit to a SERVOPACK to install an MP2000-Series Option Module. The following table lists the Option Modules that you can install.

Module	Abbreviation
Communications Modules	260IF-01
	217IF-01 and 265IF-01
	218IF-01, 218IF-02, 261IF-01, 262IF-01, 263IF-01, and 264IF-01
	266IF-01, 266IF-02, and 267IF-01
Communications Modules from other companies	AFMP-01 (from AnyWire Co., Ltd.)
	AFMP-02-C and AFMP-02-CA (from AnyWire Co., Ltd.)
	MPANL00-0, MPALL00-0, MPAL000-0, and MPAN000-0 (from ALGO System)
	MPCUNET-0 (from ALGO System)
	MPHLS-01 (from M-System Co., Ltd.)
I/O Modules	LIO-01, LIO-02, LIO-04, LIO-05, and LIO-06
	AI-01 and AO-01
	DO-01 and CNTR-01

1.13 Functions

1.13.1 Servo Section Functions

This section lists the functions of the Servo Section. Refer to the reference pages for details on the functions.

- Functions Related to the Machine

Function	Reference
Power Supply Type Settings for the Main Circuit and Control Circuit	page 5-13
Automatic Detection of Connected Motor	page 5-15
Motor Direction Setting	page 5-16
Linear Encoder Pitch Setting	page 5-17
Writing Linear Servomotor Parameters	page 5-18
Selecting the Phase Sequence for a Linear Servomotor	page 5-22
Polarity Sensor Setting	page 5-24
Polarity Detection	page 5-25
Overtravel Function and Settings	page 5-28
Holding Brake	page 5-32
Motor Stopping Methods for Servo OFF and Alarms	page 5-36
Resetting the Absolute Encoder	page 5-43
Setting the Origin of the Absolute Encoder	page 5-46
Setting the Regenerative Resistor Capacity	page 5-49
Operation for Momentary Power Interruptions	page 5-65
SEMI F47 Function	page 5-66
Setting the Motor Maximum Speed	page 5-68
Multiturn Limit Setting	page 5-75
Adjustment of Motor Current Detection Signal Offset	page 5-83
Forcing the Motor to Stop	page 5-87
Speed Ripple Compensation	page 8-58
Current Gain Level Setting	page 8-71
Speed Detection Method Selection	page 8-72
External Latches	–

- Functions Related to the Host Controller

Function	Reference
Electronic Gear Settings	page 5-41
I/O Signal Allocations	page 5-50
ALM (Servo Alarm) Signal	page 5-56
/WARN (Warning) Signal	page 5-56
/TGON (Rotation Detection) Signal	page 5-57
/S-RDY (Servo Ready) Signal	page 5-58
/V-CMP (Speed Coincidence Detection) Signal	page 5-58
/COIN (Positioning Completion) Signal	page 5-60
/NEAR (Near) Signal	page 5-62
Speed Limit during Torque Control	page 5-63
/VLT (Speed Limit Detection) Signal	page 5-63
Selecting Torque Limits	page 5-69
Vibration Detection Level Initialization	page 5-80
Alarm Reset	*
Replacing the Battery	page 10-3
Setting the Position Deviation Overflow Alarm Level	page 8-8

* Refer to the following manual for details.

📖 Σ-7-Series Σ-7C SERVOPACK Troubleshooting Manual (Manual No.: SIEP S800002 07)

- Functions to Achieve Optimum Motions

Function	Reference
Tuning-less Function	page 8-12
Autotuning without a Host Reference	page 8-23
Autotuning with a Host Reference	page 8-34
Custom Tuning	page 8-41
Anti-Resonance Control Adjustment	page 8-49
Vibration Suppression	page 8-54
Gain Selection	page 8-64
Friction Compensation	page 8-68
Gravity Compensation	page 8-70
Model Following Control	page 8-81
Compatible Adjustment Functions	page 8-84
Mechanical Analysis	page 8-88
EasyFFT	page 8-90

- Functions for Trial Operation during Setup

Function	Reference
Trial Operation for the Servomotor without a Load	page 6-6
Program Jogging	page 6-13
Origin Search	page 6-18
Test without a Motor	page 6-20
Monitoring Machine Operation Status and Signal Waveforms	page 9-6

- Functions for Inspection and Maintenance

Function	Reference
Write Prohibition Setting for Parameters	page 5-8
Initializing Parameter Settings	page 5-10
Automatic Detection of Connected Motor	page 5-15
Monitoring Product Information	page 9-2
Monitoring Product Life	page 9-10
Alarm History Display	*
Alarm Tracing	page 9-13

* Refer to the following manual for details.

📖 Σ-7-Series Σ-7C SERVOPACK Troubleshooting Manual (Manual No.: SIEP S800002 07)

1.13.2 Controller Section Functions

The following table lists the functions of the Controller Section. Refer to the reference pages for details on the functions.

Function		Reference
Programs	Ladder Programs	Refer to the following sections for details. ☞ *7.1.1 Ladder Programs* on page 7-3 ☞ *7.2 Creating Ladder Programs* on page 7-38 Refer to the following manual for details. 📖 MP3000 Series Ladder Programming Manual (Manual No.: SIEP C880725 13)
	Motion Programs	Refer to the following sections for details. ☞ *7.1.2 Motion Programs* on page 7-11 ☞ *7.3 Creating Motion Programs* on page 7-42 Refer to the following manual for details. 📖 MP3000 Series Motion Programming Manual (Manual No.: SIEP C880725 14)
	Sequence Programs	Refer to the following sections for details. ☞ *7.1.3 Sequence Programs* on page 7-23 ☞ *7.4 Creating a Sequence Program* on page 7-47 Refer to the following manual for details. 📖 MP3000 Series Motion Programming Manual (Manual No.: SIEP C880725 14)
Registers		*7.1.5 Registers* on page 7-26
Table Data		MP3000 Series Ladder Programming Manual (Manual No.: SIEP C880725 13)
Scan		*7.1 User Program Types and Execution Timing* on page 7-3
Self Configuration		*4.3 Self Configuration* on page 4-21
Communications Function Module		The Communications Function Module is used to communicate with the host controller. Refer to the following section for information on communications with the MPE720. ☞ *4.4 Going Online with a SERVOPACK* on page 4-46 Refer to the following manual for information on communications with touch panels and other devices. 📖 MP3000 Series Communications User's Manual (Manual No.: SIEP C880725 12)
Motion Control Function Module		The Motion Control Function Module is used to communicate with devices that support MECHATROLINK communications. Refer to the following manual for details. 📖 Σ-7-Series Σ-7C SERVOPACK Motion Control User's Manual (Manual No.: SIEP S800002 03)
Data Logging		*12.1 Data Logging* on page 12-3
USB Memory		*12.2 USB Memory* on page 12-17
File Transfer Specification		*12.3 File Transfer* on page 12-20
Calendar		*12.4 Calendar* on page 12-30
Maintenance Monitoring		*12.5 Maintenance Monitoring* on page 12-31
Security Functions		*12.6 Security Functions* on page 12-37
Counter Function Module		*12.8 Counter Function Module* on page 12-52
M-EXECUTOR Function Module		*12.9 The M-EXECUTOR Function Module* on page 12-68

Installation

2

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

2.1 Installation Precautions

Refer to the following section for the ambient installation conditions.

☞ *1.5.3 General Specifications* on page 1-13

■ Installation Near Sources of Heat

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

■ Installation Near Sources of Vibration

Install a vibration absorber on the mounting surface of the SERVOPACK so that the SERVOPACK will not be subjected to vibration.

■ Installation Near Devices That Generate Strong Magnetic Fields

Do not install the SERVOPACK in a location with a magnetic density of 0.01 teslas (100 gausses) or greater.

■ Other Precautions

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

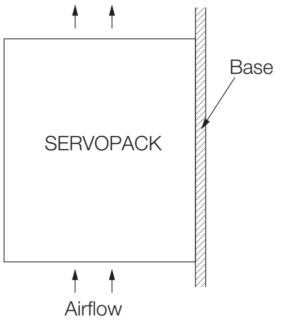
2.2 Mounting Types and Orientations

The SERVOPACKs are available in base-mounted and rack-mounted models. Regardless of the mounting type, mount the SERVOPACK vertically, as shown in the following figures.

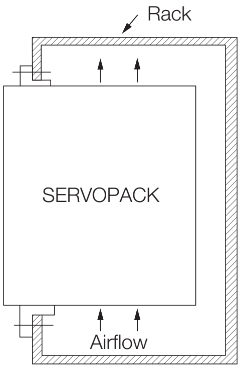
Also, mount the SERVOPACK so that the front panel is facing toward the operator.

Note: Prepare three or 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



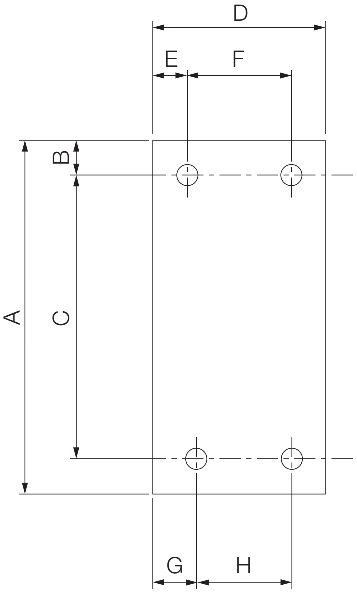
- Rack-mounted SERVOPACK



2.3 Mounting Hole Dimensions

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

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

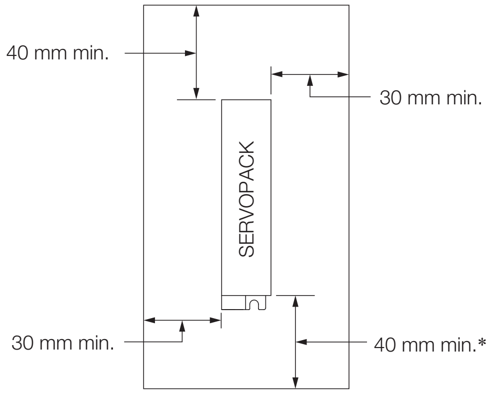


SERVOPACK Model		Dimensions (mm)								Screw Size	Number of Screws
		A	B	C	D	E	F	G	H		
SGD7C-	1R6A or 2R8A	168	5	160 ±0.5	100	5	90 ±0.5	5	90 ±0.5	M4	4
	5R5A or 7R6A	168	5	160 ±0.5	135	5	125 ±0.5	5	120 ±0.5	M4	4

2.4 Mounting Interval

2.4.1 Installing One SERVOPACK in a Control Panel

Provide the following spaces around the SERVOPACK.

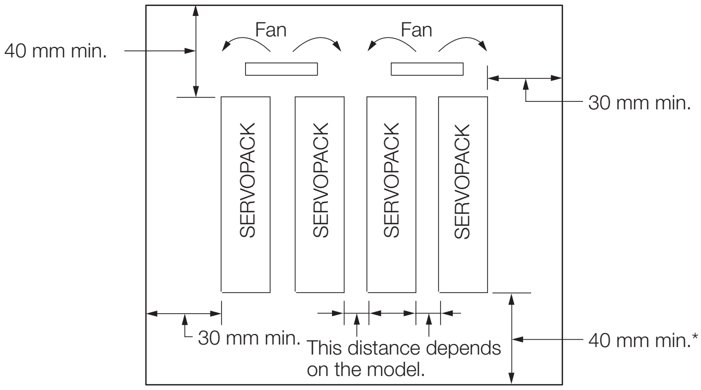


* For this dimension, ignore items protruding from the main body of the SERVOPACK.

2.4.2 Installing More Than One SERVOPACK in a Control Panel

Provide the following spaces around the SERVOPACK.

Important Install cooling fans above the SERVOPACKs so that hot spots do not occur around the SERVOPACKs. Provide sufficient intervals and spaces as shown in the following figure to enable cooling by the fans and natural convection.



* 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
SGD7C-1R6A, -2R8A, -5R5A, and -7R6A	5 mm min.	Air speed: 1.0 m/s min.

2.5 Monitoring the Installation Environment

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

You can access the SERVOPACK Installation Environment Monitor with the following menu command on the SigmaWin+: ***Life Monitor* – *Installation Environment Monitor* – *SERVOPACK***.

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

- Lower the surrounding temperature.
- Decrease the load.

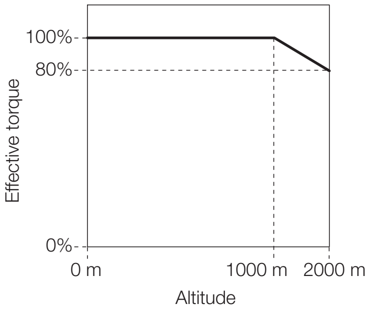
Information The value of the SERVOPACK Installation Environment Monitor parameter will increase by about 10% for each 10°C increase in the surrounding air temperature.

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.

2.6 Derating Specifications

If you use the SERVOPACK at an altitude of 1,000 m to 2,000 m, you must apply the derating rates given in the following graph.

- SGD7C-1R6A, -2R8A, -5R5A, and -7R6A



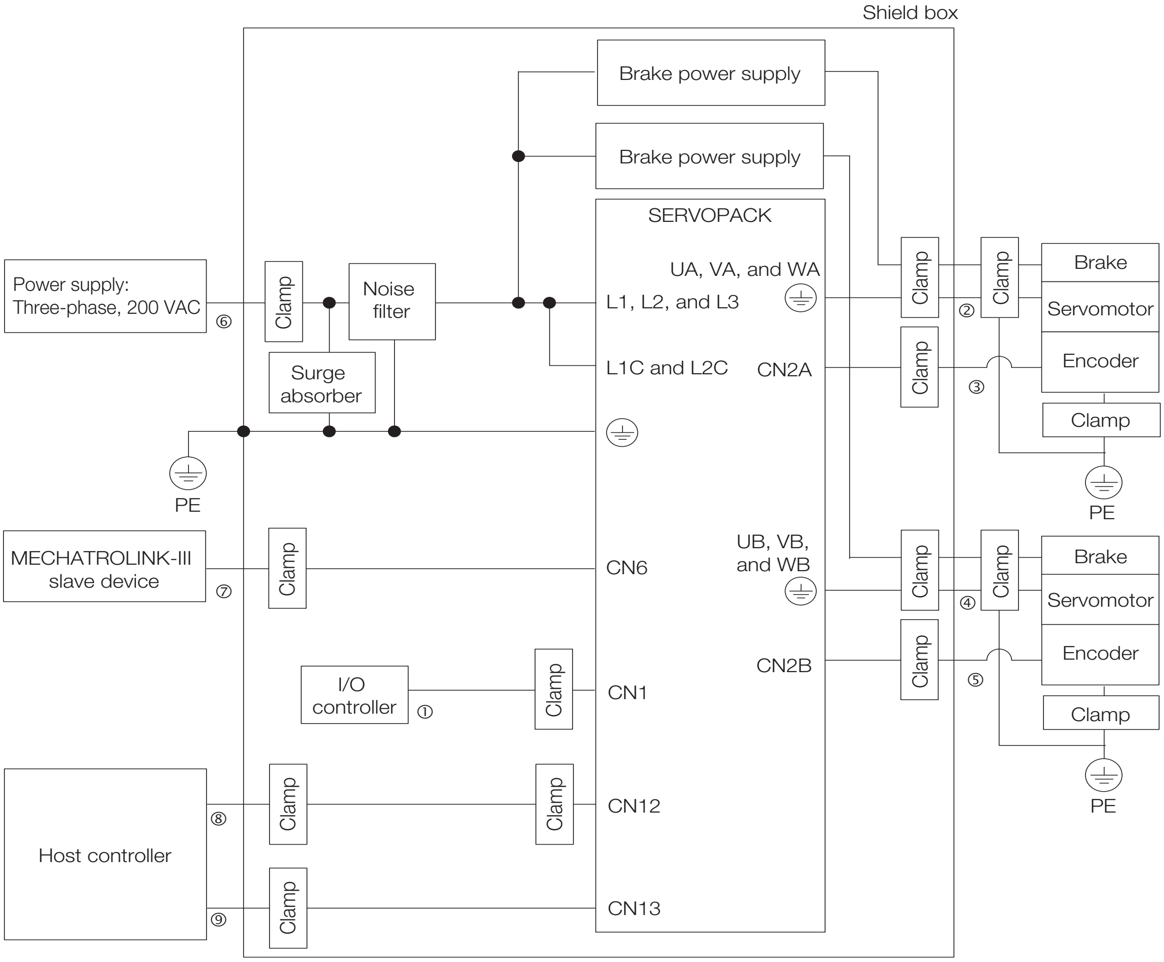
2.7 EMC Installation Conditions

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.

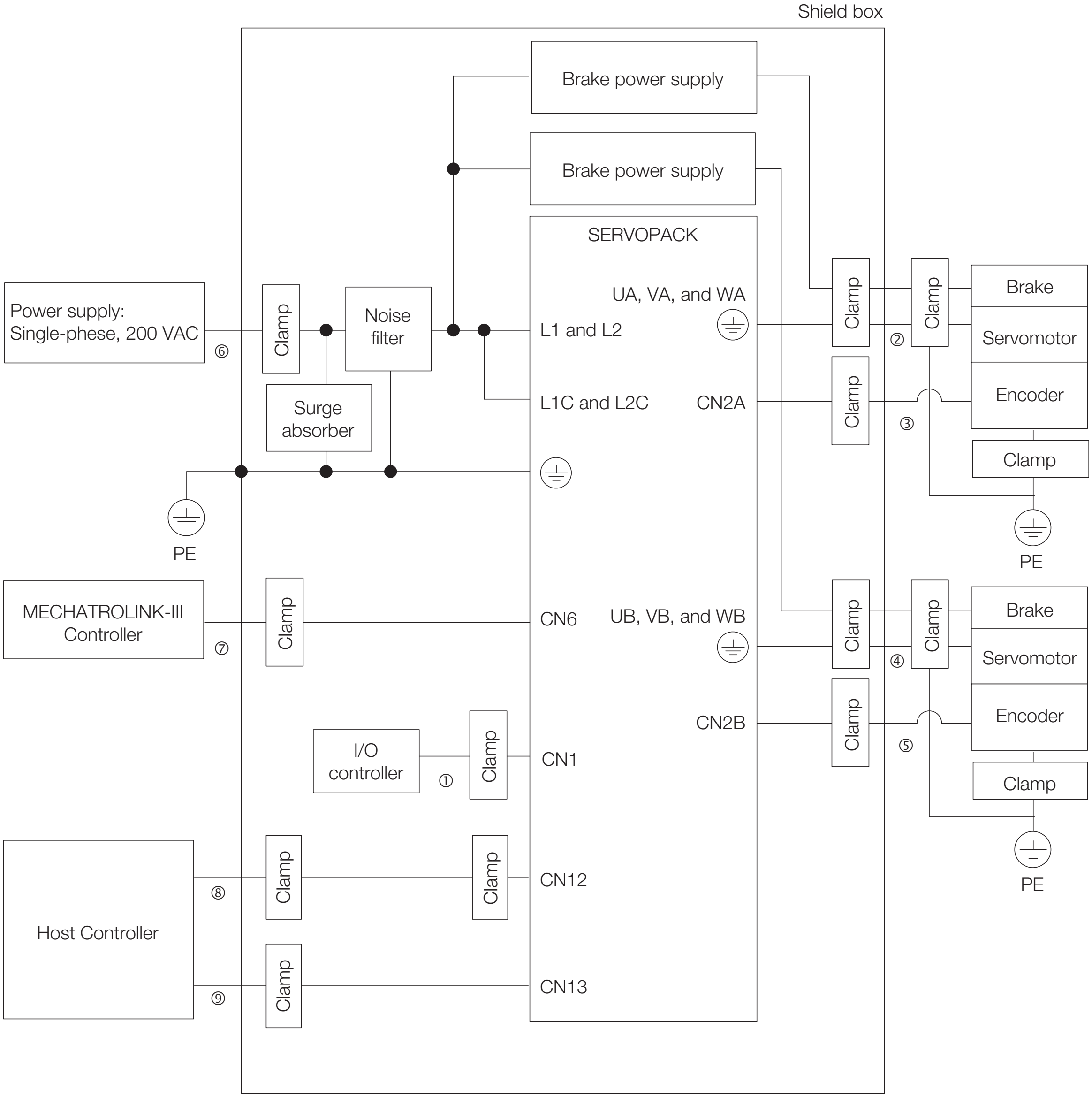
The applicable standards are EN 55011 group 1 class A, EN 61000-6-2, EN 61000-6-4, and EN 61800-3 (category C2, second environment).

- Three-Phase, 200 VAC



Code	Cable Name	Specification
①	I/O Signal Cable (CN1)	Shielded cable
②	Motor Main Circuit Cable for axis A	Shielded cable
③	Encoder Cable for axis A	Shielded cable
④	Motor Main Circuit Cable for axis B	Shielded cable
⑤	Encoder Cable for axis B	Shielded cable
⑥	Main Circuit Power Cable	Shielded cable
⑦	MECHATROLINK-III Communications Cable	Shielded cable
⑧	Ethernet Cable	Shielded cable
⑨	I/O Signal Cable (CN13)	Shielded cable

- Single-Phase, 200 VAC



Symbol	Cable Name	Specification
①	I/O Signal Cable	Shielded cable
②	Motor Main Circuit Cable for axis A	Shielded cable
③	Encoder Cable for axis A	Shielded cable
④	Motor Main Circuit Cable for axis B	Shielded cable
⑤	Encoder Cable for axis B	Shielded cable
⑥	Main Circuit Power Cable	Shielded cable
⑦	MECHATROLINK-III Communications Cable	Shielded cable
⑧	Ethernet Cable	Shielded cable
⑨	I/O Signal Cable (CN13)	Shielded cable

2.8 Installing Option Modules

You can mount one Option Module on the SERVOPACK.
First connect the Optional Unit to the SERVOPACK, and then mount the Option Module.

Refer to the following manual for details on mounting the Option Module.
📖 Σ-7-Series Option Base Instructions (Manual No.: TOMP C880725 26)

Wiring and Connections

3

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

3.1 Wiring Precautions

3.1.1 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 SERVOPACK failure.
- **Check all wiring and power supplies carefully.**
  Incorrect wiring or incorrect voltage application to the output circuits may cause short-circuit failures. If a short-circuit failure occurs as a result of any of these causes, the holding brake will not work. This could damage the machine or cause an accident that may result in death or injury.
- **Connect the AC 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

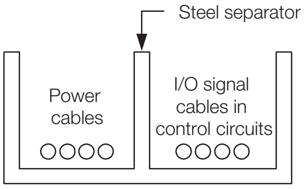
- **Wait for at least six minutes after turning OFF the power supply and then make sure that the CHARGE indicator is not lit before starting wiring or inspection work. Do not touch the power supply terminals while the CHARGE lamp is lit because high voltage may still remain in the SERVOPACK even after turning OFF the power supply.**
  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 SERVOPACK failure or malfunction.
- **Connect wires to power supply terminals and motor connection terminals securely with the specified methods and tightening torque.**
  Insufficient tightening may cause wires and terminal blocks to generate heat due to faulty contact, possibly resulting in fire.
- **Use shielded twisted-pair cables or shielded 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 Encoder Cables or Servomotor Main Circuit Cables.**
- **Observe the following precautions when wiring the SERVOPACK's main circuit terminals.**
  - Turn ON the power supply 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.
- **In places with poor power supply conditions, ensure that the input power is supplied within the specified voltage range.**
  There is a risk of equipment damage.
- **Provide sufficient shielding when using the SERVOPACK in the following locations.**
  - Locations that are subject to noise, such as from static electricity
  - Locations that are subject to strong electromagnetic or magnetic fields
  - Locations that are subject to radiation
  - Locations that are near power lines

  There is a risk of equipment damage.

⚠ CAUTION

- **Configure the circuits to turn ON the control power supply to the SERVOPACK before the 24-V I/O power supply.**
  If the control power supply to the SERVOPACK is turned ON after the external power supply, e.g., the 24-V I/O power supply, the outputs from the SERVOPACK may momentarily turn ON when the power supply to the SERVOPACK turns ON. This can result in unexpected operation that may cause injury or device damage.
- **Provide emergency stop circuits, interlock circuits, limit circuits, and any other required safety measures in control circuits outside of the SERVOPACK.**
  There is a risk of injury or equipment damage.
- **If you use MECHATROLINK I/O Modules, use the establishment of MECHATROLINK communications as an interlock output condition.**
  There is a risk of device damage.
- **Select the I/O signal wires for external wiring to connect the SERVOPACK to external devices based on the following criteria:**
  - Mechanical strength
  - Noise interference
  - Wiring distance
  - Signal voltage
- **Separate the I/O signal cables for control circuits from the power cables both inside and outside the control panel to reduce the influence of noise from the power cables.**
  If the I/O signal lines and power lines are not separated properly, malfunction may occur.

Example of Separated Cables



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 cable connector lock screws and lock mechanisms.**
  Insufficient tightening may result in cable connectors falling off during operation.
- **Do not bundle power lines (e.g., the Main Circuit Cable) and low-current lines (e.g., the I/O Signal Cables or Encoder Cables) together or run them through the same duct. If you do not place power lines and low-current lines in separate ducts, separate them by at least 30 cm.**
  If the cables are too close to each other, malfunctions may occur due to noise affecting the low-current lines.
- **Install a battery at either the host controller or on the Encoder Cable.**
  If you install batteries both at the host controller and on the Encoder Cable at the same time, you will create a loop circuit between the batteries, resulting in a risk of damage or burning.
- **When connecting a battery, connect the polarity correctly.**
  There is a risk of battery rupture or encoder failure.

Important

- Use a molded-case circuit breaker (1QF) 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 (1QF) 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 an earth leakage breaker against overloads and short-circuiting, or install an earth leakage breaker combined with a molded-case circuit breaker.
- Do not turn the power supply ON and OFF more than necessary.
  - Do not use the SERVOPACK for applications that require the power supply to turn ON and OFF frequently. Such applications will cause elements in the SERVOPACK to deteriorate.
  - After you have started normal operation, allow at least one hour between turning the power supply ON and OFF (as a guideline).

To ensure safe, stable application of the servo system, observe the following precautions when wiring.

- Use the cables specified by Yaskawa. Design and arrange the system so that each cable is as short as possible.
  Refer to the following catalog or manual for information on the specified cables.
  📖 AC Servo Drives Σ-7 Series (Catalog No.: KAEP S800001 23)
  📖 Σ-7-Series Peripheral Device Selection Manual (Manual No.: SIEP S800001 32)
- 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.

3.1.2 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.

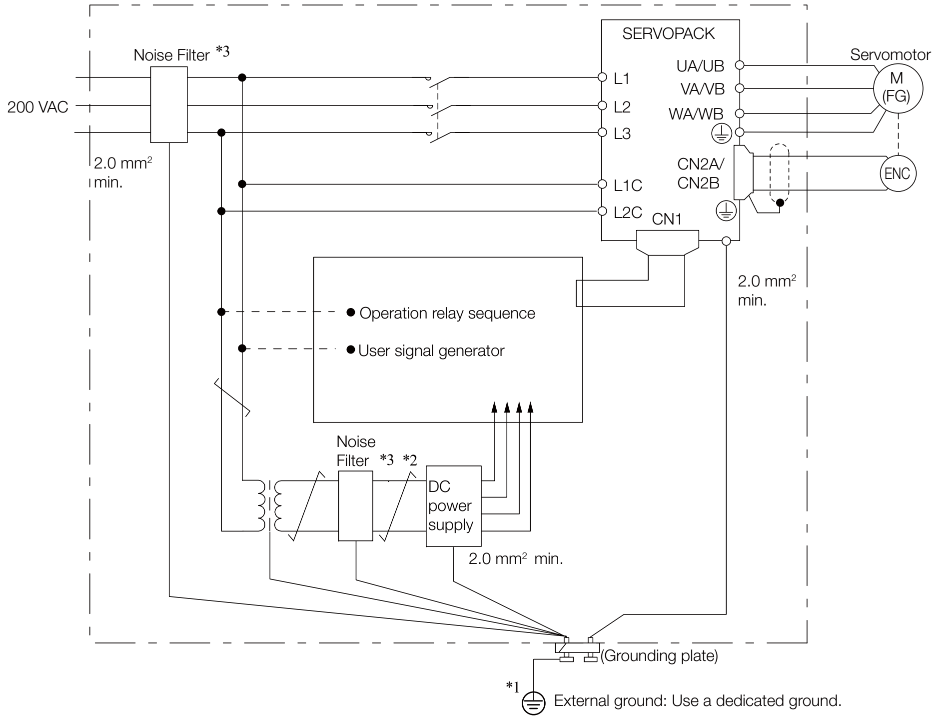
To prevent the noise from the SERVOPACK or the peripheral devices from causing malfunctions of any devices, take the following countermeasures against noise as required.

- 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.
  ☞ *Noise Filters* on page 3-7
- Implement suitable grounding measures. Refer to the following section for information on grounding measures.
  ☞ *3.1.3 Grounding* on page 3-9

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 .

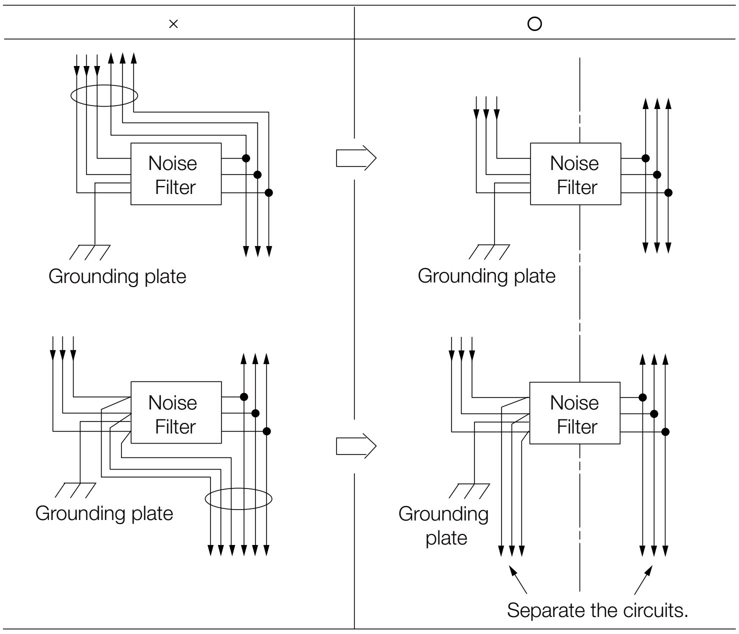
*3. Refer to the following section for precautions when using Noise Filters.

☞ *Noise Filter Wiring and Connection Precautions* on page 3-7

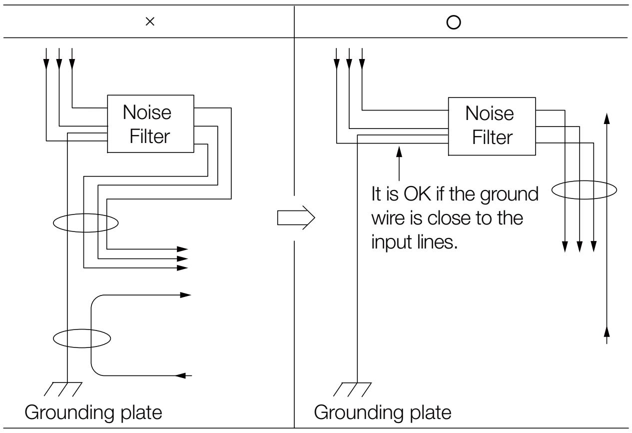
Noise Filter Wiring and Connection Precautions

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

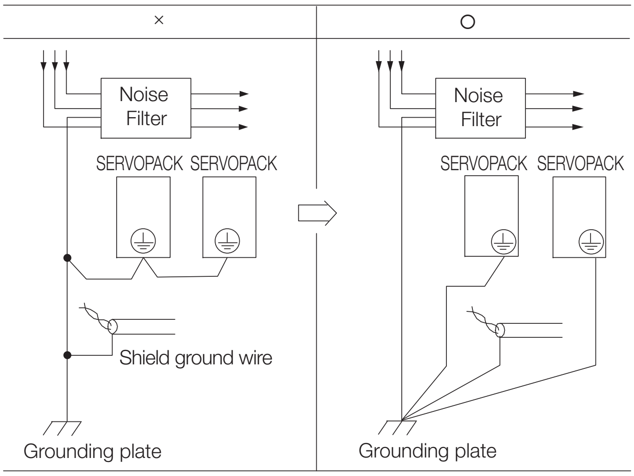
- Separate input lines from output lines. Do not place input lines and output lines in the same duct or bundle them together.



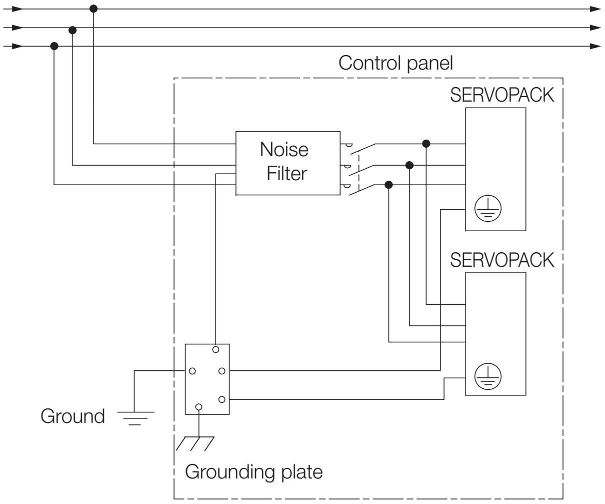
- Separate the Noise Filter ground wire from the output lines. Do not place the Noise Filter ground wire, output lines, and other signal lines in the same duct or bundle them together.



- 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.



3.1.3 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 max.
- Be sure to ground at one point only.
- Ground the Servomotor directly if the Servomotor is insulated from the machine.

Motor Frame Ground or Motor Ground

If you ground the Servomotor through the machine, switching noise current can flow from the main circuit of the SERVOPACK through the stray capacitance of the Servomotor. To prevent this, always connect the motor frame terminal (FG) or ground terminal (FG) of the Servomotor to the ground terminal (⏚) on the SERVOPACK.

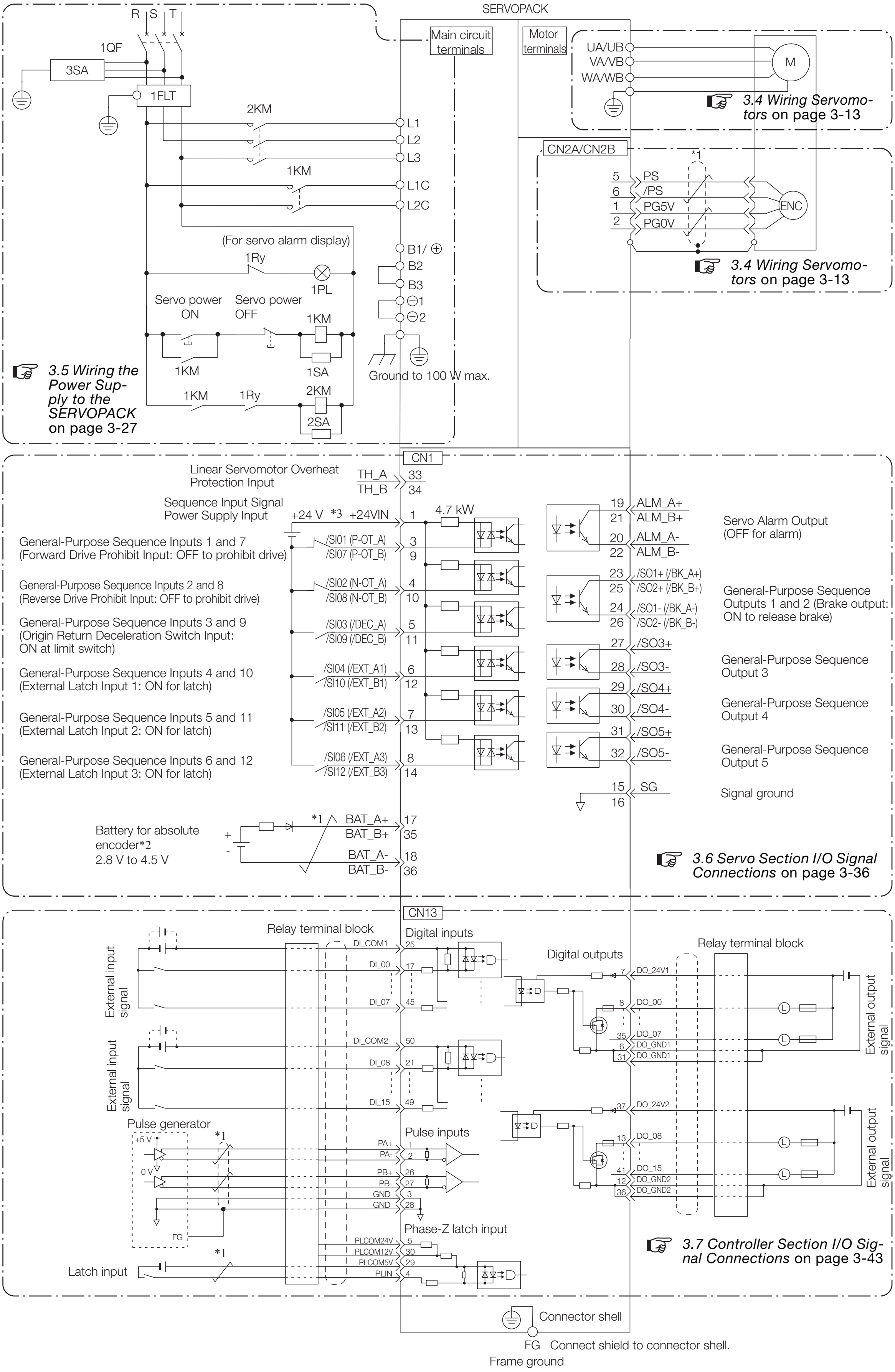
Ground both the Moving Coil and Magnetic Way of a Linear Servomotor.

Noise on I/O Signal Cables

If noise enters the I/O Signal Cable, 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.

3.2 Basic Wiring Diagrams

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



3.4 Wiring Servomotors on page 3-13

3.4 Wiring Servomotors on page 3-13

3.5 Wiring the Power Supply to the SERVOPACK on page 3-27

3.6 Servo Section I/O Signal Connections on page 3-36

3.7 Controller Section I/O Signal Connections on page 3-43

*1.  represents twisted-pair wires.

*2. Connect these when using an absolute encoder. If the Encoder Cable with a Battery Case is connected, do not connect a backup battery.

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

Note: 1. You can use parameter settings to change some of the I/O signal allocations. Refer to the following section for details.

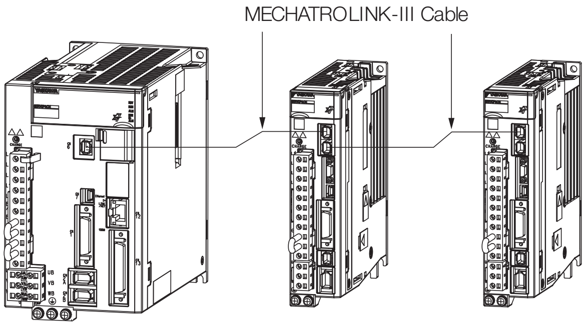
☞ *5.19 I/O Signal Allocations* on page 5-50

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.

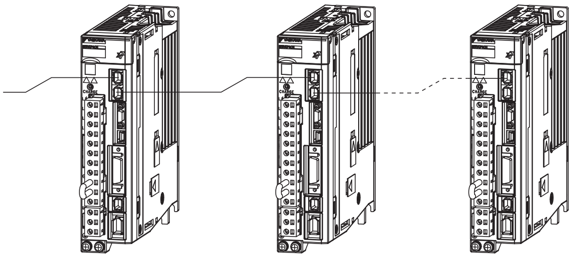
3.3 Flow of Wiring and Connections

The flow of wiring and connections is described below.

1. **Connect the SERVOPACK to the Servomotor.**
   Connect the motor cable, the encoder cable, and the ground terminals.
   Refer to the following section for details.
   ☞ *3.4 Wiring Servomotors* on page 3-13
2. **Wire the power supplies to the SERVOPACK.**
   Refer to the following section for details.
   ☞ *3.5 Wiring the Power Supply to the SERVOPACK* on page 3-27
3. **Connect the I/O signals.**
   Refer to the following sections for details.
   ☞ *3.6 Servo Section I/O Signal Connections* on page 3-36
   ☞ *3.8 Connecting MECHATROLINK Communications Cables* on page 3-46
4. **After wiring the power supplies, turn ON the power supplies, and confirm that power is being supplied normally. If power is supplied normally, the CHARGE and PWR indicators will be lit.**
   After confirmation, turn OFF the power supply.
5. **Connect the required devices using MECHATROLINK-III cables.**
   Refer to the following section for details.
   ☞ *3.8 Connecting MECHATROLINK Communications Cables* on page 3-46



Example If there is more than one Servo Drive, connect them in the same way. You can use either cascade connections or star configurations. The following figure shows an example of cascade connections. Refer to the following manual for details.
MECHATROLINK-III Compatible I/O Module User’s Manual (Manual No.: SIEP C880781 04)



3.4 Wiring Servomotors

3.4.1 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
UA, VA, and WA	Servomotor terminals for axis A	Refer to the following section for the wiring procedure. ☞ *3.5.2 Wiring Procedure for Main Circuit Connector* on page 3-29
UB, VB, and WB	Servomotor terminals for axis B	
⏚	Ground terminal	–
CN2A	Encoder connector for axis A	–
CN2B	Encoder connector for axis B	

3.4.2 Pin Layout of Encoder Connectors (CN2A and CN2B)

- When Using a Rotary Servomotor

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

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

- When Using a Direct Drive Servomotor

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

- 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	–

3.4.3 Wiring the SERVOPACK to the Encoder

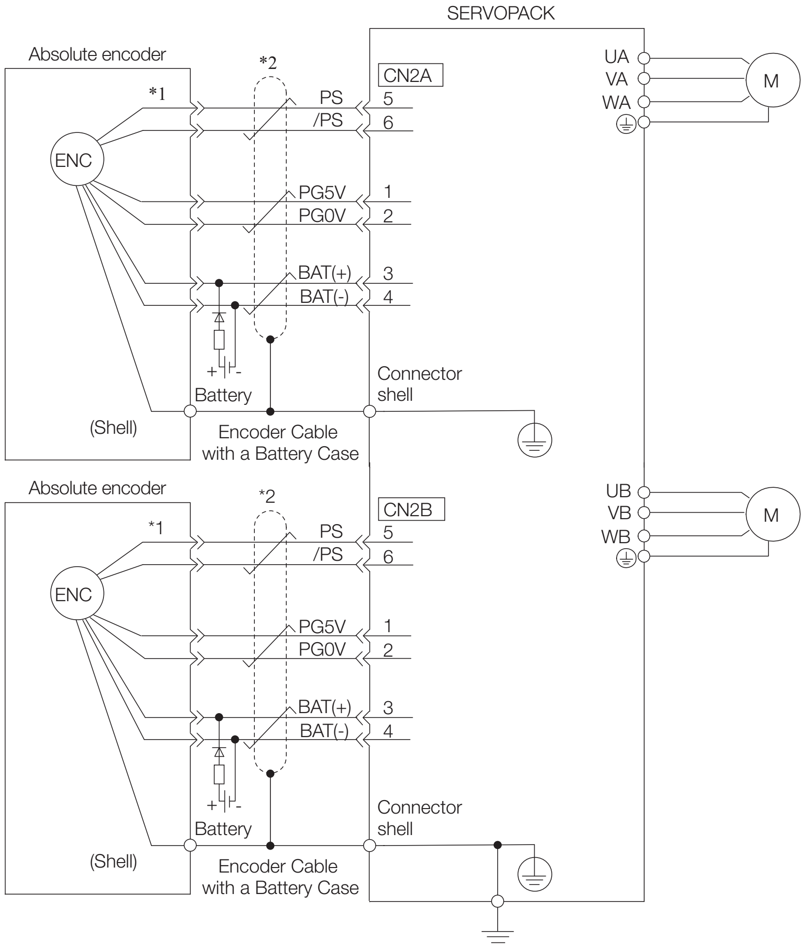
When Using an Absolute Encoder

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

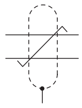
Refer to the following section for the battery replacement procedure.

☞ *10.1.3 Replacing the Battery* on page 10-3

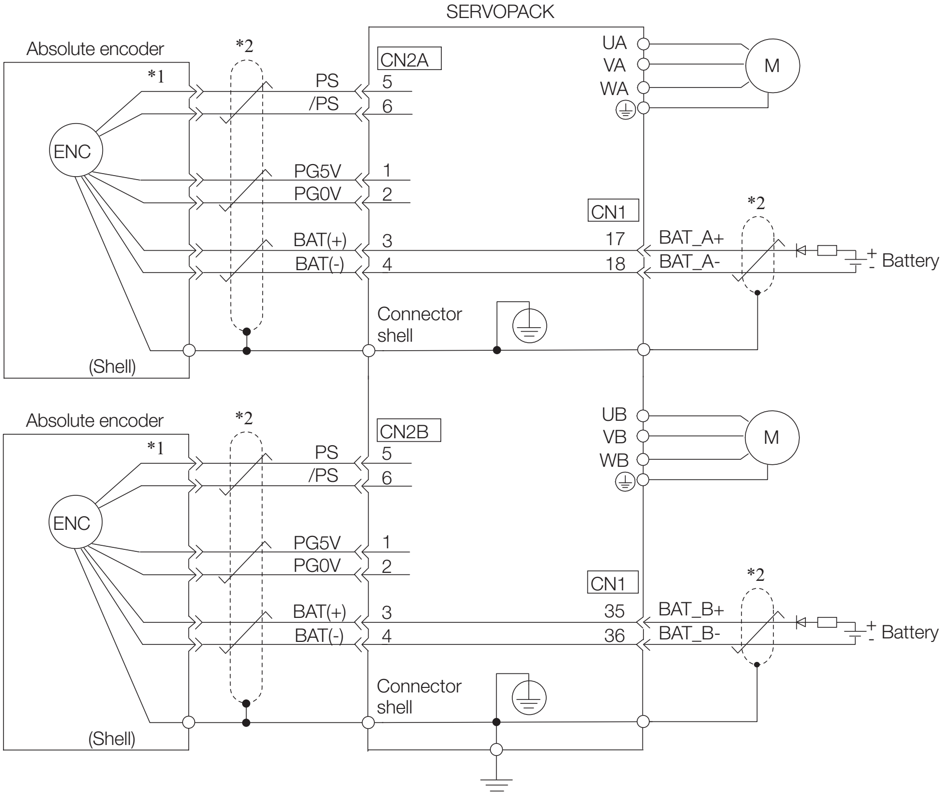
- Wiring Example When Using an Encoder Cable with a Battery Case



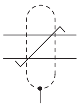
*1. The absolute encoder pin numbers for wiring the connector depend on the Servomotor that you use.

*2.  represents a shielded twisted-pair cable.

- Wiring Example When Installing a Battery on the Host Controller

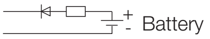


*1. The absolute encoder pin numbers for wiring the connector depend on the Servomotor that you use.

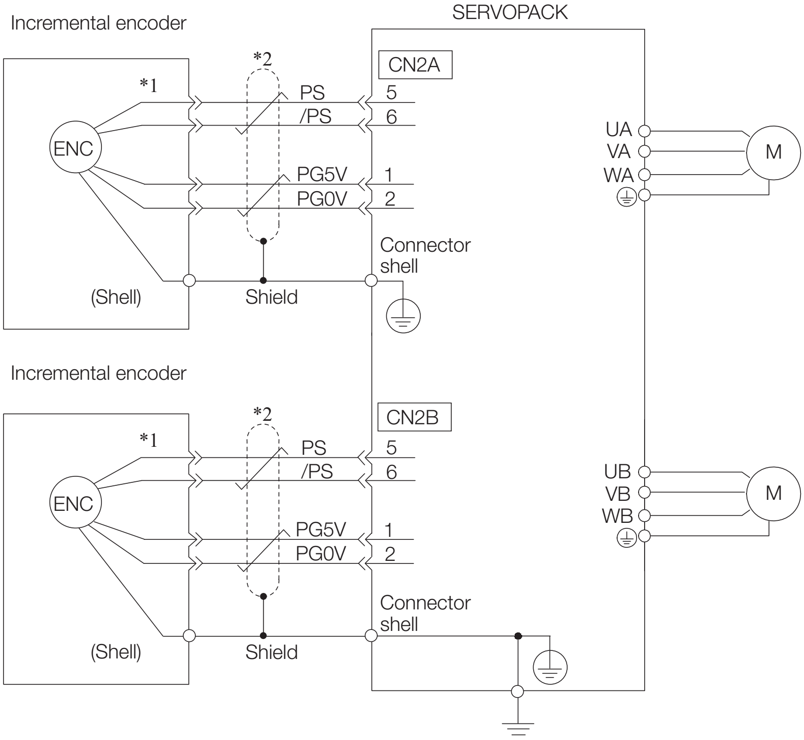
*2.  represents a shielded twisted-pair cable.

Important

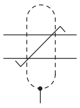
- When Installing a Battery on the Encoder Cable
  Use the Encoder Cable with a Battery Case that is specified by Yaskawa.
  Refer to the following manual for details.
  📖 **Σ-7-Series Peripheral Device Selection Manual (Manual No.: SIEP S800001 32)**
- When Installing a Battery on the Host Controller
  Insert a diode near the battery to prevent reverse current flow.

Circuit Example	Required Component Specifications	
 Battery	• 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.

When Using an Incremental Encoder



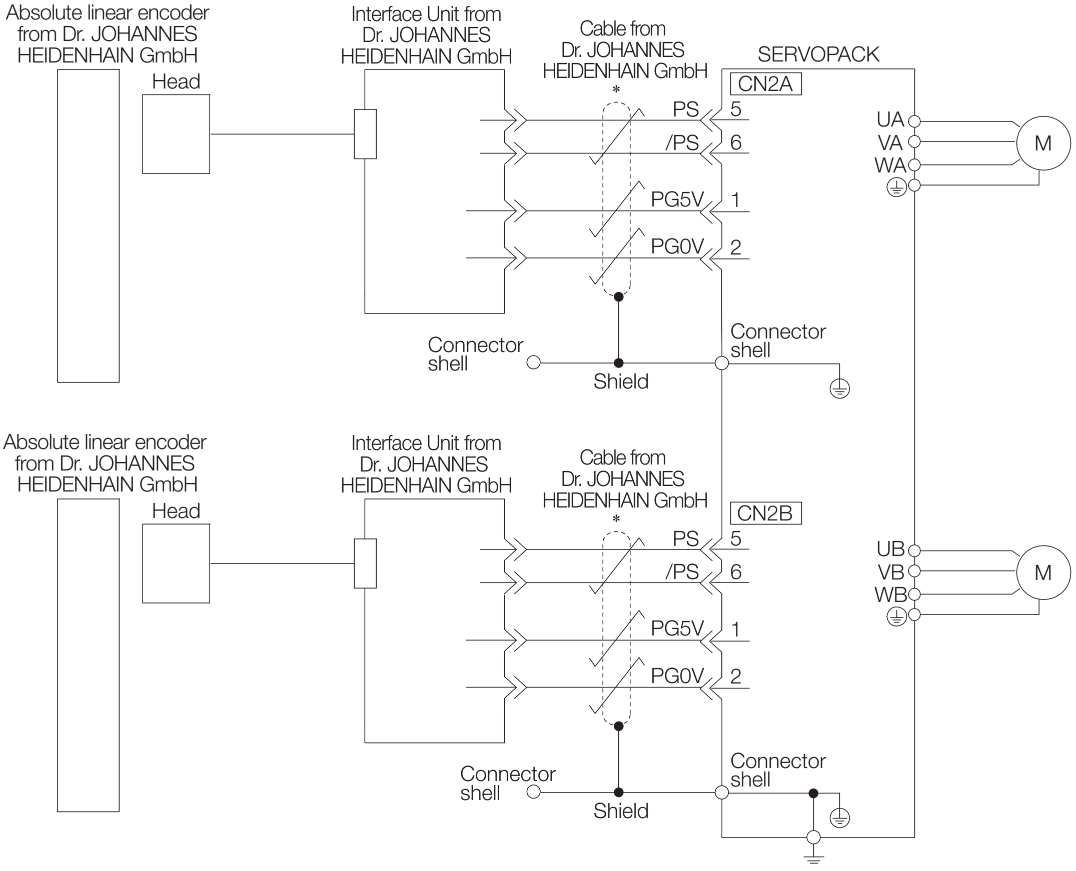
*1. The encoder pin numbers for wiring the connector depend on the Servomotor that you use.

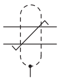
*2.  represents a shielded twisted-pair cable.

When Using an Absolute Linear Encoder

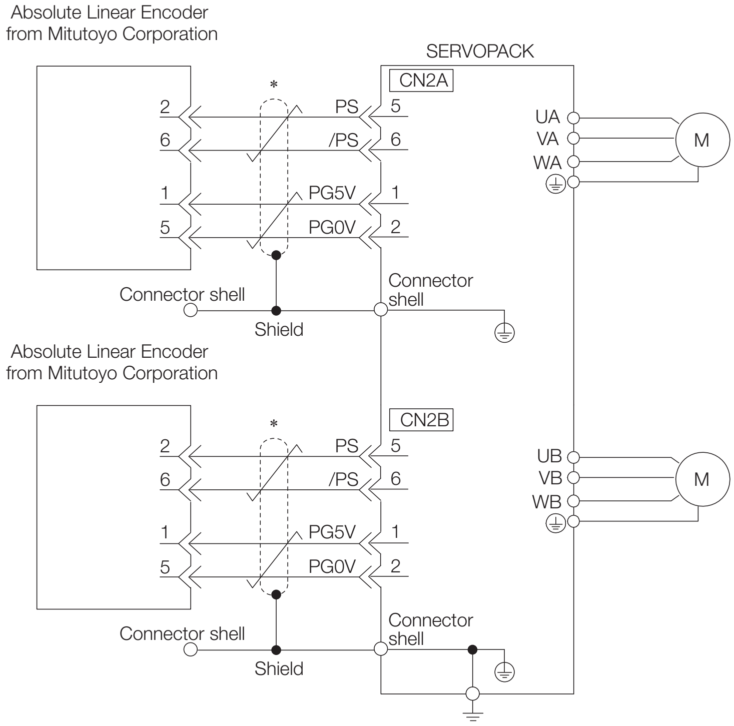
The wiring depends on the manufacturer of the linear encoder.

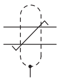
◆ Connections to Linear Encoder from Dr. JOHANNES HEIDENHAIN GmbH



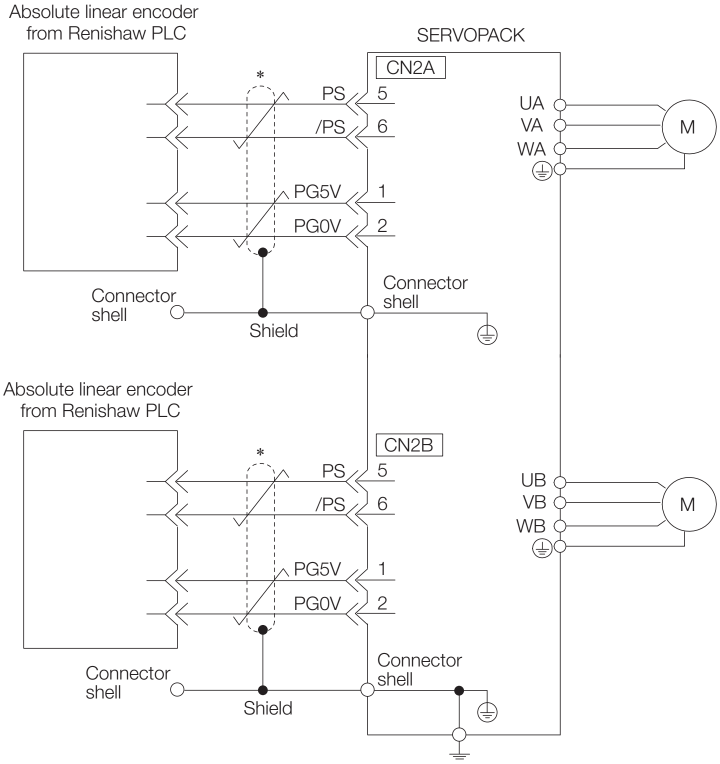
*  represents a shielded twisted-pair cable.

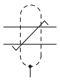
◆ Connections to Absolute Linear Encoder from Mitutoyo Corporation



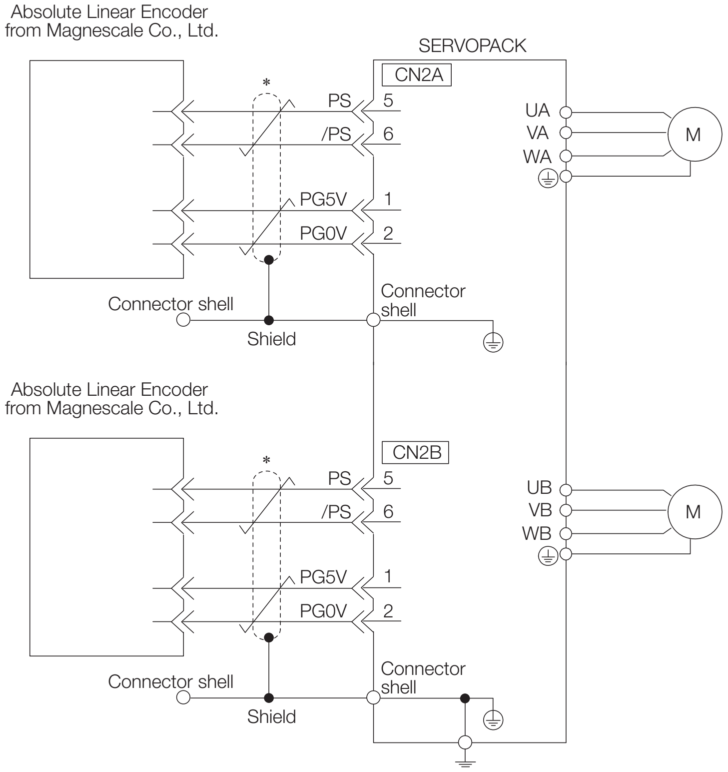
*  represents a shielded twisted-pair cable.

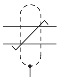
◆ Connections to Absolute Linear Encoder from Renishaw PLC



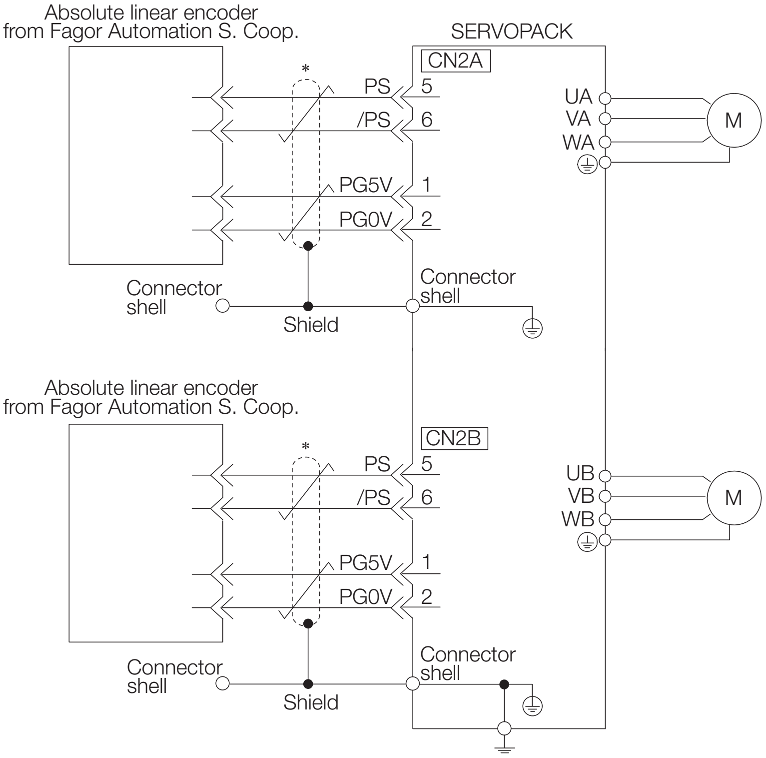
*  represents a shielded twisted-pair cable.

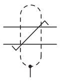
◆ Connections to Absolute Linear Encoder from Magnescale Co., Ltd.




* represents a shielded twisted-pair cable.

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

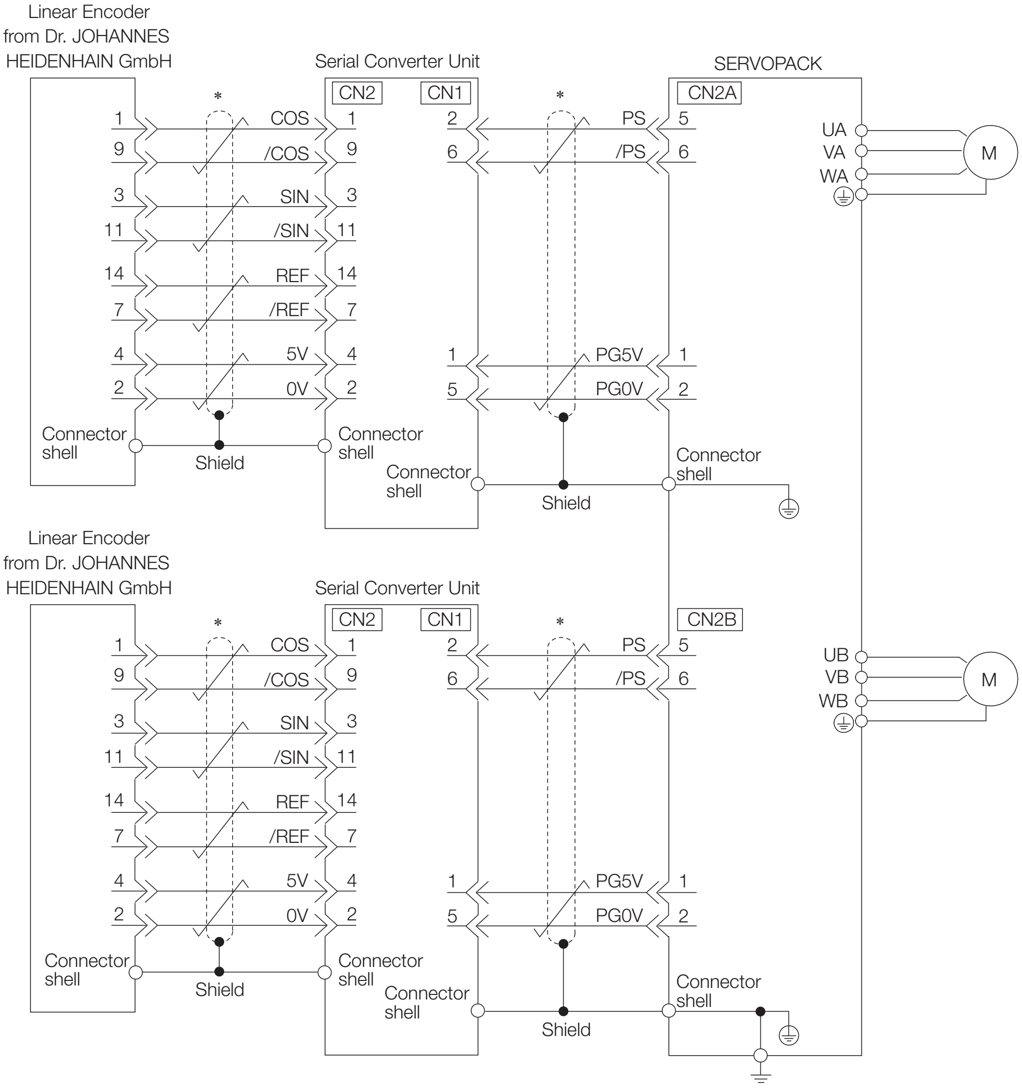


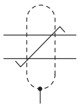

* represents a shielded twisted-pair cable.

When Using an Incremental Linear Encoder

The wiring depends on the manufacturer of the linear encoder.

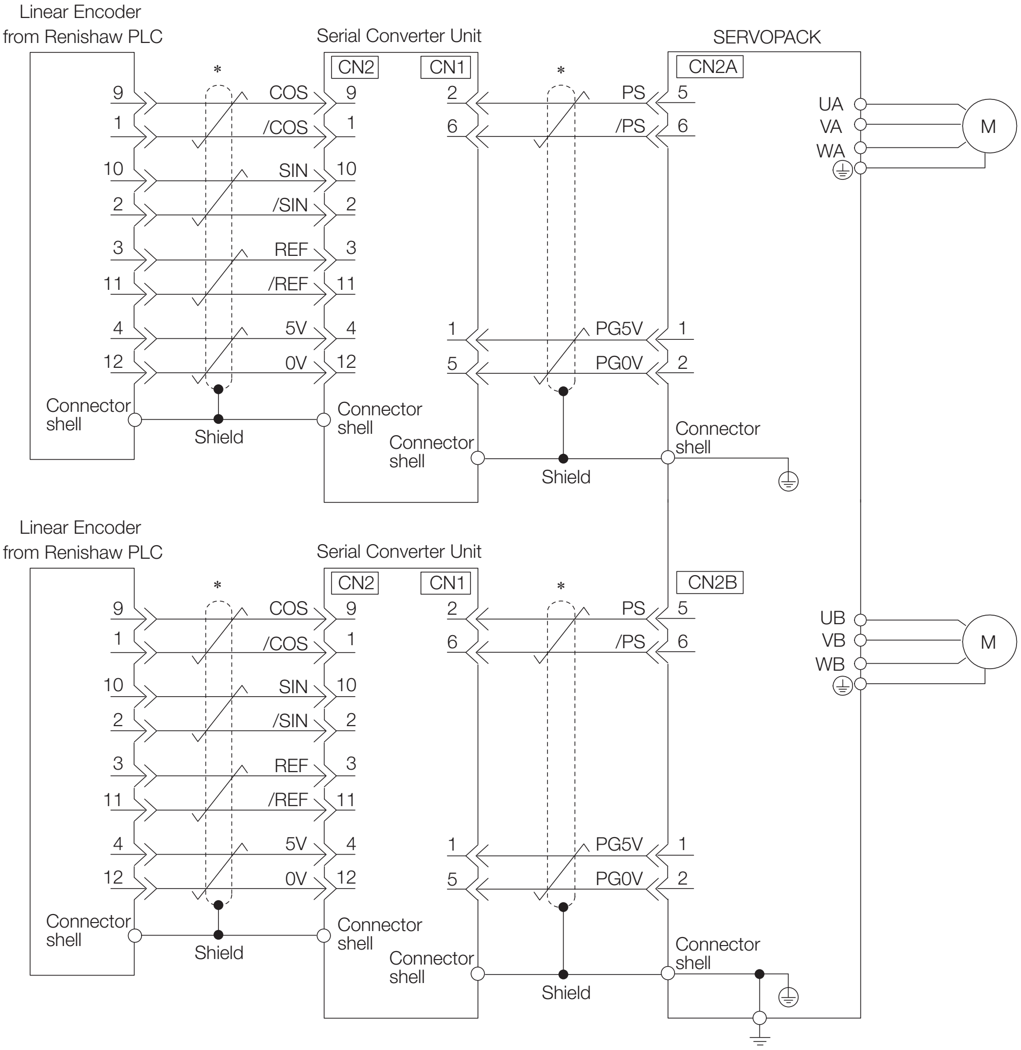
◆ Connections to Linear Encoder from Dr. JOHANNES HEIDENHAIN GmbH

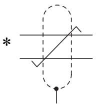




* represents a shielded twisted-pair cable.

◆ Connections to Linear Encoder from Renishaw PLC



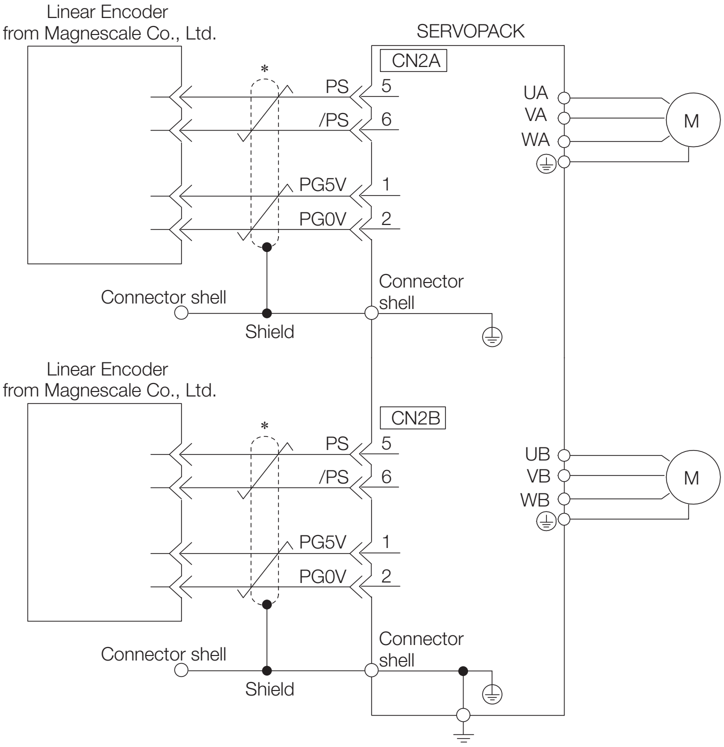


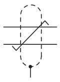
represents a shielded twisted-pair cable.

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

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

■ SR75 and SR85



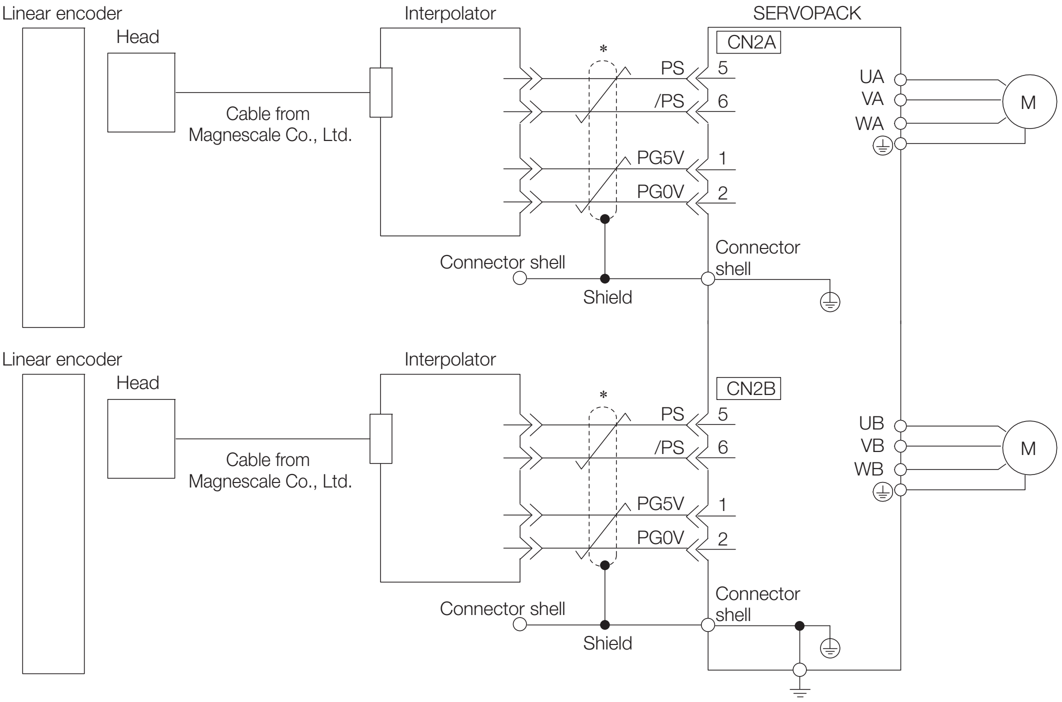

* represents a shielded twisted-pair cable.

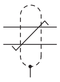
■ SL700, SL710, SL720, SL730, and SQ10

- PL101-RY, MQ10-FLA, or MQ10-GLA Interpolator
  The following table gives the Linear Encoder and Interpolator combinations.

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

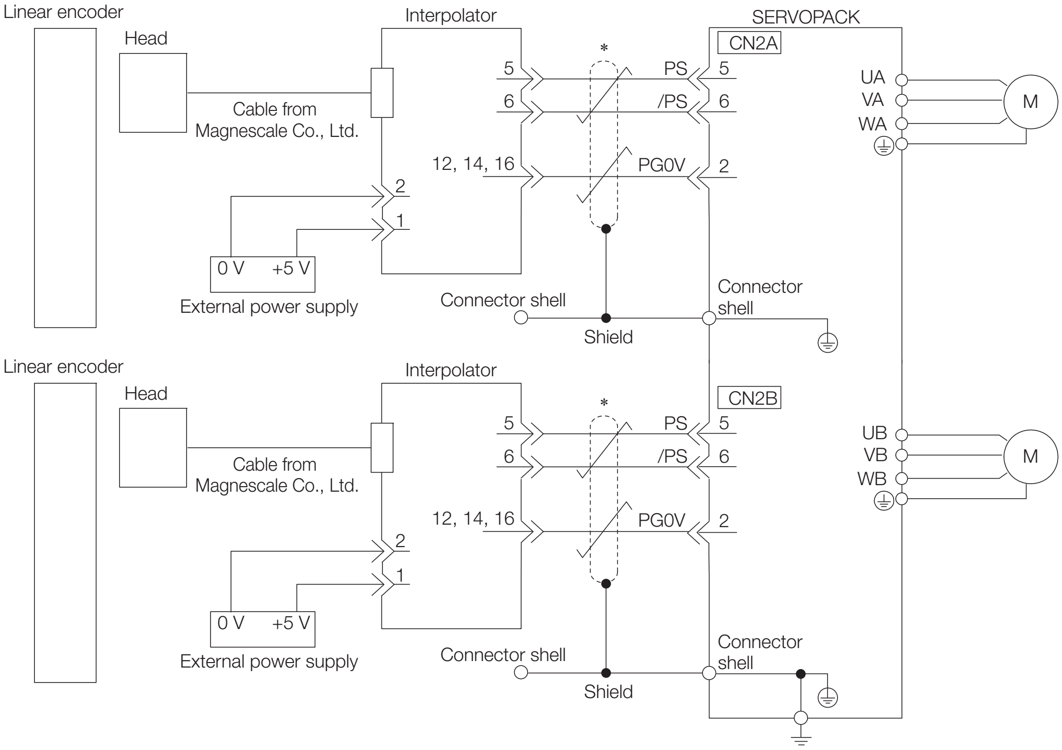
[*1] This is the model of the Head with Interpolator.
[*2] This is the model of the Interpolator.

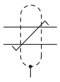


*  represents a shielded twisted-pair cable.

■ SL700, SL710, SL720, and SL730

- MJ620-T13 Interpolator



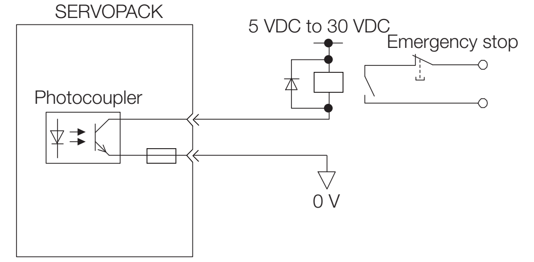
*  represents a shielded twisted-pair cable.

3.4.4 Wiring the SERVOPACK to the Holding Brake

Important

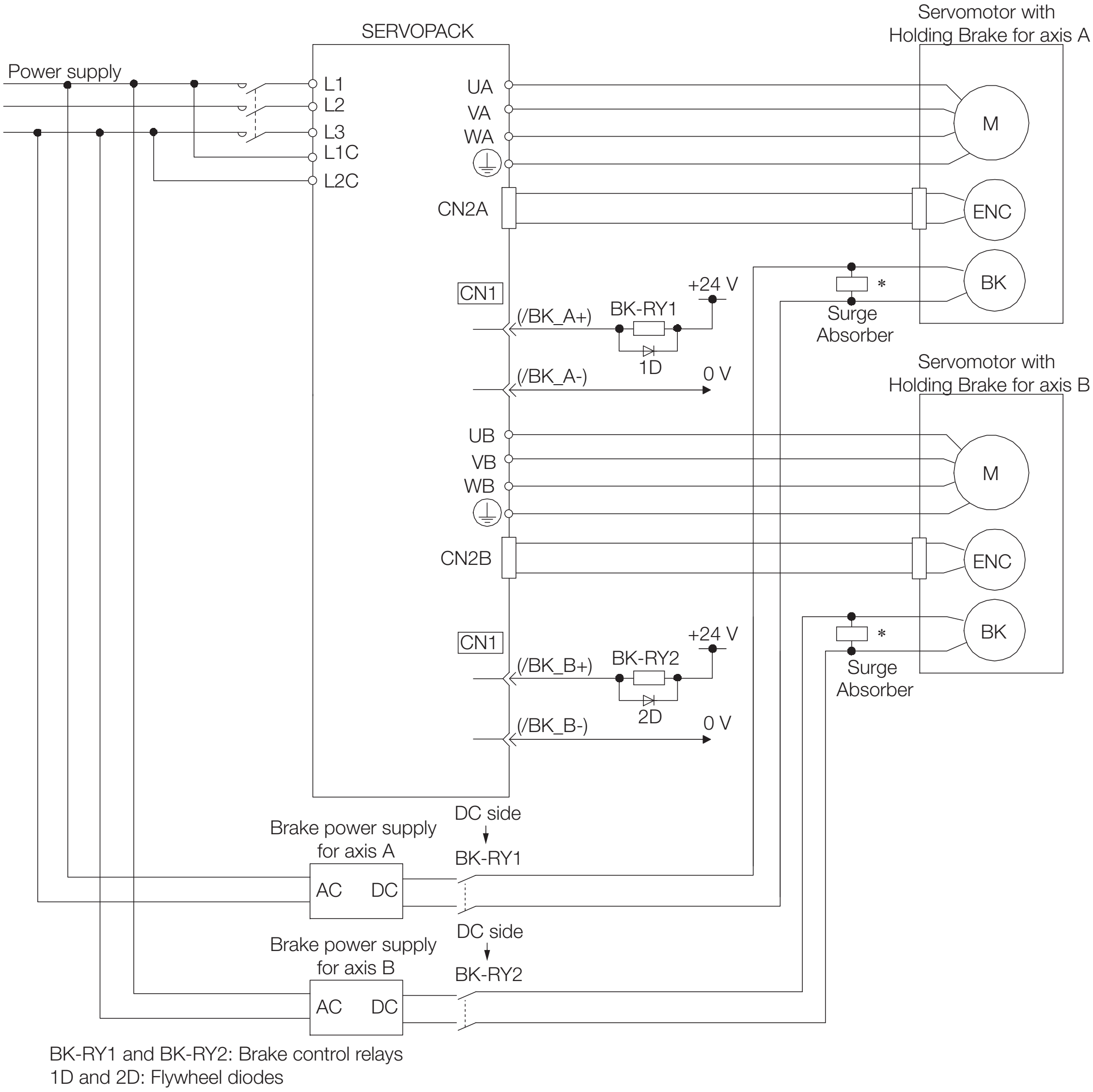
- If you use a Rotary Servomotor, select a Surge Absorber according to the brake current and brake power supply. Refer to the following manual for details.
  Σ-7-Series Peripheral Device Selection Manual (Manual No.: SIEP S800001 32)
- After the Surge Absorber is connected, check the brake operation 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.

Example for Relay Circuit



- You can change the output signal allocation of the /BK signal. Refer to the following section for details.
  Allocating the /BK (Brake Output) Signal on page 5-33
- 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.

3.4.4 Wiring the SERVOPACK to the Holding Brake



BK-RY1 and BK-RY2: Brake control relays
1D and 2D: Flywheel diodes

* Install the surge absorber near the brake terminals on the Servomotor.

3.5 Wiring the Power Supply to the SERVOPACK

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

AC Servo Drives Σ-7 Series (Catalog No.: KAEP S800001 23)

Σ-7-Series Peripheral Device Selection Manual (Manual No.: SIEP S800001 32)

3.5.1 Terminal Symbols and Terminal Names

Use the main circuit connector or terminal block 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 specified 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.

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

- Three-Phase, 200-VAC Power Supply Input

Terminal Symbols	Terminal Name	Specifications and Reference	
L1, L2, and L3	Main circuit power supply input terminals for AC power supply input	Three-phase, 200 VAC to 240 VAC, -15% to +10%, 50 Hz/60 Hz	
L1C and 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, and B3	Regenerative Resistor terminals	*3.5.5 Wiring Regenerative Resistors* on page 3-34	
		If the internal regenerative resistor is insufficient, remove the 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.	
⊖1 and ⊖2	DC Reactor terminals for power supply harmonic suppression	*3.5.6 Wiring Reactors for Harmonic Suppression* on page 3-35	
		These terminals are used to connect a DC Reactor for power supply harmonic suppression or power factor improvement.	
⊖	–	None. (Do not connect anything to this terminal.)	

- Single-Phase, 200-VAC Power Supply Input

Terminal Symbols	Terminal Name	Specifications and Reference	
L1 and L2	Main circuit power supply input terminals for AC power supply input	Single-phase, 200 VAC to 240 VAC, -15% to +10%, 50 Hz/60 Hz	
L1C and 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, and B3	Regenerative Resistor terminals	*3.5.5 Wiring Regenerative Resistors* on page 3-34	
		If the internal regenerative resistor is insufficient, remove the 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.	
⊖1 and ⊖2	DC Reactor terminals for power supply harmonic suppression	*3.5.6 Wiring Reactors for Harmonic Suppression* on page 3-35	
		These terminals are used to connect a DC Reactor for power supply harmonic suppression or power factor improvement.	
L3 and ⊖	–	None. (Do not connect anything to these terminals.)	

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

- SGD7C-1R6A, -2R8A, and -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 5-14

- DC Power Supply Input

Terminal Symbols	Terminal Name	Specifications and Reference	
L1C and 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/⊕	Main circuit power supply input terminals for DC power supply input	270 VDC to 324 VDC, -15% to +10%	
⊖2		0 VDC	
L1, L2, L3, B2, B3, ⊖1, and ⊖	–	None. (Do not connect anything to this terminal.)	

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

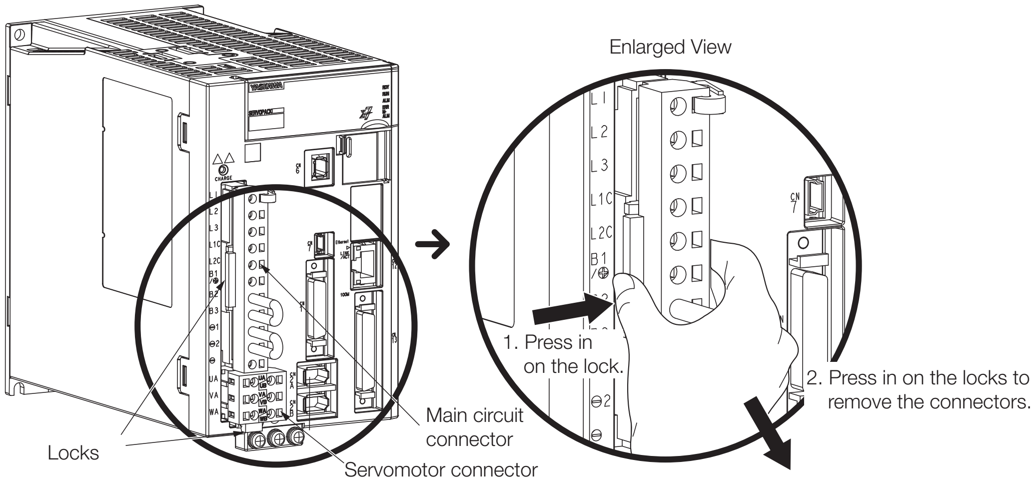
☞ *5.3.1 AC Power Supply Input/DC Power Supply Input Setting* on page 5-13

3.5.2 Wiring Procedure for Main Circuit Connector

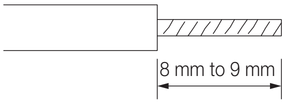
- Required Items

Required Items	Remarks
Spring Opener or Flat-blade 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

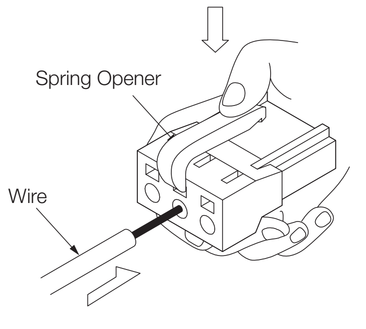
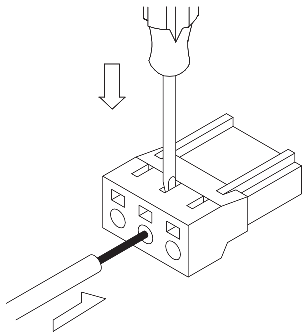
1. Remove the main circuit connector and motor connector from the SERVOPACK.



2. Remove the sheath from the wire to connect.



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

①Using a Spring Opener	②Using 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 connector into the wire insertion hole. Then, remove the Spring Opener or flat-blade screwdriver.

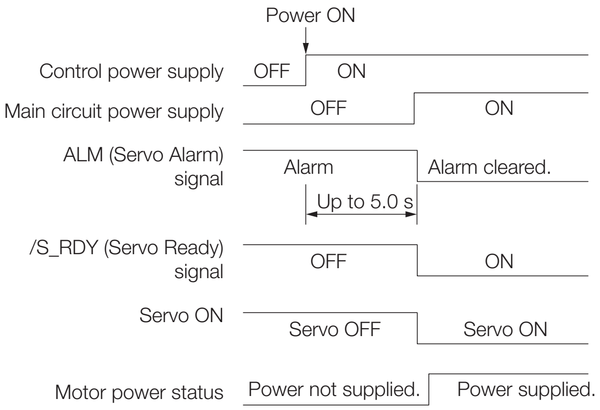
5. Make all other connections in the same way.

6. When you have completed wiring, attach the connectors to the SERVOPACK.

3.5.3 Power ON Sequence

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

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



- Design the power ON sequence so that main circuit power supply 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 supply is turned OFF before you turn it ON again.

Important

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

⚠ WARNING

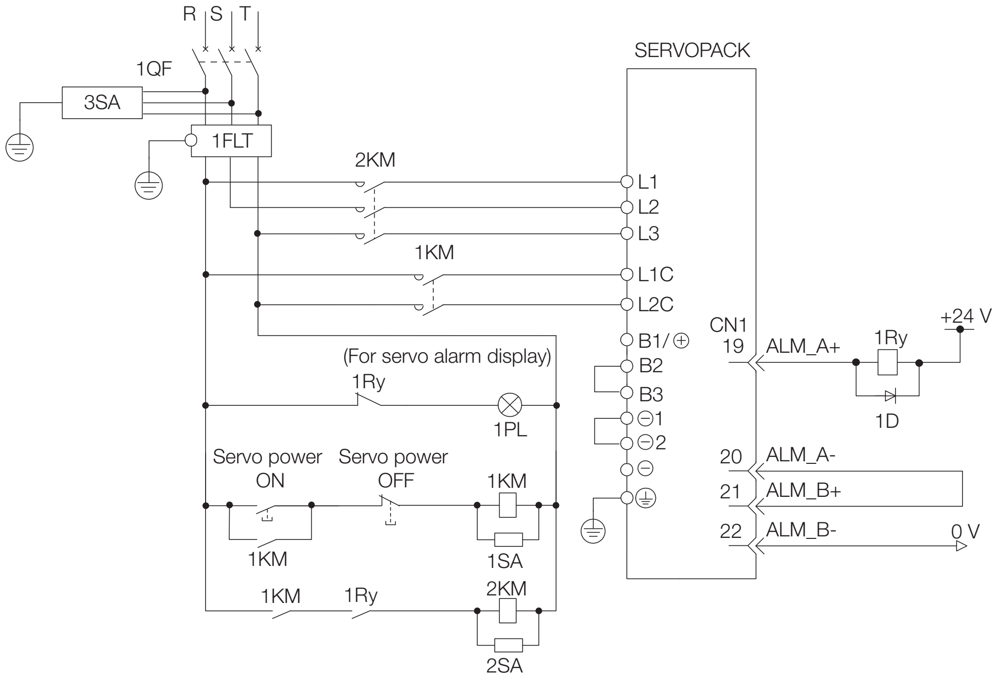
● Even after you turn OFF the power supply, a high residual voltage may still remain in the SERVOPACK. To prevent electric shock, do not touch the power supply terminals after you turn OFF the power. When the voltage is discharged, the CHARGE indicator will turn OFF. Make sure the CHARGE indicator is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

3.5.4 Power Supply Wiring Diagrams

Using Only One SERVOPACK

- Wiring Example for Three-Phase, 200-VAC Power Supply Input

The following diagram shows the wiring to stop both Servomotors when there is an alarm for one axis.

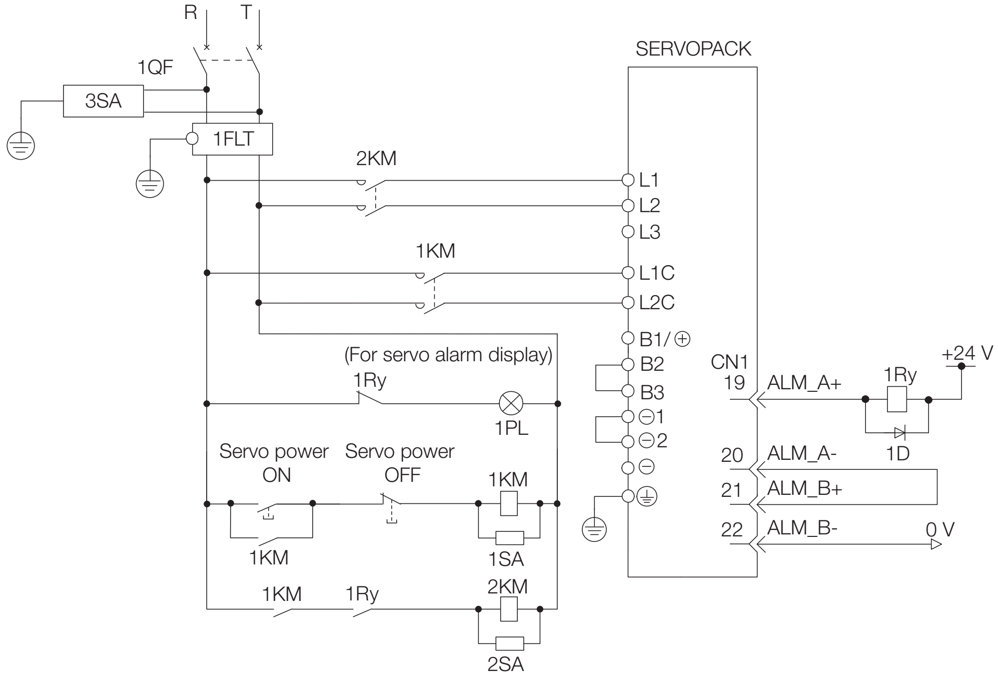


1QF: Molded-case circuit breaker
1FLT: Noise Filter
1KM: Magnetic Contactor (for control power supply)
2KM: Magnetic Contactor (for main circuit power supply)

1Ry: Relay
1PL: Indicator lamp
1SA: Surge Absorber
2SA: Surge Absorber
3SA: Surge Absorber
1D: Flywheel diode

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

The following diagram shows the wiring to stop both Servomotors when there is an alarm for one axis.

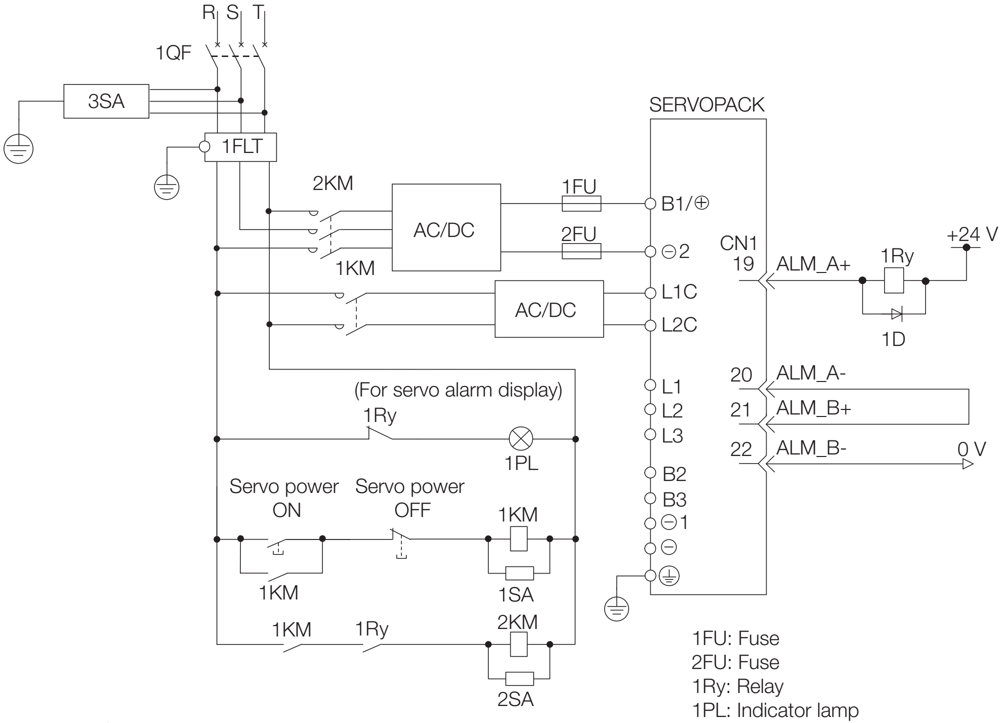


1QF: Molded-case circuit breaker
1FLT: Noise Filter
1KM: Magnetic Contactor (for control power supply)
2KM: Magnetic Contactor (for main circuit power supply)

1Ry: Relay
1PL: Indicator lamp
1SA: Surge Absorber
2SA: Surge Absorber
3SA: Surge Absorber
1D: Flywheel diode

- Wiring Example for DC Power Supply Input

The following diagram shows the wiring to stop both Servomotors when there is an alarm for one axis.



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

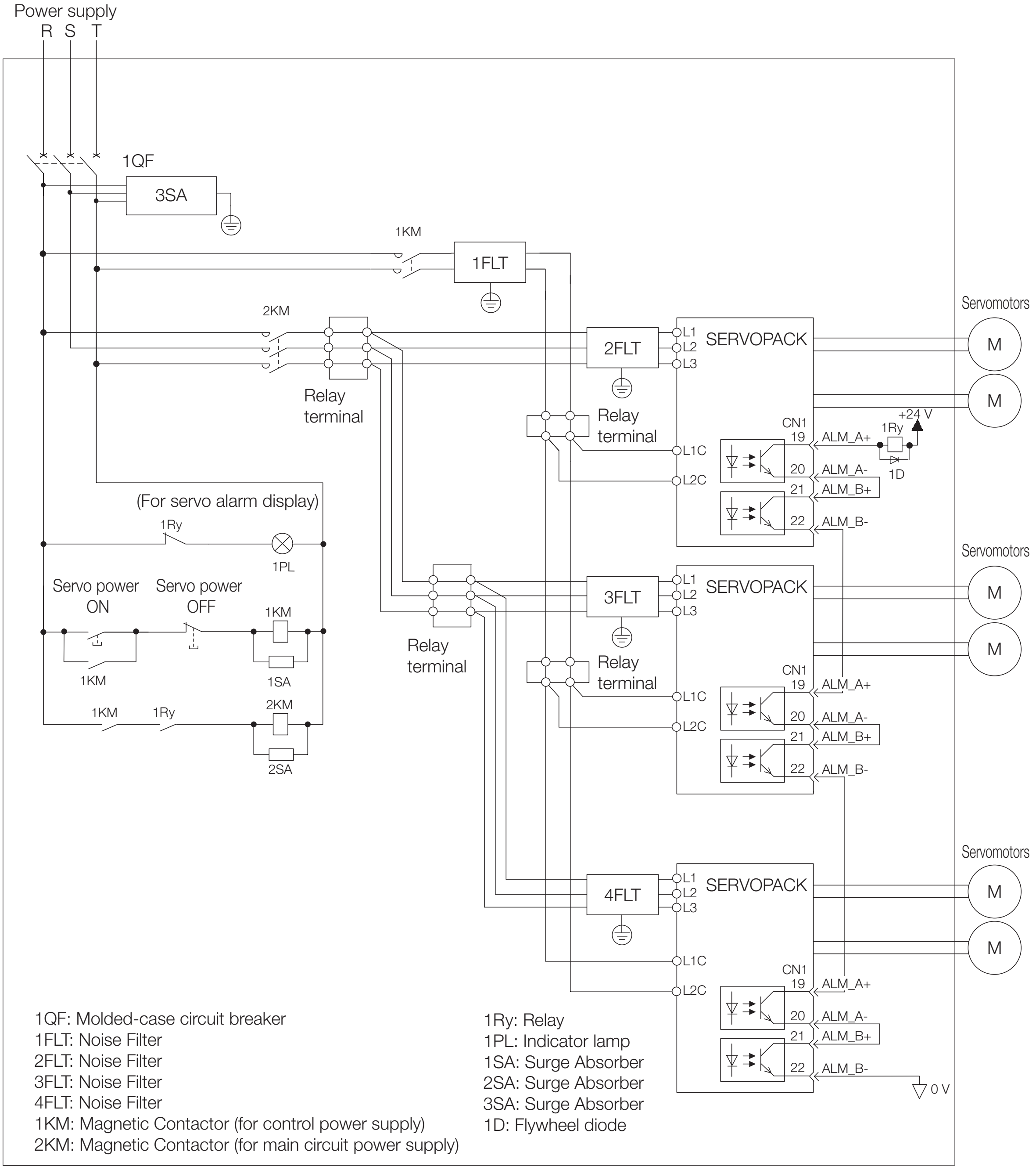
Using More Than One SERVOPACK

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 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.



1QF: Molded-case circuit breaker
1FLT: Noise Filter
2FLT: Noise Filter
3FLT: Noise Filter
4FLT: 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

3.5.5 Wiring Regenerative Resistors

This section describes how to connect External Regenerative Resistors.

Refer to the following manual to select the capacity of a Regenerative Resistor.

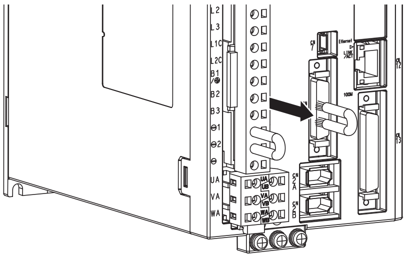
📖 Σ-7-Series Peripheral Device Selection Manual (Manual No.: SIEP S800001 32)

⚠ WARNING

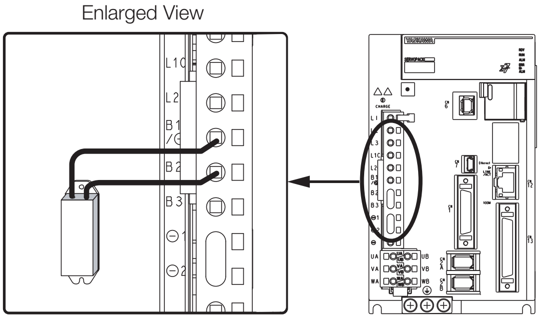
- Be sure to wire Regenerative Resistors correctly. Do not connect B1/⊕ and B2.
Doing so may result in fire or damage to the Regenerative Resistor or SERVOPACK.

Connecting Regenerative Resistors

1. Remove the lead 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.

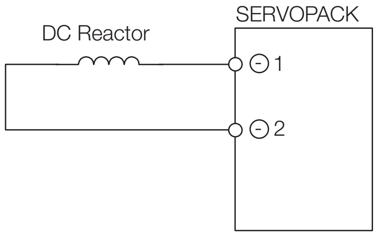
☞ *5.18 Setting the Regenerative Resistor Capacity* on page 5-49

3.5.6 Wiring Reactors for Harmonic Suppression

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

Σ-7-Series Peripheral Device Selection Manual (Manual No.: SIEP S800001 32)

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.)

3.6 Servo Section I/O Signal Connections

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

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

Input Signals

Default settings are given in parentheses.

Signal	Pin No.	Name	Function	Reference
/SI01* (P-OT_A)	3	General-Purpose Sequence Inputs 1 and 7 (Forward Drive Prohibit Input)	You can allocate the input signals to use with parameters. (Stops Servomotor drive (to prevent overtravel) when the moving part of the machine exceeds the range of movement.) • For A axis: /SI01 and /SI02 • For B axis: /SI07 and /SI08	page 5-28
/SI07* (P-OT_B)	9			
/SI02* (N-OT_A)	4	General-Purpose Sequence Inputs 2 and 8 (Reverse Drive Prohibit Input)		
/SI08* (N-OT_B)	10			
/SI03* (/DEC_A)	5	General-Purpose Sequence Inputs 3 and 9 (Origin Return Deceleration Switch Input)	You can allocate the input signals to use with parameters. (Connects the deceleration limit switch for origin return.) • For A axis: /SI03 • For B axis: /SI09	–
/SI09* (/DEC_B)	11			
/SI04* (/EXT_A1)	6	General-Purpose Sequence Inputs 4 and 10 (External Latch Input 1)	You can allocate the input signals to use with parameters. (Connect the external signals that latch the current feedback pulse counter.) • For A axis: /SI04, /SI05, and /SI06 • For B axis: /SI10, /SI11, and /SI12	–
/SI10* (/EXT_B1)	12			
/SI05* (/EXT_A2)	7	General-Purpose Sequence Inputs 5 and 11 (External Latch Input 2)		
/SI11* (/EXT_B2)	13			
/SI06* (/EXT_A3)	8	General-Purpose Sequence Inputs 6 and 12 (External Latch Input 3)		
/SI12* (/EXT_B3)	14			
+24VIN	1	Sequence Input Signal Power Supply Input	Inputs the sequence input signal power supply. Allowable voltage range: 24 VDC ±20% (The 24-V power supply is not provided by Yaskawa.)	–
BAT_A+	17	Battery for Absolute Encoder (+)	Connecting pin for the absolute encoder backup battery. Do not connect these pins if you use the Encoder Cable with a Battery Case. • For A axis: BAT_A+ and BAT_A- • For B axis: BAT_B+ and BAT_B-	–
BAT_B+	35			
BAT_A-	18	Battery for Absolute Encoder (-)		
BAT_B-	36			
TH_A	33	Linear Servomotor Overheat Protection Inputs	Inputs the overheat protection signal from a Linear Servomotor. • For A axis: TH_A • For B axis: TH_B	–
TH_B	34			

* You can change the allocations. Refer to the following section for details.
☞ *5.19.1 Input Signal Allocations* on page 5-50

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.

Output Signals

Default settings are given in parentheses.

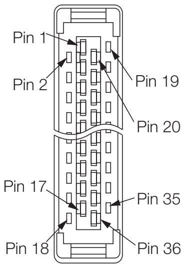
Signal	Pin No.	Name	Function	Reference
ALM_A+	19	Servo Alarm Output	Turns OFF (opens) when an error is detected. • For A axis: ALM_A+ and ALM_A- • For B axis: ALM_B+ and ALM_B-	page 5-56
ALM_A-	20			
ALM_B+	21			
ALM_B-	22			
/SO1+* (/BK_A+)	23	General-Purpose Sequence Output 1 (Brake Output)	You can allocate the output signals to use with parameters. (Controls the brake. The brake is released when the signal turns ON (closes).) • For A axis: /BK_A+ and /BK_A- • For B axis: /BK_B+ and /BK_B-	page 5-32
/SO1-* (/BK_A-)	24			
/SO2+* (/BK_B+)	25	General-Purpose Sequence Output 2 (Brake Output)		
/SO2-* (/BK_B-)	26			
/SO3+*	27	General-Purpose Sequence Output 3	Used for general-purpose outputs. Set the parameters to allocate functions.	–
/SO3-*	28			
/SO4+*	29	General-Purpose Sequence Output 4		
/SO4-*	30			
/SO5+*	31	General-Purpose Sequence Output 5		
/SO5-*	32			
SG	16 15	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.	–

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

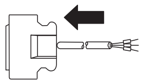
☞ *5.19.2 Output Signal Allocations* on page 5-53

3.6.2 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.



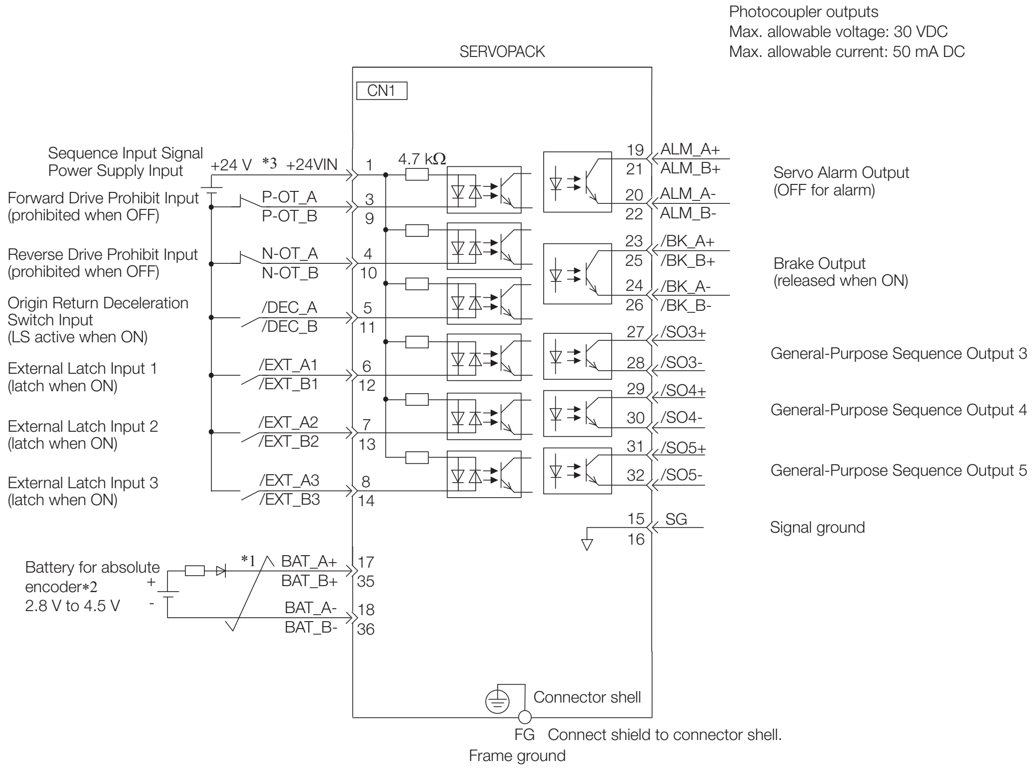
The above view is from the direction of the following arrow without the connector shell attached.



2	–	–	1	+24VIN	Sequence Input Signal Power Supply Input	20	ALM_A-	Servo Alarm Output for Axis A	19	ALM_A+	Servo Alarm Output for Axis A
4	/SI02 (N-OT_A)	General-Purpose Sequence Input 2	3	/SI01 (P-OT_A)	General-Purpose Sequence Input 1	22	ALM_B-	Servo Alarm Output for Axis B	21	ALM_B+	Servo Alarm Output for Axis B
6	/SI04 (/EXT_A1)	General-Purpose Sequence Input 4	5	/SI03 (/DEC_A)	General-Purpose Sequence Input 3	24	/SO1- (/BK_A-)	General-Purpose Sequence Output 1	23	/SO1+ (/BK_A+)	General-Purpose Sequence Output 1
8	/SI06 (/EXT_A3)	General-Purpose Sequence Input 6	7	/SI05 (/EXT_A2)	General-Purpose Sequence Input 5	26	/SO2- (/BK_B-)	General-Purpose Sequence Output 2	25	/SO2+ (/BK_B+)	General-Purpose Sequence Output 2
10	/SI08 (N-OT_B)	General-Purpose Sequence Input 8	9	/SI07 (P-OT_B)	General-Purpose Sequence Input 7	28	/SO3-	General-Purpose Sequence Output 3	27	/SO3+	General-Purpose Sequence Output 3
12	/SI10 (/EXT_B1)	General-Purpose Sequence Input 10	11	/SI09 (/DEC_B)	General-Purpose Sequence Input 9	30	/SO4-	General-Purpose Sequence Output 4	29	/SO4+	General-Purpose Sequence Output 4
14	/SI12 (/EXT_B3)	General-Purpose Sequence Input 12	13	/SI11 (/EXT_B2)	General-Purpose Sequence Input 11	32	/SO5-	General-Purpose Sequence Output 5	31	/SO5+	General-Purpose Sequence Output 5
16	SG	Signal ground	15	SG	Signal ground	34	TH_B	Linear Servomotor Overheat Protection Input for Axis B	33	TH_A	Linear Servomotor Overheat Protection Input for Axis A
18	BAT_A-	Battery for Absolute Encoder (–) for Axis A	17	BAT_A+	Battery for Absolute Encoder (+) for Axis A	36	BAT_B-	Battery for Absolute Encoder (–) for Axis B	35	BAT_B+	Battery for Absolute Encoder (+) for Axis B

3.6.3 I/O Signal Wiring Examples

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 Case is connected, do not connect a backup battery.

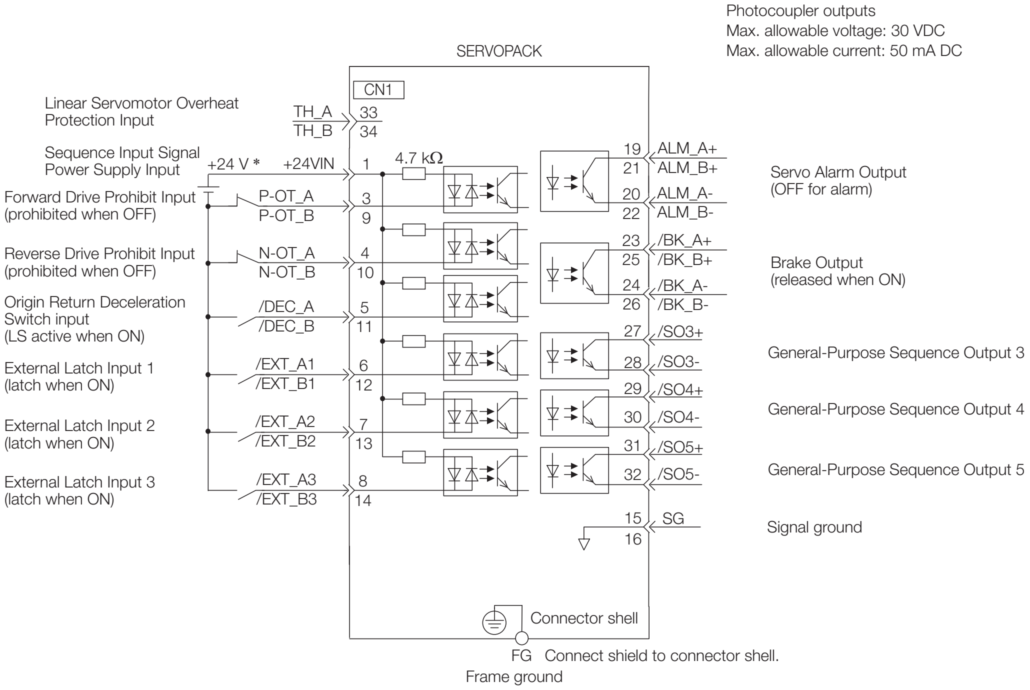
*3. The 24-VDC power supply is not provided by Yaskawa. Use a 24-VDC power supply with double insulation or reinforced insulation.

Note: 1. You can use parameter settings to change some of the I/O signal allocations. Refer to the following section for details.

☞ *5.19 I/O Signal Allocations* on page 5-50

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.

Using a Linear Servomotor



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

Note: 1. You can use parameter settings to change some of the I/O signal allocations. Refer to the following section for details.

☞ *5.19 I/O Signal Allocations* on page 5-50

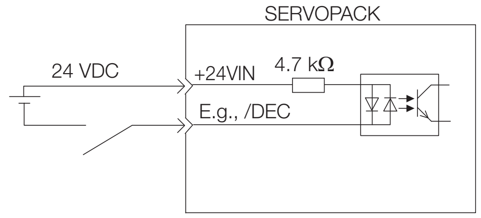
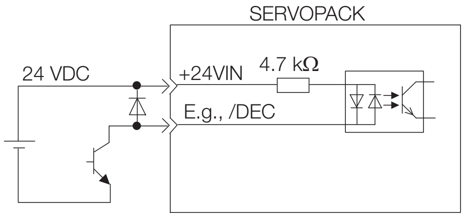
2. If you use a 24-V brake, install a separate power supply for the 24-VDC power supply from other power supplies, such as the one for the I/O signals of the CN1 connector. If the power supply is shared, the I/O signals may malfunction.

3.6.4 I/O Circuits

Sequence Input Circuits

◆ Photocoupler Input Circuits

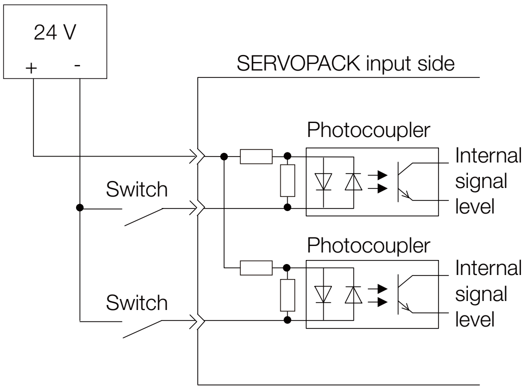
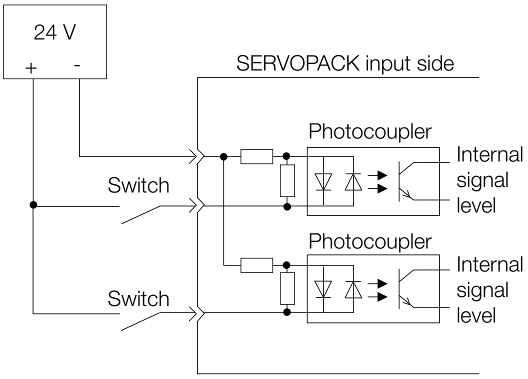
This section describes CN1 connector terminals 1 and 3 to 14.

Example for Relay Circuits	Examples for Open-Collector Circuits
	

Note: The 24-VDC external power supply capacity must be 100 mA minimum.

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

Note: The connection examples in *3.6.3 I/O Signal Wiring Examples* on page 3-39 are for sink circuit connections.

Sink Circuits	Source Circuits
	

Input Signal Polarity		Input Signal Polarity	
Photocoupler	Internal signal level	Photocoupler	Internal signal level
ON	Low level	ON	Low level
OFF	High level	OFF	High level

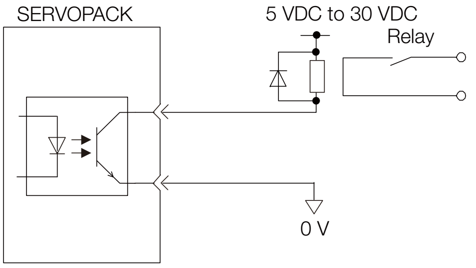
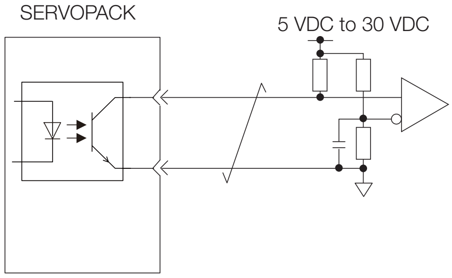
Sequence Output Circuits

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.

◆ Photocoupler Output Circuits

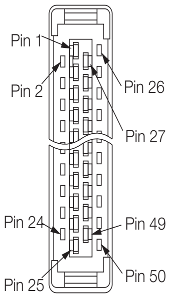
Photocoupler output circuits are used for the ALM (Servo Alarm Output) signal, /S-RDY (Servo Ready Output) signal, and other sequence output signals. Connect a photocoupler output circuit to a relay or line-receiver circuit.

Example for Relay Circuits	Example for Line Receiver Circuit
	

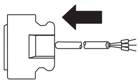
Note: The maximum allowable voltage and current range for photocoupler output circuits are as follows:
- Maximum allowable voltage: 30 VDC
- Current range: 5 mA DC to 50 mA DC

3.7 Controller Section I/O Signal Connections

3.7.1 I/O Signal Connector (CN13) Names and Pin Layout



The above view is from the direction of the following arrow without the connector shell attached.

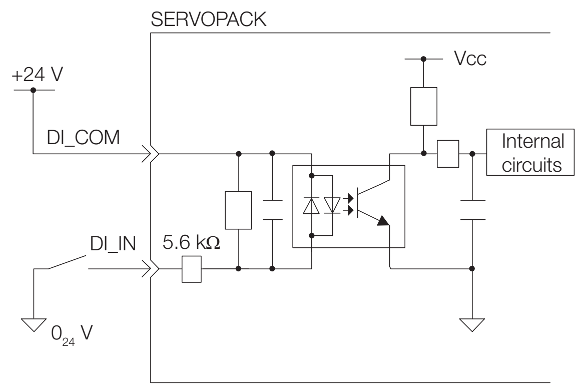
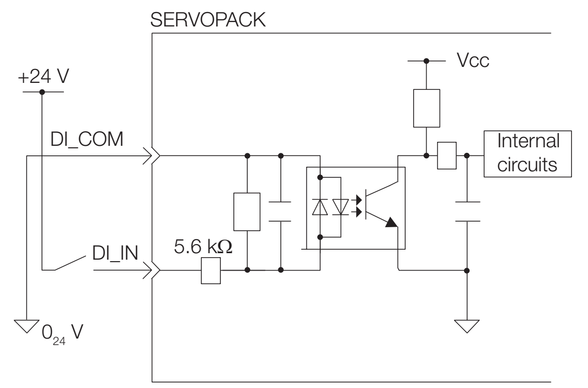


2	PA-	Phase-A Pulse (-)
4	PLIN	Phase-Z Pulse
6	DO_GND1	DO Ground 1
8	DO_00	Digital Output 0
10	DO_04	Digital Output 4
12	DO_GND2	DO Ground 2
14	DO_10	Digital Output 10
16	DO_14	Digital Output 14
18	DI_02	Digital Input 2
20	DI_06	Digital Input 6
22	DI_10	Digital Input 10
24	DI_14	Digital Input 14
1	PA+	Phase-A Pulse (+)
3	GND	Pulse Input Ground
5	PLCOM24V	Phase-Z Pulse (24 V)
7	DO_24V1	DO 24-V Input 1
9	DO_02	Digital Output 2
11	DO_06	Digital Output 6
13	DO_08	Digital Output 8
15	DO_12	Digital Output 12
17	DI_00	Digital Input 0
19	DI_04	Digital Input 4
21	DI_08	Digital Input 8
23	DI_12	Digital Input 12
25	DI_COM1	Digital Input Common 1
27	PB-	Phase-B Pulse (-)
29	PLCOM 5V	Phase-Z Pulse (5 V)
31	DO_GND1	DO Ground 1
33	DO_03	Digital Output 3
35	DO_07	Digital Output 7
37	DO_24V2	DO 24-V Input 2
39	DO_11	Digital Output 11
41	DO_15	Digital Output 15
43	DI_03	Digital Input 3
45	DI_07	Digital Input 7
47	DI_11	Digital Input 11
49	DI_15	Digital Input 15
26	PB+	Phase-B Pulse (+)
28	GND	Pulse Input Ground
30	PLCOM 12V	Phase-Z Pulse (12 V)
32	DO_01	Digital Output 1
34	DO_05	Digital Output 5
36	DO_GND2	DO Ground 2
38	DO_09	Digital Output 9
40	DO_13	Digital Output 13
42	DI_01	Digital Input 1
44	DI_05	Digital Input 5
46	DI_09	Digital Input 9
48	DI_13	Digital Input 13
50	DI_COM2	Digital Input Common 2

3.7.2 I/O Circuits

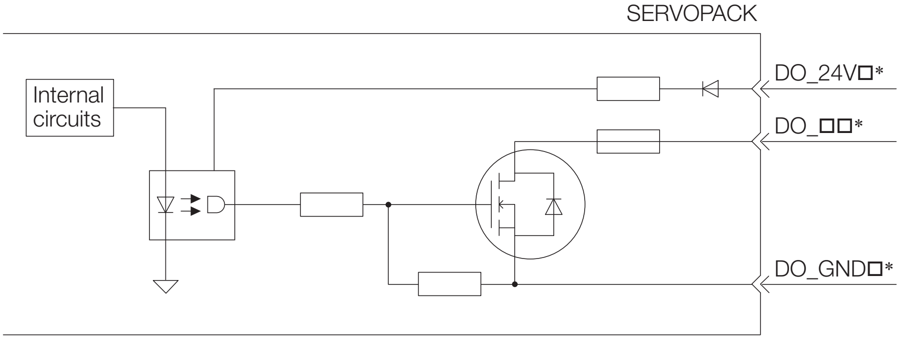
Digital Input Circuits

CN13-17 to CN13-24 and CN13-42 to CN13-49 are used for the digital inputs. Details on the digital input circuits are shown in the following figure.

Sink Circuits	Source Circuits
	

Digital Output Circuits

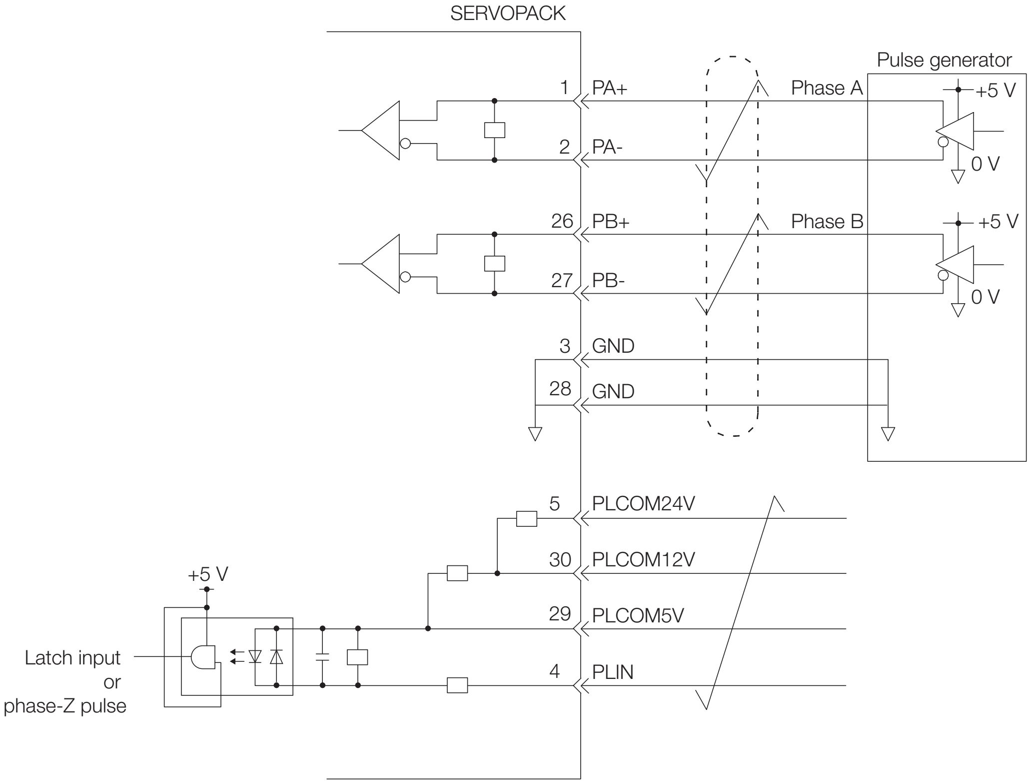
CN13-6 to CN13-16 and CN13-31 to CN13-41 are used for the digital output. Details on the digital output circuits are shown in the following figure.



* Refer to the following section for details on the signal and pins.
☞ *3.2 Basic Wiring Diagrams* on page 3-10

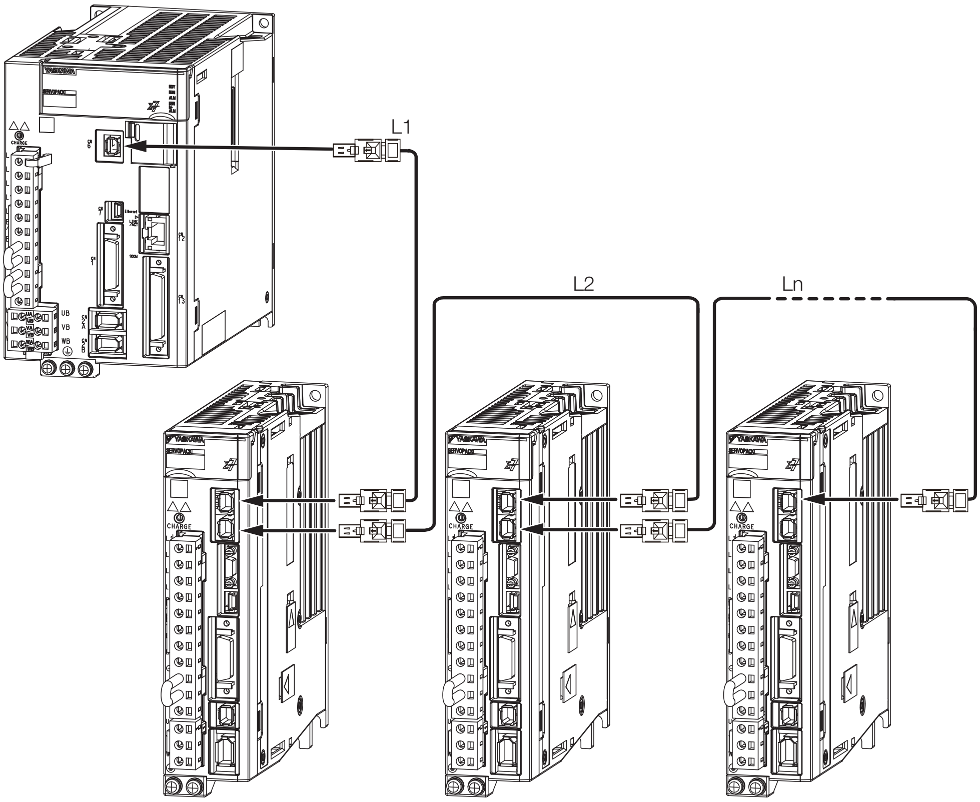
Pulse Input Circuits

CN13-1 to CN13-3 and CN13-26 to CN13-28 are used for the pulse inputs. Details on the pulse input circuits are shown in the following figure.



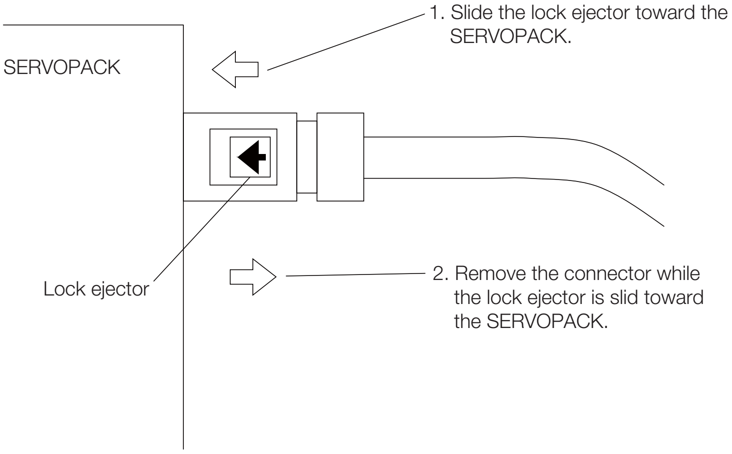
3.8 Connecting MECHATROLINK Communications Cables

Connect the MECHATROLINK-III Communications Cable to the CN6 connector.



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

Use the following procedure to remove the MECHATROLINK-III Communications Cable connectors from the SERVOPACK.



Note: The MECHATROLINK-III Communications Cable connector may be damaged if it is removed without being unlocked.

3.9 Connecting the Other Connectors

3.9.1 Computer Connector (CN7)

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

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

📖 AC Servo Drive Engineering Tool SigmaWin+ Operation Manual (Manual No.: SIET S800001 34)

Important Use the cable specified by Yaskawa. If you use any other cable, noise resistance may be low and normal operation may not be possible.

3.9.2 USB Connector (CN10)

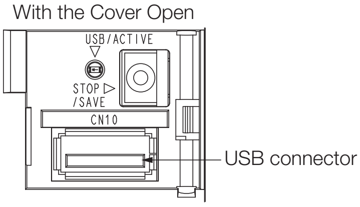
To use a USB memory device, connect the USB memory device to CN10 on the SERVOPACK.

Connecting a USB Memory Device to the USB Connector

This section describes how to insert and remove a USB memory device.

◆ Inserting a USB Memory Device

1. Open the USB connector cover.

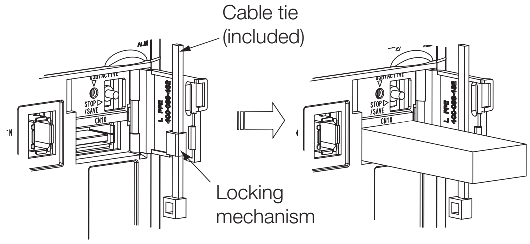


2. Insert the USB memory device into the USB connector.
Confirm that the USB ACTIVE indicator lights.
Refer to the following section for details on the USB status indicator.
☞ ◆ *USB Status Indicator* on page 1-32

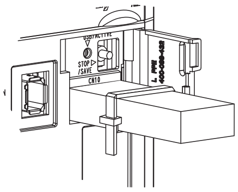
Important

If you want to use a USB memory device for an extended period of time, lock the cover as shown in the following figure and then use the enclosed cable tie to secure the USB memory device into place. Always lock the USB cover in place before you secure the USB memory device.

1. Gently pull the USB cover until it reaches the open position.
2. Release the cover once it is in the open position (90°).
   The USB cover will remain locked open until you close it.
3. Run the cable tie through the locking mechanism of the cover and insert the USB memory device.



4. Use the cable tie to secure the USB memory into place.



◆ Removing the USB Memory Device

Use the STOP/SAVE switch to remove USB memory.

After you lightly press and release this switch, the USB memory can be safely removed when the USB status indicator changes from flashing to not lit.

Note: Press and hold this switch for at least 2 seconds to save all of the data to the USB memory. The display will show the progress of saving.

Important

Before removing the USB memory device, press the STOP/SAVE switch and wait until the USB status indicator goes out. If the USB memory device is removed while the USB status indicator is lit or flashing, the data may become corrupted.

3.9.3 Ethernet Connector (CN12)

To use the MPE720 Engineering Tool or to use a device that supports Ethernet communications, connect the computer on which the MPE720 Engineering Tool is installed or the Ethernet device to CN12 on the SERVOPACK.

Refer to the following section for information on using the MPE720.

☞ *Chapter 4 Preparations*

Preparations

4

This chapter describes the Engineering Tool and the SERVOPACK setting procedure that are necessary to make device-specific settings.

4.1 Starting the Engineering Tools

4.1.1 Engineering Tools

There are two different Engineering Tools used to operate SERVOPACKs: the MPE720 and SigmaWin+.

Applications

The following tables lists the applications of the MPE720 and SigmaWin+. Select the Engineering Tool that best fits your needs.

Engineering Tool	Applications
MPE720	Writing user programs
	Monitoring the IO16 Function Module and the counter of the Controller Section
	Setting the M-EXECUTOR in the Controller Section
	Setup, adjustment, monitoring, and maintenance of the Servo Section
	Setup, adjustment, monitoring, and maintenance of MECHATROLINK-III communications slave devices
	Setting up Ethernet communications with the host controller
	Setup, adjustment, monitoring, and maintenance of the MP2000-Series Option Module installed in the Optional Unit
SigmaWin+	Setup, adjustment, monitoring, and maintenance of the Servo Section

Refer to the following manual for details on the MPE720.

📖 MP2000/MP3000 Series Engineering Tool MPE720 Version 7 User's Manual (Manual No.: SIEP C880761 03)

Refer to the following manual for details on the SigmaWin+.

📖 AC Servo Drive Engineering Tool SigmaWin+ Operation Manual (Manual No.: SIET S800001 34)

Connection Methods

The method to connect to a SERVOPACK is different for the MPE720 and SigmaWin+. The connectors and connection methods that you can use to connect the MP720 and SigmaWin+ to a SERVOPACK are given in the following table.

Engineering Tool	Connectors	Connection Method	Reference
MPE720	CN12	Ethernet	*4.4.2 Placing the MPE720 Online* on page 4-47
SigmaWin+	CN12	Ethernet connection through the Controller Section	*Connecting with Ethernet* on page 4-51
	CN7	USB	*Connecting with USB* on page 4-56

4.1.2 Installation

The MPE720 and the SigmaWin+ are used to operate SERVOPACKs.

Use the following procedure to install the MPE720 and SigmaWin+.

Refer to the following catalog for details on the system requirements of the MPE720.

📖 MPE720 Version 7 System Integrated Engineering Tool (Document No. KAEP C880761 00)

Refer to the following manual for the system requirements for the SigmaWin+.

📖 AC Servo Drive Engineering Tool SigmaWin+ Operation Manual (Manual No.: SIET S800001 34)

1. Insert the MPE720 DVD-ROM into the PC. The installer will start.

Information If the software does not start automatically, execute the SETUP.EXE file in the root directory of the DVD-ROM.

2. Click the **Install** Button.

EngineeringTool

MPE720 Ver.7

We support all engineering of machine controller MP series. (Setup, programming, test run and maintenance.)

Please download the newest installer from the following link.
http://www.e-mechatronics.com/download/tool/controller/mpe720v7/index.html

Inverter Drive EngineeringTool

DriveWizardPlus

We support from setup to test run and maintenance of Ye Inverters.

Please download the newest installer from the following link.
http://www.e-mechatronics.com/download/tool/inverter/drive_wzdpls/index.html

AC Servo Drive EngineeringTool

SigmaWin+ Ver.7

We support from setup of parameter to test run.
* You must install version 7.13 or later of the SigmaWin+ to use MPE720 version 7.

Please download the newest installer from the following link.
http://www.e-mechatronics.com/download/tool/servo/sgmwinplsver7/index.html

M-III I/O Module SetupTool

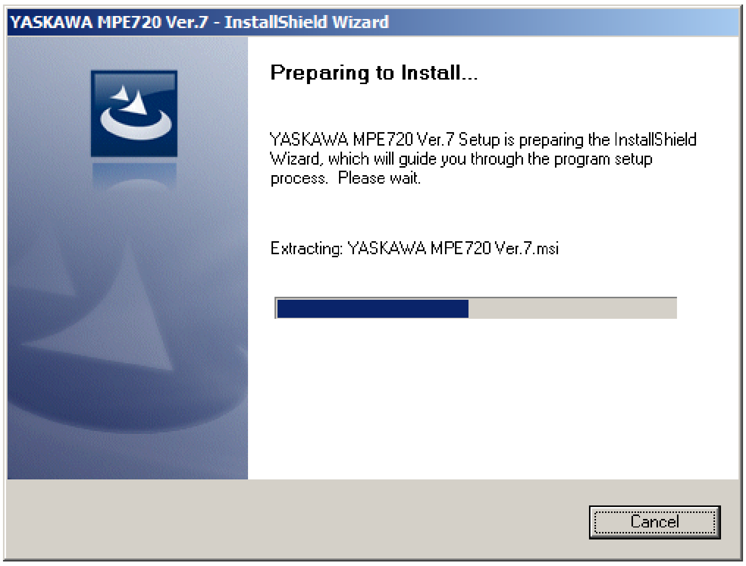
IOWin

We support parameter setup of M-III I/O modiles.

Please download the newest installer from the following link.
http://www.e-mechatronics.com/download/tool/controller/iowin/index.html

From other than Japan, it cannot access to the download page of e-mechatronics.com.

The YASKAWA MPE720 Ver.7 - InstallShield Wizard Dialog Box will be displayed.

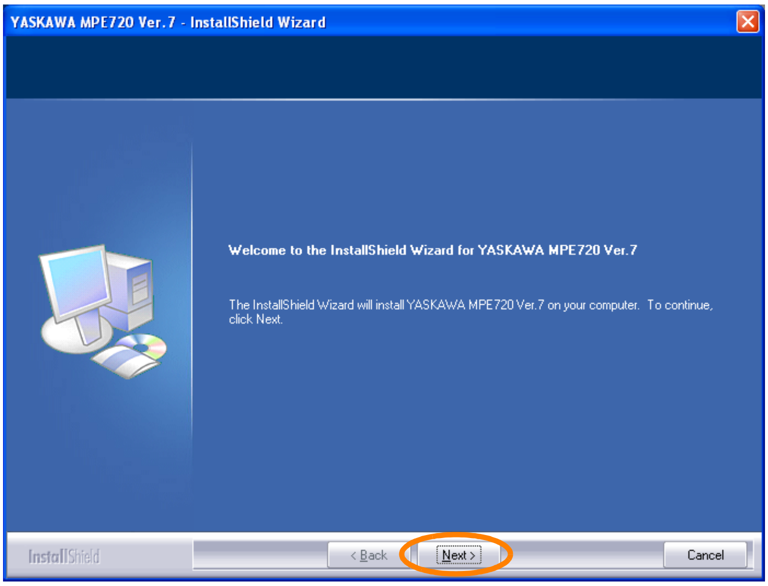


Preparing to Install...

YASKAWA MPE720 Ver.7 Setup is preparing the InstallShield Wizard, which will guide you through the program setup process. Please wait.

Extracting: YASKAWA MPE720 Ver.7.msi

3. Click the **Next** Button.

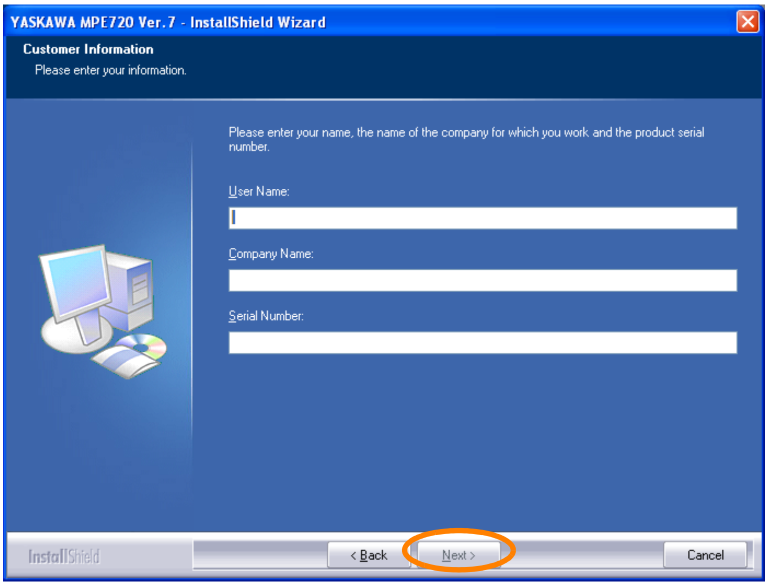


YASKAWA MPE720 Ver.7 - InstallShield Wizard

Welcome to the InstallShield Wizard for YASKAWA MPE720 Ver.7

The InstallShield Wizard will install YASKAWA MPE720 Ver.7 on your computer. To continue, click Next.

4. Enter the user name, company name, and serial number (on the DVD-ROM package), and then click the **Next** Button.



YASKAWA MPE720 Ver.7 - InstallShield Wizard

Customer Information

Please enter your information.

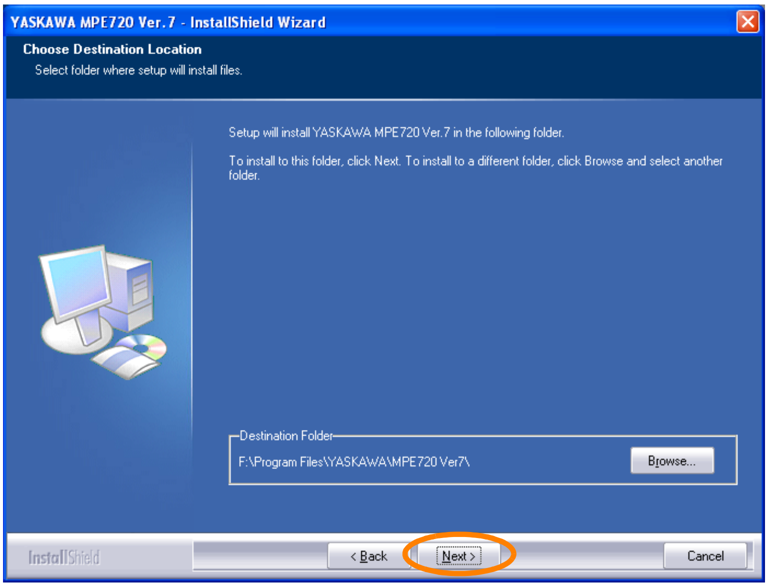
Please enter your name, the name of the company for which you work and the product serial number.

User Name:

Company Name:

Serial Number:

5. Specify the destination for the MPE720 installation. To use the default installation location, click the **Next** Button.



YASKAWA MPE720 Ver.7 - InstallShield Wizard

Choose Destination Location

Select folder where setup will install files.

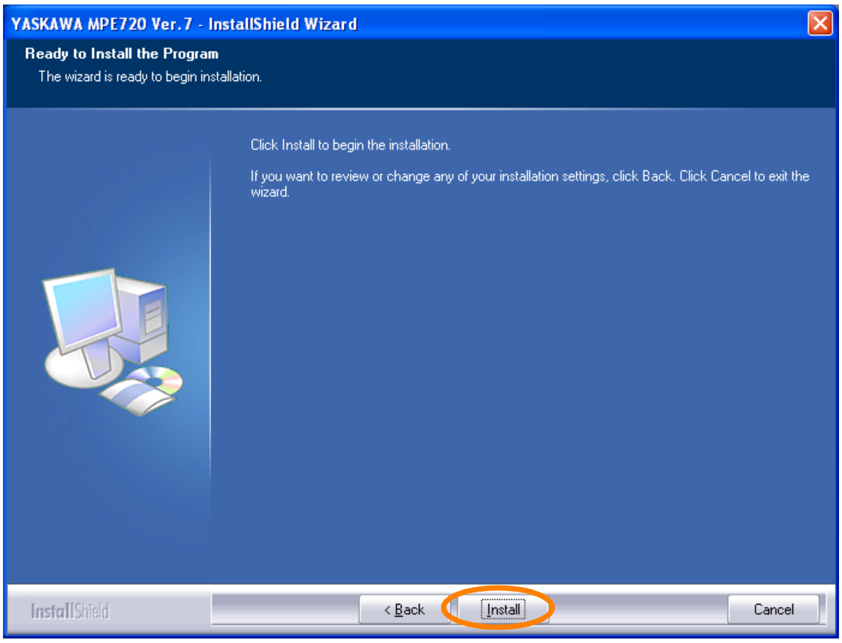
Setup will install YASKAWA MPE720 Ver.7 in the following folder.

To install to this folder, click Next. To install to a different folder, click Browse and select another folder.

Destination Folder

F:\Program Files\YASKAWA\MPE720 Ver7\

6. Click the **Install** Button.



YASKAWA MPE720 Ver.7 - InstallShield Wizard

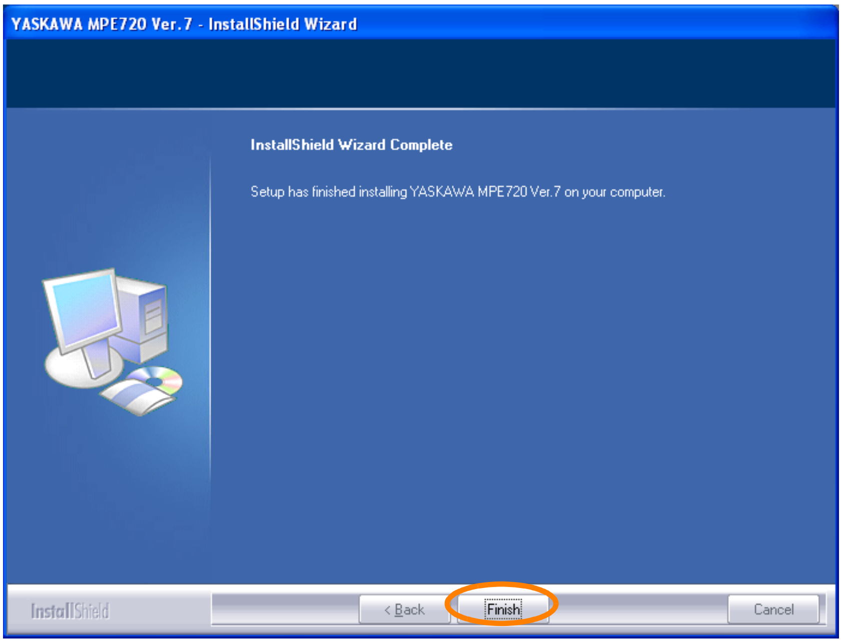
Ready to Install the Program

The wizard is ready to begin installation.

Click Install to begin the installation.

If you want to review or change any of your installation settings, click Back. Click Cancel to exit the wizard.

7. Click the **Finish** Button.



InstallShield Wizard Complete

Setup has finished installing YASKAWA MPE720 Ver.7 on your computer.

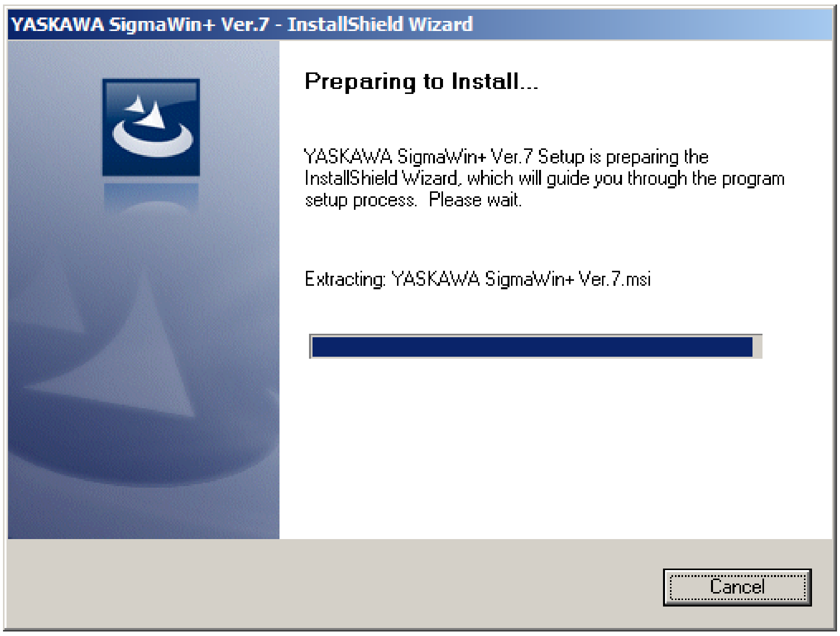
The YASKAWA Engineering Tool Install Launcher Dialog Box will be displayed.

8. Click **OK** Button.

You must install version 7.13 or later of the SigmaWin+ to use the following functionality of MPE720 version 7.
*Servo Parameter
*Servo Monitor
*Servo Tuning

Click the OK Button. The Installation Wizard for SigmaWin+ version 7 will be displayed.

The YASKAWA SigmaWin+ Ver.7 - InstallShield Wizard Dialog Box will be displayed.

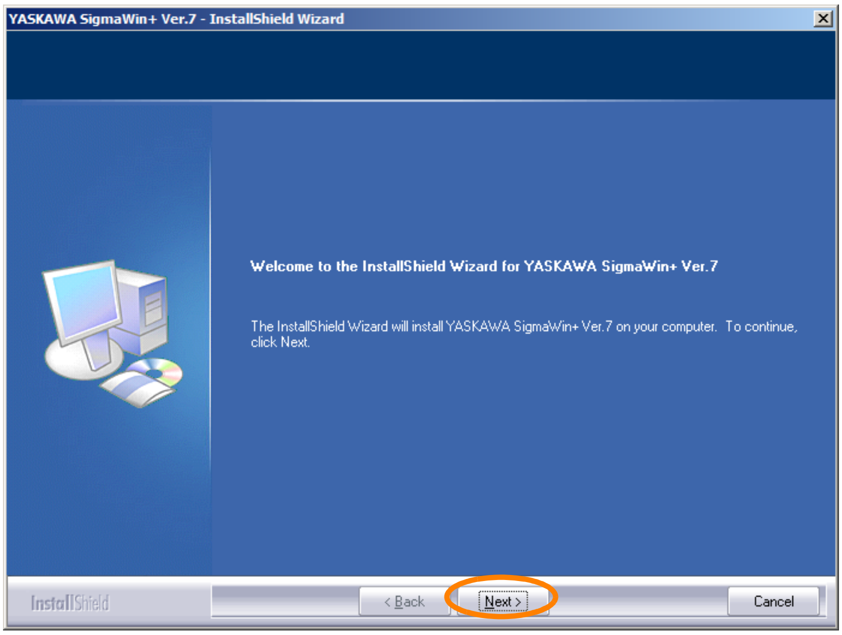


Preparing to Install...

YASKAWA SigmaWin+ Ver.7 Setup is preparing the InstallShield Wizard, which will guide you through the program setup process. Please wait.

Extracting: YASKAWA SigmaWin+ Ver.7.msi

9. Click the **Next** Button.

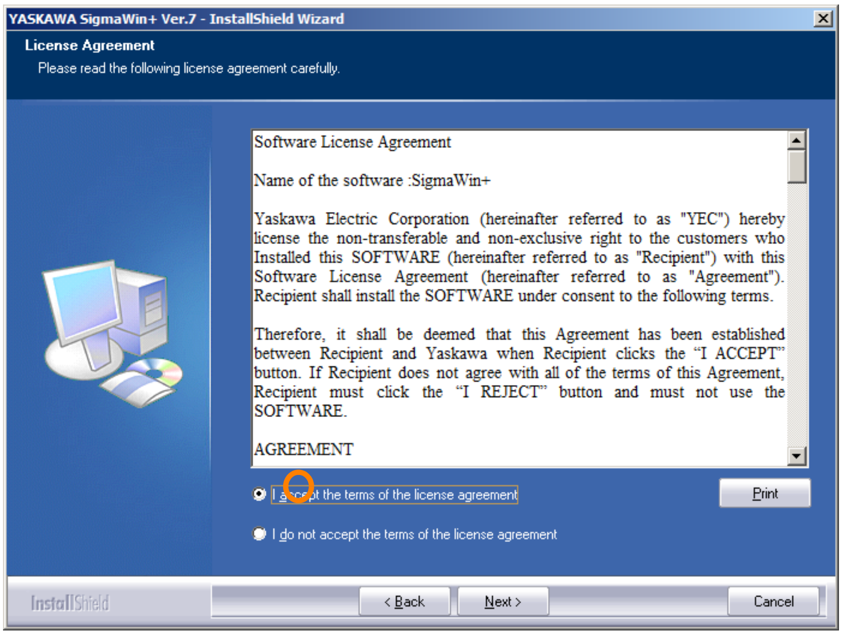


Welcome to the InstallShield Wizard for YASKAWA SigmaWin+ Ver.7

The InstallShield Wizard will install YASKAWA SigmaWin+ Ver.7 on your computer. To continue, click Next.

The License Agreement will be displayed.

10. Check the contents of the License Agreement, and then select the **accept the terms of the license agreement** Option.



Software License Agreement

Name of the software :SigmaWin+

Yaskawa Electric Corporation (hereinafter referred to as "YEC") hereby license the non-transferable and non-exclusive right to the customers who Installed this SOFTWARE (hereinafter referred to as "Recipient") with this Software License Agreement (hereinafter referred to as "Agreement"). Recipient shall install the SOFTWARE under consent to the following terms.

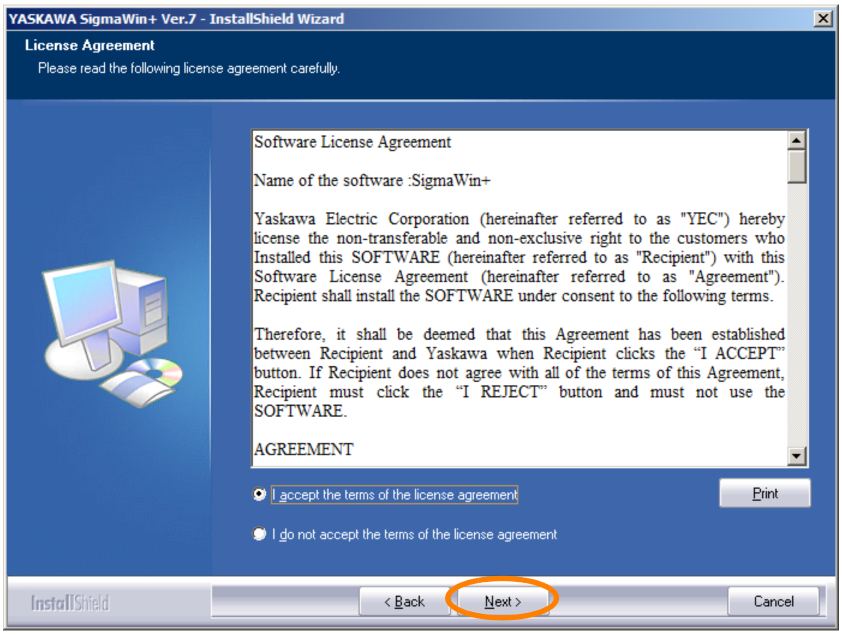
Therefore, it shall be deemed that this Agreement has been established between Recipient and Yaskawa when Recipient clicks the "I ACCEPT" button. If Recipient does not agree with all of the terms of this Agreement, Recipient must click the "I REJECT" button and must not use the SOFTWARE.

AGREEMENT

● I accept the terms of the license agreement

○ I do not accept the terms of the license agreement

11. Click the **Next** Button.



Software License Agreement

Name of the software :SigmaWin+

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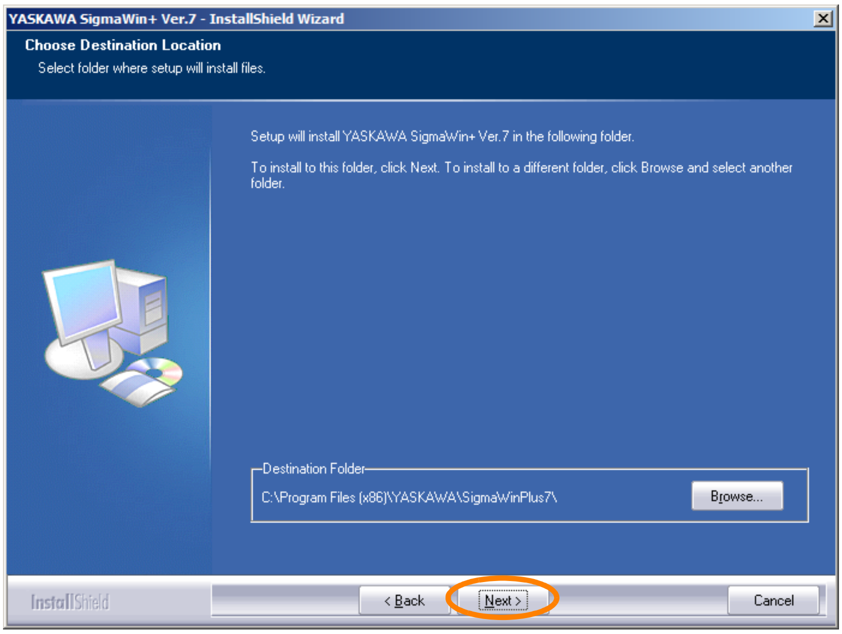
AGREEMENT

● I accept the terms of the license agreement

○ I do not accept the terms of the license agreement

12. Specify the destination for the SigmaWin+ installation. To use the default installation location, click the **Next** Button.



Choose Destination Location

Select folder where setup will install files.

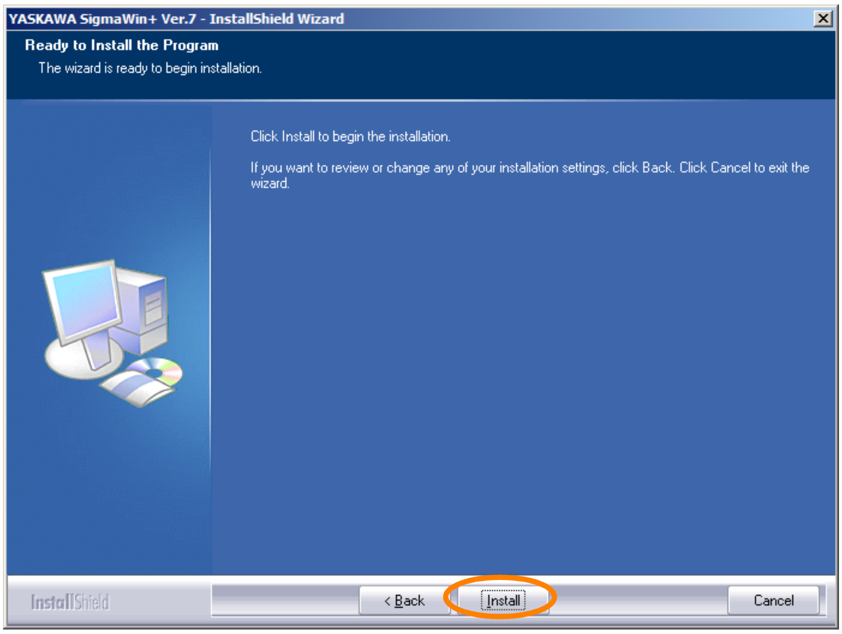
Setup will install YASKAWA SigmaWin+ Ver.7 in the following folder.

To install to this folder, click Next. To install to a different folder, click Browse and select another folder.

Destination Folder

C:\Program Files (x86)\YASKAWA\SigmaWinPlus7\

13. Click the **Install** Button.



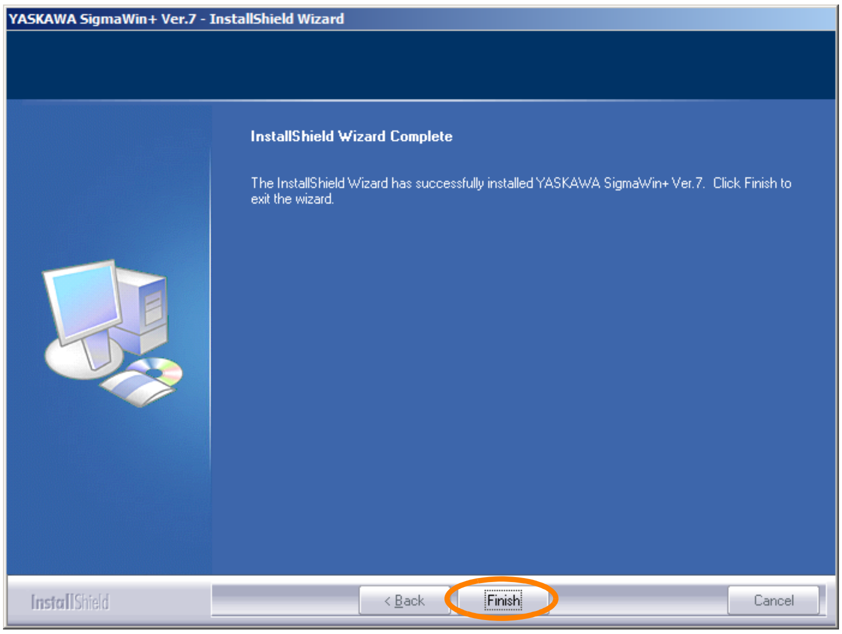
Ready to Install the Program

The wizard is ready to begin installation.

Click Install to begin the installation.

If you want to review or change any of your installation settings, click Back. Click Cancel to exit the wizard.

14. Click the **Finish** Button.



YASKAWA SigmaWin+ Ver.7 - InstallShield Wizard

InstallShield Wizard Complete

The InstallShield Wizard has successfully installed YASKAWA SigmaWin+ Ver.7. Click Finish to exit the wizard.

This concludes the installation of the MPE720 and SigmaWin+ in your computer.

4.1.3 Offline Startup

This section describes how to start the MPE720 and SigmaWin+ Engineering Tools.

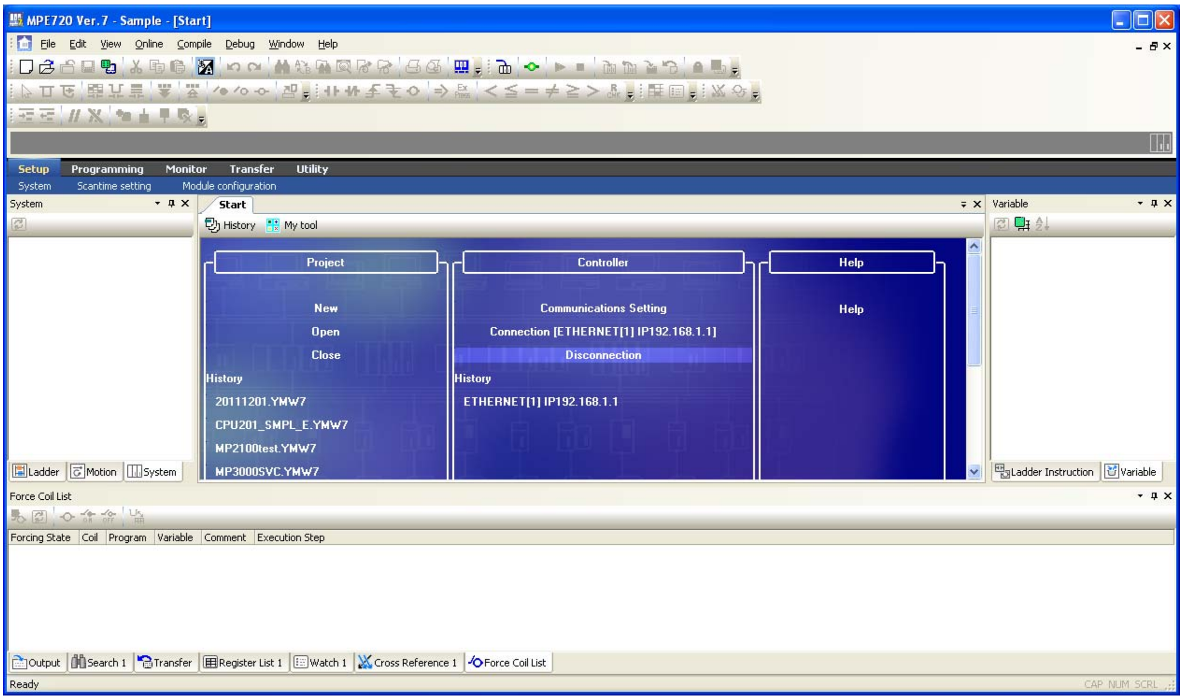
MPE720

The method for starting the MPE720 is described below.

Double-click the **MPE720 Ver.7** Icon on the desktop.

Information If there is no icon on the Desktop, then select ***All Programs*** – ***YE_Applications*** – ***MPE720 Ver.7*** from the Windows Start Menu.

When the MPE720 has started, the following window will be displayed.



This concludes the operation.

SigmaWin+

Any of the following two methods can be used to start the SigmaWin+.

- Use the desktop icon.
- Use the icon in the Function List Dialog Box of the MPE720.

◆ Using the Desktop Icon

Use the following procedure to start the SigmaWin+ with the **SigmaWin+ Ver.7** Icon located on the desktop of your computer.

1. Double-click the **SigmaWin+ Ver.7** Icon on the desktop.

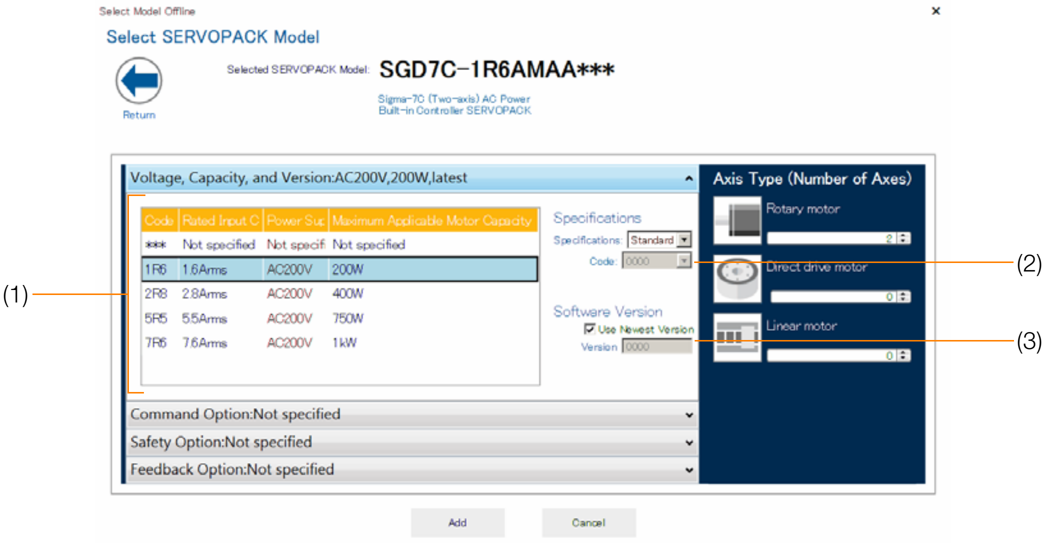
The SigmaWin+ will start.

2. Click **Start SigmaWin+ offline.**

3. Click on your SERVOPACK.

The selected SERVOPACK model will be displayed for the **Selected SERVOPACK Model** in the dialog box.

4. Click the **Voltage, Capacity, and Version** Tab, and then specify the voltage, capacity, and version of the SERVOPACK.



Select SERVOPACK Model

Selected SERVOPACK Model: SGD7C-1R6AMAA***

Sigma-7C (Two-axis) AC Power Built-in Controller SERVOPACK

Voltage, Capacity, and Version:AC200V,200W,latest

Code	Rated Input C	Power Sup	Maximum Applicable Motor Capacity
***	Not specified	Not specifi	Not specified
1R6	1.6Arms	AC200V	200W
2R8	2.8Arms	AC200V	400W
5R5	5.5Arms	AC200V	750W
7R6	7.6Arms	AC200V	1kW

Specifications
Specifications: Standard
Code: 0000

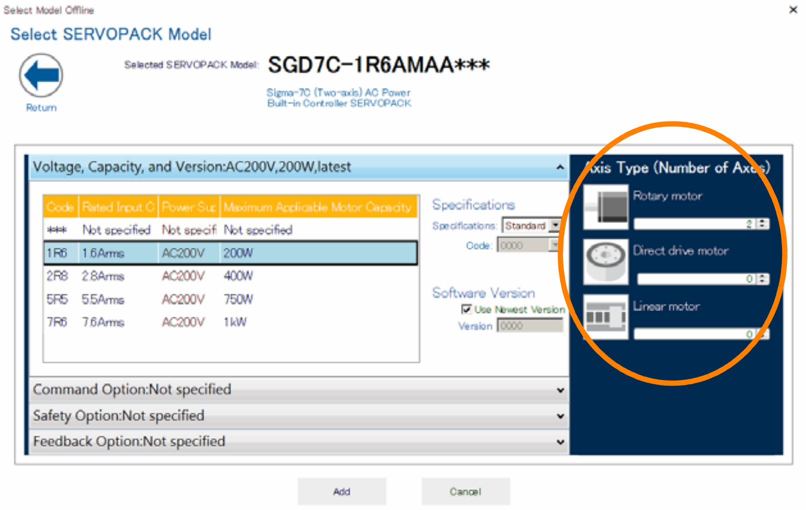
Software Version
☑ Use Newest Version
Version: 0000

Axis Type (Number of Axes)
Rotary motor: 2
Direct drive motor: 0
Linear motor: 0

Command Option:Not specified
Safety Option:Not specified
Feedback Option:Not specified

No.	Item	Description
(1)	SERVOPACK voltages and capacities	Select the voltage and capacity of the SERVOPACK from the SERVOPACK list.
(2)	Specification	Select the option specification of the SERVOPACK from the list in the Specifications Box. Select the code of the option specification for the SERVOPACK from the list in the Code Box.
(3)	Version	Enter the version of the SERVOPACK in the Version Box. If you do not know the version of the SERVOPACK, select the Use Newest Version Check Box.

5. Specify the Servomotor to connect.



Select SERVOPACK Model

Selected SERVOPACK Model: SGD7C-1R6AMAA***

Sigma-7C (Two-axis) AC Power Built-in Controller SERVOPACK

Voltage, Capacity, and Version:AC200V,200W,latest

Code	Rated Input C	Power Sup	Maximum Applicable Motor Capacity
***	Not specified	Not specifi	Not specified
1R6	1.6Arms	AC200V	200W
2R8	2.8Arms	AC200V	400W
5R5	5.5Arms	AC200V	750W
7R6	7.6Arms	AC200V	1kW

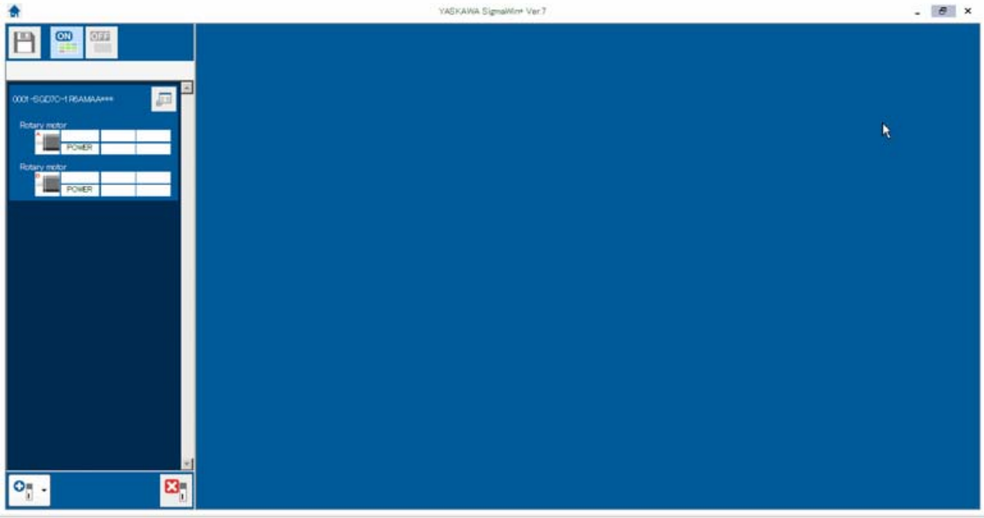
Specifications
Specifications: Standard
Code: 0000

Software Version
☑ Use Newest Version
Version: 0000

Axis Type (Number of Axes)
Rotary motor: 2
Direct drive motor: 0
Linear motor: 0

Command Option:Not specified
Safety Option:Not specified
Feedback Option:Not specified

6. Click the **Add** Button.
   The selected SERVOPACK will be placed offline, and displayed in the workspace in the Main Window.



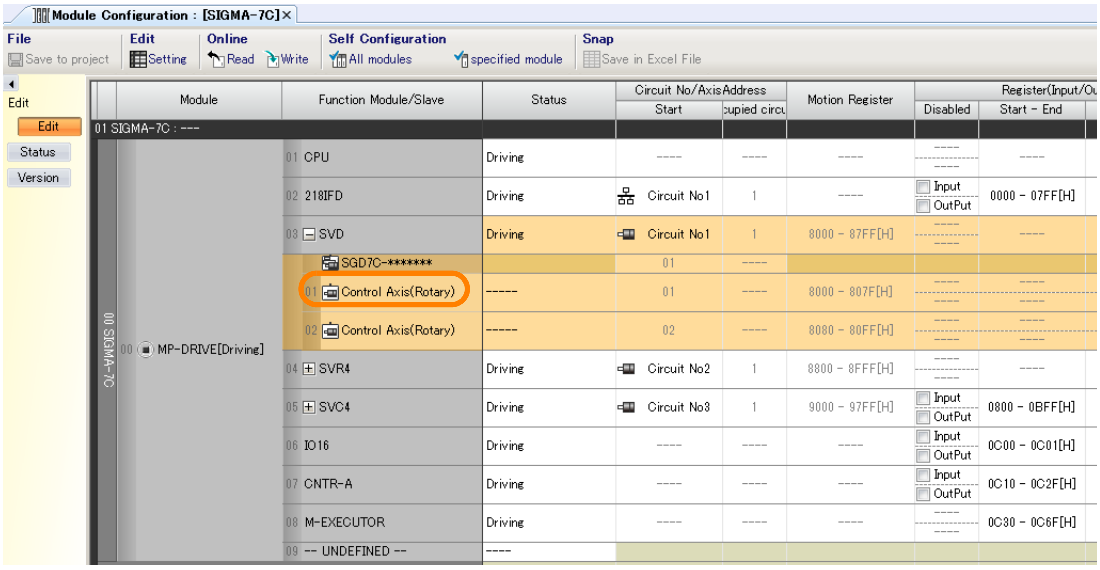
◆ Using the Icon in the Function List Dialog Box of the MPE720

Double-click the axis to operate on the Module Configuration Definition Tab Page of the MPE720. The Function List Dialog Box will be displayed. Use the following procedure to start the SigmaWin+ with the **Servo Tuning** Icon in the Function List Dialog Box.

1. Start the MPE720.

2. The Module Configuration Definition Tab Page will be displayed.

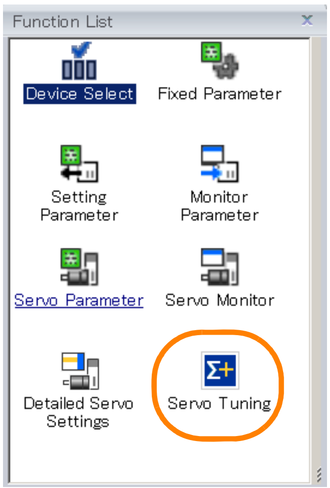
3. Double-click the axis to operate.



Module	Function Module/Slave	Status	Circuit No/AxisAddress Start	cupied circu	Motion Register	Register(Input/Ou Disabled	Start – End
01 SIGMA-7C : ---							
00 MP-DRIVE[Driving]	01 CPU	Driving	----	----	----	---- ----	----
	02 218IFD	Driving	Circuit No1	1	----	☐ Input ☐ OutPut	0000 – 07FF[H]
	03 SVD	Driving	Circuit No1	1	8000 – 87FF[H]	---- ----	----
	SGD7C-*******		01	----			
	01 Control Axis(Rotary)	-----	01	----	8000 – 807F[H]	---- ----	---- ----
	02 Control Axis(Rotary)	-----	02	----	8080 – 80FF[H]	---- ----	---- ----
	04 SVR4	Driving	Circuit No2	1	8800 – 8FFF[H]	---- ----	----
	05 SVC4	Driving	Circuit No3	1	9000 – 97FF[H]	☐ Input ☐ OutPut	0800 – 0BFF[H]
	06 IO16	Driving	----	----	----	☐ Input ☐ OutPut	0C00 – 0C01[H]
	07 CNTR-A	Driving	----	----	----	☐ Input ☐ OutPut	0C10 – 0C2F[H]
	08 M-EXECUTOR	Driving	----	----	----	---- ----	0C30 – 0C6F[H]
	09 -- UNDEFINED --	----					

The Function List Dialog Box will be displayed.

4. Double-click the **Servo Tuning** Icon.



The SigmaWin+ will start.

5. The SERVOPACK will be connected offline in the same way as when you use the desktop icon to start the SigmaWin+.
Refer to the following section for details.
☞ ◆ *Using the Desktop Icon* on page 4-11

4.2 Project Files

4.2.1 What Are Project Files?

The contents of project files depends on the operation tool. This section describes project files for the MPE720 and SigmaWin+.

MPE720

MPE720 project files include the information listed below.

System configuration	• System definitions • Scan time definitions • Module configuration definitions • Data tracing information
Programs	• Ladder programs (high-speed programs, low-speed programs, startup programs, interrupt programs, and functions) • Motion programs (main program, subprograms, and group definitions) • Table data • Variables (axis, I/O, global, constant, and user-defined structure variables) • Comments (I/O, global, and constant comments)
Registers	• M (data registers) • D (internal registers) • C (constant registers) • S (system registers) • I (input registers) • O (output registers) • G (data registers)

The project file includes files for all of the above information but allows you to handle them as a single file in Windows. The project file extension is ".YMW7".

Opening a project file enables editing all of these files.

Only one project file can be opened in a single window with MPE720. The same project file cannot be opened in more than one window with the MPE720. If you try to open a project file that is already open, the MPE720 window that contains the open project file will move to the front.

Information
- To prevent data loss in case of SERVOPACK failure, always store a backup copy of the project file. We recommend saving a copy of the project file before making any modifications to it (changing the module configuration definitions, the ladder programs, the motion programs, etc.).
- You can set passwords for project files. Refer to the following section for details.
  ☞ *12.6.1 Project File Security* on page 12-37

SigmaWin+

SigmaWin+ project files include the information listed below.

- Workspace Servo Drive information
- Parameter information for Servo Drives
- SigmaWin+ setting information

The project file includes files for all of the above information but allows you to handle them as a single file in Windows. The project file extension is ".swpp".

Only one project file can be opened in a single window with the SigmaWin+. The same project file cannot be opened in more than one window with the SigmaWin+. If you try to open a project file that is already open, the SigmaWin+ window that contains the open project file will move to the front.

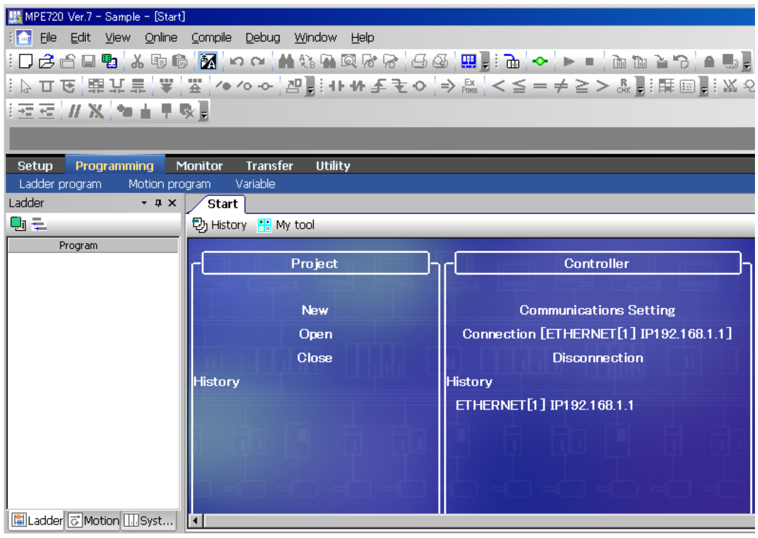
4.2.2 Creating a Project File

The procedure for creating a project file depends on the operation tool. This section provides the procedures for creating project files for the MPE720 and SigmaWin+.

MPE720

Use the following procedure to create a MPE720 project file.

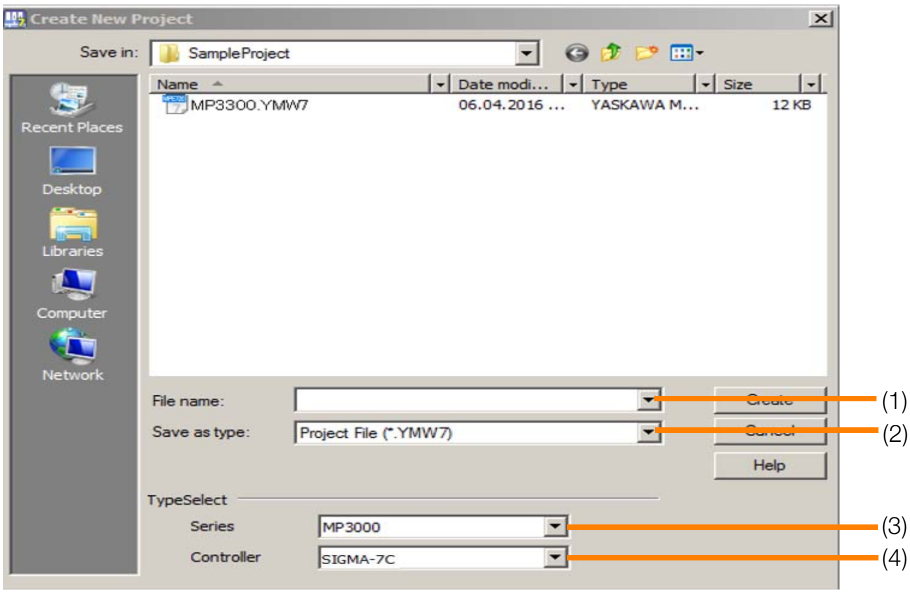
1. Start creating a project file with either of the following two methods.
   - Select ***New*** from the **Project** Area in the Start Tab Page.
   - Select ***File*** – ***New Project*** from the menu bar.



Information If a project file was being edited, a dialog box will be displayed asking whether to compile and save the project file. The buttons perform the following actions:

> **Yes** Button: The current project will be compiled and saved by overwriting the previously version, and editing will be ended.
> **No** Button: Editing will be ended without compilation and saving any changes.
> **Cancel** Button: Creating a project will be canceled and you can continue to edit the current project.

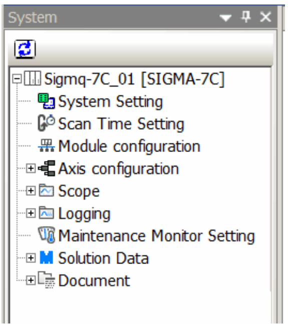
2. Open the target folder, enter the file name, select the file type, and specify the SERVOPACK to use.



Save in: SampleProject
MP3300.YMW7 06.04.2016 ... YASKAWA M... 12 KB
Save as type: Project File (*.YMW7)
Series: MP3000
Controller: SIGMA-7C

(1) File name	Enter the name of the project file to create. Note: The file name cannot contain any of the following characters: / \ :* " < > |
(2) Save as type	Select Project File (*.YMW7).
(3) Series	Select MP3000.
(4) Controller	Select SIGMA-7C.

3. Click the **Create** Button.
   After the Create/Open Project File message is displayed, the project file is created in the specified folder and the created project file is displayed in the System Pane.



After you create a project file, you can perform program file operation in the Ladder and Motion Panes.

Important

Make the following settings after you create a project file.
- Communications settings
- Module configuration settings

  ☞ *4.3 Self Configuration* on page 4-21
- System settings
- Scan settings

  ☞ *4.3.5 Setting the Scan Times* on page 4-43

Information

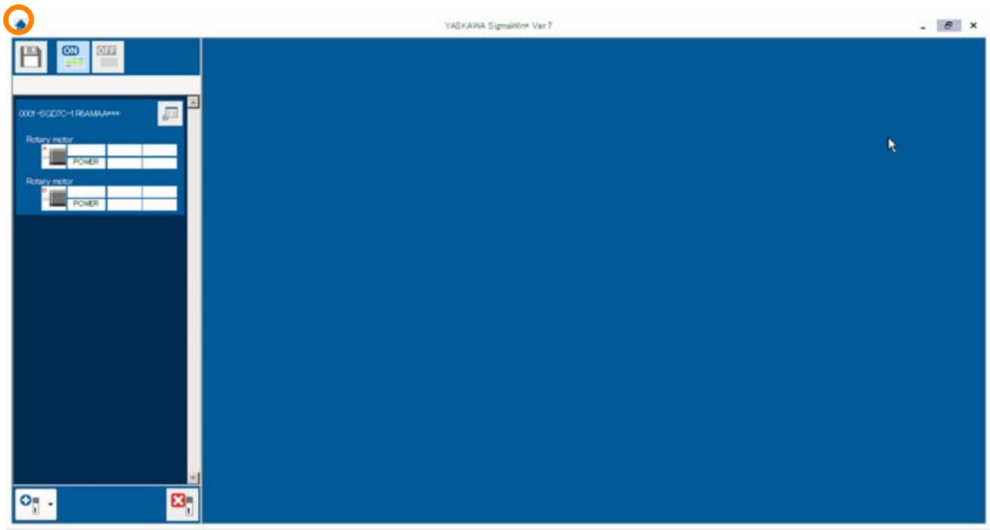
- Opening an Existing Project File
  You can open an existing project files by dragging its icon to the window of MPE720. Alternatively, select ***File*** – ***Open Project*** from the menu bar to display the Open Project Dialog Box, and then select and open the project file from there.

  Note: If another project file is already open in the same window, and there were changes made to it, then performing the operation above will display a dialog box asking whether to save the changes to the project file.
- Saving a Project File
  A project file can be saved so that it overwrites the previous version.
  Select ***File*** – ***Save Project*** from the menu bar.
  After the *Saving project file. Please wait* message is displayed, the edited project file is saved by overwriting the previous version of it.
  To save the project file with a different name, select ***File*** – ***Save as a New Project*** from the menu bar.
- Closing a Project File
  To close a project file, select ***File*** – ***Close Project*** from the menu bar. Alternatively, select ***Close*** from the **Project** Area on the Start Tab Page.

SigmaWin+

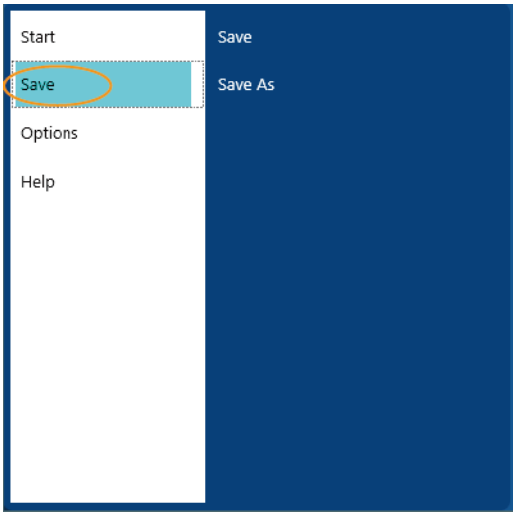
Use the following procedure to create a SigmaWin+ project file.

1. Click the **Home** Button in the SigmaWin+ Main Window.

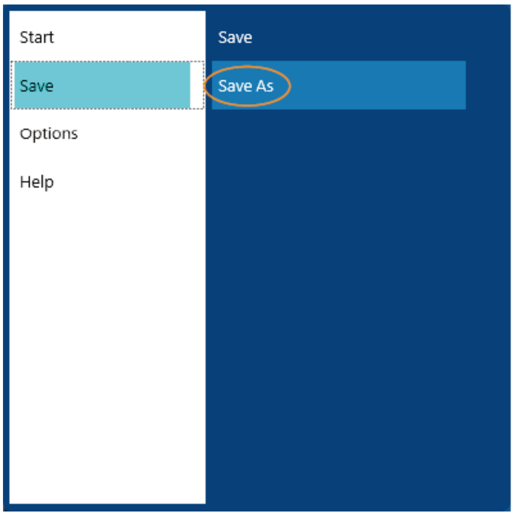


The Home Window will be displayed.

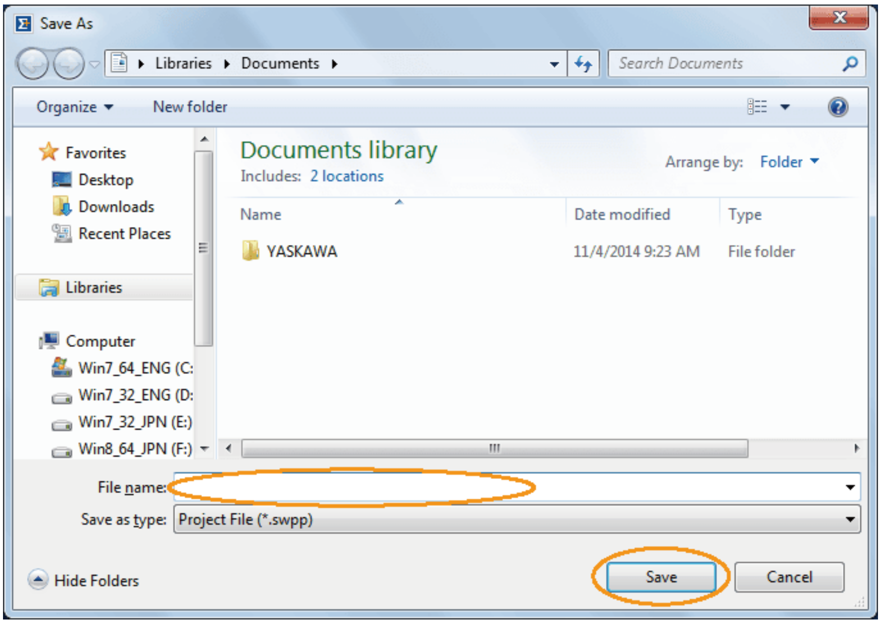
2. Click the **Save** Button.



3. Click **Save As.**



4. Enter the location and file name for the project file, and then click the **Save** Button.



Save as type: Project File (*.swpp)

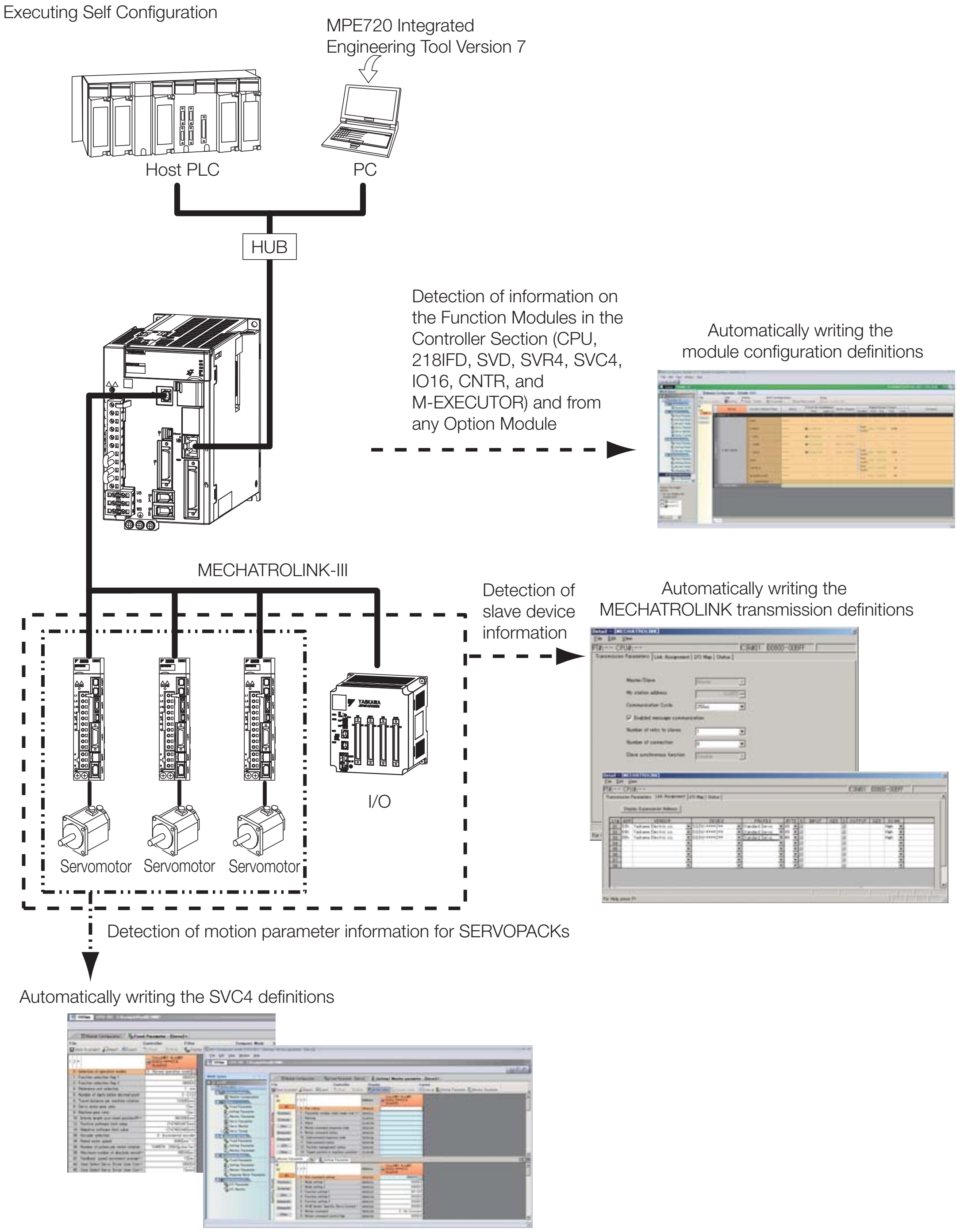
This concludes the procedure to create a project file.

4.3 Self Configuration

4.3.1 Self Configuration

Self configuration is a feature that automatically recognizes all the Option Modules that are installed in the SERVOPACK and all the slave devices that are connected via the MECHATROLINK connector (such as Servo Drives), and creates the module configuration definition files based on that information. Self configuration greatly reduces the steps that are required to set up the system. Use the DIP switch on the SERVOPACK or use the MPE720 to execute self configuration.

The following figure illustrates self configuration.



Operating Procedures

This section describes the operating methods for self configuration.

- Refer to the following section when you perform self configuration for the first time after connecting the devices.
  ☞ ◆ *Self Configuration Using the DIP Switch* on page 4-22
- If the SERVOPACK and the MPE720 are already connected, self configuration can be performed by using the MPE720.
  ☞ ◆ *Self Configuration Using the MPE720* on page 4-24

Important

Do not execute utility functions in the Servo Section while self configuration is being executed.

◆ Self Configuration Using the DIP Switch

The procedure for executing self configuration using the DIP switch depends on whether self configuration is being done for the first time since the devices were connected, or if SERVOPACKs or other devices have been added.

Both procedures are described below.

■ First Self Configuration after Connecting the Devices

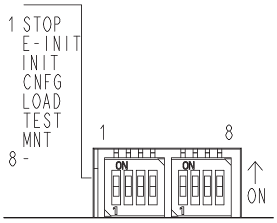
The following procedure performs a new self configuration of the SERVOPACK, and creates new definition files.

Important

1. Before performing this procedure, turn ON the power supply to the devices that perform MECHATROLINK communications.
2. This procedure will clear the following data:
   - All definition files
   - All user programs
   - All registers
   - SERVOPACK parameters

1. Turn OFF the control power supply.

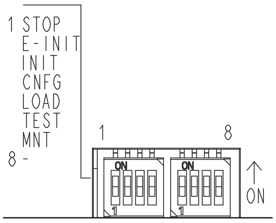
2. Turn ON only the INIT and CNFG pins on the DIP switches (mode switches).



3. Turn ON the control power supply.
Self configuration will be executed.

4. Confirm that the status indicators change in the following way:
- RDY: Goes out, and then lights.
- RUN: Goes out, flashes, and then lights.

5. Turn OFF the INIT and CNFG pins on the DIP switches (mode switches).



Important

1. INIT Pin on the DIP Switch and RAM Data
   If the power supply is turned OFF and ON again when the INIT pin on the DIP switches is turned ON, the data in RAM will be cleared.
   If the power supply is turned OFF and ON again when the INIT pin is turned OFF, the data from the flash memory will be loaded and will overwrite the RAM data. Therefore, if the power supply must be turned OFF while writing or editing a program, make sure you save the data to the SERVOPACK's flash memory to protect the RAM data.
2. Power Interruptions after Self Configuration
   After performing self configuration, turn OFF the power supply to the SERVOPACK only after the definition data is saved to the flash memory of the SERVOPACK.
   If by chance, the power supply is turned OFF before the data is saved, perform self configuration again.
   Refer to the following manual for information on saving data to the flash memory.
   📖 MP2000/MP3000 Series Engineering Tool MPE720 Version 7 User's Manual (Manual No.: SIEP C880761 03)

■ After Adding SERVOPACKs, Option Modules, or Other Devices

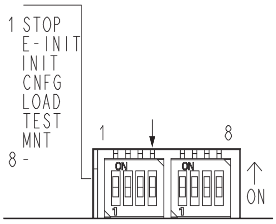
The following procedure will create the definitions for devices and Function Modules that are newly detected by MECHATROLINK transmissions. This procedure will not update any of the definitions that were made for existing devices and Function Modules. The definitions from before self configuration will be retained.

Important

Before performing this procedure, turn ON the power supply to the devices that perform MECHATROLINK communications.

1. Turn OFF the control power supply.

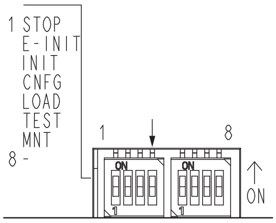
2. Turn ON only the CNFG pin on the DIP switches (mode switches).



3. Turn ON the control power supply.
Self configuration will be executed.

4. Confirm that the status indicators change in the following way:
- RDY: Goes out, and then lights.
- RUN: Goes out, flashes, and then lights.

5. Turn OFF the CNFG pin on the DIP switches (mode switches).



Important

Power Interruptions after Self Configuration

After performing self configuration, turn OFF the power supply to the SERVOPACK only after the definition data is saved to the flash memory of the SERVOPACK.

If by chance, the power supply is turned OFF before the data is saved, perform self configuration again.

Refer to the following manual for information on saving data to the flash memory.

MP2000/MP3000 Series Engineering Tool MPE720 Version 7 User's Manual (Manual No.: SIEP C880761 03)

◆ Self Configuration Using the MPE720

There are two types of self configuration that can be performed with the MPE720.

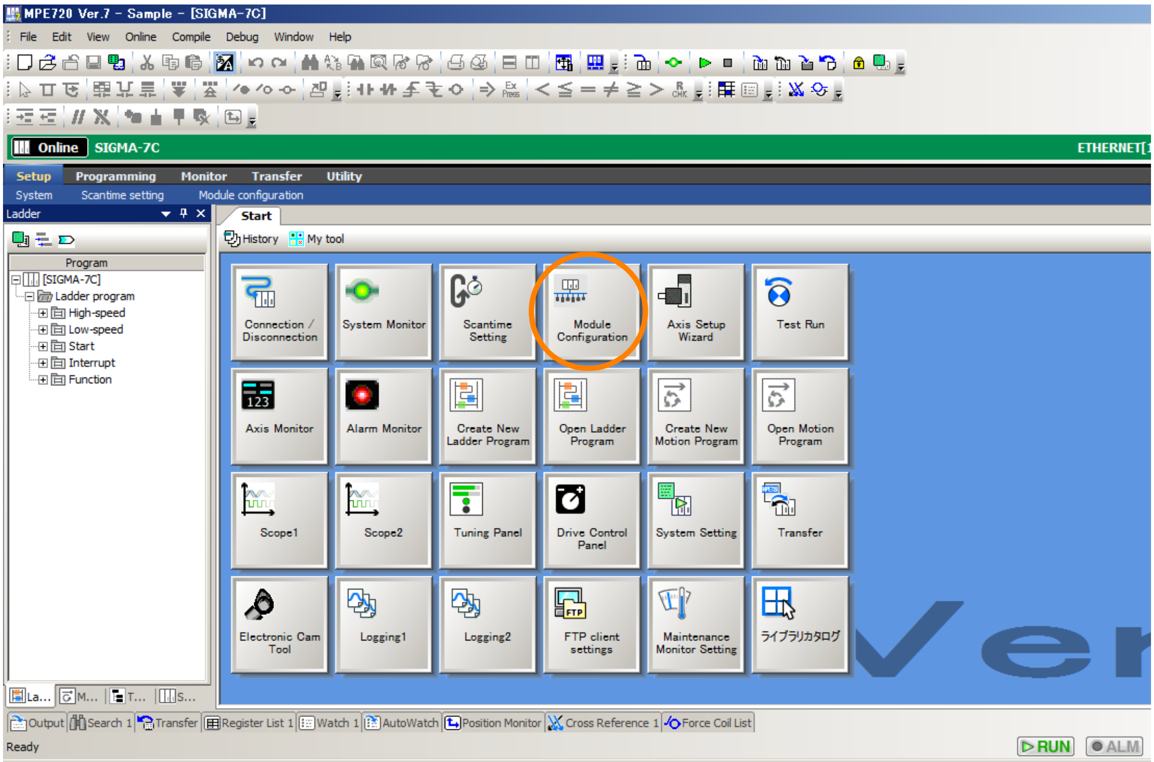
- Self configuration of all Modules: Use this mode when the system is being set up for the first time, or after the entire system has been changed.
- Self configuration of specified Modules: Use this mode when a part of the system has been changed. This process will automatically recognize all devices that have been added or removed, and automatically generate definition files for them.

■ Self Configuration of All Modules

Important

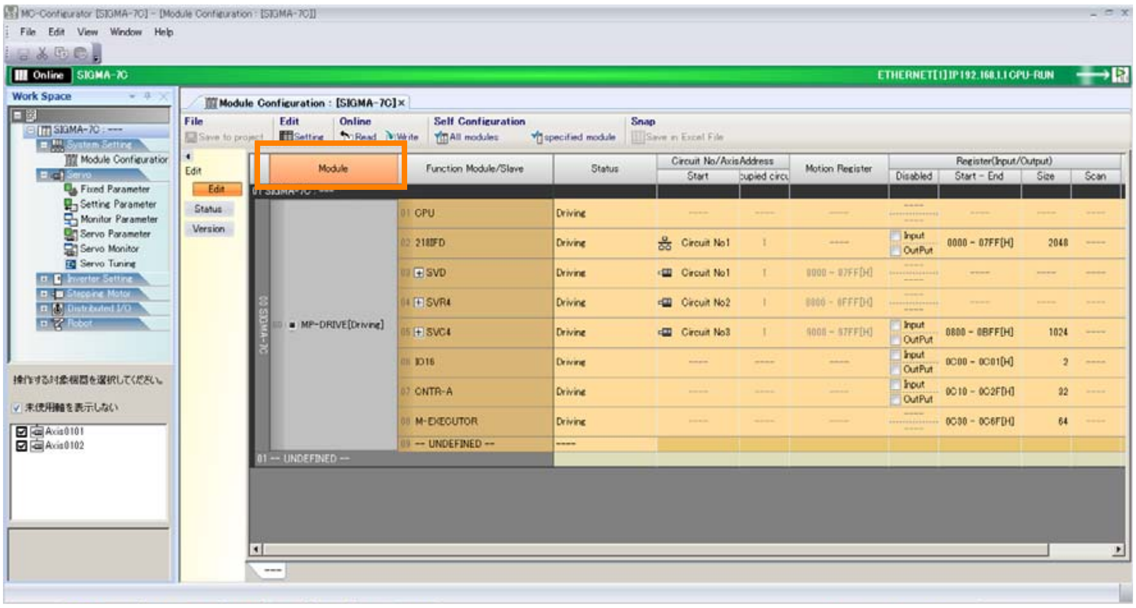
Before performing this procedure, turn ON the power supply to the devices that perform MECHATROLINK communications.

1. Click the **Module Configuration** Button on the My Tool View of the Start Tab Page.

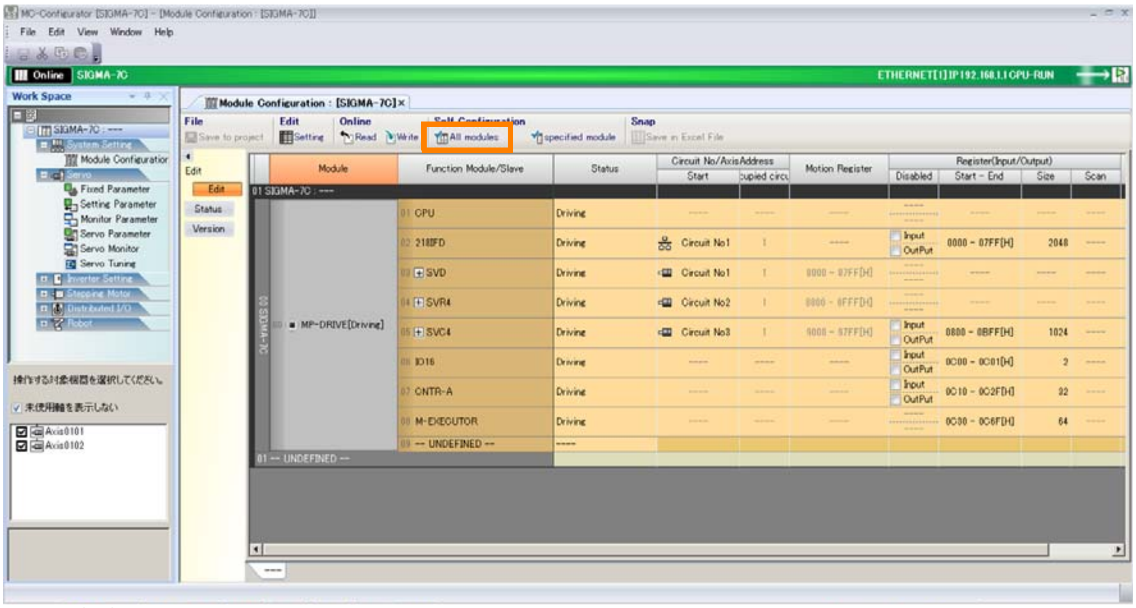


The Module Configuration Definition Tab Page will be displayed.

2. Click the **Module** Button.

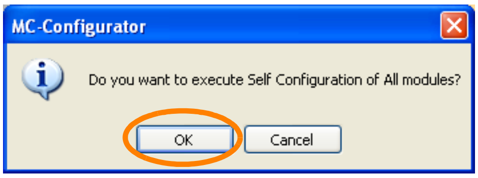


3. Click the **All modules** Button.



The MC-Configurator Dialog Box will be displayed.

4. Click the **OK** Button.



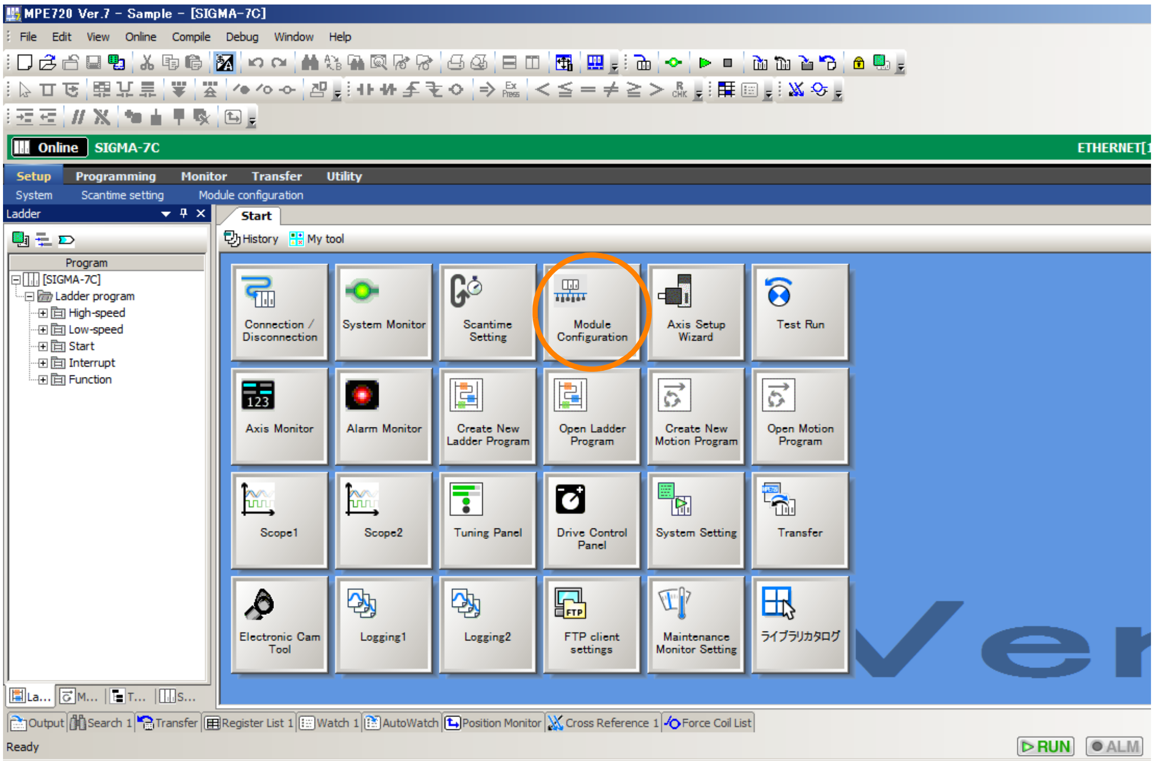
Do you want to execute Self Configuration of All modules?

Self configuration will be executed.

■ Self Configuration of Specified Modules

Important Before performing this procedure, turn ON the power supply to the devices that perform MECHATROLINK communications.

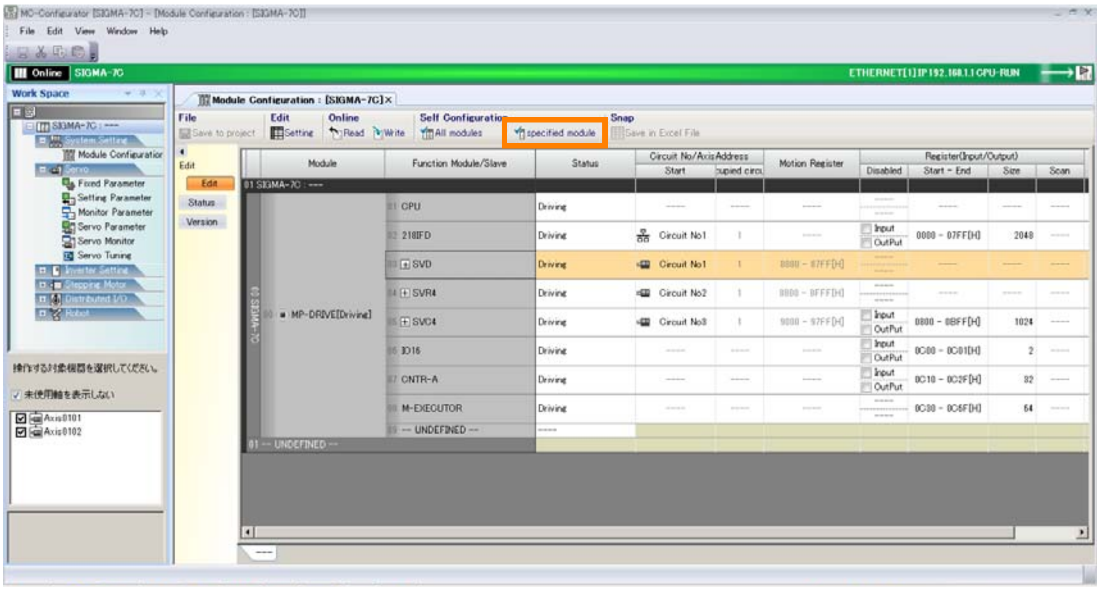
1. Click the **Module Configuration** Button on the My Tool View of the Start Tab Page.



The Module Configuration Definition Tab Page will be displayed.

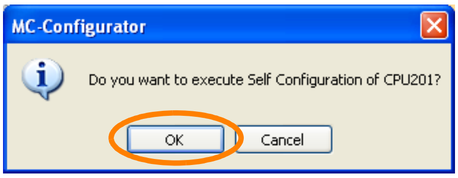
2. In the **Function Module/Slave** Column, select the Modules to configure using self configuration.

3. Click the **specified module** Button on the Launcher.



The MC-Configurator Dialog Box will be displayed.

4. Click the **OK** Button.



Do you want to execute Self Configuration of CPU201?

Self configuration will be executed only for the new devices that are detected through MECHATROLINK transmissions.

Definition Information Updated by Self Configuration

The definition information that is updated by self configuration is described below.

Information This procedure will not update any of the definitions that were made for existing devices and Function Modules. The definitions from before self configuration will be retained.

◆ I/O Registers

I/O registers are assigned to the Function Modules (218IFD, SVD, SVC4, SVR4, and M-EXECUTOR) in the SERVOPACK as shown below.

I/O registers will also be automatically assigned to any Option Modules mounted on the Base Unit.

Item		Settings after Self Configuration
218IFD		• First I/O registers: IW00000 and OW00000 • Last I/O registers: IW007FF and OW007FF (input registers: IW00000 to IW007FF, output registers: OW00000 to OW007FF)
SVD	Motion parameters	• First motion registers: IW08000 and OW08000 • Last motion registers: IW087FF and OW087FF (input registers: IW08000 to IW087FF, output registers: OW08000 to OW087FF)
SVC4	MECHATROLINK	• First I/O registers: IW00800 and OW00800 • Last I/O registers: IW00BFF and OW00BFF (input registers: IW00800 to IW00BFF, output registers: OW00800 to OW00BFF)
	Motion parameters	• First motion registers: IW08800 and OW08800 • Last motion registers: IW08FFF and OW08FFF (input registers: IW08800 to IW08FFF, output registers: OW08800 to OW08FFF)
SVR4	Motion parameters	• First motion registers: IW09000 and OW09000 • Last motion registers: IW097FF and OW097FF (input registers: IW09000 to IW097FF, output registers: OW09000 to OW097FF)
IO16		• First I/O registers: IW00C00 and OW00C00 • Last I/O registers: IW00C01 and OW00C01 (input registers: IW00C00 to IW00C01, output registers: OW00C00 to OW00C01)
CNTR		• First I/O registers: IW00C10 and OW00C10 • Last I/O registers: IW00C2F and OW00C2F (input registers: IW00C10 to IW00C2F, output registers: OW00C10 to OW00C2F)
M-EXECUTOR		• First I/O registers: IW00C50 and OW00C50 • Last I/O registers: IW00C8F and OW00C8F (input registers: IW00C50 to IW00C8F, output registers: OW00C50 to OW00C8F)

◆ 218IFD Definition

Item	Settings after Self Configuration
Local IP Address	192.168.1.1
Subnet Mask	255.255.255.0
Gateway IP Address	0.0.0.0
Module Name Definition	CONTROLLER NAME
Engineering Port	9999 (UDP)
MEMOBUS Response Time	0 s
Count of Retry (number of retries)	0

Note: Self configuration sets up the 218IFD for an engineering communications connection with the MPE720.
If you want to use MEMOBUS message communications, manually set up automatic reception or I/O message communications, or use MSG-SNDE and MSG-RCVE functions.

◆ MECHATROLINK Transmission Definition

Item	Settings after Self Configuration
Master/Slave	Master
My Station Address	0×0001
Transmission Cycle	250 µs
Message Communications	Enabled
Number of Retry to Slaves	1
Number of Connection	8
Slave Synchronous Function	Disabled

◆ SVD/SVC4/SVR4 Definitions

Refer to the following manual for details.

Σ-7-Series Σ-7C SERVOPACK Motion Control User's Manual (Manual No.: SIEP S800002 03)

◆ IO16

Item	Settings after Self Configuration
Discrete Input	IW00C00
Discrete Output	OW00C01
Interrupt Input	IB00C000

◆ CNTR

Item	Settings after Self Configuration
Fixed Parameters	Refer to the following section for details. ☞ *12.8.3 Setting Up the Counter Function Module* on page 12-62
Input Data	
Output Data	

◆ M-EXECUTOR Definitions

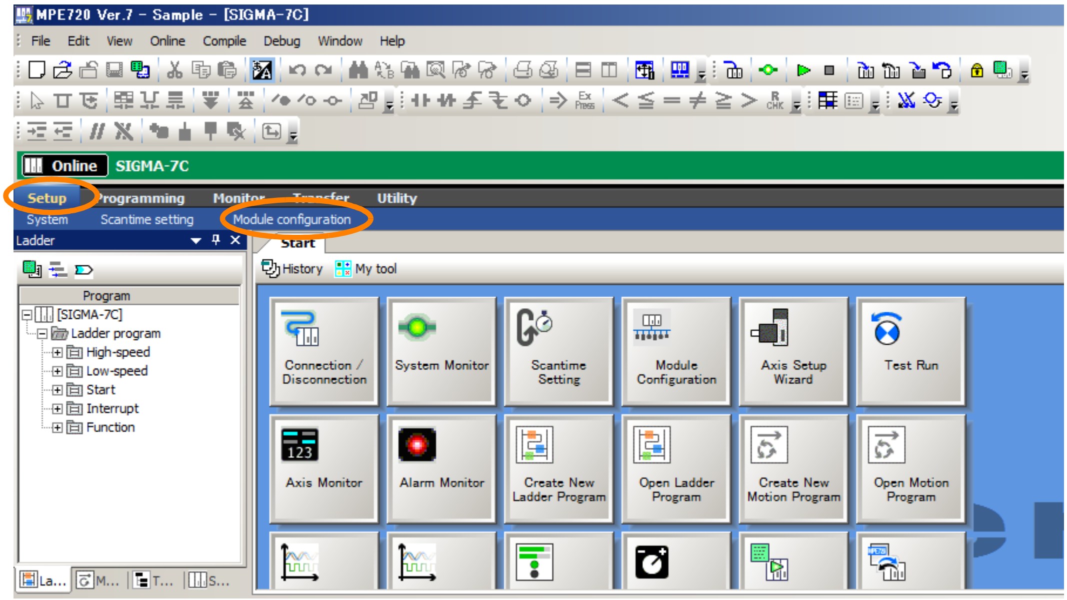
Item	Settings after Self Configuration
Program Definition Number	8
Program Assignments	Not supported.
Control Register Assignments	Not supported.

4.3.2 Confirming Definition Information Updated by Self Configuration

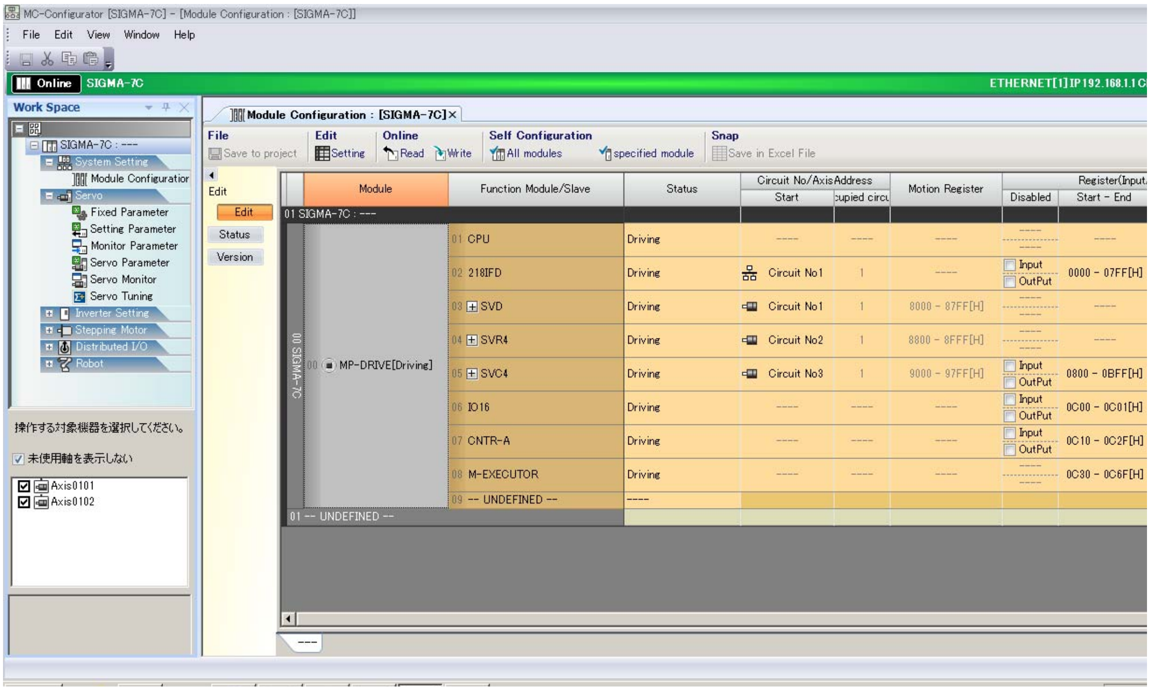
Confirm the results of the assignments to the slave devices (MECHATROLINK-connected devices, such as SERVOPACKs or distributed I/O) in the definition information during self configuration.

1. Open the project file.

2. Click ***Module configuration*** under **Setup**.



The Module Configuration Definition Tab Page will be displayed as shown below.



Module	Function Module/Slave	Status	Circuit No/Axis Address		Motion Register	Register(Input	
			Start	cupied circu		Disabled	Start - End
01 SIGMA-7C : ---							
00 SIGMA-7C 00 MP-DRIVE[Driving]	01 CPU	Driving	----	----	----	---- ----	----
	02 218IFD	Driving	Circuit No1	1	----	☐ Input ☐ OutPut	0000 - 07FF[H]
	03 SVD	Driving	Circuit No1	1	8000 - 87FF[H]	---- ----	----
	04 SVR4	Driving	Circuit No2	1	8800 - 8FFF[H]	---- ----	----
	05 SVC4	Driving	Circuit No3	1	9000 - 97FF[H]	☐ Input ☐ OutPut	0800 - 0BFF[H]
	06 IO16	Driving	----	----	----	☐ Input ☐ OutPut	0C00 - 0C01[H]
	07 CNTR-A	Driving	----	----	----	☐ Input ☐ OutPut	0C10 - 0C2F[H]
	08 M-EXECUTOR	Driving	----	----	----	---- ----	0C30 - 0C6F[H]
	09 -- UNDEFINED --	----					
01 -- UNDEFINED --							

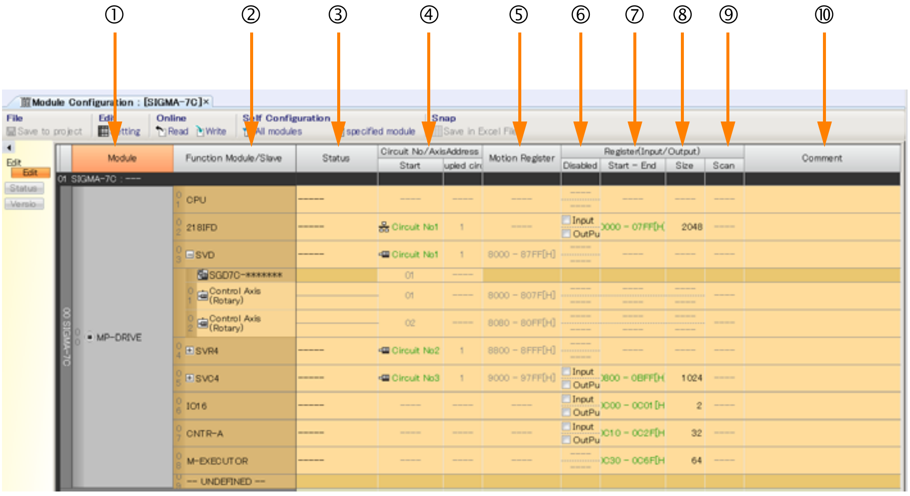
操作する対象機器を選択してください。

☑ 未使用軸を表示しない

☑ Axis0101
☑ Axis0102

Module Configuration Definition Tab Page Details

The following table describes the items that are displayed in the Module Configuration Definition Tab Page.



Module	Function Module/Slave	Status	Circuit No/AxisAddress		Motion Register	Register(Input/Output)				Comment
			Start	upied circ		Disabled	Start - End	Size	Scan	
01 SIGMA-7C : ---										
00 SIGMA-7C 00 MP-DRIVE	01 CPU	------	----	----	----	----	----	----	----	
	02 218IFD	------	Circuit No1	1	----	☐Input ☐OutPu	)000 - 07FF[H(	2048	----	
	03 SVD	------	Circuit No1	1	8000 - 87FF[H]	----	----	----	----	
	SGD7C-*******		01	----						
	01 Control Axis (Rotary)		01	----	8000 - 807F[H]	----	----	----	----	
	02 Control Axis (Rotary)		02	----	8080 - 80FF[H]	----	----	----	----	
	04 SVR4	------	Circuit No2	1	8800 - 8FFF[H]	----	----	----	----	
	05 SVC4	------	Circuit No3	1	9000 - 97FF[H]	☐Input ☐OutPu	)800 - 0BFF[H	1024	----	
	06 IO16	------	----	----	----	☐Input ☐OutPu	)C00 - 0C01 [H	2	----	
	07 CNTR-A	------	----	----	----	☐Input ☐OutPu	)C10 - 0C2F[H	32	----	
	08 M-EXECUTOR	------	----	----	----	----	)C30 - 0C6F[H	64	----	
	09 -- UNDEFINED --									

No.	Item		Display/Setting Item	Setting Range/Settings	Editing
①	Module		Displays the Module that is set for the slot.	Any module	Possible
②	Function Module/Slave		Displays the Function Modules and slaves that are used by the Module.	Any Function Module or slave	Possible
③	Status		In Online Mode, displays the status of the Function Modules and the communications status of MECHATROLINK slave devices.	Refer to the following section. ☞ *Status Display Contents* on page 4-31	Not possible
④	Circuit No./ Axis Address	Start	Displays the first circuit number that is assigned to the Module.	Circuit No. 1 to 16	Possible
		Occupied circuits	Displays the number of circuits that are assigned to the Module.	1 and 2	Possible
⑤	Motion Register		Displays the first and last register numbers of the motion parameters.	The parameter is automatically set based on the circuit numbers.	Not possible
⑥	Register (Input/Output)	Disabled	Used to disable inputs or outputs by selecting the check boxes.	Selected or not selected	Possible
⑦		Start - End	Displays the range of registers that is used as an I/O area by the Function Module. For the SVC4, the first and last registers of the I/O Modules that are connected to MECHATROLINK are displayed.	Start: 0000h to 7FFFh, End: 10000h to 17FFFh, 800h words max.*	Possible
⑧		Size	Displays the number of words in the I/O area.	The size depends on the function of the Module.	Possible
⑨		Scan	Displays the scan in which the I/O service is performed for the I/O device.	High/Low	Possible
⑩	Comment		Displays the user comment.	You can enter up to 16 characters for a Function Module. You can enter up to 32 characters for a MECHATROLINK slave.	Possible

* Set I/O registers so that the same registers are not used by more than one Function Module.

Important

Precautions When Setting the Parameters
- Always save all settings to the flash memory after changing them.
- When changing the settings, be careful not to set register numbers that overlap with other Modules.
- Set I/O start and end registers even if a I/O Module is not connected to the MECHATROLINK network.

Status Display Contents

The items displayed in the Status Column are listed below.

◆ Function Module Status

The following status is displayed for Function Modules.

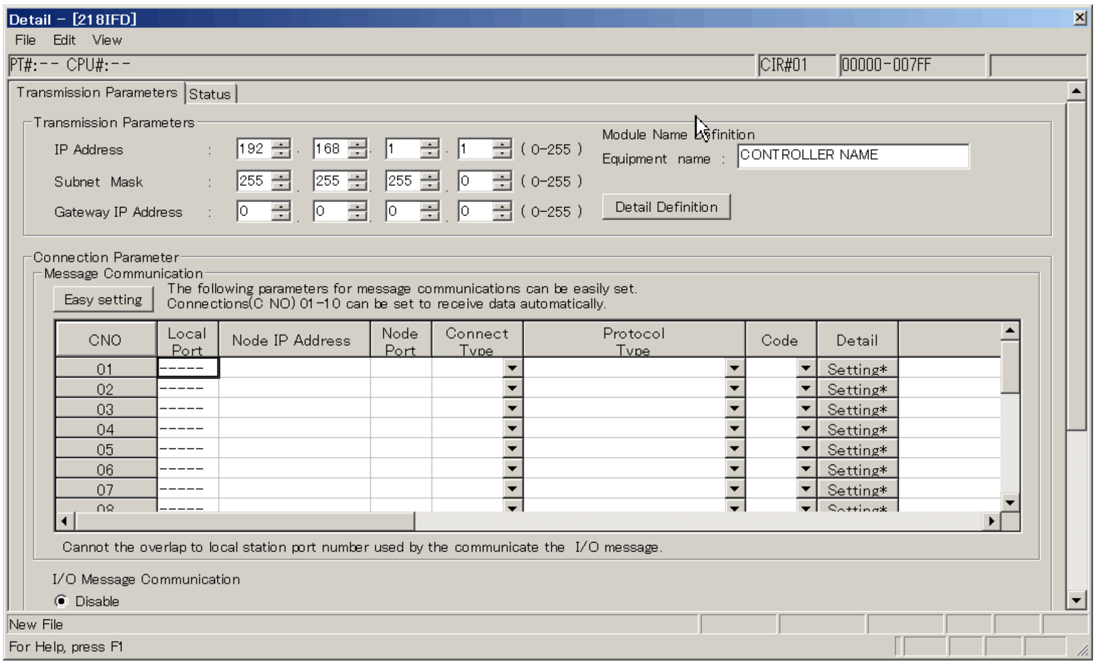
Display	Description
----	There is no Function Module Definition and the Module is not mounted.
Empty	There is a Function Module Definition, but the Module is not mounted.
Driving	The Function Module is operating normally.
Failure	An error was detected in the Function Module.
×	The mounted Module does not match the Function Module Definition.
Initializing	The Module is mounted, but there is no Detailed Function Module Definition.
Driving Stop	The CPU is stopped (The user programs are stopped).

4.3.3 Confirming the Detailed Definitions of the Function Modules

This section describes the following settings:
- 218IFD
- SVD
- SVC4

218IFD

Double-click the row for the 218IFD on the Module Configuration Definition Tab Page to display the 218IFD Detail Dialog Box.



PT#:-- CPU#:-- CIR#01 00000-007FF

Transmission Parameters
IP Address : 192 . 168 . 1 . 1 (0-255)
Subnet Mask : 255 . 255 . 255 . 0 (0-255)
Gateway IP Address : 0 . 0 . 0 . 0 (0-255)

Module Name Definition
Equipment name : CONTROLLER NAME

Connection Parameter
Message Communication
The following parameters for message communications can be easily set.
Connections(C NO) 01-10 can be set to receive data automatically.

CNO	Local Port	Node IP Address	Node Port	Connect Type	Protocol Type	Code	Detail
01	-----						Setting*
02	-----						Setting*
03	-----						Setting*
04	-----						Setting*
05	-----						Setting*
06	-----						Setting*
07	-----						Setting*

Cannot the overlap to local station port number used by the communicate the I/O message.

I/O Message Communication
● Disable

New File
For Help, press F1

◆ Preparing for Connection to the Host Device

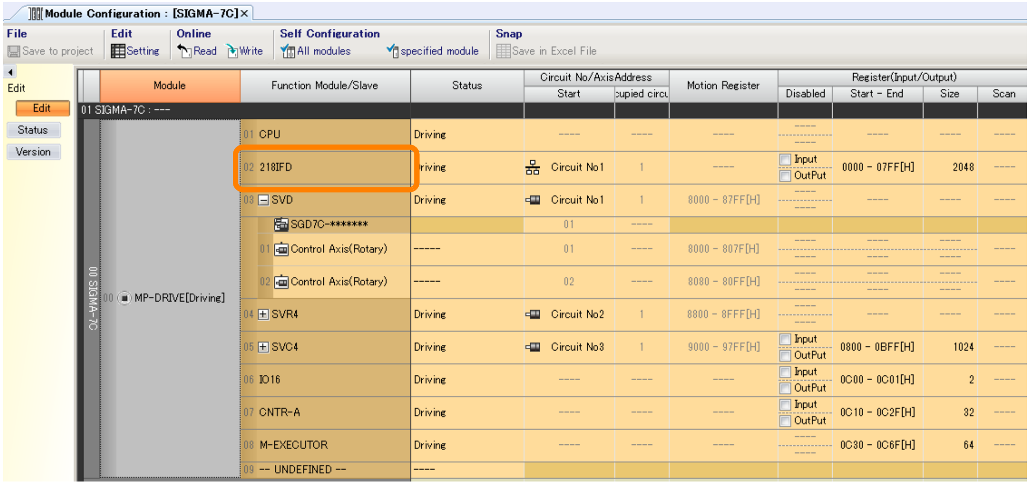
We recommend that you use an Ethernet connection to connect the SERVOPACK to the host device.

The following section describes how to easily connect to the host device with the MPE720.

> Term
>
> "Host device" is a generic term for a Machine Controller, a PLC made by another manufacturer, a touch panel, or any other similar device.

■ Using the MPE720 for Easy Connection

1. Click the row for the 218IFD on the Module Configuration Definition Tab Page.



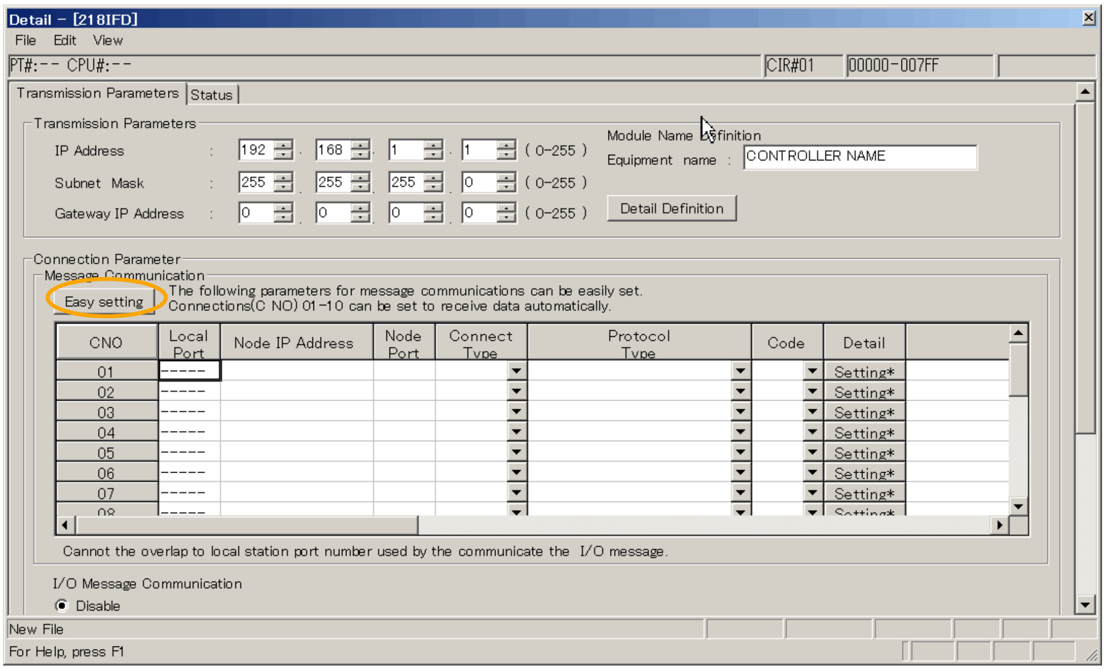
01 SIGMA-7C : ---

00 SIGMA-7C

Module	Function Module/Slave	Status	Circuit No/AxisAddress Start	cupied circu	Motion Register	Register(Input/Output) Disabled	Start - End	Size	Scan
00 MP-DRIVE[Driving]	01 CPU	Driving	----	----	----	----	----	----	----
	02 218IFD	riving	Circuit No1	1	----	☐ Input ☐ OutPut	0000 - 07FF[H]	2048	----
	03 SVD	Driving	Circuit No1	1	8000 - 87FF[H]	----	----	----	----
	SGD7C-*******		01	----					
	01 Control Axis(Rotary)	-----	01	----	8000 - 807F[H]	----	----	----	----
	02 Control Axis(Rotary)	-----	02	----	8080 - 80FF[H]	----	----	----	----
	04 SVR4	Driving	Circuit No2	1	8800 - 8FFF[H]	----	----	----	----
	05 SVC4	Driving	Circuit No3	1	9000 - 97FF[H]	☐ Input ☐ OutPut	0800 - 0BFF[H]	1024	----
	06 IO16	Driving	----	----	----	☐ Input ☐ OutPut	0C00 - 0C01[H]	2	----
	07 CNTR-A	Driving	----	----	----	☐ Input ☐ OutPut	0C10 - 0C2F[H]	32	----
	08 M-EXECUTOR	Driving	----	----	----	----	0C30 - 0C6F[H]	64	----
	09 -- UNDEFINED --	----							

The Detail Dialog Box will be displayed.

2. Click the **Easy setting** Button in the Message Communication Area.



PT#:-- CPU#:-- CIR#01 00000-007FF

Transmission Parameters

IP Address : 192 . 168 . 1 . 1 (0-255)
Subnet Mask : 255 . 255 . 255 . 0 (0-255)
Gateway IP Address : 0 . 0 . 0 . 0 (0-255)

Module Name Definition
Equipment name : CONTROLLER NAME

Connection Parameter

Message Communication

The following parameters for message communications can be easily set.
Connections(C NO) 01-10 can be set to receive data automatically.

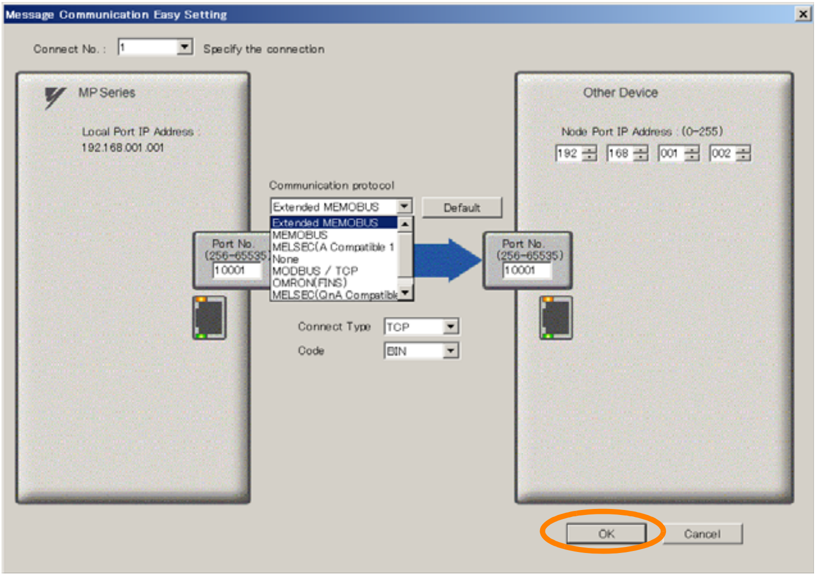
CNO	Local Port	Node IP Address	Node Port	Connect Type	Protocol Type	Code	Detail
01	-----						Setting*
02	-----						Setting*
03	-----						Setting*
04	-----						Setting*
05	-----						Setting*
06	-----						Setting*
07	-----						Setting*
08	-----						Setting*

Cannot the overlap to local station port number used by the communicate the I/O message.

I/O Message Communication
● Disable

The Message Communication Easy Setting Dialog Box will be displayed.

3. Select the communications protocol type from the list, and click the **OK** Button.



Message Communication Easy Setting

Connect No. : 1 Specify the connection

MP Series

Local Port IP Address : 192.168.001.001

Other Device

Node Port IP Address : (0–255) 192 168 001 002

Communication protocol: Extended MEMOBUS

Port No. (256–65535): 10001

Port No. (256–65535): 10001

Connect Type: TCP

Code: BIN

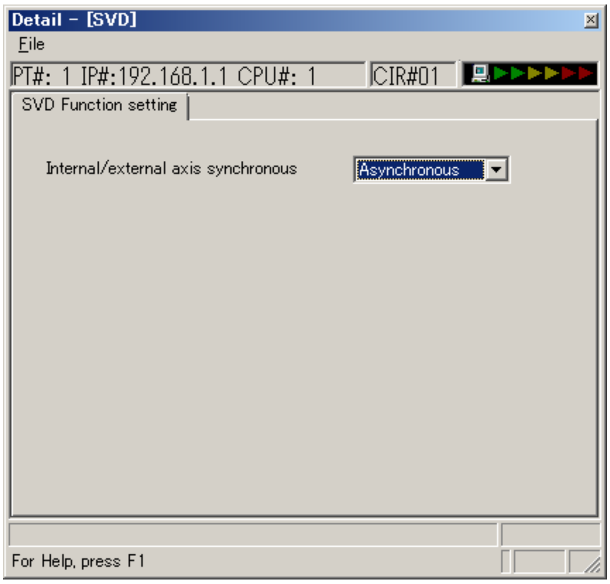
This concludes the setting procedure.

Refer to the following manual for details.

MP3000 Series Communications User’s Manual (Manual No.: SIEP C880725 12)

SVD

Double-click the row for the SVD on the Module Configuration Definition Tab Page to display the SVD Detail Dialog Box.



Detail – [SVD]

PT#: 1 IP#:192.168.1.1 CPU#: 1 CIR#01

Internal/external axis synchronous: Asynchronous

For Help, press F1

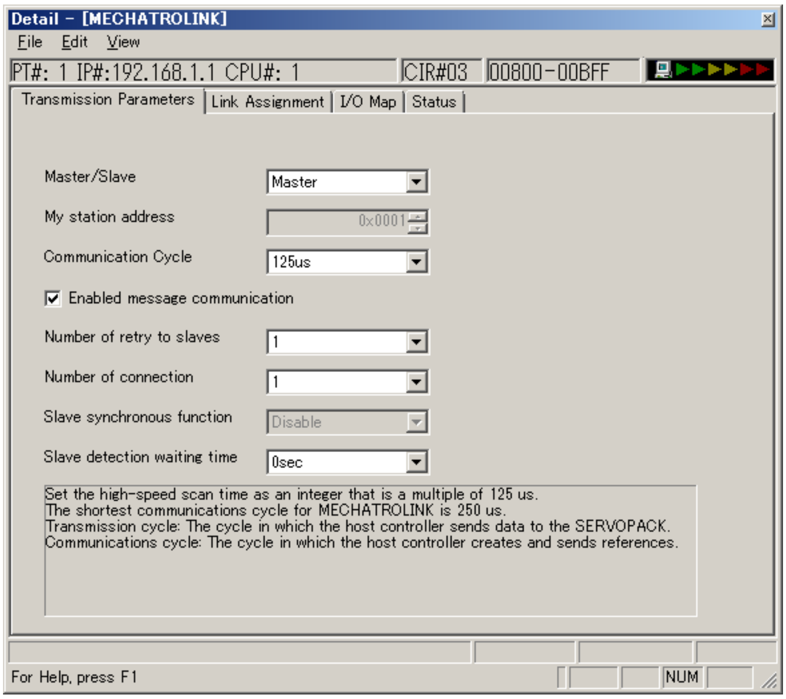
SVC4

Double-click the row for the SVC4 on the Module Configuration Definition Tab Page to display the MECHATROLINK Detail Definition Dialog Box.

The MECHATROLINK Detail Definition Dialog Box has four tabs: Transmission Parameters, Link Assignment, I/O Map, and Status. Click a tab to view the tab page.

◆ Transmission Parameters Tab Page

This tab page displays the parameters required to use the MECHATROLINK communications system.



PT#: 1 IP#:192.168.1.1 CPU#: 1 CIR#03 00800-00BFF

Master/Slave: Master

My station address: 0x0001

Communication Cycle: 125us

☑ Enabled message communication

Number of retry to slaves: 1

Number of connection: 1

Slave synchronous function: Disable

Slave detection waiting time: 0sec

Set the high-speed scan time as an integer that is a multiple of 125 us.
The shortest communications cycle for MECHATROLINK is 250 us.
Transmission cycle: The cycle in which the host controller sends data to the SERVOPACK.
Communications cycle: The cycle in which the host controller creates and sends references.

For Help, press F1

The items on the Transmission Parameters Tab Page are described in the following table.

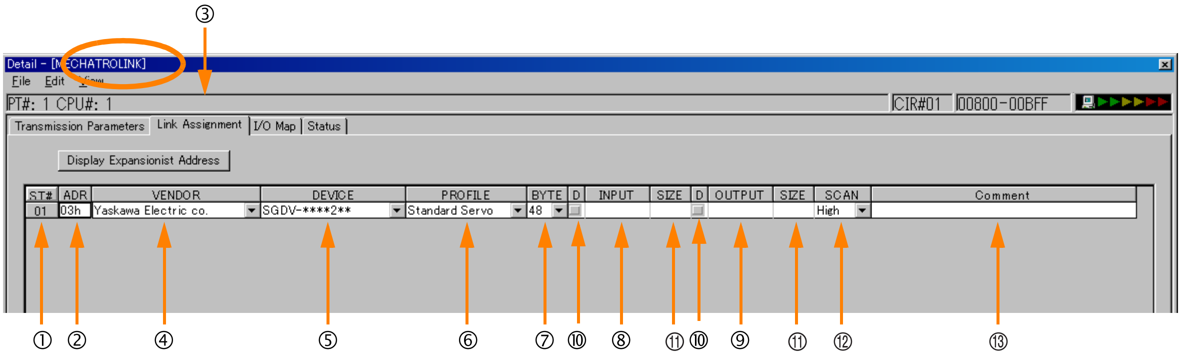
Item	Description	Precautions and Settings
Master/Slave	Displays whether the selected SVC4 Function Module used as a master station or a slave station.	The setting is always *Master.*
My station address	Displays the address of the local station.	The setting is always *01h.*
Communication Cycle	Displays the transmission cycle.	Select from the following: 125 µs, 250 µs, 500 µs, 1 ms, 1.5 ms, 2 ms, and 3 ms.
Enabled message communication	If the check box is selected, message communications are enabled.	This check box is linked to the setting of the **Number of retry to slaves** Box. If the retry count is 0, it will change to 1 when the **Enabled message communication** Check Box is selected. If a value that is higher than 1 is set for the retry count, this check box will be selected automatically.
Number of retry to slaves	Displays the maximum number of retries executed within one transmission cycle.	–
Number of connection	Displays the number of slave stations that are connected.	You can set the number of connected stations here.
Message Box	This box displays precautions on the high-speed scan time setting.	–

Important

For editable items, the settings can be changed. Always save all settings to the flash memory after changing them.

Link Assignment Tab Page

The Link Assignment Tab Page displays the assignment settings for all slave devices that were detected during self-configuration (MECHATROLINK-connected devices, such as SERVOPACKs or distributed I/O).



ST#	ADR	VENDOR	DEVICE	PROFILE	BYTE	D	INPUT	SIZE	D	OUTPUT	SIZE	SCAN	Comment
01	03h	Yaskawa Electric co.	SGDV-****2**	Standard Servo	48	☐			☐			High	

◆ Displayed Items

The following table lists the items that are displayed on the Link Assignment Tab Page.

For the valid setting ranges and setting precautions, refer to the descriptions of the items on the following pages.

No.	Item	Description
①	ST#	Displays the station number.
②	ADR	Sets the station address of the slave station.
③	ExADR	Set the individual extended addresses when multi-station modules (multi-slaves) are grouped together as a single node.
④	VENDOR	Set the vendor name of the device.
⑤	DEVICE	Sets the slave model.
⑥	PROFILE	Set the profile to use.
⑦	BYTE	Sets the number of transmission bytes.
⑧	INPUT	Sets the first register address of the input area.
⑨	OUTPUT	Sets the first register address of the output area.
⑩	D	Enables or disables the I/O registers.
⑪	SIZE	Set the input and output sizes in words.
⑫	SCAN	Sets the scan in which the input or output is performed.
⑬	Station Name (comment)	Used to enter a comment of up to 32 characters.

◆ Item Details

This section provides details on the items that are displayed on the Link Assignment Parameters Tab Page.

Important

Always save all settings to the flash memory after changing them.

■ ST#

This is the station number.

The number of rows that is displayed corresponds to the number of slave stations that is set on the Transmission Parameters Tab Page.

This number is automatically assigned.

■ ADR

Sets the station address of the slave station.

When the local station is set as a slave station, the address specified on the Transmission Parameters Tab Page is displayed.

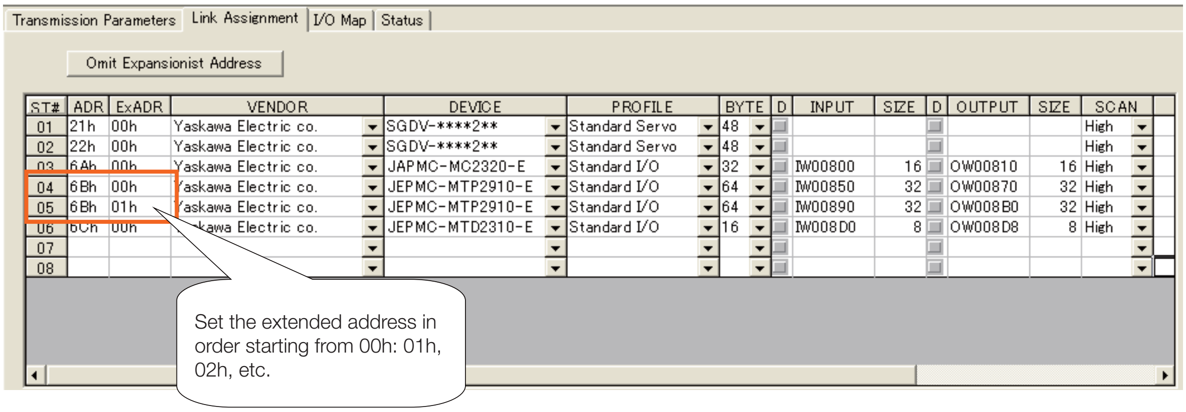
- Setting range: 03h to EFh

■ ExADR

Sets the individual extended addresses when multi-station modules (multi-slaves) are grouped together as a single node.

This box is displayed when the **Display Expansionist Address** Button is clicked, and is hidden when the **Omit Expansionist Address** Button is clicked.

- Setting range: 03h to EFh
- Extended Address Setting
  Extended addresses are set in succession from extended address 00h.
  The following figure shows an example of how to set extended addresses.



ST#	ADR	ExADR	VENDOR	DEVICE	PROFILE	BYTE	D	INPUT	SIZE	D	OUTPUT	SIZE	SCAN
01	21h	00h	Yaskawa Electric co.	SGDV-****2**	Standard Servo	48	☐			☐			High
02	22h	00h	Yaskawa Electric co.	SGDV-****2**	Standard Servo	48	☐			☐			High
03	6Ah	00h	Yaskawa Electric co.	JAPMC-MC2320-E	Standard I/O	32	☐	IW00800	16	☐	OW00810	16	High
04	6Bh	00h	Yaskawa Electric co.	JEPMC-MTP2910-E	Standard I/O	64	☐	IW00850	32	☐	OW00870	32	High
05	6Bh	01h	Yaskawa Electric co.	JEPMC-MTP2910-E	Standard I/O	64	☐	IW00890	32	☐	OW008B0	32	High
06	6Ch	00h	kawa Electric co.	JEPMC-MTD2310-E	Standard I/O	16	☐	IW008D0	8	☐	OW008D8	8	High
07							☐			☐			
08							☐			☐			

Set the extended address in order starting from 00h: 01h, 02h, etc.

■ VENDOR

Set the vendor name of the device.

- Settings: Yaskawa Electric Co. or **** Vendor

■ DEVICE

Sets the slave model.

- Link Assignment Model Details
  The relationship between the model displayed under **DEVICE** and its corresponding profile is shown below.
  If you manually assign a link, be sure that the actual device connected to the SVC4 is the same as the one that is displayed under **DEVICE** on the Link Assignment Tab Page.

DEVICE	Communications Specifications			
	Corresponding Profile	Number of Transmission Bytes	Minimum Transmission Cycle	Maximum Transmission Cycle
SGD7S-□□□□20□□□□□□□□	Standard Servo	32 or 48	125 μs	4 ms
SGD7W-□□□□20□□□□□□□□				
SGDV-□□□□2□□				
JAPMC-MC2320-E	Standard I/O	16, 32, 48, or 64	250 μs	32 ms
JEPMC-MTD2310-E	Standard I/O	16	250 μs	8 ms
JEPMC–MTA2900–E	Standard I/O	32	125 μs	8 ms
JEPMC–MTA2910–E	Standard I/O	16	125 μs	8 ms
JEPMC–MTP2900–E	Standard I/O	64	125 μs	8 ms
JEPMC–MTP2910–E	Standard I/O	64	125 μs	8 ms
WildCard Device	Standard Servo	48	Depends on the actual device.	Depends on the actual device.
	Standard I/O	16, 32, 48, or 64	Depends on the actual device.	Depends on the actual device.

■ PROFILE

Set the profile to use.

- Settings: Depends on the device.

■ BYTE

Set the number of transmission bytes.

- Settings: Depends on the profile.

■ INPUT

Sets the first register address of the input area.

These settings are disabled if the profile is set to **Standard Servo**.

- Setting range: The range of the Module's I/O registers

■ OUTPUT

Sets the first register address of the output area.

These settings are disabled if the profile is set to **Standard Servo**.

- Setting range: The range of the Module's I/O registers

■ D

Enable or disable the I/O registers.

- Settings: Enable or Disable
  ☐: Enabled

  ☑: Disabled

■ SIZE

Set the input and output sizes in words.

These settings are disabled if the profile is set to **Standard Servo**.

- Setting range: 0 to 32

■ SCAN

Sets the scan in which the input or output is performed.

This setting is always set to High if the profile is set to **Standard Servo**.

- Settings: High or Low

■ Station Name (comment)

Enter a comment of up to 32 characters if required.

◆ Deleting Station Assignments

You can delete the items on the Link Assignment Tab Page for a station.

Click any cell in the row for the station to delete, and then select ***Edit – Assignment Delete*** from the menu bar.

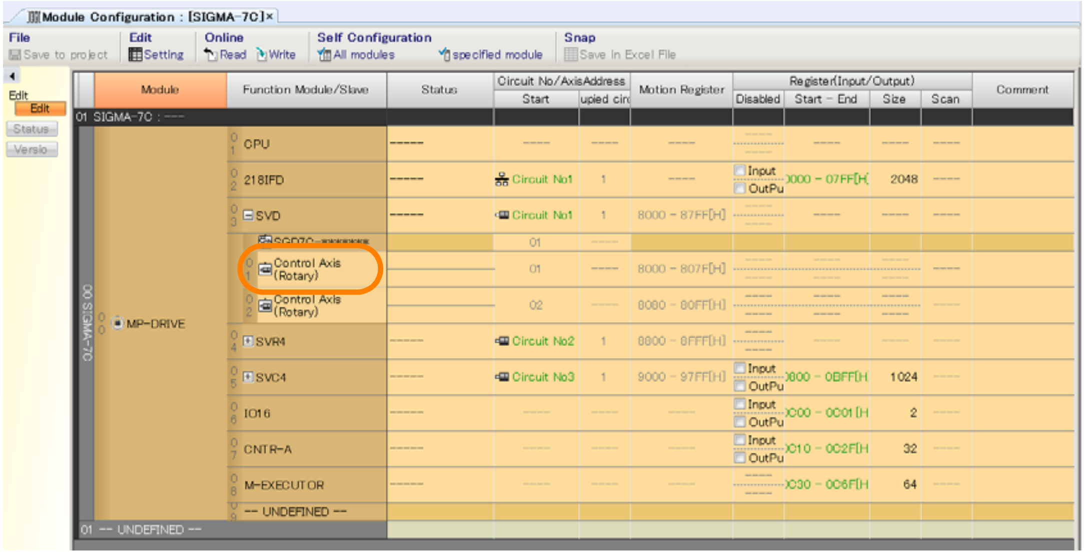
Important

Deleted station assignments cannot be restored.

Motion Control Function Modules

Use the following procedure to display the SVD Definition Tab Page.

1. Double-click the axis to monitor on the Module Configuration Definition Tab Page.



01 SIGMA-7C : ---

Module	Function Module/Slave	Status	Circuit No/AxisAddress Start	upied cir	Motion Register	Register(Input/Output) Disabled	Start – End	Size	Scan	Comment
00 SIGMA-7C 00 MP-DRIVE	01 CPU	-----	----	----	----	----	----	----	----	
	02 218IFD	-----	Circuit No1	1	----	☐ Input ☐ OutPu	)000 – 07FF[H(	2048	----	
	03 SVD	-----	Circuit No1	1	8000 – 87FF[H]	----	----	----	----	
	SGD7C-*********		01	----						
	01 Control Axis (Rotary)		01	----	8000 – 807F[H]	----	----	----	----	
	02 Control Axis (Rotary)		02	----	8080 – 80FF[H]	----	----	----	----	
	04 SVR4	-----	Circuit No2	1	8800 – 8FFF[H]	----	----	----	----	
	05 SVC4	-----	Circuit No3	1	9000 – 97FF[H]	☐ Input ☐ OutPu	)800 – 0BFF[H	1024	----	
	06 IO16	-----	----	----	----	☐ Input ☐ OutPu	)C00 – 0C01 [H	2	----	
	07 CNTR-A	-----	----	----	----	☐ Input ☐ OutPu	)C10 – 0C2F[H	32	----	
	08 M-EXECUTOR	-----	----	----	----	----	)C30 – 0C6F[H	64	----	
	09 -- UNDEFINED --									

01 -- UNDEFINED --

The Function List Dialog Box will be displayed.

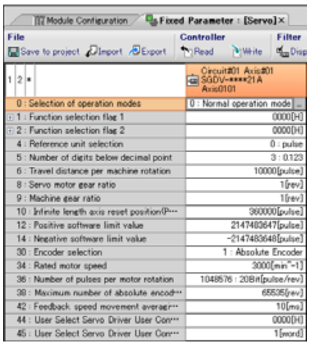
2. Click the **Device Select** Icon.

The SVD Definition Tab Page for the motion parameters of the selected axis will be displayed.

◆ Fixed Parameter Setting

The values of the fixed parameters depend on the Servomotor that is controlled by the SERVOPACK, and also on the machine that is driven by the Servomotor. These settings cannot be changed from a ladder program.

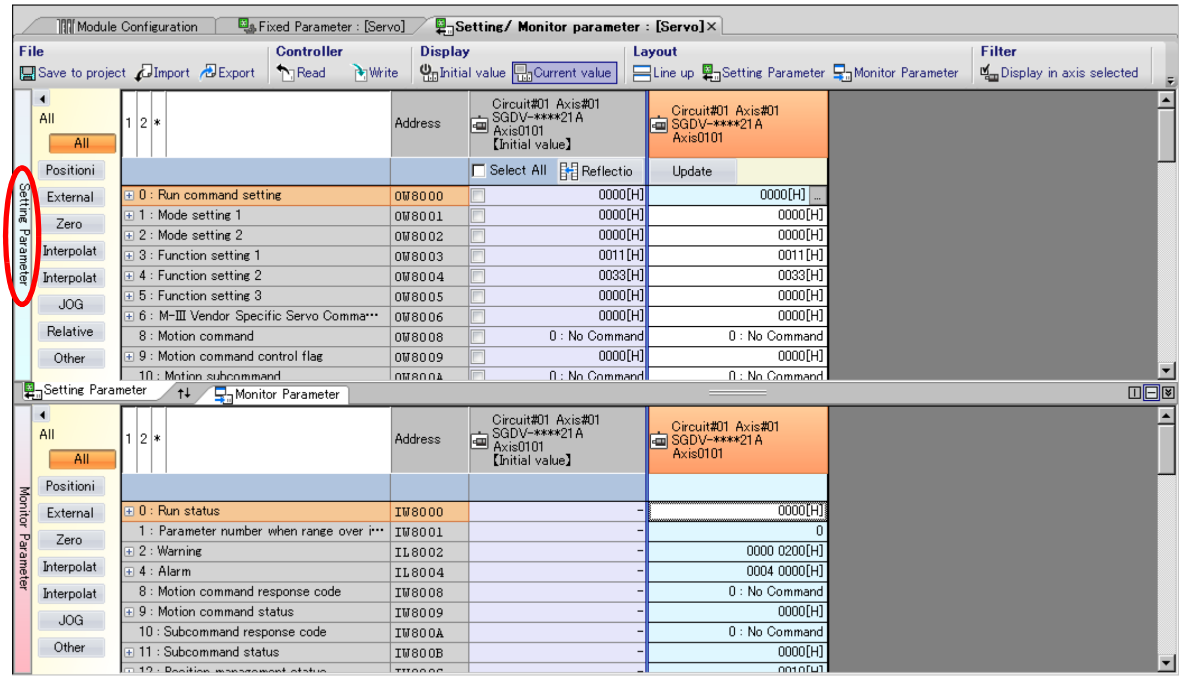
The actual values to set will depend on the Servomotor and the machine.



1 2 *	Circuit#01 Axis#01 SGDV-****21A Axis0101
0 : Selection of operation modes	0 : Normal operation mode
1 : Function selection flag 1	0000[H]
2 : Function selection flag 2	0000[H]
4 : Reference unit selection	0 : pulse
5 : Number of digits below decimal point	3 : 0.123
6 : Travel distance per machine rotation	10000[pulse]
8 : Servo motor gear ratio	1[rev]
9 : Machine gear ratio	1[rev]
10 : Infinite length axis reset position(P···	360000[pulse]
12 : Positive software limit value	2147483647[pulse]
14 : Negative software limit value	-2147483648[pulse]
30 : Encoder selection	1 : Absolute Encoder
34 : Rated motor speed	3000[min^-1]
36 : Number of pulses per motor rotation	1048576 : 20Bit[pulse/rev]
38 : Maximum number of absolute encod···	65535[rev]
42 : Feedback speed movement averagi···	10[ms]
44 : User Select Servo Driver User Con···	0000[H]
45 : User Select Servo Driver User Con···	1[word]

◆ Setting the Setting Parameters

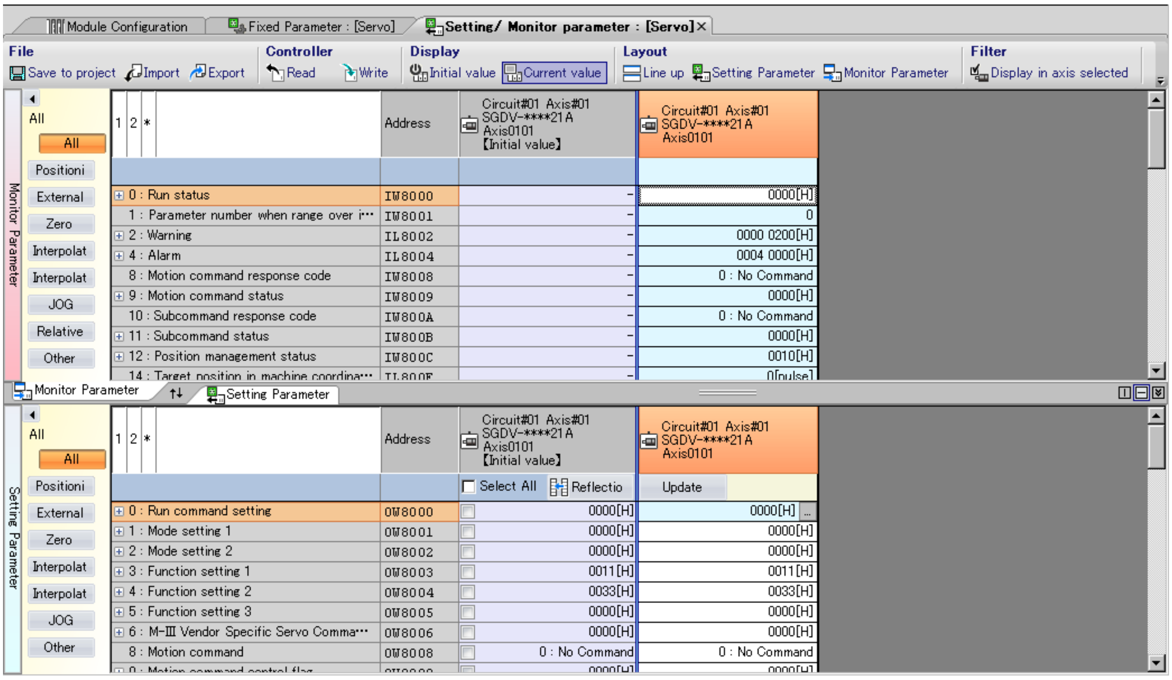
The values of these parameters are normally set from a ladder program. However, values for setting parameters that do not need to be set from a ladder program can be specified on this tab page and saved from here. These values will be used when the system is started.



1 2 *	Address	Circuit#01 Axis#01 SGDV-****21A Axis0101 【Initial value】	Circuit#01 Axis#01 SGDV-****21A Axis0101
0 : Run command setting	OW8000	0000[H]	0000[H]
1 : Mode setting 1	OW8001	0000[H]	0000[H]
2 : Mode setting 2	OW8002	0000[H]	0000[H]
3 : Function setting 1	OW8003	0011[H]	0011[H]
4 : Function setting 2	OW8004	0033[H]	0033[H]
5 : Function setting 3	OW8005	0000[H]	0000[H]
6 : M-Ⅲ Vendor Specific Servo Comma···	OW8006	0000[H]	0000[H]
8 : Motion command	OW8008	0 : No Command	0 : No Command
9 : Motion command control flag	OW8009	0000[H]	0000[H]
10 : Motion subcommand	OW800A	0 : No Command	0 : No Command

1 2 *	Address	Circuit#01 Axis#01 SGDV-****21A Axis0101 【Initial value】	Circuit#01 Axis#01 SGDV-****21A Axis0101
0 : Run status	IW8000	-	0000[H]
1 : Parameter number when range over i···	IW8001	-	0
2 : Warning	IL8002	-	0000 0200[H]
4 : Alarm	IL8004	-	0004 0000[H]
8 : Motion command response code	IW8008	-	0 : No Command
9 : Motion command status	IW8009	-	0000[H]
10 : Subcommand response code	IW800A	-	0 : No Command
11 : Subcommand status	IW800B	-	0000[H]

◆ Viewing the Motion Monitor Parameters



1 2 *	Address	Circuit#01 Axis#01 SGDV-****21A Axis0101 【Initial value】	Circuit#01 Axis#01 SGDV-****21A Axis0101
0 : Run status	IW8000	-	0000[H]
1 : Parameter number when range over i···	IW8001	-	0
2 : Warning	IL8002	-	0000 0200[H]
4 : Alarm	IL8004	-	0004 0000[H]
8 : Motion command response code	IW8008	-	0 : No Command
9 : Motion command status	IW8009	-	0000[H]
10 : Subcommand response code	IW800A	-	0 : No Command
11 : Subcommand status	IW800B	-	0000[H]
12 : Position management status	IW800C	-	0010[H]

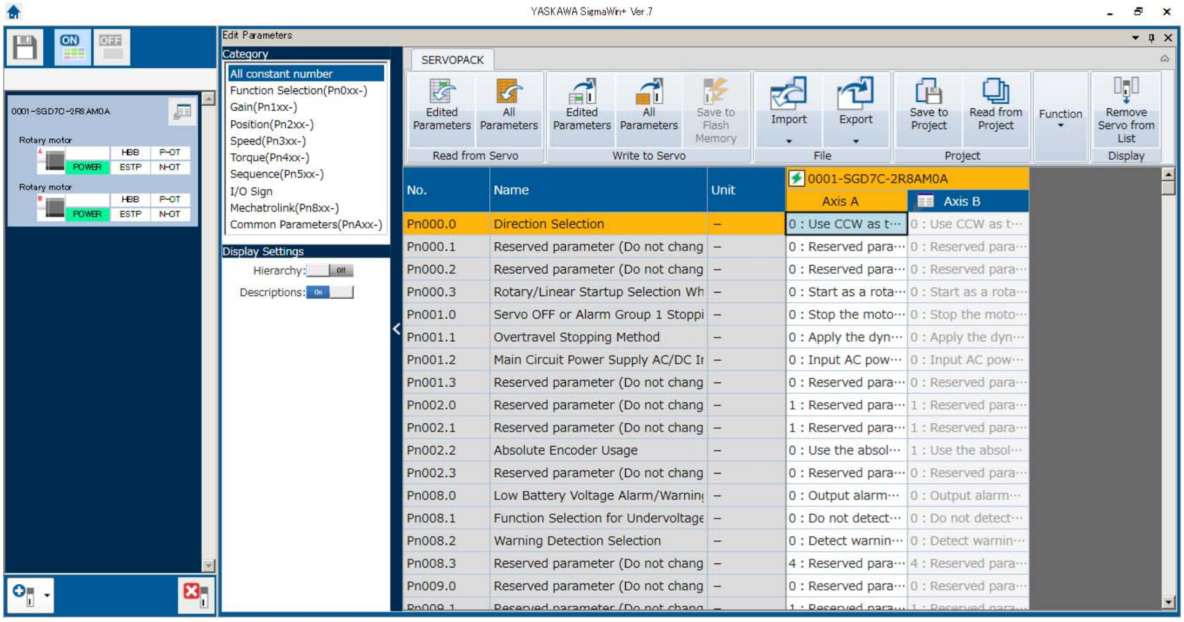
1 2 *	Address	Circuit#01 Axis#01 SGDV-****21A Axis0101 【Initial value】	Circuit#01 Axis#01 SGDV-****21A Axis0101
0 : Run command setting	OW8000	0000[H]	0000[H]
1 : Mode setting 1	OW8001	0000[H]	0000[H]
2 : Mode setting 2	OW8002	0000[H]	0000[H]
3 : Function setting 1	OW8003	0011[H]	0011[H]
4 : Function setting 2	OW8004	0033[H]	0033[H]
5 : Function setting 3	OW8005	0000[H]	0000[H]
6 : M-Ⅲ Vendor Specific Servo Comma···	OW8006	0000[H]	0000[H]
8 : Motion command	OW8008	0 : No Command	0 : No Command

◆ Setting the SERVOPACK Parameters

The settings of the parameters can be prepared inside the CPU of the SERVOPACK while it is offline. When the SERVOPACK is connected, you can transfer these values to the SERVOPACK in one batch.

Important

- The default settings are used without any changes.
- Never modify the values of parameters that are given as reserved parameters.



No.	Name	Unit	0001-SGD7C-2R8AM0A Axis A	0001-SGD7C-2R8AM0A Axis B
Pn000.0	Direction Selection	–	0 : Use CCW as t···	0 : Use CCW as t···
Pn000.1	Reserved parameter (Do not chang	–	0 : Reserved para···	0 : Reserved para···
Pn000.2	Reserved parameter (Do not chang	–	0 : Reserved para···	0 : Reserved para···
Pn000.3	Rotary/Linear Startup Selection Wh	–	0 : Start as a rota···	0 : Start as a rota···
Pn001.0	Servo OFF or Alarm Group 1 Stoppi	–	0 : Stop the moto···	0 : Stop the moto···
Pn001.1	Overtravel Stopping Method	–	0 : Apply the dyn···	0 : Apply the dyn···
Pn001.2	Main Circuit Power Supply AC/DC Ir	–	0 : Input AC pow···	0 : Input AC pow···
Pn001.3	Reserved parameter (Do not chang	–	0 : Reserved para···	0 : Reserved para···
Pn002.0	Reserved parameter (Do not chang	–	1 : Reserved para···	1 : Reserved para···
Pn002.1	Reserved parameter (Do not chang	–	1 : Reserved para···	1 : Reserved para···
Pn002.2	Absolute Encoder Usage	–	0 : Use the absol···	1 : Use the absol···
Pn002.3	Reserved parameter (Do not chang	–	0 : Reserved para···	0 : Reserved para···
Pn008.0	Low Battery Voltage Alarm/Warnin	–	0 : Output alarm···	0 : Output alarm···
Pn008.1	Function Selection for Undervoltage	–	0 : Do not detect···	0 : Do not detect···
Pn008.2	Warning Detection Selection	–	0 : Detect warnin···	0 : Detect warnin···
Pn008.3	Reserved parameter (Do not chang	–	4 : Reserved para···	4 : Reserved para···
Pn009.0	Reserved parameter (Do not chang	–	0 : Reserved para···	0 : Reserved para···
Pn009.1	Reserved parameter (Do not chang	–	1 : Reserved para···	1 : Reserved para···

4.3.4 Parameters Written during Self Configuration

The SERVOPACK parameters are written to the SERVOPACK EEPROM or RAM during self-configuration as shown below. The Servo Section parameters are also written to the Controller Section's setting parameters.

Important Servo Section parameters and Controller Section parameters may be overwritten when self configuration is executed.

Writing Parameters to the Servo Section

The following settings are written regardless of the setting of bit A (SERVOPACK Parameter Auto-Write) in fixed parameter No. 01.

Controller Section			Servo Section	
Fixed Values			Servo Common Parameters	
Name	Setting		No.	Description
P-OT Signal Mapping	Disabled	→	25. Bit 0	Limit Setting, P-OT
N-OT Signal Mapping	Disabled	→	25. Bit 1	Limit Setting, N-OT
Forward Servo Software Limit	Disabled	→	25. Bit 4	Limit Setting, P-SOT
Reverse Servo Software Limit	Disabled	→	25. Bit 5	Limit Setting, N-SOT
Servo Electronic Gear Ratio Numerator	1	→	21	Electronic Gear Ratio Numerator
Servo Electronic Gear Ratio Denominator	1	→	22	Electronic Gear Ratio Denominator
Fixed Monitor Selection	1	→	87	Fixed Monitor Selection 1
Fixed Monitor Selection	0	→	88	Fixed Monitor Selection 2

Information The above settings are not written for axes that are already defined.

Writing Parameters to the Controller Section

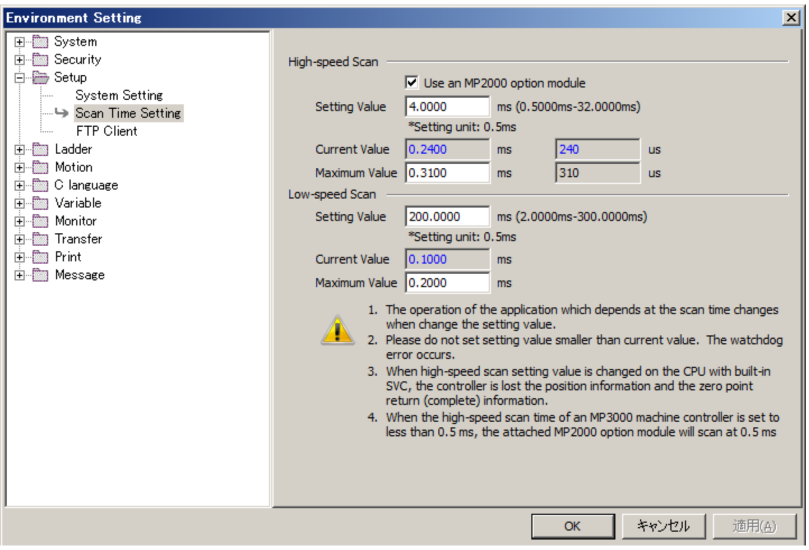
The following settings are written when bit A (SERVOPACK Parameter Auto-Write) in fixed parameter No. 01 is set to 0 (Enable).

Controller Section			Servo Section	
Setting Parameters			Servo Common Parameters	
Name	Register Number		No.	Description
Position Loop Gain	OW□□2E	←	63	Position Loop Gain
Speed Loop Gain	OW□□2F	←	61	Speed Loop Gain
Speed Feedforward Compensation	OW□□30	←	64	Feedforward Compensation
Position Loop Integral Time Constant	OW□□32	←	65	Position Loop Integration Constant
Speed Loop Integral Time Constant	OW□□34	←	62	Speed Loop Integration Constant
Filter Time Constant	OW□□3A	←	82	Average Movement Time

4.3.5 Setting the Scan Times

This section describes how to set the scan times for the high-speed and low-speed scans.

Select **Setup** – **Scan Time Setting** from the item tree of the Environment Setting Dialog Box. Alternatively, select ***Setup*** – ***Scantime setting*** from the Launcher. The following dialog box will be displayed.



High-speed Scan

☑ Use an MP2000 option module

Setting Value 4.0000 ms (0.5000ms-32.0000ms)
*Setting unit: 0.5ms
Current Value 0.2400 ms 240 us
Maximum Value 0.3100 ms 310 us

Low-speed Scan

Setting Value 200.0000 ms (2.0000ms-300.0000ms)
*Setting unit: 0.5ms
Current Value 0.1000 ms
Maximum Value 0.2000 ms

1. The operation of the application which depends at the scan time changes when change the setting value.
2. Please do not set setting value smaller than current value. The watchdog error occurs.
3. When high-speed scan setting value is changed on the CPU with built-in SVC, the controller is lost the position information and the zero point return (complete) information.
4. When the high-speed scan time of an MP3000 machine controller is set to less than 0.5 ms, the attached MP2000 option module will scan at 0.5 ms

High-speed (H) Scan

This section describes how to set the scan time of a high-speed processing program (H, H☐☐, or H☐☐.☐☐) in milliseconds.

The setting that is set here will determine the reference pulse distribution cycle (accuracy).

The following table shows the different high-speed scan time settings depending on whether the MP2000 Option Module is used.

MP2000 Option Module	Possible Settings
Used	0.5 ms to 32.0 ms (in increments of 0.5 ms)
Not used	0.5 ms to 32.0 ms (in increments of 0.250 ms)

Information The default high-speed scan time is 4.0 ms.

There are restrictions on the setting of the high-speed scan time. Refer to the following section for details.

☞ ◆ *High-speed Scan Time Setting Restrictions* on page 4-44

◆ High-speed Scan Time Setting Restrictions

This section describes the restrictions on the setting of the high-speed scan time.

■ Restrictions Imposed by the MECHATROLINK-III Transmission Cycle of the Built-in SVD Module

The high-speed scan of the CPU in the Controller Section is synchronized with the MECHATROLINK-III transmission cycle of the SVC4 Function Module. This imposes the following restrictions in the setting of the high-speed scan time.

Transmission Cycle	High-speed Scan Time Setting Restrictions	Possible Settings	
		When the MP2000 Option Module Is Not Used	When MP2000 Option Module Is Used
125 µs	Integral multiple of 250 µs	0.5 ms to 32.0 ms (in increments of 0.250 ms)	0.5 ms to 32.0 ms (in increments of 0.5 ms)
250 µs	Integral multiple of 250 µs	0.5 ms to 32.0 ms (in increments of 0.250 ms)	0.5 ms to 32.0 ms (in increments of 0.5 ms)
500 µs	Integral multiple of 500 µs	0.5 ms to 32.0 ms (in increments of 0.5 ms)	0.5 ms to 32.0 ms (in increments of 0.5 ms)
1 ms	Integral multiple of 1 ms or 1 times the integer portion	1.0 ms to 32.0 ms (in increments of 1 ms)	1.0 ms to 32.0 ms (in increments of 1 ms)

If these restrictions are not observed, the high-speed scan cycle will stop and an alarm will occur. The alarm is reported in the M-III Restrictions Error Bit (SB00041D) in the CPU Error Status System Register. Refer to the following manual for details.

📖 Σ-7-Series Σ-7C SERVOPACK Troubleshooting Manual (Manual No.: SIEP S800002 07)

■ Restrictions Imposed by Σ-V-Series SERVOPACKs Connected to the SVC4 Function Module

The specifications of MECHATROLINK-III Σ–V-Series SERVOPACKs impose the following restrictions on the setting of the high-speed scan time.

Σ-V SERVOPACK Version	Restrictions
Lower than version 21	High-speed scan time setting ≤ (32 × Transmission cycle) Example: If the MECHATROLINK-III transmission cycle is 125 µs, the setting of the high-speed scan time can be up to 4.0 ms (125 µs × 32).
Version 21 or higher	High-speed scan time setting ≤ (254 × Transmission cycle) Example: If the MECHATROLINK-III transmission cycle is 125 µs, the setting of the high-speed scan time can be up to 31.75 ms (125 µs × 254).

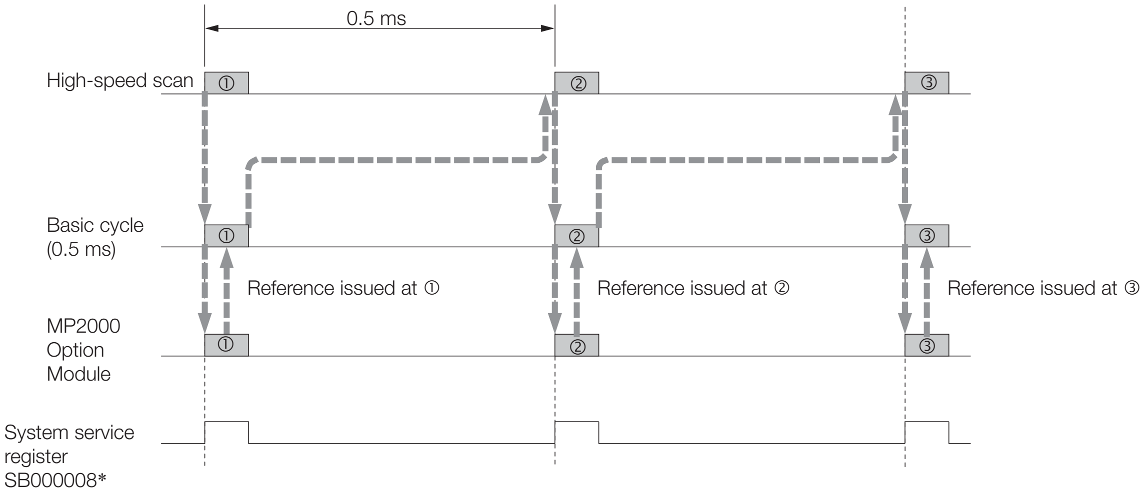
If these restrictions are not observed, an A.94B Data Setting Warning 2 (Data Out of Range) warning will occur in the SERVOPACK.

◆ I/O Processing

If the high-speed scan time is set to at least 0.5 ms, the I/O service (I/O processing) of the MP2000 Option Module will be performed every scan.

The following figures show the timing results for these settings.

■ Example: High-speed Scan = 0.5 ms



* The purpose of this system service register is to determine from a ladder program whether the MP2000 option service is being scanned.

Low-Speed (L) Scan

This section describes how to set the scan time of a low-speed processing program (L, L□□, L□□.□□) in milliseconds.

This example shows settings for a control cycle of pushbuttons and similar controls.

The following table shows the possible settings for the low-speed scan time.

MP2000 Option Module	Possible Settings
Used	2.0 ms to 300.0 ms (in 0.5-ms increments)
Not used	

Information The default low-speed scan time is 200.0 ms.

◆ I/O Processing

During the low-speed scan, the I/O service (I/O processing) is performed every scan, regardless of the setting.

4.4 Going Online with a SERVOPACK

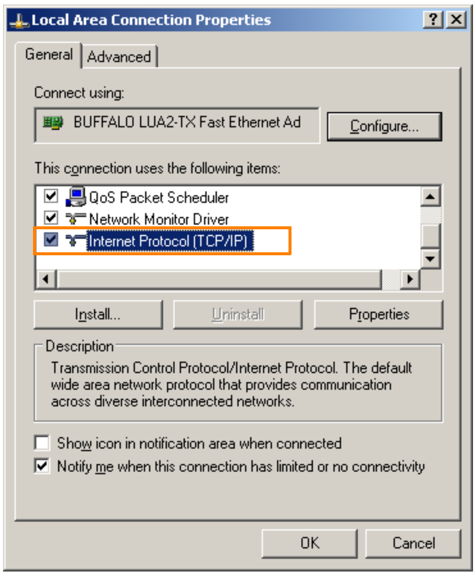
4.4.1 Preparing the Ethernet Connection

When you connect a SERVOPACK and the Engineering Tool to Ethernet, you must set the IP address of your computer. After you set the IP address for the computer, you will not need to set it again for any future connections. Also, this setting is not necessary if you use a USB connection for the SigmaWin+.

The procedure for setting the IP address of the computer is given below.

1. On the computer, select ***Control Panel*** – ***Network Connection*** – ***Local Area Connection*** – ***Properties*** from the Windows Start Menu.

2. Double-click **Internet Protocol (TCP/IP)** in the list.



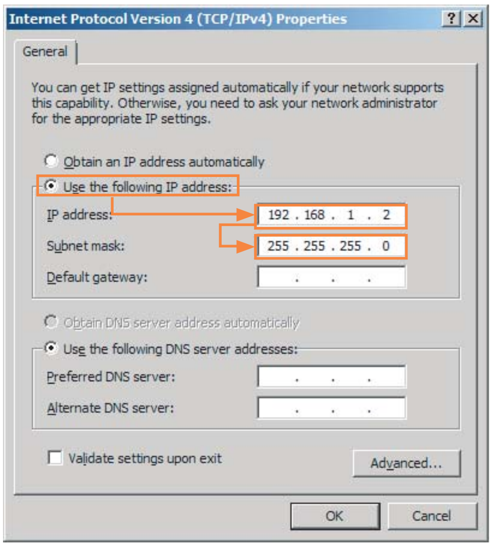
Connect using:
BUFFALO LUA2-TX Fast Ethernet Ad

This connection uses the following items:
☑ QoS Packet Scheduler
☑ Network Monitor Driver
☑ Internet Protocol (TCP/IP)

Description
Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.

☐ Show icon in notification area when connected
☑ Notify me when this connection has limited or no connectivity

3. Select the **Use the following IP address** Option, and enter the following data.
IP address =192.168.1.2
Subnet mask = 255.255.255.0



You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

○ Obtain an IP address automatically
● Use the following IP address:
IP address: 192 . 168 . 1 . 2
Subnet mask: 255 . 255 . 255 . 0
Default gateway: . . .

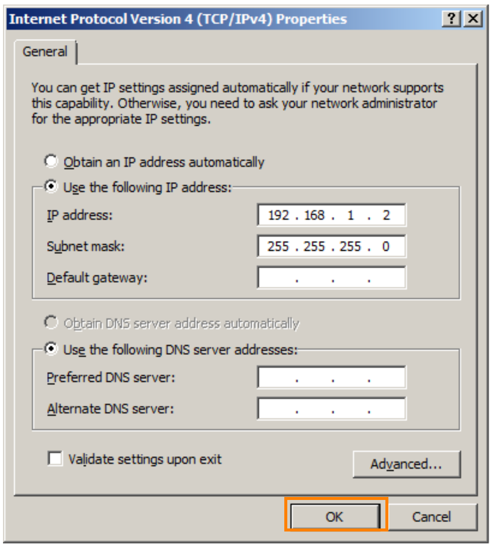
○ Obtain DNS server address automatically
● Use the following DNS server addresses:
Preferred DNS server: . . .
Alternate DNS server: . . .

☐ Validate settings upon exit

Important

Do not use the same IP address for both the MPE720 and the SERVOPACK.
The default IP address of the SERVOPACK is 192.168.1.1. Therefore, the IP address of the MPE720 must be set to 192.168.1.☐ (where ☐ is a value between 2 and 254).

4. This concludes setting the IP address.
Click the **OK** Button to close the dialog box.



Internet Protocol Version 4 (TCP/IPv4) Properties

General

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

○ Obtain an IP address automatically
● Use the following IP address:
IP address: 192 . 168 . 1 . 2
Subnet mask: 255 . 255 . 255 . 0
Default gateway: . . .

○ Obtain DNS server address automatically
● Use the following DNS server addresses:
Preferred DNS server: . . .
Alternate DNS server: . . .

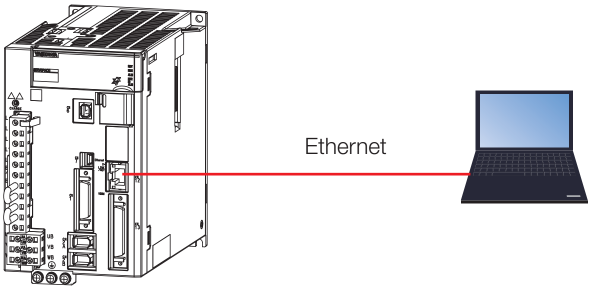
☐ Validate settings upon exit

4.4.2 Placing the MPE720 Online

Use the following procedure to place the MPE720 online. A SERVOPACK in which a project is already created can be easily placed online by using a project link connection.

Use the following procedure to place a SERVOPACK online.

1. Use an Ethernet cable to connect the Ethernet connector on the SERVOPACK to the LAN connector on the PC.

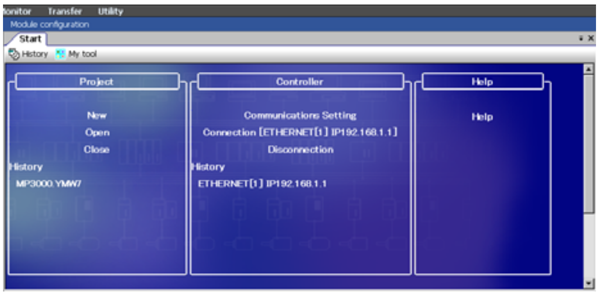


Information
- Use a hub as required.
- When you directly connect the PC to a SERVOPACK, you can use either a crossover or a straight Ethernet cable.

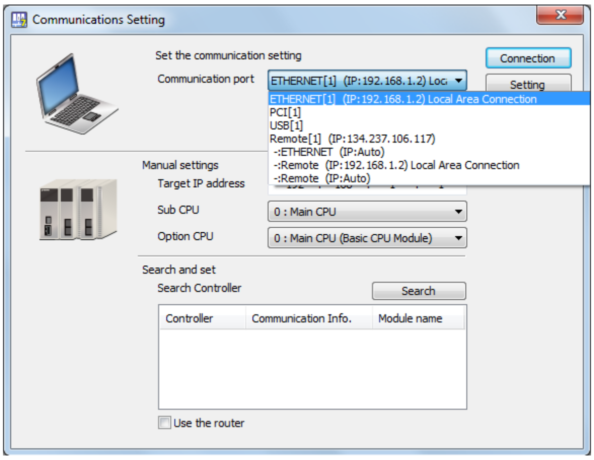
2. Double-click the **MPE720 Ver.7** Icon on the desktop.

Information If there is no icon on the Desktop, then select ***Programs*** – ***YE_Applications*** – ***MPE720 Ver.7*** from the Windows Start Menu.

3. After the MPE720 starts, select ***Communications Setting***.



4. Select the IP address that is set for the PC, such as Ethernet (IP:192.168.1.2), from the list of communications ports.



Communication port: ETHERNET[1] (IP:192.168.1.2) Loc

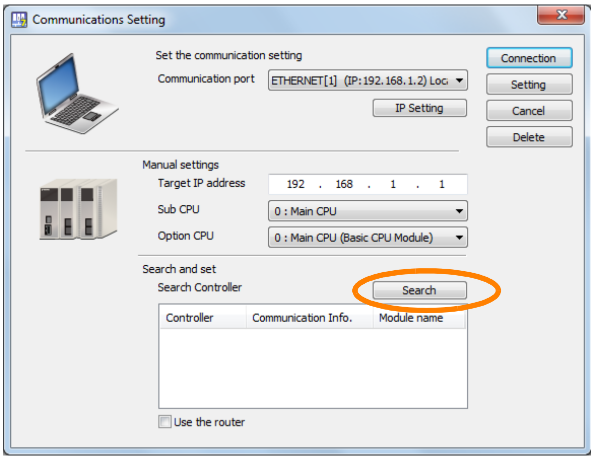
- ETHERNET[1] (IP:192.168.1.2) Local Area Connection
- PCI[1]
- USB[1]
- Remote[1] (IP:134.237.106.117)
  - -:ETHERNET (IP:Auto)
  - -:Remote (IP:192.168.1.2) Local Area Connection
  - -:Remote (IP:Auto)

Sub CPU: 0 : Main CPU

Option CPU: 0 : Main CPU (Basic CPU Module)

☐ Use the router

5. Click the **Search** Button, select the SERVOPACK, and then click the **Connection** Button.



Communication port: ETHERNET[1] (IP:192.168.1.2) Loc

Target IP address: 192 . 168 . 1 . 1

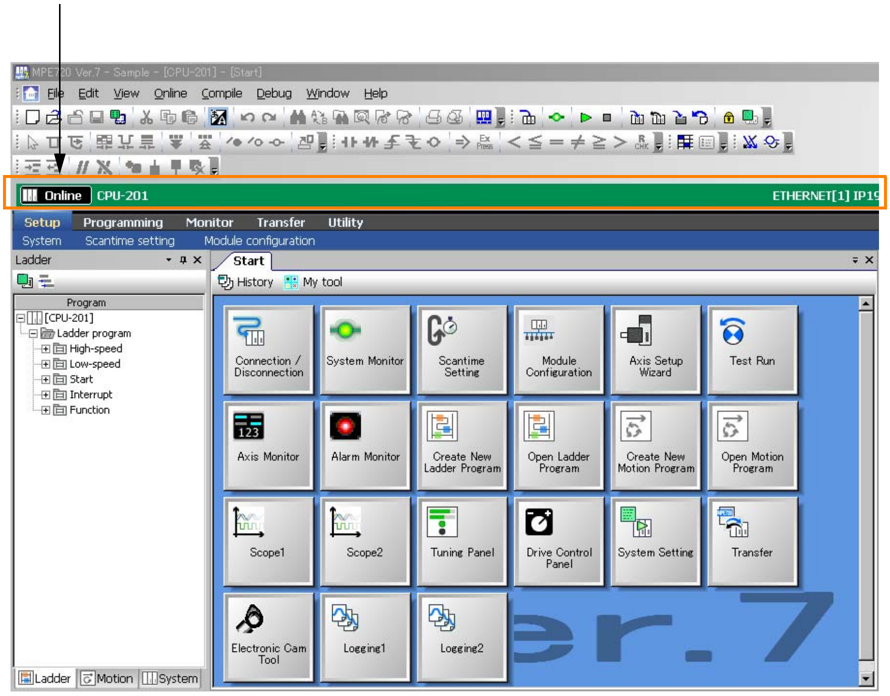
Sub CPU: 0 : Main CPU

Option CPU: 0 : Main CPU (Basic CPU Module)

☐ Use the router

6. The connection was successfully established if the MPE720 window appears with "Online" displayed in it.

Verify going online here.



Placing a SERVOPACK Online Using a Project Link Connection

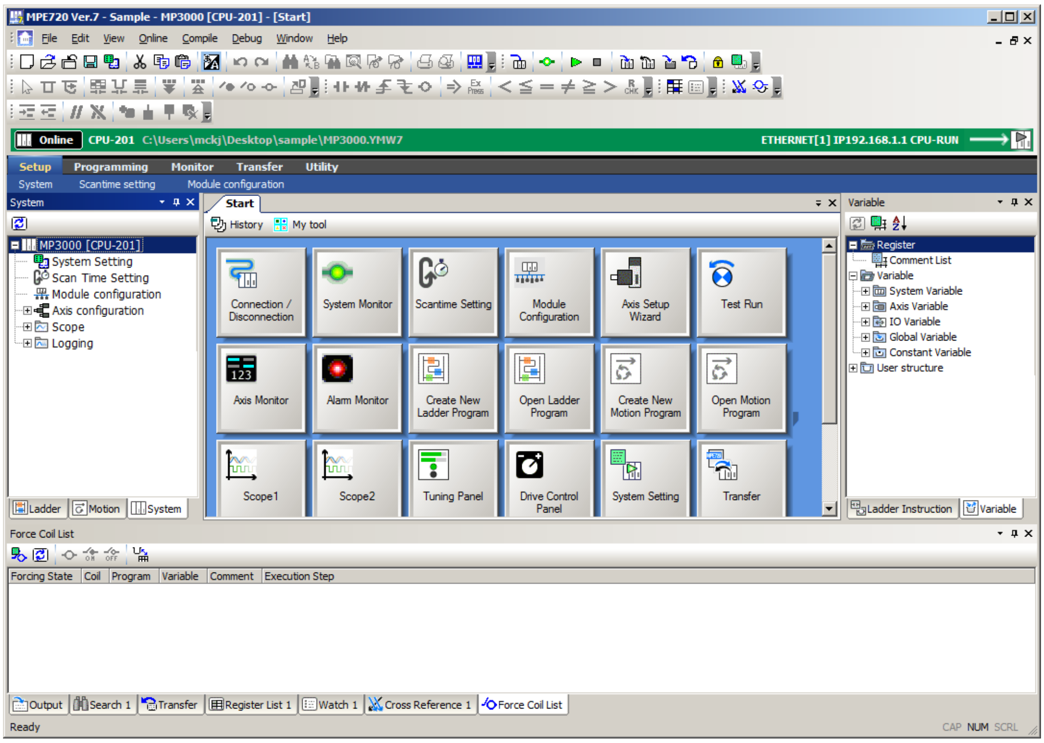
This section gives the procedure to create a project link connection.

Term

A project link connection refers to connecting the MPE720 that has an open project file to the SERVOPACK.

Use either of the following methods to connect to the SERVOPACK.
- Select ***Online*** – ***Connection*** from the menu bar.
- Click the **Connection/Disconnection** Button on the My Tool View.

After a connection to the SERVOPACK is successfully established, the name of the project file, the name of the SERVOPACK, and the ladder program tree are displayed in the System Pane.



4.4.3 Placing the SigmaWin+ Online

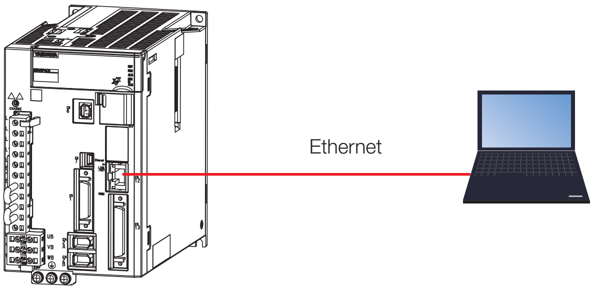
There are the following two methods to use the SigmaWin+ to go online with a SERVOPACK.

- Connecting with Ethernet
- Connecting with USB

Connecting with Ethernet

Use the following procedure to place a SERVOPACK online using an Ethernet connection.

1. **Use an Ethernet cable to connect the Ethernet connector on the SERVOPACK to the LAN connector on the PC.**

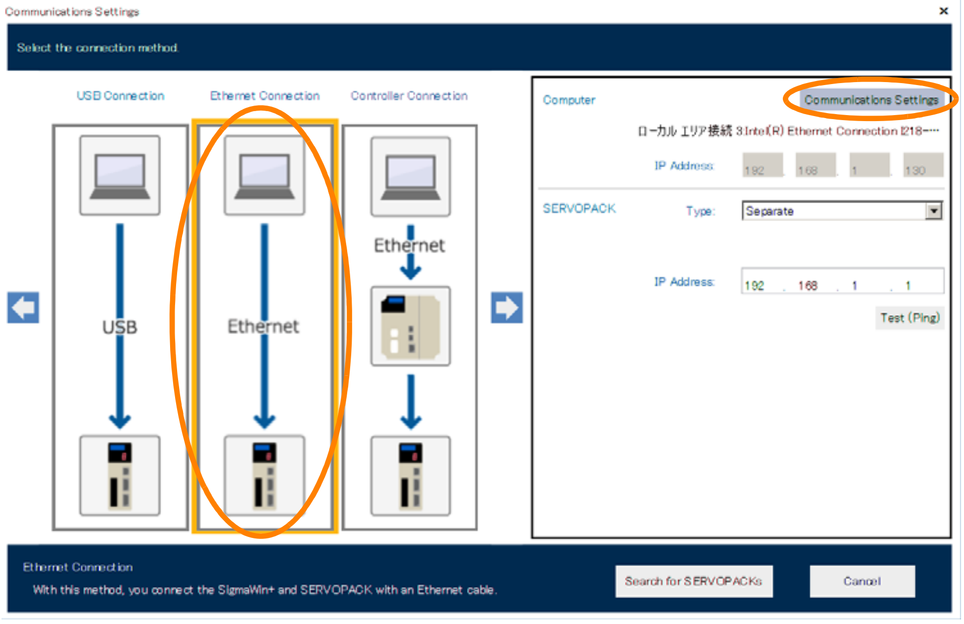


Information
- Use a hub as required.
- When you directly connect the PC to a SERVOPACK, you can use either a crossover or a straight Ethernet cable.

2. **Double-click the SigmaWin+ Ver. 7 Icon on the desktop.**
The SigmaWin+ will start.
When the SigmaWin+ starts, the Home Window will remain open and the Main Window will be displayed.

3. **Click Connect the SERVOPACK from the Start menu.**

4. Click **Ethernet Connection**, and then click the **Communications Settings** Button.



Communications Settings

Select the connection method

Computer

ローカル エリア接続 3:Intel(R) Ethernet Connection I218-···

IP Address: 192 . 168 . 1 . 130

SERVOPACK

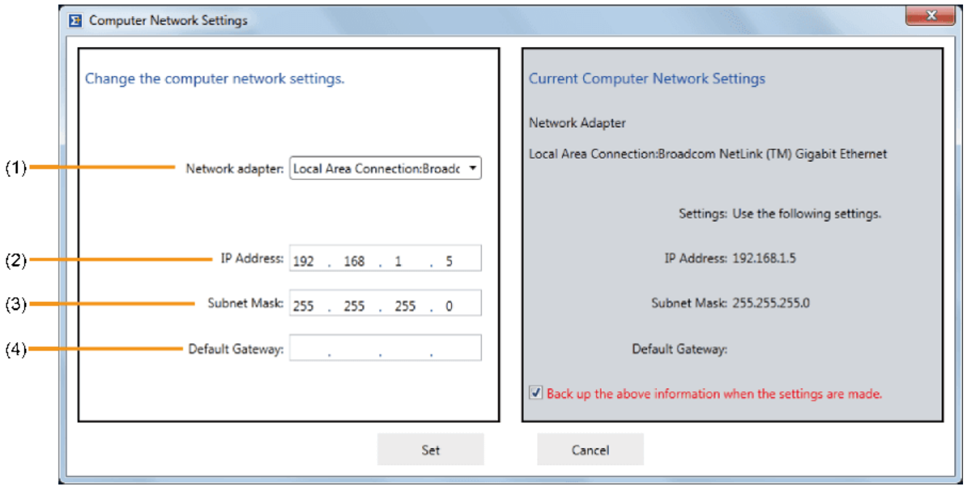
Type: Separate

IP Address: 192 . 168 . 1 . 1

Ethernet Connection

With this method, you connect the SigmaWin+ and SERVOPACK with an Ethernet cable.

5. Set the network used by the PC.



Computer Network Settings

Change the computer network settings.

Network adapter: Local Area Connection:Broadc

IP Address: 192 . 168 . 1 . 5

Subnet Mask: 255 . 255 . 255 . 0

Default Gateway: . . .

Current Computer Network Settings

Network Adapter

Local Area Connection:Broadcom NetLink (TM) Gigabit Ethernet

Settings: Use the following settings.

IP Address: 192.168.1.5

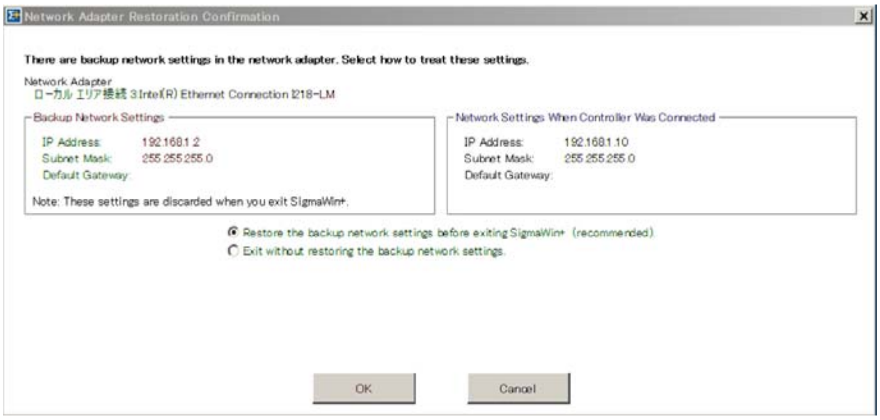
Subnet Mask: 255.255.255.0

Default Gateway:

☑ Back up the above information when the settings are made.

No.	Item	Description
(1)	Network adapter	Select your network adapter from the **Network adapter** Box.
(2)	IP Address	Enter the IP address. Note: Do not enter an IP address that is the same as the IP address of the SERVOPACK or other devices.
(3)	Subnet Mask	Enter the subnet mask.
(4)	Default Gateway	No changes or settings are required. Note: It may be necessary for the network administrator to set the default gateway.

Information If the **Backup the above information when the settings are made** Check Box is selected, the following dialog box will be displayed when the SigmaWin+ is closed.



Network Adapter Restoration Confirmation

There are backup network settings in the network adapter. Select how to treat these settings.

Network Adapter
ローカル エリア接続 3:Intel(R) Ethernet Connection I218-LM

Backup Network Settings
IP Address: 192.168.1.2
Subnet Mask: 255.255.255.0
Default Gateway:
Note: These settings are discarded when you exit SigmaWin+.

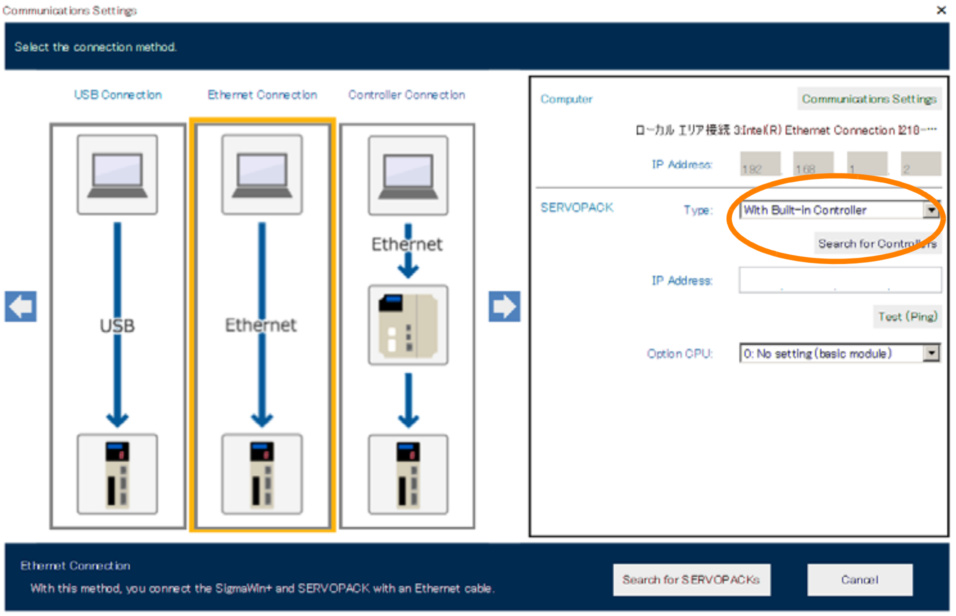
Network Settings When Controller Was Connected
IP Address: 192.168.1.10
Subnet Mask: 255.255.255.0
Default Gateway:

● Restore the backup network settings before exiting SigmaWin+ (recommended)
○ Exit without restoring the backup network settings.

Select the **Restore the backup network settings before exiting SigmaWin+** Option and then click the **OK** Button to restore the network settings to their previous settings.
Select the **Exit without restoring the backup network settings** Option and then click the **OK** Button to close with the new network settings.

6. Click the **Set** Button.
The communications settings of the PC will be set and then displayed.

7. Select **SERVOPACKs With Built-in Controllers** from the **Type** Box, and then click the **Search for Controllers** Button.



Communications Settings

Select the connection method.

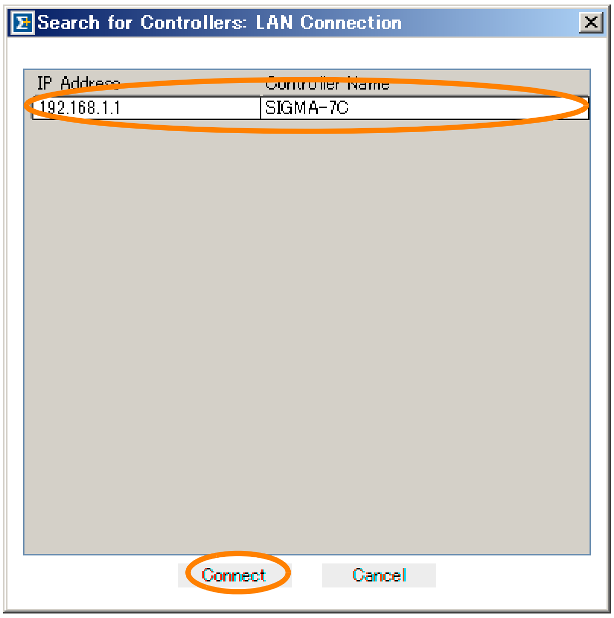
Computer
ローカル エリア接続 3:Intel(R) Ethernet Connection I218-…
IP Address: 192 . 168 . 1 . 2

SERVOPACK
Type: With Built-in Controller
IP Address: . . .
Option CPU: 0: No setting (basic module)

Ethernet Connection
With this method, you connect the SigmaWin+ and SERVOPACK with an Ethernet cable.

The Machine Controller search results will be displayed.

8. Select the Machine Controller to connect and click the **Connect** Button.

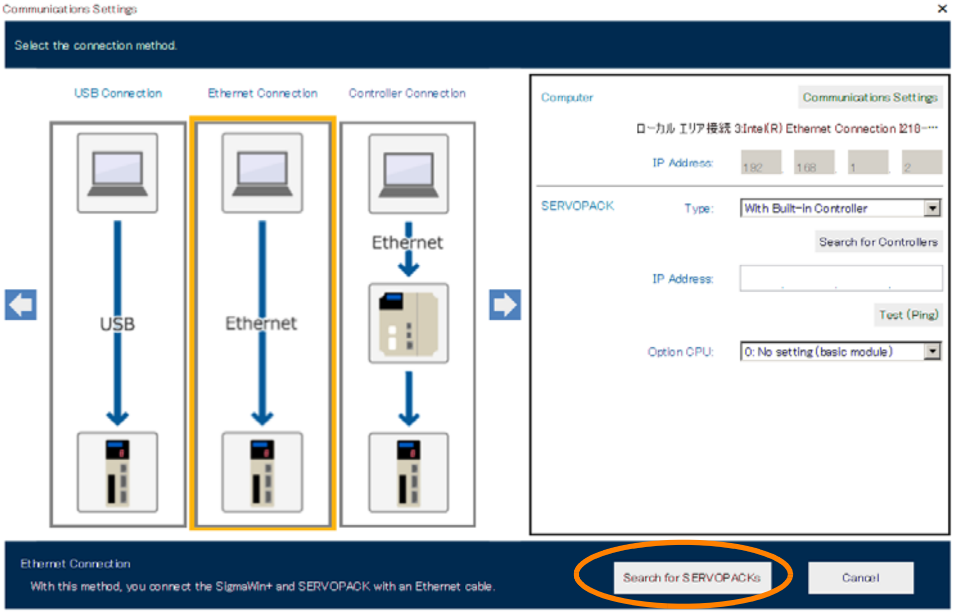


Search for Controllers: LAN Connection

IP Address	Controller Name
192.168.1.1	SIGMA-7C

The IP address of the selected Machine Controller will be displayed.

9. Click the **Search for SERVOPACKs** Button.



Communications Settings

Select the connection method.

Computer

ローカル エリア接続 3:Intel(R) Ethernet Connection I218-…

IP Address: 192 . 168 . 1 . 2

SERVOPACK

Type: With Built-in Controller

IP Address:

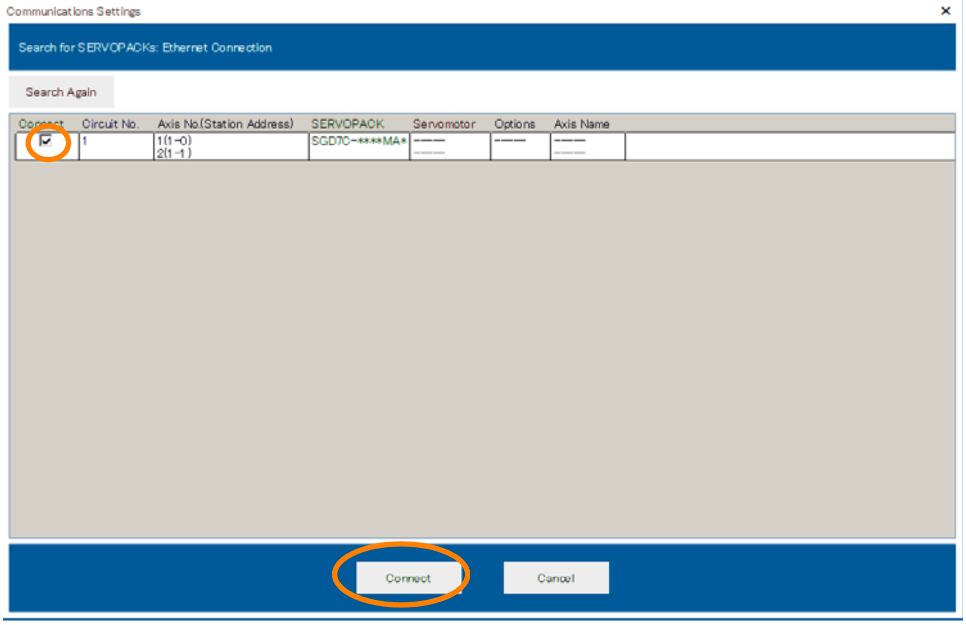
Option CPU: 0: No setting (basic module)

Ethernet Connection

With this method, you connect the SigmaWin+ and SERVOPACK with an Ethernet cable.

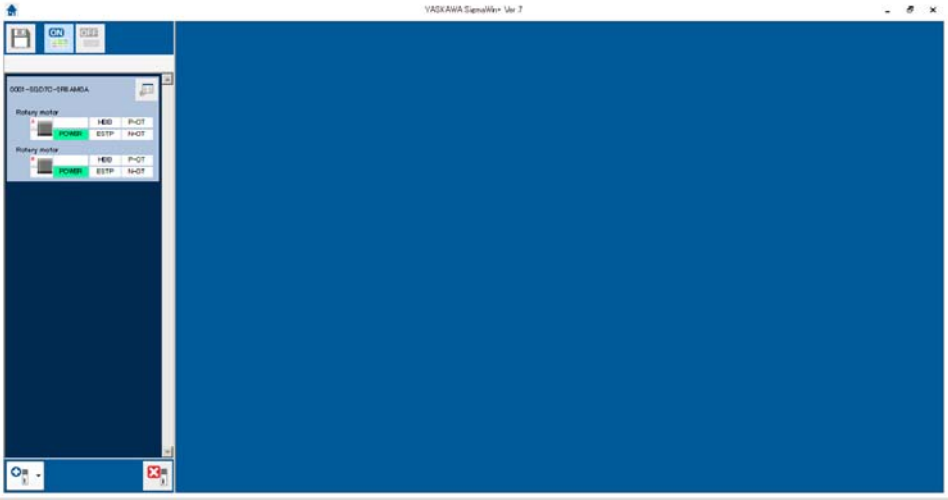
A search will be made for the SERVOPACKs that are connected to the selected SERVOPACK with a Built-in Controller.

10. Select the **Connect Target** Check Box for SERVOPACK to connect to and click the **Connect** Button.



Connect	Circuit No.	Axis No.(Station Address)	SERVOPACK	Servomotor	Options	Axis Name
☑	1	1(1-0) 2(1-1)	SGD7C-****MA*	---- ----	----	---- ----

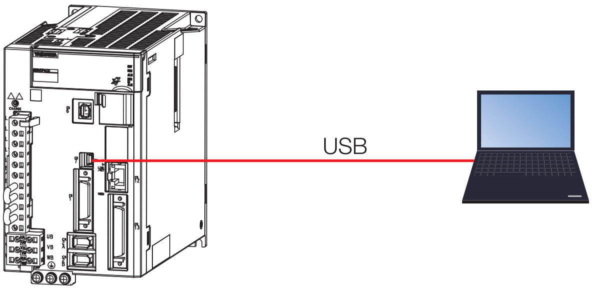
The selected SERVOPACK will be placed online and displayed in the Main Window.



Connecting with USB

Use the following procedure to place a SERVOPACK online using a USB connection.

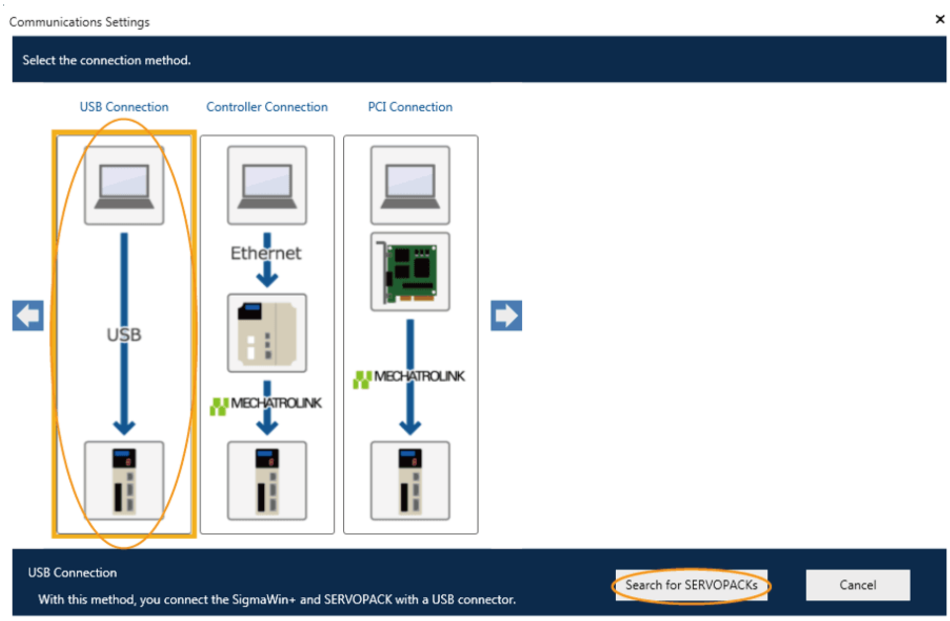
1. **Use a USB cable to connect the USB connector on the SERVOPACK to a USB connector on the PC.**



2. **Double-click the SigmaWin+ Ver. 7 Icon on the desktop.**
   The SigmaWin+ will start.
   When the SigmaWin+ starts, the Home Window will remain open and the Main Window will be displayed.

3. Click **Connect the SERVOPACK** from the Start menu.

4. Select **USB Connection** and then click the **Search for SERVOPACKs** Button.



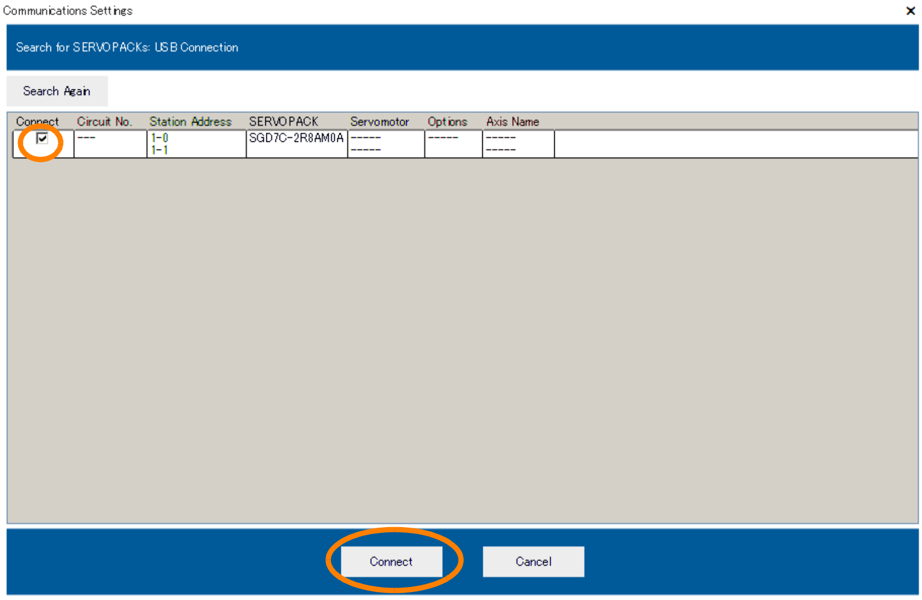
Select the connection method.

USB Connection

With this method, you connect the SigmaWin+ and SERVOPACK with a USB connector.

A search will be made for SERVOPACKs connected with USB cables.

5. Select the **Connect** Check Box for the SERVOPACK to connect to and click the **Connect** Button.

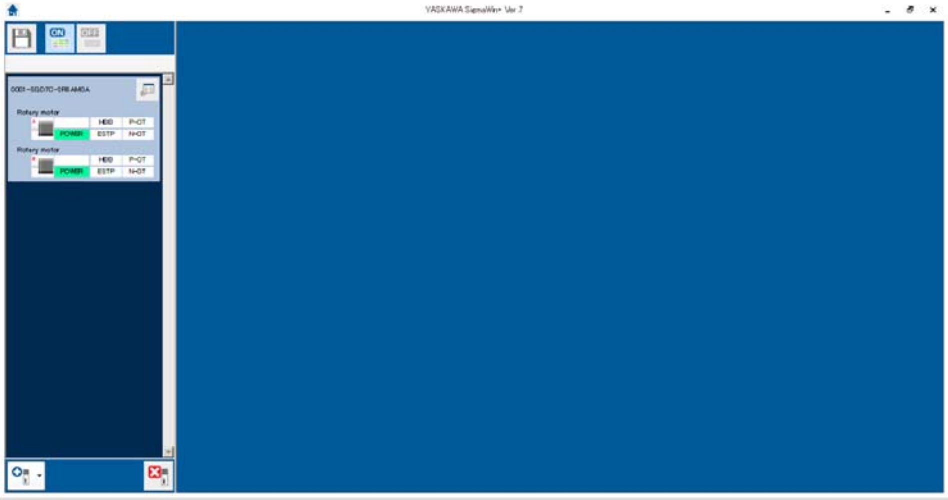


Communications Settings

Search for SERVOPACKs: USB Connection

Connect	Circuit No.	Station Address	SERVOPACK	Servomotor	Options	Axis Name
☑	---	1-0 1-1	SGD7C-2R8AM0A	----- -----	-----	----- -----

The selected SERVOPACK will be placed online and displayed in the Main Window.



Device-Specific Settings

5

This chapter describes the procedure for making device-specific settings for the Servo Drive.

5.1 Manipulating Parameters (Pn□□□)

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.

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

Setup Parameters

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

Tuning Parameters

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

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

☞ *8.6 Autotuning without Host Reference* on page 8-23

☞ *8.7 Autotuning with a Host Reference* on page 8-34

☞ *8.8 Custom Tuning* on page 8-41

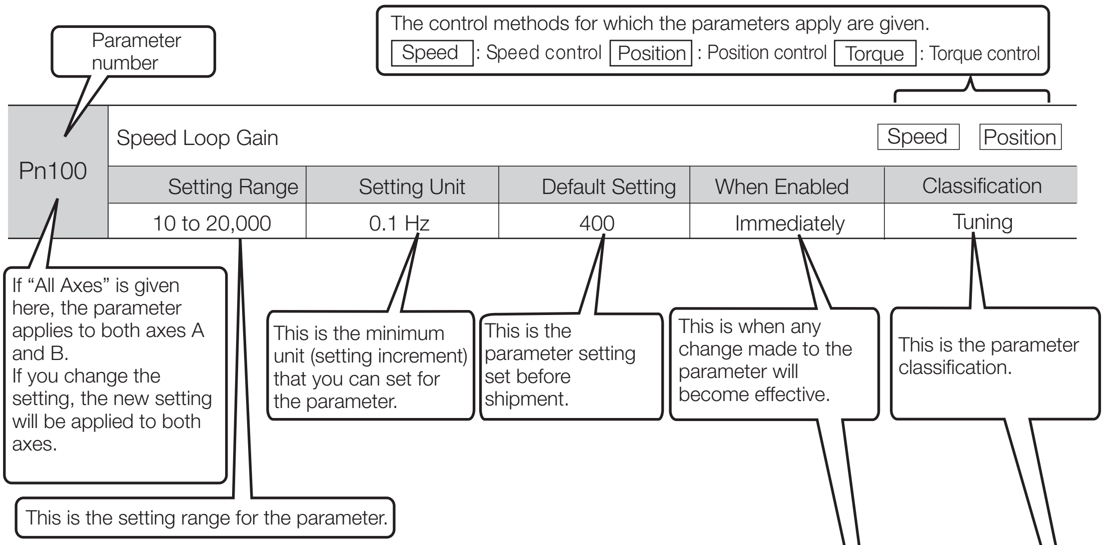
You can also set the tuning parameters individually to make adjustments. Refer to the following section for details.

☞ *8.13 Manual Tuning* on page 8-73

5.1.2 Notation for Parameters

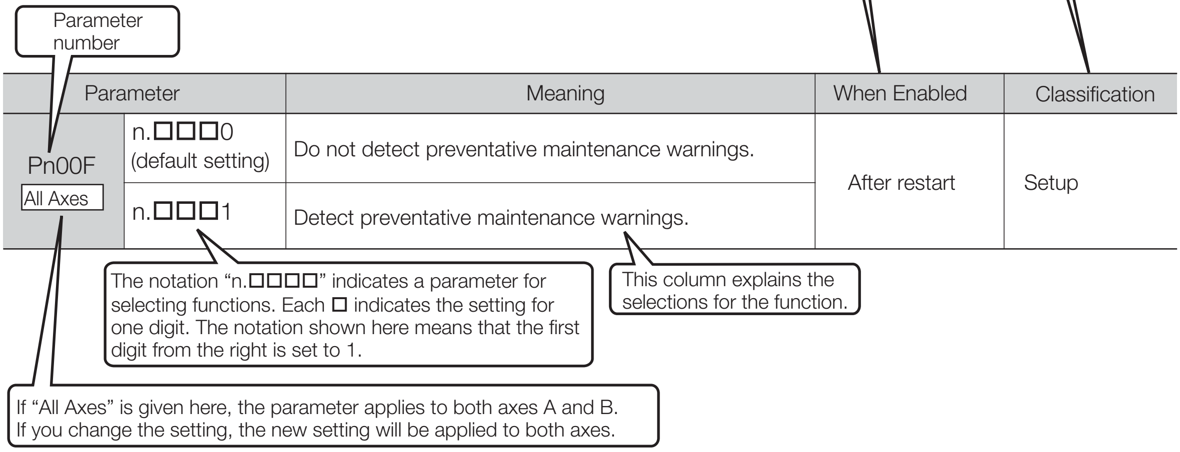
There are two types of notation used for parameters that depend on whether the parameter requires a numeric setting (parameter for numeric setting) or requires the selection of a function (parameter for selecting a function).

- Parameters for Numeric Settings



Pn100	Speed Loop Gain				Speed Position
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 20,000	0.1 Hz	400	Immediately	Tuning

- Parameters for Selecting Functions



Parameter		Meaning	When Enabled	Classification
Pn00F All Axes	n.□□□0 (default setting)	Do not detect preventative maintenance warnings.	After restart	Setup
	n.□□□1	Detect preventative maintenance warnings.		

5.1.3 Parameter Setting Methods

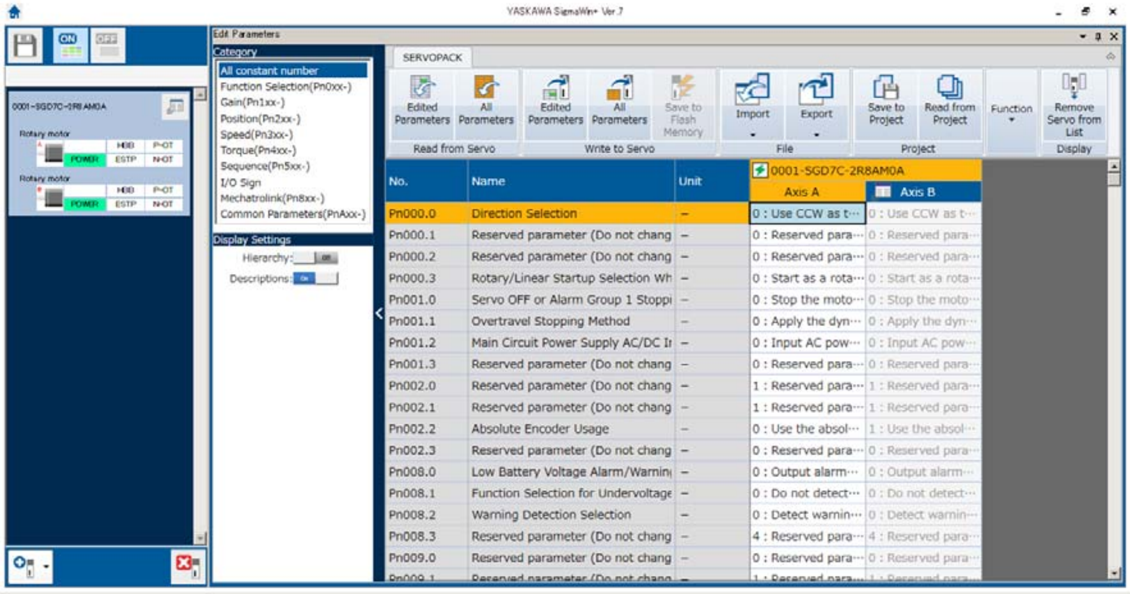
You can use the SigmaWin+ to set parameters.

Use the following procedure to set the parameters.

1. Click the **Servo Drive** Button in the workspace of the Main Window of the SigmaWin+.

2. Select **Edit Parameters** in the Menu Dialog Box.
   The Edit Parameters Dialog Box will be displayed.

3. Click the cell of the parameter to edit.
   If the parameter to edit is not displayed in the Edit Parameters Dialog Box, click the ▲ or ▼ Button to display the parameter to edit.



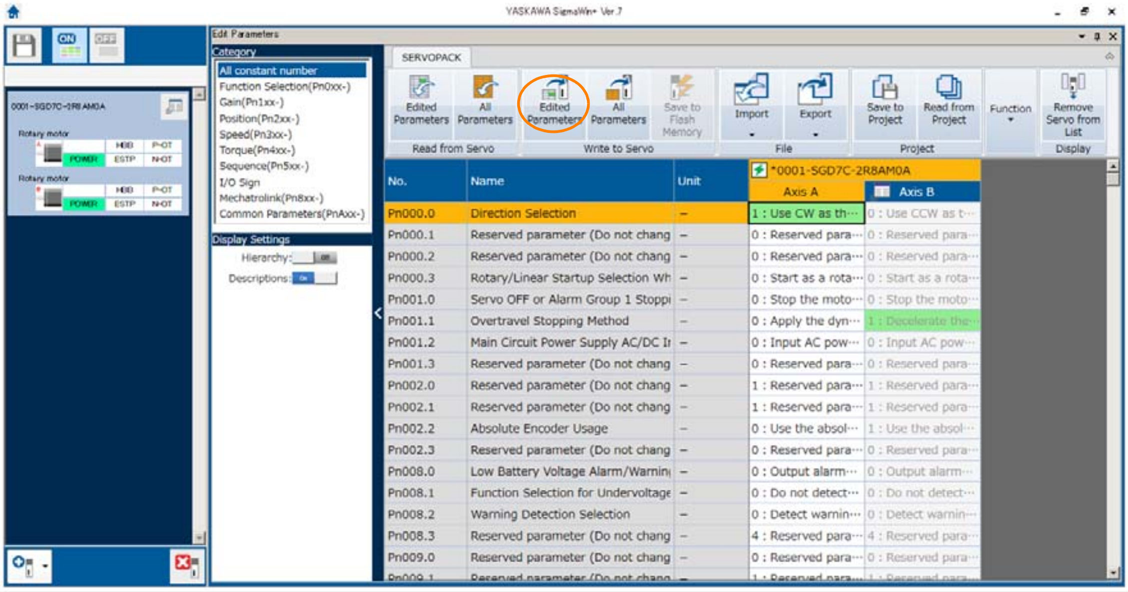
No.	Name	Unit	0001-SGD7C-2R8AM0A Axis A	Axis B
Pn000.0	Direction Selection	–	0 : Use CCW as t···	0 : Use CCW as t···
Pn000.1	Reserved parameter (Do not chang	–	0 : Reserved para···	0 : Reserved para···
Pn000.2	Reserved parameter (Do not chang	–	0 : Reserved para···	0 : Reserved para···
Pn000.3	Rotary/Linear Startup Selection Wh	–	0 : Start as a rota···	0 : Start as a rota···
Pn001.0	Servo OFF or Alarm Group 1 Stoppi	–	0 : Stop the moto···	0 : Stop the moto···
Pn001.1	Overtravel Stopping Method	–	0 : Apply the dyn···	0 : Apply the dyn···
Pn001.2	Main Circuit Power Supply AC/DC Ir	–	0 : Input AC pow···	0 : Input AC pow···
Pn001.3	Reserved parameter (Do not chang	–	0 : Reserved para···	0 : Reserved para···
Pn002.0	Reserved parameter (Do not chang	–	1 : Reserved para···	1 : Reserved para···
Pn002.1	Reserved parameter (Do not chang	–	1 : Reserved para···	1 : Reserved para···
Pn002.2	Absolute Encoder Usage	–	0 : Use the absol···	1 : Use the absol···
Pn002.3	Reserved parameter (Do not chang	–	0 : Reserved para···	0 : Reserved para···
Pn008.0	Low Battery Voltage Alarm/Warnin	–	0 : Output alarm···	0 : Output alarm···
Pn008.1	Function Selection for Undervoltage	–	0 : Do not detect···	0 : Do not detect···
Pn008.2	Warning Detection Selection	–	0 : Detect warnin···	0 : Detect warnin···
Pn008.3	Reserved parameter (Do not chang	–	4 : Reserved para···	4 : Reserved para···
Pn009.0	Reserved parameter (Do not chang	–	0 : Reserved para···	0 : Reserved para···

4. Change the setting of the parameter.

Information
1. For a parameter for a numeric setting, enter the numeric setting.
2. If the parameter requires selection of a function, select the function from the list of selections.

5. Press the **Enter** Key.
   The background of the edited parameter cell will change to green.

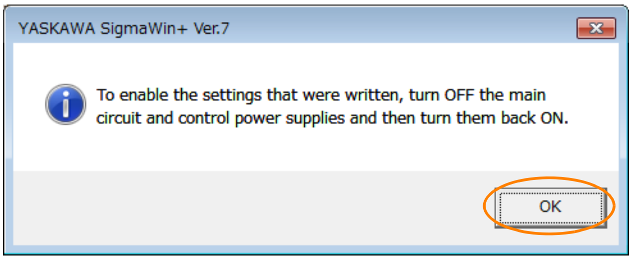
6. Select **Edited Parameters** in the **Write to Servo** Group.



No.	Name	Unit	*0001-SGD7C-2R8AM0A Axis A	Axis B
Pn000.0	Direction Selection	–	1 : Use CW as th···	0 : Use CCW as t···
Pn000.1	Reserved parameter (Do not chang	–	0 : Reserved para···	0 : Reserved para···
Pn000.2	Reserved parameter (Do not chang	–	0 : Reserved para···	0 : Reserved para···
Pn000.3	Rotary/Linear Startup Selection Wh	–	0 : Start as a rota···	0 : Start as a rota···
Pn001.0	Servo OFF or Alarm Group 1 Stoppi	–	0 : Stop the moto···	0 : Stop the moto···
Pn001.1	Overtravel Stopping Method	–	0 : Apply the dyn···	1 : Decelerate the···
Pn001.2	Main Circuit Power Supply AC/DC Ii	–	0 : Input AC pow···	0 : Input AC pow···
Pn001.3	Reserved parameter (Do not chang	–	0 : Reserved para···	0 : Reserved para···
Pn002.0	Reserved parameter (Do not chang	–	1 : Reserved para···	1 : Reserved para···
Pn002.1	Reserved parameter (Do not chang	–	1 : Reserved para···	1 : Reserved para···
Pn002.2	Absolute Encoder Usage	–	0 : Use the absol···	1 : Use the absol···
Pn002.3	Reserved parameter (Do not chang	–	0 : Reserved para···	0 : Reserved para···
Pn008.0	Low Battery Voltage Alarm/Warnin	–	0 : Output alarm···	0 : Output alarm···
Pn008.1	Function Selection for Undervoltage	–	0 : Do not detect···	0 : Do not detect···
Pn008.2	Warning Detection Selection	–	0 : Detect warnin···	0 : Detect warnin···
Pn008.3	Reserved parameter (Do not chang	–	4 : Reserved para···	4 : Reserved para···
Pn009.0	Reserved parameter (Do not chang	–	0 : Reserved para···	0 : Reserved para···

The edited parameters are written to the SERVOPACK and the backgrounds of the cells change to white.

7. Click the **OK** Button.



To enable the settings that were written, turn OFF the main circuit and control power supplies and then turn them back ON.

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

This concludes the procedure to set the parameters.

5.1.4 Write Prohibition Setting for Parameters

You can prohibit changes to parameters or prohibit the execution of specific functions. Refer to the following section for information on the functions that are prohibited.

☞ *Restrictions* on page 5-10

Important

The write prohibition setting for parameters applies to both axes A and B.
If you change the setting, the new setting will be applied to both axes.

Preparations

No preparations are required.

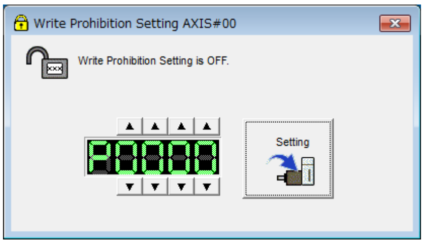
Operating Procedure

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

1. Click the **Servo Drive** Button in the workspace of the Main Window of the SigmaWin+.

2. Select **Write Prohibition Setting** in the Menu Dialog Box.
   The Write Prohibition Setting Dialog Box will be displayed.

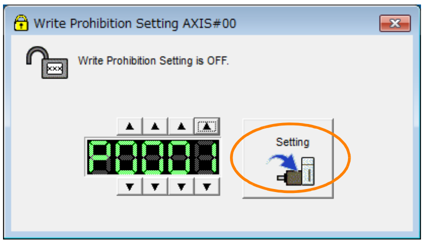
3. Click the ▼ Button or ▲ Button for the rightmost digit and set one of the following.



Write Prohibition Setting is OFF.

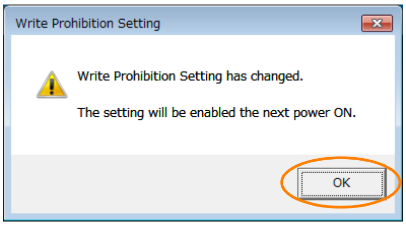
   0000: Writing is permitted (default setting).
   0001: Writing is prohibited.

4. Click the **Setting** Button.



Write Prohibition Setting is OFF.

5. Click the **OK** Button.



Write Prohibition Setting has changed.

The setting will be enabled the next power ON.

   The setting will be written to the SERVOPACK.

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

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

Restrictions

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

Button in Menu Dialog Box	Function	When Writing Is Prohibited	Reference
Basic Functions	Initialize[*1]	Cannot be executed.	page 5-10
	Product Information	Can be executed.	page 9-2
Encoder Setting	Reset Absolute Encoder	Cannot be executed.	page 5-43
	Multi-turn Limit Setup	Cannot be executed.	page 5-76
	Search Origin[*2]	Cannot be executed.	page 6-18
	Zero Point Position Setting	Cannot be executed.	page 5-46
	Polarity Detection	Cannot be executed.	page 5-26
Troubleshooting	Display Alarm	Can be executed.	[*3]
	Reset Motor Type Alarm	Cannot be executed.	
Operation	Jog	Cannot be executed.	page 6-6
	Program JOG Operation	Cannot be executed.	page 6-13
Tuning	Tuning - Autotuning without Host Reference	Cannot be executed.	page 8-23
	Tuning - Autotuning with Host Reference	Cannot be executed.	page 8-34
	Tuning - Custom Tuning	Cannot be executed.	page 8-41
	Tuning - Custom Tuning - Adjust Anti-resonance Control	Cannot be executed.	page 8-49
	Tuning - Custom Tuning - Vibration Suppression	Cannot be executed.	page 8-54
	Response Level Setting	Cannot be executed.	page 8-12
Diagnostic	EasyFFT	Cannot be executed.	page 8-90
Others	Adjust the Motor Current Detection Offsets	Cannot be executed.	page 5-83
	Initialize Vibration Detection Level	Cannot be executed.	page 5-80
	Write Prohibited Setting	Can be executed.	page 5-8

*1. An **Initialize** Button will be displayed in the Parameter Editing Dialog Box.
*2. Cannot be used when connecting a Linear Servomotor.
*3. Refer to the following manual for details.
Σ-7-Series Σ-7C SERVOPACK Troubleshooting Manual (Manual No.: SIEP S800002 07)

5.1.5 Initializing Parameter Settings

You can return the parameters to their default settings. You can specify the axis or axes to initialize.

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

Preparations

Always check the following before you initialize the parameter settings.

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

Operating Procedure

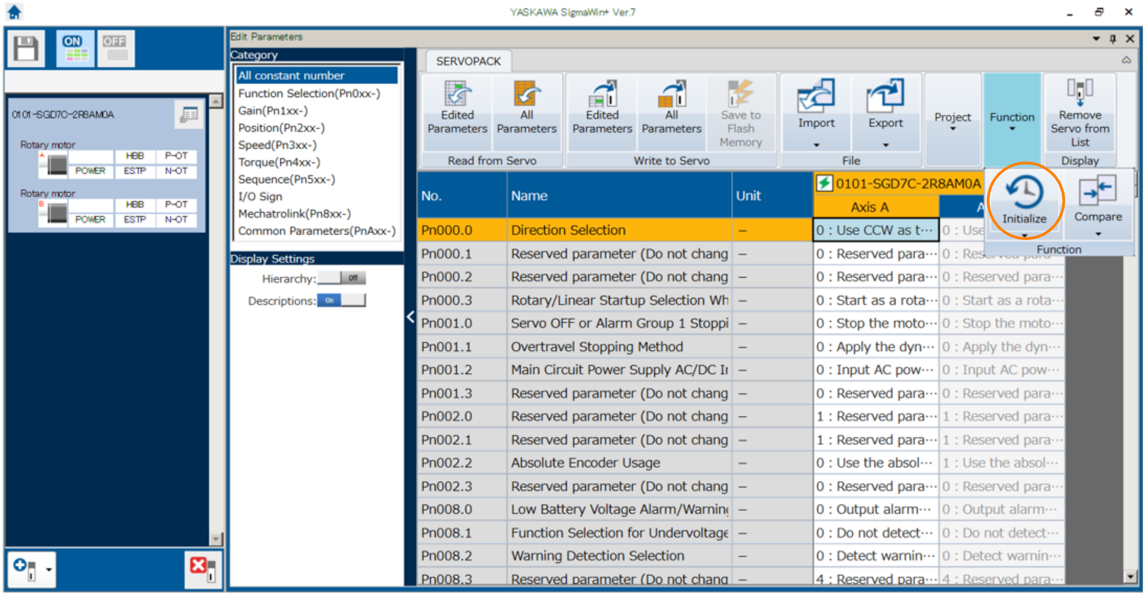
Use the following procedure to initialize the parameter settings.

1. Click the **Servo Drive** Button in the workspace of the Main Window of the SigmaWin+.

2. Select **Edit Parameters** in the Menu Dialog Box.
   The Edit Parameters Dialog Box will be displayed.

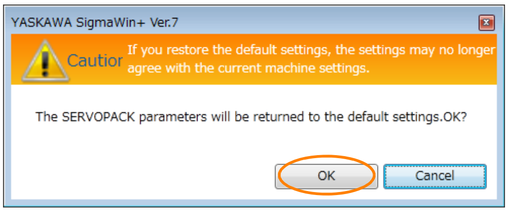
3. Select any parameter of the axis to initialize.

4. Click the **Initialize** Button in the **Function** Group.



No.	Name	Unit	0101-SGD7C-2R8AM0A	
			Axis A	A
Pn000.0	Direction Selection	–	0 : Use CCW as t···	0 : Use
Pn000.1	Reserved parameter (Do not chang	–	0 : Reserved para···	0 : Res
Pn000.2	Reserved parameter (Do not chang	–	0 : Reserved para···	0 : Reserved para···
Pn000.3	Rotary/Linear Startup Selection Wh	–	0 : Start as a rota···	0 : Start as a rota···
Pn001.0	Servo OFF or Alarm Group 1 Stoppi	–	0 : Stop the moto···	0 : Stop the moto···
Pn001.1	Overtravel Stopping Method	–	0 : Apply the dyn···	0 : Apply the dyn···
Pn001.2	Main Circuit Power Supply AC/DC Ir	–	0 : Input AC pow···	0 : Input AC pow···
Pn001.3	Reserved parameter (Do not chang	–	0 : Reserved para···	0 : Reserved para···
Pn002.0	Reserved parameter (Do not chang	–	1 : Reserved para···	1 : Reserved para···
Pn002.1	Reserved parameter (Do not chang	–	1 : Reserved para···	1 : Reserved para···
Pn002.2	Absolute Encoder Usage	–	0 : Use the absol···	1 : Use the absol···
Pn002.3	Reserved parameter (Do not chang	–	0 : Reserved para···	0 : Reserved para···
Pn008.0	Low Battery Voltage Alarm/Warnin	–	0 : Output alarm···	0 : Output alarm···
Pn008.1	Function Selection for Undervoltage	–	0 : Do not detect···	0 : Do not detect···
Pn008.2	Warning Detection Selection	–	0 : Detect warnin···	0 : Detect warnin···
Pn008.3	Reserved parameter (Do not chang	–	4 : Reserved para···	4 : Reserved para···

5. Click the **OK** Button.

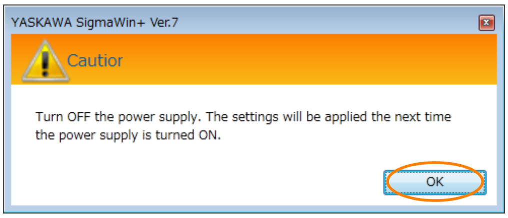


If you restore the default settings, the settings may no longer agree with the current machine settings.

The SERVOPACK parameters will be returned to the default settings.OK?

Click the **Cancel** Button to cancel initialization. The Edit Parameters Dialog Box will return.

6. Click the **OK** Button.



Turn OFF the power supply. The settings will be applied the next time the power supply is turned ON.

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

This concludes the procedure to initialize the parameter settings.

5.2 Precautions When Setting the Parameters

Observe the following precautions when making settings for the SERVOPACK.

5.2.1 Precautions When Setting Circuit Numbers

When you assign circuit numbers to the Motion Control and Communications Function Modules, you must assign numbers within the following ranges.

Type		Abbreviations of Built-in Function Modules	Circuit No.
Function Modules in CPU	Motion Control Function Modules	SVD	1 to 16
		SVC4	1 to 16
		SVR4	1 to 16
	Communications Function Module	218IFD	1 or 2
Option Module	Communications Modules	217IF-01 (217IF)	–
		218IF-01 (218IF) and 218IF-02 (218IFB)	1 or 2
		260IF-01 (260IF (DeviceNet)), 261IF-01 (261IFS (Profibus)), 262IF-01 (FL-net), 263IF-01 (EtherNet/IP), 264IF-01 (EtherCAT-S), 265IF-01 (Componet), 266IF-01, 266IF-02, 215AIF-01 (MPLINK), 215AIF-01 (CP-215), and 267IF-01 (CC-Link)	–
	I/O Modules	LIO-01, LIO-02, LIO-04, LIO-05, LIO-06, AI-01, AO-01, DO-01, and CNTR-01	–

5.2.2 Precautions When Setting Module Configuration Definitions

Observe the following precautions when you write module configuration definitions.

- Write the module configuration definitions only when the high-speed scan has sufficient unused processing time.
  Otherwise, processing may exceed the time limit of the high-speed scan.
- Before writing module configuration definitions, make sure the machine is not in operation.
- Before you use the SERVOPACK, save any written data to flash memory and turn the power supply to the Racks OFF and ON again.

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.

Example

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

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

Parameter		Meaning	When Enabled	Classification
Pn001 All Axes	n.□0□□ (default setting)	Use an AC power supply input.	After restart	Setup
	n.□1□□	Use a DC power supply input.		

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 input (Pn001 = n.□1□□) before you input DC power for the main circuit power supply.**
  If you input DC power without specifying a DC power supply input (i.e., without setting Pn001 to n.□1□□), the SERVOPACK's internal elements may burn and may cause fire or damage to the equipment.
- **With a DC power supply input, time is required to discharge electricity after the main power supply is turned OFF. A high residual voltage may remain in the SERVOPACK after the power supply is turned OFF. Be careful not to get an electric shock.**
- **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.**

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

☞ *3.5.4 Power Supply Wiring Diagrams* on page 3-31

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.

- SGD7C-1R6A, -2R8A, and -5R5A

If you use a single-phase, 200-VAC power supply input for the SERVOPACK's main circuit power supply, set Pn00B = n.□X□□ (Power Input Selection for Three-phase SERVOPACK) to 1 (Use a three-phase power supply input as a single-phase power supply input).

Parameter		Meaning	When Enabled	Classification
Pn00B All Axes	n.□0□□ (default setting)	Use a three-phase power supply input.	After restart	Setup
	n.□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 specifying a signal-phase AC power supply (Pn00B = n.□1□□), 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-motor 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.
4. Some models of SERVOPACKs require derating of the load ratio for operation on a single-phase 200-VAC power supply. Refer to the following section for details.
   ☞ *1.5.1 Ratings* on page 1-11

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

☞ • *Wiring Example for Single-Phase, 200-VAC Power Supply Input* on page 3-32

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 CN2A or CN2B connector on the SERVOPACK, the SERVOPACK will automatically determine which type of Servomotor is connected. Therefore, you normally do not need to specify the motor type.

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

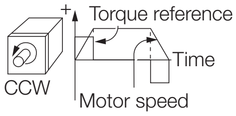
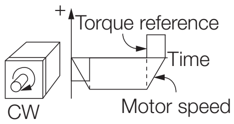
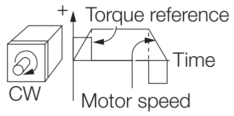
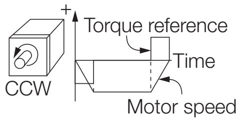
Parameter		Meaning	When Enabled	Classification
Pn000	n.0□□□ (default setting)	When an encoder is not connected, start as SERVOPACK for Rotary Servomotor.	After restart	Setup
	n.1□□□	When an encoder is not connected, start as SERVOPACK for Linear Servomotor.		

5.5 Motor Direction Setting

You can reverse the direction of Servomotor rotation by changing the setting of Pn000 = n.□□□X (Direction Selection) without changing the polarity of the speed or position reference.

- Rotary Servomotors

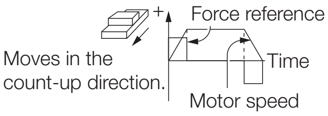
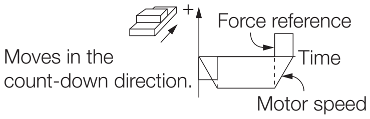
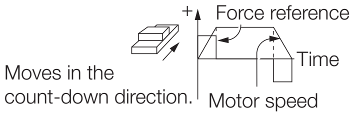
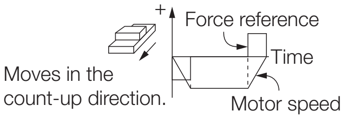
The default setting for forward rotation is counterclockwise (CCW) as viewed from the load end of the Servomotor.

Parameter		Forward/Reverse Reference	Motor Direction	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.

- Linear Servomotors

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

Parameter		Forward/Reverse Reference	Motor Direction	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 down as the forward 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.

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, you do not need to set Pn282.

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 Position Force		
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 6,553,600	0.01 μm	0	After restart	Setup

You will not be able to control the Linear Servomotor if Pn282 is not set correctly. Check the 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	Dr. JOHANNES HEIDENHAIN GmbH	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 supply OFF and ON again.

Information

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

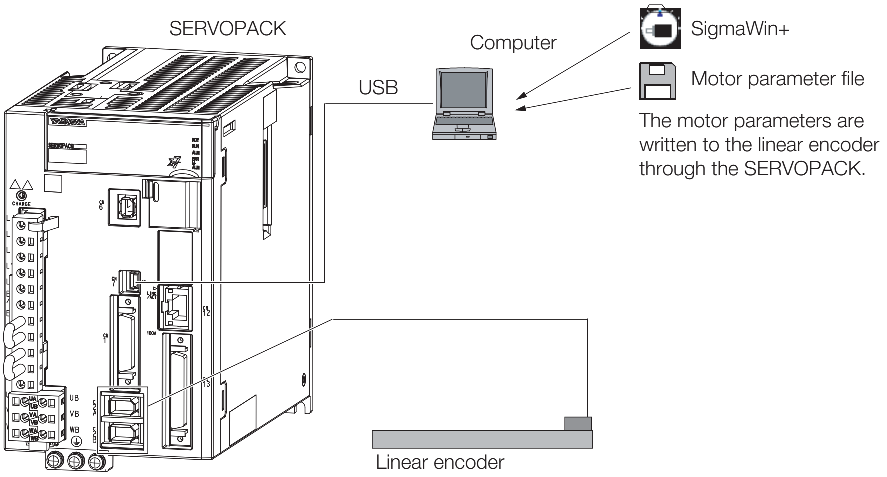
☞ *9.1 Monitoring Product Information* on page 9-2

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 parameters to the linear encoder. The motor parameters contain the information that is required by the SERVOPACK to operate the Linear Servomotor.

⚠ WARNING

- **Check the Servomotor and linear encoder information before you write the motor parameters.**
  If you do not write the correct motor parameters, the Servomotor may run out of control or burning may occur, possibly resulting in equipment damage or fire.



The motor parameters are written to the linear encoder through the SERVOPACK.

Important

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

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 parameters 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 Speed Setting Error), A.710 (Instantaneous Overload),
  A.720 (Continuous Overload), and A.C90 (Encoder Communications Error)

Operating Procedure

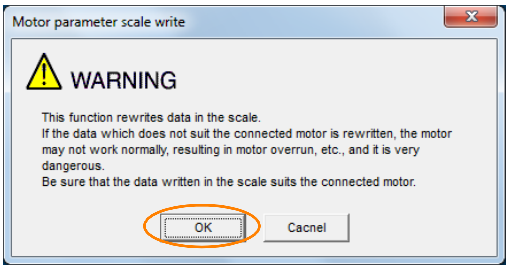
Use the following procedure to write the motor parameters to the Linear Encoder.

1. Prepare the motor parameter file to write to the linear encoder.

2. Click the **Servo Drive** Button in the workspace of the Main Window of the SigmaWin+.

3. Select **Motor Parameter Scale Write** in the Menu Dialog Box.
   The Motor Parameter Scale Write Dialog Box will be displayed.

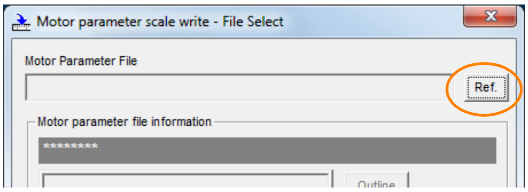
4. Click the **OK** Button.



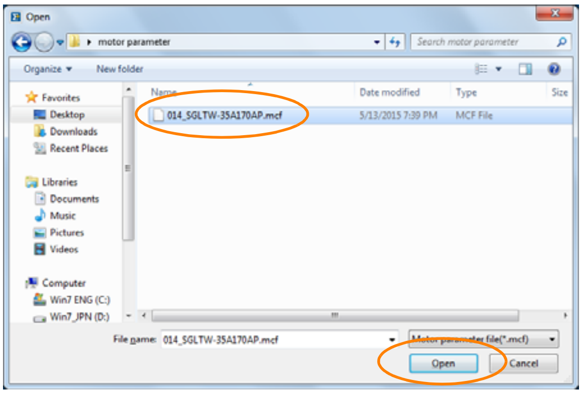
This function rewrites data in the scale.
If the data which does not suit the connected motor is rewritten, the motor may not work normally, resulting in motor overrun, etc., and it is very dangerous.
Be sure that the data written in the scale suits the connected motor.

Click the **Cancel** Button to cancel writing the motor parameters to the linear encoder. The Main Window will return.
If the write is completed normally, the Motor Parameter Scale Write - File Select Dialog Box will be displayed.

5. Click the **Ref.** Button.



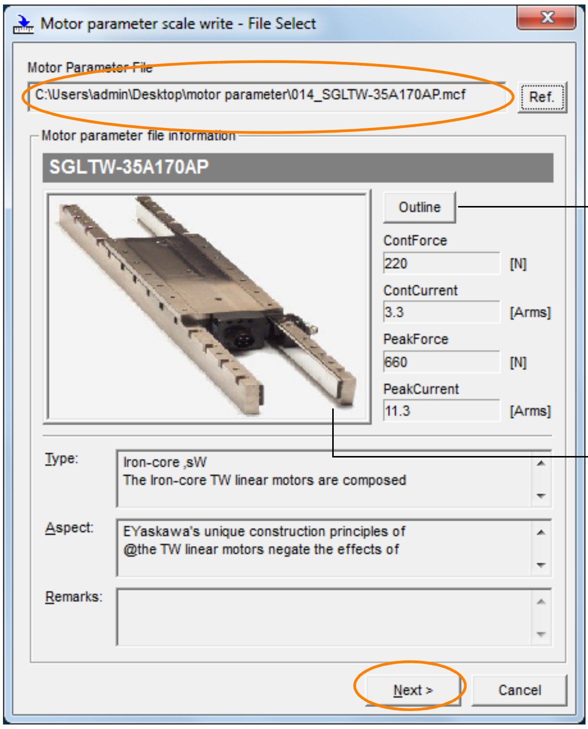
6. Select the motor parameter file that you downloaded and click the **Open** Button.



Name	Date modified	Type	Size
014_SGLTW-35A170AP.mcf	5/13/2015 7:39 PM	MCF File	

File name: 014_SGLTW-35A170AP.mcf

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



Motor parameter scale write - File Select

Motor Parameter File: C:\Users\admin\Desktop\motor parameter\014_SGLTW-35A170AP.mcf

Motor parameter file information

SGLTW-35A170AP

ContForce: 220 [N]

ContCurrent: 3.3 [Arms]

PeakForce: 660 [N]

PeakCurrent: 11.3 [Arms]

Type: Iron-core ,sW
The Iron-core TW linear motors are composed

Aspect: EYaskawa's unique construction principles of
@the TW linear motors negate the effects of

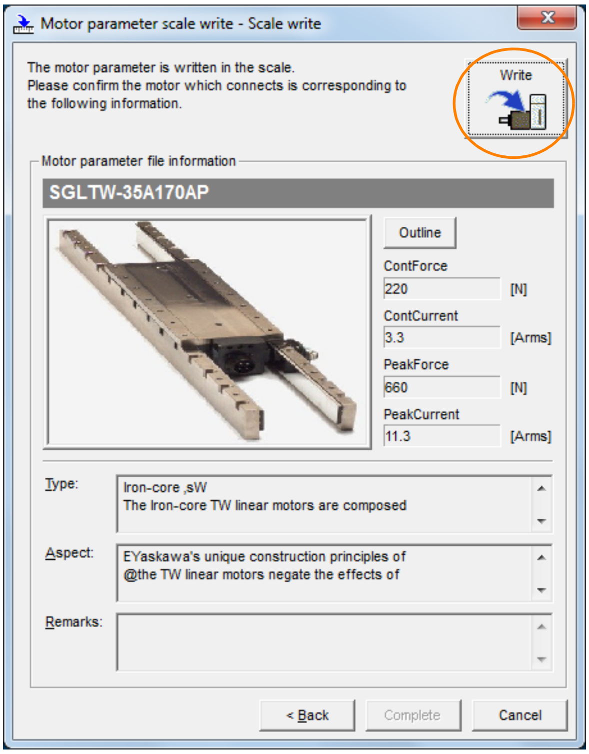
Remarks:

Displays an exterior view of the Servomotor.

Click the image to enlarge it.

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

8. Click the **Write** Button.



Motor parameter scale write - Scale write

The motor parameter is written in the scale.
Please confirm the motor which connects is corresponding to the following information.

Motor parameter file information

SGLTW-35A170AP

ContForce: 220 [N]

ContCurrent: 3.3 [Arms]

PeakForce: 660 [N]

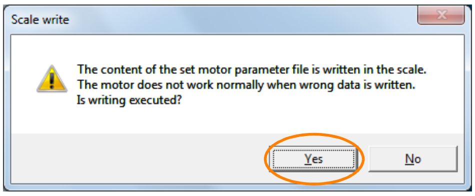
PeakCurrent: 11.3 [Arms]

Type: Iron-core ,sW
The Iron-core TW linear motors are composed

Aspect: EYaskawa's unique construction principles of
@the TW linear motors negate the effects of

Remarks:

9. Click the **Yes** Button.

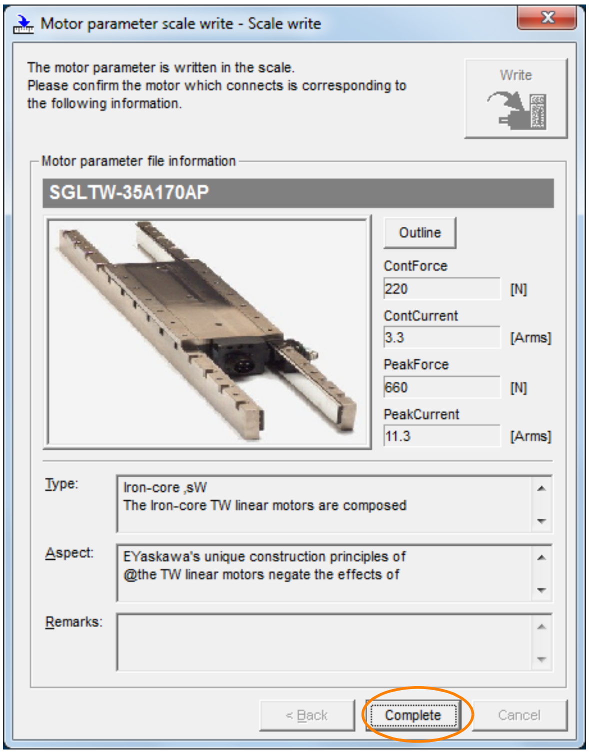


The content of the set motor parameter file is written in the scale.
The motor does not work normally when wrong data is written.
Is writing executed?

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

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

10. Click the **Complete** Button.



The motor parameter is written in the scale.
Please confirm the motor which connects is corresponding to the following information.

SGLTW-35A170AP

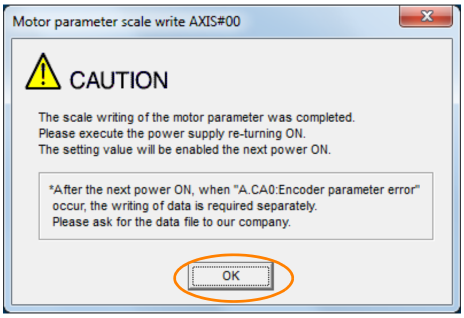
ContForce: 220 [N]
ContCurrent: 3.3 [Arms]
PeakForce: 660 [N]
PeakCurrent: 11.3 [Arms]

Type: Iron-core ,sW
The Iron-core TW linear motors are composed

Aspect: EYaskawa's unique construction principles of
@the TW linear motors negate the effects of

Remarks:

11. Click the **OK** Button.



CAUTION

The scale writing of the motor parameter was completed.
Please execute the power supply re-turning ON.
The setting value will be enabled the next power ON.

*After the next power ON, when "A.CA0:Encoder parameter error" occur, the writing of data is required separately.
Please ask for the data file to our company.

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

This concludes the procedure to write the motor parameters.

Confirming If the Motor Parameters Have Been Written

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

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

☞ *9.1 Monitoring Product Information* on page 9-2

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.

Before you set the Linear Servomotor phase sequence (Pn080 = n.□□X□), 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.

Related Parameters

Parameter		Meaning	When Enabled	Classification
Pn080	n.□□0□ (default setting)	Set a phase-A lead as a phase sequence of U, V, and W.	After restart	Setup
	n.□□1□	Set a phase-B lead as a phase sequence of U, V, and W.		

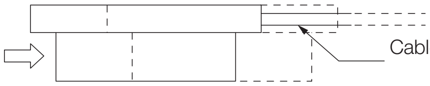
Operating Procedure

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

1. **Set Pn000 to n.□□□0 (Set a phase-A lead as a phase sequence of U, V, and W).**
   This setting is to make following confirmation work easier to understand.
2. **Select Monitor in the Menu Dialog Box.**
   The Operation Pane will be displayed so that you can check the feedback pulse counter.
3. **Manually move the Moving Coil from one end to the other of the stroke and confirm that only the correct number of feedback pulses is returned.**
   If the correct number and only the correct number of pulses is returned, the signal is being received correctly from the linear encoder.

Example

In this example, assume that a linear encoder with a scale pitch of 20 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) = 128,000 pulses.



If there are 128,000 pulses on the feedback pulse counter after you manually move the Moving Coil in the direction of the cable, you have completed the confirmation.

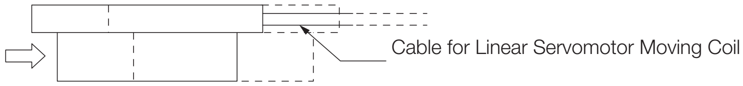
Note: The actual monitor display will be offset by the error in the travel distance. There is no problem as long as the above value is close to the calculated value.

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 Panel to confirm that it is counting up.

If the pulses are counted up, the forward direction of the Linear Servomotor is the same as the count-up direction of the linear encoder.



If the feedback pulse counter counts up when you manually move the Moving Coil in the direction of the cable, you have completed the confirmation.

5. If the feedback pulse counter counts down, set a phase-B lead as a phase sequence of U, V, and W (Pn080 = n.□□1□) and turn the power supply OFF and ON again.

6. If necessary, return Pn000 = n.□□□X (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 supply OFF and ON again to enable the new setting.

Parameter		Meaning	When Enabled	Classification
Pn080	n.□□□0 (default setting)	Use polarity sensor.	After restart	Setup
	n.□□□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 supply 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 angle phase 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 supply 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 supply to the SERVOPACK is turned OFF.)	• Start polarity detection when the servo is turned ON in the SVD. • Use the polarity detection function of the SigmaWin+.
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 supply is turned OFF.)	• Use the polarity detection function of the SigmaWin+. • Enable polarity detection (Pn587 = n.□□□1) and then use the servo ON command from the SVD.

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

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.)

Preparations

Always check the following before you execute polarity detection.

- Not using a polarity sensor must be specified (Pn080 = n.□□□1).
- The servo must be OFF for both axis A and axis B.
- The main circuit power supply must be ON.
- 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+.)
- The test without a motor function must be disabled (Pn00C = n.□□□0).
- There must be no overtravel.
- If the motor parameters have been written or the origin of the absolute linear encoder has been set, the power supply to the SERVOPACK must be turned OFF and ON again after completion of the writing or setting operation.

Important

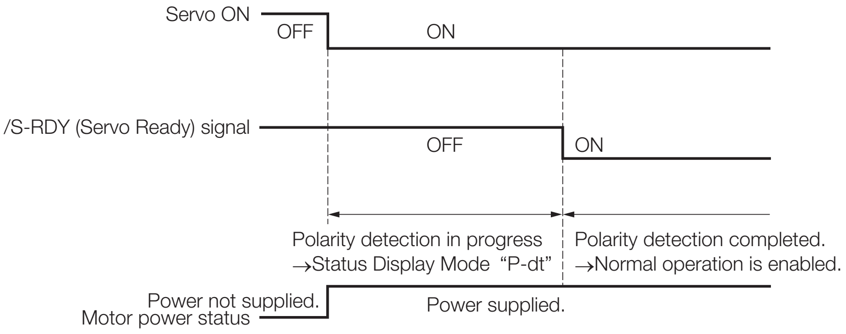
1. Power is supplied to the Servomotor during polarity detection. Be careful not to get an electric shock. Also, the Moving Coil of the Linear Servomotor may greatly move during detection. Do not approach the moving parts of the Servomotor.
2. Polarity detection is affected by many factors.
   For example, 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 Servo ON Command to Perform Polarity Detection

You can turn ON the servo in the SVD to perform polarity detection only with an incremental linear encoder.

Polarity detection will be performed when you turn the control power supply to the SERVOPACK OFF and then ON again, and then turn ON the servo. As soon as polarity detection is completed, the /S-RDY (Servo Ready Output) signal will turn ON.

Polarity detection will start as soon as the servo turns ON. As soon as polarity detection is completed, the /S-RDY signal will turn ON and the servo will remain ON.



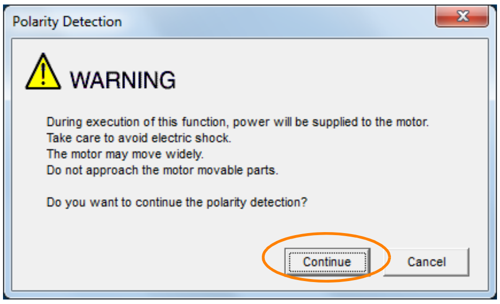
5.10.3 Using a Tool Function to Perform Polarity Detection

Operating Procedure

Use the following procedure to perform polarity detection.

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

3. Click the **Continue** Button.



Polarity Detection

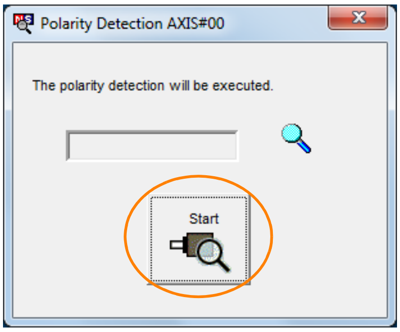
WARNING

During execution of this function, power will be supplied to the motor.
Take care to avoid electric shock.
The motor may move widely.
Do not approach the motor movable parts.

Do you want to continue the polarity detection?

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

4. Click the **Start** Button.
Polarity detection will be executed.



Polarity Detection AXIS#00

The polarity detection will be executed.

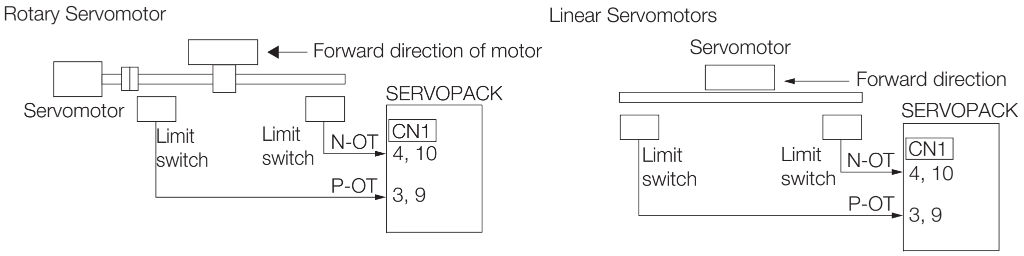
This concludes the polarity detection procedure.

5.11 Overtravel Function and 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.



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 contact faults 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.

Type	Signal	Connector Pin No.	Signal	Meaning
Input	P-OT	Axis A: CN1-3 Axis B: CN1-9	ON	Forward drive is enabled (normal operation).
			OFF	Forward drive is prohibited (forward overtravel).
	N-OT	Axis A: CN1-4 Axis B: CN1-10	ON	Reverse drive is enabled (normal 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

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

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

Parameter		Meaning	When Enabled	Classification
Pn50A	n.0□□□ (default setting)	The forward overtravel function is enabled and the P-OT (Forward Drive Prohibit Input) signal is input from CN1-3 for axis A and CN1-9 for axis B.	After restart	Setup
	n.8□□□	The forward overtravel function is disabled. Forward drive is always enabled.		
Pn50B	n.□□□1 (default setting)	The reverse overtravel function is enabled and the N-OT (Reverse Drive Prohibit Input) signal is input from CN1-4 for axis A and CN1-10 for axis B.		
	n.□□□8	The forward overtravel function is disabled. Reverse drive is always enabled.		

You can also use Pn590 (P-OT (Forward Drive Prohibit Input) Signal Allocation) and Pn591 (N-OT (Reverse Drive Prohibit Input) Signal Allocation) to enable and disable the overtravel function. Refer to the following sections for details.

☞ *5.19.1 Input Signal Allocations* on page 5-50

☞ *11.1.2 List of Servo Parameters* on page 11-3

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

☞ *5.19.1 Input Signal Allocations* on page 5-50

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 *	Status after Stopping	When Enabled	Classification
Pn001	n.□□00 (default setting)	Dynamic brake	Coasting	After restart	Setup
	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		

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

☞ *5.13.1 Stopping Method for Servo OFF* on page 5-36

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 maximum torque. However, the maximum emergency stop torque that you can actually use is the maximum torque of the Servomotor.

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

* Set a percentage of the motor rated torque.

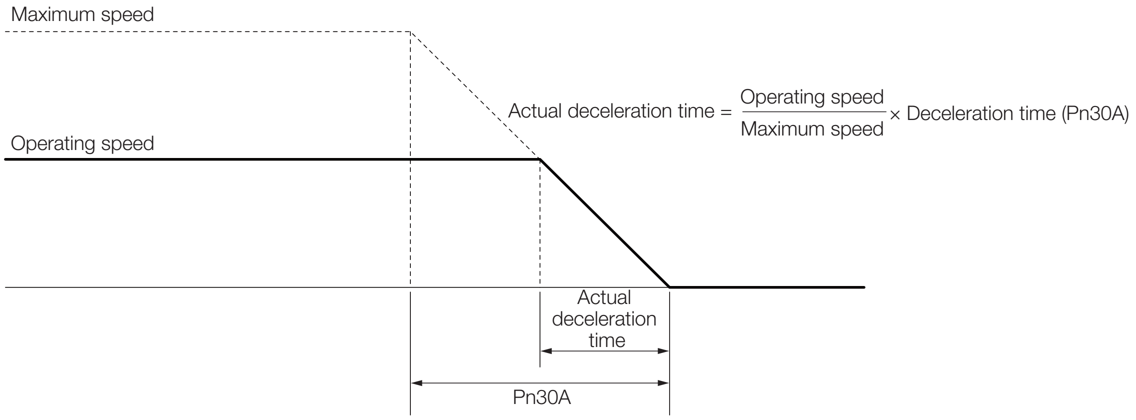
Stopping the Servomotor by Setting the Deceleration Time

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

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

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

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



$$\text{Actual deceleration time} = \frac{\text{Operating speed}}{\text{Maximum speed}} \times \text{Deceleration time (Pn30A)}$$

5.11.4 Overtravel Warnings

You can set the system to detect an A.9A0 warning (Overtravel) if overtravel occurs while the servo is ON. This allows the SERVOPACK to notify the Controller Section 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.

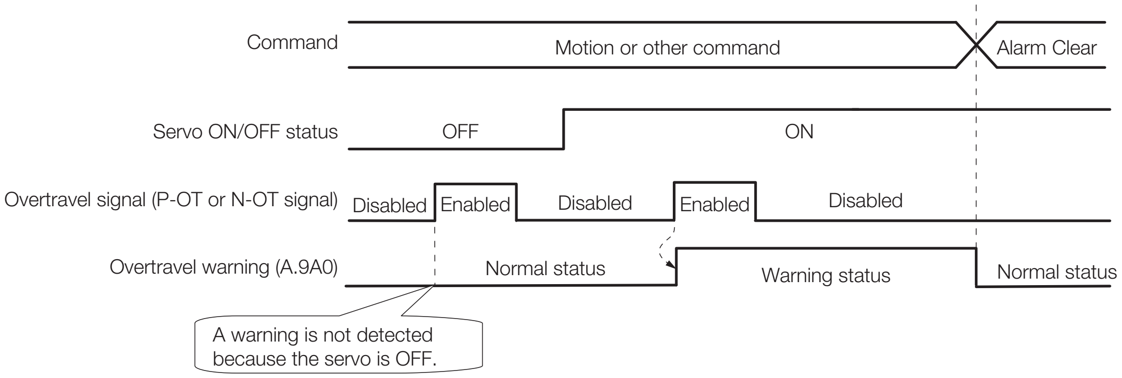
Important

1. The occurrence of an A.9A0 warning will not stop the motor or have any affect on Controller Section 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 Controller Section, operation may be affected when an overtravel warning occurs (e.g., motion may stop or not stop). Confirm the specifications and programming in the Controller Section.
2. When overtravel occurs, the SERVOPACK will perform stop processing for overtravel. Therefore, when an A.9A0 warning occurs, the Servomotor may not reach the target position specified by the Controller Section. Check the feedback position to make sure that the axis is stopped at a safe position.

The following parameter is set for this function.

Parameter		Meaning	When Enabled	Classification
Pn00D	n.0□□□ (default setting)	Do not detect overtravel warnings.	After restart	Setup
	n.1□□□	Detect overtravel warnings.		

A timing chart for warning detection is provided below.



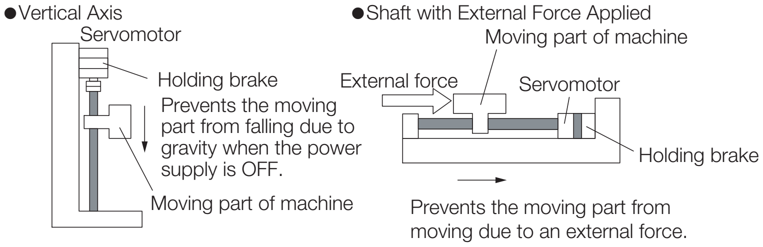
Information

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

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.

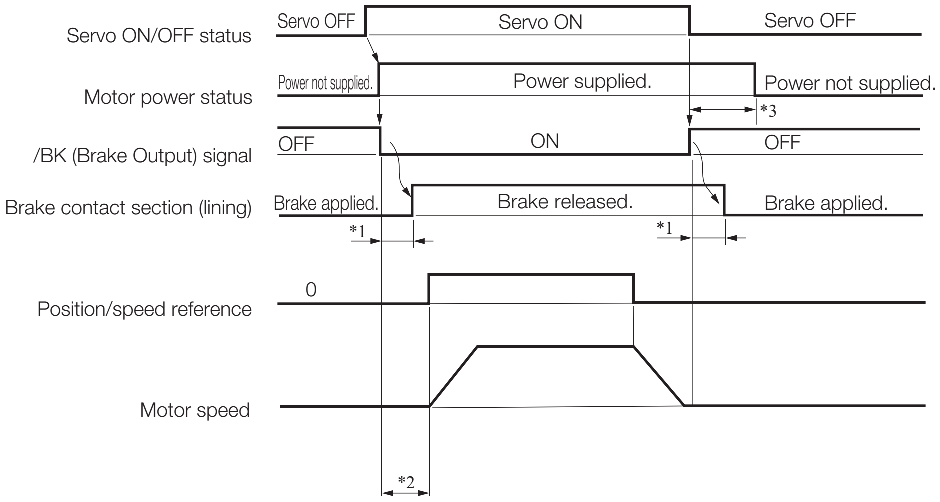
5.12.1 Brake Operating Sequence

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) signal is turned ON until the brake is actually released.

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



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

Model	Voltage	Brake Release Delay Time [ms]	Brake Operation Delay Time [ms]
SGM7J-A5 to -04	24 VDC	60	100
SGM7J-06 and -08		80	
SGM7A-A5 to -04		60	
SGM7A-06 and -08		80	
SGM7P-01		20	
SGM7P-02 and -04		40	
SGM7P-08		20	
SGM7G-03 to -09		100	80

Linear Servomotors: The times required to brake 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 SVD to the Servo Section, wait for at least 50 ms plus the brake release delay time after you turn ON the servo.

*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)

Connection Examples

Refer to the following section for information on brake wiring.

☞ *3.4.4 Wiring the SERVOPACK to the Holding Brake* on page 3-25

5.12.2 /BK (Brake Output) Signal

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

Type	Signal	Connector Pin No.	Signal Status	Meaning
Output	/BK	Axis A: CN1-23 and CN1-24 Axis B: CN1-25 and CN1-26	ON (closed)	Releases the brake.
			OFF (open)	Activates the brake.

Information The /BK signal will remain ON during overtravel. The brake will remain released.

Allocating the /BK (Brake Output) Signal

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

- Axis A

Parameter		Connector Pin No.		Meaning	When Enabled	Classification
		+ Pin	– Pin			
Pn50F	n.□0□□	–	–	The /BK signal is not used.	After restart	Setup
	n.□1□□ (default setting)	CN1-23	CN1-24	The /BK signal is output from CN1-23 and CN1-24.		
	n.□2□□	CN1-27	CN1-28	The /BK signal is output from CN1-27 and CN1-28.		

- Axis B

Parameter		Connector Pin No.		Meaning	When Enabled	Classification
		+ Pin	– Pin			
Pn50F	n.□0□□	–	–	The /BK signal is not used.	After restart	Setup
	n.□1□□ (default setting)	CN1-25	CN1-26	The /BK signal is output from CN1-25 and CN1-26.		
	n.□2□□	CN1-29	CN1-30	The /BK signal is output from CN1-29 and CN1-30.		

Important

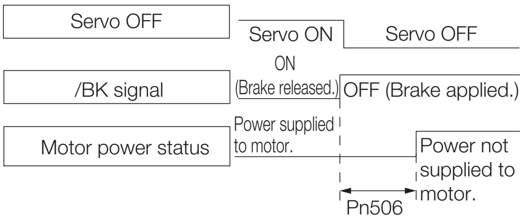
If you allocate more than one signal to the same output connector pin, a logical OR of the signals is output. Allocate the /BK signal to its own output connector pin, i.e., do not use the same output connector pin for another signal.
For example, never allocate the /TGON (Rotation Detection) signal and /BK signal to the same output connector pin. If you did so, the /TGON signal would be turned ON by the falling speed on a vertical axis, and the brake would not operate.

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 the servo is turned OFF. Use the servo OFF delay time (Pn506) to change the timing to turn OFF power supply to the motor after the servo is turned OFF.

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

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



Important

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

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 the brake reference output speed level (Rotary Servomotors: Pn507, Linear Servomotors: Pn583) and the servo OFF-brake command waiting time (Pn508).

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

- Rotary Servomotors

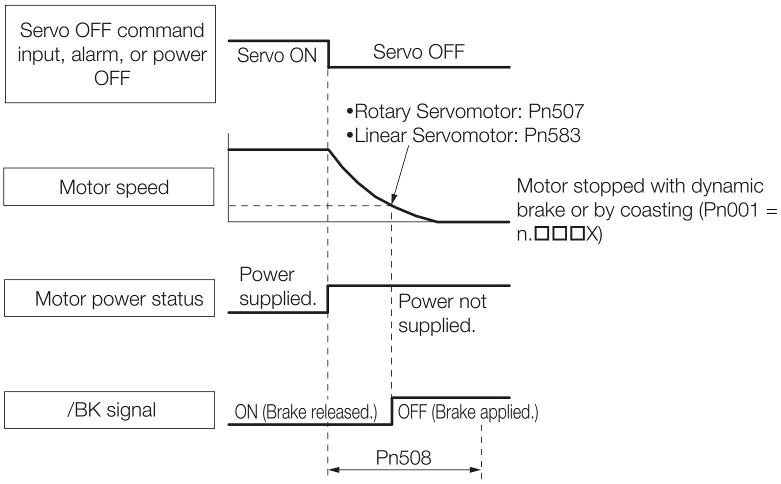
Pn507	Brake Reference Output Speed Level		Speed	Position	Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 min^{-1}	100	Immediately	Setup
Pn508	Servo OFF-Brake Command Waiting Time		Speed	Position	Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 100	10 ms	50	Immediately	Setup

- Linear Servomotors

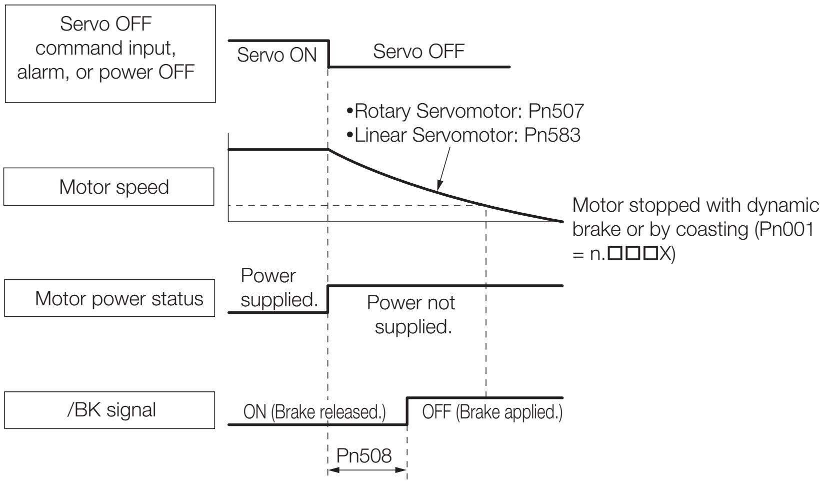
Pn583	Brake Reference Output Speed Level		Speed	Position	Force
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 mm/s	10	Immediately	Setup
Pn508	Servo OFF-Brake Command Waiting Time		Speed	Position	Force
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification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

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

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



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



Important

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

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 Clamping	The speed reference is set to 0 to stop the Servomotor quickly.
Decelerating to a Stop	Emergency stop torque is used to decelerate the motor to a stop.

There are the following three conditions after stopping.

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

Important

- The dynamic brake is used for emergency stops. The dynamic brake circuit will operate frequently if the power supply is turned ON and OFF or the servo is turned ON and OFF while a reference input is applied to start and stop the Servomotor. This may result in deterioration of the internal elements in the SERVOPACK. Use speed input references or position references to start and stop the Servomotor.
- If you turn OFF the main circuit power supply or control power supply during operation before you turn OFF the servo, the Servomotor will stop with the dynamic brake. You cannot change this by setting a parameter.
- If the Servomotor must be stopped by coasting rather than with the dynamic brake when the main circuit power supply or the control power supply is turned OFF before the servo is turned OFF, use a SERVOPACK with the Dynamic Brake Hardware 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).

Parameter		Servomotor Stopping Method	Status after Servomotor Stops	When Enabled	Classification
Pn001	n.□□□0 (default setting)	Dynamic brake	Dynamic brake	After restart	Setup
	n.□□□1		Coasting		
	n.□□□2	Coasting	Coasting		

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 manual to see which alarms are in group 1 and which are in group 2.

📖 Σ-7-Series Σ-7C SERVOPACK Troubleshooting Manual (Manual No.: SIEP S800002 07)

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 (Motor Stopping Method for Servo OFF and Group 1 Alarms). 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 5-36

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 the dynamic brake or coast the motor 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	Classification
Pn00B	Pn00A	Pn001				
n.□□0□ (default setting)	–	n.□□□0 (default setting)	Zero-speed stopping	Dynamic brake	After restart	Setup
		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 (default setting)	n.□□□0 (default setting)	Dynamic brake	Dynamic brake		
		n.□□□1		Coasting		
		n.□□□2	Coasting			
	n.□□□1	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).
☞ *Stopping the Servomotor by Setting Emergency Stop Torque* on page 5-30
4. Refer to the following section for details on Pn30A (Deceleration Time for Servo OFF and Forced Stops).
☞ *Stopping the Servomotor by Setting the Deceleration Time* on page 5-30

5.14 Motor Overload Detection Level

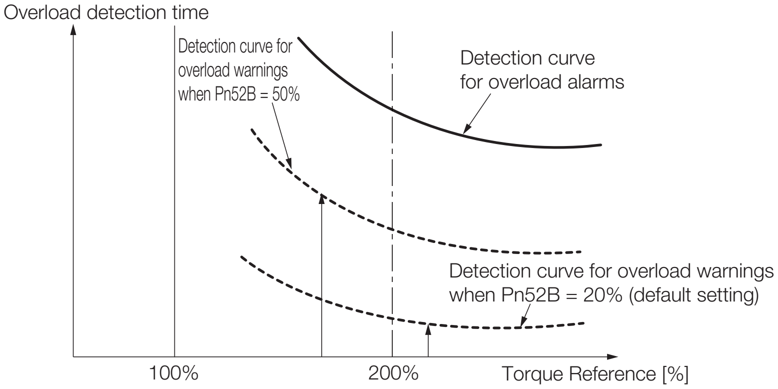
The motor overload detection level is the threshold used to detect overload alarms and overload warnings when the Servomotor is subjected to a continuous load that exceeds the Servomotor ratings.

It is designed to prevent Servomotor from 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 the overload warning level (Pn52B). You can increase safety by using overload warning detection as an overload protection function matched to the system.
The following graph shows an example of the detection of overload warnings when the overload warning level (Pn52B) is changed from 20% to 50%. An overload warning is detected in half of the time required to detect an overload alarm.



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

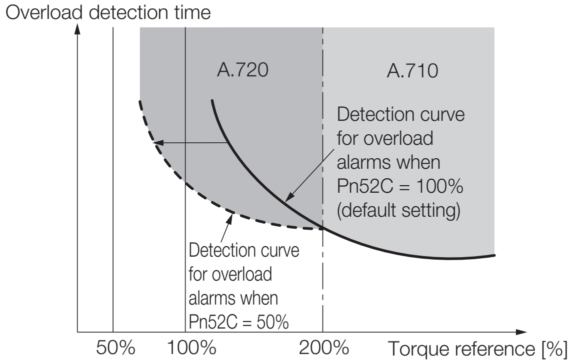
5.14.2 Detection Timing for Overload Alarms (A.720)

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 Position Torque	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 100	1%	100	After restart	Setup

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



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

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

📖 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)

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.

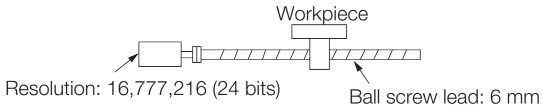
With the electronic gear, one reference unit is equal to the workpiece travel distance per reference pulse input to the SERVOPACK. In other words, if you use the SERVOPACK's electronic gear, pulses can be read as reference units.

Note: If you set an electronic gear in the Controller Section, 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:
①Calculate the number of revolutions. The Servomotor will move 6 mm for each revolution, so 10/6 revolutions are required to move 10 mm.
②Calculate the required number of reference pulses. One revolution is 16,777,216 pulses, therefore10/6 × 16,777,216 = 27,962,026.66 pulses.
③Input 27,962,027 pulses as the reference.

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

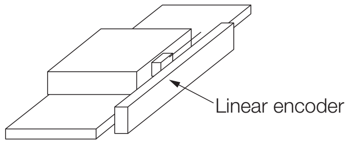
When the Electronic Gear Is Used

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

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

- Linear Servomotors

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



When the Electronic Gear Is Not Used

To move a load 10 mm:
10 × 1000 ÷ 20 × 256 = 128,000 pulses, so 128,000 pulses are input as the reference.

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

When the Electronic Gear Is Used

If we set the reference unit to 1 μm, the travel distance is 1 μm per pulse. To move the load 10 mm (10,000 μm), 10,000/1 = 10,000 pulses, so 10,000 pulses would be input as the reference.

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

5.15.1 Electronic Gear Ratio Settings

Make the electronic gear settings in the Controller Section. Refer to the following manual for details.

📖 Σ-7-Series Σ-7C SERVOPACK Motion Control User's Manual (Manual No.: SIEP S800002 03)

5.16 Resetting the Absolute Encoder

In a system that uses an absolute encoder, the multiturn data must be reset at startup. An alarm related to the absolute encoder (A.810 or A.820) will occur when the absolute encoder must be reset, such as when the power supply is turned ON. When you reset the absolute encoder, the multiturn data is reset and any alarms related to the absolute encoder are cleared.

Reset the absolute encoder in the following cases.

- When starting the system for the first time
- When an A.810 alarm (Encoder Backup Alarm) occurs
- When an A.820 alarm (Encoder Checksum Alarm) occurs
- When you want to reset the multiturn data in the absolute encoder
- When the Servomotor has been replaced

⚠ CAUTION

- **The multiturn data will be reset to a value between -2 and 2 rotations when the absolute encoder is reset. The reference position of the machine system will change. Adjust the reference position in the Controller Section to the position that results from resetting the absolute encoder.**
If the machine is started without adjusting the position in the Controller Section, unexpected operation may cause personal injury or damage to the machine.

Information The multiturn data will always be zero in the following cases. It is never necessary to reset the absolute encoder in these cases. An alarm related to the absolute encoder (A.810 or A.820) will not occur.

- When you use a single-turn absolute encoder
- When the encoder is set to be used as a single-turn absolute encoder (Pn002 = n.□2□□)

5.16.1 Precautions on Resetting

- You cannot use the alarm clear function of the SVD 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 supply 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 for both axis A and axis B.

5.16.3 Operating Procedure

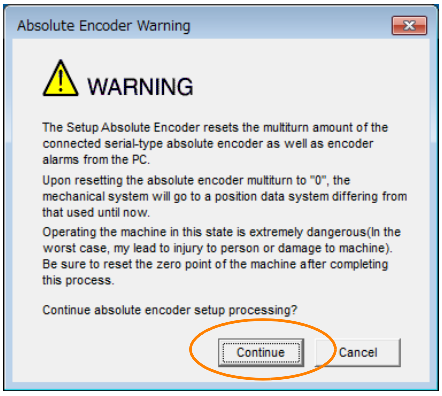
Use the following procedure to reset the absolute encoder.

1. Confirm that the servo is OFF.

2. Click the **Servo Drive** Button in the workspace of the Main Window of the SigmaWin+.

3. Select **Absolute Encoder Reset** in the Menu Dialog Box.
   The Absolute Encoder Warning Dialog Box will be displayed.

4. Click the **Continue** Button.



The Setup Absolute Encoder resets the multiturn amount of the connected serial-type absolute encoder as well as encoder alarms from the PC.

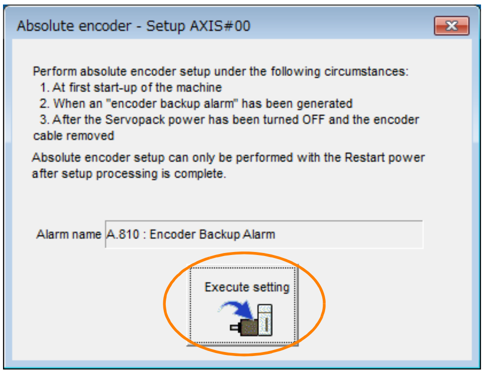
Upon resetting the absolute encoder multiturn to "0", the mechanical system will go to a position data system differing from that used until now.

Operating the machine in this state is extremely dangerous(In the worst case, my lead to injury to person or damage to machine). Be sure to reset the zero point of the machine after completing this process.

Continue absolute encoder setup processing?

Click the **Cancel** Button to cancel resetting the absolute encoder. The Main Window will return.

5. Click the **Execute setting** Button.



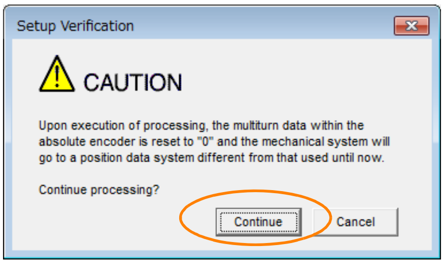
Perform absolute encoder setup under the following circumstances:
1. At first start-up of the machine
2. When an "encoder backup alarm" has been generated
3. After the Servopack power has been turned OFF and the encoder cable removed

Absolute encoder setup can only be performed with the Restart power after setup processing is complete.

Alarm name A.810 : Encoder Backup Alarm

The current alarm code and name will be displayed in the **Alarm name** Box.

6. Click the **Continue** Button.



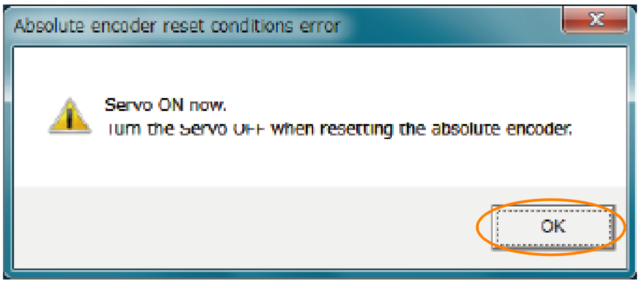
Upon execution of processing, the multiturn data within the absolute encoder is reset to "0" and the mechanical system will go to a position data system different from that used until now.

Continue processing?

Click the **Cancel** Button to cancel resetting the absolute encoder. The previous dialog box will return.

7. Click the **OK** Button.
   The absolute encoder will be reset.

   When Resetting Fails
   If you attempted to reset the absolute encoder when the servo was ON in the SERVOPACK, the following dialog box will be displayed and processing will be canceled.

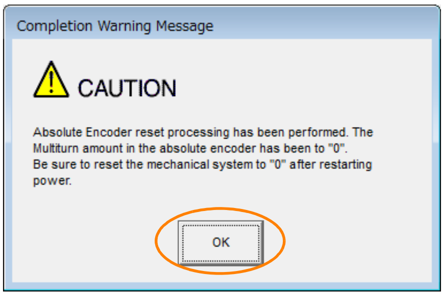


Absolute encoder reset conditions error

Servo ON now.
Turn the Servo OFF when resetting the absolute encoder.

   Click the **OK** Button. The Main Window will return. Turn OFF the servo and repeat the procedure from step 1.

   When Resetting Is Successful
   The following dialog box will be displayed when the absolute encoder has been reset.



Completion Warning Message

CAUTION

Absolute Encoder reset processing has been performed. The Multiturn amount in the absolute encoder has been to "0". Be sure to reset the mechanical system to "0" after restarting power.

   The Main Window will return.

8. To enable changes to the settings, turn the power supply 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

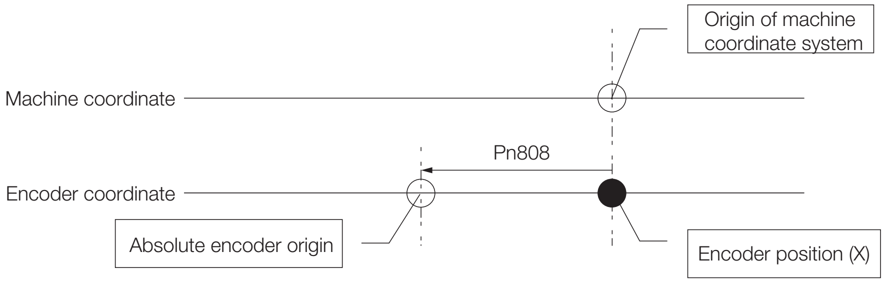
5.17.1 Absolute Encoder Origin Offset

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 turning the power supply OFF and ON again, 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 Position				
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	-1,073,741,823 to 1,073,741,823	1 reference unit	0	Immediately	Setup

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



5.17.2 Setting the Origin of the Absolute Linear Encoder

You can set any position as the origin in the following Linear Encoders.

- Mitutoyo Corporation
  ABS ST780A Series or ST1300 Series
  Models: ABS ST78□A/ST78□AL/ST13□□
- Renishaw PLC
  EVOLUTE Series
  Models: EL36Y-□□□□□□□□□
- Renishaw PLC
  RESOLUTE Series
  Models: RL36Y-□□□□□□□□□

Important

1. 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 supply OFF and ON again.
2. 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.

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.

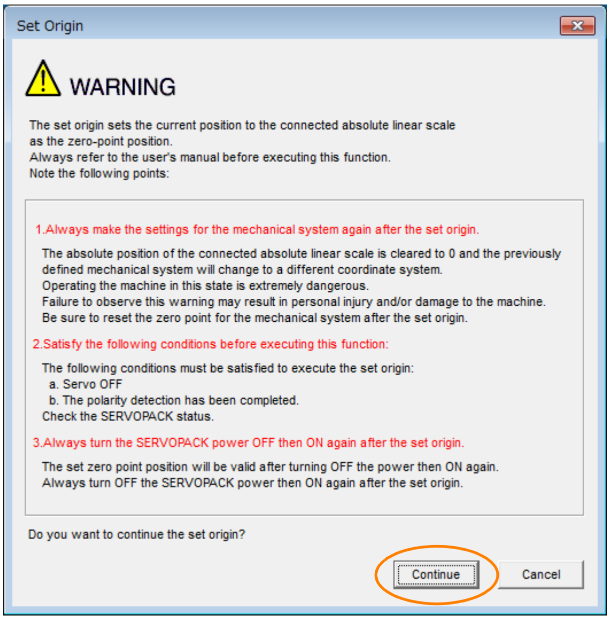
Operating Procedure

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

1. Click the **Servo Drive** Button in the workspace of the Main Window of the SigmaWin+.

2. Select **Set Origin** in the Menu Dialog Box.
   The Set Origin Dialog Box will be displayed.

3. Click the **Continue** Button.



Set Origin

WARNING

The set origin sets the current position to the connected absolute linear scale as the zero-point position.
Always refer to the user's manual before executing this function.
Note the following points:

1.Always make the settings for the mechanical system again after the set origin.

The absolute position of the connected absolute linear scale is cleared to 0 and the previously defined mechanical system will change to a different coordinate system.
Operating the machine in this state is extremely dangerous.
Failure to observe this warning may result in personal injury and/or damage to the machine.
Be sure to reset the zero point for the mechanical system after the set origin.

2.Satisfy the following conditions before executing this function:

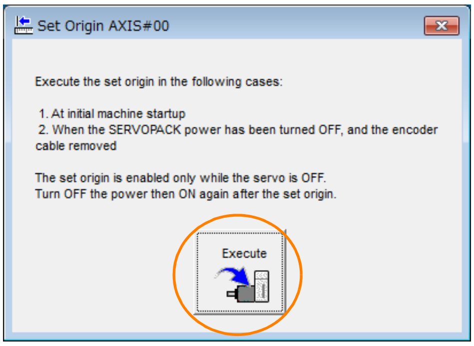
The following conditions must be satisfied to execute the set origin:
a. Servo OFF
b. The polarity detection has been completed.
Check the SERVOPACK status.

3.Always turn the SERVOPACK power OFF then ON again after the set origin.

The set zero point position will be valid after turning OFF the power then ON again.
Always turn OFF the SERVOPACK power then ON again after the set origin.

Do you want to continue the set origin?

4. Click the **Execute** Button.



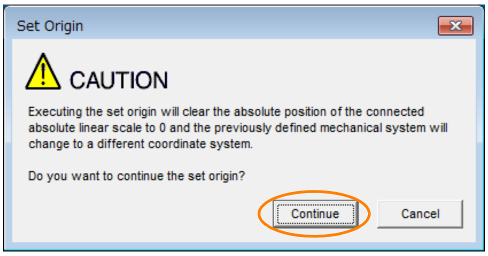
Set Origin AXIS#00

Execute the set origin in the following cases:

1. At initial machine startup
2. When the SERVOPACK power has been turned OFF, and the encoder cable removed

The set origin is enabled only while the servo is OFF.
Turn OFF the power then ON again after the set origin.

5. Click the **Continue** Button.



Set Origin

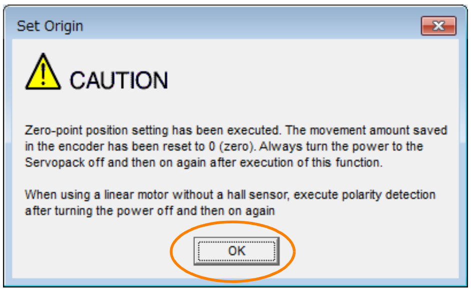
CAUTION

Executing the set origin will clear the absolute position of the connected absolute linear scale to 0 and the previously defined mechanical system will change to a different coordinate system.

Do you want to continue the set origin?

Click the **Cancel** Button to cancel setting the origin of the absolute linear encoder. The previous dialog box will return.

6. Click the **OK** Button.



Zero-point position setting has been executed. The movement amount saved in the encoder has been reset to 0 (zero). Always turn the power to the Servopack off and then on again after execution of this function.

When using a linear motor without a hall sensor, execute polarity detection after turning the power off and then on again

7. Turn the power supply to the SERVOPACK OFF and ON again.

8. If you use a Linear Servomotor that does not have a polarity sensor, perform polarity detection.

   Refer to the following section for details on the polarity detection.

   ☞ *5.10 Polarity Detection* on page 5-25

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-7-Series Peripheral Device Selection Manual (Manual No.: SIEP S800001 32)

⚠ WARNING

- **If you connect an External Regenerative Resistor, set Pn600 and Pn603 to suitable values.**
  If a suitable value is not set, A.320 alarms (Regenerative Overload) will not be detected correctly, and the External Regenerative Resistor may be damaged or personal injury or fire may result.
- **When you select an External Regenerative Resistor, make sure that it has a suitable capacity.**
  There is a risk of personal injury or fire.

Pn600 All Axes	Regenerative Resistor Capacity				Speed Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 2 times the SERVOPACK's maximum applicable motor capacity	10 W	0	Immediately	Setup

Pn603 All Axes	Regenerative Resistance				Speed Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 65,535	10 mΩ	0	Immediately	Setup

Set the regenerative resistor capacity to a value that is consistent with the allowable capacity of the External Regenerative Resistor. The setting depends on the cooling conditions of the External Regenerative Resistor.

- For self-cooling (natural convection cooling): Set the parameter to a maximum 20% of the capacity (W) of the actually installed regenerative resistor.
- For forced-air cooling: Set the parameter to a maximum 50% of the capacity (W) of the actually installed regenerative resistor.

Example For a self-cooling 100-W External Regenerative Resistor, set Pn600 to 2 (×10 W) (100 W × 20% = 20 W).

Note: 1. An A.320 alarm will be displayed if the setting is not suitable.
2. The default setting of 0 specifies that the SERVOPACK's built-in regenerative resistor or Yaskawa's Regenerative Resistor Unit is being used.

Important

1. When an External Regenerative Resistor is used at the normal rated load ratio, the resistor temperature increases to between 200°C and 300°C. Always apply derating. Consult the manufacturer for the resistor's load characteristics.
2. For safety, use an External Regenerative Resistor with a thermoswitch.

5.19 I/O Signal Allocations

Functions are allocated to the pins on the I/O signal connector (CN1) in advance. You can change the allocations and the polarity for some of the connector pins. Function allocations and polarity settings are made with parameters.

This section describes the I/O signal allocations.

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

Allocation Method	Description	Benefits
Σ-7S-Compatible I/O Signal Allocations	Predetermined combinations of I/O signals, pin numbers, and polarities are provided and you can specify the required combination with a parameter.	Compatibility with Σ-7S SERVOPACKs
Multi-Axis I/O Signal Allocations	You can specify the pin number to allocate for each I/O signal.	There are no restrictions in the combinations of I/O signals and pin numbers, allowing for flexible signal allocations.

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

Parameter		Description	When Enabled	Classification
Pn50A	n.□□□1 (default setting)	Σ-7S-compatible I/O signal allocations	After restart	Setup
	n.□□□2	Multi-axis I/O signal allocations		

5.19.1 Input Signal Allocations

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 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.

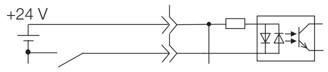
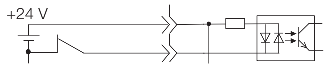
Σ-7S-Compatible Input Signal Allocations

The input signals that you can allocate to the pins on the I/O signal connector (CN1) and the related parameters are given in the following table.

Input Signal	Input Signal Name	Parameter
P-OT	Forward Drive Prohibit Input	Pn50A = n.X□□□
N-OT	Reverse Drive Prohibit Input	Pn50B = n.□□□X
/P-CL	Forward External Torque/Force Limit Input	Pn50B = n.□X□□
/N-CL	Reverse External Torque/Force Limit Input	Pn50B = n.X□□□
/DEC	Origin Return Deceleration Switch Input	Pn511 = n.□□□X
/EXT1	External Latch Input 1	Pn511 = n.□□X□
/EXT2	External Latch Input 2	Pn511 = n.□X□□
/EXT3	External Latch Input 3	Pn511 = n.X□□□
FSTP	Forced Stop Input	Pn516 = n.□□□X

◆ Relationship between Parameter Settings, Allocated Pins, and Polarities

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

Parameter Setting	Pin No.		Description
	Axis A	Axis B	
0	3	9	 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).
1	4	10	
2	5	11	
3	6	12	
4	7	13	
5	8	14	
6	–	–	Reserved setting (Do not use.)
7	–	–	The input signal is not allocated to a connector pin and it is always active. If the signal is processed on a signal edge, then it is always inactive.
8	–	–	The input signal is not allocated to a connector pin and it is always inactive. Set the parameter to 8 if the signal is not used.
9	3	9	 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).
A	4	10	
B	5	11	
C	6	12	
D	7	13	
E	8	14	
F	–	–	Reserved setting (Do not use.)

Note: 1. You cannot allocate the /EXT_A1 to /EXT_A3 and /EXT_B1 to /EXT_B3 (External Latch Inputs 1 to 3) signals to pins 6 to 8 and 12 to 14 on the I/O signal connector (CN1).

2. Refer to the following section for details on input signal parameter settings.
☞ *11.1.2 List of Servo Parameters* on page 11-3

◆ Example of Changing Input Signal Allocations

The following example shows reversing the P-OT (Forward Drive Prohibit Input) signal allocated to CN1-4 and CN1-10 and the /DEC (Origin Return Deceleration Switch Input) signal allocated to CN1-6 and CN1-12.

Pn50A = n.1□□1 Pn511 = n.□□□3 Before change

↓ ↓

Pn50A = n.3□□1 Pn511 = n.□□□1 After change

Refer to the following section for the parameter setting procedure.
☞ *5.1.3 Parameter Setting Methods* on page 5-7

Multi-Axis Input Signal Allocations

The input signals that you can allocate to the pins on the I/O signal connector (CN1) and the related parameters are given in the following table.

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

◆ Relationship between Parameter Settings, Allocated Pins, and Polarities

This section shows the relationship between the input signal parameter settings, the pins on the I/O signal connector (CN1), and the polarities using Pn592 (/DEC (Origin Return Deceleration Switch Input) Signal Allocation) as an example. Refer to the following section for information on individual input signals.

☞ *11.1.2 List of Servo Parameters* on page 11-3

- Relationship between Parameter Settings and Pin Numbers

Parameter		Description	When Enabled	Classification
Pn592	n.□003 (default setting for axis A)	Allocate the signal to CN1-3.	After restart	Setup
	n.□004	Allocate the signal to CN1-4.		
	n.□005	Allocate the signal to CN1-5.		
	n.□006	Allocate the signal to CN1-6.		
	n.□007	Allocate the signal to CN1-7.		
	n.□008	Allocate the signal to CN1-8.		
	n.□009 (default setting for axis B)	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.□014	Allocate the signal to CN1-14.		

- Relationship between Parameter Settings and Polarities

Parameter		Description	When Enabled	Classification
Pn592	n.0□□□ (default setting)	The signal is always inactive.	After restart	Setup
	n.1□□□	Active when input signal is ON (closed).		
	n.2□□□	Active when input signal is OFF (open).		
	n.3□□□	The signal is always enabled.		

Confirming the Allocation Status of Input Signals

You can confirm the allocation status of input signals with the I/O Signal Allocations Window of the SigmaWin+. Refer to the following section for details.

☞ *9.2.3 I/O Signals Status Monitor* on page 9-5

5.19.2 Output Signal Allocations

You can allocate the desired output signals to pins 23 to 32 on the I/O signal connector (CN1). The parameters that you use to allocate signals depend on whether you use Σ-7S-compatible I/O signal allocations (Pn50A = n.□□□1) or multi-axis I/O signal allocations (Pn50A = n.□□□2).

Σ-7S-Compatible Output Signal Allocations

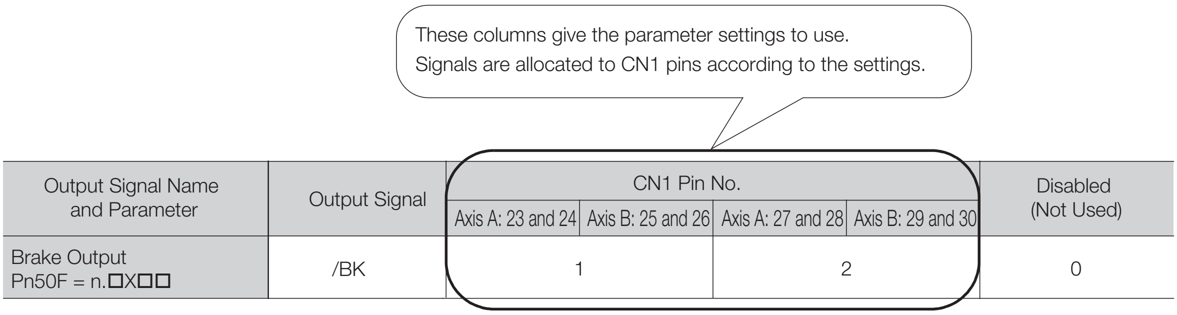
Important

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

Output signals are allocated as shown in the following table.

Refer to *Interpreting the Output Signal Allocation Tables* and change the allocations accordingly.

Interpreting the Output Signal Allocation Tables



These columns give the parameter settings to use.
Signals are allocated to CN1 pins according to the settings.

Output Signal Name and Parameter	Output Signal	CN1 Pin No.				Disabled (Not Used)
		Axis A: 23 and 24	Axis B: 25 and 26	Axis A: 27 and 28	Axis B: 29 and 30	
Brake Output Pn50F = n.□X□□	/BK	1		2		0

Output Signal Name and Parameter	Output Signal	CN1 Pin No.				Disabled (Not Used)
		Axis A: 23 and 24	Axis B: 25 and 26	Axis A: 27 and 28	Axis B: 29 and 30	
Positioning Completion Output Pn50E = n.□□□X	/COIN	1		2		0 (default setting)
Speed Coincidence Detection Output Pn50E = n.□□X□	/V-CMP	1		2		0 (default setting)
Rotation Detection Output Pn50E = n.□X□□	/TGON	1		2		0 (default setting)
Servo Ready Output Pn50E = n.X□□□	/S-RDY	1		2		0 (default setting)
Torque Limit Detection Output Pn50F = n.□□□X	/CLT	1		2		0 (default setting)
Speed Limit Detection Output Pn50F = n.□□X□	/VLT	1		2		0 (default setting)
Brake Output Pn50F = n.□X□□	/BK	1 (default setting)		2		0
Warning Output Pn50F = n.X□□□	/WARN	1		2		0 (default setting)
Near Output Pn510 = n.□□□X	NEAR	1		2		0 (default setting)
Preventative Maintenance Output Pn514 = n.□X□□	/PM	1		2		0 (default setting)
Pn512 = n.□□□1	Reverse polarity for CN1-23, CN1-24, CN1-25, and CN1-26					0 (default setting) (The polarity is not reversed in the default settings.)
Pn512 = n.□□1□	Reverse polarity for CN1-27, CN1-28, CN1-29, and CN1-30					

◆ Example of Changing Output Signal Allocations

The following example shows disabling the /COIN (Positioning Completion Output) signal allocated to CN1-27 and CN1-28 and allocating the /SRDY (Servo Ready Output) signal.

Pn50E = n.0□□2 Before change
↓
Pn50E = n.2□□0 After change

Refer to the following section for the parameter setting procedure.
☞ *5.1.3 Parameter Setting Methods* on page 5-7

Multi-Axis Output Signal Allocations

The output signals that you can allocate to the pins on the I/O signal connector (CN1) and the related parameters are given in the following table.

Output Signal	Output Signal Name	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

◆ Relationship between Parameter Settings, Allocated Pins, and Polarities

This section shows the relationship between the output signal parameter settings, the pins on the I/O signal connector (CN1), and the polarities using Pn5B0 (/COIN (Positioning Completion Output) Signal Allocation) as an example. Refer to the following section for information on individual output signals.

☞ *11.1.2 List of Servo Parameters* on page 11-3

- Relationship between Parameter Settings and Pin Numbers

Parameter		Description	When Enabled	Classification
Pn5B0	n.□000 (default setting)	Disabled (the signal output is not used).	After restart	Setup
	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.		

* If Pn5B0 is set to n.1□□□ (Output the signal) or n.2□□□ (Invert the signal and output it) and Pn5B0 is not set to any of these values, an A.040 alarm (Parameter Setting Error) will occur.

- Relationship between Parameter Settings and Polarities

Parameter		Description	When Enabled	Classification
Pn5B0	n.0□□□ (default setting)	Disabled (the signal output is not used).	After restart	Setup
	n.1□□□	Output the signal.		
	n.2□□□	Invert the signal and output it.		

Confirming the Allocation Status of Output Signals

You can confirm the allocation status of output signals with the I/O Signal Allocation Window of the SigmaWin+. Refer to the following section for details.

☞ *9.2.3 I/O Signals Status Monitor* on page 9-5

5.19.3 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	Axis A: CN1-19 and CN1-20 Axis B: CN1-21 and CN1-22	ON (closed)	Normal SERVOPACK status
			OFF (open)	SERVOPACK alarm

Alarm Reset Methods

Refer to the following manual for information on resetting alarms.

Σ-7-Series Σ-7C SERVOPACK Troubleshooting Manual (Manual No.: SIEP S800002 07)

5.19.4 /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) 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)
Multi-Axis I/O Signal Allocations	• Pn50A = n.□□□2 (Multi-Axis I/O Signal Allocations) • Pn5B7 (/WARN (Warning Output) Signal Allocation)

Refer to the following section for details.

5.19.2 Output Signal Allocations on page 5-53

5.19.5 /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	Servomotors	Meaning
Output	/TGON	Must be allocated.	ON (closed)	Rotary Servomotors	The Servomotor is operating at the setting of Pn502 or faster.
				Linear Servomotors	The Servomotor is operating at the setting of Pn581 or faster.
			OFF (open)	Rotary Servomotors	The Servomotor is operating at a speed that is slower than the setting of Pn502.
				Linear Servomotors	The Servomotor is operating at a speed that is slower than the setting of Pn581.

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

Allocation Method	Parameters 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)
Multi-Axis I/O Signal Allocations	• Pn50A = n.□□□2 (Multi-Axis I/O Signal Allocations) • Pn5B2 (/TGON (Rotation Detection Output) Signal Allocation)

Refer to the following section for details.

☞ *5.19.2 Output Signal Allocations* on page 5-53

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 Position Torque		
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 10,000	1 min^{-1}	20	Immediately	Setup

- Linear Servomotors

Pn581	Zero Speed Level		Speed Position Force		
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 10,000	1 mm/s	20	Immediately	Setup

5.19.6 /S-RDY (Servo Ready Output) Signal

The /S-RDY (Servo Ready) signal turns ON when the servo can be turned ON in the SVD.

The /S-RDY signal is turned ON under the following conditions.

- Main circuit power supply is ON.
- There are no alarms.
- If a Servomotor without a polarity sensor is used, polarity detection has been completed.*
- If an absolute encoder is used, the output of the position data from the absolute encoder to the Controller Section must have been completed.

* Do not include this condition if the servo is being turned ON in the SVD for the first time after the control power supply was turned ON. In that case, when the servo is turned ON in the SVD, 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 for the SVD to turn ON the servo.
			OFF (open)	Not ready for the SVD to turn ON the servo.

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

Allocation Method	Parameters 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 Allocation)
Multi-Axis I/O Signal Allocations	• Pn50A = n.□□□2 (Multi-Axis I/O Signal Allocations) • Pn5B3 (/S-RDY (Servo Ready Output) Signal Allocation)

Refer to the following section for details.

☞ *5.19.2 Output Signal Allocations* on page 5-53

5.19.7 /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 Servo Section and the Controller Section. 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	Parameters 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)
Multi-Axis I/O Signal Allocations	• Pn50A = n.□□□2 (Multi-Axis I/O Signal Allocations) • Pn5B1 (/V-CMP (Speed Coincidence Detection Output) Signal Allocation)

Refer to the following section for details.

☞ *5.19.2 Output Signal Allocations* on page 5-53

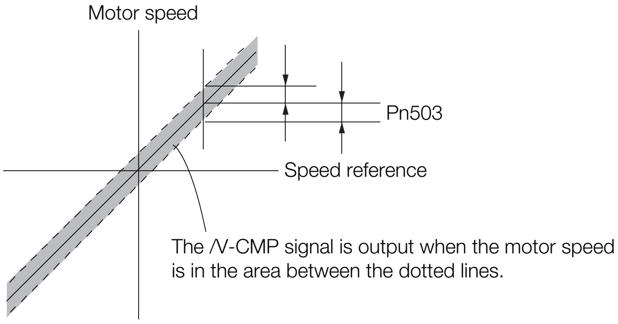
You can set the speed detection width for the /V-CMP signal in Pn503 (Speed Coincidence Detection Signal Output Width) for a Rotary Servomotor or in Pn582 (Speed Coincidence Detection Signal Output Width) for a Linear Servomotor.

- Rotary Servomotors

Pn503	Speed Coincidence Detection Signal Output Width			Speed	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 100	1 min^{-1}	10	Immediately	Setup

The signal is output when the difference between the reference speed and motor speed is equal or less than the setting.

Example If Pn503 is set to 100 and the speed reference is 2,000 min^{-1}, the signal would be output when the motor speed is between 1,900 min^{-1} and 2,100 min^{-1}.

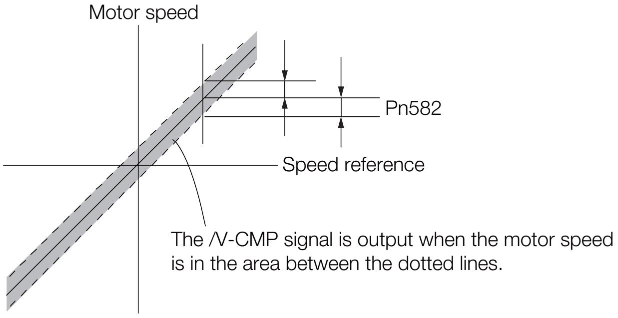


- Linear Servomotors

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

The signal is output when the difference between the reference speed and motor speed is equal or less than the setting.

Example If Pn582 is set to 100 and the speed reference is 2,000 mm/s the signal would be output when the motor speed is between 1,900 min^{-1} and 2,100 mm/s.



5.19.8 /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 SVD and the current position of the Servomotor (i.e., the position deviation as given by the value of the deviation counter) is equal to or less than the setting of the positioning completion width (Pn522).

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	Parameters 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)
Multi-Axis I/O Signal Allocations	• Pn50A = n.□□□2 (Multi-Axis I/O Signal Allocations) • Pn5B0 (/COIN (Positioning Completion Output) Signal Allocation)

Refer to the following section for details.

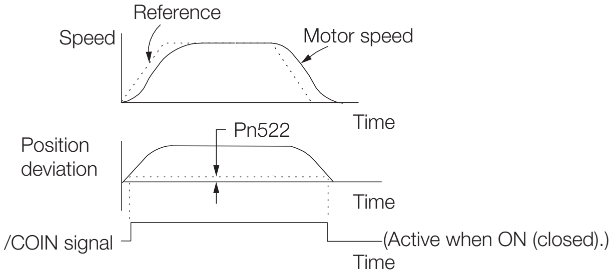
☞ *5.19.2 Output Signal Allocations* on page 5-53

Setting the Positioning Completion Width

The /COIN signal is output when the difference between the reference position and the current position (i.e., the position deviation as given by the value of the deviation counter) is equal to or less than the setting of the positioning completion width (Pn522).

Pn522	Positioning Completed Width			Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 1,073,741,824	1 reference unit	7	Immediately	Setup

The setting of the positioning completion width has no effect on final positioning accuracy.



Note: If the parameter is set to a value that is too large, the /COIN signal may be output when the position deviation is low during a low-speed operation. If that occurs, reduce the setting until the signal is no longer output.

Setting the Output Timing of the /COIN (Positioning Completion Output) Signal

You can add a reference input condition to the output conditions for the /COIN signal to change the signal output timing.

If the position deviation is always low and a narrow positioning completion 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.

Parameter		Description	When Enabled	Classification
Pn207	n. 0☐☐☐ (default setting)	Output the /COIN signal when the absolute value of the position deviation is the same or less than the setting of Pn522 (Positioning Completed Width).	After restart	Setup
	n. 1☐☐☐	Output the /COIN signal when the absolute value of the position deviation is the same or less than the setting of Pn522 (Positioning Completed Width).		
	n. 2☐☐☐	Output the /COIN signal when the absolute value of the position deviation is the same or less than the setting of Pn522 (Positioning Completed Width) and the reference input is 0.		

5.19.9 /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.

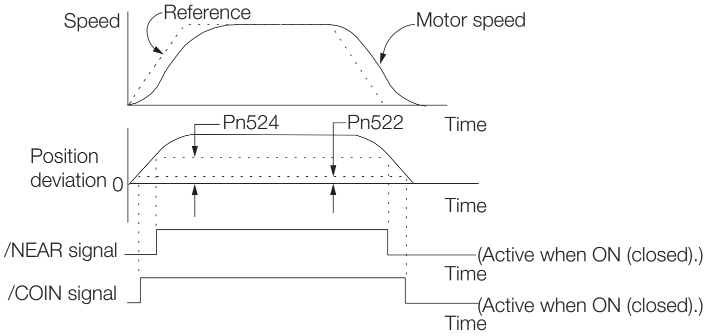
Allocation Method	Parameters to Use
Σ-7S-Compatible I/O Signal Allocations	• Pn50A = n.☐☐☐1 (Σ-7S-Compatible I/O Signal Allocations) • Pn510 = n.☐☐☐X (/NEAR (Near Output) Signal Allocation)
Multi-Axis I/O Signal Allocations	• Pn50A = n.☐☐☐2 (Multi-Axis I/O Signal Allocations) • Pn5B8 (/NEAR (Near Output) Signal Allocation)

Refer to the following section for details.
5.19.2 Output Signal Allocations on page 5-53

/NEAR (Near Output) Signal Setting

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 the near signal width (Pn524).

Pn524	Near Signal Width			Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 1,073,741,824	1 reference unit	1073741824	Immediately	Setup



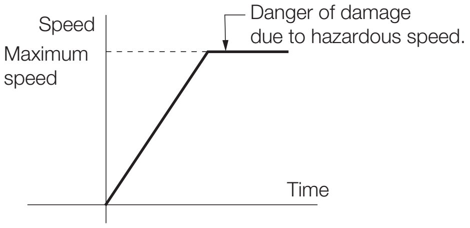
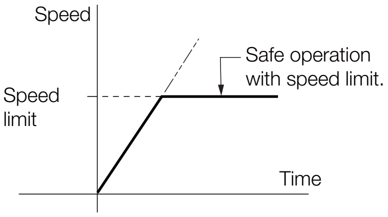
Note: Normally, set Pn524 to a value that is larger than the setting of Pn522 (Positioning Completed Width).

5.19.10 Speed Limit during Torque Control

You can limit the speed of the Servomotor to protect the machine.

When you use a Servomotor for torque control, the Servomotor is controlled to output the specified torque, but the motor speed is not controlled. Therefore, if a reference torque is input that is larger than the machine torque, the speed of the Servomotor may increase greatly. If that may occur, use this function to limit the speed.

Note: The actual limit of Servomotor speed depends on the load conditions on the Servomotor.

With No Speed Limit	With a Speed Limit
	

/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	Parameters 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) Signal Allocation)
Multi-Axis I/O Signal Allocations	• Pn50A = n.□□□2 (Multi-Axis I/O Signal Allocations) • Pn5B5 (/VLT (Speed Limit Detection) Signal Allocation)

Refer to the following section for details.

☞ *5.19.2 Output Signal Allocations* on page 5-53

Selecting the Speed Limit

The smaller of the external speed limit and internal speed limit will be used.

◆ 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. Select the overspeed alarm detection speed to limit the speed to the equivalent of the maximum motor speed.

Parameter		Meaning	When Enabled	Classification
Pn408	n.□□0□ (default setting)	Use the smaller of the maximum motor speed and the setting of Pn407 or Pn480 as the speed limit.	After restart	Setup
	n.□□1□	Use the smaller of the overspeed alarm detection speed and the setting of Pn407 or 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				Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 min^{-1}	10000	Immediately	Setup

- Linear Servomotors

Pn480	Speed Limit during Force Control				Force
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 mm/s	10000	Immediately	Setup

Note: If the parameter setting exceeds the maximum speed of the Servomotor, the Servomotor's maximum speed or the overspeed alarm detection speed will be used.

◆ External Speed Limiting

The motor speed will be limited by OW□□□0E (Speed Limit for Torque/Force Reference). Refer to the following manual for details.

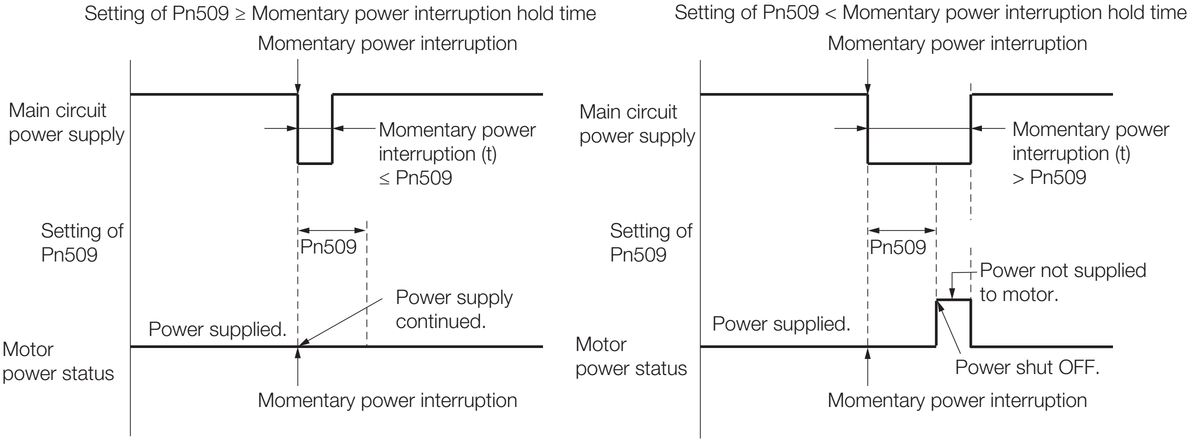
📖 **Σ-7-Series Σ-7C SERVOPACK Motion Control User's Manual (Manual No.: SIEP S800002 03)**

5.20 Operation for Momentary Power Interruptions

Even if the main power supply to the SERVOPACK is interrupted momentarily, power supply to the motor (servo ON status) will be maintained for the time set in Pn509 (Momentary Power Interruption Hold Time).

Pn509 All Axes	Momentary Power Interruption Hold Time			Speed Position Torque	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	20 to 50,000	1 ms	20	Immediately	Setup

If the momentary power interruption time is equal to or less than the setting of Pn509, power supply to the motor will be continued. If it is longer than the setting, power supply to the motor will be stopped. Power will be supplied to the motor again when the main circuit power supply recovers.



Information

1. If the momentary power interruption time exceeds the setting of Pn509, the /S-RDY (Servo Ready Output) signal will turn OFF.
2. If uninterruptible power supplies are used for the control power supply and main circuit power supply, the SERVOPACK can withstand a power interruption that lasts longer than 50,000 ms.
3. The holding time of the SERVOPACK control power supply is approximately 100 ms. If control operations become impossible during a momentary power interruption of the control power supply, the setting of Pn509 will be ignored and the same operation will be performed as for when the power supply is turned OFF normally.

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.

5.21 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 allowable momentary power interruption hold time (Pn509) to allow the Servomotor to continue operating without stopping for an alarm or without recovery work even if the power supply voltage drops.

Execution Sequence

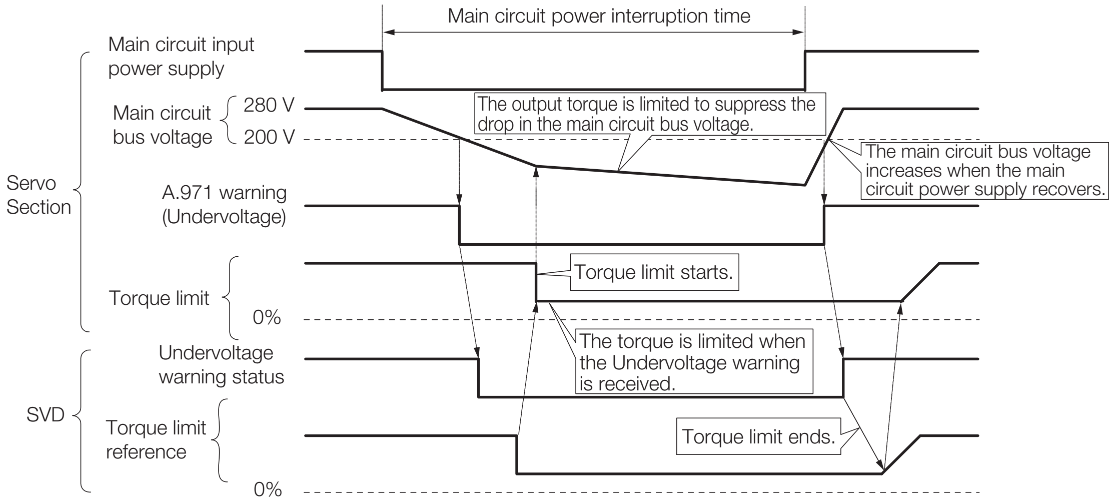
This function can be executed either with an instruction from the SVD or with the Servo Section. Use Pn008 = n.□□X□ (Function Selection for Undervoltage) to specify whether the function is executed by the SVD or by the Servo Section.

The default setting (Pn008 = n.□□0□) disables detection of an A.971 warning (Undervoltage).

Parameter		Meaning	When Enabled	Classification
Pn008	n.□□0□ (default setting)	Do not detect undervoltage.	After restart	Setup
	n.□□1□	Detect undervoltage warning and limit torque in the SVD.		
	n.□□2□	Detect undervoltage warning and limit torque with Pn424 and Pn425 (i.e., only in the Servo Section).		

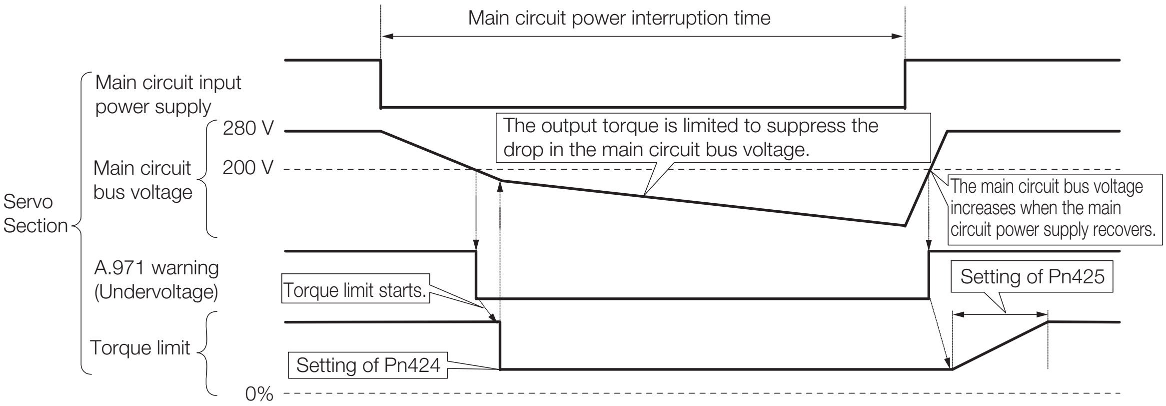
◆ Execution with the SVD (Pn008 = n.□□1□)

The SVD limits the torque in response to an A.971 warning (Undervoltage).
The SVD removes the torque limit after the Undervoltage warning is cleared.



◆ Execution with the Servo Section (Pn008 = n.□□2□)

The torque is limited in the Servo Section in response to an Undervoltage warning.
The Servo Section controls the torque limit for the set time after the Undervoltage warning is cleared.



◆ Related Parameters

The following parameters are related to the SEMI F47 function.

Pn424	Torque Limit at Main Circuit Voltage Drop			Speed Position Torque	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 100	1%*	50	Immediately	Setup
Pn425	Release Time for Torque Limit at Main Circuit Voltage Drop			Speed Position Torque	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 1,000	1 ms	100	Immediately	Setup
Pn509 All Axes	Momentary Power Interruption Hold Time			Speed Position Torque	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	20 to 50,000	1 ms	20	Immediately	Setup

* Set a percentage of the motor rated torque.

Note: If you will use the SEMI F47 function, set the time to 1,000 ms.

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 SVD or Servo Section 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 allowable momentary power interruption time to increase the amount of time from when the power supply is turned OFF until power supply to the motor is stopped. To stop the power supply to the motor immediately, turn OFF the servo from the SVD.

5.22 Setting the Motor Maximum Speed

You can set the maximum speed of the Servomotor with the following parameter.

- Rotary Servomotors

Pn316	Maximum Motor Speed			Speed Position	Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 65,535	1 min^{-1}	10000	After restart	Setup

- Linear Servomotors

Pn385	Maximum Motor Speed			Speed Position	Force
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 100	100 mm/s	50	After restart	Setup

You can achieve the following by lowering the maximum speed of the Servomotor.

- If the Servomotor speed exceeds the setting, an A.510 alarm (Overspeed) will occur.

Changing the setting of the parameter is effective in the following cases.

- To protect the machine by stopping machine operation with an alarm when the set speed is reached or exceeded
- To limit the speed so that the load is not driven beyond the allowable moment of inertia Refer to relevant manual from the following list for the relationship between the speed and the allowable moment of inertia.

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

5.23 Selecting the 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	5.23.1
External Torque Limits	The torque is limited with an input signal from the host computer.		5.23.2
Limiting Torque with the Torque/Force Limit Settings (OL□□□14)*	The TLIM data in a command is used to set the required torque limits.	Speed control or position control	–
Limiting Torque with Forward External Torque Limit (OW□□09 Bit 8) and Reverse External Torque Limit (OW□□09 Bit 9)*	The P_CL and N_CL signals in the servo command output signals (SVCMD_IO) are used to set the required limits.	Speed control or position control	–

* Refer to the following manual for details.

📖 Σ-7-Series Σ-7C SERVOPACK Motion Control User's Manual (Manual No.: SIEP S800002 03)

Note: If you set a value that exceeds the maximum torque of the Servomotor, the torque will be limited to the maximum torque of the Servomotor.

5.23.1 Internal Torque Limits

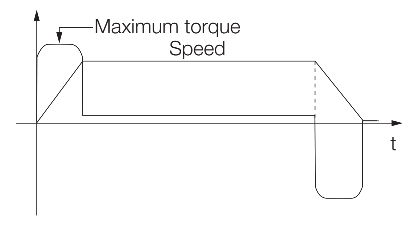
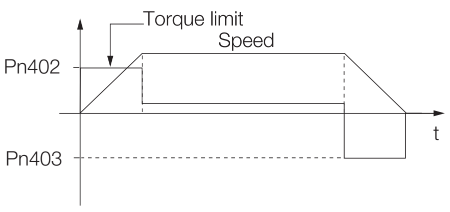
If you use internal torque limits, the maximum output torque will always be limited to the specified forward torque limit (Pn402) and reverse torque limit (Pn403).

- Rotary Servomotors

Pn402	Forward Torque Limit			Speed Position Torque	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 800	1%*	800	Immediately	Setup
Pn403	Reverse Torque Limit			Speed Position Torque	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 800	1%*	800	Immediately	Setup

* Set a percentage of the motor rated torque.

Note: If the setting of Pn402 or Pn403 is too low, the torque may be insufficient for acceleration or deceleration of the Servomotor.

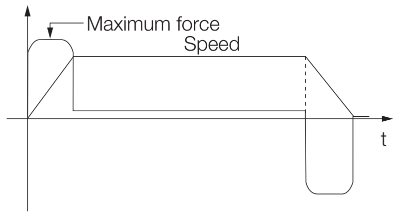
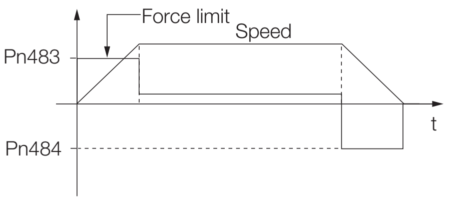
Without Internal Torque Limits (Output to the maximum torque is possible.)	With Internal Torque Limits
	

- Linear Servomotors

Pn483	Forward Force Limit			Speed Position	Force
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 800	1%*	30	Immediately	Setup
Pn484	Reverse Force Limit			Speed Position	Force
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 800	1%*	30	Immediately	Setup

* Set a percentage of the rated motor force.

Note: If the setting of Pn483 or Pn484 is too low, the force may be insufficient for acceleration or deceleration of the Servomotor.

Without Internal Force Limits (Output to the maximum force is possible.)	With Internal Force Limits
	

5.23.2 External Torque Limits

You can limit the torque only when required by the operating conditions of the machine by turning a signal ON and OFF.

You can use this for applications such as stopping on physical contact, or holding a workpiece with a robot.

External Torque Limit Reference Signals

The /P-CL (Forward External Torque/Force Limit Input) and /N-CL (Reverse External Torque/Force Limit Input) signals are used as the external torque limit reference signals. The /P-CL signal is used for the forward torque/force limit and the /N-CL signal is used for the reverse torque/force 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].
Input	/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[*2] and Pn404.
			OFF (open)	Cancels the reverse external torque limit. The torque is limited to the setting of Pn403[*2].

*1. Pn483 is used for a Linear Servomotor.

*2. Pn484 is used for a Linear Servomotor.

Note: You must allocate the /P-CL and /N-CL signals to use them. The parameters that you use depend on the allocation method.

Allocation Method	Parameters 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)
Multi-Axis I/O Signal Allocations	• Pn50A = n.□□□2 (Multi-Axis I/O Signal Allocations) • Pn598 (/P-CL (Forward External Torque Limit Input) Signal Allocation) • Pn599 (/N-CL (Reverse External Torque Limit Input) Signal Allocation)

Refer to the following section for details on allocations.
☞ *5.19.1 Input Signal Allocations* on page 5-50

Torque Limit Settings

The parameters that are related to setting the torque limits are given below.

- Rotary Servomotors
  If the setting of Pn402 (Forward Torque Limit), Pn403 (Reverse Torque Limit), Pn404 (Forward External Torque Limit), or Pn405 (Reverse External Torque Limit) is too low, the torque may be insufficient for acceleration or deceleration of the Servomotor.

Pn402	Forward Torque Limit			Speed Position	Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 800	1%*	800	Immediately	Setup
Pn403	Reverse Torque Limit			Speed Position	Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 800	1%*	800	Immediately	Setup
Pn404	Forward External Torque Limit			Speed Position	Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 800	1%*	100	Immediately	Setup
Pn405	Reverse External Torque Limit			Speed Position	Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 800	1%*	100	Immediately	Setup

* Set a percentage of the motor rated torque.

- Linear Servomotors
  If the setting of Pn483 (Forward Force Limit), Pn484 (Reverse Force Limit), Pn404 (Forward External Force Limit), or Pn405 (Reverse External Force Limit) is too low, the force may be insufficient for acceleration or deceleration of the Servomotor.

Pn483	Forward Force Limit			Speed Position	Force
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 800	1%*	30	Immediately	Setup
Pn484	Reverse Force Limit			Speed Position	Force
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 800	1%*	30	Immediately	Setup
Pn404	Forward External Force Limit			Speed Position	Force
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 800	1%*	100	Immediately	Setup
Pn405	Reverse External Force Limit			Speed Position	Force
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 800	1%*	100	Immediately	Setup

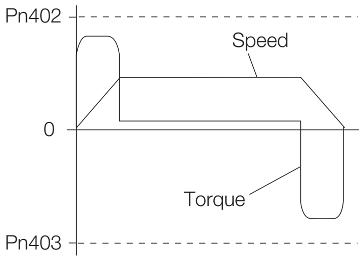
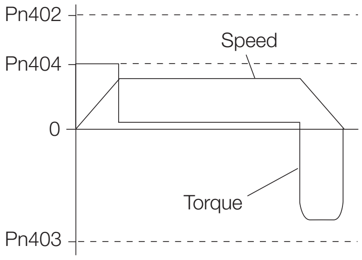
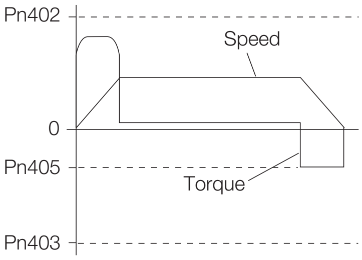
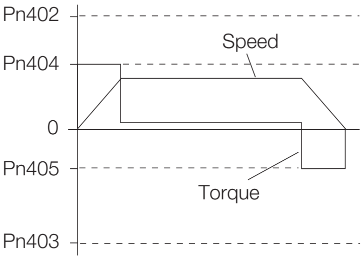
* Set a percentage of the rated motor force.

Changes in the Output Torque for External Torque Limits

The following table shows the changes in the output torque when the internal torque limit is set to 800%.

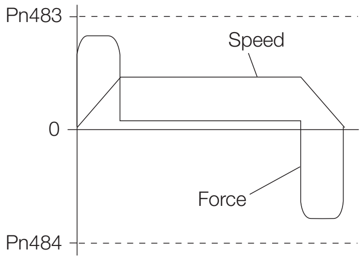
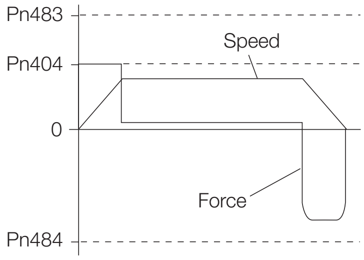
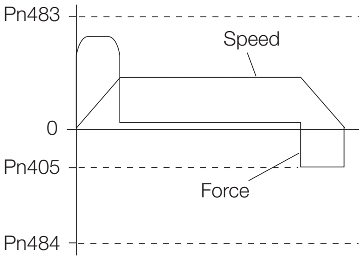
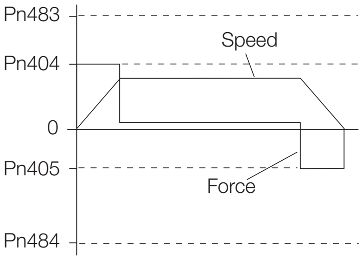
- Rotary Servomotors

In this example, the Servomotor direction is set to Pn000 = n.□□□0 (Use CCW as the forward direction).

		/P-CL signal	
		OFF	ON
/N-CL signal	OFF		
	ON		

- 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).

		/P-CL signal	
		OFF	ON
/N-CL signal	OFF		
	ON		

5.23.3 /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	Parameters to Use
Σ-7S-Compatible I/O Signal Allocations	• Pn50A = n.□□□1 (Σ-7S-Compatible I/O Signal Allocations) • Pn50F = n.□□□X (/CLT (Torque Limit Detection Output) Signal Allocation)
Multi-Axis I/O Signal Allocations	• Pn50A = n.□□□2 (Multi-Axis I/O Signal Allocations) • Pn5B4 (/CLT (Torque Limit Detection Output) Signal Allocation)

Refer to the following section for details.

☞ *5.19.2 Output Signal Allocations* on page 5-53

5.24 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 Controller Section can monitor the current position. Therefore, it is not necessary to perform an origin return operation when the power supply to the system is turned ON.

There are three types of encoders for Rotary Servomotors. The usage of the encoder is specified in Pn002 = n.□X□□.

Refer to the following manual for encoder models.

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

- Parameter Settings When Using an Incremental Encoder

Parameter		Meaning	When Enabled	Classification
Pn002	n.□0□□ (default setting)	Use the encoder as an incremental encoder. A battery is not required.	After restart	Setup
	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	Classification
Pn002	n.□0□□ (default setting)	Use the encoder as a single-turn absolute encoder. A battery is not required.	After restart	Setup
	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	Classification
Pn002	n.□0□□ (default setting)	Use the encoder as a multiturn absolute encoder. A battery is required.	After restart	Setup
	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.

5.24.1 Connecting an Absolute Encoder

You can get the position data from the absolute encoder with MECHATROLINK communications.

Refer to the following section for information on connecting absolute encoders.

☞ *3.4.3 Wiring the SERVOPACK to the Encoder* on page 3-14

5.24.2 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 multi-turn 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 (encoder resolution) + Position (number of pulses) within one rotation.

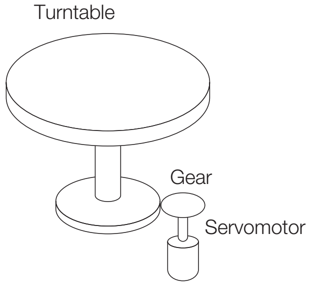
For a single-turn absolute encoder, the multiturn data is 0.

5.24.3 Reading the Position Data from the Absolute Encoder

To read the position data from the absolute encoder, turn the power supply OFF and ON again.

5.24.4 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.



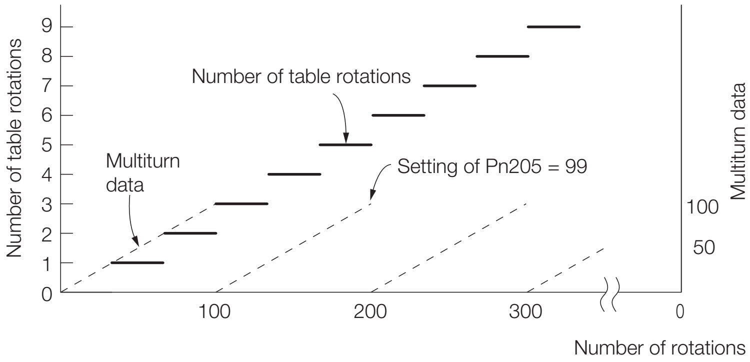
Because the turntable moves in only one direction, the upper limit to the number of rotations that can be counted by an absolute encoder will eventually be exceeded.
The multiturn limit is used in cases like this to prevent fractions from being produced by the integer ratio of the number of Servomotor rotations and the number of turntable rotations.

For a machine with a ratio of n:m between the number of Servomotor rotations and the number of turntable rotations, as shown above, the value of m minus 1 will be the setting for the multi-turn limit setting (Pn205).

Multiturn limit (Pn205) = m – 1

If m = 100 and n = 3 (i.e., the turntable rotates three times for each 100 Servomotor rotations), the relationship between the number of Servomotor rotations and the number of turntable rotations would be as shown below.

Set Pn205 to 99.
Pn205 = 100 – 1 = 99



Pn205	Multiturn Limit			Speed Position Torque	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 65,535	1 rev	65535	After restart	Setup

Note: This parameter is enabled when you use an absolute encoder.

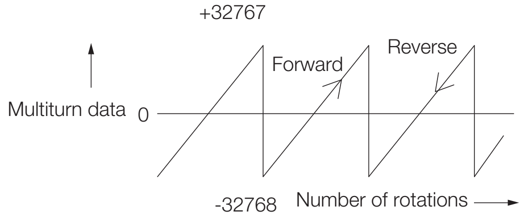
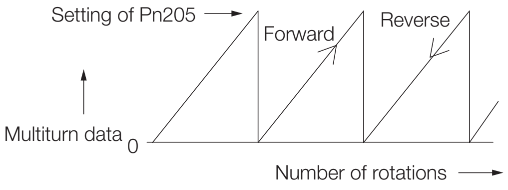
The data will change as shown below when this parameter is set to anything other than the default setting.

- If the Servomotor operates in the reverse direction when the multiturn data is 0, the multiturn data will change to the value set in Pn205.
- If the 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 multiturn limit in 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.

☞ *5.24.5 Multiturn Limit Disagreement Alarm (A.CC0)* on page 5-76

Default Setting	Not Default Setting
	

Information The multiturn data will always be 0 in the following cases. It is not necessary to reset the absolute encoder in these cases.
- When you use a single-turn absolute encoder
- When the encoder is set to be used as a single-turn absolute encoder (Pn002 = n.□2□□)

Absolute encoder-related alarms (A.810 and A.820) will not occur.

5.24.5 Multiturn Limit Disagreement Alarm (A.CC0)

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.

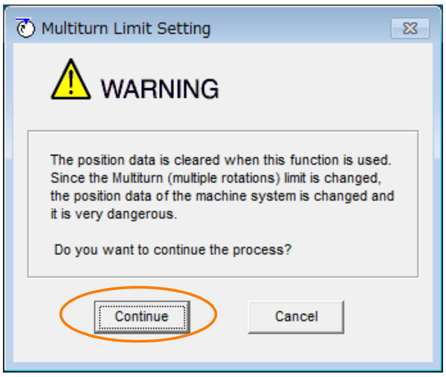
Operating Procedure

Use the following procedure to adjust the multiturn limit setting.

1. Click the **Servo Drive** Button in the workspace of the Main Window of the SigmaWin+.

2. Select **Multiturn Limit Setting** in the Menu Dialog Box.
   The Multiturn Limit Setting Dialog Box will be displayed.

3. Click the **Continue** Button.

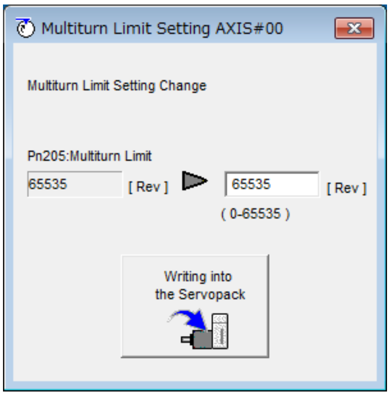


The position data is cleared when this function is used.
Since the Multiturn (multiple rotations) limit is changed,
the position data of the machine system is changed and
it is very dangerous.

Do you want to continue the process?

Click the **Cancel** Button to cancel setting the multiturn limit.
The Main Window will return.

4. Change the setting.

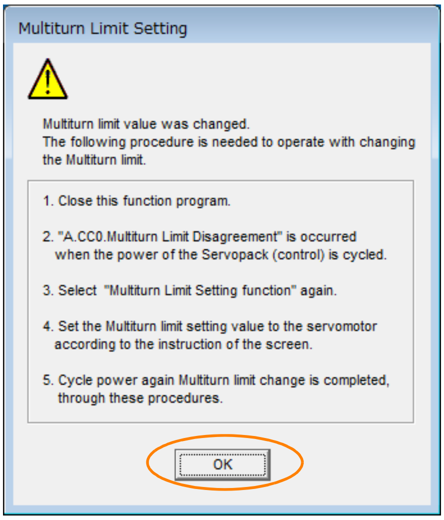


Multiturn Limit Setting Change

Pn205:Multiturn Limit
65535 [Rev] 65535 [Rev]
(0-65535)

5. Click the **Writing into the Servopack** Button.

6. Click the **OK** Button.



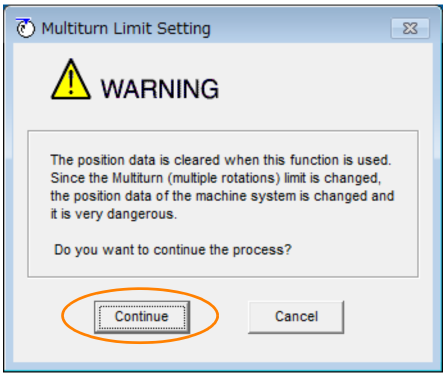
Multiturn limit value was changed.
The following procedure is needed to operate with changing
the Multiturn limit.

1. Close this function program.
2. "A.CC0.Multiturn Limit Disagreement" is occurred
   when the power of the Servopack (control) is cycled.
3. Select "Multiturn Limit Setting function" again.
4. Set the Multiturn limit setting value to the servomotor
   according to the instruction of the screen.
5. Cycle power again Multiturn limit change is completed,
   through these procedures.

7. Turn the power supply 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. Select **Multiturn Limit Setting** in the Menu Dialog Box.

9. Click the **Continue** Button.



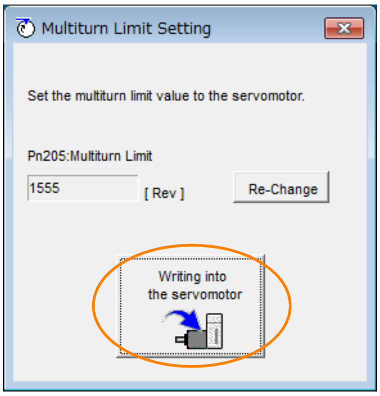
Multiturn Limit Setting

WARNING

The position data is cleared when this function is used.
Since the Multiturn (multiple rotations) limit is changed,
the position data of the machine system is changed and
it is very dangerous.

Do you want to continue the process?

10. Click the **Writing into the Servomotor** Button.



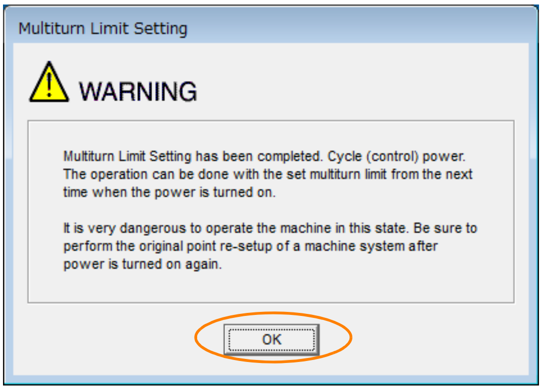
Multiturn Limit Setting

Set the multiturn limit value to the servomotor.

Pn205:Multiturn Limit
1555 [Rev]

Click the **Re-Change** Button to change the setting.

11. Click the **OK** Button.



Multiturn Limit Setting

WARNING

Multiturn Limit Setting has been completed. Cycle (control) power.
The operation can be done with the set multiturn limit from the next
time when the power is turned on.

It is very dangerous to operate the machine in this state. Be sure to
perform the original point re-setup of a machine system after
power is turned on again.

This concludes the procedure to set the multiturn limit.

5.25 Absolute Linear Encoders

The absolute linear encoder records the current position of the stop position even when the power supply is OFF.

With a system that uses an absolute linear encoder, the Controller Section can monitor the current position. Therefore, it is not necessary to perform an origin return operation when the power supply to the system is turned ON.

There are three types of linear encoders for Linear Servomotors. The usage of the linear encoder is specified in Pn002 = n.□X□□.

Refer to the following manual for linear encoder models.

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

- Parameter Settings When Using an Incremental Linear Encoder

Parameter		Meaning	When Enabled	Classification
Pn002	n.□0□□ (default setting)	Use the encoder as an incremental linear encoder.	After restart	Setup
	n.□1□□	Use the encoder as an incremental linear encoder.		

- Parameter Settings When Using an Absolute Linear Encoder

Parameter		Meaning	When Enabled	Classification
Pn002	n.□0□□ (default setting)	Use the encoder as an absolute linear encoder.	After restart	Setup
	n.□1□□	Use the encoder as an incremental linear encoder.		

5.25.1 Connecting an Absolute Linear Encoder

You can get the position data from the absolute linear encoder with MECHATROLINK communications.

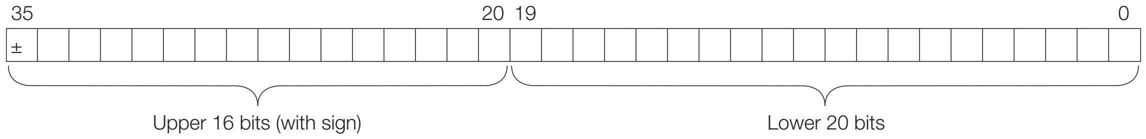
Refer to the following section for information on connecting absolute linear encoders.

☞ *3.4.3 Wiring the SERVOPACK to the Encoder* on page 3-14

5.25.2 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.

5.25.3 Reading the Position Data from the Absolute Linear Encoder

To read the position data from the absolute linear encoder, turn the power supply OFF and ON again.

5.26 Initializing the Vibration Detection Level

You can detect machine vibration during operation to automatically adjust the settings of Pn312 or Pn384 (Vibration Detection Level) to detect A.520 alarms (Vibration Alarm) and A.911 warnings (Vibration Warning) more precisely.

This function detects specific vibration components in the Servomotor speed.

Parameter		Meaning	When Enabled	Classification
Pn310	n.□□□0 (default setting)	Do not detect vibration.	Immediately	Setup
	n.□□□1	Output a warning (A.911) if vibration is detected.		
	n.□□□2	Output an alarm (A.520) if vibration is detected.		

If the vibration exceeds the detection level calculated with the following formula, an alarm or warning occurs according to Pn310 (Vibration Detection Selections).

- Rotary Servomotors

$$\text{Detection level} = \frac{\text{Vibration detection level (Pn312 [min}^{-1}\text{])} \times \text{Vibration detection sensitivity (Pn311 [\%])}}{100}$$

- Linear Servomotors

$$\text{Detection level} = \frac{\text{Vibration detection level (Pn384 [mm/s])} \times \text{Vibration detection sensitivity (Pn311 [\%])}}{100}$$

Use this function only if A.520 or A.911 alarms are not output at the correct times when vibration is detected with the default vibration detection level (Pn312 or Pn384).

There will be discrepancies in the detection sensitivity for vibration alarms and warnings depending on the condition of your machine. If there is a discrepancy, use the above formula to adjust Pn311 (Vibration Detection Sensitivity).

Pn311	Vibration Detection Sensitivity Speed Position Torque				
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	50 to 500	1%	100	Immediately	Tuning

Information

1. Vibration may not be detected because of unsuitable servo gains. Also, not all kinds of vibrations can be detected.
2. Set a suitable moment of inertia ratio (Pn103). An unsuitable setting may result in falsely detecting or not detecting vibration alarms or vibration warnings.
3. To use this function, you must input the actual references that will be used to operate your system.
4. Execute this function under the operating conditions for which you want to set the vibration detection level.
5. Execute this function while the Servomotor is operating at 10% of its maximum speed or faster.

5.26.1 Preparations

Always check the following before you initialize the vibration detection level.

- The parameters must not be write prohibited.
- The test without a motor function must be disabled (Pn00C = n.□□□0).

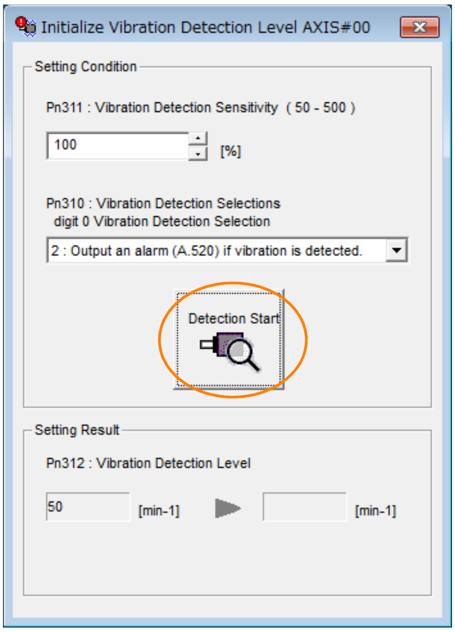
5.26.2 Operating Procedure

Use the following procedure to initialize the vibration detection level.

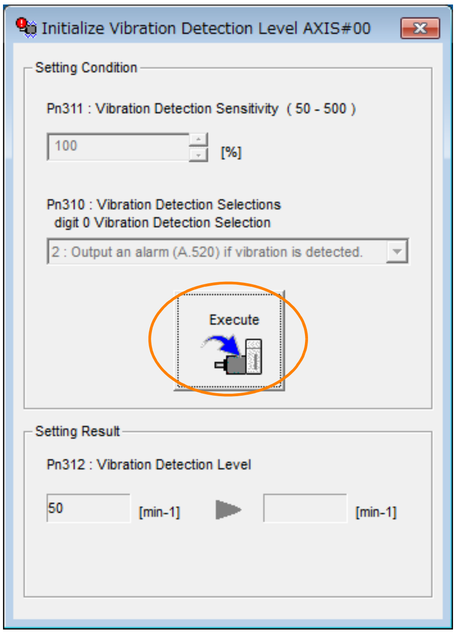
1. Click the **Servo Drive** Button in the workspace of the Main Window of the SigmaWin+.

2. Select **Initialize Vibration Detection Level** in the Menu Dialog Box.
The Initialize Vibration Detection Level Dialog Box will be displayed.

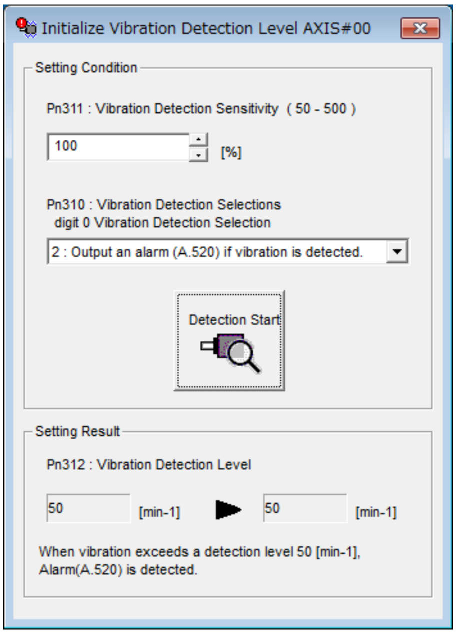
3. Select **Pn311: Vibration Detection Sensitivity** and **Pn310: Vibration Detection Selections** and then click the **Detection Start** Button.
A setting execution standby mode will be entered.


Initialize Vibration Detection Level AXIS#00
Setting Condition
Pn311 : Vibration Detection Sensitivity (50 - 500)
100 [%]
Pn310 : Vibration Detection Selections
digit 0 Vibration Detection Selection
2 : Output an alarm (A.520) if vibration is detected.
Setting Result
Pn312 : Vibration Detection Level
50 [min-1] [min-1]

4. Click the **Execute** Button.


Initialize Vibration Detection Level AXIS#00
Setting Condition
Pn311 : Vibration Detection Sensitivity (50 - 500)
100 [%]
Pn310 : Vibration Detection Selections
digit 0 Vibration Detection Selection
2 : Output an alarm (A.520) if vibration is detected.
Setting Result
Pn312 : Vibration Detection Level
50 [min-1] [min-1]

The newly set vibration detection level will be displayed and the value will be saved in the SERVOPACK.



Pn311 : Vibration Detection Sensitivity (50 - 500)
100 [%]

Pn310 : Vibration Detection Selections
digit 0 Vibration Detection Selection
2 : Output an alarm (A.520) if vibration is detected.

Pn312 : Vibration Detection Level
50 [min-1] ▶ 50 [min-1]

When vibration exceeds a detection level 50 [min-1],
Alarm(A.520) is detected.

This concludes the procedure to initialize the vibration detection level.

5.26.3 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

5.27 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.

5.27.1 Automatic Adjustment

Perform this adjustment only if highly accurate adjustment is required to reduce torque ripple.
You can specify the axis or axes to automatically adjust.
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.

Preparations

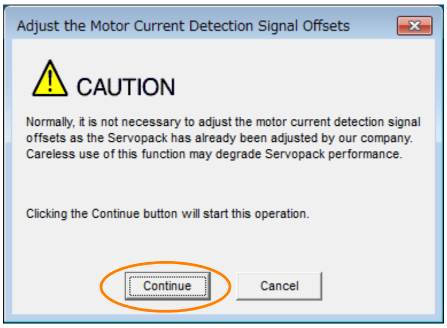
Always check the following before you automatically adjust the motor current detection signal offset.

- The parameters must not be write prohibited.
- The servo must be in ready status.
- The servo must be OFF.

Operating Procedure

Use the following procedure to automatically adjust the motor current detection signal offset.

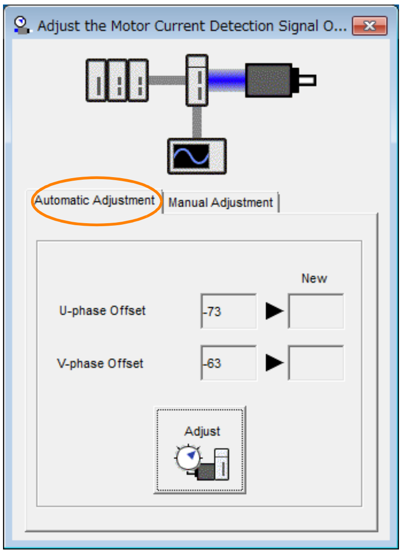
1. Click the **Servo Drive** Button in the workspace of the Main Window of the SigmaWin+.
2. Select **Adjust the Motor Current Detection Signal Offsets** in the Menu Dialog Box.
   The Adjust the Motor Current Detection Signal Offsets Dialog Box will be displayed.
3. Click the **Continue** Button.



Normally, it is not necessary to adjust the motor current detection signal offsets as the Servopack has already been adjusted by our company. Careless use of this function may degrade Servopack performance.

Clicking the Continue button will start this operation.

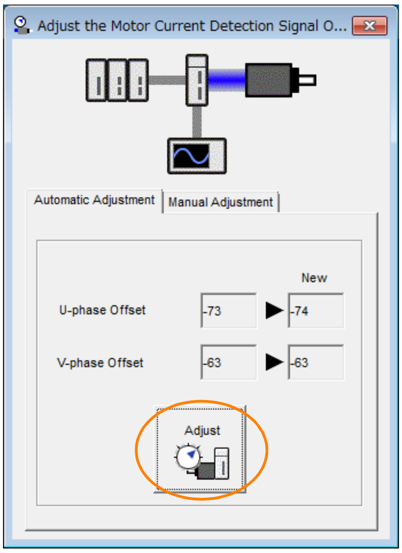
4. Click the **Automatic Adjustment** Tab in the Adjust the Motor Current Detection Offset Dialog Box.


Adjust the Motor Current Detection Signal O...

U-phase Offset -73 ▶

V-phase Offset -63 ▶

5. Click the **Adjust** Button.
The value that results from automatic adjustment will be displayed in the **New** Box.


Adjust the Motor Current Detection Signal O...

U-phase Offset -73 ▶ -74

V-phase Offset -63 ▶ -63

This concludes the procedure to automatically adjust the motor current detection signal offset.

5.27.2 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. You can specify the axis or axes to manually adjust.

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 SigmaWin+ until the ripple is minimized.
- Adjust the offsets for the phase-U current and phase-V current of the Servomotor so that they are balanced. Alternately adjust both offsets several times.

Information The offset does not use a parameter, so it will not change even if the parameter settings are initialized.

Preparations

Always check the following before you manually adjust the motor current detection signal offset.

- The parameters must not be write prohibited.

Operating Procedure

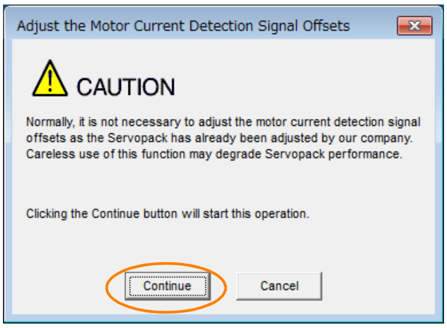
Use the following procedure to manually adjust the motor current detection signal offset.

1. Operate the Servomotor at approximately 100 min^{-1}.

2. Click the **Servo Drive** Button in the workspace of the Main Window of the SigmaWin+.

3. Select **Adjust the Motor Current Detection Signal Offsets** in the Menu Dialog Box.
   The Adjust the Motor Current Detection Signal Offsets Dialog Box will be displayed.

4. Click the **Continue** Button.



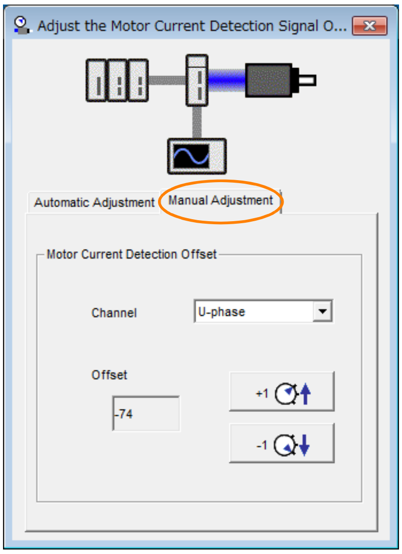
Adjust the Motor Current Detection Signal Offsets

CAUTION

Normally, it is not necessary to adjust the motor current detection signal offsets as the Servopack has already been adjusted by our company. Careless use of this function may degrade Servopack performance.

Clicking the Continue button will start this operation.

5. Click the **Manual Adjustment** Tab in the Adjust the Motor Current Detection Offset Dialog Box.



Adjust the Motor Current Detection Signal O...

Motor Current Detection Offset

Channel: U-phase

Offset: -74

6. Set the **Channel** Box in the **Motor Current Detection Offset** Area to *U-phase.*

7. Use the **+1** and **-1** Buttons to adjust the offset for phase U.
   Change the offset by about 10 in the direction that reduces the torque ripple.
   Adjustment range: -512 to +511

8. Set the **Channel** Box in the **Motor Current Detection Offset** Area to *V-phase.*

9. Use the **+1** and **-1** Buttons to adjust the offset for phase V.
   Change the offset by about 10 in the direction that reduces the torque ripple.

10. Repeat steps 6 to 9 until the torque ripple cannot be decreased any further regardless of whether you increase or decrease the offsets.
11. Reduce the amount by which you change the offsets each time and repeat steps 6 to 9.

This concludes the procedure to manually adjust the motor current detection signal offset.

5.28 Forcing the Motor to Stop

You can force the Servomotor to stop for a signal from the host controller or an external device.

To force the motor to stop, you must allocate the FSTP (Forced Stop Input) signal in Pn516 = n.□□□X. You can specify one of the following stopping methods: dynamic brake (DB), coasting to a stop, or decelerating to a stop.

Note: Forcing the motor to stop is not designed to comply with any safety standard. In this respect, it is different from the hard wire base block (HWBB).

Information Panel Operator
When a forced stop is performed, the Panel 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.

5.28.1 FSTP (Forced Stop Input) Signal

Type	Signal	Connector Pin No.	Signal Form	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	Parameters to Use
Σ-7S-Compatible I/O Signal Allocations	• Pn50A = n.□□□1 (Σ-7S-Compatible I/O Signal Allocations) • Pn516 = n.□□□X (FSTP (Forced Stop Input) Signal Allocation)
Multi-Axis I/O Signal Allocations	• Pn50A = n.□□□2 (Multi-Axis I/O Signal Allocations) • Pn597 (FSTP (Forced Stop Input) Signal Allocation)

Refer to the following section for details.

☞ *5.19.1 Input Signal Allocations* on page 5-50

5.28.2 Stopping Method Selection for Forced Stops

Use Pn00A = n.□□X□ (Stopping Method for Forced Stops) to set the stopping method for forced stops.

Parameter		Meaning	When Enabled	Classification
Pn00A	n.□□0□	Apply the dynamic brake or coast the motor to a stop (use the stopping method set in Pn001 = n.□□□X).	After restart	Setup
	n.□□1□ (default setting)	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.		
	n.□□2□	Decelerate the motor to a stop using the torque set in Pn406 as the maximum torque and then let the motor coast.		
	n.□□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.		
	n.□□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. For 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)).

Stopping the Servomotor by Setting Emergency Stop Torque (Pn406)

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

If Pn00A = n.□□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 maximum torque. However, the maximum emergency stop torque that you can actually use is the maximum torque of the Servomotor.

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

* Set a percentage of the rated motor torque.

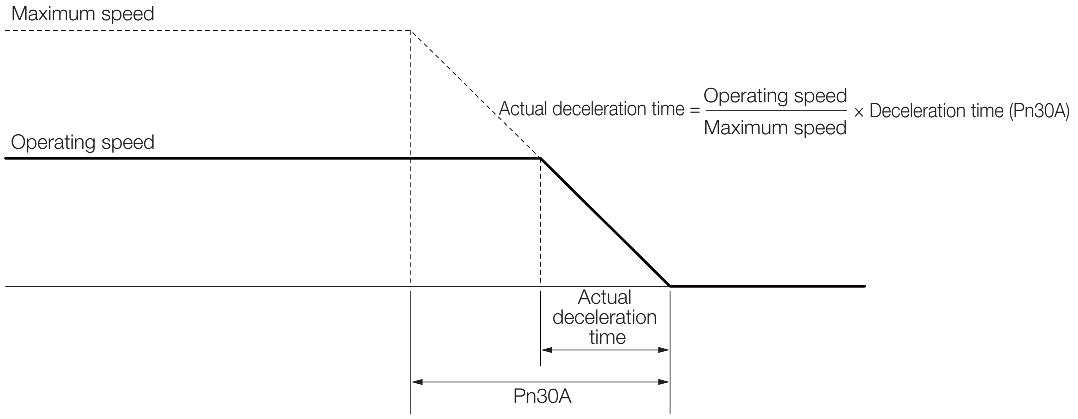
Stopping the Servomotor by Setting the Deceleration Time for Servo OFF and Forced Stops (Pn30A)

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

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

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

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

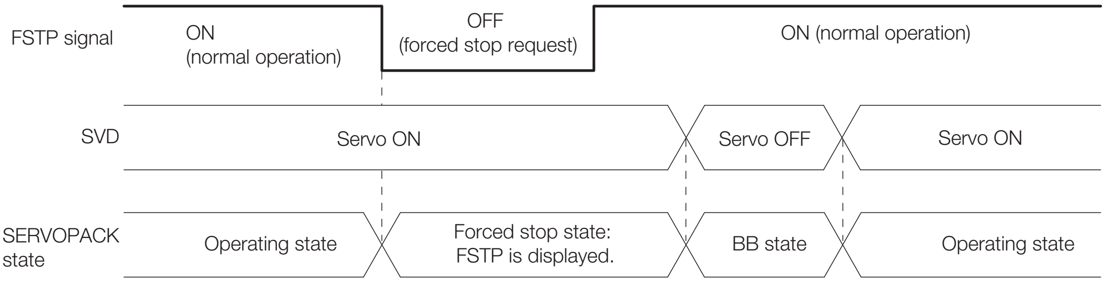


5.28.3 Resetting Method for Forced Stops

This section describes the resetting method to use after stopping operation for an FSTP (Forced Stop Input) signal.

If the FSTP (Forced Stop Input) signal is OFF and the servo ON command is input from the SVD, the forced stop state will be maintained even after the FSTP signal is turned ON.

First turn OFF the servo in the SVD to enter base block state (BB), and then turn ON the servo in the SVD.



Trial Operation

This chapter describes the flow of trial operations and the operating procedures.

6.1 Flow of Trial Operation

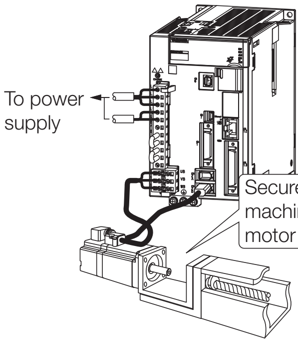
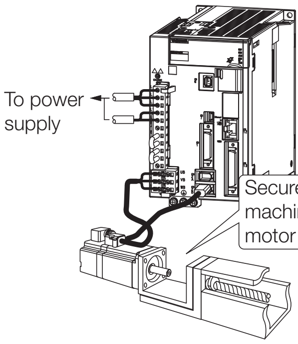
6.1.1 Flow of Trial Operation for Rotary Servomotors

The procedure for trial operation is given below.

- Preparations for Trial Operation

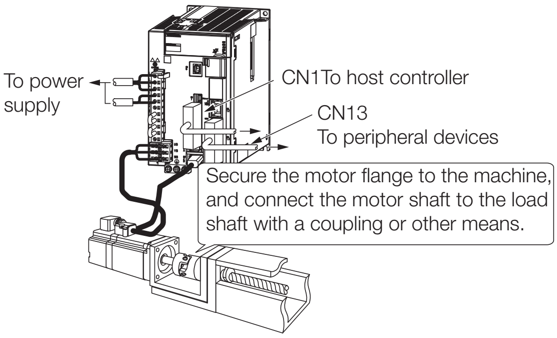
Step	Description	Reference
1	Installation Install the Servomotor and SERVOPACK according to the installation conditions. First, operation is checked with no load. Do not connect the Servomotor to the machine.	*Chapter 2 Installation*
2	Wiring and Connections Wire and connect the SERVOPACK. First, Servomotor operation is checked without a load. Do not connect the CN1 connector on the SERVOPACK.	*Chapter 3 Wiring and Connections*
3	Confirmations before Trial Operation	*6.2 Inspections and Confirmations before Trial Operation* on page 6-5
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 5-43

- Trial Operation

Step	Description	Reference
1	Trial Operation of Servomotor without a Load  	*6.3 Trial Operation for Servomotor without Load* on page 6-6
2	Trial Operation with the SVD  	*6.4 Trial Operation with the SVD* on page 6-9

Continued on next page.

Continued from previous page.

Step	Description	Reference
3	Trial Operation with the Servomotor Connected to the Machine  	*6.5 Trial Operation with the Servomotor Connected to the Machine* on page 6-11

6.1.2 Flow of Trial Operation for Linear Servomotors

The procedure for trial operation is given below.

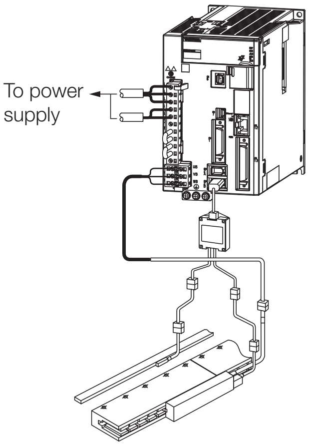
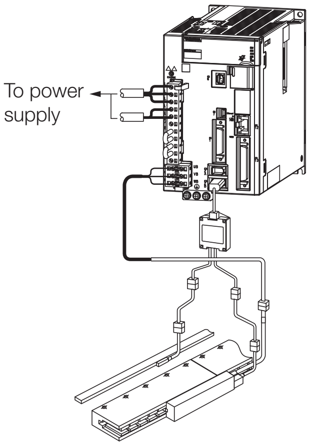
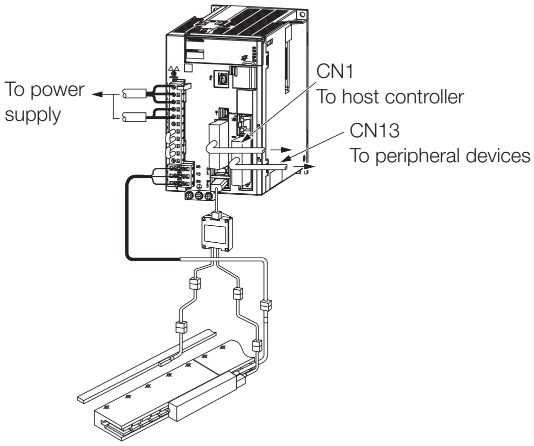
- Preparations for Trial Operation

Step	Description	Reference
1	Installation Install the Servomotor and SERVOPACK according to the installation conditions. First, operation is checked with no load. Do not connect the Servomotor to the machine.	*Chapter 2 Installation*
2	Wiring and Connections Wire and connect the SERVOPACK. First, Servomotor operation is checked without a load. Do not connect the CN1 connector on the SERVOPACK.	*Chapter 3 Wiring and Connections*
3	Confirmations before Trial Operation	*6.2 Inspections and Confirmations before Trial Operation* on page 6-5
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.	page 5-17
5-2	–	Writing Parameters to the Linear Servomotor	Set this parameter only if you are not using a Serial Converter Unit.	page 5-18
5-3	Pn080 = n.□□X□	Motor Phase Sequence Selection	–	page 5-22
5-4	Pn080 = n.□□□X	Polarity Sensor Selection	–	page 5-24
5-5	–	Polarity Detection	This step is necessary only for a Linear Servomotor without a Polarity Sensor.	page 5-25
5-6	Pn50A = n.X□□□ and Pn50B = n.□□□X, or Pn590 and Pn591	Overtravel Signal Allocations	–	page 5-28
5-7	Pn483 and Pn484	Force Control	–	page 5-69

Step	Description	Reference
6	Setting the Origin of the Absolute Linear Encoder This step is necessary only for an Absolute Linear Encoder from Mitutoyo Corporation.	*5.17.2 Setting the Origin of the Absolute Linear Encoder* on page 5-46

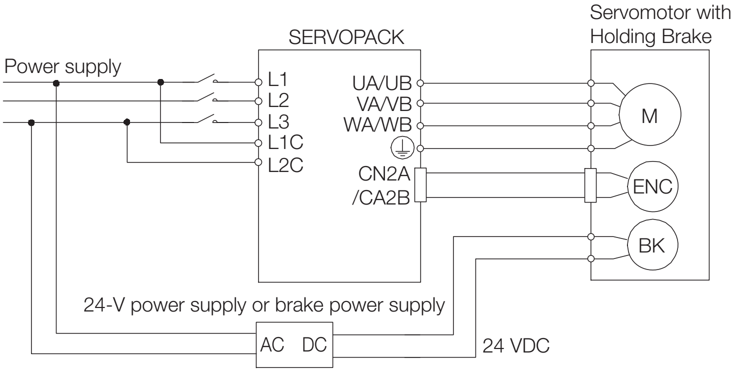
- Trial Operation

Step	Description	Reference
1	Trial Operation for the Servomotor without a Load 	*6.3 Trial Operation for Servomotor without Load* on page 6-6
2	Trial Operation with the SVD 	*6.4 Trial Operation with the SVD* on page 6-9
3	Trial Operation with the Servomotor Connected to the Machine 	*6.5 Trial Operation with the Servomotor Connected to the Machine* on page 6-11

6.2 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.



6.3 Trial Operation for Servomotor without Load

You use jogging for trial operation of the Servomotor without a load.
Jogging is used to check the operation of the Servomotor without connecting the SERVOPACK to the host controller. The Servomotor is moved at the preset jogging speed. By checking the operation of the Servomotor, you can confirm that there are no problems with wiring and connections and no Servomotor failures.

⚠ CAUTION

- During jogging, the overtravel function is disabled. Consider the range of motion of your machine when you jog the Servomotor.

6.3.1 Preparations

Always check the following before you execute jogging.

- The parameters must not be write prohibited.
- The main circuit power supply must be ON.
- There must be no alarms.
- 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

Pn304	Jogging Speed			Speed	Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 min^{-1}	500	Immediately	Setup
Pn305	Soft Start Acceleration Time			Speed	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 ms	0	Immediately	Setup
Pn306	Soft Start Deceleration Time			Speed	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 ms	0	Immediately	Setup

  - Direct Drive Servomotors

Pn304	Jogging Speed			Speed	Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	0.1 min^{-1}	500	Immediately	Setup
Pn305	Soft Start Acceleration Time			Speed	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 ms	0	Immediately	Setup
Pn306	Soft Start Deceleration Time			Speed	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 ms	0	Immediately	Setup

- Linear Servomotors

Pn383	Jogging Speed				Speed Position Force
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 mm/s	50	Immediately	Setup
Pn305	Soft Start Acceleration Time			Speed	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 ms	0	Immediately	Setup
Pn306	Soft Start Deceleration Time			Speed	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 ms	0	Immediately	Setup

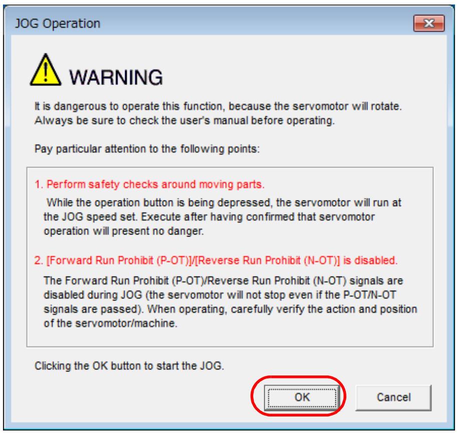
6.3.2 Operating Procedure

Use the following procedure to jog the motor.

1. Click the **Servo Drive** Button in the workspace of the Main Window of the SigmaWin+.

2. Select **JOG** in the Menu Dialog Box.
   The Jog Operation Dialog Box will be displayed.

3. Read the warnings and then click the **OK** Button.



It is dangerous to operate this function, because the servomotor will rotate.
Always be sure to check the user's manual before operating.

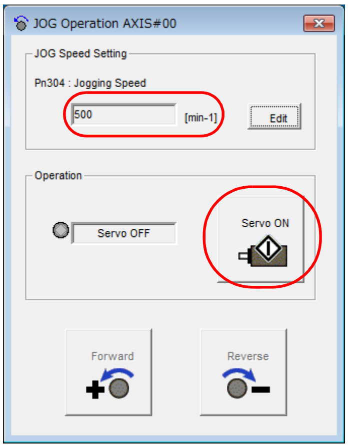
Pay particular attention to the following points:

1. Perform safety checks around moving parts.
   While the operation button is being depressed, the servomotor will run at the JOG speed set. Execute after having confirmed that servomotor operation will present no danger.

2. [Forward Run Prohibit (P-OT)]/[Reverse Run Prohibit (N-OT)] is disabled.
   The Forward Run Prohibit (P-OT)/Reverse Run Prohibit (N-OT) signals are disabled during JOG (the servomotor will not stop even if the P-OT/N-OT signals are passed). When operating, carefully verify the action and position of the servomotor/machine.

Clicking the OK button to start the JOG.

4. Check the jogging speed and then click the **Servo ON** Button.

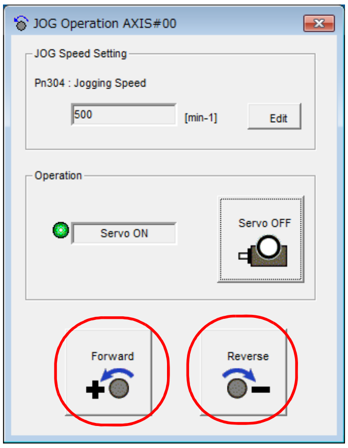


Pn304 : Jogging Speed 500 [min-1]

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. After you finish jogging, turn the power supply to the SERVOPACK OFF and ON again.

This concludes the jogging procedure.

6.4 Trial Operation with the SVD

This section gives an example of trial operation with the SVD Function Module in the Controller Section.

Refer to the following manual for details on the SVD.

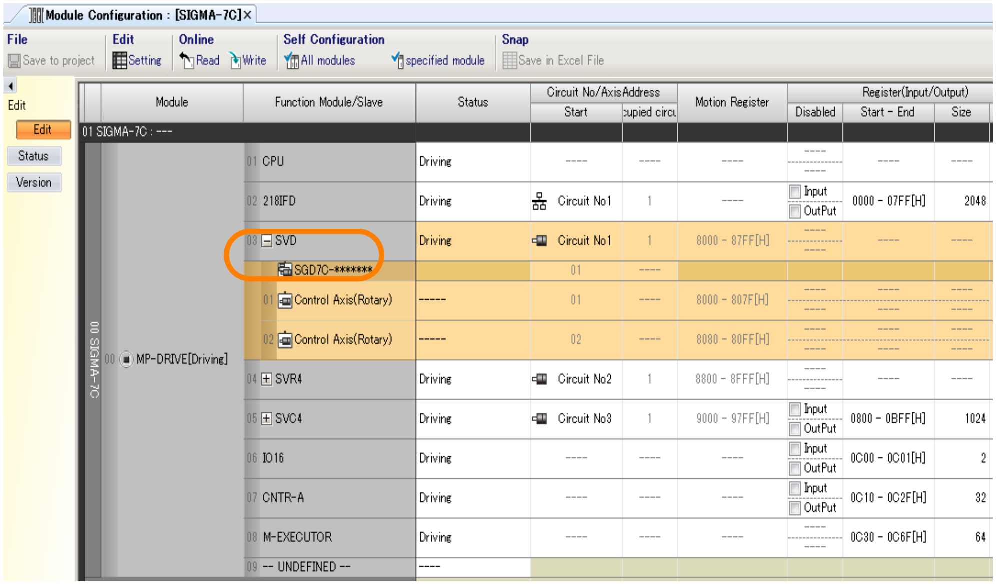
📖 Σ-7-Series Σ-7C SERVOPACK Motion Control User's Manual (Manual No.: SIEP S800002 03)

1. Confirm that the wiring is correct, and then connect the I/O signal connector (CN1 connector).
   Refer to the following chapter for details on wiring.
   ☞ *Chapter 3 Wiring and Connections*

2. Turn ON the power supplies to the SERVOPACK.
   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.

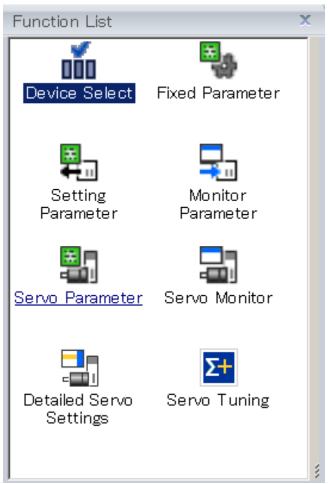
3. Place the SERVOPACK and the MPE720 online, and open the Module Configuration Definition Tab Page.

4. Double-click the axis for which to preform trial operation.



	Module	Function Module/Slave	Status	Circuit No/Axis Address		Motion Register	Register(Input/Output)		
				Start	cupied circu		Disabled	Start - End	Size
01 SIGMA-7C : ---									
00 SIGMA-7C	00 MP-DRIVE[Driving]	01 CPU	Driving	----	----	----	---- ----	----	----
		02 218IFD	Driving	Circuit No1	1	----	☐ Input ☐ OutPut	0000 - 07FF[H]	2048
		03 SVD	Driving	Circuit No1	1	8000 - 87FF[H]	---- ----	----	----
		SGD7C-*******		01	----				
		01 Control Axis(Rotary)	-----	01	----	8000 - 807F[H]	---- ----	---- ----	---- ----
		02 Control Axis(Rotary)	-----	02	----	8080 - 80FF[H]	---- ----	---- ----	---- ----
		04 SVR4	Driving	Circuit No2	1	8800 - 8FFF[H]	---- ----	----	----
		05 SVC4	Driving	Circuit No3	1	9000 - 97FF[H]	☐ Input ☐ OutPut	0800 - 0BFF[H]	1024
		06 IO16	Driving	----	----	----	☐ Input ☐ OutPut	0C00 - 0C01[H]	2
		07 CNTR-A	Driving	----	----	----	☐ Input ☐ OutPut	0C10 - 0C2F[H]	32
		08 M-EXECUTOR	Driving	----	----	----	---- ----	0C30 - 0C6F[H]	64
		09 -- UNDEFINED --	----						

The Function List Dialog Box will be displayed.



5. Set the following items, which are necessary for trial operation.

Setting	Reference
Electronic Gear Settings	*5.15 Electronic Gear Settings* on page 5-41
Motor Direction Selection	*5.5 Motor Direction Setting* on page 5-16
Overtravel	*5.11 Overtravel Function and Settings* on page 5-28

6. Save the settings that you made in step 5 in the SERVOPACK.
   Save the servo parameters online.
   Write the fixed parameters.

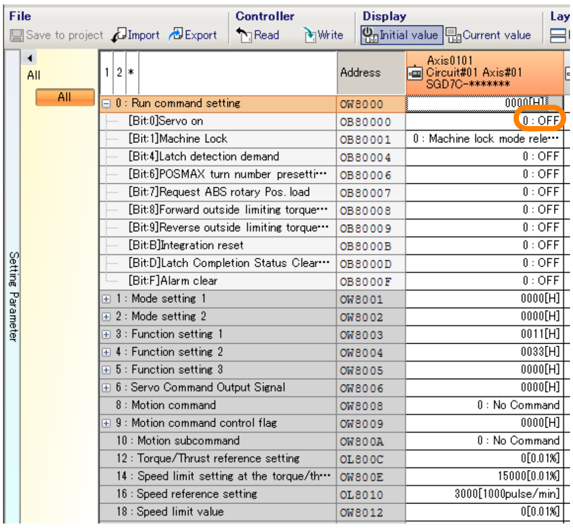
7. To enable changes to the settings, place the MPE720 offline, and then turn the power supply to the SERVOPACK OFF and ON again.

8. Place the the MPE720 back online, and open the Module Configuration Definition Tab Page.

9. Double-click the axis for which to preform trial operation.

10. Display the setting parameters.

11. Turn ON the servo in **Run command setting**.



1 2 *	Address	Axis0101 Circuit#01 Axis#01 SGD7C-*******
0 : Run command setting	OW8000	0000[H]
[Bit:0]Servo on	OB80000	0 : OFF
[Bit:1]Machine Lock	OB80001	0 : Machine lock mode rele···
[Bit:4]Latch detection demand	OB80004	0 : OFF
[Bit:6]POSMAX turn number presetti···	OB80006	0 : OFF
[Bit:7]Request ABS rotary Pos. load	OB80007	0 : OFF
[Bit:8]Forward outside limiting torque···	OB80008	0 : OFF
[Bit:9]Reverse outside limiting torque···	OB80009	0 : OFF
[Bit:B]Integration reset	OB8000B	0 : OFF
[Bit:D]Latch Completion Status Clear···	OB8000D	0 : OFF
[Bit:F]Alarm clear	OB8000F	0 : OFF
1 : Mode setting 1	OW8001	0000[H]
2 : Mode setting 2	OW8002	0000[H]
3 : Function setting 1	OW8003	0011[H]
4 : Function setting 2	OW8004	0033[H]
5 : Function setting 3	OW8005	0000[H]
6 : Servo Command Output Signal	OW8006	0000[H]
8 : Motion command	OW8008	0 : No Command
9 : Motion command control flag	OW8009	0000[H]
10 : Motion subcommand	OW800A	0 : No Command
12 : Torque/Thrust reference setting	OL800C	0[0.01%]
14 : Speed limit setting at the torque/th···	OW800E	15000[0.01%]
16 : Speed reference setting	OL8010	3000[1000pulse/min]
18 : Speed limit value	OW8012	0[0.01%]

The Servomotor can now be operated.

12. Operate the Servomotor at low speed.
    Trial Operation for Positioning
    16: Position reference setting: 10,000 (for an absolute encoder, add 10,000 to the current position)
    28: Speed reference setting = 40
    8: Positioning

13. While operation is in progress for step 12, 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 5-16
Confirm that no abnormal vibration, noise, or temperature rise occurs. If any abnormalities are found, implement corrections.	Σ-7-Series Σ-7C SERVOPACK Troubleshooting Manual (Manual No.: SIEP S800002 07)

Note: If the load machine is not sufficiently broken in before trial operation, the Servomotor may become overloaded.

6.5 Trial Operation with the Servomotor Connected to the Machine

This section provides the procedure for trial operation with both the machine and Servomotor.

6.5.1 Precautions

⚠ WARNING

- Operating mistakes that occur after the Servomotor is connected to the machine may not only damage the machine, but they may also cause accidents resulting in personal injury.

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 brake, observe the following precautions during trial operation.

- Before you check the operation of the brake, implement measures to prevent vibration from being caused by the machine falling due to gravity or an external force.
- First check the Servomotor operation and brake operation with the Servomotor uncoupled from the machine. If no problems are found, connect the Servomotor to the machine and perform trial operation again.

Control the operation of the brake with the /BK (Brake Output) signal output from the SERVOPACK.

Refer to the following sections for information on wiring and the related parameter settings.

☞ *3.4.4 Wiring the SERVOPACK to the Holding Brake* on page 3-25

☞ *5.12 Holding Brake* on page 5-32

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.

6.5.2 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 *6.4 Trial Operation with the SVD* (page 6 to 10) has been completed.
- Make sure that the SERVOPACK is connected correctly to both the host controller and the peripheral devices.
  - Overtravel wiring
  - Brake wiring
  - Allocation of the /BK (Brake Output) signal to a pin on the I/O signal connector (CN1)
  - Emergency stop circuit wiring
  - Host controller wiring

6.5.3 Operating Procedure

1. Enable the overtravel signals.

5.11.2 Setting to Enable/Disable Overtravel on page 5-29

2. Make the settings for the protective functions, such as for overtravel and the brake.

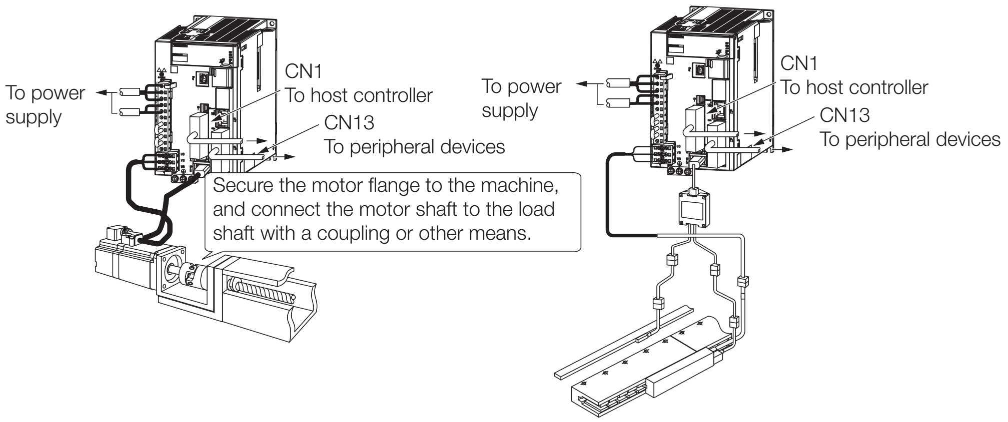
5.11 Overtravel Function and Settings on page 5-28

5.12 Holding Brake on page 5-32

3. Turn OFF the power supplies to the SERVOPACK.

The control power supply and main circuit power supply will turn OFF.

4. Couple the Servomotor to the machine.



Secure the motor flange to the machine, and connect the motor shaft to the load shaft with a coupling or other means.

5. Turn ON the power supplies to the machine and host controller and turn ON the control power supply and main circuit power supply to the SERVOPACK.

6. Check the protective functions, such overtravel and the brake, to confirm that they operate correctly.

Note: Enable activating an emergency stop so that the Servomotor can be stopped safely should an error occur during the remainder of the procedure.

7. Perform trial operation according to *6.4 Trial Operation with the SVD* on page 6-9 and confirm that the same results are obtained as when trial operation was performed on the Servomotor without a load.

8. If necessary, adjust the servo gain to improve the Servomotor response characteristics.

The Servomotor and machine may not be broken in completely for the trial operation. Therefore, let the system run for a sufficient amount of time to ensure that it is properly broken in.

9. For future maintenance, save the parameter settings with one of the following methods.

- Use the SigmaWin+ to save the parameters as a file.
- Record the settings manually.

This concludes the procedure for trial operation with both the machine and Servomotor.

6.6 Convenient Function to Use during Trial Operation

This section describes some convenient operations that you can use during trial operation.

Use them as required.

6.6.1 Program Jogging

You can use program jogging to perform continuous operation with a preset operation pattern, travel distance, travel speed, acceleration/deceleration time, waiting time, and number of movements.

You can use this operation when you set up the system in the same way as for normal jogging to move the Servomotor without connecting it to the host controller in order to check Servomotor operation and execute simple positioning operations.

Preparations

Always check the following before you execute program jogging.

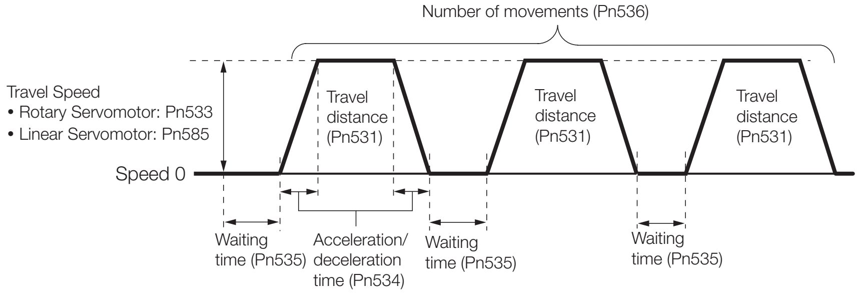
- The parameters must not be write prohibited.
- The main circuit power supply must be ON.
- There must be no alarms.
- The servo must be OFF.
- The range of machine motion and the safe travel speed of your machine must be considered when you set the travel distance and travel speed.
- There must be no overtravel.

Additional Information

- You can use the functions that are applicable to position control. However, parameters related to motion control (i.e., Pn800 and higher) are disabled.
- The overtravel function is enabled.

Program Jogging Operation Pattern

An example of a program jogging operation pattern is given below. In this example, the Servomotor direction is set to Pn000 = n.□□□0 (Use CCW as the forward direction).

Setting of Pn530	Setting	Operation Pattern
n.□□□0	(Waiting time → Forward travel distance) × Number of movements	

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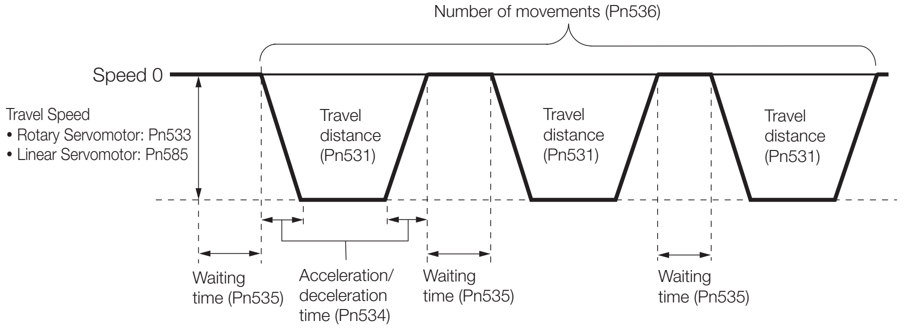
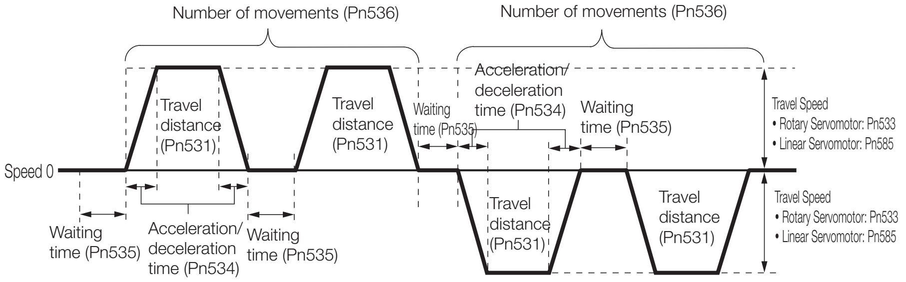
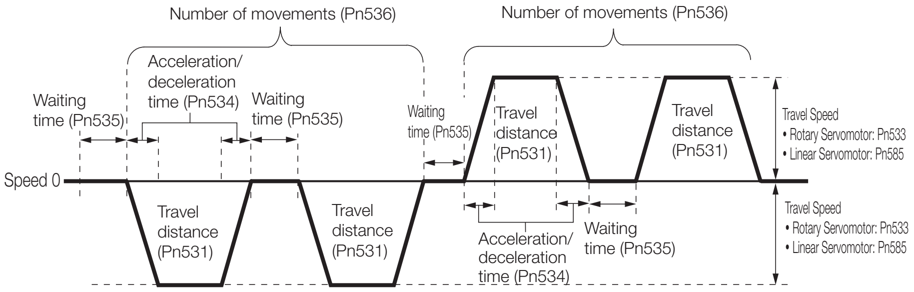
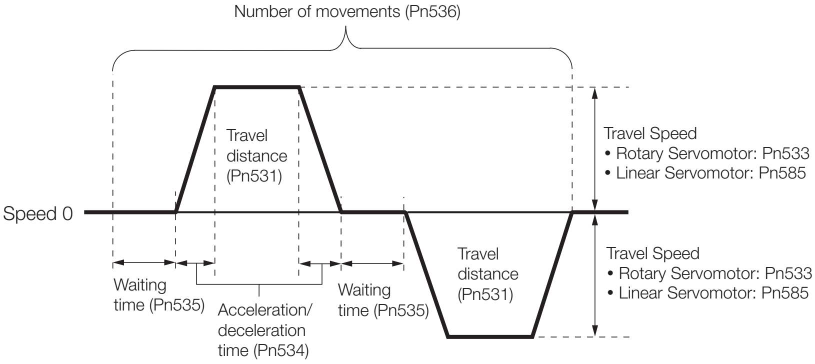
Setting of Pn530	Setting	Operation Pattern
n.□□□1	(Waiting time → Reverse by travel distance) × Number of movements	
n.□□□2	(Waiting time → Forward by travel distance) × Number of movements → (Waiting time → Reverse by travel distance) × Number of movements	
n.□□□3	(Waiting time → Reverse by travel distance) × 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	

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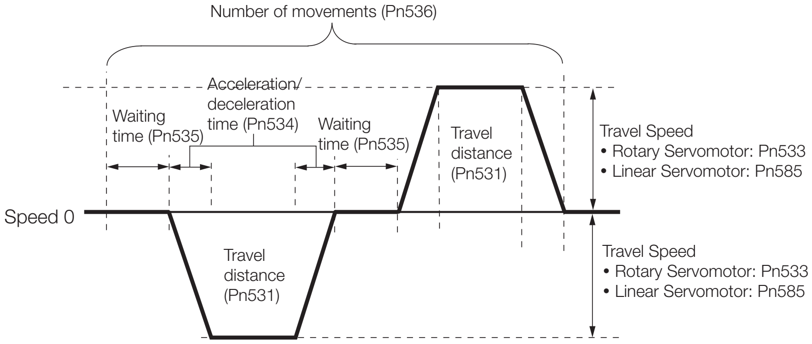
Setting of Pn530	Setting	Operation Pattern
n.□□□5	(Waiting time → Reverse by travel distance → Waiting time → Forward by travel distance) × Number of movements	

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 to n.□□□2 or n.□□□3.

Related Parameters

Use the following parameters to set the program jogging operation pattern. Do not change the settings while the program jogging operation is being executed.

- Rotary Servomotors

Pn530	Program Jogging-Related Selections				Speed Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0000h to 0005h	–	0000h	Immediately	Setup
Pn531	Program Jogging Travel Distance				Speed Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 1,073,741,824	1 reference unit	32768	Immediately	Setup
Pn533	Program Jogging Movement Speed				Speed Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 10,000	1 min^{-1}	500	Immediately	Setup
Pn534	Program Jogging Acceleration/Deceleration Time				Speed Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	2 to 10,000	1 ms	100	Immediately	Setup
Pn535	Program Jogging Waiting Time				Speed Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 ms	100	Immediately	Setup
Pn536	Program Jogging Number of Movements				Speed Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 1,000	1 time	1	Immediately	Setup

- Direct Drive Servomotors

Pn530	Program Jogging-Related Selections				Speed Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0000h to 0005h	–	0000h	Immediately	Setup
Pn531	Program Jogging Travel Distance				Speed Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 1,073,741,824	1 reference unit	32768	Immediately	Setup
Pn533	Program Jogging Movement Speed				Speed Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 10,000	0.1 min^{-1}	500	Immediately	Setup
Pn534	Program Jogging Acceleration/Deceleration Time				Speed Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	2 to 10,000	1 ms	100	Immediately	Setup
Pn535	Program Jogging Waiting Time				Speed Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 ms	100	Immediately	Setup
Pn536	Program Jogging Number of Movements				Speed Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 1,000	1 time	1	Immediately	Setup

- Linear Servomotors

Pn530	Program Jogging-Related Selections				Speed Position Force
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0000h to 0005h	–	0000h	Immediately	Setup
Pn531	Program Jogging Travel Distance				Speed Position Force
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 1,073,741,824	1 reference unit	32768	Immediately	Setup
Pn585	Program Jogging Movement Speed				Speed Position Force
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 10,000	1 mm/s	50	Immediately	Setup
Pn534	Program Jogging Acceleration/Deceleration Time				Speed Position Force
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	2 to 10,000	1 ms	100	Immediately	Setup
Pn535	Program Jogging Waiting Time				Speed Position Force
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 ms	100	Immediately	Setup
Pn536	Program Jogging Number of Movements				Speed Position Force
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 1,000	1 time	1	Immediately	Setup

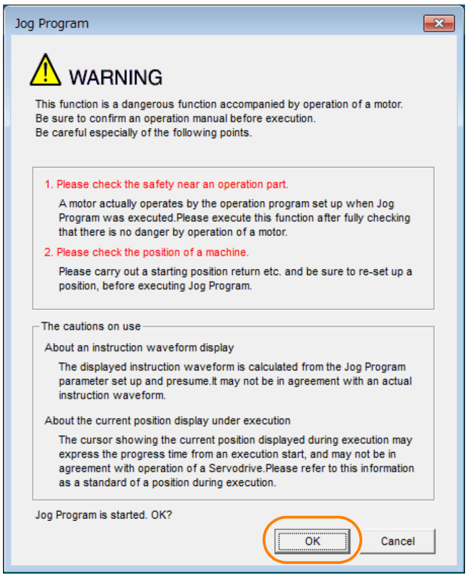
Operating Procedure

Use the following procedure for a program jog operation.

1. Click the **Servo Drive** Button in the workspace of the Main Window of the SigmaWin+.

2. Select **JOG Program** in the Menu Dialog Box.
   The Jog Program Dialog Box will be displayed.

3. Read the warnings and then click the **OK** Button.



Jog Program

WARNING

This function is a dangerous function accompanied by operation of a motor.
Be sure to confirm an operation manual before execution.
Be careful especially of the following points.

1. Please check the safety near an operation part.

A motor actually operates by the operation program set up when Jog Program was executed.Please execute this function after fully checking that there is no danger by operation of a motor.

2. Please check the position of a machine.

Please carry out a starting position return etc. and be sure to re-set up a position, before executing Jog Program.

The cautions on use

About an instruction waveform display

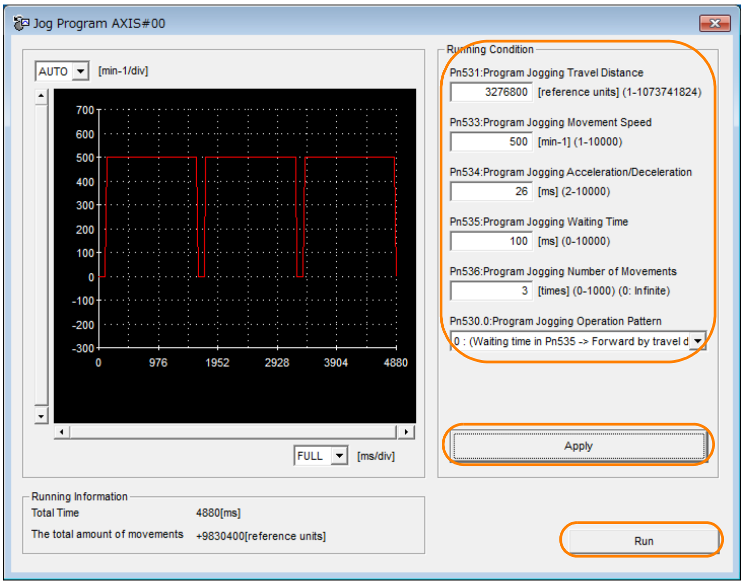
The displayed instruction waveform is calculated from the Jog Program parameter set up and presume.It may not be in agreement with an actual instruction waveform.

About the current position display under execution

The cursor showing the current position displayed during execution may express the progress time from an execution start, and may not be in agreement with operation of a Servodrive.Please refer to this information as a standard of a position during execution.

Jog Program is started. OK?

4. Set the operating conditions, click the **Apply** Button, and then click the **Run** Button.
   A graph of the operation pattern will be displayed.



Jog Program AXIS#00

AUTO [min-1/div]

FULL [ms/div]

Running Condition

Pn531:Program Jogging Travel Distance
3276800 [reference units] (1-1073741824)

Pn533:Program Jogging Movement Speed
500 [min-1] (1-10000)

Pn534:Program Jogging Acceleration/Deceleration
26 [ms] (2-10000)

Pn535:Program Jogging Waiting Time
100 [ms] (0-10000)

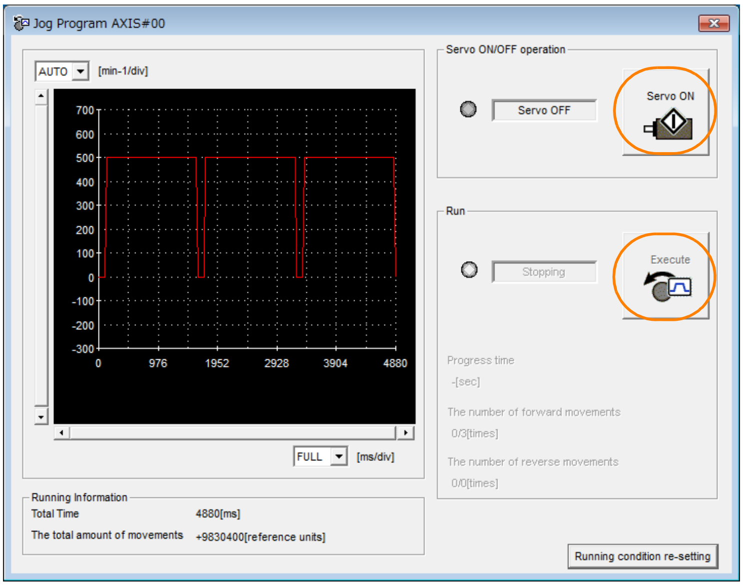
Pn536:Program Jogging Number of Movements
3 [times] (0-1000) (0: Infinite)

Pn530.0:Program Jogging Operation Pattern
0 : (Waiting time in Pn535 -> Forward by travel d

Running Information

Total Time	4880[ms]
The total amount of movements	+9830400[reference units]

5. Click the **Servo ON** Button and then the **Execute** Button. The program jogging operation will be executed.



Running Information

Total Time 4880[ms]

The total amount of movements +9830400[reference units]

Progress time -[sec]

The number of forward movements 0/3[times]

The number of reverse movements 0/0[times]

⚠ CAUTION

- **Be aware of the following points if you cancel the program jogging operation while the Servomotor is operating.**
  - If you cancel operation with the **Servo OFF** Button, the Servomotor will stop according to setting of the Servo OFF stopping method (Pn001 = n.☐☐☐X).
  - If you cancel operation with the **Cancel** Button, the Servomotor will decelerate to a stop and then enter a zero-clamped state.

This concludes the program jogging procedure.

6.6.2 Origin Search

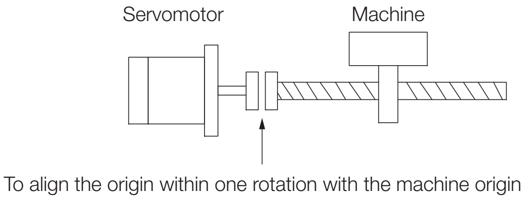
The origin search operation positions the motor to the origin within one rotation and the clamps it there.

⚠ CAUTION

- **Make sure that the load is not coupled when you execute an origin search.**
  The P-OT (Forward Drive Prohibit Input) signal and N-OT (Reverse Drive Prohibit Input) signal are disabled during an origin search.

Use an origin search when it is necessary to align the origin within one rotation with the machine origin. The following speeds are used for origin searches.

- Rotary Servomotors: 60 min^{-1}
- Direct Drive Servomotors: 6 min^{-1}
- Linear Servomotors: 15 mm/s



Preparations

Always check the following before you execute an origin search.

- The parameters must not be write prohibited.
- The main circuit power supply must be ON.
- There must be no alarms.
- The servo must be OFF.

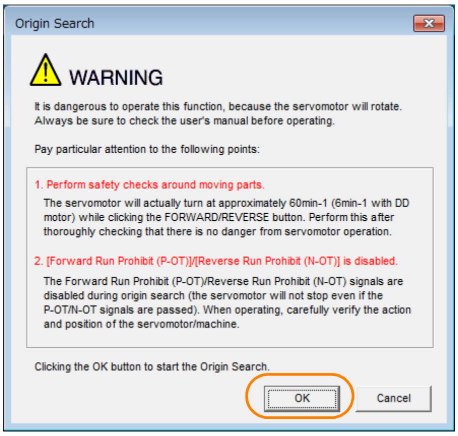
Operating Procedure

Use the following procedure to perform an origin search.

1. Click the ▤ **Servo Drive** Button in the workspace of the Main Window of the SigmaWin+.

2. Select **Search Origin** in the Menu Dialog Box.
   The Origin Search Dialog Box will be displayed.

3. Read the warnings and then click the **OK** Button.



WARNING

It is dangerous to operate this function, because the servomotor will rotate.
Always be sure to check the user's manual before operating.

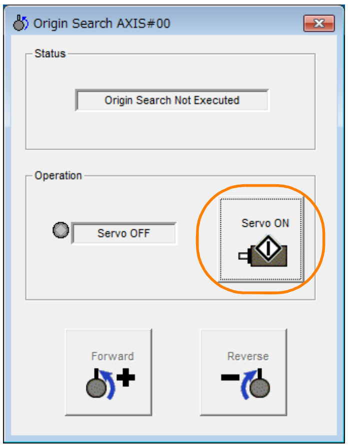
Pay particular attention to the following points:

1. Perform safety checks around moving parts.
The servomotor will actually turn at approximately 60min-1 (6min-1 with DD motor) while clicking the FORWARD/REVERSE button. Perform this after thoroughly checking that there is no danger from servomotor operation.

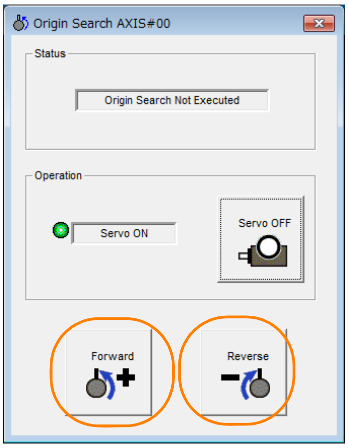
2. [Forward Run Prohibit (P-OT)]/[Reverse Run Prohibit (N-OT)] is disabled.
The Forward Run Prohibit (P-OT)/Reverse Run Prohibit (N-OT) signals are disabled during origin search (the servomotor will not stop even if the P-OT/N-OT signals are passed). When operating, carefully verify the action and position of the servomotor/machine.

Clicking the OK button to start the Origin Search.

4. Click the **Servo ON** Button.



5. Click the **Forward** Button or the **Reverse** Button.
   An origin search will be performed only while you hold down the mouse button. The motor will stop when the origin search has been completed.

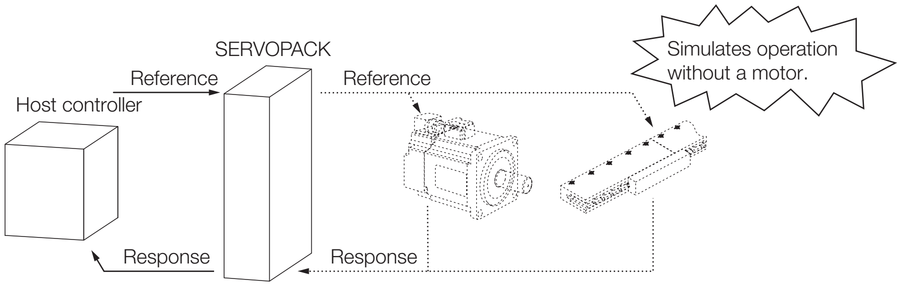


Origin Search Not Executed

This concludes the origin search procedure.

6.6.3 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.

Parameter		Meaning	When Enabled	Classification
Pn00C	n.□□□0 (default setting)	Disable tests without a motor.	After restart	Setup
	n.□□□1	Enable tests without a motor.		

Motor Information and Encoder Information

The motor and encoder information is used during tests without a motor. The source of the information depends on the device connection status.

- Rotary Servomotors

Motor Connection Status	Information That Is Used	Source of Information
Connected	Motor information • Rated motor speed • Maximum motor speed	Information in the Servomotor that is connected
	Encoder information • Encoder Resolution • Encoder type	
Not connected	Motor information • Rated motor speed • Maximum motor speed	• Setting of Pn000 = n.X□□□ (Rotary/Linear Servomotor Startup Selection When Encoder Is Not Connected) • Rated motor speed and maximum motor speed The values previously saved in the SERVOPACK will be used for the rated motor speed and maximum motor speed. Use the monitor displays (Un020: Rated Motor 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)

- Linear Servomotors

Motor Connection Status	Information That Is Used	Source of Information
Connected	Motor information	Information in the motor that is connected
	Linear encoder information • Resolution • Encoder 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)
	Linear encoder information • Resolution • Encoder pitch • Encoder type	• Resolution: 256 • Encoder pitch: Setting of Pn282 (Linear Encoder Scale Pitch) • Encoder type: Setting of Pn00C = n.□X□□ (Encoder Type Selection for Tests without a Motor)

- Related Parameters

Parameter		Meaning	When Enabled	Classification
Pn000	n.0□□□ (default setting)	When an encoder is not connected, start as SERVOPACK for Rotary Servomotor.	After restart	Setup
	n.1□□□	When an encoder is not connected, start as SERVOPACK for Linear Servomotor.		

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

Parameter		Meaning	When Enabled	Classification
Pn00C	n.□□0□ (default setting)	Use 13 bits as encoder resolution for tests without a motor.	After restart	Setup
	n.□□1□	Use 20 bits as encoder resolution for tests without a motor.		
	n.□□2□	Use 22 bits as encoder resolution for tests without a motor.		
	n.□□3□	Use 24 bits as encoder resolution for tests without a motor.		
	n.□0□□ (default setting)	Use an incremental encoder for tests without a motor.		
	n.□1□□	Use an absolute encoder for tests without a motor.		

Motor Position and Speed Responses

For a test without a motor, the following responses are simulated for references from the SVD according to the gain settings for position or speed control.

- Servomotor position
- Motor speed

The load model will be for a rigid system with the moment of inertia ratio that is set in Pn103.

Restrictions

The following functions cannot be used during the test without a motor.

- Regeneration and dynamic brake operation
- Brake output signal
  Refer to the following section for information on confirming the brake output signal.
  ☞ *9.2.2 Monitoring Operation, Status, and I/O* on page 9-3
- Items marked with “×” in the following utility function table

Button in Menu Dialog Box	Function	Executable?		Reference
		Motor Not Connected	Motor Connected	
Basic Functions	Initialize[*1]	○	○	page 5-10
	Product Information	○	○	page 9-2
Encoder Setting	Reset Absolute Encoder	×	○	page 5-43
	Multi-turn Limit Setup	×	○	page 5-76
	Search Origin[*2]	○	○	page 6-18
	Zero Point Position Setting	×	○	page 5-46
	Polarity Detection	×	×	page 5-26
Troubleshooting	Display Alarm	○	○	[*3]
	Reset Motor Type Alarm	○	○	
Operation	Jog	○	○	page 6-6
	Program JOG Operation	○	○	page 6-13
Tuning	Tuning - Autotuning without Host Reference	×	×	page 8-23
	Tuning - Autotuning with Host Reference	×	×	page 8-34
	Tuning - Custom Tuning	×	×	page 8-41
	Tuning - Custom Tuning - Adjust Anti-resonance Control	×	×	page 8-49
	Tuning - Custom Tuning - Vibration Suppression	×	×	page 8-54
	Response Level Setting	×	×	page 8-12
Diagnostic	EasyFFT	×	×	page 8-90
Others	Adjust the Motor Current Detection Offsets	×	○	page 5-83
	Initialize Vibration Detection Level	×	×	page 5-80
	Write Prohibited Setting	○	○	page 5-8

[*1] An **Initialize** Button will be displayed in the Parameter Editing Dialog Box.

[*2] Cannot be used when connecting a Linear Servomotor.

[*3] Refer to the following manual for details.
Σ-7-Series Σ-7C SERVOPACK Troubleshooting Manual (Manual No.: SIEP S800002 07)

Creating User Programs

7

The chapter describes how to create user programs for the Controller Section.

7.1 User Program Types and Execution Timing

There are three types of user programs:

- Ladder programs
- Motion programs
- Sequence programs

This section describes these programs.

7.1.1 Ladder Programs

Ladder programs are managed as drawings (ladder diagrams) that are identified by their drawing numbers (DWG numbers).
The ladder drawings form the basis of the ladder programs.

Drawing Types and Hierarchical Configuration

This section describes the types of ladder drawings and their hierarchical configuration.

◆ Type

Ladder drawings are divided into four different types based on their purpose.

- DWG.A (Startup Drawings)
  This type of ladder drawing is used to set register data. These ladder drawings are executed before high-speed scan process drawings and low-speed scan process drawings.
- DWG.I (Interrupt Drawings)
  This type of ladder drawing is used to perform processing with priority given to signals input from an Option Module.
  These ladder drawings are executed with higher priority than high-speed scan process drawings regardless of the scan cycle.
- DWG.H (High-Speed Scan Process Drawings)
  This type of ladder drawing is used to perform motion control or high-speed I/O control.
- DWG.L (Low-Speed Scan Process Drawings)
  This type of ladder drawing is used for communications with HMIs and external devices as well as for standard I/O control.

The following table lists the priority, execution conditions, and maximum number of drawings for each type of ladder drawing.

Drawing Type	Priority*	Execution Condition	Maximum Number of Drawings
DWG.A (Startup Drawings)	1	Power ON (These drawings are executed once when the power supply is turned ON.)	64
DWG.I (Interrupt Drawings)	2	External interrupt (These drawings are executed when a DI interrupt or counter match interrupt is received from an Option Module.)	64
DWG.H (High-Speed Scan Process Drawings)	3	Started at fixed intervals. (These drawings are executed once every high-speed scan.)	1,000
DWG.L (Low-Speed Scan Process Drawing)	4	Started at fixed intervals. (These drawings are executed once every low-speed scan.)	2,000

* Drawings with lower numbers have higher priority.

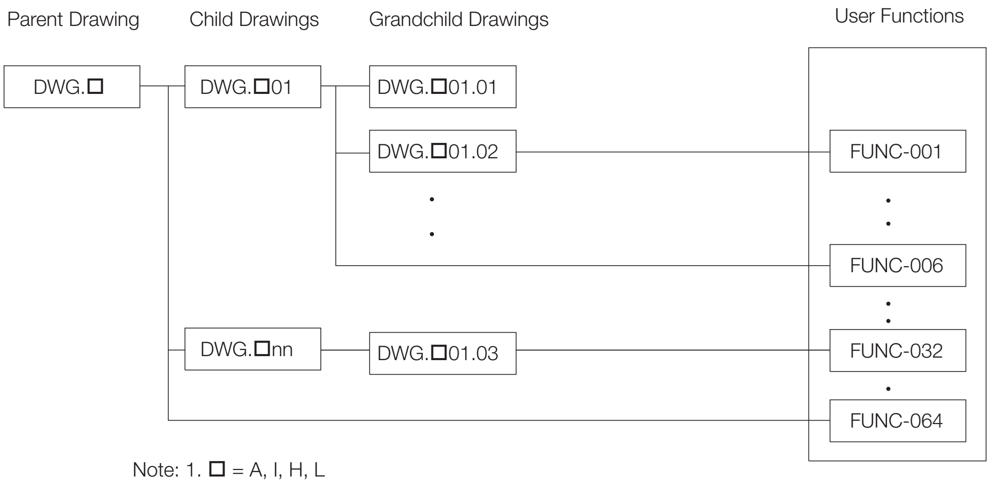
◆ Hierarchical Configuration

There are four types of ladder drawings: parent drawings, child drawings, grandchild drawings, and operation error drawings.

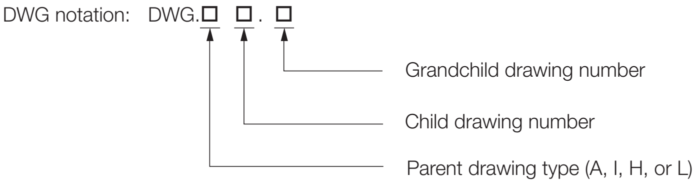
- Parent Drawings
  These drawings are automatically executed by the system program when the execution conditions are met.
- Child Drawings
  These drawings are executed when they are called from a parent drawing with a SEE instruction.
- Grandchild Drawings
  These drawings are executed when they are called from a child drawing with a SEE instruction.
- Operation Error Drawings
  These drawings are automatically executed by the system program when an operation error occurs.

A parent drawing cannot call a child drawing from a different type of drawing. Similarly, a child drawing cannot call a grandchild drawing from a different type of drawing. A parent drawing cannot call a grandchild drawing directly. The parent drawing first must call the child drawing, and then the child drawing must call the grandchild drawing. This is called the hierarchical configuration of drawings.

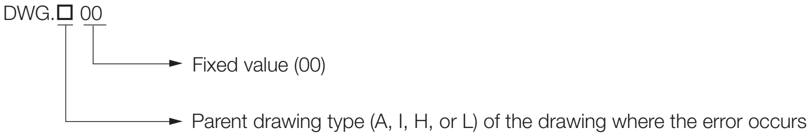
The following figure shows the parent−child−grandchild structure in which a program is created.



Note: 1. □ = A, I, H, L



2. The following notation is used for operation error drawings.



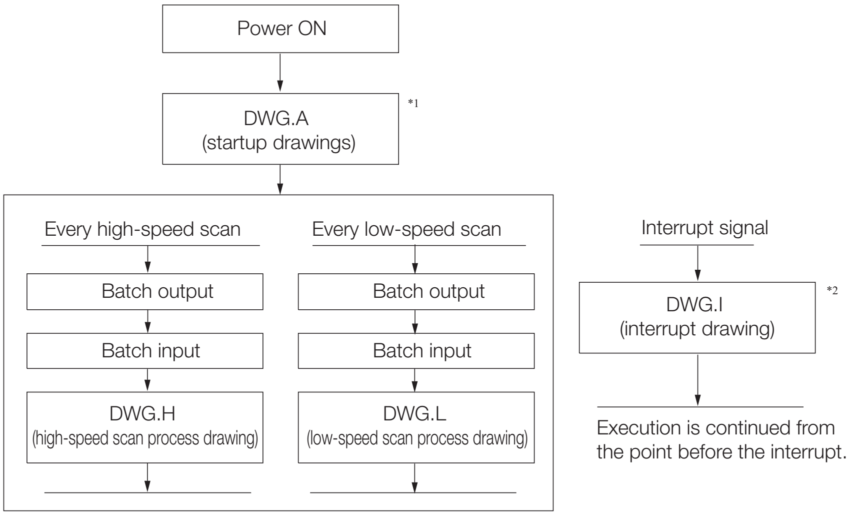
The breakdown of the number of ladder drawings in each category is given in the following table.

Drawings	Number of Drawings			
	DWG.A	DWG.I	DWG.H	DWG.L
Parent Drawings	1	1	1	1
Operation Error Drawings	1	1	1	1
Child Drawings	Total of 62 max.	Total of 62 max.	Total of 998 max.	Total of 1,998 max.
Grandchild Drawings				

Information There are separate functions that can be called from the drawings as required. Functions are executed when they are called from a parent, child, or grandchild drawing with the FUNC instruction. You can create up to 2,000 functions.

Controlling the Execution of Drawings

Drawings are executed based on their priorities, as shown in the following figure.



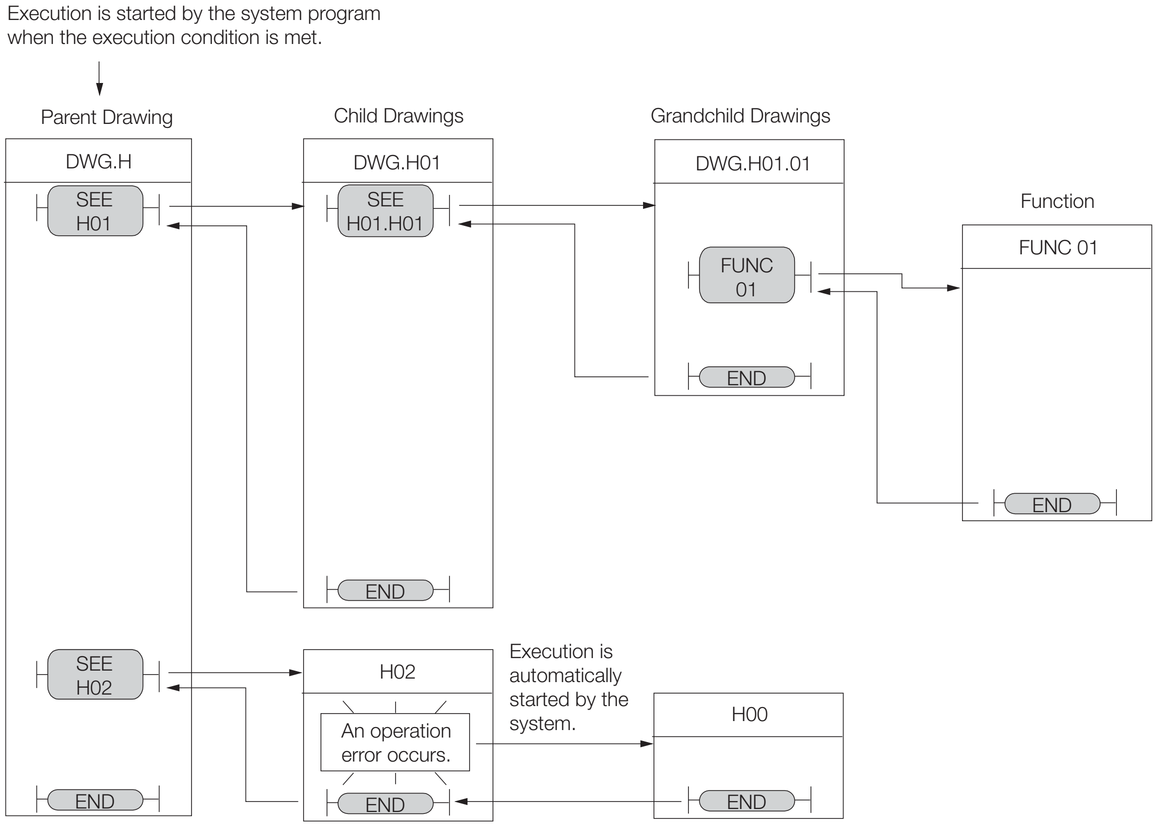
*1. DWG.A drawings are executed immediately after the power supply is turned ON.

*2. When an interrupt signal is input, execution of the DWG.I drawing is given priority even if execution of a DWG.H or DWG.L drawing is currently in progress.

Note: The parent drawing of each drawing is automatically called and executed by the system.

◆ Execution Processing of Drawings

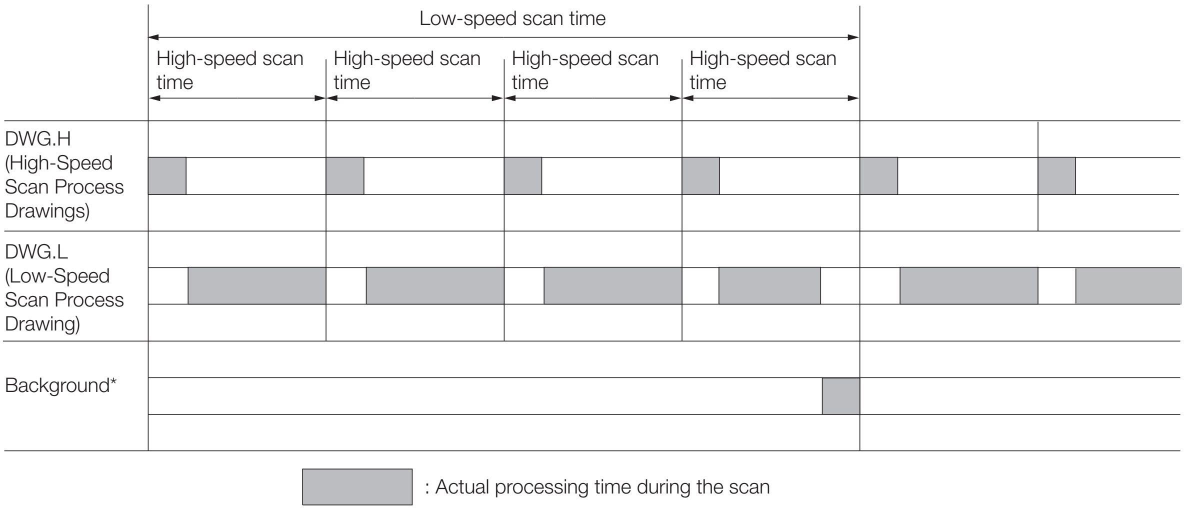
The drawings are executed by calling them from the top to the bottom, following the hierarchy of the drawings. The following figure illustrates the execution processing of a high-speed scan drawing (DWG.H).



Note: 1. The parent drawing is automatically called and executed by the system.
Child drawings and grandchild drawings are executed by calling them from a parent drawing or a child drawing using the SEE instruction.
2. You can call functions from any drawing. You can also call functions from other functions.
3. If an operation error occurs, the operation error drawing for the drawing type will be started automatically.
4. Always specify 00 as the drawing number for operation error drawings.

◆ Scheduling the Execution of High-speed and Low-speed Scan Process Drawings

High-speed scan process drawings (DWG.H) and low-speed scan process drawings (DWG.L) cannot be executed at the same time. DWG.L drawings are executed during the idle time of DWG.H drawings.
The period during which DWG.H drawings are executed is called the high-speed scan time.
The period during which DWG.L drawings are executed is called the low-speed scan time.



* Background processing is used to execute internal system processing, such as communications processing.

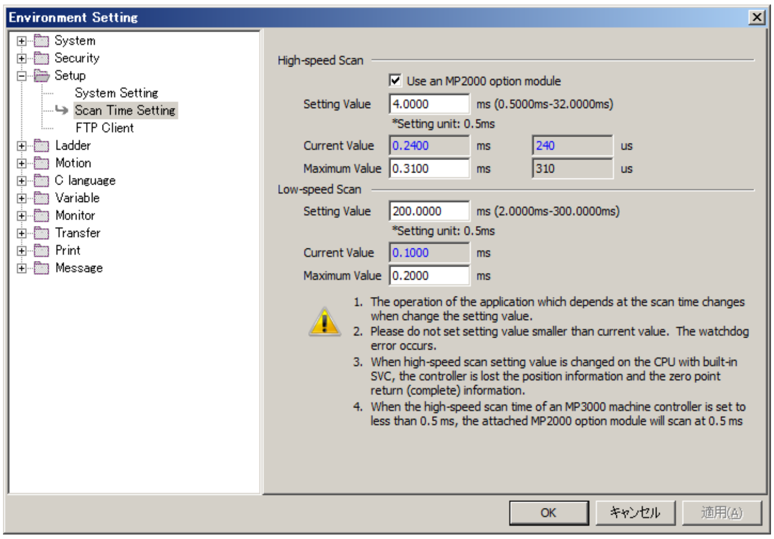
◆ Setting the High-speed and Low-speed Scan Times

Use MPE720 and perform the procedure given below to set the high-speed and low-speed scan times.

1. Stop the CPU.

2. Select ***File*** – ***Environment Setting*** from the menu bar. Alternatively, click the **System Setting** Button on the My Tool View of the Start Tab Page.
The Environment Setting Dialog Box will be displayed.

3. Select **Setup** – **Scan Time Setting.**
The following dialog box will be displayed.



High-speed Scan
☑ Use an MP2000 option module
Setting Value 4.0000 ms (0.5000ms-32.0000ms)
*Setting unit: 0.5ms
Current Value 0.2400 ms 240 us
Maximum Value 0.3100 ms 310 us

Low-speed Scan
Setting Value 200.0000 ms (2.0000ms-300.0000ms)
*Setting unit: 0.5ms
Current Value 0.1000 ms
Maximum Value 0.2000 ms

1. The operation of the application which depends at the scan time changes when change the setting value.
2. Please do not set setting value smaller than current value. The watchdog error occurs.
3. When high-speed scan setting value is changed on the CPU with built-in SVC, the controller is lost the position information and the zero point return (complete) information.
4. When the high-speed scan time of an MP3000 machine controller is set to less than 0.5 ms, the attached MP2000 option module will scan at 0.5 ms

Setting Value:	Enter the scan time settings.
Current Value:	A value of 0.0 ms is displayed when the MPE720 is offline. Otherwise, the actual processing times for the scans are displayed.

Maximum Value: The maximum processing time for the scan is displayed. You can set the maximum value. The setting is retained until it is exceeded.

4. Enter the high-speed scan time in the **Setting Value** Box under **High-speed Scan.** Enter the low-speed scan time in the **Setting Value** Box under **Low-speed Scan.**
The following table shows the possible settings and default values for each scan time.

Item	Possible Settings	Default
High-Speed Scan Time	0.5 ms to 32 ms (in increments of 0.250 ms)	4.0 ms
Low-Speed Scan Time	2.0 ms to 300.0 ms (in 0.5-ms increments)	200.0 ms

5. Click the **OK** Button.
The settings will be saved and the Environment Setting Dialog Box will close.

Important

Observe the following precautions when setting the high-speed scan time and low-speed scan time.

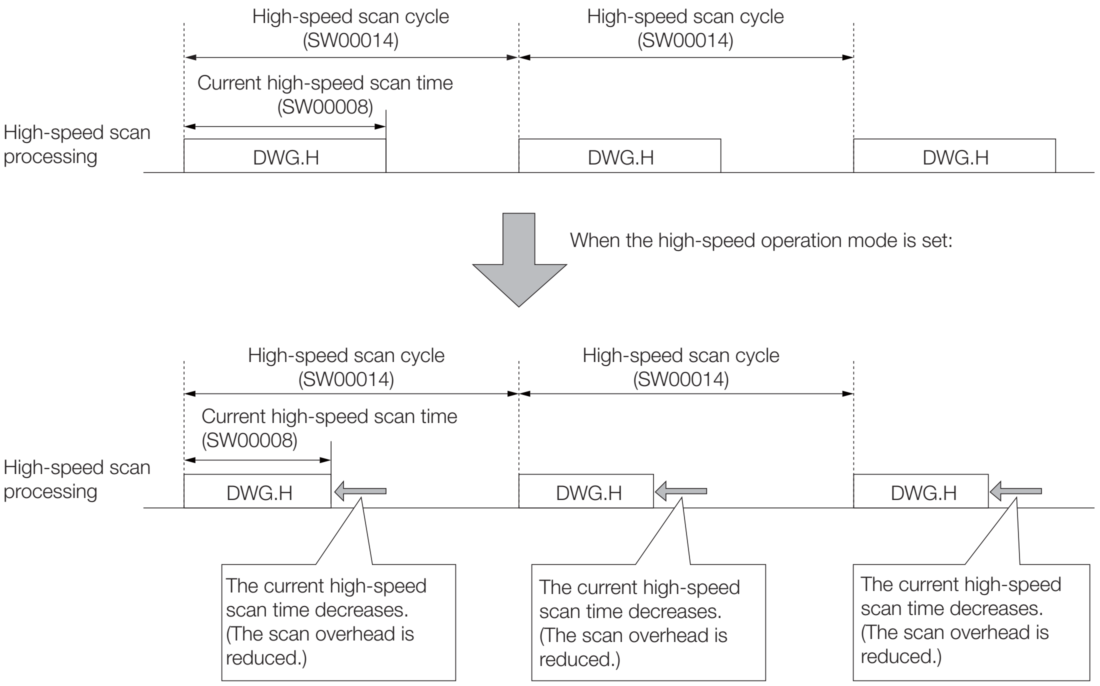
1. Set the scan setting so that it is 1.25 times greater than the maximum value.
   If the scan setting is too close to the maximum value, the refresh rate of the MPE720 window will noticeably drop and can cause communications timeout errors to occur. If the maximum value exceeds the scan setting, a watchdog error may occur and cause the SERVOPACK system to shut down.
2. If you are using MECHATROLINK-II or MECHATROLINK-III, set the scan times to an integral multiple of the communications cycle or transmission cycle. If you change the communications cycle or transmission cycle, check the scan time settings.
3. Do not change the scan setting while the Servo is ON. Never change the scan setting while an axis is in motion (i.e., while the motor is rotating). Doing so may cause the motor to rotate out of control.
4. After changing or setting a scan time, always save the data to flash memory.

◆ High-speed Drawing Operation Mode Settings

The high-speed drawing operation mode is the mode that is set for DWG.H drawings.

If no DWG.I drawings are used, select the high-speed mode. This optimizes the processing of DWG.H drawings.

If DWG.I drawings are used, select the normal mode. If the high-speed mode is selected, DWG.I drawings will not be executed.



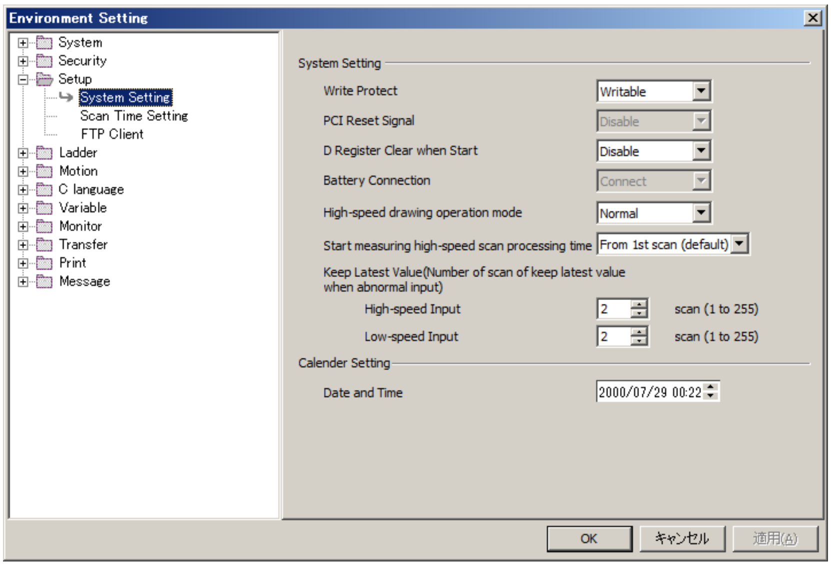
Information
- DWG.A, DWG.I, and DWG.L drawings do not have operation mode settings.
- The more often the following instructions are used, the greater the effect that the optimization will have on DWG.H processing.

Type	Function
Relay Circuit Instructions	Rising-edge NO Contact
	Falling-edge NO Contact
	Rising-edge NC Contact
	Falling-edge NC Contact
	Rising-edge Pulse
	Falling-edge Pulse
	Coil
	Reverse Coil
	Rising-edge Detection Coil
	Falling-edge Detection Coil
	Set Coil
	Reset Coil
Numeric Operation Instructions	+1Increment
	-1Decrement

Perform the following procedure with MPE720 to set the high-speed drawing operation mode.

1. Select *File* – *Environment Settings* from the menu bar. Alternatively, click the **System Setting** Button on the My Tool View of the Start Tab Page. The Environment Setting Dialog Box is displayed.

2. Select **Setup** – **System Setting.** The following dialog box will be displayed.



System Setting
Write Protect: Writable
PCI Reset Signal: Disable
D Register Clear when Start: Disable
Battery Connection: Connect
High-speed drawing operation mode: Normal
Start measuring high-speed scan processing time: From 1st scan (default)
Keep Latest Value(Number of scan of keep latest value when abnormal input)
High-speed Input: 2 scan (1 to 255)
Low-speed Input: 2 scan (1 to 255)
Calender Setting
Date and Time: 2000/07/29 00:22

3. Select **High-Speed** or **Normal** in the **High-Speed Drawing Operation Mode** Box.

Function

Functions are executed when they are called from a parent, child, or grandchild drawing with the FUNC instruction.

Functions can be freely called from any drawing. The same function can be called simultaneously from different types of drawings or different levels of drawings. You can also call functions from other functions that you have created.

The use of functions provides the following merits:

- Easy user program modularization
- Easy user program creation and maintenance

You can use standard functions that are provided by the system, and you can define user functions.

◆ Standard System Functions

The following functions for communications and other purposes are provided as standard functions in the system. You cannot change the system functions.

Symbol	Function
COUNTER	Counter
FINFOUT	First-in First-out
TRACE	Trace
DTRC-RD	Read Data Trace
MSG-SND	Send Message
MSG-SNDE	Send Message Extended
MSG-RCV	Receive Message
MSG-RCVE	Receive Message Extended
MOTREG-W	Write Motion Register
MOTREG-R	Read Motion Register

◆ User Functions

You can freely program the body of a user function and program the user function definitions.

The maximum number of user functions is 2,000 drawings.

7.1.2 Motion Programs

A motion program is a program that is written in a text-based motion language.

There are two types of motion programs.

Classification	Designation Method	Features	Number of Programs
Main programs	MPM□□□ (□□□ = 1 to 512)	• Main programs are called from a DWG.H drawing. • Main programs are called from the M-EXECUTOR program execution definitions.	You can create up to 512 motion programs, including the following programs: • Motion main programs • Motion subprograms • Sequence main programs • Sequence subprograms
Subprograms	MPS□□□ (□□□ = 1 to 512)	Subprograms are called from a main program.	

Note: There are cases when the M-EXECUTOR cannot be used. Refer to the following section for details.

☞ *7.1.4 The M-EXECUTOR Function Module* on page 7-25

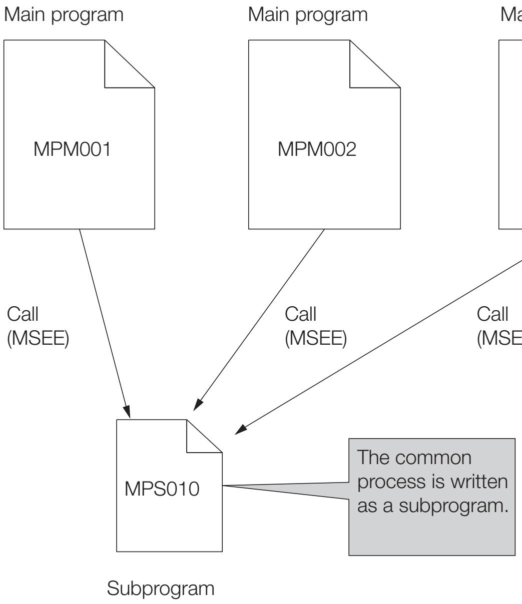
Important

1. The same numbers are used to manage the motion programs and sequence programs. Use a unique number for each program.
   - Motion program numbers are given in the form MPM□□□ or MPS□□□.
   - Sequence program numbers are given in the form SPM□□□ or SPS□□□.
2. The number of motion programs that can be executed simultaneously depends on the model of the Machine Controller. If the number of simultaneously executable programs is exceeded, an alarm will occur (No System Work Available Error).
   - The No System Work Available Error is indicated by bit E in the Status Flags of the motion program.

Term

Motion Subprograms

Subprograms are created to perform common operations. They help minimizing the number of program steps and allow efficient use of memory.



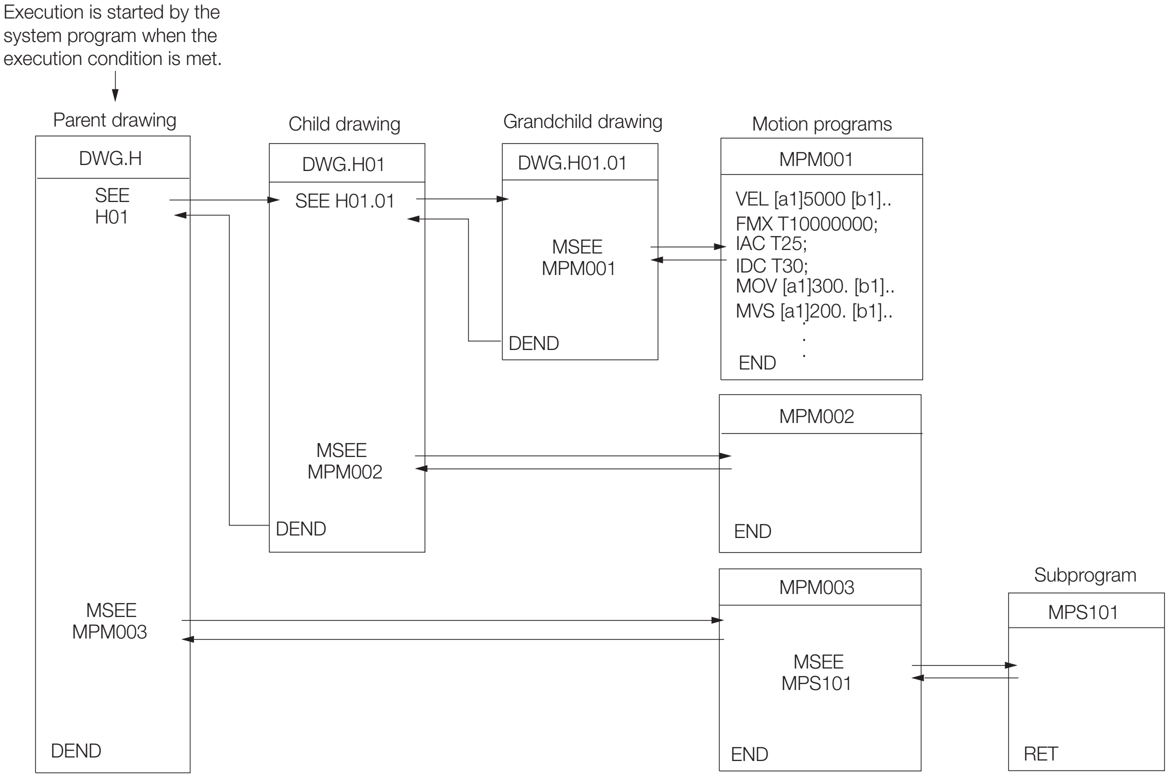
Motion Program Execution

Motion programs are called with an MSEE instruction from a ladder program in an H drawing.

Information You can also register the motion program in the M-EXECUTOR (Motion Executor) to call it. Refer to the following section for details.
☞ *7.1.4 The M-EXECUTOR Function Module* on page 7-25

After you create the motion program, place a Call Motion Program (MSEE) instruction in the ladder program of an H drawing. Motion programs can be called from any H drawing, regardless of whether it is a parent, child, or grandchild drawing.

The following figure shows an execution example.



The ladder instruction in the H drawing is executed every high-speed scan cycle according to the hierarchical organization of parent–child–grandchild drawings.

The above programming only prepares for execution of the motion program. The motion program is not executed when the MSEE instruction is inserted. To start the motion program after inserting the MSEE instruction, use a control signal to turn ON the Request for Start of Programmed Operation.

The motion program is executed in the scan cycle, but unlike ladder programs, the entire program is not executed in a single scan. Execution of motion programs is controlled by the system.

Important

The following points must be taken into consideration when executing motion programs.
- Motion programs that are registered in the M-EXECUTOR cannot be executed with MSEE instructions.
- More than one instance of the same motion program (i.e., the same program number) cannot be executed with MSEE instructions.
- Subprograms (MPS□□□) cannot be executed with MSEE instructions in a ladder program. You can call subprograms only from motion programs and motion subprograms (MPM□□□ and MPS□□□).
- You cannot call the same subprogram more than once at the same time.
- Sequence programs (SPM□□□ and SPS□□□) cannot be called with MSEE instructions from a ladder program for the CPU-03 or CPU-04.

Specifying Motion Programs

There are two methods that you can use to specify motion programs.

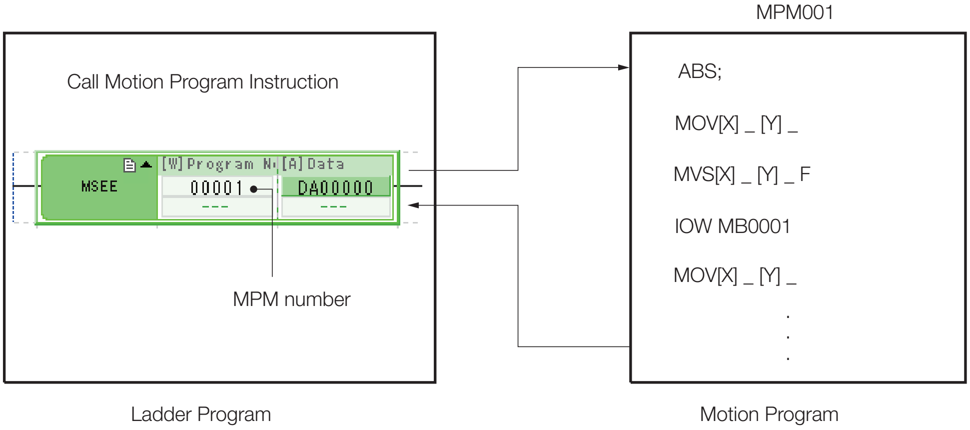
- Calling the motion program by specifying it directly
- Calling the motion program by specifying it indirectly

These two methods are described below.

◆ Calling the Motion Program by Specifying It Directly

Direct designation is used to call a motion program by specifying its program number (MPM□□□) directly.

To call the motion program from a ladder program with the MSEE instruction, specify the program number in the Program Number operand of the MSEE instruction.

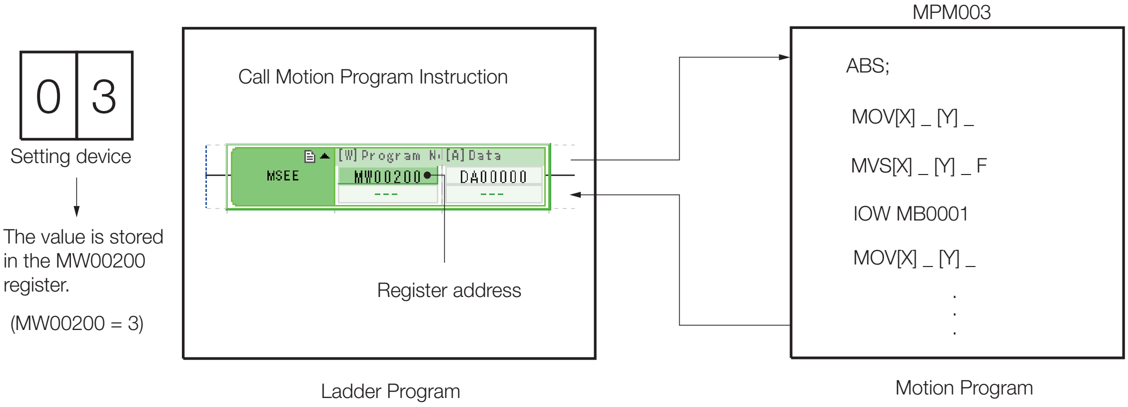


◆ Calling the Motion Program by Specifying It Indirectly

Indirect designation is used to call a motion program by specifying its number in a register.

In this method, the program (MPM□□□) whose number is the same as the value that is stored in the register is called.

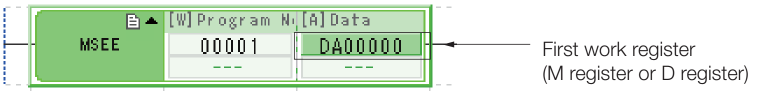
To call the motion program from a ladder program with an MSEE instruction, use the Program Number operand of the MSEE instruction to specify the M or D register that indirectly designates the motion program.



Work Registers

Work registers are used to set and monitor motion programs.

The first work register for a motion program that is called with an MSEE instruction is specified in the MSEE instruction in the ladder program. The following figure shows the structure of the work registers.



First work register
(M register or D register)

Work Register	Description
1st register	Motion Program Status Flags
2nd register	Motion Program Control Signals
3rd register	Interpolation Override
4th register	System Work Number

◆ Motion Program Status Flags

The Motion Program Status Flags give the execution condition of the motion program. The following table describes the meanings of the Status Flags.

Bit No.	Status
0	Program is being executed.
1	Program is paused.
2	Program is stopped due to a stop request (for system use).
3	Reserved.
4	Program single-block execution is stopped.
5	Reserved.
6	Reserved.
7	Reserved.
8	There is a program alarm.
9	Execution is stopped at a breakpoint.
A	Reserved.
B	The program is in Debug Mode (EWS debugging).
C	Program Type, 0: Motion Program
D	Start Request History
E	No System Work Available Error Execution Scan Error
F	Main Program Number Limit Exceeded Error

Note: If a program alarm occurs, motion program error information is provided in the Motion Alarm Dialog Box and in the S registers.

◆ Control Signals

To control the execution of a motion program, you must input program control signals (Request for Start of Programmed Operation, or Request for Stop of Program, etc.). The following table describes the control signals for motion programs.

Bit No.	Signal Name	Signal Type
0	Request for Start of Programmed Operation	Differential or NO contact
1	Request for Pause of Program	NO contact
2	Request for Stop of Program	NO contact
3	Program Single-Block Mode Selection	NO contact
4	Program Single-Block Start Request	Differential or NO contact
5	Alarm Reset Request	NO contact
6	Request for Start of Continuous Programmed Operation	Differential or NO contact
7	Reserved.	–
8	Skip 1 Information	NO contact
9	Skip 2 Information	NO contact
A	Reserved.	–
B	Reserved.	–
C	Reserved.	–
D	System Work Number Setting*[1]	NO contact
E	Interpolation Override Setting*[2]	NO contact
F	Reserved.	–

*[1] System Work Number Setting
- When the Motion Program Is Registered in M-EXECUTOR:
  The system work number cannot be specified. The system will use the definition number as the system work number.
- When a Motion Program Is Called from a Ladder Program with an MSEE Instruction:
  OFF: The system will use an automatically acquired system work number.
  The system work number will be different each time.
  ON: The work number that is specified by the system will be used.
  However, if the work number is assigned to the M-EXECUTOR, a No System Work Available Error (Status Flag Bit E) is reported.

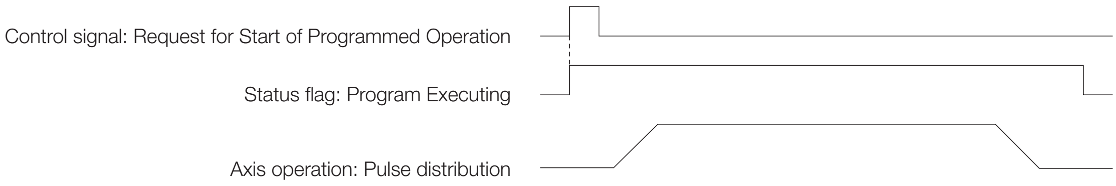
*[2] Interpolation Override Setting
OFF: The interpolation override is always 100%.
ON: The interpolation override in the parameter setting is used.

Note: 1. Use the specified signal types for the ladder program inputs.
2. If the Request for Start of Programmed Operation control signal is ON when the power supply is turned ON, the motion program with the specified program number will be executed.

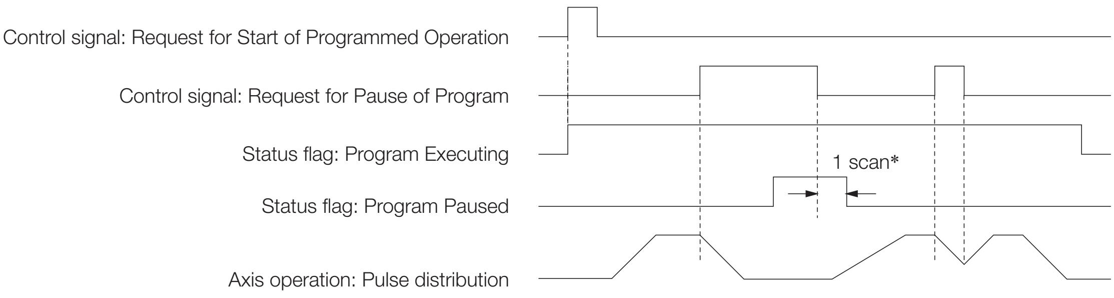
■ Motion Program Control Signals Timing Chart

Timing chart examples for axis operations and status flags after a control signal is input are provided below.

- Request for Start of Programmed Operation

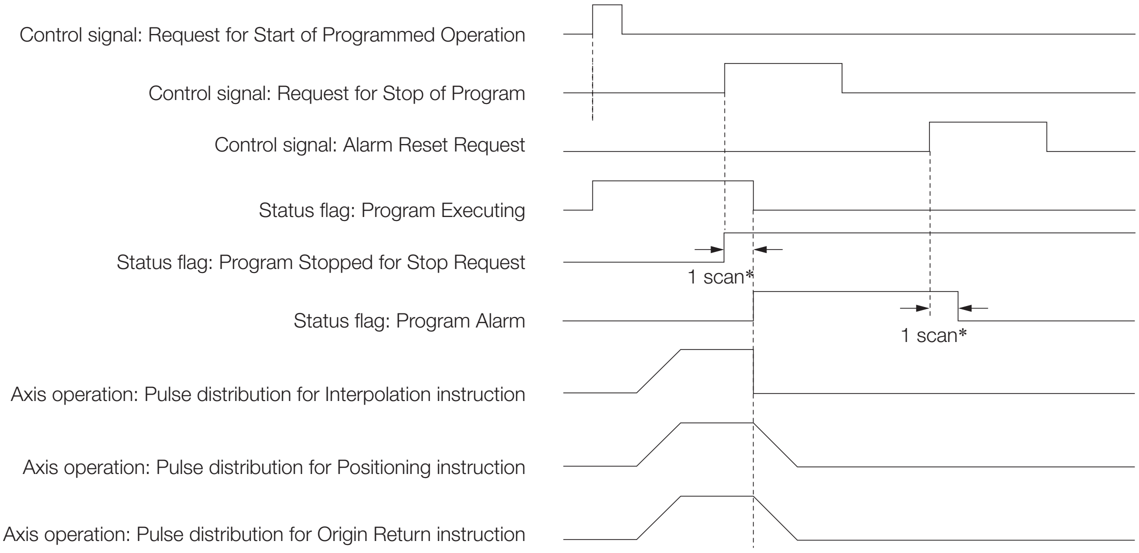


- Request for Pause



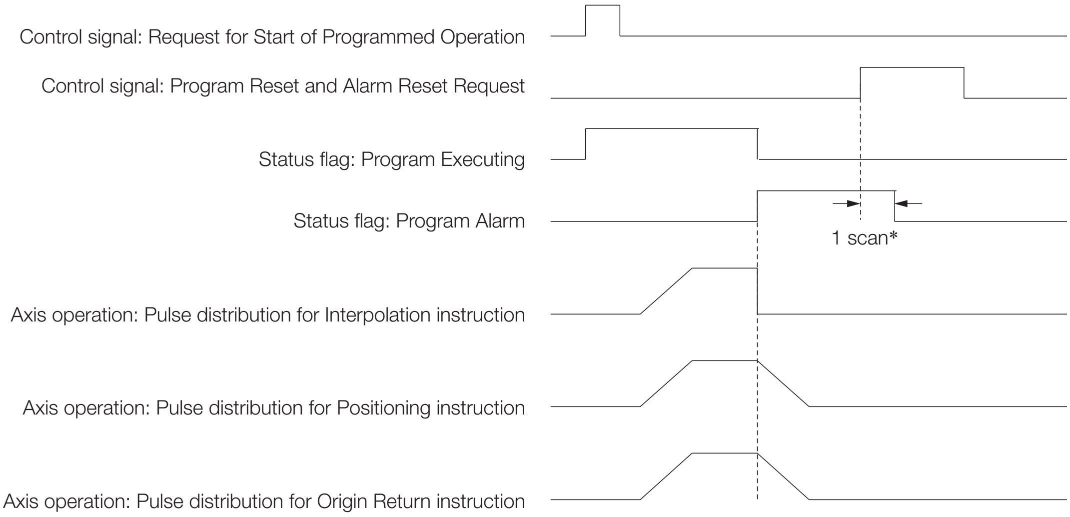
* Status flags related to control signal input are updated after one scan.

- Request for Stop



* Status flags related to control signal input are updated after one scan.

- If a Motion Program Alarm Occurs



* Status flags related to control signal input are updated after one scan.

Important

1. If the Request for Stop of Program control signal is turned ON while the axis is being controlled for a motion language instruction, an alarm will occur.
2. If the Request for Stop of Program control signal is turned ON while the axis is being controlled for an interpolation motion language instruction, the axes will stop immediately.
   To perform a deceleration stop, use the Request for Pause of Operation control signal.
3. The Request for Pause of Program control signal is not acknowledged while a ZRN (Zero Point Return) instruction is being executed.
   To stop the operation, use the Request for Stop of Program control signal.
4. If a motion program alarm occurs while an axis is in motion, the axis stops immediately.

◆ Interpolation Override

The interpolation override is used to change the output ratio of the axis travel speed reference for interpolation motion language instructions.

Set the override value to use when executing interpolation instructions (MVS, MCW, MCC, or SKP).

The interpolation override is valid only when bit E (Interpolation Override Setting) in the control signals is ON.

The setting range of the interpolation override is 0 to 32,767.

Unit: 1 = 0.01%

◆ System Work Numbers

When you call a motion program from a ladder program with the MSEE instruction, set the system work number to use to call the motion program. This system work number is valid only when bit D (System Work Number Setting) of the control signals is ON.

Setting range: 1 to 32

Important

When using MSEE instructions in ladder programs along with the M-EXECUTOR Function Module, do not specify the system work numbers that are for the M-EXECUTOR Function Module in the MSEE instructions in the ladder programs. If you specify one, a No System Work Available Error will occur.
System work numbers for the M-EXECUTOR Function Module: 0 to the setting of the number of program definitions

Information

You cannot set the system work numbers when you use the M-EXECUTOR Function Module. The system will use system work numbers that are the same as the definition numbers.

Using the Work Registers

The work registers for motion program are used differently depending on whether the motion program is called from a ladder program using an MSEE instruction, or the motion program is registered in the M-EXECUTOR program execution definitions.

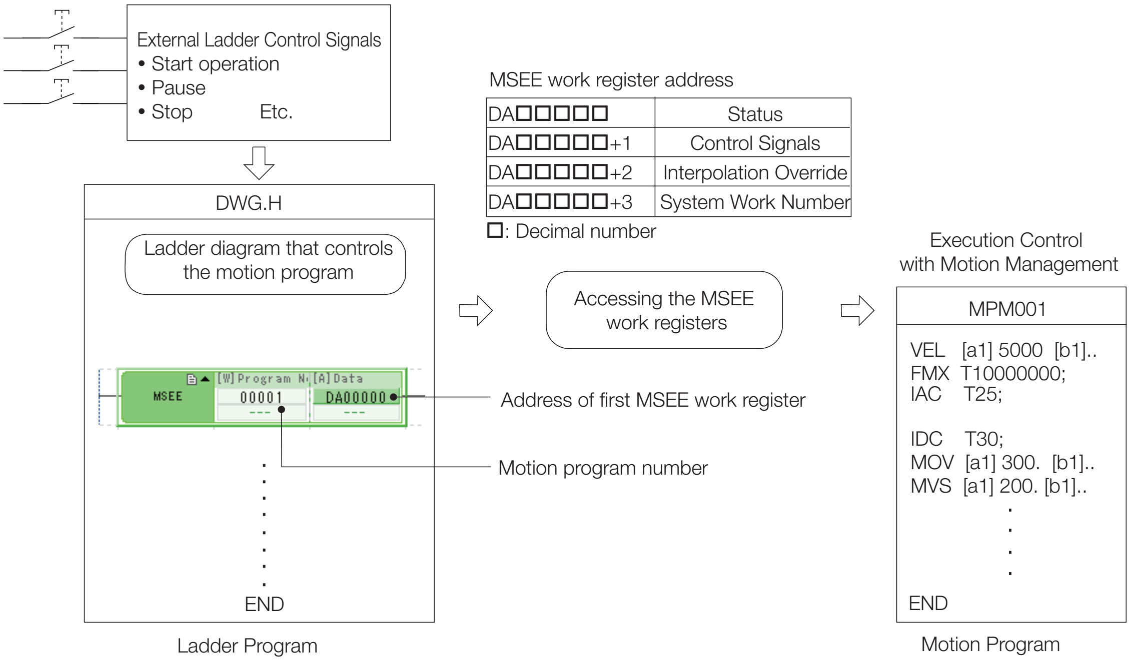
This section describes these two methods.

◆ When the Motion Program Is Called from the Ladder Program with an MSEE Instruction

When a motion program is called from the ladder program with an MSEE instruction, the motion program is controlled by either a sequence program or a ladder program.

To use this method, include the MSEE instruction in a ladder H drawing. In this case, the MSEE work registers are used to set and monitor the motion program.

The following figure shows a setting example.



MSEE work register address

DA□□□□□	Status
DA□□□□□+1	Control Signals
DA□□□□□+2	Interpolation Override
DA□□□□□+3	System Work Number

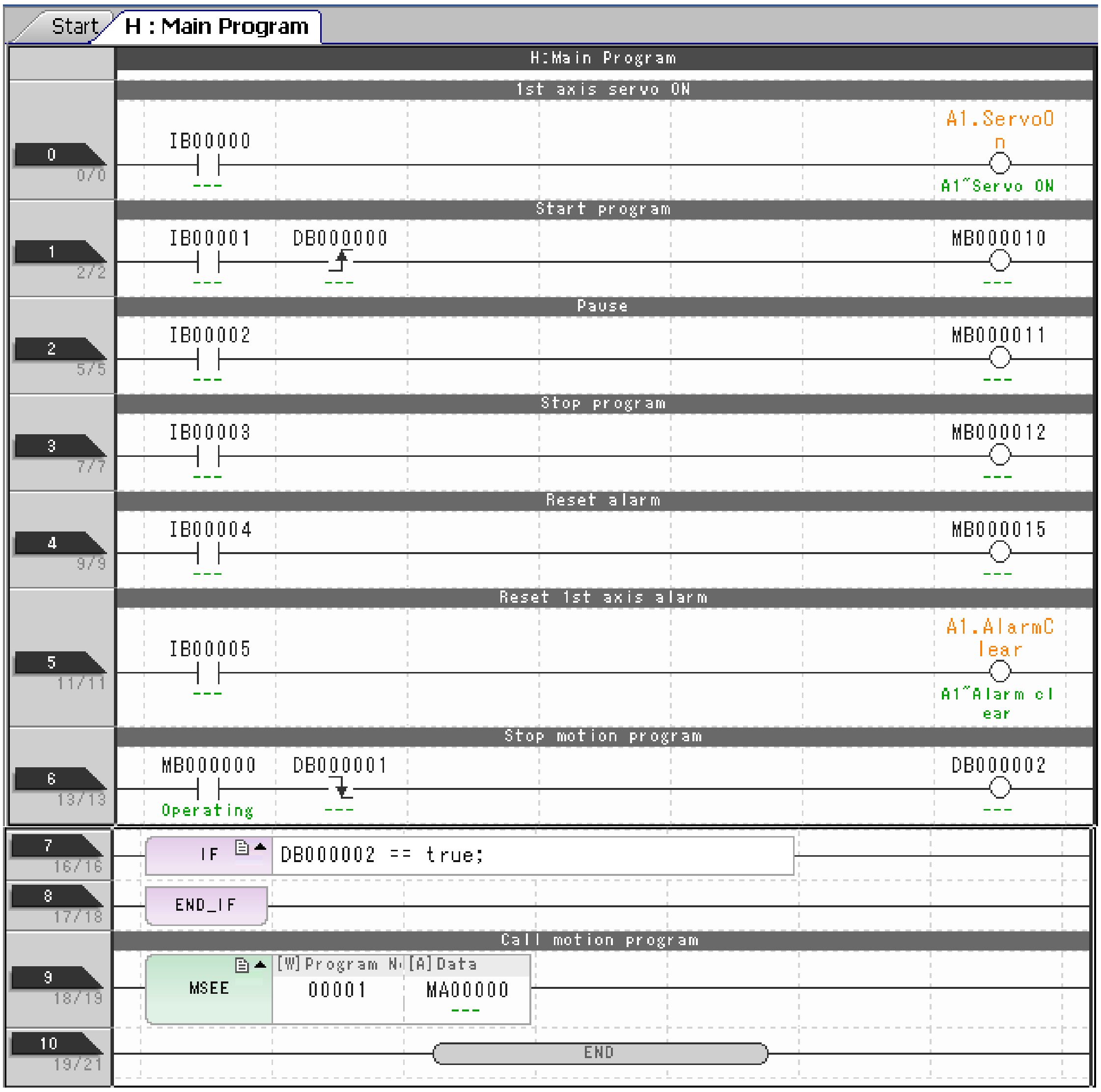
□: Decimal number

```
VEL   [a1] 5000  [b1]..
FMX  T10000000;
IAC    T25;

IDC    T30;
MOV  [a1] 300.  [b1]..
MVS  [a1] 200. [b1]..
```

The next page shows an example of a ladder program that controls the motion program.

■ Ladder Program Example



Monitoring the Execution Information on the Motion Program with S Registers

You can monitor execution information on the motion program with the S registers (SW03200 to SW05119 and SW08192 to SW09215).

The execution information is monitored differently, depending on whether the motion program is called from a ladder program with an MSEE instruction, or the motion program is registered in the M-EXECUTOR program execution definitions.

This section describes these two monitoring methods.

◆ When the Motion Program Is Called from the Ladder Program with an MSEE Instruction

When a motion program is called from the ladder program with an MSEE instruction, the monitoring method depends on the setting of bit D (System Work Number Setting) in the Motion Program Control Signals.

■ When Bit D (System Work Number Setting) in the Motion Program Control Signal Is ON

The execution information is reported in the Work n Program Information registers (SW03264 to SW05119 and SW08192 to SW09215).

For example, if the system work number is 1, you can monitor the execution information of the motion program with the Work 1 Program Information registers (SW03264 to SW03321).

■ When Bit D (System Work Number Setting) in the Motion Program Control Signal Is OFF

The system automatically determines the system work number to use. You can check the work numbers that are in use in the Active Program Numbers registers (SW03200 to SW03215).

For example, to monitor the MPM001 motion program and SW03202 is 001, that means the system number is 3. You can therefore monitor the execution information of the MPM001 motion program using the Work 3 Program Information registers (SW03380 to SW03437).

◆ When the Motion Program Is Registered in the M-EXECUTOR Program Execution Definitions:

When the motion program is registered in the M-EXECUTOR program execution definitions, the system work number will be the same as the definition number.

For example, if the motion program is registered with definition number 3, system work number 3 will be used. In this case, you can monitor the execution information of the motion program with the Work 3 Program Information registers (SW03380 to SW03437).

Refer to the following section for the register ranges for the motion program execution information.

■ Register Ranges for Motion Program Execution Information

SW03200	Active Program Numbers (the numbers of the currently executing main programs)	16W
SW03232	Program Execution Bit (ON if execution is in progress.)	32W
SW03264	Work 1 Program Information	58W
SW03322	Work 2 Program Information	58W
SW03380	Work 3 Program Information	58W
SW03438	Work 4 Program Information	58W
SW03496	Work 5 Program Information	58W
SW03554	Work 6 Program Information	58W
SW03612	Work 7 Program Information	58W
SW03670	Work 8 Program Information	58W
SW03728	Work 9 Program Information	58W
SW03786	Work 10 Program Information	58W
SW03844	Work 11 Program Information	58W
SW03902	Work 12 Program Information	58W
SW03960	Work 13 Program Information	58W
SW04018	Work 14 Program Information	58W
SW04076	Work 15 Program Information	58W
SW04134	Work 16 Program Information	58W
SW04192	Work 17 Program Information	58W
SW04250	Work 18 Program Information	58W
SW04308	Work 19 Program Information	58W
SW04366	Work 20 Program Information	58W
SW04424	Work 21 Program Information	58W
SW04482	Work 22 Program Information	58W
SW04540	Work 23 Program Information	58W
SW04598	Work 24 Program Information	58W
SW04656	Work 25 Program Information	58W
SW04714	Work 26 Program Information	58W
SW04772	Work 27 Program Information	58W
SW04830	Work 28 Program Information	58W
SW04888	Work 29 Program Information	58W
SW04946	Work 30 Program Information	58W
SW05004	Work 31 Program Information	58W
SW05062	Work 32 Program Information	58W

SW03200	Number of Program Using Work Number 1
SW03201	Number of Program Using Work Number 2
SW03202	Number of Program Using Work Number 3
SW03203	Number of Program Using Work Number 4
SW03204	Number of Program Using Work Number 5
SW03205	Number of Program Using Work Number 6
SW03206	Number of Program Using Work Number 7
SW03207	Number of Program Using Work Number 8
SW03208	Number of Program Using Work Number 9
SW03209	Number of Program Using Work Number 10
SW03210	Number of Program Using Work Number 11
SW03211	Number of Program Using Work Number 12
SW03212	Number of Program Using Work Number 13
SW03213	Number of Program Using Work Number 14
SW03214	Number of Program Using Work Number 15
SW03215	Number of Program Using Work Number 16
SW03216	Number of Program Using Work Number 17
SW03217	Number of Program Using Work Number 18
SW03218	Number of Program Using Work Number 19
SW03219	Number of Program Using Work Number 20
SW03220	Number of Program Using Work Number 21
SW03221	Number of Program Using Work Number 22
SW03222	Number of Program Using Work Number 23
SW03223	Number of Program Using Work Number 24
SW03224	Number of Program Using Work Number 25
SW03225	Number of Program Using Work Number 26
SW03226	Number of Program Using Work Number 27
SW03227	Number of Program Using Work Number 28
SW03228	Number of Program Using Work Number 29
SW03229	Number of Program Using Work Number 30
SW03230	Number of Program Using Work Number 31
SW03231	Number of Program Using Work Number 32

	Program Execution Bits
SW03232	MP□016 (Bit F) to MP□001 (Bit 0)
SW03233	MP□032 (Bit F) to MP□017 (Bit 0)
SW03234	MP□048 (Bit F) to MP□033 (Bit 0)
SW03235	MP□064 (Bit F) to MP□049 (Bit 0)
SW03236	MP□080 (Bit F) to MP□065 (Bit 0)
SW03237	MP□096 (Bit F) to MP□081 (Bit 0)
SW03238	MP□112 (Bit F) to MP□097 (Bit 0)
SW03239	MP□128 (Bit F) to MP□113 (Bit 0)
SW03240	MP□144 (Bit F) to MP□129 (Bit 0)
SW03241	MP□160 (Bit F) to MP□145 (Bit 0)
SW03242	MP□176 (Bit F) to MP□161 (Bit 0)
SW03243	MP□192 (Bit F) to MP□177 (Bit 0)
SW03244	MP□208 (Bit F) to MP□193 (Bit 0)
SW03245	MP□224 (Bit F) to MP□209 (Bit 0)
SW03246	MP□240 (Bit F) to MP□225 (Bit 0)
SW03247	MP□256 (Bit F) to MP□241 (Bit 0)
SW03248	MP□272 (Bit F) to MP□257 (Bit 0)
SW03249	MP□288 (Bit F) to MP□273 (Bit 0)
SW03250	MP□304 (Bit F) to MP□289 (Bit 0)
SW03251	MP□320 (Bit F) to MP□305 (Bit 0)
SW03252	MP□336 (Bit F) to MP□321 (Bit 0)
SW03253	MP□352 (Bit F) to MP□337 (Bit 0)
SW03254	MP□368 (Bit F) to MP□353 (Bit 0)
SW03255	MP□384 (Bit F) to MP□369 (Bit 0)
SW03256	MP□400 (Bit F) to MP□385 (Bit 0)
SW03257	MP□416 (Bit F) to MP□401 (Bit 0)
SW03258	MP□432 (Bit F) to MP□417 (Bit 0)
SW03259	MP□448 (Bit F) to MP□433 (Bit 0)
SW03260	MP□464 (Bit F) to MP□449 (Bit 0)
SW03261	MP□480 (Bit F) to MP□465 (Bit 0)
SW03262	MP□496 (Bit F) to MP□481 (Bit 0)
SW03263	MP□512 (Bit F) to MP□497 (Bit 0)

Note: □ is M or S.

■ Contents of Work n Program Information

Work n Program Information

+0	Program Status	
+1	Program Control Signals	
+2	Parallel Fork 0 Information	3W
+5	Parallel Fork 1 Information	3W
+8	Parallel Fork 2 Information	3W
+11	Parallel Fork 3 Information	3W
+14	Parallel Fork 4 Information	3W
+17	Parallel Fork 5 Information	3W
+20	Parallel Fork 6 Information	3W
+23	Parallel Fork 7 Information	3W
+26	Logical Axis 1 Program Current Position	2W
+28	Logical Axis 2 Program Current Position	2W
+30	Logical Axis 3 Program Current Position	2W
+32	Logical Axis 4 Program Current Position	2W
+34	Logical Axis 5 Program Current Position	2W
+36	Logical Axis 6 Program Current Position	2W
+38	Logical Axis 7 Program Current Position	2W
+40	Logical Axis 8 Program Current Position	2W
+42	Logical Axis 9 Program Current Position	2W
+44	Logical Axis 10 Program Current Position	2W
+46	Logical Axis 11 Program Current Position	2W
+48	Logical Axis 12 Program Current Position	2W
+50	Logical Axis 13 Program Current Position	2W
+52	Logical Axis 14 Program Current Position	2W
+54	Logical Axis 15 Program Current Position	2W
+56	Logical Axis 16 Program Current Position	2W

Active Program Numbers
Current Block Number
Alarm Code

7.1.3 Sequence Programs

A sequence program is written in a text-based motion language.

There are two types of sequence programs.

Classification	Designation Method	Features	Number of Programs
Main programs	SPM□□□ (□□□ = 1 to 512)	Main programs are called from the M-EXECUTOR program execution definitions.	You can create up to 512 motion programs, including the following programs: • Motion main programs • Motion subprograms • Sequence main programs • Sequence subprograms
Subprograms	SPS□□□ (□□□ = 1 to 512)	Subprograms are called from a main program.	

Important

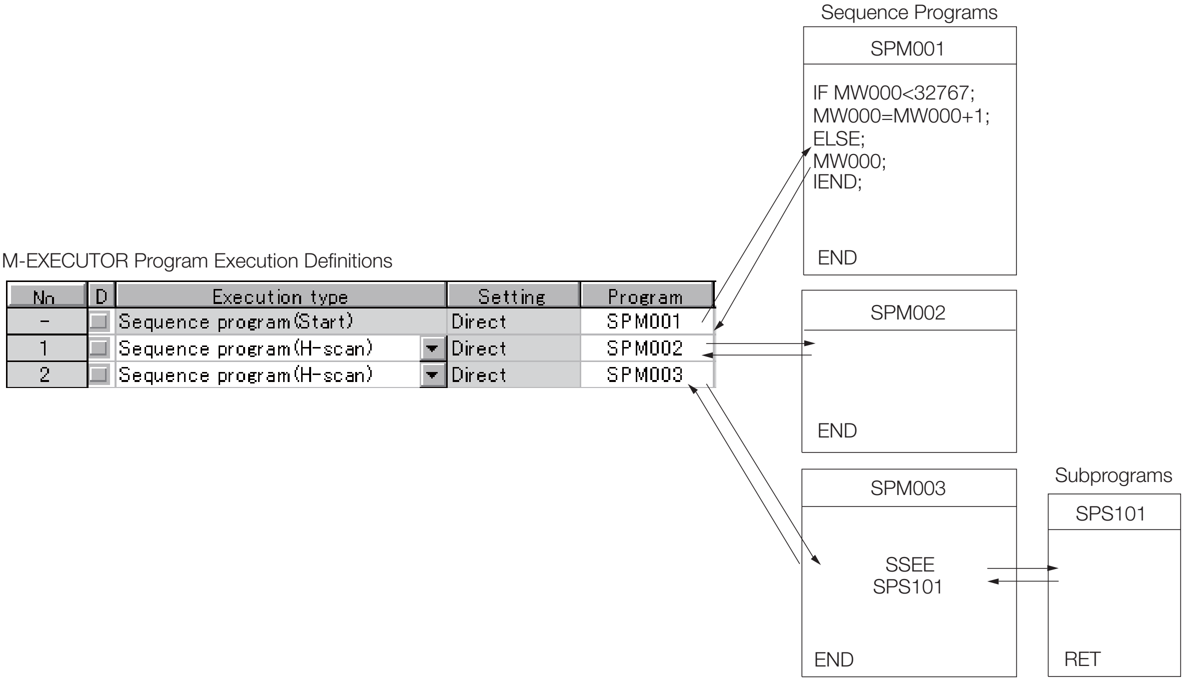
The same numbers are used to manage the sequence programs and motion programs.
Use a unique number for each program.
- Motion program numbers are given in the form MPM□□□ or MPS□□□.
- Sequence program numbers are given in the form SPM□□□ or SPS□□□.

Sequence Program Execution

A sequence program is executed by registering it in the M-EXECUTOR program execution definitions.

The sequence programs are executed in ascending order.

The following figure shows an execution example.



M-EXECUTOR Program Execution Definitions

No	D	Execution type	Setting	Program
-	☐	Sequence program(Start)	Direct	SPM001
1	☐	Sequence program(H-scan)	Direct	SPM002
2	☐	Sequence program(H-scan)	Direct	SPM003

Sequence Programs

SPM001

```
IF MW000<32767;
MW000=MW000+1;
ELSE;
MW000;
IEND;

END
```

SPM002

```
END
```

SPM003

```
SSEE
SPS101

END
```

Subprograms

SPS101

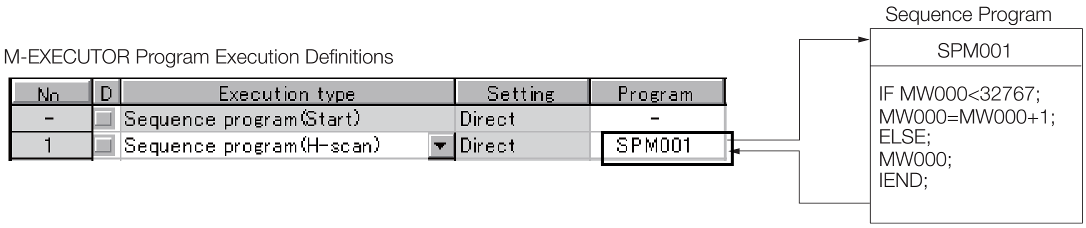
```
RET
```

If the execution type is set to an H-scan sequence program or L-scan sequence program, then the program will be executed as soon as the definition is saved. If the execution type is set to a startup sequence program, then the program will be executed the next time when the power supply is turned ON.

Specifying Sequence Programs

Sequence programs must be specified directly. Indirect designations cannot be used.

Specify the program number of the sequence program to execute (SPM□□□).



M-EXECUTOR Program Execution Definitions

No	D	Execution type	Setting	Program
-	☐	Sequence program(Start)	Direct	-
1	☐	Sequence program(H-scan)	Direct	SPM001

Sequence Program

```
SPM001

IF MW000<32767;
MW000=MW000+1;
ELSE;
MW000;
IEND;
```

Work Registers

Work registers are used to monitor sequence programs.

The work registers have Status Flags inside the M-EXECUTOR control registers, in the same way as motion programs that are registered in the M-EXECUTOR program execution definitions.

◆ Sequence Program Status Flags

The Sequence Program Status Flags give the execution condition of the sequence program.

The following table describes the meanings of the Status Flags.

Bit No.	Status
0	Program is being executed.
1	Reserved.
2	Reserved.
3	Reserved.
4	Reserved.
5	Reserved.
6	Reserved.
7	Reserved.
8	There is a program alarm.
9	Execution is stopped at a breakpoint.
A	Reserved.
B	The program is in Debug Mode (EWS debugging).
C	Program Type, 1: Sequence program
D	Start Request History
E	Reserved.
F	Reserved.

Term

Sequence Program Alarms

If an error is detected when a sequence subprogram is called with an SSEE instruction, bit 8 (Program Alarm) turns ON. When the error is removed, this bit turns OFF.

The following errors can occur.

- The called program is not registered.
- The called program is not a sequence program.
- The called program is not a subprogram (a main program was called).
- Called Program Number Limit Exceeded Error
- Too Many Nesting Levels Error

7.1.4 The M-EXECUTOR Function Module

This section describes the functionality of the M-EXECUTOR Motion Program Executor.

Term The M-EXECUTOR Function Module is a software module that executes motion and sequence programs.

Introduction

The M-EXECUTOR Function Module provides the following merits:

- Motion programs can be executed without using a ladder program.
  Motion programs can be executed without placing MSEE instructions in the ladder programs.

Information It is still possible to use MSEE instructions in the ladder programs.

- Motion programs can be controlled without using the ladder programs.
  Motion programs can be controlled directly from a host PLC.
- Sequence control can be written in motion language.
  A sequence program can be used in place of a ladder program.
  Refer to the following manual for instructions that can be used in sequence programs.
  Σ-7-Series Σ-7C SERVOPACK Motion Control User's Manual (Manual No.: SIEP S800002 03)

Information The execution of a sequence program is completed in one scan.
Sequence programs are written using the same text-based language as motion programs.

Application Methods

Refer to the following section for information on how to use the M-EXECUTOR Function Module.

12.9 The M-EXECUTOR Function Module on page 12-68

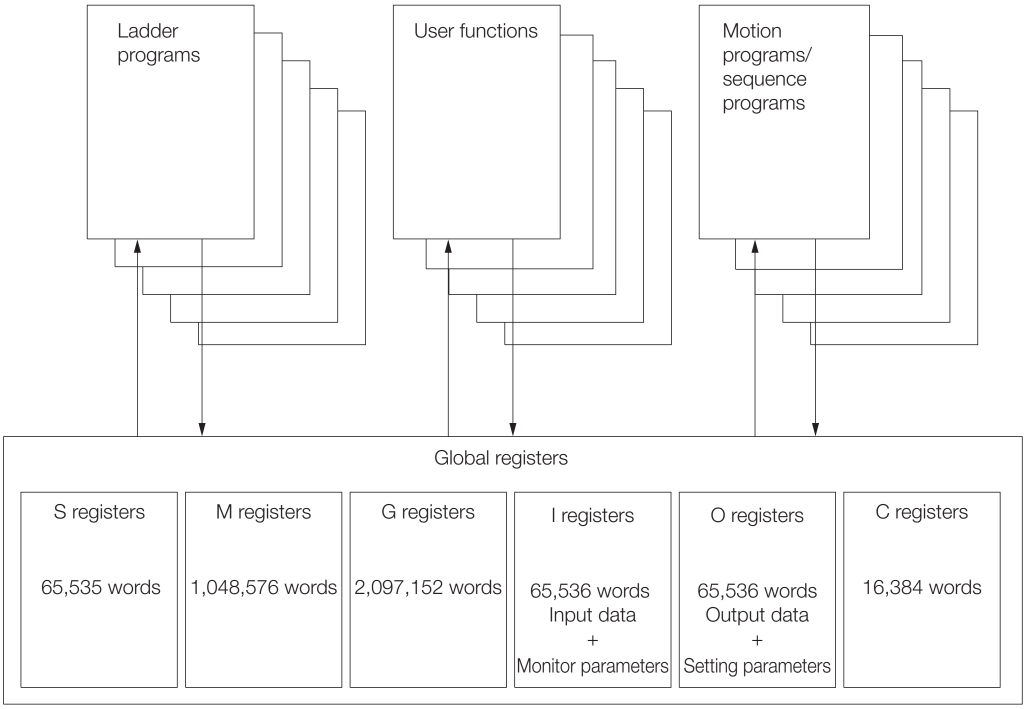
7.1.5 Registers

Registers are areas that store data within the SERVOPACK. Variables are registers with labels (variable names).

There are two kinds of registers: global registers that are shared between all programs, and local registers that are used only by a specific program.

Global Registers

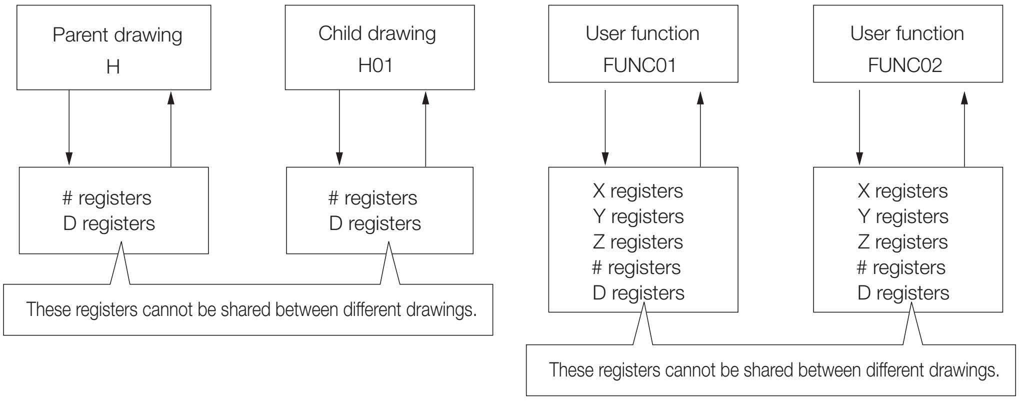
Global registers are shared by ladder programs, user functions, motion programs, and sequence programs. Memory space for global registers is reserved by the system for each register type.



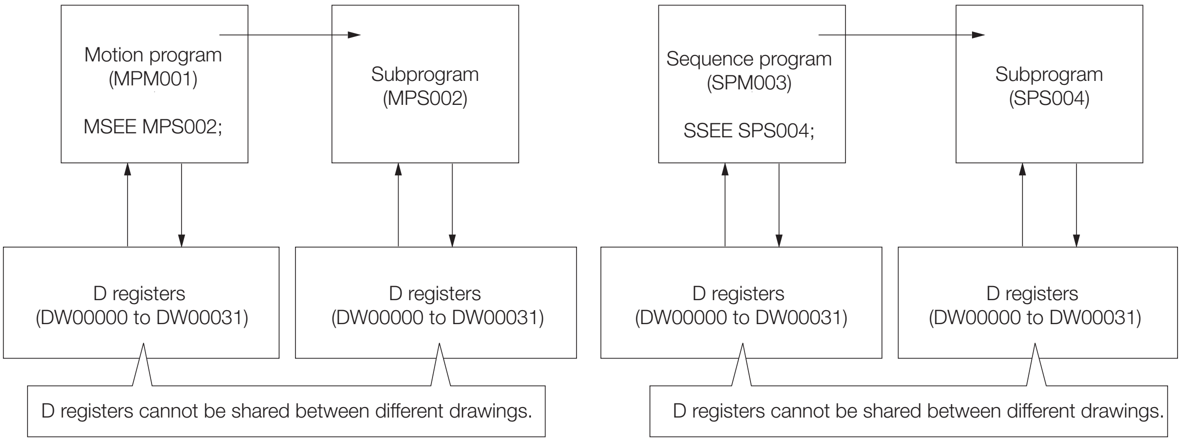
Local Registers

Local registers can be used within each specific drawing. These registers cannot be shared by other drawings. Local registers are stored in the program memory for each drawing.

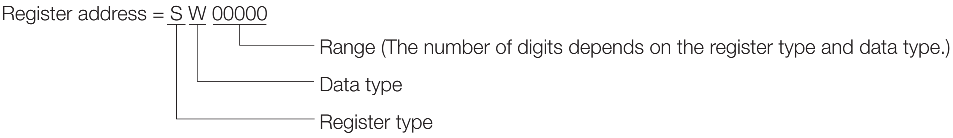
Ladder Program Conceptual Diagram



Motion Program Conceptual Diagram



Structure of Register Addresses



Information You can also use index registers or array registers as variables to address specific registers. Refer to the following sections for details.

☞ *Index Registers (i, j)* on page 7-35

☞ *Array Registers ([ ])* on page 7-37

Register Types

This section describes global and local registers.

◆ Global Registers

Global registers are shared by ladder programs, user functions, motion programs, and sequence programs. In other words, the operation results of a ladder program can be used by other user functions, motion programs, or sequence programs.

Type	Name	Designation Methods	Usable Range	Description
S	System registers (S registers)	SBnnnnnh, SWnnnnn, SLnnnnn, SQnnnnn, SFnnnnn, SDnnnnn, SAnnnnn	SW00000 to SW65534	These registers are prepared by the system. They report the status of the SERVOPACK and other information. The system clears the registers from SW00000 to SW00049 to 0 at startup.
M	Data registers (M registers)	MBnnnnnnnh, MWnnnnnnn, MLnnnnnnn, MQnnnnnnn, MFnnnnnnn, MDnnnnnnn, MAnnnnnnn	MW0000000 to MW1048575	These registers are used as interfaces between programs.

Continued on next page.

Continued from previous page.

Type	Name	Designation Methods	Usable Range	Description
G	G registers	GBnnnnnnnh, GWnnnnnnn, GLnnnnnnn, GQnnnnnnn, GFnnnnnnn, GDnnnnnnn, GAnnnnnnn,	GW0000000 to GW2097151	These registers are used as interfaces between programs.
I	Input registers (I registers)	IBhhhhhh, IWhhhhh, ILhhhhh, IQhhhhh, IFhhhhh, IDhhhhh, IAhhhhh,	IW00000 to IW07FFF, IW10000 to IW17FFF	These registers are used for input data.
			IW08000 to IW0FFFF	These registers store the motion monitor parameters. These registers are used for motion control.
			IW20000 to IW21FFF	These registers are used for CPU interface input data.
O	Output registers (O registers)	OBhhhhhh, OWhhhhh, OLhhhhh, OQhhhhh, OFhhhhh, ODhhhhh, OAhhhhh,	OW00000 to OW07FFF, OW10000 to OW17FFF	These registers are used for output data.
			IW08000 to IW0FFFF	These registers store the motion setting parameters. These registers are used for motion control.
			OW20000 to OW21FFF	These registers are used for CPU interface output data.
C	Constant registers (C registers)	CBnnnnnh, CWnnnnn, CLnnnnn, CQnnnnn, CFnnnnn, CDnnnnn, CAnnnnn	CW00000 to CW16383	These registers can be read in programs but they cannot be written. The values are set from the MPE720.

Note: n: decimal digit, h: hexadecimal digit

◆ Local Registers

Local registers are valid within only one specific program. The local registers in other programs cannot be accessed.

You specify the usable range from the MPE720.

Type	Name	Designation Methods	Description	Features
#	# registers	#Bnnnnnh, #Wnnnnn, #Lnnnnn, #Qnnnnn, #Fnnnnn, #Dnnnnn, #Annnnn	These registers can be read in programs but they cannot be written. The values are set from the MPE720.	Program-specific
D	D registers	DBnnnnnh, DWnnnnn, DLnnnnn, DQnnnnn, DFnnnnn, DDnnnnn, DAnnnnn	These registers can be used for general purposes within a program. By default, 32 words are reserved for each program. The default value after restart depends on the setting of the **D Register Clear when Start** option. Refer to the following section for details. ☞ • *Setting the **D Register Clear When Start** Option* on page 7-31	Program-specific
X	Function input registers	XBnnnnnh, XWnnnnn, XLnnnnn, XQnnnnn, XFnnnnn, XDnnnnn	These registers are used for inputs to functions. • Bit inputs: XB000000 to XB00000F • Integer inputs: XW00001 to XW00016 • Double-length integers: XL00001 to XL00015 • Quadruple-length integers: XQ00001 to XQ00013 • Real numbers: XF00001 to XF00015 • Double-precision real numbers: XD00001 to XD00013	Function-specific
Y	Function output registers	YBnnnnnh, YWnnnnn, YLnnnnn, YQnnnnn, YFnnnnn, YDnnnnn	These registers are used for outputs from functions. • Bit outputs: YB000000 to YB00000F • Integer outputs: YW00001 to YW00016 • Double-length integers: YL00001 to YL00015 • Quadruple-length integers: YQ00001 to YQ00013 • Real numbers: YF00001 to YF00015 • Double-precision real numbers: YD00001 to YD00013	
Z	Function internal registers	ZBnnnnnh, ZWnnnnn, ZLnnnnn, ZQnnnnn, ZFnnnnn, ZDnnnnn	These are internal registers that are unique within each function. You can use them for internal processing in functions. • Bits: ZB000000 to ZB00063F • Integers: ZW00000 to ZW00063 • Double-length integers: ZL00000 to ZL00062 • Quadruple-length integers: ZQ00000 to ZQ00060 • Real numbers: ZF00000 to ZF00062 • Double-precision real numbers: ZD00000 to ZD00060	
A	Function external registers	ABnnnnnh, AWnnnnn, ALnnnnn, AQnnnnn, AFnnnnn, ADnnnnn	These are external registers that use the address input value as the base address. When the address input value of an M or D register is provided by the source of the function call, then the registers of the source of the function call can be accessed from inside the function by using that address as the base.	

Note: n: decimal digit, h: hexadecimal digit

◆ Local Registers within a User Function

In addition to # registers and D registers, there are local registers that can be used only within individual user functions.

Type	Name	Designation Methods	Description
X	Function input registers	XBnnnnnh, XWnnnnn, XLnnnnn, XQnnnnn, XFnnnnn, XDnnnnn	These registers are used for inputs to functions. • Bit inputs: XB000000 to XB00000F • Integer inputs: XW00001 to XW00016 • Double-length integers: XL00001 to XL00015 • Quadruple-length integers: XQ00001 to XQ00013 • Real numbers: XF00001 to XF00015 • Double-precision real numbers: XD00001 to XD00013
Y	Function output registers	YBnnnnnh, YWnnnnn, YLnnnnn, YQnnnnn, YFnnnnn, YDnnnnn	These registers are used for outputs from functions. • Bit outputs: YB000000 to YB00000F • Integer outputs: YW00001 to YW00016 • Double-length integers: YL00001 to YL00015 • Quadruple-length integers: YQ00001 to YQ00013 • Real numbers: YF00001 to YF00015 • Double-precision real numbers: YD00001 to YD00013
Z	Function internal registers	ZBnnnnnh, ZWnnnnn, ZLnnnnn, ZQnnnnn, ZFnnnnn, ZDnnnnn	These are internal registers that are unique within each function. You can use them for internal processing in functions.
A	Function external registers	ABnnnnnh, AWnnnnn, ALnnnnn, AQnnnnn, AFnnnnn, ADnnnnn	These are external registers that use the address input value as the base address. When the address input value of an M or D register is provided by the source of the function call, then the registers of the source of the function call can be accessed from inside the function by using that address as the base.

Note: n: decimal digit, h: hexadecimal digit

Important

User functions can be called from any programs, any number of times.

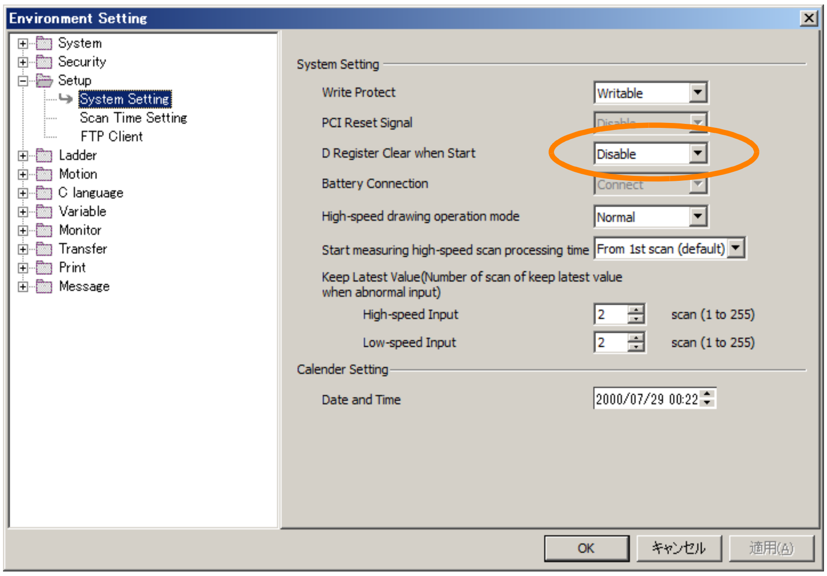
■ Precautions When Using Local Registers within a User Function

When you call a user function, consider what values could be in the local registers, and perform initialization as needed.

Name	Precautions
X registers (function input registers)	If input values are not set, the values will be uncertain. Do not use X registers that are outside of the range that is specified in the input definitions.
Y registers (function output registers)	If output values are not set, the values will be uncertain. Always set the values of the range of Y registers that is specified in the output definitions.
Z registers (function internal registers)	When the function is called, the previous settings will be lost and the values will be uncertain. These registers are not appropriate for instructions if the previous value must be retained. Use them only after initializing them within the function.
# registers	These are constant registers. Their values cannot be changed.
D registers	When the function is called, the previous settings are preserved. If a previous value is not necessary, initialize the value, or use a Z register instead. D registers retain the data until the power is turned OFF. The default value after restart depends on the setting of the **D Register Clear when Start** option. Refer to the following section for details. ☞ • *Setting the* ***D Register Clear When Start*** *Option* on page 7-31

- Setting the **D Register Clear When Start** Option

1. Select ***File*** – ***Environment Setting*** from the menu bar of the MPE720 Window.
2. Select **Setup** – **System Setting.**
3. Select **Enable** or **Disable** for the **D Register Clear when Start** Box.
   Disable: The initial values will be uncertain.
   Enable: The initial values will be 0.



System Setting
Write Protect: Writable
PCI Reset Signal: Disable
D Register Clear when Start: Disable
Battery Connection: Connect
High-speed drawing operation mode: Normal
Start measuring high-speed scan processing time: From 1st scan (default)
Keep Latest Value(Number of scan of keep latest value when abnormal input)
High-speed Input: 2 scan (1 to 255)
Low-speed Input: 2 scan (1 to 255)
Calender Setting
Date and Time: 2000/07/29 00:22

Data Types

There are various data types that you can use depending on the purpose of the application: bit, integer, double-length integer, quadruple-length integer, real number, double-precision real number, and address.

Symbol	Data Types	Range of Values	Data Size	Remarks
B	Bit	1 (ON) or 0 (OFF)	–	Used in relay circuits and to determine ON/OFF status.
W	Integer	-32,768 to 32,767 (8000h to 7FFFh)	1 word	Used for numeric operations. The values in parentheses on the left are for logical operations.
L	Double-length integer	-2,147,483,648 to 2,147,483,647 (80000000h to 7FFFFFFFh)	2 words	Used for numeric operations. The values in parentheses on the left are for logical operations.
Q	Quadruple-length integer[1]	-9,223,372,036,854,775,808 to 9,223,372,036,854,775,807 (8000000000000000h to 7FFFFFFFFFFFFFFFh)	4 words	Used for numeric operations. The values in parentheses on the left are for logical operations.
F	Real number	± (1.175E-38 to 3.402E+38) or 0	2 words	Used for advanced numeric operations.[2]
D	Double-precision real number[1]	±(2.225E-308 to 1.798E+308) or 0	4 words	Used for advanced numeric operations.[2]
A	Address	0 to 2,097,152	–	Used only as pointers for addressing.

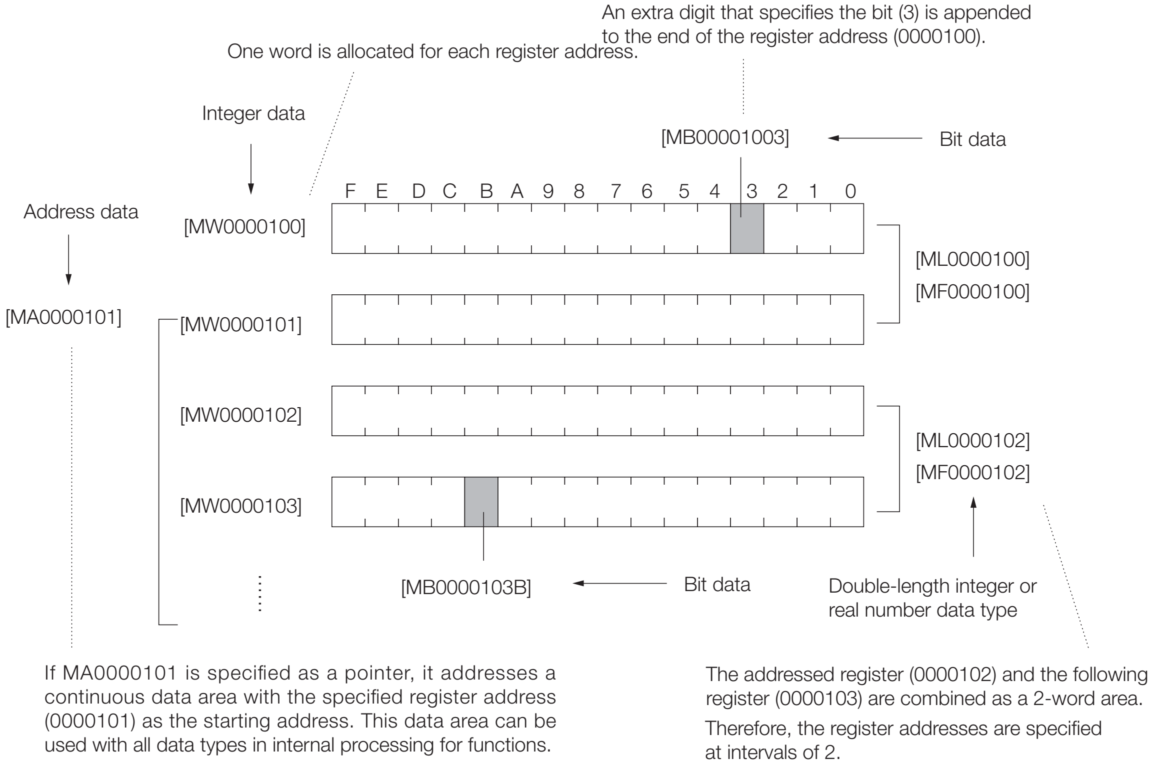
[1] These data types cannot be used for indirect designation of motion programs.

[2] Conforms to IEEE754 standards.

Important

The SERVOPACK does not have separate registers for each data type. As shown in the following figure, the same address will access the same register even if the data type is different.
For example, MB00001003, a bit address, and the MW0000100, an integer address, have different data types, but they both access the same register, MW0000100.

Data Types and Register Designations



Term

Pointer Designation

When an address is passed to a function as a parameter, this is referred to as pointer designation.

When pointer designation is used, the continuous data area starting from the address of the specified register number can be used in internal processing for functions with all data types.

◆ Precautions for Operations Using Different Data Types

If you perform an operation using different data types, be aware that the results will be different depending on the data type of the storage register, as described below.

- Storing Real Number Data in an Integer Register

  MW0000100 = MF0000200; the real number is stored after it is converted to an integer.
  (00001) (1.234)

  Note: There may be rounding error due to storing a real number in an integer register.
  Whether numbers are rounded or truncated when converting a real number to an integer can be set in the properties of the drawing.
  ☞ ■ *Setting for Real Number Casting* on page 7-34

  MW0000100 = MF0000200 + MF0000202;
  (0124) (123.48) (0.02) The result of the operation may be different depending on the value of the variable.
  (0123) (123.49) (0.01)

- Storing Real Number Data in a Double-Length Integer Register

  ML0000100 = MF0000200; the real number is stored after it is converted to an integer.
  (65432) (65432.1)

- Storing Double-Length Integer Data in an Integer Register

  MW0000100 = ML0000200; the lower 16 bits of the double-length integer are stored without change.
  (-00001) (65535)

- Storing Integer Data in a Double-Length Integer Register

  ML0000100 = MW0000200; the integer is stored after it is converted to double-length integer data.
  (0001234) (1234)

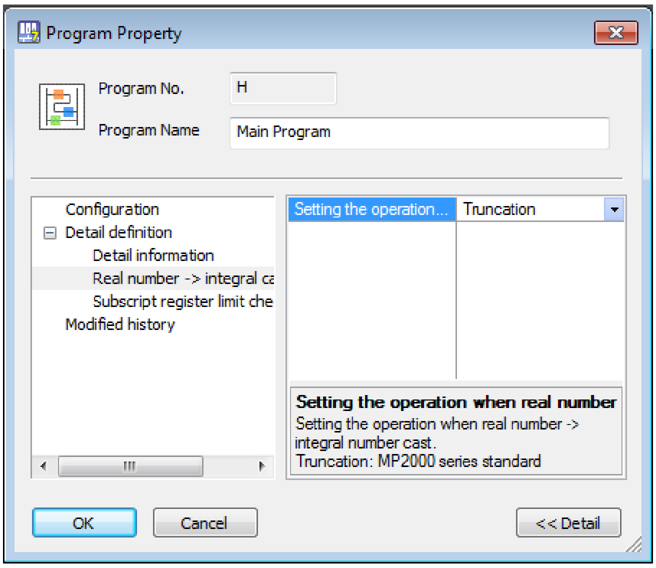
■ Setting for Real Number Casting

The casting method (truncating or rounding) can be set in **Detail information** of the Program Property Dialog Box.
The method to use for real number casting is set for each drawing.

Use the following procedure to display the Program Property Dialog Box.

1. In the Ladder Pane, select the ladder program for which to view the properties.

2. Right-click the selected program and select ***Property*** from the pop-up menu.
   The Program Property Dialog Box will be displayed.



Program No. H

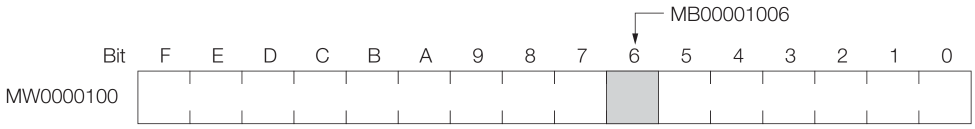
Program Name Main Program

Setting the operation... Truncation

Setting the operation when real number
Setting the operation when real number -> integral number cast.
Truncation: MP2000 series standard

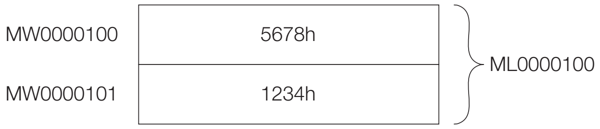
Information The data is little endian, as shown in the following example.

- MB00001006

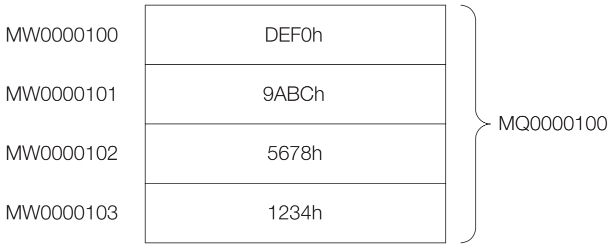


- MW0000100 = 1234h

- ML0000100 = 12345678h



- MQ0000100 = 123456789ABCDEF0h



Index Registers (i, j)

There are two special registers, i and j, that are used to modify relay and register addresses. The functions of i and j are identical. They are used to handle register addresses in registers.

The indices i and j can be expressed in decimal when specified as variables.

We will describe this with examples for each register data type.

■ Attaching an Index to a Bit Register

Using an index is the same as adding the value of i or j to the register address.

For example, if i = 2, MB00000000i is the same as MB00000002.

i = 2;

Equivalent

DB000000 = MB00000000i; ⟷ DB000000 = MB00000002;

■ Attaching an Index to an Integer Register

Using an index is the same as adding the value of i or j to the register address.

For example, if j = 30, MW0000001j is the same as MW0000031.

j = 30;

Equivalent

DW00000 = MW0000001j; ⟷ DW00000 = MW0000031;

■ Attaching an Index to a Double-Length Integer or a Real Number Register

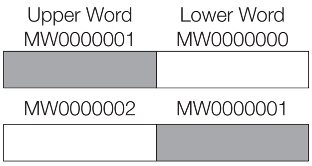
Using an index is the same as adding the value of i or j to the register address.

For example, if j = 1, ML0000000j is the same as ML0000001. Similarly, if j = 1, MF0000000j is the same as MF0000001.

Double-Length Integer

If j = 0, ML0000000j is ML0000000.

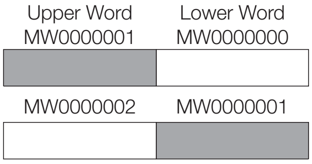
If j = 1, ML0000000j is ML0000001.



Real Number

If j = 0, MF0000000j is MF0000000.

If j = 1, MF0000000j is MF0000001.



Important Double-length integers and real numbers use a region that is 2 words in size. For example, when using ML0000000j with both j = 0 and j = 1, the one-word area of MW0000001 will overlap. Be careful of overlapping areas when indexing double-length integer or real number register addresses.

■ Attaching an Index to a Quadruple-Length Integer or a Double-Precision Real Number Register

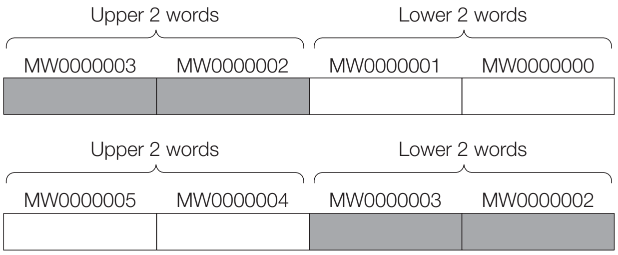
Using an index is the same as adding the value of i or j to the register address.

For example, if j = 2, MQ0000000j is the same as MQ0000002. Similarly, if j = 2, MD0000000j is the same as MD0000002.

Quadruple-Length Integer

If j = 0, MQ0000000j is MQ0000000.

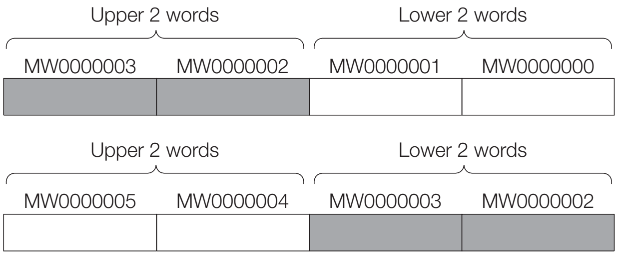
If j = 2, MQ0000000j is MQ0000002.



Double-Precision Real Number

If j = 0, MF0000000j is MD0000000.

If j = 2, MD0000000j is MD0000002.



Important Quadruple-length integers and double-precision real numbers use a region that is 4 words in size. For example, when using MQ0000000j with both j = 0 and j = 2, the two-word area of MW0000002 and MW0000003 will overlap. Be careful of overlapping areas when indexing quadruple-length integer or double-precision real number register addresses.

Array Registers ([ ])

Array registers are used to modify register addresses.

They are used to handle register addresses as variables.

As with indices, an offset can be added to the register address.

◆ Attaching an Array Register to a Bit Register

Using an array register is the same as adding the value of the array register to the register address.

For example, if DW00000 = 2, MB00000000[DW00000] is the same as MB00000002.

```
DW00000 = 2;
                                    Equivalent
DB000020 = MB00000000[DW00000];  <------------>  DB000020 = MB00000002;
```

◆ Attaching an Array Register to a Register Other Than a Bit Register

Using an array register is the same as adding the word size of the data type of the array register times the value of the array register to the register address.

For example, if DW00000 = 30, ML0000002[DW00000] is the same as ML0000062.

DL00002 = ML00000 (30×2 + 2) = ML0000062

```
DW00000 = 30;
                                    Equivalent
DL00002 = ML0000002[DW00000];  <------------>  DL00002 = ML0000062;
```

◆ Format

This section describes the formats of array registers.

```
MOV[A1]ML00000[MW00100];
          ①        ②
```

Description	Use	Usable Registers
①	Array name	All registers with any data type (excluding # and C registers)
②	Array elements	• All registers with integer and double-length integer data types (excluding # and C registers) • Constants • Index registers

◆ Programming Example

In the following example, an array register is used to calculate the total amount of 50 registers from ML0000100 to ML0000198. That amount is then stored in ML0000200.

```
ML0000200 = 0;
DW00000 = 0;
WHILE DW00000 < 50;
  ML0000200 = ML0000200 + ML0000100[DW00000];
  DW00000 = DW00000 + 1;
WEND;

END;
```

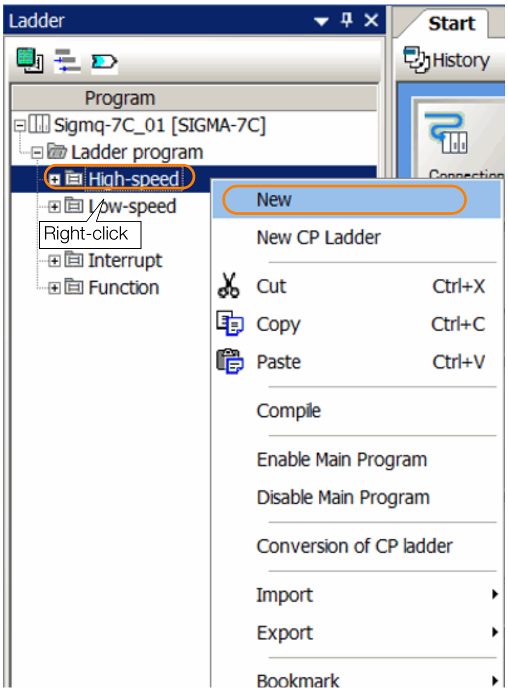
7.2 Creating Ladder Programs

Use the following procedure to create a ladder program.

Information The following example shows how to create a high-speed program, but low-speed and startup programs can be created in essentially the same way.

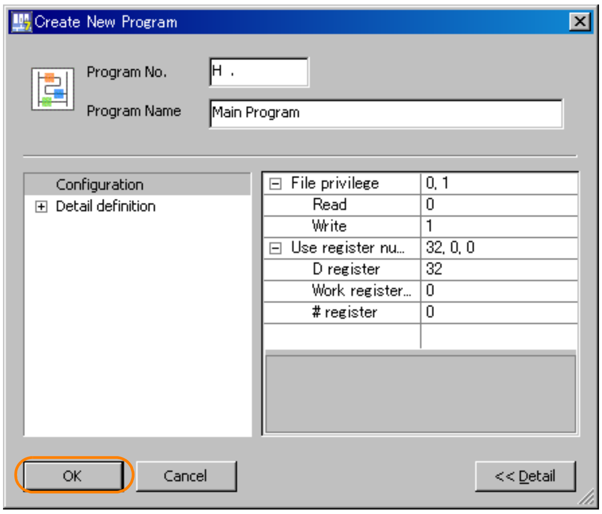
1. Select ***Programming*** – ***Ladder program*** from the Launcher.
The Ladder Pane will be displayed.

2. Right-click **High-speed** under **Ladder program,** and select ***New.***



The Create New Program Dialog Box will be displayed.

3. Click the **OK** Button.



Program No. H .
Program Name Main Program

File privilege	0, 1
Read	0
Write	1
Use register nu...	32, 0, 0
D register	32
Work register...	0
# register	0

The Edit Ladder Program Tab Page will be displayed.

4. Enter the ladder program.
Ladder programs are entered by inserting rungs, then instructions, and finally parameters for the instructions.
Refer to the following section for details.
☞ *Ladder Program Creation Example* on page 7-39

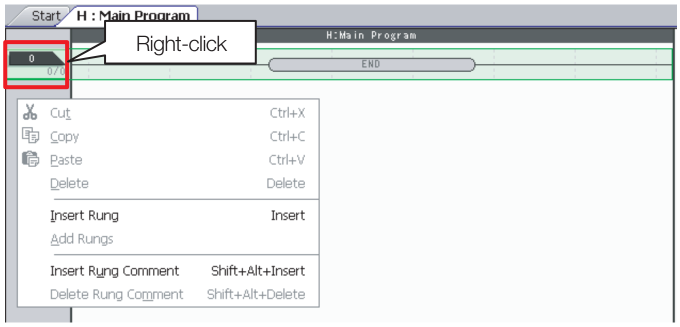
5. While displaying the ladder program, select ***Compile*** – ***Compile*** from the menu bar to compile the program.
When the compilation is finished, the ladder program will be saved automatically.

> **Important**
>
> If an error is displayed in the Output Pane during compilation, the ladder program will not be saved.

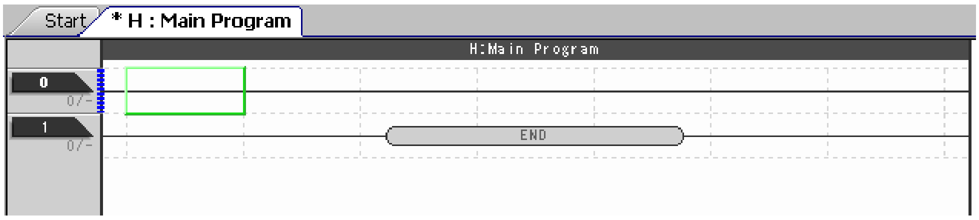
Ladder Program Creation Example

The following example shows how to insert an NO Contact instruction.

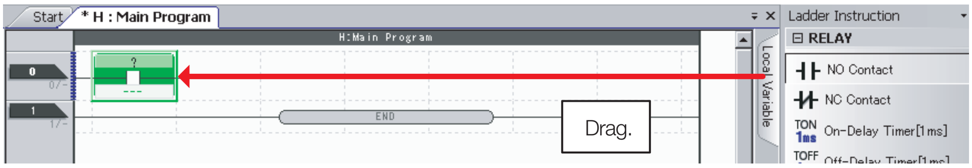
1. Right-click the tab with the row number, and select ***Insert Rung.***



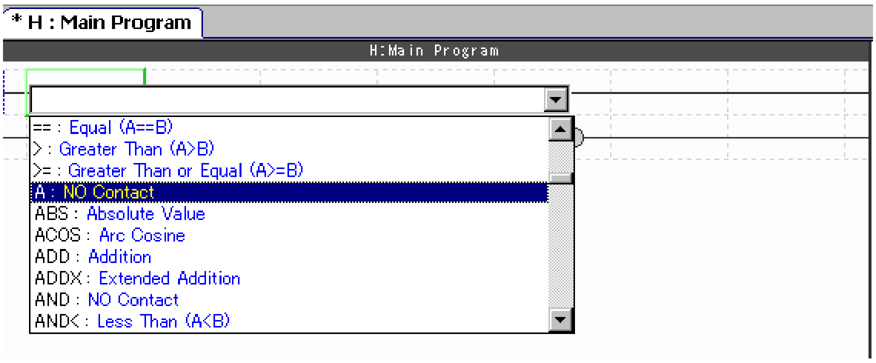
A rung will be inserted.



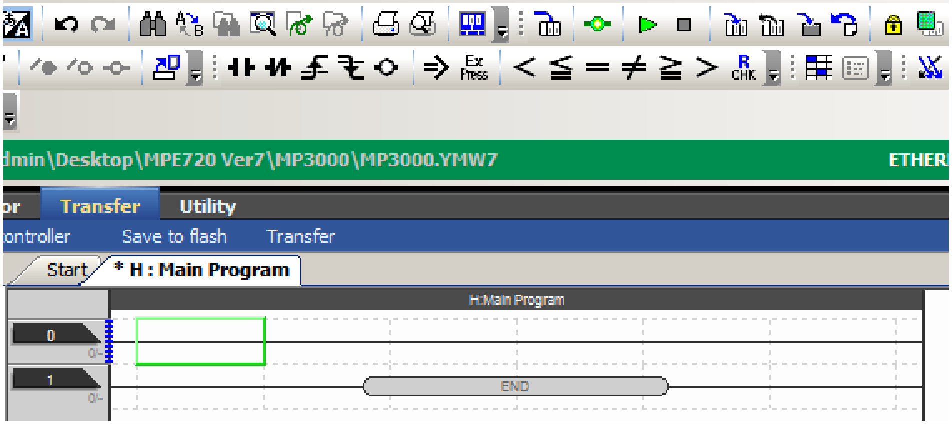
2. Create an NO Contact instruction with one of the following methods.
- Drag **NO Contact** under **RELAY** in the Ladder Instruction Pane to the rung.



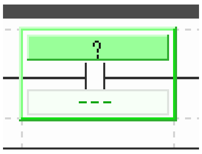
- Double-click at the location at which to insert the NO Contact instruction, and select **A: NO Contact** from the list.



- Select the location at which to insert the NO Contact instruction, and click the **NO Contact** Button.

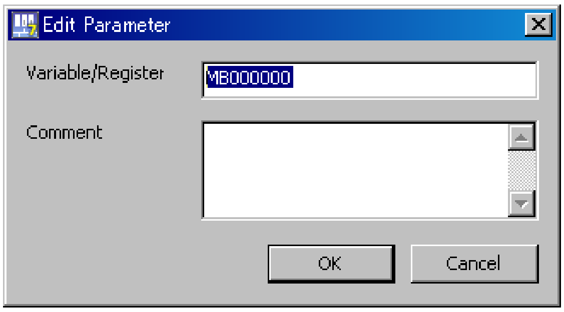


3. Double-click the box with a question mark.



The Edit Parameter Dialog Box will be displayed.

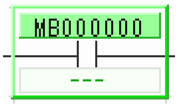
4. Enter MB000000 in the **Variable/Register** Box and click the **OK** Button.



Variable/Register: MB000000

Comment:

MB000000 will be displayed for the NO Contact instruction.



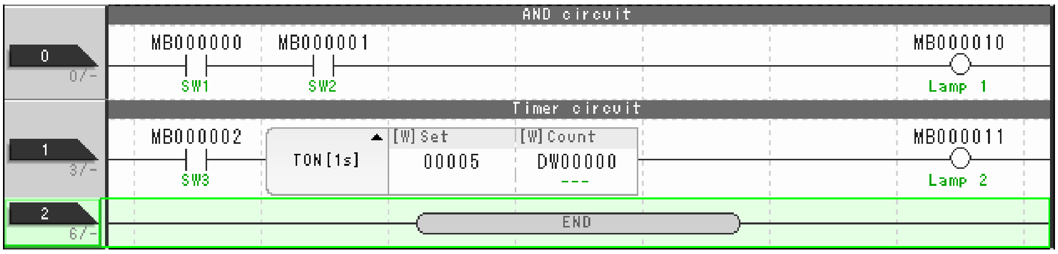
Note: The type of register and data you can use depend on the actual instruction. Refer to the following manual for details on each instruction.

Σ-7-Series Σ-7C SERVOPACK Motion Control User's Manual (Manual No.: SIEP S800002 03)

Information To insert a comment, right-click the tab with the row number, and select ***Insert Rung Comment***.

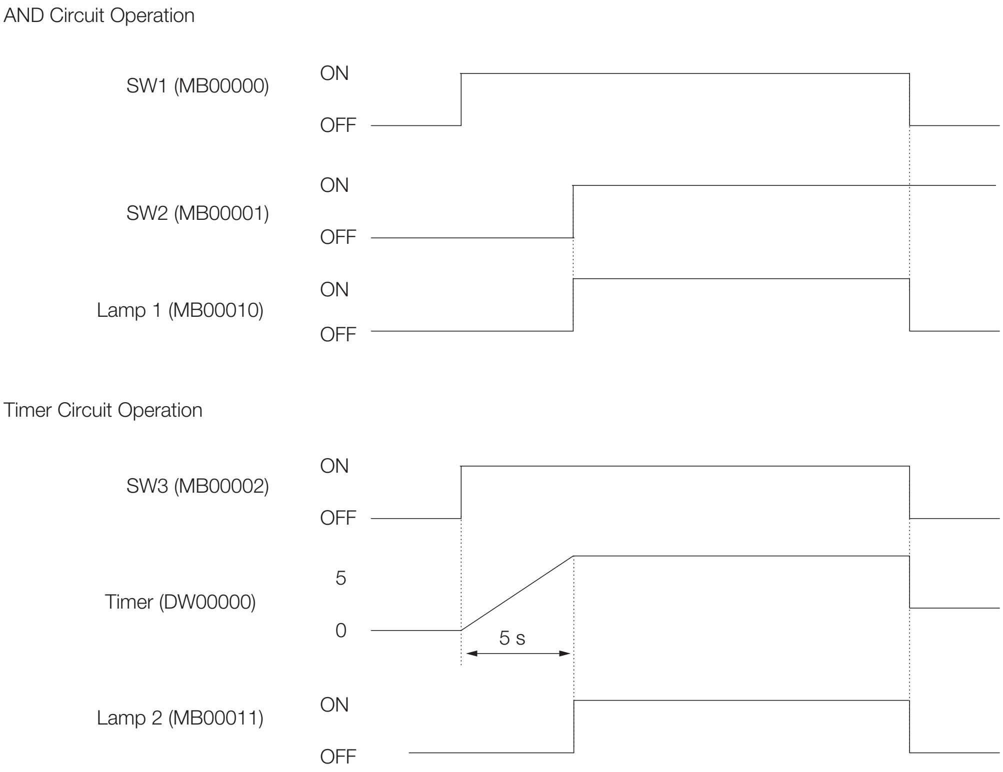
5. Repeat steps 1 to 4 until you have entered the entire ladder program. The following example shows a ladder program and its timing chart.

<Ladder Program Example>



Note: The ladder program example that is shown above uses M registers for switches and lamps. When you enter a ladder program for an actual system, use the appropriate I and O registers.

Timing Chart Example



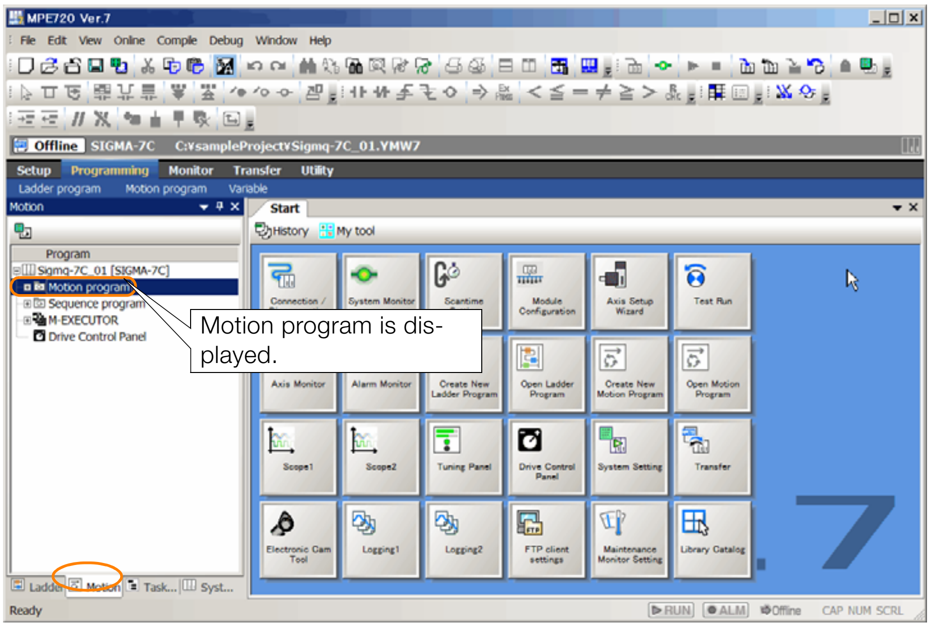
7.3 Creating Motion Programs

This section describes how to create motion main programs and motion subprograms.

7.3.1 Creating a Group Definition

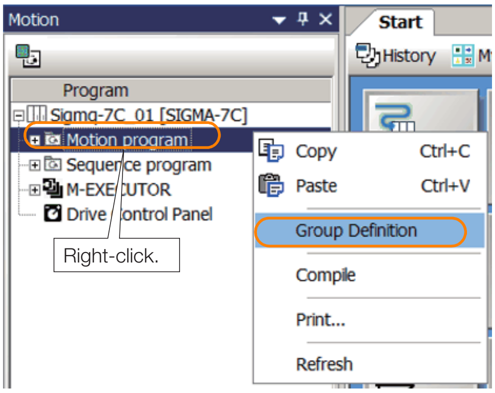
Before creating a motion program, we have to group the axes together as required by the machine configuration.

1. Click the **Motion** Tab in the Pane to display **Motion program.**



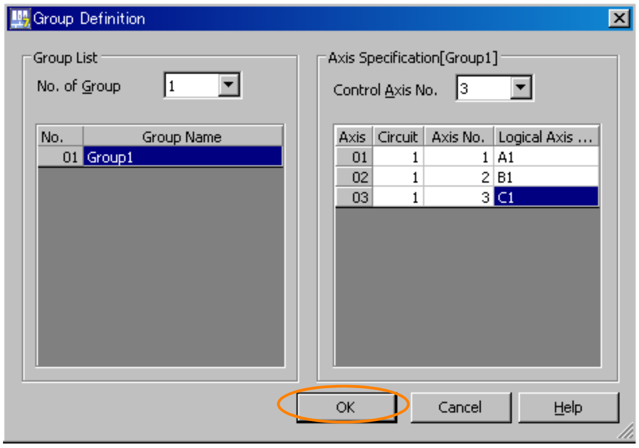
Motion program is displayed.

2. Right-click **Motion program,** and select ***Group Definition***.



Right-click.

3. Click the **OK** Button.
   Refer to the following manuals for details on group definitions.
   📖 Σ-7-Series Σ-7C SERVOPACK Motion Control User's Manual (Manual No.: SIEP S800002 03)



No. of Group: 1

No.	Group Name
01	Group1

Control Axis No.: 3

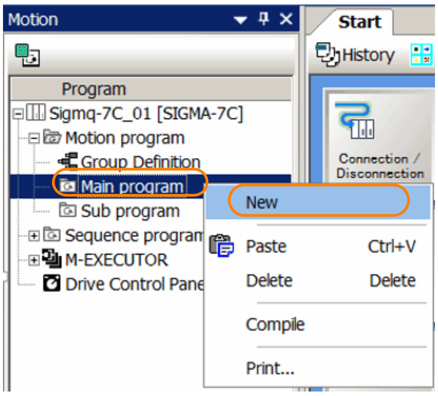
Axis	Circuit	Axis No.	Logical Axis ...
01	1	1	A1
02	1	2	B1
03	1	3	C1

7.3.2 Creating a Motion Main Program

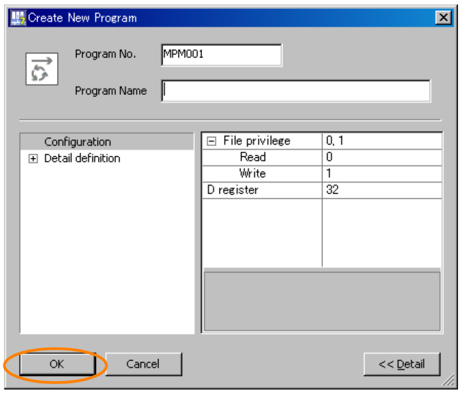
Use the following procedure to create a motion main program.

1. Display the Edit Motion Program Tab Page.

2. Expand the tree structure in the Motion Pane. Right-click **Main program** and select ***New.***



3. Click the **OK** Button.



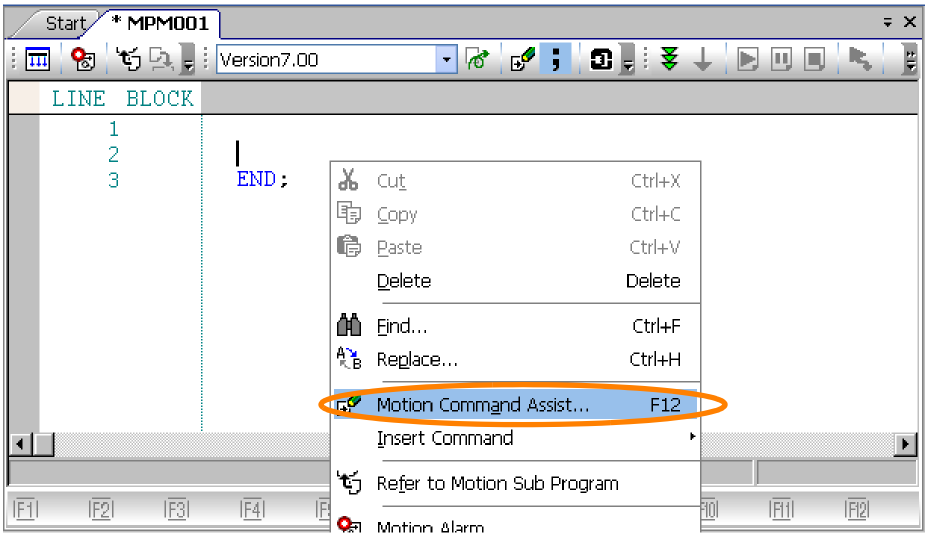
Program No.: MPM001

Program Name:

File privilege	0, 1
Read	0
Write	1
D register	32

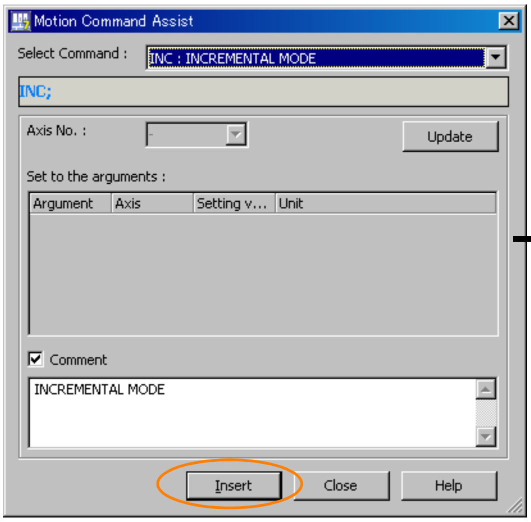
4. Edit the motion program.
Use the instruction input assistance feature to insert an INC instruction and a MOV instruction into the motion program.
The motion instruction assistance feature is used by right-clicking on the Edit Motion Program Tab Page.

- Calling the Instruction Input Assistance Feature (Select ***Motion Command Assist***.)



```
LINE  BLOCK
   1
   2
   3        END;
```

- Inserting an INC Instruction
- Inserting a MOV Instruction



Select Command : INC : INCREMENTAL MODE

INC;

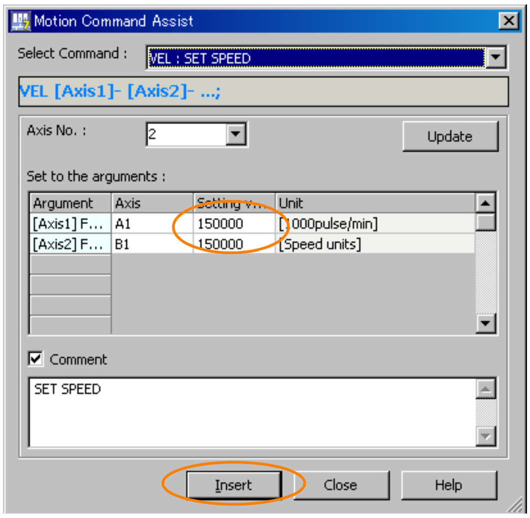
Axis No. :

Set to the arguments :

Argument	Axis	Setting v...	Unit

☑ Comment

INCREMENTAL MODE



Select Command : VEL : SET SPEED

VEL [Axis1]- [Axis2]- ...;

Axis No. : 2

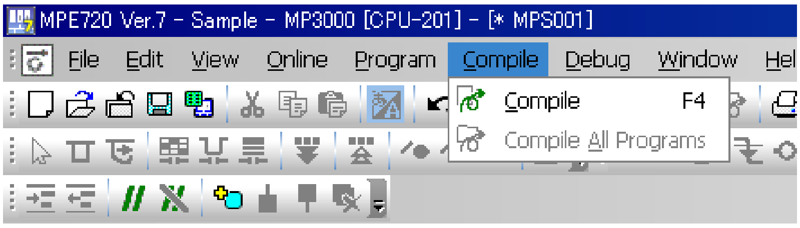
Set to the arguments :

Argument	Axis	Setting v...	Unit
[Axis1] F...	A1	150000	[000pulse/min]
[Axis2] F...	B1	150000	[Speed units]

☑ Comment

SET SPEED

5. Select ***Compile*** – ***Compile*** from the menu bar to compile the program.
When the compilation is finished, the motion program will be saved automatically.



Important

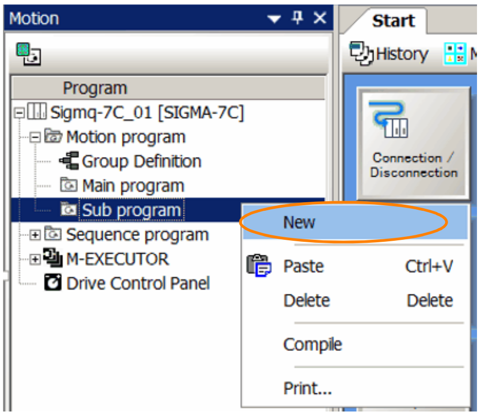
If an error occurs during compilation, the motion program will not be saved.

7.3.3 Creating a Motion Subprogram

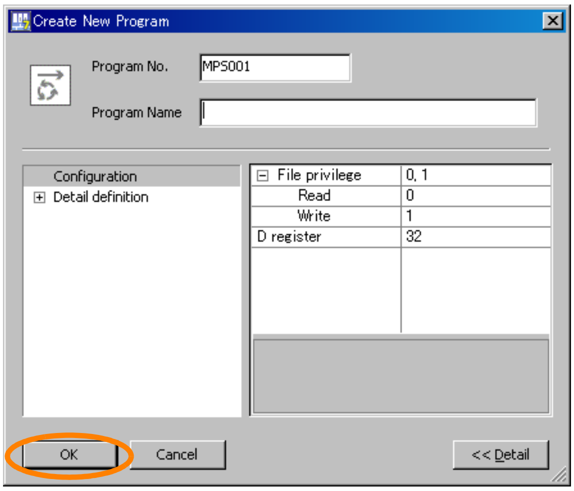
Use the following procedure to create a motion subprogram.

1. Display the Edit Motion Program Tab Page.

2. Expand the tree structure in the Motion Pane. Right-click **Sub program,** and select ***New.***



3. Click the **OK** Button.

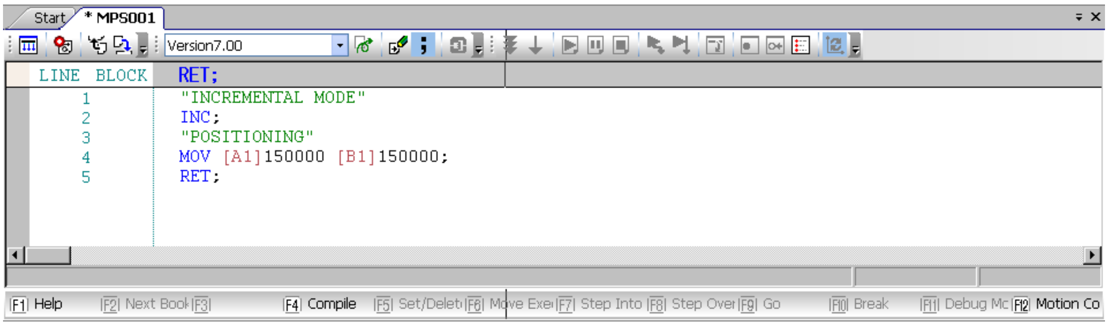


Program No. MPS001

Program Name

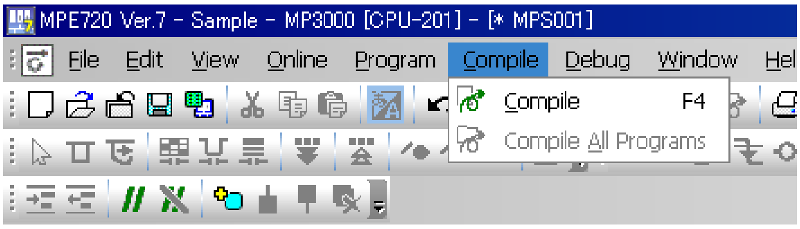
File privilege	0, 1
Read	0
Write	1
D register	32

4. Enter the motion subprogram.



```
RET;
"INCREMENTAL MODE"
INC;
"POSITIONING"
MOV [A1]150000 [B1]150000;
RET;
```

5. Select ***Compile*** – ***Compile*** from the menu bar to compile the program.
   When the compilation is finished, the motion subprogram will be saved automatically.



Important

If an error occurs during compilation, the motion subprogram will not be saved.

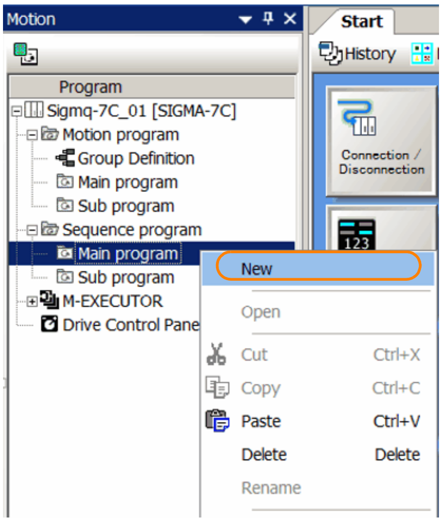
7.4 Creating a Sequence Program

This section describes how to create sequence main programs and sequence subprograms.

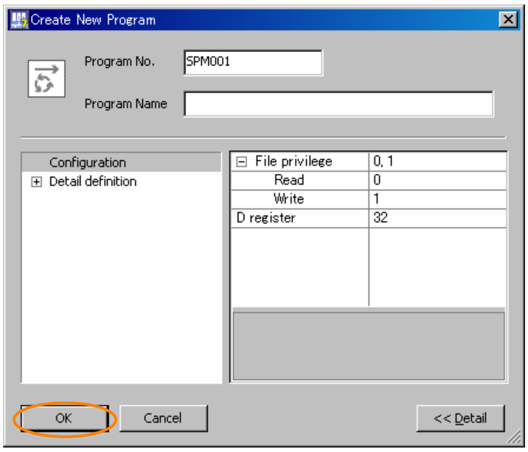
7.4.1 Creating a Sequence Main Program

Use the following procedure to create a sequence main program.

1. Display the Edit Motion Program Tab Page.
2. Expand the tree structure in the Motion Pane. Right-click **Main program** and select ***New.***



3. Click the **OK** Button.

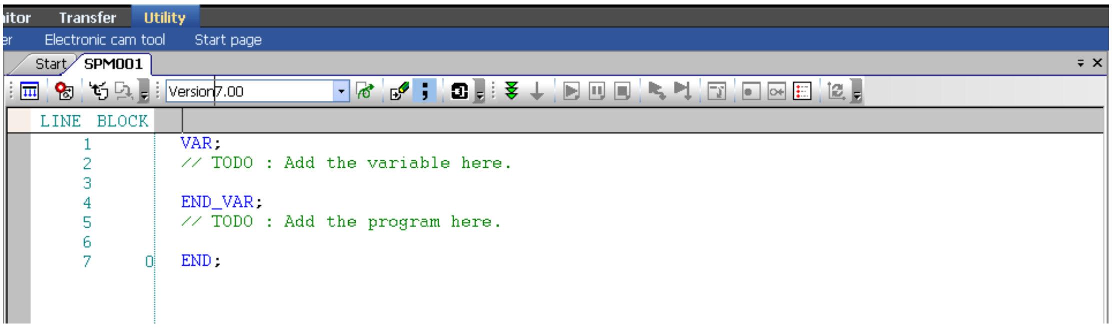

Create New Program

Program No. SPM001

Program Name

File privilege	0, 1
Read	0
Write	1
D register	32

4. Enter the sequence program.

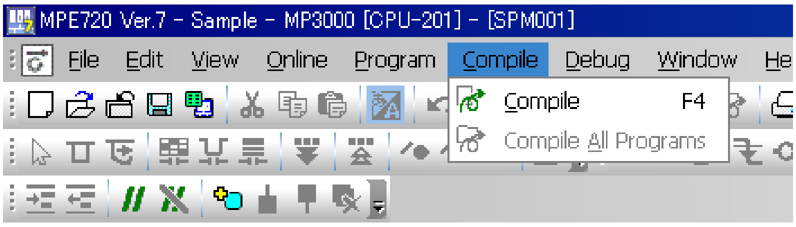


```
VAR;
// TODO : Add the variable here.

END_VAR;
// TODO : Add the program here.

END;
```

5. Select ***Compile*** – ***Compile*** from the menu bar to compile the program.
   When the compilation is finished, the sequence program will be saved automatically.



Important

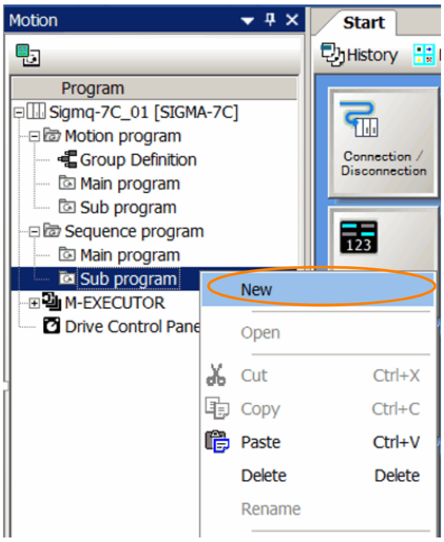
If an error occurs during compilation, the sequence program will not be saved.

7.4.2 Creating a Sequence Subprogram

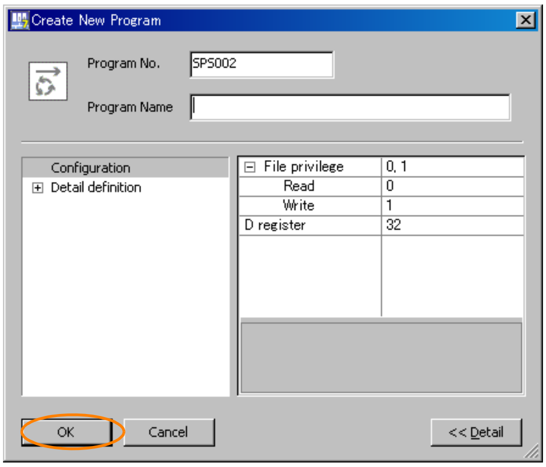
Use the following procedure to create a sequence subprogram.

1. Display the Edit Motion Program Tab Page.

2. Expand the tree structure in the Motion Pane. Right-click **Sub program,** and select ***New.***



3. Click the **OK** Button.

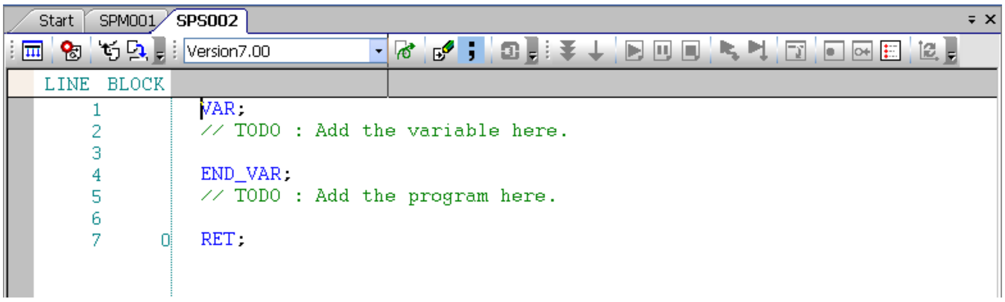


Program No. SPS002

Program Name

File privilege	0, 1
Read	0
Write	1
D register	32

4. Enter the sequence program.



```
VAR;
// TODO : Add the variable here.

END_VAR;
// TODO : Add the program here.

RET;
```

5. Click the **Save** Icon ( ) on the toolbar of the MPE720 Window to compile the program. When the compilation is completed, the sequence program is saved automatically.

> Important
>
> If an error was displayed in the Error List Dialog Box during compilation, the sequence program will not be saved.

7.5 Transferring Data with the MPE720

You can transfer data to read, write, and compare data between the external memory (MPE720 or USB) and the SERVOPACK, and save the RAM data in the SERVOPACK to flash memory.

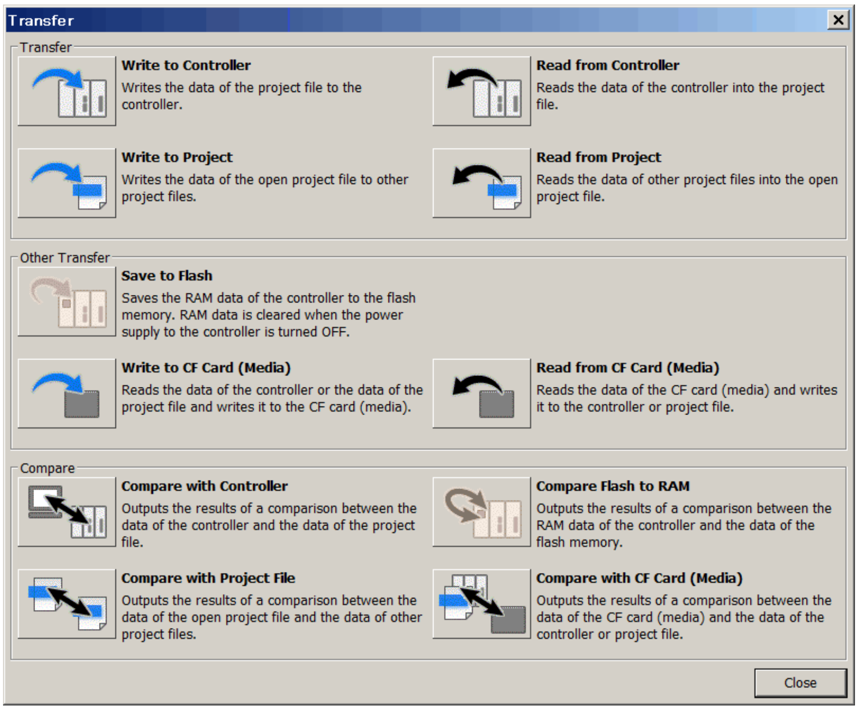
You can transfer the following data.

- System Configuration
  - System definitions
  - Scan time definitions
  - Module configuration definitions
  - Trace data
- Programs
  - Ladder programs (high-speed, low-speed, startup, and interrupt programs, and functions)
  - Motion programs (main program, subprograms, and group definitions)
  - Table data
  - Variables (axis, I/O, global, constant, and user-defined structure variables)
  - Comments (I/O, global, and constant comments)
- Registers

  M (data), D (internal), C (constant), S* (system), I* (input), O* (output), and G (G) registers

  * The contents of these registers cannot be changed.

The type of data transfer is selected in the Transfer Dialog Box. Display this dialog box by selecting ***Online*** – ***Transfer*** from the menu bar.



Write to Controller
Writes the data of the project file to the controller.

Read from Controller
Reads the data of the controller into the project file.

Write to Project
Writes the data of the open project file to other project files.

Read from Project
Reads the data of other project files into the open project file.

Save to Flash
Saves the RAM data of the controller to the flash memory. RAM data is cleared when the power supply to the controller is turned OFF.

Write to CF Card (Media)
Reads the data of the controller or the data of the project file and writes it to the CF card (media).

Read from CF Card (Media)
Reads the data of the CF card (media) and writes it to the controller or project file.

Compare with Controller
Outputs the results of a comparison between the data of the controller and the data of the project file.

Compare Flash to RAM
Outputs the results of a comparison between the RAM data of the controller and the data of the flash memory.

Compare with Project File
Outputs the results of a comparison between the data of the open project file and the data of other project files.

Compare with CF Card (Media)
Outputs the results of a comparison between the data of the CF card (media) and the data of the controller or project file.

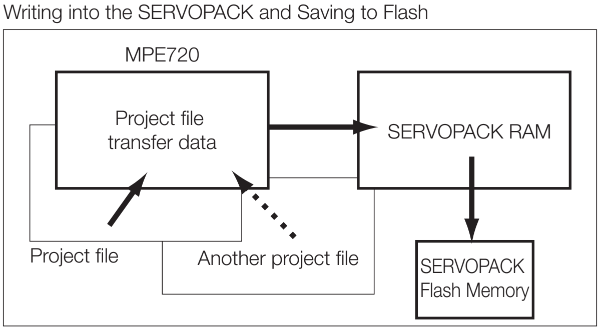
Note: 1. In the above dialog box, all icons are shown as enabled for the purpose of this description.

2. To transfer data from the menu bar, select ***Online*** – ***Write into Controller, Read from Controller***, or ***Save to Flash***.

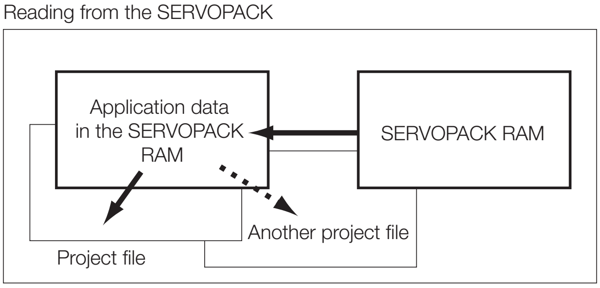
3. You can also transfer data by selecting ***Transfer*** – ***Write into Controller***, ***Transfer*** – ***Read from Controller***, or ***Transfer*** – ***Save to Flash Memory*** from the Launcher.

The following figure illustrates data transfers for MPE720.

Data Transfer Conceptual Diagram



When you perform a Write into Controller operation from the Transfer Dialog Box, the data of the open project fie (or of another project file that you specified) will be written to the RAM of the SERVOPACK. If you perform a Save to Flash operation, the data that is stored in the RAM of the SERVOPACK will be written to the flash memory of the SERVOPACK.



When you perform a Read from Controller operation from the Transfer Dialog Box, the data in the RAM of the SERVOPACK will be loaded into the MPE720 and written to the open project fie (or to another project file that you specified).

The following sections provide the data transfer procedures.

7.5.1 Writing Parameters to the SERVOPACK

The operation depends on whether a project file is currently open.

- When the Project File Is Open and the SERVOPACK Is Offline
  The data in the current project file will be transferred to the SERVOPACK. Go online with the SERVOPACK before performing the transfer.
- When a Project File Is Open and the SERVOPACK Is Connected with a Project Link
  When you select this option from the Transfer Dialog Box, the Transfer Program Dialog Box will be displayed.
- When a Direct Connection Is Established without Opening a Project File
  After you select the project file to transfer, the data in that project file will be transferred to the SERVOPACK.

7.5.2 Writing into a Project File

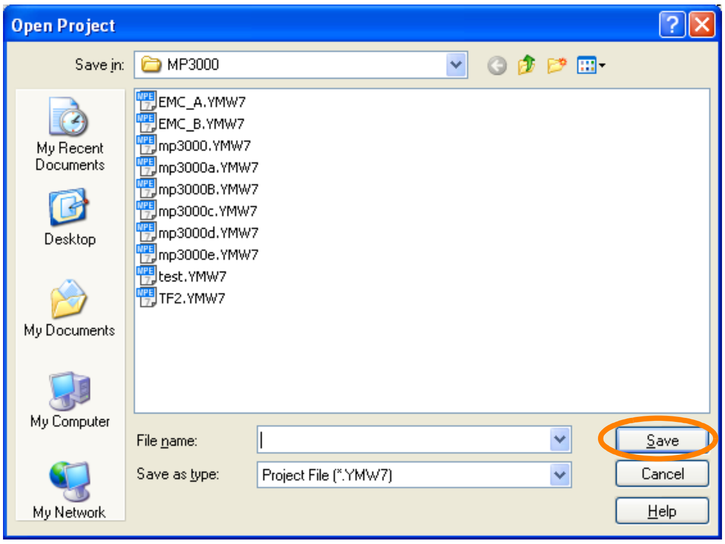
You can write the data from the currently open project file to another project file.

Important You can write to a project file only when the SERVOPACK is offline.

Use the following procedure to write the data.

1. Select *Online* – *Transfer* from the menu bar, and then click the **Write to Project** Button in the Transfer Dialog Box.
   The Open Project Dialog Box will be displayed.

2. Select the project file to which to write the data, and then click the **Save** Button.



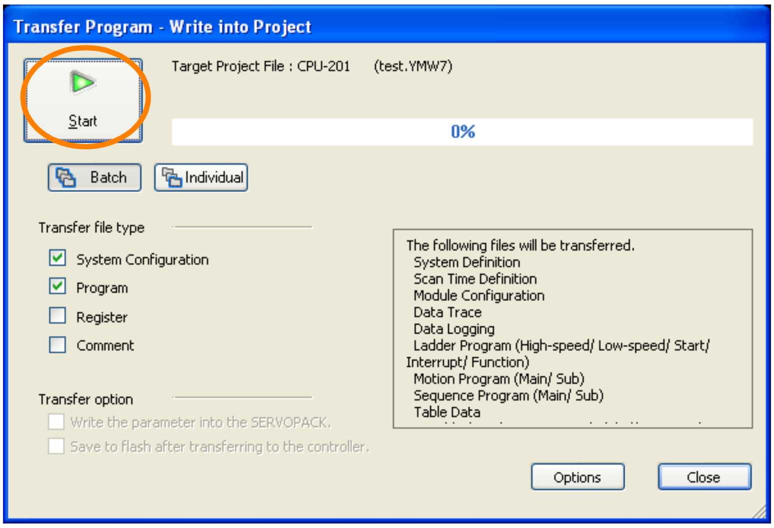
Save in: MP3000

EMC_A.YMW7
EMC_B.YMW7
mp3000.YMW7
mp3000a.YMW7
mp3000B.YMW7
mp3000c.YMW7
mp3000d.YMW7
mp3000e.YMW7
test.YMW7
TF2.YMW7

File name:
Save as type: Project File (*.YMW7)

The Transfer Program - Write into Project Dialog Box will be displayed.

3. Click the **Batch** Button or the **Individual** Button.
   If you click the **Batch** Button, use the check boxes to indicate the data to transfer: System Configuration, Program, Register, and/or Comment.
   If you click the **Individual** Button, use the check boxes to indicate the data to transfer: System Configuration, Program, Register, and/or Comment. You can then specify the individual data to transfer.



Target Project File : CPU-201 (test.YMW7)

0%

Transfer file type
☑ System Configuration
☑ Program
☐ Register
☐ Comment

The following files will be transferred.
System Definition
Scan Time Definition
Module Configuration
Data Trace
Data Logging
Ladder Program (High-speed/ Low-speed/ Start/ Interrupt/ Function)
Motion Program (Main/ Sub)
Sequence Program (Main/ Sub)
Table Data

Transfer option
☐ Write the parameter into the SERVOPACK.
☐ Save to flash after transferring to the controller.

4. Click the **Start** Button to start writing to the project file.

When the Project File Is Open and the SERVOPACK Is Online

Select ***Online*** – ***Write into Controller*** from the menu bar.
Alternatively, you can select ***Transfer*** – ***Write into Controller*** from the Launcher.

The Transfer Program - Write into Controller Dialog Box will be displayed.

7.5.3 Reading from the SERVOPACK

The operation depends on whether a project file is currently open.

- When a Project File Is Open:
  The RAM data in the SERVOPACK will be transferred to the current project file. When offline, place the SERVOPACK online before performing the transfer.
- When a Connection Is Established without Opening a Project File:
  The data in the SERVOPACK will be transferred to the target project file after the file is selected.

When the Project File Is Open and the SERVOPACK Is Online

Select ***Online*** – ***Read from Controller*** from the menu bar.
Alternatively, you can select ***Transfer*** – ***Read from Controller*** from the Launcher.

The Transfer Program - Read from Controller Dialog Box will be displayed.

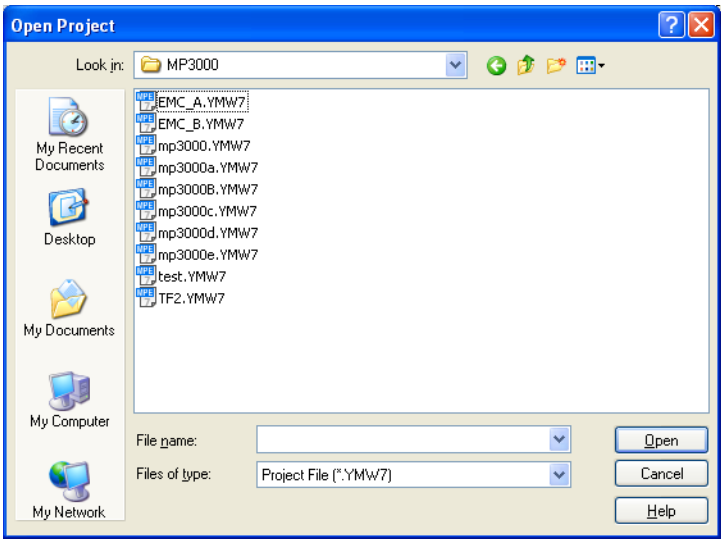
7.5.4 Reading from a Project File

You can read data from another project file into the currently open project file. You can write to a project file only when the SERVOPACK is offline.

Use the following procedure to read the data.

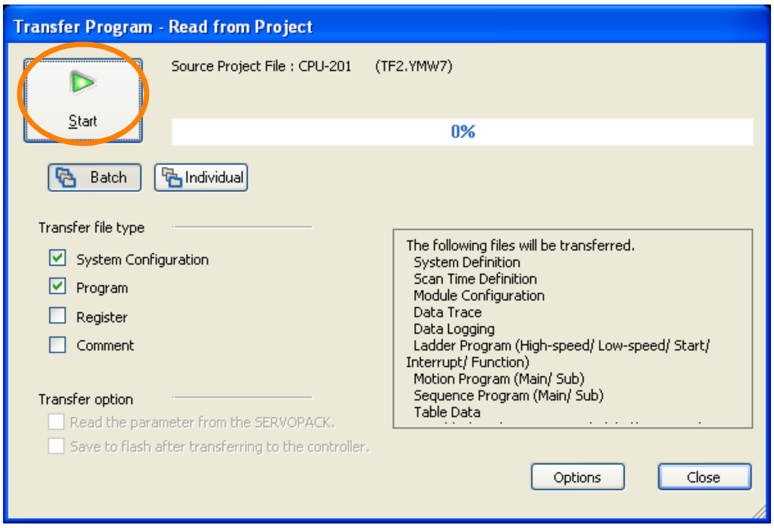
1. Select ***Online*** – ***Transfer*** from the menu bar, and then click the **Read from Project** Button in the Transfer Dialog Box.
   The Open Project Dialog Box will be displayed.

2. Select the project file from which to read the data, and click the **Open** Button.



The Transfer Program - Read from Project Dialog Box will be displayed.

3. **Click the Batch Button or the Individual Button, and then the Start Button.**
   If you click the **Batch** Button, use the check boxes to indicate the data to transfer: System Configuration, Program, Register, and/or Comment.
   If you click the **Individual** Button, use the check boxes to indicate the data to transfer: System Configuration, Program, Register, and/or Comment. You can then specify the individual data to transfer.



Source Project File : CPU-201 (TF2.YMW7)

0%

Transfer file type
☑ System Configuration
☑ Program
☐ Register
☐ Comment

Transfer option
☐ Read the parameter from the SERVOPACK.
☐ Save to flash after transferring to the controller.

The following files will be transferred.
System Definition
Scan Time Definition
Module Configuration
Data Trace
Data Logging
Ladder Program (High-speed/ Low-speed/ Start/ Interrupt/ Function)
Motion Program (Main/ Sub)
Sequence Program (Main/ Sub)
Table Data

7.5.5 Saving to Flash Memory

You can save the SERVOPACK RAM data to the flash memory of the SERVOPACK.

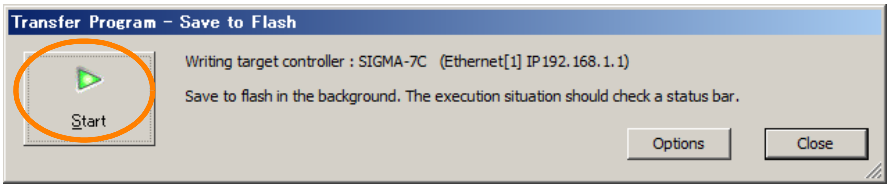
Important

You can save the data to flash memory only when the SERVOPACK is online.

Use the following procedure to save the data.

1. **Select *Online* – *Save to Flash* from the menu bar.**
   The Transfer Program – Save to Flash Dialog Box will be displayed.

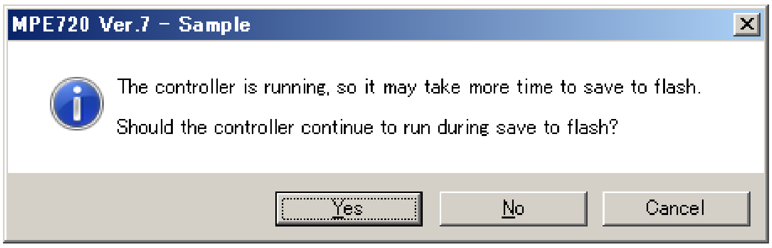
2. **Click the Start Button.**



Writing target controller : SIGMA-7C (Ethernet[1] IP192.168.1.1)

Save to flash in the background. The execution situation should check a status bar.

If the CPU Unit is running, the following message will be displayed. Click either the **Yes** or the **No** Button to save the data to the flash memory.



The controller is running, so it may take more time to save to flash.

Should the controller continue to run during save to flash?

Important

Do not turn OFF the power supply to the SERVOPACK until saving the data to flash memory has been completed.

If you turn OFF the power supply to the SERVOPACK while data is being saved to flash memory, the data will be lost.

If you then turn ON the power supply to the SERVOPACK, the SERVOPACK will start with the factory default conditions.

7.5.6 Comparing to the SERVOPACK

The operation depends on whether a project file on the PC is currently open (offline) or whether the SERVOPACK is online.

- Offline
  After a connection to the SERVOPACK is established, the currently open project file data and the SERVOPACK RAM data will be compared, and the results will be displayed in the Transfer Pane.
- Online
  When you specify (or create) a project file to compare, the project file data and the SERVOPACK RAM data will be compared, and the results will be displayed in the Transfer Pane.

7.5.7 Comparing Flash Memory and RAM Data

The SERVOPACK RAM data and the flash memory data will be compared, and the results will be displayed in the Transfer Pane. You can save the data to flash memory only when the SERVOPACK is online.

7.5.8 Comparing to a Project File

The currently open project file data and the data in another project file will be compared, and the results will be displayed in the Transfer Pane. You can save the data to flash memory only when the SERVOPACK is offline.

7.6 Debugging Ladder Programs

This section describes debugging with MPE 720.

7.6.1 Ladder Program Runtime Monitoring

You can monitor the execution status of each instruction. Using runtime monitoring requires a connection to the SERVOPACK.

Instructions where the relay output is ON are displayed in blue.

The current values of the parameter registers of the instructions that are being executed are also displayed.

ON coils are displayed in blue.

Current values of registers are displayed.

7.6.2 Register List Panes

You can monitor the current values of the registers in a continuous area (register map) on any of the Register List 1, 2, and 3 Panes. Realtime monitoring is possible if the SERVOPACK is online. You can edit the values.

Important

- If you use a project link connection, the data in the SERVOPACK is accessed. When the register map is displayed, the displayed results do not always match the project file of the linked project.
  If you display the register map when using a project link connection, first always transfer the data to the project file by clicking the **Read from Controller** Button in the Transfer Dialog Box.
- The register list can display S, I, O, M, C, D, and G registers. However, C registers are read-only. They can be read but not written.

Displaying the Register Map

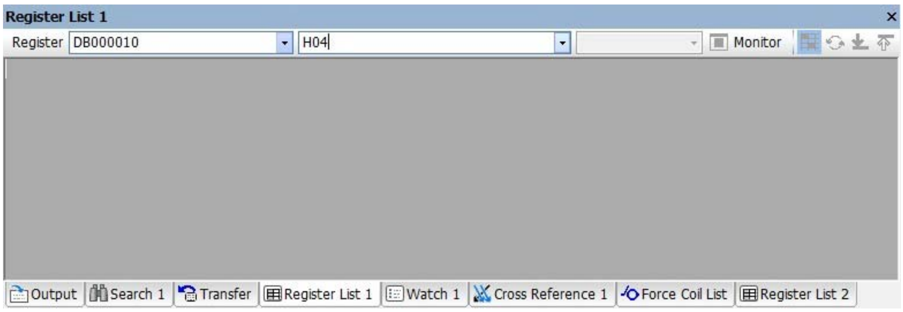
The following table gives the meaning of the background colors in the register map.

Green	Indicates a register that is used in a ladder program.
Red	Indicates a redundant register (i.e., a register that is used for more than one data type).
White	Unused registers

Use the following procedure to display the register map.

1. **Click one of the tabs for the Register List 1, 2 or 3 Panes.**
   Select ***Monitor*** – ***Register List*** from the Launcher. The Register List 1 Pane will be displayed.
   Note: You can show or hide the Register List 1, 2, and 3 Panes by selecting ***View*** – ***Register List*** – ***Register List 1***, ***View*** – ***Register List 2***, or ***View*** – ***Register List 3*** from the menu bar.

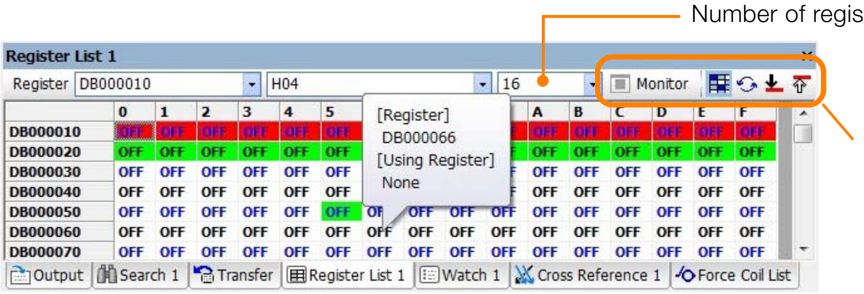
2. Enter the address of the register to display in the **Register** Box. When displaying a list of D registers, enter the program number as shown below.



Register List 1

Register DB000010 H04

3. When you press the **Enter** Key, the register map will be displayed.
The specified register will be displayed in the top row.



Number of registers displayed in one row

Switching Buttons

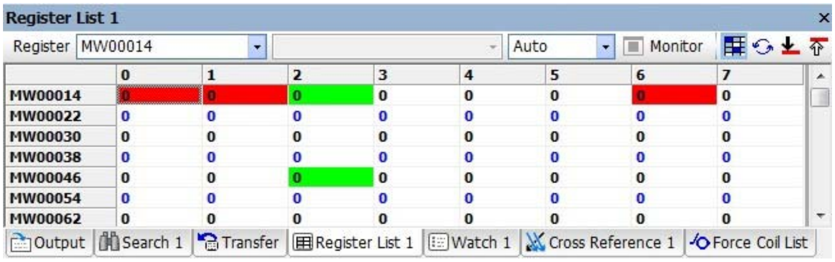
Register List 1

Register DB000010 H04 16

	0	1	2	3	4	5					A	B	C	D	E	F
DB000010	OFF	OFF	OFF	OFF	OFF	OFF					OFF	OFF	OFF	OFF	OFF	OFF
DB000020	OFF	OFF	OFF	OFF	OFF	OFF					OFF	OFF	OFF	OFF	OFF	OFF
DB000030	OFF	OFF	OFF	OFF	OFF	OFF					OFF	OFF	OFF	OFF	OFF	OFF
DB000040	OFF	OFF	OFF	OFF	OFF	OFF					OFF	OFF	OFF	OFF	OFF	OFF
DB000050	OFF	OFF	OFF	OFF	OFF	OFF	OF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
DB000060	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
DB000070	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

[Register]
DB000066
[Using Register]
None

Example of Displaying the D Register Map and Balloon



Register List 1

Register MW00014 Auto

	0	1	2	3	4	5	6	7
MW00014	0	0	0	0	0	0	0	0
MW00022	0	0	0	0	0	0	0	0
MW00030	0	0	0	0	0	0	0	0
MW00038	0	0	0	0	0	0	0	0
MW00046	0	0	0	0	0	0	0	0
MW00054	0	0	0	0	0	0	0	0
MW00062	0	0	0	0	0	0	0	0

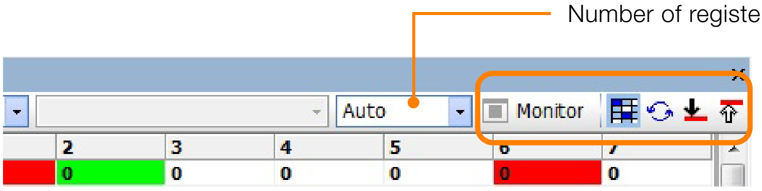
Example of an M Register Map

Information

- If you move the cursor over the register map, a balloon will show the register and the status of the register at the cursor position.
- You can change the number of registers displayed in one row. The five buttons on the top right of the pane are used to switch the displayed contents.
- If you right-click the register list, you can select ***Decimal***, ***Hex***, ***Binary***, or ***ASCII*** from the pop-up menu to change the data type of the values. However, the B and F data types cannot be changed.
- The display color alternate between blue and black for every other row.
- The **Monitor** Icon is enabled only when the SERVOPACK is online.

Switching the Register Map Display

You can change the number of registers that is displayed in one row. You can use the five buttons on the top right to switch the displayed contents of the register map.



Number of registers displayed in one row

◆ Number of registers displayed in one row

You can set the number of registers displayed in a row to between 1 and 16 either by direct numeric input or by selection from a list. For bit registers, the number is always 16 and cannot be changed. If you select **Auto**, the number of displayed registers will be set automatically based on the size of the Register List Pane.

◆ Monitor ON (▷ Monitor)/OFF (■ Monitor) Button

This button is enabled only in Online Mode. Click this button to turn monitoring ON and OFF.

When monitoring is ON, the register data will be updated and displayed continuously. When monitoring is OFF, the data will not be updated.

◆ Register Map Show (▦)/Hide (▦) Button

Click this button to show and hide the background colors of the register map.

◆ Register Map Refresh Button (⟳)

Click this button to refresh the values in the register map.

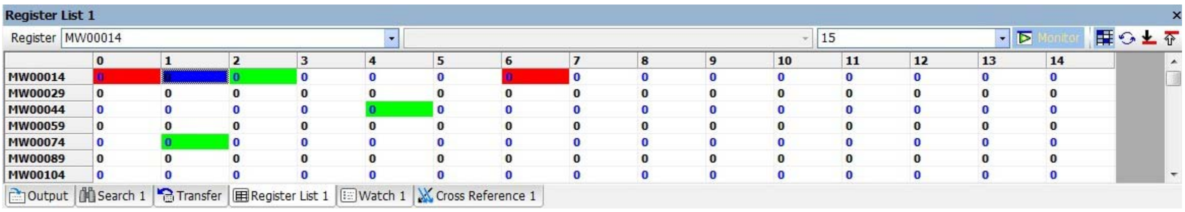
Information This button is disabled when the **Register Map Show/Hide** Button is in Hide (▦) status.

◆ Redundant Register Search Button (↑ / ↓)

This button searches for and displays redundant registers. The ↑ Button searches for redundant registers upward, and the ↓ Button searches downward.

The results will be displayed on the register map. If a redundant register was found, it will be displayed with a blue background.

Information This button is disabled when the **Register Map Show/Hide** Button is in Hide (▦) status.



Register MW00014

15

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MW00014	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MW00029	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MW00044	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MW00059	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MW00074	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MW00089	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MW00104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Editing Data

You can perform the following editing operations by selecting cells on the register map.

- Directly entering data
- Deleting data (setting the data to 0)
- Copying and pasting data

If the SERVOPACK is online, any changes in the data immediately affect the operation of the SERVOPACK.

7.6.3 Watch Panes

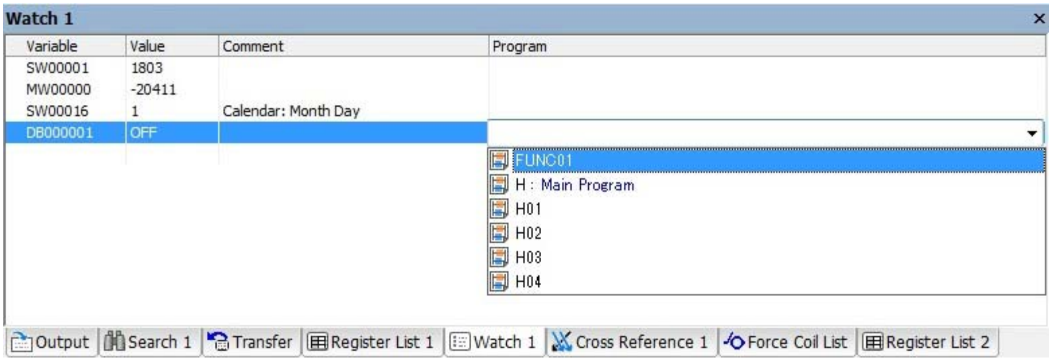
You can monitor the values and comments of the specified S, I, O, M, C, D, and G registers on the Watch 1, 2, and 3 Panes. Realtime monitoring is possible if the SERVOPACK is online. You can edit the values.

Information When a project link is used, the data registered in the Watch Pane is saved only to the SERVOPACK. To apply the watch data to the project file, transfer all of the data from the SERVOPACK.

Displaying Watch Data

1. **Click one of the tabs for the Watch 1, 2 or 3 Panes.**
   Select ***Monitor*** – ***Watch*** from the Launcher. The Watch 1 Pane will be displayed.
   Note: You can show or hide the Watch 1, 2, and 3 Panes by selecting ***View*** – ***Watch*** – ***Watch 1***, ***View*** – ***Watch*** – ***Watch 2***, or ***View*** – ***Watch*** – ***Watch 3*** from the menu bar.

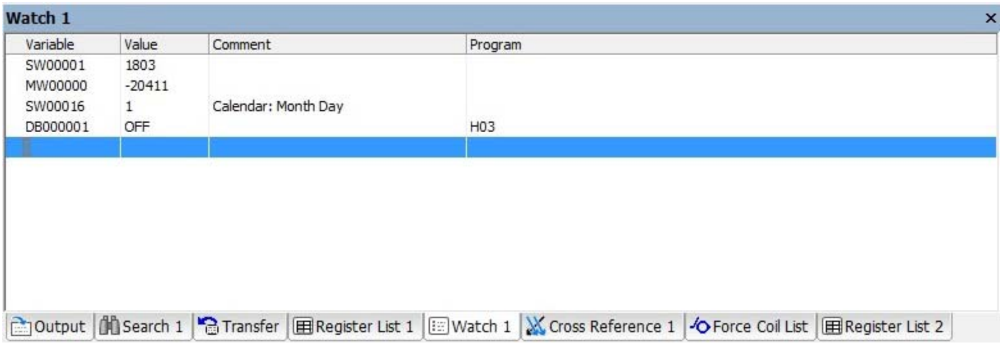
2. **Double-click the Variable Column or press the F2 Key to show the text cursor, and then enter the register or variable register to monitor.**
   Note: 1. You can also drag or copy registers from the ladder program or from the Variables Pane.
   2. When monitoring D registers, enter the program number as shown below.



Watch 1

Variable	Value	Comment	Program
SW00001	1803		
MW00000	-20411		
SW00016	1	Calendar: Month Day	
DB000001	OFF		

3. **Press the Enter Key.**
   The contents of the specified register will be displayed.



Watch 1

Variable	Value	Comment	Program
SW00001	1803		
MW00000	-20411		
SW00016	1	Calendar: Month Day	
DB000001	OFF		H03

If you right-click a row, you can select ***Decimal***, ***Hex***, ***Binary***, or ***ASCII*** from the pop-up menu to change the data type of the Value Box.

Editing the Value Column

Double-click the **Value** Column or press the F2 Key to show the text cursor. You can enter the value directly or paste a value.

Information You cannot edit the comments of the system registers.

After entering the data, press the **Enter** Key to confirm the change.

Information If the SERVOPACK is online, any changes in the data immediately affect the operation of the SERVOPACK.

7.6.4 Searching and Replacing in Programs

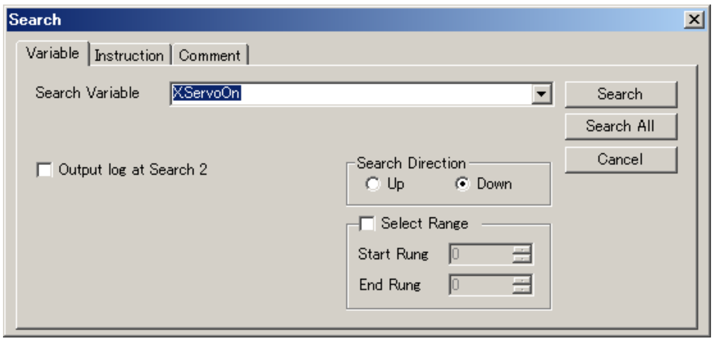
You can search for variables, instructions, and comments in a specified program. You can also search for and replace registers and register comments.

The following section describes how to search for and replace text in programs.

Searching in Programs

1. **Bring the program to search to the front in the Ladder Editor, and then select *Edit* – *Find* from the menu bar.**
   The Search Dialog Box will be displayed.

2. **Click the Variable, Instruction, or Comment Tab to set the search criteria.**



Search Variable: XServoOn

☐ Output log at Search 2

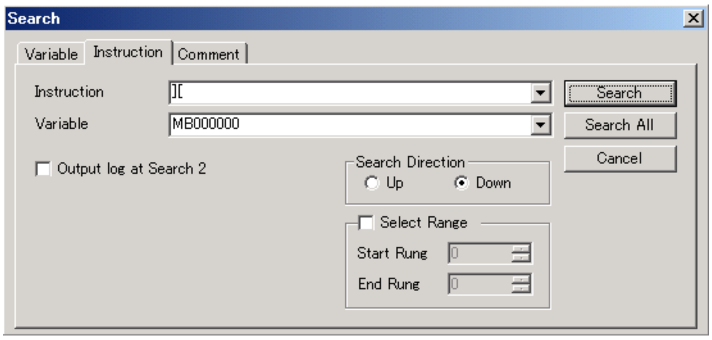
Search Direction: ○ Up ● Down

☐ Select Range

Start Rung: 0

End Rung: 0

Variable Tab Page: Allows you to search for variables and registers. You can also enter the variable by copying it from the Variables Pane.



Instruction:][

Variable: MB000000

☐ Output log at Search 2

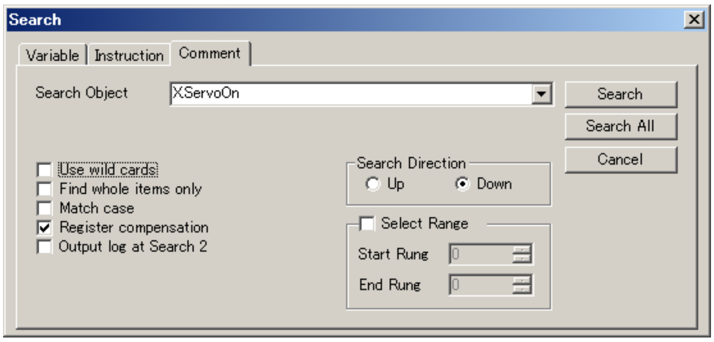
Search Direction: ○ Up ● Down

☐ Select Range

Start Rung: 0

End Rung: 0

Instruction Tab Page: Enter the name of the instruction or the assigned instruction key in the **Instruction** Box.
The **Variable** Box is displayed when an instruction is entered in the **Instruction** Box. If the SEE instruction is entered in the **Instruction** Box, **Variable** changes to **Program Name**.
You can also enter the variable by copying it from the Variables Pane.



Search Object: XServoOn

☐ Use wild cards
☐ Find whole items only
☐ Match case
☑ Register compensation
☐ Output log at Search 2

Search Direction: ○ Up ● Down

☐ Select Range

Start Rung: 0

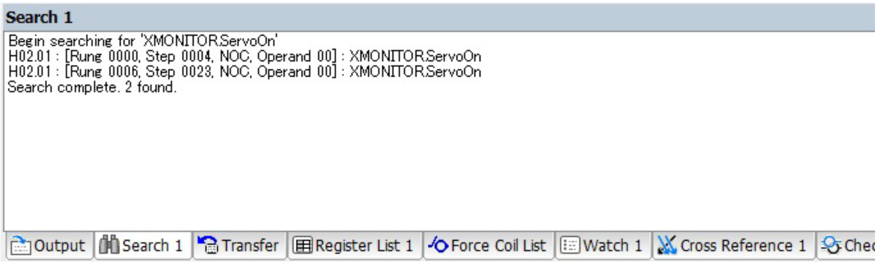
End Rung: 0

Comment Tab Page: Allows you to search for object comments, rung comments, program comments, and expression comments.

- **Use wild cards** Check Box: Select this check box to use wildcard characters (* and ?) in the search string.
- **Find whole items only** Check Box: Select this check box to search for comments where the string in the comment box is exactly the same as the search string. However, case matching is controlled by the **Match case** Check Box.
- **Match case** Check Box: Select this check box to differentiate between uppercase and lowercase characters.
- **Register compensation** Check Box: Select this check box to convert search strings that are recognized as registers into register notation.
- **Output log at Search 2** Check Box: Select this check box to display the search results in the Search 2 Pane without changing the contents of the Search 1 Pane. If you clear the selection of the check box, the search results will be displayed in the Search 1 Pane.
- **Select Range** Check Box: If you select this check box, you can specify the search range by setting the start and end rungs.

3. Click the **Search** Button or the **Search All** Button to start searching.

If you click the **Search** Button, the instruction object that was found will be selected.
If you click the **Search All** Button, the search results will be displayed in the Search 1 or Search 2 Panes.



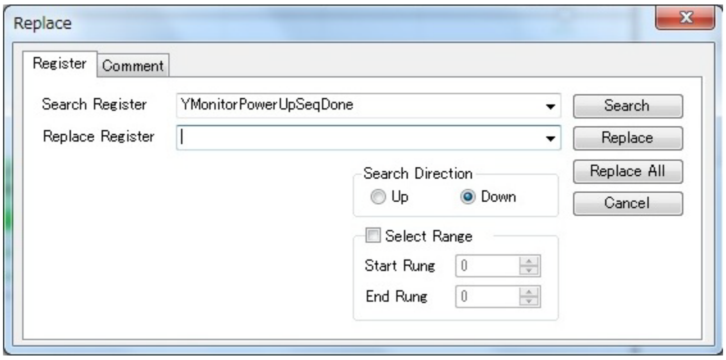
```
Begin searching for 'XMONITOR.ServoOn'
H02.01 : [Rung 0000, Step 0004, NOC, Operand 00] : XMONITOR.ServoOn
H02.01 : [Rung 0006, Step 0023, NOC, Operand 00] : XMONITOR.ServoOn
Search complete. 2 found.
```

Replacing Text in Programs

1. Bring the program in which to search and replace to the front of the Ladder Editor, and then select ***Edit*** – ***Replace*** from the menu bar.

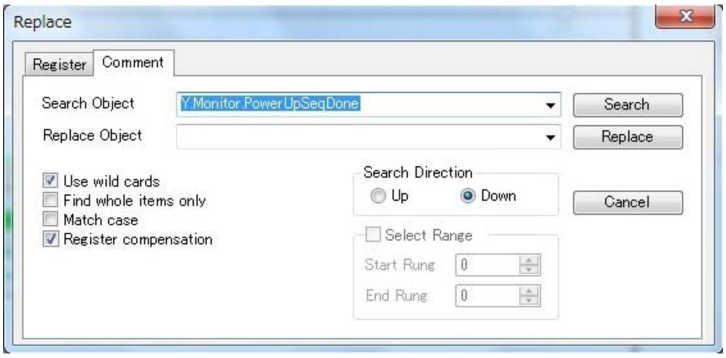
The Replace Dialog Box will be displayed.

2. Click the **Register** or **Comment** Tab to set the search criteria and the replacement string.



Search Register: YMonitorPowerUpSeqDone
Replace Register:
Search Direction: ○ Up ● Down
☐ Select Range
Start Rung: 0
End Rung: 0

Register Tab Page: Allows you to search for and replace registers.



Search Object: Y.Monitor.PowerUpSeqDone

Replace Object:

☑ Use wild cards
☐ Find whole items only
☐ Match case
☑ Register compensation

○ Up ● Down

☐ Select Range

Start Rung: 0

End Rung: 0

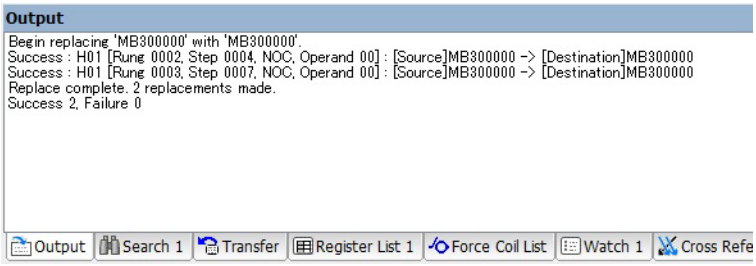
Comment Tab Page: Allows you to search for object comments, rung comments, program comments, and expression comments.

- **Use wild cards** Check Box: Select this check box to use wildcard characters (* and ?) in the search string.

  Note: If you enter an * or a ? character in the **Replace Register** Box or **Replace Object** Box, they will not be handled as wildcards, but as regular characters.

- **Select Range** Check Box: If you select this check box, you can specify the search range by setting the start and end rungs.
  However, range selection is disabled on the Comment Tab Page.

3. Start the search/replace operation.
Click the **Search** Button. The instruction object that was found will be selected. If you click the **Replace** Button, the object will be replaced by the contents of the **Replace Register** or **Replace Object** Box.
If you click the **Replace All** Button on the Register Tab Page, the registers that are found will be replaced, and the replacement results will be displayed in the Output Pane.



```
Begin replacing 'MB300000' with 'MB300000'.
Success : H01 [Rung 0002, Step 0004, NOC, Operand 00] : [Source]MB300000 -> [Destination]MB300000
Success : H01 [Rung 0003, Step 0007, NOC, Operand 00] : [Source]MB300000 -> [Destination]MB300000
Replace complete. 2 replacements made.
Success 2, Failure 0
```

7.6.5 Searching and Replacing in Project Files

You can search for variables in all ladder programs, motion programs, and sequence programs, or in only the specified programs of a project file. You can also search for and replace registers and register addresses.

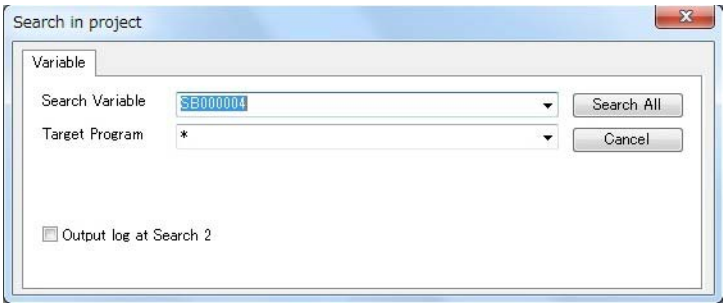
Information You can search the project file only when the SERVOPACK is offline.

The following section describes how to search for and replace text in a project file.

Searching in Project Files

1. Select *Edit – Search in Project* from the menu bar.
The Search in Project Dialog Box will be displayed.

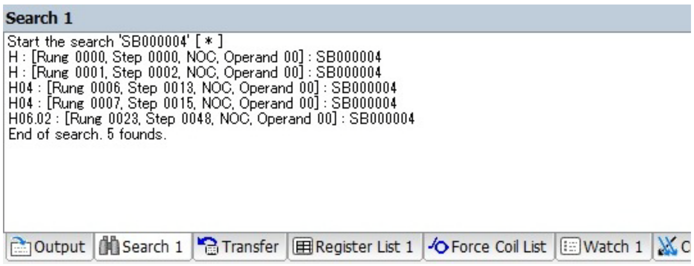
2. Specify the address of the variable to search for and the name of the program to search.



Search Variable: SB000004
Target Program: *
☐ Output log at Search 2

Note: 1. You can also enter the variable by copying it from the Variables Pane.
2. Use commas and spaces to specify more than one program in the **Target Program** Box.
The following wildcard (*) combinations can also be used in the **Target Program** Box:
, H, L*, I*, A*, F* (all functions), MPM*, MPS*, SPM*, SPS*
You can use wildcards only in the above forms. Other uses, such as “H01.*”, are not allowed.
3. **Output log at Search 2** Check Box: Select this check box to display the search results in the Search 2 Pane without changing the contents of the Search 1 Pane. If you clear the selection of the check box, the search results will be displayed in the Search 1 Pane.

3. Start the search operation.
Click the **Search All** Button. A progress bar will be displayed, and the search results will appear in the Search Pane.



```
Start the search 'SB000004' [ * ]
H : [Rung 0000, Step 0000, NOC, Operand 00] : SB000004
H : [Rung 0001, Step 0002, NOC, Operand 00] : SB000004
H04 : [Rung 0006, Step 0013, NOC, Operand 00] : SB000004
H04 : [Rung 0007, Step 0015, NOC, Operand 00] : SB000004
H06.02 : [Rung 0023, Step 0048, NOC, Operand 00] : SB000004
End of search. 5 founds.
```

Replacing in Project Files

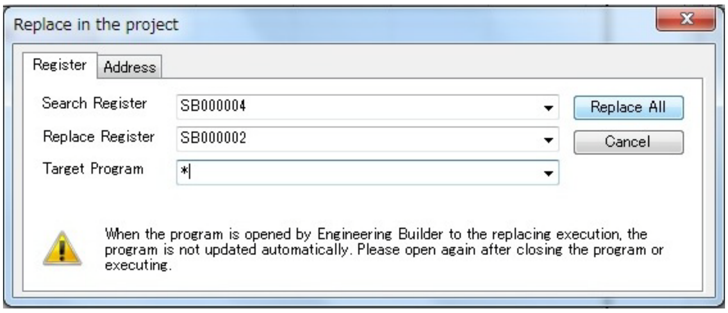
Important

After you perform a replace operation on a project file, the project file will be compiled and saved, and there will be no way to return to the previous version. Always create a backup before performing replacements on important files.

1. Bring the program to search to the front of the Ladder Editor, and then select ***Edit – Replace in the project*** from the menu bar.
The Replace in the Project Dialog Box will be displayed.

2. Specify the address of the variable to search for and the name of the program to search.
Note: 1. You can also enter the variable by copying it from the Variables Pane.
2. Use commas and spaces to specify more than one program in the **Target Program** Box. The following wildcard (*) combinations can also be used in the **Target Program** Box:
, H, L*, I*, A*, F* (all functions), MPM*, MPS*, SPM*, SPS*
You can use wildcards only in the above forms. Other uses, such as “H01.*”, are not allowed.

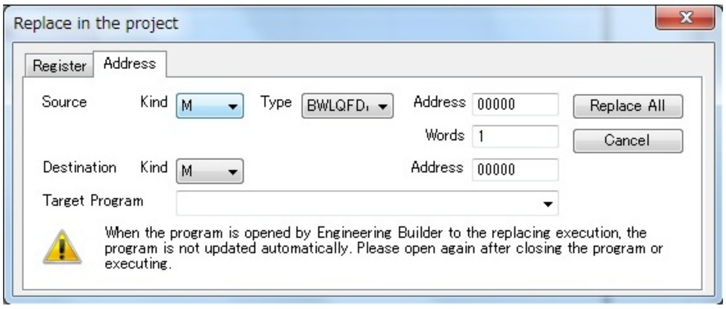
3. Click the **Register** or **Address** Tab to set the search criteria and the replacement value.



Search Register: SB000004
Replace Register: SB000002
Target Program: *

When the program is opened by Engineering Builder to the replacing execution, the program is not updated automatically. Please open again after closing the program or executing.

Register Tab Page: Allows you to replace registers.



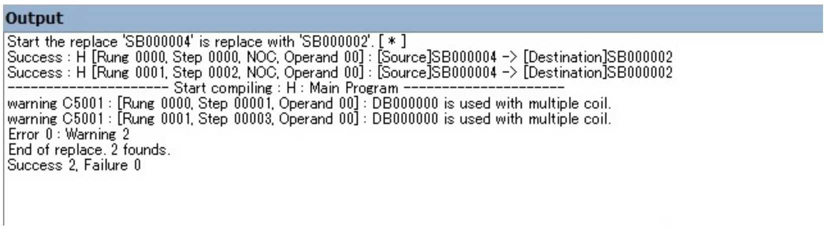
Source Kind: M Type: BWLQFD Address: 00000
Words: 1
Destination Kind: M Address: 00000
Target Program:

When the program is opened by Engineering Builder to the replacing execution, the program is not updated automatically. Please open again after closing the program or executing.

Address Tab Page: Allows you to replace registers that meet the specified criteria.

Note: The following wildcard (*) combinations can also be used in the Target Program Box:
, H, L*, I*, A*, F*, MPM*, MPS*

4. **Start the search/replace operation.**
   Click the **Replace All** Button. The replacement results will be displayed in the Output Pane.



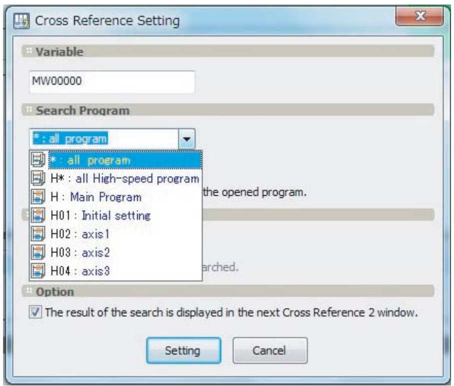
```
Output
Start the replace 'SB000004' is replace with 'SB000002'. [ * ]
Success : H [Rung 0000, Step 0000, NOC, Operand 00] : [Source]SB000004 -> [Destination]SB000002
Success : H [Rung 0001, Step 0002, NOC, Operand 00] : [Source]SB000004 -> [Destination]SB000002
--------------------- Start compiling : H : Main Program ---------------------
warning C5001 : [Rung 0000, Step 00001, Operand 00] : DB000000 is used with multiple coil.
warning C5001 : [Rung 0001, Step 00003, Operand 00] : DB000000 is used with multiple coil.
Error 0 : Warning 2
End of replace. 2 founds.
Success 2, Failure 0
```

Note: If an error occurs during compilation of a program, the replacements will not be completed.
After the replacement operation, the variables and addresses of the registers that were replaced will be displayed.

7.6.6 Cross Reference Panes

Cross referencing allows you to check whether a register is used in a program, and where it is used.

The search results indicate output registers in red, input registers in blue.



Variable: MW00000

Search Program: * : all program
- * : all program
- H* : all High-speed program
- H : Main Program
- H01 : Initial setting
- H02 : axis1
- H03 : axis2
- H04 : axis3

☑ The result of the search is displayed in the next Cross Reference 2 window.

Cross referencing executed.

Search Results Display
Red: Output registers
Blue: Input registers

Cross Reference 1 [MW00000-* : All program / Search Result 6]

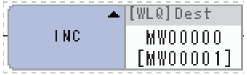
Variable: MW00000

Register	Program	Execution Instr...	Execution Step	Write/Read	Comm
Same Register					
MW00000	H02 : axis1	LOAD : Integer ...	0	Read	
MW00000	H02 : axis1	STORE : Store	1	Write	
Same Memory Address					
MB000004	H02 : axis1	NOC : NO Contact	2	Read	
MB000005	H02 : axis1	COIL : Coil	3	Write	
ML00000	H03 : axis2	LOAD : Integer ...	0	Read	
ML00000	H03 : axis2	STORE : Store	1	Write	

If the value of a register is different from its setting, it means that the value of the register may have been overwritten somewhere in the program. In this case, you can search for the registers using cross references. Check the registers displayed in red, and locate the program that is overwriting them.

Example The following section describes the search operation on arrays.

1. Register [Register] Arrays



→ MW00000 and MW00001 are subject to searching.

2. Register [Constant] Arrays

→ MW00000 and MW00005 are subject to searching.

3. Register [Constant], LONG Arrays

→ ML00000 and ML00010 are subject to searching.

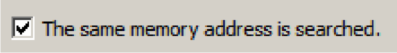
The following cross-reference criteria can be set. The following tables describe the check boxes.

☑ The local register is searched in the opened program.

Check Box	Search Method
Selected.	A search is made for local registers (D registers) in the active drawing in the MPE720 Window.
Not selected.	A search is made for local registers (D registers) in the specified drawing.

☑ The same register is searched.

Check Box	Search Method
Selected.	A search is made for registers that are the same as the register that was found. Select this check box to display the results in a list when you search the following instructions for a variable of MW00000. 
Not selected.	A search is not made for the same register and data type as the register that was found. Clear the selection of this check box to not display the results in a list when you search the following instructions for a variable of MW00000. 

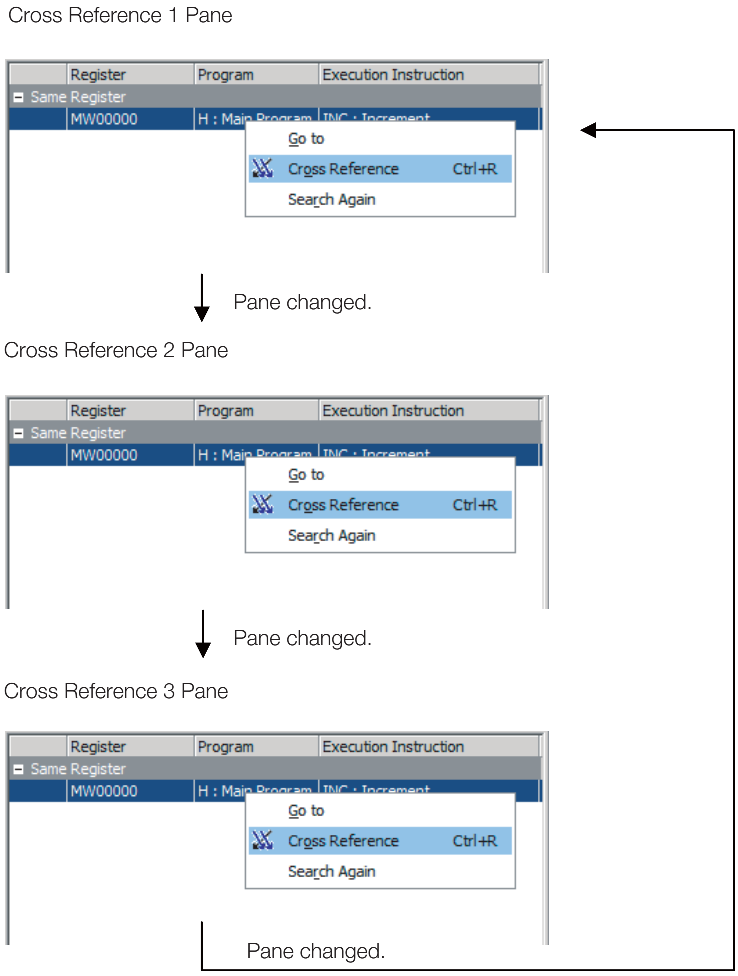
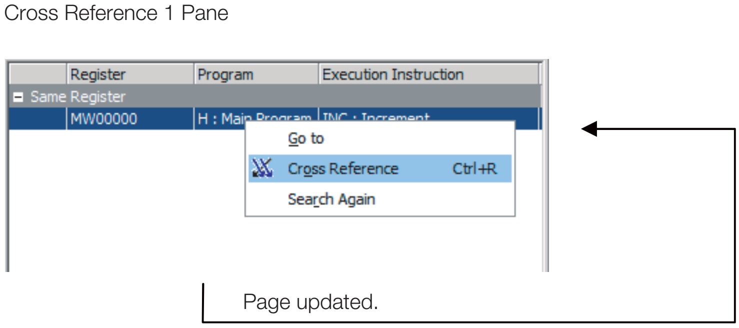


☑ The same memory address is searched.

Check Box	Search Method
Selected.	Searches for redundant addresses. Select this check box to display the results in a list when you search the following instructions with a variable with a different data type, such as ML00000. 

Check Box	Search Method
Not selected.	A search is not performed for redundant addresses. Clear the selection of this check box to not display the results in a list when you search the following instructions for a variable with a different data type, such as ML00000. 

☑ The result of the search is displayed in the next Cross Reference 2 window.

<table>
<tr><th>Check Box</th><th>Search Method</th></tr>
<tr><td>Selected.</td><td>When you perform cross referencing from the Cross Reference Pane, the results will be displayed in a separate pane.
Cross reference results can be displayed in up to 3 panes.
 </td></tr>
<tr><td>Not selected.</td><td>When you perform cross referencing from a Cross Reference Pane, the results will be displayed by updating the data in the same pane.
 </td></tr>
</table>

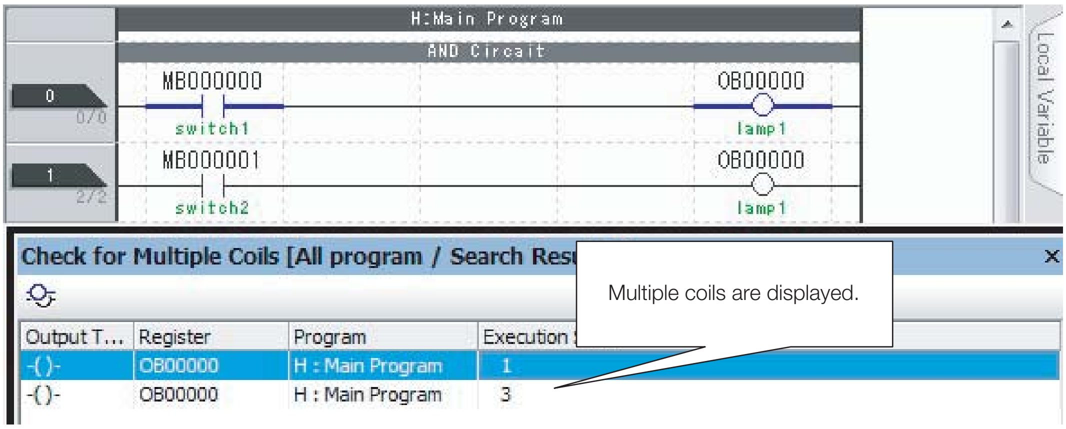
7.6.7 Checking for Multiple Coils

You can check for multiple coils (different coils that use the same register) in the entire ladder program, and display the search results.

> Important
>
> When you use a project link connection, the data in the project file is used. Sometimes the displayed results do not match the data in the linked SERVOPACK.
> When you check for multiple coils and use a project link connection, first always read the data to the project file by clicking the **Read from Controller** Button in the Transfer Dialog Box.

Select ***Debug*** – ***Check for Multiple Coils*** from the menu bar.

Searching for multiple coils will start, and the results will be displayed in the Check for Multiple Coils Pane.



Check for Multiple Coils [All program / Search Resu

Multiple coils are displayed.

Output T...	Register	Program	Execution
-( )-	OB00000	H : Main Program	1
-( )-	OB00000	H : Main Program	3

Information If the **Enable to Multiple Coil Check** Check Box is selected in the compile options, a search for multiple coils will be performed during compilation and the results will be displayed as warnings in the Output Pane.

7.6.8 Forcing Coils ON and OFF

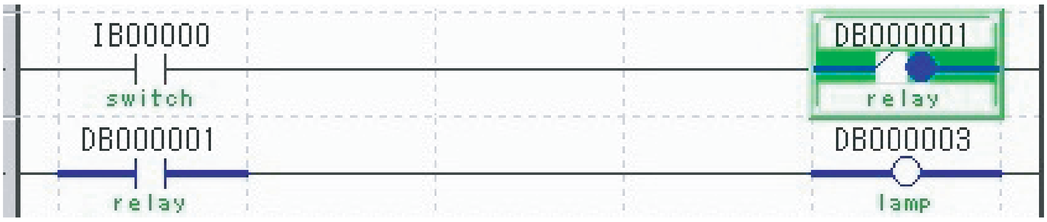
This section describes how to force coils ON and OFF, and how to change the forced status.

Forcing Coils ON or OFF from a Ladder Program

You can monitor a program by forcing specified coil objects ON or OFF in the Ladder Editor.

1. Select the coil to force ON or OFF.
2. Select ***Debug*** – ***Force ON*** or ***Debug*** – ***Force OFF*** from the menu bar.
   The selected coil will be forced ON or OFF.

Coil is forced ON.



Information Select ***Debug - Disable Force*** from the menu bar to cancel forced ON or forced OFF status.

Changing the Forced ON/OFF Status from the Force Coil List Pane

The Force Coil List Pane lists the ON/OFF status of the forced coils in the ladder program.

You can also change and cancel the ON, OFF, or canceled status of the forced coils in the entire ladder program.

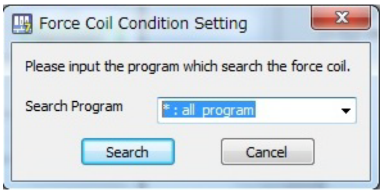
◆ Searching for Forced Coils in the Force Coil List Pane

1. Display the Force Coil List Pane.

   Note: You can show and hide the Force Coil List Pane by selecting ***View*** – ***Other Windows*** – ***Force Coil List*** from the menu bar.

2. Select ***Debug*** – ***Force Coil List*** from the Main Window of the MPE720.

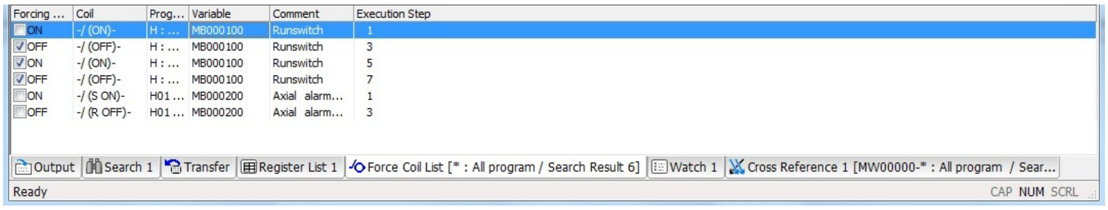
   Note: In the above case, all programs will be searched for forced coils. To specify a program for the search, click the **Forced Coil Condition Setting** Button ( ) to display the Forced Coil Condition Setting Dialog Box.



Please input the program which search the force coil.

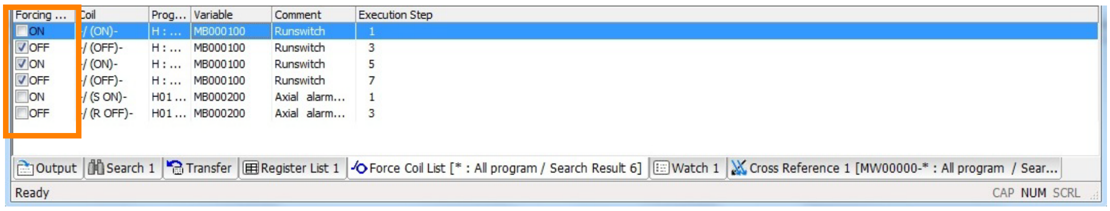
Search Program: * : all program

The search results will be displayed in the Force Coil List Pane.



Forcing ...	Coil	Prog...	Variable	Comment	Execution Step
☐ ON	-/ (ON)-	H : ...	MB000100	Runswitch	1
☑ OFF	-/ (OFF)-	H : ...	MB000100	Runswitch	3
☑ ON	-/ (ON)-	H : ...	MB000100	Runswitch	5
☑ OFF	-/ (OFF)-	H : ...	MB000100	Runswitch	7
☐ ON	-/ (S ON)-	H01 ...	MB000200	Axial alarm...	1
☐ OFF	-/ (R OFF)-	H01 ...	MB000200	Axial alarm...	3

3. Select the check boxes for the coils to force ON or OFF.



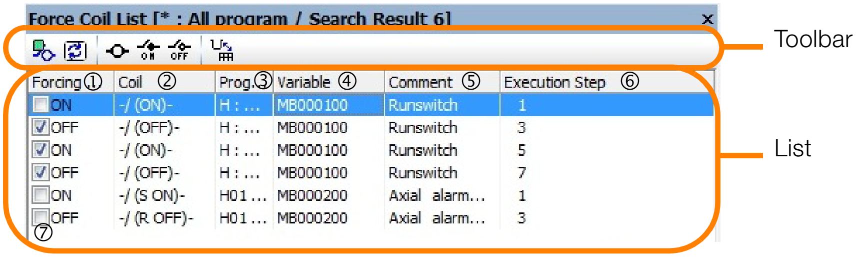
Forcing ...	Coil	Prog...	Variable	Comment	Execution Step
☐ ON	/ (ON)-	H : ...	MB000100	Runswitch	1
☑ OFF	/ (OFF)-	H : ...	MB000100	Runswitch	3
☑ ON	/ (ON)-	H : ...	MB000100	Runswitch	5
☑ OFF	/ (OFF)-	H : ...	MB000100	Runswitch	7
☐ ON	/ (S ON)-	H01 ...	MB000200	Axial alarm...	1
☐ OFF	/ (R OFF)-	H01 ...	MB000200	Axial alarm...	3

Information

1. If you right-click in the Force Coil List Pane, you can use the pop-up menu to select ***Check All*** or ***Uncheck All*** to select or clear the selections of the all of the Forcing Check Boxes.
2. If you select or double-click a search result row in the Force Coil List Pane, you can jump to the corresponding coil in the ladder program. Alternatively, you can right-click in the list in the Force Coil List Pane, and select ***Jump*** from the pop-up menu. If the program is not open, it will be opened automatically and the display will jump to the corresponding coil in the program.
3. If you right-click in the Force Coil List Pane and select ***Cross Reference*** from the pop-up menu, or select ***Debug*** – ***Cross Reference*** from the menu bar, the register that is set for the coil will be checked for cross references and the results will be displayed in the Cross Reference Pane.
4. If you edit the ladder program while the search results are displayed, the coils in the edited program will be displayed in gray.

◆ Names and Descriptions of the Force Coil List Pane Items

The Force Coil List Pane consists of a list where the forced coils are displayed, and a toolbar that is used to search and repeat searches for forced coils, and to change the forced status of coils.

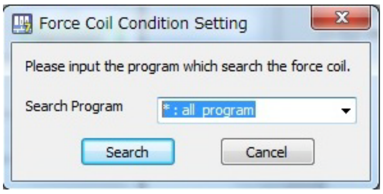


Force Coil List [* : All program / Search Result 6]

Forcing ①	Coil ②	Prog.③	Variable ④	Comment ⑤	Execution Step ⑥
☐ ON	-/ (ON)-	H : …	MB000100	Runswitch	1
☑ OFF	-/ (OFF)-	H : …	MB000100	Runswitch	3
☑ ON	-/ (ON)-	H : …	MB000100	Runswitch	5
☑ OFF	-/ (OFF)-	H : …	MB000100	Runswitch	7
☐ ON	-/ (S ON)-	H01 …	MB000200	Axial alarm…	1
☐ OFF	-/ (R OFF)-	H01 …	MB000200	Axial alarm…	3

■ Toolbar

- Force Coil Condition Setting Button ()
  Click this button to display the Force Coil Condition Setting Dialog Box. Specify the program to search for forced coils.



Please input the program which search the force coil.

Search Program: * : all program

- Repeat Search Button ()
  Click this button to repeat the forced coil search in the program that was specified in the Force Coil Condition Setting Dialog Box.
- Cancel Forcing Button ()
  Click this button to cancel the forced status of the selected coils.
- Force ON Button ()
  Click this button to force ON the selected coils.
- Force OFF Button ()
  Click this button to force OFF the selected coils.
- Variable Display Switch Button ()
  Click this button to switch the display of the register that is used by the coil between a register or a variable.

■ List

① Forcing
This column displays the forced ON or OFF status of the coils that were found.

② Coil
This column displays the coils that were found.
There are six types of coils.

Coil Type	Coil Symbol	
	ON	OFF
Coil	–/ (ON)–	–/ (OFF)–
Set Coil	–/ (S ON)–	–/ (S OFF)–
Reset Coil	–/ (R ON)–	–/ (R OFF)–

③ Programs
This column displays the names of the programs where the coils were found.

④ Variable
This column displays the variables or registers that are set for the coils that were found.

⑤ Comment
This column displays the comments of the variables.

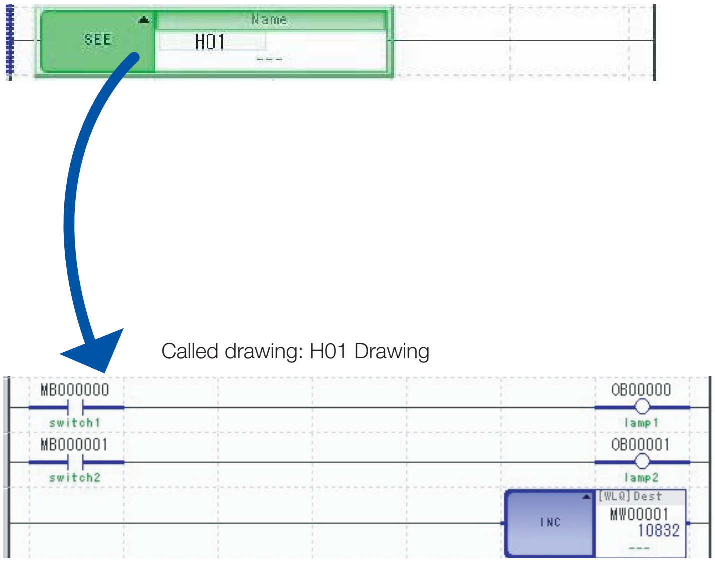
⑥ Execution Step
This column displays the execution step numbers of the coils that were found.

⑦ Check Boxes
The coils with selected check boxes will be subject to forcing operations (ON, OFF, or Cancel). You can use the toolbar buttons and also the pop-up menu to force the status of all selected coils to ON, OFF, or canceled.

7.6.9 Viewing a Called Program

You can open a drawing that is called with a SEE (Call Program) instruction or a FUNC (User Function) instruction.

Select the SEE instruction object or FUNC instruction object for the program to view, and select ***Debug*** – ***Open Program*** from the Main Window of the MPE720.


Calling instruction

Called drawing: H01 Drawing

7.6.10 Enabling and Disabling a Program

A program drawing can be disabled to temporarily prevent the program from being executed.

Right-click the program in the Ladder Pane, and select ***Enable*** or ***Disable***.

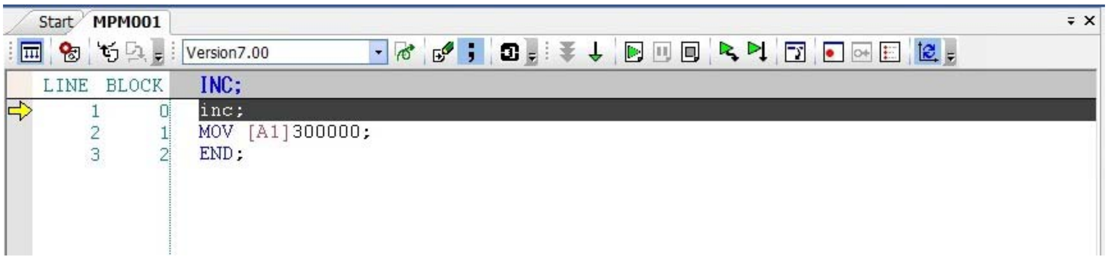
7.7 Debugging a Motion or a Sequence Program

This section describes how to execute programs in Debug Operation Mode.

The Debug Operation Mode allows you to monitor the line of the motion or sequence program that is currently being executed. This makes it easier to find bugs in the program.

You can pause the execution of a program, set breakpoints, perform single-step execution (single-block execution), and perform other operations to ensure proper operation of the program that you developed.

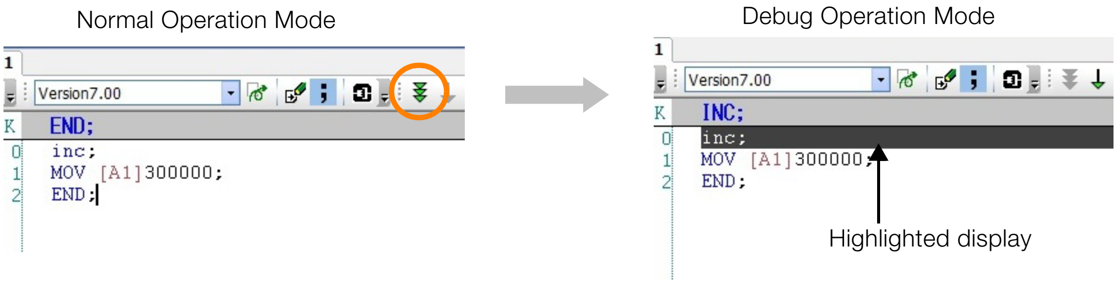
In Debug Operation Mode, the program line that is being executed is displayed at the top of the tab page as shown below.



```
INC;
inc;
MOV [A1]300000;
END;
```

To start Debug Operation Mode, first connect to the SERVOPACK, then click the Icon on the Edit Motion Program Tab Page.

In Debug Operation Mode, the program line that is being executed is highlighted at the top of the tab page.

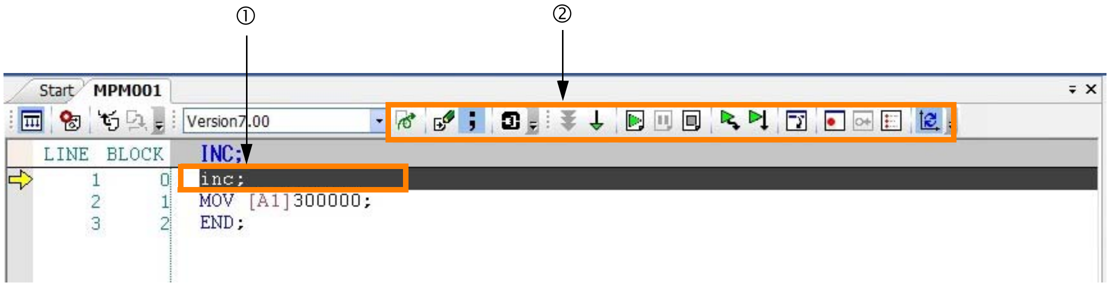


```
END;
inc;
MOV [A1]300000;
END;
```

```
INC;
inc;
MOV [A1]300000;
END;
```

Important You must register the program for execution before you can start Debug Operation Mode.

7.7.1 Tab Page Items



```
INC;
1 0 inc;
2 1 MOV [A1]300000;
3 2 END;
```

① Current Program Line

The program line that is currently being executed is displayed in blue.

If an alarm has occurred in the motion program, the line will be displayed in red. Refer to the following manual for details on motion program alarms.

📖 Σ-7-Series Σ-7C SERVOPACK Troubleshooting Manual (Manual No.: SIEP S800002 07)

② Toolbar Icons and Function Keys

The following table describes the icons and function keys that are used in Debug Operation Mode.

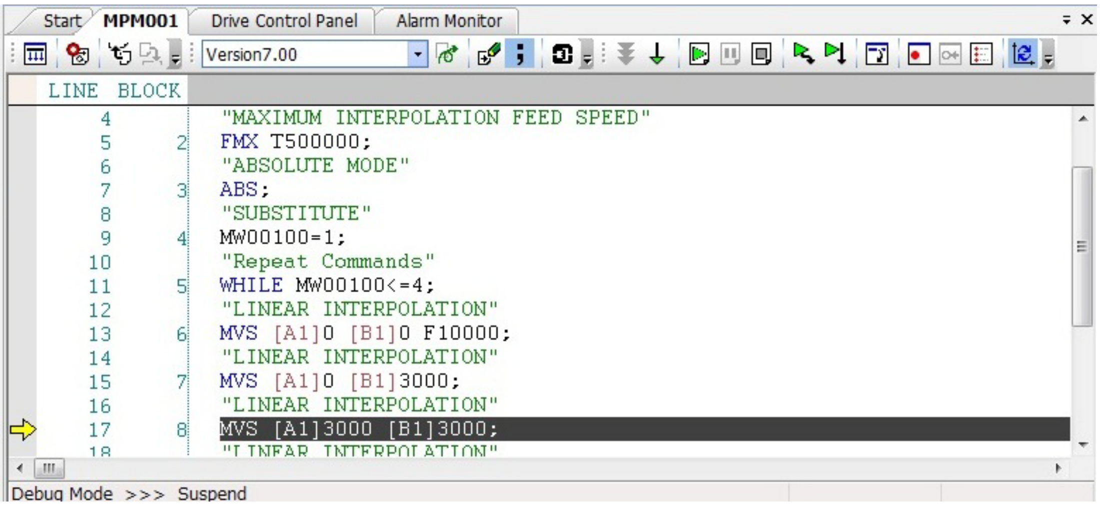
Function	Icon	Key Operation	Description	Motion Programs	Sequence Programs
Debug Operation Mode	⇊	F1	Starts Debug Operation Mode.	○	○
Normal Operation Mode	↓	F11	Ends Debug Operation Mode and starts the continuous execution of the program in Normal Operation Mode.	○	○
Move Start Point	↲	F6	Moves the start point for execution.	○	○
Breakpoint Set/ Remove	▣	F7	Sets or removes a breakpoint. Displays the breakpoints in the program.	○	○
Step In	↘	F4	Executes one block. For an MSEE or SSEE instruction, debugging will move to the first line of the subprogram.	○	○
Step Over	▶↓	F5	Executes one block. For an MSEE or SSEE instruction, the subprogram will be executed and debugging will continue at the next block after the MSEE or SSEE instruction.	○	○
Execute	▶	F8	Continuously executes a motion program in Debug Operation Mode.	○	○
Break	⏸	F10	Pauses the execution of a motion program in Debug Operation Mode.	○	○
End	■	F2	Ends execution of the motion program.	○	×
Update Current Position	↻	–	Updates the current position coordinates.	○	×
Set Motion Task		–	Sets the fork number, level number, and task of the selected program.	○	○
Breakpoint Enable/Disable	–	–	Enables or disables breakpoints. Use the Debug Menu or the pop-up menu for this setting.	○	○

Note: ○: Possible ×: Not possible.

7.7.2 Monitoring Program Execution

You can monitor the lines of the program that are currently being executed to debug the program more easily.

You can use the Drive Control Panel to monitor the execution and debug the program.



```
LINE  BLOCK
   4         "MAXIMUM INTERPOLATION FEED SPEED"
   5      2  FMX T500000;
   6         "ABSOLUTE MODE"
   7      3  ABS;
   8         "SUBSTITUTE"
   9      4  MW00100=1;
  10         "Repeat Commands"
  11      5  WHILE MW00100<=4;
  12         "LINEAR INTERPOLATION"
  13      6  MVS [A1]0 [B1]0 F10000;
  14         "LINEAR INTERPOLATION"
  15      7  MVS [A1]0 [B1]3000;
  16         "LINEAR INTERPOLATION"
  17      8  MVS [A1]3000 [B1]3000;
  18         "LINEAR INTERPOLATION"
Debug Mode >>> Suspend
```

There are two modes for debugging and monitoring: Debug Operation Mode and Normal Operation Mode.

Debug Operation Mode

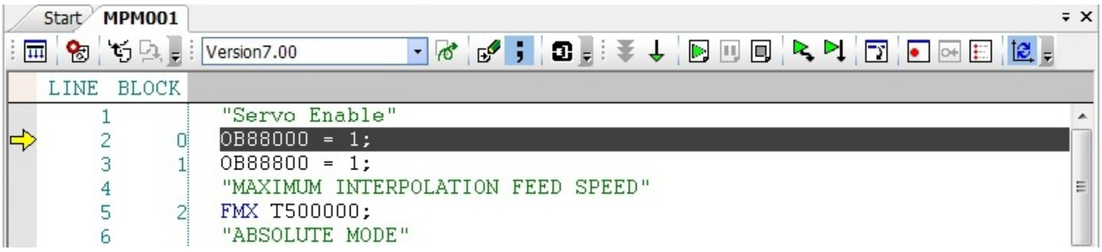
This mode executes the program one line at a time. While in Debug Operation Mode, you can check the operation status of the program in the Drive Control Panel.

Normal Operation Mode

This mode executes the program continuously from the beginning to the end. You can monitor the block lines one by one.

◆ Block Monitor Tab Page

The line that is currently being executed is highlighted.



```
LINE  BLOCK
   1         "Servo Enable"
   2      0  OB88000 = 1;
   3      1  OB88800 = 1;
   4         "MAXIMUM INTERPOLATION FEED SPEED"
   5      2  FMX T500000;
   6         "ABSOLUTE MODE"
```

■ Monitoring Subprograms

You must set a motion task for the subprogram in advance.

You cannot monitor a subprogram without a motion task setting.

■ Monitoring Sequence Programs

The Block Monitor Tab Page is displayed for sequence programs only if they are executed in Debug Operation Mode.

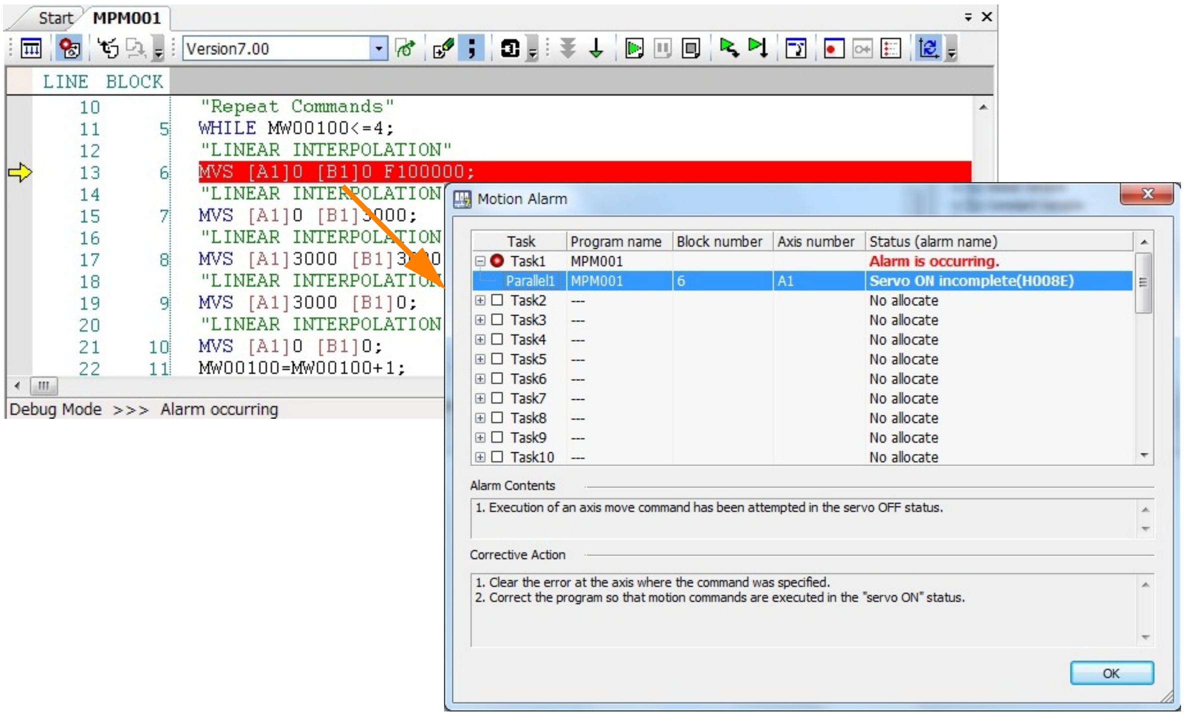
■ Monitoring Programs That Are Being Edited

If you edit the program while it is executed in monitoring mode, the Block Monitor Tab Page will change in the following way:

- If you edit the program, the Block Monitor Tab Page will disappear.
- After you edit and compile the program, the Block Monitor Tab Page will be displayed.

Alarm Indications

If an alarm occurs in the motion program during execution, the line that is being executed will be displayed in red.



```
LINE  BLOCK
 10         "Repeat Commands"
 11      5  WHILE MW00100<=4;
 12         "LINEAR INTERPOLATION"
 13      6  MVS [A1]0 [B1]0 F100000;
 14         "LINEAR INTERPOLATION
 15      7  MVS [A1]0 [B1]3000;
 16         "LINEAR INTERPOLATION
 17      8  MVS [A1]3000 [B1]3[illegible]0
 18         "LINEAR INTERPOLATIO
 19      9  MVS [A1]3000 [B1]0;
 20         "LINEAR INTERPOLATION
 21     10  MVS [A1]0 [B1]0;
 22     11  MW00100=MW00100+1;
```

Debug Mode >>> Alarm occurring

Motion Alarm

Task	Program name	Block number	Axis number	Status (alarm name)
⊟ ● Task1	MPM001			Alarm is occurring.
Parallel1	MPM001	6	A1	Servo ON incomplete(H008E)
⊞ ☐ Task2	---			No allocate
⊞ ☐ Task3	---			No allocate
⊞ ☐ Task4	---			No allocate
⊞ ☐ Task5	---			No allocate
⊞ ☐ Task6	---			No allocate
⊞ ☐ Task7	---			No allocate
⊞ ☐ Task8	---			No allocate
⊞ ☐ Task9	---			No allocate
⊞ ☐ Task10	---			No allocate

Alarm Contents

1. Execution of an axis move command has been attempted in the servo OFF status.

Corrective Action

1. Clear the error at the axis where the command was specified.
2. Correct the program so that motion commands are executed in the "servo ON" status.

7.7.3 Register List Panes

You can display a register list in the same way as you can when you debug a ladder program.

Refer to the following section for details.

☞ *7.6.2 Register List Panes* on page 7-56

7.7.4 Watch Panes

You can monitor the values and comments of the specified S, I, O, M, C, D, and G registers in the Watch 1, 2, and 3 Panes. Refer to the following section for details.

☞ *7.6.3 Watch Panes* on page 7-59

7.7.5 Searching and Replacing in Programs

You can search and replace text in the same way as you can for ladder programs. Refer to the following section for details.

☞ *7.6.4 Searching and Replacing in Programs* on page 7-60

7.7.6 Searching and Replacing in Project Files

You can search and replace text in the same way as you can for ladder programs. Refer to the following section for details.

☞ *7.6.5 Searching and Replacing in Project Files* on page 7-62

7.7.7 Viewing a Motion Subprogram

You can open and view a program that is called with an MSEE instruction.

1. Select the MSEE instruction for the drawing with the program to view, then select ***Debug – Refer to Motion Sub Program*** from the menu bar.
2. The called program will be displayed in the Edit Motion Program Tab Page.

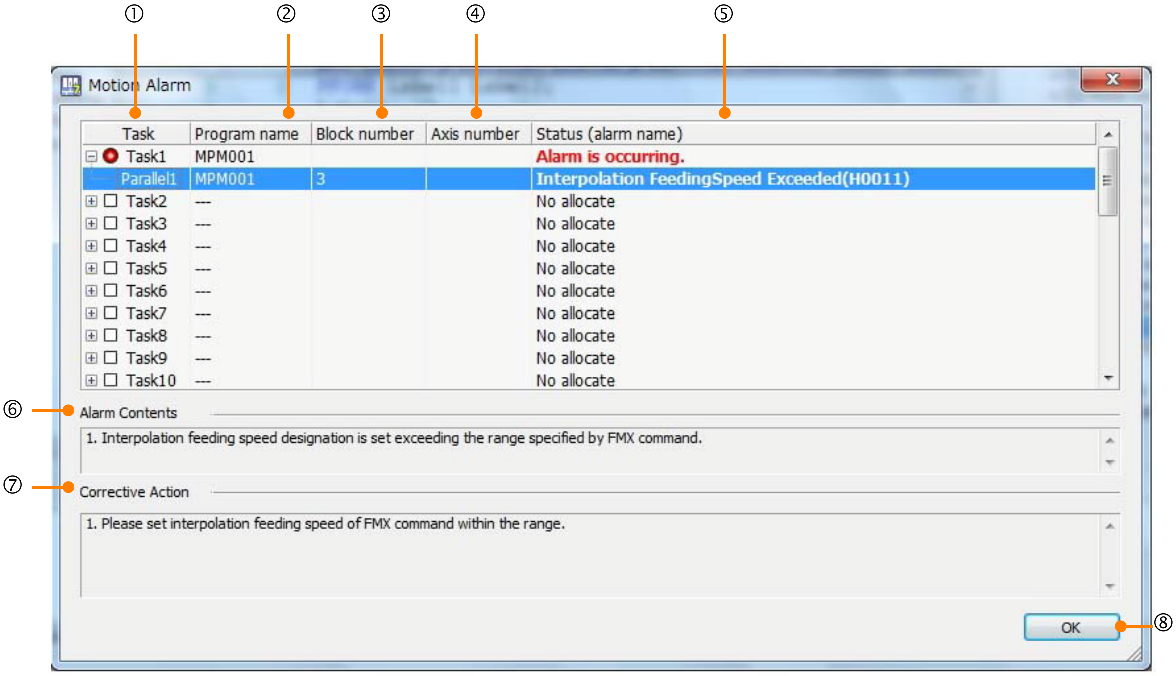
7.7.8 Cross Reference Searches

You can search and replace text in the same way as you can for ladder programs. Refer to the following section for details.

☞ *7.6.6 Cross Reference Panes* on page 7-64

7.7.9 Monitoring Motion Alarms

Use this dialog box to check any alarms that occur during motion program execution.



Task	Program name	Block number	Axis number	Status (alarm name)
⊟ ● Task1	MPM001			Alarm is occurring.
Parallel1	MPM001	3		Interpolation FeedingSpeed Exceeded(H0011)
⊞ ☐ Task2	---			No allocate
⊞ ☐ Task3	---			No allocate
⊞ ☐ Task4	---			No allocate
⊞ ☐ Task5	---			No allocate
⊞ ☐ Task6	---			No allocate
⊞ ☐ Task7	---			No allocate
⊞ ☐ Task8	---			No allocate
⊞ ☐ Task9	---			No allocate
⊞ ☐ Task10	---			No allocate

Alarm Contents

1. Interpolation feeding speed designation is set exceeding the range specified by FMX command.

Corrective Action

1. Please set interpolation feeding speed of FMX command within the range.

No.	Name	Description
①	Task	Displays the task numbers.
②	Program name	Displays the program numbers.
③	Block number	Displays the block numbers where the alarms occurred.
④	Axis number	Displays the axis numbers where the alarms occurred.
⑤	Status (alarm name)	Displays the names of the alarms.
⑥	Alarm Contents	This box displays a description of the alarm.
⑦	Corrective Action	This box displays information on correcting the condition that caused the alarm.
⑧	OK	The **OK** Button closes the Motion Alarm Dialog Box and returns to the Edit Motion Program Tab Page.

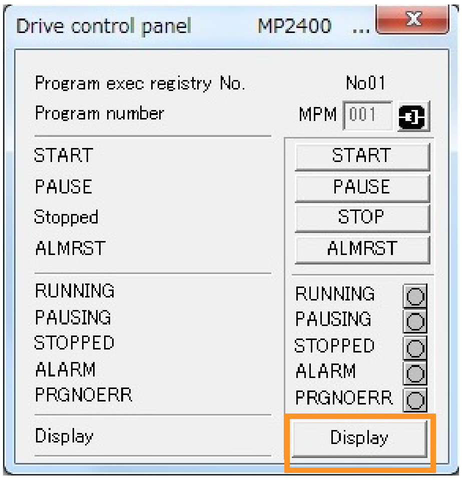
Checking Alarm Codes

When a motion program alarm occurs (i.e., when status bit 8 (Active Program Alarm) turns ON), the cause of the alarm is reported in the alarm code.

The motion program alarm codes can be checked using the Error Information Dialog Box or the S registers.

◆ Error Information Dialog Box

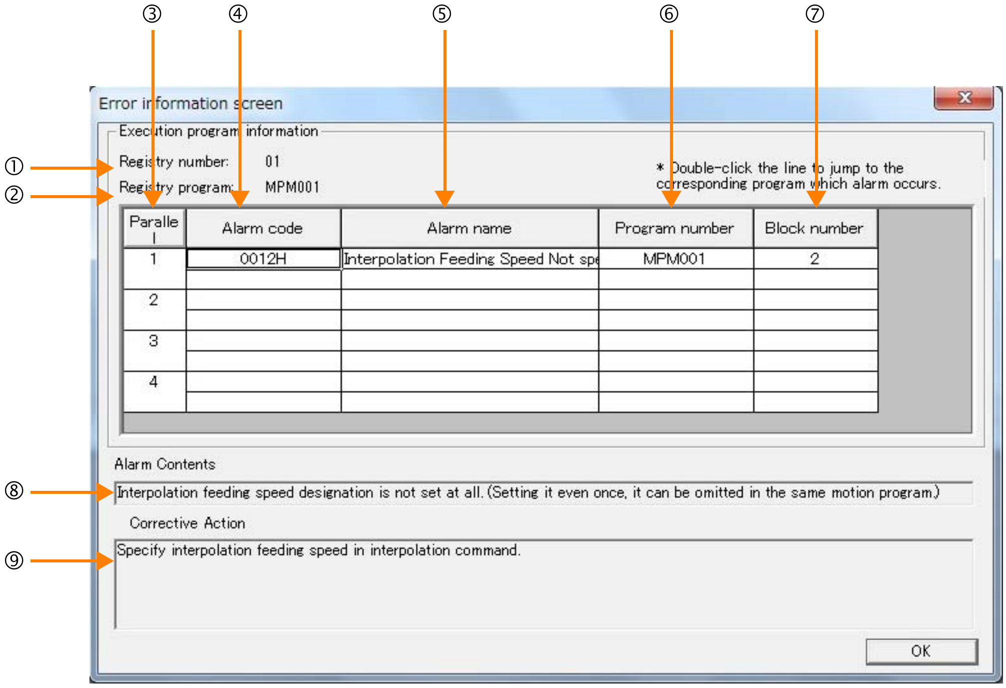
Click the **Display** Button next to **Display** in the Drive Control Panel to display the Error Information Dialog Box.



Program exec registry No. No01
Program number MPM 001

Information To open the Error Information Dialog Box from the Edit Motion Program Tab Page, right-click on the Edit Motion Program Tab Page and select ***Motion Alarm*** … from the pop-up menu.

The Error Information Dialog Box will be displayed.



Registry number: 01
Registry program: MPM001

* Double-click the line to jump to the corresponding program which alarm occurs.

Parallel	Alarm code	Alarm name	Program number	Block number
1	0012H	Interpolation Feeding Speed Not spe	MPM001	2
2				
3				
4				

Alarm Contents: Interpolation feeding speed designation is not set at all. (Setting it even once, it can be omitted in the same motion program.)

Corrective Action: Specify interpolation feeding speed in interpolation command.

① Registry Number

If the alarm occurred in a motion program that was registered in the M-EXECUTOR program execution definitions, then this box will show the M-EXECUTOR registration number.

If the alarm occurred in a motion program that was called from a ladder program with an MSEE instruction, then this box will show ---.

② Registry Program

If the alarm occurred in a motion program that was registered in the M-EXECUTOR program execution definitions, then this box will show the name of the program registered in the M-EXECUTOR.

If the alarm occurred in a motion program that was called from a ladder program with an MSEE instruction, then this box will show ---.

③ Parallel

When parallel execution (PFORK) is used in a motion program, sometimes more than one alarm will occur at the same time. Refer to the following manual for details on parallel execution.

📖 Σ-7-Series Σ-7C SERVOPACK Motion Control User's Manual (Manual No.: SIEP S800002 03)

④ Alarm Code

This column displays the alarm codes.

⑤ Alarm Name

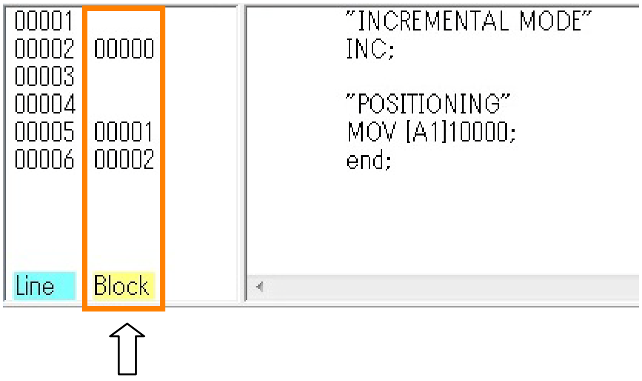
This column displays the names of the alarms.

⑥ Program Number

This column displays the names of the programs where the alarms occurred.

⑦ Block Number

This column displays the numbers of the blocks where the alarms occurred.
Double-click the block number to jump to the program where the alarms occurred.
The block numbers are displayed in the Edit Motion Program Tab Page.



```
00001         "INCREMENTAL MODE"
00002  00000  INC;
00003
00004         "POSITIONING"
00005  00001  MOV [A1]10000;
00006  00002  end;
```

⑧ Alarm Contents

This box displays a description of the alarm.

⑨ Corrective Action

This box displays instructions to correct the error that caused the alarm to occur.

◆ S Registers

Refer to the following manual for information on checking the alarm codes in the S registers.

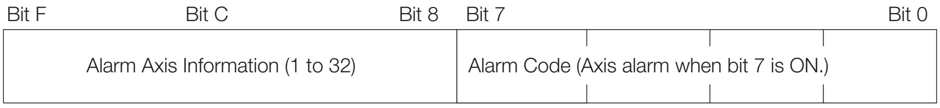
Σ-7-Series Σ-7C SERVOPACK Troubleshooting Manual (Manual No.: SIEP S800002 07)

7.7.10 Alarm Code Details

This section describes the alarm codes that are used in motion programs.

Structure of Motion Program Alarms

The following figure shows the structure of the alarm codes.



Motion Program Alarm Codes

The following table lists the alarm codes for motion programs.

Alarm Code	Alarm Name	Alarm Description	Corrective Action
0002h	Division error	The data was divided by 0.	Correct the motion program.
0010h	Turn specified instead of radius	A number of turns (T) was specified instead of a radius for a circular or helical interpolation instruction.	• Convert the radius setting to a center point coordinate setting to execute the circular or helical interpolation instruction. • Do not specify a number of turns.
0011h	Interpolation Feed Speed Exceeded	The interpolation feed speed setting exceeded the setting range of the FMX instruction.	Correct the feed speed setting of the interpolation instruction.

Continued on next page.

Continued from previous page.

Alarm Code	Alarm Name	Alarm Description	Corrective Action
0012h	No interpolation feed speed setting	The interpolation feed speed has never been set. (If you set it once, further settings can be omitted within the same program.)	Set the feed speed using the interpolation instruction.
0013h	Range exceeded after acceleration parameter conversion	The indirectly designated acceleration parameter exceeded the setting range.	Change the value of the register that is used for the indirect designation.
0014h	Circular arc length exceeded LONG_MAX	The circular arc length that was specified for a circular or helical interpolation instruction exceeded the setting range.	Correct the circular arc length setting for the circular or helical interpolation instruction.
0015h	No vertical axis set for the circular arc plane	The vertical axis was not set for a circular or helical interpolation instruction.	Set the axis with the PLN instruction.
0016h	No horizontal axis set for the circular arc plane	The horizontal axis was not set for a circular or helical interpolation instruction.	Set the axis with the PLN instruction.
0017h	Number of axes over limit	The number of specified axes exceeds the limit of a circular interpolation instruction (2 axes max.) or a helical interpolation instruction (3 axes max.).	Correct the axis setting of the circular or helical interpolation instruction.
0018h	Number of turns over limit	The number of turns that was specified for a circular or helical interpolation instruction exceeded the setting range.	Correct the number of turns setting of the circular or helical interpolation instruction.
0019h	Radius exceeded LONG_MAX	The radius that was specified for a circular or helical interpolation instruction exceeded the setting range.	Correct the radius setting for the circular or helical interpolation instruction.
001Ah	Center point setting error	The correct center point was not set for a circular or helical interpolation instruction.	Specify a correct center point for the circular or helical interpolation instruction.
001Bh	Emergency stop	The axis movement instruction was stopped due to a Request for Stop of Program.	Turn OFF the Request for Stop of Program motion program control signal, and turn ON the Alarm Reset Request.
001Ch	Linear interpolation travel distance exceeded LONG_MAX	The travel distance that was specified for a linear interpolation instruction exceeded the setting range.	Correct the travel distance for the linear interpolation instruction.
001Dh	FMX is not defined	There was no FMX instruction executed in a motion program that includes an interpolation instruction.	Execute an FMX instruction. An FMX instruction is required for each program that contains an interpolation instruction.

Continued on next page.

Continued from previous page.

Alarm Code	Alarm Name	Alarm Description	Corrective Action
001Eh	T address out of range	The address setting in an IAC/IDC/FMX instruction exceeds the setting range.	Correct the setting in the IAC/IDC/FMX instruction.
001Fh	P address out of range	The address setting in an IFP instruction exceeds the setting range.	Correct the setting in the IFP instruction.
0021h	PFORK execution error	Motion instructions were executed at the same time in the second fork of the PFORK instruction in the calling motion program and the second fork of the PFORK instruction in the subprogram.	Correct the motion program or the subprogram.
0022h	Indirect designation register range error	The specified register address exceeds the range of the register size.	Correct the motion program.
0023h	Travel distance out of range	The decimal-format axis travel distance specified in an axis movement instruction exceeds the allowed range.	Correct the axis travel distance.
0024h	Interpolation override out of range	The interpolation override setting exceeded the setting range.	Correct the interpolation override setting.
0026h	PFORK number of parallel forks error	The number of parallel forks exceeded the number set for the parallel mode.	• Correct the motion program. • Correct the parallel mode setting.
0080h	Logical axis use prohibited	More than one motion instruction was executed for the same axis.	Correct the motion program.
0081h	The infinite length axis setting exceeded POSMAX	The travel distance setting for infinite length axis exceeded the POSMAX setting.	• Set the Infinite Length Axis Reset Position fixed parameter. • Correct the motion program.
0082h	The axis travel distance exceeded LONG_MAX	The axis travel distance setting exceeded the allowed range.	Correct the motion program.
0084h	Duplicated motion command	More than one instruction was executed for the same axis.	Check to see if a reference for the same axis is being issued from any other program. If it is, correct the program.
0085h	Motion command response error	A response for a different motion command was reported by the Motion Control Function Module when a motion instruction was executed.	• Remove the cause of the alarm at the target axis. • If the Servo is not ON, turn ON the Servo. • Check to see if a reference for the same axis is being issued from any other program. If it is, correct the program.
0087h	VEL setting out of range	The setting in the VEL instruction exceeds the allowed range.	Correct the VEL instruction.
0088h	INP setting out of range	The setting in the INP instruction exceeds the allowed range.	Correct the INP instruction.
0089h	ACC/SCC/DCC setting out of range	The setting in the ACC/SCC/DCC instruction exceeds the allowed range.	Correct the ACC/SCC/DCC instruction.
008Ah	No time setting in MVT instruction	The T setting in the MVT instruction is zero.	Correct the MVT instruction.
008Bh	Command cannot be executed.	The specified motion instruction cannot be executed on the target Motion Control Function Module.	Correct the motion program.
008Ch	Distribution incomplete	A motion instruction was executed when the Motion Control Function Module has not completed distribution for a previous instruction.	Correct the motion program so that the motion instruction is executed when the Distribution Completed Bit is ON.
008Dh	Motion command error termination	The Motion Control Function Module is in Command Error status.	• Clear the error at the target axis. • Correct the motion program.

7.8 Monitoring Machine Operation

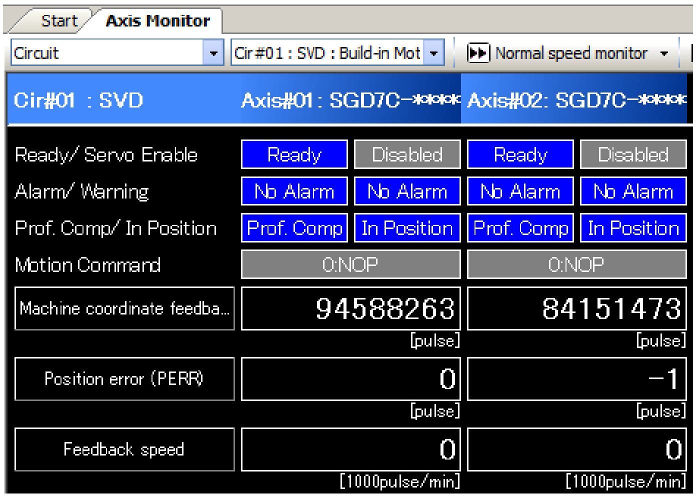
This section describes how to monitor a machine that is connected to the SERVOPACK.

7.8.1 Axis Monitor

You can continuously monitor the operating status for each axis that is connected to the SERVOPACK.

You can display the operating status of the axes and the data of other monitor parameters.

Information You can use the Axis Monitor Tab Page to check the Ready/Servo ON status (“Ready/Servo Enable”), the Alarm/Warning status, the Distribution/Positioning Completed (“Prof. Comp/In Position”) status, and the motion command.

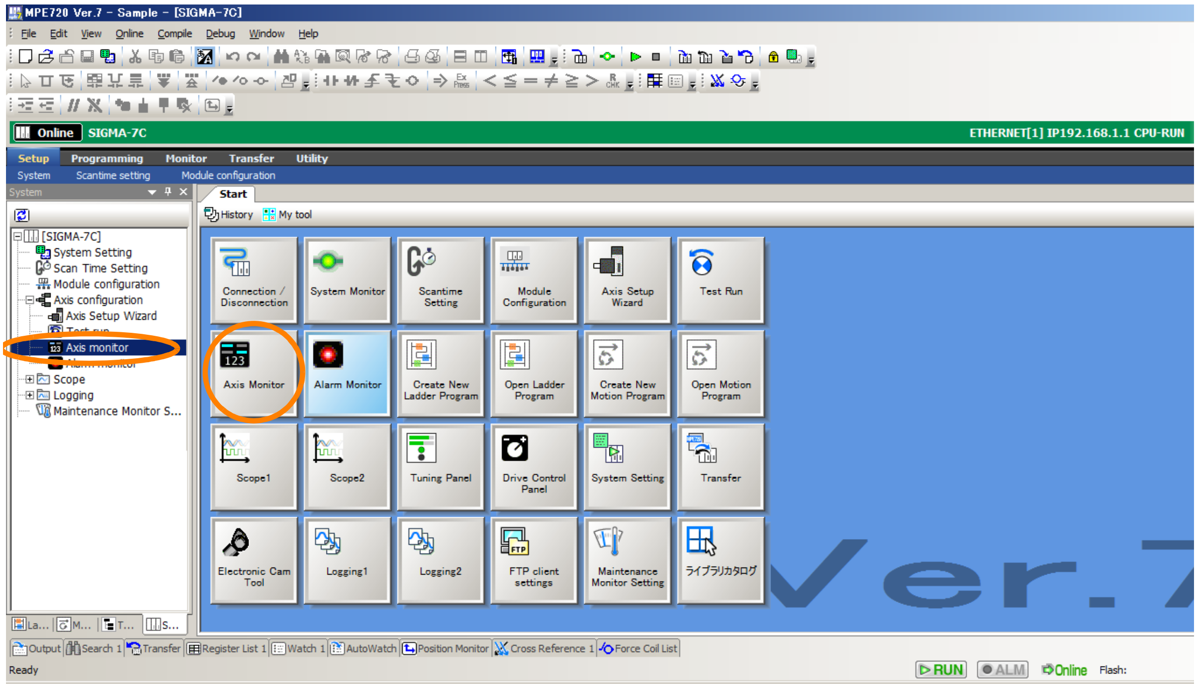


Cir#01 : SVD	Axis#01 : SGD7C-****		Axis#02: SGD7C-****	
Ready/ Servo Enable	Ready	Disabled	Ready	Disabled
Alarm/ Warning	No Alarm	No Alarm	No Alarm	No Alarm
Prof. Comp/ In Position	Prof. Comp	In Position	Prof. Comp	In Position
Motion Command	0:NOP		0:NOP	
Machine coordinate feedba...	94588263 [pulse]		84151473 [pulse]	
Position error (PERR)	0 [pulse]		−1 [pulse]	
Feedback speed	0 [1000pulse/min]		0 [1000pulse/min]	

Starting the Axis Monitor

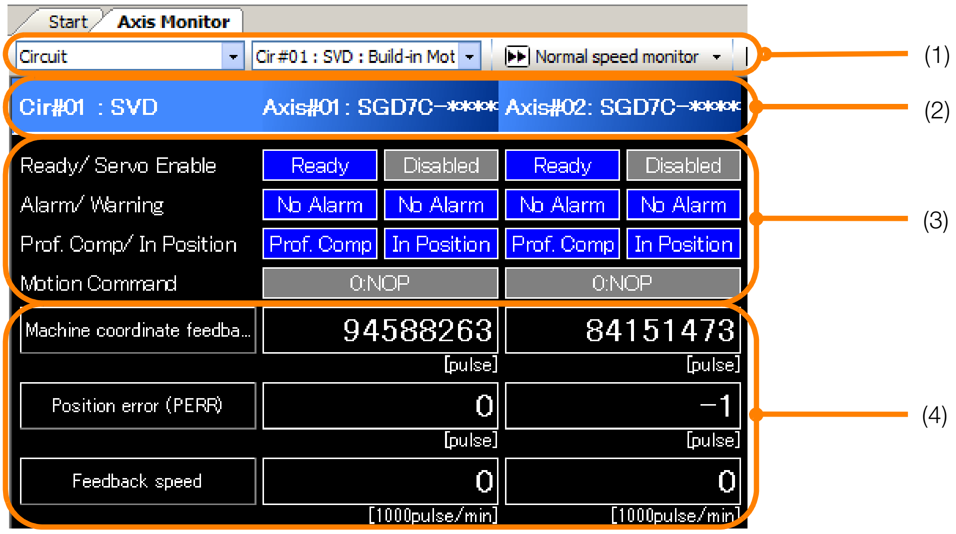
Select **Axis configuration** – **Axis monitor** in the System Pane of MPE720. And then, double-click **Axis monitor**.

Alternatively, click the **Axis Monitor** Button in the My Tool View.



Names and Functions of the Axis Monitor Tab Page Items

The following figure shows the items that are displayed on the Axis Monitor Tab Page.



Cir#01 : SVD	Axis#01 : SGD7C-****		Axis#02: SGD7C-****	
Ready/ Servo Enable	Ready	Disabled	Ready	Disabled
Alarm/ Warning	No Alarm	No Alarm	No Alarm	No Alarm
Prof. Comp/ In Position	Prof. Comp	In Position	Prof. Comp	In Position
Motion Command	0:NOP		0:NOP	
Machine coordinate feedba...	94588263 [pulse]		84151473 [pulse]	
Position error (PERR)	0 [pulse]		-1 [pulse]	
Feedback speed	0 [1000pulse/min]		0 [1000pulse/min]	

No.	Item	Function
(1)	Toolbar	Use the toolbar to update the display or stop the monitor.
(2)	Circuit and axis display	Displays the circuit number and the axis name.
(3)	Axis operating status display	Displays the operating status of the axis.
(4)	Monitor parameter display	Displays the names and current values of the monitor parameters.

Information The following axes can be displayed for the given Function Modules.
SVD: The axes connected to the SERVOPACK
SVC4: The axes connected to the MECHATROLINK
SVR4: 4 axes

The following section gives detailed information on each item.

■ Toolbar

The toolbar contains icons for selecting the circuit, changing the monitoring speed, and controlling the display.

Icon	Name	Function
Cir#01 : SVC32 : MECH	Circuit selection	Selects the circuit to monitor.
High speed monitor Normal speed monitor Low speed monitor	Monitor type	Selects the monitoring frequency from the following three options: • High-speed monitor • Normal-speed monitor • Low-speed monitor
Stop monitor Monitoring...	Stop monitor Start monitor	Stop monitor: Stops the monitor. Monitoring: The monitor is operating.
	Alarm monitor	Display the alarm monitor.
	Refresh	Updates the information on the Axis Monitor Tab Page.

■ Circuit and Axis Display

This area displays the circuit number of the Module that is connected to the SERVOPACK, the name of the Motion Control Function Module (SVD, SVC4, or SVR4), and the name of the axis connected to the Motion Control Function Module.

You can select a Module from the list to display the Axis Monitor for another Module.

■ Axis Display

This area displays the axis number, the axis type, and the comment (if there is one) for the axis.

■ Axis Operating Status Display

This area displays the operating status of the axis. You can use this area to check the Ready/Servo ON status (“Ready/Servo Enable”), the Alarm/Warning status, the Distribution/Positioning Completed (“Prof. Comp/In Position”) status, and the motion command.

- Ready/Servo ON (“Ready/Servo Enable”)

This row displays whether the axis is in ready status and whether it is in Servo ON (“Enabled”) status.

Icon	Name	Function
Ready Not Ready	Ready	Ready: Preparations for axis operation have been completed. Not Ready: Preparations for axis operation have not been completed.
Enabled Disabled	Enabled	Enabled: The Servo is ON. Disabled: The Servo is OFF.

- Alarms/Warnings

This row is displayed if an alarm or warning has occurred.

Icon	Name	Function
Alarm	Alarm	An alarm has occurred.
Warning	Warning	A warning has occurred.

To see details on the alarm or warning, click the status indicator to display the Alarm/Warning Dialog Box.

When the alarm/warning condition has been corrected, the status will change in the following way:

Icon	Name	Function
No Alarm	No Alarm	There is no alarm or warning.

- Distribution/Positioning Completed (“Prof. Comp/In Position”)

This row displays the status of the Distribution Completed and Positioning Completed bits in the Position Management Status parameter. A blue background indicates that the status bit is ON.

Icon	Name	Function
Prof. Comp Prof. Comp	Pulse Distribution Completed (“Prof. Comp”)	This box displays the status of the Distribution Completed bit.
In Position In Position	Positioning	This box displays the status of the Positioning Completed bit.

- Motion Command

This row displays the status of the motion command response code. The background is blue whenever there is a command of any type.

Setting and Displaying Monitor Parameters

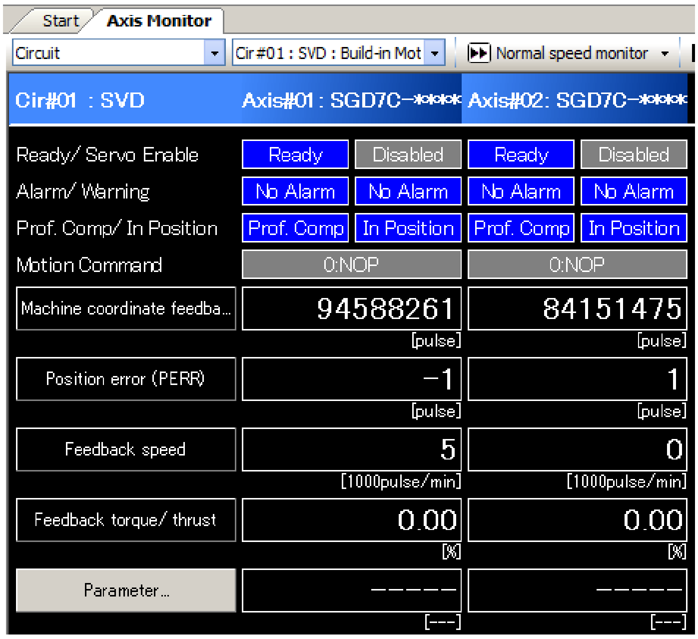
You can check the contents of the monitor parameters that are displayed in the Module Configuration Definition Tab Page.

You can monitor up to eight monitor parameters at the same time.

You can set the parameters to monitor by selecting them from the list, or by entering I/O motion registers directly.

You can also change the previously set monitor parameters.

Information The monitor parameters that you set are saved as setting information, so when you reopen the Axis Monitor Tab Page the next time, the previously set monitor parameters will be displayed.

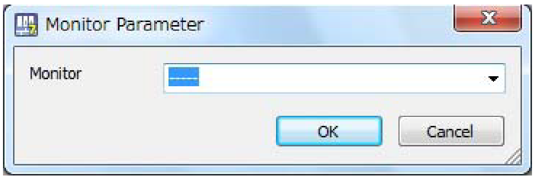


Cir#01 : SVD	Axis#01 : SGD7C-****		Axis#02: SGD7C-****	
Ready/ Servo Enable	Ready	Disabled	Ready	Disabled
Alarm/ Warning	No Alarm	No Alarm	No Alarm	No Alarm
Prof. Comp/ In Position	Prof. Comp	In Position	Prof. Comp	In Position
Motion Command	0:NOP		0:NOP	
Machine coordinate feedba...	94588261 [pulse]		84151475 [pulse]	
Position error (PERR)	-1 [pulse]		1 [pulse]	
Feedback speed	5 [1000pulse/min]		0 [1000pulse/min]	
Feedback torque/ thrust	0.00 [%]		0.00 [%]	
Parameter...	----- [---]		----- [---]	

Use the following procedure to select the monitor parameters.

1. **Click a monitor parameter that is already displayed, or click the Parameter Selection (Parameter...) Button.**
   The Motion Parameter Dialog Box will be displayed.

2. **Select the parameters to monitor from the list, or enter I/O motion registers directly.**

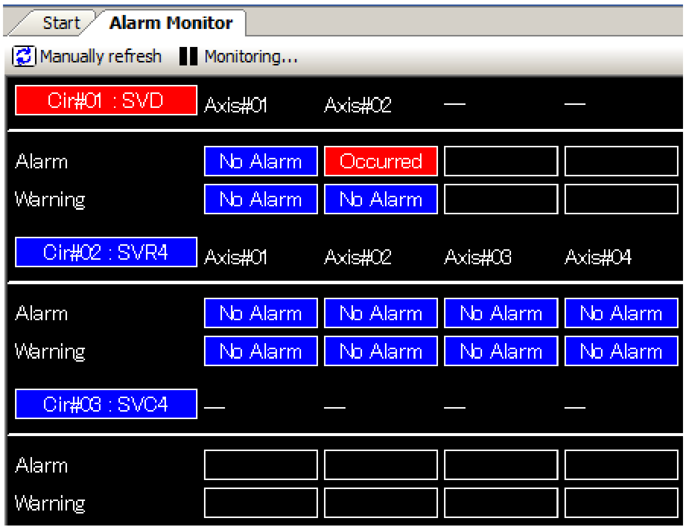


The following monitor parameters are displayed in the box list:

Monitor Parameter	Register	Unit
Machine Coordinate System Target Position (TPOS)	IL□□0E	Reference units
Machine Coordinate System Calculated Position (CPOS)	IL□□10	Reference units
Machine Coordinate System Reference Position (MPOS)	IL□□12	Reference units
Machine Coordinate System Feedback Position (APOS)	IL□□16	Reference units
Machine Coordinate System Latch Position (LPOS)	IL□□18	Reference units
Position Deviation (PERR)	IL□□1A	Reference units
Number of POSMAX Turns	IL□□1E	[rev]
Speed Reference Output Monitor	IL□□20	[pulse/sec]
Feedback Speed	IL□□40	Speed Unit Selection
Torque/Force Reference Monitor	IL□□42	Torque Unit Selection

7.8.2 Alarm Monitor

The Alarm Monitor monitors all axes that are connected to the SERVOPACK. This tab page displays the alarm and warning status of each axis.

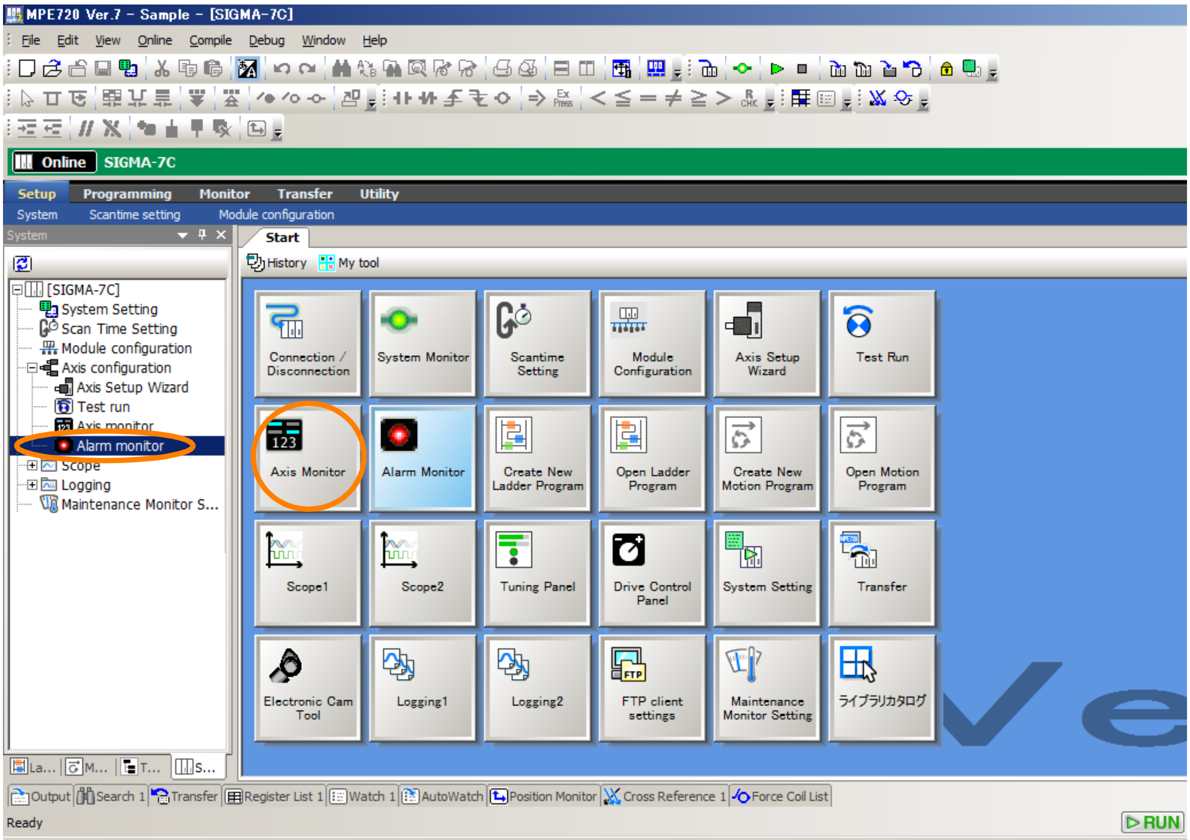


Cir#01 : SVD	Axis#01	Axis#02	—	—
Alarm	No Alarm	Occurred		
Warning	No Alarm	No Alarm		
Cir#02 : SVR4	**Axis#01**	**Axis#02**	**Axis#03**	**Axis#04**
Alarm	No Alarm	No Alarm	No Alarm	No Alarm
Warning	No Alarm	No Alarm	No Alarm	No Alarm
Cir#03 : SVC4	—	—	—	—
Alarm				
Warning				

Starting the Alarm Monitor

Select **Axis configuration** – **Alarm monitor** in the System Pane of MPE720. And then, double-click **Alarm monitor**.

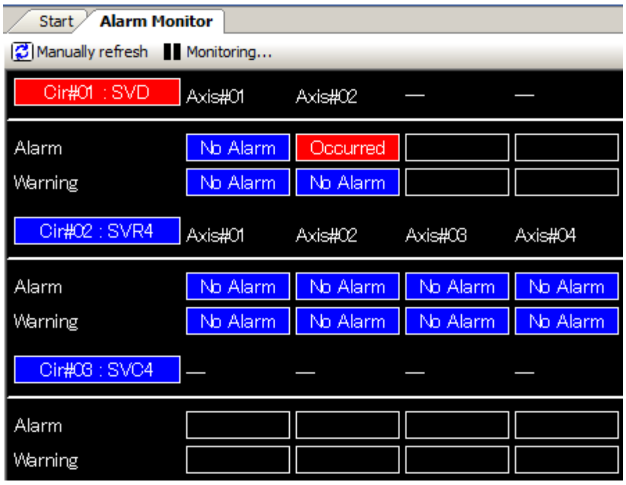
Alternatively, click the **Axis Monitor** Button on the My Tool View, or click the **Alarm Monitor** Button in the Axis Monitor Tab Page.



Names and Functions of the Alarm Monitor Tab Page Items

This tab page displays the warning and alarm status by circuit. The Alarm Monitor Tab Page can display up to eight axes in one horizontal row.

Information In offline mode, all monitor data are displayed as -----.



Cir#01 : SVD	Axis#01	Axis#02	—	—
Alarm	No Alarm	Occurred		
Warning	No Alarm	No Alarm		
Cir#02 : SVR4	**Axis#01**	**Axis#02**	**Axis#03**	**Axis#04**
Alarm	No Alarm	No Alarm	No Alarm	No Alarm
Warning	No Alarm	No Alarm	No Alarm	No Alarm
Cir#03 : SVC4	**—**	**—**	**—**	**—**
Alarm				
Warning				

■ Toolbar

The toolbar contains icons to manually change the display contents, and to stop and start monitoring.

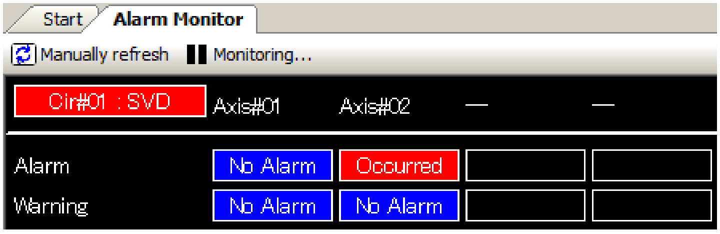
Icon	Name	Function
Manually refresh	Manually refresh	Use this button to update the alarm and warning information of the Alarm Monitor Tab Page. The Alarm Monitor Tab Page is not updated automatically.
Stop monitor Monitoring...	Stop monitor Start monitor	Stop monitor: Stops the monitor. Monitoring: The monitor is operating.

■ Circuit Number and Motion Control Function Module Name

This box displays the circuit number and the name of the Motion Control Function Module.

Click the **Circuit Number** Box to display or hide the monitor data for that circuits. This allows you to display only the required axis data.

- When a Circuit Is Displayed
  The alarm and warning data for that circuit will be displayed.



Cir#01 : SVD	Axis#01	Axis#02	—	—
Alarm	No Alarm	Occurred		
Warning	No Alarm	No Alarm		

- When a Circuit Is Hidden
  The alarm and warning data for that circuit will be hidden.

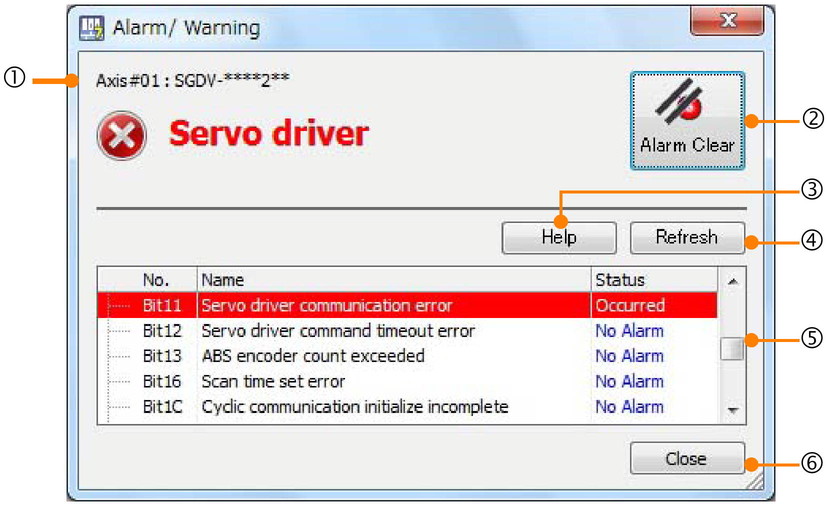
■ Status

If an alarm or a warning occurs, the alarm or warning status will be shown on the Alarm Monitor Tab Page in the following way:

Icon	Name	Function
No Alarm	No Alarm	No alarm or warning has occurred.
Occurred	Alarm Occurred	An alarm has occurred.
Occurred	Warning Occurred	A warning has occurred.

Displaying Alarms and Warnings

If an alarm or a warning occurs, double-click the axis where the alarm or warning occurred to display the Alarm/Warning Dialog Box.



Axis#01 : SGDV-****2**

Servo driver

No.	Name	Status
Bit11	Servo driver communication error	Occurred
Bit12	Servo driver command timeout error	No Alarm
Bit13	ABS encoder count exceeded	No Alarm
Bit16	Scan time set error	No Alarm
Bit1C	Cyclic communication initialize incomplete	No Alarm

No.	Item	Function
①	Axis name	This row displays the name of the axis. The display takes the following format: Assigned axis number: Comment: Type.
②	Alarm Clear	This button clears the alarm.
③	Help	This button displays the manual related to the alarm that occurred.
④	Refresh	This button updates the contents of the Alarm/Warning Dialog Box.
⑤	Alarms/warnings display	Displays the parameter name, the bit number, and the status. This area shows the alarm and warning information bit by bit for each Motion Control Function Module.
⑥	Close	This button closes the Alarm/Warning Dialog Box.

Troubleshooting Alarms and Warnings

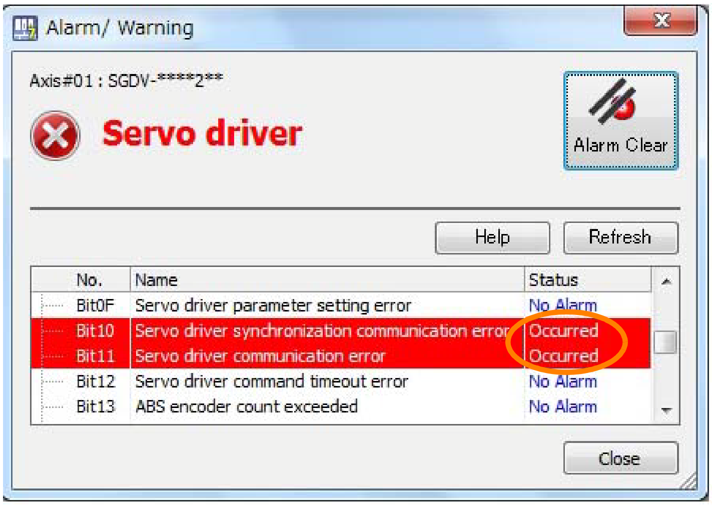
When an alarm occurs, the status will change to Occurred. When a warning occurs, the status will change to Occurred.

Click the status indicator to display the Alarm/Warning Dialog Box to see details on the alarm or warning.

This section uses a SERVOPACK Communications Error as an example to describe what to do when an alarm or warning occurs.

1. **Click the status indicator in the Alarm Monitor Tab Page.**
   The Alarm/Warning Dialog Box will be displayed.

2. Select the name of the alarm or warning where the status indicator shows **Occurred**, and click the **Help** Button.



Axis#01 : SGDV-****2**

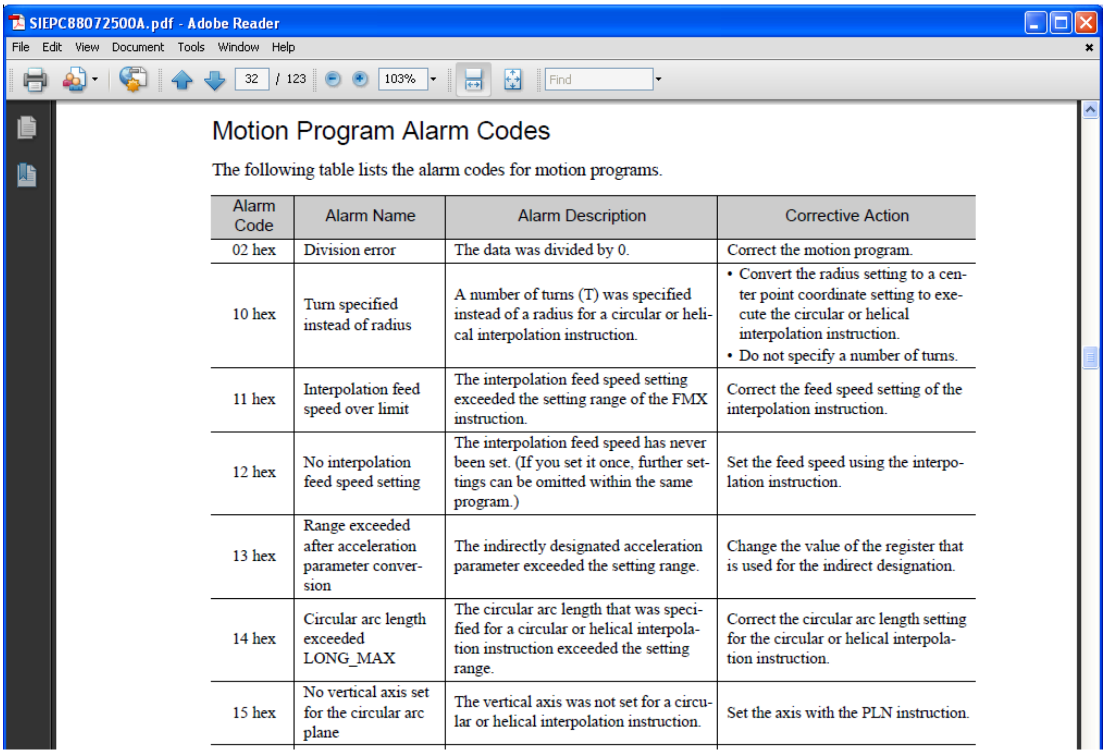
Servo driver

No.	Name	Status
Bit0F	Servo driver parameter setting error	No Alarm
Bit10	Servo driver synchronization communication error	Occurred
Bit11	Servo driver communication error	Occurred
Bit12	Servo driver command timeout error	No Alarm
Bit13	ABS encoder count exceeded	No Alarm

The manual will open, and details on the selected alarm or warning will be displayed.

Information If both an alarm and a warning occurred, the manual related to the alarm will be displayed.

3. Check details on the alarm, and follow the instructions in the manual to correct it.



Motion Program Alarm Codes

The following table lists the alarm codes for motion programs.

Alarm Code	Alarm Name	Alarm Description	Corrective Action
02 hex	Division error	The data was divided by 0.	Correct the motion program.
10 hex	Turn specified instead of radius	A number of turns (T) was specified instead of a radius for a circular or helical interpolation instruction.	• Convert the radius setting to a center point coordinate setting to execute the circular or helical interpolation instruction. • Do not specify a number of turns.
11 hex	Interpolation feed speed over limit	The interpolation feed speed setting exceeded the setting range of the FMX instruction.	Correct the feed speed setting of the interpolation instruction.
12 hex	No interpolation feed speed setting	The interpolation feed speed has never been set. (If you set it once, further settings can be omitted within the same program.)	Set the feed speed using the interpolation instruction.
13 hex	Range exceeded after acceleration parameter conversion	The indirectly designated acceleration parameter exceeded the setting range.	Change the value of the register that is used for the indirect designation.
14 hex	Circular arc length exceeded LONG_MAX	The circular arc length that was specified for a circular or helical interpolation instruction exceeded the setting range.	Correct the circular arc length setting for the circular or helical interpolation instruction.
15 hex	No vertical axis set for the circular arc plane	The vertical axis was not set for a circular or helical interpolation instruction.	Set the axis with the PLN instruction.

4. Click the **Alarm Clear** Button.

If there are no other alarms or warnings, the status indicator will change to No Alarm.

Information If there are other alarms or warnings, repeat the procedure from step 1.

7.8.3 Realtime Tracing

Realtime tracing gets the register data from the SERVOPACK and displays it in a graph. The results can be used to analyze the data movements and the timing scan by scan. There are various register data that you can get from the SERVOPACK, including speed and torque data, and bit information.

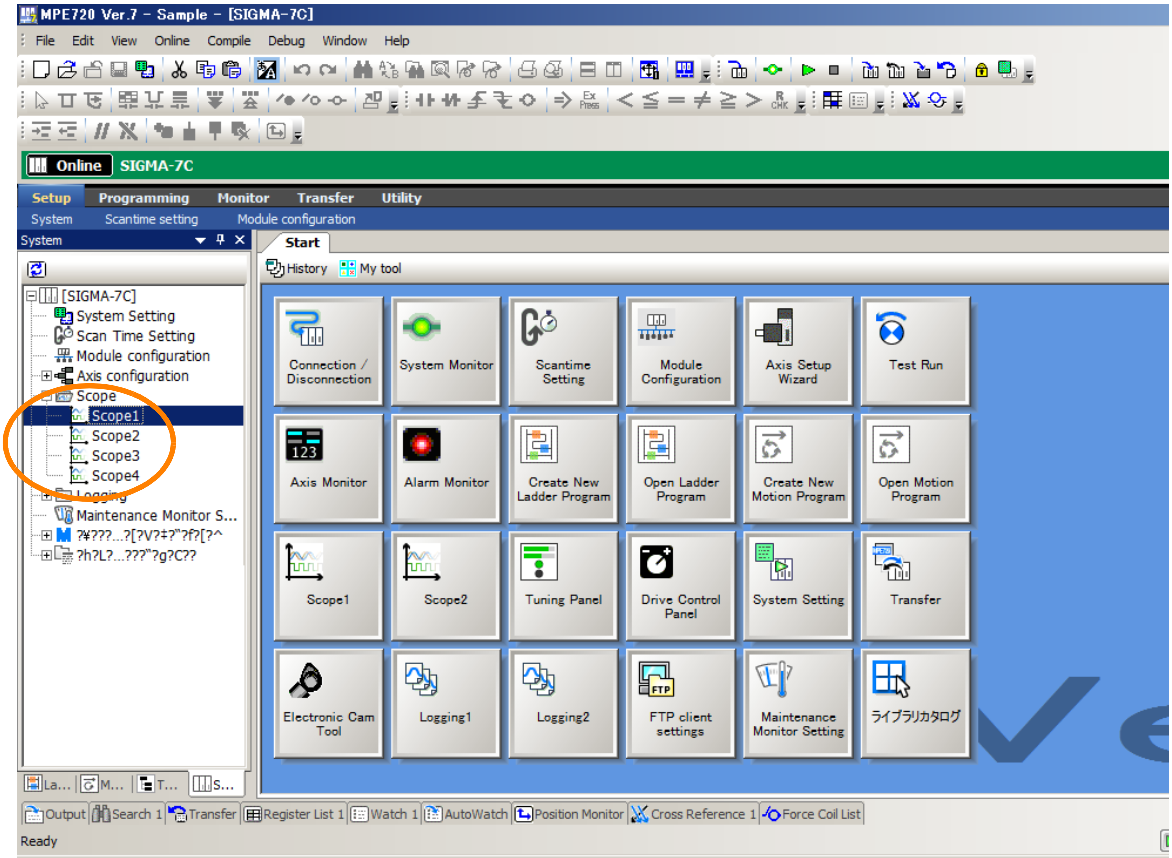
Information MPE720 supports data tracing as a monitoring function. Data tracing gets the I/O data of the SERVOPACK when it is online, and calculates and draws a graph. You can use data tracing to monitor the operating status of the program and for debugging.

Starting the Realtime Tracing

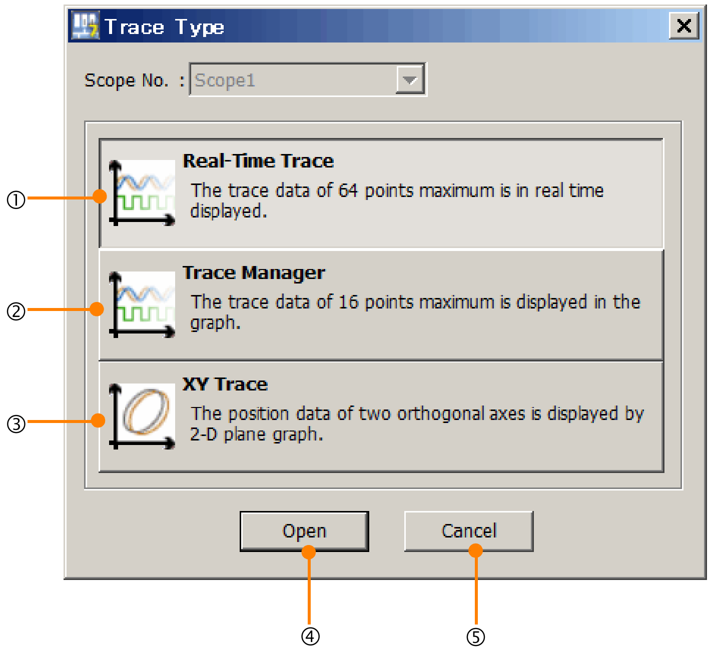
Double-click **Scope 1**, **Scope 2**, **Scope 3**, or **Scope 4** in the System Pane of MPE720, and then click the **Real-Time Trace** Button in the Trace Type Dialog Box.

Alternatively, select ***Monitor*** – ***Trace*** in the Launcher, and then click the **Real-Time Scope** Button in the Trace Type Dialog Box.

Information Another method for starting is to click the **Scope 1**, **Scope 2**, **Scope 3**, or **Scope 4** Button that was registered in the My Tool View, and then click the **Real-Time Trace** Button in the Trace Type Dialog Box.



The following dialog box will be displayed.



Real-Time Trace
The trace data of 64 points maximum is in real time displayed.

Trace Manager
The trace data of 16 points maximum is displayed in the graph.

XY Trace
The position data of two orthogonal axes is displayed by 2-D plane graph.

No.	Item	Description
①	Real-Time Trace	This button displays up to 64 points of trace data in realtime.
②	Trace Manager	This button displays up to 64 points of trace data in a graph.
③	XY Trace	This button displays the position data of two orthogonal axes in a 2-dimensional graph.
④	Open	This button starts the selected type of trace.
⑤	Cancel	This button returns you to the Main Pane without starting the selected type of trace.

Names and Functions of the Real-Time Trace Tab Page Items

Graph Toolbar
☞ page 7-92
The Graph Toolbar contains buttons to analyze the trace data.

Trace Execution Toolbar
☞ page 7-93
This toolbar contains the **Trace Data Setting**, the **Sampling & Trigger Setting**, and the **Start Trace** Buttons to perform these operations in this order.

Trend Graph
☞ page 7-98
This graph displays the trace data. You can use the Graph Toolbar, the sliders, and the cursors to analyze the trace data in realtime.

Trace List
☞ page 7-102
The **Trace List** Area displays the trace data, and the file and history data.

◆ Graph Toolbar

The following table gives details on the icons.

Icon	Function
↖	Click the **Select** Icon, and then double-click the target area to enlarge the display.
✋	Click the **Scroll** Icon to move the target area. Double-click the target area to enlarge the display.
🔍	Click the **Zoom In** Icon, and then drag or double-click the target area to enlarge the display.
⛶	Click the **Reset** Icon to return to the original display of the graph.
☰	Click the **Split Graph Display** Icon to display the graphs separately.
A	Click the **Cursor A** Icon to display cursor A, and then move it on the graph to display the values.
B	Click the **Cursor B** Icon to display cursor B, and then move it on the graph to display the values.

Continued on next page.

Continued from previous page.

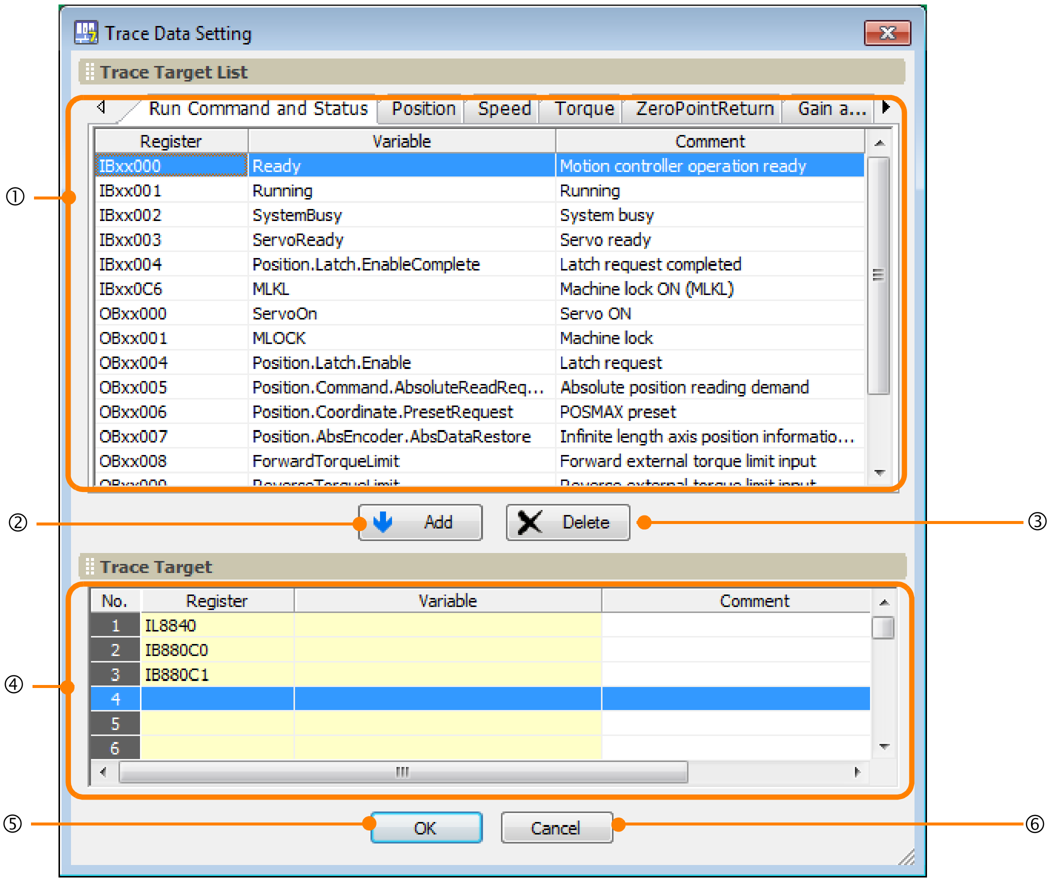
Icon	Function
C	Click the **Cursor C** Icon to display cursor C, and then move it on the graph to display the values.
D	Click the **Cursor D** Icon to display cursor D, and then move it on the graph to display the values.
↔	Click the **Cursor AB Link** Icon to lock the horizontal distance between cursors A and B.
↕	Click the **Cursor CD Link** Icon to lock the vertical distance between cursors C and D.
▦	Click the **List** Icon to display the Trace List.
📋	Click the **Copy Graph** Icon to place a screen capture of the graph on the clipboard.

◆ Trace Execution Toolbar

■ Trace Data Settings

Use these check boxes to specify the trace targets.

Click the **Trace Data Setting** Button to display the following dialog box:



Register	Variable	Comment
IBxx000	Ready	Motion controller operation ready
IBxx001	Running	Running
IBxx002	SystemBusy	System busy
IBxx003	ServoReady	Servo ready
IBxx004	Position.Latch.EnableComplete	Latch request completed
IBxx0C6	MLKL	Machine lock ON (MLKL)
OBxx000	ServoOn	Servo ON
OBxx001	MLOCK	Machine lock
OBxx004	Position.Latch.Enable	Latch request
OBxx005	Position.Command.AbsoluteReadReq...	Absolute position reading demand
OBxx006	Position.Coordinate.PresetRequest	POSMAX preset
OBxx007	Position.AbsEncoder.AbsDataRestore	Infinite length axis position informatio...
OBxx008	ForwardTorqueLimit	Forward external torque limit input

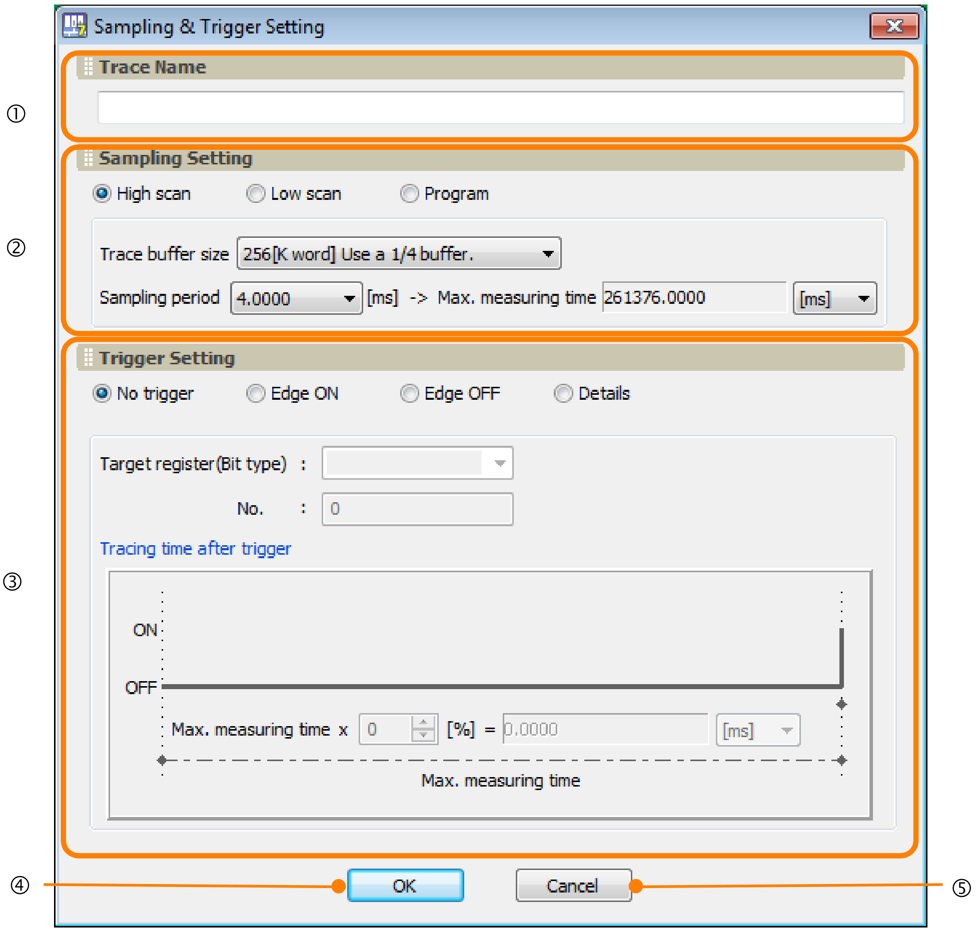
No.	Register	Variable	Comment
1	IL8840		
2	IB880C0		
3	IB880C1		
4			
5			
6			

No.	Item	Description
①	Trace Target List	Displays a list of the registers that will be traced. Right-click in the Trace Target List to display the pop-up menu to select or deselect registers. ***Add to Trace*** adds the selected register to the Trace Target List. ***Clear*** deselects multiple registers that were selected by using the **Shift** or the **Ctrl** Keys. ***Select All*** selects all registers shown on the tab page.
②	**Add** Button	Use this button to add registers to the Trace Target List.
③	**Delete** Button	Use this button to delete the selected registers from the Trace Target List.
④	Trace List	Displays the trace target registers. You can select the registers from the Trace Target List, or you can also enter the registers directly. Right-click in the Trace Target List to display the pop-up menu to edit the Trace Target List. ***Insert the Line*** inserts a blank row. ***Delete the Line*** deletes a row. If a trace target setting was added, then it will be deleted.
⑤	OK	The **OK** Button sets the Trace Target, and enables the **Sampling & Trigger Setting** Button.
⑥	Cancel	The **Cancel** Button returns you to the Real-Time Trace Dialog Box without setting the trace target.

■ Sampling and Trigger Settings

This dialog box is used to set the trace name, the sampling settings, and the trigger setting parameters.

Click the **Sampling & Trigger Setting** Button to display the following dialog box:



Sampling Setting: ● High scan ○ Low scan ○ Program

Trace buffer size 256[K word] Use a 1/4 buffer.

Sampling period 4.0000 [ms] -> Max. measuring time 261376.0000 [ms]

Trigger Setting: ● No trigger ○ Edge ON ○ Edge OFF ○ Details

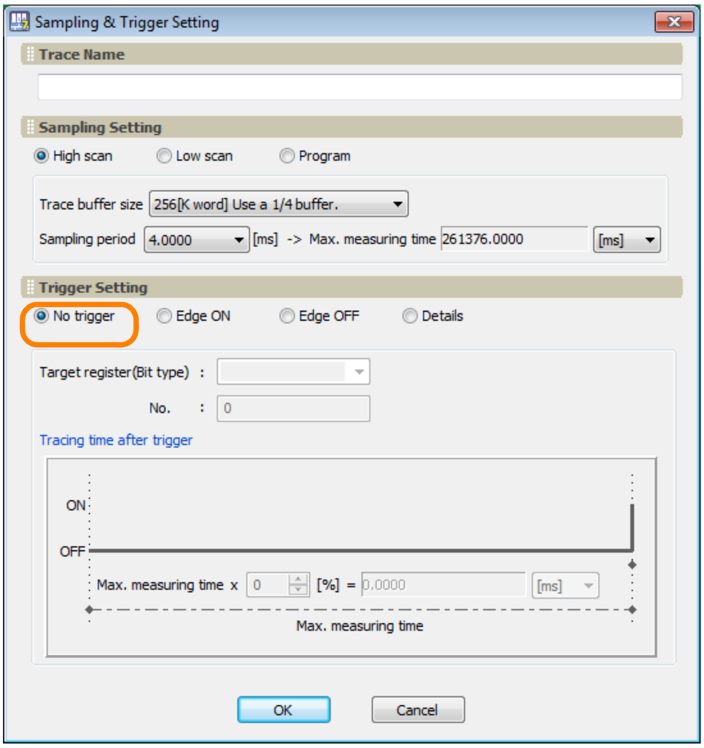
Target register(Bit type) :

No. : 0

Max. measuring time x 0 [%] = 0.0000 [ms]

No.	Item	Description
①	Trace Name	Use this box to specify a name or comment for the trace. You can use up to 32 characters.
②	Sampling Setting	Use these options to set the data sampling conditions. The recommended maximum measurement time will be displayed.
③	Trigger Setting	These settings specify the method for starting the trace data sampling. Refer to the following section for details. ☞ • *Trigger Setting Details* on page 7-95
④	OK	Click the **OK** Button to set the sampling and trigger settings, and to enable the **Start Trace** Button.
⑤	Cancel	Click the **Cancel** Button to return to the Real-Time Trace Dialog Box without setting the sampling and trigger settings.

- Trigger Setting Details
  These settings specify the conditions for starting the trace. There are four methods to start the data sampling.
- No Trigger
  Use this option to start and stop the sampling manually.



Sampling & Trigger Setting

Trace Name

Sampling Setting

● High scan ○ Low scan ○ Program

Trace buffer size: 256[K word] Use a 1/4 buffer.

Sampling period: 4.0000 [ms] -> Max. measuring time 261376.0000 [ms]

Trigger Setting

● No trigger ○ Edge ON ○ Edge OFF ○ Details

Target register(Bit type) :

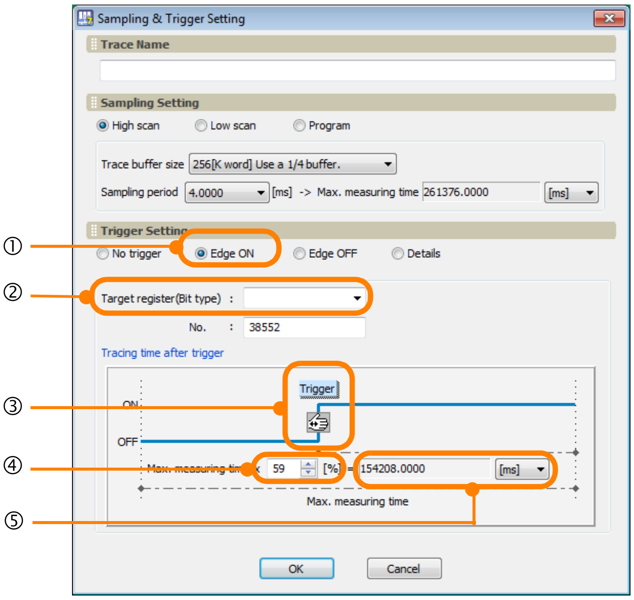
No. : 0

Tracing time after trigger

Max. measuring time x 0 [%] = 0.0000 [ms]

- Edge ON or Edge OFF
  Use these options to sample the data before and after a specified bit changes from OFF to ON or from ON to OFF.

Edge ON:



Sampling & Trigger Setting

Trace Name

Sampling Setting: ● High scan ○ Low scan ○ Program

Trace buffer size: 256[K word] Use a 1/4 buffer.

Sampling period: 4.0000 [ms] -> Max. measuring time 261376.0000 [ms]

Trigger Setting: ○ No trigger ● Edge ON ○ Edge OFF ○ Details

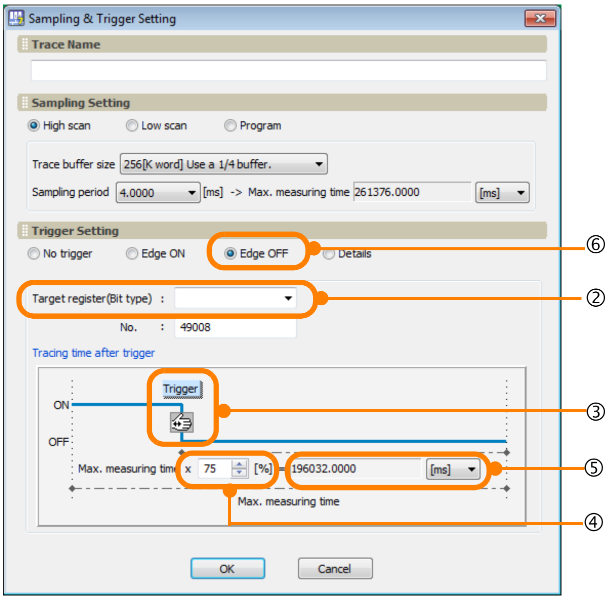
Target register(Bit type) :

No. : 38552

Tracing time after trigger

Max. measuring time x 59 [%] = 154208.0000 [ms]

Edge OFF:



Sampling & Trigger Setting

Trace Name

Sampling Setting: ● High scan ○ Low scan ○ Program

Trace buffer size: 256[K word] Use a 1/4 buffer.

Sampling period: 4.0000 [ms] -> Max. measuring time 261376.0000 [ms]

Trigger Setting: ○ No trigger ○ Edge ON ● Edge OFF ○ Details

Target register(Bit type) :

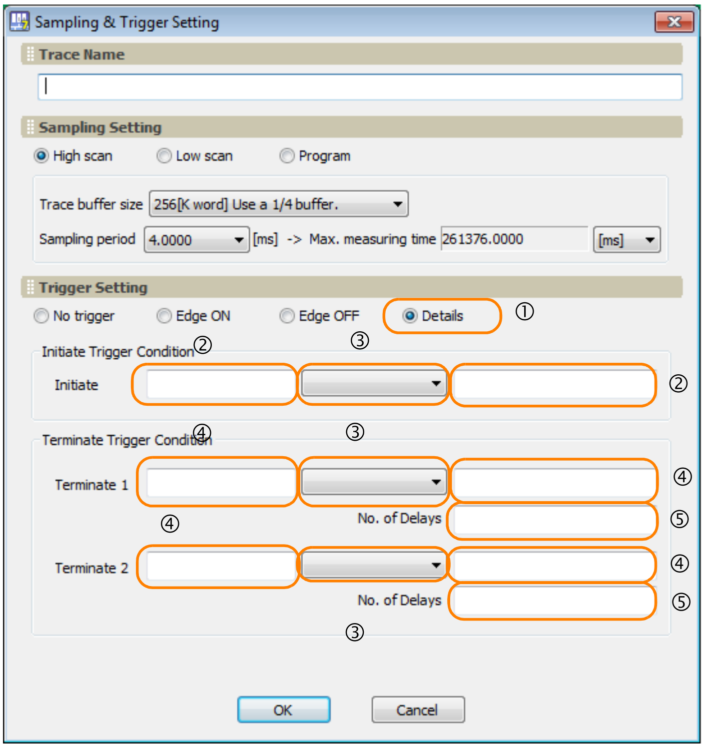
No. : 49008

Tracing time after trigger

Max. measuring time x 75 [%] = 196032.0000 [ms]

No.	Item	Description
①	Edge ON	Use these options to sample the data before and after a specified bit changes from OFF to ON or from ON to OFF.
②	Target register (Bit type)	Use this box to enter the target register.
③		Drag this icon to set the trigger position.
④	[%]	Select the numeric value to set for the trigger position.
⑤	[ms]	The maximum measurement time after the trigger is displayed in this box.
⑥	Edge OFF	Use this method to sample the data before and after a specified bit changed status from ON to OFF.

- Details
  Use this setting to specify a register for triggering the trace.



● High scan ○ Low scan ○ Program

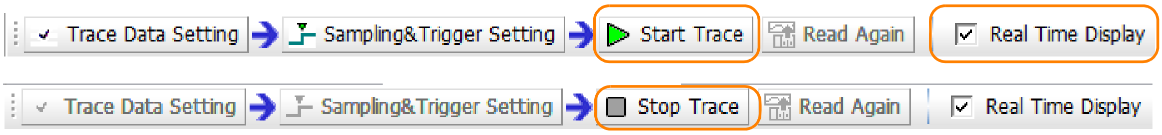
Trace buffer size 256[K word] Use a 1/4 buffer.

Sampling period 4.0000 [ms] -> Max. measuring time 261376.0000 [ms]

● Details

<table>
<tr><th>No.</th><th>Item</th><th colspan="2">Description</th></tr>
<tr><td>①</td><td>Details</td><td colspan="2">Use this option to specify the register (Bit, Word, Float, or Long) to use to trigger the trace. You can freely create the desired combination of conditions to start and stop the trace.</td></tr>
<tr><td>②</td><td>Initiate</td><td colspan="2">Enter any register and value to start the trace.
If the initiate trigger is not specified, tracing will start at the same time as the sampling.</td></tr>
<tr><td rowspan="8">③</td><td rowspan="8">Condition</td><td colspan="2">Select from the following operators:</td></tr>
<tr><td>Operator</td><td>Trigger</td></tr>
<tr><td>></td><td>A trigger occurs when the register value is greater than the comparison value.</td></tr>
<tr><td><</td><td>A trigger occurs when the register value is less than the comparison value.</td></tr>
<tr><td>=</td><td>A trigger occurs when the register value is equal to the comparison value.</td></tr>
<tr><td><></td><td>A trigger occurs when the register value is not equal to the comparison value.</td></tr>
<tr><td>>=</td><td>A trigger occurs when the register value is greater than or equal to the comparison value.</td></tr>
<tr><td><=</td><td>A trigger occurs when the register value is less than or equal to the comparison value.</td></tr>
<tr><td>④</td><td>Terminate</td><td colspan="2">Enter any register and value to start the trace.
If a terminate trigger is not specified, tracing will continue until the sampling stops.</td></tr>
<tr><td>⑤</td><td>No. of Delays</td><td colspan="2">Set the number of samplings to execute after the terminate trigger condition has been met and before the trace is stopped.</td></tr>
</table>

■ Starting and Stopping Traces



Function	Description
Start Trace	Use this button to start the trace. The data that is sampled will be displayed in real-time. If the **Program** Option was selected in the Sampling & Trigger Setting Dialog Box, the trace cannot be started manually. You can use only the **Read Again** Button.
Real Time Display	Select the **Real Time Display** Check Box to display the trace data moving in realtime. If more than one Trace Tab Page is open, you can use a realtime display for only one of them.
Stop Trace	Use this button to stop the trace. When the trace stops, all trace buffer data will be collected and displayed.

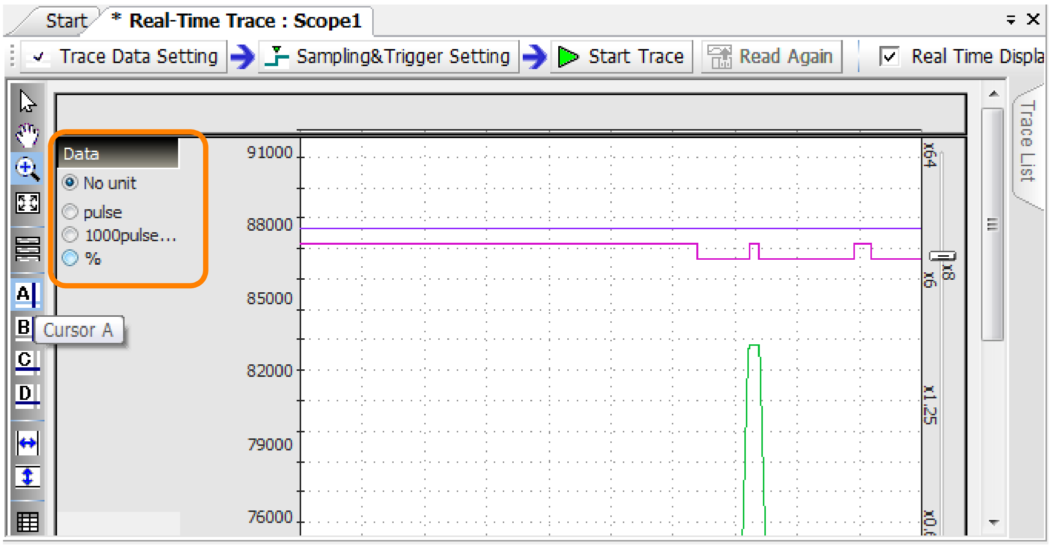
■ Read Again

The **Read Again** Button re-reads the trace data from the SERVOPACK.

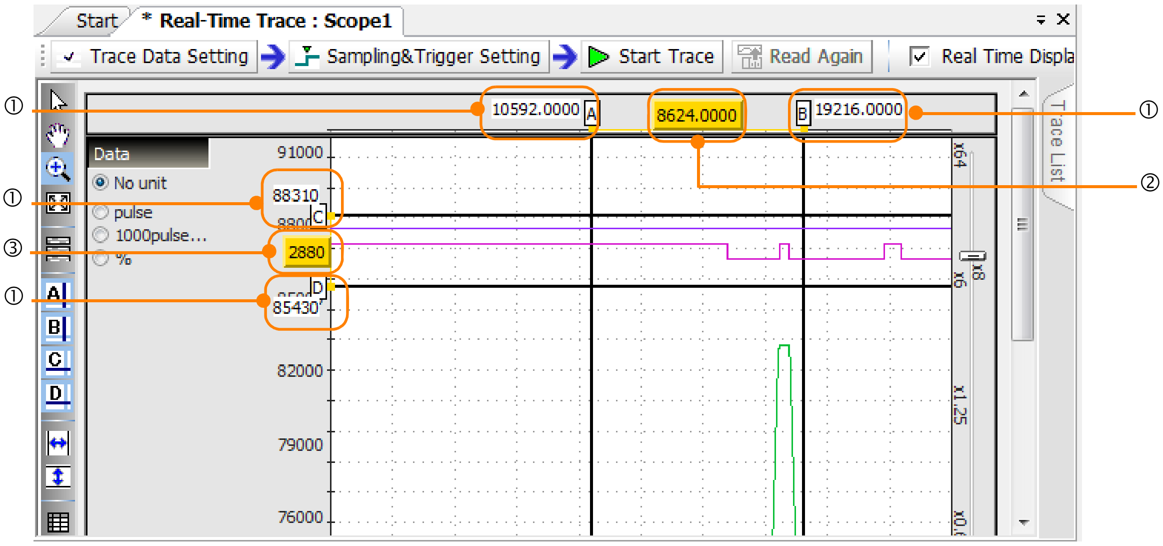
◆ Trend Graph

■ Graph Unit

The unit of the parameter that was selected for the trace target will be displayed on the graph.



■ Cursors



No.	Display	Function
①	A B C D	These boxes display the values of the cursor positions.
②	–	This box displays the horizontal distance between the positions of cursor A and cursor B.
③	–	This box displays the vertical distance between the positions of cursor C and cursor D.

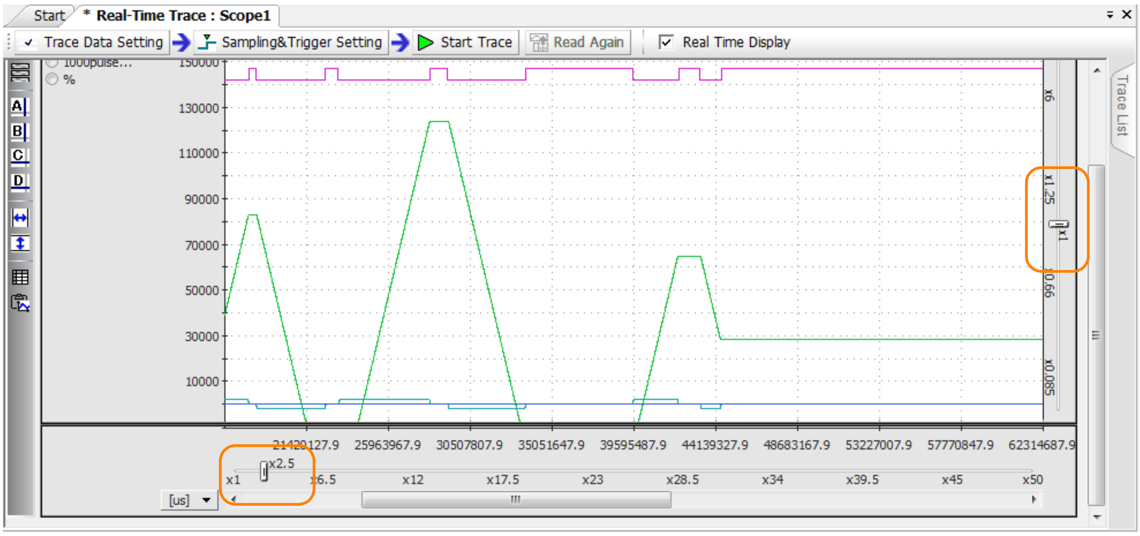
■ Sliders

Drag a scale sliders up and down or to the left and right to zoom in and out of the graph.

The scales have the following ranges:

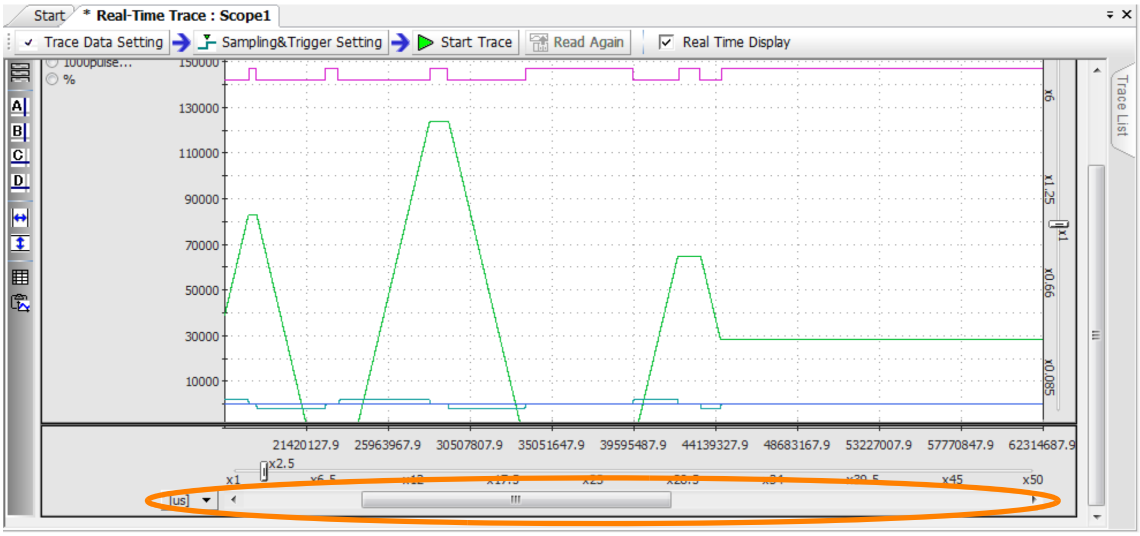
Vertical scale: x0.085 to x64

Horizontal scale: x1 to x48.5



■ Scrollbar

Slide the scrollbar to the left and right to display the graph.

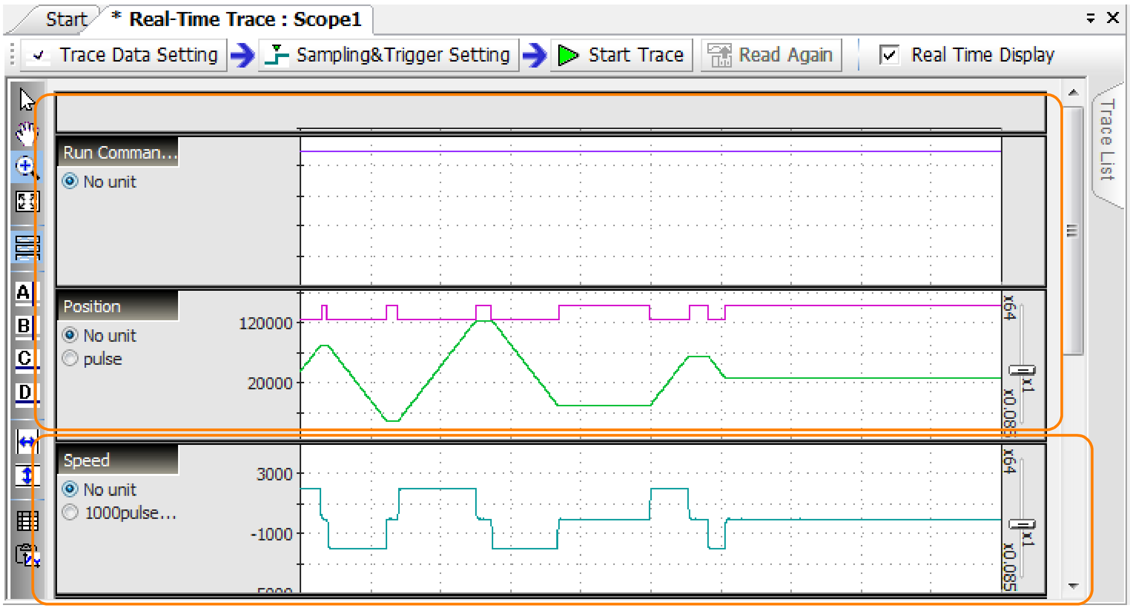


■ Split Graph Displays

You can group the trace data by data type and assign a separate graph for each group, creating a split display.

The trace data consist of the group that is on the Trace Target List of the Trace Data Setting Dialog Box, and the group of other registers.

You can switch between the split display and the combined display.



■ Changing the Graph Unit

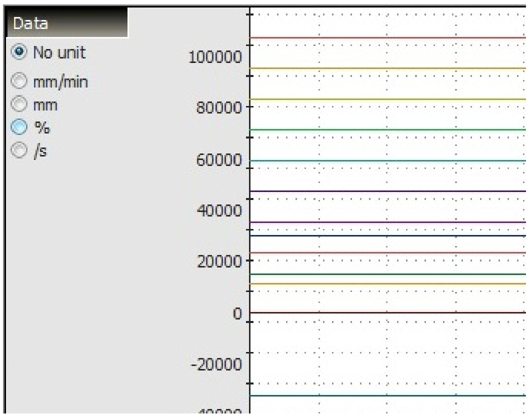
If the trace data has more than one unit, you can change the unit for the vertical axis of the graph.

When you do that, the scale of the vertical axis will change according to the axis information (unit and decimal digits), and the waveforms will be displayed accordingly.

Information

1. The available units depend on the axis information.
2. The axis unit can be changed regardless of the graph display method. It works for the split display as well as for the combined display. When you change the unit, the color of the trace lines that have a different unit will be dimmed.

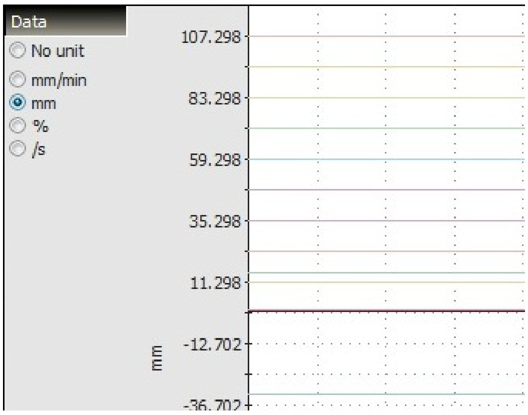
No Unit:



Data

● No unit
○ mm/min
○ mm
○ %
○ /s

Millimeters (mm):



Data

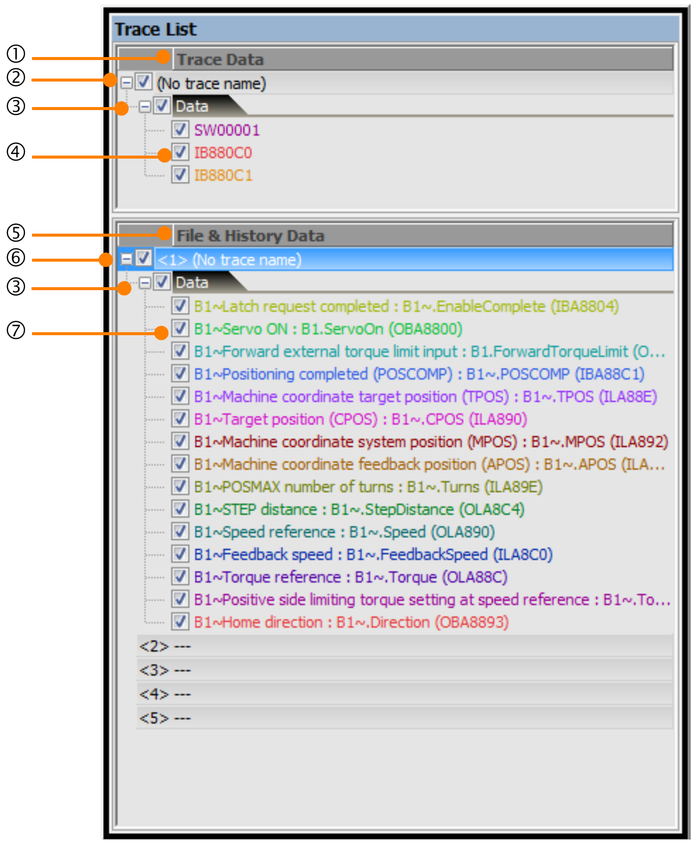
○ No unit
○ mm/min
● mm
○ %
○ /s

◆ Trace List

The Trace List displays the traced data, the trace data that was read from external files, and a history of the trace data.

You can use this information to check the waveforms, the displayed graphs, and details on the traced data.

Use the check boxes to show or hide the waveforms on the graph display.



☑ (No trace name)
☑ Data
☑ SW00001
☑ IB880C0
☑ IB880C1

☑ <1> (No trace name)
☑ Data
☑ B1~Latch request completed : B1~.EnableComplete (IBA8804)
☑ B1~Servo ON : B1.ServoOn (OBA8800)
☑ B1~Forward external torque limit input : B1.ForwardTorqueLimit (O…
☑ B1~Positioning completed (POSCOMP) : B1~.POSCOMP (IBA88C1)
☑ B1~Machine coordinate target position (TPOS) : B1~.TPOS (ILA88E)
☑ B1~Target position (CPOS) : B1~.CPOS (ILA890)
☑ B1~Machine coordinate system position (MPOS) : B1~.MPOS (ILA892)
☑ B1~Machine coordinate feedback position (APOS) : B1~.APOS (ILA…
☑ B1~POSMAX number of turns : B1~.Turns (ILA89E)
☑ B1~STEP distance : B1~.StepDistance (OLA8C4)
☑ B1~Speed reference : B1~.Speed (OLA890)
☑ B1~Feedback speed : B1~.FeedbackSpeed (ILA8C0)
☑ B1~Torque reference : B1~.Torque (OLA88C)
☑ B1~Positive side limiting torque setting at speed reference : B1~.To…
☑ B1~Home direction : B1~.Direction (OBA8893)

<2> ---
<3> ---
<4> ---
<5> ---

No.	Display	Function
①	Trace Data	Displays the trace data of the traced targets.
②	Trace name	Displays the name of the trace.
③	Trace group name	The trace data is displayed in groups, where one group consists of the data that was included in the Trace Target List of the Trace Data Setting Dialog Box, and the other group consists of other data.
④	Registers	Displays the registers that were traced. The register names are displayed in the same color as their trace lines.
⑤	File & History Data	Displays a list of trace targets that were registered for tracing, and trace data that was read from external files.
⑥	Trace name	Displays the names of trace data that was registered for tracing, and trace data that was read from external files. You can save up to five backups of the file and history data.
⑦	Registers	Displays the names of trace data that was registered for tracing, and traced registers that were read from external files. The register names are displayed in the same color as their trace lines.

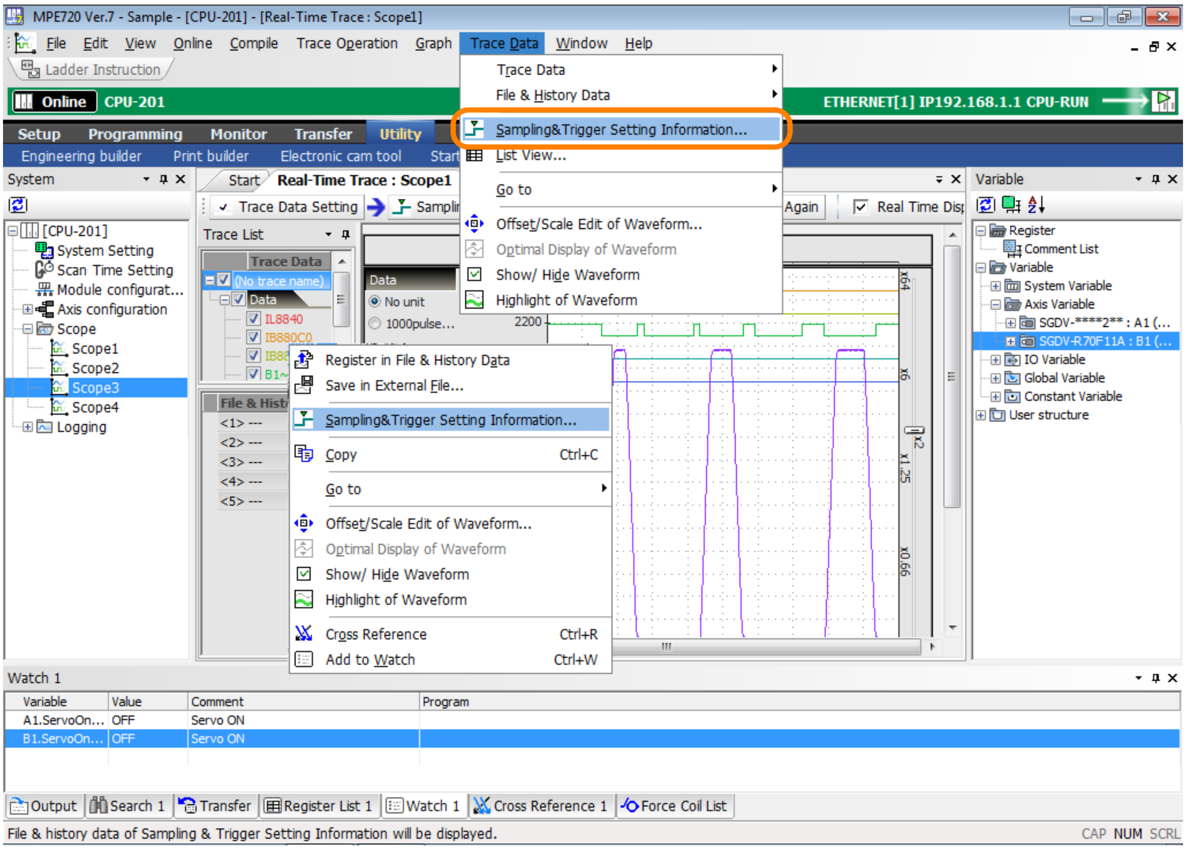
Displaying Measurement Information

You can view the trace definition information of monitor data and history data that you set as sampling and trigger setting information.

This allows you to view and reuse the trace definitions from past measurements.

Select ***Trace Data*** – ***Sampling & Trigger Setting Information*** from the MPE720 menu bar to display the Sampling & Trigger Setting Information Dialog Box.

Alternatively, right-click **Trace Data or File & History Data** in the Trace List Pane, and select ***Sampling & Trigger Setting Information*** from the pop-up menu.



Variable	Value	Comment	Program
A1.ServoOn...	OFF	Servo ON	
B1.ServoOn...	OFF	Servo ON	

File & history data of Sampling & Trigger Setting Information will be displayed.

Editing the Trace Data

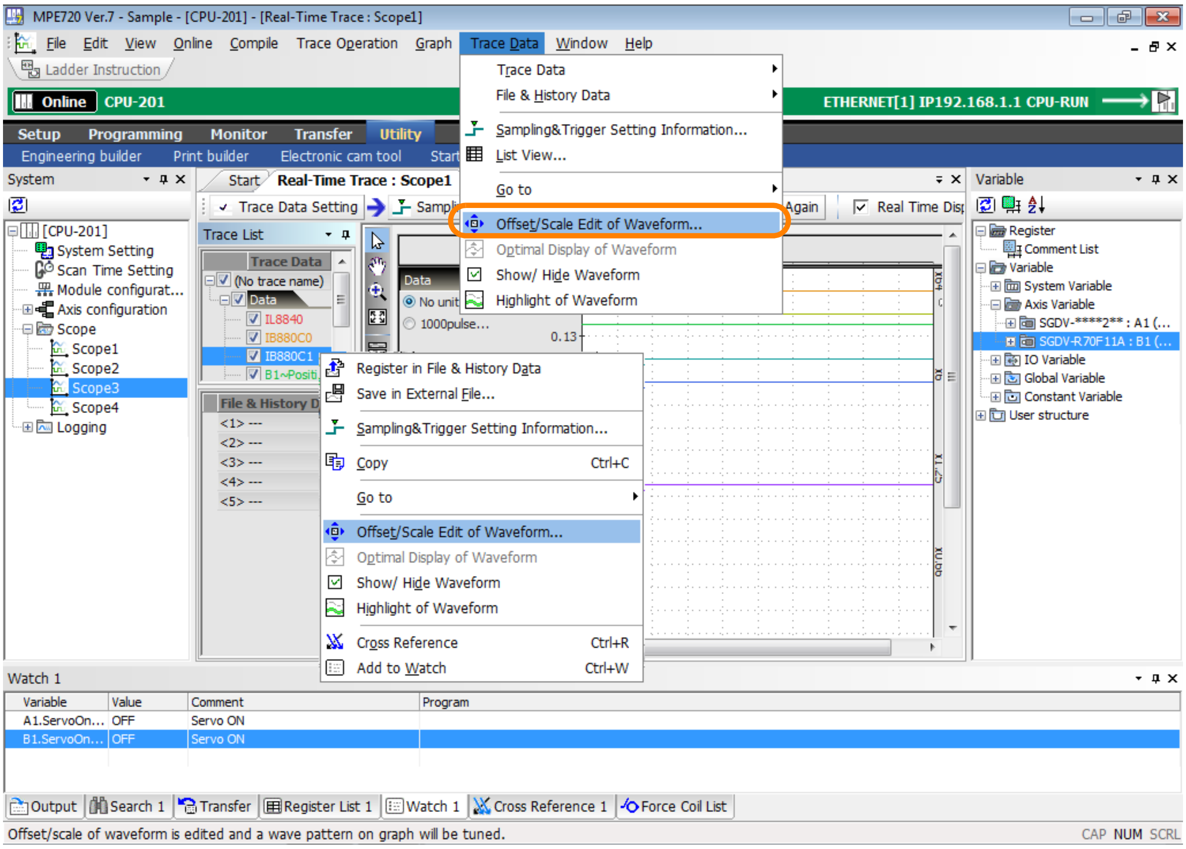
You can enlarge or reduce the waveform of the trace data, or move its position. Changing the size or position helps you compare the waveform to other lines for analysis.

Information When the trace data is refreshed, the size and position will be reset.

Select ***Trace Data*** – ***Offset/Scale Edit of Waveform*** from the MPE720 menu bar to display the Offset/Scale Edit of Waveform Dialog Box.

Alternatively, right-click **Trace Data or File & History Data** in the Trace List Pane, and select ***Offset/Scale Edit of Waveform*** from the pop-up menu.

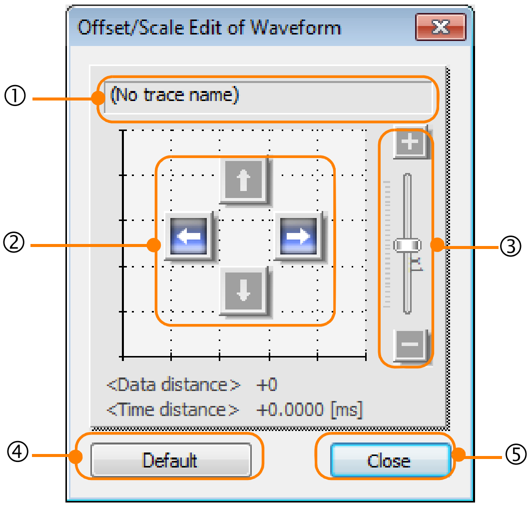
Information If you display the pop-up menu by right-clicking on a group name, you can edit the waveforms of the entire group.



Variable	Value	Comment	Program
A1.ServoOn...	OFF	Servo ON	
B1.ServoOn...	OFF	Servo ON	

Offset/scale of waveform is edited and a wave pattern on graph will be tuned.

The following dialog box will be displayed.



(No trace name)

<Data distance> +0

<Time distance> +0.0000 [ms]

No.	Display	Function
①	Trace name	This box displays the name of the trace and the file.
②	Offset move buttons	Use these buttons to move the waveforms of the specified trace data.
③	Scale adjustment slider	Use this slider to increase/decrease the amplitude of waveforms of the specified trace data.
④	Default	Click this button to return the trace data to the default settings.
⑤	Close	Click this button to close the Offset/Scale Edit of Waveform Dialog Box.

Analyzing the Trace Data

You can use the trace data editing and zooming features to analyze the trace data.

◆ Analyzing the I/O Registers and the M Registers

This section describes how to analyze the differences between settings and actual values.

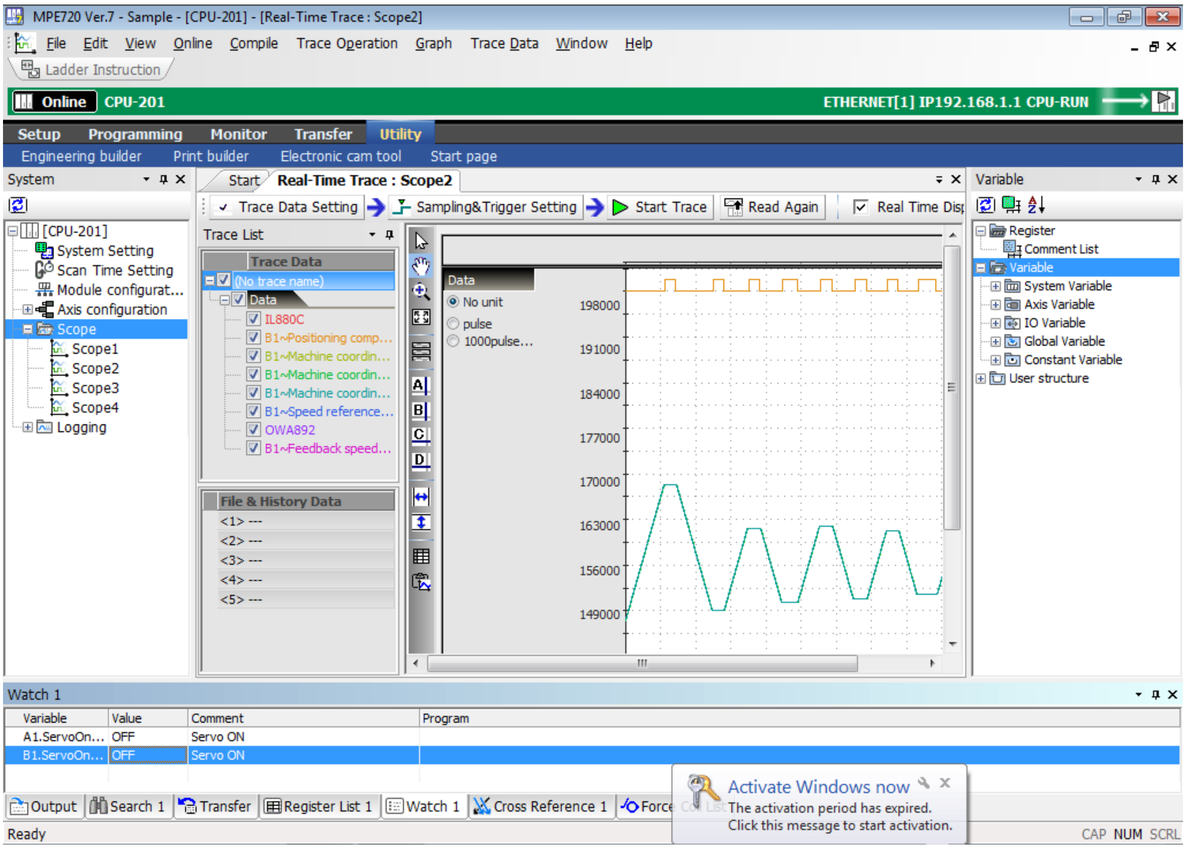
1. Display the trace data to analyze on the graph.
2. Select ***Trace Data*** – ***File & History Data*** from the menu bar. Alternatively, right-click **Trace Data or File & History Data** in the Trace List Pane, and select ***Edit Trace Data*** from the pop-up menu.
3. Use the arrow buttons to move to the location to use for comparison.
4. Click the **Cursor A** and **Cursor B** Icons or the **Cursor C** and **Cursor D** Icons on the Graph Toolbar to display the cursors, and align them on the registers to analyze.

5. The difference between the waveform of the set register values and the waveform of the actual output values of the register is analyzed.

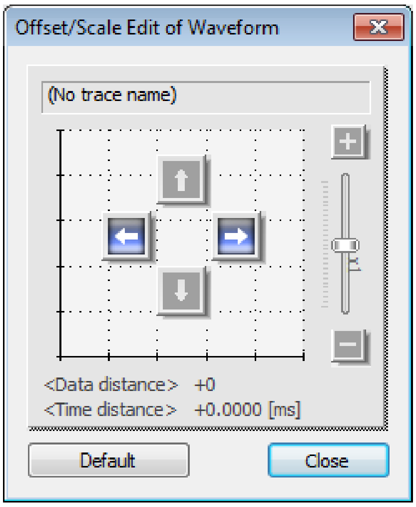
◆ Comparison to Data Sampled in the Past

This section describes how to compare trace data that was read from the SERVOPACK to trace data that was sampled in the past.

1. If you read trace data from an external file into the **File & History Data** in the Trace List Pane, the trace data waveform will be displayed as shown in the following figure.
   Note: If the trace data has already been loaded, then select the check box at the trace definition.



2. Select ***Trace Data*** – ***Offset/Scale Edit of Waveform*** from the menu bar. Alternatively, right-click **Trace Data or File & History Data** in the Trace List Pane, and select ***Offset/ Scale Edit of Waveform*** from the pop-up menu.
   The Offset/Scale Edit of Waveform Dialog Box will be displayed.



<Data distance> +0
<Time distance> +0.0000 [ms]

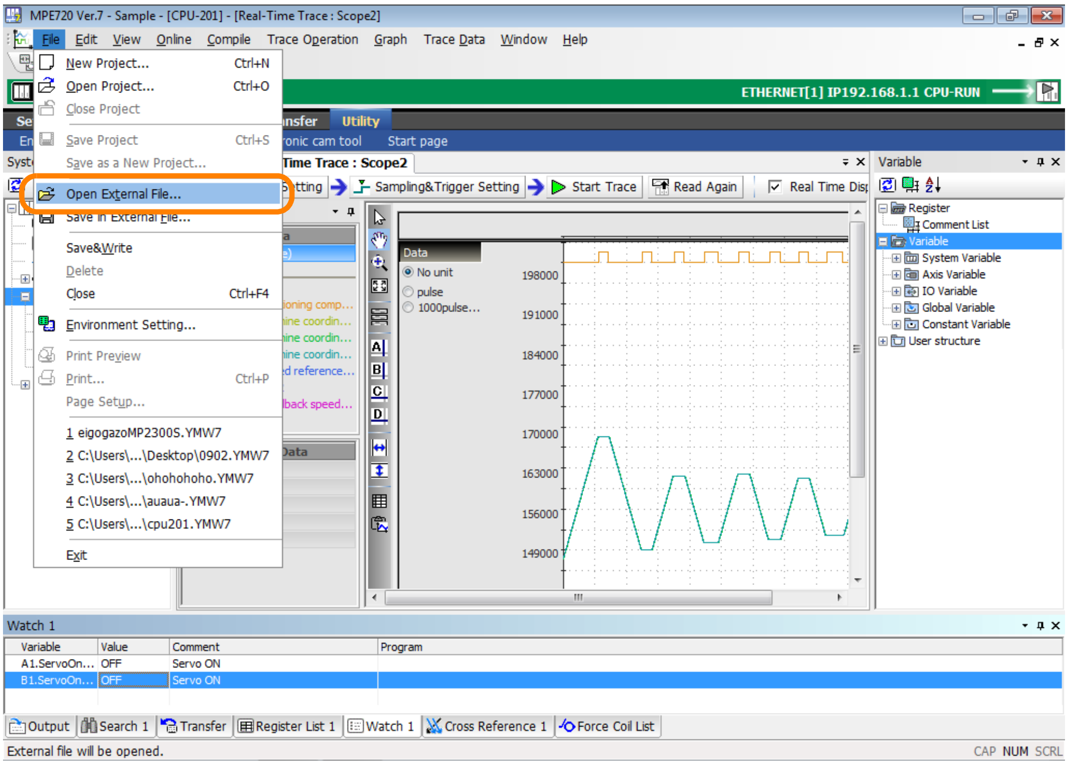
3. Use the arrow buttons to move the start position of the data to the desired location.

4. Use the editing functions, such as zoom in, zoom out, or the slider, to compare the data to the past trace data.

Reading Trace Data

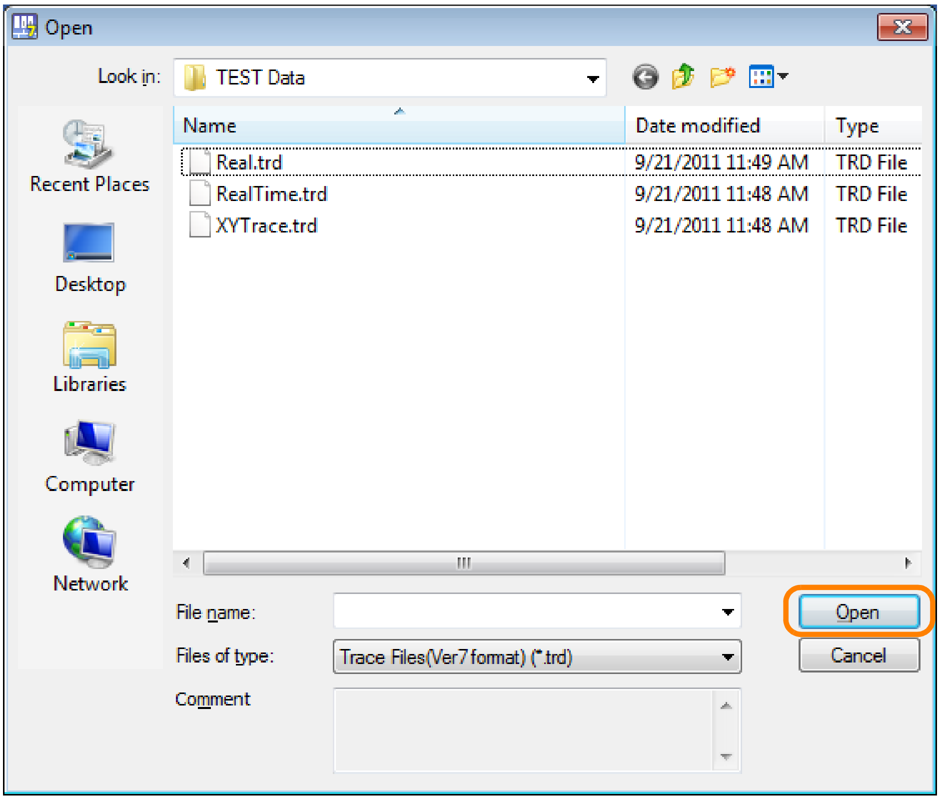
This section describes how to read saved trace data. Trace definition files (.dat) and CSV files (.csv) can be read.

Select ***File* – *Open External File*** from the menu bar. The Open Dialog Box will be displayed. Select the saved CSV file or trace definition file to open.



Variable	Value	Comment	Program
A1.ServoOn...	OFF	Servo ON	
B1.ServoOn...	OFF	Servo ON	

External file will be opened.



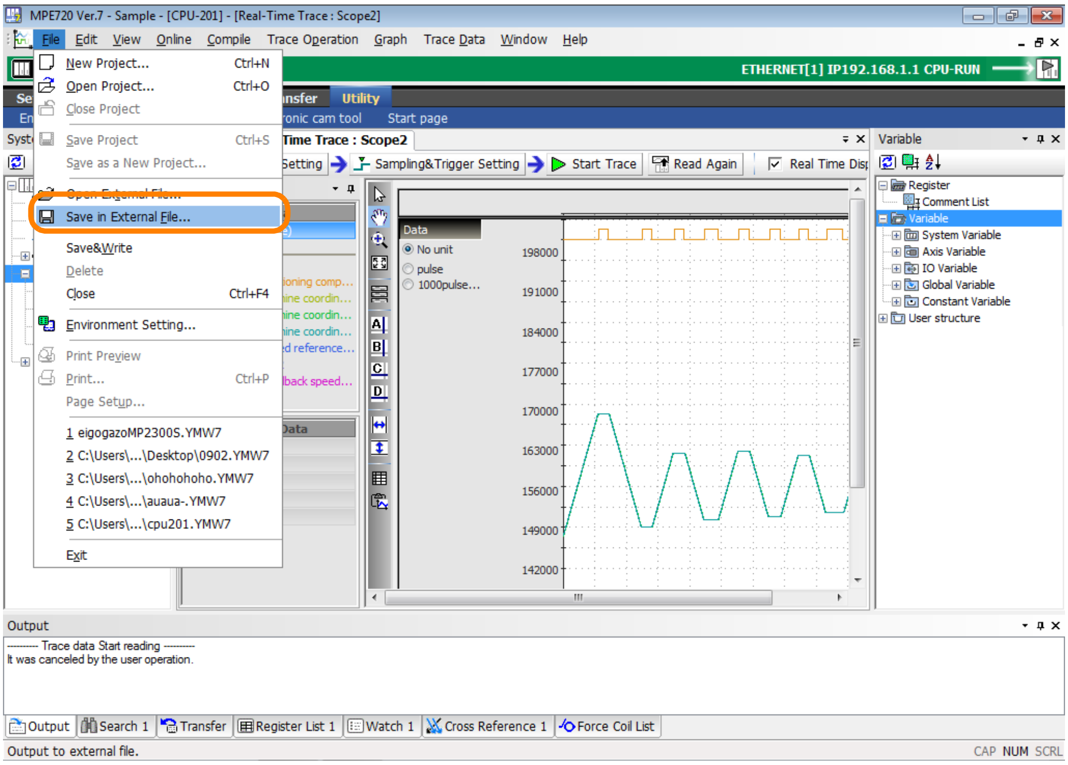
Name	Date modified	Type
Real.trd	9/21/2011 11:49 AM	TRD File
RealTime.trd	9/21/2011 11:48 AM	TRD File
XYTrace.trd	9/21/2011 11:48 AM	TRD File

Saving the Trace Data

This section describes how to save the trace data into a CSV file or a trace definition file.

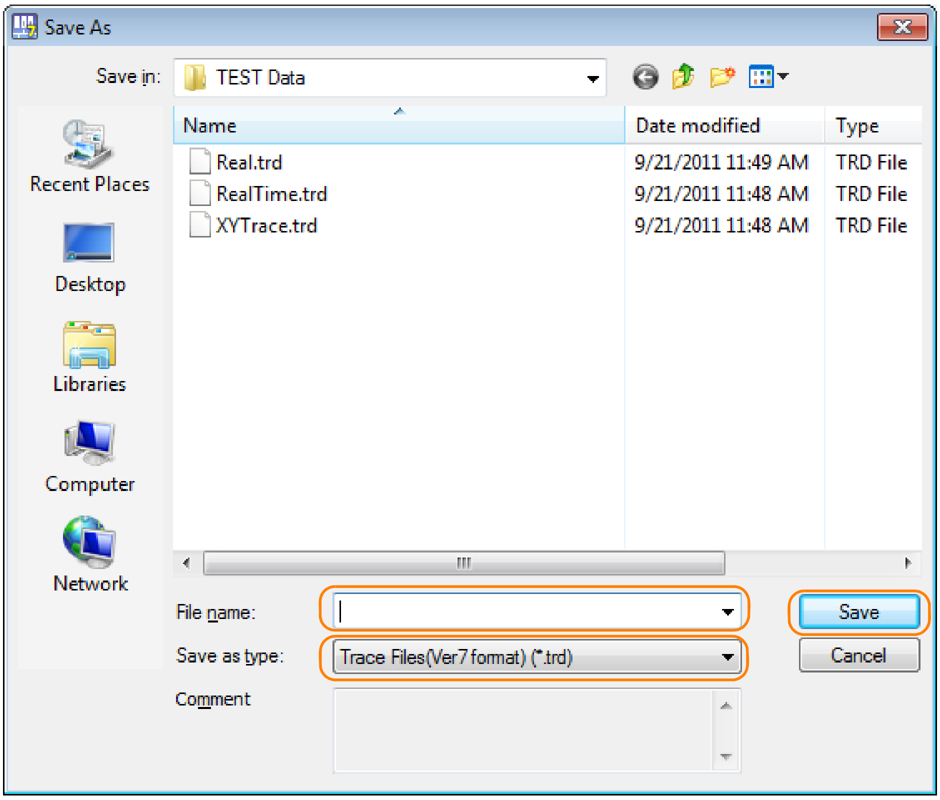
Data can be analyzed if it is saved into a CSV or a trace definition file.

Select ***File*** – ***Save in External File*** from the menu bar. Select a CSV or a trace definition file, specify a name, and save it.



```
-------- Trace data Start reading --------
It was canceled by the user operation.
```

Output to external file.



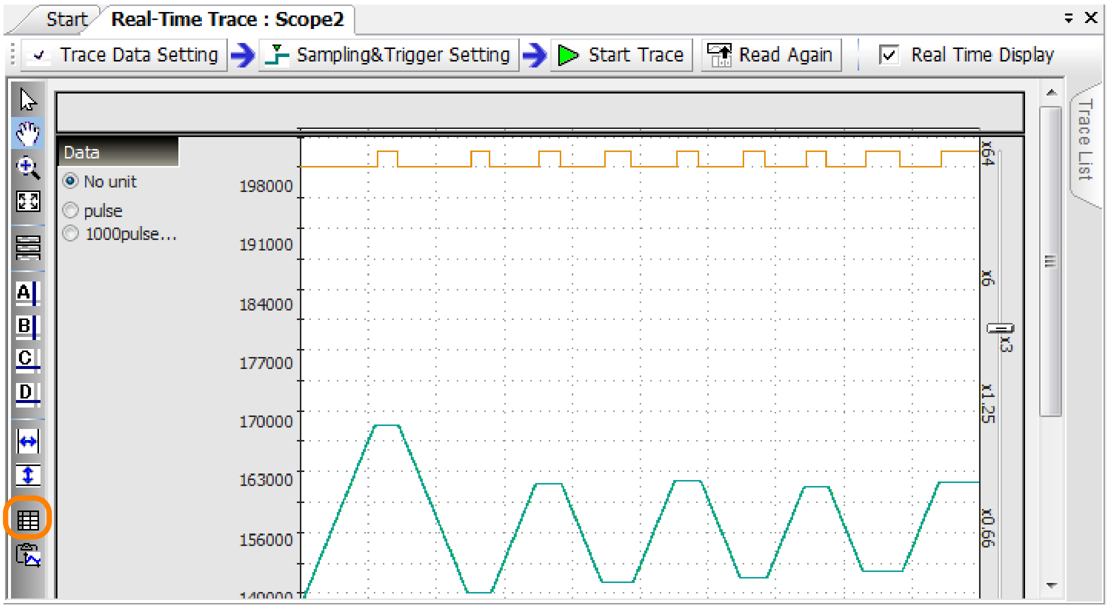
Save in: TEST Data

Name	Date modified	Type
Real.trd	9/21/2011 11:49 AM	TRD File
RealTime.trd	9/21/2011 11:48 AM	TRD File
XYTrace.trd	9/21/2011 11:48 AM	TRD File

File name:

Save as type: Trace Files(Ver7 format) (*.trd)

Information You can also display a list and copy from the trace list to an Excel file.

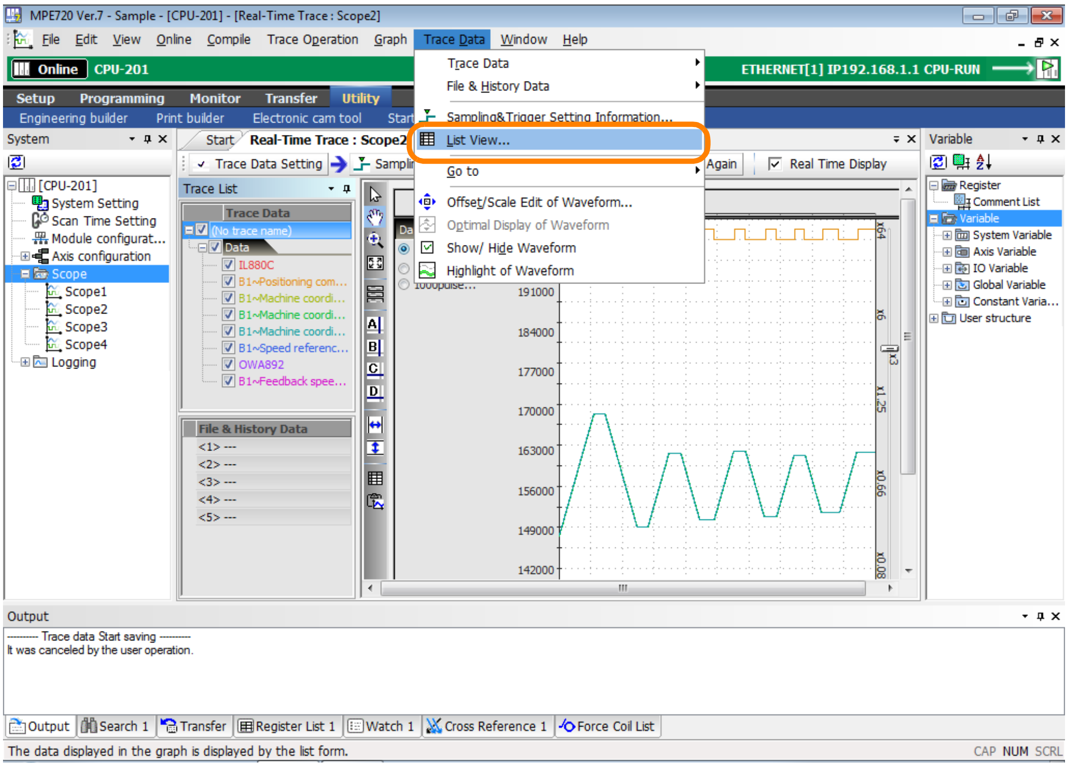


List View

You can display the graph data in a list.

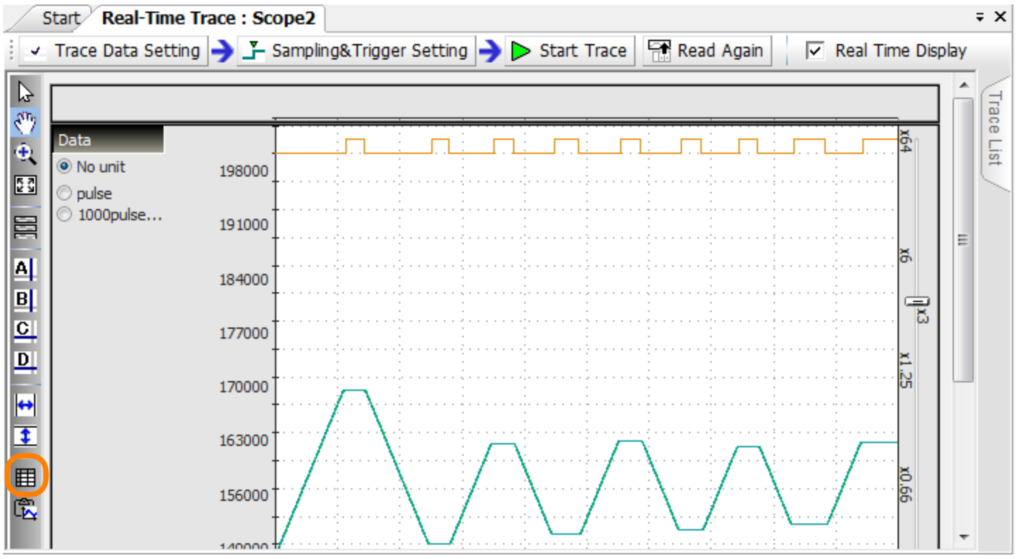
You can display the trace data and the history data in a list.

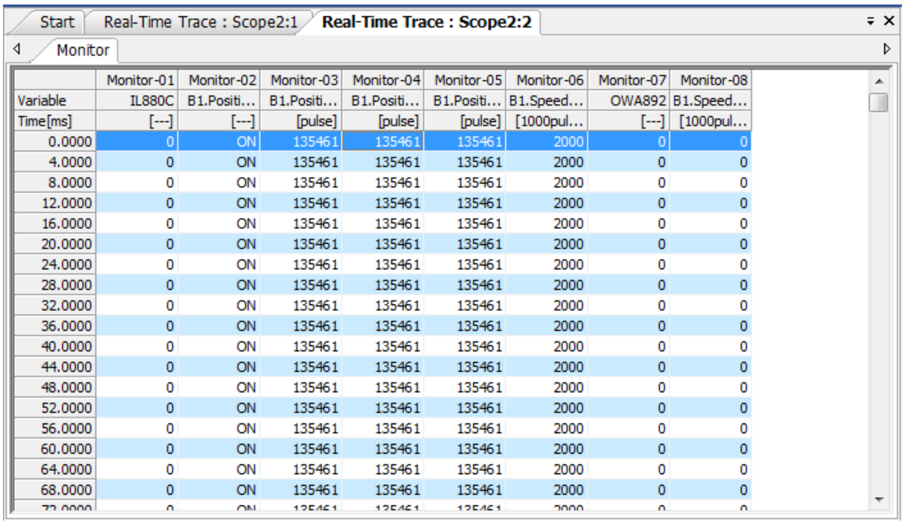
Select ***Trace Data*** – ***List View*** from the menu bar. When you select ***List View***, the trace data that is displayed in the graph will be displayed as a list.



-------- Trace data Start saving --------
It was canceled by the user operation.

The data displayed in the graph is displayed by the list form.



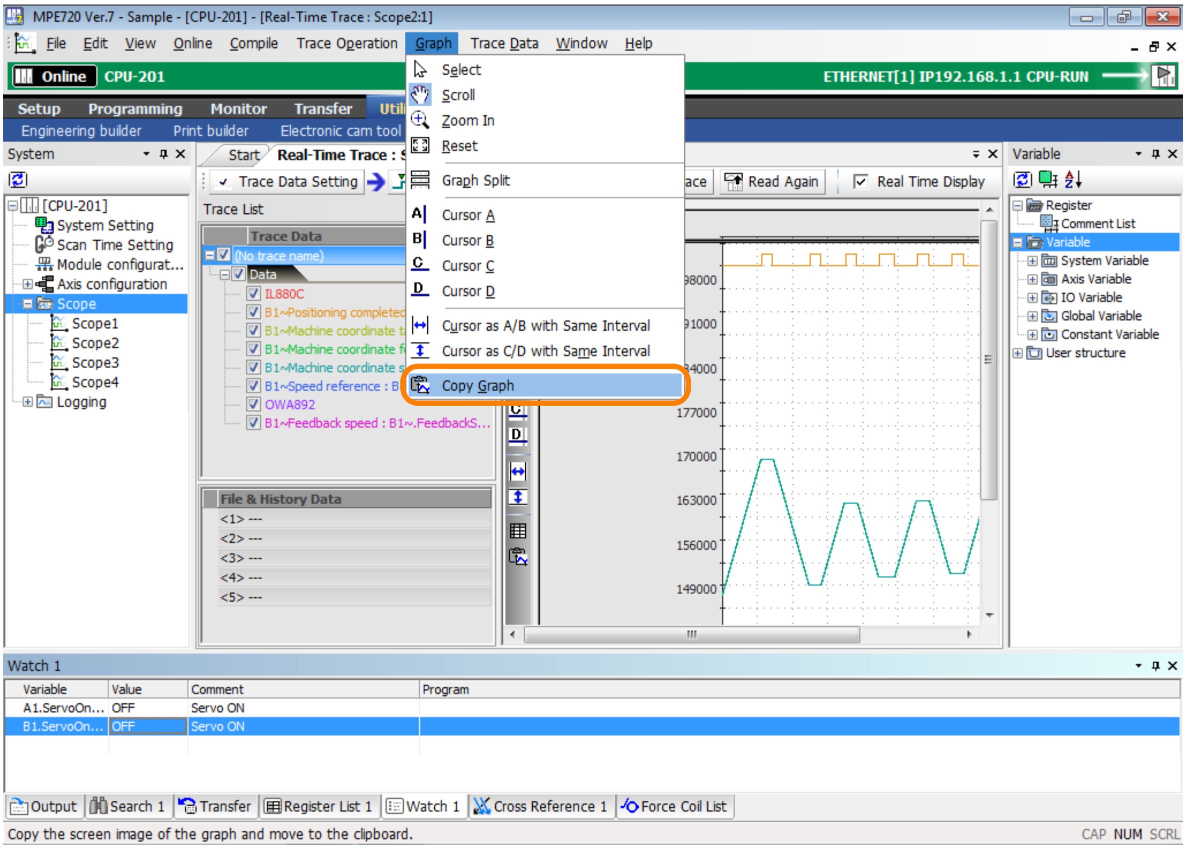


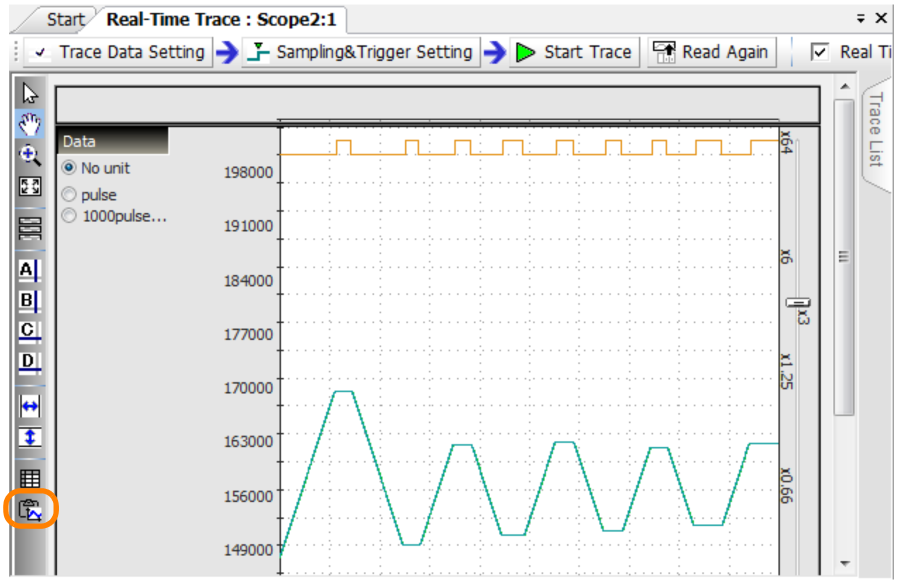
	Monitor-01	Monitor-02	Monitor-03	Monitor-04	Monitor-05	Monitor-06	Monitor-07	Monitor-08
Variable	IL880C	B1.Positi…	B1.Positi…	B1.Positi…	B1.Positi…	B1.Speed…	OWA892	B1.Speed…
Time[ms]	[---]	[---]	[pulse]	[pulse]	[pulse]	[1000pul…	[---]	[1000pul…
0.0000	0	ON	135461	135461	135461	2000	0	0
4.0000	0	ON	135461	135461	135461	2000	0	0
8.0000	0	ON	135461	135461	135461	2000	0	0
12.0000	0	ON	135461	135461	135461	2000	0	0
16.0000	0	ON	135461	135461	135461	2000	0	0
20.0000	0	ON	135461	135461	135461	2000	0	0
24.0000	0	ON	135461	135461	135461	2000	0	0
28.0000	0	ON	135461	135461	135461	2000	0	0
32.0000	0	ON	135461	135461	135461	2000	0	0
36.0000	0	ON	135461	135461	135461	2000	0	0
40.0000	0	ON	135461	135461	135461	2000	0	0
44.0000	0	ON	135461	135461	135461	2000	0	0
48.0000	0	ON	135461	135461	135461	2000	0	0
52.0000	0	ON	135461	135461	135461	2000	0	0
56.0000	0	ON	135461	135461	135461	2000	0	0
60.0000	0	ON	135461	135461	135461	2000	0	0
64.0000	0	ON	135461	135461	135461	2000	0	0
68.0000	0	ON	135461	135461	135461	2000	0	0

Copying a Graph

You can place a screen capture of the graph on the clipboard.

Select ***Graph*** – ***Copy Graph*** from the menu bar. Alternatively, click the **Copy Graph** Icon on the Graph Toolbar. The screen capture of the graph will be placed on the clipboard.





7.8.4 XY Trace

An XY trace gets the position data (target position and feedback position) of the X and Y axes in every scan and displays them on a 2-dimensional plane graph, allowing for visual analysis of the paths that the two axes take.

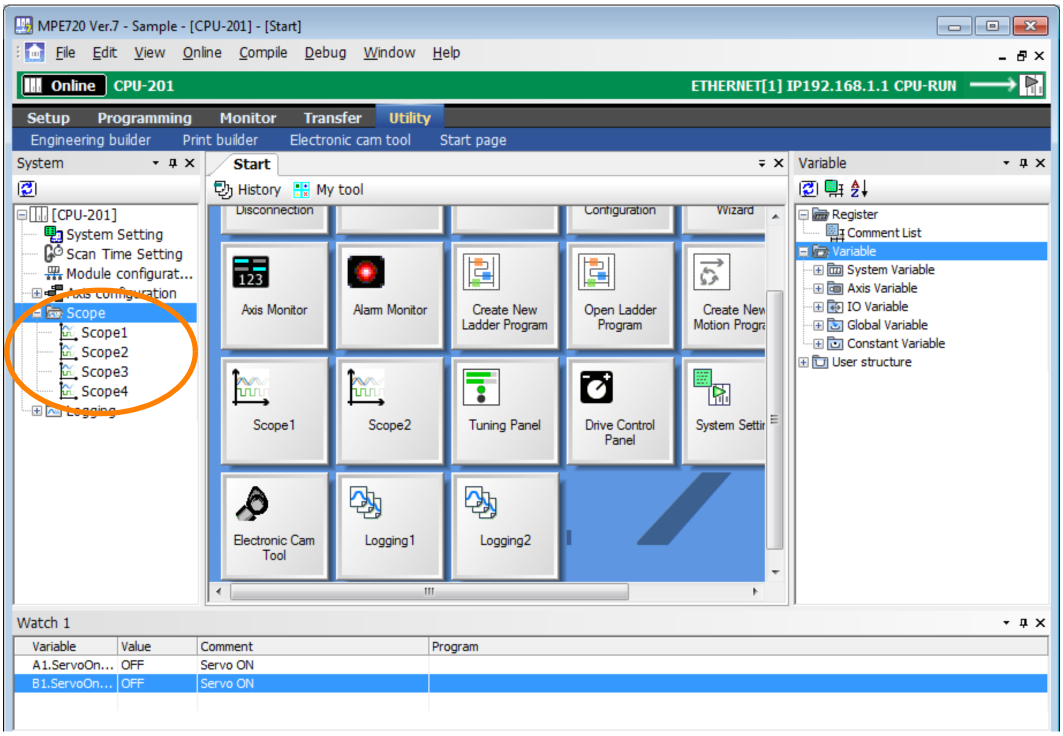
Starting the XY Trace

Double-click **Scope 1**, **Scope 2**, **Scope 3**, or **Scope 4** in the System Pane of MPE720 version 7, and then click the **XY Trace** Button in the Trace Type Dialog Box.

Alternatively, click the **Scope 1**, **Scope 2**, **Scope 3**, or **Scope 4** Button in the My Tool View, and then click the **XY Trace** Button in the Trace Type Dialog Box.

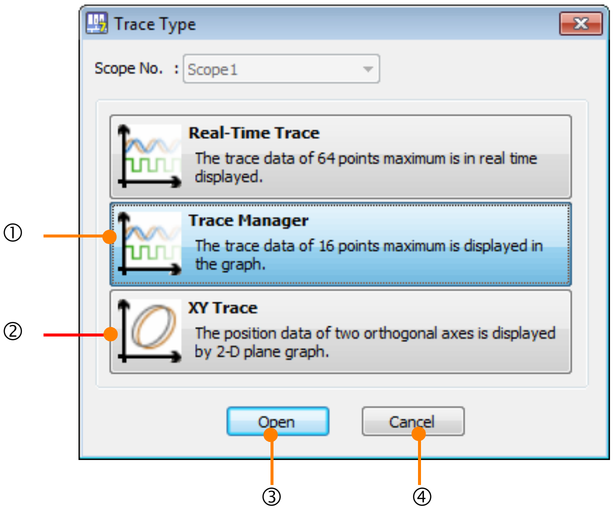
You can also start it from the Launcher by selecting ***Monitor*** – ***Trace***, and then clicking the **XY Trace** Button in the Trace Type Dialog Box.

Information By default, only the **Scope 1** and **Scope 2** Buttons are displayed in the My Tool View.



Variable	Value	Comment	Program
A1.ServoOn...	OFF	Servo ON	
B1.ServoOn...	OFF	Servo ON	

The following dialog box will be displayed.



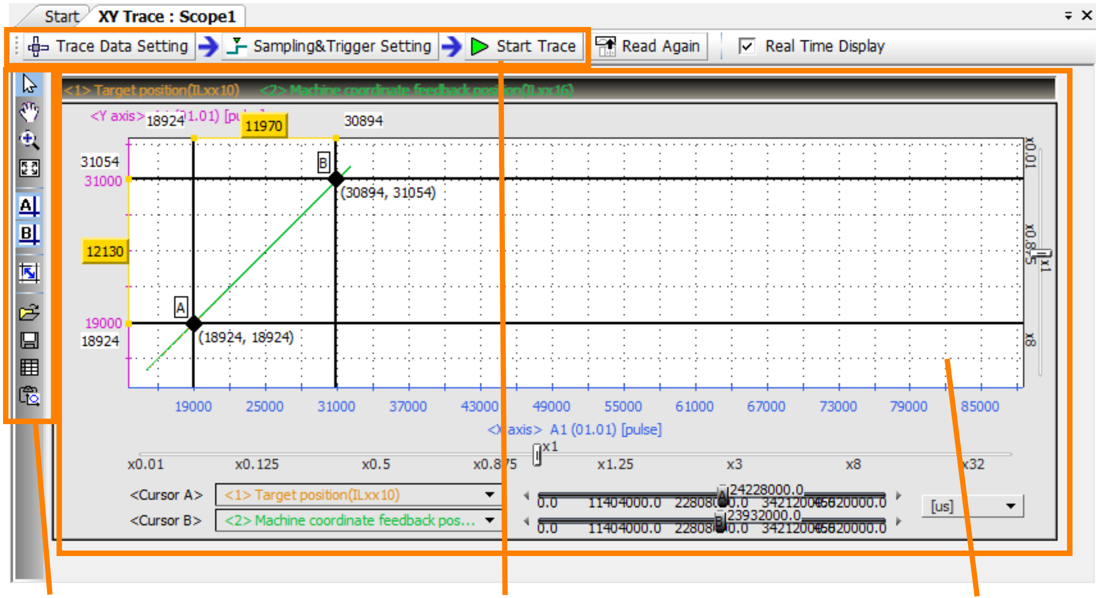
The trace data of 64 points maximum is in real time displayed.

The trace data of 16 points maximum is displayed in the graph.

The position data of two orthogonal axes is displayed by 2-D plane graph.

No.	Item	Description
①	Trace Manager	This button displays up to 16 points of trace data in a graph.
②	XY Trace	This button displays the position data of two orthogonal axes in a 2-dimensional graph.
③	Open	This button starts the selected type of trace.
④	Cancel	This button returns you to the Main Pane without starting the selected trace type.

Names and Functions of the XY Trace Tab Page Items



Graph Toolbar
The Graph Toolbar contains buttons to analyze the trace data.

Trace Execution Toolbar
This toolbar contains the **Trace Data Setting**, the **Sampling & Trigger Setting**, and the **Start Trace** Buttons to perform these operations in this order.

XY Graph
This graph displays the trace data.
You can use the Graph Toolbar, the sliders, and the cursors to analyze the XY trace data.

◆ Graph Toolbar

The following table gives details on the icons.

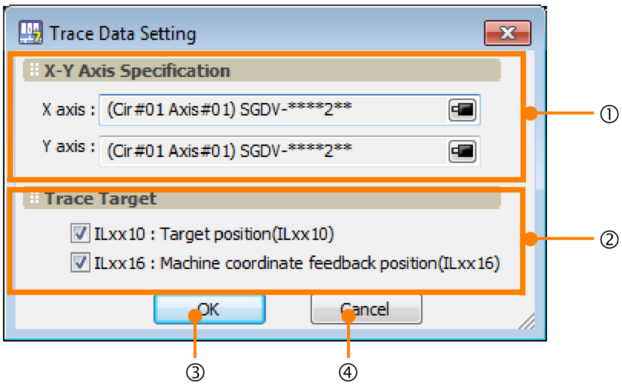
Icon	Function
↖	Click the **Select** Icon, and then double-click the target area to enlarge the display.
✋	Click the **Scroll** Icon to move the target area. Double-click the target area to enlarge the display.
🔍	Click the **Zoom In** Icon, and then drag or double-click the target area to enlarge the display.
⛶	Click the **Reset** Icon to return to the original display of the graph.
A	Click the **Cursor A** Icon to display cursor A, and then move it on the graph to display the X and Y values.
B	Click the **Cursor B** Icon to display cursor B, and then move it on the graph to display the X and Y values.
⇲	Click the **Cursor AB Link** Icon to lock the horizontal distance between cursors A and B, and to move them together at a fixed width.
📂	Click the **Open External File** Icon to display the Open Dialog Box and read the trace data from a file.
💾	Click the **Save** Icon to display the Save Dialog Box so that you can save the file with a specified name.
▦	Click the **List** Icon to display the Trace List.
📋	Click the **Copy Graph** Icon to place a screen capture of the graph on the clipboard.

◆ Trace Execution Toolbar

■ Trace Data Settings

Use this button to select the axes and the trace targets.

Click the **Trace Data Setting** Button to display the following dialog box:



X axis : (Cir#01 Axis#01) SGDV-****2**

Y axis : (Cir#01 Axis#01) SGDV-****2**

☑ ILxx10 : Target position(ILxx10)

☑ ILxx16 : Machine coordinate feedback position(ILxx16)

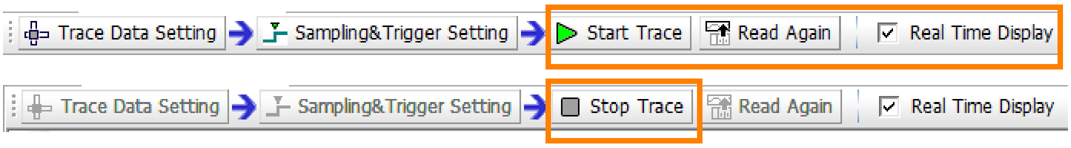
No.	Item	Description
①	X-Y Axis Specification	Use these boxes to specify the X and Y axes.
②	Trace List	Use these check boxes to specify the trace targets. You can select the following two motion parameters: IL□□□10: Machine Coordinate System Calculated Position (IL□□□10) IL□□□16: Machine Coordinate System Feedback Position (IL□□□16)
③	OK	The **OK** Button sets the X-Y axes and the trace targets, and enables the **Sampling & Trigger Setting** Button.
④	Cancel	The **Cancel** Button returns you to the XY Trace Dialog Box without setting the X-Y axes and the trace targets.

■ Sampling and Trigger Settings

This dialog box is used to set the trace name, the sampling settings, and the trigger setting parameters.
Refer to the following section for details on sampling and trigger settings.

☞ *7.8.3 Realtime Tracing– ■ Sampling and Trigger Settings* on page 7-94

■ Starting and Stopping Traces



Function	Description
Start Trace	Use this button to start the trace. The data that is sampled will be displayed in realtime.
Real Time Display	Select the **Real Time Display** Check Box to display the axes moving in realtime. If more than one Trace Tab Page is open, you can use a realtime display for only one of them.
Stop Trace	Use this button to stop the trace. When the trace stops, all trace buffer data will be collected and displayed.

Tuning

This chapter describes the flow of tuning that uses SigmaWin+, details on tuning functions, and related operating procedures.

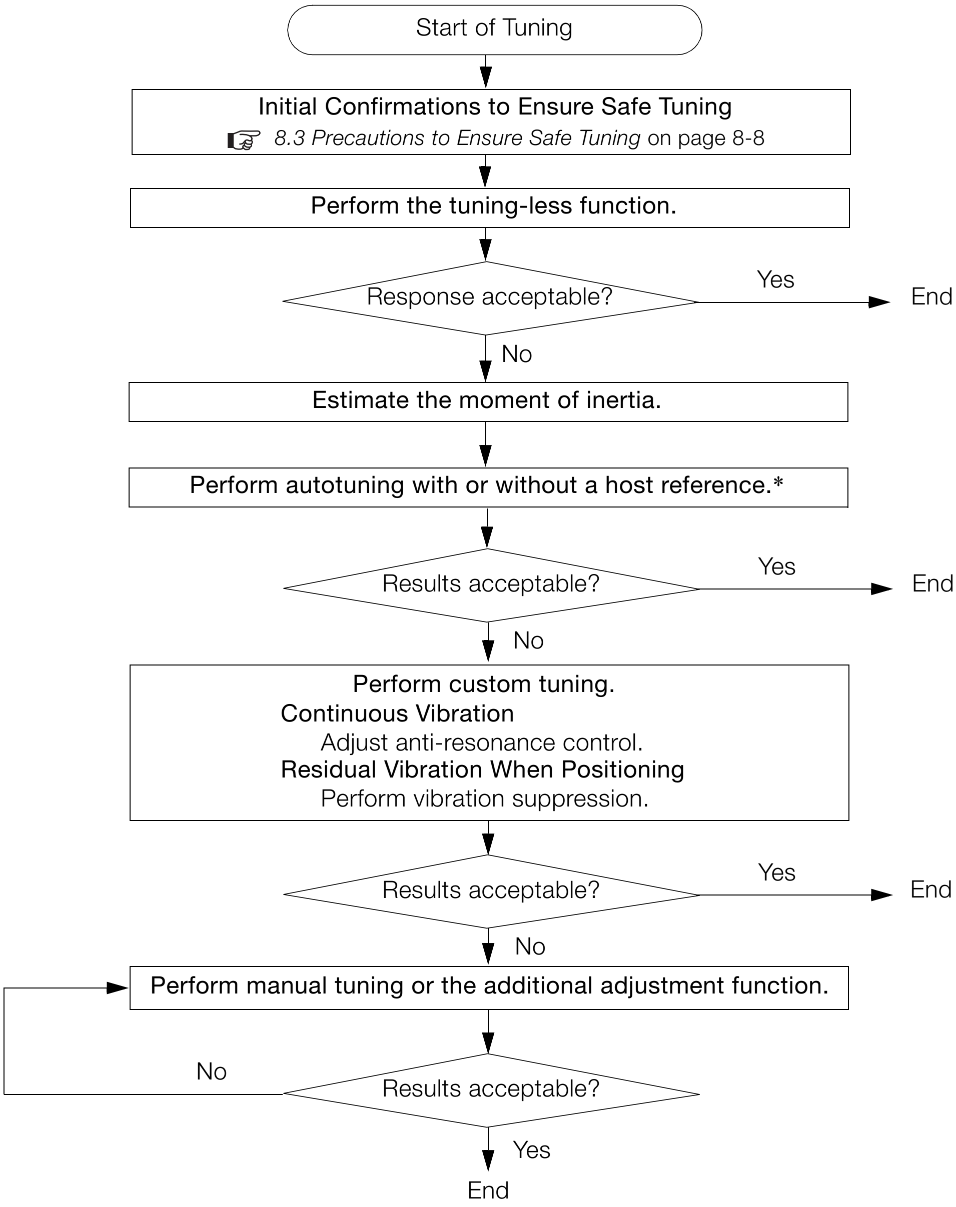
8.1 Overview and Flow of Tuning

Tuning is performed to optimize response by adjusting the servo gains in the SERVOPACK with the SigmaWin+.

The servo gains are set using a combination of parameters, such as parameters for the speed loop gain, position loop gain, filters, friction compensation, and moment of inertia ratio. These parameters influence each other, so you must consider the balance between them.

The servo gains are set to stable settings by default. Use the various tuning functions to increase the response even further for the conditions of your machine.

The basic tuning procedure is shown in the following flowchart. Make suitable adjustments considering the conditions and operating requirements of your machine.



* If possible, perform autotuning with a host reference.
If a host controller is not available, set an operation pattern that is as close as possible to the host reference and perform autotuning without a host reference.
If an operation pattern that is close to the host reference is not possible, perform autotuning with a host reference while performing program jogging.

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	page 8-12
Moment of Inertia Estimation	The moment of inertia ratio is calculated by operating the Servomotor a few times. The moment of inertia ratio that is calculated here is used in other tuning functions.	Speed control, position control, or torque control	page 8-16
Autotuning without 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	page 8-23
Autotuning with Host Reference	The following parameters are automatically adjusted with the position reference input from the SVD 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	page 8-34
Custom Tuning	The following parameters are adjusted with the position reference or speed reference input from the SVD 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	page 8-41
Anti-resonance Control	This function effectively suppresses continuous vibration.	Speed control or position control	page 8-49
Vibration Suppression	This function effectively suppresses residual vibration if it occurs when positioning.	Position control	page 8-54
Speed Ripple Compensation	This function reduces the ripple in the motor speed.	Speed control, position control, or torque control	page 8-58
Additional Adjustment Function	This function combines autotuning with custom tuning. You can use it to improve adjustment results.	Depends on the functions that you use.	page 8-64
Manual Tuning	You can manually adjust the servo gains to adjust the response.	Speed control, position control, or torque control	page 8-73

8.1.2 Diagnostic Tools

You can use the following tools to measure the frequency characteristics of the machine and set notch filters.

Diagnostic Tool	Outline	Applicable Control Methods	Reference
Mechanical Analysis	The machine is subjected to vibration to detect resonance frequencies. The measurement results are displayed as waveforms or numeric data.	Speed control, position control, or torque control	page 8-88
Easy FFT	The machine is subjected to vibration to detect resonance frequencies. The measurement results are displayed only as numeric data.	Speed control, position control, or torque control	page 8-90

8.2 Monitoring Methods

You can use data tracing on the SigmaWin+ to monitor data. 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.

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 Function and Settings* on page 5-28

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.

☞ *5.23 Selecting the Torque Limits* on page 5-69

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 position loop gain (Pn102) and the motor speed with the following formula.

- Rotary Servomotors

$$\text{Position deviation [reference units]} = \frac{\text{Motor speed [min}^{-1}\text{]}}{60} \times \frac{\text{Encoder Resolution}^{*1}}{\text{Pn102 [0.1/s]/10}^{*2,\ *3}} \times \frac{\text{Pn210}}{\text{Pn20E}}$$

- Linear Servomotors

$$\text{Position deviation [reference units]} = \frac{\text{Motor speed [mm/s]}}{\text{Pn102 [0.1/s]/10}^{*2,\ *3}} \times \frac{\text{Resolution}}{\text{Linear encoder pitch [μm]/1,000}} \times \frac{\text{Pn210}}{\text{Pn20E}}$$

Position Deviation Overflow Alarm Level (Pn520) [setting unit: reference units]

- Rotary Servomotors

$$\text{Pn520} > \frac{\text{Maximum motor speed [min-1]}}{60} \times \frac{\text{Encoder Resolution}^{*1}}{\text{Pn102 [0.1/s]/10}^{*2}} \times \frac{\text{Pn210}}{\text{Pn20E}} \times \underline{\underline{(1.2 \text{ to } 2)}}^{*3}$$

- Linear Servomotors

$$\text{Pn520} > \frac{\text{Maximum motor speed [mm/s]}}{\text{Pn102 [0.1/s]/10}^{*2}} \times \frac{\text{Resolution}}{\text{Linear encoder pitch [μm]/1,000}} \times \frac{\text{Pn210}}{\text{Pn20E}} \times \underline{\underline{(1.2 \text{ to } 2)}}^{*3}$$

*1. Refer to the following section for details.
☞ *5.15 Electronic Gear Settings* on page 5-41

*2. When model following control (Pn140 = n.□□□1) is enabled, use the setting of Pn141 (Model Following Control Gain) instead of the setting of Pn102 (Position Loop Gain).

*3. The underlined coefficient "× (1.2 to 2)" adds a margin to prevent an A.d00 alarm (Position Deviation Overflow) from occurring too frequently.

If you set a value that satisfies the formula, an A.d00 alarm (Position Deviation Overflow) should not occur during normal operation.

If the Servomotor operation does not agree with the reference, position deviation will occur, an error will be detected, and the Servomotor will stop.

The following calculation example uses a Rotary Servomotor with a maximum motor speed of 6,000 and an encoder resolution of 16,777,216 (24 bits). Pn102 is set to 400. $\frac{\text{Pn210}}{\text{Pn20E}} = \frac{1}{16}$

$$\begin{aligned} \text{Pn520} &= \frac{6000}{60} \times \frac{16777216}{400/10} \times \frac{1}{16} \times 2 \\ &= 2621440 \times 2 \\ &= 5{,}242{,}880 \text{ (default setting of Pn520)} \end{aligned}$$

If the acceleration/deceleration rate required for the position reference exceeds the tracking capacity of the Servomotor, the tracking delay will increase and the position deviation will no longer satisfy the above formulas. If this occurs, lower the acceleration/deceleration rate so that the Servomotor can follow the position reference or increase the position deviation overflow alarm level.

Related Parameters

Pn520	Position Deviation Overflow Alarm Level			Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 1,073,741,823	1 reference unit	5242880	Immediately	Setup
Pn51E	Position Deviation Overflow Warning Level			Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 100	1%	100	Immediately	Setup

Related Alarms

Alarm Number	Alarm Name	Alarm Description
A.d00	Position Deviation Overflow	This alarm is displayed when the position deviation exceeds the setting of Pn520 (Position Deviation Overflow Alarm Level).

Related Warnings

Warning Number	Warning Name	Meaning
A.900	Position Deviation Overflow	This warning occurs if the position deviation exceeds the specified percentage $\left(\frac{\text{Pn520} \times \text{Pn51E}}{100}\right)$.

8.3.4 Vibration Detection Level Setting

You can set the vibration detection level (Pn312) to more accurately detect A.520 alarms (Vibration Alarm) and A.911 warnings (Vibration) when vibration is detected during machine operation.

Set the initial vibration detection level to an appropriate value. Refer to the following section for details.

☞ *5.26 Initializing the Vibration Detection Level* on page 5-80

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.

Related Parameters

Pn526	Position Deviation Overflow Alarm Level at Servo ON			Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 1,073,741,823	1 reference unit	5,242,880	Immediately	Setup
Pn528	Position Deviation Overflow Warning Level at Servo ON			Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 100	1%	100	Immediately	Setup

- Rotary Servomotors

Pn529	Speed Limit Level at Servo ON			Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 min^{-1}	10,000	Immediately	Setup

- Linear Servomotors

Pn584	Speed Limit Level at Servo ON			Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 mm/s	10,000	Immediately	Setup

Related Alarms

Alarm Number	Alarm Name	Alarm Description
A.d01	Position Deviation Overflow Alarm at Servo ON	This alarm occurs if the servo is 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) will limit the speed when the servo is turned ON. This alarm occurs if a position reference is input and the setting of Pn520 (Position Deviation Overflow Alarm Level) is exceeded.

Refer to the following manual for information on troubleshooting alarms.

📖 Σ-7-Series Σ-7C SERVOPACK Troubleshooting Manual (Manual No.: SIEP S800002 07)

Related Warnings

Warning Number	Warning Name	Meaning
A.901	Position Deviation Overflow Warning at Servo ON	This warning occurs if the servo is turned ON while the position deviation exceeds the specified percentage $\left(\frac{\text{Pn526} \times \text{Pn528}}{100}\right)$.

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

- The tuning-less function is disabled during torque control.
- The Servomotor may momentarily emit a sound the first time the servo is turned ON after the Servomotor is connected to the machine. This sound is caused by setting the automatic notch filter. It does not indicate a problem. The sound will not be emitted from the next time the servo is turned ON.
- The Servomotor may vibrate if it exceeds the allowable load moment of inertia.
  If that occurs, set the tuning-less load level to 2 (Pn170 = n.2□□□) or reduce the tuning-less rigidity level (Pn170 = n.□X□□).
- To ensure safety, make sure that you can perform an emergency stop at any time when you execute the tuning-less function.

8.4.1 Application Restrictions

The following application restrictions apply to the tuning-less function.

Function	Executable?*	Remarks
Vibration Detection Level Initialization	○	–
Moment of Inertia Estimation	×	Disable the tuning-less function (Pn170 = n.□□□0) before you execute moment of inertia estimation.
Autotuning without Host Reference	×	Disable the tuning-less function (Pn170 = n.□□□0) before you execute autotuning without a host reference.
Autotuning with Host Reference	×	–
Custom Tuning	×	–
Adjust Anti-Resonance Control	×	–
Vibration Suppression	×	–
Easy FFT	○	The tuning-less function is disabled while you execute Easy FFT and then it is enabled when Easy FFT has been completed.
Friction Compensation	×	–
Gain Selection	×	–
Mechanical Analysis	○	The tuning-less function is disabled while you execute mechanical analysis and then it is enabled when mechanical analysis has been completed.

* ○: Yes ×: No

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.

Parameter		Meaning	When Enabled	Classification
Pn170	n.□□□0	Disable tuning-less function.	After restart	Setup
	n.□□□1 (default setting)	Enable tuning-less function.		
	n.□□0□ (default setting)	Use for speed control.		
	n.□□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.□□2□ (Use tuning-less type 3) (default setting).
If compatibility with previous models is required, set Pn14F to n.□□0□ (Use tuning-less type 1) or n.□□1□ (Use tuning-less type 2).

Parameter		Meaning	When Enabled	Classification
Pn14F	n.□□0□	Use tuning-less type 1.	After restart	Tuning
	n.□□1□	Use tuning-less type 2. (The noise level is improved more than with tuning-less type 1.)		
	n.□□2□ (default setting)	Use tuning-less type 3.		

Tuning-less Level Settings

If vibration or other problems occur, change the tuning-less levels. To change the tuning-less levels, use the SigmaWin+.

◆ Preparations

Always check the following before you set the tuning-less levels.

- The tuning-less function must be enabled (Pn170 = n.□□□1).
- The test without a motor function must be disabled (Pn00C = n.□□□0).

◆ Procedure

Use the following procedure to set the tuning-less levels.

In addition to the following procedure, you can also set the parameters directly. Refer to Related Parameters, below, for the parameters to set.

1. **Click the Servo Drive Button in the workspace of the Main Window of the SigmaWin+.**

2. **Select Response Level Setting in the Menu Dialog Box.**
   The Response Level Setting Dialog Box will be displayed.

3. **Click the ▲ or ▼ Button to adjust the response level setting. Increase the response level setting to increase the response. Decrease the response level setting to suppress vibration.**
   The default response level setting is 4.

Response Level Setting	Description	Remarks
7	Response level: High	You cannot select these levels if tuning-less type 1 or 2 (Pn14F = n.□□0□ or n.□□1□) is used.
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.

◆ Related Parameters

■ Tuning-Less Rigidity Level

If you use tuning-less type 1 or 2 (Pn14F = n.□□0□ or n.□□1□), set the tuning-less rigidity level to between 0 and 4 (Pn170 = n.□0□□ to n.□4□□). Do not set the tuning-less rigidity level to between 5 and 7 (Pn170 = n.□5□□ to n.□7□□).

Parameter		Description	When Enabled	Classification
Pn170	n.□0□□	Tuning-less rigidity level 0 (low rigidity)	Immediately	Setup
	n.□1□□	Tuning-less rigidity level 1		
	n.□2□□	Tuning-less rigidity level 2		
	n.□3□□	Tuning-less rigidity level 3		
	n.□4□□ (default setting)	Tuning-less rigidity level 4		
	n.□5□□	Tuning-less rigidity level 5		
	n.□6□□	Tuning-less rigidity level 6		
	n.□7□□	Tuning-less rigidity level 7 (high rigidity)		

■ Tuning-Less Load Level

Parameter		Description	When Enabled	Classification
Pn170	n.0□□□	Tuning-less load level 0	Immediately	Setup
	n.1□□□ (default setting)	Tuning-less load level 1		
	n.2□□□	Tuning-less load level 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 the setting of 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 the tuning-less function is enabled (Pn170 = n.□□□1) (default setting), the parameters in the following table are disabled.

Item	Parameter Name	Parameter Number
Gain-Related Parameters	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
Advanced Control-Related Parameters	Friction Compensation Function Selection	Pn408 = n.X□□□
	Anti-Resonance Control Selection	Pn160 = n.□□□X
Gain Selection-Related Parameters	Gain Switching Selection	Pn139 = n.□□□X

The tuning-less function is disabled during torque control, Easy FFT, and mechanical analysis for a vertical axis. The gain-related parameters in the above table are enabled for torque control, Easy FFT, and mechanical analysis. Of these, Pn100, Pn103, and Pn104 are enabled for torque control.

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.

Parameter		Meaning	When Enabled	Classification
Pn460	n.□0□□	Do not adjust the second stage notch filter automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.	Immediately	Tuning
	n.□1□□ (default setting)	Adjust the second stage notch filter automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.		

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
Pn40C	Second Stage Notch Filter Frequency
Pn40D	Second Stage Notch Filter Q Value

8.5 Estimating the Moment of Inertia

This section describes how the moment of inertia is calculated.

The moment of inertia ratio that is calculated here is used in other tuning functions. You can also estimate the moment of inertia during autotuning without a host reference. Refer to the following section for the procedure.

☞ *8.6.3 Operating Procedure* on page 8-25

8.5.1 Outline

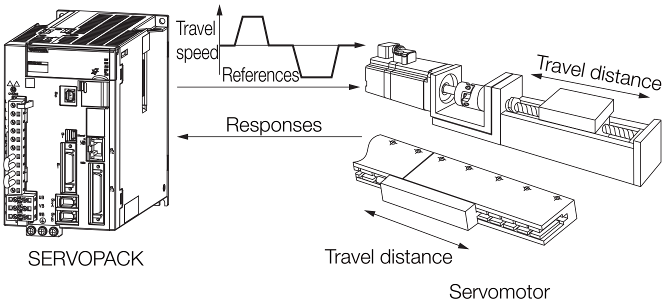
The moment of inertia during operation is automatically calculated by the SERVOPACK for round-trip (forward and reverse) operation. A reference from the SVD is not used.

The moment of inertia ratio (i.e., the ratio of the load moment of inertia to the motor moment of inertia) is a basic parameter for adjusting gains. It must be set as accurately as possible.

Although the load moment of inertia can be calculated from the weight and structure of the mechanisms, doing so is very troublesome and calculating it accurately can be very difficult with the complex mechanical structures that are used these days. With moment of inertia estimation, you can get an accurate load moment of inertia simply by operating the Servomotor in the actual system in forward and reverse a few times.

The Servomotor is operated with the following specifications.

- Maximum speed: ±1,000 min^{-1} (can be changed)
- Acceleration rate: ±20,000 min^{-1}/s (can be changed)
- Travel distance: ±2.5 rotations max. (can be changed)



Note: Execute moment of inertia estimation after jogging to a position that ensures a suitable range of motion.

8.5.2 Restrictions

The following restrictions apply to estimating the moment of inertia.

Systems for Which Execution Cannot Be Performed

- When the machine system can move only in one direction
- When the range of motion is 0.5 rotations or less

Systems for Which Adjustments Cannot Be Made Accurately

- When a suitable range of motion is not possible
- When the moment of inertia changes within the set operating range
- When the machine has high dynamic friction
- When the rigidity of the machine is low and vibration occurs when positioning is performed
- When the position integration function is used

- When proportional control is used

Note: If you specify calculating the moment of inertia, an error will occur if you use the Speed Loop P/PI Switch Bit (OW□□□01 bit 3) to change between P and PI control during moment of inertia estimation.

- When mode switching is used

Note: If you specify moment of inertia estimation, mode switching will be disabled and PI control will be used while the moment of inertia is being calculated. Mode switching will be enabled after moment of inertia estimation has been completed.

- When speed feedforward or torque feedforward is input

Preparations

Always check the following before you execute moment of inertia estimation.

- The main circuit power supply must be ON.
- There must be no overtravel.
- The servo must be OFF.
- The control method must not be set to torque control.
- The gain selection switch must be set to manual gain selection (Pn139 = n.□□□0).
- The first gains must be selected.
- The test without a motor function must be disabled (Pn00C = n.□□□0).
- There must be no alarms or warnings.
- The parameters must not be write prohibited.
- The tuning-less function must be disabled (Pn170 = n.□□□0).

8.5.3 Operating Procedure

Use the following procedure to estimate the moment of inertia ratio.

⚠ WARNING

- **Estimating the moment of inertia requires operating the Servomotor and therefore presents hazards. Observe the following precaution.**
  - Confirm safety around moving parts.
    This function involves automatic operation with vibration. Make sure that you can perform an emergency stop (to turn OFF the power supply) at any time. There will be movement in both directions within the set range of movement. Check the range of movement and the directions and implement protective controls for safety, such as the overtravel functions.

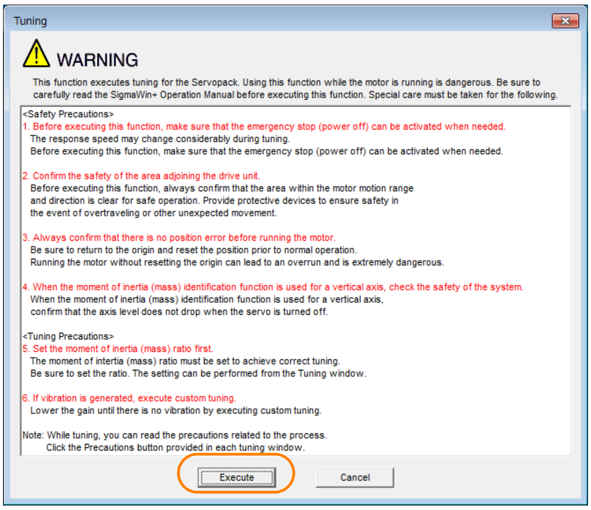
⚠ CAUTION

- **Be aware of the following points if you cancel the moment of inertia estimation while the Servomotor is operating.**
  - If you cancel operation with the **Servo OFF** Button, the Servomotor will stop according to setting of the Servo OFF stopping method (Pn001 = n.□□□X).
  - If you cancel operation with the **Cancel** Button, the Servomotor will decelerate to a stop and then enter a zero-clamped state.

1. Click the **Servo Drive** Button in the workspace of the Main Window of the SigmaWin+.

2. Select **Tuning** in the Menu Dialog Box.
   The Tuning Dialog Box will be displayed.
   Click the **Cancel** Button to cancel tuning.

3. Click the **Execute** Button.



Tuning

WARNING

This function executes tuning for the Servopack. Using this function while the motor is running is dangerous. Be sure to carefully read the SigmaWin+ Operation Manual before executing this function. Special care must be taken for the following.

<Safety Precautions>

1. Before executing this function, make sure that the emergency stop (power off) can be activated when needed.
The response speed may change considerably during tuning.
Before executing this function, make sure that the emergency stop (power off) can be activated when needed.

2. Confirm the safety of the area adjoining the drive unit.
Before executing this function, always confirm that the area within the motor motion range and direction is clear for safe operation. Provide protective devices to ensure safety in the event of overtraveling or other unexpected movement.

3. Always confirm that there is no position error before running the motor.
Be sure to return to the origin and reset the position prior to normal operation.
Running the motor without resetting the origin can lead to an overrun and is extremely dangerous.

4. When the moment of inertia (mass) identification function is used for a vertical axis, check the safety of the system.
When the moment of inertia (mass) identification function is used for a vertical axis, confirm that the axis level does not drop when the servo is turned off.

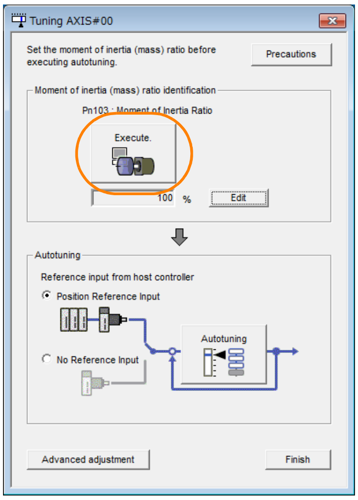
<Tuning Precautions>

5. Set the moment of inertia (mass) ratio first.
The moment of intertia (mass) ratio must be set to achieve correct tuning.
Be sure to set the ratio. The setting can be performed from the Tuning window.

6. If vibration is generated, execute custom tuning.
Lower the gain until there is no vibration by executing custom tuning.

Note: While tuning, you can read the precautions related to the process.
Click the Precautions button provided in each tuning window.

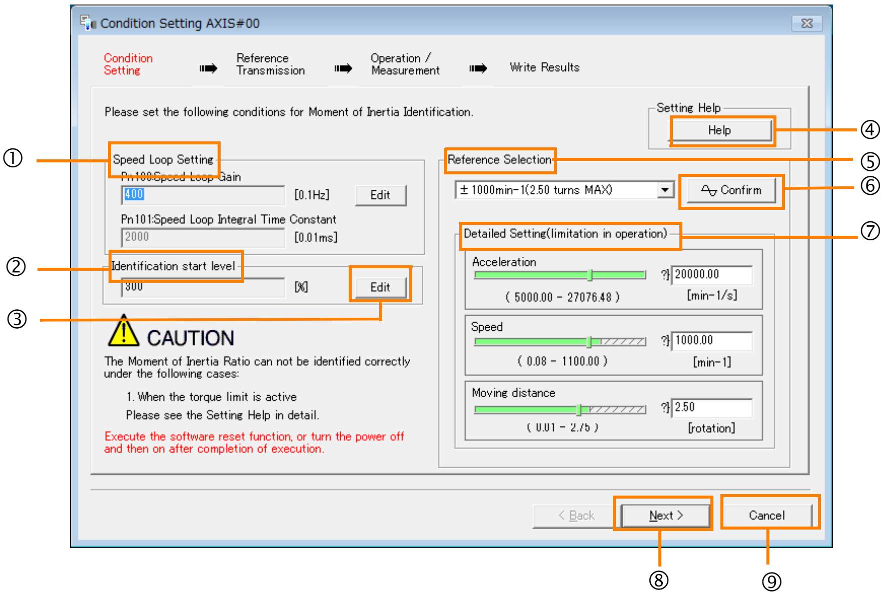
4. Click the **Execute** Button.



Tuning AXIS#00

Set the moment of inertia (mass) ratio before executing autotuning.

5. Set the conditions as required.



Condition Setting AXIS#00

Please set the following conditions for Moment of Inertia Identification.

Pn100:Speed Loop Gain: 400 [0.1Hz]
Pn101:Speed Loop Integral Time Constant: 2000 [0.01ms]
Identification start level: 300 [%]
Reference Selection: ± 1000min-1(2.50 turns MAX)
Acceleration: 20000.00 [min-1/s] (5000.00 – 27076.48)
Speed: 1000.00 [min-1] (0.08 – 1100.00)
Moving distance: 2.50 [rotation] (0.01 – 2.75)

CAUTION

The Moment of Inertia Ratio can not be identified correctly under the following cases:

1. When the torque limit is active

Please see the Setting Help in detail.

Execute the software reset function, or turn the power off and then on after completion of execution.

①**Speed Loop Setting** Area

Make the speed loop settings in this area.
If the speed loop response is too bad, it will not be possible to measure the moment of inertia ratio accurately.
The values for the speed loop response that are required for moment of inertia estimation are set for the default settings. It is normally not necessary to change these settings.
If the default speed loop gain is too high for the machine (i.e., if vibration occurs), lower the setting. It is not necessary to increase the setting any farther.

②**Identification Start Level** Area

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** Buttons

Click the button to display a dialog box to change the settings related to the speed loop or estimation start level.

④**Help** Button

Click this button to display guidelines for setting the reference conditions. Make the following settings as required.

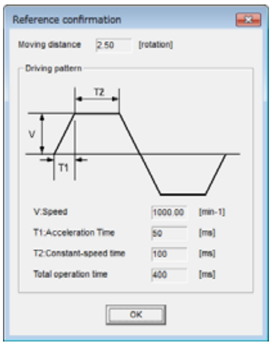
- Operate the Servomotor to measure the load moment of inertia of the machine in comparison with the rotor moment of inertia.
- Set the operation mode, reference pattern (maximum acceleration rate, maximum speed, and maximum travel distance), and speed loop-related parameters.
- Correct measurement of the moment of inertia ratio may not be possible depending on the settings. Set suitable settings using the measurement results as reference.

⑤**Reference Selection** Area

Either select the reference pattern for estimation processing from the box, or set the values in the **Detailed Setting** Area. Generally speaking, the larger the maximum acceleration rate is, the more accurate the moment of inertia estimation will be.
Set the maximum acceleration range within the possible range of movement considering the gear ratio, e.g., the pulley diameters or ball screw pitch.

⑥**Confirm** Button

Click this button to display the Reference Confirmation Dialog Box.



Moving distance 2.50 [rotation]

V:Speed 1000.00 [min-1]
T1:Acceleration Time 50 [ms]
T2:Constant-speed time 100 [ms]
Total operation time 400 [ms]

⑦**Detailed Setting** Area

You can change the settings by moving the bars or directly inputting the settings to create the required reference pattern.

⑧**Next** Button

Click this button to display the Reference Transmission Dialog Box.

⑨**Cancel** Button

Click this button to return to the Tuning Dialog Box.

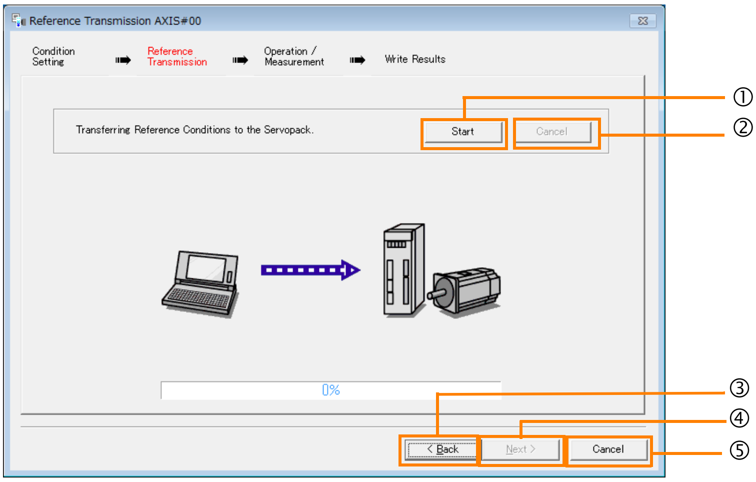
⚠ CAUTION

- 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 and undershooting 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 Reference Transmission Dialog Box will be displayed.

7. Click the **Start** Button.



Transferring Reference Conditions to the Servopack.

①**Start** Button
The reference conditions will be transferred to the SERVOPACK. A progress bar will show the progress of the transfer.

②**Cancel** Button
The **Cancel** Button is enabled only while data is being transferred to the SERVOPACK. You cannot use it after the transfer has been completed.

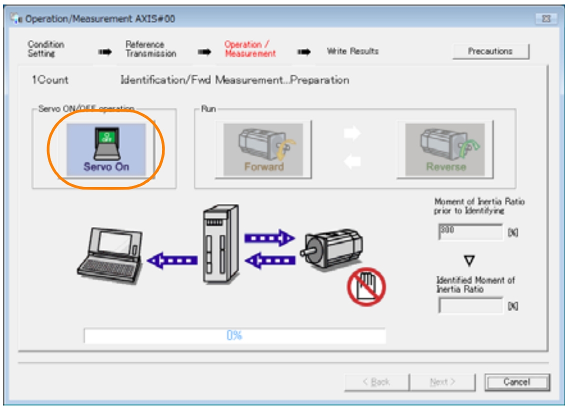
③**Back** Button
This button returns you to the Condition Setting Dialog Box. It is disabled while data is being transferred.

④**Next** Button
This button is enabled only when the data has been transferred correctly. You cannot use it if an error occurs or if you cancel the transfer before it is completed.
Click the **Next** Button to display the Operation/Measurement Dialog Box.

⑤**Cancel** Button
This button cancels processing and returns you to the Tuning Dialog Box.

8. Click the **Next** Button.
The Operation/Measurement Dialog Box will be displayed.

9. Click the **Servo On** Button.



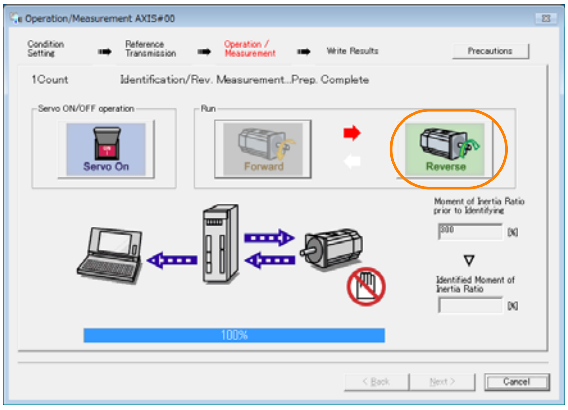
1Count Identification/Fwd Measurement...Preparation

Moment of Inertia Ratio prior to Identifying: 300 [%]

10. Click the **Forward** Button.

The shaft will rotate in the forward direction and the measurement will start. After the measurement and data transfer have been completed, the **Reverse** Button will be displayed in color.

11. Click the **Reverse** Button.



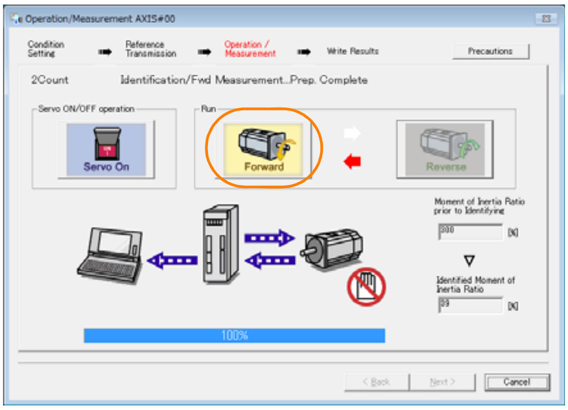
Operation/Measurement AXIS#00

1Count Identification/Rev. Measurement..Prep. Complete

Moment of Inertia Ratio prior to Identifying: 300 [%]

Identified Moment of Inertia Ratio: [%]

The shaft will rotate in the reverse direction and the measurement will start. After the measurement and data transfer have been completed, the **Forward** Button will be displayed in color.



Operation/Measurement AXIS#00

2Count Identification/Fwd Measurement..Prep. Complete

Moment of Inertia Ratio prior to Identifying: 300 [%]

Identified Moment of Inertia Ratio: 39 [%]

12. Repeat steps 9 to 11 until the **Next** Button is enabled.

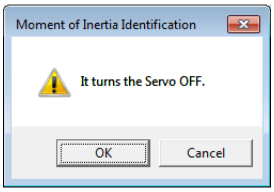
Measurements are performed from 2 to 7 times and then verified. The number of measurements is displayed in upper left corner of the dialog box. A progress bar at the bottom of the dialog box will show the progress of the transfer each time.

13. When the measurements have been completed, click the **Servo On** Button to turn OFF the servo.

14. Click the **Next** Button.

The Write Results Dialog Box will be displayed.

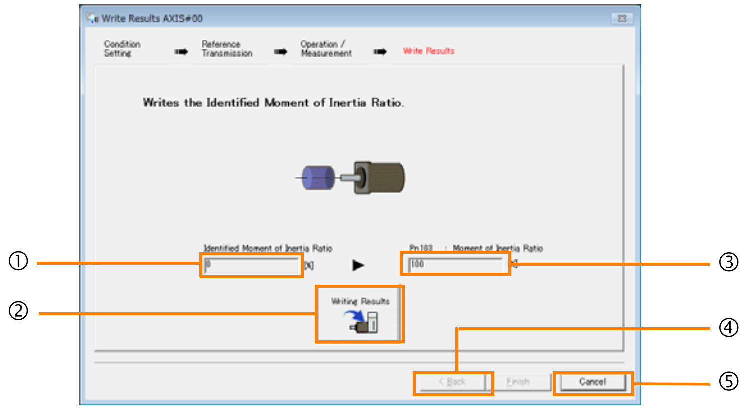
Information If you click the **Next** Button before you turn OFF the servo, the following Dialog Box will be displayed. Click the **OK** Button to turn OFF the servo.



Moment of Inertia Identification

It turns the Servo OFF.

15. Click the **Writing Results** Button.



Writes the Identified Moment of Inertia Ratio.

Identified Moment of Inertia Ratio 0 [%]

Pn103 : Moment of Inertia Ratio 100 [%]

①**Identified Moment of Inertia Ratio** Box

The moment of inertia ratio that was found with operation and measurements is displayed here.

②**Writing Results** Button

If you click this button, Pn103 (Moment of Inertia Ratio) in the SERVOPACK is set to the value that is displayed for the identified moment of inertia ratio.

③**Pn103: Moment of Inertia Ratio** Box

The value that is set for the parameter is displayed here.

After you click the **Writing Results** Button, the value that was found with operation and measurements will be displayed as the new setting.

④**Back** Button

This button is disabled.

⑤**Cancel** Button

This button will return you to the Tuning Dialog Box.

16. Confirm that the **Identified Moment of Inertia Ratio** Box and the **Pn103: Moment of Inertia Ratio** Box show the same value and then click the **Finish** Button.

If the setting of the moment of inertia ratio (Pn103) was changed, the new value will be saved and the Tuning Dialog Box will be displayed again.

This concludes the procedure to estimate the moment of inertia ratio. Turn the power supply OFF and ON again and perform operation as described below.

8.6 Autotuning without Host Reference

This section describes autotuning without a host reference.

Important

- Autotuning without a host reference performs adjustments based on the setting of the speed loop gain (Pn100). Therefore, precise adjustments cannot be made if there is vibration when adjustments are started. Make adjustments after lowering the speed loop gain (Pn100) until vibration is eliminated.
- You cannot execute autotuning without a host reference if the tuning-less function is enabled (Pn170 = n.□□□1 (default setting)). Disable the tuning-less function (Pn170 = n.□□□0) before you execute autotuning without a host reference.
- 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.)

8.6.1 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 SVD is not used.

The following items are adjusted automatically.

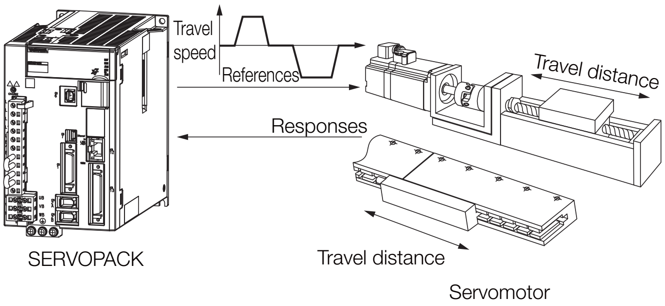
- Moment of inertia ratio
- Gains (e.g., speed loop gain and position loop gain)
- Filters (torque reference filter and notch filters)
- Friction compensation
- Anti-resonance control
- Vibration suppression (only for mode 2 or 3)

Refer to the following section for details on the parameters that are adjusted.

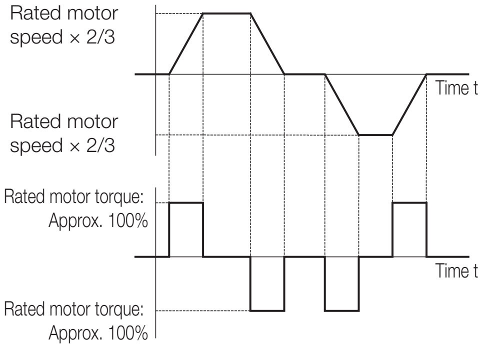
☞ *8.6.6 Related Parameters* on page 8-33

The Servomotor is operated with the following specifications.

Maximum Speed	Rated motor speed × $\frac{2}{3}$	
Acceleration Torque	Rated motor torque: Approx. 100% Note: The acceleration torque depends on the setting of the influence of the moment of inertia ratio (Pn103), machine friction, and external disturbance.	
Travel Distance	Rotary Servomotors	You can set the desired travel distance. The default setting is for a value equivalent to 3 Servomotor shaft rotations.
	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 1,000 reference units. (The default setting is for 90 mm.)



Note: Execute moment of inertia estimation after jogging to a position that ensures a suitable range of motion.



Example of Automatic Operation Pattern

⚠ WARNING

- Autotuning without a host reference requires operating the Servomotor and therefore presents hazards. Observe the following precautions.
  - Confirm safety around moving parts.
    This function involves automatic operation with vibration. Make sure that you can perform an emergency stop (to turn OFF the power supply) at any time. There will be movement in both directions within the set range of movement. Check the range of movement and the directions and implement protective controls for safety, such as the overtravel functions.

8.6.2 Restrictions

The following restrictions apply to autotuning without a host reference.

If you cannot use autotuning without a host reference because of these restrictions, use autotuning with a host reference or custom tuning. Refer to the following section for details.

☞ *8.7 Autotuning with a Host Reference* on page 8-34

☞ *8.8 Custom Tuning* on page 8-41

Systems for Which Execution Cannot Be Performed

- When the machine system can move only in one direction
- When the range of motion is 0.5 rotations or less

Systems for Which Adjustments Cannot Be Made Accurately

- When a suitable range of motion is not possible
- When the moment of inertia changes within the set operating range
- When the machine has high dynamic friction
- When the rigidity of the machine is low and vibration occurs when positioning is performed
- When the position integration function is used
- When proportional control is used

Note: If you specify calculating the moment of inertia, an error will occur if you use the Speed Loop P/PI Switch Bit (OW□□□01 bit 3) to change between P and PI control during moment of inertia estimation.

- When mode switching is used

Note: If you specify moment of inertia estimation, mode switching will be disabled and PI control will be used while the moment of inertia is being calculated. Mode switching will be enabled after moment of inertia estimation has been completed.

- When speed feedforward or torque feedforward is input
- When the positioning completion width (Pn522) is too narrow

Preparations

Always check the following before you execute autotuning without a host reference.

- The main circuit power supply must be ON.
- There must be no overtravel.
- The servo must be OFF.
- The control method must not be set to torque control.
- The gain selection switch must be set to manual gain selection (Pn139 = n.□□□0).
- The first gains must be selected.
- The test without a motor function must be disabled (Pn00C = n.□□□0).
- There must be no alarms or warnings.
- The parameters must not be write prohibited.
- The tuning-less function must be disabled (Pn170 = n.□□□0).
- 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.

8.6.3 Operating Procedure

Use the following procedure to perform autotuning without a host reference.

⚠ CAUTION

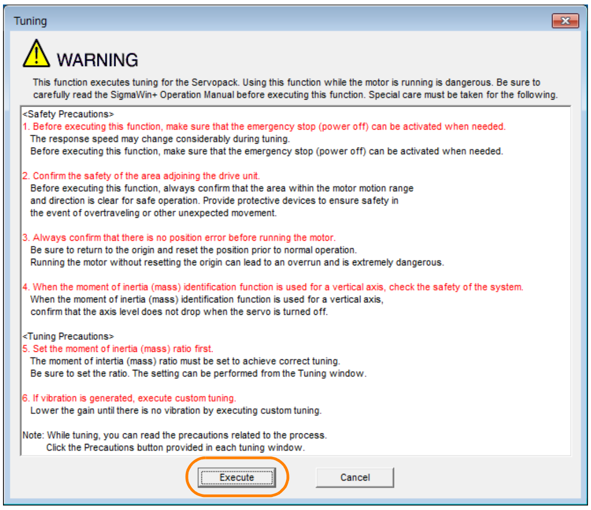
- If you specify not estimating the moment of inertia, set the moment of inertia ratio (Pn103) correctly. If the setting greatly differs from the actual moment of inertia ratio, normal control of the machine may not be possible, and vibration may result.
- If you are using the SERVOPACK for phase control, set the mode selection to 1. If 2 or 3 is selected for the mode, correct phase control may not be possible.

1. Confirm that the moment of inertia ratio (Pn103) is set correctly.

2. Click the **Servo Drive** Button in the workspace of the Main Window of the SigmaWin+.

3. Select **Tuning** in the Menu Dialog Box.
   The Tuning Dialog Box will be displayed.
   Click the **Cancel** Button to cancel tuning.

4. Click the **Execute** Button.



WARNING

This function executes tuning for the Servopack. Using this function while the motor is running is dangerous. Be sure to carefully read the SigmaWin+ Operation Manual before executing this function. Special care must be taken for the following.

<Safety Precautions>
1. Before executing this function, make sure that the emergency stop (power off) can be activated when needed.
The response speed may change considerably during tuning.
Before executing this function, make sure that the emergency stop (power off) can be activated when needed.

2. Confirm the safety of the area adjoining the drive unit.
Before executing this function, always confirm that the area within the motor motion range and direction is clear for safe operation. Provide protective devices to ensure safety in the event of overtraveling or other unexpected movement.

3. Always confirm that there is no position error before running the motor.
Be sure to return to the origin and reset the position prior to normal operation.
Running the motor without resetting the origin can lead to an overrun and is extremely dangerous.

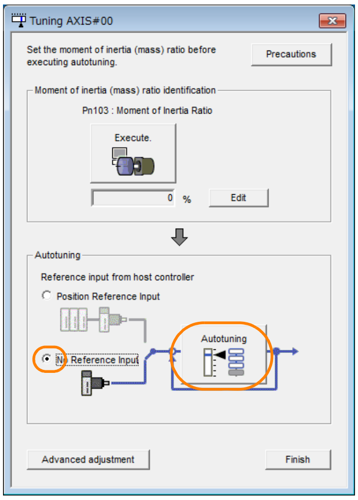
4. When the moment of inertia (mass) identification function is used for a vertical axis, check the safety of the system.
When the moment of inertia (mass) identification function is used for a vertical axis, confirm that the axis level does not drop when the servo is turned off.

<Tuning Precautions>
5. Set the moment of inertia (mass) ratio first.
The moment of intertia (mass) ratio must be set to achieve correct tuning.
Be sure to set the ratio. The setting can be performed from the Tuning window.

6. If vibration is generated, execute custom tuning.
Lower the gain until there is no vibration by executing custom tuning.

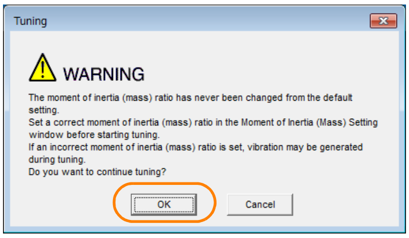
Note: While tuning, you can read the precautions related to the process.
Click the Precautions button provided in each tuning window.

5. Select the **No Reference Input** Option in the **Autotuning** Area and then click the **Autotuning** Button.



Set the moment of inertia (mass) ratio before executing autotuning.

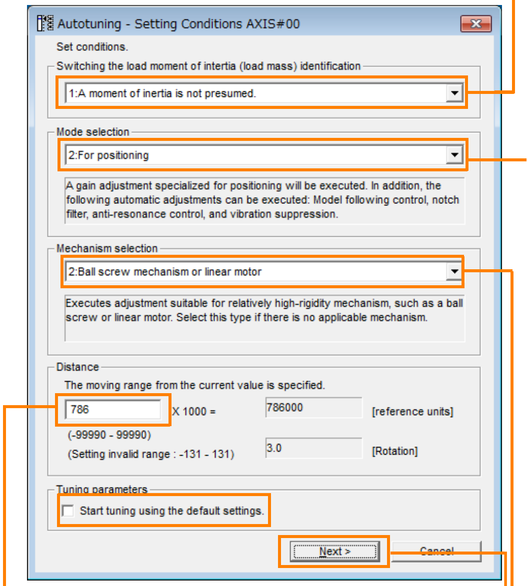
Information When the following dialog box is displayed, click the **OK** Button and then confirm that the correct moment of inertia ratio is set in Pn103 (Moment of Inertia Ratio).



WARNING

The moment of inertia (mass) ratio has never been changed from the default setting.
Set a correct moment of inertia (mass) ratio in the Moment of Inertia (Mass) Setting window before starting tuning.
If an incorrect moment of inertia (mass) ratio is set, vibration may be generated during tuning.
Do you want to continue tuning?

6. Set the conditions in the **Switching the load moment of inertia (load mass) identification** Box, the **Mode selection** Box, the **Mechanism selection** Box, and the **Distance** Box, and then click the **Next** Button.



Autotuning - Setting Conditions AXIS#00

Set conditions.

Switching the load moment of inertia (load mass) identification: 1:A moment of inertia is not presumed.

Mode selection: 2:For positioning

A gain adjustment specialized for positioning will be executed. In addition, the following automatic adjustments can be executed: Model following control, notch filter, anti-resonance control, and vibration suppression.

Mechanism selection: 2:Ball screw mechanism or linear motor

Executes adjustment suitable for relatively high-rigidity mechanism, such as a ball screw or linear motor. Select this type if there is no applicable mechanism.

Distance

The moving range from the current value is specified.

786 X 1000 = 786000 [reference units]

(-99990 - 99990)

(Setting invalid range : -131 - 131) 3.0 [Rotation]

Tuning parameters

☐ Start tuning using the default settings.

- **Switching the load moment of inertia (load mass) identification** Box
  Specify whether to estimate the moment of inertia.
  0: A moment of inertia is presumed. (default setting)
  1: A moment of inertia is not presumed.

- **Mode selection** Box
  Set the mode.

Mode Selection	Description
1: Standard	Standard gain adjustment is performed. In addition to gain adjustment, notch filters and anti-resonance control are automatically adjusted.
2: For positioning	Tuning is performed for positioning applications. In addition to gain adjustment, model following control, notch filters, anti-resonance control, and vibration suppression are automatically adjusted.
3: For positioning especially to prevent overshooting	Tuning is performed for positioning applications with emphasis on eliminating overshooting. In addition to gain adjustment, notch filters, anti-resonance control, and vibration suppression are automatically adjusted.

- **Distance** Box
  Set the travel distance.
  Movement range: -99,990,000 to +99,990,000 [reference units]
  Minimum setting increment for travel distance: 1,000 [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

- **Mechanism selection** Box
  Select the type according to the machine element to drive.
  If there is noise or if the gain does not increase, better results may be obtained by changing the rigidity type. Select the type according to the following guidelines.

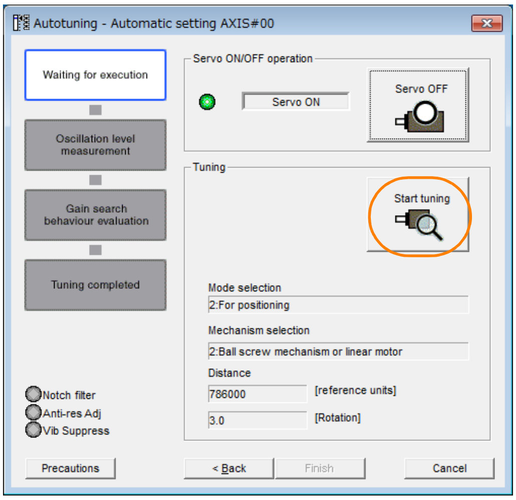
Mechanism Selection	Description
1: Belt mechanism	Tuning is performed for a mechanism with relatively low rigidity, e.g., a belt.
2: Ball screw mechanism or linear Servomotor	Tuning is performed for a mechanism with relatively high rigidity (e.g., a ball screw) or for a Linear Servomotor. Use this setting if there is no other appropriate setting.
3: Rigid model	Tuning is performed for a mechanism with high rigidity, e.g., a rigid body system.

- **Tuning parameters** Box
  Specify the parameters to use for tuning.
  If you select the **Start tuning using the default settings** Check Box, the tuning parameters will be returned to the default settings before tuning is started.

7. Click the **Servo ON** Button.

Mode selection: 2:For positioning
Mechanism selection: 2:Ball screw mechanism or linear motor
Distance: 786000 [reference units]
3.0 [Rotation]

8. Click the **Start tuning** Button.



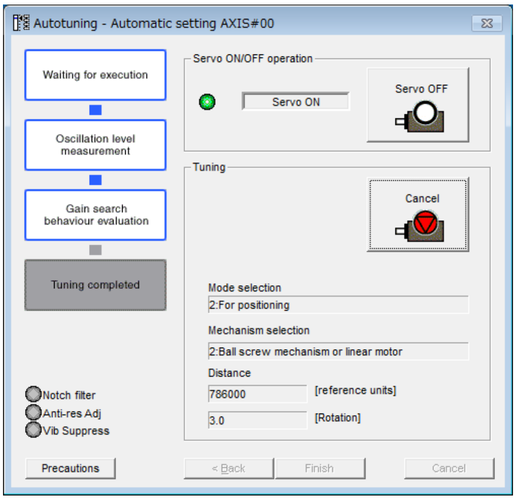
Mode selection: 2:For positioning
Mechanism selection: 2:Ball screw mechanism or linear motor
Distance: 786000 [reference units]
3.0 [Rotation]

9. Confirm safety around moving parts and click the **Yes** Button.

WARNING

Please check the safety near an operation part.
Execute?

The Servomotor will start operating and tuning will be executed.
Vibration that occurs during tuning will be detected automatically and suitable settings will be made for that vibration. When the settings have been completed, the indicators for the functions that were used will light at the lower left of the dialog box.



Mode selection: 2:For positioning

Mechanism selection: 2:Ball screw mechanism or linear motor

Distance: 786000 [reference units]

3.0 [Rotation]

10. When tuning has been completed, click the **Finish** Button.
The results of tuning will be set in the parameters and you will return to the Tuning Dialog Box.

This concludes the procedure to perform autotuning without a host reference.

8.6.4 Troubleshooting Problems in Autotuning without a Host Reference

The following tables give the causes of and corrections for problems that may occur in autotuning without a host reference.

◆ Autotuning without a Host Reference Was Not Performed

Cause	Corrective Action
Main circuit power supply is OFF.	Turn ON the main circuit power supply.
An alarm or warning occurred.	Remove the cause of the alarm or warning.
Overtraveling occurred.	Remove the cause of overtraveling.
The second gains were selected with the gain selection.	Disable automatic gain switching.
The 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.	• Disable the tuning-less function (Pn170 = n.□□□0). • Enable the tuning-less function (Pn170 = n.□□□1) and specify moment of inertia estimation.

◆ When an Error Occurs during Execution of Autotuning without a Host Reference

Error Description	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.	• Increase the setting of the positioning completion width (Pn522). • Change the mode from 2 to 3. • If machine vibration occurs, suppress the vibration with the anti-resonance control function and the vibration suppression function.
An error occurred during calculation of the moment of inertia.	Refer to the following section for troubleshooting information. ☞ ◆ *When an Error Occurs during Calculation of Moment of Inertia* on page 8-30	

Continued on next page.

Continued from previous page.

Error Description	Cause	Corrective Action
Positioning was not completed within approximately 10 seconds after position adjustment was completed.	The positioning completion width is too narrow or proportional control (P control) is being used.	• Increase the setting of the positioning completion width (Pn522). • Set the Speed Loop P/PI Switch Bit (OW□□01 Bit 3) to 0.

◆ When an Error Occurs during Calculation of Moment of Inertia

Cause	Corrective Action
The SERVOPACK started calculating the moment of inertia but the calculation was not completed.	• Increase the setting of the speed loop gain (Pn100). • 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 moment of inertia calculation starting level (Pn324).
The torque limit was reached.	• If you are using the torque limit, increase the torque limit. • Double the setting of moment of inertia calculation starting level (Pn324).
The speed control section was changed to proportional control during calculation of the moment of inertia, e.g., the Speed Loop P/PI Switch Bit (OW□□□01 Bit 3) was set to 1.	Use PI control when calculating the moment of inertia.

◆ Adjustment Results Are Not Satisfactory for Position Control

You may be able to improve the adjustment results by changing the settings of the positioning completion width (Pn522) and the electronic gear ratio (Pn20E/Pn210).

If satisfactory results are still not possible, adjust the overshoot detection level (Pn561). That may improve the adjustment results.

- Pn561 = 100% (default setting)
  This will allow tuning with overshooting that is equivalent to the positioning completion width.
- Pn561 = 0%
  This will allow tuning to be performed without overshooting within the positioning completion width, but the positioning completed width may be extended.

Pn561	Overshoot Detection Level			Speed Position	Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 100	1%	100	Immediately	Setup

8.6.5 Automatically Adjusted Function Setting

You can specify whether to automatically adjust the following functions during autotuning.

◆ 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.

Parameter		Function	When Enabled	Classification
Pn460	n.□□□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.	Immediately	Tuning
	n.□□□1 (default setting)	Adjust the first stage notch filter automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.		
	n.□0□□	Do not adjust the second stage notch filter automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.		
	n.□1□□ (default setting)	Adjust the second stage notch filter automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.		

◆ Anti-resonance Control Adjustment

This function reduces low vibration frequencies, for which the notch filters cannot be used.

Normally, set Pn160 to n.□□1□ (Adjust automatically) (default setting).
Vibration will be detected during autotuning without a host reference and anti-resonance control will be automatically adjusted.

Parameter		Function	When Enabled	Classification
Pn160	n.□□0□	Do not adjust anti-resonance control automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.	Immediately	Tuning
	n.□□1□ (default setting)	Adjust anti-resonance control automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.		

◆ 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 autotuning without a host reference.

Note: Autotuning without a host reference uses model following control. Therefore, it can be executed only if the mode is set to 2 or 3.

Parameter		Function	When Enabled	Classification
Pn140	n.□0□□	Do not adjust vibration suppression automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.	Immediately	Tuning
	n.□1□□ (default setting)	Adjust vibration suppression automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.		

◆ Friction Compensation

Friction compensation compensates for changes in the following conditions.

- Changes in the viscous resistance of the lubricant, such as grease, on the sliding parts of the machine
- Changes in the friction resistance resulting from variations in the machine assembly
- Changes in the friction resistance due to aging

The conditions for applying friction compensation depend on the mode selection.

Mode Selection Settings	Friction Compensation
1: Standard	Based on the setting of Pn408 = n.X□□□ (Friction Compensation Function Selection)*
2: For positioning	Adjusted with friction compensation.
3: For positioning especially to prevent overshooting	

Parameter		Function	When Enabled	Classification
Pn408	n.0□□□ (default setting)	Disable friction compensation.	Immediately	Setup
	n.1□□□	Enable friction compensation.		

* Refer to the following section for details.
☞ *Required Parameter Settings* on page 8-68

◆ 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, feedforward (Pn109), the speed feedforward input (VFF), and the torque feedforward input (TFF) will be disabled.

To use the model following control and the speed feedforward input (VFF) and the torque feedforward input (TFF) from the SVD in the system, set Pn140 to n.1□□□ (Use model following control and speed/torque feedforward together).

Parameter		Function	When Enabled	Classification
Pn140	n.0□□□ (default setting)	Do not use model following control and speed/torque feedforward together.	Immediately	Tuning
	n.1□□□	Use model following control and speed/torque feedforward together.		

Refer to the following manual for information on the torque feedforward input (TFF) and the speed feedforward input (VFF).
🕮 Σ-7-Series Σ-7C SERVOPACK Motion Control User's Manual (Manual No.: SIEP S800002 03)

Important When model following control is used with the feedforward function, it is used to make optimum feedforward settings in the SERVOPACK. Therefore, model following control is not normally used together with either the speed feedforward input (VFF) or torque feedforward input (TFF) from the SVD. However, model following control can be used with the speed feedforward input (VFF) or torque feedforward input (TFF) if required. An unsuitable feedforward input may result in overshooting.

8.6.6 Related Parameters

The following parameters are automatically adjusted or used as reference when you execute autotuning without a host reference.

Do not change the settings while autotuning without a host reference is being executed.

Parameter	Name	Automatic Changes
Pn100	Speed Loop Gain	Yes
Pn101	Speed Loop Integral Time Constant	Yes
Pn102	Position Loop Gain	Yes
Pn103	Moment of Inertia Ratio	Yes
Pn121	Friction Compensation Gain	Yes
Pn123	Friction Compensation Coefficient	Yes
Pn124	Friction Compensation Frequency Correction	No
Pn125	Friction Compensation Gain Correction	Yes
Pn401	First Stage First Torque Reference Filter Time Constant	Yes
Pn408	Torque-Related Function Selections	Yes
Pn409	First Stage Notch Filter Frequency	Yes
Pn40A	First Stage Notch Filter Q Value	Yes
Pn40C	Second Stage Notch Filter Frequency	Yes
Pn40D	Second Stage Notch Filter Q Value	Yes
Pn140	Model Following Control-Related Selections	Yes
Pn141	Model Following Control Gain	Yes
Pn142	Model Following Control Gain Correction	Yes
Pn143	Model Following Control Bias in the Forward Direction	Yes
Pn144	Model Following Control Bias in the Reverse Direction	Yes
Pn145	Vibration Suppression 1 Frequency A	Yes
Pn146	Vibration Suppression 1 Frequency B	Yes
Pn147	Model Following Control Speed Feedforward Compensation	Yes
Pn160	Anti-Resonance Control-Related Selections	Yes
Pn161	Anti-Resonance Frequency	Yes
Pn163	Anti-Resonance Damping Gain	Yes
Pn531	Program Jogging Travel Distance	No
Pn533	Program Jogging Movement Speed	No
Pn585	Program Jogging Movement Speed	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.

8.7 Autotuning with a Host Reference

This section describes autotuning with a host reference.

Important Autotuning with a host reference makes adjustments based on the set speed loop gain (Pn100). Therefore, precise adjustments cannot be made if there is vibration when adjustments are started. Make adjustments after lowering the speed loop gain (Pn100) until vibration is eliminated.

8.7.1 Outline

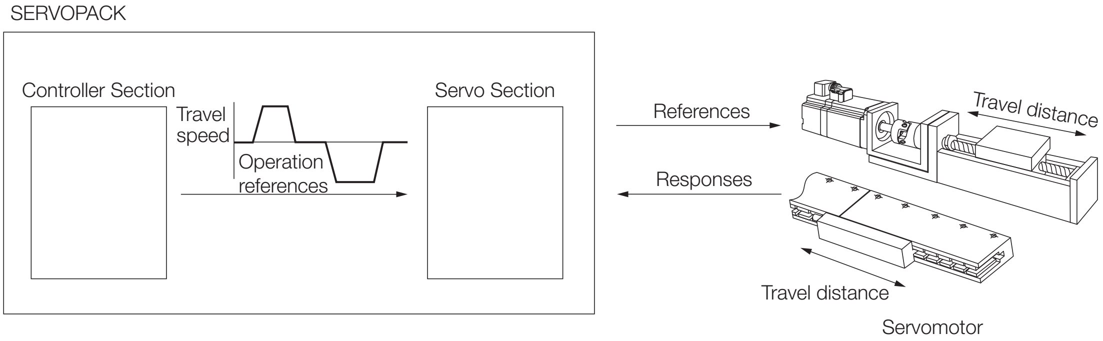
Autotuning with a host reference automatically makes optimum adjustments for operation references from the SVD.

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.

☞ *8.7.6 Related Parameters* on page 8-40



⚠ 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.

8.7.2 Restrictions

Systems for Which Adjustments Cannot Be Made Accurately

Adjustments will not be made correctly for autotuning with a host reference in the following cases. Use custom tuning.

- When the travel distance for the reference from the SVD is equal to or lower than the setting of the positioning completion width (Pn522)
- Rotary Servomotors: When the travel speed for the reference from the SVD is less than or equal to the setting of Pn502 (Rotation Detection Level).
- Linear Servomotors: When the travel speed for the reference from the SVD is less than or equal to 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 proportional control is used
- When mode switching is used
- When the positioning completion width (Pn522) is too narrow

Refer to the following sections for details on custom tuning.

☞ *8.8 Custom Tuning* on page 8-41

Preparations

Always check the following before you execute autotuning with a host reference.

- The servo must be in ready status.
- There must be no overtravel.
- The servo must be OFF.
- Position control must be selected if power is supplied to the motor (i.e., when the servo is ON).
- The gain selection switch must be set to manual gain selection (Pn139 = n.□□□0).
- The first gains must be selected.
- The test without a motor function must be disabled (Pn00C = n.□□□0).
- There must be no warnings.
- The tuning-less function must be disabled (Pn170 = n.□□□0).
- The parameters must not be write prohibited.

8.7.3 Operating Procedure

Use the following procedure to perform autotuning with a host reference.

⚠ CAUTION

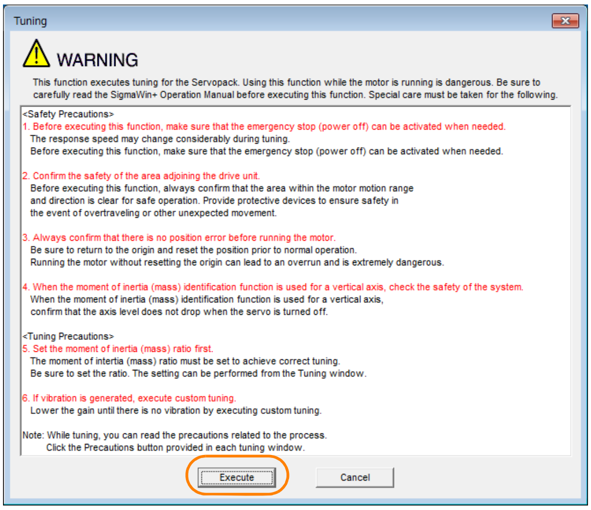
- If you are using the SERVOPACK for phase control, set the mode selection to 1. If 2 or 3 is selected for the mode, correct phase control may not be possible.

1. Confirm that the moment of inertia ratio (Pn103) is set correctly.

2. Click the **Servo Drive** Button in the workspace of the Main Window of the SigmaWin+.

3. Select **Tuning** in the Menu Dialog Box.
   The Tuning Dialog Box will be displayed.
   Click the **Cancel** Button to cancel tuning.

4. Click the **Execute** Button.



This function executes tuning for the Servopack. Using this function while the motor is running is dangerous. Be sure to carefully read the SigmaWin+ Operation Manual before executing this function. Special care must be taken for the following.

<Safety Precautions>
1. Before executing this function, make sure that the emergency stop (power off) can be activated when needed.
The response speed may change considerably during tuning.
Before executing this function, make sure that the emergency stop (power off) can be activated when needed.

2. Confirm the safety of the area adjoining the drive unit.
Before executing this function, always confirm that the area within the motor motion range and direction is clear for safe operation. Provide protective devices to ensure safety in the event of overtraveling or other unexpected movement.

3. Always confirm that there is no position error before running the motor.
Be sure to return to the origin and reset the position prior to normal operation.
Running the motor without resetting the origin can lead to an overrun and is extremely dangerous.

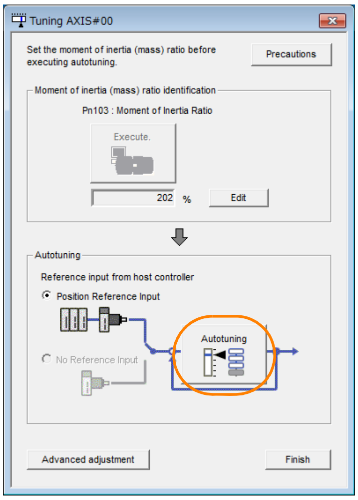
4. When the moment of inertia (mass) identification function is used for a vertical axis, check the safety of the system.
When the moment of inertia (mass) identification function is used for a vertical axis, confirm that the axis level does not drop when the servo is turned off.

<Tuning Precautions>
5. Set the moment of inertia (mass) ratio first.
The moment of intertia (mass) ratio must be set to achieve correct tuning.
Be sure to set the ratio. The setting can be performed from the Tuning window.

6. If vibration is generated, execute custom tuning.
Lower the gain until there is no vibration by executing custom tuning.

Note: While tuning, you can read the precautions related to the process.
Click the Precautions button provided in each tuning window.

5. Select the **Position Reference Input** Option in the **Autotuning** Area and then click the **Autotuning** Button.

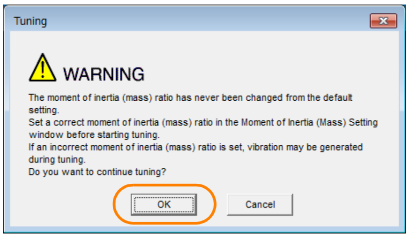


Set the moment of inertia (mass) ratio before executing autotuning.

Pn103 : Moment of Inertia Ratio
202 %

Reference input from host controller
● Position Reference Input
○ No Reference Input

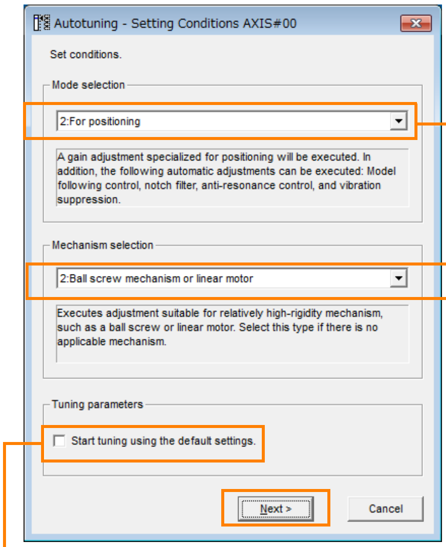
Information When the following dialog box is displayed, click the **OK** Button and then confirm that the correct moment of inertia ratio is set in Pn103 (Moment of Inertia Ratio).



The moment of inertia (mass) ratio has never been changed from the default setting.
Set a correct moment of inertia (mass) ratio in the Moment of Inertia (Mass) Setting window before starting tuning.
If an incorrect moment of inertia (mass) ratio is set, vibration may be generated during tuning.
Do you want to continue tuning?

6. Set the conditions in the **Mode selection** Box and the **Mechanism selection** Box, and then click the **Next** Button.

If you select the **Start tuning using the default settings** Check Box in the **Tuning parameters** Box, the tuning parameters will be returned to the default settings before tuning is started.



Set conditions.

Mode selection: 2:For positioning

A gain adjustment specialized for positioning will be executed. In addition, the following automatic adjustments can be executed: Model following control, notch filter, anti-resonance control, and vibration suppression.

Mechanism selection: 2:Ball screw mechanism or linear motor

Executes adjustment suitable for relatively high-rigidity mechanism, such as a ball screw or linear motor. Select this type if there is no applicable mechanism.

Tuning parameters

☐ Start tuning using the default settings.

- **Mode selection** Box

  Set the mode.

Mode Selection	Description
1: Standard	Standard gain adjustment is performed. In addition to gain adjustment, notch filters and anti-resonance control are automatically adjusted.
2: For positioning	Tuning is performed for positioning applications. In addition to gain adjustment, model following control, notch filters, anti-resonance control, and vibration suppression are automatically adjusted.
3: For positioning especially to prevent overshooting	Tuning is performed for positioning applications with emphasis on eliminating overshooting. In addition to gain adjustment, notch filters, anti-resonance control, and vibration suppression are automatically adjusted.

- **Tuning parameters** Box

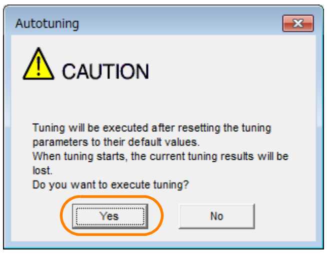
  Specify the parameters to use for tuning.
  If you select the **Start tuning using the default settings** Check Box, the tuning parameters will be returned to the default settings before tuning is started.

- **Mechanism selection** Box

  Select the type according to the machine element to drive.
  If there is noise or if the gain does not increase, better results may be obtained by changing the rigidity type. Select the type according to the following guidelines.

Mechanism Selection	Description
1: Belt mechanism	Tuning is performed for a mechanism with relatively low rigidity, e.g., a belt.
2: Ball screw mechanism or linear Servomotor	Tuning is performed for a mechanism with relatively high rigidity (e.g., a ball screw) or for a Linear Servomotor. Use this setting if there is no other appropriate setting.
3: Rigid model	Tuning is performed for a mechanism with high rigidity, e.g., a rigid body system.

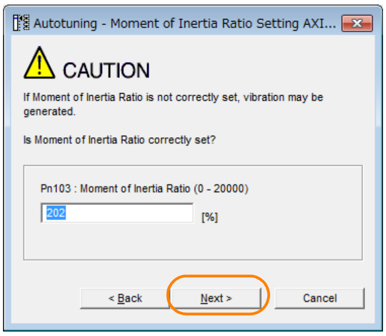
7. Click the **Yes** Button.



CAUTION

Tuning will be executed after resetting the tuning parameters to their default values.
When tuning starts, the current tuning results will be lost.
Do you want to execute tuning?

8. Input the correct moment of inertia ratio and click the **Next** Button.



Autotuning - Moment of Inertia Ratio Setting AXI...

CAUTION

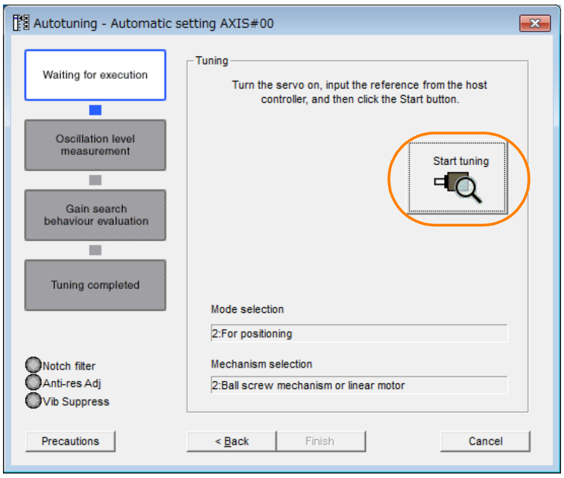
If Moment of Inertia Ratio is not correctly set, vibration may be generated.

Is Moment of Inertia Ratio correctly set?

Pn103 : Moment of Inertia Ratio (0 - 20000)

202 [%]

9. Turn ON the servo, enter a reference from the SVD, and then click the **Start tuning** Button.



Autotuning - Automatic setting AXIS#00

Tuning

Turn the servo on, input the reference from the host controller, and then click the Start button.

Mode selection: 2:For positioning

Mechanism selection: 2:Ball screw mechanism or linear motor

10. Confirm safety around moving parts and click the **Yes** Button.

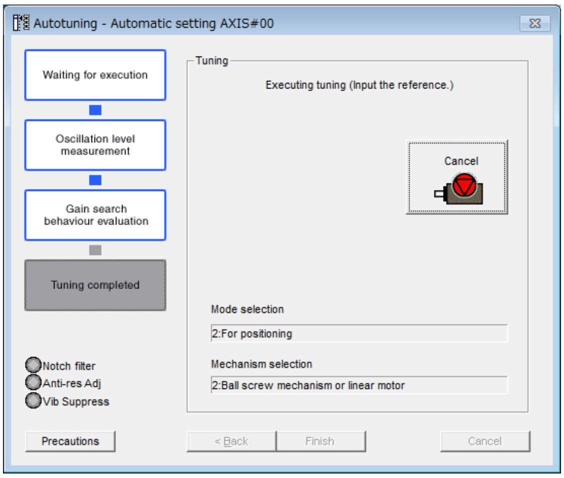
Autotuning

WARNING

Please check the safety near an operation part.
Execute?

The Servomotor will start operating and tuning will be executed.

Vibration that occurs during tuning will be detected automatically and suitable settings will be made for that vibration. When the settings have been completed, the indicators for the functions that were used will light at the lower left of the dialog box.



Autotuning - Automatic setting AXIS#00

Tuning

Executing tuning (Input the reference.)

Mode selection: 2:For positioning

Mechanism selection: 2:Ball screw mechanism or linear motor

11. When tuning has been completed, click the **Finish** Button.
The results of tuning will be set in the parameters and you will return to the Tuning Dialog Box.

This concludes the procedure to perform autotuning with a host reference.

8.7.4 Troubleshooting Problems in Autotuning with a Host Reference

The following tables give the causes of and corrections for problems that may occur in autotuning with a host reference.

◆ Autotuning with a Host Reference Was Not Performed

Possible	Corrective Action
Main circuit power supply is OFF.	Turn ON the main circuit power supply.
An alarm or warning occurred.	Remove the cause of the alarm or warning.
Overtraveling occurred.	Remove the cause of overtraveling.
The second gains were selected with the gain selection.	Disable automatic gain switching.

◆ Troubleshooting Errors

Error	Possible	Corrective Action
The gain adjustments were not successfully completed.	Machine vibration occurs or positioning completion is not stable when the Servomotor stops.	• Increase the setting of the positioning completion width (Pn522). • Change the mode from 2 to 3. • If machine vibration occurs, suppress the vibration with the anti-resonance control function and the vibration suppression function.
Positioning was not completed within approximately 10 seconds after position adjustment was completed.	The positioning completion width is too narrow or proportional control (P control) is being used.	• Increase the setting of the positioning completion width (Pn522). • Set the Speed Loop P/PI Switch Bit (OW□□□01 Bit 3) to 0.

◆ Adjustment Results Are Not Satisfactory for Position Control

You may be able to improve the adjustment results by changing the settings of the positioning completion width (Pn522) and the electronic gear ratio (Pn20E/Pn210).

If satisfactory results are still not possible, adjust the overshoot detection level (Pn561). That may improve the adjustment results.

- Pn561 = 100% (default setting)
  This will allow tuning with overshooting that is equivalent to the positioning completion width.
- Pn561 = 0%
  This will allow tuning to be performed without overshooting within the positioning completion width, but the positioning completed width may be extended.

Pn561	Overshoot Detection Level			Speed Position Torque	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 100	1%	100	Immediately	Setup

8.7.5 Automatically Adjusted Function Setting

These function settings are the same as for autotuning without a host reference. Refer to the following section.

☞ *8.6.5 Automatically Adjusted Function Setting* on page 8-30

8.7.6 Related Parameters

The following parameters are automatically adjusted or used as reference when you execute autotuning with a host reference.

Do not change the settings while autotuning with a host reference is being executed.

Parameter	Name	Automatic Changes
Pn100	Speed Loop Gain	Yes
Pn101	Speed Loop Integral Time Constant	Yes
Pn102	Position Loop Gain	Yes
Pn103	Moment of Inertia Ratio	No
Pn121	Friction Compensation Gain	Yes
Pn123	Friction Compensation Coefficient	Yes
Pn124	Friction Compensation Frequency Correction	No
Pn125	Friction Compensation Gain Correction	Yes
Pn401	First Stage First Torque Reference Filter Time Constant	Yes
Pn408	Torque-Related Function Selections	Yes
Pn409	First Stage Notch Filter Frequency	Yes
Pn40A	First Stage Notch Filter Q Value	Yes
Pn40C	Second Stage Notch Filter Frequency	Yes
Pn40D	Second Stage Notch Filter Q Value	Yes
Pn140	Model Following Control-Related Selections	Yes
Pn141	Model Following Control Gain	Yes
Pn142	Model Following Control Gain Correction	Yes
Pn143	Model Following Control Bias in the Forward Direction	Yes
Pn144	Model Following Control Bias in the Reverse Direction	Yes
Pn145	Vibration Suppression 1 Frequency A	Yes
Pn146	Vibration Suppression 1 Frequency B	Yes
Pn147	Model Following Control Speed Feedforward Compensation	Yes
Pn160	Anti-Resonance Control-Related Selections	Yes
Pn161	Anti-Resonance Frequency	Yes
Pn163	Anti-Resonance Damping Gain	Yes

Yes: The parameter is automatically set.

No: The parameter is not automatically set, but the setting is read during execution.

8.8 Custom Tuning

This section describes custom tuning.

8.8.1 Outline

You can use custom tuning to manually adjust the servo during operation using a speed or position reference input from the SVD. You can use it to fine-tune adjustments that were made with autotuning.

The following items are adjusted automatically.
- Gains (e.g., speed loop gain and position loop gain)
- Filters (torque reference filter and notch filters)
- Friction compensation
- Anti-resonance control

Refer to the following section for details on the parameters that are adjusted.

☞ *8.8.6 Related Parameters* on page 8-48

There are two adjustment methods that you can use for custom tuning.

■ Tuning Mode 0 (Setting Servo Gains Giving Priority to Stability) or 1 (Setting Servo Gains Giving Priority to Good Response)

These modes allow you to set stable control conditions for multiple servo gains by manipulating only one tuning level. Automatic setting of notch filters and anti-resonance control is provided if vibration is detected. Manual anti-resonance control adjustment is also possible during custom tuning.

■ Tuning Mode 2 (Setting Servo Gains Giving Priority to Position Control Applications) or 3 (Setting Servo Gains Giving Priority to Preventing Overshooting in Position Control Applications)

Two tuning levels are manipulated to reduce positioning time even further and set multiple servo gains. Model following control is used to reduce the positioning time. If vibration is detected, notch filters and anti-resonance control are automatically adjusted, and friction compensation is automatically set. Manual anti-resonance control adjustment and vibration suppression are also possible during custom tuning.

⚠ CAUTION

- Vibration or overshooting may occur during custom tuning. To ensure safety, make sure that you can perform an emergency stop at any time.

8.8.2 Preparations

Always check the following before you execute custom tuning.
- The test without a motor function must be disabled (Pn00C = n.☐☐☐0).
- The tuning-less function must be disabled (Pn170 = n.☐☐☐0).
- If speed control is used, tuning mode 0 or 1 must be set.
- The parameters must not be write prohibited.

8.8.3 Operating Procedure

Use the following procedure to perform custom tuning.

⚠ WARNING

- 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 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 custom tuning.
    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.

⚠ CAUTION

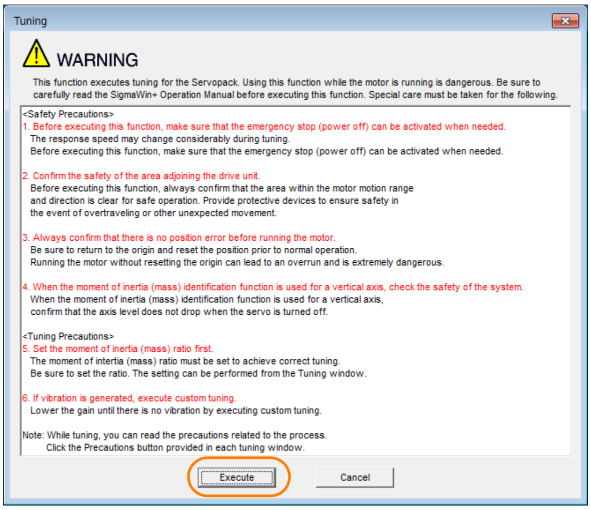
- If you are using the SERVOPACK for phase control, set the tuning mode to 0 or 1. If 2 or 3 is selected for the tuning mode, correct phase control may not be possible.

1. Confirm that the moment of inertia ratio (Pn103) is set correctly.

2. Click the **Servo Drive** Button in the workspace of the Main Window of the SigmaWin+.

3. Select **Tuning** in the Menu Dialog Box.
   The Tuning Dialog Box will be displayed.
   Click the **Cancel** Button to cancel tuning.

4. Click the **Execute** Button.



This function executes tuning for the Servopack. Using this function while the motor is running is dangerous. Be sure to carefully read the SigmaWin+ Operation Manual before executing this function. Special care must be taken for the following.

<Safety Precautions>
1. Before executing this function, make sure that the emergency stop (power off) can be activated when needed.
The response speed may change considerably during tuning.
Before executing this function, make sure that the emergency stop (power off) can be activated when needed.

2. Confirm the safety of the area adjoining the drive unit.
Before executing this function, always confirm that the area within the motor motion range and direction is clear for safe operation. Provide protective devices to ensure safety in the event of overtraveling or other unexpected movement.

3. Always confirm that there is no position error before running the motor.
Be sure to return to the origin and reset the position prior to normal operation.
Running the motor without resetting the origin can lead to an overrun and is extremely dangerous.

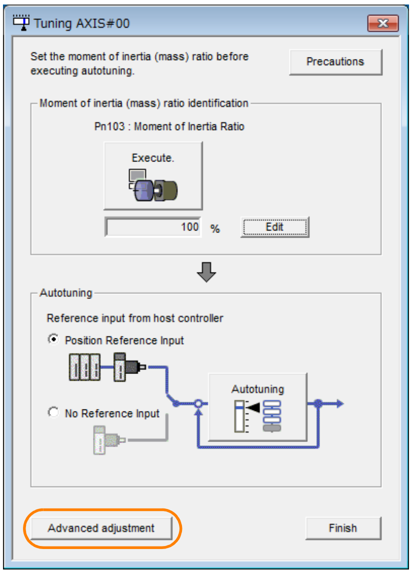
4. When the moment of inertia (mass) identification function is used for a vertical axis, check the safety of the system.
When the moment of inertia (mass) identification function is used for a vertical axis, confirm that the axis level does not drop when the servo is turned off.

<Tuning Precautions>
5. Set the moment of inertia (mass) ratio first.
The moment of intertia (mass) ratio must be set to achieve correct tuning.
Be sure to set the ratio. The setting can be performed from the Tuning window.

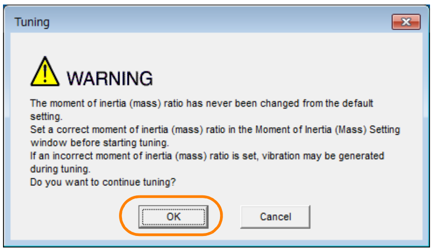
6. If vibration is generated, execute custom tuning.
Lower the gain until there is no vibration by executing custom tuning.

Note: While tuning, you can read the precautions related to the process.
Click the Precautions button provided in each tuning window.

5. Click the **Advanced adjustment** Button.

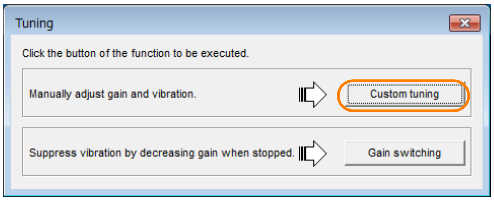


Information When the following dialog box is displayed, click the **OK** Button and then confirm that the correct moment of inertia ratio is set in Pn103 (Moment of Inertia Ratio).

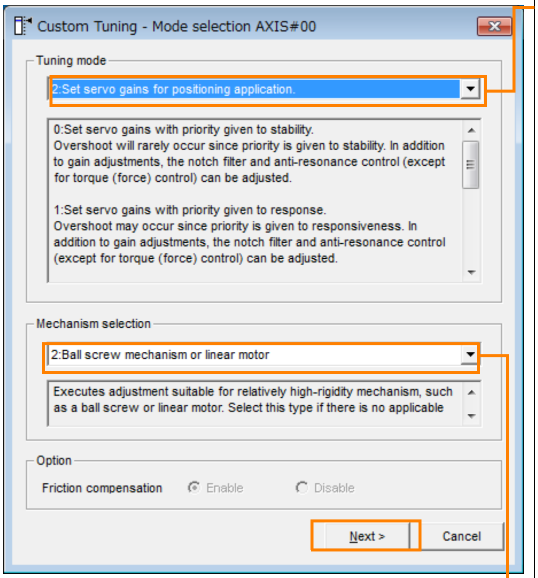


The moment of inertia (mass) ratio has never been changed from the default setting.
Set a correct moment of inertia (mass) ratio in the Moment of Inertia (Mass) Setting window before starting tuning.
If an incorrect moment of inertia (mass) ratio is set, vibration may be generated during tuning.
Do you want to continue tuning?

6. Click the **Custom tuning** Button.



7. Set the **Tuning mode** Box and **Mechanism selection** Box, and then click the **Next** Button.



Tuning mode: 2:Set servo gains for positioning application.

0:Set servo gains with priority given to stability.
Overshoot will rarely occur since priority is given to stability. In addition to gain adjustments, the notch filter and anti-resonance control (except for torque (force) control) can be adjusted.

1:Set servo gains with priority given to response.
Overshoot may occur since priority is given to responsiveness. In addition to gain adjustments, the notch filter and anti-resonance control (except for torque (force) control) can be adjusted.

Mechanism selection: 2:Ball screw mechanism or linear motor

Executes adjustment suitable for relatively high-rigidity mechanism, such as a ball screw or linear motor. Select this type if there is no applicable

Friction compensation ● Enable ○ Disable

Tuning mode Box

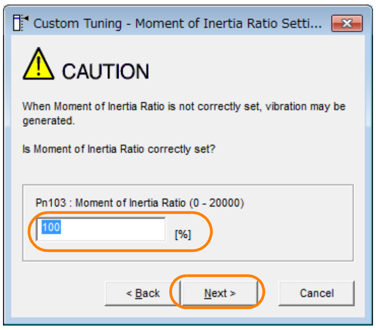
Mode Selection	Description
0: Set servo gains with priority given to stability.	This setting gives priority to stability and preventing overshooting. In addition to gain adjustment, notch filters and anti-resonance control (except during torque control) are automatically adjusted.
1: Set servo gains with priority given to response.	Overshooting may occur because priority is given to response. In addition to gain adjustment, notch filters and anti-resonance control (except during torque control) are automatically adjusted.
2: Set servo gains for positioning application.	Tuning is performed for positioning applications. In addition to gain adjustment, notch filters, anti-resonance control, and vibration suppression are adjusted.
3: Set servo gains especially to prevent overshooting during positioning application.	Tuning is performed for positioning applications with emphasis on eliminating overshooting. In addition to gain adjustment, notch filters, anti-resonance control, and vibration suppression are adjusted.

- **Mechanism selection** Box
  Select the type according to the machine element to drive.
  If there is noise or if the gain does not increase, better results may be obtained by changing the rigidity type. Select the type according to the following guidelines.

Mechanism Selection	Description
1: Belt mechanism	Tuning is performed for a mechanism with relatively low rigidity, e.g., a belt.
2: Ball screw mechanism or Linear Servomotor	Tuning is performed for a mechanism with relatively high rigidity (e.g., a ball screw) or for a Linear Servomotor. Use this setting if there is no other appropriate setting.
3: Rigid model	Tuning is performed for a mechanism with high rigidity, e.g., a rigid body system.

Information The tuning modes that you can select depend on the SERVOPACK setting.

8. If the moment of inertia ratio is not set correctly, correct the setting and then click the **Next** Button.



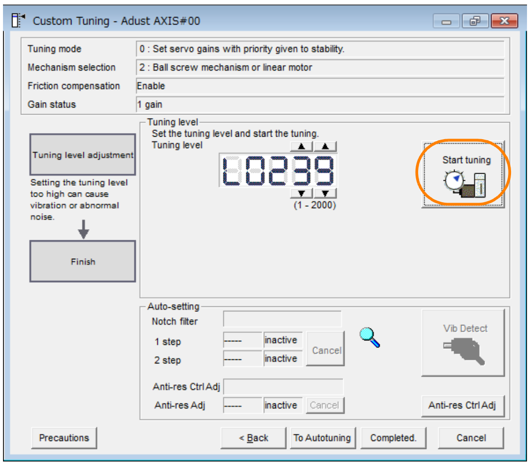
When Moment of Inertia Ratio is not correctly set, vibration may be generated.

Is Moment of Inertia Ratio correctly set?

Pn103 : Moment of Inertia Ratio (0 - 20000)
100 [%]

9. Turn ON the servo, enter a reference from the SVD, and then click the **Start tuning** Button.

Tuning Mode 0 or 1



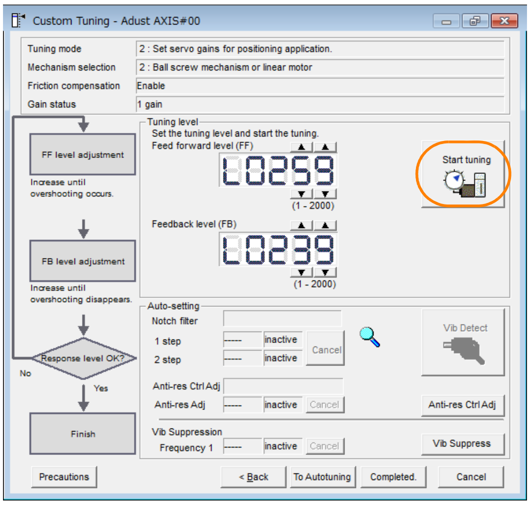
Custom Tuning - Adjust AXIS#00

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

Set the tuning level and start the tuning.

Setting the tuning level too high can cause vibration or abnormal noise.

Tuning Mode 2 or 3



Custom Tuning - Adjust AXIS#00

Tuning mode	2 : Set servo gains for positioning application.
Mechanism selection	2 : Ball screw mechanism or linear motor
Friction compensation	Enable
Gain status	1 gain

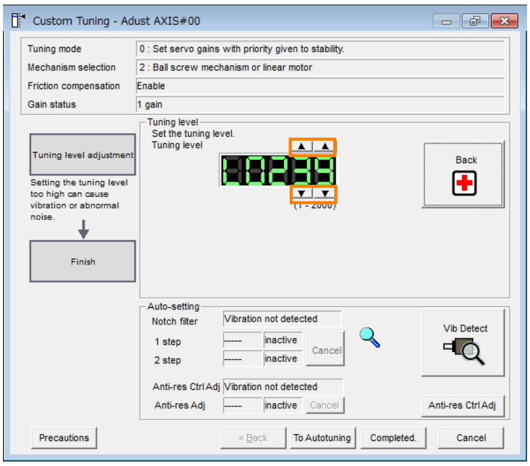
Set the tuning level and start the tuning.

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 status from before when adjustment was started will be restored.

Tuning Mode 0 or 1

If overshooting occurs, increase the tuning level.



Custom Tuning - Adjust 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

Set the tuning level.

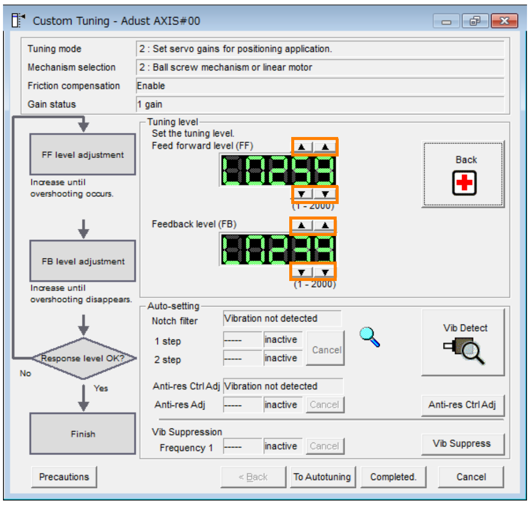
Setting the tuning level too high can cause vibration or abnormal noise.

Notch filter: Vibration not detected

Anti-res Ctrl Adj: Vibration not detected

Tuning Mode 2 or 3

Increase the feedforward level until overshooting occurs and then increase the feedback level until overshooting is eliminated. Repeat these changes to make the adjustment.



Custom Tuning - Adjust AXIS#00

Tuning mode	2 : Set servo gains for positioning application.
Mechanism selection	2 : Ball screw mechanism or linear motor
Friction compensation	Enable
Gain status	1 gain

Set the tuning level.

Notch filter: Vibration not detected

Anti-res Ctrl Adj: Vibration not detected

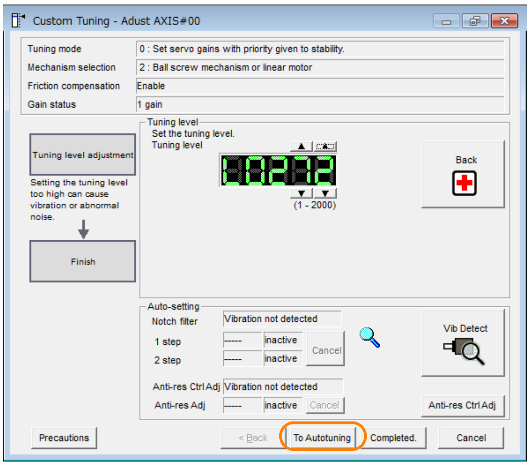
Information The new feedforward level will be used until the positioning completion signal is output.

11. You can set the functions to suppress vibration (notch filters, automatic anti-resonance setting, anti-resonance control adjustment, and autotuning with a host reference) as required.

Refer to the following section for details.

☞ *Vibration Suppression Functions* on page 8-46

12. When the adjustment has been completed, click the **Completed** Button.
The values that were changed will be saved in the SERVOPACK and you will return to the Tuning Dialog Box.



Tuning mode: 0 : Set servo gains with priority given to stability.
Mechanism selection: 2 : Ball screw mechanism or linear motor
Friction compensation: Enable
Gain status: 1 gain
Notch filter: Vibration not detected
1 step: ----- inactive
2 step: ----- inactive
Anti-res Ctrl Adj: Vibration not detected
Anti-res Adj: ----- inactive

This concludes the procedure to set up custom tuning.

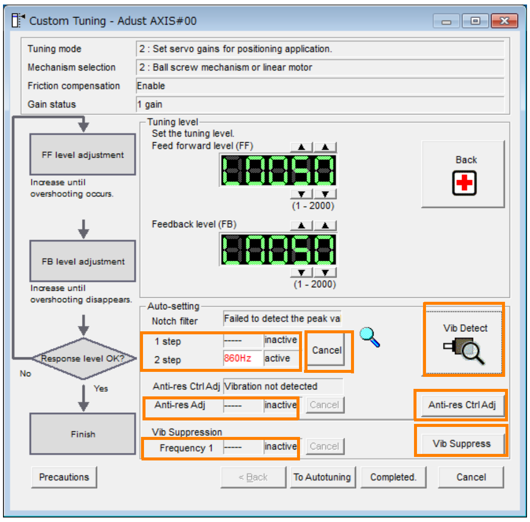
Vibration Suppression Functions

◆ Notch Filters and Automatic Anti-resonance Setting

If the vibration frequency that occurs when you increase the servo gains is at 1,000 Hz or higher, notch filters are effective to suppress vibration. If the vibration is between 100 Hz and 1,000 Hz, anti-resonance control is effective.

◆ Automatic Setting

To set vibration suppression automatically, use the parameters to enable notch filters and automatic anti-resonance control setting.
The notch filter frequency (stage 1 or 2) or anti-resonance control frequency that is effective for the vibration that was detected during tuning will be automatically set.



Tuning mode: 2 : Set servo gains for positioning application.
Mechanism selection: 2 : Ball screw mechanism or linear motor
Friction compensation: Enable
Gain status: 1 gain
Notch filter: Failed to detect the peak va
1 step: ----- inactive
2 step: 860Hz active
Anti-res Ctrl Adj: Vibration not detected
Anti-res Adj: ----- inactive
Vib Suppression
Frequency 1: ----- inactive

- **Cancel** Button
  The automatically set notch filter frequencies or the anti-resonance control frequencies may not always suppress vibration. Click the **Cancel** Button to reset the notch filter frequencies or the anti-resonance control frequencies to the values from just before these frequencies were set automatically.
  When they are reset, vibration detection will start again.

- **Vib Detect** Button
  While the notch filter or anti-resonance control adjustment automatic setting function is enabled, you can click the **Vib Detect** Button to manually detect vibration. When you click the **Vib Detect** Button, the SERVOPACK will detect vibration at that time, and set the notch filter frequency (stage 1 or 2) or anti-resonance control frequency that is effective for the detected vibration. You can also perform manual vibration detection even when the SERVOPACK does not detect vibration.
- **Anti-res Ctrl Adj** Button
  You can use the **Anti-res Ctrl Adj** Button to execute the anti-resonance control function if fine-tuning is required. Refer to the following section.
  ☞ *8.9 Anti-resonance Control Adjustment* on page 8-49
- **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.
  ☞ *8.10 Vibration Suppression* on page 8-54

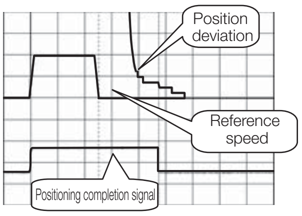
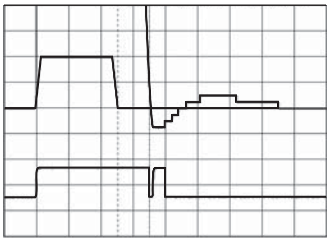
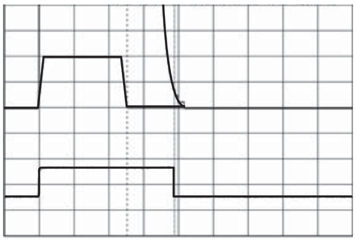
◆ Autotuning with a Host Reference

You can perform autotuning with a host reference. Refer to the following section for details.
☞ *8.7 Autotuning with a Host Reference* on page 8-34

8.8.4 Automatically Adjusted Function Setting

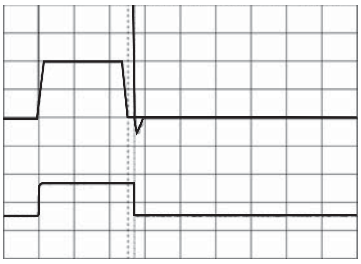
You cannot use vibration suppression functions at the same time. Other automatic function settings are the same as for autotuning without a host reference. Refer to the following section.
☞ *8.6.5 Automatically Adjusted Function Setting* on page 8-30

8.8.5 Tuning Example for Tuning Mode 2 or 3

Step	Measurement Display Examples	Operation
1		The positioning time is measured after the moment of inertia ratio (Pn103) is set correctly. Tuning is completed if the specifications are met. The tuning results are saved in the SERVOPACK.
2		The positioning time will be reduced if the feedforward level is increased. Tuning is completed if the specifications are met. The tuning results are saved in the SERVOPACK. If overshooting occurs before the specifications are met, proceed to step 3.
3		Overshooting will be reduced if the feedback level is increased. If the overshooting is eliminated, proceed to step 4.

Continued on next page.

Continued from previous page.

Step	Measurement Display Examples	Operation
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.

8.8.6 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 Integration Time Constant	Yes
Pn102	Position Loop Gain	Yes
Pn103	Moment of Inertia Ratio	No
Pn121	Friction Compensation Gain	Yes
Pn123	Friction Compensation Coefficient	Yes
Pn124	Friction Compensation Frequency Correction	No
Pn125	Friction Compensation Gain Correction	Yes
Pn401	First Stage First Torque Reference Filter Time Constant	Yes
Pn408	Torque-Related Function Selections	Yes
Pn409	First Stage Notch Filter Frequency	Yes
Pn40A	First Stage Notch Filter Q Value	Yes
Pn40C	Second Stage Notch Filter Frequency	Yes
Pn40D	Second Stage Notch Filter Q Value	Yes
Pn140	Model Following Control-Related Selections	Yes
Pn141	Model Following Control Gain	Yes
Pn142	Model Following Control Gain Correction	Yes
Pn143	Model Following Control Bias in the Forward Direction	Yes
Pn144	Model Following Control Bias in the Reverse Direction	Yes
Pn145	Vibration Suppression 1 Frequency A	No
Pn146	Vibration Suppression 1 Frequency B	No
Pn147	Model Following Control Speed Feedforward Compensation	Yes
Pn160	Anti-Resonance Control-Related Selections	Yes
Pn161	Anti-Resonance Frequency	Yes
Pn163	Anti-Resonance Damping Gain	Yes

Yes: The parameter is automatically set.

No: The parameter is not automatically set, but the setting is read during execution.

8.9 Anti-resonance Control Adjustment

This section describes anti-resonance control.

8.9.1 Outline

Anti-resonance control increases the effectiveness of vibration suppression after custom tuning.

Anti-resonance control is effective for suppression of continuous vibration frequencies from 100 to 1,000 Hz that occur when the control gain is increased. Vibration can be eliminated by setting vibration frequencies through automatic detection or by manually setting them to adjust the damping gain. Input an operation reference and execute this anti-resonance control adjustment when there is vibration.

Anti-resonance control is automatically set by autotuning without a host reference or autotuning with a host reference. Use vibration suppression 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 adjusting anti-resonance control. If the control gain is increased, e.g., when custom tuning is performed, vibration may occur again. If that occurs, adjust anti-resonance control again to fine-tune the parameters.

⚠ CAUTION

- **Related parameters will be set automatically when anti-resonance control 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 adjust anti-resonance control, set the correct moment of inertia ratio (Pn103). If the setting greatly differs from the actual moment of inertia ratio, normal control of the machine may not be possible, and vibration may occur.**

Important

- Anti-resonance control adjustment detects vibration frequencies between 100 Hz and 1,000 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 the vibration suppression function.
- Vibration reduction can be made more effective by increasing the anti-resonance damping gain (Pn163), but the vibration may become larger if the damping gain is too high. Increase the damping gain by approximately 0% to 200% in 10% increments while checking the effect on vibration. If vibration reduction is still insufficient at a gain of 200%, cancel the setting, and lower the control gain by using a different method, such as custom tuning.

8.9.2 Preparations

Always check the following before you adjust anti-resonance control.

- The tuning-less function must be disabled (Pn170 = n.□□□0).
- The test without a motor function must be disabled (Pn00C = n.□□□0).
- The control method must not be set to torque control.
- The parameters must not be write prohibited.

8.9.3 Operating Procedure

To adjust anti-resonance control, an operation reference is input, and the adjustment is executed while vibration is occurring.

The following methods can be used to adjust anti-resonance control.
- To automatically detect the vibration frequency
- To manually set the vibration frequency

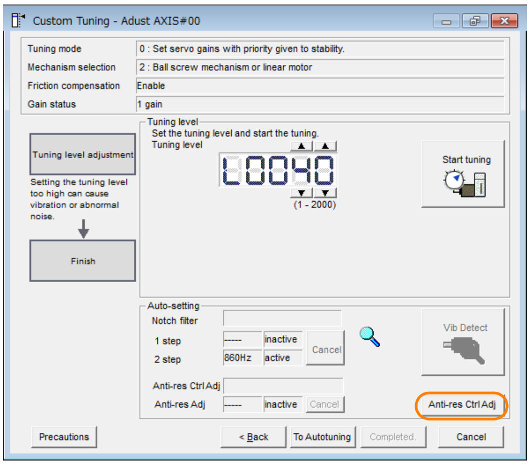
Use the following procedure to perform anti-resonance control.

⚠ CAUTION

- **Before you adjust anti-resonance control, 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.
    Parameters will be set automatically when anti-resonance control is adjusted. This may greatly affect the response before and after execution. Make sure that you can perform an emergency stop (to turn OFF the power supply) at any time.
  - Set the moment of inertia correctly before you adjust anti-resonance control.
    If the setting greatly differs from the actual moment of inertia, effective vibration reduction may not be possible.
  - If you have already adjusted anti-resonance control and then you change the frequency, the current anti-resonance control effect may be lost. Caution is particularly required when automatically detecting the vibration frequency.
  - If effective vibration reduction is not achieved even after you adjust anti-resonance control, cancel the function and lower the control gain by using a different method, such as custom tuning.
  - Perform custom tuning separately if required to increase the response after adjusting anti-resonance control.
    If the servo gain is increased, e.g., when custom tuning is performed, vibration may occur again. If that occurs, adjust anti-resonance control again to fine-tune the parameters.

1. **Perform steps 1 to 8 of the procedure for custom tuning. Refer to the following section for details.**
   ☞ *8.8.3 Operating Procedure* on page 8-42

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: L0040 (1 - 2000)

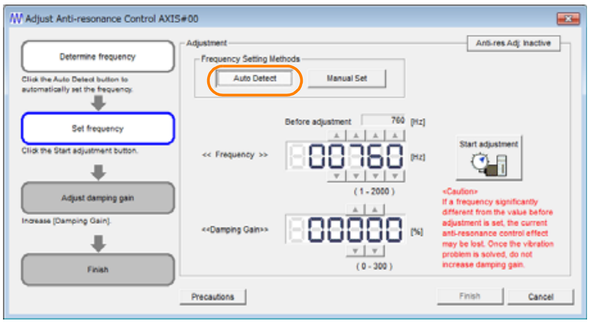
Setting the tuning level too high can cause vibration or abnormal noise.

Auto-setting
Notch filter
1 step: ------ inactive
2 step: 860Hz active
Anti-res Ctrl Adj
Anti-res Adj: ------ inactive

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 manually.



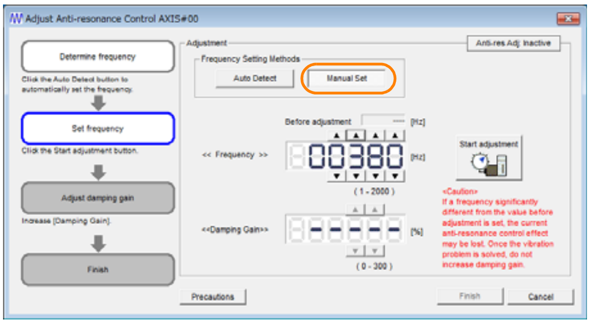
Click the Auto Detect button to automatically set the frequency.

Click the Start adjustment button.

Increase [Damping Gain].

<Caution> If a frequency significantly different from the value before adjustment is set, the current anti-resonance control effect may be lost. Once the vibration problem is solved, do not increase damping gain.

To Manually Set the Vibration Frequency



Click the Auto Detect button to automatically set the frequency.

Click the Start adjustment button.

Increase [Damping Gain].

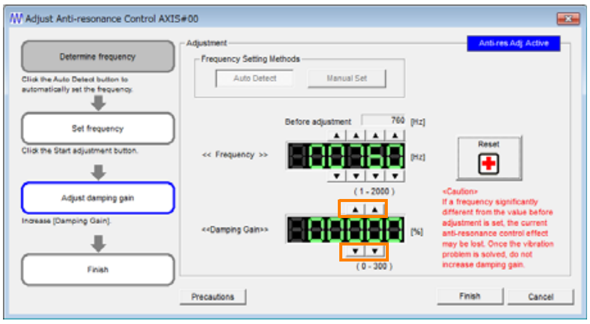
<Caution> If a frequency significantly different from the value before adjustment is set, the current anti-resonance control effect may be lost. Once the vibration problem is solved, do not increase damping gain.

4. Click the **Start tuning** Button.

5. Use the ▲ and ▼ Buttons in the **Adjustment** Area to change the settings.
   Click the **Reset** Button during adjustment to restore the setting to its original value. The tuning level will return to the value from before when custom tuning was started.

To Automatically Detect the Vibration Frequency

Change the setting of the damping gain.



Click the Auto Detect button to automatically set the frequency.

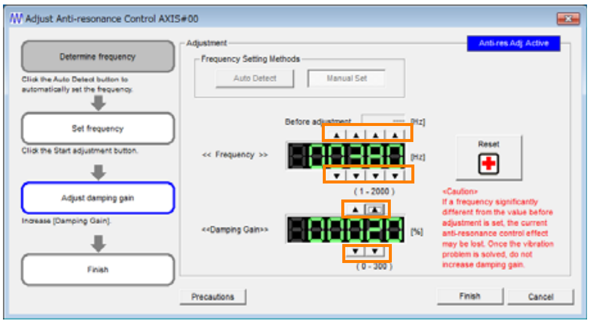
Click the Start adjustment button.

Increase [Damping Gain].

<Caution> If a frequency significantly different from the value before adjustment is set, the current anti-resonance control effect may be lost. Once the vibration problem is solved, do not increase damping gain.

To Manually Set the Vibration Frequency

Change the settings of the frequency and damping gain.



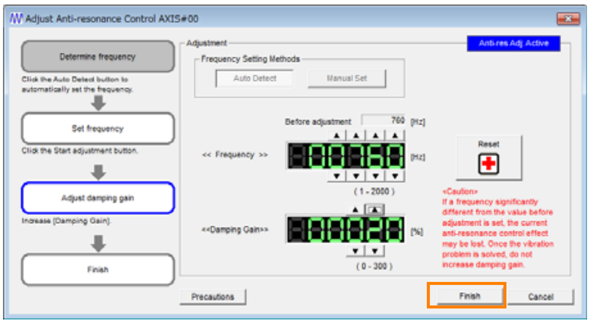
Click the Auto Detect button to automatically set the frequency.

Click the Start adjustment button.

Increase [Damping Gain].

<Caution> If a frequency significantly different from the value before adjustment is set, the current anti-resonance control effect may be lost. Once the vibration problem is solved, do not increase damping gain.

6. When the adjustment has been completed, click the **Finish** Button.
   The values that were changed will be saved in the SERVOPACK and you will return to the Tuning Dialog Box.



Click the Auto Detect button to automatically set the frequency.

Click the Start adjustment button.

Increase [Damping Gain].

<Caution> If a frequency significantly different from the value before adjustment is set, the current anti-resonance control effect may be lost. Once the vibration problem is solved, do not increase damping gain.

This concludes the procedure to set up anti-resonance control.

8.9.4 Related Parameters

The following parameters are automatically adjusted or used as reference when you adjust anti-resonance control.

Do not change the settings while anti-resonance control is being adjusted.

Parameter	Name	Automatic Changes
Pn160	Anti-Resonance Control-Related Selections	Yes
Pn161	Anti-Resonance Frequency	Yes
Pn162	Anti-Resonance Gain Correction	No
Pn163	Anti-Resonance Damping Gain	Yes
Pn164	Anti-Resonance Filter Time Constant 1 Correction	No
Pn165	Anti-Resonance Filter Time Constant 2 Correction	No

Yes: The parameter is automatically set.

No: The parameter is not automatically set, but the setting is read during execution.

8.9.5 Suppressing Different Vibration Frequencies with Anti-resonance Control

When you use anti-resonance control and increase the control gain, for some mechanisms, 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**

Anti-resonance frequency (Pn161): fa [Hz], Another vibration frequency that occurs when the control gain is increased: fb [Hz]

- Vibration frequencies: 100 Hz to 1,000 Hz
- Range of different vibration frequencies: 1 < (fb/fa) ≤ 3 to 4

Required Parameter Settings

The following parameter settings are required to use anti-resonance control for more than one vibration frequency.

Parameter		Meaning	When Enabled	Classification
Pn160	n.□□□0 (default setting)	Do not use anti-resonance control.	Immediately	Tuning
	n.□□□1	Use anti-resonance control.		

Pn161	Anti-Resonance Frequency			Speed Position	Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 20,000	0.1 Hz	1000	Immediately	Tuning
Pn162	Anti-Resonance Gain Correction			Speed Position	Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 1,000	1%	100	Immediately	Tuning
Pn163	Anti-Resonance Damping Gain			Speed Position	Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 300	1%	0	Immediately	Tuning
Pn164	Anti-Resonance Filter Time Constant 1 Correction			Speed Position	Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	-1,000 to 1,000	0.01 ms	0	Immediately	Tuning

Continued on next page.

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Pn165	Anti-Resonance Filter Time Constant 2 Correction			Speed Position Torque	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	-1,000 to 1,000	0.01 ms	0	Immediately	Tuning
Pn166	Anti-Resonance Damping Gain 2			Speed Position Torque	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 1,000	1%	0	Immediately	Tuning

Adjustment Procedure for Suppressing Different Vibration Frequencies with Anti-resonance Control

Use the following procedure to make adjustments to suppress different vibration frequencies with anti-resonance control.

Step	Operation
1	Use the gain adjustment and anti-resonance control. Refer to the following section for details. ☞ *8.9.3 Operating Procedure* on page 8-50
2	If there is vibration at a higher frequency than the vibration suppressed with anti-resonance control in step 1, adjust Pn166 (Anti-Resonance Damping Gain 2).
3	Adjust Pn166 (Anti-Resonance Damping Gain 2) while checking to see if vibration reduction is effective. To adjust Pn166 (Anti-Resonance Damping Gain 2), increase the setting by 10% at a time starting from the value that resulted in Pn163 (Anti-Resonance Damping Gain) from the adjustment in step 1.
4	If the vibration disappears, the adjustment is completed. However, if the vibration does not disappear even when you adjust Pn166 (Anti-Resonance Damping Gain 2), reduce the tuning level or feedback level until vibration does not occur.

8.10 Vibration Suppression

This section describes vibration suppression.

8.10.1 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.

Vibration suppression is automatically set by autotuning without a host reference or autotuning with a host reference. Use vibration suppression only if fine-tuning is required or readjustment is required as a result of a failure to detect vibration. To execute vibration suppression, input an operation reference and execute the function when there is vibration.

Perform custom tuning if required to increase the response after performing vibration suppression.

⚠ CAUTION

- Related parameters will be set automatically when vibration suppression 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 vibration suppression, set the correct moment of inertia ratio (Pn103) with autotuning without a host reference or another method. If the setting greatly differs from the actual moment of inertia ratio, normal control of the machine may not be possible, and vibration may occur.
- If you execute vibration suppression when you are using the SERVOPACK for phase control, correct phase control may not be possible.

Important

- Vibration suppression 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.

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, adjust anti-resonance control or perform custom tuning.

Detection of Vibration Frequencies

Frequency detection may not be possible if vibration does not appear in the position deviation or the vibration that results from the position deviation is too small. You can adjust the detection sensitivity by changing the setting of the residual vibration detection width (Pn560), which is set as a percentage of the positioning completion width (Pn522). Perform the detection of vibration frequencies again after adjusting the setting of Pn560.

Pn560	Residual Vibration Detection Width				Position
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 3,000	0.1%	400	Immediately	Setup

Note: As a guideline, change the setting 10% at a time. If the setting of this parameter is lowered, the detection sensitivity will be increased. Vibration may not be detected accurately if the setting is too small.

Information The vibration frequencies that are automatically detected may vary somewhat with each positioning operation. Perform positioning several times and make adjustments while checking the effect of vibration suppression.

8.10.2 Preparations

Always check the following before you execute vibration suppression.

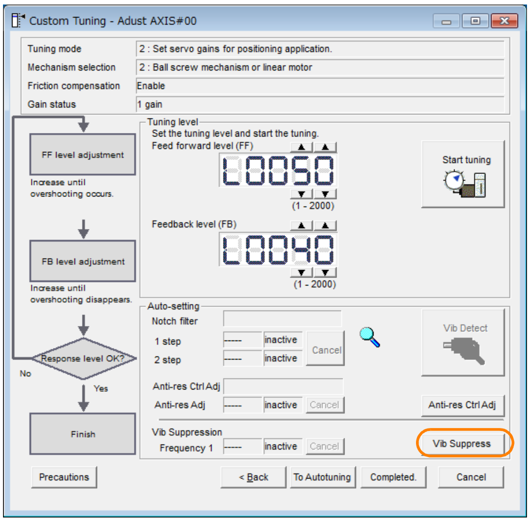
- Position control must be used.
- The tuning-less function must be disabled (Pn170 = n.□□□0).
- The test without a motor function must be disabled (Pn00C = n.□□□0).
- The parameters must not be write prohibited.

8.10.3 Operating Procedure

Use the following procedure to perform vibration suppression.

1. **Perform steps 1 to 8 of the procedure for custom tuning. Refer to the following section for details.**
   ☞ *8.8.3 Operating Procedure* on page 8-42

2. Click the **Vib Suppress** Button.



Custom Tuning - Adust AXIS#00

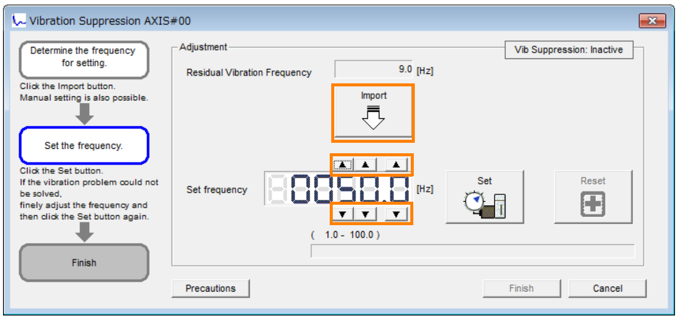
Tuning mode: 2 : Set servo gains for positioning application.
Mechanism selection: 2 : Ball screw mechanism or linear motor
Friction compensation: Enable
Gain status: 1 gain

Tuning level
Set the tuning level and start the tuning.
Feed forward level (FF): 0050 (1 - 2000)
Feedback level (FB): 0040 (1 - 2000)

Auto-setting
Notch filter
1 step: ----- inactive
2 step: ----- inactive
Anti-res Ctrl Adj
Anti-res Adj: ----- inactive
Vib Suppression
Frequency 1: ----- inactive

3. **Click the Import Button or click the ▲ Button and the ▼ Button 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.



Vibration Suppression AXIS#00

Determine the frequency for setting.

Click the Import button. Manual setting is also possible.

Set the frequency.

Click the Set button. If the vibration problem could not be solved, finely adjust the frequency and then click the Set button again.

Adjustment

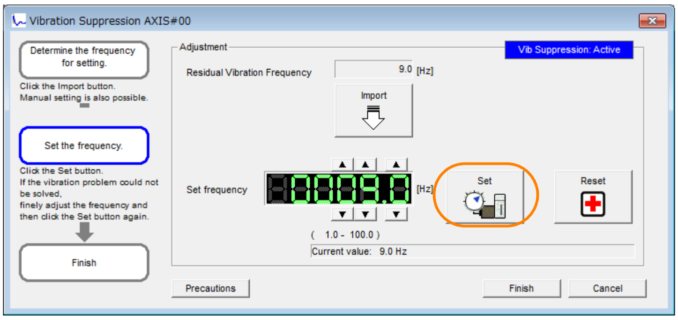
Vib Suppression: Inactive

Residual Vibration Frequency 9.0 [Hz]

Set frequency [Hz] (1.0 - 100.0)

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.



Vibration Suppression AXIS#00

Determine the frequency for setting.

Click the Import button. Manual setting is also possible.

Set the frequency.

Click the Set button. If the vibration problem could not be solved, finely adjust the frequency and then click the Set button again.

Adjustment

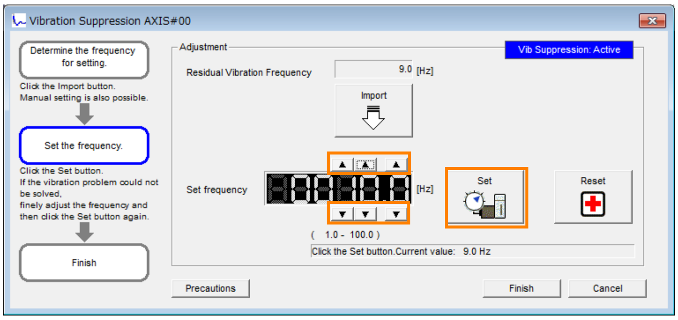
Vib Suppression: Active

Residual Vibration Frequency 9.0 [Hz]

Set frequency 0009.0 [Hz] (1.0 - 100.0)

Current value: 9.0 Hz

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.



Vibration Suppression AXIS#00

Determine the frequency for setting.

Click the Import button. Manual setting is also possible.

Set the frequency.

Click the Set button. If the vibration problem could not be solved, finely adjust the frequency and then click the Set button again.

Adjustment

Vib Suppression: Active

Residual Vibration Frequency 9.0 [Hz]

Set frequency [Hz] (1.0 - 100.0)

Click the Set button.Current value: 9.0 Hz

Click the **Reset** Button during adjustment to restore the setting to its original value. The status from before when adjustment was started will be restored.

5. When the vibration has been eliminated, click the **Finish** Button.
   The updated value will be saved in the SERVOPACK.

> Important
>
> Vibration suppression will be enabled in step 5. The Servomotor response, however, will change when the Servomotor comes to a stop with no reference input.

This concludes the procedure to set up vibration suppression.

8.10.4 Setting Combined Functions

You can also use the feedforward function when you execute vibration suppression.

In the default settings, feedforward (Pn109), the speed feedforward input (VFF), and the torque feedforward input (TFF) are disabled.

To use the speed feedforward input (VFF), the torque feedforward input (TFF), and model following control from the SVD in the system, set Pn140 to n.1□□□ (Use model following control and speed/torque feedforward together).

Parameter		Meaning	When Enabled	Classification
Pn140	n.0□□□ (default setting)	Do not use model following control and speed/torque feedforward together.	Immediately	Tuning
	n.1□□□	Use model following control and speed/torque feedforward together.		

Refer to the following manual for information on the torque feedforward input (TFF) and the speed feedforward input (VFF).

📖 Σ-7-Series Σ-7C SERVOPACK Motion Control User's Manual (Manual No.: SIEP S800002 03)

Important When model following control is used with the feedforward function, it is used to make optimum feedforward settings in the SERVOPACK. Therefore, model following control is not normally used together with either the speed feedforward input (VFF) or torque feedforward input (TFF) from the SVD. However, model following control can be used with the speed feedforward input (VFF) or torque feedforward input (TFF) if required. An unsuitable feedforward input may result in overshooting.

8.10.5 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.

8.11 Speed Ripple Compensation

This section describes speed ripple compensation.

8.11.1 Outline

Speed ripple compensation reduces the amount of ripple in the motor speed due to torque ripple or cogging torque. You can enable speed ripple compensation to achieve smoother operation. To enable it, you must set up ripple compensation on the SigmaWin+.

⚠ WARNING

- **Speed ripple compensation requires operating the Servomotor 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 speed ripple compensation only after adjusting the gains.
- Reset speed ripple compensation after you replace the Servomotor or SERVOPACK.
- Execute speed ripple compensation after jogging to a position that ensures a suitable range of motion.

8.11.2 Setting Up Speed Ripple Compensation

Restrictions

The following restrictions apply to the setup for speed ripple compensation.

◆ Systems for Which Execution Cannot Be Performed

There are no restrictions.

◆ Systems for Which Adjustments Cannot Be Made Accurately

Systems for which there is not a suitable range of motion.

◆ Preparations

Always check the following before you set up speed ripple compensation.
- The main circuit power supply must be ON.
- The servo must be OFF.
- There must be no alarms or warnings.
- The parameters must not be write prohibited.

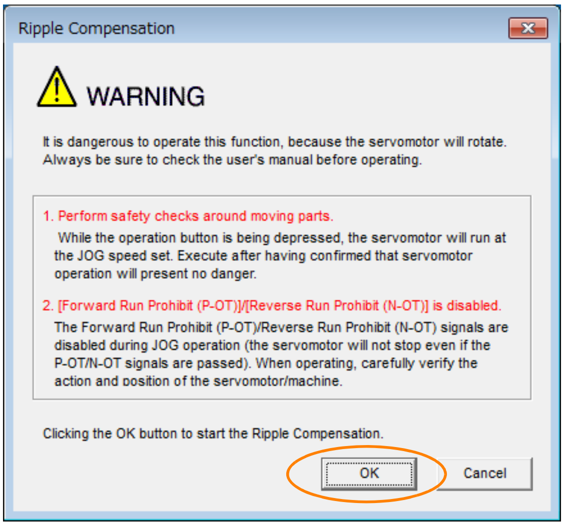
Operating Procedure

Use the following procedure to set up speed ripple compensation.

1. Click the 🖥 **Servo Drive** Button in the workspace of the Main Window of the SigmaWin+.

2. Select **Ripple Compensation** in the Menu Dialog Box.
   The Ripple Compensation Dialog Box will be displayed.

3. Click the **OK** Button.



WARNING

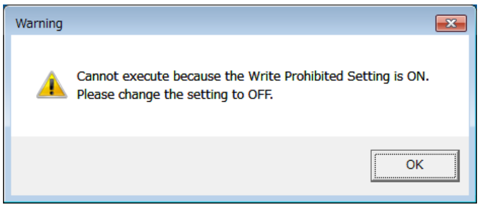
It is dangerous to operate this function, because the servomotor will rotate.
Always be sure to check the user's manual before operating.

1. Perform safety checks around moving parts.
While the operation button is being depressed, the servomotor will run at the JOG speed set. Execute after having confirmed that servomotor operation will present no danger.

2. [Forward Run Prohibit (P-OT)]/[Reverse Run Prohibit (N-OT)] is disabled.
The Forward Run Prohibit (P-OT)/Reverse Run Prohibit (N-OT) signals are disabled during JOG operation (the servomotor will not stop even if the P-OT/N-OT signals are passed). When operating, carefully verify the action and position of the servomotor/machine.

Clicking the OK button to start the Ripple Compensation.

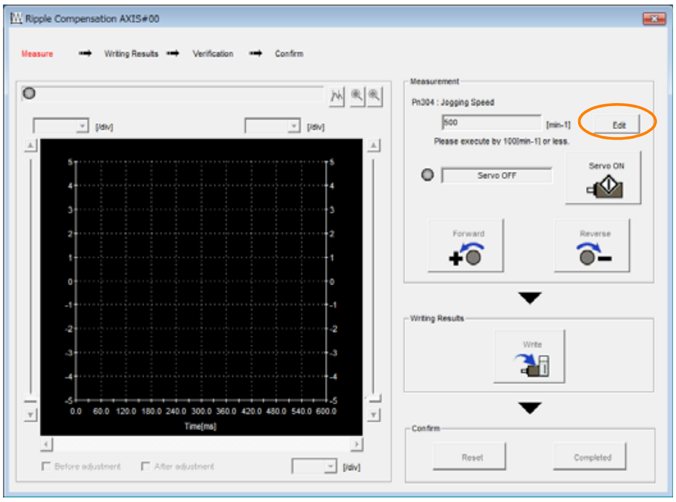
Information
1. Click the **Cancel** Button to cancel ripple compensation. The Main Window will return.
2. If write prohibition is set, the following dialog box will be displayed.



Cannot execute because the Write Prohibited Setting is ON.
Please change the setting to OFF.

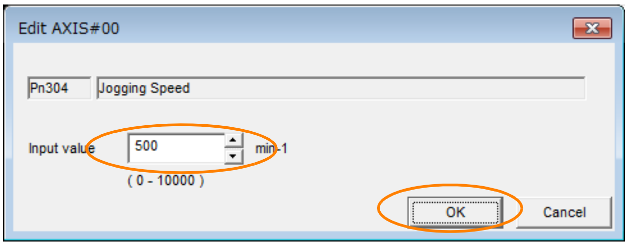
Click the **OK** Button and then cancel write prohibition.

4. Click the **Edit** Button.



Pn304 : Jogging Speed
500 [min-1]
Please execute by 100[min-1] or less.

5. Enter the jogging speed in the **Input value** Box and click the **OK** Button.

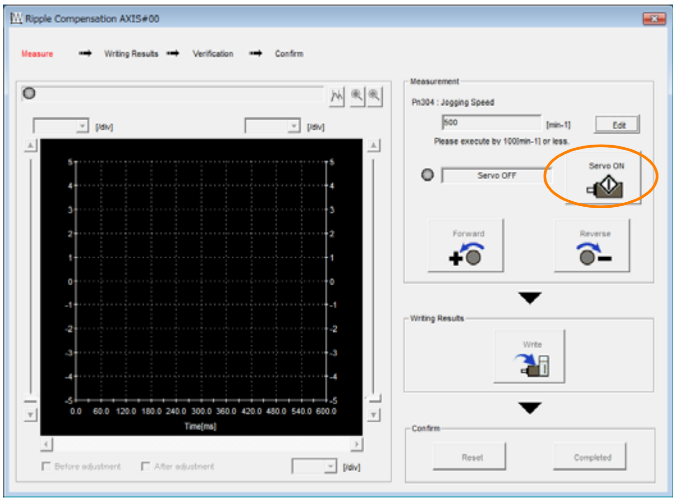


Pn304 Jogging Speed

Input value 500 min-1

(0 - 10000)

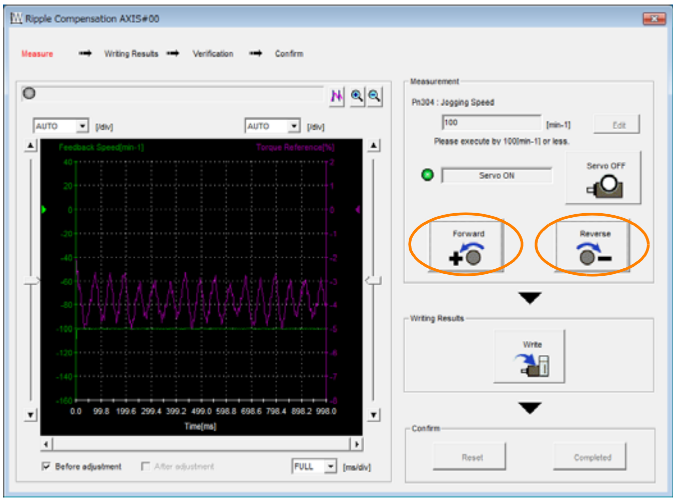
6. Click the **Servo ON** Button.



Pn304 : Jogging Speed 500 [min-1]

Please execute by 100[min-1] or less.

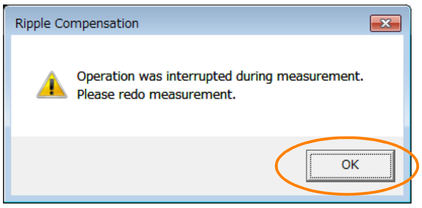
7. Click the **Forward** Button or the **Reverse** Button.
Measurement operation is started.
The Servomotor shaft will rotate at the preset jogging speed while you hold down the **Forward** or **Reverse** Button and the speed ripple will be measured.
The feedback speed and torque reference graph will be displayed in the Ripple Compensation Dialog Box during jogging.



Pn304 : Jogging Speed 100 [min-1]

Please execute by 100[min-1] or less.

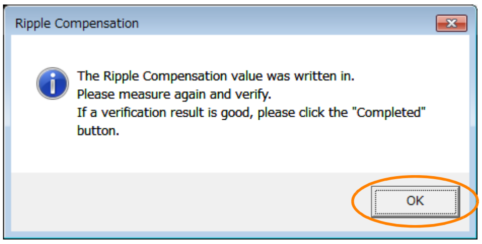
Important If the measurement time (i.e., the jogging time) for the speed ripple is too short, speed ripple measurement will not be completed. The following dialog box will be displayed if speed ripple measurement was not completed.
Click the **OK** Button and repeat the measurement.



Operation was interrupted during measurement.
Please redo measurement.

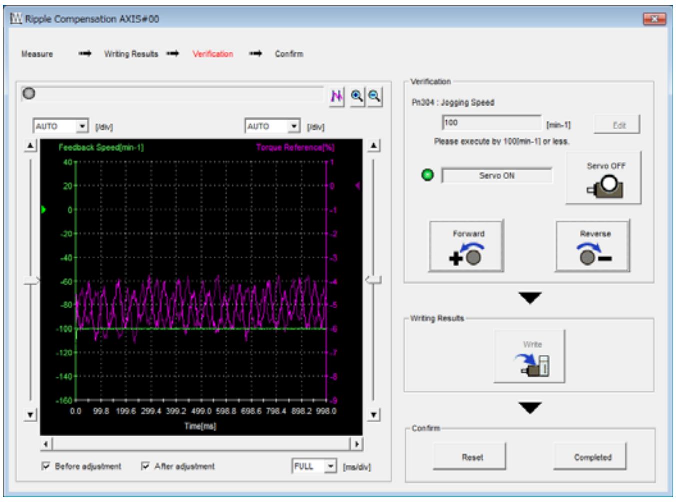
8. After speed ripple measurement has been completed, click the **Write** Button.
The ripple compensation value will be written to the SERVOPACK.

9. After writing has been completed, click the **OK** Button.



The Ripple Compensation value was written in.
Please measure again and verify.
If a verification result is good, please click the "Completed" button.

10. Click the **Forward** Button or the **Reverse** Button again.
Verification operation is started.
The Servomotor shaft will rotate at the preset jogging speed while you hold down the **Forward** or **Reverse** Button.
The waveform with speed ripple compensation applied to it will be displayed.



Pn304 : Jogging Speed 100 [min-1]
Please execute by 100[min-1] or less.

11. If the verification results are OK, click the **Completed** Button.

Information To discard the setup results, click the **Reset** Button.

This concludes the setup for speed ripple compensation.

8.11.3 Setting Parameters

The function is enabled when you perform the operating procedure on page 8-59. To cancel speed ripple compensation, use Pn423 = n.□□□0 (Disable speed ripple compensation) to disable it.

Parameter		Meaning	When Enabled	Classification
Pn423	n.□□□0 (default setting)	Disable speed ripple compensation.	Immediately	Setup
	n.□□□1	Enable speed ripple compensation.		

If you enable speed ripple compensation, a compensation reference will be applied to reduce ripple even when stopped at a 0 speed reference. In speed control mode, this may result in the Servomotor moving slightly. To prevent this, set Pn423 = n.□X□□ (Speed Ripple Compensation Enable Condition Selection) and Pn427 or Pn49F (Speed Ripple Compensation Enable Speed).

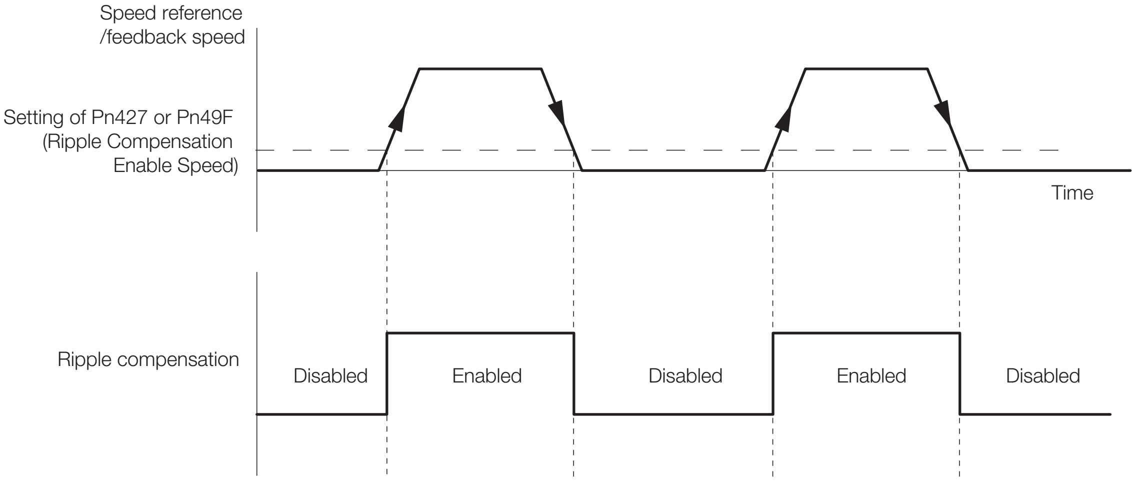
Parameter		Meaning	When Enabled	Classification
Pn423	n.□0□□ (default setting)	Speed reference	After restart	Setup
	n.□1□□	Motor speed		

- Rotary Servomotors

Pn427	Speed Ripple Compensation Enable Speed		Speed Position Torque		
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 min^{-1}	0	Immediately	Tuning

- Linear Servomotors

Pn49F	Speed Ripple Compensation Enable Speed		Speed Position Torque		
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 mm/s	0	Immediately	Tuning



Speed Ripple Compensation Warnings

The speed ripple compensation value is specific to each Servomotor. If you replace the Servomotor while speed ripple compensation is enabled, an A.942 warning (Speed Ripple Compensation Information Disagreement) will occur to warn you.
You can use any of the following methods to clear A.942.

- Reset the speed ripple compensation value on the SigmaWin+.
- Disable speed ripple compensation (Pn423 = n.□□□0).
- Disable detection of A.942 (Pn423 = n.□□1□).

Parameter		Meaning	When Enabled	Classification
Pn423	n.□□0□ (default setting)	Detect A.942 alarms.	After restart	Setup
	n.□□1□	Do not detect A.942 alarms.		

8.12 Additional Adjustment Function

This section describes the functions that you can use to make adjustments after you perform autotuning without a host reference, autotuning with a host reference, and custom tuning.

Function	Applicable Control Methods	Reference
Gain Switching	Position control, speed control, or torque control*	page 8-64
Friction Compensation	Position control or speed control	page 8-68
Current Gain Level Setting	Position control or speed control	page 8-71
Speed Detection Method Selection	Position control, speed control, or torque control	page 8-72

* Automatic gain switching is enabled only for position control.

8.12.1 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.

Parameter		Function	When Enabled	Classification
Pn139	n.□□□0 (default setting)	Use manual gain switching.	Immediately	Tuning
	n.□□□2	Use automatic gain switching pattern 1.		

Note: Pn139 = n.□□□1 is a reserved setting. Do not use this setting.

Refer to the following section for gain switching combinations.

☞ *Gain Switching Combinations* on page 8-64

Refer to the following sections for information on manual and automatic gain switching.

☞ *Manual Gain Switching* on page 8-65, *Automatic Gain Switching* on page 8-65

Gain Switching Combinations

Selected Gains	Speed Loop Gain	Speed Loop Integration Time Constant	Position Loop Gain	Torque Reference Filter	Model Following Control Gain	Model Following Control Gain Correction	Friction Compensation Gain
Gain Settings 1	Speed Loop Gain (Pn100)	Speed Loop Integral Time Constant (Pn101)	Position Loop Gain (Pn102)	First Stage First Torque Reference Filter Time Constant (Pn401)	Model Following Control Gain* (Pn141)	Model Following Control Gain Correction (Pn142)	Friction Compensation Gain (Pn121)
Gain Settings 2	Second Speed Loop Gain (Pn104)	Second Speed Loop Integral Time Constant (Pn105)	Second Position Loop Gain (Pn106)	First Stage Second Torque Reference Filter Time Constant (Pn412)	Second Model Following Control Gain* (Pn148)	Model Following Control Gain Correction* (Pn149)	Second Friction Compensation Gain (Pn122)

* Gain switching for the model following control gain and the model following control gain correction is applicable only to manual gain selection.
To enable gain switching with these parameters, a gain switching input signal must be used and the following conditions must be met. If the conditions are not met, these parameters will not be changed even if the other parameters in the above table are changed.
- There must be no reference.
- The motor must be stopped.

Manual Gain Switching

With manual gain switching, you use OW□□□01 (Switch Gain) to change between gain settings 1 and gain settings 2.

Type	Command Name	Value	Meaning
Input	Switch Gain (OW□□□01 Bit 4)	0	Changes the gain settings to gain settings 1.
		1	Changes the gain settings to gain settings 2.

Automatic Gain Switching

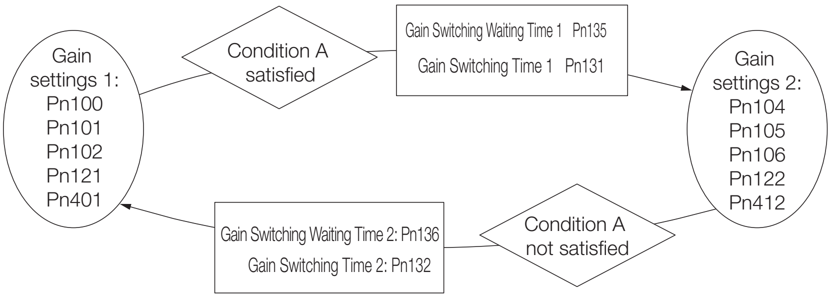
Automatic gain switching is enabled only for position control. The switching conditions are specified by using the following settings.

Parameter		Switching Condition	Selected Gains	Switching Waiting Time	Switching Time
Pn139	n.□□□2	Condition A satisfied	Gain settings 1 to gain settings 2	Gain Switching Waiting Time 1 Pn135	Gain Switching Time 1 Pn131
		Condition A not satisfied	Gain settings 2 to gain settings 1	Gain Switching Waiting Time 1 Pn136	Gain Switching Time 2 Pn132

Select one of the following settings for switching condition A.

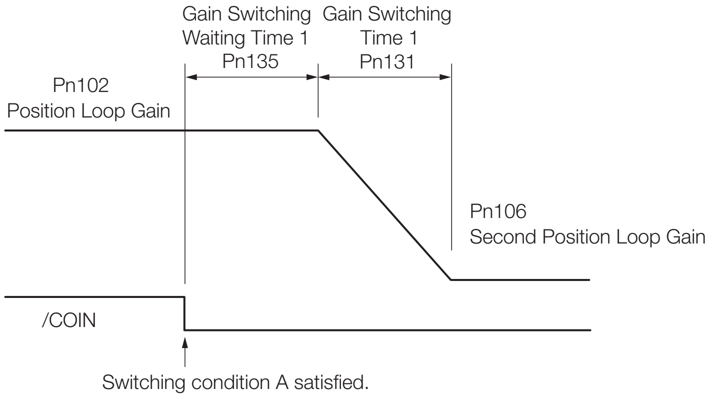
Parameter		Position Control Gain Switching Condition A	For Control Methods Other Than Position Control (No Switching)	When Enabled	Classification
Pn139	n.□□0□ (default setting)	/COIN (Positioning Completion Output) signal turns ON.	Gain settings 1 used.	Immediately	Tuning
	n.□□1□	/COIN (Positioning Completion Output) signal turns OFF.	Gain settings 2 used.		
	n.□□2□	/NEAR (Near Output) signal turns ON.	Gain settings 1 used.		
	n.□□3□	/NEAR (Near Output) signal turns OFF.	Gain settings 2 used.		
	n.□□4□	Position reference filter output is 0 and position reference input is OFF.	Gain settings 1 used.		
	n.□□5□	Position reference input is ON.	Gain settings 2 used.		

Use automatic gain switching pattern 1 (Pn139 = n.□□□2)



◆ Relationship between the Waiting Times and Switching Times for Gain Switching

In this example, an ON /COIN (Positioning Completion Output) signal is set as condition A for automatic gain switching. The position loop gain is changed from the value in Pn102 (Position Loop Gain) to the value in Pn106 (Second Position Loop Gain). When the /COIN signal turns ON, the switching operation begins after the waiting time (Pn135). The switching operation changes the position loop gain linearly from the gain set in Pn102 to the gain set in Pn106 over the switching time (Pn131).



Information You can use gain switching for either PI control or I-P control (Pn10B = n.□□0□ or □□1□).

Related Parameters

Pn100	Speed Loop Gain			Speed Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 20,000	0.1 Hz	400	Immediately	Tuning
Pn101	Speed Loop Integral Time Constant			Speed Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	15 to 51,200	0.01 ms	2,000	Immediately	Tuning
Pn102	Position Loop Gain			Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 20,000	0.1/s	400	Immediately	Tuning
Pn401	First Stage First Torque Reference Filter Time Constant			Speed Position	Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 65,535	0.01 ms	100	Immediately	Tuning
Pn141	Model Following Control Gain			Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 20,000	0.1/s	500	Immediately	Tuning
Pn142	Model Following Control Gain Correction			Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	500 to 2,000	0.1%	1,000	Immediately	Tuning
Pn121	Friction Compensation Gain			Speed Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 1,000	1%	100	Immediately	Tuning
Pn104	Second Speed Loop Gain			Speed Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 20,000	0.1 Hz	400	Immediately	Tuning
Pn105	Second Speed Loop Integral Time Constant			Speed Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	15 to 51,200	0.01 ms	2,000	Immediately	Tuning
Pn106	Second Position Loop Gain			Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 20,000	0.1/s	400	Immediately	Tuning
Pn412	First Stage Second Torque Reference Filter Time Constant			Speed Position	Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 65,535	0.01 ms	100	Immediately	Tuning
Pn148	Second Model Following Control Gain			Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 20,000	0.1/s	500	Immediately	Tuning
Pn149	Second Model Following Control Gain Correction			Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	500 to 2,000	0.1%	1,000	Immediately	Tuning
Pn122	Second Friction Compensation Gain			Speed Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 1,000	1%	100	Immediately	Tuning

Parameters Related to Automatic Gain Switching

Pn131	Gain Switching Time 1			Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 65,535	1 ms	0	Immediately	Tuning
Pn132	Gain Switching Time 2			Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 65,535	1 ms	0	Immediately	Tuning
Pn135	Gain Switching Waiting Time 1			Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 65,535	1 ms	0	Immediately	Tuning
Pn136	Gain Switching Waiting Time 2			Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 65,535	1 ms	0	Immediately	Tuning

Related Monitoring

You can use the SigmaWin+ to monitor gain switching with the status monitor or with tracing.

8.12.2 Friction Compensation

Friction compensation is used to compensate for viscous friction fluctuations and regular load fluctuations.

You can automatically adjust friction compensation with autotuning without a host reference, autotuning with a host reference, or custom tuning, or you can manually adjust it with the following procedure.

Required Parameter Settings

The following parameter settings are required to use friction compensation.

Parameter		Function	When Enabled	Classification
Pn408	n.0□□□ (default setting)	Disable friction compensation.	Immediately	Setup
	n.1□□□	Enable friction compensation.		

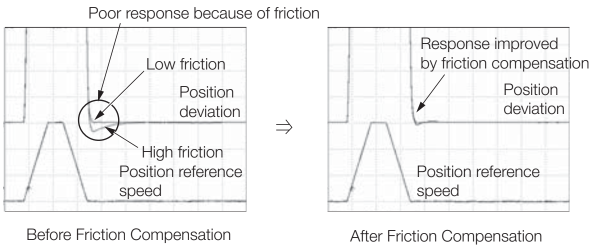
Pn121	Friction Compensation Gain			Speed Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 1,000	1%	100	Immediately	Tuning
Pn122	Second Friction Compensation Gain			Speed Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 1,000	1%	100	Immediately	Tuning
Pn123	Friction Compensation Coefficient			Speed Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 100	1%	0	Immediately	Tuning
Pn124	Friction Compensation Frequency Correction			Speed Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	-10,000 to 10,000	0.1 Hz	0	Immediately	Tuning
Pn125	Friction Compensation Gain Correction			Speed Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 1,000	1%	100	Immediately	Tuning

Operating Procedure for Friction Compensation

Use the following procedure to perform friction compensation.

⚠ CAUTION

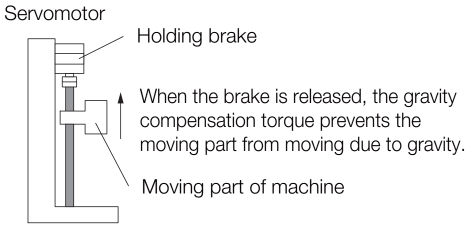
- Before you execute friction compensation, set the moment of inertia ratio (Pn103) as accurately as possible. If the setting greatly differs from the actual moment of inertia, vibration may occur.

Step	Operation
1	Set the following parameters related to friction compensation to their default settings. Friction compensation gain (Pn121): 100 Second friction compensation gain (Pn122): 100 Friction compensation coefficient (Pn123): 0 Friction compensation frequency correction (Pn124): 0 Friction compensation gain correction (Pn125): 100 Note: Always use the default settings for the friction compensation frequency correction (Pn124) and friction compensation gain correction (Pn125).
2	Gradually increase the friction compensation coefficient (Pn123) to check the effect of friction compensation. Note: Usually, set the friction compensation coefficient (Pn123) to 95% or less. If the effect is insufficient, increase the friction compensation gain (Pn121) by 10% increments until vibration stops. **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.
3	**Effect of Adjustments** The following graphs show the response with and without adjustment.  Before Friction Compensation After Friction Compensation

8.12.3 Gravity Compensation

When the Servomotor is used with a vertical axis, gravity compensation prevents the moving part from falling due to the machine's own weight when the brake is released.

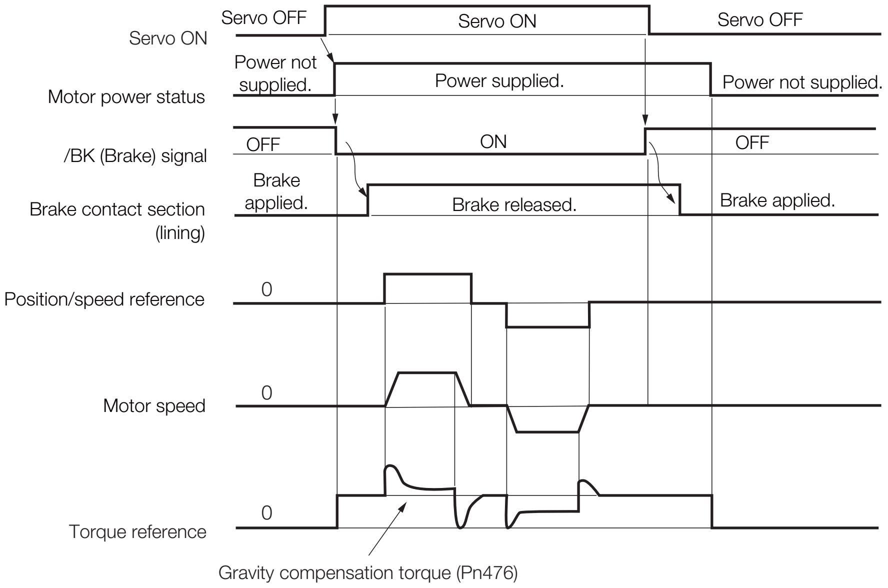
SERVOPACKs with software version 0022 or higher support gravity compensation.



A timing chart for when the moving part is raised then lowered is provided below.

Refer to the following section for details on brake operation timing.

☞ *5.12.1* ***Brake Operating Sequence*** on page 5-32



Required Parameter Settings

The following parameter settings are required to use gravity compensation.

Parameter		Description	When Enabled	Classification
Pn475	n.□□□0 (default setting)	Disable gravity compensation.	After restart	Setup
	n.□□□1	Enable gravity compensation.		

Pn476	Gravity Compensation Torque				Speed Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	-1,000 to 1,000	0.1%	0	Immediately	Tuning

Operating Procedure for Gravity Compensation

Use the following procedure to perform gravity compensation.

1. **Set Pn475 to n.□□□1 (Enable gravity compensation).**
2. **To enable changes to the settings, turn the power supply to the SERVOPACK OFF and ON again.**
3. **Use SigmaWin+ 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.**

8.12.4 Current Control Mode Selection

Current control mode selection reduces high-frequency noise while the Servomotor is being stopped.

To use current control mode selection, use current control mode 2 (set Pn009 to n.□□2□).

Parameter		Meaning	When Enabled	Classification
Pn009	n. □□0□	Use current control mode 1.	After restart	Tuning
	n. □□1□ (default setting)			
	n. □□2□	Use current control mode 2 (low noise).		

Important

If current control mode 2 is selected, the load ratio may increase while the Servomotor is being stopped.

8.12.5 Current Gain Level Setting

You can set the current gain level to reduce noise by adjusting the parameter for current control inside the SERVOPACK according to the speed loop gain (Pn100). The noise level can be reduced by decreasing the current gain level (Pn13D) from its default setting of 2,000% (disabled). However, if the setting is decreased, the level of noise will be lowered, but the response characteristic of the SERVOPACK will also be reduced. Adjust the current gain level within the range that maintains the SERVOPACK response characteristic.

Pn13D	Current Gain Level			Speed Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	100 to 2,000	1%	2,000	Immediately	Tuning

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.

8.12.6 Speed Detection Method Selection

You can use the speed detection method selection to ensure smooth Servomotor speed changes during operation. To ensure smooth motor speed changes during operation, set Pn009 to n.□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.

Parameter		Meaning	When Enabled	Classification
Pn009	n. □0□□ (default setting)	Use speed detection 1.	After restart	Tuning
	n. □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.

8.12.7 Speed Feedback Filter

You can set a first order lag filter for the speed feedback in the speed loop. This ensures smooth changes in the feedback speed to reduce vibration. If a large value is set, it will increase the delay and make response slower.

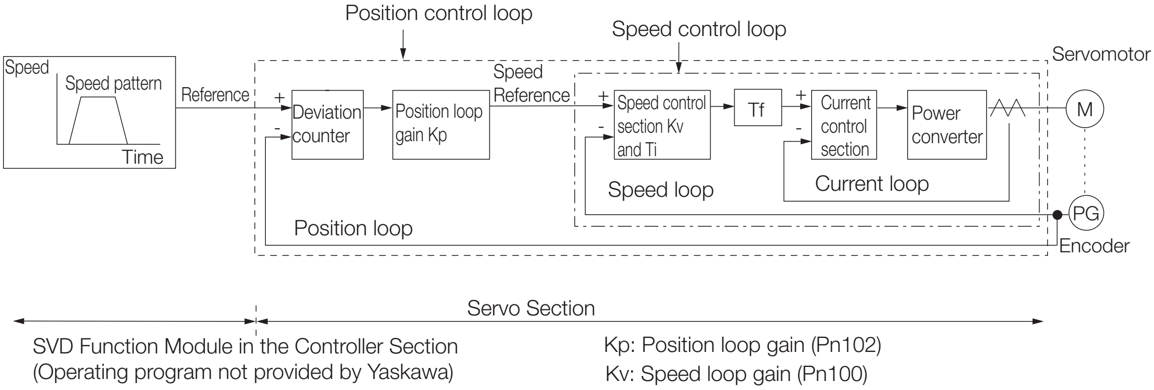
<table>
<tr><td rowspan="3">Pn308</td><td colspan="3">Speed Feedback Filter Time Constant</td><td colspan="2">Speed Position</td></tr>
<tr><td>Setting Range</td><td>Setting Unit</td><td>Default Setting</td><td>When Enabled</td><td>Classification</td></tr>
<tr><td>0 to 65,535 (0.00 ms to 655.35 ms)</td><td>0.01 ms</td><td>0
(0.00 ms)</td><td>Immediately</td><td>Setup</td></tr>
</table>

8.13 Manual Tuning

This section describes manual tuning.

8.13.1 Tuning the Servo Gains

Servo Gains



Kp: Position loop gain (Pn102)
Kv: Speed loop gain (Pn100)
Ti: Speed loop integral time constant (Pn101)
Tf: First stage first torque reference filter time constant (Pn401)

In order to manually tune the servo gains with the SigmaWin+, 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 make preparations, such as using the SigmaWin+ to monitor the output waveforms.

The SERVOPACK has three feedback systems (the position loop, speed loop, and current loop), and the response characteristic must be increased more with the inner loops. If this relationship is not maintained, the response characteristic will suffer and vibration will occur more easily.

A sufficient response characteristic is ensured for the current loop. There is never a need for it to be adjusted by the user.

Outline

You can use manual tuning to set the servo gains in the SERVOPACK to increase the response characteristic of the SERVOPACK. For example, you can reduce the positioning time for position control.

Use manual tuning in the following cases.

- When tuning with autotuning without a host reference or autotuning with a host reference does not achieve the desired results
- When you want to increase the servo gains higher than the gains that resulted from autotuning without a host reference or autotuning with a host reference
- When you want to determine the servo gains and moment of inertia ratio yourself

You start manual tuning either from the default parameter settings or from the gain settings that resulted from autotuning without a host reference or autotuning with a host reference.

Precautions

Vibration may occur while you are tuning the servo gains. We recommend that you enable vibration alarms (Pn310 = n.☐☐☐2) to detect vibration. Refer to the following section for information on vibration detection.

☞ *5.26 Initializing the Vibration Detection Level* on page 5-80

Vibration alarms are not detected for all vibration. Also, an emergency stop method is necessary to stop the machine safely when an alarm occurs. You must provide an emergency stop device and activate it immediately whenever vibration occurs.

Tuning Procedure Example (for Position Control or Speed Control)

Step	Description
1	Adjust the first stage first torque reference filter time constant (Pn401) so that vibration does not occur.
2	Increase the speed loop gain (Pn100) and reduce the speed loop integral time constant (Pn101) as far as possible within the range that does not cause machine vibration.
3	Repeat steps 1 and 2 and return the settings about 10% to 20% from the values that you set.
4	For position control, increase the position loop gain (Pn102) within the range that does not cause vibration.

Information If you greatly change any one servo gain parameter, you must adjust the other parameters again. Do not increase the setting of just one parameter. As a guideline, adjust the settings of the servo gains by approximately 5% each. As a rule, change the servo parameters in the following order.

- To Increase the Response Speed

1. Reduce the torque reference filter time constant.
2. Increase the speed loop gain.
3. Decrease the speed loop integral time constant.
4. Increase the position loop gain.

- To Reduce Response Speed and to Stop Vibration and Overshooting

1. Reduce the position loop gain.
2. Increase the speed loop integral time constant.
3. Decrease the speed loop gain.
4. Increase the torque filter time constant.

Adjusted Servo Gains

You can set the following gains to adjust the response characteristic of the SERVOPACK.

- Pn100: Speed Loop Gain
- Pn101: Speed Loop Integral Time Constant
- Pn102: Position Loop Gain
- Pn401: First Stage First Torque Reference Filter Time Constant

◆ Position Loop Gain

The position loop gain determines the response characteristic of the position loop in the 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			Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 20,000	0.1/s	400	Immediately	Tuning

Information For machines for which a high position loop gain (Pn102) cannot be set, overflow alarms can 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.

$$\text{Pn520} \geq \frac{\text{Maximum feed speed [reference units/s]}}{\text{Pn102} \div 10\ (1/\text{s})} \times 2.0$$

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			Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 1,073,741,823	1 reference unit	5,242,880	Immediately	Setup

◆ Speed Loop Gain

This parameter determines the response characteristic of the speed loop. If the response characteristic of the speed loop is low, it becomes a delay factor for the position loop located outside of the speed loop. This will result in overshooting and vibration in the speed reference. Therefore, setting the speed loop gain as high as possible within the range that will not cause the machine system to vibrate will produce a stable servo system with a good response characteristic.

Pn100	Speed Loop Gain			Speed Position	Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 20,000	0.1 Hz	400	Immediately	Tuning

$$\text{Setting of Pn103} = \frac{\text{Load moment of inertia at motor shaft } (J_L)}{\text{Servomotor moment of inertia } (J_M)} \times 100(\%)$$

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 Position	Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 20,000	1%	100	Immediately	Tuning

◆ Speed Loop Integral Time Constant

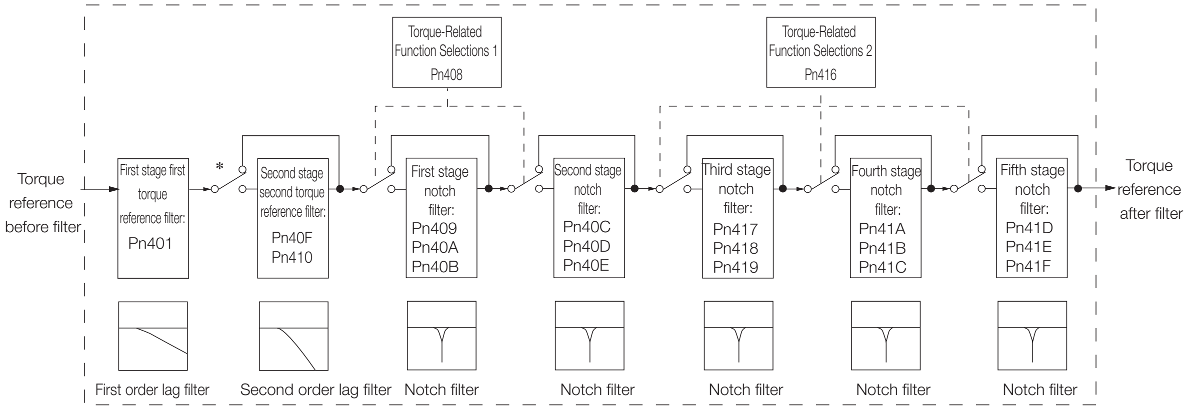
To enable response to even small inputs, the speed loop has an integral element. The integral element becomes a delay factor in the servo system. If the time constant is set too high, overshooting will occur, positioning settling time will increase, and the response characteristic will suffer.

Pn101	Speed Loop Integral Time Constant			Speed Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	15 to 51,200	0.01 ms	2,000	Immediately	Tuning

◆ Torque Reference Filter

As shown in the following diagram, the torque reference filter contains a first order lag filter and notch filters arranged in series, and each filter operates independently.

The notch filters can be enabled and disabled with Pn408 = n.□X□X and Pn416 = n.□XXX.



* The second stage second torque reference filter is disabled when Pn40F is set to 5,000 (default setting) and it is enabled when Pn40F is set to a value lower than 5,000.

■ Torque Reference Filter

If you suspect that machine vibration is being caused by the Servo Drive, try adjusting the torque reference filter time constant. This may stop the vibration. The lower the value, the better the control response characteristic will be, but there may be a limit depending on the machine conditions.

Pn401	First Stage First Torque Reference Filter Time Constant			Speed Position	Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 65,535	0.01 ms	100	Immediately	Tuning
Pn40F	Second Stage Second Torque Reference Filter Frequency			Speed Position	Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	100 to 5,000	1 Hz	5,000*	Immediately	Tuning
Pn410	Second Stage Second Torque Reference Filter Q Value			Speed Position	Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	50 to 100	0.01	50	Immediately	Tuning

* The filter is disabled if you set the parameter to 5,000

■ Notch filter

The notch filter can eliminate specific frequency elements generated by the vibration of sources such as resonance of the shaft of a ball screw.

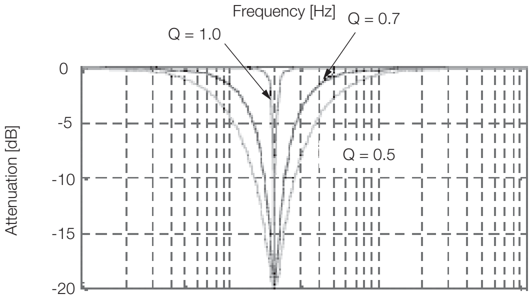
The notch filter puts a notch in the gain curve at the specific vibration frequency (called the notch frequency). The frequency components near the notch frequency can be reduced or removed with a notch filter.

Notch filters are set with three parameters for the notch filter frequency, notch filter Q value, and notch filter depth. This section describes the notch filter Q value and notch filter depth.

• Notch Filter Q Value

The setting of the notch filter Q value determines the width of the frequencies that are filtered for the notch filter frequency. The width of the notch changes with the notch filter Q value. The larger the notch filter Q value is, the steeper the notch is and the narrower the width of frequencies that are filtered is.

The notch filter frequency characteristics for different notch filter Q values are shown below.



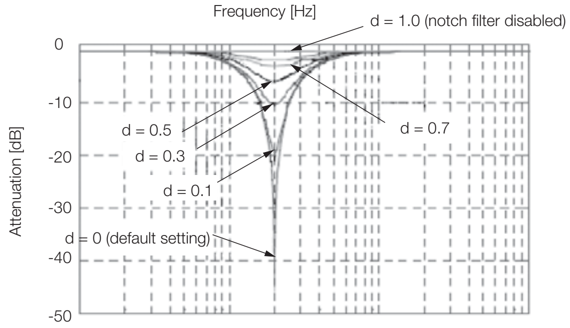
Note: The above notch filter frequency characteristics are based on calculated values and may be different from actual characteristics.

• Notch Filter Depth

The setting of the notch filter depth determines the depth of the frequencies that are filtered for the notch filter frequency. The depth of the notch changes with the notch filter depth. The smaller the notch filter depth is, the deeper the notch is, increasing the effect of vibration suppression. However, if the value is too small, vibration can actually increase.

The notch filter is disabled if the notch filter depth, d, is set to 1.0 (i.e., if Pn419 is set to 1,000).

The notch filter frequency characteristics for different notch filter depths are shown below.



Note: The above notch filter frequency characteristics are based on calculated values and may be different from actual characteristics.

You can enable or disable the notch filter with Pn408 and Pn416.

Parameter		Meaning	When Enabled	Classification
Pn408	n.□□□0 (default setting)	Disable first stage notch filter.	Immediately	Setup
	n.□□□1	Enable first stage notch filter.		
	n.□0□□ (default setting)	Disable second stage notch filter.		
	n.□1□□	Enable second stage notch filter.		
Pn416	n.□□□0 (default setting)	Disable third stage notch filter.		
	n.□□□1	Enable third stage notch filter.		
	n.□□0□ (default setting)	Disable fourth stage notch filter.		
	n.□□1□	Enable fourth stage notch filter.		
	n.□0□□ (default setting)	Disable fifth stage notch filter.		
	n.□1□□	Enable fifth stage notch filter.		

Set the machine vibration frequencies in the notch filter parameters.

Pn409	First Stage Notch Filter Frequency				Speed Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	50 to 5,000	1 Hz	5000	Immediately	Tuning
Pn40A	First Stage Notch Filter Q Value				Speed Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	50 to 1,000	0.01	70	Immediately	Tuning
Pn40B	First Stage Notch Filter Depth				Speed Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 1,000	0.001	0	Immediately	Tuning
Pn40C	Second Stage Notch Filter Frequency				Speed Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	50 to 5,000	1 Hz	5,000	Immediately	Tuning
Pn40D	Second Stage Notch Filter Q Value				Speed Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	50 to 1,000	0.01	70	Immediately	Tuning
Pn40E	Second Stage Notch Filter Depth				Speed Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 1,000	0.001	0	Immediately	Tuning
Pn417	Third Stage Notch Filter Frequency				Speed Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	50 to 5,000	1 Hz	5,000	Immediately	Tuning
Pn418	Third Stage Notch Filter Q Value				Speed Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	50 to 1,000	0.01	70	Immediately	Tuning
Pn419	Third Stage Notch Filter Depth				Speed Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 1,000	0.001	0	Immediately	Tuning
Pn41A	Fourth Stage Notch Filter Frequency				Speed Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	50 to 5,000	1 Hz	5,000	Immediately	Tuning
Pn41B	Fourth Stage Notch Filter Q Value				Speed Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	50 to 1,000	0.01	70	Immediately	Tuning

Continued on next page.

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Pn41C	Fourth Stage Notch Filter Depth			Speed	Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 1,000	0.001	0	Immediately	Tuning
Pn41D	Fifth Stage Notch Filter Frequency			Speed	Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	50 to 5,000	1 Hz	5,000	Immediately	Tuning
Pn41E	Fifth Stage Notch Filter Q Value			Speed	Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	50 to 1,000	0.01	70	Immediately	Tuning
Pn41F	Fifth Stage Notch Filter Depth			Speed	Position Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 1,000	0.001	0	Immediately	Tuning

Important

- Do not set notch filter frequencies (Pn409, Pn40C, Pn417, Pn41A, and Pn41D) that are close to the speed loop's response frequency. Set a frequency that is at least four times the speed loop gain (Pn100). (However, Pn103 (Moment of Inertia Ratio) must be set correctly. If the setting is not correct, vibration may occur and the machine may be damaged.
- Change the notch filter frequencies (Pn409, Pn40C, Pn417, Pn41A, and Pn41D) only while the Servomotor is stopped. Vibration may occur if a notch filter frequency is changed during operation.

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+ to monitor operating conditions. Even if the status is stable while the Servomotor is stopped, an unstable condition may occur when an operation reference is input. Therefore, input operation references and adjust the servo gains as you operate the Servomotor.

Stable gain: Settings that provide a good balance between parameters.

However, if the load moment of inertia is large and the machine system contains elements prone to vibration, you must sometimes use a setting that is somewhat higher to prevent the machine from vibrating.

Critical gain: Settings for which the parameters affect each other

Depending on the machine conditions, overshooting and vibration may occur and operation may not be stable. If the critical gain condition expressions are not met, operation will become more unstable, and there is a risk of abnormal motor shaft vibration and round-trip operation with a large amplitude. Always stay within the critical gain conditions.

If you use the torque reference filter, second torque reference filter, and notch filters together, the interference between the filters and the speed loop gain will be superimposed. Allow leeway in the adjustments.

Important

The following adjusted value guidelines require that the setting of Pn103 (Moment of Inertia Ratio) is correctly set for the actual machine.

◆ When Pn10B = n.□□0□ (PI Control)

Guidelines are given below for gain settings 1.

The same guidelines apply to gain settings 2 (Pn104, Pn105, Pn106, and Pn412).

- Speed Loop Gain (Pn100 [Hz]) and Position Loop Gain (Pn102 [/s])
  Stable gain: Pn102 [/s] ≤ 2π × Pn100/4 [Hz]
  Critical gain: Pn102 [/s] < 2π × Pn100 [Hz]

- Speed Loop Gain (Pn100 [Hz]) and Speed Loop Integral Time Constant (Pn101 [ms])
  Stable gain: Pn101 [ms] ≥ 4,000/(2π × Pn100 [Hz])
  Critical gain: Pn101 [ms] > 1,000/(2π × Pn100 [Hz])

- Speed Loop Gain (Pn100 [Hz]) and First Stage First Torque Reference Filter Time Constant (Pn401 [ms])
  Stable gain: Pn401 [ms] ≤ 1,000/(2π × Pn100 [Hz] × 4)
  Critical gain: Pn401 [ms] < 1,000/(2π × Pn100 [Hz] × 1)

- Speed Loop Gain (Pn100 [Hz]) and Second Stage Second Torque Reference Filter Frequency (Pn40F [Hz])
  Critical gain: Pn40F [Hz] > 4 × Pn100 [Hz]

  Note: Set the second stage second torque reference filter Q value (Pn410) to 0.70.

- Speed Loop Gain (Pn100 [Hz]) and First Stage Notch Filter Frequency (Pn409 [Hz]) (or Second Stage Notch Filter Frequency (Pn40C [Hz]))
  Critical gain: Pn409 [Hz] > 4 × Pn100 [Hz]

- Speed Loop Gain (Pn100 [Hz]) and Speed Feedback Filter Time Constant (Pn308 [ms])
  Stable gain: Pn308 [ms] ≤ 1,000/(2π × Pn100 [Hz] × 4)
  Critical gain: Pn308 [ms] < 1,000/(2π × Pn100 [Hz] × 1)

◆ When Pn10B = n.□□0□ (I-P Control)

Guidelines are given below for gain settings 1.

The same guidelines apply to gain settings 2 (Pn104, Pn105, Pn106, and Pn412).

For I-P control, the relationships between the speed loop integral time constant, speed loop gain, and position loop gain are different from the relationships for PI control. The relationship between other servo gains is the same as for PI control.

- Speed Loop Gain (Pn100 [Hz]) and Speed Loop Integral Time Constant (Pn101 [ms])
  Stable gain: Pn100 [Hz] ≥ 320/Pn101 [ms]

- Position Loop Gain (Pn102 [/s]) and Speed Loop Integral Time Constant (Pn101 [ms])
  Stable gain: Pn102 [/s] ≤ 320/Pn101 [ms]

Information **Selecting the Speed Loop Control Method (PI Control or I-P Control)**
Usually, I-P control is effective for high-speed positioning and high-speed, high-precision processing applications. With I-P control, you can use a lower position loop gain than for PI control to reduce the positioning time and reduce arc radius reduction. However, if you can use mode switching to change to proportional control to achieve the desired application, then using PI control would be the normal choice.

◆ Decimal Points in Parameter Settings

For the SGD7W SERVOPACKs, decimal places are given for the settings of parameters on the Digital 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.

Example
- Speed Loop Gain (Pn100 [Hz]) and Speed Loop Integral Time Constant (Pn101 [ms])
  Stable gain: Pn101 [ms] ≥ 4,000/(2π × Pn100 [Hz]), therefore
  If Pn100 = 40.0 [Hz], then Pn101 = 4,000/(2π × 40.0) ≅ 15.92 [ms].

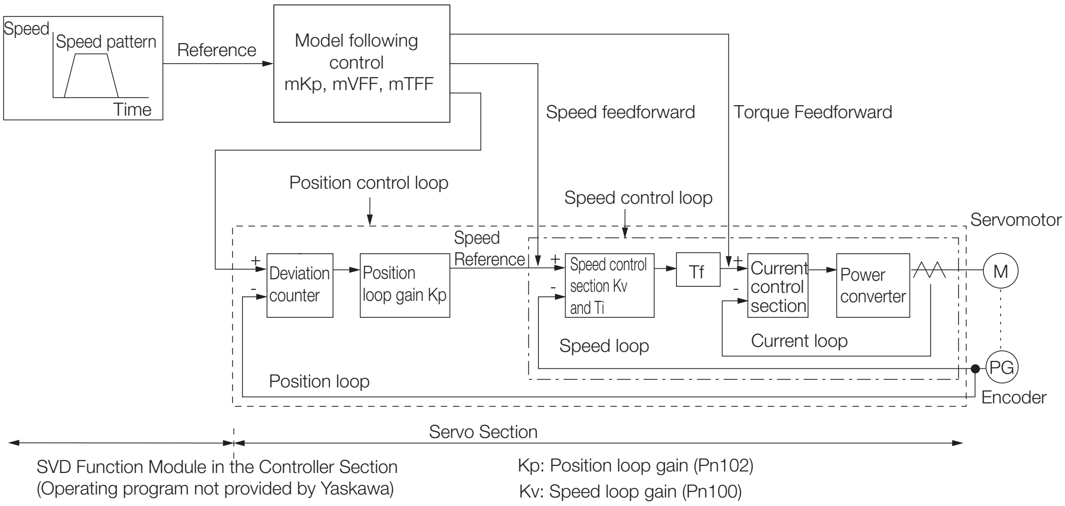
Model Following Control

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: Position loop gain (Pn102)
Kv: Speed loop gain (Pn100)
Ti: Speed loop integral time constant (Pn101)
Tf: First stage first torque reference filter time constant (Pn401)
mKp: Model following control gain (Pn141)
mTFF: Model following control bias in the forward direction (Pn143)
Model following control bias in the reverse direction (Pn144)
mVFF: Model following control speed feedforward compensation (Pn147)

◆ 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. ☞ *8.12.2 Friction Compensation* on page 8-68
2	Adjust the servo gains. Refer to the following section for an example procedure. ☞ *Tuning Procedure Example (for Position Control or Speed Control)* on page 8-74 Note: 1. Set the moment of inertia ratio (Pn103) as accurately as possible. 2. Refer to the guidelines for manually tuning the servo gains and set a stable gain for the position loop gain (Pn102). ☞ *Guidelines for Manually Tuning Servo Gains* on page 8-79
3	Increase the model following control gain (Pn141) as much as possible within the range in which overshooting and vibration do not occur.
4	If overshooting occurs or if the response is different for forward and reverse operation, fine-tune model following control with the following settings: model following control bias in the forward direction (Pn143), model following control bias in the reverse direction (Pn144), and model following control speed feedforward compensation (Pn147).

◆ Related Parameters

Next we will describe the following parameters that are used for model following control.

- Pn140 (Model Following Control-Related Selections)
- Pn141 (Model Following Control Gain)
- Pn143 (Model Following Control Bias in the Forward Direction)
- Pn144 (Model Following Control Bias in the Reverse Direction)
- Pn147 (Model Following Control Speed Feedforward Compensation)

■ Model Following Control-Related Selections

Set Pn140 = n.□□□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 use vibration suppression (Pn140 = n.□□1□ or Pn140 = n.□□2□), always set Pn140 to n.□□□1 (Use model following control).

Parameter		Function	When Enabled	Classification
Pn140	n.□□□0 (default setting)	Do not use model following control.	Immediately	Tuning
	n.□□□1	Use model following control.		
	n.□□0□ (default setting)	Do not perform vibration suppression.		
	n.□□1□	Perform vibration suppression for a specific frequency.		
	n.□□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 Position				
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 20,000	0.1/s	500	Immediately	Tuning

Information For machines for which a high model following control gain cannot be set, the size of the position deviation in model following control will be determined by the setting of the model following control gain. For a machine with low rigidity, in which a high model following control gain cannot be set, position deviation overflow alarms may occur during high-speed operation. If that is the case, you can increase the setting of the following parameter to increase the level for alarm detection.
Use the following conditional expression for reference in determining the setting.

$$\text{Pn520} \geq \frac{\text{Maximum feed speed [reference units/s]}}{\text{Pn141/10 [1/s]}} \times 2.0$$

Pn520	Position Deviation Overflow Alarm Level Position				
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 1,073,741,823	1 reference unit	5,242,880	Immediately	Setup

■ 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			Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	0.1%	1,000	Immediately	Tuning
Pn144	Model Following Control Bias in the Reverse Direction			Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	0.1%	1,000	Immediately	Tuning

■ Model Following Control Speed Feedforward Compensation

If overshooting occurs even after you adjust the model following control gain, model following control bias in the forward direction, and model following control bias in the reverse direction, you may be able to improve performance by setting the following parameter.

If you decrease the settings, the response characteristic will be lowered but overshooting will be less likely to occur.

Pn147	Model Following Control Speed Feedforward Compensation			Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	0.1%	1,000	Immediately	Tuning

■ Model Following Control Type Selection

When you enable model following control, you can select the model following control type. Normally, set Pn14F to n.□□□1 (Use model following control type 2) (default setting). If compatibility with previous models is required, set Pn14F to n.□□□0 (Use model following control type 1).

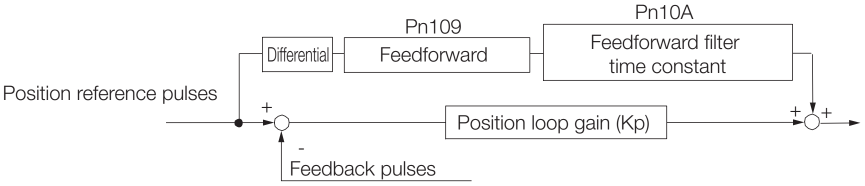
Parameter		Meaning	When Enabled	Classification
Pn14F	n.□□□0	Use model following control type 1.	After restart	Tuning
	n.□□□1 (default setting)	Use model following control type 2.		

8.13.2 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-7-Series SERVOPACKs.

Feedforward

The feedforward function applies feedforward compensation to position control to shorten the positioning time.



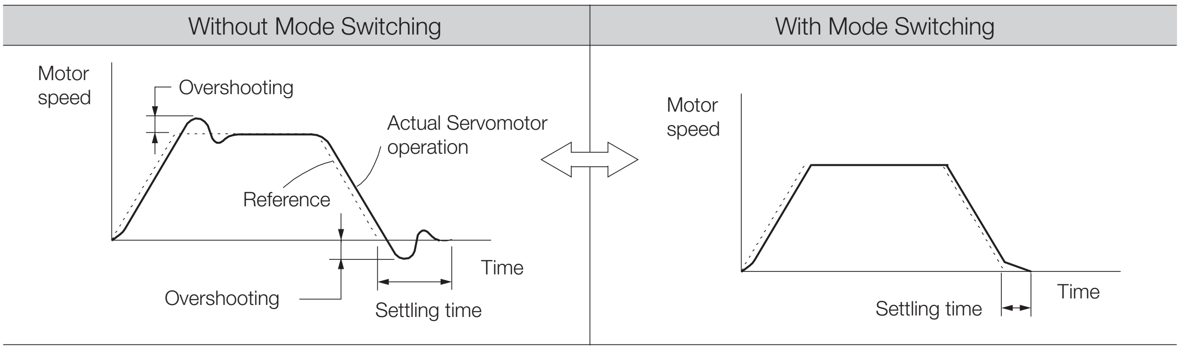
Pn109	Feedforward			Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 100	1%	0	Immediately	Tuning

Pn10A	Feedforward Filter time Constant			Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 6,400	0.01 ms	0	Immediately	Tuning

Note: If you set the feedforward value too high, the machine may vibrate. As a guideline, use a setting of 80% or less.

Mode Switching (Changing between Proportional and PI Control)

You can use mode switching to automatically change between proportional control and PI control.
Overshooting caused by acceleration and deceleration can be suppressed and the settling time can be reduced by setting the switching condition and switching levels.



◆ Related Parameters

Select the switching condition for mode switching with Pn10B = n.□□□X.

Parameter		Mode Switching Selection	Parameter That Sets the Level		When Enabled	Classification
			Rotary Servomotor	Linear Servomotor		
Pn10B	n.□□□0 (default setting)	Use the internal torque reference as the condition.	Pn10C		Immediately	Setup
	n.□□□1	Use the speed reference as the condition.	Pn10D	Pn181		
	n.□□□2	Use the acceleration reference 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	Position
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 800	1%	200	Immediately	Tuning
Pn10D	Mode Switching Level for Speed Reference			Speed	Position
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 min^{-1}	0	Immediately	Tuning
Pn10E	Mode Switching Level for Acceleration			Speed	Position
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 30,000	1 min^{-1}/s	0	Immediately	Tuning
Pn10F	Mode Switching Level for Position Deviation				Position
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 reference unit	0	Immediately	Tuning

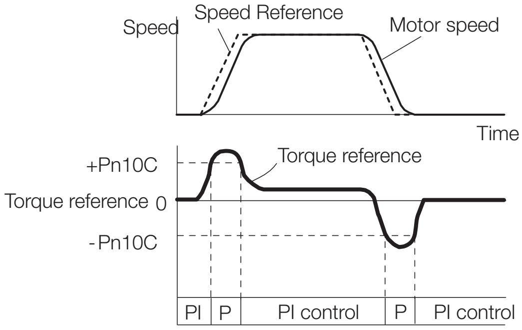
- Linear Servomotors

Pn10C	Mode Switching Level for Force Reference			Speed	Position
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 800	1%	200	Immediately	Tuning
Pn181	Mode Switching Level for Speed Reference			Speed	Position
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 mm/s	0	Immediately	Tuning
Pn182	Mode Switching Level for Acceleration			Speed	Position
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 30,000	1 mm/s^2	0	Immediately	Tuning
Pn10F	Mode Switching Level for Position Deviation				Position
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 reference unit	0	Immediately	Tuning

■ Using the Torque Reference as the Mode Switching Condition (Default Setting)

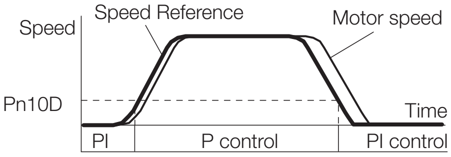
When the torque reference equals or exceeds the torque set for the mode switching level for torque reference (Pn10C), the speed loop is changed to proportional control.

The default setting for the torque reference level is 200%.

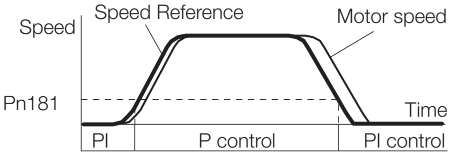


■ Using the Speed Reference as the Mode Switching Condition

- Rotary Servomotors
  When the speed reference equals or exceeds the speed set for the mode switching level for a speed reference (Pn10D), the speed loop is changed to proportional control.

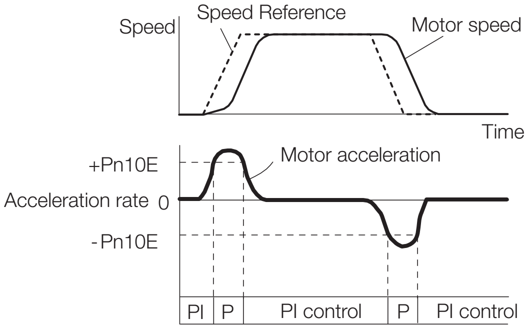


- Linear Servomotors
  When the speed reference equals or exceeds the speed set for the mode switching level for a speed reference (Pn181), the speed loop is changed to proportional control.

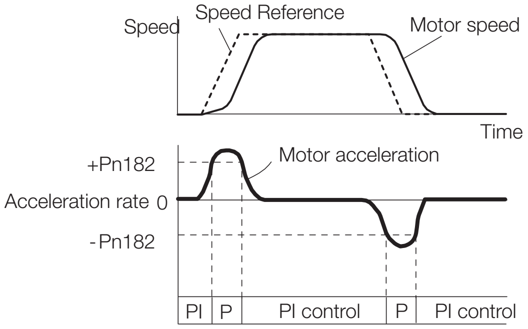


■ Using the Acceleration as the Mode Switching Condition

- Rotary Servomotors
  When the speed reference equals or exceeds the acceleration rate set for the mode switching level for acceleration (Pn10E), the speed loop is changed to proportional control.



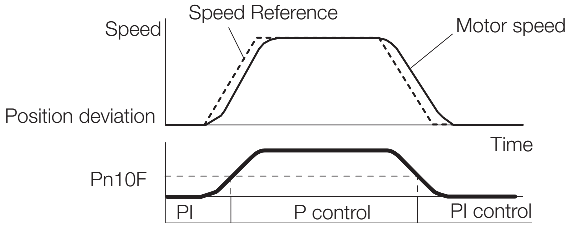
- Linear Servomotors
  When the speed reference equals or exceeds the acceleration rate set for the mode switching level for acceleration (Pn182), the speed loop is changed to proportional control.



◆ Using the Position Deviation as the Mode Switching Condition

When the position deviation equals or exceeds the value set for the mode switching level for position deviation (Pn10F), the speed loop is changed to proportional control.

This setting is enabled only for position control.



Position Integral

The position integral is the integral function of the position loop. It is used for the electronic cams and electronic shafts when using the SERVOPACK.

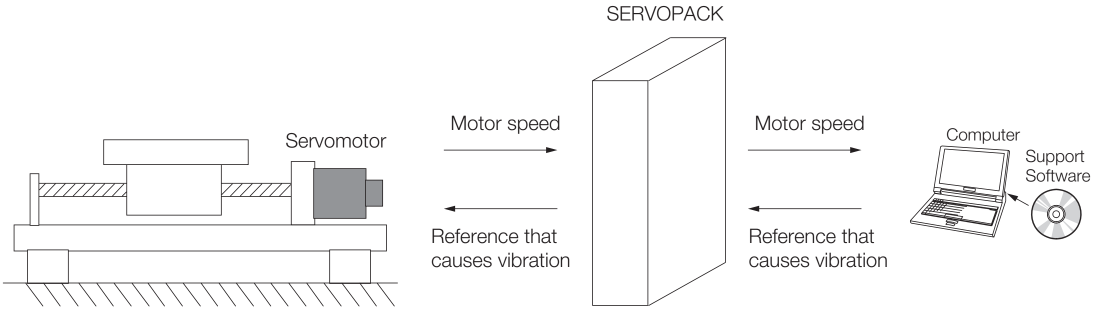
Pn11F	Position Integral Time Constant			Position	
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 50,000	0.1 ms	0	Immediately	Tuning

8.14 Diagnostic Tools

8.14.1 Mechanical Analysis

Overview

You can connect the SERVOPACK to a computer to measure the frequency characteristics of the machine. This allows you to measure the frequency characteristics of the machine without using a measuring instrument.



The Servomotor is used to cause machine vibration and then the speed frequency characteristics for the motor torque are measured. The measured frequency characteristics can be used to determine the machine resonance.

You determine the machine resonance for use in servo tuning and as reference for considering changes to the machine. The performance of the servo cannot be completely utilized depending on the rigidity of the machine. You may need to consider making changes to the machine. The information can also be used as reference for servo tuning to help you adjust parameters, such as the servo rigidity and torque filter time constant.

You can also use the information to set parameters, such as the notch filters.

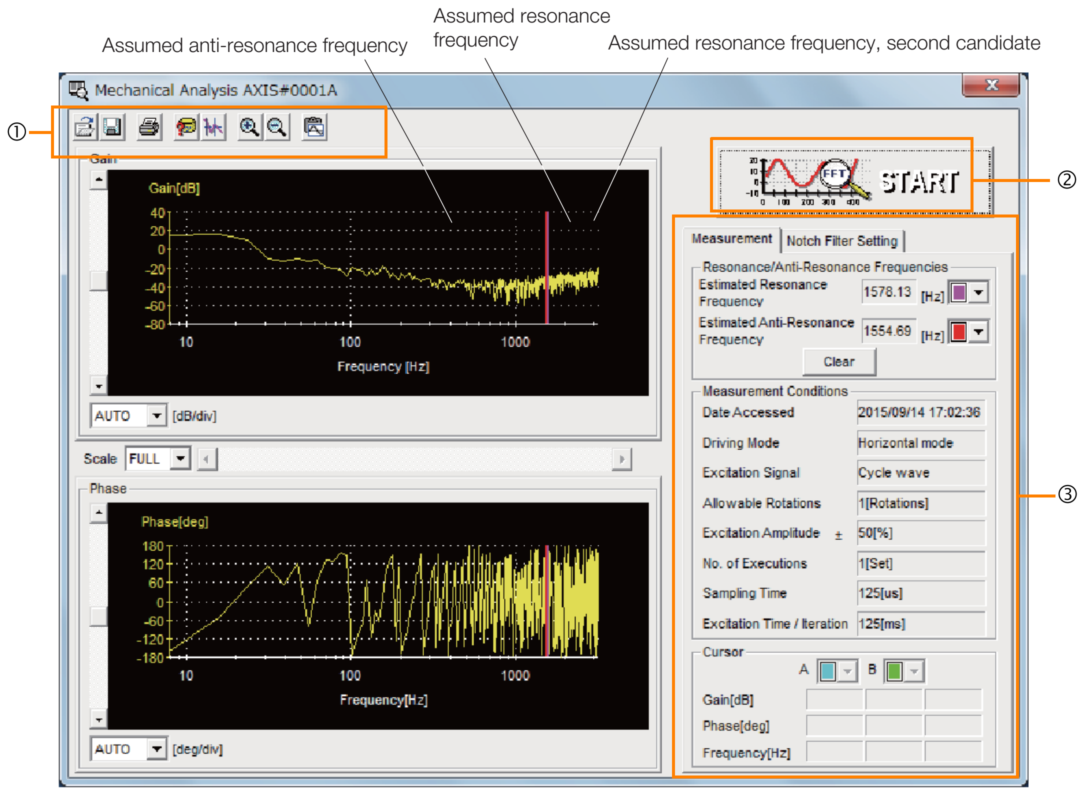
⚠ WARNING

- Mechanical analysis requires operating the Servomotor and therefore presents hazards. Before you execute mechanical analysis, check the information provided in the SigmaWin+ operating manual.

Frequency Characteristics

The Servomotor is used to cause the machine to vibrate and the frequency characteristics from the torque to the motor speed are measured to determine the machine characteristics. For a normal machine, the resonance frequencies are clear when the frequency characteristics are plotted on graphs with the gain and phase (Bode plots). The Bode plots show the size (gain) of the response of the machine to which the torque is applied, and the phase delay (phase) in the response for each frequency. Also, the machine resonance frequency can be determined from the maximum frequency of the valleys (anti-resonance) and peaks (resonance) of the gain and the phase delay.

For a Servomotor without a load or for a rigid mechanism, the gain and phase change gradually in the Bode plots.


Assumed anti-resonance frequency
Assumed resonance frequency
Assumed resonance frequency, second candidate

Resonance/Anti-Resonance Frequencies
Estimated Resonance Frequency: 1578.13 [Hz]
Estimated Anti-Resonance Frequency: 1554.69 [Hz]

Measurement Conditions
Date Accessed: 2015/09/14 17:02:36
Driving Mode: Horizontal mode
Excitation Signal: Cycle wave
Allowable Rotations: 1[Rotations]
Excitation Amplitude ±: 50[%]
No. of Executions: 1[Set]
Sampling Time: 125[us]
Excitation Time / Iteration: 125[ms]

①Toolbar
② **START** Button
  Click the **START** Button to start analysis.
③ Measurement and Notch Filter Setting Tab Pages
  Measurement Tab Page: Displays detailed information on the results of analysis.
  Notch Filter Setting Tab Page: Displays the notch filter frequencies. You can set these values in the parameters.

8.14.2 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.

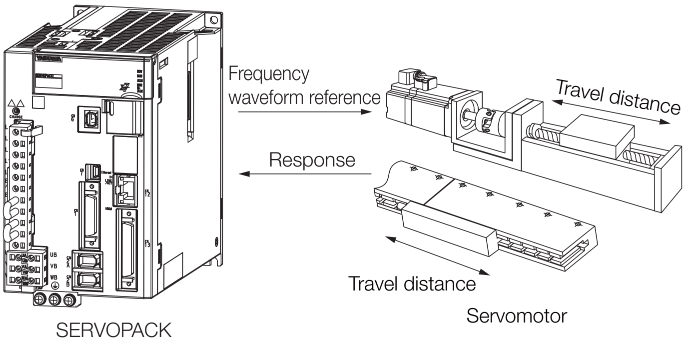
Execute Easy FFT after the servo is turned OFF if operation of the SERVOPACK results in high-frequency noise and vibration.

⚠ WARNING

- **Never touch the Servomotor or machine during execution of Easy FFT. Doing so may result in injury.**

⚠ 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.**



Easy FFT is built into the SERVOPACK for compatibility with previous products. Normally use autotuning without a host reference for tuning.

Preparations

Always check the following before you execute Easy FFT.

- The parameters must not be write prohibited.
- The main circuit power supply must be ON.
- The test without a motor function must be disabled (Pn00C = n.□□□0).
- There must be no alarms.
- The servo must be OFF.
- There must be no overtravel.
- An external reference must not be input.

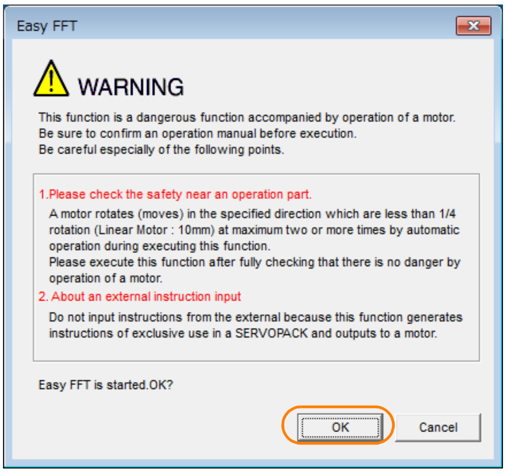
Operating Procedure

Use the following procedure for Easy FFT.

1. Click the **Servo Drive** Button in the workspace of the Main Window of the SigmaWin+.

2. Select **Easy FFT** in the Menu Dialog Box.
   The EasyFFT Dialog Box will be displayed.
   Click the **Cancel** Button to cancel Easy FFT. You will return to the Main Window.

3. Click the **OK** Button.



Easy FFT

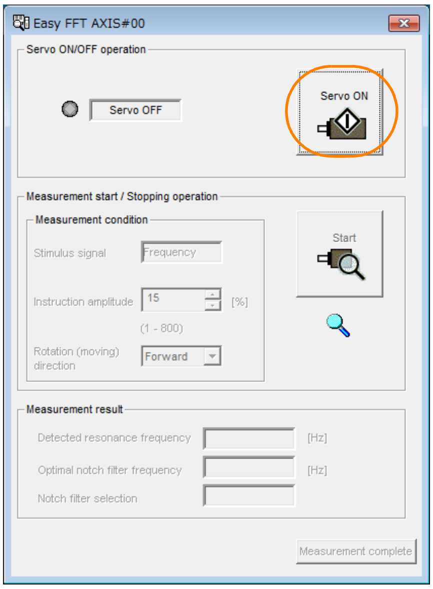
WARNING

This function is a dangerous function accompanied by operation of a motor.
Be sure to confirm an operation manual before execution.
Be careful especially of the following points.

1.Please check the safety near an operation part.
A motor rotates (moves) in the specified direction which are less than 1/4 rotation (Linear Motor : 10mm) at maximum two or more times by automatic operation during executing this function.
Please execute this function after fully checking that there is no danger by operation of a motor.
2. About an external instruction input
Do not input instructions from the external because this function generates instructions of exclusive use in a SERVOPACK and outputs to a motor.

Easy FFT is started.OK?

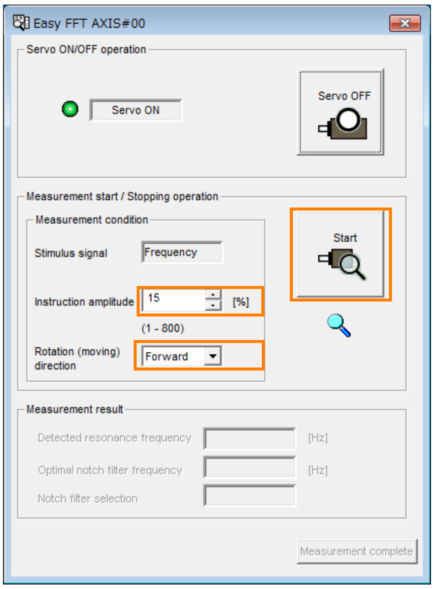
4. Click the **Servo ON** Button.



Easy FFT AXIS#00

Stimulus signal: Frequency
Instruction amplitude: 15 [%] (1 - 800)
Rotation (moving) direction: Forward

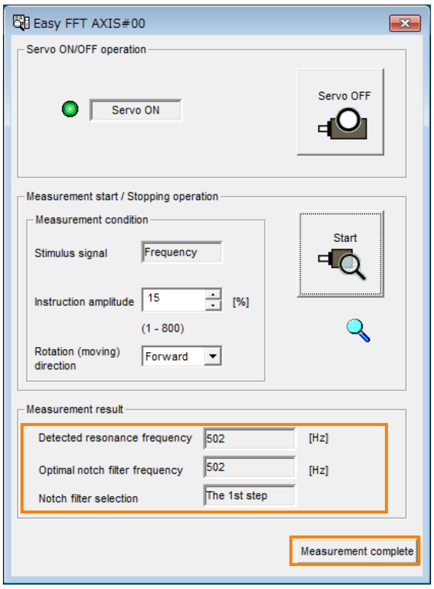
5. Select the instruction (reference) amplitude and the rotation direction in the **Measurement condition** Area, and then click the **Start** Button.
   The Servomotor shaft will rotate and measurements will start.



Stimulus signal: Frequency
Instruction amplitude: 15 [%] (1 - 800)
Rotation (moving) direction: Forward

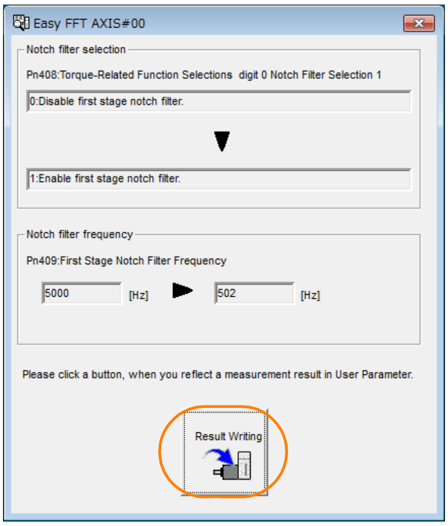
When measurements have been completed, the measurement results will be displayed.

6. Check the results in the **Measurement result** Area and then click the **Measurement complete** Button.



Stimulus signal: Frequency
Instruction amplitude: 15 [%] (1 - 800)
Rotation (moving) direction: Forward
Detected resonance frequency: 502 [Hz]
Optimal notch filter frequency: 502 [Hz]
Notch filter selection: The 1st step

7. Click the **Result Writing** Button if you want to set the measurement results in the parameters.



Pn408:Torque-Related Function Selections digit 0 Notch Filter Selection 1

0:Disable first stage notch filter. → 1:Enable first stage notch filter.

Pn409:First Stage Notch Filter Frequency

5000 [Hz] → 502 [Hz]

Please click a button, when you reflect a measurement result in User Parameter.

This concludes the procedure to set up Easy FFT.

Related Parameters

The following parameters are automatically adjusted or used as reference when you execute Easy FFT.

Do not change the settings of these parameters during execution of Easy FFT.

Parameter	Name	Automatic Changes
Pn408	Torque-Related Function Selections	Yes
Pn409	First Stage Notch Filter Frequency	Yes
Pn40A	First Stage Notch Filter Q Value	No
Pn40C	Second Stage Notch Filter Frequency	Yes
Pn40D	Second Stage Notch Filter Q Value	No
Pn456	Sweep Torque Reference Amplitude	No

Yes: The parameter is automatically set.

No: The parameter is not automatically set, but the setting is read during execution.

Monitoring

9

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

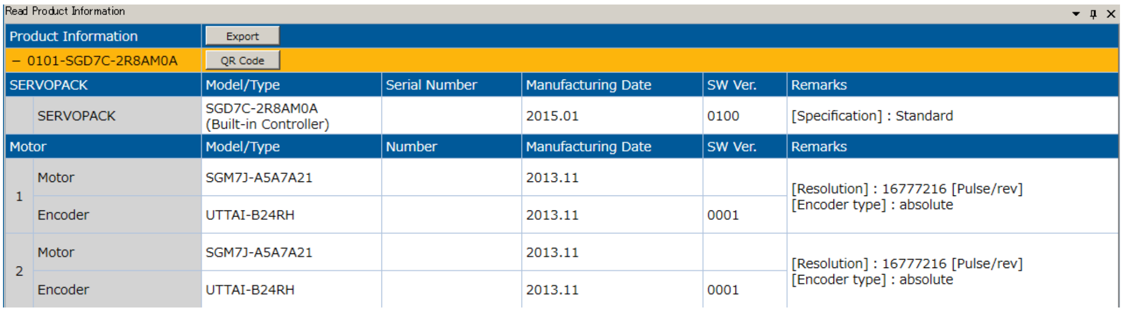
The items that you can monitor on the Product Information Dialog Box in the SigmaWin+ are listed below.

Monitor Items	
Information on SERVOPACKs	• SERVOPACK model • SERVOPACK serial number • SERVOPACK manufacturing date • SERVOPACK software version • SERVOPACK remarks (e.g., specifications)
Information on Servomotors	• Servomotor model • Servomotor serial number • Servomotor manufacturing date • Servomotor remarks (e.g., specifications)
Information on Encoders	• Encoder model • Encoder serial number • Encoder manufacturing date • Encoder software version • Encoder remarks (e.g., specifications)

9.1.2 Operating Procedure

Use the following procedure to display the product information for a Servo Drive.

- Select **Read Product Information** from the Menu Dialog Box of the SigmaWin+.
  The Product Information Dialog Box will be displayed.



− 0101-SGD7C-2R8AM0A

SERVOPACK		Model/Type	Serial Number	Manufacturing Date	SW Ver.	Remarks
	SERVOPACK	SGD7C-2R8AM0A (Built-in Controller)		2015.01	0100	[Specification] : Standard

Motor		Model/Type	Number	Manufacturing Date	SW Ver.	Remarks
1	Motor	SGM7J-A5A7A21		2013.11		[Resolution] : 16777216 [Pulse/rev] [Encoder type] : absolute
	Encoder	UTTAI-B24RH		2013.11	0001	
2	Motor	SGM7J-A5A7A21		2013.11		[Resolution] : 16777216 [Pulse/rev] [Encoder type] : absolute
	Encoder	UTTAI-B24RH		2013.11	0001	

Important

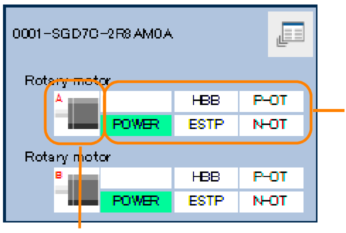
To check the version, first set the module configuration definition.

9.2 Monitoring SERVOPACK Status

9.2.1 Servo Drive Status

Use the following procedure to display the Servo Drive status.

- Start the SigmaWin+. The Servo Drive status will be automatically displayed when you go online with a SERVOPACK.



The Servo Drive status is displayed.

The Servomotor type is displayed.

9.2.2 Monitoring Operation, Status, and I/O

Items That You Can Monitor

The items that you can monitor on the Operation Pane, Status Pane, and I/O Pane are listed below.

- Operation Pane

Monitor Items	
• Motor Speed • Speed Reference • Internal Torque Reference • Angle of Rotation 1 (Number of encoder pulses from origin within one encoder rotation) • Angle of Rotation 2 (angle from origin within one encoder rotation) • Input Reference Pulse Speed • Deviation Counter (Position Deviation) • Cumulative Load • Regenerative Load	• Power Consumption • Consumed Power • Cumulative Power Consumption • DB Resistor Consumption Power • Absolute Encoder Multiturn Data • Absolute Encoder Position within One Rotation • Absolute Encoder (Lower) • Absolute Encoder (Upper) • Input Reference Pulse Counter • Feedback Pulse Counter • Total Operating Time

- Status Pane

Monitor Items	
• Main Circuit • Encoder (PGRDY) • Motor Power (Request) • Motor Power ON • Dynamic Brake (DB) • Rotation (Movement) Direction • Mode Switch • Speed Reference (V-Ref) • Torque Reference (T-Ref)	• Position Reference (PULS) • Position Reference Direction • Surge Current Limiting Resistor Short Relay • Regenerative Transistor • Regenerative Error Detection • AC Power ON • Overcurrent • Origin Not Passed

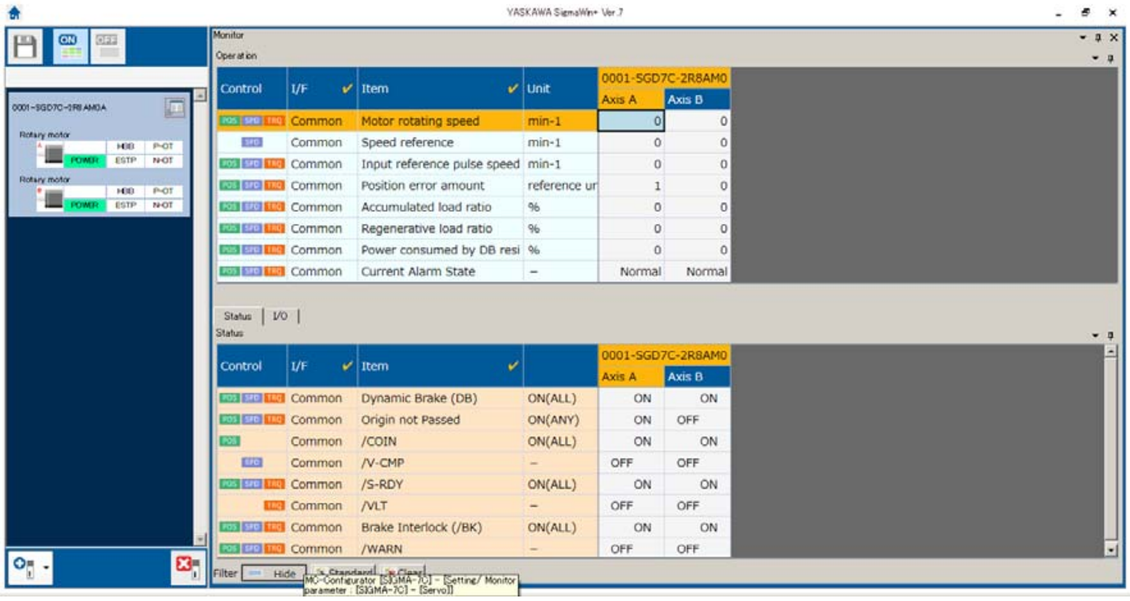
- I/O Pane

Monitor Items			
Input Signal Status	• P-OT (Forward Drive Prohibit Input Signal) • N-OT (Reverse Drive Prohibit Input Signal) • /P-CL (Forward External Torque Limit Signal) • /N-CL (Reverse External Torque Limit 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)	Output Signal Status	• 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 Signal) • /VLT (Speed Limit Detection Output Signal) • /BK (Brake Output Signal) • /WARN (Warning Output Signal) • /NEAR (Near Output Signal) • /PM (Preventative Maintenance Output Signal)

Operating Procedure

Use the following procedure to display the Operation Monitor, Status Monitor, and I/O Monitor for the SERVOPACK.

- Select **Monitor** in the SigmaWin+ Menu Dialog Box.
  The Operation Pane, Status Pane, and I/O Pane will be displayed in the Monitor Window.



Operation

Control	I/F	Item	Unit	0001-SGD7C-2R8AM0	
				Axis A	Axis B
POS SPD TRQ	Common	Motor rotating speed	min-1	0	0
SPD	Common	Speed reference	min-1	0	0
POS SPD TRQ	Common	Input reference pulse speed	min-1	0	0
POS SPD TRQ	Common	Position error amount	reference ur	1	0
POS SPD TRQ	Common	Accumulated load ratio	%	0	0
POS SPD TRQ	Common	Regenerative load ratio	%	0	0
POS SPD TRQ	Common	Power consumed by DB resi	%	0	0
POS SPD TRQ	Common	Current Alarm State	–	Normal	Normal

Status

Control	I/F	Item		0001-SGD7C-2R8AM0	
				Axis A	Axis B
POS SPD TRQ	Common	Dynamic Brake (DB)	ON(ALL)	ON	ON
POS SPD TRQ	Common	Origin not Passed	ON(ANY)	ON	OFF
POS	Common	/COIN	ON(ALL)	ON	ON
SPD	Common	/V-CMP	–	OFF	OFF
POS SPD TRQ	Common	/S-RDY	ON(ALL)	ON	ON
TRQ	Common	/VLT	–	OFF	OFF
POS SPD TRQ	Common	Brake Interlock (/BK)	ON(ALL)	ON	ON
POS SPD TRQ	Common	/WARN	–	OFF	OFF

Information You can change the contents displayed in the Monitor Window as desired. Refer to the following manual for details.

📖 AC Servo Drive Engineering Tool SigmaWin+ Operation Manual (Manual No.: SIET S800001 34)

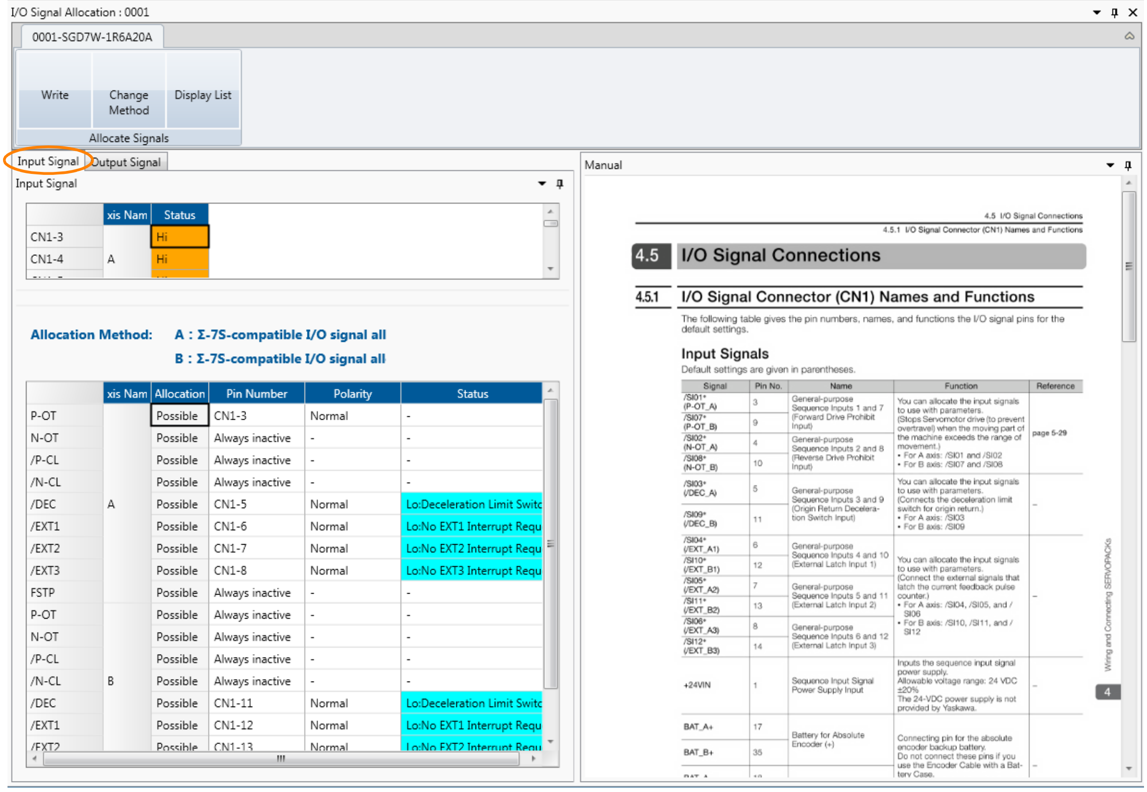
9.2.3 I/O Signals Status Monitor

Use the following procedure to check the status of the I/O signals.

1. Click the **Servo Drive** Button in the workspace of the Main Window of the SigmaWin+.

2. Select **I/O Signal Allocation** in the Menu Dialog Box.
   The I/O Signal Allocation Window will be displayed.

3. Click the **Input Signal** Tab.



	xis Nam	Status
CN1-3		Hi
CN1-4	A	Hi

Allocation Method: A : Σ-7S-compatible I/O signal all
B : Σ-7S-compatible I/O signal all

	xis Nam	Allocation	Pin Number	Polarity	Status
P-OT	A	Possible	CN1-3	Normal	-
N-OT		Possible	Always inactive	-	-
/P-CL		Possible	Always inactive	-	-
/N-CL		Possible	Always inactive	-	-
/DEC		Possible	CN1-5	Normal	Lo:Deceleration Limit Switc
/EXT1		Possible	CN1-6	Normal	Lo:No EXT1 Interrupt Requ
/EXT2		Possible	CN1-7	Normal	Lo:No EXT2 Interrupt Requ
/EXT3		Possible	CN1-8	Normal	Lo:No EXT3 Interrupt Requ
FSTP		Possible	Always inactive	-	-
P-OT	B	Possible	Always inactive	-	-
N-OT		Possible	Always inactive	-	-
/P-CL		Possible	Always inactive	-	-
/N-CL		Possible	Always inactive	-	-
/DEC		Possible	CN1-11	Normal	Lo:Deceleration Limit Switc
/EXT1		Possible	CN1-12	Normal	Lo:No EXT1 Interrupt Requ
/EXT2		Possible	CN1-13	Normal	Lo:No EXT2 Interrupt Requ

4.5 I/O Signal Connections

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

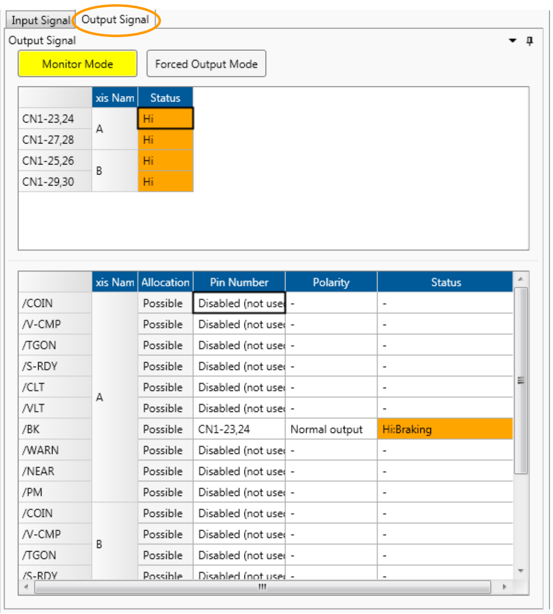
The following table gives the pin numbers, names, and functions the I/O signal pins for the default settings.

Input Signals

Default settings are given in parentheses.

Check the status of the input signals.

4. Click the **Output Signal** Tab.



	xis Nam	Status
CN1-23,24	A	Hi
CN1-27,28		Hi
CN1-25,26	B	Hi
CN1-29,30		Hi

	xis Nam	Allocation	Pin Number	Polarity	Status
/COIN	A	Possible	Disabled (not use	-	-
/V-CMP		Possible	Disabled (not use	-	-
/TGON		Possible	Disabled (not use	-	-
/S-RDY		Possible	Disabled (not use	-	-
/CLT		Possible	Disabled (not use	-	-
/VLT		Possible	Disabled (not use	-	-
/BK		Possible	CN1-23,24	Normal output	Hi:Braking
/WARN		Possible	Disabled (not use	-	-
/NEAR		Possible	Disabled (not use	-	-
/PM		Possible	Disabled (not use	-	-
/COIN	B	Possible	Disabled (not use	-	-
/V-CMP		Possible	Disabled (not use	-	-
/TGON		Possible	Disabled (not use	-	-
/S-RDY		Possible	Disabled (not use	-	-

Check the status of the 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 **Force Output Mode** Button. This will force the output signal status to change. If the signal status at the host controller changes accordingly, then the wiring is correct.
  You cannot use the **Force Output Mode** Button while the servo is ON.

For details, refer to the following manual.

📖 AC Servo Drive Engineering Tool SigmaWin+ Operation Manual (Manual No.: SIET S800001 34)

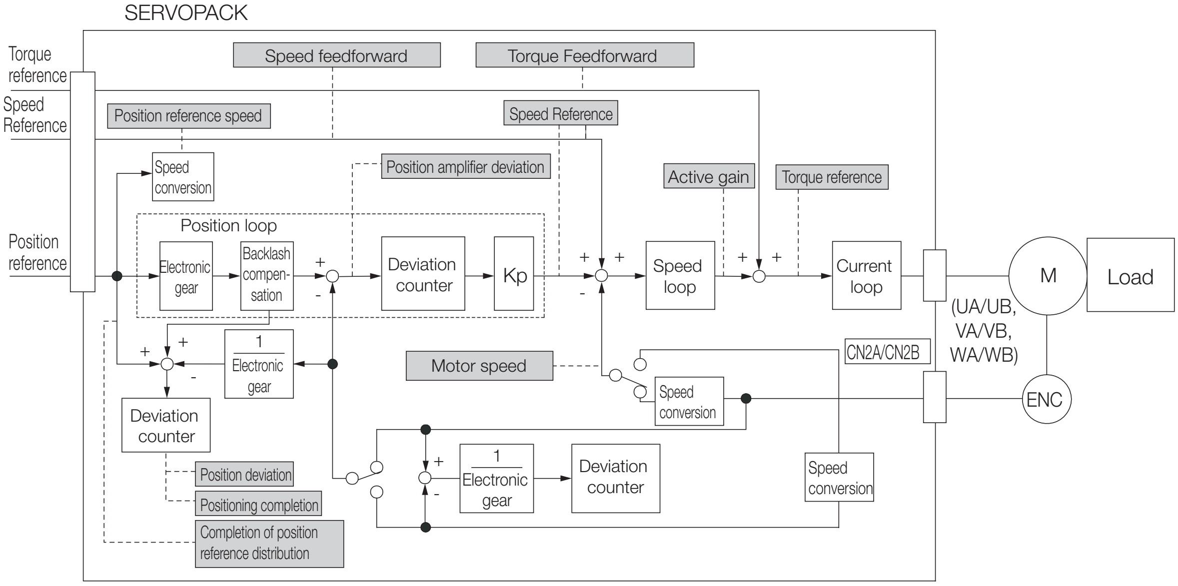
To monitor waveforms, use the SigmaWin+ trace function or a measuring instrument, such as a memory recorder.

9.3 Monitoring Machine Operation Status and Signal Waveforms

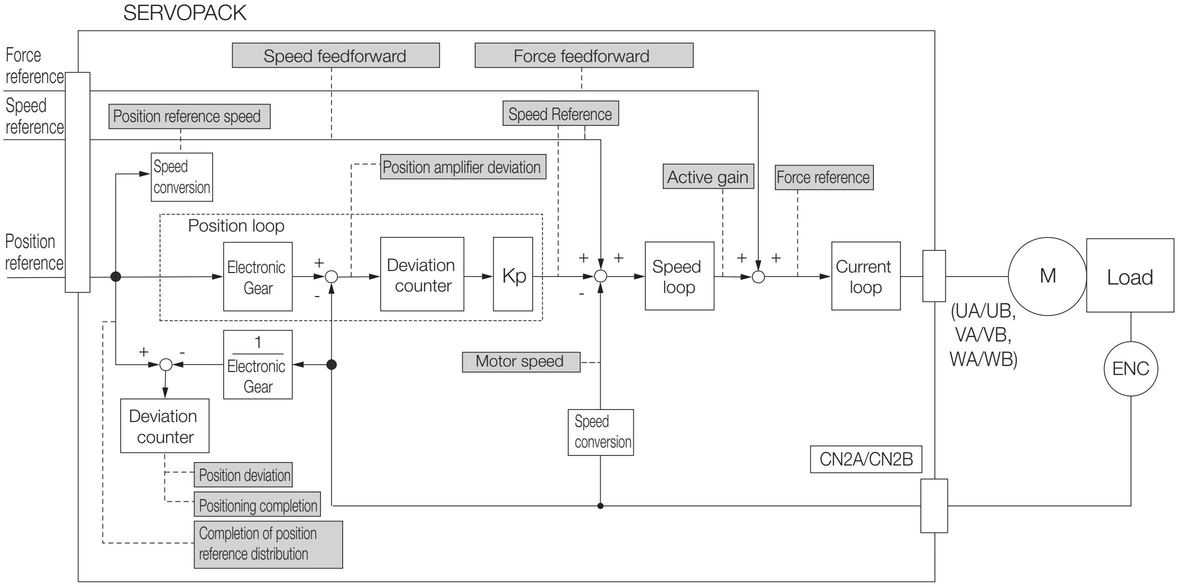
9.3.1 Items That You Can Monitor

You can use the SigmaWin+ or a measuring instrument to monitor the shaded items in the following block diagram.

- Rotary Servomotors



- Linear Servomotors



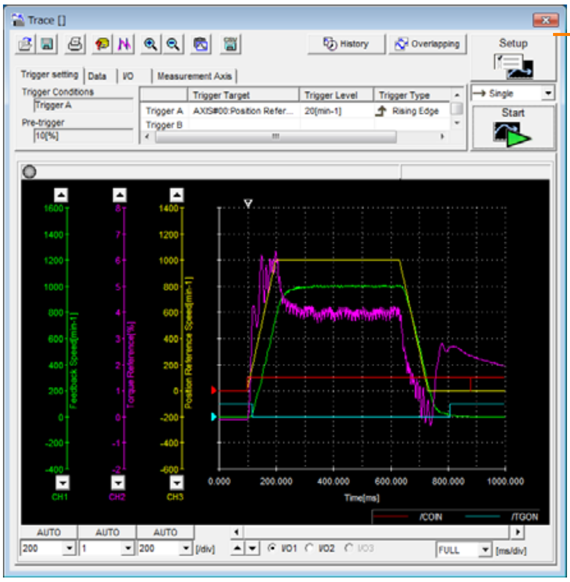
9.3.2 Operating Procedure

This section describes how to trace data with the SigmaWin+.

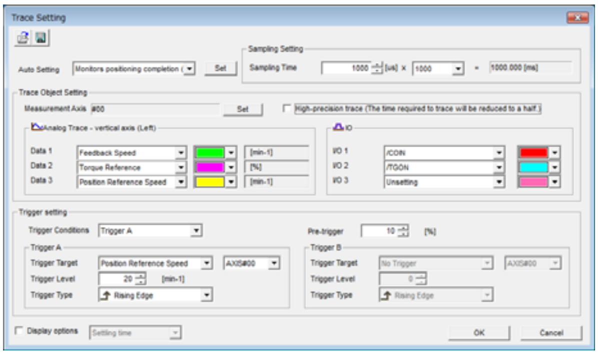
Refer to the following manual for detailed operating procedures for the SigmaWin+.
📖 AC Servo Drive Engineering Tool SigmaWin+ Operation Manual (Manual No.: SIET S800001 34)

1. Click the **Servo Drive** Button in the workspace of the Main Window of the SigmaWin+.

2. Select **Trace** in the Menu Dialog Box.
   The Trace Dialog Box will be displayed.



Click this button to display the Trace Setting Dialog Box shown below, and set the data to trace and the trace conditions.



Trace Objects

You can trace the following items.

- Data Tracing

Trace Objects	
• Torque Reference • Feedback Speed • Reference Speed • Position Reference Speed • Position Error (Deviation) • Position Amplifier Error (Deviation)	• Speed Feedforward • Torque Feedforward • Effective (Active) Gain • Main Circuit DC Voltage

- I/O Tracing

Trace Objects			
Input Signals	• P-OT (Forward Drive Prohibit Input Signal) • N-OT (Reverse Drive Prohibit Input Signal) • /P-CL (Forward External Torque/Force Limit Input Signal) • /N-CL (Reverse External Torque/Force 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)	Output Signals	• 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)
		Internal Status	• ACON (Main Circuit ON Signal) • PDETCMP (Polarity Detection Completed Signal) • DEN (Position Reference Distribution Completed Signal) • PSET (Positioning Completion Output Signal)

9.4 Monitoring Product Life

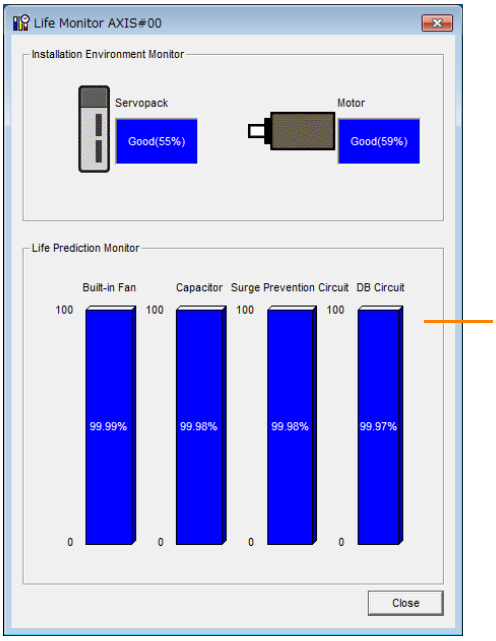
9.4.1 Items That You Can Monitor

Monitor Item	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	The operating status of the Servomotor 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.
Built-in Fan Service Life Prediction	The unused status of the SERVOPACK is treated as the 100% value. The value decreases based on the operating conditions, such as the time that the main circuit power supply is ON. Use a monitor value of 0% as a guideline for the replacement period. Refer to the following section for part replacement guidelines. ☞ *10.1.2 Guidelines for Part Replacement* on page 10-2
Capacitor Service Life Prediction	The unused status of the SERVOPACK is treated as the 100% value. The value decreases based on the operating conditions, such as the time that the main circuit power supply is ON. Use a monitor value of 0% as a guideline for the replacement period. Refer to the following section for part replacement guidelines. ☞ *10.1.2 Guidelines for Part Replacement* on page 10-2
Surge 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. ☞ *10.1.2 Guidelines for Part Replacement* on page 10-2
Dynamic Brake 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. ☞ *10.1.2 Guidelines for Part Replacement* on page 10-2

9.4.2 Operating Procedure

Use the following procedure to display the installation environment and service life prediction monitor dialog boxes.

1. Click the **Servo Drive** Button in the workspace of the Main Window of the SigmaWin+.
2. Select **Life Monitor** in the Menu Dialog Box.
   The Life Monitor Dialog Box will be displayed.



A value of 100% indicates that the SERVOPACK has not yet been used. The percentage decreases as the SERVOPACK is used and reaches 0% when it is time to replace the SERVOPACK.

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.

Preventative Maintenance Warning

An A.9b0 warning (Preventative Maintenance Warning) is detected when any of the following service life prediction values drops to 10% or less: SERVOPACK built-in fan life, capacitor life, inrush current limiting circuit life, and dynamic brake circuit life. You can change the setting of Pn00F = n.□□□X to enable or disable these warnings.

Parameter		Meaning	When Enabled	Classification
Pn00F	n.□□□0 (default setting)	Do not detect preventative maintenance warnings.	After restart	Setup
	n.□□□1	Detect preventative maintenance warnings.		

/PM (Preventative Maintenance Output) Signal

The /PM (Preventative Maintenance Output) signal is output when any of the following service life prediction values reaches 10% or less: SERVOPACK built-in fan life, capacitor life, inrush current limiting circuit life, and dynamic brake circuit life.

Even if detection of preventive maintenance warnings is disabled (Pn00F = n.☐☐☐0), the /PM signal will still be output as long as it is allocated.

Type	Signal	Connector Pin No.	Signal Status	Meaning
Output	/PM	Must be allocated.	ON (closed)	One of the following service life prediction values reached 10% or less: SERVOPACK built-in fan life, capacitor life, inrush current limiting circuit life, and dynamic brake circuit life.
			OFF (open)	All of the following service life prediction values are greater than 10%: SERVOPACK built-in fan life, capacitor life, inrush current limiting circuit life, and dynamic brake circuit life.

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

Allocation Method	Parameters to Use
Σ-7S-Compatible I/O Signal Allocations	• Pn50A = n.☐☐☐1 (Σ-7S-Compatible I/O Signal Allocations) • Pn514 = n.☐X☐☐ (/PM (Preventative Maintenance Output) Signal Allocation)
Multi-axis I/O Signal Allocations	• Pn50A = n.☐☐☐2 (Multi-Axis I/O Signal Allocations) • Pn5BC (/PM (Preventative Maintenance Output) Signal Allocation)

Refer to the following section for details.
☞ *5.19.2 Output Signal Allocations* on page 5-53

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
Torque reference
Feedback speed
Reference speed
Position reference speed
Position deviation
Load – motor position deviation
Main circuit bus voltage

ON/OFF Data
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

Maintenance

10

This chapter describes inspections and part replacement.

10.1 Inspections and Part Replacement

This section describes inspections and part replacement for SERVOPACKs.

10.1.1 Inspections

Perform the inspections given in the following table at least once every year for the SERVOPACK. Daily inspections are not required.

Item	Frequency	Inspection	Correction
Exterior	At least once a year	Check for dust, dirt, and oil on the surfaces.	Clean with compressed air or a cloth.
Loose Screws		Check for loose terminal block and connector screws and for other loose parts.	Tighten any loose screws or other loose parts.

10.1.2 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 9-10
- 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	
Relay	100,000 power ON operations	Power ON frequency: Once an hour
Battery	3 years without power supplied	Surrounding temperature without power supplied: 20°C

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.

10.1.3 Replacing the Battery

If the battery voltage drops to approximately 2.7 V or less, an A.830 alarm (Encoder Battery Alarm) or an A.930 warning (Absolute Encoder Battery Error) will be displayed.

If this alarm or warning is displayed, the battery must be replaced.
Refer to the following section for the battery replacement procedure.

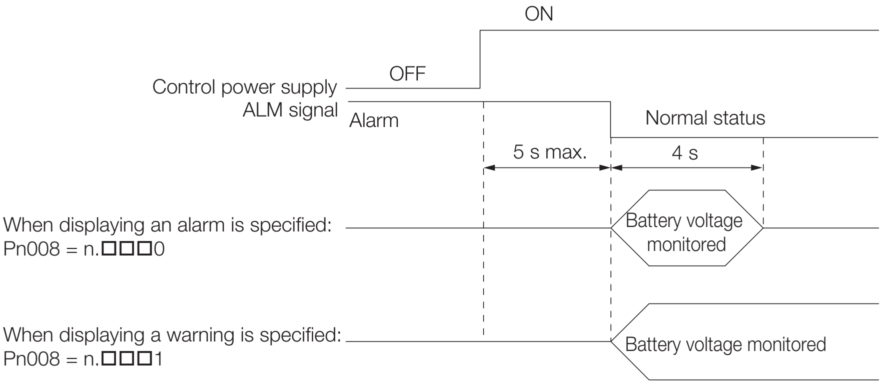
☞ *Battery Replacement Procedure* on page 10-4

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).

Parameter		Meaning	When Enabled	Classification
Pn008	n.□□□0 (default setting)	Output alarm (A.830) for low battery voltage.	After restart	Setup
	n.□□□1	Output warning (A.930) for low battery voltage.		

- Pn008 = n.□□□0
  The ALM (Servo Alarm) signal is output for up to five seconds when the control power supply is turned ON, and then the battery voltage is monitored for four seconds.
  No alarm will be displayed even if the battery voltage drops below the specified value after these four seconds.
- Pn008 = n.□□□1
  The ALM (Servo Alarm) signal is output for up to five seconds when the control power supply is turned ON, and then the battery voltage is monitored continuously.

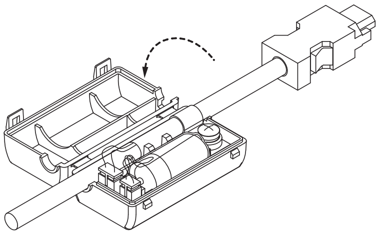


Battery Replacement Procedure

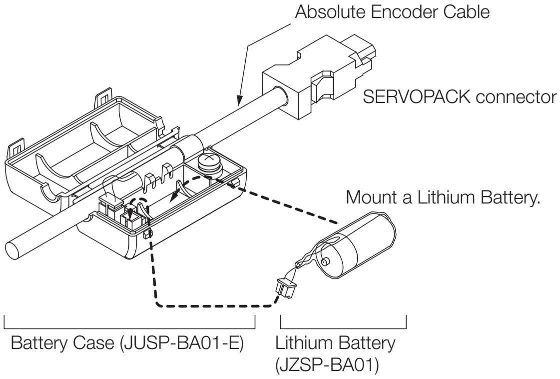
1. Turn ON only the control power supply to the SERVOPACK.

> **Important**
>
> If you remove the Battery or disconnect the Encoder Cable while the control power supply to the SERVOPACK is OFF, the absolute encoder data will be lost.

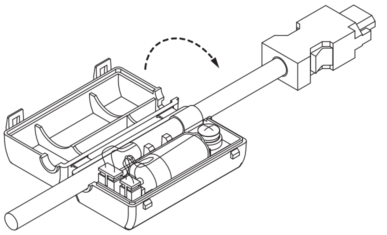
2. Open the cover of the Battery Case.



3. Remove the old Battery and mount a new Battery.



4. Close the cover of the Battery Case.



5. Turn OFF the power supply to the SERVOPACK to clear the A.830 alarm (Encoder Battery Alarm).
6. Turn ON the power supply to the SERVOPACK.
7. Make sure that the alarm has been cleared and that the SERVOPACK operates normally.

Parameter Lists

11

This chapter provides information on the parameters.

11.1 List of Servo Parameters

11.1.1 Interpreting the Parameter Lists

The types of Servomotor to which the parameter applies.

- All: The parameter is used for both Rotary Servomotors and Linear Servomotors.
- Rotary: The parameter is used for only Rotary Servomotors.
- Linear: The parameter is used for only Linear Servomotors.

Rotary Servomotor terms are used for parameters that are applicable to all Servomotors. If you are using a Linear Servomotor, you need to interpret the terms accordingly. Refer to the following section for details.

☞ ◆ *Differences in Terms for Rotary Servomotors and Linear Servomotors* on page xi

Indicates when a change to the parameter will be effective.

Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
Pn000 All Axes	2	Basic Function Selections 0	0000h to 10B1h	–	0000h	All	After restart	Setup	–

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

There are the following two classifications.
- Setup
- Tuning

Refer to the following section for details.

☞ *5.1.1 Parameter Classification* on page 5-5

		Rotation Direction Selection Movement Direction Selection	Reference
n.□□□X	0	Use CCW as the forward direction. Use the direction in which the linear encoder counts up as the forward direction.	page 5-16
	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)	

n.□□X□	Reserved parameter (Do not change.)

n.□X□□	Reserved parameter (Do not change.)

This parameter applies to both axis A and axis B. If you change the setting, the new setting will be applied to both axes.

		ar Servomotor Startup Selection When Encoder Is Not Connected	Reference
n.X□□□		When an encoder is not connected, start as SERVOPACK for Rotary Servomotor.	page 5-15
	1	When an encoder is not connected, start as SERVOPACK for Linear Servomotor.	

11.1.2 List of Servo Parameters

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

Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn000	2	Basic Function Selections 0	0000h to 10B1h	–	0000h	All	After restart	Setup	–

n.□□□X	Rotation Direction Selection Movement Direction Selection		Reference
	0	Use CCW as the forward direction. Use the direction in which the linear encoder counts up as the forward direction.	page 5-16
	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)	

n.□□X□	Reserved parameter (Do not change.)

n.□X□□	Reserved parameter (Do not change.)

n.X□□□	Rotary/Linear Servomotor Startup Selection When Encoder Is Not Connected		Reference
	0	When an encoder is not connected, start as SERVOPACK for Rotary Servomotor.	page 5-15
	1	When an encoder is not connected, start as SERVOPACK for Linear Servomotor.	

Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn001	2	Application Function Selections 1	0000h to 1142h	–	0000h	All	After restart	Setup	–

n.□□□X	Motor Stopping Method for Servo OFF and Group 1 Alarms		Reference
	0	Stop the motor by applying the dynamic brake.	page 5-36
	1	Stop the motor by the applying dynamic brake and then release the dynamic brake.	
	2	Coast the motor to a stop without the dynamic brake.	

n.□□X□	Overtravel Stopping Method		Reference
	0	Apply the dynamic brake or coast the motor to a stop (use the stopping method set in Pn001 = n.□□□X).	page 5-29
	1	Decelerate the motor to a stop using the torque set in Pn406 as the maximum torque and then servo-lock the motor.	
	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 and then servo-lock the motor.	
	4	Decelerate the motor to a stop using the deceleration time set in Pn30A and then let the motor coast.	

n.□X□□ All Axes	Main Circuit Power Supply AC/DC Input Selection		Reference
	0	Input AC power as the main circuit power supply using the L1, L2, and L3 terminals (do not use shared converter).	page 5-13
	1	Input DC power as the main circuit power supply using the B1/⊕ and ⊖ 2 terminals or the B1 and ⊖ 2 terminals (use an external converter or the shared converter).	

n.X□□□	Reserved parameter (Do not change.)

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<table>
<tr><th>Parameter No.</th><th>Size</th><th>Name</th><th>Setting Range</th><th>Setting Unit</th><th>Default Setting</th><th>Applicable Motors</th><th>When Enabled</th><th>Classi-fication</th><th>Refer-ence</th></tr>
<tr><td rowspan="2">Pn002</td><td>2</td><td>Application Function Selections 2</td><td>0000h to 4213h</td><td>–</td><td>0011h</td><td>–</td><td>After restart</td><td>Setup</td><td>–</td></tr>
<tr><td colspan="9">
<table>
<tr><td>n.□□□X</td><td colspan="4">Reserved parameter (Do not change.)</td></tr>
<tr><td>n.□□X□</td><td colspan="4">Reserved parameter (Do not change.)</td></tr>
<tr><td rowspan="4">n.□X□□</td><td colspan="2">Encoder Usage</td><td>Applicable Motors</td><td>Reference</td></tr>
<tr><td>0</td><td>Use the encoder according to encoder specifications.</td><td rowspan="2">All</td><td rowspan="3">page 5-74</td></tr>
<tr><td>1</td><td>Use the encoder as an incremental encoder.</td></tr>
<tr><td>2</td><td>Use the encoder as a single-turn absolute encoder.</td><td>Rotary</td></tr>
<tr><td>n.X□□□</td><td colspan="4">Reserved parameter (Do not change.)</td></tr>
</table>
</td></tr>
<tr><td rowspan="2">Pn008</td><td>2</td><td>Application Function Selections 8</td><td>0000h to 7121h</td><td>–</td><td>4000h</td><td>Rotary</td><td>After restart</td><td>Setup</td><td>–</td></tr>
<tr><td colspan="9">
<table>
<tr><td rowspan="3">n.□□□X</td><td colspan="2">Low Battery Voltage Alarm/Warning Selection</td><td>Reference</td></tr>
<tr><td>0</td><td>Output alarm (A.830) for low battery voltage.</td><td rowspan="2">page 10-3</td></tr>
<tr><td>1</td><td>Output warning (A.930) for low battery voltage.</td></tr>
<tr><td rowspan="4">n.□□X□</td><td colspan="2">Function Selection for Undervoltage</td><td>Reference</td></tr>
<tr><td>0</td><td>Do not detect undervoltage.</td><td rowspan="3">page 5-66</td></tr>
<tr><td>1</td><td>Detect undervoltage warning and limit torque in the SVD.</td></tr>
<tr><td>2</td><td>Detect undervoltage warning and limit torque with Pn424 and Pn425 (i.e., only in the Servo Section).</td></tr>
<tr><td rowspan="3">n.□X□□</td><td colspan="2">Warning Detection Selection</td><td>Reference</td></tr>
<tr><td>0</td><td>Detect warnings.</td><td rowspan="2">*2</td></tr>
<tr><td>1</td><td>Do not detect warnings except for A.971.</td></tr>
<tr><td>n.X□□□</td><td colspan="3">Reserved parameter (Do not change.)</td></tr>
</table>
</td></tr>
<tr><td rowspan="2">Pn009</td><td>2</td><td>Application Function Selections 9</td><td>0000h to 0121h</td><td>–</td><td>0010h</td><td>All</td><td>After restart</td><td>Tuning</td><td>–</td></tr>
<tr><td colspan="9">
<table>
<tr><td>n.□□□X</td><td colspan="3">Reserved parameter (Do not change.)</td></tr>
<tr><td rowspan="4">n.□□X□</td><td colspan="3">Current Control Mode Selection</td></tr>
<tr><td>0</td><td rowspan="2">Use current control mode 1.</td><td rowspan="3">page 8-71</td></tr>
<tr><td>1</td></tr>
<tr><td>2</td><td>Use current control mode 2 (low noise).</td></tr>
<tr><td rowspan="3">n.□X□□</td><td colspan="2">Speed Detection Method Selection</td><td>Reference</td></tr>
<tr><td>0</td><td>Use speed detection 1.</td><td rowspan="2">page 8-72</td></tr>
<tr><td>1</td><td>Use speed detection 2.</td></tr>
<tr><td>n.X□□□</td><td colspan="3">Reserved parameter (Do not change.)</td></tr>
</table>
</td></tr>
</table>

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Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi- fication	Refer- ence
Pn00A	2	Application Function Selections A	0000h to 0044h	–	0001h	All	After restart	Setup	–

n.□□□X	Motor Stopping Method for Group 2 Alarms		Reference
	0	Apply the dynamic brake or coast the motor to a stop (use the stopping method set in Pn001 = n.□□□X).	page 5-37
	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.	

n.□□X□	Stopping Method for Forced Stops		Reference
	0	Apply the dynamic brake or coast the motor to a stop (use the stopping method set in Pn001 = n.□□□X).	page 5-87
	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.	

n.□X□□	Reserved parameter (Do not change.)
n.X□□□	Reserved parameter (Do not change.)

Pn00B	2	Application Function Selections B	0000h to 1121h	–	0000h	All	After restart	Setup	–

n.□□□X	Operator Parameter Display Selection		Reference
	0	Display only setup parameters.	page 5-5
	1	Display all parameters.	

n.□□X□	Motor Stopping Method for Group 2 Alarms		Reference
	0	Stop the motor by setting the speed reference to 0.	page 5-37
	1	Apply the dynamic brake or coast the motor to a stop (use the stopping method set in Pn001 = n.□□□X).	
	2	Set the stopping method with Pn00A = n.□□□X.	

n.□X□□ All Axes	Power Input Selection for Three-phase SERVOPACK		Reference
	0	Use a three-phase power supply input.	page 5-14
	1	Use a three-phase power supply input as a single-phase power supply input.	

n.X□□□	Reserved parameter (Do not change.)

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<table>
<tr><th>Parameter No.</th><th>Size</th><th>Name</th><th>Setting Range</th><th>Setting Unit</th><th>Default Setting</th><th>Applicable Motors</th><th>When Enabled</th><th>Classi-fication</th><th>Refer-ence</th></tr>
<tr><td rowspan="2">Pn00C</td><td>2</td><td>Application Function Selections C</td><td>0000h to 0131h</td><td>–</td><td>0000h</td><td>–</td><td>After restart</td><td>Setup</td><td>page 6-20</td></tr>
<tr><td colspan="9">
<table>
<tr><td rowspan="3">n.□□□X</td><td colspan="2">Function Selection for Test without a Motor</td><td>Applicable Motors</td></tr>
<tr><td>0</td><td>Disable tests without a motor.</td><td rowspan="2">All</td></tr>
<tr><td>1</td><td>Enable tests without a motor.</td></tr>
</table>
<table>
<tr><td rowspan="5">n.□□X□</td><td colspan="2">Encoder Resolution for Tests without a Motor</td><td>Applicable Motors</td></tr>
<tr><td>0</td><td>Use 13 bits.</td><td rowspan="4">Rotary</td></tr>
<tr><td>1</td><td>Use 20 bits.</td></tr>
<tr><td>2</td><td>Use 22 bits.</td></tr>
<tr><td>3</td><td>Use 24 bits.</td></tr>
</table>
<table>
<tr><td rowspan="3">n.□X□□</td><td colspan="2">Encoder Type Selection for Tests without a Motor</td><td>Applicable Motors</td></tr>
<tr><td>0</td><td>Use an incremental encoder.</td><td rowspan="2">All</td></tr>
<tr><td>1</td><td>Use an absolute encoder.</td></tr>
</table>
<table>
<tr><td>n.X□□□</td><td>Reserved parameter (Do not change.)</td></tr>
</table>
</td></tr>
<tr><td rowspan="2">Pn00D</td><td>2</td><td>Application Function Selections D</td><td>0000h to 1001h</td><td>–</td><td>0000h</td><td>All</td><td>After restart</td><td>Setup</td><td>page 5-31</td></tr>
<tr><td colspan="9">
<table>
<tr><td>n.□□□X</td><td>Reserved parameter (Do not change.)</td></tr>
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<tr><td>n.□□X□</td><td>Reserved parameter (Do not change.)</td></tr>
</table>
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<tr><td>n.□X□□</td><td>Reserved parameter (Do not change.)</td></tr>
</table>
<table>
<tr><td rowspan="3">n.X□□□</td><td colspan="2">Overtravel Warning Detection Selection</td></tr>
<tr><td>0</td><td>Do not detect overtravel warnings.</td></tr>
<tr><td>1</td><td>Detect overtravel warnings.</td></tr>
</table>
</td></tr>
<tr><td rowspan="2">Pn00F
All Axes</td><td>2</td><td>Application Function Selections F</td><td>0000h to 2011h</td><td>–</td><td>0000h</td><td>All</td><td>After restart</td><td>Setup</td><td>–</td></tr>
<tr><td colspan="9">
<table>
<tr><td rowspan="3">n.□□□X</td><td colspan="2">Preventative Maintenance Warning Selection</td><td>Reference</td></tr>
<tr><td>0</td><td>Do not detect preventative maintenance warnings.</td><td rowspan="2">*2</td></tr>
<tr><td>1</td><td>Detect preventative maintenance warnings.</td></tr>
</table>
<table>
<tr><td>n.□□X□</td><td>Reserved parameter (Do not change.)</td></tr>
</table>
<table>
<tr><td>n.□X□□</td><td>Reserved parameter (Do not change.)</td></tr>
</table>
<table>
<tr><td>n.X□□□</td><td>Reserved parameter (Do not change.)</td></tr>
</table>
</td></tr>
<tr><td>Pn021</td><td>2</td><td>Reserved parameter (Do not change.)</td><td>–</td><td>–</td><td>0000h</td><td>All</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>Pn022</td><td>2</td><td>Reserved parameter (Do not change.)</td><td>–</td><td>–</td><td>0000h</td><td>All</td><td>–</td><td>–</td><td>–</td></tr>
</table>

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Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn080	2	Application Function Selections 80	0000h to 1111h	–	0000h	Linear	After restart	Setup	–

n.□□□X	Polarity Sensor Selection		Reference
	0	Use polarity sensor.	page 5-24
	1	Do not use polarity sensor.	

n.□□X□	Motor Phase Sequence Selection		Reference
	0	Set a phase-A lead as a phase sequence of U, V, and W.	page 5-22
	1	Set a phase-B lead as a phase sequence of U, V, and W.	

n.□X□□	Reserved parameter (Do not change.)
n.X□□□	Reserved parameter (Do not change.)

Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn100	2	Speed Loop Gain	10 to 20,000	0.1 Hz	400	All	Immedi-ately	Tuning	page 8-73
Pn101	2	Speed Loop Integral Time Constant	15 to 51,200	0.01 ms	2000	All	Immedi-ately	Tuning	page 8-73
Pn102	2	Position Loop Gain	10 to 20,000	0.1/s	400	All	Immedi-ately	Tuning	page 8-73
Pn103	2	Moment of Inertia Ratio	0 to 20,000	1%	100	All	Immedi-ately	Tuning	page 8-73
Pn104	2	Second Speed Loop Gain	10 to 20,000	0.1 Hz	400	All	Immedi-ately	Tuning	page 8-64
Pn105	2	Second Speed Loop Integral Time Constant	15 to 51,200	0.01 ms	2000	All	Immedi-ately	Tuning	page 8-64
Pn106	2	Second Position Loop Gain	10 to 20,000	0.1/s	400	All	Immedi-ately	Tuning	page 8-64
Pn109	2	Feedforward	0 to 100	1%	0	All	Immedi-ately	Tuning	page 8-84
Pn10A	2	Feedforward Filter Time Constant	0 to 6,400	0.01 ms	0	All	Immedi-ately	Tuning	page 8-84

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<table>
<tr><th>Parameter No.</th><th>Size</th><th>Name</th><th>Setting Range</th><th>Setting Unit</th><th>Default Setting</th><th>Applicable Motors</th><th>When Enabled</th><th>Classi- fication</th><th>Refer- ence</th></tr>
<tr><td rowspan="2">Pn10B</td><td>2</td><td>Gain Application Selections</td><td>0000h to 5334h</td><td>–</td><td>0000h</td><td>All</td><td>–</td><td>Setup</td><td>–</td></tr>
<tr><td colspan="9">
<table>
<tr><td rowspan="8">n.□□□X</td><td colspan="2">Mode Switching Selection</td><td>When Enabled</td><td>Reference</td></tr>
<tr><td>0</td><td>Use the internal torque reference as the condition (level setting: Pn10C).</td><td rowspan="7">Immediately</td><td rowspan="7">page 8-85</td></tr>
<tr><td rowspan="2">1</td><td>Use the speed reference as the condition (level setting: Pn10D).</td></tr>
<tr><td>Use the speed reference as the condition (level setting: Pn181).</td></tr>
<tr><td rowspan="2">2</td><td>Use the acceleration reference as the condition (level setting: Pn10E).</td></tr>
<tr><td>Use the acceleration reference as the condition (level setting: Pn182).</td></tr>
<tr><td>3</td><td>Use the position deviation as the condition (level setting: Pn10F).</td></tr>
<tr><td>4</td><td>Do not use mode switching.</td></tr>
</table>
<table>
<tr><td rowspan="4">n.□□X□</td><td colspan="2">Speed Loop Control Method</td><td>When Enabled</td><td>Reference</td></tr>
<tr><td>0</td><td>PI control</td><td rowspan="3">After restart</td><td rowspan="3">page 8-80</td></tr>
<tr><td>1</td><td>I-P control</td></tr>
<tr><td>2, 3</td><td>Reserved settings (Do not use.)</td></tr>
</table>
<table>
<tr><td>n.□X□□</td><td>Reserved parameter (Do not change.)</td></tr>
</table>
<table>
<tr><td>n.X□□□</td><td>Reserved parameter (Do not change.)</td></tr>
</table>
</td></tr>
<tr><td>Pn10C</td><td>2</td><td>Mode Switching Level for Torque Reference</td><td>0 to 800</td><td>1%</td><td>200</td><td>All</td><td>Immediately</td><td>Tuning</td><td>page 8-85</td></tr>
<tr><td>Pn10D</td><td>2</td><td>Mode Switching Level for Speed Reference</td><td>0 to 10,000</td><td>1 min^{-1}</td><td>0</td><td>Rotary</td><td>Immediately</td><td>Tuning</td><td>page 8-85</td></tr>
<tr><td>Pn10E</td><td>2</td><td>Mode Switching Level for Acceleration</td><td>0 to 30,000</td><td>1 min^{-1}/s</td><td>0</td><td>Rotary</td><td>Immediately</td><td>Tuning</td><td>page 8-85</td></tr>
<tr><td>Pn10F</td><td>2</td><td>Mode Switching Level for Position Deviation</td><td>0 to 10,000</td><td>1 reference unit</td><td>0</td><td>All</td><td>Immediately</td><td>Tuning</td><td>page 8-85</td></tr>
<tr><td>Pn11F</td><td>2</td><td>Position Integral Time Constant</td><td>0 to 50,000</td><td>0.1 ms</td><td>0</td><td>All</td><td>Immediately</td><td>Tuning</td><td>page 8-87</td></tr>
<tr><td>Pn121</td><td>2</td><td>Friction Compensation Gain</td><td>10 to 1,000</td><td>1%</td><td>100</td><td>All</td><td>Immediately</td><td>Tuning</td><td>page 8-64, page 8-68</td></tr>
<tr><td>Pn122</td><td>2</td><td>Second Friction Compensation Gain</td><td>10 to 1,000</td><td>1%</td><td>100</td><td>All</td><td>Immediately</td><td>Tuning</td><td>page 8-64, page 8-68</td></tr>
<tr><td>Pn123</td><td>2</td><td>Friction Compensation Coefficient</td><td>0 to 100</td><td>1%</td><td>0</td><td>All</td><td>Immediately</td><td>Tuning</td><td>page 8-68</td></tr>
<tr><td>Pn124</td><td>2</td><td>Friction Compensation Frequency Correction</td><td>-10,000 to 10,000</td><td>0.1 Hz</td><td>0</td><td>All</td><td>Immediately</td><td>Tuning</td><td>page 8-68</td></tr>
<tr><td>Pn125</td><td>2</td><td>Friction Compensation Gain Correction</td><td>1 to 1,000</td><td>1%</td><td>100</td><td>All</td><td>Immediately</td><td>Tuning</td><td>page 8-68</td></tr>
<tr><td>Pn131</td><td>2</td><td>Gain Switching Time 1</td><td>0 to 65,535</td><td>1 ms</td><td>0</td><td>All</td><td>Immediately</td><td>Tuning</td><td>page 8-64</td></tr>
<tr><td>Pn132</td><td>2</td><td>Gain Switching Time 2</td><td>0 to 65,535</td><td>1 ms</td><td>0</td><td>All</td><td>Immediately</td><td>Tuning</td><td>page 8-64</td></tr>
<tr><td>Pn135</td><td>2</td><td>Gain Switching Waiting Time 1</td><td>0 to 65,535</td><td>1 ms</td><td>0</td><td>All</td><td>Immediately</td><td>Tuning</td><td>page 8-64</td></tr>
<tr><td>Pn136</td><td>2</td><td>Gain Switching Waiting Time 2</td><td>0 to 65,535</td><td>1 ms</td><td>0</td><td>All</td><td>Immediately</td><td>Tuning</td><td>page 8-64</td></tr>
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Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn139	2	Automatic Gain Switching Selections 1	0000h to 0052h	–	0000h	All	Immediately	Tuning	page 8-64

n.□□□X	Gain Switching Selection	
	0	Use manual gain switching. The gain is switched manually with bit 4 in OW□□01 (Gain Switch).
	1	Reserved setting (Do not use.)
	2	Use automatic gain switching pattern 1. The gain is switched automatically from the first gain to the second gain when switching condition A is satisfied. The gain is switched automatically from the second gain to the first gain when switching condition A is not satisfied.

n.□□X□	Gain Switching Condition A	
	0	/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 parameter (Do not change.)

n.X□□□	Reserved parameter (Do not change.)

Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn13D	2	Current Gain Level	100 to 2,000	1%	2000	All	Immediately	Tuning	page 8-71
Pn140	2	Model Following Control-Related Selections	0000h to 1121h	–	0100h	All	Immediately	Tuning	–

n.□□□X	Model Following Control Selection		Reference
	0	Do not use model following control.	page 8-81
	1	Use model following control.	

n.□□X□	Vibration Suppression Selection		Reference
	0	Do not perform vibration suppression.	page 8-81
	1	Perform vibration suppression for a specific frequency.	
	2	Perform vibration suppression for two specific frequencies.	

n.□X□□	Vibration Suppression Adjustment Selection		Reference
	0	Do not adjust vibration suppression automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.	page 8-31
	1	Adjust vibration suppression automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.	

n.X□□□	Speed Feedforward (VFF)/Torque Feedforward (TFF) Selection		Reference
	0	Do not use model following control and speed/torque feedforward together.	page 8-32, page 8-57
	1	Use model following control and speed/torque feedforward together.	

Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn141	2	Model Following Control Gain	10 to 20,000	0.1/s	500	All	Immediately	Tuning	page 8-81
Pn142	2	Model Following Control Gain Correction	500 to 2,000	0.1%	1000	All	Immediately	Tuning	page 8-64
Pn143	2	Model Following Control Bias in the Forward Direction	0 to 10,000	0.1%	1000	All	Immediately	Tuning	page 8-81

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Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
Pn144	2	Model Following Control Bias in the Reverse Direction	0 to 10,000	0.1%	1000	All	Immediately	Tuning	page 8-81
Pn145	2	Vibration Suppression 1 Frequency A	10 to 2,500	0.1 Hz	500	All	Immediately	Tuning	page 8-57
Pn146	2	Vibration Suppression 1 Frequency B	10 to 2,500	0.1 Hz	700	All	Immediately	Tuning	page 8-57
Pn147	2	Model Following Control Speed Feedforward Compensation	0 to 10,000	0.1%	1000	All	Immediately	Tuning	page 8-81
Pn148	2	Second Model Following Control Gain	10 to 20,000	0.1/s	500	All	Immediately	Tuning	page 8-64
Pn149	2	Second Model Following Control Gain Correction	500 to 2,000	0.1%	1000	All	Immediately	Tuning	page 8-64
Pn14A	2	Vibration Suppression 2 Frequency	10 to 2,000	0.1 Hz	800	All	Immediately	Tuning	page 8-57
Pn14B	2	Vibration Suppression 2 Correction	10 to 1,000	1%	100	All	Immediately	Tuning	page 8-57
Pn14F	2	Control-Related Selections	0000h to 0021h	–	0021h	All	After restart	Tuning	–

n.□□□X	Model Following Control Type Selection		Reference
	0	Use model following control type 1.	page 8-83
	1	Use model following control type 2.	

n.□□X□	Tuning-less Type Selection		Reference
	0	Use tuning-less type 1.	page 8-13
	1	Use tuning-less type 2.	
	2	Use tuning-less type 3.	

n.□X□□	Reserved parameter (Do not change.)
n.X□□□	Reserved parameter (Do not change.)

Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
Pn160	2	Anti-Resonance Control-Related Selections	0000h to 0011h	–	0010h	All	Immediately	Tuning	–

n.□□□X	Anti-Resonance Control Selection		Reference
	0	Do not use anti-resonance control.	page 8-49
	1	Use anti-resonance control.	

n.□□X□	Anti-Resonance Control Adjustment Selection		Reference
	0	Do not adjust anti-resonance control automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.	page 8-31
	1	Adjust anti-resonance control automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.	

n.□X□□	Reserved parameter (Do not change.)
n.X□□□	Reserved parameter (Do not change.)

Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
Pn161	2	Anti-Resonance Frequency	10 to 20,000	0.1 Hz	1000	All	Immediately	Tuning	page 8-49
Pn162	2	Anti-Resonance Gain Correction	1 to 1,000	1%	100	All	Immediately	Tuning	page 8-49
Pn163	2	Anti-Resonance Damping Gain	0 to 300	1%	0	All	Immediately	Tuning	page 8-49

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Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn164	2	Anti-Resonance Filter Time Constant 1 Correction	-1,000 to 1,000	0.01 ms	0	All	Immedi-ately	Tuning	page 8-49
Pn165	2	Anti-Resonance Filter Time Constant 2 Correction	-1,000 to 1,000	0.01 ms	0	All	Immedi-ately	Tuning	page 8-49
Pn166	2	Anti-Resonance Damping Gain 2	0 to 1,000	1%	0	All	Immedi-ately	Tuning	page 8-52
Pn170	2	Tuning-less Function-Related Selections	0000h to 2711h	–	1401h	All	–	Setup	page 8-12

n.□□□X	Tuning-less Selection		When Enabled
	0	Disable tuning-less function.	After restart
	1	Enable tuning-less function.	

n.□□X□	Speed Control Method		When Enabled
	0	Use for speed control.	After restart
	1	Use for speed control and use host controller for position control.	

n.□X□□	Rigidity Level		When Enabled
	0 to 7	Set the rigidity level.	Immedi-ately

n.X□□□	Tuning-less Load Level		When Enabled
	0 to 2	Set the load level for the tuning-less function.	Immedi-ately

Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn181	2	Mode Switching Level for Speed Reference	0 to 10,000	1 mm/s	0	Linear	Immedi-ately	Tuning	page 8-85
Pn182	2	Mode Switching Level for Acceleration	0 to 30,000	1 mm/s^2	0	Linear	Immedi-ately	Tuning	page 8-85
Pn205	2	Multiturn Limit	0 to 65,535	1 rev	65535	Rotary	After restart	Setup	page 5-75
Pn207	2	Position Control Function Selections	0000h to 2210h	–	0010h	All	After restart	Setup	–

n.□□□X	Reserved parameter (Do not change.)

n.□□X□	Reserved parameter (Do not change.)

n.□X□□	Reserved parameter (Do not change.)

n.X□□□	/COIN (Positioning Completion Output) Signal Output Timing		Refer-ence
	0	Output when the absolute value of the position deviation is the same or less than the setting of Pn522 (Positioning Completed Width).	page 5-60
	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.	

Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn20E	4	Electronic Gear Ratio (Numerator)	1 to 1,073,741,824	1	16	All	After restart	Setup	page 5-42
Pn210	4	Electronic Gear Ratio (Denominator)	1 to 1,073,741,824	1	1	All	After restart	Setup	page 5-42

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<table>
<tr><th>Parameter No.</th><th>Size</th><th>Name</th><th>Setting Range</th><th>Setting Unit</th><th>Default Setting</th><th>Applicable Motors</th><th>When Enabled</th><th>Classi-fication</th><th>Refer-ence</th></tr>
<tr><td>Pn231</td><td>4</td><td>Backlash Compensation</td><td>-500,000 to 500,000</td><td>0.1 reference units</td><td>0</td><td>All</td><td>Immediately</td><td>Setup</td><td>–</td></tr>
<tr><td>Pn282</td><td>4</td><td>Linear Encoder Scale Pitch</td><td>0 to 6,553,600</td><td>0.01 μm</td><td>0</td><td>Linear</td><td>After restart</td><td>Setup</td><td>page 5-17</td></tr>
<tr><td>Pn304</td><td>2</td><td>Jogging Speed</td><td>0 to 10,000</td><td>Rotary: 1 min^{-1}
Direct Drive: 0.1 min^{-1}</td><td>500</td><td>Rotary</td><td>Immediately</td><td>Setup</td><td>page 6-6</td></tr>
<tr><td>Pn305</td><td>2</td><td>Soft Start Acceleration Time</td><td>0 to 10,000</td><td>1 ms</td><td>0</td><td>All</td><td>Immediately</td><td>Setup</td><td>*1</td></tr>
<tr><td>Pn306</td><td>2</td><td>Soft Start Deceleration Time</td><td>0 to 10,000</td><td>1 ms</td><td>0</td><td>All</td><td>Immediately</td><td>Setup</td><td>*1</td></tr>
<tr><td>Pn308</td><td>2</td><td>Speed Feedback Filter Time Constant</td><td>0 to 65,535</td><td>0.01 ms</td><td>0</td><td>All</td><td>Immediately</td><td>Setup</td><td>page 8-73</td></tr>
<tr><td>Pn30A</td><td>2</td><td>Deceleration Time for Servo OFF and Forced Stops</td><td>0 to 10,000</td><td>1 ms</td><td>0</td><td>All</td><td>Immediately</td><td>Setup</td><td>page 5-30</td></tr>
<tr><td>Pn30C</td><td>2</td><td>Speed Feedforward Average Movement Time</td><td>0 to 5,100</td><td>0.1 ms</td><td>0</td><td>All</td><td>Immediately</td><td>Setup</td><td>–</td></tr>
<tr><td rowspan="2">Pn310</td><td>2</td><td>Vibration Detection Selections</td><td>0000h to 0002h</td><td>–</td><td>0000h</td><td>All</td><td>Immediately</td><td>Setup</td><td>page 5-80</td></tr>
<tr><td colspan="9">
<table>
<tr><td rowspan="4">n.□□□X</td><td colspan="2">Vibration Detection Selection</td></tr>
<tr><td>0</td><td>Do not detect vibration.</td></tr>
<tr><td>1</td><td>Output a warning (A.911) if vibration is detected.</td></tr>
<tr><td>2</td><td>Output an alarm (A.520) if vibration is detected.</td></tr>
<tr><td>n.□□X□</td><td colspan="2">Reserved parameter (Do not change.)</td></tr>
<tr><td>n.□X□□</td><td colspan="2">Reserved parameter (Do not change.)</td></tr>
<tr><td>n.X□□□</td><td colspan="2">Reserved parameter (Do not change.)</td></tr>
</table>
</td></tr>
<tr><td>Pn311</td><td>2</td><td>Vibration Detection Sensitivity</td><td>50 to 500</td><td>1%</td><td>100</td><td>All</td><td>Immediately</td><td>Tuning</td><td>page 5-80</td></tr>
<tr><td>Pn312</td><td>2</td><td>Vibration Detection Level</td><td>0 to 5,000</td><td>1 min^{-1}</td><td>50</td><td>Rotary</td><td>Immediately</td><td>Tuning</td><td>page 5-80</td></tr>
<tr><td>Pn316</td><td>2</td><td>Maximum Motor Speed</td><td>0 to 65,535</td><td>1 min^{-1}</td><td>10000</td><td>Rotary</td><td>After restart</td><td>Setup</td><td>page 5-68</td></tr>
<tr><td>Pn324</td><td>2</td><td>Moment of Inertia Calculation Starting Level</td><td>0 to 20,000</td><td>1%</td><td>300</td><td>All</td><td>Immediately</td><td>Setup</td><td>page 8-30</td></tr>
<tr><td>Pn383</td><td>2</td><td>Jogging Speed</td><td>0 to 10,000</td><td>1 mm/s</td><td>50</td><td>Linear</td><td>Immediately</td><td>Setup</td><td>page 6-6</td></tr>
<tr><td>Pn384</td><td>2</td><td>Vibration Detection Level</td><td>0 to 5,000</td><td>1 mm/s</td><td>10</td><td>Linear</td><td>Immediately</td><td>Tuning</td><td>page 5-80</td></tr>
<tr><td>Pn385</td><td>2</td><td>Maximum Motor Speed</td><td>1 to 100</td><td>100 mm/s</td><td>50</td><td>Linear</td><td>After restart</td><td>Setup</td><td>page 5-68</td></tr>
<tr><td>Pn401</td><td>2</td><td>First Stage First Torque Reference Filter Time Constant</td><td>0 to 65,535</td><td>0.01 ms</td><td>100</td><td>All</td><td>Immediately</td><td>Tuning</td><td>page 8-76</td></tr>
<tr><td>Pn402</td><td>2</td><td>Forward Torque Limit</td><td>0 to 800</td><td>1%*3</td><td>800</td><td>Rotary</td><td>Immediately</td><td>Setup</td><td>page 5-69</td></tr>
<tr><td>Pn403</td><td>2</td><td>Reverse Torque Limit</td><td>0 to 800</td><td>1%*3</td><td>800</td><td>Rotary</td><td>Immediately</td><td>Setup</td><td>page 5-69</td></tr>
<tr><td>Pn404</td><td>2</td><td>Forward External Torque Limit</td><td>0 to 800</td><td>1%*3</td><td>100</td><td>All</td><td>Immediately</td><td>Setup</td><td>page 5-70</td></tr>
<tr><td>Pn405</td><td>2</td><td>Reverse External Torque Limit</td><td>0 to 800</td><td>1%*3</td><td>100</td><td>All</td><td>Immediately</td><td>Setup</td><td>page 5-70</td></tr>
<tr><td>Pn406</td><td>2</td><td>Emergency Stop Torque</td><td>0 to 800</td><td>1%*3</td><td>800</td><td>All</td><td>Immediately</td><td>Setup</td><td>page 5-30</td></tr>
</table>

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Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn407	2	Speed Limit during Torque Control	0 to 10,000	1 min^{-1}	10000	Rotary	Immedi-ately	Setup	page 5-64
Pn408	2	Torque-Related Function Selections	0000h to 1111h	–	0000h	All	–	Setup	–

	Notch Filter Selection 1		When Enabled	Reference
n.□□□X	0	Disable first stage notch filter.	Immedi-ately	page 8-76
	1	Enable first stage notch filter.		

	Speed Limit Selection		When Enabled	Reference
n.□□X□	0	Use the smaller of the maximum motor speed and the setting of Pn407 as the speed limit.	After restart	page 5-64
		Use the smaller of the maximum motor speed and the setting of Pn480 as the speed limit.		
	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.		

	Notch Filter Selection 2		When Enabled	Reference
n.□X□□	0	Disable second stage notch filter.	Immedi-ately	page 8-76
	1	Enable second stage notch filter.		

	Friction Compensation Function Selection		When Enabled	Reference
n.X□□□	0	Disable friction compensation.	Immedi-ately	
	1	Enable friction compensation.		

Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn409	2	First Stage Notch Filter Frequency	50 to 5,000	1 Hz	5000	All	Immedi-ately	Tuning	page 8-76
Pn40A	2	First Stage Notch Filter Q Value	50 to 1,000	0.01	70	All	Immedi-ately	Tuning	page 8-76
Pn40B	2	First Stage Notch Filter Depth	0 to 1,000	0.001	0	All	Immedi-ately	Tuning	page 8-76
Pn40C	2	Second Stage Notch Filter Frequency	50 to 5,000	1 Hz	5000	All	Immedi-ately	Tuning	page 8-76
Pn40D	2	Second Stage Notch Filter Q Value	50 to 1,000	0.01	70	All	Immedi-ately	Tuning	page 8-76
Pn40E	2	Second Stage Notch Filter Depth	0 to 1,000	0.001	0	All	Immedi-ately	Tuning	page 8-76
Pn40F	2	Second Stage Second Torque Reference Filter Frequency	100 to 5,000	1 Hz	5000	All	Immedi-ately	Tuning	page 8-76
Pn410	2	Second Stage Second Torque Reference Filter Q Value	50 to 100	0.01	50	All	Immedi-ately	Tuning	page 8-76
Pn412	2	First Stage Second Torque Reference Filter Time Constant	0 to 65,535	0.01 ms	100	All	Immedi-ately	Tuning	page 8-64

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<table>
<tr><th>Parameter No.</th><th>Size</th><th>Name</th><th>Setting Range</th><th>Setting Unit</th><th>Default Setting</th><th>Applicable Motors</th><th>When Enabled</th><th>Classification</th><th>Reference</th></tr>
<tr><td rowspan="2">Pn416</td><td>2</td><td>Torque-Related Function Selections 2</td><td>0000h to 1111h</td><td>–</td><td>0000h</td><td>All</td><td>Immediately</td><td>Setup</td><td>page 8-77</td></tr>
<tr><td colspan="9"><table>
<tr><td rowspan="3">n.□□□X</td><td colspan="2">Notch Filter Selection 3</td></tr>
<tr><td>0</td><td>Disable third stage notch filter.</td></tr>
<tr><td>1</td><td>Enable third stage notch filter.</td></tr>
<tr><td rowspan="3">n.□□X□</td><td colspan="2">Notch Filter Selection 4</td></tr>
<tr><td>0</td><td>Disable fourth stage notch filter.</td></tr>
<tr><td>1</td><td>Enable fourth stage notch filter.</td></tr>
<tr><td rowspan="3">n.□X□□</td><td colspan="2">Notch Filter Selection 5</td></tr>
<tr><td>0</td><td>Disable fifth stage notch filter.</td></tr>
<tr><td>1</td><td>Enable fifth stage notch filter.</td></tr>
<tr><td>n.X□□□</td><td colspan="2">Reserved parameter (Do not change.)</td></tr>
</table></td></tr>
<tr><td>Pn417</td><td>2</td><td>Third Stage Notch Filter Frequency</td><td>50 to 5,000</td><td>1 Hz</td><td>5000</td><td>All</td><td>Immediately</td><td>Tuning</td><td>page 8-77</td></tr>
<tr><td>Pn418</td><td>2</td><td>Third Stage Notch Filter Q Value</td><td>50 to 1,000</td><td>0.01</td><td>70</td><td>All</td><td>Immediately</td><td>Tuning</td><td>page 8-77</td></tr>
<tr><td>Pn419</td><td>2</td><td>Third Stage Notch Filter Depth</td><td>0 to 1,000</td><td>0.001</td><td>0</td><td>All</td><td>Immediately</td><td>Tuning</td><td>page 8-77</td></tr>
<tr><td>Pn41A</td><td>2</td><td>Fourth Stage Notch Filter Frequency</td><td>50 to 5,000</td><td>1 Hz</td><td>5000</td><td>All</td><td>Immediately</td><td>Tuning</td><td>page 8-77</td></tr>
<tr><td>Pn41B</td><td>2</td><td>Fourth Stage Notch Filter Q Value</td><td>50 to 1,000</td><td>0.01</td><td>70</td><td>All</td><td>Immediately</td><td>Tuning</td><td>page 8-77</td></tr>
<tr><td>Pn41C</td><td>2</td><td>Fourth Stage Notch Filter Depth</td><td>0 to 1,000</td><td>0.001</td><td>0</td><td>All</td><td>Immediately</td><td>Tuning</td><td>page 8-77</td></tr>
<tr><td>Pn41D</td><td>2</td><td>Fifth Stage Notch Filter Frequency</td><td>50 to 5,000</td><td>1 Hz</td><td>5000</td><td>All</td><td>Immediately</td><td>Tuning</td><td>page 8-77</td></tr>
<tr><td>Pn41E</td><td>2</td><td>Fifth Stage Notch Filter Q Value</td><td>50 to 1,000</td><td>0.01</td><td>70</td><td>All</td><td>Immediately</td><td>Tuning</td><td>page 8-77</td></tr>
<tr><td>Pn41F</td><td>2</td><td>Fifth Stage Notch Filter Depth</td><td>0 to 1,000</td><td>0.001</td><td>0</td><td>All</td><td>Immediately</td><td>Tuning</td><td>page 8-77</td></tr>
<tr><td rowspan="2">Pn423</td><td>2</td><td>Speed Ripple Compensation Selections</td><td>0000h to 1111h</td><td>–</td><td>0000h</td><td>Rotary</td><td>–</td><td>Setup</td><td>page 8-62</td></tr>
<tr><td colspan="9"><table>
<tr><td rowspan="3">n.□□□X</td><td colspan="2">Speed Ripple Compensation Function Selection</td><td>When Enabled</td></tr>
<tr><td>0</td><td>Disable speed ripple compensation.</td><td rowspan="2">Immediately</td></tr>
<tr><td>1</td><td>Enable speed ripple compensation.</td></tr>
<tr><td rowspan="3">n.□□X□</td><td colspan="2">Speed Ripple Compensation Information Disagreement Warning Detection Selection</td><td>When Enabled</td></tr>
<tr><td>0</td><td>Detect A.942 alarms.</td><td rowspan="2">After restart</td></tr>
<tr><td>1</td><td>Do not detect A.942 alarms.</td></tr>
<tr><td rowspan="3">n.□X□□</td><td colspan="2">Speed Ripple Compensation Enable Condition Selection</td><td>When Enabled</td></tr>
<tr><td>0</td><td>Speed reference</td><td rowspan="2">After restart</td></tr>
<tr><td>1</td><td>Motor speed</td></tr>
<tr><td>n.X□□□</td><td colspan="3">Reserved parameter (Do not change.)</td></tr>
</table></td></tr>
<tr><td>Pn424</td><td>2</td><td>Torque Limit at Main Circuit Voltage Drop</td><td>0 to 100</td><td>1%[*3]</td><td>50</td><td>All</td><td>Immediately</td><td>Setup</td><td>page 5-67</td></tr>
<tr><td>Pn425</td><td>2</td><td>Release Time for Torque Limit at Main Circuit Voltage Drop</td><td>0 to 1,000</td><td>1 ms</td><td>100</td><td>All</td><td>Immediately</td><td>Setup</td><td>page 5-67</td></tr>
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Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn426	2	Torque Feedforward Average Movement Time	0 to 5,100	0.1 ms	0	All	Immedi-ately	Setup	–
Pn427	2	Speed Ripple Compen-sation Enable Speed	0 to 10,000	1 min^{-1}	0	Rotary Ser-vomotor	Immedi-ately	Tuning	page 8-62
Pn456	2	Sweep Torque Refer-ence Amplitude	1 to 800	1%	15	All	Immedi-ately	Tuning	page 8-93
Pn460	2	Notch Filter Adjustment Selections 1	0000h to 0101h	–	0101h	All	Immedi-ately	Tuning	page 8-15, page 8-30

n.□□□X	Notch Filter Adjustment Selection 1	
	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	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 parameter (Do not change.)	
n.□X□□	Notch Filter Adjustment Selection 2	
	0	Do not adjust the second stage notch filter automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.
	1	Adjust the second stage notch filter automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.
n.X□□□	Reserved parameter (Do not change.)	

Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn480	2	Speed Limit during Force Control	0 to 10,000	1 mm/s	10000	Linear	Immedi-ately	Setup	page 5-64
Pn481	2	Polarity Detection Speed Loop Gain	10 to 20,000	0.1 Hz	400	Linear	Immedi-ately	Tuning	–
Pn482	2	Polarity Detection Speed Loop Integral Time Constant	15 to 51,200	0.01 ms	3000	Linear	Immedi-ately	Tuning	–
Pn483	2	Forward Force Limit	0 to 800	1%*3	30	Linear	Immedi-ately	Setup	page 5-69
Pn484	2	Reverse Force Limit	0 to 800	1%*3	30	Linear	Immedi-ately	Setup	page 5-69
Pn485	2	Polarity Detection Refer-ence Speed	0 to 100	1 mm/s	20	Linear	Immedi-ately	Tuning	–
Pn486	2	Polarity Detection Refer-ence Acceleration/ Deceleration Time	0 to 100	1 ms	25	Linear	Immedi-ately	Tuning	–
Pn487	2	Polarity Detection Con-stant Speed Time	0 to 300	1 ms	0	Linear	Immedi-ately	Tuning	–
Pn488	2	Polarity Detection Refer-ence Waiting Time	50 to 500	1 ms	100	Linear	Immedi-ately	Tuning	–
Pn48E	2	Polarity Detection Range	1 to 65,535	1 mm	10	Linear	Immedi-ately	Tuning	–
Pn490	2	Polarity Detection Load Level	0 to 20,000	1%	100	Linear	Immedi-ately	Tuning	–
Pn495	2	Polarity Detection Con-firmation Force Refer-ence	0 to 200	1%	100	Linear	Immedi-ately	Tuning	–
Pn498	2	Polarity Detection Allow-able Error Range	0 to 30	1 deg	10	Linear	Immedi-ately	Tuning	–
Pn49F	2	Speed Ripple Compen-sation Enable Speed	0 to 10,000	1 mm/s	0	Linear	Immedi-ately	Tuning	page 8-62
Pn502	2	Rotation Detection Level	1 to 10,000	1 min^{-1}	20	Rotary	Immedi-ately	Setup	page 5-57

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Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn503	2	Speed Coincidence Detection Signal Output Width	0 to 100	1 min^{-1}	10	Rotary	Immedi-ately	Setup	page 5-58
Pn506	2	Brake Reference-Servo OFF Delay Time	0 to 50	10 ms	0	All	Immedi-ately	Setup	page 5-32
Pn507	2	Brake Reference Output Speed Level	0 to 10,000	1 min^{-1}	100	Rotary	Immedi-ately	Setup	page 5-32
Pn508	2	Servo OFF-Brake Command Waiting Time	10 to 100	10 ms	50	All	Immedi-ately	Setup	page 5-32
Pn509 All Axes	2	Momentary Power Interruption Hold Time	20 to 50,000	1 ms	20	All	Immedi-ately	Setup	page 5-65
Pn50A	2	Input Signal Selections 1	0000h to FFF2h	–	0881h	All	After restart	Setup	–

	I/O Signal Allocation Mode		Reference
n.□□□X	0	Reserved setting (Do not use.)	page 5-50
	1	Use Σ-7S-compatible I/O signal allocations (Pn50A to Pn517).	
	2	Use multi-axis I/O signal allocations (Pn590 to Pn5BC).	

n.□□X□	Reserved parameter (Do not change.)

n.□X□□	Reserved parameter (Do not change.)

	P-OT (Forward Drive Prohibit) Signal Allocation		Reference
n.X□□□	0	Axis A: Enable forward drive when CN1-3 input signal is ON (closed). Axis B: Enable forward drive when CN1-9 input signal is ON (closed).	page 5-29
	1	Axis A: Enable forward drive when CN1-4 input signal is ON (closed). Axis B: Enable forward drive when CN1-10 input signal is ON (closed).	
	2	Axis A: Enable forward drive when CN1-5 input signal is ON (closed). Axis B: Enable forward drive when CN1-11 input signal is ON (closed).	
	3	Axis A: Enable forward drive when CN1-6 input signal is ON (closed). Axis B: Enable forward drive when CN1-12 input signal is ON (closed).	
	4	Axis A: Enable forward drive when CN1-7 input signal is ON (closed). Axis B: Enable forward drive when CN1-13 input signal is ON (closed).	
	5	Axis A: Enable forward drive when CN1-8 input signal is ON (closed). Axis B: Enable forward drive when CN1-14 input signal is ON (closed).	
	6	Reserved setting (Do not use.)	
	7	Set the signal to always prohibit forward drive.	
	8	Set the signal to always enable forward drive.	
	9	Axis A: Enable forward drive when CN1-3 input signal is OFF (open). Axis B: Enable forward drive when CN1-9 input signal is OFF (open).	
	A	Axis A: Enable forward drive when CN1-4 input signal is OFF (open). Axis B: Enable forward drive when CN1-10 input signal is OFF (open).	
	B	Axis A: Enable forward drive when CN1-5 input signal is OFF (open). Axis B: Enable forward drive when CN1-11 input signal is OFF (open).	
	C	Axis A: Enable forward drive when CN1-6 input signal is OFF (open). Axis B: Enable forward drive when CN1-12 input signal is OFF (open).	
	D	Axis A: Enable forward drive when CN1-7 input signal is OFF (open). Axis B: Enable forward drive when CN1-13 input signal is OFF (open).	
	E	Axis A: Enable forward drive when CN1-8 input signal is OFF (open). Axis B: Enable forward drive when CN1-14 input signal is OFF (open).	
	F	Reserved setting (Do not use.)	

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Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn50B	2	Input Signal Selections 2	0000h to FFFFh	–	8881h	All	After restart	Setup	–

Pn50B			
n.□□□X	N-OT (Reverse Drive Prohibit) Signal Allocation		Reference
	0	Axis A: Enable reverse drive when CN1-3 input signal is ON (closed). Axis B: Enable reverse drive when CN1-9 input signal is ON (closed).	page 5-29
	1	Axis A: Enable reverse drive when CN1-4 input signal is ON (closed). Axis B: Enable reverse drive when CN1-10 input signal is ON (closed).	
	2	Axis A: Enable reverse drive when CN1-5 input signal is ON (closed). Axis B: Enable reverse drive when CN1-11 input signal is ON (closed).	
	3	Axis A: Enable reverse drive when CN1-6 input signal is ON (closed). Axis B: Enable reverse drive when CN1-12 input signal is ON (closed).	
	4	Axis A: Enable reverse drive when CN1-7 input signal is ON (closed). Axis B: Enable reverse drive when CN1-13 input signal is ON (closed).	
	5	Axis A: Enable reverse drive when CN1-8 input signal is ON (closed). Axis B: Enable reverse drive when CN1-14 input signal is ON (closed).	
	6	Reserved setting (Do not use.)	
	7	Set the signal to always prohibit reverse drive.	
	8	Set the signal to always enable reverse drive.	
	9	Axis A: Enable reverse drive when CN1-3 input signal is OFF (open). Axis B: Enable reverse drive when CN1-9 input signal is OFF (open).	
	A	Axis A: Enable reverse drive when CN1-4 input signal is OFF (open). Axis B: Enable reverse drive when CN1-10 input signal is OFF (open).	
	B	Axis A: Enable reverse drive when CN1-5 input signal is OFF (open). Axis B: Enable reverse drive when CN1-11 input signal is OFF (open).	
	C	Axis A: Enable reverse drive when CN1-6 input signal is OFF (open). Axis B: Enable reverse drive when CN1-12 input signal is OFF (open).	
	D	Axis A: Enable reverse drive when CN1-7 input signal is OFF (open). Axis B: Enable reverse drive when CN1-13 input signal is OFF (open).	
	E	Axis A: Enable reverse drive when CN1-8 input signal is OFF (open). Axis B: Enable reverse drive when CN1-14 input signal is OFF (open).	
	F	Reserved setting (Do not use.)	
n.□□X□	Reserved parameter (Do not change.)		

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Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi- fication	Refer- ence
Pn50B									

		/P-CL (Forward External Torque Limit Input) Signal Allocation	Reference
n.□X□□	0	Axis A: Active when CN1-3 input signal is ON (closed). Axis B: Active when CN1-9 input signal is ON (closed).	page 5-70
	1	Axis A: Active when CN1-4 input signal is ON (closed). Axis B: Active when CN1-10 input signal is ON (closed).	
	2	Axis A: Active when CN1-5 input signal is ON (closed). Axis B: Active when CN1-11 input signal is ON (closed).	
	3	Axis A: Active when CN1-6 input signal is ON (closed). Axis B: Active when CN1-12 input signal is ON (closed).	
	4	Axis A: Active when CN1-7 input signal is ON (closed). Axis B: Active when CN1-13 input signal is ON (closed).	
	5	Axis A: Active when CN1-8 input signal is ON (closed). Axis B: Active when CN1-14 input signal is ON (closed).	
	6	Reserved setting (Do not use.)	
	7	The signal is always active.	
	8	The signal is always inactive.	
	9	Axis A: Active when CN1-3 input signal is OFF (open). Axis B: Active when CN1-9 input signal is OFF (open).	
	A	Axis A: Active when CN1-4 input signal is OFF (open). Axis B: Active when CN1-10 input signal is OFF (open).	
	B	Axis A: Active when CN1-5 input signal is OFF (open). Axis B: Active when CN1-11 input signal is OFF (open).	
	C	Axis A: Active when CN1-6 input signal is OFF (open). Axis B: Active when CN1-12 input signal is OFF (open).	
	D	Axis A: Active when CN1-7 input signal is OFF (open). Axis B: Active when CN1-13 input signal is OFF (open).	
	E	Axis A: Active when CN1-8 input signal is OFF (open). Axis B: Active when CN1-14 input signal is OFF (open).	
	F	Reserved setting (Do not use.)	

		/N-CL (Reverse External Torque Limit Input) Signal Allocation	Reference
n.X□□□	0 to F	The allocations are the same as the /P-CL (Forward External Torque Limit Input) signal allocations.	page 5-70

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Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
Pn50E	2	Output Signal Selections 1	0000h to 6666h	–	0000h	All	After restart	Setup	–

n.□□□X	/COIN (Positioning Completion Output) Signal Allocation		Reference
	0	Disabled (the above signal output is not used).	page 5-60
	1	Axis A: Output the signal from the CN1-23 or CN1-24 output terminal. Axis B: Output the signal from the CN1-25 or CN1-26 output terminal.	
	2	Axis A: Output the signal from the CN1-27 or CN1-28 output terminal. Axis B: Output the signal from the CN1-29 or CN1-30 output terminal.	
	3 to 6	Reserved setting (Do not use.)	

n.□□X□	/V-CMP (Speed Coincidence Detection Output) Signal Allocation		Reference
	0 to 6	The allocations are the same as the /COIN (Positioning Completion) signal allocations.	page 5-58

n.□X□□	/TGON (Rotation Detection Output) Signal Allocation		Reference
	0 to 6	The allocations are the same as the /COIN (Positioning Completion) signal allocations.	page 5-57

n.X□□□	/S-RDY (Servo Ready Output) Signal Allocation		Reference
	0 to 6	The allocations are the same as the /COIN (Positioning Completion) signal allocations.	page 5-58

Pn50F	2	Output Signal Selections 2	0000h to 6666h	–	0100h	All	After restart	Setup	–

n.□□□X	/CLT (Torque Limit Detection Output) Signal Allocation		Reference
	0	Disabled (the above signal output is not used).	page 5-73
	1	Axis A: Output the signal from the CN1-23 or CN1-24 output terminal. Axis B: Output the signal from the CN1-25 or CN1-26 output terminal.	
	2	Axis A: Output the signal from the CN1-27 or CN1-28 output terminal. Axis B: Output the signal from the CN1-29 or CN1-30 output terminal.	
	3 to 6	Reserved setting (Do not use.)	

n.□□X□	/VLT (Speed Limit Detection) Signal Allocation		Reference
	0 to 6	The allocations are the same as the /CLT (Torque Limit Detection Output) signal allocations.	page 5-63

n.□X□□	/BK (Brake Output) Signal Allocation		Reference
	0 to 6	The allocations are the same as the /CLT (Torque Limit Detection Output) signal allocations.	page 5-33

n.X□□□	/WARN (Warning Output) Signal Allocation		Reference
	0 to 6	The allocations are the same as the /CLT (Torque Limit Detection Output) signal allocations.	page 5-57

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Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn510	2	Output Signal Selections 3	0000h to 0666h	–	0000h	All	After restart	Setup	–

	/NEAR (Near Output) Signal Allocation		Reference
n.□□□X	0	Disabled (the above signal output is not used).	page 5-62
	1	Axis A: Output the signal from the CN1-23 or CN1-24 output terminal. Axis B: Output the signal from the CN1-25 or CN1-26 output terminal.	
	2	Axis A: Output the signal from the CN1-27 or CN1-28 output terminal. Axis B: Output the signal from the CN1-29 or CN1-30 output terminal.	
	3 to 6	Reserved setting (Do not use.)	

n.□□X□	Reserved parameter (Do not change.)
n.□X□□	Reserved parameter (Do not change.)
n.X□□□	Reserved parameter (Do not change.)

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Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn511	2	Input Signal Selections 5	0000h to FFFFh	–	5432h	All	After restart	Setup	page 5-50

n.□□□X	/DEC (Origin Return Deceleration Switch Input) Signal Allocation	
	0	Axis A: Active when CN1-3 input signal is ON (closed). Axis B: Active when CN1-9 input signal is ON (closed).
	1	Axis A: Active when CN1-4 input signal is ON (closed). Axis B: Active when CN1-10 input signal is ON (closed).
	2	Axis A: Active when CN1-5 input signal is ON (closed). Axis B: Active when CN1-11 input signal is ON (closed).
	3	Axis A: Active when CN1-6 input signal is ON (closed). Axis B: Active when CN1-12 input signal is ON (closed).
	4	Axis A: Active when CN1-7 input signal is ON (closed). Axis B: Active when CN1-13 input signal is ON (closed).
	5	Axis A: Active when CN1-8 input signal is ON (closed). Axis B: Active when CN1-14 input signal is ON (closed).
	6	Reserved setting (Do not use.)
	7	The signal is always active.
	8	The signal is always inactive.
	9	Axis A: Active when CN1-3 input signal is OFF (open). Axis B: Active when CN1-9 input signal is OFF (open).
	A	Axis A: Active when CN1-4 input signal is OFF (open). Axis B: Active when CN1-10 input signal is OFF (open).
	B	Axis A: Active when CN1-5 input signal is OFF (open). Axis B: Active when CN1-11 input signal is OFF (open).
	C	Axis A: Active when CN1-6 input signal is OFF (open). Axis B: Active when CN1-12 input signal is OFF (open).
	D	Axis A: Active when CN1-7 input signal is OFF (open). Axis B: Active when CN1-13 input signal is OFF (open).
	E	Axis A: Active when CN1-8 input signal is OFF (open). Axis B: Active when CN1-14 input signal is OFF (open).
	F	Reserved setting (Do not use.)

n.□□X□	/EXT1 (External Latch Input 1) Signal Allocation	
	0	Axis A: Active when CN1-3 input signal is ON (closed). Axis B: Active when CN1-9 input signal is ON (closed).
	1	Axis A: Active when CN1-4 input signal is ON (closed). Axis B: Active when CN1-10 input signal is ON (closed).
	2	Axis A: Active when CN1-5 input signal is ON (closed). Axis B: Active when CN1-11 input signal is ON (closed).
	3	Axis A: Active when CN1-6 input signal is ON (closed). Axis B: Active when CN1-12 input signal is ON (closed).
	4	Axis A: Active when CN1-7 input signal is ON (closed). Axis B: Active when CN1-13 input signal is ON (closed).
	5	Axis A: Active when CN1-8 input signal is ON (closed). Axis B: Active when CN1-14 input signal is ON (closed).
	6	Reserved setting (Do not use.)
	7	The signal is always active.
	8 to F	Reserved setting (Do not use.)

n.□X□□	/EXT2 (External Latch Input 2) Signal Allocation	
	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	
	0 to F	The allocations are the same as the /EXT1 (External Latch Input 1) signal allocations.

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Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn512	2	Output Signal Inverse Settings	0000h to 1111h	–	0000h	All	After restart	Setup	page 5-53

n.□□□X	Output Inversion for CN1-23, CN1-24, CN1-25, and CN1-26 Terminals (Axis A: CN1-23 and CN1-24, Axis B: CN1-25 and CN1-26)	
	0	The signal is not inverted.
	1	The signal is inverted.

n.□□X□	Output Inversion for CN1-27, CN1-28, CN1-29, and CN1-30 Terminals (Axis A: CN1-27 and CN1-28, Axis B: CN1-29 and CN1-30)	
	0	The signal is not inverted.
	1	The signal is inverted.

n.□X□□	Reserved parameter (Do not change.)
n.X□□□	Reserved parameter (Do not change.)

Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn514	2	Output Signal Selections 4	0000h to 0666h	–	0000h	All	After restart	Setup	–

n.□□□X	Reserved parameter (Do not change.)
n.□□X□	Reserved parameter (Do not change.)

n.□X□□	/PM (Preventative Maintenance Output) Signal Allocation		Reference
	0	Disabled (the above signal output is not used).	page 9-12
	1	Axis A: Output the signal from the CN1-23 or CN1-24 output terminal. Axis B: Output the signal from the CN1-25 or CN1-26 output terminal.	
	2	Axis A: Output the signal from the CN1-27 or CN1-28 output terminal. Axis B: Output the signal from the CN1-29 or CN1-30 output terminal.	
	3 to 6	Reserved setting (Do not use.)	

n.X□□□	Reserved parameter (Do not change.)

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Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn516	2	Input Signal Selections 7	0000h to FFFFh	–	8888h	All	After restart	Setup	–

n.□□□X	FSTP (Forced Stop Input) Signal Allocation		Reference
	0	Axis A: Enable drive when CN1-3 input signal is ON (closed). Axis B: Enable drive when CN1-9 input signal is ON (closed).	page 5-87
	1	Axis A: Enable drive when CN1-4 input signal is ON (closed). Axis B: Enable drive when CN1-10 input signal is ON (closed).	
	2	Axis A: Enable drive when CN1-5 input signal is ON (closed). Axis B: Enable drive when CN1-11 input signal is ON (closed).	
	3	Axis A: Enable drive when CN1-6 input signal is ON (closed). Axis B: Enable drive when CN1-12 input signal is ON (closed).	
	4	Axis A: Enable drive when CN1-7 input signal is ON (closed). Axis B: Enable drive when CN1-13 input signal is ON (closed).	
	5	Axis A: Enable drive when CN1-8 input signal is ON (closed). Axis B: Enable drive when CN1-14 input signal is ON (closed).	
	6	Reserved setting (Do not use.)	
	7	Set the signal to always prohibit drive (always force the motor to stop).	
	8	Set the signal to always enable drive (always disable forcing the motor to stop).	
	9	Axis A: Enable drive when CN1-3 input signal is OFF (open). Axis B: Enable drive when CN1-9 input signal is OFF (open).	
	A	Axis A: Enable drive when CN1-4 input signal is OFF (open). Axis B: Enable drive when CN1-10 input signal is OFF (open).	
	B	Axis A: Enable drive when CN1-5 input signal is OFF (open). Axis B: Enable drive when CN1-11 input signal is OFF (open).	
	C	Axis A: Enable drive when CN1-6 input signal is OFF (open). Axis B: Enable drive when CN1-12 input signal is OFF (open).	
	D	Axis A: Enable drive when CN1-7 input signal is OFF (open). Axis B: Enable drive when CN1-13 input signal is OFF (open).	
	E	Axis A: Enable drive when CN1-8 input signal is OFF (open). Axis B: Enable drive when CN1-14 input signal is OFF (open).	
	F	Reserved setting (Do not use.)	

n.□□X□	Reserved parameter (Do not change.)

n.□X□□	Reserved parameter (Do not change.)

n.X□□□	Reserved parameter (Do not change.)

Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn51E	2	Position Deviation Overflow Warning Level	10 to 100	1%	100	All	Immediately	Setup	*2
Pn520	4	Position Deviation Overflow Alarm Level	1 to 1,073,741,823	1 reference unit	5242880	All	Immediately	Setup	page 8-9, page 8-82
Pn522	4	Positioning Completed Width	0 to 1,073,741,824	1 reference unit	7	All	Immediately	Setup	page 5-60
Pn524	4	Near Signal Width	1 to 1,073,741,824	1 reference unit	1073741824	All	Immediately	Setup	page 5-62
Pn526	4	Position Deviation Overflow Alarm Level at Servo ON	1 to 1,073,741,823	1 reference unit	5242880	All	Immediately	Setup	page 8-10
Pn528	2	Position Deviation Overflow Warning Level at Servo ON	10 to 100	1%	100	All	Immediately	Setup	page 8-10
Pn529	2	Speed Limit Level at Servo ON	0 to 10,000	1 min^{-1}	10000	Rotary	Immediately	Setup	page 8-10
Pn52B	2	Overload Warning Level	1 to 100	1%	20	All	Immediately	Setup	page 5-39

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<table>
<tr><th>Parameter No.</th><th>Size</th><th>Name</th><th>Setting Range</th><th>Setting Unit</th><th>Default Setting</th><th>Applicable Motors</th><th>When Enabled</th><th>Classi-fication</th><th>Refer-ence</th></tr>
<tr><td>Pn52C</td><td>2</td><td>Base Current Derating at Motor Overload Detection</td><td>10 to 100</td><td>1%</td><td>100</td><td>All</td><td>After restart</td><td>Setup</td><td>page 5-40</td></tr>
<tr><td rowspan="2">Pn530</td><td>2</td><td>Program Jogging-Related Selections</td><td>0000h to 0005h</td><td>–</td><td>0000h</td><td>All</td><td>Immedi-ately</td><td>Setup</td><td>page 6-13</td></tr>
<tr><td colspan="9">
<table>
<tr><td rowspan="7">n.□□□X</td><td colspan="2">Program Jogging Operation Pattern</td></tr>
<tr><td>0</td><td>(Waiting time in Pn535 → Forward by travel distance in Pn531) × Number of movements in Pn536</td></tr>
<tr><td>1</td><td>(Waiting time in Pn535 → Reverse by travel distance in Pn531) × Number of movements in Pn536</td></tr>
<tr><td>2</td><td>(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</td></tr>
<tr><td>3</td><td>(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</td></tr>
<tr><td>4</td><td>(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</td></tr>
<tr><td>5</td><td>(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</td></tr>
<tr><td>n.□□X□</td><td colspan="2">Reserved parameter (Do not change.)</td></tr>
<tr><td>n.□X□□</td><td colspan="2">Reserved parameter (Do not change.)</td></tr>
<tr><td>n.X□□□</td><td colspan="2">Reserved parameter (Do not change.)</td></tr>
</table>
</td></tr>
<tr><td>Pn531</td><td>4</td><td>Program Jogging Travel Distance</td><td>1 to 1,073,741,824</td><td>1 reference unit</td><td>32768</td><td>All</td><td>Immedi-ately</td><td>Setup</td><td>page 6-13</td></tr>
<tr><td>Pn533</td><td>2</td><td>Program Jogging Movement Speed</td><td>1 to 10,000</td><td>Rotary: 1 min^{-1}
Direct Drive: 0.1 min^{-1}</td><td>500</td><td>Rotary</td><td>Immedi-ately</td><td>Setup</td><td>page 6-13</td></tr>
<tr><td>Pn534</td><td>2</td><td>Program Jogging Acceleration/Deceleration Time</td><td>2 to 10,000</td><td>1 ms</td><td>100</td><td>All</td><td>Immedi-ately</td><td>Setup</td><td>page 6-13</td></tr>
<tr><td>Pn535</td><td>2</td><td>Program Jogging Waiting Time</td><td>0 to 10,000</td><td>1 ms</td><td>100</td><td>All</td><td>Immedi-ately</td><td>Setup</td><td>page 6-13</td></tr>
<tr><td>Pn536</td><td>2</td><td>Program Jogging Number of Movements</td><td>0 to 1,000</td><td>1 time</td><td>1</td><td>All</td><td>Immedi-ately</td><td>Setup</td><td>page 6-13</td></tr>
<tr><td>Pn55A
All Axes</td><td>2</td><td>Power Consumption Monitor Unit Time</td><td>1 to 1,440</td><td>1 min</td><td>1</td><td>All</td><td>Immedi-ately</td><td>Setup</td><td>–</td></tr>
<tr><td>Pn560</td><td>2</td><td>Residual Vibration Detection Width</td><td>1 to 3,000</td><td>0.1%</td><td>400</td><td>All</td><td>Immedi-ately</td><td>Setup</td><td>page 8-54</td></tr>
<tr><td>Pn561</td><td>2</td><td>Overshoot Detection Level</td><td>0 to 100</td><td>1%</td><td>100</td><td>All</td><td>Immedi-ately</td><td>Setup</td><td>page 8-30,
page 8-39</td></tr>
<tr><td>Pn581</td><td>2</td><td>Zero Speed Level</td><td>1 to 10,000</td><td>1 mm/s</td><td>20</td><td>Linear</td><td>Immedi-ately</td><td>Setup</td><td>page 5-57</td></tr>
<tr><td>Pn582</td><td>2</td><td>Speed Coincidence Detection Signal Output Width</td><td>0 to 100</td><td>1 mm/s</td><td>10</td><td>Linear</td><td>Immedi-ately</td><td>Setup</td><td>page 5-58</td></tr>
<tr><td>Pn583</td><td>2</td><td>Brake Reference Output Speed Level</td><td>0 to 10,000</td><td>1 mm/s</td><td>10</td><td>Linear</td><td>Immedi-ately</td><td>Setup</td><td>page 5-32</td></tr>
<tr><td>Pn584</td><td>2</td><td>Speed Limit Level at Servo ON</td><td>0 to 10,000</td><td>1 mm/s</td><td>10000</td><td>Linear</td><td>Immedi-ately</td><td>Setup</td><td>page 8-10</td></tr>
</table>

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Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn585	2	Program Jogging Movement Speed	1 to 10,000	1 mm/s	50	Linear	Immediately	Setup	page 6-13
Pn586	2	Motor Running Cooling Ratio	0 to 100	1%/ Max. speed	0	Linear	Immediately	Setup	–
Pn587	2	Polarity Detection Execution Selection for Absolute Linear Encoder	0000h to 0001h	–	0000h	Linear	Immediately	Setup	–

Pn587

n.□□□X	Polarity Detection Selection for Absolute Linear Encoder		Reference
	0	Do not detect polarity.	page 5-25
	1	Detect polarity.	

n.□□X□	Reserved parameter (Do not change.)

n.□X□□	Reserved parameter (Do not change.)

n.X□□□	Reserved parameter (Do not change.)

Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn590	2	P-OT (Forward Drive Prohibit) Signal Allocation	0000h to 3019h	–	Axis A: 1003h, Axis B: 1009h	All	After restart	Setup	page 5-29, page 5-52

Pn590

n.□XXX	Allocated Pin Number	
	003	Allocate the signal to CN1-3.
	004	Allocate the signal to CN1-4.
	005	Allocate the signal to CN1-5.
	006	Allocate the signal to CN1-6.
	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.
	014	Allocate the signal to CN1-14.

n.X□□□	Polarity Selection	
	0	Set the signal to always enable forward drive.
	1	Active when input signal is ON (closed).
	2	Active when input signal is OFF (open).
	3	Set the signal to always prohibit forward drive.

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Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn591	2	N-OT (Reverse Drive Prohibit) Signal Allocation	0000h to 3019h	–	Axis A: 1004h, Axis B: 1010h	All	After restart	Setup	page 5-29, page 5-52

n.□XXX	Allocated Pin Number	
	003	Allocate the signal to CN1-3.
	004	Allocate the signal to CN1-4.
	005	Allocate the signal to CN1-5.
	006	Allocate the signal to CN1-6.
	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.
	014	Allocate the signal to CN1-14.

n.X□□□	Polarity Selection	
	0	Set the signal to always enable reverse drive.
	1	Active when input signal is ON (closed).
	2	Active when input signal is OFF (open).
	3	Set the signal to always prohibit reverse drive.

Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn592	2	/DEC (Origin Return Deceleration Switch Input) Signal Allocation	0000h to 3019h	–	Axis A: 1005h, Axis B: 1011h	All	After restart	Setup	–

n.□XXX	Allocated Pin Number	
	003	Allocate the signal to CN1-3.
	004	Allocate the signal to CN1-4.
	005	Allocate the signal to CN1-5.
	006	Allocate the signal to CN1-6.
	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.
	014	Allocate the signal to CN1-14.

n.X□□□	Polarity Selection	
	0	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.

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Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn593	2	/EXT1 (External Latch Input 1) Signal Allocation	0000h to 2019h	–	Axis A: 1006h, Axis B: 1012h	All	After restart	Setup	–

		Allocated Pin Number
n.□XXX	000 to 005	The signal is always inactive.
	006	Allocate the signal to CN1-6.
	007	Allocate the signal to CN1-7.
	008	Allocate the signal to CN1-8.
	009 to 011	The signal is always inactive.
	012	Allocate the signal to CN1-12.
	013	Allocate the signal to CN1-13.
	014	Allocate the signal to CN1-14.

		Polarity Selection
n.X□□□	0	The signal is always inactive.
	1	Active when input signal is ON (closed).
	2	Active when input signal is OFF (open).

Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn594	2	/EXT2 (External Latch Input 2) Signal Allocation	0000h to 2019h	–	Axis A: 1007h, Axis B: 1013h	All	After restart	Setup	–

		Allocated Pin Number
n.□XXX	000 to 005	The signal is always inactive.
	006	Allocate the signal to CN1-6.
	007	Allocate the signal to CN1-7.
	008	Allocate the signal to CN1-8.
	009 to 011	The signal is always inactive.
	012	Allocate the signal to CN1-12.
	013	Allocate the signal to CN1-13.
	014	Allocate the signal to CN1-14.

		Polarity Selection
n.X□□□	0	The signal is always inactive.
	1	Active when input signal is ON (closed).
	2	Active when input signal is OFF (open).

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Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn595	2	/EXT3 (External Latch Input 3) Signal Allocation	0000h to 2019h	–	Axis A: 1008h, Axis B: 1014h	All	After restart	Setup	–

n.□XXX	Allocated Pin Number	
	000 to 005	The signal is always inactive.
	006	Allocate the signal to CN1-6.
	007	Allocate the signal to CN1-7.
	008	Allocate the signal to CN1-8.
	009 to 011	The signal is always inactive.
	012	Allocate the signal to CN1-12.
	013	Allocate the signal to CN1-13.
	014	Allocate the signal to CN1-14.

n.X□□□	Polarity Selection	
	0	The signal is always inactive.
	1	Active when input signal is ON (closed).
	2	Active when input signal is OFF (open).

Pn597	2	FSTP (Forced Stop Input) Signal Allocation	0000h to 3019h	–	0000h	All	After restart	Setup	page 5-87

n.□XXX	Allocated Pin Number	
	003	Allocate the signal to CN1-3.
	004	Allocate the signal to CN1-4.
	005	Allocate the signal to CN1-5.
	006	Allocate the signal to CN1-6.
	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.
	014	Allocate the signal to CN1-14.

n.X□□□	Polarity Selection	
	0	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).

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Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn598	2	/P-CL (Forward External Torque Limit Input) Signal Allocation	0000h to 3019h	–	0000h	All	After restart	Setup	page 5-52, page 5-70

n.□XXX	Allocated Pin Number	
	003	Allocate the signal to CN1-3.
	004	Allocate the signal to CN1-4.
	005	Allocate the signal to CN1-5.
	006	Allocate the signal to CN1-6.
	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.
	014	Allocate the signal to CN1-14.

n.X□□□	Polarity Selection	
	0	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.

Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn599	2	/N-CL (Reverse External Torque Limit Input) Signal Allocation	0000h to 3019h	–	0000h	All	After restart	Setup	page 5-52, page 5-70

n.□XXX	Allocated Pin Number	
	003	Allocate the signal to CN1-3.
	004	Allocate the signal to CN1-4.
	005	Allocate the signal to CN1-5.
	006	Allocate the signal to CN1-6.
	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.
	014	Allocate the signal to CN1-14.

n.X□□□	Polarity Selection	
	0	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.

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Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn5B0	2	/COIN (Positioning Completion Output) Signal Allocation	0000h to 2039h	–	0000h	All	After restart	Setup	page 5-55, page 5-60

n.□XXX	Allocated Pin Number	
	023	Allocate the signal to CN1-23.
	025	Allocate the signal to CN1-25.
	027	Allocate the signal to CN1-27.
	029	Allocate the signal to CN1-29.
	031	Allocate the signal to CN1-31.

n.X□□□	Polarity Selection	
	0	Disabled (the above signal output is not used).
	1	Output the above signal.
	2	Invert the above signal and output it.

Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn5B1	2	/V-CMP (Speed Coincidence Detection Output) Signal Allocation	0000h to 2039h	–	0000h	All	After restart	Setup	page 5-55, page 5-58

n.□XXX	Allocated Pin Number	
	023	Allocate the signal to CN1-23.
	025	Allocate the signal to CN1-25.
	027	Allocate the signal to CN1-27.
	029	Allocate the signal to CN1-29.
	031	Allocate the signal to CN1-31.

n.X□□□	Polarity Selection	
	0	Disabled (the above signal output is not used).
	1	Output the above signal.
	2	Invert the above signal and output it.

Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn5B2	2	/TGON (Rotation Detection Output) Signal Allocation	0000h to 2039h	–	0000h	All	After restart	Setup	page 5-55, page 5-57

n.□XXX	Allocated Pin Number	
	023	Allocate the signal to CN1-23.
	025	Allocate the signal to CN1-25.
	027	Allocate the signal to CN1-27.
	029	Allocate the signal to CN1-29.
	031	Allocate the signal to CN1-31.

n.X□□□	Polarity Selection	
	0	Disabled (the above signal output is not used).
	1	Output the above signal.
	2	Invert the above signal and output it.

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<table>
<tr><th>Parameter No.</th><th>Size</th><th>Name</th><th>Setting Range</th><th>Setting Unit</th><th>Default Setting</th><th>Applicable Motors</th><th>When Enabled</th><th>Classi-fication</th><th>Refer-ence</th></tr>
<tr><td rowspan="2">Pn5B3</td><td>2</td><td>/S-RDY (Servo Ready) Signal Allocation</td><td>0000h to 2039h</td><td>–</td><td>0000h</td><td>All</td><td>After restart</td><td>Setup</td><td>page 5-55, page 5-58</td></tr>
<tr><td colspan="9">
<table>
<tr><td rowspan="6">n.□XXX</td><td colspan="2">Allocated Pin Number</td></tr>
<tr><td>023</td><td>Allocate the signal to CN1-23.</td></tr>
<tr><td>025</td><td>Allocate the signal to CN1-25.</td></tr>
<tr><td>027</td><td>Allocate the signal to CN1-27.</td></tr>
<tr><td>029</td><td>Allocate the signal to CN1-29.</td></tr>
<tr><td>031</td><td>Allocate the signal to CN1-31.</td></tr>
</table>
<table>
<tr><td rowspan="4">n.X□□□</td><td colspan="2">Polarity Selection</td></tr>
<tr><td>0</td><td>Disabled (the above signal output is not used).</td></tr>
<tr><td>1</td><td>Output the above signal.</td></tr>
<tr><td>2</td><td>Invert the above signal and output it.</td></tr>
</table>
</td></tr>
<tr><td rowspan="2">Pn5B4</td><td>2</td><td>/CLT (Torque Limit Detection Output) Signal Allocation</td><td>0000h to 2039h</td><td>–</td><td>0000h</td><td>All</td><td>After restart</td><td>Setup</td><td>page 5-55, page 5-73</td></tr>
<tr><td colspan="9">
<table>
<tr><td rowspan="6">n.□XXX</td><td colspan="2">Allocated Pin Number</td></tr>
<tr><td>023</td><td>Allocate the signal to CN1-23.</td></tr>
<tr><td>025</td><td>Allocate the signal to CN1-25.</td></tr>
<tr><td>027</td><td>Allocate the signal to CN1-27.</td></tr>
<tr><td>029</td><td>Allocate the signal to CN1-29.</td></tr>
<tr><td>031</td><td>Allocate the signal to CN1-31.</td></tr>
</table>
<table>
<tr><td rowspan="4">n.X□□□</td><td colspan="2">Polarity Selection</td></tr>
<tr><td>0</td><td>Disabled (the above signal output is not used).</td></tr>
<tr><td>1</td><td>Output the above signal.</td></tr>
<tr><td>2</td><td>Invert the above signal and output it.</td></tr>
</table>
</td></tr>
<tr><td rowspan="2">Pn5B5</td><td>2</td><td>/VLT (Speed Limit Detection) Signal Allocation</td><td>0000h to 2039h</td><td>–</td><td>0000h</td><td>All</td><td>After restart</td><td>Setup</td><td>page 5-55, page 5-63</td></tr>
<tr><td colspan="9">
<table>
<tr><td rowspan="6">n.□XXX</td><td colspan="2">Allocated Pin Number</td></tr>
<tr><td>023</td><td>Allocate the signal to CN1-23.</td></tr>
<tr><td>025</td><td>Allocate the signal to CN1-25.</td></tr>
<tr><td>027</td><td>Allocate the signal to CN1-27.</td></tr>
<tr><td>029</td><td>Allocate the signal to CN1-29.</td></tr>
<tr><td>031</td><td>Allocate the signal to CN1-31.</td></tr>
</table>
<table>
<tr><td rowspan="4">n.X□□□</td><td colspan="2">Polarity Selection</td></tr>
<tr><td>0</td><td>Disabled (the above signal output is not used).</td></tr>
<tr><td>1</td><td>Output the above signal.</td></tr>
<tr><td>2</td><td>Invert the above signal and output it.</td></tr>
</table>
</td></tr>
</table>

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<table>
<tr><th>Parameter No.</th><th>Size</th><th>Name</th><th>Setting Range</th><th>Setting Unit</th><th>Default Setting</th><th>Applicable Motors</th><th>When Enabled</th><th>Classi-fication</th><th>Refer-ence</th></tr>
<tr><td rowspan="2">Pn5B6</td><td>2</td><td>/BK (Brake Output) Signal Allocation</td><td>0000h to 2039h</td><td>–</td><td>Axis A: 1023h,
Axis B: 1025h</td><td>All</td><td>After restart</td><td>Setup</td><td>page 5-55</td></tr>
<tr><td colspan="9">
<table>
<tr><td rowspan="6">n.□XXX</td><td colspan="2">Allocated Pin Number</td></tr>
<tr><td>023</td><td>Allocate the signal to CN1-23.</td></tr>
<tr><td>025</td><td>Allocate the signal to CN1-25.</td></tr>
<tr><td>027</td><td>Allocate the signal to CN1-27.</td></tr>
<tr><td>029</td><td>Allocate the signal to CN1-29.</td></tr>
<tr><td>031</td><td>Allocate the signal to CN1-31.</td></tr>
</table>
<table>
<tr><td rowspan="4">n.X□□□</td><td colspan="2">Polarity Selection</td></tr>
<tr><td>0</td><td>Disabled (the above signal output is not used).</td></tr>
<tr><td>1</td><td>Output the above signal.</td></tr>
<tr><td>2</td><td>Invert the above signal and output it.</td></tr>
</table>
</td></tr>
<tr><td rowspan="2">Pn5B7</td><td>2</td><td>/WARN (Warning Output) Signal Allocation</td><td>0000h to 2039h</td><td>–</td><td>0000h</td><td>All</td><td>After restart</td><td>Setup</td><td>page 5-55, page 5-56</td></tr>
<tr><td colspan="9">
<table>
<tr><td rowspan="6">n.□XXX</td><td colspan="2">Allocated Pin Number</td></tr>
<tr><td>023</td><td>Allocate the signal to CN1-23.</td></tr>
<tr><td>025</td><td>Allocate the signal to CN1-25.</td></tr>
<tr><td>027</td><td>Allocate the signal to CN1-27.</td></tr>
<tr><td>029</td><td>Allocate the signal to CN1-29.</td></tr>
<tr><td>031</td><td>Allocate the signal to CN1-31.</td></tr>
</table>
<table>
<tr><td rowspan="4">n.X□□□</td><td colspan="2">Polarity Selection</td></tr>
<tr><td>0</td><td>Disabled (the above signal output is not used).</td></tr>
<tr><td>1</td><td>Output the above signal.</td></tr>
<tr><td>2</td><td>Invert the above signal and output it.</td></tr>
</table>
</td></tr>
<tr><td rowspan="2">Pn5B8</td><td>2</td><td>/NEAR (Near Output) Signal Allocation</td><td>0000h to 2039h</td><td>–</td><td>0000h</td><td>All</td><td>After restart</td><td>Setup</td><td>page 5-55, page 5-62</td></tr>
<tr><td colspan="9">
<table>
<tr><td rowspan="6">n.□XXX</td><td colspan="2">Allocated Pin Number</td></tr>
<tr><td>023</td><td>Allocate the signal to CN1-23.</td></tr>
<tr><td>025</td><td>Allocate the signal to CN1-25.</td></tr>
<tr><td>027</td><td>Allocate the signal to CN1-27.</td></tr>
<tr><td>029</td><td>Allocate the signal to CN1-29.</td></tr>
<tr><td>031</td><td>Allocate the signal to CN1-31.</td></tr>
</table>
<table>
<tr><td rowspan="4">n.X□□□</td><td colspan="2">Polarity Selection</td></tr>
<tr><td>0</td><td>Disabled (the above signal output is not used).</td></tr>
<tr><td>1</td><td>Output the above signal.</td></tr>
<tr><td>2</td><td>Invert the above signal and output it.</td></tr>
</table>
</td></tr>
</table>

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<table>
<tr><th>Parameter No.</th><th>Size</th><th>Name</th><th>Setting Range</th><th>Setting Unit</th><th>Default Setting</th><th>Applicable Motors</th><th>When Enabled</th><th>Classi-fication</th><th>Refer-ence</th></tr>
<tr><td rowspan="2">Pn5BC</td><td>2</td><td>/PM (Preventative Maintenance Output) Signal Allocation</td><td>0000h to 2039h</td><td>–</td><td>0000h</td><td>All</td><td>After restart</td><td>Setup</td><td>page 9-12</td></tr>
<tr><td colspan="9">
<table>
<tr><td rowspan="6">n.□XXX</td><td colspan="2">Allocated Pin Number</td></tr>
<tr><td>023</td><td>Allocate the signal to CN1-23.</td></tr>
<tr><td>025</td><td>Allocate the signal to CN1-25.</td></tr>
<tr><td>027</td><td>Allocate the signal to CN1-27.</td></tr>
<tr><td>029</td><td>Allocate the signal to CN1-29.</td></tr>
<tr><td>031</td><td>Allocate the signal to CN1-31.</td></tr>
</table>
<table>
<tr><td rowspan="4">n.X□□□</td><td colspan="2">Polarity Selection</td></tr>
<tr><td>0</td><td>Disabled (the above signal output is not used).</td></tr>
<tr><td>1</td><td>Output the above signal.</td></tr>
<tr><td>2</td><td>Invert the above signal and output it.</td></tr>
</table>
</td></tr>
<tr><td>Pn600
All Axes</td><td>2</td><td>Regenerative Resistor Capacity[*4]</td><td>Depends on model.[*4]</td><td>10 W</td><td>0</td><td>All</td><td>Immediately</td><td>Setup</td><td>page 5-49</td></tr>
<tr><td>Pn601</td><td>2</td><td>Dynamic Brake Resistor Allowable Energy Consumption</td><td>0 to 65,535</td><td>10 J</td><td>0</td><td>All</td><td>After restart</td><td>Setup</td><td>*5</td></tr>
<tr><td>Pn603
All Axes</td><td>2</td><td>Regenerative Resistance</td><td>0 to 65,535</td><td>10 mΩ</td><td>0</td><td>All</td><td>Immediately</td><td>Setup</td><td>page 5-49</td></tr>
<tr><td>Pn604</td><td>2</td><td>Dynamic Brake Resistance</td><td>0 to 65,535</td><td>10 mΩ</td><td>0</td><td>All</td><td>After restart</td><td>Setup</td><td>*5</td></tr>
</table>

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<table>
<tr><th>Parameter No.</th><th>Size</th><th>Name</th><th>Setting Range</th><th>Setting Unit</th><th>Default Setting</th><th>Applicable Motors</th><th>When Enabled</th><th>Classification</th><th>Reference</th></tr>
<tr><td rowspan="2">Pn800</td><td>2</td><td>Communications Controls</td><td>0000h to 1FF3h</td><td>–</td><td>1040h</td><td>All</td><td>Immediately</td><td>Setup</td><td>–</td></tr>
<tr><td colspan="9">
<table>
<tr><td rowspan="5">n.□□□X</td><td colspan="2">MECHATROLINK Communications Check Mask for Debugging</td></tr>
<tr><td>0</td><td>Do not mask.</td></tr>
<tr><td>1</td><td>Ignore MECHATROLINK communications errors (A.E60).</td></tr>
<tr><td>2</td><td>Ignore WDT errors (A.E50).</td></tr>
<tr><td>3</td><td>Ignore both MECHATROLINK communications errors (A.E60) and WDT errors (A.E50).</td></tr>
</table>
<table>
<tr><td rowspan="17">n.□□X□</td><td colspan="2">Warning Check Masks</td></tr>
<tr><td>0</td><td>Do not mask.</td></tr>
<tr><td>1</td><td>Ignore data setting warnings (A.94□).</td></tr>
<tr><td>2</td><td>Ignore command warnings (A.95□).</td></tr>
<tr><td>3</td><td>Ignore both A.94□ and A.95□ warnings.</td></tr>
<tr><td>4</td><td>Ignore communications warnings (A.96□).</td></tr>
<tr><td>5</td><td>Ignore both A.94□ and A.96□ warnings.</td></tr>
<tr><td>6</td><td>Ignore both A.95□ and A.96□ warnings.</td></tr>
<tr><td>7</td><td>Ignore A.94□, A.95□, and A.96□ warnings.</td></tr>
<tr><td>8</td><td>Ignore data setting warnings (A.97A and A.97b).</td></tr>
<tr><td>9</td><td>Ignore A.94□, A.97A, and A.97b warnings.</td></tr>
<tr><td>A</td><td>Ignore A.95□, A.97A, and A.97b warnings.</td></tr>
<tr><td>B</td><td>Ignore A.94□, A.95□, A.97A, and A.97b warnings.</td></tr>
<tr><td>C</td><td>Ignore A.96□, A.97A, and A.97b warnings.</td></tr>
<tr><td>D</td><td>Ignore A.94□, A.96□, A.97A, and A.97b warnings.</td></tr>
<tr><td>E</td><td>Ignore A.95□, A.96□, A.97A, and A.97b warnings.</td></tr>
<tr><td>F</td><td>Ignore A.94□, A.95□, A.96□, A.97A, and A.97b warnings.</td></tr>
</table>
<table>
<tr><td>n.□X□□</td><td>Reserved parameter (Do not change.)</td></tr>
</table>
<table>
<tr><td rowspan="3">n.X□□□</td><td colspan="2">Automatic Warning Clear Selection for Debugging*6</td></tr>
<tr><td>0</td><td>Retain warnings for debugging.</td></tr>
<tr><td>1</td><td>Automatically clear warnings (MECHATROLINK-III specification).</td></tr>
</table>
</td></tr>
<tr><td>Pn803</td><td>2</td><td>Origin Range</td><td>0 to 250</td><td>1 reference unit</td><td>10</td><td>All</td><td>Immediately</td><td>Setup</td><td>*1</td></tr>
<tr><td>Pn808</td><td>4</td><td>Absolute Encoder Origin Offset</td><td>-1,073,741,823 to 1,073,741,823</td><td>1 reference unit</td><td>0</td><td>All</td><td>Immediately *6</td><td>Setup</td><td>page 5-46</td></tr>
<tr><td>Pn810</td><td>2</td><td>Exponential Acceleration/Deceleration Bias</td><td>0 to 65,535</td><td>100 reference units/s</td><td>0</td><td>All</td><td>Immediately *8</td><td>Setup</td><td>*1</td></tr>
<tr><td>Pn811</td><td>2</td><td>Exponential Acceleration/Deceleration Time Constant</td><td>0 to 5,100</td><td>0.1 ms</td><td>0</td><td>All</td><td>Immediately *8</td><td>Setup</td><td>*1</td></tr>
<tr><td>Pn812</td><td>2</td><td>Movement Average Time</td><td>0 to 5,100</td><td>0.1 ms</td><td>0</td><td>All</td><td>Immediately *8</td><td>Setup</td><td>*1</td></tr>
<tr><td>Pn814</td><td>4</td><td>External Positioning Final Travel Distance</td><td>-1,073,741,823 to 1,073,741,823</td><td>1 reference unit</td><td>100</td><td>All</td><td>Immediately</td><td>Setup</td><td>*1</td></tr>
<tr><td>Pn817 *9</td><td>2</td><td>Origin Approach Speed 1</td><td>0 to 65,535</td><td>100 reference units/s</td><td>50</td><td>All</td><td>Immediately *7</td><td>Setup</td><td>*1</td></tr>
<tr><td>Pn818 *10</td><td>2</td><td>Origin Approach Speed 2</td><td>0 to 65,535</td><td>100 reference units/s</td><td>5</td><td>All</td><td>Immediately *7</td><td>Setup</td><td>*1</td></tr>
<tr><td>Pn819</td><td>4</td><td>Final Travel Distance for Origin Return</td><td>-1,073,741,823 to 1,073,741,823</td><td>1 reference unit</td><td>100</td><td>All</td><td>Immediately</td><td>Setup</td><td>*1</td></tr>
</table>

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Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn820	4	Forward Latching Area	-2,147,483,648 to 2,147,483,647	1 reference unit	0	All	Immediately	Setup	*1
Pn822	4	Reverse Latching Area	-2,147,483,648 to 2,147,483,647	1 reference unit	0	All	Immediately	Setup	*1
Pn824	2	Option Monitor 1 Selection	0000h to FFFFh	–	0000h	–	Immediately	Setup	*1

Setting	Monitor	Applicable Motors
High-Speed Monitor Region		
0000h	Motor speed [1000000h/overspeed detection speed]	All
0001h	Speed reference [1000000h/overspeed detection speed]	All
0002h	Torque [1000000h/maximum torque]	All
0003h	Position deviation (lower 32 bits) [reference units]	All
0004h	Position deviation (upper 32 bits) [reference units]	All
000Ah	Encoder count (lower 32 bits) [reference units]	All
000Bh	Encoder count (upper 32 bits) [reference units]	All
Low-Speed Monitor Region		
0010h	Un000: Motor speed [min^{-1}]	All
0011h	Un001: Speed Reference [min^{-1}]	All
0012h	Un002: Torque Reference [%]	All
0013h	Un003: Rotational Angle 1 [encoder pulses] Number of encoder pulses from origin within one encoder rotation displayed in decimal	All
	Un003: Rotational 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 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
0023h	Initial multiturn data [Rev]	Rotary
0024h	Initial incremental data [pulses]	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

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<table>
<tr><th>Parameter No.</th><th>Size</th><th>Name</th><th>Setting Range</th><th>Setting Unit</th><th>Default Setting</th><th>Applicable Motors</th><th>When Enabled</th><th>Classi-fication</th><th>Refer-ence</th></tr>
<tr><td>Pn824</td><td colspan="9">
<table>
<tr><th>Setting</th><th>Monitor</th><th>Applicable Motors</th></tr>
<tr><td colspan="3">Communications Module Only</td></tr>
<tr><td>0080h</td><td>Previous value of latched feedback position (LPOS1) [reference units]</td><td>All</td></tr>
<tr><td>0081h</td><td>Previous value of latched feedback position (LPOS2) [reference units]</td><td>All</td></tr>
<tr><td>0084h</td><td>Continuous Latch Status (EX STATUS)</td><td>All</td></tr>
<tr><td colspan="3">All Areas</td></tr>
<tr><td>Other values</td><td>Reserved settings (Do not use.)</td><td>All</td></tr>
</table>
</td></tr>
<tr><td rowspan="2">Pn825</td><td>2</td><td>Option Monitor 2 Selection</td><td>0000h to FFFFh</td><td>–</td><td>0000h</td><td>All</td><td>Immediately</td><td>Setup</td><td>[1]</td></tr>
<tr><td colspan="9">
<table>
<tr><td>0000h to 0084h</td><td>The settings are the same as those for the Option Monitor 1 Selection.</td></tr>
</table>
</td></tr>
<tr><td>Pn829</td><td>2</td><td>SVOFF Waiting Time (for SVOFF at Deceleration to Stop)</td><td>0 to 65,535</td><td>10 ms</td><td>0</td><td>All</td><td>Immediately [7]</td><td>Setup</td><td>[1]</td></tr>
<tr><td>Pn840</td><td>4</td><td>Linear Deceleration Constant 2 for Stopping</td><td>1 to 20,971,520</td><td>10,000 reference units/s^2</td><td>100</td><td>All</td><td>Immediately [7]</td><td>Setup</td><td>[1]</td></tr>
<tr><td>Pn842 [12]</td><td>4</td><td>Second Origin Approach Speed 1</td><td>0 to 20,971,520</td><td>100 reference units/s</td><td>0</td><td>All</td><td>Immediately [7]</td><td>Setup</td><td>[1]</td></tr>
<tr><td>Pn844 [13]</td><td>4</td><td>Second Origin Approach Speed 2</td><td>0 to 20,971,520</td><td>100 reference units/s</td><td>0</td><td>All</td><td>Immediately [7]</td><td>Setup</td><td>[1]</td></tr>
<tr><td>Pn846</td><td>2</td><td>POSING Command S-Curve Acceleration/ Deceleration Rate</td><td>0 to 50</td><td>1%</td><td>0</td><td>All</td><td>Immediately [7]</td><td>Setup</td><td>–</td></tr>
<tr><td>Pn850</td><td>2</td><td>Number of Latch Sequences</td><td>0 to 8</td><td>–</td><td>0</td><td>All</td><td>Immediately</td><td>Setup</td><td>[1]</td></tr>
<tr><td>Pn851</td><td>2</td><td>Continuous Latch Sequence Count</td><td>0 to 255</td><td>–</td><td>0</td><td>All</td><td>Immediately</td><td>Setup</td><td>[1]</td></tr>
<tr><td rowspan="2">Pn852</td><td>2</td><td>Latch Sequence 1 to 4 Settings</td><td>0000h to 3333h</td><td>–</td><td>0000h</td><td>All</td><td>Immediately</td><td>Setup</td><td>[1]</td></tr>
<tr><td colspan="9">
<table>
<tr><td rowspan="5">n.□□□X</td><td colspan="2">Latch Sequence 1 Signal Selection</td></tr>
<tr><td>0</td><td>Phase C</td></tr>
<tr><td>1</td><td>EXT1 signal</td></tr>
<tr><td>2</td><td>EXT2 signal</td></tr>
<tr><td>3</td><td>EXT3 signal</td></tr>
</table>
<table>
<tr><td rowspan="2">n.□□X□</td><td colspan="2">Latch Sequence 2 Signal Selection</td></tr>
<tr><td>0 to 3</td><td>The settings are the same as those for the Latch Sequence 1 Signal Selection.</td></tr>
</table>
<table>
<tr><td rowspan="2">n.□X□□</td><td colspan="2">Latch Sequence 3 Signal Selection</td></tr>
<tr><td>0 to 3</td><td>The settings are the same as those for the Latch Sequence 1 Signal Selection.</td></tr>
</table>
<table>
<tr><td rowspan="2">n.X□□□</td><td colspan="2">Latch Sequence 4 Signal Selection</td></tr>
<tr><td>0 to 3</td><td>The settings are the same as those for the Latch Sequence 1 Signal Selection.</td></tr>
</table>
</td></tr>
</table>

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Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
Pn853	2	Latch Sequence 5 to 8 Settings	0000h to 3333h	–	0000h	All	Immediately	Setup	*1

n.□□□X	Latch Sequence 5 Signal Selection	
	0	Phase C
	1	EXT1 signal
	2	EXT2 signal
	3	EXT3 signal
n.□□X□	Latch Sequence 6 Signal Selection	
	0 to 3	The settings are the same as those for the Latch Sequence 5 Signal Selection.
n.□X□□	Latch Sequence 7 Signal Selection	
	0 to 3	The settings are the same as those for the Latch Sequence 5 Signal Selection.
n.X□□□	Latch Sequence 8 Signal Selection	
	0 to 3	The settings are the same as those for the Latch Sequence 5 Signal Selection.

Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classification	Reference
Pn860	2	Input Signal Monitor Allocations 1	0000h to 1717h	–	0000h	All	Immediately	Setup	*1

n.□□□X	Input Signal Monitor Allocation for CN1-3	
	0	Allocate bit 18 of IL□□28 (Servo Command Input Signal) to CN1-3 input signal monitor.
	1	Allocate bit 19 of IL□□28 (Servo Command Input Signal) to CN1-3 input signal monitor.
	2	Allocate bit 1A of IL□□28 (Servo Command Input Signal) to CN1-3 input signal monitor.
	3	Allocate bit 1B of IL□□28 (Servo Command Input Signal) to CN1-3 input signal monitor.
	4	Allocate bit 1C of IL□□28 (Servo Command Input Signal) to CN1-3 input signal monitor.
	5	Allocate bit 1D of IL□□28 (Servo Command Input Signal) to CN1-3 input signal monitor.
	6	Allocate bit 1E of IL□□28 (Servo Command Input Signal) to CN1-3 input signal monitor.
	7	Allocate bit 1F of IL□□28 (Servo Command Input Signal) to CN1-3 input signal monitor.
n.□□X□	CN1-3 Input Signal Monitor Enable/Disable Selection	
	0	Disable allocation for CN1-3 input signal monitor.
	1	Enable allocation for CN1-3 input signal monitor.
n.□X□□	Input Signal Monitor Allocation for CN1-4	
	0 to 7	The settings are the same as the CN1-3 allocations.
n.X□□□	CN1-4 Input Signal Monitor Enable/Disable Selection	
	0	Disable allocation for CN1-4 input signal monitor.
	1	Enable allocation for CN1-4 input signal monitor.

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Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn861	2	Input Signal Monitor Allocations 2	0000h to 1717h	–	0000h	All	Immedi-ately	Setup	*1

n.□□□X	Input Signal Monitor Allocation for CN1-5	
	0 to 7	The settings are the same as the CN1-3 allocations.
n.□□X□	CN1-5 Input Signal Monitor Enable/Disable Selection	
	0	Disable allocation for CN1-5 input signal monitor.
	1	Enable allocation for CN1-5 input signal monitor.
n.□X□□	Input Signal Monitor Allocation for CN1-6	
	0 to 7	The settings are the same as the CN1-3 allocations.
n.X□□□	CN1-6 Input Signal Monitor Enable/Disable Selection	
	0	Disable allocation for CN1-6 input signal monitor.
	1	Enable allocation for CN1-6 input signal monitor.

Pn862	2	Input Signal Monitor Allocations 3	0000h to 1717h	–	0000h	All	Immedi-ately	Setup	*1

n.□□□X	Input Signal Monitor Allocation for CN1-7	
	0 to 7	The settings are the same as the CN1-3 allocations.
n.□□X□	CN1-7 Input Signal Monitor Enable/Disable Selection	
	0	Disable allocation for CN1-7 input signal monitor.
	1	Enable allocation for CN1-7 input signal monitor.
n.□X□□	Input Signal Monitor Allocation for CN1-8	
	0 to 7	The settings are the same as the CN1-3 allocations.
n.X□□□	CN1-8 Input Signal Monitor Enable/Disable Selection	
	0	Disable allocation for CN1-8 input signal monitor.
	1	Enable allocation for CN1-8 input signal monitor.

Pn863	2	Input Signal Monitor Allocations 4	0000h to 1717h	–	0000h	All	Immedi-ately	Setup	*1

n.□□□X	Input Signal Monitor Allocation for CN1-9	
	0 to 7	The settings are the same as the CN1-3 allocations.
n.□□X□	CN1-9 Input Signal Monitor Enable/Disable Selection	
	0	Disable allocation for CN1-9 input signal monitor.
	1	Enable allocation for CN1-9 input signal monitor.
n.□X□□	Input Signal Monitor Allocation for CN1-10	
	0 to 7	The settings are the same as the CN1-3 allocations.
n.X□□□	CN1-10 Input Signal Monitor Enable/Disable Selection	
	0	Disable allocation for CN1-10 input signal monitor.
	1	Enable allocation for CN1-10 input signal monitor.

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<table>
<tr><th>Parameter No.</th><th>Size</th><th>Name</th><th>Setting Range</th><th>Setting Unit</th><th>Default Setting</th><th>Applicable Motors</th><th>When Enabled</th><th>Classi-fication</th><th>Refer-ence</th></tr>
<tr><td rowspan="2">Pn864</td><td>2</td><td>Input Signal Monitor Allocations 5</td><td>0000h to 1717h</td><td>–</td><td>0000h</td><td>All</td><td>Immedi-ately</td><td>Setup</td><td>*1</td></tr>
<tr><td colspan="9">
<table>
<tr><td rowspan="2">n.□□□X</td><td colspan="2">Input Signal Monitor Allocation for CN1-11</td></tr>
<tr><td>0 to 7</td><td>The settings are the same as the CN1-3 allocations.</td></tr>
</table>
<table>
<tr><td rowspan="3">n.□□X□</td><td colspan="2">CN1-11 Input Signal Monitor Enable/Disable Selection</td></tr>
<tr><td>0</td><td>Disable allocation for CN1-11 input signal monitor.</td></tr>
<tr><td>1</td><td>Enable allocation for CN1-11 input signal monitor.</td></tr>
</table>
<table>
<tr><td rowspan="2">n.□X□□</td><td colspan="2">Input Signal Monitor Allocation for CN1-12</td></tr>
<tr><td>0 to 7</td><td>The settings are the same as the CN1-3 allocations.</td></tr>
</table>
<table>
<tr><td rowspan="3">n.X□□□</td><td colspan="2">CN1-12 Input Signal Monitor Enable/Disable Selection</td></tr>
<tr><td>0</td><td>Disable allocation for CN1-12 input signal monitor.</td></tr>
<tr><td>1</td><td>Enable allocation for CN1-12 input signal monitor.</td></tr>
</table>
</td></tr>
<tr><td rowspan="2">Pn865</td><td>2</td><td>Input Signal Monitor Allocations 6</td><td>0000h to 1717h</td><td>–</td><td>0000h</td><td>All</td><td>Immedi-ately</td><td>Setup</td><td>*1</td></tr>
<tr><td colspan="9">
<table>
<tr><td rowspan="2">n.□□□X</td><td colspan="2">Input Signal Monitor Allocation for CN1-13</td></tr>
<tr><td>0 to 7</td><td>The settings are the same as the CN1-3 allocations.</td></tr>
</table>
<table>
<tr><td rowspan="3">n.□□X□</td><td colspan="2">CN1-13 Input Signal Monitor Enable/Disable Selection</td></tr>
<tr><td>0</td><td>Disable allocation for CN1-13 input signal monitor.</td></tr>
<tr><td>1</td><td>Enable allocation for CN1-13 input signal monitor.</td></tr>
</table>
<table>
<tr><td rowspan="2">n.□X□□</td><td colspan="2">Input Signal Monitor Allocation for CN1-14</td></tr>
<tr><td>0 to 7</td><td>The settings are the same as the CN1-3 allocations.</td></tr>
</table>
<table>
<tr><td rowspan="3">n.X□□□</td><td colspan="2">CN1-14 Input Signal Monitor Enable/Disable Selection</td></tr>
<tr><td>0</td><td>Disable allocation for CN1-14 input signal monitor.</td></tr>
<tr><td>1</td><td>Enable allocation for CN1-14 input signal monitor.</td></tr>
</table>
</td></tr>
</table>

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Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn868	2	Output Signal Monitor Allocations 1	0000h to 1717h	–	0000h	All	Immedi-ately	Setup	*1

n.□□□X	Output Signal Monitor Allocation for CN1-23 and CN1-24	
	0	Allocate bit 24 (IO_STS1) to CN1-23/CN1-24 output signal monitor.
	1	Allocate bit 25 (IO_STS2) to CN1-23/CN1-24 output signal monitor.
	2	Allocate bit 26 (IO_STS3) to CN1-23/CN1-24 output signal monitor.
	3	Allocate bit 27 (IO_STS4) to CN1-23/CN1-24 output signal monitor.
	4	Allocate bit 28 (IO_STS5) to CN1-23/CN1-24 output signal monitor.
	5	Allocate bit 29 (IO_STS6) to CN1-23/CN1-24 output signal monitor.
	6	Allocate bit 30 (IO_STS7) to CN1-23/CN1-24 output signal monitor.
	7	Allocate bit 31 (IO_STS8) to CN1-23/CN1-24 output signal monitor.
n.□□X□	CN1-23/CN1-24 Output Signal Monitor Enable/Disable Selection	
	0	Disable allocation for CN1-23/CN1-24 output signal monitor.
	1	Enable allocation for CN1-23/CN1-24 output signal monitor.
n.□X□□	Output Signal Monitor Allocation for CN1-25 and CN1-26	
	0 to 7	The settings are the same as the CN1-23/CN1-24 allocations.
n.X□□□	CN1-25/CN1-26 Output Signal Monitor Enable/Disable Selection	
	0	Disable allocation for CN1-25/CN1-26 output signal monitor.
	1	Enable allocation for CN1-25/CN1-26 output signal monitor.

Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn869	2	Output Signal Monitor Allocations 2	0000h to 1717h	–	0000h	All	Immedi-ately	Setup	*1

n.□□□X	Output Signal Monitor Allocation for CN1-27 and CN1-28	
	0 to 7	The settings are the same as the CN1-23/CN1-24 allocations.
n.□□X□	CN1-27/CN1-28 Output Signal Monitor Enable/Disable Selection	
	0	Disable allocation for CN1-27/CN1-28 output signal monitor.
	1	Enable allocation for CN1-27/CN1-28 output signal monitor.
n.□X□□	Output Signal Monitor Allocation for CN1-29 and CN1-30	
	0 to 7	The settings are the same as the CN1-23/CN1-24 allocations.
n.X□□□	CN1-29/CN1-30 Output Signal Monitor Enable/Disable Selection	
	0	Disable allocation for CN1-29/CN1-30 output signal monitor.
	1	Enable allocation for CN1-29/CN1-30 output signal monitor.

Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn86A	2	Output Signal Monitor Allocations 3	0000h to 1717h	–	0000h	All	Immedi-ately	Setup	*1

n.□□□X	Output Signal Monitor Allocation for CN1-31 and CN1-32	
	0 to 7	The settings are the same as the CN1-23/CN1-24 allocations.
n.□□X□	CN1-31/CN1-32 Output Signal Monitor Enable/Disable Selection	
	0	Disable allocation for CN1-31/CN1-32 output signal monitor.
	1	Enable allocation for CN1-31/CN1-32 output signal monitor.
n.□X□□	Reserved parameter (Do not change.)	
n.X□□□	Reserved parameter (Do not change.)	

Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn882	2	Reserved parameter (Do not change.)	–	–	–	–	–	–	–

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Parameter No.	Size	Name	Setting Range	Setting Unit	Default Setting	Applicable Motors	When Enabled	Classi-fication	Refer-ence
Pn883	2	Reserved parameter (Do not change.)	–	–	–	–	–	–	–
Pn890 to Pn8A6	4	Reserved parameter (Do not change.)	–	–	–	–	–	–	–
Pn8A8 to Pn8BE	4	Reserved parameter (Do not change.)	–	–	–	–	–	–	–
Pn900	2	Number of Parameter Banks	0 to 16	–	0	All	After restart	Setup	*1
Pn901	2	Number of Parameter Bank Members	0 to 15	–	0	All	After restart	Setup	*1
Pn902 to Pn910	2	Parameter Bank Member Definition	0000h to 08FFh	–	0000h	All	After restart	Setup	*1
Pn920 to Pn95F	2	Parameter Bank Data (Not saved in nonvolatile memory.)	0000h to FFFFh	–	0000h	All	Immedi-ately	Setup	*1

*1. Refer to the following manuals for details.

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

  📖 **Σ-7-Series Σ-7C SERVOPACK Motion Control User's Manual (Manual No.: SIEP S800002 03)**

*2. Refer to the following manual for details.

  📖 **Σ-7-Series Σ-7C SERVOPACK Troubleshooting Manual (Manual No.: SIEP S800002 07)**

*3. Set a percentage of the motor rated torque.

*4. Normally set this parameter to 0. If you use an External Regenerative Resistor, set the capacity (W) of the External Regenerative Resistor.

*5. These parameters are for SERVOPACKs with the dynamic brake option. Refer to the following manual for details.

  📖 **Σ-7-Series Σ-7S/Σ-7W SERVOPACK with Dynamic Brake Hardware Option Specifications Product Manual (Manual No.: SIEP S800001 73)**

*6. The parameter setting is enabled after the SVD completes servo ON execution.

*7. Change the setting when the reference is stopped (i.e., while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

*8. The settings are updated only if the reference is stopped (i.e., only if DEN is set to 1).

*9. The setting of Pn842 is valid while Pn817 is set to 0.

*10.The setting of Pn844 is valid while Pn818 is set to 0.

11.2 Controller Section Parameters

The Controller Section has the following types of parameters.

- Fixed parameters
- Setting parameters
- Monitor parameters

Collectively, these three types of parameters are called motion parameters.

Refer to the following manual for details on motion parameters.

📖 Σ-7-Series Σ-7C SERVOPACK Motion Control User’s Manual (Manual No.: SIEP S800002 03)

Functions of the Controller Section

12

This chapter describes the functions of the Controller Section.

12.1 Data Logging

Data logging saves the values of specified registers in a log file according to the preset trigger timing and conditions.

The data is stored in the RAM in the CPU or on the USB memory device.

Data Storage Location	Merits	Demerits
CPU RAM	The file writing speed is fast and the overhead that is placed on the scan is low.	• Data is lost when the control power supply is turned OFF. • Storage capacity is limited to 8 MB.
USB memory	• Data can be stored for a long time. • Logged data can be viewed easily by inserting the USB memory device into a PC.	The file writing speed is slow and the overhead that is placed on the scan is high.

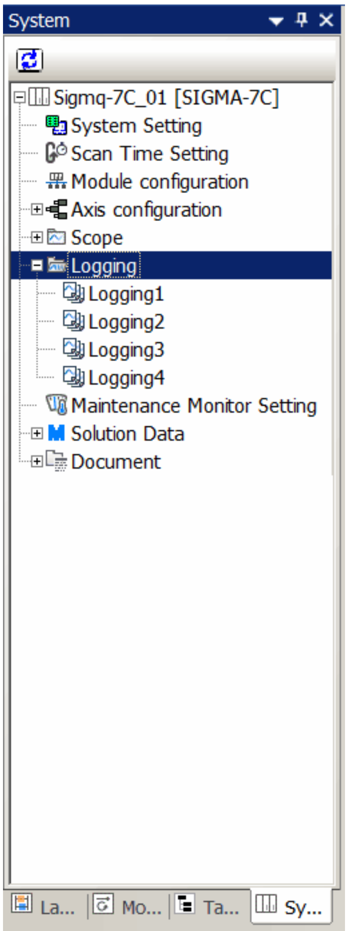
12.1.1 Operating Procedure

This section describes how to perform data logging.

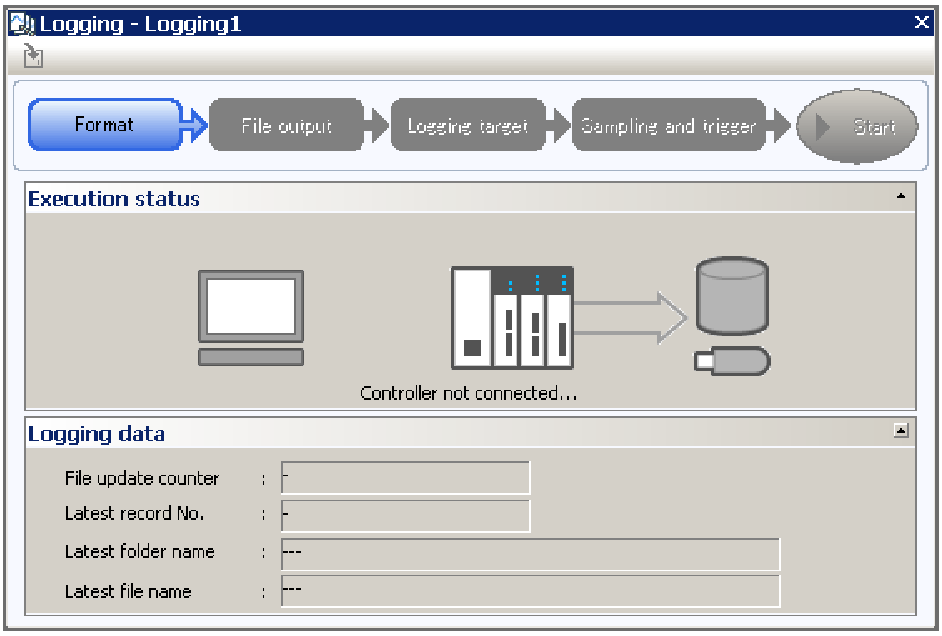
1. **Connect the SERVOPACK to the PC, and start the MPE720.**
   Refer to the following section for details.
   ☞ *Chapter 4 Preparations*

2. **Select *View* – *System* from the menu bar.**
   The System Pane will be displayed on the left side of the window.

3. **Click the Expand [+] Button next to the Logging item to display the log files in the System Pane and double-click Logging1.**



The Logging 1 Dialog Box will be displayed.



Execution status

Controller not connected...

Logging data

File update counter : -

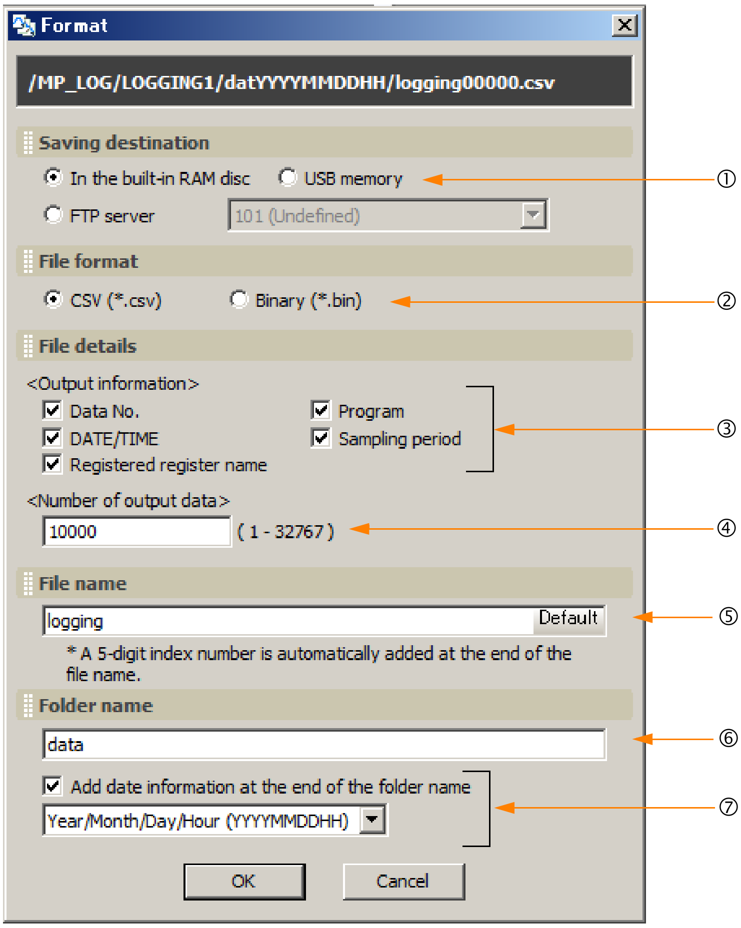
Latest record No. : -

Latest folder name : ---

Latest file name : ---

4. Click the **Format** Button.
   The Format Dialog Box will be displayed.

5. Set the format.



/MP_LOG/LOGGING1/datYYYYMMDDHH/logging00000.csv

Saving destination

● In the built-in RAM disc ○ USB memory

○ FTP server 101 (Undefined)

File format

● CSV (*.csv) ○ Binary (*.bin)

File details

<Output information>

☑ Data No. ☑ Program

☑ DATE/TIME ☑ Sampling period

☑ Registered register name

<Number of output data>

10000 (1 - 32767)

File name

logging

* A 5-digit index number is automatically added at the end of the file name.

Folder name

data

☑ Add date information at the end of the folder name

Year/Month/Day/Hour (YYYYMMDDHH)

① **Select the storage location.**

Selection	Description
In the built-in RAM disc	Writes the sampled data to the built-in RAM disk in the CPU.
USB memory	Writes the sampled data to the USB memory device in the CPU.
FTP server	Writes the sampled data to the FTP server connected to Ethernet.

② **Select the file format.**

Selection	Description
CSV	This file format can be opened in general-purpose applications such as Excel and Notepad.
Binary	This file format is not affected by the range of character codes. Binary files are smaller than CSV files, so they can be written faster and with less overhead on the scan.

③ **Select the file information to output.**
The selected items are appended to the header information in the output file.

Selection	Description
Data No.	The number that is assigned to the sampled data
DATE/TIME	The date and time down to the seconds when the data was sampled Make sure to set the calendar in advance. Refer to the following section for details. ☞ *12.4 Calendar* on page 12-30
Registered register name	Name of the register
Program	Program names
Sampling period	The frequency at which data was sampled Set this in the Sampling and Trigger Dialog Box that is explained later in this section.

④ **Enter the number of data items to output.**
Enter the number of lines to write to a single file.

- Setting range: 1 to 32,767

⑤ **Set the file name.**

- Characters allowed: Alphabet A to Z and a to z, numerals 0 to 9, the minus sign, and the underscore.
- Maximum string length: 32 characters

Information
1. A five-digit index number that starts from 00001 is automatically added to the end of the specified file name.
2. Click the **Default** Button to enter "logging".

⑥ **Set the name of the folder to create.**

- Characters allowed: Alphabet A to Z and a to z, numerals 0 to 9, the minus sign, and the underscore.
- Maximum string length: 32 characters*

* If you select **Year/Month/Day/Hour (YYYYMMDDHH)** in step ⑦, the maximum string length will be 31.

Information If this box is left blank, a folder will not be created. Instead, the file will be created in the root directory of the specified storage location.

⑦ Select whether to add date information to the folder name.
- To omit date information, clear the selection of the check box.
- To add date information, select the check box and select the date format from the list.

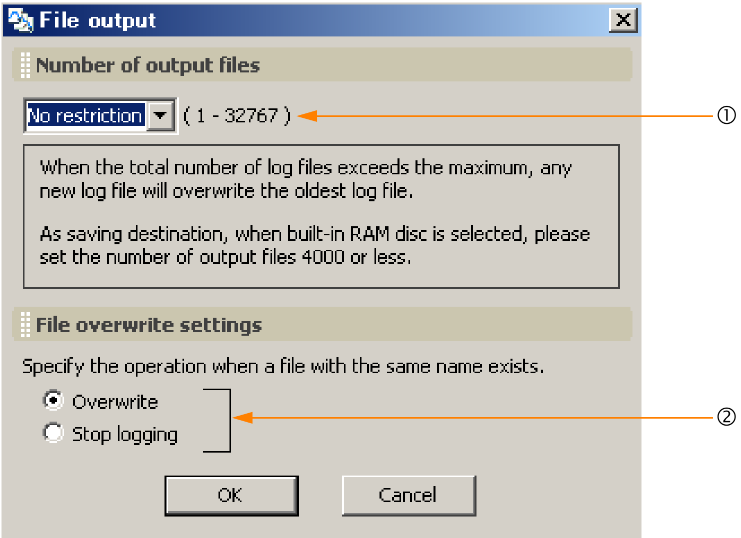
Selection	Description
Year (YYYY)	Adds the year to the specified folder name. Example: □□□2011
Year/Month (YYYYMM)	Adds the year and month to the specified folder name. Example: □□□201109
Year/Month/Day (YYYYMMDD)	Adds the year, month, and day to the specified folder name. Example: □□□20110920
Year/Month/Day/Hour (YYYYMMDDHH)	Adds the year, month, and day to the specified folder name and creates another folder directly below it named with the hour. Example: □□□20110920 └ 12 (The sampled data is stored in this folder.)

Information Click the **Cancel** Button to return to the Logging 1 Dialog Box without registering the settings.

6. Click the **OK** Button.
The Format Dialog Box closes.

7. Click the **File output** Button in the Logging 1 Dialog Box.
The File Output Dialog Box will be displayed.

8. Set the file output settings.



No restriction (1 - 32767)

When the total number of log files exceeds the maximum, any new log file will overwrite the oldest log file.

As saving destination, when built-in RAM disc is selected, please set the number of output files 4000 or less.

Specify the operation when a file with the same name exists.

● Overwrite
○ Stop logging

① Set the number of output files.[*1]
- Settings: No restriction[*2], 1, 10, 50, 100, 500, or 1,000

*1. This is the total number of files that are created from when the power supply is turned ON to when it is turned OFF.

*2. If the built-in RAM disk is the storage location, the upper limit is 4,000 files.
If the USB memory device is the storage location, the upper limit is 10,000 files.

② Set the file overwrite settings.

Selection	Description
Overwrite	When the file number reaches the upper limit on the specified number of output files, older files will be deleted to allow the creation of new files.
Stop logging	When the file number reaches the upper limit of the specified number of output files, logging will stop.

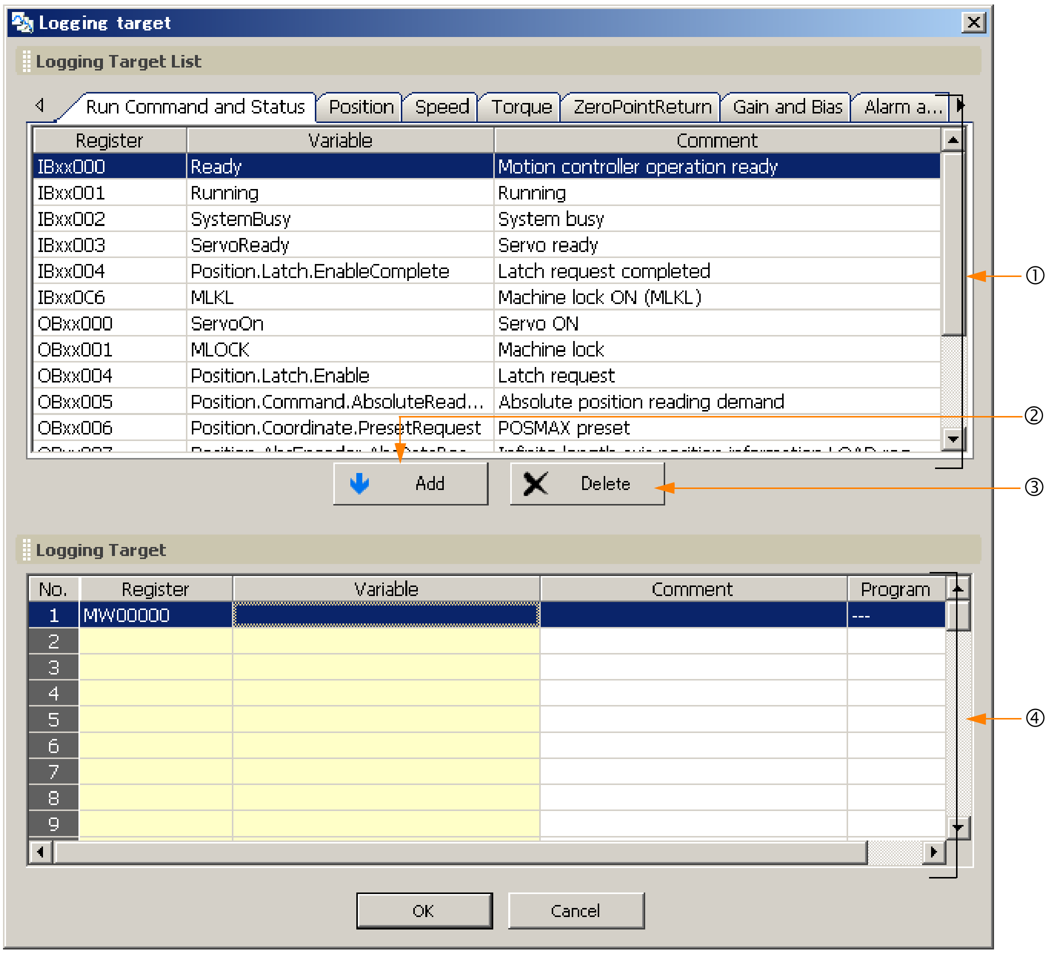
Information Click the **Cancel** Button to return to the Logging 1 Dialog Box without registering the settings.

9. Click the **OK** Button.

The File Output Dialog Box closes.

10. Click the **Logging target** Button in the Logging 1 Dialog Box.
The Logging Target Dialog Box will be displayed.

11. Add the registers to log.



Register	Variable	Comment
IBxx000	Ready	Motion controller operation ready
IBxx001	Running	Running
IBxx002	SystemBusy	System busy
IBxx003	ServoReady	Servo ready
IBxx004	Position.Latch.EnableComplete	Latch request completed
IBxx0C6	MLKL	Machine lock ON (MLKL)
OBxx000	ServoOn	Servo ON
OBxx001	MLOCK	Machine lock
OBxx004	Position.Latch.Enable	Latch request
OBxx005	Position.Command.AbsoluteRead...	Absolute position reading demand
OBxx006	Position.Coordinate.PresetRequest	POSMAX preset

No.	Register	Variable	Comment	Program
1	MW00000			---
2				
3				
4				
5				
6				
7				
8				
9				

No.	Item	Description
①	Logging Target List	Displays a list of the registers that can be selected for logging. • Right-click in the Logging Target List to display the pop-up menu to select or deselect registers. ***Add to Trace*** adds the selected register to the Trace Target List. ***Clear*** deselects multiple registers that were selected by using the **Shift** or the **Ctrl** Keys. ***Select All*** selects all registers shown on the tab page.
②	**Add** Button	Adds the selected register to the list of registers to be logged.
③	**Delete** Button	Removes the selected registers from the list of registers to be logged.
④	Logging Target	Displays a list of the registers that will be logged. Registers can be added to this list either by selecting them from the Logging Target List or by entering them directly. • Right-click in the Logging Target Area to display the pop-up menu to edit the registers to be logged. ***Insert the Line*** inserts a blank row. ***Delete the Line*** deletes a row. If a logging target was added, then it will be deleted.

Information
Registers with the following register types can be logged.
- S, M, G, I, O, and D registers

Information Refer to the following table for the data size for each data type.

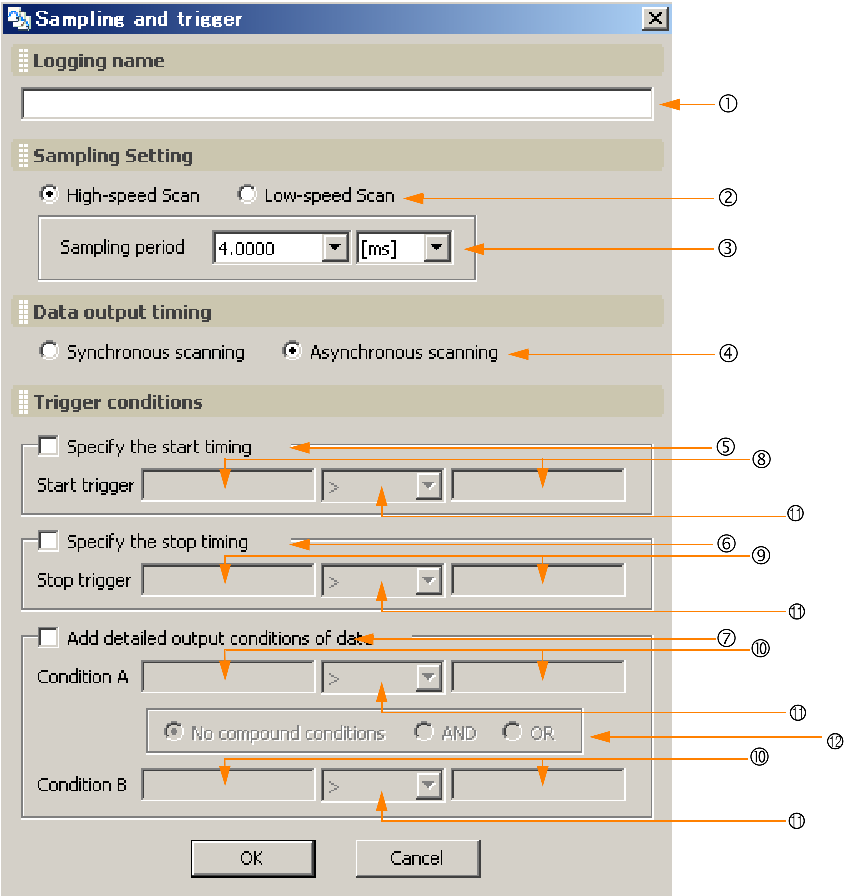
Data Type	Data Size
B: Bit	1 word
W: Integer	1 word
L: Double-length integer	2 words
Q: Quadruple-length integer	4 words
F: Single-precision real number	2 words
D: Double-precision real number	4 words

Information Click the **Cancel** Button to return to the Logging 1 Dialog Box without registering the settings.

12. Click the **OK** Button.
The Logging Target Dialog Box closes.

13. Click the **Sampling and trigger** Button in the Logging 1 Dialog Box.
The Sampling and Trigger Dialog Box will be displayed.

14. Set the sampling and trigger settings.



Sampling and trigger

Logging name

Sampling Setting
● High-speed Scan ○ Low-speed Scan
Sampling period 4.0000 [ms]

Data output timing
○ Synchronous scanning ● Asynchronous scanning

Trigger conditions
☐ Specify the start timing
Start trigger >
☐ Specify the stop timing
Stop trigger >
☐ Add detailed output conditions of data
Condition A >
● No compound conditions ○ AND ○ OR
Condition B >

① Set the logging name.
- Maximum name length: 32 characters

② Set the data sampling rate.

Selection	Description
High-speed Scan	Samples data synchronized with the high-speed scan. Data is sampled immediately after completing execution of the DWG.H ladder program.
Low-speed Scan	Samples data synchronized with the low-speed scan. Data is sampled immediately after completing execution of the DWG.L ladder program.

③ Set the data sampling period.
Specify the value and unit to control whether data is sampled every scan or once in more than one scan.
To sample data every scan, specify the same value as the scan setting.

④ Specify whether data is to be logged synchronized or asynchronized with the scan.

Selection	Description	Benefits	Demerits
Synchronous scanning	Data is written to the log synchronously with the scan	No data is lost.	This creates an overhead on the scan and can cause Watchdog Errors (E.001), or cause the CPU to go down.
Asynchronous scanning	Data is written to the log asynchronously with the scan.	There is no overhead on the scan.	If the scan setting is set to a fast rate or if the idle time of the scan is low, logging can fall behind or data can be missed if there are too many data points to sample.

Refer to the following section for guidelines on scan settings.

☞ *Scan Setting Guidelines* on page 12-11

⑤ to ⑫ Set the logging conditions using items ⑤ to ⑫.

No.	Item	Description
⑤	Specify the start timing	If the check box is selected, the timing of the start of logging is controlled by the register status. If conditions are set in items ⑧ and ⑪, logging will start when these conditions are met. If the check box is cleared, logging will start according to manual operation of the buttons displayed on the MPE720.
⑥	Specify the stop timing	If the check box is selected, the timing of the end of logging is controlled by the register status. If conditions are set in items ⑨ and ⑪, logging will stop when these conditions are met. If the check box is cleared, logging will stop according to manual operation of the buttons displayed on the MPE720.
⑦	Add detailed output conditions of data	• If no detailed output conditions are specified: Clear the check box. • If detailed output conditions are specified: Select the check box and specify the conditions for items ⑩, ⑪, and ⑫. Logging will start when these conditions are met. Even if logging stops because the output conditions are no longer met, it will start when the conditions are met again.
⑧	Start trigger	Specify any S, M, G, I, or O register and numeric value, or ON/OFF. The start condition is when the rising edge is detected (when the register changes from OFF to ON). The stop condition is detected by the state of the register. (If the register is ON, the condition is always detected.)
⑨	Stop trigger	
⑩	Condition A and Condition B	Specify any S, M, G, I, or O register and numeric value. If both Condition A and Condition B are specified, select one of three conditions in ⑫.

Continued on next page.

Continued from previous page.

<table>
<tr><th>No.</th><th>Item</th><th>Description</th></tr>
<tr><td>⑪</td><td>Condition</td><td>Select one of the following operators.
<table>
<tr><th>Selection</th><th>Description</th></tr>
<tr><td>></td><td>Condition is met when the left register value is greater than the right register value.</td></tr>
<tr><td><</td><td>Condition is met when the left register value is less than the right register value.</td></tr>
<tr><td>=</td><td>Condition is met when the left register value is equal to the right register value.</td></tr>
<tr><td><></td><td>Condition is met when the left register value is not equal to the right register value.</td></tr>
<tr><td>>=</td><td>Condition is met when the left register value is greater than or equal to the right register value.</td></tr>
<tr><td><=</td><td>Condition is met when the left register value is less than or equal to the right register value.</td></tr>
</table></td></tr>
<tr><td>⑫</td><td>Compound condition</td><td>If both Condition A and Condition B are specified, select one of the following conditions.
<table>
<tr><th>Selection</th><th>Description</th></tr>
<tr><td>No compound condition</td><td>The compound condition is met when Condition A is met. Condition B will be ignored, even if it is specified.</td></tr>
<tr><td>AND</td><td>The compound condition is met when both condition A and condition B are met.</td></tr>
<tr><td>OR</td><td>The compound condition is met when either condition A or condition B is met.</td></tr>
</table></td></tr>
</table>

Example

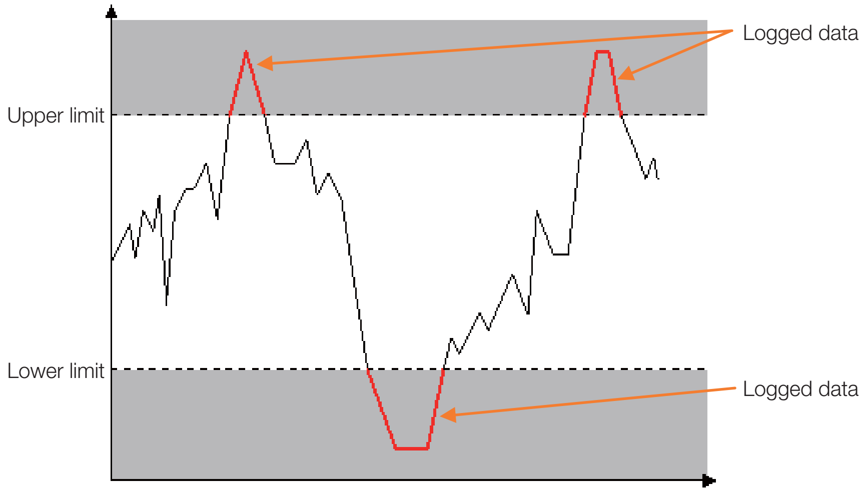
To automatically start logging when the power supply is turned ON, set the **Start trigger** to the following condition.

- When the **Saving destination** is set to **USB memory**:
  Setting example: Start trigger SB006540 = ON
  Note: The SB006540 register turns ON when a USB memory device is detected.
- When the **Saving destination** is set to **In the built-in RAM disc**:
  Setting example: Start trigger SB000001 or SB000003 = ON
  Note: The SB000001 register turns ON during the first scan of the high-speed scan.
  The SB000003 register turns ON during the first scan of the low-speed scan.

Example

In the following example, the output conditions are set to log only the data in the shaded region.

Setting example: Condition A > = Upper limit, Condition B < = Lower limit, Compound condition = OR



Information

Click the **Cancel** Button to return to the Logging 1 Dialog Box without registering the settings.

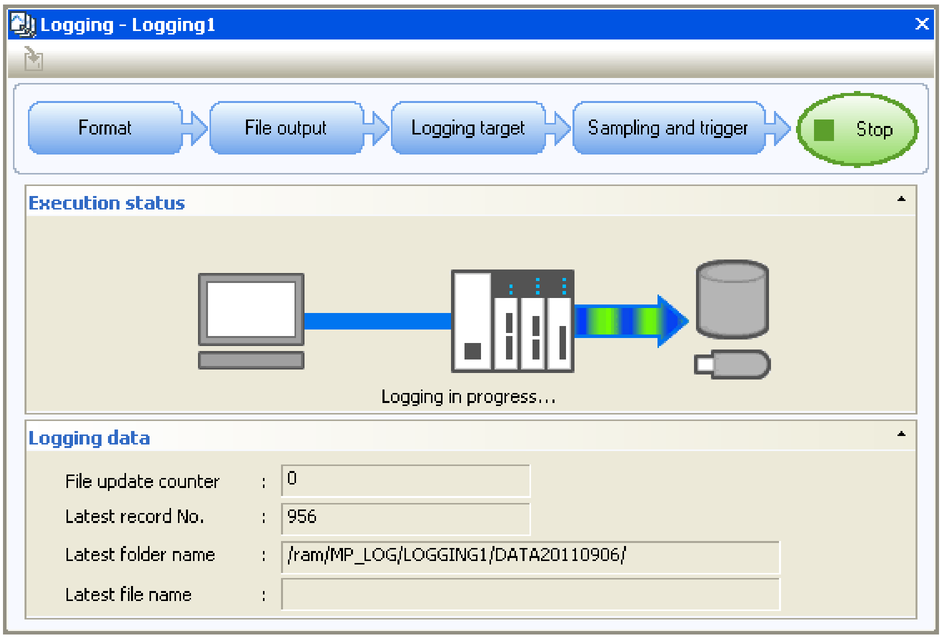
15. Click the **OK** Button.

The Sampling and Trigger Dialog Box closes.

16. Click the **Start** Button in the Logging 1 Dialog Box.

Logging starts. While logging is in progress, the following items are displayed in the Logging 1 Dialog Box.

- File update counter
- Latest record number
- Latest folder name
- Latest file name



File update counter : 0
Latest record No. : 956
Latest folder name : /ram/MP_LOG/LOGGING1/DATA20110906/
Latest file name :

17. To stop logging, click the **Stop** Button in the Logging 1 Dialog Box.

Logging will stop.

The following table gives the range of each data and the timing at which logging is reset.

Data Name	Range		Reset Timing
File name	When the **Saving destination** is set to **USB memory**	logging00001 to logging10000	The file name resets to logging00001 when the power supply is turned ON. If a file already exists in memory, it will be overwritten.
	When the **Saving destination** is set to **In the built-in RAM disk**	logging00001 to logging4000	
Latest record number	0 to 18,446,744,073,709,551,615		The latest record number is reset to 0 when logging starts after a stop.

12.1.2 Scan Setting Guidelines

This section describes guidelines for the scan settings based on when data is logged.

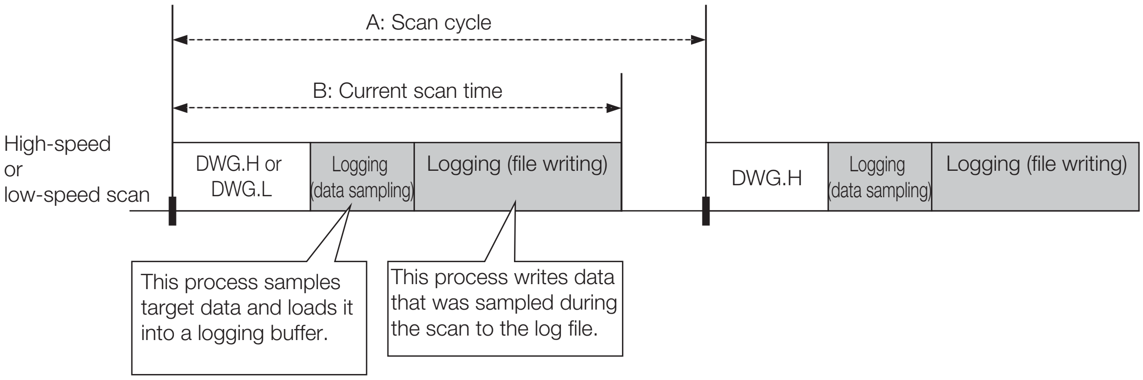
If Logging Is Synchronous with the Scan

The general logging overhead is given below. Set the scan setting to a value that is larger than this value.

Storage Location	Number of Registered Data Items		
	1 to 8	9 to 60	61 to 64
Built-in RAM disk	1.0 ms	1.5 ms	2.0 ms
USB memory	Due to the large overhead, USB memory cannot be used to log synchronously with the scan.		

Note: These overhead values are for word data without an application. Set the scan setting according to the application usage conditions (number of registers to log, register types, ladder programs, etc.).

This timing chart illustrates the logging process when performed synchronously with the scan.



The logging processes for sampling the data and writing it to a file are performed within the scan cycle. Therefore, the scan cycle (time period A in the above chart), must be set to a value greater than the current scan time (time period B in the above chart).

If the scan cycle is shorter than the current scan time, a scan time over limit error will occur and the count of SW00044 (H Scan Exceeded Count) or SW00046 (L Scan Exceeded Count) will be incremented. This can also cause a Watchdog Timer Error (E.001) or cause the CPU to go down.

Set the scan time so that it is long enough to log the number of registered data items.

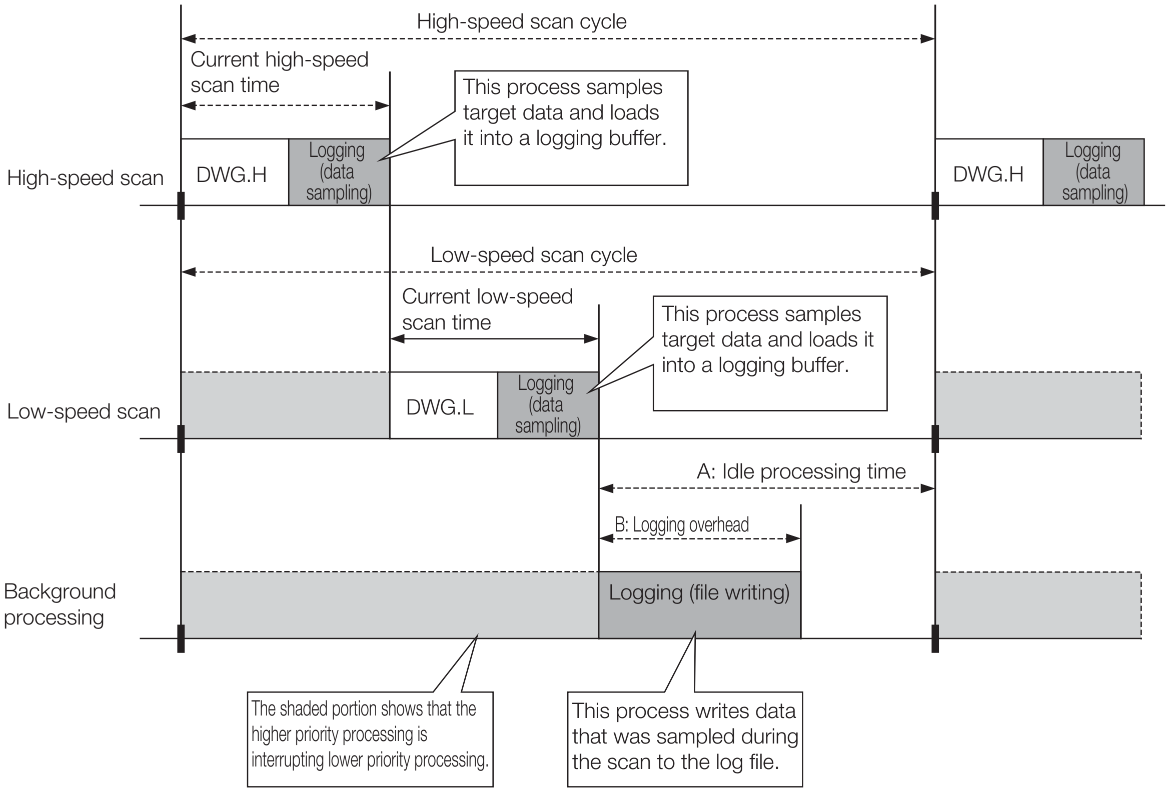
If Logging Is Asynchronous with the Scan

The scan setting for logging asynchronously with the scan should be set as given below.

Storage Location	Scan Setting Guideline
Built-in RAM disk	0.250 ms min.
USB memory	0.500 ms min.

Note: These values are for word data without an application. Set the scan setting according to the application usage conditions (number of registers to log, register types, ladder programs, etc.).

This timing chart illustrates the logging process when performed asynchronously with the scan.



The logging process for sampling the data is performed within the scan, while the process of writing the data to a file is performed in background processing.

The background process is performed during the idle processing time of the scan. Therefore, the idle processing time (time period A in the above chart) must be longer than the logging overhead (time period B in the above chart).

If the logging overhead time is longer than the idle processing time of the scan, the file writing process can run into the next scan and cause an over limit error. The number of over limit errors can be checked in the overrun counter (SW24008).

12.1.3 Monitoring the Logging Execution Status

You can monitor the execution status of data logging by checking the system registers. Refer to the following manual for details.

📖 Σ-7-Series Σ-7C SERVOPACK Troubleshooting Manual (Manual No.: SIEP S800002 07)

12.1.4 Viewing the Log Data

To view the log data in a PC, the data that is stored in the RAM in the CPU or USB memory device must be transferred to the PC. Refer to the following section for details on data transfers.

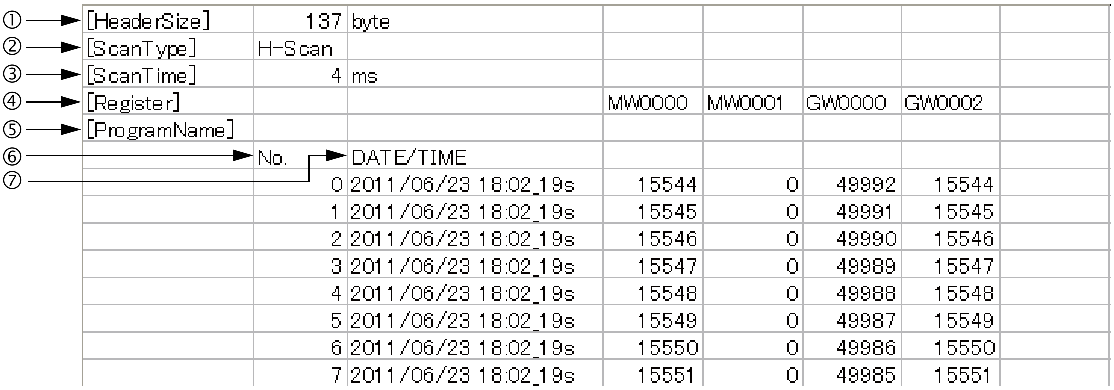
☞ *12.3 File Transfer* on page 12-20

12.1.5 Analyzing Log Data

This section describes how the log data is formatted when viewed on a PC.

CSV File Format

This example shows how log data that is stored in the CSV format appears when it is opened in Microsoft Excel.



[HeaderSize]	137	byte				
[ScanType]	H-Scan					
[ScanTime]	4	ms				
[Register]			MW0000	MW0001	GW0000	GW0002
[ProgramName]						
	No.	DATE/TIME				
	0	2011/06/23 18:02_19s	15544	0	49992	15544
	1	2011/06/23 18:02_19s	15545	0	49991	15545
	2	2011/06/23 18:02_19s	15546	0	49990	15546
	3	2011/06/23 18:02_19s	15547	0	49989	15547
	4	2011/06/23 18:02_19s	15548	0	49988	15548
	5	2011/06/23 18:02_19s	15549	0	49987	15549
	6	2011/06/23 18:02_19s	15550	0	49986	15550
	7	2011/06/23 18:02_19s	15551	0	49985	15551

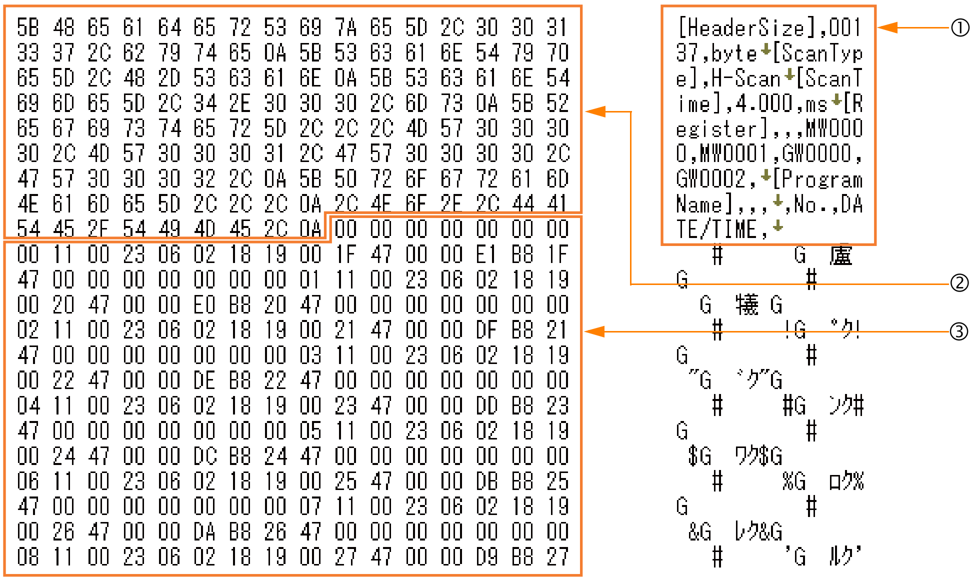
- Header Details

No.	Item	Description	Corresponding Item in MPE720
①	HeaderSize	Gives the size of the header that is appended to the file.	–
②*	ScanType	The type of scan where the data was obtained (high-speed scan or low-speed scan) is displayed.	**Sampling period** on the Format Dialog Box.
③*	ScanTime	Gives the data sampling period.	
④*	Register	Gives the registers specified in the data settings.	**Registered register name** on the Format Dialog Box.
⑤*	ProgramName	Gives the program name specified in the data settings.	**Program** on the Format Dialog Box.
⑥*	No.	Gives the number of the data that was sampled.	**Data No.** on the Format Dialog Box.
⑦*	DATE/TIME	Gives the time down to the seconds when the data was sampled. This is a running value from 1970, which is the lower limit of the calendar setting.	**DATE/TIME** on the Format Dialog Box.

* These items may not be given depending on the settings in the MPE720. Refer to the following section for details.
☞ *Operating Procedure* on page 12-3

Binary File Format

This example shows how log data that was stored in the binary format appears when it is opened in a text editor.



```
5B 48 65 61 64 65 72 53 69 7A 65 5D 2C 30 30 31
33 37 2C 62 79 74 65 0A 5B 53 63 61 6E 54 79 70
65 5D 2C 48 2D 53 63 61 6E 0A 5B 53 63 61 6E 54
69 6D 65 5D 2C 34 2E 30 30 30 2C 6D 73 0A 5B 52
65 67 69 73 74 65 72 5D 2C 2C 2C 4D 57 30 30 30
30 2C 4D 57 30 30 30 31 2C 47 57 30 30 30 30 2C
47 57 30 30 30 32 2C 0A 5B 50 72 6F 67 72 61 6D
4E 61 6D 65 5D 2C 2C 2C 0A 2C 4E 6F 2E 2C 44 41
54 45 2F 54 49 4D 45 2C 0A 00 00 00 00 00 00 00
00 11 00 23 06 02 18 19 00 1F 47 00 00 E1 B8 1F
47 00 00 00 00 00 00 00 01 11 00 23 06 02 18 19
00 20 47 00 00 E0 B8 20 47 00 00 00 00 00 00 00
02 11 00 23 06 02 18 19 00 21 47 00 00 DF B8 21
47 00 00 00 00 00 00 00 03 11 00 23 06 02 18 19
00 22 47 00 00 DE B8 22 47 00 00 00 00 00 00 00
04 11 00 23 06 02 18 19 00 23 47 00 00 DD B8 23
47 00 00 00 00 00 00 00 05 11 00 23 06 02 18 19
00 24 47 00 00 DC B8 24 47 00 00 00 00 00 00 00
06 11 00 23 06 02 18 19 00 25 47 00 00 DB B8 25
47 00 00 00 00 00 00 00 07 11 00 23 06 02 18 19
00 26 47 00 00 DA B8 26 47 00 00 00 00 00 00 00
08 11 00 23 06 02 18 19 00 27 47 00 00 D9 B8 27
```

```
[HeaderSize],001
37,byte↓[ScanTyp
e],H-Scan↓[ScanT
ime],4.000,ms↓[R
egister],,,MW000
0,MW0001,GW0000,
GW0002,↓[Program
Name],,,↓,No.,DA
TE/TIME,↓
   #      G  盧
G          #
  G  犠 G
   #     !G  ｰｸ!
G          #
 ″G  ｰｸ″G
   #     #G  ﾝｸ#
G          #
 $G  ﾜｸ$G
   #     %G  ﾛｸ%
G          #
 &G  ﾚｸ&G
   #     'G  ﾙｸ'
```

①Header

The header is given in ASCII characters.

Item	Description	Corresponding Item in MPE720
HeaderSize	Gives the size of the header that is appended to the file.	–
ScanType*	The type of scan where the data was obtained (high-speed scan or low-speed scan) is displayed.	**Sampling period** on the Format Dialog Box.
ScanTime*	Gives the data sampling period.	
Register*	Gives the registers specified in the data settings.	**Registered register name** on the Format Dialog Box.
ProgramName*	Gives the program name specified in the data settings.	**Program** on the Format Dialog Box.
No.*	Gives the number of the data that was sampled.	**Data No.** on the Format Dialog Box.
DATE/TIME*	Gives the time down to the seconds when the data was sampled. This is a running value from 1970, which is the lower limit of the calendar setting.	**DATE/TIME** on the Format Dialog Box.

* These items may not be given depending on the settings in the MPE720. Refer to the following section for details.

☞ *Operating Procedure* on page 12-3

②Bit Pattern of Header Information

③Register Data

The register data is displayed here. The volume of data depends on the data types of the registers.

Data Type	Data Size
B: Bit	2 bytes
W: Integer	2 bytes
L: Double-length integer	4 bytes
Q: Quadruple-length integer	8 bytes
F: Single-precision real number	4 bytes
D: Double-precision real number	8 bytes

Example

The following example shows how the register data is given for the settings and conditions listed below.

File Details to Output
- **Data No.** and **DATE/TIME** are selected.

Target Register to Log
- MW00000

Status
- **Data No.**: 000001
- **DATE/TIME**: 2011/06/23 18:02:19
- Value of MW00000 register: 100

Displayed Value

The data is stored in little endian as shown below.

01 00 00 00 00 00 00 00 11 00 23 06 02 18 19 00 64 00

MW00000 = 100

DATE/TIME =
2011/06/23 18:02:19

Data No. = 1

12.2 USB Memory

You can transfer user application data between the RAM in the CPU and the USB memory device.

Operation		Outline	Reference
USB memory batch transfer	Batch load	Loads all of the user application data that is saved in the USB memory device to the CPU's non-volatile memory.	*Batch Loading from USB Memory Device* on page 12-17
	Batch save	Saves all of the user application data that is saved in the CPU's RAM to the USB memory device.	*Batch Saving to USB Memory* on page 12-18
Data logging		Saves all of the logged data in the CPU to the USB memory device.	*12.3 File Transfer* on page 12-20
Import/ Export instructions	Batch load	Loads all of the user application data that is saved in the USB memory device to the CPU's RAM from within a ladder program.	MP3000 Series Ladder Programming Manual (Manual No.: SIEP C880725 13)
	Batch save	Saves all of user application data that is saved in the CPU's RAM to the USB memory device from within a ladder program.	

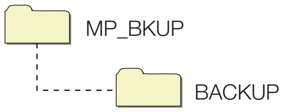
12.2.1 Operating Procedure

This section describes the procedures for loading all of the data from the USB memory device and saving all of the data to the USB memory device.

Batch Loading from USB Memory Device

1. Turn OFF the control power supply to the SERVOPACK.
2. Insert the USB memory device that contains the application data to transfer into the USB connector (CN10).

Information Make sure that the folder hierarchy and file naming where the application data is to be stored is as shown below.



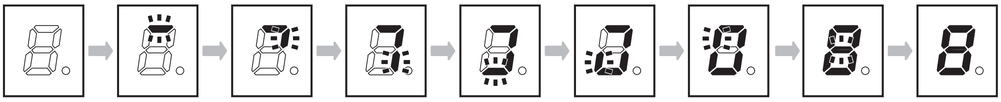
3. Turn ON only the LOAD pin on the DIP switch (mode switch).
4. Set the INIT pin on the DIP switch (mode switch) according to the register type to load.

Registers to Load	INIT Pin Setting	
	OFF	ON
M Registers	Transferred.	Not transferred.
G registers	Not transferred regardless of INIT pin setting.	
S registers		
I registers		
O registers		
C registers	Always transferred regardless of INIT pin setting.	
# registers		
D registers		

5. **Turn ON the control power supply to the SERVOPACK.**
The batch load operation starts.

Information If the load operation fails, an error code will be displayed on the display on the Controller Section. Refer to the following manual to troubleshoot the problem, then perform the batch save again.
Σ-7-Series Σ-7C SERVOPACK Troubleshooting Manual (Manual No.: SIEP S800002 07)

The progress of processing will be shown on the display during the batch load operation as follows:



6. **Turn OFF the control power supply to the SERVOPACK.**

7. **Press the STOP/SAVE switch. Confirm that the USB status indicator changes from flashing to not lit and then remove the USB memory.**

8. **Turn OFF the LOAD pin on the DIP switch (mode switch).**

9. **Turn ON the control power supply to the SERVOPACK.**

Batch Saving to USB Memory

Important

When a save operation is performed to the USB memory device, any data that is stored on the USB memory device will be overwritten.

1. **Turn ON the control power supply to the SERVOPACK.**

2. **Make sure the security password has not been set.**
Otherwise, any attempts to perform a batch save will fail. Refer to the following section for details on the security password.
☞ *12.6 Security Functions* on page 12-37

3. **Insert the USB memory device into the USB connector (CN10).**

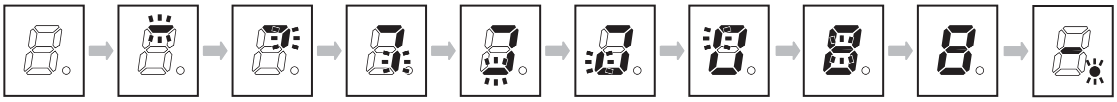
4. **Set the INIT pin on the DIP switch (mode switch) according to the register type to save.**

Registers to Load	INIT Pin Setting	
	OFF	ON
M registers	Transferred.	Not transferred.
G registers	Transferred.	Not transferred.
S registers	Transferred.	Not transferred.
I registers	Transferred.	Not transferred.
O registers	Transferred.	Not transferred.
C registers	Always transferred regardless of INIT pin setting.	
# registers		
D registers		

5. **Press and hold the STOP/SAVE switch for at least two seconds.**
The batch save operation starts.

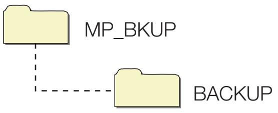
Information If the save operation fails, an error code will be displayed on the display on the Controller Section. Refer to the following manual to troubleshoot the problem, then perform the batch save again.
Σ-7-Series Σ-7C SERVOPACK Troubleshooting Manual (Manual No.: SIEP S800002 07)

The progress of processing will be shown on the display during the batch save operation as follows: The batch save operation has been completed when the normal operation display appears on the display (i.e., the lower right dot will flash).



6. **Press the STOP/SAVE switch. Confirm that the USB status indicator changes from flashing to not lit and then remove the USB memory.**

Information The hierarchy of the folders in which the application data was saved will be as shown below. Only the alarm history file will be in CSV format. It is stored with the following name: ALARM_HISTORY.csv.

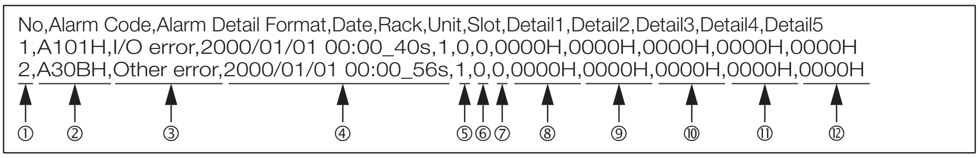


12.2.2 Alarm History File

This section describes the data that is displayed when an alarm history file is viewed on a PC.

Format of the Alarm History File

The following example shows how the CSV file is displayed when it is opened in a text editor.



```
No,Alarm Code,Alarm Detail Format,Date,Rack,Unit,Slot,Detail1,Detail2,Detail3,Detail4,Detail5
1,A101H,I/O error,2000/01/01 00:00_40s,1,0,0,0000H,0000H,0000H,0000H,0000H
2,A30BH,Other error,2000/01/01 00:00_56s,1,0,0,0000H,0000H,0000H,0000H,0000H
```

No.	Item	Additional Information
①	Index	Range: 1 to 100
②	Alarm Code	Refer to the following manual for details. 📖 MP3000 Series MP3200/MP3300 Troubleshooting Manual (Manual No.: SIEP C880725 01)
③	Alarm Detail Format	• Operation error • I/O error • Other error
④	Time When Alarm Occurred	yyyy/mm/dd/ hh:mm_ss
⑤	Alarm Rack Number	–
⑥	Alarm Unit Number	–
⑦	Alarm Slot Number	–
⑧	Alarm Detail 1	Alarm Details (3) The information depends on the alarm details format type. • Operation Errors Alarm detail 1: Error drawing number Alarm detail 2: Referenced drawing number Alarm detail 3: Referenced drawing step number Alarm details 4 and 5: Reserved. • I/O Error Alarm details 1 to 5: Reserved. • Other Error Alarm details 1 to 5: Reserved.
⑨	Alarm Detail 2	
⑩	Alarm Detail 3	
⑪	Alarm Detail 4	
⑫	Alarm Detail 5	

12.3 File Transfer

Both an FTP server and FTP client are provided for file transfers.

The features of both of these are given in the following table. Use them as best suited to your system.

Description	FTP Server	FTP Client
Overview	Sends data in response to requests from remote FTP clients.	Actively sends data to remote FTP servers.
Remote FTP Clients/ Servers	You can set up to five clients.	You can set up to 20 servers.
Data to Transfer	• Log data • Register data	Log data
Data Size	RAM: 8 MB USB memory device: 4 GB	RAM: 8 MB
Data Update Timing	When a request is received from a remote FTP client	When a log data file is output

12.3.1 FTP Server

The FTP server is provided so that you can transfer data between the RAM in the CPU or the USB memory device and a remote device capable of acting as an FTP client.

Data to Transfer	Transfer Direction	Remarks	Reference
Log data	CPU to remote device	–	*Operating Procedure* on page 12-3
Register data	CPU to remote device	Uses the Export instruction from a ladder program.	MP3000 Series Ladder Programming Manual (Manual No.: SIEP C880725 13)
	Remote device to CPU	Uses the Import instruction from a ladder program.	

Important

- The full path of the file to be transferred must be within 256 characters including all folder and file names.
- If you transfer too many files at the same time, a 426 error (connection closed; transfer aborted) will occur at the remote device and the files will not be transferred normally.
  If that occurs, separate the files into more than one transfer and transfer them again.

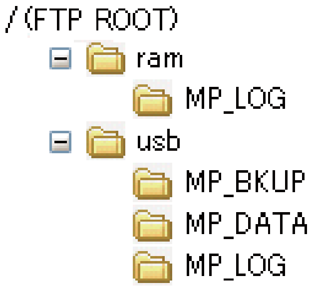
Information

1. The FTP server supports up to five simultaneous connections.
2. You can transfer up to 8 MB when using the RAM in the CPU. You can transfer up to 4 GB of data for the recommended USB memory device.
3. The IP address of the FTP server is the same as the IP address that is set on the 218IFD Detail Definition Dialog Box for the Communications Module or the IP address that is set on the rotary switches. Refer to the following manual or section for details.
   - 218IFD Detail Definition Dialog Box

     MP3000 Series Communications User's Manual (Manual No.: SIEP C880725 12)

Folder Structure

This section describes the folder structure of the FTP server.



/(FTP ROOT)
- ram
  - MP_LOG Stores log data.
- usb
  - MP_BKUP Stores batch transfer data for the USB memory device.
  - MP_DATA Stores data from an Import or Export instruction.
  - MP_LOG Stores log data.

Setting Up FTP Accounts

FTP accounts must be set up to allow FTP clients to access the FTP server. This section describes the default settings of an FTP account, and how to change those settings.

◆ Default Settings

The default settings of an FTP account are given below.

User Name	Password	FTP Privileges
USER-A	USER-A	R/W*

* R: Files can be read from the FTP client.
W: Files can be written from the FTP client.

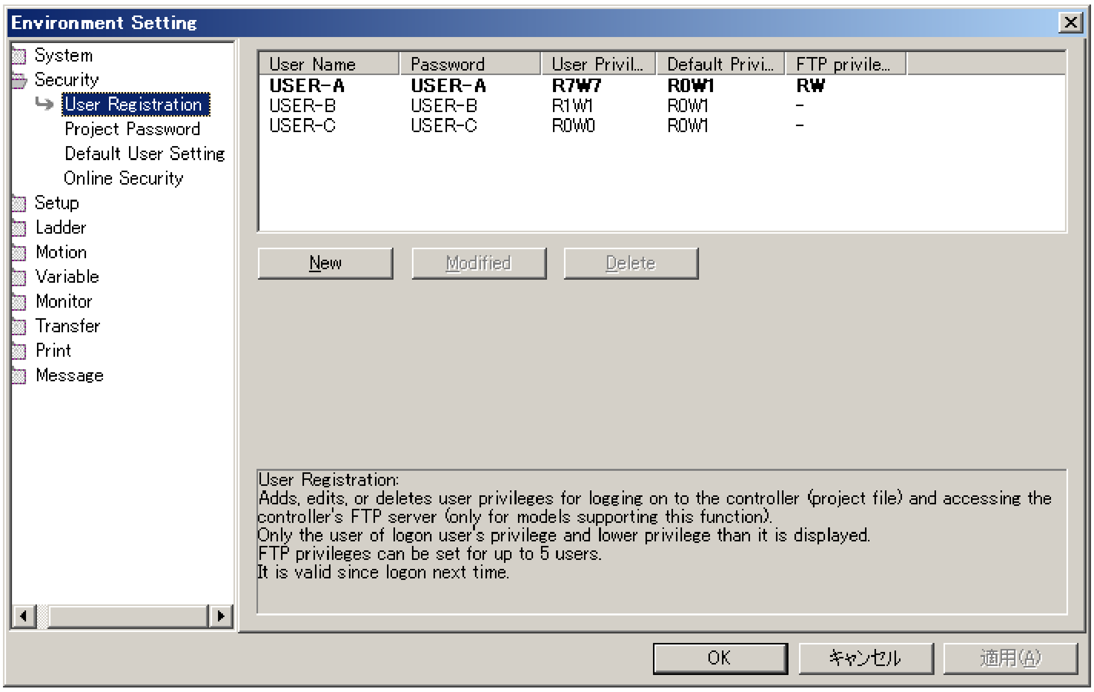
◆ Setting Up FTP Accounts

If you need to change the default settings or add a new FTP account, use the MPE720. You can define up to five FTP accounts.

Use the following procedure.

1. Connect the SERVOPACK to the PC, and start the MPE720.
   Refer to the following section for details.
   ☞ *Chapter 4 Preparations*
2. Select ***File*** – ***Environment Setting*** from the menu bar.

3. Select **Security – User Registration.**



User Name	Password	User Privil...	Default Privi...	FTP privile...
USER-A	**USER-A**	**R7W7**	**R0W1**	**RW**
USER-B	USER-B	R1W1	R0W1	-
USER-C	USER-C	R0W0	R0W1	-

User Registration:
Adds, edits, or deletes user privileges for logging on to the controller (project file) and accessing the controller's FTP server (only for models supporting this function).
Only the user of logon user's privilege and lower privilege than it is displayed.
FTP privileges can be set for up to 5 users.
It is valid since logon next time.

- Adding a New FTP Account

  Click the **New** Button.
  The User Registration Dialog Box will be displayed.

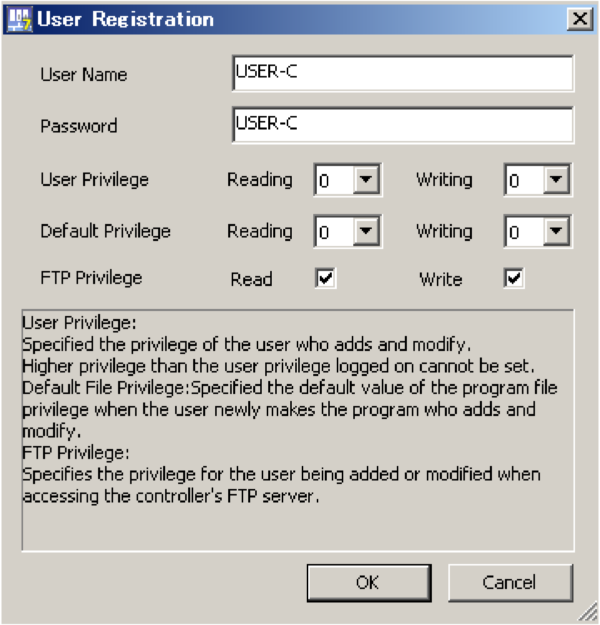
- Changing the Settings of an Existing FTP Account

  Select the user name for the FTP account to be changed and click the **Modified** Button.
  The User Registration Dialog Box will be displayed.

- Deleting an Existing FTP Account

  Select the user name for the FTP account to be deleted and click the **Delete** Button.
  The FTP account settings for the selected user name will be deleted. Proceed to step 5.

4. Set the FTP account information in the User Registration Dialog Box.



User Name: USER-C
Password: USER-C
User Privilege: Reading 0, Writing 0
Default Privilege: Reading 0, Writing 0
FTP Privilege: Read ☑ Write ☑

User Privilege:
Specified the privilege of the user who adds and modify.
Higher privilege than the user privilege logged on cannot be set.
Default File Privilege:Specified the default value of the program file privilege when the user newly makes the program who adds and modify.
FTP Privilege:
Specifies the privilege for the user being added or modified when accessing the controller's FTP server.

No.	Item	Description	Remarks
①	User Name	This is the name that the FTP client on the remote device must use to log in to perform a file transfer.	• You can enter up to 16 characters. • The string is case sensitive.
②	Password	This is the password that the FTP client on the remote device must use to log in to perform a file transfer.	• You can enter up to 16 characters. • The string is case sensitive.
③	User Privilege	Reserved.	Specify 0 for reading and writing.
④	Default Privilege	Reserved.	Specify 0 for reading and writing.
⑤	FTP Privilege	This is the file read and write privileges that the FTP client on the remote device will have during file transfers.	• Refer to the following section for details on the tasks that are affected by the FTP privilege settings. ☞ *◆ FTP Privileges and Applicable FTP Commands* on page 12-23 • A client cannot be set to writing only.

5. Click the **OK** Button.

6. Log off from the MPE720.

The settings are enabled.

◆ FTP Privileges and Applicable FTP Commands

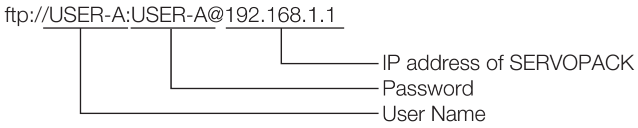
Item	Command	FTP Privileges		Description
		R	R/W	
Connection/ Disconnection	bye	○	○	Disconnects and terminates the connection with the FTP server.
	close	○	○	Disconnects the connection with the FTP server.
	open	○	○	Starts a connection with the FTP server.
	quit	○	○	Disconnects and terminates the connection with the FTP server.
	user	○	○	Enters the user name when logging in to the FTP server.
File/Directory Operations	cd	○	○	Changes the current directory of the FTP server
	delete	×	○	Deletes a file on the FTP server.
	mdelete	×	○	Deletes multiple files on the FTP server.
	dir	○	○	Displays a list of the files in the current directory of the FTP server, including file names, sizes, and last revision dates.
	ls	○	○	Displays a list of the file names in the current directory of the FTP server.
	mkdir	×	○	Creates a directory in the FTP server.
	pwd	○	○	Displays the current directory of the FTP server.
	rename	×	○	Renames a file on the FTP server.
	rmdir	×	○	Deletes a directory in the FTP server.
File Transfers	get	○	○	Downloads a file from the FTP server.
	mget	○	○	Downloads multiple files from the FTP server.
	put	×	○	Uploads a file to the FTP server.
	mput	×	○	Uploads multiple files to the FTP server.

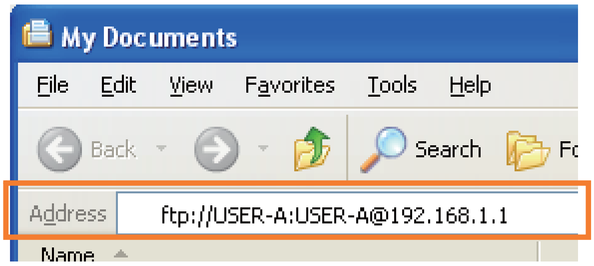
Note: ○: Allowed, ×: Not allowed.

Accessing the FTP Server

This section describes how to access the FTP server from a Windows PC.

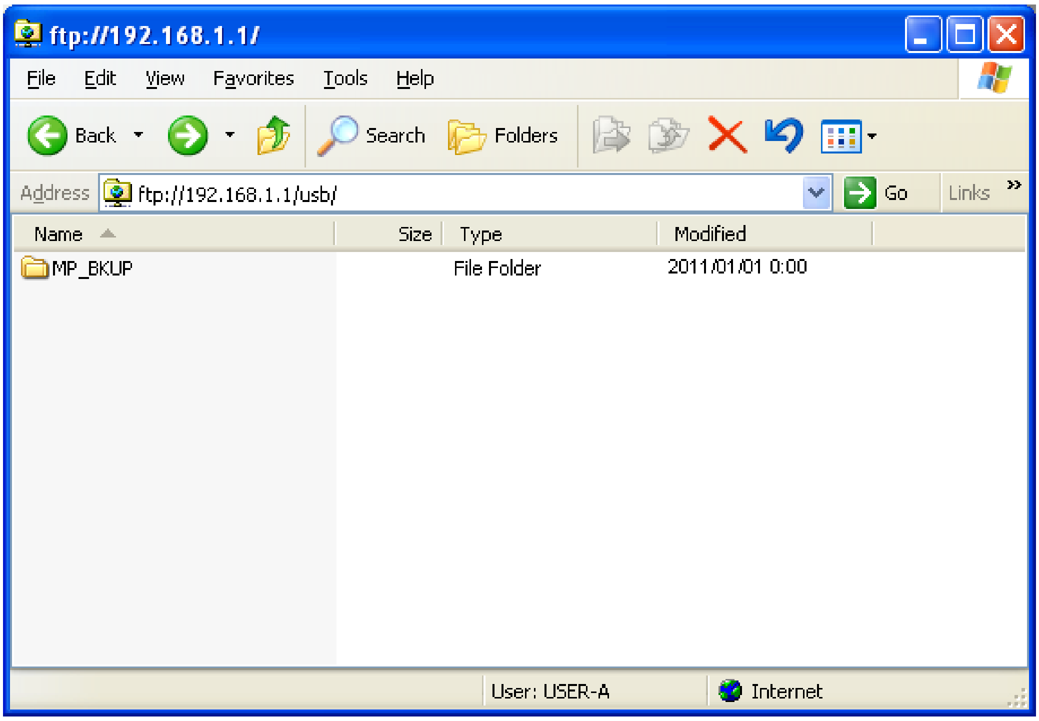
1. Enter the address in the address bar.
   The address structure is as follows:





Address: ftp://USER-A:USER-A@192.168.1.1

2. Press the **Enter** Key.
   The folder (contents of the USB memory device) of the FTP server will be displayed.



Address: ftp://192.168.1.1/usb/

Name	Size	Type	Modified
MP_BKUP		File Folder	2011/01/01 0:00

User: USER-A
Internet

12.3.2 FTP Client

The FTP client is provided so that you can transfer data between the RAM in the CPU or the USB memory device and a remote device capable of acting as an FTP server.

No special programming is required to get the log data in the application in the device that provides the FTP server.

Data to Transfer	Transfer Direction	Reference
Log data	CPU to remote device	*Operating Procedure* on page 12-3

Information
1. You can connect to up to 20 servers at the same time.
2. You can transfer up to 8 MB when using the RAM in the CPU.

Specifications

The specifications of the FTP client are given in the following table.

Item		Description
Client	IP address	The local IP address of the 218IFD is used.
	Control port number	A port number is automatically assigned.
	Service port number	A port number is automatically assigned.
	Source directory path	The directory path that is specified in the data logging format settings is used. (The built-in RAM is used as a temporary folder.)
	Send file name	The file name that is specified in the data logging format settings is used.
Server	IP address	An IP address is specified.
	Control port number	ACTIV mode: 21, PASV mode: Any port number
	Service port number	ACTIV mode: 20, PASV mode: Any port number
	Number of connected servers	20
	User Name	Up to 32 alphanumeric characters (case sensitive).
	Password	Up to 32 alphanumeric characters (case sensitive).
	Directory path	Up to 64 alphanumeric characters (case sensitive, directories separated with slashes).

Procedures to Use the FTP Client

◆ Setting Procedure for Log Data Transfer

The FTP client settings are set in the SERVOPACK with the MPE720. The data from the files that are output by the logging function are sent to a server.

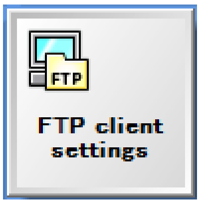
Use the following procedure to make the settings.

1. **Connect the SERVOPACK to the PC, and start the MPE720.**
   Refer to the following section for details.
   ☞ *Chapter 4 Preparations*

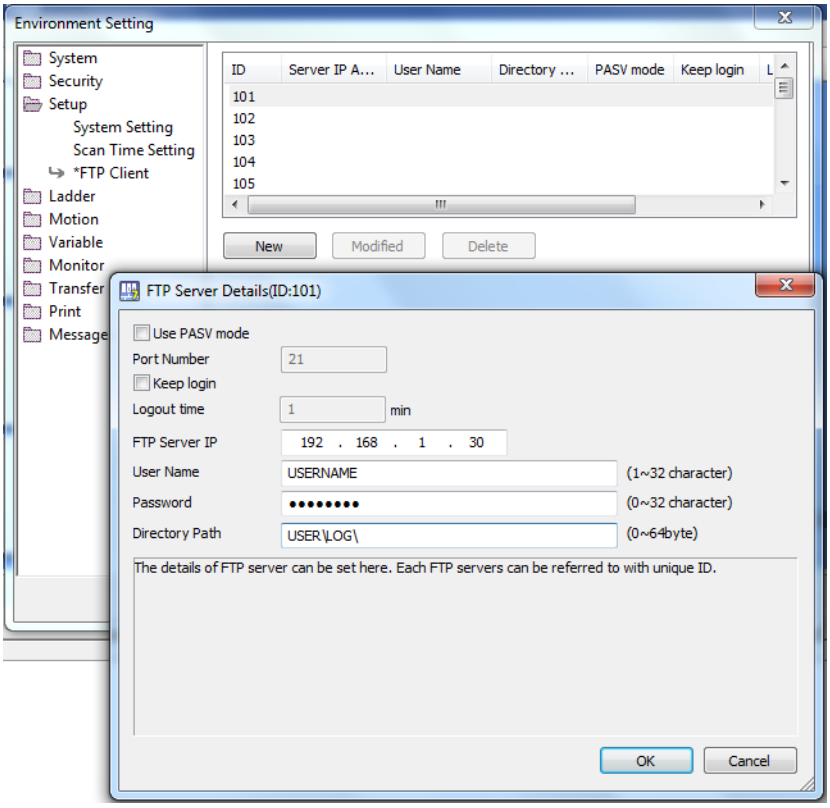
2. **Display the Module Configuration Definition Tab Page and double-click the cell for 218IFD.**

3. **Set the IP address, subnet mask, and gateway address to set the local station.**

4. Click the **FTP client settings** Button on the My Tool View.



The Environment Setting Dialog Box will be displayed. You can set up to 20 FTP servers.



ID	Server IP A...	User Name	Directory ...	PASV mode	Keep login	L
101						
102						
103						
104						
105						

☐ Use PASV mode
Port Number 21
☐ Keep login
Logout time 1 min
FTP Server IP 192 . 168 . 1 . 30
User Name USERNAME (1~32 character)
Password •••••••• (0~32 character)
Directory Path USER\LOG\ (0~64byte)

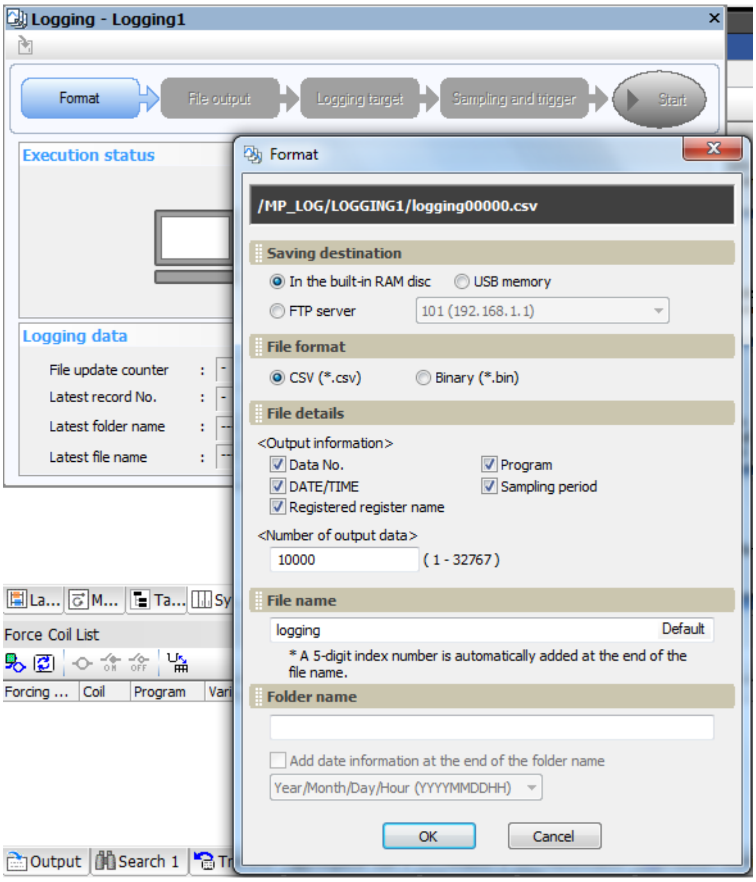
The details of FTP server can be set here. Each FTP servers can be referred to with unique ID.

5. Double-click the row for each ID.
The FTP Server Details Dialog Box will be displayed. Refer to the following section for details on the settings.
☞ ◆ *Details on the FTP Server Details Dialog Box* on page 12-28

6. Make the FTP server settings and then click the **OK** Button.

7. Click the **OK** or **Apply** Button in the Environment Setting Dialog Box.

8. In the Format Dialog Box for the logging 1 or logging 2 settings, select the **FTP server** Option for the saving destination and select the ID number that you set in the FTP Server Details Dialog Box.



/MP_LOG/LOGGING1/logging00000.csv

Saving destination

● In the built-in RAM disc ○ USB memory

○ FTP server 101 (192.168.1.1)

File format

● CSV (*.csv) ○ Binary (*.bin)

File details

<Output information>

☑ Data No. ☑ Program

☑ DATE/TIME ☑ Sampling period

☑ Registered register name

<Number of output data>

10000 (1 - 32767)

File name

logging Default

* A 5-digit index number is automatically added at the end of the file name.

Folder name

☐ Add date information at the end of the folder name

Year/Month/Day/Hour (YYYYMMDDHH)

Note: 1. The file that is set in the **File name** Area will be transferred. It will be written to the FTP server using the same file name.

2. If you select an FTP server as the destination, the built-in RAM disk that is specified for the folder name is used as a temporary area.

9. Make the other settings for logging.

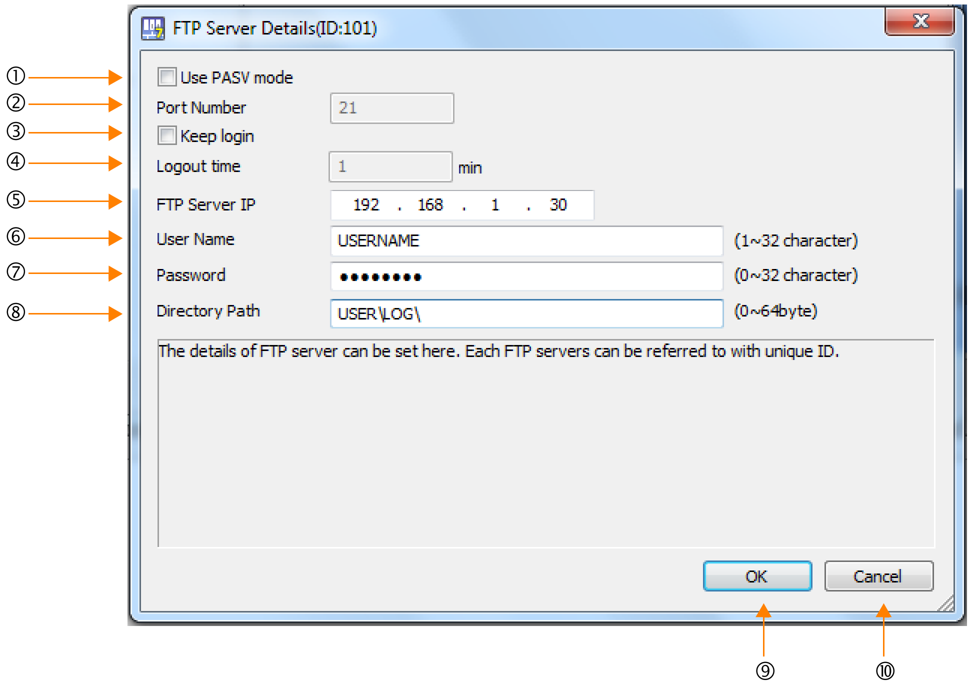
10. Click the **OK** Button.

11. Save the data to flash memory as required.

12. Execute the logging.
When the specified number of output data has been logged and the file is ready, the file will be transferred to the FTP server.

◆ Details on the FTP Server Details Dialog Box

The contents of the FTP Server Details Dialog Box are described in the following table.



FTP Server Details(ID:101)

☐ Use PASV mode
Port Number 21
☐ Keep login
Logout time 1 min
FTP Server IP 192 . 168 . 1 . 30
User Name USERNAME (1~32 character)
Password •••••••• (0~32 character)
Directory Path USER\LOG\ (0~64byte)

The details of FTP server can be set here. Each FTP servers can be referred to with unique ID.

No.	Item	Description	Remarks
①	Use PASV mode.	Specify whether to use PASV mode.	If PASV mode is not specified, ACTIV mode is used.
②	Port Number	1 to 65,535 This setting is valid in PASV mode.	Port 21 is always used for ACTIV mode.
③	Keep login	Specify whether to stay logged in.	If you do not specify staying logged in, the FTP client will be logged out each time a file is uploaded.
④	Logout time	1 to 60 This setting is valid only when you specify staying logged in. The FTP client will be logged out if this time elapses before the next operation is performed after the last log file is transferred.	The FTP client will also be logged out for FTP transfer errors or if the CPU stops regardless of the logout time setting.
⑤	FTP Server IP	Enter the IP address of the FTP server. The setting range is determined by the IP address rules for the 218IFD.	The 218IFD settings are used for the gateway IP address and subnet mask.
⑥	User Name	Enter the login name for the FTP server.	1 to 32 characters There are no restrictions to the characters that can be used.
⑦	Password	Enter the login password for the FTP server.	0 to 32 characters There are no restrictions to the characters that can be used.
⑧	Directory Path	Set the directory path to which to write data in the FTP server.	0 to 64 characters There are no restrictions to the characters that can be used. Use slashes to separate directories. The file name that is specified for logging is used as the name of the file that is written.
⑨	OK Button	Click the **OK** Button to apply the changes and end.	–
⑩	Cancel Button	Click the **Cancel** Button to not apply the changes and end.	–

◆ Precautions

- Logging Overruns
  FTP transfers are performed as part of the logging function. Logging data is not possible during FTP transfers. Adjust the amount of data to log and the timing so that logging overruns do not occur.
- Watchdog Timeout Errors for Large Data Transfers
  If you transfer a large quantity of data with an FTP transfer when there is little idle time in the high-speed or low-speed scan, a scan exceeded error may occur. If you frequently transfer large amounts of data, provide sufficient idle time in scan processing.
- Online Parameter Changes for FTP Client Settings
  If you change the FTP client settings when an FTP transfer is not in progress, the changes are made online. If an FTP transfer is in progress, the changes will not be applied and the operation will continue with the original settings. If the **Keep login** Option is selected, the system assumes that an FTP transfer is in progress as long as the FTP client is logged in. Therefore, the changes will not be applied and the operation will continue with the original settings. Changes that were not applied will be applied after restarting after data is saved to flash memory.

12.4 Calendar

The calendar is used to manage dates and times in the CPU. If the calendar has been set, the date and time will be automatically recorded when an alarm occurs.

The calendar is backed up by an EDLC (electronic double-layer capacitor). This allows it to maintain the correct time even if the power to the SERVOPACK is turned OFF. (The calendar has an error of 1 minute a day, and remains backed up for about a month.)

The date and time information can be set, changed, and accessed through the system registers. Refer to the following section for details.

☞ • *Calendar* on page 12-81

12.5 Maintenance Monitoring

You can use maintenance monitoring to monitor maintenance data in the SERVOPACK.

Information If you use maintenance monitoring at the same time as the SigmaWin+, both the SigmaWin+ and maintenance monitoring may become slower.

12.5.1 Maintenance Data

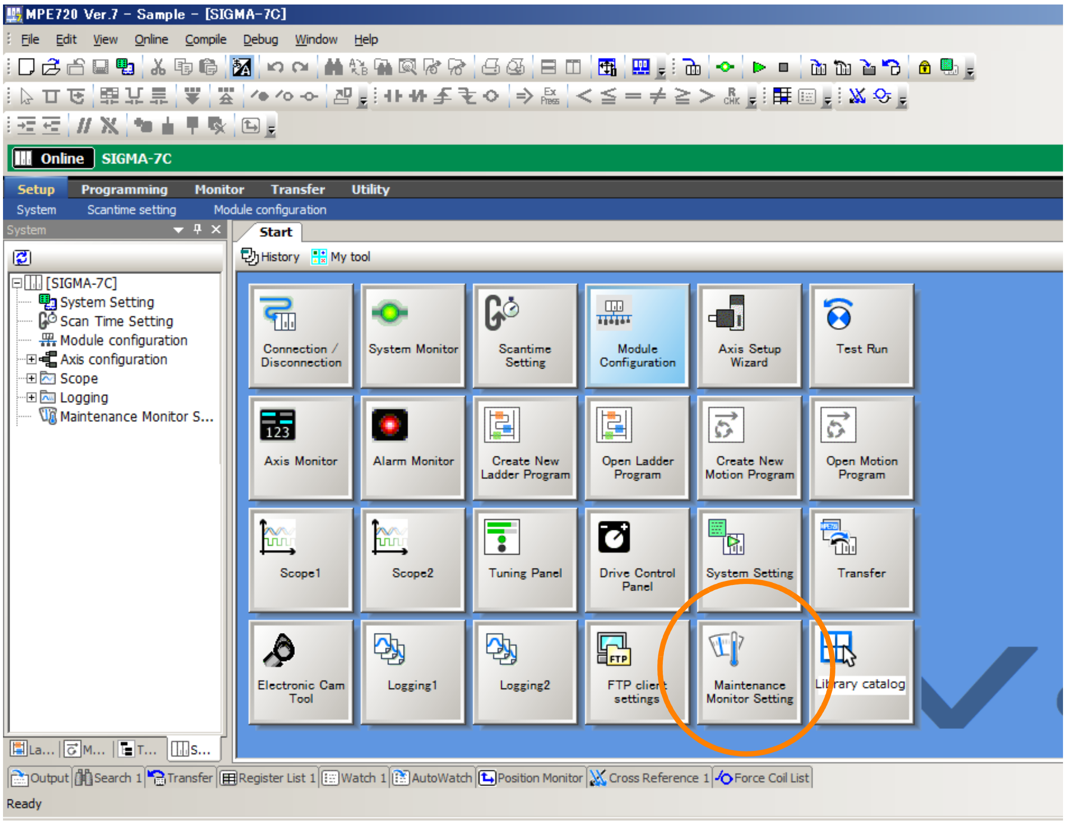
The maintenance data that you can monitor are listed in the following table.

Data Category	Detailed Contents
Installation environment data	Temperature environment load status of SERVOPACK and Servomotors
Power consumption data	Power consumptions of SERVOPACKs and Servomotors
Life estimation data	• Total operating times of SERVOPACKs • Remaining lives of consumable parts (internal fans, capacitors, inrush-current prevention circuits, and dynamic brake circuits)

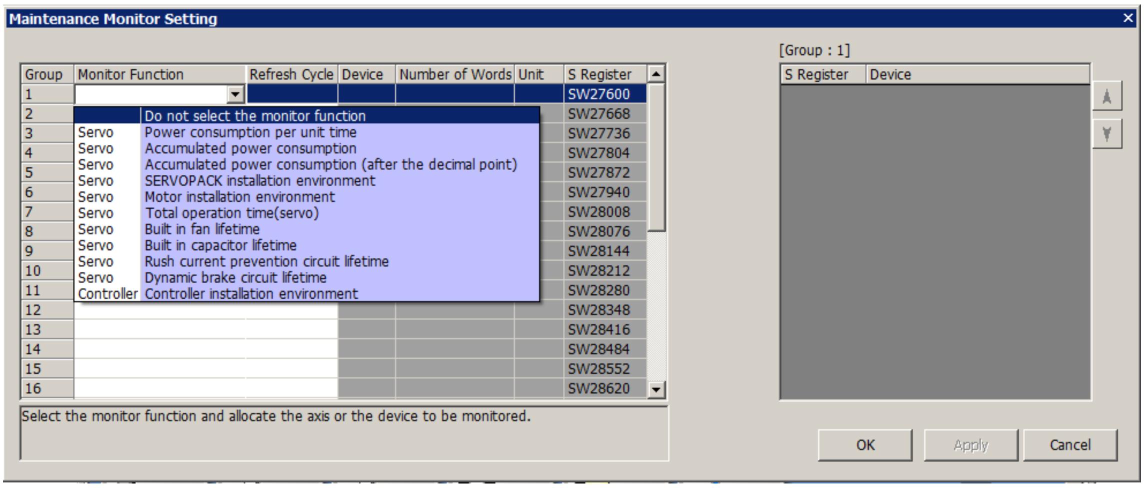
12.5.2 Setting Procedure

Use the following procedure to set the maintenance data.

1. Click the **Maintenance Monitor Settings** Button from the Start Tab Page in the MPE720.



The Maintenance Monitor Settings Dialog Box will be displayed.



Maintenance Monitor Setting

Group	Monitor Function	Refresh Cycle	Device	Number of Words	Unit	S Register
1						SW27600
2						SW27668
3						SW27736
4						SW27804
5						SW27872
6						SW27940
7						SW28008
8						SW28076
9						SW28144
10						SW28212
11						SW28280
12						SW28348
13						SW28416
14						SW28484
15						SW28552
16						SW28620

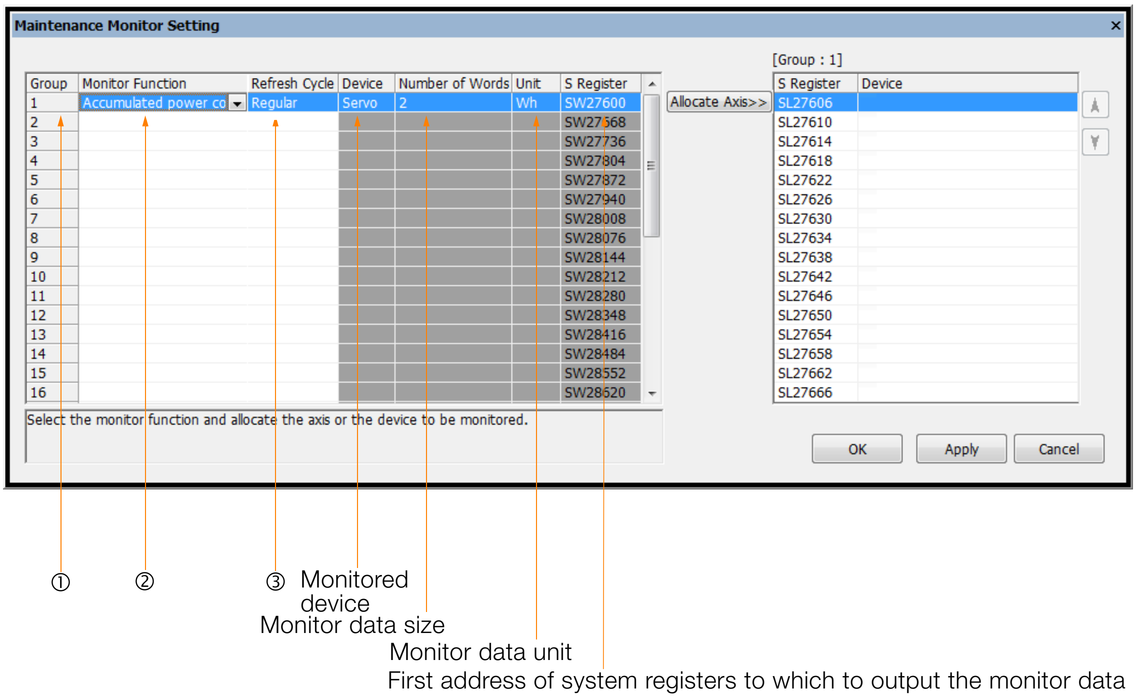
	Do not select the monitor function
Servo	Power consumption per unit time
Servo	Accumulated power consumption
Servo	Accumulated power consumption (after the decimal point)
Servo	SERVOPACK installation environment
Servo	Motor installation environment
Servo	Total operation time(servo)
Servo	Built in fan lifetime
Servo	Built in capacitor lifetime
Servo	Rush current prevention circuit lifetime
Servo	Dynamic brake circuit lifetime
Controller	Controller installation environment

Select the monitor function and allocate the axis or the device to be monitored.

[Group : 1]

S Register	Device

2. Set the maintenance monitor data.



Maintenance Monitor Setting

Group	Monitor Function	Refresh Cycle	Device	Number of Words	Unit	S Register
1	Accumulated power co	Regular	Servo	2	Wh	SW27600
2						SW27668
3						SW27736
4						SW27804
5						SW27872
6						SW27940
7						SW28008
8						SW28076
9						SW28144
10						SW28212
11						SW28280
12						SW28348
13						SW28416
14						SW28484
15						SW28552
16						SW28620

[Group : 1]

S Register	Device
SL27606	
SL27610	
SL27614	
SL27618	
SL27622	
SL27626	
SL27630	
SL27634	
SL27638	
SL27642	
SL27646	
SL27650	
SL27654	
SL27658	
SL27662	
SL27666	

Select the monitor function and allocate the axis or the device to be monitored.

① ② ③ Monitored device

Monitor data size

Monitor data unit

First address of system registers to which to output the monitor data

① Select a group number.

- Maximum number of groups: 32

② Select the item to monitor.

Selection	Description	Monitored Device	Number of Words	Unit
Power consumption per unit time	The power consumption per unit time is displayed.	SERVOPACK	2	1 Wh
Accumulated power consumption	The accumulated power consumption since operation was started is displayed.	SERVOPACK	2	1 Wh
Accumulated power consumption (after the decimal point)	The three digits below the decimal point of the accumulated power consumption since operation was started are displayed.	SERVOPACK	2	0.001 Wh
SERVOPACK installation environment	The temperature environment load status in the SERVOPACK is displayed.	SERVOPACK	1	1%

Continued on next page.

Continued from previous page.

Selection	Description	Monitored Device	Number of Words	Unit
Motor installation environment	The temperature environment load status in the Servomotor is displayed.	SERVOPACK	1	1%
Total operating time (servo)	The total operating time of the SERVOPACK is displayed.	SERVOPACK	2	100 ms
Built in fan lifetime	The total operating time of the cooling fan is displayed as a percentage. When usage is first started, 100% is displayed. The percentage become smaller as the operating time increases. When 0% is displayed, it is time to consider replacement.	SERVOPACK	1	0.01%
Built in capacitor lifetime	The maintenance time of the electrolytic capacitors in the main circuit and control circuit is displayed as a percentage. When usage is first started, 100% is displayed. The percentage become smaller as the operating time increases. When 0% is displayed, it is time to consider replacement.	SERVOPACK	1	0.01%
Rush current prevention circuit lifetime	The maintenance period of the inrush prevention relay is displayed as a percentage. When usage is first started, 100% is displayed. The percentage become smaller as the operating time increases. When 0% is displayed, it is time to consider replacement.	SERVOPACK	1	0.01%
Dynamic brake circuit lifetime	The maintenance period of the IGBT is displayed as a percentage. When usage is first started, 100% is displayed. The percentage become smaller as the operating time increases. When 0% is displayed, it is time to consider replacement.	SERVOPACK	1	0.01%
Controller installation environment	The temperature environment load status in the Controller is displayed.	Controller	1	1%

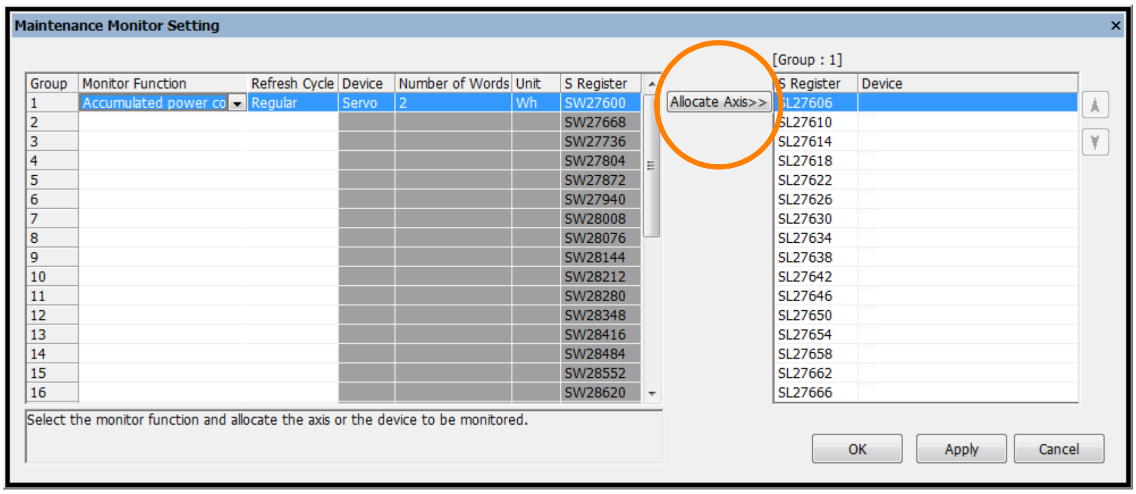
Information You can select the same monitor item for more than one group.

③ Select the data update period.

Selection	Description
Frequent	The data is updated approximately once every second.
Regular	The data is updated approximately once every 10 seconds.
Infrequent	The data is updated approximately once every 100 seconds.

Information The data update periods are guidelines. The update periods may be increased depending on the number of monitored axes.

3. Click the **Allocate Axis** Button.



Maintenance Monitor Setting

Group	Monitor Function	Refresh Cycle	Device	Number of Words	Unit	S Register
1	Accumulated power co	Regular	Servo	2	Wh	SW27600
2						SW27668
3						SW27736
4						SW27804
5						SW27872
6						SW27940
7						SW28008
8						SW28076
9						SW28144
10						SW28212
11						SW28280
12						SW28348
13						SW28416
14						SW28484
15						SW28552
16						SW28620

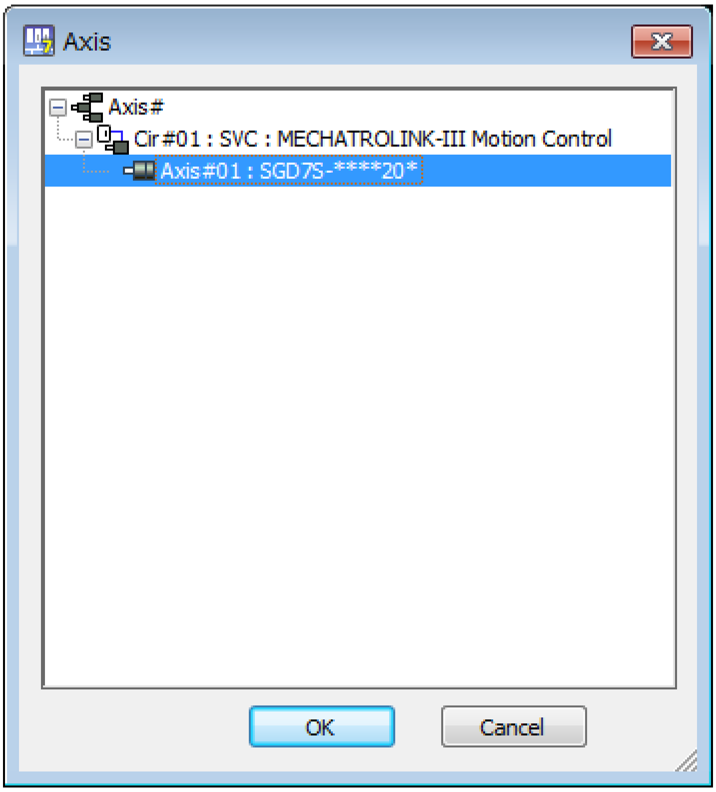
[Group : 1]

S Register	Device
L27606	
SL27610	
SL27614	
SL27618	
SL27622	
SL27626	
SL27630	
SL27634	
SL27638	
SL27642	
SL27646	
SL27650	
SL27654	
SL27658	
SL27662	
SL27666	

Select the monitor function and allocate the axis or the device to be monitored.

The Axis Selection Dialog Box will be displayed.

4. Select the axis to assign.



Axis

Axis#
Cir#01 : SVC : MECHATROLINK-III Motion Control
Axis#01 : SGD7S-****20*

- Maximum number of assigned axes: 16/group

5. Click the **OK** Button.
Monitoring will be started.

12.5.3 Confirmation Method

System Registers

The monitored data is stored in system registers.

The ranges of the system registers that you can use for maintenance monitoring are given in the following table.

Information □□□□ is the first address of the system register that is displayed on the Maintenance Monitor Setting Dialog Box.

System Register	Item		Additional Information
SL□□□□ + 0	Reserved (monitor parameter type).		–
SW□□□□ + 2	Monitor Size		0001h: Word 0002h: Long word
SW□□□□ + 3	Reserved.		–
SW□□□□ + 4	Axis 1	Circuit No.	If an error occurs, the error code is stored here. ☞ ◆ *Error Codes* on page 12-36
SW□□□□ + 5		Axis No.	If an error occurs, the error code is stored here. ☞ ◆ *Error Codes* on page 12-36
SL□□□□ + 6		Monitor Value	–
SW□□□□ + 8	Axis 2	Circuit No.	Same as above.
SW□□□□ + 9		Axis No.	
SW□□□□ + 10		Monitor Value	
SW□□□□ + 12	Axis 3	Circuit No.	Same as above.
SW□□□□ + 13		Axis No.	
SL□□□□ + 14		Monitor Value	
SW□□□□ + 16	Axis 4	Circuit No.	Same as above.
SW□□□□ + 17		Axis No.	
SL□□□□ + 18		Monitor Value	
SW□□□□ + 20	Axis 5	Circuit No.	Same as above.
SW□□□□ + 21		Axis No.	
SL□□□□ + 22		Monitor Value	
SW□□□□ + 24	Axis 6	Circuit No.	Same as above.
SW□□□□ + 25		Axis No.	
SL□□□□ + 26		Monitor Value	
SW□□□□ + 28	Axis 7	Circuit No.	Same as above.
SW□□□□ + 29		Axis No.	
SL□□□□ + 30		Monitor Value	
SW□□□□ + 32	Axis 8	Circuit No.	Same as above.
SW□□□□ + 33		Axis No.	
SL□□□□ + 34		Monitor Value	
SW□□□□ + 36	Axis 9	Circuit No.	Same as above.
SW□□□□ + 37		Axis No.	
SL□□□□ + 38		Monitor Value	
SW□□□□ + 40	Axis 10	Circuit No.	Same as above.
SW□□□□ + 41		Axis No.	
SL□□□□ + 42		Monitor Value	
SW□□□□ + 44	Axis 11	Circuit No.	Same as above.
SW□□□□ + 45		Axis No.	
SL□□□□ + 46		Monitor Value	

Continued on next page.

Continued from previous page.

System Register	Item		Additional Information
SW□□□□ + 48	Axis 12	Circuit No.	Same as above.
SW□□□□ + 49		Axis No.	
SL□□□□ + 50		Monitor Value	
SW□□□□ + 52	Axis 13	Circuit No.	Same as above.
SW□□□□ + 53		Axis No.	
SL□□□□ + 54		Monitor Value	
SW□□□□ + 56	Axis 14	Circuit No.	Same as above.
SW□□□□ + 57		Axis No.	
SL□□□□ + 58		Monitor Value	
SW□□□□ + 60	Axis 15	Circuit No.	Same as above.
SW□□□□ + 61		Axis No.	
SL□□□□ + 62		Monitor Value	
SW□□□□ + 64	Axis 16	Circuit No.	Same as above.
SW□□□□ + 65		Axis No.	
SL□□□□ + 66		Monitor Value	

◆ Error Codes

If reading the monitor data cannot be completed normally, one of the following error codes is displayed in the system registers that normally contain the circuit number and axis number.

System Registers		Error Description
Circuit No.	Axis No.	
80h	18h	Relay error: An error occurred in message communications with the SERVOPACK.
80h	22h	Timeout error: A response was not received from the SERVOPACK within 5 seconds.

Monitoring Methods

You can use the following methods to monitor the data stored in the system registers.

- Ladder Programming
  Refer to the following manual for operating details.
  📖 MP2000/MP3000 Series Engineering Tool MPE720 Version7 User's Manual (Manual No.: SIEP C880761 03)
- Tracing
  Refer to the following manual for operating details.
  📖 MP2000/MP3000 Series Engineering Tool MPE720 Version7 User's Manual (Manual No.: SIEP C880761 03)
- Data Logging
  Refer to the following section for operating details.
  ☞ *12.1 Data Logging* on page 12-3

Information You can also use a touch panel to monitor the stored data.

12.6 Security Functions

12.6.1 Project File Security

This section describes the security features for project files.

Setting a Project Password

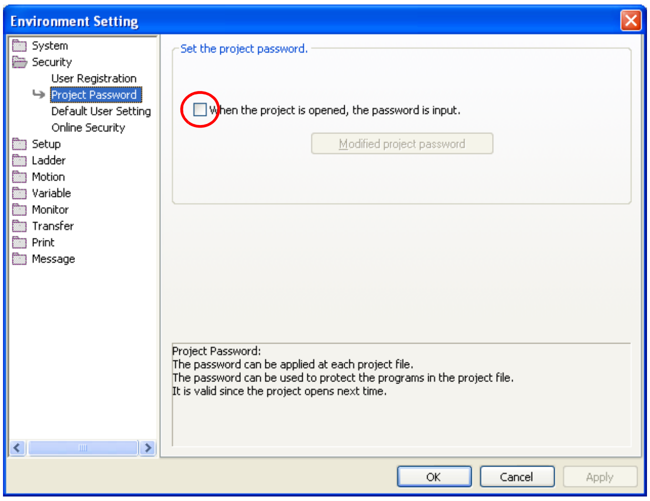
You can set a password for the project file that is currently open.

Important

If you forget the password that you set, there is no way to recover it and it will be impossible to open the password-protected project file.

Creating or Changing a Password

1. Select **Security** – **Project Password** from the tree structure in the Environment Setting Dialog Box. The following view will be displayed.

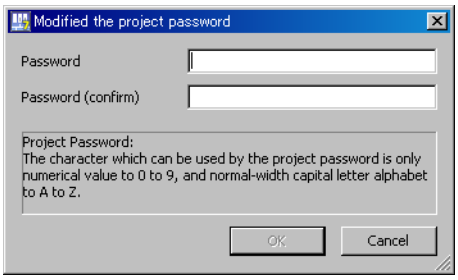


Set the project password.

☐ When the project is opened, the password is input.

Project Password:
The password can be applied at each project file.
The password can be used to protect the programs in the project file.
It is valid since the project opens next time.

2. Select the **When the project is opened, the password is input** Check Box and then click the **Modified project password** Button. The following dialog box will be displayed. Enter each item, and then click the **OK** Button.

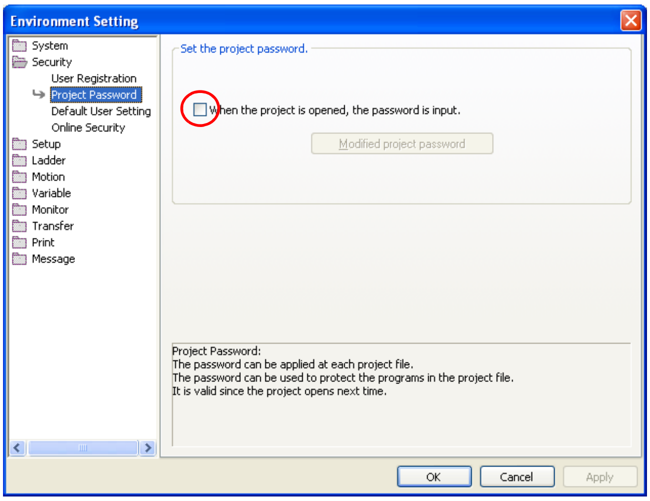


Project Password:
The character which can be used by the project password is only numerical value to 0 to 9, and normal-width capital letter alphabet to A to Z.

Item	Description
Password	Enter 1 to 16 alphanumeric characters. The password is not case sensitive.
Password (confirm)	Enter the same password one more time, and then click the **OK** Button. Note: The **OK** Button will be enabled when one or more characters are entered in the **Password (confirm)** Box.

Deleting a Password

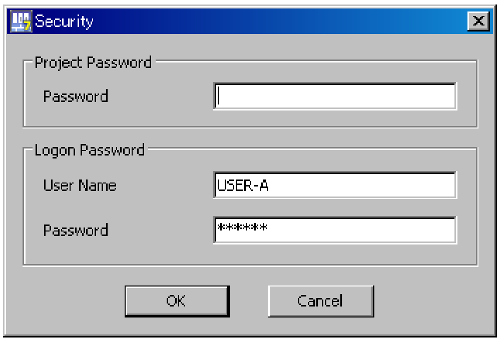
Clear the **When the project is opened, the password is input** Check Box to delete the password that you set previously.



☐ When the project is opened, the password is input.

Project Password:
The password can be applied at each project file.
The password can be used to protect the programs in the project file.
It is valid since the project opens next time.

Information When you try to open a password-protected project file, the Security Dialog Box will be displayed.

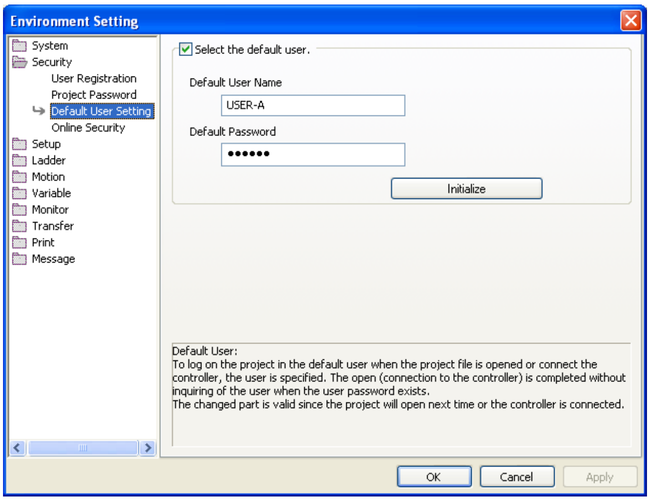


Password:
User Name: USER-A
Password: ******

Enter the project password, and then click the **OK** Button to open the project file.

Setting the Default User

Select **Security – Default User Setting** from the tree structure in the Environment Setting Dialog Box. The following view will be displayed.



☑ Select the default user.

Default User Name: USER-A
Default Password: ••••••

Default User:
To log on the project in the default user when the project file is opened or connect the controller, the user is specified. The open (connection to the controller) is completed without inquiring of the user when the user password exists.
The changed part is valid since the project will open next time or the controller is connected.

Select the **Select the default user** Check Box to enable accessing the project file (or the SERVOPACK) with the default user account. If the specified user name is not among the registered users, the Logon Dialog Box will be displayed.

Enter 1 to 16 alphanumeric characters into the **Default User Name** and **Default Password** Boxes.

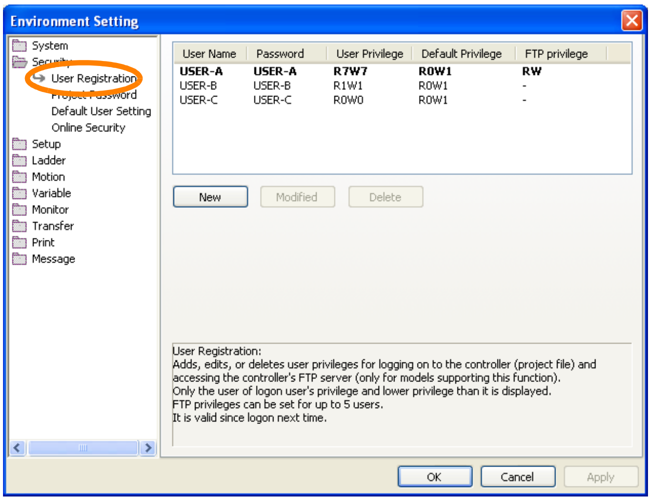
User Management

You can register and change the name of users who can open a project file.

You can make this setting when the project file is open, or when the SERVOPACK is online. If the setting is performed while the SERVOPACK is online, the setting will provide access and writing privileges to the SERVOPACK.

> **Important**
>
> If you forget the password that you set, there is no way to recover it and it will be impossible for the user to open the password-protected project file.

Select **Security** – **User Registration** from the tree structure in the Environment Setting Dialog Box. The following view will be displayed.

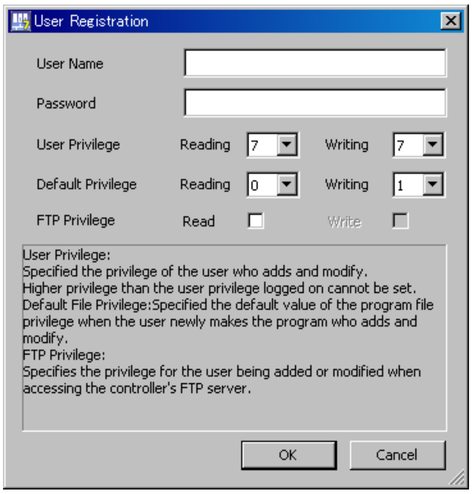


User Name	Password	User Privilege	Default Privilege	FTP privilege
USER-A	**USER-A**	**R7W7**	**R0W1**	**RW**
USER-B	USER-B	R1W1	R0W1	-
USER-C	USER-C	R0W0	R0W1	-

User Registration:
Adds, edits, or deletes user privileges for logging on to the controller (project file) and accessing the controller's FTP server (only for models supporting this function).
Only the user of logon user's privilege and lower privilege than it is displayed.
FTP privileges can be set for up to 5 users.
It is valid since logon next time.

◆ Registering a New User

Click the **New** Button on the User Registration View. The User Registration Dialog Box will be displayed. Enter each item, and then click the **OK** Button.



User Name
Password
User Privilege Reading 7 Writing 7
Default Privilege Reading 0 Writing 1
FTP Privilege Read ☐ Write ☐

User Privilege:
Specified the privilege of the user who adds and modify.
Higher privilege than the user privilege logged on cannot be set.
Default File Privilege:Specified the default value of the program file privilege when the user newly makes the program who adds and modify.
FTP Privilege:
Specifies the privilege for the user being added or modified when accessing the controller's FTP server.

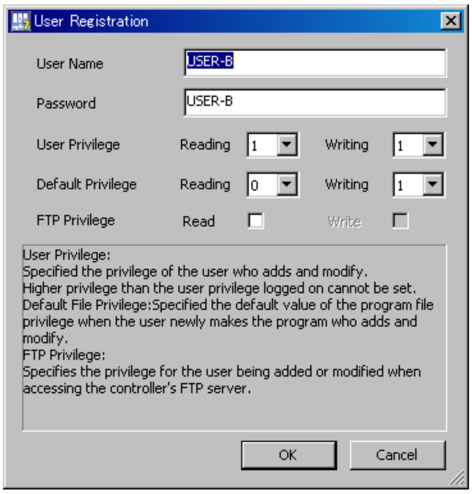
User Name	Enter from 1 to 16 alphanumeric characters.
Password	Enter from 1 to 16 alphanumeric characters.
User Privilege	Select the reading and writing privilege levels for the user from 0 to 7. Higher numbers represent higher levels of privileges.
Default Privileges	In these boxes, set the default levels of privileges when a user creates a program.

Term

Reading and Writing Privileges
Reading and writing privilege levels are set to maintain the security of the programs. To open a program, the user must have at least the same reading level privilege as was set for that program. Similarly, to edit and save a program, the user must have at least the same writing level privilege as was set for that program.

◆ Changing Registration Information

Select the user whose information you want to change in the User Registration View of the Environment Setting Dialog Box and then click the **Modified** Button. The User Registration Dialog Box will be displayed. Set the items as needed, and then click the **OK** Button to change the user information.



User Name: USER-B
Password: USER-B
User Privilege: Reading 1, Writing 1
Default Privilege: Reading 0, Writing 1
FTP Privilege: Read ☐ Write ☐

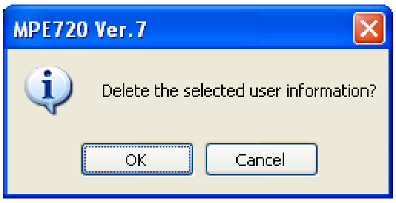
User Privilege:
Specified the privilege of the user who adds and modify.
Higher privilege than the user privilege logged on cannot be set.
Default File Privilege:Specified the default value of the program file privilege when the user newly makes the program who adds and modify.
FTP Privilege:
Specifies the privilege for the user being added or modified when accessing the controller's FTP server.

Important

If the selected user is the default user, only the default privileges can be changed.
Refer to the following section for information on specifying the default user.
☞ *Setting the Default User* on page 12-38

◆ Deleting a Registered User

Select the user whose information you want to delete in the User Registration View of the Environment Setting Dialog Box and then click the **Delete** Button. The following dialog box will be displayed. Click the **OK** Button to delete the selected user.



Delete the selected user information?

12.6.2 Program Security

You can set separate passwords for ladder programs and motion programs. A lock mark is displayed for each password-protected program. To edit a password-protected program, you must first enter the password.

The purpose of this password is to control access for editing. It does not affect the management of program files (copying, cutting, pasting, deleting, or enable/disable settings).

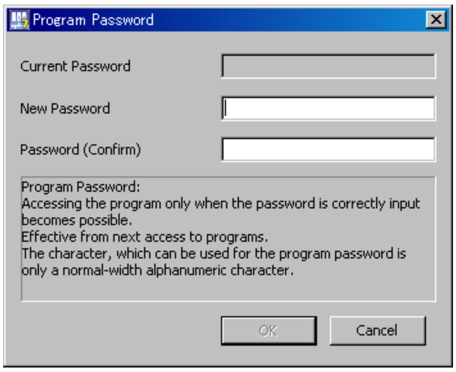
Important

If you forget the password that you set, there is no way to recover it, and it will be impossible to open the password-protected program.

This section describes the security that is provided, using a ladder program as an example.

Setting the Password

1. In the Ladder Pane, right-click on the program for which you want to set a password. Select ***Set the Password*** from the pop-up menu.
The Program Password Dialog Box will be displayed.

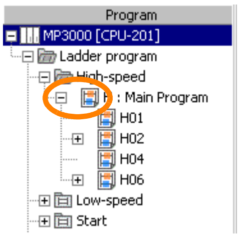


Program Password:
Accessing the program only when the password is correctly input becomes possible.
Effective from next access to programs.
The character, which can be used for the program password is only a normal-width alphanumeric character.

2. Enter 1 to 8 alphanumeric characters in the **New Password** Box. Enter the same password again in the **Password (Confirm)** Box, and then click the **OK** Button.

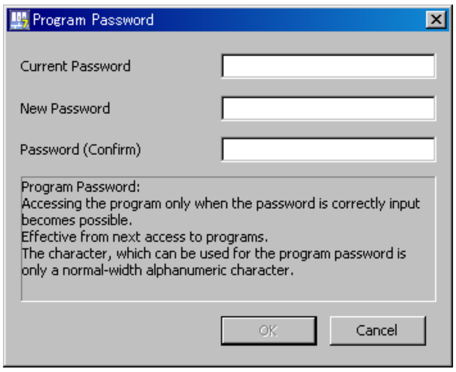
Note: 1. The **OK** Button will be enabled when one or more characters are entered in the **Password (Confirm)** Box.
2. The password is not case sensitive.

The Program Password Dialog Box will be closed, and a padlock icon will be displayed next to the ladder program that was selected in Step 1. If the program was displayed in the main window, it will be closed.



Changing a Password

1. In the Ladder Pane, right-click on the program for which you want to change the password. Select ***Set the Password*** from the pop-up menu.
   The Program Password Dialog Box will be displayed.



Program Password:
Accessing the program only when the password is correctly input becomes possible.
Effective from next access to programs.
The character, which can be used for the program password is only a normal-width alphanumeric character.

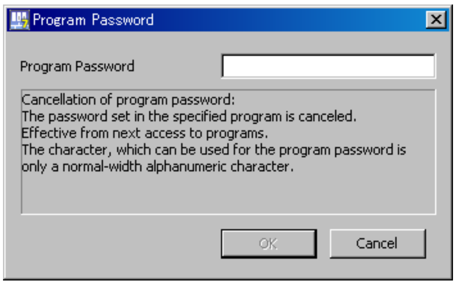
2. Enter the current password in the **Current Password** Box.
   Enter 1 to 8 alphanumeric characters in the **New Password** Box. Enter the same password again in the **Password (Confirm)** Box, and then click the **OK** Button.

   Note: The **OK** Button will be enabled when one or more characters are entered in the **Password (Confirm)** Box.

   The password will be changed and the Program Password Dialog Box will be closed.

Deleting a Password

1. In the Ladder Pane, right-click on the program from which you want to delete the password. Select ***Cancel the Password*** from the pop-up menu.
   The Program Password Dialog Box will be displayed.



Cancellation of program password:
The password set in the specified program is canceled.
Effective from next access to programs.
The character, which can be used for the program password is only a normal-width alphanumeric character.

2. Enter the current password in the **Program Password** Box, and then click the **OK** Button.

   Note: The **OK** Button will be enabled when one or more characters are entered in the **Program Password** Box.

   The padlock icon will be removed from the ladder program that was selected in step 1, and the Program Password Dialog Box will be closed.

Opening a Password-Protected Ladder Program

1. When you attempt to open a password-protected ladder program (i.e., one with a padlock icon next to its name), the Program Password Dialog Box will be displayed.

Program Password:
The password is set in the specified program. It is necessary to input the password to open the program.
The character, which can be used for the program password is only a normal-width alphanumeric character.

2. Enter the current password in the **Program Password** Box, and then click the **OK** Button.

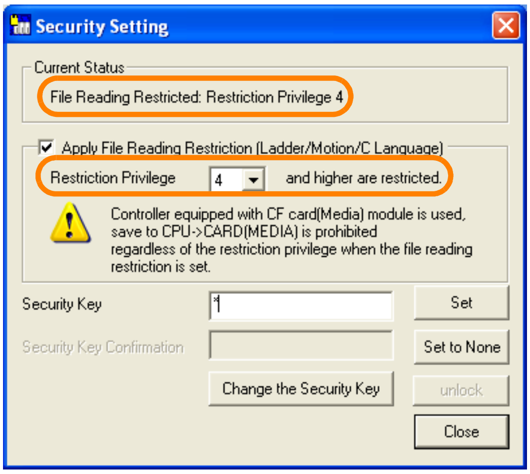
   Note: The **OK** Button will be enabled when one or more characters are entered in the **Program Password** Box.

   The selected ladder program will be opened in the main window.

12.6.3 Online Security

Online security refers to limiting the ability to read data from the SERVOPACK.

You can set security keys (i.e., a password) and privilege levels for programs to restrict the ability to read the program data from the SERVOPACK or to open the programs to users who have at least the specified level of privilege.



File Reading Restricted: Restriction Privilege 4

☑ Apply File Reading Restriction (Ladder/Motion/C Language)

Restriction Privilege 4 and higher are restricted.

Controller equipped with CF card(Media) module is used, save to CPU->CARD(MEDIA) is prohibited regardless of the restriction privilege when the file reading restriction is set.

Security Key *

Item	Description
Current Status	This area displays the current status of the security setting.
Apply File Reading Restriction	Select this check box to apply a reading restriction. This check box can be used to set file reading restrictions for ladder programs, motion programs, and C programs. Note: If a value is entered in the **Security Key** Box without selecting the **Apply File Reading Restriction** Check Box, only the security key will be set. The file reading restriction will not be set.
Restriction Privilege	Use this box to set the privilege level to restrict the group of users who can read the files. Note: The user must have a privilege level at least as high as the specified privilege to read the files.
Security Key and Security Key Confirmation	Enter the password that will be required to set online security. Enter 1 to 8 alphanumeric characters. The password is case sensitive.
Change the Security Key Button	Click this button to change the security key.
Set Button	Click this button to set the file reading restriction.
Set to None Button	Click this button to delete the current security key setting.
Unlock Button	Click this button to temporarily unlock the current online security. Even if you save the settings to the flash memory while the security key is temporarily unlocked, the temporary unlocked status will not be saved, and the online security setting will be maintained. The temporary unlock will be valid until you turn OFF the power supply to the SERVOPACK, disconnect the MPE720 from the SERVOPACK, or press the **Lock** Button on the Security Setting Dialog Box.
Close Button	Click this button to close the Security Setting Dialog Box.

Important

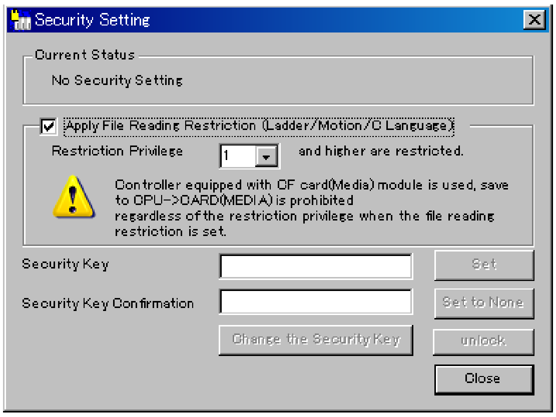
If the reading privilege is set to 4, then programs with a reading privilege of 4 or higher cannot be opened.
To manage program security, the current user must have a writing privilege level of 7.

Setting Online Security

This section describes how to set restrictions on reading the data from the SERVOPACK.

Use the following procedure to set online security.

1. With the SERVOPACK online, select ***Online*** – ***Online Security Setting*** from the menu bar.
   The Security Setting Dialog Box will be displayed.



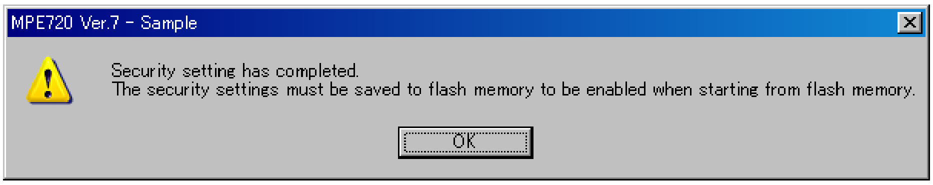
No Security Setting

☑ Apply File Reading Restriction (Ladder/Motion/C Language)

Controller equipped with CF card(Media) module is used, save to CPU->CARD(MEDIA) is prohibited regardless of the restriction privilege when the file reading restriction is set.

2. Select the **Apply File Reading Restriction** Check Box, and then select a restriction privilege level from the list of **Restriction Privilege** Box.

3. Enter the password in the **Security Key** Box. Enter the same password again in the **Security Key Confirmation** Box, and then click the **Set** Button.
   The **Set** Button will be enabled when one or more characters of text are entered in the **Security Key** Box.
   The file reading restriction and the security key will be set, and the following message will be displayed to ask for confirmation.



Security setting has completed.
The security settings must be saved to flash memory to be enabled when starting from flash memory.

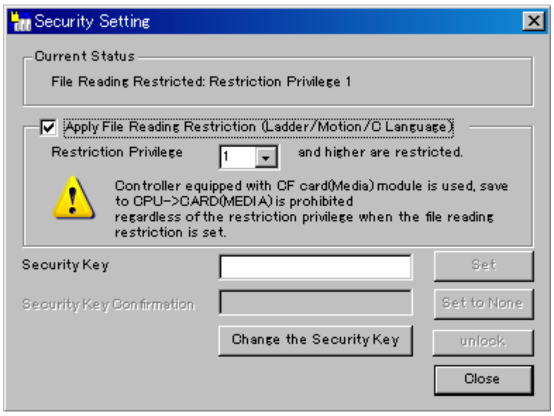
4. Click the **OK** Button.
   Click the **Close** Button to close the Security Setting Dialog Box.
   Save to flash memory, if necessary.

Changing Online Security

This section describes how to change the online security settings.

Use the following procedure to change the current file reading restriction and restriction privilege settings.

1. With the SERVOPACK online, select *Online* – *Online Security Setting* from the menu bar.
   The Security Setting Dialog Box will be displayed.



File Reading Restricted: Restriction Privilege 1

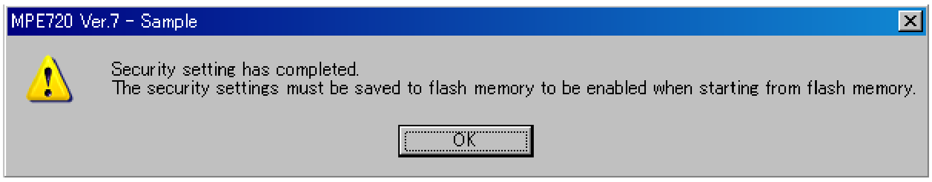
☑ Apply File Reading Restriction (Ladder/Motion/C Language)

Restriction Privilege 1 and higher are restricted.

Controller equipped with CF card(Media) module is used, save to CPU->CARD(MEDIA) is prohibited regardless of the restriction privilege when the file reading restriction is set.

2. Select or clear the **Apply File Reading Restriction** Check Box, and then change the value of the **Restriction Privilege** Box.

3. Enter the current security key in the **Security Key** Box, and then click the **Set** Button.
   The following confirmation message will be displayed.



Security setting has completed.
The security settings must be saved to flash memory to be enabled when starting from flash memory.

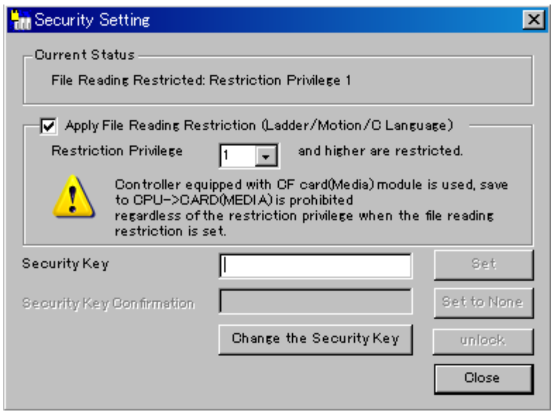
4. Click the **OK** Button.
   Click the **Close** Button to close the Security Setting Dialog Box.
   Save to flash memory, if necessary.

Deleting Online Security

This section describes how to delete the online security settings.

Use the following procedure to delete the security that was set for the SERVOPACK.

1. With the SERVOPACK online, select *Online* – *Online Security Setting* from the menu bar.
   The Security Setting Dialog Box will be displayed.



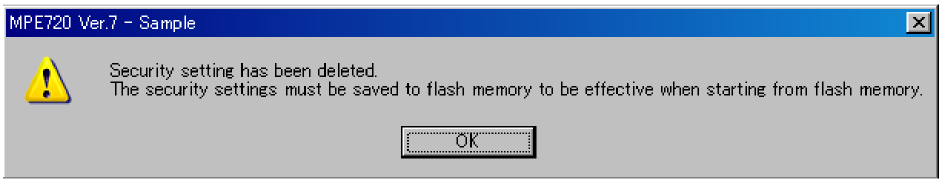
File Reading Restricted: Restriction Privilege 1

☑ Apply File Reading Restriction (Ladder/Motion/C Language)

Restriction Privilege 1 and higher are restricted.

Controller equipped with CF card(Media) module is used, save to CPU->CARD(MEDIA) is prohibited regardless of the restriction privilege when the file reading restriction is set.

2. Enter the current security key in the **Security Key** Box, and then click the **Set to None** Button.
   The following confirmation message will be displayed.



Security setting has been deleted.
The security settings must be saved to flash memory to be effective when starting from flash memory.

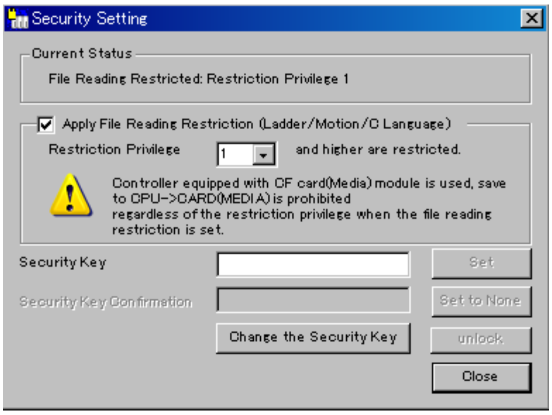
3. Click the **OK** Button.
   Click the **Close** Button to close the Security Setting Dialog Box.
   Save to flash memory, if necessary.

Changing the Security Key

This section describes how to change the security key of the online security.

Use the following procedure to change the security key.

1. With the SERVOPACK online, select ***Online*** – ***Online Security Setting*** from the menu bar.
   The Security Setting Dialog Box will be displayed.



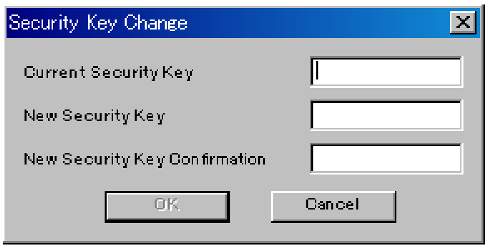
File Reading Restricted: Restriction Privilege 1

☑ Apply File Reading Restriction (Ladder/Motion/C Language)

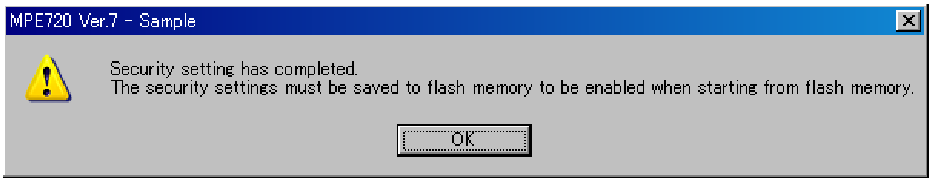
Restriction Privilege 1 and higher are restricted.

Controller equipped with CF card(Media) module is used, save to CPU->CARD(MEDIA) is prohibited regardless of the restriction privilege when the file reading restriction is set.

2. Click the **Change the Security Key** Button.
   The Security Key Change Dialog Box will be displayed.



3. Enter the current password in the **Current Security Key** Box, and then enter the new password in the **New Security Key** Box. Enter the same new password in the **New Security Key Confirmation** Box, and then click the **OK** Button.
   The following confirmation message will be displayed.



Security setting has completed.
The security settings must be saved to flash memory to be enabled when starting from flash memory.

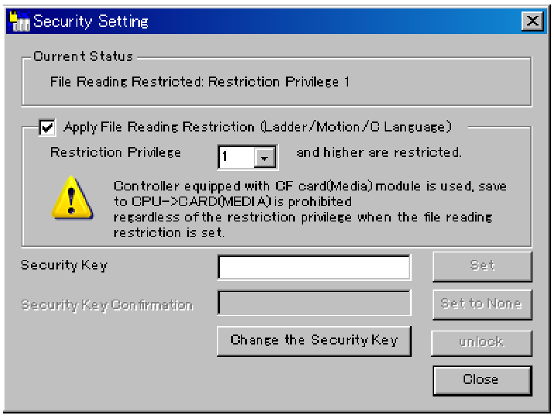
4. **Click the OK Button.**
   Click the **Close** Button to close the Security Setting Dialog Box.
   Save to flash memory, if necessary.

Unlocking Online Security Temporarily

This section describes how to temporarily unlock the online security settings.

Use the following procedure to temporarily unlock the security that was set for the SERVOPACK.

1. With the SERVOPACK online, select *Online* – *Online Security Setting* from the menu bar.
   The Security Setting Dialog Box will be displayed.



Security Setting

Current Status

File Reading Restricted: Restriction Privilege 1

☑ Apply File Reading Restriction (Ladder/Motion/C Language)

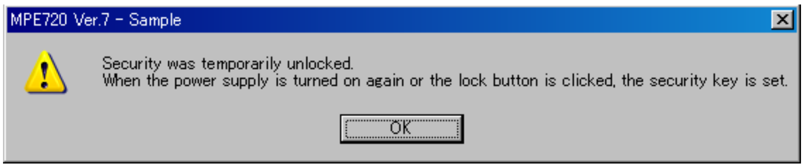
Restriction Privilege 1 and higher are restricted.

Controller equipped with CF card(Media) module is used, save to CPU->CARD(MEDIA) is prohibited regardless of the restriction privilege when the file reading restriction is set.

Security Key

Security Key Confirmation

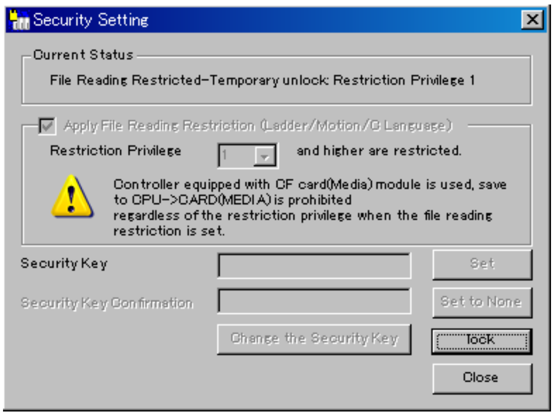
2. Enter the current security key in the **Security Key** Box, and then click the **Unlock** Button.
   The following confirmation message will be displayed.



MPE720 Ver.7 - Sample

Security was temporarily unlocked.
When the power supply is turned on again or the lock button is clicked, the security key is set.

3. **Click the OK Button.**
   Click the **Close** Button to close the Security Setting Dialog Box.
   Even if you save the settings to the flash memory, the temporary unlocked status will not be saved, and the online security setting will be maintained.



Security Setting

Current Status

File Reading Restricted-Temporary unlock: Restriction Privilege 1

☑ Apply File Reading Restriction (Ladder/Motion/C Language)

Restriction Privilege 1 and higher are restricted.

Controller equipped with CF card(Media) module is used, save to CPU->CARD(MEDIA) is prohibited regardless of the restriction privilege when the file reading restriction is set.

Security Key

Security Key Confirmation

12.7 IO16 Function Module

12.7.1 What Is the IO16 Function Module?

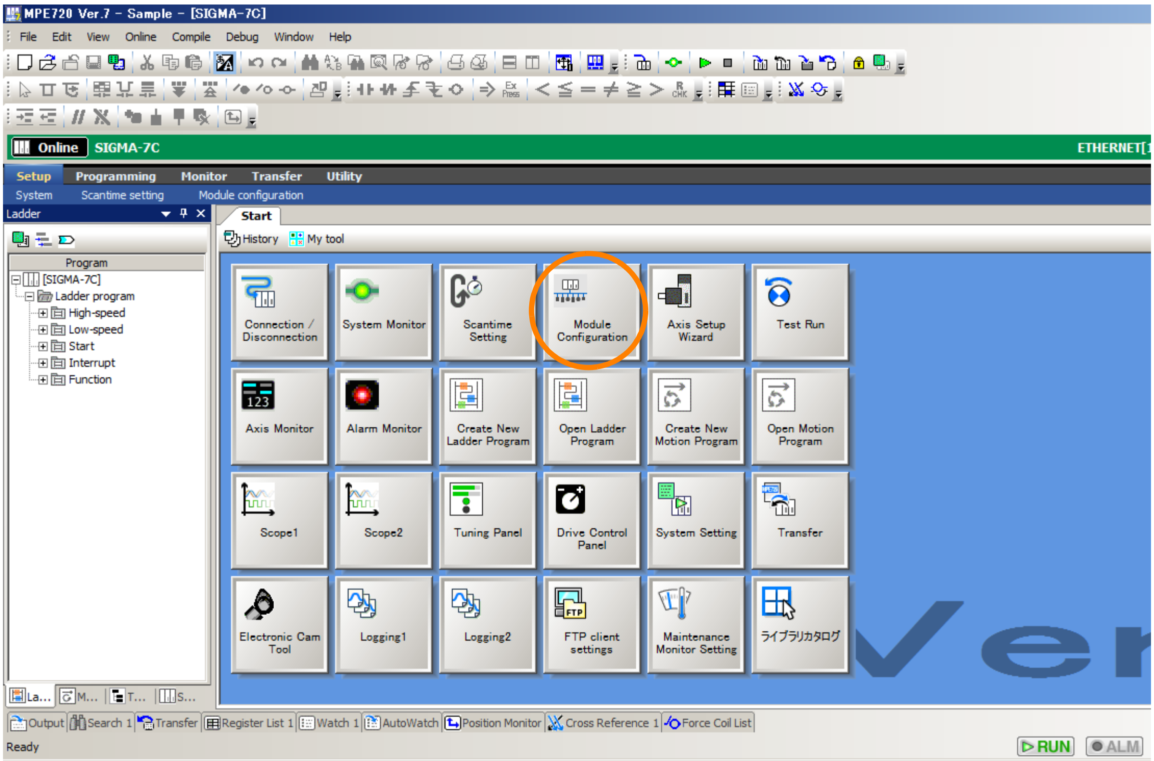
The IO16 Function Module provides 16 digital inputs (DI), 16 digital outputs (DO), and 16 sink outputs. These inputs and outputs are performed in a fixed cycle for each high-speed and low-speed scan in the Controller Section.

12.7.2 Setting Procedure for the IO16 Function Module

Use the following procedure to make the settings required to use the IO16 Function Module. Use the MPE720 to make the settings for the IO16 Function Module.

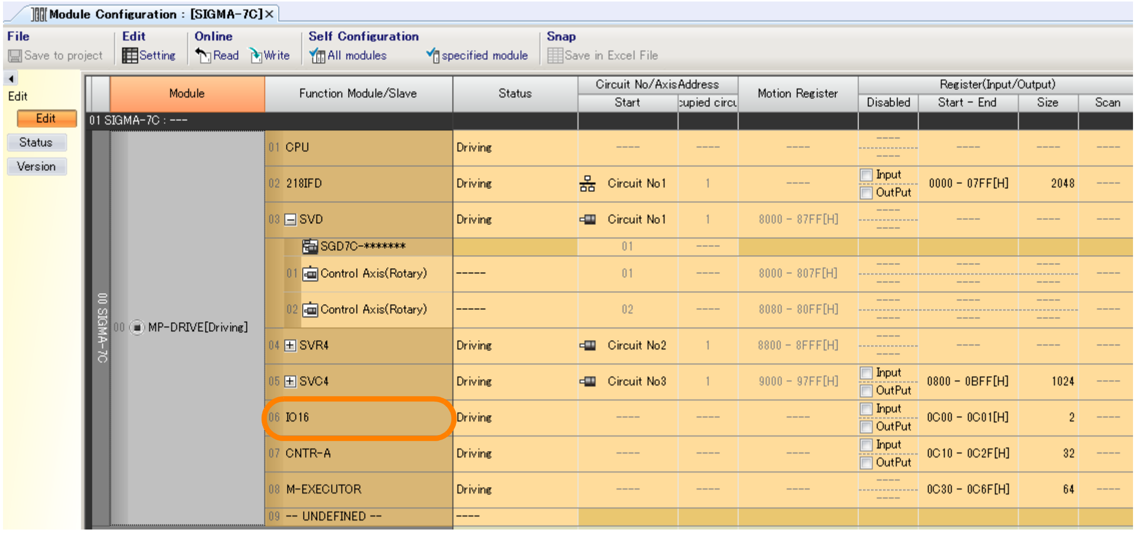
Displaying the Setting Dialog Box

1. Click the **Module Configuration** Button from the Start Tab Page in the MPE720.



The Module Configuration Definition Tab Page will be displayed.

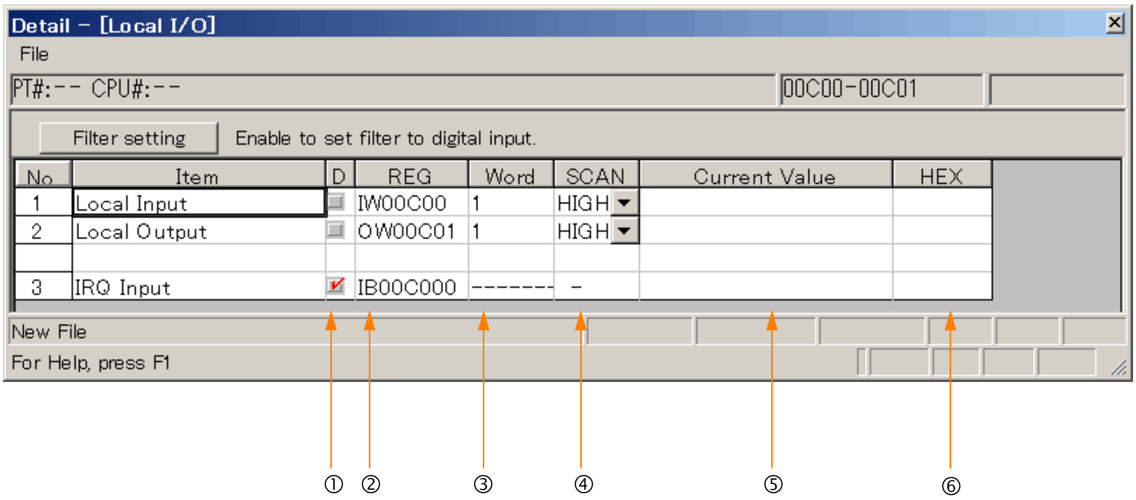
2. Double-click the **IO16** Cell.



Module	Function Module/Slave	Status	Circuit No/AxisAddress Start	cupied circu	Motion Register	Register(Input/Output) Disabled	Start - End	Size	Scan
01 SIGMA-7C : ---									
00 MP-DRIVE[Driving]	01 CPU	Driving	----	----	----	---- ----	----	----	----
	02 218IFD	Driving	Circuit No1	1	----	☐ Input ☐ OutPut	0000 - 07FF[H]	2048	----
	03 ⊟ SVD	Driving	Circuit No1	1	8000 - 87FF[H]	---- ----	----	----	----
	SGD7C-*******		01	----					
	01 Control Axis(Rotary)	-----	01	----	8000 - 807F[H]	---- ----	---- ----	---- ----	----
	02 Control Axis(Rotary)	-----	02	----	8080 - 80FF[H]	---- ----	---- ----	---- ----	----
	04 ⊞ SVR4	Driving	Circuit No2	1	8800 - 8FFF[H]	---- ----	----	----	----
	05 ⊞ SVC4	Driving	Circuit No3	1	9000 - 97FF[H]	☐ Input ☐ OutPut	0800 - 0BFF[H]	1024	----
	06 IO16	Driving	----	----	----	☐ Input ☐ OutPut	0C00 - 0C01[H]	2	----
	07 CNTR-A	Driving	----	----	----	☐ Input ☐ OutPut	0C10 - 0C2F[H]	32	----
	08 M-EXECUTOR	Driving	----	----	----	---- ----	0C30 - 0C6F[H]	64	----
	09 -- UNDEFINED --	----							

The Detail - [Local I/O] Dialog Box will be displayed.

3. Make the settings for discrete inputs, discrete outputs, and interrupt inputs.



PT#:-- CPU#:-- 00C00-00C01

Enable to set filter to digital input.

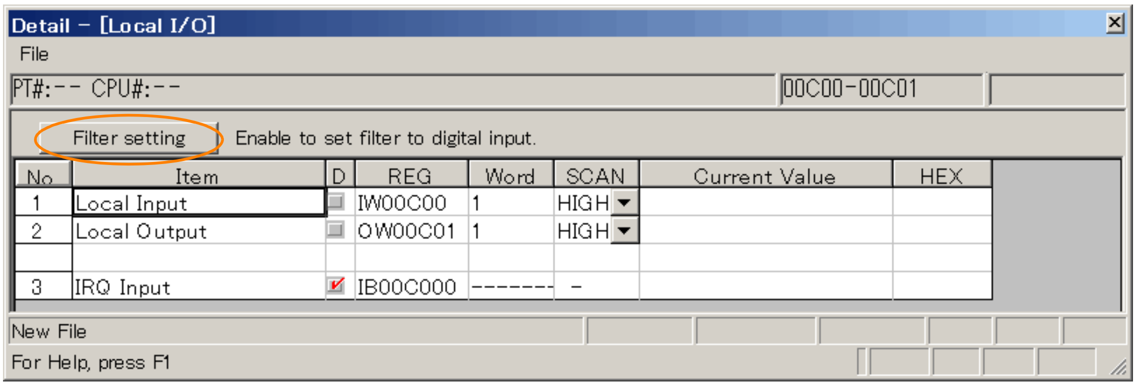
No	Item	D	REG	Word	SCAN	Current Value	HEX
1	Local Input	☐	IW00C00	1	HIGH ▾		
2	Local Output	☐	OW00C01	1	HIGH ▾		
3	IRQ Input	☑	IB00C000	--------	-		

New File

For Help, press F1

No.	Item	Description
①	D	Click to enable or disable each item. ☐ : Enable ☑ : Disable The register length is one word and cannot be changed. Therefore, each setting applies to all 16 inputs or 16 outputs.
②	REG	Displays the register addresses that are assigned to the inputs and outputs. The register addresses cannot be changed.
③	Word	Displays the data size in number of words of the register. The number of words cannot be changed.
④	SCAN	Select high-speed, low-speed, or NA (not specified) as the scan in which to process the inputs and outputs.
⑤	Current Value	If the SERVOPACK is online, the current values of the registers are displayed as binary numbers. The current values are not displayed when the SERVOPACK is offline. You can change the current values of the discrete outputs to set the outputs to external devices. The settings are immediately saved in the register when the settings are confirmed. Other current values cannot be changed.
⑥	HEX	If the SERVOPACK is online, the current values of the registers are displayed as hexadecimal numbers. The current values are not displayed when the SERVOPACK is offline.

4. Click the **Filter Setting** Button.



PT#:-- CPU#:--

00C00-00C01

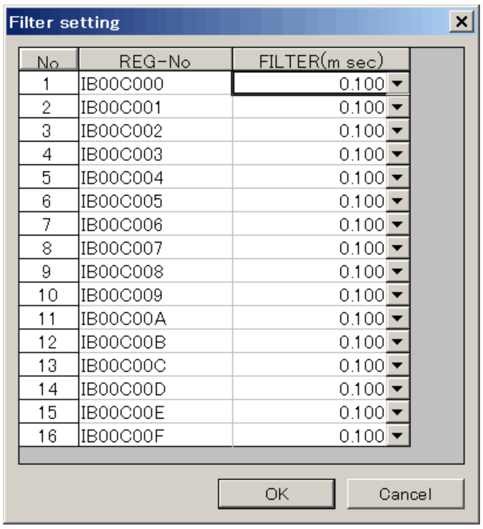
Enable to set filter to digital input.

No	Item	D	REG	Word	SCAN	Current Value	HEX
1	Local Input	☐	IW00C00	1	HIGH		
2	Local Output	☐	OW00C01	1	HIGH		
3	IRQ Input	☑	IB00C000	-------	–		

New File

For Help, press F1

5. Set the time constants of the digital filters for the input terminals.



No	REG-No	FILTER(m sec)
1	IB00C000	0.100
2	IB00C001	0.100
3	IB00C002	0.100
4	IB00C003	0.100
5	IB00C004	0.100
6	IB00C005	0.100
7	IB00C006	0.100
8	IB00C007	0.100
9	IB00C008	0.100
10	IB00C009	0.100
11	IB00C00A	0.100
12	IB00C00B	0.100
13	IB00C00C	0.100
14	IB00C00D	0.100
15	IB00C00E	0.100
16	IB00C00F	0.100

6. Click the **OK** Button.

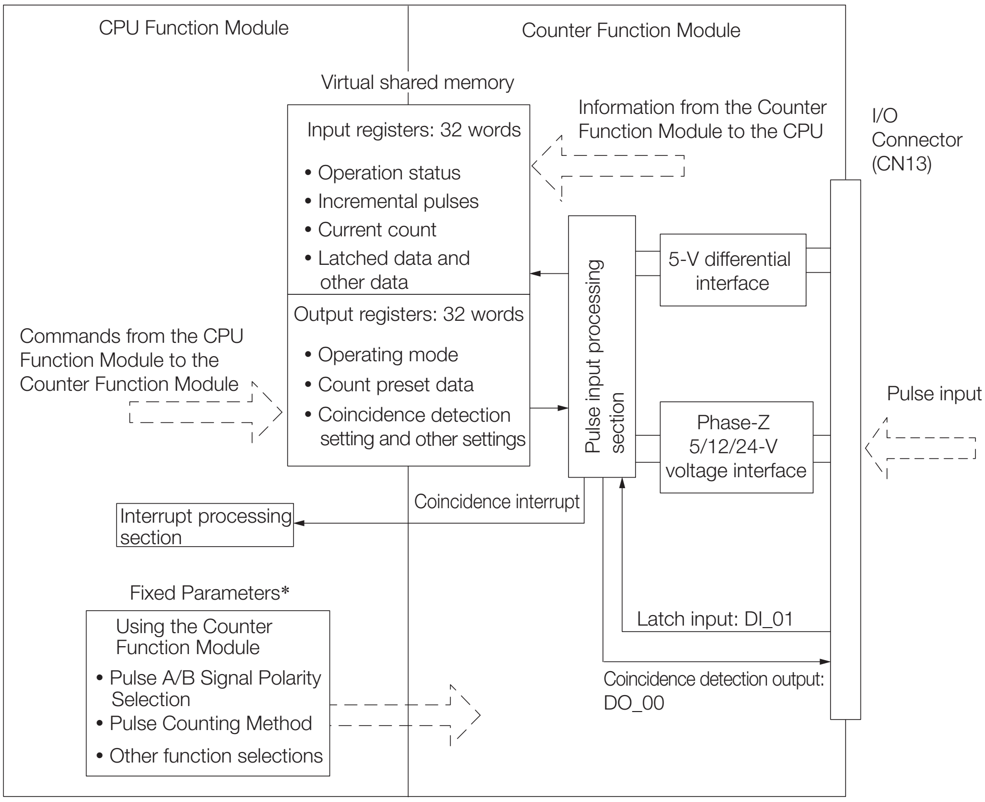
If you have changed the local I/O definitions, select ***File*** - ***Save*** from the main menu of the MPE720 to save the new definitions.

12.8 Counter Function Module

12.8.1 What Is the Counter Function Module?

The application methods of the Counter Function Module are determined according to the settings in fixed parameters and output registers. The Counter Function Module reports counter status and the count in input registers

The following figure gives the flow of data in the Counter Function Module.

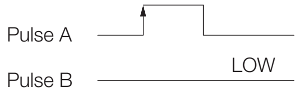
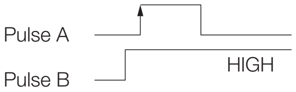
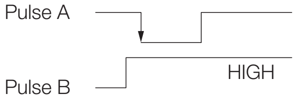
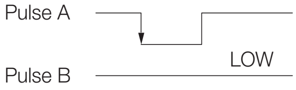


* In this section, “fixed parameters” refers to the fixed parameters of the Counter Function Module, unless otherwise specified.

The pulse counting method, pulse counting, coincidence detection/interrupt, and PI latching of the Counter Function Module are described in detail below.

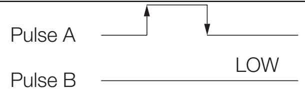
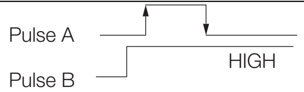
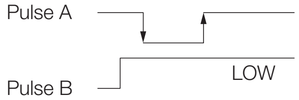
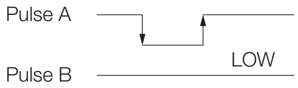
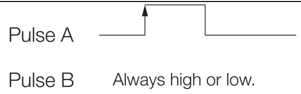
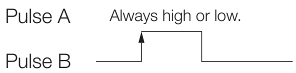
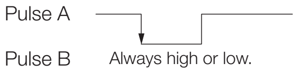
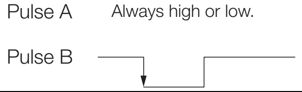
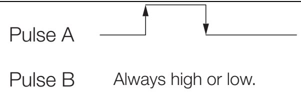
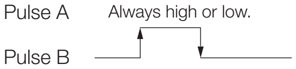
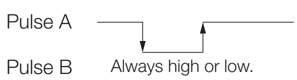
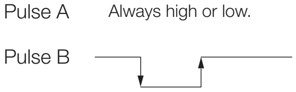
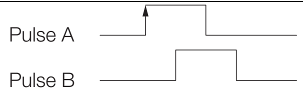
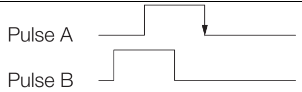
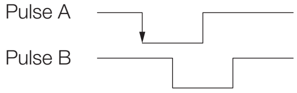
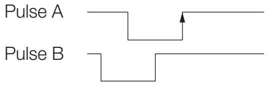
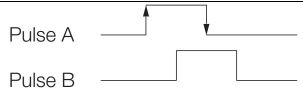
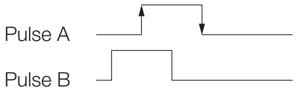
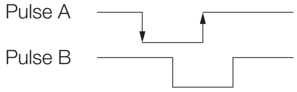
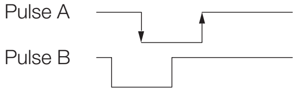
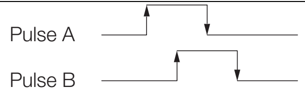
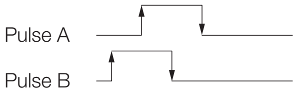
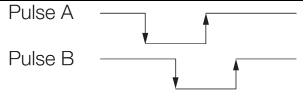
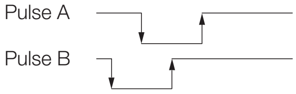
Pulse Counting Method

You can combine the settings of fixed parameter No. 03 (Pulse Counting Mode Selection) and No. 02 (A/B Pulse Signal Polarity Selection) to select the counting methods as shown below.

Pulse Counting Method	Polarity	Increment (Forward)	Decrement (Reverse)
Signed with multiplier of 1*	Positive logic		
	Negative logic		

Continued on next page.

Continued from previous page.

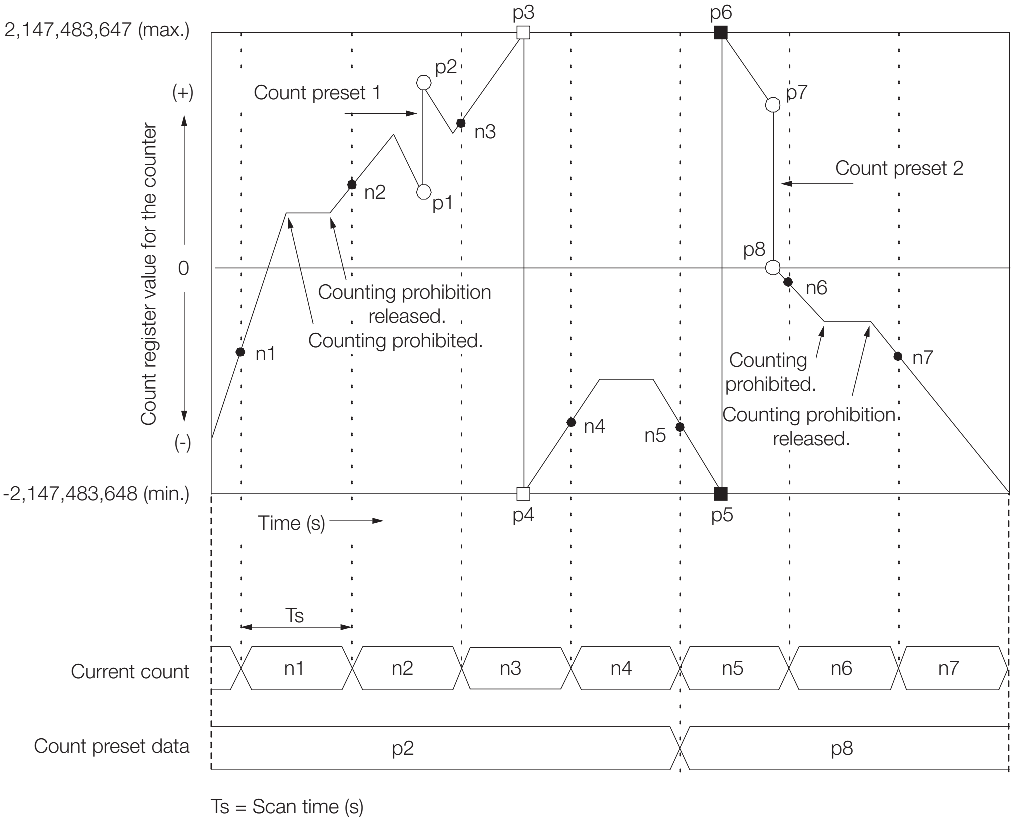
Pulse Counting Method	Polarity	Increment (Forward)	Decrement (Reverse)
Signed with multiplier of 2*	Positive logic		
	Negative logic		
Up/down pulses with multiplier of 1	Positive logic		
	Negative logic		
Up/down pulses with multiplier of 2	Positive logic		
	Negative logic		
Pulses A/B with multiplier of 1	Positive logic		
	Negative logic		
Pulses A/B with multiplier of 2	Positive logic		
	Negative logic		
Pulses A/B with multiplier of 4	Positive logic		
	Negative logic		

* If you use a sign pulse, input pulse A while the sign pulse (pulse B) is fixed.

Pulse Counting

Pulse counting is used to read the pulse A/B input signals and increment (forward) or decrement (reverse) the count.

A time graph that illustrates pulse counting for different operating modes is provided below.

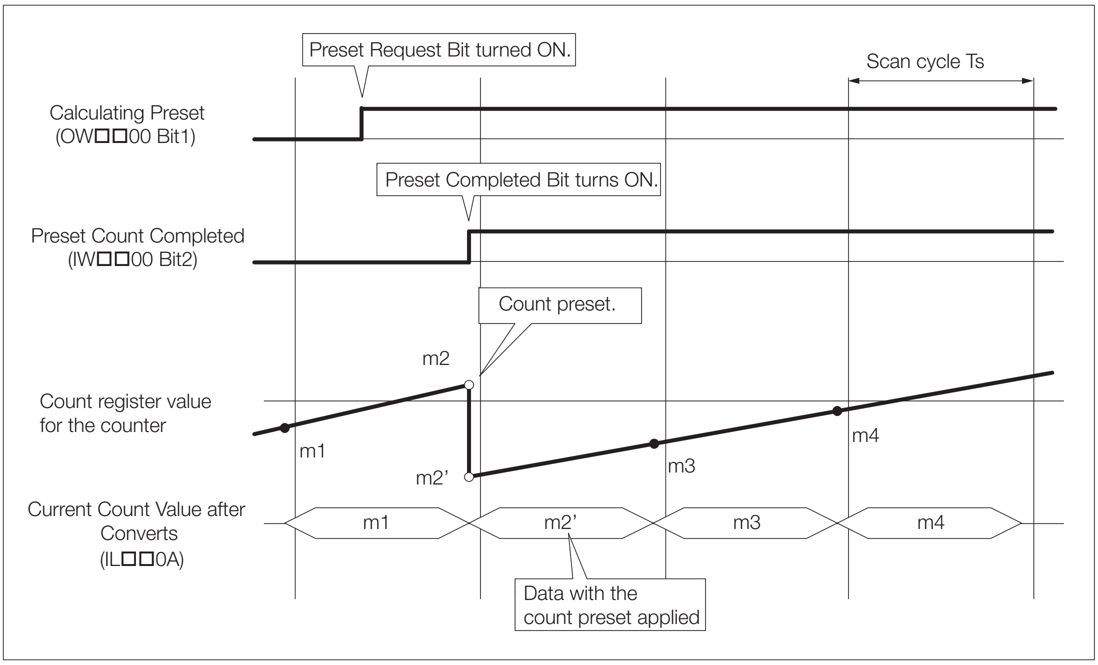


The above graph is described in the following table.

Item	Description
Current count	The values n1 to n7 (count for each scan) are given in sequence in IL□□04 (Current Count).
Count preset 1	The count is preset at position p1. Therefore, the count is forced to the preset value (p2).
Maximum overflow	When the count reaches the maximum value (p3), it is automatically reset to the minimum value (p4).
Minimum overflow	When the count reaches the minimum value (p5), it is automatically reset to the maximum value (p6).
Count preset 2	The count is preset at position p7. Therefore, the count is forced to the preset value (p8).

◆ Completion Timing of the Count Presets

The completion timing of presetting the count is illustrated in the following figure.

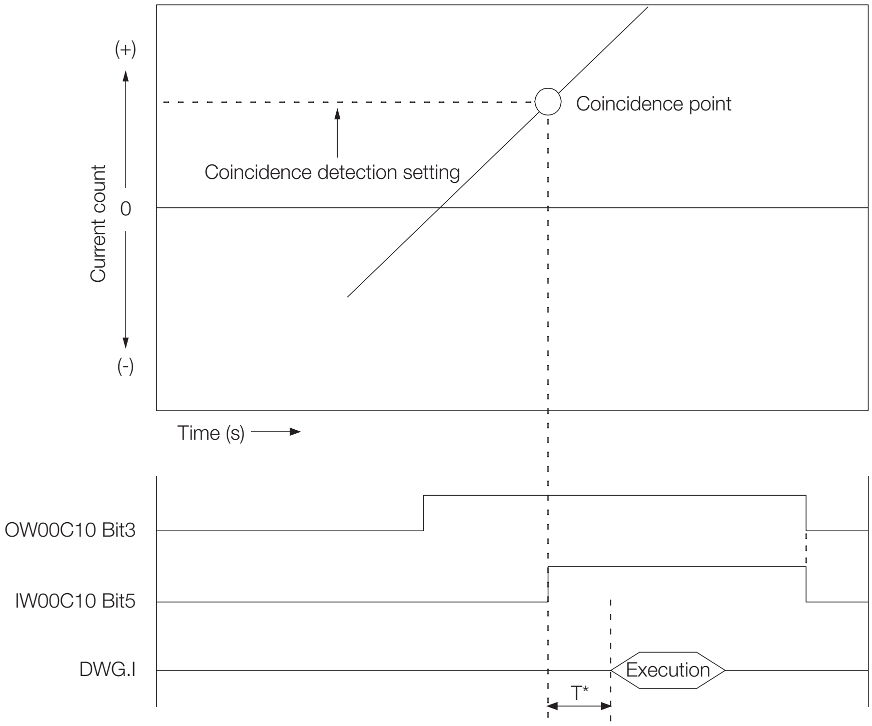


Coincidence Detection and Coincidence Interrupts

Coincidence detection and coincidence interrupts are used to output an external output signal (Coincidence Output signal) and to output an interrupt signal to the CPU when the current count coincides with the preset value of an output register (Agreed Detection Value (Coincidence Detection Set Value): OL□□04).

- The coincidence detection request (output data/operation data) is enabled when fixed parameter No. 05 (Coincidence Detection Function Use Selection) is set to Use.
- The coincidence interrupt request is enabled when fixed parameter No. 06 (Coincidence Interrupt Function Use Selection) is set to Use.

The time changes that occur after a coincidence detection request is made until the coincidence point is detected and execution of DWG.I (interrupt drawing) starts are illustrated in the following figure.



* Time from when the coincidence point is detected until execution of DWG.I (interrupt drawing) starts (approx. 60 µs to 440 µs).

Note: 1. DO_00 is used for the coincidence output signal. Therefore, when Use is selected for fixed parameter No. 05 (Coincidence Detection Function Use Selection), DO_00 is masked, and the actual signal output is not affected even if the register assigned to DO_07 is turned ON or OFF in a ladder program.

2. To monitor output of the coincidence output signal, use the Coincidence Detection Signal in the Operation Status.

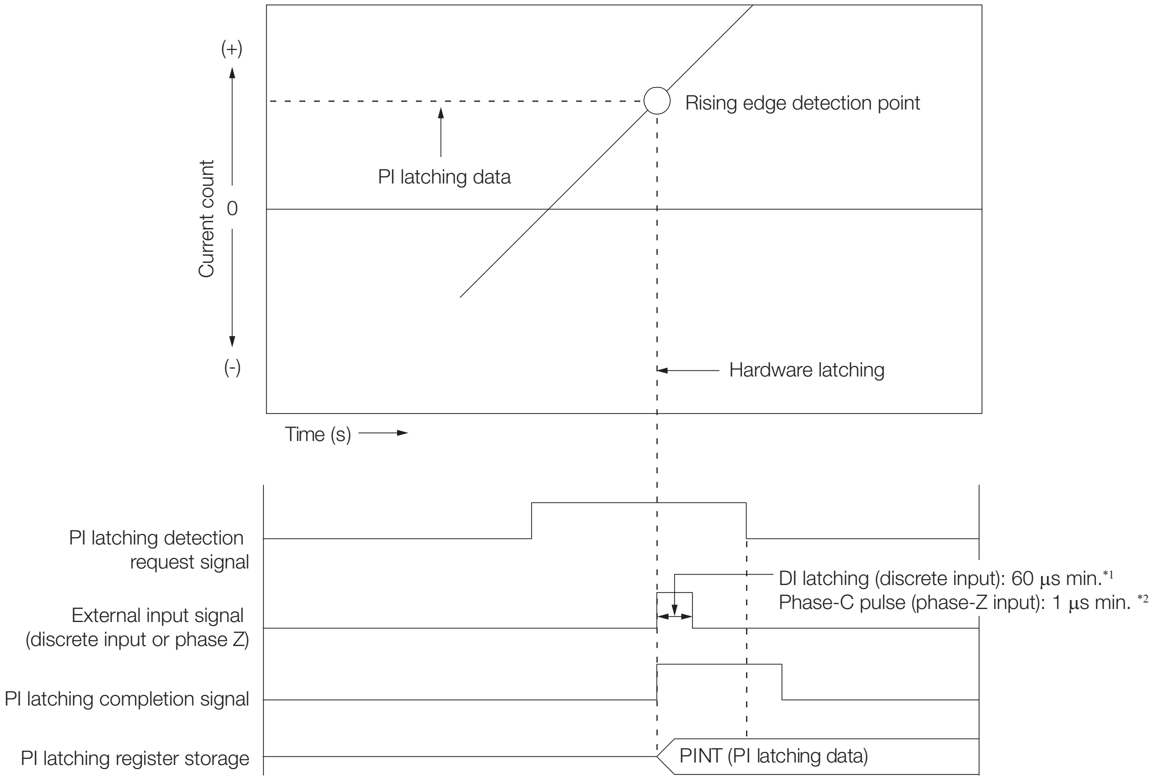
3. To execute a count preset, first clear the coincidence detection request. If you execute a count preset without clearing the coincidence detection request, the coincidence point from before the coordinate type is reconfigured will be used, which could result in coincidence detection at a position that is different from the current count.

PI Latching

PI latching is used to record (i.e., latch) the current count at the moment (i.e., on the rising edge detection point) when an external signal is input to the recording register (IL□□06) as PI latching data.

A discrete input (DI latching) or the phase-C pulse (phase-Z latching) is selected as the external signal.

The time changes from when the PI latching request is made until the rising edge point of the external input signal is detected and the PI latching data is stored are illustrated in the following figure.



*1. After the discrete input changes from ON to OFF, it cannot be turned ON again for at least 500 ms.

*2. If you use a 5-V or 12-V input, the discrete input cannot be turned ON again for at least 1 µs after it is turned OFF.
If you use a 24-V input, the discrete input cannot be turned ON again for at least 2 µs after it is turned OFF.

Axis Type

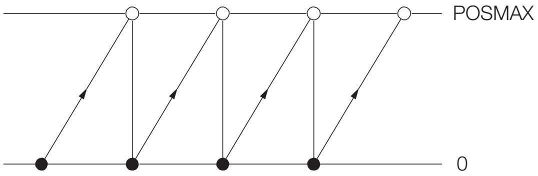
There are two types of axes: finite-length axes that reset the current count to a specified value, and infinite-length axes that do not reset the current count.

An infinite-length axis is used to reset the current count every rotation, such as when using a conveyor belt. A finite length axis is used when it is not necessary to reset the current count even when a rotation is completed, such as when operating within a set segment in a round-trip operation or when rotating in one direction only.

Select the type of axes to use with fixed parameter No. 07 (Axis Selection).

If an infinite-length axis is selected, the current count after the change and the PI latching data after the change will be given in a range from 0 to 1 less than the reset position of the infinite-length axis.

Set the reset position of the infinite-length axis with parameter No. 13 (Maximum Value of Rotary Counter (Infinite Length Axis Reset Position) (POSMAX)).



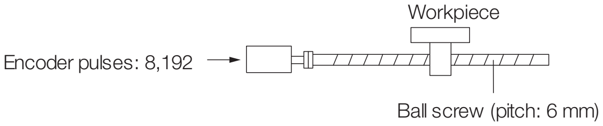
12.8.2 Electronic Gear

The electronic gear can be used when fixed parameter No. 08 (Reference Unit Selection) is set to a value other than pulses (such as mm, deg, or inch).

Overview of the Electronic Gear

The electronic gear allows you to set the workpiece travel distance per pulse input to the Counter Function Module.

For example, to move a workpiece 10 mm with the following type of device, the operation depends on whether the electronic gear is used, as described below. If the electronic gear is used, all that is required is to input the number of reference units based on the travel distance without worrying about calculations based on the number of pulses.



When the Electronic Gear Is Not Used

The device will move 6 mm for each rotation, so the number of rotations required to move the device 10 mm is 10 mm ÷ 6 mm/rotation = 1.666 rotations.

The number of pulses per rotation is 2,048 × 4 (multiplier) = 8,092 pulses, so the number of pulses required for 1.666 rotations is 1.666 × 8,092, or 13,653 pulses. You must perform this conversion on the host controller and input 13,653 pulses as the reference.

When the Electronic Gear Is Used

The machine conditions are defined in advance, and the minimum reference unit, for example 1 µm, is set.

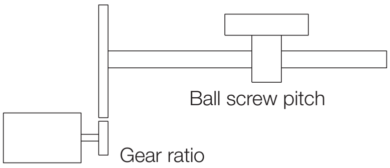
The number of reference units required to move 10 mm is 10 mm ÷ 1 µm, or 10,000. Therefore, 10,000 reference units must be input.

Electronic Gear Settings

Use the following procedure to set the electronic gear.

1. Check the following machine specifications.

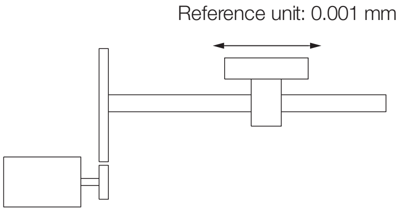
Electronic Gear-related Elements
- Gear ratio
- Ball screw pitch
- Pulley diameter, etc.



2. Set fixed parameter No. 14 (Number of Pulses Per Encoder Rotation) to the amount of change in the current count when the encoder rotates one revolution.

3. Set the reference unit (the minimum unit of reference data used to move the load) by setting fixed parameter No. 8 (Reference Unit Selection) and fixed parameter No. 9 (Number of Digits Below Decimal Point). Consider factors such as the machine specifications and positioning accuracy when you determine the reference unit.

Moving the Table with a Reference Unit of 0.001 mm.

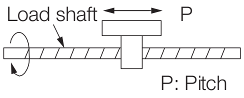
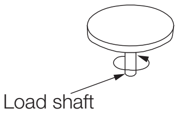
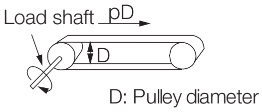


Example If the reference unit is 1 µm, and 50,000 reference pulses are input, the workpiece will move 50,000 × 1 µm, or 50 mm.

4. Use the reference unit to determine the travel distance per machine rotation, and then set fixed parameter No. 10 (Travel Distance per Machine Rotation) to that travel distance.

$$\text{Travel distance per load shaft revolution (reference units)} = \frac{\text{Distance moved per rotation of the load shaft}}{\text{Reference units}}$$

Example Examples of machine configurations and the formulas used for them are given in the following table.

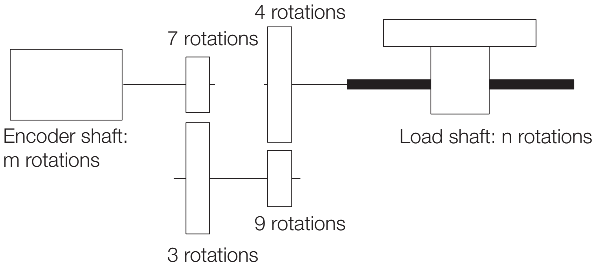
	Ball Screw	Rotary Table	Belt and Pulley
Example machine configuration			
Formula for calculating the travel distance (reference units) per load shaft	$\frac{P}{\text{Reference unit}}$	$\frac{360°}{\text{Reference unit}}$	$\frac{\pi D}{\text{Reference unit}}$

Example The following formula is used to calculate the travel distance (reference units) per load shaft rotation when the ball screw pitch is 5 mm and the reference unit is 0.001 mm.

$$\frac{5}{0.001} = 5,000 \text{ (reference units)}$$

5. **Set fixed parameter No. 11 (Encoder Gear Ratio) and fixed parameter No. 12 (Machine Gear Ratio).**
   For a machine configuration in which the load shaft rotates n times when the encoder shaft has rotated m times, make the settings shown below (setting range: 1 to 65,535 (rotations)).
   - No. 11 (Encoder Gear Ratio) = m (rotations)
   - No. 12 (Machine Gear Ratio) = n (rotations)

Example

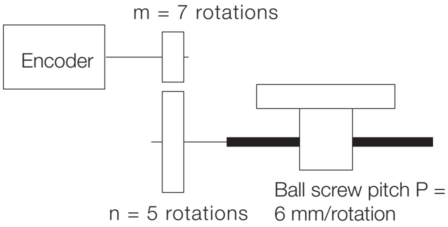


In the above example, the gear ratio is n/m = (3/7) × (4/9), or 4/21. Therefore, the following settings are made.
No. 11 (Encoder Gear Ratio) = 4 (rotations)
No. 12 (Machine Gear Ratio) = 21 (rotations)

Electronic Gear Setting Example

This section gives examples of settings for various types of load mechanisms.

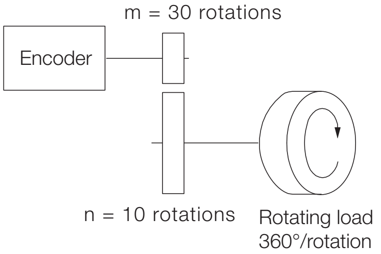
◆ Example of Electronic Gear Parameter Settings for a Ball Screw



If the reference unit for the above machine system is 0.001 mm, the fixed parameters would be set to the values given below.

- Travel distance per machine rotation = 6 mm ÷ 0.001 mm/reference unit = 6,000 reference units
- No. 11 (Encoder Gear Ratio) = 7 (rotations)
- No. 12 (Machine Gear Ratio) = 5 (rotations)

◆ Example of Gear Parameter Settings for a Rotating Load



If the reference unit for the above machine system is 0.1°, the fixed parameters would be set to the values given below.

- Travel distance per machine rotation = 360° ÷ 0.1°/reference unit = 3,600 reference units
- No. 11 (Encoder Gear Ratio) = 3 (rotations)
- No. 12 (Machine Gear Ratio) = 1 (rotations)

Precautions When Using the Electronic Gear

When you use the electronic gear, make sure that IL□□08 (After Convert Increment Pulse) does not exceed the double-length integer range (-2,147,483,648 to 2,147,483,647). If the range is exceeded, the parameters (IL□□08 (After Convert Increment Pulse), IL□□0A (Current Count Value After Converts), and IL□□0C (PL Latch Value After Converts)) of the Counter Function Module, which are handled as double-length integers, may not be reported correctly.

◆ Conditional Expressions to Ensure the Parameters Are Within the Range

Use the following conditional expression to make sure that IL□□08 (After Convert Increment Pulse) does not exceed the double-length integer range.

$$\text{Input pulse maximum frequency (Hz)} \times \frac{\text{Ts* (ms)}}{\text{1000 (ms)}} \times \text{Travel distance per load shaft rotation (reference unit/pulse)} \leq 2{,}147{,}483{,}6471$$

* Set scan time

Use the following formula to calculate the workpiece travel distance per pulse.

Workpiece travel distance per pulse (reference units/pulse)

$$= \frac{\text{No. }10^{*1}\text{ (Travel Distance per Machine Rotation)}}{\text{No. }14^{*1}\text{ (Encoder Resolution (Pre Quadrature)) (Number of Pulses per Encoder Rotation)} \times \text{Multiplier}^{*2}} \times \frac{\text{No. }12^{*1}\text{ (Machine Gear Ratio)}}{\text{No. }11^{*1}\text{ (Encoder Gear Ratio)}}$$

*1. This is the fixed parameter number.

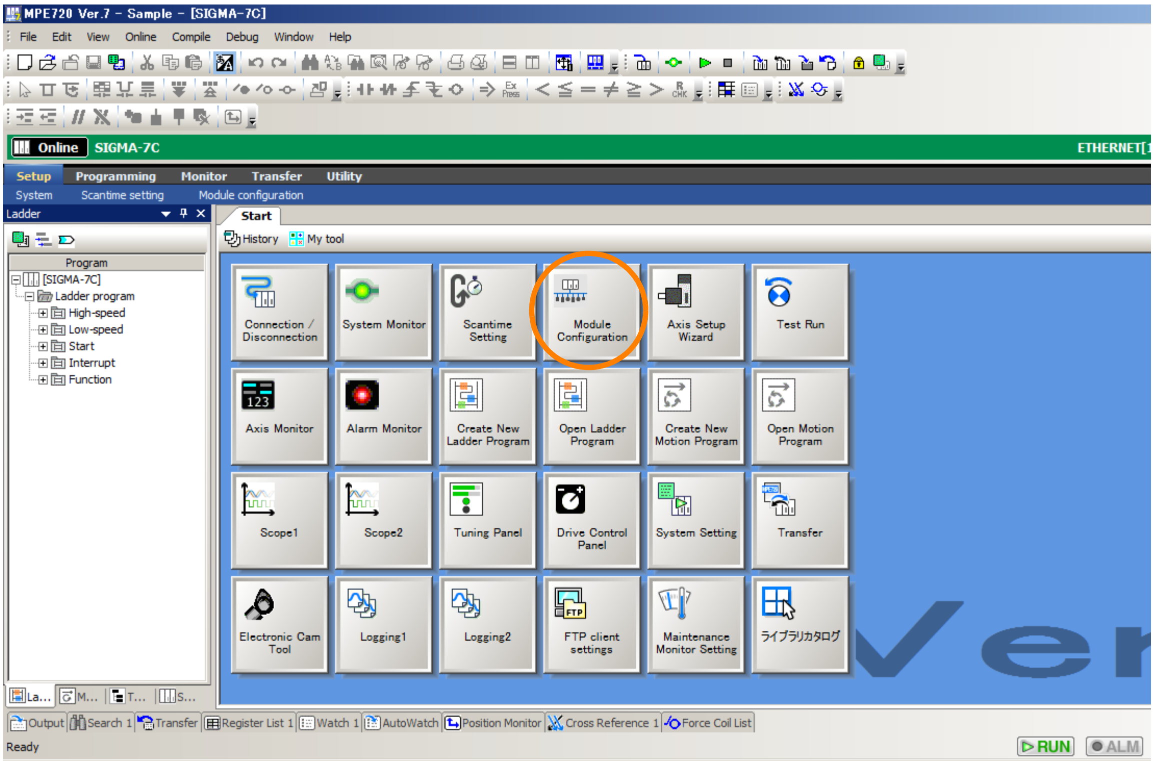
*2. The multiplier is the multiplier value set with fixed parameter No. 03 (Pulse Counting Mode Selection). (Example: If pulses A/B with a multiplier of 4 are used, the multiplier is 4.)

12.8.3 Setting Up the Counter Function Module

Use the following procedure to make the settings for the Counter Function Module. Use the MPE720 to make the settings for the Counter Function Module.

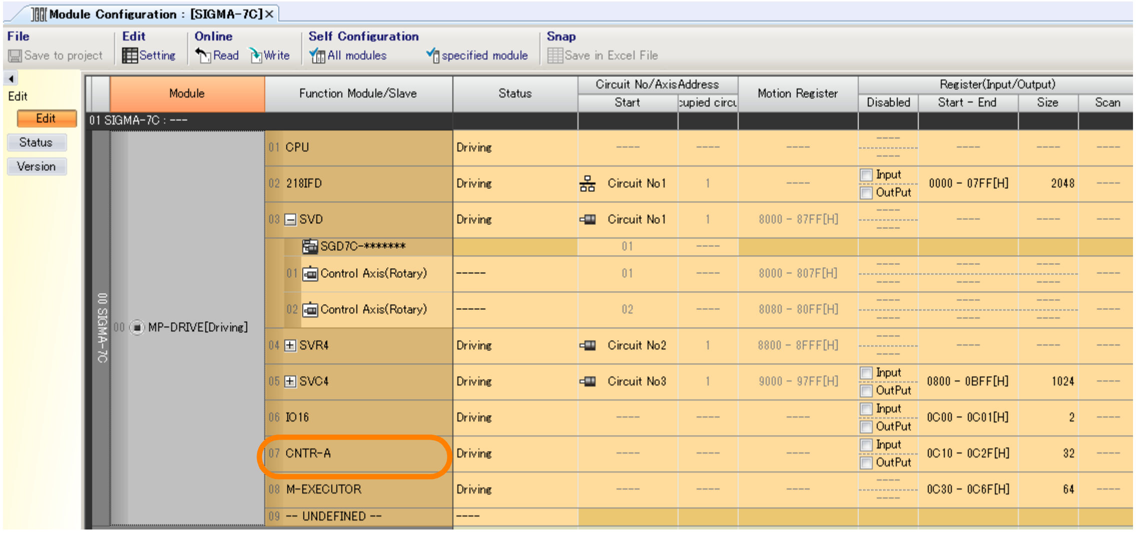
Displaying the Setting Dialog Box

1. Click the **Module Configuration** Button from the Start Tab Page in the MPE720.



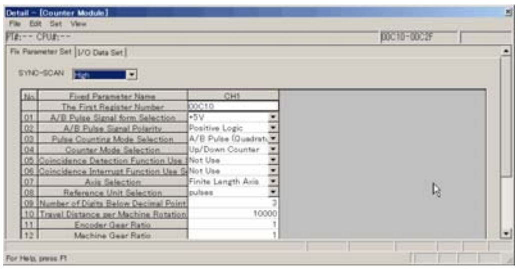
The Module Configuration Definition Tab Page will be displayed.

2. Double-click the **CNTR** Cell.



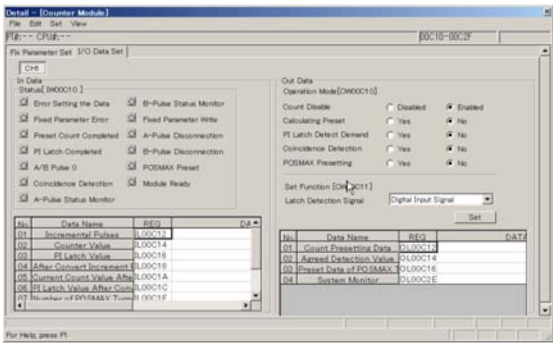
Module	Function Module/Slave	Status	Circuit No/AxisAddress		Motion Register	Register(Input/Output)			
			Start	cupied circu		Disabled	Start - End	Size	Scan
01 SIGMA-7C : ---									
00 MP-DRIVE[Driving]	01 CPU	Driving	----	----	----	---- ----	----	----	----
	02 218IFD	Driving	Circuit No1	1	----	☐ Input ☐ OutPut	0000 - 07FF[H]	2048	----
	03 SVD	Driving	Circuit No1	1	8000 - 87FF[H]	---- ----	----	----	----
	SGD7C-*******		01	----					
	01 Control Axis(Rotary)	-----	01	----	8000 - 807F[H]	---- ----	---- ----	---- ----	----
	02 Control Axis(Rotary)	-----	02	----	8080 - 80FF[H]	---- ----	---- ----	---- ----	----
	04 SVR4	Driving	Circuit No2	1	8800 - 8FFF[H]	---- ----	----	----	----
	05 SVC4	Driving	Circuit No3	1	9000 - 97FF[H]	☐ Input ☐ OutPut	0800 - 0BFF[H]	1024	----
	06 IO16	Driving	----	----	----	☐ Input ☐ OutPut	0C00 - 0C01[H]	2	----
	07 CNTR-A	Driving	----	----	----	☐ Input ☐ OutPut	0C10 - 0C2F[H]	32	----
	08 M-EXECUTOR	Driving	----	----	----	---- ----	0C30 - 0C6F[H]	64	----
	09 -- UNDEFINED --	----							

The Detail – [Counter Module] Dialog Box will be displayed. This dialog box contains the Fixed Parameter Set Tab Page and the I/O Data Set Tab Page.



SYNC-SCAN: High

No.	Fixed Parameter Name	CH1
	The First Register Number	00C10
01	A/B Pulse Signal form Selection	+5V
02	A/B Pulse Signal Polarity	Positive Logic
03	Pulse Counting Mode Selection	A/B Pulse (Quadrat
04	Counter Mode Selection	Up/Down Counter
05	Coincidence Detection Function Use	Not Use
06	Coincidence Interrupt Function Use S	Not Use
07	Axis Selection	Finite Length Axis
08	Reference Unit Selection	pulses
09	Number of Digits Below Decimal Point	3
10	Travel Distance per Machine Rotation	10000
11	Encoder Gear Ratio	1
12	Machine Gear Ratio	1



In Data

Status[IW00C10]

☑ Error Setting the Data
☑ Fixed Parameter Error
☑ Preset Count Completed
☑ PI Latch Completed
☑ A/B Pulse 0
☑ Coincidence Detection
☑ A-Pulse Status Monitor
☑ B-Pulse Status Monitor
☑ Fixed Parameter Write
☑ A-Pulse Disconnection
☑ B-Pulse Disconnection
☑ POSMAX Preset
☑ Module Ready

No.	Data Name	REG
01	Incremental Pulses	IL00C12
02	Counter Value	IL00C14
03	PI Latch Value	IL00C16
04	After Convert Increment	IL00C18
05	Current Count Value Afte	IL00C1A
06	PI Latch Value After Conv	IL00C1C
07	Number of POSMAX Turn	IL00C1E

Out Data

Operation Mode[OW00C10]

Count Disable ○ Disabled ● Enabled
Calculating Preset ○ Yes ● No
PI Latch Detect Demand ○ Yes ● No
Coincidence Detection ○ Yes ● No
POSMAX Presetting ○ Yes ● No

Set Function [OW00C11]
Latch Detection Signal: Digital Input Signal

No.	Data Name	REG	DATA
01	Count Presetting Data	OL00C12	
02	Agreed Detection Value	OL00C14	
03	Preset Data of POSMAX T	OL00C16	
04	System Monitor	OL00C2E	

Fixed Parameter Settings

Use the Fixed Parameter Set Tab Page in the Detail – [Counter Module] Dialog Box to set the following parameters.

Self configuration must be performed before setting the fixed parameters. Refer to the following section for details on self configuration.

☞ *4.3 Self Configuration* on page 4-21

No.	Name	Description and Selections	Size	Default Setting
–	SYNC-SCAN (Synchronous Scan Selection)	Set the I/O data update cycle of the Counter Function Module to correspond to either the high-speed scan cycle or the low-speed scan cycle.	–	High
–	The First Register Number	The first register address for the parameters is displayed. The first register address cannot be specified.	1 word	–
01	A/B Pulse Signal Form Selection	The signal form of the phase A and phase B pulses. Always specify a +5 V differential input.	1 word	+5 V (differential input)
02	A/B Pulse Signal Polarity Selection[*1]	Set the polarity of the phase-A pulse signal and phase-B pulse signal to positive logic or negative logic.	1 word	Positive logic
03	Pulse Counting Mode Selection[*1]	Select one of the following seven pulse counting methods[*1]. • Signed with multiplier of 1 • Signed with multiplier of 2 • Up/down pulses with multiplier of 1 • Up/down pulses with multiplier of 2 • Pulses A/B with multiplier of 1 • Pulses A/B with multiplier of 2 • Pulses A/B with multiplier of 4	1 word	Pulses A/B with multiplier of 4
04	Counter Mode Selection	Always specify a reversible counter.	1 word	Reversible counter
05	Coincidence Detection Function Use Selection	Specify whether to use coincidence detection[*2].	1 word	Not used.
06	Coincidence Interrupt Function Use Selection	Specify whether to use coincidence interrupt[*2]. (This setting is valid only when coincidence detection is used.)	1 word	Not used.
07	Axis Selection	Set the axis type[*3] to a finite-length axis or an infinite length axis.	1 word	Finite-length axis
08	Reference Unit Selection	Specify the unit to use for references. • pulse • mm • deg • inch If the reference unit is set to pulses, the electronic gear will not be used. If any other option is selected, the electronic gear is used.	1 word	pulse

Continued on next page.

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No.	Name	Description and Selections	Size	Default Setting
09	Number of Digits Below Decimal Point	Set the number of digits below the decimal point for the minimum reference unit[*4] to a value from 0 to 5. For example, to set the minimum reference unit to 1 µm (10^{-3} mm), set fixed parameter No. 8 (Reference Unit Selection) to mm, and set fixed parameter No. 09 (Number of Digits Below Decimal Point) to 3.	1 word	3
10	Travel Distance per Machine Rotation[*4, *5]	Set the load travel distance per load shaft rotation to a value from 1 to 2,147,483,647 (reference units).	2 words	10,000
11	Encoder Gear Ratio[*4, *5]	Set the value of m when the load shaft rotates n times in response to m encoder shaft rotations to a value from 1 to 65,535.	1 word	1
12	Machine Gear Ratio[*4, *5]	Set the value of n when the load shaft rotates n times in response to m encoder shaft rotations to a value from 1 to 65,535.	1 word	1
13	Maximum Value of Rotary Counter (Infinite Length Axis Reset Position (POSMAX))[*3]	When an infinite-length axis is selected with fixed parameter No. 7 (Axis Type Selection), set the position at which to reset every rotation to a value from 1 to 2,147,483,647.	2 words	360,000
14	Encoder Resolution (Pre Quadrature) (Number of Pulses Per Encoder Rotation (before Multiplication))	Set the number of pulses per encoder rotation to a value from 1 to 2,147,483,647 (pulses/rev).	2 words	2,048
15	Detection of A/B-pulse Disconnection	Enable or disable disconnection detection for phases A and B.	1 word	Disabled
16	C Phase Filter Setting	Set the phase-C pulse filter to a value from 0 to 65,535 (µs).	1 word	0

*1. Refer to the following section for details.
☞ *Pulse Counting Method* on page 12-52

*2. Refer to the following section for details.
☞ *Coincidence Detection and Coincidence Interrupts* on page 12-56

*3. Refer to the following section for details.
☞ *Axis Type* on page 12-58

*4. Refer to the following section for details.
☞ *12.8.2 Electronic Gear* on page 12-58

*5. When fixed parameter No. 8 (Reference Unit Selection) parameter is set to *Pulse*, the settings for fixed parameters No. 10 to 12 are ignored.

Important

After you change the synchronized scan, you must save the settings to flash memory, and then restart the SERVOPACK.

I/O Data Settings

Use the I/O Data Set Tab Page in the Detail - [Counter Module] Dialog Box to make the settings for the I/O data. The I/O Data Set Tab Page is divided between the **In Data** Group and the **Out Data** Group.

◆ Input Data Settings

The **In Data** Group settings are described below. Abbreviations for data are give in parentheses in the Name column.

<table>
<tr><th>No.</th><th>Register Address</th><th>Name</th><th colspan="2">Description</th><th>Range</th><th>Unit</th><th>Size</th></tr>
<tr><td rowspan="14">–</td><td rowspan="14">IW□□□00
*1</td><td rowspan="14">Status
(Run Status)
(RUNSTS)</td><td colspan="2">Displays the operation status of the Counter Function Module with individual bits.
Online
●: ON (= 1),
○: OFF(= 0),
Offline: ●</td><td rowspan="14">–</td><td rowspan="14">–</td><td rowspan="14">1 word</td></tr>
<tr><td>Bit 0</td><td>Error Setting the Data (Data Setting Error)</td></tr>
<tr><td>Bit 1</td><td>Fixed Parameter Error</td></tr>
<tr><td>Bit 2</td><td>Count Preset Completed</td></tr>
<tr><td>Bit 3</td><td>PI Latch Completed</td></tr>
<tr><td>Bit 4</td><td>A/B Pulse 0 (Feedback pulses = ±1)</td></tr>
<tr><td>Bit 5</td><td>Coincidence Detection Signal</td></tr>
<tr><td>Bit 6</td><td>A-Pulse Status Monitor</td></tr>
<tr><td>Bit 7</td><td>B-Pulse Status Monitor</td></tr>
<tr><td>Bit 9</td><td>Fixed Parameter Write</td></tr>
<tr><td>Bit A</td><td>A-Pulse Disconnection</td></tr>
<tr><td>Bit B</td><td>B-Pulse Disconnection</td></tr>
<tr><td>Bit C</td><td>POSMAX Preset (POSMAX turns presetting completed)</td></tr>
<tr><td>Bit F</td><td>Module Ready</td></tr>
<tr><td>01</td><td>IL□□□02</td><td>Incremental Pulses (PDV)</td><td colspan="2">Displays the difference between the pulse count during the previous scan and the pulse count during the current scan.</td><td>-2,147,483,648 to 2,147,483,647</td><td>pulse</td><td>2 words</td></tr>
<tr><td>02</td><td>IL□□□04</td><td>Counter Value (PFB)</td><td colspan="2">Displays the pulse count during the scan.</td><td>-2,147,483,648 to 2,147,483,647</td><td>pulse</td><td>2 words</td></tr>
<tr><td>03</td><td>IL□□□06</td><td>PI Latch Value (FREQ)</td><td colspan="2">Displays the current count when an external signal is input.</td><td>-2,147,483,648 to 2,147,483,647</td><td>pulse</td><td>2 words</td></tr>
</table>

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No.	Register Address	Name	Description	Range	Unit	Size
04	IL□□□08	After Convert Increment Pulse (PDVG)	Displays the value calculated by converting the number of incremental pulses to reference units. This value will be the same as the number of incremental pulses when fixed parameter No. 08 (Reference Unit Selection) specifies pulses (i.e., when the electronic gear is not used).	-2,147,483,648 to 2,147,483,647	Reference units	2 words
05	IL□□□0A	Current Count Value After Converts (PFBG)	Displays the value calculated by converting the current count to reference units. This value will be the same as the current count when fixed parameter No. 08 (Reference Unit Selection) specifies pulses (i.e., when the electronic gear is not used).	-2,147,483,648 to 2,147,483,647	Reference units	2 words
06	IL□□□0C	PL Latch Value After Converts (FREQG)	Displays the value calculated by converting the PI latching data to reference units. This value will be the same as the PI latching data when fixed parameter No. 08 (Reference Unit Selection) specifies pulses (i.e., when the electronic gear is not used).	-2,147,483,648 to 2,147,483,647	Reference units	2 words
07	IL□□□0E	Number of POSMAX Turns	Displays the current total number of rotations when fixed parameter No. 07 (Axis Type) specifies an infinite-length axis.	-2,147,483,648 to 2,147,483,647	Rotations	2 words
08	IL□□□10	Feedback Speed	This register is the moving average of the speed calculated over 32 scans for the following processing results. • When the electronic gear is not used (the reference unit is pulses): • Feedback speed (pulses/s) = (Number of incremental pulses × 1,000)/Ts • When the electronic gear is used (the reference unit is not *pulse*): • Feedback speed (reference units/s) = (Number of incremental pulses after conversion × 1,000)/Ts Ts: Scan time of the counter's synchronized scan (ms) The unit will be pulses/s when the electronic gear[*2] is not used.	-2,147,483,648 to 2,147,483,647	Reference units	2 words
09	IL□□□1E	System Monitor	Reserved.	-2,147,483,648 to 2,147,483,647	–	2 words

[*1] IW□□□00 is the register address that is given in the **First Register Address** Box of the Fixed Parameter Set Tab Page plus 00.

[*2] Refer to the following section for details.
☞ *12.8.2 Electronic Gear* on page 12-58

◆ Output Data Settings

The **Out Data** Group settings are described below. Abbreviations for data are give in parentheses in the Name column.

No.	Register Address	Name	Description		Range	Unit	Size
–	OW□□□00 [*1]	Operation Mode (Run Mode) (RUNMOD)	Bit 0	**Count Disable** ON (1): Prohibited. OFF (0): Enabled (default setting) If this bit is ON (1), counting by the counter is prohibited.	–	–	1 word
			Bit 1	**Calculating Preset** ON (1): Execute. OFF (0): Do not execute (default setting) If this bit is ON (1), the counter is reset to the preset value.			
			Bit 2	**PL Latch Detect Command**[*2] ON (1): Execute. OFF (0): Do not execute (default setting) If this bit is ON (1), the current count is recorded when the external signal is input.			
			Bit 3	**Coincidence Detection**[*3] ON (1): Execute. OFF (0): Do not execute (default setting) If this bit is ON (1), the match detection signal is output when the count matches the match detection setting.			
			Bit 4	**POSMAX Presetting (POSMAX Turns Presetting Request)** ON (1): Execute. OFF (0): Do not execute (default setting) If this bit is ON (1), the number of POSMAX turns is reset to the preset value.			
–	OW□□□01	Set Function/ Latch Detection Signal	Set the external signal to use PI latching. 0001h: DI latching (discrete input) 0002h: Z-latching (phase-z input)		0001h to 0002h	–	1 word
01	OL□□□02	Count Presetting Data (PRSDAT)	The current count is reset to this value when a count preset request is made.		-2147483648 to 2147483647	Reference units	2 words
02	OL□□□04	Agreed Detection Value (Coincidence Detection Set Value) (COINDAT)	A coincidence detection signal and then an interrupt signal are output when the current count reaches this value after a coincidence detection request has been made.		-2147483648 to 2147483647	Reference units	2 words
03	OL□□□06	Preset Data of POSMAX Turns	The number of POSMAX turns is reset to this value when a number of POSMAX turns preset request is made.		-2147483648 to 2147483647	Rotations	2 words
04	OL□□□1E	System Monitor	Reserved.		–	–	–

[*1] OW□□□00 is the register address that is given in the **First Register Address** Box of the Fixed Parameter Set Tab Page plus 00.

[*2] Refer to the following section for details.
☞ *PI Latching* on page 12-57

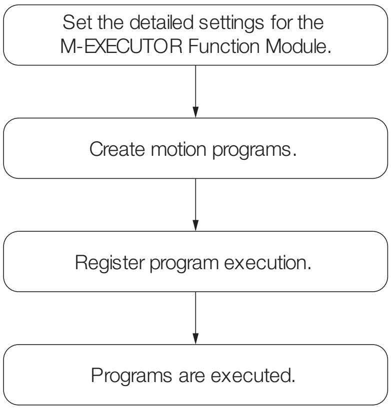
[*3] Refer to the following section for details.
☞ *Coincidence Detection and Coincidence Interrupts* on page 12-56

12.9 The M-EXECUTOR Function Module

This section describes how to use the M-EXECUTOR Function Module. Refer to the following section for an introduction to the M-EXECUTOR Function Module.

☞ *7.1.4 The M-EXECUTOR Function Module* on page 7-25

Procedure



☞ *M-EXECUTOR Function Module Detail Set-*

☞ *7.3 Creating Motion Programs* on page 7-42

☞ *Registering Program Execution* on page 12-75

M-EXECUTOR Function Module Detail Settings

The detailed settings for the M-EXECUTOR Function Module are performed on the Module Configuration Definition Tab Page and the Detail Dialog Box.

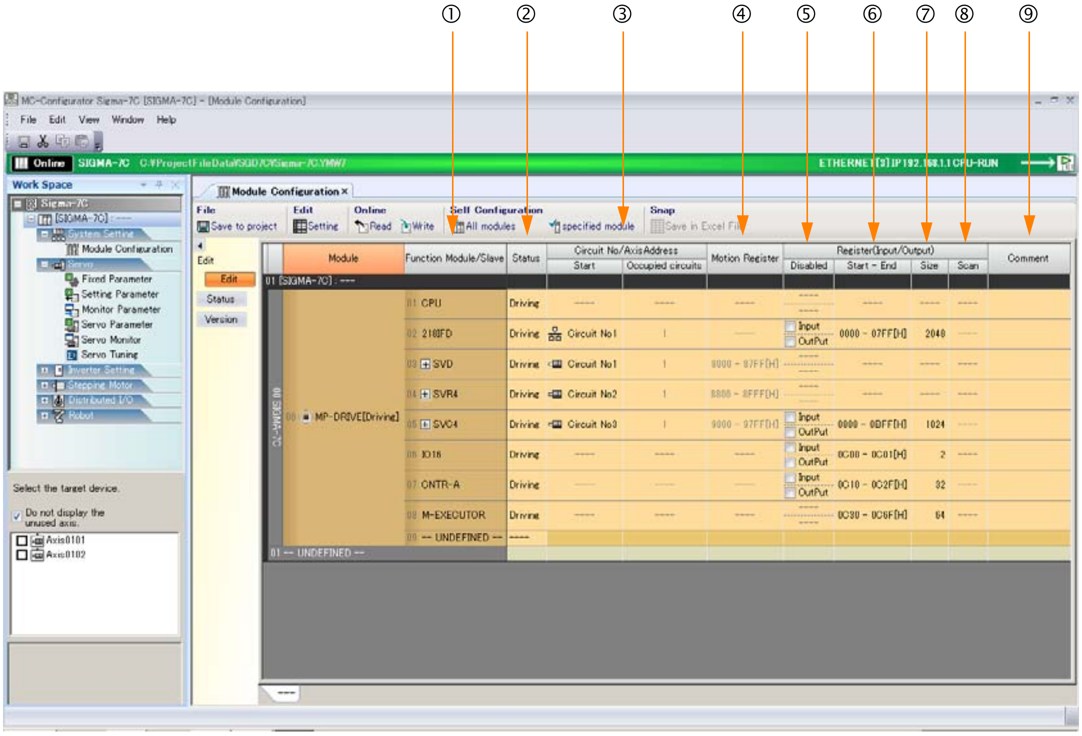
This section provides the procedures to display this tab page and dialog box, and describes their contents.

◆ Module Configuration Definition Tab Page

Use the following procedure to display the Module Configuration Definition Tab Page.

- Click the **Module Configuration** Button from the Start Tab Page.

The information on the M-EXECUTOR Function Module is displayed in the M-EXECUTOR cell of the Function Module/Slave Column.



Module	Function Module/Slave	Status	Circuit No/Axis Address Start	Circuit No/Axis Address Occupied circuits	Motion Register	Register(Input/Output) Disabled	Register(Input/Output) Start - End	Register(Input/Output) Size	Register(Input/Output) Scan	Comment
01 [SIGMA-7C] : ---										
00 MP-DRIVE[Driving]	01 CPU	Driving	----	----	----	----	----	----	----	
	02 218IFD	Driving	Circuit No1	1	----	☐ Input ☐ OutPut	0000 - 07FF[H]	2048	----	
	03 SVD	Driving	Circuit No1	1	8000 - 87FF[H]	----	----	----	----	
	04 SVR4	Driving	Circuit No2	1	8800 - 8FFF[H]	----	----	----	----	
	05 SVC4	Driving	Circuit No3	1	9000 - 97FF[H]	☐ Input ☐ OutPut	0800 - 0BFF[H]	1024	----	
	06 IO16	Driving	----	----	----	☐ Input ☐ OutPut	0C00 - 0C01[H]	2	----	
	07 CNTR-A	Driving	----	----	----	☐ Input ☐ OutPut	0C10 - 0C2F[H]	32	----	
	08 M-EXECUTOR	Driving	----	----	----	----	0C30 - 0C6F[H]	64	----	
	09 -- UNDEFINED --	----								
01 -- UNDEFINED --										

The following table describes the items that are displayed on the Module Configuration Definition Tab Page.

No.	Item	Display/Setting Item	Editing
①	Function Module/Slave	Displays whether the M-EXECUTOR Function Module is enabled. • UNDEFINED: Disabled • M-EXECUTOR: Enabled	Possible
②	Status	Displays the status of the M-EXECUTOR Function Module.	Possible
③	Circuit No./Axis Address	Not used. "––––" is always displayed.	Not possible
④	Motion Registers	Not used. "––––" is always displayed.	Not possible

Continued on next page.

Continued from previous page.

No.	Item		Display/Setting Item	Editing
⑤	Register (Input/ Output)	Disabled	Not used. "––––" is always displayed.	Not possible
⑥		Start - End	Displays the range of registers that is used as the I/O area. • Setting range: 00000h to 07FFFh Or, 10000h to 17FFFh Refer to the following section for details. ☞ ◆ *Details on the I/O Registers* on page 12-70	Possible
⑦		Size	Displays the number of words in the I/O area. • Setting range: 64 to 128 Four words each of input registers and output registers are required to register a single motion program or sequence program in the M-EXECUTOR. If you need to register more than 16 programs, set the size with four additional words for each program to add. A maximum of 32 programs can be registered (maximum number of program definitions).	Possible
⑧		Scan	Not used. "––––" is always displayed.	Not possible
⑨	Comment		Displays the user comment. Enter a comment of up to 16 characters.	Possible

◆ Details on the I/O Registers

The I/O registers that are assigned to the M-EXECUTOR Function Module are used to execute motion and sequence programs, as well as to monitor sequence programs.

The following tables give the contents of the M-EXECUTOR I/O registers.

M-EXECUTOR Input Registers

M-EXECUTOR Input Register	Item	
IW□□□□ + 0	Definition No. 1	Status
IW□□□□ + 1		Reserved.
IW□□□□ + 2		Reserved.
IW□□□□ + 3		Reserved.
IW□□□□ + 4	Definition No. 2	Status
IW□□□□ + 5		Reserved.
IW□□□□ + 6		Reserved.
IW□□□□ + 7		Reserved.
⋮	⋮	⋮
IW□□□□ + 3C	Definition No. 16	Status
IW□□□□ + 3D		Reserved.
IW□□□□ + 3E		Reserved.
IW□□□□ + 3F		Reserved.

M-EXECUTOR Output Registers

M-EXECUTOR Output Register	Item	
OW□□□□ + 0	Definition No. 1	Program Number
OW□□□□ + 1		Control Signals
OW□□□□ + 2		Override
OW□□□□ + 3		Reserved.
OW□□□□ + 4	Definition No. 2	Program Number
OW□□□□ + 5		Control Signals
OW□□□□ + 6		Override
OW□□□□ + 7		Reserved.
⋮	⋮	⋮
OW□□□□ + 3C	Definition No. 16	Program Number
OW□□□□ + 3D		Control Signals
OW□□□□ + 3E		Override
OW□□□□ + 3F		Reserved.

◆ Detail Dialog Box

The Detail Dialog Box has two tab pages, the Program Definition Tab Page and the Allocation Control Register Tab Page.

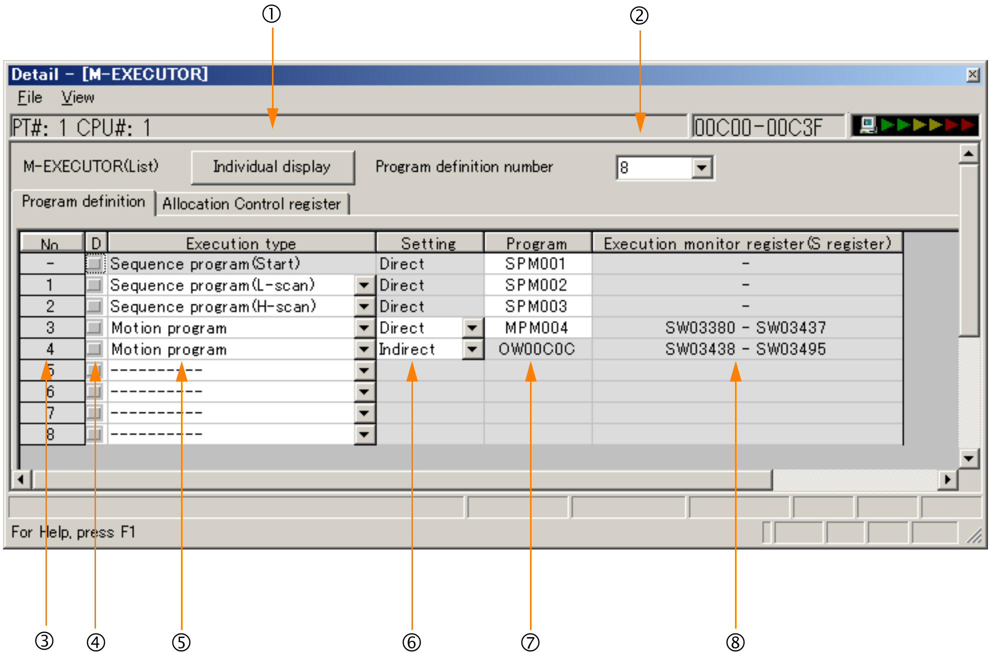
Use the following procedure to display the Detail Definition Dialog Box.

1. Click the **Module Configuration** Button from the Start Tab Page.
2. Double-click the M-EXECUTER cell in the **Function Module/Slave** Column.

■ Program Definition Tab Page

Register the motion or sequence programs to execute.

This section describes the items that are displayed on the Program Definition Tab Page.



No	D	Execution type	Setting	Program	Execution monitor register(S register)
-	☐	Sequence program(Start)	Direct	SPM001	-
1	☐	Sequence program(L-scan)	Direct	SPM002	-
2	☐	Sequence program(H-scan)	Direct	SPM003	-
3	☐	Motion program	Direct	MPM004	SW03380 - SW03437
4	☐	Motion program	Indirect	OW00C0C	SW03438 - SW03495
5	☐	----------			
6	☐	----------			
7	☐	----------			
8	☐	----------			

① Individual Display Button

Click this button to display the M-EXECUTOR Function Module in a separate window.

② Program Definition Number

Set the number of program definitions that can be registered in the M-EXECUTOR Function Module.

- Setting range: 0 to 32
- Default value: 8

③ No.

The execution order of the programs is displayed. Programs are executed in the scans in ascending order of their numbers.

④ D

The check boxes are used to enable or disable the definitions.

- Not selected: Definition is enabled.
- Selected: Definition is disabled.

⑤ Execution Type

Set the execution type of the program.

Execution Type	Executed Programs	Execution Conditions
----------	None.	–
Sequence program (Start)	Sequence programs	Power ON (This program is executed once when the power supply is turned ON.)
Sequence program (L-scan)		Started at a fixed interval. (These programs are executed once every low-speed scan cycle.)
Sequence program (H-scan)		Started at a fixed interval. (These programs are executed once every high-speed scan cycle.)
Motion program	Motion programs	Request for Start of Programmed Operation control signal (The program is executed when the Request for Start of Programmed Operation is turned ON.)

⑥ Setting

Set the program designation method.
The designation method can be different for each program.

Designation Method	Motion Programs	Sequence Programs	Description
Direct	Possible	Possible	The program is specified with the program number. Examples: MPM001 or SPM002
Indirect	Possible	Not possible	The program is specified by specifying a register that contains the program number. Example: OW0C0C (If 1 is stored in OW0C0C, MPM001 will be called.)

⑦ Program

Set the program number.

Execution Type	Description
Sequence programs (Start, L-scan, or H-scan)	If you enter 1 and press the **Enter** Key, SPM001 will be set automatically. You can specify a program that is not registered or leave the program number empty. In either case, no program will be executed.
Motion programs	Direct designation: If you enter 1 and press the **Enter** Key, MPM001 will be set automatically. You can specify a program that is not registered or leave the program number empty. In either case, no program will be executed. Indirect designation: The O register of the M-EXECUTOR Function Module will be set automatically. Only the system can set this.

⑧ Execution Monitor Register (S Registers)

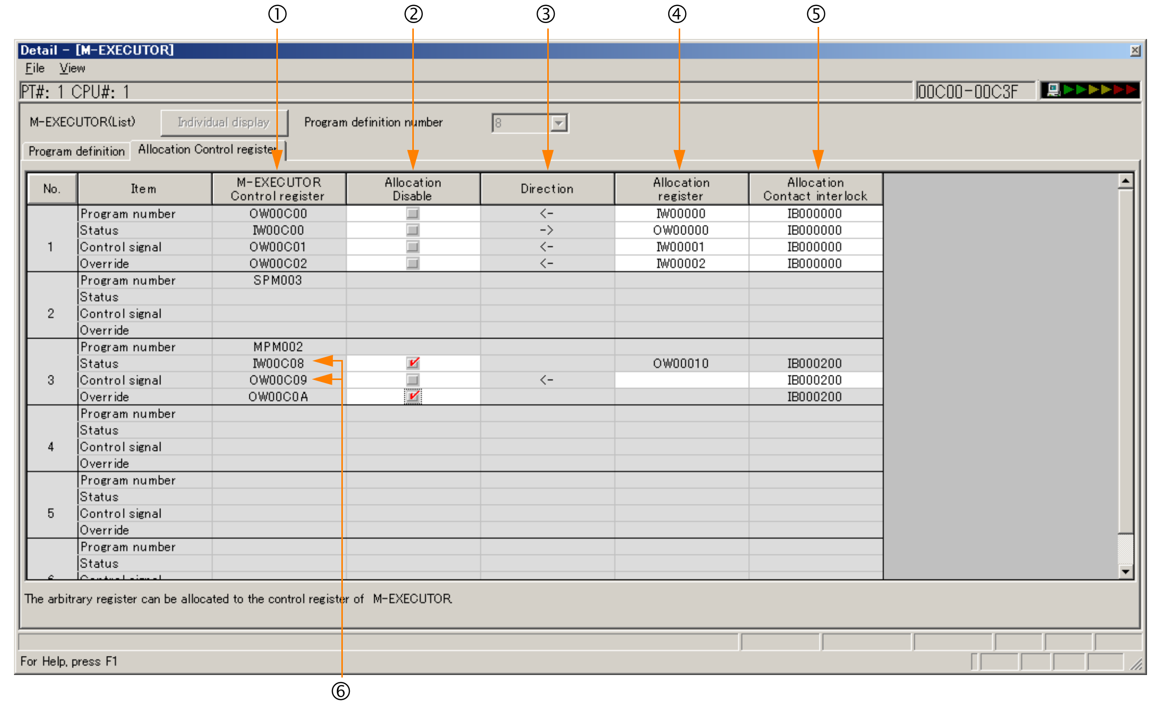
If the execution type is set to a motion program, the range of the execution monitor registers (S registers) will be displayed. Refer to the following manuals for details on the execution monitor registers.

📖 MP3000 Series Motion Programming Manual (Manual No.: SIEP C880725 14)

■ Allocation Control Register Tab Page

This tab page is used to assign registers.

This section describes the items that are displayed on the Allocation Control Register Tab Page.



Detail – [M-EXECUTOR]

PT#: 1 CPU#: 1

00C00-00C3F

M-EXECUTOR(List)

Program definition number 8

No.	Item	M-EXECUTOR Control register	Allocation Disable	Direction	Allocation register	Allocation Contact interlock
1	Program number	OW00C00	☐	<-	IW00000	IB000000
	Status	IW00C00	☐	->	OW00000	IB000000
	Control signal	OW00C01	☐	<-	IW00001	IB000000
	Override	OW00C02	☐	<-	IW00002	IB000000
2	Program number	SPM003				
	Status					
	Control signal					
	Override					
3	Program number	MPM002				
	Status	IW00C08	☑		OW00010	IB000200
	Control signal	OW00C09	☐	<-		IB000200
	Override	OW00C0A	☑			IB000200
4	Program number					
	Status					
	Control signal					
	Override					
5	Program number					
	Status					
	Control signal					
	Override					
	Program number					
	Status					

The arbitrary register can be allocated to the control register of M-EXECUTOR.

For Help, press F1

① M-EXECUTOR Control Register

This column displays the I/O registers that are assigned to the M-EXECUTOR Function Module.

The M-EXECUTOR control registers are used to control or monitor the motion programs.

M-EXECUTOR Control Registers	Application
Program Number	Sets the program number. This register is only used for indirect designation.
Status	Monitors the program execution status.
Control Signal	Controls the program.
Override	Sets the override value to use when executing interpolation motion instructions.

② Allocation Disable

Use these check boxes to enable or disable the assigned registers.

- Not selected: Definition is enabled.
- Selected: Definition is disabled.

③ Direction

This column displays the data I/O directions.

④ Allocation Register

The data of the assigned registers and the M-EXECUTOR control registers will move in the direction that is given in ③.

You can assign any register numbers.

Note: You can set word-type I, O, or M registers (except motion registers) in the **Allocation register** Column.

⑤ Allocation Contact Interlock

This contact controls the movement of data between the assigned registers and the M-EXECUTOR control registers. When the assigned interlock contact is ON, the data in the assigned registers and the M-EXECUTOR control registers will move in the direction that is given in ③.

Any register bit number can be assigned as the interlock contact.

Note: You can set bit-type I, O, S, M, or C registers (except motion registers) in the **Allocation Contact interlock** Column.

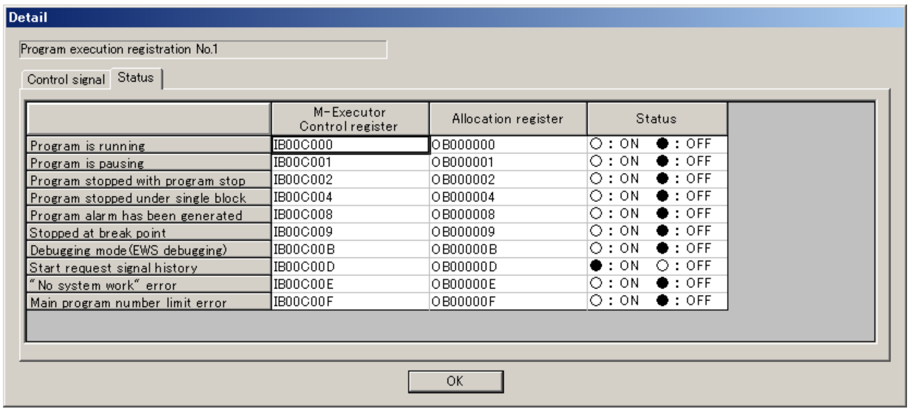
Important

The allocated interlock contact is used to interlock motion programmed operation.
If you assign a register, always assign an interlock contact.

⑥ Status and Control Signal

Double-click the Status or the Control Signal cell to display the Detail Dialog Box.
This dialog box is used to verify the status and the control signals.

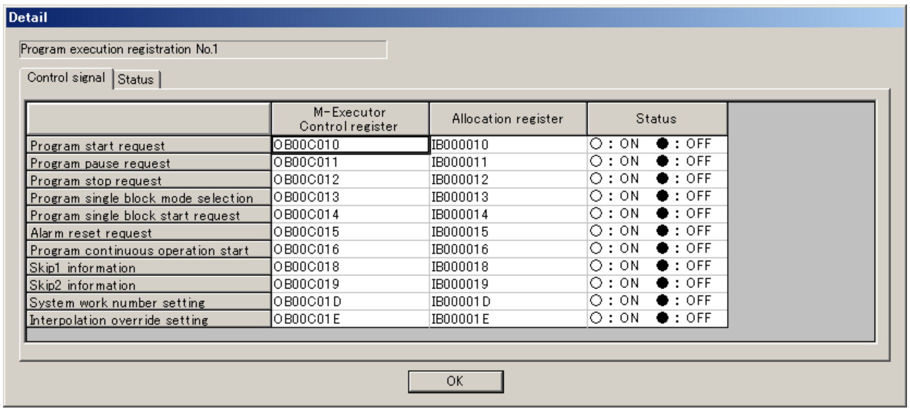
- Status



Program execution registration No.1

	M-Executor Control register	Allocation register	Status
Program is running	IB00C000	OB000000	○ : ON ● : OFF
Program is pausing	IB00C001	OB000001	○ : ON ● : OFF
Program stopped with program stop	IB00C002	OB000002	○ : ON ● : OFF
Program stopped under single block	IB00C004	OB000004	○ : ON ● : OFF
Program alarm has been generated	IB00C008	OB000008	○ : ON ● : OFF
Stopped at break point	IB00C009	OB000009	○ : ON ● : OFF
Debugging mode (EWS debugging)	IB00C00B	OB00000B	○ : ON ● : OFF
Start request signal history	IB00C00D	OB00000D	● : ON ○ : OFF
"No system work" error	IB00C00E	OB00000E	○ : ON ● : OFF
Main program number limit error	IB00C00F	OB00000F	○ : ON ● : OFF

- Control Signals



Program execution registration No.1

	M-Executor Control register	Allocation register	Status
Program start request	OB00C010	IB000010	○ : ON ● : OFF
Program pause request	OB00C011	IB000011	○ : ON ● : OFF
Program stop request	OB00C012	IB000012	○ : ON ● : OFF
Program single block mode selection	OB00C013	IB000013	○ : ON ● : OFF
Program single block start request	OB00C014	IB000014	○ : ON ● : OFF
Alarm reset request	OB00C015	IB000015	○ : ON ● : OFF
Program continuous operation start	OB00C016	IB000016	○ : ON ● : OFF
Skip1 information	OB00C018	IB000018	○ : ON ● : OFF
Skip2 information	OB00C019	IB000019	○ : ON ● : OFF
System work number setting	OB00C01D	IB00001D	○ : ON ● : OFF
Interpolation override setting	OB00C01E	IB00001E	○ : ON ● : OFF

Creating Motion Programs

Refer to the following manual for details.

Σ-7-Series Σ-7C SERVOPACK Motion Control User's Manual (Manual No.: SIEP S800002 03)

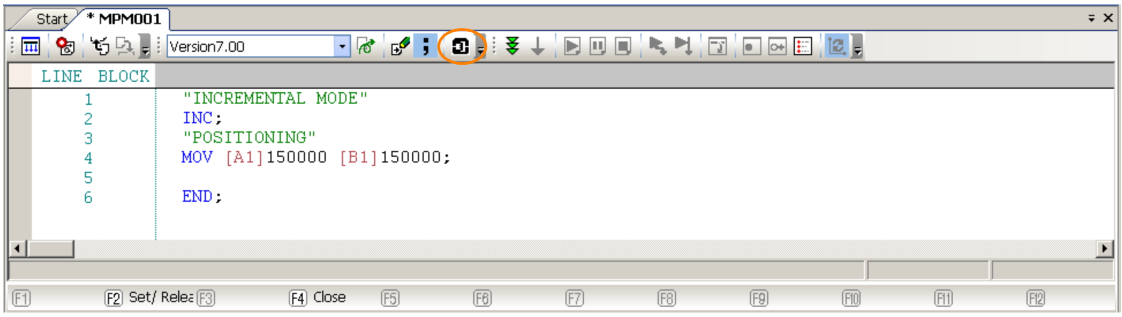
Registering Program Execution

This section gives the procedure to register the execution of programs.

1. Display the program to register for execution.

2. Click the **Task Allocation** ( ) Icon.

The Task Allocation Dialog Box will be displayed.



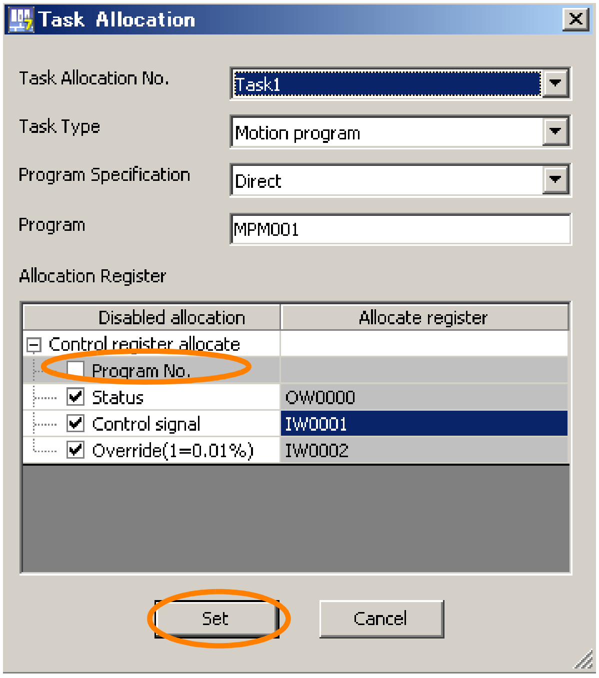
```
"INCREMENTAL MODE"
INC;
"POSITIONING"
MOV [A1]150000 [B1]150000;

END;
```

Information You can also use the Task Allocation Dialog Box to change the settings. Refer to the following manual for details.

Σ-7-Series Σ-7C SERVOPACK Motion Control User's Manual (Manual No.: SIEP S800002 03)

3. Check that the settings match the contents of the Allocation Control Register Tab Page, and then click the **Set** Button.

The registered contents will be saved.



Task Allocation No.: Task1

Task Type: Motion program

Program Specification: Direct

Program: MPM001

Allocation Register

Disabled allocation	Allocate register
⊟ Control register allocate	
☐ Program No.	
☑ Status	OW0000
☑ Control signal	IW0001
☑ Override(1=0.01%)	IW0002

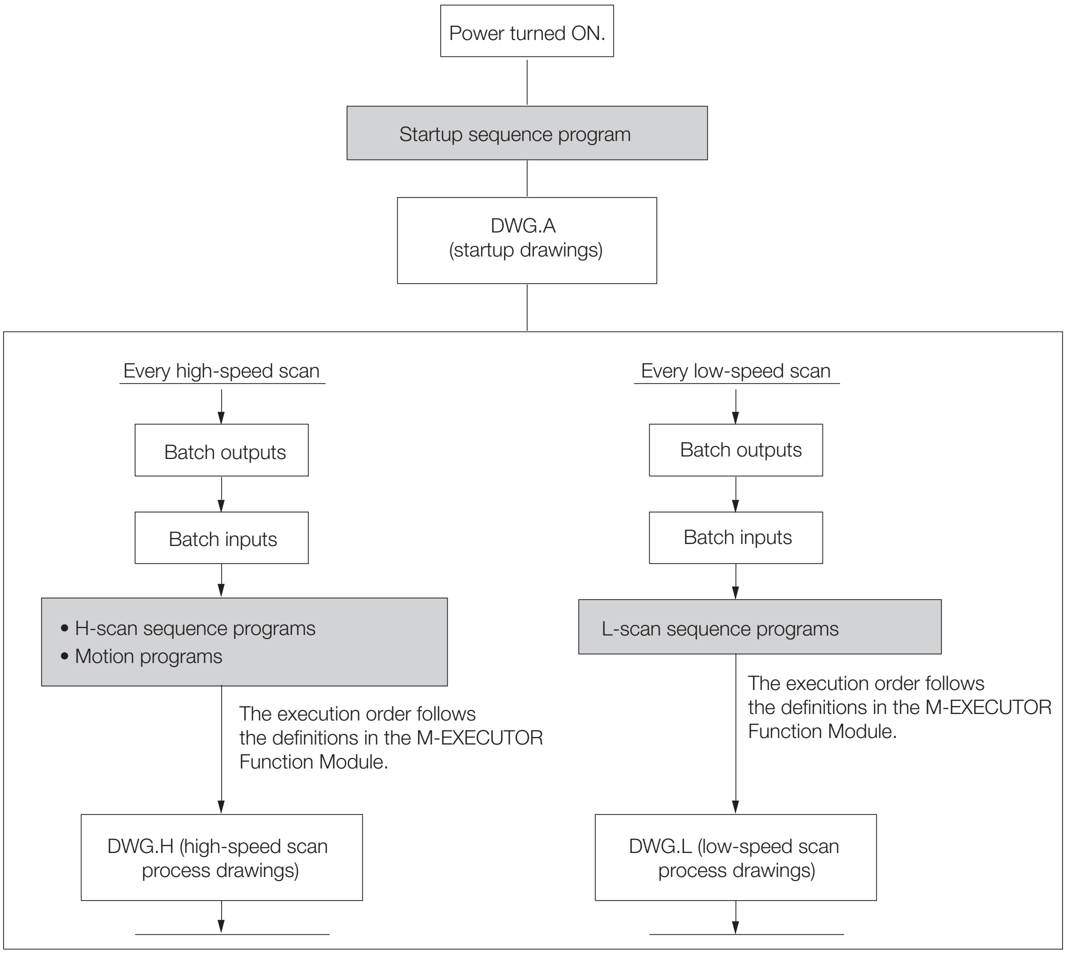
Refer to the following section for details on the Allocation Control Register Tab Page.

■ *Allocation Control Register Tab Page* on page 12-73

Execution Scheduling

Programs that are registered in the M-EXECUTOR Function Module are executed in the order of their priority levels (execution types).

Programs that are registered in the M-EXECUTOR Function Module are executed immediately before processing the ladder programs.



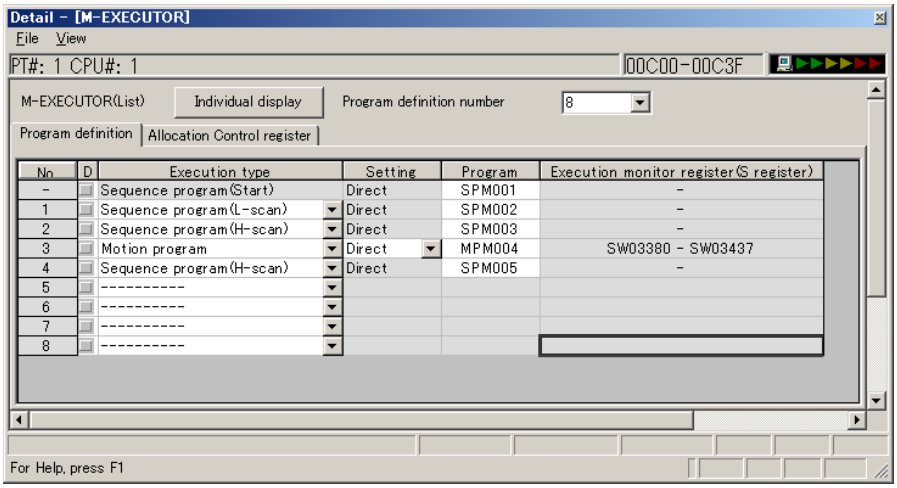
The following is an execution example.

- M-EXECUTOR Program Execution Definitions

Example

Sequence Program Execution Example

The following figure shows an example of the sequence programs registered in the M-EXECUTOR Function Module.



PT#: 1 CPU#: 1

00C00-00C3F

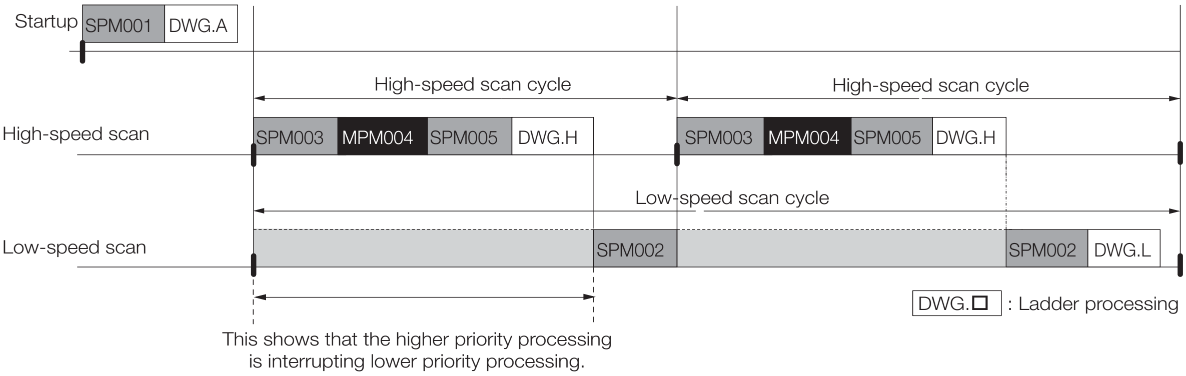
Program definition number: 8

No	D	Execution type	Setting	Program	Execution monitor register (S register)
-	☐	Sequence program (Start)	Direct	SPM001	-
1	☐	Sequence program (L-scan)	Direct	SPM002	-
2	☐	Sequence program (H-scan)	Direct	SPM003	-
3	☐	Motion program	Direct	MPM004	SW03380 - SW03437
4	☐	Sequence program (H-scan)	Direct	SPM005	-
5	☐	----------			
6	☐	----------			
7	☐	----------			
8	☐	----------			

■ Execution Timing

This section describes the execution timing of programs in the above example.

The following figure shows how program and drawing execution is based on the order of registration in the M-EXECUTOR program execution definitions.



12.10 System Service Registers

This section provides detailed descriptions of the System Service Registers.

Refer to the following section for information on the overall structure of system registers.

☞ *System Register Specifications* on page 1-23

Refer to the following manual for details on alarm-related registers.

📖 Σ-7-Series Σ-7C SERVOPACK Troubleshooting Manual (Manual No.: SIEP S800002 07)

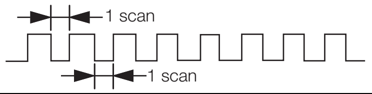
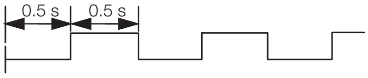
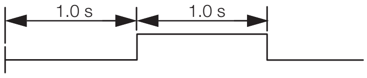
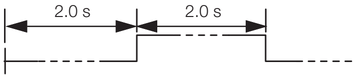
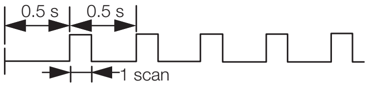
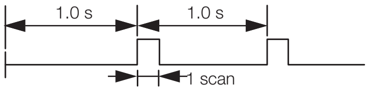
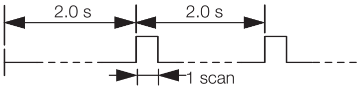
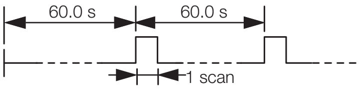
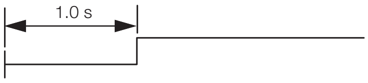
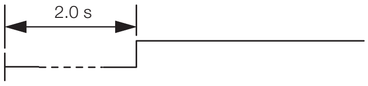
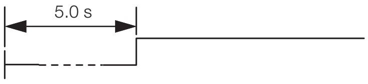
The data stored in the System Service Registers give the execution status and specifications of the programs. The System Service Registers are reset to zero when the system is started.

- All Drawings

Register Address		Name	Remarks
SW00000	SB000000	Reserved.	–
	SB000001	High-speed (H) Scan	ON for only the first scan after high-speed scan is started.
	SB000002	Reserved.	–
	SB000003	Low-speed (L) Scan	ON for only the first scan after low-speed scan is started.
	SB000004	Always ON	Always ON (1).
	SB000005	High-speed (H) Scan 2	Only ON for one scan when the high-speed scan starts after the CPU changes to RUN Mode.
	SB000006	Low-speed (L) Scan 2	Only ON for one scan when the low-speed scan starts after the CPU changes to RUN Mode.
	SB000007	High-speed Scan in Progress	1: High-speed scan in progress.
	SB000008	MP2000 Option Service Executing	ON (1) during the service scan for the MP2000-series Option Modules.
	SB000009 to SB00000F	Reserved.	–

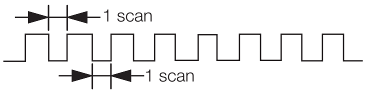
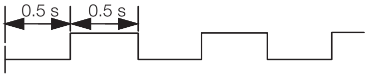
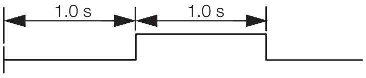
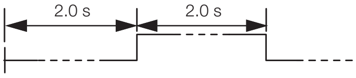
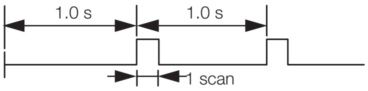
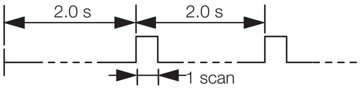
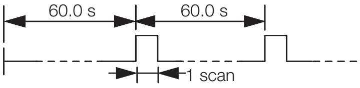
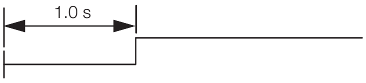
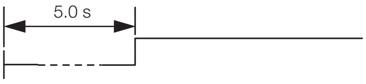
- DWG.H Only

Operation starts when the high-speed scan starts.

Register Address		Name	Remarks
SW00001	SB000010	1-Scan Flicker Relay	
	SB000011	0.5-s Flicker Relay	
	SB000012	1.0-s Flicker Relay	
	SB000013	2.0-s Flicker Relay	
	SB000014	0.5-s Sampling Relay	
	SB000015	1.0-s Sampling Relay	
	SB000016	2.0-s Sampling Relay	
	SB000017	60.0-s Sampling Relay	
SW00001	SB000018	1.0 s after Start of Scan Processing	
	SB000019	2.0 s after Start of Scan Processing	
	SB00001A	5.0 s after Start of Scan Processing	
	SB00001B to SB00001F	Reserved.	–
SW00002		Reserved.	–

- DWG.L Only

Operation starts when the low-speed scan starts.

Register Address		Name	Remarks
SW00003	SB000030	1-Scan Flicker Relay	
	SB000031	0.5-s Flicker Relay	
	SB000032	1.0-s Flicker Relay	
	SB000033	2.0-s Flicker Relay	
	SB000034	0.5-s Sampling Relay	
	SB000035	1.0-s Sampling Relay	
	SB000036	2.0-s Sampling Relay	
	SB000037	60.0-s Sampling Relay	
	SB000038	1.0 s after Start of Scan Processing	
	SB000039	2.0 s after Start of Scan Processing	
	SB00003A	5.0 s after Start of Scan Processing	
	SB00003B to SB00003F	Reserved.	–

- Scan Execution Status

Register Address	Name	Remarks
SW00004	High-Speed Scan Setting	High-speed scan setting (0.1 ms)
SW00005	Current High-Speed Scan Time	Current high-speed scan time (0.1 ms)
SW00006	Maximum High-Speed Scan Time	Maximum high-speed scan time (0.1 ms)
SW00007	High-Speed Scan Setting 2	High-speed scan setting (μs)
SW00008	Current High-Speed Scan Time 2	Current high-speed scan time (μs)
SW00009	Maximum High-Speed Scan Time 2	Maximum high-speed scan time (μs)
SW00010	Low-Speed Scan Setting	Low-speed scan setting (0.1 ms)
SW00011	Current Low-Speed Scan Time	Current low-speed scan time (0.1 ms)
SW00012	Maximum Low-Speed Scan Time	Maximum low-speed scan time (0.1 ms)
SW00013	Reserved.	–
SW00014	Current Scan Time	Scan time of currently executing scan (0.1 ms)

- Calendar

Register Address	Name	Remarks	Example
SW00015	Calendar Year	Gives the last two digits of the year in BCD format.	2011: 0011
SW00016	Calendar Month and Day	Gives the month and day in BCD format.	December 31: 1231
SW00017	Calendar Hours and Minutes	Gives the hours and minutes in BCD format.	23 hours 59 minutes: 2359
SW00018	Calendar Seconds	Gives the seconds in BCD format.	59 s: 0059
SW00019	Calendar Week	Gives the day of the week as a number between 0 and 6. 0: Sunday, 1: Monday, 2: Tuesday, 3: Wednesday, 4: Thursday, 5: Friday, and 6: Saturday	–

- System Program Software Version

Register Address	Name	Remarks
SW00020	System Program Software Version	Ver. □□.□□ (Gives the version in BCD format.)
SW00021 to SW00025	Reserved.	–

- Remaining Program Memory Capacity

Register Address	Name	Remarks
SL00026	Remaining Program Memory Capacity	Bytes
SL00028	Total Memory Capacity	Bytes

12.11 Option Base Unit

12.11.1 Specifications

The specifications of the Option Base Unit are listed in the following table.

Item		Specification
Model		JEPMC-OP3C01-E
Number of Slots		1
Applicable Modules		MP2000-series Option Modules
Power Supply Section	Input Voltage	24 VDC
	Allowable Input Voltage Range	19.2 to 28.8 VDC
	Input Current	0.8 A (at rated input/output)
	Allowable Power Loss Time	1 ms
	Rated Voltage	5.15 V
	Rated Current	3.0 A
	Output Current Range	0 to 3.0 A
	Rated Voltage Accuracy	5.15 V ±2% max. (5.05 to 5.25 V)
Connectors		Power supply connector

12.11.2 Option Modules

The following table lists Option Modules that can be mounted on the Base Unit.

Type	Abbreviation	Model Number	Description
Communications Modules	217IF-01	JAPMC-CM2310-E	RS-232C/RS-422 communications
	218IF-01	JAPMC-CM2300-E	RS-232C/Ethernet communications (10Base-T)
	218IF-02	JAPMC-CM2302-E	RS-232C/Ethernet communications (100Base-TX/10Base-T)
	260IF-01	JAPMC-CM2320-E	RS-232C/DeviceNet communications
	261IF-01	JAPMC-CM2330-E	RS-232C/PROFIBUS communications
	262IF-01	JAPMC-CM2303-E	FL-net communications
	263IF-01	JAPMC-CM2304-E	EtherNet/IP communications
	264IF-01	JAPMC-CM2305-E	EtherCAT (EtherCAT slave)
	265IF-01	JAPMC-CM2390-E	CompoNet (I/O communications and message communications)
	266IF-01	JAPMC-CM2306-E	PROFINET (PROFINET master)
	266IF-02	JAPMC-CM2307-E	PROFINET (PROFINET slave)
	267IF-01	JAPMC-CM23A0-E	CC-Link (CC-Link master)
	AFMP-01	–	Anywire-Master DB by Anywire Corporation
	AFMP-02-C	–	CC-Link by Anywire Corporation
Communications Modules	AFMP-02-CA	–	CC-Link and Anywire-Master DB by Anywire Corporation
	MPANL00-0	–	A-net/A-Link by ALGO System
	MPALL00-0	–	A-Link/ALink by Algo System
	MPAL000-0	–	A-Link by ALGO System
	MPAN000-0	–	A-net by ALGO System
	MPCUNET-0	–	CUnet by Algo System
	MPHLS-01	–	HLS by M-System Co., Ltd.

Continued on next page.

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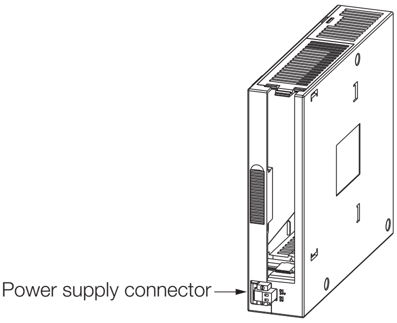
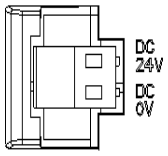
Type	Abbreviation	Model Number	Description
I/O Modules	LIO-01	JAPMC-IO2300-E	16 inputs, 16 sink outputs, 1 pulse-train input
	LIO-02	JAPMC-IO2301-E	16 inputs, 16 source outputs, 1 pulse-train input
	LIO-04	JAPMC-IO2303-E	32 inputs, 32 sink outputs
	LIO-05	JAPMC-IO2304-E	32 inputs, 32 source outputs
	LIO-06	JAPMC-IO2305-E	8 digital inputs, 8 digital sink outputs 1 analog input channel and 1 analog output channel 1 pulse-train counter channel
	DO-01	JAPMC-DO2300-E	64 sink outputs
	AI-01	JAPMC-AN2300-E	8 analog input channels
	AO-01	JAPMC-AN2310-E	4 analog output channels
	CNTR-01	JAPMC-PL2300-E	2 counter channels, selection of 2 input circuits: 5-V differential or 12 V

12.11.3 Appearance and Part Names

The following figure shows the appearance of the Option Base Unit and a part name.



Power Supply Connector



Type	Model	Manufacturer
Terminal block connector with screw connections	BL3.5/2F-AU	Weidmüller Interface GmbH & Co. KG

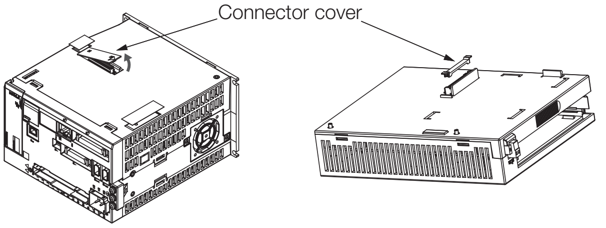
Pin Assignments

Signal name	Description
24 VDC	Power input wire for 24 VDC
0 VDC	Power input wire for 0 VDC

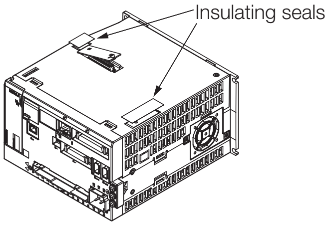
12.11.4 Connecting an Option Base Unit

Use the following procedure to connect an Option Base Unit.

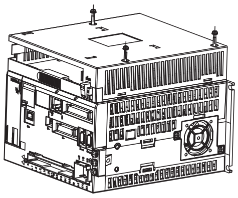
1. Remove the connector covers from the SERVOPACK and the Option Base Unit.



2. Remove the two insulating seals from the SERVOPACK.



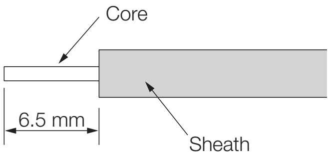
3. Hold the Option Base Unit on both sides and securely insert the connector on it into the connector on the SERVOPACK.
4. Secure the Option Base Unit with three screws.
   (Tightening torque: 0.49 N·m)



12.11.5 Connection Method

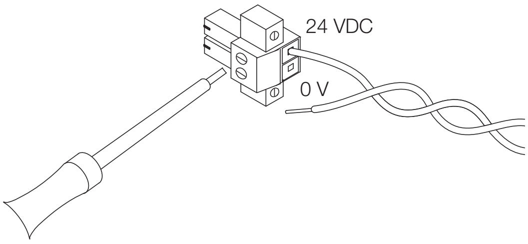
Use the following procedure to connect the 24-VDC power supply to the power supply connector.

1. Prepare an AWG24 to AWG20 (0.2 mm^2 to 0.51 mm^2) twisted-pair cable.
2. Remove the sheath for approximately 6.5 mm from the end of the cable.

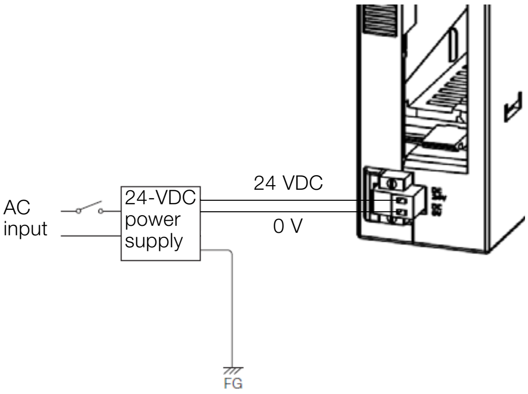


3. Remove the plug from the power supply connector.

4. Insert the cores of the cable all the way into the openings in the plug and then tighten the screws to a tightening torque of approximately 0.2 to 0.25 N·m.



5. Connect the wires as shown in the following diagram.



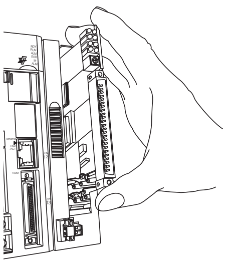
Important

- For a 24-VDC power supply, use a power supply device with double insulation or reinforced insulation.
- Turn ON the 24-V power supply either simultaneously with or after you turn ON the control power supply to the SERVOPACK.
- Do not turn the 24-V power supply to the Option Base Unit and the control power supply to the SERVOPACK OFF and ON again separately.

12.11.6 Installing an Option Module

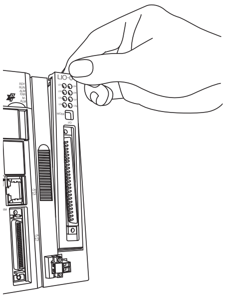
Use the following procedure to install an Option Module.

1. Hold the top and bottom of the Option Module to be installed, line up the Module with the left side of the guide rail inside the option slot, and then insert the Module straight in.



2. After the Option Module is completely inserted, place your hand on the front of the Option Module and press the Option Module firmly until it mates with the Mounting Base connectors in the Unit. The front of the Option Module and the tabs will be aligned if the Option Module has been installed properly.

3. Place the hole on the bottom of the panel of the Option Module onto the tab on the bottom of the Unit. Next, hook the hole at the top of the panel of the Option Module onto the tab on the Unit.



This completes the installation procedure.

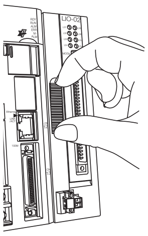
12.11.7 Replacing an Option Module

Use the following procedure to replace an Option Module.

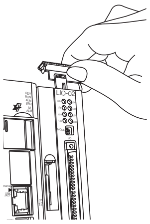
Important

Always create a backup before replacing an Option Module.
Back up the program from the SEVOPACK to the PC using the MPE720.

1. Turn OFF the power supply and disconnect all cables from the SEVOPACK.
2. Remove the tool from the Option Base Unit.

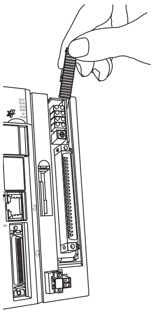


3. Insert the protruding part of the tool into the slot on top of the Option Module panel to unhook the tab.

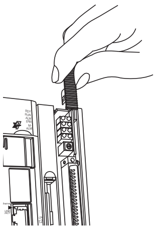


Unhook the bottom tab in the same way.

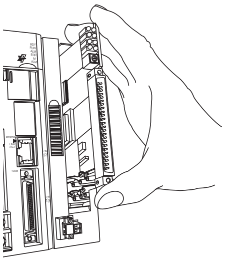
4. Pull the top of the Option Module panel toward you and remove it. A notch on the Option Module will be visible from the gap of the panel. Hook the round knob on the tool into the notch in the Option Module.



5. Hold the center of the tool, and turn it around the round knob while pushing it toward the back to disconnect the Module from the Mounting Base connectors. Then, pull the Module forward.



6. Hold the Option Module at the top and bottom and pull it straight out. Hold the edges of the Module and avoid touching the components on the Module.



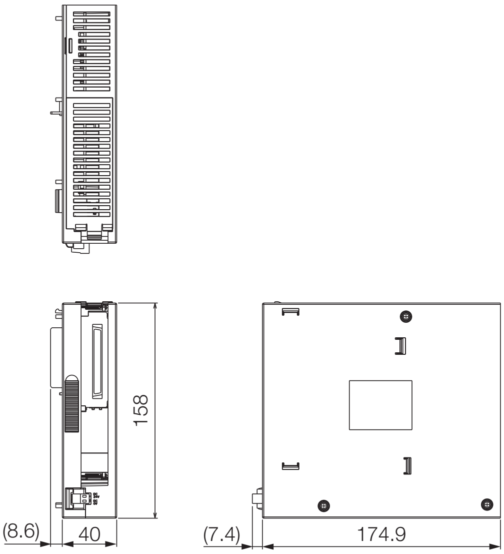
Note: Put the Module that you removed into the bag that was supplied when you purchased it and store the Module in this bag.

7. Install the Option Module that you want to use.

☞ *12.11.6 Installing an Option Module* on page 12-85

12.11.8 External Dimensions

The dimensions of the Option Base Unit are given in the following figure.



Approx. mass: 0.4 kg
Unit: mm

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Revision History

The revision dates and numbers of the revised manuals are given on the bottom of the back cover.

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Date of Publication	Rev. No.	Web Rev. No.	Section	Revised Content
February 2019	<3>	0	5.1.4, 6.6.3	Revision: Information in table of restrictions
			9.2.2, 9.2.3	Partly revised.
			Back cover	Revision: Address
September 2018	<2>	0	Preface	Partly revised.
			3.4.3, 5.17.2	Addition: Absolute linear encoder from Fagor Automation S. Coop.
			Back cover	Revision: Address
January 2018	<1>	1	3.2, 3.7.2	Revision: Digital Output Circuits
July 2017		0	All chapters	Addition: Information on Direct Drive Servomotors (SGM7E and SGM7F)
			Preface	Revision: Information on certification for standards
			1.5.1	Addition: Ratings of 270VDC
			2.7	Addition: EMC installations for single-phase 200-VAC models
			3.4.3	Addition: Information on SQ47 and SQ57 Linear Encoders from Magnescale Co., Ltd.
			3.4.3, 5.17.2	Addition: Information on Renishaw PLC EVOLUTE linear scales
			5.1	Deletion: Information on SigmaWin+ Setup Wizard
			5.17.2	Addition: Information on RESOLUTE Linear Encoders from Renishaw PLC.
			8.12.3	Addition: Gravity Compensation
			Chapter 11	Addition: Pn022, Pn475 and Pn476
			11.1.2	Revision: Reference information
			12.11	Addition: Option Base Unit
			Back cover	Revision: Address
February 2017	<0>	1	8.5.3	Revision: Procedure to estimate the moment of inertia
			8.6.2	Revision: Restrictions for autotuning without a host reference
			Back cover	Revision: Address
July 2016	–	–	–	First edition

Σ-7-Series AC Servo Drive

Σ-7C SERVOPACK

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