Machine Controller MP920

USER'S MANUAL
DESIGN AND MAINTENANCE

YASKAWA

MANUAL NO. SIEZ-C887-2.1B

Copyright © 1998 YASKAWA ELECTRIC CORPORATION

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form, or by any means, mechanical, electronic, photocopying, recording, or otherwise, without the prior written permission of Yaskawa. No patent liability is assumed with respect to the use of the information contained herein. Moreover, because Yaskawa is constantly striving to improve its high-quality products, the information contained in this manual is subject to change without notice. Every precaution has been taken in the preparation of this manual. Nevertheless, Yaskawa assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of the information contained in this publication.

Using this Manual

Please read this manual to ensure correct usage of the MP920 system. Keep this manual in a safe place for future reference.

■ Overview

This manual describes the design and maintenance for the MP920 Machine Controller, including the following information.

- Overview and component specifications
- Installation and wiring
- Examples of internal panel layout and drilling plan

Read this manual carefully to ensure the proper use of the MP920 Machine Controller. Also, keep this manual in a safe place so that it can be referred to whenever necessary.

■ Intended Audience

This manual is intended for the following users.

- Those responsible for estimating the MP920 system
- Those responsible for deciding whether to apply the MP920 system
- Those responsible for designing the MP920 system so that it can be mounted in the control and operating panels
- Those responsible for making, inspecting, testing, adjusting, and maintaining the control and operating panels in which the MP920 is mounted

■ Basic Terms

Unless otherwise specified, the following definitions are used:

- MP920 = MP920 Machine Controller
- PC: Programmable Logic Controller
- PP: Programming Panel
- "—" in "MOV [axis1]—..." represents numeric data for axis 1.

■ Visual Aids

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

IMPORTANT	Indicates important information that should be memorized.
INFO	Indicates supplemental information.
◀ EXAMPLE ▶	Indicates application examples.
TERMS	Describes technical terms that are difficult to understand, or in the text without an explanation being given.

■ Indication of Reverse Signals

In this manual, the names of reverse signals (ones that are valid when low) are written with a forward slash (/) before the signal name, as shown in the following example:

- $\overline{\text{S-ON}}$ = /S-ON
- $\overline{\text{P-CON}}$ = /P-CON

■ Related Manuals

Refer to the following related manuals as required.

Thoroughly check the specifications, restrictions, and other conditions of the product before attempting to use it.

Manual Name	Manual Number	Contents
Machine Controller MP900/MP2000 Series User's Manual Ladder Programming	SIEZ-C887-1.2	Describes the instructions used in MP900/MP2000 Series ladder logic programming.
Machine Controller MP900/MP2000 Series User's Manual Motion Programming	SIEZ-C887-1.3	Describes the motion programming language used for MP900/MP2000 Series Machine Controllers.
Machine Controller MP900/MP2000 Series User's Manual MPE720 Software for Programming Device	SIEPC88070005	Describes how to install and operate the MP900/MP2000 Series programming system MPE720.
Machine Controller MP900/MP2000 Series New Ladder Editor Programming Manual	SIEZ-C887-13.1	Describes the programming instructions of the New Ladder Editor, which assists MP900/MP2000 Series design and maintenance.
Machine Controller MP900/MP2000 Series New Ladder Editor User's Manual	SIEZ-C887-13.2	Describes the operating methods of the New Ladder Editor, which assists MP900/MP2000 Series design and maintenance.
Machine Controller MP920 Motion Module User's Manual	SIEZ-C887-2.5	Describes the functions, specifications, and usage of the MP920 Motion Modules (SVA-01A, SVB-01, and PO-01.)
Machine Controller MP920 Communications Module User's Manual	SIEZ-C887-2.6	Describes the functions, specifications, and usage of the MP920 Communications Modules (215IF, 217IF, and 218IFA).
Machine Controller MP900/MP2000 Series MECHATROLINK System User's Manual	SIE-C887-5.1	Describes the functions, specifications, and usage of the modules that can be connected using MECHATROLINK communications system.
Machine Controller MP900 Series 260IF DeviceNet System User's Manual	SIEZ-C887-5.2	Describes the functions, specifications, and usage of the MP920 DeviceNet Module (260IF).

MP920 Related Manuals Configuration

The MP920 related manuals are configured as follows.

MP920 Related Manuals

Design and Maintenance	SIEZ-C887-2.1	Describes the design and maintenance of the MP920 Machine Controller.
Motion Module	SIEZ-C887-2.5	Describes the functions, specifications, and usage of the MP920 Motion Modules (SVA-01A, SVB-01, and PO-01).
Communications Module	SIEZ-C887-2.6	Describes the functions, specifications, and usage of the MP920 Communications Modules (215IF, 217IF, and 218IFA).
DeviceNet Module	SIEZ-C887-5.2	Describes the functions, specifications, and usage of the MP920 DeviceNet Module (260IF).

Manuals Common for MP900-Series Machine Controllers

MECHATROLINK System	SIEZ-C887-5.1	Describes the functions, specifications, and usage of the modules that can be connected using MECHATROLINK communications system.
Ladder Programming	SIEZ-C887-1.2	Describes the instructions used in MP900 Series ladder logic programming.
Motion Programming	SIEZ-C887-1.3	Describes the motion programming language used for MP900 Series Machine Controllers.
MPE720	SIEPC88070005	Describes how to install and operate the MP900 Series programming system (MPE720).
New Ladder Editor Programming Manual	SIE-C887-13.1	Describes the programming instructions of the New Ladder Editor, which assists MP900 Series design and maintenance.
New Ladder Editor User's Manual	SIE-C887-13.2	Describes the operating methods of the New Ladder Editor, which assists MP900 Series design and maintenance.

Safety Information

The following conventions are used to indicate precautions in this manual. Failure to heed provided in this manual can result in serious or possibly even fatal injury or damage to he products or to related equipment and systems.

⚠ WARNING	Indicates precautions that, if not heeded, could possibly result in loss of life, serious injury.
⚠ CAUTION	Indicates precautions that, if not heeded, could result in relatively serious or minor injury, damage to the product, or faulty operation.
⃠ PROHIBITED	Indicates prohibited actions that must not be performed. For example, this symbol would be used as follows to indicate that fire is prohibited: .
❗ MANDATORY	Indicates compulsory actions that must be performed. For example, this symbol would be used as follows to indicate that grounding is compulsory: .

The warning symbols for ISO and JIS standards are different, as shown below.

ISO	JIS
⚠	◇!

The ISO symbol is used in this manual.

Both of these symbols appear on warning labels on Yaskawa products. Please abide by these warning labels regardless of which symbol is used.

Safety Precautions

This section describes precautions to ensure the correct application of the product. Before installing, operating, maintaining, or inspecting the product, always read this manual and all other documents provided to ensure correct work procedures and application. Before using the equipment, familiarize yourself with equipment details, safety information, and all other precautions.

■ Handling

⚠ CAUTION

- Do not subject the product to halogen gases, such as fluorine, chlovine, bromine, and iodine, at any time even during transportation or installation.

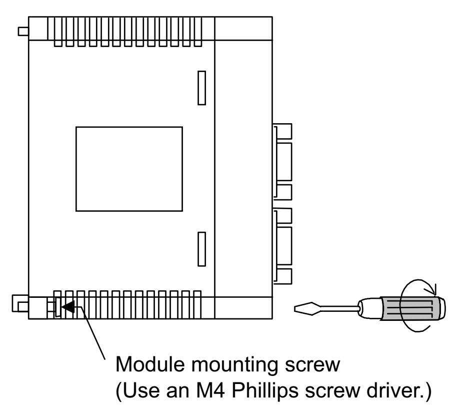
  Failure to observe this caution may cause damage or failure of the product.

■ Installation

⚠ CAUTION

- Firmly tighten the Module mounting screws and terminal block mounting screws to prevent them from loosening during operation.

  Loose screws may result in a malfunction of the MP920.



- Always turn OFF the power supply to the Module before installing it.
- Insert the connectors of the cables that are to be connected to the MP920 Modules and secure them well.

  Incorrect insertion of the connectors may result in a malfunction of the MP920.

■ Wiring

⚠ CAUTION

- **Always connect a power supply that meets the given specifications.**

  Connecting an inappropriate power supply may cause fires.
- **Wiring must be performed by qualified personnel.**

  Incorrect wiring may cause fires, product failure, or electrical shocks.
- **Do not accidentally leave foreign matter such as wire chips on the Mounting Base or in the Module when wiring.**

  This may cause fires, failures, and malfunctions.

MANDATORY

- **Always ground the FG terminal to a ground resistance 100Ω or less.**

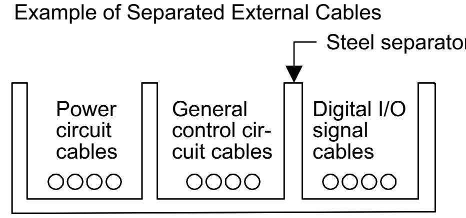
  Failure to ground the MP920 may result in electrical shocks or malfunctioning.

Select, separate, and lay external cables correctly.

- **Consider the following items when selecting the I/O signal lines (external cables) to connect the MP920 Module to external devices.**
  - Mechanical strength
  - Noise interference
  - Wiring distance
  - Signal voltage, etc.
- **Separate the I/O signal lines from the power lines both inside and outside the control panel to reduce the influence of noise from the power lines.**

  If the I/O signal lines and power lines are not separated properly, malfunctioning may result.

Example of Separated External Cables



■ Application

⚠ WARNING
• Do not touch any Module terminals when the system power is ON. There is a risk of electrical shock.

⚠ CAUTION
• Do not attempt to modify the MP920 programs, force outputs, switch between RUN and STOP, or perform other similar operations while the MP920 is operating without knowing the direct and indirect consequences of the operation. Incorrect programming or operation may damage the equipment or cause an accident.

■ Maintenance

⚠ WARNING
• Make sure that the polarity of the Module's built-in battery is correct. The battery must be installed correctly and must not be charged, disassembled, heated, thrown into fire, or short-circuited. Improper handling may cause the battery to explode or ignite.

⃠ PROHIBITED
• Do not attempt to disassemble or modify the MP920 Modules in any way. Doing so can cause fires, product failure, or malfunctions. • The customer must not replace any built-in fuses. If the customer replaces a built-in fuse, the MP920 Module may malfunction or break down. The built-in fuse must always be replaced by Yaskawa service staff.

■ General

Always note the following to ensure safe use.
• MP920 was not designed or manufactured for use in devices or systems directly related to human life. Users who intend to use the product described in this manual for special purposes such as devices or systems relating to transportation, medical, space aviation, atomic power control, or underwater use must contact Yaskawa Electric Corporation beforehand. • MP920 has been manufactured under strict quality control guidelines. However, if this product is to be installed in any location in which a failure of MP920 involves a life and death situation or in a facility where failure may cause a serious accident, safety devices MUST be installed to minimize the likelihood of any accident. • Drawings in this manual show typical product examples that may differ somewhat from the product delivered. • This manual may change without prior notice due to product improvements and specification changes or for easier use. We will update the manual number of the manual and issue revisions when changes are made. The revision number of the revised manual appears on the back of the manual. • Contact your nearest Yaskawa sales representative or the dealer from whom you purchased the product and quote the manual number on the front page of the manual if you need to replace a manual that was lost or destroyed. • Contact your nearest Yaskawa sales representative or the dealer from whom you purchased the product to order new nameplates whenever a nameplate becomes worn or damaged. • Products modified by the customer are not covered by the Yaskawa warranty, nor does Yaskawa assume any liability for injury or damage that may result from such modifications.

CONTENTS

Appendix A

INDEX

Revision History

1

MP920 Overview and Features

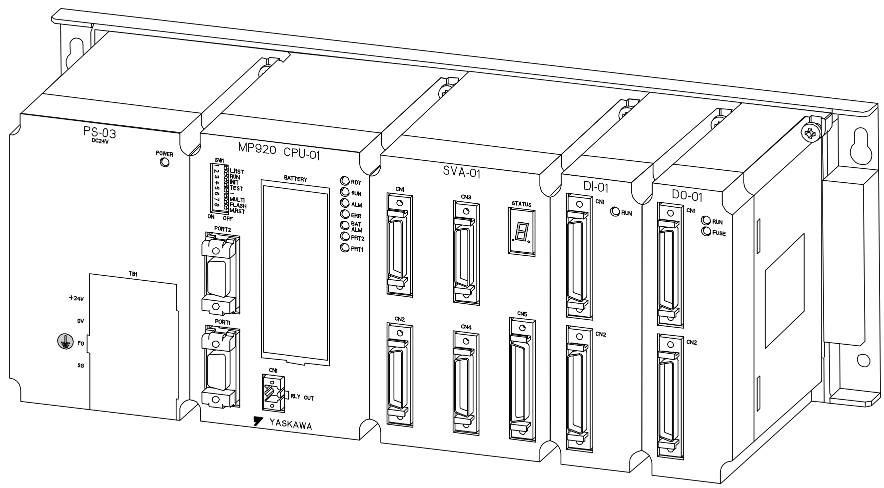
This chapter gives an overview and features of the MP920 Modules.

1.1 Overview of the MP920

This section gives an overview of the MP920.

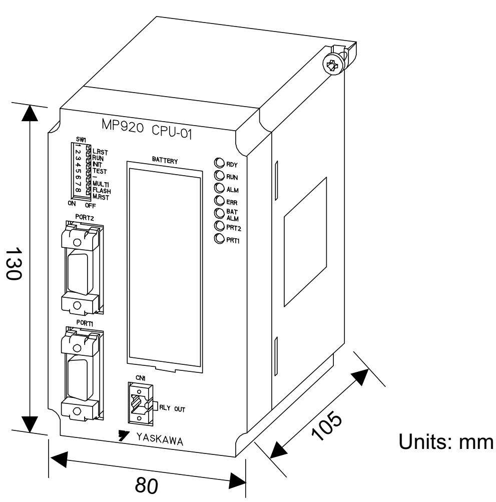
1.1.1 Appearance of MP920 Modules

The MP920 is an expandable modular machine controller in which the Modules required for the system to be mounted to a Mounting Base.



The MP920 Modules can be divided into the following one-slot Modules and two-slot Modules according to the size.

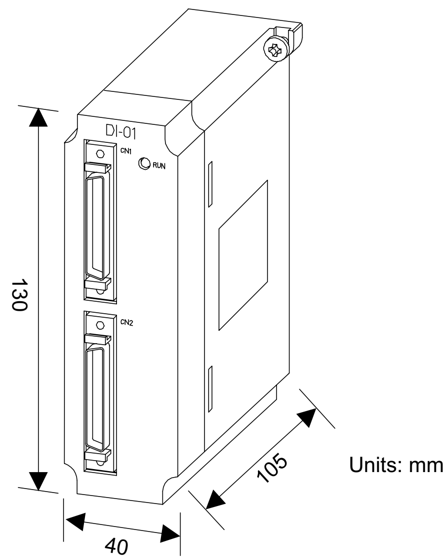
■ Two-slot Modules



The following Modules are two-slot Modules.

- CPU-01
- CPU-02
- SVA-01A
- PS-03
- PS-01

■ One-slot Modules



The following Modules are one-slot Modules.

• DI-01	• PO-01
• DO-01	• AI-01
• LIO-01	• AO-01
• SVA-02A	• 217IF
• SVB-01	• 215IF
• CNTR-01	• 218IFA
• EXIOIF	• 260IF

1.1.2 List of Modules

Table 1.1 lists the Modules and devices used for the MP920 system.

Table 1.1 List of Modules

Group	Name	Model Number	Description	Slots Used	Remarks
Power Supply Modules	DC Power Supply Module	JEPMC-PS200	PS-03	Dedicated	24-VDC input power supply
	AC Power Supply Module	JEPMC-PS210	PS-01	Dedicated	100/200-VAC input power supply
CPU Modules	CPU Module	JEPMC-CP200	CPU-01	2	MP920 CPU (2-MB memory)
	CPU Module	JEPMC-CP210	CPU-02	2	MP920 CPU (4-MB memory)
I/O Modules	Input Module	JEPMC-IO200	DI-01	1	64 input points
	Output Module	JEPMC-IO210	DO-01	1	64 output points
	I/O Module	JEPMC-IO220	LIO-01	1	32 input points and 32 output points
Servo Modules	4-axis Servo Module	JEPMC-MC200A	SVA-01A	2	4-axis servo for analog output
	2-axis Servo Module	JEPMC-MC220A	SVA-02A	1	2-axis servo for analog output
	MECHATROLINK Interface Servo Module	JEPMC-MC210	SVB-01	1	MECHATROLINK interface servo (14 axes max.)
Pulse Modules	Pulse Input Module	JEPMC-PL200	CNTR-01	1	4-channel pulse input
	Pulse Output Module	JEPMC-PL210	PO-01	1	4-channel pulse output
Analog Modules	Analog Input Module	JEPMC-AN200	AI-01	1	4-channel analog input
	Analog Output Module	JEPMC-AN210	AO-01	1	4-channel analog output
Communications Module	Communications Module	JEPMC-CM200	217IF	1	RS-232C/RS422 communications
	Communications Module	JEPMC-CM210A	218IFA	1	Ethernet communications
	Communications Module	JEPMC-CM220	215IF	1	215IF communications
	Communications Module	JEPMC-CM230	260IF	1	DeviceNet interface module
Expansion Module	Expansion Interface Module	JEPMC-EX200	EXIOIF	1	System bus expansion interface
Mounting Bases	Long Mounting Base	JEPMC-MB200	MB-01	–	Long mounting base (power supply + 9 slots)
	Short Mounting Base	JEPMC-MB210	MB-02	–	Short mounting base (power supply + 6 slots)

1.1.3 Features of the MP920

The MP920 is a high-speed and multifunctional modular machine controller that can be used for various applications ranging from stand-alone machines to FA systems.

■ Wide Range of Applications

The MP920 provides comprehensive Modules to support a variety of applications.

Motor Drives

The MP920 supports analog outputs, high-speed field network outputs, pulse outputs, and other output methods to control motor drives for servo, inverter, and pulse motors.

I/O Modules

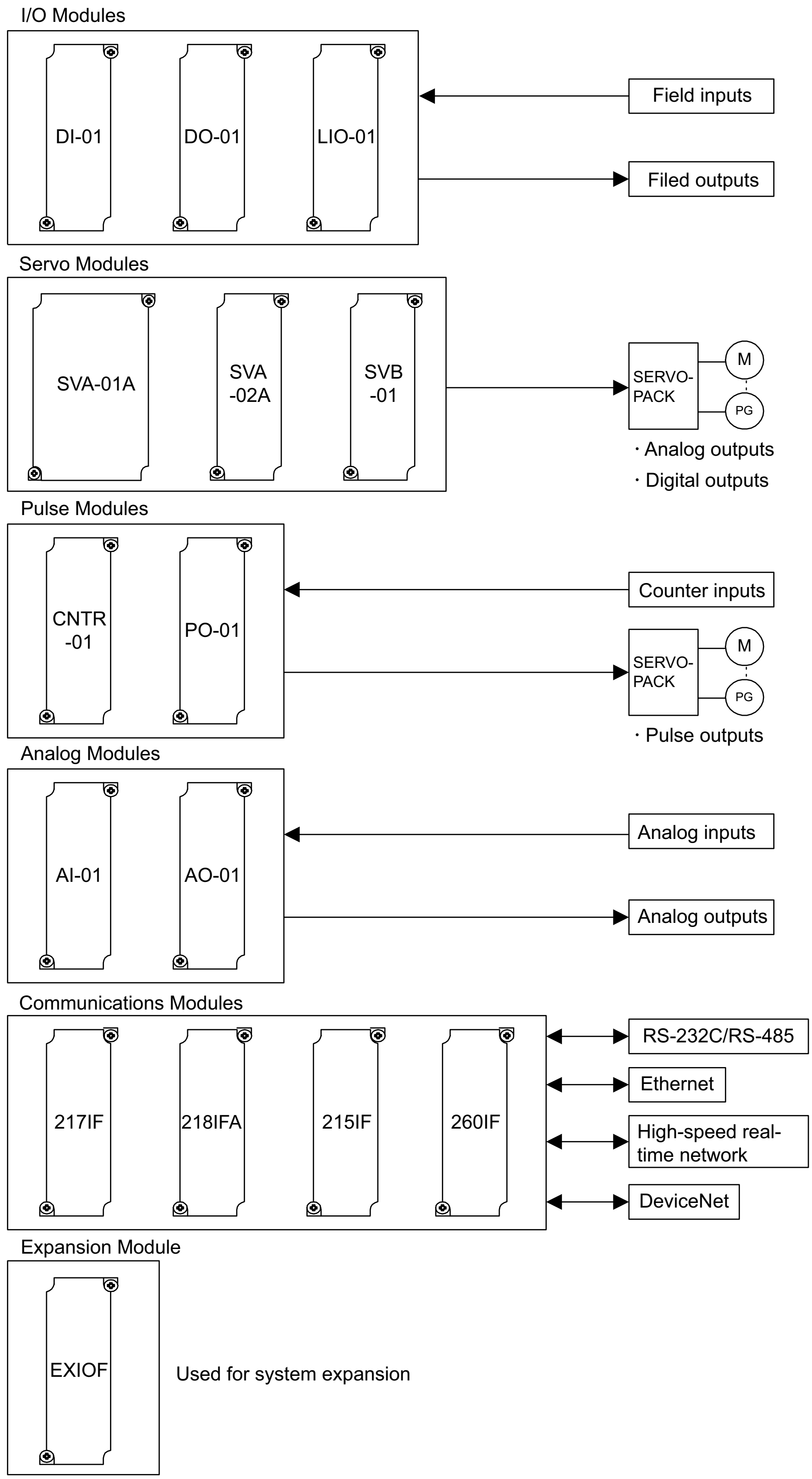
The MP920 is equipped with Digital, Analog, and Pulse I/O Modules.

Compatible with Communications Interfaces

- RS-232C/RS-485 (217IF)
  (Protocols: MEMOBUS, MELSEC, and OMRON)
- Ethernet (218IFA)
- High-speed Real-time Network (215IF)
- DeviceNet Interface (260IF)

MP920 Modules

The following Modules are available with the MP920. Select the Modules suitable for your applications.



■ High-speed, Multi-axis, Parallel Processing

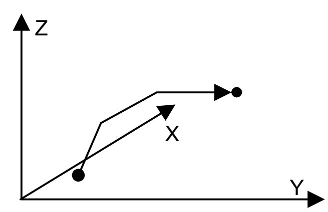
- The MP920 allows synchronous control of up to 60 axes when using 15 SVA-01A Modules.
- The MP920 provides a multitasking function to run multiple motion programs in parallel.

■ Wide Range of Motion Controls

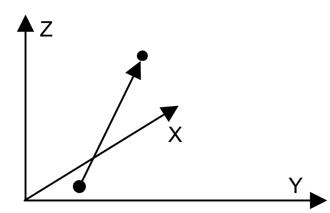
- Motion program instructions are executed to perform positioning and linear/circular/helical interpolation.
- High-speed position control, synchronous phase control, speed control, and torque control can be performed.
- Highly effective motion control is possible for electronic shafts and gears.

Motion Control Examples

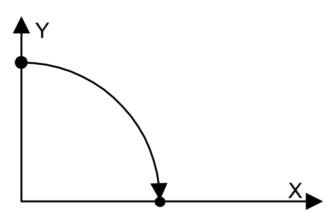
◀ EXAMPLE ▶



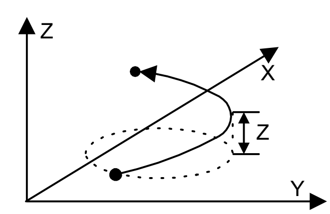
Positioning (3 axes)



Linear Interpolation (3 axes)



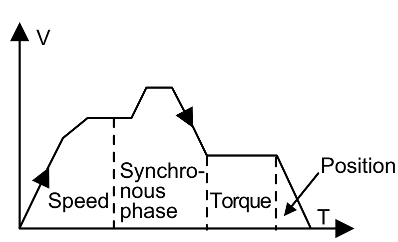
Circular Interpolation (2 axes)



Helical Interpolation (3 axes)

Servo Control Examples

Position, synchronous phase, speed, and torque control are possible with 4-mode control.

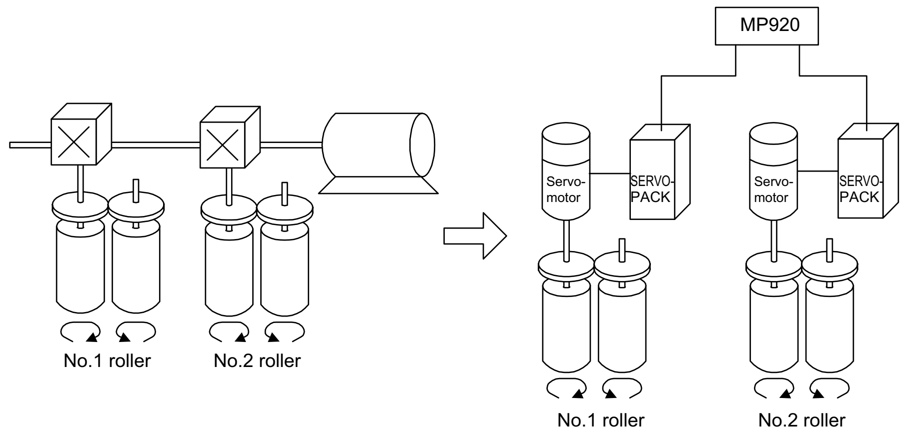


4-mode Control

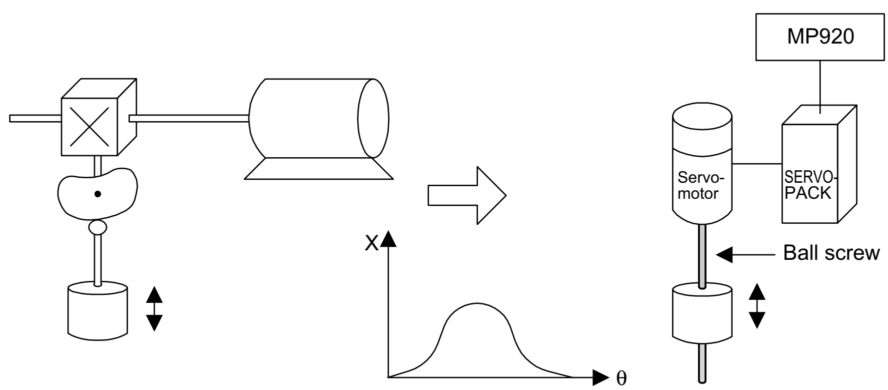
Synchronous Phase Control Application Examples

1. Electronic Shafts

◀ EXAMPLE ▶



2. Electronic Cams



1.1.4 Comparison between the MP920 and MP930

The following table shows differences between the MP920 and the MP930.

Item		MP920	MP930
Design Concept		Intelligent standalone design	Compact all-in-one design
Configuration		Power Supply Module + CPU Module + Optional Modules	MC Unit + Expansion I/O Units
Data Memory	M Registers	32 Kwords	32 Kwords
	I Registers	5 Kwords	2 Kwords
	O Registers	5 Kwords	2 Kwords
	S Registers	1 Kwords	1 Kwords
	D Registers	16 Kwords max.	16 Kwords max.
	# Registers	16 Kwords max.	16 Kwords max.
	C Registers	16 Kwords	4 Kwords
	Servo Parameters	Fixed I/O registers (128 words/axis)	Fixed I/O registers (128 words/axis)
Engineering Ports (CPU Module)	PP Service	Yes	Yes
	MEMOBUS (Slave)	Yes	Yes
	MEMOBUS (Master)	Yes	Yes
	MELSEC Communications	Yes	Yes
	OMRON Communications	No	No
Option I/O	LIO	DI Module (64 points)	No
		DO Module (64 points)	No
		DI/DO Module (DI/DO: 32 points each)	DI/DO: 64 points
Optional Motion Modules	Analog (SVA)	4-axis (SVA-01A) 2-axis (SVA-02A)	No
	Digital (SVB)	14-axis	14-axis MECHATROLINK 1-port digital servo
	Pulse (PO-01)	4-axis	No
Optional Communications Modules	217IF	Yes	No
	215IF	Yes	No
	218IFA	Yes	No
Communications with Other Vendors' Products		CPU Module supports MELSEC protocol, and 217IF Communications Module supports MELSEC and OMRON protocols.	No
Hot Swapping		No	No

(cont'd)

Item			MP920	MP930
Motion Control	Number of Controlled Axes		SVA-01A: 60 axes max. SVA-02A: 32 axes max. SVB-01: 224 axes max. PO-01: 64 axes max.	14 axes max.
	Servo Control	Speed Reference Output	Yes (SVA-01A, SVA-02A)	No
		Torque Reference Output	Yes (SVA-02A)	No
		Position Control	Yes	Yes
		Phase Control	Yes (SVA-01A, SVA-02A)	No
		Linear/Circular Interpolation	Yes	Yes
		Infinite Length Positioning	Yes	Yes
		Software Limit	Yes	Yes
	Control Cycle		SVA, PO-01: Completely synchronizes with high-speed CPU scan. SVB: Completely synchronizes with MECHATROLINK communications cycle.	Completely synchronizes with high-speed CPU scan. The high-speed CPU scan is an integer multiple of the communications cycle (2 ms).
	Connected Driver		• Analog references • MECHATROLINK communications (servo, inverter, distributed I/O) • Pulse-train	• MECHATROLINK communications (servo, inverter, distributed I/O)

2

MP920 Specifications and System Configuration

2

This chapter explains the MP920 Module specifications, together with the products used in the system configuration of the MP920.

2.1 Specifications

This section gives an overview of the specifications and functions of the MP920 Modules.

2.1.1 General Specifications

■ General Specifications of the MP920 Modules

Table 2.1 lists the general specifications of the MP920 Modules.

Table 2.1 General Specifications of the MP920 Modules

Item		Specifications
Environmental Conditions	Ambient Operating Temperature	0 to 55 °C
	Storage Temperature	-25 to 85 °C
	Ambient Operating Humidity	30% to 95% RH (with no condensation)
	Ambient Storage Humidity	5% to 95% RH (with no condensation)
	Pollution Level	Pollution level 1 (conforming to JIS B 3501)
	Corrosive Gas	There must be no combustible or corrosive gas.
	Operating Altitude	2,000 m above sea level or lower
Electrical Operating Conditions	Noise Resistance	Conforming to JIS B 3502: 1,500 V (p-p) in either normal or common modes with a pulse width of 100 ns/11 μs and a rise time of 1 ns (tested with impulse noise simulator)
Mechanical Operating Conditions	Vibration Resistance	Conforming to JIS B 3502: 10 to 57 Hz with single-amplitude of 0.075 mm 57 to 150 Hz with fixed acceleration of 9.8 m/s^2 (1G) 10 sweeps each in X, Y, and Z directions (sweep time: 1 octave/min)
	Shock Resistance	Conforming to JIS B 3502: Peak acceleration of 147 m/s^2 (15G) twice for 11 ms each in the X, Y, and Z directions
Installation Requirements	Ground	Ground to 100 Ω max.
	Cooling Method	Natural cooling

2.1.2 Hardware Specifications

■ Power Supply Module (PS-03)

Table 2.2 shows the hardware specifications of PS-03 the Power Supply Module.

Table 2.2 Hardware Specifications of the PS-03 Power Supply Module

Item	Specifications	
Name	Power Supply Module	
Model Number	JEPMC-PS200	
Description	PS-03	
Input Signals	Input voltage	24 VDC ±20% (19.2 to 28.8 VDC)
	Surge current	Inrush current, 10 A max.
	Fuse rating	6 A
	Safety standards	Conforming to UL and CSA
	Efficiency	70% min.
	Output voltage	5 V
	Adjustment error	Within ±1%
	Maximum output current	10 A
	Output fluctuation	1 to 10 A
	Total fluctuation	Within ±2%
Indicator	POWER (green): Lit while power is ON	
Dimensions (mm)	80 × 130 × 105 (W × H × D)	

■ Power Supply Module (PS-01)

Table 2.3 shows the hardware specifications of the PS-01 Power Supply Module.

Table 2.3 Hardware Specifications of the PS-01 Power Supply Module

Item	Specifications	
Name	AC Power Supply Module	
Model Number	JEPMC-PS210	
Description	PS-01	
Input Conditions	Input voltage	85 to 276 VAC
	Input current	3.0 A max. (rated I/O)
	Inrush current	10 A max. at cold start 100 VAC: 4.5 A 200 VAC: 9.5 A
Output Characteristics	Output voltage	5 V
	Rated current	10.0 A
	Output current range	1.0 to 10.0 A
	Adjustment error	Within ±2% (input voltage fluctuation, load fluctuation)
	Efficiency	70% min.
Protection	Power failure detection level	65 to 85 VAC
	Overcurrent protection	Effective when output current is more than 105% of rated current. It is reset automatically.
	Overvoltage protection	Output stops at 6.0 to 7.0 V more than the specified maximum voltage, and resets when input turns ON again.
	Power failure detection	If power stops for less than 20 ms, it is not considered a power failure. Between 20 ms and 35 ms is indeterminate, and more than 35 ms is always treated as a power failure.
Safety	Safety standards	Conforming to UL and CSA
	Fuse	250 V/3 A
External Wiring Terminals	External power terminals	AC, AC
	Protective ground terminal	FG, SG
	Terminal screws: Phillips M4 Terminal wire size :1.5 mm^2 (AWG16) to 2.5 mm^2 (AWG13)	
Hot Swapping (Insert/Remove while power is being supplied)	Not allowed.	
Indicators	POWER (green): Lit while power is ON	
Dimensions (mm)	80 × 130 × 105 (W × H × D)	

■ CPU Module (CPU-01)

Table 2.4 shows the hardware specifications of the CPU-01 Module.

Table 2.4 Hardware Specifications of the CPU-01 Module

Item	Specifications	
Name	CPU Module	
Model Number	JEPMC-CP200	
Description	CPU-01	
Memory	FLASH	2MB
	SRAM	2MB (battery backup)
Communications Ports	RS-232C × 2 ports Baud rate: 9.6/14.4/19.2 kbps Female 9-pin D-sub connector (special pin assignments) Protocols: • MEMOBUS • No protocol • MELSEC	
Current Consumption	980 mA	
Indicators	Module status LED indicators READY (green) RUN (green) ALM (red) ERR (red) BATALM (red) PRT2 (green) PRT1 (green)	
Setting Switch	Mode setting DIP switch L.RST RUN/STOP INITIAL TEST – MULTI FLASH M.RST	
Dimensions (mm)	80 × 130 × 105 (W × H × D)	

■ CPU Module (CPU-02)

Table 2.5 shows the hardware specifications of the CPU-02 Module.

Table 2.5 Hardware Specifications of the CPU-02 Module

Item	Specifications	
Name	CPU Module	
Model Number	JEPMC-CP210	
Description	CPU-02	
Memory	FLASH	4 MB
	SRAM	4 MB (battery backup)
Communications Ports	RS-232C × 2 ports Baud rate: 9.6/14.4/19.2 kbps Female 9-pin D-sub connector (special pin assignments) Protocols: • MEMOBUS • MELSEC • No protocol	
Memory Backup	Lithium battery	1
	Battery life	5 years at 25 °C
Current Consumption	1200 mA	
Indicators	Module status LED iindicators READY (green) RUN (green) ALM (red) ERR (red) BATALM (red) PRT2 (green) PRT1 (green)	
Setting Switch	Mode setting DIP switch L.RST RUN/STOP INITIAL TEST – MULTI FLASH M. RST	
Dimensions (mm)	80 × 130 × 105 (W × H × D)	

■ Input Module (DI-01)

Table 2.6 shows the hardware specifications of the DI-01 Input Module.

Table 2.6 Hardware Specifications of the DI-01 Input Module

Item	Specifications	
Name	Input Module	
Model Number	JEPMC-IO200	
Description	DI-01	
Input Signals	Inputs	64 points/Module, 8 points/common
	Input format	Combined sinking/sourcing
	Input type	Type 1 (JIS-B3501)
	Isolation method	Photocoupler
	Working voltage	17.4 to 28.8 VDC 35 VDC (peak)
	Rated current	4.1 mA
	Input impedance	Approx. 5.9 kΩ
	Operating voltages	ON voltage: 15 VDC or more OFF voltage: 5 VDC or less
	OFF current	0.9 mA max.
	Response time	OFF → ON: 0.5 ms or less ON → OFF: 1.5 ms or less
	Current consumption	100 mA
Interrupt	Interrupts possible by turning ON points 1, 2, 33, and 34.	
Current Consumption	370 mA	
Indicator	Module status LED indicator RUN (green)	
Connectors	CN1	10250-52A2JL
	CN2	10250-52A2JL
Dimensions (mm)	40 × 130 × 105 (W × H × D)	

2

■ Output Module (DO-01)

Table 2.7 shows the hardware specifications of the DO-01 Output Module.

Table 2.7 Hardware Specifications of the DO-01 Output Module

Item	Specifications	
Name	Output Module	
Model Number	JEPMC-IO210	
Description	DO-01	
Output Signals	Outputs	64 points/Module, 8 points/common
	Output format	Sink output
	Output type	Transistor output
	Isolation method	Photocoupler
	Load voltage	19.2 to 28.8 VDC 35 VDC (peak)
	Load current	0.1 A/circuit, 0.8 A/common
	ON voltage	1.0 V max.
	External power supply	24 VDC ±20% 120 mA (common: 15 mA)
	Output protection	1 fuse per common
	Fuse rating	1.5 A (fusing time: Within 5 seconds at 3A)
	Response time	OFF → ON: 0.5 ms or less ON → OFF: 1.5 ms or less
	Current consumption	400 mA
Current Consumption	300 mA	
Indicator	Module status LED indicators RUN (green) FUSE (red)	
Connectors	CN1	10250-52A2JL
	CN2	10250-52A2JL
Dimensions (mm)	40 × 130 × 105 (W × H × D)	

■ I/O Module (LIO-01)

Table 2.8 shows the hardware specifications of the LIO-01 I/O Module.

Table 2.8 Hardware Specifications of the LIO-01 I/O Module

Item	Specifications	
Name	I/O Module	
Model Number	JEPMC-IO220	
Description	LIO-01	
Input Signals	Inputs	32 points/Module, 8 points/common
	Input format	Combined sinking/sourcing
	Input type	Type 1 (JIS-B3501)
	Isolation method	Photocoupler
	Working voltage	19.2 to 28.8 VDC 35 VDC (peak)
	Rated current	4.9 mA/24 VDC
	Input impedance	Approx. 4.9 kΩ
	Operating voltages	ON voltage: 15 VDC or more OFF voltage: 5 VDC or less
	OFF current	1.0 mA max.
	Response time	OFF → ON: 0.5 ms or less ON → OFF: 1.0 ms or less
	Current consumption	100 mA
Interrupts	Interrupts possible by turning ON points 1, 2, 16, and 17.	
Output Signals	Outputs	32 points/Module, 8 points/common
	Output format	Sink output
	Output type	Transistor output
	Isolation method	Photocoupler
	Load voltage	19.2 to 28.8 VDC 35 VDC (peak)
	Load current	0.1 A/circuit, 0.8 A/common
	ON voltage	0.5 V max. (10 ms max.)
	External power supply	24 VDC ±20% 60 mA (common: 15 mA)
	Output protection	1 fuse per common
	Fuse rating:	1.5 A (fusing time: Within 5 seconds at 3 A)
	Response time	OFF → ON: 0.5 ms or less ON → OFF: 1.5 ms or less
Current Consumption	400 mA	
Indicator	Module status LED indicator RUN (green), FUSE (red)	
Connectors	CN1	10250-52A2JL
	CN2	10250-52A2JL

Table 2.8 Hardware Specifications of the LIO-01 I/O Module (cont'd)

Item	Specifications
Hot Swapping (Insert/Remove while power is being supplied)	Not allowed
Dimensions (mm)	40 × 130 × 105 (W × H × D)

■ Counter Module (CNTR-01)

Table 2.9 shows the hardware specifications of the CNTR-01 Counter Module.

Table 2.9 Hardware Specifications of the CNTR-01 Counter Module

Item	Specifications		
Name	Counter Module		
Model Number	JEPMC-PL200		
Description	CNTR-01		
Number of Channels	4		
Input Circuit (Software switching)	5-V differential	12-V	
	Response frequency:2 MHz RS422 type	Response frequency: 120 kHz 12 V, 7 mA, current sourcing mode input Photocoupler insulation	
Input Method (Software switching)	Phases A/B/C (×1, ×2, ×4)	Up/Down (×1, ×2)	Sign (×1, ×2)
Counter Function (Software switching)	Reversible counter	Interval counter	Frequency measurement
	Frequency: 2 MHz max. (with 5-V differential input)		
Coincidence Interrupt	Output to the CPU Module via the system bus Outputs the DO at the same time.		
Coincidence Output	4 points, 24 V, 50 mA, current sinking mode output, photocoupler insulation		
PI Latch Input	4 points, 24 V, 50 mA, current sinking mode output, photocoupler insulation		
Indicators	Module status LED indicators RUN (green): Normally operating/ Unlit in stop status ERR (red): Normal/ Module failure COUNT1 (green): CH1 counting up/down COUNT2 (green): CH2 counting up/down COUNT3 (green): CH3 counting up/down COUNT4 (green): CH4 counting up/down		
Connectors	CN1	10250-52A2JL (5-V differential input, 4 channels)	
	CN2	10250-52A2JL (12-V input, 4 channels)	
Hot Swapping (Insert/Remove while power is being supplied)	Not allowed		
Dimensions (mm)	40 × 130 × 105 (W × H × D)		

■ Analog Input Module (AI-01)

Table 2.10 shows the hardware specifications of the AI-01 Analog Input Module.

Table 2.10 Hardware Specifications of the AI-01 Analog Input Module

<table>
<tr><th>Item</th><th colspan="2">Specifications</th></tr>
<tr><td>Name</td><td colspan="2">Analog Input Module</td></tr>
<tr><td>Model Number</td><td colspan="2">JEPMC-AN200</td></tr>
<tr><td>Description</td><td colspan="2">AI-01</td></tr>
<tr><td>Number of Channels</td><td colspan="2">4</td></tr>
<tr><td>Input Type</td><td colspan="2">Isolated</td></tr>
<tr><td>Input Voltage Range</td><td colspan="2">-10 to +10 V or 0 to 10 V (software setting)
0 to 20 mA (mode set by hardware or software setting)</td></tr>
<tr><td rowspan="3">Digital Resolution</td><td colspan="2">16 bits</td></tr>
<tr><td>-10 to + 10 V</td><td>-31276 to +31276</td></tr>
<tr><td>0 to 10 V, 0 to 200 mA</td><td>0 to +31276</td></tr>
<tr><td>Input Impedance</td><td colspan="2">Voltage input: 20 kΩ
Current input: 250 Ω</td></tr>
<tr><td>Absolute Accuracy</td><td colspan="2">100 mV max.</td></tr>
<tr><td>Temperature Drift</td><td colspan="2">100 µV/°C max.</td></tr>
<tr><td>Current Consumption</td><td colspan="2">310 mA (typ.)</td></tr>
<tr><td>Sampling Interval</td><td colspan="2">Input is refreshed at every scan of the CPU Module.</td></tr>
<tr><td>Indicator</td><td colspan="2">RUN (green)</td></tr>
<tr><td>Connector</td><td colspan="2">CN1: 10226-52A2JL</td></tr>
<tr><td>Hot Swapping (Insert/Remove while power is being supplied)</td><td colspan="2">Not allowed.</td></tr>
<tr><td>Dimensions (mm)</td><td colspan="2">40 × 130 × 105 (W × H × D)</td></tr>
</table>

■ Analog Output Module (AO-01)

Table 2.11 shows the hardware specifications of the AO-01 Analog Output Module.

Table 2.11 Hardware Specifications of the AO-01 Analog Output Module

<table>
<tr><th>Item</th><th colspan="2">Specifications</th></tr>
<tr><td>Name</td><td colspan="2">Analog Output Module</td></tr>
<tr><td>Model Number</td><td colspan="2">JEPMC-AN210</td></tr>
<tr><td>Description</td><td colspan="2">AO-01</td></tr>
<tr><td>Number of Channels</td><td colspan="2">4</td></tr>
<tr><td>Output Type</td><td colspan="2">Isolated (no isolation between channels)</td></tr>
<tr><td>Output Voltage Range</td><td colspan="2">-10 to +10 V or 0 to 10 V (software setting)</td></tr>
<tr><td>Linearity Protection Range</td><td colspan="2">-10 to +10 V</td></tr>
<tr><td>Maximum Voltages</td><td colspan="2">±10.5 V</td></tr>
<tr><td rowspan="3">Digital Resolution</td><td colspan="2">16 bits</td></tr>
<tr><td>-10 to + 10 V</td><td>-31276 to +31276</td></tr>
<tr><td>0 to 10 V</td><td>0 to +31276</td></tr>
<tr><td>Output Impedance</td><td colspan="2">20 Ω max.</td></tr>
<tr><td>Absolute Accuracy</td><td colspan="2">100 mV max.</td></tr>
<tr><td>Temperature Drift</td><td colspan="2">100 µV/ °C max.</td></tr>
<tr><td>Current Consumption</td><td colspan="2">550 mA</td></tr>
<tr><td>Indicator</td><td colspan="2">RUN (green)</td></tr>
<tr><td>Connector</td><td colspan="2">CN1: 10220-52A2JL</td></tr>
<tr><td>Hot Swapping (Insert/Remove while power is being supplied)</td><td colspan="2">Not allowed.</td></tr>
<tr><td>Dimensions (mm)</td><td colspan="2">40 × 130 × 105 (W × H × D)</td></tr>
</table>

■ Four-axis Servo Module (SVA-01A)

Table 2.12 shows the hardware specifications of the SVA-01A Analog Servo Module.

Table 2.12 Hardware Specifications of the SVA-01A 4-axis Servo Module

Item	Specifications	
Name	Four-axis Servo Module	
Model Number	JEPMC-MC200A	
Description	SVA-01A	
Servo Interface	Pulse input circuit	5 V differential, maximum 1 MHz input
	Pulse input method	Phase-A/B/C pulses input (can be selected from ×1, ×2, and ×4), A/B mode, sign mode, up/down mode
	Pulse counter latch	DI (can be selected from zero point and external latch signal)
Analog Outputs	D/A speed references	Sign + 15 bits, 4 points
	Output range	0 to ±11 V
Digital Inputs	Servo DI	3 points × 4 channels, 4 mA at 24 VDC, source input SV ALM, SRDY, BRK
	External DI	6 points × 4 channels, 4 mA at 24 VDC, source input OTF, OTR, DEC, ZERO, EXT, RI (ZERO and EXT can be latched.)
Digital Outputs	Servo DO	6 points SV ON, ALM RST, P_CON, SEN, OTR, OTF
	External DO	2 points × 4 channels, 24 VDC ±2%
	Output current	100 mA BRK, RO
Connectors	CN1	Servo connector 1 10236-52A2JL
	CN2	Servo connector 2 10236-52A2JL
	CN3	Servo connector 3 10236-52A2JL
	CN4	Servo connector 4 10236-52A2JL
	CN5	External interface connector 10250-52A2JL
Current Consumption	720 mA	
Indicator	Module status 7-segment LED indicator (green)	
Dimensions (mm)	80 × 130 × 105 (W × H × D)	

■ Two-axis Servo Module (SVA-02A)

Table 2.13 shows the hardware specifications of the SVA-02A 2-axis Servo Module.

Table 2.13 Hardware Specifications of the SVA-02A 2-axis Servo Module

Item	Specifications	
Name	2-axis Servo Module	
Model Number	JEPMC-MC220A	
Description	SVA-02A	
Pulse Inputs	Input circuit	5-V differential,maximum 1 MHz input (maximum1.5 MHz input for the hardware version B.5 or later)
	Input method	Phase-A/B/C pulses input (can be selected from ×1, ×2, and × 4), A/B mode, sign mode, up-down mode
	Counter latch	DI
Analog Outputs	D/A speed references	16-bit PWM, 2 channels
	Torque references	12-bit D/A, 2 channels
Analog Inputs	16 bits × 2 channels	
Digital Inputs	General-purpose DI	6 points × 2 channels, 24 VDC, 4 mA, sourcing mode input General-purpose DIs (RDY, ALM, BRK, OTF, OTR) PI latch
Digital Outputs	General-purpose DO	6 points × 2 channels, 24 VDC±2 % Output current: 100 mA SVON, ALMRST, P_CON, SEN, general-pupose 1, general-purpose 2 (5-V sourcing mode or 24-V output for SEN output)
Connectors	CN1	Servo connector 110236-52A2JL
	CN2	Servo connector 20236-52A2JL
	CN3	24-V input, BL3.5/2F-AU
Indicator	Module status 7-segment LED indicator (green)	
Hot Swapping (Insert/Remove while power is being supplied)	Not allowed.	
Dimensions (mm)	40 × 130 × 105 (W × H × D)	

■ MECHATROLINK Interface Module (SVB-01)

Table 2.14 shows the hardware specifications of the SVB-01 MECHATROLINK Interface Module.

Table 2.14 Hardware Specificatios of the SVB-01 MECHATROLINK Interface Module

Item	Specifications
Name	MECHATROLINK Interface Module
Model Number	JEPMC-MC210
Description	SVB-01
Field Bus	MECHATROLINK (High-speed field network) Up to 14 stations such as servo, I/O, and 216IF can be connected.
Connector	USB connector (Male 4-pin, soldered) Model: DUSB-APA41-B1-C50
Current Consumption	500 mA
Indicator	Module status 7-segment LED indicator (green)
Hot Swapping (Insert/Remove while power is being supplied)	Not allowed.
Dimensions (mm)	40 × 130 × 105 (W × H × D)

■ Pulse Output Module (PO-01)

Table 2.15 shows the hardware specifications of the PO-01 Pulse Output Module.

Table 2.15 Hardware Specifications of the PO-01 Pulse Output Module

Item	Specifications	
Name	Pulse Output Module	
Model Number	JEPMC-PL210	
Description	PO-01	
No. of Controlled Axes	4	
Pulse Output	Methods	Sign + pulse, pulse
	Frequency	500 kpps max. (software switching)
	Interface	5-V differential output
	Other functions	Can be switched between positive and negative logic by software. Two emergency stopping method (immediate stop/deceleration to a stop)
Digital Inputs	Photocoupler insulation, current sourcing mode input 5 points × 4 channels DI_0: Individual power supply 5 V/5 mA, 12 V/12 mA, or 24 V/5 mA DI_1 to DI_4: Common power supply, 0.5 ms filter, 24 V/5 mA	
Allocation example	DI_0	Zero point
	DI_1	Dog signal/general-purpose
	DI_2	Limit 1
	DI_3	Limit 2
	DI_4	Emergency stop/Deceleration to a stop
Digital Outputs	24-V open-collector (current sinking mode output) 4 points × 4 channels Photocoupler insulation, 100 mA max.	
Allocation example	DO_0	Excitation ON
	DO_1	General-purpose
	DO_2	General-purpose
	DO_3	General-purpose
Indicator	Module status 7-segment LED indicator (green)	
Connectors	CN1	Axis-1 and -2 connector 10250-52A2JL
	CN2	Axis-3, and -4 connector 10250-52A2JL
Hot Swapping (Insert/Remove while power is being supplied)	Not allowed.	
Dimensions (mm)	40 × 130 × 105 (W × H × D)	

■ 218I/F Communications Module (218IFA)

Table 2.16 shows the specifications of the 218IFA Communications Module.

Table 2.16 Specifications of the 218IF Communications Module

Item		Specifications
Hardware Specifications	Name	218IF Communications Module (Ethernet Communications Module)
	Model Number	JEPMC-CM210A
	Description	218IFA
	Dimensions (mm)	40 × 130 × 105 (W × H × D) Occupies one MP920 option slot.
	Mass	Board: 220 g, case: 220 g
Communications Specifications	Interface	10Base-T: RJ-45
	Transmission Distance	Total length : 500 m (yellow cable) via 10Base5
	Baud Rate	10 Mbps
	Access Mode	IEEE 802.3 CSMA/CD
	Frames	Ethernet, Ver.2 (DIX specifications)
	Connections	TCP/UDP/IP/ARP
	Max. Number of Nodes	Depends on applicable HUB or network.
	Communications Modes	Message communication
	Max. Number of Transmission Words	512 words (1,024 bytes)
	Communications Protocol	MEMOBUS (Master/Slave), MELSEC
	Max. Number of Connections	20 (max.10 connections for simultaneous communications. 20 connections can be used by switching the connections using the main program.)

■ 217I/F Communications Module (217IF)

Table 2.17 shows the specifications of the 217IF Communications Module.

Table 2.17 Specifications of the 217IF Communications Module

Item		Specifications	
Hardware Specifications	Name	217IF Communications Module (Serial Communications Module)	
	Model Number	JEPMC-CM200	
	Description	217IF	
	Dimensions (mm)	40 × 130 × 105 (W × H × D) Occupies one MP920 option slot	
	Mass	Board: 200 g, case: 165 g	
	Power Supply	Supplied from the Mounting Base, +5 V, 300 mA	
Communications Specifications	Interface	RS-232	2 lines
		RS-422/485	1 line
	Connectors	RS-232 (CN1)	Female 9-pin D-sub
		RS-232 (CN2)	Female 9-pin D-sub
		RS-422/485 (CN3)	Female MR-8
	Transmission Distance	RS-232	15 m max.
		RS-422/485	300 m max.
	Baud Rate	RS-232 (CN1/CN2)	300 bps to 19.2 kbps*
		RS-422/485 (CN3)	2400 bps to 76.8 kbps
		(300/600/1200/2400/4800/9600/14400/19200/28800/38400/48000/57600/64000/76800 bps)	
	Access Mode	Asynchronous (Start-stop synchronization)	
	Communications Modes	Message communication and engineering communication	
	Communications Protocol	MEMOBUS (Master/Slave), MELSEC, OMRON	
	Media Access Control Method	RS-232	1 : 1
		RS-422	1 : 1
		RS-485	1 : N
	Transmission Format (Can be set)	Data bit length	7 or 8 bits
		Stop bits	1 or 2 bits
		Parity	Even, Odd, or None

* The max. baud rate for RS422/485 (CN3) depends on the baud rate setting of CN1 and CN2.
If the baud rate for CN1 and CN2 is set to 19.2 kbps, the max. baud rate for CN3 is limited to 19.2 kbps.

■ 215I/F Communications Module (215IF)

Table 2.18 shows the specifications of the 215IF Communications Module.

Table 2.18 Specifications of the 215IF Communications Module

Item		Specifications	
Hardware Specifications	Name	215IF Communications Module	
	Model Number	JEPMC-CM220	
	Description	215IF	
	Dimensions (mm)	40 × 130 × 105 (W × H × D) Occupies one MP920 option slot.	
	Mass	Board: 165 g, case: 165 g	
	Power Supply	Supplied from the Mounting Base, +5 V, 375 mA	
Communications Specifications	Connection Form	Electric bus	
	Connection	Electric bus YS-IPEV-SB, 1P× 0.3 mm^2 (75 Ω system) YS-IPEV-SB, 3P × 0.3 mm^2 (75 Ω system) YS-IPEV-S (Cu), 1P × 1.25 mm^2 (75 Ω system)	
	Transmission Distance	Total length	
		At 4 Mbps	170 m
		At 2 Mbps	270 m
		At 1 Mbps	420 m
		Can be extended to 600 m max. by connecting a repeater	
	Baud Rate	1, 2, or 4 Mbps (can be switched by software.)	
	Access Mode	Token passing method	
	Frames	Conforming to HDLC	
	Max. Number of Nodes	30/segment	
	Communications Modes	Link communication, message communication: Approx. 1,024 words/10 ms Engineering communication	
	Max. Number of Transmission Words	Link communications	2,048 words
		Message communications, engineering communications	512 words
	Communications Protocol	MEMOBUS (Master/Slave), No protocol	
	Max. Number of Connections	30 (64 when repeaters are used)	
	Media Access Control Method	N : N	
	Error Detection	CRC check, Data length check, timer	

■ DeviceNet Interface Module (260IF)

Table 2.19 shows the hardware specifications of the 260IF DeviceNet Interface Module.

Table 2.19 Hardware Specifications of the 260IF DeviceNet Interface Module

Item		Specifications	
Name		260IF	
Model Number		JEPMC-CM230	
Number of Lines		1	
Supported Communications Methods		I/O transmission function Explicit messages (Both must conform to DeviceNet.)	
I/O Transmission	Max. Number of Slaves	63 nodes	
	Max. Number of I/O Bytes	2,048 bytes, 256 bytes/node	
Message Communications (Only for Master)	Max. Number of Nodes for Message	63 nodes Max. number of nodes for simultaneous communications: 8	
	Max. Message Length	256 bytes	
	Function for Execution	MSG-SEND function	
Settings		2 rotary switches on the front panel	Node address setting
		DIP switch on the front panel	Baud rate setting Master/slave selection
Indicators		2 LED indicators	MS and NS
Power Supply Voltage for Communications		24 VDC ±10 % (supplied by special cable)	
Current Consumption		Communications power supply: 45 mA max. (supplied from the communications connector) Internal circuit power supply (supplied from the PLC)	
Mass		100 g	
Dimensions (mm)		40 × 130 × 105 (W × H × D)	

■ Expansion Interface Module

Table 2.20 shows the hardware specifications of the Expansion Interface Module.

Table 2.20 Hardware Specifications of the Expansion Interface Module

Item	Specifications
Name	Expansion Interface Module
Model Number	JEPMC-EX200
Description	EXIOIF
Function	System bus expansion
Supply Voltage	+5 V, 400 mA, power supply from Mounting Base
Interface	GPIP driver (equivalent to SN75160 (TI)) Address bus (30 bits), data (16 bits), control signals, etc.
Rack 1 Recognition	Rack 1 in which the CPU Module is mounted will be automatically recognized when an extension cable is connected. (The rack is recognized as Rack 1 when no 1N connector is connected.)
Cable Length	Between Racks: 3 m max. Maximum cable length with 4 Racks used: 5 m
Current Consumption	580 mA
Indicator	Module status LED indicator RUN (green)
Setting Switch	SW1: DIP switch – MODE – –
Dimensions (mm)	40 × 130 × 105 (W × H × D)

2

2.1.3 Function Lists

■ MP920 Motion Control Function Specifications

Table 2.21 lists the motion control function specifications for the MP920.

Table 2.21 MP920 Motion Control Function Specifications

Item		Specification
Number of Controlled Axes		1 to 60 axes (when SVA-01 Module is used.)
Control Specifications	PTP Control	Linear, rotary, infinite-length, and independent axes
	Interpolation	Up to 16 linear axes, 2 circular axes, and 3 helical axes
	Speed Reference Output	Available with SVA-01A and SVA-02A Modules.
	Torque Reference Output	Available with SVA-02A Module.
	Position Control	Positioning, external positioning, zero point return, interpolation, interpolation with position detection function, fixed speed feed, fixed length feed
	Phase Control	Available with SVA-01A and SVA-02A Modules.
Reference Unit		mm, inch, deg, pulse
Reference Unit Minimum Setting		1, 0.1, 0.01, 0.001, 0.0001, 0.00001
Maximum Programmable Value		-2147483648 to +2147483647 (signed 32-bit value)
Speed Reference Unit		mm/min, inch/min, deg/min, pulse/min
Acceleration/Deceleration Type		Linear, asymmetric, S-curve
Override Function		Positioning: 0.01% to 327.67% by axis Interpolation: 0.01% to 327.67% by group
Coordinate System		Rectangular coordinates
Zero Point Return		Eight types 1. DEC1 + C-phase 2. DEC2 + C-phase 3. DEC1 + LMT 4. C-phase 5. DEC1 + ZERO 6. DEC2 + ZERO 7. DEC1 + LMT + ZERO 8. ZERO
Programs	Language	Special motion language, ladder
	Number of Tasks	Up to eight programs can be executed in parallel.
	Number of Programs	Up to 256
	Program Capacity	80 Kbytes
Applicable SERVOPACK		• Analog SGDA-□/SGDB-□□□/SGDM-□□/SGDS-□□ • Network SGD-□N/SGDB-□N/SGDH-□□□E + NS100
Encoder		Incremental or absolute

Table 2.21 MP920 Motion Control Function Specifications (cont'd)

Item	Specification
Commands	Axis Move Commands: 8 commands MOV, MVS, MCW, MCC, ZRN, SKP, MVT, EXM Basic Control Commands: 6 commands ABS, INC, POS, PLN, MVM, PLD Speed and Acceleration/Deceleration Commands: 8 commands ACC, DCC, SCC, VEL, IAC, IDC, IFP, FMX High-level Control Commands: 4 commands PFN, INP, SNG, UFC Control Commands: 10 commands MSEE, TIM, IOW, END, RET, EOX, IF ELSE IEND, WHILE WEND, PFORK JOINTO PJOINT, SFORK JOINTO SJOINT Math and Sequence Control Commands: 36 commands =, +, -, *, /, MOD, |, ^, &, !, (), S{}, R{}, SIN, COS, TAN, ASN, ACS, ATN, SQRT, BIN, BCD, = =, < >, >, <, >=, <=, SFR, SFL, BLK, CLR

■ PLC Function Specifications

Table 2.22 lists the PLC function specifications.

Table 2.22 PLC Function Specifications

Item	Specifications
Program Capacity	Equivalent to 4 Ksteps (varies according to amount of motion program used; 20 Ksteps max.)
Control Method	Sequence: High-speed and low-speed scan methods
Programming Language	CP language Ladder logic diagram: Relay circuit Text-type language: Numeric operations, logic operations, etc.
Scanning	Two scan levels: High-speed scan and low-speed scan High-speed scan time setting: 0.4 to 300 ms (0.1 ms units) Low-speed scan time setting: 1.0 to 300 ms (0.1 ms units)
User Drawings, Functions and Motion Programs	Start drawings (DWG.A): 64 drawings max. Up to three hierarchical drawing levels High-speed scan process drawings (DWG.H): 200 drawings max. Up to three hierarchical drawing levels Low-speed scan process drawings (DWG.L): 500 drawings max. Up to three hierarchical drawing levels Interrupt processing drawings (DWG.I): 64 drawings max. Up to three hierarchical drawing levels Number of steps: Up to 500 steps per drawing User functions: Up to 500 functions Motion programs: Up to 256 Revision history of drawings and motion programs Security function for drawings and motion programs
Data Memory	Common data (M) registers: 32 kwords System (S) registers: 1 kwords Drawing local (D) registers: Up to 16 kwords per drawing Drawing constant (#) registers: Up to 16 kwords per drawing Input (I) registers: 5 kwords (including internal input registers) Output (O) registers: 5 kwords (including internal output registers) Constant (C) registers: 16 kwords
Trace Memory	Data trace: 128 kwords (32 kwords × 4 groups), 16 points defined Failure trace: 4 kwords, 64 items defined
Memory Backup	Program memory: CMOS battery backup

Table 2.22 PLC Function Specifications (cont'd)

Item	Specifications
Data Types	Bit (relay): ON/OFF Integer: -32768 to +32767 Double-length integer: -2147483648 to +2147483647 Real number: ± (1.175E - 38 to 3.402E + 38)
Register Designation Method	Register number: Direct designation of register number Symbolic designation: Up to 8 alphanumeric characters (up to 200 symbols per drawing) With automatic number or symbol assignment
Instructions	Program control instructions: 14 instructions Direct I/O instructions: 2 instructions Relay circuit instructions: 14 instructions (including set and reset coils) Logic operation instructions: 3 instructions Numeric operation instructions: 16 instructions Numeric conversion instructions: 9 instructions Numeric comparison instructions: 7 instructions Data manipulation instructions: 14 instructions Basic function instructions: 10 instructions Table data manipulation instructions: 11 instructions DDC instructions: 13 instructions System functions: 10 instructions

■ Motion Command List

The following table lists the motion commands.

Classification	Command	Name	Programming Format	Function/Meaning
Axis Move Commands	MOV	POSITIONING	MOV [*axis1*] – [*axis2*] – ···; (Up to 16 axes can be designated.)	Executes positioning at rapid traverse speed for up to 16 axes simultaneously. In programming, replace "–" with the numerical data for each axis.
	MVS	LINEAR INTERPOLATION	MVS [*axis1*] – [*axis2*] – ···F–; (Up to 16 axes can be designated.)	Executes linear travel at interpolation feed speed F for up to 16 axes simultaneously.
	MCW MCC	CLOCKWISE CIRCULAR INTERPOLATION COUNTERCLOCKWISE CIRCULAR INTERPOLATION	MCW [*axis1*] – [*axis2*] – R– F–; MCC [*axis1*] – [*axis2*] – U– V– T– F–;	Executes circular interpolation at tangential speed F for two axes simultaneously following radius R (or designated center point coordinates). With the center point coordinate designation, multiple circles can be designated with T–. (T– can also be omitted.)
	MCW MCC	CLOCKWISE HELICAL INTERPOLATION COUNTERCLOCKWISE HELICAL INTERPOLATION	MCW [*axis1*] – [*axis2*] –U– V– [*axis3*] –T– F–; MCC [*axis1*] – [*axis2*] –R– [*axis3*] –F-;	Moves three axes simultaneously in a combination of circular interpolation and linear interpolation outside of the circular interpolation plane. Speed F will be the circular interpolation tangential speed. With the center point coordinate designation, the number of turns can be designated with T–. (T– can also be omitted.)
	ZRN	ZERO POINT RETURN	ZRN [*axis1*] – [*axis2*] – ···; (Up to 16 axes can be designated.)	Returns each axis to its zero point.
	SKP	SKIP	SKP [*axis1*]– [*axis2*]- ··· SS–; (Up to 16 axes can be designated.)	If the SKIP signal turns ON during a linear interpolation operation, skips the remaining movement and proceeds to the next block.
	MVT	SET TIME POSITIONING	MVT [*axis1*] – [*axis2*] – ··· T–; (Up to 16 axes can be designated.)	Executes positioning by clamping the feed speed so that travel can be completed at the designated time.
	EXM	EXTERNAL POSITIONING	EXM [*axis1*] – D–;	When an external positioning signal is input while external positioning is being executed, only the travel distance designated by "D–" is positioned with an incremental value, and then the next command is executed.

(cont'd)

Classification	Command	Name	Programming Format	Function/Meaning
Basic Control Commands	ABS	ABSOLUTE MODE	ABS;	Treats all subsequent coordinate words as absolute values.
	INC	INCREMENTAL MODE	INC;	Treats all subsequent coordinate words as incremental values.
	POS	CURRENT POSITION SET	POS [*axis1*] – [*axis2*] – ···;	Changes the current values to the desired coordinate values for up to 16 axes simultaneously. Subsequent move commands use this new coordinate system.
	PLN	COORDINATE PLANE SETTING	PLN [*axis1*] [*axis2*]	Designates the coordinate plane to be used for a command requiring a plane designation command.
	MVM	MOVE ON MACHINE COORDINATE	MVM MOV [*axis1*] – [*axis2*] –; or MVM MVS [*axis1*] – [*axis2*]–;	Goes to the target position on the machine coordinate system. The coordinate system set automatically on completion of the zero point return is called a machine coordinate system. This coordinate system is not affected by the POS command.
	PLD	PROGRAM CURRENT POSITION UPDATE	PLD [*axis1*] – [*axis2*] – ···;	Updates the program current position for axes shifted by manual intervention. Up to 16 axes can be designated.
Speed and Acceleration/ Deceleration Commands	ACC	ACCELERATION TIME CHANGE	ACC [*axis1*] – [*axis2*] – ···;	Sets the acceleration time for linear acceleration/deceleration for up to 16 axes simultaneously.
	DCC	DECELERATION TIME CHANGE	DCC [*axis1*] – [*axis2*] – ···;	Sets the deceleration time for linear acceleration/deceleration for up to 16 axes simultaneously.
	SCC	S-CURVE TIME CONSTANT CHANGE	SCC [*axis1*] – [*axis2*] – ···;	Sets the time constant for moving average acceleration/deceleration for up to 16 axes simultaneously.
	VEL	SET VELOCITY	VEL [*axis1*] – [*axis2*] – ···;	Sets the feed speed for up to 16 axes.
	IAC	INTERPOLATION ACCELERATION TIME CHANGE	IAC T–;	Sets the acceleration time for linear acceleration/deceleration for interpolation travel.
	IDC	INTERPOLATION DECELERATION TIME CHANGE	IDC T–;	Sets the deceleration time for linear acceleration/deceleration for interpolation travel.
	IFP	INTERPOLATION FEED SPEED RATIO SETTING	IFP P–;	Designates the maximum feed % for the speed designation during an interpolation feed.
	FMX	MAXIMUM INTERPOLATION FEED SPEED SETTING	FMX T–;	Sets the maximum speed during an interpolation feed. The interpolation acceleration time is the time from "0" until this speed is reached.

2

(cont'd)

Classification	Command	Name	Programming Format	Function/Meaning
High-Level Control Commands	PFN	IN-POSITION CHECK	MVS [*axis1*] – [*axis2*] – ··· PFN; or PFN [*axis1*] [*axis2*] ;	Proceeds to the next block after the positioning commanded by the interpolation travel command in the same block or a previous block enters the positioning completion range (parameter setting).
	INP	SECOND IN-POSITION CHECK	INP [*axis1*] – [*axis2*] – ···;	Proceeds to the next block after the positioning subsequently commanded by the interpolation travel command with PFN enters the second positioning completion range.
	SNG	IGNORE SINGLE BLOCK SIGNAL	SNG MVS [*axis1*] 100. [*axis2*] 200. F1000;	A block with this command will be executed continuously, even in single-block operation mode. SNG cannot be designated on its own.
	UFC	USER FUNCTION CALL	UFC Function_name Input_data, Input_address, Output_data;	Calls a function created by the user.
Sequence Commands	=	SUBSTITUTE	(Result) = (Arithmetic expression)	Substitutes operation results. Performs calculations from left to right (with no order of priority).
	+	ADD	MW– = MW– + MW–; MW– = MW– + 123456; MW– = 123456 + MW–;	Performs integer and real number addition. Calculates combinations of integers and real numbers as real numbers.
	-	SUBTRACT	MW– = MW– – MW–; MW– = MW– – 123456; MW– = 123456 – MW–;	Performs integer and real number subtraction. Calculates combinations of integers and real numbers as real numbers.
	∗	MULTIPLY	MW– = MW– ∗ MW–; MW– = MW– ∗ 123456; MW– = 123456 ∗ MW–;	Performs integer and real number multiplication. Calculates combinations of integers and real numbers as real numbers.
	/	DIVIDE	MW– = MW–/MW–; MW– = MW–/123456; MW– = 123456/MW–;	Performs integer and real number division. Calculates combinations of integers and real numbers as real numbers.
	MOD	REMAINDER	MW– = MW–/MW–; MW– = MOD;	When programmed in the next block after a division, MOD stores the remainder in the designated register.

(cont'd)

<table>
<tr><th>Classification</th><th>Command</th><th>Name</th><th>Programming Format</th><th>Function/Meaning</th></tr>
<tr><td>Sequence Commands (cont'd)</td><td>|</td><td>OR (logical OR)</td><td>MB– = MB– | MB–;
MB– = MB– | 1;
MW– = MW– | MW–;
MW– = MW– | H00FF;</td><td>Performs bit/integer logical OR.</td></tr>
<tr><td></td><td>^</td><td>XOR (logical exclusive OR)</td><td>MW– = MW– ^ MW–;
MW– = MW– ^ H00FF;</td><td>Performs integer logical exclusive OR.</td></tr>
<tr><td></td><td>&</td><td>AND (logical AND)</td><td>MB– = MB– & MB–;
MB– = MB– & 1;
MW– = MW– & MW–;
MW– = MW– & H00FF;</td><td>Performs bit/integer logical AND.</td></tr>
<tr><td></td><td>!</td><td>NOT (logical complement)</td><td>MB– = !MB–;
MB– = !1;
MW– = !MW–;
MW– = !H00FF;</td><td>Performs bit/integer logical complement (inverts bits).</td></tr>
<tr><td></td><td>( )</td><td>PARENTHESES</td><td>MW– = MW– & (MW– | MW–);</td><td>The logical arithmetic expression inside parentheses is calculated first.</td></tr>
<tr><td></td><td>S{ }</td><td>SET BIT</td><td>S{MB–} = MB– & MB–;</td><td>If the logical operation result is "true," the designated bit turns ON. The designated bit does not turn OFF, even if the logical operation result is "false."</td></tr>
<tr><td></td><td>R{ }</td><td>RESET BIT</td><td>R{MB–} = MB– & MB–;</td><td>If the logical operation result is "true," the designated bit turns OFF. The designated bit does not turn ON, even if the logical operation result is "false."</td></tr>
<tr><td></td><td>SIN</td><td>SINE</td><td>SIN (MW–);
SIN (90);</td><td>Obtains the sine of the integer or real number (deg), and returns a real value.</td></tr>
<tr><td></td><td>COS</td><td>COSINE</td><td>COS (MW–);
COS (90);</td><td>Obtains the cosine of the integer or real number (deg), and returns a real value.</td></tr>
<tr><td></td><td>TAN</td><td>TANGENT</td><td>TAN (MF–);
TAN (45.0);</td><td>Obtains the tangent of the real number (deg), and returns a real value.</td></tr>
<tr><td></td><td>ASN</td><td>ARC SINE</td><td>ASN (MF–);
ASN (90.0);</td><td>Obtains the arc sine of the real number (deg), and returns a real value.</td></tr>
<tr><td></td><td>ACS</td><td>ARC COSINE</td><td>ACS (MF–);
ACS (90.0);</td><td>Obtains the arc cosine of the real number (deg), and returns a real value.</td></tr>
</table>

(cont'd)

Classification	Command	Name	Programming Format	Function/Meaning
Sequence Commands (cont'd)	ATN	ARC TANGENT	ATN (MW–); ATN (45);	Obtains the arc tangent of the integer or real number (deg), and returns a real value.
	SQRT	SQUARE ROOT	SQRT (MW–); SQRT (100);	Obtains the square root of the integer or real number, and returns a real value.
	BIN	BCD-TO-BINARY	BIN (MW–);	Converts BCD data to binary data.
	BCD	BINARY-TO-BCD	BCD (MW–);	Converts binary data to BCD data.
	= =	MATCH	IF MW– = = MW–; WHILE MW– = = MW–;	Used in an IF or WHILE conditional expression. If the left side and right side match, the condition is "true."
	< >	MISMATCH	IF MW– < > MW–; WHILE MW– < > MW–;	Used in an IF or WHILE conditional expression. If the left side and right side do not match, the condition is "true."
	>	GREATER THAN	IF MW– > MW–; WHILE MW– > MW–;	Used in an IF or WHILE conditional expression. If the left side is greater than the right side, the condition is "true."
	<	LESS THAN	IF MW– < MW–; WHILE MW– < MW–;	Used in an IF or WHILE conditional expression. If the left side is less than the right side, the condition is "true."
	> =	GREATER THAN OR EQUAL TO	IF MW– >= MW–; WHILE MW– >= MW–;	Used in an IF or WHILE conditional expression. If the left side is greater than or equal to the right side, the condition is "true."
	< =	LESS THAN OR EQUAL TO	IF MW– <= MW–; WHILE MW– <= MW–;	Used in an IF or WHILE conditional expression. If the left side is less than or equal to the right side, the condition is "true."
	SFR	RIGHT SHIFT	SFR MB– N– W–;	Shifts only the designated number of word variables to the right.
	SFL	LEFT SHIFT	SFL MB– N– W–;	Shifts only the designated number of word variables to the left.
	BLK	BLOCK MOVE	BLK MW– MW– W–;	Moves the block (constant designation) beginning with the designated bit (word) variable.
	CLR	CLEAR	CLR MB– W–;	Sets the number of constants specified in the variable group beginning with the designated bit (word) variable to OFF ("0").

(cont'd)

Classification	Command	Name	Programming Format	Function/Meaning
Control Commands	MSEE	SUBROUTINE CALL	MSEE MPS– ;	Executes the MPS- subroutine.
	TIM	DWELL TIME	TIM T–;	Waits for the period of time specified by T, and then proceeds to the next block.
	IOW	I/O WAIT	IOW MB– = = ***;	Stops execution of the motion program until the conditional expression given in the command is satisfied.
	END	PROGRAM END	END;	Ends the motion program.
	RET	SUBROUTINE RETURN	RET;	Ends the subroutine.
	EOX	ONE SCAN WAIT	EOX;	Separates continuous sequence instructions and forces a wait of one scan before continuing execution.

	IF
	ELSE
	IEND
		Branching commands	IF (conditional expression) ;
			(process 1)
			ELSE;
			(process 2)
			IEND;
				Executes process 1 if the conditional expression is satisfied, and executes process 2 if the conditional expression is not satisfied.

	WHILE WEND	Repeat commands	WHILE (conditional expression) ; … WEND;	Repeatedly executes WHILE to WEND processing for as long as the conditional expression is satisfied.
	PFORK JOINTO PJOINT	Parallel execution commands	PFORK label 1, label 2,…; Label 1: Process 1 JOINTO label X Label 2: Process 2 JOINTO label X Label . . Label X: PJOINT;	Executes the blocks designated by the labels in parallel. With a subroutine, a maximum of two labels can be designated. Also, a motion command cannot be used in the block designated by the second label. END and RET cannot be used during parallel execution processing.
	SFORK JOINTO SJOINT	Selective execution commands	SFORK conditional expression 1? label 1, Conditional expression 2? label 2,…; Label 1: Process 1 JOINTO label X Label 2: Process 2 JOINTO label X Label . . Label X: SJOINT;	Executes process 1 if conditional expression 1 is satisfied, and executes process 2 if the conditional expression 2 is satisfied.

2

■ Ladder Instruction List

Table 2.23 lists the ladder instructions.

Table 2.23 Ladder Instructions

Type	Name	Symbol	Description
Program Control Instructions	CHILD DRAWING CALL	SEE	Designate the child drawing number or the grandchild drawing number to be called after SEE. SEE H01
	MOTION PROGRAM CALL	MSEE	Designate the motion program number and the MSEE work register address to be called after MSEE. MSEE MPM001 DA00000
	FOR Structure	FOR : : FEND	Repeats execution statement 1. FOR V = a to b by c V: Can designate any integer register I or J. a, b, c: Can designate an any integer value (b > a > 0, c > 0). FEND: End of FOR instruction.
	WHILE Structure	WHILE : ON/OFF : WEND	Repeats execution statement 2. WEND: End of WHILE-ON/OFF instruction
	IF Structure	IFON/IFOFF : ELSE : IEND	Conditional execution statement IEND: End of IFON/IFOFF instruction
	DRAWING END	DEND	End of drawing (DWG)
	COMMENT	"nnnnnnn"	A character string enclosed in quotation marks is treated as a comment.
	FUNCTION I/F	FSTART	Calls a function.
		FIN	Function input instruction Stores input data from the designated input register in the function input register.
		FOUT	Function output instruction Stores output data from the function output register in the designated output register.
		XCALL	Calls an extension program.
Direct I/O Instructions	INPUT STRAIGHT	INS	INS MA00100 ——○——┤ Executes the input and storage of data with interrupts disabled.
	OUTPUT STRAIGHT	OUTS	OUTS MA00100 ——○——┤ Executes the setting and output of data with interrupts disabled.
Relay Circuit Instruction	NO CONTACT	┤├	No limit in a series circuit. Bit designation of any register as a relay number is possible.
	NC CONTACT	┤/├	No limit in a series circuit. Bit designation of any register as a relay number is possible.

Table 2.23 Ladder Instructions (cont'd)

Type	Name	Symbol	Description
Relay Circuit Instruction (cont'd)	RISING PULSE		No limit in a series circuit. Bit designation of any register as a relay number is possible.
	FALLING PULSE		No limit in a series circuit. Bit designation of any register as a relay number is possible.
	10-MS ON-DELAY TIMER	-[T]-	Set value: Timer register -[T]-
	10-MS OFF-DELAY TIMER	-[T]-	Set value: Timer register Set value = any register or constant (setting unit: 10 ms) Timer register = M or D register
	1-S ON-DELAY TIMER	-[S]-	Set value: Timer register -[S]-
	1-S OFF-DELAY TIMER	-[S]-	Set value = any register or constant (setting unit: 10 ms) Timer register = M or D register
	COIL	-O-	MB000000 ⊢ MW0200 = 0001 —O- MB000000 ⊢ ⊣ ⊢ IFON
	SET COIL	-[S]-	MB000000 MB000010 ⊢ ⊣ ⊢ —[S]- MB000010 turns ON when MB000000 is ON. Then, MB000010 will stay ON if MB000000 turns OFF.
	RESET COIL	-[R]-	MB000020 MB000010 ⊢ ⊣ ⊢ —[R]- MB000010 turns OFF when MB000020 is ON. Then, MB000010 will stay OFF if MB000020 turns OFF.
	Branching/ convergence		A branching or convergence symbol can be connected to any of the above relay instructions.
Logic Operation Instructions	AND	∧	Integer designation of any register or constant is possible.
	OR	∨	Integer designation of any register or constant is possible.
	XOR	⊕	Integer designation of any register or constant is possible.
Numeric Operation Instructions	ADDITION	+	Ordinary numeric addition (with operation error) ⊢ MW00280 + 00100 ⇒ MW00220
	SUBTRACTION	–	Ordinary numeric subtraction (with operation error) ⊢ MW00280 - 00100 ⇒ MW00220
	EXTENDED ADDITION	++	Closed numeric addition (without operation error) 0 → 32767 → -32768 → 0

Table 2.23 Ladder Instructions (cont'd)

Type	Name	Symbol	Description
Numeric Operation Instructions (cont'd)	EXTENDED SUBTRACTION	- -	Closed numeric subtraction (without operation error) 0 → 32768 → -32767 → 0
	INTEGER ENTRY	⊢	Starts an integer operation. ⊢ MW00280 + 00100 ⇒ MW00220
	REAL NUMBER ENTRY	⊩	Starts a real number operation. ⊩ MW00280 + 00100 ⇒ MW00220
	STORE	⇒	Stores the operation result in the designated register.
	MULTIPLICATION	×	For integer and long integers, use × and ÷ in combination.
	DIVISION	÷	
	INCREMENT	INC	Adds 1 to the designated register. INC MW00100
	DECREMENT	DEC	Subtracts 1 from the designated register. DEC MW00100
	MOD	MOD	Gets the remainder of the division result. ⊢ MW00100 × 00100 ÷ 00121 MOD ⇒ MW00101
	REM	REM	Gets the remainder of the division result. MF00200 REM 1.5 ⇒ MF00202
	ADD TIME	TMADD	Addition of hours, minutes, and seconds TMADD MW00000, MW00100
	SUBTRACT TIME	TMSUB	Subtraction of hours, minutes, and seconds TMSUB MW00000, MW00100
	SPEND TIME	SPEND	Calculates the elapsed time between two times. SPEND MW00000, MW00100
Numeric Conversion Instructions	SIGN INVERSION	INV	⊢ MW00100 INV If MW00100 = 99, the operation result = -99.
	1'S COMPLEMENT	COM	⊢ MW00100 COM If MW00100 = FFFFH, the operation result = 0000H.
	ABSOLUTE VALUE CONVERSION	ABS	⊢ MW00100 ABS If MW00100 = -99, the operation result = 99.
	BINARY CONVERSION	BIN	⊢ MW00100 BIN If MW00100 = 1234H (hexadecimal), the operation result = 1234 (decimal).
	BCD CONVERSION	BCD	⊢ MW00100 BCD If MW00100 = 1234 (decimal), the operation result = 1234H (hexadecimal).
	PARITY CONVERSION	PARITY	Calculates the number of binary bits that are ON. If MW00100 = F0F0H, the operation result = 8.
	ASCII CONVERSION 1	ASCII	The designated character string is converted to ASCII code and substituted in the register. MW00200 "ABCDEFG"

Table 2.23 Ladder Instructions (cont'd)

Type	Name	Symbol	Description
Numeric Conversion Instructions (cont'd)	ASCII CONVERSION 2	BINASC	Converts 16-bit binary data to 4-digit hexadecimal ASCII code. BINASC MW00100
	ASCII CONVERSION 3	ASCBIN	Converts the numeric value indicated by a 4-digit hexadecimal ASCII code to 16-bit binary data. ASCBIN MW00100
Numeric Comparison Instructions	<	<	MB000010 ├MW00000 < 10000 ——○┤ MB000010 ├┤├—— IFON
	≦	≦	
	=	=	
	≠	≠	
	≧	≧	
	>	>	
	RANGE CHECK	RCHK	Checks whether or not the value in the A register is in range. ├ MW00100 RCHK -1000, 1000
Data Operation Instructions	BIT ROTATION RIGHT	ROTR	Bit-addr Count Width ROTR MB00100A → N = 1 W = 20
	MOVE BITS	MOVB	Source Desti. Width MOVB MB00100A → MB00200A W = 20
	MOVE WORD	MOVW	Source Desti. Width MOVW MB00100 → MB00200 W = 20
	EXCHANGE	XCHG	Source1 Source2 Width XCHG MB00100 →MB00200 W = 20
	SET WORDS	SETW	Desti. Data Width SETW MW00200 D = 00000 W = 20
	BYTE-TO-WORD EXPANSION	BEXTD	Expands the byte data stored in the word registers into words. BEXTD MW00100 to MW00200 B = 10
	WORD-TO-BYTE COMPRESSION	BPRESS	Collects the lower bytes of the word data stored in the word register area. BPRESS MW00100 to MW00200 B = 10
	BINARY SEARCH	BSRCH	Retrieves the register position that matches the data within the designated register range. BSRCH MW00000 W = 20 D = 100 R = MW00100
	SORT	SORT	Sorts registers within the designated register range. SORT MW00000 W = 100
	BIT SHIFT LEFT	SHFTL	Shifts the designated bit strings to the left. SHFTL MB00100A N = 1 W = 20
	BIT SHIFT RIGHT	SHFTR	Shifts the designated bit strings to the right. SHFTR MB00100A N = 1 W = 2
	COPY WORD	COPYW	Copies the designated register range. COPYW MW00100 → MW00200 W = 20
	BYTE SWAP	BSWAP	The upper and lower bytes of the designated word are swapped. BSWAP MW00100

Table 2.23 Ladder Instructions (cont'd)

Type	Name	Symbol	Description
Basic Function Instructions	SQUARE ROOT	SQRT	Taking the square root of a negative number will result in the square root of the absolute value multiplied by -1. ‖⊢ MF00100 SQRT
	SINE	SIN	Input = degrees ‖⊢ MF00100 SIN
	COSINE	COS	Input = degrees ‖⊢ MF00100 COS
	TANGENT	TAN	Input = degrees ‖⊢ MF00100 TAN
	ARC SINE	ASIN	‖⊢ MF00100 ASIN
	ARC COSINE	ACOS	‖⊢ MF00100 ACOS
	ARC TANGENT	ATAN	‖⊢ MF00100 ATAN
	EXPONENT	EXP	‖⊢ MF00100 EXP e MF00100
	NATURAL LOGARITHM	LN	‖⊢ MF00100 LN $\log_e$ (FM00100)
	COMMON LOGARITHM	LOG	‖⊢ MF00100 LOG $\log_{10}$ (FM00100)
DDC Instructions	DEAD ZONE A	DZA	⊢ MW00100 DZA 00100
	DEAD ZONE B	DZB	⊢ MW00100 DZB 00100
	UPPER LIMIT	LIMIT	⊢ MW00100 LIMIT -00100 00100
	PI CONTROL	PI	⊢ MW00100 PI MA00200
	PD CONTROL	PD	⊢ MW00100 PD MA00200
	PID CONTROL	PID	⊢ MW00100 PID MA00200
	FIRST-ORDER LAG	LAG	⊢ MW00100 LAG MA00200
	PHASE LEAD/LAG	LLAG	⊢ MW00100 LLAG MA00200
	FUNCTION GENERATOR	FGN	⊢ MW00100 FGN MA00200
	INVERSE FUNCTION GENERATOR	IFGN	⊢ MW00100 IFGN MA00200
	LINEAR A CCELERATOR/ DECELERATOR 1	LAU	⊢ MW00100 LAU MA00200
	LINEAR ACCELERATOR/ DECELERATOR 2	SLAU	⊢ MW00100 SLAU MA00200
	PULSE WIDTH MODULATION	PWM	⊢ MW00100 PWM MA00200

Table 2.23 Ladder Instructions (cont'd)

Type	Name	Symbol	Description
Table Data Operation Instructions	TABLE READ	TBLBR	TBLBR TBL1, MA00000, MA00100
	TABLE WRITE	TBLBW	TBLBW TBL1, MA00000, MA00100
	ROW SEARCH	TBLSRL	TBLSRL TBL1, MA00000, MA00100
	COLUMN SEARCH	TBLSRC	TBLSRC TBL1, MA00000, MA00100
	TABLE CLEAR	TBLCL	TBLCL TBL1, MA00000
	TABLE BLOCK MOVE	TBLMV	TBLMV TBL1, TBL2, MA00000
	QUEUE TABLE READ	QTBLR	QTBLR TBL1, MA00000, MA00100
	QUEUE TABLE READ AND INCREMENT	QTBLRI	QTBLRI TBL1, MA00000, MA00100
	QUEUE TABLE WRITE	QTBLW	QTBLW TBL1, MA00000, MA00100
	QUEUE TABLE WRITE AND INCREMENT	QTBLWI	QTBLWI TBL1, MA00000, MA00100
	QUEUE POINTER CLEAR	QTBLCL	QTBLCL TBL1
Standard System Functions	COUNTER	COUNTER	Increments or decrements a counter.
	FIRST-IN FIRST-OUT	FINFOUT	First-in, first-out
	TRACE	TRACE	Data trace execution control
	DATA TRACE READ	DTRC-RD	Data readout from data trace memory to user memory
	FAILURE TRACE READOUT	FTRC-RD	Data readout from failure trace memory to user memory
	INVERTER TRACE READ	ITRC-RD	Reads inverter trace data to store it in user memory.
	SEND MESSAGE	MSG-SND	Sending a message from a Communications Module
	RECEIVE MESSAGE	MSG-RCV	Receiving a message from a Communications Module
	INVERTER CONSTANT WRITE	ICNS-WR	Writes 215IF-, 216IF-connnected inverter constants.
	INVERTER CONSTANT READ	ICNS-RD	Reads 215IF-, 216IF-connnected inverter constants to register.

■ Program Development Support Tool Function Specifications

Table 2.24 lists the program development support tool specifications.

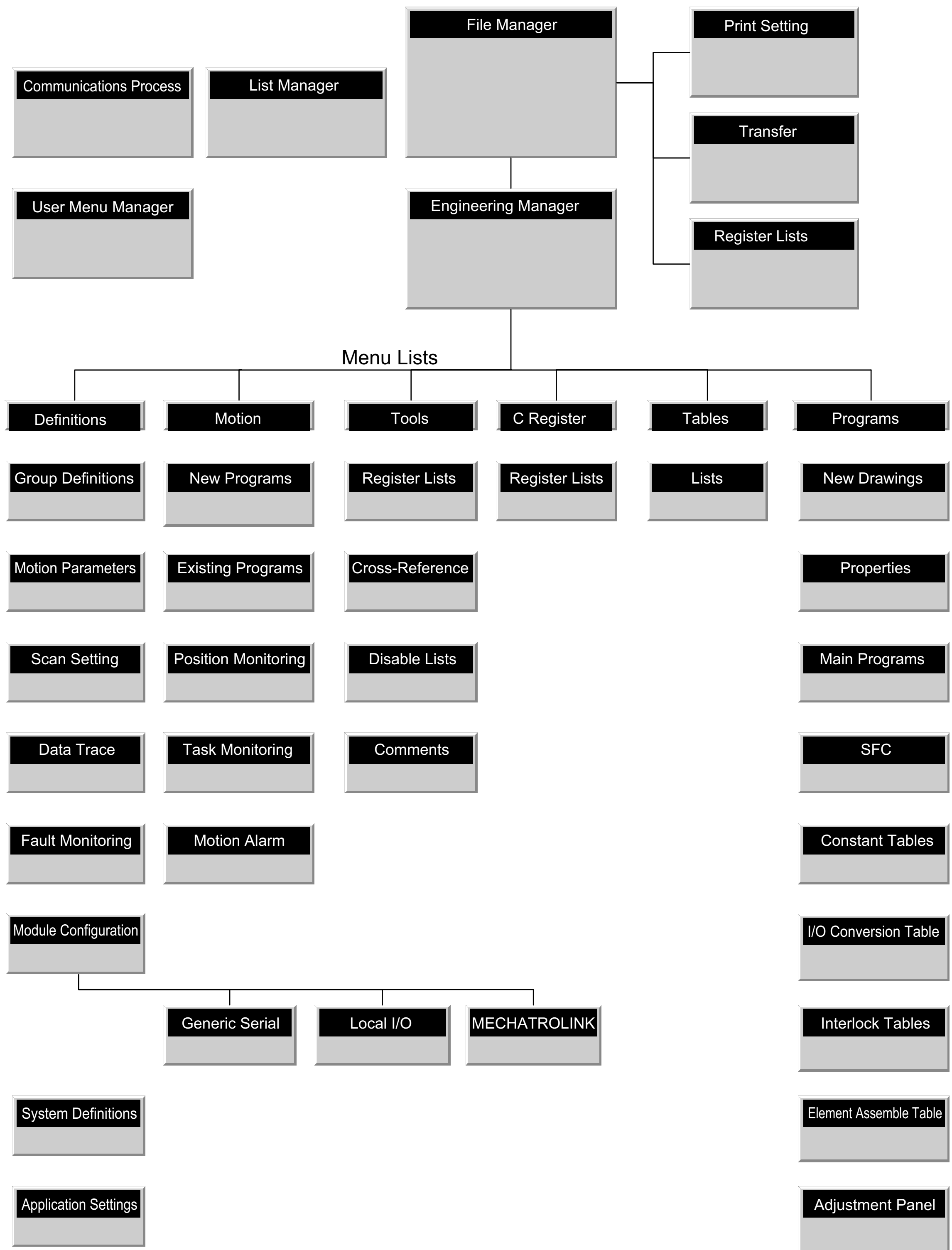
Table 2.24 Program Development Support Tool Specifications

Item		Specifications
Basic Hardware	Model	DOS/V *1 Pentium 200 MHz or better, or equivalent *2
	Main Storage	64 Mbytes min. (128 Mbytes recommended) *3
	Display Resolution	800 × 600 min.
	HDD	200 Mbytes min. of unused capacity is required. *4
	Pointing Device	PS/2 interface
Basic Software	Operating System	Windows 95, Windows 98, Windows NT 4.0
Printer		Windows 95-compatible
Functions	File Manager	Folder management, user management, file transfer, command execution
	Engineering Manager	Command execution Definition setting Ladder logic programs Tools C registers Table data definition Motion programs
	User Menu Manager	Shortcuts
	Communications Process	Communications environment setup
	List Manager	Print monitoring
	Register Lists	Register displays

* 1. NEC9800-series personal computer can be used, however, communications with a Machine Controller is limited to RS-232C. The high-speed communications board 215IF is not supported.
* 2. Intel CPU or equivalent
* 3. Increase the memory capacity if running two or more application programs simultaneously. Otherwise, the performance will be lowered by frequent use of memory resource.
* 4. Includes the space required for normal operation after installation.

■ Tree Structure of Program Development Support Tool

The following illustration shows the tree structure of the program development support tool.



2.2 Basic System Configuration

This section gives an overview of the system configuration used by the MP920, together with the various devices in this configuration.

2.2.1 List of Basic Modules

Table 2.25 to *Table 2.27* list the Modules and other devices required in a system using the MP920.

Table 2.25 List of Basic Modules

Group	Name	Model	Description	Slots Used	Outline
Power Supply Modules	DC Power Supply Module	JEPMC-PS200	PS-03	Dedicated	24-VDC Input Power Supply Module
	AC Power Supply Module	JEPMC-PS210	PS-01	Dedicated	100/200-VAC Input Power Supply Module
CPU Modules	CPU Module	JEPMC-CP200	CPU-01	2	CPU Module (2MB) for the MP920
	CPU Module	JEPMC-CP210	CPU-02	2	CPU Module (4 MB) for the MP920
I/O Modules	Input Module	JEPMC-IO200	DI-01	1	64-point Input Module
	Output Module	JEPMC-IO210	DO-01	1	64-point Output Module
	I/O Module	JEPMC-IO220	LIO-01	1	32-point Input/32-point Output Module
	Pulse Input Module	JEPMC-PL200	CNTR-01	1	4-channel Pulse Input Module
Analog Modules	Analog Input Module	JEPMC-AN200	AI-01	1	4-channel Analog Input Module
	Analog Output Module	JEPMC-AN210	AO-01	1	4-channel Analog Output Module
Motion Modules	4-axis Servo Module	JEPMC-MC200A	SVA-01A	2	4-axis Servo Module for analog output
	2-axis Servo Module	JEPMC-MC220A	SVA-02A	1	2-axis Servo Module for analog output
	MECHATROLINK Interface Servo Module	JEPMC-MC210	SVB-01	1	MECHATROLINK Interface Servo Module (14 axes max.)
	Pulse Output Module	JEPMC-PL210	PO-01	1	4-channel Pulse Output Module
Communi-cations Modules	Communications Module	JEPMC-CM210A	218IFA	1	Ethernet Communications Module
	Communications Module	JEPMC-CM200	217IF	1	RS-232C/RS-422A Communications Module
	Communications Module	JEPMC-CM220	215IF	1	215IF Communications Module
	Communications Module	JEPMC-CM230	260IF	1	DeviceNet Communications Module
Expansion Modules	Expansion Interface Module	JEPMC-EX200	EXIOIF	1	System Bus Expansion Interface Module
	Long Mounting Base	JEPMC-MB200	MB-01	–	Long Mounting Base (power supply + 9 slots)
	Short Mounting Base	JEPMC-MP210	MB-02	–	Short Mounting Base (power supply + 6 slots)

Table 2.26 List of SERVOPACKs

Model	Name	SVA-01A	SVA-02A	SVB-01
SGDA-□□□S	SGDA SERVOPACKs	YES	YES	NO
SGDB-□□AD□	SGDB SERVOPACKs	YES	YES	NO
SGDM-□□D	SGDM SERVOPACKs	YES	YES	NO
SGDS-□□	SGDS SERVOPACKs	YES	YES	NO
SGD-□□N	MECHATROLINK-compatible SGDA SERVOPACKs	NO	NO	YES
SGDB-□AN	MECHATROLINK-compatible SGDB SERVOPACKs	NO	NO	YES
SGDH + NS100	MECHATROLINK-compatible SGDH SERVOPACKs	NO	NO	YES

Use the cables listed below for the system with MP920 Modules.

Table 2.27 List of Cables

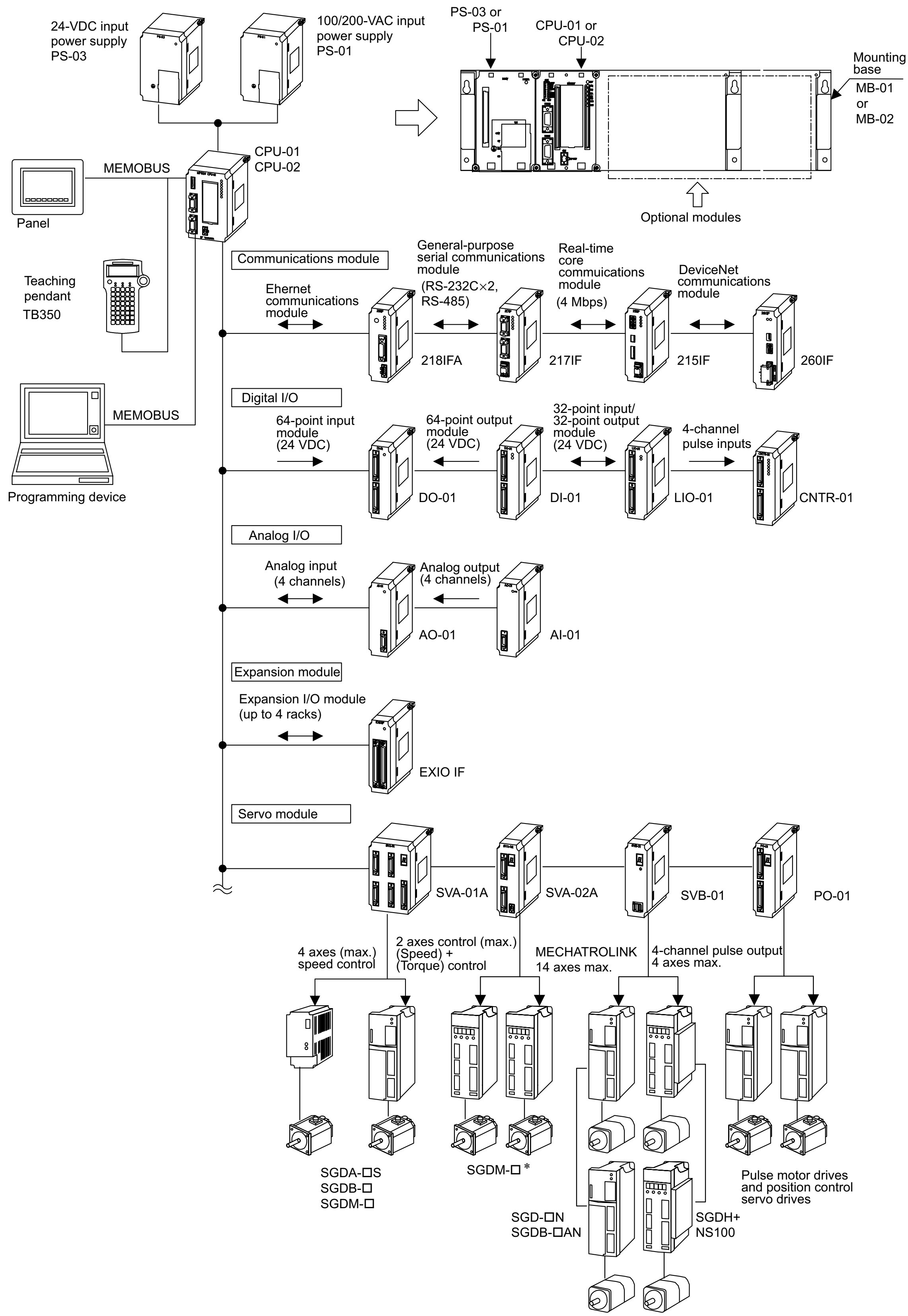
Module	Connector Name	Type	Model	Length	Specifications
CPU-01 CPU-02	PORT1 or PORT2	RS-232C communications port	JEPMC-W5310-03	2.5 m	MEMOBUS 9-pin ⇔ 25-pin male D-sub connector
			JEPMC-W5310-15	15 m	
			JEPMC-W5311-03	2.5 m	MEMOBUS ⇔ DOS (9-pin ⇔ 9-pin)
			JEPMC-W5311-15	15 m	
DI-01	CN1 or CN2	External inputs	JEPMC-W6060-□□	–	DI-01 ⇔ External input
DO-01	CN1 or CN2	External outputs	JEPMC-W6060-□□	–	DO-01 ⇔ External output
LIO-01	CN1 or CN2	External I/O	JEPMC-W6060-□□	–	LIO-01 ⇔ External I/O
CNTR-01	CN1 or CN2	Counter input	JEPMC-W6060-□□	–	CNTR-01 ⇔ External device
AI-01	CN1	Analog inputs	JEPMC-W6080-05	0.5 m	AI-01 ⇔ External device (26-pin)
			JEPMC-W6080-10	1.0 m	
			JEPMC-W6080-30	3.0 m	
AO-01	CN1	Analog outputs	JEPMC-W6090-05	0.5 m	AO-01 ⇔ External device (20-pin)
SVA-01A	CN1 to CN4	Analog Servo interface (SGDA)	JEPMC-W6040-05	0.5 m	SVA-01A ⇔ SGDA
			JEPMC-W6040-10	1.0 m	
			JEPMC-W6040-30	3.0 m	
		Analog Servo interface (SGDB)	JEPMC-W6050-05	0.5 m	SVA-01A ⇔ SGDB, SGM
			JEPMC-W6050-10	1.0 m	
			JEPMC-W6050-30	3.0 m	
	CN5	External I/O	JEPMC-W6060-05	0.5 m	SVA-01A ⇔ External I/O
			JEPMC-W6060-10	1.0 m	
			JEPMC-W6060-30	3.0 m	

Table 2.27 List of Cables (cont'd)

Module	Connector Name	Type	Model	Length	Specifications
SVA-02A	CN1 or CN2	Analog Servo interface (SGDA)	JEPMC-W6070-05	0.5 m	SVA-02A ⇔ SGDA
			JEPMC-W6070-10	1.0 m	
			JEPMC-W6070-30	3.0 m	
		Analog Servo interface (SGDB)	JEPMC-W6071-05	0.5 m	SVA-02A ⇔ SGDB, SGDM
			JEPMC-W6071-10	1.0 m	
			JEPMC-W6071-30	3.0 m	
SVB-01	CN1	MECHATROLINK interface	JEPMC-W6000-A3	0.3 m	USB ⇔ USB
			JEPMC-W6010-01	1.0 m	USB ⇔ Loose wires
			JEPMC-W6010-03	3.0 m	
			JEPMC-W6010-05	5.0 m	
			JEPMC-W6010-07	7.0 m	
			JEPMC-W6010-10	10.0 m	
			JEPMC-W6010-15	15.0 m	
			JEPMC-W6010-20	20.0 m	
			JEPMC-W6010-30	30.0 m	
			JEPMC-W6010-40	40.0 m	
			JEPMC-W6010-50	50.0 m	
			JEPMC-W6020	–	Terminator
PO-01	CN1 or CN2	Pulse output	JEPMC-W6060-□□	–	PO-01 ⇔ Pulse driver
218IFA	CN1	Ethernet communications port	None	–	
217IF	CN1, CN2, or CN3	RS-232C, RS-485	None	–	
215IF	CN1	215 communications port	None	–	
260IF	CN1	DeviceNet connector	None	–	
EXIOIF	CN1 or CN2	Rack-to-Rack connection	JEPMC-W6130-A5	0.5 m	EXIO ⇔ EXIO
			JEPMC-W6130-01	1.0 m	

Note: Standard JEPMC-W6060-05, JEPMC-W6060-10, and JEPMC-W6060-30 Cables (with connector at one end only) are used to connect SVA-01A Modules (CN5), DI-01 Modules, DO-01 Modules, LIO-01 Modules, CNTR-01 Modules, and PO-01 Modules. There are many cables that use the same connectors. To avoid connecting cables incorrectly, distinguish the cables using color tape or by placing labels on the connectors.

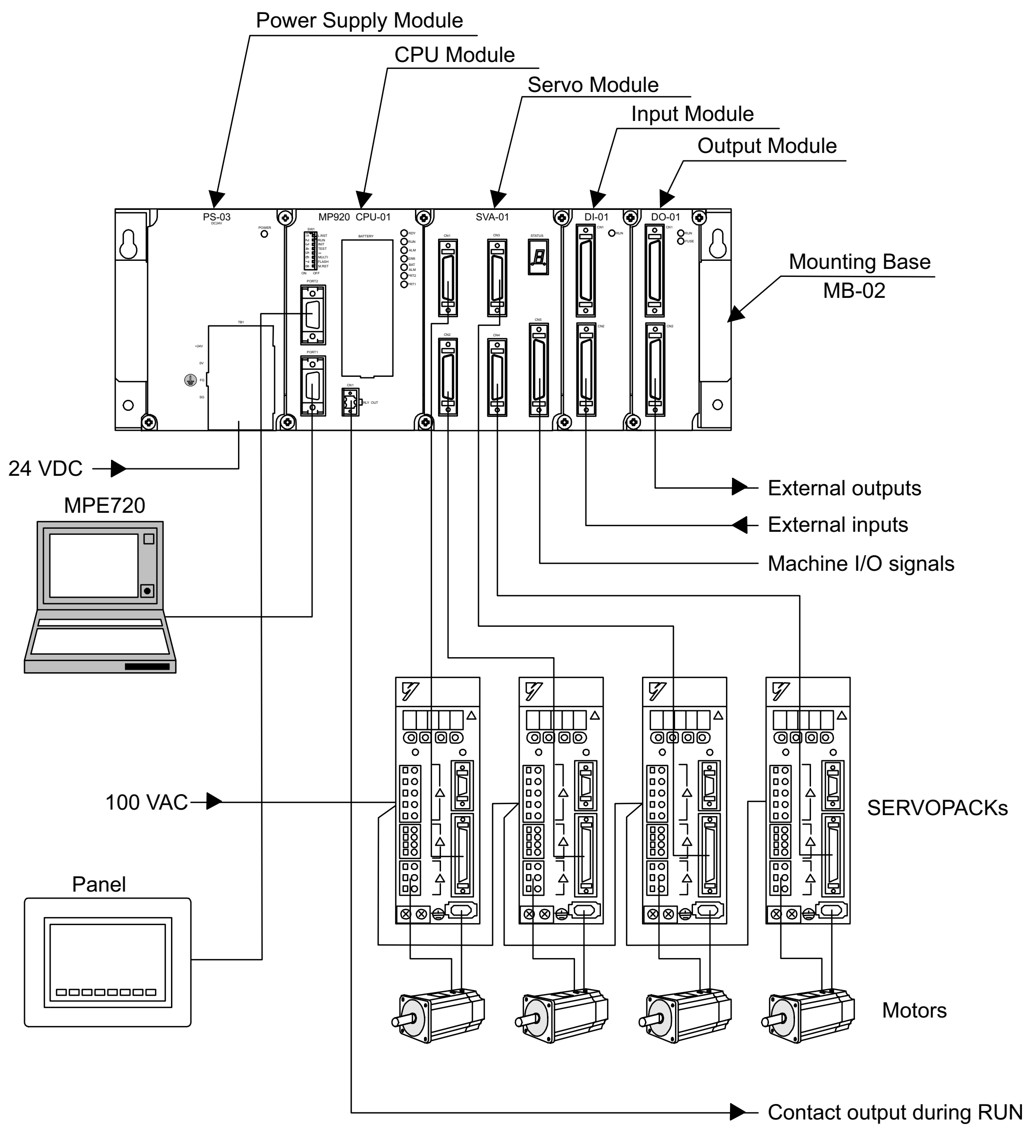
2.2.2 Overall Configuration



* For connection with Σ-II series servomotors, refer to *A.6 Connection between Σ-II Series SERVOPACKs and MP920 Modules*.

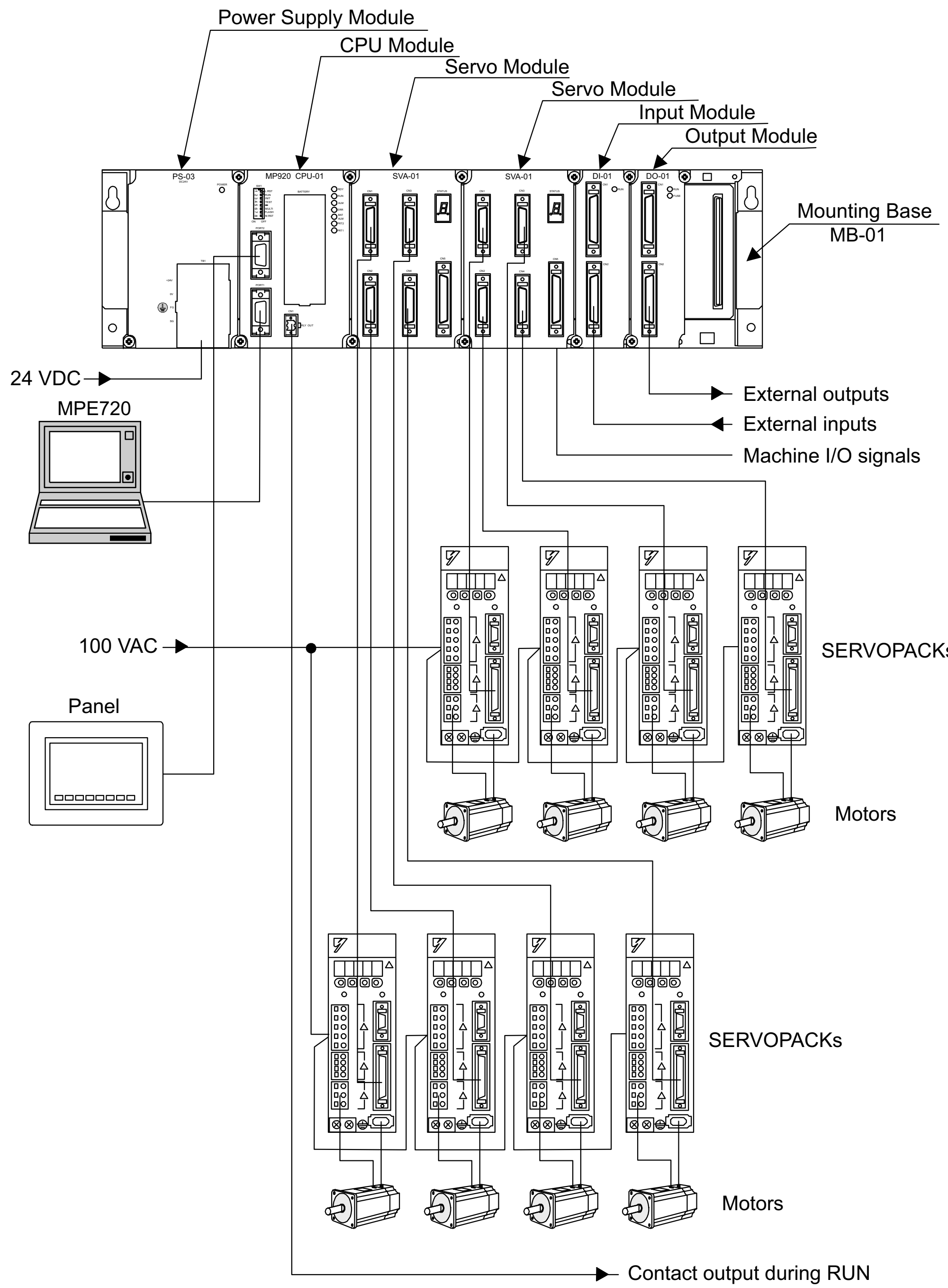
■ Four-axis System Configuration Example

Up to four axes can be controlled using SVA-01A, DI-01, and DO-01 Modules. Up to 128 I/O points, 64 input points, and 64 output points can be used. The following illustration shows a 4-axis system configuration example.



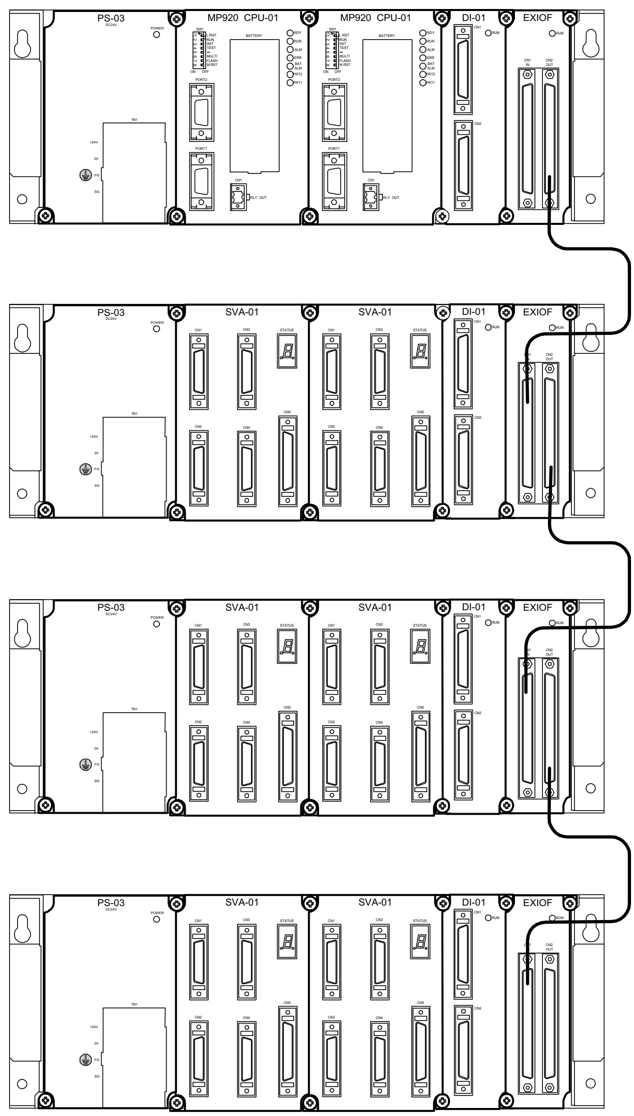
■ Eight-axis System Configuration Example

Up to eight axes can be controlled using two SVA-01A, one DI-01, and one DO-01 Modules. Up to 128 I/O points, 64 input points, and 64 output points can be used. The following illustration shows an 8-axis system configuration example.



■ Example of Maximum Configuration Using Short Mounting Bases (MB-02)

Up to four racks can be used for the Mounting Base by using EXIOF Expansion Modules. The following illustration shows an example of maximum configuration using Short Mounting Bases.



System Configuration

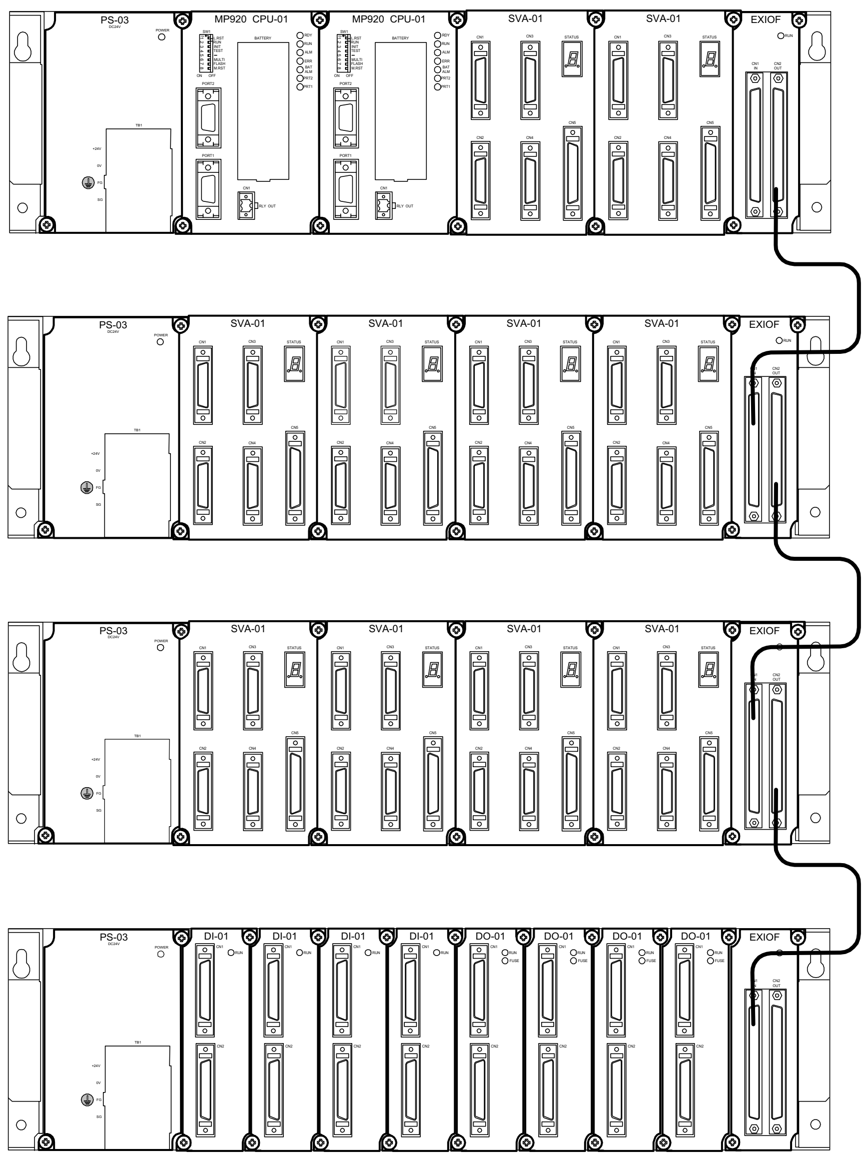
- PS-03 × 4
- CPU-01 × 2
- SVA-01A × 6 (24 axes)
- DI-01 × 2 (128 points)
- DO-01 × 2 (128 points)
- EXIOIF × 4

IMPORTANT

1. Cable length between racks: 1 m max.
2. Total cable length when connecting 4 racks: 3 m max.

■ Example of Maximum Configuration Using Long Mounting Bases (MB-01)

Up to four racks can be used for the Mounting Base by using EXIOF Expansion Modules. The following illustration shows an example of maximum configuration using Long Mounting Bases.

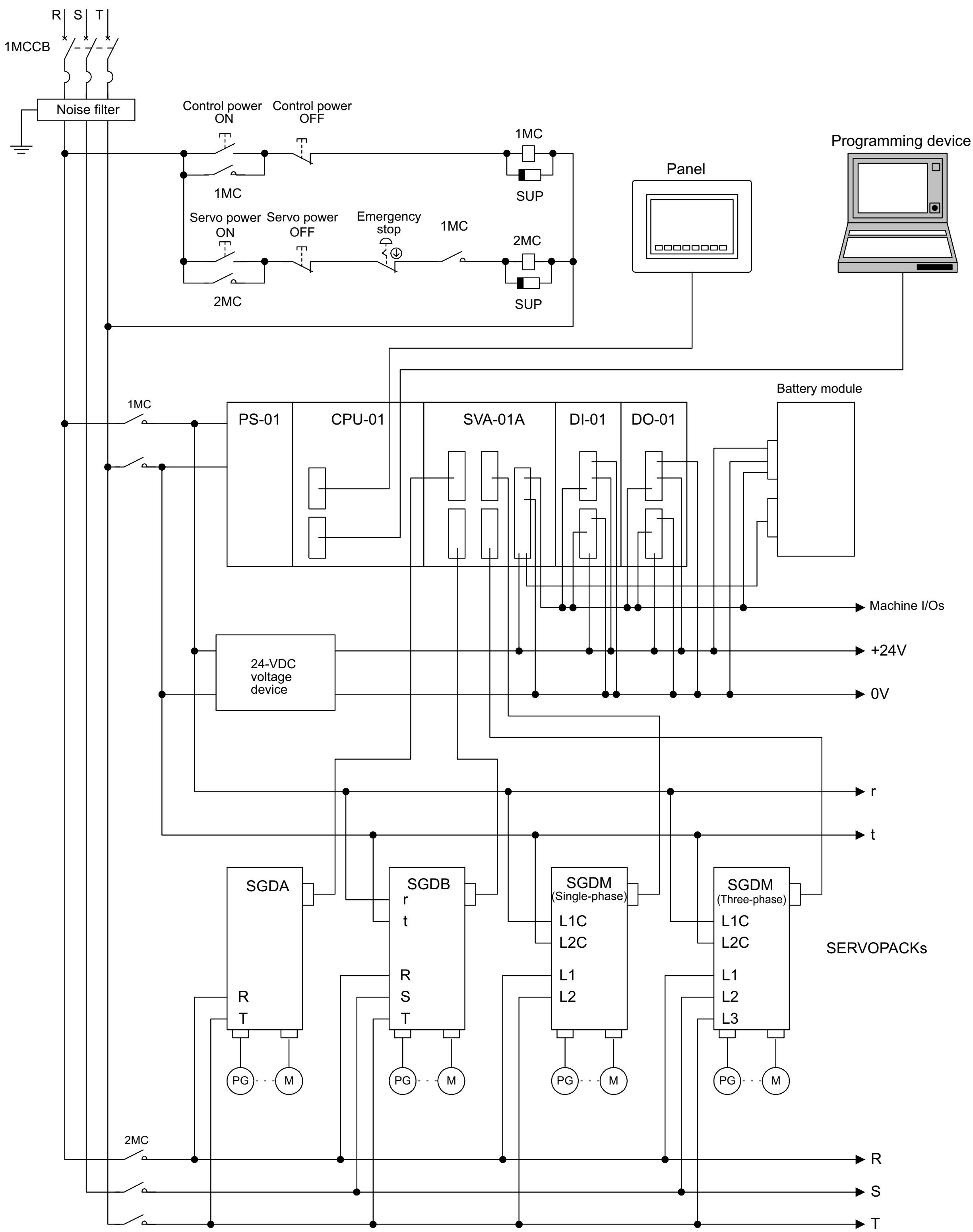


System Configuration

- PS-03 × 4
- CPU-01 × 2
- SVA-01A × 10 (40 axes)
- DI-01 × 4 (256 points)
- DO-01 × 4 (256 points)
- EXIOIF × 4

■ MP920 System Connection Example

The following diagram shows a connection example for an MP920 system using a Servomotor with an absolute encoder.



3

Basic System Operation

This chapter explains the basic operation of the MP920 system.

3.1 Operating Modes

This section explains the online operating mode and the offline stop mode, both of which indicate the MP920 operating status.

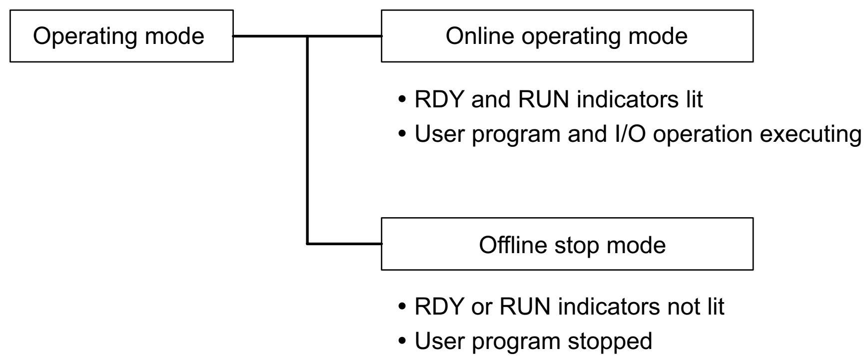


Fig. 3.1 MP920 Operating Modes

3.1.1 Online Operating Mode

When the power for the MP920 is turned ON, the RDY and RUN indicators will light (the ERR and ALM indicators will not light) and the Module will enter the online operating mode. This means that the user program and I/O operations are being executed in the MP920 without any errors or failures. If an alarm does occur, such as for an I/O conversion error or a user calculation error, the execution of the user program will not stop, and the online operating mode will be maintained. The ALM indicator lights to indicate the occurrence of an error. For details on the error content and the action to be taken, see *Chapter12 Troubleshooting*.

3.1.2 Offline Stop Mode

The execution of the user program is stopped, and all outputs are reset (i.e., “0” is output for all digital outputs). The RUN or RDY indicator will go OFF to indicate the status. Drawings (DWG.H and DWG.L) are not executed in this status.

The Controller will be in the offline stop mode in the following four cases:

1. When the program memory has not been initialized
2. When a serious failure, such as watchdog timer error, has occurred
3. When a STOP operation has been performed from the MPE720
4. When the RUN/STOP switch has been set to OFF (STOP) and the power has been turned ON

Note: The above cases 1, 2, and 3 apply when a user program error occurs, or when there is hardware fault in the MP920. For details on the error contents and the actions to be taken, see *Chapter12 Troubleshooting*.

3.2 Start and Stop Sequences

This section explains the start and stop sequences of the MP920. The methods of setting the DIP switch, the types of self-diagnosis, and the indicator patterns are also explained.

3.2.1 DIP Switch Settings

The DIP switch on the CPU Module are used to control start and stop sequences. As shown in the figure below, there are eight pins on the DIP switch on the CPU Module. *Table 3.1* shows the function of each pin.

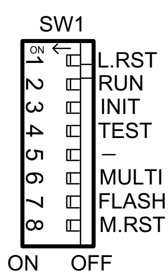
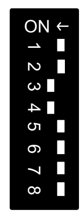
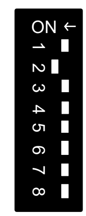


Table 3.1 DIP Switch Pin Functions

Pin	Name	Setting	Function	Default Setting
1	L.RST	ON	Local reset	OFF
		OFF	Online	
2	RUN	ON	User program operating	ON
		OFF	User program stopped	
3	INITIAL	ON	Pin 4 ON: Memory clear	OFF
		OFF	Pin 4 ON: Setting disabled	
4	TEST	ON	Terminal mode/initialization mode	OFF
		OFF	Online	
5	PP Default	ON	Defaults for port 1 only	OFF
		OFF	Use memory settings	
6	MULTI	ON	Multiple CPU configuration	OFF
		OFF	Single CPU configuration	
7	FLASH	ON	Copy program data from flash memory to RAM	OFF
		OFF	Do not copy program data from flash memory to RAM	
8	M.RST	ON	Master reset	OFF
		OFF	Online	

Memory Initialization

When the DIP switch is set according to the following procedure and the power is turned ON and OFF, memory will be initialized, and the user programs and definition data will be deleted.

①	②	③	④	⑤
Turn OFF the MP920 power.	Turn ON DIP switch pins 3 and 4. 	Turn ON the power, and check that the RDY and RUN indicators flash (about 3 seconds).	Turn OFF the power, and return the DIP switch pins to their original settings. 	Turn ON the power again.

Always initialize memory if you remove the battery when the Module power supply is turned OFF.

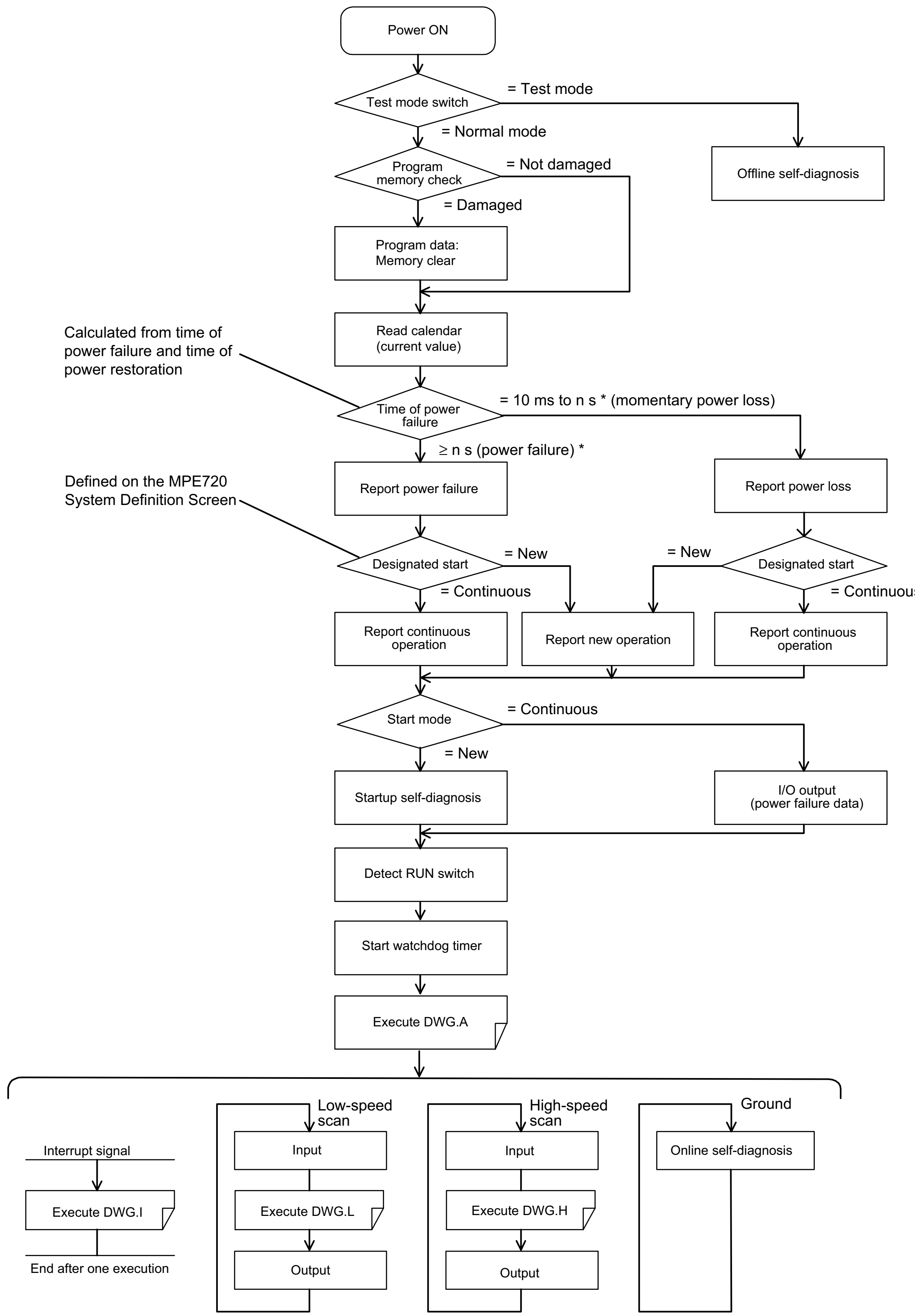
3.2.2 Start Sequence

The MP920 makes a number of determinations at startup. If an error is detected, the ERR indicator will flash and the error content will be indicated by the number of times the indicator flashes. When the indicator is flashing, the MPE720 cannot be operated. For details on the error content and the action to be taken, see *Chapter12 Troubleshooting*. *Table 3.2* shows the MP920 indicators.

Table 3.2 Indicators and Indicator Patterns

Type	Indicator					Meaning
	RDY	RUN	ALM	ERR	BAT ALM	
Normal	Not lit	Not iit	Lit	Lit	Not lit	Hardware reset status (while display is continuing)
	Not lit	Not lit	Not lit	Not lit	Not lit	Initializing (while display is continuing)
	Lit	Not lit	Not lit	Not lit	Not lit	User program stopped
	Lit	Lit	Not lit	Not lit	Not lit	User program executing normally
Error	Not lit	Lit	Not lit	Lit	Not lit	A serious failure has occurred.
	Not lit	Not lit	Not lit	Flashing	Not lit	Flashing twice: RAM diagnosis error Flashing three times: ROM diagnosis error Flashing four times: Peripheral LSI error
Alarm	–	–	–	–	Lit	Battery alarm
	Lit	Lit	Lit	Not lit	Not lit	Operation error I/O error
	Reported to the system (S) register (no indicator display)					Hardware status (power interruption, RUN/STOP, Test Mode, etc.)
Other	Flashing	Flashing	Not lit	Not lit	Not lit	Memory initialization has been completed for the DIP switch settings.
	RDY and RUN flash repeatedly at the same time.					
	Not lit	Not lit	Lit	Not lit	Not lit	Offline test mode

■ MP920 Start Sequence and Basic Operation



* The time for momentary power loss is defined on the MPE720 System Definition Window.

The MP920 start sequence and basic operations are as follows:

1. Startup Self-diagnosis

   The following operations are provided for startup self-diagnosis:

   - Memory (RAM) read/write diagnosis
   - System program (ROM) diagnosis
   - Main processor (CPU) function diagnosis
   - Numeric co-processor (FCPU) function diagnosis

   If an error occurs in the diagnostic result, the RDY indicator will flash the specified number of times.

2. Online Self-diagnosis

   The following operations are provided for online self-diagnosis:

   - System program (ROM) diagnosis
   - Main processor (CPU) function diagnosis
   - Numeric co-processor (FCPU) function diagnosis

   If an error occurs in the diagnostic result, the RDY indicator will flash the specified number of times.

3. New Operation Start

   Set the operation method for “New Operation” on the MPE720 System Definition Window. When the system is next started, the new operation will be used to start. Unlike a continuous operation start, self-diagnostic processing is performed before DWG.A is executed.

4. Continuous Operation Start

   a) Set the operation method for “Continuous Operation” on the MPE720 System Definition Window. When the system is next started, the continuous operation will be used to start. Unlike a new operation start, no self-diagnostic processing is performed. Therefore, the startup time for drawing execution is shortened.

   b) If the RUN switch is ON (RUN) or if it turns ON (RUN) from OFF (STOP), the CPU starts the watchdog timer and then executes DWG.A.

   c) Once the execution of DWG.A has been completed, the scan is started. The initial scan is executed only after the time for the high-speed or low-speed scan has elapsed following the completion of DWG.A. System inputs and outputs are executed from the first scan.

5. Operation Stop

   The MP920 stops operating in the following cases:

   a) When the power supply is interrupted (see * 1.)

   b) When a power failure has occurred (see * 1.)

   c) When a fatal error has occurred (see * 2.)

   d) When a STOP operation has been performed from the MPE720 (see * 3.)

   * 1. The MP920 can be restarted only by turning ON the power again.
   * 2. Restart the system by turning the power OFF and ON. The cause of the error can be ascertained by the indicator status.
   * 3. Restart the system by performing a RUN operation from the MPE720.

3.3 Power Failures

This section explains the processing when an MP920 power failure occurs.

3.3.1 Power Failure Detection

Table 3.3 shows the start methods used when an MP920 power failure occurs.

The MP920 can select two types of startup: Continuous operation and new operation. The selection of continuous operation or new operation is made on the MPE720 System Definition Window.

For details on the MPE720 operation method, refer to the *Machine Controller MP900/ MP2000 Series MPE720 Software for Programming Device User's Manual* (SIEPC8807005).

3

Table 3.3 MP920 Start Modes

Length of Power Failure	Continuous Operation/ New Operation	Start Method
0 to 20 ms	–	Operations continue.
20 ms to Ns* (Power loss)	When continuous operation is selected	After the CPU is reset, no self-diagnosis is performed, and operations continue.
	When new operation is selected	After the CPU is reset, self-diagnosis is performed, and the new operation starts.
Ns* or more	When continuous operation is selected	After the CPU is reset, no self-diagnosis is performed, and operations continue.
	When new operation is selected	After the CPU is reset, self-diagnosis is performed, and the new operation starts.

* Ns (power loss decision time) is defined on the MPE720 System Definition Window.

3.4 User Programs

This section explains the basic operation of the MP920, such as the types of user program, the priority levels, and the execution processing methods.

3.4.1 Drawings (DWGs)

User programs are managed in units of programming called drawings. Each drawing is identified by a drawing number (DWG No.). These drawings serve as the basis of user programs.

The drawings include parent drawings, child drawings, grandchild drawings, and operation error drawings. Besides the drawings, there are functions that can be freely called from each drawing, and motion programs that can be called only from H drawings.

- Parent Drawings

  Parent drawings are executed automatically by the system program when the execution condition is established. See *Table 3.4* for execution conditions.
- Child Drawings

  Child drawings are executed by being called from a parent drawing using the SEE command.
- Grandchild Drawings

  Grandchild drawings are executed by being called from a child drawing using the SEE instruction.
- Operation Error Drawings

  Operation error drawings are executed automatically by the system program when an operation error occurs.
- Functions

  Functions are executed by being called from a parent, child, or grandchild drawing using the FSTART instruction.
- Motion Programs

  Motion programs can be called only from H drawings. They can be executed by being called from a parent, child, or grandchild drawing using the MSEE instruction.

Types and Priority Levels of Parent Drawings

Parent drawings are classified by the first character of the drawing number (A, I, H, L) according to the purpose of the process. The priority levels and execution conditions are as shown in *Table 3.4*.

Table 3.4 Types and Priority Levels of Parent Drawings

Type of Parent Drawing	Role of Drawing	Priority Level	Execution Condition	Number of Drawings
DWG.A	Startup process	1	Started when power is turned ON (executed once only when the power is turned ON)	64
DWG.I	Interrupt process	2	Executed by external interrupts, such as Optional Module DI interrupts or counter interrupts.	64
DWG.H	High-speed scan process	3	Started at a fixed interval (executed during each high-speed scan)	200
DWG.L	Low-speed scan process	4	Started at a fixed interval (executed during each low-speed scan)	500

Table 3.5 gives details of the number of drawings for each type of drawing.

Table 3.5 Details of Drawings

Drawing	Number of Drawings			
	DWG.A	DWG.I	DWG.H	DWG.L
Parent Drawing	1 (A)	1 (I)	1 (H)	1 (L)
Operation Error Drawing	1 (A00)	1 (I00)	1 (H00)	1 (L00)
Child Drawings	Maximum total of 62 drawings	Maximum total of 62 drawings	Maximum total of 198 drawings	Maximum total of 498 drawings
Grandchild Drawings				

3.4.2 Execution Control of Parent Drawings

Each drawing is executed based on its priority level, as shown in *Fig. 3.2*.

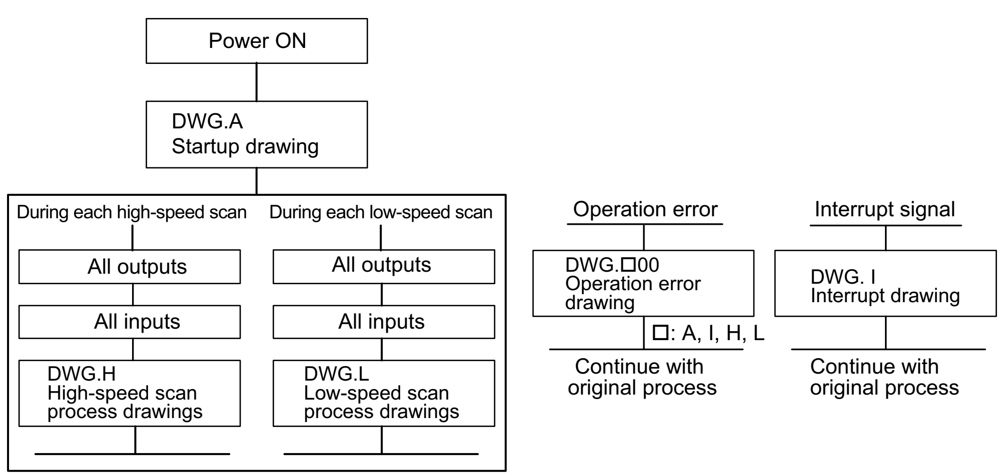
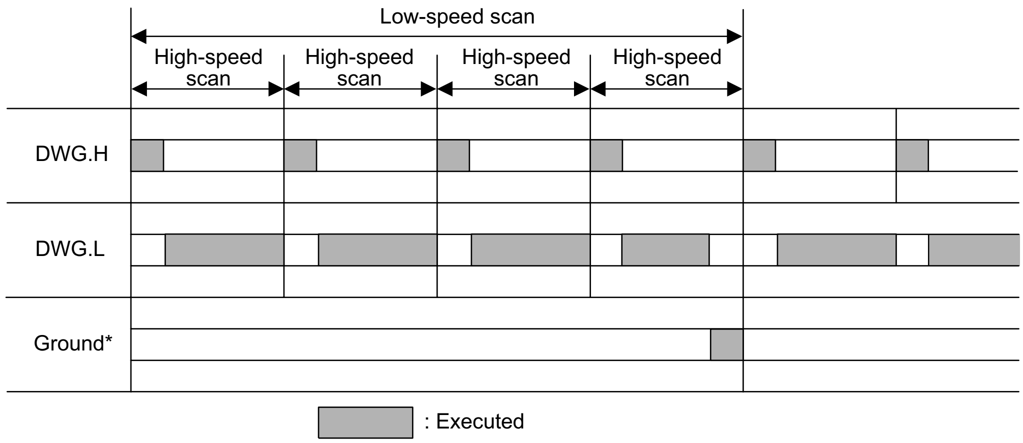


Fig. 3.2 Execution Control of Parent Drawings

■ Execution Scheduling of Scan Process Drawings

The scan process drawings are not executed simultaneously. As shown in *Fig. 3.3*, they are scheduled based on the priority level and are executed according to the schedule.



* Used for internal system processes, such as self diagnosis.

Fig. 3.3 Execution Scheduling of Scan Process Drawings

IMPORTANT

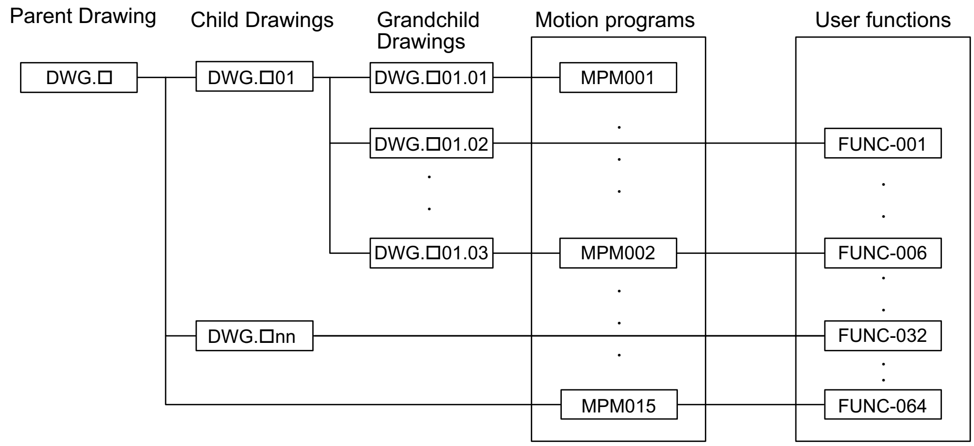
The low-speed scan process is executed in the unused time of the high-speed scan process. Therefore, as a guideline, set a time that is twice the execution time of all the DWG.H drawings as the high-speed scan time.

■ Hierarchical Arrangement of Drawings

Drawings are arranged in the following order: Parent drawing, child drawings, grandchild drawings. A parent drawing cannot call a child drawing of a different type, and a child drawing cannot call a grandchild drawing of a different type. A parent drawing also cannot directly call a grandchild drawing. A child drawing is called from a parent drawing, and a grandchild drawing is called from that child drawing. This is called the hierarchical arrangement of drawings.

■ Execution of Drawings

The user prepares each processing program with the parent drawing, child drawing, grandchild drawing hierarchy, as shown in *Fig. 3.4*.



Note: Substitute A, I, H, or L for □.

Fig. 3.4 Hierarchical Arrangement of Drawings

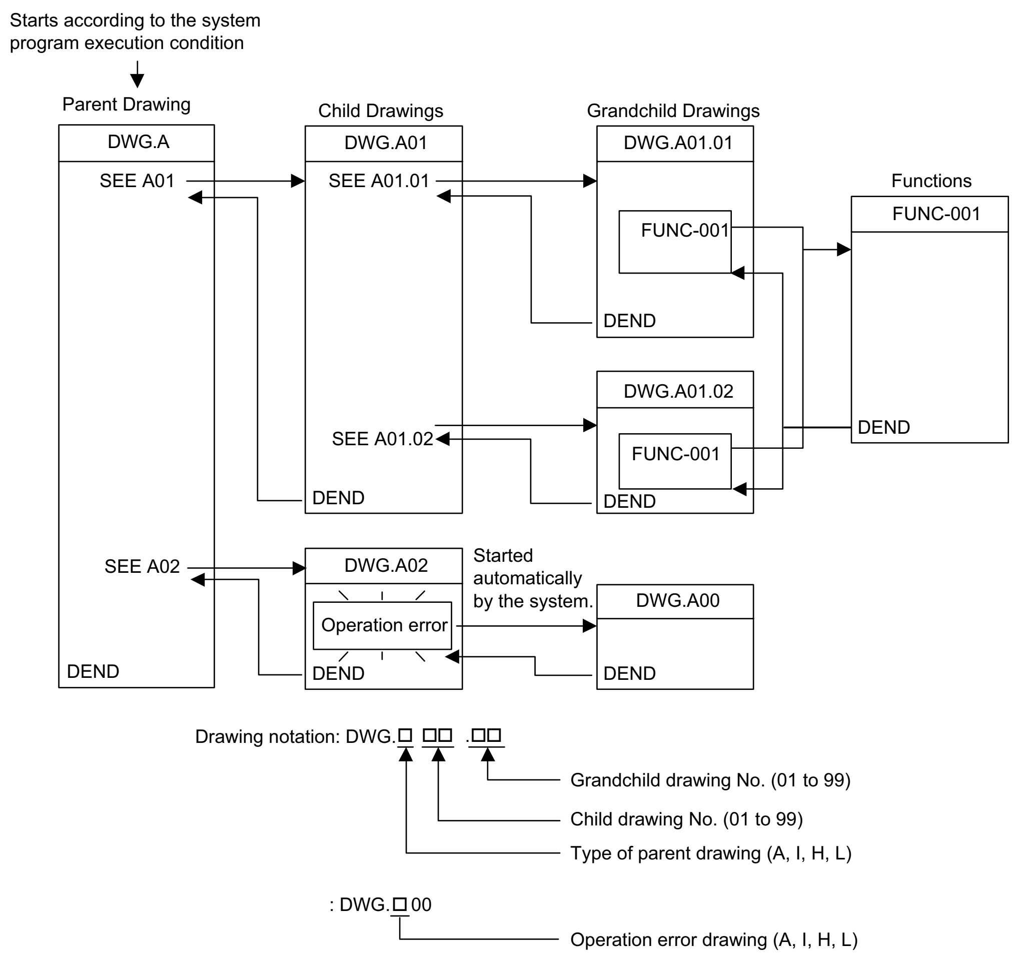
Note: 1. A parent drawing is executed automatically by the system, because the execution condition is determined for each one. In other words, a parent drawing is automatically called by the system. See *Table 3.4 Types and Priority Levels of Parent Drawings*. The user can execute any child or grandchild drawing by programming an instruction that calls a drawing (the SEE instruction) in a parent or child drawing.
2. Functions can be called from any drawing. A function can also be called from a function.
3. If an operation error occurs, the operation error drawing corresponding to the drawing will be called.
4. Motion programs must be called from H drawings using the MSEE instruction. The MSEE instruction can be used from any H drawing, i.e., from parent, child, or grandchild H drawings.

INFO

1. A parent drawing cannot call a child drawing of a different type, and a child drawing cannot call a grandchild drawing of a different type.
2. A parent drawing cannot directly call a grandchild drawing. A child drawing must be referenced from a parent drawing, and a grandchild drawing must be called from that child drawing.
3. A parent drawing is automatically called (and executed) by the system. A child drawing is called from a parent drawing using the SEE instruction. Therefore, user programs containing only child and grandchild drawings cannot be executed.

■ Execution Processing Method of Drawings

Drawings in the hierarchy are executed by the lower-level drawings being called from upper-level drawings. The following figure below shows the hierarchical arrangement of drawings, using the example of DWG.A.



3.4.3 Motion Programming

■ Overview of Motion Programs

Motion programming is a textual motion programming language. Motion programming can be used to create 256 programs separate from the ladder drawings.

Two types of motion program are provided: Main programs (MPM□□□) that can be called from DWG.H, and subroutines (MPS□□□) that can be called from the main programs.

Table 3.6 Types of Motion Program

Classification	Designation Method	Feature	Number of Programs
Main Programs	MPM□□□ 1 to 256	Can be called from DWG.H drawings.	A total of up to 256 main programs and subroutines can be created.
Subroutines	MPS□□□ 1 to 256	Can be called from the main programs.	

IMPORTANT

Each MPM□□□ and MPS□□□ program number must be unique.

There are two methods of designating a motion program: Direct designation of the program number, and indirect designation of the number of the register in which the program number is stored.

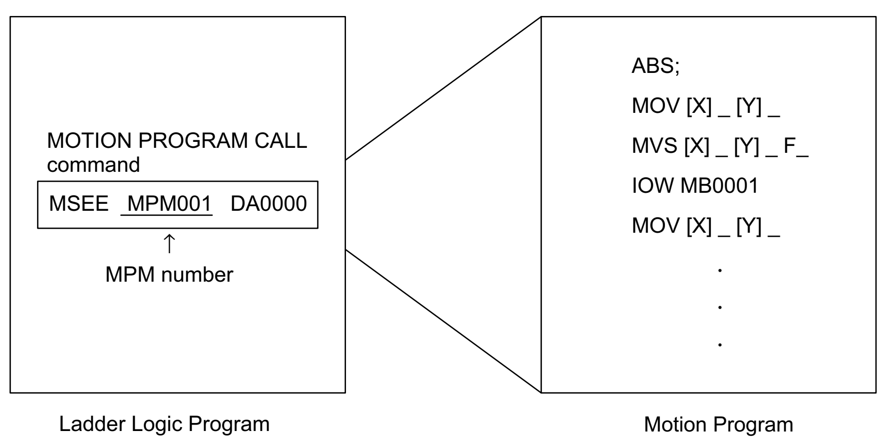


Fig. 3.5 Starting a Motion Program by Direct Designation

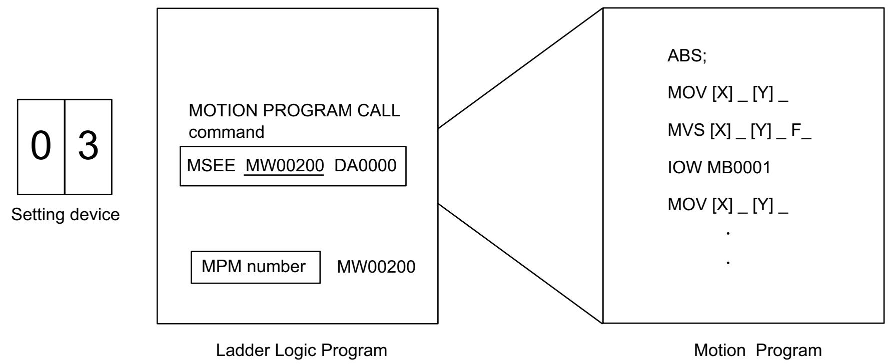
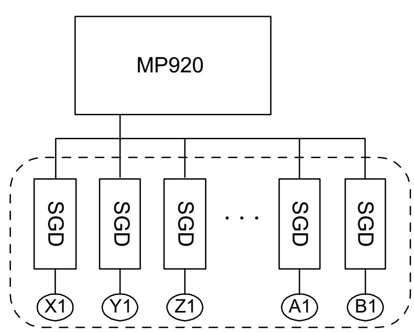


Fig. 3.6 Starting a Motion Program by Indirect Designation

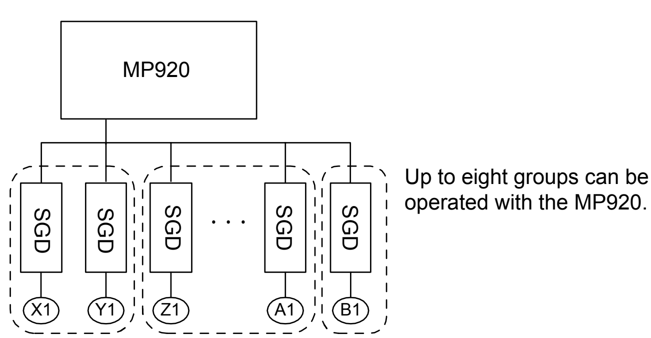
■ Groups

With the MP920, the axes can be grouped by operation so that multiple machines can be independently controlled by one Machine Controller. This enables programming to be done for each axis group. The axes to be included in a group are defined in the group definitions. For details, refer to the *Machine Controller MP900/MP2000 Series MPE720 Software for Programming Device User's Manual* (SIEPC8807005).

Operation as One Group

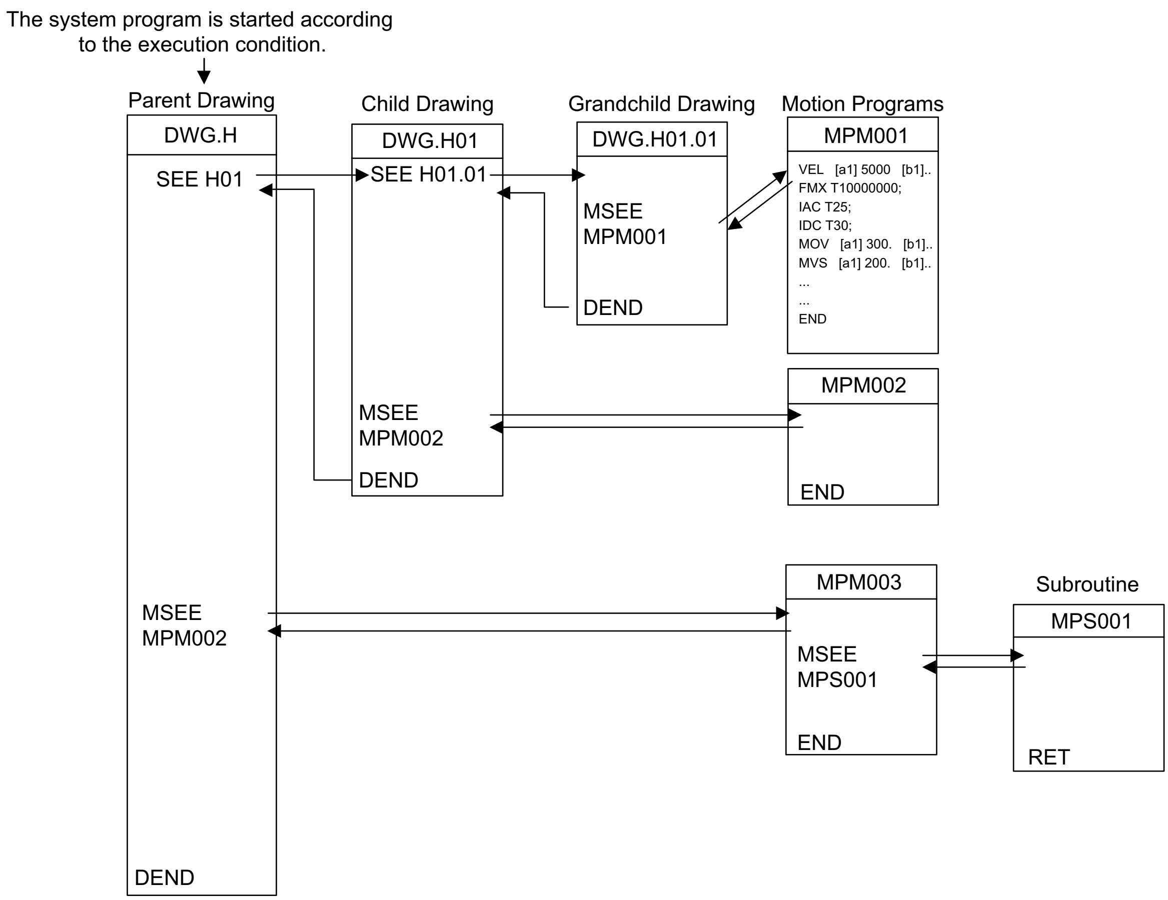


Operation with Multiple Groups



■ Motion Program Execution Processing Method

A motion program must be executed from DWG.H using the MSEE instruction. Motion programs can be executed from any H drawing, i.e., from parent, child, and grandchild H drawings.



1. In each high-speed scanning cycle, the ladder logic instructions for H drawings are executed in the following hierarchical order: Parent drawing-child drawing-grandchild drawing.
2. Motion programs are called in the scanning cycle, but as with ladder logic programs, all programs cannot be executed in one scan. Motion programs are executed and controlled by special system motion management functions.
3. Motion programs are called in the scanning cycle, but they are not executed only in this cycle. The control signals set on the Group Definition Window must be input. (See the table on the next page.)

INFO

The following restrictions apply to calling motion programs. Call motion program with care.

- More than one motion program with the same number cannot be called using the MSEE instruction.
- Subroutines (MPS□□□) cannot be called from the ladder logic program MSEE instruction. They can be called only from within motion programs (MPM□□□ and MPS□□□).
- The same subroutine cannot be called from two different locations at the same time.

■ Executing Motion Programs

To execute a motion program called from a DWG.H drawing by the MSEE instruction, program control signals (such as program operation start requests and program stop requests) must be input. Operations are enabled by inputting the external control signals defined on the Group Definition Window as the program control signals.

1. The signals used to control motion programs are shown in the following table.

Bit	Signal Name	Signal Type
b0:	Program operation start request	Differential input
b1:	Program pause request	NO contact (Normally open contact)
b2:	Program stop request	NO contact
b3:	Program debugging mode selection	NO contact
b4:	Program debugging start request	Differential input
b5:	Alarm reset request	NO contact
b8:	Skip 1 information	NO contact
b9:	Skip 2 information	NO contact

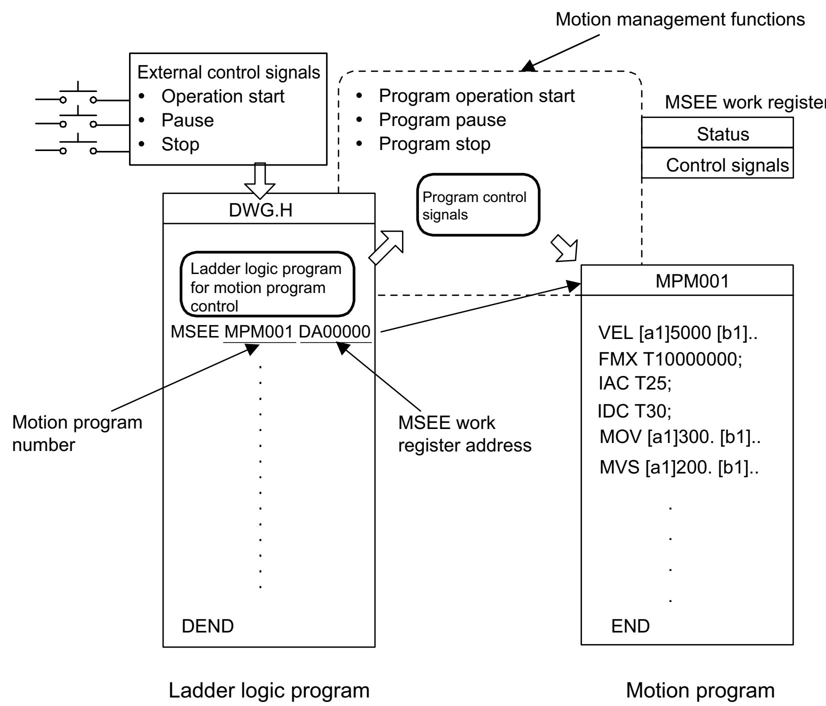
2. The motion program operation, stop, pause, and so on, can be controlled by using a ladder logic program to input these signals into the one register higher than the work register specified with the MSEE instruction.

   For the ladder logic program inputs, make sure the signals are in accordance with the signal type.

IMPORTANT

When the start signal is input using an NO contact, the program is completed and then restarted. The program will not be executed if the start signal has been turned ON when the power is turned ON.

3. The following illustration shows the method of executing a motion program.



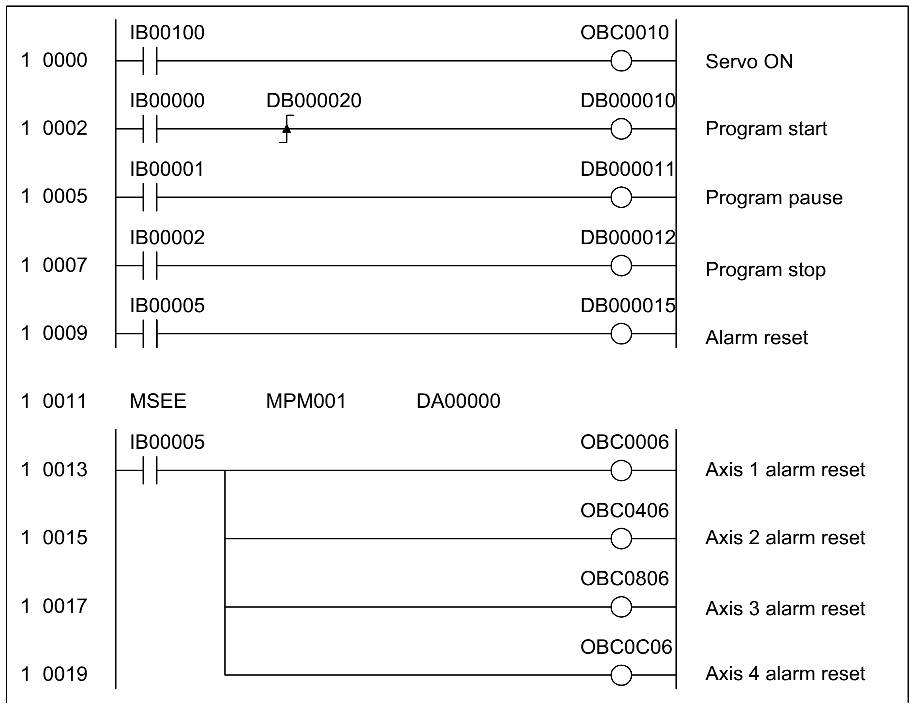
■ Motion Program Status Flags

The first word of the MSEE work registers consists of motion program status flags, which indicate the status of motion program execution. The following table shows the status flags.

Bit	Status
b0:	Program is running.
b1:	Program is temporarily stopped.
b2:	(Reserved by the system)
b3:	(Reserved by the system)
b4:	Program is being debugged.
b8:	Program alarm has been generated.
b9:	Program is stopped because of MPE720 debugging mode.
bB:	Debugging mode (EWS debugging)
bE:	Main program duplication error
bF:	Main program number limit error

■ Example of a Ladder Logic Program for Motion Program Control

1. The minimum ladder logic program required to control a motion program is shown in the following illustration.



2. The contents of this ladder logic program are shown in the following table.

Step Number	Program Content
1 to 7	The signals connected to the MP920 external input signals are stored as the motion program control signals. IW0000 (external input signals) → DW00001 (second word of MSEE work registers) • Program operation start • Program pause • Program stop • Alarm reset
8	Calls motion program MPM001 MSEE <u>MPM001</u> <u>DA00000</u> ① ② ① Motion program number ② MSEE work register address
11 to 15	Resets the alarm (bit 6 of OW□□00) using the alarm reset signal (IB00005), and clears the alarm for each axis.

3. When the external input signals (IB00000 to IB00007) connected to the MP920 are input to DW00001 (second word of MSEE work registers) as motion program control signals using the ladder logic program shown above, motion program operations such as run, stop and pause can be performed by the system motion management functions.

◀ EXAMPLE ▶

Table 3.7 shows an example of external input signals required to create the minimum ladder logic program for running motion programs on the MP920.

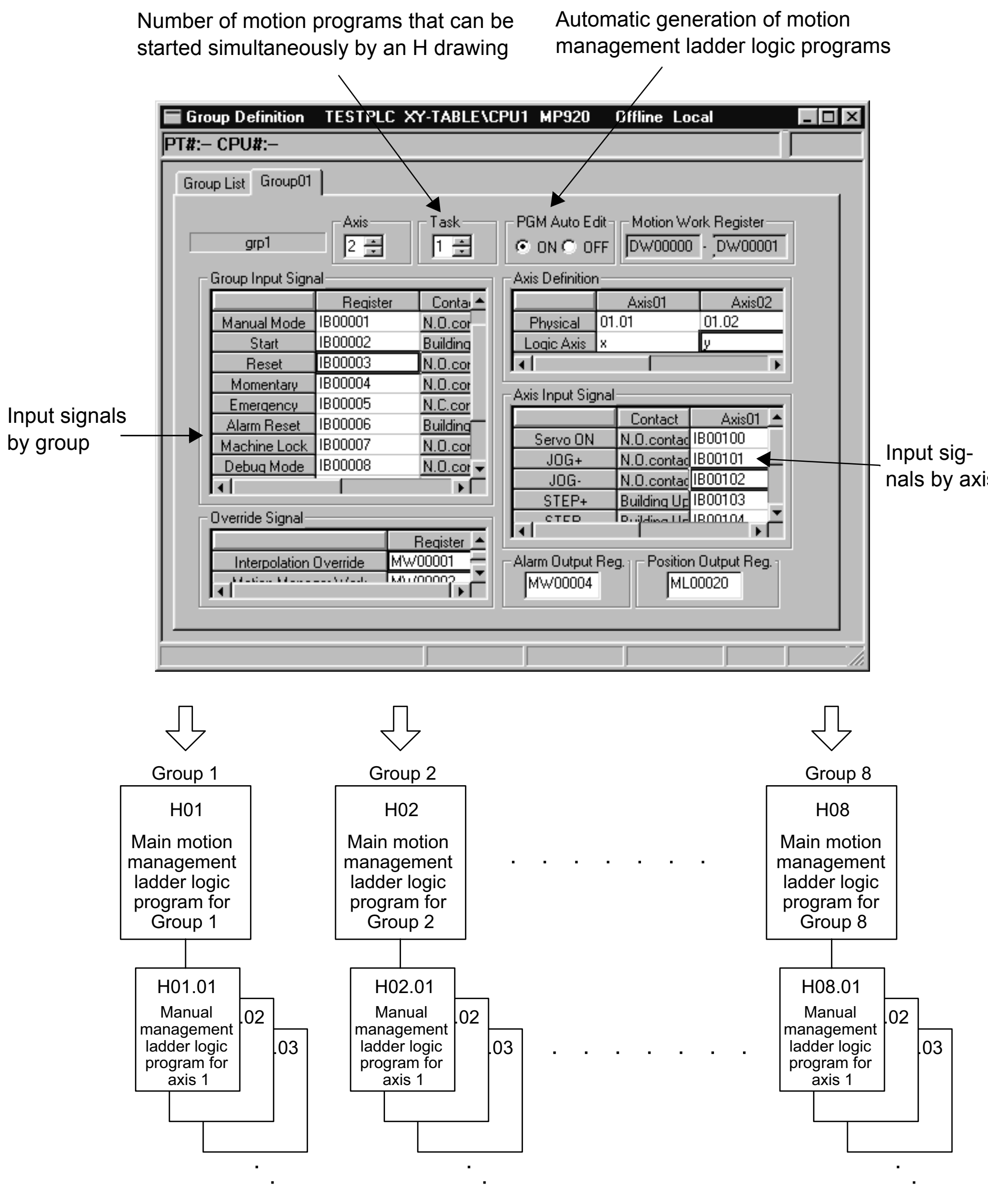
Table 3.7 External Input Signals and Motion Program Control Signals

External Signal Address	External Signal Name
IB00000:	Program operation start
IB00001:	Program pause
IB00002:	Program stop
IB00003:	Program debugging mode
IB00004:	Program debugging start
IB00005:	Alarm reset

BIT	Motion Program Control Signal
b0:	Program operation start request
b1:	Program pause request
b2:	Program stop request
b3:	Program debugging mode selection
b4:	Program debugging start request
b5:	Alarm reset request

■ Automatic Generation of Motion Management Ladder Logic Programs

An automatic generation function for the ladder logic programs used to control motion programs is provided with the MP920. This function enables JOG operations and program operations to be performed without the need for special ladder logic programs to be created, and greatly reduces the system startup time.



INFO

- The ladder logic programs that are generated for motion program control are created automatically using the external input signals that are allocated on the Group Definition Window. These ladder logic programs can also be used as is. It is recommended, however, that they be used as templates to be optimized (changed) to suit individual system requirement.
- When a ladder logic programs used for motion program control is created by automatic generation, up to eight motion programs can be called simultaneously from the ladder logic program. In other words, when automatic generation is used, a maximum of eight groups will be controlled.

3.5 Functions

This section explains the methods of using and the advantages of the MP920 functions.

Functions are executed by being called from a parent, child, or grandchild drawing using the FSTART instruction.

Unlike child and grandchild drawings, functions can be called from any drawing. The same function can also be called simultaneously from drawings of different types and different hierarchies. Moreover, a function can also be called from another function that was previously created.

The following advantages can be obtained by using functions:

- Programs can be easily divided into parts.
- Programs can be easily prepared and maintained.

Functions are divided into standard system functions, which are provided by the system, and user functions, which are defined by the user.

3

3.5.1 Standard System Functions

Seven functions, including the transfer function, are provided by the system as standard functions. See *Table 3.8*. The user cannot change the standard system functions.

Table 3.8 List of Standard System Functions

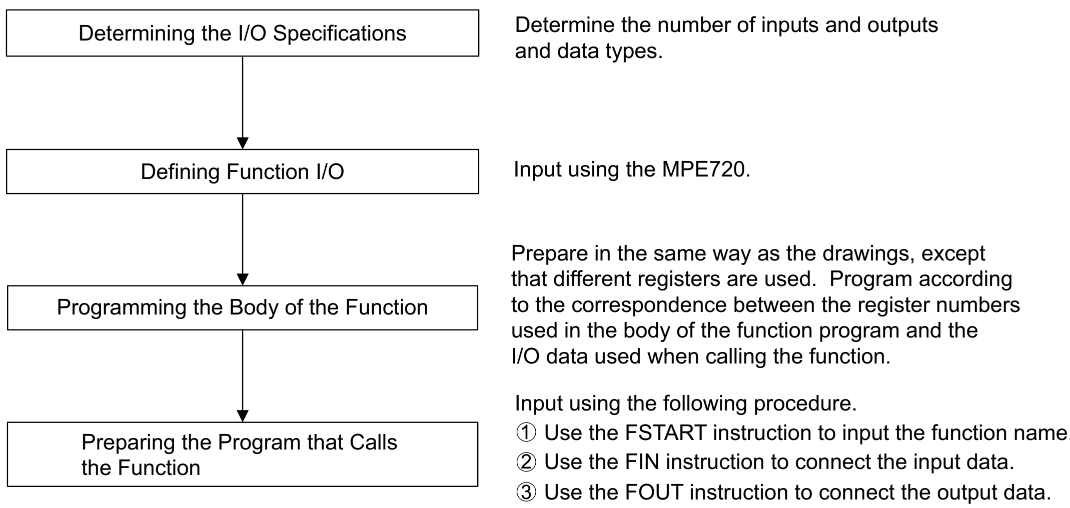
Type	Name	Symbol	Description
System Functions	Counter	COUNTER	Up/down counter
	First-in first-out	FINFOUT	First-in or first-out stack
	Trace function	TRACE	Data trace execution control
	Data trace read	DTRC-RD	Data readout from data trace memory to user memory
	Inverter trace read	ITRC-RD	Reading inverter trace data to store it in user registers
	Failure trace readout	FTRC-RD	Data readout from failure trace memory to user memory
	Send message function	MSG-SND	Sending a message from a Communications Module
	Receive message function	MSG-RCV	Receiving a message from a Communications Module
	Inverter constant write	ICNS-WR	Writing 215IF-connected inverter constants
	Inverter constant read	ICNS-RD	Reading 215IF-connected inverter constants

3.5.2 Creating User Functions

The body of the function (program) and the function definitions can be set by the user. The maximum number of user functions is 500 per drawing.

For details on the MPE720 operation methods, refer to the *Machine Controller MP900/MP2000 Series MPE720 Software for Programming Device User's Manual* (SIEPC8807005). For details on instructions, such as the FSTART instruction, refer to the *Machine Controller MP900/MP2000 Series User's Manual: Ladder Programming* (SIEZ-C887-1.2).

The methods for creating user functions is explained according to the following procedure.



3.5.3 Determining the I/O Specifications

When a user function is created, the function capabilities, the number of inputs and outputs required to satisfy the function, and other specifications must first be determined. Determine the four types of specification shown in *Table 3.9*.

Table 3.9 Overview of Function Definition Values

Specification to be Determined	Overview
Function Name	Up to eight characters can be input.
Number of Inputs	The number of arguments input into a function. Up to 16 can be input. Up to 17 arguments are possible if the address input is also counted.
Number of Address Inputs*	The designated number of addresses required by the function. A maximum of one value can be input.
Number of Outputs	The number of outputs from the function. Up to 16 can be input.

* Indicates the number of pointers to be provided for the external function registers used by the function.

3.5.4 Defining Function I/O

1. The function name and other specifications determined in the previous step are defined using the MPE720. For details on operation methods, refer to the *Machine Controller MP900/MP2000 Series MPE720 Software for Programming Device User's Manual* (SIEPC8807005).

◀ EXAMPLE ▶

Fig. 3.7 shows the graphic representation of a function when the following function is defined: Function name = TEST, number of inputs = 4, number of address inputs = 1, and number of outputs = 4.

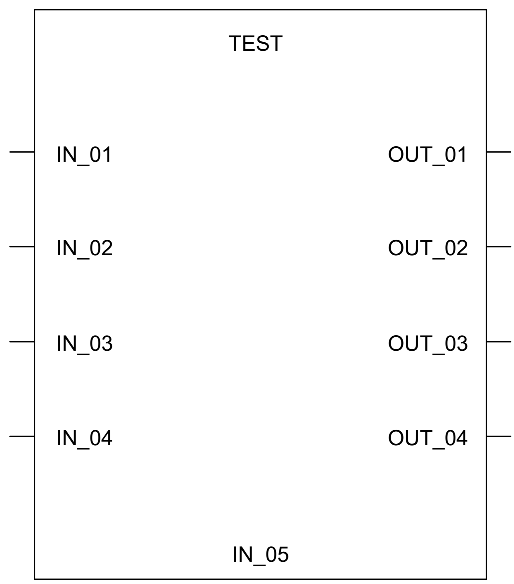


Fig. 3.7 Graphic Representation of a Function 1 (Example)

Note: 1. After creating the graphic representation of the function, define the data types of the function inputs, outputs, and address inputs.
2. Three data types can be defined: Bit, integer, and long integer.
3. When the data types are defined, the system automatically allocates inputs to the X registers, outputs to the Y registers, and address inputs to the A registers.

2. *Fig. 3.8* shows an example of the I/O definitions of a function.

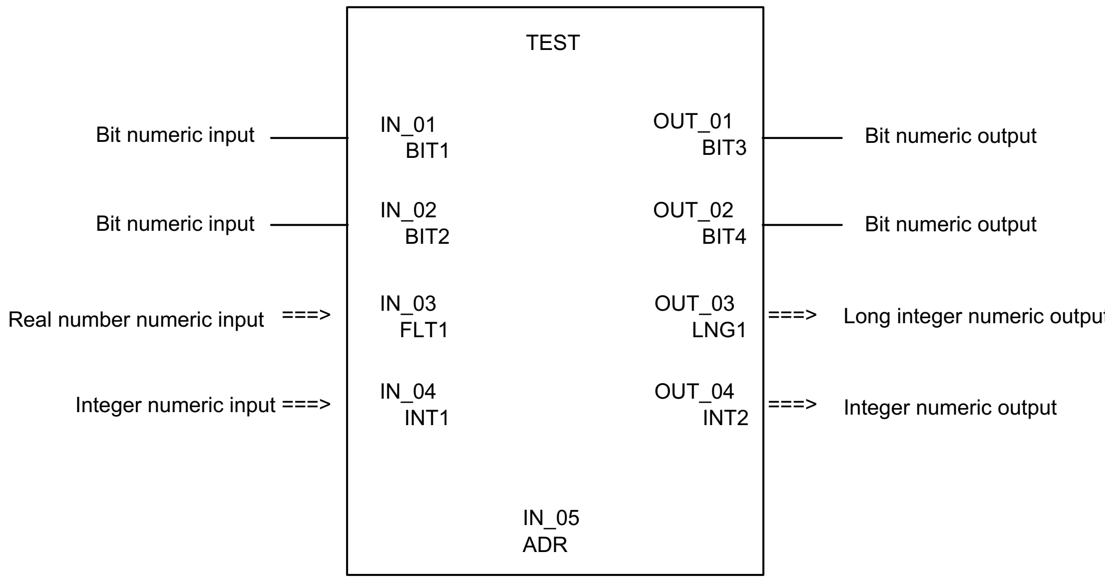


Fig. 3.8 Graphic Representation of a Function 2 (Example)

3. I/O signal addresses are automatically allocated from the highest signal on the graphic representation. For the example given in *Fig. 3.8*, the allocation of each I/O register will be as shown in *Table 3.10*.

Table 3.10 Allocation of I/O Registers

Name	Data Type	I/O Register
IN_01 (BIT1)	Bit	XB000000
IN_02 (BIT2)	Bit	XB000001
IN_03 (FLT1)	Real number	XF00001
IN_04 (INT1)	Integer	XW00003
IN_05 (ADR)	Address input	AW00000
OUT_01 (BIT3)	Bit	YB000000
OUT_02 (BIT4)	Bit	YB000001
OUT_03 (LNG1)	Double-length integer	YL00001
OUT_04 (INT2)	Integer	YW00003

Note: XW00000 and YW00000 of the X and Y registers are used for bit data.

4. The function I/O registers shown in *Fig. 3.8* are allocated automatically. The external framework of the function is completed at this stage.

3.5.5 Creating the Body of the Function

The body of the function is created in the same way as the drawings except that the types of register used are different. For details on the registers, see *3.6.3 Types of Register*.

3.5.6 Creating the Program that Calls the Function

The user function is completed when the graphic representation and body program of the function have been created. As with the standard system functions, user functions can be called from any parent, child, or grandchild drawing or any other user function.

Functions can be called from a drawing or from within the program of another user function by using the following procedure. For details on the operation methods, refer to the *Machine Controller MP900/MP2000 Series User's Manual: Ladder Programming* (SIEZ-C887-1.2).

1. Input the function name using the FSTART instruction.
   Example: Input "FSTART, *Enter Key*, TEST, *Enter Key*".
   The previously defined graphic representation of the function will be displayed.
2. Use the FIN instruction to create the input data program.
   Provide input data for the function inputs and address inputs.
3. Use the FOUT instruction to create the output data program.

   Example: I/O data is provided for the graphic representation as shown in the following illustration.

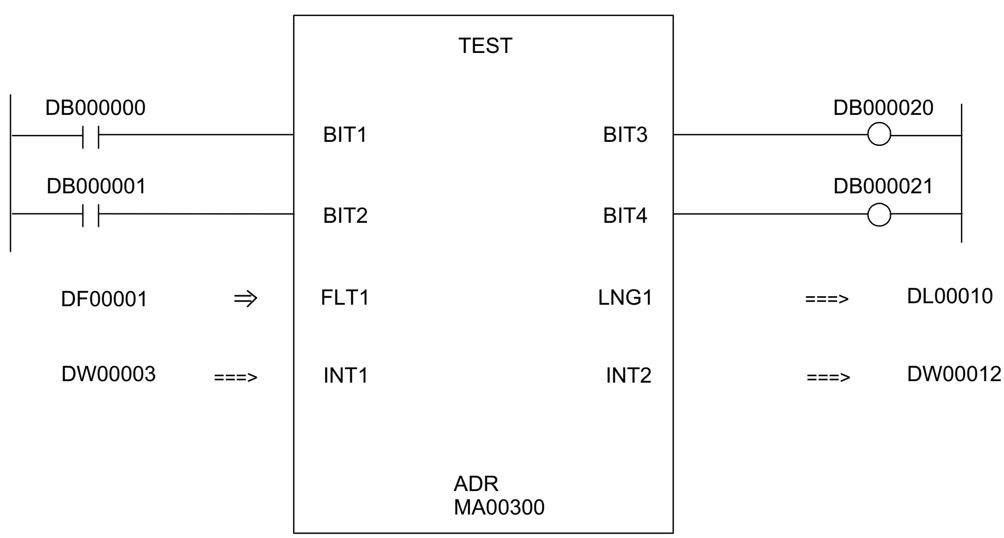


Fig. 3.9 Graphic Representation for which Input Data is Provided (Example)

Table 3.11 Relationship Between I/O Data and Internal Function Registers

Name	I/O Data	Internal Function Register
BIT1	DB000000 →	XB000000
BIT2	DB000001 →	XB000001
FLT1	DF00001 →	XF00001
INT1	DW00003 →	XW00003
ADR	MA00300 ↔	AW000000
BIT3	OB00020 ←	YB000000
BIT4	OB00021 ←	YB000001
LNG1	DL00010 ←	YL00001
INT2	DW0012 ←	YW00003

In the table, address input register AW00000 is allocated to MA00300. That is, registers AW00000, AW00001, and so on, used inside the TEST function correspond to external registers MA00300, MA00301, and so on. Therefore, if a given value in AW00000 is stored inside the function, this value will be stored in MA00300.

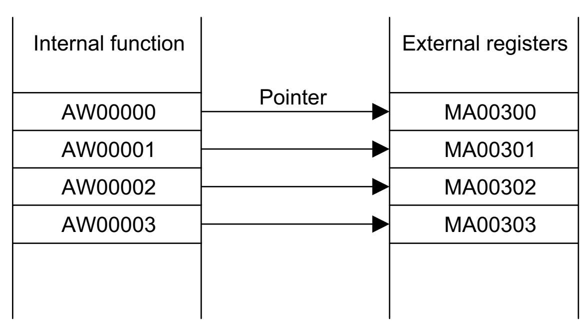


Fig. 3.10 Pointer Designation for Address Input Registers

4. Creating a motion program that calls the function.

   User functions can also be called from motion programs.

   Example: The user functions shown in *Table 3.11* would be called from a motion program using the following coding:

```
UFC TEST DB000000 DB000001 DF00001 DW00003,MA00300,
          DB000020 DB000021 DL00010 DW00012;
```

■ Conditions for referencing a user function from a motion program

• The first item of output data must be bit data.

This output will be the completion signal for moving to the next motion command.

UFC DB000000..., MA00300, DB000020...;
↓ condition BB000020==ON
MVS [X]100. [Y]200. F10000;

.
.
.

3.6 Registers

This section explains the types of register used by MP920 user programs and how these registers are used.

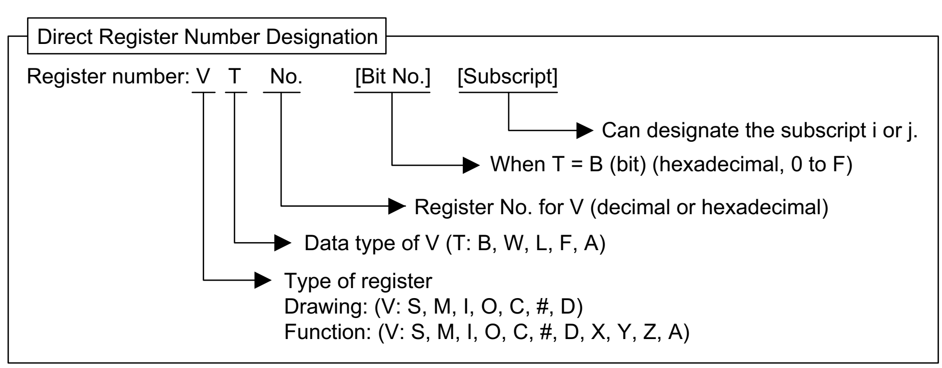
3.6.1 Register Designation Methods

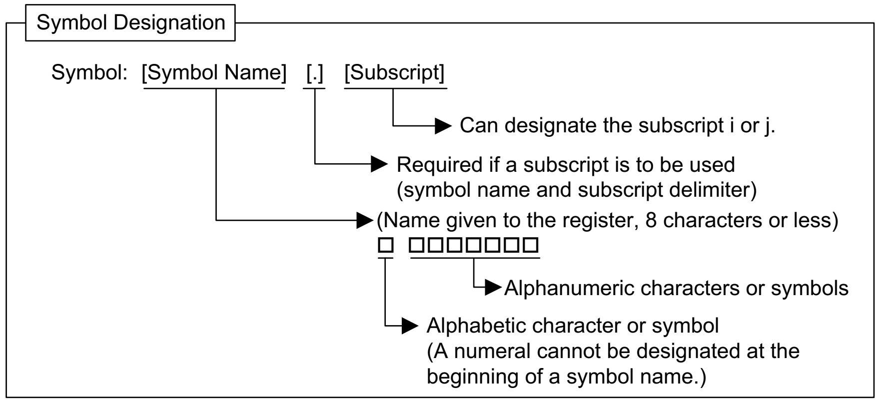
Registers can be designated by direct designation of the register number or by symbolic designation. These two types of register designation can be used together in the same user program. When symbolic designation is used, the correspondence between the symbols and the register numbers is defined in the symbol table that is described later.

Table 3.12 shows the register designation methods.

Table 3.12 Register Designation Methods

Designation Type	Description
Direct Register Number Designation	Bit registers: MB00100A□ Integer registers: MW00100□ Double-length integer registers: ML00100□ Real # registers: MF00100□ Address registers: MA00100□ □: For subscripts, add the subscript i or j after the register number.
Symbol Designation	Bit registers: RESET-A.□ Integer registers: STIME-H.□ Double-length integer registers: POS-REF.□ Real # registers: IN-DEF.□ Address registers: PID-DATA.□ ↓ Address registers are designated using up to 8 alphanumeric characters. □: For subscripts, add a period (.) and then the subscript i or j after the symbol.



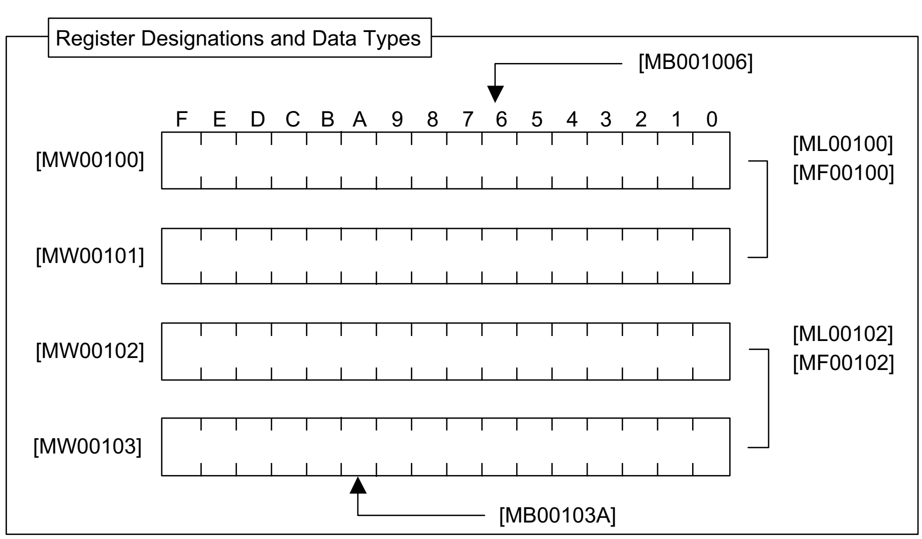


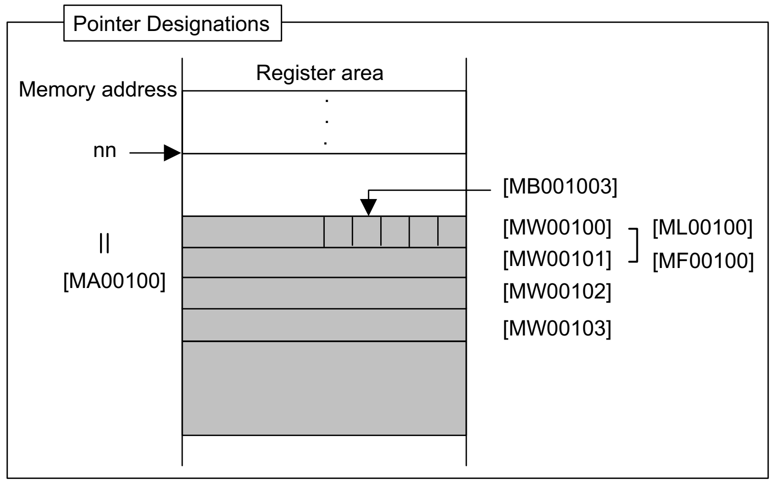
3.6.2 Data Types

There are five data types: Bit, integer, double-length integer, real number, and address. Use them as required. Address data is used only for pointer designations inside functions. For details, refer to the *Machine Controller MP900/MP2000 Series User's Manual: Ladder Programming* (SIEZ-C887-1.2). *Table 3.13* shows the data types.

Table 3.13 Data Types and Numeric Range

Type	Data Type	Numeric Range	Remarks
B	Bit	ON, OFF	Used in relay circuits.
W	Integer	-32768 to +32767 (8000H) (7FFFH)	Used in numeric operations. The values in parentheses ( ) are used in logic operations.
L	Double-length integer	-2147483648 to +2147483647 (80000000H) (7FFFFFFFH)	Used in numeric operations. The values in parentheses ( ) are used in logic operations.
F	Real number	± (1.175E–38 to 3.402E+38), 0	Used in numeric operations.
A	Address	0 to 32767	Used only for pointer designations.

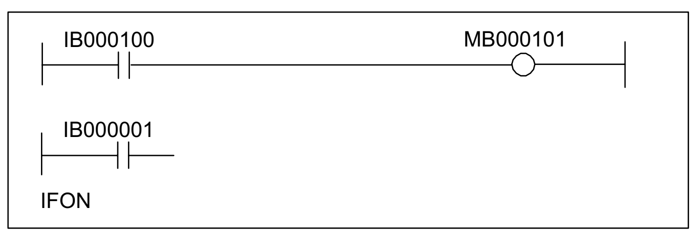




Examples of Use by Data Type

1. Bits

   Bits are used for relay circuit ON/OFF or for logic operations.



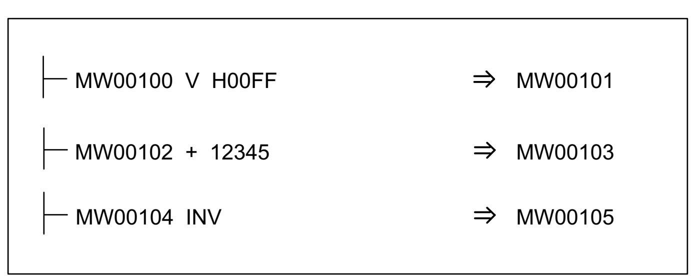
◀ EXAMPLE ▶

- Motion Program Example

```
MB000101=IB000100;
IF IB000001==1;
DB000001=DB000001|1
```

2. Words

   Words are used for numeric operations and logic operations.



◀ EXAMPLE ▶

- Motion Program Example

```
MW00101=MW00100|00FFH;
MW00103=MW00102+12345;
MW00105=MW00104*-1;
```

3. Double-length Integers

Double-length integers are used for numeric operations and logic operations.

```
├─ ML00100 + ML00102            ⇒ ML00104

├─ ML00106 × ML00108 ÷ 18000    ⇒ ML00110

├─ ML00112 BIN                  ⇒ ML00114
```

◀ EXAMPLE ▶

• Motion Program Example

```
ML00104=ML00100+ML00102;
ML00110=ML00106*ML00108/18000;
ML00114=BIN (ML00112);
```

4. Real Numbers

Real numbers are used for floating-point numeric operations.

```
||├─ 1.23456              ⇒ DF00100
                             (1.23456)

||├─ DF00102  SIN         ⇒ DF00104
      (30.0)                 (0.5)

||├─ DF00200  TAN         ⇒ DF00202
      (45.0)                 (1.0)
```

◀ EXAMPLE ▶

• Motion Program Example

```
DF00100=1.23456;
DF00104=SIN (DF00102);
DF00202=TAN (DF00200);
```

5. Addresses

Addresses are used only for pointer designations.

MF00200 to MF00228 are used as the parameter table in the following example.

```
||├── MF00200   ◀── Error input value
 PID MA00200                                   MF00022
      ▲                                           ▲
Parameter table leading address            PID output value
```

MF00200 to MF00204 are used as the parameter table in the following example.

```
├── MW00200   ◀── Input value
 LAG MA00200                                 ⇒ MW00022
      ▲                                           ▲
Parameter table leading address            LAG output value
```

3.6.3 Types of Register

■ Registers in Drawings

The seven types of register shown in *Table 3.14* can be used in all drawings and motion programs.

Table 3.14 Types of Drawing Register

Type	Name	Designation Method	Range	Description	Characteristic
S	System registers	SB, SW, SL, SFnnnnn (SAnnnnn)	SW00000 to SW01023	System registers provided by the system. Register number nnnnn is expressed as a decimal number. When the system is started, SW00000 to SW00049 are cleared to 0.	Common to all drawings
M	Data registers	MB, MW, ML, MFnnnnn (MAnnnnn)	MW00000 to MW32767	Data registers are shared by all drawings. Used as interfaces between drawings. Register number nnnnn is expressed as a decimal number.	
I	Input registers	IB, IW, IL, IFhhhh (IAhhhh)	IW0000 to IW13FF	Registers used for input data. Register number hhhh is expressed as a hexadecimal number.	
O	Output registers	OB, OW, OL, OFhhhh (OAhhhh)	OW0000 to OW13FF	Registers used for output data. Register number hhhh is expressed as a hexadecimal number.	
C	Constant registers	CB, CW, CL, CFnnnnn (CAnnnnn)	CW00000 to CW16383	Constant registers can be called only in the program. Register number nnnnn is expressed as a decimal number.	
#	# registers	#B, #W, #L, #Fnnnnn (#Annnnn)	#W00000 to #W16383	# registers can be called only in the program and can be used only in the corresponding drawing. The actual range used is specified by the user on the MPE720. Register number nnnnn is expressed as a decimal number.	Unique to each drawing
D	D registers	DB, DW, DL, DFnnnnn (DAnnnnn)	DW00000 to DW16383	D registers are unique to each drawing and can be used only in the corresponding drawing. The actual range used is specified by the user on MPE720. Register number nnnnn is expressed as a decimal number.	

INFO

registers cannot be used in motion programs.

■ Registers in Functions

The 11 types of register shown in *Table 3.15* can be used in functions.

Table 3.15 Types of Function Register

<table>
<tr><th>Type</th><th>Name</th><th>Designation Method</th><th>Range</th><th>Description</th><th>Charac-teristic</th></tr>
<tr><td>X</td><td>Function input registers</td><td>XB, XW, XL, XFnnnnn</td><td>XW00000 to XW00016</td><td>Input to a function.
Bit input: XB000000 to XB0000F
Integer input: XW00001 to XW00016
Long integer input: XL00001 to XL00015
Register number nnnnn is expressed as a decimal number.</td><td rowspan="11">Unique to each function</td></tr>
<tr><td>Y</td><td>Function output registers</td><td>YB, YW, YL, YFnnnnn</td><td>YW00000 to YW00016</td><td>Output from a function.
Bit input: YB000000 to YB0000F
Integer input: YW00001 to YW00016
Long integer input: YL00001 to YL00015
Register number nnnnn is expressed as a decimal number.</td></tr>
<tr><td>Z</td><td>Internal function registers</td><td>ZB, ZW, ZL, ZFnnnnn</td><td>ZW0000 to ZW00063</td><td>Internal registers unique to each function. Can be used in the function for internal processes. Register number nnnnn is expressed as a decimal number.</td></tr>
<tr><td>A</td><td>External function registers</td><td>AB, AW, AL, AFnnnnn</td><td>AW0000 to AW32767</td><td>External registers that use the address input value as the base address. For linking with S, M, I, O, #, and DAnnnnn registers. Register number nnnnn is expressed as a decimal number.</td></tr>
<tr><td>#</td><td># registers</td><td>#B, #W, #L, #Fnnnnn (#Annnnn)</td><td>#W00000 to #W16383</td><td>Registers that can only be called by a function. Can be used only by the corresponding function.
The actual range used is specified by the user on the MPE720. Register number nnnnn is expressed as a decimal number.</td></tr>
<tr><td>D</td><td>D registers</td><td>DB, DW, DL, DFnnnnn (DAnnnnn)</td><td>DW00000 to DW16383</td><td>Internal registers unique to each function. Can be used only by the corresponding function.
The actual range used is specified by the user on the MPE720. Register number nnnnn is expressed as a decimal number.</td></tr>
<tr><td>S</td><td>System registers</td><td>SB, SW, SL, SFnnnnn (SAnnnnn)</td><td colspan="2" rowspan="5">Same as the registers for drawings.
These registers can be called from any drawings or function. Use them carefully when the same function is referenced from drawings with different priority levels.</td></tr>
<tr><td>M</td><td>Data registers</td><td>MB, MW, ML, MFnnnnn (MAnnnnn)</td></tr>
<tr><td>I</td><td>Input registers</td><td>IB, IW, IL, IFhhhh (IAhhhh)</td></tr>
<tr><td>O</td><td>Output registers</td><td>OB, OW, OL, OFhhhh (OAhhhh)</td></tr>
<tr><td>C</td><td>Constant registers</td><td>CB, CW, CL, CFnnnnn (CAnnnnn)</td></tr>
</table>

Note: SA, MA, IA, OA, DA, #A, and CA registers can be also used inside functions.

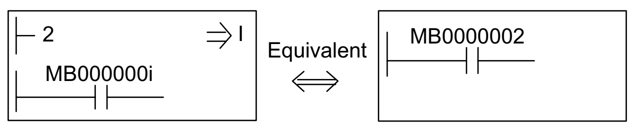
3.6.4 Using Subscripts I and J

Two types of register, I and J, are used exclusively for modifying relay numbers and register numbers. I and J have exactly the same function.

An example of each register data type is explained below.

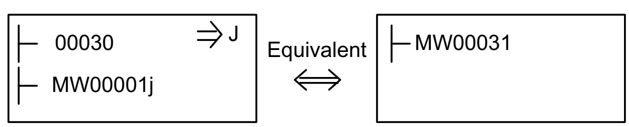
■ Subscripts Attached to Bit Data

When subscript i or j is attached to bit data, the value of I or J is added to the relay number. For example, if I = 2, MB000000i will be the same as MB000002. If J = 27, MB000000j will be the same as MB00001B.



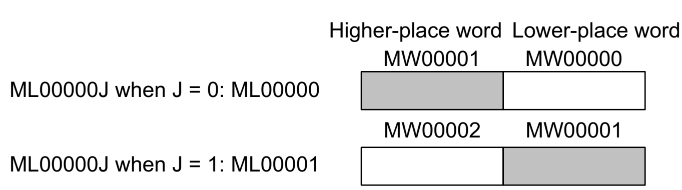
■ Subscripts Attached to Integer Data

When a subscript is attached to integer data, the value of I or J is added to the relay number. For example, if I = 3, MW00010i will be the same as MW00013. If J = 30, MW00001j will be the same as MW00031.



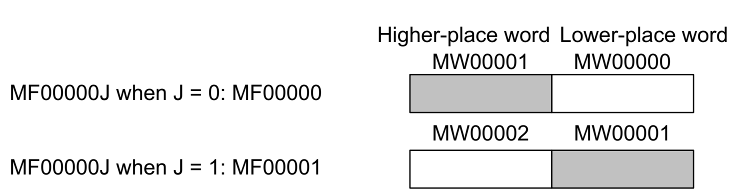
■ Subscripts Attached to Double-length Integer Data

When a subscript is attached to double-length integer data, the value of I or J is added to the relay number. For example, if I = 1, ML00000i will be the same as ML00001. ML00000j when J = 0, and ML00000j when J = 1 will be as follows:



■ Subscripts Attached to Real Number Data

When a subscript is attached to long integer data, the value of I or J is added to the relay number. For example, if I = 1, MF00000i will be the same as MF00001. MF00000j when J = 0, and MF00000j when J = 1 will be as follows:



◀ EXAMPLE ▶

Programming Example Using Subscripts

The programming code shown in *Fig. 3.11* sets the sum of 100 registers from MW00100 to MW00199 in MW00200 using subscript J.

```
├  00000                                  ⇒ MW00200
FOR       J = 00000 to 00099 by 00001
├                 MW00200  +  MW00100j    ⇒ MW00200
FEND
```

Fig. 3.11 Programming Example Using a Subscript

INFO

Subscripts I and J cannot be used in motion programs.

3.6.5 I/O and Registers in Functions

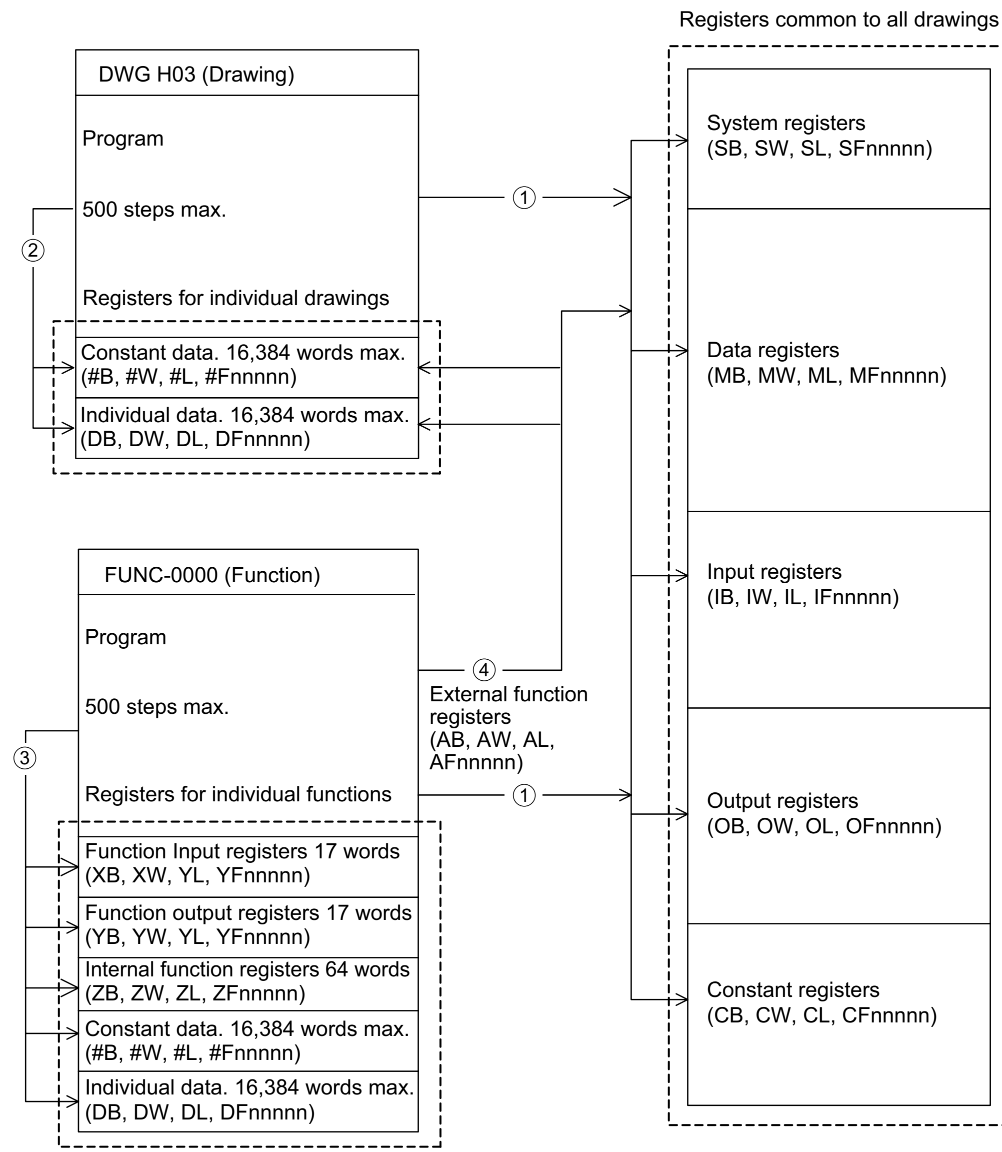
Table 3.16 shows the I/O and registers referenced in functions.

Table 3.16 Correspondence Between I/O and Registers in Functions

Function I/O	Function Register
Bit inputs	The bit numbers increase continuously from XB000000 in order of the bit inputs: XB000000, XB000001, XB000002, ……, XB00000F
Integer, double-length integer, and real number inputs	The register numbers increase continuously from XW, XL, and XF00001 in order of the integer, double-length integer, and real number inputs: XW00001, XW00002, XW00003, ……, XW00016 XL00001, XL00003, XL00005, ……, XL00015 XF00001, XF00003, XF00005, ……, XF00015
Address inputs	The address input values correspond to register numbers 0 of the external register: Input value = MA00100: MW00100 = AW00000, MW00101 = AW00001...
Bit outputs	The bit number increases consecutively from YB000000 in order of bit outputs: (YB000000, YB000001, YB000002, YB00000F)
Integer, double-length integer, and real number outputs	The register numbers increase continuously from YW, YL, and YF00001 in order of the integer, double-length integer, and real number outputs. YW00001, YW00002, YW00003, ..., YW00016 YL00001, YL00003, YL00005, ..., YL00015 YF00001, YF00003, FY00005, ..., YF00015

3.6.6 Register Ranges in Programs

The following figure shows the ranges that can be called for registers in programs.



①: Registers that are common to all drawings can be called from any drawing or function.

②: Registers that are unique to each drawing can be called only from within that drawing.

③: Registers that are unique to each function can be called only from within that function.

④: Registers that are common to all drawings and registers that are unique to each drawing can be called from a function using the external function registers.

3.7 Managing Symbols

3.7.1 Symbols in Drawings

The symbols used in drawings are all managed with a symbol table, such as the one shown in the table below. For details, refer to the *Machine Controller MP900/MP2000 Series User's Manual: Ladder Programming* (SIEZ-C887-1.2).

No.	Register No.	Symbol	Size *	Remarks
0	IB00000	STARTPBL	1	The register number is expressed as a hexa-decimal number.
1	OB00000	STARTCOM	1	The register number is expressed as a hexa-decimal number.
2	MW00000	SPDMAS	1	
3	MB000010	WORK-DB	16	
4	MW00010	PIDDATA	10	
5	MW00020	LAUIN	1	
6	MW00021	LAUOUT	1	
:				
N				

* If a program is written using data configurations such as arrays or indexed data, define the size to be used in the data configuration.
For example, if the data is referenced as PIDDATA_1 and i varies in a range of 0 to 9, define the size as 10.

3.7.2 Symbols in Functions

All symbols used in the functions are managed with the function symbol table shown in *Table 3.17*. For details, refer to the *Machine Controller MP900/MP2000 Series User's Manual: Ladder Programming* (SIEZ-C887-1.2).

Table 3.17 Function Symbol Table

No.	Register No.	Symbol	Size *	Remarks
0	XB000000	EXECOM	1	
1	XW00001	INPUT	1	
2	AW00001	P-GAIN	1	
3	AB00000F	ERROR	1	
4	YB000000	PIDEXE	1	
5	YW00001	PIDOUT	1	
6	ZB000000	WORKCOIL	4	
7	ZW00001	WORK1	1	
8	ZW00002	WORK2	1	
:				
N				

* If a program is prepared using data configurations such as arrays or

indexed data, define the size to be used in the data configuration.
For example, if the data is referenced as PIDDATA_1 and i varies in a range of 0 to 9, define the size as 10.

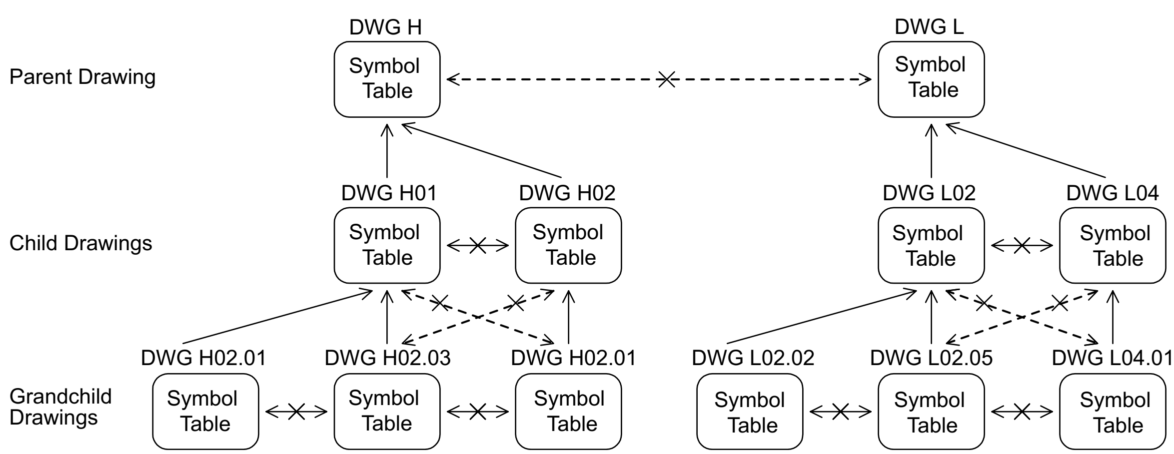
3.7.3 Upward Linking of Symbols

Table 3.18 shows the symbols that can be linked and the symbols tables that are subject to linking. For details on the upward linking of symbols, refer to the *Machine Controller MP900/MP2000 Series User's Manual: Ladder Programming* (SIEZ-C887-1.2) and the *Machine Controller MP900/MP2000 Series MPE720 Software for Programming Device User's Manual* (SIEPC8807005).

Table 3.18 Linkable Symbols and Symbol Table for Linking

Symbols \ Symbol Table	Parent Drawing	Child Drawing	Grandchild Drawing
Parent Drawing Symbols	No	No	No
Child Drawing Symbols	**Yes**	No	No
Grandchild Drawing Symbols	**Yes**	**Yes**	No
Symbols Within A Function	No	No	No

Note: **Yes:** Possible
No: Not possible



3.7.4 Automatic Register Number Allocation

Table 3.19 shows the register numbers for which automatic allocation is possible and those for which it is not possible. For details on the automatic allocation of register numbers, refer to the *Machine Controller MP900/MP2000 Series User's Manual: Ladder Programming* (SIEZ-C887-1.2) and the *Machine Controller MP900/MP2000 Series MPE720 Software for Programming Device User's Manual* (SIEPC8807005).

Table 3.19 Automatic Allocation of Register Numbers

Drawing Symbol Table	Automatic Number Allocaliton	Function Symbol Table	Automatic Number Allocation
	MPE720		MPE720
System registers S	Yes	System registers S	Yes
Input registers I	Yes	Input registers I	Yes
Output registers O	Yes	Output registers O	Yes
Data registers M	Yes	Data registers M	Yes
# registers #	Yes	# registers #	Yes
C registers C	Yes	C registers C	Yes
D registers D	Yes	D registers D	Yes
–	–	Function input registers X	No
–	–	Function output registers Y	No
–	–	Internal function registers Z	Yes
–	–	External function registers A	No

Note: **Yes:** Automatic number allocation possible
No: Automatic number allocation not possible

4

Motion Control

This chapter gives an overview of motion control and describes the motion commands.

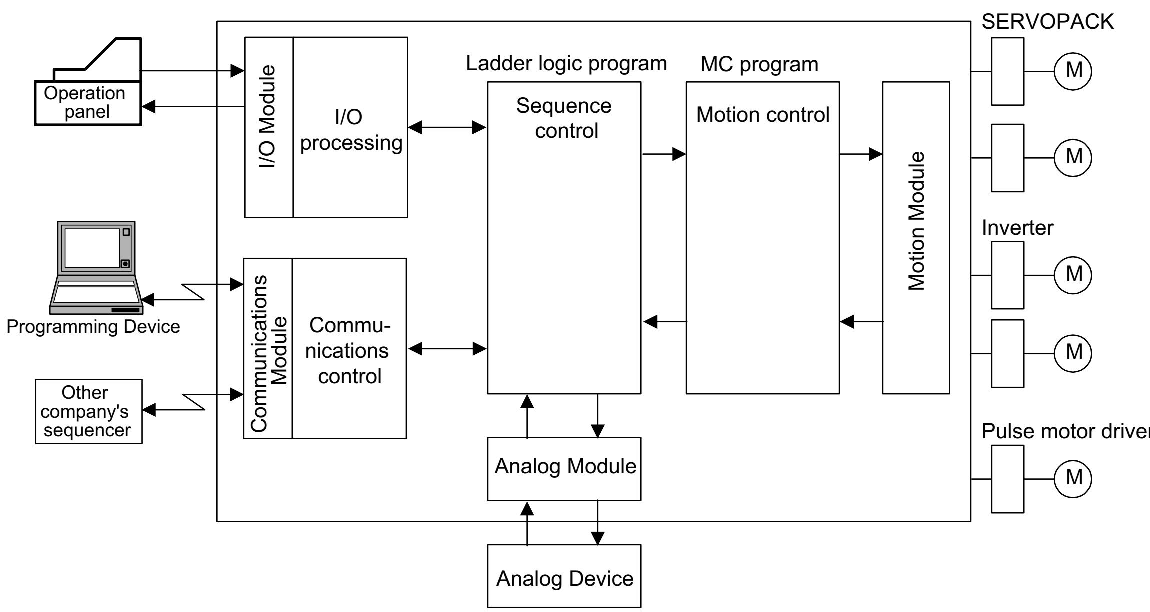
4.1 Overview of Motion Control

This section describes the methods used for motion control and gives some examples of their use.

4.1.1 Motion Control for the MP920

The MP920 Machine Controller provides fully integrated sequence control and motion control.

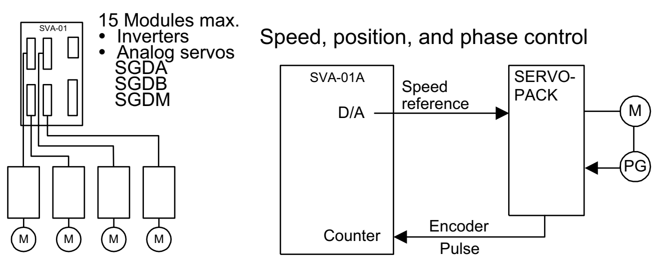
The following figure shows a conceptual diagram of the MP920 system.



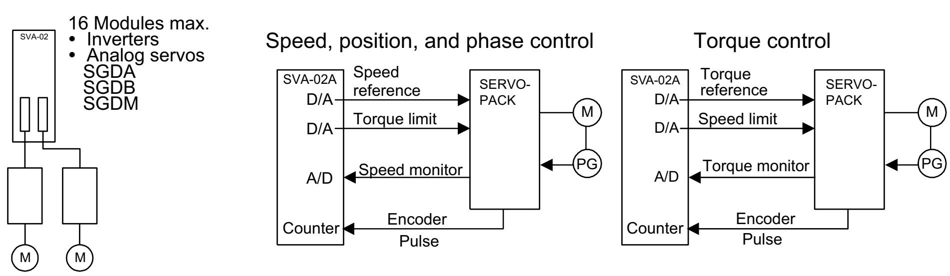
A wide range of Motion Modules is provided for the MP920, and these can be selected according to the purpose.

The following table shows the types of Motion Module and their features.

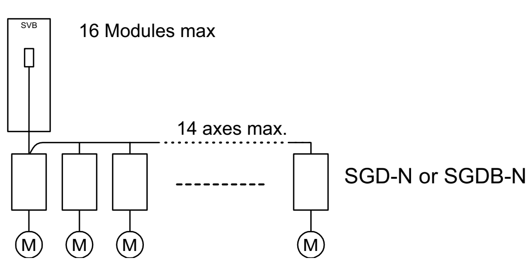
<table>
<tr><th>Name</th><th>Features</th></tr>
<tr><td>SVA-01A</td><td>
Analog-output 4-axis Servo Module
Independent position control, speed control, and phase control are possible for each axis.
Up to 60 axes (up to 15 Modules) can be controlled.
Interpolations and complex processing operations can be easily programmed in motion programs.



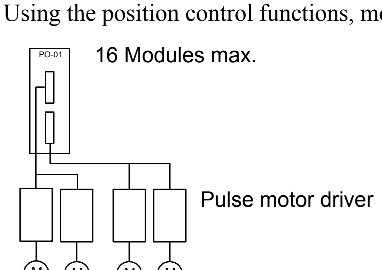
</td></tr>
<tr><td>SVA-02A</td><td>
Analog-output 2-axis Servo Module
Independent position control, speed control, torque control, and phase control are possible for each axis.
Up to 32 axes (up to 16 Modules) can be controlled.
Interpolations and complex processing operations can be easily programmed by motion programs.



</td></tr>
<tr><td>SVB-01</td><td>
By using the high-speed field network (MECHATROLINK) interface, up to 14 axes can be controlled with less wiring. (Using a maximum of 16 Modules, 224 axes can be controlled.)
Using the position control functions, motion programs can perform positioning, zero point returns, and interpolations.



</td></tr>
<tr><td>PO-01</td><td>
Pulse output type 4-axis Pulse Output Module
Up to 64 axes (up to 16 Modules) can be controlled.
Using the position control functions, motion programs can perform positioning, zero point returns, and interpolations.



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

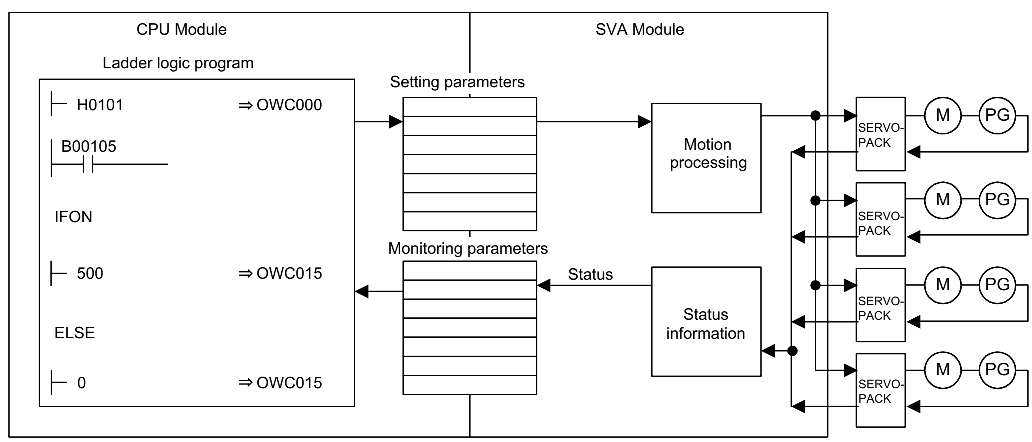
4.1.2 Motion Control Methods

By using Motion Modules, motions for a wide variety of applications can be controlled. There are two programming methods for controlling motions: Ladder logic programs and motion programs.

An overview of each programming method is given below.

■ Ladder Logic Programming

Ladder logic programs are designed mainly for sequence control. The setting parameters and monitoring parameters used as interfaces with the Motion Modules are directly written to and read by the ladder logic programs to perform motion control.

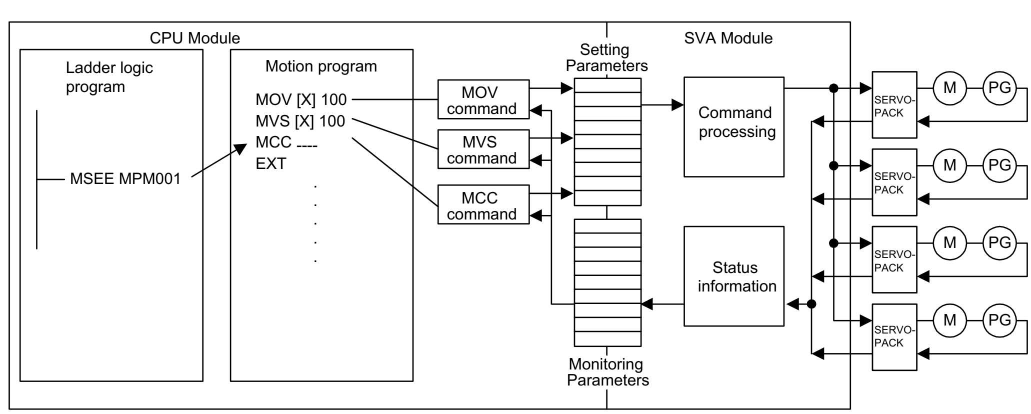


Special operations can be programmed and combined as user functions.

For details, see *Chapter7 Parameters*.

■ Motion Programming

The motion programs that have been created perform motion control using a special motion language. Up to 256 programs can be created, and these can also be executed in parallel.



The use of the special motion language enables complex operations to be easily programmed. The special motion commands shown in the following table are provided as standard in the MP9□□ Series.

Commands	Axis move commands: 8 types MOV, MVS, MCW, MCC, ZRN, SKP, MVT, EXM Basic control commands: 6 types ABS, INC, POS, PLN, MVM, PLD Speed and acceleration/deceleration commands: 7 types ACC, SCC, VEL, IAC, IDC, IFP, FMX High-level control commands: 4 types PFN, INP, SNG, UFC Control commands: 10 types MSEE, TIM, IOW, END, RET, EOX, IF ELSE IEND, WHILE WEND, PFORK JOINTO PJOINT, SFORK JOINTO SJOINT Math and sequence control commands: 32 types =. +. -, *, /, MOD, |, ^, &, !, ( ), S{ }, R { }, SIN, COS, TAN, ASN, ACS, ATN, SQRT, BIN, BCD, = =, < >, >, <, >=, <=, SFR, SFL, BLK, CLR

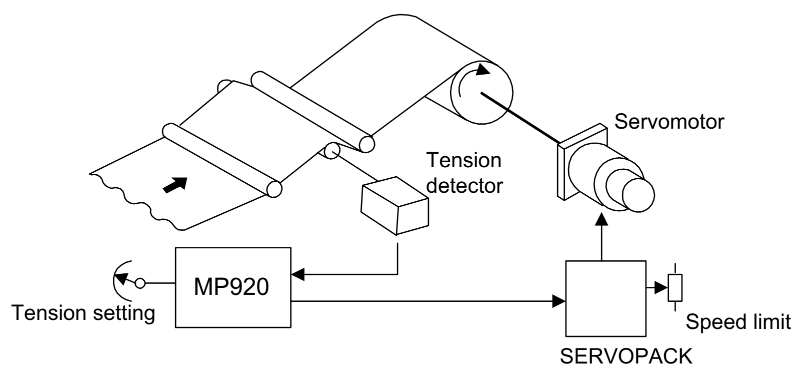
4

4.1.3 Examples of Motion Control Applications

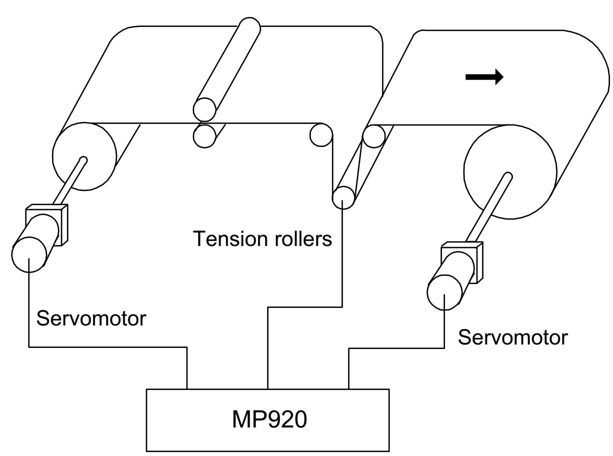
The following illustrations show examples of the use of each control mode for an SVA Module.

■ Speed Reference Output Control and Torque Reference Output Control

Winder A

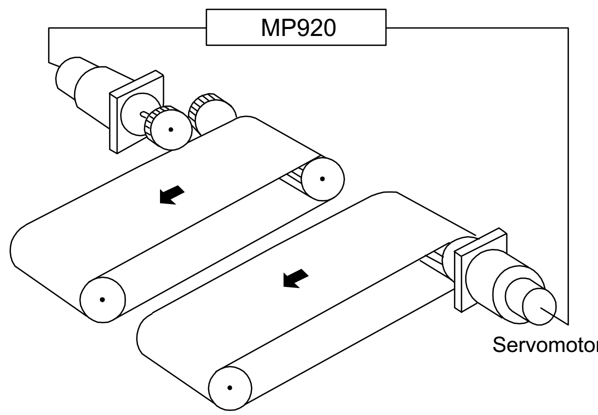


Winder B



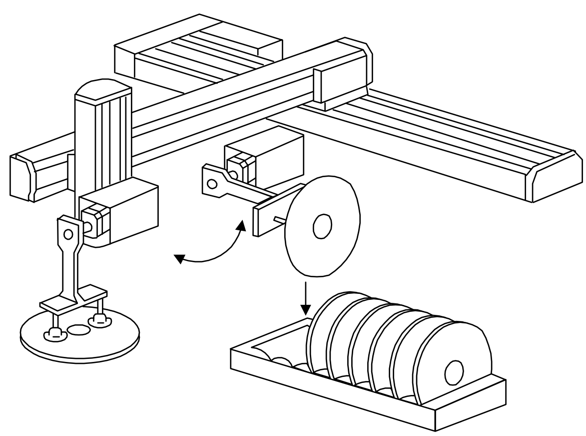
■ Phase Control

Conveyor Synchronization

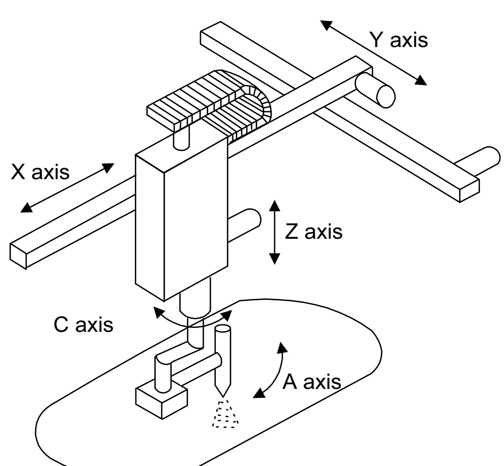


■ Position Control

Conveyor



Coater



4.2 Control Modes

This section describes the motion control modes that can be used by the MP920.

4.2.1 Overview of Control Modes

Five control modes are available for MP920 Motion Modules. These modes can be switched in real time, according to the purpose.

The following table shows the control mode that can be used by MP920 Motion Modules, and gives an overview and some examples of their uses.

Control Mode	Overview	Typical Applications	SVA1	SVA2	SVB	PO01
Speed Reference Output Mode	Rotates the motor at the specified speed.	Conveyors or main axes	Yes	Yes	No	No
Torque Reference Output Mode	Outputs the specified torque.	Injection molding machines or presses	No	Yes	No	No
Position Control Mode*	Specifies the target position and speed. Executes a position loop, identifies the difference to the target position from the encoder, converts the difference to the speed reference, and performs position control.	Conveyors or XY tables	Yes	Yes	Yes	Yes
Phase Control Mode	While executing speed control using a standard speed reference, generates the target position from the speed reference, and performs phase control.	Electronic cams or electronic shafts	Yes	Yes	No	No
Zero Return Mode*	Performs zero point positioning when an incremental encoder is used.	–	Yes	Yes	No	No

* There are two methods for returning to the zero point:

- Using ZERO POINT RETURN command for position control
- Using Zero Return Mode

4.2.2 Speed Reference Output Mode

■ Overview

This mode is used to rotate the motor at the desired speed.

A speed reference is output to the servo driver according to the specified speed reference, linear acceleration/deceleration time constant, and filter time constant.

The acceleration/deceleration time can be set as desired.

S-curve acceleration/deceleration can be easily performed by the user program (one command).

The speed reference output mode can also be used for a general-purpose D/A converter. In this case, set the linear acceleration/deceleration time constant and the filter time constant to "0."

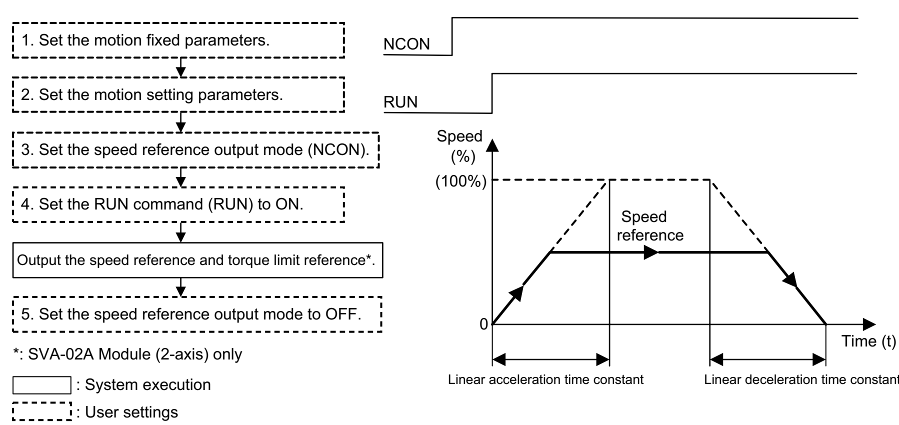
IMPORTANT

The speed reference output mode can be used only with SVA-01A and SVA-02A Modules. It cannot be used with SVB-01 or PO-01 Module.

4

■ Details

Use the following procedure to perform operation in the speed reference output mode.



1. Set the motion fixed parameters according to the user's machine.

Table 4.1 Examples of Fixed Parameters

No.	Name	Setting Range	Meaning	Setting Example
7	Rated Motor Speed Setting	1 to 32000	Rated motor speed	3000 r/min
8	Feedback Pulses per Motor Rotation	4 to 65532	Number of pulses before multiplica-tion	2048 pulses/rev
9	D/A Output Voltage at 100% Speed	0.001 to 10.000	1 = 1 V	6.000 V
	Feedback Pulses per Motor Rotation (for High-resolution) *1	4 to 2147483647	1 = 1 pulse/rev	2048 pulses/rev
10	D/A Output Voltage at 100% Torque Limit *2	0.001 to 10.000	0.001 = 0.001 V 1 = 1 V	3.000 V

* 1. Valid only with an SVB-01 Module.
* 2. Valid only with an SVA-02A Module.

2. Set the motion parameters.

   The following three methods can be used to set the setting parameters.

   - Using the MPE720 Setting Parameter Window
   - Using a ladder logic program
   - Using a motion program

Examples of Setting Parameters

Name	Register No.	Setting Range	Meaning	Setting Example
Positive Torque Limit Setting (TLIMP)*	OW□□02	-32768 to 32767	1 = 0.01%	-10000 (-100.00%)
Positive Speed Limiter Setting (NLIMP)	OW□□04	0 to 32767	1= 0.01%	13000 (130.00%)
Negative Speed Limiter Setting (NLIMN)	OW□□05	0 to 32767	1= 0.01%	13000 (130.00%)
Linear Acceleration Time Constant (NACC)	OW□□0C	0 to 32767	Linear acceleration time constant (ms) at speed pattern generation	1000 (1 second)
Linear Deceleration Time Constant (NDEC)	OW□□0D	0 to 32767	Linear deceleration time constant (ms) at speed pattern generation	1000 (1 second)
Filter Time Constant Setting (NNUM)	OW□□14	0 to 255	For simple S-curve acceleration	0
Speed Reference Setting (NREF)	OW□□15	-32768 to 32767	Speed reference value 1= 0.01%	5000 (50.00%)

* Valid only with an SVA-02A Module.

In the examples, SERVOPACK is used as axis 1 of Module No. 1. When the Module number and the axis number are different, see *7.1.2 Module Numbers and Motion Parameter Register Numbers*, and change the register numbers.

3. Select the Speed Reference Output Mode (NCON) (bit 0 of OW□□00).
4. Set the Servo ON (RUN) to ON (bit 0 of OW□□01).
   The speed reference will be output for the axis according to the specified motion parameters.
   With an SVA-02A Module (2-axis), the speed reference is output from channel 1, and the torque limit reference is output from channel 2.
   Even while the speed reference output mode is being selected, the motion parameter settings can be changed.
5. To stop operation, set the RUN command (RUN) and the speed reference output mode (NCON) to OFF.

■ User Program Examples

Example of RUN Operation

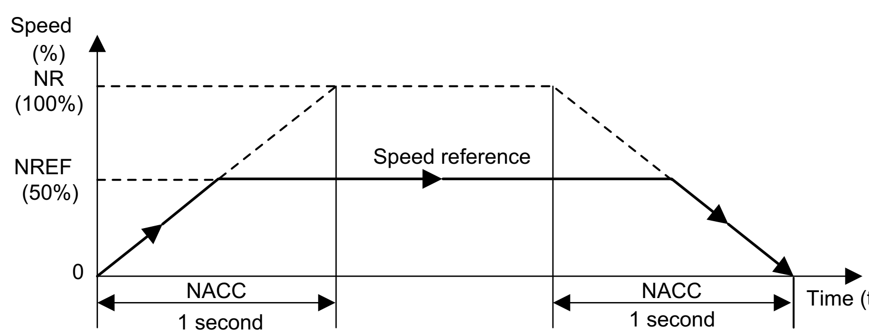


Fig. 4.1 Speed Pattern

Ladder Logic Program Example

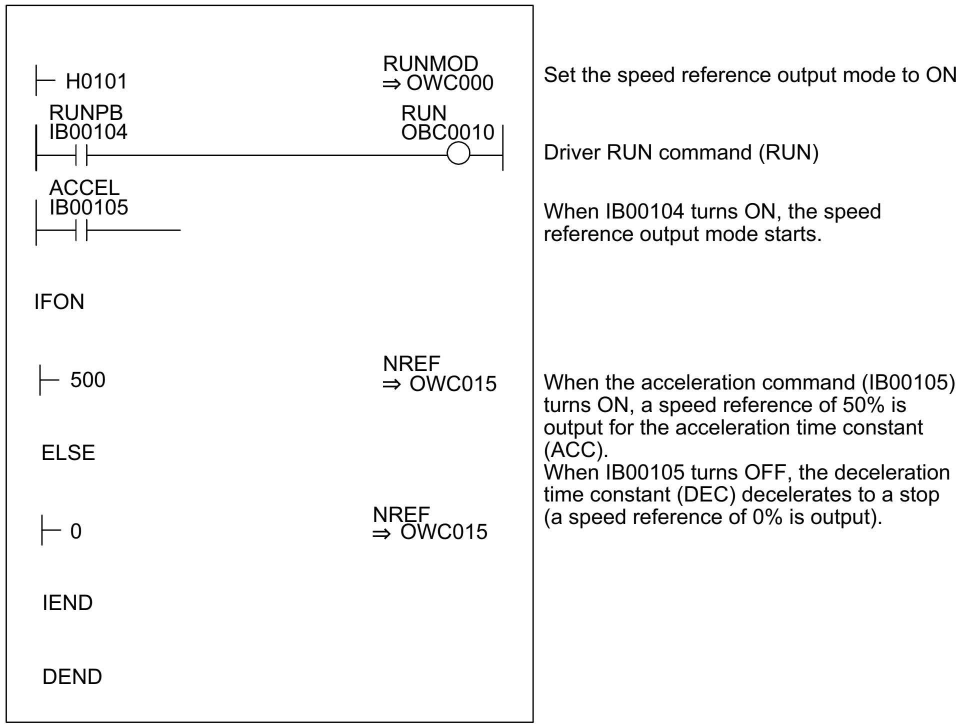


Fig. 4.2 RUN Commands (DWG H01)

The example in the above illustration has been greatly simplified. In actual operation, each register can be controlled from the user program.

4.2.3 Torque Reference Output Mode

■ Overview

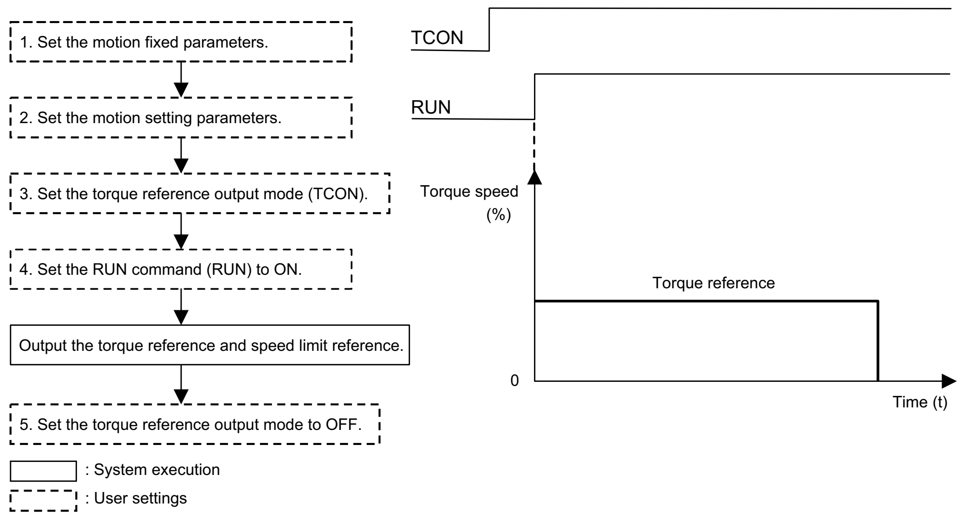
This mode is used to generate a constant torque, regardless of the speed.
Select this mode to keep the metal mold of a plastic molding machine, such as an injection molding machine, at a constant pressure.
When the torque reference output mode is selected, the specified torque reference and speed limit reference are output by the servo driver.
This mode can be used only with an SVA-02A Module (2-axis).

IMPORTANT

The torque reference output mode can be used only with SVA-02A Module. It cannot be used with SVA-01A, SVB-01, or PO-01 Module.

■ Details

Use the following procedure to perform operations in the torque reference output mode.



1. Set the motion fixed parameters according to the user's machine.
   Table 4.2 shows the related parameters when the torque reference output mode is used.

Table 4.2 Examples of Fixed Parameters

No.	Name	Setting Range	Meaning	Setting Example
7	Rated Motor Speed Setting	1 to 32000	Rated motor speed	3000 r/min
8	Number of Feedback Pulses per Motor Rotation	4 to 65532	Number of pulses before multiplica-tion	2048 pulses/rev
9	D/A Output Voltage at 100% Speed	0.001 to 10.000	1 = 1 V	6.000 V
	Feedback Pulses per Motor Rotation (for High-resolution) *1	4 to 2147483647	1 = 1 pulse/rev	2048 pulses/rev
10	D/A Output Voltage at 100% Torque Limit*2	0.001 to 10.000	0.001 = 0.001 V 1 = 1 V	3.000 V

* 1. Valid only with an SVB-01 Module.
* 2. Valid only with an SVA-02A Module.

2. Set the motion parameters.

Table 4.3 Examples of Setting Parameters

Name	Register No.	Meaning	Setting Example
Torque Reference Setting (TREF)	OW☐☐1B	Sets the torque reference value at 0.01%.	5000 (50.00%)
Speed Limit Setting (NLIM)	OW☐☐1C	Sets the speed limit value at 0.01%.	5000 (50.00%)

3. Select the Torque Reference Output Mode (TCON) (bit 1 of OW☐☐00).

4. Set the Servo ON (RUN) to ON (bit 0 of OW□□01).
   The torque reference and the speed limit reference will be output for the axis according to the specified motion parameters.
   Even while the torque reference output mode is being selected, the motion parameter settings can be changed.
5. To stop operation, set the RUN command (RUN) and the torque reference output mode (TCON) to OFF.

■ User Program Example

Example of RUN Operation

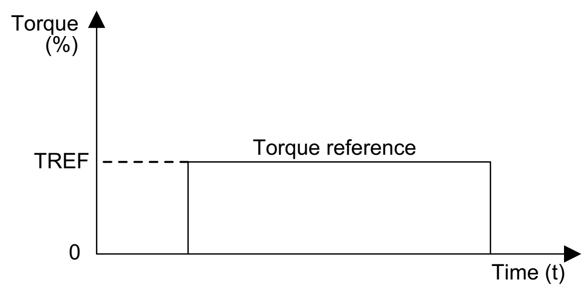


Fig. 4.3 Torque Pattern

Ladder Logic Program Example

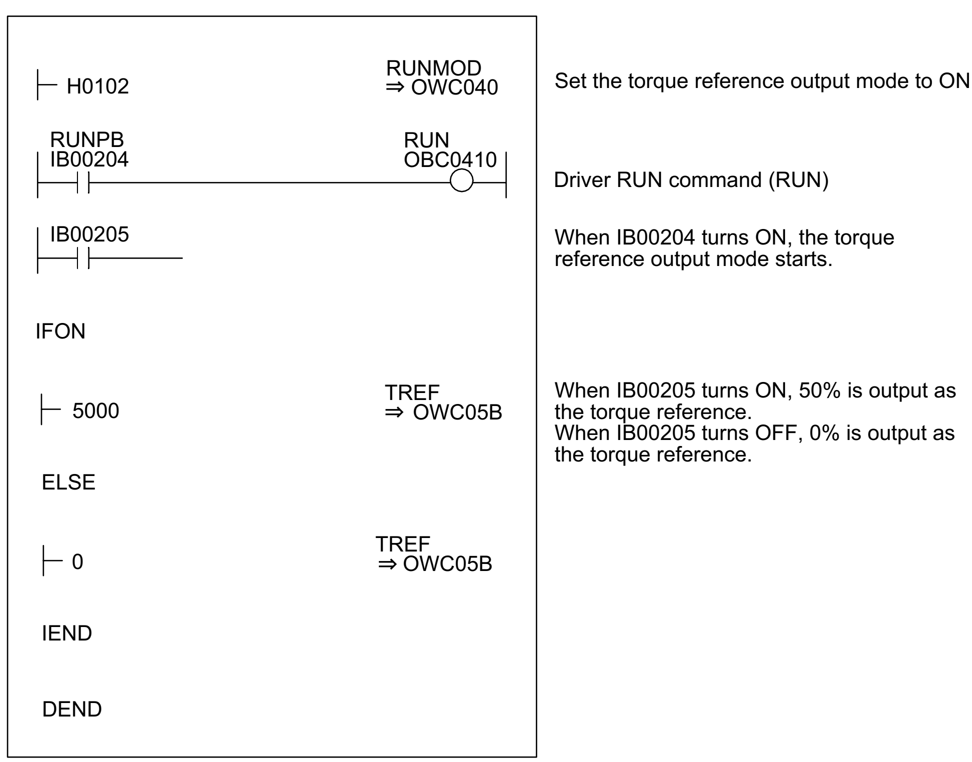


Fig. 4.4 RUN Commands (DWG H02)

The example in the above illustration has been greatly simplified. In actual operation, each register can be controlled from the user program.

4.2.4 Phase Control Mode

■ Overview

This mode is used to rotate the motor according to the specified speed reference, and at the same time to strictly control the number of rotations.
Phase control uses multiple axes, ensuring that no deviation occurs in the angle of rotation (phase) for the motors and enabling endless rotation for printing and other machines being controlled.
Electronic shafts and electronic cams can thus be used in the servomotors of complex machine configurations. Phase alignment and synchronous operation, as well as ratio operation and cam variable speed operation have all been replaced by software.

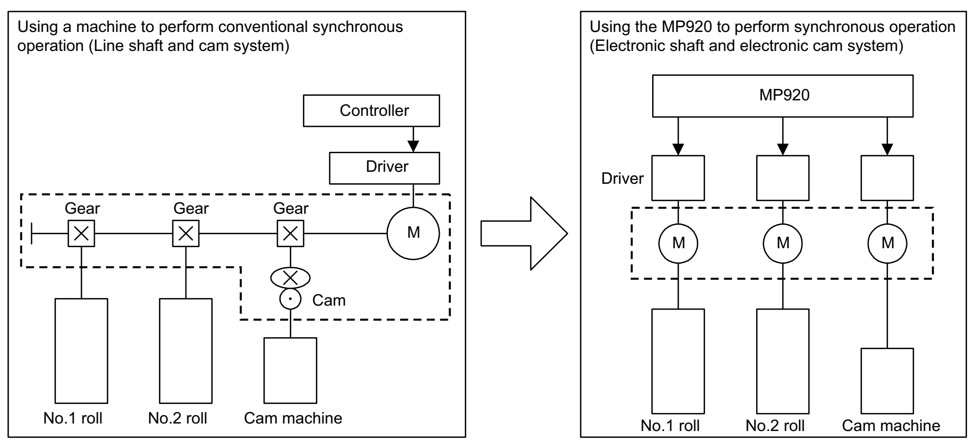


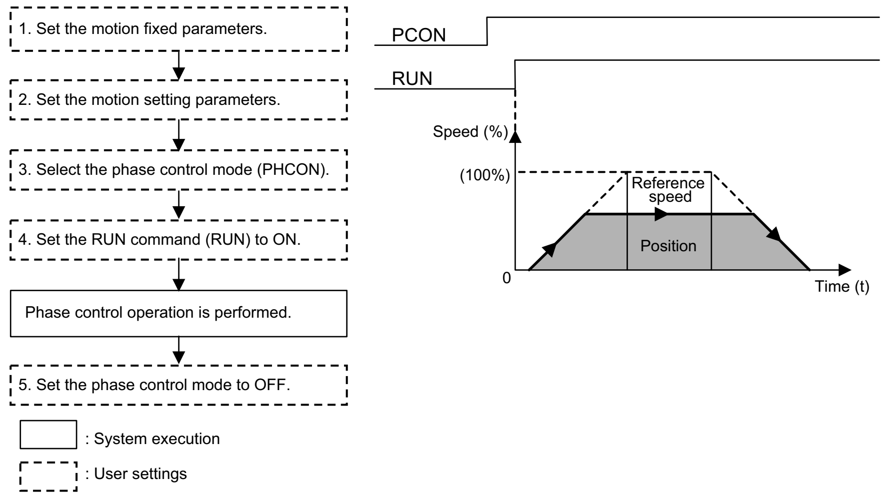
Fig. 4.5 Electronic Cam and Electronic Shaft Illustration

IMPORTANT

The phase output mode can be used only with SVA-01A and SVA-02A Modules. It cannot be used with SVB-01 or PO-01 Module.

■ Details

Use the following procedure to perform phase control operation.



1. Set the motion fixed parameters according to the user's machine.

Table 4.4 Examples of Fixed Parameters

No.	Name	Setting Range	Meaning	Setting Example
7	Rated Motor Speed Setting	1 to 32000	Rated motor speed	3000 r/min
8	Number of Feedback Pulses per Motor Rotation	4 to 65532	Number of pulses before multiplication	2048 pulses/rev
9	D/A Output Voltage at 100% Speed	0.001 to 10.000	1 = 1 V	6.000 V
	Feedback Pulses per Motor Rotation (for High-resolution) *1	4 to 2147483647	1 = 1 pulse/rev	2048 pulses/rev
10	D/A Output Voltage at 100% Torque Limit *2	0.001 to 10.000	0.001 = 0.001 V 1 = 1 V	3.000 V

* 1. Valid only with an SVB-01 Module.
* 2. Valid only with an SVA-02A Module.

2. Set the motion parameters. Use the user program to control the reference speed so that no shock occurs.

   The following three methods can be used to set the setting parameters.

   - Using the MPE720 Setting Parameter Window
   - Using a ladder logic program
   - Using a motion program

   Table 4.5 shows the related parameters when the phase control mode is used.

Table 4.5 Examples of Setting Parameters

Name	Register No.	Setting Range	Meaning	Electronic Shaft Setting Example	Electronic Cam Setting Example
Positive Torque Limit Setting (TLIMP)*	OW☐☐02	-32768 to 32767	1 = 0.01%	-10000 (-100.00%)	-10000 (-100.00%)
Positive Speed Limiter Setting (NLIMP)	OW☐☐04	0 to 32767	1 = 0.01%	13000 (130.00%)	13000 (130.00%)
Negative Speed Limiter Setting (NLIMN)	OW☐☐05	0 to 32767	1 = 0.01%	13000 (130.00%)	13000 (130.00%)
Error Count Alarm Detection Setting (EOV)	OW☐☐0F	0 to 65535	1 = 1 pulse	65535	65535
Speed Reference Setting (NREF)	OW☐☐15	-32768 to 32767	1 = 0.01%	5000 (50.00%)	Set by the ladder logic program.
Phase Bias Setting (PHBIAS)	OL☐☐16	-2^{31} to $2^{31}-1$	1 = 1 pulse	Set by the ladder logic program.	Set by the ladder logic program.
Speed Compensation Setting (NCOM)	OW☐☐18	-32768 to 32767	1 = 0.01%	0	0
Proportional Gain Setting (PGAIN)	OW☐☐19	0 to 32767	0.1 = 0.1 /s 1 = 1 /s	1.5 (1.5)	250.0 (250.0)
Integral Time Setting (TI)	OW☐☐1A	0 to 32767	1 = 1 ms	300 (300 ms)	0 (0 ms)

* Valid only with an SVA-02A Module.

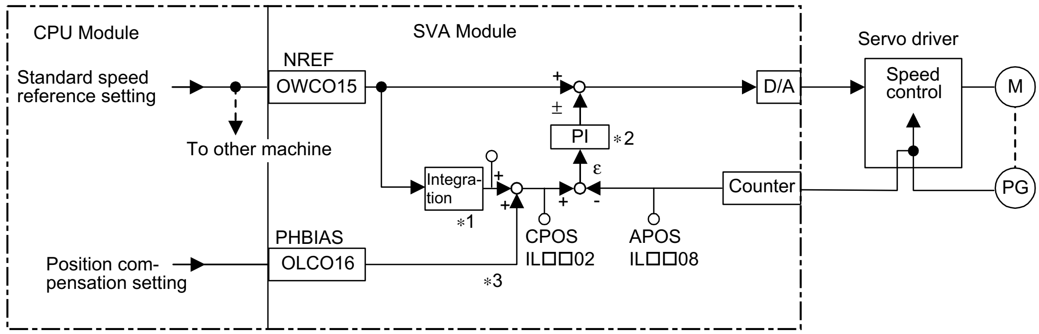
3. Select the Phase Control Mode (PHCON) (bit 3 of OW☐☐00).
   At this time, also set Phase Reference Disable (PHREFOFF: bit 7 of OW☐☐00). Normally, this bit is set to OFF for electronic shaft applications, and it is set to ON for electronic cam applications.
4. Set the Servo ON (RUN) to ON (bit 0 of OW☐☐01).
   Phase control will be performed for the axis according to the specified motion parameters.
   Even while phase control is being performed, the motion parameter settings can be changed.
5. To stop operation, set the RUN command (RUN) and the phase control mode (PHCON) to OFF.

■ User Program Example 1: Electronic Shaft

Example of RUN Operation

Phase control can be called “speed control with position compensation” or “position control with 100% speed feed forward.” “Position” means the motor angle of rotation, and is therefore called “phase control.” An electronic shaft can be configured using this phase control.

Fig. 4.6 shows a block diagram of a phase control loop.



* 1. Integrates the reference speed reference, and calculates the corresponding position (pulse).

* 2. Generates the speed reference from the target position (CPOS) and current position (APOS) error ε. This is the position (phase) compensation.

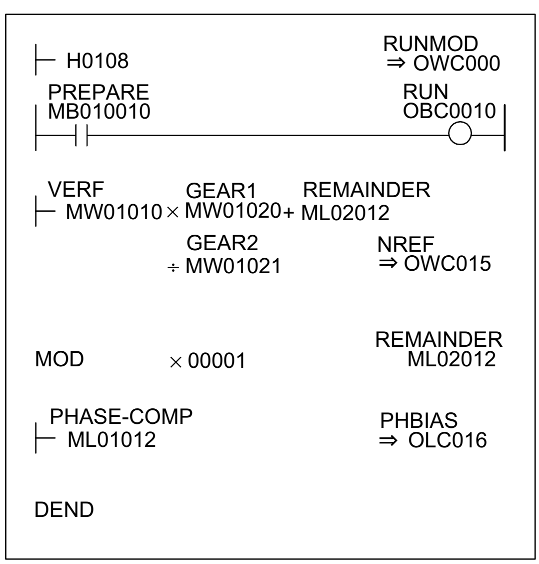
* 3. To move the phase, the distance to be moved (the angle of rotation of the motor axis converted to the number of pulses) can be added as the phase compensation setting.

Fig. 4.6 Block Diagram of Phase Control Loop

The rotational phase of the motor can be managed (controlled) using the above method.

This control loop is processed in the SVA-02A Module. Therefore, the user can easily control the electronic shaft simply by selecting the phase control mode on the CPU Module and providing the required parameters for the SVA Module.

Ladder Logic Program Example



Set the phase control mode to ON.
Set Phase Reference Generation Operation Disable to OFF.

Driver RUN command (RUN)
When MB01010 turns ON, phase control starts.

Set the reference speed reference (NREF). The speed reference is stored in advance in MW01010. The gear ratios are stored in advance in MW01020 and MW01021. If gears are not required, "1" is stored in advance.

To move the phase, set the phase compensation (OLC016). The distance to be moved (the angle of rotation of the motor axis converted to the number of pulses) is stored in advance in ML01012.

Fig. 4.7 RUN Commands (DWG H04)

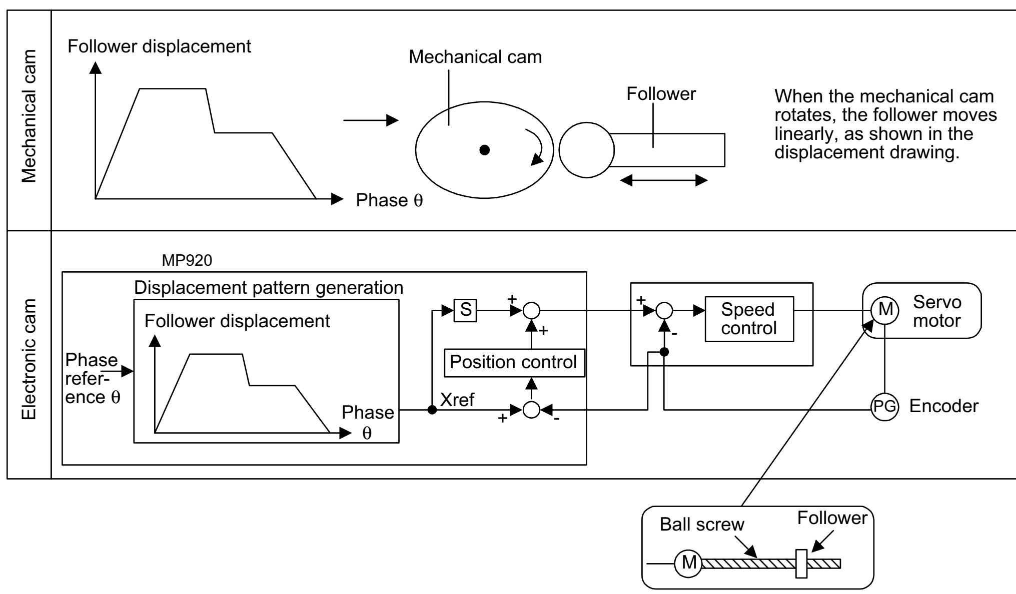
The example in the above illustration has been greatly simplified. In actual operation, each register can be controlled from the user program.

■ User Program Example 2: Electronic Cam

Example of RUN Operation

Cams are one of the conventional methods for changing a rotational movement to a linear movement, and they are used to obtain the desired operation curve (displacement drawing) during a cycle.

- A mechanical cam forms a cam with a shape corresponding to this displacement drawing. Placing a follower on the circumference and rotating the cam enables the desired linear operation to be obtained.
- An electronic cam holds the actual displacement drawing data in the controller as a position pattern, and performs regular position control for the so-called continuous path (CP) by changing the phase.



An electronic cam control loop can be configured using phase control. With normal phase control, the position reference is generated by integrating the reference speed reference into the SVA Module (see *Fig. 4.8*).

An electronic cam control loop cuts the integral circuit of the reference speed reference, and provides the position reference from the phase compensation settings (see *Fig. 4.9*).

The following illustration shows a block diagram of a phase control loop.

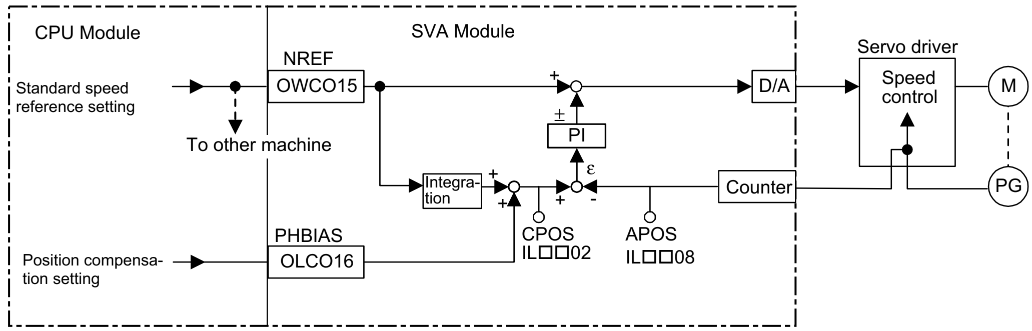


Fig. 4.8 Block Diagram of Phase Control Loop

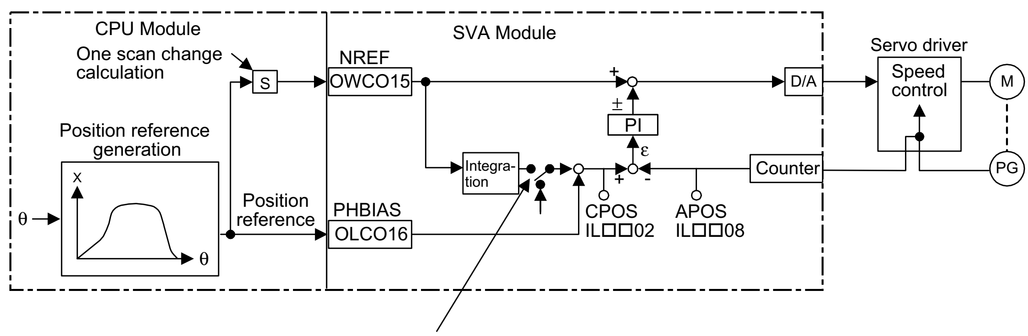


Fig. 4.9 Block Diagram of Electronic Cam Control Loop

The electronic cam control loop is processed in the SVA Module. Therefore, the user can easily control the electronic cam simply by selecting the phase control mode on the CPU Module and providing the required parameters for the SVA Module.

Ladder Logic Program Example

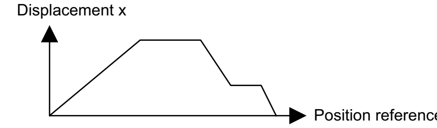
├ H0188 RUNMOD ⇒ OWC000	Set the phase control mode to ON. Set Phase Reference Generation Operation Disable to ON.
├ K1 MW00040 × TsH SW00004	Calculate the speed scaling constant (ks).
K2 ÷MW00041 KS ⇒ ML03010	High-speed scan setting: SW0004 $\dfrac{NR \times FBppr \times n}{60 \times 10^4}$ → Numerator *MW00040, Denominator *MW00041 NR = Rated speed FBppr = Number of feedback pulses n = Number of pulse multipliers (1, 2, or 4) Note Reduce the fraction to the lowest terms so that it can be stored as one word.
├ 10000 FFGAIN ⇒ MW03012	Feed forward gain [10000/100%]
PREPARE MB010010 ─┤├─ RUN OBC0010 ─( )─	Driver RUN command (RUN) When MB01010 turns ON, phase control starts.
PHASE REFERENCE ├ ML03030	
FGN DISPLACEMENT PATTERN MA03050 DISPLACEMENT X ⇒ ML03020	The phase reference displacement [pulse] is read from the FGN function.  The FGN pattern is set in advance.
DISPLACEMENT X ├ ML03020 PREVIOUS VALUE -ML03024 CHANGE ⇒ ML03022	Changes [pulses] per scan
├ 00000	
RUN command MB010020 ─┤├─	When RUN command MB010020 turns ON, the machine operates at the reference speed NREF. When MB010020 turns OFF, the reference speed NREF remains at “0.”
CHANGE [├ ML03022] FFGAIN ×MW03012	
KS ÷ML03010 NREF ⇒ OWC015	Standard speed reference setting [0.01%]
Position bias [├ ML03022] DISPLACEMENT X [+MW03020] PHBIAS [⇒ OLC016]	Phase compensation setting [pulse]
DISPLACEMENT X ├ ML03020 PREVIOUS VALUE ⇒ ML03024	Phase reference previous displacement value [pulse]
DEND	

Fig. 4.10 RUN Command (DWG H04)

The example in the above illustration has been greatly simplified. In actual operation, each register can be controlled from the user program.

4.2.5 Zero Return Mode

■ Overview

The zero point return operation returns the machine to the machine-specific zero point.

When an incremental encoder is used, the system zero point position data is destroyed if the power supply is disconnected. Therefore, after turning ON the power, the system zero point must be repositioned. As a general rule, a pulse generator (PG) with a zero point pulse and a limit switch showing the zero point area are used to determine the zero point.

There are two zero point return methods. One method uses motion commands, and the other method uses the zero return control mode. Care is required because zero point return operations are different with these two methods.

Using the zero return mode is explained below.

Note: To use motion commands, see *4.4.9 Zero Point Setting (ZSET)*.

When an absolute encoder is used, position reference “0” will be the position control when zero point return is selected.

■ Details

Use the following procedure to perform operation in the zero return mode.

1. Set the motion fixed parameters.
2. Set the motion setting parameters.
3. Set the zero return mode (ZRN) to ON.
4. Set the RUN command (RUN) to ON.

The axis is moved at approach speed in the zero point direction.

a) When LSDEC turns ON, the axis is decelerated to creep speed.

b) LSDEC turns from ON to OFF, and decelerates to a stop after detecting the initial zero point pulse (C-phase pulse).

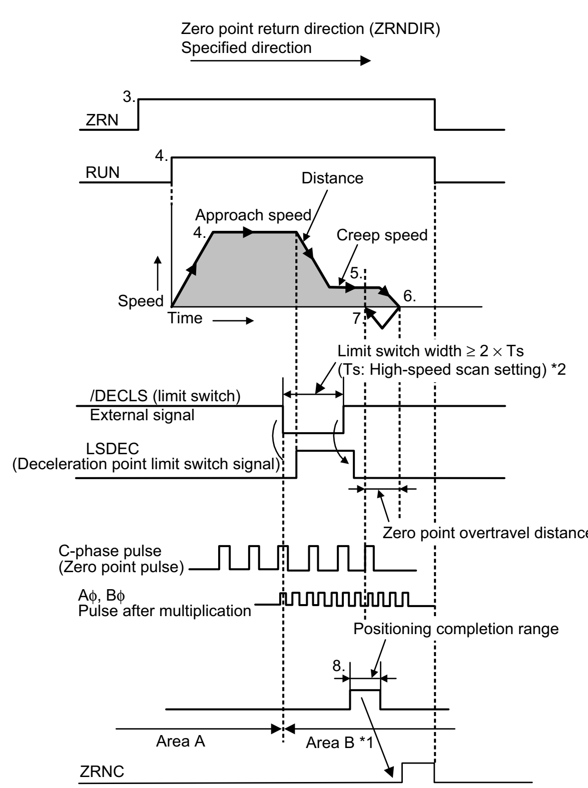
c) After decelerating to a stop, the axis is moved only the zero point overtravel distance, and stops at the zero point position.

d) The zero point return completion signal (ZRNC) turns ON.

5. Set the zero return mode to OFF.

: System execution

: User settings



* 1. If the machine is in Area B after the power is turned ON, a return cannot be performed correctly. Be sure to move the machine back to Area A before performing a return.

* 2. The limit switch (/DECLS) width must be at least twice that of the high-speed scan setting.

1. Set the motion fixed parameters according to the user's machine.

Table 4.6 Examples of Fixed Parameters

No.	Name	Setting Range	Meaning	Setting Example
7	Rated Motor Speed Setting	1 to 32000	Rated motor speed	3000 r/min
8	Number of Feedback Pulses per Motor Rotation	4 to 65532	Number of pulses before multiplication	2048 pulses/rev
9	D/A Output Voltage at 100% Speed	0.001 to 10.000	1 = 1 V	6.000 V
	Feedback Pulses per Motor Rotation (for High-resolution) *1	4 to 2147483647	1 = 1 pulse/rev	2048 pulses/rev
10	D/A Output Voltage at 100% Torque Limit *2	0.001 to 10.000	0.001 = 0.001 V 1 = 1 V	3.000 V

* 1. Valid only with an SVB-01 Module.
* 2. Valid only with an SVA-02A Module.

2. Set the motion parameters.

   The following three methods can be used to set the setting parameters.

   - Using the MPE720 Setting Parameter Window
   - Using a ladder logic program
   - Using a motion program

Table 4.7 Examples of Setting Parameters

Name	Register No.	Setting Range	Meaning	Setting Example
Positive Torque Limit Setting (TLIMP)*	OW□□02	-32768 to 32767	1 = 0.01%	-10000 (-100.00%)
Positive Speed Limiter Setting (NLIMP)	OW□□04	0 to 32767	1 = 0.01%	13000 (130.00%)
Negative Speed Limiter Setting (NLIMN)	OW□□05	0 to 32767	1 = 0.01%	13000 (130.00%)
Zero Point Offset (ABSOFF)	OL□□06	-2^{31} to $2^{31}-1$	1 = 1 reference unit With pulse: 1 = 1 pulse	100 pulses
Approach Speed Setting (NAPR)	OW□□0A	0 to 32767	Value (%) for rated speed: 1 = 0.01%	2000 (20.00 %)
Creep Speed Setting (NCLP)	OW□□0B	0 to 32767	Value (%) for rated speed: 1 = 0.01%	1000 (10.00 %)
Linear Acceleration Time Constant (NACC)	OW□□0C	0 to 32767	Linear acceleration time constant (ms) at speed pattern generation	1000 (1 second)
Linear Deceleration Time Constant (NDEC)	OW□□0D	0 to 32767	Linear deceleration time constant (ms) at speed pattern generation	1000 (1 second)
Positioning Completed Range Setting (PEXT)	OW□□0E	0 to 65535	1 = 1 reference unit With pulse: 1 = 1 pulse	10 pulses
Error Count Alarm Detection Setting (EOV)	OW□□0F	0 to 65535	1 = 1 reference unit With pulse: 1 = 1 pulse	65535 pulses
Position Loop Gain Setting (KP)	OW□□10	0 to 32767	0.1 = 0.1 /s 1 = 1 /s	300 (30.0 /s)
Filter Time Constant (NNUM)	OW□□14	0 to 255	For simple S-curved acceleration	0

* Valid only with an SVA-02A Module.

In the example, the SERVOPACK is used as axis 1 of Module No. 1. When the Module number and the axis number are different, see *7.1.2 Module Numbers and Motion Parameter Register Numbers*, and change the register number.

3. Set the Zero Return Mode (ZRN) to ON (bit 4 of OW□□00).
4. Set the Servo ON (RUN) to ON (bit 0 of OW□□01).
   a) The axis will be moved in the direction specified by the Zero Point Return Direction Selection ZRNDIR (bit 9 of OW□□00).
   b) When the Zero Point Return Deceleration Point Limit Switch LSDEC (bit F of OW□□01) turns ON, the axis is decelerated to creep speed.

IMPORTANT

A user program must be created to connect the Limit Switch Signal DECLS (the DI signal included in the LIO-01 Module) to the Zero Point Return Deceleration Point Limit Switch LSDEC (bit F of OW□□01).

c) When LSDEC turns from ON to OFF, the point detected by the initial zero point pulse (C-phase pulse) is the zero point position. The axis is decelerated to a stop after detecting the initial zero point pulse.

d) After decelerating to a stop, the axis is moved only the zero point overtravel distance at creep speed in the zero point position direction and stops at the zero point position. A zero point position offset value can also be set. (If Zero Point Position Offset OL□□06 is set in advance to 100, the position data will be 100.)

5. The zero point return operation is completed when the axis enters the positioning completed range. When the zero point return operation is completed, the Zero Point Return Completed Signal ZRNC (bit F of IW□□00) turns ON.

   After checking that the zero point return completion signal (ZRNC) is turned ON, set the RUN command (RUN) and the zero return mode (ZRN) to OFF.

■ User Program Example

Example of RUN Operation

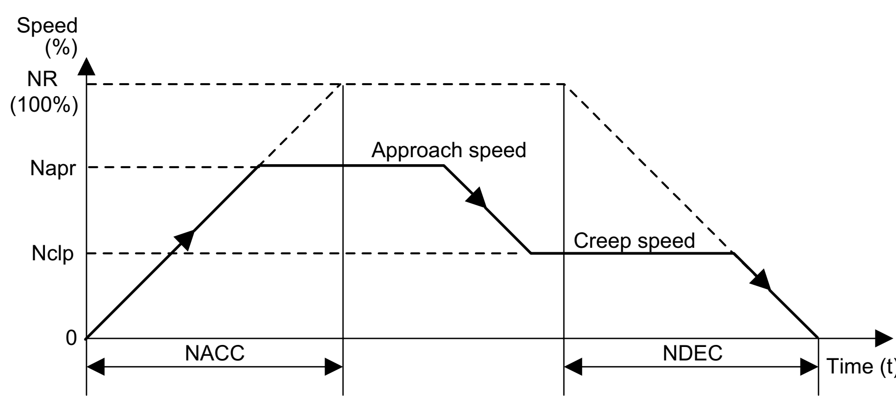


Fig. 4.11 Zero Point Return Pattern

Operating Conditions

Input a limit switch signal width at least twice that of the high-speed scan setting.

Ladder Logic Program Example

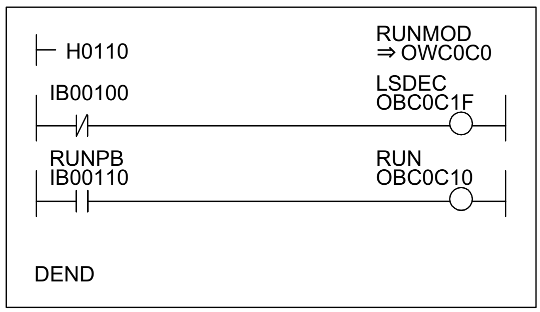


Fig. 4.12 RUN Commands (DWG H01)

The example in the above illustration has been greatly simplified. In actual operation, each register can be controlled from the user program.

4.3 Position Control

This section describes the prerequisites for position control, and position control without using motion commands.

4.3.1 Prerequisites for Position Control

■ Overview

With position control, the axis is moved to the target position, stops there, and holds that position (servo clamp).

An incremental encoder or a Yaskawa absolute encoder is used as the position detector. When a Yaskawa absolute encoder is used, the absolute position is stored, even when the power for the machine (positioning device) is disconnected. Therefore, when the power is turned ON again, the zero point return operation is not required.

There are two position control methods. One method uses motion commands (OW☐☐20), and the other method does not use motion commands.

Whether or not motion commands (OW☐☐20) are to be used is set in the motion parameters shown in the following table.

Motion Parameter	Motion Command (OW☐☐20) Not Used	Motion Command (OW☐☐20) Used
Motion fixed parameter No. 14 Bit 7 of Additional Function Selections (Motion Command Selection)	0 (= Not used)	1 (= Used)
Motion setting parameter Bit 8 of RUN Mode Settings (OW☐☐00) (Motion Command Code Enable/Disable)	0 (= Disabled)	1 (= Enabled)

Note: When bit 7 (motion command selection) of motion fixed parameter No. 14 (Additional Function Selections) is not selected for use and bit 8 (motion command code enable) of the RUN Mode Settings (OW☐☐00) motion setting parameter is set to “1” (= enabled), the axis is controlled without motion commands (OW☐☐20).

IMPORTANT

The position control mode is applicable for any motion module. However, it is applicable for SVB-01 and PO-01 Modules, only when the motion commands are enabled. The table below shows the conditions to use the position control mode for each module.

	Position Control Mode	
	Motion Command Enabled	Motion Command Disabled
SVA-01A	Applicable	Applicable
SVA-02A	Applicable	Applicable
SVB-01	Applicable	N/A
PO-01	Applicable	N/A

4

IMPORTANT

When using a motion program, the bit 14 of OW☐☐01 (Position Reference Type) must be set to 1 (Incremental Addition Mode).

The default setting is 1 (Incremental Addition Mode).

Table 4.8 shows the differences when motion commands (OW☐☐20) are used, and when no motion command is used.

Table 4.8 Differences When Motion Commands are Used/Not Used

Item	Motion Commands (OW☐☐20) Not Used	Motion Commands (OW☐☐20) Used
Reference Unit	Pulse	Pulse, mm, inch, or deg can be selected.
Electronic Gear Function	Not possible	Possible
Finite length position control	Possible	Possible
Infinite length position control that rotates the axis in one direction only, without resetting after one rotation	Possible	Possible
Infinite length position control that resets the axis after one rotation	Not possible	Possible
Position reference	Absolute position mode	Absolute position mode or incremental addition mode can be selected.
Position buffer	Not possible	Possible
Position monitor	Pulse unit	Reference unit
Speed reference	Percentage (%) reference	The percentage (%) reference or the reference unit can be selected.

The meaning of the terms used in the above table and their method of application are discussed below.

■ Reference Unit

The reference units input to the Module are set with the following motion fixed parameter settings.

Pulses, millimeters, degrees, or inches can be used as the reference unit. The reference unit is specified in bits 0 to 3 of motion fixed parameter No. 17 (Motion Controller Function Selection Flags).

The minimum reference unit that can be specified in the Module is determined by the above unit settings and the setting of motion fixed parameter No. 18 (Number of Digits Below Decimal Point).

When motion commands (OW☐☐20) are not used, the unit will be the pulse.

Table 4.9 Minimum Reference Unit (1 Reference Unit)

Number of Digits Below Decimal Point	Motion Fixed Parameter No. 17 Bits 0 to 3 of Motion Controller Function Selection Flags			
	Pulse (= 0)	mm (= 1)	deg (= 2)	inch (= 3)
0	1 pulse	1 mm	1 deg	1 inch
1	1 pulse	0.1 mm	0.1 deg	0.1 inch
2	1 pulse	0.01 mm	0.01 deg	0.01 inch
3	1 pulse	0.001 mm	0.001 deg	0.001 inch
4	1 pulse	0.0001 mm	0.0001 deg	0.0001 inch
5	1 pulse	0.00001 mm	0.00001 deg	0.00001 inch

Note: The number of digits below the decimal point is specified in motion fixed parameter No. 18 (Number of Digits Below Decimal Point).

■ Electronic Gear

In contrast to the reference unit input to the Module, the mechanical travel unit is called the "output unit."

The electronic gear converts position or speed units from reference units (millimeters, degrees, or inches) to output units (millimeters, degrees, or inches).

When the axis at the motor has rotated m times and the mechanical configuration allows the axis at the load to rotate n times, this electronic gear function can be used to make the reference unit equal to the output unit.

The electronic gear function is set in the motion setting parameters shown in *Table 4.10*.

Table 4.10 Electronic Gear Parameters

Motion Fixed Parameter	Name and Meaning
No. 17 Bit 4 of Motion Controller Function Selection Flags	Electronic gear enabled selection (0: Disabled, 1: Enabled) • Disabled when the unit selected is the pulse. Set Disabled (= 0).
No. 19 Distance Travelled per Machine Rotation	Travel distance per machine rotation • This parameter setting is invalid when Disabled (= 0) is set for the electronic gear enabled selection.
No. 21 Servomotor Gear Ratio	Motor side gear ratio • This parameter setting is invalid when Disabled (= 0) is set for the electronic gear enabled selection.
No. 22 Machine Gear Ratio	Machine side gear ratio • This parameter setting is invalid when Disabled (= 0) is set for the electronic gear enabled selection.

When the unit selected is the pulse and motion commands (OW☐☐20) are not used, the electronic gear function is disabled.

Table 4.11 shows the meanings of the above parameters and gives some setting examples.

Table 4.11 Electronic Gear Parameters and Constant

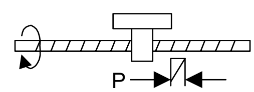
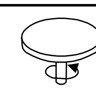
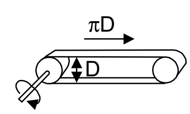
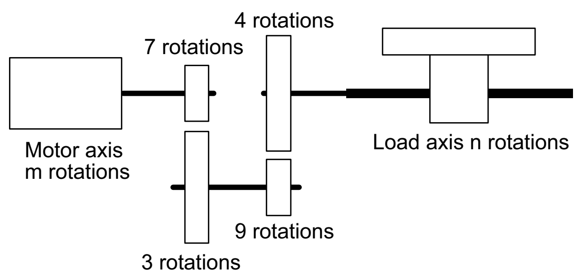
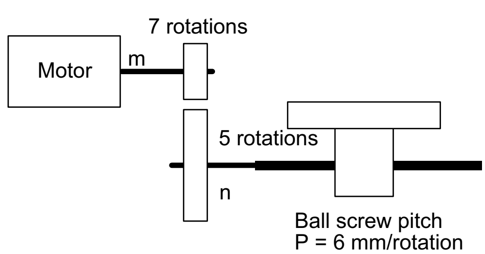
<table>
<tr><th>Servo Fixed Parameter No.</th><th>Name</th><th colspan="3">Description</th><th>Initial Value</th></tr>
<tr><td rowspan="6">No.19</td><td rowspan="6">Distance Travelled Per Machine Rotation</td><td colspan="3">• This parameter shows the load travel distance for each rotation of the load axis. Sets the load travel distance value divided by the minimum reference unit.
$$\text{No.19} = \frac{\text{Load travel distance per load axis rotation}}{\text{Minimum reference unit}}$$
• Some examples of the load travel distance are shown below.</td><td rowspan="6">10000</td></tr>
<tr><td>Distance Travelled Per Machine Rotation</td><td colspan="2">Load Configuration Examples</td></tr>
<tr><td>P [mm]</td><td>Ball screw</td><td>
P = Ball screw pitch</td></tr>
<tr><td>360 [°]</td><td>Round table</td><td>
One rotation = 360°</td></tr>
<tr><td>π D [mm]</td><td>Belt</td><td></td></tr>
<tr><td colspan="3">• No. 19 setting range: 1 to 2^{31} - 1 [1 = 1 reference unit]
Setting Examples
• Load travel distance per load axis rotation = 12 mm
• Minimum reference unit = 0.001 mm [reference unit: mm, digit number after decimal point: 3]
$$\text{No.19} = \frac{12\text{ mm}}{0.001\text{ mm}} = 12000$$</td></tr>
</table>

Table 4.11 Electronic Gear Parameters and Constant (cont'd)

Servo Fixed Parameter No.	Name	Description	Initial Value
No.21 No.22	Servomotor Gear Ratio Machine Gear Ratio	• These parameters are used to set the gear ratio between the motor and the load. When the motor axis has rotated m times and the mechanical configuration allows the load axis to rotate n times, set the following values: No. 21 = m rotations No. 22 = n rotations • Setting range: 1 to 65,535 [rotations] Setting Examples  Gear ratio $= \frac{n}{m} = \frac{3}{7} \times \frac{4}{9} = \frac{4}{21}$ Therefore, set the following values: No. 21 = 21 No. 22 = 4	1

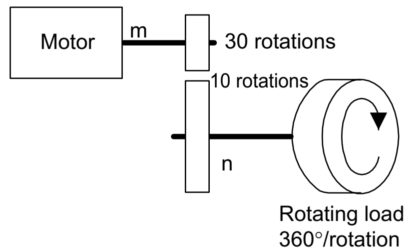
Electronic Gear Parameter Setting Example (A): With Ball Screw



In the above machine system, if the requirement is reference unit = output unit = 0.001 mm, the setting of each parameter will be as follows:

- No.19 $= \frac{6 \text{ mm}}{0.001 \text{ mm}} =$ **6000**
- Gear ratio $= \frac{n}{m} = \frac{5}{7}$
- No.21 = **7**
- No.22 = **5**

Electronic Gear Parameter Setting Example (B): Rotating Load



In the above machine system, if the requirement is reference unit = output unit = 0.1°, the setting of each parameter will be as follows:

- No.19 = $\frac{360°}{0.1°}$ = **6000**
- Gear ratio = $\frac{n}{m}=\frac{10}{30}=\frac{1}{3}$
- No.21 = **3**
- No.22 = **1**

■ Axis Selection

There are two types of position control: Finite length position control, where return and other operations are performed only within a specified range, i.e., within a prescribed positioning interval, and infinite length position control, which is used for rotation in one direction only.

There are two infinite length position control methods. One method involves resetting the conveyor belt or other device to “0” after one rotation; the other method involves rotating the conveyor belt in one direction only, without resetting after one rotation.

Axis selection involves selecting which of these types of position control is to be used. The axis selection is set in bit 5 of motion fixed parameter No. 17 (Motion Controller Function Selection Flags).

When motion commands (OW□□20) are not used, axis selection is disabled. (Set as a finite length axis (= 0).)

Table 4.12 Axis Selections

Types of Position Control	Axis Selection
Finite length position control	Finite length axis (= 0)
Infinite length position control that rotates the axis in one direction only, without resetting after one rotation	Finite length axis (= 0)
Infinite length position control that resets the axis after one rotation*	Infinite length axis (= 1)

* The reset position is set in motion fixed parameter No. 23 (Infinite Length Axis Reset Position).

■ Position Reference

There are two methods of setting the position reference: Direct designation, which directly sets the position reference in OL□□12, and indirect designation, which specifies the number of the position buffer from which the position reference is stored in OL□□12.

There are two direct designation methods: The absolute position reference mode, in which the absolute position is set in OL□□12, and the incremental addition mode, in which the present travel distance is added to the previous position reference value (previous value of OL□□12).

Table 4.13 shows the parameters relating to the position reference.

Table 4.13 Position Reference Parameters

Parameter Type	Parameter No. (Register No.)	Name	Description	Initial Value
Motion Setting Parameters	Bit 12 of OW□□01	Position Reference Value Selection	Sets the position reference designation method. • 0: Direct designation Directly sets the position data in OL□□12. Specifies in bit 14 of OW□□01 whether the position data is to be set in the absolute position mode or the incremental addition mode. • 1: Indirect designation Sets the number of the position buffer in OL□□12. The absolute position must first be stored in the specified position buffer.	0
	Bit 14 of OW□□01	Position Reference Type	Specifies the type of position data. • 0: Absolute position mode Sets the absolute position in OL□□12. • 1: Incremental addition mode Adds the present travel distance value to the previous value of OL□□12 and sets the result in OL□□12.*1	1
	OL□□12	Position Reference Setting	Sets the position data.*2	0

* 1. This parameter is invalid when the position reference value selection is the position buffer (indirect designation).

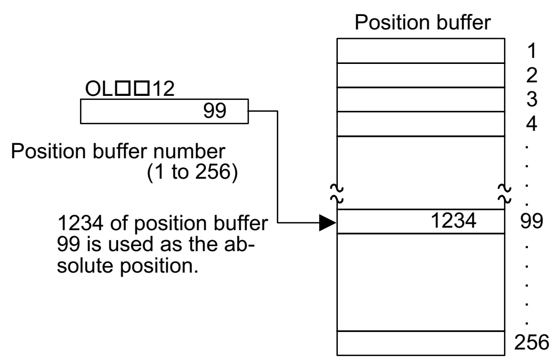
* 2. The setting data differs according to the setting of the Position Reference Value Selection (bit 12 of OW□□01) and the Position Reference Type (bit 14 of OW□□01).

IMPORTANT

When indirect designation is used to specify the position buffer number, the positions stored in the position buffer are treated as absolute positions.

When a motion command (OW□□20) is not used, the position reference value set in OL□□12 is treated as an absolute position.

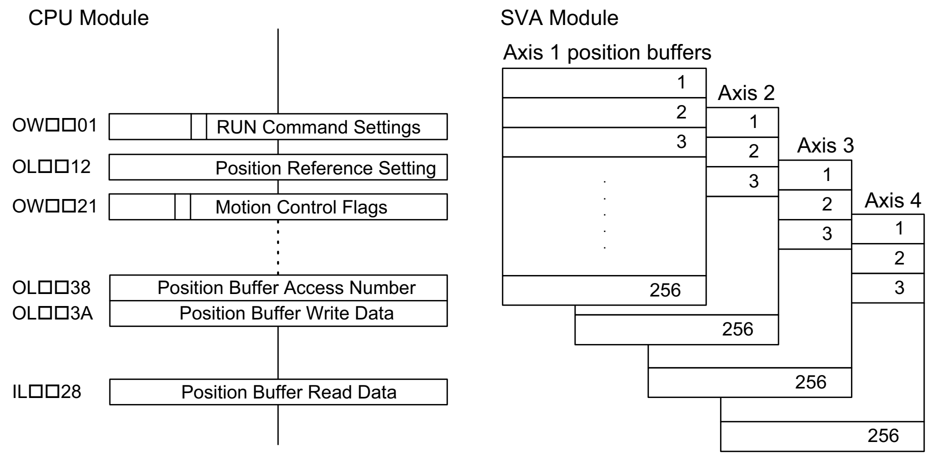
Table 4.14 Position Reference Value Selection

Position Reference Value Selection (Bit 12 of OW□□01)	Position Reference Type (Bit 14 of OW□□01)	Position Reference (OL□□12)
0 (Direct designation)	0 (Absolute position mode)	Sets the absolute position. (Moves to the setting position.) Example: OL□□12←10000 OL□□12←20000
	1 (Incremental addition mode)	Sets the present travel distance value (increment) added to the previous value of OL□□12. OL□□12 ← Previous OL□□12 + Incremental travel distance Example: When the previous OL□□12 = 1,000 and the present travel distance is 500, then: OL□□12 ← 1000 + 500 = 1500
1 (Indirect designation)	0 (Absolute position mode)	Sets the position buffer number.  The absolute position must be stored in advance in the position buffer with the specified number.

With the position reference for an infinite length axis, the present travel distance (incremental travel distance) is added to the previous position reference (OL□□12), and the position reference (OL□□12) is reset. The position reference (OL□□12) must not be set in the range of 0 to (infinite length axis reset position – 1).

Position Buffers

The position buffers are a collection of position data stored in the SVA Module, and a maximum of 256 points can be stored for each axis. They are used for the position data when POSITIONING and other motion commands are executed. Continuous operation is enabled by storing the position data in advance, and by using a simple program that only specifies the points.

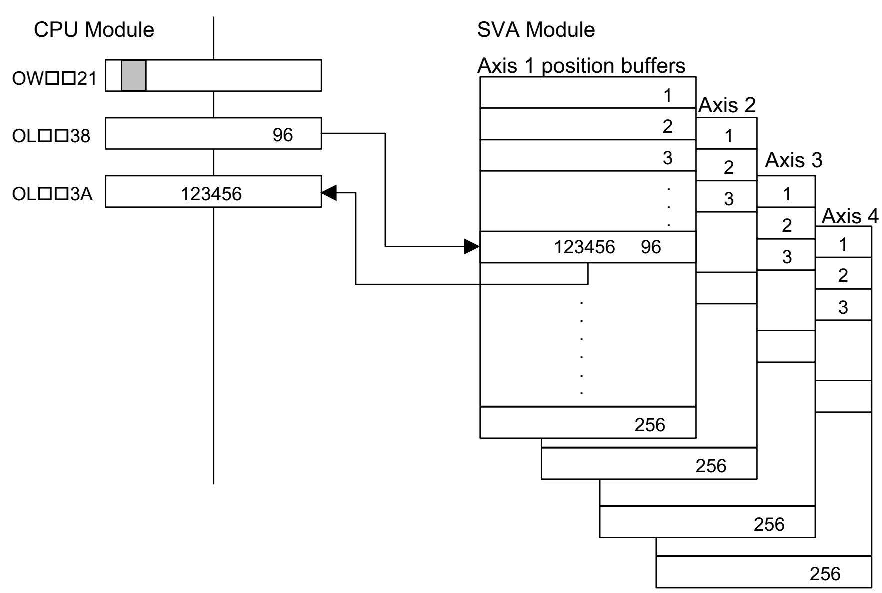


INFO With the SVA-02A (2-axis Servo Module), there are position buffers for only 2 axes.

Using the Position Buffers

1. By first storing in the position buffers the position information for a machine whose operating pattern has been determined in advance, continuous positioning of up to 256 points is enabled simply by refreshing the buffer pointer at the completion of a single-block operation.

Writing to Position Buffers

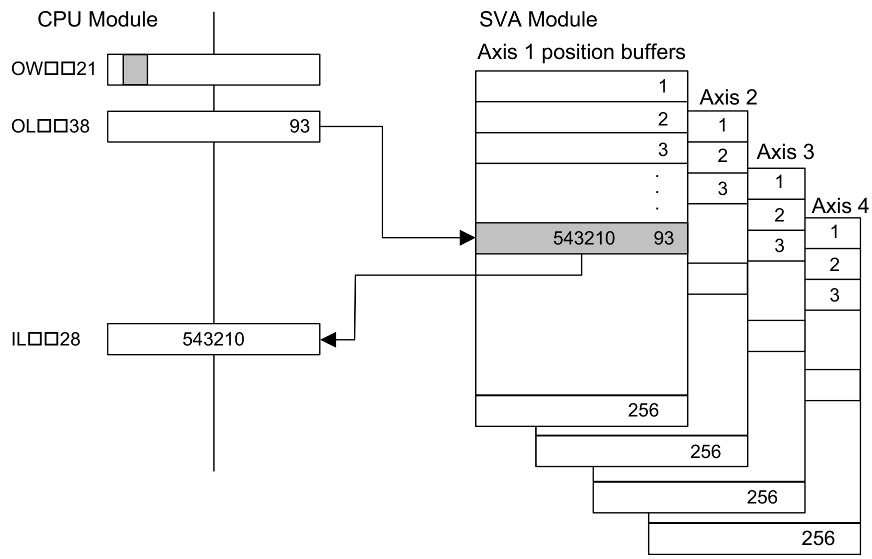


a) Set the Position Buffer Access Number (OL□□38)(1 to 256).

b) Set the Position Buffer Write Data (OL□□3A).

c) Set the Position Buffer Write (OB□□21E) in the Motion Command Control Flags to ON.

2. Reading Position Buffers



a) Set the Position Buffer Access Number (OL□□38)(1 to 256).

b) Set the Position Buffer Read (OB□□21F) in the Motion Command Control Flags to ON. After two scans, the position data specified in Position Buffer Read Data (IL□□28) will be stored.

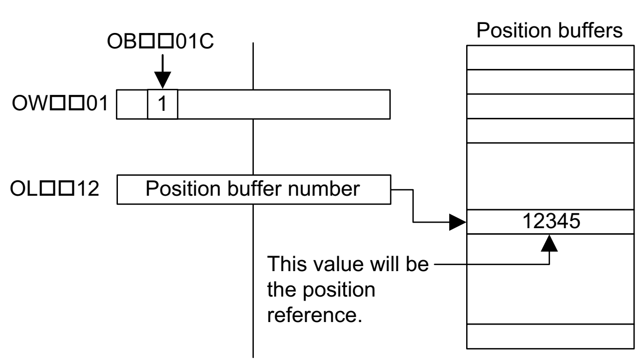
INFO

1. Position buffers can be used only when motion commands are used in the position control mode.
2. The position data specified in the position buffers are absolute position references.

IMPORTANT

The data in the position buffers is deleted by turning OFF the power and resetting the CPU Module Master. Be sure to set the data when the power is turned ON, or before using the position buffers.

Using the Position Buffers as Position References



1. Set bit 12 of the RUN Command Settings (OW□□01) to ON.
2. Set a position buffer number 1 to 256 in place of the position reference in the Position Reference Setting (OL□□12).

In this way, the data for the position buffer number specified in OL□□12 functions as the position reference.

■ Position Monitoring

Table 4.15 shows the parameters used to monitor positioning.

Table 4.15 Position Monitor Parameters

Motion Monitor Parameter No. (Register No.)	Name	Description
IL☐☐02	Calculated Position in the Machine Coordinate System (CPOS)	The calculated position of the machine coordinate system managed by the SVA Module is reported. Normally, the position data reported in this parameter will be the target position for each scan.*2
IL☐☐08	Machine Coordinate System*1 Feedback Position (APOS)	The feedback position of the machine coordinate system is reported.*3
IL☐☐18	Machine Coordinate System Reference Position (MPOS)	The position output externally by the SVA Module and the reference position of the machine coordinate system are reported. In machine lock status, this data is not refreshed. (With the machine lock status, the data is not output externally.) When the machine lock function is not used, this position is the same as that in IL☐☐02.
IL☐☐2E	Calculated Reference Coordinate System Position (POS)	This position is significant when the axis selected is an infinite length axis. With an infinite length axis, the target position for each scan corresponding to the position reference in this parameter is reported.*4

* 1. Machine coordinate system
The basic coordinate system that is set according to the zero return mode execution, the Zero Point Return (ZRET) motion command execuiton, or the Zero Point Setting (ZSET) motion command operation.
The SVA Module manages the positions using this machine coordinate system.

* 2. When an infinite length axis is selected, a range of 0 to (infinite length axis reset position – 1) is reported.
With the position reference for an infinite length axis, the present travel distance (incremental travel distance) is added to the previous position reference (OL☐☐12), and reset as the position reference (OL☐☐12).
The position reference (OL☐☐12) must not be set in the range of 0 to (infinite length axis reset position – 1).

* 3. When an infinite length axis is selected, a range of 0 to (infinite length axis reset position – 1) is reported.

* 4. With a finite length axis, this position is the same as that in IL☐☐02.

■ Speed Reference

There are two methods of setting the speed reference. One method involves using a reference unit for the speed reference setting, such as the rapid traverse speed, approach speed, or creep speed. The other method involves setting the percentage (%) corresponding to the rated speed.

Table 4.16 shows the parameters relating to the speed reference.

Table 4.16 Speed Reference Parameters

Parameter Type	Parameter No. (Register No.)	Name	Description
Motion Fixed Parameters	No.5	Pulse Counting Mode Selection	Sets the pulse count mode and multiplier 0: Sign mode, ×1 1: Sign mode, ×2 2: UP/DOWN mode, ×1 3: UP/DOWN mode, ×2 4: A/B mode, ×1 5: A/B mode, ×2 6: A/B mode, ×4
	No.7	Rated Motor Speed Setting	Sets the number of rotations when the motor is rotated at the rated speed (100% speed).
	No.8	Number of Feedback Pulses Per Motor Rotation	Sets the number of pulses (the value before multiplication) per motor rotation.
Motion Setting Parameters	Bit 13 of OW□□01	Speed Reference Value Selection	Specifies the setting unit for the rapid traverse speed, approach speed, and creep speed, and specifies the register number for the rapid traverse speed. 0: Specifies the speed using a reference unit, and sets the Rapid Traverse Speed in OL□□22. 1: Specifies the speed using the percentage (%) corresponding to the rated speed, and sets the Rapid Traverse Speed in OW□□15.
	OW□□0A	Approach Speed Setting	Sets the zero point return (ZRET) approach speed. The unit varies according to the Speed Reference Selection (bit 13 of OW□□01).
	OW□□0B	Creep Speed Setting	Sets the zero point return (ZRET) creep speed. The unit varies according to the Speed Reference Selection (bit 13 of OW□□01).
	OW□□15	Speed Reference Setting	This setting is valid when the Speed Reference Selection (bit 13 of OW□□01) is “1.” Sets the percentage (1 = 0.01%) corresponding to the rated speed as the rapid traverse speed.
	OW□□22	Rapid Traverse Speed	This speed is valid when the Speed Reference Selection (bit 13 of OW□□01) is “0.” Set the rapid traverse speed using the reference unit.
	OW□□2C	Override	Changes the actual rapid traverse speed.

When Motion Commands Are Not Used

When motion commands are not used, the Speed Reference Selection Flags are disabled, and the speed-related parameters have the meanings shown in the following table.

Parameter No.	Name	Description
Bit 3 of OW□□01	Speed Reference Value Selection	Invalid
OW□□0A	Approach Speed Setting	Specified as a percentage (%) of the rated speed.
OW□□0B	Creep Speed Setting	Specified as a percentage (%) of the rated speed.
OW□□15	Speed Reference Setting	The rapid traverse speed is specified as a percentage (%) of the rated speed.
OW□□22	Rapid Traverse Speed	Invalid
OW□□2C	Override	Invalid

When Motion Commands Are Used

When motion commands are used, the meanings of the speed-related parameters differ according to the Speed Reference Selection (bit 13 of OW□□01).

Bit 13 of OW□□01	Parameter No.	Name	Description
0	OW□□0A	Approach Speed Setting	Specified using the reference unit.
	OW□□0B	Creep Speed Setting	Specified using the reference unit.
	OW□□15	Speed Reference Setting	Invalid
	OW□□22	Rapid Traverse Speed	Specified using the reference unit.
	OW□□2C	Override	Valid
1	OW□□0A	Approach Speed Setting	Specified as a percentage (%) of the rated speed.
	OW□□0B	Creep Speed Setting	Specified as a percentage (%) of the rated speed.
	OW□□15	Speed Reference Setting	The rapid traverse speed is specified as a percentage (%) of the rated speed
	OW□□22	Rapid Traverse Speed	Invalid
	OW□□2C	Override	Valid

Table 4.17 shows some examples of the parameter settings.

Table 4.17 Parameter Setting Examples

Parameter Type	Parameter No. (Register No.)	Name	Description	Initial Value
Motion Fixed Parameters	No.5	Pulse Counting Mode Selection	No. 5 = A/B mode, ×4 No. 7 = 3,000 r/min No. 8 = 2,048 p/r Therefore, Rated speed = 3,000 r/min = 3,000 × 2,048 × 4[*2] = 2,575,000 ppm Various parameter setting examples are given below.	A/B mode (×4)
	No.7	Rated Motor Speed Setting		3000
	No.8	Number of Feedback Pulses Per Motor Rotation		2048
Motion Setting Parameters	Bit 13 of OW□□01	Speed Reference Value Selection		0
	OW□□0A	Approach Speed Setting		0
	OW□□0B	Creep Speed Setting		0
	OW□□15	Speed Reference Setting		0
	OW□□22	Rapid Traverse Speed		0
	OW□□2C	Override[*1]		100%

* 1. Select Enabled (= 1) in bit 9 (override enabled selection) of motion fixed parameter No. 17.
* 2. "4" is the pulse multiplier.

Parameter Setting Examples

1. Speed Reference Value Selection Set to "0"

   a) Pulses Selected as the Unit

   When you wish to perform operations with the fixed parameters set for a rapid traverse speed of 1,500 r/min, an approach speed of 300 r/min, and a creep speed of 150 r/min, use the following settings.

   - OW□□0A = 30 (r/min) × 2,048 × 4 (ppr) ÷ 1,000 = 2,457 (= 2457000 ppm)
   - OW□□0B = 150 (r/min) × 2,048 × 4 (ppr) ÷ 1,000 = 1,228 (= 1228000 ppm)
   - OW□□15 = ——— (Invalid)
   - OW□□22 = 1,500 (r/min) × 2,048 × 4 (ppr) ÷ 1,000 = 12,288 (= 12288000 ppm)
   - OW□□2C = 10,000 (100%)

   b) Millimeters Selected as the Unit

   When you wish to perform operations with the fixed parameters set for a rapid traverse speed of 900 mm/min, an approach speed of 180 mm/min, and a creep speed of 90 mm/min in a machine configuration that moves the axis 10 mm in one rotation, use the following settings.

   - OW□□0A = 180
   - OW□□0B = 90
   - OW□□15 = ——— (Invalid)
   - OW□□22 = 900
   - OW□□2C = 10,000 (100%)

2. Speed Reference Value Selection Set to “1”

   a) When you wish perform operations with the fixed parameters set for a rapid traverse speed of 1,500 r/min, an approach speed of 300 r/min, and a creep speed of 150 r/min, use the following settings.

   - OW□□0A = $\frac{300\ \text{(r/min)}}{3{,}000\ \text{(r/min)}} \times 10{,}000 = 1{,}000\ (10.00\%)$
   - OW□□0B = $\frac{150\ \text{(r/min)}}{3{,}000\ \text{(r/min)}} \times 10{,}000 = 500\ (5.00\%)$
   - OW□□15 = $\frac{1{,}500\ \text{(r/min)}}{3{,}000\ \text{(r/min)}} \times 10{,}000 = 5{,}000\ (50.00\%)$
   - OW□□22 = ——— (Invalid)
   - OW□□0A = 10,000 (100%)

   b) When you wish to leave the above speed reference settings unchanged, but halve the operating speed, use the following setting.

   - OW□□2C = 5,000 (50.00%)

4

4.3.2 Position Control Without Using Motion Commands

■ Overview

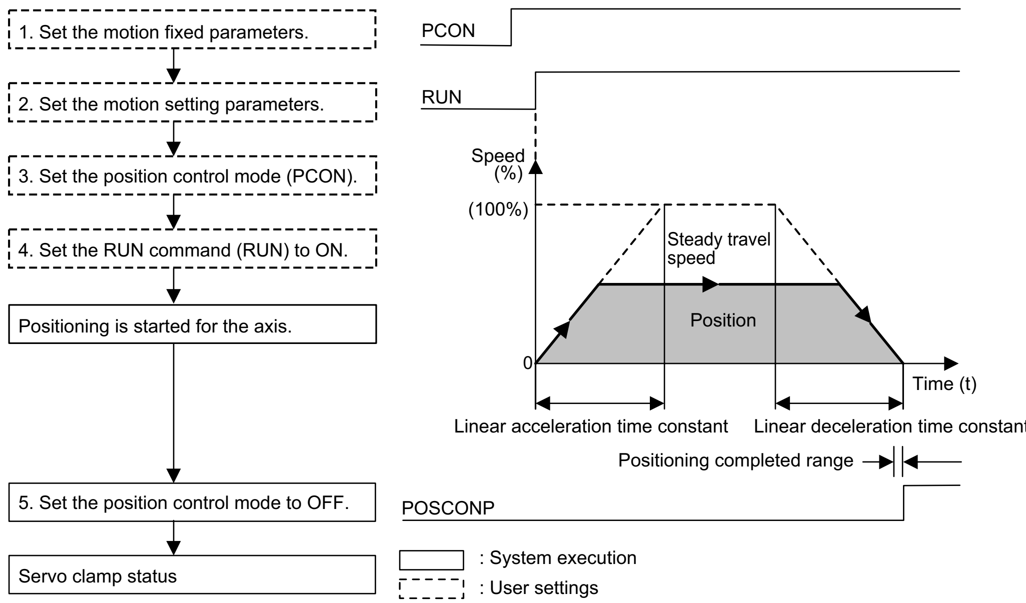
Position control performs speed acceleration/deceleration according to the related parameters, and positions the axis to the target position of the position reference setting parameter (OL□□12).

IMPORTANT

The position control without using motion commands is not applicable for SVB-01 and PO-01 Modules. Always set the parameters to enable the motion commands for the position control using SVB-01 or PO-01 Module.

■ Details

Use the following procedure to perform position control operations without using motion commands.



1. Set the motion fixed parameters according to the user's machine.

Table 4.18 Examples of Fixed Parameters

No.	Name	Setting Range	Meaning	Setting Example
7	Rated Motor Speed Setting	1 to 32000	Rated motor speed	3000 r/min
8	Number of Feedback Pulses per Motor Rotation	4 to 65532	Number of pulses before multiplication	2048 pulses/rev
9	D/A Output Voltage at 100% Speed	0.001 to 10.000	1 = 1 V	6.000 V
	Feedback Pulses per Motor Rotation (for High-resolution) *1	4 to 2147483647	1 = 1 pulse/rev	2048 pulses/rev
10	D/A Output Voltage at 100% Torque Limit *2	0.001 to 10.000	0.001 = 0.001 V 1 = 1 V	3.000 V

* 1. Valid only with an SVB-01 Module.
* 2. Valid only with an SVA-02A Module.

2. Set the motion parameters.
   The following three methods can be used to set the setting parameters.
   - Using the MPE720 Setting Parameter Window
   - Using a ladder logic program
   - Using a motion program

Table 4.19 Examples of Setting Parameters

Name	Register No.	Setting Range	Meaning	Setting Example
Positive Torque Limit Setting (TLIMP)*	OW□□02	-32768 to 32767	1 = 0.01%	-10000 (-100.00%)
Positive Speed Limiter Setting (NLIMP)	OW□□04	0 to 32767	1 = 0.01%	13000 (130.00%)
Negative Speed Limiter Setting (NLIMN)	OW□□05	0 to 32767	1 = 0.01%	13000 (130.00%)
Zero Point Offset (ABSOFF)	OL□□06	-2^{31} to 2^{31}-1	1 = 1 reference unit With pulse: 1 = 1 pulse	100 pulses
Linear Acceleration Time Constant (NACC)	OW□□0C	0 to 32767	Linear acceleration time constant (ms) at speed pattern generation	1000 (1 second)
Linear Deceleration Time Constant (NDEC)	OW□□0D	0 to 32767	Linear deceleration time constant (ms) at speed pattern generation	1000 (1 second)
Positioning Completed Range Setting (PEXT)	OW□□0E	0 to 65535	1 = 1 reference unit With pulse: 1 = 1 pulse	10 pulses
Error Count Alarm Detection Setting (EOV)	OW□□0F	0 to 32767	1 = 1 reference unit With pulse: 1 = 1 pulse	65535 pulses
Position Loop Gain Setting (KP)	OW□□10	0 to 32767	0.1 = 0.1 /s 1 = 1 /s	300 (30.0 /s)
Filter Time Constant (NNUM)	OW□□14	0 to 255	For simple S-curved acceleration	0
Feed Forward Gain Setting (Kf)	OW□□11	0 to 200	1 = 0.01%	0
Position Reference Setting (XREF)	OL□□12	-2^{31} to 2^{31}-1	1 = 1 reference unit With pulse: 1 = 1 pulse	10000 pulses
Speed Reference Setting (NREF)	OW□□15	-32768 to 32767	Speed reference value 1 = 0.01%	5000 (50.00%)

* Valid only with an SVA-02A Module.

3. Select the Speed Reference Output Mode (PCON) (bit 2 of OW□□00).
4. Set the Servo ON (RUN) to ON (bit 0 of OW□□01).

   The axis is positioned according to the specified motion parameters.
   Even during positioning, the motion parameter settings can be changed.
5. To stop position control, set the RUN command (RUN) and the position control mode (PCON) to OFF.

   The POSCOMP Positioning Completed Signal (bit D of IW□□00) turns ON when the axis enters the positioning completed range. Control continues even when the axis enters the positioning completed range (the axis enters servo clamp status).

■ User Program Example

Example of RUN Operation

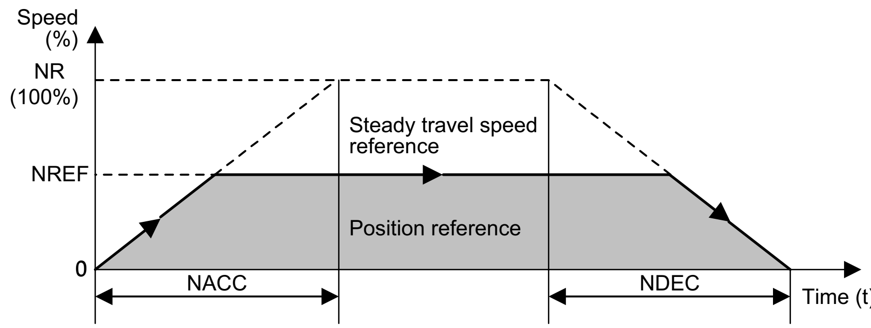


Fig. 4.13 Position Pattern

Operating Conditions

In the pattern shown in the above illustration, the axis is stopped at an absolute position of 10000 (pulses).

- Position reference: XREF = 10000 (pulses)

Ladder Logic Program Example

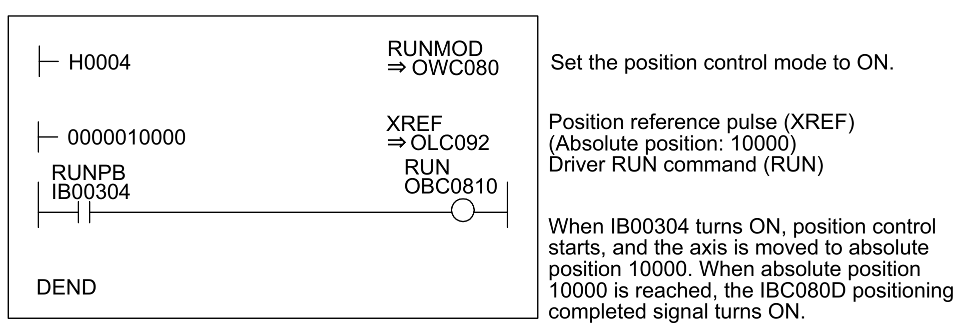


Fig. 4.14 RUN Commands (DWG H03)

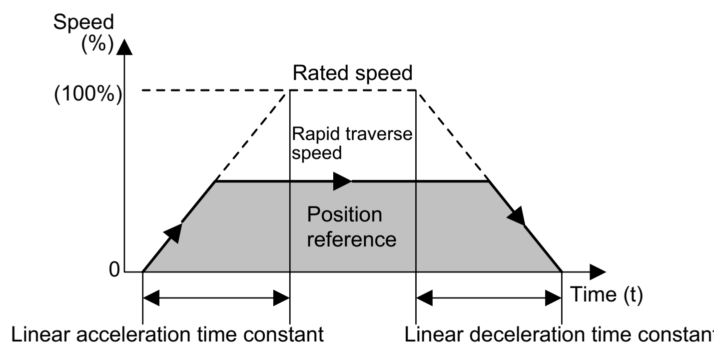
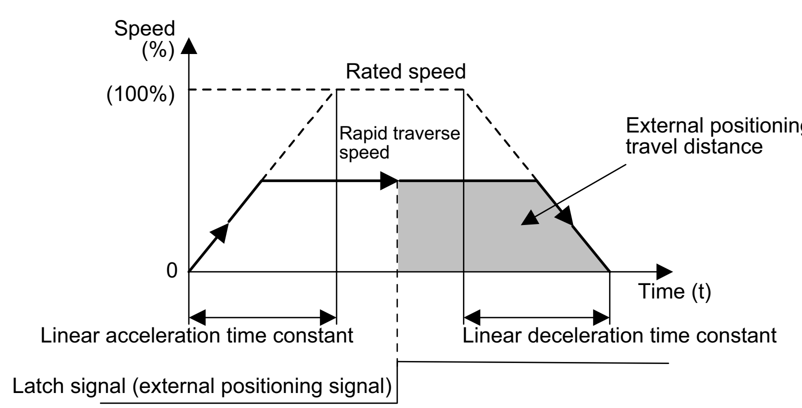
The example in the above illustration has been greatly simplified. In actual operation, each register can be controlled from the user program.

4.4 Position Control Using Motion Commands

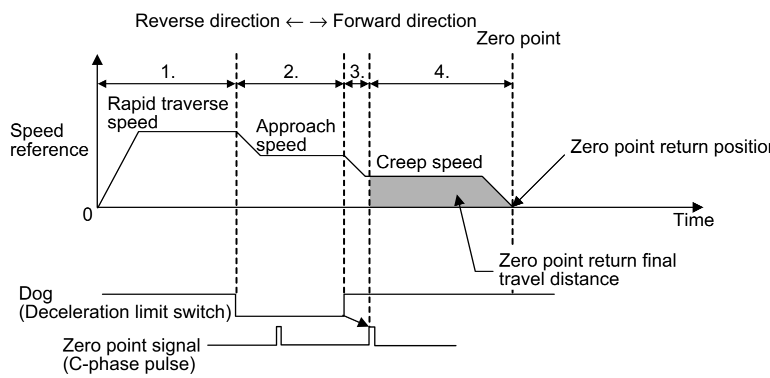
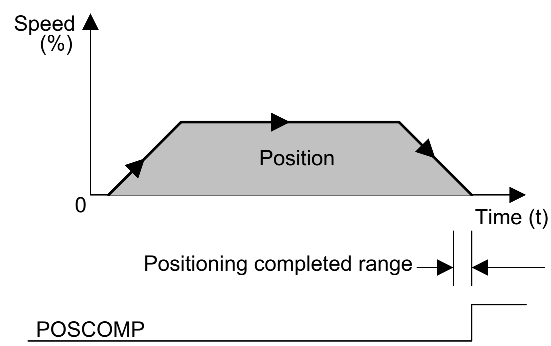
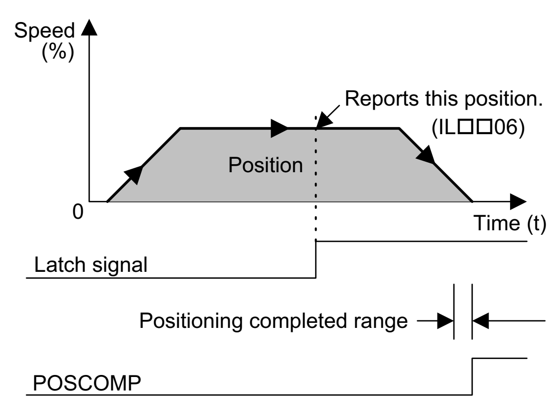
This section describes position control using motion commands.

4.4.1 Overview of Motion Commands

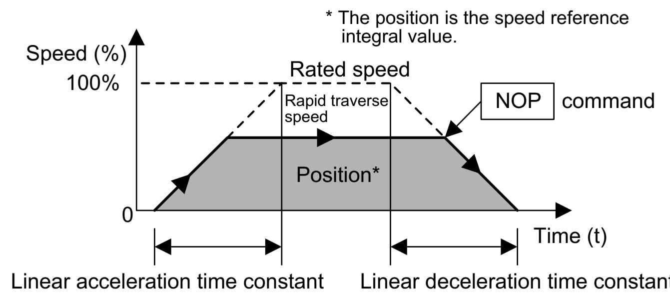
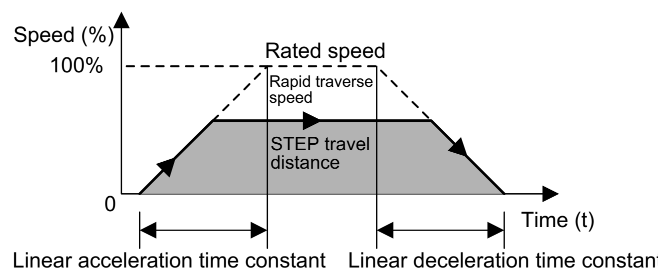
The following table lists the motion commands and gives an overview of each.

Command	Name	Description
1	Positioning (POSING)	Positions the axis at the specified position using the specified acceleration/deceleration time constant and speed. 
2	External Positioning (EX_POSING)	Latches a counter when a latch signal (external positioning signal) is input during positioning (POSING), and positions the axis at a position where it has traveled the external positioning travel distance from that position. 

(cont'd)

Command	Name	Description
3	Zero Point Return (ZRET)	Returns the system to the machine coordinate system zero point. Eight zero return modes are provided. 
4	Interpolation (INTERPOLATE)	Performs interpolation feeding using the position data distributed from the CPU Module. 
5	Not used.	This command is used by the system. Do not use it in a user program.
6	Interpolation with Position Detection (LATCH)	Latches a counter when a latch signal is input during an interpolation feed operation, and reports the changed latch position to the reference unit system. 

(cont'd)

<table>
<tr><th>Command</th><th>Name</th><th>Description</th></tr>
<tr><td>7</td><td>Fixed Speed Feed
(FEED)</td><td>Performs rapid traverse in the infinite length direction at the specified speed and acceleration time.

</td></tr>
<tr><td>8</td><td>Fixed Length Feed
(STEP)</td><td>Performs STEP travel positioning using the specified direction, speed, and acceleration time constant.

</td></tr>
<tr><td>9</td><td>Zero Point Setting
(ZSET)</td><td>Determines the machine coordinate zero point, and validates the stroke limit check.</td></tr>
</table>

4.4.2 Positioning (POSING)

■ Overview

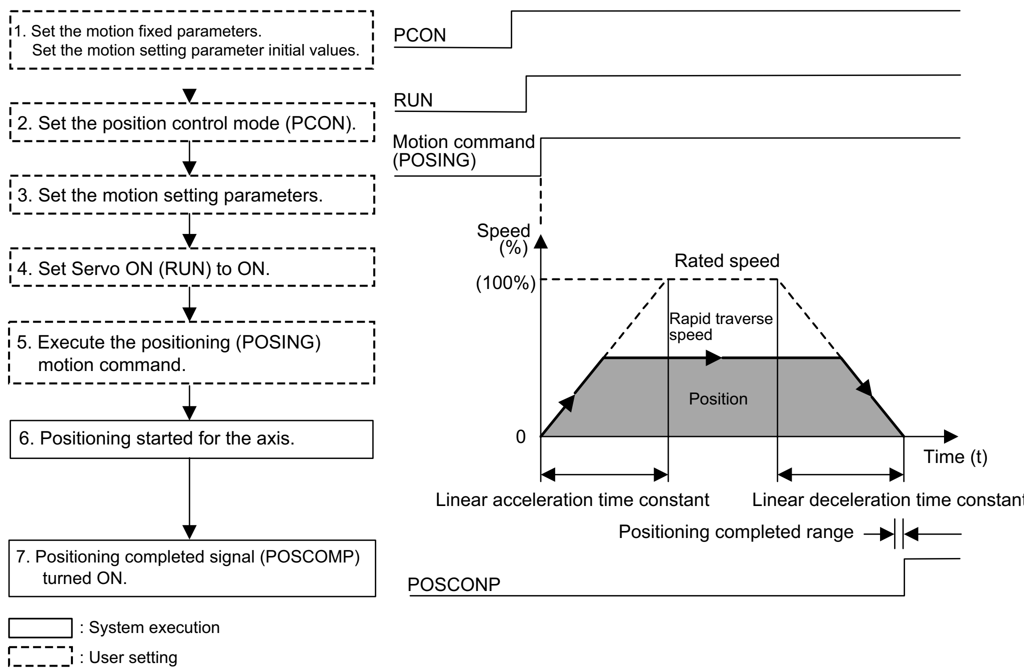
Positions the axis at the position reference position using the specified acceleration/deceleration time constant and the specified rapid traverse speed.

The rapid traverse speed and the position reference value can be changed during operations.

When the change in the position reference value is less than the deceleration distance or the reverse direction is used, the system first decelerates to a stop and then is repositioned according to the position reference value.

■ Details

Use the following procedure to perform positioning operations.



1. Set the initial values for the motion fixed parameters and the motion setting parameters according to the user’s machine.

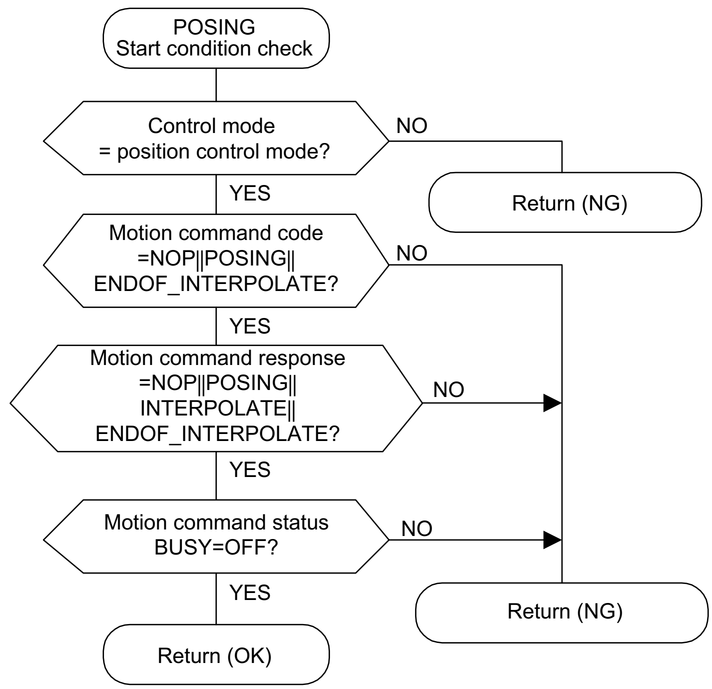
   When performing position control using motion commands, be sure to set the following parameters:

   - Set “Use (= 1)” in bit 7 (motion command use selection) of motion fixed parameter No. 14 (Additional Function Selections).
   - Set “1 (= Enabled)” in bit 8 (motion command code enabled selection) in the RUN Mode Settings (OW□□00) motion setting parameter.

2. Set the Position Control Mode (PCON) (bit 2 of OW□□00).
3. Set the motion setting parameters used for positioning (POSING).
4. Set Servo ON (RUN) to ON (bit 0 of OW□□01).

   For a PO-01 Module, set Excitation ON (RUN) to ON.

5. Set positioning (POSING) in the motion command code (OW□□20).



6. Start positioning command execution.

   The axis starts positioning according to the specified motion parameters. Even during positioning, the motion parameter settings can be changed.

   The positioning command operations are as follows:

   a) Operation Start

      Servo ON (bit 0 of OW□□01).

      Set the positioning (POSING = 1) to motion command code (OW□□20).

   b) Feed Hold

      Set Hold (bit 0 of OW□□21) to ON.

      At feed hold completion, HOLDL (bit 1 of IW□□15) turns ON.

   c) Feed Hold Release

      Set Hold (bit 1 of OW□□21) to OFF. Positioning resumes.

   d) Abort

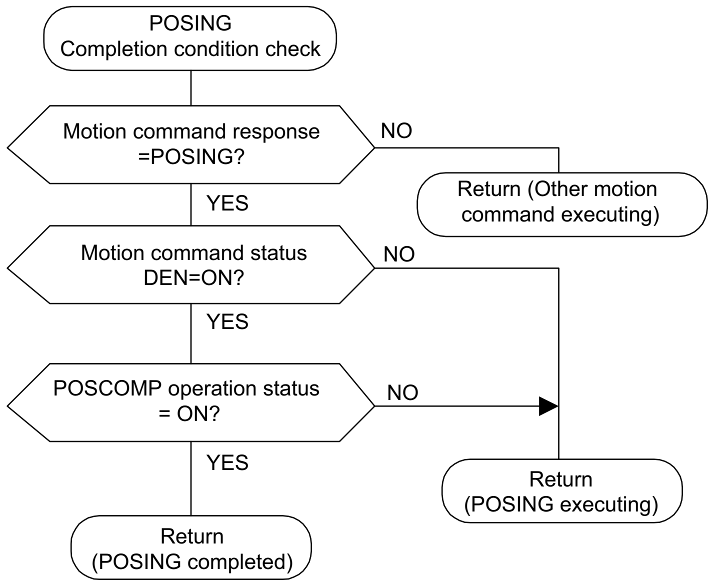
      Set Abort (bit 1 of OW□□21) to ON, or set NOP (= 0) in the motion command code.

      Busy (bit 0 of IW□□15) turns ON during abort processing, and turns OFF at completion of the abort.

   Note: When the abort has been completed and released (ABORT turns OFF), the following occurs:

   - When the Position Reference Type (bit 14 of OW□□01) is the absolute position mode (= 0), positioning resumes in the direction of the Position Reference (OL□□12).
   - When the Position Reference Type (bit 14 of OW□□01) is the incremental addition mode (= 1), operations remain stopped until the Reference Position (OL□□12) is reset.

7. When the axis enters the Positioning Completed Range (OW□□0E) after Distribution Completed (bit 2 of IW□□15 is ON), the POSCOMP Positioning Completed Signal (bit D of IW□□00) turns ON.



■ User Program Example: Positioning

Example of RUN Operation

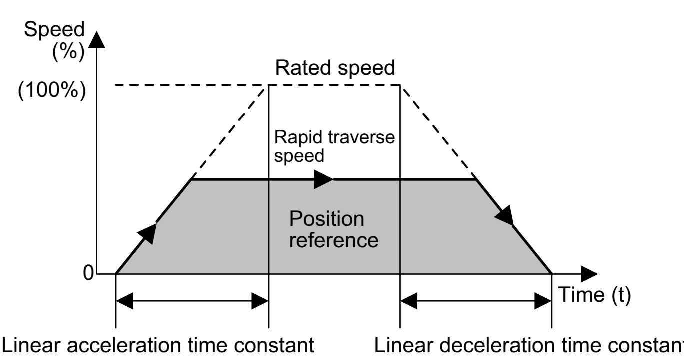


Fig. 4.15 Positioning Pattern

Ladder Logic Program Example

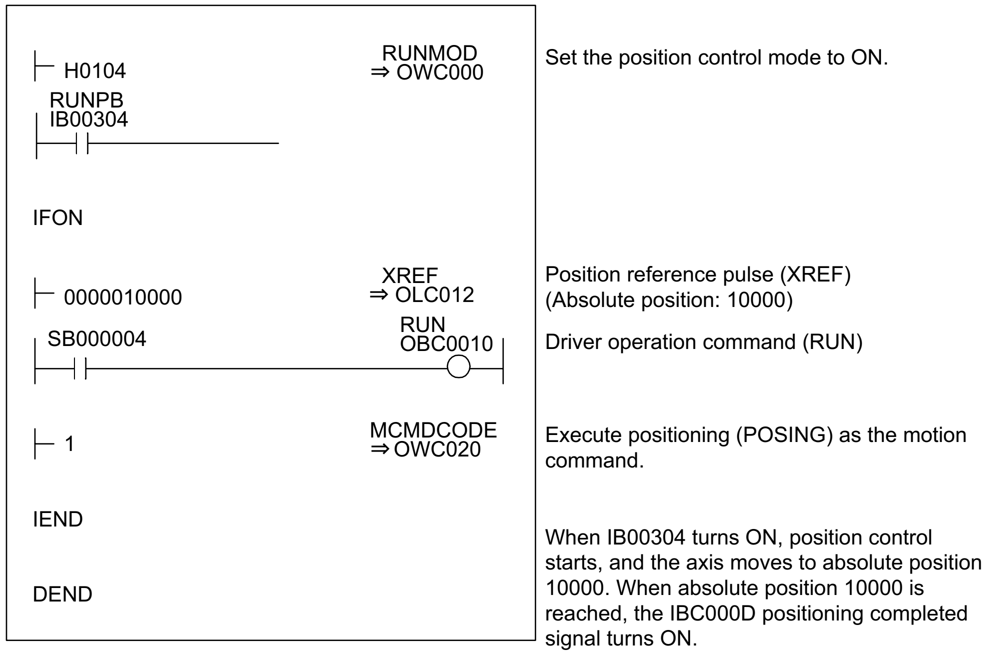


Fig. 4.16 Positioning Programming Example (DWG H03)

The example in the above illustration has been greatly simplified. In actual operation, each register can be controlled from the user program.

4.4.3 External Positioning (EX_POSING)

■ Overview

In the same way as the positioning (POSING) command, the external positioning (EX_POSING) command positions the axis at the position reference position using the specified acceleration/deceleration time constant and the specified rapid traverse speed.

If a latch signal (external positioning signal) is input while at the feed speed, external positioning uses the latch signal to latch the current position, and positions the axis at a position where it has traveled the external positioning travel distance set as a parameter from that position.

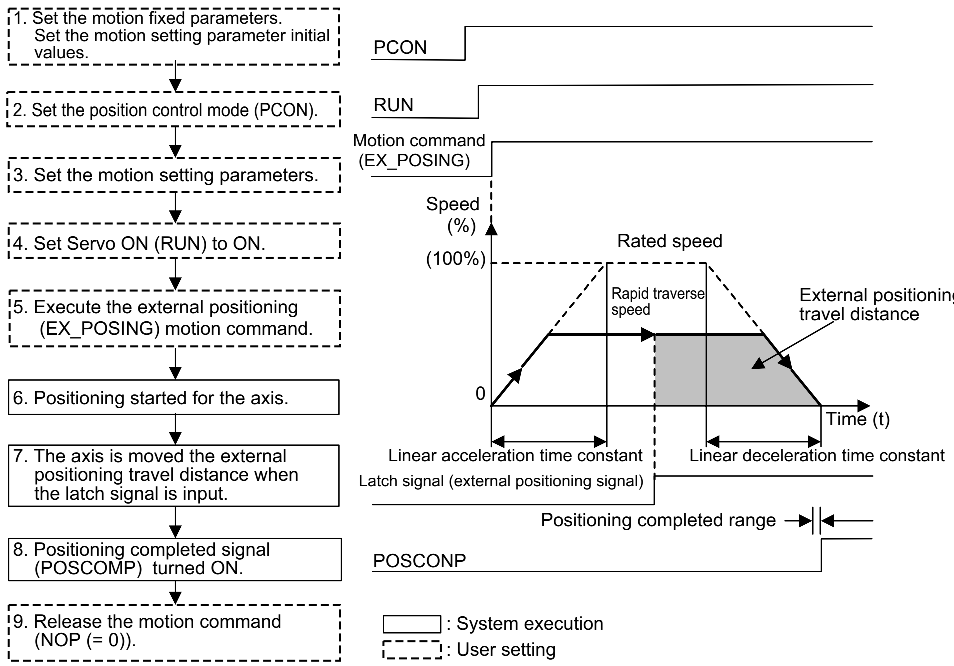
When the specified external positioning travel distance is less than the deceleration distance, the system first decelerates to a stop and then is repositioned according to the position reference value.

The external positioning travel distance can be changed before the latch signal (external positioning signal) is input.

A specific discrete input (DI input) is used for the latch signal (external positioning signal).

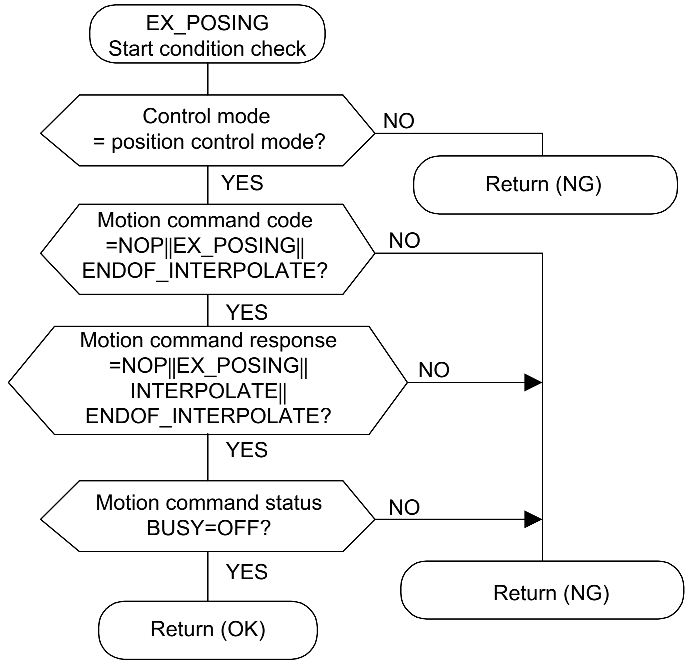
■ Details

Use the following procedure to perform external positioning operations.



1. Set the initial values for the motion fixed parameters and the motion setting parameters according to the user's machine.
2. Set the Position Control Mode (PCON) (bit 2 of OW□□00).
3. Set the motion setting parameters.
4. Set Servo ON (RUN) to ON (bit 0 of OW□□01).

   For a PO-01 Module, set Excitation ON (RUN) to ON.
5. Set external positioning (EX_POSING) in the motion command code (OW□□20).
6. Start the external positioning command execution.



The specified motion parameters are used to position the axis.
Even during positioning, the motion parameter setting values can be changed.

The external positioning command operations are as follows:

a) Operation Start

Servo ON (bit 0 of OW□□01).

Set the external positioning (EX_POSING) to motion command code (OW□□20).

b) Feed Hold

Set Hold (bit 0 of OW□□21) to ON.

At feed hold completion, HOLDL (bit 1 of IW□□15) turns ON.

c) Feed Hold Release

Set Hold (bit 1 of OW□□21) to OFF. Positioning resumes.

d) Abort

Set Abort (bit 1 of OW□□21) to ON, or set NOP (= 0) in the motion command code.

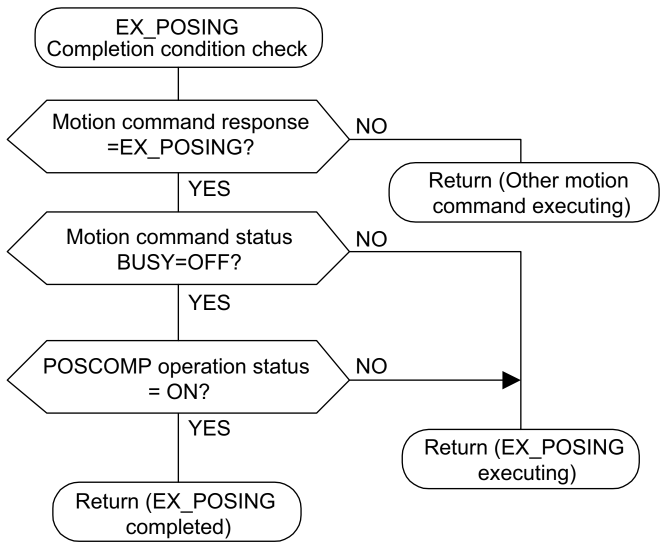
Busy (bit 0 of IW□□15) turns ON during abort processing, and turns OFF at abort completion.

7. When the latch signal is input, the axis will move for the external positioning travel distance (OL□□24) and stop.

INFO

At abort completion, operations remain stopped even if the abort is released (ABORT turns OFF) and regardless of whether the Position Reference Type (bit 14 of OW□□01) is the absolute position mode (= 0) or the incremental addition mode (= 1).

8. When the axis enters the Positioning Completed Range (OW☐☐0E) after Distribution Completed (bit 2 of IW☐☐15 is ON), the POSCOMP Positioning Completed Signal (bit D of IW☐☐00) turns ON.



9. Once external positioning has been completed, set the NOP command to 0 to release the external positioning motion command.

INFO

External positioning is detected at startup. Therefore, when external positioning has been executed, the motion command must immediately be set to NOP, and external positioning must be reset in a motion command.

■ User Program Example: External Positioning

Example of RUN Operation

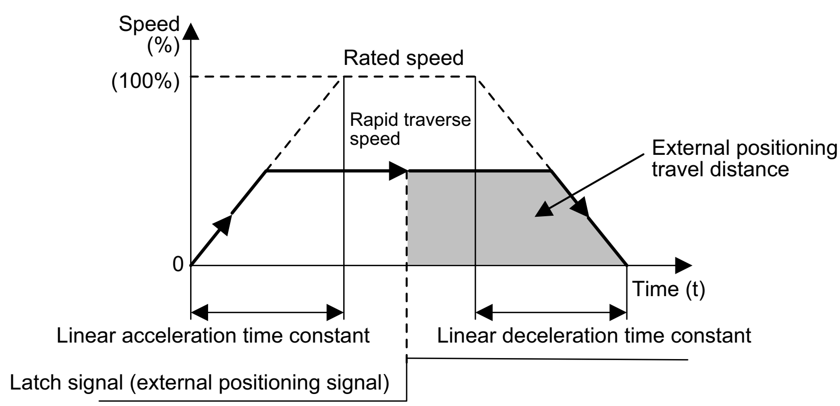


Fig. 4.17 Example of an External Positioning Pattern

Ladder Logic Program Example

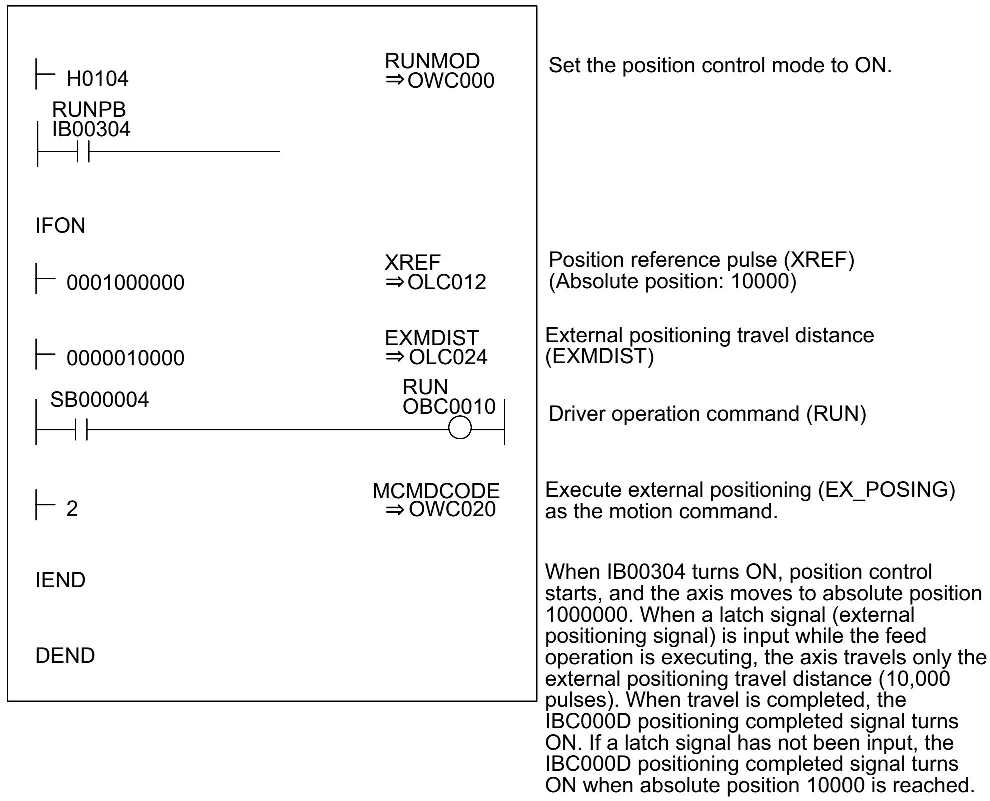


Fig. 4.18 External Positioning Programming Example

The example in the above illustration has been greatly simplified. In actual operation, each register can be controlled from the user program.

4.4.4 Zero Point Return (ZRET)

■ Overview

The zero point return operation is used to return to the machine coordinate system zero point.

The machine coordinate system zero point position data is destroyed when the power is turned OFF. Therefore, after turning ON the power, the machine coordinate system zero point must be repositioned. In general, a zero point pulse (C-phase pulse) and a limit switch showing the zero point area are used to determine the zero point.

There are two zero point return methods. One method uses motion commands, and the other method uses the zero return mode. Care is required because zero point return operations are different with these two methods.

The method of using motion commands is described below.

■ Zero Point Return Method

The following methods are available with the zero point return (ZRET) motion command.

Zero Point Return Method	Fixed Parameter 31 Setting	SVA-01A	SVA-02A	SVB-01	PO-01
DEC1 + C-phase pulse	0	Applicable	Applicable	Applicable	N/A
DEC2 + C-phase pulse	6	Applicable	Applicable	N/A	N/A
DEC1 + LMT + C-phase pulse	7	Applicable	Applicable	N/A	N/A
C-phase pulse	3	Applicable	Applicable	Applicable	N/A
DEC1 + ZERO signal	2	Applicable	N/A	Applicable	Applicable
DEC2 + ZERO signal	4	Applicable	N/A	N/A	Applicable
DEC1 + LMT + ZERO signal	5	Applicable	N/A	N/A	Applicable
ZERO signal	1	Applicable	N/A	Applicable	N/A

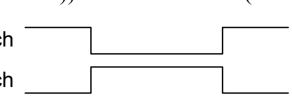
INFO

- With a limit switch (deceleration limit switch) and a zero point return limit signal, a user program must be created to connect the LIO-01 or other external DI signal to the next motion setting parameters.
  - Limit Switch Signal*: OB□□01F
  - Reverse Limit Signal for Zero Point Return: OB□□21C
  - Forward Limit Signal for Zero Point Return: OB□□21D

  * DI5 (DI signal) can also be used with a 4-axis SVA-01A Module. Whether a DI signal or OB□□01F is used as the limit switch signal is set in the bit 2 in motion fixed parameter No. 14 (Additional Function Selections).
- A limit switch (deceleration limit switch) signal's polarity can be reversed using the setting of bit 10 (Deceleration Limit Switch Inversion Selection) in motion fixed parameter No. 17 (Motion Controller Function Selection Flags (SVFUNCSEL)). The default is 0 (do not reverse).

  0: Do not reverse   Deceleration limit switch   NC contact

  1: Reverse   Deceleration limit switch   NO contact



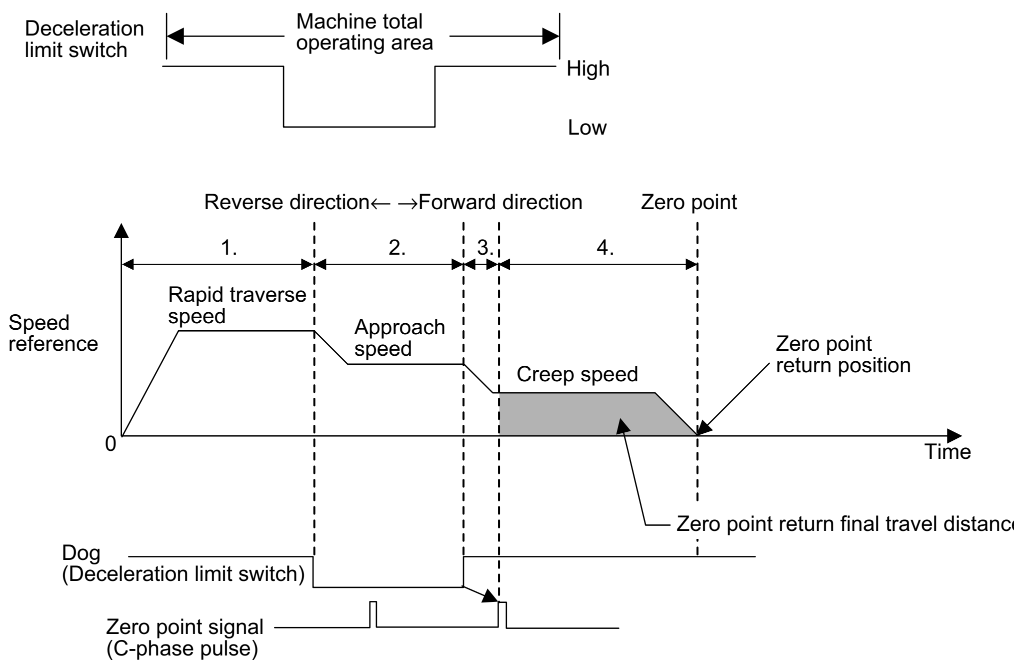
- Refer to *4.2.5 Zero Return Mode* for details.
- For the zero point return method, set the fixed parameter No. 31 (Zero Point Return Method) to a number between 0 and 7.

Details on each method are given next.

■ DEC1 + C-phase Pulse

This method is used to perform zero point return using a limit switch (deceleration limit switch) and a zero point signal (C-phase pulse) by rapid traverse using linear acceleration/ deceleration (with a dog width).

This method can be used in the mechanical configuration with the limit switch as shown in the illustration below.



1. The axis travels at rapid traverse speed in the direction specified in the motion setting parameter (OB□□009).
2. The axis decelerates to approach speed at the falling edge of the dog (deceleration limit switch) signal.
3. The axis decelerates to creep speed at the rising edge of the dog (deceleration limit switch) signal.
4. When the dog high, the axis stops after traveling only the zero point return final travel distance (OL□□2A) from the initial zero point signal (C-phase pulse), and that position will be the machine coordinate system zero point.

SVA-01A	SVA-02A	SVB-01	PO-01
Applicable	Applicable	Applicable	N/A

IMPORTANT

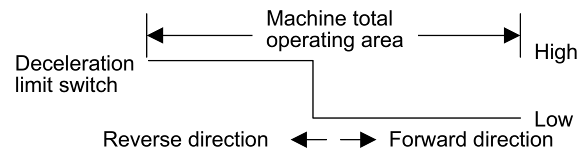
Automatic return is not performed with this zero point return method. Where zero point return to a position is not possible, use a manual operation to return to the zero point.

■ DEC2 + C-phase Pulse

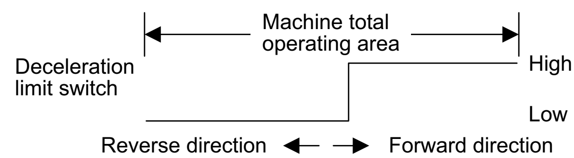
This method is used to perform zero point return using a limit switch (deceleration limit switch) and a zero point signal (C-phase pulse) by rapid traverse using linear acceleration/deceleration (without a dog width).

This method can be used in the mechanical configuration with the limit switch as shown in the illustration below.

Pattern (A)



Pattern (B)

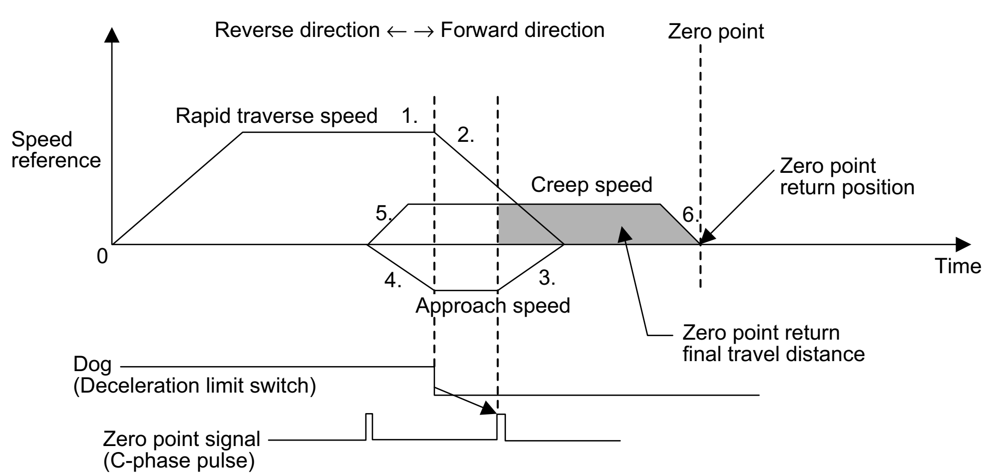


SVA-01A	SVA-02A	SVB-01	PO-01
Applicable	Applicable	N/A	N/A

INFO

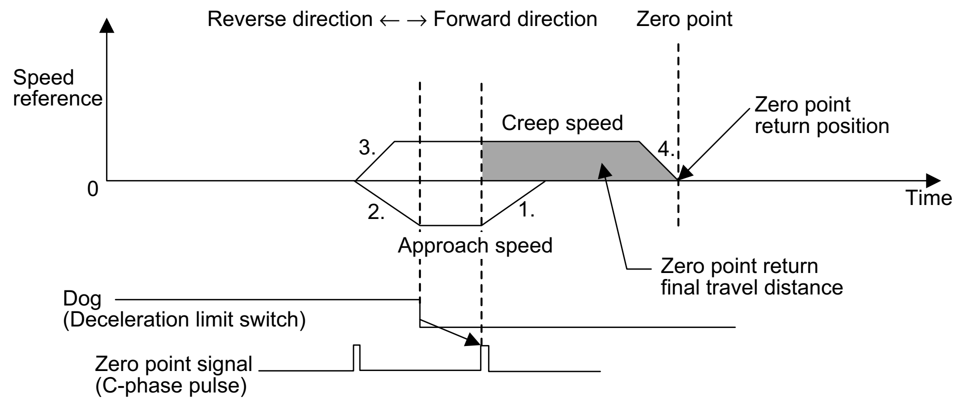
1. With this method, the axis recognizes the machine position by the deceleration limit switch ON/OFF status, and automatically performs a return operation. Be sure to perform zero point return under the same conditions.
2. With pattern (B), set the deceleration limit switch inversion selection (bit 10) of motion fixed parameter No. 17 to ON.

Zero Point Return Operation Started with the Dog (Deceleration Limit Switch) Signal in the High Area



1. The axis travels at rapid traverse speed in the forward direction.
2. The axis decelerates at the falling edge of the dog (deceleration limit switch) signal.
3. The axis travels at approach speed in the reverse direction.
4. The axis decelerates at the rising edge of the dog (deceleration limit switch) signal.
5. The axis travels at creep speed in the forward direction.
6. After the falling edge of the dog (deceleration limit switch) is detected, the axis stops after traveling only the zero point return final travel distance (OL□□2A) from the initial zero point signal, and that position will be the machine coordinate system zero point.

Zero Point Return Operation Started with the Dog (Deceleration Limit Switch) Signal in the Low Area

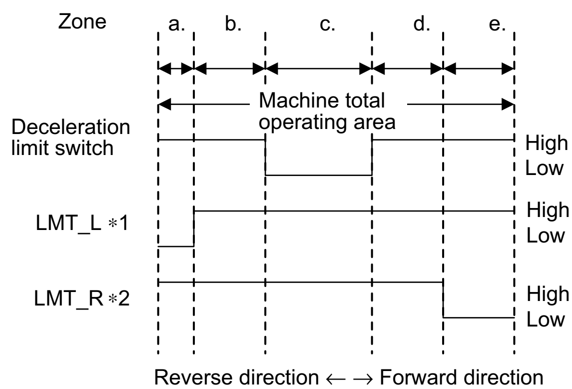


1. The axis travels at approach speed in the reverse direction.
2. The axis decelerates at the rising edge of the dog (deceleration limit switch) signal.
3. The axis travels at creep speed in the forward direction.
4. After the falling edge of the dog (deceleration limit switch) is detected, the axis stops after traveling only the zero point return final travel distance (OL□□2A) from the initial zero point signal, and that position will be the machine coordinate system zero point.

■ DEC1 + LMT + C-phase Pulse

This method is used to perform zero point return using a limit switch (deceleration limit switch), a zero point return limit signal, and a zero point signal (C-phase pulse) by rapid traverse using linear acceleration/deceleration (with a dog width).

This method can be used in the mechaincal configuration with the limit switch (deceleration limit switch) and the zero point return limit signal as shown in the illustration below.

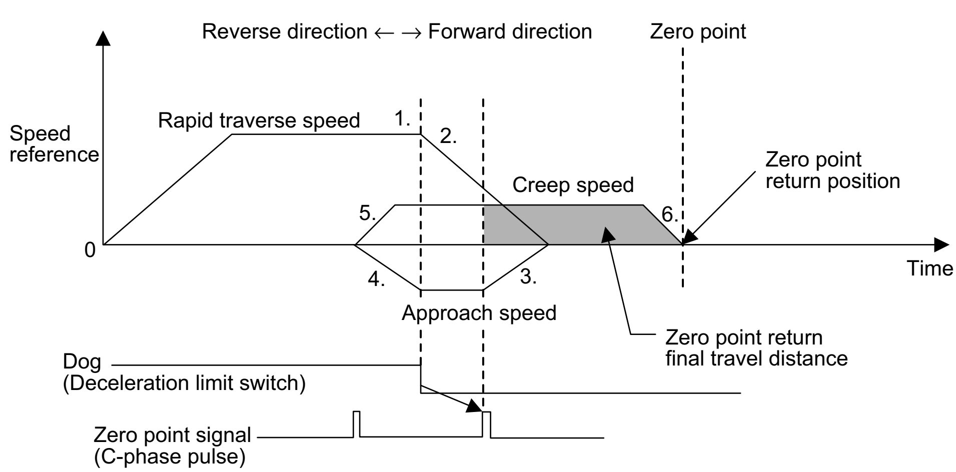


* 1. Zero point return reverse limit signal (OB☐☐21C)

* 2. Zero point return forward limit signal (OB☐☐21D)

SVA-01A	SVA-02A	SVB-01	PO-01
Applicable	Applicable	N/A	N/A

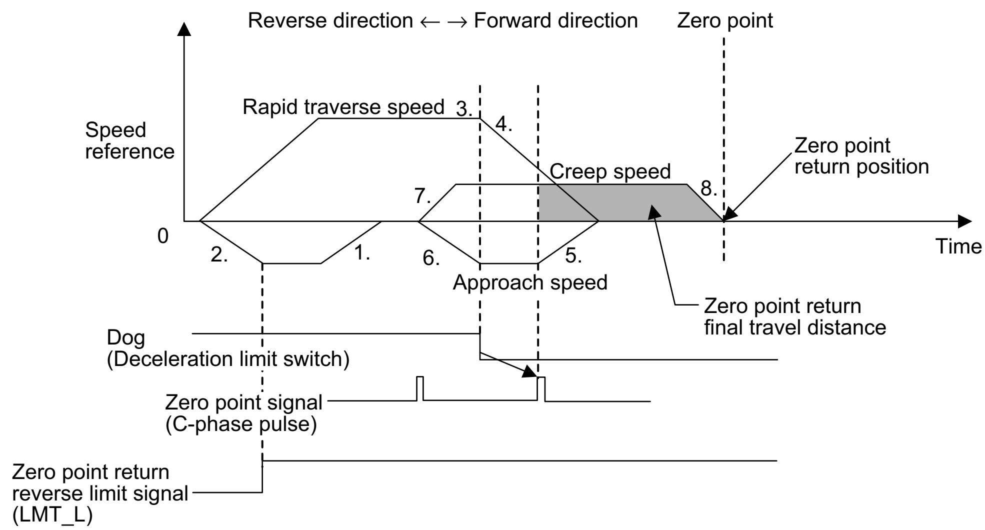
Zero Point Return Operation Started and Zone (a) Used



1. The axis travels at rapid traverse speed in the forward direction.
2. The axis decelerates at the falling edge of the dog (deceleration limit switch) signal.
3. The axis travels at approach speed in the reverse direction.
4. The axis decelerates at the rising edge of the dog (deceleration limit switch) signal.
5. The axis travels at creep speed in the forward direction.

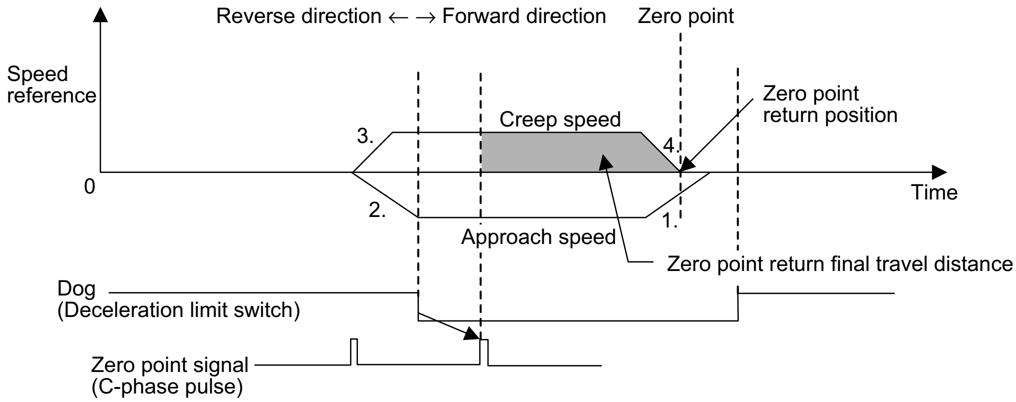
6. After the falling edge of the dog (deceleration limit switch) is detected, the axis stops after traveling only the zero point return final travel distance (OL□□2A) from the initial zero point signal, and that position will be the machine coordinate system zero point.

Zero Point Return Operation Started and Zone (b) Used



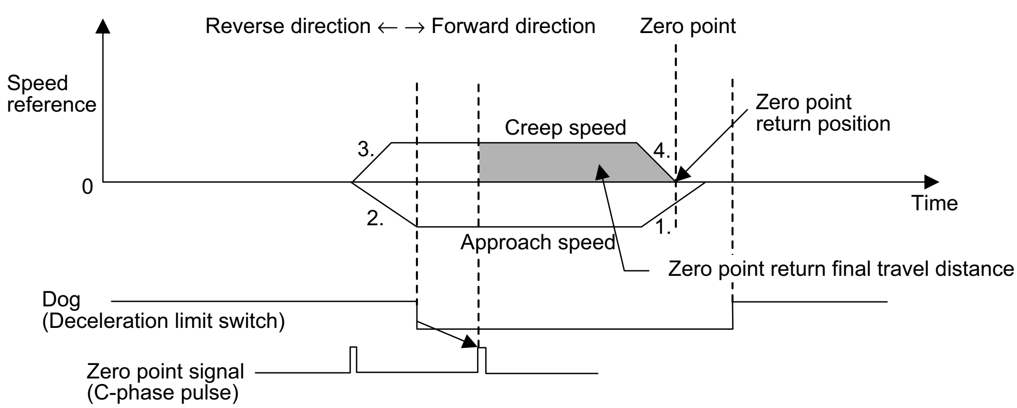
1. The axis travels at approach speed in the reverse direction.
2. The axis decelerates at the falling edge of the zero point return reverse limit signal (LMT_L).
3. The axis travels at rapid traverse speed in the forward direction.
4. The axis decelerates at the falling edge of the dog (deceleration limit switch) signal.
5. The axis travels at approach speed in the reverse direction.
6. The axis decelerates at the rising edge of the dog (deceleration limit switch) signal.
7. The axis travels at creep speed in the forward direction.
8. After the falling edge of the dog (deceleration limit switch) is detected, the axis stops after traveling only the zero point return final travel distance (OL□□2A) from the initial zero point signal, and that position will be the machine coordinate system zero point.

Zero Point Return Operation Started and Zone (c) Used



1. The axis travels at approach speed in the reverse direction.
2. The axis decelerates at the rising edge of the dog (deceleration limit switch) signal.
3. The axis travels at creep speed in the forward direction.
4. After the falling edge of the dog (deceleration limit switch) is detected, the axis stops after traveling only the zero point return final travel distance (OL□□2A) from the initial zero point signal, and that position will be the machine coordinate system zero point.

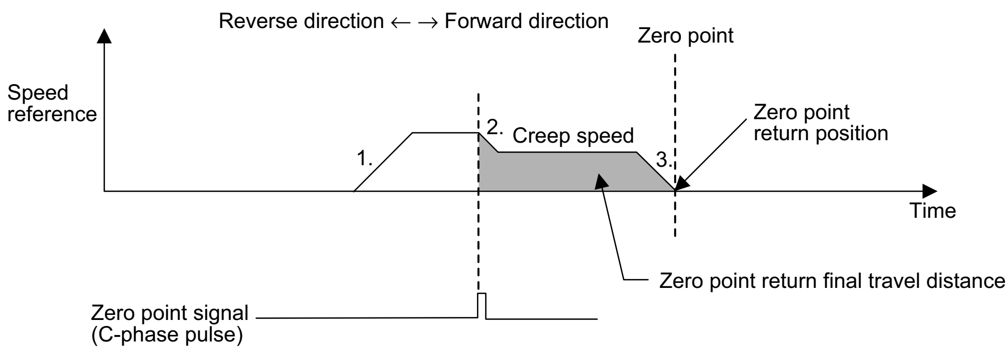
Zero Point Return Operation Started and Zones (d) and (e) Used



1. The axis travels at approach speed in the reverse direction.
2. The axis decelerates at the rising edge of the dog (deceleration limit switch) signal.
3. The axis travels at creep speed in the forward direction.
4. After the falling edge of the dog (deceleration limit switch) is detected, the axis stops after traveling only the zero point return final travel distance from the initial zero point signal, and that position will be the machine coordinate system zero point.

■ C-phase Pulse

This method is used to perform zero point return using only a zero point signal (C-phase pulse) by rapid traverse using linear acceleration/deceleration.



1. The axis travels at approach speed in the direction specified in the motion setting servo parameter (OB□□009).
2. The axis decelerates to creep speed after detecting the initial zero point signal.
3. The axis stops after traveling only the zero point return final travel distance from the initial zero point signal, and that position will be the machine coordinate system zero point.

SVA-01A	SVA-02A	SVB-01	PO-01
Applicable	Applicable	Applicable	N/A

■ DEC1 + ZERO Signal

This method can be used only with a 4-axis SVA-01 Module.

Zero point return is performed using a ZERO signal (DI signal) in place of the C-phase pulse used in the *DEC1 + C-phase Pulse* described above.

For details, see *DEC1 + C-phase Pulse*.

SVA-01A	SVA-02A	SVB-01	PO-01
Applicable	N/A	Applicable	Applicable

■ DEC2 + ZERO Signal Method

This method can be used only with a 4-axis SVA-01 Module.

Zero point return is performed using a ZERO signal (DI signal) in place of the C-phase pulse used in the *DEC2 + C-phase Pulse* discussed above.

For details, see *DEC2 + C-phase Pulse*.

SVA-01A	SVA-02A	SVB-01	PO-01
Applicable	N/A	N/A	Applicable

■ DEC1 + LMT + ZERO Signal Method

This method can be used only with a 4-axis SVA-01 Module.

Zero point return is performed using a ZERO signal (DI signal) in place of the C-phase pulse used in the *DEC1 + LMT + C-phase Pulse* discussed above.

For details, see *DEC1 + LMT + C-phase Pulse*.

SVA-01A	SVA-02A	SVB-01	PO-01
Applicable	N/A	N/A	Applicable

■ ZERO Signal Method

This method can be used only with a 4-axis SVA-01 Module.

Zero point return is performed using a ZERO signal (DI signal) in place of the C-phase pulse used in the *C-phase Pulse* discussed above.

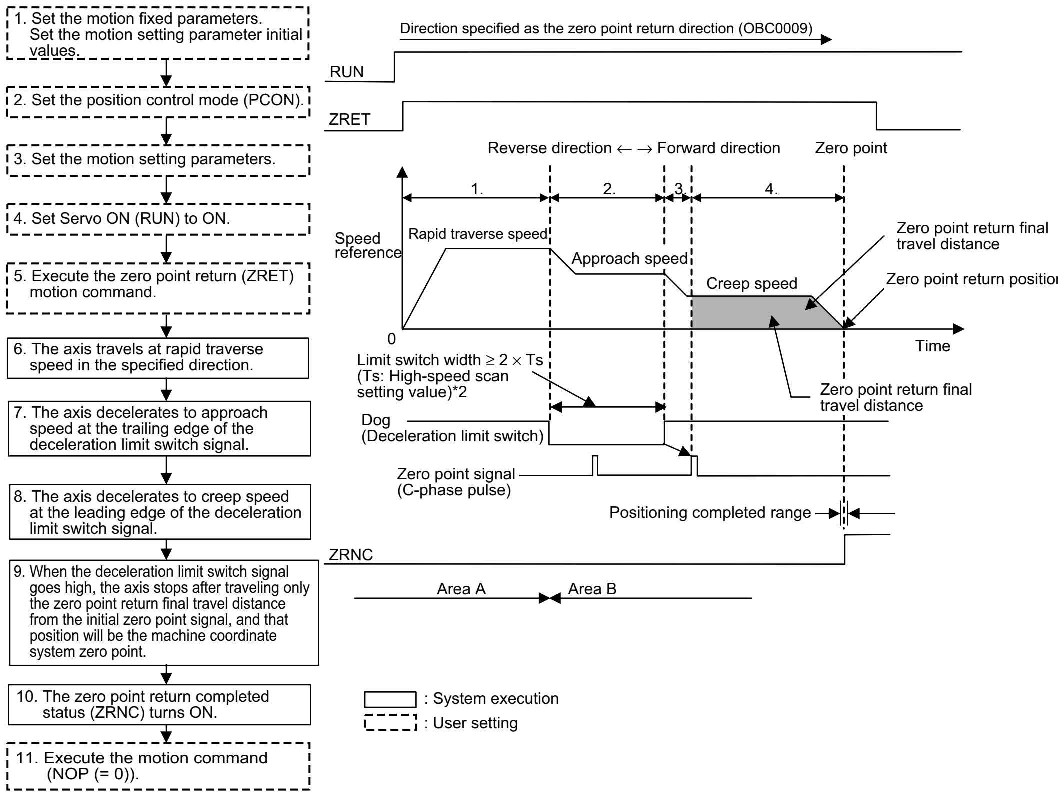
For details, see *C-phase Pulse*.

SVA-01A	SVA-02A	SVB-01	PO-01
Applicable	N/A	Applicable	N/A

■ Example of the Zero Point Return Operations

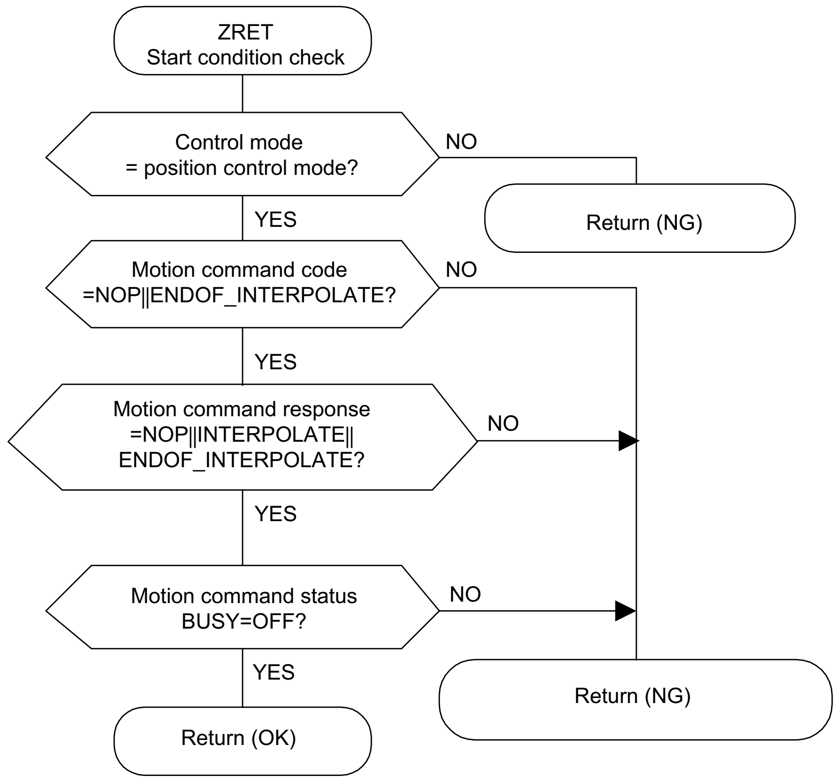
Use the following procedure to perform zero point return operations.

The following illustration shows an example of the DEC1 + C-phase pulse method.



1. Set the initial values for the motion fixed parameters and the motion setting parameters according to the user's machine.
2. Set the Position Control Mode (PCON) (bit 2 of OW□□00).
3. Set the motion setting parameter to be used with zero point return (ZRET).
4. Set Servo ON (RUN) to ON (bit 0 of OW□□01).
   For a PO-01 Module, set Excitation ON (RUN) to ON.
5. Set zero point return (ZRET = 3) in the motion command code (OW□□20).

6. Zero point return (ZRET) starts.



The axis travels at rapid traverse speed in the direction specified by the zero point return direction selection (OBC0009).

The motion parameter setting values cannot be changed during a zero point return operation.

The zero point return command operations are as follows:

a) Operation Start

Servo ON (bit 0 of OW☐☐01). Excitation ON for PO-01 Module.

Set the zero point return (ZRET) to motion command code (OW☐☐20).

b) Feed Hold

Not possible.

c) Abort

Set Abort (bit 1 of OW☐☐21) to ON, or set NOP (= 0) in the motion command code.

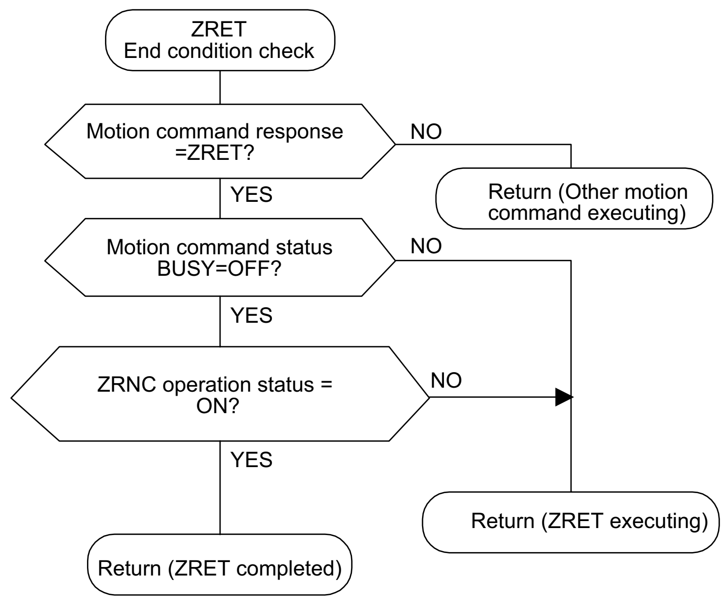
Busy (bit 0 of IW☐☐15) turns ON during abort processing, and turns OFF at abort completion.

Note: Even when the abort is completed and the abort is released (ABORT turns OFF), operations remain stopped.

7. The axis decelerates to approach speed at the falling edge of the dog (deceleration limit switch) signal.

8. The axis decelerates to creep speed at the rising edge of the dog (deceleration limit switch) signal.

9. When the dog goes high, the axis stops after traveling only the zero point return final travel distance (OL□□2A) from the initial zero point signal (C-phase pulse), and that position will be the machine coordinate system zero point.
   A zero point position offset value can also be set. (If Zero Point Offset OL□□06 is set in advance to 100, the position data will be 100.)
10. The zero point return operation is completed when the axis enters the Positioning Completed Range (OW□□0E) after Distribution Completed (bit 2 of IW□□15 is ON).
    When the zero point return operation is completed, the ZRNC Zero Point Return Completed (bit 6 of IW□□15) turns ON.



11. After checking that the ZRNC Zero Point Completed (bit 6 of IW□□15) is ON, set NOP (= 0) in the motion command code (OW□□20).

IMPORTANT

- If the machine is in Area B after the power is turned ON, the return cannot be performed correctly. Be sure to move the machine back to Area A before performing a return.
- The deceleration limit switch width must be at least twice that of the high-speed scan setting value. The criteria for the deceleration limit switch width (L) can be calculated using the formula shown below.

  - Ts (s) = High-speed scan set value (ms)/1000
  - f (m/s) = K × {NR × n × FBppr}/60

    F : 100% speed (m/s)

    K : Weight of 1 pulse (m/pulse)

    NR : Rated rotation speed (r/min)

    FBppr : Feedback pulse resolution (p/r)

    n : Pulse multiplication (1, 2, or 4)
  - t (s) = Linear acceleration/deceleration time (s)
  - α (m/s^2) = f/t

    If α = acceleration/deceleration time constant (m/s^2), the following equation applies.

    $L = 1/2 \cdot \alpha\ (2 \times Ts)^2 = 2\,\alpha\ Ts^2$

- When a short distance is set for the zero point return final travel distance, the axis returns to the zero point after the zero point has been passed once.

■ User Program Example: Zero Point Return

1. Example of RUN Operation

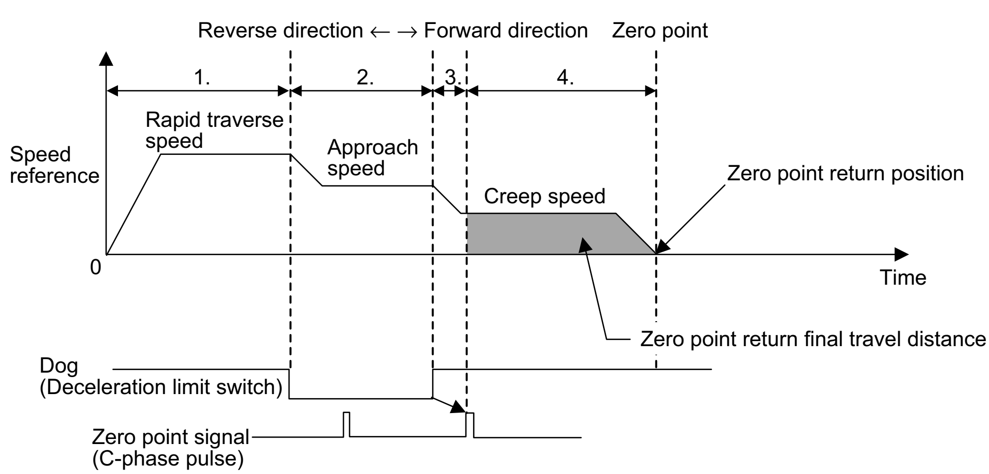
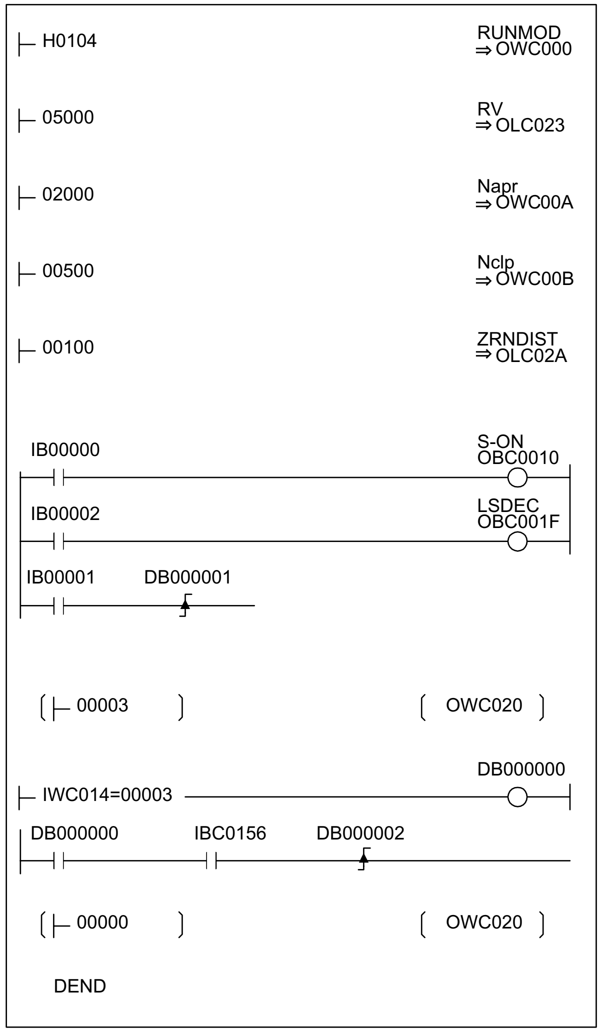


Fig. 4.19 Example of a Zero Point Pattern (DEC1 + C-phase Pulse Signal Method)

2. Ladder Logic Program Example



Set the position control mode to ON.

Rapid traverse speed
(5,000,000 pulses/min.)

Approach speed
(2,000,000 pulses/min.)

Creep speed
(5,000,000 pulses/min.)

Zero point return final travel distance *
(100 pulses)

Servo ON command

IB00002: Limit switch signal

Zero point return switch
When IB00002 turns ON, the rising edge is detected and the zero point return command will be executed.

When the zero point return operation has been completed, the zero point return completed status turns ON.

After the zero point return operation has been completed, set NOP to clear the command.

Fig. 4.20 Zero Point Return Programming Example (DWG H03)

* With SVB-01 Module, set the zero point return final travel distance using the SERVOPACK parameter.

The example in the above illustration has been greatly simplified. In actual operation, each register can be controlled from the user program.

4

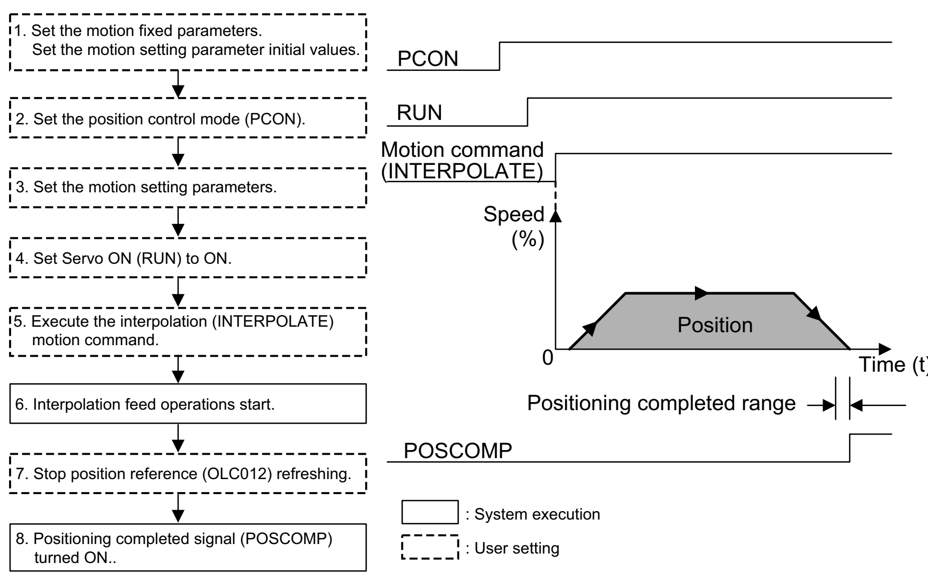
4.4.5 Interpolation (INTERPOLATE, END_OF_INTERPOLATE)

■ Overview

This command performs interpolation feeding using the position data distributed from the CPU Module.

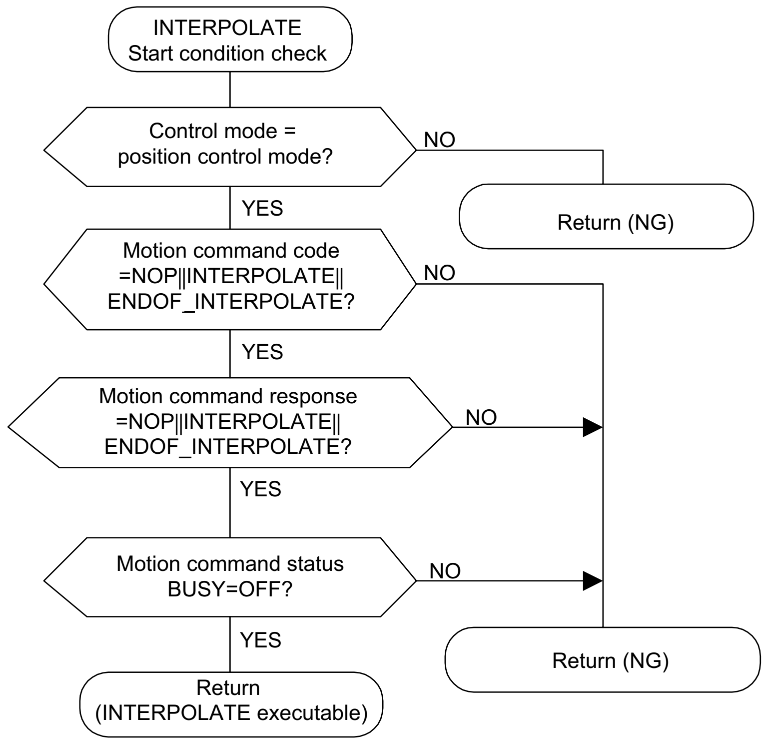
■ Details

Use the following procedure to perform interpolation feed operations.



1. Set the initial values for the motion fixed parameters and the motion setting parameters according to the user's machine.
2. Set the Position Control Mode (PCON) (bit 2 of OW☐☐00).
3. Set the Position Reference Setting (OLC☐☐12).
   If required, set any motion setting parameters to use with interpolation (INTERPOLATE), such as the Filter Constant (OW☐☐14).
4. Set Servo ON (RUN) to ON (bit 0 of OW☐☐01).
   For a PO-01 Module, set Excitation ON (RUN) to ON.

5. Set interpolation (INTERPOLATE = 4) in the motion command code (OW□□20).



6. When interpolation (INTERPOLATE) is set as the motion command, the axis performs interpolation feed using the specified motion parameter.
7. Stop refreshing the position reference (OL□□12).
8. Set the motion command to 0.
9. When the axis enters the Positioning Completed Range (OW□□0E) after Distribution Completed (bit 2 of IW□□15 is ON), the POSCOMP Positioning Completed Signal (bit D of IW□□00) turns ON.

INFO

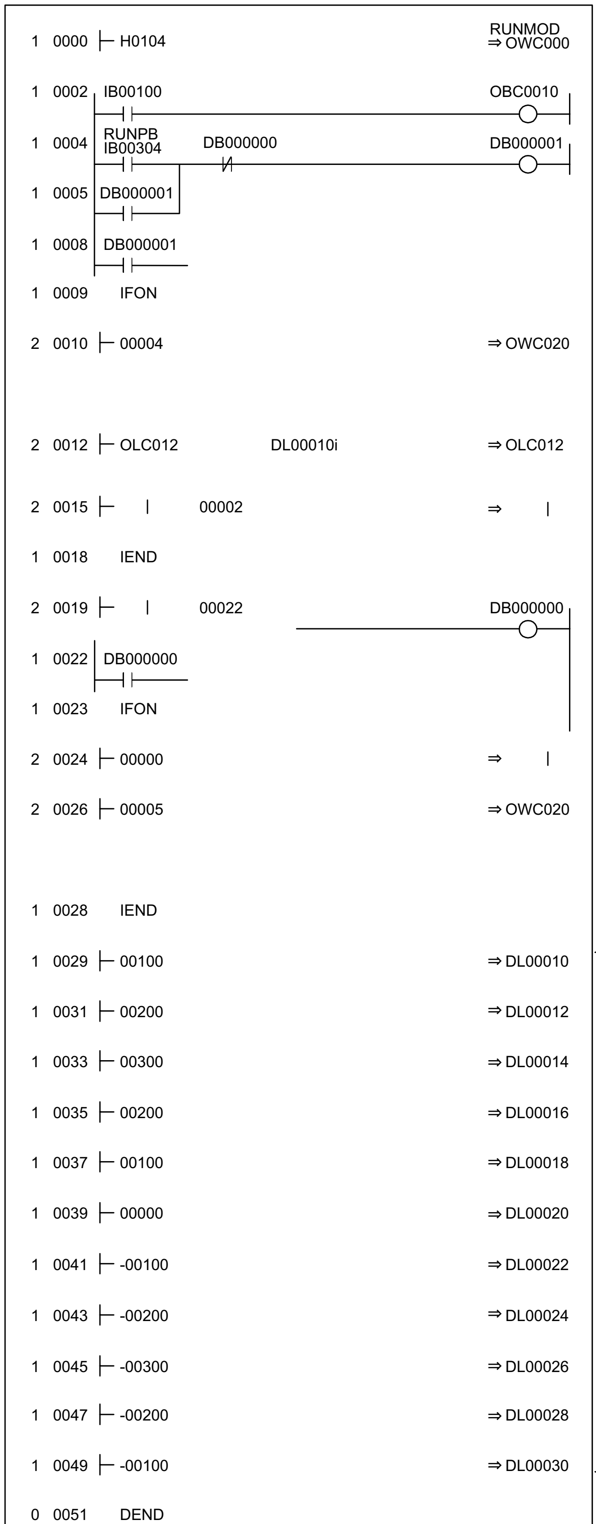
When END_OF_INTERPOLATE is used for the motion command, the system will automatically reset the motion command to 0 at the next scan.

IMPORTANT

There is no parameter to set speed reference for the interpolation command. The change in the position reference every scan is used as the speed for the interpolation command.

■ User Program Example: Interpolation

Ladder Logic Program Example



Set the position control mode to ON.

RUN command to the driver

Execute INTERPOLATE command.

Set the position reference.

Confirm the completion of the specified distribution.

Execute END_OF_INTERPOLATE command.

Incremented daa of position reference evey scan

Fig. 4.21 Interpolation Programming Example (INTERPOLATE, END_OF_INTERPOLATE)

The example in the above illustration has been greatly simplified. In actual operation, each register can be controlled from the user program.

4.4.6 Interpolation with Position Detection (LATCH)

■ Overview

In the same way as for an interpolation feeding, the latch signal is used to latch the current position counter while the interpolation feed is being executed, and reports the changed latch position converted to the reference unit system.

A specific discrete input (DI input) is used for the latch signal.

■ Details

For details on interpolation operations, see *4.4.5 Interpolation (INTERPOLATE, END_OF_INTERPOLATE)*.

IMPORTANT

When latching is performed again after current position counter latching has been executed once by the latch signal, first set the motion command to NOP for 1 scan or more, and then execute the LATCH command.

4.4.7 Fixed Speed Feed (FEED)

■ Overview

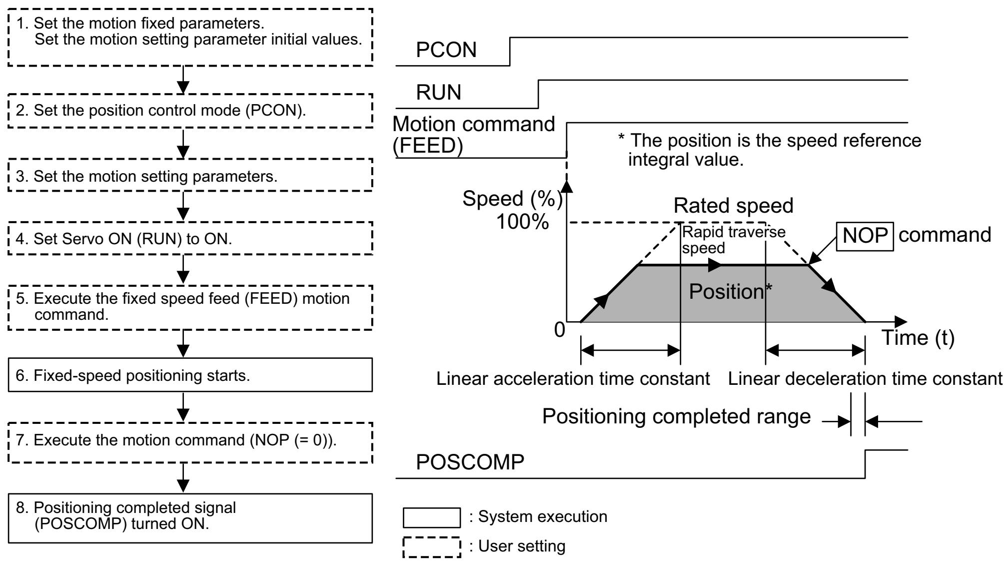
This command performs rapid traverse in the infinite length direction using the specified acceleration/deceleration time constant and the specified rapid traverse speed.

The rapid traverse speed can be changed during operations.

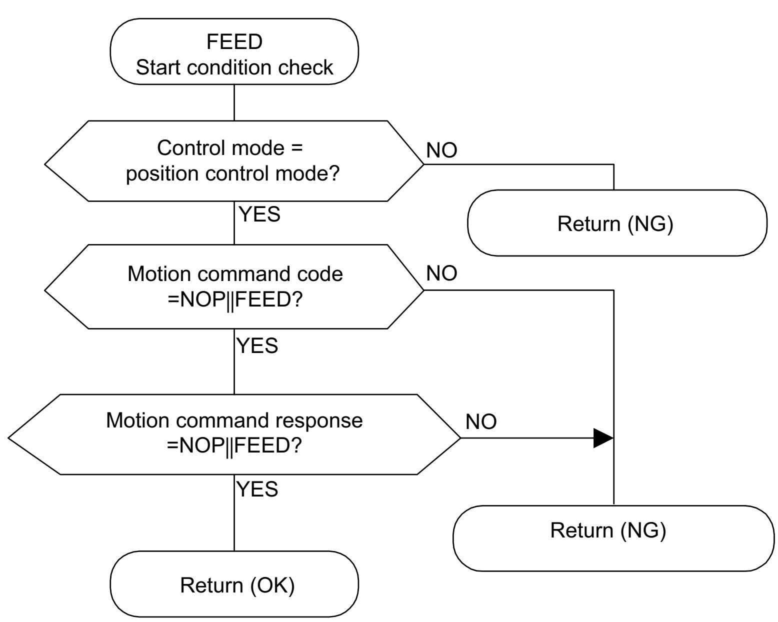
The axis decelerates to a stop when NOP (= 0) is set in the motion command code (OW□□20).

■ Details

Use the following procedure to perform fixed speed feed operations.



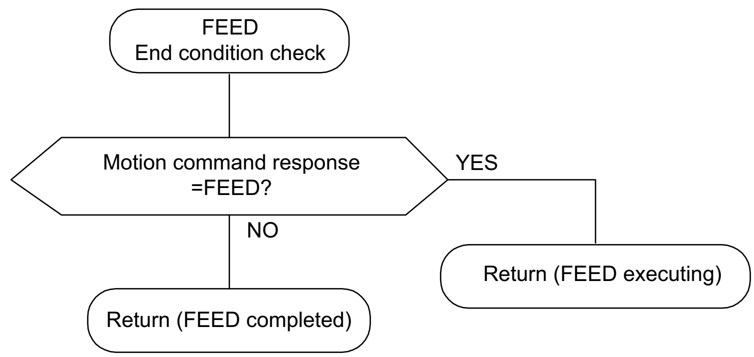
1. Set the initial values for the motion fixed parameters and the motion setting parameters according to the user’s machine.
2. Set the Position Control Mode (PCON) (bit 2 of OW□□00).
3. Set the Rapid Traverse Speed (OL□□22 or OW□□15).
   Set the motion setting parameter to be used with fixed speed feed (FEED).
4. Set Servo ON (RUN) to ON (bit 0 of OW□□01).
   For a PO-01 Module, set Excitation ON (RUN) to ON.
5. Set fixed speed feed (FEED) in the motion command code (OW□□20).
6. FEED operation starts.



The axis performs fixed speed feed using the specified motion parameter.

Fixed speed feed cannot be temporarily stopped.

7. To stop (abort) fixed speed feed, set NOP (= 0) in the motion command code (OW□□20).
8. When the axis enters the Positioning Completed Range (OW□□0E) after Distribution Completed (bit 2 of IW□□15 is ON), the POSCOMP Positioning Completed Signal (bit D of IW□□00) turns ON.



■ User Program Example: Fixed Speed Feed

Example of RUN Operation

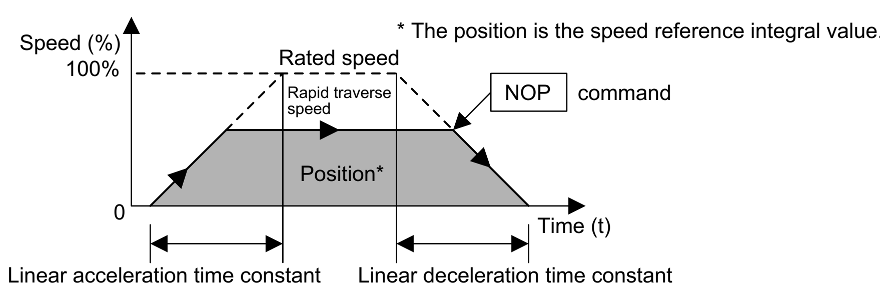
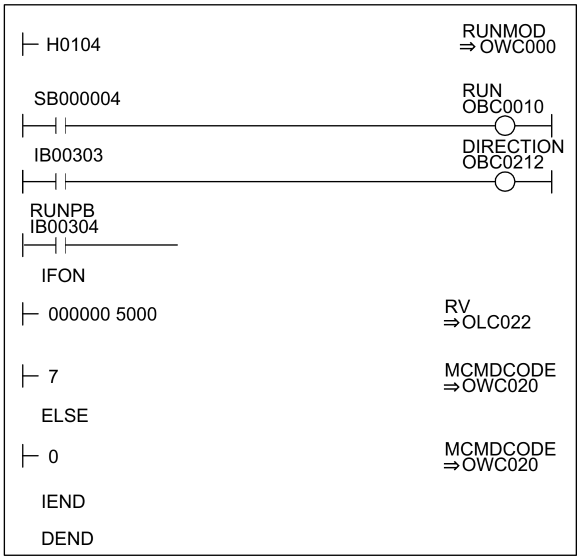


Fig. 4.22 Example of a Fixed Speed Feed Pattern

Ladder Logic Program Example



Set the position control mode to ON.

Run command to the driver.

When IB00303 turns ON, the rotation direction will be changed to the reverse direction.
When IB00304 turns ON, FEED operation will start.

Rapid traverse speed (RV): 5,000,000 pulses/min.

Set the motion command to FEED.

When IB00304 turns OFF, the axis decelerates to a stop. When the axis stops, the positioning completed signal (IBC000D) will turn ON.

Fig. 4.23 Fixed Speed Feed Programming Example (DWG H03)

The example in the above illustration has been greatly simplified. In actual operation, each register can be controlled from the user program.

4.4.8 Fixed Length Feed (STEP)

■ Overview

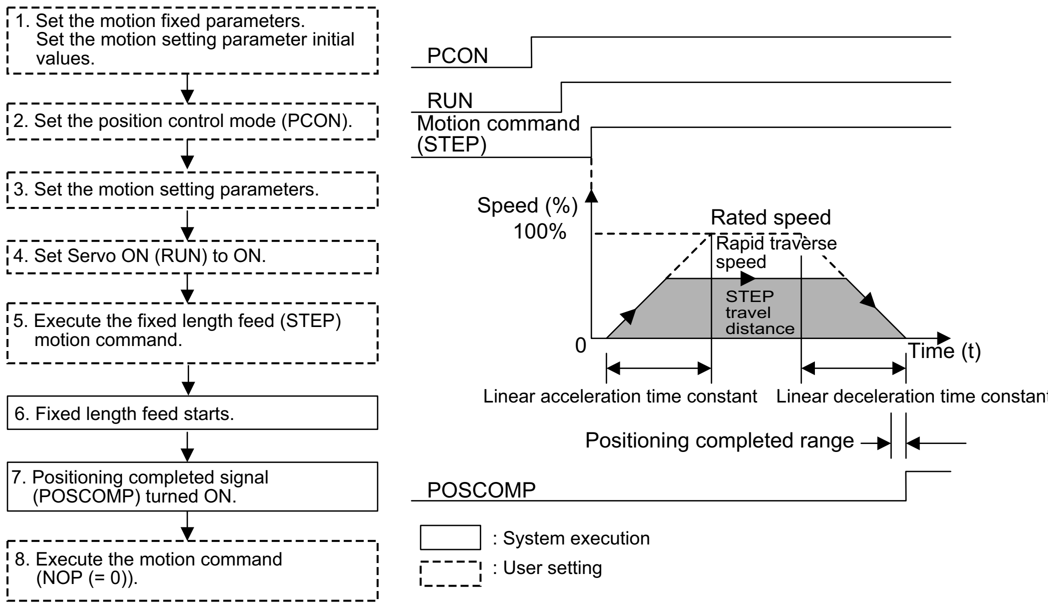
This command positions the axis at rapid traverse speed in the specified direction for only the specified travel distance (STEP travel distance) using the specified acceleration/deceleration time constant.

The rapid traverse speed can be changed during operations.

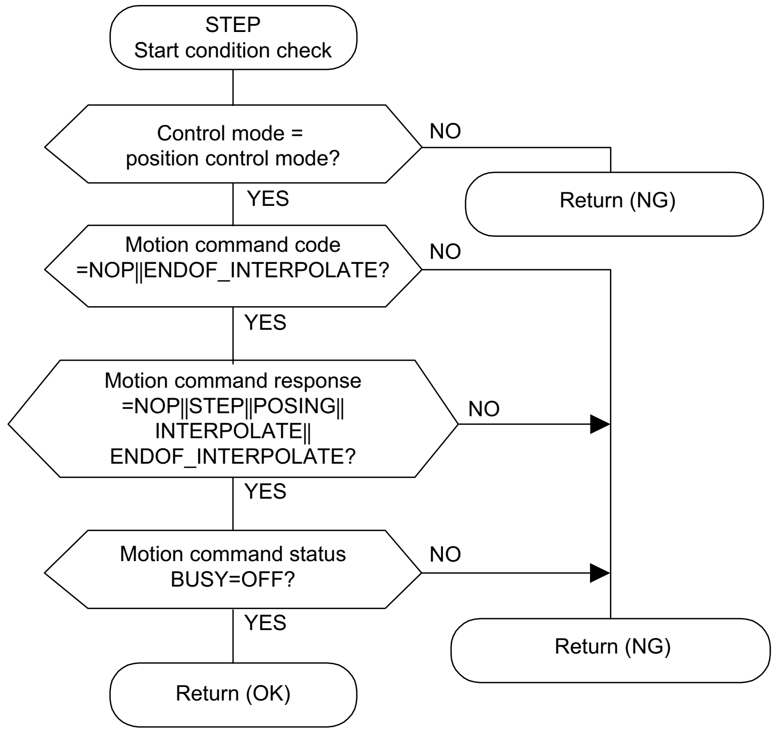
When you change the travel distance during operations, the changed value will be incorporated when the next fixed length feed (STEP) is executed.

■ Details

Use the following procedure to perform fixed length feed operations.



1. Set the initial values for the motion fixed parameters and the motion setting parameters according to the user's machine.
2. Set the Position Control Mode (PCON) (bit 2 of OW□□00).
3. Set the Step travel distance (OL□□28) and the Rapid Traverse Speed (OL□□22 or OW□□15).
   Set the motion setting parameter to be used with fixed length feed (STEP).
4. Set Servo ON (RUN) to ON (bit 0 of OW□□01).
   For a PO-01 Module, set Excitation ON (RUN) to ON.
5. Set fixed length feed (STEP = 8) to the motion command code (OW□□20).
6. STEP operation starts.



The axis performs positioning using the specified motion parameter. Even during fixed length feed operations, the motion parameter settings can be changed.

The fixed length feed command operations are as follows:

a) Operation Start

Servo ON (bit 0 of OW☐☐01).

Set fixed length feed (STEP) in the motion command code (OW☐☐20).

b) Feed Hold

Set Hold (bit 0 of OW☐☐21) to ON.

At feed hold completion, HOLDL (bit 1 of IW☐☐15) turns ON.

c) Feed Hold Release

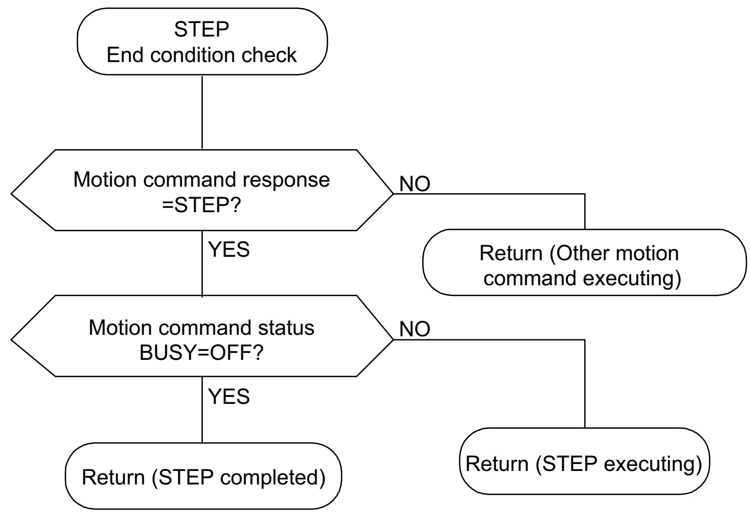
Set Hold (bit 1 of OW☐☐21) to OFF. Positioning resumes.

d) Abort

Set Abort (bit 1 of OW☐☐21) to ON, or set NOP (= 0) in the motion command code.

Note: Even when the abort is completed and the abort is released (ABORT turns OFF), operations remain stopped.

7. When the axis enters the Positioning Completed Range (OW□□0E) after Distribution Completed (bit 2 of IW□□15 is ON), the POSCOMP Positioning Completed Signal (bit D of IW□□00) turns ON.



8. Once positioning has been completed, the fixed length feed motion command is released.

Note: Fixed length feed is detected at the leading edge. Therefore, when fixed length feed has been executed, the motion command must be set to NOP for 1 scan or more, and fixed length feed must be reset as the motion command.

■ User Program Example: Fixed Length Feed

Example of RUN Operation

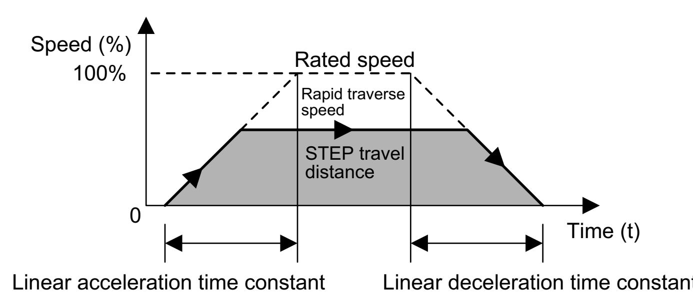
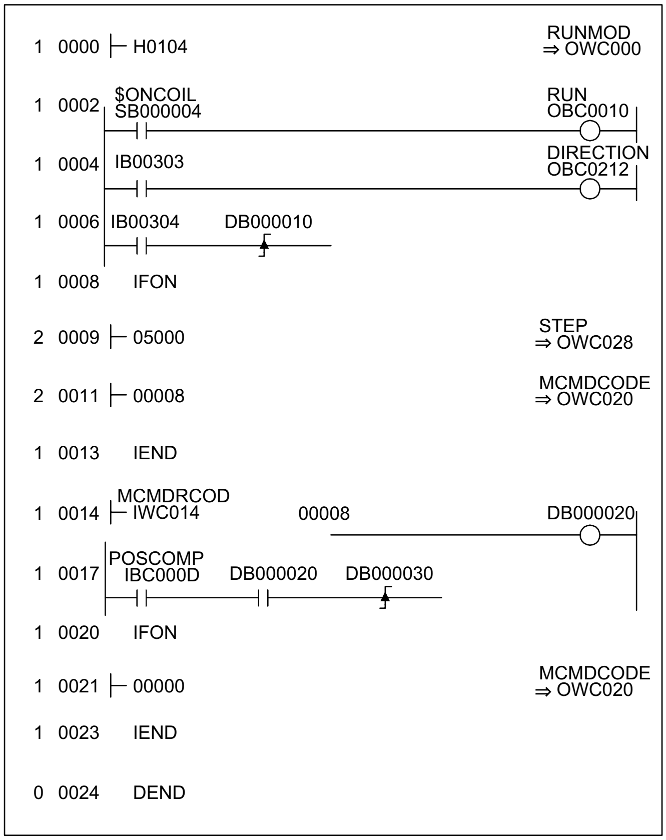


Fig. 4.24 Example of a Fixed Length Feed Pattern

Ladder Logic Program Example



Set the position control mode to ON.

RUN command to the driver.

When IB00303 turns ON, the rotation direction will be changed to the reverse direction.

STEP travel amount: 2,000 pulses

When IB00304 turns ON, the STEP operation starts and the axis will move for the STEP travel amount.

When the axis moved for the STEP travel amount, the positioning completed signal (IBC00D) will turn ON.

After the positioning has been completed, set NOP to clear the command.

The example in the above illustration has been greatly simplified. In actual operation, each register can be controlled from the user program.

4.4.9 Zero Point Setting (ZSET)

> ⚠ **WARNING**
>
> - The zero return setting (ZSET) command is used to set the machine coordinate system zero point. Therefore, if the ZSET setting position is incorrect, the movement for subsequent operations will differ from the actual position. Before executing operations, be sure to check that the correct machine coordinate system zero point has been set.
>
>   Failure to carry out this check may result in damage to equipment, serious personal injury, or even death.

■ Overview

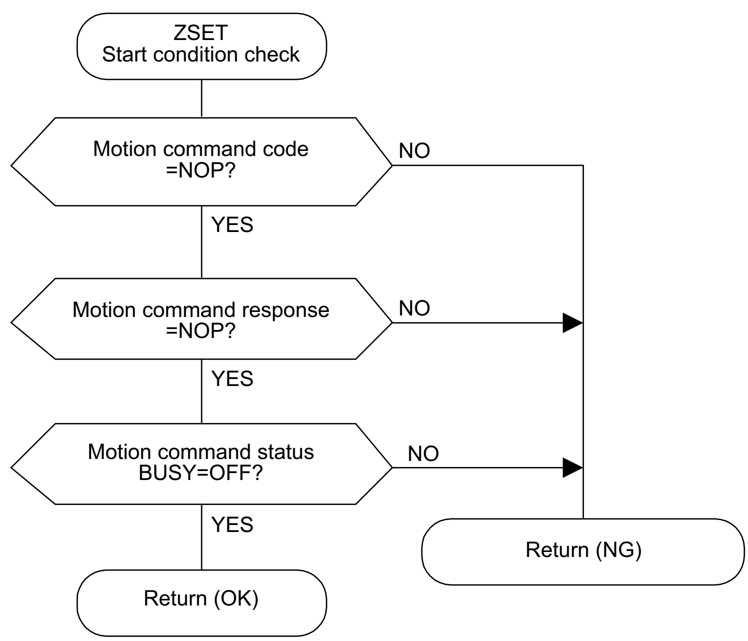
When the zero point setting is executed, the current position will be the machine coordinate system zero point. Therefore, the zero point can be set without performing a zero point return operation.

When a stored stroke limit is used, be sure to execute a zero point return operation or a zero point setting.

■ Details

Use the following procedure to set the zero point.

1. Move the machine to the zero point using fixed speed feed, fixed length feed, or manual operation.
2. Set the Position Control Mode (PCON) (bit 2 of OW□□00).



Note: Set "Use (= 1)" in bit 7 (motion command use selection) of motion fixed parameter No. 14 (Additional Function Selections). Set "1 (= Enabled)" in bit 8 (motion command code enabled selection) of the RUN Mode Selection (OW□□00) motion setting parameter.

3. Set the zero point setting (ZSET = 9) in the motion command code (OW□□20).

Note: Servo ON (bit 0 of OW□□01) may be either ON or OFF. The zero point setting (ZRET) command cannot be executed when the axis is traveling if motion fixed parameter No. 3 (Encoder Selection) is set in the absolute encoder (= 1) and bit 5 (axis selection) of motion fixed parameter No. 17 (Motion Controller Function Selection Flags) is set to "infinite length axis" (= 1),

4. When the zero point setting has been completed, Zero Point Setting Completed (bit 3 of IW□□15) and the Zero Point Return Completed (bit 6 of IW□□15) turn ON.

5

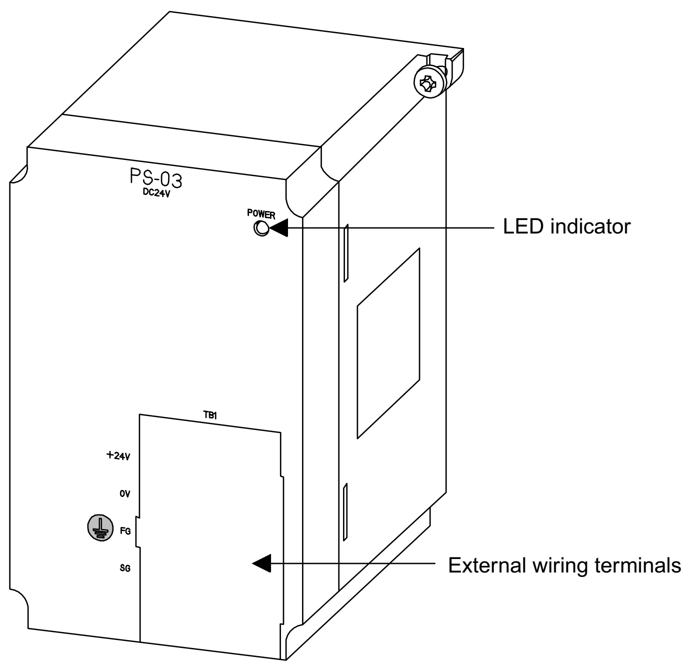
Modules

This chapter explains how to handle each part of the MP920 Modules and how to connect the modules to the system.

5.1 Power Supply Modules

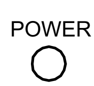
5.1.1 PS-03 Module

The following illustration shows the appearance of the PS-03 Power Supply Module.



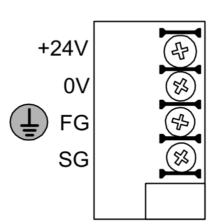
The details of each part of the PS-03 Module are described below.

■ LED Indicator



Indicator Name	Indicator Color	Meaning When Indicator Is Lit
POWER	Green	The PS-03 Module is operating.

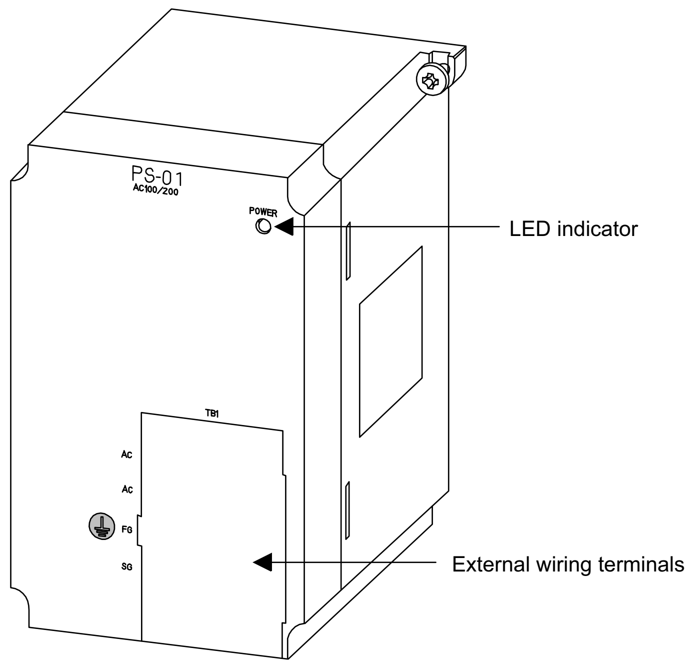
■ External Wiring Terminals



Terminal Name	Function
+24 V	+24 VDC
0 V	0 VDC
FG	Protective ground terminal
SG	

5.1.2 PS-01 Module

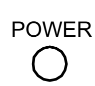
The following illustration shows the appearance of the PS-01 Power Supply Module.



The details of each part of the PS-01 Module are described below.

■ LED Indicator

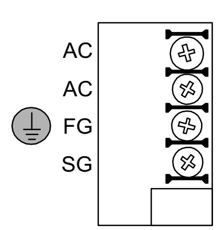
The meaning of the indicator on the front panel of the Module is as follows:



Indicator Name	Indicator Color	Meaning When Indicator Is Lit
POWER	Green	The PS-01 Module is operating.

■ External Wiring Terminals

The external wiring terminals are used as follows:



Terminal Name	Function
AC	External power supply terminal
AC	External power supply terminal
FG	Protective ground terminal
SG	Internal power supply ground terminal

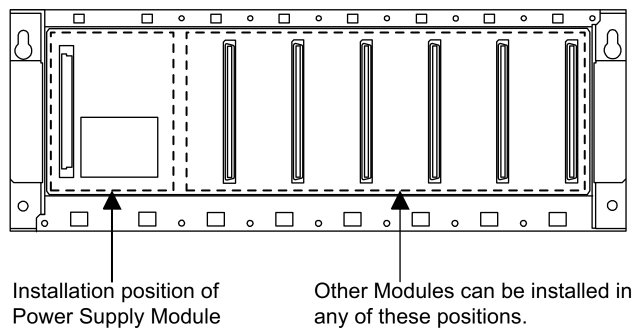
INFO

The SG terminal is the ground for the Controller's internal power supply. Do not connect the SG terminal for normal operation.

■ Application Precautions

Observe the following precautions when using the PS-01 Power Supply Module.

- One Power Supply Module is required for every Mounting Base.
- More than one Power Supply Module cannot be mounted to one Mounting Base. The Power Supply Module must be mounted to the dedicated slot on the left side of the Mounting Base.



- The supply of direct current from the Power Supply Module is restricted depending on the Mounting Base to which the Power Supply Module is mounted. Power is not supplied to Modules that are mounted to a a different Mounting Base.
- The output current capacity of the PS-01 Power Supply Module is 10 A.
- The following table shows the input current for a maximum load (maximum output current) of 10 A when using an input voltage of 100 or 200 VAC.

Maximum Load	Input Voltage (VAC)	Input Current (A)
10 A	100	1.2
	200	0.6

- Make sure that the maximum total internal current consumption of the Modules mounted to the Mounting Base is always less than the output current capacity of the Power Supply Module mounted to the same Mounting Base.

  The following table shows the maximum internal current consumption of the Modules.

Table 5.1 Internal Current Consumption of Modules

Group	Name	Description	Model	Maximum Internal Current Consumption
CPU Modules	CPU Module	CPU-01	JEPMC-CP200	980 mA
	CPU Module	CPU-02	JEPMC-CP210	1200 mA
Digital I/O Modules	Input Module	DI-01	JEPMC-IO200	370 mA
	Output Module	DO-01	JEPMC-IO210	300 mA
	I/O Module	LIO-01	JEPMC-IO220	140 mA
Motion Modules	4-Axis Servo Module	SVA-01A	JEPMC-MC200A	720 mA
	2-Axis Servo Module	SVA-02A	JEPMC-MC220A	800 mA
	MECHATROLINK Interface Module	SVB-01	JEPMC-MC210	500 mA
	Pulse Output Module	PO-01	JEPMC-PL200	530 mA
Counter Modules	Pulse Input Module	CNTR-01	JEPMC-PL210	650 mA
Analog Modules	Analog Input Module	AI-01	JEPMC-AN200	310 mA
	Analog Output Module	AO-01	JEPMC-AN210	550 mA
Communications Modules	RS-232C/RS-422 Communications Module	217IF	JEPMC-CM200	230 mA
	Ethernet Communications Module	218IFA	JEPMC-CM210A	450 mA
	215IF Communications Module	215IF	JEPMC-CM220	414 mA
	DeviceNet Communications Module	260IF	JEPMC-CM230	
Other Modules	Expansion Interface Module	EXIOIF	JEPMC-EX200	580 mA

■ Connecting External Power Supply Terminals

⚠ CAUTION

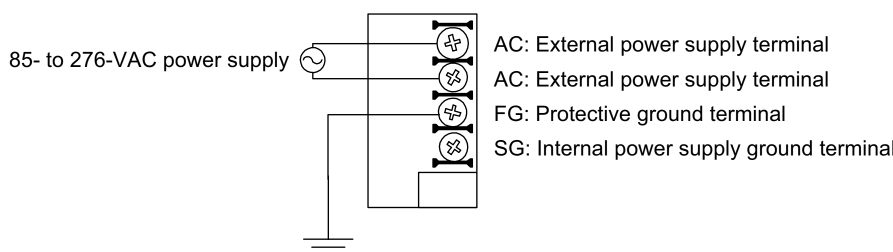
- Do not accidentally leave foreign matter such as wire chips in a Module when wiring.

  This may cause fires, failures, and malfunctions.
- Make sure that the polarity of the power lines connected to the external power supply terminals is correct.

  Incorrect polarity of the connections at the terminals may damage the Module.

Power Supply Specifications

Supply an 85- to 276-VAC power supply to the external power supply terminals (AC, AC) of the PS-01 Module, as shown in the following diagram.



Use an AC power supply for the PS-01 Module with low noise interference. If the power supply has high noise interference, use a noise filter.

Power Supply Connections

Make sure that the wires in the power lines used to connect the power to the external power supply terminals of the PS-01 Module are the correct size, as specified below. The ambient temperature and other conditions will affect the allowable current capacity of the power lines. Check the conditions of use and select cables that are an appropriate size. Always use twisted wires for power lines.

- Power line wire size: 1.5 mm^2 (AWG16) to 2.5 mm^2 (AWG13)

Use Phillips M4 screws for the external power supply terminals. Use M4 screw crimp terminals on the ends of the power lines.

If a noise filter is used, always wire the primary side separately from the secondary side.

■ Grounding

> ⚠ **CAUTION**
>
> • Do not accidentally leave foreign matter such as wire chips in a Module when wiring.
>
> This may cause fires, failures, and malfunctions.

> **MANDATORY**
>
> • Always ground the protective ground terminal (FG) to a ground resistance of 100 Ω or less.
>
> Failure to ground the PS-01 Module may result in electrical shocks or malfunctioning.

Protective Ground Terminal (FG)

A ground wire must be connected to the protective ground terminal (FG) of the PS-01 Module.

Connect the protective ground terminal (FG) of the PS-01 Module to the ground terminal (E) of the Control Panel using an internal panel ground wire of the following size.

- Ground wire size: 1.5 mm^2 (AWG16) to 2.5 mm^2 (AWG13)

When more than one Power Supply Module is used, do not wire the internal panel ground wire to the protective ground terminal. For multiple Power Supply Modules, wire the protective ground terminal of each Power Supply Module independently to the ground terminal of the Control Panel.

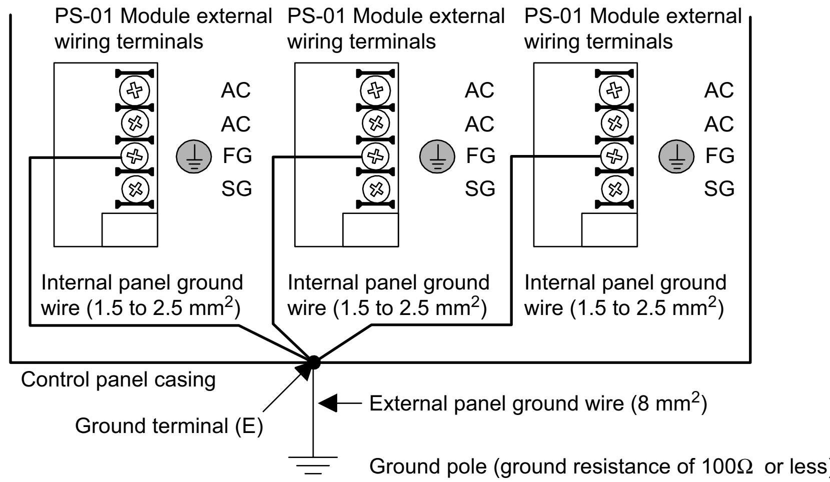
Use Phillips M4 screws for the protective ground terminals. Use M4 screw crimp terminals on the ends of the internal panel ground wires.

Control Panel Grounding

Wire the control panel ground terminal to the ground pole using an external panel ground wire with a thickness of at least 8 mm^2 (AWG8). Make the ground wire as short as possible.

Use a ground pole with a resistance of 100 Ω or less. Do not share the ground line or ground pole with other high-power electrical devices, such as electrically powered equipment or three-phase devices.

5



■ Built-in Fuses

⃠ PROHIBITED
• The customer must not replace any built-in fuses. If the customer replaces a built-in fuse, the PS-01 Module may malfunction or break down. The built-in fuse must always be replaced by Yaskawa service staff.

The PS-01 Module has a built-in fuse to prevent the burning of the Module resulting from the following causes.

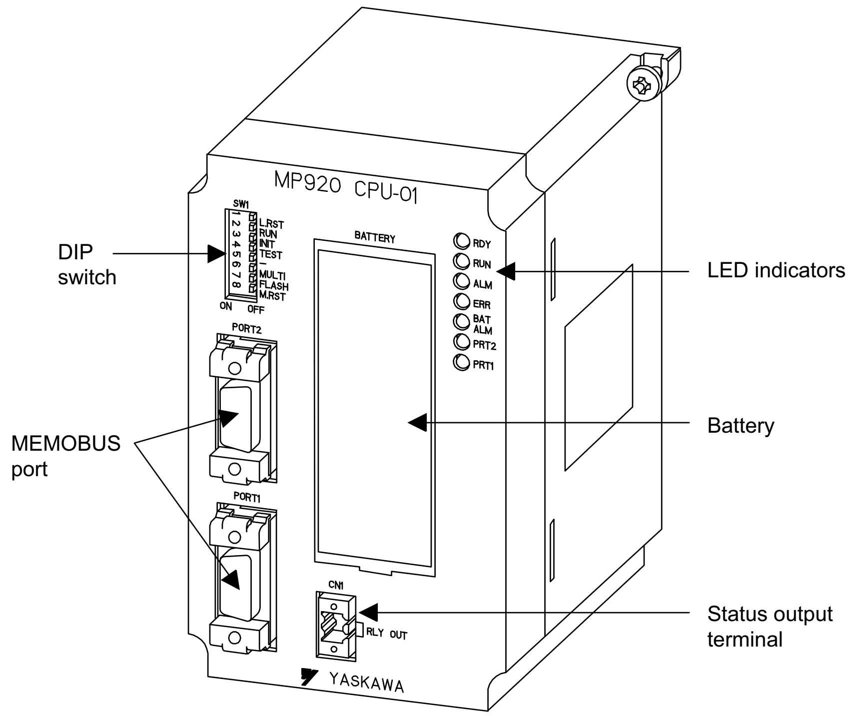
- External causes:For example, if a PS-01 Module external power supply terminal is subjected to overvoltage.
- Internal causes:For example, if a wire chip or other foreign wiring matter is left in the PS-01 Module causing a short-circuit failure in an internal circuit.

If the PS-01 Module built-in fuse is blown, the POWER indicator on the front panel of the PS-01 Module will turn OFF. After eliminating the cause of the blown fuse, replace the PS-01 Module.

5.2 CPU Modules

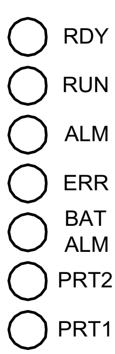
5.2.1 CPU-01 Module

The following illustration shows the appearance of the CPU-01 CPU Module.



The details of each part of the CPU-01 Module are described below.

■ LED Indicators



Indicator Name	Indicator Color	Meaning When Indicator Is Lit
RDY	Green	System operating normally.
RUN	Green	User program running.
ALM	Red	Minor system failure occurred.
ERR	Red	System fault or failure occurred.
BAT ALM	Red	Battery needs replacing.
PRT2	Green	Port 2 sending data.
PRT1	Green	Port 1 sending data.

■ DIP Switch

The DIP switch consists of eight pins. The pins are numbered 1 to 8, as shown in the diagram with *Table 5.2*.

Each pin is ON when it is moved to the left.

The pins other than L.RST and M.RST are valid only when the power turns ON and at the startup after resetting.

Turn OFF the power and then ON again when changing the mode.

The function of each pin is described below.

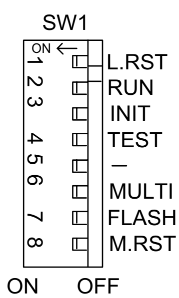
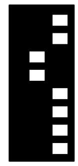
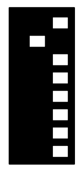
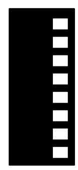
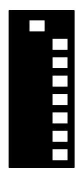
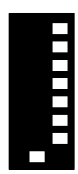


Table 5.2 DIP Switch Functions

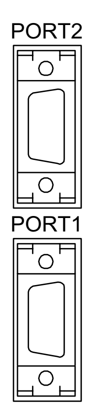
Pin	Name	Setting	Function	Default
1	L. RESET	ON	Local reset	OFF
		OFF	Online	
2	RUN	ON	User program executed.	ON
		OFF	User program stopped.	
3	INITIAL	ON	Pin 4 ON: Memory cleared.	OFF
		OFF	Pin 4 ON: Setting disabled.	
4	TEST	ON	Terminal mode/initialization mode	OFF
		OFF	Online	
5	PP Defaults	ON	Defaults for port 1 only	OFF
		OFF	Use memory settings.	
6	MULTI	ON	Multiple CPU in configuration	OFF
		OFF	Single CPU in configuration	
7	FLASH	ON	Program copied from flash memory to RAM.	OFF
		OFF	Program not copied from flash memory to RAM.	
8	M.RST	ON	Master reset	OFF
		OFF	Online	

Switch Setting	Function	Explanation
	Memory clear	Initializes the CPU Module. Perform this operation when starting the system.
	Program run	Runs the user program. Normally, this setting is used during system operation.
	Program stop	Stops the user program.
	Local reset	Resets only the CPU Module. (Other Modules will not be reset.)
	Master reset	Resets all Modules.

■ MEMOBUS Ports

Using RS-232C, the CPU Module can communicate with other devices on the MEMOBUS network through the MEMOBUS ports.
The following transmission devices can be connected to the MEMOBUS ports: Programming Devices, i.e., computers with an RS-232C interface.
The MEMOBUS port connector is a D-sub 9-pin, female connector. *Table 5.3* shows the layout of the connector pins and the signal names.

Table 5.3 MEMOBUS Port Layout and Signal Names



Pin	Abbreviation	Signal Name
1	FG	Protective ground
2	TXD	Transmitting data
3	RXD	Receiving data
4	RTS	Request to send
5	CTS	Clear to send
6	DSR	Data set ready
7	GND	Signal ground
8	–	
9	DTR	Data terminal ready

MEMOBUS Port Connection Example

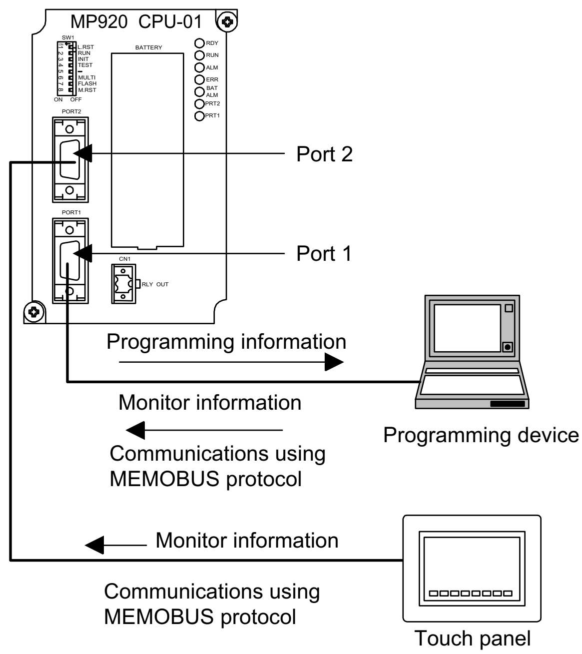
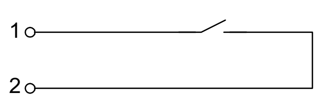
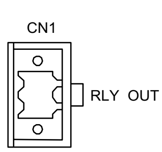


Fig. 5.1 Example of Touch Panel Connected to the Port 2

■ Status Output Terminals

The status output terminals output the RDY status of the CPU Module.



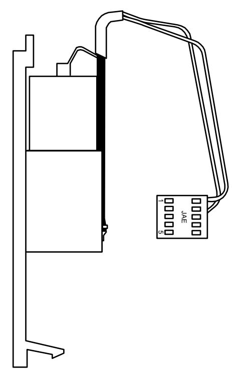


Pin	I/O	Remarks
1	OUT	During normal operation: Short-circuited During abnormal operation: Released
2	OUT	

The control rating: 0.5 A at 24 VDC, 0.5 A at 125 VAC

■ Battery

The battery is used as backup power supply for the SRAM.



Pin	Signal Name	I/O	Remarks
1	GND	I	Battery Connector Battery: ZZK000062 Battery (ER6VC Lithium Battery from Toshiba)
2	BAT	I	
3	BAT	I	
4	(NC)	I	
5	GND	I	

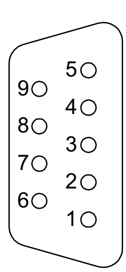
■ Connector Specifications

The following table shows the specifications of the connectors used to connect the CPU-01 Module.

Name	Connector Name	No. of Pins	Connector Model			Cable Model
			Module	Cable-end	Manufacturer	
Serial Port 1	PORT1	9	D-sub,9-pin female	D-sub,9-pin male		JEPMC-W5310-□□ JEPMC-W5311-□□
Serial Port 2	PORT2	9	D-sub,9-pin female	D-sub,9-pin male		JEPMC-W5310-□□ JEPMC-W5311-□□
Status Output Terminals	CN1	2	SL3.5-2-90F	BL3.5 / 2F-AU	Weidmüller	The CN1 connector is provided on the CPU-01 Module. The connection cable must be prepared by the customer.

■ Connector Pin Layour (Serial Ports)

The pin layout of the serial port 1 and 2 is shown below.



Pin Layout at
Connection Side

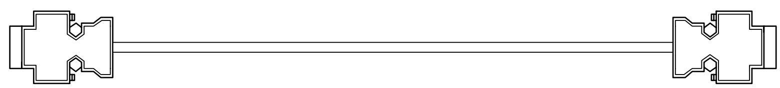
Pin No.	Description	Signal Name
1	FG	Protective grounding
2	TXD	Send data
3	RXD	Receive data
4	RTS	Request to send
5	CTS	Clear to send
6	DSR	Data set ready
7	GND	Signal grounding
8	–	–
9	DTR	Data terminal ready

■ Serial Port Connection Cable

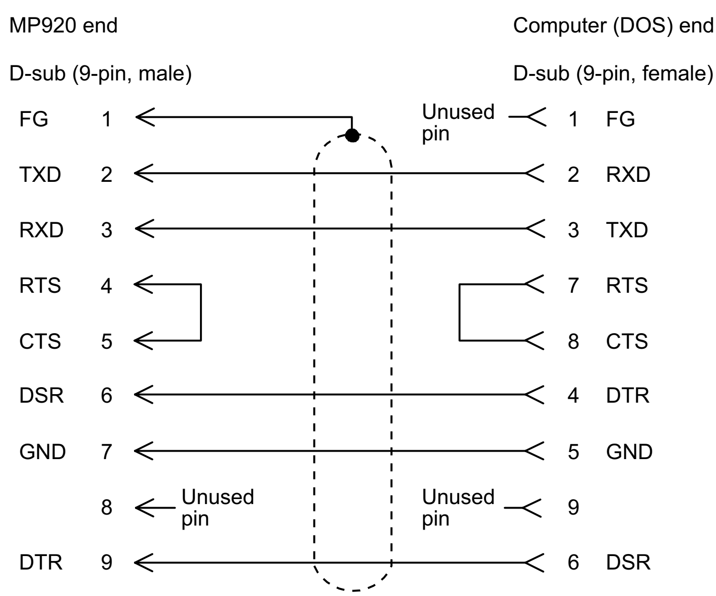
Model

JEPMC-W5311-□□

Appearance

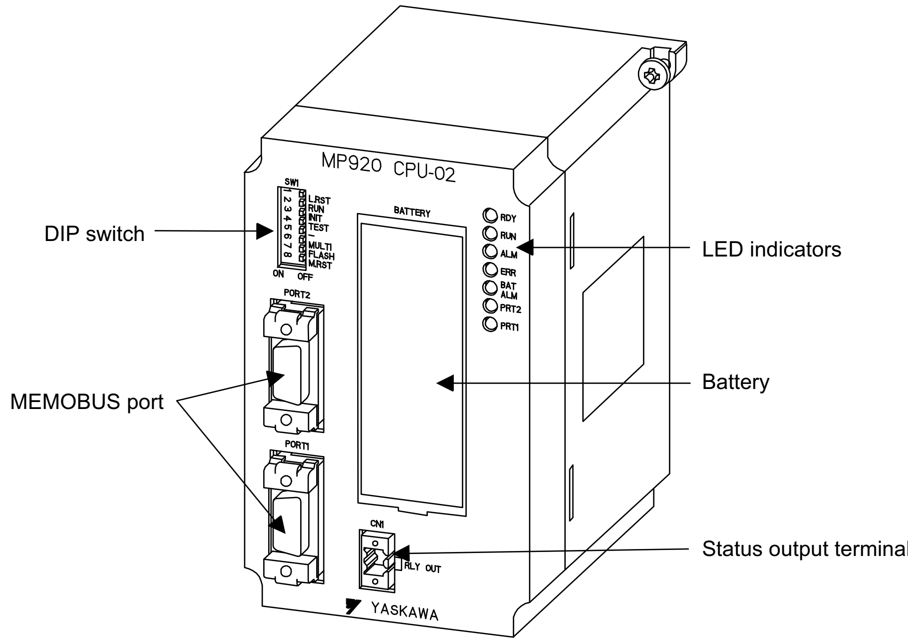


Cable Connection Diagram



5.2.2 CPU-02 Module

The following illustration shows the appearance of the CPU-02 CPU Module.

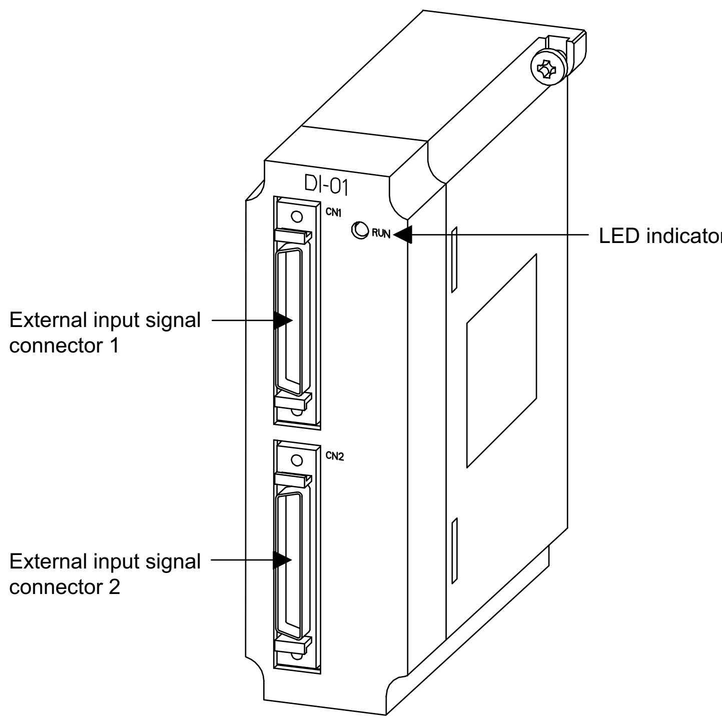


For the details of each part of the CPU-02 Modules, refer to *5.2.1 CPU-01 Module*.

5.3 I/O Modules

5.3.1 DI-01 Input Module

The following illustration shows the appearance of the DI-01 Input Module.



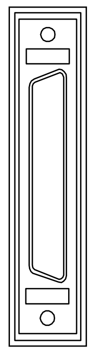
The details of each part of the DI-01 Module are described below.

■ LED Indicator

○RUN

Indicator Name	Indicator Color	Meaning
RUN	Green	Lit: When the Input Module is mounted in a slot and operating normally Not lit: When the Input Module is stopped

■ External Input Connector



The external input Connector is used to connect a DI-01 Module to external input signal terminals.

Use the following standard cable for this connector.

• JEPMC-W6060-□□

Number of input points: 64 points (32 points × 2)
Input type: Combined sourcing/sinking

■ Connector Specifications

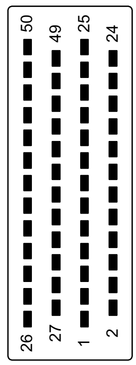
The following table shows the specifications of the connectors used to connect the DI-01 Module.

Name	Connector Name	Number of Pins	Connector			Cable
			On Module	On Cable	Manufacturer	
External Input Signal Connector 1	CN1	50	10250-52A2JL	• Connector body: 10150-3000VE • Shell: 10350-52A0-008 (Screw lock) 10350-52F0-008 (One-touch lock)	3M	JEPMC-W6060-□□
External Input Signal Connector 2	CN2	50	10250-52A2JL	• Connector body: 10150-3000VE • Shell: 10350-52A0-008 (Screw lock) 10350-52F0-008 (One-touch lock)	3M	JEPMC-W6060-□□

5

■ Connector Pin Layout (CN1)

The pin layout of the CN1 connector is as follows:



Pin Layout on Wiring Side

50		49		25		24	
48	DI-31	47	DI-29	23	DI-30	22	DI-28
46	DI-27	45	DI-25	21	DI-26	20	DI-24
44		43		19	COM-4	18	
42	DI-23	41	DI-21	17	DI-22	16	DI-20
40	DI-19	39	DI-17	15	DI-18	14	DI-16
38		37		13	COM-3	12	
36	DI-15	35	DI-13	11	DI-14	10	DI-12
34	DI-11	33	DI-09	9	DI-10	8	DI-08
32		31		7	COM-2	6	
30	DI-07	29	DI-05	5	DI-06	4	DI-04
28	DI-03	27	DI-01	3	DI-02	2	DI-00
26				1	COM-1		

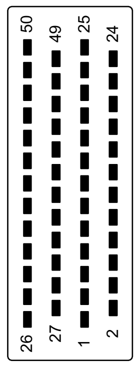
The following table shows the name and function of the CN1 connector pins.

Pin No.	Signal Name	Function	Pin No.	Signal Name	Function
1	COM-1	Common 1	26		
2	DI-00	Digital input 0 (also used as interrupt input)	27	DI-01	Digital input 1 (also used as interrupt input)
3	DI-02	Digital input 2	28	DI-03	Digital input 3
4	DI-04	Digital input 4	29	DI-05	Digital input 5
5	DI-06	Digital input 6	30	DI-07	Digital input 7
6			31		
7	COM-2	Common 2	32		
8	DI-08	Digital input 8	33	DI-09	Digital input 9
9	DI-10	Digital input 10	34	DI-11	Digital input 11
10	DI-12	Digital input 12	35	DI-13	Digital input 13
11	DI-14	Digital input 14	36	DI-15	Digital input 15
12			37		
13	COM-3	Common 3	38		
14	DI-16	Digital input 16	39	DI-17	Digital input 17
15	DI-18	Digital input 18	40	DI-19	Digital input 19
16	DI-20	Digital input 20	41	DI-21	Digital input 21
17	DI-22	Digital input 22	42	DI-23	Digital input 23
18			43		
19	COM-4	Common 4	44		
20	DI-24	Digital input 24	45	DI-25	Digital input 25
21	DI-26	Digital input 26	46	DI-27	Digital input 27
22	DI-28	Digital input 28	47	DI-29	Digital input 29
23	DI-30	Digital input 30	48	DI-31	Digital input 31
24			49		
25			50		

5

■ Connector Pin Layout (CN2)

The pin layout of the CN2 connector is as follows:



Pin Layout on
Wiring Side

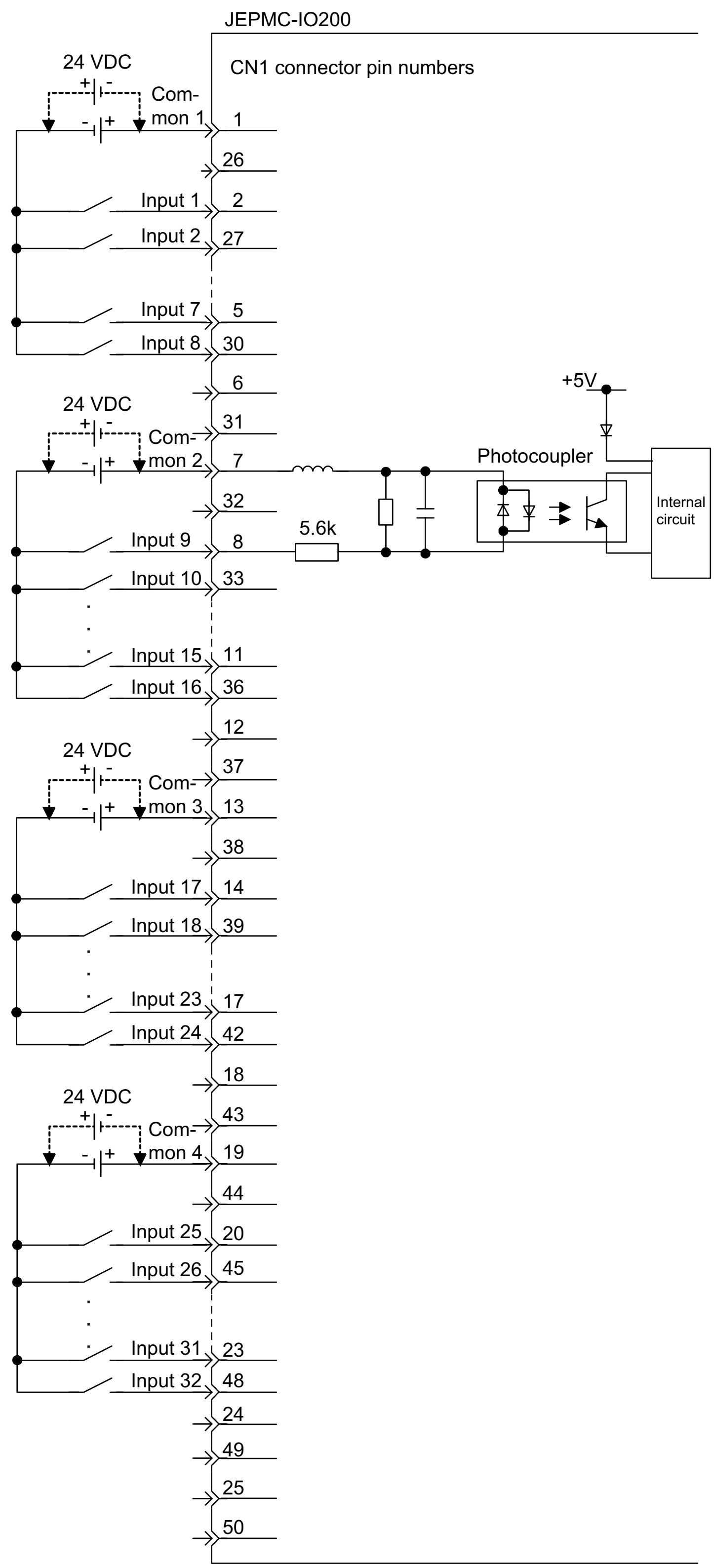
50		49		25		24	
48	DI-63	47	DI-61	23	DI-62	22	DI-60
46	DI-59	45	DI-57	21	DI-58	20	DI-56
44		43		19	COM-8	18	
42	DI-55	41	DI-53	17	DI-54	16	DI-52
40	DI-51	39	DI-49	15	DI-50	14	DI-48
38		37		13	COM-7	12	
36	DI-47	35	DI-45	11	DI-46	10	DI-44
34	DI-43	33	DI-41	9	DI-42	8	DI-40
32		31		7	COM-6	6	
30	DI-39	29	DI-37	5	DI-38	4	DI-36
28	DI-35	27	DI-33	3	DI-34	2	DI-32
26				1	COM-5		

The following table shows the name and function of the CN2 connector pins.

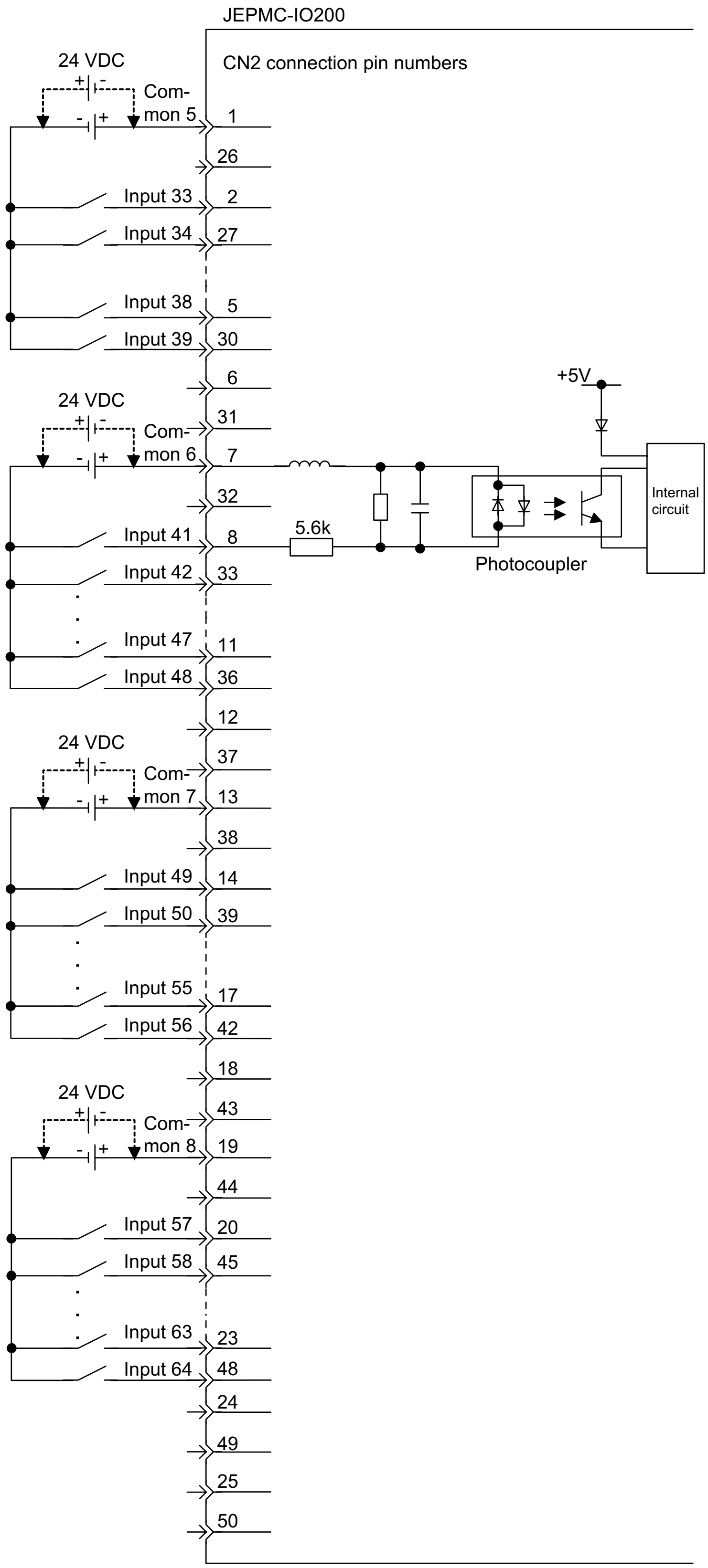
Pin No.	Signal Name	Function	Pin No.	Signal Name	Function
1	COM-5	Common 5	26		
2	DI-32	Digital input 32 (also used as interrupt input)	27	DI-33	Digital input 33 (also used as interrupt input)
3	DI-34	Digital input 34	28	DI-35	Digital input 35
4	DI-36	Digital input 36	29	DI-37	Digital input 37
5	DI-38	Digital input 38	30	DI-39	Digital input 39
6			31		
7	COM-6	Common 6	32		
8	DI-40	Digital input 40	33	DI-41	Digital input 41
9	DI-42	Digital input 42	34	DI-43	Digital input 43
10	DI-44	Digital input 44	35	DI-45	Digital input 45
11	DI-46	Digital input 46	36	DI-47	Digital input 47
12			37		
13	COM-7	Common 7	38		
14	DI-48	Digital input 48	39	DI-49	Digital input 49
15	DI-50	Digital input 50	40	DI-51	Digital input 51
16	DI-52	Digital input 52	41	DI-53	Digital input 53
17	DI-54	Digital input 54	42	DI-55	Digital input 55
18			43		
19	COM-8	Common 8	44		
20	DI-56	Digital input 56	45	DI-57	Digital input 57
21	DI-58	Digital input 58	46	DI-59	Digital input 59
22	DI-60	Digital input 60	47	DI-61	Digital input 61
23	DI-62	Digital input 62	48	DI-63	Digital input 63
24			49		
25			50		

■ Module Connection Examples

An example of connections to the CN1 connector and an input circuit for the DI-01 Input Module are shown below.

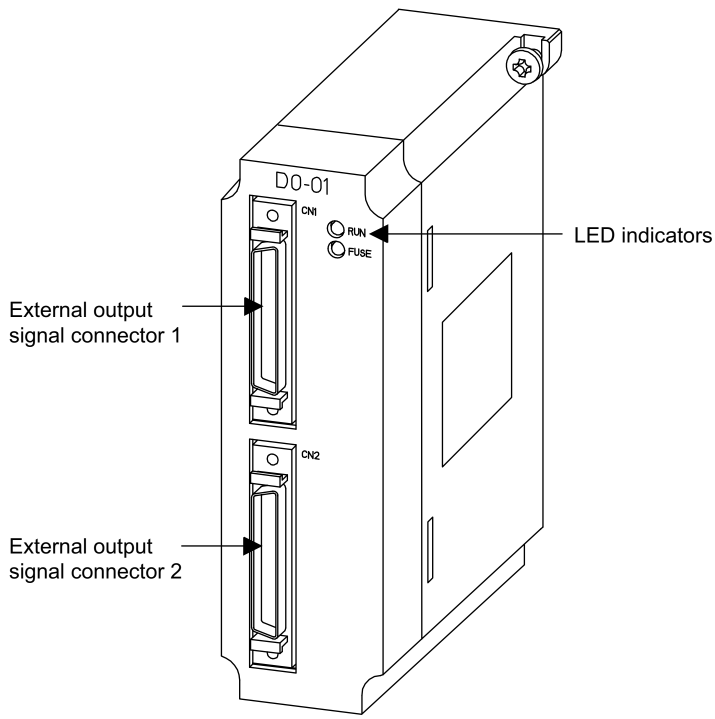


An example of connections to the CN2 connector and an input circuit for the DI-01 Input Module are shown below.



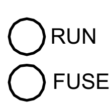
5.3.2 DO-01 Output Module

The following illustration shows the appearance of the DO-01 Output Module.



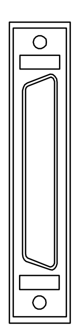
The details of each part of the DO-01 Module are described below.

■ LED Indicators



Indicator Name	Indicator Color	Meaning
RUN	Green	Lit: When the Output Module is mounted in a slot and operating normally Unlit: When the Output Module is stopped
FUSE	Red	Lit: When the output fuse is blown

■ External I/O Connector



The external I/O connector is used to connect a DO-01 Module to external output signal terminals.
Use the following cable for this connector.

- JEPMC-W6060-□□

Number of output points: 64 points (32 points × 2)

■ Connector Specifications

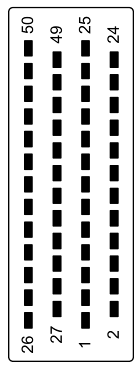
The following table shows the specifications of the connectors used to connect the DO-01 Module.

Name	Connector Name	Number of Pins	Connector			Cable
			On Module	On Cable	Manufacturer	
External Output Signal Connector 1	CN1	50	10250-52A2JL	• Connector body: 10150-3000VE • Shell: 10350-52A0-008 (Screw lock) 10350-52F0-008 (One-touch lock)	3M	JEPMC-W6060-□□
External Output Signal Connector 2	CN2	50	10250-52A2JL	• Connector body: 10150-3000VE • Shell: 10350-52A0-008 (Screw lock) 10350-52F0-008 (One-touch lock)	3M	JEPMC-W6060-□□

5

■ Connector Pin Layout (CN1)

The pin layout of the CN1 connector is as follows:



Pin Layout on
Wiring Side

50		49	0V-4	25		24	0V-4
48	DO-31	47	DO-29	23	DO-30	22	DO-28
46	DO-27	45	DO-25	21	DO-26	20	DO-24
44	0V-4	43	0V-3	19	+24V-4	18	0V-3
42	DO-23	41	DO-21	17	DO-22	16	DO-20
40	DO-19	39	DO-17	15	DO-18	14	DO-16
38	0V-3	37	0V-2	13	+24V-3	12	0V-2
36	DO-15	35	DO-13	11	DO-14	10	DO-12
34	DO-11	33	DO-09	9	DO-10	8	DO-08
32	0V-2	31	0V-1	7	DO-2	6	0V-1
30	DO-07	29	DO-05	5	DO-06	4	DO-04
28	DO-03	27	DO-01	3	DO-02	2	DO-00
26	0V-1			1	+24V-1		

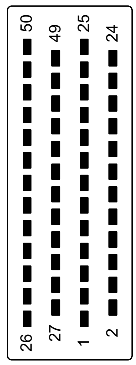
The following table shows the name and function of the CN1 connector pins.

Pin No.	Signal Name	Function	Pin No.	Signal Name	Function
1	+24V-1	24 V power supply 1	26	0V-1	Common ground 1
2	DO-00	Digital output 0	27	DO-01	Digital output 1
3	DO-02	Digital output 2	28	DO-03	Digital output 3
4	DO-04	Digital output 4	29	DO-05	Digital output 5
5	DO-06	Digital output 6	30	DO-07	Digital output 7
6	0V-1	Common ground 1	31	0V-1	Common ground 1
7	+24V-2	24 V power supply 2	32	0V-2	Common ground 2
8	DO-08	Digital output 8	33	DO-09	Digital output 9
9	DO-10	Digital output 10	34	DO-11	Digital output 11
10	DO-12	Digital output 12	35	DO-13	Digital output 13
11	DO-14	Digital output 14	36	DO-15	Digital output 15
12	0V-2	Common ground 2	37	0V-2	Common ground 2
13	+24V-3	24 V power supply 3	38	0V-3	Common ground 3
14	DO-16	Digital output 16	39	DO-17	Digital output 17
15	DO-18	Digital output 18	40	DO-19	Digital output 19
16	DO-20	Digital output 20	41	DO-21	Digital output 21
17	DO-22	Digital output 22	42	DO-23	Digital output 23
18	0V-3	Common ground 3	43	0V-3	Common ground 3
19	+24V-4	24 V power supply 4	44	0V-4	Common ground 4
20	DO-24	Digital output 24	45	DO-25	Digital output 25
21	DO-26	Digital output 26	46	DO-27	Digital output 27
22	DO-28	Digital output 28	47	DO-29	Digital output 29
23	DO-30	Digital output 30	48	DO-31	Digital output 31
24	0V-4	Common ground 4	49	0V-4	Common ground 4
25			50		

5

■ Connector Pin Layout (CN2)

The pin layout of the CN2 connector is as follows:



Pin Layout on Wiring Side

50		49	0V-8	25		24	0V-8
48	DO-63	47	DO-61	23	DO-62	22	DO-60
46	DO-59	45	DO-57	21	DO-58	20	DO-56
44	0V-8	43	0V-7	19	+24V-8	18	0V-7
42	DO-55	41	DO-53	17	DO-54	16	DO-52
40	DO-51	39	DO-49	15	DO-50	14	DO-48
38	0V-7	37	0V-6	13	+24V-7	12	0V-6
36	DO-47	35	DO-45	11	DO-46	10	DO-44
34	DO-43	33	DO-41	9	DO-42	8	DO-40
32	0V-6	31	0V-5	7	+24V-6	6	0V-5
30	DO-39	29	DO-37	5	DO-38	4	DO-36
28	DO-35	27	DO-33	3	DO-34	2	DO-32
26	0V-5			1	+24V-5		

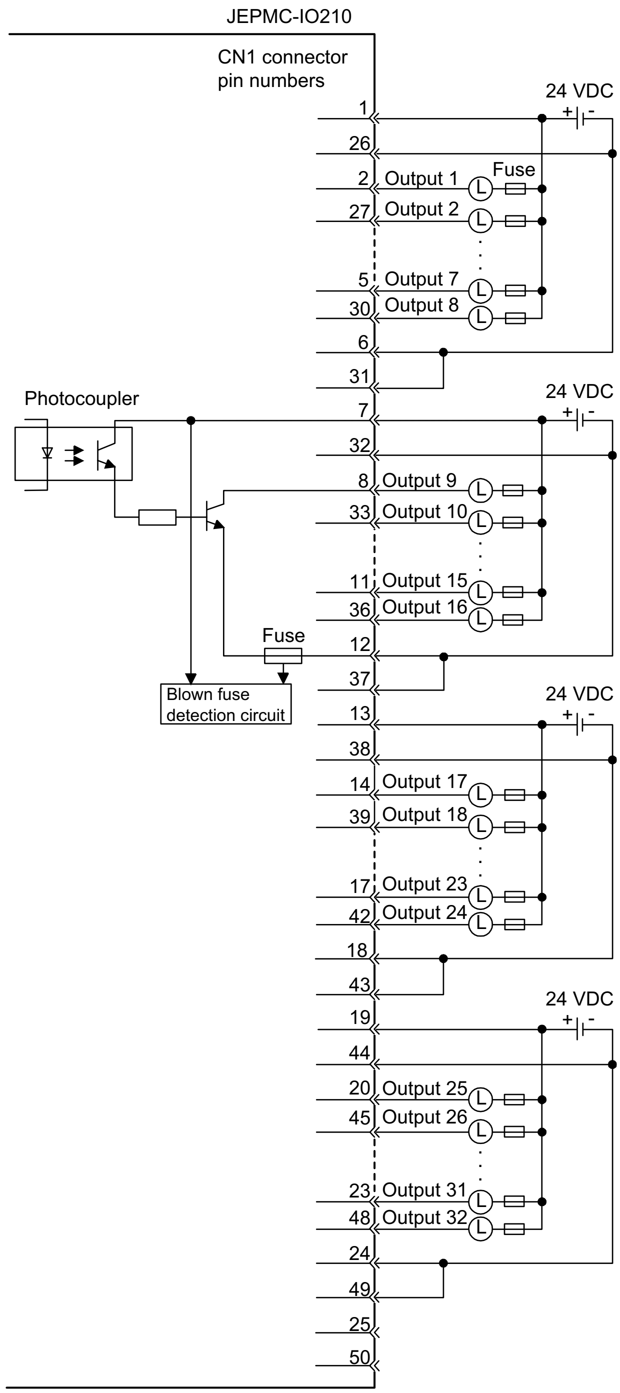
The following table shows the name and function of the CN2 connector pins.

Pin No.	Signal Name	Function	Pin No.	Signal Name	Function
1	+24V-5	24 V power supply 5	26	0V-5	Common ground 5
2	DO-32	Digital output 32	27	DO-33	Digital output 33
3	DO-34	Digital output 34	28	DO-35	Digital output 35
4	DO-36	Digital output 36	29	DO-37	Digital output 37
5	DO-38	Digital output 38	30	DO-39	Digital output 39
6	0V-5	Common ground 5	31	0V-5	Common ground 5
7	+24V-6	24 V power supply 6	32	0V-6	Common ground 6
8	DO-40	Digital output 40	33	DO-41	Digital output 41
9	DO-42	Digital output 42	34	DO-43	Digital output 43
10	DO-44	Digital output 44	35	DO-45	Digital output 45
11	DO-46	Digital output 46	36	DO-47	Digital output 47
12	0V-6	Common ground 6	37	0V-6	Common ground 6
13	+24V-7	24 V power supply 7	38	0V-7	Common ground 7
14	DO-48	Digital output 48	39	DO-49	Digital output 49
15	DO-50	Digital output 50	40	DO-51	Digital output 51
16	DO-52	Digital output 52	41	DO-53	Digital output 53
17	DO-54	Digital output 54	42	DO-55	Digital output 55
18	0V-7	Common ground 7	43	0V-7	Common ground 7
19	+24V-8	24 V power supply 8	44	0V-8	Common ground 8
20	DO-56	Digital output 56	45	DO-57	Digital output 57
21	DO-58	Digital output 58	46	DO-59	Digital output 59
22	DO-60	Digital output 60	47	DO-61	Digital output 61
23	DO-62	Digital output 62	48	DO-63	Digital output 63
24	0V-8	Common ground 8	49	0V-8	Common ground 8
25			50		

5

■ Module Connection Examples

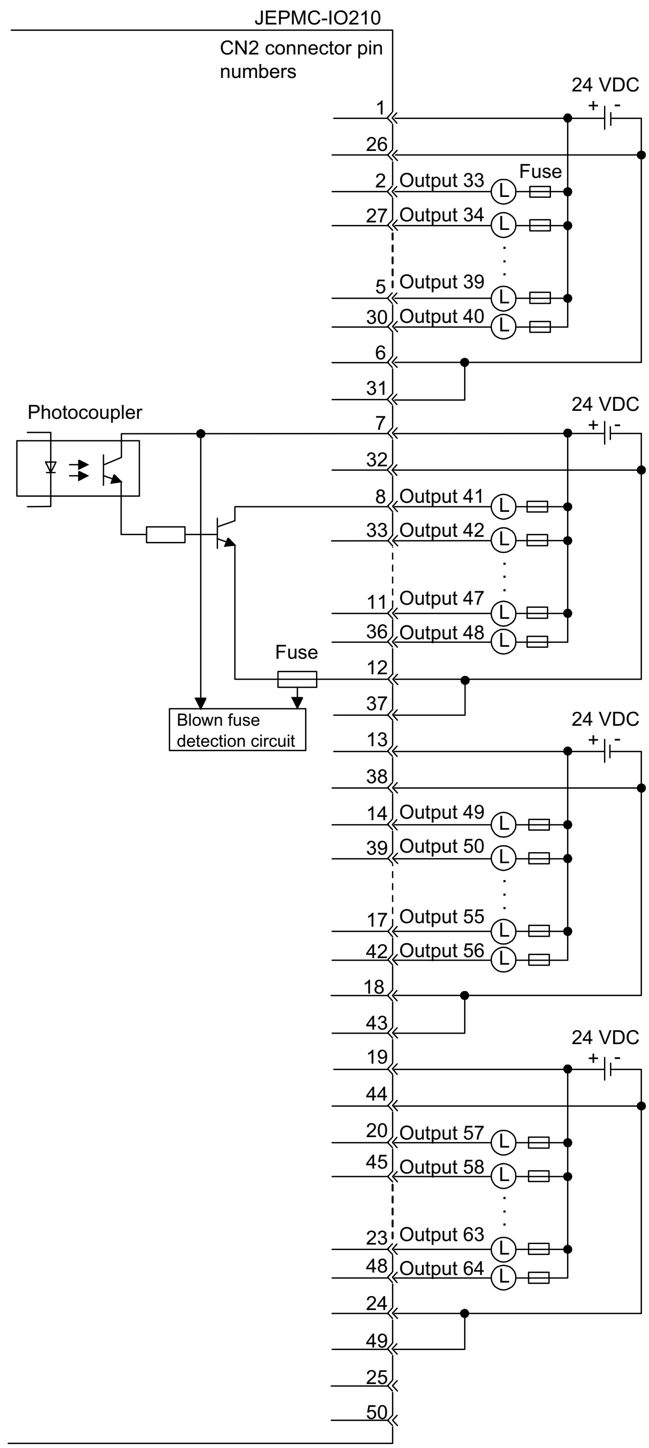
An example of connections to the CN1 connector and an output circuit for the DO-01 Output Module are shown below.



IMPORTANT

A fuse is inserted in the output common line of the DO-01 Module as a protective circuit. If the output short-circuit is incomplete, there is a risk that the fuse may not blow. Insert a protective element, such as a fuse, for each output as shown in the above illustration.

An example of connections to the CN2 connector and an output circuit for the DO-01 Output Module are shown below.

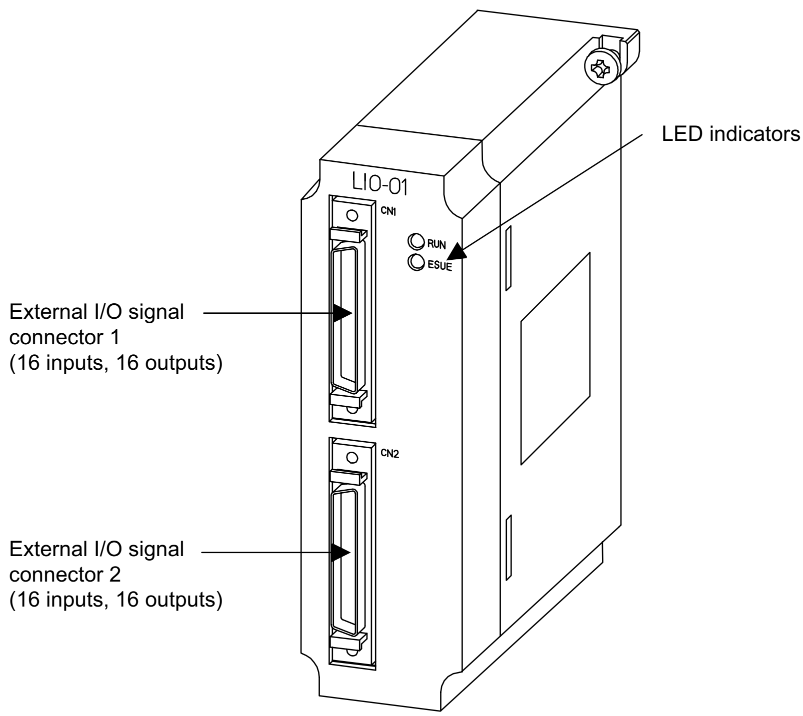


IMPORTANT

A fuse is inserted in the output common line of the DO-01 Modules as a protective circuit. If the output short-circuit is incomplete, there is a risk that the fuse may not blow. Insert a protective element, such as a fuse, for each output as shown in the above illustration.

5.3.3 LIO-01 I/O Module

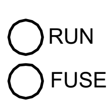
The following illustration shows the appearance of the LIO-01 I/O Module.



The details of each part of the LIO-01 Module are described below.

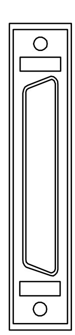
■ LED Indicators

The meanings of the indicators on the front panel of the Module are as follows:



Indicator Name	Indicator Color	Meaning when Indicator Is Lit
RUN	Green	Lit: The LIO-01 Module is mounted to the slot and is operating normally. Not lit: The LIO-01 Module is stopped.
FUSE	Red	Lit: The output fuse is blown.

■ External I/O Connectors



The connector is used to connect an LIO-01 Module to I/O signals.
Use the following standard cable for this connector.

- JEPMC-W6060-□□

Number of input points: 32 (8 points per common)
Input type: Combined sourcing and sinking
Number of output points: 32 (8 points per common)
Output type: Sinking
Connect 16 inputs and 16 outputs to each of the connectors CN1 and CN2.

■ Connector Specifications

The following table shows the specifications of the connectors used to connect the LIO-01 Module.

Name	Connector Name	Number of Pins	Connector			Cable
			On Module	On Cable	Manufacturer	
External I/O Connector 1	CN1	50	10250-52A2JL	• Connector body: 10150-3000VE • Shell: 10350-52A0-008 (Screw lock) 10350-52F0-008 (One-touch lock)	3M	JEPMC-W6060-□□
External I/O Connector 2	CN2	50	10250-52A2JL	• Connector body: 10150-3000VE • Shell: 10350-52A0-008 (Screw lock) 10350-52F0-008 (One-touch lock)	3M	JEPMC-W6060-□□

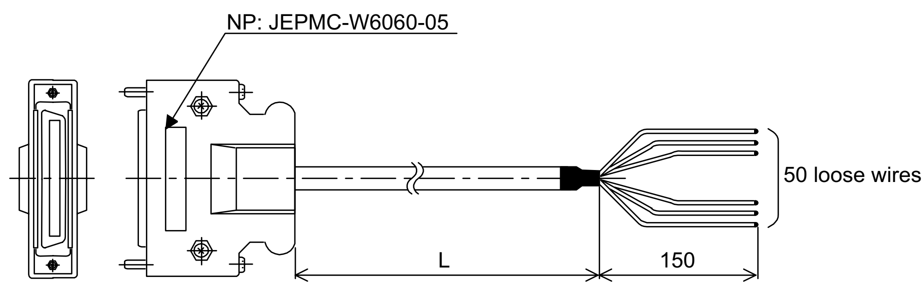
5

■ External I/O Cables

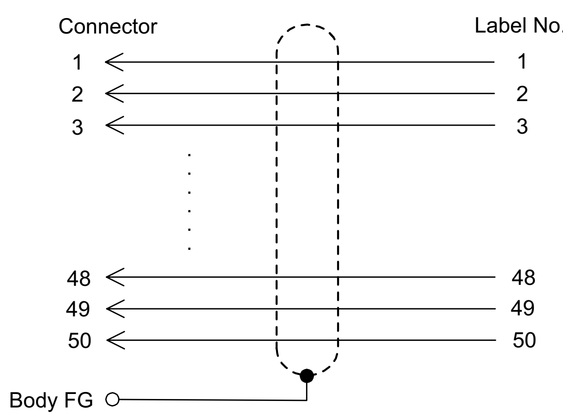
Models

JEPMC-W6060-05: 0.5 m
JEPMC-W6060-10: 1.0 m
JEPMC-W6060-30: 3.0 m

Appearance

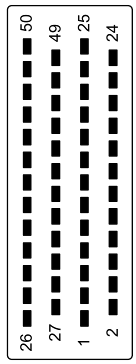


Cable Connection Diagram



■ Connector Pin Layout (CN1)

The pin layout of the CN1 connector is as follows:



Pin Layout on
Wiring Side

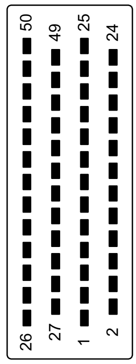
50	0V-2	49	DO-15	25		24	DO-14
48	DO-13	47		23	DO-12	22	+24V-2
46	0V-2	45	DO-11	21		20	DO-10
44	DO-09	43	0V-1	19	DO-08	18	
42	DO-07	41	DO-05	17	DO-06	16	DO-04
40		39	0V-1	15	+24V-1	14	
38	DO-03	37	DO-01	13	DI-02	12	DO-00
36		35	DI-15	11		10	DI-14
34	DI-13	33	DI-11	9	DI-12	8	DI-10
32	DI-09	31		7	DI-08	6	COM-2
30	DI-07	29	DI-05	5	DI-06	4	DI-04
28	DI-03	27	DI-01	3	DI-02	2	DI-00
26				1	COM-1		

The following table shows the name and funciton of the CN1 connector pins.

Pin No.	Signal Name	Function	Pin No.	Signal Name	Function
1	COM-1	Common 1	26		
2	DI-00	Digital input 0 (also used as an interrupt input)	27	DI-01	Digital input 1 (also used as an interrupt input)
3	DI-02	Digital input 2	28	DI-03	Digital input 3
4	DI-04	Digital input 4	29	DI-05	Digital input 5
5	DI-06	Digital input 6	30	DI-07	Digital input 7
6	COM-2	Common 2	31		
7	DI-08	Digital input 8	32	DI-09	Digital input 9
8	DI-10	Digital input 10	33	DI-11	Digital input 11
9	DI-12	Digital input 12	34	DI-13	Digital input 13
10	DI-14	Digital input 14	35	DI-15	Digital input 15
11			36		
12	DO-00	Digital output 0	37	DO-01	Digital output 1
13	DO-02	Digital output 2	38	DO-03	Digital output 3
14			39	0V-1	Common ground 1
15	+24V-1	24-V power supply 1	40		
16	DO-04	Digital output 4	41	DO-05	Digital output 5
17	DO-06	Digital output 6	42	DO-07	Digital output 7
18			43	0V-1	Common ground 1
19	DO-08	Digital output 8	44	DO-09	Digital output 9
20	DO-10	Digital output 10	45	DO-11	Digital output 11
21			46	0V-2	Common ground 2
22	+24V-2	24-V power supply 2	47		
23	DO-12	Digital output 12	48	DO-13	Digital output 13
24	DO-14	Digital output 14	49	DO-15	Digital output 15
25			50	0V-2	Common ground 12

■ Connector Pin Layout (CN2)

The pin layout of the CN2 connector is as follows:



Pin Layout on
Wiring Side

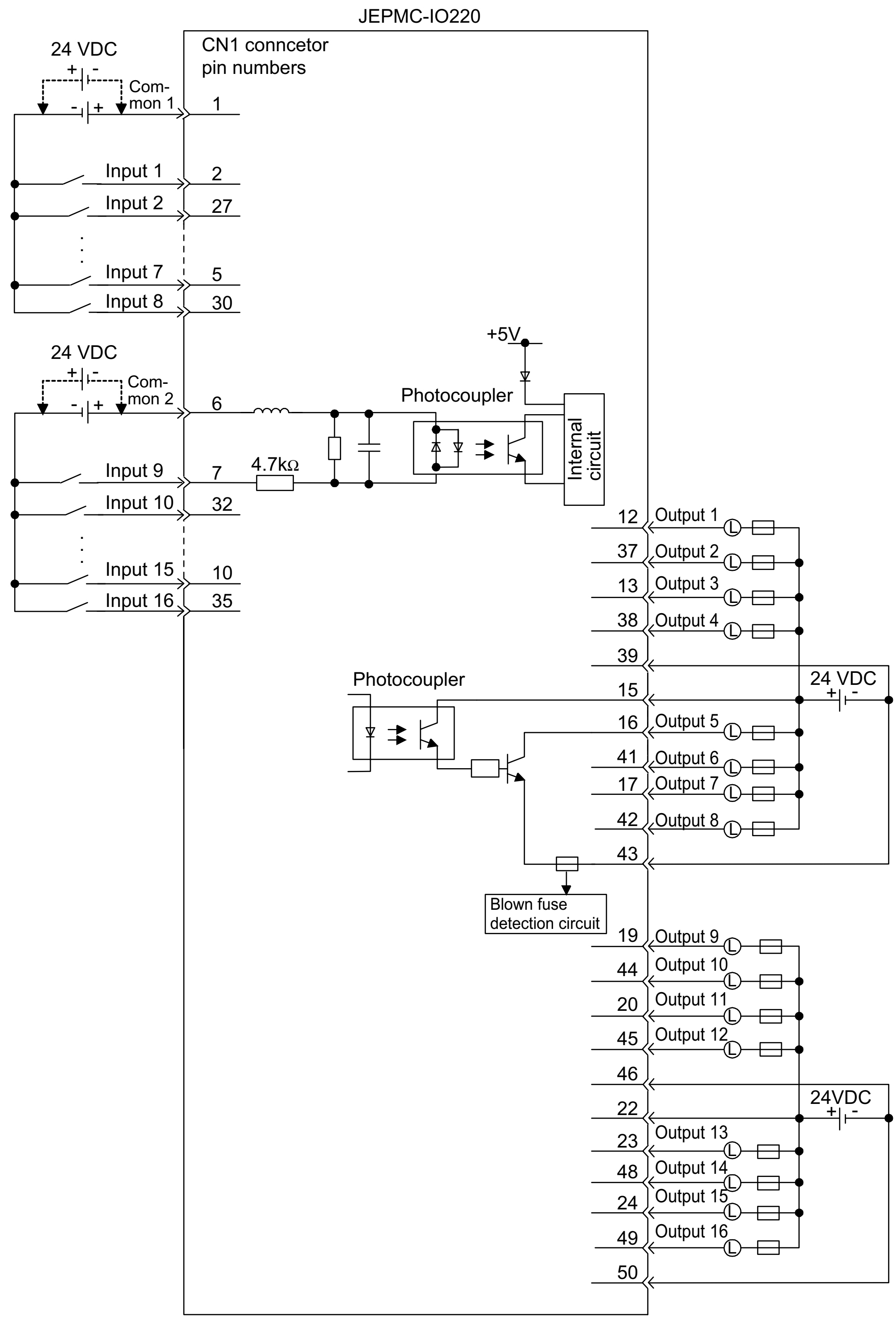
50	0V-4	49	DO-31	25		24	DO-30
48	DO-29	47		23	DO-28	22	+24V-4
46	0V-4	45	DO-27	21		20	DO-26
44	DO-25	43	0V-3	19	DO-24	18	
42	DO-23	41	DO-21	17	DO-22	16	DO-20
40		39	0V-3	15	+24V-3	14	
38	DO-19	37	DO-17	13	DI-18	12	DO-16
36		35	DI-31	11		10	DI-30
34	DI-29	33	DI-27	9	DI-28	8	DI-26
32	DI-25	31		7	DI-24	6	COM-4
30	DI-23	29	DI-21	5	DI-22	4	DI-20
28	DI-19	27	DI-17	3	DI-18	2	DI-16
26				1	COM-3		

The following table shows the name and function of the CN2 connector pins.

Pin No.	Signal Name	Function	Pin No.	Signal Name	Function
1	COM-3	Common 3	26		
2	DI-16	Digital input 16 (also used as an interrupt input)	27	DI-17	Digital input 17 (also used as an interrupt input)
3	DI-18	Digital input 18	28	DI-19	Digital input 19
4	DI-20	Digital input 20	29	DI-21	Digital input 21
5	DI-22	Digital input 22	30	DI-23	Digital input 23
6	COM-4	Common 4	31		
7	DI-24	Digital input 24	32	DI-25	Digital input 25
8	DI-26	Digital input 26	33	DI-27	Digital input 27
9	DI-28	Digital input 28	34	DI-29	Digital input 29
10	DI-30	Digital input 30	35	DI-31	Digital input 31
11			36		
12	DO-16	Digital output 16	37	DO-17	Digital output 17
13	DO-18	Digital output 18	38	DO-19	Digital output 19
14			39	0V-3	Common ground 3
15	+24V-3	24-V power supply 3	40		
16	DO-20	Digital output 20	41	DO-21	Digital output 21
17	DO-22	Digital output 22	42	DO-23	Digital output 23
18			43	0V-3	Common ground 3
19	DO-24	Digital output 24	44	DO-25	Digital output 25
20	DO-26	Digital output 26	45	DO-27	Digital output 27
21			46	0V-4	Common ground 4
22	+24V-4	24-V power supply 4	47		
23	DO-28	Digital output 28	48	DO-29	Digital output 29
24	DO-30	Digital output 30	49	DO-31	Digital output 31
25			50	0V-4	Common ground 4

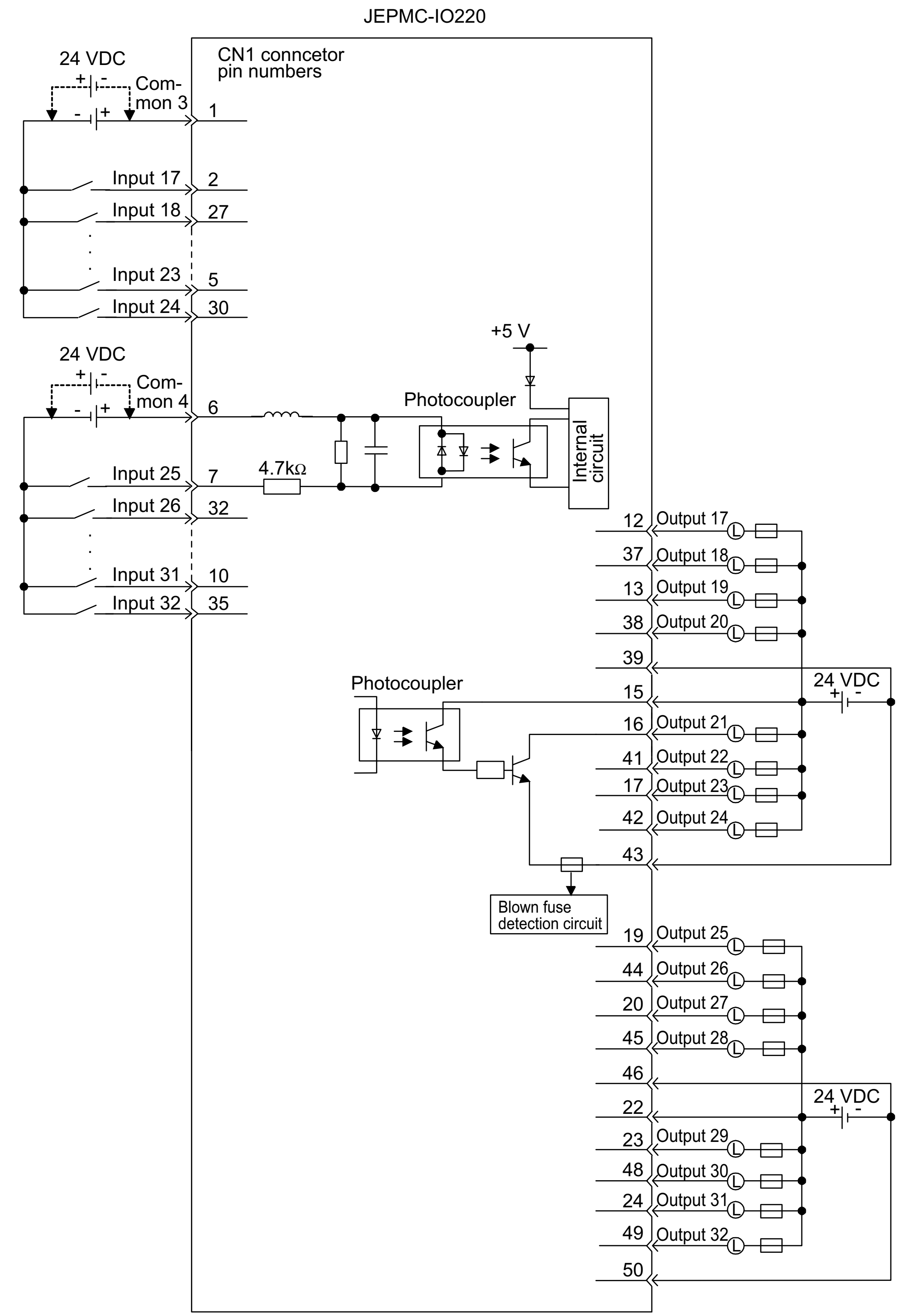
■ Module Connection Example 1

An example of connections to the CN1 connector and and an input circuit for the LIO-01 Module are shown below.



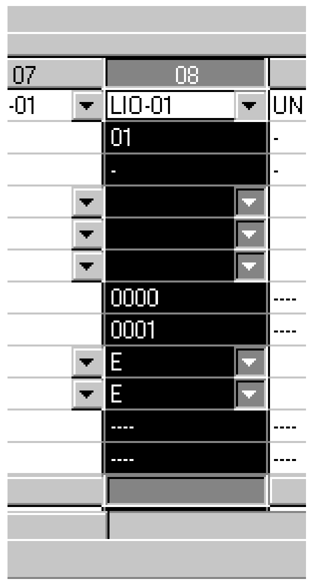
■ Module Connection Example 2

An example of connections to the CN2 connector and and an input circuit for the LIO-01 Module are shown below.



■ LIO-01 Module Allocations

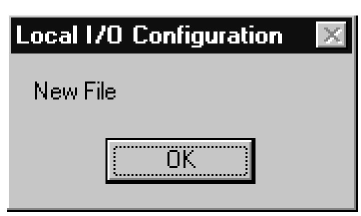
Channels for the LIO-01 Module are allocated according to the following procedure.



1. Click the ▼ button on the right side of the ***Module*** field in the applicable slot number column (***08*** in the above example) in the Module Definition Window. Click LIO-01 and set the starting I/O register. Double-click the slot number, and the LIO-01 Configuration Window will be displayed.

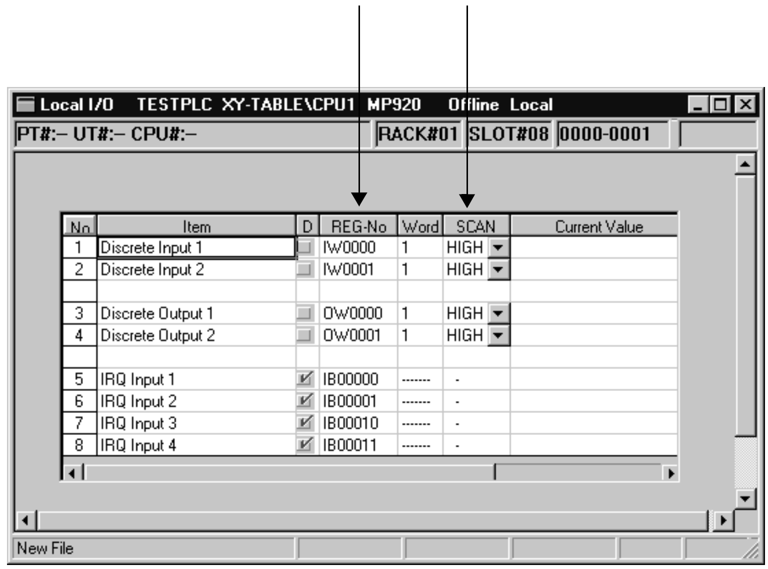
INFO

When configuring the LIO-01 Module for the first time, a message box asking whether to create a new file will be displayed. Click the **OK** button and the Local I/O Configuration Window will be displayed. Continue the procedure from this window.



2. Set the applicable values in the ***REG No.***, and ***SCAN*** columns for discrete input and discrete output in the Local I/O Configuration Window. Set the register number to a value

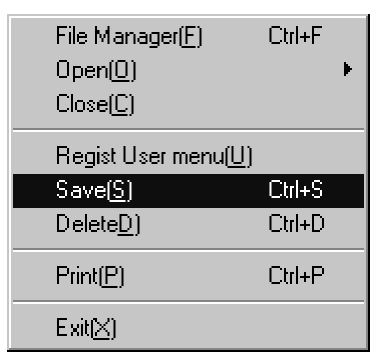
within the range specified by the start and end I/O register numbers set in the Module Definition Window. Make sure that the same values are not set more than once.



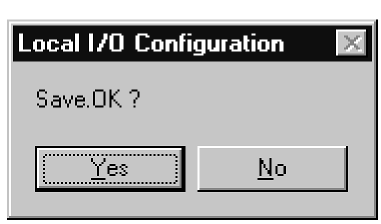
Interrupt inputs 1 to 4 are automatically allocated according to the discrete I/O settings.

■ Saving the LIO-01 Configuration

1. Click ***Save(S)*** in the ***File(F)*** menu in the Local I/O Configuration Window.

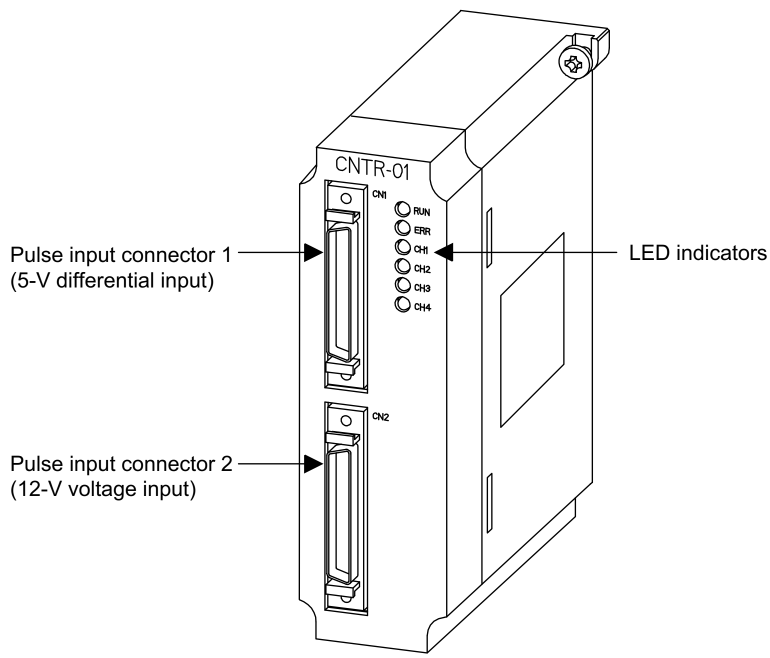


2. Click the **Yes** button in the following message box.



5.3.4 CNTR-01 Counter Module

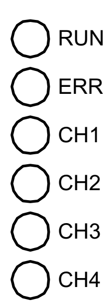
The following illustration shows the appearance of the CNTR-01 Module.



The details of each part of the CNTR-01 Module are described below.

■ LED Indicators

The meanings of the indicators on the front panel of the Module are as follows:



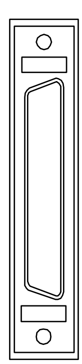
Indicator Name	Indicator Color	Meaning When Indicator Is Lit
RUN	Green	Normally operating
ERR	Red	Malfunctions (Lit/Blinking)
CH1	Green	CH1 counter pulse being input
CH2	Green	CH2 counter pulse being input
CH3	Green	CH3 counter pulse being input
CH4	Green	CH4 counter pulse being input

The table below shows the LED indicator patterns when an error occurs in the CNTR-01 Module.

Error Contents (Detected by Online Self-diagnosis Function)	LED Indicator		
	RUN	ERR	CH1 to CH4
ROM diagnostic error	Lit	Blinks once	Not specified
RAM diagnostic error	Lit	Blinks twice	Not specified
Shared memory diagnostic error	Lit	Blinks three times	Not specified
CPU built-in timer diagnostic error	Lit	Blinks four times	Not specified
Timer diagnostic error	Lit	Blinks five times	Not specified
Illegal general instruction interrupt	Unlit	Blinks once	Not specified
Illegal slot instruction interrupt	Unlit	Blinks twice	Not specified
CPU address error interrupt	Unlit	Blinks three times	Not specified
DMA address error interrupt	Unlit	Blinks four times	Not specified
User break interrupt	Unlit	Blinks five times	Not specified
Trap instruction interrupt	Unlit	Blinks six times	Not specified
Watchdog timeout error	Lit	Blinks fifteen times	Not specified

■ Pulse Input Connectors

Pulse Input Connector 1

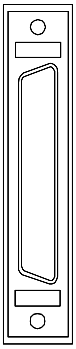


5-V Differential type pulse input connector

The CN1 connector is used to connect 5-V differential type pulse input signals to the CNTR-01 Module

Number of channels: 4

Pulse Input Connector 2


CN2

12-V voltage type pulse input, latch input, and coincidence detection output connector

Used to connect 12-V voltage type pulse input signals, latch input signal, coincidence detection output signal to the CNTR-01 Module.

Number of channels: 4

IMPORTANT

The CNTR-01 Module has a 5-V differential type pulse input connector with 4 channels and a 12-V voltage type pulse input connector with 4 channels. Either 5-V differential or 12-V voltage must be selected for each channel, so 4 channels in total per CNTR-01 Module can be operated.

■ CN1 Connector

The following table shows the name and function of the CN1 connector pins.

Pin No.	Signal Name	Function	Pin No.	Signal Name	Function
1			26		
2			27		
3	+5PA1	+PI 5V phase-A 1	28	-5PA1	+PI 5V phase-A 1
4	+5PB1	+PI 5V phase-B 1	29	-5PB1	+PI 5V phase-B 1
5	+5PC1	+PI 5V phase-C 1	30	-5PC1	+PI 5V phase-C 1
6	GND	Ground	31	GND	Ground
7			32		
8			33		
9	+5PA2	+PI 5V phase-A 2	34	-5PA2	+PI 5V phase-A 2
10	+5PB2	+PI 5V phase-B 2	35	-5PB2	+PI 5V phase-B 2
11	+5PC2	+PI 5V phase-C 2	36	-5PC2	+PI 5V phase-C 2
12	GND	Ground	37	GND	Ground
13			38		
14	+5PA3	+PI 5V phase-A 3	39	-5PA3	+PI 5V phase-A 3
15	+5PB3	+PI 5V phase-B 3	40	-5PB3	+PI 5V phase-B 3
16	+5PC3	+PI 5V phase-C 3	41	-5PC3	+PI 5V phase-C 3
17	GND	Ground	42	GND	Ground
18			43		
19			44		
20	+5PA4	+PI 5V phase-A 4	45	-5PA4	+PI 5V phase-A 4
21	+5PB4	+PI 5V phase-B 4	46	-5PB4	+PI 5V phase-B 4
22	+5PC4	+PI 5V phase-C 4	47	-5PC4	+PI 5V phase-C 4
23	GND	Ground	48	GND	Ground
24			49		
25			50		

■ CN2 Connector

The following table below shows the name and function of the CN2 connector pins.

Pin No.	Signal Name	Function	Pin No.	Signal Name	Function
1	0V1 (24 V)	Ground (GND) for coincidence output	26	0V1(24V)	Ground (GND) for coincidence output
2	COIN1	CH1 (Channel 1) coincidence output	27	COIN2	CH2 (Channel 2) coincidence output
3	COIN3	CH3 (Channel 3) coincidence output	28	COIN4	CH4 (Channel 4) coincidence output
4			29		
5	+24V	External power supply for PIL (PI Latch)	30	+24V	External power supply for PIL (PI Latch)
6	PIL1	CH1 (Channel 1) PI latch input	31	PIL2	CH2 (Channel 2) PI latch input
7	PIL3	CH3 (Channel 3) PI latch input	32	PIL4	CH4 (Channel 4) PI latch input
8			33		
9	12VA1	+12 V power supply phase-A 1	34	12PA1	PI 12V phase-A 1
10	12VB1	+12 V power supply phase-B 1	35	12PB1	PI 12V phase-B 1
11	12/24VC1	+12 V/24 V power supply phase-C 1	36	12PC1	PI 12V phase-C 1
12			37	24PC1	PI 24V phase-C 1
13	12VA2	+12 V power supply phase-A 2	38	12PA2	PI 12V phase-A 2
14	12VB2	+12 V power supply phase-B 2	39	12PB2	PI 12V phase-B 2
15	12/24VC2	+12V/24V power supply phase-C 2	40	12PC2	PI 12V phase-C 2
16			41	24PC2	PI 24V phase-C 2
17			42		
18	12VA3	+12 V power supply phase-A 3	43	12PA3	PI 12V phase-A 3
19	12VB3	+12 V power supply phase-B 3	44	12PB3	PI 12V phase-B 3
20	12/24VC3	+ 12 V/24 V power supply phase-C 3	45	12PC3	PI 12V phase-C 3
21			46	24PC3	PI 24V phase-C 3
22	12VA4	+12 V power supply phase-A 4	47	12PA4	PI 12V phase-A 4
23	12VB4	+12 V power supply phase-B 4	48	12PB4	PI 12V phase-B 4
24	12/24VC4	+12 V/24 V power supply phase-C 4	49	12PC4	PI 12V phase-C 4
25			50	24PC4	PI 24V phase-C 4

■ Connector Specifications

The following table shows the specifications of the connectors used to connect the CNTR-01 Module.

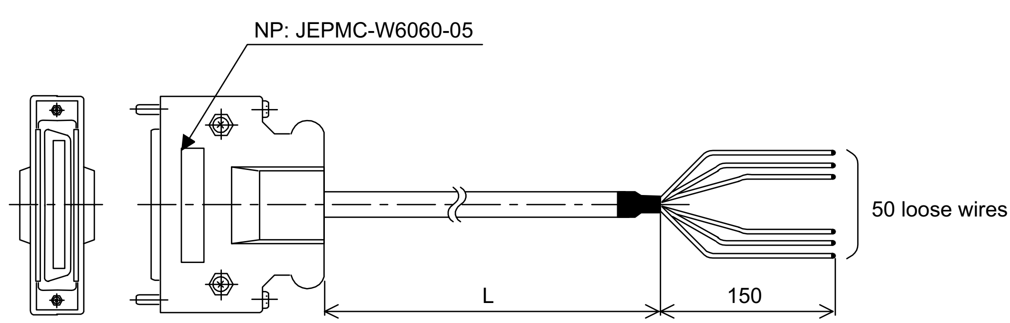
Name	Connector Name	Number of Pins	Connector Model			Cable
			On Module	On Cable	Manu-facturer	
Pulse Input Connector 1	CN1	50	10250-52A2JL	Connector body: 10150-3000VE Shell: 10350-52A0-008 (Screw lock) 10350-52F0-008 (One-touch lock)	3M	JEPMC-W6060-□□
Pulse Input Connector 2	CN2	50	10250-52A2JL	Connector body: 10150-3000VE Shell: 10350-52A0-008 (Screw lock) 10350-52F0-008 (One-touch lock)	3M	JEPMC-W6060-□□

■ Cables

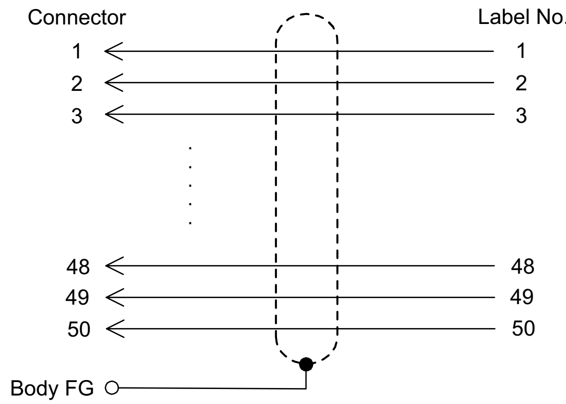
Models

JEPMC-W6060-05: 0.5 m
JEPMC-W6060-10: 1.0 m
JEPMC-W6060-30: 3.0 m

Appearance



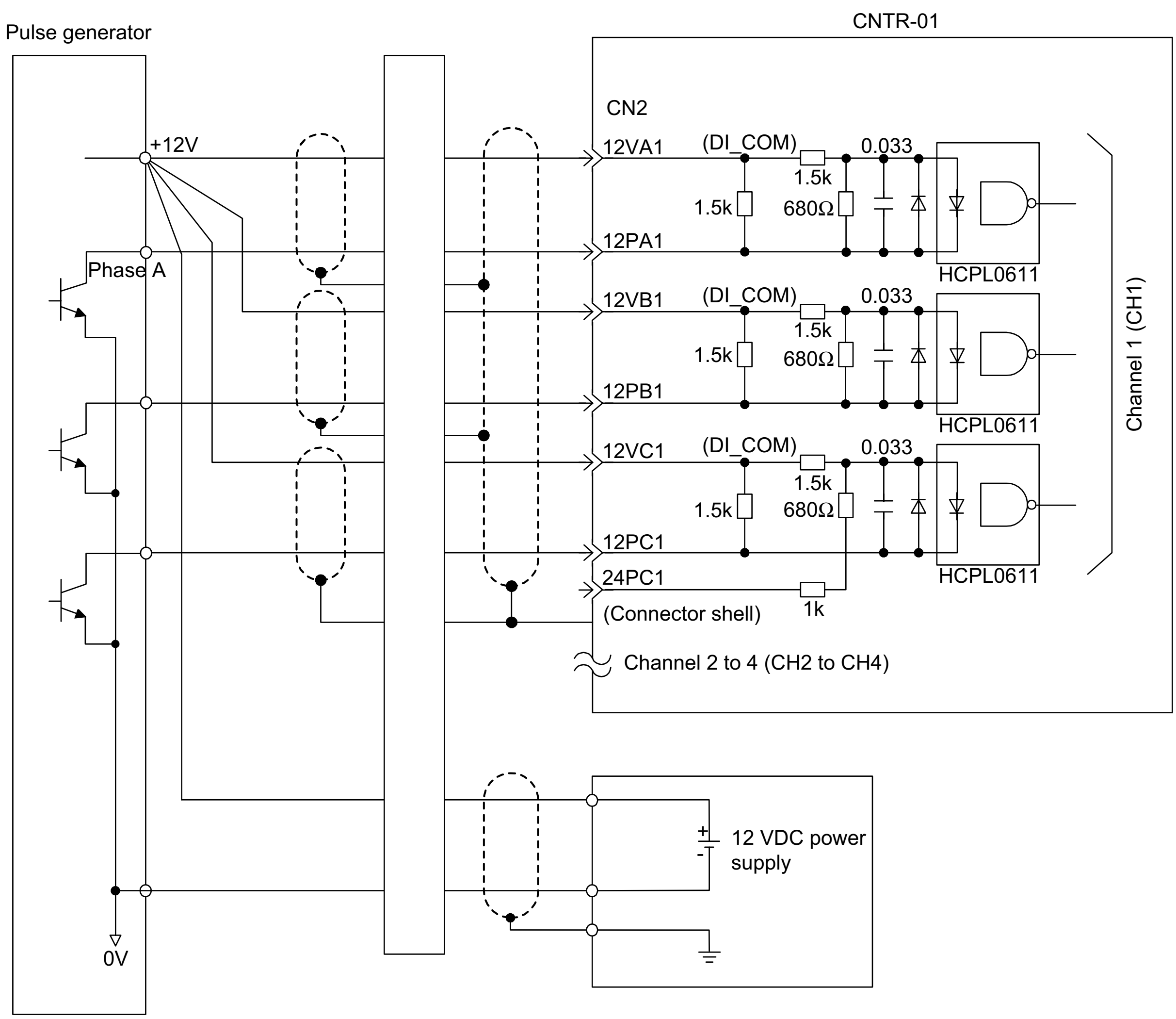
Cable Connection Diagram



■ Module Connection Examples

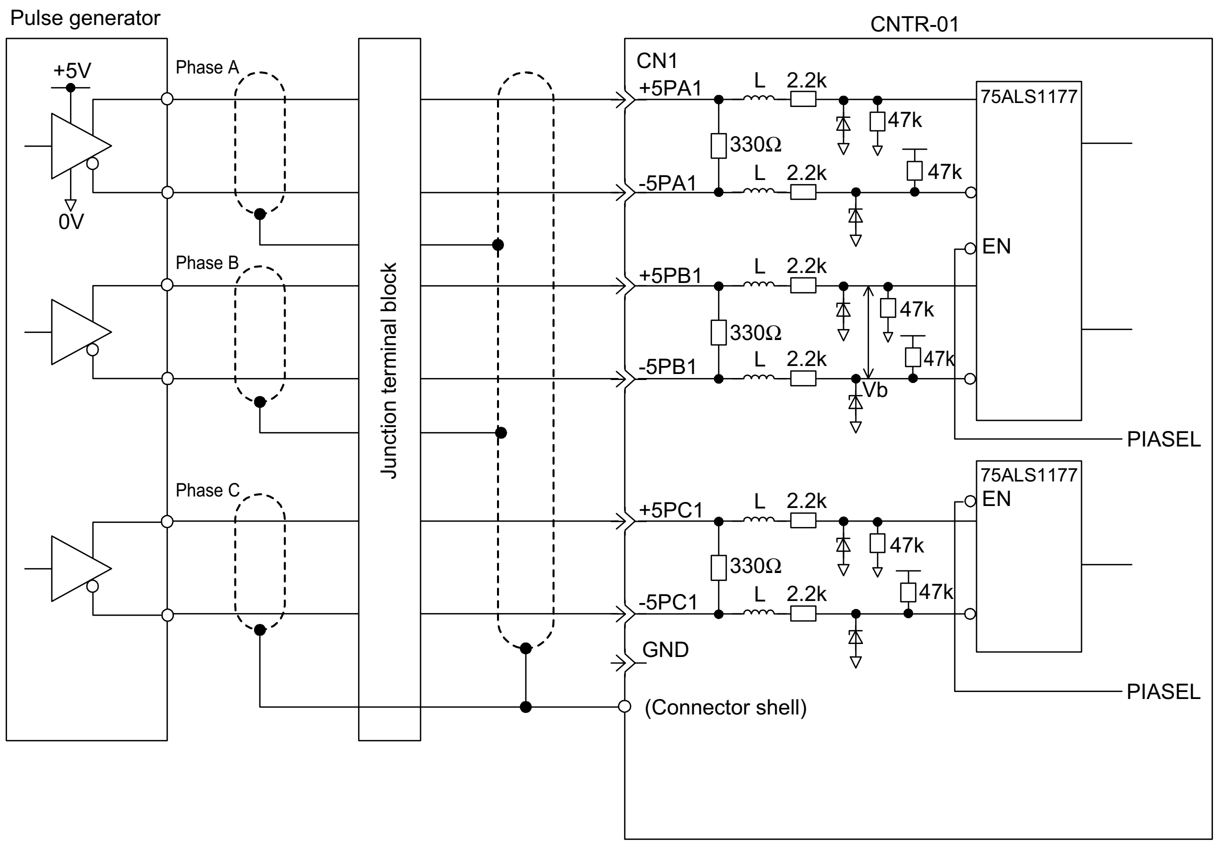
Connection to a Pulse Generator with Open-collector Output (12 VDC)

An example of connection to a pulse generator with open-collector output (12 VDC) is shown below.



Connection to a Pulse Generator with 5-V Differential Output

An example of connection to a pulse generator with 5-V differential output is shown below.



5

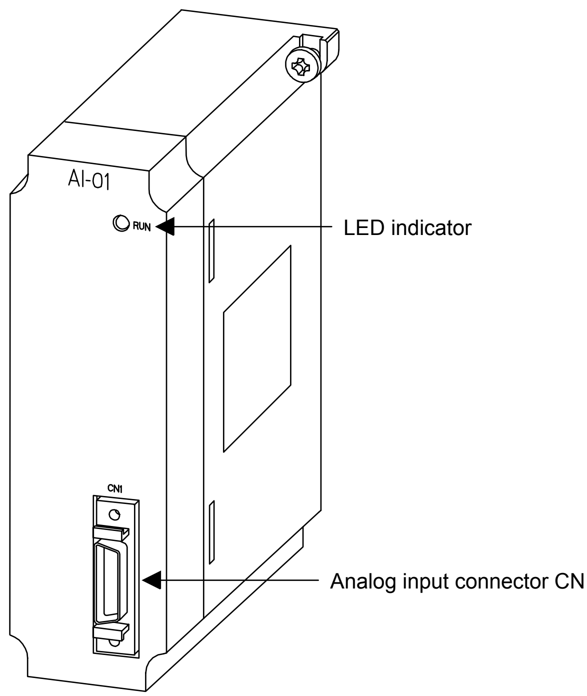
INFO

- Use the cable model JEPMC-W6060-☐☐ for connection between the CNTR-01 Module and the junction terminals.
- Use the following cable for connection between the junction terminal block and the pulse generator.
- Shielded twisted-pair cable
- Do not connect anything to the unused input terminals.

5.4 Analog Modules

5.4.1 AI-01 Analog Input Module

The following illustration shows the appearance of the AI-01 Analog Input Module.



The details of each part of the AI-01 Module are described below.

■ LED Indicator

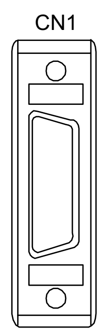
The meaning of the indicator on the front panel of the Module is as follows:

◯ RUN

Indicator Name	Indicator Color	Meaning when Indicator Is Lit
RUN	Green	Lit: The AI-01 Module is mounted in a slot and is operating normally. Not lit: The AI-01 Module is stopped.

■ Analog Input Connectors

The use of the analog input connectors is shown below.



The CN1 connector is used to connect an AI-01 Module to external devices. Use the following standard cable for this connector.
• JEPMC-W6080-□□
Number of input channels: 4

■ Connector Specifications

The following table shows the specifications of the connector used to connect the AI-01 Module.

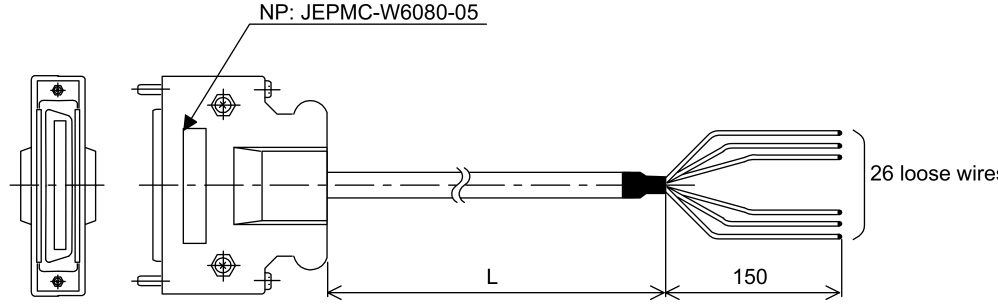
Name	Connector Name	Number of Pins	Connector			Cable
			On Module	On Cable	Manufacturer	
Analog Input Connector	CN1	26	10226-52A2JL	• Connector body: 10126-3000VE • Shell: 10326-52A0-008 (Screw lock) 10326-52F0-008 (One-touch lock)	3M	JEPMC-W6080-05 JEPMC-W6080-10 JEPMC-W6080-30

■ AI-01 Connecting Cables

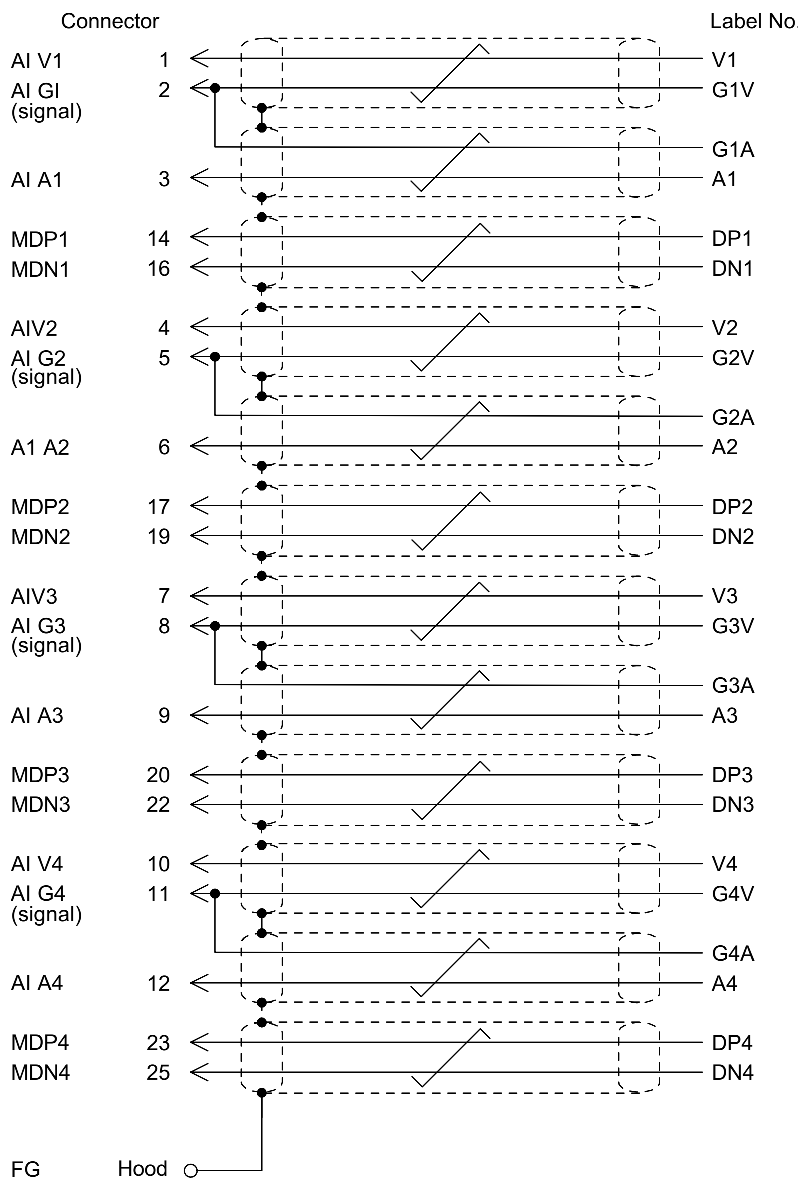
Models

JEPMC-W6080-05: 0.5 m
JEPMC-W6080-10: 1.0 m
JEPMC-W6080-30: 3.0 m

Appearance



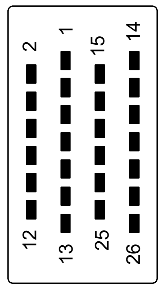
Cable Connection Diagram



■ Connector Pin Layout (CN1)

The pin layout of the CN1 connector is as follows:

CN1 26 pin
Connector



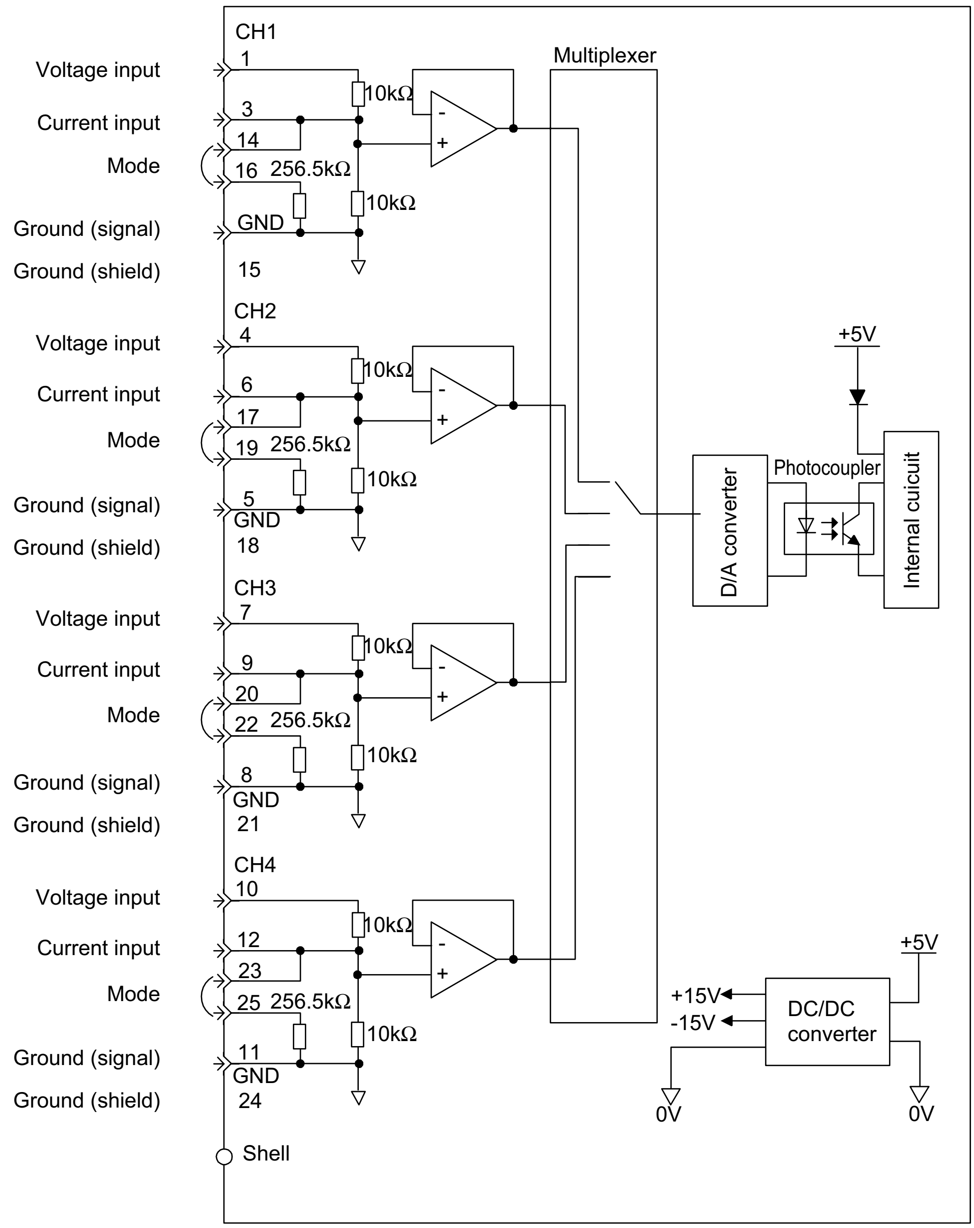
Pin Layout on
Wiring Side

2	AIG1	1	AIV1	15	AIG1	14	MDP1A
4	AIV2	3	AIA1	17	MDP2	16	MDN1
6	AIA2	5	AIG2	19	MDN2	18	AIG2
8	AIG3	7	AIV3	21	AIG3	20	MDP3
10	AIV4	9	AIA3	23	MDP4	22	MDN3
12	AIA4	11	AIG4	25	MDN4	24	AIG4
		13				26	

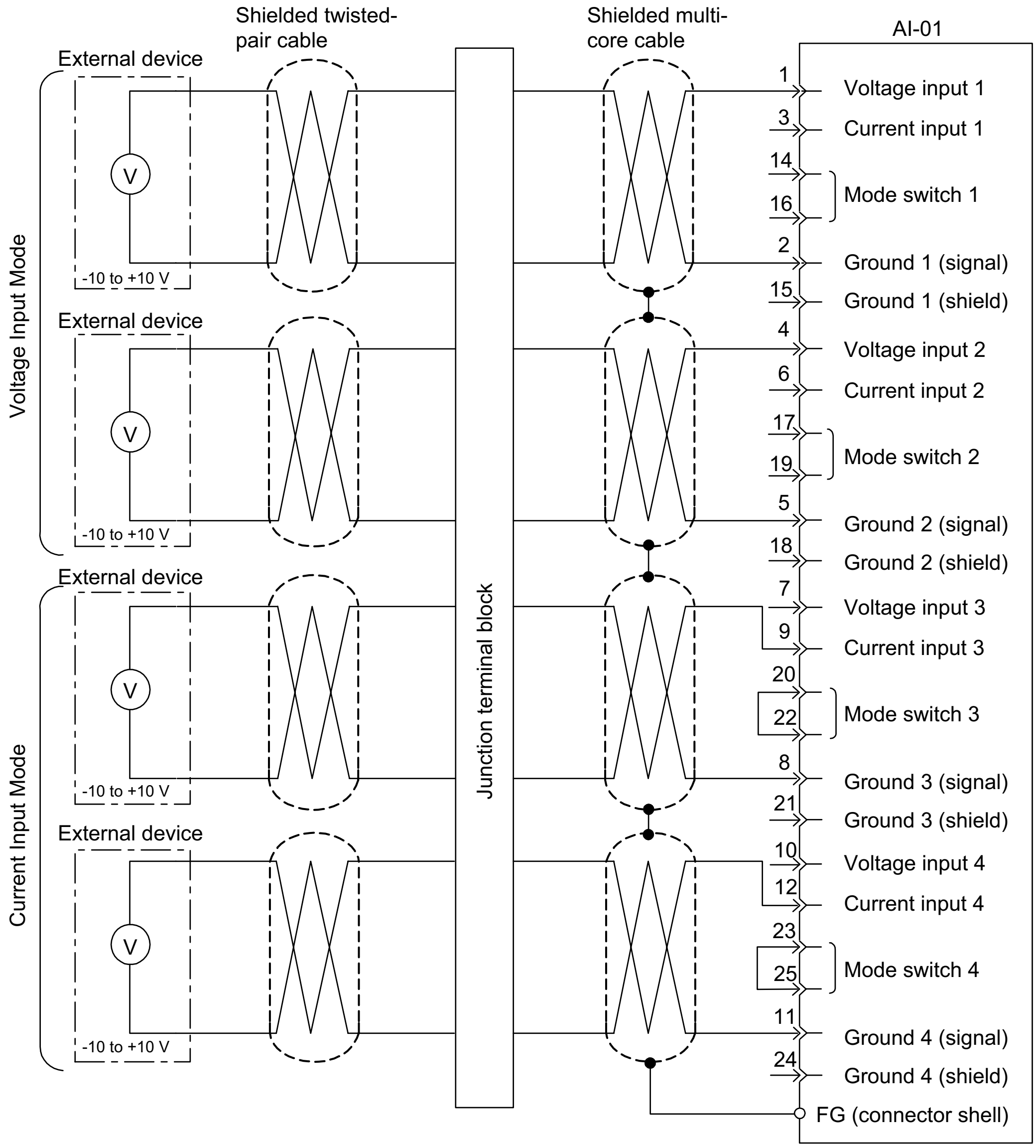
The following table shows the name and function of the CN1 connector pins.

Pin No.	Signal Name	Function	Pin No.	Signal Name	Function
1	AIV1	Voltage input 1	14	MDP1	Mode switch terminal 1
2	AIG1	Ground 1 (signal)	15	AIG1	Ground 1 (shield)
3	AIA1	Current input 1	16	MDN1	Mode switch terminal 1
4	AIV2	Voltage input 2	17	MDP2	Mode switch terminal 2
5	AIG2	Ground 2 (signal)	18	AIG2	Ground 2 (shield)
6	AIA2	Current input 2	19	MDN2	Mode switch terminal 2
7	AIV3	Voltage input 3	20	MDP3	Mode switch terminal 3
8	AIG3	Ground 3 (signal)	22	AIG3	Ground 3 (shield)
9	AIA3	Current input 3	22	MDN3	Mode switch terminal 3
10	AIV4	Voltage input 4	23	MDP4	Mode switch terminal 4
11	AIG4	Ground 4 (signal)	24	AIG4	Ground 4 (shield)
12	AIA4	Current input 4	25	MDN4	Mode switch terminal 4
13			26		

■ Circuit Configuration



■ AI-01 Module Connection Example: Voltage Input Mode



IMPORTANT

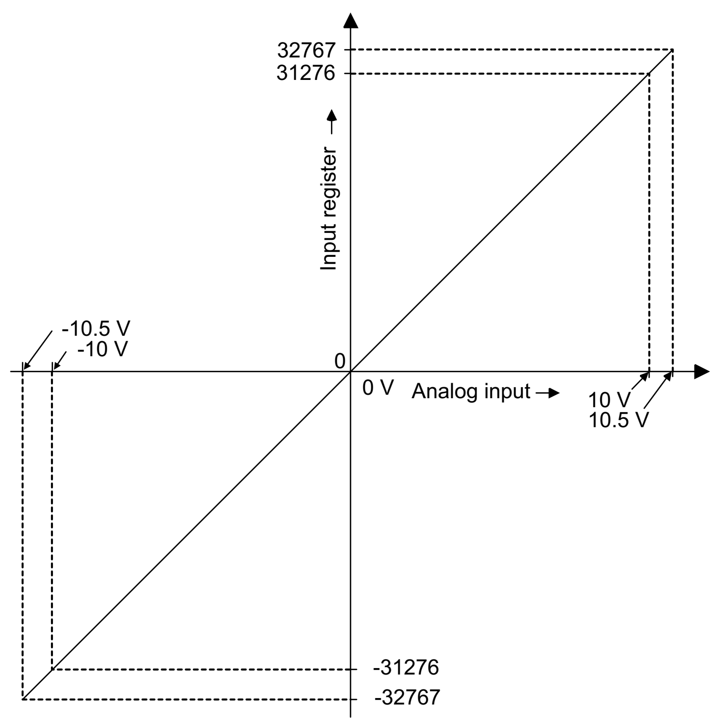
1. When voltage input mode is used, leave the mode switch terminals open and do not connect anything to the current input terminals.
2. Use standard JEPMC-W6080-☐☐ Cable to connect external devices to the AI-01 Module. Use junction terminal blocks to allow for differences in distances from the AI-01 Module will be different.
3. When current input mode is used, short-circuit the mode switch terminal and do not connect anything to the the voltage input terminals.

■ Input Characteristics

Analog Input	Voltage Mode		Current Mode
	-10 to +10 V	0 to +10 V	0 to 20 mA
-10.5 V*	-32768	–	–
-10.0 V	-31276	–	–
-5.0 V	-15638	–	–
0.0 V (0.0 mA)	0	0	0
+5.0 V (10 mA)	15638	15638	15638
+10.0 V (20 mA)	31276	31276	31276
+10.5 V (21 mA)*	32767	32767	32767

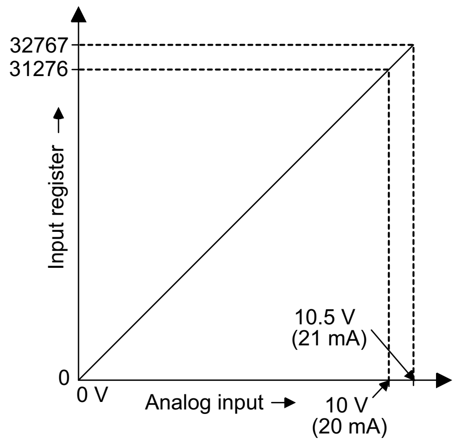
* Linearity cannot be guaranteed if the analog input is more than 10.0 V.

Voltage Mode: -10 to +10 V



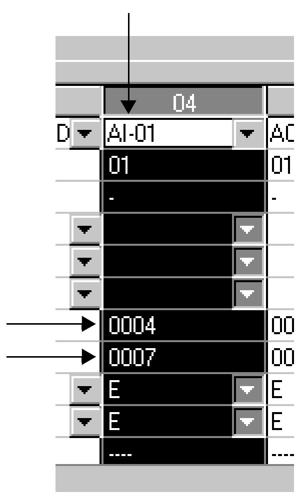
5

Voltage Mode: 0 to 10 V, Current Mode: 0 to 20 mA



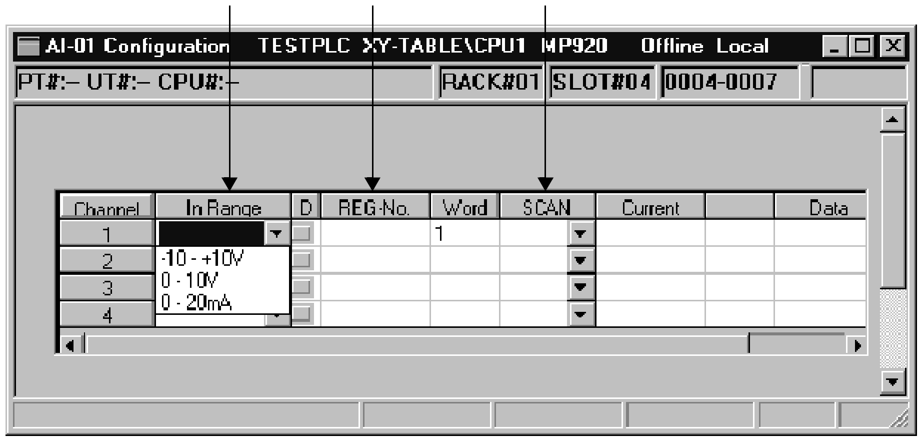
■ AI-01 Module Allocations

Channels for the AI-01 Module are allocated according to the following procedure.

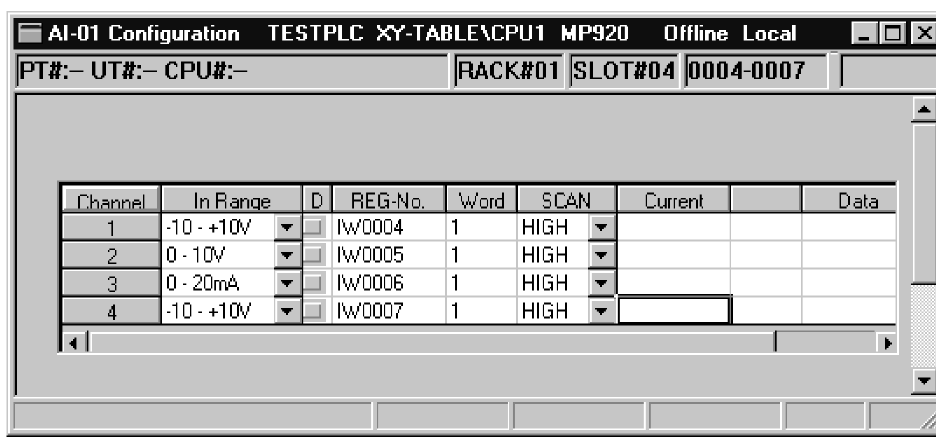


1. Click the ▼ button on the right side of the ***Module*** field in the applicable slot number column (***04*** in the above example) in the Module Definition Window. Click AI-01 and set the starting I/O register. Double-click the slot number, and the AI-01 Configuration Window will be displayed.
2. Set the applicable values in the ***In Range***, ***REG No.***, and ***SCAN*** columns in the AI-01 Configuration Window. Set the register number to a value within the range specified by

the start and end I/O register numbers set in the Module Definition Window. Make sure that the same values are not set more than once.



3. Set the input range, register number, and scan for channels that will be used. Do not enter settings for channels that will not be used.



INFO

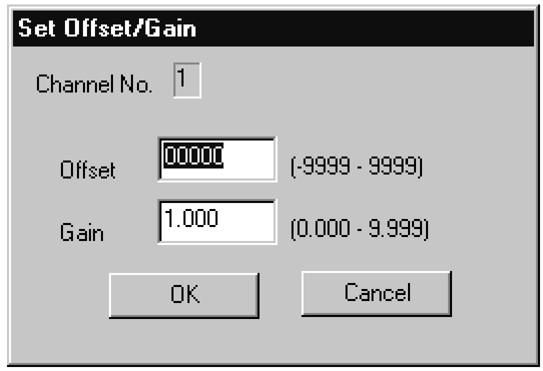
The data input for the AI-01 Module will be stored in the input register set in the AI-01 Configuration Window.

■ Offset/Gain Settings

The normal offset and gain for the AI-01 Module do not need to be changed because the register input values specified for the required voltage (or current) are adjusted at shipment for input. Use the following procedure to adjust the offset and gain only when the 0-V adjustment is required for external devices.

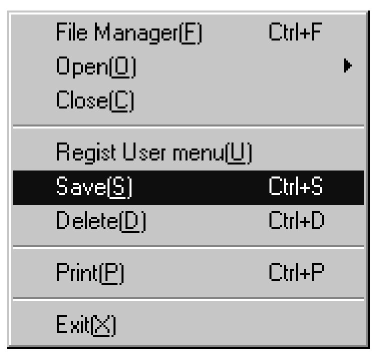
1. Click the ***Channel*** field and click ***Offset/Gain(O)*** in the ***Set(S)*** menu in the AI-01 Configuration Window.

2. Change the voltage for the external device to 0 V, 5 V, or 10 V to determine the offset value and gain from the AI-01 Module's current values (for a range of 0 to 10 V).
3. Set the offset and gain and click the **OK** button.

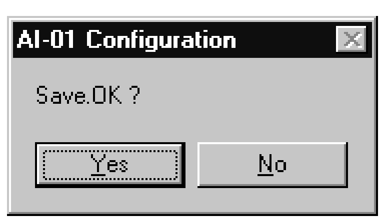


■ Saving the AI-01 Configuration

1. Click ***Save(S)*** in the ***File(F)*** menu in the AI-01 Configuration Window.

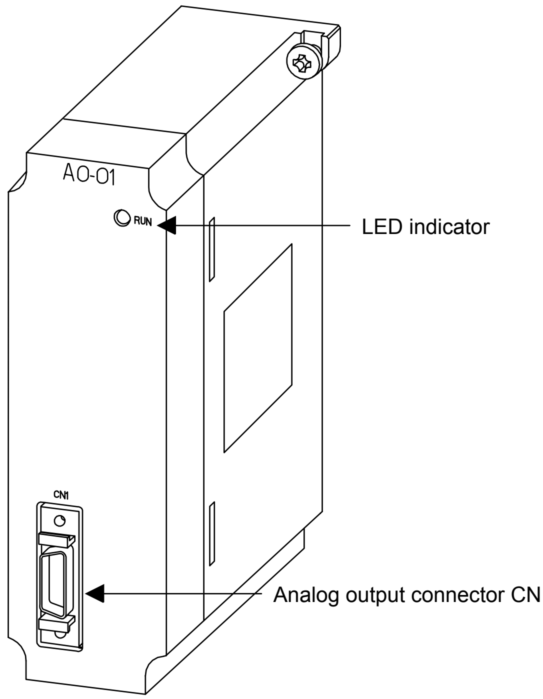


2. Click the **Yes** button in the following message box.



5.4.2 AO-01 Analog Output Module

The following illustration shows the appearance of the AO-01 Analog Output Module.



The dedails of each part of the AO-01 Module are described below.

■ LED Indicator

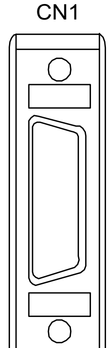
The meaning of the indicator on the front panel of the Module is as follows:

Indicator Name	Indicator Color	Meaning when Indicator Is Lit
RUN	Green	Lit: The AO-01 Module is mounted to the slot and is operating normally. Not lit: The AO-01 Module is stopped.

■ Analog Output Connectors

The use of the external input connectors are shown below.

CN1



The CN1 connector is used to connect an AO-01 Module to external devices. Use the following standard cable for this connector.

- JEPMC-W6090-□□

Number of input channels: 4

■ Connector Specifications

The following table shows the specifications of the connector used to connect the AO-01 Module.

Name	Connector Name	Number of Pins	Connector			Cable
			On Module	On Cable	Manufacturer	
Analog Output Connector	CN1	20	10220-52A2JL	• Connector body: 10120-3000VE • Shell: 10320-52A0-008 (Screw lock) 10320-52F0-008 (One-touch lock)	3M	JEPMC-W6090-05 JEPMC-W6090-10 JEPMC-W6090-30

■ AO-01 Connecting Cables

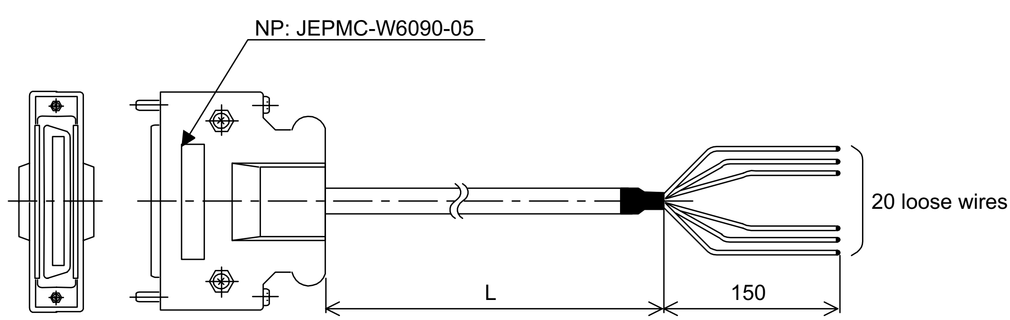
Models

JEPMC-W6090-05: 0.5 m

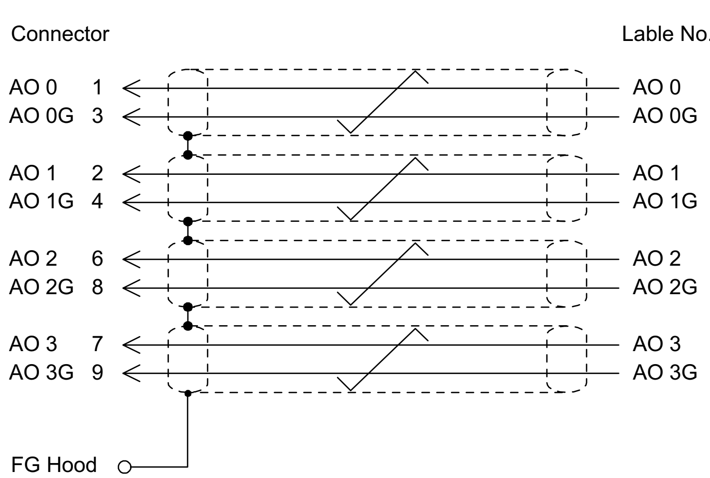
JEPMC-W6090-10: 1.0 m

JEPMC-W6090-30: 3.0 m

Appearance



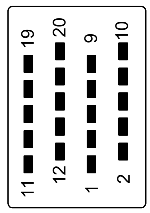
Cable Connection Diagram



■ Connector Pin Layout (CN1)

The pin layout of the CN1 connector is as follows:

CN1 20-pin Connector



Pin Layout on Wiring Side

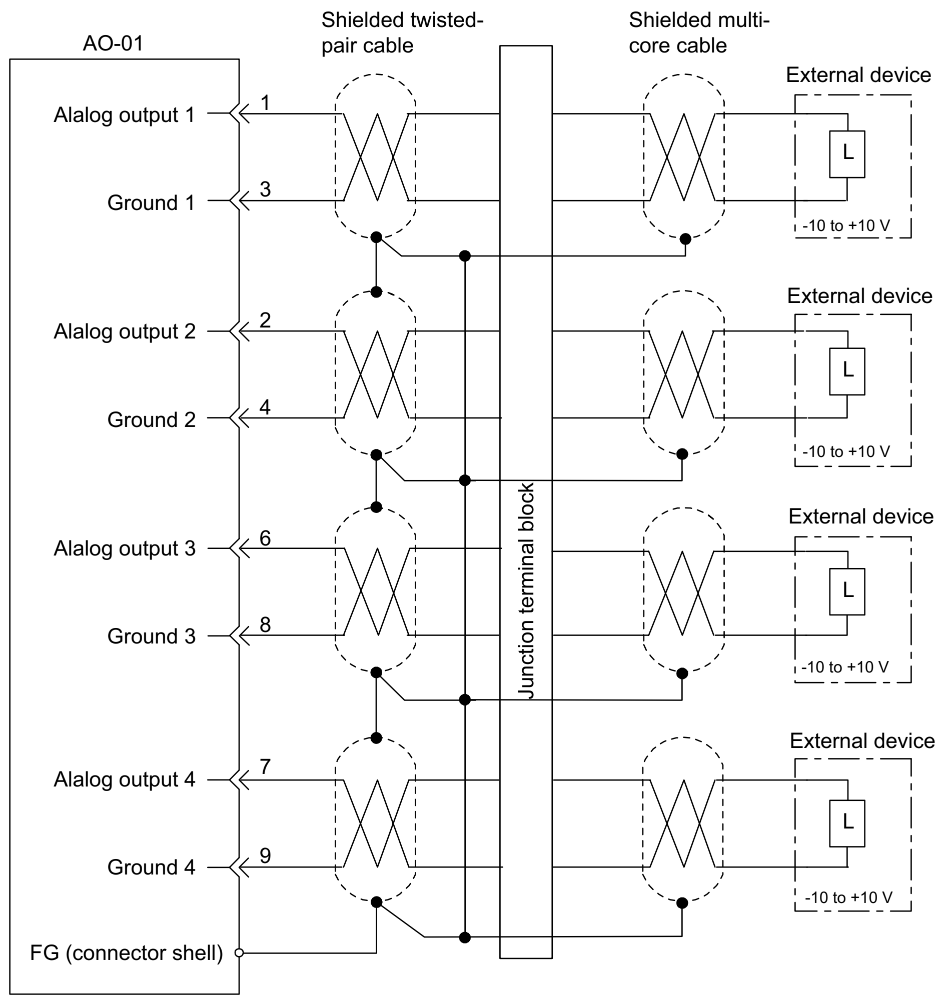
		20				10	
19				9	AO3G		
		16				8	AO2G
17				7	AO3		
		16				6	AO2
15				5			
		14				4	AO1G
13				3	AO0G		
		12				2	AO1
11				1	AO0		

The following table shows the name and function of the CN1 connector pins.

Pin No.	Signal Name	Function	Pin No.	Signal Name	Function
1	AO0	Analog output 0	11		
2	AO1	Analog output 1	12		
3	AO0G	Ground 0	13		
4	AO1G	Ground 1	14		
5			15		
6	AO2	Analog output 2	16		
7	AO3	Analog output 3	17		
8	AO2G	Ground 2	18		
9	AO3G	Ground 3	19		
10			20		

5

■ AO-01 Module Connection Example



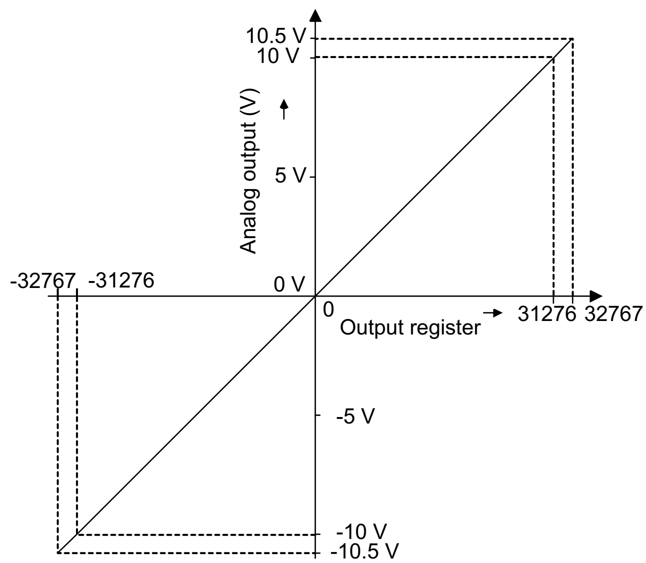
■ Output Characteristics

Click either ***-10 to +10 V Mode*** or ***0 to 10 V Mode*** in the AO-01 Configuration Window from CP-717 software.

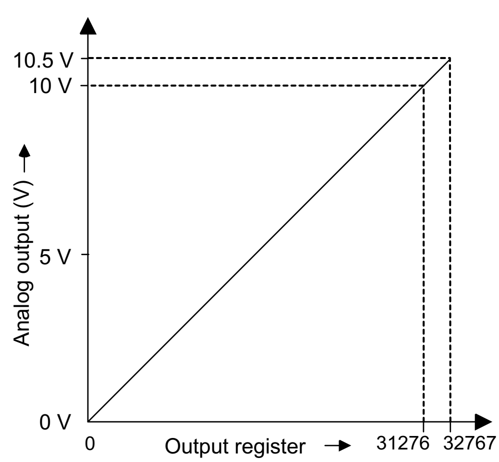
Output Register	Analog Input	
	-10 to +10 V Mode	0 to 10 V Mode
-32768	-10.5 V*	–
-31276	-10.0 V	–
-15638	-5.0 V	–
0	0.0 V	0.0 V
15638	+5.0 V	+5.0 V
31276	+10.0 V	+10.0 V
32767	+10.5 V*	+10.5 V*

* Linearity cannot be guaranteed if the analog input is more than 10.0 V.

-10 to +10 V Mode



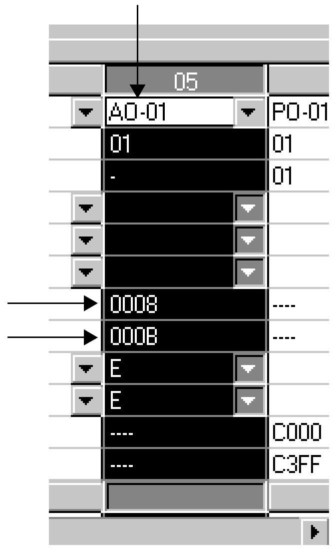
0 to 10 V Mode



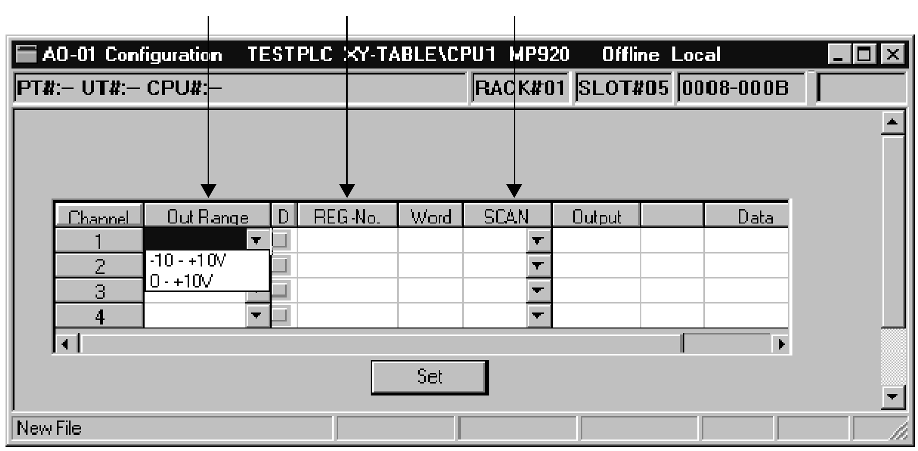
5

■ AO-01 Module Allocations

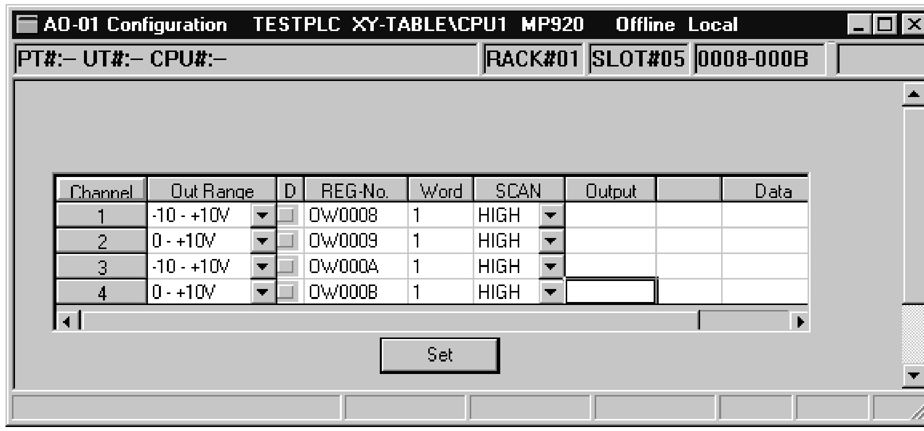
Channels for the AO-01 Module are allocated according to the following procedure.



1. Click the ▼ button on the right side of the ***Module*** field in the applicable slot number column (***05*** in the above example) in the Module Definition Window. Click AO-01 and set the starting I/O register. Double-click the slot number, and the AO-01 Configuration Window will be displayed.
2. Set the applicable values in the ***Out Range***, ***REG No.***, and ***SCAN*** columns in the AO-01 Configuration Window. Set the register number to a value within the range specified by the start and end I/O register numbers set in the Module Definition Window. Make sure that the same values are not set more than once.



3. Set the output range, register number, and scan for channels that will be used. Do not enter settings for channels that will not be used.



INFO

The analog output data that is output for the AO-01 Module will be the data in the output register set in the AO-01 Configuration Window.

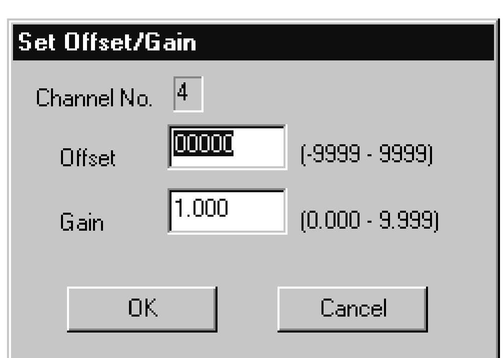
■ Offset/Gain Settings

The normal offset and gain for the AO-01 Module do not need to be changed because the register output values specified for the required voltage are adjusted at shipment for output. Use the following procedure to adjust the offset and gain only when the 0-V adjustment is required for external devices.

5

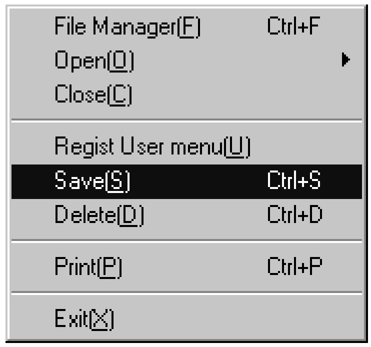
1. Click the ***Channel*** field and click ***Offset/Gain(O)*** in the ***Set(S)*** menu in the AO-01 Configuration Window.

2. Set an appropriate value for 0 V, 5 V, and 10 V in the output register of the AO-01 Module, and at the same time measure the voltage at the external device terminals to determine the offset value and gain.
3. Set the offset and gain and click the **OK** button.

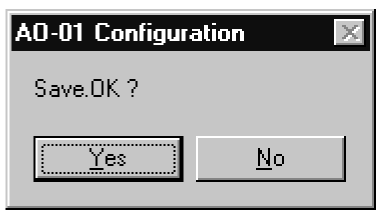


■ Saving the AO-01 Configuration

1. Click ***Save(S)*** in the ***File(F)*** menu in the AO-01 Configuration Window.



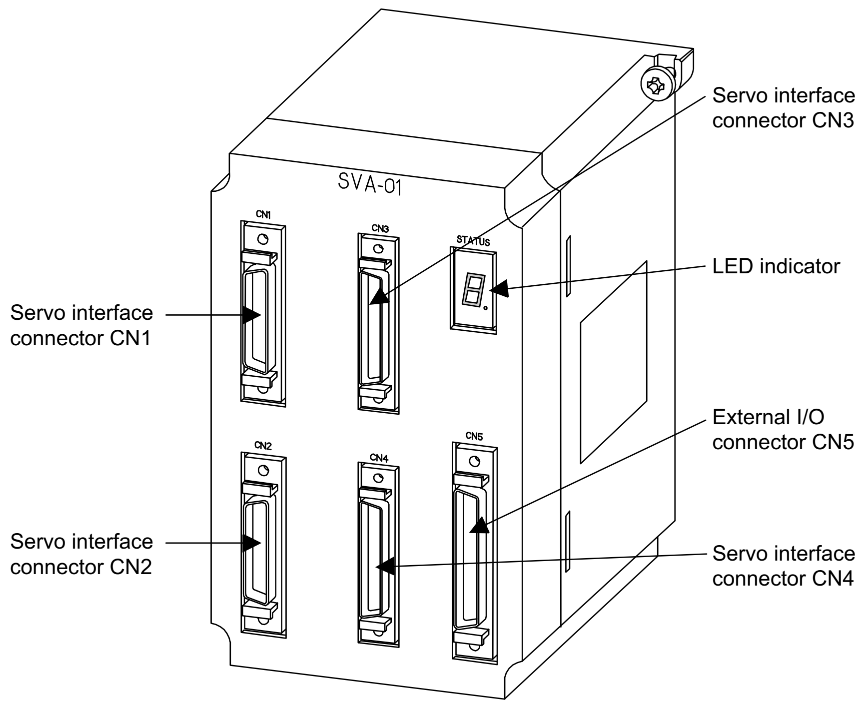
2. Click the **Yes** button in the following message box.



5.5 Motion Modules

5.5.1 Servo Module (4-axis)

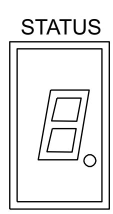
The following illustration shows the appearance of the SVA-01A Four-axis Servo Module.



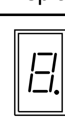
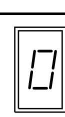
The details of each part of the SVA-01A Module are described below.

■ LED Indicator

The STATUS indicator is a 7-segment LED indicator that displays the RUN/error status of the SVA-01A Module.



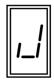
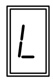
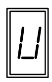
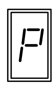
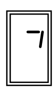
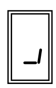
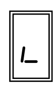
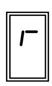
The table below shows the indicator display patterns.

Display	Category	Meaning
	Hardware reset	The SVA-01A Module is in hardware reset status.
	Initializing	This display appears one to six seconds after the SVA-01A Module is turned ON or reset.

(cont'd)

Display	Category	Meaning
1 2 3 4 5 6 7 8 9 A b C d E r y	Normal operation	One of Servo Module numbers 1 to 16 will be displayed. The Servo Module is operating normally and there is no error or alarm.
F or F. followed by error code	Serious fault	A two-digit error code appears following F. Examples: F → 0 → 1: Watchdog timeout error F → 0 → 2: Synchronization error F → 4 → 1: ROM diagnostic error F → 4 → 2: RAM diagnostic error F → 4 → 3: Shared memory diagnositc error F → 4 → 4: Built-in CPU timer diagnostic error F → 4 → 5: Timer diagnostic error F → 4 → 6: NVRAM read error F → 4 → 7: NVRAM write error F → 4 → 8: Illegal general instruction interrupt F → 4 → 9: Illegal slot instruction interrupt F → 5 → 0: CPU address error interrupt F → 5 → 1: DMA address error interrupt F → 5 → 2: User break interrupt F → 5 → 3: Trap instruction interrupt F → 5 → 4: UPD71054 diagnostic error

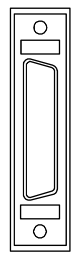
(cont'd)

Display		Category	Meaning
	Axis 1	Alarm (SVRDY: ON) Error (SVRDY: OFF)	Check the contents of IW☐☐00 + the axis offset to determine which of the items shown below is the cause of the problem. Alarm (SVRDY: ON) • Error fault • Setting parameter setting error Error (SVRDY: OFF) • Fixed servo parameter setting error • Absolute Encoder interface error
	Axis 2		
	Axis 3		
	Axis 4		
		Other CPU operation stop	Some other Module is stopped. Check other Modules. For example, check whether the PLC (CPU1/ CPU2) is stopped.
   		Absolute position read retry status	A retry has occurred for absolute positioning read processing during initialization because the power has been turned ON or the Module has been reset when the fixed parameter encoder selection was set for an absolute encoder.

Note: Refer to *12.3.3 Processing Performed When an SVA Module Error Occurs* for details.

5

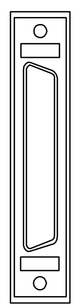
■ Servo Interface Connectors (CN1 to CN4)



The servo interface connector is used to connect an SVA-01A Module and a Four-axis SERVOPACK.
Use the following standard cable for this connector.

- SGDA: JEPMC-W6040-□□
- SGDB and SGDM: JEPMC-W6050-□□

■ External I/O Connector



The external I/O connector is used to connect an SVA-01A Servo Module to external I/O signal terminals.
Use the following standard cable for this connector.

- JEPMC-W6060-□□

Number of signal points: DI: 6 (points) × 4 (axes) + common DI points
DO: 2 (points) × 4 (axes) + common DI points

■ Connector Specifications

The following table shows the specifications of the connectors used to connect the SVA-01A Module.

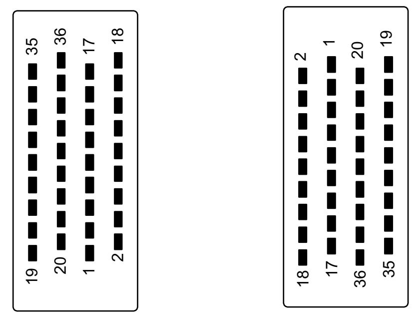
Name	Connector Name	Number of Pins	Connector			Cable
			On Module	On Cable	Manufacturer	
Servo Interface Connector 1 Connector 2 Connector 3 Connector 4	CN1 CN2 CN3 CN4	36	10236-52A2JL	• Connector body: 10136-3000VE • Shell: 10336-52A0-008 (Screw lock) 10336-52F0-008 (One-touch lock)	3M	JEPMC-W6040-□□ (for SGDA) JEPMC-W6050-□□ (for SGDB, SGDM)
External I/O Connector	CN5	50	10250-52A2JL	• Connector body: 10150-3000VE • Shell: 10350-52A0-008 (Screw lock) 10350-52F0-008 (One-touch lock)	3M	JEPMC-W6060-□□

■ Connector Pin Layout (CN1 to CN4)

The pin layout of the CN1 to CN4 connectors are as follows:

CN1/CN2 36-pin Connector

CN3/CN4 36-pin Connector



Pin Layout on Wiring Side

2	NREF	1	SG	20	SEN	19	SG
4	PAL	3	PA	22	BAT	21	0BAT
6	PCL (5 V)	5	PC (5 V)	24	PBL	23	PB
8		7	SG	26		25	SG
10	0V (24 V)	9		28	0V (24 V)	27	
12	PCON	11	0V (24 V)	30	ALM RST	29	0V (24 V)
14	OTF	13	OTR	32	SEN	31	SV ON
16	+24V	15		34	+24 V	33	
18		17	SV ALM	36		35	SRDY

Note: Although the connector orientation differs with each connector CN1 to CN4, the pin layout is the same for all connectors.

The following table shows the name and function of the pins of the CN1 to CN4 connectors.

Pin No.	Signal Name	Function	Pin No.	Signal Name	Function
1	SG	Ground (for analog)	19	SG	Ground (for SEN signal)
2	NREF	Speed reference	20	SEN	SEN signal
3	PA	5-V differential pulse input (+)	21	0BAT	BAT output terminal (-) for absolute specification
4	PAL	5-V differential pulse input (-)	22	BAT	BAT output terminal (+) for absolute specification
5	PC (5V)	5-V differential pulse input (+)	23	PB	5-V differential B pulse terminal (+)
6	PCL (5V)	5-V differential pulse input (-)	24	PBL	5-V differential B pulse terminal (-)
7	SG	Ground	25	SG	Ground
8			26		
9			27		
10	0V (24V)	0 V (24 V)	28	0V (24V)	0 V (24 V)
11	0V (24V)	0 V (24 V)	29	0V (24V)	0 V (24 V)
12	PCON	P operation reference, DO-2	30	ALM RST	Alarm reset, DO-1
13	OTR	Overtravel (-)	31	SV ON	Servo ON, DO-0
14	OTF	Overtravel (+)	32	SEN	VS866 SEN output
15			33		
16	+24V	+24 V power supply	34	+24V	+24 V power supply
17	SV ALM	Servo alarm input, DI-0	35	SRDY	Servo ready input, DI-1
18	BRK	Brake ON input, DI-2	36		

IMPORTANT

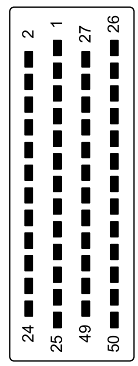
Either 5 V or 24 V can be selected for the SEN signal. Connect the SEN signal to either Pin 20 or Pin 32 according to the application.

The standard cable is connected to Pin 20.

■ Connector Pin Layout (CN5)

The pin layout of the CN5 connector is as follows:

CN5 50-pin Connector



Pin Layout on Wiring Side

		1	BAT			26	0BAT
2		3	+24V1	27	DEC1	28	OTF IN1
4	OTR IN1	5	ZERO1	29	0V1	30	EXT1
6	RI1	7	BLK OUT1	31		32	RO1
8	+24V2	9	OTR IN2	33	OTF IN2	34	DEC2
10	ZERO2	11	RI2	35	EXT2	36	0V2
12	BLK OUT2	13	+24V3	37	RO2	38	OTF IN3
14	OTR IN3	15	ZERO3	39	DEC3	40	EXT3
16	RI3	17	BLK OUT3	41	0V3	42	RO3
18	+24V4	19	OTR IN4	43	OTF IN4	44	DEC4
20	ZERO4	21	RI4	45	EXT4	46	0V4
22	BLK OUT4	23	RIC	47	RO4	48	ROC
24	+24V	25	0V (24V)	49	+24V	50	0V (24V)

The following table shows the name and function of the CN5 connector pins.

Pin No.	Signal Name	Function	Pin No.	Signal Name	Function
1	BAT	BAT input terminal (+) for absolute specification	26	0BAT	BAT input terminal (-) for absolute specification
2			27		
3	+24V1	Axis 1 input common	28	OTF IN1 (DI-3)	Axis 1 overtravel (+) input
4	OTR IN1 (DI-4)	Axis 1 overtravel (-) input	29	DEC1 (DI-5)	Axis 1 deceleration limit input
5	ZERO1 (DI-6)	Axis 1 zero point latch input	30	EXT1 (DI-7)	Axis 1 external positioning latch input
6	RI1 (DI-8)	Reserved axis 1 input	31	0V1	Axis 1 output common
7	BLK OUT1	Axis 1 brake control output	32	RO1 (DO-3)	Reserved axis 1 output
8	+24V2	Axis 2 input common	33	OTF IN2 (DI-3)	Axis 2 overtravel (+) input
9	OTR IN2 (DI-4)	Axis 2 overtravel (-) input	34	DEC2 (DI-5)	Axis 2 deceleration limit input
10	ZERO2 (DI-6)	Axis 2 zero point latch input	35	EXT2 (DI-7)	Axis 2 external positioning latch input
11	RI2 (DI-8)	Reserved axis 2 input	36	0V2	Axis 2 output common
12	BLK OUT2	Axis 2 brake control output	37	RO2 (DO-3)	Reserved axis 2 output
13	+24V3	Axis 3 input common	38	OTF IN3 (DI-3)	Axis 3 overtravel (+) input
14	OTR IN3 (DI-4)	Axis 3 overtravel (-) input	39	DEC3 (DI-4)	Axis 3 deceleration limit input
15	ZERO3 (DI-6)	Axis 3 zero point latch input	40	EXT3 (DI-7)	Axis 3 external positioning latch input
16	RI3 (DI-8)	Reserved axis 3 input	41	0V3	Axis 3 output common
17	BLK OUT3	Axis 3 brake control output	42	RO3 (DO-3)	Reserved axis 3 output
18	+24V4	Axis 4 input common	43	OTF IN4 (DI-3)	Axis 4 overtravel (+) input
19	OTR IN4 (DI-4)	Axis 4 overtravel (-) input	44	DEC4 (DI-4)	Axis 4 deceleration limit input
20	ZERO4 (DI-6)	Axis 4 zero point latch input	45	EXT4 (DI-7)	Axis 4 external positioning latch input
21	RI4 (DI-8)	Reserved axis 4 input	46	0V4	Axis 4 output common
22	BLK OUT4	Axis 4 brake control output	47	RO4 (DO-3)	Reserved axis 4 output
23	RIC (DI-9)	Reserved input common	48	ROC (DO-4)	Reserved output common
24	+24V	+24 V servo power supply	49	+24V	+24 V servo power supply
25	0V (24V)	0 V servo power supply	50	0V (24V)	0 V servo power supply

■ Standard Cables

The following standard cables are available for use with the Four-axis Servo Module (SVA-01A). Use these cables to connect the SVA-01A Module to SERVOPACKs and other devices, such as overtravel limit switches.

Table 5.4 Standard Cables

Cable	Model	Length
SGDA-□□□ SERVOPACK Connecting Cables	JEPMC-W6040-05	0.5 m
	JEPMC-W6040-10	1.0 m
	JEPMC-W6040-30	3.0 m
SGDB-□□□, SGDM, SGDS SERVOPACK Connecting Cables	JEPMC-W6050-05	0.5 m
	JEPMC-W6050-10	1.0 m
	JEPMC-W6050-30	3.0 m
External I/O Cables	JEPMC-W6060-05	0.5 m
	JEPMC-W6060-10	1.0 m
	JEPMC-W6060-30	3.0 m

These cables are described below.

■ SGDA-□□□S SERVOPACK Connecting Cables

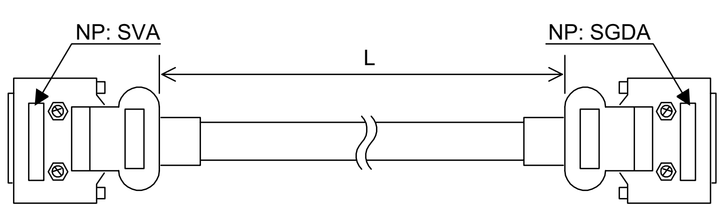
Models

JEPMC-W6040-05: 0.5 m

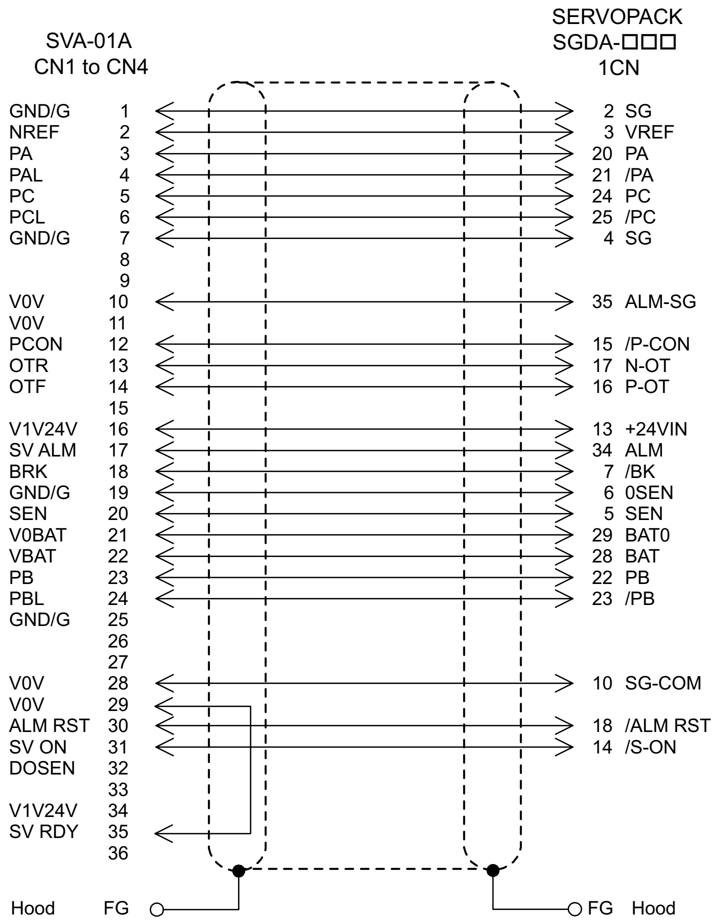
JEPMC-W6040-10: 1.0 m

JEPMC-W6040-30: 3.0 m

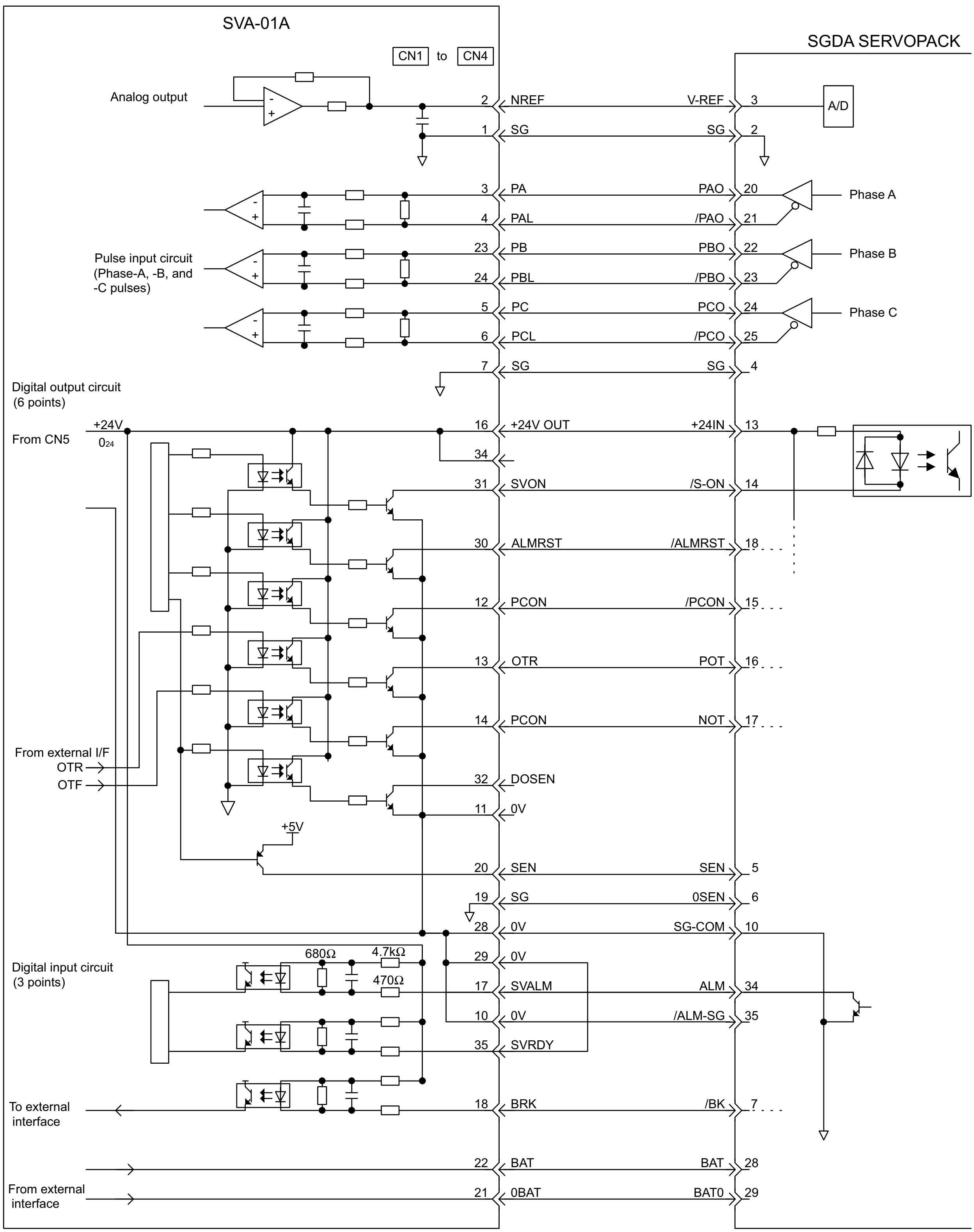
Appearance



Cable Connection Diagram



Example of Connections to SGDA-☐☐☐ SERVOPACK



5

■ SGDB, SGDM, and SGDS SERVOPACK Connecting Cables

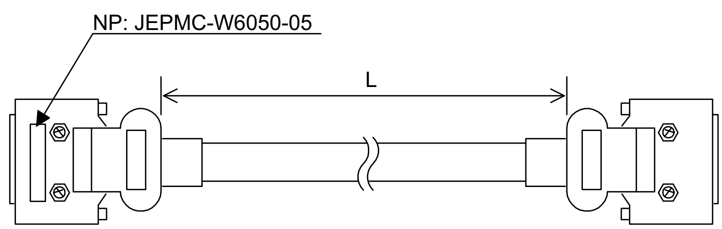
Models

JEPMC-W6050-05: 0.5 m

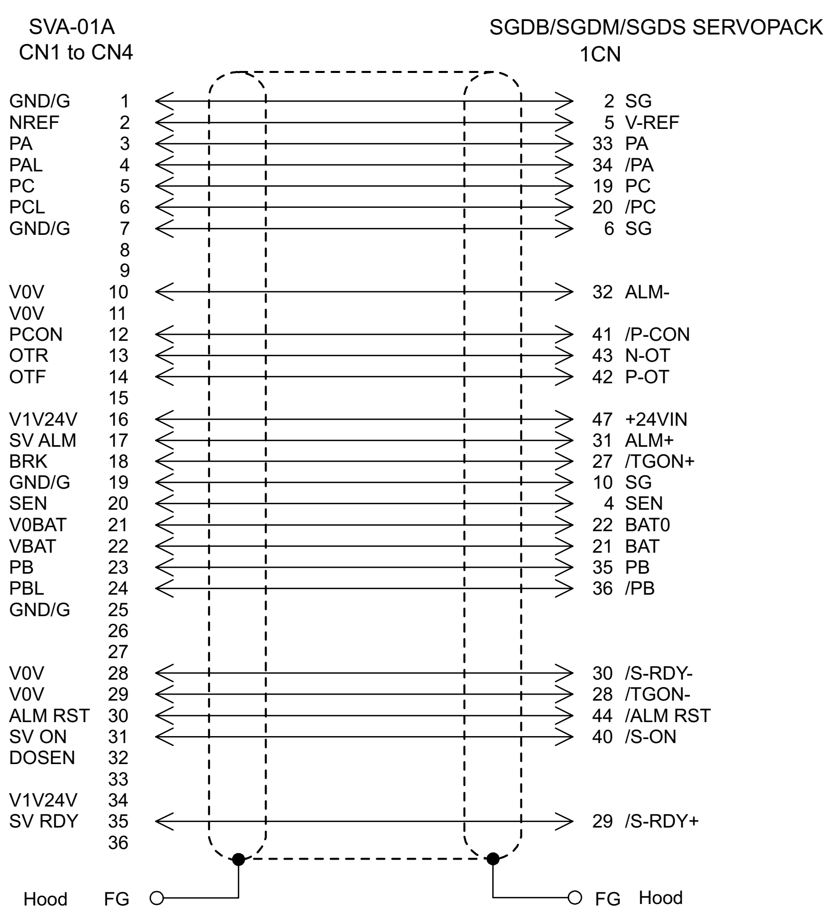
JEPMC-W6050-10: 1.0 m

JEPMC-W6050-30: 3.0 m

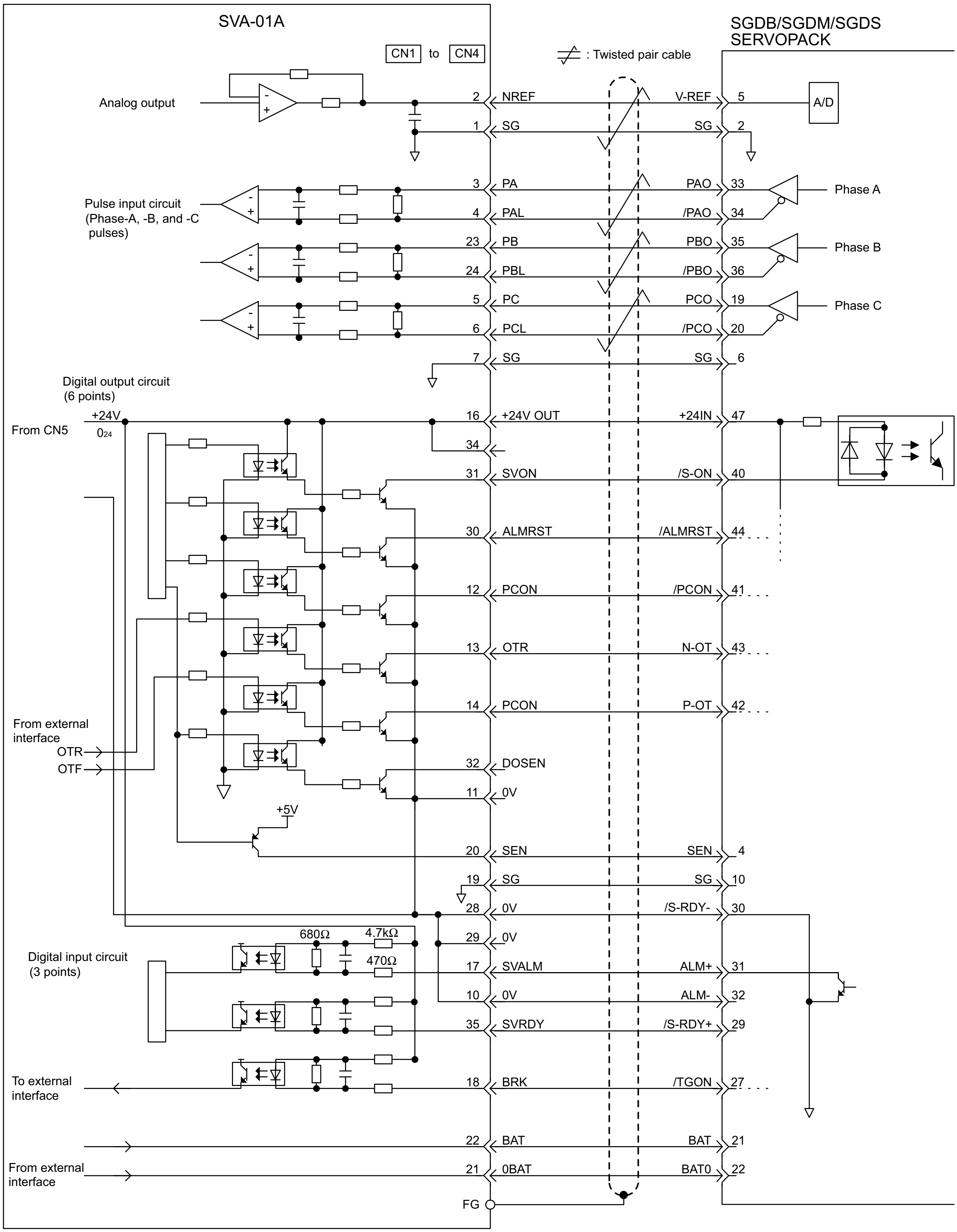
Appearance



Cable Connection Diagram



Example of Connections to SGDB/SGDM/SGDS SERVOPACK



Connection Example Using Standard Cable JEPMC-W6050-□□

IMPORTANT

The following SERVOPACK parameters must be set when the brake signal is used.

The standard cable is made to connect the SEN signal to Pin 20.

- Select whether the BK signal will be output from pins 27 and 28 of the CN1 connector.
  Cn-2D (OUTSEL output signal selection) = □ 4 □
  ↑1BK output from pins 27 and 28 of CN1
- Cn-12 (Time delay from brake command until Servo turns OFF)
  Cn-15 (Brake output speed level for motor rotation time)
  Cn-16 (Brake output timing for motor rotation time)

■ External I/O Cables

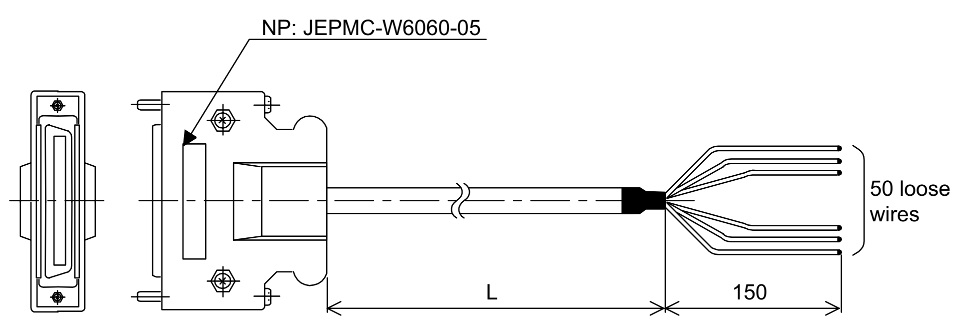
Models

JEPMC-W6060-05: 0.5 m

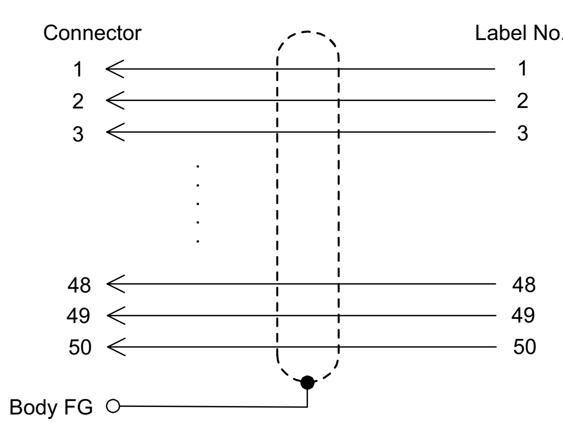
JEPMC-W6060-10: 1.0 m

JEPMC-W6060-30: 3.0 m

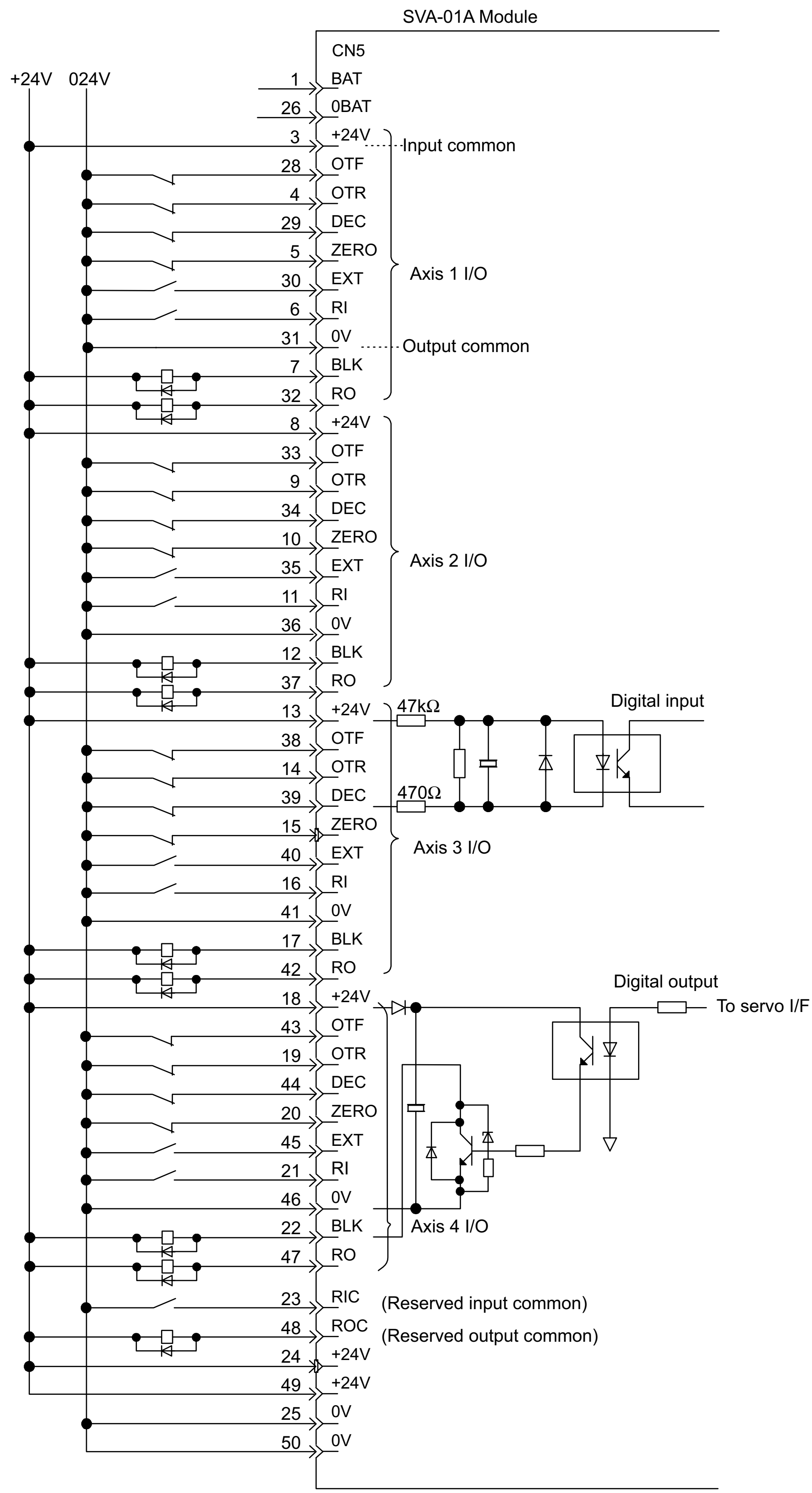
Appearance



Cable Connection Diagram

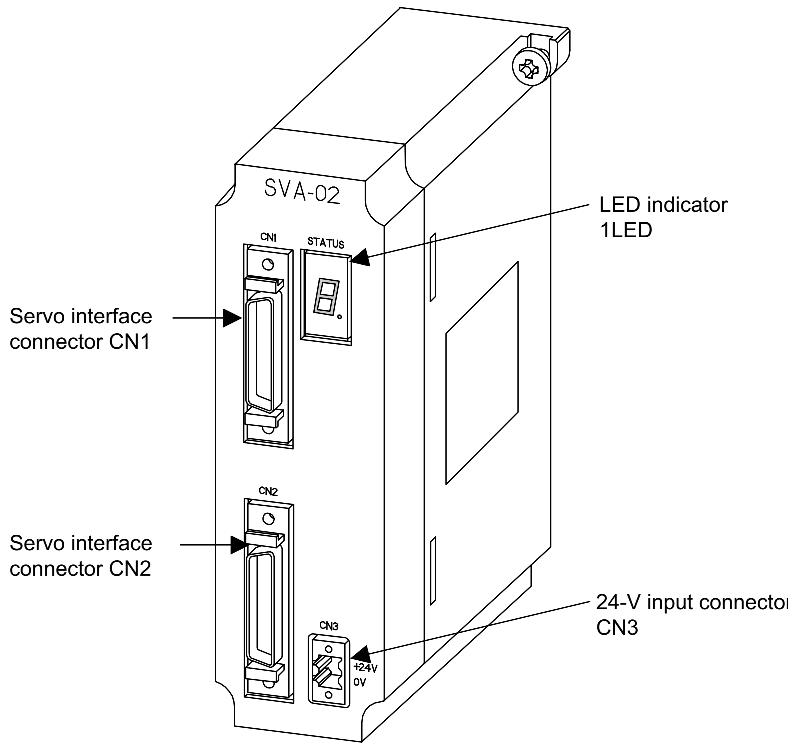


Example of Connections to External Devices



5.5.2 Servo Module (2-axis)

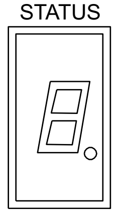
The following illustration shows the appearance of the SVA-02A Two-axis Servo Module.



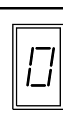
The details of each part of the SVA-02A Module are described below.

■ LED Indicator

The STATUS indicator is a 7-segment LED indicator that displays the RUN/error status of the SVA-02A Module.



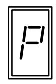
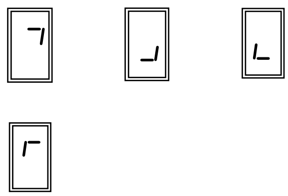
The table below shows the indicator display patterns.

Display	Category	Meaning
	Hardware reset	The SVA-02A Module is in hardware reset status.
	Initializing	This display appears one to six seconds after the SVA-02A Module is turned ON or reset.

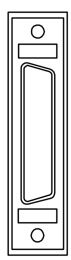
(cont'd)

Display		Category	Meaning
1 2 3 4 5 6 7 8 9 A b C d E r y		Normal operation	One of Servo Module numbers 1 to 16 will be displayed. The Servo Module is operating normally and there is no error or alarm.
F or F. followed by error code		Serious fault	A two-digit error code appears following F. Examples: F → 0 → 1: Watchdog timeout error F → 0 → 2: Synchronization error F → 4 → 1: ROM diagnostic error F → 4 → 2: RAM diagnostic error F → 4 → 3: Shared memory diagnostic error F → 4 → 4: Built-in CPU timer diagnostic error F → 4 → 5: Timer diagnostic error F → 4 → 6: NVRAM read error F → 4 → 7: NVRAM write error F → 4 → 8: Illegal general instruction interrupt F → 4 → 9: Illegal slot instruction interrupt F → 5 → 0: CPU address error interrupt F → 5 → 1: DMA address error interrupt F → 5 → 2: User break interrupt F → 5 → 3: Trap instruction interrupt F → 5 → 4: UPD71054 diagnostic error
J	Axis 1	Alarm (SVRDY: ON) Error (SVRDY: OFF)	Check the contents of IW□□00 + the axis offset to determine which of the items shown below is the cause of the problem. • Alarm Deviation error Setting parameter setting error • Error Fixed parameter setting error Absolute encoder interface error
L	Axis 2		

(cont'd)

Display	Category	Meaning
	Other CPU operation stop	Some other Module is stopped. For example, check whether the CPU Module is stopped.
	Absolute position read retry status	A retry has occurred for absolute position read processing during initialization because the power has been turned ON or the Module has been reset when the fixed parameter encoder selection was set for the absolute encoder.

■ Servo Interface Connectors (CN1, CN2)



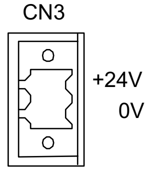
The servo interface connectors CN1 and CN2 are used to connect an SVA-02A Module and a Two-axis SERVOPACK.
Use the following standard cable for this connector.
JEPMC-W6070-05 (For SGDA SERVOPACK)
JEPMC-W6071-05 (For SGDB or SGDM SERVOPACK)

■ 24-V Input Connector (CN3)

The CN3 connector is used to connect the SVA-02A Module and a +24-VDC power supply for servo I/Os.

A screw type terminal connector BL3.5/2F-AU (manufactured by Weidmüller) is used for the CN3.

CN3



Pin No.	Signal Name	Function
2	24V	+24 VDC input
1	0V	0 V

■ Connector Specifications

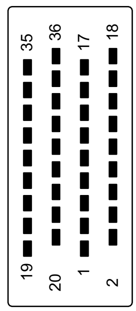
The following table shows the specifications of the connectors used to connect the SVA-02A Module.

Name	Connector Name	No. of Pins	Connector			Cable
			On Module	Cable-end	Manufacturer	
Servo Interface Connectors 1, 2	CN1 CN2	36	10236-52A2JL	Connector body: 10136-3000VE Shell: 10336-52A0-008 (Screw lock) 10336-52F0-008 (One-touch lock)	3M	JEPMC-W6070-□□ (For SGDA SERVOPACK) JEPMC-W6071-□□ (For SGDB and SGDM SERVOPACKs)
24-V Input Connector	CN3	2		BL3.5/2F-AU	Weidmüller	The CN3 connector is provided on the SVA-02A Module. The connection cable must be prepared by the customer.

■ Connector Pin Layout (CN1, CN2)

The pin layout of the CN1 and CN2 connectors is shown as follows:

CN1/CN2 36-pin
Connector



Pin Layout on
Wiring Side

2	NREF	1	SG	20	SEN	19	SG
4	PAL	3	PA	22		21	
6	PCL (5 V)	5	PC (5 V)	24	PBL	23	PB
8	AI-IN	7	SG	26	AI-GND	25	SG
10	0V (24 V)	9	AO-OUT	28	0V (24 V)	27	AO-GND
12	PCON (DO-2)	11	0V (24 V)	30	ALM RST (DO-1)	29	0V (24 V)
14	OTF (DO-3)	13	OTR (DO-4)	32	SEN	31	SV ON (DO-0)
16	+24V	15	OTF (DI-3)	34	+24V	33	OTR (DI-4)
18	BRK (DI-2)	17	SV ALM (DI-0)	36	EXT (DI-5)	35	SRDY (DI-1)

The following table shows the names and functions of the CN1/CN2 connector pins.

Pin No.	Signal Name	Function	Pin No.	Signal Name	Function
1	SG	Ground (for analog)	19	SG	Ground (For SEN signal)
2	NREF	Speed reference	20	SEN (5V)	SEN signal
3	PA	5-V differential phase-A pulse input (+)	21	Unused	
4	PAL	5-V differential phase-A pulse input (-)	22	Unused	
5	PC (5 V)	5-V differential phase-C pulse input (+)	23	PB	5-V differential phase-B pulse input (+)
6	PCL (5 V)	5-V differential phase-C pulse input (-)	24	PBL	5-V differential phase-B pulse input (-)
7	SG	Ground	25	SG	Ground
8	AI-IN	Analog input	26	AI-GND	Analog input ground
9	AO-OUT	Analog output	27	AO-GND	Analog output ground
10	0V (24V)	0 V (24 V)	28	0V (24V)	0 V (24 V)
11	0V (24V)	0 V (24 V)	29	0V (24V)	0 V (24 V)
12	PCON	P operation reference, DO-2	30	ALM RST	Alarm reset DO-1
13	OTR	Overtravel (-), DO-4	31	SV ON	Servo ON DO-0
14	OTF	Overtravel (+), DO-3	32	SEN (24V)	SEN output for VS866
15	General-purpose DI	General-purpose input (OTF) DI-3	33	General-purpose DI	General-purpose input (OTR) DI-4
16	+24V	+24 V power supply	34	+24V	+24V power supply
17	SV ALM	Servo alarm input, DI-0	35	SRDY	Servo ready input DI-1
18	BRK	Brake ON input, DI-2	36	General-purpose DI	General-purpose input DI-5 (External positioning latch)

IMPORTANT

Either 5 V or 24V can be selected for the SEN signal. Connect the SEN signal to either Pin 20 or Pin 32 according to the application. The standard cable is to connected to the Pin 20 (5 V).

5

■ Standard Cables

The following standard cables are available for use with the Two-axis Servo Module (SVA-02A). Use these cables to connect the SVA-02A Module to SERVOPACKs and other devices, such as overtravel limit switches.

Standard Cables

Cables	Model	Length
SGDA-□□□S SERVOPACK Connecting Cables	JEPMC-W6070-05	0.5 m
	JEPMC-W6070-10	1.0 m
	JEPMC-W6070-30	3.0 m
SGDB-□□, SGDM, SGDS SERVOPACK Connecting Cables	JEPMC-W6071-05	0.5 m
	JEPMC-W6071-10	1.0 m
	JEPMC-W6071-30	3.0 m

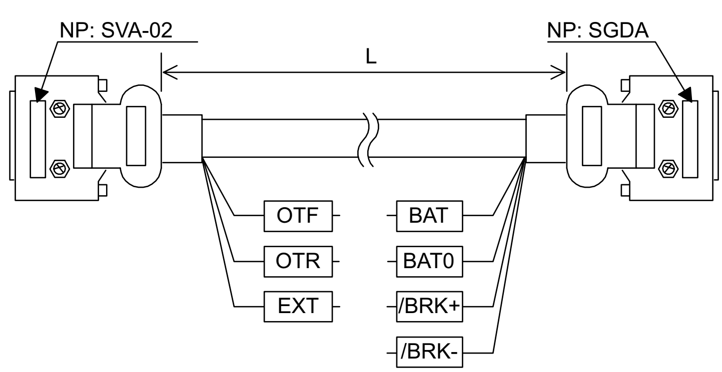
These cables are described below.

■ SGDA-□□□S SERVOPACK Connecting Cables

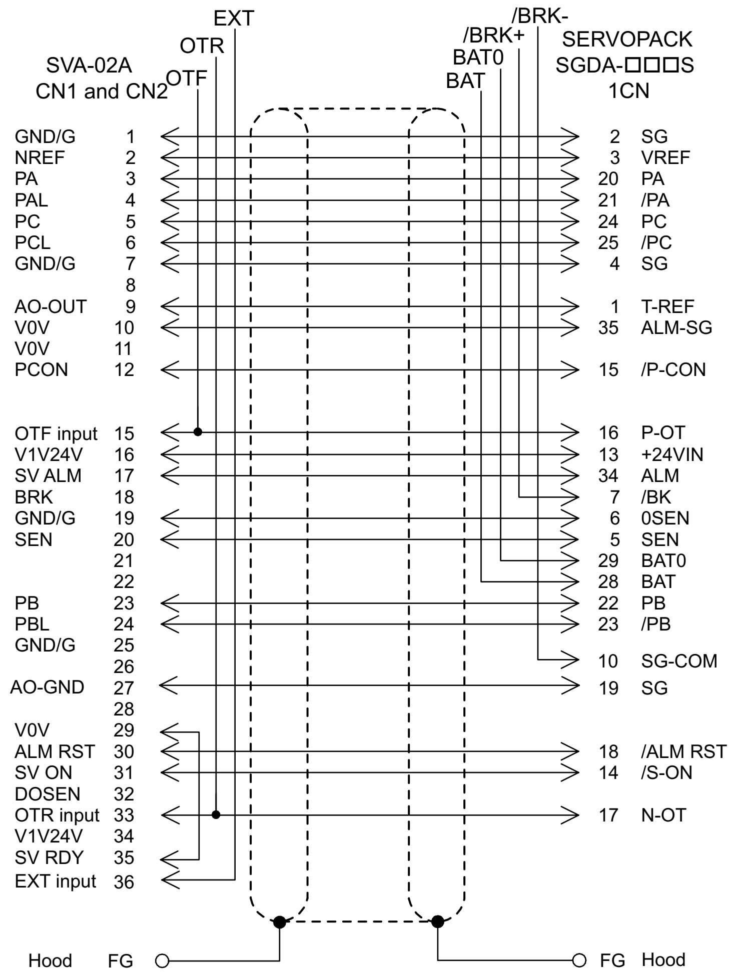
Models

JEPMC-W6070-05: 0.5 m
JEPMC-W6070-10: 1.0 m
JEPMC-W6070-30: 3.0 m

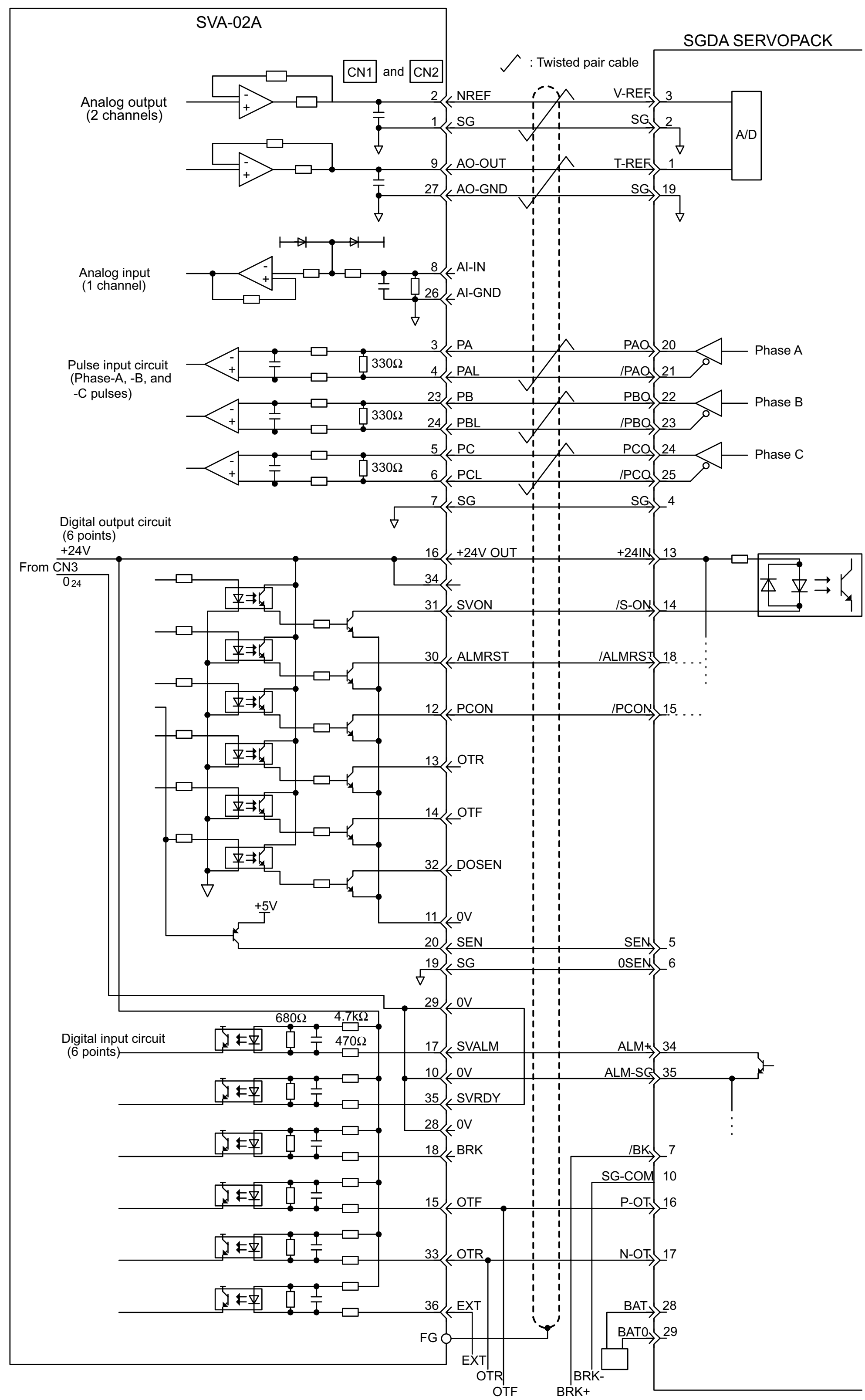
Appearance



Cable Connection Diagram



Example of Connections to SGDA-☐☐☐ SERVOPACK



Connection Example Using Standard Cables JEPMC-W6070-☐☐

■ SGDB, SGDM, and SGDS SERVOPACK Connecting Cables

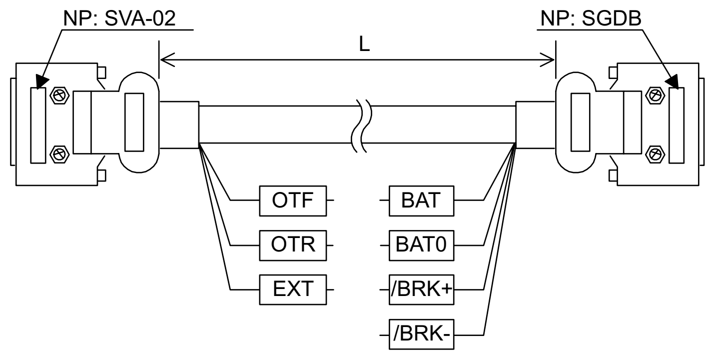
Models

JEPMC-W6071-05: 0.5 m

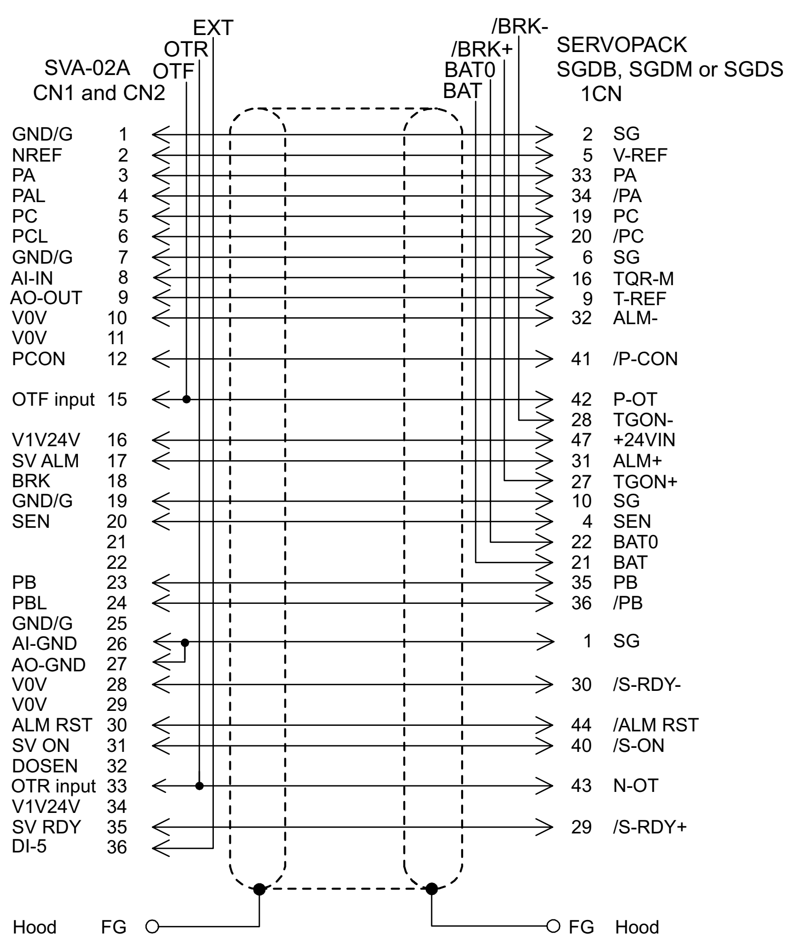
JEPMC-W6071-10: 1.0 m

JEPMC-W6071-30: 3.0 m

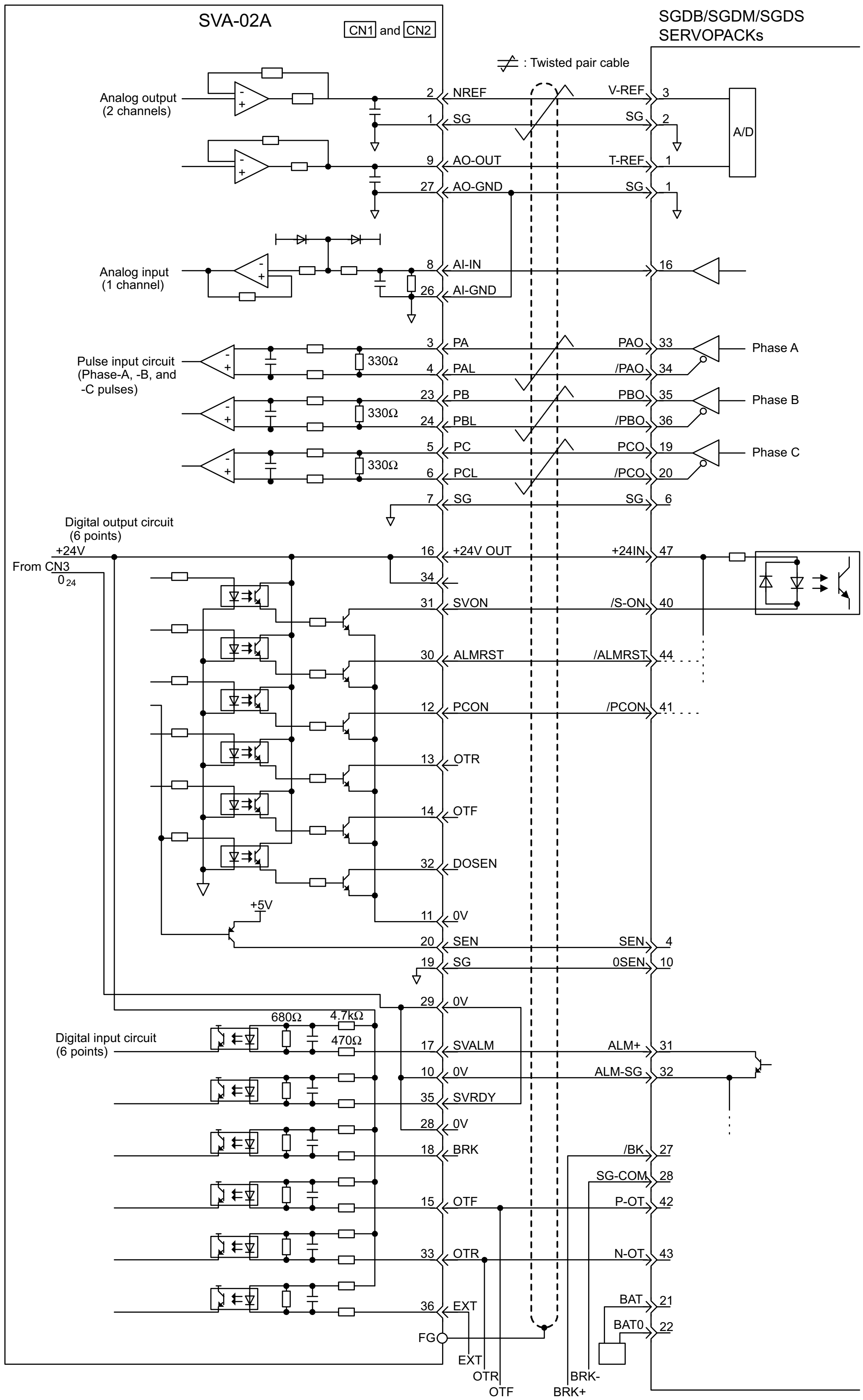
Appearance



Cable Connection Diagram



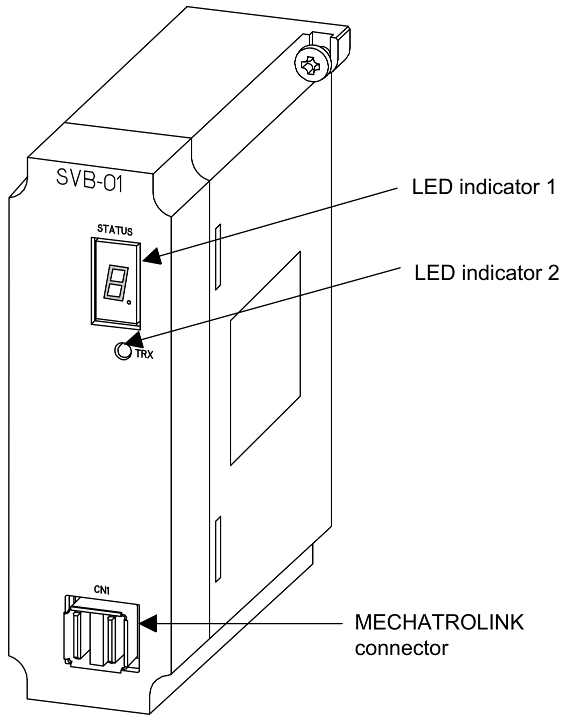
Example of Connections to SGDB, SGDM, and SGDS SERVOPACKs



Connection Example Using Standard Cables JEPMC-W6070-□□

5.5.3 MECHATROLINK Interface Module (SVB-01)

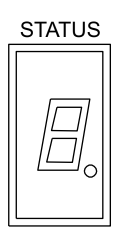
The following illustration shows the appearance of the SVB-01 MECHATROLINK Interface Module.



The details of each part of the SVB-01 Module are described below.

■ LED Indicator 1

The STATUS indicator is a 7-segment LED indicator that displays the RUN/error status of the SVB-01 Module.



The table below shows the indicator display patterns.

Display	Category	Meaning
	Hardware reset	The SVB-01 Module is in hardware reset status.
	Initializing	This display appears one or six seconds after the SVB-01 Module is turned ON or reset.

(cont'd)

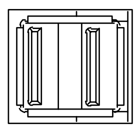
Display	Category	Meaning
1 2 3 4 5 6 7 8 9 A b C d E r y	Normal operation	One of Servo Module numbers 1 to 16 will be displayed. The Servo Module is operating normally and there is no error and alarm.
F or F. followed by error code	Serious fault	A two-digit error code appears following F Examples: F → 0 → 1: Watchdog timeout error F → 4 → 1: ROM diagnostic error F → 4 → 2: RAM diagnostic error F → 4 → 3: Shared memory diagnostic error F → 4 → 8: Illegal general instruction interrupt F → 4 → 9: Illegal slot instruction interrupt F → 5 → 0: CPU address error interrupt F → 5 → 2: User break interrupt F → 5 → 3: Trap instruction interrupt F → 5 → 5: CERF initialization error F → 5 → 8: TLB mistake exception interrupt F → 5 → 9: TLB mistake exception interrupt F → 6 → 0: TLB invalid exception interrupt F → 6 → 1: TLB invalid exception interrupt F → 6 → 2: Initialization page writing exception interrupt F → 6 → 3: TLB protection exception interrupt F → 6 → 4: TLB protection exception interrupt
J	Alarm	One of the following occurs in one of the axes 1 to 14. 1. Motion setting parameter setting error (See IB□□001.) 2. Alarm occurrence (See IL□□22.) 3. Motion command abnormal end (When IB□□155 = ON)
	Error	The following error occurs in one of the axes 1 to 14. Motion fixed parameter setting error (See IB□□002.)

■ LED Indicator 2

The TRX indicator displays the communications status of the SVB-01 Module.

Indicator Name	Indicator Color	Meaning When Indicator Is Lit
TRX	Green	Transmission enabled

■ MECHATROLINK Connector



The MECHATROLINK connector is used to connect an SVB-01 Module and SERVOPACK and IO350 unit using MECHATROLINK cables (JEPMC-W6000-A3 or JEPMC-W6000-01).

■ Connector Specifications

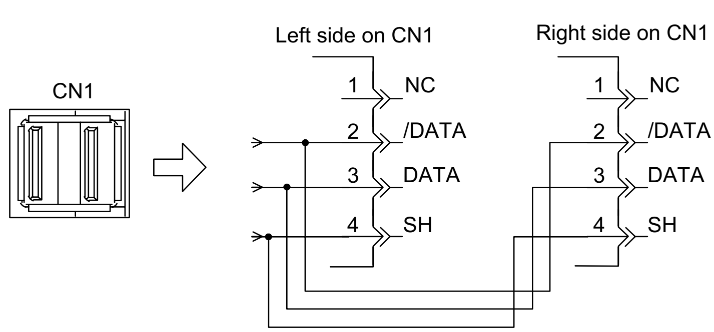
The following table shows the specifications of the connector used to connect the SVB-01 Module.

Name	Connector Name	Number of Pins	Connector			Cable
			On Module	On Cable	Manufacturer	
MECHATR-OLINK Connector	CN1	4	DUSB-APA42-T11	USB-USB connector boby: DUSB-APA41-B1-C50	DDK	JEPMC-W6000-A3
				USB-Loose wires connector boby: DUSB-APA41-B1-C50	DDK	JEPMC-W6010-01 JEPMC-W6010-03 JEPMC-W6010-05
				USB terminator connector boby: DUSB-APA41-B1-C50	DDK	JEPMC-W6020

■ CN1 Connections

The connector ports on the right and left sides of the CN1 are the same. Use either the left or rigth port.

Insert an USB terminator JEPMC-W6020 in the unused port.

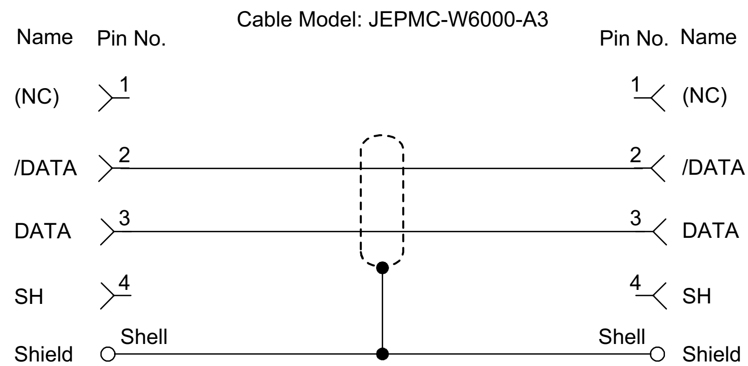


IMPORTANT

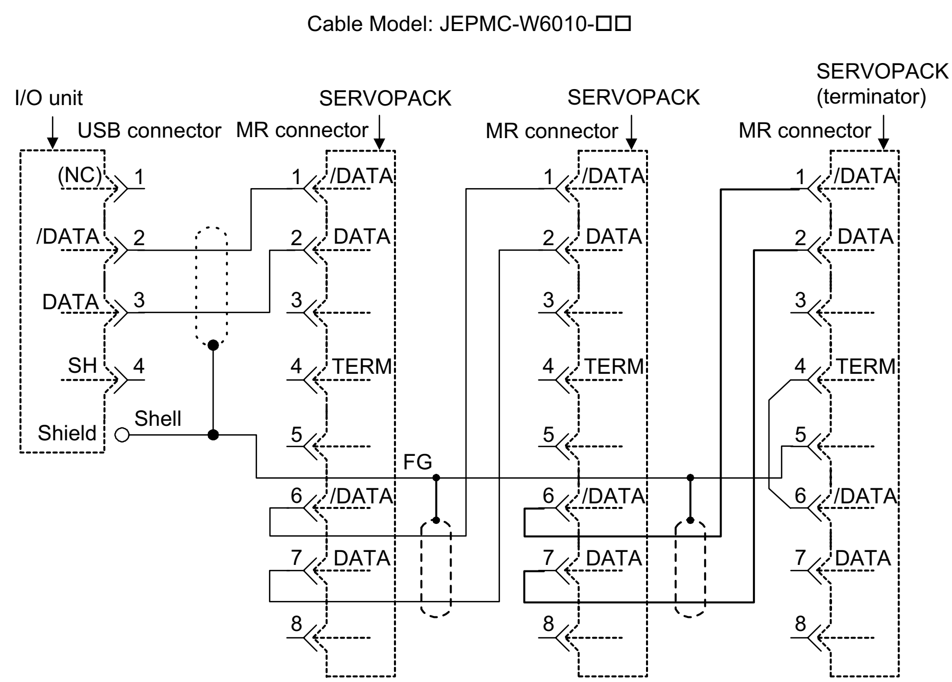
The SVB-01 Module has MECHATROLINK port for one channel. Two ports are provided on the CN1 MECHATROLINK connector, however, these two ports are the same as shown in the figure above.

■ Cable Connection Diagram

The following figure shows the cable internal connection between the SVB-01 Module and the IO350 I/O unit.



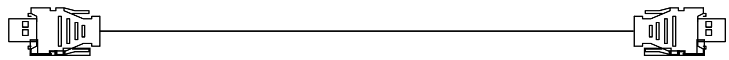
The connections when one SVB-01 Module is connected to multiple SERVOPACKs (1: N transmission) using MECHATROLINK cables is shown below.



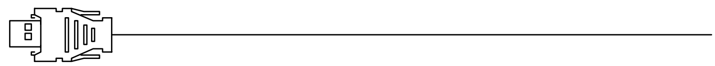
Note: 1. The JEPMC-6010-□□ cable has a USB connector on one end and loose wires on the other end. The customer must assemble the cable for 1: N connection using the appropriate MR connectors and wires.
2. Red lead: DATA
Black lead: /DATA
3. The shield can be connected according to the instructions given in the corresponding SERVOPACK manual. However, the connection shown above is recommended when connecting MP900-series Machine Controllers.

MECHATROLINK Cable Appearance

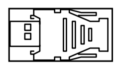
Model: JEPMC-W6000-A3



Model: JEPMC-W6010-□□



Model: JEPMC-W6010-□□



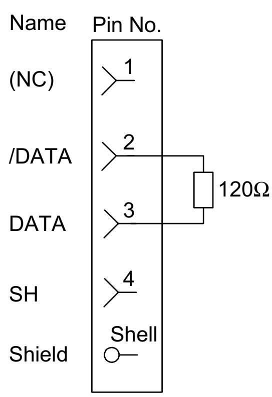
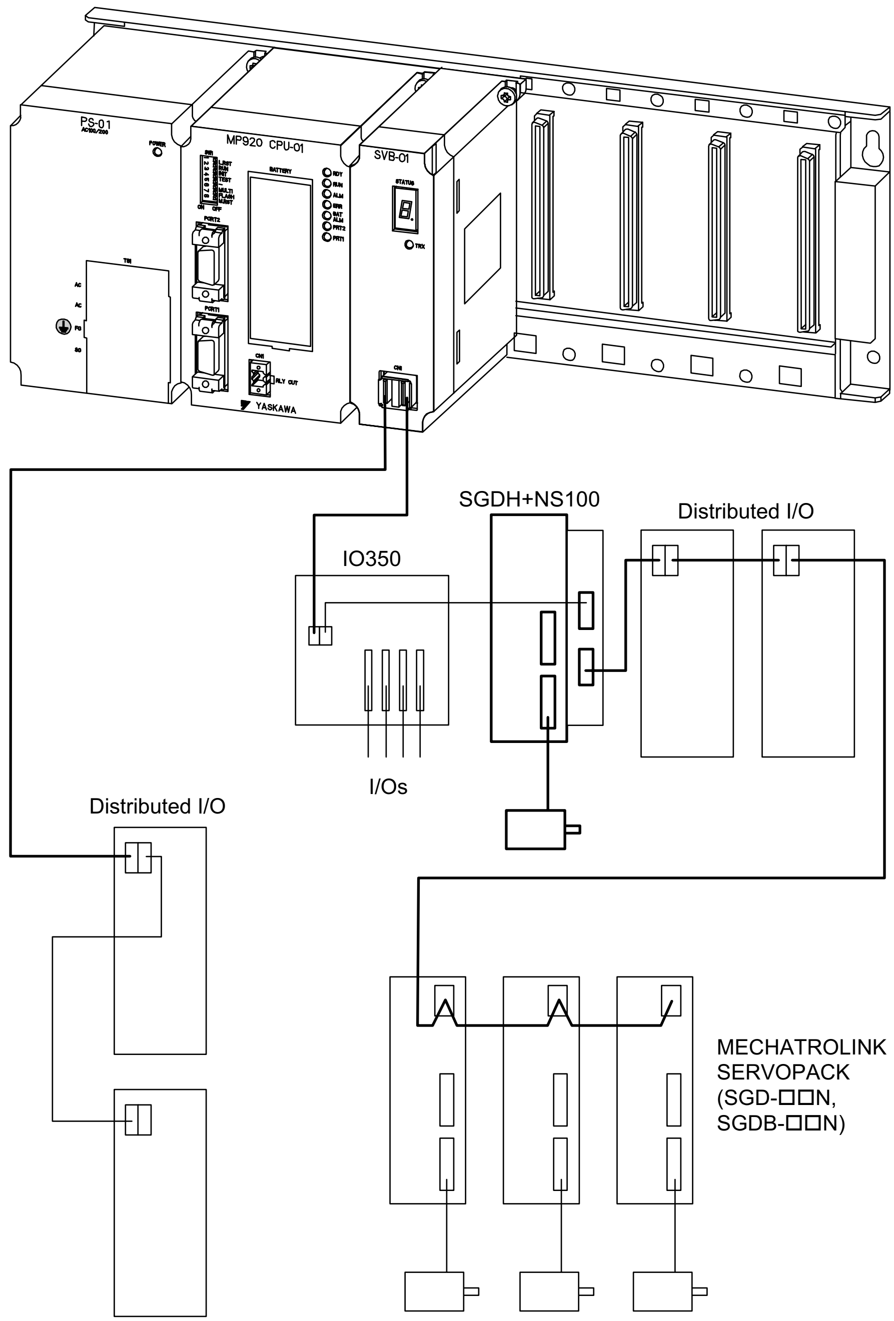


Fig. 5.2 USB Terminator Connection Diagram

■ SVB-01 System Configuration

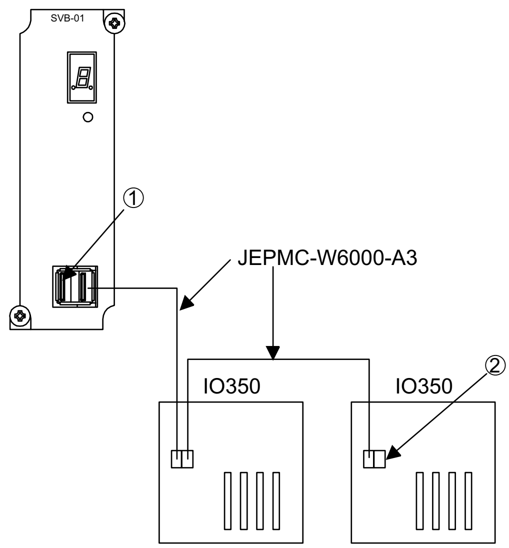


IMPORTANT

The SVB-01 Module has a MECHATROLINK port for one channel. Two ports are provided on the MECHATROLINK connector, however these two ports are the same. Only one of these ports can be used to connect 14 stations maximum.

■ SVB-01 Module Connections

Connecting IO350 Units to an SVB-01 Module

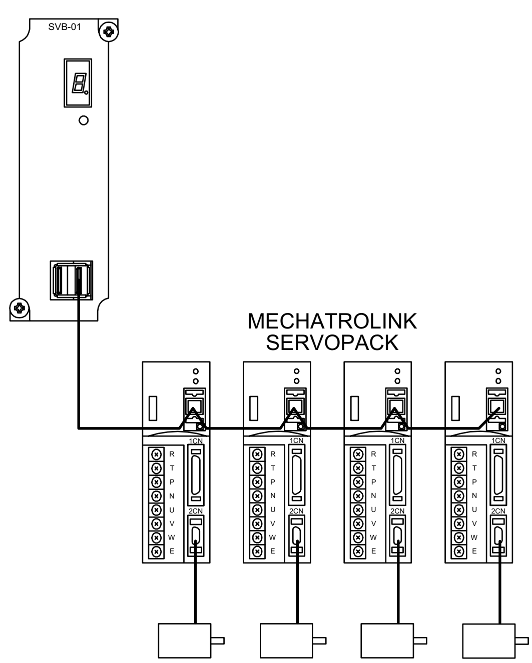


- Use the standard cable JEPMC-W6000-A3 for connection between the SVB-01 Module and IO350 unit and between IO350 units.

IMPORTANT

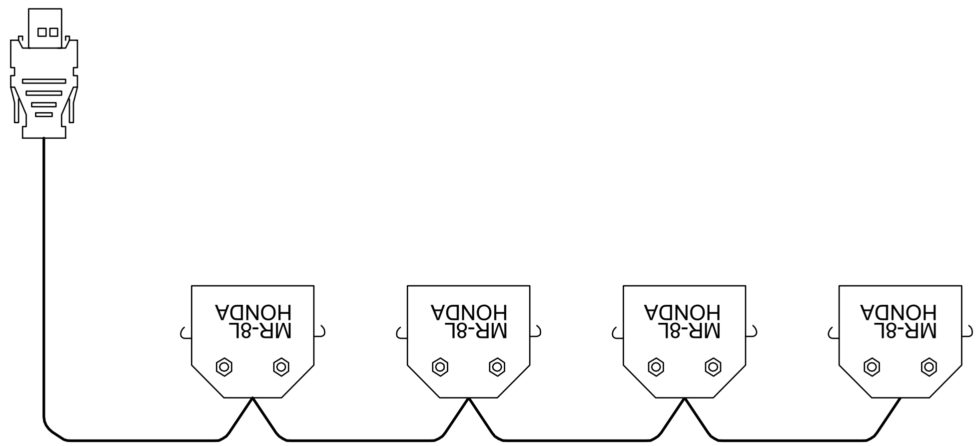
Be sure to insert USB terminators JEPMC-W6020 on the connectors on both ends of the line (① and ② in the above figure).
Refer to ■*Cables* for the connector and cable appearance and internal connection diagram.

Connecting MECHATROLINK SERVOPACKs to an SVB-01 Module



5

Assemble the cables for connection between the SVB-01 Module and MECHATROLINK SERVOPACK and between MECHATROLINK SERVOPACKs using the standard cable JEPMC-W6010-□□ and appropriate MR connectors and wires.



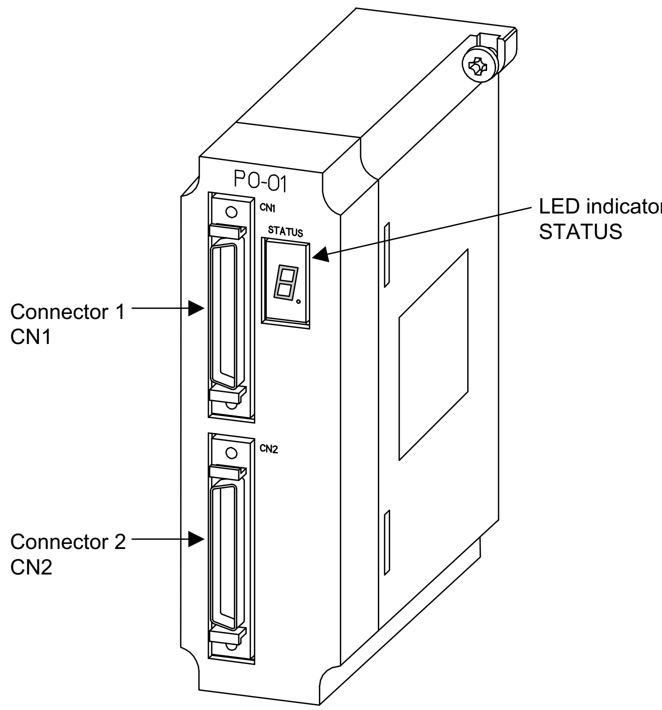
Refer to ■*Connection and External View of Standard Cables* in *6.1.2 Handling* of *Machine Controller MP920 User's Manual: Motion Module* (SIEZ-C887-2.5) for the cable appearance and internal connection diagram.

The following table lists the slave modules that can be connected to the SVB-01 Module.

Slave Module Type	Name	Model
Servo Drives Applicable for MECHATROLINK	Σ Series SGD Servodrive	SGD-□□□N
	Σ Series SGDB Servodrive	SGDB-□□□N
	Σ Series SGDH Servodrive	SGDH-□□□E + JUSP-NS100
Digital I/O Module	64-point I/O	JEPMC-IO350
	16-point I/O	87816-1100X
	Wide-range Voltage 8-point Output	JAMSC-120DRA83030
	100-VAC 8-point Input	JAMSC-120DAI53330
	200 VAC 8-point Input	JAMSC-120DAI73330
	12/24-VDC 16-point Input	JAMSC-120DDI34330
	12/24-VDC 16-point Output	JAMSC-120DDO34340
	100/200-VAC 8-point Output	JAMSC-120DAO83330
	Wild Card I/O	
Analog I/O Module	Analog Voltage ±10 V Input	JAMSC-120AVI02030
	Analog Voltage ±10 V Output	JAMSC-120AVO01030
Advanced-function Module	Reversible Counter with Preset Function	JAMSC-120EHC21140
	Pulse MC	JAMSC-120MMB20230
PLC Module	MP940 (For MECHATROLINK)	JEPMC-MC400
	MP940D (For DeviceNet)	JEPMC-MC410

5.5.4 Pulse Output Module (PO-01)

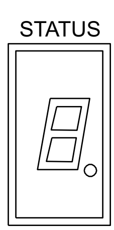
The following illustration shows the appearance of the PO-01 Pulse Output Module.



The details of each part of the PO-01 Module are described below.

■ LED Indicator

The STATUS indicator is a 7-segment LED indicator that displays the RUN/error status of the PO-01 Module.



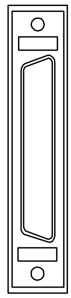
The table below shows the LED indicator display patterns.

Display	Category	Meaning
	Hardware reset	The PO-01 Module is in hardware reset status.
	Initializing	This display appears one to six seconds after the PO-01 Module is turned ON or reset.

(cont'd)

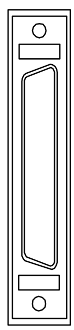
Display		Category	Meaning
1 2 3 4 5 6 7 8 9 A b C d E r y		Normal operation	One of Module numbers 1 to 16 will be displayed. The Module is operating normally and there is no error or alarm.
F or F. followed by error code		Serious fault	A two-digit error code appears following F. Examples: F → 0 → 1: Watchdog timeout error F → 0 → 2: Synchronization error F → 4 → 1: ROM diagnostic error F → 4 → 2: RAM diagnostic error F → 4 → 3: Shared memory diagnostic error F → 4 → 4: Built-in CPU timer diagnostic error F → 4 → 5: JL-035 diagnostic error F → 4 → 8: Illegal general instruction interrupt F → 4 → 9: Illegal slot instruction interrupt F → 5 → 0: CPU address error interrupt F → 5 → 1: DMA address error interrupt F → 5 → 2: User break interrupt F → 5 → 3: Trap instruction interrupt F → 5 → 4: UPD71054 diagnostic error
J	Axis 1	Alarm	1. Motion setting parameter setting error (See IB□□001.) 2. Alarm occurrence (See IL□□22.) 3. Motion command abnormal end (When IB□□155 = ON)
L	Axis 2		
n	Axis 3	Error	Motion fixed parameter setting error (See IB□□002.)
U	Axis 4		
P		Other CPU operation stop	Some other module is stopped. For example, check whether the CPU Module is stopped.

■ Connector 1



The connector 1 (CN1) is used to connect the PO-01 Module and the pulse motor drivers for 2 axes.
CN1: Axis 1 and Axis 2
Use the following cable.
- JEPMC-W6060-□□

■ Connector 2



The connector 2 (CN2) is used to connect the PO-01 Module and the pulse motor drivers for 2 axes.
CN2: Axis 3 and Axis 4
Use the following cable.
JEPMC-W6060-□□

■ Pulse Interface Connector Specifications

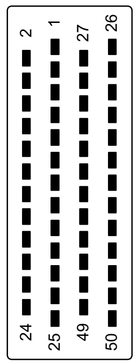
The following table shows the specifications of the connectors used to connect the PO-01 Module.

Name	Connector Name	No. of Pins	Connector			Cable
			On Module	On Cable	Manufacturer	
Pulse Interface Connector	CN1 CN2	50	10250-52A2JL	• Connector body: 10150-3000VE • Shell: 10350-52A0-008 (Screw lock) 10350-52F0-008 (One-touch lock)	3M	JEPMC-W6060-05 JEPMC-W6060-10 JEPMC-W6060-30

■ Connector Pin Layout (CN1)

The pin layout of the CN1 connector is as follows:

CN1 50-pin Connector



Pin Layout on Wiring Side

2	CW1+	1	NC	27	CCW1+ (sign+)	26	NC
4	PO_0V	3	CW1-	29	PO_0V	28	CCW1- (Sign)
6	DI1_0- (24 V)	5	DI1_0+	31	DO1_0	30	NC
8	DI1_1	7	DI1_0- (5/12 V)	33	DO1_1	32	DO1_0 (with resistor)
10	DI1_3	9	DI1_2	35	DO1_2	34	DO1_1 (with resistor)
12	NC	11	DI1_4	37	NC	36	DO1_3
14	CW2-	13	CW2+	39	CCW2- (sign-)	38	CCW2+ (sign-)
16	DI2_0+	15	PO_0V	41	NC	40	PO_0V
18	DI2_0- (5/12 V)	17	DI2_0- (24 V)	43	DO2_0 (with resistor)	42	DO2_0
20	DI2_2	19	DI2_1	45	DO2_1 (with resistor)	44	DO2_1
22	DI2_4	21	DI2_3	47	DO2_3	46	DO2_2
24	0V_1	23	24 V_1	49	0V_1	48	24V_1
		25	NC			50	NC

The following table shows the name and function of the CN1 connector pins.

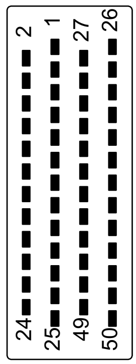
Pin No.	Signal Name	Function	Pin No.	Signal Name	Function
1	NC		26	NC	
2	CW1+	CH1 CW output (+)	27	CCW1+ (sign+)	CH1 CW (sign) output (+)
3	CW1-	CH1 CW output (-)	28	CCW1- (sign-)	CH1 CW (sign) output (-)
4	PO_0V	Common with Module 0 V	29	PO_0V	Common with Module 0 V
5	DI1_0+	CH1 input _0 (+)	30	NC	
6	DI1_0- (24V)	CH1 input _0 (-) 24 V	31	DO1_0	CH1 DO output _0
7	DI1_0- (5/12V)	CH1 input _0 (-) 5 V/12 V	32	DO1_0- (with resistor)	CH1 DO output _0 (with 1.5 kΩ)
8	DI1_1	CH1 input _1	33	DO1_1	CH1 DO output _1
9	DI1_2	CH1 input _2	34	DO1_1 (with resistor)	CH1 DO output _1 (with 1.5 kΩ)
10	DI1_3	CH1 input _3	35	DO1_2	CH1 DO output _2
11	DI1_4	CH1 input _4 (Emergency stop)	36	DO1_3	CH1 DO output _3
12	NC		37	NC	
13	CW2+	CH2 CW output (+)	38	CCW2+ (sign+)	CH2 CW (sign) output (+)
14	CW2-	CH2 CW output (-)	39	CCW2- (sign-)	CH2 CW (sign) output (-)
15	PO_0V	Common with Module 0 V	40	PO_0V	Common with Module 0 V
16	DI2_0+	CH2 input _0 (+)	41	NC	
17	DI2_0- (24V)	CH2 input _0 (-) 24 V	42	DO2_0	CH2 DO output _0
18	DI2_0- (5/12V)	CH2 input _0 (-) 5 V/12 V	43	DO2_0 (with resistor)	CH2 DO ourput _0 (with 1.5 kΩ)
19	DI2_1	CH2 input _1	44	DO2_1	CH2 DO output _1
20	DI2_2	CH2 input _2	45	DO2_1- (with resistor)	CH2 DO output _1 (with 1.5 kΩ)
21	DI2_3	CH2 input _3	46	DO2_2	CH2 DO output _2
22	DI2_4	CH2 input _4 (Emergency stop)	47	DO2_3	CH2 DO output _3
23	24V_1	I/O power supply input (24 V)	48	24V_1	I/O power supply input (24 V)
24	0V_1	I/O power supply input (0 V)	49	0V_1	I/O power supply input (0 V)
25	NC		50	NC	

5

■ Connector Pin Layout (CN2)

The pin layout of the CN2 connector is as follows:

CN2 50-pin Connector



Pin Layout on Wiring Side

2	CW3+	1	NC	27	CCW3+ (sign+)	26	NC
4	PO_0V	3	CW3-	29	PO_0V	28	CCW3- (Sign-)
6	DI3_0- (24 V)	5	DI3_0+	31	DO3_0	30	NC
8	DI3_1	7	DI3_0- (5/12V)	33	DO3_1	32	DO3_0 (with resistor)
10	DI3_3	9	DI3_2	35	DO3_2	34	DO3_1 (with resistor)
12	NC	11	DI3_4	37	NC	36	DO3_3
14	CW4-	13	CW4+	39	CCW4- (sign-)	38	CCW4+ (with resistor)
16	DI4_0+	15	PO_0V	41	NC	40	PO_0V
18	DI4_0- (5/12 V)	17	DI4_0-	43	DO4_0 (with resistor)	42	DO4_0
20	DI4_2	19	DI4_1	45	DO4_1 (with resistor)	44	DO4_1
22	DI4_4	21	DI4_3	47	DO4_3	46	DO4_2
24	0V_2	23	24V_2	49	0V_2	48	24V_2
		25	NC			50	NC

The table below shows the name and function of the CN2 connector pins.

Pin No.	Signal Name	Function	Pin No.	Signal Name	Function
1	NC		26	NC	
2	CW3+	CH3 CW output (+)	27	CCW3+ (sign+)	CH3 CCW (sign) output (+)
3	CW3-	CH3 CW output (-)	28	CCW3- (sign-)	CH3 CCW (sign) output (-)
4	PO_0V	Common with Module 0 V	29	PO_0V	Common with Module 0 V
5	DI3_0+	CH3 input _0 (+)	30	NC	
6	DI3_0- (24V)	CH3 input _0 (-) 24 V	31	DO3_0	CH3 DO output _0
7	DI3_0- (5/12V)	CH3 input _0 (-) 5 V/12 V	32	DO3_0- (with resistor)	CH3 DO output _0 (with 1.5 kΩ)
8	DI3_1	CH3 input _1	33	DO3_1	CH3 DO output _1
9	DI3_2	CH3 input _2	34	DO3_1 (with resistor)	CH3 DO output _1 (with 1.5 kΩ)
10	DI3_3	CH3 input _3	35	DO3_2	CH3 DO output _2
11	DI3_4	CH3 input _4 (Emergency stop)	36	DO3_3	CH3 DO output _3
12	NC		37	NC	
13	CW4+	CH4 CW output (+)	38	CCW4+ (sign+)	CH4 CCW (sign) output (+)
14	CW4-	CH4 CW output (-)	39	CCW4- (sign-)	CH4 CCW (sign) output (-)
15	PO_0V	Common with Module 0 V	40	PO_0V	Common with Module 0 V
16	DI4_0+	CH4 input _0 (+)	41	NC	
17	DI4_0- (24V)	CH4 input _0 (-) 24 V	42	DO4_0	CH4 DO output _0
18	DI4_0- (5/12V)	CH4 input _0 (-) 5 V/12 V	43	DO4_0 (with resistor)	CH4 DO output _0 (with 1.5 kΩ)
19	DI4_1	CH4 input _1	44	DO4_1	CH4 DO output _1
20	DI4_2	CH4 input _2	45	DO4_1 (with resistor)	CH4 DO output _1 (with 1.5 kΩ)
21	DI4_3	CH4 input _3	46	DO4_2	CH4 DO output _2
22	DI4_4	CH4 input _4 (Emergency stop)	47	DO4_3	CH4 DO output _3
23	24V_2	I/O power supply input (24 V)	48	24V_2	I/O power supply input (24 V)
24	0V_2	I/O power supply input (0 V)	49	0V_2	I/O power supply input (0 V)
25	NC		50	NC	

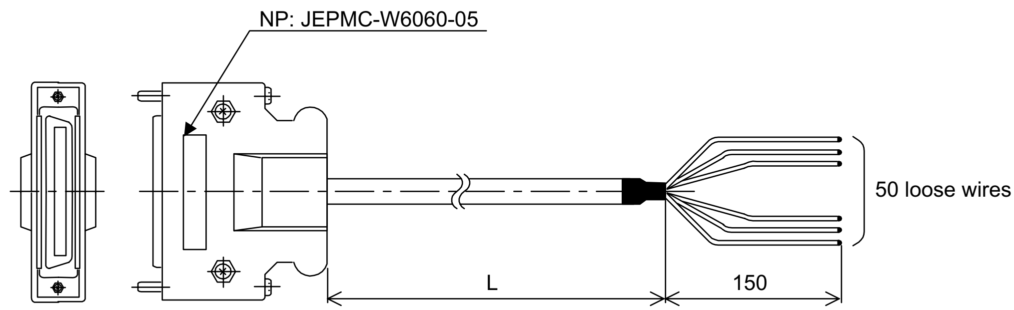
5

■ External I/O Cables

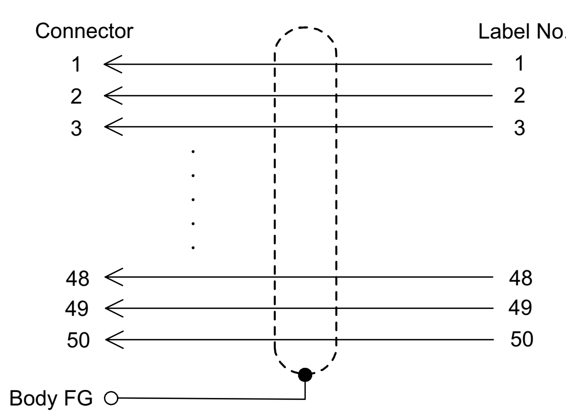
Models

JEPMC-W6060-05: 0.5 m
JEPMC-W6060-10: 1.0 m
JEPMC-W6060-30: 3.0 m

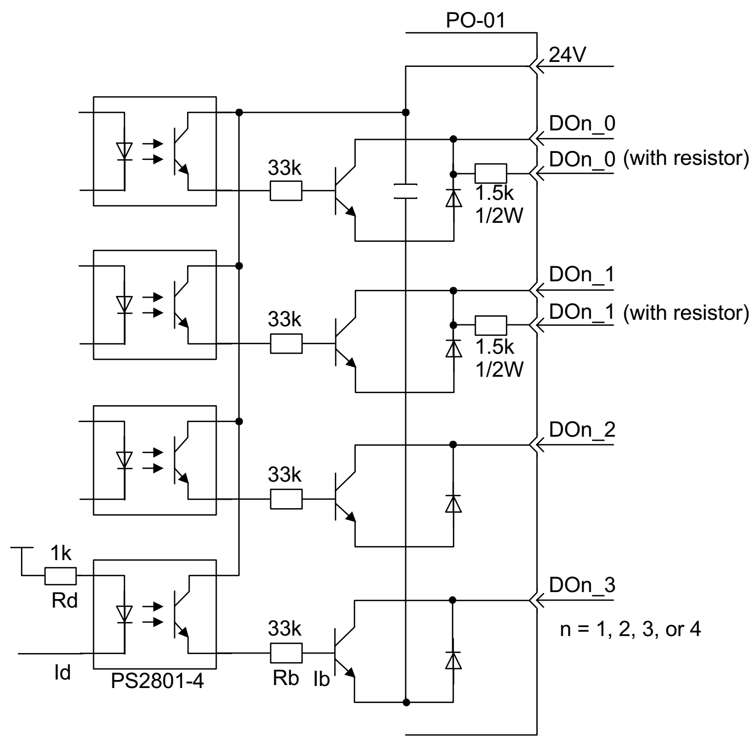
Appearance



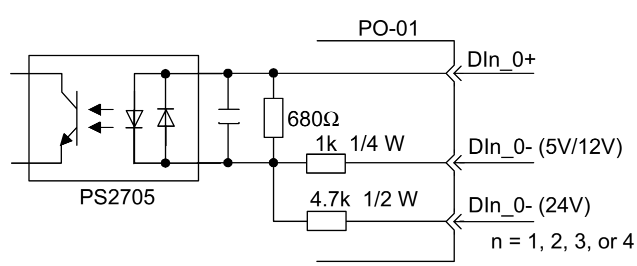
Cable Connection Diagram



■ DO Output Circuit



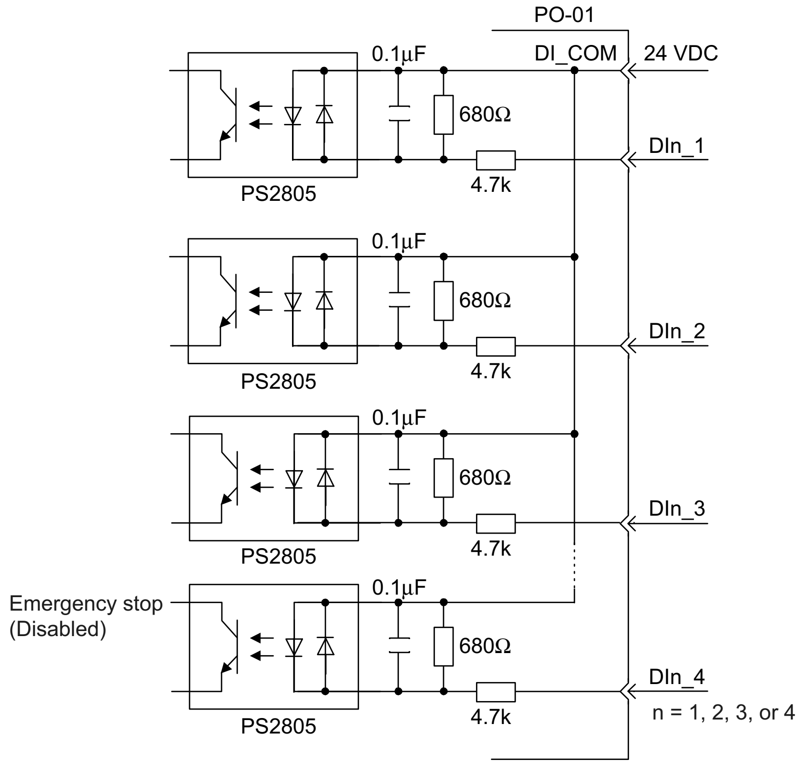
■ DI Input Circuit (DIn_0)



INFO

The DIn-0 input circuit is isolated from the circuits of DIn-1 to DIn-4.

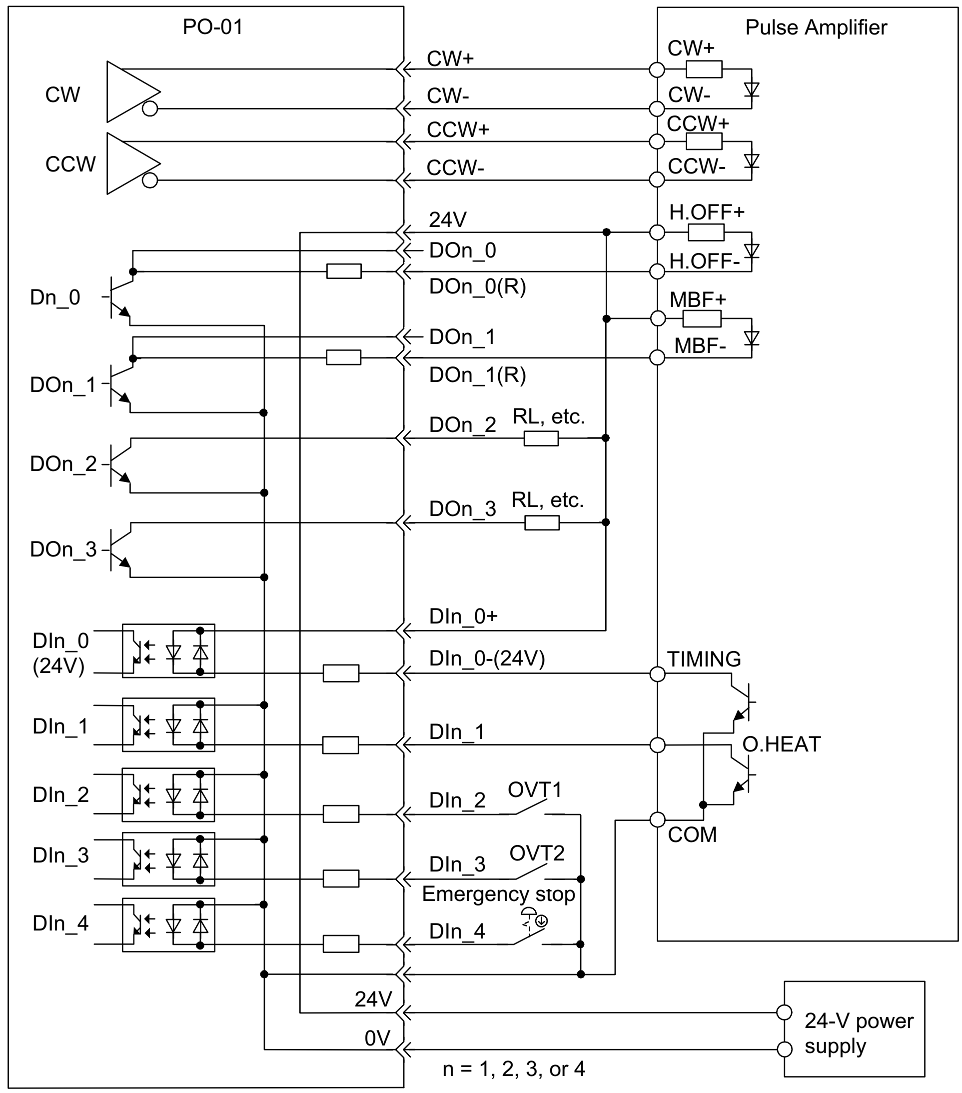
■ DI Input Circuits (DIn_1 to DIn_4)



INFO

The positive (+) side (DI_COM) of the DIn_1 to DIn_4 is connected to 24 V.

■ PO-01 Module Connection Example



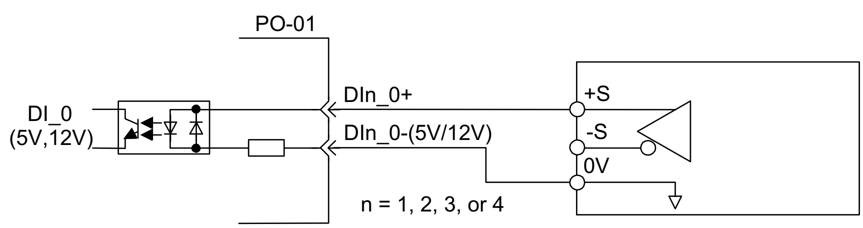
5

■ DIn_0 Application Examples

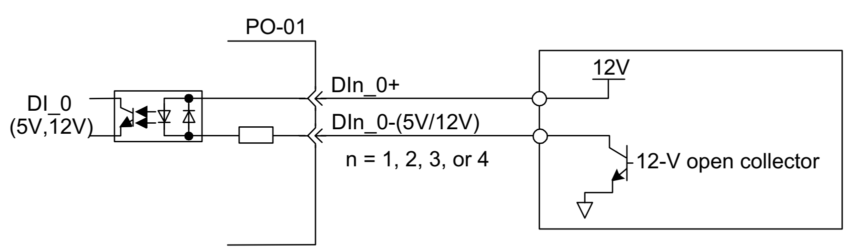
The DIn_0 can be used with not only 24 V but also 5-V differential input and 12-V open-collector input.

The application examples are shown below.

5-V Differential Input



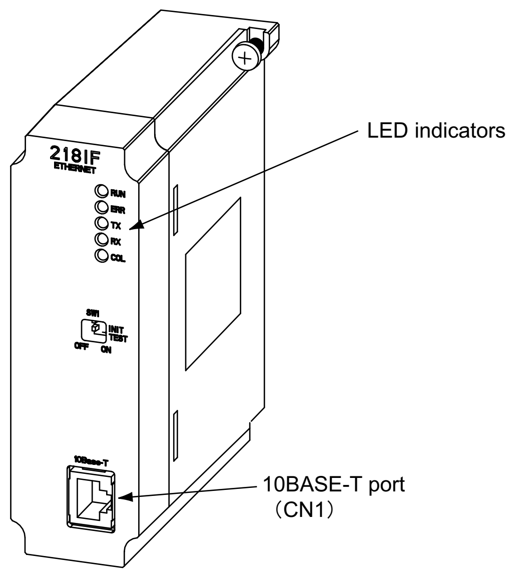
12-V Open-collector Input



5.6 Communications Modules

5.6.1 218 I/F Communications Module (218IFA)

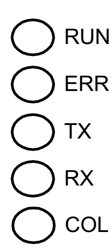
The following illustration shows the appearance of the 218IFA Communications Module.



The details of each part of the 218IFA Module are described below.

■ LED Indicators

While the 218IFA Module is operating normally, the RUN LED indicator is lit and the ERR LED indicator is unlit. When a failure occurs, the RUN lights off and the ERR lights up or blinks. The TX or RX LED indicator is lit while the 218IFA Module is sending or receiving data.



Indicator	Name	Color	Status When Lit
RUN	RUN	Green	Normally operating
ERR	ERROR	Red	Failure occurrence (lights or blinks)
TX	218TX	Green	218IFA sending data
RX	218RX	Green	218IFA receiving data
COL	COLLISION	Green	218IFA collision detected

The LED indicators indicate error or failure occurred in the Module as shown below.

LED Indicators When Error/Failure Occurs

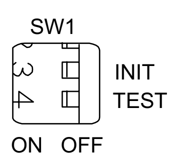
Error/Failure	Details of Error/Failure	LED Indicators			
		RUN	ERR	TX	RX
PROM checksum error	PROM checksum error was detected during online self-diagnosis.	Unlit	Blinking (1)	Depends on the conditions.	
SRAM error in Module	A hardware fault was detected during online self-diagnosis.	Unlit	Blinking (2)	Unlit	Unlit
CPU interface error	An error in the data transmission with CPU was detected during online self-diagnosis.	Unlit	Blinking (3)	Unlit	Unlit
Transmission error	Transmission data error	Lit	Lit	Depends on the conditions.	
Watchdog timeout error	Watchdog timeout	Unlit	Lit	Depends on the conditions.	

Note: The number in parentheses ( ) indicates the number of blinkings.

■ DIP Switch (SW1)

The SW1 is used for self-diagnosis.

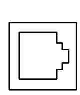
All the pins are set by default to OFF (to the right).



Pins	Name	Setting	Operation
–	Unused		
–	Unused		
INIT	Initial startup	ON	Starts up with the default IP address and engineering port number.*
		OFF	Starts up with the IP address and engineering port number set on MPE720.
TEST	TEST	ON	Executes self-diagnosis when started with this pin set to ON.
		OFF	

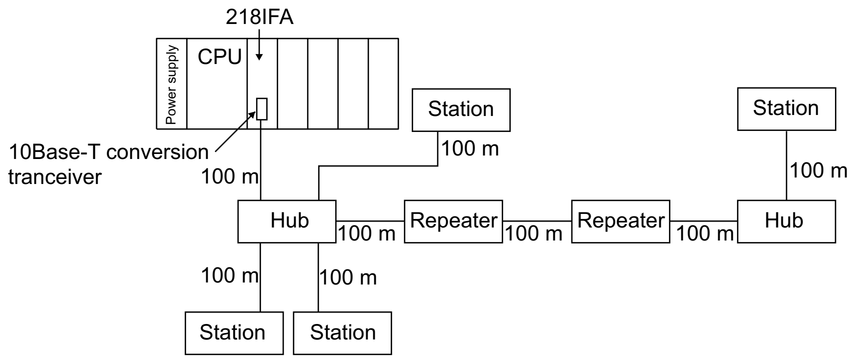
* Default IP address: 192.168.1.1
Default engineering port number: 10000 (UDP)
At the initial start up, the 218IFA Module can use only engineering communications function with MPE720.

■ 10BASE -T Port (CN1)



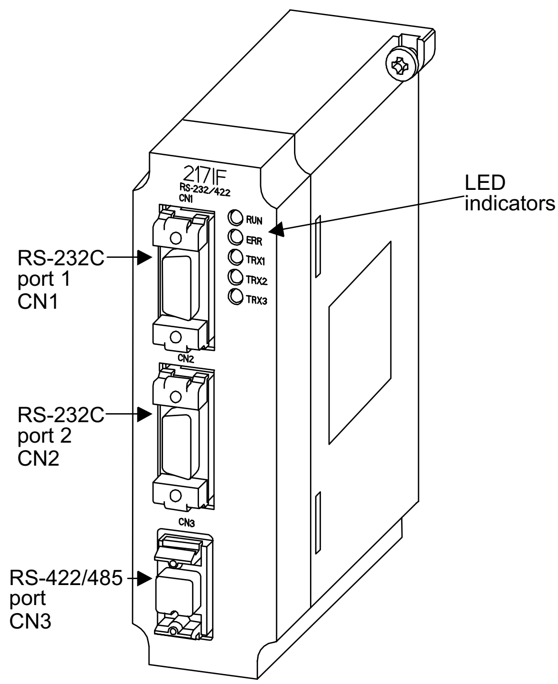
The CN1 is used to connect the 218IFA Module and the 10Base-T Ethernet.
No standard cable available

■ Connection to Ethernet



5.6.2 217 I/F Communications Module (217IF)

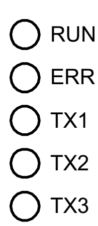
The following illustration shows the appearance of the 217IF Communications Module.



The details of each part of the 217IF Module are described below.

■ LED Indicators

While the 217IF Module is operating normally, the RUN LED indicator is lit and the ERR LED indicator is unlit. When a failure occurs, the RUN lights off and the ERR lights up or blinks. The TX1, TX2, or TX3 LED indicator is lit while the corresponding port is transmitting data.



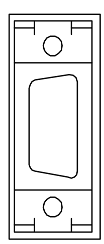
Indicator	Name	Color	Status When Lit
RUN	RUN	Green	Normally operating
ERR	ERROR	Red	Failure occurrence (lights/ blinks)
TX1	CN1TX/RX	Green	217IF CN1 transmitting data
TX2	CN2TX/RX	Green	217IF CN2 transmitting data
TX3	CN3TX/RX	Green	217IF CN3 transmitting data

The LED indicators indicate error or failure occurred in the Module as shown below.

Error/Failure	Details of Error/Failure	LED Indicators			
		RUN	ERR	TX	RX
PROM checksum error	PROM checksum error was detected during online self-diagnosis.	Unlit	Blinking (1)	Depends on the conditions.	
SRAM error in Module	A hardware fault was detected during online self-diagnosis.	Unlit	Blinking (2)	Unlit	Unlit
CPU interface error	An error in the data transmission with CPU was detected during self-diagnosis.	Unlit	Blinking (3)	Unlit	Unlit
Transmission error	Transmission data error	Lit	Lit	Depends on the conditions.	
Watchdog timeout error	Watchdog timeout	Unlit	Lit	Depends on the conditions.	

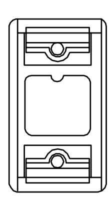
Note: The number in parentheses ( ) indicates the number of blinkings.

■ RS-232C Ports 1 and 2 (CN1 and CN2)



The CN1 and CN2 are used to connect devices with RS-232C interface.
No standard cable available.

■ RS-422/485 Port (CN3)

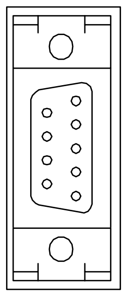


The CN3 is used to connect a device with RS-422 or RS-485 interface.
No standard cable available.

■ Specifications of RS-232C Ports 1 and 2 (CN1 and CN2)

The following table shows the name and function of the CN1/CN2 connector pins.

Table 5.5 RS-232 Ports (CN1 and CN2)



Pin No.	Signal Name	Function	Pin No.	Signal Name	Function
1	FG	Protective grounding	6	DSR	Data set ready
2	SD	Send data	7	SG	Signal grounding (0 V)
3	RD	Receive data	8	N.C	Not connected
4	RS	Request to send	9	DTR	Data
5	CS	Ready to send			

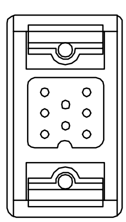
For the connector on the Module, D-sub 9-pin female connector 17LE-13090-27 (D2BC) manufactured by DDK Ltd. is used.

Use a D-sub 9-pin male connector 17JE-23090-02 (D8B) manufactured by DDK Ltd. for the cable-end connector.

■ Specifications of RS-422/485 Port (CN3)

The following table shows the name and function of the CN3 connector pins.

Table 5.6 RS-422/485 Port (CN3)



Pin No.	Signal Name	Function	Pin No.	Signal Name	Function
1	RX (-)	Receive data (-)	5	TRX (+)	*
2	RX (+)	Receive data (+)	6	TX (-)	Send data (-)
3	N.C	Not connected	7	TX (+)	Send data (+)
4	RXR (+)	*	8	SG	Signal grounding

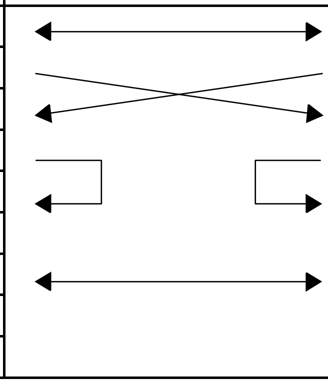
* A terminator is provided on the positive (+) polarity side.

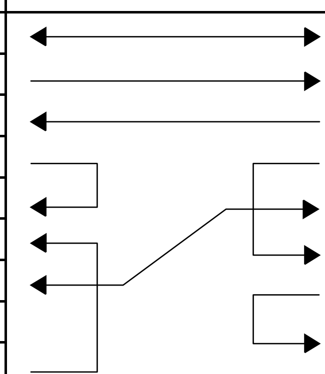
For the connector on the Module, MR-8RFA4 (G) manufactured by Honda Tsushin Kogyo Co., Ltd. is used.

Use an MR-8M (G) (case: MR-8L) connector for the cable-end connector.

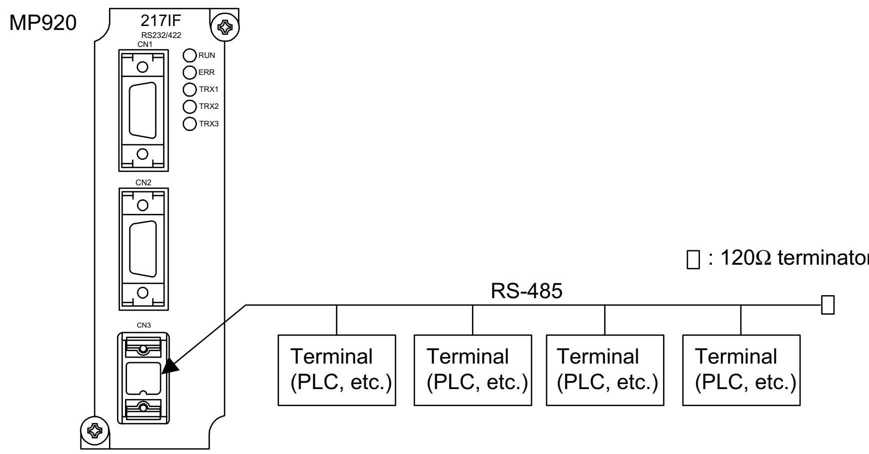
■ RS-232C Port Connection Example

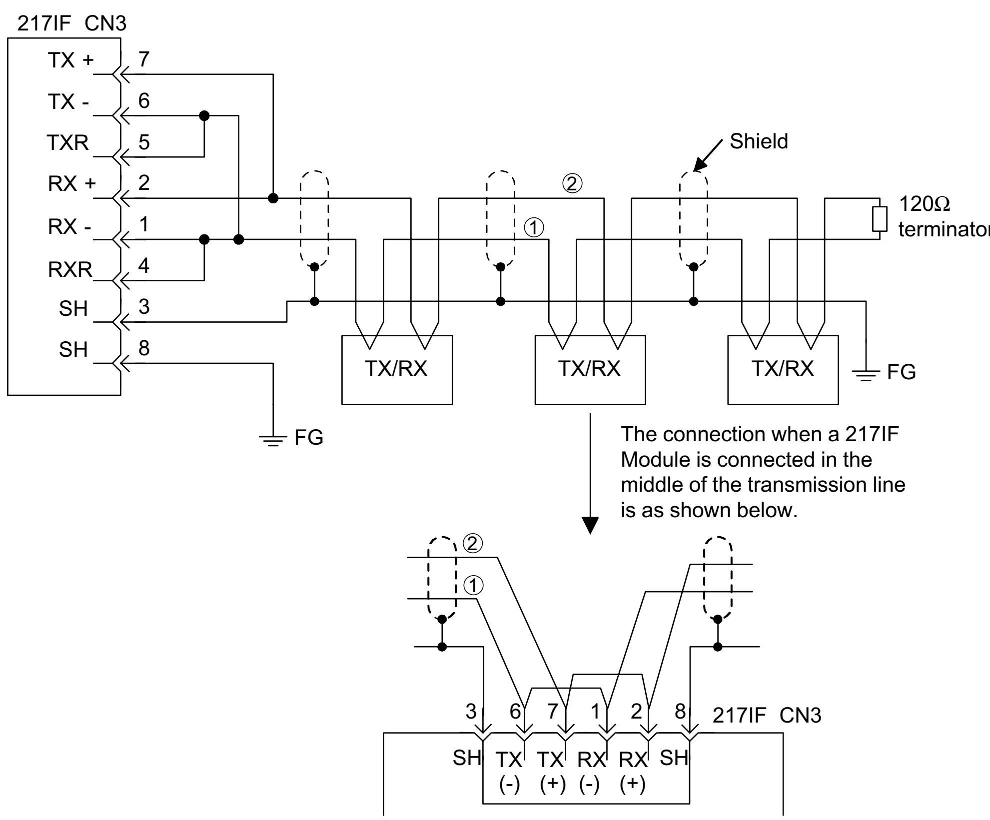
Table 5.7 217IF Module RS-232C Transmission Line Connection

MP920 217IF (CN1, CN2)		Cable Connection and Signal Direction	Remote Station (D-sub 9-pin) (Yaskawa specifications)	
Signal Name	Pin No.		Pin No.	Signal Name
FG	1		1	FG
SD (TXD)	2		2	SD (TXD)
RD (RXD)	3		3	RD (RXD)
RS	4		4	RS
CS (CTS)	5		5	CS
DR (DSR)	6		6	DR (DSR)
SG	7		7	SG
CD	8		8	CD
ER (DTR)	9		9	ERC(DTR)

MP920 217IF (CN1)		Cable Connection and Signal Direction	DOS/V Personal Computer	
Signal Name	Pin No.		Pin No.	Signal Name
FG	1		1	FG
SD (TXD)	2		2	RD (RXD)
RD (RXD)	3		3	SD (TXD)
RS	4		4	DTR
CS (CTS)	5		5	GND
DR (DSR)	6		6	DSR (DR)
SG	7		7	RTS
CD	8		8	CTS
ER (DTR)	9		9	–

■ RS-485 Port Connection Example



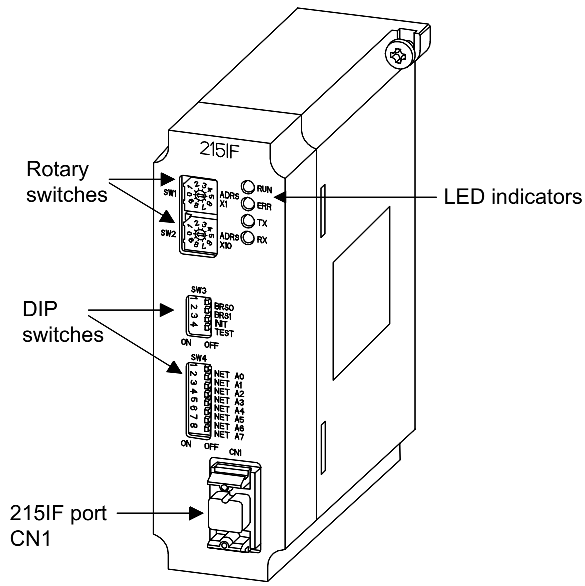


Note: 1. With the CN3 interface, the terminator is enabled by connecting pins 5 and 6 and pins 1 and 4.

2. Connect the FG of the 217IF CN3 to the FG terminal of the Power Supply Module using a lead wire.

5.6.3 215IF Communications Module (215IF)

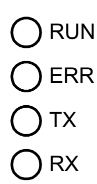
The following illustration shows the appearance of the 215IF Communications Module.



The details of each part of the 215IF Module are described below.

■ LED Indicators

While the 215IF Module is operating normally, the RUN LED indicator is lit and the ERR LED indicator is unlit. When a failure occurs, the RUN lights off and the ERR lights up or blinks. The TX or RX LED indicator is lit while the 215IF Module is sending or receiving data.



Indicator	Name	Color	Status When Lit
RUN	RUN	Green	Normally operating
ERR	ERROR	Red	Failure occurrence (lights or blinks)
TX	215 TX	Green	215IF sending data
RX	215 RX	Green	215IF receiving data

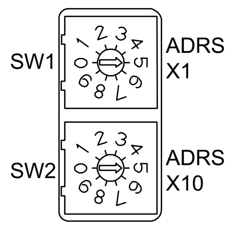
The LED indicators indicate error or failure occurred in the Module as shown below.

Error/Failure	Details of Error/Failure	LED Indicators			
		RUN	ERR	TX	RX
PROM checksum error	PROM checksum error was detected during online self-diagnosis.	Unlit	Blinking (1)	Unlit	Unlit
Hardware error in Module	A hardware failure was detected during online self-diagnosis.	Unlit	Blinking (2)	Unlit	Unlit
CPU interface error	A data transmission error with the CPU was detected during online self-diagnosis.	Unlit	Blinking (3)	Unlit	Unlit
Transmission error	A transmission error was detected.	Lit	Lit	Lit	Lit
Watchdog timeout error	Watchdog timeout	Unlit	Lit	Unlit	Unlit

Note: The number in parentheses ( ) indicates the number of blinkings.

■ Rotary Switches

The SW1 and SW2 are used to set the station address on the 215IF transmission. The SW1 sets the 1s digit (×1) and the SW2 sets the 10s digit (×10). Set a station address between 1 and 64. The SW1 and SW2 are valid only when the INIT of SW3 is set to ON.

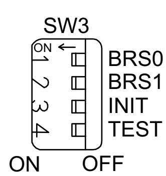


Indicator	Name	Setting	Function
ADRS × 1	ADDRESS × 1	0 to 6	Sets the station address 1s digit.
ADRS × 10	ADDRESS × 10	0 to 6	Sets the station address 10s digit.

■ DIP Switch (SW3)

The SW3 is used to set the operation mode such as transmission speed and self-diagnosis.

All the pins of SW3 are set by default to OFF (to the right).



<table>
<tr><th>Pins</th><th>Name</th><th>Setting</th><th>Operation</th></tr>
<tr><td rowspan="2">BRS0</td><td rowspan="2">Baud Rate Select 0</td><td>ON</td><td rowspan="4">Transmission speed setting
(Valid only when the INIT is set to ON)
<table><tr><td>Transmission speed (bps)</td><td>4M</td><td>2M</td><td>1M</td><td>–</td></tr><tr><td>BRS0</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td></tr><tr><td>BRS1</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td></tr></table></td></tr>
<tr><td>OFF</td></tr>
<tr><td rowspan="2">BRS1</td><td rowspan="2">Baud Rate Select 1</td><td>ON</td></tr>
<tr><td>OFF</td></tr>
<tr><td rowspan="2">INIT</td><td rowspan="2">INITIAL</td><td>ON</td><td>SW1, SW2, and BRS0 and BRS1 of SW3 are valid.</td></tr>
<tr><td>OFF</td><td>Depends on the CPU transmission parameter setting (software setting).</td></tr>
<tr><td rowspan="2">TEST</td><td rowspan="2">TEST</td><td>ON</td><td>Offline self-diagnosis mode</td></tr>
<tr><td>OFF</td><td>Normal operation mode</td></tr>
</table>

INFO

■ INIT Pin of DIP Switch SW3

When the power is turned ON with the INIT pin set to ON, the 215IF Module executes message communications according to the station addresses set by SW1 and SW2, the transmission speed set by BRS0 and BRS1 of SW3, and the network address set by SW4. In this case, the link communication is not executed and the relay function is disabled.

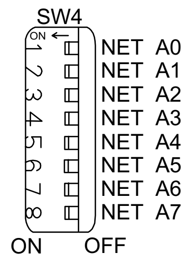
When the power is turned ON with the INIT pin set to OFF, the 215IF Module executes the link communications and message communications according to the settings in the Module Condiguration Definition Window of the MPE720. In this case, the settings of SW1, SW2, BRS0 and BRS1 of SW3, and SW4 will be ignored.

To perform engineerings such as programming and register display on the MPE720 using the 215IF Module when no module configuration definition is set, set the INIT pin to ON. Set the INIT pin to ON only when forcibly communicating with the MPE720 such as when the CPU memory is cleared.

■ DIP Switch (SW4)

The SW4 is used to set the network number of the 215IF transmission. Set a network number between 1 and 254. The SW4 is valid only when the INIT of SW3 is set to ON.

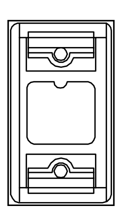
All the pins of SW4 are set by default to OFF (to the right).



Pins	Name	Setting	Operation
NET A0	NETWORK ADDRESS 0	ON	See the table below.
		OFF	
NET A1	NETWORK ADDRESS 1	ON	
		OFF	
NET A2	NETWORK ADDRESS 2	ON	
		OFF	
NET A3	NETWORK ADDRESS 3	ON	
		OFF	
NET A4	NETWORK ADDRESS 4	ON	
		OFF	
NET A5	NETWORK ADDRESS 5	ON	
		OFF	
NET A6	NETWORK ADDRESS 6	ON	
		OFF	
NET A7	NETWORK ADDRESS 7	ON	
		OFF	

Network Number	1	2	3	···	254
A0	ON	OFF	ON	···	OFF
A1	OFF	ON	ON	···	ON
A2	OFF	OFF	OFF	···	ON
A3	OFF	OFF	OFF	···	ON
A4	OFF	OFF	OFF	···	ON
A5	OFF	OFF	OFF	···	ON
A6	OFF	OFF	OFF	···	ON
A7	OFF	OFF	OFF	···	ON

■ 215IF Port (CN1)

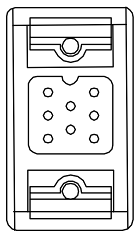


The CN1 is used for connection between 215IF Modules.
No standard cable available.

■ Specifications of CN1 Connector Pin

The following table shows the names and functions of the CN1 connector pins.

Table 5.8 215IF Port (CN1)

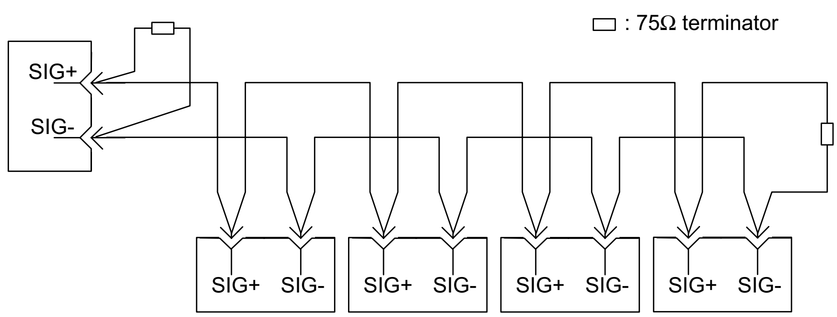


Pin No.	Signal Name	Function	Pin No.	Signal Name	Function
1	SIG-	Send/receive data (-)	5	N.C.	Not connected
2	N.C.	Not connected	6	N.C.	Not connected
3	N.C.	Not connected	7	N.C.	Not connected
4	N.C.	Not connected	8	SIG+	Send/receive data (+)

For the connector on the Module, MR-8RFA4 (G) manufactured by Honda Tsushin Kogyo Co., Ltd is used. Use an MR-8M (G) (case: MR-8L) for the cable-end connector.

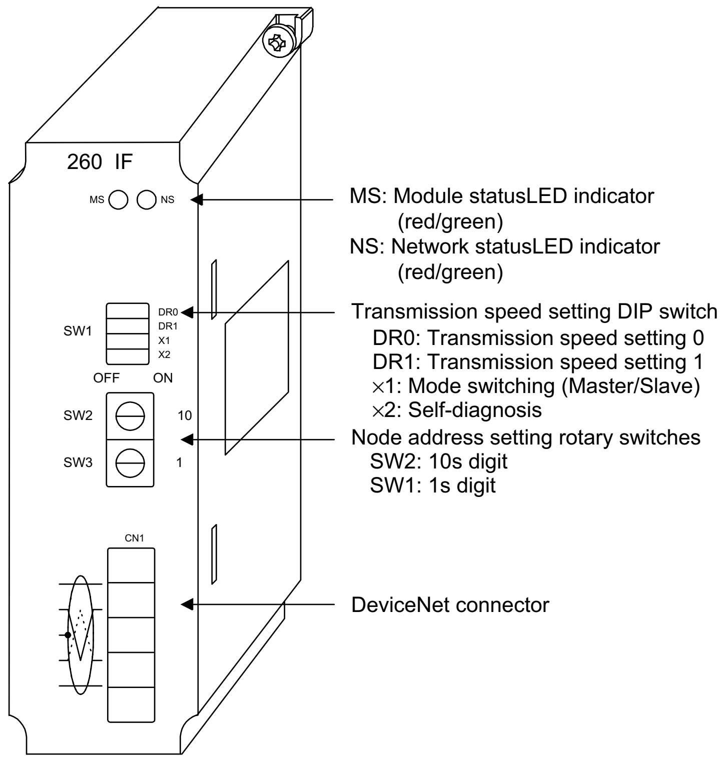
■ 215IF Modules Connection Example

The following figure shows the 215IF Module connection example.



5.6.4 DeviceNet Interface Module (260IF)

The following illustration shows the appearance of the 260IF DeviceNet Interface Module.



The detalis of each part of the 260IF Module are described below.

■ DIP Switch (SW1)

The SW1 is used to set the DeviceNet transmission speed and select the DeviceNet mode, Slave or Master.

Table 5.9 DIP Switch SW1

<table>
<tr><th>Name</th><th>Meaning</th><th colspan="3">Setting</th></tr>
<tr><td>DR0</td><td rowspan="2">DeviceNet Transmission Speed Setting</td><td>DR1</td><td>DR0</td><td></td></tr>
<tr><td rowspan="4">DR1</td><td>OFF</td><td>OFF</td><td>125 kbps (factory setting)</td></tr>
<tr><td></td><td>OFF</td><td>ON</td><td>250 kbps</td></tr>
<tr><td></td><td>ON</td><td>OFF</td><td>500 kbps</td></tr>
<tr><td></td><td>ON</td><td>ON</td><td>This setting is prohibited</td></tr>
<tr><td rowspan="2">X1</td><td rowspan="2">DeviceNet Mode Selection</td><td colspan="3">OFF: DeviceNet Slave mode (factory setting)</td></tr>
<tr><td colspan="3">ON: DeviceNet Master mode</td></tr>
<tr><td>X2</td><td>Not used</td><td colspan="3">Always set to OFF.</td></tr>
</table>

■ Rotary Switches SW2 and SW3

The SW2 and SW3 are used to set the MAC ID of the DeviceNet.

Table 5.10 Rotary Switches SW2 and SW3

Name	Meaning	Setting	
*10 (SW2)	MACID 10s digit	0 to 6	Use these two rotary switches to set the node MAC ID in decimal between 0 and 63. (Factory setting: 00)
*1 (SW3)	MACID 1s digit	0 to 9	

■ LED Indicators

The following table shows the LED indicator display patterns.

Table 5.11 LED Indicator Display Patterns

Name	Display	Status	Meaning
MS	2-color LED (red/green)	Unlit Lit in green Lit in red	Module power supply disconnected Normal operation Self-diagnosis error/Watchdog timeout error
NS	2-color LED (red/green)	Unlit Green blinking Lit in green Red blinking Lit in red	Module power supply disconnected/Offline status*1 No connection being established in online status Connection being established in online status No DeviceNet communications Communications disabled (duplicated MAC ID)/Bus OFF Watchdog timeout error *2

* 1. Offline status: Status from the time the LED test after startup completes to the time the MAC ID duplication check completes (2 seconds)
Online status: Status after the MAC ID duplication check completes at startup

* 2. If a DeviceNet bus OFF error occurs due to disconnection from the power supply, the 260IF Module executes the Automatic Reset operation according to the DeviceNet specifications. In this case, the NS lights up in red in a instant, then lights out. When the network power supply is restored, the NS will start blinking in green (no connection being established in online).

The 260IF executes the MS and NS LED check for one second when the power is turned ON according to the DeviceNet Specifications. The following figure shows the LED display during the LED test.

The LED test sequence after the power is turned ON is shown below. Check to see if there is a LED failure according to the status of each LED. The time required for the LED test is 1 second.

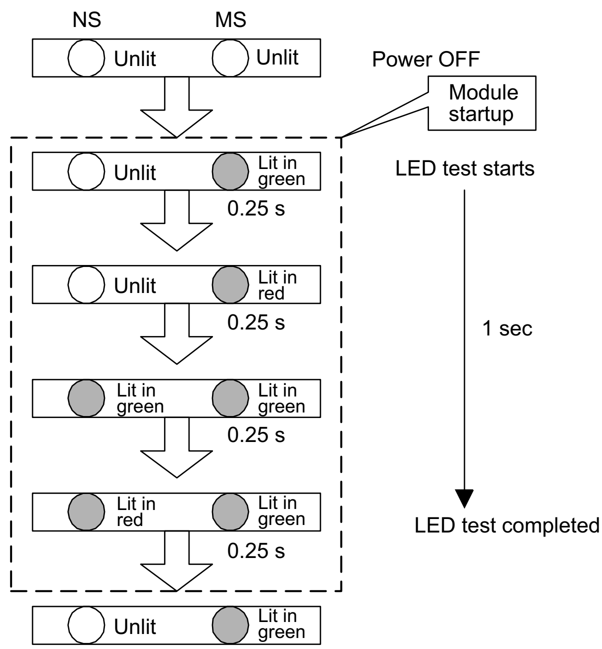


Fig. 5.3 LED Display Status during LED Check

■ Specifications of DeviceNet Connector CN1

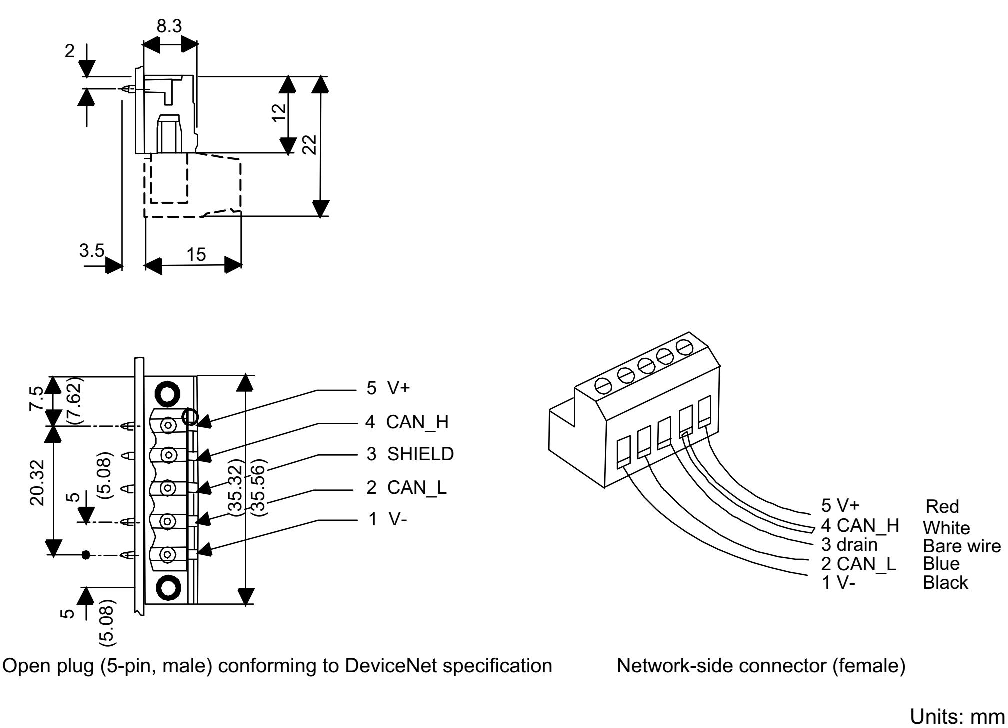


Fig. 5.4 DeviceNet Connector CN1

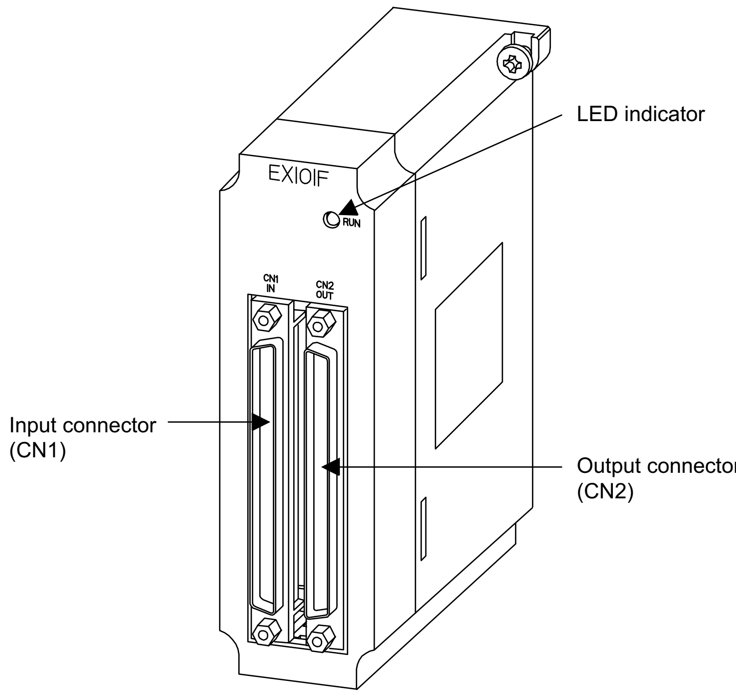
■ CN1 Signal Name

Pin No.	Signal Name	I/O
1	V –	I
2	CAN_L	I/O
3	SHIELD	–
4	CAN_H	I/O
5	V +	I

5.7 Expansion Module

5.7.1 Expansion Interface Module (EXIOIF)

The following illustration shows the appearance of the EXIOIF Expansion Interface Module.

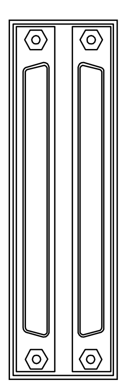


The details of each part of the EXIOIF Module are described below.

■ LED Indicator

Indicator Name	Indicator Color	Meaning
RUN	Green	Lit when the RUN instruction is executed from the CPU.

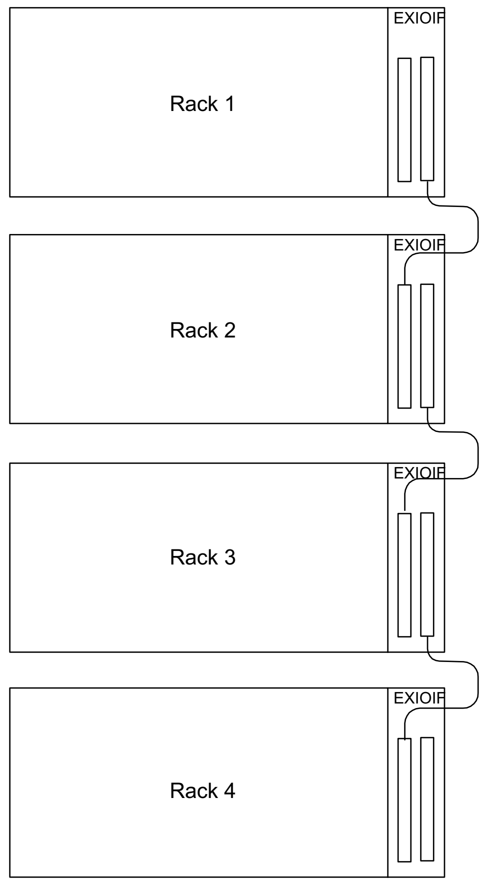
■ External I/O Connectors



The I/O connector is used to connect a Mounting Base to up to four racks.
Use the following cable for this connector.

- JEPMC-W6130-A5 (0.5 m)
- JEPMC-W6130-01 (1.0 m)

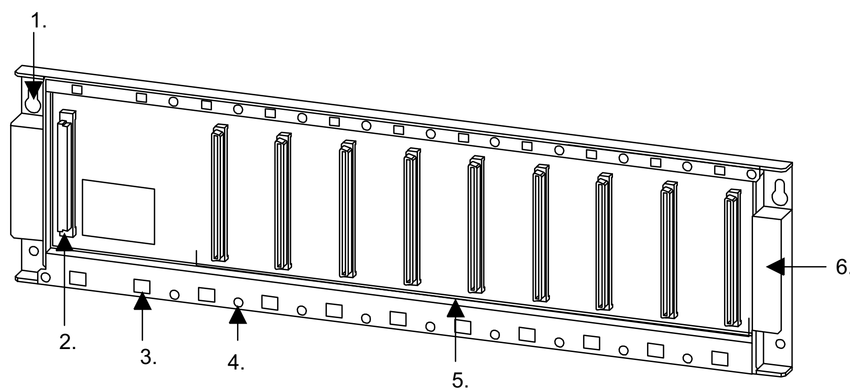
The following illustration shows how to connect the I/O connectors.



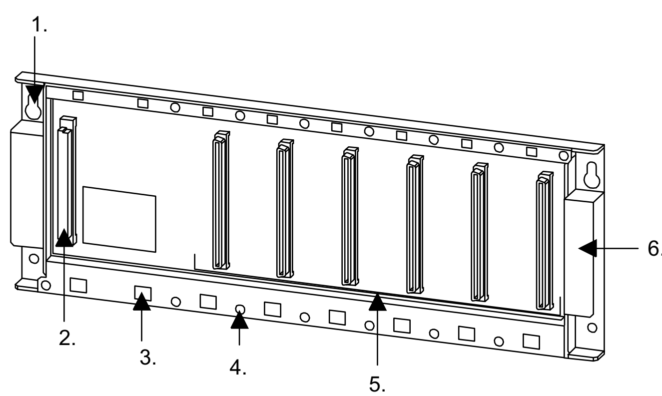
5.7.2 Mounting Base

The following illustration shows the appearances of the MB-01 and MB-02 Mounting Bases.

■ MB-01



■ MB-02



The parts of the Mounting Base are described below.

1. Base Mounting Holes

   Elongated holes used to mount the Mounting Base to a panel, such as a control panel.

2. Power Supply Module Connector

   A dedicated connector used to mount the Power Supply Module (PS-01, PS-03).

3. Module Mounting Hole

   A hole in which the protrusion on the back of a Module is inserted to secure the Module.

4. Module Mounting Tapped Hole

   A tapped hole used to secure a Module to the Mounting Base.

5. Module Connector

   A connector used to mount a Module (except the Power Supply Module).

6. Handles

   Handles used when installing the Mounting Base.

6

System Startup

This chapter describes the procedure to start up the MP920 system.

6

6.1 Overview

This section overviews the system startup procedure and describes the test system configuration and preparation.

6.1.1 Overview of the Startup Procedure

The system startup procedure is as follows:

1. Prepare the equipment to be used.
   Prepare the equipment to be used by referring to *6.1.2 Test System Configuration* and *6.1.3 Equipment Preparations*.

⇩

2. Mount the Units.
   Install the Power Supply Module, CPU Module, SVA Module, and I/O Modules on the Mounting Base.

⇩

3. Connect and wire the system.
   Connect the Programming Device, and wire the external I/O signals, servomotor, and SERVOPACK.

⇩

4. Start the Programming Device.
   Prepare the system definitions, such as the Module definitions, group definitions, and scan time settings.

⇩

5. Create, save, and transfer a motion program.
   Use the Programming Device to create the motion program for testing.

⇩

6. Transfer definitions, parameters, and program.

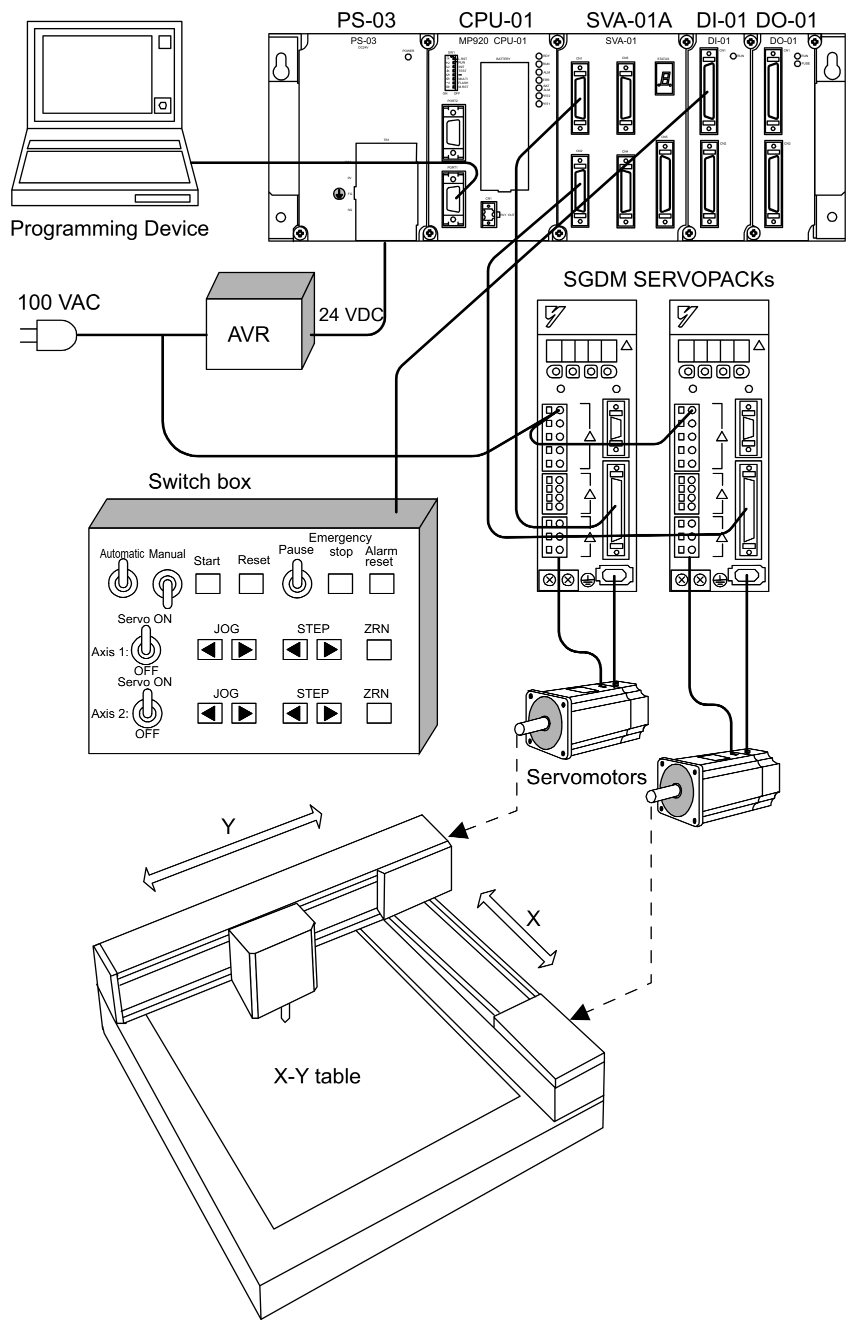
⇩

7. Check operation.
   Execute the program and check the test operation.

6.1.2 Test System Configuration

The Test System is a simple system for explaining MP920 system startup. The Test System is different from the one that is used for actual applications.

The following illustration shows the Test System configuration.



IMPORTANT

Because this system is used for testing, there is no emergency stop circuit, and no servo amp power OFF circuit for overtravel. For actual applications, be sure to insert the correct emergency stop circuits.

6

6.1.3 Equipment Preparations

Prepare the equipment shown in the following tables.

■ Controller-related Equipment

Name	Model
Power Supply Module	JEPMC-PS200
CPU Module	JEPMC-CP200
Input Module	JEPMC-IO200
Output Module	JEPMC-IO210
Four-axis Servo Module	JEPMC-MC200A
Short Mounting Base	JEPMC-MB210
Analog Servo Interface Cable (for SGDA)	JEPMC-W6040-05
Analog Servo Interface External I/O Cable	JEPMC-W6060-05
External Input Cable	JEPMC-W6060-05
External Output Cable	JEPMC-W6060-05

■ Servo-related Equipment

Name	Model
SERVOPACK	SGD-01BN × 2
Servomotor	SGM-01B312 × 2
Motor Cable	DP9320081-1 × 2
PG Cable	DP9320089-1 × 2

■ Programming Device-related Equipment

Name	Model
Computer	Windows 98, Windows NT4.0 (SP5 or later), Windows 2000 (SP1 or later), or Windows XP running personal computer
Software	MPE720
MEMOBUS Cable	JEPMC-W5311-03

■ Other Required Equipment

Name	Model
Switch box	–
24-VDC power supply (AVR)	–
No-fuse breaker	–
Switches	–
Wiring material	–

6.2 System Startup Procedure

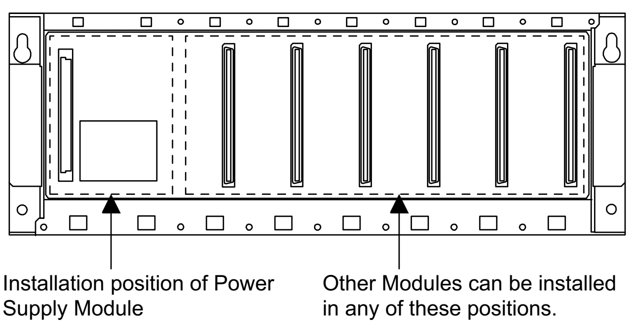
This section explains the procedure when a Test System is used for positioning control. Refer to the relevant reference manuals for the operation required for each procedure. Details of the machine system design have been omitted here.

6.2.1 Installing the Modules

Install the Power Supply, CPU, Input, Output, and other Modules on the Mounting Base.

■ Installation Position of Each Module

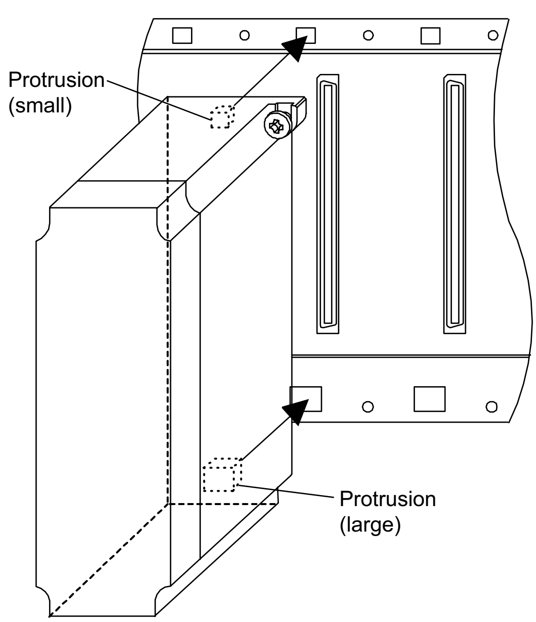
The installation position of the Power Supply Module is fixed, but other Modules can be installed in any other position.



6

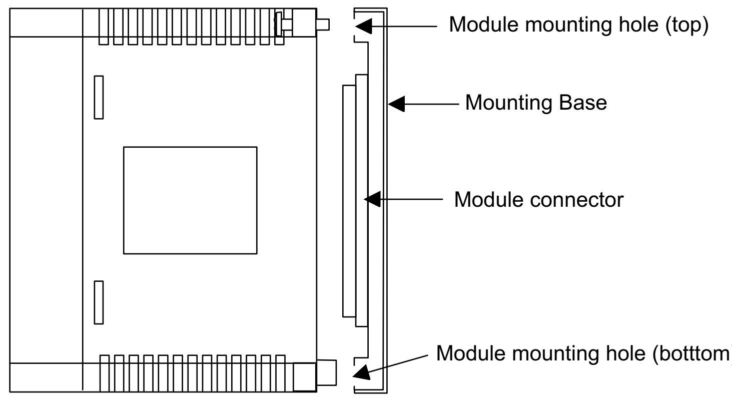
■ Procedure for Installing Modules

The large and small protrusions on the back of each Module fit into the corresponding holes in the Mounting Base.

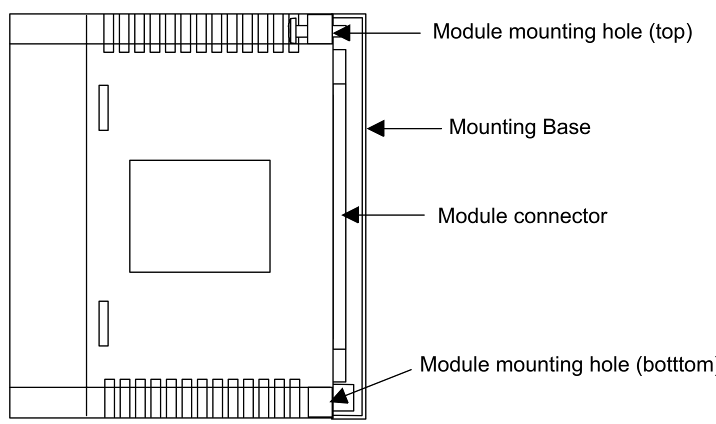


Use the following procedure to install a Module.

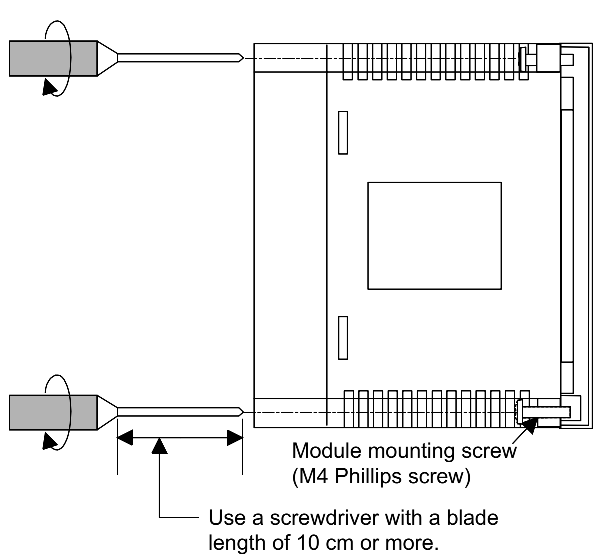
1. Align the two protrusions on the back of the Module with the module mounting holes in the Mounting Base.



2. Press the Module onto the Mounting Base so that the connector on the back of the Module fits into the connector on the Mounting Base.



3. Tighten the top and bottom module mounting screws with a Phillips screwdriver.

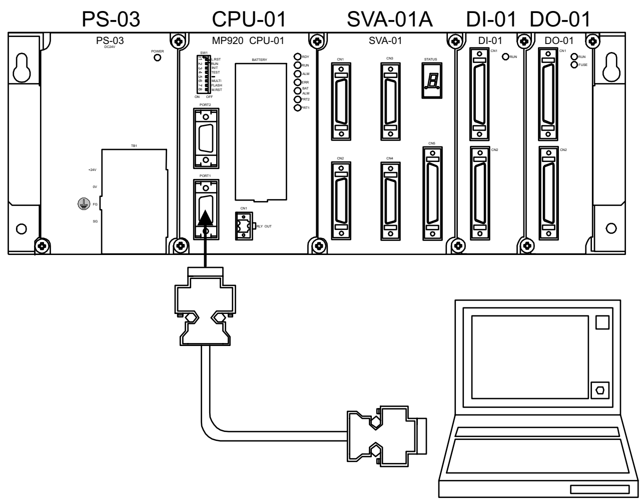


This completes the installation procedure.

6.2.2 Connecting Devices

■ Connecting the Programming Device

The following illustration shows the method of connecting the Programming Device and the CPU-01 Module.



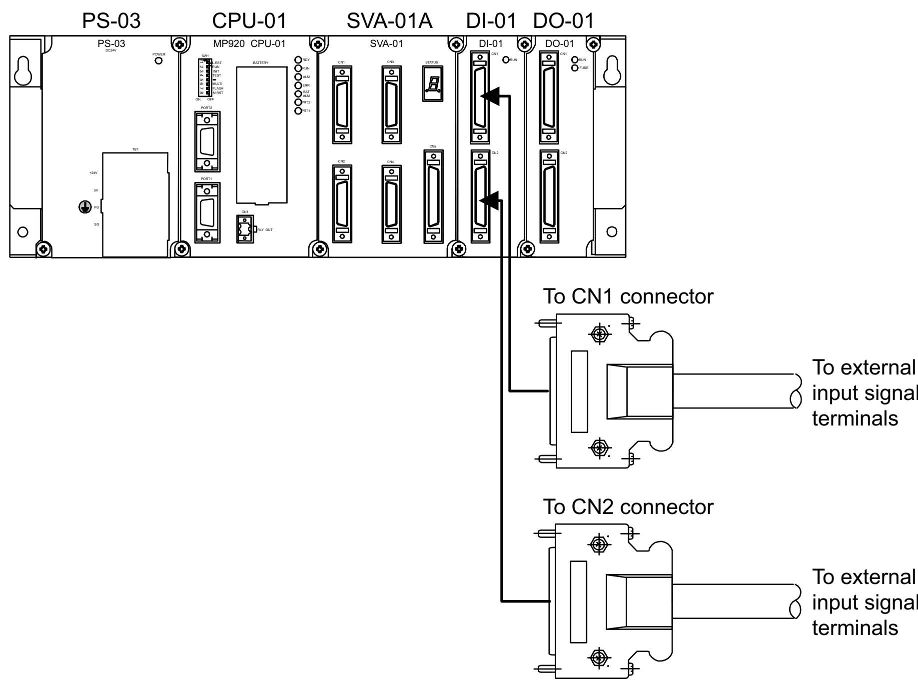
When connecting the Programming Device and the CPU-01 Module communications port, use the following cables.

MEMOBUS Communications Cables

Cable Length	Model
2.5 m	JEPMC-W5311-03
15 m	JEPMC-W5311-15

■ Local Input Module Connector Wiring

The following illustration shows the method of connecting the external input signal terminals and the DI-01 Input Module connectors.



When connecting the external input signal terminals and the DI-01 Input Module connector, use the following cables.

External Input Cables

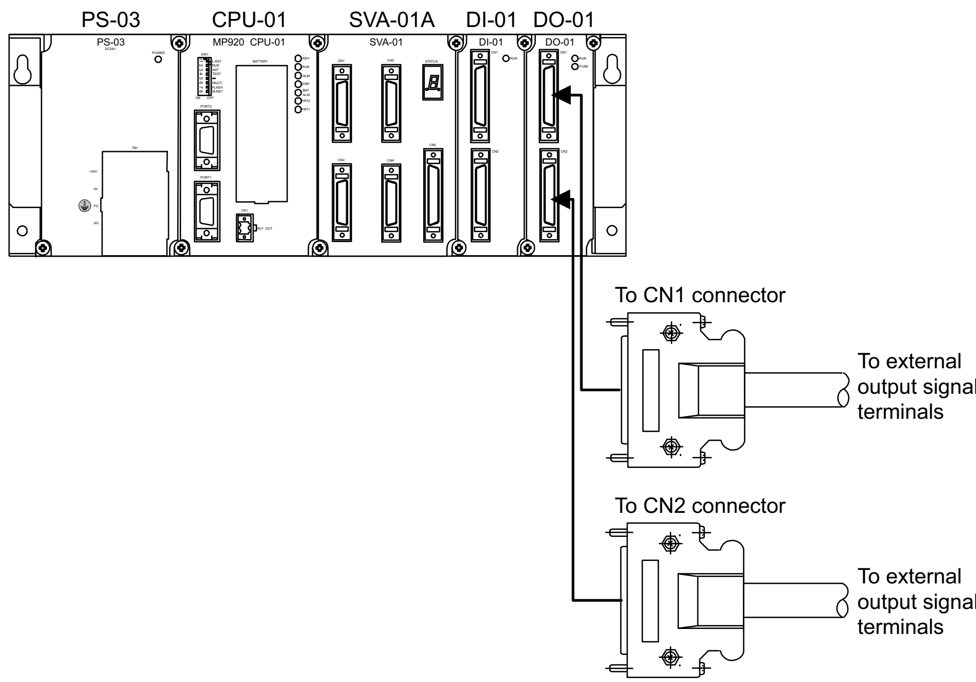
Cable Length	Model
0.5 m	JEPMC-W6060-05
1 m	JEPMC-W6060-10
3 m	JEPMC-W6060-30

INFO

See *5.3.1 DI-01 Input Module* for the DI-01 Input Module connector specifications, connector pin layout, and connection examples.

■ Remote Output Module Connector Wiring

The following illustration shows the method of connecting the external output signal terminals and the DO-01 Output Module connectors.



When connecting the external output signal terminals and the DO-01 Output Module connector, use the following cables.

External Output Cables

Cable Length	Model
0.5 m	JEPMC-W6060-05
1 m	JEPMC-W6060-10
3 m	JEPMC-W6060-30

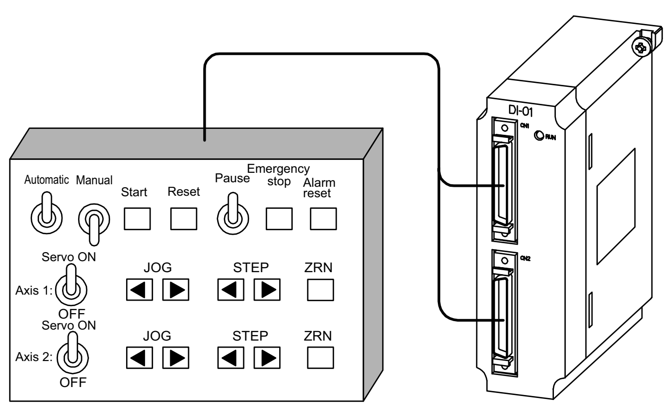
INFO

See *5.3.2 DO-01 Output Module* for the DO-01 Output Module connector specifications, connector pin layout, and connection examples.

■ Connecting the Switch Box

The switch box used by the ladder logic program that is automatically generated on the Group Definition Window is connected as shown in the following illustration.

- Axis input signals: DI-01 Module CN1 connector



Switch Box External Signal Allocation

Allocate the switch box signals as shown in the following table.

Group Input Signals		Axis 1 Input Signals		Axis 2 Input Signals	
IB00000	Automatic mode	IB00010	Servo ON	IB00020	Servo ON
IB00001	Manual mode	IB00011	JOG+	IB00021	JOG+
IB00002	Start	IB00012	JOG-	IB00022	JOG-
IB00003	Reset	IB00013	STEP+	IB00023	STEP+
IB00004	Pause	IB00014	STEP-	IB00024	STEP-
IB00005	Emergency stop	IB00015	ZRN	IB00025	ZRN
IB00006	Alarm reset	–	–	–	–
IB00007	–	–	–	–	–
IB00008	–	–	–	–	–
IB00009	–	–	–	–	–
IB0000A	–	–	–	–	–
IB0000B	–	–	–	–	–

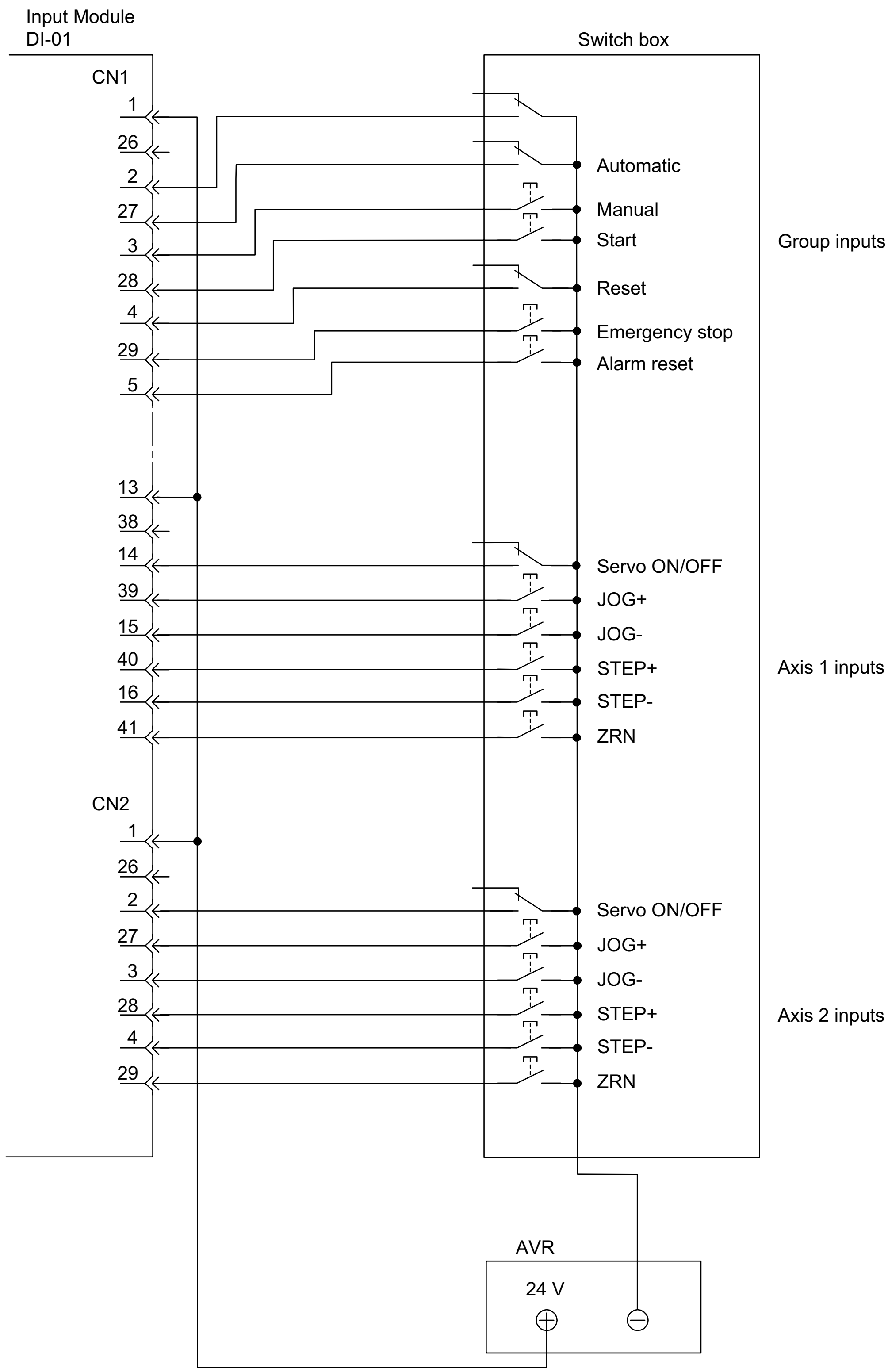
INFO

By default, the group input signals and axis input signals are allocated sequentially starting from IB00000. When a test must be conducted without connecting the input signal lines, it is convenient to set the M registers.

Turning ON or OFF the signals on the Register List Window has the same effect as using the switch box.

Switch Box Connection Diagram

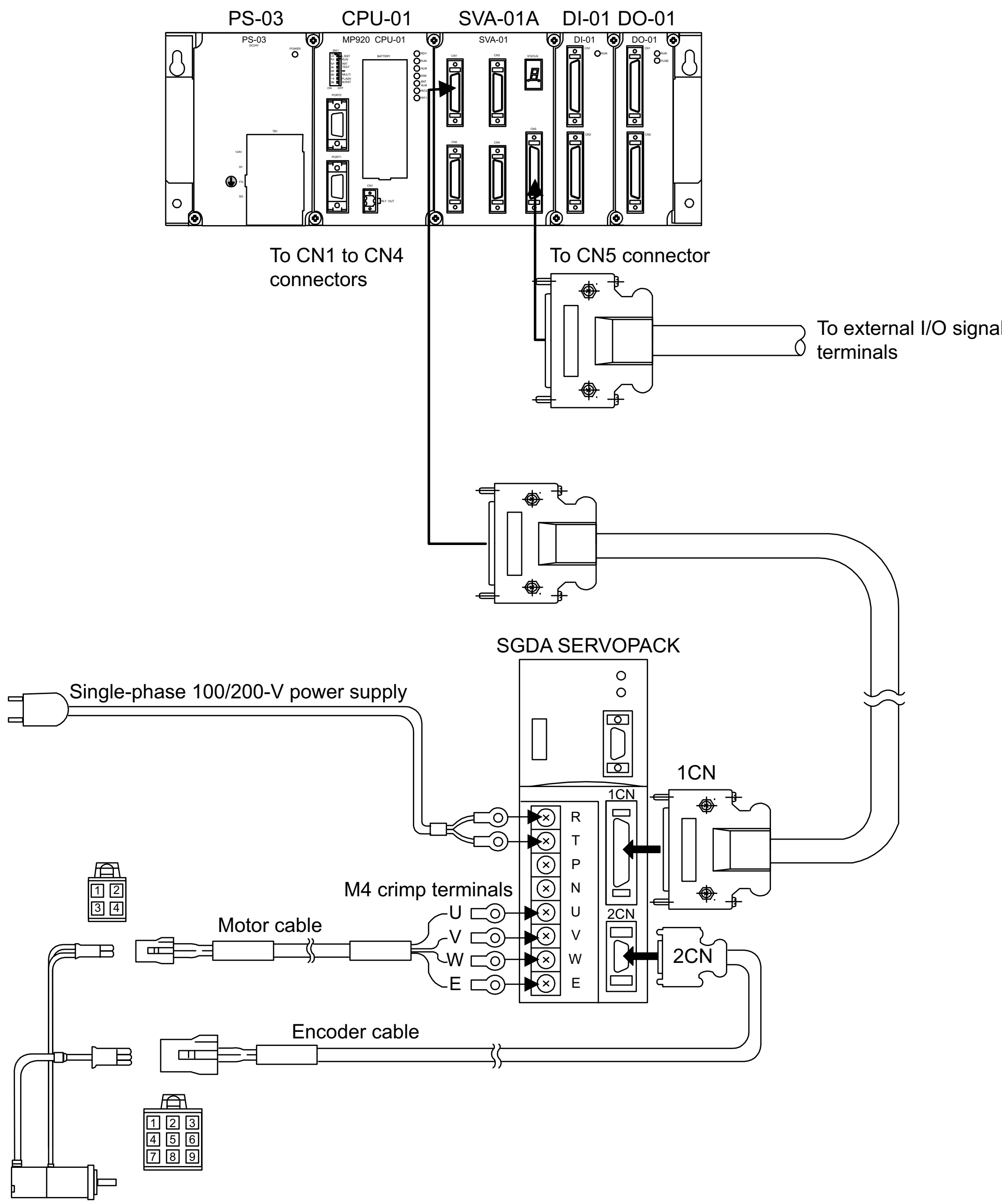
The following illustration shows a switch box connection diagram.



■ Connection of SERVOPACK and Servomotor

Use the special cable and encoder cable to connect the SERVOPACK and Servomotor.

SGDA SERVOPACK



Motor Cables

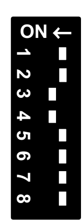
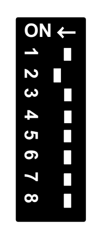
Cable Length	Model	Cable Length	Model
3 m	DP9320081-1	3 m	DP9320083-1
5 m	DP9320081-2	5 m	DP9320083-2
10 m	DP9320081-3	10 m	DP9320083-3
15 m	DP9320081-4	15 m	DP9320083-4
20 m	DP9320081-5	20 m	DP9320083-5

Encoder Cables

Cable Length	Model
3 m	DP9320089-1
5 m	DP9320089-2
10 m	DP9320089-3
15 m	DP9320089-4
20 m	DP9320089-5

■ Memory Initialization

Use the following procedure to initialize the memory. The user programs and definition data will be erased.

1	2	3	4	5
Turn OFF the MP920 power.	Turn ON DIP switch pins 3 and 4. 	Turn ON the power, and check that the RDY and RUN indicators flash (about 3 seconds).	Turn OFF the power, and return the DIP switch pins to their original settings. 	Turn ON the power again.

Always initialize memory if you remove the battery when the MP920 Modules are turned OFF.

6.2.3 Starting the MPE720

This section explains the Modules configuring the MP920, the module configuration definitions for I/O allocation, and the methods of setting group definitions for the number of axes and tasks. Be sure to set these when the system is first started up.

■ MPE720 Startup Procedure

Make sure the MPE720 System Software is installed in advance.

The following is an overview of the MPE720 startup procedure.

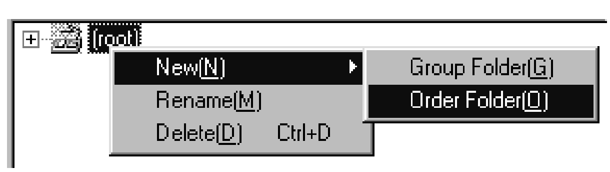
①	Create an Order Folder.
②	Create a Controller Folder.
③	Logon offline.
④	Set the Module Configuration Definitions.
⑤	Set the Group Definitions.
⑥	Set the Scan Time.

■ Creating an Order Folder

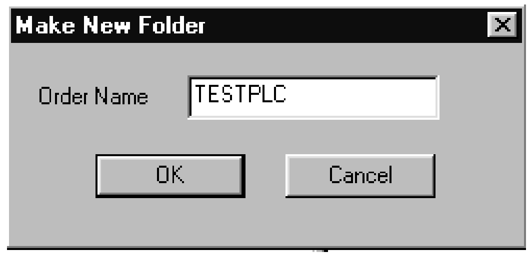
Start the MPE720 and create an order folder from the File Manager Window.

- Example: File name: TESTPLC

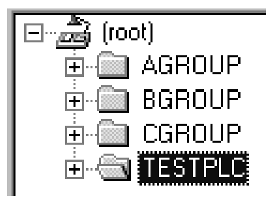
1. Point to ***root***, and then click ***New (N)*** → ***Order Folder (O)***.



2. In the dialog box, input the order folder name and click the **OK** button. The order folder name must be eight characters or less.



The new "TESTPLC" order folder will be created.

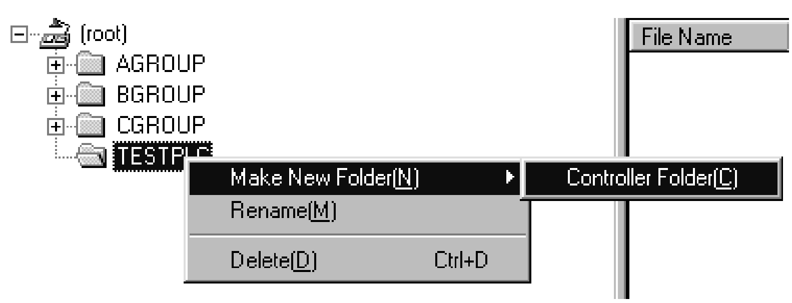


■ Creating a Controller Folder

Register the new Controller to be used to create the program.

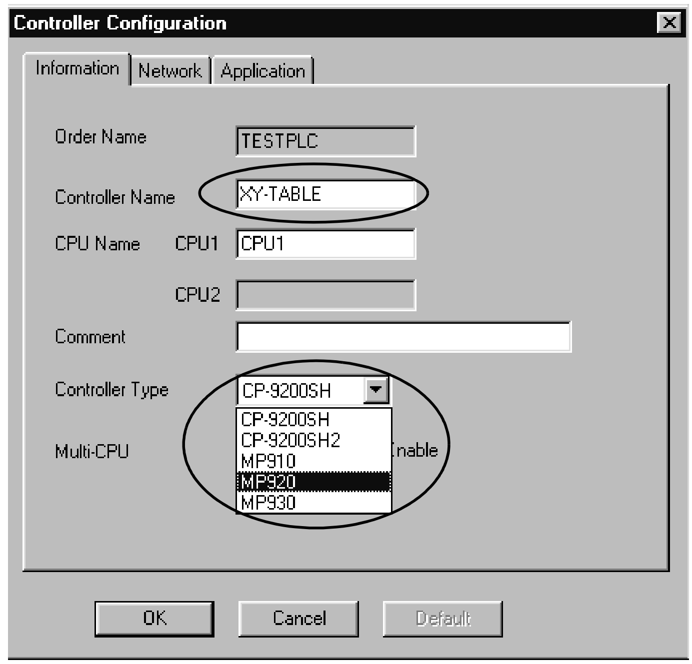
- Example: Controller name: XY-TABLE
  Controller type: MP920

1. Point to the TESTPLC order folder, right click, and then click ***Make New Folder (N)*** → ***Controller Folder (C)***.

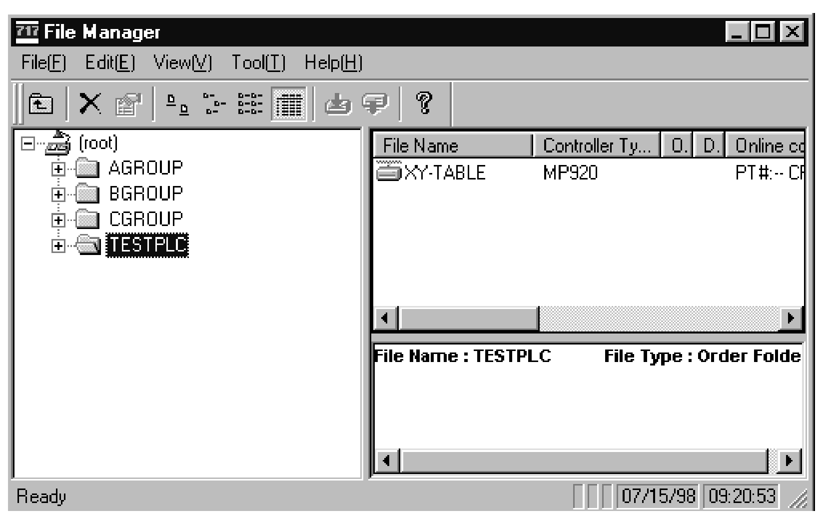


6

2. In the Controller Configuration Window, set the Controller Name and Controller Type, and click the **OK** button.



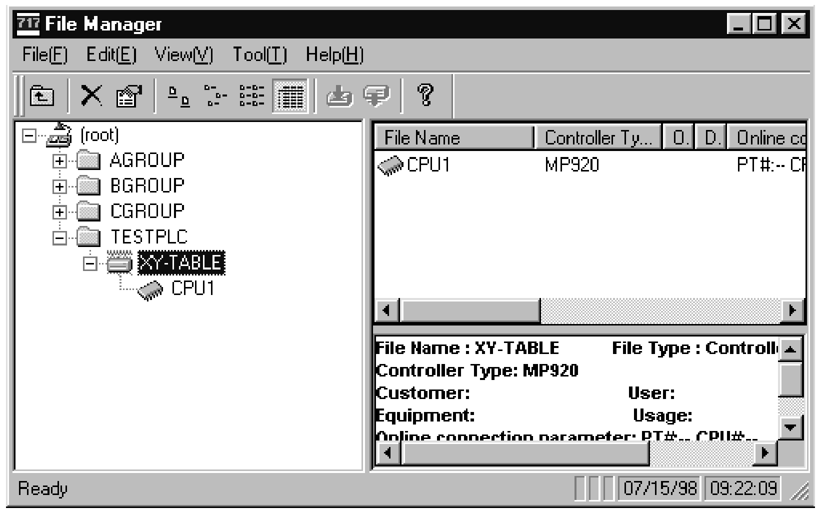
The new Controller Folder will be created.



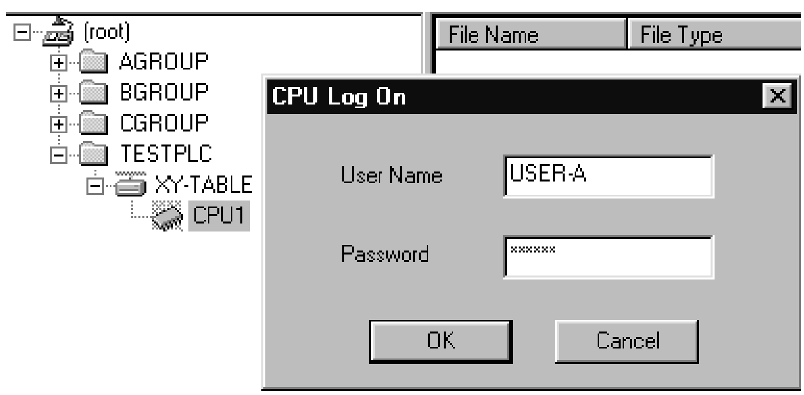
■ Logging On Offline

When creating a Controller program or definition data, you must log onto the Controller.

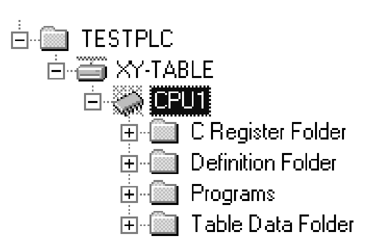
1. Double-click the ***XY-TABLE*** Controller Folder and CPU1.



2. Input the user name **USER-A** and password **USER-A**, and click the **OK** button.



The Controller Folder XY-TABLE C Register, Definition, Programs, and Table Data Folders will be displayed, and logon has been completed.

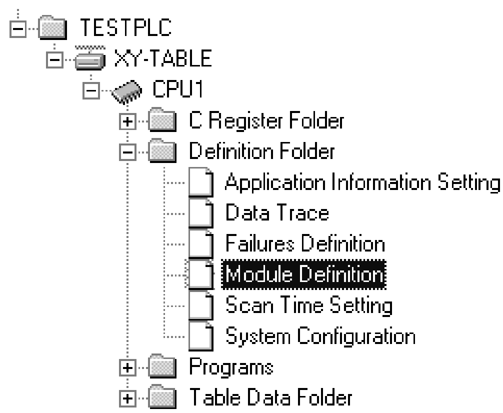


6

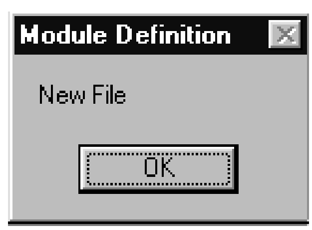
■ Module Definitions

Set the MP920 CPU Module, SVA-01 Module and I/O Module.

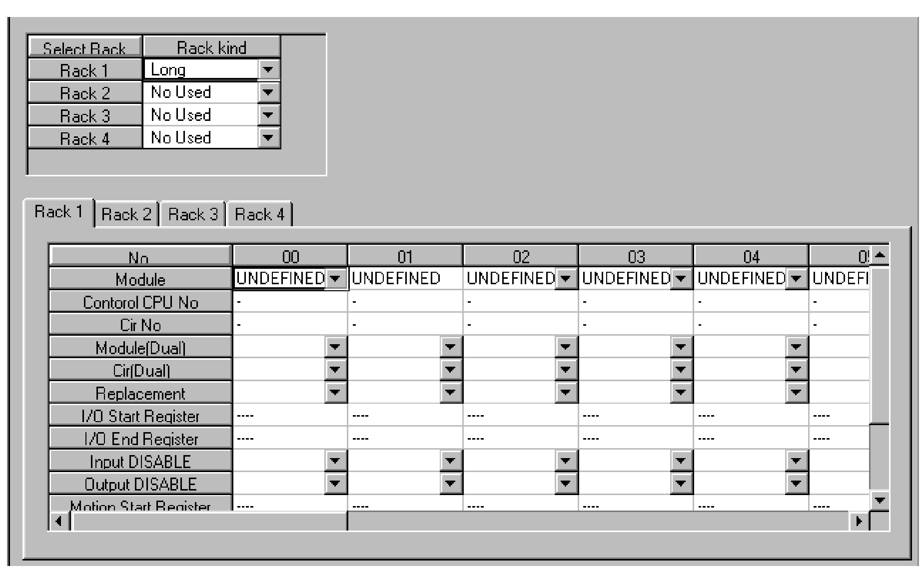
1. On the File Manager Window, double-click ***XY-TABLE***, ***CPU1***, ***Definition Folder***, and ***Module Definition*** in this order.



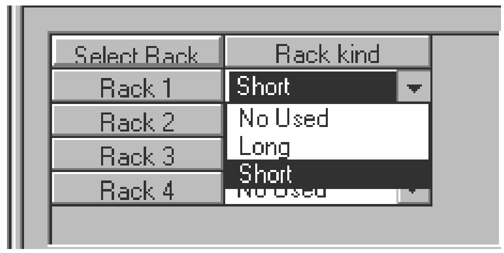
2. Click the **OK** button in the following message box.



The Module Definition Window will be displayed.



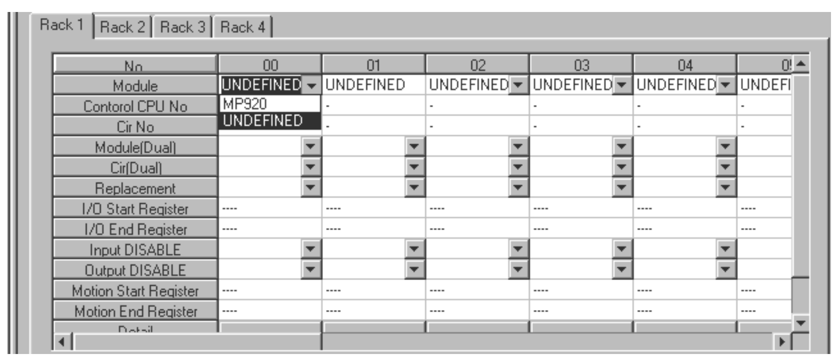
3. To select the rack kind, click the ▼ button on the right side of ***Rack 1*** and then click ***Short***.



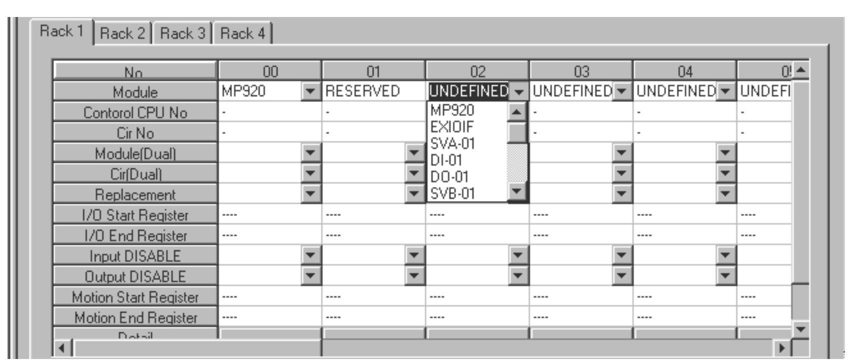
4. Use the following procedure to select the Modules that are mounted to Rack 1.
   The following table shows the Modules allocated to each slot.

Slot			
0, 1	2, 3	4	5
MP920	SVA-01A	DI-01	DO-01

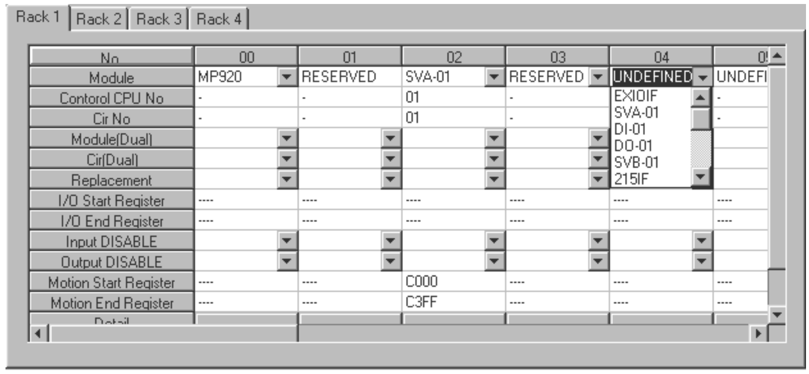
a) To allocate the MP920 Module to slots 0 and 1, click the ▼ button on the right side of Module No. **00** and then click ***MP920***.



b) To allocate the SVA-01A Module to slots 2 and 3, click the ▼ button on the right side of Module No. **02** and then click ***SVA-01***.



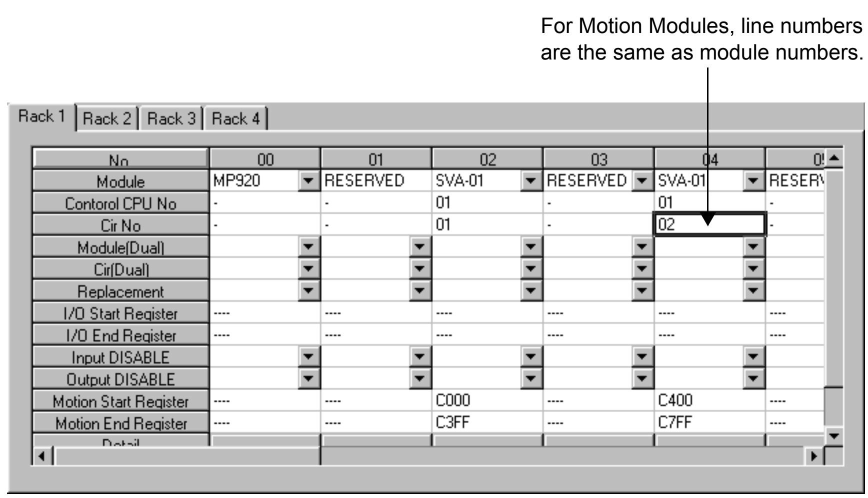
c) To allocate the DI-01 Module to slot 4, click the ▼ button on the right side of Module No. **04** and then click ***DI-01***.



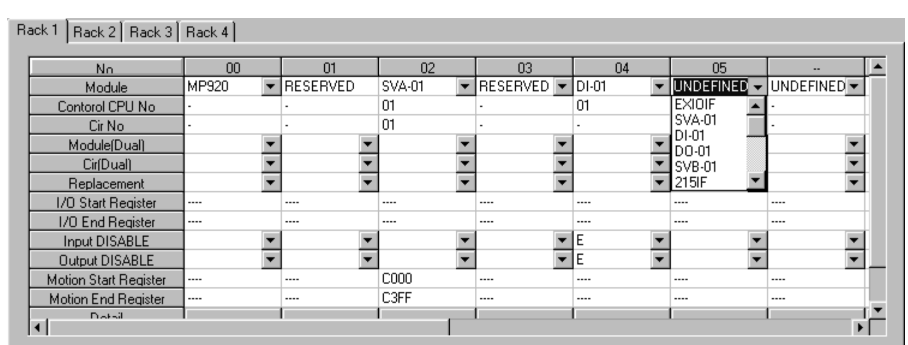
When using more than one SVA-01A Module, specify consecutive numbers for the line numbers.

The motion leading register number and the motion end register number will be automatically assigned.

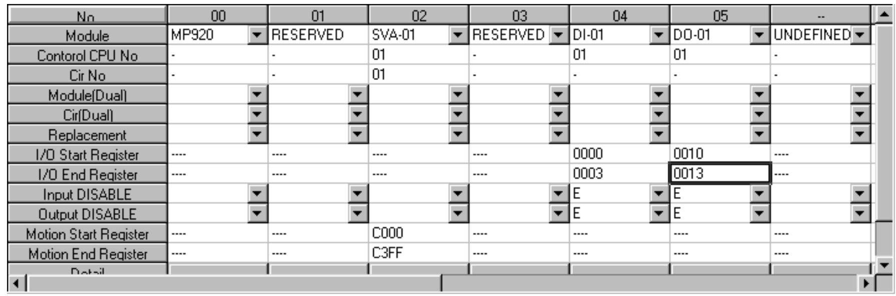
See *7.1.2 Module Numbers and Motion Parameter Register Numbers* for the relationship between Servo Module numbers and motion register numbers.



d) Allocate the DO-01 Module to slot 5, click the ▼ button on the right side of Module No. **05** and then click ***DO-01***.



e) Set the I/O start register numbers (0 for DI-01, 10 for D0-01).

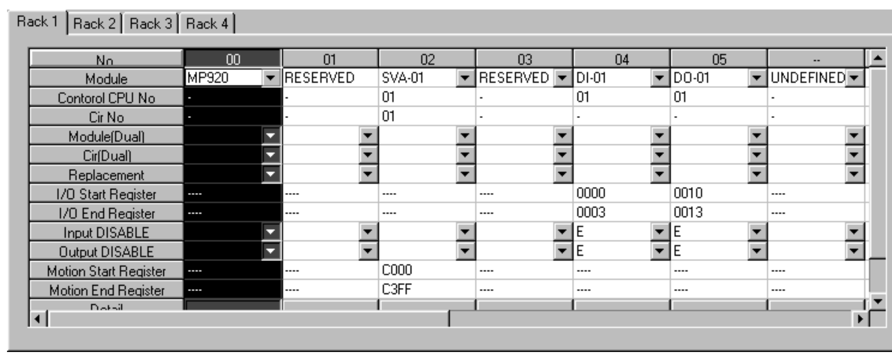


No	00	01	02	03	04	05	--
Module	MP920	RESERVED	SVA-01	RESERVED	DI-01	DO-01	UNDEFINED
Contorol CPU No	-	-	01	-	01	01	-
Cir No	-	-	01	-	-	-	-
Module(Dual)							
Cir(Dual)							
Replacement							
I/O Start Register	----	----	----	----	0000	0010	----
I/O End Register	----	----	----	----	0003	0013	----
Input DISABLE					E	E	
Output DISABLE					E	E	
Motion Start Register	----	----	C000	----	----	----	----
Motion End Register	----	----	C3FF	----	----	----	----

This completes the module allocation procedure.

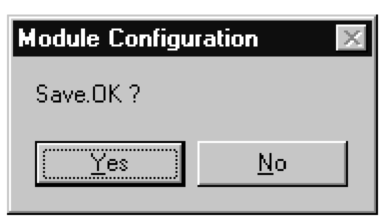
5. Use the following procedure to set information on the MP920 Modules.

a) Double-click slot No. **00**.

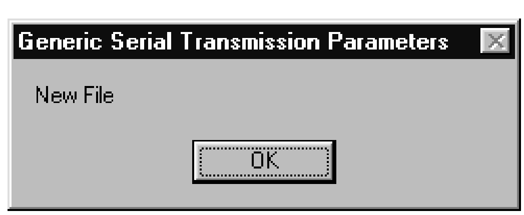


No	00	01	02	03	04	05	--
Module	MP920	RESERVED	SVA-01	RESERVED	DI-01	DO-01	UNDEFINED
Contorol CPU No	-	-	01	-	01	01	-
Cir No	-	-	01	-	-	-	-
Module(Dual)							
Cir(Dual)							
Replacement							
I/O Start Register	----	----	----	----	0000	0010	----
I/O End Register	----	----	----	----	0003	0013	----
Input DISABLE					E	E	
Output DISABLE					E	E	
Motion Start Register	----	----	C000	----	----	----	----
Motion End Register	----	----	C3FF	----	----	----	----

b) Click the **Yes** button in the following message box.



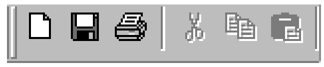
c) Click the **OK** button in the following message box.



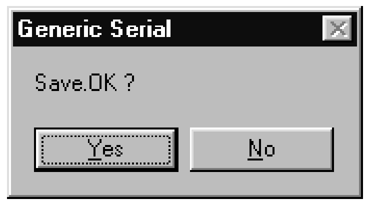
The Generic Serial Window will be displayed.

d) Check the CIR#01 and CIR#02 settings.

e) Click Save on the Toolbar.



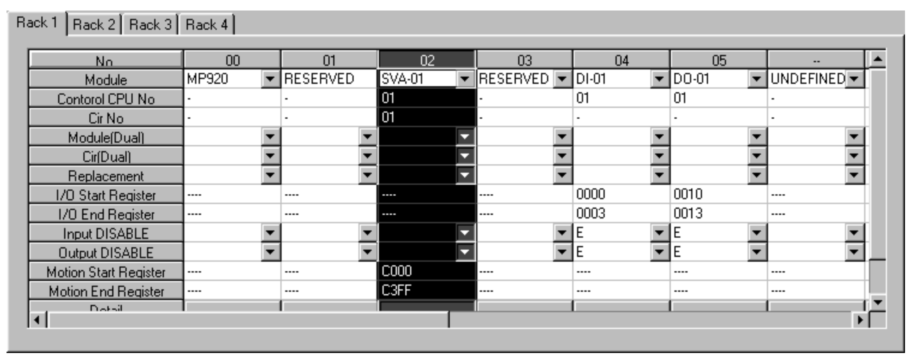
f) Click the **Yes** button in the following message box.



This completes the Generic Serial setting procedure.

6. Use the following procedure to set information on the SVA-01A Module.

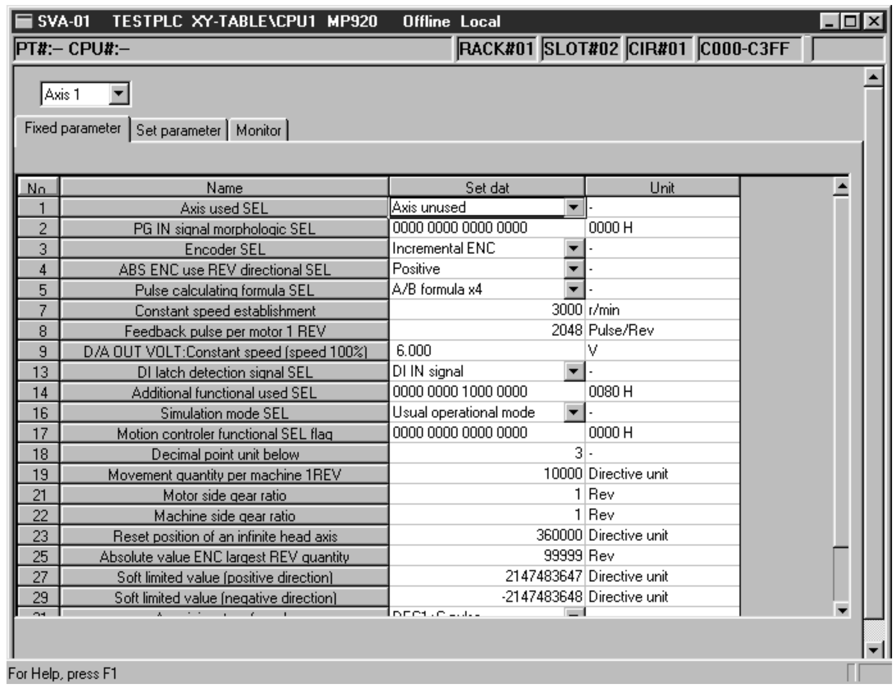
a) Double-click slot No. **02**.



No	00	01	02	03	04	05	--
Module	MP920	RESERVED	SVA-01	RESERVED	DI-01	DO-01	UNDEFINED
Contorol CPU No	-	-	01	-	01	01	-
Cir No	-	-	01	-	-	-	-
Module(Dual)							
Cir(Dual)							
Replacement							
I/O Start Register	----	----	----	----	0000	0010	----
I/O End Register	----	----	----	----	0003	0013	----
Input DISABLE					E	E	
Output DISABLE					E	E	
Motion Start Register	----	----	C000	----	----	----	----
Motion End Register	----	----	C3FF	----	----	----	----
Detail							

b) Click the **OK** button in the following message box.

The SVA-01A Motion Parameter Window will be displayed.



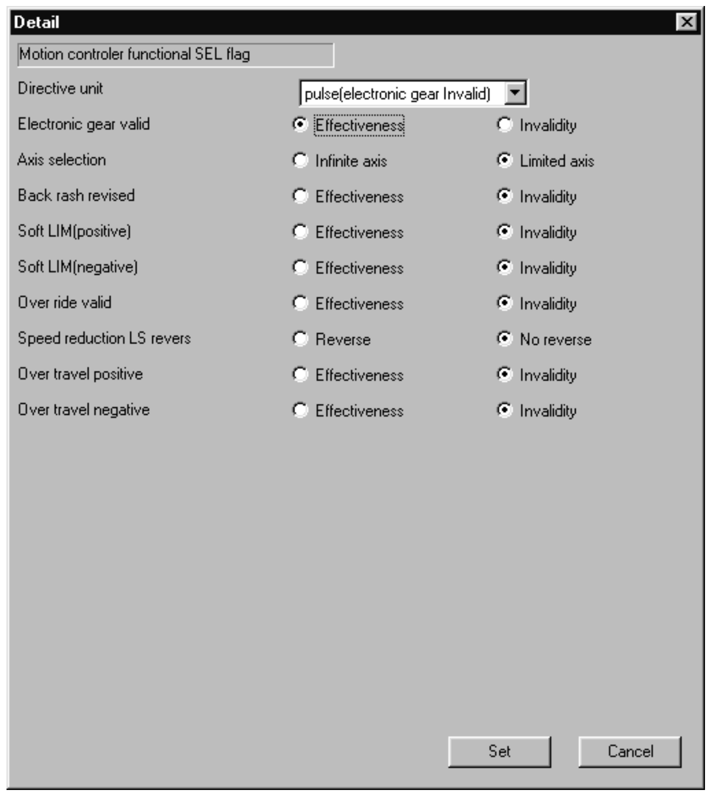
c) Set fixed parameter No. 1 ***Axis used SEL*** (Axis Selection) as follows:

Click the ▼ button on the right side of ***Axis used SEL*** (Axis Selection) in the ***Set dat*** column, and then click ***Axis used***.

6

d) Set fixed parameter No. 17 ***Motion controller functional SEL flag*** (Motion Controller Function Selection Flags) as follows:

Double-click ***Motion controller functional SEL flag*** (Motion Controller Function Selection Flags) in the ***Set dat*** column. The following Detail Setting Window will be displayed.



- Set ***Directive unit*** (Reference Unit Selection) to **mm**.
- Set ***Electronic gear valid*** (Electronic Gear Selection) to **Effectiveness** (Enabled).

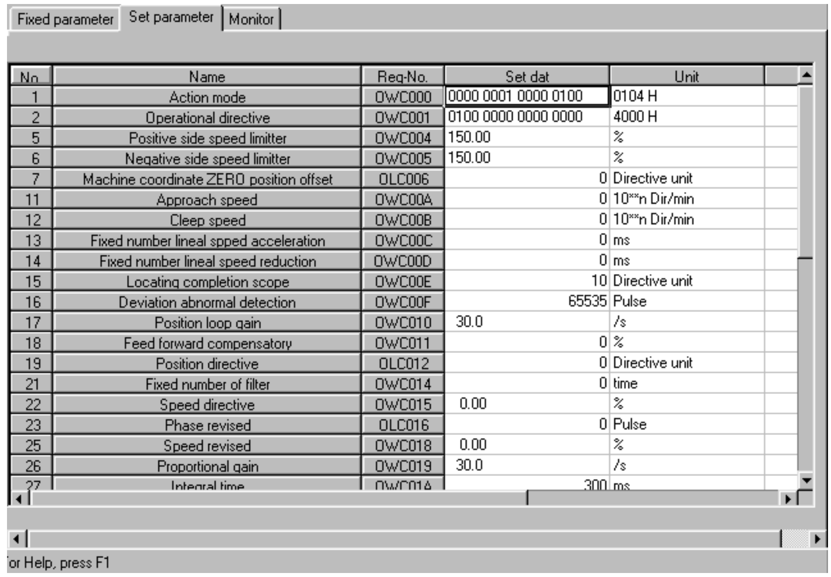
Then, click the **Set** button.

e) Click Save on the Toolbar.

This completes the fixed parameter setting procedure.

f) Set the setting parameters as follows:

Click the ***Setting parameter*** tab to display the Setting Parameter Tab.



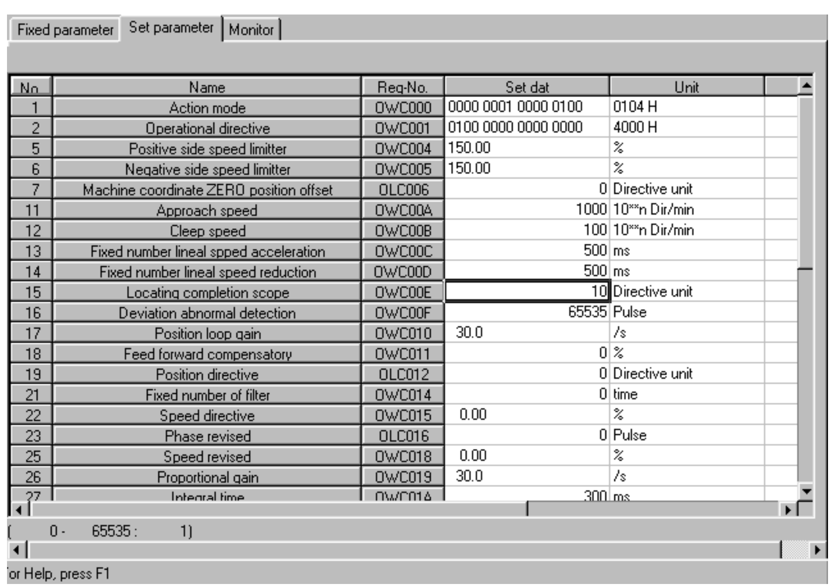
Fixed parameter | Set parameter | Monitor

No.	Name	Reg-No.	Set dat	Unit
1	Action mode	OWC000	0000 0001 0000 0100	0104 H
2	Operational directive	OWC001	0100 0000 0000 0000	4000 H
5	Positive side speed limitter	OWC004	150.00	%
6	Negative side speed limitter	OWC005	150.00	%
7	Machine coordinate ZERO position offset	OLC006	0	Directive unit
11	Approach speed	OWC00A	0	10**n Dir/min
12	Cleep speed	OWC00B	0	10**n Dir/min
13	Fixed number lineal spped acceleration	OWC00C	0	ms
14	Fixed number lineal speed reduction	OWC00D	0	ms
15	Locating completion scope	OWC00E	10	Directive unit
16	Deviation abnormal detection	OWC00F	65535	Pulse
17	Position loop gain	OWC010	30.0	/s
18	Feed forward compensatory	OWC011	0	%
19	Position directive	OLC012	0	Directive unit
21	Fixed number of filter	OWC014	0	time
22	Speed directive	OWC015	0.00	%
23	Phase revised	OLC016	0	Pulse
25	Speed revised	OWC018	0.00	%
26	Proportional gain	OWC019	30.0	/s
27	Integral time	OWC01A	300	ms

or Help, press F1

g) Set the following parameters for axis 1.

- No.11 Approach speed (Approach Speed Setting)
- No.12 Creep speed (Creep Speed Setting)
- No.13 Fixed number lineal speed acceleration (Linear Acceleration Time Constant)
- No.14 Fixed number lineal speed reduction (Linear Deceleration Time Constant)



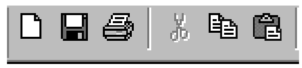
Fixed parameter | Set parameter | Monitor

No.	Name	Reg-No.	Set dat	Unit
1	Action mode	OWC000	0000 0001 0000 0100	0104 H
2	Operational directive	OWC001	0100 0000 0000 0000	4000 H
5	Positive side speed limitter	OWC004	150.00	%
6	Negative side speed limitter	OWC005	150.00	%
7	Machine coordinate ZERO position offset	OLC006	0	Directive unit
11	Approach speed	OWC00A	1000	10**n Dir/min
12	Cleep speed	OWC00B	100	10**n Dir/min
13	Fixed number lineal spped acceleration	OWC00C	500	ms
14	Fixed number lineal speed reduction	OWC00D	500	ms
15	Locating completion scope	OWC00E	10	Directive unit
16	Deviation abnormal detection	OWC00F	65535	Pulse
17	Position loop gain	OWC010	30.0	/s
18	Feed forward compensatory	OWC011	0	%
19	Position directive	OLC012	0	Directive unit
21	Fixed number of filter	OWC014	0	time
22	Speed directive	OWC015	0.00	%
23	Phase revised	OLC016	0	Pulse
25	Speed revised	OWC018	0.00	%
26	Proportional gain	OWC019	30.0	/s
27	Integral time	OWC01A	300	ms

(0 - 65535 : 1)

or Help, press F1

h) Click Save on the Toolbar.

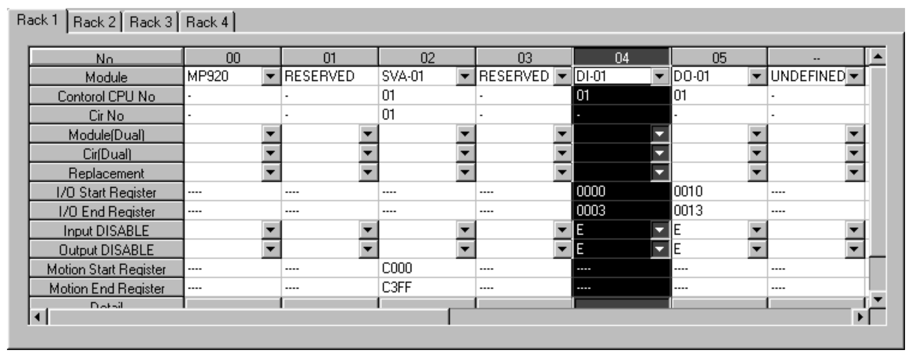


This completes the setting parameter setting procedure.

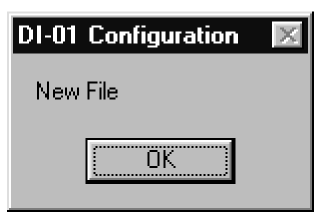
The Module Definition Window will return.

7. Use the following procedure to set information on the DI-01 Module.

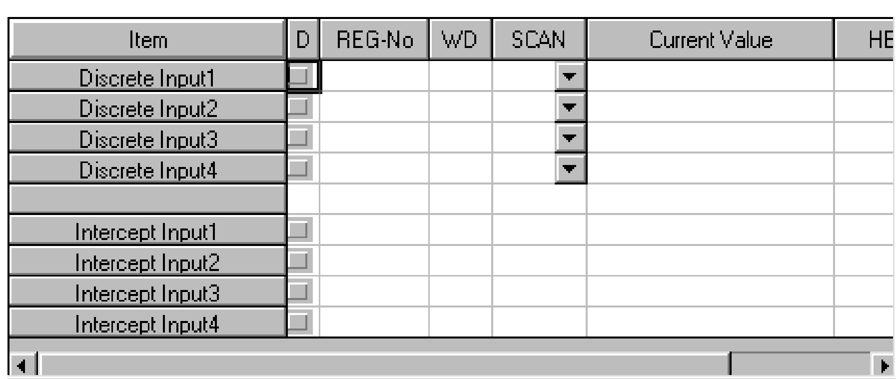
a) Double-click slot No. **04**.



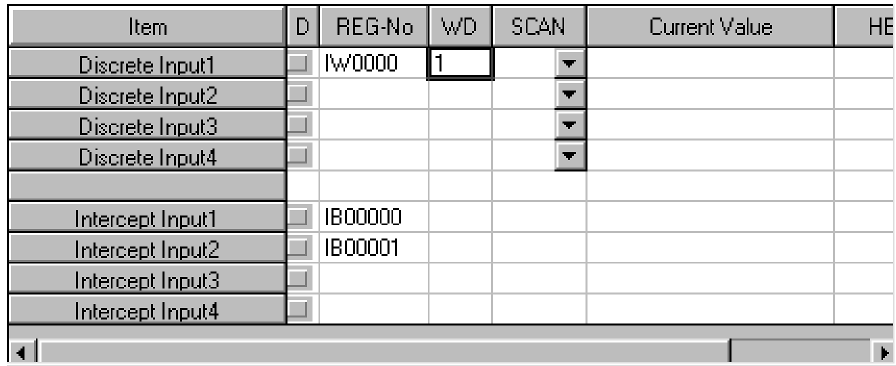
b) Click the **OK** button in the following message box.



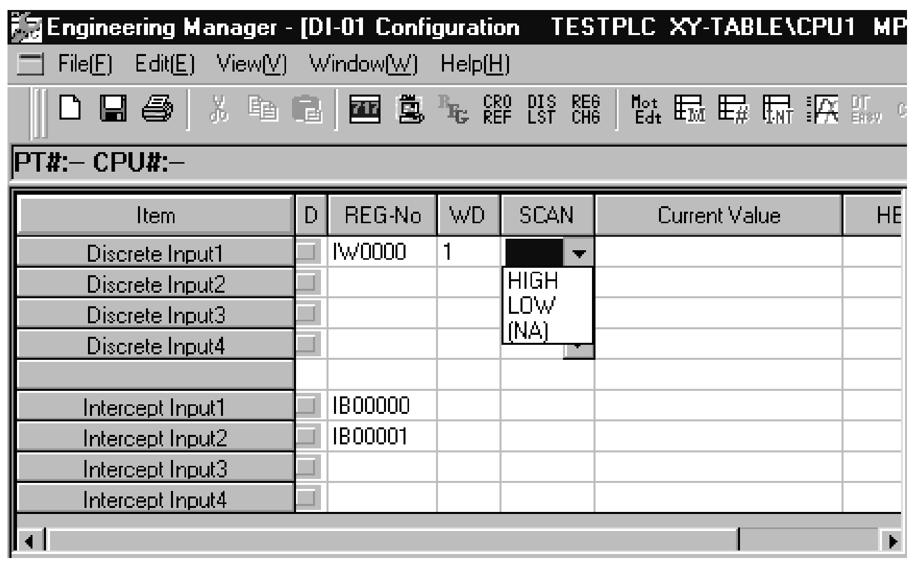
The DI Definition Window will be displayed.



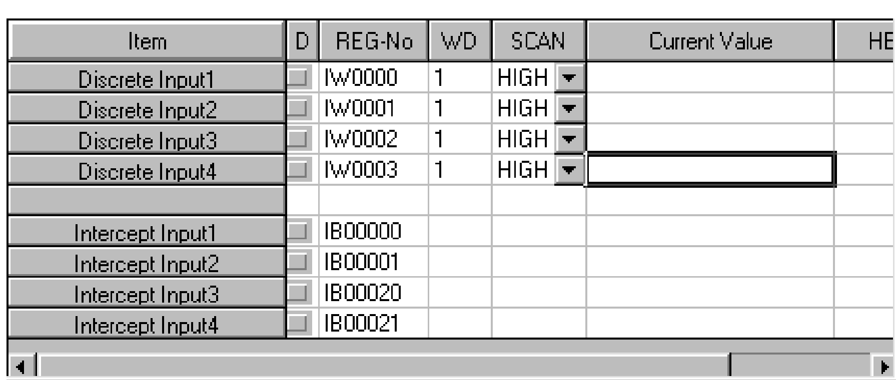
c) Double-click ***Discrete Input1*** in the ***REG-No*** column, and then input **0** after **IW**.



d) Click the ▼ button on the right side of ***Discrete Input1*** in the ***Scan*** column, and then click ***High***.



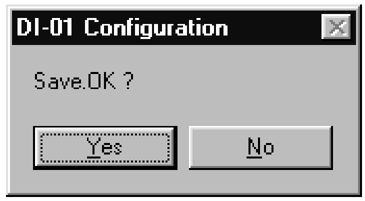
e) Repeat steps c) and d) for ***Discrete Input2*** to ***Discrete Input4*** to set the values as shown below.



6

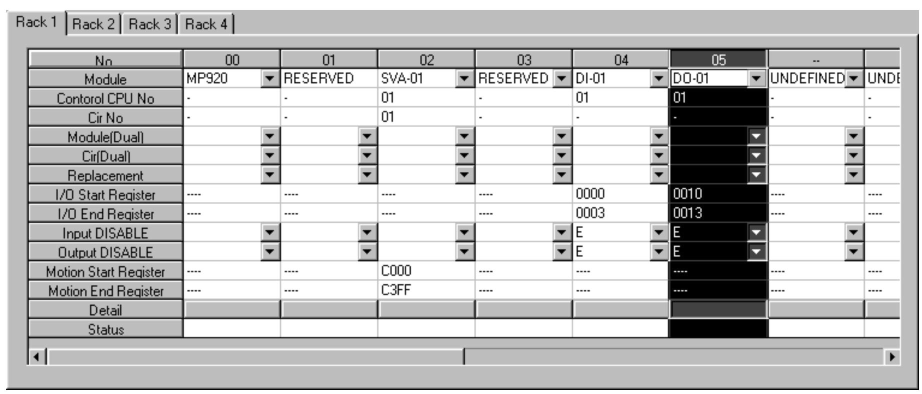
f) Click Save on the Toolbar.

g) Click the **Yes** button in the following message box. The definition data will be saved.

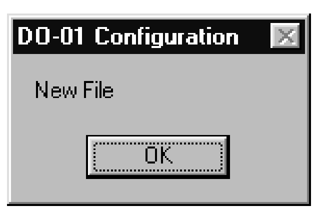


8. Use the following procedure to set information on the DO-01 Module.

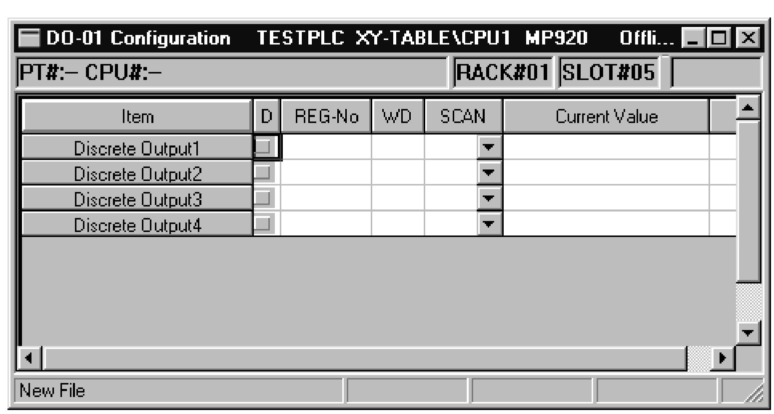
a) Double-click slot No. **05**.



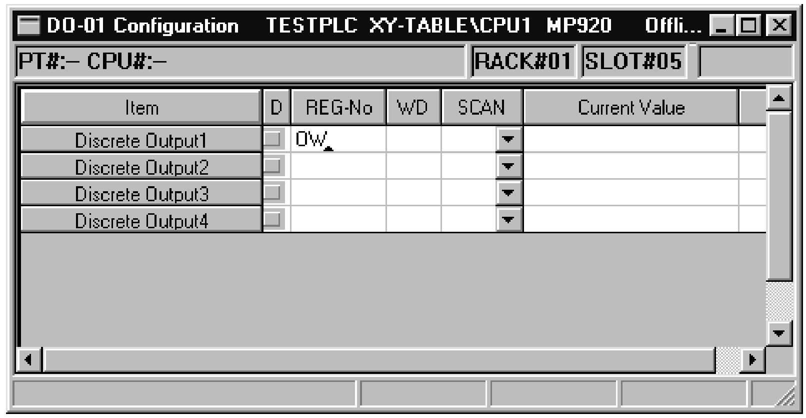
b) Click the **OK** button in the following message box.



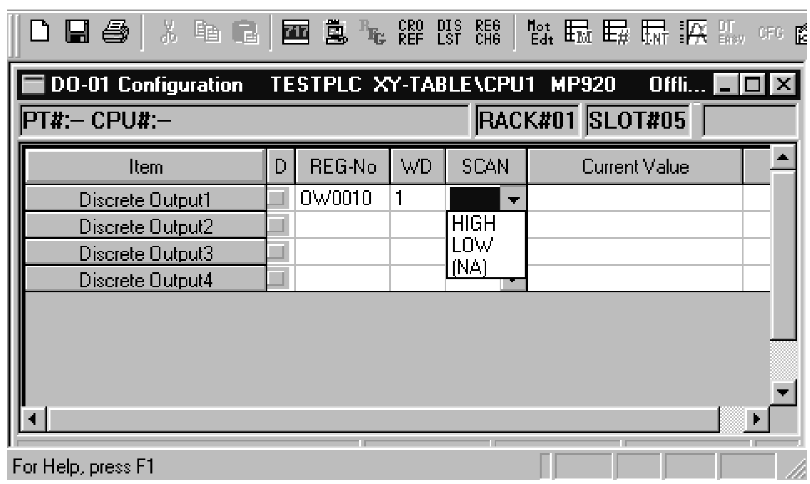
The DO Definition Window will be displayed.



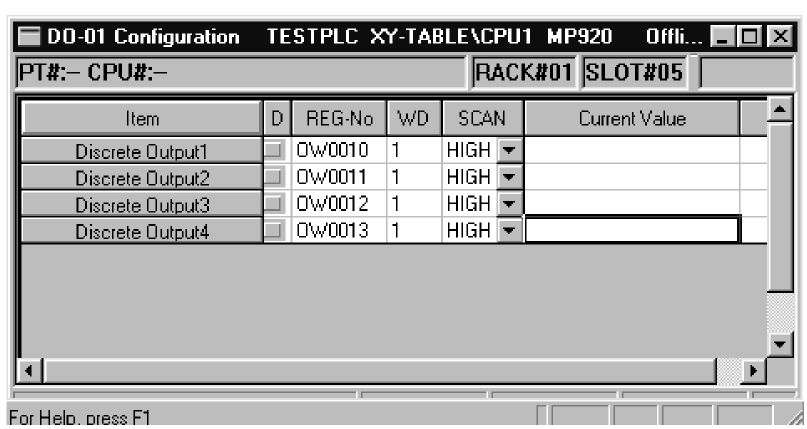
c) Double-click ***Discrete Output1*** in the ***REG-No*** column, and then input **10** after **OW**.



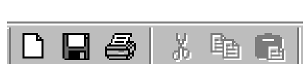
d) Click the ▼ button on the right side of ***Discrete Output1*** in the ***Scan*** column, and then click ***High***.



e) Repeat steps c) and d) for ***Discrete Output2*** to ***Discrete Output4*** to set the values as shown below.

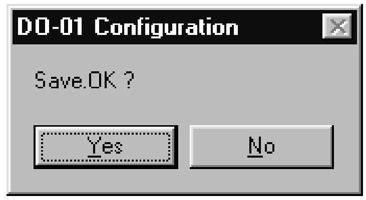


f) Click Save on the Toolbar.



6

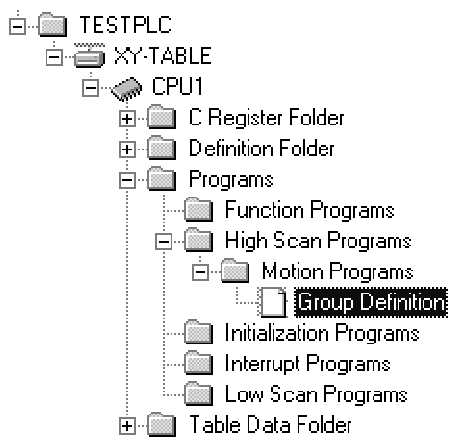
g) Click the **Yes** button in the following message box. The definition data will be saved.



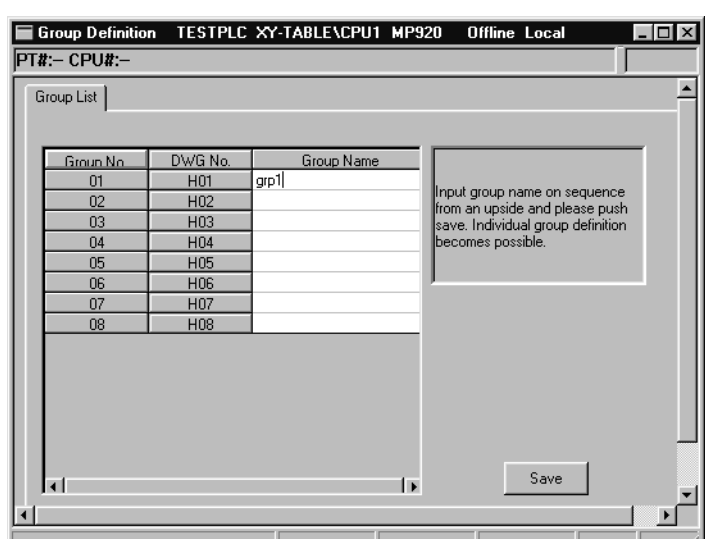
■ Group Definitions

Set the number of axes, the number of tasks, and the axis names required for MP920 motion control.

1. On the File Manager Screen, scroll down in order of ***XY-TABLE*** → ***CPU1*** → ***Programs*** → ***High Scan Programs*** → ***Motion Programs*** → ***Group Definition***, place the cursor on ***Group Definition***, and double-click.



2. Double-click the ***Group Name*** field under Group No. 01, and set **grpl**. Then click the **Save** button to register the group name. The registered Group Number tab will be added to the window.

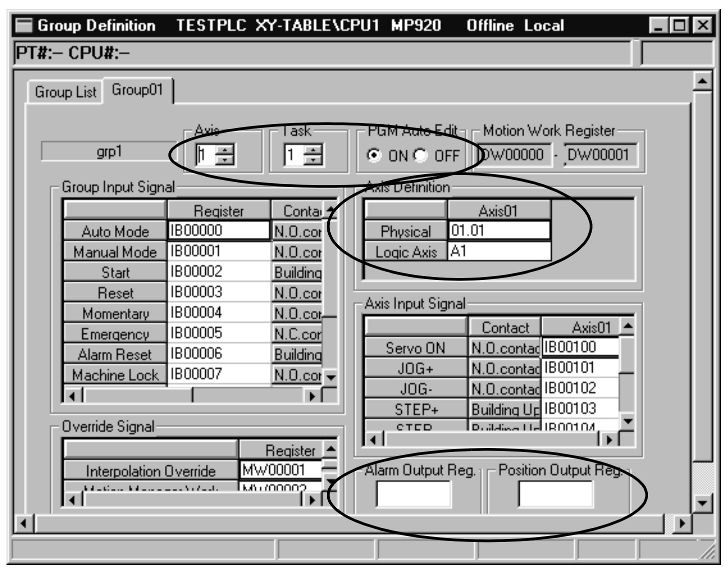


3. Click the **OK** button in the following message box.

4. Click the ***Group 01*** tab in the Group Definition window.

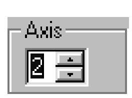
   The Group 01 Group Definition Window will be displayed.

5. Use the following procedure to change the circled parts of the Group 01 Group Definition Window.



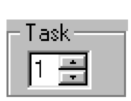
a) Number of Controlled Axes

   Click the ▲ button and set the number of axes to 2.



b) Number of Tasks

   Confirm that the number of tasks is 1.



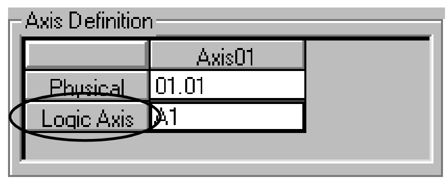
6

c) PGM Automatic Generation

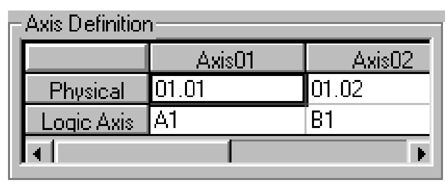
Confirm that PGM automatic generation is set to **ON**. (The default setting is ON.)

d) Axis Definition

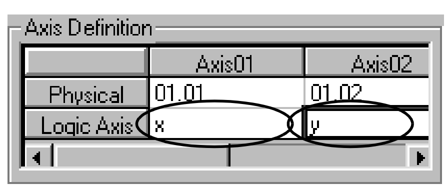
Click the ***Logic Axis*** name.



e) The two axes set in step a) will be displayed.



f) Click ***A1*** for Logical Axis Name axis 01, and input **X**.
Click ***B1*** for Logical Axis Name axis 02, and input **Y**.



INFO

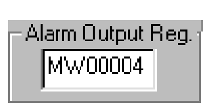
When more than one SVA-01A Module is used to control four or more axes, the physical axis numbers must correspond to the Module numbers.

Module number 2: 02.01, 02.02, 02.03, 02.04

Module number 3: 03.01, 03.02, 03.03, 03.04

g) Alarm Output Register

Click the ***Alarm Output Reg.*** field, and input **MW00004**.



h) Position Output Register

Click the ***Position Output Reg.*** field, and input **ML00020**.

INFO

- When the settings are made as shown in g) and h), the following registers will be allocated.
  Number of parallel processings (set in the Motion Properties (default = 4))

	Alarm Output Register
Parallel 1	MW00004
Parallel 2	MW00005
Parallel 3	MW00006
Parallel 4	MW00007

The position output registers for the number of axes in the group are automatically allocated.

	Position Output Register
Axis 01	ML00020
Axis 02	ML00022

- By default, the group input signals and axis input signals are allocated sequentially starting from IB00000. When a test must be conducted without connecting the input signal lines, it is convenient to set M registers.

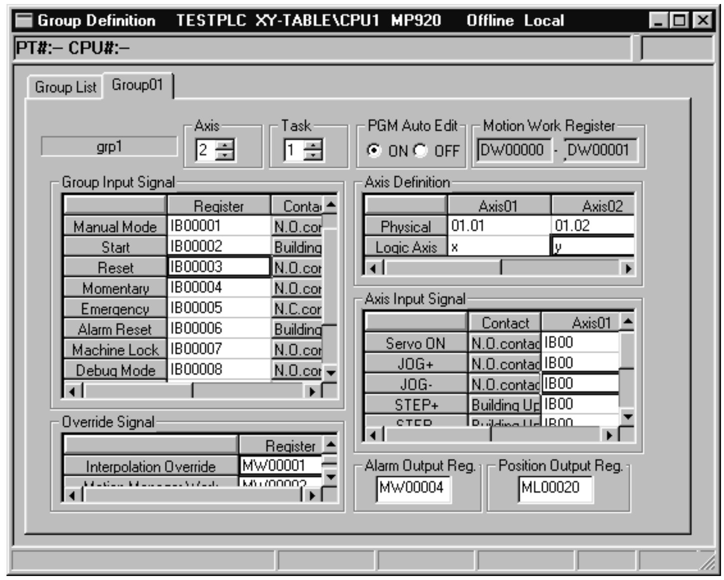
  Turning ON or OFF the signals on the Register List Screen has the same effect as using the switch box.

i) Axis Input Signal

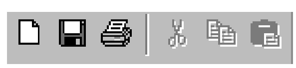
Set as follows in the setting field.

	Axis 01	Axis 02
Servo ON	IB00010	IB00020
JOG+	IB00011	IB00021
JOG-	IB00012	IB00022
STEP+	IB00013	IB00023
STEP-	IB00014	IB00024
ZRN	IB00015	IB00025
Set Zero Point	IB00016	IB00026
Stop	IB00017	IB00027

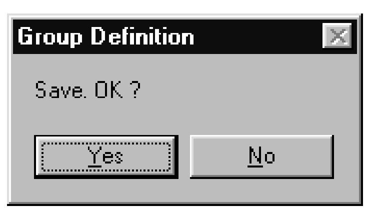
The Group Definition Window will be as shown in the following illustration after the settings have been completed.



6. Click Save on the Toolbar.



7. Click the **Yes** button in the following message box.



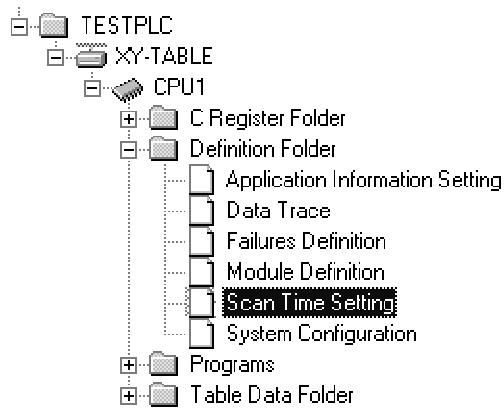
8. Click the **OK** button in the following message box.

9. The Save Completed message box will be displayed, and the group definition settings have been completed. Click the **OK** button.

■ Scan Time Setting

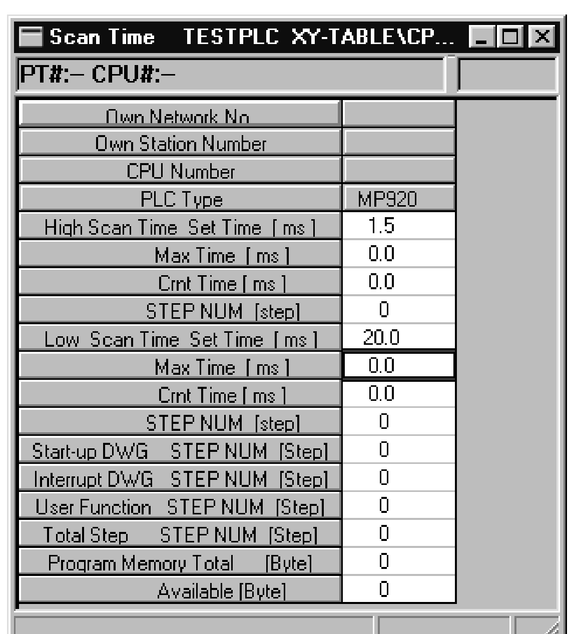
The MP920 sets the cycle for executing user programs (high-speed drawings and low-speed drawings).

1. On the File Manager Screen, double-click ***XY-TABLE***, ***CPU1, Definition Folder***, and ***Scan Time Setting*** in this order.



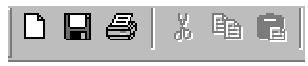
2. Click the **OK** button in the following message box.

3. Set the **High Scan Time** to **2.0** ms and the **Low Scan Time** to **30** ms.

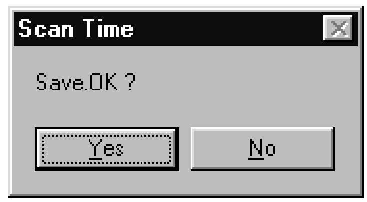


6

4. Click Save on the Toolbar.



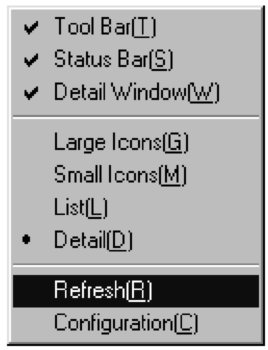
5. Click the **Yes** button in the following message box.



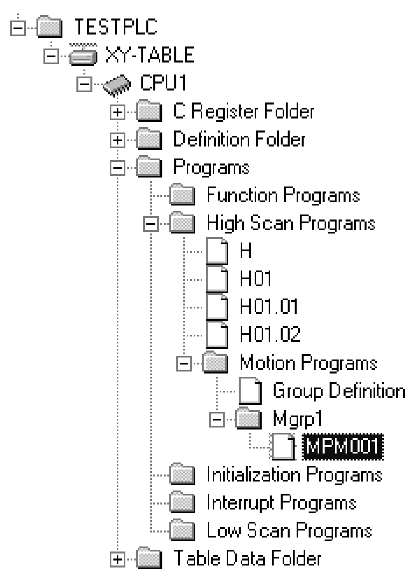
This completes the scan time setting procedure.

6.2.4 Creating and Saving Motion Programs

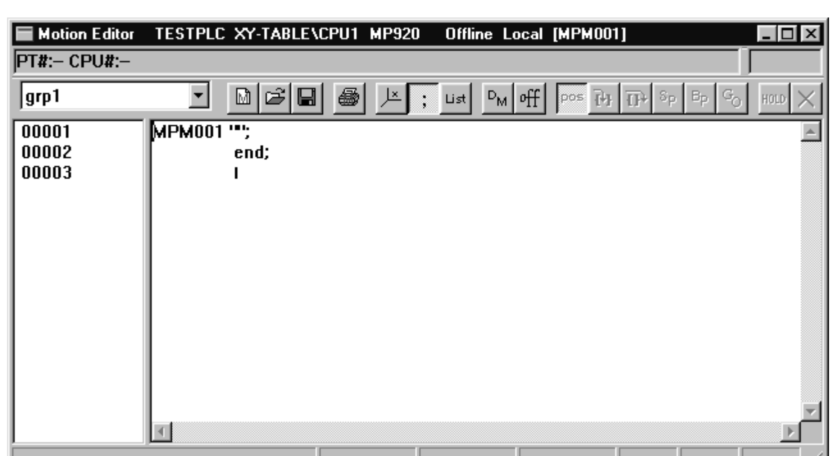
1. Click ***Refresh (R)*** under ***View (V)*** on the File Manager menu. This will refresh the information displayed in the XY-TABLE folder.



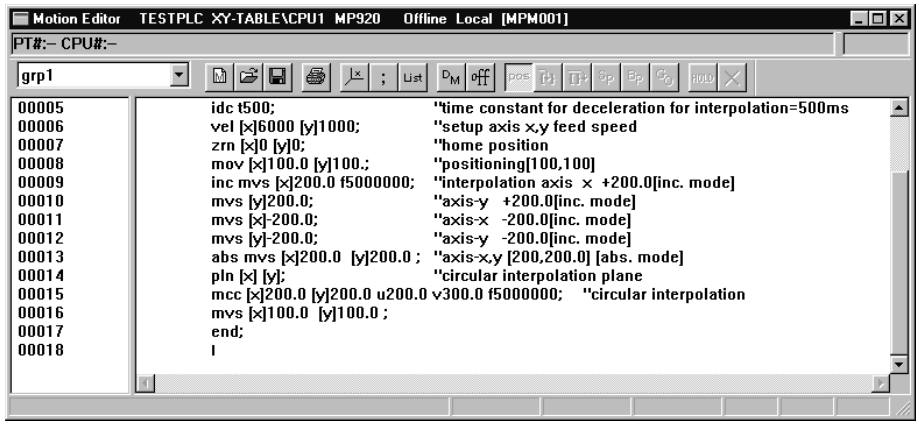
2. On the File Manager Screen, double-click ***XY-TABLE***, CPU1, ***Programs***, ***High Scan Programs***, ***Motion Programs***, ***Mgrp1***, and ***MPM001*** in this order.



The motion program MPM001 file will be displayed.



3. Input the following program between the MPM001 “ ”; and end; lines

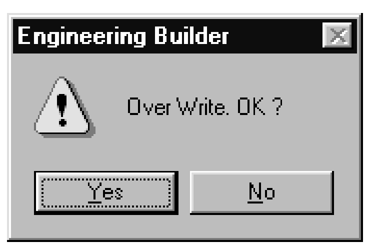


Saving Motion Programs

Use the following procedure to save a motion program that has been created.

1. Click ***Save*** on the Motion Editor toolbar.

2. Click the **Yes** button in the following message box.



The motion program will be compiled and saved.

MPM001 Operation

Start

X, Y axis origin return

Axis moves by rapid traverse speed to reference point (100.0, 100.0).

A square is drawn in order of + X → +Y → -X → -Y by linear interrpolation

Axis moves to (200.0, 200.0) by linear interpolation

One-circle operation at the center point (200.0, 300.0)

Axis moves by linear interpolation to reference point (100.0, 100.0).

End

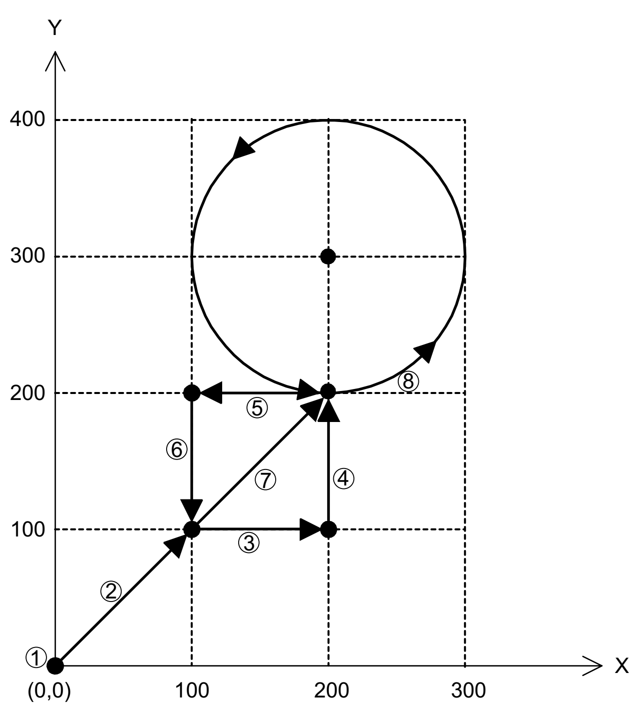


Fig. 6.1 Move Operation Chart According to Program

6

6.2.5 Ladder Logic Programs

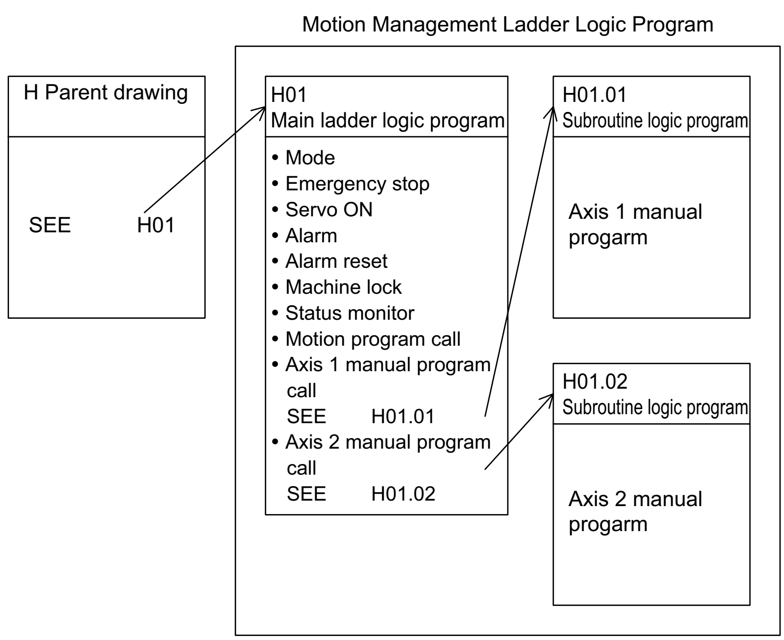
■ Overview

Ladder logic programs are automatically generated on the MPE720 by selecting Yes for PGM Automatic Generation on the Group Definition Screen and then saving the programs.

These ladder logic programs, called motion management ladder logic programs, are used to execute JOG, STEP, and HOME RETURN in manual mode, and to execute motion programs in automatic mode.

■ Structure of Ladder Logic Programs

The following illustration shows the structure of an automatically generated motion management ladder logic program (MM ladder logic program).



■ Control Specifications

Motion management ladder logic programs with the following specifications are automatically generated for the Test Unit.

Number of controlled axes	2 axes
Number of tasks	1
Number of groups	1

■ External Signal Allocation

The external signals used by motion management ladder logic programs are allocated according to the group definition as shown in the following table.

Group Input Signals		Axis 1 Input Signals		Axis 2 Input Signals	
IB00000	Automatic mode	IB00010	Servo ON	IB00020	Servo ON
IB00001	Manual mode	IB00011	JOG+	IB00021	JOG+
IB00002	Start	IB00012	JOG-	IB00022	JOG-
IB00003	Reset	IB00013	STEP+	IB00023	STEP+
IB00004	Momentary stop	IB00014	STEP-	IB00024	STEP-
IB00005	Emergency stop	IB00015	ZRN	IB00025	ZRN
IB00006	Alarm reset	IB00016	Zero point setting	IB00026	Zero point setting
IB00007	Machine lock setting	IB00017	Stop	IB00027	Stop
IB00008	Block operation mode	–	–	–	–
IB00009	Block operation	–	–	–	–
IB0000A	Skip 1 operation	–	–	–	–
IB0000B	Skip 2 operation	–	–	–	–

■ Registers Used by Motion Management Ladder Logic Programs

Data Transfer between Main and Subroutine Logic Programs

MW00002 (1 word) is used as the register for data transfer between main and subroutine logic programs.

Registers in the Main Ladder Logic Program (H01)

The following illustration shows the configuration of the group work registers used by the main ladder logic program.

Register Number	Size	Description
DW00100	1 word	Group status
DW00101	1 word	Group control signal
DW00102	1 word	Automatic, common
DW00103	1 word	Manual, common
DW00104	1 word	Axis 1 manual status
DW00105	1 word	Axis 2 manual status
:		:
DW00151	1 word	Axis 48 manual status

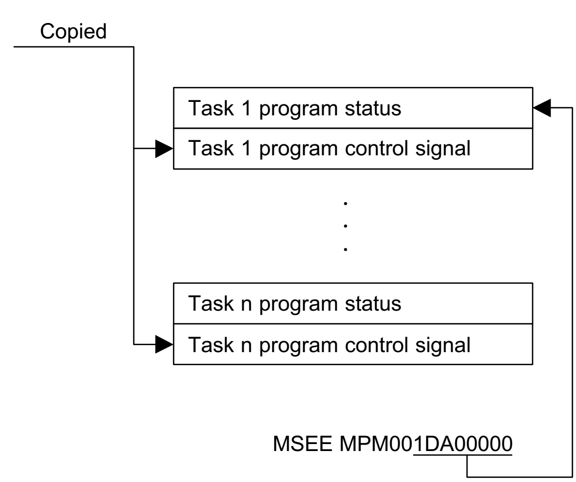


Fig. 6.2 Group Work Register Configuration

A detailed description of the registers is given in the following table.

Program Status (DW00100)		Program Control Signal (DW00101)	
b0	Program running	b0	Program start request
b1	Program paused	b1	Program pause request
b2	(Used by the system.)	b2	Program forced stop request
b3	(Used by the system.)	b3	Program debugging mode selection
b4	Program being debugged	b4	Program debugging start request
b8	Program alarm generated	b5	Alarm reset request
bB	Debugging mode (EWS debugging)	b8	Skip 1 information
bE	Main program duplication error	b9	Skip 2 information
bF	Main program number exceeded error	–	–

Automatic, Common (DW00102)		Manual, Common (DW00103)	
b0	Stopped for emergency	b0	Operating manually
b1	Status history	–	–
b2	Debugging start history	–	–
b3	Automatic mode status OFF request	–	–
b4	Manual mode status OFF request	–	–
b5	Program start request	–	–

Manual Status (DW00104)	
b0	Axis alarm generated
b1	Command duplication command alarm
b2	Operating manually

Registers in Subroutine Logic Programs (H01.01, H01.02)

The following table shows the configuration of the group work registers used by the subroutine logic programs.

Register Number	Size	Description
DW00100	1 word	Manual status
DW00101	1 word	Command/Response
DW00102	1 word	FEED status
DW00103	1 word	STEP status
DW00104	1 word	ZRET status
DW00105	1 word	ZSET status

A detailed description of the registers is given in the following table.

Manual status (DW00100)		Axis Command/Response (DW00101)	
b0	Axis alarm generated	b0	Command = No command
b1	Command duplication command alarm	b1	Command = INTERPOLATION END SEGMENT
b2	Operating manually	b2	Command = FEED
b3	Manual system command completed	b6	Response = No command
b4	Command interrupted	b7	Response = POSITIONING
–	–	b8	Response = EXTERNAL POSITIONING
–	–	b9	Response = ZRET
–	–	bA	Response = INTERPOLATION
–	–	bB	Response = INTERPOLATION END SEGMENT
–	–	bC	Response = FEED
–	–	bD	Response = STEP
–	–	bE	Response = ZSET

FEED status (DW00102)		STEP status (DW00103)	
b0	FEED start request	b0	STEP start request
b1	FEED command completion check	b1	STEP start history
b2	FEED execution	b2	STEP execution
b3	FEED command operating	b3	STEP command operating
b4	FEED command completed	b4	STEP command completed

ZRET status (DW00104)		ZSET status (DW00105)	
b0	ZRET start request	b0	ZSET start request
b1	ZRET start history	b1	ZSET start history
b2	ZRET execution	b2	ZSET execution
b3	ZRET command operating	b3	ZSET command operating
b4	ZRET command completed	b4	ZSET command completed

■ Motion Management Ladder Logic Programs

The programs that are automatically generated on the Group Definition Window are shown in the following illustrations.

H Drawing Main Program

PSH9200-962401 P00101 DWG. H Main program

COMMENT.CROSS REF. ($,&,@=WRITE,/=DWG, -=ABOX, I=SFC,==SYMBOL,%=FBD,:=TBL)

1 0000"SEESTT"

1 0001 SEE H01 (Motion management ladder logic program call)

1 0002"SEE01"

0 0003 DEXD

	Draw. Date 1997.12.17	DWG. H Main program	PSH9200-962401 P00101

Main Motion Management Ladder Logic Program

PSH9200-962401 P00103 DWG. H01 Main program

COMMENT.CROSS REF. ($,&,@=WRITE,/=DWG, -=ABOX, I=SFC,==SYMBOL,%=FBD,:=TBL)

1 0000 $FSCAN-H SB000001 1st

1 0001 IFON

■ Work memory initialization

2 0002 00000 ⇒ DW00000 Task 1 program status

2 0004 ⇒ DW00001 Task 1 program control signals

2 0005 SETW DW00100 D=00000 W=00006

1 0008 IEND

■ Emergency stop

1 0009 IB00005 Emergency stop — DB001020 Stopped for emergency

1 0010 DB001020 Stopped for emergency, IB00006 Alarm reset

■ Mode selection

1 0013 IB00000 Automatic mode, IB00001 Manual mode, DB00100A Manual mode status, DB001023 Automatic mode status OFF request — DB001009 Automatic mode status

1 0016 DB001009 Automatic mode status

1 0019 IB00001 Manual mode, IB00000 Automatic mode, DB001009 Automatic mode status, DB001024 Manual mode status OFF request — DB00100A Manual mode status

1 0022 DB00100A Manual mode status

1 0025 "ST-AXSCHG01"

■ Servo ON

1 0026 DB001020 Stopped for emergency, IB00010 Axis servo ON (axis 1) — OBC0010 Servo parameter (SVRUNCMD)

1 0029 DB001020 Stopped for emergency, IB00020 Axis servo ON (axis 2) — OBC0410 Servo parameter (SVRUNCMD)

1 0032 "ED-AXSCHG01"

1 0033 "ST-AXSCHG02"

■ Alarms

1 0034 ILC022 Servo parameter (ALARM) ≠ 00000 — DB001040 Axis alarm generated Axis 1

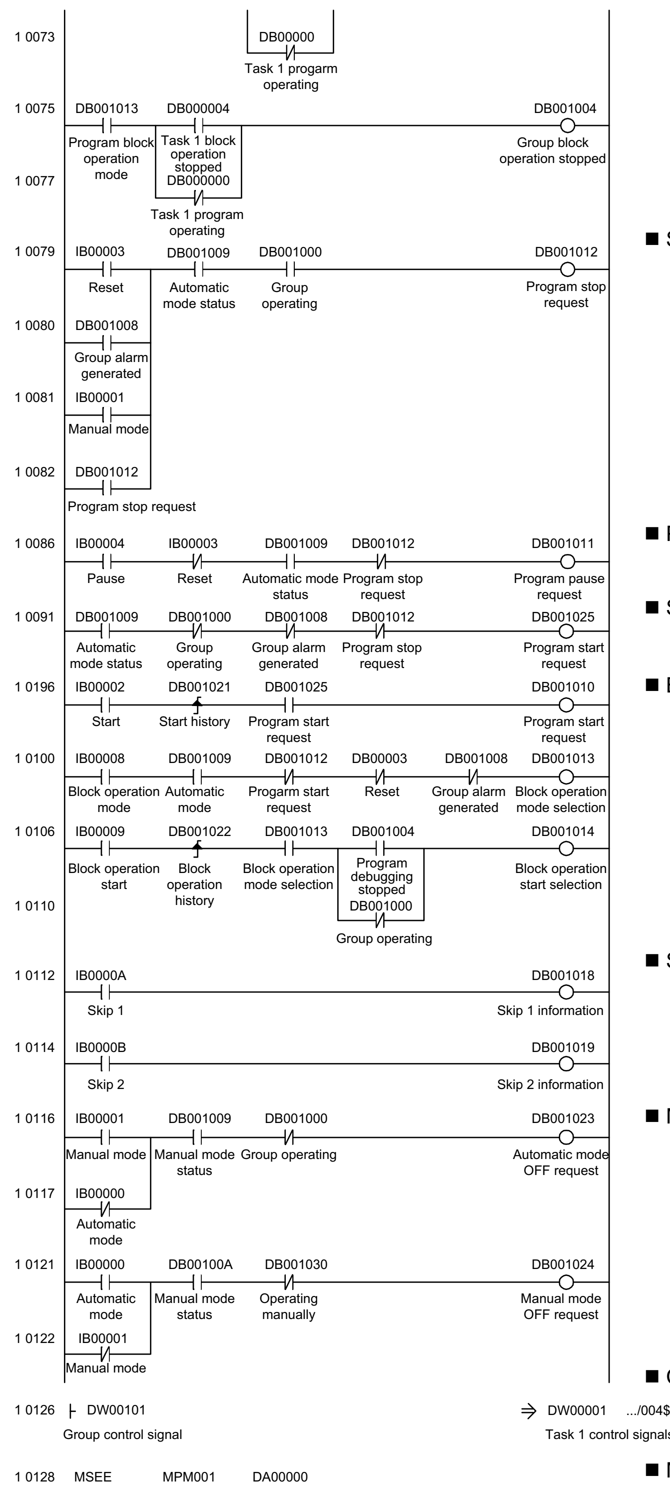
1 0037 ILC062 Servo parameter (ALARM) ≠ 00000 — DB001050 Axis alarm generated Axis 2

1 0040 "ED-AXSCHG02"

	Draw. Date 1997.12.17	DWG. H01 Main program	PSH9200-962401 P00103

PSH9200-962401 P00105 DWG. H01 Main program

COMMENT.CROSS REF. ($,&,@=WRITE,/=DWG, -=ABOX, I=SFC,==SYMBOL,%=FBD,:=TBL).U.



■ Stop

■ Pause

■ Start

■ Block operation

■ Skip operation

■ Mode resetting

■ Control signal distribution

■ Motion program call (Task 1)

	Draw. Date 1997.12.17	DWG. H01 Main program	PSH9200-962401 P00105

PSH9200-962401 P00106 DWG. H01 Main program

COMMENT.CROSS REF. ($,&,@=WRITE,/=DWG, -=ABOX, I=SFC,==SYMBOL,%=FBD,:=TBL)

MM Manual mode
■ Status monitor

1 0130 DB00100A
Manual mode status

1 0131 IFON

2 0132 "ST-AXSCHG06"

2 0133 DW00104 MW00002
Axis 1 manual mode status
H01.01

2 0135 SEE H01.01 (Axis 1 manual mode ladder logic program call)

2 0136 MB000021 DB001041
Command duplication alarm generated — Command duplication alarm generated

2 0138 MB000022 DB001042
Operating manually — Operating manually

2 0140 DW00105 MW00002
Axis 2 manual mode status

2 0142 SEE H01.02 (Axis 2 manual mode ladder logic program call)

2 0143 MB000021 DB001051
Command duplication alarm generated — Command duplication alarm generated

2 0145 MB000022 DB001052
Operating manually — Operating manually

2 0147 "ED-AXSCHG06"

2 0148 "ST-AXSCHG07"

2 0149 DB001042 DB001030
Axis 1 operating — Operating manualy

2 0150 DB001051
Axis 2 operating

2 0152 "ED-AXSCHG07"

1 0153 IEND

0 0154 DEND End of main ladder logic program

	Draw. Date 1997.12.17	DWG. H01 Main progarm	PSH9200-962401 P00106

6

Axis 1 Manual Program

PSH9200-962401 P00108 DWG. H01.01 Main program

MM subroutine Logic Program

COMMENT.CROSS REF. ($,&,@=WRITE,/=DWG, -=ABOX, I=SFC,==SYMBOL,%=FBD,:=TBL)

■ Initialization

```
         $FSCAN-H
0 0000   SB000001
         High-speed 1 scan
1 0001   IFON
2 0002   SETW       DW00100   D=00000    W=00006
1 0005   IEND
```

■ Status monitor

```
1 0006   DB00101C                                   DB001002
         Fixed speed feed                           Operating manually
1 0007   DB00101D
         Fixed length feed
1 0008   DB00101E
         Zero point return
```

■ Motion command status

```
1 0010   OWC020  =  00000                           DB001010
         Motion command                             No command
                                                    C_NOP
1 0013   OWC020  =  00005                           DB001011
         Motion command                             Interpolation end segment
                                                    C_E_INT
```

■ Motion command response status

```
1 0016   OWC020  =  00007                           DB001012
         Motion command response                    Fixed length feed
                                                    C_FEED
1 0019   IWC014  =  00000                           DB001016
                                                    No command
                                                    R_NOP
1 0022   IWC014  =  00001                           DB001017
                                                    POSITIONING
                                                    R_POS
1 0025   IWC014  =  00002                           DB001018
                                                    EXTERNAL POSITIONING
                                                    R_EX_POS
1 0028   IWC014  =  00003                           DB001019
                                                    Zero point return
                                                    R_ZRET
1 0031   IWC014  =  00004                           DB00101A
                                                    Interpolation
                                                    R_INT
1 0034   IWC014  =  00005                           DB00101B
                                                    Interpolation end segment
                                                    R_E_INT
1 0037   IWC014  =  00007                           DB00101C
                                                    Fixed speed feed
                                                    R_FEED
1 0040   IWC014  =  00008                           DB00101D
                                                    Fixed length feed
                                                    R_STEP
1 0043   IWC014  =  00009                           DB00101E
                                                    Zero point setting
                                                    R_ZSET
```

■ Motion command duplication alarm

FEED (Fixed speed feed)

```
1 0046   DB001010   DB001012   DB001023             DB001001
         C_NOP      C_FEED     FEED command         Command
                               operating            duplication alarm
1 0048   DB001016   DB00101C
         R_NOP      R_FEED
```

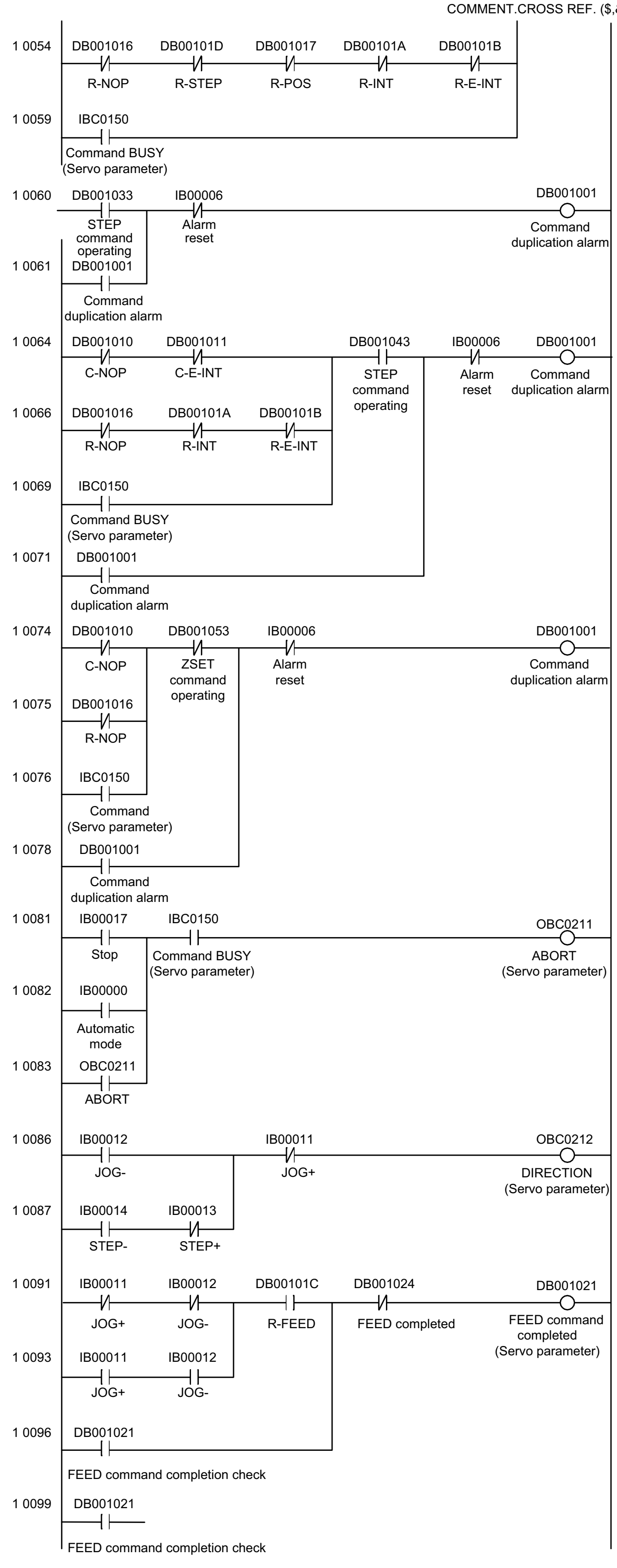
STEP (Fixed length feed)

```
1 0052   DB001010   DB001011
         C_NOP      C_E_INT
```

		Draw. Date 1997.12.17	DWG. H01.01 Main program	PSH9200-962401 P00108

PSH9200-962401 P00109 DWG. H01.01 Main program

COMMENT.CROSS REF. ($,&,@=WRITE,/=DWG, -=ABOX, I=SFC,==SYMBOL,%=FBD,:=TBL).U.



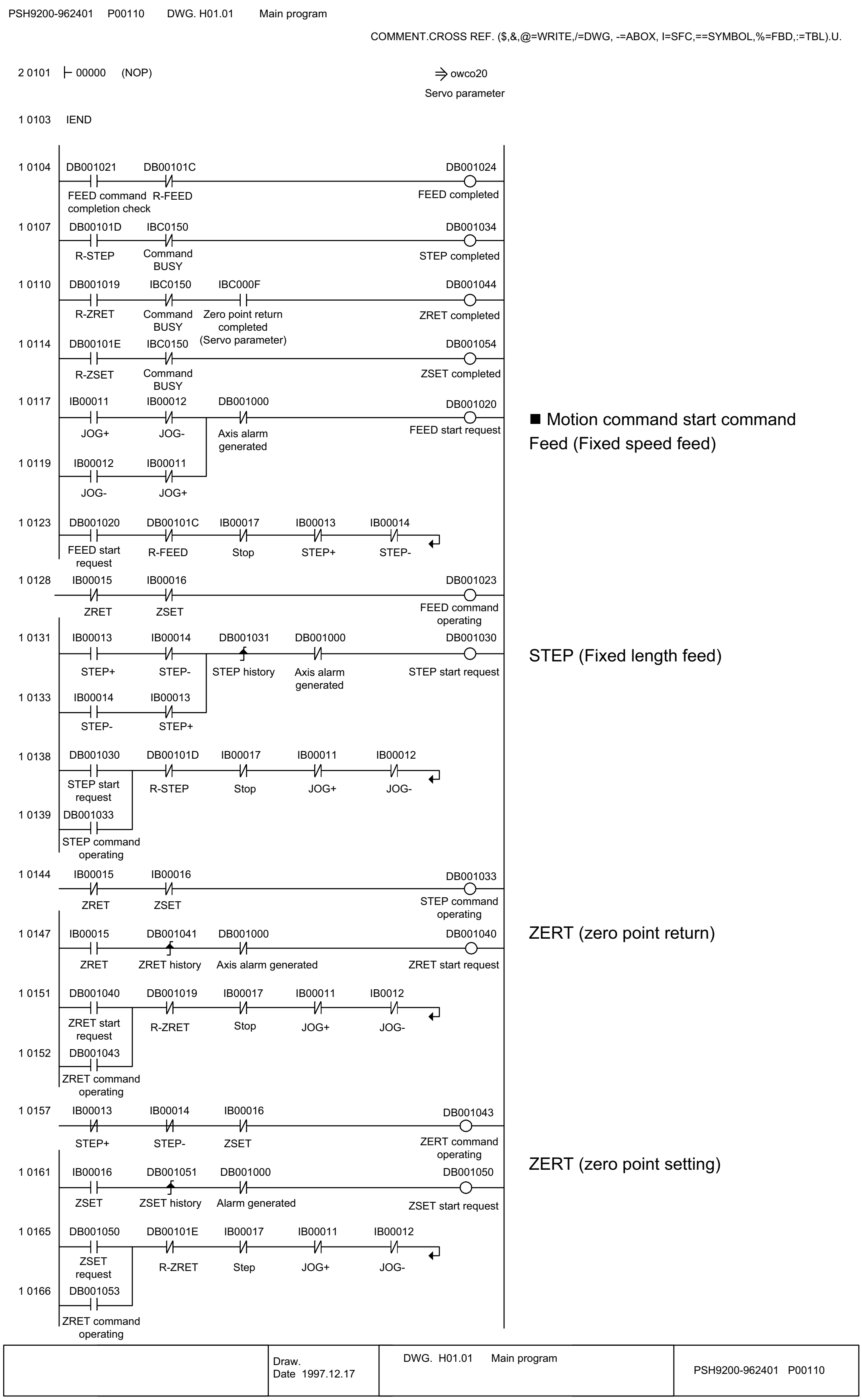
■ ZRET (zero point return)

■ ZRET (zero point setting)

■ Motion command interruption request completion check

■ Reverse operation command

	Draw. Date 1997.12.17	DWG. H01.01 Main program	PSH9200-962401 P00109



■ Motion command start command
Feed (Fixed speed feed)

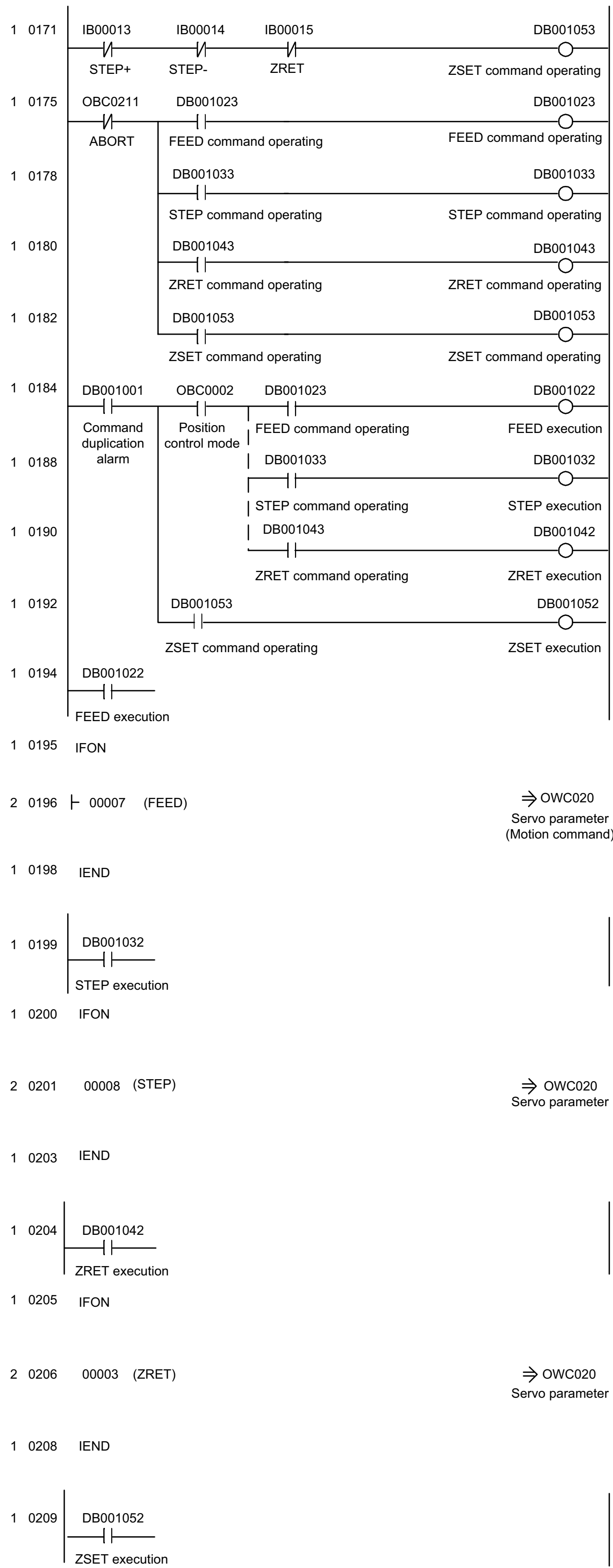
STEP (Fixed length feed)

ZERT (zero point return)

ZERT (zero point setting)

PSH9200-962401 P00111 DWG. H01.01 Main program

COMMENT.CROSS REF. ($,&,@=WRITE,/=DWG, -=ABOX, I=SFC,==SYMBOL,%=FBD,:=TBL).U.



■ Command execution

	Draw. Date 1997.12.17	DWG. H01.01 Main program	PSH9200-962401 P00111

PSH9200-962401 P00112 DWG. H01.01 Main program

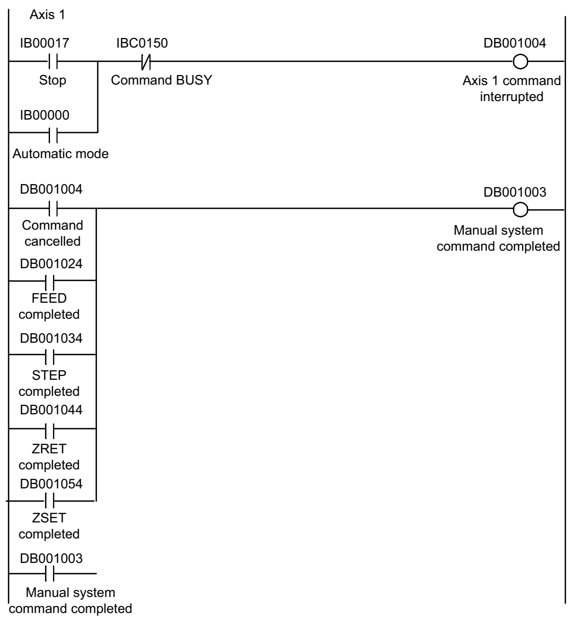
COMMENT.CROSS REF. ($,&,@=WRITE,/=DWG, -=ABOX, I=SFC,==SYMBOL,%=FBD,:=TBL).U.

1 0210 IFON

2 0211 ⊦ 00009 (ZSET) ⇒OWC020 Servo Parameter

1 0213 IEND

1 0214
1 0215
1 0218
1 0219
1 0220
1 0221
1 0222
1 0224



■ Stop command

■ Motion command end

2 0225 IFON

2 0226 ⊦ 00000 (NOP) ⇒OWC020 Motion command

2 0228 ⊦OWC021 Motion command control flags HFFFD (ABORT=OFF) ⇒OWC021 Motion command control flags

1 0231 IEND

1 0232 ⊦DW00100 Manual status ⇒MW00002 Manual status

1 0234 DEND Subroutine end

	Draw. Date 1997.12.17	DWG. H01.01 Main program	PSH9200-962401 P00112

6.2.6 Transferring Definitions, Parameters, and Programs

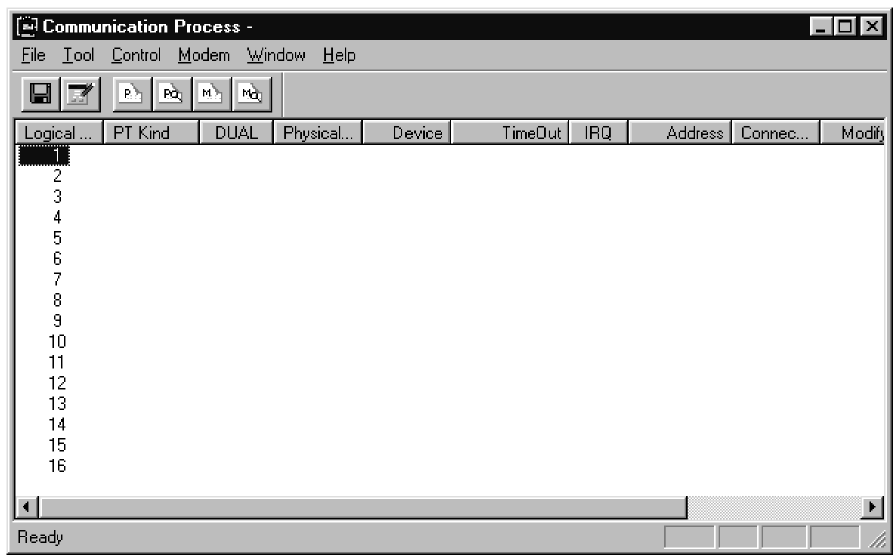
■ Setting Up Communications Environment

Use the following procedure to set up the communications environment for the computer connected to the serial port on the front panel of the MP920 CPU-01 Module.

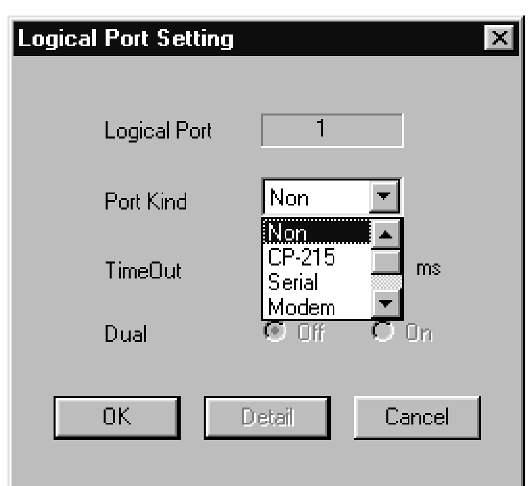
1. Click ***Communication Process*** to display the Communication Process Window.

2. Use the following procedure to set up the communications environment for Port 1.

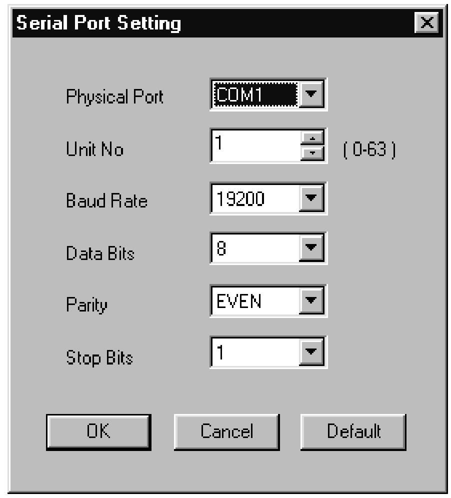
   a) Double-click ***1*** in the ***Logical*** column on the Communication Process Window to display the Setting Window.



   b) Click the ▼ button on the right side of ***Port Kind*** and then click ***Serial***. Next, click the Detail button to display the Detail Setting Window.

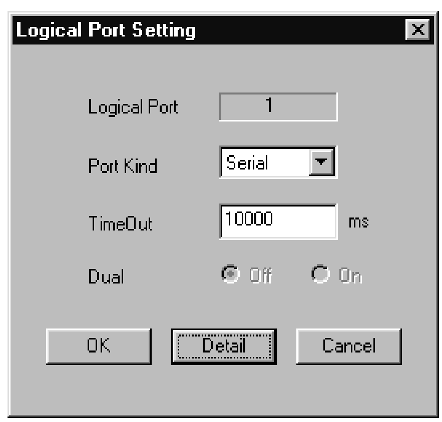


c) Click the **OK** button.

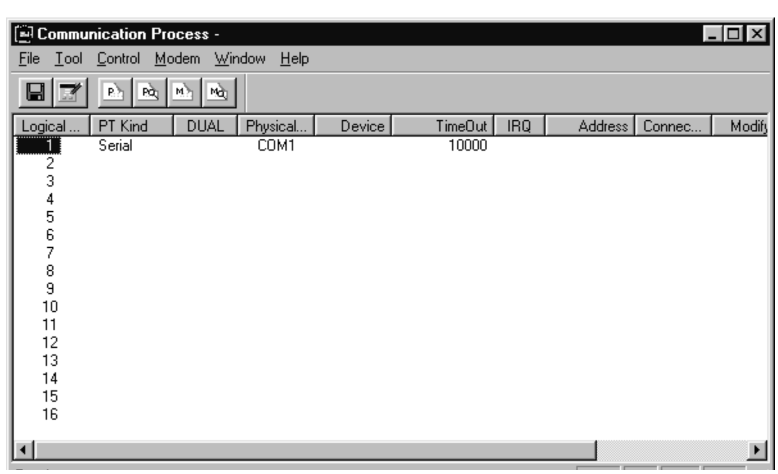


The Detail Setting Window will return.

d) Click the **OK** button.

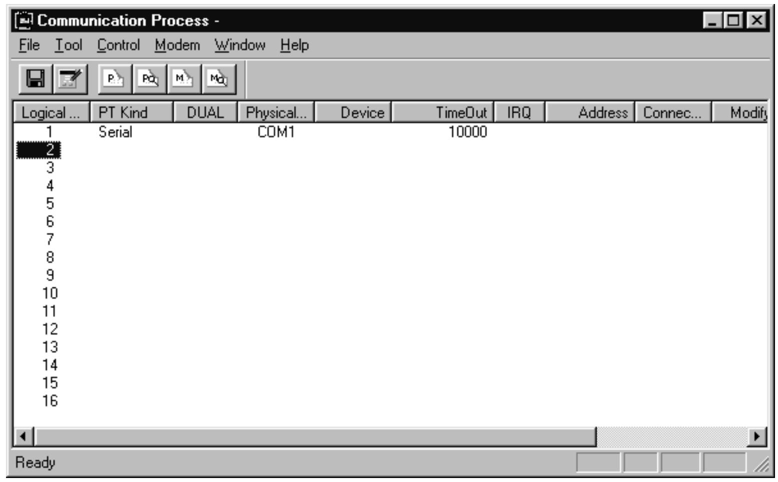


The port 1 setting procedure is completed and the Communication Process Window will be displayed as shown below.

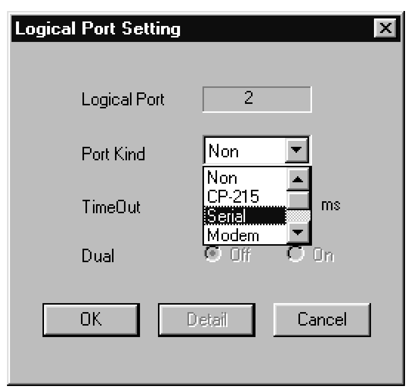


3. Use the following procedure to set up the communications environment for Port 2.

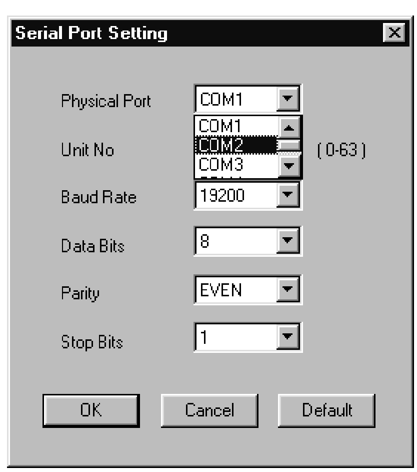
   a) Double-click ***2*** in the Logical column on the Communication Process Window to display the Setting Window.



   b) Click the ▼ button on the right side of ***Port Kind*** and then click ***Serial***. Next, click the ***Detail*** button to display the Detail Setting Window.

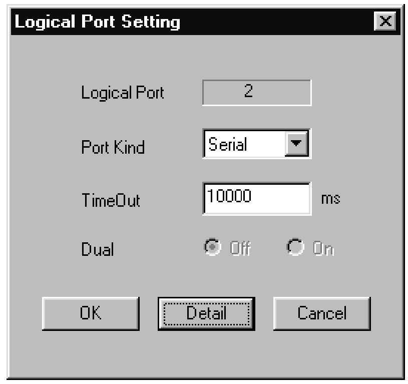


   c) Click the ▼ button on the right side of ***Physical Port*** in the Detail Setting Window and click ***COM2***. Then, click the **OK** button.

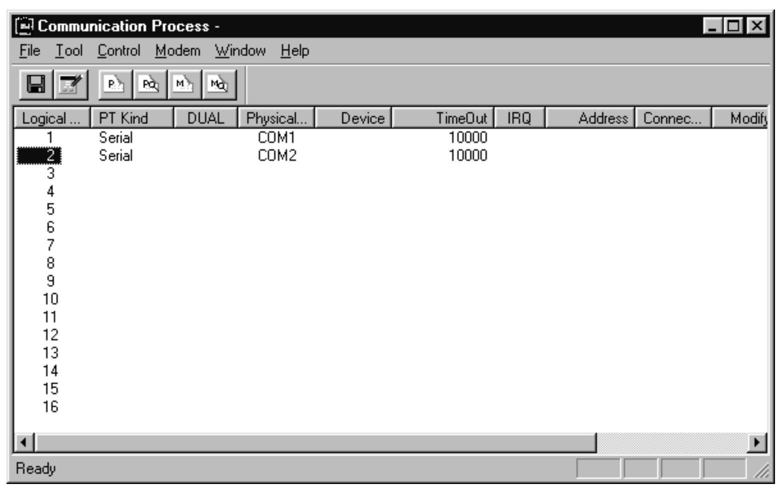


   The Detail Setting Window will return.

d) Click the **OK** button.

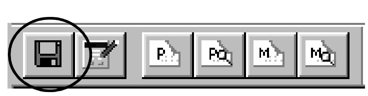


The Port 2 setting procedure is completed and the Communication Process Window will be displayed as shown below.

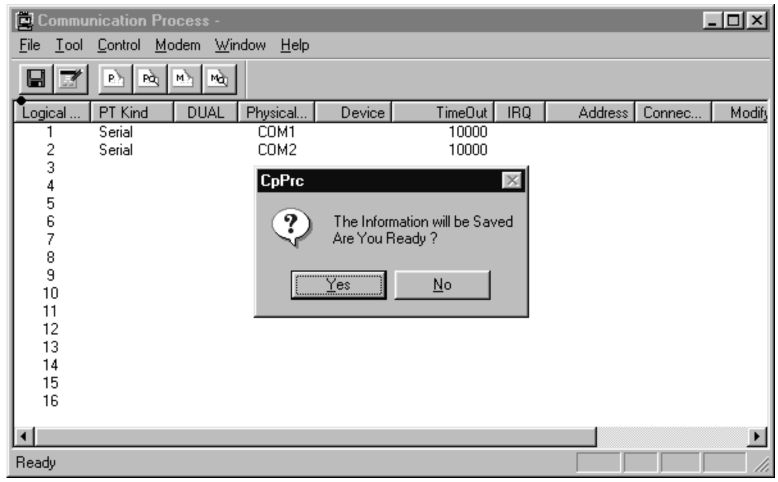


Ports 1 and 2 have been set up.

4. Click Save on the Toolbar to save the set data.



5. Click the **Yes** button in the following message box.



This completes the serial port setting procedures for the MP920 CPU-01 Module.

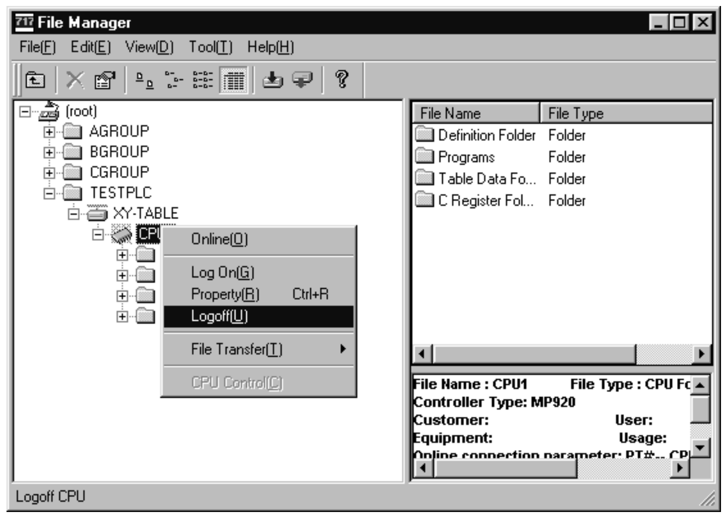
6

Preparations for Transfer

Use the following procedure to set the CPU to STOP status after switching from offline to online.

1. Logoff

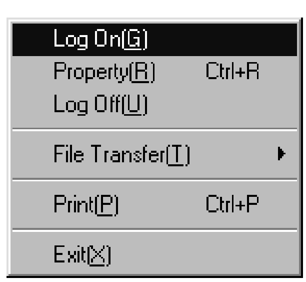
   On the File Manager Window, right-click ***CPU1*** in the ***XY-TABLE*** PLC folder and click ***Logoff (U)***.



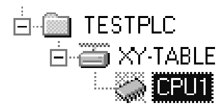
2. Click the **Yes** button in the following message box.

3. Logon

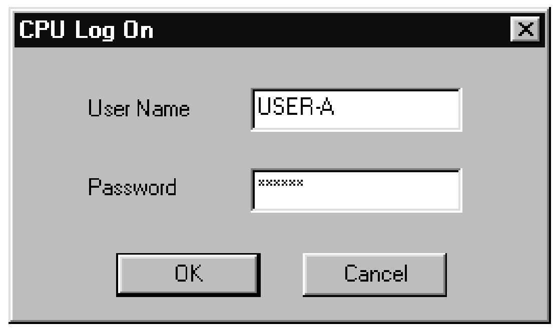
   a) On the File Manager Window, right-click ***CPU1*** in the ***XY-TABLE*** PLC folder and then click ***Online (O)***.



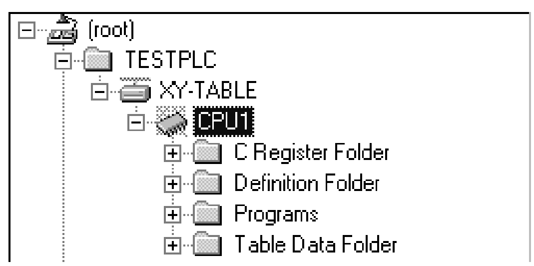
b) Double-click the ***XY-TABLE*** PLC folder.



c) Input the user name **USER-A** and password **USER-A**, then click the **OK** button.

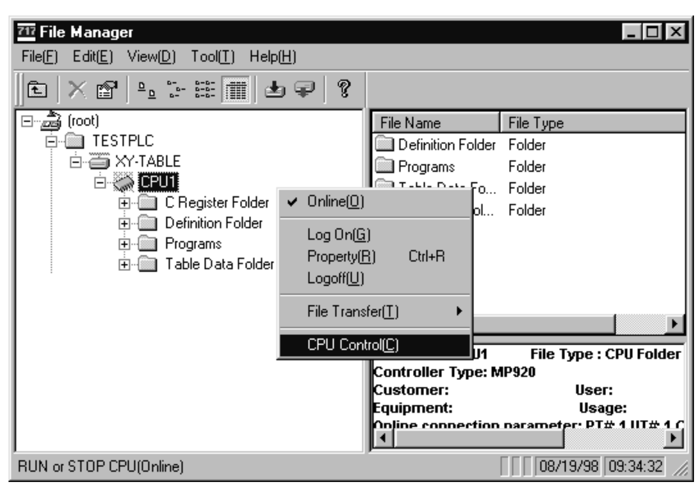


The Programs, Definition, and Table Data folders will be displayed in the XY-TABLE PLC folder, and logon has been completed.

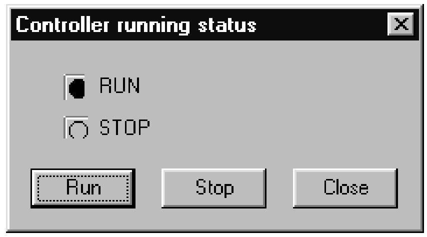


4. Stopping CPU Operation

a) Right-click the ***XY-TABLE*** PLC folder and click ***CPU Control (C)***.



b) Click the **Stop** button in the following message box.



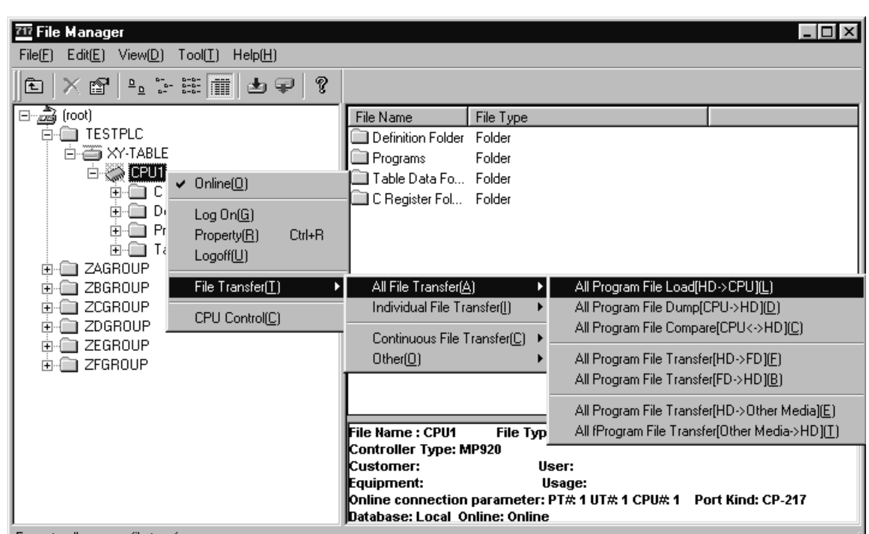
c) Click the **Yes** button in the following message box.

d) Confirm that the message box has entered STOP status, and click the **Close** button.

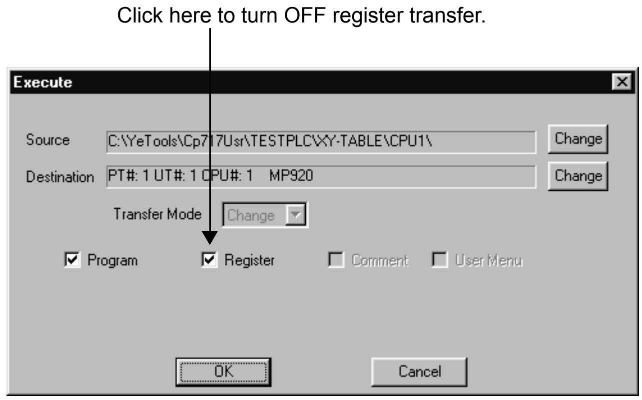
■ Transfer Procedure

The following screens show the transfer procedure for definitions, parameters, and programs.

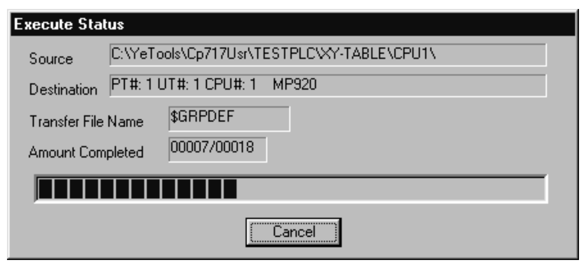
1. Right-click ***CPU1*** in the ***XY-TABLE*** PLC folder, scroll down in order of ***File Transfer (T)*** → ***All File Transfer (A)*** → ***All Program File Load (HD → CPU) (L)***, place the cursor on ***All Program File Load (HD → CPU) (L)***, and click.



2. Registers do not need to be transferred, so turn OFF the register selection, and click **OK** to start the transfer.



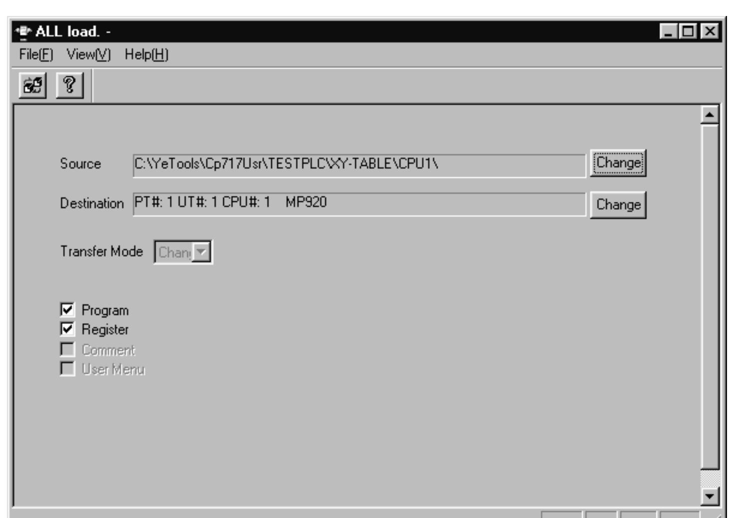
The Status Window will be displayed during transfer.



When transfer has been completed, the following message box will be displayed.

3. Click the **OK** button.

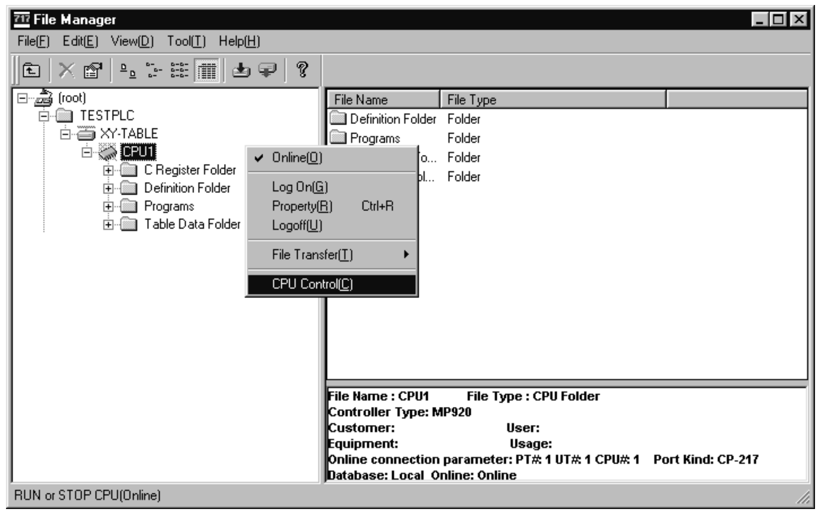
The Completion Confirmation Window will be displayed.



4. Starting CPU Operation

Once the transfer has been completed, start CPU operation, and execute the user program according to the definitions, parameters, and programs that have been sent.

a) Right-click the ***XY-TABLE*** PLC folder and click ***CPU Control (C)***.



b) Click the **RUN** button in the following message box.

c) Click the **Yes** button in the following message box.

d) Confirm that the message box has entered RUN status, and click the **Close** button.

Execution of the user program will have been started by this procedure, and the CPU Module RUN indicator will light.

e) Turn OFF pin 8 (M.RST) of the DIP switch on the CPU-01 Module to execute master reset.

6.2.7 Checking Operations

After wiring has been completed, and after the definitions, parameters, motion programs, and ladder logic programs have been created and transferred, use the following procedure to check operations.

■ Operation Check Procedure

Set the Automatic and Manual switches to Manual.

⇩

Set the emergency stop signal to ON.

⇩

Set the Servo ON/OFF switch to ON.

⇩

Press the JOG buttons.

⇩

Set the Automatic and Manual switches to Automatic.

⇩

Press the Start button and start the motion program.

■ Selecting Manual Mode

In the switch box, set the Automatic switch to OFF and the Manual switch to ON to select Manual mode.

■ Setting the Emergency Stop Signal to ON

Switch the emergency stop signal switch from OFF to ON. Because this signal is an N.C. contact, the emergency stop will be released when the switch is turned OFF.

■ Setting the Servo to ON

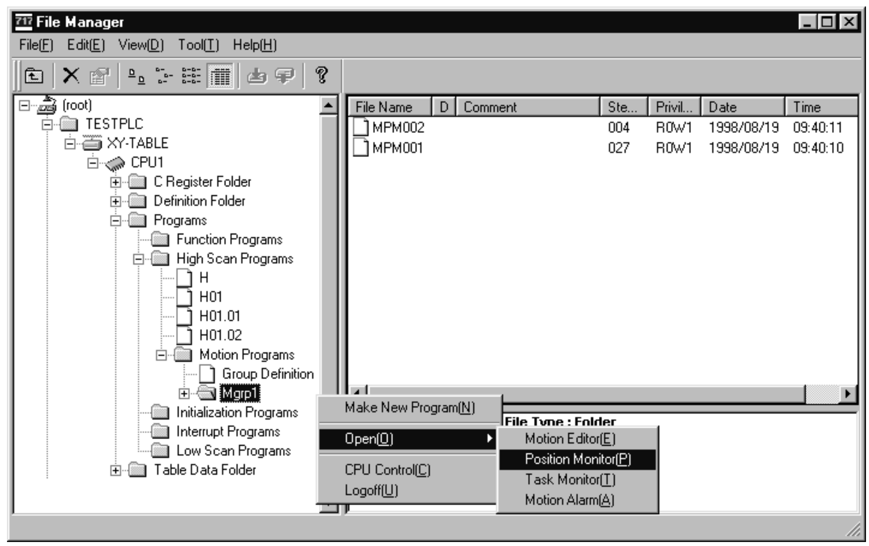
Switch the SERVO ON/OFF switch in the switch box from OFF to ON. The SERVOPACK power will be clamped, and will enter servo clamp status.

■ JOG Operation Check

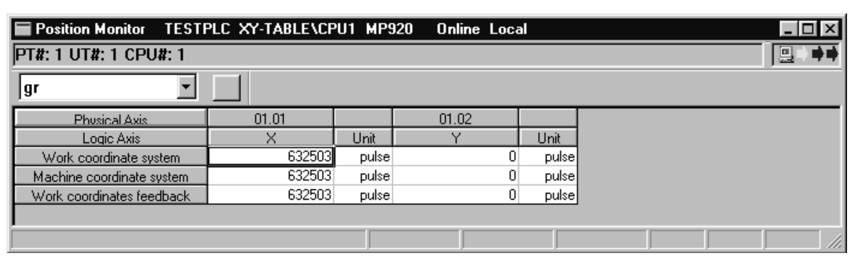
Check the JOG operation of each axis.
When the X+ button is pressed, the X axis will move in the positive direction while the button is being pressed. The current position of the X axis on the Position Monitor Screen will increase.
When the X- button is pressed, the X axis will move in the negative direction while the button is being pressed. The current value of the X axis on the Position Monitor Screen decreases.
Perform the same operation for the Y axis.

The procedure for displaying and checking the current position is as follows:

1. On the File Manager Window, scroll down in order of ***Programs*** → ***High Scan Programs*** → ***Motion Programs*** → ***Mgrp1***, right-click ***Mgrp1***, and click ***Open (O)*** → ***Position Monitor (P)***.



2. The Position Monitor Window will be displayed. The current position of each axis can be monitored.



Changes in the current position can be checked by pressing the X+ and X- buttons.

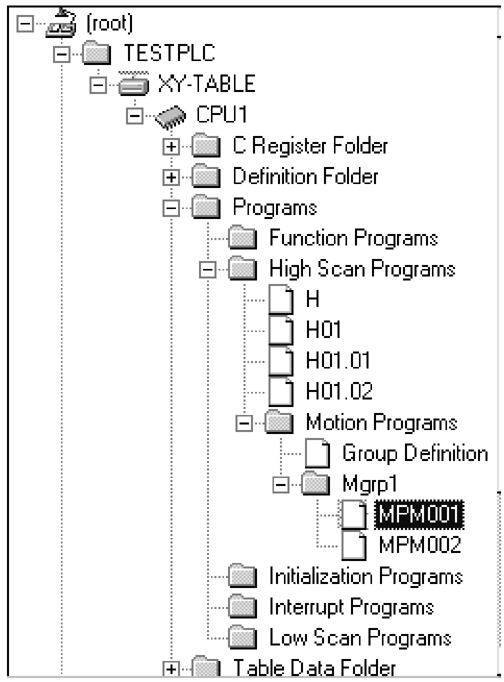
■ Motion Program Operation Check

Set the Automatic switch to ON and the Manual switch to OFF to select Automatic mode. Next, press the Start button to execute the motion program.
To monitor the motion program, display and check the Motion Editor Screen.

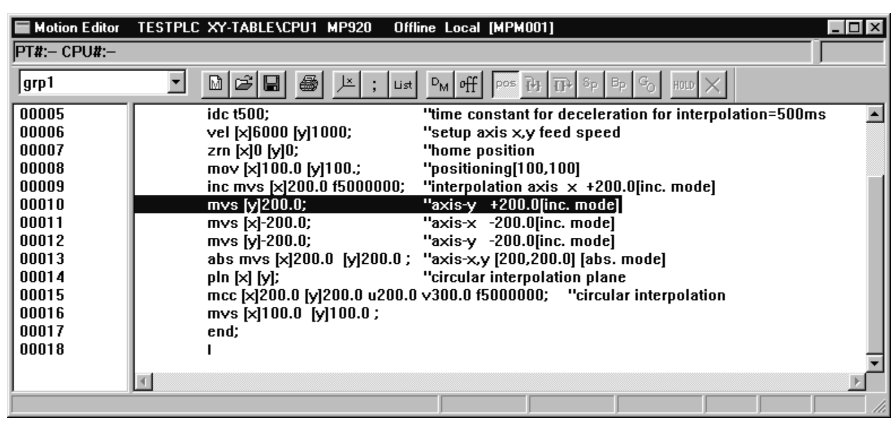
The procedure referred to above is shown in more detail in the following illustrations.

1. Set the Automatic switch to ON and the Manual switch to OFF to switch to Automatic mode.

2. On the File Manager Window, scroll down in order of ***Programs*** → ***High Scan Programs*** → ***Motion Programs*** → ***Mgrp1*** → ***MPM001***, and double-click ***MPM001***.



3. Press the switch box Start button. The block being executed will be displayed in reverse video.



7

Parameters

This chapter describes the procedure for the setting parameters needed to run the MP920.

7.1 Description of Parameters

This section describes parameters critical to motion functions in the SVA Modules.

7.1.1 Parameter Classifications

Parameters are specific constants needed for SVA Module motion functions. Set these parameters to values appropriate for machine specifications as well as for applicable Servodrive (Servomotor + SERVOPACK) performance.

Use a MPE720 Programming Device to create and edit parameters.

■ Parameter Types

Parameters are classified into the following three types.

Classification	Register No.	Description
Fixed Parameters	No registers	These parameters set machine, Servomotor, encoder, and other mechanical conditions. They are not normally changed once they are set, and they cannot be changed while the system is running.
Setting Parameters	OW□□00 to OW□□3F	These parameters are used to provide commands to the servo control section. They can be set from a motion program or ladder logic program while the system is running.
Monitor Parameters	IW□□00 to IW□□3F	These parameters are servo monitor data reported by the servo control section. They can serve as reference for motion programs or ladder logic programs.

The list of parameters is given in *Appendix A.3 Parameter List*.

■ Editing Parameters

The list of parameters is given in *Appendix A.3 Parameter List*.

The following table describes the procedures used to create, edit, or change parameters.

Setting Method	Procedure	Remarks
Personal Computer Programmer	• Parameters are edited in the Definitions Folder from the Setting Window.	
Motion Programs	• Motion programs can be used to set setting parameters (output registers OW□□00 to OW□□3F) with substitution statements.	
Ladder Logic Programs	• Parameters can be set directly from ladder logic programs.	

INFO

Refer to the *MP920 Machine Controller User's Manual: Motion Modules* (SIEZ-C887-2.5) for details on SVB and PO Module parameters.

7.1.2 Module Numbers and Motion Parameter Register Numbers

The motion parameter register numbers (I register numbers and O register numbers) will vary with the motion number and the individual axis (axis 1 to 4).

The following equation is used to determine motion parameter register numbers.

- Motion register number (IW□□□□ and OW□□□□) = Motion number offset + axis offset.
- The following are Module number offsets listed by Module number.

Module No.	Offset Value	Module No.	Offset Value
1	C000	9	E000
2	C400	10	E400
3	C800	11	E800
4	CC00	12	EC00
5	D000	13	F000
6	D400	14	F400
7	D800	15	F800
8	DC00	16	FC00

The following equations gives the axis offsets according to the axis number.

7

Axis offset = (axis number - 1) $\times$ 40H (64 words)

This yields the following servo parameter register numbers.

Table 7.1 Motion Parameter Register Numbers

Module No.	Axis 1 IW(OW)	Axis 2 IW(OW)	Axis 3 IW(OW)	Axis 4 IW(OW)
1	C000 to C03F	C040 to C07F	C080 to C0BF	C0C0 to C0FF
2	C400 to C43F	C440 to C47F	C480 to C4BF	C4C0 to C4FF
3	C800 to C83F	C840 to C87F	C880 to C8BF	C8C0 to C8FF
4	CC00 to CC3F	CC40 to CC7F	CC80 to CCBF	CCC0 to CCFF
5	D000 to D03F	D040 to D07F	D080 to D0BF	D0C0 to D0FF
6	D400 to D43F	D440 to D47F	D480 to D4BF	D4C0 to D4FF
7	D800 to D83F	D840 to D87F	D880 to D8BF	D8C0 to D8FF
8	DC00 to DC3F	DC40 to DC7F	DC80 to DCBF	DCC0 to DCFF
9	E000 to E03F	E040 to E07F	E080 to E0BF	E0C0 to E0FF
10	E400 to E43F	E440 to E47F	E480 to E4BF	E4C0 to E4FF
11	E800 to E83F	E840 to E87F	E880 to E8BF	E8C0 to E8FF
12	EC00 to EC3F	EC40 to EC7F	EC80 to ECBF	ECC0 to ECFF
13	F000 to F03F	F040 to F07F	F080 to F0BF	F0C0 to F0FF
14	F400 to F43F	F440 to F47F	F480 to F4BF	F4C0 to F4FF
15	F800 to F83F	F840 to F87F	F880 to F8BF	F8C0 to F8FF
16	FC00 to FC3F	FC40 to FC7F	FC80 to FCBF	FCC0 to FCFF

IMPORTANT

Register numbers will not be consecutive across registers for different Module numbers, but will be consecutive among axes for the same Module number. Therefore, special attention must be paid when using superscripts (I, J) in user programs.

Example:

I = 0 to 255 can be read using ├IW(OW) C000i.

IW(OW) C000 reads the registers for Module number 1, that is in the range from IW(OW) C000 to IW(OW) C0FF. It will not read correctly beyond I > 256.

7.2 Parameters for Each Motion Module

This section describes the functions and settings of parameters for each motion module.

7.2.1 Motion Fixed Parameters

Motion fixed parameters are set only once unless there is a configurational, specification, or other machine-related change. They are set from the Fixed Parameter Setting Window on the MPE720.

IMPORTANT

Motion fixed parameters cannot be changed if bit 0 of the RUN command (OW□□01) is ON.
Position and other data will be initialized every time a motion fixed parameter is changed.

Table 7.2 Motion Fixed Parameters

No.	Name	Setting Range	Meaning	Remarks	SVA -01A	SVA -02A	SVB -01	PO-01
1	Axis Selection (USESEL)	0 or 1 (Default = 0)	0: Not used selection 1: Use selection		√	√	√	√
2	PG Input Signal Form Selections (PGSEL)	Bit 0 to 7: Not used.	–					
		Bit 8: ABPISEL	A/B Pulse Input Signal Polarity Selection	0: Positive logic 1: Negative logic	√	√		
		Bit 9: CPISEL	C Pulse Input Signal Polarity Selection	0: Positive logic 1: Negative logic	√	√		
		Bit 10 to 15: Not used.	–					
3	Encoder Selection (ENCSEL)	0 to 2 (Default = 0)	0: Incremental encoder 1: Absolute encoder 2: Absolute encoder used as an incremental encoder		√	√	√	
4	Rotation Direction Selection with an Absolute Encoder (DIRINV)	0 or 1 (Default = 0)	0: Forward direction selection 1: Reverse direction selection		√	√		
5	Pulse Counting Mode Selection (PULMODE)	0 to 6 (Default = 6)	0: Sign, × 1		√	√		
			1: Sign, × 2		√	√		
			2: Up/down, × 1		√	√		
			3: Up/down, × 2		√	√		
			4: A/B mode, × 1		√	√	√	
			5: A/B mode, × 2		√	√	√	
			6: A/B mode, × 4		√	√	√	
6	Not used.	–	–					
7	Rated Motor Speed Setting (NR)	1 to 32000 (Default = 3000)	1 = 1 r/min		√	√	√	√

Table 7.2 Motion Fixed Parameters (cont'd)

No.	Name	Setting Range	Meaning	Remarks	SVA -01A	SVA -02A	SVB -01	PO -01
8	Number of Feedback Pulses Per Rotation (FBppr)	Multiple of 4 between 4 and 65532 (Default = 2048)	1 = 1 pulse/rev	Set the value prior to multiplying.	√	√	√	
9	D/A Output Voltage at 100% Speed (V1)	0.001 to 10.000 (Default = 6 V = 6.000)	1 = 1V		√	√		
	Number of Feedback Pulses per Rotation (for High-resolution)	(Default = 2048)	1 = 1 pulse/rev				√	
10	D/A Output Voltage at 100% Torque Limit (V2)	0.001 to 10.000 (Default = 3 V = 3.000)	1 = 1V	Valid only for 2-axis SVA-02A Modules.		√		
11	Input Voltage at 100% Speed Monitoring (A/D) (MV1)	0.001 to 10.000 (Default = 6 V = 6.000)	1 = 1V	Valid only for 2-axis SVA-02A Modules.		√		
12	Not used.	–	–					
13	DI Latch Signal Selection (DIINTSEL)	0 or 1 (Default = 0)	0: DI input signal 1: C pulse input signal		√	√		
14	Additional Function Selections (AFUNCSEL)	Bit 0 to 1: Not used.	–					
		Bit 2: LIMITSEL	Limit Switch Signal Selection	0: Use OB□□01F. 1: Use the DI signal.	√			√
		Bit 3: LMT_LSEL	Reverse Limit Signal Selection for Zero Point Return	0: Use OB□□21C. 1: Use the DI signal.				√
		Bit 4: LMT_RSEL	Forward Limit Signal Selection for Zero Point Return	0: Use OB□□21D. 1: Use the DI signal.				√
		Bit 5: EMGSEL	Emergency Stop Signal Selection	0: Emergency stop (hardware) 1: Deceleration to stop (software)				√
		Bit 6: ABSRDSEL	Absolute Position Read at Startup	0: Execute. 1: Do not execute.	√	√		
		Bit 7: MCMDSEL	Motion Command Code Selection	0: Not used. 1: Use.	√	√		√
		Bit 9:	Σ-II Series SERVOPACK Selection	0: OFF 1: ON	√	√		
		Bits 12 to 15:	Error Count Alarm Detection Setting Coefficient	Setting range: 0 to 4	√	√		
		Bit 9:	Selection for Feedback Pulses per Motor Rotation for High Resolution	0: Disabled 1: Enabled			√	
15	Not used.	–	–					

Table 7.2 Motion Fixed Parameters (cont'd)

No.	Name	Setting Range	Meaning	Remarks	SVA -01A	SVA -02A	SVB -01	PO -01
16	Simulation Mode Selection (SIMULATE)	0 to 2 (Default = 0)	0: Normal operation mode		√	√	√	
			1: Simulation mode		√	√	√	
			2: Factory adjustment mode		√	√		
17	Motion Controller Function Selection Flags (SVFUNCSEL)	Bit 0 to 3: 0 to 7 CMD_UNIT	Reference Unit Selection	0: pulse (Electronic gear disabled)	√	√	√	√
				1: mm	√	√	√	√
				2: deg	√	√	√	√
				3: inch	√	√	√	√
		Bit 4: USE_GEAR	Electronic Gear Selection	0: Disabled 1: Enabled	√	√	√	√
		Bit 5: PMOD_SEL	Axis Selection	0: Finite length axis 1: Infinite length axis	√	√	√	√
		Bit 6: USE_BKRSH	Backlash Compensation Enabled Selection	0: Disabled 1: Enabled	√	√		
		Bit 7: USE_SLIMP	Positive Software Limit Selection	0: Disabled 1: Enabled	√	√	√	√
		Bit 8: USE_SLIMN	Negative Software Limit Selection	0: Disabled 1: Enabled	√	√	√	√
		Bit 9: USE_OV	Override Selection	0: Disabled 1: Enabled	√	√	√	√
		Bit 10: INV_DEC	Deceleration Limit Switch Inversion Selection	0: Do not reverse. 1: Reverse.	√	√		√
		Bit 11: Not used.	–					
		Bit 12:	Servo Drive Transparent Reference Mode	0: Normal 1:Transparent reference mode			√	
		Bit 13: OVT1_SEL	Positive Overtravel Selection	0: Disabled 1: Enabled	√	√		
		Bit 14: OVT2_SEL	Negative Overtravel Selection	0: Disabled 1: Enabled	√	√		
		Bit 15: SEGBUF	Interpolation Segment Distribution Selection	0: Enabled 1: Disabled			√	
18	Number of Digits Below Decimal Point (DECNUM)	0 to 5 (Default = 3)	Sets the number of digits below decimal point in commands. (Example) With 3 digits below decimal point mm: 1 reference unit = 0.001 mm deg: 1 reference unit = 0.001 deg inch:1 reference unit = 0.001 inch	Minimum reference unit is determined by this parameter as well as by the Reference Unit Selection (see fixed servo parameter no. 17.). They do not affect the pulse minimum unit.	√	√	√	√
19	Distance Traveled Per Machine Rotation (PITCH)	1 to 2^{31}-1 (Default = 10000)	1 = 1 reference unit		√	√	√	√

Table 7.2 Motion Fixed Parameters (cont'd)

No.	Name	Setting Range	Meaning	Remarks	SVA -01A	SVA -02A	SVB -01	PO -01
21	Servomotor Gear Ratio (GEAR_MOTOR)	1 to 65535 (Default = 1)	1 = 1 rev (rotation)		√	√	√	√
22	Machine Gear Ratio (GEAR_ MACHINE)	1 to 65535 (Default = 1)	1 = 1 rev (rotation)		√	√	√	√
23	Infinite Length Axis Reset Position (POSMAX)	1 to 2^{31}-1 (Default = 360000)	1 = 1 reference unit		√	√	√	√
25	Maximum Number of Absolute Encoder Turns (MAXTURN)	1 to 2^{31}-1 (Default = 99999)	1 = 1 rev (rotation)		√	√	√	
27	Positive Software Limit (SLIMP)	-2^{31} to 2^{31}-1 (Default = 2^{31}-1)	1 = 1 reference unit		√	√	√	√
29	Negative Software Limit (SLIMN)	-2^{31} to 2^{31}-1 (Default = 2^{31}-1)	1 = 1 reference unit		√	√	√	√
31	Zero Point Return Method (ZRETSEL)	0 to 7 (Default = 0)	0: DEC1 + C-phase pulse		√	√	√	
			1: ZERO		√		√	
			2: DEC1 + ZERO		√		√	√
			3: C-phase pulse		√	√	√	
			4: DEC2 + ZERO		√			√
			5: DEC1 + LMT + ZERO		√			√
			6: DEC2 + C-phase pulse		√	√		
			7: DEC1 + LMT + C-phase pulse		√	√		
32	Backlash Compensation (BKLSH)	0 to 32767 (Default = 0)	1 = 1 reference unit		√	√		
33	Number of Feedback Pulses per Rotation (For Simulation)	1 to 2^{31}-1 (Default = 200)	1 = 1 pulse	Number of pulses per stepping motor rotation				√
35	Bias Speed (BIASSPD)	0 to 32767 (Default = 0)	1 = 10^n reference units/min (n = Number of digits below decimal point) Pulse units: 1 = 1,000 pulses/min. mm units: 1 = 1 mm/min deg units: 1 = 1 deg/min inch units: 1 = 1 inch/min					√
36	Bias Speed for the Exponential Acceleration/Deceleration Filter (EXPBIAS)	0 to 32767 (Default = 0)	1 = 10^n reference units/min (n: Number of digits below decimal point) Pulse units: 1 = 1,000 pulses/min mm units: 1 = 1 mm/min deg units: 1 = 1 deg/min inch units: 1 = 1 inch/min		√	√		√

Table 7.2 Motion Fixed Parameters (cont'd)

No.	Name	Setting Range	Meaning	Remarks	SVA -01A	SVA -02A	SVB -01	PO -01
37	Pulse Output Signal Form Selection (AFUNCSEL)	Bits 0 to 7:	Not used					
		Bit: 8: ABPOSEL	Pulse output signal polarity selection	0: Positive logic 1: Negative logic				√
		Bits 9 to 11:	Not used					
		Bits 12 to 15: POUTMODE	Pulse output method selection	0: CW/CCW 1: Sign (CCW) + pulse (CW)				√
38	Max. Pulse Output Frequency (MAXHZ)	1 to 50 (Default = 10)	1 = 10 kHz Set 1, 2, 4, 8, 10, 20, 25, 40, or 50. The set values for 4 axes (including unused axes) must be the same.					√
39 to 48	Not used.	–	–					

7.2.2 Motion Setting Parameters

Motion setting parameters serve as instructions to SVA Modules. They are located at the top of high-speed scans and are sent together to SVA Modules. Motion can be controlled simply by setting parameters in these registers.

Table 7.3 Motion Setting Parameters

No.	Name	Register No.	Setting Range	Meaning	Remarks	SVA-01A	SVA-02A	SVB-01	PO-01
1	RUN Mode Settings (RUNMODE)	OW□□00	Bit 0: NCON	Speed Reference Output Mode	0: OFF, 1: ON	✓	✓		
			Bit 1: TCON	Torque Reference Output Mode	0: OFF, 1:ON		✓		
			Bit 2: PCON	Position Control Mode	0: OFF, 1:ON	✓	✓	✓	✓
			Bit 3: PHCON	Phase Control Mode	0: OFF, 1:ON	✓	✓		
			Bit 4: ZRN	Zero Point Return Mode	0: OFF, 1:ON	✓	✓		
			Bit 5: PHTEST	Phase Control Test Signal	0: OFF, 1:ON	✓	✓		
			Bit 6: ACR	Alarm Clear	0: OFF, 1:ON	✓	✓	✓	✓
			Bit 7: PHREFOFF	Phase Reference Disable	0: OFF, 1:ON	✓	✓		
			Bit 8: MCDSEL	Motion Command Mode Enable/Disable	0: OFF, 1:ON	✓	✓	✓	✓
			Bit 9: ZRNDIR	Zero Point Return Direction Selection	0: OFF, 1:ON	✓	✓	✓	✓
			Bit 10: ABSRD	Absolute Position Read Request	0: OFF, 1:ON	✓	✓		
			Bit 11:	Feedforward Compensation at Swithing Control Mode	0: OFF, 1:ON	✓	✓		
			Bit 12:	Not used					
			Bit 13: DIINTREQ	DI Latch Request	0: OFF, 1:ON	✓	✓		
			Bit 14:	Not used					
			Bit 15: IRESET	Phase Control Integration Reset	0: OFF, 1:ON	✓	✓		
2	RUN Command Settings (SVRUNCMD)	OW□□01	Bit 0: RUN	Servo ON (DO0)	0: OFF, 1:ON	✓	✓	✓	
				Excitation ON (DO0)	0: OFF, 1:ON				✓
			Bit 1: D01	DO1	0: OFF, 1:ON	✓	✓		✓
			Bit 2: D02	DO2	0: OFF, 1:ON	✓	✓		✓
			Bit 3: D03	DO3	0: OFF, 1:ON	✓	✓		✓
			Bit 4: D04	ROC	0: OFF, 1:ON	✓			
				DO4	0: OFF, 1:ON		✓		
			Bit 5:	Not used					
			Bits 6 to 10:	Not used					

Table 7.3 Motion Setting Parameters (cont'd)

No.	Name	Register No.	Setting Range	Meaning	Remarks	SVA-01A	SVA-02A	SVB-01	PO-01
2	RUN Command Settings (SVRUNCMD) (cont'd)	OW□□01	Bit 11: EMRST	Emergency Stop/Deceleration to a Stop Signal Reset					✓
			Bit 12: USE_BUF	Position Reference Value Selection 0: OL□□12 1: Position buffer		✓	✓	✓	✓
			Bit 13: SPDTYPE	Speed Reference Value Selection 0: OL□□22 1: OW□□15		✓	✓	✓	✓
			Bit 14: XREFTYPE	Position Reference Type 0: Absolute mode 1: Incremental addition mode		✓	✓	✓	✓
			Bit 15: LSDEC	Zero Point Return Deceleration Point Limit Switch Signal	0: OFF 1: ON	✓	✓		✓
3	Positive Torque Limit Setting (TLIMP)	OW□□02	–32768 to 32767 (Default = -300.00)	1 = 0.01% (–30000 = –300.00%)			✓		
4	Not used	OW□□03	–	Set to 0.					
5	Positive Speed Limiter Setting (NLIMP)	OW□□04	0 to 32767 (Default = 150.00)	1 = 0.01 % (15000 = 150.00 %)		✓	✓		
6	Negative Speed Limiter Setting (NLIMN)	OW□□05	0 to 32767 (Default = 150.00)	1 = 0.01 % (15000 = 150.00 %)		✓	✓		
7	Machine Coordinate System Zero Point Offset Setting (ABSOFF)	OL□□06	-2^{31} to $2^{31}-1$ (Default = 0)	1 = 1 reference unit pulse units: 1 = 1 pulse		✓	✓	✓	✓
9	Not used	OL□□08	–	Set to 0.					
11	Approach Speed Setting (NAPR)	OW□□0A	0 to 32767 (Default = 0)	The unit will vary with the speed reference selection (OB□□01D). When the speed reference value selection = 0 1 = 10^n reference units/min (n = Number of digits below decimal point) pulse units: 1 = 1000 pulses/min (For PO-01 Module, 1 = 100 pulses/min) mm units: 1 = 1mm/min deg units: 1 = 1 deg/min inch units: 1 = 1 inch/min When the speed reference value selection = 1 1 = 0.01 % (1000 = 10.00 %)		✓	✓		✓
12	Creep Speed Setting (NCLP)	OW□□0B	0 to 32767 (Default = 0)			✓	✓		✓
13	Linear Acceleration Time Constant (NACC)	OW□□0C	0 to 32767 (Default = 0)	1 = 1 ms (300 = 0.300 s)		✓	✓	✓	✓

Table 7.3 Motion Setting Parameters (cont'd)

No.	Name	Register No.	Setting Range	Meaning	Remarks	SVA-01A	SVA-02A	SVB-01	PO-01
14	Linear Deceleration Time Constant (NDEC)	OW□□0D	0 to 32767 (Default = 0	1 = 1 ms (300 = 0.300 s)		✓	✓	✓	✓
15	Positioning Completed Range Setting (PEXT)	OW□□0E	0 to 65535 (absolute value) (Default = 10)	1 = 1 reference unit pulse unit: 1 = 1 pulse		✓	✓		
16	Error Count Alarm Detection Setting (EOV)	OW□□0F	0 to 65535 (absolute value) (Default = 0)	1 = 1 pulse (0 = No error detected)		✓	✓		
17	Position Loop Gain Setting (kp)	OW□□10	0 to 32767 (Default = 30.0)	1 = 0.1/s (300 = 30.0)		✓	✓	✓	
18	Feed Forward Gain Setting (kf)	OW□□11	0 to 200 (Default = 0)	1 = 1 % (10 = 10 %)		✓	✓	✓	
19	Position Reference Setting (XREF)	OL□□12	-2^{31} to $2^{31}-1$ (Default = 0)	1 = 1 reference unit pulse units: 1 = 1 pulse When the position reference value selection (OB□□01C) = 1, position buffer number (1 to 256)		✓	✓	✓	✓
21	Filter Time Constant (NNUM)	OW□□14	Constant during Position Control Mode and S-curved (moving average) movement with the Speed Reference Output Mode and motion command disabled. 0 to 255 (1 = 1 time) (0 = 1 = No averaging)			✓	✓		
			Constant during S-curved (moving average) movement when bits 4 to 7 at OW□□21 are set to 2. 0 to 255 (1 = 1 time) (0 = 1 = No averaging) For SVB Module, 0 to 65535 (1 = 0.1 ms)			✓	✓	✓	✓
			Constant during exponential acceleration/deceleration when bits 4 to 7 at OW□□21 are set to 1. 0 to 32767 (1 = 1 ms) For SBV Module, 0 to 65535 (1 = 0.1 ms)			✓	✓	✓	✓
22	Speed Reference Setting (NREF)	OW□□15	–32768 to 32767 (Default = 0.00)	1 = 0.01 % (5000 = 50.00 %)		✓	✓	✓	✓
23	Phase Bias Setting (PHBIAS)	OL□□16	-2^{31} to $2^{31}-1$ (Default = 0)	1 = 1 pulse		✓	✓		
25	Speed Compensation Setting (NCOM)	OW□□18	–32768 to 32767 (Default = 0.00)	1 = 0.01 % (100 = 1.00 %)		✓	✓		
26	Proportional Gain Setting (Pv)	OW□□19	0 to 32767 (Default = 30.0)	1 = 0.01 % (300 = 30.0)		✓	✓		
27	Integral Time Setting (Ti)	OW□□1A	0 to 32767 (Default = 300)	1 = 1 ms (0 = No integration) (300 = 0.300s)		✓	✓		

Table 7.3 Motion Setting Parameters (cont'd)

No.	Name	Register No.	Setting Range	Meaning	Remarks	SVA-01A	SVA-02A	SVB-01	PO-01
28	Torque Reference Setting (TREF)	OW□□1B	–32768 to 32767 (Default = 0.00)	1 = 0.01 % (10000 = 100.00 %)			✓		
29	Speed Limit Setting (NLIM)	OW□□1C	–32768 to 32767 (Default = 150.00)	1 = 0.01 % (15000 = 150.00 %)			✓		
30	Speed Loop Gain (kv)	OW□□1D	1 to 20000 (Default = 40.0)	1 = 0.1 Hz (400 = 40.0 Hz)				✓	
31	Pulse Bias Setting (PULBIAS)	OL□□1E	-2^{31} to $2^{31}-1$ (Default = 0)	1 = 1 pulse		✓	✓		✓
33	Motion Command Code (MCMDCODE)	OW□□20	0 to 65535 (Default = 0)	0: NOP	No command	✓	✓	✓	✓
				1: POSING	Positioning	✓	✓	✓	✓
				2: EX_POSING	External positioning	✓	✓	✓	
				3: ZRET	Zero point return	✓	✓	✓	✓
				4: INTERPOLATE	Interpolation	✓	✓	✓	✓
				5: ENDOF_ INTERPOLATE	Interpolation end segment	✓	✓	✓	✓
				6: LATCH	Interpolation with latch	✓	✓	✓	
				7: FEED	Feed (JOG)	✓	✓	✓	✓
				8: STEP	Step	✓	✓	✓	✓
				9: ZSET	Zero point setting	✓	✓	✓	✓
				10: ACC	Change 1st step linear acceleration/deceleration time constant			✓	
				11: DCC	Change deceleration time constant			*	
				12: SCC	Change moving average time constant			✓	
				13: CHG_FILTER	Change filter type			✓	
				14: KVS	Change speed loop gain (Kv)			✓	
				15: KPS	Change position loop gain (Kp)			✓	
				16: KFS	Change feed forward (Kf)			✓	
				17: CN_RD	Read servo driver Cn constant			✓	
				18: CN_WR	Change servo driver Cn constant			✓	

Table 7.3 Motion Setting Parameters (cont'd)

No.	Name	Register No.	Setting Range	Meaning	Remarks	SVA-01A	SVA-02A	SVB-01	PO-01
33	Motion Command Code (MCMDCODE) (cont'd)	OW□□20	0 to 65535 (Default = 0)	19: ALM_MON	Monitor current alarm occurrence in servo driver			✓	
				20: ALMHIST_MON	Monitor servo driver alarm history			✓	
				21: ALMHIST_CLR	Clear servo driver alarm history			✓	
				22 to 65535: Not used					
34	Motion Command Control Flags (MCMDCTRL) (Default = 0, all the bits are set to OFF)	OW□□21	Bit0: HOLD	Command hold	0: OFF, 1: ON	✓	✓	✓	✓
			Bit 1: ABORT	Command abort	0: OFF, 1: ON	✓	✓	✓	✓
			Bit 2: DIRECTION	Direction of movement (For JOG and STEP)	0: Forward 1: Reverse	✓	✓	✓	✓
			Bit 3: P_PI	Speed loop P/PI switching	0: PI 1: P			✓	
			Bit 3: REMCUT	No feed speed remaining compensation	0: OFF 1: ON				✓
			Bit 3: LAGRST	No primary lag (Same as primary lag time constant = 0)	0: OFF 1: ON	✓	✓		
			Bits 4 to 7: FILTERTYPE	Filter type selection 0: No filter 1: Exponential filter (exponential acceleration/deceleration) 2: Movement averaging filter (simple S-curved acceleration/ deceleration)		✓	✓	✓	✓
			Bit 8: POS_PPI	Position loop P/PI switch 0: P, 1: PI		✓	✓		
			Bit 9: POS_IRST	Position control integration reset	0: OFF 1: ON	✓	✓		
			Bit 10: NCOMSEL	Speed compensation (OW□□18) during position control	0: OFF 1: ON	✓	✓		
			Bit 11: Not used	–					
			Bit 12: LMT_L	Reverse limit signal for zero point return	Valid only when the fixed parameter No. 14 (Additional Function Selection) is set to OB□□21□ (setting parameter) used. 0: OFF, 1: ON	✓	✓		✓
			Bit 13: LMT_R	Forward limit signal for zero point return		✓	✓		✓

Table 7.3 Motion Setting Parameters (cont'd)

No.	Name	Register No.	Setting Range	Meaning	Remarks	SVA-01A	SVA-02A	SVB-01	PO-01
34	Motion Command Control Flags (MCMDCTRL) (Default = 0, all the bits are set to OFF) (cont'd)	OW☐☐21	Bit 14: BUF_W	Position buffer write	0: OFF 1: ON	✓	✓	✓	✓
			Bit 15: BUF_R	Position buffer read	0: OFF 1: ON	✓	✓	✓	✓
35	Rapid Feed Speed (RV)	OL☐☐22	0 to $2^{31}-1$ (Default = 3000)	$1 = 10^n$ reference units/min (n = Number of digits below decimal point) pulse units: 1 = 1000 pulses/min mm units: 1 = 1 mm/min deg units: 1 = 1 deg/min inch units: 1 = 1 inch/min		✓	✓	✓	
				$1 = 10^n$ reference units/min (n = Number of digits below decimal point) pulse units: 1 = 100 pulses/min mm units: 1 = 1 mm/min deg units: 1 = 1 deg/min inch units: 1 = 1 inch/min					✓
37	External Positioning Travel Distance (EXMDIST)	OL☐☐24	-2^{31} to $2^{31}-1$ (Default = 0)	1 = 1 reference unit	1 = 1 pulse for pulse units	✓	✓	✓	
39	Stopping Distance (STOPDIST)	OL☐☐26	-2^{31} to $2^{31}-1$ (Default = 0)	1 = 1 reference unit	Used for motion management (for the system)	✓	✓	✓	✓
41	Step Travel Distance (STEP)	OL☐☐28	0 to $2^{31}-1$ (Default = 0)	1 = 1 reference unit		✓	✓	✓	✓
43	Zero Point Return Final Travel Distance (ZRNDIST)	OL☐☐2A	-2^{31} to $2^{31}-1$ (Default = 0)	1 = 1 reference unit		✓	✓		✓
45	Override (OV)	OW☐☐2C	0 to 32767 (Default = 100.00)	1 = 0.01% (10000 = 100.00%)		✓	✓	✓	✓
46	Position Control Flags (POSCTRL) (Default = 0, all the bits are set to OFF)	OW☐☐2D	Bit 0: MLK	Machine lock mode setting 0: OFF 1: ON (Machine lock mode setting)		✓	✓	✓	✓
			Bit 1: TPRSREQ	Request for preset number of POSMAX turns 1: Request ON	0: OFF 1: ON	✓	✓	✓	✓
			Bit 2: ABSLDREQ	Request to load ABS system infinite length position control data 1: Request ON	0: OFF 1: ON	✓	✓	✓	

7

Table 7.3 Motion Setting Parameters (cont'd)

No.	Name	Register No.	Setting Range	Meaning	Remarks	SVA-01A	SVA-02A	SVB-01	PO-01
46	Position Control Flags (POSCTRL) (Default = 0, all the bits are set to OFF) (cont'd)	OW□□2D	Bit 3: PUNITSEL	Position monitor 2 (IL□□34) unit selection 0: Reference unit, 1: Pulse unit		✓	✓		
			Bits 4 to 11:	Not used					
			Bits 12 to 15: USRMONSEL	Servo driver user monitor information selection	Setting range: 0 to 4 See the relevant servo driver's manual.			✓	
47	Workpiece Coordinate System Offset (OFFSET)	OL□□2E	-2^{31} to $2^{31}-1$ (Default = 0)	1 = 1 reference unit	1 = 1 pulse for pulse units	✓	✓	✓	✓
49	Preset Number of POSMAX Turns Data (TURNPRS)	OL□□30	-2^{31} to $2^{31}-1$ (Default = 0)	1 = 1 rev (rotation)		✓	✓	✓	✓
51	Second In-position Width (INPWIDTH)	OW□□32	0 to 65535 (Default = 0)	1 = 1 reference unit	1 = 1 pulse for pulse units	✓	✓	✓	
52	Zero Point Position Output Width (PSETWIDTH)	OW□□33	0 to 65535 (Default = 10)	1 = 1 reference unit		✓	✓	✓	✓
53	Positioning Completed Check Time (PSETTIME)	OW□□34	0 to 65535 (Default = 0)	1 = 1 ms		✓	✓	✓	
54	Servo Driver Parameter No. (Cn_No.)	OW□□35	Set the SERVOPACK Cn constant number when the Motion Command Code (OW□□20) = 17 or 18. (See the relevant servo driver's manual for Cn constants.)					✓	
	Position Control Integral Time (PTi)		0 to 32767 (Default = 300)	1 = 1 ms		✓	✓		
55	Change Servo Driver Parameter Data (Cn_DAT)	OL□□36	-2^{31} to $2^{31}-1$ (Default = 32767)	Set the Cn constant changed data when the Motion Command Code (OW□□20) = 18.				✓	
	Upper/Lower Limit for Position Control Integration (ILIMIT)					✓	✓		
56	Primary Lag Time Constant (LAGTi)	OW□□37	0 to 32767 (Default = 0)	1 = 1 ms		✓	✓		

Table 7.3 Motion Setting Parameters (cont'd)

No.	Name	Register No.	Setting Range	Meaning	Remarks	SVA-01A	SVA-02A	SVB-01	PO-01
57	Encoder Position at Shutdown (Lower-place two words)	OL□□38	-2^{31} to $2^{31}-1$ (Default = 0)	Lower-place two words of the encoder position at shutdown when the Request to Load ABS System Infinite Length Position Control Data (OB□□2D2) is ON (1 = 1 pulse)		✓	✓	✓	
	Position Buffer Access No. (eposL)			Position buffer access No. when the Motion Command Control Flag BUF_W (OB□□21E) = 1 or BUF_R (OB□□21F) = 1 (1 to 256, 0 = Disabled)					✓
59	Encoder Position at Shutdown (Upper-place two words)	OL□□3A	-2^{31} to $2^{31}-1$ (Default = 0)	Upper-place two words of the encoder position at shutdown when the Request to Load ABS System Infinite Length Position Control Data (OB□□2D2) is ON (1 = 1 pulse)		✓	✓	✓	
	Position Buffer Write Data			Position buffer write data when the Motion Command Control Flag BUF_W (OB□□21E) = 1					✓
61	Pulse Position at Shutdown (Lower-place two words)	OL□□3C	-2^{31} to $2^{31}-1$ (Default = 0)	Lower-place two words of the pulse position at shutdown when the Request to Load ABS System Infinite Length Position Control Data (OB□□2D2) is ON (1 = 1 pulse)		✓	✓	✓	
63	Pulse Position at Shutdown (Upper-place two words)	OL□□3E	-2^{31} to $2^{31}-1$ (Default = 0)	Upper-place two words of the pulse position at shutdown when the Request to Load ABS System Infinite Length Position Control Data (OB□□2D2) is ON (1 = 1 pulse)		✓	✓	✓	

* Valid when using an SGDH+NS100.

7

7.2.3 Motion Monitoring Parameter

Motion monitoring parameters are parameters reported by SVA Modules. They are located at the top of high-speed scans and are reported together. Use these parameters to control applications and to debug user programs.

Table 7.4 Motion Monitoring Parameters

No	Name	Register No.	Bit (Setting Range)	Meaning	Remarks	SVA-01A	SVA-02A	SVB-01	PO-01
1	RUN Status (RUNSTS)	IW□□00	Bit 0: EOVER	Error counter over		✓	✓		
			Bit 1: PRMERR	Motion setting parameter setting error		✓	✓	✓	✓
			Bit 2: FPRMERR	Motion fixed parameter setting error		✓	✓	✓	✓
			Bit 3: Not used						
			Bit 4: PGER	Cumulative number of rotations receiving error		✓	✓		
			Bit 5: Not used						
			Bit 6: Not used						
			Bit 7: SVCRDY	Motion controller RUN ready		✓	✓	✓	✓
			Bit 8: SVCRUN	Motion controller running		✓	✓	✓	✓
			Bit 9: DIRINV	Rotation direction when using absolute encoder		✓	✓		
			Bit 10: ABCRDC	Absolute position read completed signal		✓	✓		
			Bit 11: DIINT	DI latch completed signal		✓	✓		
			Bit 12: FBPO	Feedback pulse 0		✓	✓		
			Bit 13: POSCOMP	Positioning completed signal		✓	✓	✓	✓
			Bit 14: Not used						
			Bit 15: ZRNC	Zero point return completed		✓	✓		
2	Servo Driver Status (SYSTS)	IW□□01	Bits 0 to 15	The meaning of each bit depends on the Module type. See the explanation on monitoring parameters of each Module.				✓	
	General-purpose DI Monitor					✓	✓		✓
3	Machine Coordinate System Calculated Position (CPOS)	IL□□02	-2^{31} to $2^{31}-1$	1 = 1 pulse or 1 = 1 reference unit 1 = 1 pulse for pulse unit Will be updated also when the machine is locked.		✓	✓	✓	✓
5	Target Position Difference Monitor (PTGDIF)	IL□□04	-2^{31} to $2^{31}-1$	1 = 1 pulse or 1 = 1 reference unit 1 = 1 pulse for pulse unit		✓	✓		✓
7	Machine Coordinate System Latch Position (LPOS)	IL□□06	-2^{31} to $2^{31}-1$	1 = 1 reference unit (1 = 1 pulse for pulse unit)		✓	✓	✓	

Table 7.4 Motion Monitoring Parameters (cont’d)

No	Name	Register No.	Bit (Setting Range)	Meaning	Remarks	SVA-01A	SVA-02A	SVB-01	PO-01
9	Machine Coordinate System Feedback Position (APOS)	IL☐☐08	-2^{31} to $2^{31}-1$	1 = 1 reference unit (1 = 1 pulse for pulse unit) Note: Will not be updated if the machine is locked.		✓	✓	✓	
11	Position Error (PERR)	IL☐☐0A	-2^{31} to $2^{31}-1$	1 = 1 pulse		✓	✓		
13	Speed Reference Output Monitor (%) (SPDREF)	IW☐☐0C	–32768 to 32767	1 = 0.01%		✓	✓		
14	Speed Monitor (NFB)	IW☐☐0D	–32768 to 32767	1 = 0.01%			✓		
15	Not used	IW☐☐0E							
16	Out of Range Parameter Number (ERNO)	IW☐☐0F	1 to 63 101 to 148	Motion setting parameter error number Motion fixed parameter error number + 100		✓	✓	✓	✓
17	Cumulative Rotations from Absolute Encoder (ABSREV)	IL☐☐10	0 to ±99999	1 = 1 rev (rotation)		✓	✓		
19	Initial Incremental Pulses from Absolute Encoder (IPULSE)	IL☐☐12	-2^{31} to $2^{31}-1$	1 = 1 pulse		✓	✓		
21	Motion Command Response Code (MCMDRCODE)	IW☐☐14	0 to 65535	Motion command that is being executed (See OW☐☐20 for details.)		✓	✓	✓	✓
22	Motion Command Status (MCMDSTS)	IW☐☐15	Bit 0: BUSY	Command executing fllag		✓	✓	✓	✓
			Bit 1: HOLDL	Command hold completed		✓	✓	✓	✓
			Bit 2: DEN	Distriction completed		✓	✓	✓	✓
			Bit 3: ZSET	Zero point setting completed		✓	✓	✓	✓
			Bit 4: EX_LATCH	External positioning signal latch completed		✓	✓	✓	
			Bit 5: FAIL	Command error end		✓	✓	✓	✓
			Bit 6: ZRNC	Zero point return completed		✓	✓	✓	✓
			Bits 7 to 15:	Not used					
23	Number of Digits Below Decimal Point Monitor (DECNUMM)	IW☐☐16	0 to 5	Copies motion fixed parameter Number of Digits Below Decimal Point.		✓	✓	✓	✓
24	Position Control Status (POSSTS)	IW☐☐17	Bit 0: MLKL	Machine locked		✓	✓	✓	✓
			Bit 1: ZERO	Zero point position		✓	✓	✓	✓
			Bit 2: PSET2	Second in-position completed		✓	✓	✓	✓
			Bit 3: ABSLDE	ABS system infinite length position control data load completed		✓	✓	✓	

7

Table 7.4 Motion Monitoring Parameters (cont'd)

No	Name	Register No.	Bit (Setting Range)	Meaning	Remarks	SVA-01A	SVA-02A	SVB-01	PO-01
24	Position Control Status (POSSTS) (cont'd)	IW□□17	Bit 4: TPRSE	No. of POSMAX turns preset completed		✓	✓	✓	✓
			Bit 5: GEARM	Copies the fixed parameter Electronic Gear Selection.		✓	✓	✓	✓
			Bit 6: MODSELM	Copies the fixed parameter Axis Selection.		✓	✓	✓	✓
			Bits 7 to 11:	Not used					
			Bits 12 to 15: USRMONSELR	Servo driver user monitor data selection response				✓	
25	Machine Coordinate System Reference Position (MPOS)	IL□□18	-2^{31} to $2^{31}-1$	1 = 1 reference unit 1 = 1 pulse for pulse unit Will not be updated when the machine is locked.		✓	✓	✓	✓
27	Not used	IL□□1A	–	–					
29	POSMAX Monitor (PMAXMON)	IL□□1C	1 to $2^{31}-1$	1 = 1 reference unit Copies the motion fixed parameter POSMAX.		✓	✓	✓	✓
31	Number of POSMAX Turns (PMAXTURN)	IL□□1E	-2^{31} to $2^{31}-1$	1 = 1 rev (rotation) Increments or decrements the count each time the POSMAX is exceeded. (Will be reset to 0 when the power is turned ON.)		✓	✓	✓	✓
33	Servo Driver User Monitor Data (USRMON)	IL□□20	-2^{31} to $2^{31}-1$	See the relevant servo driver manual.				✓	
35	Alarms (ALARM)	IL□□22	Bit 0: SVERROR	SERVOPACK fault				✓	
			Bit 1: OTF	Positive overtravel		✓	✓	✓	
			Bit 2: OTR	Negative overtravel		✓	✓	✓	
			Bit 3: SOTF	Positive software limit		✓	✓	✓	✓
			Bit 4: SOTR	Negative software limit		✓	✓	✓	✓
			Bit 5: SVOFF	Servo OFF				✓	
				Excitation OFF					✓
			Bit 6: TIMEOVER	Positioning time over		✓	✓	✓	
			Bit 7: DISTOVER	Positioning travel amount exceeded				✓	
				Speed exceeded					✓
			Bit 8: FILTYOERR	Filter type change error				✓	
			Bit 9: FILTYMERR	Filter time constant change error				✓	
			Bit 10: MODERR	Control mode error		✓	✓	✓	✓
			Bit 11: ZSET_NRDY	Zero point not set		✓	✓	✓	
			Bit 12: ZSET_MOV	Zero point set during movement				✓	
			Bit 13: CN_ERR	Servo driver Cn constant setting error				✓	
			Bit 14: WDT_ERR	Servo driver synchronized communications error				✓	

Table 7.4 Motion Monitoring Parameters (cont’d)

No	Name	Register No.	Bit (Setting Range)	Meaning	Remarks	SVA-01A	SVA-02A	SVB-01	PO-01
35	Alarms (ALARM) (cont’d)	IL☐☐22	Bit 15: COM_ERR	Servo driver communications error				✓	
			Bit 16: SVTI-MOUT	Servo driver command timeout				✓	
			Bit 17: ABSOVER	ABS encoder rotations exceeded		✓	✓	✓	
			Bit 18: PGLFLT	Broken PG wire error		✓	✓		
			Bit 19:	Not used					
			Bits 20 to 31:	Not used					
37	Servo Driver Alarm Code (SVALARM)	IW☐☐24	–32768 to 32767	Error code when an absolute position read error occurs		✓	✓		
				Alarm code that is occurring				✓	
38	Servo Driver I/O Monitor (ALARM)	IW☐☐25	Bit 0: P-OT	Forward limit switch input				✓	
			Bit 1: N-OT	Reverse limit switch input				✓	
			Bit 2: DEC	Deceleration dog switch input				✓	
			Bit 3: PA	Encoder phase-A signal input				✓	
			Bit 4: PB	Encoder phase-B signal input				✓	
			Bit 5: PC	Encoder phase-C signal input				✓	
			Bit 6: EXT1	1st external (latch) signal input				✓	
			Bit 7: EXT2	2nd external (latch) signal input				✓	
			Bit 8: EXT3	3rd external (latch) signal input				✓	
			Bit 9: BRK	Brake status output				✓	
			Bits 10 to 15:	Not used					
39	Speed Refer-ence Output Mon-itor (pulse/s) (RVMON)	IL☐☐26	-2^{31} to $2^{31}-1$	Valid when the Speed Reference Value Selection (OB☐☐01D) = 0. 1 = 1 reference unit/s				✓	
				Valid when the Speed Reference Value Selection (OB☐☐☐01D) = 0. 1 = 1 reference unit/high-speed scan		✓	✓		✓
41	Cn Constant Read Data (CNMON)	IL☐☐28	-2^{31} to $2^{31}-1$	Stores the data of the SERVOPACK Cn conatant specified by OW☐☐35 when the Motion Command Code (OW☐☐20) = 17.				✓	
	Position Buffer Read Data (CNMON)			Copies the position buffer data when the Motion Command Control Flag BUF_R (OB☐☐21F) = 1.		✓	✓		✓
43	Position Refer-ence Output Mon-itor (XREFMON)	IL☐☐2A	-2^{31} to $2^{31}-1$	1 = 1 pulse	Absolute posi-tion in units of pulse			✓	
	Number of Output Pulses (XREFMON)								✓
45	Integral Output Monitor (YIMON)	IL☐☐2C	-2^{31} to $2^{31}-1$			✓	✓		

Table 7.4 Motion Monitoring Parameters (cont'd)

No	Name	Register No.	Bit (Setting Range)	Meaning	Remarks	SVA-01A	SVA-02A	SVB-01	PO-01
47	Calculated Reference Coordinate System Position (POS)	IL□□2E	-2^{31} to $2^{31}-1$	1 = 1 reference unit		✓	✓	✓	✓
49	Primary Lag Monitor (LAGMON)	IL□□30	-2^{31} to $2^{31}-1$	(PI output value – Primary lag output value)		✓	✓		
51	Position Loop Output Monitor (PIMON)	IL□□32	-2^{31} to $2^{31}-1$	Position loop output value (Value before adding the calculated feed forward value)		✓	✓		
53	Position Monitor 2 (APOS2)	IL□□34	-2^{31} to $2^{31}-1$	Depends on the Position Monitor 2 Unit Selection (OB□□2D3): When OB□□2D3 = 0 (reference unit selected), 1 = 1 reference unit When OB□□2D3 = 1 (pulse selected), 1 = 1 pulse		✓	✓		
55	Not used	IW□□36	–	–					
56	Not used	IW□□37	–	–					
57	Encoder Position at Shutdown (Lower-place two words)	IL□□38	-2^{31} to $2^{31}-1$	1 = 1 pulse (For ABS system infinite length position control)		✓	✓	✓	
59	Encoder Position at Shutdown (Upper-place two words)	IL□□3A		1 = 1 pulse (For ABS system infinite length position control)		✓	✓	✓	
61	Pulse Position at Shutdown (Lower-place two words)	IL□□3C	-2^{31} to $2^{31}-1$	1 = 1 pulse (For ABS system infinite length position control)		✓	✓	✓	
63	Pulse Position at Shutdown (Upper-place two words)	IL□□3E	-2^{31} to $2^{31}-1$	1 = 1 pulse (For ABS system infinite length position control)		✓	✓	✓	

8

Controlled Axis Support Functions

This chapter describes controlled axis support functions for positioning control in systems that use the MP920.

8

8.1 Reference Unit

A reference unit is the unit of measure used for positioning. In the MP920, the reference unit can be millimeters, degrees, inches, or pulses. It is also referred to as a minimum reference unit when it expresses the minimum measurement unit for a position. The minimum reference unit is determined by two fixed parameters: Reference Unit Selection and Number of Digits Below Decimal Point.

Table 8.1 Reference Units

Number of Digits Below Decimal Point	Reference Unit (Electronic Gear Enabled)			Pulse (Electronic Gear Disabled)
	mm	deg	inch	
0	1[mm]	1[deg]	1[inch]	1[pulse]
1	0.1[mm]	0.1[deg]	0.1[inch]	
2	0.01[mm]	0.01[deg]	0.01[inch]	
3	0.001[mm]	0.001[deg]	0.001[inch]	
4	0.0001[mm]	0.0001[deg]	0.0001[inch]	
5	0.00001[mm]	0.00001[deg]	0.00001[inch]	

IMPORTANT

The fixed parameter: Number of Digits Below Decimal Point is disabled when the pulse unit is selected.

8.2 Electronic Gear

An electronic gear converts position or speed units into user units (reference units) and internal controller units (pulses), and it converts pulses into reference units. The electronic gear function is not used to select a detector (encoder) suitable for the machine system but rather for position control.

Forward Electronic Gear Conversion

$$\text{Controller units [pulses]} = \frac{\text{Electronic gear numerator}}{\text{Electronic gear denominator}} \times \text{Reference units position [reference units]}$$

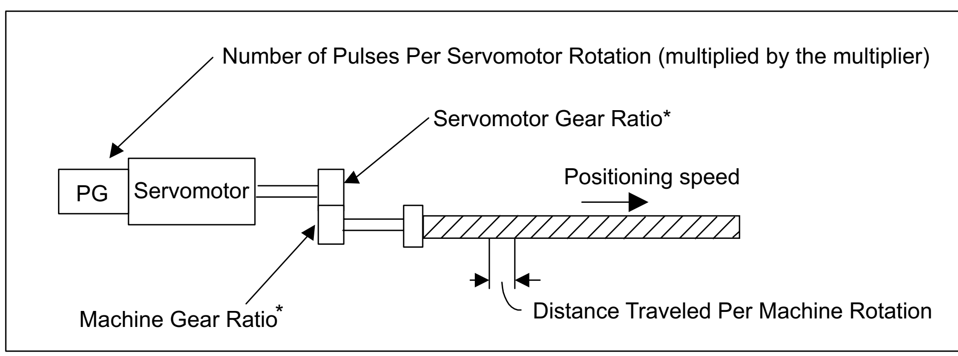
Reverse Electronic Gear Conversion

$$\text{User reference units position [reference units]} = \frac{\text{Electronic gear numerator}}{\text{Electronic gear denominator}} \times \text{Controller internal unit position [pulses]}$$

Electronic gear numerator = Servomotor Gear Ratio × Number of Pulses Per Servomotor Rotation (multiplied by the multiplier)

Electronic gear numerator = Machine Gear Ratio × Distance Traveled Per Machine Rotation

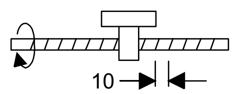
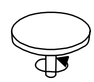
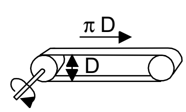
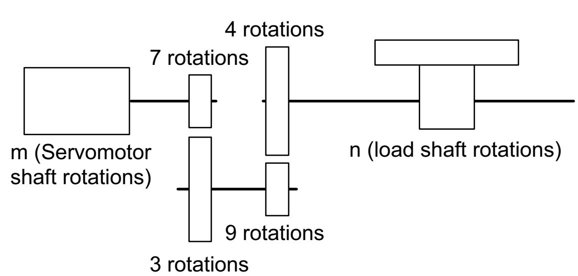
Electronic Gear Concept



* When the electronic gear system is structured so that the shaft on the machine end will turn n times when the shaft on the Servomotor end turns m times, m is the Servomotor gear ratio and n is the machine gear ratio.

8

The following parameters are related to the electronic gear.

<table>
<tr><th>Parameter No.</th><th>Name</th><th colspan="2">Description</th><th>Default</th></tr>
<tr><td>18</td><td>Number of Digits Below Decimal Point</td><td colspan="2">The minimum reference unit is determined by this parameter and Reference Unit Selection in the Motion Controller Function Selection Flags (b0 to b3).
Parameter set values are described below.</td><td>3</td></tr>
<tr><td rowspan="4">19</td><td rowspan="4">Machine Rotations Per Reference Unit</td><td colspan="2">Sets the amount a load moves (reference unit) per load axis rotation.
Setting range: 1 to 2^{31}-1</td><td rowspan="4">10000</td></tr>
<tr><td>Ball screw

Ball screw pitch = 10 mm</td><td>Ball screw pitch = 10 mm, Reference Unit Selection = mm, Number of Digits Below Decimal Point = 3
↓
Set the Distance Travelled Per Machine Rotation to 10,000.</td></tr>
<tr><td>Rotating table

One rotation 360°</td><td>One table rotation = 360°, Reference Unit Selection = deg, Number of Digits Below Decimal Point = 3
↓
Set the Distance Travelled Per Machine Rotation to 360,000.</td></tr>
<tr><td>Belt
</td><td>Roller 1 rotation = 360°, Reference unit selection = mm, Number of Digits Below Decimal Point = 3
↓
Set the Distance Travelled Per Machine Rotation to $\pi D \times$ 1,000.</td></tr>
<tr><td>20</td><td>Servomotor Gear Ratio</td><td colspan="2" rowspan="2">These parameters are used to set the gear ratio for the Servomotor and load.
Set the following at values that will allow the load shaft to rotate n times when the Servomotor shaft rotates m times.
• Servomotor Gear Ratio = m
• Load Gear Ratio = n
Setting example

In the preceding diagram, the deceleration ratio, n/m = 3/7 × 4/9 = 4/21
Consequently, set the Servomotor Gear Ratio to 21 and the Load Gear Ratio to 4.</td><td>1</td></tr>
<tr><td>21</td><td>Load Gear Ratio</td><td>1</td></tr>
</table>

8.3 Override Function

When an axis is moving via rapid traverse or interpolation feed for example, the speed of movement can be changed by setting a override percentage with respect to the specified speed.

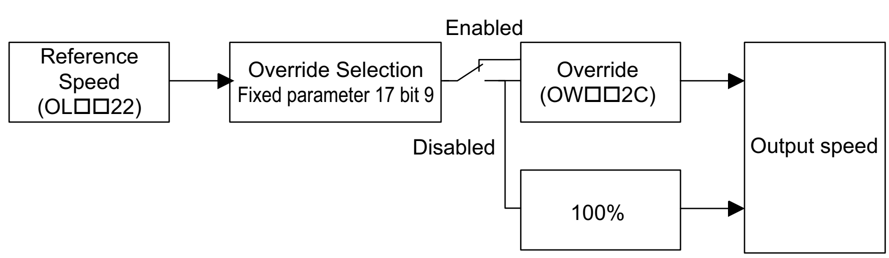
- The procedure used to set override is different in rapid traverse and interpolation operations.

Rapid Traverse	Jog, Step, Rapid Traverse (MOV)	By axis: Override Selection (fixed parameter 17 bit 9) Override (setting parameter OW□□2C)
Interpolation	Linear interpolation, Circular interpolation, Skip	By group: Set according to the group definition. The default is MW00001. This override is always enabled. MW00001 (100% = 10000)

- An override in the range of 0% to 327.67% can be selected for the Rapid Traverse Speed. Set Override (OW□□2C) in the setting parameter for each axis.
- There are three override setting methods: Motion program, ladder logic program, or the Parameter Setting Window.

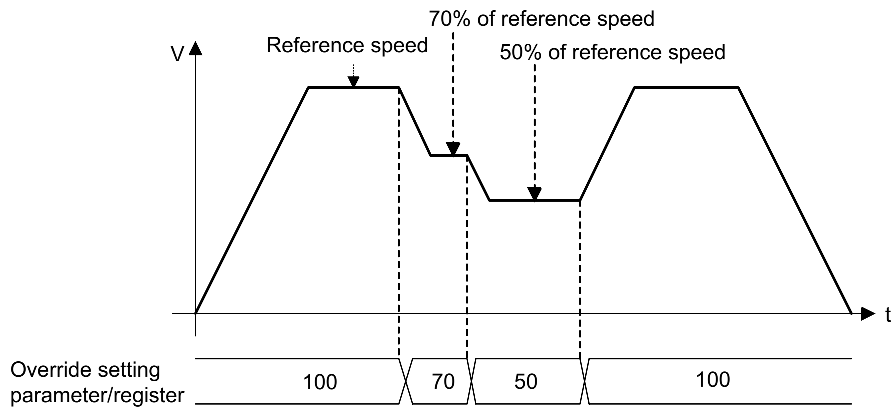
■ Rapid Traverse Speed Output

Reference Speed × Override = Output speed
(OL□□22) (OW□□2C)



- The override is always enabled during initial operation, but this can be changed from a ladder program, motion program, or parameter settings while an axis is moving.
- A parameter setting error will be generated if the override data setting causes the output speed to fall outside the acceptable range.

- The following illustration shows speed change timing for changes to the override[1].

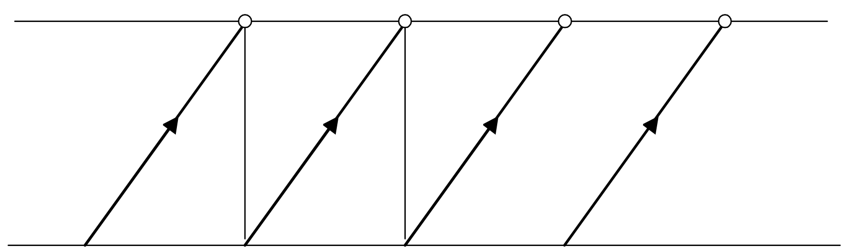


TERMS [1] override

The meaning of "override" is to neutralize some action. However, in this manual, it is used to mean changing setting.

8.4 Infinite Length Positioning

Infinite Length Positioning is a function that automatically updates the machine position, program position, and current values at regular intervals according to fixed parameter settings. The function can be used for repeated positioning in one direction.



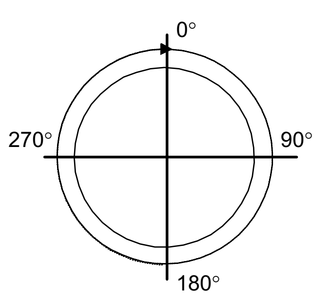
- The following tables list the parameters related to Infinite Length Positioning.

Name	Parameter No.	Setting Range	Remarks
Servo Module Function Selection Flags	Fixed parameter 17 bit 5	0, 1	0: Finite Length Mode 1: Infinite Length Mode
POSMAX	Fixed parameter 22	1 to 2^{31}-1	1 = 1 reference unit

- Procedure for Specifying Incremental Mode in Infinite Length Mode Axis

  A relative reference can be set in Infinite Length Mode Axis at the same range as that for Finite Length Mode Axis. (Range: -214783648 to 214783647.)

◀ EXAMPLE ▶




```
ZRN [X1] 0;
INC MOV [X1] 180.0;
INC MOV [X1] 2700.0; Move clockwise 7.5 rotations to 0°.
```


8

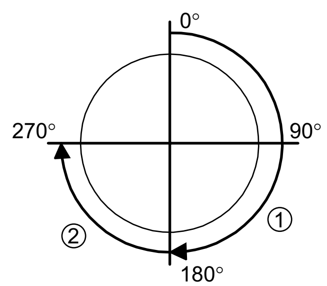
- Procedure for Specifying Absolute Mode in Infinite Length Mode Axis

  Reference codes signify the direction of rotation and reference angles signify absolute position as shown in the figure below when absolute references are set in Infinite Length Mode Axis.

  Refer to the following figures where the current position is specified at position 180°.

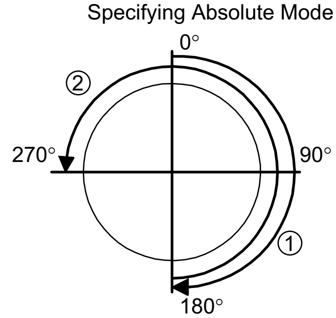
◀ EXAMPLE ▶

Specifying Absolute Mode in Infinite Length Mode Axis (Example 1)




```
ZRN [X1] 0;
① INC MOV [X1] 180.0;
② ABS MOV [X1] 270.0; Turn clockwise to 270°.
```

Specifying Absolute Mode in Infinite Length Mode Axis (Example 2)



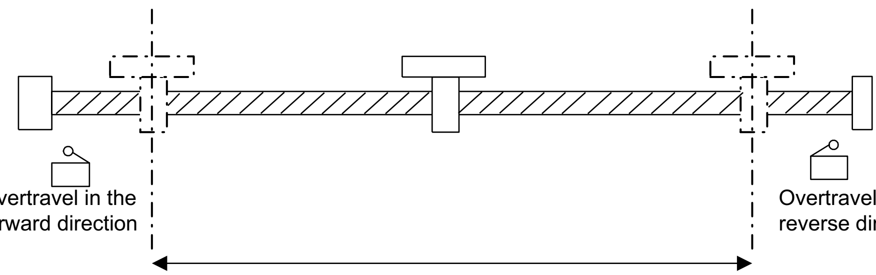

```
ZRN [X1] 0;
① INC MOV [X1] 180.0;
② ABS MOV [X1] -270.0; Turn counter
   clockwise to 270°.
```

INFO

- The software limit function is disabled when Infinite Length Positioning is selected.
- When moving to 0° by specifying Absolute Mode in Infinite Length Mode Axis, the axis does not move counterclockwise even if -0.0 is specified. Specify -360.0 to move the axis counterclockwise.

8.5 Software Limit Function

The software limit function is used to set upper and lower limits in fixed parameters for machine system range of movement so the controller can constantly monitor the operating range of the machine. The function prevents machine runaway or damage due to incorrect operation as well as incorrect references in a motion program.



- The following fixed parameters must be set in order to use the software limit function.

Parameter No.	Name	Units	Remarks
17	Servo Module Function Selection Flags b7: Positive Software Limit Selection b8: Negative Software Limit Selection	–	 0: Disabled, 1: Enabled 0: Disabled, 1: Enabled
25	Positive Software Limit	1 = 1 reference unit	-2147483648 to 2147483647
26	Negative Software Limit	1 = 1 reference unit	-2147483648 to 2147483647

- Set the positive and negative software limits for a machine coordinate system.
- The machine coordinate system is determined by returning to the zero point.
- The software limit function is implemented after the machine returns to the zero point.

8

- Be sure to return to the zero point after power is turned ON.

Type of Axis Movement	Check	Remarks
Program Operation • Positioning • Interpolation	Yes	• If a positioning reference is shifted to a position beyond the software limit, the axis will be positioned on the software limit and an alarm will be generated. • The software limit range is constantly checked during an interpolation move, and the axis will decelerate to a stop at the software limit position.
JOG Operation	Yes	• If the software limit function is enabled, a move is executed to the software limit position. • After an error is cleared, the axis can be moved to within the stroke range.
STEP Operation	Yes	• If a positioning reference is given for a position beyond the software limit, the axis will be positioned on the software limit and an alarm will be generated.

9

Multi-CPU System

This chapter describes the features of a Multi-CPU System and how to set up the CPU Modules.

9.1 Overview

This section describes the features of a Multi-CPU System.

9.1.1 Features

A Multi-CPU System can be constructed by mounting two CPU Modules in an MP920 Controller.

With a Multi-CPU System, programs are executed by both CPU Modules. Therefore, in an application for which there is too much processing for the required scan time for a Single-CPU System, the total load can be divided between two CPU Modules to shorten the scan time and improve performance.

In an MP920 Multi-CPU System, the two CPU Modules use the same Power Supply Module and Mounting Base and each CPU Module can read the data in the other using shared memory. Accordingly, the system can be made much more compact in comparison with two complete MP920 Controllers.

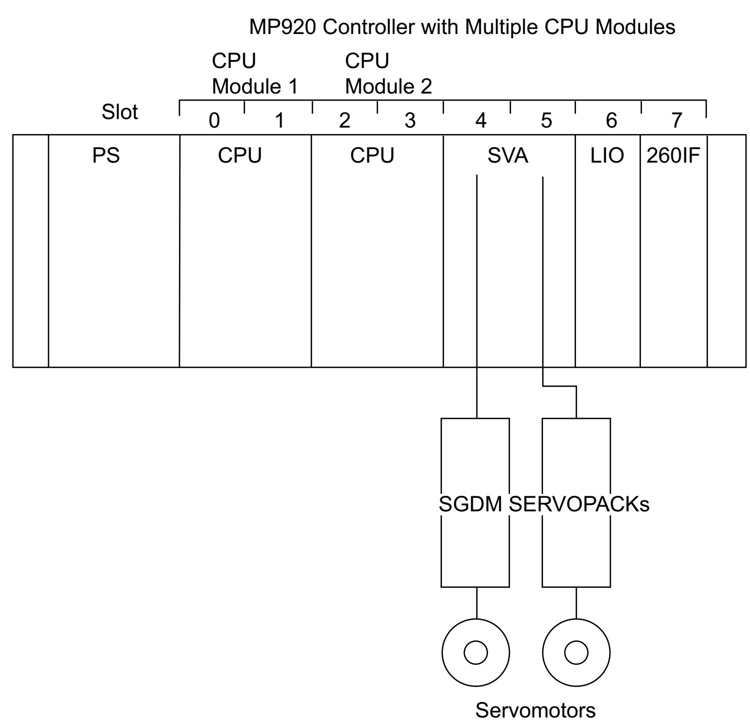


Fig. 9.1 Multi-CPU System Configuration Example

9.1.2 Operation

The CPU Module mounted in slots 0 and 1 of the Mounting Base is called CPU Module 1, and the CPU Module mounted in the slots 2 and 3 of the Mounting Base is called CPU Module 2. This section describes the functions and processing assigned to CPU Module 1 and CPU Module 2 and the operation of the system.

■ Connecting the MPE720 Programming Device

It is possible to log on to both CPU Module 1 and CPU Module 2 from one MPE720 Programming Device without changing the cable connection for engineering operations, such as setup, programming, and register display. For example, it is possible to log on to both CPU Module 1 and CPU Module 2 from a Programming Device connected to the RS-232C port of CPU Module 1 or from a Programming Device connected via a Communications Module, such as the 217IF, 218IFA, and 215IF. Logging on to both CPU Module 1 and CPU Module 2 is possible via a Communications Module no matter which CPU Module is specified as the Control CPU Module described in *Controlling Optional Modules* in this section.

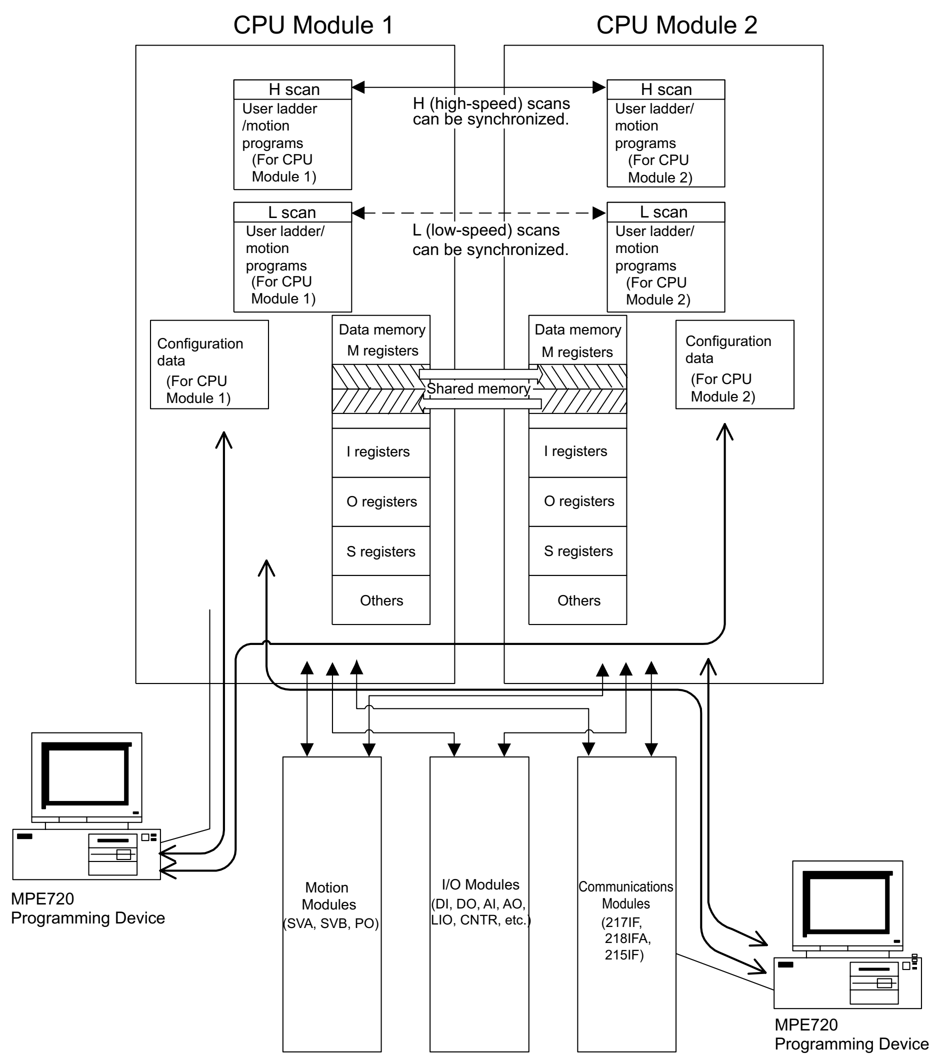


Fig. 9.2 Multi-CPU System Function Block Diagram

■ Program Execution

Load user application programs, such as ladder and motion programs, to both CPU Module 1 and CPU Module 2. Each CPU Module executes the programs loaded onto it independently.

Determine the processing to be executed by each CPU Module considering the balance of the loads on the CPU Modules and the assignments for Optional Modules (e.g., which CPU Module is used for I/O processing), and then prepare programs for CPU Module 1 and CPU Module 2.

The scans to be synchronized in the Multi-CPU System can be set in the System Configuration Window: ***H/L*** (both high-speed and low-speed scans), ***Only H scan***, ***Only L scan***, or ***No Synchronize***. The default setting is ***Only H scan***. For details, refer to *b)* of *step 4* in *9.2.2 Setup Procedure Using the MPE720*.

When scan synchronization (***H/L***, ***Only H scan***, or ***Only L scan***) is selected, execution of processing starts at the same time for the specified scans. Therefore, coordinated processing between CPU Module 1 and CPU Module 2 can be achieved. Each step in the processing, however, is not synchronized, so it is not possible to execute specified steps in the processing of CPU Module 1 and CPU Module 2 at the same time during a scan. (Refer to *Fig. 9.4*.)

When ***No Synchronize*** is selected, it is possible to use one CPU Module for high-speed processing and the other CPU Module for low-speed processing.

Not Synchronizing the High-speed Scans

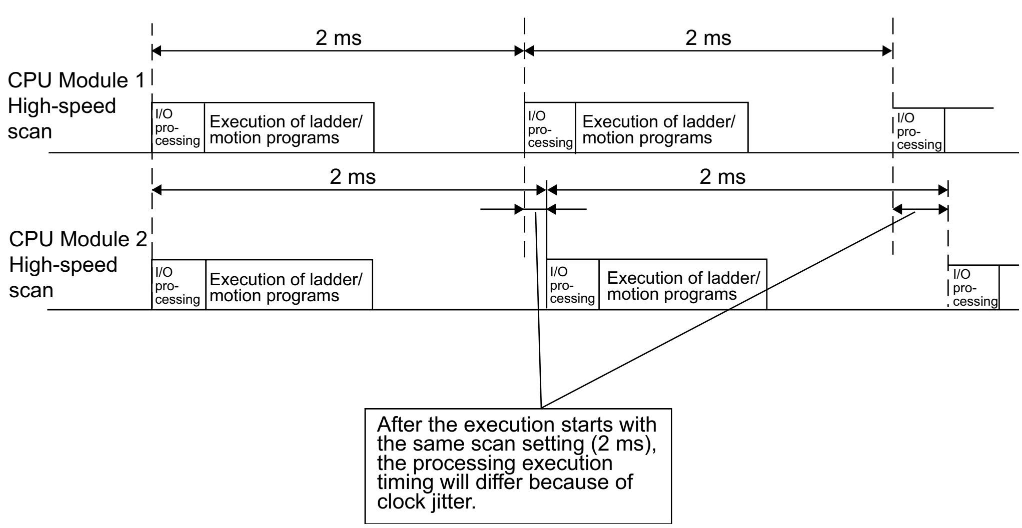


Fig. 9.3 CPU Module Processing Timing Example 1

Synchronizing the High-speed Scans

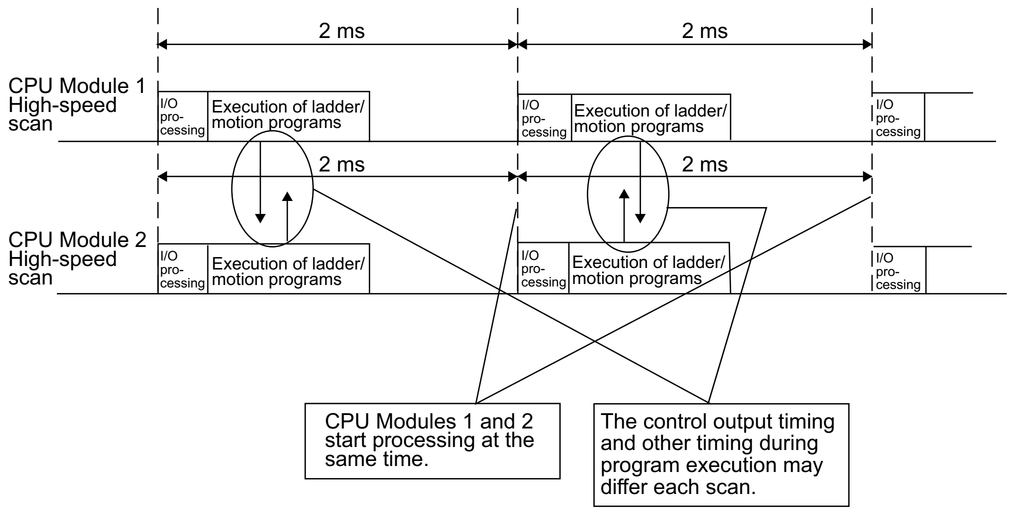


Fig. 9.4 CPU Module Processing Timing Example 2

■ Harmony Stop and Stand Alone Operation

If one CPU Module fails and stops operation following a self-diagnostic error, the other CPU Module will stop operation (***Harmony Stop***). It is also possible to change the default setting so that the other CPU Module will continue running (***Stand Alone***). (Refer to *a*) of *step 4* in *9.2.2 Setup Procedure Using the MPE720.*) If the run mode is set to Stand Alone, devices such as actuators may continue operating even when there is a system failure. Therefore, do not change the setting, but rather use the default setting (Harmony Stop).

The failure of the other CPU Module can be monitored by using a system (S) register. Therefore, the two CPU Modules can be interlocked using the user ladder programs. Use system registers SW00801 and SW00809 to monitor the operating status of the other CPU Module.

Table 9.1 Registers Used to Monitor CPU Module Status

Register Address	Contents
SW00801 *	Operating status of CPU Module 1 (mounted in slots 0 and 1)
SW00809 *	Operating status of CPU Module 2 (mounted in slots 2 and 3)

* Register values
SW00801, SW00809 = 2: CPU Module running
7: CPU Module stopped or failed

IMPORTANT

The Harmony Stop setting stops one CPU Module when the other CPU Module fails. This operation is not related to the RUN/STOP operation of the CPU Module.

A RUN/STOP setting operation for one CPU Module from a Programming Device will not change the operating status of the other CPU Module in a MP920 Multi-CPU System.

■ CPU Module Registers and Shared Memory

By default, the CPU Module 1 and CPU Module 2 data memory areas (M, S, D, #, I, O, and C registers) are independent from each other. M registers, however, can be set as shared memory to allow each CPU Module to read the specified M registers in the other CPU Module. Refer to *5 Settings on the Common Memory Assignment Tab Page of the System Configuration Window* in *9.2.2 Setup Procedure Using the MPE720* for details.

■ Controlling Optional Modules

In an MP920 Multi-CPU System, the CPU Module that initializes an Optional Module and synchronizes processing is called the Control CPU Module. The other CPU Module is called the Sub CPU Module. The Control CPU Module must be set for each Optional Module in the Module Configuration Definition Window. Which CPU Module (CPU Module 1 or CPU Module 2) is to be specified as the Control CPU Module depends on the Optional Modules as described next.

Motion Modules

For any Motion Module (SVA, SVB, or PO), set CPU Module 1 as the Control CPU Module [* 1].

By setting CPU Module 1 as the Control CPU Module, a Motion Module operates in synchronization with CPU Module 1. Therefore, access the Motion Module from the Control CPU Module (CPU Module 1).

If the previously described synchronized scans have been set, it is possible to access the Motion Module from the Sub CPU Module (CPU Module 2). In this case, do not access the Motion Module immediately after the start of scanning [* 2] and assign one CPU Module to access each axis to avoid malfunctions caused by conflicts between multiple accesses.

* 1. If the Control CPU Module of the Motion Module is inadvertently set to CPU Module 2, initialization and synchronized processing will not be performed and normal operation may not be possible.
* 2. For the default setting, both CPU Module 1 and CPU Module 2 are synchronized on the high-speed scans as shown in *Fig. 9.5*. A Motion Module, however, executes commands at the input and output timing of the Control CPU Module (CPU Module 1) and its execution is not synchronized with the Sub CPU Module (CPU Module 2). Accordingly, when controlling a Motion Module from the Sub CPU Module, do not access the Motion Module from the Sub CPU Module immediately after the start of scanning.

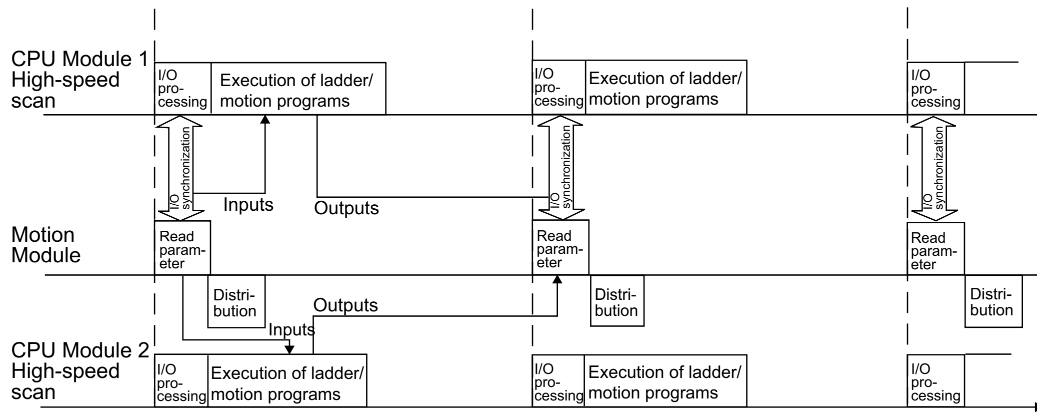


Fig. 9.5 Synchronization with a Motion Module

I/O Control

For Communications Modules, such as the 215IF and 260IF Modules, that perform I/O transmission with I/O Modules such as the DI, DO, LIO, CNTR, AI, and AO Modules, specify the CPU Module that inputs and outputs data using I and O registers as the Control CPU Module. Change the module output settings of the Sub CPU Module so that the Sub CPU Module will not output to these Modules. (Refer to *6 Module Configuration Definitions* in *9.2.2 Setup Procedure Using the MPE720* for details.) Otherwise, outputs from the Sub CPU Module may conflict with outputs from the Control CPU Module, causing errors such as undefined output values.

It is possible to read the input data on the Sub CPU Module. However, word data may not be concurrent because there is no synchronization between inputs from the Sub CPU Module and inputs from the Motion Module. For example, when reading input data for several words from an Inverter connected to a network, new and old input data may be mixed. To avoid this problem and ensure word data concurrency, program the CPU Modules so that the Sub CPU Module reads the I registers that were read and stored in the shared memory by the Control CPU Module.

Message Communications

For Communications Modules performing message communications, such as the 217IF, 218IFA, and 215IF Modules, normally specify the CPU Module in which the message functions (MSG-SND and MSG-RCV) are programmed as the Control CPU Module. If the message functions are programmed in both CPU Modules, specify CPU Module 1 as the Control CPU Module.

For Communications Modules, such as the 215IF Module, that perform I/O transmission as well, however, select the Control CPU Module on the base of the criterion described in *I/O Control*, above.

Message processing (MSG-SND and MSG-RCV function processing) is normally executed in the Sub CPU Module, too, but the transmission parameters in the Control CPU Module will be used.

9.2 Setting Up a Multi-CPU System

This section describes the settings unique to a Multi-CPU System. For settings that are the same as a Single-CPU System, refer to *3.2 Start and Stop Sequences* and *Chapter5 Modules*.

9.2.1 Hardware Settings

Mount one CPU Module in slots 0 and 1 and another CPU Module in slots 2 and 3 on the Mounting Base (rack 1 in a multiple rack configuration). The CPU Module in slots 0 and 1 is CPU Module 1, and the CPU Module in slots 2 and 3 is CPU Module 2.

CPU Module 1 and CPU Module 2 have their own CPU numbers as shown in the following table.

Table 9.2 Mounting Slots

Name	Mounting Slots	CPU Number
CPU Module 1	0 and 1	01
CPU Module 2	2 and 3	02

IMPORTANT

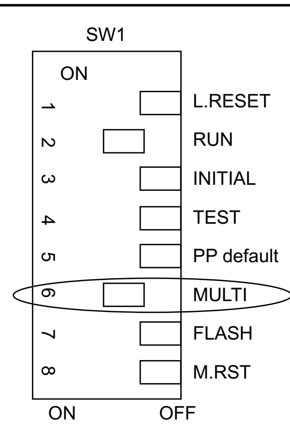
Use the same model of CPU Module. Their software versions must also be the same. If the models of the two CPU Modules are different, data sharing may not be dependable.

Turn ON the DIP switch pin SW1-6 (MULTI) on both CPU Module 1 and CPU Module 2. The settings of other pins are the same as for a Single-CPU System. Refer to *3.2 Start and Stop Sequences* for details.

INFO

If SW1-6 (MULTI) on either CPU Module 1 or CPU Module 2 is OFF, the Multi-CPU System will not operate normally. Even if the LED indicator status is correct, it will be impossible to log on from the the MPE720.

Table 9.3 DIP Switch SW1 Settings



Pin No.	Name	Factory Setting	Setting for Multi-CPU System
1	L.RESET	OFF	OFF
2	RUN	ON	ON
3	INITIAL	OFF	OFF
4	TEST	OFF	OFF
5	PP Default	OFF	OFF
6	MULTI	OFF	ON
7	FLASH	OFF	OFF
8	M.RST	OFF	OFF

9.2.2 Setup Procedure Using the MPE720

■ Setup Procedure for a Multi-CPU System

Use the following procedure to set up a Multi-CPU System using the MPE720.

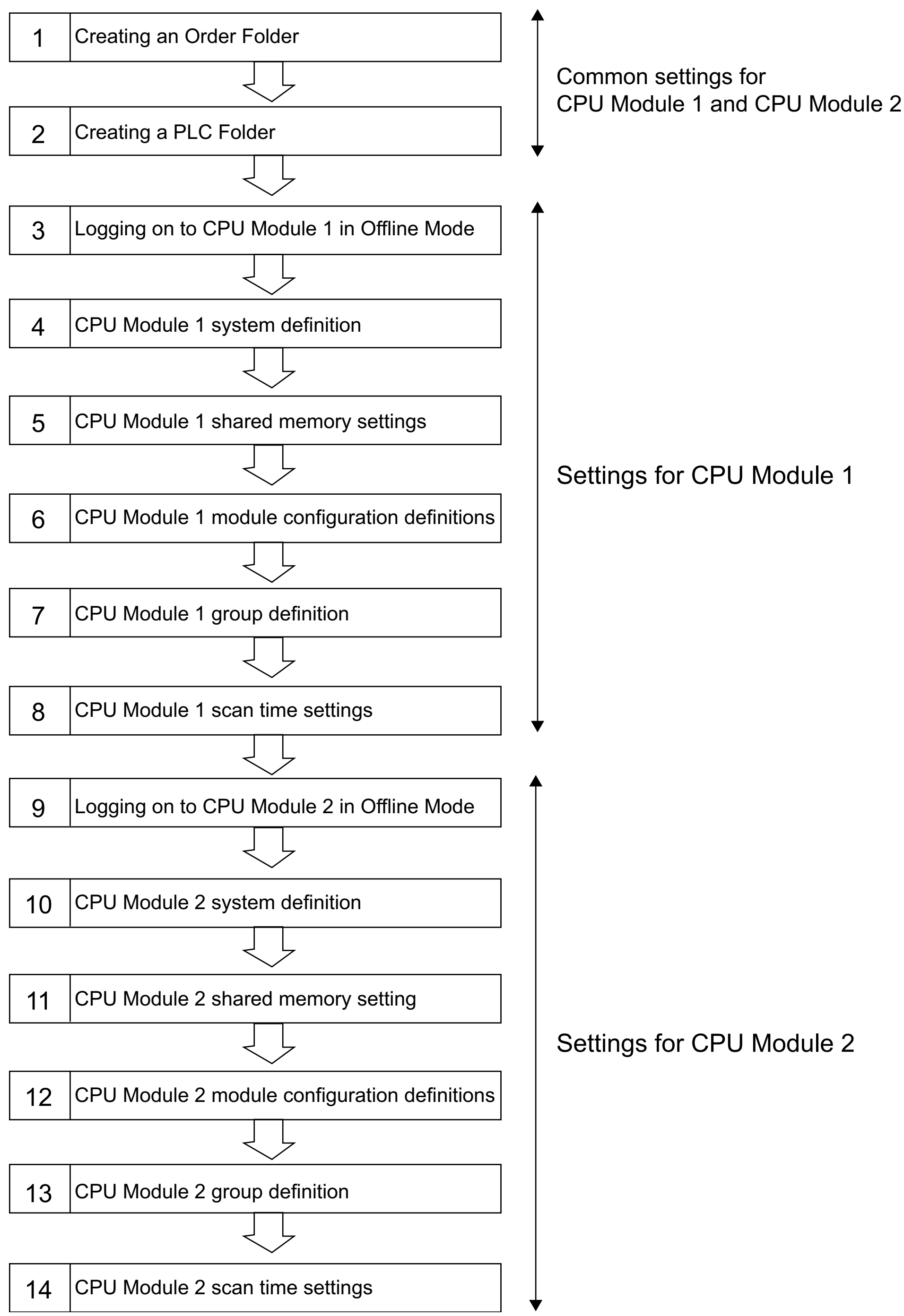


Fig. 9.6 Setup Procedure for a Multi-CPU System Using the MPE720

1. Creating an Order Folder

   The procedure is the same as for a Single-CPU System.

2. Creating a PLC Folder

   Select *MP920* or *MP920-02* for the **Controller Type** on the Information Tab Page of the Controller Configuration Window to activate the **Multi-CPU** settings. Select the **Enable** Option.
   A CPU1 folder for CPU Module 1 and a CPU2 folder for CPU Module 2 will be created in the specified PLC folder.

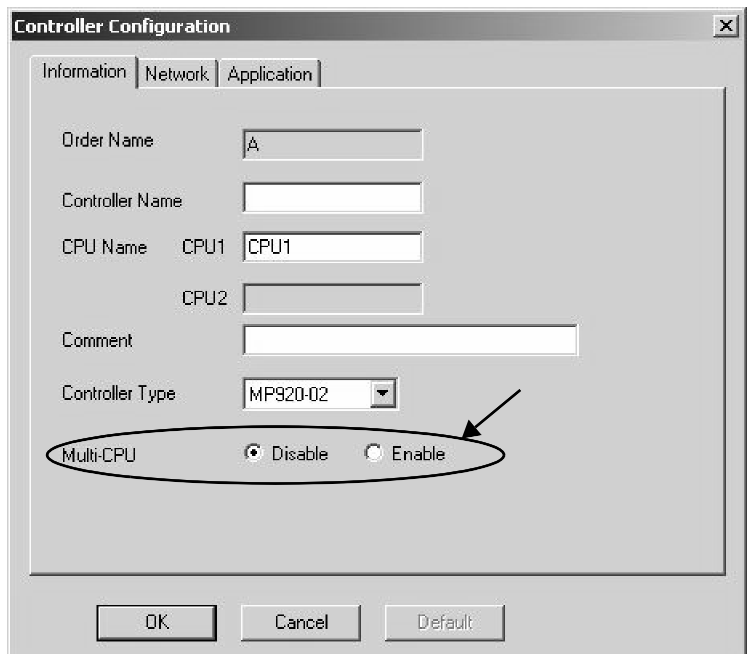


Fig. 9.7 Controller Configuration Window

3. Logging On in Offline Mode

   Log on to the CPU1 and CPU2 folder in the PLC folder to input settings and programming. Double-click the folder of the CPU Module for which settings and programming are to be input.

   It is possible to log on to CPU Module 2 from a MPE720 Programming Device connected to the serial port of CPU Module 1 or log on to CPU Module 1 from a MPE720 Programming Device connected to the serial port of CPU Module 2.

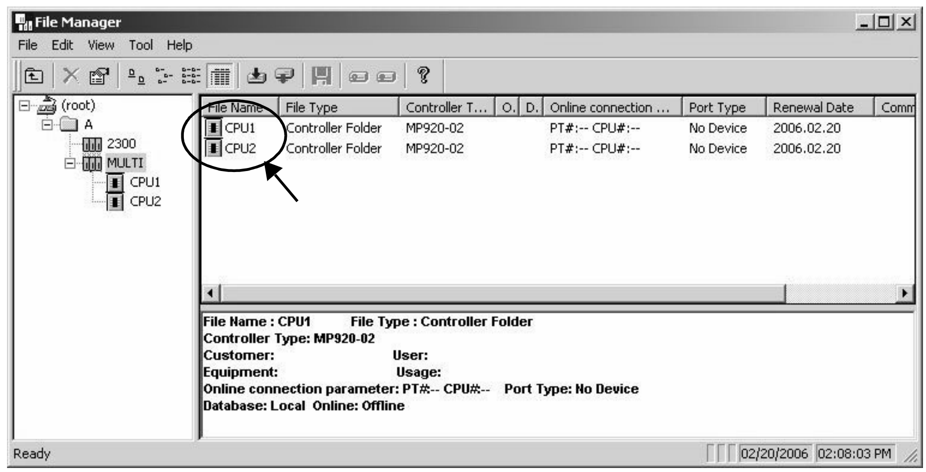


Fig. 9.8 Logging On from the File Manager

   Log on to CPU Module 1 and make the following settings.

4. Settings on System Configuration Tab Page of System Configuration Window

   Normally, the default settings in the System Configuration Window may be used without changes. This section explains two setting items unique to Multi-CPU Systems.

   a) Multi-CPU System Run Mode Setting

      The **Run Mode** sets the operation of the CPU Module when the other CPU Module fails. The **Run Mode** is set by default to ***Harmony Stop***: The CPU Module will stop when the other CPU Module stops.

IMPORTANT

Set the same Run Mode for both CPU Module 1 and CPU Module 2. If a different mode is set, the operation of the CPU Module will not be predictable when the other CPU Module stops.

9

b) Multi-CPU System Synchronized Scan Setting (Sync Scan)

Set the scans for which the start of the scans are to be synchronized between CPU Module 1 and CPU Module 2. The start of processing will be synchronized between the set scans. The scans must also be synchronized to enable sharing data between the two CPU Modules. The default is to synchronize only the high-speed scans. Normally, use the default setting.

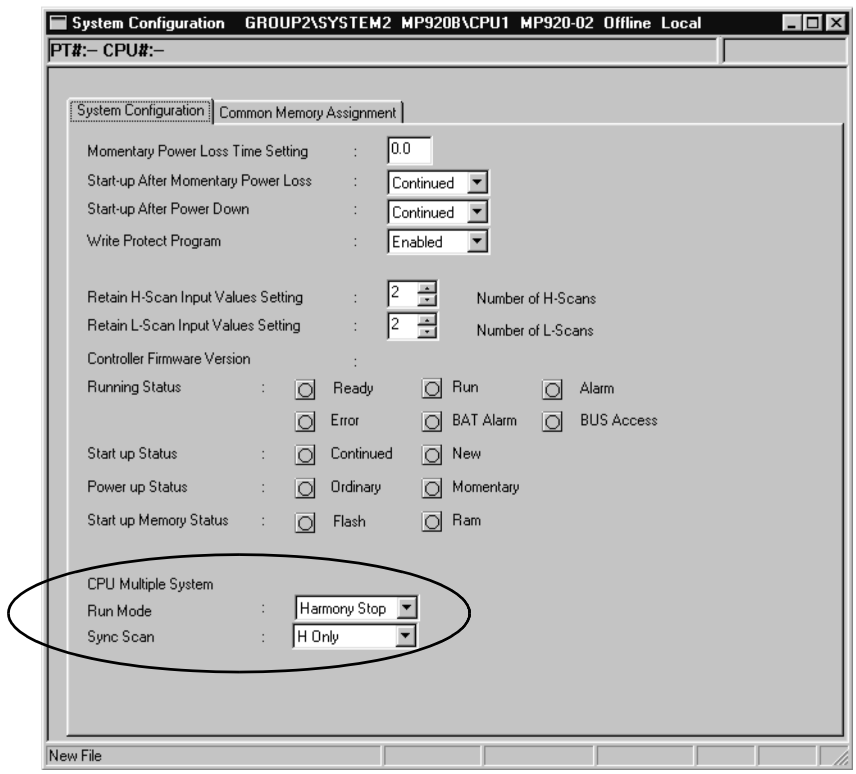


Fig. 9.9 System Configuration Tab Page

5. Settings on the Common Memory Assignment Tab Page of the System Configuration Window

   With a Multi-CPU System, the data in specified M registers can be input and output during the specified scan between the CPU Modules. The data is copied at the start of the specified scan. The I/O registers must be assigned so that they do not overlap. Click the **Common Memory Assignment** Tab in the System Configuration Window to open the tab page to assign shared memory.

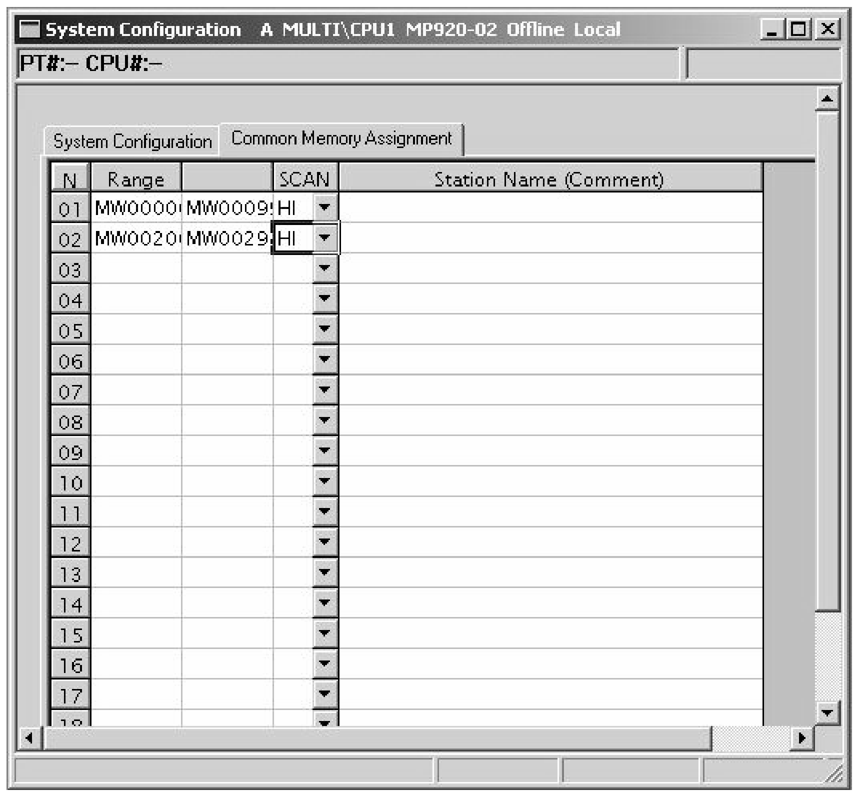


Fig. 9.10 Common Memory Assignment Tab Page

Input the following items on this tab page: Read source MW register addresses from the other CPU Module (the same addresses as the read destination of this CPU Module) and the scan during which to execute I/O processing to read data (high-speed scan or low-speed scan).

Table 9.4 Scan Selection

HO/LO Settings	Writes the contents of the M registers specified in this CPU Module to the M registers with the same addresses in the other CPU Module. ***HO*** will execute the write during the system I/O processing in the high-speed scan. ***LO*** will execute the write during the system I/O processing in the low-speed scan. Select ***HO*** when the user ladder program is being used in the high-speed scan and select ***LO*** when the user ladder program is being used in the low-speed scan.

9

Table 9.4 Scan Selection (cont'd)

HI/LI Settings	Reads the contents of the M registers specified by the other CPU Module and writes them to the M registers with the same addresses in this CPU Module. ***HI*** will execute the write during the system I/O processing in the high-speed scan. ***LI*** will execute the write during the system I/O processing in the low-speed scan. Select ***HI*** when the user ladder program is being used in the high-speed scan, and select ***LI*** when the user ladder program is being used in the low-speed scan.

This setting must be made only for the CPU Module to read the data. If the common memory assignments are made for both CPU Modules, the shared memory function will not be executed correctly.

◀ EXAMPLE ▶

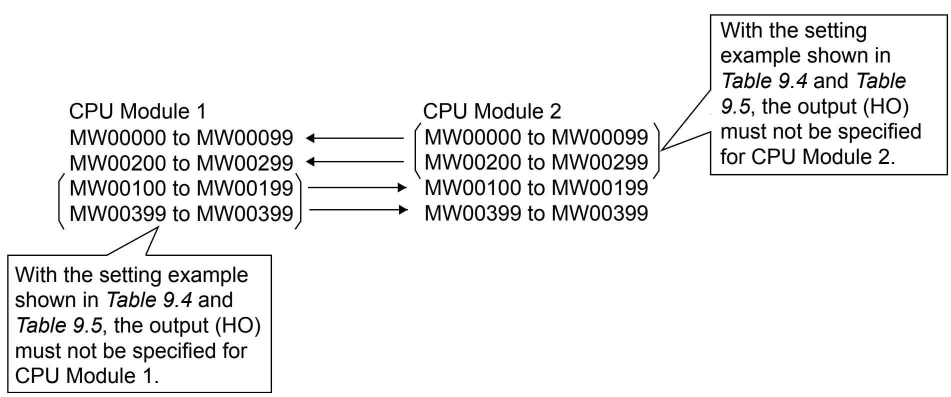
- Setting Example

Table 9.5 CPU Module 1

No.	Range	Scan
01	MW00000 to MW00099	HI
02	MW00200 to MW00299	HI
03		
04		

Table 9.6 CPU Module 2

No.	Range	Scan
01	MW00100 to MW00199	HI
02	MW00300 to MW00399	HI
03		
04		



6. Module Configuration Definitions

   Log on to CPU Module 1 in offline mode from the MPE720 to define the module configuration. Once the settings for CPU Module 1 are made and saved, the settings will be copied in the file of CPU Module 2. Simply check the copied settings for CPU Module 2, and then make settings for other Modules in the configuration.

   a) Setting Two CPU Modules

   Set CPU Module 1 in slot 00, and then set CPU Module 2 in slot 02.

b) Setting the Optional Modules

The module configuration must be set according to the actually mounted Optional Modules. All the Optional Modules that are actually mounted must be set, no matter which CPU Module is the Control CPU Module for each Optional Module.

After setting and saving the module configuration in offline mode, the same module configuration definition will be set in CPU Module 1 and CPU Module 2, and saved in the MPE720.

c) Designating the Control CPU Number

Select the Control CPU Module that initializes the Optional Modules and I/O by specifying 01 or 02.

For Motion Modules such as the SVA, SVB, and PO, always specify 01 for the Control CPU Module. If 02 is specified, operation may not be dependable.

For the Control CPU Module selection of other Modules such as I/O Modules and Communications Modules, refer to *Controlling Optional Modules* in *9.1.2 Operation*.

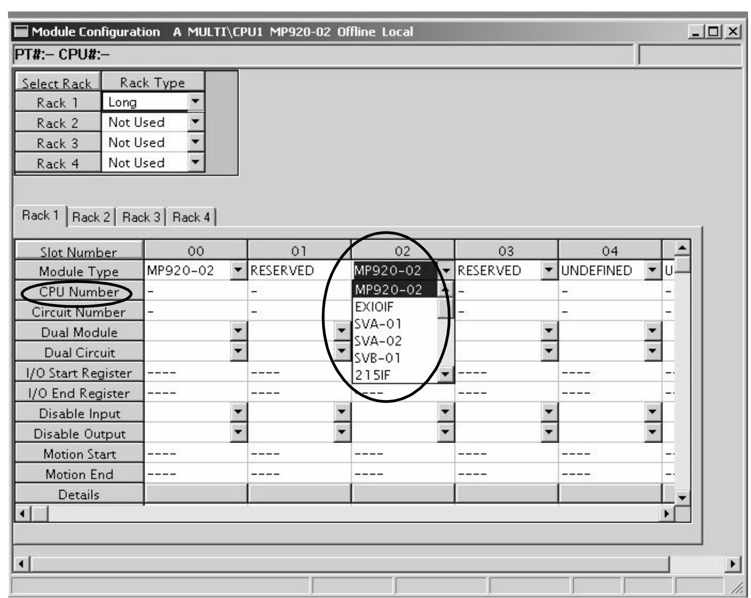


Fig. 9.11 Module Configuration Window

d) I/O Module Definitions

The definitions of the I/O Modules to be used must be set seperately in CPU Module 1 and CPU Module 2. There are some Modules whose definitions must be the same in CPU Module 1 and CPU Module 2 because of their usage.

i) I/O Processing

The normal I/O processing of I/O Modules is executed by CPU Module 1 and CPU Module 2 at the start of each scan. I/O data will be updated in synchronization with the scans set in the Control CPU Module.

ii) Transmission Parameters and Link Map Allocations

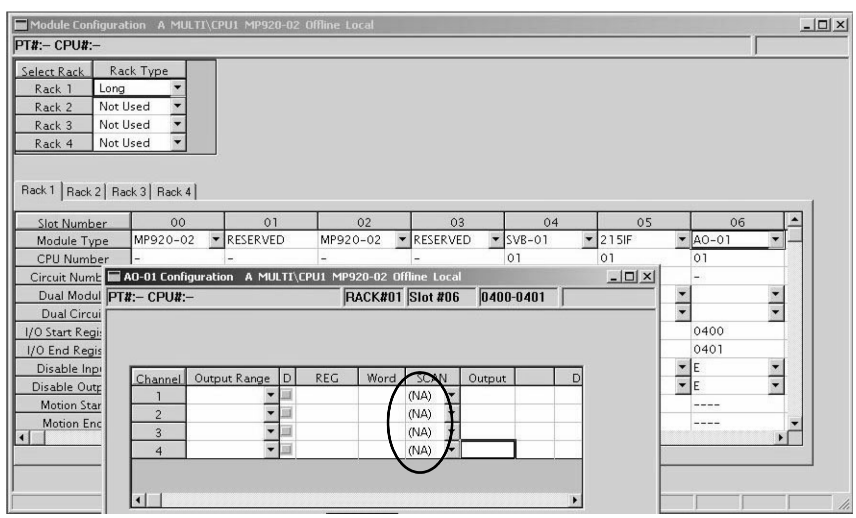
The settings of transmission parameters and link map allocations used for I/O Modules must be the same for both CPU Module 1 and CPU Module 2.

INFO If the settings for CPU Module 1 and CPU Module 2 are different, the transmission parameters of the Control CPU Module will be used.

iii) I/O Map Allocations

Allocate outputs (HO or LO) only in the Control CPU Module. If the outputs are allocated in both CPU Modules, it will be impossible to tell which CPU Module will output data. In the Module Setting Window for the Sub CPU Module, set “NA” in the scan setting (SCAN) of the output data so that the output section of the Sub CPU Module will be disabled.

For input allocations (HI/LI), there will be no problem in input signals to CPU Module 1 and CPU Module 2 as long as the input is in units of bits or words. When a synchronized scan is specified, the inputs to CPU Module 1 and CPU Module 2 will be concurrent. However, if synchronization is not specified, inputs may not be concurrent.
The input signals in the Control CPU Module are concurrent within one scan, however, signals in the Sub CPU Module will be concurrent only within individual registers.



e) Motion Module Definitions

Set the motion fixed parameters to the same values for CPU Module 1 and CPU Module 2. The settings of CPU Module 1 will be written to the fixed parameters of the Motion Module, but set the same values for both CPU Modules for reference by the internal processing.

Manually setting temporary motion setting parameters using the MPE720 is possible for either CPU Module 1 or CPU Module 2.

When accessing data from user application programs, use the Control CPU Module. If the Sub CPU Module is used, do not access the data immediately after the start of the scan and assign one CPU Module to write the setting parameters for each axis to avoid malfunctions caused by access conflicts. Set the synchronized scan to the high-speed scan and run the application program in the high-speed scan. Set the group definitions required for the user application program in each CPU Module. Be sure that each axis is allocated in only one CPU Module.

The values of the setting parameters saved in the CPU Module 1 will be used as the initial values at startup. Therefore, save the settings in the CPU Module 1.

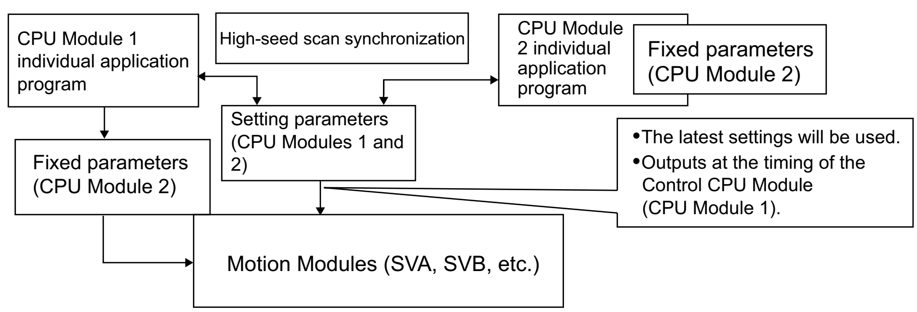


Fig. 9.12 Motion Module Data Configuration

f) Communications Module Definitions

Set the transmission parameters to the same values in CPU Module 1 and CPU Module 2. If the settings are different, the transmission parameters of the Control CPU Module will be used.

Do not allocate any outputs (O registers) in the link map and I/O map for the Sub CPU Module. Allocate outputs only for the Control CPU Module. When allocating the inputs (I registers) for the Sub CPU Module, match the settings to those of the Control CPU Module. In this way, the input data can be referenced.

The values of the input data (I registers) is not concurrent between words, and new and old data may be mixed. For an application that requires concurrency between words, program the Modules so that the Sub CPU Module reads the I registers that were read and stored in the shared memory by the Control CPU Module.

INFO

For message communications using the MSG-SND and MSG-RCV functions, specify CIR = 1 or 2 for the CPU Module 1 port 1 or 2, CIR = 3 or 4 for the CPU Module 2 port 1 or 2.

7. Group Definitions

   The group definition procedure is the same as for a Single-CPU System.

   To access a Motion Module from CPU Module 2, allocate the axes so that the axes controlled by CPU Module 1 do not overlap with the axes controlled by CPU Module 2. Use the default setting (high-speed scan) for the synchronized scans.

8. Scan Time Settings

   Set scan times individually for CPU Module 1 and CPU Module 2. For the synchronized scans (the default is the high-speed scan), set the same scan time for CPU Module 1 and CPU Module 2.

INFO

If the scan time for a synchronized scan set for CPU Module 1 is different from that set for CPU Module 2, synchronization will be performed with the scan time set for CPU Module 1. The operation of instructions such as timer instructions, however, may not be normal because the time set for the CPU Module 2 internal scan would be different from that for CPU Module 1. Always set the same scan time for scans that are synchronized between CPU Module 1 and CPU Module 2.

---

9. Saving the Data

   CPU Module 1 and CPU Module 2 data must be saved seperately. When transferring data from the MPE720 to removable media, the destination folder and file names for CPU Module 1 will be the same as those for CPU Module 2 with the default settings.

   If the folders and files for two CPU Modules are transferred with the default settings, the data transferred first will be overwritten. Save the data for two CPU Units on different floppy disks or change the folder and file names before transferring the data.

10

Absolute Position Detection

This chapter describes an absolute detection system that uses an absolute encoder. Be sure to read this chapter carefully when using a Servomotor equipped with an absolute encoder.

10.1 Structure of the Absolute Position Detection Function

This section describes the Absolute Position Detection Function in the MP920.

10.1.1 Description of the Function

The Absolute Position Detection Function detects the position of the machine even if power is turned OFF. This allows it to set the machine coordinate system automatically and to begin operating automatically without having to return to the zero point after power is turned ON.

The following are features of the absolute position detection system.

- Eliminates the need to return to the zero point after power is turned ON.
- Eliminates the need for a zero point dog and overtravel limit switch.

10.1.2 Structure of Absolute Position Detection

■ Basic Terminology

The following explanation for basic terminology used in this chapter is provided to ensure basic understanding.

Absolute Encoder

Absolute position detection is generally performed in a semi-closed loop using an absolute encoder built into a Servomotor. The detector is comprised of an encoder that is used to detect absolute position within one rotation and a counter that is used to count the number of rotations.

Absolute Data

Absolute data that is stored in an absolute encoder is comprised of the number of rotations (P) from the absolute reference position and position (PO) in a one Servomotor rotation. This absolute data is read as serial data when the machine is turned ON.

All other operations are the same as that for ordinary incremental encoders.

In other words, we can determine the absolute position PO from the equation for absolute value (P) which is absolute value (P) = N × PR+ PO if we use the following:

- Number of rotations from the absolute reference position: N
- Number of pulses per one Servomotor rotation: PR
- Position in one Servomotor rotation: PO

Holding Absolute Data

An absolute encoder uses a battery to maintain absolute data at all times even though power is turned OFF. It also updates data if there is a change.

The battery is connected to the battery terminal of the SERVOAPACK.

Yaskawa supplies the battery module (JRMSP–120XC9600) on which the following battery is mounted.

- Type of battery: Lithium
- Battery configuration: ER6VC3, 3.6 V × 1
- Non-conducting service life: About 1 year

Reading Absolute Data

When power is turned ON, absolute data is read to the SERVOAPACK as well as to the MP920 where it is used to automatically calculate the absolute position and set the machine coordinate system. This way the absolute machine position can be detected and automatic operation can begin immediately after power is turned ON.

10.2 Starting the Absolute Position Detection Function

This section describes the procedure that is used to start the Absolute Position Detection Function.

10.2.1 System Startup Procedure

The system must be started up using the following procedure.

1	Connect the Devices	Check to see if the SERVOPACK, Servomotor, and cables are the right products and models for the absolute encoder.
2	Set the MP920 and SERVOPACK Parameters	Set the absolute position detection function related parameters of MP920 and SERVOPACK.
3	Initialize the Absolute Encoder	Set the absolute encoder to its default value.
4	Set the Zero Point	Set the zero point: The absolute zero point, that is, the machine coordinate system zero point.

If steps 1 to 4 are not successfully completed, the absolute position detection function will not operate normally.

Perform the absolute position detection system startup procedure in the following situations.

- When starting up the absolute position detection system for the first time
- When the Servomotor is changed
- When an absolute encoder-related alarm occurs

10.2.2 Setting Related Parameters

⚠ CAUTION

- If the parameters for which IMPORTANT information is given in ■Details are not set, the current position may be shifted when the power is turned OFF and then ON.
  Set the required parameters properly. Otherwise, damage to the machine may be resulted.

This section describes absolute position detection related parameters in the MP920 parameter.

Set the following parameters prior to starting up the absolute position detection system.

■ MP920 Parameters

MP920 Parameters for SVA-01A and SVA-02A Modules

Parameter No.	Name	Setting Range	Units
Fixed Parameter No. 3	Encoder Selection	0 to 2 0: Incremental encoder 1: Absolute encoder 2: Absolute encoder (used as incremental encoder)	–
Fixed Parameter No. 4	Rotation Direction When Using Absolute Encoder	0 or 1 0: Forward 1: Reverse	–
Fixed Parameter No. 8	Number of Feedback Pulses per Rotation	Multiples of 4 in the range between 4 and 65535	1 = 1 pulse/rev
Fixed Parameter No. 14, Bit 9	Σ-II Series SERVOPACK Selection	ON / OFF	–
Fixed Parameter No. 17, Bit 5	Axis Selection	Finite length axis / Infinite length axis	–
Fixed Parameter No. 23	Infinite Length Axis Reset Position	1 to $2^{31}-1$	1 = 1 reference unit
Fixed Parameter No. 25	Max. Number of Absolute Encoder Turns	1 to $2^{31}-1$	1 = 1 rev (rotation)

MP920 Parameters for SVB-01 Module

Parameter No.	Name	Setting Range	Units
Fixed Parameter No. 3	Encoder Selection	0 to 2 0: Incremental encoder 1: Absolute encoder 2: Absolute encoder (used as incremental encoder)	–
Fixed Parameter No. 8	Number of Feedback Pulses per Rotation	Multiples of 4 in the range between 4 and 65535	pulse
Fixed Parameter No. 9	Number of Feedback Pulses per Rotation (for High-resolution)	Multiples of 4 in the range between 4 and 65535	pulse
Fixed Parameter No. 14, Bit 9	Validation of Number of Feedback Pulses for High Resolution	ON / OFF	–
Fixed Parameter No. 17, Bit 5	Axis Selection	Finite length axis / Infinite length axis	–
Fixed Parameter No. 23	Infinite Length Axis Reset Position	1 to $2^{31}-1$	1 = 1 reference unit
Fixed Parameter No. 25	Max. Number of Absolute Encoder Turns	1 to $2^{31}-1$	1 = 1 rev (rotation)

■ SERVOPACK Parameters

SERVOPACK Model	Parameters	Name	Setting Range	Units
Σ Series	Cn-0001, Bit E	Encoder Selection	0: Incremental encoder 1: Absolute encoder	–
	Cn-0002, Bit 0	Reverse Rotation Mode	0: CCW as forward rotation 1: CW as forward rotation (Reverse rotation mode)	–
	Cn0011	Number of Encoder Pulses	513 to 32767	pulse/rev
Σ-II Series	Pn000.0	Rotation Direction Selection	0: CCW as forward rotation 1: CW as forward rotation (Reverse rotation mode)	–
	Pn201	PG Dividing Ratio	16 to 16384	pulse/rev
	Pn205	Multi-turn Limit Setting	0 to 65535	rev
	Pn002.2	Absolute Encoder Usage	0: Use as absolute encoder 1: Use as incremental encoder	–

■ Details

Encoder Selection/Absolute Encoder Usage

- MP920 fixed parameter No. 3
- SERVOPACK parameter Cn-0001 bit E, Pn002.2

Set the MP920 fixed parameter No. 3 and SERVOPACK parameter Cn-001 bit E or parameter Pn002.2 as shown in the table below.

Parameter	Setting
MP920 Fixed Parameter No. 3	Absolute encoder
Σ Series SERVOPACK Cn-001, Bit E	1: Absolute encoder
Σ-II Series SERVOPACK Pn002.2	0: Use absolute encoder as absolute encoder.

Be sure to set both MP920 parameter and SERVOPACK parameter since the both parameters are used.

IMPORTANT

If the above parameters are not correctly set, the motion control will not be performed correctly.

Rotation Direction Selection When Using Absolute Encoder/Reverse Rotation Mode/Rotation Direction Selection

- MP920 SVA-01A and SVA-02A module fixed parameter No. 4
- SERVOPACK parameter Cn0002 bit 0 or parameter Pn000.0

When the SERVOPACK parameter for Servomotor Rotation Direction is set to Reverse Rotation, set the MP920 fixed parameter No. 4 (Rotation Direction When Using Absolute Encoder) to Reverse Rotation.

The servomotor rotation direction can be set to Reverse Rotation Mode by setting Cn-0002 bit 0 = 1 for Σ series SERVOPACK and Pn000.0 = 1 for Σ -II series SERVOPACK.

IMPORTANT

If the above settings are omitted, the absolute encoder position data cannot be read correctly when the power is turned OFF and then ON, resulting in current position deviation.

Number of Feedback Pulses per Motor Rotation/Number of Encoder Pulses/PG Dividing Ratio

- MP920 fixed parameter No. 8
- SERVOPACK parameter Cn-0011, Pn201

Set the number of absolute encoder pulses in the MP920 fixed parameter No. 8 and SERVOPACK parameter Cn-0011 or Pn201 as shown in the table below.

No. of Bits	MP920 Fixed Parameter No. 8	SERVOPACK Parameter (Cn-0011/Pn201)
12	1024	1024
13	2048	2048
14	4096	4096
15	8192	8192
16 or more	16384 *	16384 *

* When using an SVA-01 or SVA-02 Module in combination with an encoder of 16 bits or more, rotating the servomotor at 3,000 min^{-1} or faster may cause errors in counting pulses because the response frequency exceeds 1 MHz.
To avoid such errors, make settings for 15-bit encoder.
(The SVA-01A and SVA-02A hardware version B5 or later supports the response frequency 1.5 MHz. For these models, the settings for 16-bit encoder can be used.)

Be sure to set both MP920 parameter and SERVOPACK parameter since the both parameters are used.

IMPORTANT

If the above parameters are not correctly set, the motion control will not be performed correctly.

Σ-II Series SERVOPACK Selection

- MP920 SVA-01A/SVA-02A Module fixed parameter No. 14, bit 9

Set the above bit to ON when the MP920 SVA-01A/SVA-02A Module is connected to Σ-II series SERVOPACK.

Set to OFF when the MP920 SVA-01A/SVA-02A Module is connected to Σ series SERVOPACK.

IMPORTANT

If the above parameters are not correctly set, the position may be shifted.

Axis Selection

- MP920 fixed parameter No. 17, bit 5

Set either an infinite or finite length mode for controlled axis movement.

For information on position control methods for finite and infinite length axes, refer to *10.3 Using an Absolute Encoder*.

Infinite Length Axis Reset Position

- MP920 fixed parameter No. 23

Set the number of Infinite Length Mode Axis rotations (refer to *10.3.2 Infinite Length Mode Axis*) in reference units. This parameter is enabled when Infinite Length Axis is selected.

The set data can be monitored in the monitoring parameter IL☐☐1C (POSMAX Monitor).

Max. Number of Absolute Encoder Turns/Multi-turn Limit Setting

- MP920 fixed parameter No. 25
- Σ-II Series SERVOPACK parameter Pn205

Set the maximum value of the encoder rotations that is managed by the SERVOPACK and Machine Controller.

The settings depend on the SERVOPACK model and the axis type to be used as shown in the table below.

	Fixed Parameter No. 25	SERVOPACK Parameter Pn205
Finite Length Axis for Σ Series SERVOPACK	99999	–
Infinite Length Axis for Σ Series SERVOPACK	99999	–
Finite Length Axis for Σ-II Series SERVOPACK	65535	65535
Infinite Length Axis for Σ-II Series SERVOPACK	65534 *	65534 *

* If the fixed parameter No. 25 is set to 65535 for the Infinite Length Axis for Σ-II series SERVOPACK, the Fixed Parameter Setting Error (IW☐☐00 Bit2 = 0) will occur.

IMPORTANT

If the above parameters are not correctly set, position may be shifted.

10

Validation of Number of Feedback Pulses for High Resolution/ Number of Feedback Pulses per Rotation (For High-Resolution)

- MP920 SVB-01 Module fixed parameter No. 14, bit 9
- MP920 SVB-01 Module fixed parameter No. 9

Always set the bit 9 of MP920 fixed parameter No. 14 to ON when the MP920 SVB-01 Module is connected to Σ-II series SERVOPACK.

Setting this bit to ON enables the fixed parameter No. 9 Number of Feedback Pulses per Rotation (For High-Resolution) and disables the fixed parameter No. 8 Number of Feedback Pulses per Rotation.

The setting values for the fixed parameter No. 9 are the same as for the fixed parameter No. 8 Number of Feedback Pulses per Rotation. Refer to the explanations on Number of Feedback Pulses per Motor Rotation/Number of Encoder Pulses/PG Dividing Ratio.

10.2.3 Initializing the Absolute Encoder

Initialize the absolute encoder in the following situations.

- When the absolute position detection system is started up for the first time
- When the number of rotations from the absolute reference position of the absolute encoder needs to be initialized to 0
- When a Servomotor has been left disconnected for more than four days with no battery connected to the absolute encoder
- When an alarm occurs

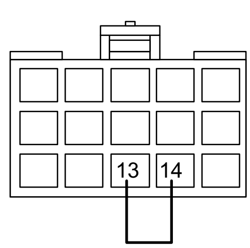
■ Initializing a 12-bit Absolute Encoder

Follow the procedure below to initialize a 12-bit absolute encoder.

1. Properly connect the SERVOPACK, Servomotor, and MP920.
2. Reset Absolute Position Data in the encoder.

   a) Disconnect the connector on the encoder end.

   b) Use a short piece to short-circuit together connector pins 13 and 14 on the encoder end for 1 to 2 seconds.



   c) Remove the short piece and insert the connector securely in its original position.
3. Rewire the cables using normal wiring and make sure the encoder battery is connected.

4. Turn ON the system.

   Repeat the procedure starting from step 1 if an Absolute Encoder Alarm occurs, otherwise the system has been successfully initialized.

■ Initializing a 15-bit Absolute Encoder

Follow the procedure below to initialize a 15 bit-type absolute encoder.

1. Turn OFF the SERVOPACK and MP920.
2. Discharge the large-capacity capacitor in the encoder using one of the following methods.

   a) At the encoder end connector

      i) Disconnect the connector on the SERVOPACK end.

      ii) Use a short piece to short-circuit together connector pins 10 and 13 on the encoder end.

      iii) Leave the pins short-circuited for at least 2 minutes.

      iv) Remove the short piece and insert the connector securely in its original position.

   b) At the SERVOPACK end connector

      i) Disconnect the connector on the encoder end.

      ii) Use a short piece to short–circuit together connector pins R and S on the encoder end.

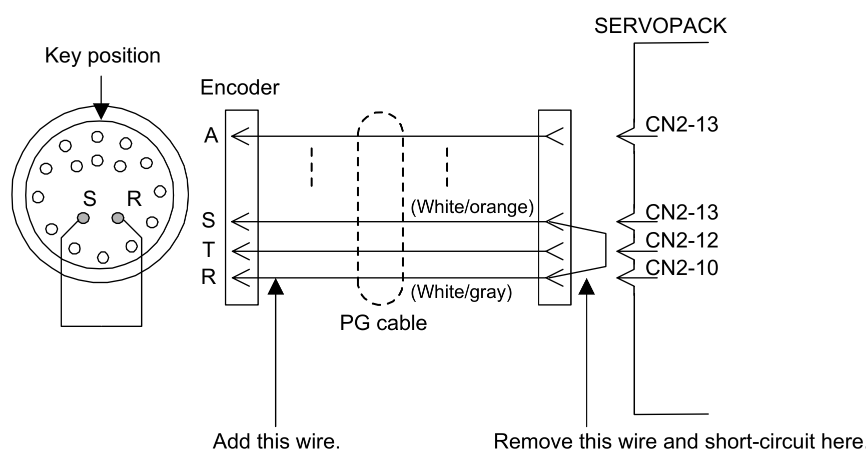


Fig. 10.1 Setup procedure using a PG cable

      iii) Leave the pins short-circuited for at least 2 minutes.

      iv) Remove the short piece and insert the connector securely in its original position.

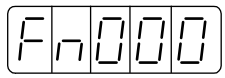
3. Rewire the cables using normal wiring and make sure the encoder battery is connected.
4. Turn ON the system.

   Repeat the procedure starting from step 1 if an Absolute Encoder Alarm occurs, otherwise the system has been successfully initialized.

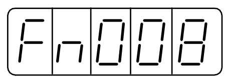
■ For Σ-II Series SERVOPACKs

Setup Using a Hand-held Digital Operator

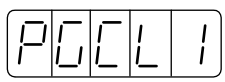
1. Press the DSPL/SET Key to select the utility function mode.



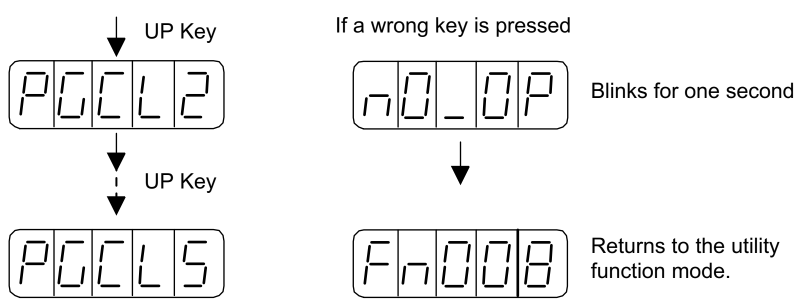
2. Press the UP or DOWN Key to select the parameter Fn008.



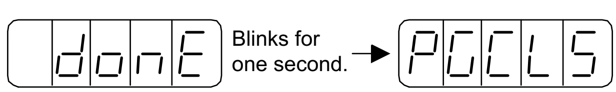
3. Press the DATA/ENTER Key. The display will be as shown below.



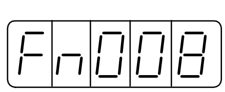
4. Press the UP Key. The display will change as shown below. Repeat pressing the UP Key until “PGCL5” is displayed. If a wrong key is pressed, the display “nO_OP” will blink for about one second. The digital operator will return to the utility function mode. Repeat the operation from step 3.



5. When “PGCL5” is displayed, press the DSPL/SET Key. The display will be as shown below, and the multi-turn data of the absolute encoder will be cleared.



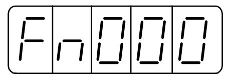
6. Press the DATA/ENTER Key to return to the display of the utility function mode.



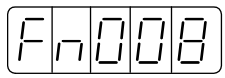
This completes the setup operation of the absolute encoder. Turn OFF the power, and then turn ON again.

Setup Using the Built-in Panel Operator

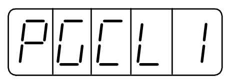
1. Press the MODE/SET Key to select the utility function mode.



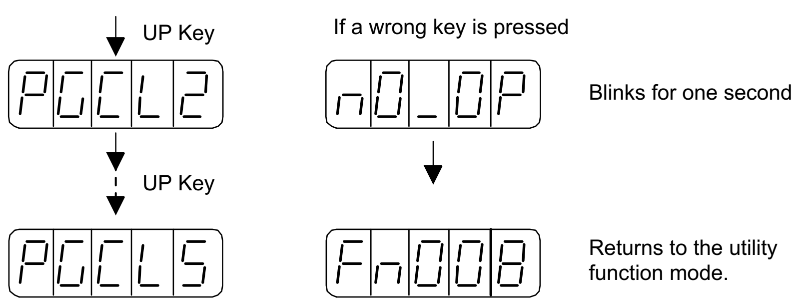
2. Press the UP or DOWN Key to select the parameter Fn008.



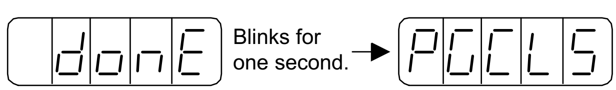
3. Keep pressing the DATA/SHIFT Key for one second or more. The display will be as shown below.



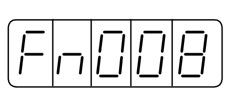
4. Press the UP Key. The display will change as shown below. Repeat pressing the UP Key until “PGCL5” is displayed. If a wrong key is pressed, the display “nO_OP” will blink for about one second. The panel operator will return to the utility function mode. Repeat the operation from step 3.



5. When “PGCL5” is displayed, press the MODE/SET Key. The display will be as shown below, and the multi-turn data of the absolute encoder will be cleared.



6. Repeat pressing the DATA/SHIFT Key for one second or more. The display will return to the utility function mode.



This completes the setup operation of the absolute encoder. Turn OFF the power, and then turn ON again.

10

INFO

■ The following Servomotor models have absolute encoders.

- 12-bit Encoder

  ☐ – ☐☐☐W☐☐

- 15-bit Encoder

  ☐ – ☐☐☐S☐☐

- 16-bit Encoder

  ☐ – ☐☐☐1☐☐

- 17-bit Encoder

  ☐ – ☐☐☐2☐☐

10.3 Using an Absolute Encoder

This section describes precautions regarding use as well as the procedure for setting the zero point when using an absolute encoder.

10.3.1 Finite Length Mode Axis

⚠ CAUTION

- Do not change the Zero Point Position Offset (OL☐☐06) while operating in Finite Length Mode.

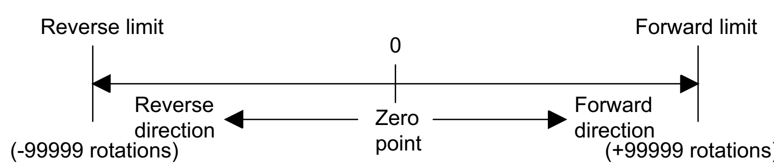
  Otherwise this may cause machine damage or an accident.

■ Overview

An absolute encoder stores the number of rotations from the encoder zero point in internal memory backed up by battery. This way the zero point of the coordinate system can be determined without returning to the zero point when the system is started up. Once the system is started, the encoder functions just like an incremental encoder.

Unfortunately, the maximum number of rotations from the encoder zero point is ±99999 rotations at which point it is reset to 0. When system power is turned ON therefore, the MP920 position may not be the same before and after power is turned ON.

A Finite Length Mode Axis has only limited movement that falls within a range of ±99999 absolute encoder rotations.



Therefore be sure to note the following precautions when using an absolute encoder as a Finite Length Mode Axis.

- Be sure to initialize the encoder prior to setting the zero point.
- Use an absolute encoder only within the range of ±99999 rotations

  Note: The actual machine operating range may vary depending on parameters like the gear ratio.

10

■ Position Control with a Finite Length Mode Axis

Initialize the axis position as described next when power is turned ON if an absolute encoder is used for a Finite Length Mode Axis.

Current position for the machine coordinate system =
(Encoder position when servo power is turned ON)*
+ Setting parameter OL□□06: Zero Point Offset

* Multi-turn data × the number of encoder pulses + initial increment

Setting parameter OL□□06: Zero Point Offset is always enabled in Finite Length Mode. This means that the current position of the machine coordinate system (zero point setting) can be changed at any time.

The meaning of setting parameter OL□□06 will depend on whether Finite Length Mode or Infinite Length Mode is set.

Finite Length Mode

Set - (IL□□02) + OL□□06 at OL□□06 in order to make the current position of the machine coordinate system the zero position.

◀ EXAMPLE ▶

IL□□02 = 10,000 and OL□□06 = 100
Setting the current position of the machine coordinate system to 0 when the zero point is set.
-(10,000) + 100 = -9,900 OL□□06 to -9,900
IL□□02: Monitor the calculated position of the machine coordinate system

Infinite Length Mode

Set the desired position at OL□□06 and that setting will be used for the current position of the machine coordinate system when the zero point is set.

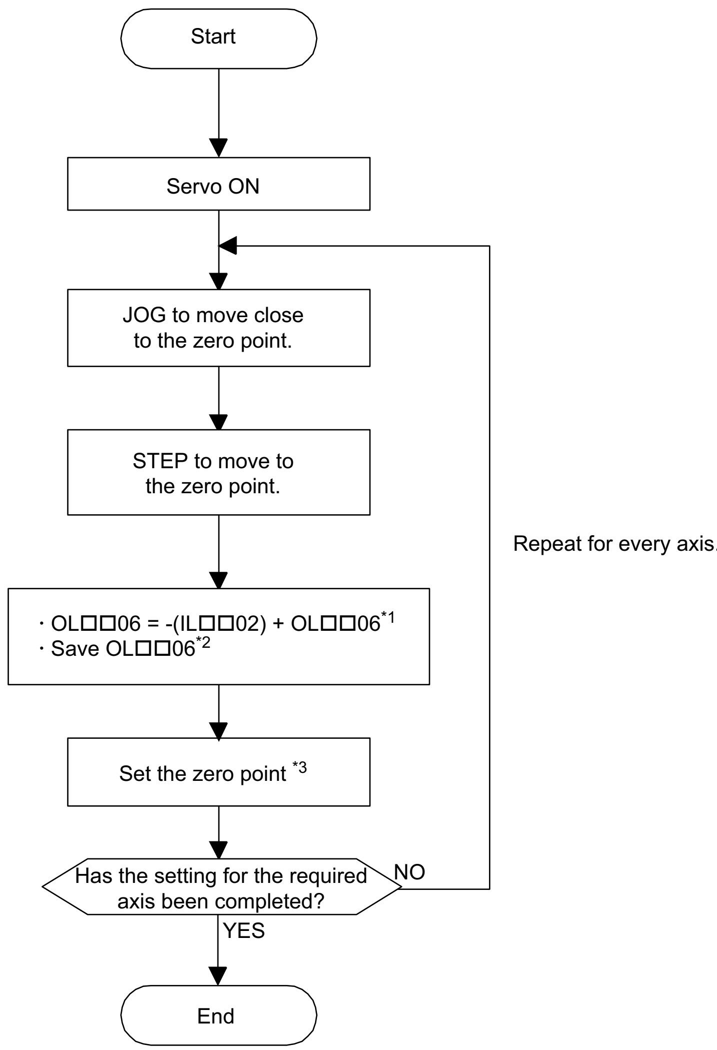
◀ EXAMPLE ▶

Setting the current position of the machine coordinate system to 0 when the zero point is set
Set OL□□06 to 0.

■ Setting the Zero Point for a Finite Length Mode Axis

Set the zero point as described here after initializing the absolute encoder to set the zero point of the machine coordinate system and to establish the machine coordinate system.

The following illustration shows the procedure for setting the zero point for a Finite Length Mode Axis.



* 1. The OL□□06 value must be saved when it is set.
* 2. See the information on the next page for more details on saving the OL□□06 value.
* 3. Execute with the ZSET command.

10

INFO

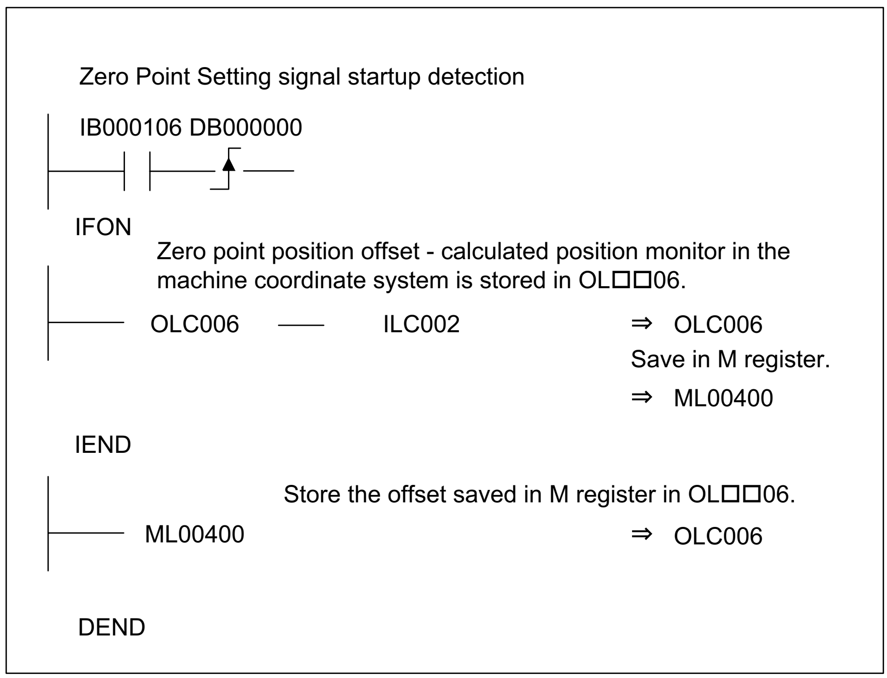
■ The following methods are used to save the Zero Point Offset (OL□□06).

- Saving in a Ladder Logic Program M Register

  Calculate (-(calculated position monitored in the machine coordinate system) + the Zero Point Offset) and save the results in the M register when they are stored at OL□□06.

  Store the contents saved in M register at setting parameter OL□□06: Zero Point Offset when system or servo power is turned back ON.

  Ladder Logic Program Required for a Finite Length Mode Axis: ABS System Finite Length Mode Axis (Axis No. 1)



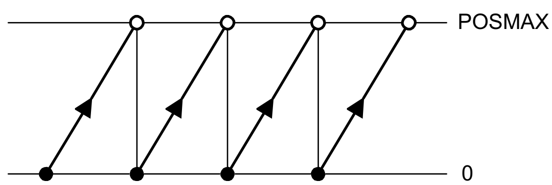
- Saving the OL□□06: Zero Point Offset from the MPE720 Parameter Window

  After the zero point and the Zero Point Offset (OL□□06) value (current value) are set, use SAVE to save the settings to the Controller. When power is turned back ON, the value that was saved for Zero Point Offset (OL□□06) will be stored automatically.

10.3.2 Infinite Length Mode Axis

■ Description

Infinite Length Positioning is a function that automatically updates machine position, program position (absolute values in a program coordinate system), and current values at regular intervals according to fixed parameter settings. The function can be used for repeated positioning in one direction.



As the number of rotations from the encoder zero point is controlled in the range shown below, the number of rotations will be reset to 0 when it exceed the range.

- For Σ series SERVOPACKs: ±99,999 rotations
- For Σ-II series SERVOPACKs: 0 to 65,534 rotations

When the system power is turned ON therefore, the position data that the MP920 manages may not be the same before and after power is turned ON.

This problem can be resolved using the following method.

■ Position Control for an Infinite Length Mode Axis

Determine the MP920 position when power is turned ON and use the following equation to determine the pulse unit position from the relative encoder position.

Always save the pulse position and encoder position as paired data in memory backed up by battery power. This data is used as pulse position and encoder position at power OFF settings the next time power is turned ON in order to determine number of pulses from the relative encoder position using the following equation.

Pulse position = pulse position at power OFF
+ (encoder position - encoder position at power OFF)*

* Indicates the distance traveled while power is OFF (relative encoder position).

INFO

■ The following explains the terminology used here.

- Encoder position: Position data for an absolute encoder
  (Multi-turn data × the number of encoder pulses + initial increment)
- Pulse position: MP920 position data converted to pulses.

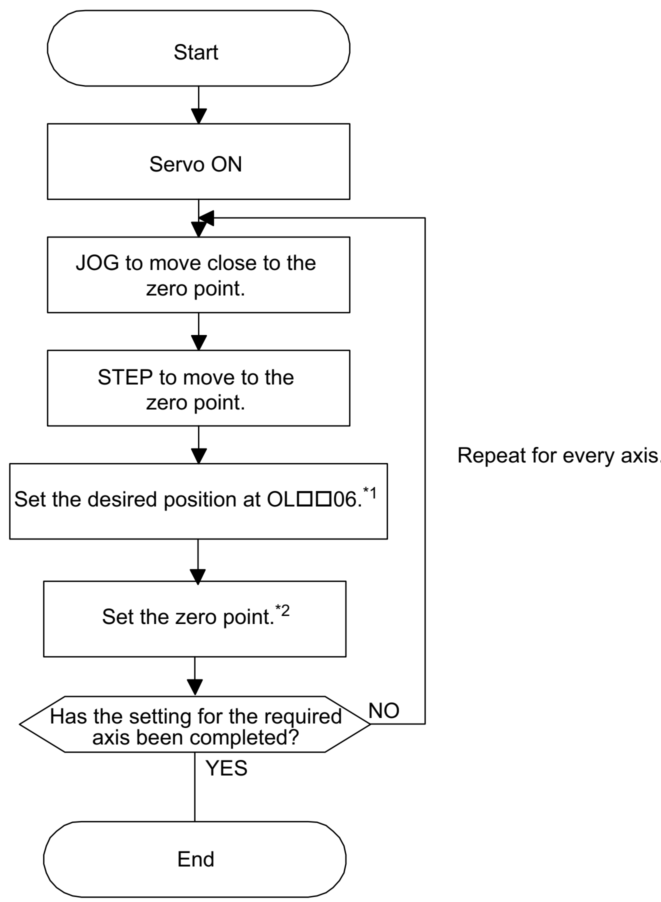
10

■ Setting the Zero Point for an Infinite Length Mode Axis

Execute the ZSET motion command (zero point setting).

The system will check pulse position at power OFF, encoder position at power OFF, and all position data when the zero point is set.

The following illustration shows the procedure for setting the zero point for an Infinite Length Mode Axis.



* 1. With an Infinite Length Mode Axis, the setting parameter OL□□06: Zero Point Offset is only enabled when the ZSET command is executed. Therefore, the OL□□06 value must be set at the M register. Set the desired coordinates at Zero Point Offset (OL□□06) when using an Infinite Length Mode Axis.
Example:
When setting the current stop position to 0 (zero point position for the machine coordinate system)
0 → OL□□06

* 2. Execute with the ZSET command.

■ Ladder Logic Program for Infinite Length Mode Axis Position Control

Special ladder logic programs for normal operation and for restarting the system are needed for absolute Infinite Length Mode Axis position control when an absolute encoder is used as an Infinite Length Mode Axis.

Normal Operation

1. Check the Zero Point Setting Complete status.

   Check to see if monitor parameter Zero Point Setting Completed (IW□□15 bit 3) is ON. If it is, go to step 2.

   If it is not, it means that the pulse position at power OFF, encoder position at power OFF and all position data was not checked. In that case, restart the system and set up the position data again or execute the ZSET motion command (zero point setting) to check the position data all over from the start.

2. Save the pulse position at power OFF and encoder position at power OFF.

   Use the customer's ladder logic program to save the following monitor parameters with high–speed scan timing at an M register backed up by battery.

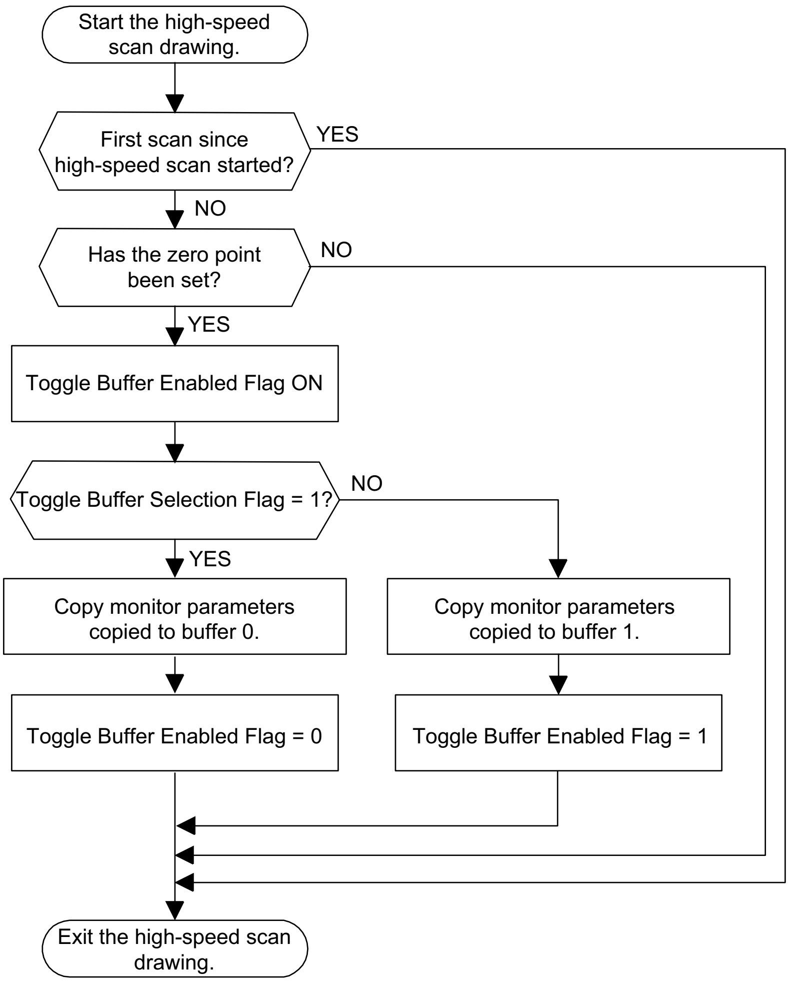
   Monitor parameter: Encoder Position at Power OFF (All four words at IL□□38 to IL□□3A)
   Monitor parameter: Pulse Position at Power OFF (All four words at IL□□3C to IL□□3E)

   The M register that is used to save the above monitor parameters is structured as shown below.

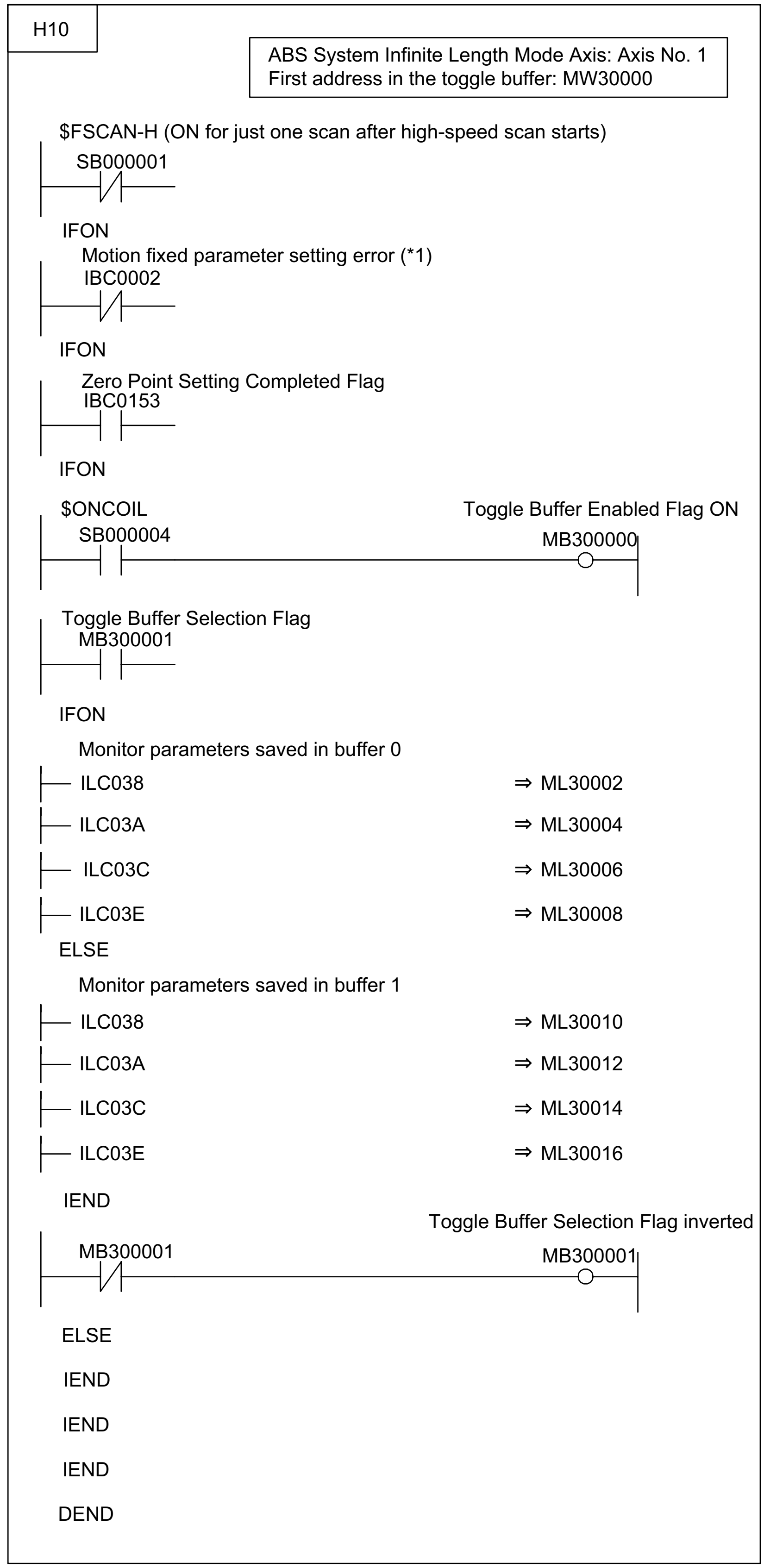
MWxxxxx	Bit 0	Toggle Buffer Enabled Flag (0: Disabled/1: Enabled)	
	Bit 1	Toggle Buffer Selection Flag (0: Buffer 0/1: Buffer 1)	
	Bit 2	Position Data Re-setup Request Flag (0: Complete/1: Request)	
MWxxxxx +1	Not used		
MLxxxxx +2 MLxxxxx +4	Buffer 0	Monitor parameter: Encoder Position at Power OFF	Lower-place two words (IL□□38)
			Upper-place two words (IL□□3A)
MLxxxxx +6 MLxxxxx +8		Monitor parameter: Pulse Position at Power OFF	Lower-place two words (IL□□3C)
			Upper-place two words (IL□□3E)
MLxxxxx +10 MLxxxxx +12	Buffer 1	Monitor parameter: Encoder Position at Power OFF	Lower-place two words (IL□□38)
			Upper-place two words (IL□□3A)
MLxxxxx +14 MLxxxxx +16		Monitor parameter: Pulse Position at Power OFF	Lower-place two words (IL□□3C)
			Upper-place two words (IL□□3E)

Note: Two buffers are needed to save the encoder position and the pulse position at power OFF because the program may be exited without checking position data at all four words if power is turned OFF during the high-speed scan.

Use the following flowchart to store values in buffers.



The following programming example (ladder logic program) is for the flowchart shown above. The axis used here is axis No. 1 of module No. 1. Change the motion parameter register number if the module and axis numbers are different.


H10
ABS System Infinite Length Mode Axis: Axis No. 1
First address in the toggle buffer: MW30000
$FSCAN-H (ON for just one scan after high-speed scan starts)
SB000001
IFON
Motion fixed parameter setting error (*1)
IBC0002
IFON
Zero Point Setting Completed Flag
IBC0153
IFON
$ONCOIL
SB000004
Toggle Buffer Enabled Flag ON
MB300000
Toggle Buffer Selection Flag
MB300001
IFON
Monitor parameters saved in buffer 0
ILC038 ⇒ ML30002
ILC03A ⇒ ML30004
ILC03C ⇒ ML30006
ILC03E ⇒ ML30008
ELSE
Monitor parameters saved in buffer 1
ILC038 ⇒ ML30010
ILC03A ⇒ ML30012
ILC03C ⇒ ML30014
ILC03E ⇒ ML30016
IEND
Toggle Buffer Selection Flag inverted
MB300001
MB300001
ELSE
IEND
IEND
IEND
DEND

Turning the System Back ON (Turning the Servo Back ON)

Set up position data again from the customer's ladder logic program using high-speed scan timing as shown below. This is done when system power or servo power is turned back ON.

1. Store Pulse Position at Power OFF and Encoder Position at Power OFF at setting parameters.

   Store the Pulse Position at Power OFF and Encoder Position at Power OFF values saved in M register at the following setting parameters.

Monitor parameter: Encoder Position at Power OFF (All four words at OL□□38 to OL□□3A) Monitor parameter: Pulse Position at Power OFF (All four words at OL□□3C to OL□□3E)

   Store the contents of the buffer selected by the previously output Toggle Buffer Selection Flag at this time.

2. ABS System Infinite Length Position Control Data LOAD Request

   Turn the setting parameter: ABS System Infinite Length Position Control Data LOAD Request (OW□□2D bit 2) OFF, ON and OFF again. This will allow all position data to be checked. The following monitor parameters will then be enabled when monitor parameter: Zero Point Setting Completed (IW□□15 bit 3) is ON.

Monitor parameter: Encoder Position at Power OFF (All four words at IL□□38 to IL□□3A) Monitor parameter: Pulse Position at Power OFF (All four words at IL□□3C to IL□□3E)

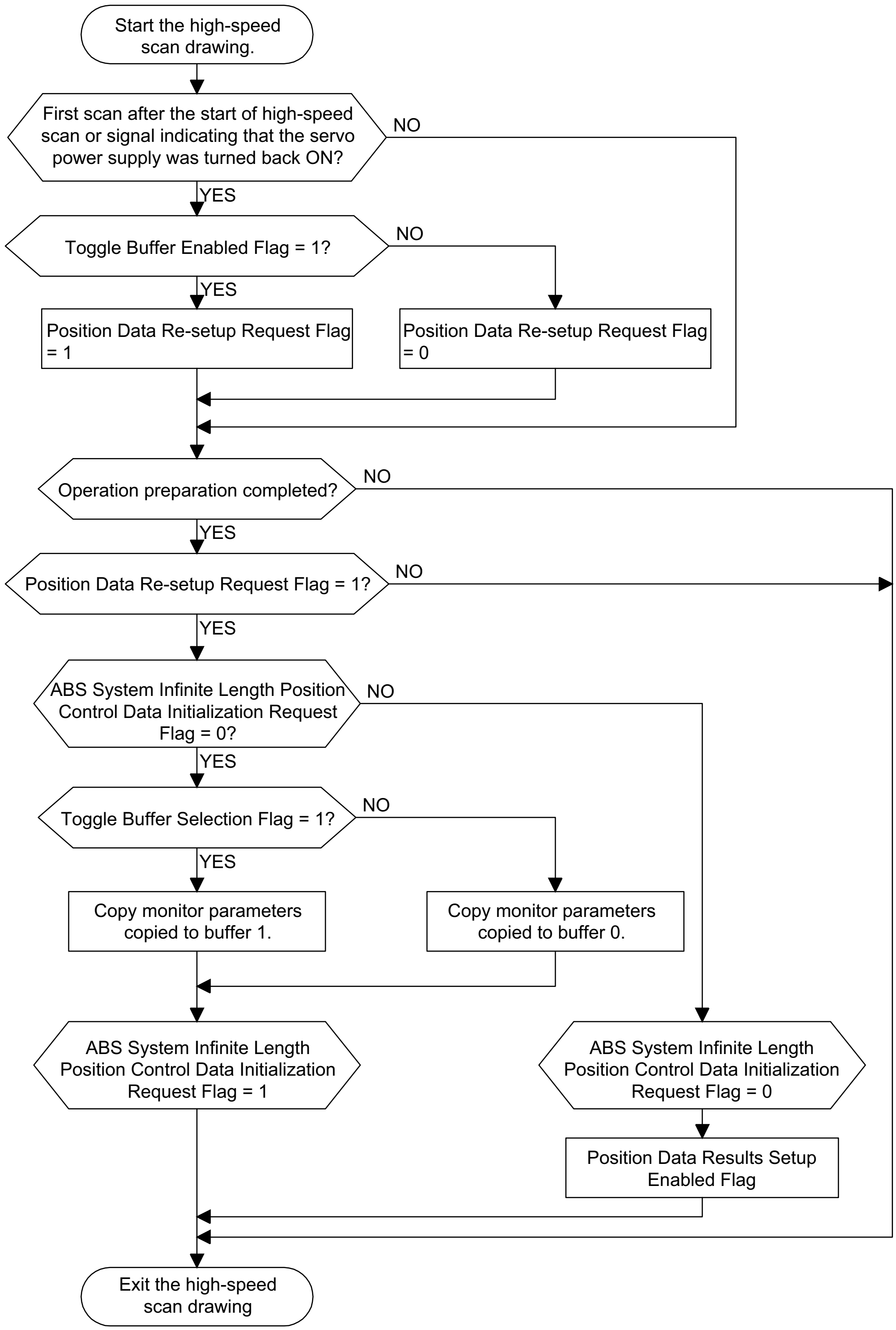
   The system will create position data using the following equation when ABS System Infinite Length Position Control Data LOAD is requested.

   Pulse position = pulse position at power OFF
   + (encoder position - encoder position at power OFF)*

   * Indicates the distance traveled while power is OFF.

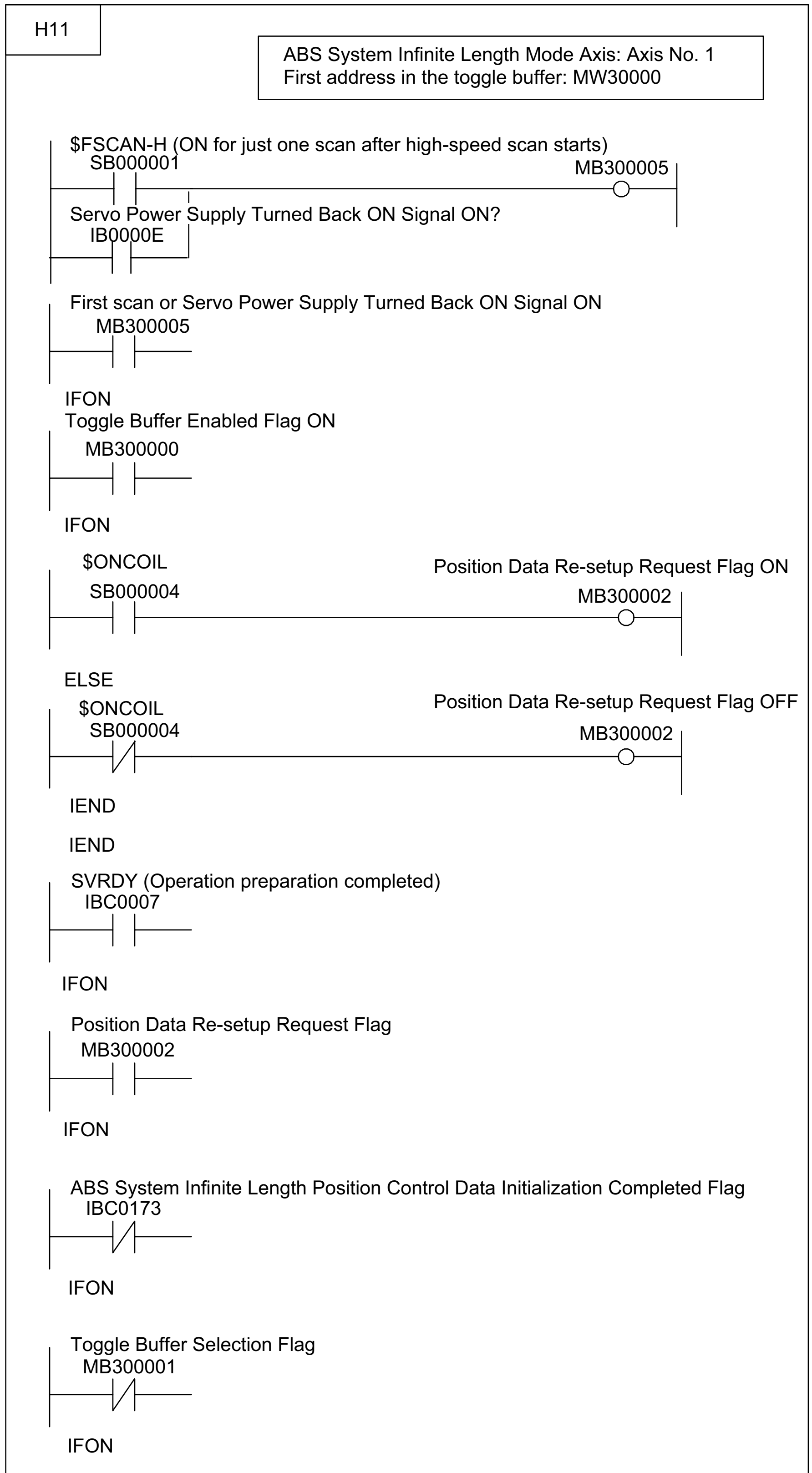
Execute the following flowchart when Position Data Re-Setup Request is ON.

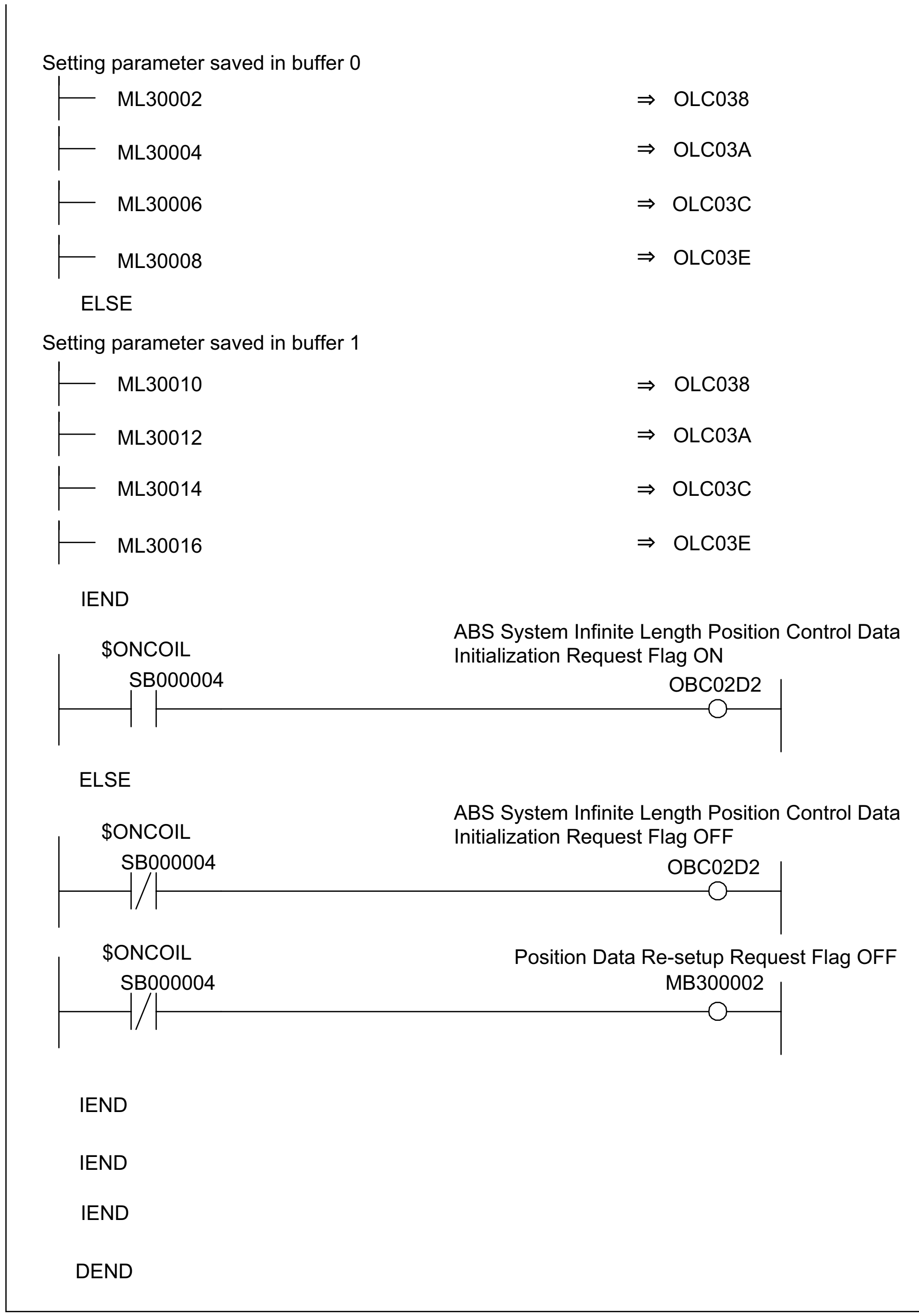
Follow the procedure below to set up position data again.



10

The following programming example (ladder logic program) is for the flowchart shown above. The axis used here is axis No. 1 of module No. 1. Change the motion parameter register number if the module and axis numbers are different.





INFO

There are no restrictions in the executing order for ladder logic programs H10 and H11 when an absolute encoder is used as an Infinite Length Mode Axis.

11

Maintenance and Inspection

This chapter describes daily and regular inspection items to ensure that the MP920 can always be used at its best conditions.

11

11.1 Inspection Items

This section summarizes daily and regular inspection items that must be performed by the customer.

11.1.1 Daily Inspections

The table below lists the daily inspection items.

Daily Inspection Items

No.	Inspection Item		Inspection Details	Criteria	Action
1	Installation conditions of Module, etc.		Check the mounting screws for looseness. Check whether the covers are all in place.	The screws and covers must be secured correctly.	Retighten the screws.
2	Connection conditions		Check the terminal screws for looseness.	The screws must be tight.	Retighten the screws.
			Check the connectors for looseness.	The connectors must be tight.	Retighten the connector set screws.
			Check the gap between crimp terminals.	There must be an appropriate gap between the terminals.	Correct as necessary.
3	Indicators	POWER indicator	Check whether the indicator is lit.	The indicator must be lit. (It is abnormal if the indicator is not lit.)	–
		READY indicator	Check whether the indicator is lit.	The indicator must be lit. (It is abnormal if the indicator is not lit.)	See *Chapter12 Troubleshooting*.
		RUN indicator	Check whether the indicator is lit while the system is in RUN state.	The indicator must be lit. (It is abnormal if the indicator is not lit.)	See *Chapter12 Troubleshooting*.
		ERR indicator	Check whether the indicator is not lit.	The indicator must be not lit. (It is abnormal if the indicator is lit.)	See *Chapter12 Troubleshooting*.
		ALM indicator	Check whether the indicator is not lit.	The indicator must be not lit. (It is abnormal if the indicator is lit.)	See *Chapter12 Troubleshooting*.
		BAT indicator	Check whether the indicator is not lit.	The indicator must be not lit. (The battery voltage is too low if the indicator is lit.)	Replace the battery.
		I/O indicators	Check whether the indicator comes on and goes off correctly.	The indicators must come on when I/O is ON, and go off when I/O is OFF. It is abnormal if a indicator does not come on or go off as above.	–

11.1.2 Regular Inspections

This section describes inspection items that must be performed once or twice every six months to one year. Inspections must also be performed when the equipment is relocated or modified or when the wiring is changed.

⃠ PROHIBITED
• Do not replace the built-in fuse. If the customer replaces the built-in fuse, the MP920 may malfunction or break down. Contact your Yaskawa representative.

Regular Inspection Items

No.	Inspection Item		Inspection Details	Criteria	Action
1	Operating environment	Ambient temperature	Check the temperature and humidity with a thermometer and hygrometer, respectively. Check for corrosive gases.	0 to 55 °C	If the MP930 is used inside a panel, treat the temperature inside the panel as the ambient temperature.
		Ambient humidity		30% to 95% RH	
		Atmosphere		There must be no corrosive gases.	
2	Power supply voltage check	PS-01 Module	Measure the voltage between 100/200 VAC terminals.	85 to 276 VAC	Change the power supply as necessary.
		PS-03 Module	Measure the voltage between 24-VDC terminals.	20.4 to 28.8 VDC	
3	Installation conditions	Looseness and excess play	Attempt to move the Module.	The Module must be secured properly.	Retighten the screws.
		Dust and other foreign matter	Visually check.	The Module must be free from dust and other foreign matter.	Clean.
4	Connection conditions	Check the terminal screws for looseness.	Check by retightening the screws.	The screws must be tight.	Retighten.
		Gap between crimp terminals	Visually check.	There must be an appropriate gap between the terminals.	Correct.
		Looseness of connectors	Visually check.	The screws must be tight.	Retighten the connector set screws.
5	Battery	Battery	Check the “BAT” indicator on the front panel of the CPU Module.	The “BAT” indicator must be not lit.	If the “BAT” indicator is lit, replace the battery.

11.2 CPU Module Battery

The CPU Module has one replaceable built-in battery, which is used to prevent the programs and data stored in the memory from being lost when a power failure occurs (i.e., when the power supply to the CPU Module is interrupted).

11.2.1 Battery Life

The built-in battery can retain the contents of the memory until the total time of power interruptions reaches one year. The warrantee period of the battery is five years from the date of purchase. These values, however, differ according to the operating conditions, including the ambient temperature.

If the BAT indicator on the CPU Module lights, replace the battery with a replacement battery within two weeks. Any delay in battery replacement will result in the programs and data stored in the memory being lost.

IMPORTANT

If the power supply is left OFF for one hour or more while the battery voltage badly decreases or the battery is not connected, the programs and data stored in the memory will be lost. Replace the battery with a new battery within one hour.

The following case is assumed for the above.

- The BAT indicator was lit once before a holiday and the power has been turned OFF during the holiday. When the power is turned ON after the holiday, the BAT indicator lights again.

11.2.2 Battery Replacement

This section describes how to replace the battery.

■ Preparations

Saving the Memory Contents

Before replacing the battery, save the programs and data from the memory of the CPU Module to floppy disks or a hard disk. The saved programs and data will be used if the programs and data are accidentally deleted during battery replacement.

Obtain a Replacement Battery

Obtain a replacement battery. This battery is not commercially available, and must be order from your nearest Yaskawa sales representative. The appearance of the battery is illustrated below.

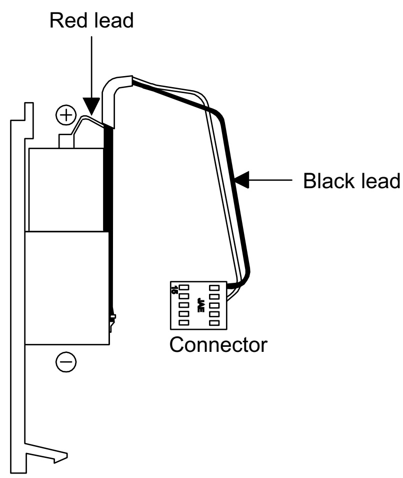


Fig. 11.1 Obtain a Replacement Battery (ZZK000062)

■ Replacing the Battery

Use the following procedure to replace the battery.

1. Make sure that the POWER indicator on the CPU Module is lit.
2. Open the battery cover on the lower part of the CPU Module.
3. Remove the connector on the end of the built-in battery lead from the connector on the CPU Module, then remove the built-in battery from the battery holder.
4. Firmly connect the connector on the end of the replacement battery lead to the connector on the CPU Module. Then, place the replacement battery into the battery holder.
5. Make sure that the BAT indicator on the CPU Module is not lit.
6. Close the cover.

This completes the battery replacement procedure.

IMPORTANT

Be sure to replace the battery with the power supply to the CPU Module turned ON.

Replacing the battery with the power supply to the CPU Module turned OFF will result in the programs and data stored in the memory being lost.

11.3 Absolute Encoder Battery

The Absolute Encoder Battery Module is connected to the MP920 Servo Module (SVA-01A, SVA-02A, or SVB) to serve as a backup power supply for the Absolute Encoder.

11.3.1 Appearance of the Battery Module

The following illustration shows the appearance of the Absolute Encoder Battery Module and the name of each part.

- Model: JRMSP-120XCP68000

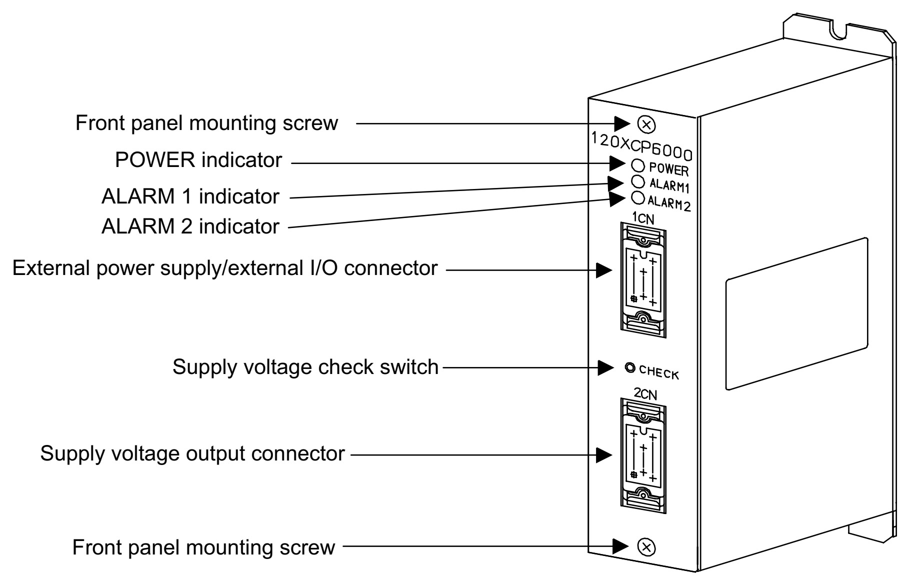


Fig. 11.2 Appearance of Battery Module

11.3.2 General Specifications

The table below shows the general specifications of the Absolute Encoder Battery Module.

General Specifications of Battery Module

Item		Specifications
Environmental Conditions	Ambient Operating Temperature	0 to 60°C
	Ambient Storage Temperature	-25 to +70°C
	Ambient Operating Humidity	30% to 95% RH (with no condensation)
	Ambient Storage Humidity	5% to 95% RH (with no condensation)
	Pollution Level	Pollution level 1 (conforming to JIS B 3501)
	Corrosive Gas	There must be no corrosive gas.
	Operating Altitude	2,000 m above sea level or lower
Mechanical Operating Conditions	Vibration Resistance	Conforming to JIS B 3502 10 to 57 Hz with single-amplitude of 0.075 mm 57 to 150 Hz with fixed acceleration of 9.8 m/s^2 (1G) 8-minute sweep × 10 times each in X, Y, and Z directions
	Shock Resistance	Conforming to JIS B 3502. Peak acceleration of 147 m/s^2 (15G) twice for 11 ms each in ±X, ±Y, and ±Z directions
Installation Requirements	Structure	Wall mounted
	Cooling Method	Natural cooling
	Approx. Mass	500 g
	Dimensions (mm)	35 × 160 × 73 (W × H × D)

11.3.3 Specifications of Battery Module

The table below shows the specifications of the Absolute Encoder Battery Module.

Specifications of Battery Module

<table>
<tr><th>Item</th><th colspan="3">Specifications</th></tr>
<tr><td>Name</td><td colspan="3">Absolute Encoder Battery Module</td></tr>
<tr><td>Model</td><td colspan="3">JRMSP-120XCP96000</td></tr>
<tr><td>Maximum number of axes to which power can be supplied</td><td colspan="3">8 axes</td></tr>
<tr><td>Indicators</td><td colspan="3">POWER: Lit when external 24 VDC power is supplied to CN1 connector. This indicator is not lit while a battery voltage check reference is being issued.
ALARM1: Lit when the battery voltage drops below 3.3 V.
ALARM2: Lit when the battery voltage drops below 3.0 V.</td></tr>
<tr><td>Battery Specifications</td><td colspan="3">Model: ER6VC3 Battery (Toshiba) with connector (Yaskawa speci fications)
Voltage: 3.6 V
Current capacity: 2,000 mAh</td></tr>
<tr><td>Maximum number of days in which battery must be replaced after low battery voltage is detected</td><td colspan="3">14 days after the ALARM1 indicator lights up (battery voltage drops below 3.3 V), provided that all eight axes are connected, no power is supplied to the Motion Module or Servo Amplifier, and the motor does not rotate due to external force, etc.</td></tr>
<tr><td rowspan="2">External Input Signal</td><td colspan="3">Signal type: 24 VDC, sourcing input (sinking input)
Input current: 5 mA
OFF current (1 mA or less)
Input conditions: ON voltage (supply voltage: -9 V) or more (sinking: 9 V or more), OFF voltage (supply voltage: -5 V) or less
Input impedance: 4.7 kΩ</td></tr>
<tr><td>Signal name</td><td>CHK</td><td>Battery voltage check reference. This signal checks battery voltage when turned ON.</td></tr>
<tr><td rowspan="4">External Output Signal</td><td colspan="3">Signal type: 24 VDC, sinking output (open collector)
Load current: 50 mA, OFF current (1 mA or less)
Load voltage: 20.4 to 28.8 VDC, 35 VDC (at peak), ON voltage (1.5 V, 50 mA)</td></tr>
<tr><td rowspan="3">Signal names</td><td>ALM1</td><td>Alarm 1. This signal is turned OFF when battery voltage drops below 3.3 V.</td></tr>
<tr><td>ALM2</td><td>Alarm 2. This signal is turned OFF when battery voltage drops below 3.0 V.</td></tr>
<tr><td>PON</td><td>Power ON. This signal is ON while 24 VDC external power is being supplied to CN1 connector. This signal is OFF while battery voltage check reference is being issued.</td></tr>
<tr><td>Delay Time</td><td colspan="3">Power ON → ALM1/ALM2 output: 100 ms or less
CHK signal input → ALM1/ALM2 output: 10 ms or less</td></tr>
<tr><td>Protective Circuit</td><td colspan="3">Battery charging prevention diode</td></tr>
<tr><td>Supply Voltage</td><td colspan="3">20.4 to 28.8 VDC (external power supply)</td></tr>
<tr><td>Current Consumption</td><td colspan="3">0.2 A or less</td></tr>
</table>

11.3.4 Functions of Battery Module

This section describes the functions of the Battery Module.

■ Data Backup for Absolute Encoder

The Battery Module backs up motor revolution data from the Absolute Encoder by using a high-capacity capacitor and lithium battery.

When the power supply to the MP920 is turned OFF, the Battery Module first uses the built-in high-capacity capacitor to back up the motor revolution data from the Absolute Encoder. Next, when the voltage of the capacitor drops below that of the lithium battery, the Battery Module uses the lithium battery to back up the motor revolution data from the Absolute Encoder

IMPORTANT

The Battery Module does not back up the ladder logic programs, motion programs, parameters, and other data stored in the memory of the MP920.

■ Data Backup for Absolute Encoders for up to Eight Axes

The Battery Module can be connected to the BAT terminal of the SVA-01A Module to back up motor revolution data from Absolute Encoders for up to eight axes.

When Absolute Encoders are used for all four axes for SVA-01A Modules, the Battery Module can be connected to two SVA-01A Modules.

■ Backup Time

When Absolute Encoders are connected to eight axes, the Battery Module can back up data from these Absolute Encoders for one year even if they receive absolutely no power supply.

However, if the Absolute Encoder rotates while it receives no power supply, the backup time will be shortened because the Absolute Encoder consumes much electrical power.

■ Lithium Battery Voltage Check Function

The Battery Module checks the voltage of the built-in lithium battery and externally outputs the results by means of an indicator and output signal.

A lithium battery voltage check is performed in the following situations.

- When the Battery Module is turned ON
- When the battery voltage check switch on the Battery Module is pressed
- When battery voltage check signal CHK is input

IMPORTANT

1. The Battery Module performs a lithium battery voltage check sequence and outputs the results when +24 VDC external power supply is turned ON. However, it does not automatically perform the voltage check while the power is ON unless an external reference is received.
   The Battery Module does not externally output an alarm even if the battery voltage drops due to battery self-discharge and so on while the power is ON. For 24-hour nonstop systems, therefore, it is recommended that battery voltage check signal CHK be input at regular intervals to check for lithium battery voltage drop.
   Performing a battery voltage check consumes extra battery power. For this reason, it is recommended that a voltage check sequence be performed approximately once a day.
2. To check the lithium battery status while the power is ON, press the battery voltage check switch on the Battery Module.
   Use a tapered precision screwdriver or similar tool to press the battery voltage check switch.

■ Alarm Display/Output Function

The Battery Module externally displays or outputs an alarm when it detects that the lithium battery voltage drops below the specified level. The table below shows the relationship between lithium battery status, indicators, and output signals.

Lithium Battery Status, Indicators, and Output Signals

Lithium Battery Status	Indicator	Output Signal	Condition
Battery has enough power.	“ALARM1” not lit	“ALM1” ON	3.3 V < Battery voltage
	“ALARM2” not lit	“ALM2” ON	
Battery needs to be replaced.	“ALARM1” lit	“ALM1” OFF	3.0 V < Battery voltage ≤ 3.3 V
	“ALARM2” not lit	“ALM2” ON	
Absolute Encoder data cannot be guaranteed.	“ALARM1” lit	“ALM1” OFF	Battery voltage ≤ 3.0 V
	“ALARM2” lit	“ALM2” OFF	

IMPORTANT

- One of the lithium battery characteristics is that battery voltage sharply declines once a voltage drop starts. The battery should therefore be replaced as soon as possible (within a week after the ALARM1 indicator lights up).
- The Battery Module retains the indicator and output signal statuses until the power is turned OFF or the next voltage check is performed.

■ Lithium Battery Voltage Measurement Reporting Function

The Battery Module uses an indicator and output signal to externally report the lithium battery voltage check currently in progress. The table below shows the relationship between operating status, indicators, and output signals.

Operating Status, Indicators, and Output Signals

Operating Status	Indicator	Output Signal	Remarks
External power supply ON	“POWER” lit	“PON” ON	
External power supply OFF or battery voltage check in progress	“POWER” not lit	“PON” OFF	The states of ALARM1 and ALARM2 indicators, and the states of ALM1 and ALM2 output signals are indeterminate.

IMPORTANT

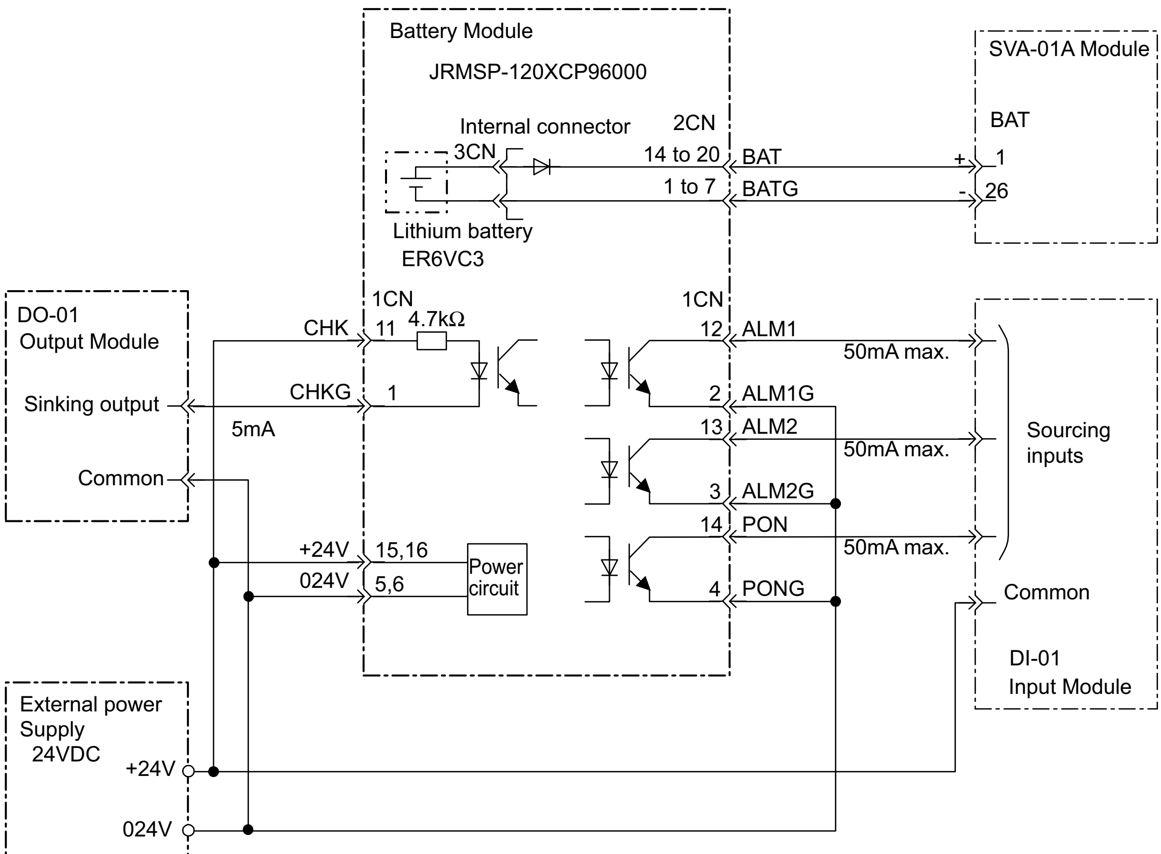
- The Battery Module performs a lithium battery voltage check sequence when the power is turned ON, when battery voltage check signal CHK is turned ON for 1 ms or more, or when the battery voltage check switch is pressed.
- If battery voltage check signal CHK is left ON, or the battery voltage check switch is held down, the POWER indicator will remain not lit and the PON output signal will remain OFF.
- Input the battery voltage check signal CHK as a pulse signal. Do not hold down the battery voltage check switch.

11.3.5 Connecting to SVA-01A Module

This section describes how to connect the Battery Module to the SVA-01A Module.

■ System Connection Example

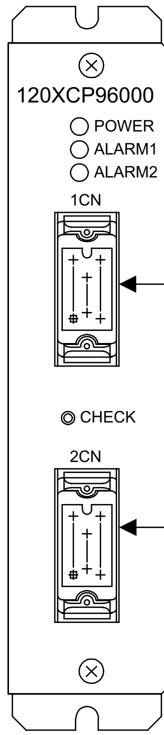
The following illustration shows an example of connecting a system that uses the SVA-01A, Input, and Output Modules.



IMPORTANT

- The customers are responsible to prepare connecting cables because they are not prepared by Yaskawa.
- The cable-end connectors connected to the external power supply/external I/O connector (1CN) and the battery voltage output connector (2CN) on the Battery Module are attached to the Battery Module.

■ Battery Module Connectors



Name	Label	Number of Pins	Model		Manufacturer
			Module	Cable	
External Power Supply/External I/O Connector	1CN	16	MR-16RMA4	MR-16F MR-16L	HONDA TSUSHIN KOGYO
Battery Voltage Output Connector	2CN	20	MR-20RFA4	MR-20M MR-20L	HONDA TSUSHIN KOGYO

Note: 1. The models in the upper row of the *Cable* column are a connector body (soldered), and the models in the lower row of the *Cable* column are a hood.
2. The cable-end connectors are attached to the Battery Module.

11

■ Connector Pin Layout

1CN: External Power Supply/External I/O Connector

The external power supply/external I/O connector (1CN) connects +24 V external power supply, alarm output, battery voltage check input, and so on. The pin layout of this connector is shown below.

Connector Model: MR-16F (Soldered, Manufactured by HONDA TSUSHIN KOGYO)

6	024V	External power input			16	+24V	External power input
5	024V	External power input	10	Not used	15	+24V	External power input
4	PONG	Power ON GND	9	Not used	14	PON	Power ON output
3	ALM2G	Voltage drop 1 GND	8	Not used	13	ALM2	Voltage drop 1 output
2	ALM1G	Voltage drop 2 GND	7	Not used	12	ALM1	Voltage drop 2 output
1	CHKG	Battery voltage check GND			11	CHK	Battery voltage check input

2CN: Battery Voltage Output Connector

The battery voltage output connector (2CN) supplies backup power to the Absolute Encoder through the SVA-01A Module. The pin layout of this connector is shown below.

Connector Model: MR-20M (Soldered, Manufactured by HONDA TSUSHIN KOGYO)

1	BATG	Battery voltage GND	8	Not used	14	BAT	Battery voltage output
2	BATG	Battery voltage GND	9	Not used	15	BAT	Battery voltage output
3	BATG	Battery voltage GND	10	Not used	16	BAT	Battery voltage output
4	BATG	Battery voltage GND	11	Not used	17	BAT	Battery voltage output
5	BATG	Battery voltage GND	12	Not used	18	BAT	Battery voltage output
6	BATG	Battery voltage GND	13	Not used	19	BAT	Battery voltage output
7	BATG	Battery voltage GND			20	BAT	Battery voltage output

■ Connecting to SVA-01A Module

The following illustration shows how to connect the battery connector (BAT) on the SVA-01A Module to the battery voltage output connector (2CN) on the Battery Module.

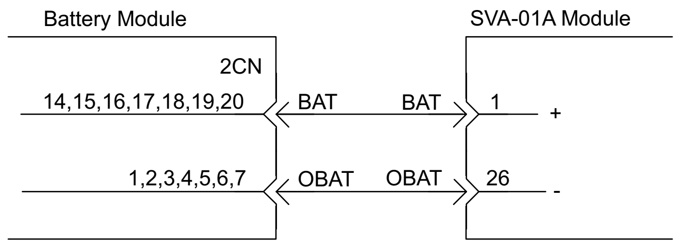


Fig. 11.3 Module-to-Module Connection

IMPORTANT

A lithium battery charging prevention diode is mounted in the battery voltage output section of the Battery Module in case of reverse voltage being applied to the output connector. Take due care during connection work.

11.3.6 Replacing the Battery

When the Battery Module detects a lithium battery voltage drop and lights the ALARM1 indicator or turns OFF the ALM1 output signal, the built-in lithium battery must be replaced.

■ Replacement Battery Preparations

Prepare the following items when replacing the lithium battery.

- Phillips screwdriver
- Lithium battery: BA507 (Yaskawa)

  Note: The lithium battery itself is manufactured by Toshiba, but the battery with a connector is produced based on Yaskawa specifications. For ordering, contact your Yaskawa sales representative.

■ Battery Replacement Procedure

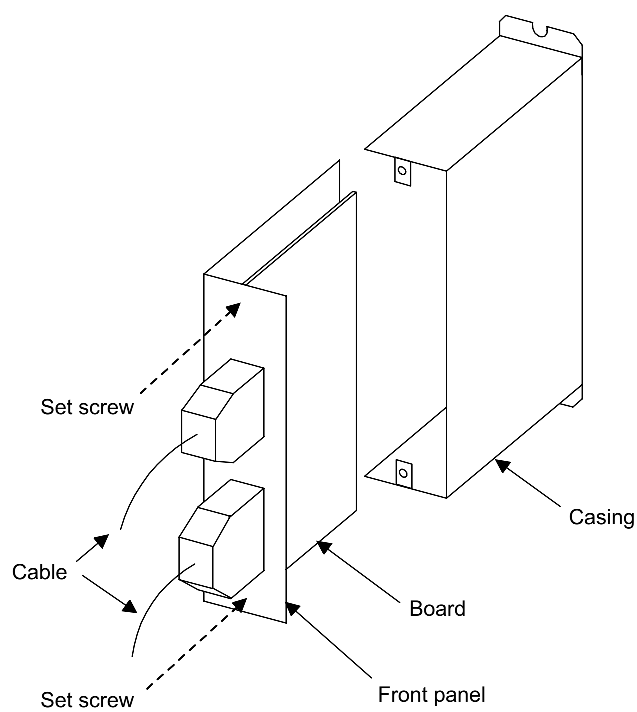
Use the following procedure to replace the lithium battery without the Absolute Encoder data being lost.

1. Turn ON the system power and leave it ON for 10 minutes.
2. Turn OFF the Battery Module.

   At this stage, it will not matter whether the system power supply (SERVOPACK power supply) is ON or OFF.
3. Remove the front panel of the Battery Module.

   a) Remove the two upper and lower screws from the front panel.

   b) Remove the front panel from the casing with the cables connected.



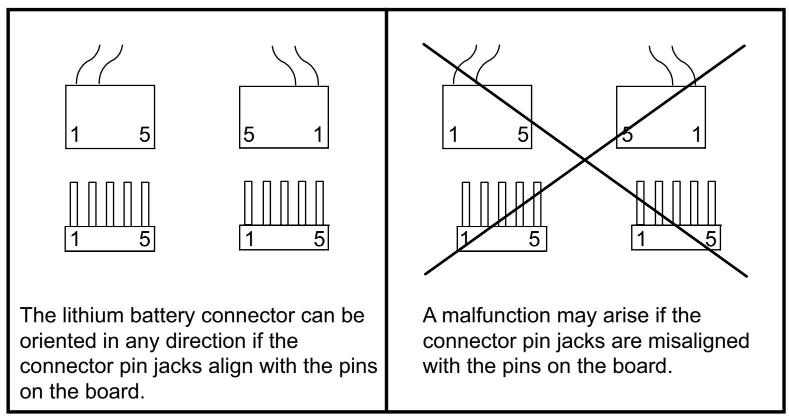
Note: 1. Be careful not to scratch the board when removing the front panel.
2. Do not apply excessive force to the cables during the work.

4. Replace the lithium battery.

   a) When replacing the lithium battery, be careful not to touch the internal circuit on the board with the hands, screwdriver, etc.

   b) Connect the lithium battery connector properly.

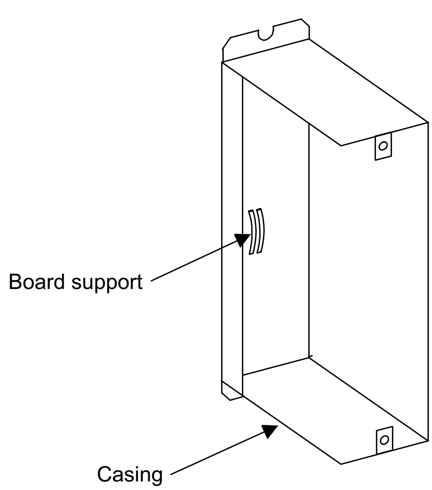
   The lithium battery connector can be connected regardless of its orientation, provided that the connector pin jacks align with the pins on the board. Note, however, that a malfunction may arise if the connector pin jacks are misaligned with the pins on the board.



5. Reinstall the front panel on the Battery Module.

   a) Install the front panel in the casing so that the board fits into the board support on the rear part of the casing.

   b) Tighten the front panel set screws.



6. Make sure that the cables are correctly connected to the connectors on the front panel, then turn ON the Battery Module.

7. Check the indicators and output signals.

   a) Indicators

   It is normal if the POWER indicator is lit, and the ALARM1 and ALARM2 indicators are not lit.

   b) Output Signals

   It is normal if the PON signal is ON, and the ALM1 and ALM2 signals are OFF.

   It is abnormal if the POWER indicator is not lit, or both or either of the ALARM1 and ALARM2 indicators are lit. If this is the case, repeat the above procedure from step 2.

   The possible cause of this abnormality is as follows:

   - The lithium battery connector is connected incorrectly or incompletely.
   - The external power supply/external I/O connector (CN1) is not connoted properly, or the cables are broken.

8. Unless there is abnormality, the battery replacement procedure is complete. If the system power is OFF, turn it ON.

IMPORTANT

- Before replacing the lithium battery, turn ON the Battery Module and the Absolute Encoder, and leave them ON for about 10 minutes. The high-capacity capacitor of the Absolute Encoder will be charged.
- Be careful not to touch the internal circuit on the board with the hands or screwdriver during the work.
- The built-in lithium battery in the Battery Module may explode if charged. Never charge the battery.

12

Troubleshooting

This chapter describes the details, causes, and remedies for errors that can occur when using the system.

12.1 Overview of Troubleshooting

This section shows the basic troubleshooting flow and provides a list of errors.

12.1.1 Troubleshooting Methods

There are three checks available for checking the system when an errors occurs. They are checks by symptoms, error codes, and monitor functions of peripheral devices. Checking procedures are categorized by status conditions to help determine the cause quickly.

■ Checking by Symptoms

Here, factors like indicators on the front of the Module and the control status of all devices are visually checked to determine a cause and implement corrections.

■ Checking by Error Codes

Here, error codes generated when errors occur are monitored to determine a cause and implement corrections. Errors are classified into two groups.

Classification	Type of Error Code
Sequence Control Error Code	• Starting from system register (S register) SW00040
Motion Control Error Code	• Motion program error code • Servo error by axis

■ Checking by Monitor Functions of Peripheral Devices

Here, the monitor functions of peripheral devices are used to determine the control status and to find the cause of errors. The status of the following functions can be checked.

- Program monitoring
- Position monitoring
- Error monitoring
- Traces

12.1.2 Basic Troubleshooting Flow

When a problem occurs, it is important to determine the cause and treat the problem fast to get the system up and running as quickly as possible. The following table shows the basic troubleshooting flow.

No.	Point	Basic Details Examined
1	Visual Check	• Equipment operation (status while stopped) • Power ON/OFF • I/O equipment status • Wiring status • Status of indicators (indicators on all Modules) • Status of all switches (DIP switches and other switches) • Parameters and program content check
2	Error Check	Observe whether the following alters the error in any way. • Stopping the Controller. • Resetting the alarm. • Turning power OFF and ON.
3	Narrowing the Range	Consider possible failure locations based on the results of 1 and 2 above. • Is the problem in the Controller or external? • Is the problem in sequence control or motion control? • Is the problem software or hardware?

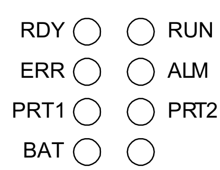
12.1.3 Indicator Errors

Error details can be checked by the status of indicators on the front of the MP920 Module.

In the process, we narrow down the repair location in a program by getting an overview of the error from indicators, checking the contents of the system (S) registers, examining the drawing or function number that caused the error and then getting an overview of operation error details.

■ Indicators

The following indicators show operating status and error details for the MP920.

<table>
<tr><th>Indicator Section</th><th>Indicator Name</th><th>Indicator Color</th><th>Significance When Lit</th></tr>
<tr><td rowspan="7">
</td><td>RDY</td><td>Green</td><td>System operating normally</td></tr>
<tr><td>RUN</td><td>Green</td><td>User program running</td></tr>
<tr><td>ERR</td><td>Red</td><td>System error</td></tr>
<tr><td>ALM</td><td>Red</td><td>Minor system error</td></tr>
<tr><td>PRT1</td><td>Green/Red</td><td>Port 1 sending/receiving</td></tr>
<tr><td>PRT2</td><td>Green/Red</td><td>Port 2 sending/receiving.</td></tr>
<tr><td>BAT</td><td>Red</td><td>Low battery voltage</td></tr>
</table>

■ Indicator Details

The following describes details and remedies for indicators showing operating status and errors in the MP920.

Classi-fication	Indicator					Indicator Details	Remedy
	RDY	RUN	ALM	ERR	BAT		
Normal	Not lit	Not lit	Lit	Lit	Not lit	Hardware reset status	Normally the CPU activates within a second. If this status continues for more than a second, the problem is a user program error or hardware failure. Troubleshoot system errors.
	Not lit	Not lit	Not lit	Not lit	Not lit	Initializing	
	Not lit	Lit	Not lit	Not lit	Not lit	Drawing A executing	
	Lit	Not lit	Not lit	Not lit	Not lit	User program stopped (Offline Stop Mode)	This status will occur if a program is stopped from the MPE720 or by turning OFF the RUN switch.
	Lit	Lit	Not lit	Not lit	Not lit	User program executing normally	This status will occur during normal operation.
Error	Not lit	Lit	Not lit	Lit	Not lit	A serious failure has occurred.	See *12.2.3 Processing Flow When a User Program Error Occurs*.
	Lit	Not lit	Not lit	Lit	Not lit	• Program memory initialization incomplete • Improper scan time setting	• Clear program memory from the System Definition Window on the MPE720. • If this does not restore the system, then hardware has probably failed.
	Not lit	Not lit	Not lit	Flash-ing	Not lit	Hardware errors No. of flashes 1: System program error 2: RAM diagnosis error 3: ROM diagnosis error 6: CPU function diagnosis error 7: FPU function diagnosis error	Hardware errors. Troubleshoot system errors. • Clear the memory and turn OFF the power and then ON again. • If this does not restore the system, replace the Module.
Alarm	–	–	–	–	Lit	Battery alarm	Replace the battery.
	Lit	Lit	Lit	Not lit	Not lit	Operation error	–
						I/O error	–
						Wrong interrupt occurs	–
	System register warning (no indicator display)					MPE720 connection data	See *System Status* in *12.2.4 System Register Configuration*.
						Hardware status (power interruption, RUN/STOP, Test Mode, etc.)	See *System Status* in *12.2.4 System Register Configuration*.

12.2 System Errors

This section describes system error details and remedies.

12.2.1 Overview of System Errors

Indicators on the front panel of the CPU Module indicate the operating and error status of the MP920. Used the system (S) registers to get for more details on errors. Carefully check system register details to figure out the failure location and implement corrections.
The following sections describes the system register in more detail.

■ System Register Allocation

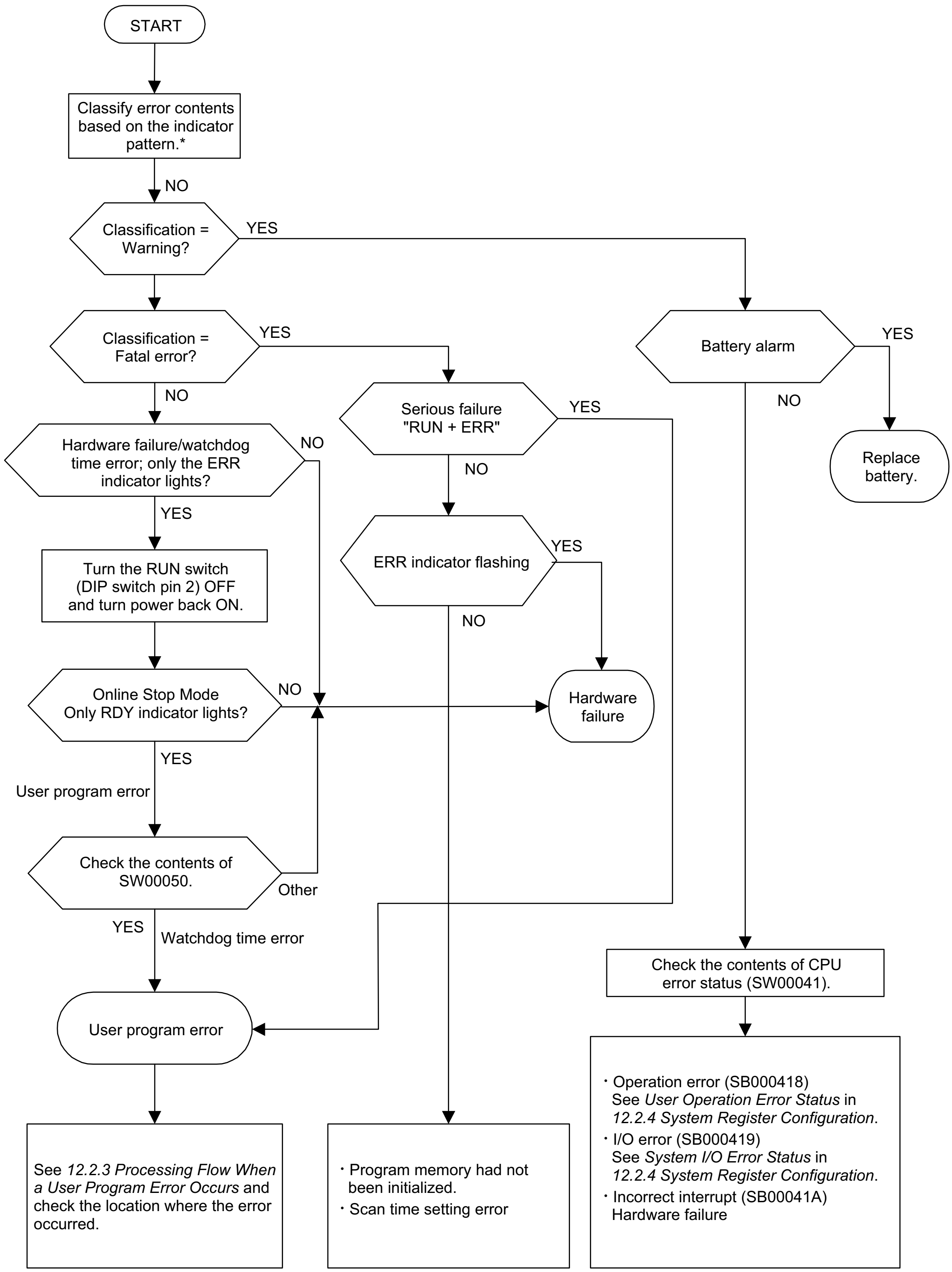
The following illustration shows the configuration of the system registers.

SW00000	System - Service Registers
SW00030	System Status*
SW00050	System Error Status*
SW00080	User Operation Error Status*
SW00090	System Service Execution Status
SW00100	Interrupt Input Error Status
SW00110	User Operation Error Status, Details*
SW00200	System I/O Error Status
SW00424	Reserved for the System
SW00500	System Analysis Status
SW00530	Reserved for the System
SW00600	System Operation Error Status
SW00620	Reserved for the System
SW00800	Reserved for Optional Modules
SW01023	

* See *12.2.4 System Register Configuration* for details.

12.2.2 Processing Flow When a System Error Occurs

The following illustration shows the processing flow when a system error occurs.



* See *Indicator Details* in *12.1.3 Indicator Errors* for more details on indicator patterns.

12.2.3 Processing Flow When a User Program Error Occurs

A serious failure has probably occurred if the RUN and ERR indicators are lit on the front panel of the MP920. Use the following procedures to check the error program.

1 Check by Type of Serious Failure Error	Check the contents of SW00050 (Error Type) to determine if the error is a system error or a user program error.

↓

2 Check by Type of Error Program	Check the contents of SW00055 (Program Type) to determine if the error occurred in a drawing or in a function.

↓

3 Check the Error Drawing	Check the contents of SW00054 (Error Task) and SW00056 (DWG No.) to find the error drawing.

↓

4 Check the Error Function	The error occurred in a function if SW00056 (DWG No.) reads 01zzH. Check the contents of SW00057 (Error Task) and SW00058 (DWG No.) to find the error drawing. Check SW00059 (Function Referencing DWG Step No.) for the STEP number where an operation error occurred.

↓

5 Check Whether an Operation Error Occurred	Check the error count of all drawings at SW00080 to SW00088. Operation errors are occurring if the count is going up.

↓

6 Check the Details and Location of Operation Errors	• Check Error Details Check error codes for drawings where the error count is going up. DWG.A: SW00111 DWG.H: SW00143 DWG.I: SW00127 DWG.L: SW00175 • Check the DWG Number Check the error DWG number for the DWG number where an error occurred. DWG.A: SW00122 DWG.H: SW00154 DWG.I: SW00138 DWG.L: SW00186 • Check the Function Referencing DWG Number and Function Referencing STEP Number if an error occurred in a function. DWG.A: SW001203, 4 DWG.H: SW00155, 6 DWG.I: SW00139, 40 DWG.L: SW00187, 8

↓

7 Correct the Program	Correct the program at the point where the error occurred.

12.2.4 System Register Configuration

■ System Status

System status indicates the operating status and error details for the system. System status details are used to determine whether hardware or software is the cause of an error.

Table 12.1 System Status List

Name	Register No.	Contents		
Reserved for the System	SW00030 to SW00039	(Not used)		
CPU Status	SW00040	SB000400	READY	1: Normal, 0: Communications/Self-diagnosis error
		SB000401	RUN	1: Running, 0: Stopped
		SB000402	ALARM	1: Alarm, 0: Normal
		SB000403	ERROR	1: Error, 0: Normal
		SB000404	RESUME	1: Continued startup operation 0: New startup operation
		SB000405	Start status	1: Restoration from power interruption 0: Ordinary restoration
		SB000406	Reserved by system.	(Not used)
		SB000407	WEN	1: WRITE enabled, 0: WRITE disabled
		SB000408	Reserved by system.	–
		SB000409	MASTER	1: Control system CPU, 0: Standby system
		SB00040A	Reserved by system.	(Not used)
		SB00040B		
		SB00040C		
		SB00040D		
		SB00040E	Operation stop request	1: STOP selection, 0: RUN selection
		SB00040F	Reserved by system.	(Not used)
CPU Error Status	SW00041	SB000410	Serious failure	1: WDGE, undefined command See SW00050 for more details.
		SB000411	Program memory error	1: Program memory error
		SB000412	Calendar IC error	1: Calendar IC error
		SB000413	Reserved by system.	(Not used)
		SB000414		
		SB000415		
		SB000416		
		SB000417		
		SB000418	User operation error	1: User operation error
		SB000419	I/O error	1: I/O error
		SB00041A to SB00041F	Reserved by system.	(Not used)

Table 12.1 System Status List (cont'd)

Name	Register No.	Contents		
Software Switch Selection Status	SW00047	SB000470	Startup mode in case of power interruption	0: New startup, 1: Continued startup
		SB000471 SB000472	Reserved by system.	(Not used)
		SB000473	Program WRITE selection	0: WRITE enabled, 1: WRITE disabled
		SB000474	Startup mode in case of ordinary power interruption	0: New startup, 1: Continued startup
		SB000475	Reserved by system.	(Not used)
		SB000476 to SB00047F	Reserved by system.	(Not used)
Hardware Status Configuration	SW00048	SB000480	RUN	DIP switch report 0: ON 1: OFF
		SB000481	INIT	
		SB000482	TEST	
		SB000483	–	
		SB000484	MULTI	
		SB000485	FLASH	
		SB000486	–	
		SB000487	Battery alarm	1: Battery alarm
Reserved by System	SW00049	SB000490 to SB00049F	Reserved by system.	(Not used)

■ System Error Status

The following table lists data when a system error status list is generated.

Table 12.2 System Error Status List

Name	Register No.	Contents	
Error Type	SW00050	0001H	Watchdog time error
		0002H	Bus time over
		0006H	Execution of a breakpoint interrupt
		0007H	Bound error (boundary check error)
		0008H	Execution of an undefined command
		000CH	Double fault
		000DH	Illogical TSS
		000EH	Segment does not exist
		000FH	Stack error
		0010H	General protection error
		0011H	Page fault
		0012H	Data alignment error
		0041H	ROM diagnosis error
		0042H	RAM diagnosis error
		0043H	CPU diagnosis error
		0044H	FPU diagnosis error
		0051H	Multi-CPU coordinated stop (only for multi-CPU configuration)
		0081H	Overflow, Underflow *
		0083H	0 division *
		0084H	FPU segment error *
		0085H	FPU operation error *
		0088H	Index error *
		0090H	General protection error *
Error Code	SW00051	For system error analysis	
Error IP	SW00052	For system error analysis	
Error CS	SW00053	For system error analysis	
Error Task	SW00054	0000H: System 0001H: DWG.A 0002H: DWG.I	0003H: DWG.H 0005H: DWG.L
Program Type	SW00055	0000H: System 0001H: DWG.A 0002H: DWG.I 0003H: DWG.H	0005H: DWG.L 0008H: Function 0010H: Main motion program 0011H: Motion subroutine

* These errors occur only with version A03. With other versions, these errors occur as a user operation error.

12

Table 12.2 System Error Status List (cont'd)

Name	Register No.	Contents	
Error DWG No.	SW00056	Parent drawing: FFFFH Function: 0100H Child drawing: □□00H (H□□: Child drawing No.) motion program No. Grandchild drawing: VVyyH (Hyy: Grandchild drawing No.)	
Function Calling DWG Type	SW00057	Type of DWG that calls the function in which an error occurred.	
		0001H: DWG.A 0002H: DWG.I 0003H: DWG.H 0005H: DWG.L	0008H: Function 0010H: Main motion program 0011H: Motion subroutine
Function Calling DWG No.	SW00058	Number of DWG that calls the function in which an error occurred. Parent drawing: FFFFH Function: 0100H Child drawing: □□00H (H□□: Child drawing No.) motion program No. Grandchild drawing: □□yyH (Hyy: Grandchild drawing No.)	
Function Calling DWG Step No.	SW00059	STEP Number of the DWG that calls the function in which an error occurred. 0 when DWG error + motion program occurred	
Error Data	SW00060	SW00060	For system error analysis (ES)
		SW00061	For system error analysis (DS)
		SW00062	For system error analysis (DI)
		SW00063	For system error analysis (SI)
		SW00064	For system error analysis (BP)
		SW00065	For system error analysis (SP)
		SW00066	For system error analysis (BX)
		SW00067	For system error analysis (DX)
		SW00068	For system error analysis (CX)
		SW00069	For system error analysis (AX)
		SW00070 to SW00079	Reserved by system.

■ User Operation Error Status

The following tables list data when a user operation error occurs.

Table 12.3 User Operation Error Status - 1

Name	Register No.	Contents
DWG.A Error Count	SW00080	Operation error code: *See Table 12.5 User Operation Error Status - 3.* Error code when an index error occurs: *See Table 12.6 User Operation Error Status - 4.*
Error Code	SW00081	
DWG.I Error Count	SW00082	
Error Code	SW00083	
DWG.H Error Count	SW00084	
Error Code	SW00085	
Reserved by System	SW00086	
	SW00087	
DWG.L Error Count	SW00088	
Error Code	SW00089	

Table 12.4 User Operation Error Status - 2

Name	Register No.				Remarks
	DWG.A	DWG.I	DWG.H	DWG.L	
Error Count	SW00110	SW00126	SW00142	SW00174	Error DWG Number Parent drawing: FFFFH Child drawing: □□00H (H□□: Child drawing No.) Grandchild drawing: □□yyH (Hyy: Grandchild drawing No.) Function: 0100H
Error Code	SW00111	SW00127	SW00143	SW00175	
Error A Register	SW00112	SW00128	SW00144	SW00176	
	SW00113	SW00129	SW00145	SW00177	
Modification A Register	SW00114	SW00130	SW00146	SW00178	
	SW00115	SW00131	SW00147	SW00179	
Error F Register	SW00116	SW00132	SW00148	SW00180	Function Calling DWG Number Number of the DWG that calls the function in which an error occurred.
	SW00117	SW00133	SW00149	SW00181	
Modification F Register	SW00118	SW00134	SW00150	SW00182	
	SW00119	SW00135	SW00151	SW00183	Function Calling DWG Step No. Step No. of the DWG that calls the function in which an error occurred. This will be “0” if the error occurred inside the DWG.
Error IP	SW00120	SW00136	SW00152	SW00184	
Error CS	SW00121	SW00137	SW00153	SW00185	
Error DWG No.	SW00122	SW00138	SW00154	SW00186	
Function Calling DWG Type	SW00123	SW00139	SW00155	SW00187	
Function Calling DWG Step No.	SW00124	SW00140	SW00156	SW00188	
Reserved by System	SW00125	SW00141	SW00157	SW00189	

Table 12.5 User Operation Error Status - 3

Name	Error Code	Error Contents	User	System Default
Integer Operation	0001H	Integer operation - underflow	Yes	-32768 [-32768]
	0002H	Integer operation - overflow	Yes	32767 [32767]
	0003H	Integer operation - division error	Yes	The A register remains the same.
	0009H	Double-length integer operation - underflow	Yes	-2147483648 [-2147483648]
	000AH	Double-length integer operation - overflow	Yes	2147483647 [2147483647]
	000BH	Double-length integer operation - division Error	Yes	The A register remains the same.
	010□H	Integer operation error within operation error processing drawing (□ = 1 to B)	No	Default indicated above.
Real Number Operation	0010H	Integer storage - non-numeric error	Yes	Store not executed. [00000]
	0011H	Integer storage - underflow	Yes	Store not executed. [-32768]
	0012H	Integer storage - overflow	Yes	Store not executed. [+32767]
	0021H	Real number storage - underflow	Yes	Store not executed. [-1.0E+38]
	0022H	Real number storage - overflow	Yes	Store not executed. [1.0E+38]
	0023H	Real number operation - division-by-zero error	Yes	Operation not executed. The F register remains the same.
	0030H	Real number operation - invalid operation (non-numeric)	No	Operation not executed.
	0031H	Real number operation - exponent underflow	No	0.0
	0032H	Real number operation - exponent overflow	No	Maximum value
	0033H	Real number operation - division error (non-numeric 0/0)	No	Operation not executed.
	0034H	Real number storage - exponent underflow	No	Stores 0.0.
	0035H	Real number operation - stack error		
	0040H to 0059H	Real number operation error within a standard system function	No	Interrupt operation and output = 0.0

	0040H: SQRT	0041H: SIN	0042H: COS	0043H: TAN
	0044H: ASIN	0045H: ACOS	0046H: ATAN	0047H: EXP
	0048H: LN	0049H: LOG	004AH: DZA	004BH: DZB
	004CH: LIM	004DH: PI	004EH: PD	004FH: PID
	0050H: LAG	0051H: LLAG	0053H: FGN	0054H: IFGN
	0054H: LAU	0055H: SLAU	0056H: REM	0057H: RCHK
	0058H: BSRCH	0059H: SQRT		

1000H or 2000H is added for an index error.

Operation error in a motion function
The number of the function where the error occurred + 200H will be stored.

Table 12.5 User Operation Error Status - 3 (cont’d)

Name	Error Code	Error Contents		User	System Default
Real Number Operation	0040H to 0059H	0200H: MOV	0201H: MVS	0202H: MCC	0203H: MCW
		0204H:	0205H: SKP	0206H:	0207H:
		0208H: POS	0209H:	020AH: ACC	020BH: DCC
		020CH: SCC	020DH: VEL	020EH: INP	020FH: IAC
		0210H: IDC	0211H: IFP	0212H: FMX	0213H:
		0214H: MVT	0215H: EXM		

Table 12.6 User Operation Error Status - 4

Name	Error Code	Error Contents		User	System Default
Integer - Real Number Operations	1000H	Index error within DWG		No	Re-executed with i, j = 0
	2000H	Index error within function		No	Re-executed with i, j = 0
Integer Operation	□060H to □077H (□ = 1, 2)	Index error within integer system function		No	The A register remains the same.
		□06DH: PI	□06DH: PD	□06FH: PID	□070H: LAG
		□071H: LLAG	□072H: FGN	□073H: IFGN	□074H: LAU
		□075H: SLAU	□076H: FGN	□077H: IFGN	

■ System Service Execution Status

Name	Register No.	Remarks
System Error Count	SW00090	
System Error Code	SW00091	
Failure Occurrence Count	SW00092	
Failure Restoration Count	SW00093	
Reserved by System	SW00094 to SW00097	(Not used)
Existence of Data Trace Definition	SW00098	Bit 0 to 3 = Group 1 to 4 Definition exists = 1, No definition = 0
Data Trace Execution Status	SW00099	Bit 0 to 3 = Group 1 to 4 Trace executing = 1, Trace stopped = 0

Table 12.7 Latest Data Trace Record Number

Name	Register No.	Remarks
Data Trace Group 1	SW00100	Latest record number
Data Trace Group 2	SW00101	Latest record number
Data Trace Group 3	SW00102	Latest record number
Data Trace Group 4	SW00103	Latest record number

■ System I/O Error Status

Name	Register No.	Remarks
I/O Error Count	SW00200	Number of I/O errors
Input Error Count	SW00201	Number of input errors
Input Error Address	SW00202	Latest input error address (For future use) (Register number of OW□□□□)
Output Error Count	SW00203	Number of output errors
Output Error Address	SW00204	Latest input error address (For future use) (Register number of OW□□□□)
Reserved by System	SW00205	(Not used)
	SW00206	
	SW00207	
I/O Error Status	SW00208 to SW00211	Slot 2 error status
	SW00212 to SW00215	Slot 3 error status
	: :	
	SW00420 to SW00423	Slot 55 error status

■ Actions to be Taken when a Transmission Error Occurs

When a transmission error occurs during system I/O, the error status is reported in the system register as shown below.

Name	Register Number	Remarks
Slot 2 Error Status	SW00208 to SW00211	Differs depending on the Module mounted.
Slot 3 Error Status	SW00212 to SW00215	Differs depending on the Module mounted.
	: :	
Slot 55 Error Status	SW00420 to SW00423	Differs depending on the Module mounted.

◀ EXAMPLE ▶

1. CP-215 Station Error Status

   Slot 2

Bit No.	F		3	2	1	0
SW00208	ST#16	....	ST#4	ST#3	ST#2	ST#1
SW00209	ST#32	....			ST#18	ST#17
SW00210	ST#48	....			ST#34	ST#33
SW00211	ST#64	....			ST#50	ST#49

◀ EXAMPLE ▶

2. LIO Error Status

   Slot 2

Bit No.	F		9	8	1	0
SW00208	Not used	....			Not used	Error
						Error flag
SW00209	Not used	....				Not used
SW00210	Not used	....				Not used
SW00211	Not used	....				Not used

■ System Operation Error Status

Table 12.8 System Operation Error Code Status - 1

Name	Register No.	Remarks
Error Count	SW00600	Reported when an operation error occurs in the system program.
Error Code	SW00601	
Error A Register	SW00602	
	SW00603	
Modification A Register	SW00604	
	SW00605	
Error F Register	SW00606	
	SW00607	
Modification F Register	SW00608	
	SW00609	
Error IP	SW00610	
Error CS	SW00611	
Error DWG No.	SW00612	
Function Calling DWG Type	SW00613	
Function Calling DWG Step No.	SW00614	
Reserved by System	SW00615	(Not used)

Table 12.9 System Operation Error Code Status - 2

Name	Error Code	Error Contents	System Default
Integer Operation	0001H	Integer operation - underflow	-32768
	0002H	Integer operation - overflow	+32767
	0003H	Integer operation - division error	0

Table 12.10 Optional Module Information

Name	Register No.	Remarks
Optional Module Information	SW00800 to SW00803	Slot 0-mounted module information
	SW00804 to SW00807	Slot 1-mounted module information
	SW00808 to SW00811	Slot 2-mounted module information
	:	–
	SW01020 to SW01023	Slot 55 mounted module information

12.3 Motion Errors

This section describes the details and remedies for errors that occur in motion functions.

12.3.1 Description of Motion Errors

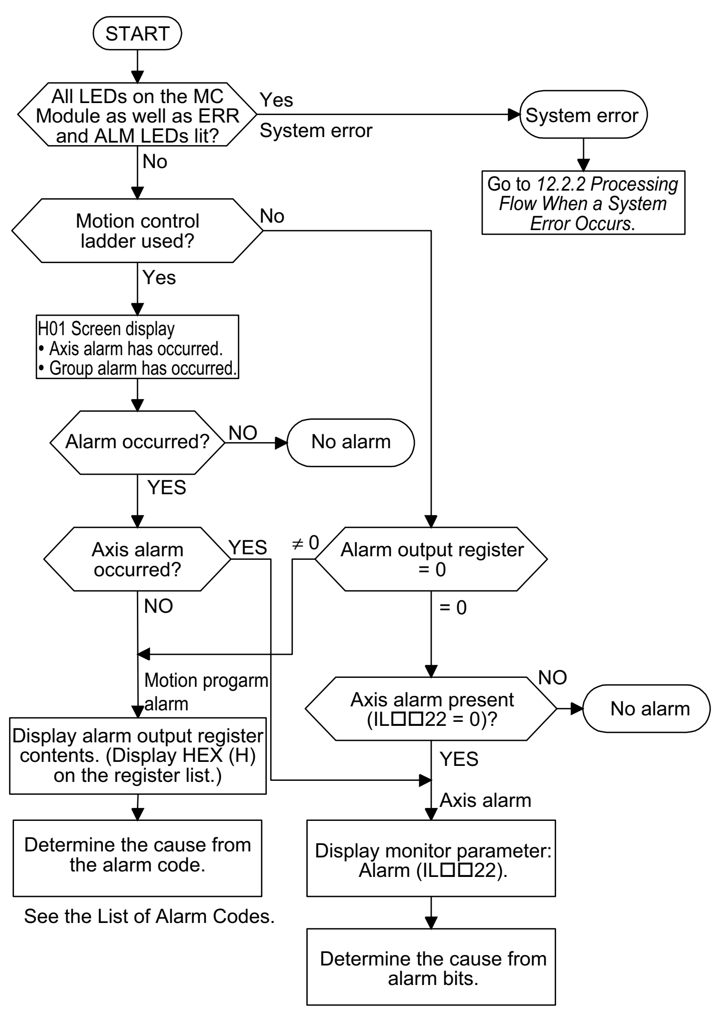
Motion errors in the MP920 are classified as alarms detected in motion programs and axis alarms detected in SERVOPACK units.

The failure location can be determined and appropriate corrections can be taken simply by checking the contents of the alarm output register set from the Define Group Screen for motion program alarms and the contents of monitor parameter: Alarms (IL□□22) for axis alarms.

12.3.2 Processing Flow When a Motion Error Occurs

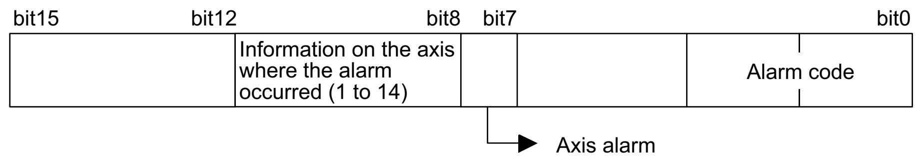
■ Troubleshooting Flow

The following illustration shows the troubleshooting flow when a motion error occurs.



■ Motion Alarm Configuration

The following illustration shows the motion alarm configuration stored in the alarm output register.



■ List of Motion Program Alarm Codes

The following table lists the List of Motion Program Alarm Codes. Use HEX(H) for the Display Mode when displaying the register list.

Name	Alarm Code	Contents	Remedy
Program Alarm	0	No alarm	Check the alarm details on the instructions of the motion program that was being run when an alarm occurred.
	1	–	
	2	Division-by-zero error	
	3	–	
	4	–	
	10h	Circumference specified alarm for radius specification	
	11h	Exceeded the interpolation feed speed	
	12h	No interpolation feed speed specified	
	13h	Out of range after changing acceleration and deceleration parameters	
	14h	Circular length exceeds LONG_MAX	
	15h	No vertical axis specified for circular plane specification	
	16h	No horizontal axis specified for circular plane specification	
	17h	Exceeded the specified axis	
	18h	Exceeded the specified number of turns	
	19h	Radius exceeds LONG_MAX	
	1Ah	Center point specification error	
	1Bh	Emergency stop reference executing	
	1Ch	Linear interpolation block distance traveled exceeds LONG_MAX	
	1Dh	FMX not defined	
	1Eh	Address T outside the range	
	1Fh	Address P outside the range	
	20h	REG data error	

Name	Alarm Code	Contents	Remedy
Axis Alarm*	80h	Logic-control axis use prohibited	Check the alarm details on the instructions of the motion program that was being run when an alarm occurred
	81h	Value exceeding POSMAX specified at Infinite Length Mode Axis specification.	
	82h	Distance the axis traveled exceeds LONG_MAX	
	83h	Illegal control mode	
	84h	Duplicate motion commands	
	85h	Duplicate motion command response	
	86h	Illegal motion command mode	
	87h	Outside the VEL data range setting	
	88h	Outside the INP data range setting	
	89h	Outside the ACC/SCC/SCC data range setting	
	8Ah	T command in MVT instruction is 0	
	8Bh	An instruction that cannot be executed with the Motion Module was executed.	

* Axis numbers are stored in bits 8 to 11 when an axis alarm occurs.

12

■ Motion Parameter: Alarm IL□□22 Details

The following tables lists the axis alarm flags (IL□□22).

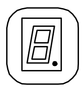
Parameter No.	Contents	Remedy
b0:	Not used	
b1: OTF	Positive Overtravel • Servo Amp overtravel in the positive direction detected (P_OT signal ON)	
b2: OTR	Negative Overtravel • Servo Amp overtravel in the negative direction detected (N_OT signal ON)	
b3: SOTF	Positive Software Limit • Machine movement toward the positive software limit range detected	
b4: SOTR	Negative Software Limit • Machine movement toward the negative software limit range detected	
b5:	Not used	
b6: TIMEOVER	Positioning Time Exceeded • Positioning was not completed in the time set at OW□□34: Positioning Complete Check Time after distribution.	
b7:	Not used	
b8:	Not used	
b9:	Not used	
b10: MODERR	Control Mode Error • A Position Control Mode motion command is used in a mode other than position control.	
b11: ZSET_NRDY	Zero Point Not Set • When an Absolute Encoder was used, the zero point is not set and a move was executed without a set zero point.	
b12:	Not used	
b13:	Not used	
b14:	Not used	
b15:	Not used	
b16:	Not used	
b17:	ABS Encoder Rotation Count Over • The number of ABS encoder rotations exceeded the range of the MP920.	
b18: PGLEFT	Broken PG Wiring • Broken PG wiring was detected when the A/B mode was selected as a pulse calculation mode.	
b19 to b31:	Not used	

12.3.3 Processing Performed When an SVA Module Error Occurs

■ Servo Number LED Display

The status LED indicators display a servo number (1 to b) when the SVA Module is normally operating in online mode.

Table 12.11 LED1 (8-segment LED)



Indicator	Color	When Lit
STATUS	Green	Displays a servo number or an error.

Table 12.12 Indicator Display Status

Display	Meaning	Remedy
8.	Hardware reset status	The hardware has been reset. Check the DIP switch settings, and correct them as necessary. If the status does not change, replace the Module.
0.	Initializing	1. The system usually enters this status for one to six seconds after the system is turned ON or reset. If the Servo Module is set up so that an Absolute Encoder is connected, and the interface with the Absolute Encoder causes an error, this status will last for 30 seconds per axis. 2. This status lasts if the system enters a permanent loop in an A Drawing of PLC (CPU1/CPU2). 3. This display indicates that the SVA Module is not registered in the Module definitions. To use the Module, register it in the Module definitions and then specify the fixed SVA parameters and the servo parameters for each axis. 4. If 1 to 3 above do not apply, replace the Module. 5. If the problem persists, a hardware error (such as a synchronization error during initialization for the link between the PLC (CPU1/CPU2) and the SVA Module) may be the cause of the problem. Replace other Modules and racks one at a time to isolate the problem cause.
1	Servo number. No. 1	A servo number (1 to 16) is displayed when the servo is operating normally without an error or alarm. Note, however, that this indicator display also appears when “no axis” is selected.
2	Servo number. No. 2	
3	Servo number. No. 3	
4	Servo number. No. 4	
5	Servo number. No. 5	
6	Servo number. No. 6	
7	Servo number. No. 7	
8	Servo number. No. 8	

Table 12.12 Indicator Display Status (cont'd)

Display	Meaning	Remedy
9	Servo number. No. 9	A servo number (1 to 16) is displayed when the servo is operating normally without an error or alarm. Note, however, that this indicator display also appears when "no axis" is selected.
A	Servo number. No. 10	
b	Servo number. No. 11	
C	Servo number. No. 12	
d	Servo number. No. 13	
E	Servo number. No. 14	
r	Servo number. No. 15	
y	Servo number. No. 16	

■ Alarm Indicator Displays

When an error or alarm occurs, refer to the following table.

Table 12.13 Alarm Indicator Displays

<table>
<tr><th>Display</th><th colspan="2">Meaning</th><th>Remedy</th></tr>
<tr><td>F or , F.
followed by
error code</td><td colspan="2">Serious fault (operation stop)

F→0→1 : Watchdog timeout
F→0→2 : Synchronization error
F→4→1 : ROM diagnostic error
F→4→2 : RAM diagnostic error
F→4→3 : Shared memory diagnostic error
F→4→4 : Built-in CPU timer diagnostic error
F→4→5 : Timer diagnostic error
F→4→6 : NVRAM read error
F→4→7 : NVRAM write error
F→4→8 : Illegal general instruction interrupt
F→4→9 : Illegal slot instruction interrupt
F→5→0 : CPU address error interrupt
F→5→1 : DMA address error interrupt
F→5→2 : User break interrupt
F→5→3 : Trap instruction interrupt</td><td>A Motion Module hardware error has occurred. Replace the Module.
1. A watchdog timeout error may occur when the user program processing time exceeds the scan time setting. Check the user program and the scan time setting.
2. A synchronization error indicates a problem with synchronization between the PLC (CPU1/CPU2) and a Servo Module. Check other Modules. If they are normal, replace racks and Modules one at a time to isolate the cause of the problem.
Note: The alarm displays shown here are applicable to SVA-01A Modules, SVA-02A Modules, and PO-01 Modules</td></tr>
<tr><td>┘</td><td>Axis 1</td><td rowspan="4">Alarm (SVRDY “ON”)
• Error fault
• Servo parameter setting error
Error (SVRDY “OFF”)
• Fixed servo parameter setting error
• Absolute Encoder interface error</td><td rowspan="4">Check the contents of IW□□00 + the axis offset to determine which of the items shown on the left is the cause of the problem.
• A Servo parameter setting error indicates that any of the values specified in the Servo parameters are outside the allowable range. Check the Servo parameter settings, and correct them as necessary.
• A fixed servo parameter setting error indicates that any of the values specified in the fixed servo parameters are outside the allowable range. Check the fixed servo parameter settings, and correct them as necessary.
• For an Absolute Encoder interface error, initialize the Absolute Encoder.</td></tr>
<tr><td>L</td><td>Axis 2</td></tr>
<tr><td>∏</td><td>Axis 3</td></tr>
<tr><td>⊔</td><td>Axis 4</td></tr>
<tr><td>P</td><td colspan="2">Other CPU operation stop</td><td>Some other Module is stopped. Check other Modules. For example, check whether the PLC (CPU1/CPU2) is stopped.</td></tr>
<tr><td>┐</td><td colspan="2" rowspan="4">Absolute position read retry status</td><td rowspan="4">A retry has occurred for absolute positioning read processing during initialization because the power has been turned ON or the Module has been reset while the fixed parameter encoder selection is set for an absolute value encoder.</td></tr>
<tr><td>┘</td></tr>
<tr><td>└</td></tr>
<tr><td>┌</td></tr>
</table>

Appendix A

A

A.1 Module Dimensional Drawings

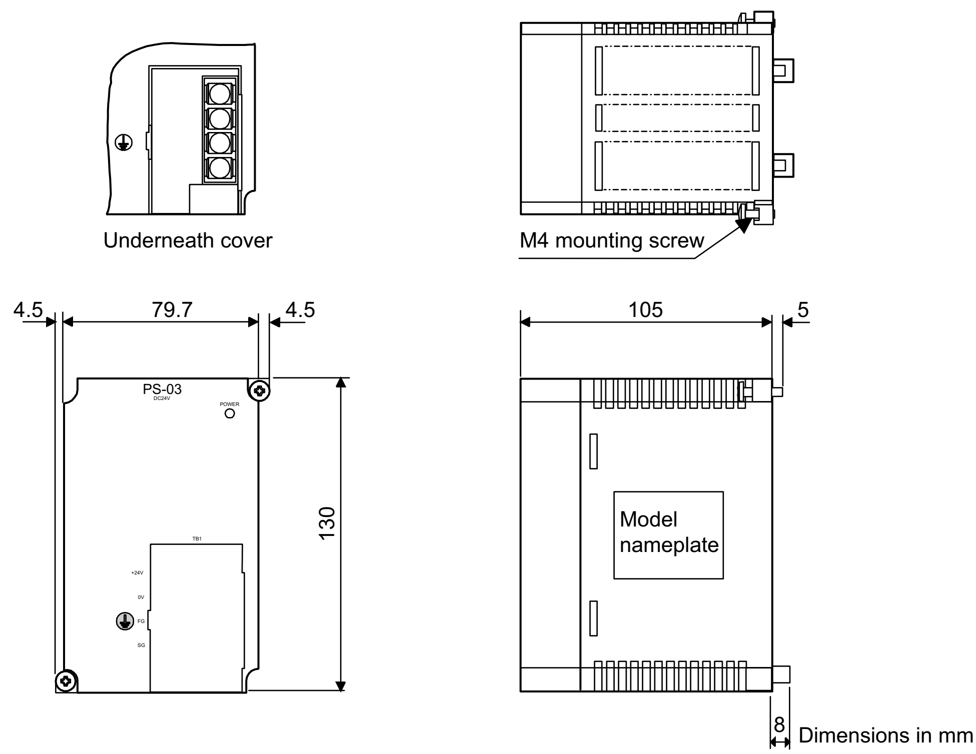
This appendix shows the appearance of the Modules used in the MP920 Machine Controller.

A.1.1 Two-slot Modules

■ Power Supply Module (DC Input)

Description: PS-03

Model: JEPMC-PS200

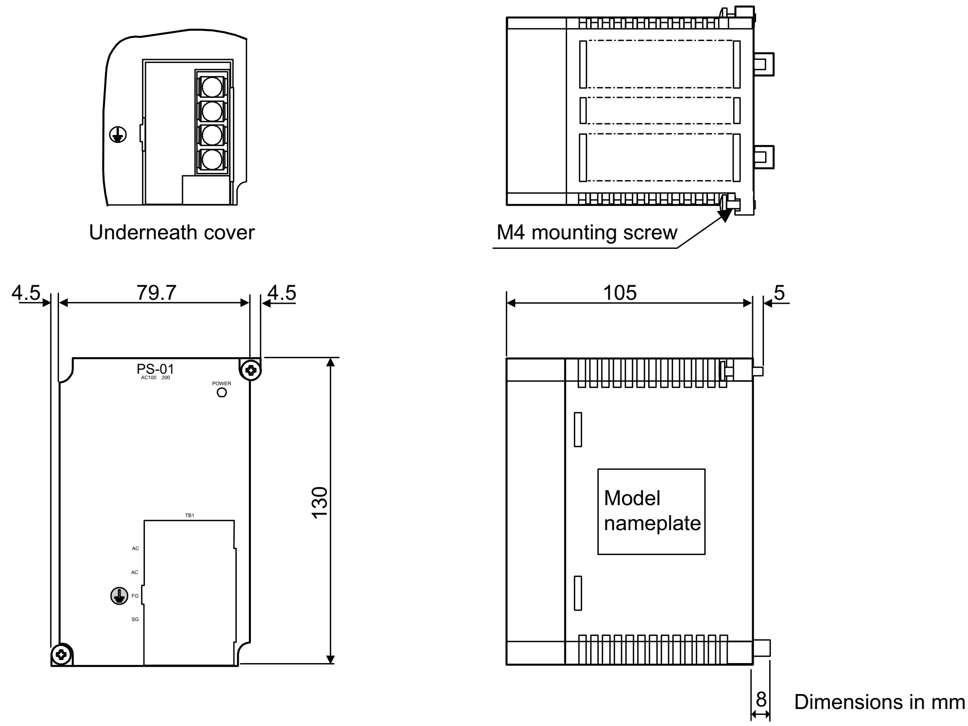


A

■ Power Supply Module (AC Input)

Description: PS-01

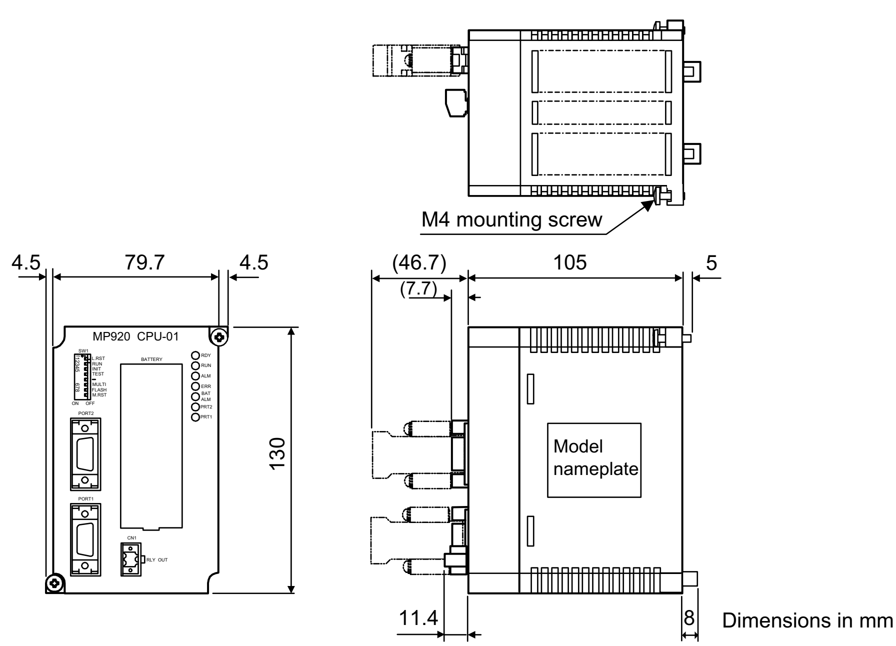
Model: JEPMC-PS210



■ CPU Module (CPU-01)

Description: CPU-01

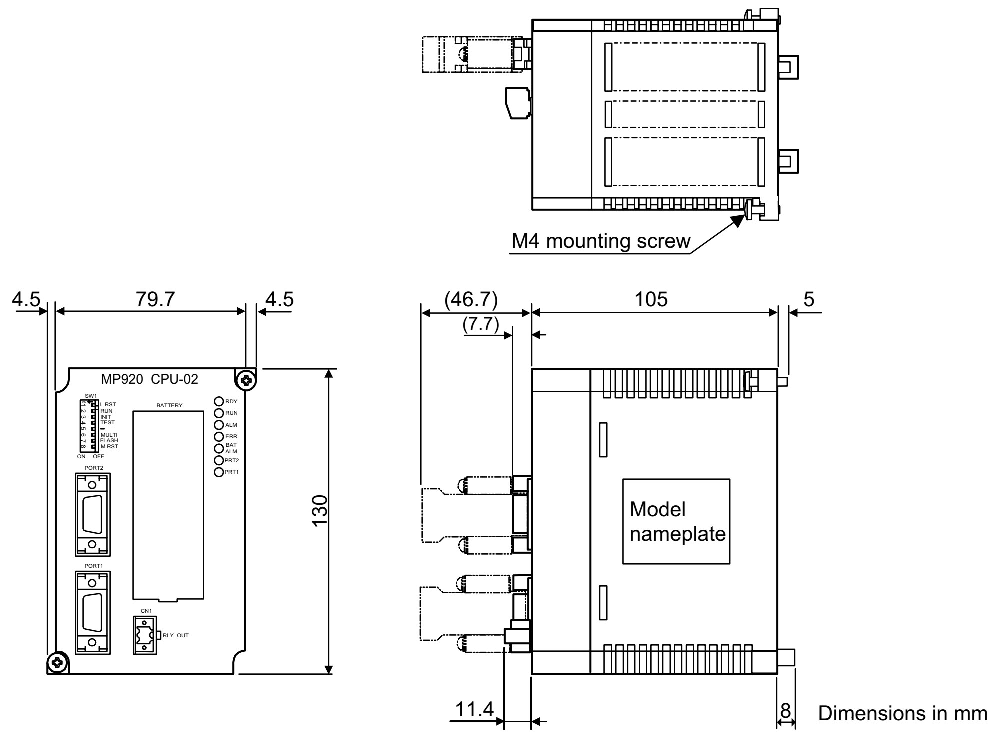
Model: JEPMC-CP200



■ CPU Module (CPU-02)

Description: CPU-02

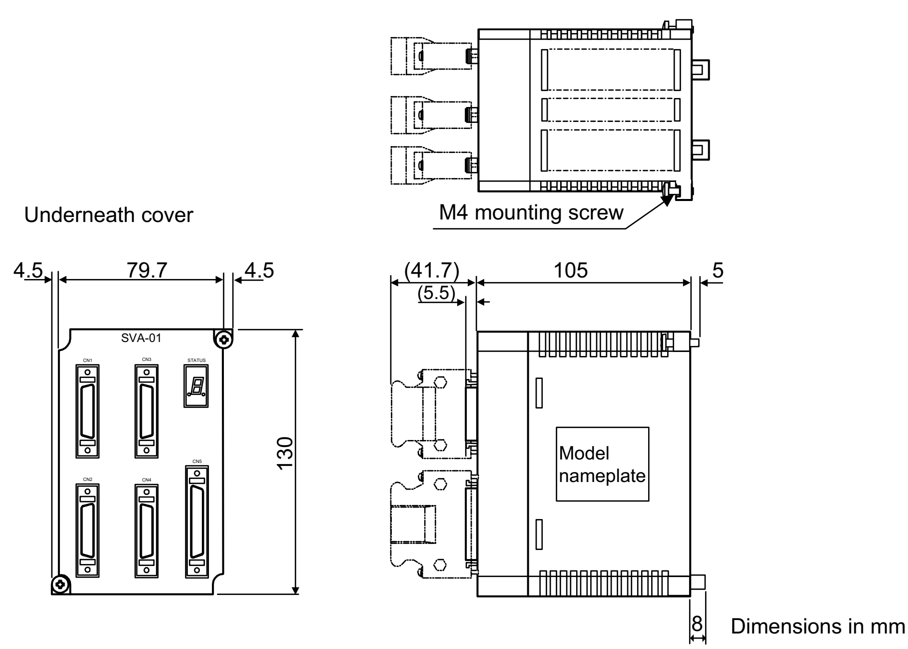
Model: JEPMC-CP210



■ Four-axis Servo Module

Description: SVA-01

Model: JEPMC-MC200A

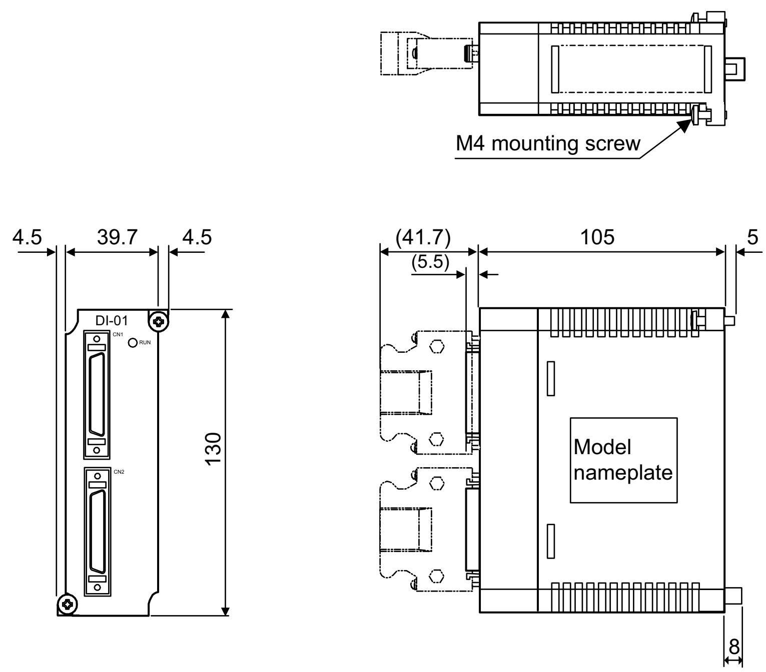


A.1.2 One-slot Modules

■ Digital Input Module

Description: DI-01

Model: JEPMC-IO200

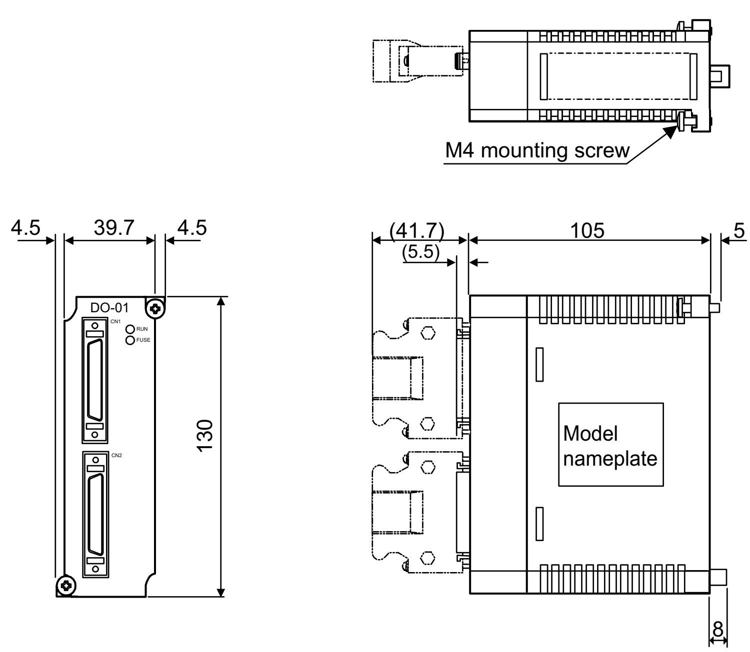


Dimensions in mm

■ Digital Output Module

Description: DO-01

Model: JEPMC-IO210

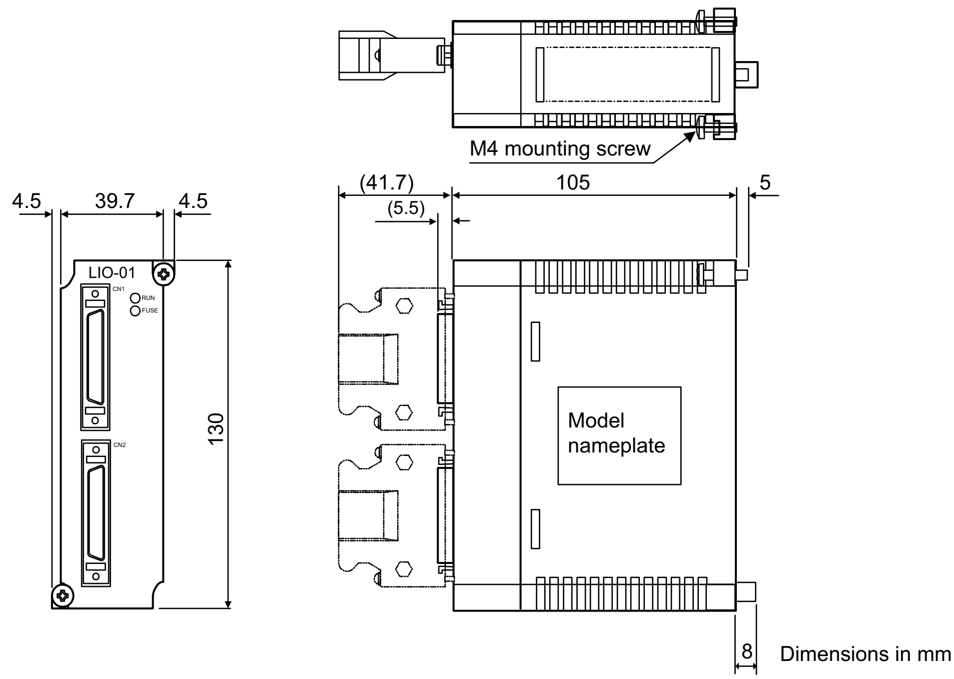


Dimensions in mm

■ Digital I/O Module

Description: LIO-01

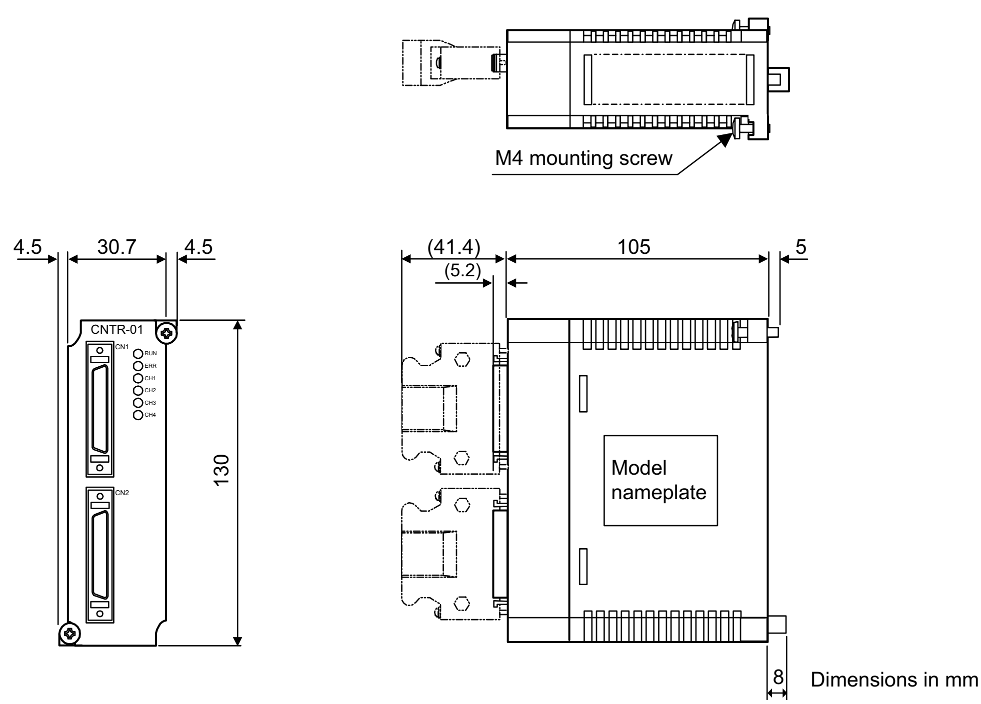
Model: JEPMC-IO220



■ Counter Module

Description: CNTR-01

Model: JEPMC-PL200

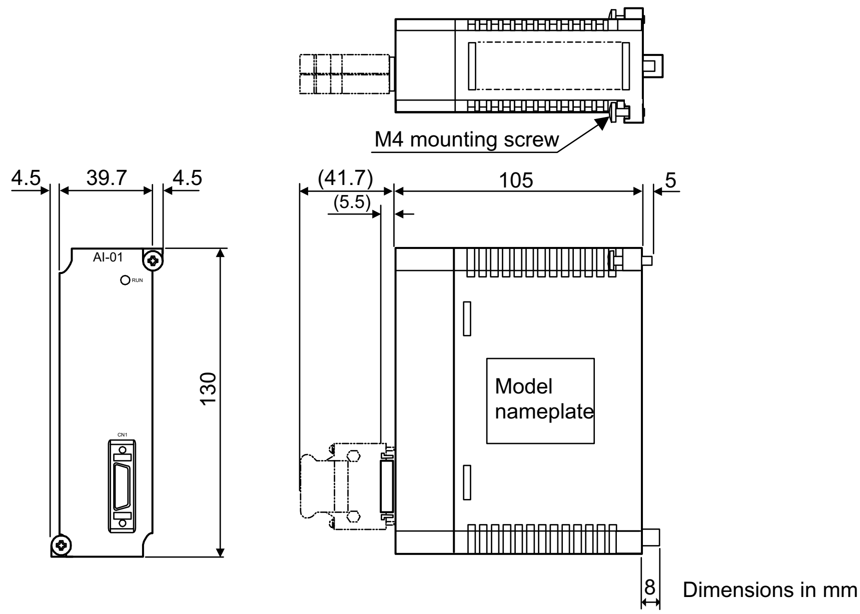


A

■ Analog Input Module

Description: AI-01

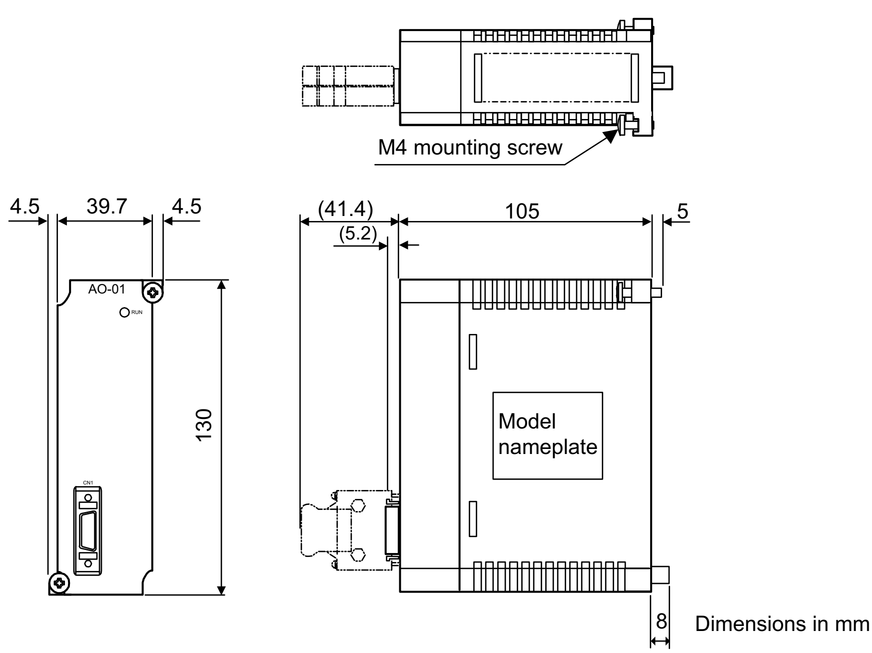
Model: JEPMC-AN200



■ Analog Output Module

Description: AO-01

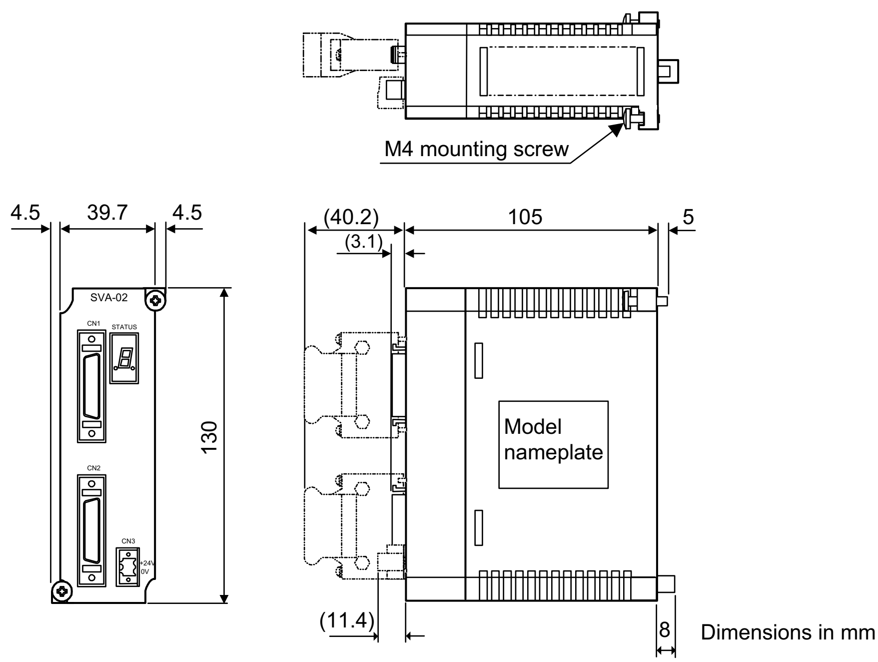
Model: JEPMC-AN210



■ Two-axis Servo Module

Description: SVA-02A

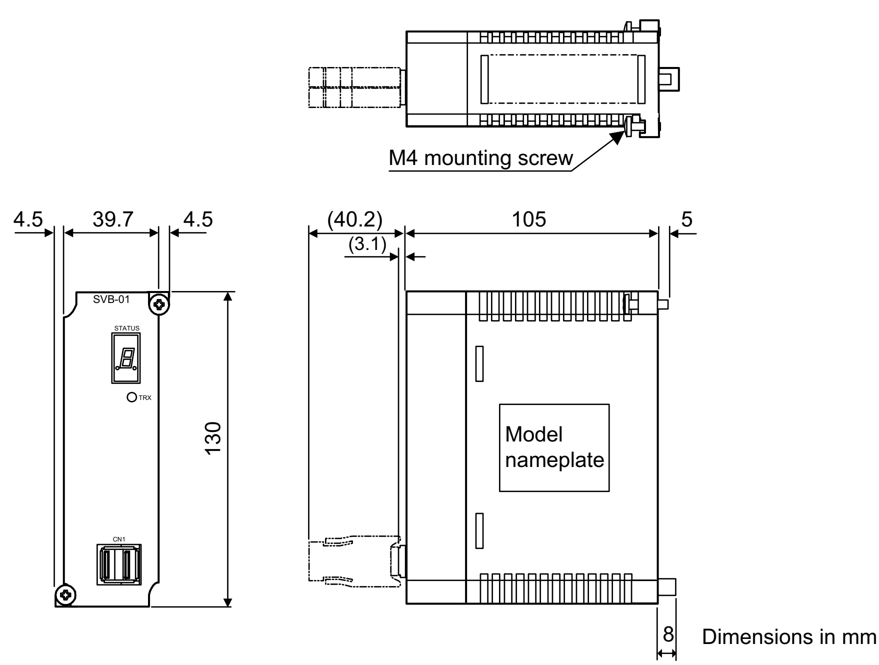
Model: JEPMC-MC220A



■ MECHATROLINK Interface Servo Module

Description: SVB-01

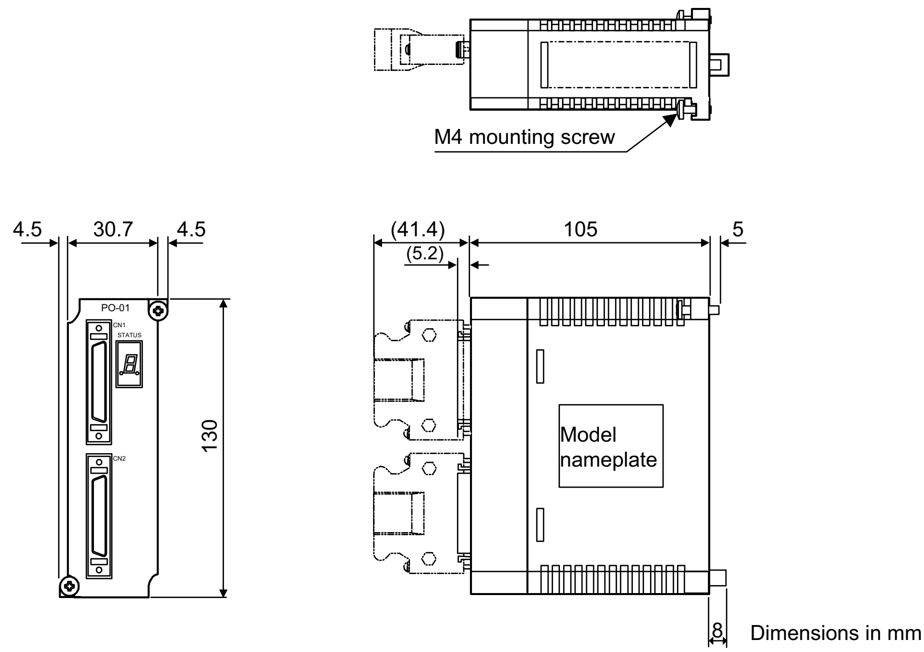
Model: JEPMC-MC210



■ Pulse Output Module

Description: PO-01

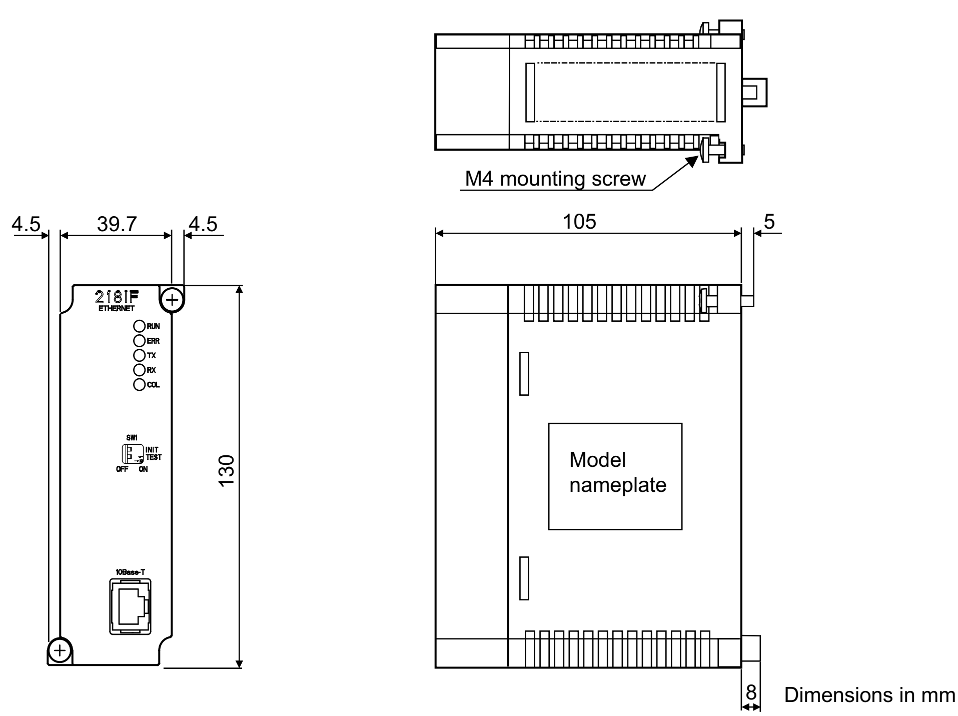
Model: JEPMC-PL210



■ 218I/F Communications Module

Description: 218IFA

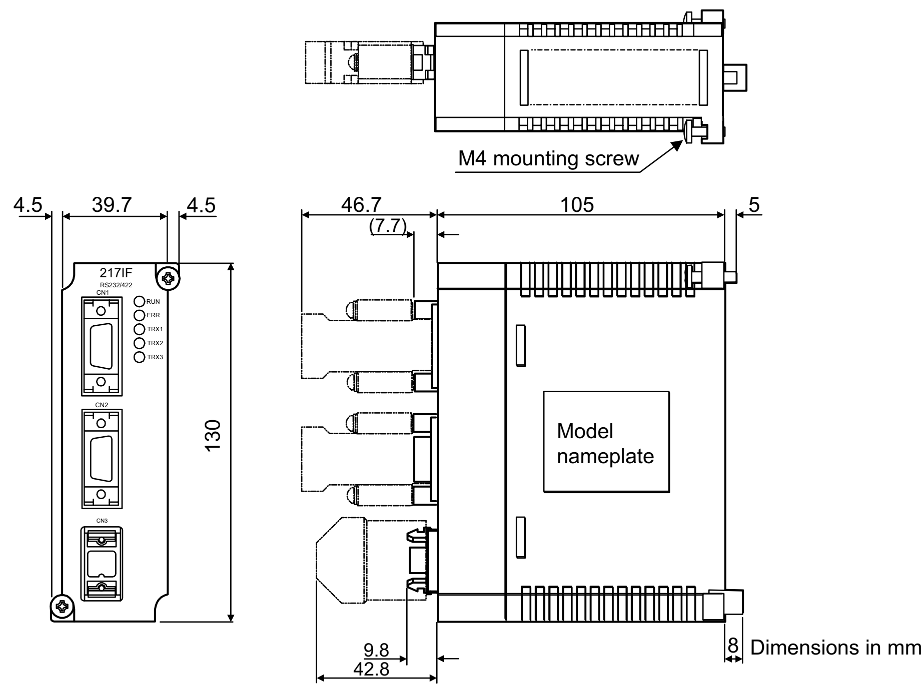
Model: JEPMC-CM210A



■ 217I/F Communications Module

Description: 217IF

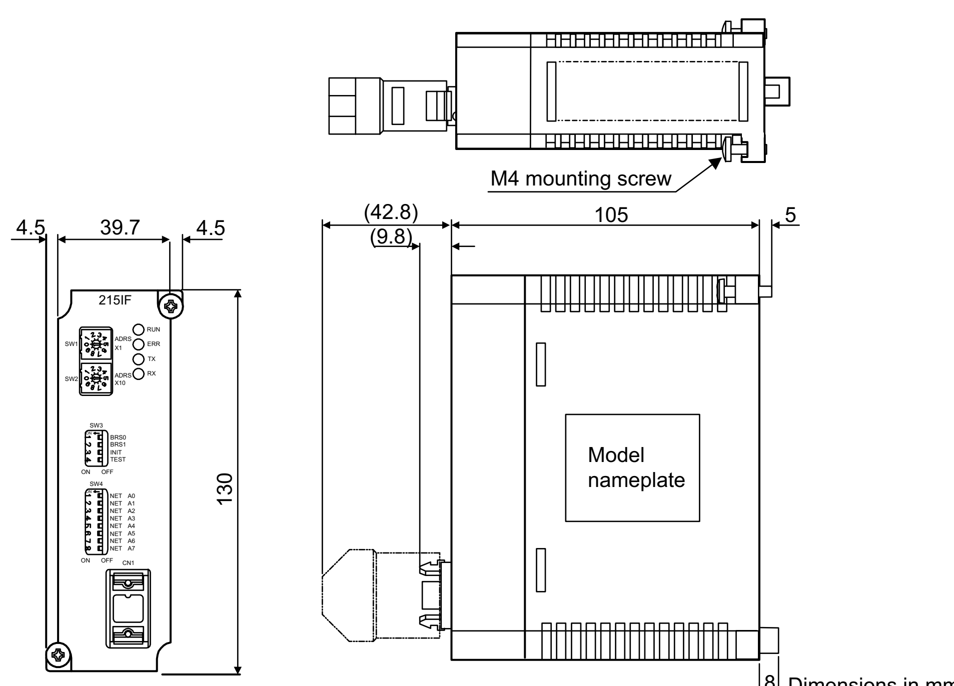
Model: JEPMC-CM200



■ 215I/F Communications Module

Description: 215IF

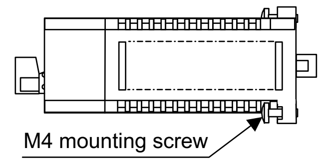
Model: JEPMC-CM220

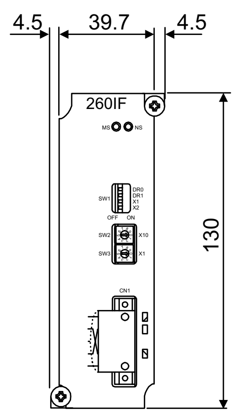


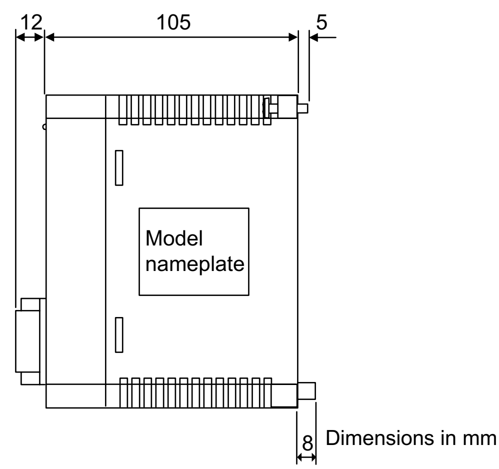
■ DeviceNet Interface Module

Description: 260IF

Model: JEPMC-CM230



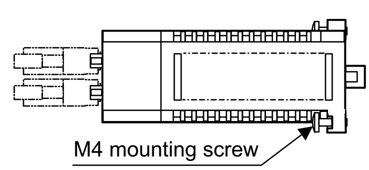


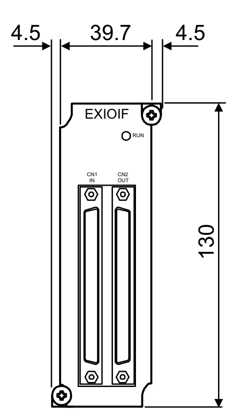


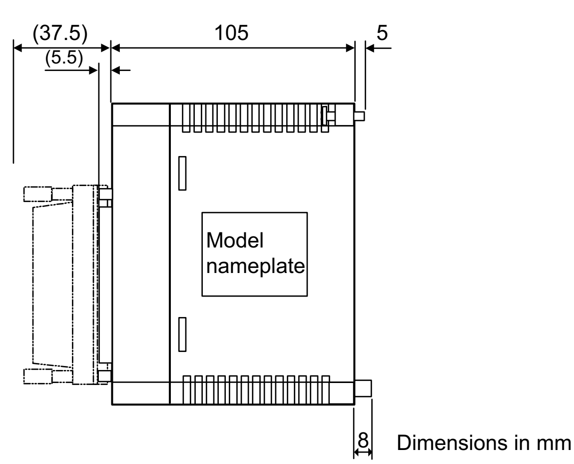
■ Expansion Interface Module

Description: EXIOF

Model: JEPMC-EX200





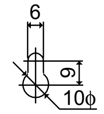


A.1.3 Mounting Bases

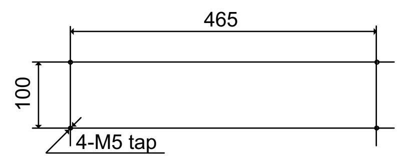
■ Long Mounting Base (9 Slots)

Description: MB-01

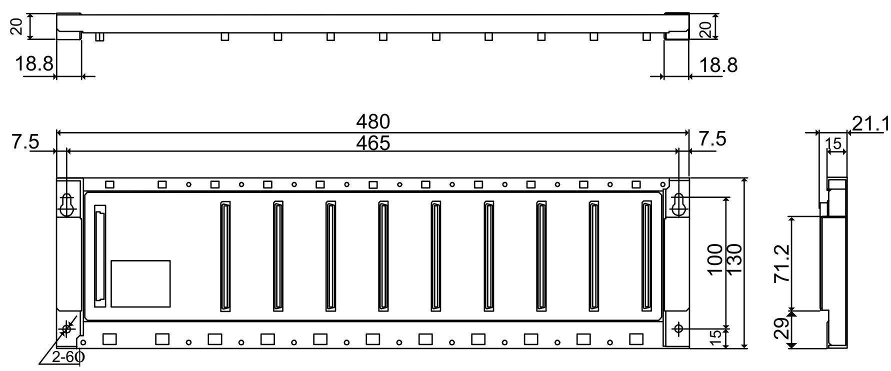
Model: JEPMC-MB200



Upper mounting holes (×2)



Mounting hole dimensions

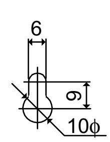


Dimensions in mm

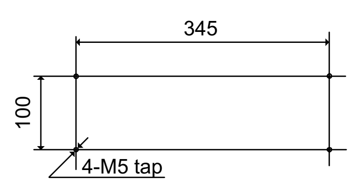
■ Short Mounting Base (6 Slots)

Description: MB-02

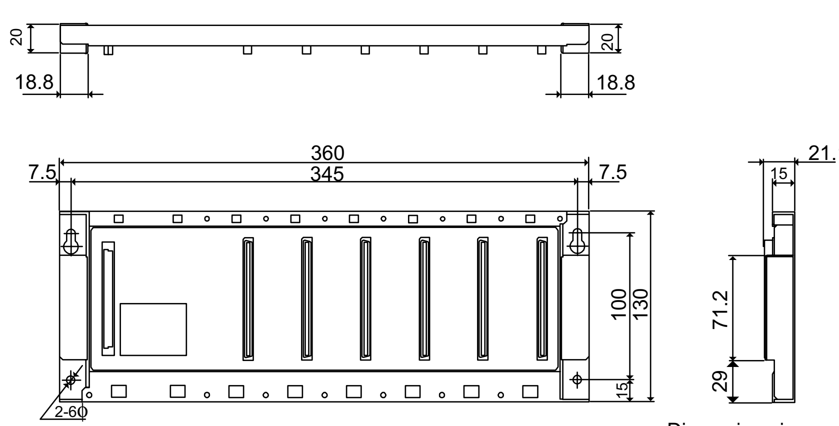
Model: JEPMC-MB210



Upper mounting holes (×2)



Mounting hole dimensions



Dimensions in mm

A.2 Motion Commands, Ladder Instructions, and Standard System Functions

The motion commands, ladder instructions, are explained and standard system functions

A.2.1 Ladder Instruction List

The following table shows a list of the ladder instructions and standard system functions.

Type	Name	Symbol	Description
Program Control Instructions	CHILD DRAWING CALL	SEE	Designate the child drawing number or the grandchild drawing number to be called after SEE. SEE H01
	MOTION PROGRAM CALL	MSEE	Designate the motion program number and the MSEE work register address to be called after MSEE. MSEE MPM001 DA00000
	FOR Structure	FOR : : FEND	Repeats execution statement 1 FOR V = a to b by c V: Can designate any integer register I or J. a, b, c: Can designate an any integer value (b > a > 0, c > 0). FEND: End of FOR instruction.
	WHILE Structure	WHILE : ON/OFF : WEND	Repeats execution statement 2 WEND: End of WHILE-ON/OFF instruction
	IF Structure	IFON/IFOFF : ELSE : IEND	Conditional execution statement IEND: End of IFON/IFOFF instruction
	DRAWING END	DEND	End of drawing (DWG)
	COMMENT	"nnnnnnn"	A character string enclosed in quotation marks is treated as a comment.
	FUNCTION Interface	FSTART	Calls a function.
		FIN	Function input instruction Stores input data from the designated input register in the function input register.
		FOUT	Function output instruction Stores output data from the function output register in the designated output register.
		XCALL	Calls an extension program.
Direct I/O Instructions	INPUT STRAIGHT	INS	INS MA00100 Executes the input and storage of data with interrupts disabled.
	OUTPUT STRAIGHT	OUTS	OUTS MA00100 Executes the setting and output of data with interrupts disabled.

(cont'd)

Type	Name	Symbol	Description
Relay Circuit Instruction	NO CONTACT	┤├	No limit in a series circuit. Bit designation of any register as a relay number is possible.
	NC CONTACT	┤/├	No limit in a series circuit. Bit designation of any register as a relay number is possible.
	RISING PULSE	┤↑├	No limit in a series circuit. Bit designation of any register as a relay number is possible.
	FALLING PULSE	┤↓├	No limit in a series circuit. Bit designation of any register as a relay number is possible.
	10-MS ON-DELAY TIMER	┤[T]├	Set value: Timer register ┤[T]├ Set value = any register or constant (setting unit: 10 ms) Timer register = M or L register
	10-MS OFF-DELAY TIMER	┤[T]├	
	1-S ON-DELAY TIMER	┤[S]├	Set value: Timer register ┤[S]├ Set value = any register or constant (set ting unit: 10 ms) Timer register = M or L register
	1-S OFF-DELAY TIMER	┤[S]├	
	COIL	─○┤	MB000000 ├ MW0200 = 0001 ──────○┤ MB000000 ├──┤├─── IFON
	SET COIL	┤[S]├	MB000000 MB000010 ├──┤├──────────┤[S]├
	RESET COIL	┤[R]├	MB000020 MB000010 ├──┤├──────────┤[R]├
	Branching/ convergence	↧ ↥ ⤴	A branching or convergence symbol can be connected to any of the above relay instructions.
Logic Operation Instructions	AND	∧	Integer designation of any register or constant is possible.
	OR	∨	Integer designation of any register or constant is possible.
	XOR	⊕	Integer designation of any register or constant is possible.
Numeric Operation Instructions	ADDITION	+	Ordinary numeric addition (with operation error) ├ MW00280 + 00100 ⇒ MW00220
	SUBTRACTION	-	Ordinary numeric subtraction (with operation error) ├ MW00280 - 00100 ⇒ MW00220
	EXTENDED ADDITION	++	Closed numeric addition (without operation error) 0 → 32767 → -32768 → 0
	EXTENDED SUBTRACTION	- -	Closed numeric subtraction (without operation error) 0 → -32768 → 32767 → 0
	INTEGER ENTRY	├	Starts an integer operation. ├ MW00280 + 00100 ⇒ MW00220
	REAL NUMBER ENTRY	‖├	Starts a real number operation. ‖├ MF00280 + 1.000000E + 002 ⇒ MF00220

(cont'd)

Type	Name	Symbol	Description
Numeric Conversion Instructions (cont'd)	STORE	⇒	Stores the operation result in the designated register.
	MULTIPLICATION	×	For integer and long integers, use × and ÷ in combination.
	DIVISION	÷	
	INCREMENT	INC	Adds 1 to the designated register. INC MW00100
	DECREMENT	DEC	Subtracts 1 from the designated register. DEC MW00100
	MOD	MOD	Gets the remainder of the division result. ⊢ MW00100 × 00100 ÷ 00121 MOD ⇒ MW00101
	REM	REM	Gets the remainder of the division result. MF00200 REM 1.5 ⇒ MF00202
	ADD TIME	TMADD	Addition of hours, minutes, and seconds TMADD MW00000, MW00100
	SUBTRACT TIME	TMSUB	Subtraction of hours, minutes, and seconds TMSUB MW00000, MW00100
	SPEND TIME	SPEND	Calculates the elapsed time between two times. SPEND MW00000, MW00100
	SIGN INVERSION	INV	⊢ MW00100 INV If MW00100 = 99, the operation result = -99.
	1'S COMPLEMENT	COM	⊢ MW00100 COM If MW00100 = FFFFH, the operation result = 0000H.
	ABSOLUTE VALUE CONVERSION	ABS	⊢ MW00100 ABS If MW00100 = -99, the operation result = 99.
	BINARY CONVERSION	BIN	⊢ MW00100 BIN If MW00100 = 1234H (hexadecimal), the operation result = 1234 (decimal).
	BCD CONVERSION	BCD	⊢ MW00100 BCD If MW00100 = 1234 (decimal), the operation result = 1234H (hexadecimal).
	PARITY CONVERSION	PARITY	Calculates the number of binary bits that are ON. If MW00100 = F0F0H, the operation result = 8.
	ASCII CONVERSION 1	ASCII	The designated character string is converted to ASCII code and substituted in the register. MW00200 "ABCDEFG"
	ASCII CONVERSION 2	BINASC	Converts 16-bit binary data to 4-digit hexadecimal ASCII code. BINASC MW00100
	ASCII CONVERSION 3	ASCBIN	Converts the numeric value indicated by a 4-digit hexadecimal ASCII code to 16-bit binary data. ASCBIN MW00100

(cont'd)

Type	Name	Symbol	Description
Numeric Comparison Instructions	<	<	MB000010 ├ MW00000 < 10000 ──O┤ MB000010 ├─┤├── IFON
	≦	≦	
	=	=	
	≠	≠	
	≧	≧	
	>	>	
	RANGE CHECK	RCHK	Checks whether or not the value in the A register is in range. ├ MW00100 RCHK -1000, 1000
Data Operation Instructions	BIT ROTATION RIGHT	ROTR	Bit-addr Count Width ROTR MB00100A → N = 1 W = 20
	MOVE BITS	MOVB	Source Desti. Width MOVB MB00100A → MB00200A W = 20
	MOVE WORD	MOVW	Source Desti. Width MOVW MB00100 → MB00200 W = 20
	EXCHANGE	XCHG	Source1 Source2 Width XCHG MB00100 →MB00200 W = 20
	SET WORDS	SETW	Desti. Data Width SETW MW00200 D = 00000 W = 20
	BYTE-TO-WORD EXPANSION	BEXTD	Expands the byte data stored in the word registers into words. BEXTD MW00100 to MW00200 B = 10
	WORD-TO-BYTE COMPRESSION	BPRESS	Collects the lower bytes of the word data stored in the word register area. BPRESS MW00100 to MW00200 B = 10
	BINARY SEARCH	BSRCH	Retrieves the register position that matches the data within the designated register range. BSRCH MW00000 W = 20 D = 100 R = MW00100
	SORT	SORT	Sorts registers within the designated register range. SORT MW00000 W = 100
	BIT SHIFT LEFT	SHFTL	Shifts the designated bit strings to the left. SHFTL MB00100A N = 1 W = 20
	BIT SHIFT RIGHT	SHFTR	Shifts the designated bit strings to the right. SHFTR MB00100A N = 1 W = 2
	COPY WORD	COPYW	Copies the designated register range. COPYW MW00100 → MW00200 W = 20
	BYTE SWAP	BSWAP	The upper and lower bytes of the designated word are swapped. BSWAP MW00100

(cont'd)

Type	Name	Symbol	Description
Basic Function Instructions	SQUARE ROOT	SQRT	Taking the square root of a negative number will result in the square root of the absolute value multiplied by -1. |├ MF00100 SQRT
	SINE	SIN	Input = degrees |├ MF00100 SIN
	COSINE	COS	Input = degrees |├ MF00100 COS
	TANGENT	TAN	Input = degrees |├ MF00100 TAN
	ARC SINE	ASIN	|├ MF00100 ASIN
	ARC COSINE	ACOS	|├ MF00100 ACOS
	ARC TANGENT	ATAN	|├ MF00100 ATAN
	EXPONENT	EXP	|├ MF00100 EXP e MF00100
	NATURAL LOGARITHM	LN	|├ MF00100 LN $\log_e$ (FM00100)
	COMMON LOGARITHM	LOG	|├ MF00100 LOG $\log_{10}$ (FM00100)
DDC Instructions	DEAD ZONE A	DZA	├ MW00100 DZA 00100
	DEAD ZONE B	DZB	├ MW00100 DZB 00100
	UPPER/LOWER LIMIT	LIMIT	├ MW00100 LIMIT -00100 00100
	PI CONTROL	PI	├ MW00100 PI MA00200
	PD CONTROL	PD	├ MW00100 PD MA00200
	PID CONTROL	PID	├ MW00100 PID MA00200
	FIRST-ORDER LAG	LAG	├ MW00100 LAG MA00200
	PHASE LEAD/LAG	LLAG	├ MW00100 LLAG MA00200
	FUNCTION GENERATOR	FGN	├ MW00100 FGN MA00200
	INVERSE FUNCTION GENERATOR	IFGN	├ MW00100 IFGN MA00200
	LINEAR ACCELERATOR/ DECELERATOR 1	LAU	├ MW00100 LAU MA00200
	LINEAR ACCELERATOR/ DECELERATOR 2	SLAU	├ MW00100 SLAU MA00200
	PULSE WIDTH MODULATION	PWM	├ MW00100 PWM MA00200

(cont'd)

Type	Name	Symbol	Description
Table Data Operation Instructions	TABLE READ	TBLBR	TBLBR TBL1, MA00000, MA00100
	TABLE WRITE	TBLBW	TBLBW TBL1, MA00000, MA00100
	ROW SEARCH	TBLSRL	TBLSRL TBL1, MA00000, MA00100
	COLUMN SEARCH	TBLSRC	TBLSRC TBL1, MA00000, MA00100
	TABLE CLEAR	TBLCL	TBLCL TBL1, MA00000
	TABLE BLOCK MOVE	TBLMV	TBLMV TBL1, TBL2, MA00000
	QUEUE TABLE READ	QTBLR	QTBLR TBL1, MA00000, MA00100
	QUEUE TABLE READ AND INCREMENT	QTBLRI	QTBLRI TBL1, MA00000, MA00100
	QUEUE TABLE WRITE	QTBLW	QTBLW TBL1, MA00000, MA00100
	QUEUE TABLE WRITE AND INCREMENT	QTBLWI	QTBLWI TBL1, MA00000, MA00100
	QUEUE POINTER CLEAR	QTBLCL	QTBLCL TBL1
Standard System Functions	COUNTER	COUNTER	Increments or decrements a counter.
	FIRST-IN FIRST-OUT	FINFOUT	First-in, first-out
	TRACE	TRACE	Data trace execution control
	DATA TRACE READ	DTRC-RD	Data readout from data trace memory to user memory
	FAILURE TRACE READOUT	FTRC-RD	Data readout from failure trace memory to user memory
	INVERTER TRACE READ	ITRC-RD	Reads inverter trace data to store it in user register.
	SEND MESSAGE	MSG-SND	Sending a message from a Communications Module
	RECEIVE MESSAGE	MSG-RCV	Receiving a message from a Communications Module
	INVERTER CONSTANT WRITE	ICNS-WR	Writes 215IF/216IF Connected inverter constants.
	INVERTER CONSTANT READ	ICNS-RD	Reads 215IF/216IF Connected inverter constants to register.

A

A.2.2 Motion Command List

The motion commands are listed in the following table.

Classification	Command	Name	Programming Format	Function/Meaning
Axis Move Commands	MOV	POSITIONING	MOV [axis1] – [axis2] – ···;* (Up to 16 axes can be designated.)	Executes positioning at rapid traverse speed for up to 16 axes simultaneously. In programming, replace "–" with the numerical data for each axis.
	MVS	LINEAR INTERPOLATION	MVS [axis1] – [axis2] – ···F–; (Up to 16 axes can be designated.)	Executes linear travel at interpolation feed speed F for up to 16 axes simultaneously.
	MCW MCC	CLOCKWISE CIRCULAR INTERPOLATION COUNTER-CLOCKWISE CIRCULAR INTERPOLATION	MCW [axis1] – [axis2] – R–F–; MCC [axis1] – [axis2] – U– V– T– F–;	Executes circular interpolation at tangential speed F for two axes simultaneously following radius R (or designated center point coordinates). With the center point coordinate designation, multiple circles can be designated with T–. (T– can also be omitted.)
	MCW MCC	CLOCKWISE HELICAL INTERPOLATION COUNTER-CLOCKWISE HELICAL INTERPOLATION	MCW [axis1] – [axis2] –U–V– [axis3] –T– F–; MCC [axis1] – [axis2] –R– [axis3] –F–;	Moves three axes simultaneously in a combination of circular interpolation and linear interpolation outside of the circular interpolation plane. Speed F will be the circular interpolation tangential speed. With the center point coordinate designation, the number of turns can be designated with T–. (T– can also be omitted.)
	ZRN	ZERO POINT RETURN	ZRN [axis1] – [axis2] – ···; (Up to 16 axes can be designated.)	Returns each axis to its zero point.
	SKP	SKIP	SKP [axis1]– [axis2]– ··· SS–; (Up to 16 axes can be designated.)	If the SKIP signal turns ON during a linear interpolation operation, skips the remaining movement and proceeds to the next block.
	MVT	POSITIONING WITH TIME SPECIFIED	MVT [axis1]– [axis2]– ··· T–; (Up to 16 axes can be designated.)	Executes positioning by clamping the feed speed so that travel can be completed at the designated time.
	EXM	EXTERNAL POSITIONING	EXM [axis1]– D–;	When an external positioning signal is input while external positioning is being executed, only the travel distance designated by "D–" is positioned with an incremental value, and then the next command is executed.
Basic Control Commands	ABS	ABSOLUTE MODE	ABS;	Treats all subsequent coordinate words as absolute values.
	INC	INCREMENTAL MODE	INC;	Treats all subsequent coordinate words as incremental values.
	POS	CHANGE CURRENT POSITION	POS [axis1] – [axis2] – ···;	Changes the current values to the desired coordinate values for up to 16 axes simultaneously. Subsequent move commands use this new coordinate system.

(cont'd)

Classification	Command	Name	Programming Format	Function/Meaning
Basic Control Commands (cont'd)	PLN	COORDINATE PLANE SETTING	PLN [axis1] [axis2]	Designates the coordinate plane to be used for a command requiring a plane designation command.
	MVM	MOVE ON MACHINE COORDINATE	MVM MOV [axis1]– [axis2]–; or MVM MVS [axis1]– [axis2]–;	Goes to the target position on the machine coordinate system. The coordinate system set automatically on completion of the zero point return is called a machine coordinate system. This coordinate system is not affected by the POS command.
	PLD	PROGRAM CURRENT POSITION UPDATE	PLD [axis1] – [axis2] – ···;	Updates the program current position for axes shifted by manual intervention. Up to 16 axes can be designated.
Speed and Acceleration/ Deceleration Commands	ACC	ACCELERATION TIME CHANGE	ACC [axis1] – [axis2] – ···;	Sets the acceleration time for linear acceleration/deceleration for up to 16 axes simultaneously.
	DCC	DECELERATION TIME CHANGE	DCC [axis1] – [axis2] – ···;	Sets the deceleration time for linear acceleration/deceleration for up to 16 axes simultaneously.
	SCC	S-CURVE TIME CONSTANT CHANGE	SCC [axis1] – [axis2] – ···;	Sets the time constant for moving average acceleration/deceleration for up to 16 axes simultaneously.
	VEL	SET VELOCITY	VEL [axis1] – [axis2] – ···;	Sets the feed speed for up to 16 axes.
	IAC	INTERPOLATION ACCELERATION TIME CHANGE	IAC T–;	Sets the acceleration time for linear acceleration/deceleration for interpolation travel.
	IDC	INTERPOLATION DECELERATION TIME CHANGE	IDC T–;	Sets the deceleration time for linear acceleration/deceleration for interpolation travel.
	IFP	INTERPOLATION FEED SPEED RATIO SETTING	IFP P–;	Designates the maximum feed % for the speed designation during an interpolation feed.
	FMX	MAXIMUM INTERPOLATION FEED SPEED SETTING	FMX T–;	Sets the maximum speed during an interpolation feed. The interpolation acceleration time is the time from "0" until this speed is reached.
High-Level Control Commands	PFN	IN-POSITION CHECK	MVS [axis1] – [axis2] – ··· PFN; or PFN [axis1] [axis2] ;	Proceeds to the next block after the positioning commanded by the interpolation travel command in the same block or a previous block enters the positioning completion range (parameter setting).
	INP	SECOND IN-POSITION CHECK	INP [axis1] – [axis2] – ···;	Proceeds to the next block after the positioning subsequently commanded by the interpolation travel command with PFN enters the second positioning completion range.

(cont'd)

<table>
<tr><th>Classification</th><th>Command</th><th>Name</th><th>Programming Format</th><th>Function/Meaning</th></tr>
<tr><td rowspan="2">High-Level Control Commands (cont'd)</td><td>SNG</td><td>IGNORE SINGLE BLOCK SIGNAL</td><td>SNG MVS [axis1] 100. [axis2] 200. F1000;</td><td>A block with this command will be executed continuously, even in single-block operation mode.
SNG cannot be designated on its own.</td></tr>
<tr><td>UFC</td><td>USER FUNCTION CALL</td><td>UFC Function_name Input data, Input address, Output data;</td><td>Calls a function created by the user.</td></tr>
<tr><td rowspan="15">Sequence Commands</td><td>=</td><td>SUBSTITUTE</td><td>(Result) = (Arithmetic expression)</td><td>Substitutes operation results. Performs calculations from left to right (with no order of priority).</td></tr>
<tr><td>+</td><td>ADD</td><td>MW– = MW– + MW–;
MW– = MW– + 123456;
MW– = 123456 + MW–;</td><td>Performs integer and real number addition. Calculates combinations of integers and real numbers as real numbers.</td></tr>
<tr><td>-</td><td>SUBTRACT</td><td>MW– = MW– – MW–;
MW– = MW– – 123456;
MW– = 123456 – MW–;</td><td>Performs integer and real number subtraction. Calculates combinations of integers and real numbers as real numbers.</td></tr>
<tr><td>∗</td><td>MULTIPLY</td><td>MW– = MW– ∗ MW–;
MW– = MW– ∗ 123456;
MW– = 123456 ∗ MW–;</td><td>Performs integer and real number multiplication. Calculates combinations of integers and real numbers as real numbers.</td></tr>
<tr><td>/</td><td>DIVIDE</td><td>MW– = MW–/MW–;
MW– = MW–/123456;
MW– = 123456/MW–;</td><td>Performs integer and real number division. Calculates combinations of integers and real numbers as real numbers.</td></tr>
<tr><td>MOD</td><td>REMAINDER</td><td>MW– = MW–/MW–;
MW– = MOD;</td><td>When programmed in the next block after a division, MOD stores the remainder in the designated register.</td></tr>
<tr><td>|</td><td>OR (logical OR)</td><td>MB– = MB– | MB–;
MB– = MB– | 1;
MW– = MW– | MW–;
MW– = MW– | H00FF;</td><td>Performs bit/integer logical OR.</td></tr>
<tr><td>^</td><td>XOR (logical exclusive OR)</td><td>MW– = MW– ^ MW–;
MW– = MW– ^ H00FF;</td><td>Performs integer logical exclusive OR.</td></tr>
<tr><td>&</td><td>AND (logical AND)</td><td>MB– = MB– & MB–;
MB– = MB– & 1;
MW– = MW– & MW–;
MW– = MW– & H00FF;</td><td>Performs bit/integer logical AND.</td></tr>
<tr><td>!</td><td>NOT (logical complement)</td><td>MB– = !MB–;
MB– = !1;
MW– = !MW–;
MW– = !H00FF;</td><td>Performs bit/integer logical complement (inverts bits).</td></tr>
<tr><td>( )</td><td>PARENTHESES</td><td>MW– = MW– & (MW– | MW–);</td><td>The logical arithmetic expression inside parentheses is calculated first.</td></tr>
<tr><td>S{ }</td><td>SET BIT</td><td>S{MB–} = MB– & MB–;</td><td>If the logical operation result is "true," the designated bit turns ON. The designated bit does not turn OFF, even if the logical operation result is "false."</td></tr>
<tr><td>R{ }</td><td>RESET BIT</td><td>R{MB–} = MB– & MB–;</td><td>If the logical operation result is "true," the designated bit turns OFF. The designated bit does not turn ON, even if the logical operation result is "false."</td></tr>
</table>

(cont'd)

Classification	Command	Name	Programming Format	Function/Meaning
Sequence Commands (cont'd)	SIN	SINE	SIN (MW–); SIN (90);	Obtains the sine of the integer or real number (deg), and returns a real value.
	COS	COSINE	COS (MW–); COS (90);	Obtains the cosine of the integer or real number (deg), and returns a real value.
	TAN	TANGENT	TAN (MF–); TAN (45.0);	Obtains the tangent of the real number (deg), and returns a real value.
	ASN	ARC SINE	ASN (MF–); ASN (90.0);	Obtains the arc sine of the real number (deg), and returns a real value.
	ACS	ARC COSINE	ACS (MF–); ACS (90.0);	Obtains the arc cosine of the real number (deg), and returns a real value.
	ATN	ARC TANGENT	ATN (MW–); ATN (45);	Obtains the arc tangent of the integer or real number (deg), and returns a real value.
	SQRT	SQUARE ROOT	SQT (MW–); SQT (100);	Obtains the square root of the integer or real number, and returns a real value.
	BIN	BCD-TO-BINARY	BIN (MW–);	Converts BCD data to binary data.
	BCD	BINARY-TO-BCD	BCD (MW–);	Converts binary data to BCD data.
	= =	MATCH	IF MW– = = MW–; WHILE MW– = = MW–;	Used in an IF or WHILE conditional expression. If the left side and right side match, the condition is "true."
	< >	MISMATCH	IF MW– < > MW–; WHILE MW– < > MW–;	Used in an IF or WHILE conditional expression. If the left side and right side do not match, the condition is "true."
	>	GREATER THAN	IF MW– > MW–; WHILE MW– > MW–;	Used in an IF or WHILE conditional expression. If the left side is greater than the right side, the condition is "true."
	<	LESS THAN	IF MW– < MW–; WHILE MW– < MW–;	Used in an IF or WHILE conditional expression. If the left side is less than the right side, the condition is "true."
	> =	GREATER THAN OR EQUAL TO	IF MW– >= MW–; WHILE MW– >= MW–;	Used in an IF or WHILE conditional expression. If the left side is greater than or equal to the right side, the condition is "true."
	< =	LESS THAN OR EQUAL TO	IF MW– <= MW–; WHILE MW– <= MW–;	Used in an IF or WHILE conditional expression. If the left side is less than or equal to the right side, the condition is "true."
	SFR	RIGHT SHIFT	SFR MB– N– W–;	Shifts only the designated number of word variables to the right.
	SFL	LEFT SHIFT	SFL MB– N– W–;	Shifts only the designated number of word variables to the left.
	BLK	BLOCK MOVE	BLK MW– MW– W–;	Moves the block (constant designation) beginning with the designated bit (word) variable.
	CLR	CLEAR	CLR MB– W–;	Sets the number of constants specified in the variable group beginning with the designated bit (word) variable to OFF ("0").

A

(cont'd)

Classification	Command	Name	Programming Format	Function/Meaning
Control Commands	MSEE	SUBROUTINE CALL	MSEE MPS– ;	Executes the MPS– subroutine.
	TIM	DWELL TIME	TIM T–;	Waits for the period of time specified by T, and then proceeds to the next block.
	IOW	I/O WAIT	IOW MB– = = ***;	Stops execution of the motion program until the conditional expression given in the command is satisfied.
	END	PROGRAM END	END;	Ends the motion program.
	RET	SUBROUTINE RETURN	RET;	Ends the subroutine.
	EOX	ONE SCAN WAIT	EOX;	Separates continuous sequence instructions and forces a wait of one scan before continuing execution.

	IF
	ELSE
	IEND
		Branching commands	IF (conditional expression) ;
			(process 1)
			ELSE;
			(process 2)
			IEND;
				Executes process 1 if the conditional expression is satisfied, and executes process 2 if the conditional expression is not satisfied.

	WHILE WEND	Repeat commands	WHILE (conditional expression) ; ... WEND;	Repeatedly executes WHILE to WEND processing for as long as the conditional expression is satisfied.
	PFORK JOINTO PJOINT	Parallel execution commands	PFORK label 1, label 2,...; Label 1: Process 1 JOINTO label X Label 2: Process 2 JOINTO label X Label • • Label X: PJOINT;	Executes the blocks designated by the labels in parallel. With a subroutine, a maximum of two labels can be designated. Also, a motion command cannot be used in the block designated by the second label. END and RET cannot be used during parallel execution processing.
	SFORK JOINTO SJOINT	Selective execution commands	SFORK conditional expression 1? label 1, Conditional expression 2? label 2,...; Label 1: Process 1 JOINTO label X Label 2: Process 2 JOINTO label X Label • • Label X: SJOINT;	Executes process 1 if conditional expression 1 is satisfied, and executes process 2 if the conditional expression 2 is satisfied.

* – in MOV [axis1] – ···; indicates the numerical data of [axis1].

A.3 Parameter List

The motion fixed parameters, motion setting parameters, and motion monitoring parameters are explained.

A.3.1 Motion Fixed Parameters

The following table lists motion fixed parameters.

No.	Name	Setting Range	Meaning	Standard Setting					
				Zero Point Return	Speed	Torque	Position		Phase
							Position 1*1	Position 2*2	
1	Axis Selection (USESEL)	0 or 1 (Default = 0)	0: Not used 1: Used	1	1	1	1		1
2	PG Input Signal Form Selections (PGSEL)	Set each bit. (Default = 0000H)	See *7.2.1 Motion Fixed Parameters*.	0000H (Set an appropriate value.)					
3	Encoder Selection (ENCSEL)	0 to 2 (Default = 0)	0: Incremental encoder 1: Absolute encoder 2: Absolute encoder used as incremental encoder	0 (incremental encoder) (Set an appropriate value.)					
4	Rotation Direction Selection with an Absolute Encoder (DIRINV)	0 or 1 (Default = 0)	0: Forward 1: Reverse	0 (forward) (Set an appropriate value.)					
5	Pulse Counting Mode Selection (PULMODE)	0 to 6 (Default = 6)	0: Sign (×1) 1: Sign (×2) 2: Up/Down (×1) 3: Up/Down (×2) 4: A/B mode (×1) 5: A/B mode (×2) 6: A/B mode (×4)	(A/B pulses ×4) (Set an appropriate value.)					
7	Rated Motor Speed Setting (NR)	1 to 32000 (Default = 3000)	1 = 1 r/min	3000 (Set an appropriate value.)					
8	Number of Feedback Pulses Per Rotation (FBppr)	Multiple of 4 from 4 to 65532 (Default = 2048)	1 = 1 pulse/rev	2048 (Set an appropriate value.)					
9	D/A Output Voltage at 100% Speed (V1)	1 to 10000 (Default = 6000)	1 = 1 mV	6000	6000	6000	6000		6000
10	D/A Output Voltage at 100% Torque Limit (V2)	1 to 10000 (Default = 3000)	1 = 1 mV	3000	3000	3000	3000		3000
11	Input Voltage at 100% Speed Monitoring (A/D) (MV1)	1 to 10000 (Default = 6000)	1 = 1 mV	6000	6000	6000	6000		6000

(cont'd)

No.	Name	Setting Range	Meaning	Standard Setting					
				Zero Point Return	Speed	Torque	Position		Phase
							Position 1[*1]	Position 2[*2]	
13	DI Latch Signal Selection (DIINTSEL)	0 or 1 (Default = 0)	0: DI input signal 1: C pulse input signal	0 (DI input signal) (Set an appropriate value.)					
14	Additional Function Selections (AFUNCSEL)	Set by bit (Default = 0080H)	See *7.2.1 Motion Fixed Parameters*.	0080H	0080H	0080H	0000H	0080H	0080H
				(Set an appropriate value.)					
16	Not Used	–	–	–		–	–		–
17	Motion Controller Function Selection Flags (SVFUNCSEL)	Set by bit (Default = 0000H)	See *7.2.1 Motion Fixed Parameters*.	0000H (Set an appropriate value.)					
18	Number of Digits Below Decimal Point (DECNUM)	0 to 5 (Default = 3)	Set the number of digits below the decimal point for commands.	3					
19	Distance Traveled Per Machine Rotation (PITCH)	1 to 2^{31} -1 (Default = 10000)	1 = 1 reference unit	10000					
21	Servomotor Gear Ratio (GEAR_MOTOR)	1 to 65535 (Default = 1)	1 = 1 rotation	1					
22	Machine Gear Ratio (GEAR_MACHINE)	1 to 65535 (Default = 1)	1 = 1 rotation	1					
23	Infinite Length Axis Reset Position (POSMAX)	1 to 2^{31} -1 (Default = 360000)	1 = 1 reference unit	360000					
25	Maximum Number of Absolute Encoder Turns (MAXTURN)	1 to 2^{31} -1 (Default = 99999)	1 = 1 rotation	99999					
27	Positive Software Limit (SLIMP)	-2^{31} to 2^{31}-1 (Default = 2^{31}-1)	1 = 1 reference unit	2^{31}-1					
29	Negative Software Limit (SLIMN)	-2^{31} to 2^{31}-1 (Default = -2^{31})	1 = 1 reference unit	-2^{31}					
31	Zero Point Return Method (ZRETSEL)	0 to 7 (Default = 0)	0: DEC1 + C-phase pulse 1: ZERO 2: DEC1 + ZERO 3: C-phase pulse 4: DEC2 + ZERO 5: DEC1 + LMT + ZERO 6: DEC2 + C-phase pulse 7: DEC1 + LMT + C pulse	0 (DEC1 + C-phase pulse)					

(cont'd)

<table>
<tr><th rowspan="3">No.</th><th rowspan="3">Name</th><th rowspan="3">Setting Range</th><th rowspan="3">Meaning</th><th colspan="6">Standard Setting</th></tr>
<tr><th rowspan="2">Zero Point Return</th><th rowspan="2">Speed</th><th rowspan="2">Torque</th><th colspan="2">Position</th><th rowspan="2">Phase</th></tr>
<tr><th>Position 1*1</th><th>Position 2*2</th></tr>
<tr><td>32</td><td>Backlash Compensation (BKLSH)</td><td>0 to 32767 (Default = 0)</td><td>1 = 1 reference unit</td><td colspan="6">0</td></tr>
<tr><td>36</td><td>Bias Speed for Exponential Acceleration/ Deceleration Filter (EXPBIAS)</td><td>0 to 32767 (Default = 0)</td><td>1 = 10^n reference units/min</td><td colspan="6">0</td></tr>
</table>

* 1. Use motion commands.
* 2. Does not use motion commands.

A.3.2 Motion Setting Parameters

The following table lists motion setting parameters.

No.	Name	Register Number	Setting Range	Meaning	Basic Counter					
					Zero Point Return	Speed	Torque	Position		Phase
								Position 1	Position 2	
1	RUN Mode Settings (RUNMOD)	OW□□00	Set by bit (Default = 0104H)	See *7.2.2 Motion Setting Parameters*.	0010H	0001H	0002H	0004H	0104H	0008H
2	RUN Command Settings (SVRUNCMD)	OW□□01	Set by bit (Default = 4000H)	See *7.2.2 Motion Setting Parameters*.	4001H	4001H	4005H	4001H		4001H
3	Positive Torque Limit Setting (TLIMP)	OW□□02	0 to ±32767 (Default = -30000)	1 = 0.01%	VS-866: 20000 (200%) SERVOPACK: -20000 (-200%)		–	VS-866: 20000 (200%) SERVOPACK: -20000 (-200%)		
4	Not used	OW□□03	–	–	–		–	–		
5	Positive Speed Limiter Setting (NLIMP)	OW□□04	0 to 32767 (Default = 15000)	1 = 0.01%	15000 (150%)	15000 (150%)	–	15000 (150%)		15000 (150%)
6	Negative Speed Limiter Setting (NLIMN)	OW□□05	0 to 32767 (Default = 15000)	1 = 0.01%	15000 (150%)	15000 (150%)	–	15000 (150%)		15000 (150%)
7	Machine Coordinate System Zero Point Offset Setting (ABSOFF)	OL□□06	0 to $\pm 2^{31}$-1 (Default = 0)	1 = 1 reference unit	0 (Set an appropriate value only when this function is used.)					
9	Not used	OW□□08	–	–	–					
11	Approach Speed Setting (Napr)	OW□□0A	0 to 32767 (Default = 0)	1 = 0.01% or 1 = 10^n reference units/min	2000 (20%)	–	–	–	2000 (2000 kpulses/min)	–
12	Creep Speed Setting (Nclp)	OW□□0B	0 to 32767 (Default = 0)	1 = 0.01% or 1 = 10^n reference units/min	1000 (10%)	–	–	–	1000 (1000 kpulses/min)	–
13	Linear Acceleration Time Constant (NACC)	OW□□0C	0 to 32767 (Default = 0)	1 = 1 ms	300 (0.3 s)	300 (0.3 s)	–	300 (0.3 s)		–
14	Linear Deceleration Time Constant (NDEC)	OW□□0D	0 to 32767 (Default = 0)	1 = 1 ms	300 (0.3 s)	300 (0.3 s)	–	300 (0.3 s)		–

(cont'd)

No.	Name	Register Number	Setting Range	Meaning	Basic Counter					
					Zero Point Return	Speed	Torque	Position		Phase
								Position 1	Position 2	
15	Positioning Completed Range Setting (PEXT)	OW□□0E	0 to 65535 (Default = 10)	1 = 1 pulse or 1 = 1 reference unit	100	–	–	10		–
16	Error Count Alarm Detection Setting (EOV)	OW□□0F	0 to 65535 (Default = 65535)	1 = 1 pulse	65535	–	–	65535		65535
17	Position Loop Gain Setting (Kp)	OW□□10	1 to 32767 (Default = 300)	1 = 0.1 /s	500 (50.0)	–	–	Set an appropriate value.		–
18	Feed Forward Gain Setting (Kf)	OW□□11	0 to 200 (Default = 0)	1 = 1% (10 = 10%)	–	–	–			–
19	Position Reference Setting (XREF)	OL□□12	0 to $\pm 2^{31}$-1 (Default = 0)	1 = 1 pulse or 1 reference unit	–	–	–			–
21	Filter Time Constant Setting (NNUM)	OW□□14	0 to 255 or 0 to 32767 (Default = 0)	1 = 1 time or 1 ms (0 or 1 = No averaging)	–	0	–	0		–
22	Speed Reference Setting (NREF)	OW□□15	0 to ±32767 (Default = 0)	1 = 0.01%	–	10000 (100%)	–	10000 (100%)		10000 (100%)
23	Phase Bias Setting (PHBIAS)	OL□□16	0 to $\pm 2^{31}$-1 (Default = 0)	1 = 1 pulse	–	–	–	–		Set an appropriate value.
25	Speed Compensation Setting (NCOM)	OW□□18	0 to ±32767 (Default = 0)	1 = 0.01%	–	–	–			
26	Proportional Gain Setting (Kv)	OW□□19	0 to ±32767 (Default = 300)	1 = 0.1 /s	–	–	–			–
27	Integral Time Setting (Ti)	OW□□1A	0 to ±32767 (Default = 0)	1 = 1 ms (0 = No integration)	–	–	–	–		300 (300 ms)
28	Torque Reference Setting (TREF)	OW□□1B	0 to ±32767 (Default = 0)	1 = 0.01%	–	–	10000 (100%)	–		–
29	Speed Limit Setting (NLIM)	OW□□1C	0 to ±32767 (Default = 15000)	1 = 0.01%	–	–	10000 (100%)	–		–
30	Not used	OW□□1D	-	-	–	–	–	–	–	–

(cont'd)

No.	Name	Register Number	Setting Range	Meaning	Basic Counter					
					Zero Point Return	Speed	Torque	Position		Phase
								Position 1	Position 2	
31	Pulse Bias Setting (PULBIAS)	OW□□1E	0 to $\pm2^{31}$-1 (Default = 0)	1 = 1 pulse	–	–	–	0		–
33	Motion Command Code (MCMDCODE)	OW□□20	0 to 65535 (Default = 0)	0: No NOP command 1: Positioning (POSING) 2: External position (EX_POSING) 3: Zero point return (ZRET) 4: Interpolation (INTERPOLATE) 5: Interpolation end segment (ENDOF_INTERPOLATE) 6: Interpolation with latch (LATCH) 7: Feed (FEED) 8: Step (STEP) 9: Zero point setting (ZSET) 10 to 21: Used for SVB only. 22 to 65535: Not used.	–	–	–	–	Set an appropriate value.	–
34	Motion Command Control Flags (MCMDCTRL)	OW□□21	Set by bit. (Default = 0)	See *7.2.2 Motion Setting Parameters*.	0	–	–	0	0	–

(cont'd)

No.	Name	Register Number	Setting Range	Meaning	Basic Counter					
					Zero Point Return	Speed	Torque	Position		Phase
								Position 1	Position 2	
35	Rapid Traverse Speed (RV)	OL□□22	0 to 2^{31}-1 (Default = 3000)	1 = 10^n reference units/min	–	–	–	–	5000 (5000 kpulses/ min)	–
37	External Positioning Travel Distance (EXMDIST)	OL□□24	-2^{31} to 2^{31}-1 (Default = 0)	1 = 1 reference unit	–	–	–	–	0	–
39	Stopping Distance (STOPDIST)	OL□□26	-2^{31} to 2^{31}-1 (Default = 0)	1 = 1 reference unit	–	–	–	–	0	–
41	Step Travel Distance (STEP)	OL□□28	-2^{31} to 2^{31}-1 (Default = 0)	1 = 1 reference unit	–	–	–	–	0	–
43	Zero Point Return Final Travel Distance (ZRNDIST)	OL□□2A	-2^{31} to 2^{31}-1 (Default = 0)	1 = 1 reference unit	–	–	–	–	0	–
45	Override (OV)	OW□□2C	0 to 32767 (Default = 10000)	1 = 0.01%	–	–	–	–	10000 (100.00 %)	–
46	Position Control Flags (POSCTRL)	OW□□2D	Set by bit (Default = 0)	See *7.2.2 Motion Setting Parameters*.	–	–	–	–	0	–
47	Workpiece Coordinate System Offset (OFFSET)	OL□□2E	-2^{31} to 2^{31}-1 (Default = 0)	1 = 1 reference unit (Pulses: 1 = 1 pulse)	–	–	–	–	0	–
49	Preset Number of POSMAX Turns Data (TURNPRS)	OL□□30	-2^{31} to 2^{31}-1 (Default = 0)	1 = 1 turn	–	–	–	–	0	–
51	Second In-position Width (INPWIDTH)	OW□□32	0 to 65535 (Default = 0)	1 = 1 reference unit	–	–	–	–	0	–
52	Zero Point Position Output Width (PSETWIDTH)	OW□□33	0 to 65535 (Default = 0)	1 = 1 reference unit	–	–	–	–	10	–
53	Positioning Completed Check Time (PSETTIME)	OW□□34	0 to 65535 (Default = 0)	1 = 1 ms	–	–	–	–	0	–
54	Position Control Integral Time (PTi)	OW□□35	0 to 32767 (Default = 300)	1 = 1 ms	300 (300 ms)	–	–	300 (300 ms)		–

(cont'd)

No.	Name	Register Number	Setting Range	Meaning	Basic Counter					
					Zero Point Return	Speed	Torque	Position		Phase
								Position 1	Position 2	
55	Upper/Lower Limit for Position Control Integral (ILIMIT)	OW□□36	0 to 32767 (Default = 32767)	–	32767	–	–	32767		–
56	Primary Lag Time Constant (LAGTi)	OW□□37	0 to 32767 (Default = 0)	1 = 1 ms	0	–	–	0		–
57	Position Buffer Access Number or Lower-place Two Words of the Encoder Position at Shutdown (eposL)	OL□□3A	-2^{31} to $2^{31}-1$ (Default = 0)	See *7.2.2 Motion Setting Parameters*.	–	–	–	–	0	–
59	Position Buffer Write Data or Upper-place Two Words of the Encoder Position at Shutdown (eposH)	OL□□3A	-2^{31} to $2^{31}-1$ (Default = 0)	See *7.2.2 Motion Setting Parameters*.	–	–	–	–	0	–
61	Lower-place Two Words of the Pulse Position at Shutdown (aposL)	OL□□3C	-2^{31} to $2^{31}-1$ (Default = 0)	See *7.2.2 Motion Setting Parameters*.	–	–	–	–	0	–
63	Upper-place Two Words of the Pulse Position at Shutdown (aposH)	OL□□3E	-2^{31} to $2^{31}-1$ (Default = 0)	See *7.2.2 Motion Setting Parameters*.	–	–	–	–	0	–

Note: 1. A horizontal line indicates the parameter is not used in that mode. Set the default setting.
2. In the Position column (Position Control Mode) under Basic Counter, Position 1 indicates Position Control Mode without using OW□□20: Motion Command Code, and Position 2 indicates Position Control Mode using OW□□20: Motion Command Code.

A.3.3 Motion Monitor Parameters

The following table lists motion monitor servo parameters.

No.	Name	Register Number	Setting Range	Meaning	Control Mode Where Data Is Valid											
									Position Control Mode							
									Motion Command Code (OB☐☐008)							
										Motion Command Code (OW☐☐20)						
					Zero Point Return Mode	Speed Control Mode	Torque Control Mode	Phase Control Mode	Motion Command Disabled	Positioning	External Position	Zero Point Return	Interpolation	Latch	Feed	Step
1	RUN Status (RUNSTS)	IW☐☐00	Reports the SVA Module operation status.													
2	General-purpose DI Monitors (SVSTS)	IW☐☐01	Reports the status of general-purposeDI signals, or input signals from SERVOPACK.													
3	Calculated Position in Machine Coordinate System (CPOS)	IL☐☐02	-2^{31} to $2^{31}-1$	1 = 1 pulse or 1 = 1 reference unit 1 = 1 pulse for pulses Updated when the machine is locked.	√			√	√	√	√	√	√	√	√	√
5	Target Position Difference Monitor (PTGDIF)	IL☐☐04	-2^{31} to $2^{31}-1$	1 = 1 pulse or 1 = 1 reference unit 1 = 1 pulse for pulses	√			√	√	√	√	√	√	√	√	√
7	Machine Coordinate System Latch Position (LPOS)	IL☐☐06	-2^{31} to $2^{31}-1$	1 = 1 reference unit (1 = 1 pulse for pulses)	√	√	√	√	√	√	√		√	√	√	√
9	Machine Coordinate System Feedback Position (APOS)	IL☐☐08	-2^{31} to $2^{31}-1$	1 = 1 reference units (1 = 1 pulse for pulses) Note: Will not be updated if the machine is locked.	√	√	√	√	√	√	√	√	√	√	√	√
11	Position Error (PERR)	IL☐☐0A	-2^{31} to $2^{31}-1$	1 = 1 reference unit (1 = 1 pulse for pulses)	√			√	√	√	√	√	√	√	√	√
13	Speed Reference Output Monitor (SPDREF)	IW☐☐0C	-32768 to 32767	1 = 0.01%	√	√	√	√	√	√	√	√	√	√	√	√
14	Speed Monitor (NFB)	IW☐☐0D	-32768 to 32767	1 = 0.01% Note: Valid only with a 2-axis SVA Module.	√	√	√	√	√	√	√	√	√	√	√	√
15	Not used	IW☐☐0E	–	–												
16	Out of Range Parameter Number (ERNO)	IW☐☐0F	1 to 63 101 to 148	Set motion parameter error number Fixed motion parameter error number	√	√	√	√	√	√	√	√	√	√	√	√

(cont'd)

No.	Name	Register Number	Setting Range	Meaning	Control Mode Where Data Is Valid											
									Position Control Mode							
									Motion Command Code (OB□□008)							
										Motion Command Code (OW□□20)						
					Zero Point Return Mode	Speed Control Mode	Torque Control Mode	Phase Control Mode	Motion Command Disabled	Positioning	External Position	Zero Point Return	Interpolation	Latch	Feed	Step
17	Cumulative Rotations from Absolute Encoder (ABSREV)	IL□□10	0 to ±99999	1 = 1 turn	√	√	√	√	√	√	√	√	√	√	√	√
19	Initial Incremental Pulses from Absolute Encoder (IPULSE)	IL□□12	-2^{31} to $2^{31}-1$	1 = 1 pulse	√	√	√	√	√	√	√	√	√	√	√	√
21	Motion Command Response Code (MCMDRCODE)	IW□□14	0 to 65535	Motion command that is currently executing. (See OW□□20 for more details.)						√	√	√	√	√	√	√
22	Motion Command Status (MCMDSTS)	IW□□15	Reports the execution status of motion command (OW□□20).													
23	Number of Digits Below Decimal Point Monitor (DECNUMM)	IW□□16	0 to 5	Copies fixed motion parameter Number of Digits Below Decimal Point.						√	√	√	√	√	√	√
					√	√	√	√	√							
24	Position Control Status (POSSTS)	IW□□17	Reports position information managed by the SVA Module.													
25	Machine Coordinate System Reference Position (MPOS)	IL□□18	-2^{31} to $2^{31}-1$	1 = 1 pulse for pulses Note: Will not be updated if the machine is locked.						√	√	√	√	√	√	√
27	Not used	IL□□1A	–	–												
29	POSMAX Monitor (PMAXMON)	IL□□1C	1 to $2^{31}-1$	1 = 1 reference unit Copies fixed motion parameter "POSMAX."						√	√	√	√	√	√	√
					√	√	√	√	√							
31	Number of POSMAX Turns (PMAXTURN)	IL□□1E	-2^{31} to $2^{31}-1$	1 = 1 turn Counit is incremented or decemented each time POSMAX is exceeded. (Initializes to 0 at power ON.)						Valid when infinite length axis is selected at fixed motion parameter Motion Controller Function Selection Flag.						

(cont'd)

No.	Name	Register Number	Setting Range	Meaning	Control Mode Where Data Is Valid: Zero Point Return Mode	Speed Control Mode	Torque Control Mode	Phase Control Mode	Position Control Mode: Motion Command Code (OB□□008): Motion Command Disabled	Motion Command Code (OW□□20): Positioning	External Position	Zero Point Return	Interpolation	Latch	Feed	Step
33	Not used	IL□□20	–	–												
35	Alarms (ALARM)	IL□□22	Reports alarm information.													
37	Servo Driver Alarm Code (SVALARM)	IW□□24	-32768 to 32767	Error code when an absolute position read error occurs	Valid when an absolute position read error occurs											
38	Not used	IW□□25	–	–												
39	Speed Reference Output Monitor (RVMON)	IL□□26	-2^{31} to $2^{31}-1$	1 = 1 reference unit/H scan (For system use)						√	√	√	√	√	√	√
41	Position Buffer Read Data (CNMON)	IL□□28	-2^{31} to $2^{31}-1$	Position buffer data						Valid when position buffer read (OB□□21F) is ON.						
43	Not used	IL□□2A	–	–												
45	Integral Output Monitor (YIMON)	IL□□2C	-2^{31} to $2^{31}-1$		√			√	√	√	√	√	√	√	√	√
47	Calculated Reference Coordinate System Position (POS)	IL□□2E	-2^{31} to $2^{31}-1$	1 = 1 reference unit						√	√	√	√	√	√	√
49	Primary Lag Monitor (LAGMON)	IL□□30	-2^{31} to $2^{31}-1$	(PI output value - primary lag output value)	√			√	√	√	√	√	√		√	√
51	Position Loop Output Monitor	IL□□32	-2^{31} to $2^{31}-1$	Position loop output value (value prior to adding the calculated feed forward value)	√			√	√	√	√	√	√		√	√
53	Position Monitor 2 (APOS2)	IL□□34	-2^{31} to $2^{31}-1$	Depends on Position Moniter 2 Unit Selection (OB□□2D3). 1. OB□□2D3 = 0 (Reference unit selected) 1 = 1 reference unit	(OB□□00 is ON) with motion command code enabled selected.					√	√	√	√	√	√	√
				2. OB□□2D3 = 1 (Pulses selected) 1 = 1 pulse	√	√	√	√								
55	Not used	IW□□36	–	–												

(cont'd)

No.	Name	Register Number	Setting Range	Meaning	Control Mode Where Data Is Valid											
										Position Control Mode						
										Motion Command Code (OB□□008)						
									Motion Command Code (OW□□20)							
					Zero Point Return Mode	Speed Control Mode	Torque Control Mode	Phase Control Mode	Motion Command Disabled	Positioning	External Position	Zero Point Return	Interpolation	Latch	Feed	Step
56	Not used	IW□□37	–	–												
57	Lower-place Two Words of the Encoder Position at Shut-down (eposmL)	IL□□38	-2^{31} to $2^{31}-1$	1 = 1 pulse (*For ABS system unlimited length position control)						Valid when absolute encoder is selected at fixed motion parameter Encoder Selection, when unlimited length axis is selected at fixed motion parameter Motion Con-troller Function Selec-tion Flags, and when Zero Point Setting Com-pleted (IB□□153) is ON.						
59	Upper-place Two Words of the Encoder Posi-tion Shutdown (eposmH)	IL□□3A	-2^{31} to $2^{31}-1$	1 = 1 pulse (*For ABS system unlimited length position control)												
61	Lower-place Two Words of the Pulse Posi-tion at Shutdown (aposmL)	IL□□3C	-2^{31} to $2^{31}-1$	1 = 1 pulse (*For ABS system unlimited length position control)												
63	Upper-place Two Words of the Pulse Position at Shutdown (aposmH)	IL□□3E	-2^{31} to $2^{31}-1$	1 = 1 pulse (*For ABS system unlimited length position control)												

A.4 Monitoring Parameter Alarms

This section describes the monitoring parameter alarms, together with their causes and corrective actions to be taken.

A.4.1 Setting Errors in Fixed and Setting Parameters

The following table shows the parameter No.1 operation status (bit 1 and bit 2).

Register Number	Bit	Alarm Name	Cause	Action
IW☐☐00	b1: PRMERR	Setting Parameter Setting Error	A setting that exceeds the setting range has been made in a setting parameter.	Reset the setting parameter.
	b2: FPRMERR	Fixed Parameter Setting Error	A setting that exceeds the setting range has been made in a fixed parameter.	Reset the fixed parameter.

The parameter number in which the setting range error has occurred can be identified using IW☐☐0F (Parameter Number Out of Range).

Parameter Number	Name	Register Number	Description	Remarks
11	Parameter Number Out of Range	IW☐☐0F	• When a setting that exceeds the setting range has been made in a fixed parameter or a setting parameter, the last parameter number in which a setting range error occurred is stored. • Setting parameters: 1 to 47 • Fixed parameters: 101 to 127	

A

A.4.2 Monitoring Parameter Number 23 Alarms

The following table shows the servo-related alarms for each axis.

Register Number	Bit	Alarm Name	Cause	Action
IL□□22	b0:	Not used	–	–
	b1: OTF	Forward Overtravel	• Forward overtravel of the SERVOPACK was detected (P-OT signal ON).	• Check the overtravel limit switch, and bring it back in the opposite direction after resetting the alarm. • Check the overtravel input signal. • Check the parameters relating to overtravel alarm detection.
	b2: OTR	Reverse Overtravel	• Reverse overtravel of the SERVOPACK was detected (N-OT signal ON).	• Check the overtravel limit switch, and bring it back in the opposite direction after resetting the alarm. • Check the overtravel input signal. • Check the parameters relating to overtravel alarm detection.
	b3: SOTF	Positive Software Limit	• Movement towards the positive software limit area was detected.	• After checking the program and operation, reset the alarm and bring the switch back in the opposite direction. • Check the parameters relating to the software limit.
	b4: SOTR	Negative Software Limit	• Movement towards the negative software limit area was detected.	• After checking the program and operation, reset the alarm and bring the switch back in the opposite direction. • Check the parameters relating to the software limit.
	b5:	Not used	–	–
	b6: TIMEOVER	Positioning time exceeded	• After the command was executed, positioning could not be completed in the time set in OW□□34 (Positioning Completed Check Time).	• Check the parameters relating to the servo characteristics (each gain setting). • Check the connections between the SERVOPACK and motors.
	b7:	Not used	–	–
	b8:	Not used	–	–
	b9:	Not used	–	–
	b10:	Not used	–	–
	b11: SET_NRDY	No Zero Point	• No zero point has been set.	• Set the zero point.
	b12 to b16:	Not used	–	–
	b18: PGLEFT	Broken PG Wiring	• Encoder wiring is faulty or broken. • Encoder or SERVOPACK is faulty. • SVA Module is faulty.	• Check the encoder wiring. • Contact your Yaskawa sales representative.
	b19:	Not used	–	–

A.5 List of System Registers

This section outlines the system (S) registers that contain MP920 operation status and error information.

A.5.1 System (S) Register Allocation

SW00000	System service registers
SW00030	System status
SW00050	System error status
SW00080	User operation status
SW00090	System service execution status
SW00100	Interrupt input error status
SW00110	User operation error status
SW00200	System I/O error status
SW00424	Reserved for system
SW00500	Status for system analysis
SW00530	Reserved for system
SW00600	System operation error status
SW00620	Reserved for system
SW00800 SW01023	Reserved for Optional Modules

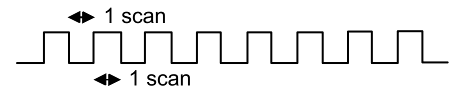
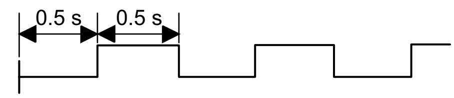
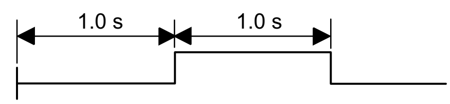
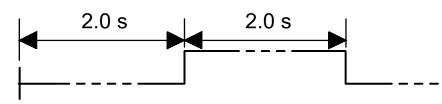
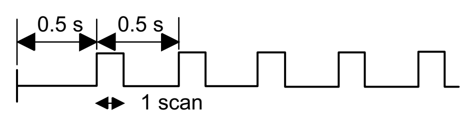
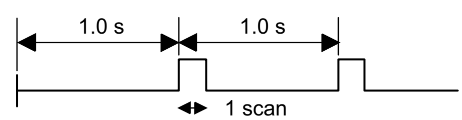
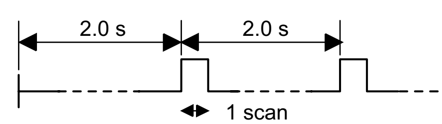
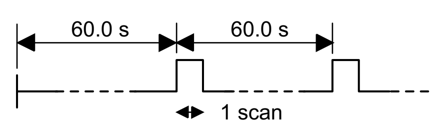
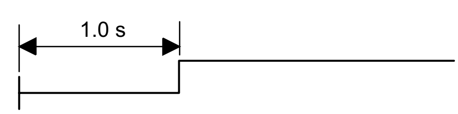
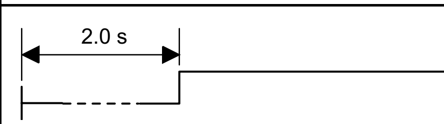
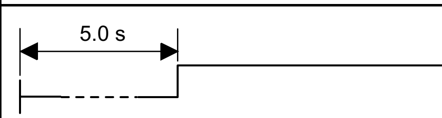
A.5.2 System Service Registers

■ Registers Common to All Drawings

Name	Register Number	Remarks
First High-speed Scan	SB000001	ON for only the first scan after high-speed scan is started.
First Low-speed Scan	SB000003	ON for only the first scan after low-speed scan is started.
Always ON	SB000004	–

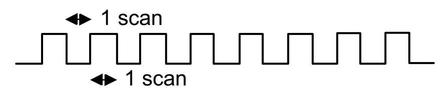
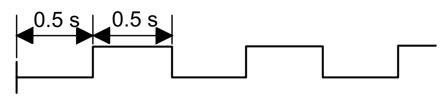
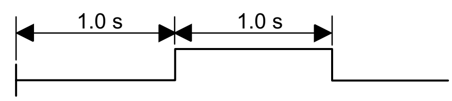
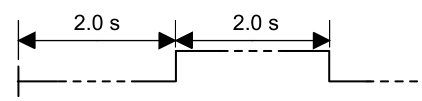
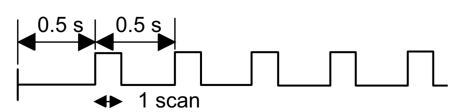
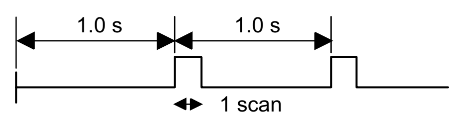
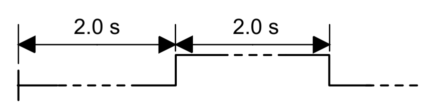
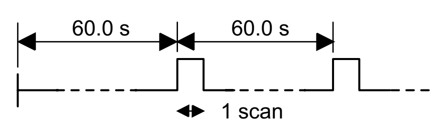
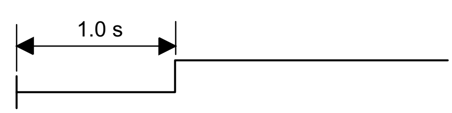
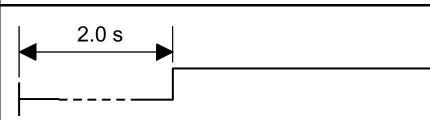
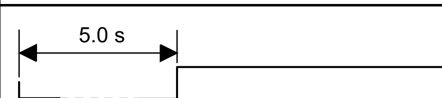
■ Registers Specific to DWG.H

These registers are set when HSCAN starts.

Name	Register Number	Remarks
1-scan Flicker Relay	SB000010	
0.5-s Flicker Relay	SB000011	
1.0-s Flicker Relay	SB000012	
2.0-s Flicker Relay	SB000013	
0.5-s Sampling Relay	SB000014	
1.0-s Sampling Relay	SB000015	
2.0-s Sampling Relay	SB000016	
60.0-s Sampling Relay	SB000017	
1.0 s After Start of Scan Relay	SB000018	
2.0 s After Start of Scan Relay	SB000019	
5.0 s After Start of Scan Relay	SB00001A	

■ Registers Specific to DWG.L

These registers are set when LSCAN starts.

Name	Register Number	Remarks
1-scan Flicker Relay	SB000030	
0.5-s Flicker Relay	SB000031	
1.0-s Flicker Relay	SB000032	
2.0-s Flicker Relay	SB000033	
0.5-s Sampling Relay	SB000034	
1.0-s Sampling Relay	SB000035	
2.0-s Sampling Relay	SB000036	
60.0-s Sampling Relay	SB000037	
1.0 s After Start of Scan Relay	SB000038	
2.0 s After Start of Scan Relay	SB000039	
5.0 s After Start of Scan Relay	SB00003A	

A

A.5.3 Scan Execution Status and Calendar

Name	Register Number	Remarks
High-speed Scan Set Value	SW00004	High-speed scan set value (0.1 ms)
High-speed Scan Current Value	SW00005	High-speed scan current value (0.1 ms)
High-speed Scan Maximum Value	SW00006	High-speed scan maximum value (0.1 ms)
Reserved for system	SW00007 to SW00009	Not used
Low-speed Scan Set Value	SW00010	Low-speed scan set value (0.1 ms)
Low-speed Scan Current Value	SW00011	Low-speed scan current value (0.1 ms)
Low-speed Scan Maximum Value	SW00012	Low-speed scan maximum value (0.1 ms)
Reserved for system	SW00013	Not used
Executing Scan Current Value	SW00014	Current value of the scan being executed (0.1 ms)
Calendar: Year	SW00015	Year 1999: 0099 (BCD) (lower 2 digits only)
Calendar: Month Day	SW00016	December 31: 1231 (BCD)
Calendar: Hours Minutes	SW00017	23 hours 59 minutes: 2359 (BCD)
Calendar: Seconds	SW00018	59 seconds: 59 (BCD)
Calendar: Day of week	SW00019	0 to 6: Sun. to Sat.

A.5.4 System Program Software Numbers and Remaining Program Memory Capacity

Name	Register Number	Remarks
System Program Software Number	SW00020	S□□□□ (□□□□ is stored as BCD.)
System Number	SW00021 to SW00025	Not used
Remaining Program Memory Capacity	SW00026	In bytes
Total Module Memory Capacity	SW00028	In bytes

A.6 Connection between Σ-II Series SERVOPACKs and MP920 Modules

The following conditions must be satisfied to connect Σ-II series SERVOPACKs and the MP920 Modules.

■ Software Version Number

MP920 Modules and MPE720		Version No.
MPE720		Ver.3.10 or later
MP920	SVA-01A	A08 or later
	SVA-02A	A05 or later
	SVB-01	A05 or later
	CPU-01	A07 or later

■ MP920 Fixed Parameters

SVA-01A and SVA-02A Modules

No.	Name			Setting	Description
14	Additional Function Selection	Bit 9	Σ-II series Servopack selection	1	Set this bit to 1 to enable the processing for Σ-II series SERVOPACK. 0: Use Σ-I series SERVOPACK. 1: Use Σ-II series SERVOPACK.
		Bits 12 to 15	Error detection coefficient	0 (default)	Change the setting if a position error occurs when using a high-resolution encoder. Position error will be checked by comparing the position with the value of the setting parameter OW☐☐0F (Error Count Alarm Detection Setting) mutiplied by 2^n (n: Error detection coefficient).

SVB-01 Module

No.	Name			Setting	Description
9	Number of Feedvack Pulses per Rotation (For High-resolution)			(No. of encoder pulses)	Set the number of encoder pulses before multiplication.
14	Additional Function Selection	bit 9	Number of encoder pulses setting selection	1	Set this bit to 1 to enable the fixed parameter No. 9. 0: Enables the fixed parameter No. 8. 1: Enables the fixed parameter No. 9.

INDEX

Numerics

A

B

C

Revision History

The revision dates and numbers of the revised manuals are given on the bottom of the back cover.

MANUAL NO. SIEZ-C887-2.1

© Printed in Japan December 2000 98-12 1-0

WEB revision number

Revision number

Date of printing

Date of original publication

Date of Printing	Rev. No.	WEB Rev. No.	Section	Revised Content
December 1998	–	–		First edition
December 2000	1	–	Back cover	Revision: Address
October 2002	2	–	Back cover	Revision: Address
November 2003	3	–	Back cover	Revision: Address
July 2005	4	–	Back cover	Revision: Address
March 2006	5	0		Based on Japanese user’s manual, SIZ-C887-2.1E<10>-1, available on the Web.
			All chapters	Completely revised

Machine Controller MP920

USER'S MANUAL
DESIGN AND MAINTENANCE

IRUMA BUSINESS CENTER (SOLUTION CENTER)
480, Kamifujisawa, Iruma, Saitama 358-8555, Japan
Phone 81-4-2962-5696 Fax 81-4-2962-6138

YASKAWA ELECTRIC AMERICA, INC.
2121 Norman Drive South, Waukegan, IL 60085, U.S.A.
Phone 1-847-887-7000 Fax 1-847-887-7370

YASKAWA ELÉTRICO DO BRASIL COMÉRCIO LTD.A.
Avenida Fagundes Filho, 620 Bairro Saude-Sao Pãulo-SP, Brazil CEP: 04304-000
Phone 55-11-5071-2552 Fax 55-11-5581-8795

YASKAWA ELECTRIC EUROPE GmbH
Am Kronberger Hang 2, 65824 Schwalbach, Germany
Phone 49-6196-569-300 Fax 49-6196-569-312

YASKAWA ELECTRIC UK LTD.
1 Hunt Hill Orchardton Woods Cumbernauld, G68 9LF, United Kingdom
Phone 44-1236-735000 Fax 44-1236-458182

YASKAWA ELECTRIC KOREA CORPORATION
7F, Doore Bldg. 24, Yeoido-dong, Youngdungpo-Ku, Seoul 150-877, Korea
Phone 82-2-784-7844 Fax 82-2-784-8495

YASKAWA ELECTRIC (SINGAPORE) PTE. LTD.
151 Lorong Chuan, #04-01, New Tech Park 556741, Singapore
Phone 65-6282-3003 Fax 65-6289-3003

YASKAWA ELECTRIC (SHANGHAI) CO., LTD.
No.18 Xizang Zhong Road. Room 1702-1707, Harbour Ring Plaza Shanghai 200001, China
Phone 86-21-5385-2200 Fax 86-21-5385-3299

YASKAWA ELECTRIC (SHANGHAI) CO., LTD. BEIJING OFFICE
Room 1011A, Tower W3 Oriental Plaza, No.1 East Chang An Ave.,
Dong Cheng District, Beijing 100738, China
Phone 86-10-8518-4086 Fax 86-10-8518-4082

YASKAWA ELECTRIC TAIWAN CORPORATION
9F, 16, Nanking E. Rd., Sec. 3, Taipei, Taiwan
Phone 886-2-2502-5003 Fax 886-2-2505-1280

YASKAWA ELECTRIC CORPORATION

YASKAWA

In the event that the end user of this product is to be the military and said product is to be employed in any weapons systems or the manufacture thereof, the export will fall under the relevant regulations as stipulated in the Foreign Exchange and Foreign Trade Regulations. Therefore, be sure to follow all procedures and submit all relevant documentation according to any and all rules, regulations and laws that may apply.

Specifications are subject to change without notice
for ongoing product modifications and improvements.

© 1998-2006 YASKAWA ELECTRIC CORPORATION. All rights reserved.

MANUAL NO. SIEZ-C887-2.1B

Printed in Japan March 2006 98-12 5-0
05-7 7