



PROGRAMMABLE CONTROLLERS

**MELSEC iQ-F**  
series

## MELSEC iQ-F FX5 Simple Motion Module User's Manual (Startup)

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FX5-40SSC-S



# SAFETY PRECAUTIONS

(Read these precautions before use.)

Before using this product, please read this manual and the relevant manuals introduced in this manual carefully and pay full attention to safety in order to handle the product correctly.

This manual classifies the safety precautions into two categories: [⚠ WARNING] and [⚠ CAUTION].

<b>⚠ WARNING</b>	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
<b>⚠ CAUTION</b>	Indicates that incorrect handling may cause hazardous conditions, resulting in minor or moderate injury or property damage.

Depending on the circumstances, procedures indicated by [⚠ CAUTION] may also cause severe injury.

It is important to follow all precautions for personal safety.

Store this manual in a safe place so that it can be read whenever necessary. Always forward it to the end user.

## [DESIGN PRECAUTIONS]

### ⚠ WARNING

- Make sure to set up the following safety circuits outside the PLC to ensure safe system operation even during external power supply problems or PLC failure. Otherwise, malfunctions may cause serious accidents.
  - Most importantly, set up the following: an emergency stop circuit, a protection circuit, an interlock circuit for opposite movements (such as forward vs. reverse rotation), and an interlock circuit to prevent damage to the equipment at the upper and lower positioning limits.
  - Note that when the CPU module detects an error, such as a watchdog timer error, during self-diagnosis, all outputs are turned off. Also, when an error that cannot be detected by the CPU module occurs in an input/output control block, output control may be disabled. External circuits and mechanisms should be designed to ensure safe machine operation in such a case.
  - Note that the output current of the 24 V DC service power supply varies depending on the model and the absence/presence of extension modules. If an overload occurs, the voltage automatically drops, inputs in the PLC are disabled, and all outputs are turned off. External circuits and mechanisms should be designed to ensure safe machine operation in such a case.
  - Note that when an error occurs in a relay, triac or transistor of an output circuit, the output might stay on or off. For output signals that may lead to serious accidents, external circuits and mechanisms should be designed to ensure safe machine operation.
- Construct an interlock circuit in the program to ensure safe operation for the whole system when executing control (for data change) of the PLC in operation.  
Read the manual thoroughly and ensure complete safety before executing other controls (for program change, parameter change, forced output and operation status change) of the PLC in operation. Otherwise, the machine may be damaged and accidents may occur due to erroneous operations.
- In an output circuit, when a load current exceeding the current rating or an overcurrent caused by a load short-circuit flows for a long time, it may cause smoke and fire. To prevent this, configure an external safety circuit, such as a fuse.
- For the operating status of each station after a communication failure of the network, refer to relevant manuals for the network. Incorrect output or malfunction may result in an accident.

## [DESIGN PRECAUTIONS]

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### CAUTION

- When an inductive load such as a lamp, heater, or solenoid valve is controlled, a large current (approximately ten times greater than normal) may flow when the output is turned from off to on. Take proper measures so that the flowing current does not exceed the value corresponding to the maximum load specification of the resistance load.
  - After the CPU module is powered on or is reset, the time taken to enter the RUN status varies depending on the system configuration, parameter settings, and/or program size.  
Design circuits so that the entire system will always operate safely, regardless of this variation in time.
  - Simultaneously turn on and off the power supplies of the CPU module and extension modules.
  - If a long-time power failure or an abnormal voltage drop occurs, the PLC stops, and output is turned off. When the power supply is restored, it will automatically restart (when the RUN/STOP/RESET switch is on RUN).
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## [INSTALLATION PRECAUTIONS]

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### WARNING

- Make sure to cut off all phases of the power supply externally before attempting installation or wiring work. Failure to do so may cause electric shock or damage to the product.
  - Use the product within the generic environment specifications described in the generic specifications of the following manual.  
**MELSEC iQ-F FX5 User's Manual (Hardware)**  
Never use the product in areas with excessive dust, oily smoke, conductive dusts, corrosive gas (salt air, Cl<sub>2</sub>, H<sub>2</sub>S, SO<sub>2</sub> or NO<sub>2</sub>), flammable gas, vibration or impacts, or expose it to high temperature, condensation, or rain and wind.  
If the product is used in such conditions, electric shock, fire, malfunctions, deterioration or damage may occur.
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## [INSTALLATION PRECAUTIONS]

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### CAUTION

- Do not touch the conductive parts of the product directly. Doing so may cause device failures or malfunctions.
  - When drilling screw holes or wiring, make sure that cutting and wiring debris do not enter the ventilation slits of the PLC. Failure to do so may cause fire, equipment failures or malfunctions.
  - For product supplied together with a dust proof sheet, the sheet should be affixed to the ventilation slits before the installation and wiring work in order to block foreign objects such as cutting and wiring debris.  
However, when the installation work is completed, make sure to remove the sheet to provide adequate ventilation. Failure to do so may cause fire, equipment failures or malfunctions.
  - Install the product on a flat surface. If the mounting surface is rough, undue force will be applied to the PC board, thereby causing nonconformities.
  - Install the product securely using a DIN rail or mounting screws.
  - Connect the expansion board and expansion adapter securely to their designated connectors. Loose connections may cause malfunctions.
  - Make sure to affix the expansion board with tapping screws. Tightening torque should follow the specifications in the manual. If the screws are tightened outside of the specified torque range, poor connections may cause malfunctions.
  - Work carefully when using a screwdriver during product installation. Failure to do so may cause damage to the product or accidents.
  - Connect the extension cables, peripheral device cables, input/output cables and battery connecting cable securely to their designated connectors. Loose connections may cause malfunctions.
  - When using an SD memory card, insert it into the SD memory card slot. Check that it is inserted completely. Poor contact may cause malfunction.
  - Turn off the power to the PLC before attaching or detaching the following devices. Failure to do so may cause device failures or malfunctions.
    - Peripheral devices, expansion board and expansion adapter
    - Extension modules and bus conversion module
    - Battery
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## [WIRING PRECAUTIONS]

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### **WARNING**

- Make sure to cut off all phases of the power supply externally before attempting installation or wiring work. Failure to do so may cause electric shock or damage to the product.
- Make sure to attach the terminal cover, provided as an accessory, before turning on the power or initiating operation after installation or wiring work. Failure to do so may cause electric shock.
- The temperature rating of the cable should be 80°C or more.
- Make sure to wire the screw terminal block in accordance with the following precautions. Failure to do so may cause electric shock, equipment failures, a short-circuit, wire breakage, malfunctions, or damage to the product.
  - Wire terminals should follow the dimensions described in the manual.
  - Tightening torque should follow the specifications in the manual.
  - Tighten the screws using a Phillips-head screwdriver No. 2 (shaft diameter 6 mm (0.24") or less).  
Make sure that the screwdriver does not touch the partition part of the terminal block.
- Make sure to wire the terminal block (European type) in accordance with the following precautions. Failure to do so may cause electric shock, equipment failures, a short-circuit, wire breakage, malfunctions, or damage to the product.
  - Wire terminals should follow the dimensions described in the manual.
  - Tightening torque should follow the specifications in the manual.
  - Twist the ends of stranded wires and make sure that there are no loose wires.
  - Do not solder-plate the electric wire ends.
  - Do not connect more than the specified number of wires or electric wires of unspecified size.
  - Affix the electric wires so that neither the terminal block nor the connected parts are directly stressed.

## [WIRING PRECAUTIONS]

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### **CAUTION**

- Do not supply power to the [24 +] and [24 V] terminals (24 V DC service power supply) on the CPU module or extension modules. Doing so may cause damage to the product.
- Perform class D grounding (grounding resistance: 100 Ω or less) of the grounding terminal on the CPU module and extension modules with a wire 2 mm<sup>2</sup> or thicker.  
However, do not use common grounding with heavy electrical systems. Refer to the following for the details.  
[MELSEC iQ-F FX5 User's Manual \(Hardware\)](#)
- Connect the power supply wiring to the dedicated terminals described in the manual. If an AC power supply is connected to a DC input/output terminal or DC power supply terminal, the PLC will burn out.
- Do not wire vacant terminals externally. Doing so may cause damage to the product.
- Install module so that excessive force will not be applied to terminal blocks, power connectors, I/O connectors, communication connectors, or communication cables. Failure to do so may result in wire damage/breakage or PLC failure.

## **CAUTION**

- Make sure to observe the following precautions in order to prevent any damage to the machinery or accidents due to malfunction of the PLC caused by abnormal data written to the PLC due to the effects of noise.
  - Do not bundle the power line, control line and communication cables together with or lay them close to the main circuit, high-voltage line, load line or power line. As a guideline, lay the power line, control line and connection cables at least 100 mm (3.94") away from the main circuit, high-voltage line, load line or power line.
  - Ground the shield of the shield wire or shielded cable at one point on the PLC. However, do not use common grounding with heavy electrical systems.
  - Ground the shield of the analog input/output cable at one point on the signal receiving side. Do not use common grounding with heavy electrical systems.

## [STARTUP AND MAINTENANCE PRECAUTIONS]

### **WARNING**

- Do not touch any terminal while the PLC's power is on. Doing so may cause electric shock or malfunctions.
- Before cleaning or retightening terminals, cut off all phases of the power supply externally. Failure to do so may cause electric shock.
- Before modifying the program in mid-operation, forcing output, running or stopping the PLC, read through the manual carefully, and ensure complete safety. An operation error may damage the machinery or cause accidents.
- Do not change the program in the PLC from two or more peripheral equipment devices at the same time. (i.e. from an engineering tool and a GOT) Doing so may cause destruction or malfunction of the PLC program.
- Use the battery for memory backup in conformance to the following manual.

MELSEC iQ-F FX5 User's Manual (Hardware)

- Use the battery for the specified purpose only.
- Connect the battery correctly.
- Do not charge, disassemble, heat, put in fire, short-circuit, connect reversely, weld, swallow or burn the battery, or apply excessive force (vibration, impact, drop, etc.) to the battery.
- Do not store or use the battery at high temperatures or expose to direct sunlight.
- Do not expose to water, bring near fire or touch liquid leakage or other contents directly.

Incorrect handling of the battery may cause excessive heat, bursting, ignition, liquid leakage or deformation, and lead to injury, fire or failures and malfunction of facilities and other equipment.

## [STARTUP AND MAINTENANCE PRECAUTIONS]

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### CAUTION

- Do not disassemble or modify the PLC. Doing so may cause fire, equipment failures, or malfunctions.  
\*For repair, contact your local Mitsubishi Electric representative.
- After the first use of the SD memory card, do not insert/remove the memory card more than 500 times. Insertion/removal 500 times or more may cause malfunction.
- Turn off the power to the PLC before connecting or disconnecting any extension cable. Failure to do so may cause device failures or malfunctions.
- Turn off the power to the PLC before attaching or detaching the following devices. Failure to do so may cause device failures or malfunctions.
  - Peripheral devices, expansion board and expansion adapter
  - Extension modules and bus conversion module
  - Battery

## [OPERATION PRECAUTIONS]

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### CAUTION

- Construct an interlock circuit in the program to ensure safe operation for the whole system when executing control (for data change) of the PLC in operation. Read the manual thoroughly and ensure complete safety before executing other controls (for program change, parameter change, forced output and operation status change) of the PLC in operation. Otherwise, the machine may be damaged and accidents may occur by erroneous operations.

## [DISPOSAL PRECAUTIONS]

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### CAUTION

- Please contact a certified electronic waste disposal company for the environmentally safe recycling and disposal of your device.
- When disposing of batteries, separate them from other waste according to local regulations. For details on the Battery Directive in EU countries, refer to the following.  
MELSEC iQ-F FX5 User's Manual (Hardware)

## [TRANSPORTATION PRECAUTIONS]

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### CAUTION

- When transporting the PLC with the optional battery, turn on the PLC before shipment, confirm that the battery mode is set in PLC parameters and the BAT LED is OFF, and check the battery life. If the PLC is transported with the BAT LED on or the battery exhausted, the battery-backed data may be lost during transportation.
  - The PLC is a precision instrument. During transportation, avoid impacts larger than those specified in the general specifications by using dedicated packaging boxes and shock-absorbing palettes. Failure to do so may cause failures in the PLC. After transportation, verify operation of the PLC and check for damage of the mounting part, etc. For details on the general specifications, refer to the following.  
MELSEC iQ-F FX5 User's Manual (Hardware)
  - When transporting lithium batteries, follow required transportation regulations. For details on the regulated products, refer to the following.  
MELSEC iQ-F FX5 User's Manual (Hardware)
  - Fumigants that contain halogen materials such as fluorine, chlorine, bromine, and iodine used for disinfecting and protecting wooden packaging from insects will cause malfunction in Mitsubishi products. Please take necessary precautions to ensure that residual fumigants do not enter the product, or treat packaging with methods other than fumigation (heat method). Additionally, disinfect and protect wood from insects before packing.
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# CONDITIONS OF USE FOR THE PRODUCT

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- (1) Mitsubishi programmable controller ("the PRODUCT") shall be used in conditions;
- i) where any problem, fault or failure occurring in the PRODUCT, if any, shall not lead to any major or serious accident; and
  - ii) where the backup and fail-safe function are systematically or automatically provided outside of the PRODUCT for the case of any problem, fault or failure occurring in the PRODUCT.

- (2) The PRODUCT has been designed and manufactured for the purpose of being used in general industries.

MITSUBISHI SHALL HAVE NO RESPONSIBILITY OR LIABILITY (INCLUDING, BUT NOT LIMITED TO ANY AND ALL RESPONSIBILITY OR LIABILITY BASED ON CONTRACT, WARRANTY, TORT, PRODUCT LIABILITY) FOR ANY INJURY OR DEATH TO PERSONS OR LOSS OR DAMAGE TO PROPERTY CAUSED BY the PRODUCT THAT ARE OPERATED OR USED IN APPLICATION NOT INTENDED OR EXCLUDED BY INSTRUCTIONS, PRECAUTIONS, OR WARNING CONTAINED IN MITSUBISHI'S USER, INSTRUCTION AND/OR SAFETY MANUALS, TECHNICAL BULLETINS AND GUIDELINES FOR the PRODUCT.

("Prohibited Application")

Prohibited Applications include, but not limited to, the use of the PRODUCT in;

- Nuclear Power Plants and any other power plants operated by Power companies, and/or any other cases in which the public could be affected if any problem or fault occurs in the PRODUCT.
- Railway companies or Public service purposes, and/or any other cases in which establishment of a special quality assurance system is required by the Purchaser or End User.
- Aircraft or Aerospace, Medical applications, Train equipment, transport equipment such as Elevator and Escalator, Incineration and Fuel devices, Vehicles, Manned transportation, Equipment for Recreation and Amusement, and Safety devices, handling of Nuclear or Hazardous Materials or Chemicals, Mining and Drilling, and/or other applications where there is a significant risk of injury to the public or property.

Notwithstanding the above, restrictions Mitsubishi may in its sole discretion, authorize use of the PRODUCT in one or more of the Prohibited Applications, provided that the usage of the PRODUCT is limited only for the specific applications agreed to by Mitsubishi and provided further that no special quality assurance or fail-safe, redundant or other safety features which exceed the general specifications of the PRODUCTS are required. For details, please contact the Mitsubishi representative in your region.

# INTRODUCTION

Thank you for purchasing the Mitsubishi MELSEC iQ-F series programmable controllers.

This manual describes the functions and programming of the relevant products listed below. Before using this product, please read this manual and the relevant manuals carefully and develop familiarity with the functions and performance of the MELSEC iQ-F series programmable controller to handle the product correctly.

When applying the program examples provided in this manual to an actual system, ensure the applicability and confirm that it will not cause system control problems.

Please make sure that the end users read this manual.

## Relevant products

FX5-40SSC-S



In this manual, buffer memories are classified using the following symbols. Each area name can represent the buffer memories corresponding to each axis.

- [Pr.\*\*]: Symbols indicating positioning parameter or home position return parameter items
- [Da.\*\*]: Symbols indicating positioning data or block start data items
- [Md.\*\*]: Symbols indicating monitor data items
- [Cd.\*\*]: Symbols indicating control data items

## Outline Precautions

- This product has been manufactured as a general-purpose part for general industries, and has not been designed or manufactured to be incorporated in a device or system used in purposes related to human life.
- Before using the product for special purposes such as nuclear power, electric power, aerospace, medicine or passenger movement vehicles, consult Mitsubishi Electric.
- This product has been manufactured under strict quality control. However when installing the product where major accidents or losses could occur if the product fails, install appropriate backup or failsafe functions in the system.

## Disclaimer

- If in doubt at any stage during the installation of the product, always consult a professional electrical engineer who is qualified and trained in the local and national standards. If in doubt about the operation or use, please consult the nearest Mitsubishi Electric representative.
- Since the examples indicated by this manual, technical bulletin, catalog, etc. are used as a reference, please use it after confirming the function and safety of the equipment and system. Mitsubishi Electric will accept no responsibility for actual use of the product based on these illustrative examples.
- This manual content, specification etc. may be changed, without a notice, for improvement.
- The information in this manual has been carefully checked and is believed to be accurate; however, if you notice a doubtful point, an error, etc., please contact the nearest Mitsubishi Electric representative. When doing so, please provide the manual number given at the end of this manual.

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# RELATED MANUALS

Manual name <manual number>	Description
MELSEC iQ-F FX5 Simple Motion Module User's Manual (Startup) <IB-0300251> (This manual)	Specifications, procedures before operation, system configuration, wiring, and operation examples of the Simple Motion module
MELSEC iQ-F FX5 Simple Motion Module User's Manual (Application) <IB-0300253>	Functions, input/output signals, buffer memories, parameter settings, programming, and troubleshooting of the Simple Motion module
MELSEC iQ-F FX5 Simple Motion Module User's Manual (Advanced Synchronous Control) <IB-0300255>	Functions and programming for the synchronous control of the Simple Motion module

This manual does not include detailed information on the followings:

- General specifications
- Available CPU modules and the number of mountable modules
- Installation

For details, refer to the following.

 MELSEC iQ-F FX5U User's Manual (Hardware)

 MELSEC iQ-F FX5UC User's Manual (Hardware)

## Point

e-Manual refers to the Mitsubishi FA electronic book manuals that can be browsed using a dedicated tool.

e-Manual has the following features:

- Required information can be cross-searched in multiple manuals.
- Other manuals can be accessed from the links in the manual.
- The hardware specifications of each part can be found from the product figures.
- Pages that users often browse can be bookmarked.

# TERMS

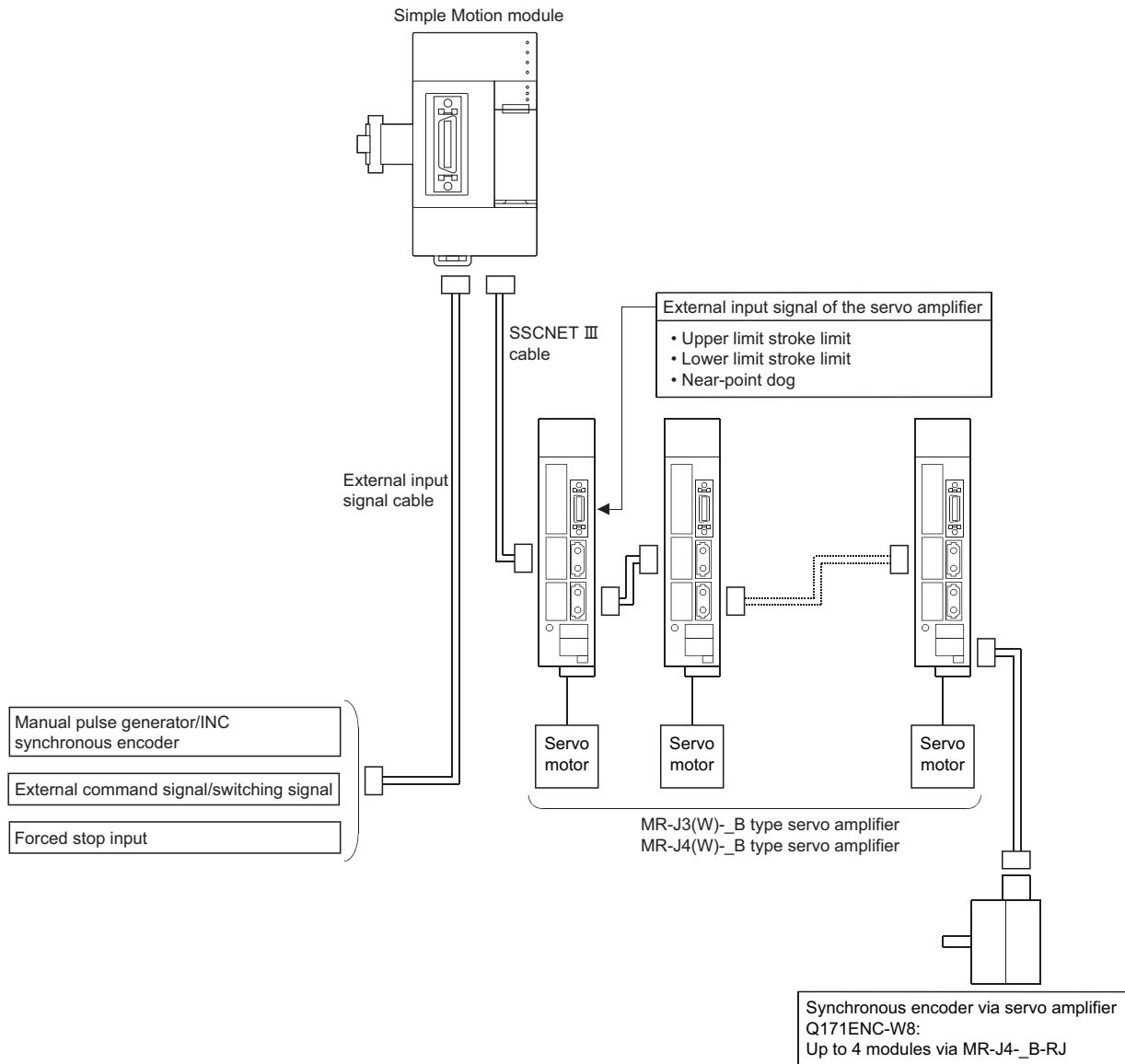
Unless otherwise specified, this manual uses the following terms.

Term	Description
CPU module	Abbreviation for the MELSEC iQ-F series CPU module.
Simple Motion module	Abbreviation for the MELSEC iQ-F series Simple Motion module.
40SSC-S	Another term for the MELSEC iQ-F series Simple Motion module.
Servo amplifier	Abbreviation for SSCNET <sup>III</sup> /H and SSCNET <sup>III</sup> compatible servo amplifier.
MR-J4(W)-B	MR-J4-_B/MR-J4W_-_B Servo amplifier series
MR-J3(W)-B	MR-J3-_B/MR-J3W_-_B Servo amplifier series
MR-JE-B	MR-JE-_B Servo amplifier series
Engineering tool	Generic term for GX Works3 and MR Configurator2.
GX Works3	Product name of the software package for the MELSEC programmable controllers (Version 1.005F or later).
MR Configurator2	Product name of the setup software for the servo amplifier (Version 1.34L or later).
Intelligent function module	A MELSEC iQ-F series module that has functions other than input or output, such as Simple Motion module
Manual pulse generator	Abbreviation for manual pulse generator (prepared by user).
SSCNET <sup>III</sup> /H <sup>*1</sup>	High speed synchronous communication network between Simple Motion module and servo amplifier.
SSCNET <sup>III</sup> <sup>*1</sup>	
SSCNET <sup>III</sup> (/H)	
Servo network	Generic term for SSCNET <sup>III</sup> /H, SSCNET <sup>III</sup> .

\*1 SSCNET: Servo System Controller NETwork

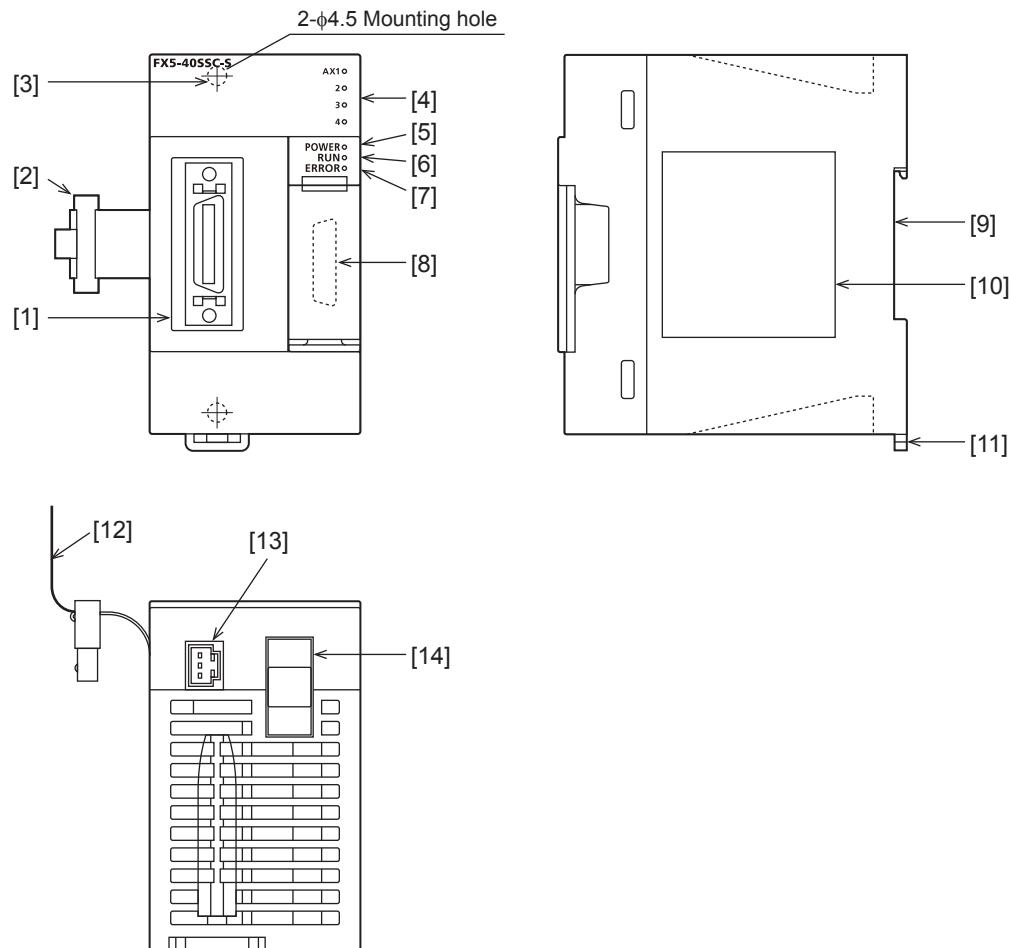
# PERIPHERALS

The following figure shows the peripherals when the Simple Motion module is used.



# 1 PART NAMES

This chapter describes the part names of the Simple Motion module.



No.	Name	Description
[1]	External input connection connector	Connects to a mechanical system input, manual pulse generator/incremental synchronous encoder, or forced stop input. (26-pin connector) For the signal layout, refer to the following. <a href="#">Page 19 Specifications of Interfaces with External Devices</a>
[2]	Extension cable	Connects to a CPU module, etc.
[3]	Direct mounting hole: 2 holes of Φ4.5 (0.18") (mounting screw: M4 screw)	Holes which are used when installed directly.
[4]	Axis display LED (AX1, AX2, AX3, AX4)	For details, refer to the following. <a href="#">Page 16 LED Display Specifications</a>
[5]	POWER LED	
[6]	RUN LED	
[7]	ERROR LED	
[8]	Extension connector	Connects to an expansion module on the next tier.
[9]	DIN rail mounting groove	Using this slot, the module can be mounted to DIN rail "DIN46277" (width: 35 mm).
[10]	Name plate	Serial No. etc., are printed.
[11]	DIN rail mounting hook	Hook which is used for mounting the module onto the DIN rail.
[12]	Pullout tab	Tab for removing from a CPU module, etc.
[13]	Power supply connector	Connects to a module to the power.
[14]	SSCNETIII cable connector	Connects to a servo amplifier.

# 1.1 LED Display Specifications

This section lists LED display specifications.

□: OFF, ■: ON, ●: Flashing

Simple Motion module status	LED display	Description
Normal operation	AX1 □ AX2 □ AX3 □ AX4 □	The axes stopped The axes on standby
	POWER ■*1 RUN ■ ERROR □	
	AX1 ■ AX2 □ AX3 □ AX4 □	The axis in operation
	POWER ■*1 RUN ■ ERROR □	
	AX1 ● AX2 □ AX3 □ AX4 □	
	POWER ■*1 RUN ■ ERROR ■	
Operation failure	AX1 □ AX2 □ AX3 □ AX4 □	Minor error
	POWER ■*1 RUN ■ ERROR ■	
	AX1 □ AX2 □ AX3 □ AX4 □	Moderate error Watchdog timer error
	POWER ■*1 RUN ■ ERROR ●	

\*1 When the power is supplied for the Simple Motion module, the POWER LED turns ON. When the power is not supplied, all LEDs including the POWER LED turn OFF.

\*2 When an error occurs in the synchronous encoder axis, only the ERROR LED operates. (The AX LED does not operate.)

# 2 SPECIFICATIONS

This chapter describes the specifications of the 40SSC-S.

## 2.1 General Specifications

General specifications except the following are the same as the connected CPU module.

Refer to the CPU module User's Manual for the general specifications that can be used.

Items	Specifications	
Dielectric withstand voltage	500 V AC for 1 minute	Between all terminals and ground terminal
Insulation resistance	10 MΩ or higher by 500 V DC insulation resistance tester	

## 2.2 Power Supply Specifications

Items	Specifications	
External power supply	Power supply voltage	24 V DC +20% -15%
	Permitted instantaneous power failure time	Operation continues when the instantaneous power failure is shorter than 5 ms.
	Electricity consumption	6 W
	Power fuse	1 A
Internal power supply	PLC power supply	Not used.

## 2.3 Performance Specifications

This section lists the performance specifications of the 40SSC-S.

Item	Description
Number of controlled axes	4 axes
Operation cycle	1.777 ms
Interpolation function	2-, 3-, or 4-axis linear interpolation, 2-axis circular interpolation
Control system	PTP (Point To Point) control, path control (both linear and arc can be set), speed control, speed-position switching control, position-speed switching control, speed-torque control
Control unit	mm, inch, degree, pulse
Positioning data	600 data/axis
Execution data backup function	Parameters, positioning data, and block start data can be saved on flash ROM. (battery-less backup)

Item		Description
Positioning	Positioning system	PTP control: Incremental system/absolute system Speed-position switching control: Incremental system/absolute system Position-speed switching control: Incremental system Path control: Incremental system/absolute system
	Positioning range	In absolute system <ul style="list-style-type: none"> <li>• -214748364.8 to 214748364.7 (<math>\mu\text{m}</math>)</li> <li>• -21474.83648 to 21474.83647 (inch)</li> <li>• 0 to 359.99999 (degree)</li> <li>• -2147483648 to 2147483647 (pulse)</li> </ul> In incremental system <ul style="list-style-type: none"> <li>• -214748364.8 to 214748364.7 (<math>\mu\text{m}</math>)</li> <li>• -21474.83648 to 21474.83647 (inch)</li> <li>• -21474.83648 to 21474.83647 (degree)</li> <li>• -2147483648 to 2147483647 (pulse)</li> </ul> In speed-position switching control (INC mode)/position-speed switching control <ul style="list-style-type: none"> <li>• 0 to 214748364.7 (<math>\mu\text{m}</math>)</li> <li>• 0 to 21474.83647 (inch)</li> <li>• 0 to 21474.83647 (degree)</li> <li>• 0 to 2147483647 (pulse)</li> </ul> In speed-position switching control (ABS mode) <sup>*1</sup> 0 to 359.99999 (degree)
	Speed command	0.01 to 2000000.00 (mm/min) 0.001 to 2000000.000 (inch/min) 0.001 to 2000000.000 (degree/min) <sup>*2</sup> 1 to 1000000000 (pulse/s)
	Acceleration/deceleration process	Trapezoidal acceleration/deceleration, S-curve acceleration/deceleration
	Acceleration/deceleration time	1 to 8388608 (ms) (Four patterns can be set for each of acceleration time and deceleration time.)
	Sudden stop deceleration time	1 to 8388608 (ms)
	Starting time <sup>*3</sup>	1.777 ms
	External wiring connection system	26-pin connector
Applicable wire size <sup>*4</sup>		AWG30 to 24 (0.05 to 0.2 mm <sup>2</sup> ) <sup>*4</sup>
External input wiring connector		LD77MHIOCON
Manual pulse generator/ Incremental synchronous encoder input maximum frequency	Differential-output type	Up to 1 M pulses/s
	Open-collector type	Up to 200 k pulses/s
Manual pulse generator 1 pulse input magnification		1 to 10000 times
Flash ROM write count		Max. 100000 times
Number of occupied I/O points		8 points
Mass		Approx. 0.3 kg

\*1 The speed-position switching control (ABS mode) can be used only when the control unit is "degree".

\*2 When "Speed control 10 times multiplier setting for degree axis function" is valid, the setting range is 0.01 to 2000000.00 (degree/min).

\*3 Time from accepting the positioning start signal until BUSY signal turns ON.

\*4 AWG24 (0.2 mm<sup>2</sup>) is recommended.

## 2.4 Specifications of Interfaces with External Devices

### Electrical specifications of input signals

2

#### External input signal/switching signal

##### ■Specifications of external input signal/switching signal

Item	Specifications
Signal name	Near-point dog signal/External input signal/Switching signal
Number of input points	4 points
Input method	Positive common/Negative common shared
Common terminal arrangement	4 points/common (Common contact: COM)
Isolation method	Photocoupler
Rated input voltage	24 V DC
Rated input current ( $I_{IN}$ )	Approx. 5 mA
Operating voltage range	19.2 to 26.4 V DC (24 V DC+10/-20%, ripple ratio 5% or less)
ON voltage/current	17.5 V DC or more/3.5 mA or more
OFF voltage/current	7 V DC or less/1 mA or less
Input resistance	Approx. 6.8 kΩ
Response time	OFF → ON ON → OFF

#### Forced stop input

##### ■Specifications of forced stop input signal

Item	Specifications
Number of input points	1 point
Input method	Positive common/Negative common shared
Common terminal arrangement	1 point/common (Common contact: EMI.COM)
Isolation method	Photocoupler
Rated input voltage	24 V DC
Rated input current ( $I_{IN}$ )	Approx. 5 mA
Operating voltage range	19.2 to 26.4 V DC (24 V DC+10/-20%, ripple ratio 5% or less)
ON voltage/current	17.5 V DC or more/3.5 mA or more
OFF voltage/current	7 V DC or less/1 mA or less
Input resistance	Approx. 6.8 kΩ
Response time	OFF → ON ON → OFF

## Manual pulse generator/Incremental synchronous encoder input

### ■Specifications of manual pulse generator/incremental synchronous encoder

Item	Specifications	
Signal input form <sup>*1</sup>	Phase A/Phase B (Magnification by 4/Magnification by 2/Magnification by 1), PULSE/SIGN	
Differential-output type (26LS31 or equivalent)	Maximum input pulse frequency	1 Mpulses/s (After magnification by 4, up to 4 Mpulses/s) <sup>*2</sup>
	Pulse width	1 µs or more
	Leading edge/trailing edge time	0.25 µs or less
	Phase difference	0.25 µs or more
	Rated input voltage	5.5 V DC or less
	High-voltage	2.0 to 5.25 V DC
	Low-voltage	0 to 0.8 V DC
	Differential voltage	±0.2 V
Cable length		Up to 30 m (98.43 ft.)
Example of waveform		<p>(Note): Duty ratio 50%</p>
Voltage-output type/Open-collector type (5 V DC)	Maximum input pulse frequency	200 kpulses/s (After magnification by 4, up to 800 kpulses/s) <sup>*2</sup>
	Pulse width	5 µs or more
	Leading edge/trailing edge time	1.2 µs or less
	Phase difference	1.2 µs or more
	Rated input voltage	5.5 V DC or less
	High-voltage	3.0 to 5.25 V DC/2 mA or less
	Low-voltage	0 to 1.0 V DC/5 mA or more
	Cable length	Up to 10 m (32.81 ft.)
Example of waveform		<p>(Note): Duty ratio 50%</p>

\*1 Set the signal input form in "[Pr.24] Manual pulse generator/Incremental synchronous encoder input selection".

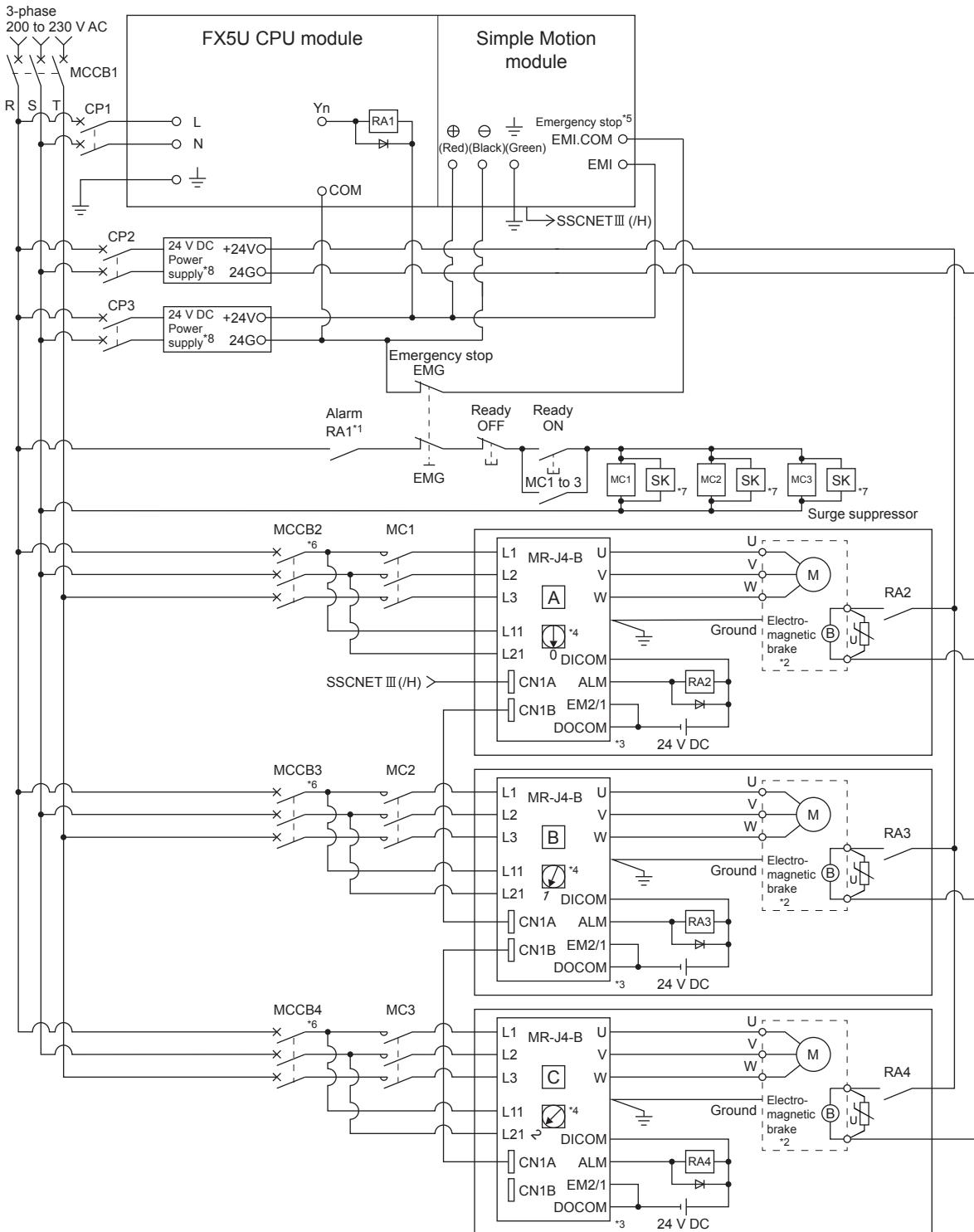
[Pr.24] Manual pulse generator/Incremental synchronous encoder input selection	[Pr.151] Manual pulse generator/Incremental synchronous encoder input logic selection	
	Positive logic	Negative logic
Phase A/Phase B	Forward run  Reverse run   	Forward run  Reverse run   
PULSE/SIGN	Forward run  Reverse run  HIGH LOW	Forward run  Reverse run  LOW HIGH

\*2 Maximum input pulse frequency is magnified by 4, when "A-phase/B-phase Magnification by 4" is set in "[Pr.24] Manual pulse generator/Incremental synchronous encoder input selection".

## 2.5 External Circuit Design

Configure up the power supply circuit and main circuit which turn off the power supply after detection alarm occurrence and servo forced stop. When designing the main circuit of the power supply, make sure to use a circuit breaker (MCCB). The outline diagrams for the external device connection interface are shown below.

### Example when using the forced stop of the Simple Motion module (For MR-J4-B)



- \*1 Configure up the power supply circuit which switches off the electromagnetic contactor (MC) after detecting the alarm occurrence on the CPU module.
- \*2 It is also possible to use a full wave rectified power supply as the power supply for the electromagnetic brake.
- \*3 It is also possible to perform the forced stop using a forced stop terminal of the servo amplifier.
- \*4 Set the axis selection rotary switch of servo amplifier as follows to set the axis No. of servo amplifier.
  - Axis 1: 0, Axis 2: 1, Axis 3: 2, Axis 4: 3
- \*5 The status of forced stop input signal can be confirmed with "[Md.50] Forced stop input". Be sure that the forced stop 24 V DC power supply is not used with the electromagnetic brake of the motor or the electromagnetic valve power supply.
- \*6 Refer to the servo amplifier instruction manual for selection of the circuit breaker and electromagnetic contactor.
- \*7 The surge suppressor is recommended to be used for an AC relay or electromagnetic contactor (MC) near the servo amplifier. Refer to the servo amplifier instruction manual for selection of the surge suppressor.
- \*8 Wire the electromagnetic brake power supply and the control power supply using a separate power supply.

## Precautions

- Be sure to shut off the both of main circuit power supply L1/L2/L3 and control power supply L11/L21 after disconnection of SSCNET communication by the connect/disconnect function of SSCNET communication at the time of exchange of servo amplifier. At this time, it is not possible to communicate between the servo amplifier and Simple Motion module. Therefore, be sure to exchange the servo amplifier after stopping the operating of machine beforehand.
- If the emergency stop signal of Simple Motion module turns OFF when setting of "[Pr.82] Forced stop valid/invalid selection" to "0: Valid", servomotor is stopped with dynamic brake. (The LED display of servo amplifier indicates "E7.1" (Controller forced stop input warning).)
- When the control power supply of servo amplifier is shut off, it is not possible to communicate with the servo amplifier after that.

### Ex.

When the control power supply L11/L21 of the servo amplifier B in the figure is shut off, it is also not possible to communicate with the servo amplifier C.

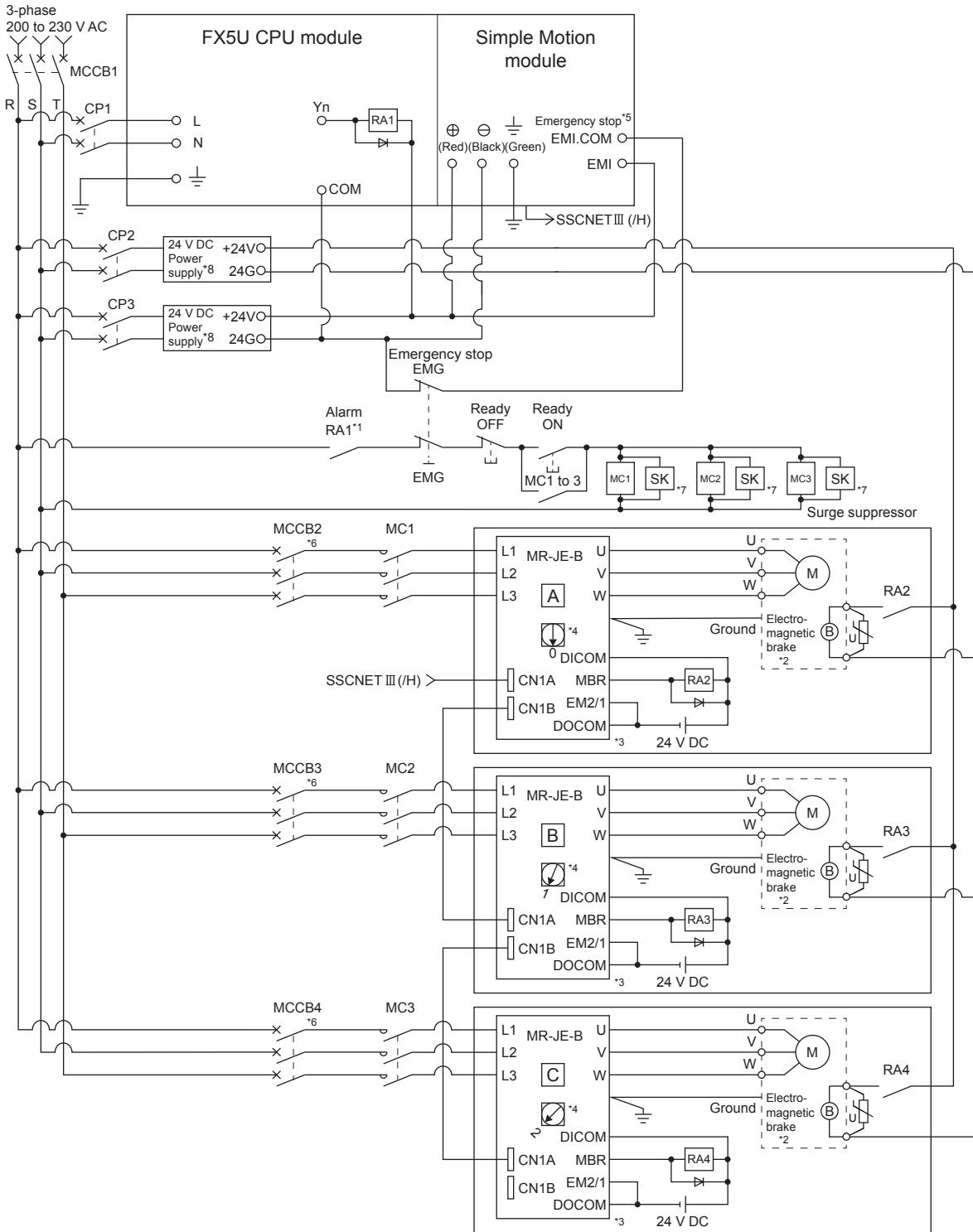
If only a specific servo amplifier main circuit power supply is shut off, be sure to shut off the main circuit power supply L1/L2/L3, and do not shut off the control power supply L11/L21.

## Example when using the forced stop of the Simple Motion module (For MR-JE-B)

### Restriction

- The hot line forced stop function is enabled at the MR-JE-B factory-set. (Only MR-JE-B)
- This function is used to execute deceleration stop for all axes by outputting the hot line forced stop signal to all axes and generating "E7.1" (Controller forced stop input warning) at the alarm occurrence.
- This function can be disabled by the servo parameter (PA27).
- For using the MR-JE-B, configure up the power supply circuit which switches off the all axes electromagnetic contactor (MC) from the CPU module after detecting the alarm occurrence on the CPU module.

2



- \*1 Configure up the power supply circuit which switches off the electromagnetic contactor (MC) after detecting the alarm occurrence on the CPU module.
- \*2 It is also possible to use a full wave rectified power supply as the power supply for the electromagnetic brake.
- \*3 It is also possible to perform the forced stop using a forced stop terminal of the servo amplifier.
- \*4 Set the axis selection rotary switch of servo amplifier as follows to set the axis No. of servo amplifier.
  - Axis 1: 0, Axis 2: 1, Axis 3: 2, Axis 4: 3
- \*5 The status of forced stop input signal can be confirmed with "[Md.50] Forced stop input". Be sure that the forced stop 24 V DC power supply is not used with the electromagnetic brake of the motor or the electromagnetic valve power supply.
- \*6 Refer to the servo amplifier instruction manual for selection of the circuit breaker and electromagnetic contactor.
- \*7 The surge suppressor is recommended to be used for an AC relay or electromagnetic contactor (MC) near the servo amplifier. Refer to the servo amplifier instruction manual for selection of the surge suppressor.
- \*8 Wire the electromagnetic brake power supply and the control power supply using a separate power supply.

## Precautions

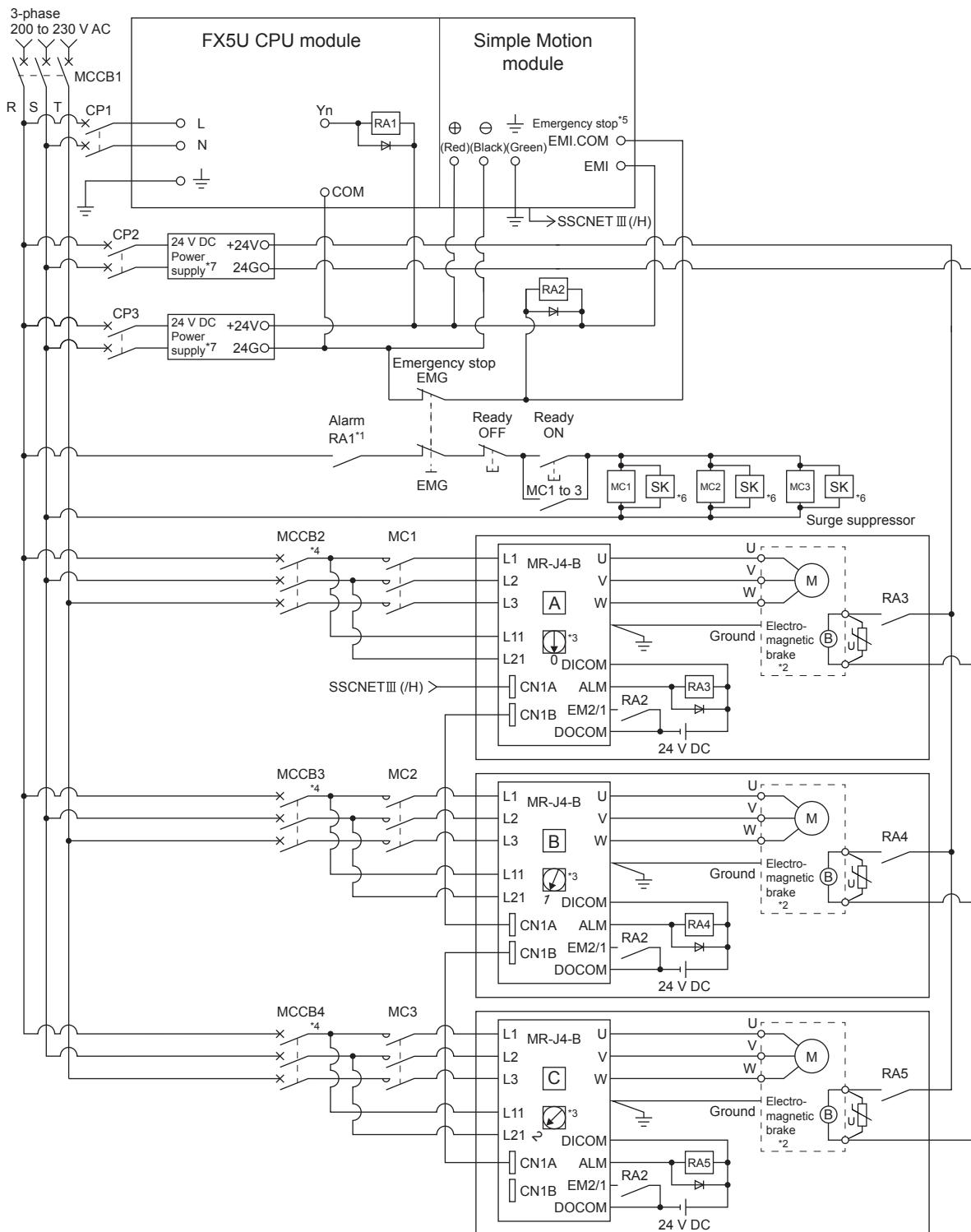
- Be sure to shut off the both of main circuit power supply L1/L2/L3 and control power supply L11/L21 after disconnection of SSCNET communication by the connect/disconnect function of SSCNET communication at the time of exchange of servo amplifier. At this time, it is not possible to communicate between the servo amplifier and Simple Motion module. Therefore, be sure to exchange the servo amplifier after stopping the operating of machine beforehand.
- If the emergency stop signal of Simple Motion module turns OFF when setting of "[Pr.82] Forced stop valid/invalid selection" to "0: Valid", servomotor is stopped with dynamic brake. (The LED display of servo amplifier indicates "E7.1" (Controller forced stop input warning).)
- When the control power supply of servo amplifier is shut off, it is not possible to communicate with the servo amplifier after that.

### Ex.

When the control power supply L11/L21 of the servo amplifier B in the figure is shut off, it is also not possible to communicate with the servo amplifier C.

If only a specific servo amplifier main circuit power supply is shut off, be sure to shut off the main circuit power supply L1/L2/L3, and do not shut off the control power supply L11/L21.

## Example when using the forced stop of the Simple Motion module and MR-J4-B



- \*1 Configure up the power supply circuit which switches off the electromagnetic contactor (MC) after detecting the alarm occurrence on the CPU module.
- \*2 It is also possible to use a full wave rectified power supply as the power supply for the electromagnetic brake.
- \*3 Set the axis selection rotary switch of servo amplifier as follows to set the axis No. of servo amplifier.
  - Axis 1: 0, Axis 2: 1, Axis 3: 2, Axis 4: 3
- \*4 Refer to the servo amplifier instruction manual for selection of the circuit breaker and electromagnetic contactor.
- \*5 The status of forced stop input signal can be confirmed with "[Md.50] Forced stop input". Be sure that the forced stop 24 V DC power supply is not used with the electromagnetic brake of the motor or the electromagnetic valve power supply.
- \*6 The surge suppressor is recommended to be used for an AC relay or electromagnetic contactor (MC) near the servo amplifier. Refer to the servo amplifier instruction manual for selection of the surge suppressor.
- \*7 Wire the electromagnetic brake power supply and the control power supply using a separate power supply.

## Precautions

- Be sure to shut off the both of main circuit power supply L1/L2/L3 and control power supply L11/L21 after disconnection of SSCNET communication by the connect/disconnect function of SSCNET communication at the time of exchange of servo amplifier. At this time, it is not possible to communicate between the servo amplifier and Simple Motion module. Therefore, be sure to exchange the servo amplifier after stopping the operating of machine beforehand.
- The dynamic brake operates and servomotor occurs to the free run when EM1 (forced stop) of the servo amplifier is turned OFF. At the time, the display shows "E6.1" (Forced stop warning). During ordinary operation, do not use EM1 (forced stop) of the servo amplifier to alternate stop and run. The service life of the servo amplifier may be shortened.
- When the control power supply of servo amplifier is shut off, it is not possible to communicate with the servo amplifier after that.

### Ex.

When the control power supply L11/L21 of the servo amplifier B in the figure is shut off, it is also not possible to communicate with the servo amplifier C.

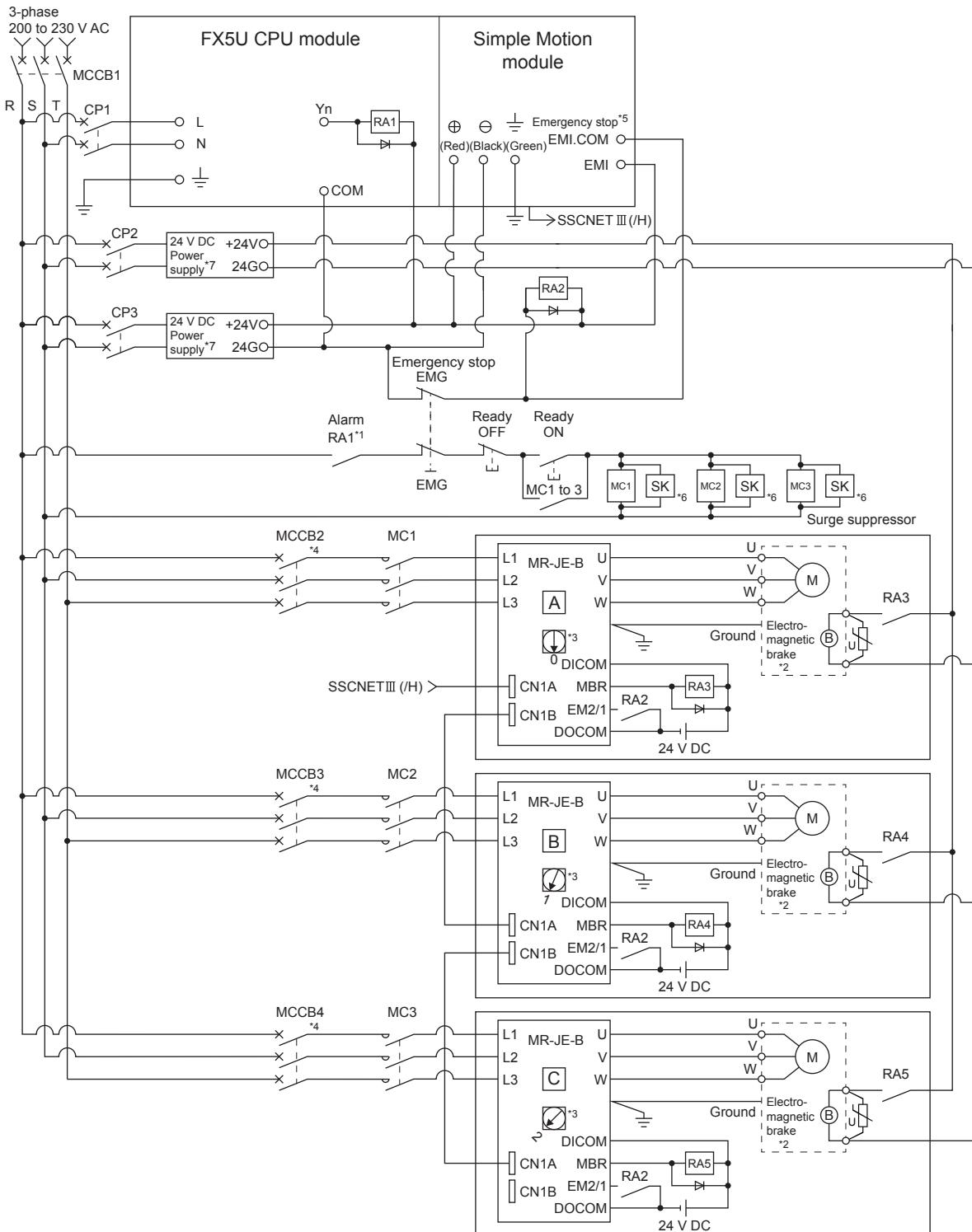
If only a specific servo amplifier main circuit power supply is shut off, be sure to shut off the main circuit power supply L1/L2/L3, and do not shut off the control power supply L11/L21.

## Example when using the forced stop of the Simple Motion module and MR-JE-B

### Restriction

- The hot line forced stop function is enabled at the MR-JE-B factory-set. (Only MR-JE-B)
- This function is used to execute deceleration stop for all axes by outputting the hot line forced stop signal to all axes and generating "E7.1" (Controller forced stop input warning) at the alarm occurrence.
- This function can be disabled by the servo parameter (PA27).
- For using the MR-JE-B, configure up the power supply circuit which switches off the all axes electromagnetic contactor (MC) from the CPU module after detecting the alarm occurrence on the CPU module.

2



- \*1 Configure up the power supply circuit which switches off the electromagnetic contactor (MC) after detecting the alarm occurrence on the CPU module.
- \*2 It is also possible to use a full wave rectified power supply as the power supply for the electromagnetic brake.
- \*3 Set the axis selection rotary switch of servo amplifier as follows to set the axis No. of servo amplifier.
  - Axis 1: 0, Axis 2: 1, Axis 3: 2, Axis 4: 3
- \*4 Refer to the servo amplifier instruction manual for selection of the circuit breaker and electromagnetic contactor.
- \*5 The status of forced stop input signal can be confirmed with "[Md.50] Forced stop input". Be sure that the forced stop 24 V DC power supply is not used with the electromagnetic brake of the motor or the electromagnetic valve power supply.
- \*6 The surge suppressor is recommended to be used for an AC relay or electromagnetic contactor (MC) near the servo amplifier. Refer to the servo amplifier instruction manual for selection of the surge suppressor.
- \*7 Wire the electromagnetic brake power supply and the control power supply using a separate power supply.

## Precautions

- Be sure to shut off the both of main circuit power supply L1/L2/L3 and control power supply L11/L21 after disconnection of SSCNET communication by the connect/disconnect function of SSCNET communication at the time of exchange of servo amplifier. At this time, it is not possible to communicate between the servo amplifier and Simple Motion module. Therefore, be sure to exchange the servo amplifier after stopping the operating of machine beforehand.
- The dynamic brake operates and servomotor occurs to the free run when EM1 (forced stop) of the servo amplifier is turned OFF. At the time, the display shows "E6.1" (Forced stop warning). During ordinary operation, do not use EM1 (forced stop) of the servo amplifier to alternate stop and run. The service life of the servo amplifier may be shortened.
- When the control power supply of servo amplifier is shut off, it is not possible to communicate with the servo amplifier after that.

### Ex.

When the control power supply L11/L21 of the servo amplifier B in the figure is shut off, it is also not possible to communicate with the servo amplifier C.

If only a specific servo amplifier main circuit power supply is shut off, be sure to shut off the main circuit power supply L1/L2/L3, and do not shut off the control power supply L11/L21.

# 3 FUNCTION LIST

## 3.1 Control Functions

The Simple Motion module has several functions. Refer to the following for details on each function.

 MELSEC iQ-F FX5 Simple Motion Module User's Manual (Application)

In this manual, the Simple Motion module functions are categorized and explained as follows.

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### Main functions

#### ■Home position return control

"Home position return control" is a function (Fast home position return) that established the start point for carrying out positioning control (Machine home position return), and carries out positioning toward that start point. This is used to return a workpiece, located at a position other than the home position when the power is turned ON or after positioning stop, to the home position. The "home position return control" is pre-registered in the Simple Motion module as the "Positioning start data No. 9001 (Machine home position return)", and "Positioning start data No. 9002 (Fast home position return)".

#### ■Major positioning control

This control is carried out using the "Positioning data" stored in the Simple Motion module. Positioning control, such as position control and speed control, is executed by setting the required items in this "positioning data" and starting that positioning data. An "operation pattern" can be set in this "positioning data", and with this whether to carry out control with continuous positioning data (ex.: positioning data No. 1, No. 2, No. 3, etc.) can be set.

#### ■High-level positioning control

This control executes the "positioning data" stored in the Simple Motion module using the "block start data". The following types of applied positioning control can be carried out.

- Random blocks, handling several continuing positioning data items as "blocks", can be executed in the designated order.
- "Condition judgment" can be added to position control and speed control.
- The operation of the positioning data that is set for multiple axes can be started simultaneously. (Command is output simultaneously to multiple servo amplifiers.)
- The designated positioning data can be executed repeatedly, etc.

#### ■Manual control

The Simple Motion module executes the random positioning operation by inputting a signal into the Simple Motion module from an external device.

Use this manual control to move the workpiece to a random position (JOG operation), and to finely adjust the positioning (inching operation, manual pulse generator operation), etc.

#### ■Expansion control

The following controls other than the positioning control can be executed.

- Speed control and torque control not including position loop for the command to servo amplifier (Speed-torque control).
- Synchronous control with gear, shaft, change gear and cam not by mechanical, but by software use "synchronous control parameter", and is synchronized with input axis (Synchronous control).

### Sub functions

When the main functions are executed, this function compensates and limits controls, or adds functions.

### Common functions

Common control using the Simple Motion module for "Parameter initialization function" or "Execution data backup function" can be carried out.

## 3.2 Main Functions

The outline of the main functions for positioning control with the Simple Motion module is described below.

Main functions		Details
Home position return control	Machine home position return control	Mechanically establishes the positioning start point using a near-point dog, etc. In the data setting method, no axis movement occurs since the current position is set as the home position. (Positioning start No. 9001)
	Fast home position return control	Positions a target to the home position address ([Md.21] Machine feed value) stored in the Simple Motion module using machine home position return. (Positioning start No. 9002)
Major positioning control	Position control	Linear control (1-axis linear control) (2-axis linear interpolation control) (3-axis linear interpolation control) (4-axis linear interpolation control)
		Positions a target using a linear path to the address set in the positioning data or to the position designated with the movement amount.
		Fixed-feed control (1-axis fixed-feed control) (2-axis fixed-feed control) (3-axis fixed-feed control) (4-axis fixed-feed control)
		Positions a target by the movement amount designated with the amount set in the positioning data. (With fixed-feed control, the "[Md.20] Current feed value" is set to "0" when the control is started. With 2-, 3-, or 4-axis fixed-feed control, the fixed-feed is fed along a linear path obtained by interpolation.)
		2-axis circular interpolation control
		Positions a target using an arc path to the address set in the positioning data, or to the position designated with the movement amount, sub point or center point.
	Speed control	Speed control (1-axis speed control) (2-axis speed control) (3-axis speed control) (4-axis speed control)
		Continuously outputs the command corresponding to the command speed set in the positioning data.
		Speed-position switching control
		First, carries out speed control, and then carries out position control (positioning with designated address or movement amount) by turning the "speed-position switching signal" ON.
High-level positioning control	Other control	Position-speed switching control
		First, carries out position control, and then carries out speed control (continuous output of the command corresponding to the designated command speed) by turning the "position-speed switching signal" ON.
		Current value changing
		Changes the current feed value ([Md.20]) to the address set in the positioning data. The following two methods can be used. (The machine feed value ([Md.21]) cannot be changed.) <ul style="list-style-type: none"><li>• Current value changing using positioning data</li><li>• Current value changing using current value changing start No. (No. 9003)</li></ul>
		NOP instruction
	JUMP instruction	No execution control system. When NOP instruction is set, this instruction is not executed and the operation of the next data is started.
		Unconditionally or conditionally jumps to designated positioning data No.
		LOOP
		Carries out loop control with repeated LOOP to LEND.
	LEND	Returns to the beginning of the loop control with repeated LOOP to LEND.
	Block start (Normal start)	With one start, executes the positioning data in a random block with the set order.
	Condition start	Carries out condition judgment set in the "condition data" for the designated positioning data, and then executes the "block start data". When the condition is established, the "block start data" is executed. When not established, that "block start data" is ignored, and the next point's "block start data" is executed.
	Wait start	Carries out condition judgment set in the "condition data" for the designated positioning data, and then executes the "block start data". When the condition is established, the "block start data" is executed. When not established, stops the control until the condition is established. (Waits.)
	Simultaneous start	Simultaneously executes the positioning data having the No. for the axis designated with the "condition data". (Outputs commands at the same timing.)
	Repeated start (FOR loop)	Repeats the program from the block start data set with the "FOR loop" to the block start data set in "NEXT" for the designated number of times.
	Repeated start (FOR condition)	Repeats the program from the block start data set with the "FOR condition" to the block start data set in "NEXT" until the conditions set in the "condition data" are established.

<b>Main functions</b>		<b>Details</b>
Manual control	JOG operation	Outputs a command to servo amplifier while the JOG start signal is ON.
	Inching operation	Outputs commands corresponding to minute movement amount by manual operation to servo amplifier. (Performs fine adjustment with the JOG start signal.)
	Manual pulse generator operation	Outputs pulses commanded with the manual pulse generator to servo amplifier.
Expansion control	Speed-torque control	Carries out the speed control or torque control that does not include the position loop for the command to servo amplifier by switching control mode.
	Synchronous control	Carries out the synchronous control that synchronizes with input axis by setting the system such as gear, shaft, change gear and cam to the "synchronous control parameter".

In "major positioning control" ("high-level positioning control"), "Operation pattern" can be set to designate whether to continue executing positioning data. Outlines of the "operation patterns" are given below.

<b>[Da.1] Operation pattern</b>	<b>Details</b>
Independent positioning control (positioning complete)	When "independent positioning control" is set for the operation pattern of the started positioning data, only the designated positioning data will be executed, and then the positioning will end.
Continuous positioning control	When "continuous positioning control" is set for the operation pattern of the started positioning data, after the designated positioning data is executed, the program will stop once, and then the next following positioning data will be executed.
Continuous path control	When "continuous path control" is set for the operation pattern of the started positioning data, the designated positioning data will be executed, and then without decelerating, the next following positioning data will be executed.

## 3.3 Sub Functions and Common Functions

### Sub functions

The outline of the functions that assist positioning control using the Simple Motion module is described below.

Sub function	Details	
Functions characteristic to machine home position return	Home position return retry function This function retries the home position return with the upper/lower limit switches during the machine home position return. This allows machine home position return to be carried out even if the axis is not returned to before the near-point dog with JOG operation, etc.	
	Home position shift function After returning to the machine home position, this function compensates the position by the designated distance from the machine home position and sets that position as the home position address.	
Functions that compensate control	Backlash compensation function This function compensates the mechanical backlash amount. Feed commands equivalent to the set backlash amount are output each time the movement direction changes.	
	Electronic gear function By setting the movement amount per pulse, this function can freely change the machine movement amount per commanded pulse. When the movement amount per pulse is set, a flexible positioning system that matches the machine system can be structured.	
	Near pass function <sup>*1</sup> This function suppresses the machine vibration when the speed is changed during continuous path control in the interpolation control.	
Functions that limit control	Speed limit function If the command speed exceeds "[Pr.8] Speed limit value" during control, this function limits the commanded speed to within the "[Pr.8] Speed limit value" setting range.	
	Torque limit function If the torque generated by the servomotor exceeds "[Pr.17] Torque limit setting value" during control, this function limits the generated torque to within the "[Pr.17] Torque limit setting value" setting range.	
	Software stroke limit function If a command outside of the upper/lower limit stroke limit setting range, set in the parameters, is issued, this function will not execute positioning for that command.	
	Hardware stroke limit function This function carries out deceleration stop with the hardware stroke limit switch.	
	Forced stop function This function stops all axes of the servo amplifier with the forced stop input signal connected to the external input connection connector on the Simple Motion module.	
Functions that change control details	Speed change function This function changes the speed during positioning. Set the new speed in the speed change buffer memory ([Cd.14] New speed value), and change the speed with the speed change request ([Cd.15]).	
	Override function This function changes the speed within a percentage of 1 to 300% during positioning. This is executed using "[Cd.13] Positioning operation speed override".	
	Acceleration/deceleration time change function This function changes the acceleration/deceleration time during speed change.	
	Torque change function This function changes the "torque limit value" during control.	
	Target position change function This function changes the target position during positioning. Position and speed can be changed simultaneously.	
Functions related to positioning start	Pre-reading start function This function shortens the virtual start time.	
Absolute position system		This function restores the absolute position of designated axis.
Functions related to positioning stop	Stop command processing for deceleration stop function Function that selects a deceleration curve when a stop cause occurs during deceleration stop processing to speed 0.	
	Continuous operation interrupt function This function interrupts continuous operation. When this request is accepted, the operation stops when the execution of the current positioning data is completed.	
	Step function This function temporarily stops the operation to confirm the positioning operation during debugging, etc. The operation can be stopped at each "automatic deceleration" or "positioning data".	

Sub function	Details
Other functions	Skip function This function stops (decelerates to a stop) the positioning being executed when the skip signal is input, and carries out the next positioning.
	M code output function This function issues a command for a sub work (clamp or drill stop, tool change, etc.) corresponding to the M code No. (0 to 65535) that can be set for each positioning data.
	Teaching function This function stores the address positioned with manual control into the "[Da.6] Positioning address/movement amount" having the designated positioning data No. ([Cd.39]).
	Command in-position function This function calculates the remaining distance for the Simple Motion module to reach the positioning stop position. When the value is less than the set value, the "command in-position flag" is set to "1". When using another auxiliary work before ending the control, use this function as a trigger for the sub work.
	Acceleration/deceleration processing function This function adjusts the acceleration/deceleration.
	Deceleration start flag function Function that turns ON the flag when the constant speed status or acceleration status switches to the deceleration status during position control, whose operation pattern is "Positioning complete", to make the stop timing known.
	Follow up function This function monitors the motor rotation amount with the servo turned OFF, and reflects it on the current feed value.
	Speed control 10 times multiplier setting for degree axis function This function executes the positioning control by the 10 times speed of the command speed and the speed limit value when the setting unit is "degree".
	Operation setting for incompleteness of home position return function This function is provided to select whether positioning control is operated or not, when the home position return request flag is ON.

\*1 The near pass function is featured as standard and is valid only for position control. It cannot be set to be invalid with parameters.

## Common functions

The outline of the functions executed as necessary is described below.

Common functions	Details
Parameter initialization function	This function returns the setting data stored in the buffer memory/internal memory and flash ROM/internal memory (nonvolatile) of Simple Motion module to the default values. The following two methods can be used. <ul style="list-style-type: none"><li>• Method using a program</li><li>• Method using an engineering tool</li></ul>
Execution data backup function	This function writes the execution data being used in the control into the flash ROM/internal memory (nonvolatile). The following two methods can be used. <ul style="list-style-type: none"><li>• Method using a program</li><li>• Method using an engineering tool</li></ul>
External input signal select function	This function sets the input type, input terminal, signal logic and input filter for each external input signal of each axis (upper/lower stroke limit signal (FLS/RLS), near-point dog signal (DOG), and stop signal (STOP)). The function enables the assignment of external input signal of each axis to any terminals of 20 points of the external input connection connector on the Simple Motion module.
History monitor function	This function monitors start history and current value history of all axes.
Amplifier-less operation function	This function executes the positioning control of Simple Motion module without connecting to the servo amplifiers. It is used to debug the program at the start-up of the device or simulate the positioning operation.
Virtual servo amplifier function	This function executes the operation as the axis (virtual servo amplifier axis) that operates only command (instruction) virtually without servo amplifiers.
Driver communication function	This function uses the "Master-slave operation function" of servo amplifier. The Simple Motion module controls the master axis and the slave axis is controlled by data communication between servo amplifiers (driver communication) without Simple Motion module.
Mark detection function	This function is used to latch any data at the input timing of the mark detection signal (DI).
Optional data monitor function	This function is used to store the data selected by user up to 4 data per axis to buffer memory and monitor them.
Connect/disconnect function of SSCNET communication	Temporarily connect/disconnect of SSCNET communication is executed during system's power supply ON. This function is used to exchange the servo amplifiers or SSCNET <sup>III</sup> cables.
Hot line forced stop function	This function is used to execute deceleration stop safety for other axes when the servo alarm occurs in the servo amplifier MR-JE-B.

## 3.4 Combination of Main Functions and Sub Functions

With positioning control using the Simple Motion module, the main functions and sub functions can be combined and used as necessary. A list of the main function and sub function combinations is given below.

### Combination of main functions and operation patterns

○: Combination possible

△: Combination limited

✗: Combination not possible

3

Main functions		Combination with operation pattern <sup>*1</sup>	
Home position return control	Machine home position return control	✗	
	Fast home position return control	✗	
Major positioning control	Position control	1-axis linear control	○
		2-, 3-, or 4-axis linear interpolation control	○
		1-axis fixed-feed control	△ (Continuous path control cannot be set)
		2-, 3-, or 4-axis fixed-feed control (interpolation)	△ (Continuous path control cannot be set)
		2-axis circular interpolation control	○
	Speed control (1- to 4-axis)		△ (Only independent positioning control can be set)
	Speed-position switching control		△ (Continuous path control cannot be set)
	Position-speed switching control		△ (Only independent positioning control can be set)
	Other control	Current value changing	△ (Continuous path control cannot be set)
		NOP instruction	✗
		JUMP instruction	✗
		LOOP to LEND	
Manual control	JOG operation, inching operation		✗
	Manual pulse generator operation		✗
Expansion control	Speed-torque control		✗

\*1 The operation pattern is one of the "positioning data" setting items.

## Combination of main functions and sub functions

○: Combination possible

△: Combination limited

✗: Combination not possible

Main functions		Functions characteristic to machine home position return		Functions that compensate control		
		Home position return retry function	Home position shift function	Backlash compensation function	Electronic gear function	Near pass function
Home position return control	Machine home position return control	△ <sup>*1</sup>	○	○	○	<sup>*2</sup>
	Fast home position return control	✗	✗	○	○	
Major positioning control	Position control	1-axis linear control	✗	✗	○	○
		2-, 3-, or 4-axis linear interpolation control	✗	✗	○	○
		1-axis fixed-feed control	✗	✗	○	○
		2-, 3-, or 4-axis fixed-feed control (interpolation)	✗	✗	○	○
		2-axis circular interpolation control	✗	✗	○	○
	Speed control (1- to 4-axis)	Speed control (1- to 4-axis)	✗	✗	○	○
		Speed-position switching control	✗	✗	○	○
		Position-speed switching control				
	Other control	Current value changing	✗	✗	✗	✗
		NOP instruction				
		JUMP instruction	✗	✗	✗	✗
		LOOP to LEND				
Manual control	JOG operation, inching operation	✗	✗	○	○	✗
	Manual pulse generator operation	✗	✗	○	○	✗
Expansion control	Speed-torque control	✗	✗	✗	○	✗

\*1 Home position return retry function cannot be used during the scale origin signal detection method machine home position return.

\*2 The near pass function is featured as standard and is valid only for setting continuous path control for position control.

◎: Always combine

○: Combination possible

✗: Combination not possible

Main functions		Functions that limit control				
		Speed limit function	Torque limit function	Software stroke limit function	Hardware stroke limit function	Forced stop function
Home position return control	Machine home position return control	○	○	✗	◎	○
	Fast home position return control	○	○	✗	◎	○
Major positioning control	Position control	1-axis linear control	○	○	○	○
		2-, 3-, or 4-axis linear interpolation control	○	○	○	○
		1-axis fixed-feed control	○	○	○	○
		2-, 3-, or 4-axis fixed-feed control (interpolation)	○	○	○	○
		2-axis circular interpolation control	○	○	○	○
	Speed control (1- to 4-axis)	Speed control (1- to 4-axis)	○	○	○	○
		Speed-position switching control	○	○	○	○
		Position-speed switching control				
	Other control	Current value changing	✗	✗	○	○
		NOP instruction			✗	
		JUMP instruction	✗	✗	✗	○
		LOOP to LEND				
Manual control	JOG operation, inching operation	○	○	○	○	○
	Manual pulse generator operation	○	○	○	○	○
Expansion control	Speed-torque control	○	○	○	○	○

○: Combination possible

△: Combination limited

✗: Combination not possible

Main functions		Functions that change control details				
		Speed change function	Override function	Acceleration/deceleration time change function	Torque change function	Target position change function
Home position return control	Machine home position return control	△ *1	△ *1	△ *1	○	✗
	Fast home position return control	○	○	○	○	✗
Major positioning control	Position control	1-axis linear control	○	○	○	○
		2-, 3-, or 4-axis linear interpolation control	○	○	○	○
		1-axis fixed-feed control	○	○	○	○
		2-, 3-, or 4-axis fixed-feed control (interpolation)	○	○	○	○
		2-axis circular interpolation control	○	○	○	○
	Speed control (1- to 4-axis)	Speed control (1- to 4-axis)	○	○	○	○
		Speed-position switching control	○	○	○	○
		Position-speed switching control				
	Other control	Current value changing	✗	✗	✗	✗
		NOP instruction				
		JUMP instruction	✗	✗	✗	✗
Manual control	JOG operation, inching operation		△ *3	△ *3	△ *3	○
	Manual pulse generator operation		✗	✗	✗	○
Expansion control	Speed-torque control	✗	✗	✗	○	✗

\*1 Invalid during creep speed.

\*2 Invalid during continuous path control.

\*3 Combination with the inching operation is not available. (Inching operation does not perform acceleration/deceleration processing.)

○: Combination possible

△: Combination limited

✗: Combination not possible

Main functions		Functions related to positioning start	Functions related to positioning stop		Other functions	
			Pre-reading start function	Step function	Stop command processing for deceleration stop function	Skip function
Home position return control	Machine home position return control	✗	✗	○	✗	✗
	Fast home position return control	✗	✗	○	✗	✗
Major positioning control	Position control	1-axis linear control	○	○	○	○
		2-, 3-, or 4-axis linear interpolation control	○	○	○	○
		1-axis fixed-feed control	○	○	○	○
		2-, 3-, or 4-axis fixed-feed control (interpolation)	○	○	○	○
		2-axis circular interpolation control	○	○	○	○
	Speed control (1- to 4-axis)	○	✗	○	✗	○
		○	○	○	○	○
		Position-speed switching control			✗	
	Other control	Current value changing	✗	○	✗	△ <sup>*1</sup>
		NOP instruction		✗	✗	✗
		JUMP instruction	✗	✗	✗	✗
		LOOP to LEND				
Manual control	JOG operation, inching operation	✗	✗	✗	✗	✗
	Manual pulse generator operation	✗	✗	✗	✗	✗
Expansion control	Speed-torque control	✗	✗	✗	✗	✗

\*1 Change the current value using the positioning data. Disabled for a start of positioning start No. 9003.

○: Combination possible

△: Combination limited

✗: Combination not possible

Main functions		Other functions					
		Teaching function	Command in-position function	Acceleration/deceleration processing function	Deceleration start flag function	Speed control 10 times multiplier setting for degree axis function	Operation setting for incompleteness of home position return function
Home position return control	Machine home position return control	✗	✗	○	✗	○	✗
	Fast home position return control	✗	○	○	✗	○	✗
Major positioning control	Position control	1-axis linear control	✗	○	○	○	○
		2-, 3-, or 4-axis linear interpolation control	✗	○	○	△ <sup>*1</sup>	○
		1-axis fixed-feed control	✗	○	○	○	○
		2-, 3-, or 4-axis fixed-feed control (interpolation)	✗	○	○	△ <sup>*1</sup>	○
		2-axis circular interpolation control	✗	○	○	✗	○
	Speed control (1- to 4-axis)			○	✗	○	○
				○	○	△ <sup>*2</sup>	○
		Position-speed switching control					
	Other control	Current value changing	✗	✗	✗	✗	△ <sup>*3</sup>
		NOP instruction	✗	✗	✗		
		JUMP instruction	✗	✗	✗	✗	✗
		LOOP to LEND	✗	✗	✗		
Manual control	JOG operation, inching operation		○	✗	△ <sup>*4</sup>	✗	✗
	Manual pulse generator operation		○	✗	✗	✗	△ <sup>*5</sup>
Expansion control	Speed-torque control		✗	✗	△ <sup>*6</sup>	✗	○

\*1 Valid for the reference axis only.

\*2 Valid for only the case where a deceleration start is made during position control.

\*3 Valid for a start of positioning start No.9003, but invalid for a start of positioning data (No. 1 to 600).

\*4 Combination with the inching operation is not available. (Inching operation does not perform acceleration/deceleration processing.)

\*5 Valid for "[Md.22] Feedrate" and "[Md.28] Axis feedrate".

\*6 Refer to the following for acceleration/deceleration processing in the speed-torque control.

MELSEC iQ-F FX5 Simple Motion Module User's Manual (Application)

# 4 PROCEDURES BEFORE OPERATIONS

This chapter describes the procedures before operation.

## 1. Mounting the module

Mount the Simple Motion module to the CPU module. For details, refer to the following.

MELSEC iQ-F FX5U User's Manual (Hardware)

MELSEC iQ-F FX5UC User's Manual (Hardware)

## 2. Wiring

Connect the Simple Motion module to external devices.

## 3. Adding the module

Add the 40SSC-S to the module map of the project using an engineering tool.

## 4. Module setting

Set values for the module setting using an engineering tool. For details, refer to the following.

GX Works3 Operating Manual

## 5. Auto refresh setting

Set values for the refresh settings using an engineering tool. For details, refer to the following.

GX Works3 Operating Manual

## 6. Checking connection

Check that the Simple Motion module is connected to external devices correctly.

## 7. Programming

Create programs. For details, refer to the following.

MELSEC iQ-F FX5 Simple Motion Module User's Manual (Application)

## 8. Test operation

Check that the positioning is correctly carried out as designed.

# 5 WIRING

## 5.1 Precautions for Wiring

The precautions for wiring the Simple Motion module are shown below. Execute the work following the precautions below.

### Warning for wiring

#### ⚠️ WARNING

- Completely turn off the externally supplied power used in the system before installation or wiring. Not doing so could result in electric shock or damage to the product.

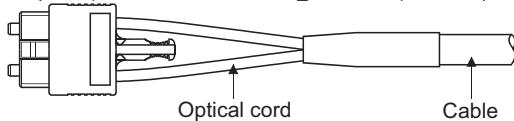
### Caution for wiring

#### ⚠️ CAUTION

- Check the layout of the terminals and then properly route the wires to the module.
- The external input wiring connector must be crimped or pressured with the tool specified by the manufacturer, or must be correctly soldered. Insufficient connections may cause short circuit, fire, or malfunction.
- Be careful not to let foreign matter such as sawdust or wire chips get inside the module. These may cause fires, failure or malfunction.
- The top surface of the module is covered with protective films to prevent foreign objects such as cable off cuts from entering the module when wiring. Do not remove this film until the wiring is complete. Before operating the system, be sure to remove the film to provide adequate ventilation.
- Securely connect the connector for SSCNETⅢ cable to the bottom connector on the module.
- When removing the cable from the module, do not pull the cable. Hold the connector that is connected to the module. Pulling the cable that is still connected to the module may cause malfunction or damage to the module or cable.
- The external input/output signal cable and the communication cable should not be routed near or bundled with the main circuit cable, power cable and/or other such load - carrying cables other than those for the PLC. These cables should be separated by at least 100 mm (3.94 inch) or more. They can cause electrical interference, surges and inductance that can lead to mis-operation.
- The shielded cable for connecting Simple Motion module can be secured in place. If the shielded cable is not secured, unevenness or movement of the shielded cable or careless pulling on it could result in damage to the Simple Motion module, servo amplifier or shielded cable or defective cable connections could cause mis-operation of the unit.
- If the cable connected to the Simple Motion module and the power line must be adjacently laid (less than 100 mm (3.94 inch)), use a shielded cable. Ground the shield of the cable securely to the control panel on the Simple Motion module side.
- Forcibly removal the SSCNETⅢ cable from the Simple Motion module will damage the Simple Motion module and SSCNETⅢ cables.
- After removal of the SSCNETⅢ cable, be sure to put a cap on the SSCNETⅢ connector. Otherwise, adhesion of dirt deteriorates in characteristic and it may cause malfunctions.
- Do not remove the SSCNETⅢ cable while turning on the power supply of Simple Motion module and servo amplifier. Do not see directly the light generated from SSCNETⅢ connector and the end of SSCNETⅢ cable. When the light gets into eye, may feel something wrong with eyes.(The light source of SSCNETⅢ cable complies with class1 defined in JISC6802 or IEC60825-1.)
- If a power such as a major shock, lateral pressure, haul, sudden bending or twist is added to the SSCNETⅢ cable, it distorts or breaks inside and optical transmission is not be available. Note that the short SSCNETⅢ cable can be twisted easily.
- Be sure to use the SSCNETⅢ cable within the range of operating temperature described in each servo amplifier instruction manual. Especially, as optical fiber for MR-J3BUS\_M and MR-J3BUS\_M-A are made of synthetic resin, it melts down if being left near the fire or high temperature. Therefore, do not make it touched the part which becomes high temperature, such as radiator or regenerative option of servo amplifier, or servomotor.
- When laying the SSCNETⅢ cable, be sure to secure the minimum cable bend radius or more.
- Put the SSCNETⅢ cable in the duct or fix the cable at the closest part to the Simple Motion module with bundle material in order to prevent SSCNETⅢ cable from putting its own weight on SSCNETⅢ connector. When laying cable, the optical cord should be given loose slack to avoid from becoming smaller than the minimum bend radius, and it should not be twisted. Also, fix and hold it in position with using cushioning such as sponge or rubber which does not contain plasticizing material. If adhesive tape for bundling the cable is used, fire resistant acetate cloth adhesive tape 570F (Teraoka Seisakusho Co., Ltd) is recommended.

## ! CAUTION

- Migrating plasticizer is used for vinyl tape. Keep the MR-J3BUS\_M, and MR-J3BUS\_M-A cables away from vinyl tape because the optical characteristic may be affected. Generally, soft polyvinyl chloride (PVC), polyethylene resin (PE) and fluorine resin contain non-migrating plasticizer and they do not affect the optical characteristic of SSCNET<sup>III</sup> cable. However, some wire sheaths and cable ties, which contain migrating plasticizer (phthalate ester), may affect MR-J3BUS\_M and MR-J3BUS\_M-A cables (made of plastic). In addition, MR-J3BUS\_M-B cable (made of quartz glass) is not affected by plasticizer.



- : Normally, cable is not affected by plasticizer.
- △: Phthalate ester plasticizer such as DBP and DOP may affect optical characteristic of cable.

SSCNET <sup>III</sup> cable	Cord	Cable
MR-J3BUS_M	△	
MR-J3BUS_M-A	△	△
MR-J3BUS_M-B	○	○

- If the adhesion of solvent and oil to the cord part of SSCNET<sup>III</sup> cable may lower the optical characteristic and machine characteristic. To use the cable in that environment, be sure to do the protection measures to the cord part.
- When keeping the Simple Motion module or servo amplifier, be sure to attach a cap to the connector part so that a dirt should not adhere to the end of SSCNET<sup>III</sup> connector.
- To protect a light device inside a connector from dust, a cap is attached to the SSCNET<sup>III</sup> connector for the SSCNET<sup>III</sup> cable. Therefore, do not remove a cap until just before connecting the SSCNET<sup>III</sup> cable. Also, when removing the SSCNET<sup>III</sup> cable, make sure to attach a cap.
- Keep the cap and the tube for protecting light cord end of SSCNET<sup>III</sup> cable in a plastic bag with a zipper included with the SSCNET<sup>III</sup> cable to prevent them from becoming dirty.
- When exchanging the Simple Motion module or servo amplifier, make sure to attach a cap to the SSCNET<sup>III</sup> connector. When asking repair of Simple Motion module or servo amplifier for some troubles, make also sure to attach a cap to the SSCNET<sup>III</sup> connector. When a cap is not attached, the light device may be damaged at the transit. In this case, exchange or repair of the light device is required.

## Precautions for wiring

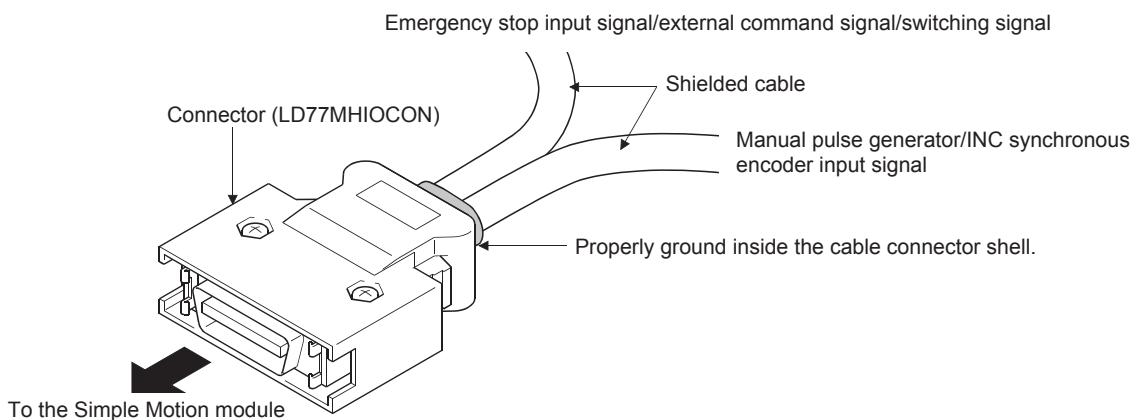
- Use separate cables for connecting to the Simple Motion module and for the power cable that creates surge and inductance.
- The cable for connecting the Simple Motion module should be placed in the duct or secured in place by clamps. If the cable is not placed in the duct or secured by clamps, unevenness or movement of the cable or careless pulling on it could result in damage to the unit or cable or defective cable connections could cause mis-operation of the unit.
- If a duct is being used, separate the cables to connect the Simple Motion module from the power line duct, or use metal piping. Ground the pipes securely after metal piping.
- Use the twisted pair shielded cable (wire size 0.3 mm<sup>2</sup> or more). The shielded must be grounded on the Simple Motion module side.
- Use separate shielded cables for the external input signal, forced stop input, and manual pulse generator/incremental synchronous encoder input for connecting to the Simple Motion module. They can cause electrical interference, surges and inductance that can lead to mis-operation.
- When malfunctioning in environment with a lot of noise, the effects of noise may be reduced by the following measure. Please attach a ferrite core (Ex. TDK co., Ltd. ZCAT3035-1330 or similar) to the Simple Motion module side of the cable connected to the forced stop input signal, external command signal/switching signal, and manual pulse generator/incremental synchronous encoder input signal.
- For wiring, refer to the following and each servo amplifier instruction manual.

MELSEC iQ-F FX5U User's Manual (Hardware)

MELSEC iQ-F FX5UC User's Manual (Hardware)

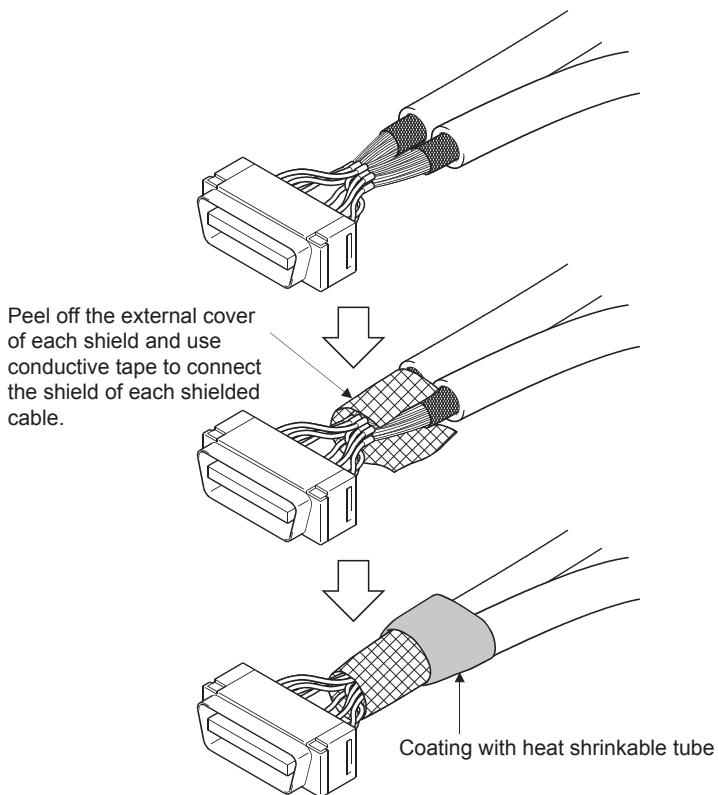
## ■Wiring example of shielded cable

The following shows a wiring example for noise reduction when the connector (LD77MHIOCON) is used.

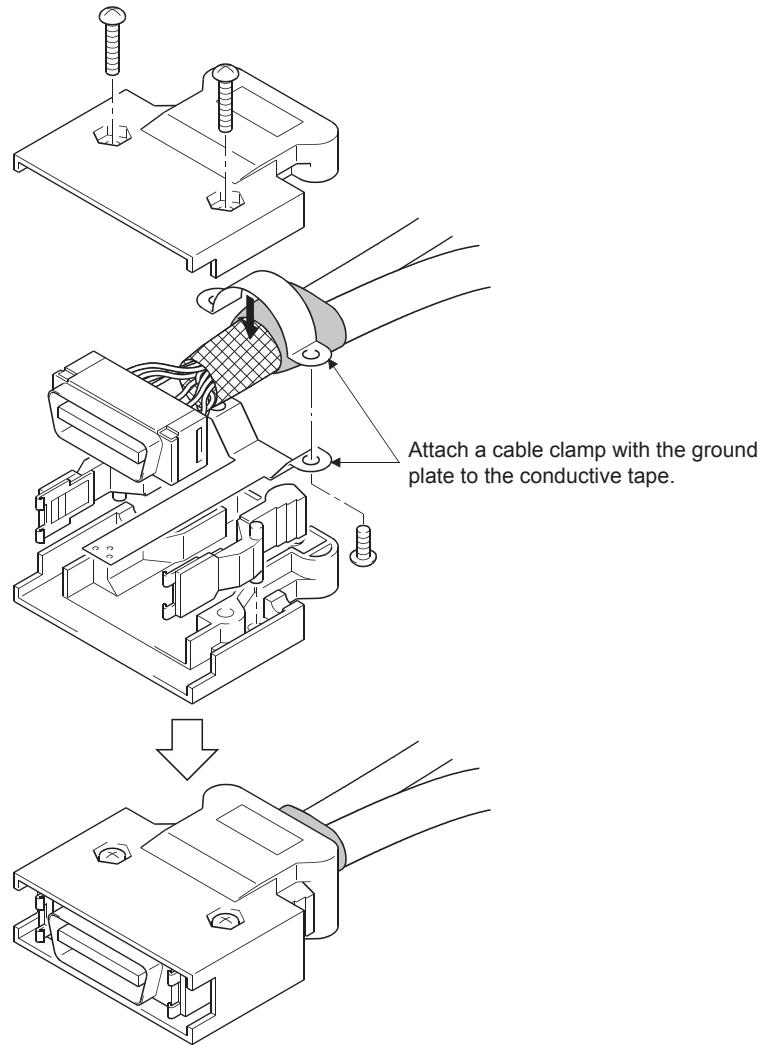


## ■Processing example of shielded cables

Connections of FG wire and each shielded cable



## ■Assembly of connector (LD77MHIOCON)



5

## Precautions for SSCNET<sup>III</sup> cable wiring

SSCNET<sup>III</sup> cable is made from optical fiber. If optical fiber is added a power such as a major shock, lateral pressure, haul, sudden bending or twist, its inside distorts or breaks, and optical transmission will not be available. Especially, as optical fiber for MR-J3BUS\_M, MR-J3BUS\_M-A is made of synthetic resin, it melts down if being left near the fire or high temperature. Therefore, do not make it touched the part which becomes high temperature, such as radiator or regenerative option of servo amplifier and servomotor. Be sure to use optical fiber within the range of operating temperature described in each servo amplifier instruction manual. Read described item of this section carefully and handle it with caution.

### ■Minimum bend radius

Make sure to lay the cable with greater radius than the minimum bend radius.

Do not press the cable to edges of equipment or others. For SSCNET<sup>III</sup> cable, the appropriate length should be selected with due consideration for the dimensions and arrangement of Simple Motion module or servo amplifier. When closing the door of control panel, pay careful attention for avoiding the case that SSCNET<sup>III</sup> cable is hold down by the door and the cable bend becomes smaller than the minimum bend radius.

Model name of SSCNET <sup>III</sup> cable	Minimum bend radius [mm] ([inch])
MR-J3BUS_M	25 (0.98)
MR-J3BUS_M-A	Enforced covering cord: 50 (1.97), Cord: 25 (0.98)
MR-J3BUS_M-B	Enforced covering cord: 50 (1.97), Cord: 30 (1.18)

### ■Tension

If tension is added on the SSCNET<sup>III</sup> cable, the increase of transmission loss occurs because of external force which concentrates on the fixing part of SSCNET<sup>III</sup> cable or the connecting part of SSCNET<sup>III</sup> connector. At worst, the breakage of SSCNET<sup>III</sup> cable or damage of SSCNET<sup>III</sup> connector may occur. For cable laying, handle without putting forced tension. (Refer to each servo amplifier instruction manual for the tension strength of SSCNET<sup>III</sup> cable.)

### ■Lateral pressure

If lateral pressure is added on the SSCNET<sup>III</sup> cable, the cable itself distorts, internal optical fiber gets stressed, and then transmission loss will increase. At worst, the breakage of SSCNET<sup>III</sup> cable may occur. As the same condition also occurs at cable laying, do not tighten up SSCNET<sup>III</sup> cable with a thing such as nylon band (TY-RAP).

Do not trample it down or tuck it down with the door of control box or others.

### ■Twisting

If the SSCNET<sup>III</sup> cable is twisted, it will become the same stress added condition as when local lateral pressure or bend is added. Consequently, transmission loss increases, and the breakage of SSCNET<sup>III</sup> cable may occur at worst.

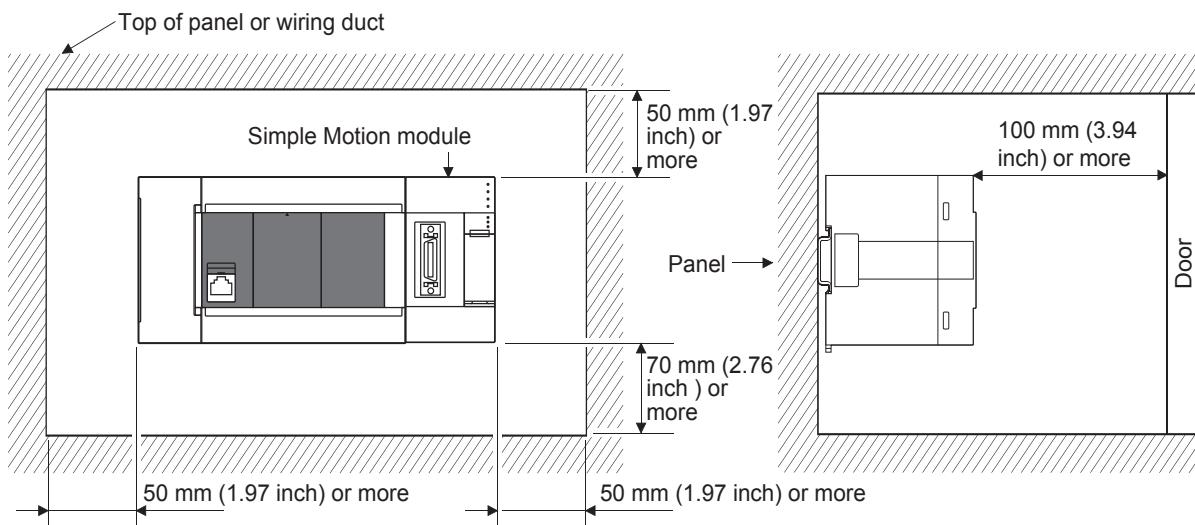
### ■Disposal

When incinerating optical cable (cord) used for SSCNET<sup>III</sup> cable, hydrogen fluoride gas or hydrogen chloride gas which is corrosive and harmful may be generated. For disposal of SSCNET<sup>III</sup> cable, request for specialized industrial waste disposal services that have incineration facility for disposing hydrogen fluoride gas or hydrogen chloride gas.

## ■Wiring process of SSCNET<sup>III</sup> cable

Put the SSCNET cable in the duct or fix the cable at the closest part to the Simple Motion module with bundle material in order to prevent SSCNET cable from putting its own weight on SSCNET connector. Leave the following space for wiring.

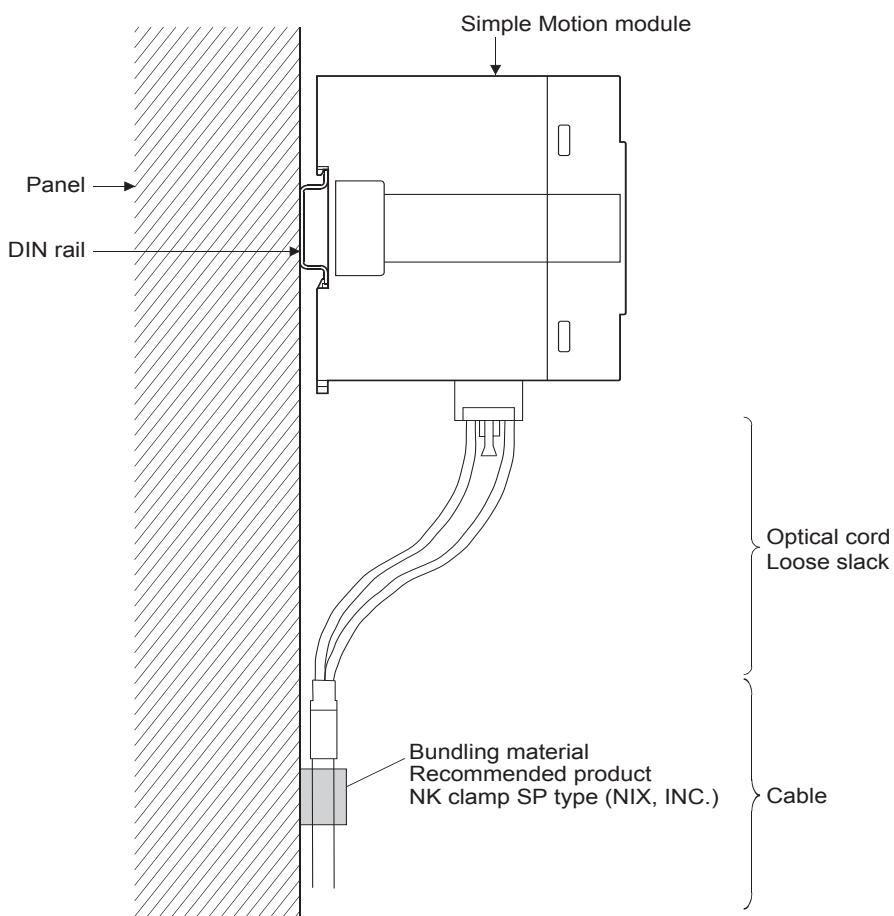
- Putting in the duct



5

- Bundle fixing

Optical cord should be given loose slack to avoid from becoming smaller than the minimum bend radius, and it should not be twisted. When laying cable, fix and hold it in position with using cushioning such as sponge or rubber which does not contain plasticizing material.



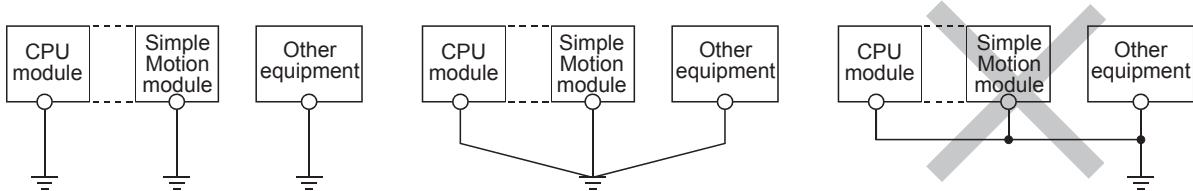
## Precautions for wiring of grounding terminal

Be sure to follow the grounding procedures below.

- Be sure to make every effort to use independent grounding.

Be sure to perform grounding work with a ground resistance of 100 Ω or less.

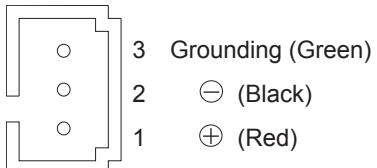
- If it is not possible to perform independent grounding, then use the shared grounding shown on 2) in the figure below.



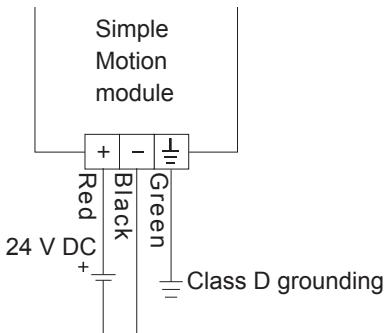
- Be sure to locate the grounding point as close as possible to the Simple Motion module and keep the grounding wire short.

## Power supply wiring

### Power supply connector



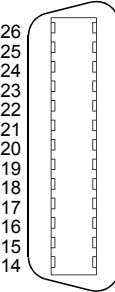
### Power supply wiring



## 5.2 External Input Connection Connector

### Signal layout for external input connection connector

The signal layout for the external input connection connector of Simple Motion module is shown below.

Pin layout (Front view of the module)	Pin No.	Signal name		Pin No.	Signal name		
	1	No connect <sup>*5</sup>		14	No connect <sup>*5</sup>		
	2	SG	Signal ground	15	SG	Signal ground	
	3	HA <sup>*1*2*3</sup>	Manual pulse generator/ Incremental synchronous encoder A phase/PULSE	16	HB <sup>*1*2*3</sup>	Manual pulse generator/ Incremental synchronous encoder B phase/SIGN	
	4	HAH <sup>*1*2*4</sup>		17	HBH <sup>*1*2*4</sup>		
	5	HAL <sup>*1*2*4</sup>		18	HBL <sup>*1*2*4</sup>		
	6	No connect <sup>*5</sup>		19	No connect <sup>*5</sup>		
	7			20			
	8			21			
	9			22			
	10	EMI	Forced stop input signal	23	EMI.COM	Forced stop input signal common	
	11	DI1 <sup>*6</sup>	External command/ Switching signal	24	DI2 <sup>*6</sup>	External command/ Switching signal	
	12	DI3 <sup>*6</sup>		25	DI4 <sup>*6</sup>		
	13	COM <sup>*7</sup>	Common (COM)	26	COM <sup>*7</sup>	Common (COM)	

\*1 Input type from manual pulse generator/incremental synchronous encoder is switched in "[Pr.89] Manual pulse generator/Incremental synchronous encoder input type selection". (Only the value specified for axis 1 is valid).

0: Differential-output type

1: Voltage-output/open-collector type (Default value)

\*2 Set the signal input form in "[Pr.24] Manual pulse generator/Incremental synchronous encoder input selection".

\*3 Manual pulse generator/Incremental synchronous encoder input selection/open-collector type

Connect the A-phase/PULSE signal to HA, and the B-phase/SIGN signal to HB.

\*4 Manual pulse generator/Incremental synchronous encoder input selection in Differential-output type

Connect the A-phase/PULSE signal to HAH, and the A-phase/PULSE inverse signal to HAL.

Connect the B-phase/SIGN signal to HBH, and the B-phase/SIGN inverse signal to HBL.

\*5 Do not connect to any of the terminal explained as "No connect".

\*6 Set the external command signal [DI] in "[Pr.95] External command signal selection".

\*7 DI1 to DI4 common terminal arrangement is COM(Common contact), 4 points/common.

## List of input signal details

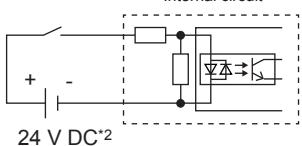
Signal name		Pin No.	Signal details
Differential-output type	Manual pulse generator/ Incremental synchronous encoder A phase/PULSE	4 HAH (A+)	<p>(1) Phase A/Phase B</p> <ul style="list-style-type: none"> <li>Input the pulse signal from the manual pulse generator/incremental synchronous encoder A phase and B phase.</li> <li>If the A phase leads the B phase, the positioning address will increase at the rising and falling edges of each phase.</li> <li>If the B phase leads the A phase, the positioning address will decrease at the rising and falling edges of each phase.</li> </ul> <p><b>(a) Magnification by 4</b></p> <p>[When increased] A phase B phase Positioning address +1+1+1+1+1+1+1+1</p> <p>[When decreased] A phase B phase Positioning address -1 -1 -1 -1 -1 -1 -1 -1</p>
		5 HAL (A-)	<p><b>(b) Magnification by 2</b></p> <p>[When increased] A phase B phase Positioning address +1+1+1+1+1+1+1+1</p> <p>[When decreased] A phase B phase Positioning address -1 -1 -1 -1 -1 -1 -1 -1</p>
	Manual pulse generator/ Incremental synchronous encoder B phase/SIGN	17 HBH (B+)	<p><b>(c) Magnification by 1</b></p> <p>1) Positive logic</p> <p>[When increased] A phase B phase Positioning address +1 +1 +1 +1</p> <p>[When decreased] A phase B phase Positioning address -1 -1 -1 -1</p>
		18 HBL (B-)	<p>2) Negative logic</p> <p>[When increased] A phase B phase Positioning address +1 +1 +1 +1</p> <p>[When decreased] A phase B phase Positioning address -1 -1 -1 -1</p>
Voltage-output type/open-collector type	Manual pulse generator/ Incremental synchronous encoder A phase/PULSE	3 HA (A)	<p><b>(2) PULSE/SIGN</b></p> <p>Input the pulse signal for counting the increased/decreased pulse in the pulse input (PULSE). Input the signal for controlling forward run and reverse run in the direction sign (SIGN).</p> <p>1) "[Pr.151] Manual pulse generator/Incremental synchronous encoder input logic selection" is positive logic</p> <ul style="list-style-type: none"> <li>The motor will forward run when the direction sign is HIGH.</li> <li>The motor will reverse run when the direction sign is LOW.</li> </ul> <p>2) "[Pr.151] Manual pulse generator/Incremental synchronous encoder input logic selection" is negative logic</p> <ul style="list-style-type: none"> <li>The motor will forward run when the direction sign is LOW.</li> <li>The motor will reverse run when the direction sign is HIGH.</li> </ul>
	Manual pulse generator/ Incremental synchronous encoder B phase/SIGN	16 HB (B)	<p>[When increased] Positive logic SIGN HIGH PULSE Positioning address +1+1+1</p> <p>[When decreased] Positive logic SIGN LOW PULSE Positioning address -1 -1 -1</p> <p>[When increased] Negative logic SIGN LOW PULSE Positioning address +1+1+1</p> <p>[When decreased] Negative logic SIGN HIGH PULSE Positioning address -1 -1 -1</p>

Signal name	Pin No.	Signal details
External command signal/ Switching signal	(DI1)	11
	(DI2)	24
	(DI3)	12
	(DI4)	25
Common (COM)	13 26	• Common for external command/switching signals.
Forced stop input signal (EMI)	10	• This signal is input when batch forced stop is available for all axes of servo amplifier. EMI ON (Opened): Forced stop EMI OFF (24 V DC input): Forced stop release
Forced stop input signal common (EMI.COM)	23	
Signal ground (SG)	2 15	The signal ground in the case of using manual pulse generator/INC synchronous encoder by the voltage output type/open-collector type.

## Interface internal circuit

The outline diagrams of the internal circuits for the external device connection interface (for the Simple Motion module) are shown below.

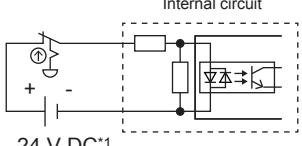
### Interface between external command signals/switching signals

Input or Output	Signal name	DI_*	Pin No.				Wiring example	Description
			1	2	3	4		
Input	External command signal/Switching signal	DI_*	11	24	12	25	 Internal circuit	External command signal/ Switching signal
		COM	13	26				

\*1 \_ = 1 to 4

\*2 As for the 24 V DC sign, both "+" and "-" are possible.

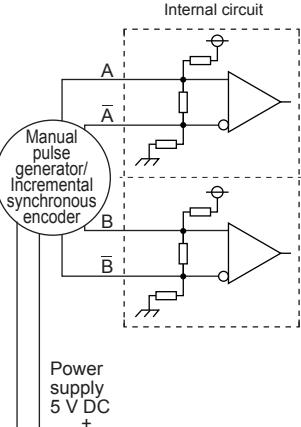
### Interface with forced stop input signals

Input or Output	Signal name	Pin No.	Wiring example	Description	
Input	Forced stop input	EMI	10	 Internal circuit	Forced stop input signal
	EMI.COM	23			

\*1 As for the 24 V DC sign, both "+" and "-" are possible.

### Manual pulse generator/Incremental synchronous encoder input

#### ■ Interface between manual pulse generator/incremental synchronous encoder (Differential-output type)

Input or Output	Signal name	Pin No.	Wiring example		
Input <sup>*1,*2</sup>	Manual pulse generator, phase A/PULSE	4	 Internal circuit	Manual pulse generator/ Incremental synchronous encoder	
	HAL (A-)	5			
	Manual pulse generator, phase B/SIGN	17	 Internal circuit		
	HBL (B-)	18			

\*1 Set "0: Differential-output type" in "[Pr.89] Manual pulse generator/Incremental synchronous encoder input type selection" if the manual pulse generator/Incremental synchronous encoder of differential-output type is used.

The default value is "1: Voltage-output/open-collector type".

\*2 Set the signal input form in "[Pr.24] Manual pulse generator/Incremental synchronous encoder selection".

## ■Interface between manual pulse generator/Incremental synchronous encoder (Voltage-output type/open-collector type)

Input or Output	Signal name	Pin No.	Wiring example
Input <sup>*1, *2</sup>	Manual pulse generator, phase A/PULSE	HA (A) 3	
	Manual pulse generator, phase B/SIGN	HB (B) 16	
	Signal ground	SG 2 15	

\*1 Set "1: Voltage-output/open-collector type" in "[Pr.89] Manual pulse generator/Incremental synchronous encoder input type selection" if the manual pulse generator/Incremental synchronous encoder of voltage-output/open-collector type is used.

The default value is "1: Voltage-output/open-collector type".

\*2 Set the signal input form in "[Pr.24] Manual pulse generator/Incremental synchronous encoder input selection".

### Wiring example for manual pulse generator/incremental synchronous encoder

Wire the manual pulse generator/incremental synchronous encoder of differential output type and voltage output type/open-collector type as follows.

Switch the input type of 40SSC-S by "[Pr.89] Manual pulse generator/Incremental synchronous encoder input type selection".

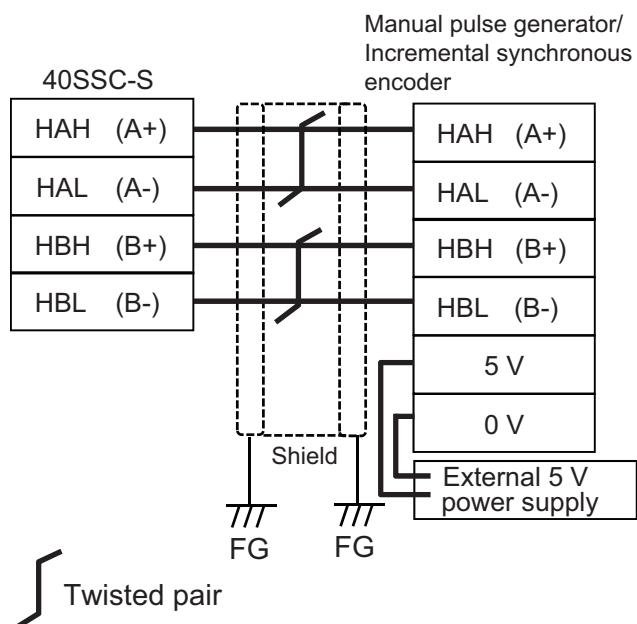
Use the external 5 V power supply (5 V DC±5%) for the power supply of the manual pulse generator/incremental synchronous encoder.

In the case of voltage output type/open-collector type, connect the 0 V (-) of the manual pulse generator/incremental synchronous encoder and the SG of 40SSC-S.

Select the external power supply with due consideration for the capacity of manual pulse generator/incremental synchronous encoder.

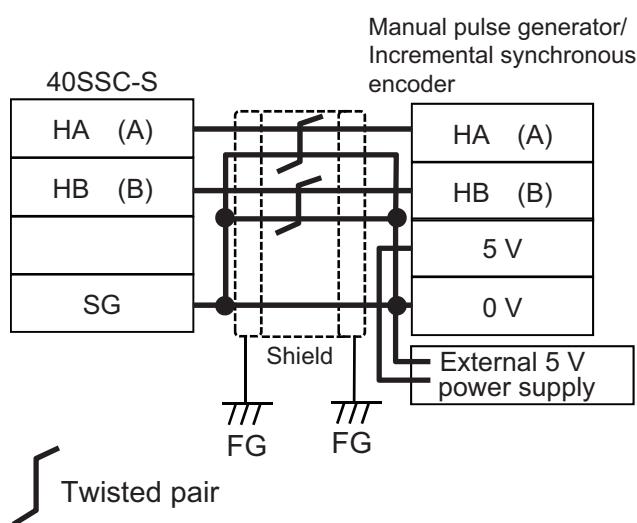
## ■Manual pulse generator/Incremental synchronous encoder of differential output type

Recommended wiring example



## ■Manual pulse generator/Incremental synchronous encoder of voltage output type/open-collector type

Recommended wiring example



# 6 OPERATION EXAMPLES

This chapter describes the programming procedure and the basic program of the Simple Motion module. When applying the program examples provided in this manual to an actual system, properly verify the applicability and reliability of the control on the system.

## Overall configuration

The program examples show the programs of the following operations.

- Machine home position return execution
- Execution of 1-axis linear control using axis 1
- JOG operation execution

The following table shows the overall configuration of the positioning control operation examples. Note that the programs in the list are the ones using the axis 1 only.

No.	Program name	Description
1	PLC READY signal ON program	Notifies the Simple Motion module that the CPU module is normal before the start of positioning control.
2	All axis servo ON program	Enables the servo amplifier to operate.
3	Positioning start No. setting program	Sets the positioning data that are executed with a positioning start program. The operation example is the case when the start No. is for machine home position return or the positioning data No.1 of the axis 1 is used.
4	Positioning start program	Starts the machine home position return or the positioning control using positioning data.
5	JOG operation setting program	Sets the JOG operation speed.
6	JOG operation execution program	Starts the JOG operation.

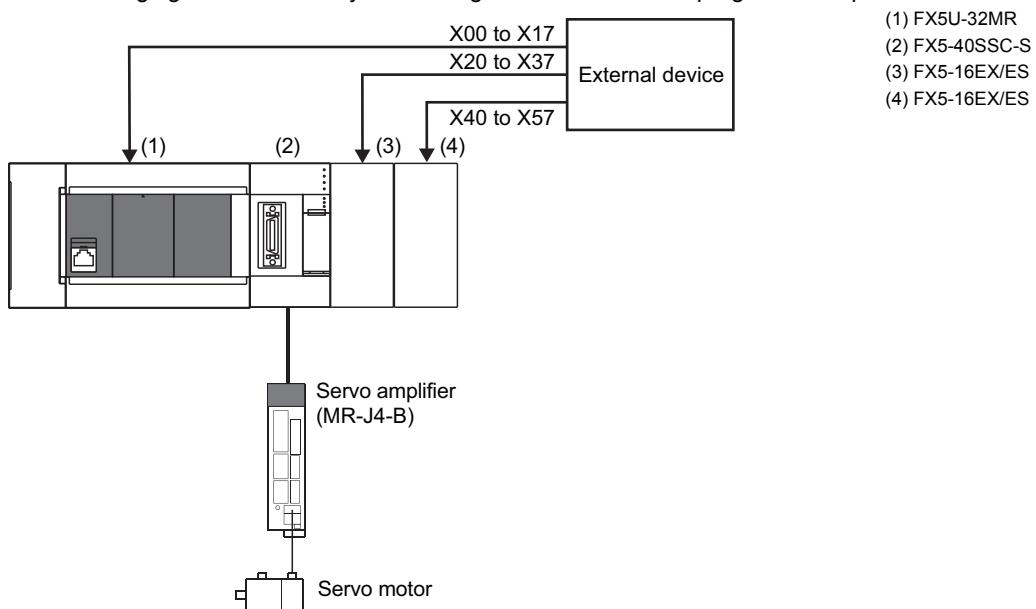
## Programming procedure

Take the following steps to create a program for the motion control:

1. Set the system structure setting and parameter setting of the Simple Motion module setting for the initial setting.  
☞ Page 56 System setting, Page 57 Parameters
2. Set the positioning data of the Simple Motion module setting.  
☞ Page 57 Positioning data
3. Program examples of each control

## System configuration

The following figure shows the system configuration used for the program examples in this section.

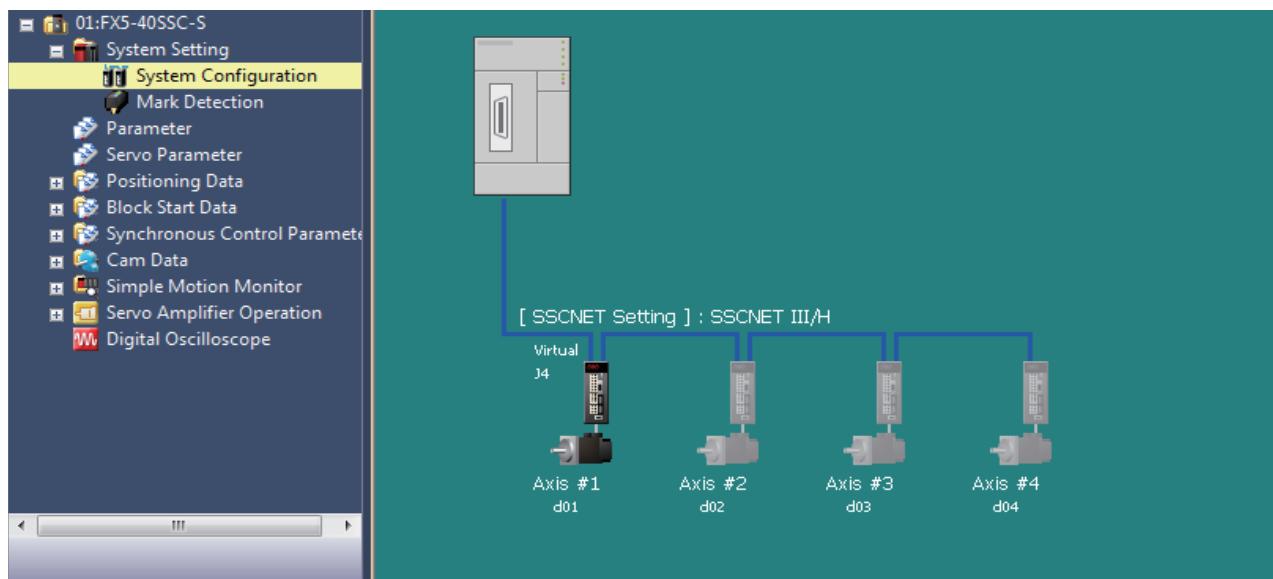


## Initial setting details

Set the system setting, parameters and positioning data using the engineering tool.

### ■System setting

The system setting is shown below.



## ■Parameters

The following table lists parameters. Use the default values for the setting items not listed here or the setting items for the axes not described here.

Setting item		Setting value (Axis 1)
Common parameters	[Pr.82] Forced stop valid/invalid selection	1: Invalid
Basic parameters 1	[Pr.1] Unit setting	0: mm
	[Pr.2] Number of pulses per rotation	4194304 pulses
	[Pr.3] Movement amount per rotation	250000.0 µm
Detailed parameters 1	[Pr.22] Input signal logic selection: Lower limit	1: Positive logic
	[Pr.22] Input signal logic selection: Upper limit	1: Positive logic
	[Pr.116] FLS signal selection: input type	2: Buffer memory
	[Pr.117] RLS signal selection: input type	2: Buffer memory
	[Pr.118] DOG signal selection: input type	2: Buffer memory
Home position return basic parameters	[Pr.46] Home position return speed	50.00 mm/min
	[Pr.47] Creep speed	15.00 mm/min
	[Pr.48] Home position return retry	1: Retry home position return with limit switch

## ■Positioning data

The following table lists positioning data. Use the default values for the setting items not listed here or the setting items for the axes not described here.

Setting item (Axis 1 Positioning data)	Setting value (Positioning data No.1)	Setting value (Positioning data No.2)	Setting value (Positioning data No.3)
Operation pattern	0: Positioning complete		
Control system	01h: ABS Linear 1 1-axis linear control (ABS)	06h: FWD V/P Speed-position switching control (forward run)	08h: FWD P/V Position-speed switching control (forward run)
Axis to be interpolated	—		
Acceleration time No.	0: 1000		
Deceleration time No.	0: 1000		
Positioning address	-10000.0 µm	2500.0 µm	2000.0 µm
Arc address	—		
Command speed	20.00 mm/min	180.00 mm/min	180.00 mm/min
Dwell time	300 ms	0 ms	300 ms
M code	9843	0	0

## List of devices to be used

In the program examples, the devices to be used are assigned as follows.

In addition, change the module access device, external inputs, internal relays, data resistors, and timers according to the system used.

### ■Buffer memory address of Simple Motion module, external inputs, internal relay

Device name	Device				Application	Description at device ON			
	Axis 1	Axis 2	Axis 3	Axis 4					
Buffer memory address of Simple Motion module	U1\G31500.0				READY signal	READY			
	U1\G31500.1				Synchronization flag	Buffer memory accessible			
	U1\G2417.C	—			M code ON signal	M code outputting			
	U1\G2417.D				Error detection signal	Error detection			
	U1\G31501.0				BUSY signal	BUSY (operating)			
	U1\G2417.E				Start complete signal	Start completed			
	U1\G5950				PLC READY signal	CPU module preparation completed			
	U1\G5951				All axis servo ON signal	All axis servo ON signal			
	U1\G30101				Forward run JOG start signal	Starting forward run JOG			
	U1\G30102				Reverse run JOG start signal	Starting reverse run JOG			
	U1\G30104				Positioning start signal	Requesting start			
External input (command)	X3	—	—	—	Machine home position return command	Commanding machine home position return			
	X4				Fast home position return command	Commanding fast home position return			
	X5				Positioning start command	Commanding positioning start			
	X6				Speed-position switching operation command	Commanding speed-position switching operation			
	X7				Speed-position switching enable command	Commanding speed-position switching enable			
	X10				Speed-position switching prohibit command	Commanding speed-position switching prohibit			
	X11				Movement amount change command	Commanding movement amount change			
	X12				High-level positioning control start command	Commanding high-level positioning control start			
	X15				JOG operation speed setting command	Commanding JOG operation speed setting			
	X16				Forward run JOG/inching command	Commanding forward run JOG/inching operation			
	X17				Reverse run JOG/inching command	Commanding reverse run JOG/inching operation			
	X40				Position-speed switching operation command	Position-speed switching operation command			
	X41				Position-speed switching enable command	Position-speed switching enable command			
	X42				Position-speed switching prohibit command	Position-speed switching prohibit command			
	X43				Speed change command	Speed change command			
	X53				PLC READY signal ON	PLC READY signal ON			
	X55				For Unit (degree)	For Unit (degree)			
	X56				Positioning start signal command	Commanding positioning start			
	X57				All axis servo ON command	All axis servo ON command			

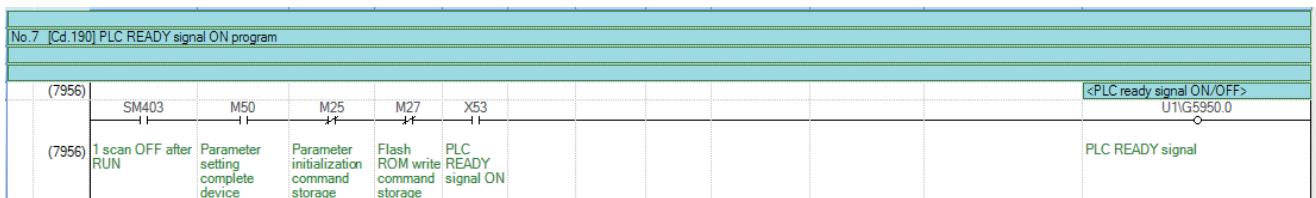
Device name	Device				Application	Description at device ON
	Axis 1	Axis 2	Axis 3	Axis 4		
Internal relay	M3	—	—	—	Fast home position return command	Commanding fast home position return
	M4				Fast home position return command storage	Fast home position return command held
	M5				Positioning start command pulse	Positioning start commanded
	M6				Positioning start command storage	Positioning start command held
	M7				JOG/inching operation termination	JOG/inching operation termination
	M9				Manual pulse generator operating flag	Manual pulse generator operating flag
	M25				Parameter initialization command storage	Parameter initialization command held
	M27				Flash ROM write command storage	Flash ROM write command held
	M50				Parameter setting complete device	Parameter setting completed

## ■Data registers and timers

Device name	Device				Application	Storage details		
	Axis 1	Axis 2	Axis 3	Axis 4				
Data register	D0	—	—	—	Home position return request flag	[Md.31] Status: b3		
	D1				Speed (low-order 16 bits)	[Cd.25] Position-speed switching control speed change register		
	D3				Movement amount (low-order 16 bits)	[Cd.23] Speed-position switching control movement amount change register		
	D5				Inching movement amount	[Cd.16] Inch movement amount		
	D6				JOG operation speed (low-order 16 bits)	[Cd.17] JOG speed		
	D32				Start number	—		
Code	U1\G2417				Status	[Md.31] Status		
	U1\G4300				Positioning start No.	[Cd.3] Positioning start No.		
	U1\G4301				Positioning starting point No.	[Cd.4] Positioning starting point No.		
	U1\G4326				Speed-position switching control movement amount	[Cd.23] Speed-position switching control movement amount change register		
	U1\G4328				Speed-position switching enable flag	[Cd.24] Speed-position switching enable flag		
	U1\G4330				Position-speed switching control speed change	[Cd.25] Position-speed switching control speed change register		
	U1\G4332				Position-speed switching enable flag	[Cd.26] Position-speed switching enable flag		

## Program example

### ■PLC READY signal ON program



### ■All axis servo ON program



## ■Positioning start No. setting program

No.9 Positioning start number setting program					
(1) Machine HPR					
(8159)	X3		<Writing Machine HPR (9001)>		
(8159)	Machine HPR command		MOV	K9001	D32 Start number
(2) Fast HPR					
(8272)	X4		<Extracting HPR request flag ON/OFF>		
(8272)	Fast HPR command		WANDP	U1IG2417 Status	H8 D0 HPR request flag
	=	D0 HPR request flag		SET	M3 Fast HPR command
		K0	<Enabling fast HPR start>		
			MOV	K9002	D32 Start number
			<Writing fast HPR (9002)>		
			SET	M4	Fast HPR command storage
(3) Positioning with positioning data No. 1					
(8453)	X5		<Positioning data No. 1 setting>		
(8453)	Positioning start command		MOV	K1	D32 Start number
(4) Speed-position switching operation (Positioning data No. 2) (In the ABS mode, new movement amount write is not needed.)					
(8513)	X6		<Positioning data No. 2 setting>		
(8513)	Speed/position switching operation command		MOV	K2	D32 Start number
(8577)	X7		<Setting speed/position switching signal enable>		
(8577)	Speed/position switching enable command		MOV	K1	U1IG4328 Speed/position switching enable flag
(8641)	X10		<Setting speed/position switching signal prohibit>		
(8641)	Speed/position switching prohibit command		MOV	K0	U1IG4328 Speed/position switching enable flag
(8707)	X11		<Writing movement amount after change>		
(8707)	Movement amount change command		DMOV	D3 Movement amount (low-order 16 bits)	U1IG4326 Speed/position switching control movement amount

(5) Position/speed switching operation (positioning data No. 3)			
(8772)	X40		<Positioning data No. 3 setting>
(8772)	Position/speed switching operation command		MOV P K3 D32 Start number
(8831)	X41 X42		<Setting position/speed switching signal enable>
(8831)	Position/speed switching enable command	Position/speed switching prohibit command	MOV P K1 U1IG4332 Position/speed switching enable flag
(8897)	X41 X42		<Setting position/speed switching signal prohibit>
(8897)	Position/speed switching enable command	Position/speed switching prohibit command	MOV P K0 U1IG4332 Position/speed switching enable flag
(8965)	X43		<Writing speed after change>
(8965)	Speed change command		DMOV P D1 Speed (low-order 16 bits) U1IG4330 Position/speed switching control speed change
(6) High-level positioning control			
(9007)	X12		<Writing block positioning (7000)>
(9007)	High-level positioning control start command		MOV P K7000 D32 Start number
			<Writing positioning start point number (1)>
			MOV P K1 U1IG4301 Positioning starting point No.
(7) Fast HPR command and fast HPR command storage OFF (Not required when fast HPR is not used)			
(9127)	X3		<Fast HPR command OFF>
(9127)	Machine HPR command		RST M3 Fast HPR command
	X5		<Fast HPR command storage OFF>
	Positioning start command		RST M4 Fast HPR command storage
	X6		
	Speed/position switching operation command		
	X40		
	Position/speed switching operation command		
	X12		
	High-level positioning control start command		
	M6		
	Positioning start command storage		

## ■Positioning start program

No.10 Positioning start program (When fast HPR is not performed, contacts of M3 and M4 are not needed.) (When M code is not used, contacts of U0/G2417.C are not needed.) (When JOG/inching operation is not performed, contacts of M7 are not needed.) (When manual pulse generator operation is not performed, contacts of M9 is not needed.)									
(9228)	X56							<Pulse conversion of positioning start command>	
(9228)	Positioning start signal command							PLS	M5 Positioning start command pulse
(9356)	M5	U1G30104.0	U1G2417.E	U1G2417.C	M7	M9	M3	<Holding the positioning start command>	
	Positioning start command pulse	Positioning start signal (axis 1)	Start complete signal (axis 1)	M code ON signal (axis 1)	JOG/inching operation flag	Manual pulse generator operating flag	Fast HPR command	SET	M6 Positioning start command storage
							M3 M4		Fast HPR command Fast HPR command storage
(9427)	M6							<Positioning start No. setting>	
	Positioning start command storage							MOVP	D32 Start number U1G4300 Positioning start No.
								SET	U1G30104.0 Positioning start signal (axis 1)
								RST	<Positioning start command storage OFF> M6 Positioning start command storage
(9560)	U1G30104.0	U1G2417.E	U1G31501.0					RST	U1G30104.0 Positioning start signal (axis 1)
	Positioning start signal (axis 1)	Start complete signal (axis 1)	BUSY signal (axis 1)						
			U1G2417.D						
			Error detection signal (axis 1)						

## ■JOG operation setting program

No.12 JOG operation setting program									
(9801)	X15						<JOG operation speed (100.00 mm/min) setting>		
	JOG operation speed setting command						DMOVP	K10000	D6 JOG operation speed (low-order 16 bits)
	X55						<JOG operation speed (1200.000 degrees/min) setting>		
	For unit (degree)						DMOVP	K1200000	D6 JOG operation speed (low-order 16 bits)
							<Setting the inching movement amount to (0)>		
							MOV	K0	D5 Inching movement amount
							<Writing JOG operation speed>		
							TOP	H1 K4317 D5 Inching movement amount	K3

## ■JOG operation execution program

No.14 JOG operation/inching operation execution program									
						<JOG/inching operation flag ON>			
(10240)	X16 Forward run JOG/inching command	READY signal	BUSY signal (axis 1)		SET	M7 JOG/inching operation flag			
	X17 Reverse run JOG/inching command			<JOG/inching operation end>					
(10363)	X16 Forward run JOG/inching command	X17 Reverse run JOG/inching command			RST	M7 JOG/inching operation flag			
(10402)	X16 Forward run JOG/inching command	M7 JOG/inching operation flag	U1IG30102.0 Reverse run JOG start signal (axis 1)			<Executing forward run JOG/inching operation> U1IG30101.0 Forward run JOG start signal (axis 1)			
(10465)	X17 Reverse run JOG/inching command	M7 JOG/inching operation flag	U1IG30101.0 Forward run JOG start signal (axis 1)			<Executing reverse run JOG/inching operation> U1IG30102.0 Reverse run JOG start signal (axis 1)			

# APPENDICES

## Appendix 1 Component List

The positioning system using the Simple Motion module is configured of the following devices.

No.	Part name	Type	Remarks
1	Simple Motion module	FX5-40SSC-S	—
2	Servo amplifier	—	—
3	Manual pulse generator	—	Recommended: MR-HDP01 (Manufactured by Mitsubishi Electric Corporation) Operation has been checked: UFO-M2-0025-2Z1-B00E (Manufactured by Nemicon Corporation)
4	SSCNETIII cable	—	Cables are needed for connecting the Simple Motion module with a servo amplifier, or between servo amplifiers. (☞ Page 64 Reference product)
5	External input signal cable	—	Cables are needed for connecting the Simple Motion module with an external device. (Prepare them referring to the manuals for the connected devices and information given in the following. ☞ Page 49 Signal layout for external input connection connector)

## Reference product

### Connection cable

The cables for connecting between the Simple Motion module and servo amplifiers. Refer to each servo amplifier instruction manual for details.

[SSCNETIII cable]

\_ = Cable length

(015: 0.15 m (0.49 ft.), 03: 0.3 m (0.98 ft.), 05: 0.5 m (1.64 ft.), 1: 1 m (3.28 ft.), 3: 3 m (9.84 ft.), 5: 5 m (16.40 ft.), 10: 10 m (32.81 ft.), 20: 20 m (65.62 ft.), 30: 30 m (98.43 ft.), 40: 40 m (131.23 ft.), 50: 50 m (164.04 ft.) )

Model name	Cable length [m (ft.)]	Description
MR-J3BUS_M (Standard cord for inside panel)	MR-J3BUS015M	0.15 (0.49)
	MR-J3BUS03M	0.3 (0.98)
	MR-J3BUS05M	0.5 (1.64)
	MR-J3BUS1M	1 (3.28)
	MR-J3BUS3M	3 (9.84)
MR-J3BUS_M-A (Standard cable for outside panel)	MR-J3BUS5M-A	5 (16.40)
	MR-J3BUS10M-A	10 (32.81)
	MR-J3BUS20M-A	20 (65.62)
MR-J3BUS_M-B (Long distance cable)	MR-J3BUS30M-B	30 (98.43)
	MR-J3BUS40M-B	40 (131.23)
	MR-J3BUS50M-B	50 (164.04)

### Connection connector

The connector for the external input wiring.

[External input wiring connector]

Part name	Specification
Applicable connector	LD77MHIOCON
Applicable wire size	AWG30 to 24 (0.05 to 0.2 mm <sup>2</sup> ) <sup>1</sup>

\*1 AWG24 (0.2 mm<sup>2</sup>) is recommended.

## Specifications of recommended manual pulse generator

Item	Specification
Model name	MR-HDP01
Ambient temperature	-10 to 60°C (14 to 140 °F)
Pulse resolution	25 pulses/rev (100 pulses/rev after magnification by 4)
Output method	Voltage-output, Output current Max. 20 mA
Power supply voltage	4.5 to 13.2 V DC
Current consumption	60 mA
Output level	"H" level: Power supply voltage <sup>*1</sup> - 1 V or more (in no load) "L" level: 0.5 V or less (with maximum leading-in)
Life time	1000000 revolutions (at 200 r/min)
Permitted axial loads	Radial load: Max. 19.6 N Thrust load: Max. 9.8 N
Weight	0.4 [kg]
Number of max. revolution	Instantaneous Max. 600 r/min. normal 200 r/min
Pulse signal status	2 signals: A phase, B phase, 90° phase difference
Start friction torque	0.06 N·m (20°C (68°F))

\*1 If a separate power supply is used, use a stabilized power supply of voltage 5 V DC ± 0.25 V.

## Manual pulse generator that the operation has been checked

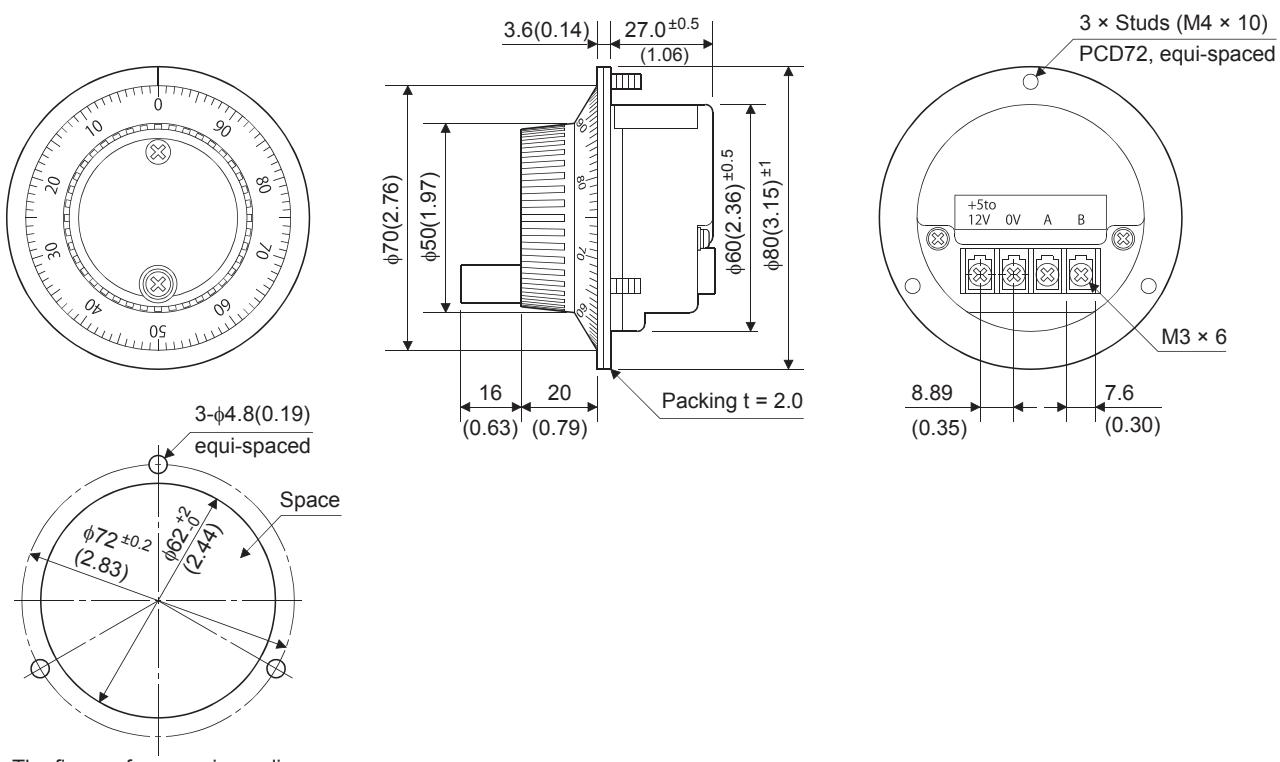
Manufacturer	Model name
Nemicon Corporation <sup>*1</sup>	UFO-M2-0025-2Z1-B00E

\*1 Contact: <http://www.nemicon.co.jp/nemicon/>

## External dimension drawing of manual pulse generator

MR-HDP01 (Manufactured by Mitsubishi Electric Corporation)

[Unit: mm (inch)]



The figure of processing a disc

## Serial absolute synchronous encoder specifications

Item	Specifications
Model name	Q171ENC-W8 <sup>*1</sup>
Ambient temperature	-5 to 55°C (23 to 131°F)
Resolution	4194304 pulses/rev
Transmission method	Serial communications (Connected to MR-J4-_B-RJ)
Direction of increasing addresses	CCW (viewed from end of shaft)
Protective construction	Dustproof/Waterproof (IP67: Except for the shaft-through portion.)
Permitted speed at power ON	3600 r/min
Permitted speed at power OFF <sup>*2</sup>	500 r/min
Permitted axial loads	Radial load: Up to 19.6 N, Thrust load: Up to 9.8 N
Runout at input shaft tip	0.02 mm (0.00079 inch) or less, (15 mm (0.59 inch) from tip)
Start friction torque	0.04 N•m (20°C (68°F))
Recommended coupling	Bellows coupling
Permitted angular acceleration	40000 rad/s <sup>2</sup>
Vibration resistance	5 G (50 to 200 Hz)
Shock resistance	50 G (11 ms or less)
Internal current consumption [A]	0.2
Mass [kg]	0.6
Connecting cable [m (ft.)]	Q170ENCCBL_M (_ = Cable length: 2 (6.56), 5 (16.40), 10 (32.81), 20 (65.62), 30 (98.43), 50 (164.04))
Communications method	Differential driver/receiver
Transmission distance	Up to 50 m (164.04 ft.)

\*1 When "o-ring" is required, please purchase separately by a customer.

\*2 If it exceeds a permitted speed at power OFF, a position displacement is generated.

## Specifications of serial absolute synchronous encoder input (CN2L) of servo amplifier

Item	Specifications
Applicable types	Q171ENC-W8
Applicable signal types	Differential-output type: (SN75C1168 or equivalent)
Transmission method	Serial communications
Synchronous method	Counter-clock-wise (viewed from end of shaft)
Communication speed	2.5 Mbps
Position detection method	Absolute (ABS) method
Resolution	4194304 pulses/rev (22 bit)
Number of modules	1/module (MR-J4-_B-RJ)
External connector type	20 pin connector
Applicable connector for the external connection	MR-J3CN2 (Optional)
Applicable wire	J14B103715-00 12 pairs
Connecting cable [m (ft.)]	Q170ENCCBL_M-A (_ = Cable length: 2 (6.56), 5 (16.40), 10 (32.81), 20 (65.62), 30 (98.43), 50 (164.04))
Cable length	Up to 50 m (164.04 ft.)
Back up the absolute position.	Depends on the battery (MR-BAT6V1SET).
Battery service life time (value in actual)	10000 [h] (When MR-BAT6V1SET is used while the device is turned OFF at the ambient temperature of 25°C (77°F))

## Serial absolute synchronous encoder cable

Generally use the serial absolute synchronous encoder cables available as our products. If the required length is not found in our products, fabricate the cable by a customer side.

### ■Selection

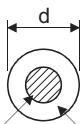
The following table indicates the serial absolute synchronous encoder cables used with the serial absolute synchronous encoder. Connector sets (MR-J3CN2) are also available for your fabrication.

Cable model	Cable length [m (ft.)]	Wire model
Q170ENCCBL_M-A	2 (6.56), 5 (16.40), 10 (32.81), 20 (65.62), 30 (98.43), 50 (164.04)	J14B103715-00 12 pairs (BLACK)

Use the following or equivalent twisted pair cables as the serial absolute synchronous encoder cables.

Connector sets type		Description				
Wire model	Core size [mm <sup>2</sup> ]	Number of cores	Characteristics of one core			Finished OD [mm] <sup>*2</sup>
J14B103715-00 12 pairs (BLACK)	0.2	24 (12 pairs)	Structure [Number of wires/mm]	Conductor resistance [ $\Omega/\text{km}$ ]	Insulating sheath OD d [mm] <sup>*1</sup>	9.0

\*1 d is as shown below.



Conductor Insulation sheath

\*2 Standard OD (Outside Diameter). Maximum OD is about 10% larger.

### ⚠ CAUTION

- When fabricating the encoder cable, do not make incorrect connection. Wrong connection will cause runaway or explosion.

## ■Q170ENCCBL\_M-A

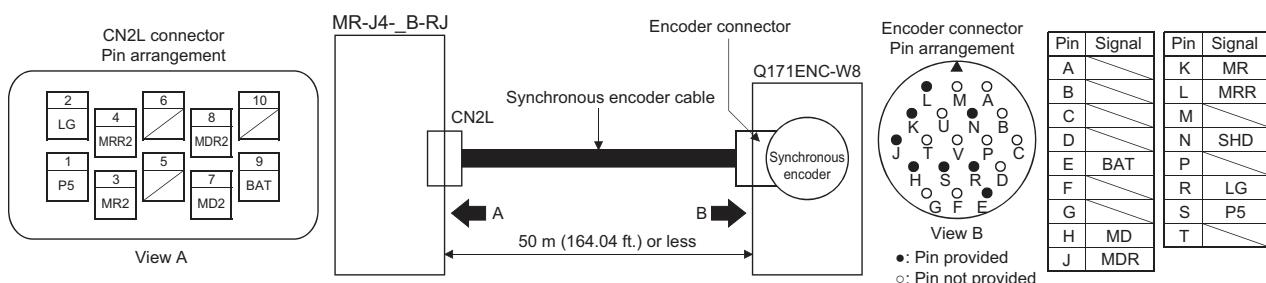
- Model explanation

Type: Q170ENCCBL\_M - A

Symbol	Cable length [m (ft.)]
2	2 (6.56)
5	5 (16.40)
10	10 (32.81)
20	20 (65.62)
30	30 (98.43)
50	50 (164.04)

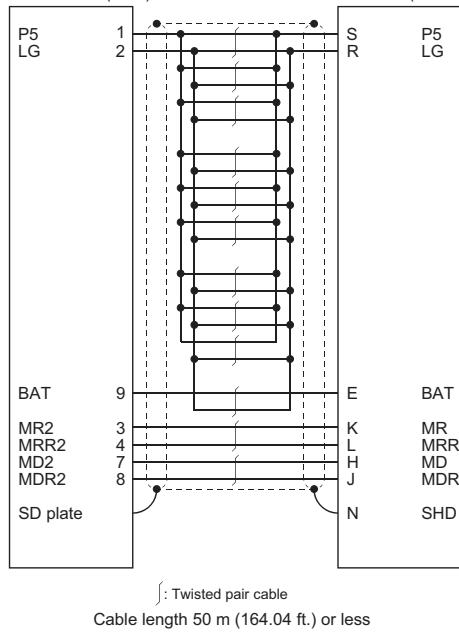
- Connection diagram

When fabricating a cable, use the recommended wire and connector set MR-J3CN2 for encoder cable given above, and make the cable as shown in the following connection diagram. Maximum cable length is 50 m (164.04 ft.).



Servo amplifier side  
36210-0100PL(plug)  
36310-3200-008(shell)

Encoder side  
MS3106B22-14S(plug)  
MS3057-12A(cable clump)



\*: Layout twisted pair for signal to avoid contact.



●: Twisted pair for signal (BAT/LG, MR/MRR, MD/MDR)  
○: Twisted pair (P5/LG)

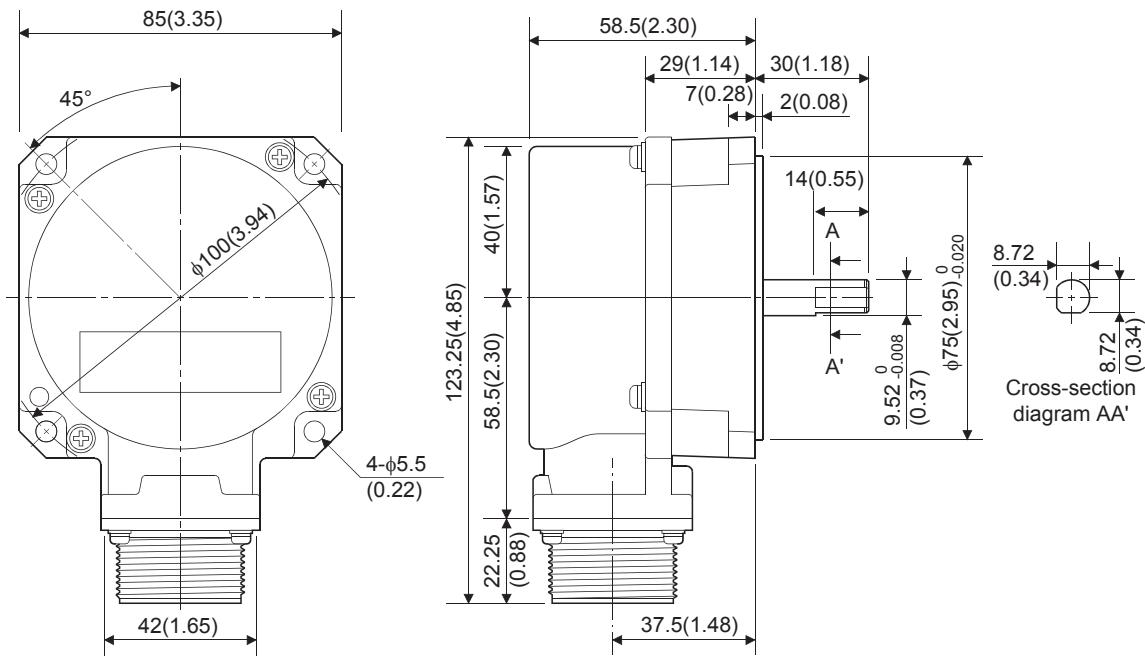
Cable cross-section diagram

## External dimension drawing of serial absolute synchronous encoder

## ■Serial absolute synchronous encoder (Q171ENC-W8)

[Unit: mm (inch)]

A



# Appendix 2 Connection with External Devices

## Connector

Mounted onto an external input connection connector of the Simple Motion module and used for wiring an external device. The "external device connector" includes the following 3 types.

### Connector type

Type	Model name		
	Connector	Connector case	
Soldering type (LD77MHIOCON)	One-touch lock style	10126-3000PE	10326-52F0-008
Soldering type <sup>*1</sup>	Screw tightening style	10126-3000PE	10326-52AO-008
Pressure-displacement type <sup>*1</sup>	One-touch lock style	10126-6000EL	10326-3210-000

\*1 Make sure to purchase the connector which is sold separately since this is not an option.

### Specifications of the connector

Part name	Specification	
Applicable connector	Soldering type (One-touch lock style/Screw tightening style)	Pressure-displacement type (One-touch lock style)
Applicable wire size	AWG30 to AWG24 (0.05 to 0.2 mm <sup>2</sup> )	AWG28 (twisted, 0.08 mm <sup>2</sup> )

\*1 The external input wiring connector has been prepared. Please purchase them by a customer.

#### Specialized tool

- Manual harness tool for pressure-displacement type (Manufactured by Sumitomo 3M Limited.)

#### Model name:

10960 (Press body)

10962 (Fixture unit)

10963 (Fixture block)

10964-1 (Cable clamp (small) for 14 to 50 poles)

- Contact for the specialized tool

Sumitomo 3M Limited: [http://solutions.3m.com/wps/portal/3M/ja\\_JP/WW2/Country/](http://solutions.3m.com/wps/portal/3M/ja_JP/WW2/Country/)

# External input signal cable

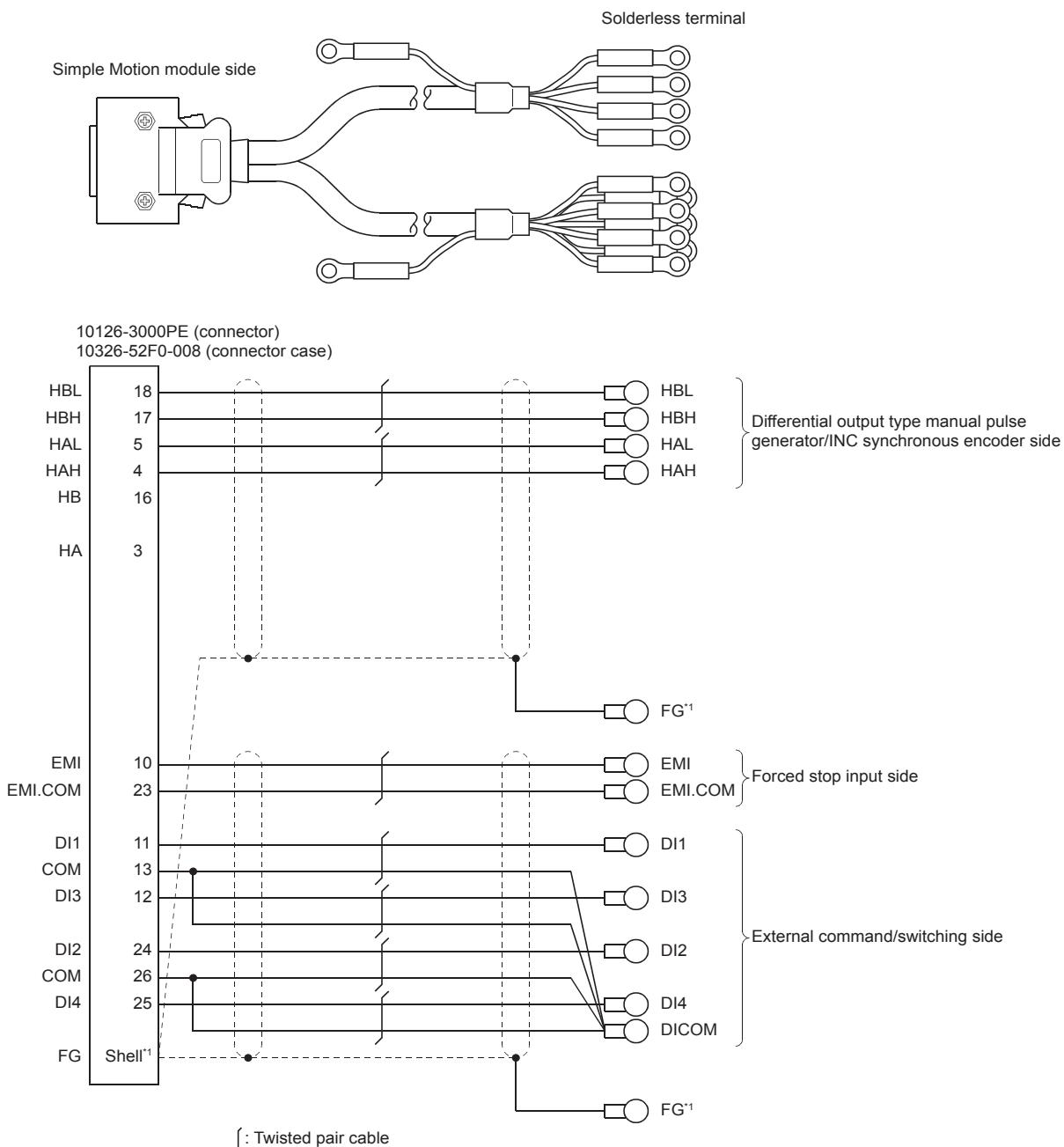
The external input signal cable is not prepared as an option. Fabricate the cable on the customer side.

## Connection diagram

Make the cable as shown in the following connection diagram.

### ■ Differential-output type

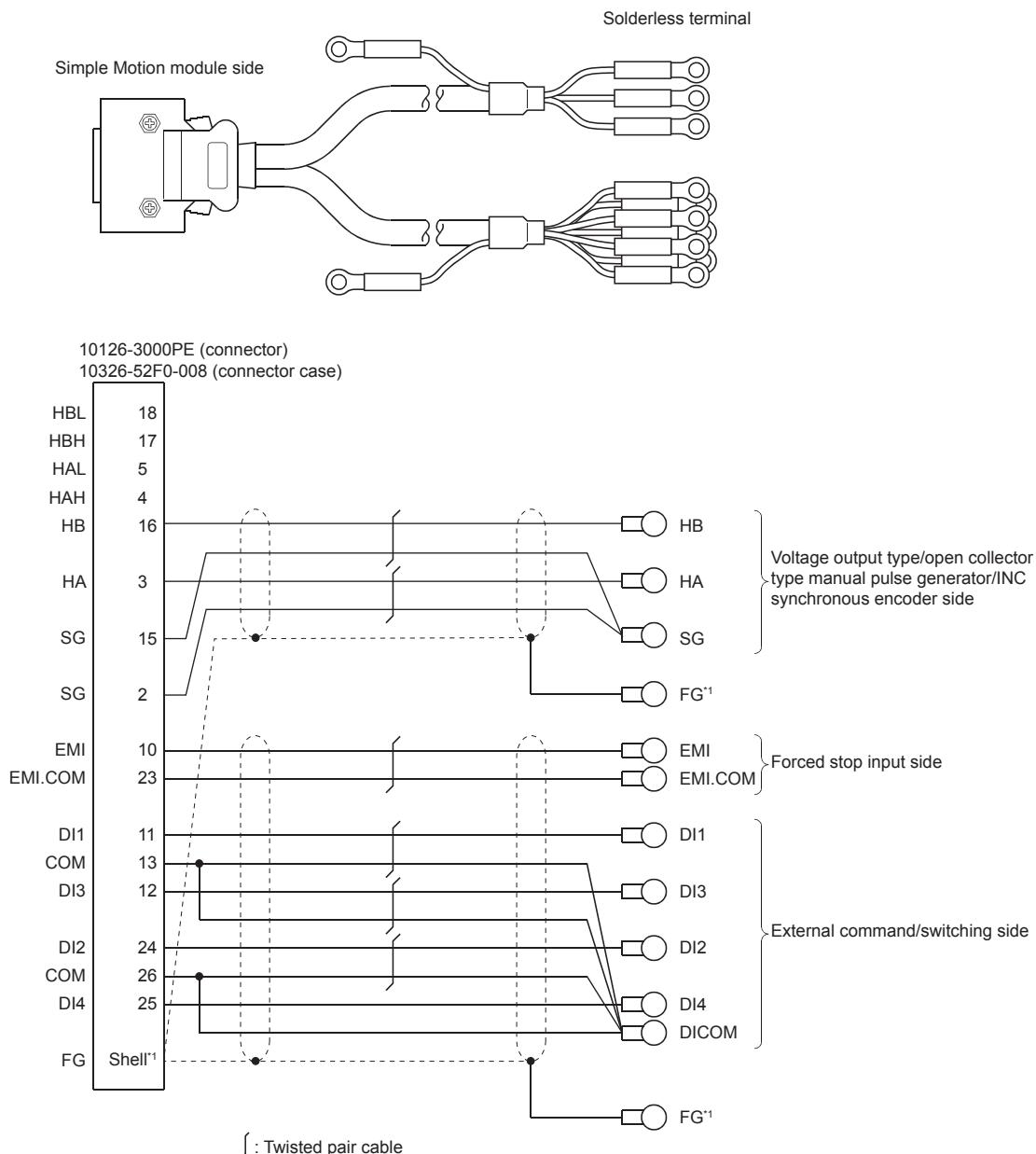
Make the cable within 30 m (98.5 ft.).



\*1 Make sure to perform shield treatment on the used equipment side. Also, connect it to the shell of connector side.

## ■Voltage-output type/Open-collector type

Make the cable within 10 m (32.81 ft.).

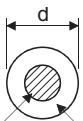


\*1 Make sure to perform shield treatment on the used equipment side. Also, connect it to the shell of connector side.

- The following table indicates the external input wiring connector cables. Make selection according to your operating conditions.

Wire model	Core size	Number of cores	Characteristics of one core			Finish OD [mm] <sup>*2</sup>
			Structure [Number of wires/mm]	Conductor resistance [ $\Omega/\text{km}$ ]	Insulating sheath OD d [mm] <sup>*1</sup>	
20276FACBL 7/0.18 mm×4P	AWG25 (0.16 mm <sup>2</sup> )	8 (4 pairs)	7/0.18TA	115	1.0	6.8
20276FACBL 7/0.18 mm×5P	AWG25 (0.16 mm <sup>2</sup> )	10 (5 pairs)	7/0.18TA	115	1.0	7.3

\*1 d is as shown below.



Conductor Insulation sheath

\*2 Standard OD. Max. OD is about 10% larger.

## !**CAUTION**

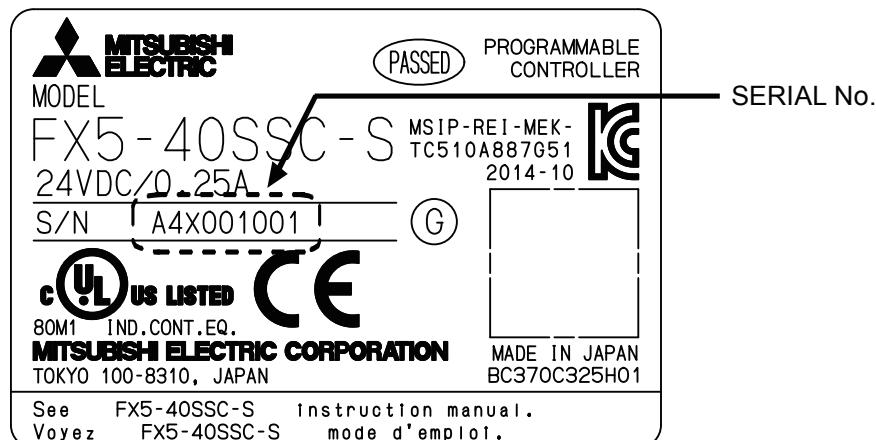
- When fabricating the cable, do not make incorrect connection. Wrong connection will cause runaway or explosion.

# Appendix 3 How to Check the SERIAL No.

The SERIAL No. of the Simple Motion module can be checked in the following method.

## Confirming the serial number on the rating plate

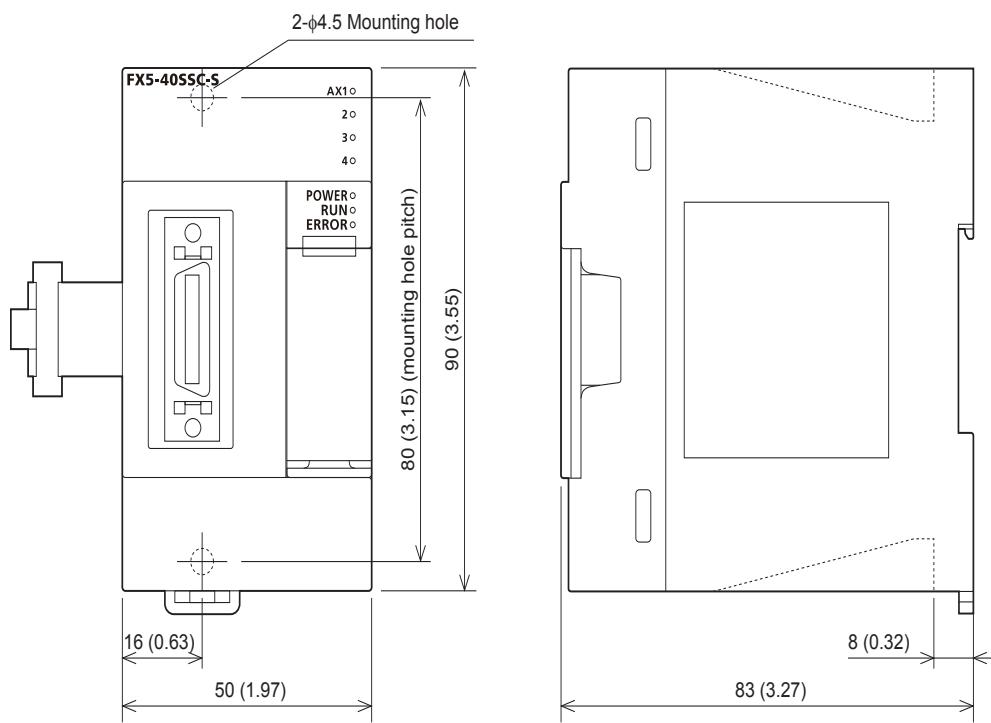
The rating plate is situated on the side face of the Simple Motion module.



# Appendix 4 External Dimensions

[Unit: mm(inch)]

A



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# Warranty

Read and completely understand the warranty below when using this product.

## 1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "Failure") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be repaired at no cost via the sales representative or Mitsubishi Service Company. However, if repairs are required onsite at domestic or overseas location, expenses to send an engineer will be solely at the customer's discretion. Mitsubishi shall not be held responsible for any re-commissioning, maintenance, or testing on-site that involves replacement of the failed module.

### [Gratis Warranty Term]

The gratis warranty term of the product shall be for one year after the date of purchase or delivery to a designated place. Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be six (6) months, and the longest gratis warranty term after manufacturing shall be eighteen (18) months. The gratis warranty term of repair parts shall not exceed the gratis warranty term before repairs.

### [Gratis Warranty Range]

- 1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.
- 2) Even within the gratis warranty term, repairs shall be charged for in the following cases.
  - a) Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
  - b) Failure caused by unapproved modifications, etc., to the product by the user.
  - c) When the Mitsubishi product is assembled into a user's device, Failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
  - d) Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
  - e) Relay failure or output contact failure caused by usage beyond the specified life of contact (cycles).
  - f) Failure caused by external irresistible forces such as fires or abnormal voltages, and failure caused by force majeure such as earthquakes, lightning, wind and water damage.
  - g) Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
  - h) Any other failure found not to be the responsibility of Mitsubishi or that admitted not to be so by the user.

## 2. Onerous repair term after discontinuation of production

- 1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued. Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.
- 2) Product supply (including repair parts) is not available after production is discontinued.

## 3. Overseas service

Overseas, repairs shall be accepted by Mitsubishi's local overseas FA Center. Note that the repair conditions at each FA Center may differ.

## 4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation of damages caused by any cause found not to be the responsibility of Mitsubishi, loss in opportunity, lost profits incurred to the user or third person by failure of Mitsubishi products, special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products, replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

## 5. Changes in product specifications

The specifications given in the catalogs, manuals or technical documents are subject to change without prior notice.

## 6. Product application

- 1) In using the Mitsubishi MELSEC programmable controller, the usage conditions shall be that the application will not lead to a major accident even if any problem or fault should occur in the programmable logic controller device, and that backup and fail-safe functions are systematically provided outside of the device for any problem or fault.
- 2) The Mitsubishi programmable controller has been designed and manufactured for applications in general industries, etc. Thus, applications in which the public could be affected such as in nuclear power plants and other power plants operated by respective power companies, and applications in which a special quality assurance system is required, such as for railway companies or public service purposes shall be excluded from the programmable logic controller applications.  
In addition, applications in which human life or property that could be greatly affected, such as in aircraft, medical applications, incineration and fuel devices, manned transportation, equipment for recreation and amusement, and safety devices, shall also be excluded from the programmable logic controller range of applications.  
However, in certain cases, some applications may be possible, providing the user consults their local Mitsubishi representative outlining the special requirements of the project, and providing that all parties concerned agree to the special circumstances, solely at the user's discretion.

# Revision History

\*The manual number is listed on the back cover of this manual.

Date	Manual number	Revision
November 2014	IB(NA)-0300251-A	First edition
January 2015	IB(NA)-0300251-B	■Added or modified parts SAFETY PRECAUTIONS, RELEVANT MANUALS, TERMS, Section 2.5, 3.1, 3.4, Chapter 4, Section 5.1, 5.2, Chapter 6, Appendix 2

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Manual number: IB(NA)-0300251-B(1501)MEE

Model: FX5SSC-U-S-E

Model code: 1XB018

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