MITSUBISHI ELECTRIC

Personal Computer Embedded Type Servo System Controller

Simple Motion Board User's Manual (Startup)

-MR-EM340GF

SAFETY PRECAUTIONS

(Read these precautions before using this product.)
Before using this product, please read this manual and the relevant manuals carefully and pay full attention to safety to handle the product correctly.
The precautions given in this manual are concerned with this product only.
In this manual, the safety precautions are classified into two levels: "⚠WARNING" and "⚠CAUTION".

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

Under some circumstances, failure to observe the precautions given under "⚠CAUTION" may lead to serious consequences.
Observe the precautions of both levels because they are important for personal and system safety.
Make sure that the end users read this manual and then keep the manual in a safe place for future reference.

[Design Precautions]

⚠WARNING

- Configure safety circuits externally to ensure that the entire system operates safely even when a fault occurs in the personal computer. Failure to do so may result in an accident due to an incorrect output or malfunction.
  (1) Configure external safety circuits, such as an emergency stop circuit, protection circuit, and protective interlock circuit for forward/reverse operation or upper/lower limit positioning.
  (2) If an incorrect home position return direction is set, motion control may continue without deceleration. To prevent machine damage caused by this, configure an interlock circuit external to the Simple Motion board.
  (3) When the Simple Motion board detects an error, the motion slows down and stops or the motion rapidly stops, depending on the stop group setting in parameter. Set the parameter to meet the specifications of a positioning control system. In addition, set the home position return parameter and positioning data within the specified setting range.
- For the operating status of each station after a communication failure, refer to manuals relevant to the network. Incorrect output or malfunction due to a communication failure may result in an accident.
- When modifying data of a running Simple Motion board, configure an interlock in the program to ensure that the entire system will always operate safely. For other forms of control (such as program modification, parameter change, forced output, or operating status change) of a running Simple Motion board, read the relevant manuals carefully and ensure that the operation is safe before proceeding. Improper operation may damage machines or cause accidents. Determine corrective actions to be taken in case of a communication failure.
- Especially, when a remote Simple Motion board is controlled, immediate action cannot be taken if a problem occurs in the Simple Motion board due to a communication failure. To prevent this, configure an interlock in the program, and determine corrective actions to be taken in case of a communication failure.
- Do not write any data to the "system area" and "write-protect area" of the buffer memory in the Simple Motion board. Doing so may cause malfunction of the Simple Motion board. For the "system area", and "write-protect area", refer to the user's manual for the Simple Motion board.

[Design Precautions]

⚠WARNING

- If a communication cable is disconnected, the network may be unstable, resulting in a communication failure of multiple stations. Configure an interlock in the program to ensure that the entire system will always operate safely even if communications fail. Failure to do so may result in an accident due to an incorrect output or malfunction.
- To maintain the safety of the Simple Motion board against unauthorized access from external devices via the network, take appropriate measures. To maintain the safety against unauthorized access via the Internet, take measures such as installing a firewall.
- If safety standards (ex., robot safety rules, etc.,) apply to the system using the Simple Motion board, servo amplifier and servomotor, make sure that the safety standards are satisfied.
- Construct a safety circuit externally of the Simple Motion board or servo amplifier if the abnormal operation of the Simple Motion board or servo amplifier differs from the safety directive operation in the system.

[Design Precautions]

⚠CAUTION

- Do not install the control lines or communication cables together with the main circuit lines or power cables. Keep a distance of 100 mm or more between them. Failure to do so may result in malfunction due to noise.
- After the personal computer is powered on or rebooted, the time taken for the Simple Motion board 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 the time.
- Do not power off or reboot the personal computer during the setting registration. Doing so will make the data in the flash ROM undefined. The data need to be set in the buffer memory and to be written to the flash ROM again. Doing so may cause malfunction or failure of the Simple Motion board.

[Installation Precautions]

⚠WARNING

- Shut off the external power supply (all phases) used in the system before mounting or removing the Simple Motion board to or from the personal computer. Failure to do so may result in electric shock or cause the Simple Motion board to fail or malfunction.
- Do not touch any connectors while power is on. Doing so may cause electric shock or malfunction.

[Installation Precautions]

⚠CAUTION

- Use the Simple Motion board in an environment that meets the general specifications in the Simple Motion Board User's Manual. Failure to do so may result in electric shock, fire, malfunction, or damage to or deterioration of the product.
- Fix the Simple Motion board securely with the board-fixing screw. Tighten the screws within the specified torque range. Undertightening can cause drop of the screw, short circuit, or malfunction. Overtightening can damage the screw and/or Simple Motion board, resulting in drop, short circuit, or malfunction. For the tightening torque of the board-fixing screws, refer to the manual supplied with the personal computer.
- Do not directly touch any conductive parts and electronic components of the Simple Motion board. Hold the front panel or edge of the print board. Not holding by the front panel or edges may cause malfunction or failure of the Simple Motion board.
- Do not disassemble or modify the Simple Motion board. Doing so may cause failure, malfunction, injury, or a fire.
- Before handling the Simple Motion board, touch a conducting object such as a grounded metal to discharge the static electricity from the human body. Failure to do so may cause the Simple Motion board to fail or malfunction.
- Install the Simple Motion board to a personal computer which is compliant with PCI Express® standard. Failure to do so may cause a failure or malfunction.
- Securely insert the Simple Motion board into the slot following the board installation instruction of the personal computer. Incorrect insertion of the Simple Motion board may cause malfunction, failure, or drop of the board.
- When installing the Simple Motion board, take care not to contact with other boards.
- When installing the Simple Motion board, take care not to get injured by an implemented component or a surrounding member.
- Handle the Simple Motion board in a place where static electricity will not be generated. Failure to do so may cause a failure or malfunction.
- The Simple Motion board is included in an antistatic envelope. When storing or transporting it, be sure to put it in the antistatic envelope. Failure to do so may cause a failure or malfunction.
- Do not drop or apply a strong impact to the Simple Motion board. Doing so may cause a failure or malfunction.

[Wiring Precautions]

⚠WARNING

- Shut off the external power supply (all phases) used in the system before installation and wiring. Failure to do so may result in electric shock or damage to the Simple Motion board.
- After installation and wiring, attach the cover of the equipment the Simple Motion board is installed to before turning it on for operation. Failure to do so may result in electric shock.

[Wiring Precautions]

⚠CAUTION

- Ground the controllers, servo amplifiers and servo motors embedded with a Simple Motion board with a ground resistance of 100 ohm or less. Do not use a common grounding with other equipment.
- Check the rated voltage and signal layout before wiring to the Simple Motion board, and connect the cables correctly. Connecting a power supply with a different voltage rating or incorrect wiring may cause fire or failure.
- Connectors must be correctly connected. Incomplete connections may cause short circuit, fire, or malfunction.
- Securely connect the connector to the Simple Motion board. Poor contact may cause malfunction.
- Do not install the control lines or communication cables together with the main circuit lines or power cables. Keep a distance of 100 mm or more between them. Failure to do so may result in malfunction due to noise.
- Place the cables in a duct or clamp them. If not, dangling cable may swing or inadvertently be pulled, resulting in damage to the Simple Motion board or cables or malfunction due to poor contact.
- Check the interface type and correctly connect the cable. Incorrect wiring (connecting the cable to an incorrect interface) may cause failure of the Simple Motion board and external device.
- When disconnecting the cable from the Simple Motion board, do not pull the cable by the cable part. For the cable with connector, hold the connector part of the cable. Pulling the cable connected to the Simple Motion board may result in malfunction or damage to the Simple Motion board or cable.
- Prevent foreign matter such as dust or wire chips from entering the personal computer. Such foreign matter can cause a fire, failure, or malfunction.
- For Ethernet cables to be used in the system, select the ones that meet the specifications in the user's manual of the Simple Motion board. If not, normal data transmission is not guaranteed.

[Startup and Maintenance Precautions]

⚠WARNING

- Shut off the external power supply (all phases) used in the system before cleaning or retightening the board-fixing screws. Failure to do so may result in electric shock or malfunction.
- Turn off the external power supply for the system in all phases before installing the Simple Motion board to or removing it from the personal computer. Failure to do so may result in electric shock or cause the Simple Motion board to fail or malfunction.
- Do not connect or disconnect any communication cable while power is on. Doing so may result in a malfunction.

[Startup and Maintenance Precautions]

⚠CAUTION

- When modifying data of a running Simple Motion board, configure an interlock in the program to ensure that the entire system will always operate safely. For other forms of control (such as program modification, parameter change, forced output, or operating status change) of a running Simple Motion board, read the relevant manuals carefully and ensure that the operation is safe before proceeding. Improper operation may damage machines or cause accidents. Determine corrective actions to be taken in case of a communication failure.
- Especially, when a remote Simple Motion board is controlled, immediate action cannot be taken if a problem occurs in the Simple Motion board due to a communication failure. To prevent this, configure an interlock in the program, and determine corrective actions to be taken in case of a communication failure.
- Do not disassemble or modify the Simple Motion board. Doing so may cause failure, malfunction, injury, or a fire.
- Use any radio communication device such as a cellular phone or PHS (Personal Handyphone System) more than 25 cm away in all directions from the Simple Motion board. Failure to do so may cause malfunction.
- Shut off the external power supply (all phases) used in the system before mounting or removing the Simple Motion board. Failure to do so may cause the Simple Motion board to fail or malfunction.
- Tighten the board-fixing screws within the specified torque range. Undertightening can cause drop of the component or wire, short circuit, or malfunction. Overtightening can damage the screw and/or Simple Motion board, resulting in drop, short circuit, or malfunction. For the tightening torque of the board-fixing screws, refer to the manual supplied with the personal computer.
- After the first use of the product, do not mount/remove the Simple Motion board to/from the personal computer more than 50 times. Exceeding the limit of 50 times may cause malfunction.
- Maintenance must be performed by qualified maintenance personnel with knowledge.
- Before handling the Simple Motion board, touch a conducting object such as a grounded metal to discharge the static electricity from the human body. Failure to do so may cause the Simple Motion board to fail or malfunction.
- The Simple Motion board is included in an antistatic envelope. When storing or transporting it, be sure to put it in the antistatic envelope. Failure to do so may cause a failure or malfunction.
- The microprocessor built in the Simple Motion board will reach a high temperature during operation. Do not touch it directly when replacing the Simple Motion board. Doing so may result in a burn.
- Before testing the operation, set a low speed value for the speed limit parameter so that the operation can be stopped immediately upon occurrence of a hazardous condition.
- Confirm and adjust the program and each parameter before operation. Unpredictable movements may occur depending on the machine.
- When using the absolute position system function, on starting up, and when the Simple Motion board or absolute position motor has been replaced, always perform a home position return.
- Before starting the operation, confirm the brake function.
- Do not perform a megger test (insulation resistance measurement) during inspection.
- After maintenance and inspections are completed, confirm that the position detection of the absolute position detection function is correct.
- Extreme adjustments and changes may lead to unstable operation, so never make them.

[Startup and Maintenance Precautions]

⚠CAUTION

- Do not place the Simple Motion board or servo amplifier on metal that may cause a power leakage or wood, plastic or vinyl that may cause static electricity buildup. Doing so can cause malfunction or failure of the Simple Motion board.

[Operating Precautions]

⚠CAUTION

- When changing data and operating status, and modifying program of the running Simple Motion board, read relevant manuals carefully and ensure the safety before operation. Incorrect change or modification may cause system malfunction, damage to the machines, or accidents.
- Do not power off or reboot the personal computer while the setting values in the buffer memory are being written to the flash ROM in the Simple Motion board. Doing so will make the data in the flash ROM undefined. The values need to be set in the buffer memory and written to the flash ROM again. Doing so also can cause malfunction or failure of the Simple Motion board.
- Note that when the reference axis speed is specified for interpolation operation, the speed of the partner axis (2nd, 3rd, or 4th axis) may exceed the speed limit value.
- Do not go near the machine during test operations or during operations such as teaching. Doing so may lead to injuries.

[Disposal Precautions]

⚠CAUTION

- When disposing of this product, treat it as industrial waste.

[Transportation Precautions]

⚠CAUTION

- The halogens (such as fluorine, chlorine, bromine, and iodine), which are contained in a fumigant used for disinfection and pest control of wood packaging materials, may cause failure of the product. Prevent the entry of fumigant residues into the product or consider other methods (such as heat treatment) instead of fumigation. The disinfection and pest control measures must be applied to unprocessed raw wood.
- The Simple Motion board is a precision machine, so do not drop or apply strong impacts on it.

CONDITIONS OF USE FOR THE PRODUCT

(1) Mitsubishi Simple Motion board ("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 personal computer embedded type servo system controllers.
This manual describes the specifications, procedures before operation and wiring 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 personal computer embedded type servo system 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

MR-EM340GF

Point

Symbols used in this manual are shown below.
A serial No. is inserted in the "**" mark.
- [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

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RELEVANT MANUALS

Manual name [manual number]	Description	Available form
Simple Motion Board User's Manual (Startup) [IB-0300322] (This manual)	Specifications, procedures before operation, system configuration, wiring, and operation examples of the Simple Motion board	Print book e-Manual PDF
Simple Motion Board User's Manual (Application) [IB-0300324]	Functions, input/output signals, buffer memory, parameter settings, programming, and troubleshooting of the Simple Motion board	Print book e-Manual PDF
Simple Motion Board User's Manual (Advanced Synchronous Control) [IB-0300326]	Functions and programming for the synchronous control of the Simple Motion board	Print book e-Manual PDF
Simple Motion Board User's Manual (Network) [IB-0300328]	Functions, parameter settings, troubleshooting, and buffer memory of CC-Link IE Field Network	Print book e-Manual PDF
Simple Motion Board User's Manual (API Library) [IB-0300330]	API library and others that the host personal computer uses to control the Simple Motion board	Print book e-Manual PDF

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

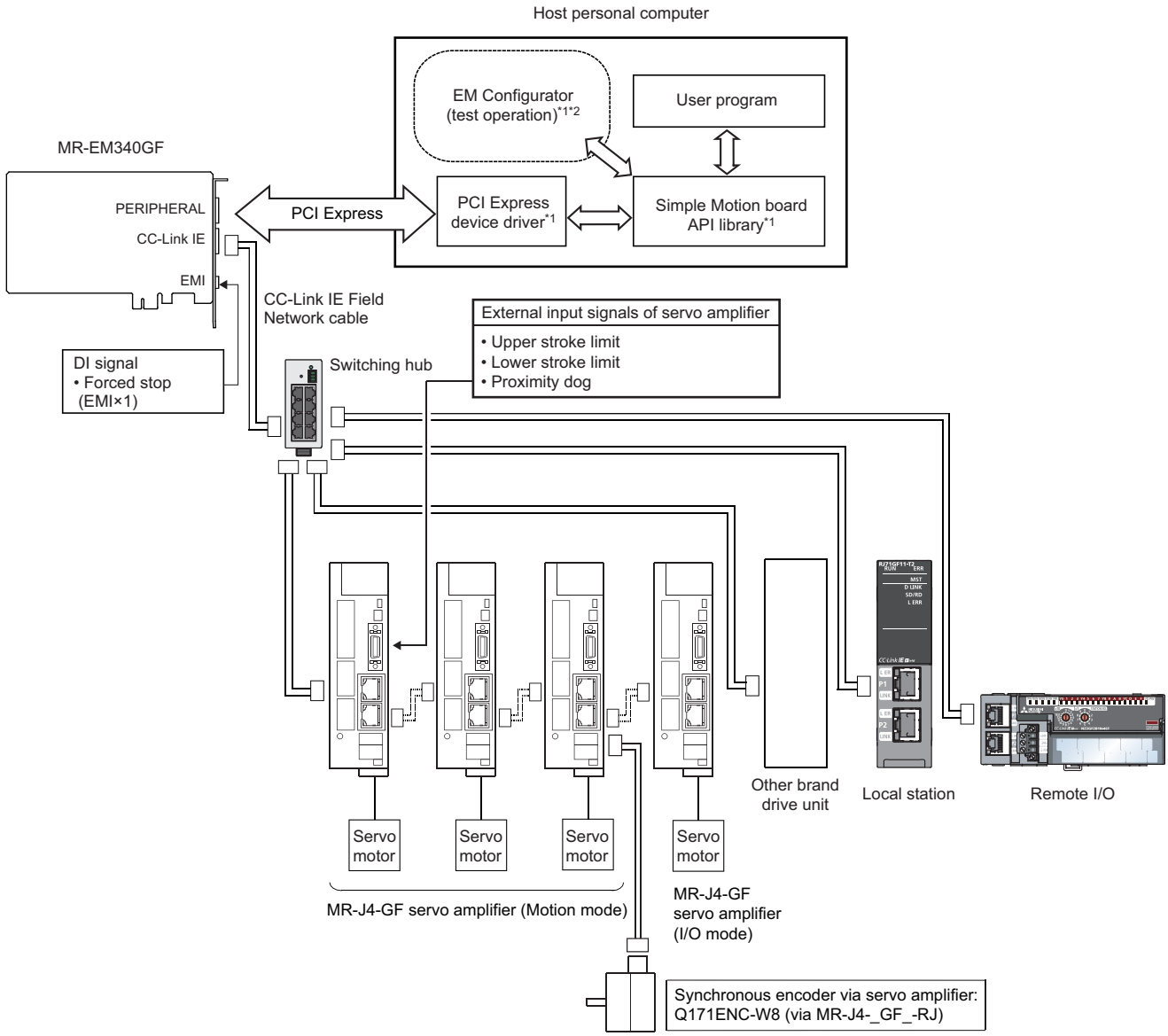
Unless otherwise specified, this manual uses the following terms.

Term	Description
API library	A general name for the library that creates the application on the host personal computer controlling the Simple Motion board
Axis	Another term for a servo amplifier
Buffer memory	A memory in the Simple Motion board, where data (such as setting values and monitoring values) are stored
CC-Link IE Field Network	A high-speed and large-capacity open field network that is based on Ethernet (1000BASE-T)
Cyclic transmission	A function by which data are periodically exchanged among stations on the network using link devices
Data link	A generic term for cyclic transmission and transient transmission
Device	A device (X, Y, RX, RY, or others) in the Simple Motion board
Disconnection	A process of stopping data link if a data link error occurs
DMA transmission	Automatic data transfer between a buffer memory of the MR-EM340GF and a memory in the host personal computer
EM Configurator	A product name for start-up and examination tool for Simple Motion board
EM Software Development Kit	A product name for software development kit for Simple Motion board
Ethernet device	A generic term for the devices supporting IP communication (such as personal computers)
GX Works2	The product name of the software package for the MELSEC programmable controllers
GX Works3	
Head module	The abbreviation for the LJ72GF15-T2 CC-Link IE Field Network head module
Host personal computer	A general name for a personal computer which operates user programs
Intelligent device station	A station that exchanges I/O signals (bit data) and I/O data (word data) with another station by cyclic transmission. This station responds to a transient transmission request from another station and also issues a transient transmission request to another station.
Label	A label that represents one of memory areas (I/O signals and buffer memory areas) specific to the Simple Motion board in a given character string
Link device	A device (RX, RY, RWr, or RWw) in a module on CC-Link IE Field Network
Link scan (link scan time)	Time required for all the stations on the network to transmit data. The link scan time depends on data volume and the number of transient transmission requests.
Link special register (SW)	Word data that indicates the operating status and data link status of a module on CC-Link IE Field Network
Link special relay (SB)	Bit data that indicates the operating status and data link status of a module on CC-Link IE Field Network
Local station	A station that performs cyclic transmission and transient transmission with the master station and other local stations
Master station	A station that controls the entire network. This station can perform cyclic transmission and transient transmission with all stations. Only one master station can be used in a network.
Master/local module	A generic term for the following modules when the CC-Link IE Field Network function is used: • RJ71GF11-T2 • RJ71EN71 • RnENCPU
MR-EM340GF	Another term for the Simple Motion board compatible with CC-Link IE Field Network
MR-J4-GF	MR-J4-_GF_(-RJ) Servo amplifier series
Operation cycle	A motion operation cycle that is set in the inter-module synchronization cycle setting of the Simple Motion board
RAS	The abbreviation for Reliability, Availability, and Serviceability. This term refers to usability of automated equipment.
Remote device station	A station that exchanges I/O signals (bit data) and I/O data (word data) with another station by cyclic transmission. This station responds to a transient transmission request from another station.
Remote I/O station	A station that exchanges I/O signals (bit data) with the master station by cyclic transmission
Remote input (RX)	Bit data input from a slave station to the master station (For some areas in a local station, data are output in the opposite direction.)
Remote output (RY)	Bit data output from the master station to a slave station (For some areas in a local station, data are output in the opposite direction.)
Remote register (RWr)	Word data input from a slave station to the master station (For some areas in a local station, data are output in the opposite direction.)
Remote register (RWw)	Word data output from the master station to a slave station (For some areas in a local station, data are output in the opposite direction.)
Reserved station	A station reserved for future use. This station is not actually connected, but counted as a connected station.
Return	A process of restarting data link when a station recovers from an error

Term	Description
Servo amplifier	A generic term for a drive unit Unless specified in particular, indicates the motor driver unit of the sequential command method which is controlled by the Simple Motion board (belonging to own station).
Simple Motion board	The abbreviation for the personal computer embedded type servo system controller Simple Motion board
Slave station	A generic term for a local station, remote I/O station, remote device station, and intelligent device station
Transient transmission	A function of communication with another station, which is used when requested by EM Configurator
User program	A general name for applications using the API library

PERIPHERALS

The following figure shows the peripherals when the MR-EM340GF is used.



*1 Provided by EM Software Development Kit

*2 At the startup and debug

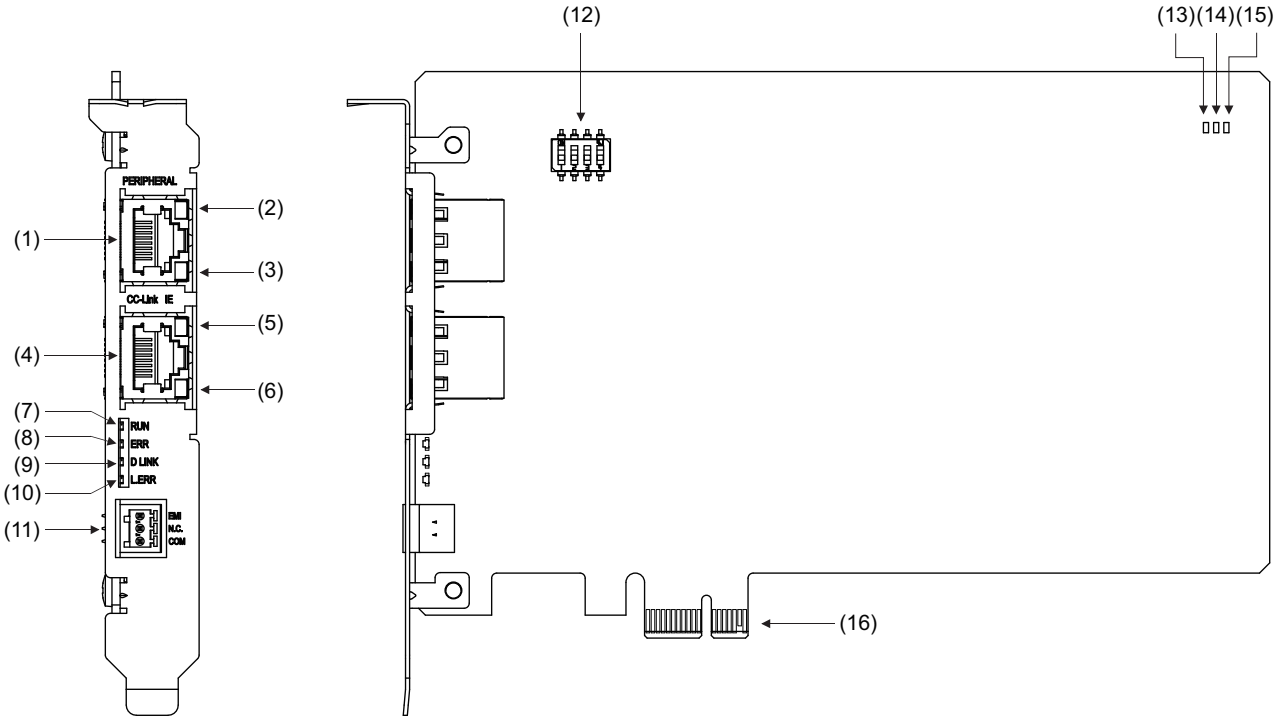
Point

- The external input signal cannot be used depending on the connected device. Confirm the specification of the connected device.

1 PART NAMES

Part names of the MR-EM340GF

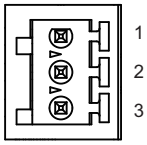
This chapter describes the part names of the Simple Motion board.



No.	Name		Description
(1)	Connector for PERIPHERAL		Ethernet communication port. Connects to the host personal computer to use EM Configurator.
(2)	Connector LEDs for PERIPHERAL	LINK LED	For details, refer to the following. ☞ Page 16 LED Display Specifications
(3)		SPEED LED	
(4)	Connector for CC-Link IE Field		CC-Link IE communication port. Connects to servo amplifiers and other CC-Link IE products. In the following manual, this connector is referred to as "PORT2", "P2", or "Port 2". 📖Simple Motion Board User's Manual (Network)
(5)	Connector LEDs for CC-Link IE Field	L.ER LED	For details, refer to the following. ☞ Page 16 LED Display Specifications
(6)		LINK LED	
(7)	Display LEDs (CC-Link IE)	RUN LED	Indicates the communication status of CC-Link IE communication. For details, refer to the following. ☞ Page 16 LED Display Specifications
(8)		ERR LED	
(9)		D LINK LED	
(10)		L.ERR LED	
(11)	Connector for external forced stop		Inputs the external forced stop signal. 24 V DC is applied. For details, refer to the following. ☞ Page 15 External forced stop connector
(12)	Switch for board ID setting		Switches which set the distinguished IDs when the multiple boards are used simultaneously. For details, refer to the following. ☞ Page 17 Board ID Setting Switch
(13)	Display LEDs (System status)	PCI Express LED	Indicates the operating status of the board system. For details, refer to the following. ☞ Page 16 LED Display Specifications
(14)		RUN LED	
(15)		ERR LED	
(16)	Card edge connector for PCI Express ×1		Communicates with the host personal computer using PCI Express.

External forced stop connector

The following shows the pin layout and connections of the external forced stop connector as viewed from the front.



Pin No.	Signal name
1	EMI
2	No connect*1
3	EMI.COM

*1 Do not connect to any of the terminals explained as "No connect".

- Applicable connector model name

FK-MC0,5/3-ST-2,5 (PHOENIX CONTACT GmbH & Co. KG)

- Wire

AWG28 to AWG20

1.1 LED Display Specifications

This section lists the LED display specifications.

For the remedy of the LED display descriptions, refer to the following.

Simple Motion Board User's Manual (Application)

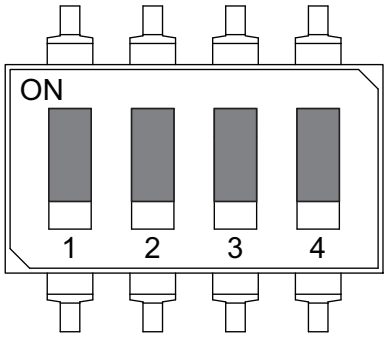
LED	Status	LED display	Description
Connector LEDs for PERIPHERAL	Indicates the LAN data communication status.	LINK ■	Link-up
		LINK ●	Data communication being performed
		LINK □	Link-down
	Indicates the LAN communication speed.	SPEED ■	100 Mbps
		SPEED □	10 Mbps
Connector LEDs for CC-Link IE Field	Indicates the port status.	L.ER ■	Abnormal data received
		L.ER □	Normal data received
	Indicates the link status.	LINK ■	Link-up
		LINK □	Link-down
Display LEDs (CC-Link IE)	Indicates the operation status.	RUN ■	Normal operation
		RUN □	Error
	Indicates the Simple Motion board error status.	ERR ■	All stations error detection or error*1 occurrence
		ERR ●	Flashing (500 ms interval): A data link faulty station detected Flashing (200 ms interval): Error*1
		ERR □	Normal operation
	Indicates the data link status.	D LINK ■	Data link (cyclic transmission being performed)
		D LINK ●	Data link (cyclic transmission stopped)
		D LINK □	Data link not performed (disconnection)
	Indicates the receive data and line error status.	L.ERR ■	Abnormal data received
		L.ERR □	Normal data received
Display LEDs (System status)	Indicates the PCI Express communication status.	PCI Express ■	PCI Express link-up
		PCI Express □	PCI Express link-down
	Indicates the Simple Motion board status.	RUN ■	Power supply ON
		RUN ●	Communicating with slave stations
		RUN □	Error
	Indicates the Simple Motion board operation error.	ERR ■	Error
		ERR □	Normal operation

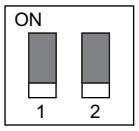
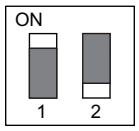
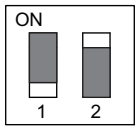
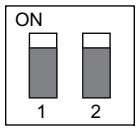
□: OFF, ■: ON, ●: Flashing

*1 Network control or Motion control.

1.2 Board ID Setting Switch

This section lists the specifications of the board ID setting switch.



Switch	Description		Switch status	Board ID
Switch 1 Switch 2	Board ID setting	Define a board ID in order to distinguish between multiple boards that are installed in the host personal computer. IDs from 0 to 3 are set to each board, so that up to 4 boards can be installed in the host personal computer.	 Switch1: OFF Switch2: OFF	Board ID: 0
			 Switch1: ON Switch2: OFF	Board ID: 1
			 Switch1: OFF Switch2: ON	Board ID: 2
			 Switch1: ON Switch2: ON	Board ID: 3

Precautions

- Set the board ID so that it will not be duplicated. If it is duplicated, it cannot distinguish the board on the host personal computer side.
- The switch 3 and 4 are provided for manufacturer setting, so that make sure the switches are always OFF.
- When the switch 4 is turned on, the warning "Board ID setting error" (warning code: 0E00H) is output. Review the board ID setting.

2 SPECIFICATIONS

This chapter describes the specifications of the MR-EM340GF.

2.1 General Specifications

This section lists the general specifications.

Item	Specification
Operating ambient temperature	0 to +55℃ (32 to 131℉)
Storage ambient temperature	-25 to +75℃ (-13 to 167°F)
Operating ambient humidity	5 to 95% RH: non-condensing
Storage ambient humidity	5 to 95% RH: non-condensing
Operating ambience	Indoors (where not subject to direct sunlight), no corrosive gas, no significant amount of dirt or dust
Operating altitude*1	2000 m (6561.68 ft.) or less
Mounting location	Inside control panel
Overvoltage category*2	Ⅱ or less
Pollution level*3	2 or less

*1 Do not use or store the board under pressure higher than the atmospheric pressure of altitude 0 m. Doing so can cause an operation failure. When using the board under pressure, please contact with our sales representative.

*2 This indicates the section of the power supply to which the equipment is assumed to be connected between the public electrical power distribution network and the machinery within premises. CategoryⅡ applies to equipment for which electrical power is supplied from fixed facilities. The surge voltage withstand level for up to the rated voltage of 300 V is 2500 V.

*3 This index indicates the degree to which conductive material is generated in terms of the environment in which the equipment is used. Pollution level 2 is when only non-conductive pollution occurs. A temporary conductivity caused by condensing must be expected occasionally.

2.2 Performance Specifications

This section lists the performance specifications.

Item		MR-EM340GF
Number of controlled axes		16 axes
Operation cycle		0.50 ms/1.00 ms/2.00 ms/4.00 ms
Interpolation function		2-, 3-, or 4-axis linear interpolation 2-axis circular interpolation 3-axis helical interpolation
Control method		PTP (Point To Point) control, path control (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 (All the data points can be set with the buffer memory.)
Execution data backup function		Parameters, positioning data, and block start data can be saved on flash ROM. (battery-less backup)
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 • -214748364.8 to 214748364.7 (μm) • -21474.83648 to 21474.83647 (inch) • 0 to 359.99999 (degree) • -2147483648 to 2147483647 (pulse) In incremental system • -214748364.8 to 214748364.7 (μm) • -21474.83648 to 21474.83647 (inch) • -21474.83648 to 21474.83647 (degree) • -2147483648 to 2147483647 (pulse) In speed-position switching control (INC mode)/position-speed switching control • 0 to 214748364.7 (μm) • 0 to 21474.83647 (inch) • 0 to 21474.83647 (degree) • 0 to 2147483647 (pulse) In speed-position switching control (ABS mode)*1 0 to 359.99999 (degree)
	Speed command	0.01 to 20000000.00 (mm/min) 0.001 to 2000000.000 (inch/min) 0.001 to 2000000.000 (degree/min)*2 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.)
	Rapid stop deceleration time	1 to 8388608 (ms)
Manual pulse input	Signal input form	Link device
	1 pulse input magnification	1 to 10000 times
Flash ROM write count		Max. 100000 times
Number of occupied I/O points		32 points
PERIPHERAL interface data transmission speed		100 Mbps
Internal current consumption*3	12 V DC	0.4 A
	3.3 V DC	0.6 A
External dimensions		167.65×111.15 mm (6.60×4.38 inch)
Mass		0.13 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 20000000.00 (degree/min).

*3 Two types of power supplies of 12 V and 3.3 V are required.

The performance specifications of CC-Link IE Field Network is shown below.

Item			MR-EM340GF
Maximum number of link points per network		RX	16K points (16384 points, 2K bytes)
		RY	16K points (16384 points, 2K bytes)
		RWr	8K points (8192 points, 16K bytes)
		RWw	8K points (8192 points, 16K bytes)
Maximum number of link points per station	Master station	RX	16K points (16384 points, 2K bytes)
		RY	16K points (16384 points, 2K bytes)
		RWr	8K points (8192 points, 16K bytes)
		RWw	8K points (8192 points, 16K bytes)
	Local station*1	RX	2K points (2048 points, 256 bytes)
		RY	2K points (2048 points, 256 bytes)
		RWr	256 points (512 bytes)
		RWw	256 points (512 bytes)
Inter-module synchronization cycle*2 (with synchronization communication)			0.50 ms/1.00 ms/2.00 ms/4.00 ms
Transient transmission			1: N communication (such as monitor, user program upload/download)
Transient transmission capacity			1920 bytes maximum
Maximum number of transient transmissions per link scan			4
Communication speed			1 Gbps
Network topology			Line topology, star topology*3
Communication cable			• Ethernet cable which satisfies 1000BASE-T standard: Category 5e or higher, straight cable (double shielded, STP) • RJ45 connector
Maximum station-to-station distance			100 m (conforms to ANSI/TIA/EIA-568-B (Category 5e))
Overall cable distance	Single master configuration		Line topology: 12000 m (when 121 stations are connected) Star topology: Depends on the system configuration.
Number of cascade connections			4 levels maximum
Maximum number of connectable stations	Single master configuration		121 stations (master station: 1, slave station: 120)
Maximum number of networks			239
Communication method			Token passing

*1 The maximum number of points that a master station can assign to one station. A local station can receive the range assigned to other stations using the cyclic transmission function.

*2 The cycle that each module performs the synchronous control via a network using the synchronous communication function.

*3 A switching hub supporting synchronous communication is required for the star topology.

2.3 Specifications of Interfaces with External Devices

Electrical specifications of input signals

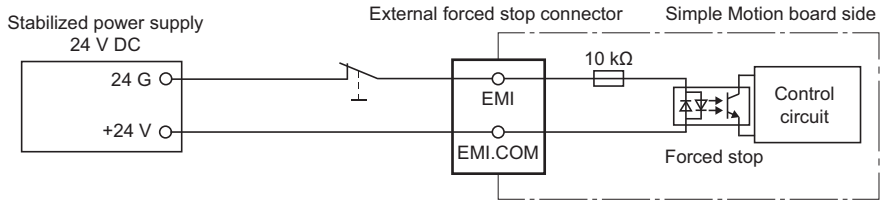
Forced stop input

■Specifications of forced stop input signal

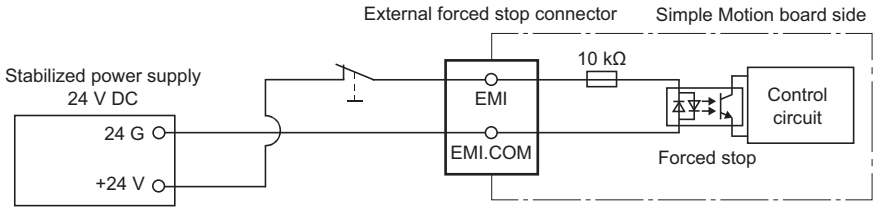
Item		Specifications
Number of input points		1 point
Input method		Positive common/Negative common shared
Rated input current		2.4 mA
Isolation method		Photocoupler
Operating voltage range		20.4 to 26.4 V DC (+10/-15%, ripple ratio 5% or less)
ON voltage/current		17.5 V DC or more/2.0 mA or more
OFF voltage/current		1.8 V DC or less/0.18 mA or less
Input resistance		Approx. 10 kΩ
Response time	OFF → ON	1 ms or less
	ON → OFF	
External connector type		3 pin connector
Recommended wire size		0.08 to 0.5 mm2 (AWG28 to AWG20)

■Forced stop circuit

• Positive common



• Negative common

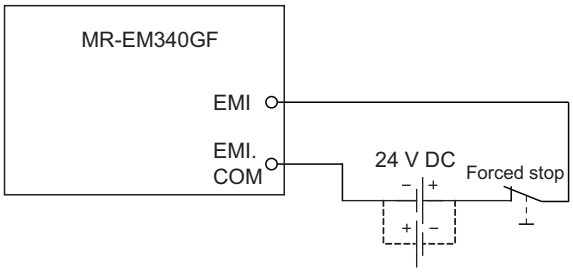


2.4 External Circuit Design

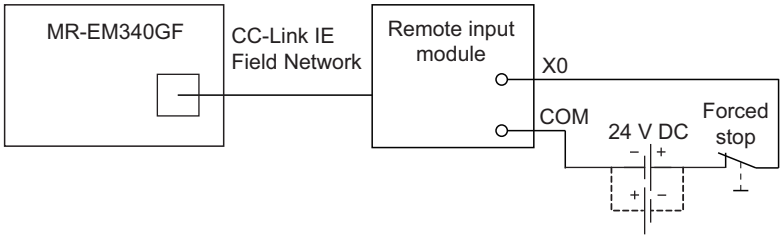
Forced stop circuit

The forced stop of all servo amplifiers is possible in a lump by using the forced stop input of Simple Motion board. After forced stop, the forced stop factor is removed and the forced stop canceled. (The servo error detection signal does not turn on with the forced stop.)

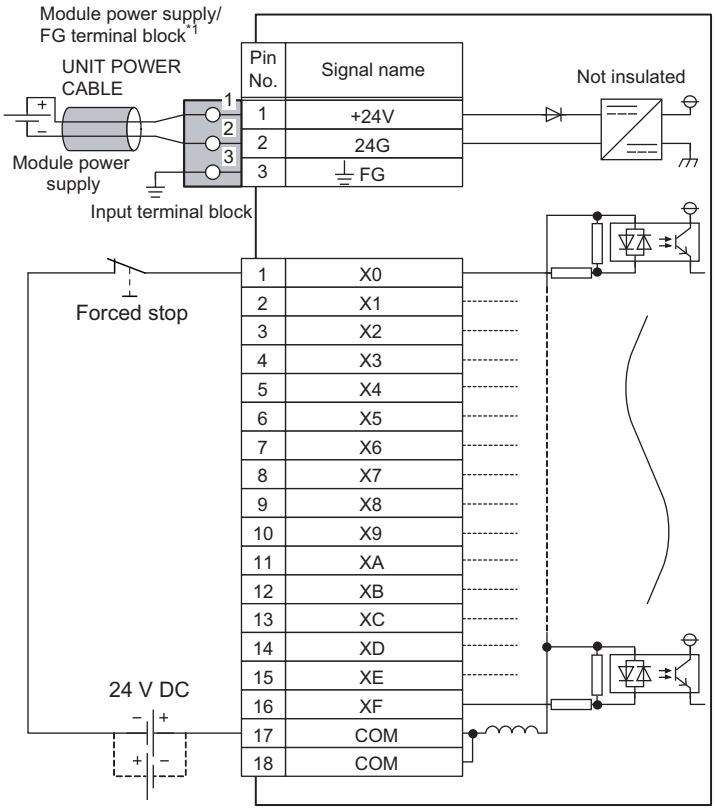
A wiring example which uses a Simple Motion board for the forced stop input is shown below. Set "[Pr.82] Forced stop valid/invalid selection" to "0: Valid (External input signal)".



A wiring example which uses a remote input module (NZ2GF2B1(N)-16D) for the forced stop input is shown below. Set "[Pr.82] Forced stop valid/invalid selection" to "3: Valid (Link device)", and set forced stop signals (EMI) ([Pr.900] to [Pr.903]) according to the input modules.



<Remote input module NZ2GF2B1(N)-16D>



*1 Only one wire can be connected to a terminal of the terminal block for module power supply and FG. Multiple wires cannot be connected to a terminal. Connecting two or more wires may cause a poor contact.

It is also possible to use the forced stop signal of the servo amplifier. Operation status of the emergency stop, servo amplifier forced stop and the Motion controller forced stop are as follows.

Item	Operation when the signal is turned on	Remarks
Emergency stop	Servo OFF	The power supply of the servo amplifier is shut off by external circuit, and the servomotor stops.
Servo amplifier forced stop		A stop command from the external circuit to the servo amplifier is output, and the servo amplifier stops the servomotor.
Motion controller forced stop		A stop command from the Simple Motion board to the servo amplifier is output, and the servo amplifier stops the servomotor.

Shut-off the main circuit power supply of a servo amplifier when an emergency stop, alarm, servo amplifier forced stop, or motion controller forced stop occurs. Make sure to use molded-case circuit breakers (MCCB) for input wires of a servo amplifier power supply. For details, refer to the servo amplifier instruction manual.

3 FUNCTION LIST

There are restrictions in the function that can be used by the software of the Simple Motion board and the version of EM Software Development Kit. Refer to the following for details.
📖Simple Motion Board User's Manual (Application)

3.1 Control Functions

The Simple Motion board has several functions. Refer to the following for details on each function.
📖Simple Motion Board User's Manual (Application)
In this manual, the Simple Motion board functions are categorized and explained as follows.

Main functions

Home position return control

"Home position return control" is a function that established the start point for carrying out positioning control (Machine home position return), and carries out positioning toward that start point (Fast home position return). 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 board 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 board. 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 board 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 board executes the random positioning operation by inputting a signal into the Simple Motion board 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 "advanced synchronous control parameter", and is synchronized with input axis (Advanced synchronous control).
- Direct control that controls the servo amplifier based on the arbitrary position command data written to the buffer memory (Direct control).

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

Main functions			Details
Home position return control	Machine home position return control		Mechanically establishes the positioning start point using a proximity 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] Feed machine value) stored in the Simple Motion board 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] Feed current 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.
		3-axis helical interpolation control	Positions a target using a helical path to a specified position. (Specify the position by specifying the end point address directly or by specifying the relative distance from the current position (movement amount).)
	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.
	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.
	Other control	Current value changing	Changes the feed current value ([Md.20]) to the address set in the positioning data. The following two methods can be used. (The feed machine value ([Md.21]) cannot be changed.) • Current value changing using positioning data • Current value changing using current value changing start No. (No. 9003)
		NOP instruction	No execution control method. When NOP instruction is set, this instruction is not executed and the operation of the next data is started.
		JUMP instruction	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.
High-level positioning control	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 designated positioning data of 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.

Main functions		Details
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.
Inter-module synchronization function		Carries out CC-Link IE Field Network synchronous communication with the Simple Motion board as the inter-module synchronization master.
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.
	Advanced 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 "advanced synchronous control parameter".
	Direct control	Carries out the servo amplifier control based on the arbitrary position command data written to the buffer memory.

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.

[Da.1] Operation pattern	Details
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.

Sub functions

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

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

Sub function		Details
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*1	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 signal.
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 0 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.) according to the code No. (0 to 65535) that can be set for each positioning data. The M code output timing 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 board 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 feed current 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 incompletion 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.
	Controller in-position function	This function controls ON/OFF of the controller in-position flag according to the controller in-position range check of the Simple Motion board.

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

Common functions

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

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 board to the default values. The following two methods can be used. • Method using a user program • Method using EM Configurator
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. • Method using a user program • Method using EM Configurator
External input signal select function	This function sets the input type and signal logic for each external input signal of each axis (upper/lower stroke limit signal (FLS/RLS), proximity dog signal (DOG), and stop signal (STOP)).
Link device external signal assignment function	This function assigns link devices to external signals of the Simple Motion board.
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 board 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.
Mark detection function	This function is used to latch any data at the input timing of the mark detection signal (DI).
Event history function	This function is used to save errors and event information occurred in the Simple Motion board in the internal memory (nonvolatile). The error history can be checked even after the power cycle or remote RESET by holding the error contents in the Simple Motion board.
Servo cyclic transmission function	This function reads and writes CiA402 objects of slave devices with cyclic transmission.
Servo transient transmission function	This function reads and writes CiA402 objects of slave devices with transient transmission.
Test mode	This mode executes the test operation and adjustment of axes using EM Configurator.
Servo parameter change function	This function transfers servo parameters. Servo parameters, which are controlled by servo amplifiers, can be changed with a Simple Motion board.
User watchdog function	This function checks errors of the host personal computer.
Remote operation	This function restarts the Simple Motion board using EM Configurator or API.
Time setting	This function notifies the start time to the Simple Motion board.
PCI Express connection	This function detects link-down of the PCI Express connection between the Simple Motion board and the host personal computer by the PCI Express link-down detection function.
Interrupt function	This function generates an interrupt to the user program when the interrupt factor is detected. The interrupt occurs under the conditions such as positioning complete or the current value, so that the event-driven programming can be performed. There are the following interrupt methods: event interrupt and operation cycle interrupt.
DMA transmission function	This function transfers the data of the Simple Motion board to the memory area allocated by the user program. The read time of the buffer memory from the user program can be shorten by using DMA transmission function.
Ethernet communication connection	This function connects the Simple Motion board and EM Configurator with the Ethernet cable and performs the communication. There are the following Ethernet communication connections between the Simple Motion board and EM Configurator: "direct connection" that connects directly and "connection via hub" that connects via hub.

3.2 Combination of Main Functions and Sub Functions

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

Combination of main functions and operation patterns

○: Combination possible

△: Combination limited

×: Combination not possible

Main functions			Combination with operation pattern*1
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	○
		3-axis helical 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		×
	Advanced synchronous control (output axis)		×
	Direct 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		△*2	△*2	△*2	△*2	×
	Fast home position return control		×	×	○	○	△*1
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	×	×	○	○	
		3-axis helical interpolation control	×	×	○	○	
	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		×	×	×	○	×
	Advanced synchronous control (output axis)		×	×	○	○	×
	Direct control		×	×	○	○	×

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

*2 Availability of the function depends on the home position return specifications of the servo amplifier.

◎: Always combine

○: Combination possible

△: Combination limited

×: 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		△*1	△*1	△*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	○	○	○	◎	○
		3-axis helical interpolation control	○	○	○	◎	○
	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		○	○	○	◎	○
	Advanced synchronous control (output axis)		×	○	○	◎	○
	Direct control		○	○	△*2	△*2	○

*1 Availability of the function depends on the home position return specifications of the servo amplifier.

*2 Refer to the following for details.

Simple Motion Board User's Manual (Application)

○: 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		×	×	×	×	×
	Fast home position return control		○	○	○	○	×
Major positioning control	Position control	1-axis linear control	○	○	○	○	△*1
		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	○	○	○	○	×
		3-axis helical interpolation control	○	○	○	○	×
	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		△*2	△*2	△*2	○	×
	Manual pulse generator operation		×	×	×	○	×
Expansion control	Speed-torque control		×	×	×	○	×
	Advanced synchronous control (output axis)		×	×	×	○	×
	Direct control		×	×	×	○	×

*1 Invalid during continuous path control.

*2 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	M code output function	Teaching 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	○	○	○	○	○	×
		3-axis helical interpolation control	○	○	○	○	○	×
	Speed control (1- to 4-axis)		○	×	○	×	○	×
	Speed-position switching control		○	○	○	○	○	×
	Position-speed switching control					×		
	Other control	Current value changing	×	○	×	○	△*1	×
		NOP instruction		×		×	×	
		JUMP instruction	×	×	×	×	×	×
		LOOP to LEND						
Manual control	JOG operation, inching operation		×	×	×	×	×	○
	Manual pulse generator operation		×	×	×	×	×	○
Expansion control	Speed-torque control		×	×	×	×	×	×
	Advanced synchronous control (output axis)		×	×	×	×	×	×
	Direct 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					
			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 incompletion of home position return function	Controller in-position 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	○	○	○
		1-axis fixed-feed control	○	○	○	○	○	○
		2-, 3-, or 4-axis fixed-feed control (interpolation)	○	○	△*1	○	○	○
		2-axis circular interpolation control	○	○	×	×	○	○
		3-axis helical interpolation control	○	○	×	×	○	○
	Speed control (1- to 4-axis)		×	○	×	○	○	×
	Speed-position switching control		○	○	△*2	○	○	△*8
	Position-speed switching control							
	Other control	Current value changing	×	×	×	×	△*3	×
		NOP instruction					×	
		JUMP instruction	×	×	×	×	×	×
		LOOP to LEND						
Manual control	JOG operation, inching operation		×	△*4	×	○	×	×
	Manual pulse generator operation		×	×	×	△*5	×	×
Expansion control	Speed-torque control		×	△*6	×	○	○	×
	Advanced synchronous control (output axis)		×	△*7	×	△*7	○	○
	Direct control		×	×	×	×	×	○

*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.
Simple Motion Board User's Manual (Application)

*7 Refer to the following for details.
Simple Motion Board User's Manual (Advanced Synchronous Control)

*8 Valid for only during position control.

3.3 List of Network Function

Function list of CC-Link IE Field Network

The following table lists the functions of CC-Link IE Field Network. For details on the functions, refer to the following.
Simple Motion Board User's Manual (Network)

Cyclic transmission

Function		Description
Fixed-cycle communication		The communication cycle of the Simple Motion board is fixed cycle. Communicates with slave modules in a cycle set in the operation cycle setting (the inter-module synchronization setting).
Communications with other stations	Communications using RX and RY	Communicates I/O data in units of bits between the master station and other stations.
	Communications using RWr and RWw	Communicates I/O data in units of words between the master station and other stations.
Access to devices and link devices	Direct access to link devices	Directly accesses the link devices of the Simple Motion board from a user program by the API library.
Cyclic data integrity assurance		Assures the cyclic data integrity in units of 32 bits.
Mode selection for cyclic transmission		Selects the mode for optimizing the performance of cyclic transmission based on the cyclic transmission and transient transmission frequency.
Input status setting for data link faulty station		Selects whether input data from another station where a data link error occurs is cleared or held.
Output status setting when failure occurs in the host personal computer		Selects whether cyclic data output is held or cleared when failure occurs in the host personal computer mounted with the Simple Motion board.
Cyclic transmission stop and restart		Stops the cyclic transmission during debugging and other operations. (Data reception from a slave station and data sending from the own station are stopped.) Also, the stopped cyclic transmission is restarted. Transient transmission does not stop.

Transient transmission

Function	Description
Communications within the same network	Performs the transient transmission to other stations using EM Configurator.

RAS

Function	Description
Slave station disconnection (only for asynchronized stations)	Disconnects only the slave station where an error occurs, and continues the data link with the stations that are operating normally. In a line topology, all stations connected after the faulty station are disconnected.
Automatic return	Automatically returns the station disconnected from the network due to a data link error to the network when it recovers and restarts data link.

Diagnostics

Function		Description
CC-Link IE Field Network diagnostics		Checks the status of CC-Link IE Field Network using EM Configurator. The error locations, error causes, and corrective actions can be checked in EM Configurator.
Diagnostics of own network	Cable test	Checks the connection status of the Ethernet cables.
	Communication test	Checks whether the communication route for transient transmission from the own station to the destination station is correct or not.

Others

Function	Description
CC-Link IE Field Network synchronous communication function*1	Synchronizes control intervals between slave stations over CC-Link IE Field Network according to synchronization cycle specified in the master station. This allows different slave stations on the same network to operate with the same timing.
Reserved station specification	Specifies stations reserved for future use. The reserved stations are not actually connected, but counted as connected stations. The stations are not detected as faulty stations even though they are not actually connected.
Temporary cancel of the reserved station setting (only for asynchronized stations)	Temporarily cancels the reserved station specification without changing the parameters.
Error invalid station and temporary error invalid station setting	Prevents the master station from detecting a slave station as a faulty station even if the slave station is disconnected during data link. This function is used to replace a slave station during data link, for instance.
Interrupt request to host personal computer	Checks interrupt conditions every operation cycle, and outputs an interrupt request to the host personal computer if the interrupt conditions are met.

*1 When the network synchronization communication is performed with local stations, set the inter-module synchronization cycle to any of the following.
· 0.50 ms
· 1.00 ms
· 2.00 ms
· 4.00 ms
For the inter-module synchronization cycle when the network synchronization communication is performed with the slave stations other than local stations, refer to the manual for the slave station used.
For the setting method of the inter-module synchronization cycle, refer to the following.
Simple Motion Board User's Manual (Network)

4 PROCEDURES BEFORE OPERATIONS

Procedures before operation

This chapter describes the procedures before operation.

1. Simple Motion board setting

Set board IDs by the board ID setting switches of the Simple Motion board.

For details, refer to the following.

☞ Page 40 Simple Motion board setting

2. Check of wiring and ambient environment

Check whether the Simple Motion board, servo amplifier, and slave station are wired correctly. Also, check the ambient environment.

For details, refer to the following.

☞ Page 40 Check of wiring and ambient environment

3. Installation of EM Software Development Kit to the host personal computer

Select the MR-EM340GF from [New] of [Project] using EM Configurator.

4. Network parameter setting

Set the inter-module synchronization in "Network Parameter" of EM Configurator.

The operation cycle is set by the inter-module synchronization setting of the Simple Motion board.

- Set any of 0.50 ms, 1.00 ms, 2.00 ms, or 4.00 ms as the inter-module synchronous cycle according to the number of control axes and network device configuration.

For details, refer to the following.

📖Simple Motion Board User's Manual (Application)

Point

A reference of the inter-module synchronization cycle that can be set is shown below. The cycle that can be set depends on the control and number of link devices. If processing in the Simple Motion board is not completed within the inter-module synchronization cycle, it may cause the warning "Inter-module synchronization cycle over" (warning code: 0CC0H), the error "Inter-module synchronization processing error" (error code: 2600H), or "Operation cycle over error" (error code: 193FH), etc.

The following number of setting stations is for the case that 1 to 16 stations are set to the MR-J4-GF (Motion Mode), and 17 to 120 stations are set to 160 points (RX/RY) and 72 points (RWw/RWr) per station on average.

- 1 to 4 stations: 0.50 ms (It is recommended to set "[Pr.152] Maximum number of control axes" based on the number of axes.)
- 5 to 16 stations: 1.00 ms (It is recommended to set "[Pr.152] Maximum number of control axes" based on the number of axes.)
- 17 to 48 stations: 2.00 ms
- 49 to 120 stations: 4.00 ms

Set network parameters in "Network Parameter" of EM Configurator.

- Set a slave station for Network Configuration Settings.
  Devices of the station No.1 to 16 and slave stations which support the motion mode (stations selected to "Motion Mode" in "Station-specific mode setting" when the MR-J4-GF is used) are used as the axis 1 to 16.

For details, refer to the following.

📖Simple Motion Board User's Manual (Network)
📖Simple Motion Board User's Manual (Application)
📖MR-J4-_GF_(-RJ) SERVO AMPLIFIER INSTRUCTION MANUAL (MOTION MODE)

5. Parameter setting

Configure the setting related to axis control in "Parameter" of EM Configurator.

For details, refer to the following.

📖Simple Motion Board User's Manual (Application)

6. Writing parameters

Write the set parameters to the Simple Motion board.

Executes the power cycle of the Simple Motion board or remote RESET and reflects the parameters as necessary.

7. Start network communication using watch function of EM Configurator

Check that the synchronization flag signal [X1] (bit 1 of U0\G6300120) is turned ON. Turn the user program READY signal [Y0] (bit 0 of U0\G6300136) ON and start the network communication. Then, check that the READY signal [X0] (bit 0 of U0\G6300120) turns ON.

8. Connection status check

For details, refer to the following.

📖Simple Motion Board User's Manual (Network)

9. Parameter settings in slave devices

Set parameters of the servo amplifier to use. When using the MR-J4-GF, always set the followings.

- Set Function selection C-5 (PC18) to "_ _ 0 _" (Absolute position counter warning: Disabled). (for unlimited length feed)
- Set Function selection T-3 (PT29) to "_ _ _ 1" (Dog detection with on). (To use signals other than servo amplifier as external input signals.)

In addition, it is recommended to set the following parameter.

- Set Function selection D-4 (PD41) to "_ 1 _ _" (Stroke limit enabling condition selection: Enabled only for home position return mode).

Set the followings to use the linear servo motor control mode, direct drive motor control mode and fully closed loop control mode.

Operation mode	Setting
Linear servo motor control mode	• Set the operation mode (PA01) to "_ _ 4 _" (Linear servo motor control mode).
Direct drive motor control mode	• Set the operation mode (PA01) to "_ _ 6 _" (DD motor control mode).
Fully closed loop control mode	• Set the operation mode (PA01) to "_ _ 1 _" (Fully closed loop control mode). • Set "[Cd.133] Semi/Fully closed loop switching request" to "1: Fully closed loop control". The switching status of semi closed loop control/fully closed loop control is displayed in "[Md.113] Semi/Fully closed loop status".

For details, refer to the following.

📖MR-J4-_GF_(-RJ) SERVO AMPLIFIER INSTRUCTION MANUAL (MOTION MODE)

Point

To operate an axis before creating a user program, use the test operation of EM Configurator.

For details, refer to the following.

📖Simple Motion Board User's Manual (Application)

10. Programming

Create and execute programs.

For details, refer to the following.

☞ Page 74 List of labels to be used

Execute a test operation and check that the user program is correctly executed as created.

Restriction

When the Simple Motion board is installed in the PCI Express slot connected with chipset supported for 6th Generation Intel® Core™ processors (such as Intel® Q170 and H170), do not access to the Simple Motion board via PCI Express using a user program or the monitor or watch function of EM Configurator during the remote RESET.

Simple Motion board setting

Set board IDs by board ID setting switches of the Simple Motion board.

■Board ID

Board IDs and board ID setting switch Nos. are related as shown on the table below. Set the board ID so that it will not be duplicated. If it is duplicated, it cannot distinguish one of the Simple Motion boards duplicated on the host personal computer. The switch 3 and 4 are provided for manufacturer setting, so that make sure the switches are always OFF.

Board ID	Switch 1	Switch 2
0	OFF	OFF
1	ON	OFF
2	OFF	ON
3	ON	ON

Check of wiring and ambient environment

■Wiring

- Check that the port for CC-Link IE Field of the Simple Motion board and the port for CC-Link IE Field of the servo amplifier and the slave station are connected by Ethernet cables.
- Check that external forced stop connector is connected.

■Cable treatment

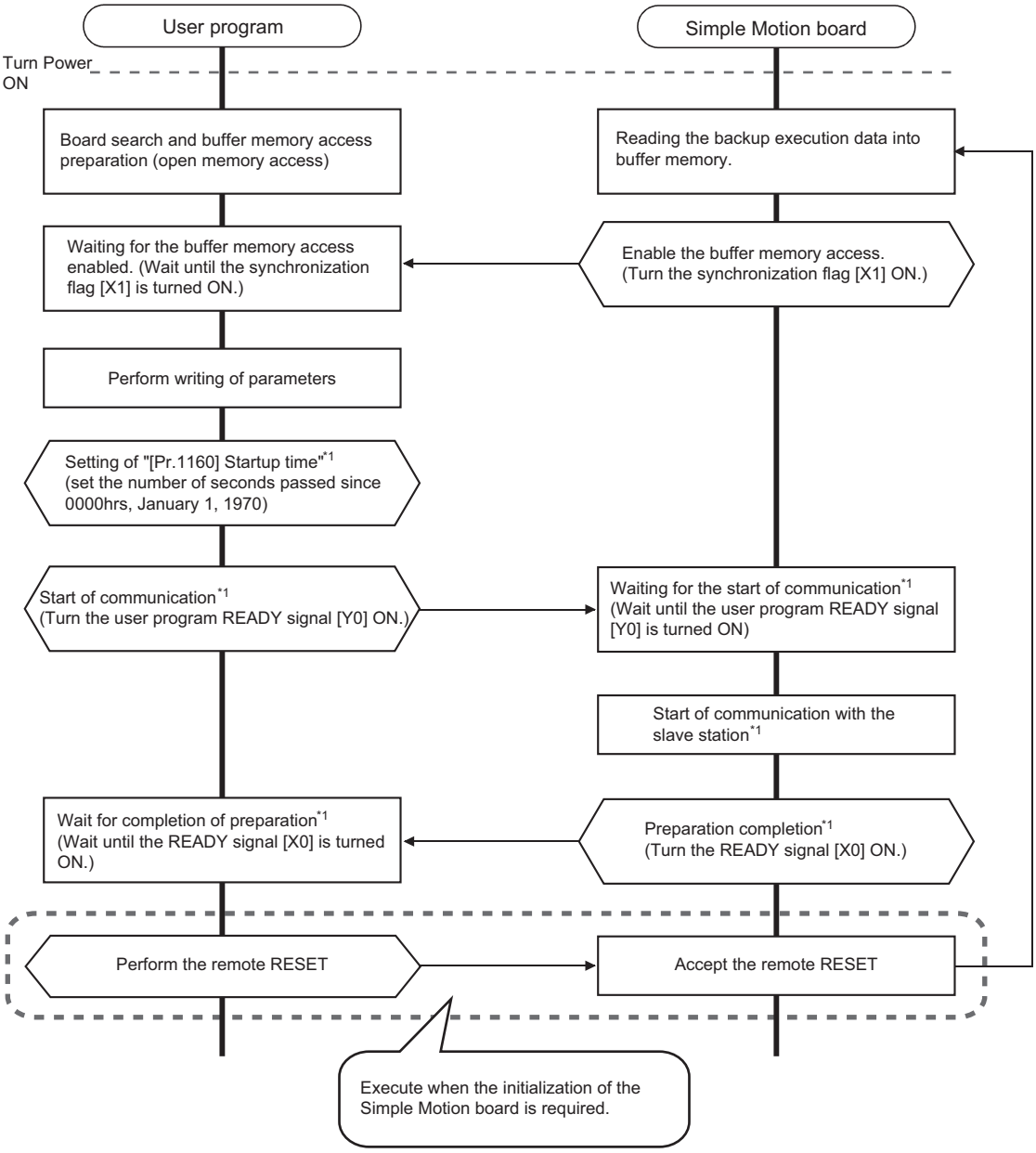
- Check that wiring cables and connector parts are not strained.

■Environment

- Check that signal cables and the PCI Express slot of the host personal computer are not shorted by wire offcuts and metallic dust.

Start of communication

The following shows the procedure from the power supply is switched on until the Simple Motion board is ready.



Point

[API library]

*1 Executed by the MMC_Controller::SetUserProgramReady(MMC_ON) method.

5 NETWORK CONFIGURATION

5.1 CC-Link IE Field Network Configuration

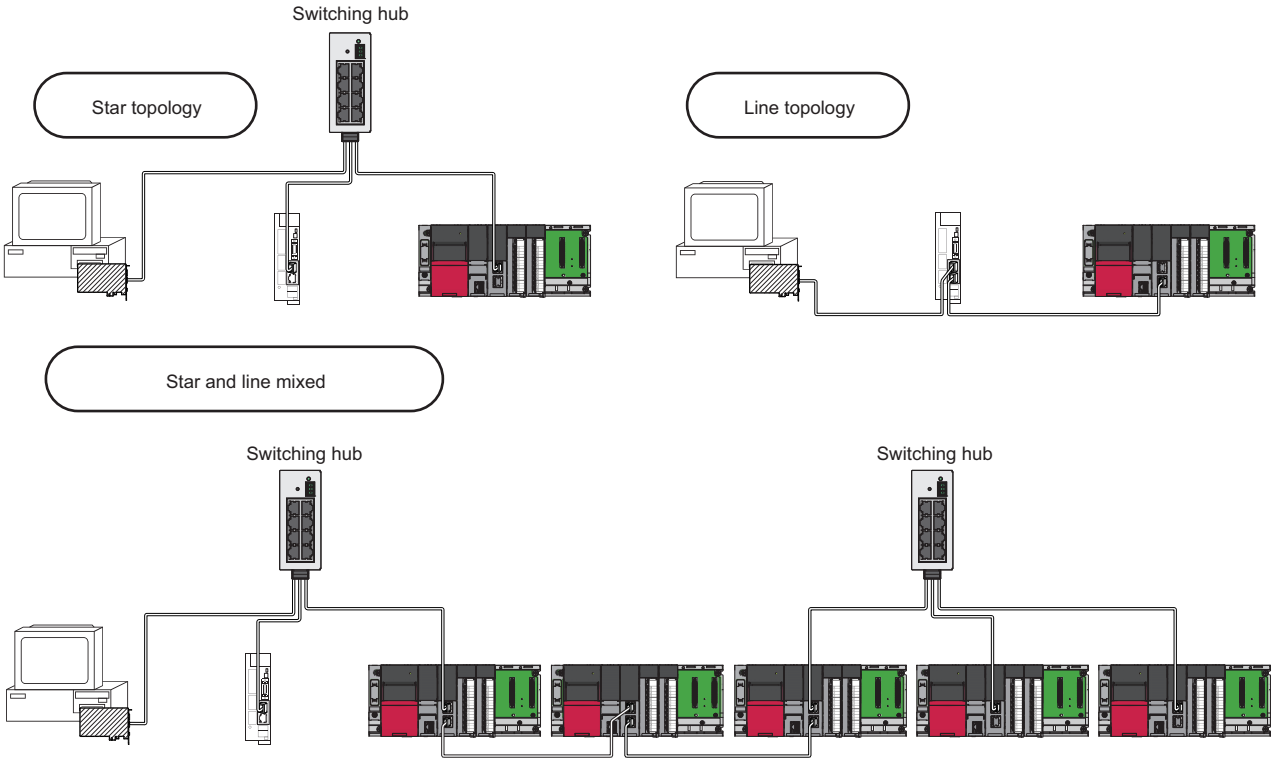
CC-Link IE Field Network is configured using Ethernet cables.

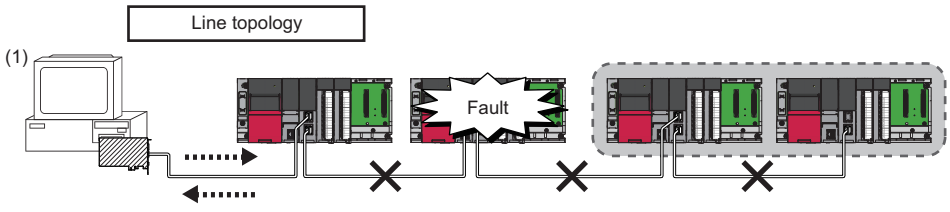
Network topology

■Star topology/Line topology

For the Simple Motion board, configure the network in star topology or line topology using the Ethernet cables.

Star topology and line topology can be combined in a network. The Simple Motion board does not support ring topology.

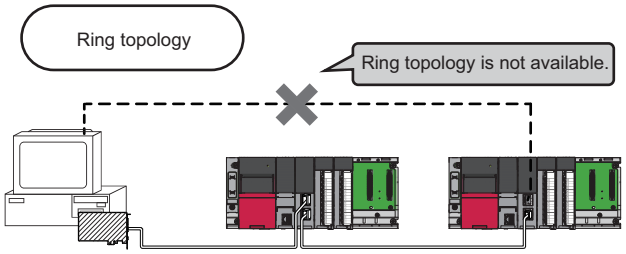


Item	Description
Star topology	The network is configured into a star shape using a switching hub and Ethernet cables. Slave stations can be easily added to the network using this topology.*1 When an error occurs in a slave station, data link can be continued with the stations that are operating normally.
Line topology	The network is configured into a line using Ethernet cables. A switching hub is not required.*1 When an error occurs in a slave station, the stations connected after the faulty station will be disconnected.  (1)Master station (station No.0)

*1 Add/remove slave stations one by one. If multiple slave stations are added/removed at a time, all stations on the network will be reconnected, and an error may momentarily occur in all the stations.

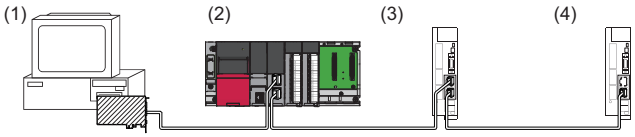
■Ring topology

Ths Simple Motion board does not support ring topology.



Station No. and connection position

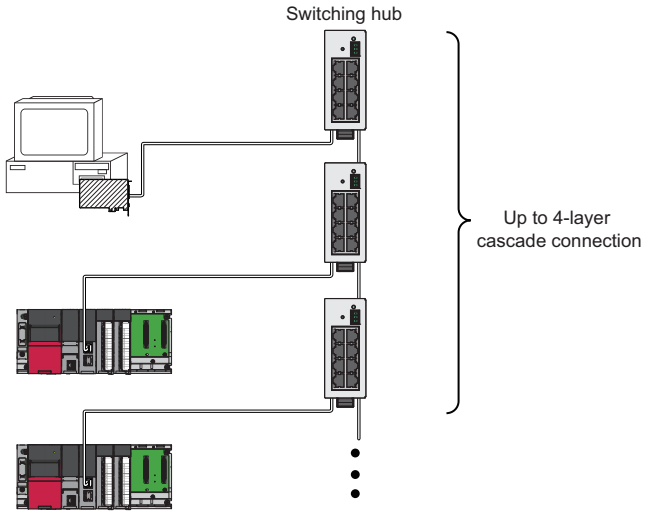
Modules can be connected in any order regardless of the station No.



(1) Station No.0 (master station)
(2) Station No.1
(3) Station No.3
(4) Station No.2

Cascade connection

Cascade connection is available up to 4 levels.



Precautions

Addition of slave stations

Do not connect 121 or more slave stations. If a slave station is added to a system having 120 slave stations, all stations will fail and data link cannot be performed.

Point

- Whether the number of the connected slave stations exceeds the controllable number can be checked using "Number of connected modules over occurrence status" (SB0099). Number of connected modules detected by "Number of connected modules over occurrence status" (SB0099) is the total of the slave stations which are currently connected and the disconnected stations (slave stations which were previously connected).
- The number of stations which were previously connected can be cleared by executing the network map update of the CC-Link IE Field Network diagnostics. (Simple Motion Board User's Manual (Network))
- A data link error may momentarily occur in all the stations and outputs of the connected slave stations may turn off since all stations on the network will be reconnected when executing the network map update. Set output data if needed. (☞ Page 45 Output hold when a data link error occurs)

Connecting/disconnecting a cable and powering off/on a device

If the following operations are performed, the actual network configuration and the network map of the CC-Link IE Field Network diagnostics may be a mismatch. Whether mismatch is occurred or not can be checked using "Network configuration mismatch occurrence status" (SB0098).

In addition, if the following operations are performed, an alarm (communication error) may occur in the station in which the synchronization communication is performed or a data link error may momentarily occur in all the stations and outputs of the connected slave stations may turn off. An operation cycle time over error or an inter-module synchronization cycle over error may be detected in the Simple Motion board. Check parameters related to output hold setting, inter-module synchronization cycle, and alarm detection for slave stations again if needed.

Network configuration	Operation
Star topology	• Powering off and on a slave station or switching hub • Connecting/disconnecting an Ethernet cable connected to the switching hub • Disconnecting an Ethernet cable from a slave station and connecting it to another slave station or a switching hub • Disconnecting more than 9 stations, or half the number of slave stations or more in the system • Changing the network topology when adding a slave station
Line topology	• Simultaneously powering off/on multiple stations • Simultaneously connecting/disconnecting Ethernet cables to/from multiple stations (When a data link faulty station returns, a data link error will occur in all the stations.) • Disconnecting more than 9 stations, or half the number of slave stations or more in the system • Changing the network topology when adding a slave station

Point

The actual network configuration and network map can be matched by executing the network map update of the CC-Link IE Field Network diagnostics. (Simple Motion Board User's Manual (Network))

A data link error may momentarily occur in all the stations and outputs of the connected slave stations may turn off since all stations on the network will be reconnected when executing the network map update. Set output data if needed. (☞ Page 45 Output hold when a data link error occurs)

Output hold when a data link error occurs

Setting the following allows to hold the outputs when a data link error occurs.

■Simple Motion board

Select the "Hold" in the following setting.

Navigation window ⇨ "Network Parameter" ⇨ "Application Settings" ⇨ "I/O Maintenance Settings" ⇨ "Data Link Error Station Setting"

■For a head module whose serial No. (first five digits) is "12071" or earlier

Select the "Hold" in the following setting using GX Works2.

Navigation window ⇨ "Parameter" ⇨ "PLC Parameter" ⇨ [I/O Assignment] tab ⇨ [Detailed Setting] button ⇨ "Error Time Output Mode"

This setting is not required for a head module whose serial No. (first five digits) is "12072" or later.

Connected station No.

Do not duplicate station No. Data link may be stopped when the station No. is duplicated.

Power-on order

To avoid incorrect input from slave stations, power on slave stations before the master station.

Processing time during connection

When the servo amplifier is reconnected during transient communication (such as transient transmission function, communication with EM Configurator), it may take some time to complete the connection.

5.2 Precautions for System Configuration

Connecting devices to the same network

Do not connect the Ethernet devices compatible with other than the CC-Link IE Field Network (such as personal computers) to the switching hub used in the CC-Link IE Field Network. A timeout may occur in the master station and all the stations may be disconnected.

Connecting devices to the host personal computer

When connecting devices to the host personal computer, power off the host personal computer before connection.

6 WIRING

This section describes wiring for when an Ethernet cable is used.

Wiring methods

■Connecting the cable

1. Push the Ethernet cable connector into the Simple Motion board until it clicks. Pay attention to the connector's direction.
2. Lightly pull it to check that it is securely connected.
3. Check whether the LINK LED of the port connected with an Ethernet cable is on.*1*2

*1 The time between the cable connection and the LINK LED turning on may vary. The LINK LED usually turns on in a few seconds.

*2 When using the CC-Link IE Field Network cable, the time may be extended further if the link-up processing is repeated depending on the status of the device on the line. If the LINK LED does not turn on, refer to the following and take corrective actions.
Simple Motion Board User's Manual (Application)

■Disconnecting the cable

1. Press the latch down and unplug the Ethernet cable.

Precautions for wiring Ethernet cables

- Connect a CC-Link IE Field Network cable to a CC-Link IE Field Network cable connector. Use the supported Ethernet cable to connect a PERIPHERAL connector. Otherwise, failure may be caused.
- Place the Ethernet cable in a duct or clamp them. If not, dangling cable may swing or inadvertently be pulled, resulting in damage to the board or cables or malfunction due to poor contact.
- Do not touch the core of the cable-side or board-side connector, and protect it from dirt or dust. If oil from your hand, dirt or dust is attached to the core, it can increase transmission loss, arising a problem in data link.
- Check that the Ethernet cable is not disconnected or not shorted and there is no problem with the connector connection.
- Do not use Ethernet cables with broken latches. Doing so may cause the cable to unplug or malfunction.
- Hold the connector part when connecting and disconnecting the Ethernet cable. Pulling the cable connected to the board may result in malfunction or damage to the board or cable.
- For connectors without Ethernet cable, attached connector cover should be placed to prevent foreign matter such as dirt or dust.
- The maximum station-to-station distance of the Ethernet cable is 100 m. However, the length may be shorter depending on the operating environment of the cable. For details, contact your cable manufacturer.
- The bend radius of the Ethernet cable is limited. For details, check the specifications of the Ethernet cable to be used.

Wiring products

The following describes the devices used for CC-Link IE Field Network. For reference products of Ethernet cables and recommended products of hubs, refer to the following.

☞ Page 79 Component List

■Ethernet cable

Use the Ethernet cable that meets the following standards.

Ethernet cable		Connector	Cable	Standard
CC-Link IE Field Network cable	Category 5e or higher, STP cable (double shielded)	RJ45 connector	Straight cable	• IEEE802.3 (1000BASE-T) • ANSI/TIA/EIA-568-B (Category 5e)
PERIPHERAL cable*1	Category 5 or higher, STP cable	RJ45 connector	Straight cable Crossover cable (direct connection)	• 100BASE-TX

*1 Use the cable that meets the following conditions.
Diameter of lead: AWG26 or higher
Shield: Copper braid shield and drain wire, or copper braid shield and aluminium layered type shield

■Hub

Use hubs that meet all the conditions listed below. Operation is not guaranteed if the hubs do not meet these conditions.

- Compliance with the IEEE802.3 (1000BASE-T)
- Support of the auto MDI/MDI-X function
- Support of the auto negotiation function
- Switching hub (layer 2 switch)*1

*1 A repeater hub is not available.

Wiring of connector

Specialised tools are not required for wiring the external forced stop cable connector because plugs with spring connection are used.

■Applicable wire size and wire fabrication

- Applicable wire size

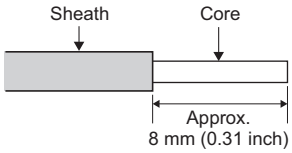
The applicable wire size for external forced stop cable connector is shown below.

Connector	Type	Applicable wire size
External forced stop cable connector	FK-MC0,5/3-ST-2,5	0.08 to 0.5 mm^2 (AWG28 to AWG20)

- Wire fabrication

Strip the wire according to stripped length indicated in the figure below.

Slide the sheath off the wire and gently twist and straighten the strands. When using the wire, be careful not to short with stray strands entering the neighbouring poles. Do not use solder on the wire's core as this may lead to insufficient contact.



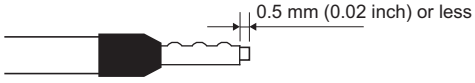
[Using a ferrule]

A ferrule can also be used to connect with the connector.

Use the ferrules in the table below for the external forced stop cable connector.

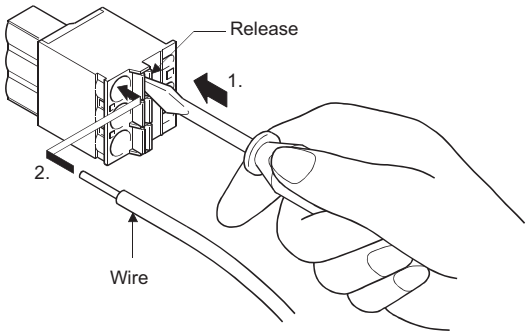
Connector	Wire size	Ferrule model		Crimping tool	Manufacturer
		For 1 wire	For 2 wires		
External forced stop cable connector	AWG21	AI0.5-8 OG	—	CRIMPFOX-ZA3	PHOENIX CONTACT GmbH & Co. KG

Cut the wire sticking out from the end of the ferrule to 0.5 mm (0.02 inch) or less.



■Inserting wire

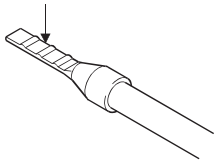
1. Press the connector release with a tool such as a flathead screwdriver.
2. While holding the release down, insert the wire all the way in.



Point

When using a ferrule, make sure the bumpy side is facing towards the release.
When inserting 2 wires into one terminal, use a twin ferrule.

Insert the wire with the bumpy side facing the release.

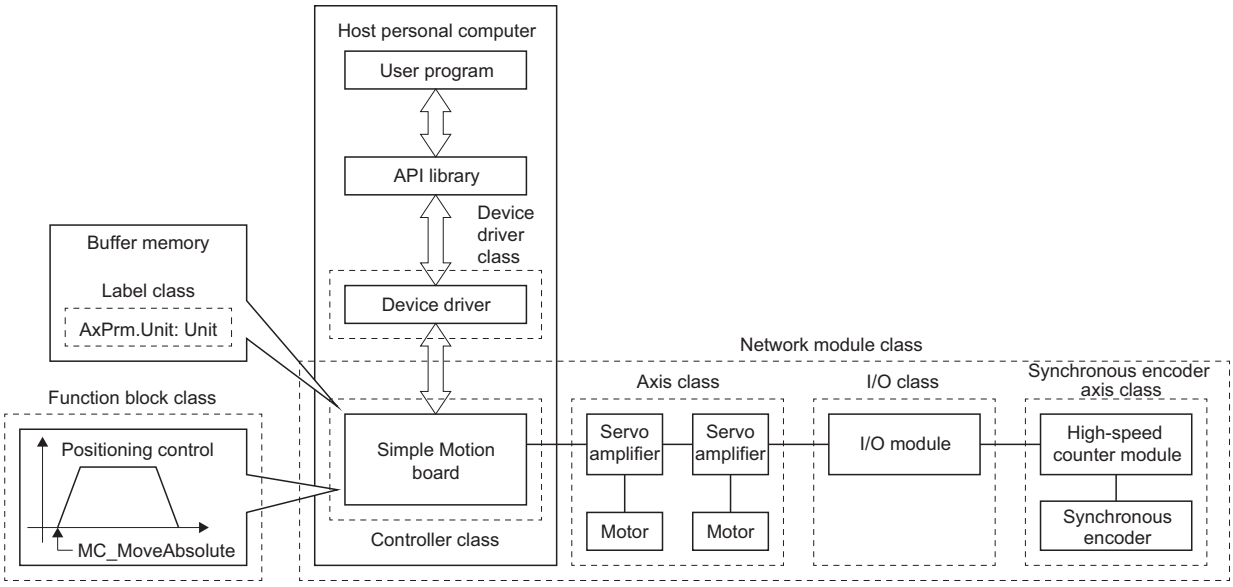


7 OPERATION EXAMPLES

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

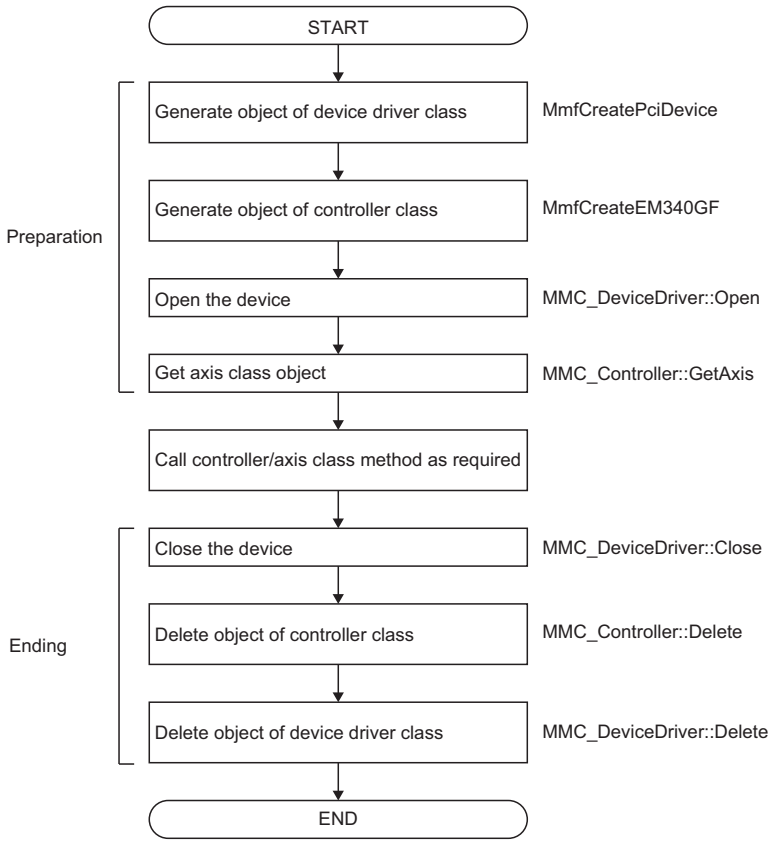
7.1 User Program Examples

Positioning data and monitor data are assigned in the buffer memory of the Simple Motion board. A user program accesses the buffer memory using the label and method of the controller object and axis object created by API library.
Refer to the following for details.
Simple Motion Board User's Manual (API Library)

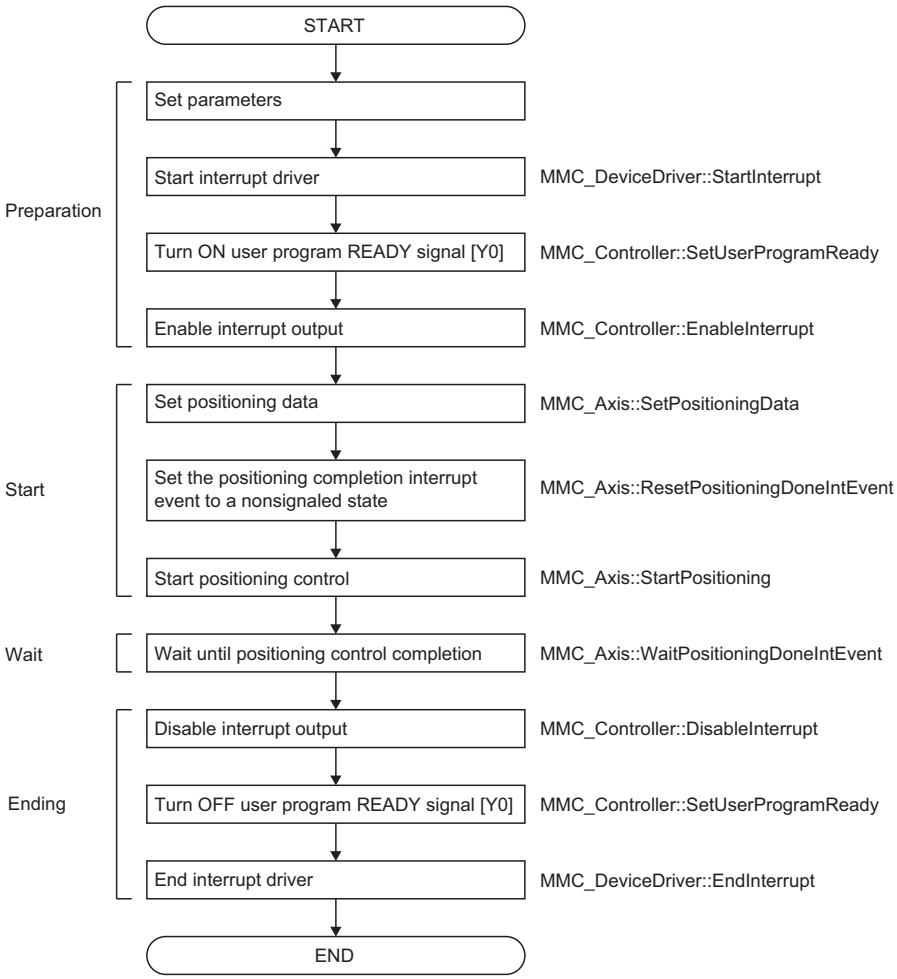


The procedure for executing a sample program is shown below.

- Preparation and ending procedure for using the methods of controller class and axis class



• Procedure for starting positioning control, and waiting for positioning completion interrupt



Point

The basic programs that are explained in this section are contained in the sample programs (InterruptPositioningSample).
To use the function block class that meets the specification of PLCopen® motion control function block (FB), refer to the following and the sample program (FunctionBlock).
Simple Motion Board User's Manual (API Library)

Overall configuration

The user program examples show the programs of the following operations.

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

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

No.	User function name	Description
1	CreateObjects	Creates objects of a device driver class and a controller class.
2	StartSystem	Enables the device open and interrupt, and turns the user program READY signal[Y0] ON.
3	InterruptHomePositionReturn	Executes the machine home position return.
4	InterruptPositioning	Starts the positioning control.
5	StopSystem	Disables the interrupt and turns the user program READY signal[Y0] OFF.
6	DeleteObjects	Deletes the created objects.

Programming procedure

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

1. Set the system structure setting and parameter setting of the Simple Motion board setting for the initial setting.

☞ Page 54 System setting, Page 55 Parameters

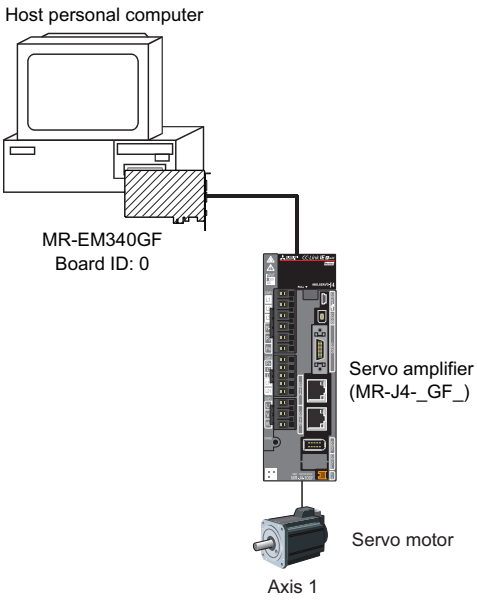
2. Set the positioning data of the Simple Motion board setting.

☞ Page 55 Positioning data

3. User program examples of each control

System configuration

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



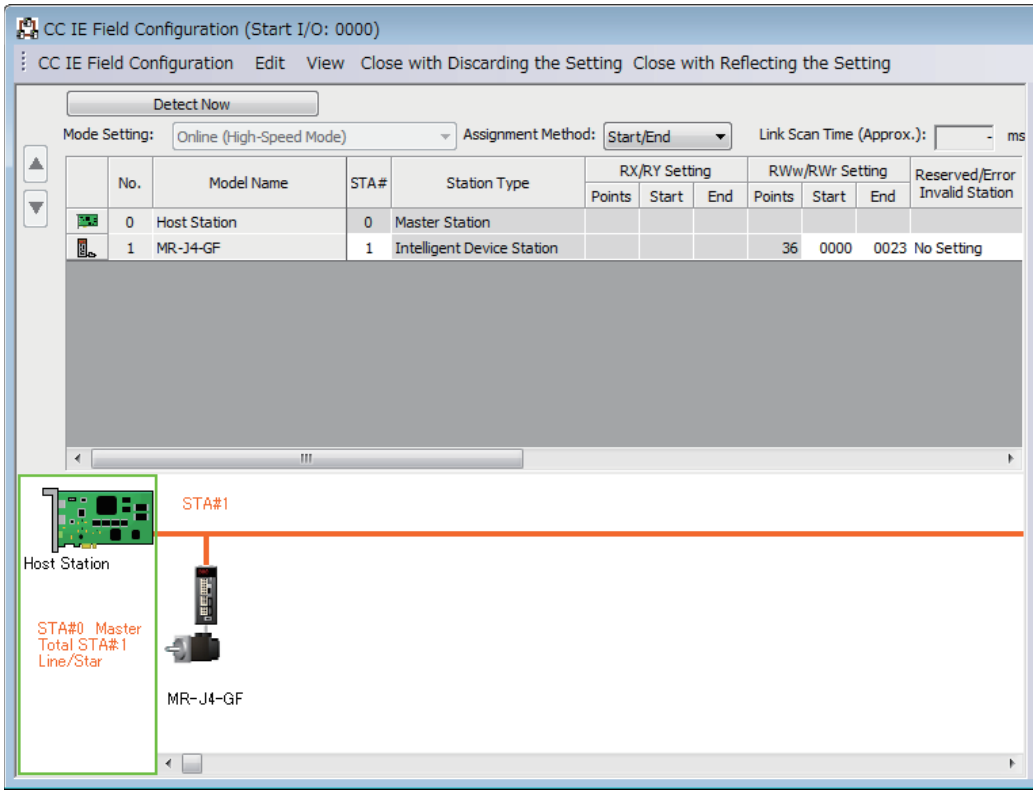
Initial setting details

Set the system setting, parameters and positioning data using EM Configurator.

■System setting

The system setting is shown below.

Configure the setting on "CC IE Field Configuration".



■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 (AP)	4194304 pulses
	[Pr.3] Movement amount per rotation (AL)	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
Controller in-position parameters	[Pr.1190] Controller in-position range	1600 pulses
Servo parameters	Function selection A-1 (PA04)	2100H (Not using EM2 or EM1)
	Function selection D-4 (PD41)	1100H (Input from controller, enabled only for home position return mode.)

Point

Be sure to set the "[Pr.1190] Controller in-position range" because the API library judges the positioning complete using the controller in-position.

■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)
Operation pattern	0: Positioning complete	
Control method	01h: ABS Linear 1 1-axis linear control (ABS)	
Axis to be interpolated	—	
Acceleration time No.	0: 1000	
Deceleration time No.	0: 1000	
Positioning address	-10000.0 µm	0.0 µm
Arc address	—	
Command speed	20.00 mm/min	
Dwell time	300 ms	
M code	0	
M code ON signal output timing	0: Use the setting value of M code ON signal output timing	
ABS direction in degrees	0: Use the setting value of ABS direction setting at degree	
Interpolation speed designation method	0: Use the setting value of interpolation speed designation method	

List of labels to be used

The following table lists the labels used for the user program examples in this section. I/O signals or buffer memory areas of the Simple Motion board shown in the system configuration are described in the programs using the labels.

■Label

The following table lists the board labels of the Simple Motion board used for the user program examples in this section.

Classification	Name	Details
Label	MMC_Controller::BitDevice.AllAxisServoOn	RW: All axis servo ON
	MMC_Axis::AxMntr.AxisOperationStatus	R: [Md.26] Axis operation status
Method	MMC_DeviceDriver::Open	Opens device.
	MMC_DeviceDriver::Close	Closes device.
	MMC_DeviceDriver::StartInterrupt	Starts interrupt driver.
	MMC_DeviceDriver::EndInterrupt	Ends interrupt driver.
	MMC_DeviceDriver::Delete	Deletes object.
	MMC_Controller::ResetController	Executes remote RESET.
	MMC_Controller::SetUserProgramReady	Sets the user program READY signal [Y0].
	MMC_Controller::EnableInterrupt	Enables the interrupt output.
	MMC_Controller::DisableInterrupt	Disables the interrupt output.
	MMC_Controller::GetAxis	Gets the object of the axis class.
	MMC_Controller::Delete	Deletes object.
	MMC_Axis::AxMntr.AxisOperationStatus.Wait	Waits until the axis operation status is on standby.
	MMC_Axis::StartPositioning	Starts positioning control.
	MMC_Axis::WaitPositioningDoneIntEvent	Waits until the positioning complete interrupt event is in a signaled state.
	MMC_Axis::SetPositioningData	Sets the positioning data.
	MMC_Axis::ResetPositioningDoneIntEvent	Sets the positioning complete interrupt event to a nonsignaled state.
Function	MmfCreatePciDevice	Generates PCI Express device driver class objects.
	MmfCreateEM340GF	Generates MMC_EM340GF class objects.

Program example

The program examples use the API library and labels.

For details on API library, refer to the following.

📖Simple Motion Board User's Manual (API Library)

■CreateObjects

C++

```
unsigned long CreateObjects( MMC_DeviceDriver **retDevice, MMC_Controller **retController )
{
    unsigned long retCode;

    MMC_DeviceDriver    *pciDev = NULL;          /* PCIe device object */
    MMC_Controller      *controller = NULL;      /* controller object */


    /* create PCIe device object */
    retCode = MmfCreatePciDevice( boardID, &pciDev );
    if( retCode != MMC_OK ) { /* Error process */ }

    *retDevice = pciDev;

    /* create controller object */
    retCode = MmfCreateEM340GF( pciDev, (MMC_EM340GF **)&controller );
    if( retCode != MMC_OK ) { /* Error process */ }

    *retController = controller;

    return( MMC_OK );
}
```

■StartSystem

C++

```
#define WAIT_AXIS_STANDBY_TIMEOUT   (10000)
#define AXIS_MAX                    (16)
#define AX_STATUS_STANDBY           (0)
unsigned short          existAxisBit = 0x0001;          /* exist axis flag [ bit0: axis1, bit1: axis2, ... bit15: axis16 ] */

unsigned long StartSystem( MMC_DeviceDriver *pciDev, MMC_Controller *controller )
{
    unsigned long   retCode;
    unsigned long   axisCnt;
    MMC_Axis        *axis[AXIS_MAX];

    /* open PCIe device */
    retCode = pciDev->Open();
    if( retCode != MMC_OK ) { /* Error process */ }

    /* remote reset */
    retCode = controller->ResetController();
    if( retCode != MMC_OK ) { /* Error process */ }

    /*****************************/
    /* start system              */
    /*****************************/

    /* start interrupt */
    retCode = pciDev->StartInterrupt( INTERRUPT_THREAD_PRIORITY );
    if( retCode != MMC_OK ) { /* Error process */ }

    /* turn on the User program ready signal */
    retCode = controller->SetUserProgramReady( MMC_ON );
    if( retCode != MMC_OK ) { /* Error process */ }

    /* enable interrupt */
    retCode = controller->EnableInterrupt();
    if( retCode != MMC_OK ) { /* Error process */ }

    /* turn on the All axis servo ON signal */
    controller->BitDevice.AllAxisServoOn = MMC_ON;

    /* wait until axis standby */
    for( axisCnt = 0;  axisCnt < AXIS_MAX; axisCnt++ )
    {
        if( ( existAxisBit & ( 1 << axisCnt ) ) == 0 )
        {
            continue;
        }

        controller->GetAxis( axisCnt + 1, &axis[axisCnt] );

        retCode = axis[axisCnt]->AxMntr.AxisOperationStatus.Wait(
            MMC_WAIT_EQUAL, AX_STATUS_STANDBY, WAIT_AXIS_STANDBY_TIMEOUT );
        if( retCode != MMC_OK ) { /* Error process */ }
    }

    return( MMC_OK );
}
```

■InterruptHomePositionReturn

C++

```
void InterruptHomePositionReturn( MMC_Axis *axis )
{
    unsigned long retCode;

    /* reset positioning finish */
    retCode = axis->ResetPositioningDoneIntEvent();
    if( retCode != MMC_OK ) { /* Error process */ }

    /* start home position return */
    retCode = axis->StartPositioning( MMC_STNO_HOMING );
    if( retCode != MMC_OK ) { /* Error process */ }

    /* wait positioning finish */
    retCode = axis->WaitPositioningDoneIntEvent( MMC_POSITIONING_DONE_INP, WAIT_POSITIONING_DONE_TIMEOUT );
    if( retCode != MMC_OK ) { /* Error process */ }

    return;
}
```

■InterruptPositioning

C++

```
#define WAIT_POSITIONING_DONE_TIMEOUT    (10000)

void InterruptPositioning( MMC_Axis *axis )
{
    unsigned long retCode;
    unsigned short dataNo;

    dataNo = 1;

    /* reset positioning finish */
    retCode = axis->ResetPositioningDoneIntEvent();
    if( retCode != MMC_OK ) { /* Error process */ }

    /* start positioning (positioning data No.1) */
    retCode = axis->StartPositioning( dataNo );
    if( retCode != MMC_OK ) { /* Error process */ }

    /* wait positioning finish */
    retCode = axis->WaitPositioningDoneIntEvent( MMC_POSITIONING_DONE_INP, WAIT_POSITIONING_DONE_TIMEOUT );
    if( retCode != MMC_OK ) { /* Error process */ }

    dataNo = 2;

    /* reset positioning finish */
    retCode = axis->ResetPositioningDoneIntEvent();
    if( retCode != MMC_OK ) { /* Error process */ }

    /* start positioning (positioning data No.2) */
    retCode = axis->StartPositioning( dataNo );
    if( retCode != MMC_OK ) { /* Error process */ }

    /* wait positioning finish */
    retCode = axis->WaitPositioningDoneIntEvent( MMC_POSITIONING_DONE_INP, WAIT_POSITIONING_DONE_TIMEOUT );
    if( retCode != MMC_OK ) { /* Error process */ }
}
```

■StopSystem

C++

```
unsigned long StopSystem( MMC_DeviceDriver *pciDev, MMC_EM340GF *controller )
{
    unsigned long retCode;

    /* turn off the All axis servo ON signal */
    controller->BitDevice.AllAxisServoOn = MMC_OFF;

    /* disable interrupt */
    retCode = controller->DisableInterrupt();
    if( retCode != MMC_OK ) { /* Error process */ }

    /* turn off the User program ready signal */
    retCode = controller->SetUserProgramReady( MMC_OFF );
    if( retCode != MMC_OK ) { /* Error process */ }

    /* end interrupt */
    retCode = pciDev->EndInterrupt();
    if( retCode != MMC_OK ) { /* Error process */ }

    /* close PCIe device */
    retCode = pciDev->Close();
    if( retCode != MMC_OK ) { /* Error process */ }

    return( MMC_OK );
}
```

■DeleteObjects

C++

```
unsigned long DeleteObjects( MMC_DeviceDriver **pciDev, MMC_Controller **controller )
{
    /* delete object */
    if( controller != NULL )
    {
        if( *controller != NULL )
        {
            (*controller)->Delete();
            *controller = NULL;
        }
    }

    if( pciDev != NULL )
    {
        if( *pciDev != NULL )
        {
            (*pciDev)->Delete();
            *pciDev = NULL;
        }
    }

    return( MMC_OK );
}
```

Operation check using the sample program

Store the sample program under My Document.

<Copy source file>

For 32-bit operating system:

"C:\Program Files\MELSOFT\EM SDK\API Library\Samples\CPP\InterruptPositioning

"For 64-bit operating system:

"C:\Program Files (x86)\MELSOFT\EM SDK\API Library\Samples\CPP\InterruptPositioning"

<Copy destination folder>

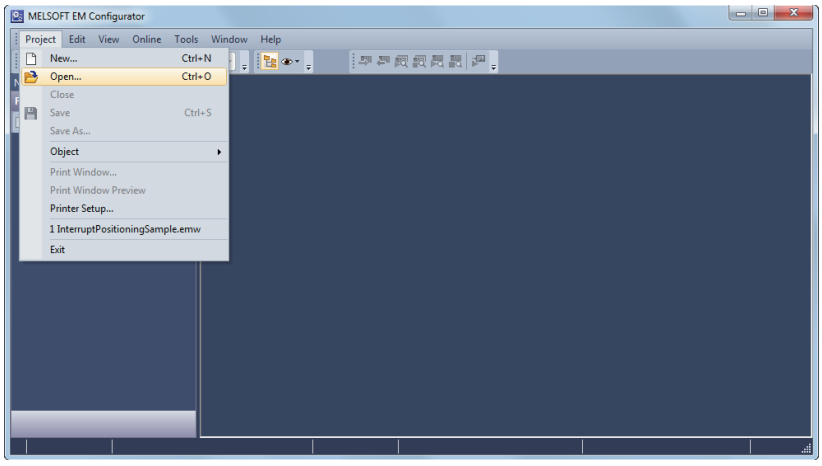
"C:\Users***\Documents\InterruptPositioning"

Point

- The destination *** will be the user name.
- Copy the source folder. Click [Start] ⇨ [All programs] ⇨ [SimpleMotionBoard] ⇨ [MR-EM340GF] ⇨ [API Library] ⇨ [Sample].
- The copy source file indicates the install folder.

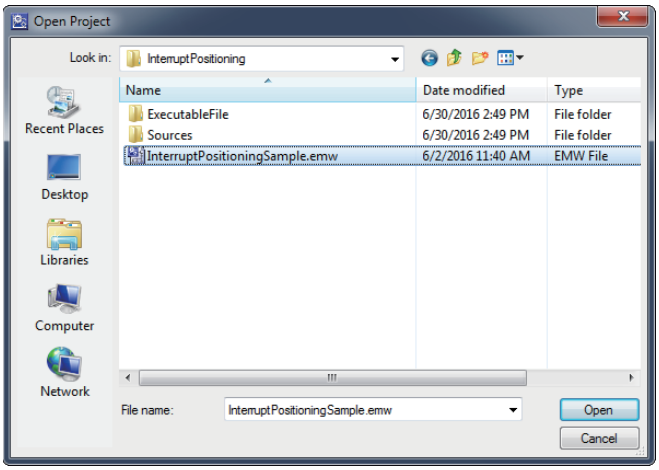
■Project writing using EM Configurator

1. Click [Project] ⇨ [Open] on EM Configurator

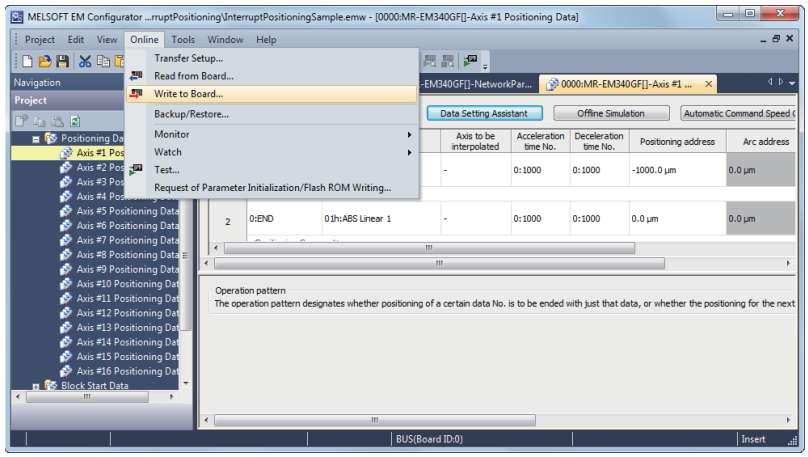


2. Choose "InterruptPositioningSample.emw".

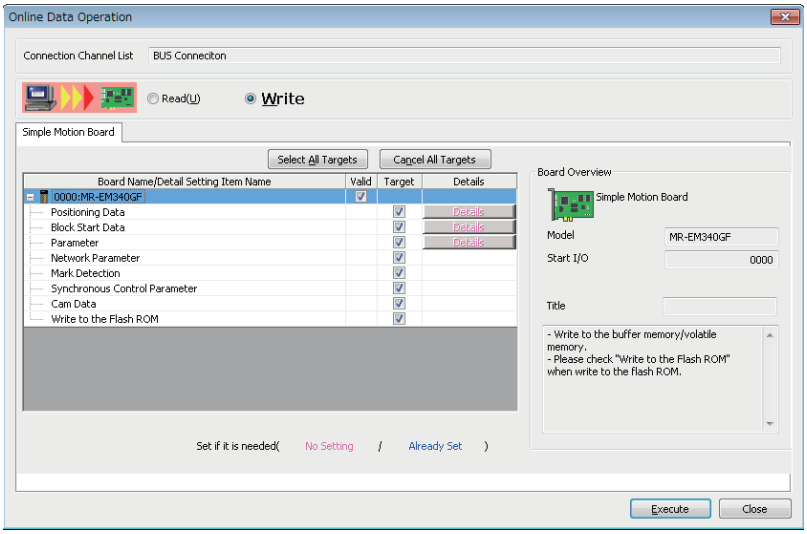
<Source folder> "C:\Users***\Documents\InterruptPositioning"



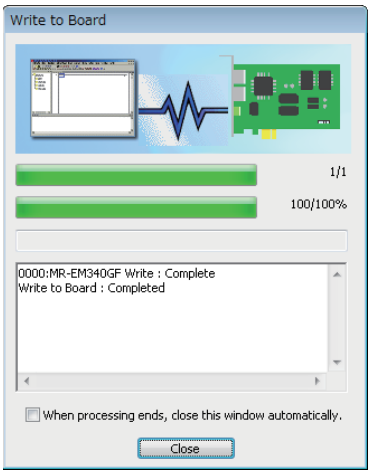
3. Click [Online] ⇨ [Write to Board].



4. Click [Execute] on the "Online Data Operation" window.



5. Make sure that the write to board is completed and click [Close].



Point

After the write to board is completed, write the servo parameters.

- Function selection A-1 (PA04)

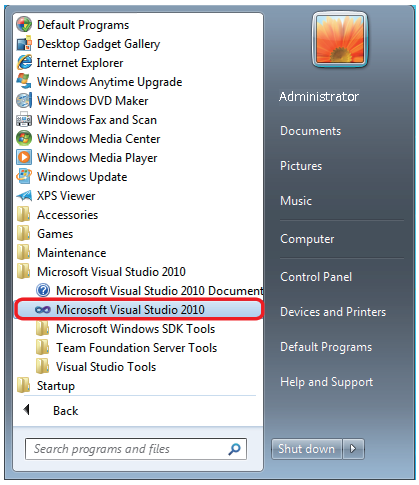
Setting value: 2100H (Not using EM2 or EM1)

- Function selection D-4 (PD41)

Setting value: 1100H (Input from controller, enabled only for home position return mode)

■Project reading using Visual Studio

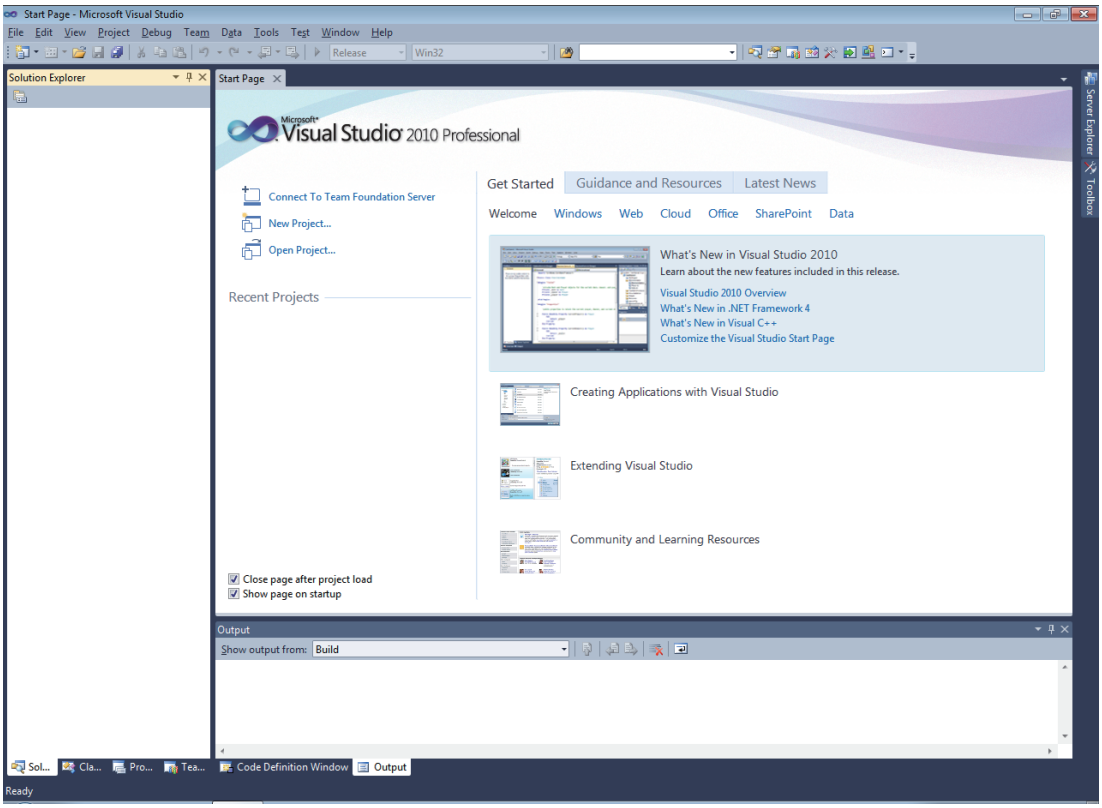
1. Choose [Start] ⇨ [All programs] ⇨ [Microsoft Visual Studio ****] ⇨ [Microsoft Visual C++ ****].



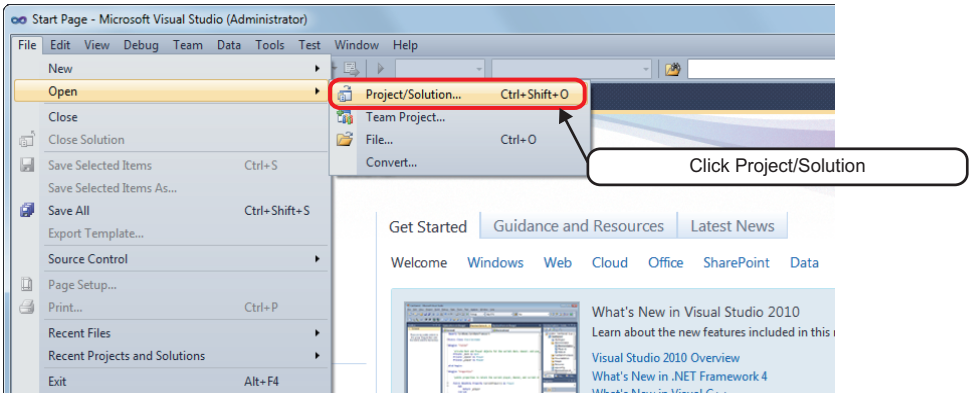
Point

Representation of **** of Start menu depends on your compiler.

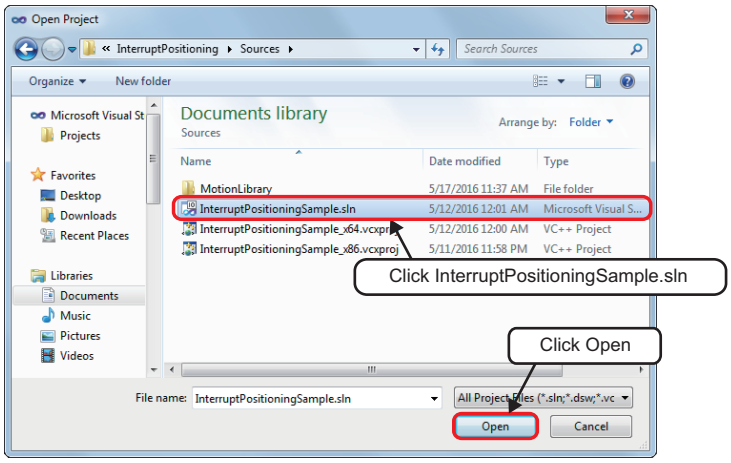
2. Make sure that the main screen of Visual Studio is displayed.



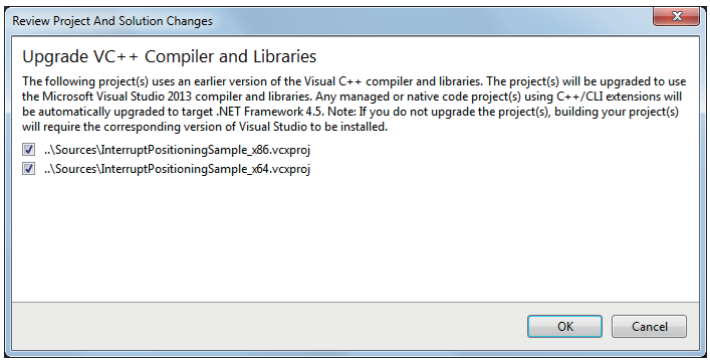
3. Click menu [File] ⇨ [Open] ⇨ [Project/Solution].



4. Choose "InterruptPositioningSample.sln".

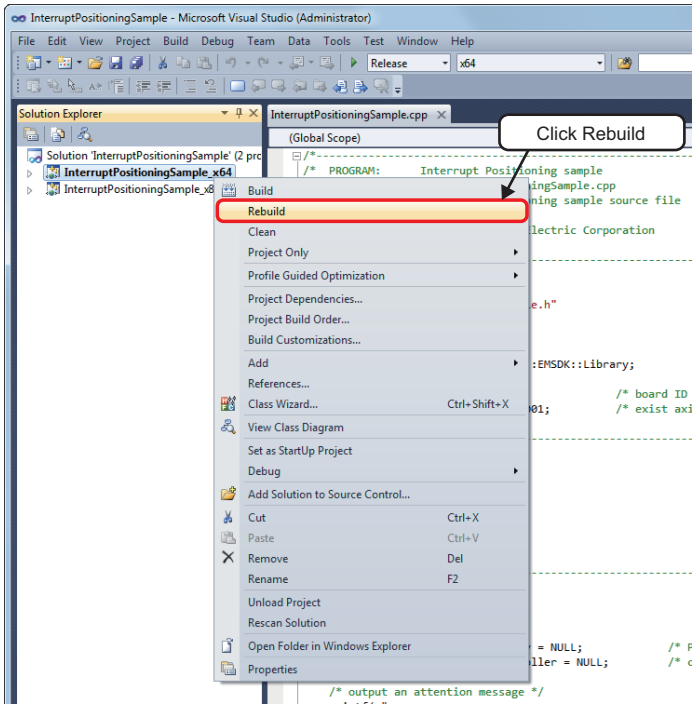


5. When using other than the Visual C++2010, follow the instructions of the conversion wizard displayed to convert.



■Run the sample program

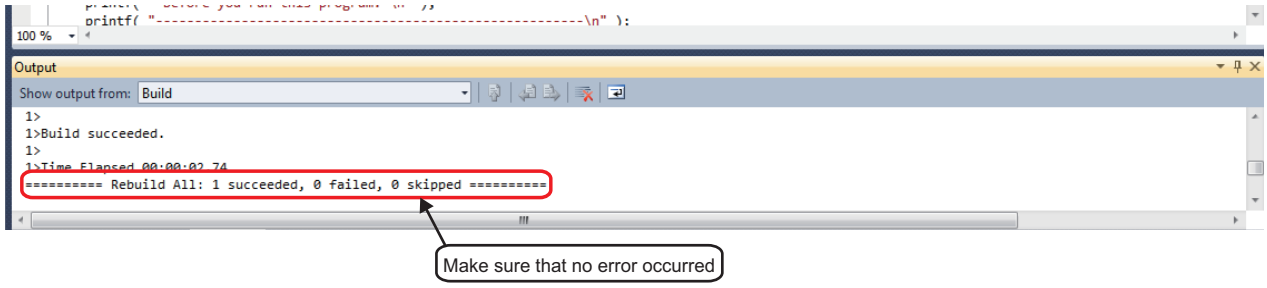
1. Right mouse button click on the "InterruptPositioningSample_x64" and select "Rebuild".



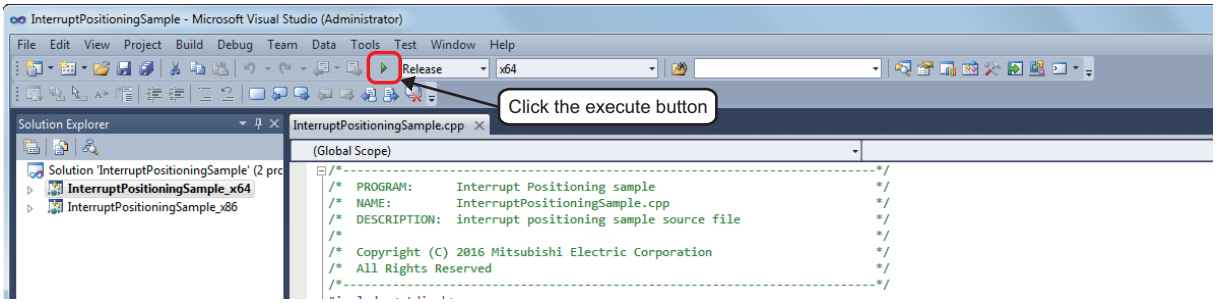
Point

Use "InterruptPositioningSample_x86" when the host personal computer is 32-bit operating system.

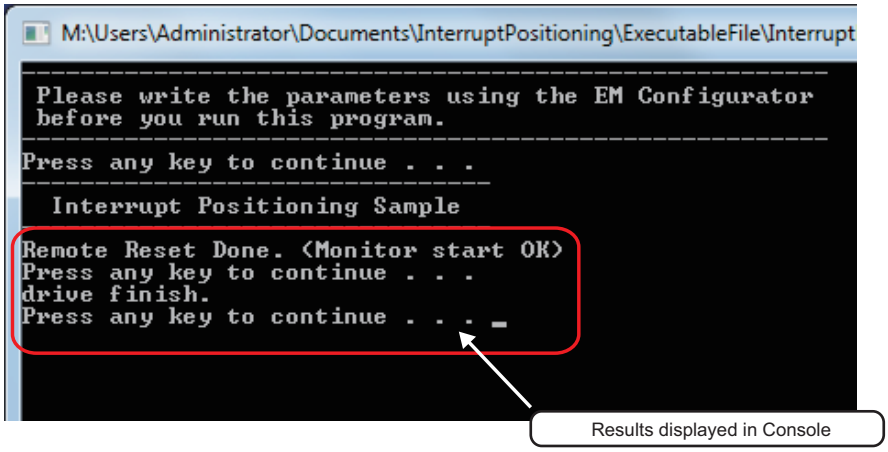
2. Make sure that no error occurred in "Output result".



3. Click the execute button.



4. Make sure that sample program execution result is displayed.



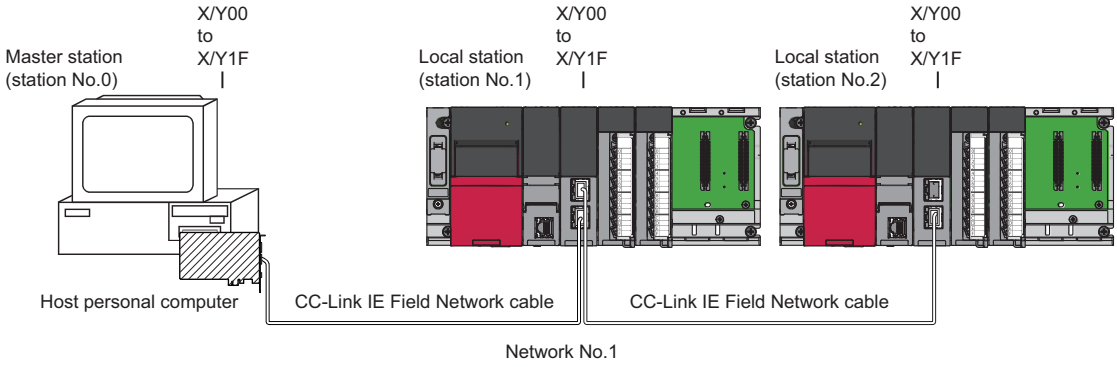
7.2 Communication Examples

This section describes communications between the master station and local station.

System configuration

The following system configuration is used to explain communication between the master station and local station.

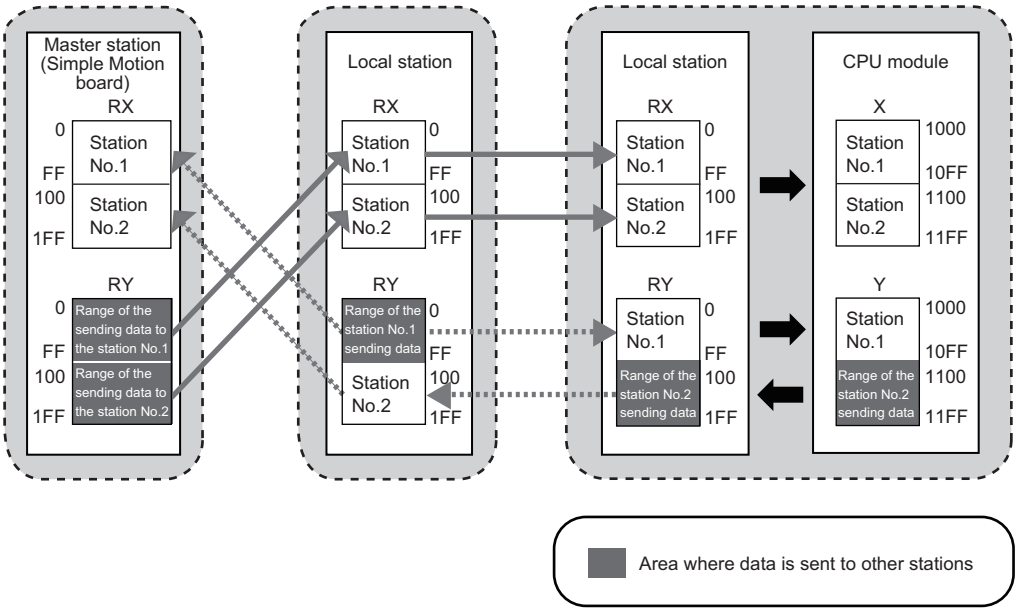
- Simple Motion board: MR-EM340GF
- Power supply module: R61P
- CPU module: R04CPU
- Local module: RJ71GF11-T2
- Input module: RX10
- Output module: RY10R2



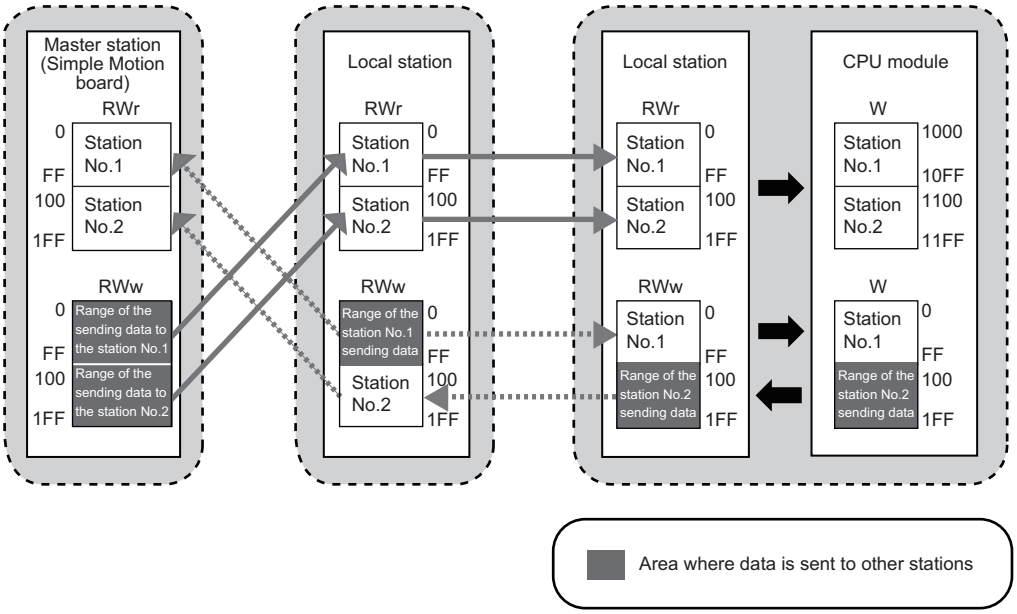
Link device assignment

256 points are assigned to each station.

■RX/RY assignment

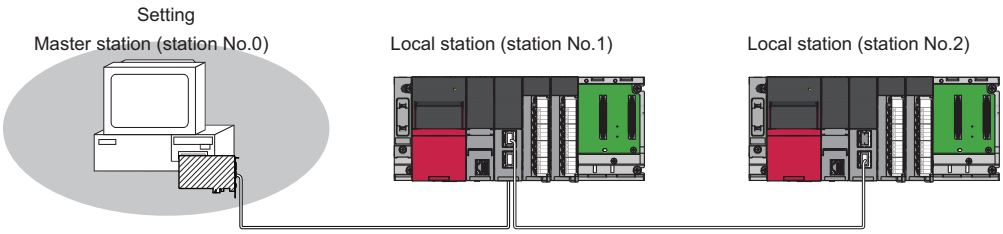


■RWr/RWw assignment



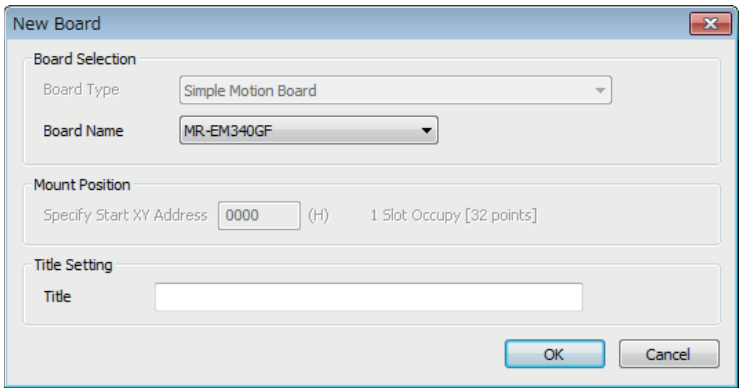
Setting in the master station

Connect EM Configurator to the Simple Motion board on the master station and set parameters.



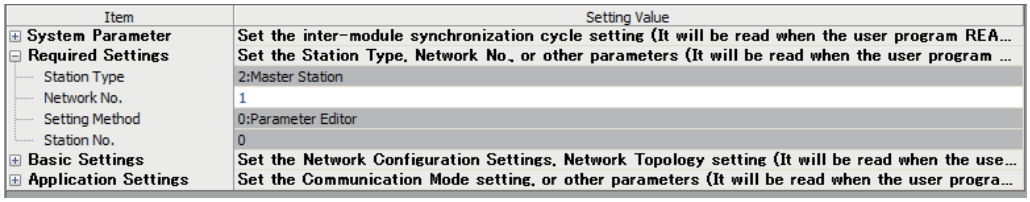
1. Set the Simple Motion board in the following item.

[Project] ⇨ [New]



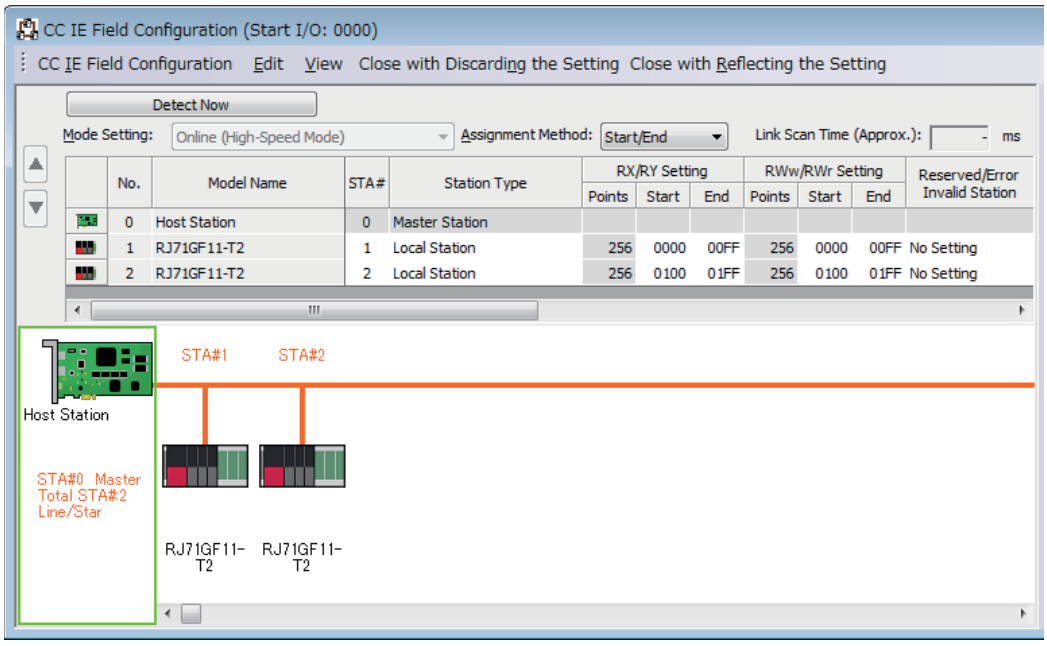
2. Set the contents of "Required Settings" in the following item.

Navigation window ⇨ "Network Parameter" ⇨ "Required Settings"



3. Set the network configuration in the following item.

Navigation window ⇨ "Network Parameter" ⇨ "Basic Settings" ⇨ "Network Configuration Settings"



4. Write the set parameters to the flash ROM of the Simple Motion board. Then, execute the power cycle of the Simple Motion board or remote RESET.

[Online] ⇨ [Write to Board]

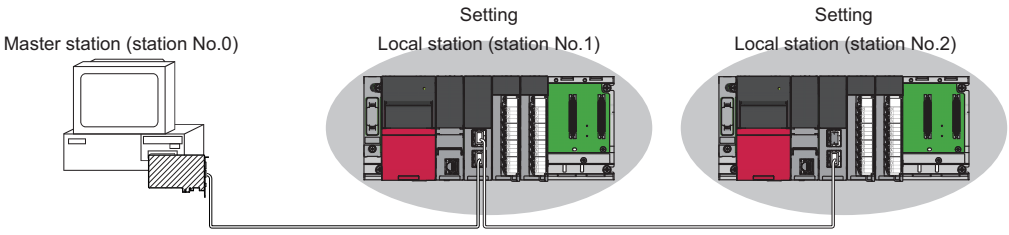
Point

In this example, default values were used for parameters that are not shown above. For the parameters, refer to the following.

Simple Motion Board User's Manual (Application)

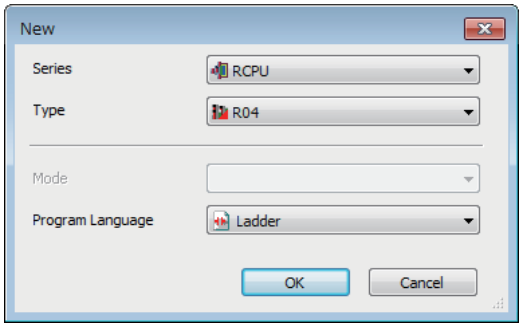
Setting in the local station

Connect GX Works3 to the CPU module on the local station and set parameters. Set the station No.1 and 2 to the same setting.



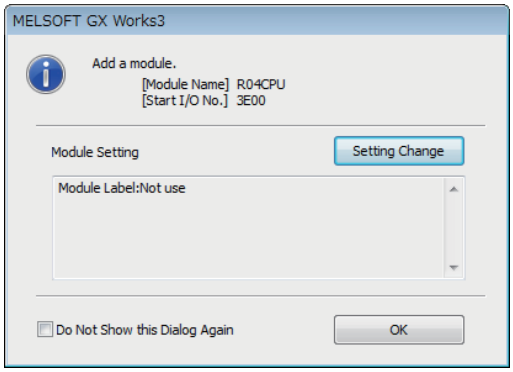
1. Set the CPU module in the following item.

[Project] ⇨ [New]



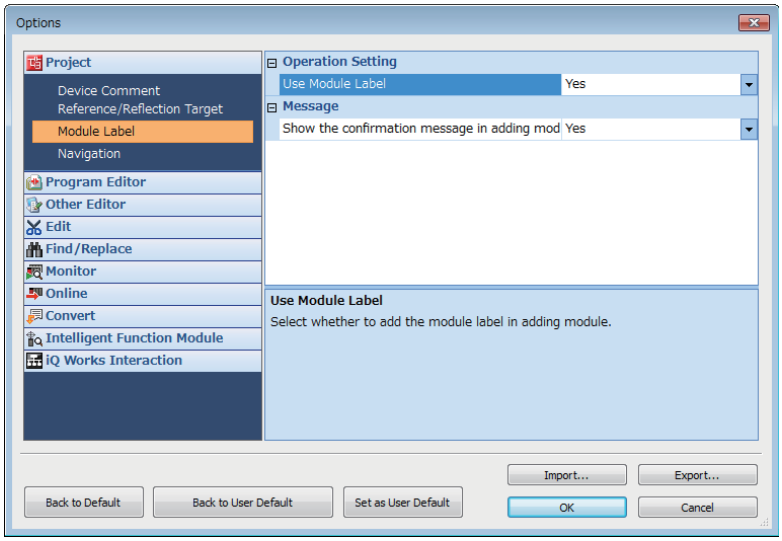
2. Click the [Setting change].

Click the [Setting change] button.



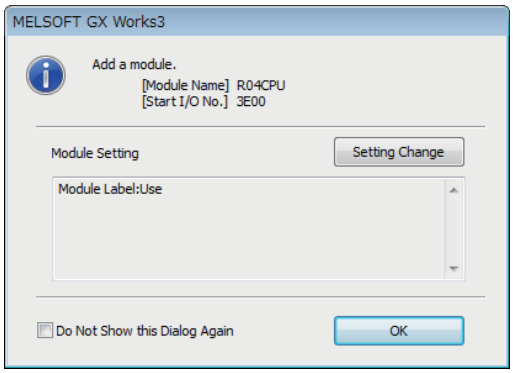
3. Add the module labels of the CPU module.

"Module Label" ⇨ "Operation Setting" ⇨ "Use Module Label" ⇨ [Yes] ⇨ Click the [OK] button.



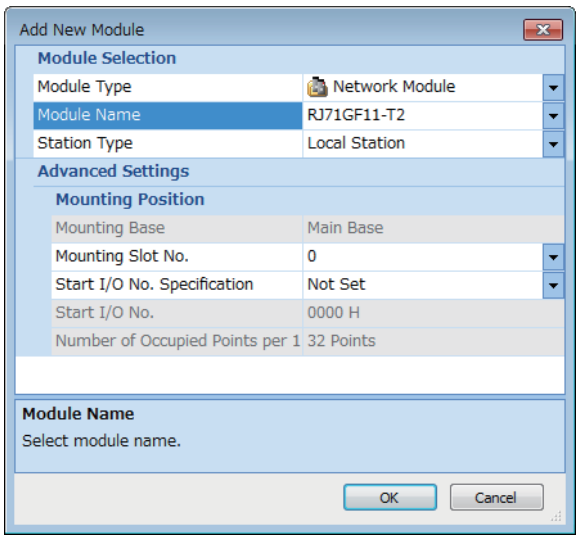
4. Confirm the "Module Label: Use" is set, then add the CPU module.

Click the [OK] button.



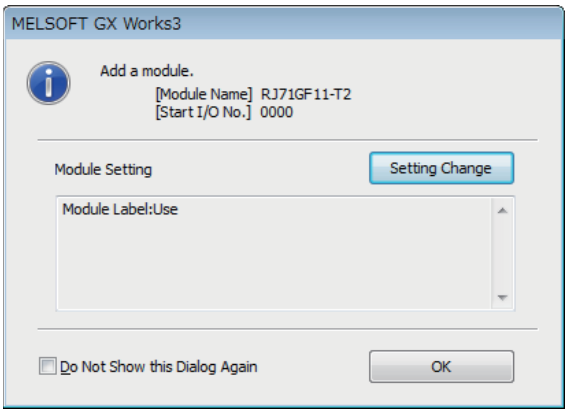
5. Set the master/local module in the following item.

Navigation window ⇨ "Parameter" ⇨ "Module Information" ⇨ Right-click ⇨ [Add New Module]



6. Click the [OK] button on the screen below and add the master/local module. The method to add the module labels is the same as the procedure 2 to 3 shown above.

Click the [OK] button.



7. Set the contents of "Required Settings" in the following item. For station No.2, set "Station Number" to "2".

Navigation window ⇨ "Parameter" ⇨ "Module Information" ⇨ "RJ71GF11-T2" ⇨ "Module Parameter" ⇨ "Required Settings"

Setting Item

Item	Setting
Station Type	
Station Type	Local Station
Network Number	
Network Number	1
Station Number	
Setting Method	Parameter Editor
Station No.	1
Parameter Setting Method	
Setting Method of Basic/Application Settings	Parameter Editor

8. Set the refresh settings in the following item. Set the station No.1 and 2 of the local station to the same refresh settings.

Navigation window ⇨ "Parameter" ⇨ "Module Information" ⇨ "RJ71GF11-T2" ⇨ "Module Parameter" ⇨ "Basic Settings" ⇨ "Refresh Setting"

No.	Link Side					CPU Side				
	Device Name	Points	Start	End		Target	Device Name	Points	Start	End
-	SB	512	00000	001FF		Module Lab				
-	SW	512	00000	001FF		Module Lab				
1	RX	512	00000	001FF		Device	X	512	01000	011FF
2	RY	512	00000	001FF		Device	Y	512	01000	011FF
3	RWr	512	00000	001FF		Device	W	512	01000	011FF
4	RWw	512	00000	001FF		Device	W	512	00000	001FF

9. Write the set parameters to the CPU module on the local station. Then reset the CPU module or power off and on the system.

[Online] ⇨ [Write to PLC]

Point

In this example, default values were used for parameters that are not shown above. For the parameters, refer to the following.

Simple Motion Board User's Manual (Application)

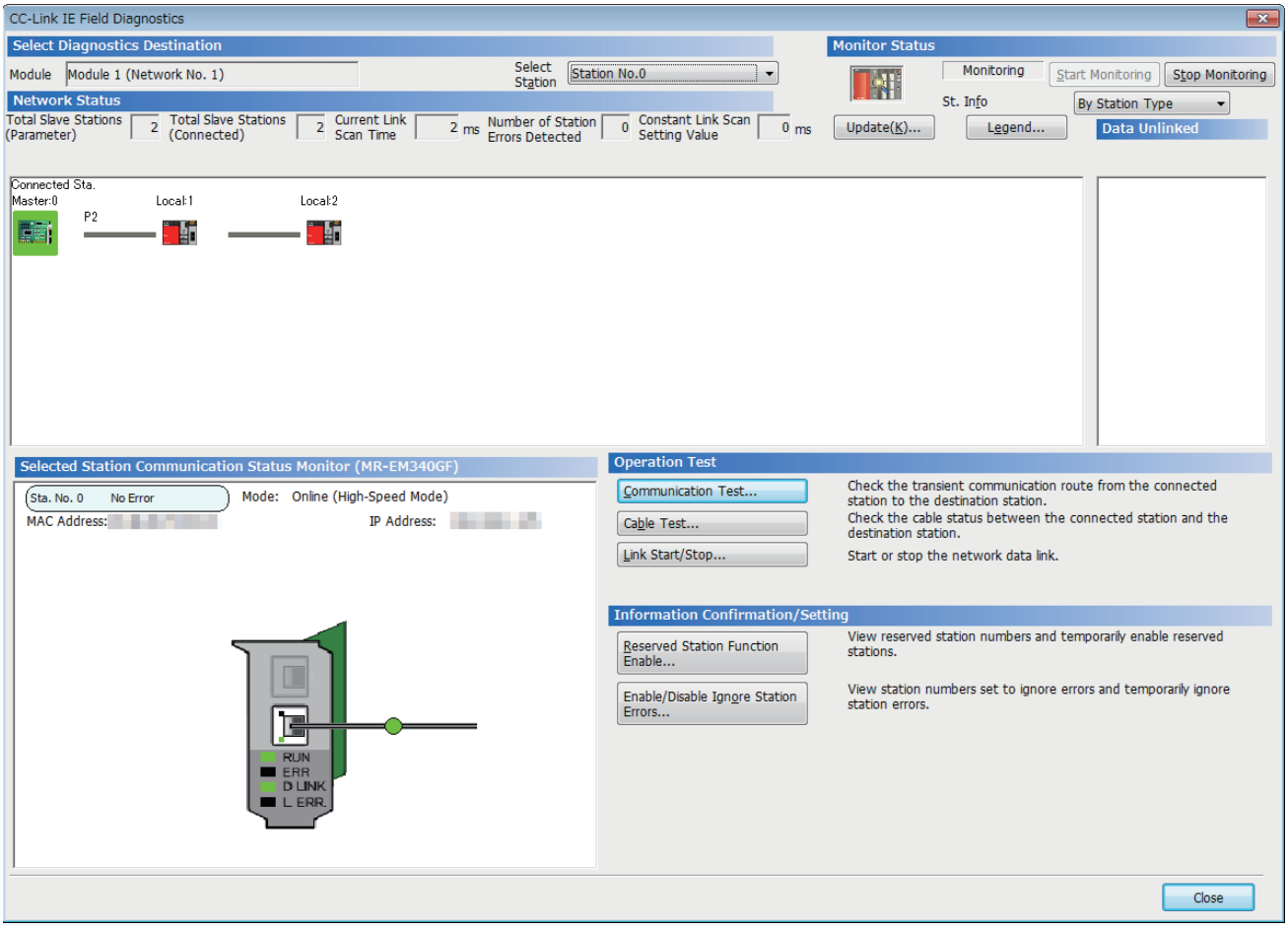
Checking the network status

Once parameters are set for the master station and local station, the CC-Link IE Field Network diagnostics of EM Configurator can be used to check whether data link is normally operating.

1. Connect EM Configurator to the Simple Motion board on the master station.
2. Start the CC-Link IE Field Network diagnostics.

[Diagnostics] ⇨ [CC-Link IE Field Diagnostics]

If the following display appears, data link is normal.



When an icon indicating an error is displayed in "Network Status" in "CC-Link IE Field Diagnostics", use the CC-Link IE Field Network diagnostics to identify the cause of the error and take corrective actions. (Simple Motion Board User's Manual (Network))

List of labels to be used

The following table lists the labels used for the program examples in this section. I/O signals or buffer memory areas of the Simple Motion board shown in the system configuration are described in the user programs using the labels.

• Master station (station No.0)

Classification	Label name	Description
Label	MMC_EM340GF::IEFieldInfo.bRX	R: RX area
	MMC_EM340GF::IEFieldInfo.bRY	RW: RY area
	MMC_EM340GF::IEFieldInfo.dwRX	R: RX area (for double word access)
	MMC_EM340GF::IEFieldInfo.dwRY	RW: RY area (for double word access)
	MMC_EM340GF::IEFieldInfo.wRWw	RW: RWw area
	MMC_EM340GF::IEFieldInfo.wRWr	R: RWr area
	MMC_EM340GF::IEFieldInfo.dwRWw	RW: RWw area (for double word access)
	MMC_EM340GF::IEFieldInfo.dwRWr	R: RWr area (for double word access)
	MMC_EM340GF::IEFieldInfo.SB	RW: SB area
	MMC_EM340GF::IEFieldInfo.SW	RW: SW area

Program example

C++

```
void LinkDeviceSample( MMC_Controller *controller )
{
    MMC_EM340IEFieldInfo *iefieldInfo = &((MMC_EM340GF *)controller)->IEFieldInfo;

    if( iefieldInfo->SB[0x0049] == MMC_OFF )
    {/* Turn the data link error status of own station OFF */

        if( ( iefieldInfo->SW[0x00B0] & 0x0001 ) == MMC_OFF )
        {/* Turn the data link status of each station (station No.1) OFF */

            unsigned short rx0;
            unsigned short rwr0;

            rx0 = iefieldInfo->bRX[0];              /* Get RX0                      */
            iefieldInfo->bRY[0] = MMC_ON;           /* Turn RY0 ON                  */

            rwr0 = iefieldInfo->wRWr[0];            /* Get RWr0                     */
            iefieldInfo->wRWw[0] = 1;               /* Write 1 to RWw0              */
        }

        if( ( iefieldInfo->SW[0x00B0] & 0x0002 ) == MMC_OFF )
        {/* Turn the data link status of each station (station No.2) OFF */

            unsigned long rx100_11F;
            unsigned long rwr100_101;

            rx100_11F = iefieldInfo->dwRX[8];       /* Get RX100-RX11F              */
            iefieldInfo->dwRY[8] = 0xFFFFFFFF;      /* Turn all of RY100-RY11F ON   */

            rwr100_101 = iefieldInfo->dwRWr[128];   /* Get RWr100-RWr101            */
            iefieldInfo->dwRWw[128] = 1;            /* Write 1 to RWw100-RWw101     */
        }
    }
}
```

8 EMC AND LOW VOLTAGE DIRECTIVES

Compliance with the EMC Directive, which is one of the EU directives, has been mandatory for products sold within EU member states since 1996 as well as compliance with the Low Voltage Directive since 1997.
For products compliant to the EMC and Low Voltage Directives, their manufacturers are required to declare compliance and affix the CE marking.
The sales representative in EU member states is:
Company: Mitsubishi Electric Europe B.V.
Address: Mitsubishi-Electric-Platz1, 40882 Ratingen, Germany

8.1 Measures to Comply with the EMC Directive

The EMC Directive sets requirements for emission (conducted and radiated electromagnetic interference emitted by a product) and immunity (the ability of a product not to be influenced by externally generated electromagnetic interference).
This section describes the precautions for machinery constructed with the Simple Motion boards to comply with the EMC Directive.
These precautions are based on the requirements of the EMC Directive and the harmonized standards. However, they do not guarantee that the entire machinery constructed according to the descriptions complies with the EMC Directive. The manufacturer of the machinery must determine the testing method for compliance and declare conformity to the EMC Directive.

EMC Directive related standards

■Emission requirements

Standard: EN61131-2:2007

Test item	Test description	Value specified in standard
CISPR16-2-3 Radiated emission*2	The electromagnetic wave emitted by the product to the external space is measured.	• 30 to 230MHz, QP: 40dBμV/m (measured at 10m distance)*1 • 230 to 1000MHz, QP: 47dBμV/m (measured at 10m distance)
CISPR16-2-1, CISPR16-1-2 Conducted emission*2	The noise level which the product emits to the power line is measured.	• 0.15 to 0.5MHz, QP: 79dB, Mean: 66dB*1 • 0.5 to 30MHz, QP: 73dB, Mean: 60dB

*1 QP: Quasi-Peak value, Mean: Average value
*2 The Simple Motion board is an open-type device intended to be placed in a conductive control panel or similar type of enclosure. The tests were conducted with the Simple Motion board installed in a control panel.

■Immunity requirements

Standard: EN61131-2:2007

Test item	Test description	Value specified in standard
EN61000-4-2 Electrostatic discharge immunity*1	An electrostatic discharge is applied to the enclosure of the equipment.	• 8kV: Air discharge • 4kV: Contact discharge
EN61000-4-3 Radiated, radio-frequency, electromagnetic field immunity*1	An electric field is radiated to the product.	80% AM modulation @1kHz • 80 to 1000MHz: 10V/m • 1.4 to 2.0GHz: 3V/m • 2.0 to 2.7GHz: 1V/m
EN61000-4-4 Fast transient burst immunity*1	Burst noise is applied to power lines and signal lines.	• AC/DC power, I/O power, and AC I/O (unshielded) lines: 2kV • DC I/O, analog, and communication lines: 1kV
EN61000-4-5 Surge immunity*1	Lightning surge is applied to power lines and signal lines.	• AC power, AC I/O power, and AC I/O (unshielded) lines: 2kV CM, 1kV DM • DC power and DC I/O power lines: 0.5kV CM, 0.5kV DM • DC I/O, AC I/O (shielded), analog, and communication lines: 1kV CM
EN61000-4-6 Conducted RF immunity*1	High-frequency noise is applied to power lines and signal lines.	0.15 to 80MHz, 80% AM modulation@1kHz, 10Vrms
EN61000-4-8 Power-frequency magnetic field immunity*1	The product is immersed in the magnetic field of an induction coil.	50/60Hz, 30A/m

Test item	Test description	Value specified in standard
EN61000-4-11 Voltage dips and interruption immunity*1	Power voltage is momentarily interrupted.	• 0%, 0.5 period, starting at zerocrossing • 0%, 250/300 period (50/60Hz) • 40%, 10/12 period (50/60Hz) • 70%, 25/30 period (50/60Hz)

*1 The Simple Motion board is an open-type device intended to be placed in a conductive control panel or similar type of enclosure.

Installation in a control panel

The Simple Motion board is an open-type device intended to be placed in a conductive control panel or similar type of enclosure.

Remote modules on each network must be also installed inside the control panel. Waterproof type remote modules can be installed outside the control panel.

This ensures safety as well as effective shielding of electromagnetic noise emitted from the host personal computer.

■Control panel

- Use a conductive control panel.
- Mask off an area used for grounding in advance.
- To ensure electrical contact between inner plates and the control panel, mask off the bolt installation areas of each inner plate so that conductivity can be ensured in the largest area.
- Ground the control panel with a thick ground cable so that low impedance can be ensured even at high frequencies.
- Keep the diameter of the holes on the control panel to 10 cm (3.94 inch) or less. If the diameter is larger than 10 cm (3.94 inch), electromagnetic wave may leak. In addition, because electromagnetic wave leaks through a clearance between the control panel and its door, reduce the clearance as much as possible. Use of EMI gaskets (sealing the clearance) can suppress undesired radiated emissions.

The tests were conducted by Mitsubishi Electric Corporation using a control panel having damping characteristics of 37 dB (maximum) and 30 dB (average) (measured at 3 m distance, 30 to 300 MHz).

■Power cable and ground cable

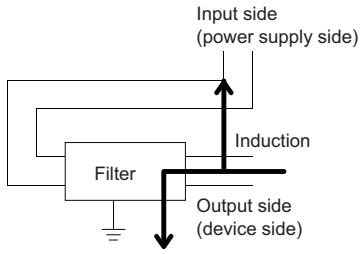
- Provide a ground point to the control panel near the host personal computer. Ground the FG terminal of the host personal computer to the ground point with the thickest and shortest ground cable possible (2 mm^2, 30 cm (11.82 inch) or shorter).

■Noise filter (power supply line filter)

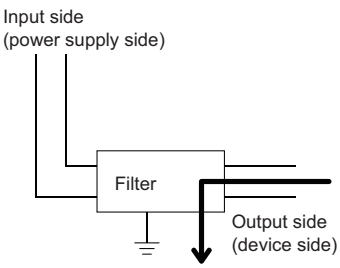
A noise filter is effective for reducing conducted noise in the 10 MHz or less frequency band. (Use of a noise filter can suppress noise.)

The following are the installation precautions.

- Do not bundle the cables on the input side and output side of the noise filter. If bundled, the noise on the output side is induced into the filtered cable on the input side.



• Problematic example
Noise is induced when the input and output cables are bundled.



• Modification example
Install the input and output cables separately.

- Ground the ground terminal of the noise filter to the ground point of the control panel with the shortest cable possible (approximately 10 cm (3.94 inch)).

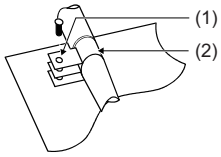
Cables extended out of the control panel

Use a shielded cable for a cable extended out of the control panel such as an I/O signal line (including a common line) and cable for communications.

If a shielded cable is not used or not grounded properly, the noise immunity will not meet the requirement.

■Grounding a shielded cable

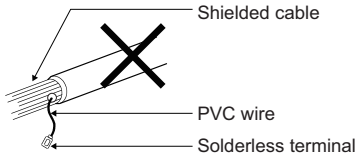
- Ground the shield of a shielded cable as close to the module as possible so that the grounded cable will not be affected by electromagnetic induction from ungrounded cables.
- Ground the exposed shield to a large area on the control panel. A clamp can be used as shown below. In this case, mask off the inner wall surface of the control panel, which comes in contact with the clamp.



(1) Paint mask
(2) Clamp

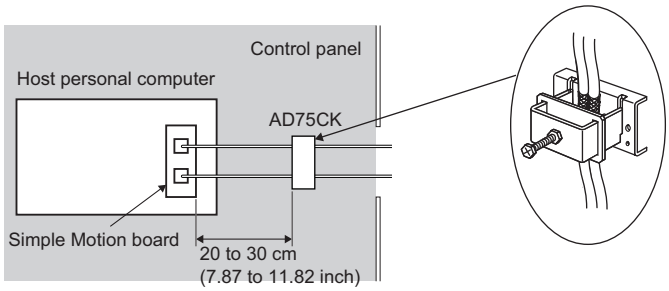
Point

Do not use the tip of a PVC wire soldered onto a shield of the shielded cable for grounding. Doing so will raise the high-frequency impedance, resulting in loss of the shielding effect.



■Grounding cables with a cable clamp

Use shielded cables for external wiring and ground the shields of the shielded cables to the control panel with an AD75CK cable clamp (manufactured by Mitsubishi). Ground the shields within 20 to 30 cm (7.87 to 11.82 inch) from the Simple Motion board.



For details on the AD75CK, refer to the following.

AD75CK-type Cable Clamping Instruction Manual

■Recommended cable clamp

Manufacturer	Model name
Mitsubishi Electric Corporation	AERSBAN-DSET
	AERSBAN-ESET
	AD75CK

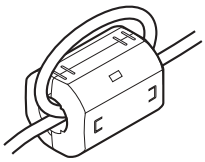
■Ferrite core

A ferrite core is effective for reducing radiated noise in the 30 MHz to 100 MHz frequency band. It is recommended to install a ferrite core if a shield cable extended out of the control panel does not provide sufficient shielding effects.

Install a ferrite core to the cable in the position just before the cable is extended out of the control panel. If the installation position is not appropriate, the ferrite core will not produce any effect.

Install a ferrite core to each power cable as shown below.

Ex.

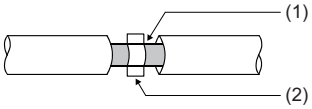


■Recommended ferrite core

Manufacturer	Model name
TDK Corporation	ZCAT3035-1330

■PERIPHERAL cable

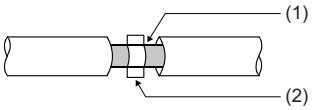
- Use a shielded twisted pair cable for connection to the 100BASE-TX connector. Strip a part of the jacket of the shielded twisted pair cable as shown below and ground the exposed shield to the largest area.



(1) Shield
(2) Clamp

■CC-Link IE Field Network cable

- Use an cable recommended by CC-Link Partner Association.
- The cable is a shielded cable. Strip a part of the jacket as shown below and ground the exposed shield to the largest area.



(1) Shield
(2) Clamp

■External forced stop cable

Make the cable within 30 m (98.43 ft).

For details, refer to the following.

☞ Page 81 External forced stop cable

Static Electricity Precautions

Before handling the Simple Motion board, touch a conducting object such as a grounded metal to discharge the static electricity from the human body. Failure to do so may cause the Simple Motion board to fail or malfunction.

Do not directly touch the conductive parts of Simple Motion board and electronic components. Touching them could cause an operation failure or damage the Simple Motion board.

8.2 Measures to Comply with the Low Voltage Directive

The MR-EM340GF does not use the power supply between 50 to 1000 V AC or 75 to 1500 V DC, so that the product is not targeted for the Low Voltage Directive compliance.

APPENDICES

Appendix 1 Component List

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

No.	Part name	Type	Remarks
1	Simple Motion board	MR-EM340GF	MR-EM340GF GF: CC-Link IE Field Network model
2	Servo amplifier	—	—
3	EM Software Development Kit	SW1DND-EMKIT-B	—
4	Slave device compatible with CC-Link IE Field Network	—	—
5	CC-Link IE Field Network cable	—	Cables are needed for connecting the Simple Motion board with a servo amplifier/slave device compatible with CC-Link IE Field Network, or between servo amplifiers/slave devices compatible with CC-Link IE Field Network. (☞ Page 79 CC-Link IE Field Network cable)
6	PERIPHERAL cable	—	Cables are needed for connecting the Simple Motion board and the host personal computer. (☞ Page 79 PERIPHERAL cable)
7	Ethernet hub	—	Switching hubs are needed for connecting the Simple Motion board, a servo amplifier, and other brand drive units in star topology. (☞ Page 80 Recommended product)

Reference product

Connection cable

■CC-Link IE Field Network cable

Cables for CC-Link IE Field Network are available from Mitsubishi Electric System & Service Co., Ltd. (Catalogs for cable are also available.)

In addition, the connector processing of cable length is available for your preference. Please consult your local Mitsubishi representative.

Ethernet cable	Model (Manufacturer)
CC-Link IE Field Network cable	SC-E5EW series (Mitsubishi Electric System & Service Co., Ltd.)

• Cable types

The following cable types are available depending on the operating environment:

- Standard type: Cables for inside the control panel and indoor connection
- L type: Cables for outdoor connection

Cables and relay adapters of flame retardant or waterproof type are also available. Please contact your local Mitsubishi representative.

■PERIPHERAL cable

Model	Manufacturer
IETP-SB-S***C (*** indicates 3 digits of cable length.)	JMACS Japan Co., Ltd

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Recommended product

Hub

Use the recommended hubs listed below. Operation is not guaranteed if hubs other than the recommended ones are used.

Type	Model (Manufacturer)
Industrial managed switch	NZ2MHG-T8F2 (Mitsubishi Electric Corporation)
Industrial switching hub	NZ2EHG-T8N (Mitsubishi Electric Corporation)

Use the CC-Link IE Field Network synchronization communication-compatible switching hubs when using the CC-Link IE Field Network synchronization communication function.
CC-Link IE Field Network synchronization communication-compatible switching hubs are available from Mitsubishi Electric System & Service Co., Ltd. Please consult your local Mitsubishi representative.

Type	Model (Manufacturer)	Maximum extension level
Industrial managed switch	NZ2MHG-T8F2 (Mitsubishi Electric Corporation)	4 levels
CC-Link IE Field Network synchronization communication-compatible switching hub	DT135TX (Mitsubishi Electric System & Service Co., Ltd.)	4 levels

Applicable system

Number of mountable boards on the host personal computer

The Simple Motion boards can be connected to the host personal computer up to 4.
Note that it depends on the specification of the host personal computer (such as the number of PCI Express slots and free space of the memory).

Programming tool

The programming tool corresponding to the Simple Motion board is described below.

■User program

A user program performs the programming in user development environment using the API library provided by EM Software Development Kit. For the development environment (such as OS) corresponding to the API library, refer to the following.
📖Simple Motion Board User's Manual (API Library)

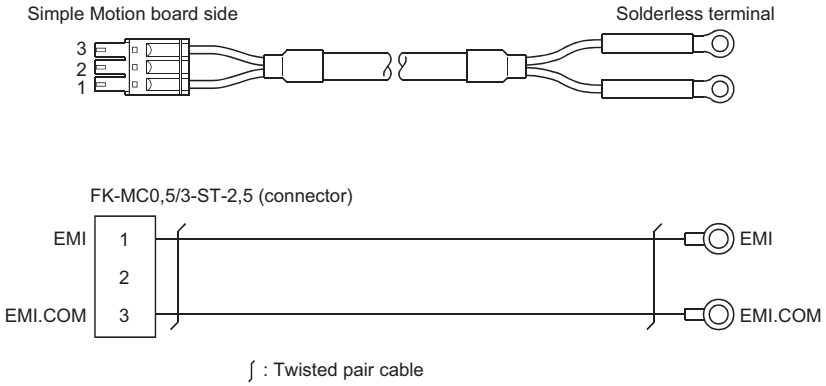
EM Configurator

EM Configurator is the tool that sets the parameter and checks the operation of the Simple Motion board. For details, refer to the "EM Configurator Help".

Appendix 2 Connection with External Devices

External forced stop cable

The external forced stop cable is not prepared as an option. Fabricate the cable on the customer side.
Make the cable as shown in the following connection diagram.
Make the cable within 30 m (98.43 ft.).



Point

- Use a cable of wire size AWG28 to AWG20.
- Use solderless terminals that suit the size of the wire and terminals being used.

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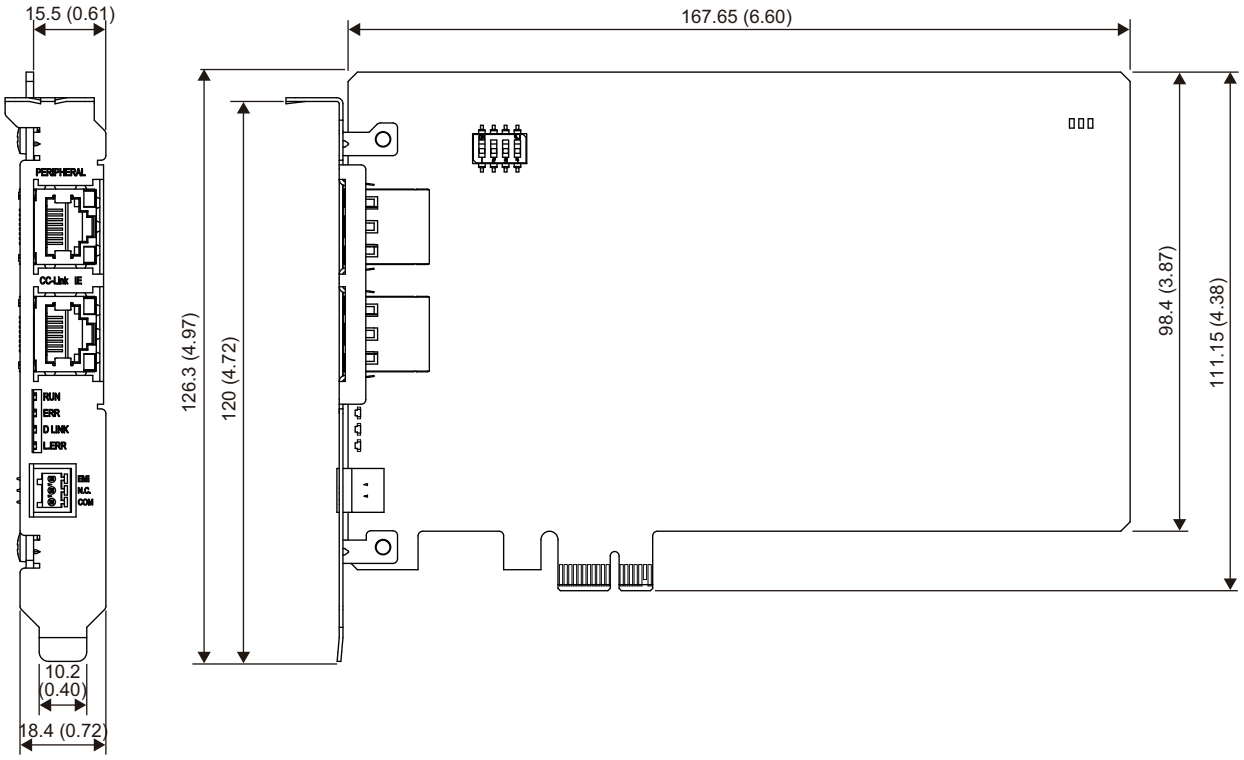
Appendix 3 External Dimensions

MR-EM340GF

[Unit: mm (inch)]



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REVISIONS

*The manual number is given on the bottom left of the back cover.

Revision date	*Manual number	Description
August 2016	IB(NA)-0300322-A	First edition
June 2017	IB(NA)-0300322-B	■Added functions Event history function, Direct control, CC-Link IE Field Network diagnostics ■Added or modified parts SAFETY PRECAUTIONS, TERMS, Chapter 3, Section 3.1, 3.2, 3.3, 5.1, 7.2, 8.1, Appendix 1
January 2024	IB(NA)-0300322-C	■Added or modified parts INFORMATION AND SERVICES, TRADEMARKS

Japanese manual number: IB-0300321-C

WARRANTY

Please confirm the following product warranty details before 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.

1. Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
2. Failure caused by unapproved modifications, etc., to the product by the user.
3. 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.
4. Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
5. 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.
6. Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
7. 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 to:

(1) Damages caused by any cause found not to be the responsibility of Mitsubishi.

(2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.

(3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.

(4) 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.

INFORMATION AND SERVICES

For further information and services, please contact your local Mitsubishi Electric sales office or representative.
Visit our website to find our locations worldwide.

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IB(NA)-0300322-C(2401)MEE
MODEL: EM340-U-S-E
MODEL CODE: 1XB046

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