MITSUBISHI ELECTRIC

Programmable Controller

MELSEC iQ-R series

MELSEC iQ-R Simple Motion Module User's Manual (Startup)

-RD77MS2
-RD77MS4
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SAFETY PRECAUTIONS

(Read these precautions before using this product.)

Before using MELSEC iQ-R series programmable controllers, please read the manuals for the product and the relevant manuals introduced in those manuals carefully, and pay full attention to safety to handle the product correctly. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

The precautions given in this manual are concerned with this product only. For the safety precautions of the programmable controller system, refer to the MELSEC iQ-R Module Configuration Manual.

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 external to the programmable controller to ensure that the entire system operates safely even when a fault occurs in the external power supply or the programmable controller. Failure to do so may result in an accident due to an incorrect output or malfunction.
  (1) Emergency stop circuits, protection circuits, and protective interlock circuits for conflicting operations (such as forward/reverse rotations or upper/lower limit positioning) must be configured external to the programmable controller.
  (2) When the programmable controller detects an abnormal condition, it stops the operation and all outputs are:
    • Turned off if the overcurrent or overvoltage protection of the power supply module is activated.
    • Held or turned off according to the parameter setting if the self-diagnostic function of the CPU module detects an error such as a watchdog timer error.
  (3) All outputs may be turned on if an error occurs in a part, such as an I/O control part, where the CPU module cannot detect any error. To ensure safety operation in such a case, provide a safety mechanism or a fail-safe circuit external to the programmable controller. For a fail-safe circuit example, refer to "General Safety Requirements" in the MELSEC iQ-R Module Configuration Manual.
  (4) Outputs may remain on or off due to a failure of a component such as a relay and transistor in an output circuit. Configure an external circuit for monitoring output signals that could cause a serious accident.
- In an output circuit, when a load current exceeding the rated current or an overcurrent caused by a load short-circuit flows for a long time, it may cause smoke and fire. To prevent this, configure an external safety circuit, such as a fuse.
- Configure a circuit so that the programmable controller is turned on first and then the external power supply. If the external power supply is turned on first, an accident may occur due to an incorrect output or malfunction.

[Design Precautions]

⚠WARNING

- Configure a circuit so that the external power supply is turned off first and then the programmable controller. If the programmable controller is turned off first, an accident may occur due to an incorrect output or malfunction.
- For the operating status of each station after a communication failure, refer to manuals for the network used. For the manuals, please consult your local Mitsubishi representative. Incorrect output or malfunction due to a communication failure may result in an accident.
- When connecting an external device with a CPU module or intelligent function module to modify data of a running programmable controller, configure an interlock circuit 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 programmable controller, read the relevant manuals carefully and ensure that the operation is safe before proceeding. Improper operation may damage machines or cause accidents.
- Especially, when a remote programmable controller is controlled by an external device, immediate action cannot be taken if a problem occurs in the programmable controller due to a communication failure. To prevent this, configure an interlock circuit in the program, and determine corrective actions to be taken between the external device and CPU module 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 module. Also, do not use any "use prohibited" signals as an output signal from the CPU module to each module. Doing so may cause malfunction of the programmable controller system. For the "system area", "write-protect area", and the "use prohibited" signals, refer to the user's manual for the module used. For areas used for safety communications, they are protected from being written by users, and thus safety communications failure caused by data writing does not occur.
- If a communication cable is disconnected, the network may be unstable, resulting in a communication failure of multiple stations. Configure an interlock circuit 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. When safety communications are used, an interlock by the safety station interlock function protects the system from an incorrect output or malfunction.
- Configure safety circuits external to the programmable controller to ensure that the entire system operates safely even when a fault occurs in the external power supply or the programmable controller. Failure to do so may result in an accident due to an incorrect output or malfunction.
  (1) Machine home position return is controlled by two kinds of data: a home position return direction and a home position return speed. Deceleration starts when the proximity dog signal turns on. 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 programmable controller.
  (2) When the module 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.
  (3) Outputs may remain on or off, or become undefined due to a failure of a component such as an insulation element and transistor in an output circuit, where the module cannot detect any error. In a system that the incorrect output could cause a serious accident, configure an external circuit for monitoring output signals.

[Design Precautions]

⚠WARNING

- If safety standards (ex., robot safety rules, etc.,) apply to the system using the module, servo amplifier and servo motor, make sure that the safety standards are satisfied.
- Construct a safety circuit externally of the module or servo amplifier if the abnormal operation of the module or servo amplifier differs from the safety directive operation in the system.
- Do not remove the SSCNETⅢ cable while turning on the control circuit power supply of the module and servo amplifier. Do not see directly the light generated from SSCNETⅢ connector of the module or servo amplifier and the end of SSCNETⅢ cable. When the light gets into eyes, you may feel something wrong with eyes. (The light source of SSCNETⅢ complies with class1 defined in JISC6802 or IEC60825-1.)

[Design Precautions]

⚠CAUTION

- Do not install the control lines or communication cables together with the main circuit lines or power cables. Doing so may result in malfunction due to electromagnetic interference. Keep a distance of 100 mm or more between those cables.
- During control of an inductive load such as a lamp, heater, or solenoid valve, a large current (approximately ten times greater than normal) may flow when the output is turned from off to on. Therefore, use a module that has a sufficient current rating.
- After the CPU module is powered on or is reset, the time taken to enter the RUN status varies depending on the system configuration, parameter settings, and/or program size. Design circuits so that the entire system will always operate safely, regardless of the time.
- Do not power off the programmable controller or reset the CPU module while the settings are being written. Doing so will make the data in the flash ROM and SD memory card undefined. The values need to be set in the buffer memory and written to the flash ROM and SD memory card again. Doing so also may cause malfunction or failure of the module.
- When changing the operating status of the CPU module from external devices (such as the remote RUN/STOP functions), select "Do Not Open by Program" for "Opening Method" of "Module Parameter". If "Open by Program" is selected, an execution of the remote STOP function causes the communication line to close. Consequently, the CPU module cannot reopen the line, and external devices cannot execute the remote RUN function.

[Security Precautions]

⚠WARNING

- To maintain the security (confidentiality, integrity, and availability) of the programmable controller and the system against unauthorized access, denial-of-service (DoS) attacks, computer viruses, and other cyberattacks from external devices via the network, take appropriate measures such as firewalls, virtual private networks (VPNs), and antivirus solutions.

[Installation Precautions]

⚠WARNING

- Shut off the external power supply (all phases) used in the system before mounting or removing the module. Failure to do so may result in electric shock or cause the module to fail or malfunction.

[Installation Precautions]

⚠CAUTION

- Use the programmable controller in an environment that meets the general specifications in the Safety Guidelines (IB-0800525). Failure to do so may result in electric shock, fire, malfunction, or damage to or deterioration of the product.
- To mount a module, place the concave part(s) located at the bottom onto the guide(s) of the base unit, and push in the module until the hook(s) located at the top snaps into place. Incorrect interconnection may cause malfunction, failure, or drop of the module.
- To mount a module with no module fixing hook, place the concave part(s) located at the bottom onto the guide(s) of the base unit, push in the module, and fix it with screw(s). Incorrect interconnection may cause malfunction, failure, or drop of the module.
- When using the programmable controller in an environment of frequent vibrations, fix the module with a screw.
- Tighten the 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 module, resulting in drop, short circuit, or malfunction. For the specified torque range, refer to the MELSEC iQ-R Module Configuration Manual.
- When using an extension cable, connect it to the extension cable connector of the base unit securely. Check the connection for looseness. Poor contact may cause malfunction.
- When using an SD memory card, fully insert it into the SD memory card slot. Check that it is inserted completely. Poor contact may cause malfunction.
- Securely insert an extended SRAM cassette or a battery-less option cassette into the cassette connector of the CPU module. After insertion, close the cassette cover and check that the cassette is inserted completely. Poor contact may cause malfunction.
- Beware that the module could be very hot while power is on and immediately after power-off.
- Do not directly touch any conductive parts and electronic components of the module, SD memory card, extended SRAM cassette, battery-less option cassette, or connector. Doing so can cause malfunction or failure of the module.

[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 cause the module to fail or malfunction.
- After installation and wiring, attach a blank cover module (RG60) to each empty slot and an included extension connector protective cover to the unused extension cable connector before powering on the system for operation. Failure to do so may result in electric shock.

[Wiring Precautions]

⚠CAUTION

- Individually ground the FG and LG terminals of the programmable controller with a ground resistance of 100 ohms or less. Failure to do so may result in electric shock or malfunction.
- Use applicable solderless terminals and tighten them within the specified torque range. If any spade solderless terminal is used, it may be disconnected when the terminal screw comes loose, resulting in failure.
- Check the rated voltage and signal layout before wiring to the module, and connect the cables correctly. Connecting a power supply with a different voltage rating or incorrect wiring may cause fire or failure.
- Connectors for external devices must be crimped or pressed with the tool specified by the manufacturer, or must be correctly soldered. Incomplete connections may cause short circuit, fire, or malfunction.
- Securely connect the connector to the module. Poor contact may cause malfunction.
- Do not install the control lines or communication cables together with the main circuit lines or power cables. Doing so may result in malfunction due to noise. Keep a distance of 100 mm or more between those cables.
- Place the cables in a duct or clamp them. If not, dangling cables may swing or inadvertently be pulled, resulting in malfunction or damage to modules or cables.
  In addition, the weight of the cables may put stress on modules in an environment of strong vibrations and shocks.
  Do not clamp the extension cables with the jacket stripped. Doing so may change the characteristics of the cables, resulting in malfunction.
- Check the interface type and correctly connect the cable. Incorrect wiring (connecting the cable to an incorrect interface) may cause failure of the module and external device.
- Tighten the terminal screws or connector screws within the specified torque range. Undertightening can cause drop of the screw, short circuit, fire, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, fire, or malfunction.
- When disconnecting the cable from the module, do not pull the cable by the cable part. For the cable with connector, hold the connector part of the cable. For the cable connected to the terminal block, loosen the terminal screw. Pulling the cable connected to the module may result in malfunction or damage to the module or cable.
- Prevent foreign matter such as dust or wire chips from entering the module. Such foreign matter can cause a fire, failure, or malfunction.
- When a protective film is attached to the top of the module, remove it before system operation. If not, inadequate heat dissipation of the module may cause a fire, failure, or malfunction.
- Programmable controllers must be installed in control panels. Connect the main power supply to the power supply module in the control panel through a relay terminal block. Wiring and replacement of a power supply module must be performed by qualified maintenance personnel with knowledge of protection against electric shock. For wiring, refer to the MELSEC iQ-R Module Configuration Manual.
- For Ethernet cables to be used in the system, select the ones that meet the specifications in this manual. If not, normal data transmission is not guaranteed.

[Startup and Maintenance Precautions]

⚠WARNING

- Do not touch any terminal while power is on. Doing so will cause electric shock or malfunction.
- Correctly connect the battery connector. Do not charge, disassemble, heat, short-circuit, solder, or throw the battery into the fire. Also, do not expose it to liquid or strong shock. Doing so will cause the battery to produce heat, explode, ignite, or leak, resulting in injury and fire.
- Shut off the external power supply (all phases) used in the system before cleaning the module or retightening the terminal screws, connector screws, or module fixing screws. Failure to do so may result in electric shock.

[Startup and Maintenance Precautions]

⚠CAUTION

- When connecting an external device with a CPU module or intelligent function module to modify data of a running programmable controller, configure an interlock circuit 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 programmable controller, read the relevant manuals carefully and ensure that the operation is safe before proceeding. Improper operation may damage machines or cause accidents.
- Especially, when a remote programmable controller is controlled by an external device, immediate action cannot be taken if a problem occurs in the programmable controller due to a communication failure. To prevent this, configure an interlock circuit in the program, and determine corrective actions to be taken between the external device and CPU module in case of a communication failure.
- Do not disassemble or modify the modules. Doing so may cause failure, malfunction, injury, or a fire.
- Use any radio communication device such as a cellular phone or PHS (Personal Handy-phone System) 25 cm or more away in all directions from the programmable controller. Failure to do so may cause malfunction.
- Shut off the external power supply (all phases) used in the system before mounting or removing the module. Failure to do so may cause the module to fail or malfunction.
- Tighten the 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 module, resulting in drop, short circuit, or malfunction.
- After the first use of the product, do not perform each of the following operations more than 50 times (IEC 61131-2/JIS B 3502 compliant).
  Exceeding the limit may cause malfunction.
  - Mounting/removing the module to/from the base unit
  - Inserting/removing the extended SRAM cassette or battery-less option cassette to/from the CPU module
  - Mounting/removing the terminal block to/from the module
  - Connecting/disconnecting the extension cable to/from the base unit
- After the first use of the product, do not insert/remove the SD memory card to/from the CPU module more than 500 times. Exceeding the limit may cause malfunction.
- Do not touch the metal terminals on the back side of the SD memory card. Doing so may cause malfunction or failure of the module.

[Startup and Maintenance Precautions]

⚠CAUTION

- Do not touch the integrated circuits on the circuit board of an extended SRAM cassette or a battery-less option cassette. Doing so may cause malfunction or failure of the module.
- Do not drop or apply shock to the battery to be installed in the module. Doing so may damage the battery, causing the battery fluid to leak inside the battery. If the battery is dropped or any shock is applied to it, dispose of it without using.
- Startup and maintenance of a control panel must be performed by qualified maintenance personnel with knowledge of protection against electric shock. Lock the control panel so that only qualified maintenance personnel can operate it.
- Before handling the module, touch a conducting object such as a grounded metal to discharge the static electricity from the human body. Wearing a grounded antistatic wrist strap is recommended. Failure to discharge the static electricity may cause the module to fail or malfunction.
- After unpacking, eliminate static electricity from the module to prevent electrostatic discharge from affecting the module. If an electrostatically charged module comes in contact with a grounded metal object, a sudden electrostatic discharge of the module may cause failure. For details on how to eliminate static electricity from the module, refer to the following.
  Antistatic Precautions Before Using MELSEC iQ-R Series Products (FA-A-0368)
- Use a clean and dry cloth to wipe off dirt on the module.
- 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 module 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.
- Lock the control panel and prevent access to those who are not certified to handle or install electric equipment.

[Operating Precautions]

⚠CAUTION

- When changing data and operating status, and modifying program of the running programmable controller from an external device such as a personal computer connected to an intelligent function module, 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 the programmable controller or reset the CPU module while the setting values in the buffer memory are being written to the flash ROM in the module. Doing so will make the data in the flash ROM and SD memory card undefined. The values need to be set in the buffer memory and written to the flash ROM and SD memory card again. Doing so also may cause malfunction or failure of the module.
- 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.

[Computer Connection Precautions]

⚠CAUTION

- When connecting a personal computer to a module having a USB interface, observe the following precautions as well as the instructions described in the manual for the personal computer used. Failure to do so may cause the module to fail.
  (1) When the personal computer is AC-powered
  When the personal computer has a 3-pin AC plug or an AC plug with a grounding wire, connect the plug to a grounding receptacle or ground the grounding wire. Ground the personal computer and the module with a ground resistance of 100 ohms or less.
  When the personal computer has a 2-pin AC plug without a grounding wire, connect the computer to the module by following the procedure below. For power supplied to the personal computer and the module, using the same power source is recommended.
  1. Unplug the personal computer from the AC receptacle.
  2. Check that the personal computer is unplugged. Then, connect the personal computer to the module with a USB cable.
  3. Plug the personal computer into the AC receptacle.
  (2) When the personal computer is battery-powered
  The personal computer can be connected to the module without taking specific measures.
  For details, refer to the following.
  Cautions When Using Mitsubishi Programmable Controllers or GOTs Connected to a Personal Computer With the RS-232/USB Interface (FA-A-0298)
  When the USB cable used is the GT09-C30USB-5P manufactured by Mitsubishi Electric, specific measures are not required to connect the AC-powered personal computer to the module. However, note that the signal ground (SG) is common for the module and its USB interface. Therefore, if an SG potential difference occurs between the module and the connected devices, it causes failures of the module and the connected devices.

[Disposal Precautions]

⚠CAUTION

- When disposing of this product, treat it as industrial waste.
- When disposing of batteries, separate them from other wastes according to the local regulations. For details on battery regulations in EU member states, refer to the MELSEC iQ-R Module Configuration Manual.

[Transportation Precautions]

⚠CAUTION

- When transporting lithium batteries, follow the transportation regulations. For details on the regulated models, refer to the MELSEC iQ-R Module Configuration Manual.
- 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.

INTRODUCTION

Thank you for purchasing the Mitsubishi Electric MELSEC iQ-R series programmable 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 MELSEC iQ-R series programmable controller to handle the product correctly.
When applying the program examples provided in this manual to an actual system, ensure the applicability and confirm that it will not cause system control problems.
Please make sure that the end users read this manual.

Relevant products

RD77MS2, RD77MS4, RD77MS8, RD77MS16
RD77GF4, RD77GF8, RD77GF16, RD77GF32

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
- [RD77MS]: Symbols indicating that it corresponds to only RD77MS
- [RD77GF]: Symbols indicating that it corresponds to only RD77GF

COMPLIANCE WITH EMC AND LOW VOLTAGE DIRECTIVES

Method of ensuring compliance

To ensure that Mitsubishi programmable controllers maintain EMC and Low Voltage Directives when incorporated into other machinery or equipment, certain measures may be necessary. Please refer to one of the following manuals.
MELSEC iQ-R Module Configuration Manual
Safety Guidelines (IB-0800525)
The CE mark on the side of the programmable controller indicates compliance with EMC and Low Voltage Directives.

Additional measures

To ensure that this product maintains EMC and Low Voltage Directives, please refer to one of the following manuals.
MELSEC iQ-R Module Configuration Manual
Safety Guidelines (IB-0800525)

CONTENTS

RELEVANT MANUALS

Manual name [manual number]	Description	Available form
MELSEC iQ-R Simple Motion Module User's Manual (Startup) [IB-0300245ENG] (This manual)	Specifications, procedures before operation, system configuration, wiring, and operation examples of the Simple Motion module	Print book e-Manual PDF
MELSEC iQ-R Simple Motion Module User's Manual (Application) [IB-0300247ENG]	Functions, input/output signals, buffer memory, parameter settings, programming, and troubleshooting of the Simple Motion module	Print book e-Manual PDF
MELSEC iQ-R Simple Motion Module User's Manual (Advanced Synchronous Control) [IB-0300249ENG]	Functions and programming for the synchronous control of the Simple Motion module	Print book e-Manual PDF
MELSEC iQ-R Simple Motion Module User's Manual (Network) [IB-0300307ENG]	Functions, parameter settings, troubleshooting, and buffer memory of CC-Link IE Field Network	Print book e-Manual PDF

This manual does not include detailed information on the following:

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

For details, refer to the following.

MELSEC iQ-R Module Configuration Manual

This manual does not include information on the module function blocks. For details, refer to the Function Block Reference for the module used.

Point

e-Manual refers to the Mitsubishi Electric 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.
- Sample programs can be copied to an engineering tool.

TERMS

Unless otherwise specified, this manual uses the following terms.

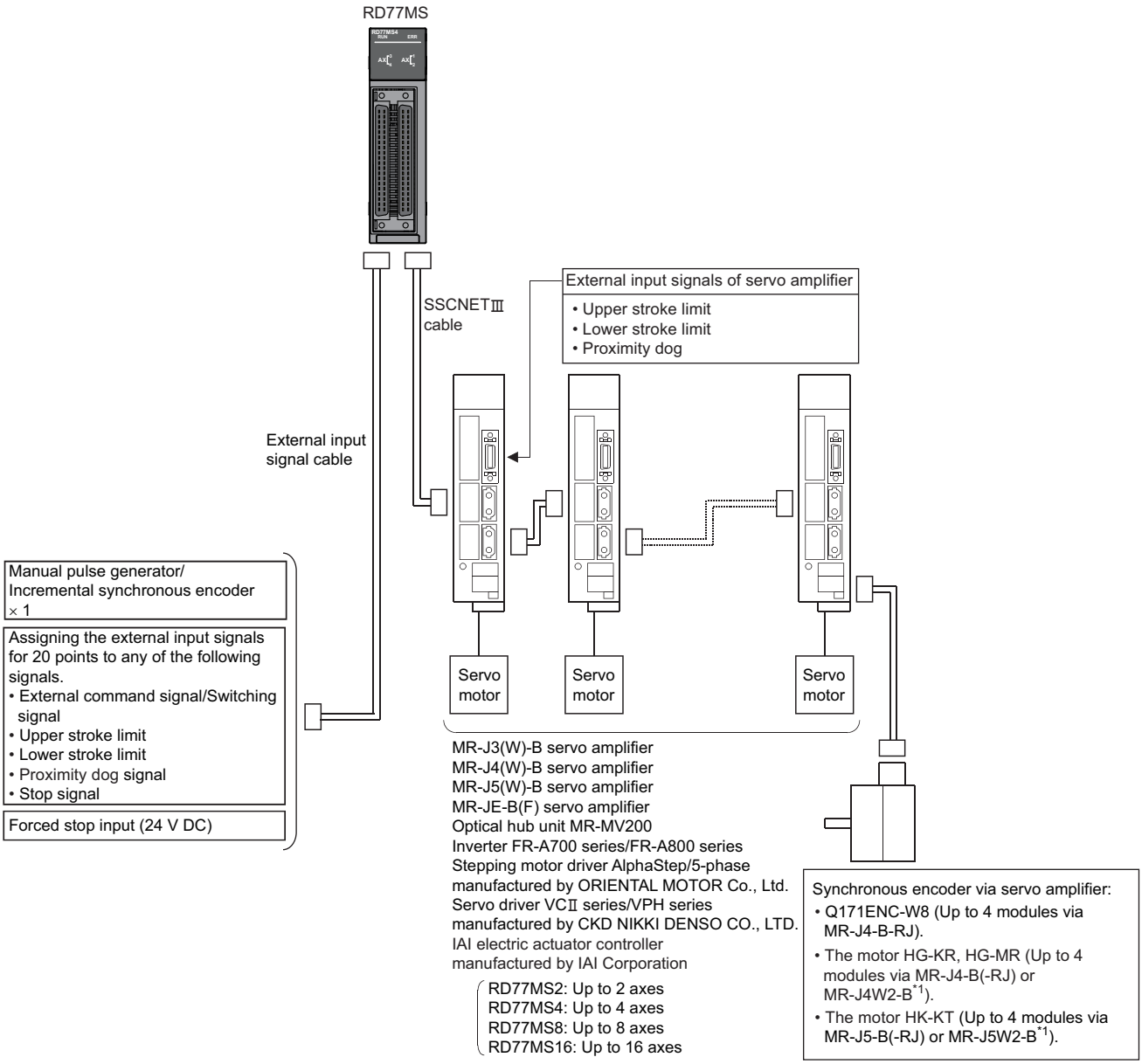
Term	Description
2-axis module	A generic term for RD77MS2
4-axis module	A generic term for RD77MS4 and RD77GF4
8-axis module	A generic term for RD77MS8 and RD77GF8
16-axis module	A generic term for RD77MS16 and RD77GF16
32-axis module	A generic term for RD77GF32
Axis	Another term for a servo amplifier
Buffer memory	A memory in an intelligent function module, where data (such as setting values and monitoring values) are stored. When using the CPU module, the memory is indicated for storing data (such as setting values and monitored values) of the Ethernet function and data used for data communication of the multiple CPU function.
CC-Link IE Field Network	A high-speed and large-capacity open field network that is based on Ethernet (1000BASE-T)
CPU module	The abbreviation for the MELSEC iQ-R series CPU module
CPU module (built-in Ethernet port part)	A built-in Ethernet port part of the CPU module (CPU part for the RnENCPU) (MELSEC iQ-R Ethernet/CC-Link IE User's Manual (Startup))
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
Dedicated instruction	An instruction for using functions of the module
Device	A device (X, Y, M, D, or others) in a CPU module
Disconnection	A process of stopping data link if a data link error occurs
Engineering tool	A generic term for GX Works2, GX Works3, and MR Configurator2
Ethernet device	A generic term for the devices supporting IP communication (such as personal computers)
Global label	A label that is enabled for all program data when creating multiple program data in the project. There are two types of global labels: module label that is automatically generated by GX Works2 and GX Works3 and label that can be created for the any of the specified devices.
GX Works2	The product name of the software package for the MELSEC programmable controllers
GX Works3	
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.
Intelligent function module	A MELSEC iQ-R series module that has functions other than input and output, such as an A/D converter module and D/A converter module
Label	A label that represents a device in a given character string
Link device	A device (RX, RY, RWr, or RWw) in a module on CC-Link IE Field Network
Link refresh	Automatic data transfer between a link device of the Simple Motion module and a device in a CPU module
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
Module label	A label that represents one of memory areas (I/O signals and buffer memory areas) specific to each module in a given character string. GX Works2 and GX Works3 automatically generate this label, which can be used as a global label.
MR Configurator2	The product name of the setup software for the servo amplifier
MR-J3(W)-B	MR-J3-_B_(-RJ)/MR-J3W-_B Servo amplifier series
MR-J4(W)-B	MR-J4-_B_(-RJ)/MR-J4W_-_B Servo amplifier series
MR-J4W2-B	MR-J4W2-_B Servo amplifier series
MR-J4-B-RJ	MR-J4-_B_-RJ Servo amplifier series

Term	Description
MR-J4-GF	MR-J4-_GF_(-RJ) Servo amplifier series
MR-J5(W)-B	MR-J5-_B_(-RJ)/MR-J5W_-_B Servo amplifier series
MR-J5W2-B	MR-J5W2-_B Servo amplifier series
MR-JE-B(F)	MR-JE-_B(F) Servo amplifier series
Network module	A generic term for the following modules: • Ethernet interface module • CC-Link IE Controller Network module • Module on CC-Link IE Field Network • MELSECNET/H network module • MELSECNET/10 network module • RnENCPU (network part)
RAS	The abbreviation for Reliability, Availability, and Serviceability. This term refers to usability of automated equipment.
RD77GF	Another term for the MELSEC iQ-R series Simple Motion module (compatible with CC-Link IE Field Network)
RD77MS	Another term for the MELSEC iQ-R series Simple Motion module (compatible with SSCNETⅢ/H)
Relay station	A station that includes two or more network modules. Data are passed through this station to stations on other networks
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 input 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 input 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
RnENCPU	A generic term for the R04ENCPU, R08ENCPU, R16ENCPU, R32ENCPU, and R120ENCPU
Safety communications	A function to exchange safety data between safety stations on the same network
Safety connection	A connection established for safety communications
Safety CPU	A generic term for the R08SFCPU, R16SFCPU, R32SFCPU, and R120SFCPU
Safety data	Data exchanged through safety communications
Safety station	A generic term for a station that performs safety communications and standard communications
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 module (belonging to own station).
Simple Motion module	The abbreviation for the MELSEC iQ-R series Simple Motion module
Slave station	A generic term for a local station, remote I/O station, remote device station, and intelligent device station
SSCNETⅢ[*1]	High speed synchronous communication network between RD77MS and servo amplifier
SSCNETⅢ/H[*1]	
Transient transmission	A function of communication with another station, which is used when requested by a dedicated instruction or the engineering tool

*1 SSCNET: Servo System Controller NETwork

PERIPHERALS

The following figure shows the peripherals when the RD77MS is used.

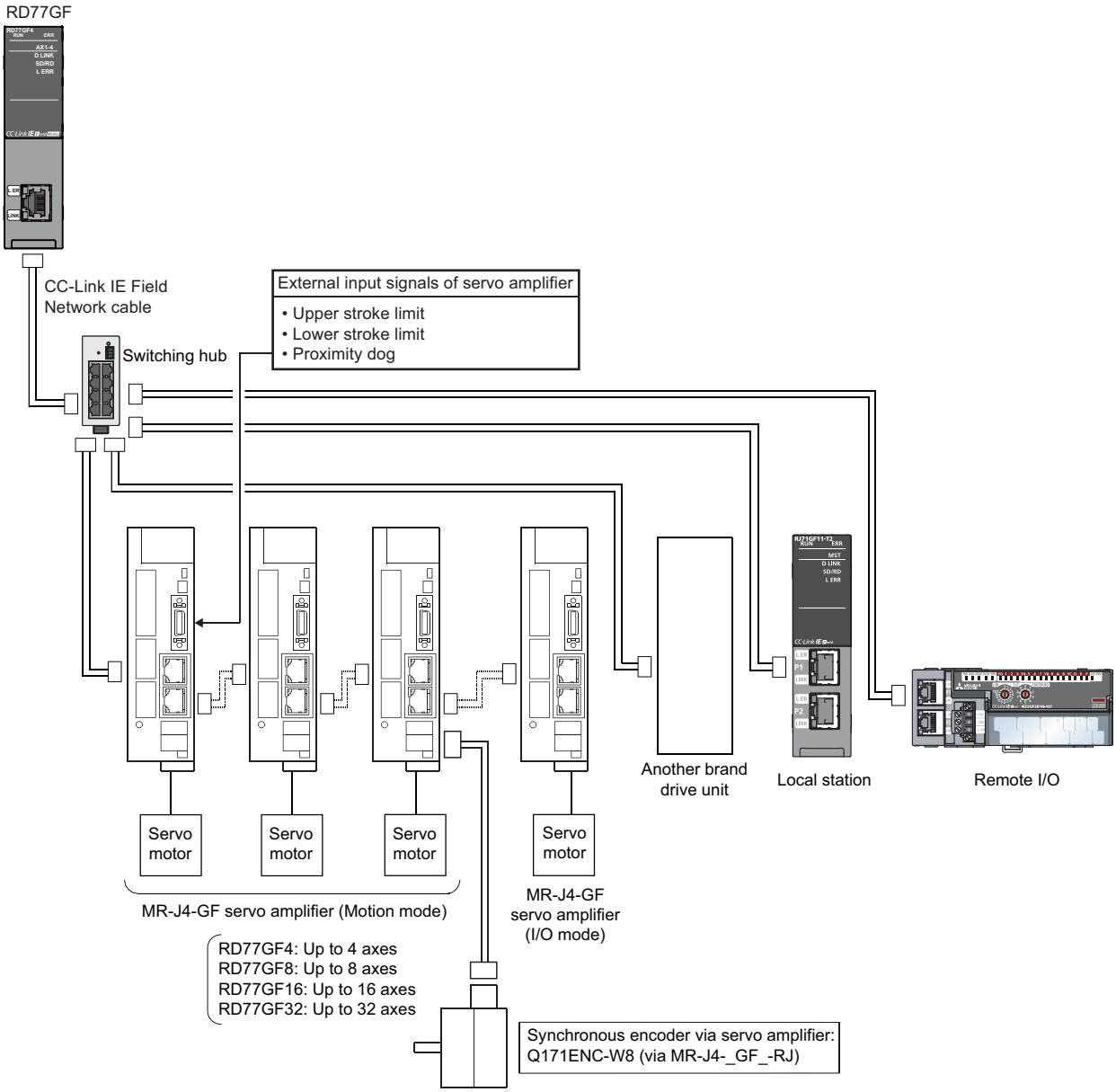


*1 Use the servo amplifier which supports the scale measurement function.
Refer to the servo amplifier instruction manuals and manuals for the version of the servo amplifier which supports the scale measurement function and the encoder which can be used with the scale measurement function.

Point

- The external input signal might not be usable depending on the connected device. Confirm the specification of the connected device.
- When using RD77MS2, the external input signals that can be assigned are for 10 points.

The following figure shows the peripherals when the RD77GF is used.

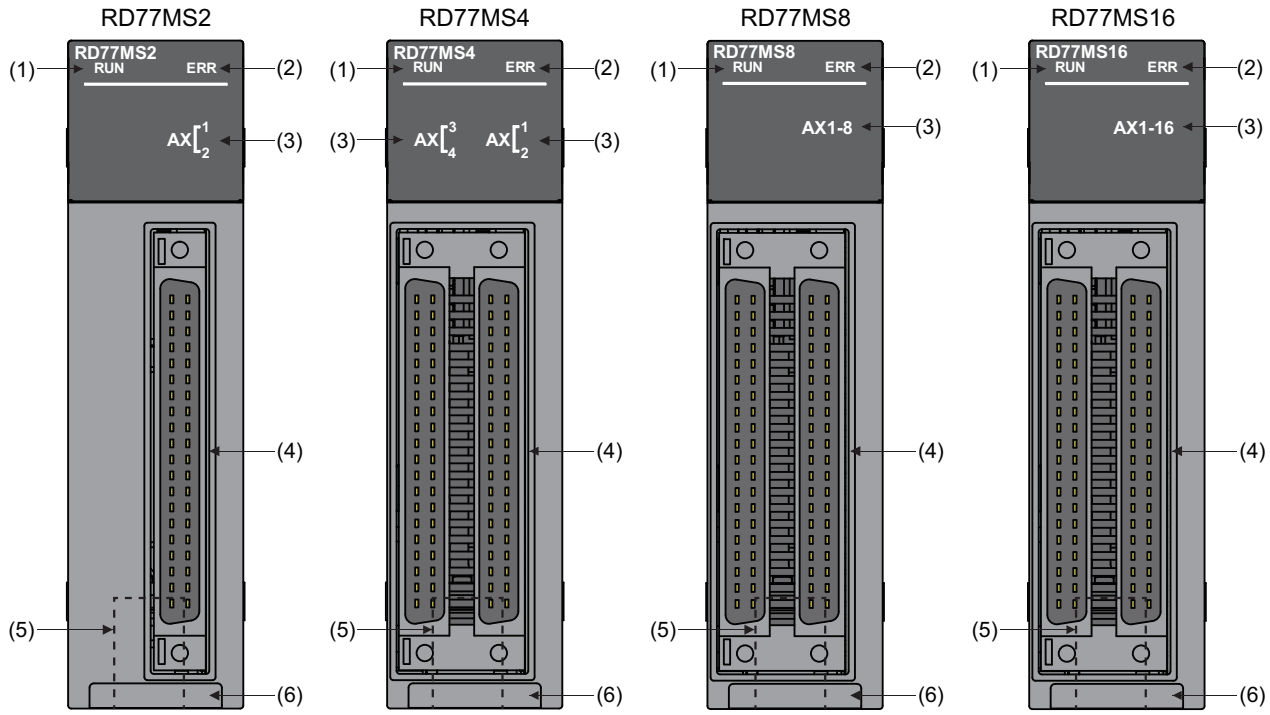


Point

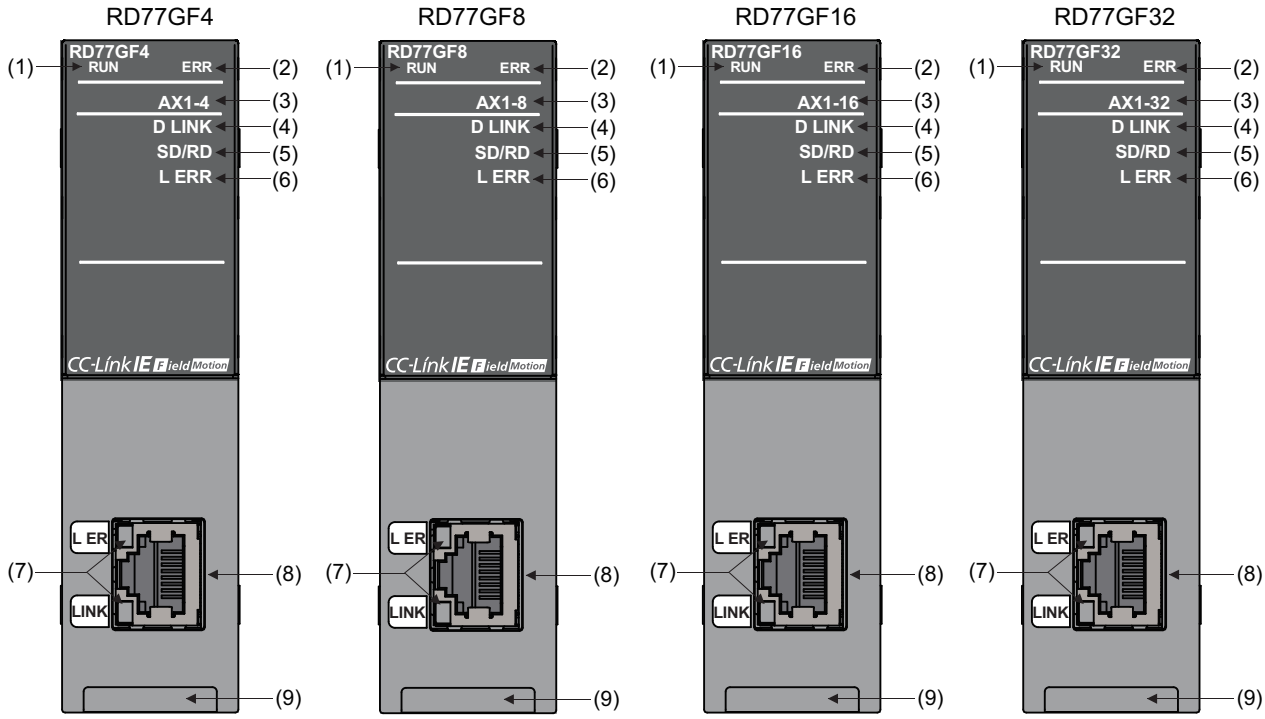
- The external input signal cannot be used depending on the connected device. Confirm the specification of the connected device.

1 PART NAMES

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



No.	Name	Description
(1)	RUN LED	For details, refer to the following. ☞ Page 20 LED Display Specifications of the RD77MS
(2)	ERR LED	
(3)	Axis display LED	
(4)	External input connection connector	Connects to a mechanical system input, manual pulse generator/incremental synchronous encoder, or forced stop input. For the signal layout, refer to the following. ☞ Page 26 Specifications of Interfaces with External Devices of the RD77MS
(5)	SSCNETⅢ cable connector	Connects to a servo amplifier.
(6)	Serial No. marking	Shows the serial No. printed on the Simple Motion module.



No.	Name	Description
(1)	RUN LED	For details, refer to the following. ☞ Page 21 LED Display Specifications of the RD77GF
(2)	ERR LED	
(3)	Axis display LED	
(4)	D LINK LED	
(5)	SD/RD LED	
(6)	L ERR LED	
(7)	LEDs for CC-Link IE Field connector	
(8)	Connector for CC-Link IE Field Network cable	Connects to a slave station. In the following manual, this connector is referred to as "PORT2", "P2", or "Port 2". 📖MELSEC iQ-R Simple Motion Module User's Manual (Network)
(9)	Serial No. marking	Shows the serial No. printed on the Simple Motion module.

1.1 LED Display Specifications of the RD77MS

This section lists the LED display specifications of the RD77MS.

☐: OFF, ■: ON, ●: Flashing

Simple Motion module status	LED display		Description
Normal operation	RUN ■ ERR ☐	AX1 ☐ AX2 ☐ AX3 ☐ AX4 ☐	The axes stopped The axes on standby
		AX1-8 ☐*1	
		AX1-16 ☐*1	
	RUN ■ ERR ☐	AX1 ■ AX2 ☐ AX3 ☐ AX4 ☐	The axis in operation
		AX1-8 ■*2	
		AX1-16 ■*2	
Operation failure	RUN ■ ERR ■	AX1 ● AX2 ☐ AX3 ☐ AX4 ☐	Minor error
		AX1-8 ●*3	
		AX1-16 ●*3	
	RUN ■ ERR ●	AX1 ☐ AX2 ☐ AX3 ☐ AX4 ☐	Moderate error Watchdog timer error
		AX1-8 ☐	
		AX1-16 ☐	
Online module change	RUN ● ERR ☐	AX1 ☐ AX2 ☐ AX3 ☐ AX4 ☐	Module remove selection in operation
		AX1-8 ☐	
		AX1-16 ☐	
	RUN ☐ ERR ☐	AX1 ☐ AX2 ☐ AX3 ☐ AX4 ☐	Module change in operation
		AX1-8 ☐	
		AX1-16 ☐	

*1 When all axes are stopped or on standby, the AX LED turns OFF.
*2 When any of the axes is in operation, the AX LED turns ON.
*3 When an error occurs in any of the axes, the AX LED is flashing.

1.2 LED Display Specifications of the RD77GF

This section lists the LED display specifications of the RD77GF.

☐: OFF, ■: ON, ●: Flashing

Simple Motion module status	LED display		Description
Normal operation	RUN ■ ERR ☐	AX1-4 ☐*1	The axes stopped The axes on standby
		AX1-8 ☐*1	
		AX1-16 ☐*1	
		AX1-32 ☐*1	
	RUN ■ ERR ☐	AX1-4 ■*2	The axis in operation
		AX1-8 ■*2	
		AX1-16 ■*2	
		AX1-32 ■*2	
Operation failure	RUN ■ ERR ■	AX1-4 ●*3	Minor error (related to axis)
		AX1-8 ●*3	
		AX1-16 ●*3	
		AX1-32 ●*3	
	RUN ■ ERR ■	AX1-4 ☐*4	Minor error (general)
		AX1-8 ☐*4	
		AX1-16 ☐*4	
		AX1-32 ☐*4	
	RUN ■ ERR ●	AX1-4 ☐	Flashing (500 ms interval): A data link faulty station detected Flashing (200 ms interval): Moderate error
		AX1-8 ☐	
		AX1-16 ☐	
		AX1-32 ☐	
	RUN ☐ ERR ■	AX1-4 ☐	Major error
		AX1-8 ☐	
		AX1-16 ☐	
		AX1-32 ☐	

*1 When all axes are stopped or on standby, the AX LED turns OFF.
*2 When any of the axes is in operation, the AX LED turns ON.
*3 When an error occurs in any of the axes, the AX LED is flashing.
*4 The AX LED does not turn OFF when the axis is in operation or a minor error (related to axis) has occurred.

☐: OFF, ■: ON, ●: Flashing

Status	LED display	Description
Indicates the data link status.	D LINK ■*1	Data link (cyclic transmission being performed)
	D LINK ●*1	Data link (cyclic transmission stopped)
	D LINK ☐*1	Data link not performed (disconnection)
Indicates the data sending/receiving status.	SD/RD ■	Data being sent or received
	SD/RD ☐	Data not sent nor received
Indicates the receive data and line error status.	L ERR ■	Abnormal data received
	L ERR ☐	Normal data received
Indicates the port status.	L ER ■	Abnormal data received
	L ER ☐	Normal data received
Indicates the link status.	LINK ■	Link-up
	LINK ☐	Link-down

*1 The LED is always OFF in offline mode.

2 SPECIFICATIONS

This chapter describes the performance specifications of the RD77MS and the RD77GF.

2.1 Performance Specifications of the RD77MS

This section lists the performance specifications of the RD77MS.

Item		RD77MS2	RD77MS4	RD77MS8	RD77MS16
Number of controlled axes		2 axes	4 axes	8 axes	16 axes
Operation cycle		0.444 ms/0.888 ms/1.777 ms/3.555 ms			
Interpolation function		2-axis linear interpolation, 2-axis circular interpolation	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, arc, and helix 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 (The 101st data to the 600th data can be set only with the engineering tool.)			
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)			

Item			RD77MS2	RD77MS4	RD77MS8	RD77MS16
Starting time[*3]	Operation cycle 0.444 ms	Maximum number of axes: 1 axis	0.7 ms			
		Maximum number of axes: 2 axes	0.7 ms			
		Maximum number of axes: 4 axes	0.74 ms			
	Operation cycle 0.888 ms	Maximum number of axes: 4 axes	1.1 ms			
		Maximum number of axes: 8 axes	1.32 ms			
		Maximum number of axes: 12 axes	1.46 ms			
	Operation cycle 1.777 ms	Maximum number of axes: 8 axes	1.1 ms			
		Maximum number of axes: 12 axes	1.46 ms			
		Maximum number of axes: 16 axes	1.59 ms			
	Operation cycle 3.555 ms	Maximum number of axes: 8 axes	0.92 ms			
		Maximum number of axes: 12 axes	1.12 ms			
		Maximum number of axes: 16 axes	1.52 ms			
External wiring connection system			40-pin connector			
Applicable wire size[*4]	When A6CON1 or A6CON4 is used		0.088 to 0.3 mm^2 (AWG28 to AWG22) stranded wire			
	When A6CON2 is used		0.088 to 0.24 mm^2 (AWG28 to AWG24) stranded wire			
External input wiring connector			A6CON1, A6CON2, A6CON4 (sold separately)			
Maximum station-to-station distance		SSCNETⅢ/H	100 m (328.08 ft.)			
		SSCNETⅢ	50 m (164.04 ft.)			
Manual pulse generator/ Incremental synchronous encoder input maximum frequency		Differential-output type	Up to 1 Mpulses/s			
		Open-collector type	Up to 200 kpulses/s			
Manual pulse generator 1 pulse input magnification			1 to 10000 times			
Flash ROM write count			Max. 100000 times			
Number of occupied I/O points			32 points (I/O assignment: Intelligent function module 32 points)			
Internal current consumption (5 V DC)			1.0 A			
External dimensions	Height		106 mm (4.17 inch)			
	Width		27.8 mm (1.09 inch)			
	Depth		110 mm (4.33 inch)			
Mass			0.22 kg	0.23 kg		

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

*2 When "Speed control 10 × multiplier setting for degree axis function" is valid, the setting range is 0.01 to 20000000.00 (degree/min).

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

*4 Use cables with outside diameter of 1.3 mm (0.05 inch) or shorter to connect 40 cables to the connector. In addition, consider the amount of current to be used and select appropriate cables.

2.2 Performance Specifications of the RD77GF

This section lists the performance specifications of the RD77GF.

Item		RD77GF4	RD77GF8	RD77GF16	RD77GF32
Number of controlled axes		4 axes	8 axes	16 axes	32 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)			
Starting time		0.2 ms to 5.0 ms			
Manual pulse generator	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 (I/O assignment: Intelligent function module 32 points)			64 points (I/O assignment: Intelligent function module 64 points)
Internal current consumption (5 V DC)		1.1 A			
External dimensions	Height	106 mm (4.17 inch)			
	Width	27.8 mm (1.09 inch)			
	Depth	110 mm (4.33 inch)			
Mass		0.23 kg			

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

*2 When "Speed control 10 × multiplier setting for degree axis function" is valid, the setting range is 0.01 to 20000000.00 (degree/min).

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

Item			RD77GF4	RD77GF8	RD77GF16	RD77GF32
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	1K points (1024 points, 2K bytes) 256 points when communication mode is "High-Speed"			
		RWw	1K points (1024 points, 2K bytes) 256 points when communication mode is "High-Speed"			
Safety communications	Maximum number of safety connectable stations per network		121 stations			
	Maximum number of safety connections per network		1814 connections			
	Maximum number of safety connections per station		120 connections			
	Maximum number of link points per safety connection		8 words (input: 8 words, output: 8 words)			
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, program upload/download) Dedicated instructions from sequence programs			
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 (328.08 ft.) (conforms to ANSI/TIA/EIA-568-B (Category 5e))			
Overall cable distance	Single master configuration		Line topology: 12000 m (39370 ft.) (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 of the RD77MS

Electrical specifications of input signals

External input signal

■Specifications of external input signal

Item		Specifications
Signal name		Input signal (SIN)
Number of input points		RD77MS2: 10 points, RD77MS4/RD77MS8/RD77MS16: 20 points
Input method		Positive common/Negative common shared
Common terminal arrangement		4 points/common (Common contact: COM)
Isolation method		Photocoupler
Rated input voltage		24 V DC
Rated input current (I_{IN})		Approx. 5 mA
Operating voltage range		19.2 to 26.4 V DC (24 V DC+10/-20%, ripple ratio 5% or less)
ON voltage/current		17.5 V DC or more/3.5 mA or more
OFF voltage/current		7 V DC or less/1 mA or less
Input resistance		Approx. 6.8 kΩ
Response time	OFF → ON	1 ms or less
	ON → OFF	

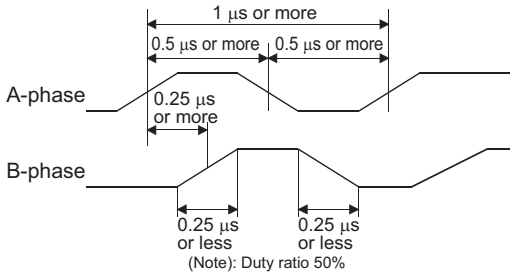
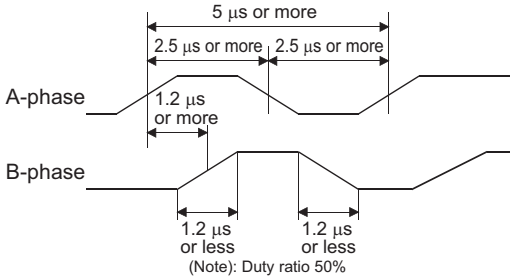
Forced stop input

■Specifications of forced stop input signal

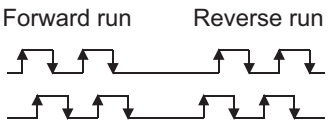
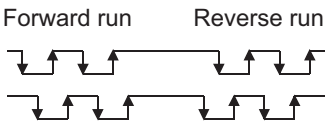
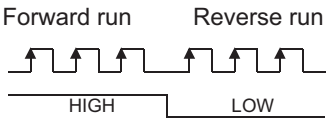
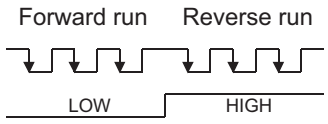
Item		Specifications
Number of input points		1 point
Input method		Positive common/Negative common shared
Common terminal arrangement		1 point/common (Common contact: EMI.COM)
Isolation method		Photocoupler
Rated input voltage		24 V DC
Rated input current (I_{IN})		Approx. 5 mA
Operating voltage range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

Manual pulse generator/Incremental synchronous encoder input

■Specifications of manual pulse generator/incremental synchronous encoder

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

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

[Pr.24] Manual pulse generator/Incremental synchronous encoder input selection	[Pr.151] Manual pulse generator/Incremental synchronous encoder input logic selection	
	Positive logic	Negative logic
A-phase/B-phase		
PULSE/SIGN		

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

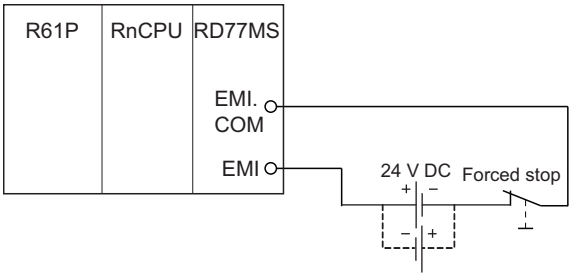
2.4 External Circuit Design

Forced stop circuit

The forced stop of all servo amplifiers is possible in a lump by using the forced stop input of Simple Motion module. 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.)

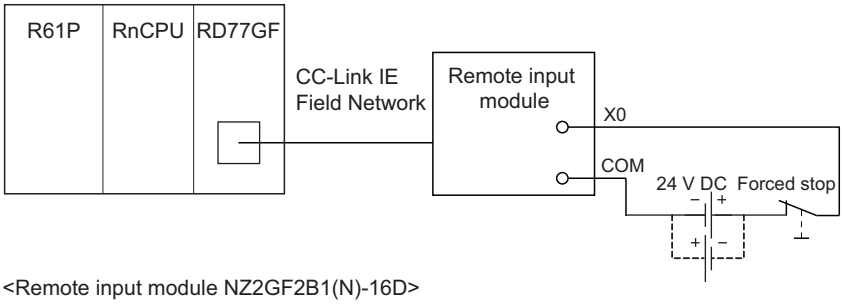
[RD77MS]

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

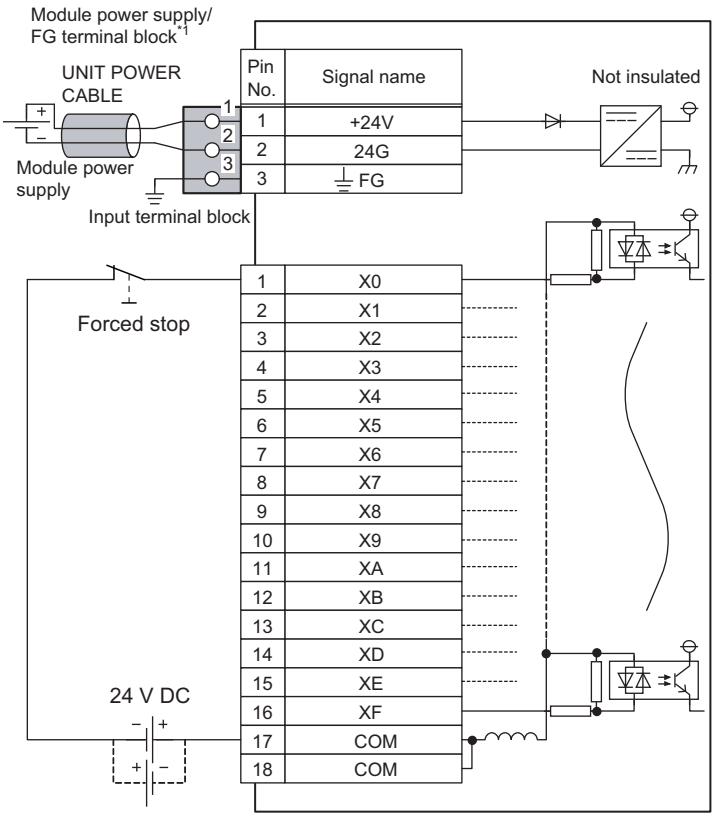


[RD77GF]

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 servo motor stops.
Servo amplifier forced stop		A stop command from the external circuit to the servo amplifier is output, and the servo amplifier stops the servo motor.
Motion controller forced stop		A stop command from the Simple Motion module to the servo amplifier is output, and the servo amplifier stops the servo motor.

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 module and the version of engineering tool. For details, refer to "Restrictions by the version" in the following manual.
MELSEC iQ-R Simple Motion Module User's Manual (Application)

3.1 Control Functions

The Simple Motion module has several functions. Refer to the following manual for details on each function.
MELSEC iQ-R Simple Motion Module User's Manual (Application)
In this manual, the Simple Motion module 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 module as the "Positioning start data No. 9001 (Machine home position return)", and "Positioning start data No. 9002 (Fast home position return)".

Major positioning control

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

High-level positioning control

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

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

etc.

Manual control

The Simple Motion module executes the random positioning operation by inputting a signal into the Simple Motion module from an external device.
Use this manual control to move the workpiece to a random position (JOG operation), and to finely adjust the positioning (inching operation, manual pulse generator operation), etc.

Expansion control

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

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

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

Main functions			Details
Home position return control	Machine home position return control		Mechanically establishes the positioning start point using a 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] Machine feed value) stored in the Simple Motion module using machine home position return. (Positioning start No. 9002)
Major positioning control	Position control	Linear control (1-axis linear control) (2-axis linear interpolation control) (3-axis linear interpolation control) (4-axis linear interpolation control)	Positions a target using a linear path to the address set in the positioning data or to the position designated with the movement amount.
		Fixed-feed control (1-axis fixed-feed control) (2-axis fixed-feed control) (3-axis fixed-feed control) (4-axis fixed-feed control)	Positions a target by the movement amount designated with the amount set in the positioning data. (With fixed-feed control, the "[Md.20] Command position 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 command position value ([Md.20]) to the address set in the positioning data. The following two methods can be used. (The machine feed value ([Md.21]) cannot be changed.) • 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		Synchronizes the control timings among multiple modules on the same base.
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".

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 module is described below.

Sub function		Details
Functions characteristic to machine home position return	Home position return retry function [RD77MS]	This function retries the home position return with the upper/lower limit switches during the machine home position return. This allows machine home position return to be carried out even if the axis is not returned to before the proximity dog with JOG operation, etc.
	Home position shift function [RD77MS]	After returning to the machine home position, this function compensates the position by the designated distance from the machine home position and sets that position as the home position address.
Functions that compensate control	Backlash compensation function	This function compensates the mechanical backlash amount. Feed commands equivalent to the set backlash amount are output each time the movement direction changes.
	Electronic gear function	By setting the movement amount per pulse, this function can freely change the machine movement amount per commanded pulse. When the movement amount per pulse is set, a flexible positioning system that matches the machine system can be structured.
	Near pass function[*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 servo motor 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 module to reach the positioning stop position. When the value is less than the set value, the "command in-position flag" is set to "1". When using another auxiliary work before ending the control, use this function as a trigger for the sub work.
	Acceleration/deceleration processing function	This function adjusts the acceleration/deceleration.
	Deceleration start flag function	Function that turns ON the flag when the constant speed status or acceleration status switches to the deceleration status during position control, whose operation pattern is "Positioning complete", to make the stop timing known.
	Follow up function	This function monitors the motor rotation amount with the servo turned OFF, and reflects it on the command position value.
	Speed control 10 × 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.

*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 module 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 module to the default values. The following two methods can be used. • Method using a program • Method using an engineering tool
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 program • Method using an engineering tool
External input signal select function	[RD77MS] This function sets the input type, input terminal, signal logic and input filter for each external input signal of each axis (upper/lower stroke limit signal (FLS/RLS), proximity dog signal (DOG), and stop signal (STOP)). The function enables the assignment of external input signal of each axis to any terminals of the external input connection connector on the Simple Motion module. [RD77GF] 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 [RD77GF]	This function assigns link devices to external signals of the Simple Motion module.
History monitor function	This function monitors start history and current value history of all axes.
Amplifier-less operation function	This function executes the positioning control of Simple Motion module without connecting to the servo amplifiers. It is used to debug the program at the start-up of the device or simulate the positioning operation.
Virtual servo amplifier function	This function executes the operation as the axis (virtual servo amplifier axis) that operates only command (instruction) virtually without servo amplifiers.
Driver communication function [RD77MS]	This function uses the "Master-slave operation function" of servo amplifier. The Simple Motion module controls the master axis and the slave axis is controlled by data communication between servo amplifiers (driver communication) without Simple Motion module.
Mark detection function	This function is used to latch any data at the input timing of the mark detection signal (DI).
Optional data monitor function [RD77MS]	This function is used to store the data selected by user up to 4 data per axis to buffer memory and monitor them.
Event history function	This function collects errors and event information occurred in the Simple Motion module in the CPU module, and saves them to an SD memory card. The error history can be checked even after the power OFF or reset by holding the error contents in the CPU module.
Connect/disconnect function of SSCNET communication [RD77MS]	Temporarily connect/disconnect of SSCNET communication is executed during system's power supply ON. This function is used to exchange the servo amplifiers or SSCNETⅢ cables.
Servo cyclic transmission function [RD77GF]	This function reads and writes objects of slave devices with cyclic transmission.
Servo transient transmission function [RD77GF]	This function reads and writes objects of slave devices with transient transmission.
Online module change [RD77MS]	Allows to replace a module without stopping the system. For procedures for the online module change, refer to the following. MELSEC iQ-R Online Module Change Manual
Test mode	This mode executes the test operation and adjustment of axes using an engineering tool.
Servo parameter change function [RD77GF]	This function transfers servo parameters. Servo parameters, which are controlled by servo amplifiers, can be changed with a Simple Motion module.
Positioning data, block start data write/read function [RD77MS]	This function is used to write/read optional positioning data and block start data by using the positioning data and the control data for block starting data.
Hot line forced stop function	This function is used to execute deceleration stop safety for other axes when the servo alarm occurs in the servo amplifier MR-JE-B(F).

3.2 Combination of Main Functions and Sub Functions

With positioning control using the Simple Motion module, the main functions and sub functions can be combined and used as necessary. A list of the main function and sub function combinations is 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	△*2
		2-, 3-, or 4-axis fixed-feed control (interpolation)	△*2
		2-axis circular interpolation control	○
		3-axis helical interpolation control	○
	Speed control (1- to 4-axis)		△*3
	Speed-position switching control		△*2
	Position-speed switching control		△*3
	Other control	Current value changing	△*2
		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)		×

*1 The operation pattern is one of the "positioning data" setting items.
*2 Continuous path control cannot be set.
*3 Only independent positioning control can be set.

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		△*1[RD77MS] △*3[RD77GF]	○[RD77MS] △*3[RD77GF]	○[RD77MS] △*3[RD77GF]	○[RD77MS] △*3[RD77GF]	△*2[RD77MS] ×[RD77GF]
	Fast home position return control		×	×	○	○	△*2
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)		×	×	○	○	×

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

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

*3 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		○[RD77MS] △*1[RD77GF]	○[RD77MS] △*1[RD77GF]	×[RD77MS] △*1[RD77GF]	◎[RD77MS] △*1[RD77GF]	○[RD77MS] △*1[RD77GF]
	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)		○	○	○	◎	○

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

○: Combination possible

△: Combination limited

×: Combination not possible

Main functions			Functions that change control details				
			Speed change function	Override function	Acceleration/ deceleration time change function	Torque change function	Target position change function
Home position return control	Machine home position return control		△*1[RD77MS] ×[RD77GF]	△*1[RD77MS] ×[RD77GF]	△*1[RD77MS] ×[RD77GF]	○[RD77MS] ×[RD77GF]	×
	Fast home position return control		○	○	○	○	×
Major positioning control	Position control	1-axis linear control	○	○	○	○	△*2
		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		△*3	△*3	△*3	○	×
	Manual pulse generator operation		×	×	×	○	×
Expansion control	Speed-torque control		×	×	×	○	×
	Advanced synchronous control (output axis)		×	×	×	○	×

*1 Invalid during creep speed.

*2 Invalid during continuous path control.

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

○: Combination possible

△: Combination limited

×: Combination not possible

Main functions			Functions related to positioning start	Functions related to positioning stop		Other functions	
			Pre-reading start function	Step function	Stop command processing for deceleration stop function	Skip function	M code output function
Home position return control	Machine home position return control		×	×	○[RD77MS] ×[RD77GF]	×	×
	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)		×	×	×	×	×

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

○: Combination possible

△: Combination limited

×: Combination not possible

Main functions			Other functions					
			Teaching function	Command in-position function	Acceleration/ deceleration processing function	Deceleration start flag function	Speed control 10 × multiplier setting for degree axis function	Operation setting for incompletion of home position return function
Home position return control	Machine home position return control		×	×	○[RD77MS] ×[RD77GF]	×	○[RD77MS] ×[RD77GF]	×
	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	○	○
	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	○

*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] Speed command" and "[Md.28] Axis speed command".

*6 Refer to "Speed-torque Control" in the following manual for acceleration/deceleration processing in the speed-torque control.
MELSEC iQ-R Simple Motion Module User's Manual (Application)

*7 For details, refer to "Output Axis Sub Functions" in the following manual.
MELSEC iQ-R Simple Motion Module (Advanced Synchronous Control)

3.3 List of RD77GF 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 "FUNCTIONS" in the following manual.

MELSEC iQ-R Simple Motion Module User's Manual (Network)

Cyclic transmission

Function		Description
Fixed-cycle communication		The communication cycle of the Simple Motion module is fixed cycle. Communicates with slave modules in a cycle set in the inter-module synchronization cycle 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	Link refresh	Automatically transfers data between the link device of the Simple Motion module and the device of the CPU module
	Direct access to link devices	Directly accesses the link devices of the Simple Motion module from a program.
Cyclic data integrity assurance*1		Assures the cyclic data integrity in units of 32 bits or station-based units.
Interlink transmission		Transfers data in the link devices of the master station to another network module on a relay station.
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*2		Selects whether input data from another station where a data link error occurs is cleared or held.
Output status setting for CPU STOP		Selects whether cyclic data output is held or cleared when the CPU module mounted with a Simple Motion module is set to STOP.
Output status setting for CPU stop error		Selects whether cyclic transmission output is held or cleared when a stop error occurs in the CPU module which a Simple Motion module is mounted with.
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.

*1 When the software version of the Simple Motion module is "Ver.01":
The set parameter is ignored in the Simple Motion module and operate as "Disable" in station-based units. Assure data using interlock programs as required.
When the software version of the Simple Motion module is "Ver.02" or later:
To enable data assurance in an asynchronous station, read/write data by direct access in the inter-module synchronous interrupt program (I44) without using a link refresh.

*2 When the software version of the Simple Motion module is "Ver.01":
The set parameter is ignored in the Simple Motion module and operate as "Hold". Add "Data link status of each station" (SW00B0 to SW00B7) to an interlock of the program as required.

Transient transmission

Function	Description
Communications within the same network	Performs the transient transmission to other stations using dedicated instructions and the engineering tool.
Communications with different networks	Performs the transient transmission seamlessly to stations on different networks using dedicated instructions and the engineering tool.
Dedicated instruction	An instruction for using functions of modules. (MELSEC iQ-R Programming Manual (CPU Module Instructions, Standard Functions/Function Blocks))

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 the engineering tool. The error locations, error causes, and corrective actions can be checked in the engineering tool.
Diagnostics of own network	Cable test	Checks the connection status of the Ethernet cables.
Diagnostics of other network	Communication test	Checks whether the communication route for transient transmission from the own station to the destination station is correct or not.
	IP communication test	Checks whether no error occurs in the communication path when the IP packet transfer function is used.

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. (MELSEC iQ-R Inter-Module Synchronization Function Reference Manual)
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.
IP packet transfer function	Enables communications in a protocol such as FTP and HTTP using the specified IP address of an Ethernet device, over CC-Link IE Field Network. With this function, two networks of CC-Link IE Field Network and Ethernet are not required, resulting in reduced wiring cost.
Automatic detection of connected devices	Reduces the time of setting parameters by automatically reading information of slave stations. For details, refer to the following. iQ Sensor Solution Reference Manual
iQ Sensor Solution data backup/restoration function	Backs up the setting data of the slave station into the SD memory card of the CPU module on the master station. The setting data backed up on the SD memory card of the CPU module on the master station is restored into the slave module. For details, refer to the following. MELSEC iQ-R CPU Module User's Manual (Application)
Safety communication function	Establishes a safety connection and enables one-on-one safety communications periodically between safety stations in the same network.

*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.
MELSEC iQ-R Inter-Module Synchronization Function Reference Manual

4 PROCEDURES BEFORE OPERATIONS

4.1 Procedures before Operation of the RD77MS

This chapter describes the procedures before operation of the RD77MS.

1. Mounting the module

Mount the Simple Motion module to the main base unit or extension base unit.

For details, refer to the following.

MELSEC iQ-R Module Configuration Manual

2. Wiring

Connect the Simple Motion module to external devices.

3. Adding the module

Add the RD77MS to the module map of the project using an engineering tool.

4. Module setting

Set values for the module setting using an engineering tool.

For details, refer to "Simple Motion Module Setting" in the following manual.

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

5. Auto refresh setting

Set values for the refresh settings using an engineering tool.

For details, refer to "Module Parameters" in the following manual.

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

6. Checking connection

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

7. Programming

Create programs.

For details, refer to "PROGRAMMING" in the following manual.

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

8. Test mode

Execute the test operation using an engineering tool.

For details, refer to "Test mode" in the following manual.

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

9. Test operation

Confirm that the created programs are able to execute properly.

4.2 Procedures before Operation of the RD77GF

This chapter describes the procedures before operation of the RD77GF.

1. Mounting the module

Mount the Simple Motion module to the main base unit or extension base unit.

For details, refer to the following.

MELSEC iQ-R Module Configuration Manual

2. Wiring

Connect the Simple Motion module to external devices.

3. Adding the module

Add the RD77GF to the module map of the project using an engineering tool.

4. Module setting (system parameter)

[When the software version of the Simple Motion module is "Ver.04" or before]

The RD77GF uses the CC-Link IE Field Network synchronous communication function. Therefore, the inter-module synchronization function needs to be set.

Set the inter-module synchronization in "System parameter" of the engineering tool.

- Set the RD77GF as the synchronization target module in the inter-module synchronization setting.
- 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.

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 module is not completed within the inter-module synchronization cycle, it may cause the warning "Synchronization cycle time over" (warning code: 0CC0H), the error "Inter-module synchronization process error" (error code: 2600H), or "Operation cycle time 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 13 stations: 1.00 ms (It is recommended to set "[Pr.152] Maximum number of control axes" based on the number of axes.)
- 14 to 64 stations: 2.00 ms
- 65 to 120 stations: 4.00 ms

[When the software version of the Simple Motion module is "Ver.05" or later]

Set the inter-module synchronization function as required.

Point

The CC-Link IE Field Network synchronous communication cycle is set to the inter-module synchronization cycle when using the inter-module synchronization. When not using the inter-module synchronization, it depends on "[Pr.96] Operation cycle setting".

Adjust the setting cycle depending on the control and number of link devices and stations. If processing in the Simple Motion module is not completed within the cycle that is set, it may cause the warning "Synchronization cycle time over" (warning code: 0CC0H), the error "Inter-module synchronization process error" (error code: 2600H), or "Operation cycle time over error" (error code: 193FH), etc.

For details, refer to "INTER-MODULE SYNCHRONIZATION FUNCTION" in the following manual.

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

Or, refer to the following manual.

MELSEC iQ-R Inter-Module Synchronization Function Reference Manual

5. Network construction

Set network parameters in "Module Parameter (Network)" of the engineering tool.

- Set a slave station for Network Configuration Settings.
  Devices of the station No.1 to 32 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 32.

For details, refer to the following manual or instruction manual.

MELSEC iQ-R Simple Motion Module User's Manual (Network)

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

CC-Link IE Field Network Interface Servo Amplifier Instruction Manual (Motion Mode)

6. Module setting (module extended parameter)

Configure the setting related to axis control in "Module Extended Parameter" of the engineering tool.

For details, refer to "Simple Motion Module Setting (Module Extended Parameter [RD77GF])" in the following manual.

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

7. Auto refresh setting

Set the link refresh settings in "Basic Settings" of Module Parameter (Network).

For details, refer to "Basic Settings" in the following manual.

MELSEC iQ-R Simple Motion Module User's Manual (Network)

Set the refresh setting for monitor data of axis control in Module Parameter (Motion).

For details, refer to "Module Parameters" in the following manual.

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

8. Programming

Create programs.

For details, refer to the following.

Page 72 List of labels to be used

Note the following when using the inter-module synchronization function.

- Always create an inter-module synchronous interrupt program (I44) and enable interrupt (EI instruction). If a sequence program does not include "I44" or "EI", I/O signals (X/Y) of the RD77GF may not be refreshed. Even when control of the RD77GF does not need to be synchronized with the inter-module synchronization cycle, create an empty inter-module synchronous interrupt program (I44).

For details, refer to the following manual.

MELSEC iQ-R Inter-Module Synchronization Function Reference Manual

MELSEC iQ-R Programming Manual (Program Design)

9. Writing parameters

Write the set parameters and programs to the CPU module.

- "Simple Motion Module" or "CPU module (including an SD memory card inserted into the CPU module)" can be selected as a parameter storage location of module extended parameters. The initial setting is "Simple Motion Module". When writing module extended parameters, specify the same storage location in the writing destination of the engineering tool as "Module extended parameter storage location setting" in "Module operation setting" of Module Parameter (Motion).

For details, refer to "Module Parameters" in the following manual.

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

10. Network diagnostics

Using network diagnostics, check if the cables are connected properly and communication are performed normally with the configured parameters.

For details, refer to "Checking the Network Status" in the following manual.

MELSEC iQ-R Simple Motion Module User's Manual (Network)

11. Parameter settings in slave devices

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

- 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 following 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*1	• 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".

*1 When the software version of the Simple Motion module is "Ver.01":
The connection with MR-J4-GF (linear servo motor control mode) is not supported.
If connected, the error "Connection servo amplifier speed unit setting error" (error code: 1CBDH) occurs and the target axis becomes disconnected.

For details, refer to the following instruction manual.

CC-Link IE Field Network Interface Servo Amplifier Instruction Manual (Motion Mode)

12. Test mode

Execute the test operation using an engineering tool.

For details, refer to "Test Mode" in the following manual.

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

13. Test operation

Confirm that the created programs are able to execute properly.

5 NETWORK CONFIGURATION OF RD77GF

5.1 CC-Link IE Field Network Configuration

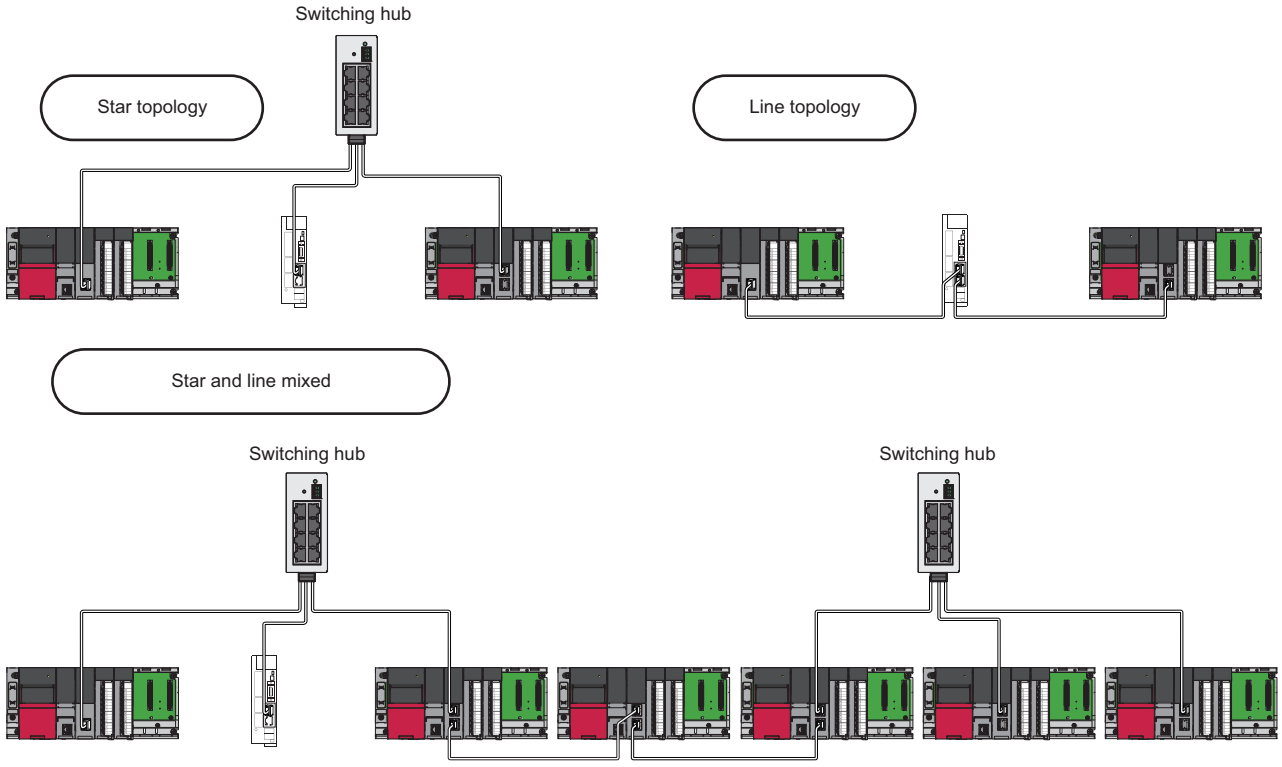
CC-Link IE Field Network is configured using Ethernet cables.

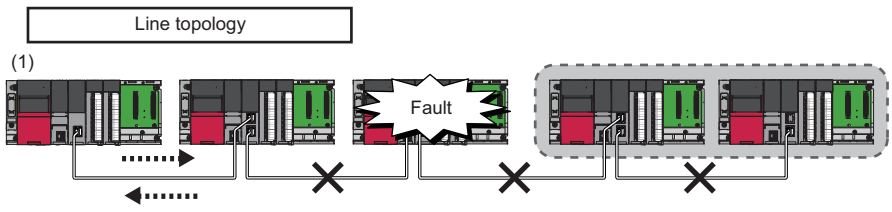
Network topology

■Star topology/Line topology

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

Star topology and line topology can be combined in a network.

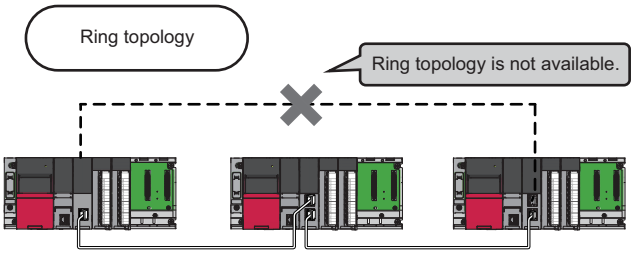


Item	Description
Star topology	The network is configured into a star shape using a switching hub and Ethernet cables. Slave stations can be easily added to the network using this topology.*1 When an error occurs in a slave station, data link can be continued with the stations that are operating normally.
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.

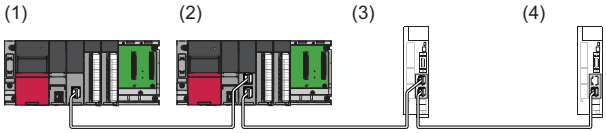
■Ring topology

The Simple Motion module does not support ring topology.



Station No. and connection position

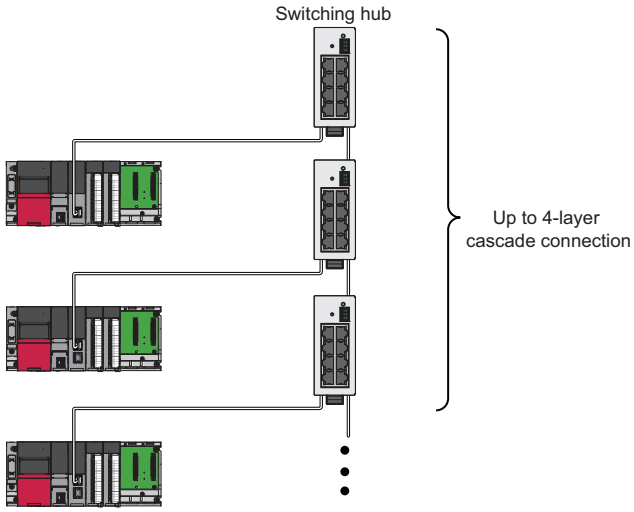
Modules can be connected in any order regardless of the station No.



(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.



When mounting with the Safety CPU

When the Simple Motion module is mounted with the Safety CPU, safety communications is available in addition to the standard communications (cyclic transmission and transient transmission).

For details on the safety communications, refer to "Safety Communication Function" in the following manual.

MELSEC iQ-R Simple Motion Module User's Manual (Network)

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. (MELSEC iQ-R Simple Motion Module 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 52 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 module. 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. (MELSEC iQ-R Simple Motion Module 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 52 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 module

Select the "Hold" in the following setting.

Navigation window ⇨ "Parameter" ⇨ "Module Information" ⇨ Target module ⇨ "Module Parameter" ⇨ "Application Settings" ⇨ "Supplementary Cyclic 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 Nos.

Do not duplicate station Nos. 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 dedicated instruction, transient transmission function, communication with an engineering tool), 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 CPU module (built-in Ethernet port part)

When connecting devices to the CPU module (built-in Ethernet port part), power off the CPU module before connection.

6 WIRING

6.1 Wiring of the RD77MS

Precautions

The precautions for wiring the RD77MS are shown below. Execute the work following the precautions below.

Warning for wiring

⚠WARNING

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

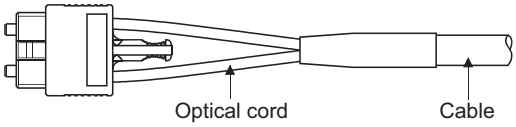
Caution for wiring

⚠CAUTION

- Check the layout of the terminals and then properly route the wires to the module.
- The external input wiring connector must be crimped or pressured with the tool specified by the manufacturer, or must be correctly soldered. Insufficient connections may cause short circuit, fire, or malfunction.
- Be careful not to let foreign matter such as sawdust or wire chips get inside the module. These may cause fires, failure or malfunction.
- The top surface of the module is covered with protective films to prevent foreign objects such as cable off cuts from entering the module when wiring. Do not remove this film until the wiring is complete. Before operating the system, be sure to remove the film to provide adequate ventilation.
- Securely connect the connector for SSCNETⅢ cable to the bottom connector on the module.
- When removing the cable from the module, do not pull the cable. Hold the connector that is connected to the module. Pulling the cable that is still connected to the module may cause malfunction or damage to the module or cable.
- The external input/output signal cable and the communication cable should not be routed near or bundled with the main circuit cable, power cable and/or other such load - carrying cables other than those for the PLC. These cables should be separated by at least 100 mm (3.94 inch) or more. They can cause electrical interference, surges and inductance that can lead to mis-operation.
- The shielded cable for connecting Simple Motion module can be secured in place. If the shielded cable is not secured, unevenness or movement of the shielded cable or careless pulling on it could result in damage to the Simple Motion module, servo amplifier or shielded cable or defective cable connections could cause mis-operation of the unit.
- If the external input/output signal cable and the power line must be adjacently laid (less than 100 mm (3.94 inch)), use a shielded cable. Ground the shield of the cable securely to the control panel on the Simple Motion module side.
- Forcibly removal the SSCNETⅢ cable from the Simple Motion module will damage the Simple Motion module and SSCNETⅢ cables.
- After removal of the SSCNETⅢ cable, be sure to put a cap on the SSCNETⅢ connector. Otherwise, adhesion of dirt deteriorates in characteristic and it may cause malfunctions.
- Do not remove the SSCNETⅢ cable while turning on the power supply of Simple Motion module and servo amplifier. Do not see directly the light generated from SSCNETⅢ connector and the end of SSCNETⅢ cable. When the light gets into eye, may feel something wrong with eyes.(The light source of SSCNETⅢ cable complies with class1 defined in JISC6802 or IEC60825-1.)
- If a power such as a major shock, lateral pressure, haul, sudden bending or twist is added to the SSCNETⅢ cable, it distorts or breaks inside and optical transmission is not be available. Note that the short SSCNETⅢ cable can be twisted easily.
- Be sure to use the SSCNETⅢ cable within the range of operating temperature described in each servo amplifier manual and instruction manual. Especially, as optical fiber for MR-J3BUS_M and MR-J3BUS_M-A are made of synthetic resin, it melts down if being left near the fire or high temperature. Therefore, do not make it touched the part which becomes high temperature, such as radiator or regenerative option of servo amplifier, or servo motor.
- When laying the SSCNETⅢ cable, be sure to secure the minimum cable bend radius or more.
- Put the SSCNETⅢ cable in the duct or fix the cable at the closest part to the Simple Motion module with bundle material in order to prevent SSCNETⅢ cable from putting its own weight on SSCNETⅢ connector. When laying cable, the optical cord should be given loose slack to avoid from becoming smaller than the minimum bend radius, and it should not be twisted. Also, fix and hold it in position with using cushioning such as sponge or rubber which does not contain plasticizing material. If adhesive tape for bundling the cable is used, fire resistant acetate cloth adhesive tape 570F (Teraoka Seisakusho Co., Ltd) is recommended.

⚠CAUTION

- Migrating plasticizer is used for vinyl tape. Keep the MR-J3BUS_M, and MR-J3BUS_M-A cables away from vinyl tape because the optical characteristic may be affected. Generally, soft polyvinyl chloride (PVC), polyethylene resin (PE) and fluorine resin contain non-migrating plasticizer and they do not affect the optical characteristic of SSCNETⅢ cable. However, some wire sheaths and cable ties, which contain migrating plasticizer (phthalate ester), may affect MR-J3BUS_M and MR-J3BUS_M-A cables (made of plastic). In addition, MR-J3BUS_M-B cable (made of quartz glass) is not affected by plasticizer.



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

SSCNETⅢ cable	Cord	Cable
MR-J3BUS_M	△	
MR-J3BUS_M-A	△	△
MR-J3BUS_M-B	○	○

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

Precautions for wiring

- Use separate cables for connecting to the Simple Motion module and for the power cable that creates surge and inductance.
- The cable for connecting the Simple Motion module should be placed in the duct or secured in place by clamps. If the cable is not placed in the duct or secured by clamps, unevenness or movement of the cable or careless pulling on it could result in damage to the unit or cable or defective cable connections could cause mis-operation of the unit.
- If a duct is being used, separate the cables to connect the Simple Motion module from the power line duct, or use metal piping. Ground the pipes securely after metal piping.
- Use the twisted pair shielded cable (wire size 0.3 mm^2 or more). The shielded must be grounded on the Simple Motion module side.
- Use separate shielded cables for the external input signal, forced stop input, and manual pulse generator/incremental synchronous encoder input for connecting to the Simple Motion module. They can cause electrical interference, surges and inductance that can lead to mis-operation.
- For wiring, refer to the following and each servo amplifier manual and instruction manual.

📖MELSEC iQ-R Module Configuration Manual

Precautions for SSCNETIII cable wiring

SSCNETⅢ cable is made from optical fiber. If optical fiber is added a power such as a major shock, lateral pressure, haul, sudden bending or twist, its inside distorts or breaks, and optical transmission will not be available. Especially, as optical fiber for MR-J3BUS_M, MR-J3BUS_M-A is made of synthetic resin, it melts down if left near a fire or an object with a high temperature. For this reason, keep the cable away from objects which can become hot, such as a radiator or regenerative option of servo amplifier and servo motor. Be sure to use optical fiber within the range of operating temperature described in each servo amplifier manual and instruction manual. Read the described items of this section carefully and handle it with caution.

■Minimum bend radius

Make sure to lay the cable with greater radius than the minimum bend radius.
Do not press the cable to edges of equipment or others. For SSCNETⅢ cable, the appropriate length should be selected with due consideration for the dimensions and arrangement of Simple Motion module or servo amplifier. When closing the door of control panel, make sure the SSCNETⅢ cable is not held down by the door and the cable bend does not become smaller than the minimum bend radius.

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

■Tension

If tension is added on the SSCNETⅢ cable, the increase of transmission loss occurs because of external force which concentrates on the fixing part of SSCNETⅢ cable or the connecting part of SSCNETⅢ connector. At worst, the breakage of SSCNETⅢ cable or damage of SSCNETⅢ connector may occur. For cable laying, handle it with care without putting tension on the cables. (Refer to each servo amplifier manual and instruction manual for the tension strength of SSCNETⅢ cable.)

■Lateral pressure

If lateral pressure is added on the SSCNETⅢ cable, the cable itself distorts, internal optical fiber gets stressed, and then transmission loss will increase. At worst, the breakage of SSCNETⅢ cable may occur. As the same condition also occurs at cable laying, do not tighten up SSCNETⅢ cable with a thing such as nylon band (TY-RAP).
Do not trample on it or tuck it down within the door of control box or others.

■Twisting

If the SSCNETⅢ cable is twisted, it will damage the cable in the same way as when local lateral pressure or bend is added. Consequently, transmission loss will increase, and damage to the SSCNETⅢ cable may occur.

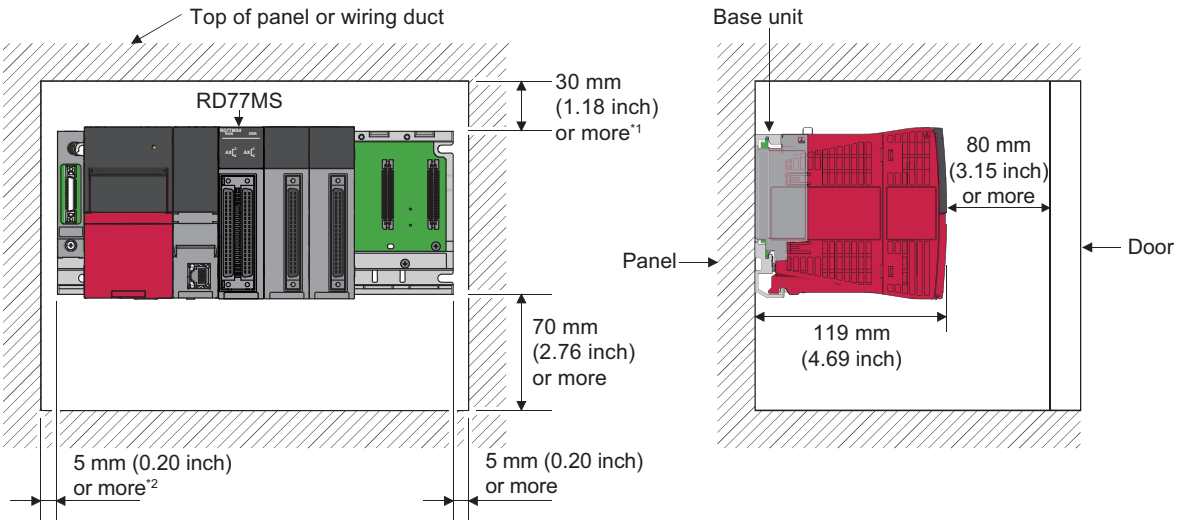
■Disposal

When incinerating optical cables (cord) used for SSCNETⅢ cable, hydrogen fluoride gas or hydrogen chloride gas which is corrosive and harmful may be generated. For disposal of SSCNETⅢ cable, request for specialized industrial waste disposal services that have incineration facilities for disposing hydrogen fluoride gas or hydrogen chloride gas.

■Wiring process of SSCNETⅢ cable

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

• Putting in the duct

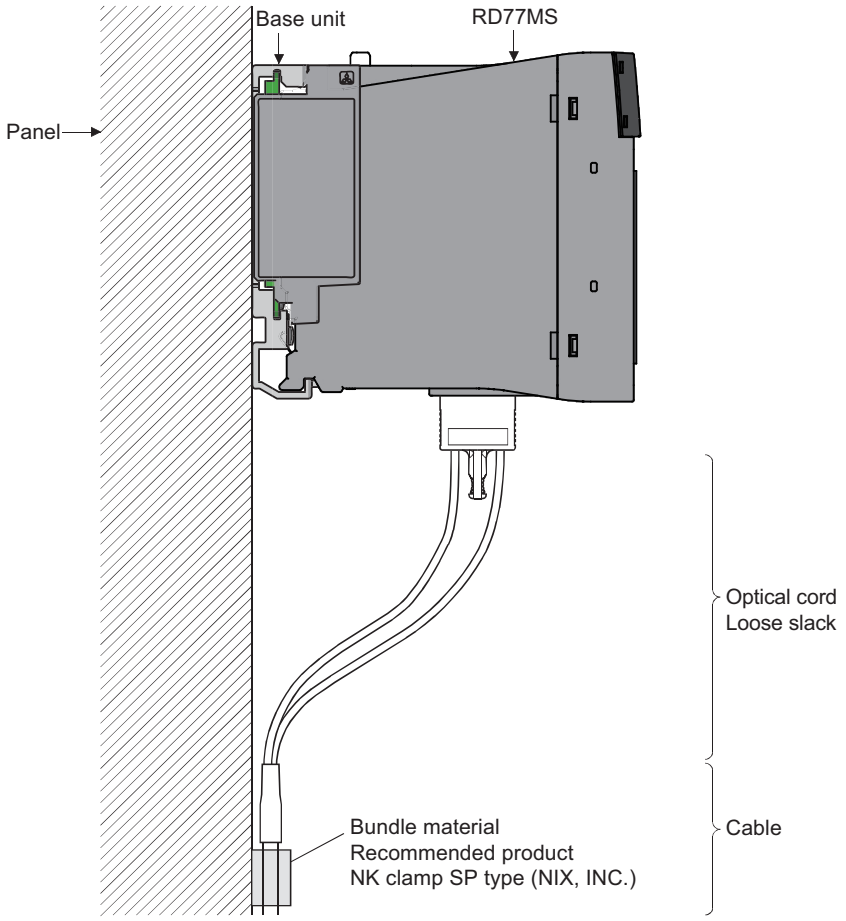


*1 For wiring duct with 50 mm (1.97 inch) or less height. For other cases, 40 mm (1.58 inch) or more.

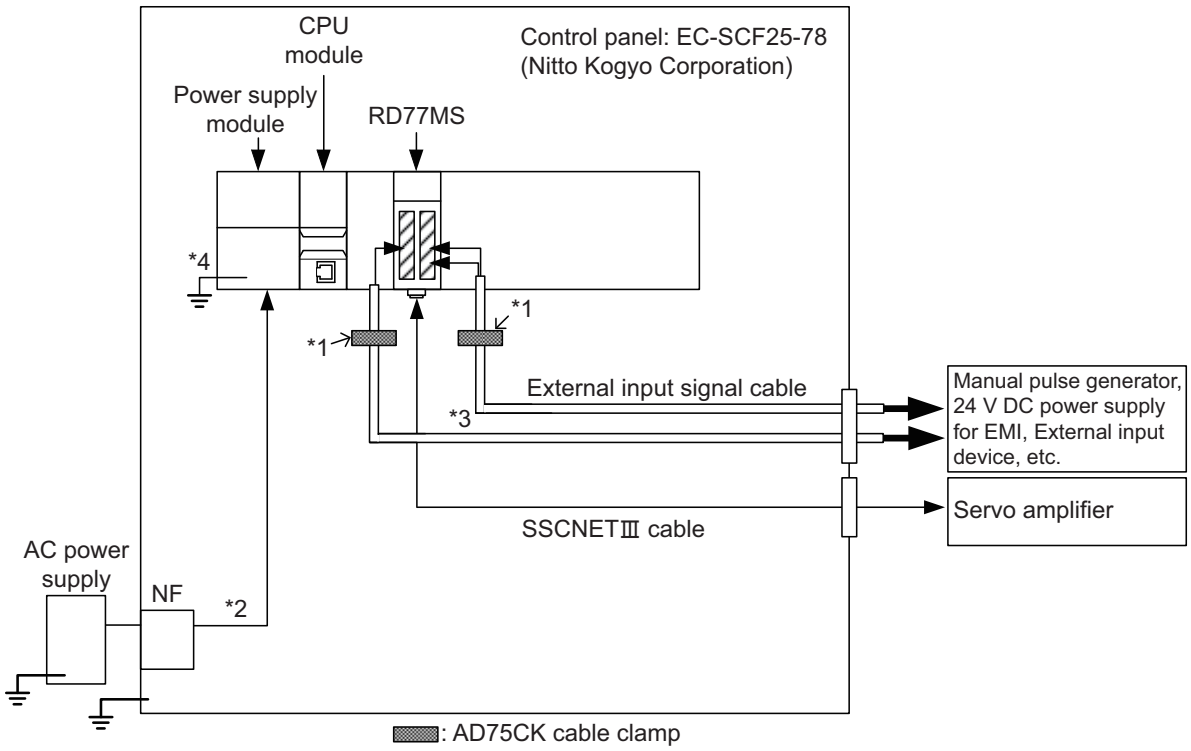
*2 20 mm (0.79 inch) or more when the adjacent module is not removed and the extension cable is connected.

• Bundle fixing

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



Example of measure against noise for compliance with the EMC directive



*1 Ground the cables at a position within 30 cm (11.82 inch) from the module with the cable clamp.

*2 Wire the power supply cable as short as possible using the twisted cable (2 mm^2 or more).

*3 Use the shielded twisted cable (cable length: 30 m (98.43 ft.) or less) for the external input signal cable.
(Manual pulse generator cable (open-collector type): 10 m (32.81 ft.) or less)

*4 Wire the power supply module as short as possible using the cable of approx. 2 mm^2, and ground to the control panel from the FG/LG terminal.

- Refer to this chapter or "EMC and Low Voltage Directives" of the following manuals for basic wire. We examined RD77MS by the above example.

MELSEC iQ-R Module Configuration Manual

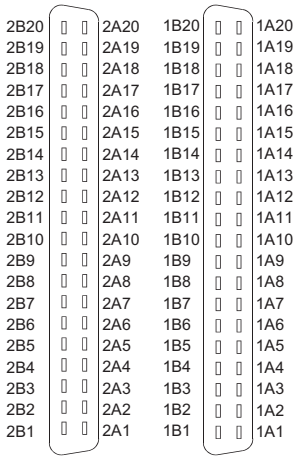
Safety Guidelines (IB-0800525)

- In wiring inside the panel, the power line connected to the power or servo amplifier and the communication cable such as an expansion cable or a network cable must not be mixed. In the duct, leave 10 cm (3.94 inch) or more between the power line and the communication cable, and separate using a separator (made of metal), etc. It is required in the same control panel as well. Mixing the power line and communication cable may cause increase of noise or malfunction due to noise influence.

6.2 External Input Connection Connector of the RD77MS

Signal layout for external input connection connector

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

Pin layout (Front view of the module)	Pin No.	Signal name	Pin No.	Signal name	Pin No.	Signal name	Pin No.	Signal name
	2B20	No connect*5	2A20	No connect*5	1B20	HB*1, *2, *3	1A20	5 V*7
	2B19		2A19		1B19	HA*1, *2, *3	1A19	5 V*7
	2B18		2A18		1B18	HBL*1, *2, *4	1A18	HBH*1, *2, *4
	2B17		2A17		1B17	HAL*1, *2, *4	1A17	HAH*1, *2, *4
	2B16		2A16		1B16	No connect*5	1A16	No connect*5
	2B15		2A15		1B15	5 V*7	1A15	5 V*7
	2B14		2A14		1B14	SG*7	1A14	SG*7
	2B13		2A13		1B13	No connect*5	1A13	No connect*5
	2B12		2A12		1B12		1A12	
	2B11		2A11		1B11		1A11	
	2B10		2A10		1B10		1A10	
	2B9		2A9		1B9		1A9	
	2B8		2A8		1B8	EMI. COM	1A8	EMI
	2B7	COM	2A7	COM	1B7	COM	1A7	COM
	2B6	COM	2A6	COM	1B6	COM	1A6	COM
	2B5	SIN20*6	2A5	SIN15*6	1B5	SIN10*6	1A5	SIN5*6
	2B4	SIN19*6	2A4	SIN14*6	1B4	SIN9*6	1A4	SIN4*6
	2B3	SIN18*6	2A3	SIN13*6	1B3	SIN8*6	1A3	SIN3*6
	2B2	SIN17*6	2A2	SIN12*6	1B2	SIN7*6	1A2	SIN2*6
	2B1	SIN16*6	2A1	SIN11*6	1B1	SIN6*6	1A1	SIN1*6

RD77MS2 does not have Pin No. of 2A20 to 2A1 and 2B20 to 2B1.

*1 Input type from manual pulse generator/incremental synchronous encoder is switched in "[Pr.89] Manual pulse generator/Incremental synchronous encoder input type selection". (Only the value specified against the axis 1 is valid.)
- 0: Differential-output type
- 1: Voltage-output/open-collector type (Default value)

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

*3 With the manual pulse generator/incremental synchronous encoder of voltage-output/open-collector type
Connect the A-phase/PULSE signal to HA, and the B-phase/SIGN signal to HB.

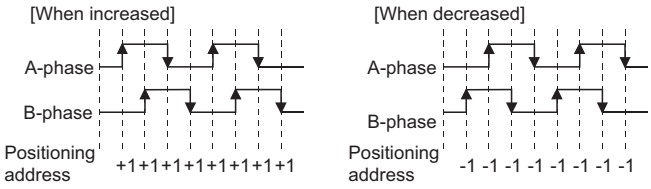
*4 With the manual pulse generator/incremental synchronous encoder of differential-output type
Connect the A-phase/PULSE signal to HAH, and the A-phase/PULSE inverse signal to HAL.
Connect the B-phase/SIGN signal to HBH, and the B-phase/SIGN inverse signal to HBL.

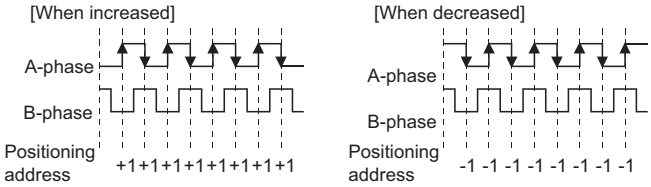
*5 Do not connect to any terminals explained as "No connect".

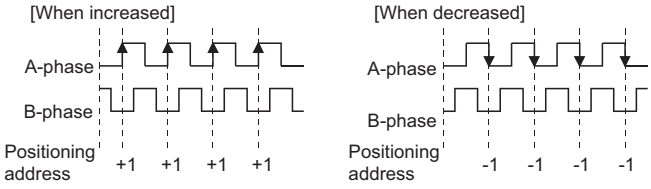
*6 Set the external command signal [DI, FLS, RLS, DOG, STOP] in "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", "[Pr.118] DOG signal selection", "[Pr.119] STOP signal selection" and "[Pr.95] External command signal selection".

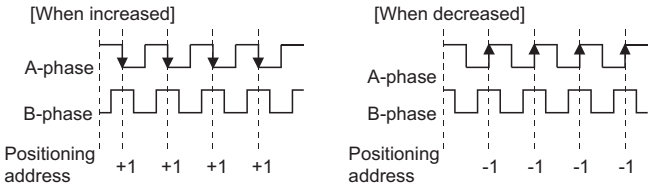
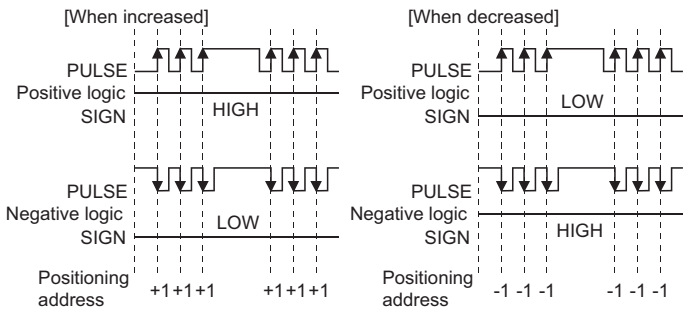
*7 Do not use 1A20, 1A19, 1A(B)15 and 1A(B)14 for other than the power supply of manual pulse generator.

List of input signal details

<table>
<tr><th colspan="3">Signal name</th><th>Pin No.</th><th>Signal details</th></tr>
<tr><td rowspan="3">Differential-output type</td><td rowspan="2">Manual pulse generator/ Incremental synchronous encoder A-phase/PULSE</td><td>HAH (A+)</td><td>1A17</td><td rowspan="4">(1) A-phase/B-phase
• Input the pulse signal from the manual pulse generator/incremental synchronous encoder A-phase and B-phase.
• If the A-phase leads the B-phase, the positioning address will increase at the rising and falling edges of each phase.
• If the B-phase leads the A-phase, the positioning address will decrease at the rising and falling edges of each phase.
(a) Magnification by 4
 

(b) Magnification by 2
 

(c) Magnification by 1
1) Positive logic
 

2) Negative logic
 
</td></tr>
<tr><td>HAL (A-)</td><td>1B17</td></tr>
<tr><td rowspan="2">Manual pulse generator/ Incremental synchronous encoder B-phase/SIGN</td><td>HBH (B+)</td><td>1A18</td></tr>
<tr><td>HBL (B-)</td><td>1B18</td></tr>
<tr><td rowspan="2">Voltage-output type/open-collector type</td><td rowspan="2">Manual pulse generator/ Incremental synchronous encoder A-phase/PULSE</td><td>HA (A)</td><td>1B19</td><td rowspan="2">(2) PULSE/SIGN
Input the pulse signal for counting the increased/decreased pulse in the pulse input (PULSE). Input the signal for controlling forward run and reverse run in the direction sign (SIGN).
1) "[Pr.151] Manual pulse generator/Incremental synchronous encoder input logic selection" is positive logic
• The motor will forward run when the direction sign is HIGH.
• The motor will reverse run when the direction sign is LOW.
2) "[Pr.151] Manual pulse generator/Incremental synchronous encoder input logic selection" is negative logic
• The motor will forward run when the direction sign is LOW.
• The motor will reverse run when the direction sign is HIGH.
 
</td></tr>
<tr><td>Manual pulse generator/ Incremental synchronous encoder B-phase/SIGN</td><td>HB (B)</td><td>1B20</td></tr>
</table>

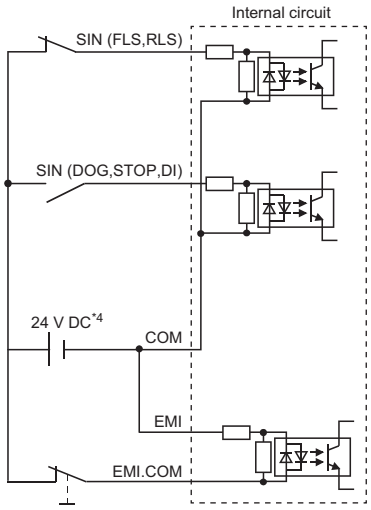
Signal name	Pin No.	Signal details	
Manual pulse generator power supply output (+ 5 V DC) (5 V)	1A20 1A19	• Power supply for manual pulse generator. (+ 5 V DC) Do not connect wires other than the signal wires of the manual pulse generator.	
Input signal (SIN)	1A1 to 1A5, 1B1 to 1B5, 2A1 to 2A5, 2B1 to 2B5	Upper limit signal (FLS)	• This signal is input from the limit switch installed at the upper limit position of the stroke. • Positioning will stop when this signal turns OFF. • When the home position return retry function is valid, this will be the upper limit for finding the proximity dog signal.
		Lower limit signal (RLS)	• This signal is input from the limit switch installed at the lower limit position of the stroke. • Positioning will stop when this signal turns OFF. • When the home position return retry function is valid, this will be the lower limit for finding the proximity dog signal.
		Proximity dog signal (DOG)	• This signal is used for detecting the proximity dog during the home position return. • The proximity dog OFF → ON is detected at the rising edge. • The proximity dog ON → OFF is detected at the falling edge.
		Stop signal (STOP)	• Input this signal to stop positioning. • When this signal turns ON, the RD77MS will stop the positioning being executed. After that, even if this signal is turned from ON to OFF, the system will not start.
		External command/ Switching signal (DI)	• Input a control switching signal during speed-position or position-speed switching control. • Use this signal as the input signal of positioning start, speed change request, skip request and mark detection from an external device. Set the function to use this signal in "[Pr.42] External command function selection". Set the signal in "[Pr.95] External command signal selection".
Common (COM)	1A6 1A7 1B6 1B7 2A6 2A7 2B6 2B7	• Common for upper/lower limit, proximity dog, stop, and external command/switching signals.	
Forced stop input signal (EMI)	1A8	• This signal is input when batch forced stop is available for all axes of servo amplifier. EMI ON (Opened): Forced stop EMI OFF (24 V DC input): Forced stop release	
Forced stop input signal common (EMI.COM)	1B8		
Manual pulse generator power supply output (+ 5 V DC) (5 V)	1A15 1B15	• Power supply for manual pulse generator (+ 5 V DC) This power supply is used for manual pulse generator. It must not be used except for the manual pulse generator power supply.	
Manual pulse generator power supply output (GND) (SG)	1A14 1B14	• Power supply for manual pulse generator (GND) This power supply is used for manual pulse generator. It must not be used except for the manual pulse generator power supply.	

RD77MS2 does not have Pin No. of 2A20 to 2A1 and 2B20 to 2B1.

Interface internal circuit

The outline diagrams of the internal circuits for the external device connection interface (for the Simple Motion module, axis 1) are shown below.

Interface between external input signals/forced stop input signals

Input or Output	Signal name		Pin No.	Wiring example	Description
Input	External input signal[*1] (Upper/Lower limit signal[*2])	SIN (FLS, RLS)	_ _1 to 5[*3]		Upper-limit signal, Lower-limit signal, Proximity dog signal, Stop signal, External command signal, Switching signal, Forced stop input signal
	External input signal[*1] (Proximity dog[*2], Stop, External command/Switching signal)	SIN (DOG, STOP, DI)			
	Common	COM	_ _6[*3]		
			_ _7[*3]		
	Forced stop input signal	EMI	1A8		
		EMI.COM	1B8		

*1 When using external input signal of servo amplifier, set "1" with "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", and "[Pr.118] DOG signal selection".

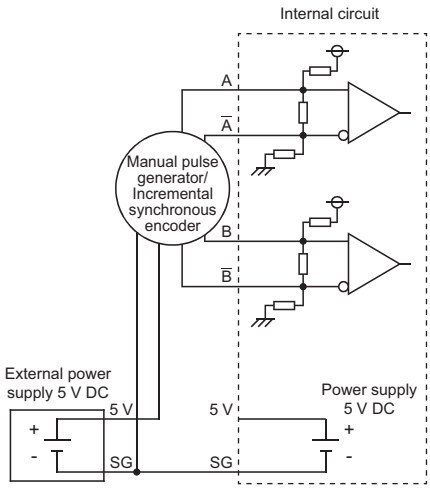
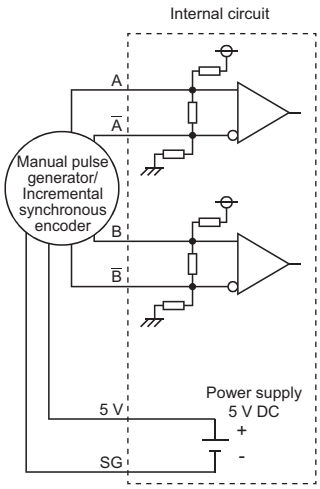
*2 Refer each servo amplifier manual and instruction manual for wiring of the input/output signals of servo amplifier.

*3 "_ _" indicates "1A", "1B", 2A ", or "2B".

*4 As for the 24 V DC polarity, both "+" and "-" are possible.

Manual pulse generator/Incremental synchronous encoder input

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

Input or Output	Signal name		Pin No.	Wiring example	
				When using the external power supply (Recommended)	When using the internal power supply
Input[*1,*2]	Manual pulse generator, A-phase/PULSE	HAH (A+)	1A17		
		HAL (A-)	1B17		
	Manual pulse generator, B-phase/SIGN	HBH (B+)	1A18		
		HBL (B-)	1B18		
Power supply	5 V[*3]		1A15 1B15		
	SG[*4]		1A14 1B14		

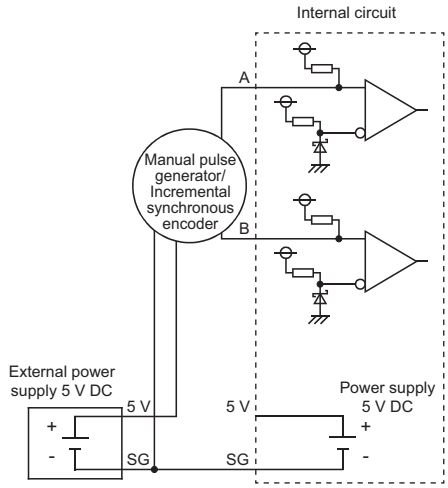
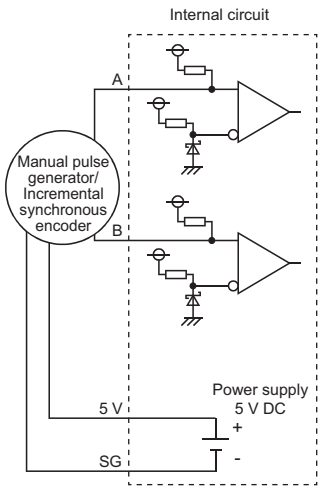
*1 Set "0: Differential-output type" in "[Pr.89] Manual pulse generator/Incremental synchronous encoder input type selection" if the manual pulse generator/incremental synchronous encoder of differential-output type is used.
The default value is "1: Voltage-output/open-collector type".

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

*3 The 5 V DC power supply from the Simple Motion module must not be used if a separate power supply is applied to the manual pulse generator/incremental synchronous encoder. If a separate power supply is used, use a stabilized power supply of voltage 5 V DC. Anything else may cause a failure.

*4 Be sure to connect the 0 V (-) of the manual pulse generator/incremental synchronous encoder and the SG of the Simple Motion module.

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

Input or Output	Signal name		Pin No.	Wiring example	
				When using the external power supply (Recommended)	When using the internal power supply
Input*1, *2	Manual pulse generator, A-phase/PULSE	HA (A)	1B19		
	Manual pulse generator, B-phase/SIGN	HB (B)	1B20		
Power supply	5 V*3		1A15 1B15		
	SG*4		1A14 1B14		

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

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

*3 The 5 V DC power supply from the Simple Motion module must not be used if a separate power supply is applied to the manual pulse generator/incremental synchronous encoder. If a separate power supply is used, use a stabilized power supply of voltage 5 V DC. Anything else may cause a failure.

*4 Be sure to connect the 0 V (-) of the manual pulse generator/incremental synchronous encoder and the SG of the Simple Motion module.

Wiring example for manual pulse generator/incremental synchronous encoder

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

Switch the input type of RD77MS by "[Pr.89] Manual pulse generator/Incremental synchronous encoder input type selection".

It is recommended to use the external 5 V power supply (5 V DC±5%) for the power supply of the manual pulse generator/incremental synchronous encoder. When using the external power supply, do not connect with the 5 V terminal of RD77MS.

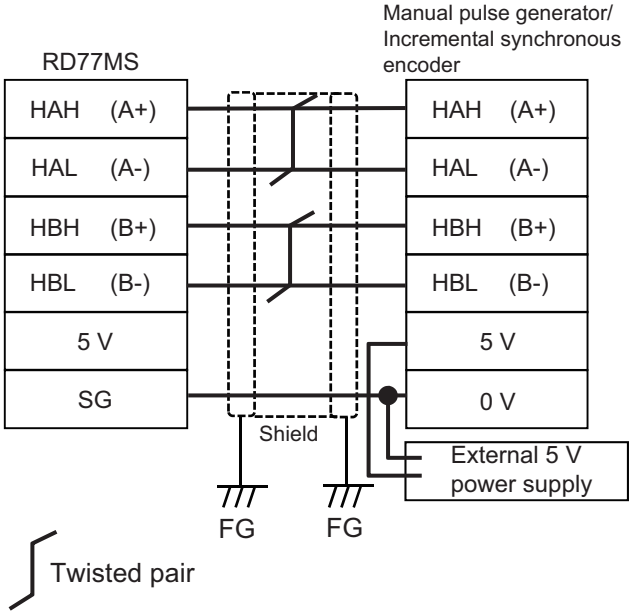
When using the internal power supply, connect the 5 V terminal of RD77MS and the 5 V (+) of the manual pulse generator/incremental synchronous encoder.

In either case, connect the 0 V (-) of the manual pulse generator/incremental synchronous encoder and the SG of RD77MS.

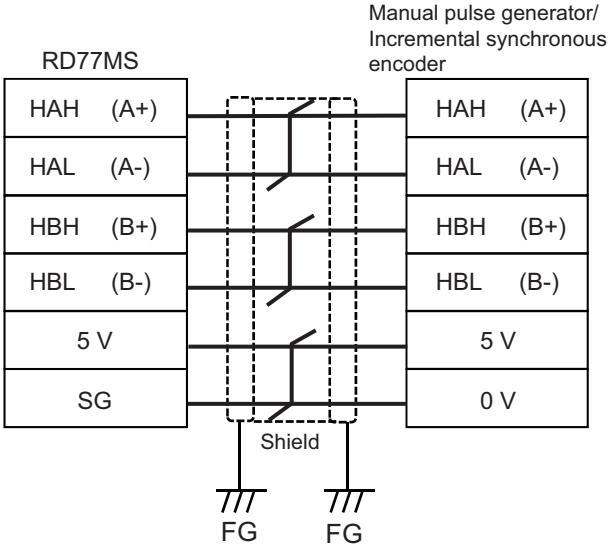
Do not use the 5 V terminal of RD77MS except for connecting the manual pulse generator/incremental synchronous encoder. It may cause a failure. Also, do not connect the manual pulse generator/incremental synchronous encoder whose current consumption exceeds 200 mA.

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

When using the external power supply (Recommended)

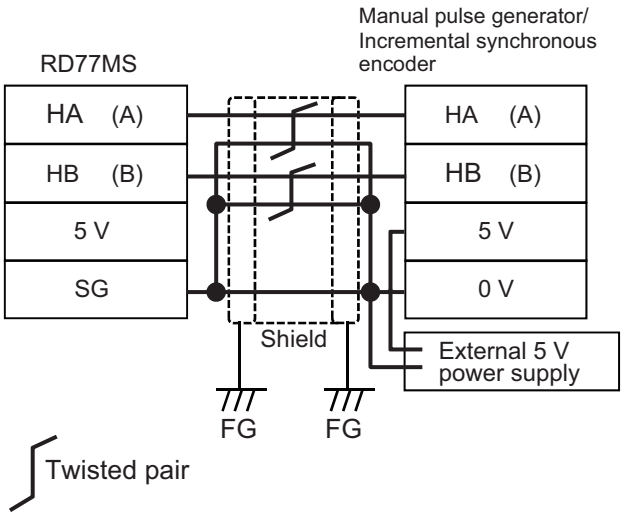


When using the internal power supply

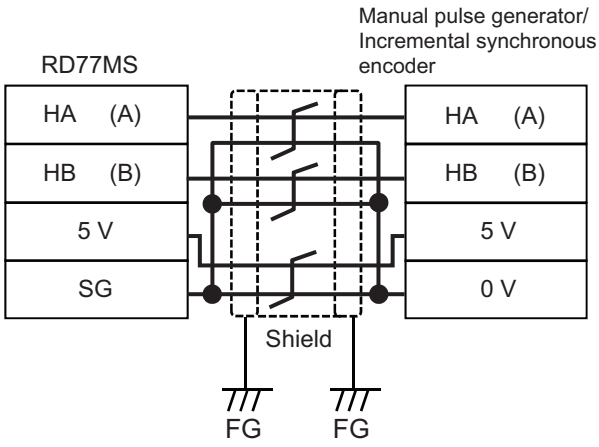


■Manual pulse generator/Incremental synchronous encoder of voltage output type/open-collector type

When using the external power supply (Recommended)



When using the internal power supply



6

6.3 Wiring of the RD77GF

This section describes wiring for when CC-Link IE Field Network is used.

Wiring methods

The following describes connection and disconnection of the Ethernet cable.

■Connecting the cable

1. Push the Ethernet cable connector into the Simple Motion module 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

*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. Note, however, that 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 "Troubleshooting Procedure" in the following manual and take corrective actions.
MELSEC iQ-R Simple Motion Module 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. 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 module or cables or malfunction due to poor contact.
- Do not touch the core of the cable-side or module-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 of the Ethernet cable and perform installation or removal. If the cable is pulled out while connected to the module, it may cause damage to the module or the cable, or may cause a malfunction due to poor connector contact.
- 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 (328.08 ft.). 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.
- When connecting the Ethernet cable, refer to the CC-Link IE Field Network Cable Installation Manual available from the website of CC-Link Partner Association (www.cc-link.org). The cable installation not following the contents of the manual may cause malfunction.

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 95 Component List of the RD77GF

■Ethernet cable

Use the Ethernet cable that meets the following standards.

Ethernet cable	Connector	Standard
Category 5e or higher, straight cable (double shielded, STP)	RJ45 connector	The following conditioning cables: • IEEE802.3 (1000BASE-T) • ANSI/TIA/EIA-568-B (Category 5e)

■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.

7 OPERATION EXAMPLES

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

7.1 Operation Examples

Overall configuration

The program examples show the programs of the following operations.

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

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

No.	Program name	Description
1	PLC READY signal [Y0] ON program	Notifies the Simple Motion module that the CPU module is normal before the start of positioning control.
2	All axis servo ON program	Enables the servo amplifier to operate.
3	Positioning start No. setting program	Sets the positioning data that are executed with a positioning start program. The operation example is the case when the start No. is for machine home position return or the positioning data No.1 of the axis 1 is used.
4	Positioning start program	Starts the machine home position return or the positioning control using positioning data.
5	JOG operation setting program	Sets the JOG operation speed.
6	JOG operation execution program	Starts the JOG operation.

Programming procedure

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

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

☞ Page 70 System setting, Page 71 Parameters

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

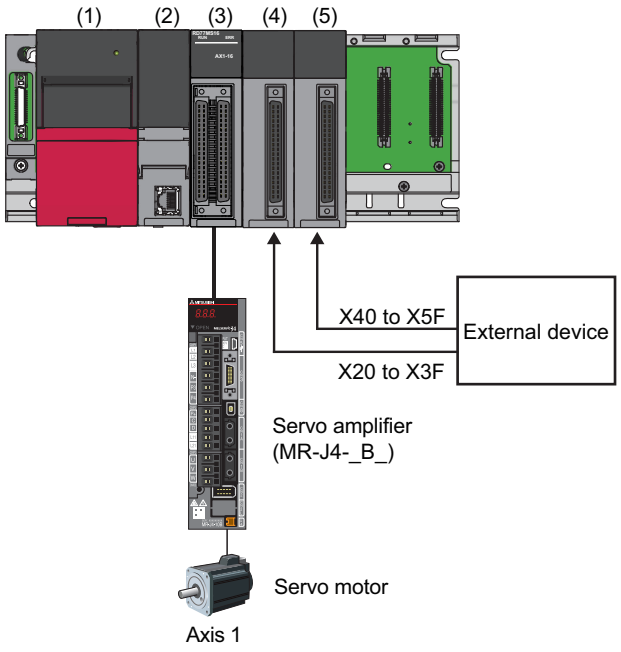
☞ Page 71 Positioning data

3. Program examples of each control

System configuration

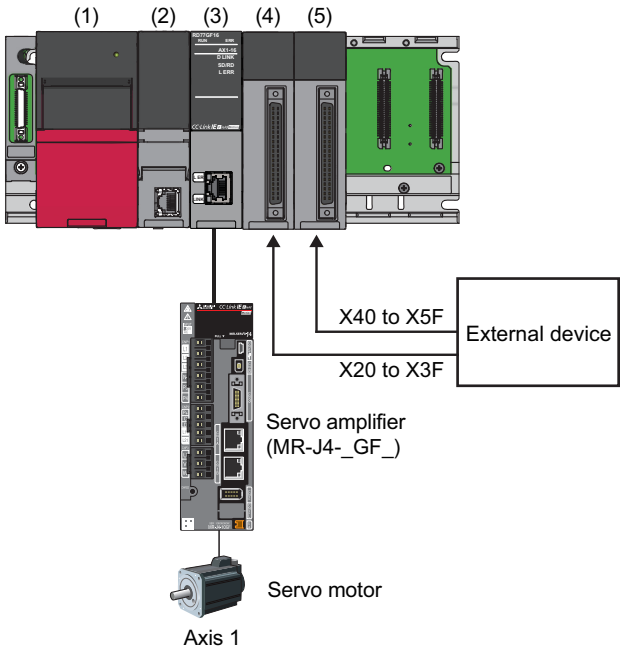
The following figure shows the system configuration used for the program examples in this section.

[RD77MS]



(1) R61P
(2) R16CPU
(3) RD77MS16 (X0 to X1F/Y0 to Y1F)
(4) RX40C7 (X20 to X3F)
(5) RX40C7 (X40 to X5F)

[RD77GF]



(1) R61P
(2) R16CPU
(3) RD77GF16 (X0 to X1F/Y0 to Y1F)
(4) RX10 (X20 to X3F)
(5) RY10R2 (X40 to X5F)

Initial setting details

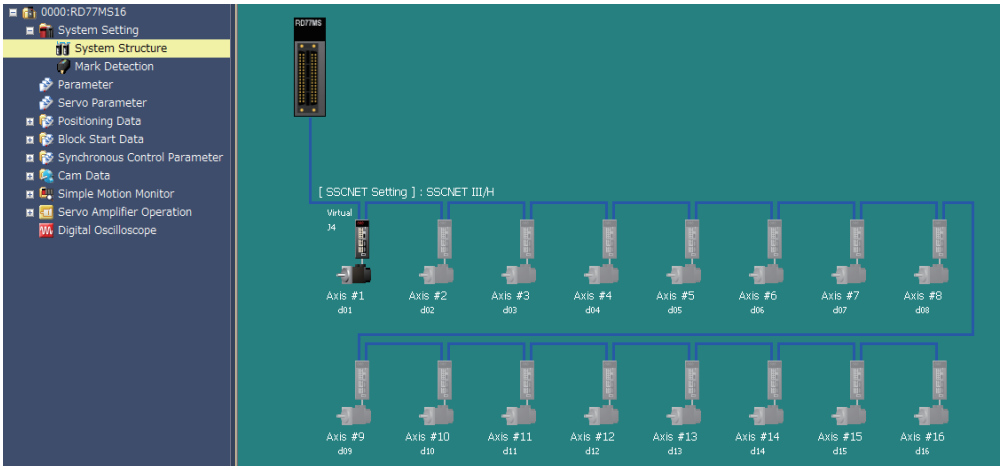
Set the system setting, parameters and positioning data using the engineering tool.

■System setting

The system setting is shown below.

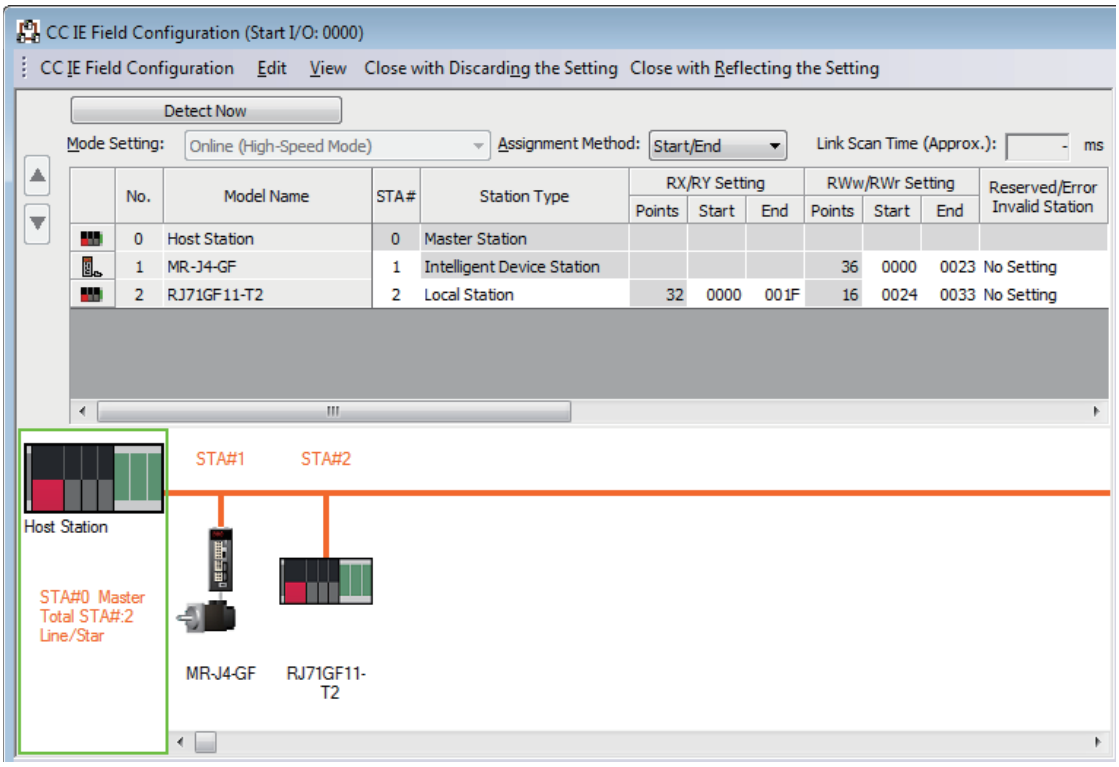
[RD77MS]

Configure the setting with "Simple Motion Module Setting Function".



[RD77GF]

Configure the setting on "CC IE Field Configuration" window.



■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 (0002H): Buffer memory
	[Pr.117] RLS signal selection: input type	2 (0002H): Buffer memory
	[Pr.118] DOG signal selection: input type	2 (0002H): Buffer memory
Home position return basic parameters	[Pr.46] Home position return speed	50.00 mm/min
	[Pr.47] Creep speed	15.00 mm/min
	[Pr.48] Home position return retry	1: Retry home position return with limit switch

■Positioning data

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

Setting item (Axis 1 Positioning data)	Setting value (Positioning data No.1)	Setting value (Positioning data No.2)	Setting value (Positioning data No.3)
Operation pattern	0: Positioning complete		
Control method	01h: ABS Linear 1 1-axis linear control (ABS)	06h: FWD V/P Speed-position switching control (forward run)	08h: FWD P/V Position-speed switching control (forward run)
Axis to be interpolated	—		
Acceleration time No.	0: 1000		
Deceleration time No.	0: 1000		
Positioning address	-10000.0 μm	2500.0 μm	2000.0 μm
Arc address	—		
Command speed	20.00 mm/min	180.00 mm/min	180.00 mm/min
Dwell time	300 ms	0 ms	300 ms
M code	9843	0	0
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 program examples in this section. I/O signals or buffer memory areas of the modules shown in the system configuration are described in the programs using the labels.

For details on the global labels, refer to the following.

MELSEC iQ-R Programming Manual (Program Design)

■Module label

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

[RD77MS example]

Device name	Device	Label name	Signal name
	Axis 1		
I/O signals	X1	RD77_1.bSynchronizationFlag	Synchronization flag
	DX1	RD77_1.bSynchronizationFlag_D	Synchronization flag
	X0	RD77_1.bReady	READY
	X10	RD77_1.bnBusy[0]	BUSY signal
	Y0	RD77_1.bPLC_Ready	PLC READY
	Y1	RD77_1.bAllAxisServoOn	All axis servo ON
Buffer memory	U0\G2417.3	RD77_1.stnAxMntr[0].uStatus.3	Axis 1 Home position return request flag
	U0\G2417.D	RD77_1.stnAxMntr_D[0].uStatus_D.D	Axis 1 Error detection
	U0\G2417.F	RD77_1.stnAxMntr_D[0].uStatus_D.F	Axis 1 Positioning complete
	U0\G4326	RD77_1.stnAxCtrl1_D[0].udVP_NewMovementAmount_D	Axis 1 Speed-position switching control movement amount change register
	U0\G4328	RD77_1.stnAxCtrl1_D[0].uEnableVP_Switching_D	Axis 1 Speed-position switching enable flag
	U0\G4330	RD77_1.stnAxCtrl1_D[0].udPV_NewSpeed_D	Axis 1 Position-speed switching control speed change register
	U0\G4332	RD77_1.stnAxCtrl1_D[0].uEnablePV_Switching_D	Axis 1 Position-speed switching enable flag

■Global label

The following table lists the global labels, which are created by a user if necessary, used for the program examples in this section. Set the following in the global label of the engineering tool.

[RD77MS example]

- External input (command)

	Label Name	Data Type		Class	Assign (Device/Label)	English(Display Target)
1	bAllAxisServoOnReq	Bit	...	VAR_GLOBAL	X4F	All axis servo ON command
2	bInputChangePositionSpeedSwitchingSpeedReq	Bit	...	VAR_GLOBAL	X43	Speed change command
3	bInputPositionSpeedSwitchingDisableReq	Bit	...	VAR_GLOBAL	X42	Position-speed switching prohibit command
4	bInputPositionSpeedSwitchingEnableReq	Bit	...	VAR_GLOBAL	X41	Position-speed switching enable command
5	bInputPositionSpeedSwitchingReq	Bit	...	VAR_GLOBAL	X40	Position-speed switching operation command
6	bInputReverseJogStartReq	Bit	...	VAR_GLOBAL	X2F	Reverse run JOG
7	bInputForwardJogStartReq	Bit	...	VAR_GLOBAL	X2E	Forward run JOG
8	bInputSetJogSpeedReq	Bit	...	VAR_GLOBAL	X2D	JOG operation speed setting command
9	bInputStartPositioningReq	Bit	...	VAR_GLOBAL	X2B	Positioning start command
10	bInputStartAdvancedPositioningReq	Bit	...	VAR_GLOBAL	X2A	High-level positioning control start command
11	bInputChangeSpeedPositionSwitchingMovementAmount	Bit	...	VAR_GLOBAL	X29	Movement amount change command
12	bInputSpeedPositionSwitchingDisableReq	Bit	...	VAR_GLOBAL	X28	Speed-position switching prohibit command
13	bInputSpeedPositionSwitchingEnableReq	Bit	...	VAR_GLOBAL	X27	Speed-position switching enable command
14	bInputSpeedPositionSwitchingReq	Bit	...	VAR_GLOBAL	X26	Speed-position switching operation command
15	bInputSetStartPositioningNoReq	Bit	...	VAR_GLOBAL	X25	Positioning start No. setting command
16	bInputFastOPRStartReq	Bit	...	VAR_GLOBAL	X24	Fast home position return command
17	bInputOPRStartReq	Bit	...	VAR_GLOBAL	X23	Machine home position return command

- Internal relay, data device (The settings of Assign (Device/Label) are not required because the unused internal relay and data device are automatically assigned.)

	Label Name	Data Type		Class	Assign (Device/Label)	English(Display Target)
1	bJOG_bENO	Bit	...	VAR_GLOBAL		Execution status (JOG/Inching FB)
2	bJOG_bOK	Bit	...	VAR_GLOBAL		Normal termination (JOG/Inching FB)
3	bJOG_bErr	Bit	...	VAR_GLOBAL		Error completion (JOG/Inching FB)
4	uJOG_uErrId	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL		Error code (JOG/Inching FB)
5	bBasicParamSetComp	Bit	...	VAR_GLOBAL		Basic parameter 1 setting complete
6	udMovementAmount	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL		Speed-position switching control movement amount
7	udSpeed	Double Word [Signed]	...	VAR_GLOBAL		Position-speed switching control speed
8	bStartPositioning_bENO	Bit	...	VAR_GLOBAL		Execution status (Positioning start FB)
9	bStartPositioning_bOK	Bit	...	VAR_GLOBAL		Normal termination (Positioning start FB)
10	bStartPositioning_bErr	Bit	...	VAR_GLOBAL		Error completion (Positioning start FB)
11	uStartPositioning_uErrId	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL		Error code (Positioning start FB)
12	bFastOPRStartReq	Bit	...	VAR_GLOBAL		Fast home position return command
13	bFastOPRStartReq_H	Bit	...	VAR_GLOBAL		Fast home position return command storage
14	bDuringJogInchingOperation	Bit	...	VAR_GLOBAL		In-JOG/Inching operation flag
15	udJogOperationSpeed	Double Word [Unsigned]/Bit String [32-bit]	...	VAR_GLOBAL		JOG operation speed
16	uInchingMovementAmount	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL		Inching movement amount
17	bInitializeParameterReq	Bit	...	VAR_GLOBAL		Parameter initialization command
18	bWriteFlashReq	Bit	...	VAR_GLOBAL		Flash ROM write command
19	bABRSTReq	Bit	...	VAR_GLOBAL		Absolute position restoration command
20	bPositioningStartReq	Bit	...	VAR_GLOBAL		Positioning start command
21	uPositioningStartNo	Word [Unsigned]/Bit String [16-bit]	...	VAR_GLOBAL		Positioning start No.
22	bDuringMPGOperation	Bit	...	VAR_GLOBAL		Manual pulse generator operating flag
23	bOPRParamSetComp	Bit	...	VAR_GLOBAL		Home position return basic parameter setting complete

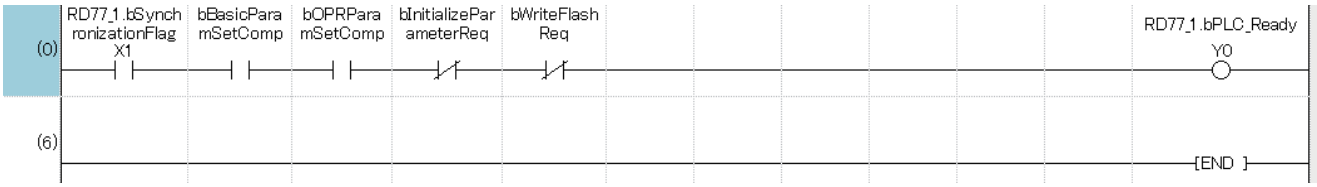
Program example

The program examples use the module function blocks (FBs) and module labels displayed in "Module POU".

For details on module function blocks, refer to "Simple Motion Module FB" in the following manual.

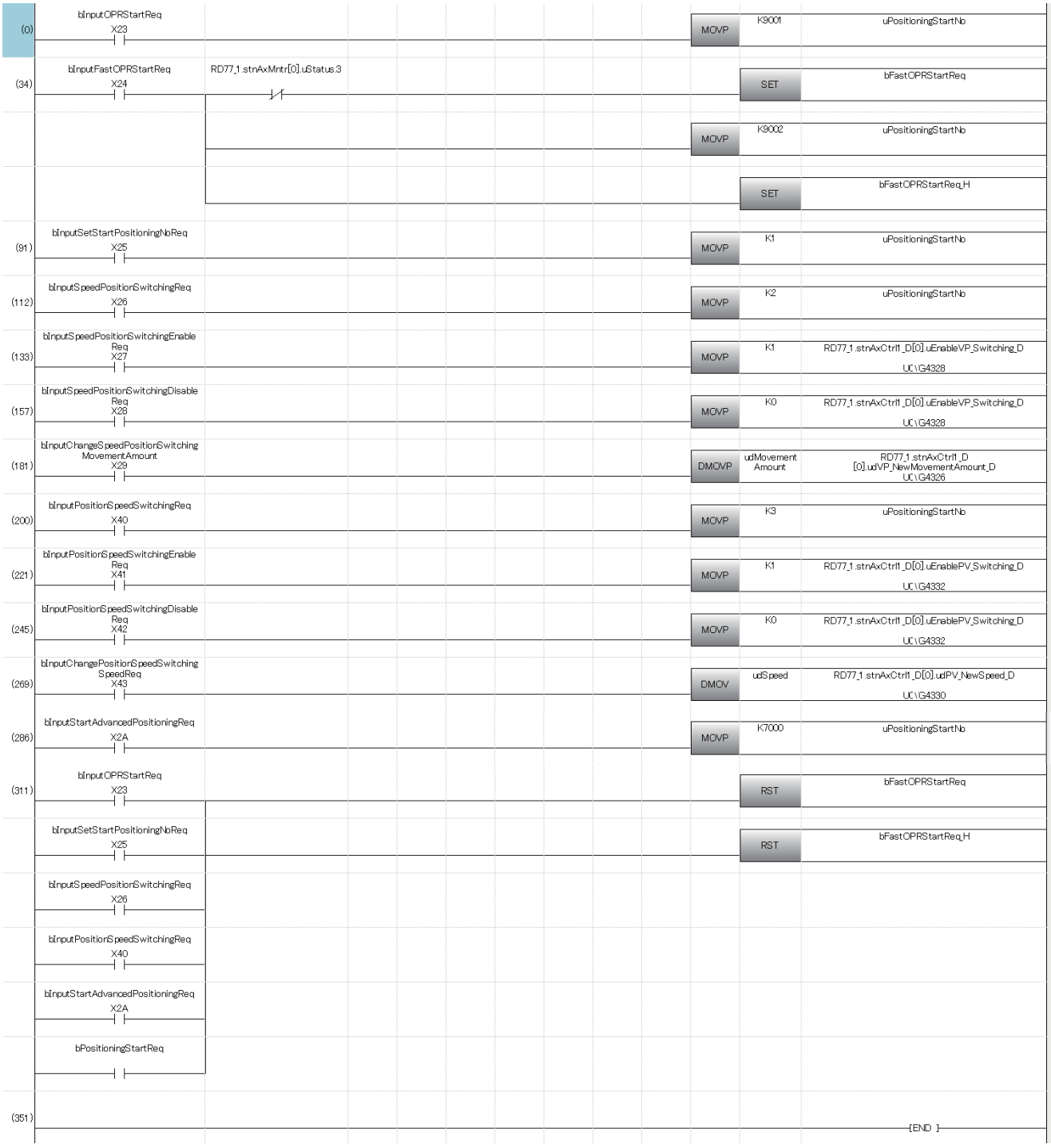
MELSEC iQ-R Simple Motion Module Function Block Reference

■PLC READY signal [Y0] ON program



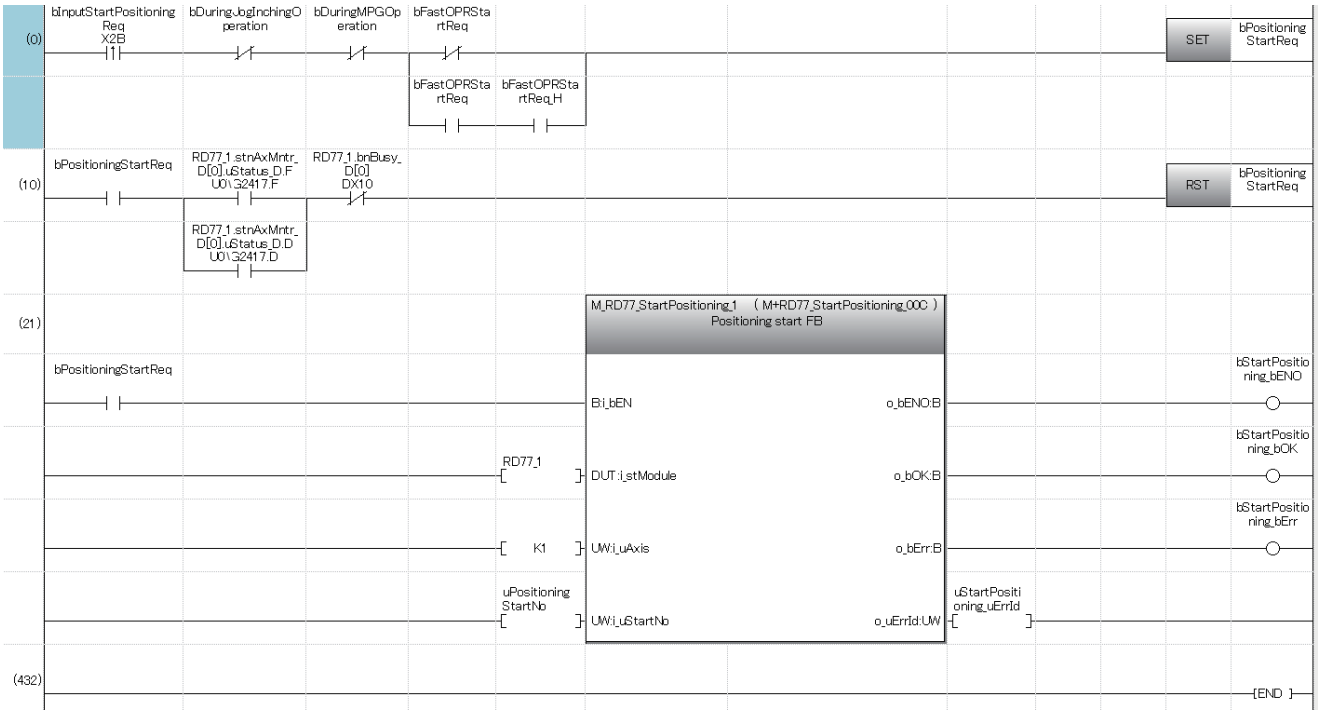
■All axis servo ON signal [Y1] ON program

■Positioning start No. setting program

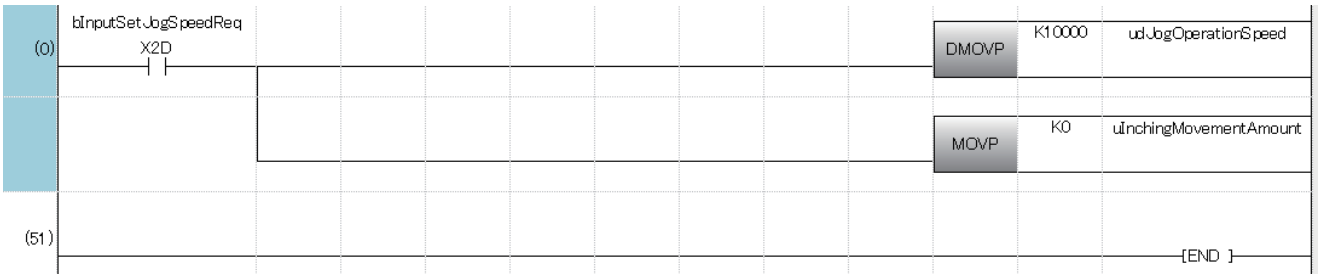


■Positioning start program

[RD77MS example]



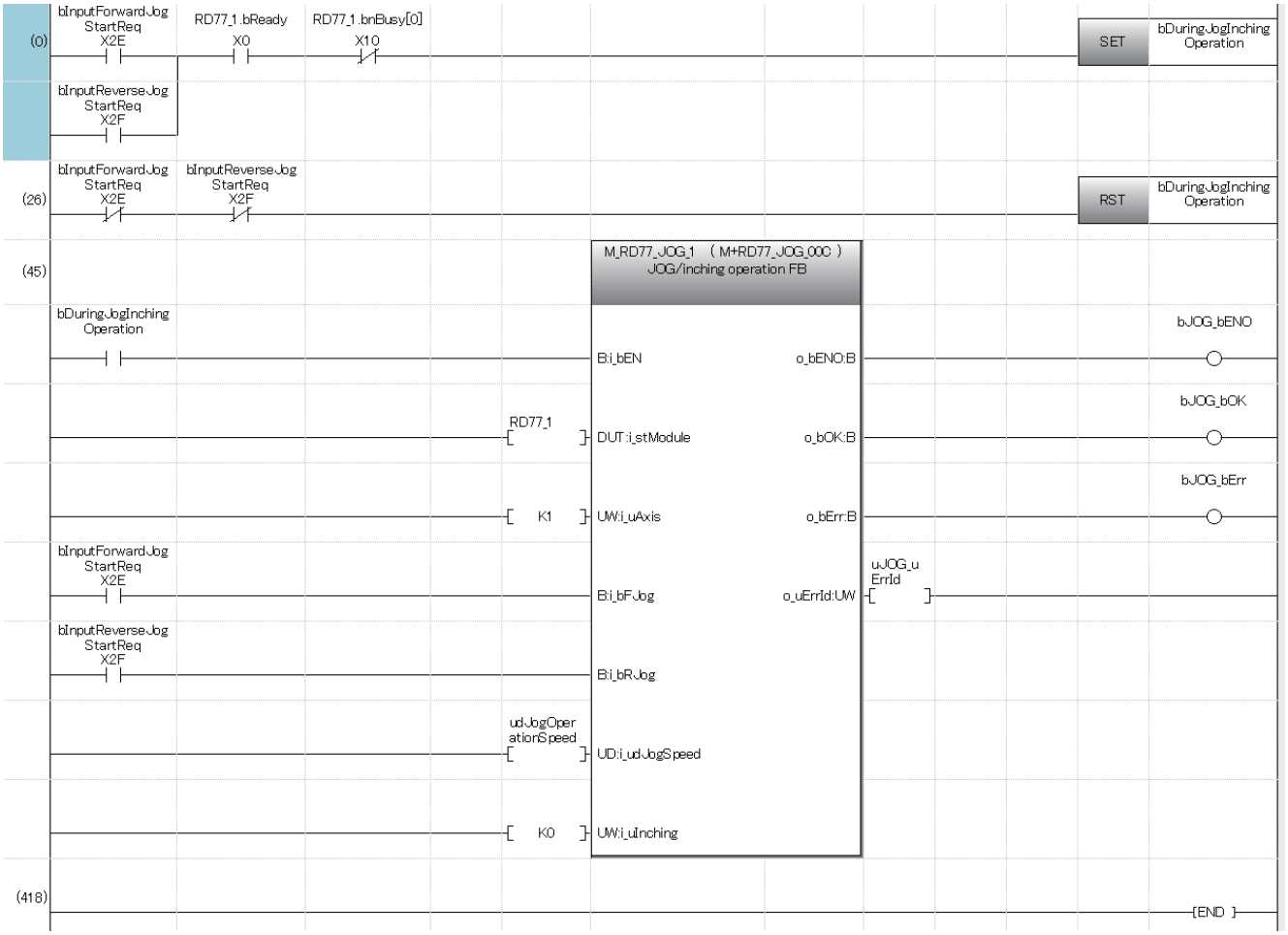
■JOG operation setting program



7

■JOG operation execution program

[RD77MS example]



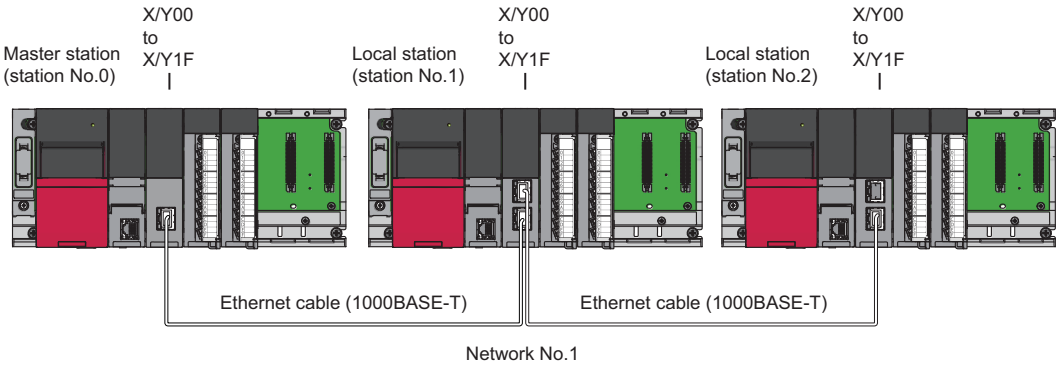
7.2 Communication Examples of the RD77GF

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.

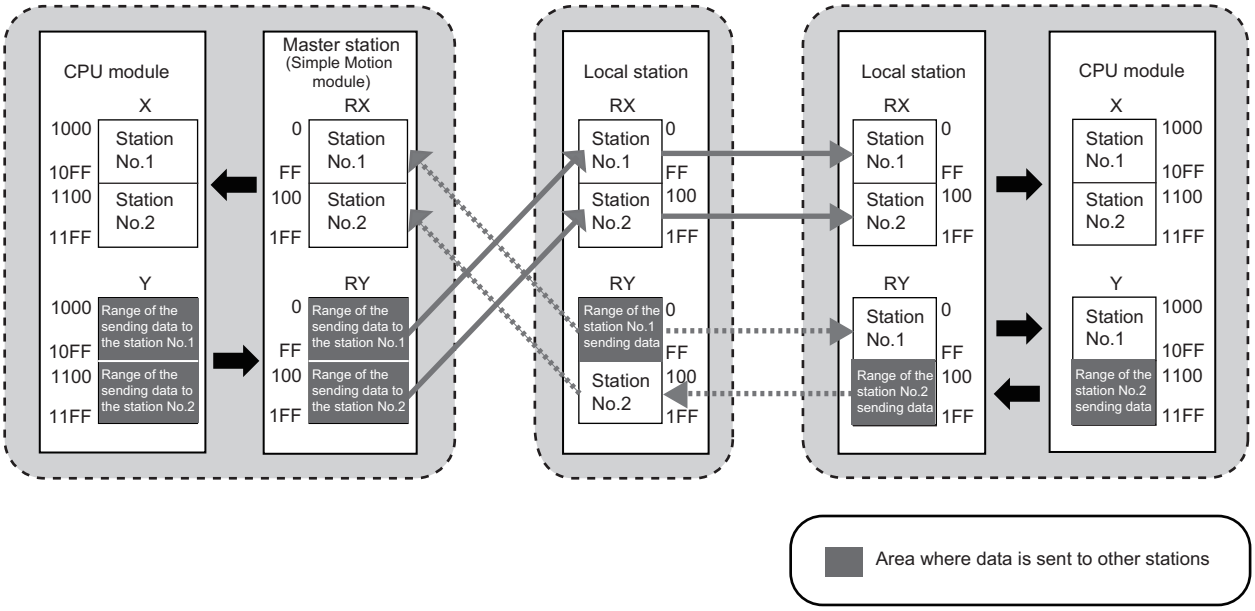
- Power supply module: R61P
- CPU module: R04CPU
- Master module: RD77GF16
- Local module: RJ71GF11-T2
- Input module: RX10
- Output module: RY10R2



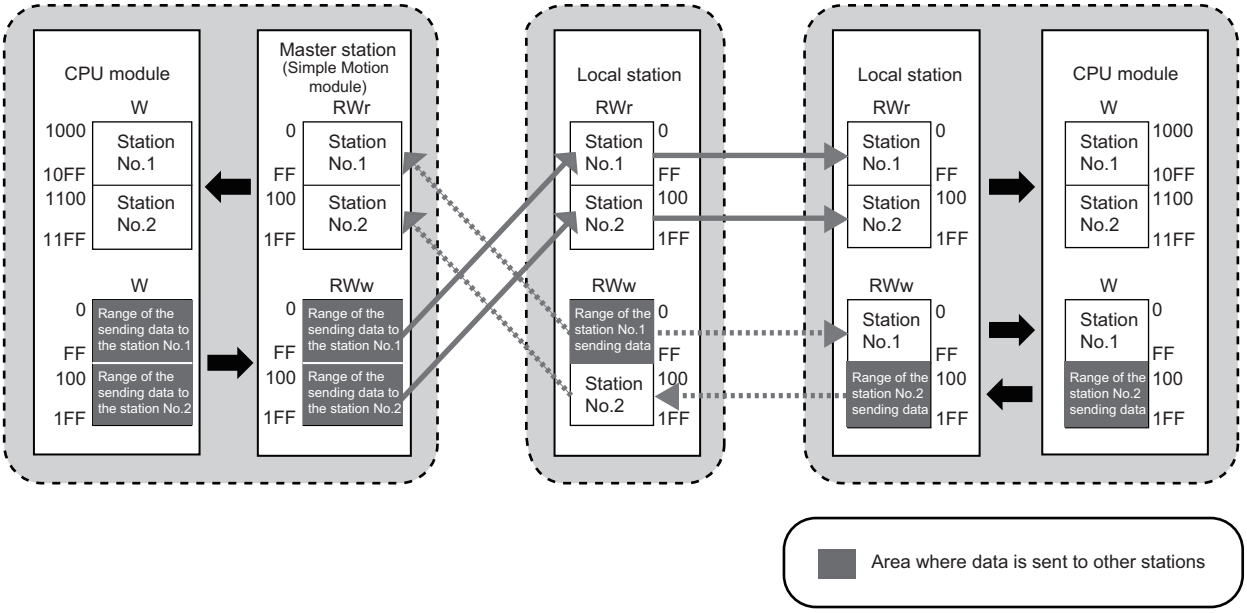
Link device assignment

256 points are assigned to each station.

■RX/RY assignment

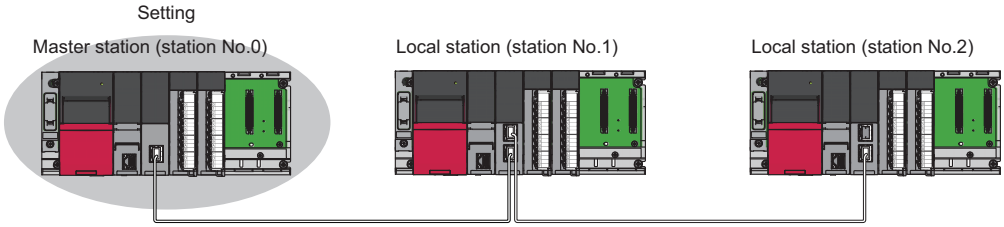


■RWr/RWw assignment



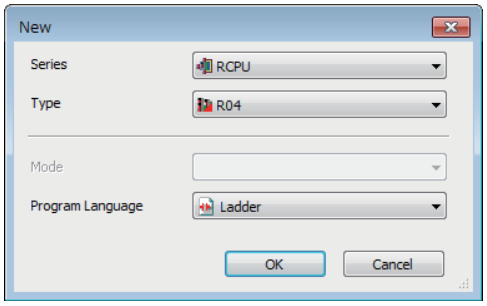
Setting in the master station

Connect the engineering tool to the CPU module on the master station and set parameters.



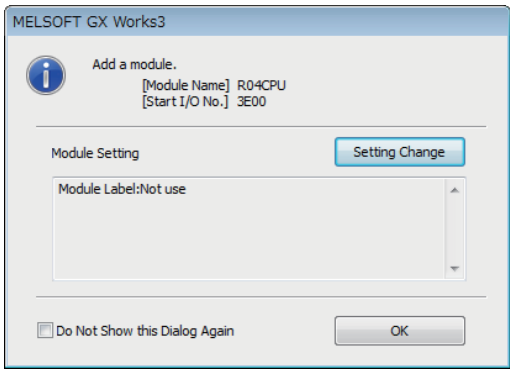
1. Set the CPU module in the following item.

[Project] ⇨ [New]



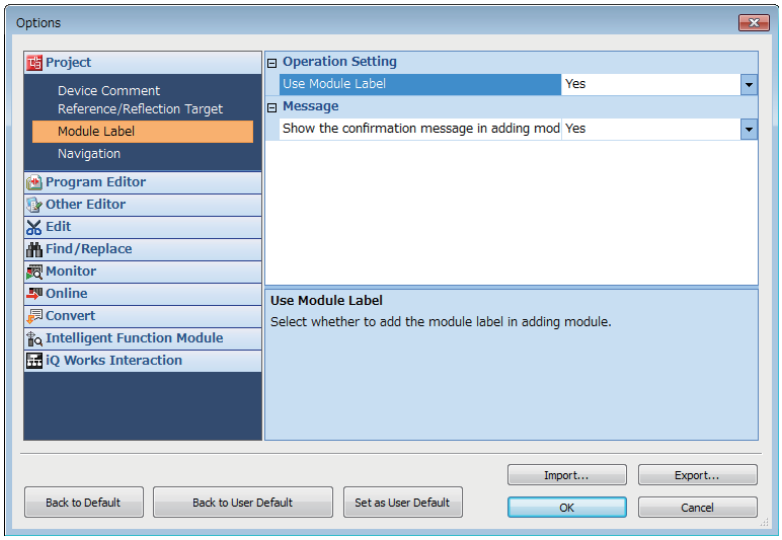
2. Click the [Setting change].

Click the [Setting change] button.



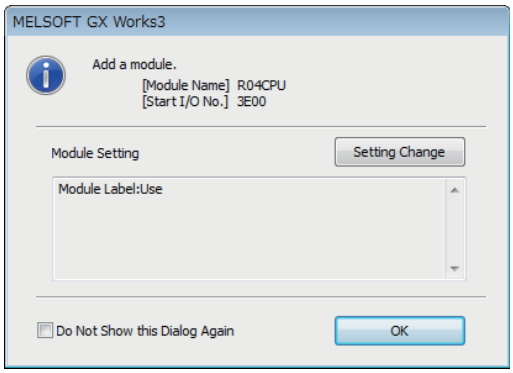
3. Add the module labels of the CPU module.

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



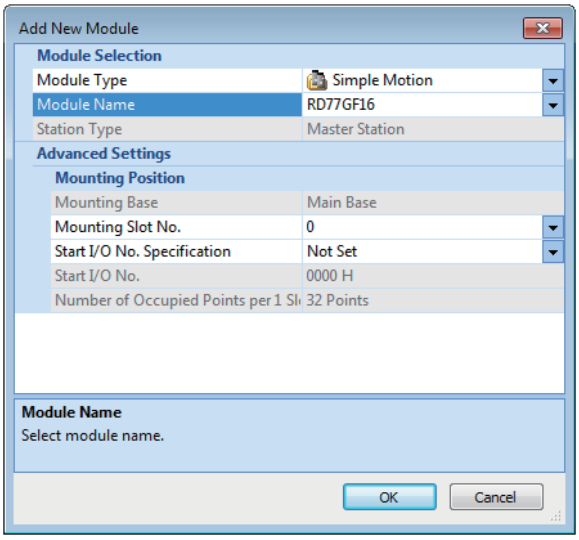
4. Confirm the "Module Label: Use" is set, then add the CPU module.

Click the [OK] button.



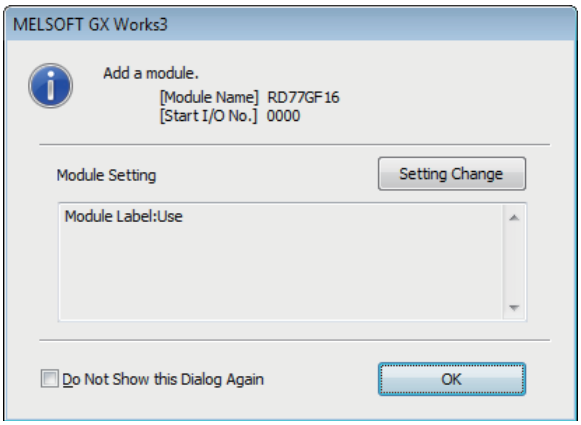
5. Set the Simple Motion module in the following item.

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



6. Click the [OK] button to add the Simple Motion 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.

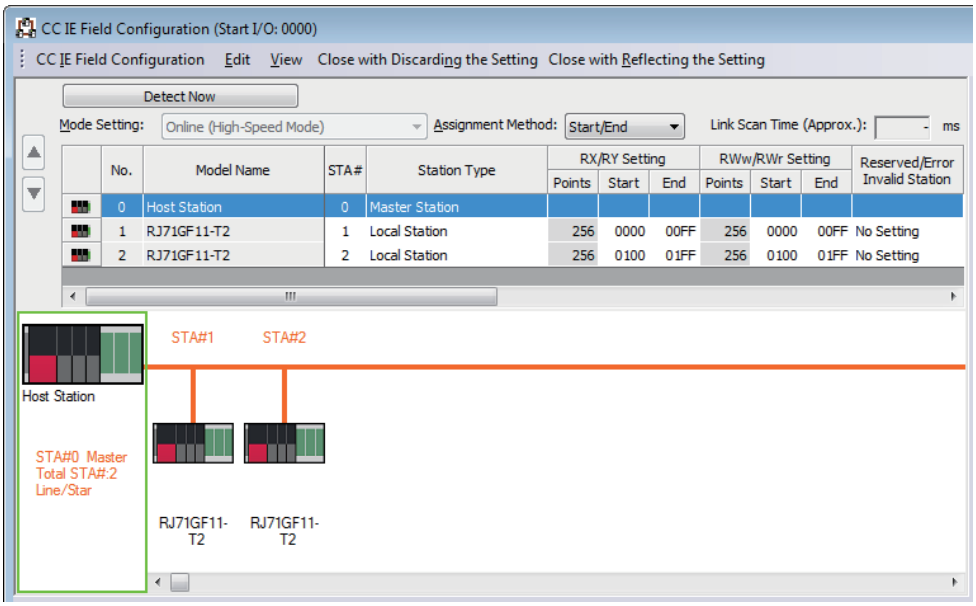
Navigation window ⇨ "Parameter" ⇨ "Module Information" ⇨ "RD77GF16" ⇨ "Module Parameter (Network)" ⇨ "Required Settings"

Setting Item

Item	Setting
Station Type	
Station Type	Master Station
Network No.	
Network No.	1
Station No.	
Setting Method	Parameter Editor
Station No.	0
Parameter Setting Method	
Setting Method of Basic/Application Settings	Parameter Editor

8. Set the network configuration in the following item.

Navigation window ⇨ "Parameter" ⇨ "Module Information" ⇨ "RD77GF16" ⇨ "Module Parameter (Network)" ⇨ "Basic Settings" ⇨ "Network Configuration Settings"



9. Set the refresh settings in the following item.

Navigation window ⇨ "Parameter" ⇨ "Module Information" ⇨ "RD77GF16" ⇨ "Module Parameter (Network)" ⇨ "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

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

[Online] ⇨ [Write to PLC]

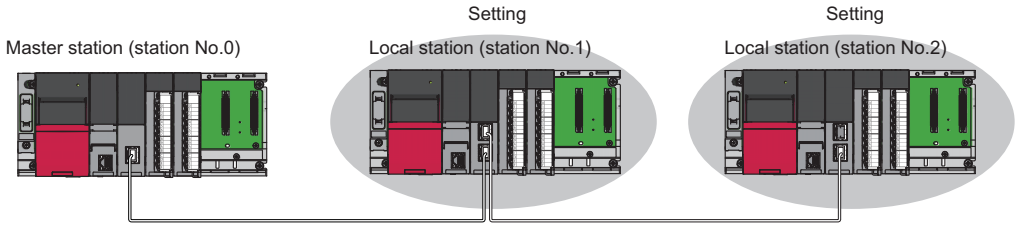
Point

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

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

Setting in the local station

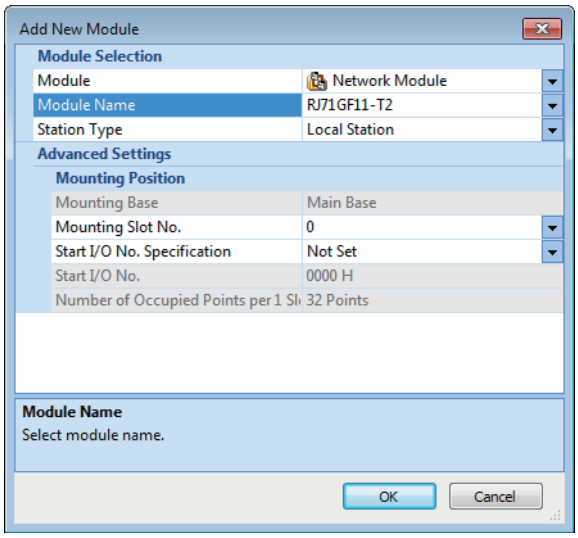
Connect the engineering tool to the CPU module on the local station and set parameters. Set the station No.1 and 2 to the same setting.



1. Set the CPU module and add a module label of the CPU module. The setting method of the CPU module and addition method of the module label are the same as those of the master station. (☞ Page 79 Setting in the master station)

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

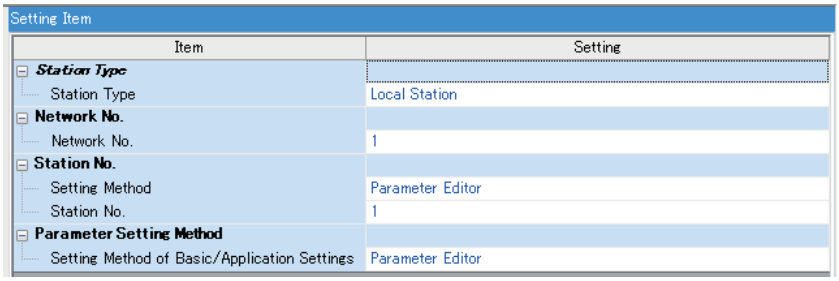
Navigation window ⇨ "Parameter" ⇨ "Module Information" ⇨ Right-click ⇨ [Add New Module]



3. Add a module label of the master/local module. The addition method of the module label is the same as that of the master station. (☞ Page 79 Setting in the master station)

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

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



5. 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

6. 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 "Basic Settings" in the following manual.

📖MELSEC iQ-R CC-Link IE Field Network User's Manual (Application)

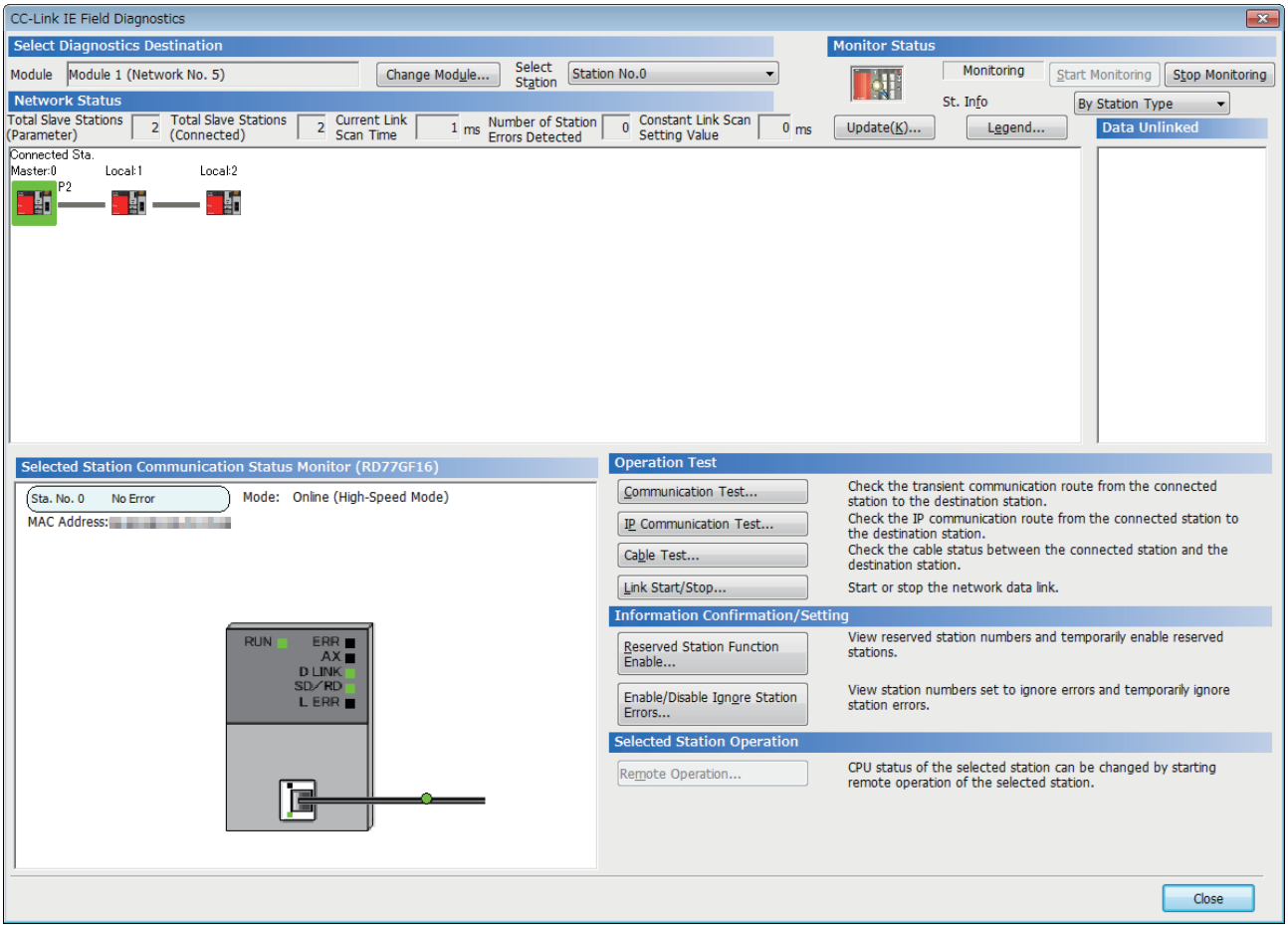
Checking the network status

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

1. Connect the engineering tool to the CPU module 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. (MELSEC iQ-R Simple Motion Module User's Manual (Network))

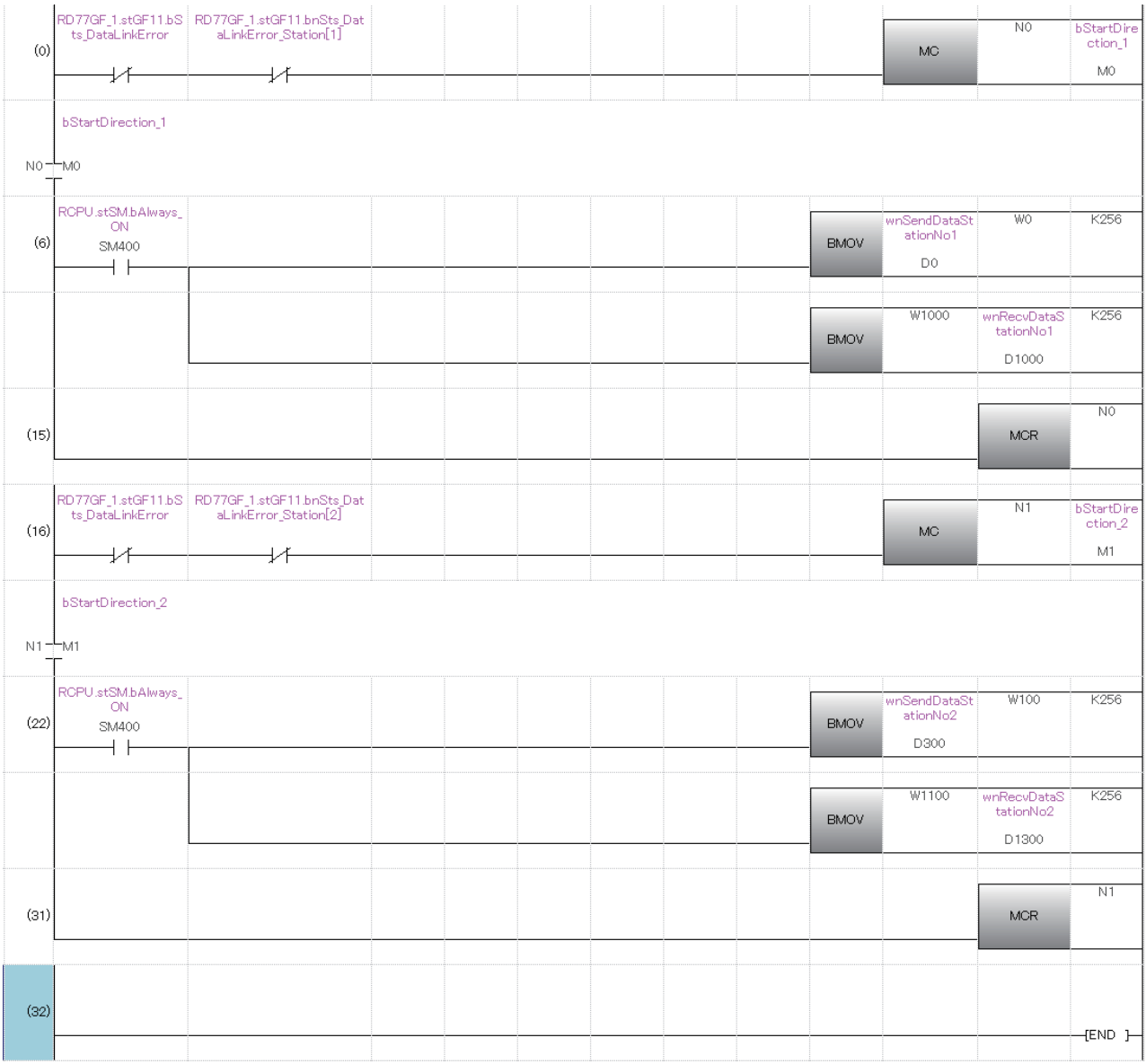
List of labels to be used

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

• Master station (station No.0)

Classification	Label name	Description	Device
Module label	RD77GF_1.stGF11.bSts_DataLinkError	Data link error status of own station	SB0049
	RD77GF_1.stGF11.bnSts_DataLinkError_Station[1]	Data link status of each station (station No.1)	SW00B0.0
	RD77GF_1.stGF11.bnSts_DataLinkError_Station[2]	Data link status of each station (station No.2)	SW00B0.1
Label to be defined	Define global labels as shown below: Label Name / Data Type / Class / Assign (Device/Label) 1 bStartDirection_1 / Bit / VAR_GLOBAL / M0 2 bStartDirection_2 / Bit / VAR_GLOBAL / M1 3 wnSendDataStationNo1 / Word [Signed](0..255) / VAR_GLOBAL / D0 4 wnRecvDataStationNo1 / Word [Signed](0..255) / VAR_GLOBAL / D1000 5 wnSendDataStationNo2 / Word [Signed](0..255) / VAR_GLOBAL / D300 6 wnRecvDataStationNo2 / Word [Signed](0..255) / VAR_GLOBAL / D1300		

Program example



(6) Communication program with station No.1
(22) Communication program with station No.2

Point

If no response is received for several link scans, the "Data link status of each station" (SW00B0 to SW00B7) is determined to be a cyclic transmission faulty station.

APPENDICES

Appendix 1 Component List of the RD77MS

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

No.	Part name	Type	Remarks
1	Simple Motion module	RD77MS2	RD77MS□ Number of control axes MS: SSCNETⅢ(/H) model
		RD77MS4	
		RD77MS8	
		RD77MS16	
2	Servo amplifier	—	—
3	Manual pulse generator	—	Recommended: MR-HDP01 (Manufactured by Mitsubishi Electric Corporation) Operation has been checked: UFO-M2-0025-2Z1-B00E (Manufactured by Nemicon Corporation)
4	SSCNETⅢ cable	—	Cables are needed for connecting the Simple Motion module with a servo amplifier, or between servo amplifiers. (☞ Page 87 Reference product)
5	External input signal cable	—	Cables are needed for connecting the Simple Motion module with an external device. (Prepare them referring to the manuals for the connected devices and information given in the following. ☞ Page 59 Signal layout for external input connection connector)

Reference product

Connection cable

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

For long distance cables over 50 m (164.04 ft.) and cables with an ultra-long bending life, refer to SSCNETⅢ cables manufactured by Mitsubishi Electric System & Service Co., Ltd. (☞ Page 88 SSCNETⅢ cables manufactured by Mitsubishi Electric System & Service Co., Ltd (SC-J3BUS_M-C))

■SSCNETⅢ cable

_ = Cable length

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

Model name		Cable length [m (ft.)]	Description
MR-J3BUS_M (Standard cord for inside panel)	MR-J3BUS015M	0.15 (0.49)	• Simple Motion module ↔ MR-J5(W)-B/MR-J4(W)-B/MR-JE-B(F)/MR-J3(W)-B • MR-J5(W)-B/MR-J4(W)-B/MR-JE-B(F)/MR-J3(W)-B ↔ MR-J5(W)-B/MR-J4(W)-B/MR-JE-B(F)/MR-J3(W)-B
	MR-J3BUS03M	0.3 (0.98)	
	MR-J3BUS05M	0.5 (1.64)	
	MR-J3BUS1M	1 (3.28)	
	MR-J3BUS3M	3 (9.84)	
MR-J3BUS_M-A (Standard cable for outside panel)	MR-J3BUS5M-A	5 (16.40)	
	MR-J3BUS10M-A	10 (32.81)	
	MR-J3BUS20M-A	20 (65.62)	
MR-J3BUS_M-B (Long distance cable)	MR-J3BUS30M-B	30 (98.43)	
	MR-J3BUS40M-B	40 (131.23)	
	MR-J3BUS50M-B	50 (164.04)	

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■SSCNETⅢ cables manufactured by Mitsubishi Electric System & Service Co., Ltd (SC-J3BUS_M-C)

Cables are available in lengths from 1 m (3.28 ft.) to 100 m (328.08 ft.) in increments of 1 m (3.28 ft.). A number indicating the cable length (1 to 100) is included in the "_" portion of the model name.

Model name	Cable length [m (ft.)]	Bending life	Description
SC-J3BUS_M-C	1 to 100 (3.28 to 328.08)	Ultra-long	Long distance cable

Point

- For details of the SSCNETⅢ cables, consult your nearest Mitsubishi representative.
- Do not look directly at the light generated by the CN1A and CN1B connectors of the servo amplifier or the tip of the SSCNETⅢ cable. The light can cause discomfort if it enters the eyes.

Connection connector

The connector for the external input wiring.

[External input wiring connector]

Part name	Specification
Applicable connector	A6CON1, A6CON2, A6CON4 (Sold separately)
Applicable wire size	0.3 mm^2 (When A6CON1 and A6CON4 are used), AWG28 to AWG24 (When A6CON2 is used)

Specifications of recommended manual pulse generator

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

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

Manual pulse generator that the operation has been checked

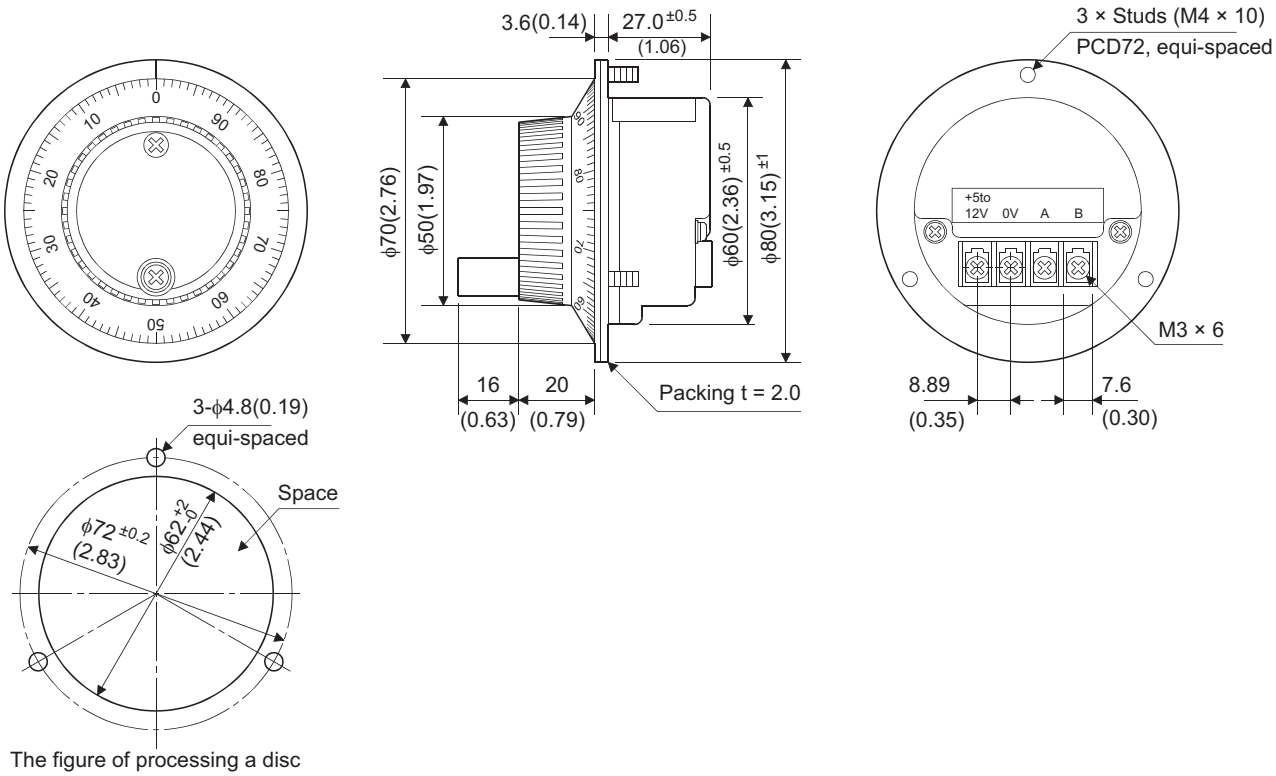
Manufacturer	Model name
Nemicon Corporation*1	UFO-M2-0025-2Z1-B00E

*1 Contact: https://www.nemicon.co.jp/en/

External dimension drawing of manual pulse generator

MR-HDP01 (Manufactured by Mitsubishi Electric Corporation)

[Unit: mm (inch)]



The figure of processing a disc

Serial absolute synchronous encoder specifications

Item	Specifications
Model name	Q171ENC-W8[*1]
Ambient temperature	-5 to 55℃
Resolution	4194304 pulses/rev
Transmission method	Serial communications (Connected to MR-J4-B-RJ)
Direction of increasing addresses	CCW (viewed from end of shaft)
Protective construction	Dustproof/Waterproof (IP67: Except for the shaft-through portion.)
Permitted speed at power ON	3600 r/min
Permitted speed at power OFF[*2]	500 r/min
Permitted axial loads	Radial load: Up to 19.6 N, Thrust load: Up to 9.8 N
Runout at input shaft tip	0.02 mm (0.00079 inch) or less, (15 mm (0.59 inch) from tip)
Start friction torque	0.04 N•m (20℃)
Recommended coupling	Bellows coupling
Permitted angular acceleration	40000 rad/s^2
Vibration resistance	5 G (50 to 200 Hz)
Shock resistance	50 G (11 ms or less)
Internal current consumption [A]	0.25
Mass [kg]	0.6
Connecting cable [m (ft.)]	Q170ENCCBL_M (_ = Cable length: 2 (6.56), 5 (16.40), 10 (32.81), 20 (65.62), 30 (98.43), 50 (164.04))
Communications method	Differential driver/receiver
Transmission distance	Up to 50 m (164.04 ft.)

*1 If an "o-ring" is required, the user should purchase it separately.

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

Point

The serial absolute synchronous encoder backs up the absolute position with the battery for back up of absolute position data of the servo amplifier (MR-J4-B-RJ) it is connected to.

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

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

Serial absolute synchronous encoder cable

For the serial absolute synchronous encoder cables, please use our products. If the required length is not found in our products, the user should fabricate a cable.

■Selection

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

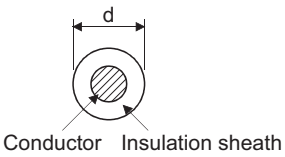
Cable model	Cable length [m (ft.)]
Q170ENCCBL_M-A	2 (6.56), 5 (16.40), 10 (32.81), 20 (65.62), 30 (98.43), 50 (164.04)

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

Connector sets type	Description
MR-J3CN2	Servo amplifier connector

Core size [mm^2]	Number of cores	Characteristics of one core			Finished OD [mm]*2
		Structure [Number of wires/mm]	Conductor resistance [Ω/km]	Insulating sheath OD d [mm]*1	
0.2	24 (12 pairs)	40/0.08	105 or less	0.88	9.0

*1 d is as shown below.



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

⚠CAUTION

• When fabricating the encoder cable, do not make an incorrect connection. An incorrect connection will cause runaway or an explosion.

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■Q170ENCCBL_M-A

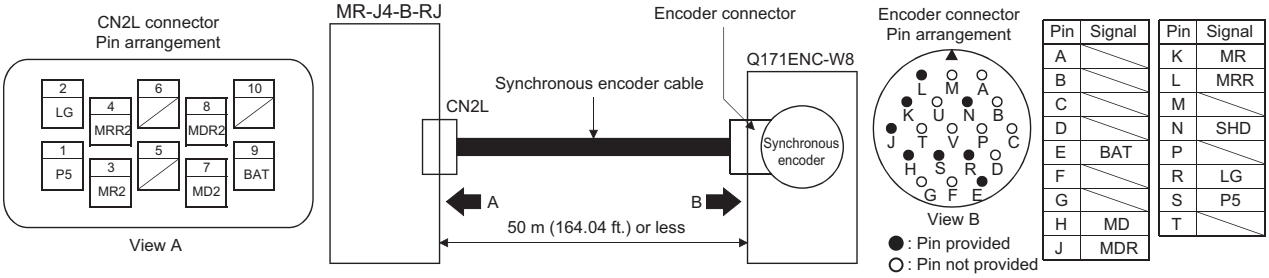
• Model explanation

Type: Q170ENCCBL_M - A

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

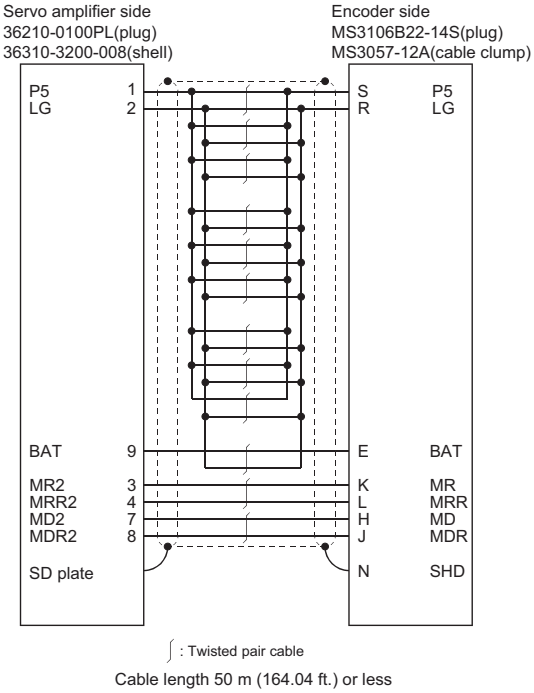
• Connection diagram

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

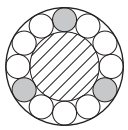


Pin	Signal
A	
B	
C	
D	
E	BAT
F	
G	
H	MD
J	MDR

Pin	Signal
K	MR
L	MRR
M	
N	SHD
P	
R	LG
S	P5
T	



Wire the cable as shown in figure below so that twisted pair for signal do not touch.



Cable cross-section diagram

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

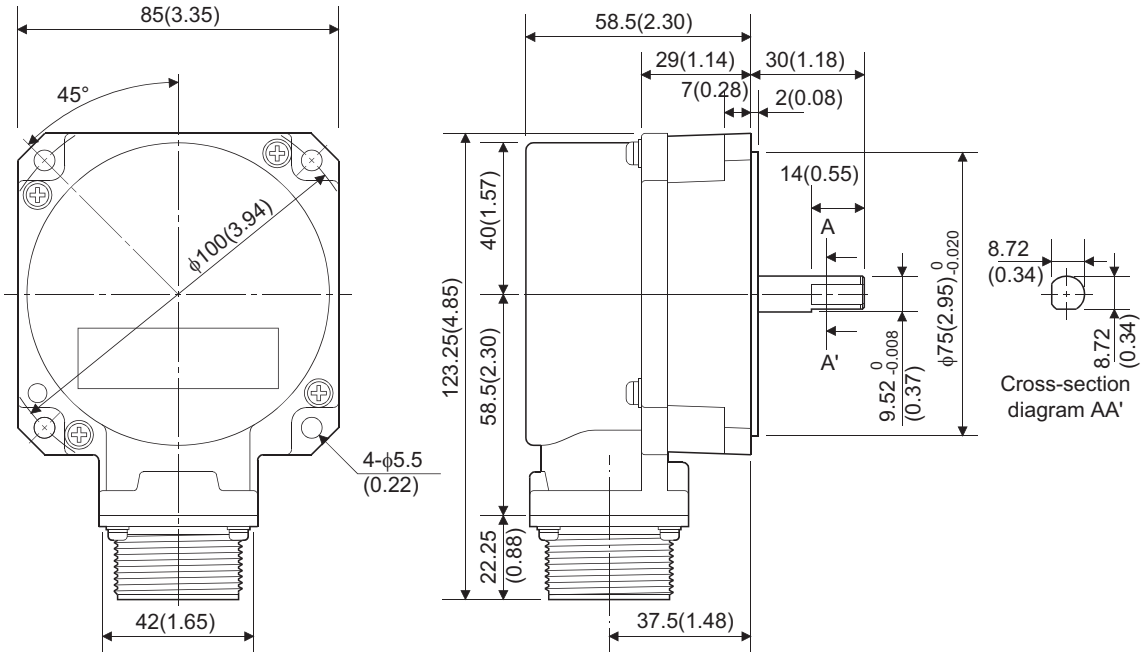
: Twisted pair (P5/LG)

: Core

External dimension drawing of serial absolute synchronous encoder

■Serial absolute synchronous encoder (Q171ENC-W8)

[Unit: mm (inch)]



Cable connector for serial absolute synchronous encoder

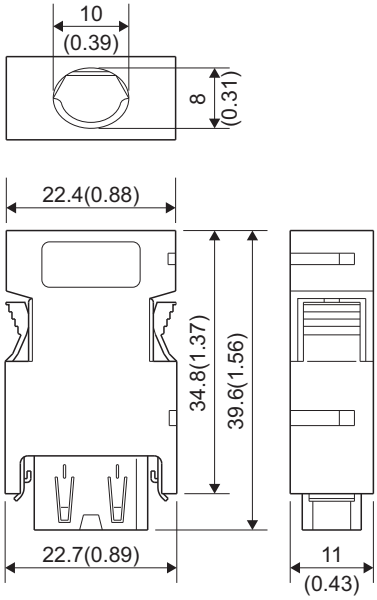
Manufactured by 3M Japan Limited (SCR type)

■Type

Plug: 36210-0100PL

Shell: 36310-3200-008

[Unit: mm (inch)]



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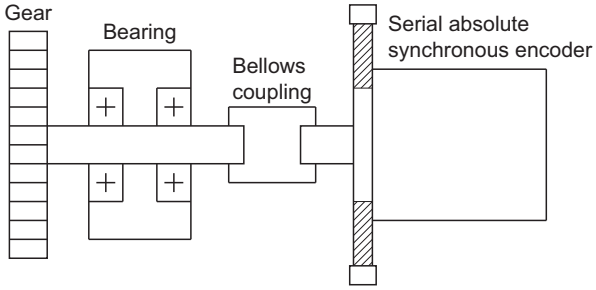
Mounting of serial absolute synchronous encoder

This section describes precautions for handling the serial absolute synchronous encoder.

- If the serial absolute synchronous encoder is linked to a chain, timing belt, or gears, the machine rotating shaft should be supported by a separate bearing and connected to serial absolute synchronous encoder through a bellows coupling. Ensure that excessive force (greater than the permitted shaft load) is not applied to the shaft of serial absolute synchronous encoder.



Item	Radial direction	Thrust direction
Permitted shaft load	Up to 19.6 N	Up to 9.8 N

- Excessive load is applied to the shaft of serial absolute synchronous encoder by the large mounting errors in eccentricity and angle of deviation. As a result, it might damage the machine or shorten extremely the life. Minimize loads applied to the shaft such that they make within the permitted shaft load range.

⚠CAUTION

- The serial absolute synchronous encoder contains a glass disk and precision mechanism. Take care when handling it. The encoder performance may deteriorate if it is dropped or subjected to shocks or vibration exceeding the prescribed limits.
- Do not connect the shaft of serial absolute synchronous encoder directly to machine side rotary shaft. Always after connecting the shaft of serial absolute synchronous encoder to another bearing once, connect the shaft through a bellows coupling.
- Never hit the end of the serial absolute synchronous encoder shaft with a hammer when connecting the bellows coupling to it. The large loads applied to serial absolute synchronous encoder will damage it.
- The serial absolute synchronous encoder uses optical parts. Mount it in an atmosphere where there are extremely few water drops and little oil and dust.
- When mounting the serial absolute synchronous encoder to any place where it is exposed to water and/or oil, provide protection from oil and water, e.g. mount a cover. In addition, run the cable downward to prevent oil and/or water from running on the cable into the serial absolute synchronous encoder. When it is inevitable to mount the serial absolute synchronous encoder vertically or obliquely, trap for the cable.
- Use the serial absolute synchronous encoder within the specified temperature range (-5 to 55℃).
- Do not use rigid couplings. Doing so applies an excessive bending load to the axis, and may break the axis of the servo motor or cause deterioration of the bearings.

Appendix 2 Component List of the RD77GF

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

No.	Part name	Type	Remarks
1	Simple Motion module	RD77GF4	RD77GF□ Number of controlled axes GF: CC-Link IE Field Network model
		RD77GF8	
		RD77GF16	
		RD77GF32	
2	Servo amplifier	—	—
3	Slave device compatible with CC-Link IE Field	—	—
4	CC-Link IE Field Network cable	—	Cables are needed for connecting the Simple Motion module with a servo amplifier/slave device compatible with CC-Link IE Field, or between servo amplifiers/slave devices compatible with CC-Link IE Field. (☞ Page 95 Reference product)
5	Ethernet hub	—	Switching hubs are needed for connecting the Simple Motion module, a servo amplifier, and other brand drive units in star topology. (☞ Page 95 Recommended product)

Reference product

Connection 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.

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.) DT135TXA (Mitsubishi Electric System & Service Co., Ltd.)	4 levels

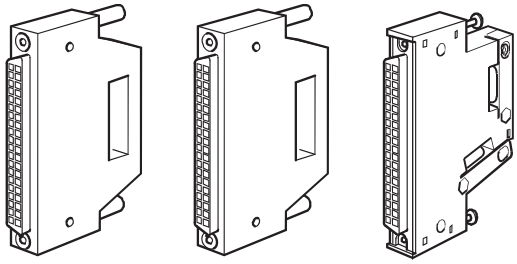
Appendix 3 Connection with External Devices of the RD77MS

Connector

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

Appearance

A6CON1 A6CON2 A6CON4



Connector type

Type	Model
	Connector
Soldering type, useable for straight out	A6CON1
Crimp-contact type, useable for straight out	A6CON2
Soldering type, useable for straight out and diagonal out	A6CON4

Specifications of the connector

Part name	Specification	
Applicable connector	A6CON1, A6CON4	A6CON2
Applicable wire size	0.3 mm^2	AWG28 to AWG24

The external input wiring connector has not been prepared. The user should purchase it separately.

■Specialized tool

• Pressure-bonding tool for A6CON2

Model name:
FCN-363T-T005/H

• Contact for the specialized tool

Fujitsu component LTD.

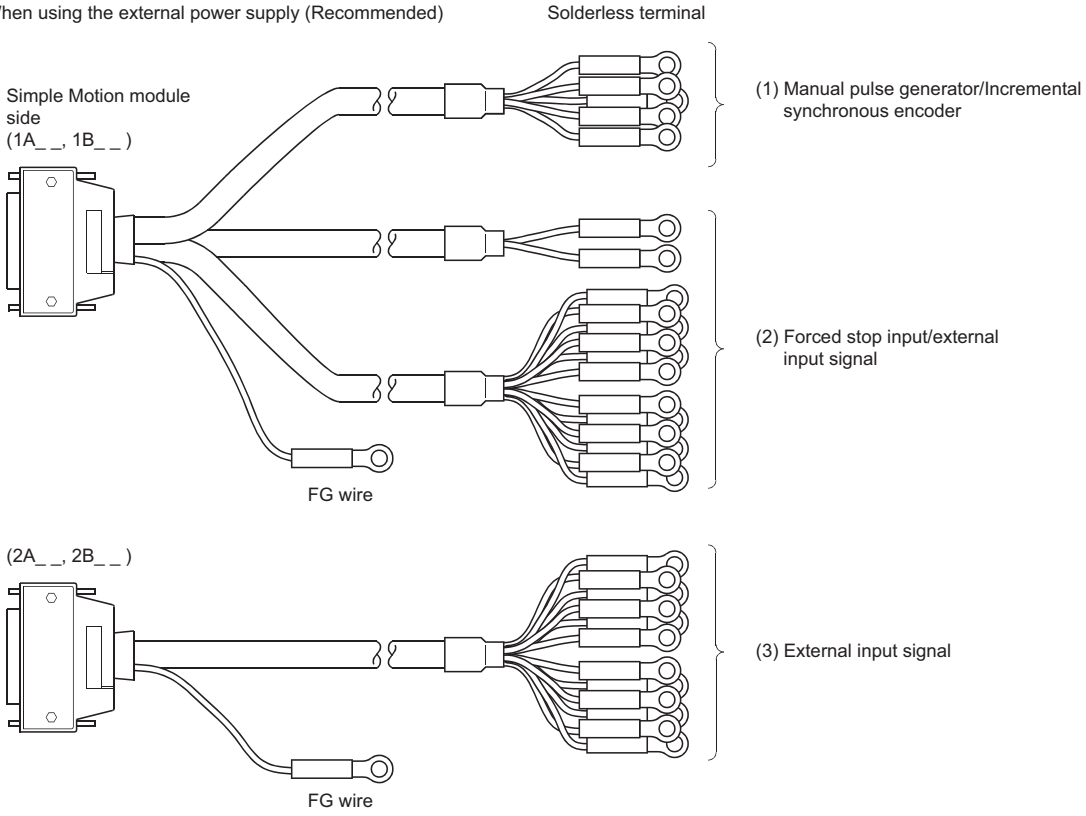
External input signal cable

The external input signal cable is not prepared as an option. The user should fabricate a cable.

The connection diagram differs depending on the type of the manual pulse generator/incremental synchronous encoder to be used and the connected power supply.

Make the cable as shown in the following connection diagram.

When using the external power supply (Recommended)



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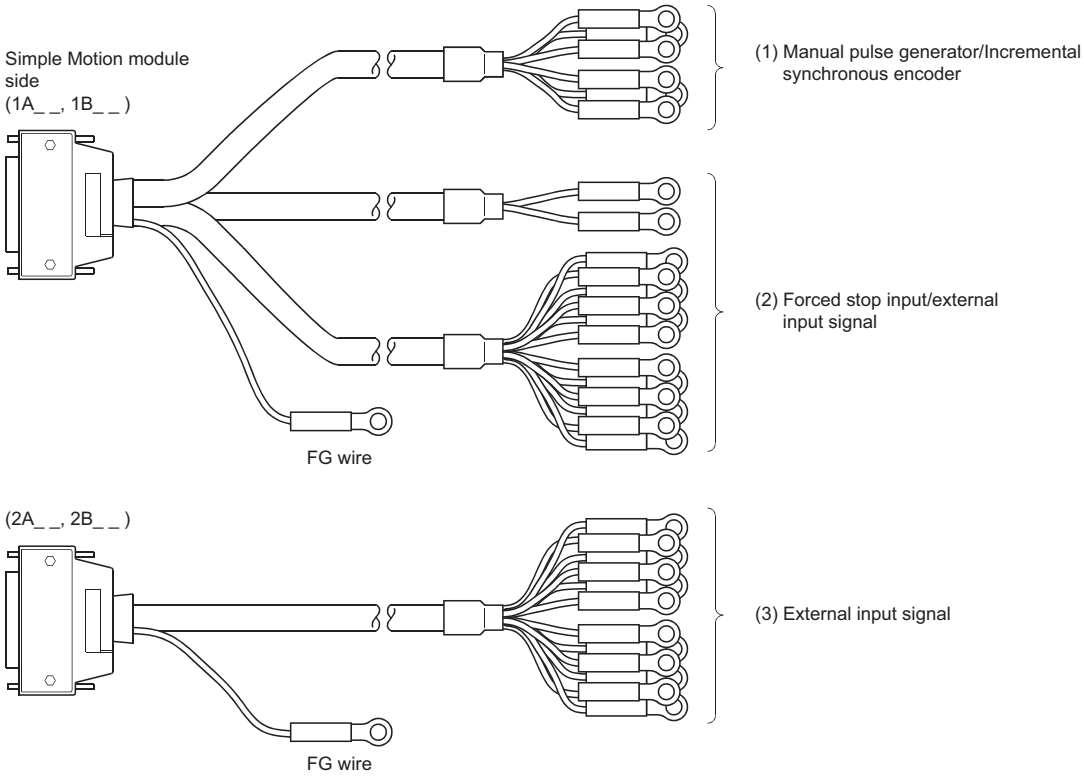
When using the internal power supply

Solderless terminal

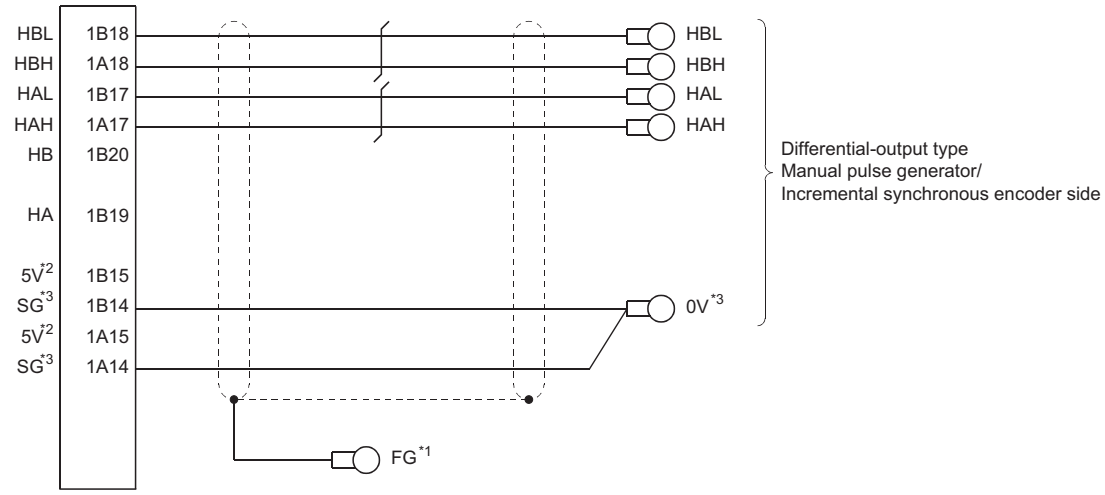


Manual pulse generator/Incremental synchronous encoder

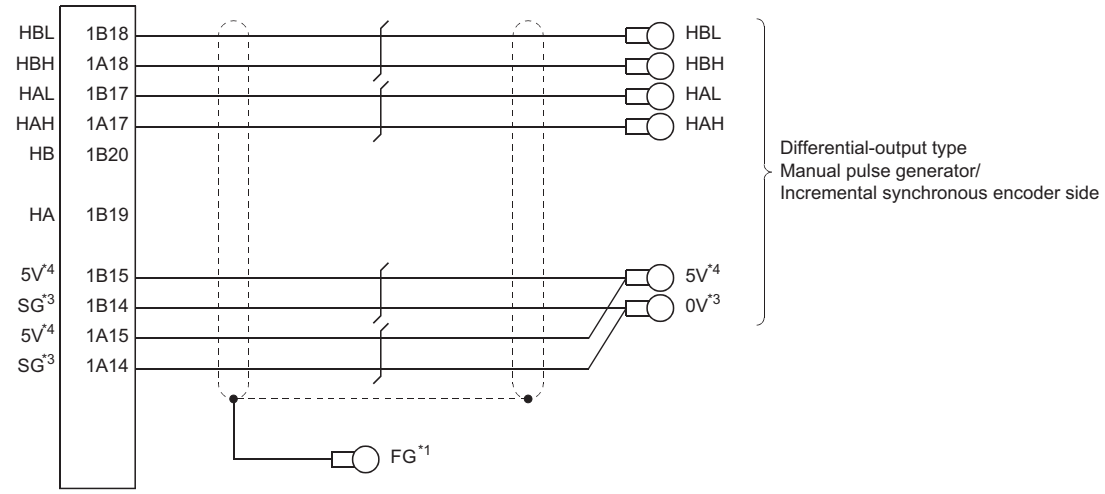
■Differential-output type

Make the cable within 30 m (98.43 ft.).

When using the external power supply (Recommended)



When using the internal power supply



∫ : Twisted pair cable

*1 Ground FG terminal on the used equipment side.

*2 The 5 V DC power supply from the Simple Motion module must not be used.

*3 Be sure to connect the 0 V (-) of the manual pulse generator/incremental synchronous encoder and the SG of the Simple Motion module.

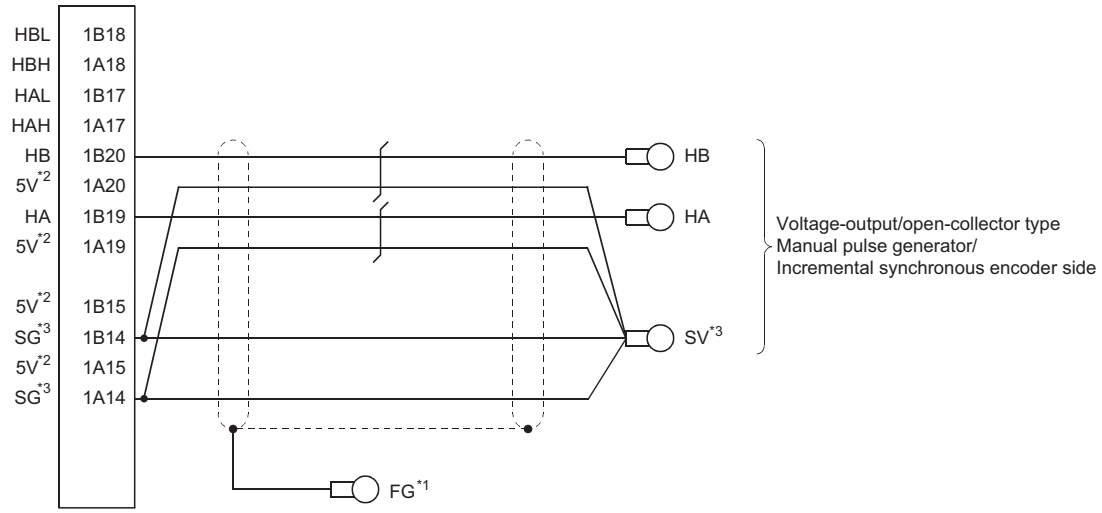
*4 Be sure not to be used except for supplying the power to the manual pulse generator.

A

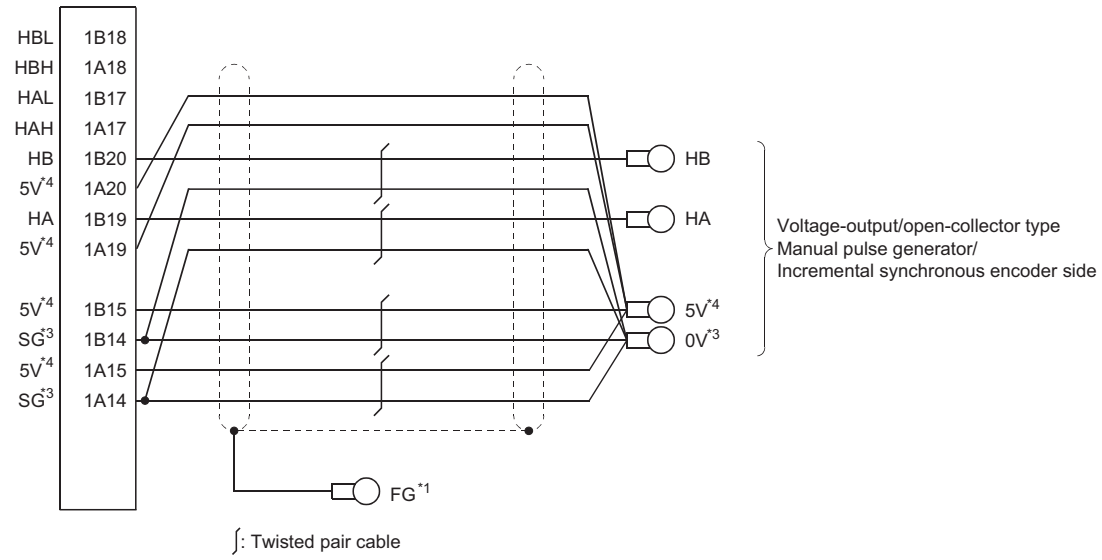
■Voltage-output/Open-collector type

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

When using the external power supply (Recommended)



When using the internal power supply



∫: Twisted pair cable

*1 Ground FG terminal on the used equipment side.

*2 The 5 V DC power supply from the Simple Motion module must not be used.

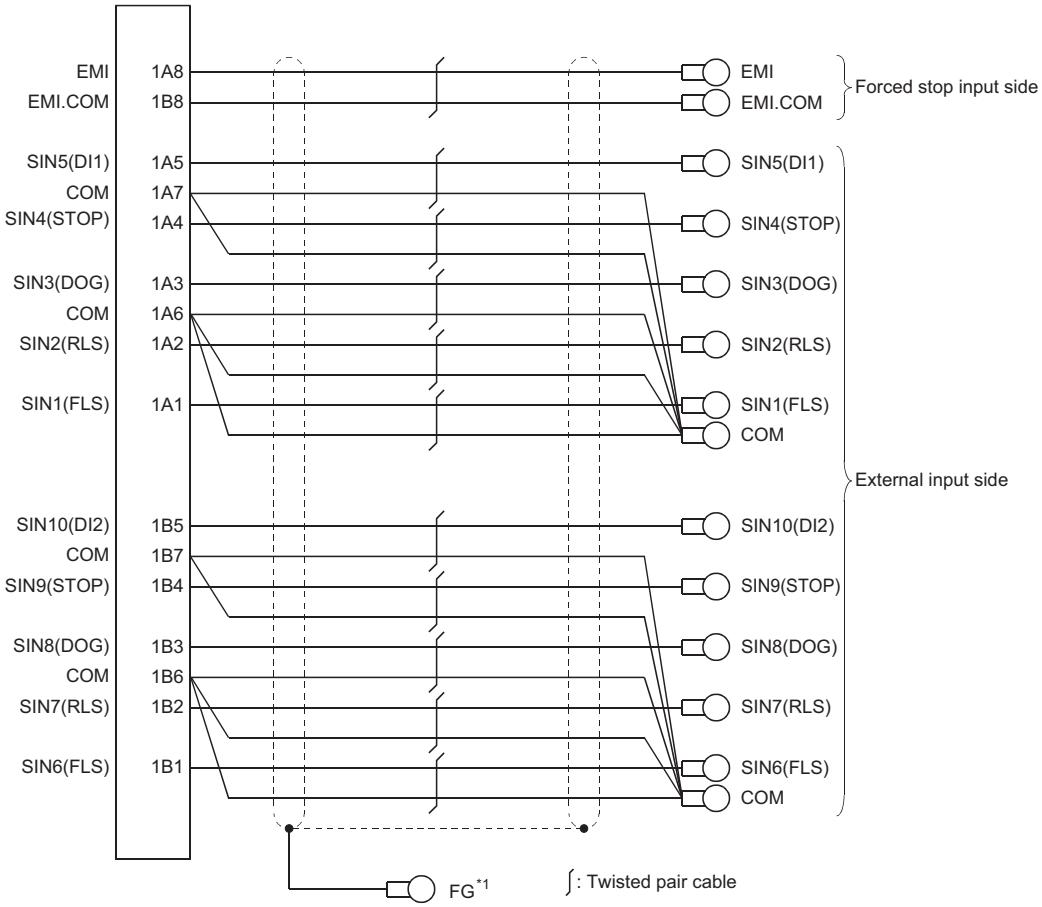
*3 Be sure to connect the 0 V (-) of the manual pulse generator/incremental synchronous encoder and the SG of the Simple Motion module.

*4 Be sure not to be used except for supplying the power to the manual pulse generator.

Forced stop input/ External input signal

The following connection diagram shows an example using the assignment below. The assignment can be changed arbitrarily.

Input signal	External input signal
SIN1	FLS
SIN2	RLS
SIN3	DOG
SIN4	STOP
SIN5	DI1
SIN6	FLS
SIN7	RLS
SIN8	DOG
SIN9	STOP
SIN10	DI2

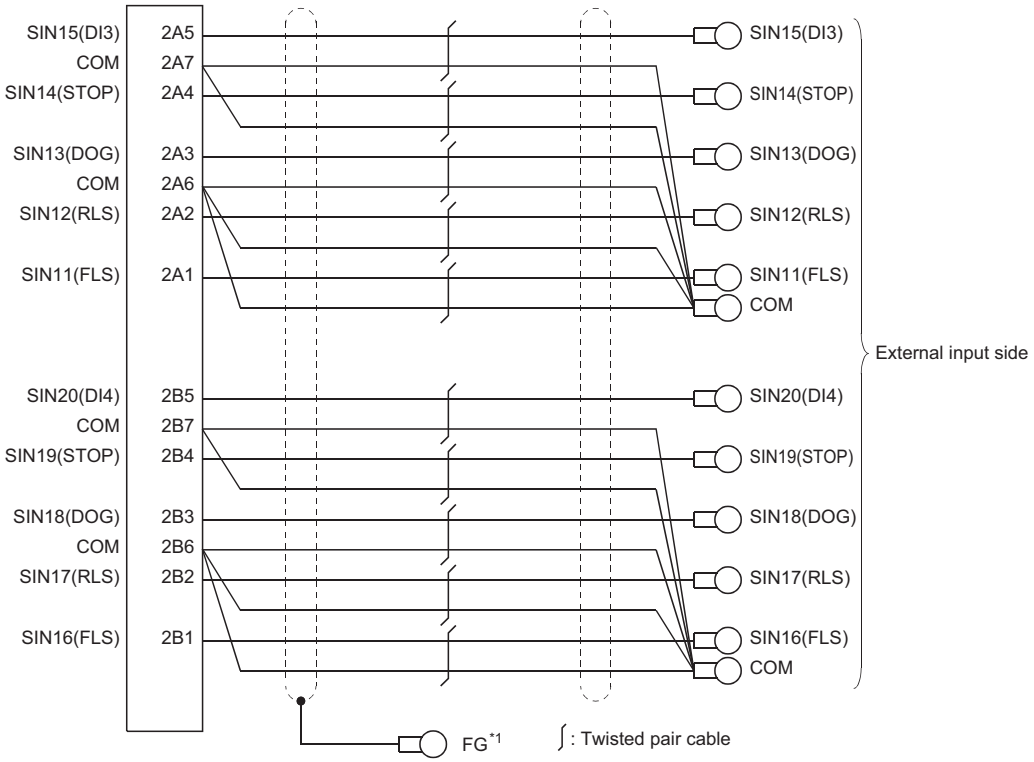


*1 Ground FG terminal on the used equipment side.

External input signal

The following connection diagram shows an example using the assignment below. The assignment can be changed arbitrarily.

Input signal	External input signal
SIN11	FLS
SIN12	RLS
SIN13	DOG
SIN14	STOP
SIN15	DI3
SIN16	FLS
SIN17	RLS
SIN18	DOG
SIN19	STOP
SIN20	DI4

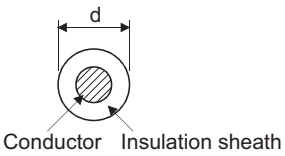


*1 Ground FG terminal on the used equipment side.

• The following table indicates the external input wiring connector cables. Select a cable according to your operating conditions.

Wire model	Core size [mm^2]	Number of cores	Characteristics of one core			Finish OD [mm]*2
			Structure [Number of wires/mm]	Conductor resistance [Ω/km]	Insulating sheath OD d [mm]*1	
17/0.16 1P SRV-SV(2464)-K	0.3	2 (1 pairs)	17/0.16	57.5	0.77	5.3
17/0.16 4P SRV-SV(2464)-K	0.3	8 (4 pairs)	17/0.16	57.5	0.77	7.6
17/0.16 10P SRV-SV(2464)-K	0.3	20 (10 pairs)	17/0.16	57.5	0.77	10.0

*1 d is as shown below.



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

⚠CAUTION

• When fabricating the cable, do not make an incorrect connection. An incorrect connection will cause runaway or an explosion.

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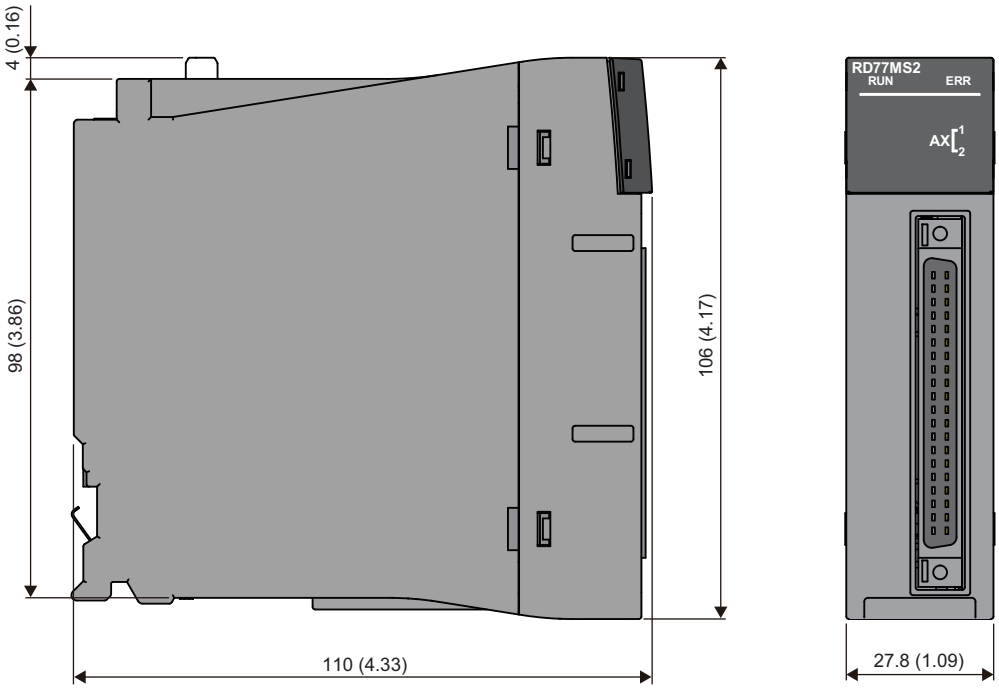
Appendix 4 External Dimensions of the RD77MS

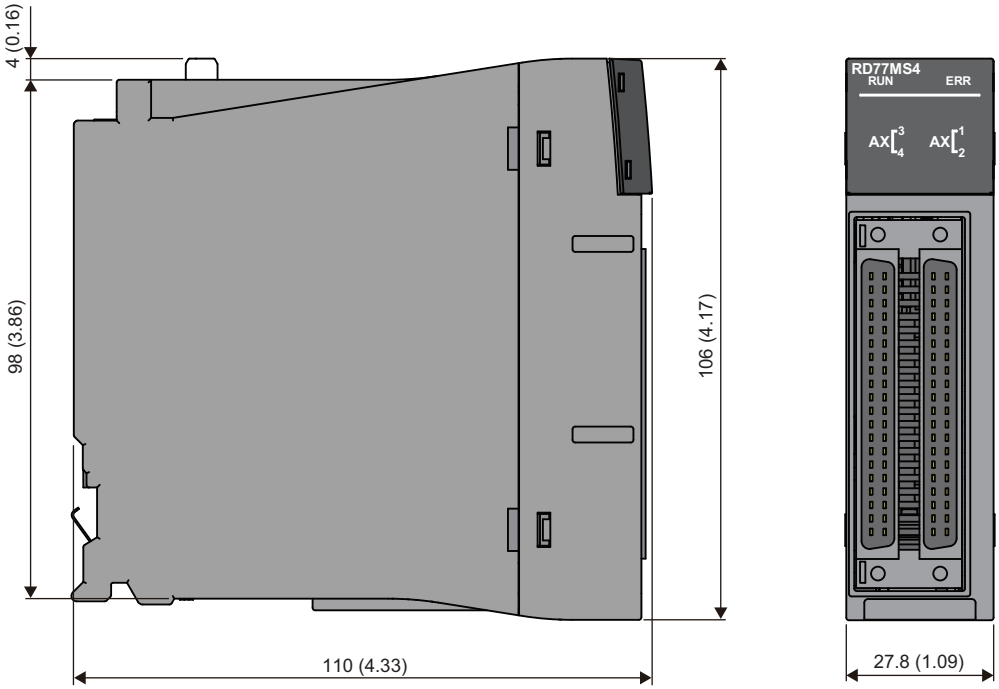
RD77MS2

[Unit: mm (inch)]



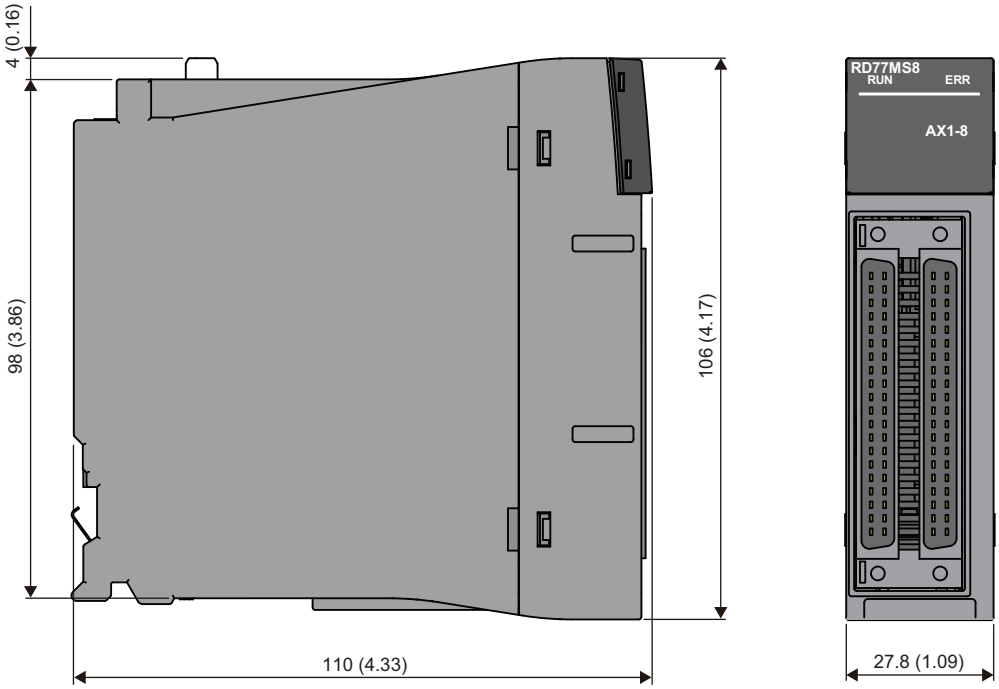
RD77MS4

[Unit: mm (inch)]



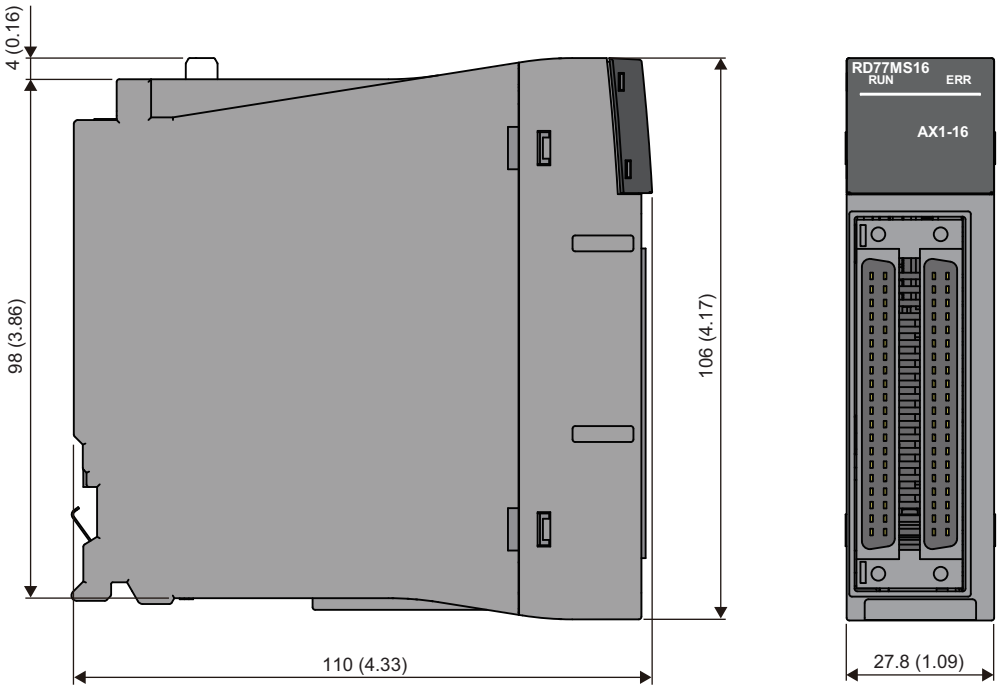
RD77MS8

[Unit: mm (inch)]



RD77MS16

[Unit: mm (inch)]



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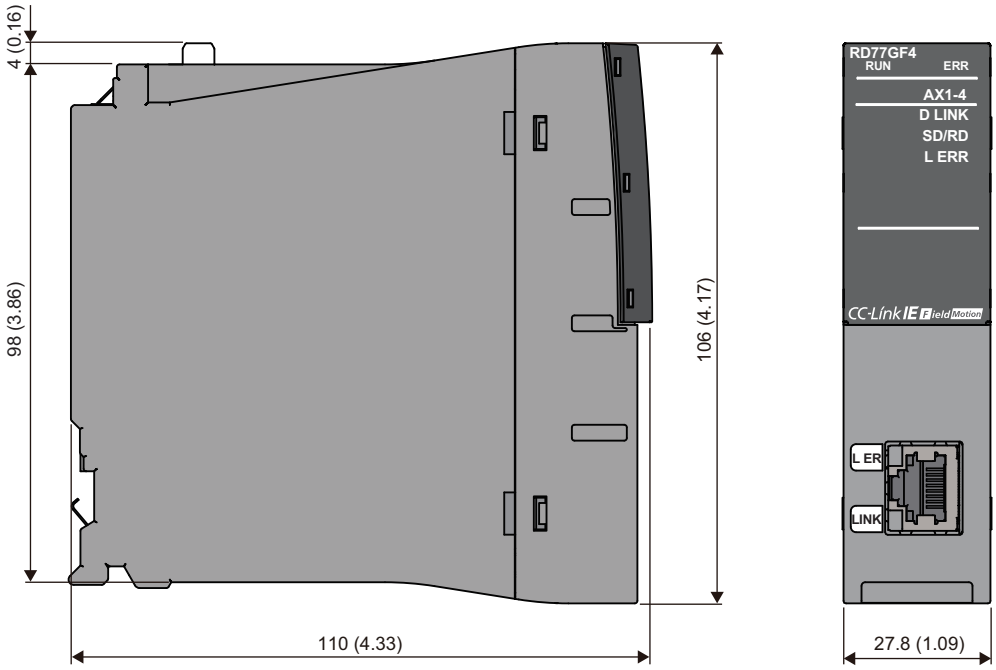
Appendix 5 External Dimensions of the RD77GF

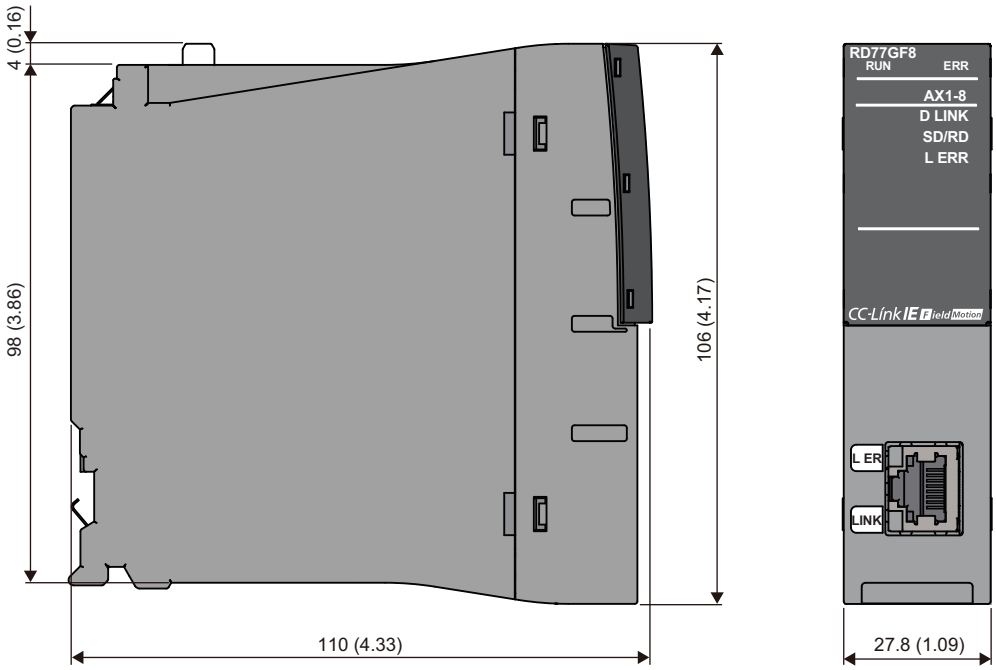
RD77GF4

[Unit: mm (inch)]



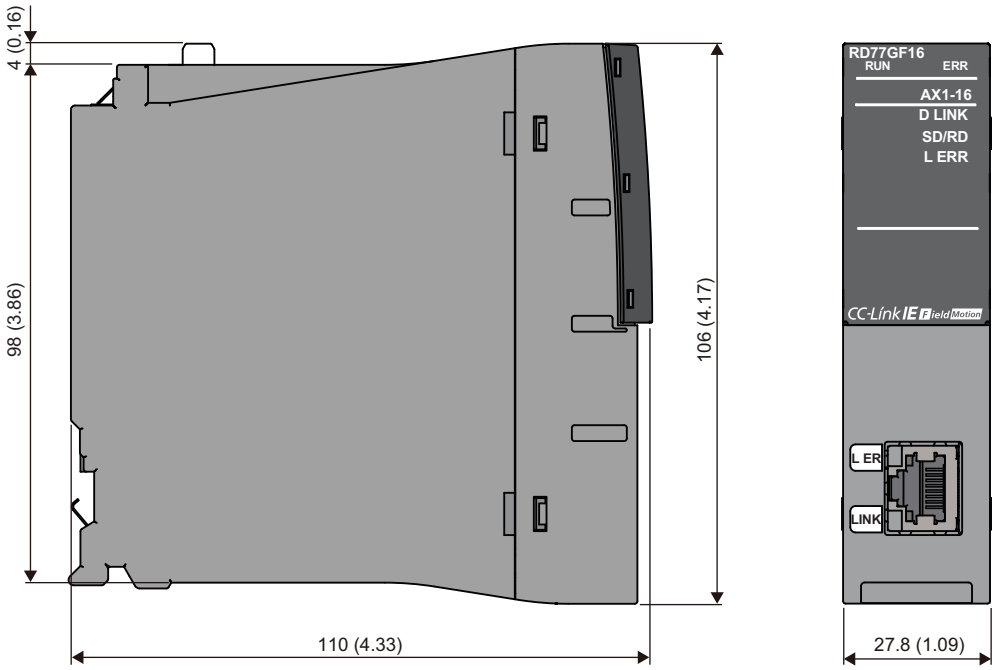
RD77GF8

[Unit: mm (inch)]



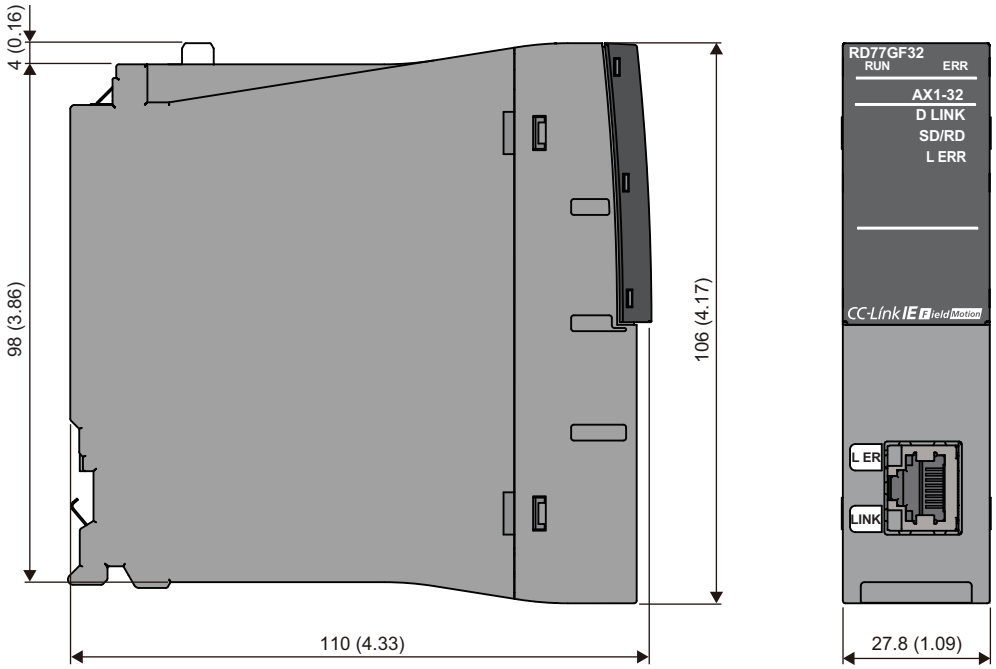
RD77GF16

[Unit: mm (inch)]



RD77GF32

[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
June 2014	IB(NA)-0300245ENG-A	First edition
February 2015	IB(NA)-0300245ENG-B	■Added functions 3-axis helical interpolation control, Inter-module synchronization function, Online module change, Hot line forced stop function ■Added or modified parts RELEVANT MANUALS, TERMS, PERIPHERALS, Section 1.1, 2.1, 2.2, 2.3, 3.2, 3.3, 3.4, Chapter 4, Section 5.1, 5.2, Chapter 6, Appendix 1, 2
May 2015	IB(NA)-0300245ENG-C	■Added functions Test mode, Optical hub unit MR-MV200 ■Added or modified parts PERIPHERALS, Section 3.3, Chapter 4
March 2016	IB(NA)-0300245ENG-D	■Added models RD77GF4, RD77GF8, RD77GF16 ■Added functions Link device external signal assignment function, Servo cyclic transmission function, Servo transient transmission function, Servo parameter change function, Stepping motor driver AlphaStep/5-phase manufactured by ORIENTAL MOTOR Co., Ltd. ■Added or modified parts SAFETY PRECAUTIONS, INTRODUCTION, RELEVANT MANUALS, TERMS, PERIPHERALS, Chapter 1, Section 1.1, 1.2, 2.1, 2.2, 2.3, 2.4, 3.1, 3.2, 3.3, 4.1, 4.2, Chapter 5, Section 5.1, 5.2, 6.1, 6.2, 6.3, 7.1, 7.2, Appendix 1, 2, 3, 4, 5, WARRANTY
December 2016	IB(NA)-0300245ENG-E	■Added models RD77GF32 ■Added functions Safety communication function, Normal mode setting of communication mode, iQ Sensor Solution data backup/restoration function ■Added or modified parts SAFETY PRECAUTIONS, TERMS, PERIPHERALS, Chapter 1, Section 1.2, 2.2, 2.3, 2.4, 3.1, 3.3, 4.2, 5.1, 6.1, 7.1, 7.2, Appendix 2, 5
June 2018	IB(NA)-0300245ENG-F	■Added functions MR-JE-BF ■Added or modified parts SAFETY PRECAUTIONS, RELEVANT MANUALS, TERMS, PERIPHERALS, Section 2.1, 2.2, Chapter 3, Section 3.1, 3.2, 3.3, 6.1, 6.2, 6.3, 7.1, Appendix 1, 3
July 2022	IB(NA)-0300245ENG-G	■Added functions [RD77MS] MR-J5(W)-B, Positioning data, block start data write/read function ■Added or modified parts SAFETY PRECAUTIONS, COMPLIANCE WITH EMC AND LOW VOLTAGE DIRECTIVES, RELEVANT MANUALS, TERMS, PERIPHERALS, Chapter 1, Section 1.2, 2.1, 2.2, Chapter 3, Section 3.1, 3.2, 3.3, 4.1, 4.2, 5.1, 6.1, 6.2, 6.3, 7.1, 7.2, Appendix 1, Appendix 2, Appendix 3, WARRANTY, TRADEMARKS
June 2024	IB(NA)-0300245ENG-H	■Added or modified parts SAFETY PRECAUTIONS, Section 3.1, 3.2, INFORMATION AND SERVICES, TRADEMARKS

Japanese manual number: IB-0300244-J

WARRANTY

Warranty

1. Warranty period and coverage

We will repair any failure or defect hereinafter referred to as "failure" in our FA equipment hereinafter referred to as the "Product" arisen during warranty period at no charge due to causes for which we are responsible through the distributor from which you purchased the Product or our service provider. However, we will charge the actual cost of dispatching our engineer for an on-site repair work on request by customer in Japan or overseas countries. We are not responsible for any on-site readjustment and/or trial run that may be required after a defective unit are repaired or replaced.

[Term]

For terms of warranty, please contact your original place of purchase.

[Limitations]

(1) You are requested to conduct an initial failure diagnosis by yourself, as a general rule.
It can also be carried out by us or our service company upon your request and the actual cost will be charged. However, it will not be charged if we are responsible for the cause of the failure.

(2) This limited warranty applies only when the condition, method, environment, etc. of use are in compliance with the terms and conditions and instructions that are set forth in the instruction manual and user manual for the Product and the caution label affixed to the Product.

(3) Even during the term of warranty, the repair cost will be charged on you in the following cases;

1. a failure caused by your improper storing or handling, carelessness or negligence, etc., and a failure caused by your hardware or software problem
2. a failure caused by any alteration, etc. to the Product made on your side without our approval
3. a failure which may be regarded as avoidable, if your equipment in which the Product is incorporated is equipped with a safety device required by applicable laws and has any function or structure considered to be indispensable according to a common sense in the industry
4. a failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced
5. any replacement of consumable parts (battery, fan, smoothing capacitor, etc.)
6. a failure caused by external factors such as inevitable accidents, including without limitation fire and abnormal fluctuation of voltage, and acts of God, including without limitation earthquake, lightning and natural disasters
7. a failure generated by an unforeseeable cause with a scientific technology that was not available at the time of the shipment of the Product from our company
8. any other failures which we are not responsible for or which you acknowledge we are not responsible for

2. Term of warranty after the stop of production

(1) We may accept the repair at charge for another seven (7) years after the production of the product is discontinued. The announcement of the stop of production for each model can be seen in our Sales and Service, etc.

(2) Please note that the Product (including its spare parts) cannot be ordered after its stop of production.

3. Service in overseas countries

Our regional FA Center in overseas countries will accept the repair work of the Product. However, the terms and conditions of the repair work may differ depending on each FA Center. Please ask your local FA center for details.

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. Change of Product specifications

Specifications listed in our catalogs, manuals or technical documents may be changed without notice.

6. Application and use of the Product

(1) For the use of our Simple motion module, its applications should be those that may not result in a serious damage even if any failure or malfunction occurs in the Simple motion module, and a backup or fail-safe function should operate on an external system to the Simple motion module when any failure or malfunction occurs.

(2) Our Simple motion module is designed and manufactured as a general purpose product for use at general industries.
Therefore, applications substantially influential on the public interest for such as atomic power plants and other power plants of electric power companies, and also which require a special quality assurance system, including applications for railway companies and government or public offices are not recommended, and we assume no responsibility for any failure caused by these applications when used
In addition, applications which may be substantially influential to human lives or properties for such as airlines, medical treatments, railway service, incineration and fuel systems, man-operated material handling equipment, entertainment machines, safety machines, etc. are not recommended, and we assume no responsibility for any failure caused by these applications when used.
We will review the acceptability of the abovementioned applications, if you agree not to require a specific quality for a specific application. Please contact us for consultation.

(3) Mitsubishi shall have no responsibility or liability for any problems involving programmable controller trouble and system trouble caused by DoS attacks, unauthorized access, computer viruses, and other cyberattacks.

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.

MITSUBISHI ELECTRIC Factory Automation Global Website
Locations Worldwide
www.MitsubishiElectric.com/fa/about-us/overseas/

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IB(NA)-0300245ENG-H(2406)MEE
MODEL: RD77-U-S-E
MODEL CODE: 1XB012

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