MITSUBISHI ELECTRIC

Programmable Controller

MELSEC iQ-R series

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

-RD78G4
-RD78G8
-RD78G16
-RD78G32
-RD78G64
-RD78GHV
-RD78GHW

WHEN USING A SWITCHING HUB WITH CC-Link IE TSN

A dedicated TSN hub may be required depending on parameter settings or the network topology used to connect modules on CC-Link IE TSN.

Read the following carefully.

· When using PLCopen Motion control mode

☞ Page 44 SYSTEM CONFIGURATION

☞ Page 85 Switching hub

· When using Simple Motion mode

☞ Page 117 SYSTEM CONFIGURATION

☞ Page 153 Switching hub

SAFETY PRECAUTIONS

(Read these precautions before using this product.)

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

The precautions given in this manual are concerned with this product only. Refer to the MELSEC iQ-R Module Configuration Manual for a description of the PLC system safety precautions.

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.
- When the programmable controller is turned off, 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.

[Design Precautions]

⚠WARNING

- 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. When a Safety CPU is used, data cannot be modified while the Safety CPU is in SAFETY MODE.
- 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. Incorrect output or malfunction due to a communication failure may result in an accident. 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 homing is controlled by two kinds of data: a homing direction and a homing speed. Deceleration starts when the proximity dog signal turns on. If an incorrect homing 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 homing 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.
- If safety standards (ex., robot safety rules, etc.,) apply to the system using the module, drive unit and servo motor, make sure that the safety standards are satisfied.
- Construct a safety circuit externally of the module or drive unit if the abnormal operation of the module or drive unit differs from the safety directive operation in the system.

[Design Precautions]

⚠CAUTION

- Do not install the control lines or communication cables together with the main circuit lines or power cables. Doing so may result in malfunction due to electromagnetic interference. Keep a distance of 100mm 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.
- 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 before powering on the system for operation. Also, attach an extension connector protective cover[*1] to each unused extension cable connector as necessary. Directly touching any conductive parts of the connectors while power is on may result in electric shock.
  *1 For details, please consult your local Mitsubishi Electric representative.

[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 100mm 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) 25cm 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 homing.
- 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 can 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 Electric 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

RD78G4, RD78G8, RD78G16, RD78G32, RD78G64, RD78GHV, RD78GHW

Point

Symbols used in this manual are shown below.

- Underlined variables (AxisName, etc.): Variables defined by users

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 (This manual is included with the base unit.)
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 (This manual is included with the base unit.)

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RELEVANT MANUALS

The following manuals are relevant to this product.

Manual name [manual number]	Description	Supported mode*1	
		PLCopen Motion control FB mode	Simple Motion mode
MELSEC iQ-R Motion Module User's Manual (Startup) [IB-0300406ENG] (this manual)	Specifications, procedures before operation, system configuration, and wiring of the Motion module	○	○
MELSEC iQ-R Motion Module User's Manual (Application) [IB-0300411ENG]	Functions, I/O signals, variables, labels, programming, and troubleshooting of the Motion module	○	
MELSEC iQ-R Motion Module User's Manual (Network) [IB-0300426ENG]	Functions, parameter settings, troubleshooting, and buffer memory of CC-Link IE TSN	○	○
MELSEC iQ-R Motion Module User's Manual (Application for Simple Motion Mode) [IB-0300572ENG]	Functions, I/O signals, buffer memory, parameter settings, programming, and troubleshooting of the Simple Motion mode		○
MELSEC iQ-R Motion Module User's Manual (Advanced Synchronous Control for Simple Motion Mode) [IB-0300575ENG]	Functions and programming for the synchronous control of the Simple Motion mode		○
MELSEC iQ-R Programming Manual (Motion Module Instructions, Standard Functions/ Function Blocks) [IB-0300431ENG]	Instructions for the Motion module and standard functions/ function blocks	○	
MELSEC iQ-R Programming Manual (Motion Control Function Blocks) [IB-0300533ENG]	Motion control function blocks, variables, and programming	○	
Motion Module Quick Start Guide [L03191ENG]	Describes system startup, parameter settings, and programming methods for first-time users of the Motion module	○	
Motion Module Quick Start Guide (PLC CPU Ladder Program) [L03194ENG]	Describes system startup, parameter settings, and programming methods for first-time users of the Motion module	○	
MELSEC iQ-R Motion Module (Simple Motion Mode) Function Block Reference [BCN-B62005-1040]	Specifications, functions, and I/O labels of the function blocks of the Motion module (Simple Motion mode)		○

*1 For details of supported modes, refer to the following.
☞ Page 20 SUPPORTED MODE

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

For programs, refer to the following.

📖MELSEC iQ-R Programming Manual (Program Design)

TERMS

Unless otherwise specified, this manual uses the following terms.

Term	Description
Actual position	A position address returned by a device station assigned to an axis that is rounded by the ring counter. It is affected by a current position change.
Axis	A target for motion control.
Buffer memory	A memory in an intelligent function module, where data (such as setting values and monitoring values) are stored.
Buffer mode	A generic term for multiple start.
CC-Link IE TSN	An open network that uses "TSN (Time-Sensitive Networking)", which is an extension of the Ethernet standard, to ensure real-time control and handle information from other open networks simultaneously.
CC-Link IE TSN Class*1	A group of devices and switching hubs compatible with CC-Link IE TSN, classified according to the functions and performance by the CC-Link Partner Association. For CC-Link IE TSN Class, refer to the CC-Link IE TSN Installation Manual (BAP-C3007ENG-001) published by the CC-Link Partner Association.
CC-Link IE TSN Protocol version 1.0	This protocol is used to perform communications by using the time sharing method defined by IEEE 802.1AS or IEEE 1588 for time synchronization.
CC-Link IE TSN Protocol version 2.0	This protocol is used to perform communications by using the time sharing method defined by IEEE 802.1AS and time-managed polling method for time synchronization. Supporting this protocol version mitigates restrictions when "Mixture of CC-Link IE TSN Class B/A or CC-Link IE TSN Class A Only" is set in the system configuration, and increases the number of connectable devices.
Continuous update	Continuously reflecting input values to the control while the ContinuousUpdate input of the motion control FB is TRUE.
Cumulative current position	A command position address that is not rounded by a ring counter. It is affected by a current position change.
Cyclic transmission	A function by which data is periodically exchanged among stations on the network.
Dedicated instruction	An instruction for using functions of the module.
Device	A memory of a CPU module to store data. Devices such as X, Y, M, D, and others are provided depending on the intended use.
Disconnection	A process of stopping data link if a data link error occurs.
Execute	Set TRUE to the Execute input or the Enable input to the motion control FB.
Feed machine position	A command position address that is not rounded by the ring counter. It is based on the home position, and it is not affected by a current position change.
General-purpose hub	A CC-Link IE TSN Class A switching hub authorized by CC-Link Partner Association. • When using PLCopen motion control mode ☞ Page 85 Switching hub • When using Simple Motion mode ☞ Page 153 Switching hub
GX Works3	The product name of the software package for the MELSEC programmable controllers.
Hardware reboot	Turning ON the power of the system again or resetting.
Input variable	An FB input argument.
Intelligent function module	A module that has functions other than input and output, such as an A/D converter module and D/A converter module.
Jerk	Chronological change ratio of the acceleration or the deceleration.
Label	A variable used in a program.
Link device	A device (RX, RY, RWr, or RWw) in a module on CC-Link IE TSN.
Link refresh	Processing of data transfer between link devices of the Motion module and CPU module devices. Link refresh is performed in "END processing" of the sequence scan of the CPU module.
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.
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. From the module used, GX Works3 automatically generates this label, which can be used as a global label.
Motion area	A software that performs the motion control in the Motion module.
Motion control FB	FB related to motion control whose name begins with MC_ or MCv_.
Motion FB	A motion control FB that takes an axis or an axes group for the argument and changes the axis status or the axes status by execution.

Term	Description
Motion control station	A device station that exchanges cyclic data by using slave labels and the motion control.
Motion module	Another term for RD78G(H).
MR-J5-G	Servo amplifier model MR-J5-_G_(-RJ).
MR-J5D-G	Servo amplifier model MR-J5D_-_G_.
MR-J5W-G	Servo amplifier model MR-J5W_-_G.
MR-JET-G	Servo amplifier model MR-JET-_G.
Multiple start	Executing another motion control FB to the same axis while a motion control FB is executed.
Network area	A software that performs the network control in the Motion module.
Object	Various data held by the CANopen-compatible device station.
RAS	The abbreviation for Reliability, Availability, and Serviceability. This term refers to usability of automated equipment.
RD78G	Another term for the MELSEC iQ-R series Motion module (compatible with CC-Link IE TSN).
RD78GH	
Real axis	An axis that is linked with a device station on network.
Real drive axis	An axis that is linked with a device station which supports CC-Link IE TSN compatible with csp/csv/cst mode (sequential command) of the CiA402 drive profile.
Real encoder axis	An axis that generates a commanded position from the current position of the encoder connected with a device station. It is used for the master axis of the single axis synchronous control.
Relay station	A station that relays data link to other station with mounting more than one network modules on one programmable controller.
Remote station	A station that exchanges I/O signals (bit data) and I/O data (word data) with another station by cyclic transmission. A transient transmission is available.
Reserved station	A station which is actually not connected to the network. It is included in the total station number in the network for future connection.
Retrigger	Starting up the Execute input again while executing an FB to a motion control FB that has the Execute input.
Return	A process of restarting data link when a faulty station recovers from an error.
Safety communications	A function to exchange safety data between safety stations on the same network.
Safety connection	A connection established for safety communication.
Safety data	Data exchanged through safety communication.
Set position	A command position address rounded by the ring counter. It is affected by a current position change.
SLMP	A SeamLess Message Protocol. This protocol is used to access an SLMP-compatible device or a programmable controller connected to an SLMP-compatible device from an external device.
Software reboot	Resetting only motion area and network area without a hardware reboot.
Standard communications	Communications other than safety communications, such as cyclic transmission and transient transmission of CC-Link IE TSN.
Standard station	A device station other than a motion control station.
Start	Executing a motion FB for the first time to an axis or an axes group.
Target position	A command position address that is specified in the motion FB.
Transient transmission	A function of non-periodic data communication among nodes (station) on network. A function used to send message to the target station when requested by a link dedicated instruction or the engineering tool. Communication is available with station on another network via relay station, or gateway.
TSN hub	A CC-Link IE TSN Class B switching hub authorized by CC-Link Partner Association. • When using PLCopen motion control mode ☞ Page 85 Switching hub • When using Simple Motion mode ☞ Page 153 Switching hub
Unicast mode	A communication mode used to send cyclic data to one station.
Virtual axis	An axis that is not linked with a device station on network.
Virtual drive axis	A virtual axis that can generate a command virtually.
Virtual encoder axis	An axis that generates a command position from a variable. It is used for the master axis of the single axis synchronous control.
Virtual linked axis	An axis that connects FBs and transmits a command in the single axis synchronous control.

*1 The term has been changed for standardization among manuals and software applications related to CC-Link IE TSN. However, the term used in some CC-Link IE TSN related software windows may remain unchanged and may be different from the term used in this manual.
In case of inconsistency, refer to the following.

Term used in software window	Term after change
Authentication Class	CC-Link IE TSN Class

GENERIC TERMS AND ABBREVIATIONS

Unless otherwise specified, this manual uses the following generic terms and abbreviations.

Generic term/abbreviation	Description
CC-Link IE	A generic term for the following: • CC-Link IE TSN • CC-Link IE Controller Network (MELSEC iQ-R CC-Link IE Controller Network User's Manual (Application)) • CC-Link IE Field Network (MELSEC iQ-R CC-Link IE Field Network User's Manual (Application))
CPU module	An abbreviation for the MELSEC iQ-R series CPU module.
cst	An abbreviation for the cyclic synchronous torque mode. (one of the control modes on the driver side)
csv	An abbreviation for the cyclic synchronous velocity mode. (one of the control modes on the driver side)
Data link	A generic term for a cyclic transmission and a transient transmission.
Device station	A generic term for a local station and remote station on CC-Link IE TSN.
Drive unit	A generic term for motor drive devices, such as servo amplifiers.
Engineering tool	A generic term for GX Works3 and MR Configurator2.
Ethernet device	A generic term for the devices supporting IP communication (such as a personal computer, a vision sensor, and a bar code reader).
GOT	A generic term for the Mitsubishi Electric GOTs (GOT1000, GOT2000 series).
Motion system	A generic term for software that performs the motion control and the network control.
MR-J5(W)-G	A generic term for MR-J5-_G_(-RJ)/MR-J5W_-_G/MR-J5D_-_G_ servo amplifiers.
Network module	A generic term for the following modules: • Ethernet interface module • Module on CC-Link IE TSN (the Motion module, a CC-Link IE TSN master/local module, a CC-Link IE TSN Plus master/local module, and a module on a remote station) • CC-Link IE Controller Network module • Module on CC-Link IE Field Network (a master/local module, and a module on a remote I/O station, a remote device station, and an intelligent device station) • MELSECNET/H network module • MELSECNET/10 network module • RnENCPU (network part)
LB	An abbreviation for a link relay of the link device. Bit data sent from each station of the network.
LW	An abbreviation for a link register of the link device. 16-bit (1-word) data sent from each station of the network.
PDO	An abbreviation for Process Data Object. A collection of the application objects transmitted periodically between multiple CANopen nodes.
Protocol version	An abbreviation for CC-Link IE TSN Protocol version.
RAS	An abbreviation for Reliability, Availability, and Serviceability. This term refers to the overall usability of automated equipment.
RD78G(H)	A generic term for RD78G_, RD78GH_ (high performance version).
RWr	An abbreviation for a remote register of the link device. This refers to 16-bit (1-word) data input from a device station to the master station. (Not applicable for some local stations.)
RWw	An abbreviation for a remote register of the link device. This refers to 16-bit (1-word) data output from the master station to a device station. (Not applicable for some local stations.)
RX	An abbreviation for remote input of the link device. This refers to bit data input from a device station to the master station. (Not applicable for some local stations.)
RY	An abbreviation for remote output of the link device. This refers to bit data output from the master station to a device station. (Not applicable for some local stations.)
Safety CPU	A generic term for R08SFCPU, R16SFCPU, R32SFCPU, and R120SFCPU.
Safety station	A generic term for a station that performs safety communications and standard communications.
SB	An abbreviation for a link special relay. Bit data that indicates the operating status and data link status of a module on CC-Link IE.
Software	A generic term for a firmware which configures the motion system. It consists of add-ons, baseSystem software, and boot software.
SW	An abbreviation for a link special register. 16-bit (1-word) data that indicates the operating status and data link status of a module on CC-Link IE.

SUPPORTED MODE

The Motion module has the PLCopen Motion control FB mode and Simple Motion mode. Users can freely switch the mode. When performing the positioning control with the PLCopen Motion Control FB, use the PLCopen Motion control FB mode. When performing the positioning control using the buffer memory similarly to the SSCNETⅢ/H compatible Simple Motion module (QD77MS, RD77MS), use the Simple Motion mode.

Supported mode	Applicable model	Reference
PLCopen Motion control FB mode	RD78G4, RD78G8, RD78G16, RD78G32, RD78G64, RD78GHV, RD78GHW	☞ PLCopen MOTION CONTROL FB MODE
Simple Motion mode	RD78G4, RD78G8, RD78G16	☞ SIMPLE MOTION MODE

Mode selection

The PLCopen Motion control FB mode or Simple Motion mode can be set by selecting a module supported by the mode for use in Module selection in GX Works3.

Supported mode	Model name	Details
PLCopen Motion control FB mode	RD78G_*1	Set the Motion module without (S) at the end of module name.
Simple Motion mode	RD78G_(S)*1	Set the Motion module with (S) at the end of module name.

*1 The _ displays the number of control axes.

The mode is set to the PLCopen Motion control FB mode by default. For how to PLCopen Motion control FB mode or Simple Motion mode, refer to the following.

- PLCopen Motion control FB mode (☞ Page 39 PROCEDURES BEFORE OPERATIONS)
- Simple Motion mode (☞ Page 113 PROCEDURES BEFORE OPERATIONS)

When an applicable model is not mounted on the slot position set in GX Works3, or a non-applicable model is mounted on the set slot position, "module configuration error" occurs in the CPU module.

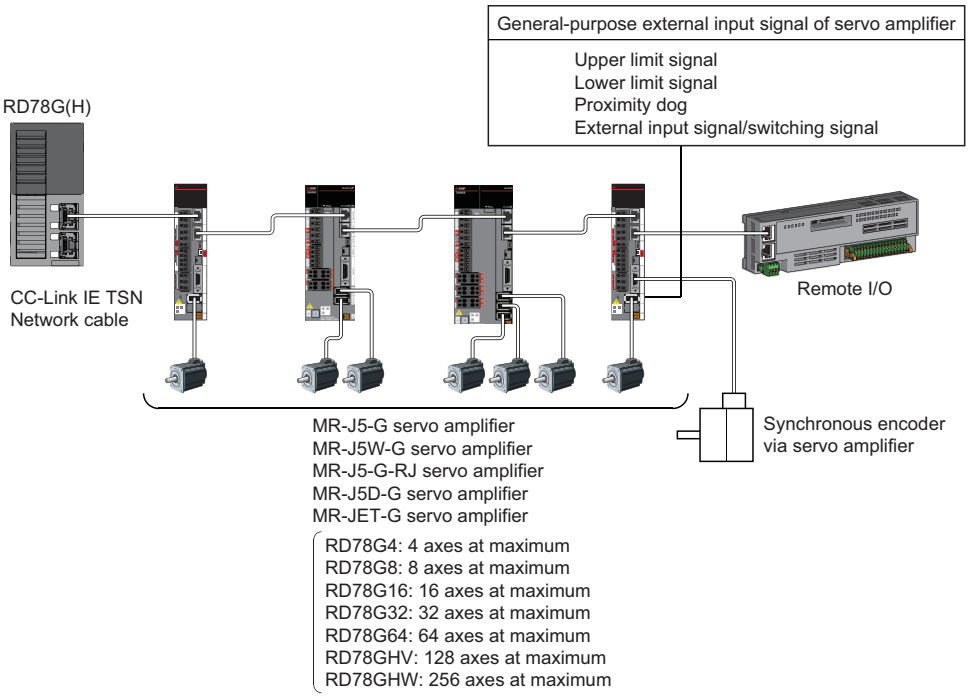
■Precautions when using Simple Motion mode

The following shows the precautions when using Simple Motion mode.

- The add-on for Simple Motion control is required for using the Simple Motion mode. Simple Motion, which is the add-on for Simple Motion mode, is included in the motion system software version "16" or later.
- For motion system software version "15" or earlier, when a system configuration that includes RD78G(S) is written to the CPU module, "module configuration error" occurs from the CPU module.
- The motion control FB of the Motion module cannot be used. Use "MELSEC iQ-R Motion Module (Simple Motion mode) FB" in the Simple Motion mode.
- The setting item of the default mapping differs between the servo amplifiers "MR-J5(W)-G" and "MR-JET-G".

COMPONENT

The following figure shows the components when the RD78G(H) is used.



MEMO

PART 1 PLCopen MOTION CONTROL FB MODE

This part consists of the following chapters. This chapter describes in detail about using the Motion module in PLCopen Motion control mode.

1 PART NAMES

2 SPECIFICATIONS

3 FUNCTION LIST

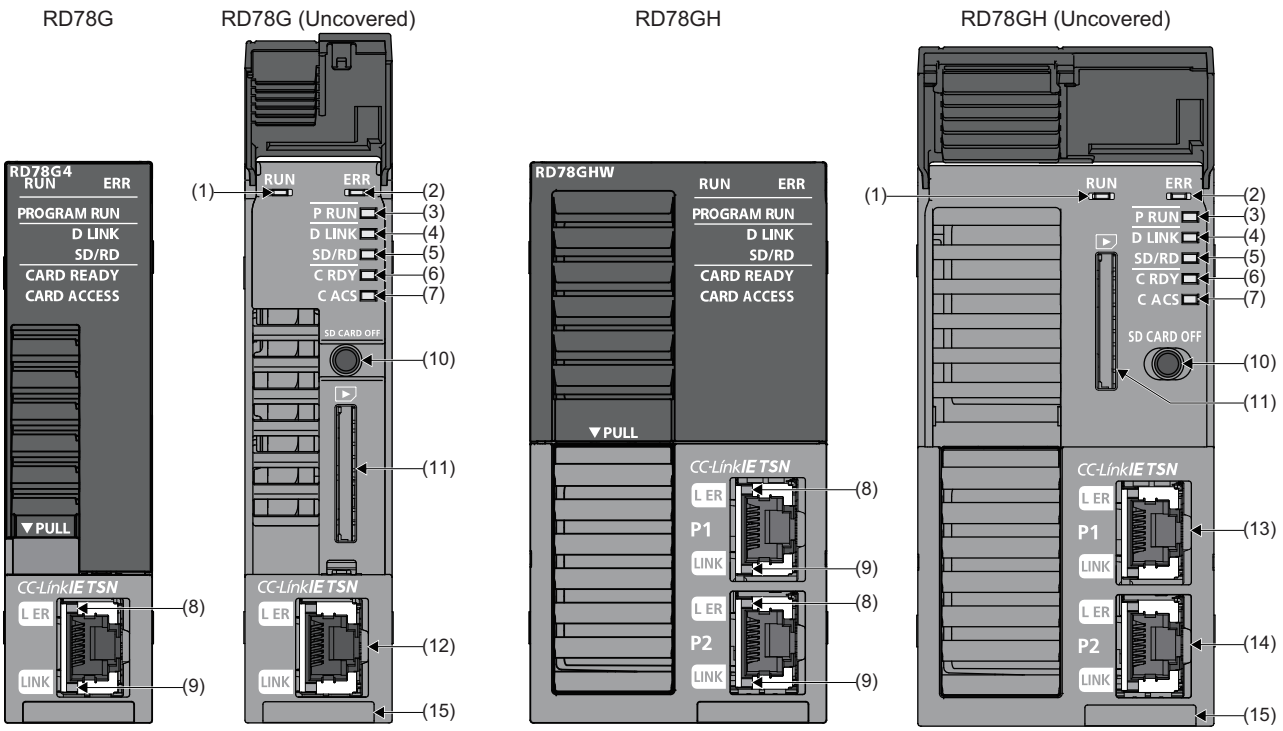
4 PROCEDURES BEFORE OPERATIONS

5 SYSTEM CONFIGURATION

6 INSTALLATION AND WIRING

1 PART NAMES

This chapter describes the part names of the Motion module.



No.	Name	Details
(1)	RUN LED[*1][*2]	Indicates the operating status. • ON: Operating normally • Flashing (every 500ms): Clear/Quick clearing • OFF: Error, Initializing
(2)	ERR LED[*1]	Indicates the error status. • OFF: Operating normally • ON: Error • Flashing (every 200ms): Error • Flashing (every 500ms): A data link faulty station detected
(3)	PROGRAM RUN LED[*2] (P RUN is shown inside the cover)	Indicates the execution status of built-in programs. • ON: Executing program • OFF: Stopping program
(4)	D LINK LED	Indicates the data link status. • ON: Data link (cyclic transmission being performed) • Flashing: Data link (cyclic transmission stopped) • OFF: Data link not performed (disconnection)
(5)	SD/RD LED	Indicates the data communicating status. • ON: Communicating data[*3] • OFF: Not communicating data[*3]
(6)	CARD READY LED[*2] (C RDY is shown inside the cover)	Indicates the status of SD memory card. • ON: An SD memory card is usable. • Flashing: Preparing • OFF: No SD memory card inserted
(7)	CARD ACCESS LED (C ACS is shown inside the cover)	Indicates the access status of SD memory card. • ON: Accessing SD memory card • OFF: Not accessing SD memory card
(8)	L ER LED[*4]	Indicates the port status. • ON: Abnormal data received • OFF: Normal data received
(9)	LINK LED	Indicates the link status. • ON: Link-up • OFF: Link-down

No.	Name	Details
(10)	SD memory card access control switch	Switch for stopping card access when removing the SD memory card. (☞ Page 80 SD Memory Card)
(11)	SD memory card slot	A slot to insert an SD memory card.
(12)	Ethernet port	Connects to a device station.
(13)	Ethernet port (P1)	
(14)	Ethernet port (P2)	
(15)	Product information marking	Shows the product information on the Motion module.

*1 The error status can be determined by the status of the RUN LED and the ERR LED.
When multiple errors occur, the error status is displayed in the order of major, moderate, and minor.

RUN LED	ERR LED	Error status	Description
OFF	ON, Flashing	Major error	An error such as hardware failure or memory failure. The module stops operating.
ON	Flashing	Moderate error	An error, such as parameter error, which affect module operation. The module stops operating.
ON	ON	Minor error	An error such as communication, positioning control, and program error. The module continues operating.

*2 The following table lists the LED displays during software installation.

RUN LED	PROGRAM RUN LED	CARD READY LED	Description
Flashing (every 500ms)	Flashing (every 500ms)	OFF	Executing the installation.
OFF	ON	ON	The installation is normally completed.
OFF	Flashing (every 200ms)	Flashing (every 200ms)	The installation is completed with an error.

*3 Includes cyclic transmission and transient transmission data for CC-Link IE TSN.

*4 For RD78GH, the status that the L ER LED display indicates varies depending on the Add-on baseSystem version as follows.

L ER LED	Add-on baseSystem version	
	"1.28" or earlier	"1.30" or later
ON	Abnormal data received	Abnormal data received or a loopback being executed*5
Flashing	Normal data received	Normal data received and a loopback not executed.

*5 When the station number is not set for a station where a loopback is being executed, the L ER LED of the station with no station number setting will not turn ON.
When a station with no station number setting is included in a ring configuration, the L ER LED of the loopback stations will not turn ON.

2 SPECIFICATIONS

2.1 Performance Specifications of Motion Module

This section lists the performance specifications of the Motion module.

Item		RD78G4	RD78G8	RD78G16	RD78G32	RD78G64	RD78GHV	RD78GHW
Number of controlled axes	Real drive axis*1	4 axes	8 axes	16 axes	32 axes	64 axes	128 axes	256 axes
	Virtual drive axis	Total 1024 axes The number of settable axes depends on the setting of the system memory capacity.*2						
	Virtual linked axis							
	Real encoder axis							
	Virtual encoder axis							
Operation cycle*3		62.5μs to 8ms*4					31.25μs to 8ms	
Interpolation function		1-axis to 4-axis linear interpolation 2-axis circular interpolation						
Control method		PTP (Point To Point) control, path control (linear, and arc can be set), speed control, speed-torque control						
Control unit		pulse, m, degree, Revolution, inch, arbitrary unit character string						
Positioning	Positioning range	-10000000000.0 ≤ Positioning range < 10000000000.0						
	Speed command	In position control: 0, +0.0001 to +2500000000.0 In speed control: 0, ±0.0001 to ±2500000000.0						
	Acceleration/deceleration process	Acceleration/deceleration specification method (acceleration, deceleration, jerk), acceleration/deceleration time constant method						
	Acceleration/deceleration time	■Acceleration/deceleration specification method Unit: U/s^2 Range: 0.0000, 0.0001 to 2147483647.0 ■Acceleration/deceleration time constant method Unit: s Range: 0.000000, 0.000001 to 8400.0						
	Rapid stop deceleration time							
Flash ROM write count		Up to 100000 times						
Number of occupied I/O points		32 points/slot (I/O assignment: 32 points)					48 points, 2 slots (I/O assignment: Empty 16 points + 32 points)	
Internal current consumption (5V DC)		1.93A					2.33A	
External dimensions	Height	106mm (4.17inch)						
	Width	27.8mm (1.09inch) (1 slot width)					56mm (2.2inch) (2 slots width)	
	Depth	110mm (4.33inch)						
Mass		0.26kg					0.44kg	

*1 When a multi-axis drive unit and a general output device are used as multiple axes, the number of those axes are counted.
<Example>
The 2-axis drive unit is counted as 2 axes.

*2 For memory capacity, refer to "Memory usage" in the following manual.
MELSEC iQ-R Motion Module User's Manual (Application)

*3 It depends on the number of controlled axes.

*4 For the version of Add-on baseSystem, "1.4" or earlier, operation cycle is "125μs to 4ms".

2.2 Specifications of Interfaces with External Devices

This section lists the external interfaces.

○: Support possible

Interface name	RD78G	RD78GH	Application
CC-Link IE TSN	1 port	2 ports	Network connection
SD memory card	○	○	Restoration of parameters and logs, installation of Motion module software

Performance specifications of CC-Link IE TSN

The performance specifications of the CC-Link IE TSN are shown below.

Item			RD78G4	RD78G8	RD78G16	RD78G32	RD78G64	RD78GHV	RD78GHW
Maximum number of link points per network[*1]		RX/RY (Slave label, link device)	16K points each (16384 points, 2K bytes)						
		RWr/RWw (Slave label, link device)	8K points each (8192 points, 16K bytes)						
		LB	32K points (32768 points, 4K bytes)						
		LW	16K points (16384 points, 32K bytes)						
Maximum number of link points per station	Master station	RX/RY (Slave label, link device)	16K points each (16384 points, 2K bytes)						
		RWr/RWw (Slave label, link device)	8K points each (8192 points, 16K bytes)						
		LB	32K points (32768 points, 4K bytes)						
		LW	16K points (16384 points, 32K bytes)						
Transient transmission capacity			1920 bytes maximum						
Safety communications[*2]	Maximum number of connectable safety stations per network		121 stations						
	Maximum number of safety connections per station		Master station: 120 connections						
	Maximum number of safety connections per the same communication destination station		1 connection						
	Maximum number of link points per safety connection		• Input: 8 words • Output: 8 words						
Communication speed			• 1Gbps • 100Mbps[*3]						
Minimum synchronization cycle			62.50μs[*4]					31.25μs	
Time synchronization accuracy			±1μs						
CC-Link IE TSN Class			CC-Link IE TSN Class B device						
CC-Link IE TSN protocol version			2.0/1.0[*5]						
Network topology[*7]			Line topology, star topology, coexistence of line and star topologies					Line topology, star topology, coexistence of line and star topologies, ring topology[*6]	
Communication cable			Ethernet cable which satisfies standard (☞ Page 84 Wiring products)						
Maximum station-to-station distance			100m (328.08ft.)						
Overall cable distance	Line topology		12000m (39370.08ft.) (when 121 stations[*8] are connected)						
	Ring topology		—					12100m (39698.16ft.) (when 121 stations[*8] are connected)[*6]	
	Others		Depends on the system configuration.						
Maximum number of connectable stations[*9]			121 stations[*8*10*11*12]						

Item	RD78G4	RD78G8	RD78G16	RD78G32	RD78G64	RD78GHV	RD78GHW
Maximum number of connectable devices	257 devices*8*13*14						
Maximum number of networks	239						
Communication method	Time sharing method						
Multicast filter	Supported						

*1 The maximum number of points for all link devices may not be used simultaneously depending on the number of device stations, or the number of points and assignments of the link devices that are set on the "CC-Link IE TSN Configuration" window.
*2 Availability differs depending on the firmware version. For details, refer to "Safety communication" in the following manual.
MELSEC iQ-R Motion Module User's Manual (Network)
*3 This speed can be used for the version of Add-on baseSystem, "1.8" or later.
*4 For the version of Add-on baseSystem, "1.4" or earlier, the minimum synchronization cycle is "125.00μs".
*5 "2.0" can be used with Add-on baseSystem version "1.20" or later. Protocol version "1.0" can be used when the remote station protocol version 1.0 is used with Add-on baseSystem version "1.20" or later.
*6 This can be used for the version of Add-on baseSystem, "1.30" or later.
*7 When the communication cycle is 31.25μs or 62.50μs, the line topology is only available. When connecting with the star topology, coexistence of line and star topologies, and ring topology, the communication cycle must be set to 125.00μs or more.
*8 Includes the master station.
*9 An error will not occur even if there is no station and axis in the network setting.
*10 Even if the station is a multi-axis drive unit device (a device which can control two axes or more), the number of station is counted as one station when it is recognized as one station.
*11 When an axis emulate is carried out, the number of stations is counted according to the connected device setting.
*12 For the version of Add-on baseSystem, "1.4" or earlier, the maximum number of stations is "65 stations".
*13 For the version of Add-on baseSystem, "1.4" or earlier, the maximum number of devices is "65 devices".
*14 Also includes the number of extension modules.

Performance specifications of Ethernet

The performance specifications of Ethernet are shown below.

Item			Description	
Transmission specifications	Data transmission speed		• 1Gbps • 100Mbps*1	
	Communication mode		• 1000BASE-T • 100BASE-TX*1	Full-duplex
	Interface		RJ45 connector (Auto MDI/MDI-X)	
	Maximum frame size		1518 bytes	
	Jumbo frame		Not available	
	Maximum segment length		100m (328.08ft.) (distance between a switching hub and a station)*2	
	Number of cascade connections		*3	
	IP version		Compatible with IPv4	
Sending/receiving data storage memory	Number of simultaneous open connections (maximum number of connections)	Connection with MELSOFT products and a GOT	8 connections*4	
		Connection to SLMP-compatible devices	8 connections*4	

*1 This speed can be used with Add-on baseSystem version, "1.8" or later.
*2 For maximum segment length (length between switching hubs), consult the manufacturer of the switching hub used.
*3 Consult the manufacturer of the switching hub used.
*4 When one connection is for one station, up to eight stations can be connected.

Point

The operation of commercial devices used for the following applications is not guaranteed. Check the operation before using the module.

- Internet (general public line) (Internet-access service offered by an Internet service provider or a telecommunications carrier)
- Firewall device(s)
- Broadband router(s)
- Wireless LAN

SD memory card

The specifications of the SD memory card is shown below.

Item	Specification
Card type	SD/SDHC memory card
Card capacity	Up to 32G bytes
UHS	Unsupported
Number of times of installation/removal	Within 500 times

Use the recommended SD memory card listed below.

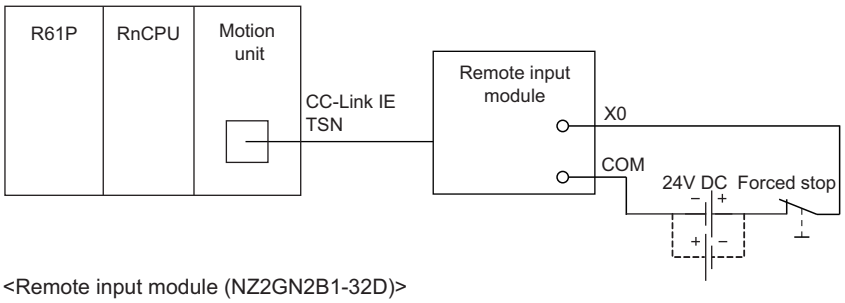
Model	Manufacturer	Card type	Card capacity
NZ1MEM-2GBSD	Mitsubishi Electric Corporation	SD	2G bytes
NZ1MEM-4GBSD		SDHC	4G bytes
NZ1MEM-8GBSD			8G bytes
NZ1MEM-16GBSD			16G bytes

Before using a commercially available SD memory card, check that the card does not affect the control of the target system on user's own responsibility.

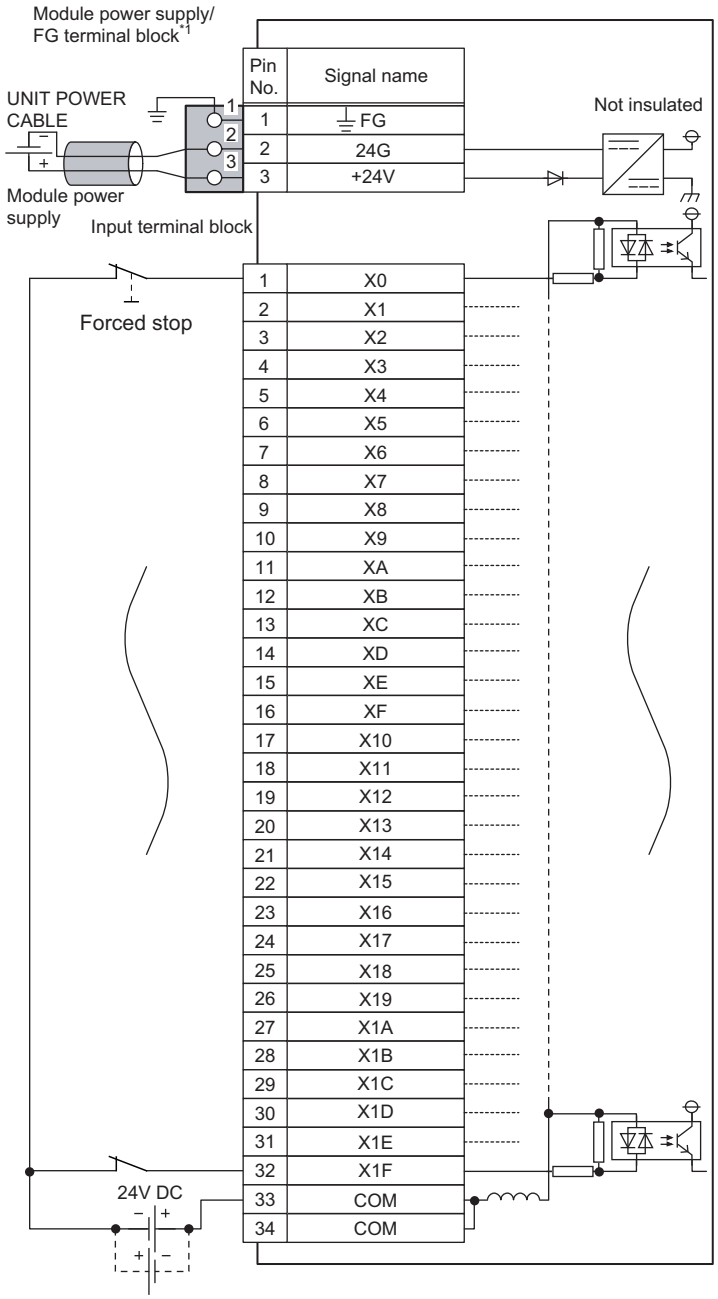
2.3 External Circuit Design

Forced stop circuit

A wiring example which uses a remote input module (NZ2GN2B1-32D) for the forced stop input is shown below.
Set the forced stop signal (AxisName.Pr.ForcedStop_Signal) according to the input modules.



<Remote input module (NZ2GN2B1-32D)>



*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 drive unit. Operation status of the emergency stop, drive unit 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 drive unit is shut off by external circuit, and the servo motor stops.
Drive unit forced stop		A stop command from the external circuit to the drive unit is output, and the drive unit stops the servo motor.
Motion controller forced stop		A stop command from the remote input module to the drive unit is output, and the drive unit stops the servo motor.

Shut-off the main circuit power supply of a drive unit when an emergency stop, alarm, servo amplifier forced stop, or remote input module forced stop occurs. Make sure to use molded-case circuit breakers (MCCB) for input wires of a drive unit power supply. For details, refer to the drive unit manual.
MR-J5(W)-G: MR-J5 User's Manual (Hardware)

3 FUNCTION LIST

There are restrictions in the function that can be used by the software of the Motion module and the version of engineering tool. For details, refer to "Restrictions by the version" in the following manual.

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

3.1 Control Functions

The PLCopen Motion control FB mode has several functions. For details on each function, refer to the following.

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

Basic specifications

Functions		Details
Axis control functions	Technical units	The position command unit and the velocity command unit used in the motion control can be set. Since the unit can be specified freely depending on the control target, intuitive programming and monitoring are available.
	Servo ON/OFF	This function executes servo ON/OFF of the real axis connected to the motion system. The servo ON enables the operation of the real axis.
	Follow up	Reflects the input (current position) from the device station assigned to an axis to the set position of the axis.
	Absolute position control	Restores the current position of an axis.
Basic functions	Operation cycle	In the motion system, operation processing related to the motion control is performed in the fixed cycle (operation cycle).
	Add-on function	The motion system functions can be expanded by installing add-on libraries.
	System memory settings	Sets the memory size used in the add-on library in the system memory (RAM) and the system memory (backup RAM).
	Software reboot	The software reboot (reset the system) is executed by writing the reboot command to the control command. When "Clear" is specified at the software reboot command, the system restarts and all data of the system is deleted.

Motion control

Functions			Details
Start and stop	Start		Starts motion control.
	Retrigger/continuous update		Changes the control of the on-going FB with a retrigger/continuous update.
	Multiple start (buffer mode)		Multiple motion control FBs execute continuously without stopping by executing the motion FB of another instance to the axis and the axes group that are executing the motion control FB.
	Stop		Stops motion control.
	Forced stop		Stops axes by the forced stop signal.
Homing	Homing request		Establishes the start point for carrying out positioning control (home position), and carries out positioning toward that start point. This is used to return a machine system, located at a position other than the home position when the Motion module requires "homing request" such as when the power is turned ON or after positioning stop, to the home position.
	Driver homing method		
	Data set homing method		
	Operation setting for incompletion of homing		Selects whether the axis starts or not, when the homing request is TRUE.
Axis control functions	Single axis positioning control		Executes positioning to the specified position by using address information.
	Single axis speed control		Executes the speed control for the specified axis with the specified speed.
	Single axis manual control		Executes the random positioning operation by inputting a signal from an external device. The following method is available for single axis manual operation. • JOG operation: the machine is moved by only an movement amount.
	Multiple axes positioning control		Uses address information and executes positioning to the specified position using interpolation control.
	Multiple axes positioning data operation		This function conducts the continuous positioning operation specified in the operation profile (multiple axes positioning data format) for an axis group.
Direct control	Velocity control		The driver control mode is switched to csv, and the control excluding the position loop is executed.
	Torque control		The driver control mode is switched to cst, and the control is carried out.
Functions related to position	Current position change function		Changes the set position and cumulative current position to an arbitrary address.
	Command in-position		Checks the remaining distance to the target position, and turns the command in-position flag to TRUE.
	Software stroke limit		An address is set as the movable range. Even if a movement command to the address outside the setting range is issued, the command will not be executed.
	Hardware stroke limit		Limit switches are set at the upper/lower limit of the physical movable range, and the control is stopped by the input of a signal from the limit switch.
Functions related to speed	Acceleration/deceleration processing function		Adjusts the acceleration/deceleration of each motion control to the acceleration/deceleration curve suitable for device.
	Speed limit		Limits the command speed to a value within the speed limit value setting range when the command speed during control exceeds the speed limit value.
	Override function		Changes the speed during control.
Functions related to torque	Torque limit		Limits the generated torque to a value within the torque limit value range when the torque generated in the servo motor exceeds the torque limit value.
	Torque limit value change function		Changes the torque limit value during control.
Sub functions of control	Compensation function	Driver unit conversion function	Converts the cumulative current position to the driver command value and pass it to the target position (Target Position). Also, it converts the current position of the driver and calculates the actual position.
	Command filter	Smoothing filter	Used to suppress load-side vibration, such as work-side vibration and base shake.
		Direction limit filter	Limits a direction of an axis.
		Speed limit filter	Limits a speed of axis.
		Backlash compensation filter	Compensates amount of mechanical backlash (play).
	Input variable change in execution		Changes input variables during control.
Common functions	External signal selection		Sets I/O signals to be used in various control.
	Touch probe		Records (latches) arbitrary data at trigger input signal detection.
	Axis emulate		Carries out axis control on the real axis without connecting the device station.
	Inter-module synchronization function		Synchronizes the control timing among multiple modules on the same base.
	Master-slave operation		Using the "master-slave operation function" of the servo amplifier, this function controls the master axis with the motion system, while the slave axes are controlled by data communication between servo amplifiers (driver communication) without using the motion system.

Functions		Details
Synchronous control	Cam operation	Operates by synchronizing the slave axis with the master axis based on cam table.
	Gear operation	Sets the speed ratio between the master axis and the slave axis, and starts gear operation.
	Addition/Subtraction positioning	Combines the movement amount of 2 axes and transmits.
Operation profile function	Operation profile data	Performs opening profile for the cam and reading/writing for the cam.
Expansion function	Advanced synchronous control	Sets mechanisms such as gears, clutches, speed change gears, and cams to "parameters for advanced synchronous control" to synchronize movement with the input axis.

Control/Operation/Maintenance

Functions			Details
Logging	Data logging function		Collects the motion system data at a specified interval based on the logging setting (trigger condition or data collection condition) written by the engineering tool and save the result to the data logging file.
	Real-time monitor		Sets the data collection and monitor the collected data (waveform display) in real time in the status where the engineering tool has been connected with the motion system.
	Application function	Event detection	When File save setting is set to "Disabled" in the logging setting, only the trigger detection is executed without saving files.
		Auto logging	When inserting an SD memory card, which holds logging setting, into the motion system, the data logging automatically starts based on the logging setting information on the SD memory card.
RAS functions	Execution time monitor		Monitors the operation cycle processing and the normal task execution time.
	History data	Event history function	Saves the data such as the error detected by the motion system, the operation executed to the module, and the event related to the motion control of start and stop as even history.
		Position data history	The position data history of each axis can be monitored by the engineering tool.
	Servo system recorder		Generates logging setting file which is optimal for analyzing of the error factors and continuously monitors the error status of the motion system and supported device stations. When an error is detected, the state before and after the occurrence will be recorded for a certain period of time and saved in the file.
	Co-recording function		Synchronizes data-saving trigger generation between devices supporting the co-recording function.
File control	File transfer function		Executes file operation based on the specified command.
	Parameter read/write function		Parameters can be read or written.
Security	Security key authentication		Prevents unauthorized viewing of a program in the engineering tool. Also prevents unauthorized program execution in a motion system. (By using a security key.) A program locked by a security key can only be executed with a motion system that has the same security key set to it.
Motion module software install			When updating or changing to the new software, users have to install the software again.

3.2 List of Network Function

The following table lists the functions of CC-Link IE TSN. For details on the functions, refer to "Functions" in the following manual.

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

Cyclic transmission

This function allows periodic data communications among stations on the network using link devices.

○: Connection available, ×: Connection not available

Function		Description	Availability	
			Standard station	Motion control station
Communications using RX, RY, RWr, and RWw		Communicates data in units of bits and words between the master station and device stations.	○	×
Communications using LB and LW		Communicates data in units of bits and words between the master station and local stations.	○	×
Communications using RX, RY, RWr, RWw, LB and LW		Communication using link devices (RX, RY, RWr, RWw) and communication using link devices (LB, LW) can be performed at the same time.	○	×
Link refresh		Automatically transfers data between the link devices of the Motion module and the devices of the CPU module.	○	×
Direct access to link devices		Directly reads or writes the corresponding data to/from link devices (RWw/RWr/RX/RY/SB/SW/LB/LW) of the CC-Link IE Network module using a sequence program.	○	×
Direct access to link devices from built-in Motion program		Directly reads or writes the corresponding data to/from link devices (RWw/RWr/RX/RY/SB/SW/LB/LW) of the CC-Link IE Network module using a built-in Motion program.	○	×
Cyclic data assurance		Assures the cyclic data integrity in units of 32 bits or station-based units.	○	×
Link refresh		Transfers data in the link devices of the master station to another network module on a relay station.	○	×
Communication cycle coexistence		When device stations with different communication cycles are included in the network, multiple communication cycles according to each device station are used for communications.	○	×
I/O maintenance settings	Output mode upon CPU error	Sets whether to hold or clear output when a stop error occurs in the CPU module. Set it on the sending side.	○	×
	Output hold/clear setting during CPU STOP	Sets whether to hold or clear output when the status of the CPU module changes from RUN to STOP. Set it on the sending side.	○	×
	Data link faulty station setting	Sets whether to clear or hold input from a disconnected station. Set it on the receiving side.	○	×
Remote device test		Arbitrarily turns on or off the output of the remote station when the CPU module is in STOP state.	○	×
CANopen communication		Controls a servo amplifier supporting the CANopen profile.	○	○

Transient transmission

This function is used for communications at any timing and has the following three functions.

○: Connection available, ×: Connection not available

Function	Description	Availability	
		Standard station	Motion control station
Communications using a dedicated instruction	Reads/writes data from the master station or local station to a remote station CPU module device, or a remote station buffer memory by the dedicated instructions.	○	○
Communications using the SLMP	Reads/writes data of master station and remote station CPU module device, or a remote station buffer memory from the Motion module and the external device such as a personal computer or HMI (Human Machine Interface) via an SLMP.	○	○
Communications using engineering tool	Configures the settings of or monitors each station using an engineering tool.	○	○

Ethernet connection

This function connects an Ethernet device to a module without interfering with CC-Link IE TSN.

○: Connection available, ×: Connection not available

Function	Description	Availability	
		Standard station	Motion control station
Connection with MELSOFT products and a GOT	Allows programming and monitoring of the CPU module using the engineering tool, and monitoring and testing of the CPU module from the GOT via Ethernet.	○	○
Connection with SLMP-compatible devices	Connects SLMP-compatible devices (such as a personal computer or a vision sensor, etc.) to the Motion module.	○	○

Security

This function ensures optimal security according to the network environment by restricting access for each communication path to the CPU module.

○: Connection available, ×: Connection not available

Function	Description	Availability	
		Standard station	Motion control station
IP filter	Identifies the IP address of the access source to limit access to the Motion module.	○	○
Remote password	Prevents illegal access of the CPU module from a remote location for each function.	○	○

RAS

This function improves Reliability, Availability, and Serviceability and makes automated equipment easy to use comprehensively.

○: Connection available, ×: Connection not available

Function	Description	Availability	
		Standard station	Motion control station
Device station disconnection	Stops data link of the device station where an error occurred, and continues data link only for device stations that are operating normally.	○	○
Automatic return	Restarts the data link automatically when the device station that was disconnected due to an error becomes normal again.	○	○
Loopback function	Continues data link with normally operating stations even if a cable disconnection or faulty station occurs in a ring topology network configuration. Only supported by RD78GH.	○	○
Master station duplication detection	When one network has multiple master stations, detects duplication.	○	○
IP address duplication detection	When one network has stations with the same IP address, detects duplication.	○	○
Time synchronization	Synchronizes the time of device stations with the time synchronization source (CPU module of the master station).	○	○

Synchronization function

This function adjusts the timing with the timing of different device stations connected to the same network.

○: Connection available, ×: Connection not available

Function	Description	Availability	
		Standard station	Motion control station
CC-Link IE TSN Network synchronous communication function	Synchronizes control cycles between device stations over CC-Link IE TSN according to the inter-module synchronization cycle specified in the master station. This allows different device stations on the same network to operate with the same timing.	○	×
	Synchronizes the control cycle of device stations according to the communication cycle of the master station. This allows device stations specified in Motion control stations to operate with the same timing as the Motion operation of the Motion module.	×	○

Safety communications

This function allows safety data to be exchanged between safety stations on the same network.

○: Connection available, ×: Connection not available

Function	Description	Availability	
		Standard station	Motion control station
Safety communications	Establishes a safety connection and enables “one-on-one” safety communications periodically between safety stations in the same network.	○	○

Troubleshooting

This function shows the status of the module and network by executing diagnostics and operation tests using the engineering tool.

○: Connection available, ×: Connection not available

Function	Description	Availability	
		Standard station	Motion control station
CC-Link IE TSN/CC-Link IE Field diagnostics	Monitors the CC-Link IE TSN status. The network maps, stations where data link is not operating, selected station communications status monitor and so on are displayed on the engineering tool.	○	○
Communication test	Checks if transient transmission data can be properly routed from the own station to the communication target.	○	○

Others

○: Connection available, ×: Connection not available

Function		Description	Availability	
			Standard station	Motion control station
"CC-Link IE TSN Configuration" window	Parameter setting of a device station	Sets parameters of device stations (the number of points and assignment of link devices) in the master station.	○	○
	Detection of connected/ disconnected devices	Detects connected device stations and the stations are displayed on the "CC-Link IE TSN Configuration" window.	○	○
	Parameter processing of a device station	Reads and saves the parameters from the device station, and writes the saved parameters to the device station.	○	○
	Command execution to device stations	Executes commands (Error clear request, Error history clear request) to a device station.	○	○
	IP address setting of a device station	Sets an IP address of the device station that is set as the master station.	○	○
Reserved station setting		A device station that is set in the parameters and included as a station in the network when its number is counted. This station is reserved for network extension in the future, and thus the station is not actually connected, and is not detected as a faulty station despite being not connected.	○	○
Error invalid station setting		A device station that is set to be not detected as a faulty station by the master station. Carry out this setting when replacing a device station during a data link as well.	○	○
Slave station parameter automatic setting		Parameters of the device station on CC-Link IE TSN set using the engineering tool are written in the data memory of the CPU module or the SD memory card, and those are automatically set via the master station when the device station is returned/replaced by power ON or connected.	○	○
Data collection by CC-Link IE TSN Communication Software		CC-Link IE TSN cyclic data is sent using the CC-Link IE TSN Communication Software. For details on the CC-Link IE TSN Communication Software, refer to the following. 📖CC-Link IE TSN Communication Software for Windows User's Manual	○	○
Co-recording		The master station or local station relays co-recording triggers between recording devices on its base unit and recording devices of other stations. 📖MELSEC iQ-R System Recorder Co-recording Function Reference Manual	○	○

4 PROCEDURES BEFORE OPERATIONS

This chapter describes the procedures before operation of RD78G(H) using PLCopen Motion control FB mode.

1. Mounting the module

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

For details on mounting modules, refer to the following.

MELSEC iQ-R Module Configuration Manual

2. Wiring

Connect the Motion module to external devices.

3. Adding the module

Add the RD78G(H) to the module map of the project using GX Works3.

4. Network construction

Set network parameters in "Module Parameter (Network)" of GX Works3.

- Set the communication cycle setting for Network Configuration Settings.
  Set the basic communication cycle according to the number of controlled axes or network device configuration. For a reference of the cycle, refer to the following manual for "Operation Cycle".
  MELSEC iQ-R Motion Module User's Manual (Application)
- Set a device station for Network Configuration Settings.
  The device station controlled in the Motion module needs to be set in the motion control station. Also, when setting in the motion control station, set the basic cycle for the communication cycle.

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

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

5. Module setting (module extended parameter)

Configure the settings related to axis control in "Module Extended Parameter" of GX Works3.

For details, refer to "Motion Module Program Creation" in the following manual.

MELSEC iQ-R Programming Manual (Motion Control Function Blocks)

Point

- When switching from Simple Motion mode to PLCopen Motion control FB mode, the backup data saved in the system memory (backup RAM) needs to be cleared. To clear the backup data, perform quick clearing from the "Remote Operation" function of "Motion Control Setting Function" in PLCopen Motion control FB mode. For details on the operation method, refer to "Help" in the Motion Control Setting Function.
- When the backup data from Simple Motion mode is needed, during Simple Motion mode use the "backup/restoration" function of "Simple Motion Module Setting Function". For details on the operation method, refer to "Help" in the Simple Motion Module Setting Function.

6. 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 Motion Module User's Manual (Network)

7. Programming

Create programs.

For details, refer to "Motion Module Program Creation" in the following manual.

MELSEC iQ-R Programming Manual (Motion Control Function Blocks)

8. Writing parameters

Write the set parameters and programs to the Motion module.

- "Motion Module (Built-in Memory)" or "Motion Module (SD Memory Card)" can be selected as a parameter storage location of module extended parameters. The initial setting is "Motion Module (Built-in Memory)". When writing module extended parameters, specify the same storage location in the writing destination of GX Works3 as "Module Extended Parameter Storage Location Setting" in "Module Operation Setting" of Module Parameter (Motion).

For details, refer to "Memory and File" in the following manual.

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

Point

After changing settings related to public labels always "Reflect Public Labels" with the Motion Control Setting Function and write projects for both the CPU module and the Motion module. Executing a program with inconsistencies between the CPU module and Motion module can lead to unintended operations.

9. Network diagnostics

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

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

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

10. Parameter settings in device stations

Set parameters of the drive unit to use.

For details, refer to each drive unit manual.

MR-J5(W)-G: MR-J5-G/MR-J5W-G User's Manual (Parameters)

11. Test operation

Check that the program is correctly carried out as created

Point

When multiple device stations are powered on simultaneously, the startup time of the device stations may vary. In such a case, the networks are connected in turn, resulting in the possibility of the longer time to complete data links at all stations.

Powering on the master station after all device stations have started prevents the time required for data links at all stations to increase.

4.1 Communication with the Engineering Tool

This section describes communication between the motion system and external devices such as GX Works3 (motion control setting function).

For details of the online function, refer to the following manual.

📖GX Works3 Operating Manual

For communication for access to other module from a tool such as the engineering tool via the Motion module, refer to "Communications using the engineering tool" in the following manual.

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

Operation of this function for each system status

○: Possible, △: Possible (with restrictions)

Status	Operation availability
STOP	○
RUN	○
Moderate error	○
Major error	△ (Communication with the Motion module may not be performed depending on the error status. In that case, monitor the error status on the control CPU side.)

Accessible path

Communication with the Motion module is possible only through connection with the control CPU or own Motion module. Communication via a module other than the control CPU or own Motion module on the base may not be possible depending on the path.

SLMP communication

The labels and files in the motion system can be accessed by using SLMP.

For details on the SLMP communication method, refer to "Transient Transmission" in the following manual.

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

Or, refer to the following manual.

📖SLMP Reference Manual

To issue SLMP to the motion system, set the value obtained by "I/O number of the Motion module ÷ 16" in "request destination module I/O number" in the request message.

The following shows the commands that can be executed by SLMP addressed to the motion system.

Item		Command	Sub command	Description
Type	Operation			
Remote Control	Read Type Name	0101	0000	Reads the model name and model code of the module to be accessed.
Label	Read Random	041C	0000	Reads the data with a label specified.
	Write Random	141B	0000	Writes the data with a label specified.
File	Read Directory/File	1810	0040	Reads the list information of the file.
	New File	1820	0000	Reserves the storage area of the specified file.
	Delete File	1822	0040	Deletes the file.
	Open File	1827	0040	Opens the file.
	Read File	1828	0000	Reads the contents of the file.
	Write File	1829	0000	Writes the contents to the file.
	Close File	182A	0000	Closes the opened file.

Precautions

The following shows the specifications specific to the SLMP commands for the motion system (points that differ from the descriptions in "SLMP Reference Manual").

- "Model codes" that can be acquired with the Read Type Name command are listed below.

Model name	Model code
RD78G4	6940H
RD78G8	6941H
RD78G16	6942H
RD78G32	6943H
RD78G64	6944H
RD78GHV	6945H
RD78GHW	6946H

- The following shows the read data length of the Label Read Random command. The data type not shown below and Label Write Random command (all data type) are not different from the ones described in SLMP Reference Manual.

Data type name	Data type ID	Read data length (byte)	
		Motion system	SLMP Reference Manual
Bit	1	1	2
String	9	(Number of defined characters of the label + 1) × 2	Number of defined characters of the label + N When the number of defined characters is an odd number, N is "1". When the number of defined characters is an even number, N is "2".

- For "drive No." specified with the File command, refer to "FILE CONTROL" in the following manual.
  MELSEC iQ-R Motion Module User's Manual (Application)
- The file name can be specified in "path name of the directory" of the Read Directory/File command. Only the information of the corresponding file will be returned.
- When the Read Directory/File command is executed via the path other than the Motion module (such as the Ethernet port of the control CPU module), not all the files may be read. For the application in which all the files are enumerated by executing the Read Directory/File multiple times, use the Ethernet port of the Motion module.
- The Open File command does not lock the file access. Therefore, access from other processing or file deletion with the Delete File command is not inhibited even for an opened file. Do not access a file which is being written.
- "Offset address" specified with the Read File and Write File commands can be used in both the even/odd number addresses. There are no restrictions on each drive.
- "All the files locked by the external device that executes the command" cannot be specified for "close type" of the Close File command.

Precautions

Communication with the Motion module is possible only through connection with the control CPU or own Motion module.
Communication via a module other than the control CPU or own Motion module on the base may not be possible depending on the path.

Relevant Add-ons, Versions

Communication with the engineering tool is possible without even one add-on being installed.

Point

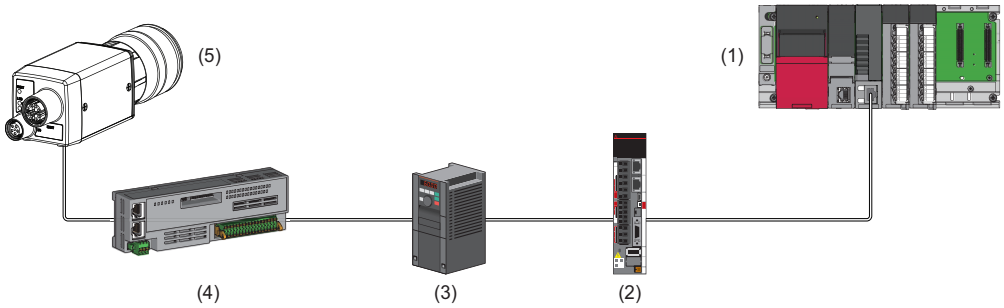
When file transfer function (Add-on File Transfer) is enabled, transfer time of reading and writing the project data from the engineering tool is shortened by compressing the data.

System memory capacity

The system memory will not be used because add-on is not used for the communication.
However, when file transfer function (Add-on File Transfer) is enabled, Add-on File Transfer will use the system memory when reading and writing the project data from the engineering tool.

5 SYSTEM CONFIGURATION

CC-Link IE TSN is configured using Ethernet cables. (☞ Page 83 Ethernet cable)
For specifications on connectable devices, refer to the manual of each device.



(1) Motion module
(2) Drive unit
(3) Inverter device
(4) Remote I/O module
(5) Ethernet device

Point

Both P1 and P2 can be used when using RD78GH. When only one of the connector is used, either P1 or P2 can be connected.

List of system configurations

The following table is a list of different system configurations.

List of system configurations	Reference
Modules on CC-Link IE TSN (CC-Link IE TSN Class B only) and Ethernet devices	☞ Page 46 Structure of CC-Link IE TSN Class B Devices Only
Modules on CC-Link IE TSN (Mixture of CC-Link IE TSN Class B/A or CC-Link IE TSN Class A only) and Ethernet devices	☞ Page 57 Structure of CC-Link IE TSN Class B/A Devices
Modules on CC-Link IE TSN, modules on CC-Link IE Field Network, and Ethernet devices	☞ Page 73 Structure of a CC-Link IE TSN and CC-Link IE Field Network
CC-Link IE TSN communication software and modules on CC-Link IE TSN	☞ Page 74 Structure when CC-Link IE TSN Communication Software is Used
Modules on CC-Link IE TSN (mixed protocol version 2.0/1.0) and Ethernet devices	☞ Page 154 System configuration with CC-Link IE TSN Class B/A Devices (Protocol Version 2.0/1.0)
Modules on CC-Link IE TSN (protocol version 1.0 only) and Ethernet devices	☞ Page 156 System configuration with CC-Link IE TSN Class B/A Devices (Protocol Version 1.0 only)

Precautions

A dedicated TSN hub may be required depending on parameter settings or the network topology used to connect modules on CC-Link IE TSN.

Unicast mode and multicast mode

Cyclic transmission differs depending on the communication mode set by the module parameter of the master station. The types of communication modes are as follows:

- Unicast mode
- Multicast mode

For details, refer to the following.

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

CC-Link IE TSN Class setting

From "Connection Device Information" under "Basic Settings" of the engineering tool, select either of the following items according to devices to be connected.

Connected device information	System configuration	Supported standard
CC-Link IE TSN Class B Only	Select this if the system is to be configured without connecting the CC-Link IE TSN Class A device. • ☞ Page 51 Connection with modules on CC-Link IE TSN only • ☞ Page 56 Connection with modules on CC-Link IE TSN and Ethernet devices	IEEE802.1AS
Mixture of CC-Link IE TSN Class B/A or CC-Link IE TSN Class A Only	Select this when connecting a CC-Link IE TSN Class A device, or when configuring a system that will connect to a CC-Link IE TSN Class A device in the future. (A configuration using only CC-Link IE TSN Class B device can also be connected) ☞ Page 57 Structure of CC-Link IE TSN Class B/A Devices	IEEE802.1AS or IEEE1588*1

*1 IEEE1588 is for Add-on baseSystem version "1.18" or earlier.
If Add-on baseSystem version "1.20" or later is used, either IEEE802.1AS or IEEE1588 will be used depending on the protocol version of the connected device. For details, refer to the following.
☞ Page 155 Device time synchronization method and connection specifications

Ethernet connection

For connection with MELSOFT products and a GOT, and connection with SLMP-compatible devices, refer to "Ethernet Connection" in the following manual.
📖MELSEC iQ-R Motion Module User's Manual (Network)

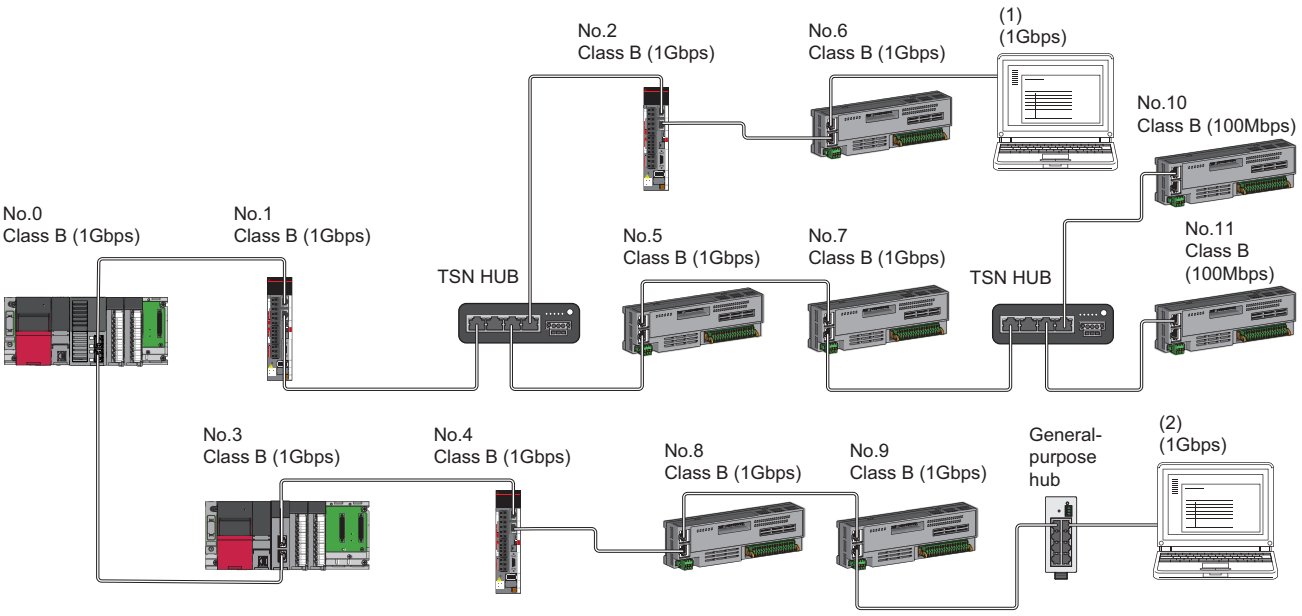
With the Safety CPU

When the Motion module is used with the Safety CPU, the safety communications are available in addition to the standard communications (cyclic transmission and transient transmission).
For details on the safety communications, refer to "Safety Communication" in the following manual.
📖MELSEC iQ-R Motion Module User's Manual (Network)

5.1 Structure of CC-Link IE TSN Class B Devices Only

The following shows the system configuration when "Connection Device Information" under "Basic Settings" is set to "CC-Link IE TSN Class B Only" in the engineering tool.

When "Connection Device Information" under "Basic Settings" of the master station is set to "CC-Link IE TSN Class B Only", up to 121 stations (one master station and 120 device stations) can be connected.

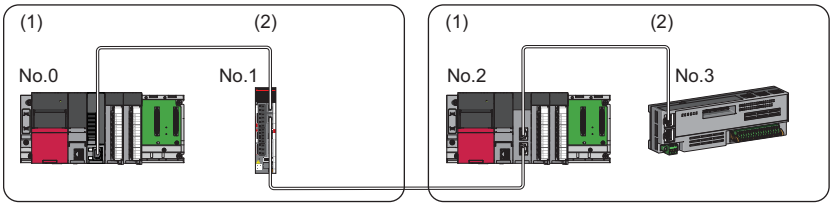


No.0: Master station
No.3: Local station
No.1, No.2, No.4, No.5, No.6, No.7, No.8, No.9, No.10, No.11: Remote station
(1), (2) Ethernet device
Class B: CC-Link IE TSN Class B device

The availability of connection of network configuration devices varies depending on the communication mode and communication speed.

- When using unicast mode
  - ☞ Page 47 When the communication speed for the master station is set to 1Gbps
  - ☞ Page 48 When the communication speed for the master station is set to 100Mbps
- When using multicast mode
  - ☞ Page 49 When the communication speed for the master station is set to 1Gbps
  - ☞ Page 50 When the communication speed for the master station is set to 100Mbps

The following terms are used to describe the terms in the tables referenced.



No.0: Master station
No.2: Local station
No.1, No.3: Remote station
(1) Device on the master station side (The master station or a device near the master station)
(2) Device on the end side (A device far from the master station)

Restriction

- When "Network Topology" under "Basic Settings" is set to "Ring", "Network parameter error" (error code: 2221H) will occur in the Motion module.
- "Network parameter error" (error code: 2221H) will occur in the Motion module if the following settings are made when the add-on baseSystem version is "1.22" or earlier.
  · If "Local station" is set for the "Network configuration setting"
  · If "Multicast" is set for the "Communication mode"

Availability of connection with devices (when using unicast mode)

The following shows the case when "Communication Mode" under "Application Settings" is set to "Unicast".

When the communication speed for the master station is set to 1Gbps

The following table lists the availability of connection with a network configuration device when the "Communication Speed" for the master station is set to "1Gbps".

○: Connection available, ●: Connection available via a switching hub, ×: Connection not available

△: Connection available only when the device on the end side is a standard station.

▲: Connection available only when the device on the end side is a standard station, and is connected via a switching hub.

S: TSN hub available

H: General-purpose hub available

Device on the master station side (A device near the master station)		Device on the end side (A device far from the master station)					
		Local station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class B device)		Ethernet device	
		1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps
Master station (CC-Link IE TSN Class B device)	1Gbps	△S	×	○S	▲S*1*3	○SH	●SH*3
Local station (CC-Link IE TSN Class B device)	1Gbps	△S	×	○S	▲S*1*2*3	○SH	●SH*3
	100Mbps	×	×	×	×	×	×
Remote station (CC-Link IE TSN Class B device)	1Gbps	△S	×	○S	▲S*1*2*3	○SH	●SH*3
	100Mbps	×	×	×	△S*1*2*3	×	○SH*3

*1 For a device station with a communication speed of 100Mbps, set "Communication Period Setting" to "Low-Speed".

*2 A connection cannot be established if the total cyclic data size of all device stations on the 100Mbps device side exceeds 2K bytes. This includes the devices with a communication speed of 100Mbps that form a boundary between the communication speed of 1Gbps and 100Mbps. (☞ Page 79 Calculation of the total cyclic data size)

*3 When the Add-on baseSystem version is, "1.15" or earlier, only one of P1 or P2 can be used.

Precautions

When a TSN hub is used, check the TSN hub specifications on the CC-Link Partner Association website (www.cc-link.org).

When the communication speed for the master station is set to 100Mbps

The following table lists the availability of connection with a network configuration device when the "Communication Speed" for the master station is set to "100Mbps".

○: Connection available, ×: Connection not available

△: Connection available only when the device on the end side is a standard station

S: TSN hub available

H: General-purpose hub available

Device on the master station side (A device near the master station)		Device on the end side (A device far from the master station)					
		Local station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class B device)		Ethernet device	
		1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps
Master station (CC-Link IE TSN Class B device)	100Mbps	×	△S*1	×	○S*1	×	○SH
Local station (CC-Link IE TSN Class B device)	1Gbps	×	×	×	×	×	×
	100Mbps	×	△S*1	×	○S*1	×	○SH
Remote station (CC-Link IE TSN Class B device)	1Gbps	×	×	×	×	×	×
	100Mbps	×	△S*1	×	○S*1	×	○SH

*1 For a device station with a communication speed of 100Mbps, set "Communication Period Setting" to "Basic Period" or "Normal-Speed".

Precautions

When a TSN hub is used, check the TSN hub specifications on the CC-Link Partner Association website (www.cc-link.org).

Availability of connection with devices (when using multicast mode)

The following shows the case when "Communication Mode" under "Application Settings" is set to "Multicast".

When the communication speed for the master station is set to 1Gbps

The following table lists the availability of connection with a network configuration device when the "Communication Speed" for the master station is set to "1Gbps".

○: Connection available, ●: Connection available via a switching hub, ×: Connection not available

△: Connection available only when the device on the end side is a standard station.

▲: Connection available only when the device on the end side is a standard station, and is connected via a switching hub.

S: TSN hub available

H: General-purpose hub available

Device on the master station side (A device near the master station)		Device on the end side (A device far from the master station)					
		Local station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class B device)		Ethernet device	
		1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps
Master station (CC-Link IE TSN Class B device)	1Gbps	△S*2	×	○S*2	▲S*1*2	○SH*2	●SH*2
Local station (CC-Link IE TSN Class B device)	1Gbps	△S*2	×	○S*2	▲S*1*2*3*4	○SH*2*4	●SH*2*4
	100Mbps	×	×	×	×	×	×
Remote station (CC-Link IE TSN Class B device)	1Gbps	△S*2	×	○S*2	▲S*1*2*3*4	○SH*2*4	●SH*2*4
	100Mbps	×	×	×	△S*1*2*3	×	○SH*2*4

*1 For a device station with a communication speed of 100Mbps, set "Communication Period Setting" to "Low-Speed".

*2 When the device is connected on the end side via the switching hub as shown below, communication may not be possible depending on the type of the device.
The communication will be enabled by configuring settings with the switching hub so that the multicast frame (with multicast MAC address 09:00:70:00:10:02 and 09:00:70:00:10:05) will not be transferred to the ports specified below.

Connection configurations that cannot communicate	Port prohibiting transmission of multicast frame
Device stations with communication speeds of 1Gbps and 100Mbps coexist.	Connection port of the device station with a communication speed of 100Mbps.
A local station and Ethernet device coexist.	Connection port of the Ethernet device.
The remote station and Ethernet device coexist.	

*3 A connection cannot be established if the total cyclic data size of all device stations 100Mbps device side exceeds 2K bytes. This includes the devices with a communication speed of 100Mbps that form a boundary between the communication speed of 1Gbps and 100Mbps. (☞ Page 79 Calculation of the total cyclic data size)

*4 For a local station or remote station of a device on the master station side, use a device supporting the multicast filter. (📖Manual for the device used)

Precautions

When a TSN hub is used, check the TSN hub specifications on the CC-Link Partner Association website (www.cc-link.org).

When the communication speed for the master station is set to 100Mbps

The following table lists the availability of connection with a network configuration device when the "Communication Speed" for the master station is set to "100Mbps".

○: Connection available, ●: Connection available via a switching hub, ×: Connection not available

△: Connection available only when the device on the end side is a standard station.

S: TSN hub available

H: General-purpose hub available

Device on the master station side (A device near the master station)		Device on the end side (A device far from the master station)					
		Local station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class B device)		Ethernet device	
		1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps
Master station (CC-Link IE TSN Class B device)	100Mbps	×	△S*1*2	×	○S*1*2	×	○SH*2
Local station (CC-Link IE TSN Class B device)	1Gbps	×	×	×	×	×	×
	100Mbps	×	△S*1*2	×	○S*1*2	×	○SH*2*3
Remote station (CC-Link IE TSN Class B device)	1Gbps	×	×	×	×	×	×
	100Mbps	×	△S*1*2	×	○S*1*2	×	○SH*2*3

*1 For a device station with a communication speed of 100Mbps, set "Communication Period Setting" to "Basic Period" or "Normal-Speed".

*2 When the device is connected on the end side via the switching hub as shown below, communication may not be possible depending on the type of the device.
The communication will be enabled by configuring settings with the switching hub so that the multicast frame (with multicast MAC address 09:00:70:00:10:02 and 09:00:70:00:10:05) will not be transferred to the ports specified below.

Connection configurations that cannot communicate	Port prohibiting transmission of multicast frame
A local station and Ethernet device coexist.	Connection port of the Ethernet device.
The remote station and Ethernet device coexist.	

*3 For a local station or remote station of a device on the master station side, use a device supporting the multicast filter. (Manual for the device used)

Precautions

When a TSN hub is used, check the TSN hub specifications on the CC-Link Partner Association website (www.cc-link.org).

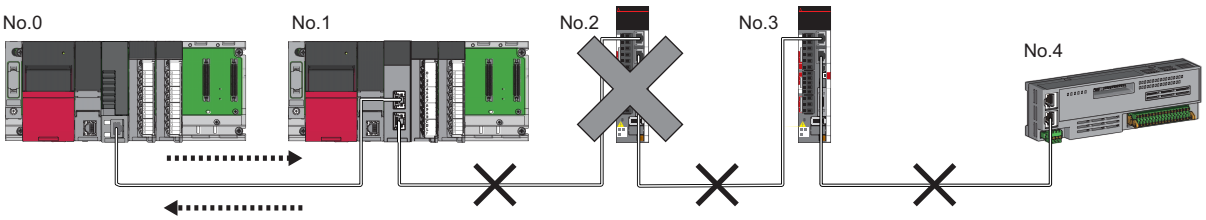
Structure of modules on CC-Link IE TSN only

Connection with modules on CC-Link IE TSN only

■Line topology

Modules are connected in a line topology. A TSN hub is not required.

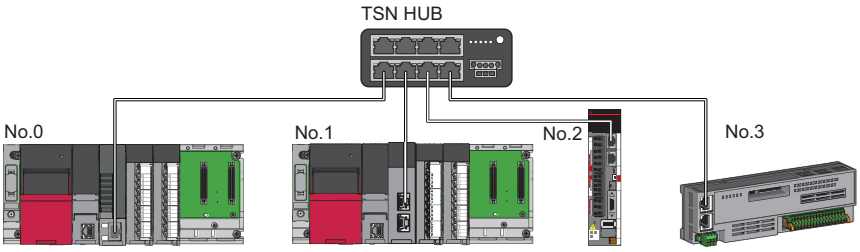
When an error occurs in a device station, the stations connected after the faulty station will be disconnected.



No.0: Master station
No.1: Local station
No.2, No.3, No.4: Remote station

■Star topology

The network is configured in a star topology via a TSN hub. This allows devices to be added easily.

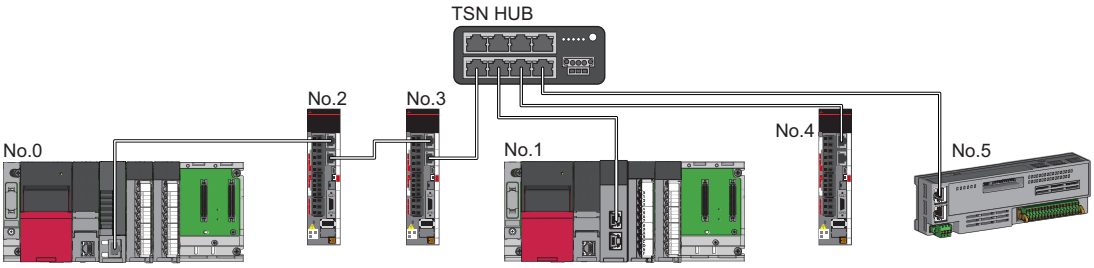


No.0: Master station
No.1: Local station
No.2, No.3: Remote station

Even when an error occurs in a device station, a data link can be continued with the stations that are operating normally.

■Coexistence of line and star topologies

Line and star topologies are mixed.

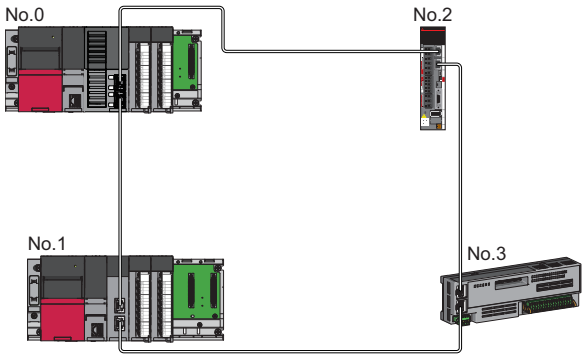


No.0: Master station
No.1: Local station
No.2, No.3, No.4, No.5: Remote station

■Ring topology

For RD78GH, modules are connected in a ring topology.

For the devices supporting a ring topology, refer to the CC-Link Partner Association website (www.cc-link.org).



No.0: Master station
No.1: Local station
No.2, No.3: Remote station

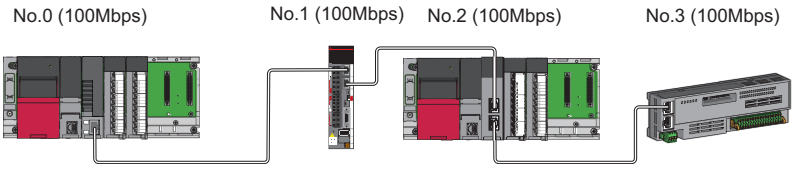
Connection with modules on CC-Link IE TSN with a communication speed of 100Mbps

This section describes the network topology when "Communication Speed" under "Application Settings" is set to "100Mbps".

■Line topology

Modules are connected in a line topology.

- Adjust the communication speed of each module.
- When connecting modules with different communication speeds, connect the modules via a TSN hub.

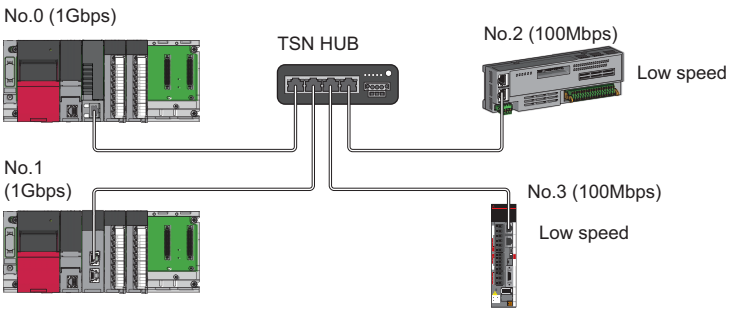


No.0: Master station
No.2: Local station
No.1, No.3: Remote station

■Star topology

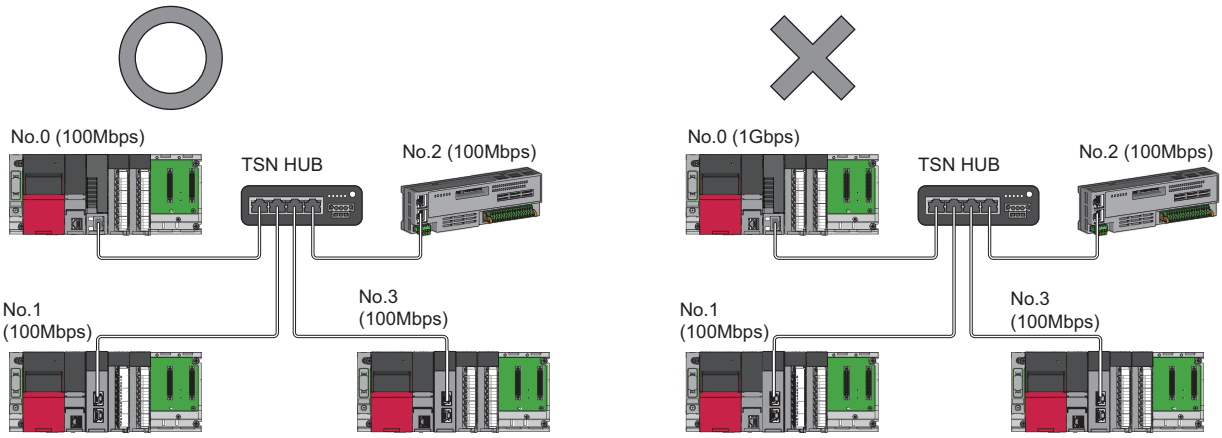
Modules are connected in a star topology via a switching hub.

- When the master station with a communication speed of 1Gbps and a remote station with a communication speed of 100Mbps exist in the structure, set "Communication Period Setting" to "Low-Speed" for the remote station with a communication speed of 100Mbps.



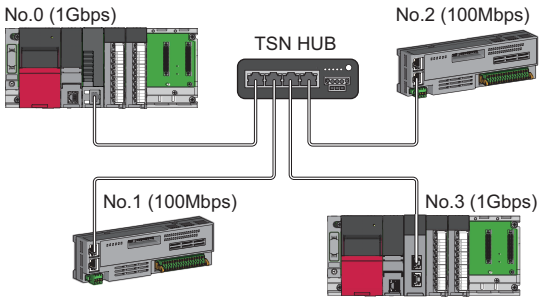
No.0: Master station
No.1: Local station
No.2, No.3: Remote station

- Connect the master station and the local station with the same communication speed.



No.0: Master station
No.1, No.3: Local station
No.2: Remote station

- When "Communication Mode" is set to "Multicast" and "Communication Speed" of the master station is set to "1Gbps", communication may not be possible depending on the type of the device if device stations with different communication speeds of 1Gbps and 100Mbps coexist on the end side via the switching hub. The communication will be enabled by configuring settings with the TSN hub so that the multicast frame (with multicast MAC address 09:00:70:00:10:02 and 09:00:70:00:10:05) will not be transferred to the device station with 100Mbps.

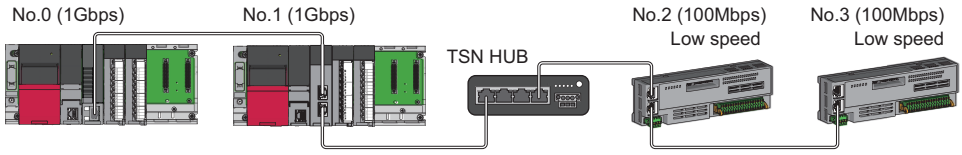


No.0: Master station
No.1, No.2: Remote station
No.3: Local station

■Coexistence of line and star topologies

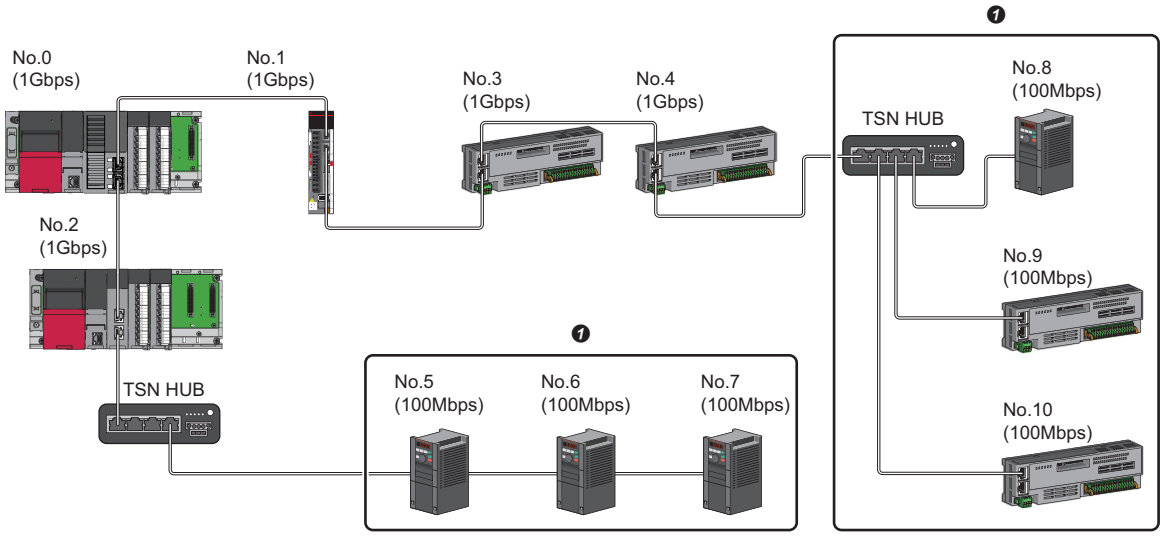
Line and star topologies can be mixed in the same network configuration.

- When the master station with a communication speed of 1Gbps and a device station with a communication speed of 100Mbps exist in the structure, set "Communication Period Setting" to "Low-Speed" for the device station with a communication speed of 100Mbps.



No.0: Master station
No.1: Local station
No.2, No.3: Remote station

- When the communication speed of the master station is 1Gbps, a connection cannot be established if the total cyclic data size of all device stations on the 100Mbps device side exceeds 2K bytes. This includes the devices with a communication speed of 100Mbps that form a boundary between the communication speed of 1Gbps and 100Mbps.

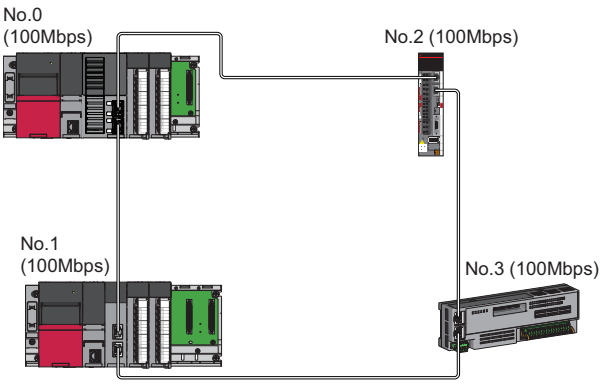


No.0: Master station
No.1: Local station
No.2, No.3, No.4, No.5, No.6, No.7, No.8, No.9, No.10: Remote station
❶ Set the total cyclic data size within 2K bytes.

■Ring topology

For RD78GH, modules are connected in a ring topology.

For the devices supporting a ring topology, refer to the CC-Link Partner Association website (www.cc-link.org).



No.0: Master station
No.1: Local station
No.2, No.3: Remote station

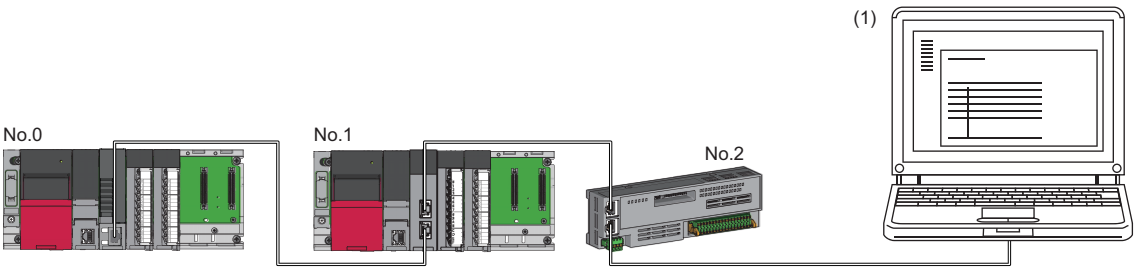
Structure of modules on CC-Link IE TSN and Ethernet devices

Connection with modules on CC-Link IE TSN and Ethernet devices

■Line topology

The network with modules and devices is configured in a line topology. A TSN hub is not required.

Connect an Ethernet device to the end of the network.



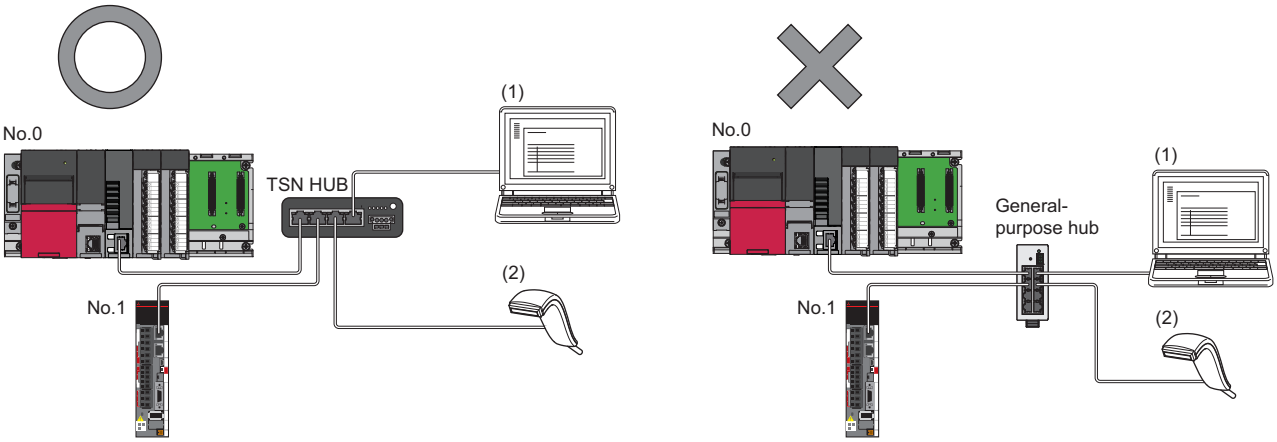
No.0: Master station
No.1: Local station
No.2: Remote station
(1) Ethernet device (such as a personal computer)

When an error occurs in a device station, the stations connected after the faulty station will be disconnected.

■Star topology

The network is configured in a star topology via a switching hub.

Device stations cannot be connected with a general-purpose hub. Line and star topologies should be mixed in the same network configuration.

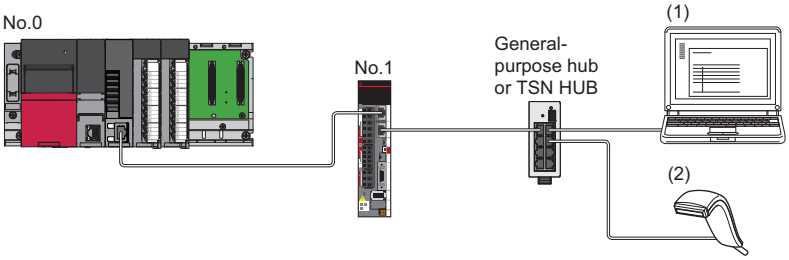


No.0: Master station
No.1: Remote station
(1), (2): Ethernet device

■Coexistence of line and star topologies

Line and star topologies can be mixed in the same network configuration.

Connect Ethernet devices to the end of the network.



No.0: Master station
No.1: Remote station
(1), (2): Ethernet device

■Ring topology

Mixed ring topology of Ethernet devices is not possible with the "CC-Link IE TSN Class B Only" system configuration.

5.2 Structure of CC-Link IE TSN Class B/A Devices

This section describes the system configuration in the following cases.

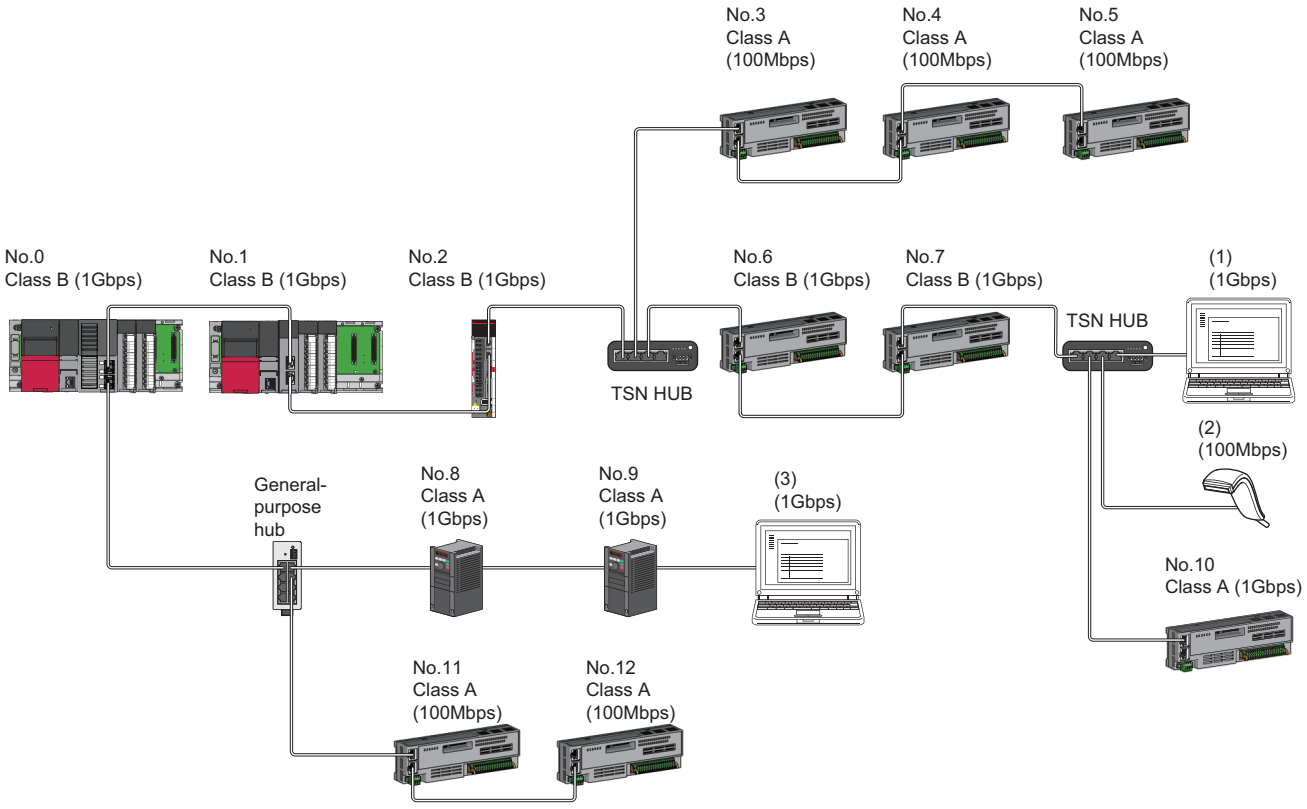
- Motion module supports the protocol version 2.0
- The CC-Link IE TSN module supports the protocol version 2.0 only
- Set "Connection Device Information" under "Basic settings" of the engineering tool to "Mixture of CC-Link IE TSN Class B/A or CC-Link IE TSN Class A only"

When "Connection Device Information" under "Basic Settings" of the master station is set to "Mixture of CC-Link IE TSN Class B/A or CC-Link IE TSN Class A Only", up to 121 stations (one master station and 120 device stations) can be connected.

Point

If the Motion module add-on baseSystem version is “1.18" or earlier, or if protocol version "1.0" is used in the connected CC-Link IE TSN module, refer to the following.

☞ Page 156 System configuration with CC-Link IE TSN Class B/A Devices (Protocol Version 1.0 only)
☞ Page 154 System configuration with CC-Link IE TSN Class B/A Devices (Protocol Version 2.0/1.0)

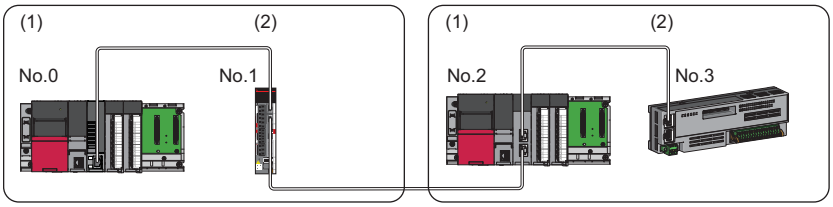


No.0: Master station
No.1: Local station
No.2 to No.12: Remote station
(1), (2), (3) Ethernet device
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

The availability of connection of network configuration devices varies depending on the communication mode and communication speed.

- When using unicast mode
  - ☞ Page 59 When the communication speed for the master station is set to 1Gbps
  - ☞ Page 60 When the communication speed for the master station is set to 100Mbps
- When using multicast mode
  - ☞ Page 61 When the communication speed for the master station is set to 1Gbps
  - ☞ Page 62 When the communication speed for the master station is set to 100Mbps

The following terms are used to describe the terms in the tables referenced.



No.0: Master station
No.2: Local station
No.1, No.3: Remote station
(1) Device on the master station side (The master station or a device near the master station)
(2) Device on the end side (A device far from the master station)

Restriction

- When "Network Topology" under "Basic Settings" is set to "Ring", "Network parameter error" (error code: 2221H) will occur in the Motion module.
- "Network parameter error" (error code: 2221H) will occur in the Motion module if the following settings are made when the add-on baseSystem version is "1.22" or earlier.
  · If "Local station" is set for the "Network configuration setting"
  · If "Multicast" is set for the "Communication Mode"

Availability of connection with devices (when using unicast mode)

The following shows the case when "Communication Mode" under "Application Settings" is set to "Unicast".

When the communication speed for the master station is set to 1Gbps

The following table lists the availability of connection with a network configuration device when the "Communication Speed" for the master station is set to "1Gbps".

○: Connection available, ●: Connection available via a switching hub, ×: Connection not available

△: Connection available only when the device on the end side is a standard station.

▲: Connection available only when the device on the end side is a standard station, and is connected via a switching hub.

S: TSN hub available

H: General-purpose hub available

Device on the master station side (A device near the master station)		Device on the end side (A device far from the master station)							
		Local station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class A device)		Ethernet device	
		1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps
Master station (CC-Link IE TSN Class B device)	1Gbps	△S	×	○S	▲S*1	○SH	▲SH*1	○SH	●SH
Local station (CC-Link IE TSN Class B device)	1Gbps	△S	×	○S	▲S*1*2	○SH	▲SH*1	○SH	●SH
	100Mbps	×	×	×	×	×	×	×	×
Remote station (CC-Link IE TSN Class B device)	1Gbps	△S	×	○S	▲S*1*2	○SH	▲SH*1	○SH	●SH
	100Mbps	×	×	×	△S*1*2	×	△SH*1*2	×	○SH
Remote station (CC-Link IE TSN Class A device)	1Gbps	×	×	×	×	○SH	▲SH*1	○SH	●SH
	100Mbps	×	×	×	×	×	△SH*1	×	○SH

*1 For a device station with a communication speed of 100Mbps, set "Communication Period Setting" to "Low-Speed".

*2 A connection cannot be established if the total cyclic data size of all device stations on the 100Mbps device side exceeds 2K bytes. This includes the devices with a communication speed of 100Mbps that form a boundary between the communication speed of 1Gbps and 100Mbps. (☞ Page 79 Calculation of the total cyclic data size)

Precautions

When a TSN hub is used, check the TSN hub specifications on the CC-Link Partner Association website (www.cc-link.org).

When the communication speed for the master station is set to 100Mbps

The following table lists the availability of connection with a network configuration device when the "Communication Speed" for the master station is set to "100Mbps".

○: Connection available, ×: Connection not available

△: Connection available only when the device on the end side is a standard station.

S: TSN hub available

H: General-purpose hub available

Device on the master station side (A device near the master station)		Device on the end side (A device far from the master station)							
		Local station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class A device)		Ethernet device	
		1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps
Master station (CC-Link IE TSN Class B device)	100Mbps	×	△S*1	×	○S*1	×	○SH	×	○SH
Local station (CC-Link IE TSN Class B device)	1Gbps	×	×	×	×	×	×	×	×
	100Mbps	×	△S*1	×	○S*1	×	○H*1	×	○SH
Remote station (CC-Link IE TSN Class B device)	1Gbps	×	×	×	×	×	×	×	×
	100Mbps	×	△S*1	×	○S*1	×	○SH	×	○SH
Remote station (CC-Link IE TSN Class A device)	1Gbps	×	×	×	×	×	×	×	×
	100Mbps	×	×	×	×	×	○SH	×	○SH

*1 For a device station with a communication speed of 100Mbps, set "Communication Period Setting" to "Basic Period" or "Normal-Speed".

Precautions

When a TSN hub is used, check the TSN hub specifications on the CC-Link Partner Association website (www.cc-link.org).

Availability of connection with devices (when using multicast mode)

The following shows the case when "Communication Mode" under "Application Settings" is set to "Multicast".

When the communication speed for the master station is set to 1Gbps

The following table lists the availability of connection with a network configuration device when the "Communication Speed" for the master station is set to "1Gbps".

○: Connection available, ●: Connection available via a switching hub, ×: Connection not available

△: Connection available only when the device on the end side is a standard station.

▲: Connection available only when the device on the end side is a standard station, and is connected via a switching hub.

S: TSN hub available

H: General-purpose hub available

Device on the master station side (A device near the master station)		Device on the end side (A device far from the master station)							
		Local station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class A device)		Ethernet device	
		1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps
Master station (CC-Link IE TSN Class B device)	1Gbps	△S*2	×	○S*2	▲S*1*2	○SH*2	▲SH*1*2	○SH*2	●SH*2
Local station (CC-Link IE TSN Class B device)	1Gbps	△S*2	×	○S*2	▲S*1*2*3*4	○SH*2*3	▲SH*1*2*3	○SH*2*3	●SH*2*3
	100Mbps	×	×	×	×	×	×	×	×
Remote station (CC-Link IE TSN Class B device)	1Gbps	△S*2	×	○S*2	▲S*1*2*3*4	○SH*2*3	▲SH*1*2*3*4	○SH*2*3	●SH*2*3
	100Mbps	×	×	×	△S*1*2*4	×	△SH*1*2*3*4	×	○SH*2*3
Remote station (CC-Link IE TSN Class A device)	1Gbps	×	×	×	×	○SH*2	▲SH*1*2	○SH	●SH
	100Mbps	×	×	×	×	×	△SH*1*2	×	○SH

*1 For a device station with a communication speed of 100Mbps, set "Communication Period Setting" to "Low-Speed".

*2 When the device is connected on the end side via the switching hub as shown below, communication may not be possible depending on the type of the device.
The communication will be enabled by configuring settings with the switching hub so that the multicast frame (with multicast MAC address 09:00:70:00:10:02 and 09:00:70:00:10:05) will not be transferred to the ports specified below.

Connection structure that cannot be communicated	Port that prohibits multicast frame transfer
Device stations with communication speeds of 1Gbps and 100Mbps coexist.	Connection port of the device station with a communication speed of 100Mbps
A local station and Ethernet device coexist.	The Ethernet device connection port
The local station and CC-Link IE TSN Class A remote station are mixed.	CC-Link IE TSN Class A remote station connection port

*3 For a local station or remote station of a device on the master station side, use a device supporting the multicast filter. (Manual for the device used)

*4 A connection cannot be established if the total cyclic data size of all device stations 100Mbps device side exceeds 2K bytes. This includes the devices with a communication speed of 100Mbps that form a boundary between the communication speed of 1Gbps and 100Mbps. (☞ Page 79 Calculation of the total cyclic data size)

Precautions

When a TSN hub is used, check the TSN hub specifications on the CC-Link Partner Association website (www.cc-link.org).

When the communication speed for the master station is set to 100Mbps

The following table lists the availability of connection with a network configuration device when the "Communication Speed" for the master station is set to "100Mbps".

○: Connection available, ×: Connection not available

△: Connection available only when the device on the end side is a standard station.

S: TSN hub available

H: General-purpose hub available

Device on the master station side (A device near the master station)		Device on the end side (A device far from the master station)							
		Local station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class A device)		Ethernet device	
		1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps
Master station (CC-Link IE TSN Class B device)	100Mbps	×	△S*1*2	×	○S*1*2	×	○SH*2	×	○SH*2
Local station (CC-Link IE TSN Class B device)	1Gbps	×	×	×	×	×	×	×	×
	100Mbps	×	△S*1*2	×	○S*1*2	×	○SH*2*3	×	○SH*2*3
Remote station (CC-Link IE TSN Class B device)	1Gbps	×	×	×	×	×	×	×	×
	100Mbps	×	△S*1*2	×	○S*1*2	×	○SH*2*3	×	○SH*2*3
Remote station (CC-Link IE TSN Class A device)	1Gbps	×	×	×	×	×	×	×	×
	100Mbps	×	×	×	×	×	○SH*2	×	○SH

*1 For a device station with a communication speed of 100Mbps, set "Communication Period Setting" to "Basic Period" or "Normal-Speed".

*2 When the device is connected on the end side via the switching hub as shown below, communication may not be possible depending on the type of the device.
The communication will be enabled by configuring settings with the switching hub so that the multicast frame (with multicast MAC address 09:00:70:00:10:02 and 09:00:70:00:10:05) will not be transferred to the ports specified below.

Connection structure that cannot be communicated	Port that prohibits multicast frame transfer
A local station and Ethernet device coexist.	Connection port of the Ethernet device
The local station and CC-Link IE TSN Class A remote station are mixed.	Connection port of CC-Link IE TSN Class A remote station

*3 For a local station or remote station of a device on the master station side, use a device supporting the multicast filter. (Manual for the device used)

Precautions

When a TSN hub is used, check the TSN hub specifications on the CC-Link Partner Association website (www.cc-link.org).

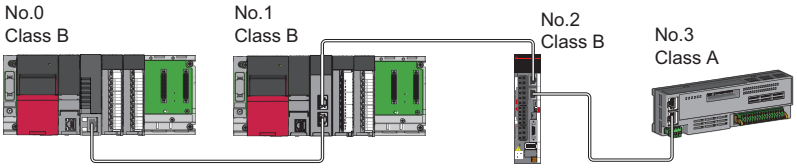
Structure of modules on CC-Link IE TSN only

Connection with modules on CC-Link IE TSN only

■Line topology

Modules are connected in a line topology.

- Connect the CC-Link IE TSN Class A device to the end of the CC-Link IE TSN Class B device.

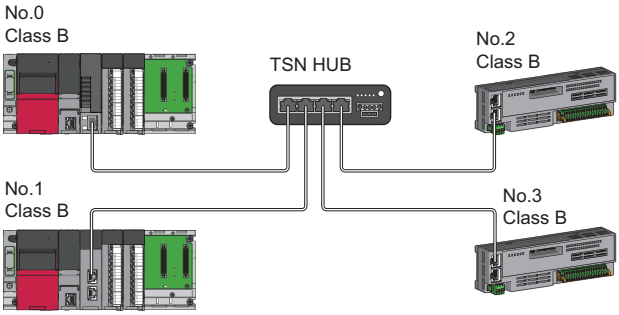


No.0: Master station
No.1: Local station
No.2, No.3: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

■Star topology

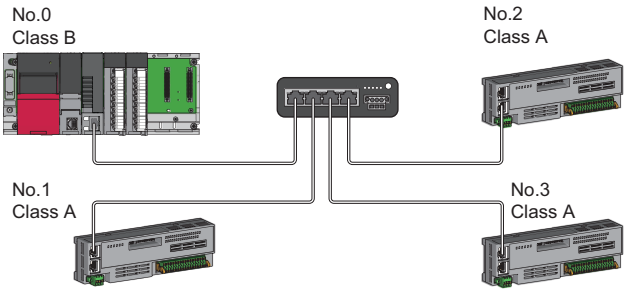
Modules or devices are connected in a star topology via a switching hub.

- When connecting a CC-Link IE TSN Class B device in a star topology, use a TSN hub.



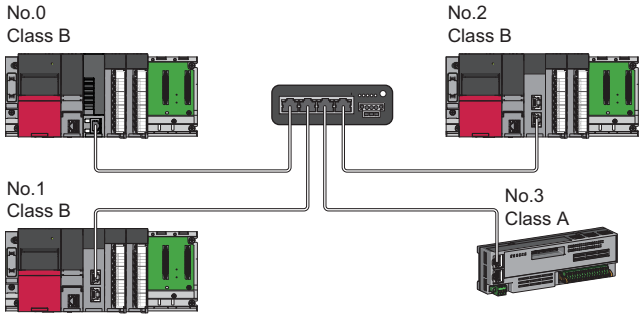
No.0: Master station
No.1: Local station
No.2, No.3: Remote station
Class B: CC-Link IE TSN Class B device

- When connecting a CC-Link IE TSN Class B device to a CC-Link IE TSN Class A device or connecting a CC-Link IE TSN Class A device to a CC-Link IE TSN Class A device in a star topology, connect them via a switching hub.



No.0: Master station
No.1, No.2, No.3: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

- When the "Communication Mode" is "Multicast", communication may not be possible depending on the communication device if a local station is connected with a CC-Link IE TSN Class A remote station as a mixture on the end side via a switching hub. The communication will be enabled by configuring settings with the switching hub so that the multicast frame (with multicast MAC address 09:00:70:00:10:02 and 09:00:70:00:10:05) will not be transferred to the CC-Link IE TSN Class A remote station port.

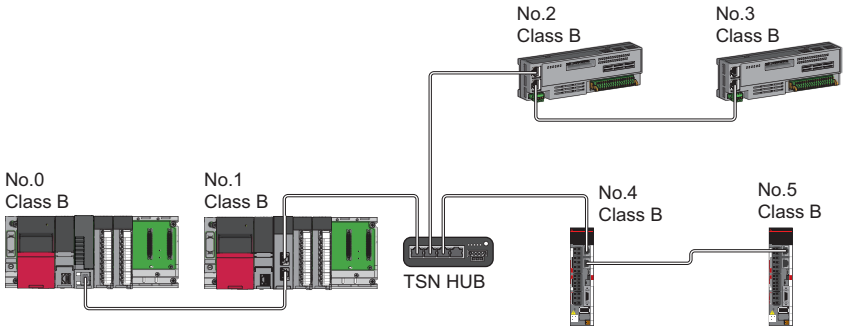


No.0: Master station
No.1, No.2: Local station
No.3: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

■Coexistence of line and star topologies

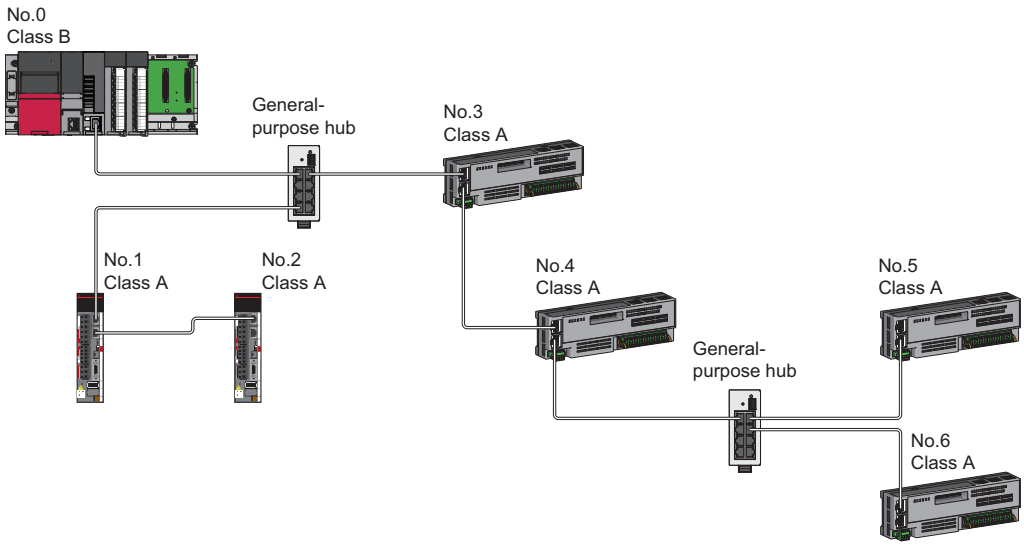
Line and star topologies can be mixed according to the availability of connection described below.

- When connecting a CC-Link IE TSN Class B device to a star topology, use a TSN hub.



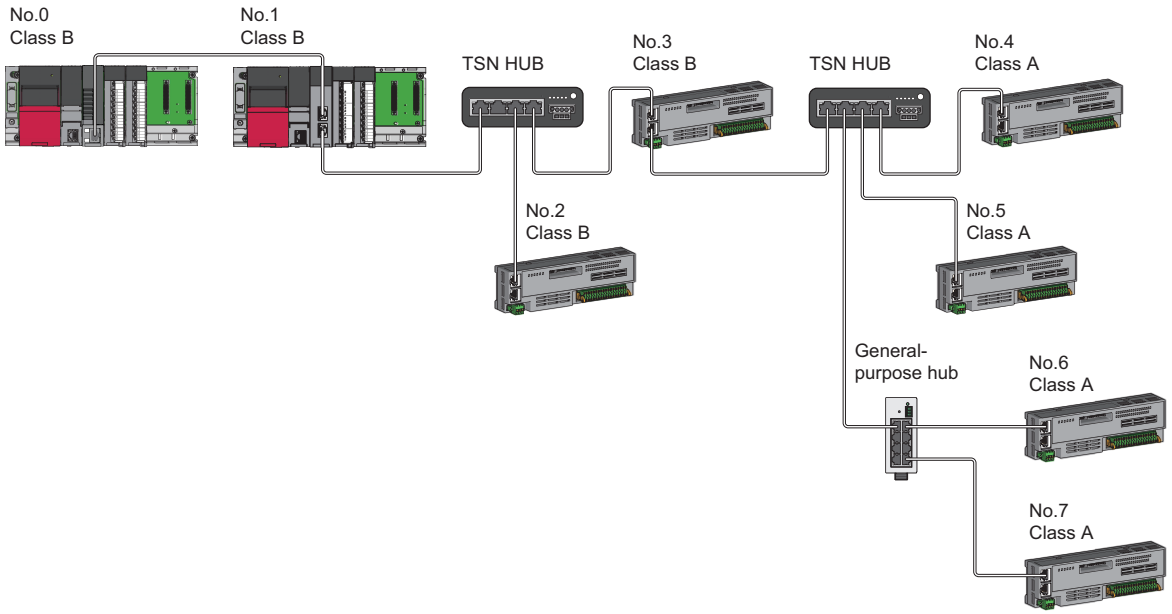
No.0: Master station
No.1: Local station
No.2, No.3, No.4, No.5: Remote station
Class B: CC-Link IE TSN Class B device

- When connecting a CC-Link IE TSN Class A device only structure in a star topology, use a general-purpose hub.



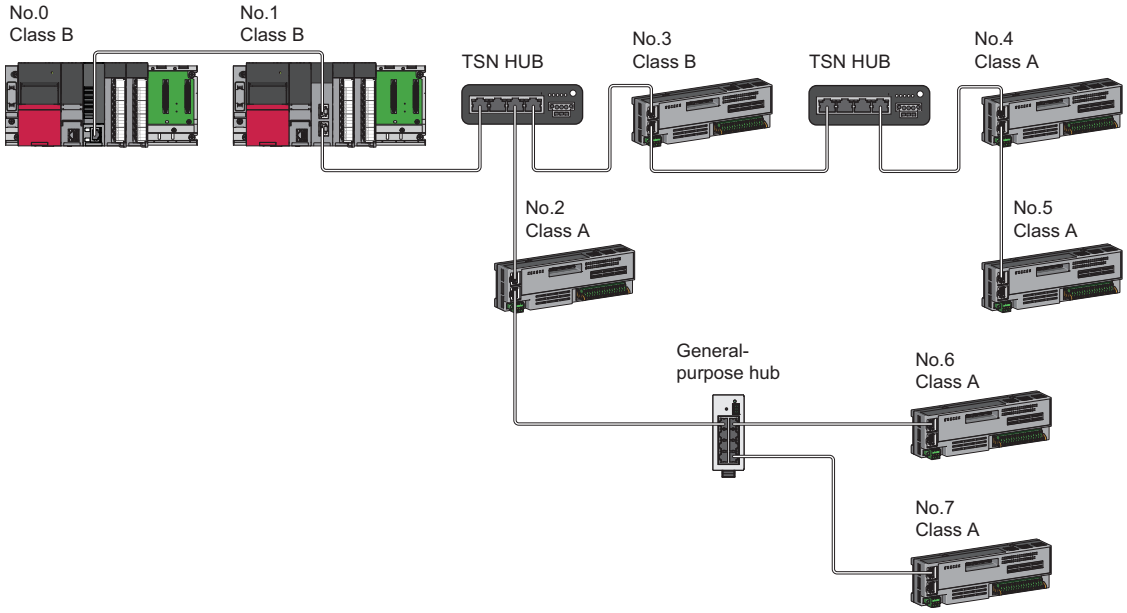
No.0: Master station
No.1, No.2, No.3, No.4, No.5, No.6: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

- In a CC-Link IE TSN Class B/A mixed structure, when connecting a CC-Link IE TSN Class B device in a star topology, connect the CC-Link IE TSN Class A device via a TSN hub.



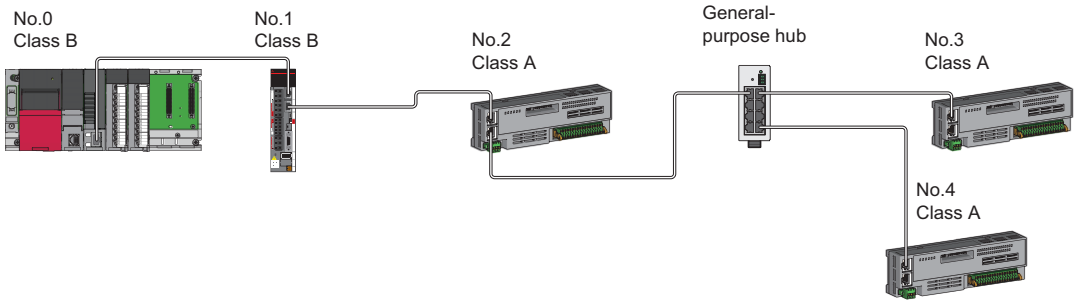
No.0: Master station
No.1: Local station
No.2, No.3, No.4, No.5, No.6, No.7: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

- In a CC-Link IE TSN Class B/A mixed structure, the CC-Link IE TSN Class A device can be connected from the TSN hub between the CC-Link IE TSN Class B devices.

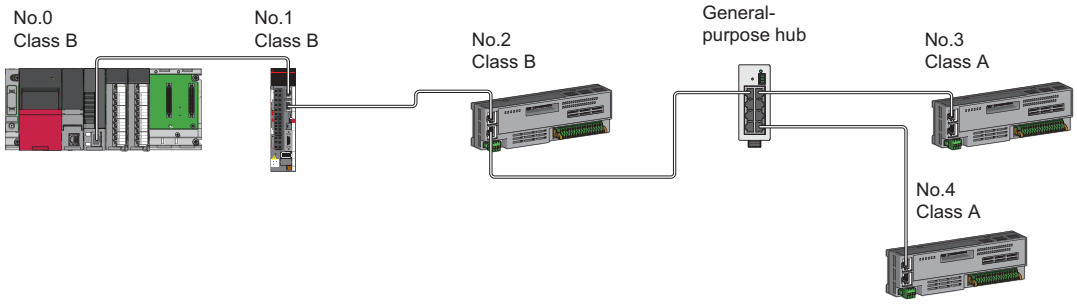


No.0: Master station
No.1: Local station
No.2, No.3, No.4, No.5, No.6, No.7: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

- In a CC-Link IE TSN Class B/A mixed structure, when connecting a CC-Link IE TSN Class B device in a line topology, connect the CC-Link IE TSN Class A device directly or via a general-purpose hub.

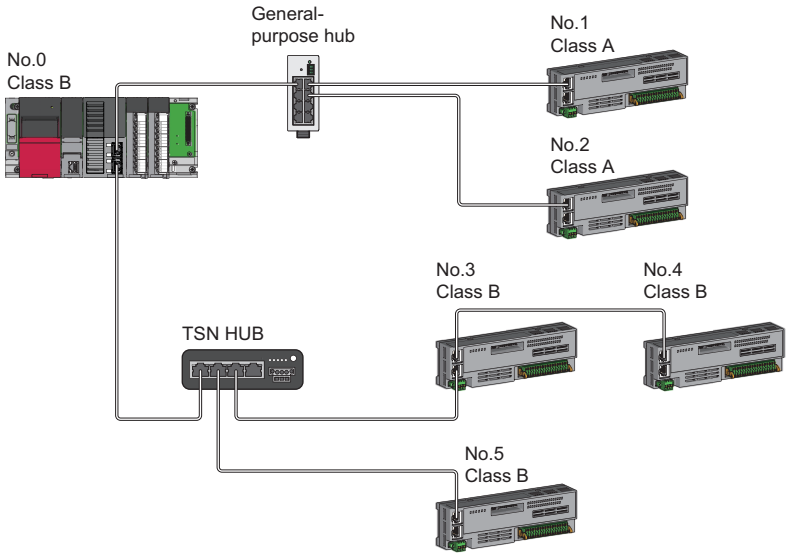


No.0: Master station
No.1, No.2, No.3, No.4: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device



No.0: Master station
No.1, No.2, No.3, No.4: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

- When using RD78GH, in a CC-Link IE TSN Class B/A mixed structure, when a CC-Link IE TSN Class B device is connected in a star topology using a TSN hub, the CC-Link IE TSN Class A device station can be connected to another port of the master station directly or via a general-purpose hub. (Example: P1 is a CC-Link IE TSN Class A device, and P2 is a CC-Link IE TSN Class B device)



No.0: Master station
No.1, No.2, No.3, No.4, No.5: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

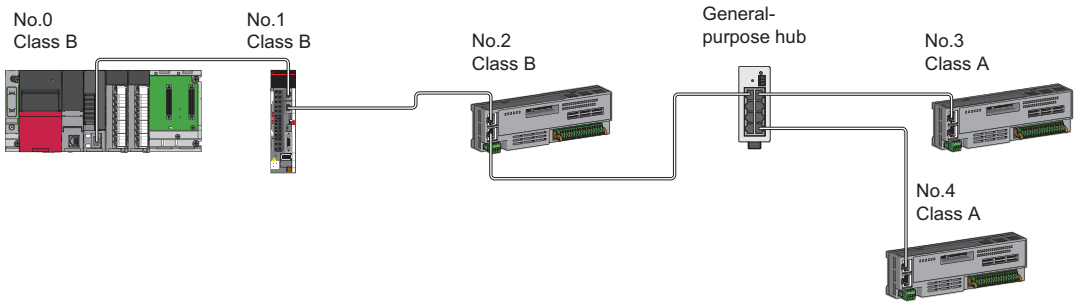
Precautions

In a CC-Link IE TSN Class B/A mixed structure, set whether to use a TSN hub in the "TSN HUB Setting" of "Connection Device Information" under "Basic settings". If the "TSN hub setting" and the system structure differ in whether a TSN hub is present, the CC-Link IE TSN Class A device may not perform a data link.

Ex.

When connecting a CC-Link IE TSN Class B device in a line topology

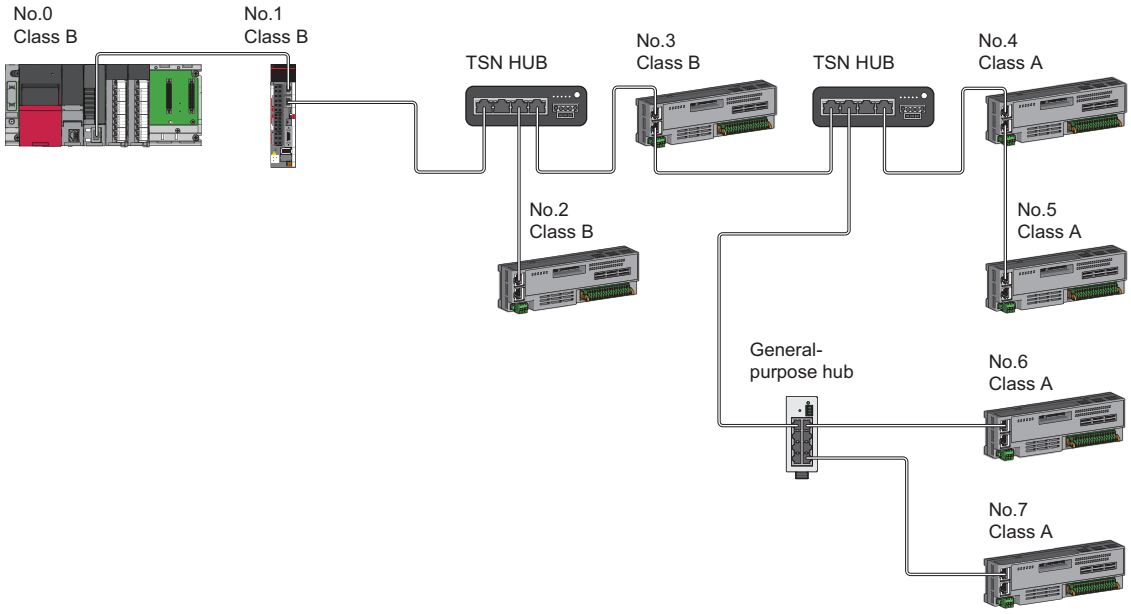
- Set "TSN HUB Setting" of "Connection Device Information" under "Basic settings" to "Not to Use TSN HUB".
- CC-Link IE TSN Class B and CC-Link IE TSN Class A devices are connected by a general-purpose hub.



Ex.

When connecting a CC-Link IE TSN Class B device in a star topology

- Set "TSN HUB setting" under "Connection device information" in "Basic setting" to "Use TSN HUB".
- For CC-Link IE TSN Class B devices and CC-Link IE TSN Class A devices, connect these using a TSN hub.



■Ring topology

Ring topology is not possible with "Mixture of CC-Link IE TSN Class B/A or CC-Link IE TSN Class A Only" system configuration.

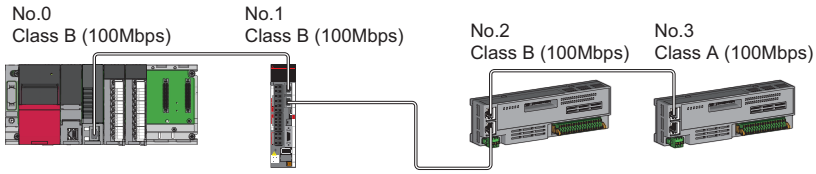
Connection with modules on CC-Link IE TSN with a communication speed of 100Mbps

This section describes the network topology when "Communication Speed" under "Application Settings" is set to "100Mbps".

■Line topology

Modules are connected in a line topology.

- Adjust the communication speed of the module.
- When connecting modules with different communication speeds, connect the modules via a switching hub.

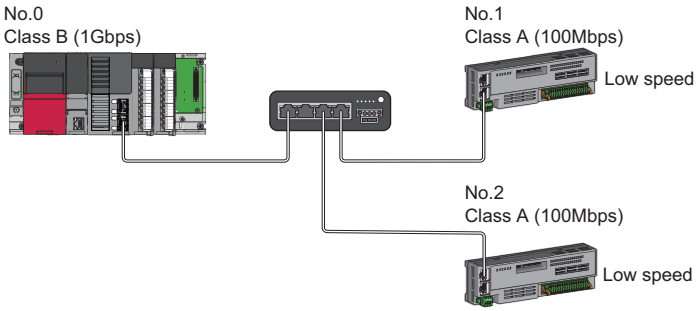


No.0: Master station
No.1: Local station
No.2, No.3: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

■Star topology

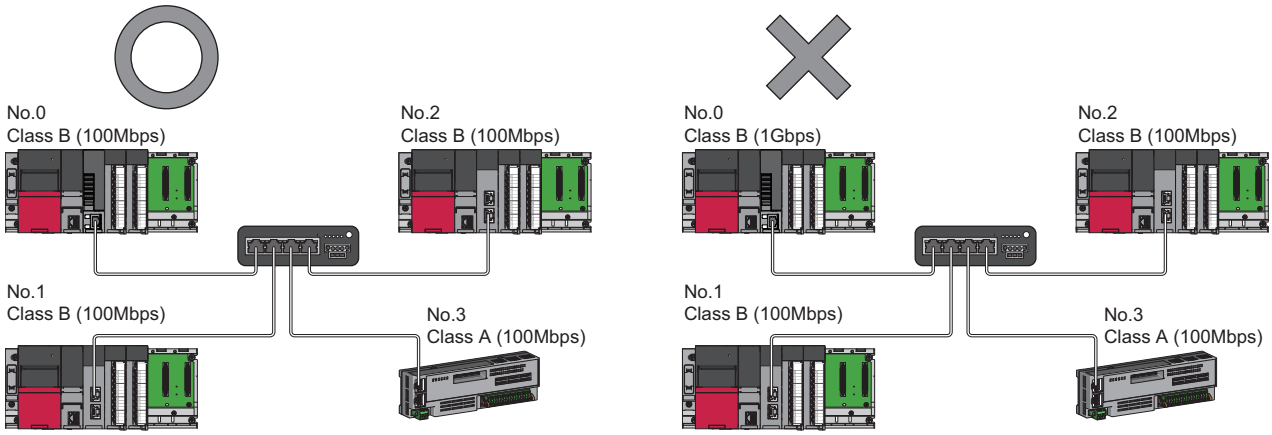
The network is configured in a star topology via a switching hub.

- When the master station with a communication speed of 1Gbps and a device station with a communication speed of 100Mbps exist in the structure, set "Communication Period Setting" to "Low-Speed" for the device station with a communication speed of 100Mbps.



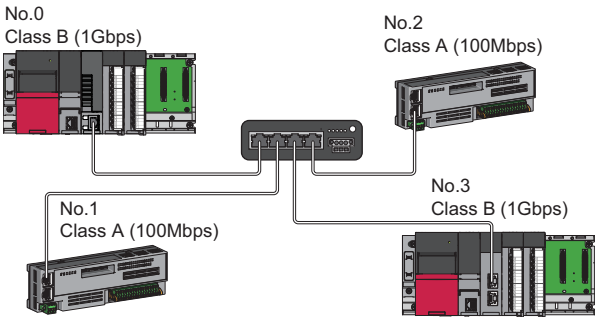
No.0: Master station
No.1, No.2: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

- Connect the master station and local station at the same communication speed.



No.0: Master station
No.1, No.2: Local station
No.3: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

- When "Communication Mode" is set to "Multicast" and the communication speed of the master station is 1Gbps, communication may not be possible depending on the type of the device if device stations with different communication speeds of 1Gbps and 100Mbps coexist on the end side via the switching hub. The communication will be enabled by configuring settings with the switching hub so that the multicast frame (with multicast MAC address 09:00:70:00:10:02 and 09:00:70:00:10:05) will not be transferred to the port of the device station with 100Mbps.

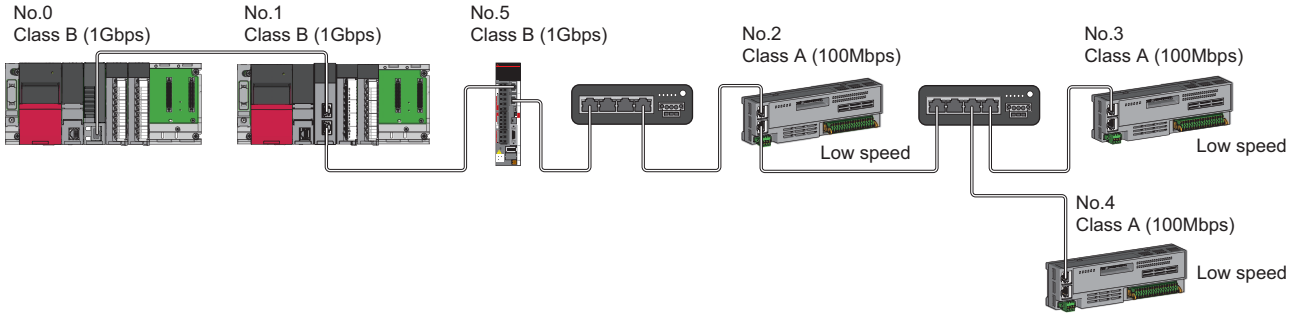


No.0: Master station
No.1, No.2: Remote station
No.3: Local station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

■Coexistence of line and star topologies

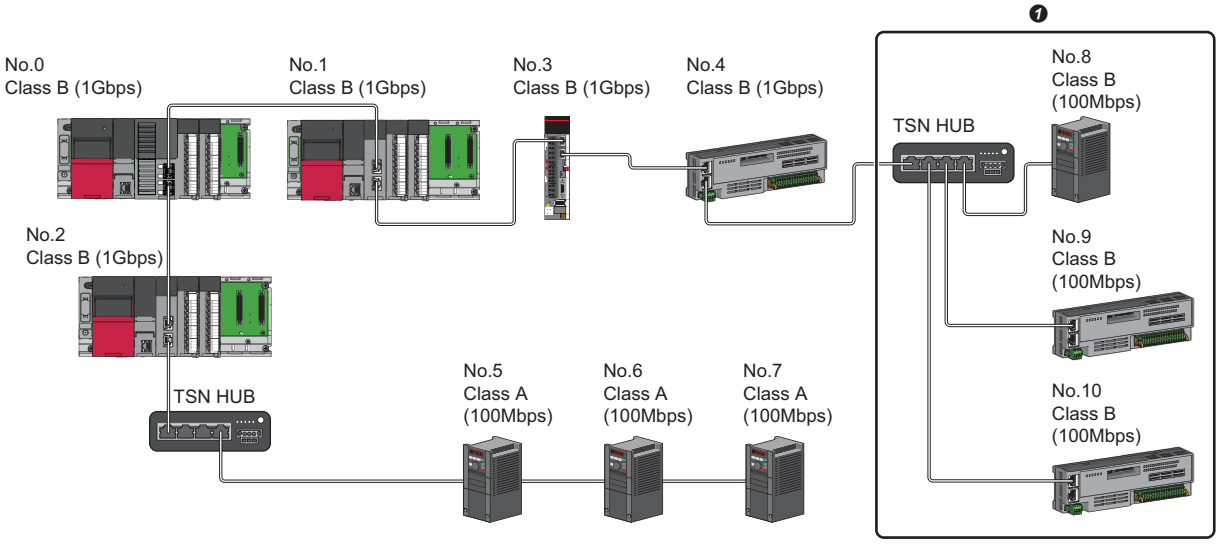
Line and star topologies can be mixed in the same network configuration.

- When the master station with a communication speed of 1Gbps and a device station with a communication speed of 100Mbps exist in the structure, set "Communication Period Setting" to "Low-Speed" for the device station with a communication speed of 100Mbps.



No.0: Master station
No.1: Local station
No.2, No.3, No.4, No.5: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

- When the communication speed of the master station is 1Gbps, a connection cannot be established if the total cyclic data size of device stations on the 100Mbps device side exceeds 2K bytes. This includes the devices with a communication speed of 100Mbps that form a boundary between the communication speed of 1Gbps and 100Mbps.



No.0: Master station
No.1, No.2: Local station
No.3 to No.10: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

❶ Set the total cyclic data size within 2K bytes.

■Ring topology

Ring topology is not possible with "Mixture of CC-Link IE TSN Class B/A or CC-Link IE TSN Class A Only" system configuration.

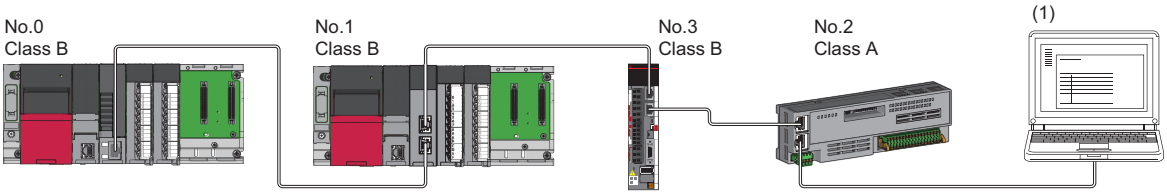
Structure of modules on CC-Link IE TSN and Ethernet devices

Connection with modules on CC-Link IE TSN and Ethernet devices

■Line topology

The network with modules and devices is configured in a line topology. A general-purpose hub is not required.

Connect Ethernet devices to the end of the network.



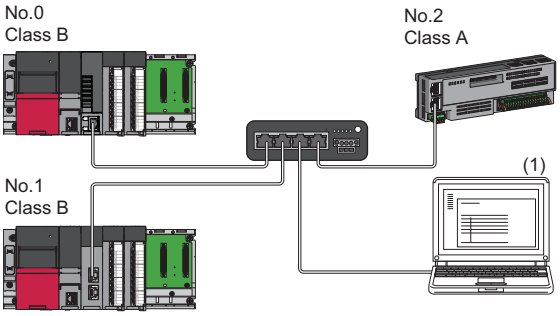
No.0: Master station
No.1: Local station
No.2, No.3: Remote station
(1) Ethernet device
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

■Star topology

Modules or Ethernet devices are connected in a star topology via a switching hub. This allows devices to be added easily.

When connecting an Ethernet device with a network communication speed of 100Mbps, a general-purpose hub is required.

When using RD78GH, a general-purpose hub can be connected to P1 or P2 of the master station respectively.



No.0: Master station
No.1: Local station
No.2: Remote station
(1) Ethernet device (such as a personal computer, vision sensor, or bar code reader)
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

Point

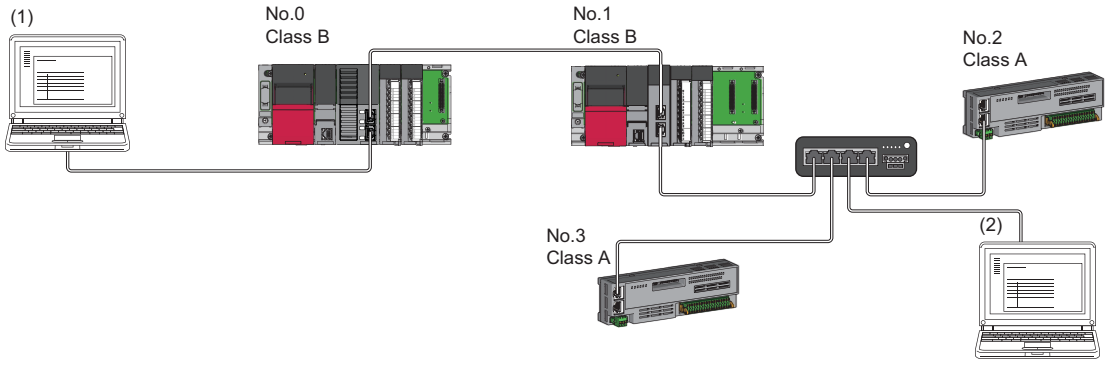
Since cyclic data is sent to an Ethernet device when "Communication Mode" is set to "Multicast" and a local station is used with an Ethernet device on the end side via a switching hub, communication may not be possible depending on the type of an Ethernet device.

The communication will be enabled by configuring settings with the TSN hub so that the multicast frame (with multicast MAC address 09:00:70:00:10:02 and 09:00:70:00:10:05) will not be transferred to the port of the Ethernet device.

■Coexistence of line and star topologies

Line and star topologies can be mixed by following these connection requirements.

- Connect Ethernet devices at the end of a line topology.
- When connecting the Ethernet device in a star topology, connect the Ethernet device to a switching hub.



No.0: Master station
No.1: Local station
No.2, No.3: Remote station
(1), (2): Ethernet device
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

■Ring topology

Ring topology is not possible with "Mixture of CC-Link IE TSN Class B/A or CC-Link IE TSN Class A Only" system configuration.

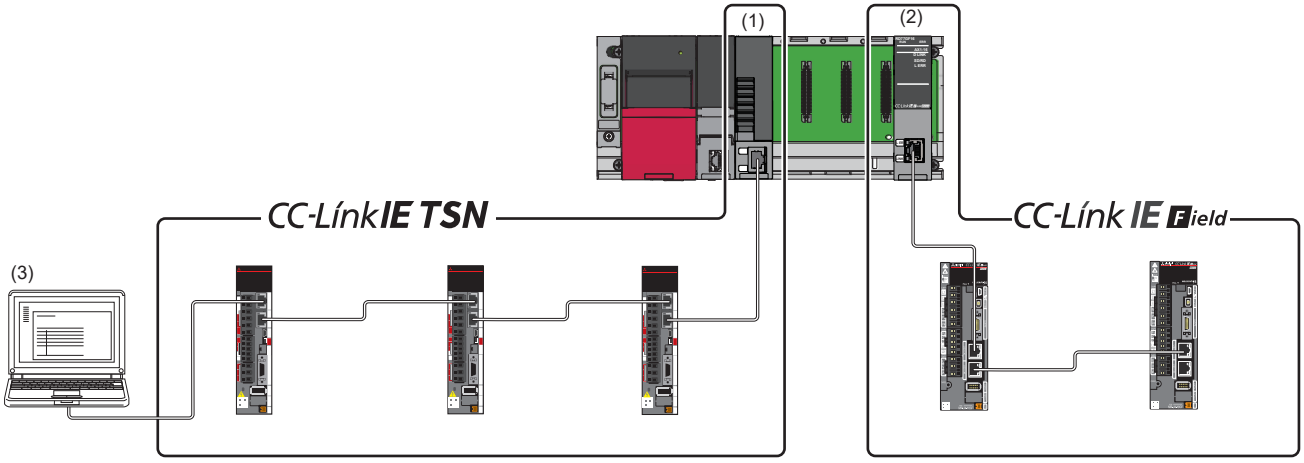
5.3 Structure of a CC-Link IE TSN and CC-Link IE Field Network

Set the Motion module and CC-Link IE Field compatible network modules to different network numbers, and mount the master station of each network to the same base unit.

Connect Ethernet devices to the end of the network.

For details on CC-Link IE Field Network, refer to the following.

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



(1) Master station (Network No.1)
(2) Master station (Network No.3)
(3) Ethernet device

Point

The communication data of the CC-Link IE TSN and CC-Link IE Field Network are transferred between master stations.

5.4 Structure when CC-Link IE TSN Communication Software is Used

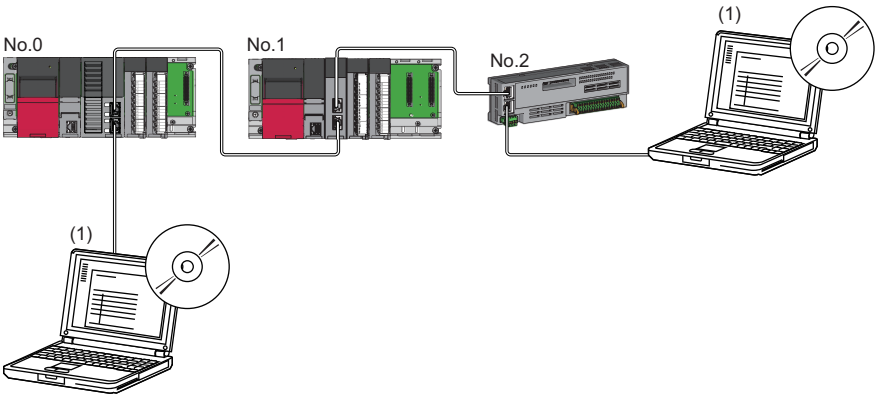
Connection specifications

CC-Link IE TSN Communication Software can be connected to a port of the CC-Link IE TSN Class B device (supporting CC-Link IE TSN) or a TSN hub.

Up to two CC-Link IE TSN Communication Software can be connected.

■Line topology

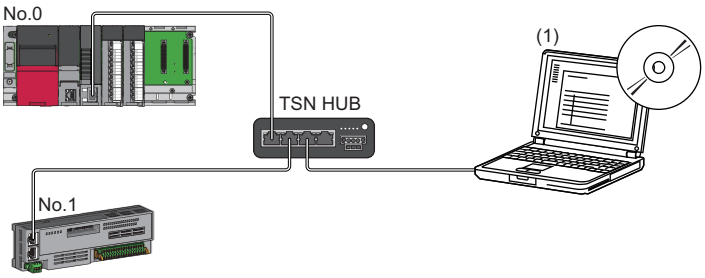
Connect a cable for CC-Link IE TSN Communication Software to the end of the network.



No.0: Master station
No.1: Local station
No.2: Remote station
(1) CC-Link IE TSN Communication Software

■Star topology

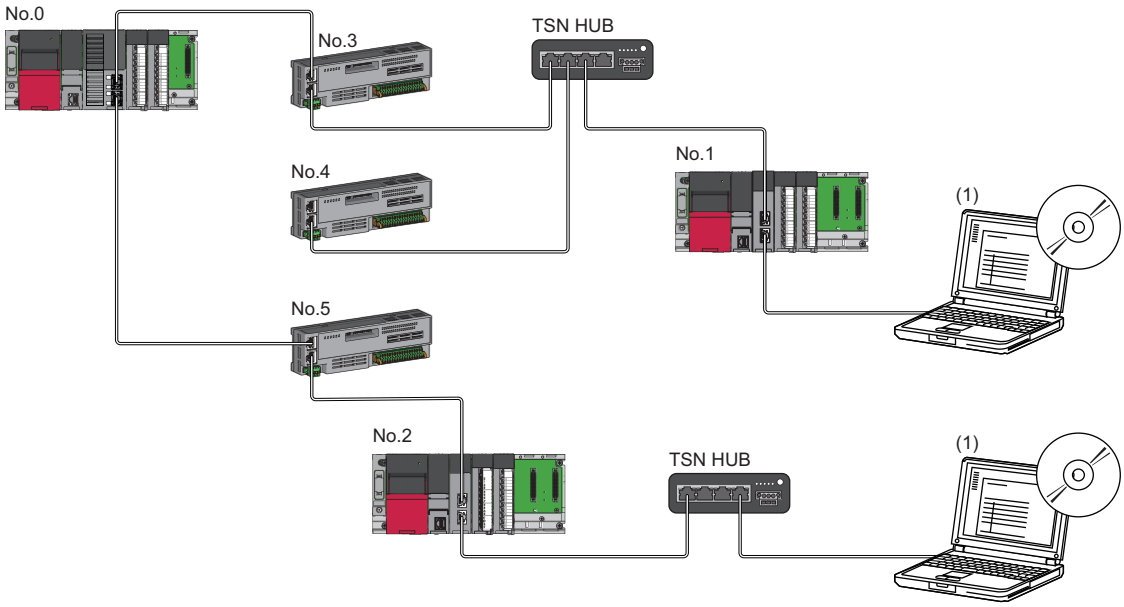
Connect a cable for CC-Link IE TSN Communication Software to a port of the TSN hub.



No.0: Master station
No.1: Remote station
(1) CC-Link IE TSN Communication Software

■Coexistence of line and star topologies

Connect a cable for CC-Link IE TSN Communication Software to a port of the TSN hub or the end of the network.



No.0: Master station
No.1, No.2: Local station
No.3, No.4, No.5: Remote station
(1) CC-Link IE TSN Communication Software

5.5 Precautions for System Configuration

Local station connection and multicast setting limitations

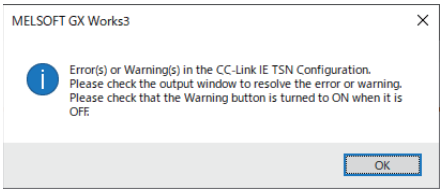
Local station connection and multicast setting have the following version restrictions.

GX Works3 version	Motion module Add-on baseSystem version	
	"1.22" or earlier	"1.24" or later
"1.082L" or earlier	When there is a local station in the network configuration, a network parameter error occurs in the operation module.	If there is a device station set as the motion control station and a local station in the network configuration, an engine tool version combination error occurs in the Motion module.
"1.085P" or later	When there is a local station in the network configuration or when multicast is set in communication mode, a network parameter error occurs in the Motion module.	An engine tool version combination error will occur in the Motion module if the following two conditions are met. • A local station exists in the network configuration, or the communication mode is set to multicast. • The motion control station link device start is not set.

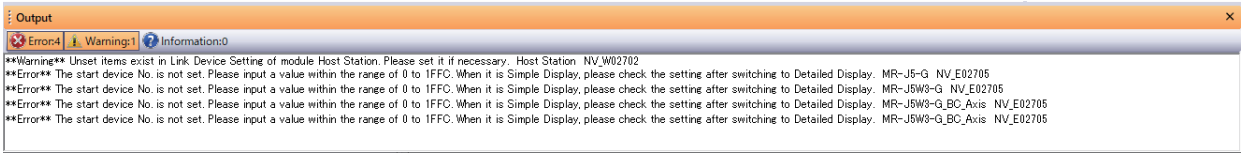
Precautions

If a project created with GX Works3 version "1.082L" or earlier is opened with GX Works3 version "1.085P" or later, the following error will occur for the link device setting of the motion control station on the "CC-Link IE TSN Configuration" window.

• Message



• "CC-Link IE TSN Configuration" screen output window



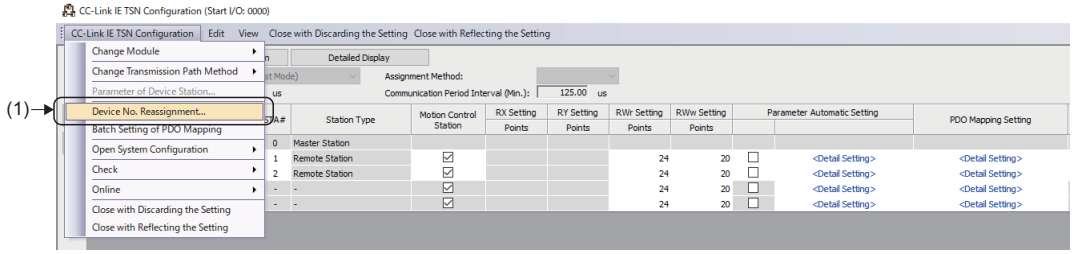
If the above error occurs, follow the following procedure to set the motion control station link device.

■Link device setting procedure

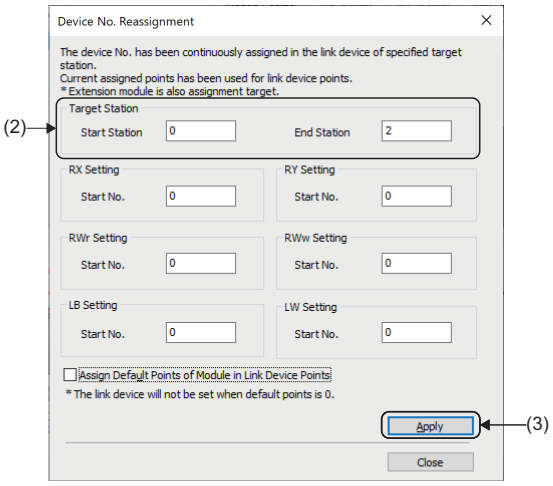
1. Set the beginning/end of the link device of the Motion Management Authority with the device reset function or manually.

• When using the device number reassignment function to set the first/last motion control station link device

• From the menu, select [CC-Link IE TSN Configuration] ⇨ [Device No. Reassignment] (1) to display the device No. reassignment screen.



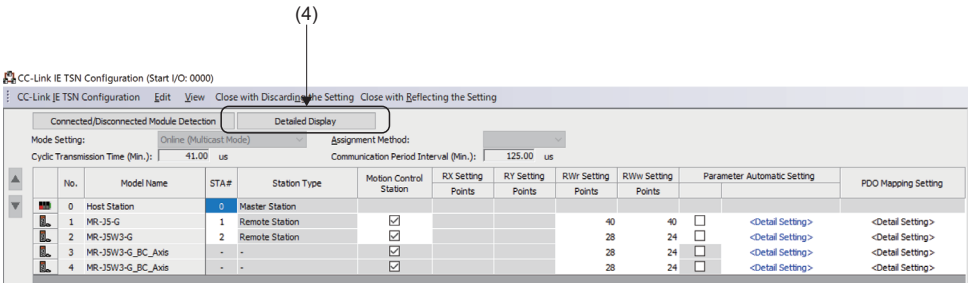
• Select the range of station numbers to be reassigned device numbers (start station to end station) (2), and click the [Apply] button (3). The start/end of the linked device will be set automatically.



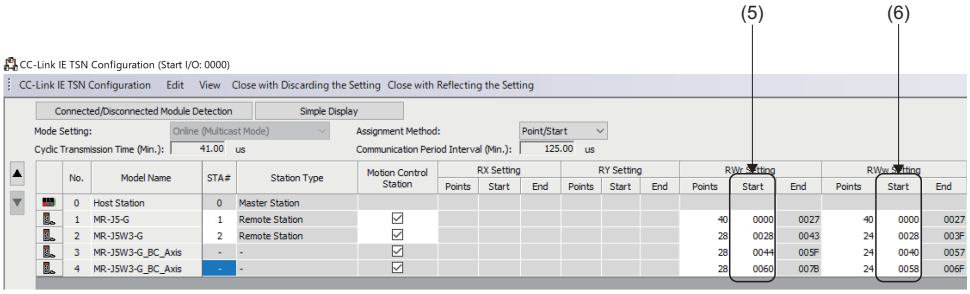
Point

When reallocating device numbers, if the station number of the standard station is included in the setting range, the device setting of the standard station will be overwritten. If a standard station is set, set the station number of the standard station to outside of the setting range, or manually set the motion control station link device start/end.

- When manually setting the motion control station link device start/end
  - Click the [Detailed Display] button (4) to switch to the details display.



- Set the motion control station link device start in the first column of the RWr setting (5) and RWw setting (6) that are blank voluntarily.



Point

If the communication mode is unicast and a local station does not exist in the network configuration settings, the Motion module will ignore the setting of the motion control station link device start.

Ring topology limitations

For a ring topology, use the Add-on baseSystem version "1.30" or later. When using Add-on baseSystem version "1.29" or earlier, data link is not performed.

The following table lists the operations when "Network Topology" under "Basic Settings" is set to "Ring", and the setting network topology is different from the actual connection status.

Actual connection status	Communication speed	Operation
Line topology	Mixture of different communication speeds	A data link is not performed.
	Same communication speed used by all stations	A data link is performed in a state in which a loopback station is available.
Star topology	—	A data link is not performed.
Coexistence of line and star topologies	—	
Ring topology	Mixture of different communication speeds	
	Same communication speed used by all stations	A data link is performed normally.

Devices connected to the same network

Do not connect the devices as described below. Doing so may cause the disconnection of all stations.

- A module on CC-Link IE TSN and a device having different network types (such as CC-Link IE Controller Network or CC-Link IE Field Network) other than an Ethernet device are connected to the same network.
- A module on CC-Link IE TSN and an Ethernet device (such as a personal computer), both of which are on different networks, are connected to one switching hub.

Adding a device station with no IP address setting

In line topology, do not connect the device station with no IP address setting at a place other than the end of the line. Data link may not be performed in the device stations after the device station with no IP address setting.

CC-Link IE TSN/CC-Link IE Field diagnostics

If the following operations are performed, the actual network configuration and the network map of the CC-Link IE TSN/CC-Link IE Field diagnostics may be a mismatch.

Network configuration	Operation
Star topology	• Powering off and on a device station or switching hub • Connecting/disconnecting an Ethernet cable connected to the switching hub • Disconnecting an Ethernet cable from a device station and connecting it to another device station or a switching hub • Disconnecting more than nine stations, or half the number of device stations or more in the system • Changing the network topology when adding a device station
Line topology	• Simultaneously powering off or 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 nine stations, or half the number of device stations or more in the system • Changing the network topology when adding a device station

Point

The actual network configuration and network map can be matched by executing the network map update of the CC-Link IE TSN/CC-Link IE Field diagnostics. For details, refer to "Basic Settings" in the following manual.

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

Calculation of the total cyclic data size

The following shows the calculation formula of the total cyclic data size. The part of the variable surrounded by double quotes (" ") is the setting value of "CC-Link IE TSN Configuration" window.

Total cyclic data size = 256 + (146 × Number of local station) + (106 × Number of remote stations) + (Number of "RX Setting" points / 8) +(Number of "RWr Setting" points × 2) + (Number of "LB Setting" points / 8) + (Number of "LW Setting" points × 2) [byte]

6 INSTALLATION AND WIRING

6.1 SD Memory Card

For SD memory card handling, refer to "SD Memory Card" in the following manual.
MELSEC iQ-R Motion Module User's Manual (Application)

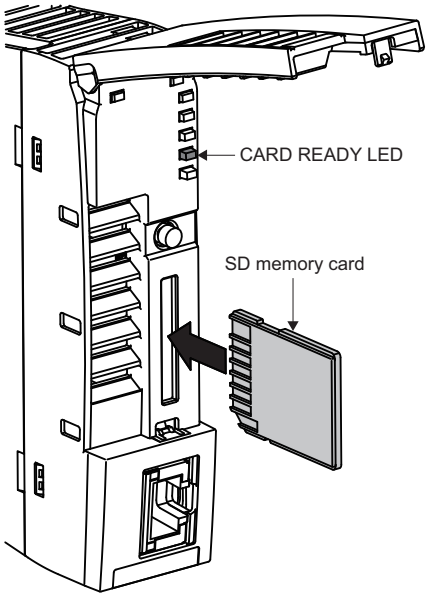
Installation and removal of SD memory card

This section describes the methods for installation of an SD memory card to the Motion module, and removal.

Installation of SD memory card

When installing an SD memory card to the Motion module, take note of the SD memory card position, and install using the following procedure.

1. With the notch facing downwards, insert the SD memory card straight into the slot. After inserting check the SD memory card is inserted all the way in. If the SD memory card is not inserted properly, insufficient contact may cause an operation failure.
2. The CARD READY LED flickers until the SD memory card can be used. When the CARD READY LED is ON, the SD memory card can be used.
3. If the CARD READY LED does not turn on after installing an SD memory card, check that SD memory card force disabled command (System.Cd.Storage_sdcForcedDisable) and SD memory card force disabled (System.Md.Storage_sdcForcedDisabled) are FALSE (Forced stop release).



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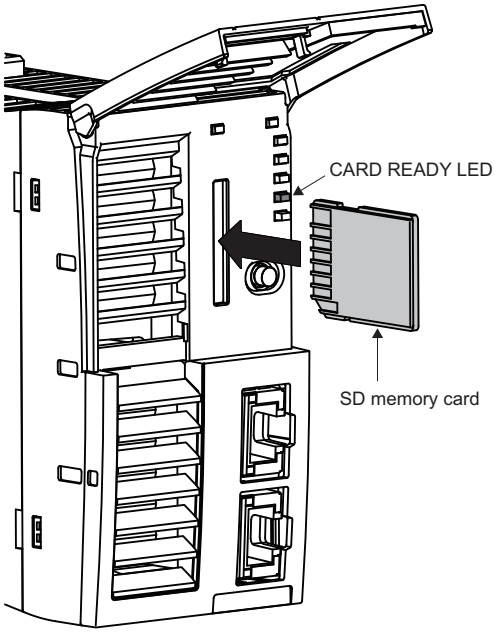


RD78GH

Point

- Installation of an SD memory card is registered with the event history (type: operation).
- When installing an SD memory card, the operation of SD memory card access control switch is not required.

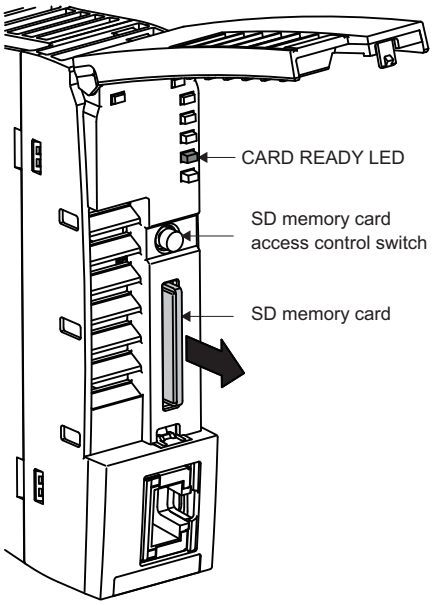
Removal of the SD memory card

When removing an SD memory card from the Motion module, remove the SD memory card using the following procedure.

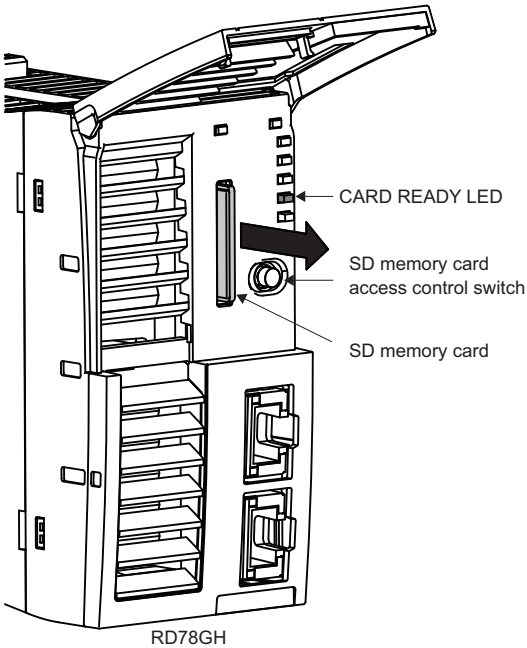
1. Carry out one of the following methods to stop access of the SD memory card.
- Hold the SD memory card access control switch for longer than 1 second.
- Set SD memory card force disabled command (System.Cd.Storage_sdcForcedDisable) to TRUE (Forced stop).

2. During the process of stopping access to the SD memory card, the CARD READY LED flickers, then turns OFF when the process is complete. Before removing, be sure to confirm that the CARD READY LED turns OFF.

3. After pushing in the SD memory card once, pull the SD memory card out straight.



RD78G



RD78GH

Precautions

- When SD memory card removal prohibition (System.Cd.Storage_sdcRemovalProhibit) is TRUE (Removal prohibited), removal using the SD memory card access control switch is possible. To remove an SD memory card while SD memory card removal prohibition (System.Cd.Storage_sdcRemovalProhibit) is TRUE (Removal prohibited), set SD memory card force disabled command (System.Cd.Storage_sdcForcedDisable) to TRUE (Forced stop). Then, SD memory card removal prohibition (System.Cd.Storage_sdcRemovalProhibit) turns FALSE (Removal allowed) in the system and the SD memory card can be removed.
- When the SD memory card is removed without being disabled, an "SD Memory card Unload" (error code: 342FH) will occur.
- The access control operation may be rejected depending on the system status (such as initializing, installing software, high system load). In such a case, execute the access control operation again after a while.

Point

- Removal of an SD memory card is registered with the event history (type: operation).
- The access control process (CARD READY LED is flashing) may take time.
- Do not remove an SD memory card while the CARD READY LED is not turned OFF. Doing so may damage the data on the SD memory card.
- Even while the SD memory card is accessed (CARD ACCESS LED is ON), holding the SD memory card access control switch for longer than 1 second operates the SD memory card forced disable function, and the SD memory card can be stopped access (removal enabled).

■Release of the SD memory card forced disable state

The SD memory card forced disable state can be released by turning SD memory card force disabled command (System.Cd.Storage_sdcForcedDisable) from TRUE (Forced stop) to FALSE (Forced stop release). Also, either of the following operation automatically sets SD memory card force disabled command (System.Cd.Storage_sdcForcedDisable) to FALSE (Forced stop release) and the SD memory card is access enabled.

Operation
Install the SD memory card again. (The CARD READY LED turns from flashing to ON.)
Turn ON the power of the Motion module again or carry out reset operation.

6.2 Wiring

This section describes the wiring method and wiring products for Ethernet cables and switching hubs.

Ethernet cable

The Motion module is connected with an Ethernet cable.

Wiring methods

The following describes connection and disconnection of the Ethernet cable.

■Connecting the cable

1. Push the Ethernet cable connector into the Motion module until it clicks. Pay attention to the direction of the connector.
2. Lightly pull it to check that it is securely connected.
3. Check whether the LINK LED of the Ethernet 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 "Checking with LED" in the following manual and take corrective actions.
MELSEC iQ-R Motion Module User's Manual (Network)

■Disconnecting the cable

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

Precautions

Be sure to follow the precautions for wiring. Otherwise, some functions may not operate normally. (It may operate normally temporarily.)

- 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, causing problems for data link.
- Check that the Ethernet cable is not disconnected or not shorted and there is no problem with the connector connection.
- When connecting the Ethernet cable, refer to the CC-Link IE TSN 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.
- Do not use Ethernet cables with broken latches. Doing so may cause the cable to unplug or malfunction.
- Hold the connector part when connecting and disconnecting the Ethernet cable. Pulling the cable connected to the module may result in malfunction or damage to the module or connector.
- For connectors without Ethernet cables, attached connector covers should be placed to prevent foreign matter such as dirt or dust.
- The maximum station-to-station distance of the Ethernet cable is 100m (328.08ft.). However, the length may be shorter depending on the operating environment of the cable. For details, contact the manufacturer of the cable used.
- The bend radius of the Ethernet cable is limited. For details, check the specifications of the Ethernet cable for use.
- In a line topology, do not connect the device station with no IP address setting between the master station and device stations, or between device stations. A data link may not be performed in the device stations connected from the device station with no IP address setting onwards. However, if the device station with no IP address setting is connected at the end of line topology, the device stations between the master station and the device station at the end perform a data link.
- Communication with the Ethernet device may not be possible depending on the specifications of the connected Ethernet device or switching hub. If communication is not possible, reduce the communication data volume of the Ethernet device.
- When setting "Communication Speed" of the master station and local station to 100Mbps to connect a device with a communication speed of 100Mbps, enable auto-negotiation of the device.
- When the "Network Topology" under "Basic Settings" is ring topology, do not connect a device station whose communication speed is different to the "Communication Speed" of the master station. Doing so may result in an incorrectly configured ring topology, causing data links to stop.

Wiring products

Use an Ethernet cable that meets the following standards.

Communication speed	Ethernet cable	Standard	Connector
1Gbps	Category 5e or higher, straight cable (shielded, STP)	The following conditioning cables: • IEEE 802.3 (1000BASE-T) • ANSI/TIA/EIA-568-B (Category 5e)	RJ45 connector
100Mbps	Category 5 or higher, straight cable (shielded, STP)	The following conditioning cables: • IEEE 802.3 (100BASE-TX) • ANSI/TIA/EIA-568-B (Category 5)	

Cables for CC-Link IE TSN are available from Mitsubishi Electric System & Service Co., Ltd. (Catalogs for these cables are also available.)

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

Communication speed	Type	Model (Manufacturer)
1Gbps	Category 5e or higher, straight cable (double shielded, STP)	SC-E5EW series (Mitsubishi Electric System & Service Co., Ltd.)

Point

The communication error can occur with the high-frequency noise from the device except CPU unit depending on the connecting environment. The following indicates the countermeasure of the Motion module side to prevent the effect of the high-frequency noise.

Wiring connection

- Use a double-shielded type cable.
- In wiring process, keep a distance with the main circuit lines or power cables.
- Place the cable in a duct.

Switching hub

Use the following industrial switching hub for connecting Motion modules.

Term	Description	CC-Link IE TSN Class
TSN HUB*1*2	For the models and usage methods of the switching hubs, refer to the CC-Link Partner Association website (www.cc-link.org).	CC-Link IE TSN Class B device
General-purpose hub*3		CC-Link IE TSN Class A device

*1 When using a TSN hub, use Add-on baseSystem version "1.8" or later.

*2 Use of the following is recommended for TSN hub.

Type	Model (Manufacturer)	Reference
CC-Link IE TSN industrial managed switch	NZ2MHG-TSNT□ (Mitsubishi Electric Corporation)	📖CC-Link IE TSN Industrial Managed Ethernet Switch User's Manual

*3 When connecting a CC-Link IE TSN Class A device that supports protocol version 2.0 with a general-purpose hub, disable the VLAN setting of the hub.
If the VLAN setting is enabled, cyclic transmission with a CC-Link IE TSN Class A device that supports protocol version 2.0 cannot be performed.

A switching hub can be used for cascade connection.
When the switching hub is used for cascade connection, check the specifications of the switching hub used.

Precautions

- Since there are different restrictions for system configuration using a TSN hub and system configuration using a general-purpose hub, setting with an engineering tool is required. (☞ Page 44 SYSTEM CONFIGURATION)
- For switching hub restrictions, refer to the manual of each product.
- Do not configure a ring topology when modules are connected to a switching hub. When a ring topology is configured, an error occurs in all stations, and data links cannot be performed.
- An incorrectly configured ring topology can be confirmed in the CC-Link IE TSN/CC-Link IE Field diagnostics and the event history. However, when the system configuration contains a switching hub, confirmation may not be possible.

MEMO

PART 2 SIMPLE MOTION MODE

This part consists of the following chapters. This chapter describes in detail about using the Motion module in Simple Motion mode.

7 PART NAMES

8 SPECIFICATIONS

9 FUNCTION LIST

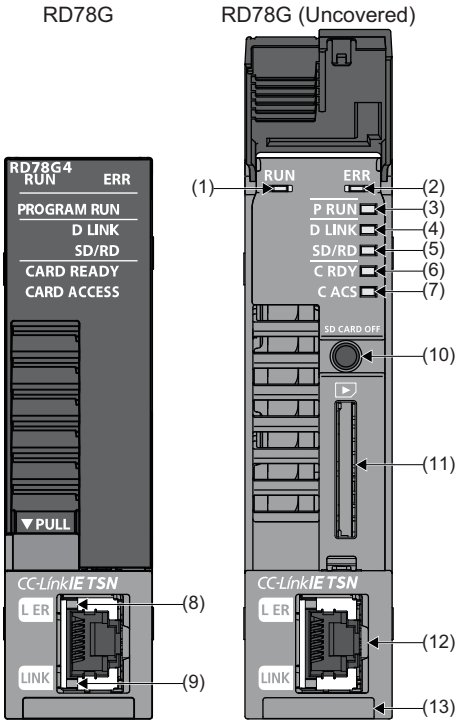
10 PROCEDURES BEFORE OPERATIONS

11 SYSTEM CONFIGURATION

12 INSTALLATION AND WIRING

7 PART NAMES

This chapter describes the part names of the Motion module.



No.	Name	Details
(1)	RUN LED[*1*2]	Indicates the operating status. • ON: Operating normally • Flashing (every 500ms): Clear/Quick-clearing • OFF: Error occurring, initializing
(2)	ERR LED[*1]	Indicates the error status. • OFF: Operating normally • ON: Error occurring • Flashing (every 200ms): Error occurring • Flashing (every 500ms): Data link error station detected
(3)	PROGRAM RUN LED[*2] (P RUN is shown inside the cover)	Indicates the PLC READY status. • ON: PLC READY ON • OFF: PLC READY OFF
(4)	D LINK LED	Indicates the data link status. • ON: Data link (cyclic transmission being performed) • Flashing: Data link (cyclic transmission stopped) • OFF: Data link not performed (disconnection)
(5)	SD/RD LED	Indicates the data communication status. • ON: Communicating data[*3] • OFF: Not communicating data[*3]
(6)	CARD READY LED[*2] (C RDY is shown inside the cover)	Indicates the SD memory card status. • ON: SD memory card usable • Flashing: Preparing • OFF: Not inserted
(7)	CARD ACCESS LED (C ACS is shown inside the cover)	Indicates the access status of the SD memory card. • ON: Accessing the SD memory card • OFF: Not accessing the SD memory card
(8)	L ER LED	Indicates the port status. • ON: Abnormal data received • OFF: Normal data received
(9)	LINK LED	Indicates the link status. • ON: Link-up • OFF: Link-down
(10)	SD memory card access control switch	Switch for stopping card access when removing the SD memory card. (☞ Page 150 Installation and Removal of SD Memory Card)

No.	Name	Details
(11)	SD memory card slot	A slot to insert an SD memory card.
(12)	Ethernet port	Connects to a device station.
(13)	Product information marking	Shows the product information on the Motion module.

*1 The error status can be determined by the status of the RUN LED and the ERR LED.
When multiple errors occur, the error status is displayed in the order of major, moderate, and minor.

RUN LED	ERR LED	Error status	Description
OFF	ON, Flashing	Major error	An error such as hardware failure or memory failure. The module stops operating.
ON	Flashing	Moderate error	An error, such as parameter error, which affect module operation. The module stops operating.
ON	ON	Minor error	An error such as communication, positioning control, and program error. The module continues operating.

*2 The following table lists the LED displays during software installation.

RUN LED	PROGRAM RUN LED	CARD READY LED	Description
Flashing (500ms interval)	Flashing (500ms interval)	OFF	Executing the installation.
OFF	ON	ON	The installation is normally completed.
OFF	Flashing (200ms interval)	Flashing (200ms interval)	The installation is completed with an error.

*3 Includes cyclic transmission and transient transmission data for CC-Link IE TSN.

8 SPECIFICATIONS

8.1 Performance Specifications of Motion Module

This section lists the performance specifications of the Motion module.

Item		RD78G4	RD78G8	RD78G16
Number of controlled axes		4 axes	8 axes	16 axes
Operation cycle		0.250ms/0.500ms/1.000ms/2.000ms/4.000ms		
Interpolation function		2-axis to 4-axis linear interpolation 2-axis circular interpolation 3-axis helical interpolation		
Control method		PTP (Point To Point) control, path control (linear, circular, and helical 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 data can be set from the buffer memory)		
Execution data backup function		Saving the parameters, positioning data, and block start data in the flash ROM (battery-less)		
Positioning	Positioning method	PTP control: Increment method/absolute method Speed-position switching control: Increment method/absolute method Position-speed switching control: Increment method Path control: Increment method/absolute method		
	Positioning range	■Absolute method • -214748364.8 to 214748364.7 (μm) • -21474.83648 to 21474.83647 (inch) • 0 to 359.99999 (degree) • -2147483648 to 2147483647 (pulse) ■Increment method • -214748364.8 to 214748364.7 (μm) • -21474.83648 to 21474.83647 (inch) • -21474.83648 to 21474.83647 (degree) • -2147483648 to 2147483647 (pulse) ■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) ■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 acceleration/deceleration time each		
	Rapid stop deceleration time	1 to 8388608 (ms)		
Start time*3	Operation cycle 0.250ms	0.25 to 0.69ms		
	Operation cycle 0.500ms	0.38 to 0.84ms		
	Operation cycle 1.000ms	0.60 to 1.50ms		
	Operation cycle 2.000ms	0.74 to 2.60ms		
	Operation cycle 4.000ms	0.77 to 4.50ms		
Station-to-station distance (max.)		100m (328.08ft.)		
Number of write accesses to flash ROM		Up to 100000 times		
Number of occupied I/O points		32 points (I/O assignment: Intelligent function module 32 points)		
Internal current consumption (5V DC)		1.93A		
External dimensions	Height	106mm (4.17inch)		
	Width	27.8mm (1.09inch) (1 slot width)		
	Depth	110mm (4.33inch)		

Item	RD78G4	RD78G8	RD78G16
Mass	0.26kg		

*1 In the speed-position switching control (ABS mode), only the control unit "degree" can be used.
*2 When "Speed control 10 × multiplier setting for degree axis function" is valid, the speed is 0.01 to 20000000.00 (degree/min).
*3 The time from when the positioning start signal is received until when the BUSY signal turns ON

8.2 Specifications of Interfaces with External Devices

This section lists the external interfaces.

○: Support possible

Interface name	RD78G	Application
CC-Link IE TSN	1 port	Network connection
SD memory card	○	Restoration of parameters and logs, installation of Motion module software

Performance specifications of CC-Link IE TSN

The performance specifications of the CC-Link IE TSN are shown below.

Item			RD78G4	RD78G8	RD78G16
Maximum number of link points per network[*1]		RX/RY (Link device)	16K points each (16384 points, 2K bytes)		
		RWr/RWw (Link device)	8K points each (8192 points, 16K bytes)		
		LB	32K points (32768 points, 4K bytes)		
		LW	16K points (16384 points, 32K bytes)		
Maximum number of link points per station	Master station	RX/RY (Link device)	16K points each (16384 points, 2K bytes)		
		RWr/RWw (Link device)	8K points each (8192 points, 16K bytes)		
		LB	32K points (32768 points, 4K bytes)		
		LW	16K points (16384 points, 32K bytes)		
Transient transmission capacity			1920 bytes maximum		
Safety communications[*2]	Maximum number of connectable safety stations per network		121 stations		
	Maximum number of safety connections per station		Master station: 120 connections		
	Maximum number of safety connections per the same communication destination station		1 connection		
	Maximum number of link points per safety connection		• Input: 8 words • Output: 8 words		
Communication speed			• 1Gbps • 100Mbps		
Minimum synchronization cycle			250.00μs		
Time synchronization accuracy			±1μs		
CC-Link IE TSN Class			CC-Link IE TSN Class B device		
CC-Link IE TSN protocol version			2.0/1.0[*3]		
Network topology			Line topology, star topology, coexistence of line and star topologies		
Communication cable			Ethernet cable which satisfies standard (☞ Page 153 Wiring products)		
Maximum station-to-station distance			100m (328.08ft.)		
Overall cable distance	Line topology		12000m (39370.08ft.) (when 121 stations[*4] are connected)		
	Others		Depends on the system configuration		
Maximum number of connectable stations[*5]			121 stations[*4*6*7]		
Maximum number of connectable devices			257 devices[*4*8]		
Maximum number of networks			239		
Communication method			Time sharing method		
Multicast filter			Supported		

*1 The maximum number of points for all link devices may not be used simultaneously depending on the number of device stations, or the number of points and assignments of the link devices that are set on the "CC-Link IE TSN Configuration" window.

*2 Availability differs depending on the firmware version. For details, refer to "Safety communication" in the following manual.
MELSEC iQ-R Motion Module User's Manual (Network)

*3 "2.0" can be used with Add-on baseSystem version "1.20" or later. Protocol version "1.0" can be used when the remote station protocol version 1.0 is used with Add-on baseSystem version "1.20" or later.

*4 Includes the master station.
*5 An error will not occur even if there is no station and axis in the network setting.
*6 Even if the station is a multi-axis drive unit device (a device which can control two axes or more), the number of station is counted as one station when it is recognized as one station.
*7 When an axis emulate is carried out, the number of stations is counted according to the connected device setting.
*8 Also includes the number of extension modules.

Performance specifications of Ethernet

The performance specifications of Ethernet are shown below.

Item			Description	
Transmission specifications	Data transmission speed		• 1Gbps • 100Mbps	
	Communication mode		• 1000BASE-T • 100BASE-TX	Full-duplex
	Interface		RJ45 connector (Auto MDI/MDI-X)	
	Maximum frame size		1518 bytes	
	Jumbo frame		Not available	
	Maximum segment length		100m (328.08ft.) (distance between a switching hub and a station)*1	
	Number of cascade connections		*2	
	IP version		Compatible with IPv4	
Sending/receiving data storage memory	Number of simultaneous open connections (maximum number of connections)	Connection with MELSOFT products and a GOT	8 connections*3	
		Connection to SLMP-compatible devices	8 connections*3	

*1 For maximum segment length (length between switching hubs), consult the manufacturer of the switching hub used.
*2 Consult the manufacturer of the switching hub used.
*3 When one connection is for one station, up to eight stations can be connected.

Point

The operation of commercial devices used for the following applications is not guaranteed. Check the operation before using the module.

- Internet (general public line) (Internet-access service offered by an Internet service provider or a telecommunications carrier)
- Firewall device(s)
- Broadband router(s)
- Wireless LAN

SD memory card

The specifications of the SD memory card is shown below.

Item	Specification
Card type	SD/SDHC memory card
Card capacity	Up to 32G bytes
UHS	Unsupported
Number of times of installation/removal	Within 500 times

Use the recommended SD memory card listed below.

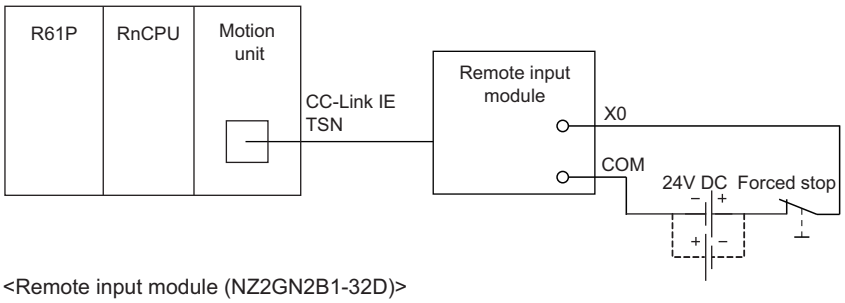
Model	Manufacturer	Card type	Card capacity
NZ1MEM-2GBSD	Mitsubishi Electric Corporation	SD	2G bytes
NZ1MEM-4GBSD		SDHC	4G bytes
NZ1MEM-8GBSD			8G bytes
NZ1MEM-16GBSD			16G bytes

Before using a commercially available SD memory card, check that the card does not affect the control of the target system on user's own responsibility.

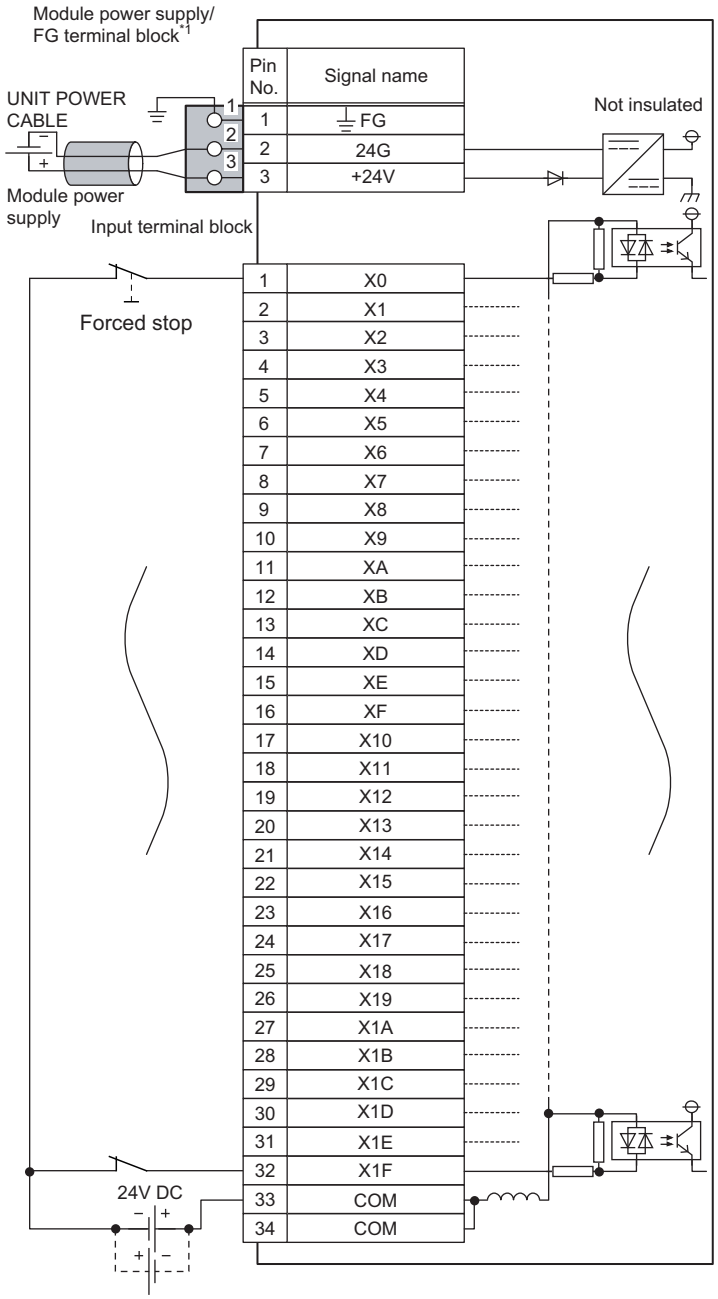
8.3 External Circuit Design

Forced stop circuit

A wiring example which uses a remote input module (NZ2GN2B1-32D) for the forced stop input is shown below.
Set "[Pr.82] Forced stop valid/invalid selection" and "[Cd.158] Forced stop input" according to the input modules.



<Remote input module (NZ2GN2B1-32D)>



*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 drive unit. Operation status of the emergency stop, drive unit 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 drive unit is shut off by external circuit, and the servo motor stops.
Drive unit forced stop		A stop command from the external circuit to the drive unit is output, and the drive unit stops the servo motor.
Motion controller forced stop		A stop command from the remote input module to the drive unit is output, and the drive unit stops the servo motor.

Shut-off the main circuit power supply of a drive unit when an emergency stop, alarm, servo amplifier forced stop, or remote input module forced stop occurs. Make sure to use molded-case circuit breakers (MCCB) for input wires of a drive unit power supply. For details, refer to the drive unit manual.
MR-J5(W)-G: 📖MR-J5 User's Manual (Hardware)

9 FUNCTION LIST

9.1 Control Functions

The Simple Motion mode has several functions. For details on each function, refer to the following.
MELSEC iQ-R Motion Module User's Manual (Application for Simple Motion Mode)

Main functions

Home position return control

"Home position return control" is a function (Fast home position return) that established the start point for carrying out positioning control (Machine home position return), and carries out positioning toward that start point. This is used to return a workpiece, located at a position other than the home position when the power is turned ON or after positioning stop, to the home position. The "home position return control" is pre-registered in the Motion module as "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 Motion module. Positioning control, such as position control and speed control, is executed by setting the required items in "positioning data" and starting that positioning data. An "operation pattern" can be set in "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 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 Motion module executes the random positioning operation by inputting a signal into the 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 that uses "advanced synchronous control parameter" to synchronize with the input axis using software instead of using a mechanical configuration consisting of a gear, shaft, change gear, and cam. (Advanced synchronous control).

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

Main functions			Details
Home position return control	Machine home position return control		Mechanically establishes the positioning start point. (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 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 (movement amount) from the current position.)
	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.
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.

Main functions		Details
Inter-module synchronization function		Synchronizes the control timings of 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 the 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 Motion module is described below.

Sub function		Details
Functions that compensate control	Backlash compensation function	This function compensates the mechanical backlash amount. Feed commands equivalent to the set backlash amount are output each time the movement direction changes.
	Electronic gear function	By setting the movement amount per pulse, this function can freely change the machine movement amount per commanded pulse. When the movement amount per pulse is set, a flexible positioning system that matches the machine system can be structured.
	Near pass function*1	This function suppresses the machine vibration when the speed is changed during continuous path control in the interpolation control.
Functions that limit control	Speed limit function	If the command speed exceeds "[Pr.8] Speed limit value" during control, this function limits the commanded speed to within the "[Pr.8] Speed limit value" setting range.
	Torque limit function	If the torque generated by the 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".
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 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.
	Speed control 10 times multiplier setting for degree axis function	This function executes the positioning control by the 10 times speed of the command speed and the speed limit value when the setting unit is "degree".

Sub function		Details
Other functions	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.
Servo ON/OFF	Servo ON/OFF	This function executes servo ON/OFF of the servo amplifiers connected to the Motion module.
	Follow-up function	This function monitors the motor rotation amount with the servo turned OFF, and reflects it on the command position value.

*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 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 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 in use 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	This function is used to select from the following signals when using each external input signal of each axis (upper/lower stroke limit signal (FLS/RLS), proximity dog signal (DOG), and stop signal (STOP)). • External input signal of servo amplifier • External input signal via CPU (buffer memory)
History monitor function	This function monitors start history and current value history of all axes.
Virtual servo amplifier function	This function executes the operation as the axis (virtual servo amplifier axis) that operates only command (instruction) virtually without servo amplifiers.
Mark detection function	This function is used to latch any data at the input timing of the mark detection signal (DI).
Optional data monitor function	This function is used to store the data selected by user up to 4 data per axis to buffer memory and monitor them.
Event history function	This function takes errors that occur on the Motion module and event information and collects them in the CPU module or saves them to the SD memory card. Storing the errors in the CPU allows the error history to be checked even after turning OFF the power or resetting.
Servo transient transmission function	This function reads and writes objects of the device station via transient transmission.
Test mode	This mode executes the test operation and adjustment of axes using an engineering tool.

9.2 Combination of Main Functions and Sub Functions

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

Combination of main functions and operation patterns

○: Combination possible

△: Combination limited

×: Combination not possible

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

■Functions that compensate control

○: Combination possible

△: Combination limited

×: Combination not possible

Main functions			Backlash compensation function	Electronic gear function	Near pass function
Home position return control	Machine home position return control		△*1	△*1	×
	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 Depends on the home position return specifications of the drive unit side.

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

■Functions that limit control

◎: Always combine

○: Combination possible

△: Combination limited

×: Combination not possible

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

*1 Depends on the home position return specifications of the drive unit side.

■Functions that change control details

○: Combination possible

△: Combination limited

×: Combination not possible

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

*1 Invalid during continuous path control.

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

■Other functions

○: Combination possible

△: Combination limited

×: Combination not possible

Main functions			Step function	Skip function	M code output function	Teaching function	Command in-position function
Home position return control	Machine home position return control		×	×	×	×	×
	Fast home position return control		×	×*1	×	×	○
Major positioning control	Position control	1-axis linear control	○	○	○	×	○
		2-, 3-, or 4-axis linear interpolation control	○	○	○	×	○
		1-axis fixed-feed control	○	○	○	×	○
		2-, 3-, or 4-axis fixed-feed control (interpolation)	○	○	○	×	○
		2-axis circular interpolation control	○	○	○	×	○
		3-axis helical interpolation control	○	○	○	×	○
	Speed control (1- to 4-axis)		×	×	○	×	×
	Speed-position switching control		○	○	○	×	○
	Position-speed switching control			×			
	Other control	Current value changing	○	○	△*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 Only independent positioning control can be set.

*2 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			Acceleration /deceleration processing function	Pre-reading start function	Deceleration start flag function	Stop command processing for deceleration stop function	Speed control 10 times multiplier setting for degree axis function	Operation setting for incompletion of home position return function
Home position return control	Machine home position return control		×	×	×	×	×	×
	Fast home position return control		○	×	×	○	○	×
Major positioning control	Position control	1-axis linear control	○	○	○	○	○	○
		2-, 3-, or 4-axis linear interpolation control	○	○	△*3	○	○	○
		1-axis fixed-feed control	○	○	○	○	○	○
		2-, 3-, or 4-axis fixed-feed control (interpolation)	○	○	△*3	○	○	○
		2-axis circular interpolation control	○	○	×	○	×	○
		3-axis helical interpolation control	○	○	×	○	×	○
	Speed control (1- to 4-axis)		○	○	×	○	○	○
	Speed-position switching control		○	○	△*4	○	○	○
	Position-speed switching control							
	Other control	Current value changing	×	×	×	×	×	△*5
		NOP instruction						×
		JUMP instruction	×	×	×	×	×	×
		LOOP to LEND						
Manual control	JOG operation, inching operation		△*6	×	×	×	○	×
	Manual pulse generator operation		×	×	×	×	△*7	×
Expansion control	Speed-torque control		△*8	×	×	×	○	○
	Advanced synchronous control (output axis)		△*9	×	×	×	△*9	○

*3 Valid for the reference axis only.

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

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

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

*7 Valid for "[Md.22] Speed command" and "[Md.28] Axis speed command".

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

*9 For details, refer to "Output Axis Sub Functions" in the following manual.
MELSEC iQ-R Motion Module User's Manual (Advanced Synchronous Control for Simple Motion Mode)

9.3 Network Function List

The following table lists the functions of CC-Link IE TSN. For details on the functions, refer to "Functions" in the following manual.

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

Cyclic transmission

This function allows periodic data communications among stations on the network using link devices.

○: Connection available, ×: Connection not available

Function		Description	Availability	
			Standard station	Motion control station
Communications using RX, RY, RWr, and RWw		Communicates data in units of bits and words between the master station and device stations.	○	×
Communications using LB and LW		Communicates data in units of bits and words between the master station and local stations.	○	×
Communications using RX, RY, RWr, RWw, LB and LW		Communication using link devices (RX, RY, RWr, RWw) and communication using link devices (LB, LW) can be performed at the same time.	○	×
Link refresh		Automatically transfers data between the link devices of the Motion module and the devices of the CPU module.	○	×
Direct access to link devices		Directly reads or writes the corresponding data to/from link devices (RWw/RWr/RX/RY/SB/SW/LB/LW) of the CC-Link IE Network module using a sequence program.	○	×
Cyclic data assurance		Assures the cyclic data integrity in units of 32 bits or station-based units.	○	×
Communication cycle coexistence		When device stations with different communication cycles are included in the network, multiple communication cycles according to each device station are used for communications.	○	×
Link refresh		Transfers data in the link devices of the master station to another network module on a relay station.	○	×
I/O maintenance settings	Output mode upon CPU error	Sets whether to hold or clear output when a stop error occurs in the CPU module. Set it on the sending side.	○	×
	Output hold/clear setting during CPU STOP	Sets whether to hold or clear output when the status of the CPU module changes from RUN to STOP. Set it on the sending side.	○	×
	Data link faulty station setting	Sets whether to clear or hold input from a disconnected station. Set it on the receiving side.	○	×
Remote device test		Arbitrarily turns on or off the output of the remote station when the CPU module is in STOP state.	○	×
CANopen communication		Controls a servo amplifier that supports the CANopen profile.	○	○

Transient transmission

This function is used for communications at any timing and has the following three functions.

○: Connection available, ×: Connection not available

Function	Description	Availability	
		Standard station	Motion control station
Communications using a dedicated instruction	Reads/writes data from the master station or local station to a remote station CPU module device, or a remote station buffer memory by the dedicated instructions.	○	○
Communications using the SLMP	Reads/writes data of master station and remote station CPU module device, or a remote station buffer memory from the Motion module and the external device such as a personal computer or HMI (Human Machine Interface) via an SLMP.	○	○
Communications using engineering tool	Configures the settings of or monitors each station using an engineering tool.	○	○

Ethernet connection

This function connects an Ethernet device to a module without interfering with CC-Link IE TSN.

○: Connection available, ×: Connection not available

Function	Description	Availability	
		Standard station	Motion control station
Connection with MELSOFT products	Programming and monitoring of the programmable controller are performed via Ethernet using the engineering tool.	○	○
Connection with SLMP-compatible devices	Connects SLMP-compatible devices (such as a personal computer or a vision sensor) to the Motion module.	○	○

Security

This function builds security according to the network environment by restricting access for each communication path to the CPU module.

○: Connection available, ×: Connection not available

Function	Description	Availability	
		Standard station	Motion control station
IP filter	Identifies the IP address of the access source, and prevents unauthorized access.	○	○
Remote password	Permits or prohibits access from the external device to the CPU module via the Motion module.	○	○

RAS

RAS stands for Reliability, Availability, and Serviceability. This function improves overall usability of automated equipment.

○: Connection available, ×: Connection not available

Function	Description	Availability	
		Standard station	Motion control station
Device station disconnection	Stops data link of the station where an error occurred, and continues data link only for stations that are operating normally.	○	○
Automatic return	Restarts the data link automatically when the device station that was disconnected due to an error becomes normal again.	○	○
Master station duplication detection	When one network has multiple master stations, detects duplication.	○	○
IP address duplication detection	When one network has stations with the same IP address, detects duplication.	○	○
Time synchronization	Synchronizes the time of device stations with the time synchronization source (the CPU module of the master station).	○	○

Synchronization function

This function adjusts the timing with the timing of different device stations connected to the same network.

○: Connection available, ×: Connection not available

Function	Description	Availability	
		Standard station	Motion control station
CC-Link IE TSN Network synchronous communication function	Synchronizes control cycles between device stations over CC-Link IE TSN according to the inter-module synchronization cycle specified in the master station. This allows different device stations on the same network to operate with the same timing.	○	×
	Synchronizes the control cycle of device stations according to the communication cycle of the master station. This allows device stations specified in Motion control stations to operate with the same timing as the Motion operation of the Motion module.	×	○

Safety communications

This function allows safety data to be exchanged between safety stations on the same network.

○: Connection available, ×: Connection not available

Function	Description	Availability	
		Standard station	Motion control station
Safety communications	Establishes a safety connection and enables “one-on-one” safety communications periodically between safety stations in the same network.	○	○

Troubleshooting

This function checks the status of modules and networks by executing diagnostics and operation tests using the engineering tool.

○: Connection available, ×: Connection not available

Function	Description	Availability	
		Standard station	Motion control station
CC-Link IE TSN/CC-Link IE Field diagnostics	Monitors the status of CC-Link IE TSN. The network maps, stations where data link is not operating, selected station communication status monitor, and other items are displayed on the engineering tool.	○	○
Communication test	Checks if transient transmission data can be properly routed from the own station to the communication target.	○	○

Others

○: Connection available, ×: Connection not available

Function		Description	Availability	
			Standard station	Motion control station
"CC-Link IE TSN Configuration" window	Parameter setting of a device station	Sets parameters of device stations (the number of points and assignment of link devices) in the master station.	○	○
	Detection of connected/ disconnected devices	Detects connected device stations and the stations are displayed on the "CC-Link IE TSN Configuration" window.	○	○
	Parameter processing of a device station	Reads the parameters from the device station and saves them, then writes the saved parameters to the device station.	○	○
	Command execution to device stations	Executes commands (Error clear request, Error history clear request) to a device station.	○	○
	IP address setting of a device station	Sets an IP address of the device station that is set as the master station.	○	○
Reserved station setting		A device station that is set in the parameters and included as a station in the network when its number is counted. This station is reserved for network extension in the future, and thus the station is not actually connected, and is not detected as a faulty station despite being not connected.	○	○
Error invalid station setting		A device station that is set to be not detected as a faulty station by the master station. Carry out this setting when replacing a device station during a data link as well.	○	○
Device station parameter automatic setting		Saves parameters of the device station to the master station, and sets the parameters automatically when the device station is connected or returned to the network.	○	○
Data collection by CC-Link IE TSN Communication Software		CC-Link IE TSN cyclic data is sent using the CC-Link IE TSN Communication Software. For details on the CC-Link IE TSN Communication Software, refer to the following. 📖CC-Link IE TSN Communication Software for Windows User's Manual	○	○

10 PROCEDURES BEFORE OPERATIONS

This chapter describes the procedures before operations of RD78G using Simple Motion mode.

1. Mounting the module

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

For details on mounting modules, refer to the following.

MELSEC iQ-R Module Configuration Manual

2. Wiring

Connect the Motion module to external devices.

3. Adding the module

Add the "RD78G_(S)[*1]" to the module map of the project using GX Works3.

*1 "_" (underscore) indicates the number of control axes (4/8/16).

Point

- When using Simple Motion mode, set the Motion modules which have a module model name that ends with (S) (RD78G4(S)/RD78G8(S)/RD78G16(S)) in the module configuration of GX Works3. The Motion modules with names that do not end with (S) (RD78G4/RD78G8/RD78G16) do not support Simple Motion mode.
- When the Simple Motion mode is used, "RD78G_(S)" is displayed as the module model name in GX Works3.

4. Network construction

Set network parameters in "Module Parameter (Network)" of GX Works3.

- Set the communication cycle setting for "Network Configuration Settings".
  Set the basic communication cycle according to the number of control axes or network device configuration. For a reference of the communication cycle according to the number of control axes, check the tables shown below.

■When using a module in positioning control[*1] (recommended setting)

Communication cycle interval (μs)	250.00	500.00	1000.00	2000.00
Number of controllable real servo amplifier axes	4	9	16	16

■When using a module in advanced synchronous control with command generation axis disabled[*1] (recommended setting)

Communication cycle interval (μs)	250.00	500.00	1000.00	2000.00
Number of controllable real servo amplifier axes	2	6	16	16

■When using a module with a command generation axis set as an input axis, and a real servo amplifier set as an output axis in advanced synchronous control[*1*2] (recommended setting)

Communication cycle interval (μs)	250.00	500.00	1000.00	2000.00
Number of controllable real servo amplifier axes	1	5	15	16
Number of command generation axes that can be set as input axes	1	5	8	8

*1 Set the number of real servo amplifier axes so that it matches the setting value of "[Pr.152] Maximum number of control axes".

*2 Set the number of enabled command generation axes so that it does not exceed "[Pr.152] Maximum number of control axes".

- For the network configuration, set the device stations in the control setting with them assigned to axes.
  The device station to be controlled in the Motion module needs to be set in the motion control station. Also, for a station set as the motion control station, set the basic cycle for the communication cycle. For setting details and calculations for the communication cycle according to the number of device stations, refer to "Communication cycle interval" under "Processing Time" in the following manual.
  MELSEC iQ-R Motion Module User's Manual (Network)

5. Auto refresh setting

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

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

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

Configure the refresh settings for the monitor data of the control axis in "Module Parameter (Motion)".

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

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

6. Module setting (Simple Motion module setting function (module extended parameter))

Configure the settings related to axis control in "Simple Motion Module Setting Function (Module Extended Parameter)" of the engineering tool.

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

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

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

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

Or, refer to the following manual.

MELSEC iQ-R Motion Module User's Manual (Advanced Synchronous Control for Simple Motion Mode)

Point

- When switching from PLCopen Motion control FB mode to Simple Motion mode, the backup data saved in the system memory (backup RAM) needs to be cleared. To clear the backup data, perform quick clearing from the "Remote Operation" function of "Motion Control Setting Function" in PLCopen Motion control FB mode. For details on the operation method, refer to "Help" in the Motion Control Setting Function.
- When the backup data from PLCopen Motion control FB mode is needed, during PLCopen Motion control FB mode use the "backup/restoration" function of "Motion Control Setting Function". For details on the operation method, refer to "Help" in the Motion Control Setting Function.

7. Programming

Create programs.

For details, refer to "Creating a Program" in the following manual.

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

Point

When using Simple Motion mode, create an interlock using the program to access the buffer memory after the synchronization flag [X1] turns ON. If an interlock is not created, an unintended value may be read or be written.

8. Writing parameters (CPU module)

Write the parameters set and program created in GX Works3 to the CPU module.

9. Switching the system

Restart the system by powering OFF and ON the system or by resetting the CPU module.

10. Writing parameters (Motion module)

Write the parameters (Simple Motion module setting) set in GX Works3 to the Motion module.

11. Network diagnostics

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

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

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

12. Parameter settings in device stations.

Set parameters of the drive unit to use.

For details, refer to each drive unit manual.

For MR-J5(W)-G: 📖MR-J5-G/MR-J5W-G User's Manual (Parameters)

13. Test mode

Execute the test operation using GX Works3.

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

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

14. Test operation

Check that the program is correctly carried out as created.

Point

When multiple device stations are powered on simultaneously, the startup time of the device stations may vary. In such a case, the networks are connected in turn, resulting in the possibility of the longer time to complete data links at all stations.

Powering on the master station after all device stations have started prevents the time required for data links at all stations to increase.

10.1 Communication with the Engineering Tool

This section describes communication between the motion system and external devices such as GX Works3 (Simple Motion module setting function).
For details of the online function, refer to the following manual.
📖GX Works3 Operating Manual
For communication for access to other module from a tool such as the engineering tool via the Motion module, refer to "Communications using the engineering tool" in the following manual.
📖MELSEC iQ-R Motion Module User's Manual (Network)

Operation of this function for each system status

○: Possible, △: Possible (with restrictions)

Status	Operation availability
STOP	○
RUN	○
Moderate error	○
Major error	△ (Communication with the Motion module may not be performed depending on the error status. In that case, monitor the error status on the control CPU side.)

Accessible path

Communication with the Motion module is possible only through connection with the control CPU or own Motion module.
Communication via a module other than the control CPU or own Motion module on the base may not be possible depending on the path.

Precautions

The error will occur when accessing to the motion system from multiple devices simultaneously. (Or the error may not occur.)
In such a case, try communication again after a while.

Relevant Add-ons, Versions

Communication with the engineering tool is possible without even one add-on being installed.

Point

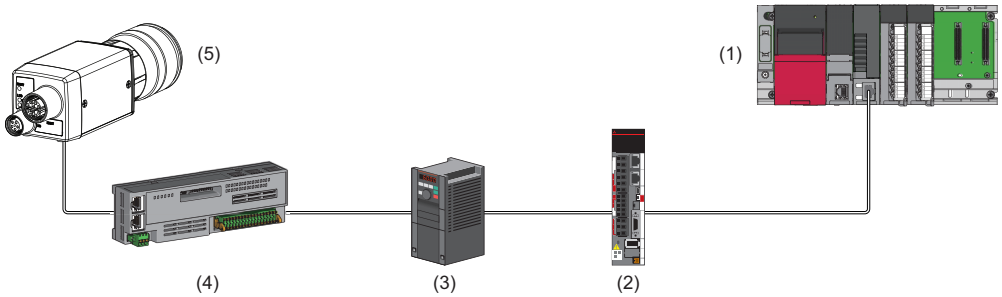
When file transfer function (Add-on File Transfer) is enabled, transfer time of reading and writing the project data from the engineering tool is shortened by compressing the data.

System memory capacity

The system memory will not be used because add-on is not used for the communication.
However, when file transfer function (Add-on File Transfer) is enabled, Add-on File Transfer will use the system memory when reading and writing the project data from the engineering tool.

11 SYSTEM CONFIGURATION

CC-Link IE TSN is configured using Ethernet cables. (☞ Page 152 Ethernet cable)
For specifications on connectable devices, refer to the manual of each device.



(1) Motion module
(2) Drive unit
(3) Inverter device
(4) Remote I/O module
(5) Ethernet device

List of system configurations

The following table is a list of different system configurations.

List of system configurations	Reference
Modules on CC-Link IE TSN (CC-Link IE TSN Class B only) and Ethernet devices	☞ Page 119 Structure of CC-Link IE TSN Class B Devices Only
Modules on CC-Link IE TSN (Mixture of CC-Link IE TSN Class B/A or CC-Link IE TSN Class A only) and Ethernet devices	☞ Page 128 Structure of CC-Link IE TSN Class B/A Devices
Modules on CC-Link IE TSN, modules on CC-Link IE Field Network, and Ethernet devices	☞ Page 144 Structure of a CC-Link IE TSN and CC-Link IE Field Network
CC-Link IE TSN communication software and modules on CC-Link IE TSN	☞ Page 145 Structure when CC-Link IE TSN Communication Software is Used
Modules on CC-Link IE TSN (mixed protocol version 2.0/1.0) and Ethernet devices	☞ Page 154 System configuration with CC-Link IE TSN Class B/A Devices (Protocol Version 2.0/1.0)
Modules on CC-Link IE TSN (protocol version 1.0 only) and Ethernet devices	☞ Page 156 System configuration with CC-Link IE TSN Class B/A Devices (Protocol Version 1.0 only)

Precautions

A dedicated TSN hub may be required depending on parameter settings or the network topology used to connect modules on CC-Link IE TSN.

Unicast mode and multicast mode

Cyclic transmission differs depending on the communication mode set by the module parameter of the master station. The types of communication modes are as follows:

- Unicast mode
- Multicast mode

For details, refer to the following.

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

CC-Link IE TSN Class setting

From "Connection Device Information" under "Basic Settings" of the engineering tool, select either of the following items according to devices to be connected.

Connected device information	System configuration	Supported standard
CC-Link IE TSN Class B Only	Select this if the system is to be configured without connecting the CC-Link IE TSN Class A device. • ☞ Page 124 Connection with modules on CC-Link IE TSN only • ☞ Page 127 Connection with modules on CC-Link IE TSN and Ethernet devices	IEEE802.1AS
Mixture of CC-Link IE TSN Class B/A or CC-Link IE TSN Class A Only	Select this when connecting a CC-Link IE TSN Class A device, or when configuring a system that will connect to a CC-Link IE TSN Class A device in the future. (A configuration using only CC-Link IE TSN Class B device can also be connected) • ☞ Page 128 Structure of CC-Link IE TSN Class B/A Devices	IEEE802.1AS or IEEE1588*1

*1 IEEE1588 is for Add-on baseSystem version "1.18" or earlier.
If Add-on baseSystem version "1.20" or later is used, either IEEE802.1AS or IEEE1588 will be used depending on the protocol version of the connected device. For details, refer to the following.
☞ Page 155 Device time synchronization method and connection specifications

Ethernet connection

For connection with MELSOFT products and a GOT, and connection with SLMP-compatible devices, refer to "Ethernet Connection" in the following manual.
📖MELSEC iQ-R Motion Module User's Manual (Network)

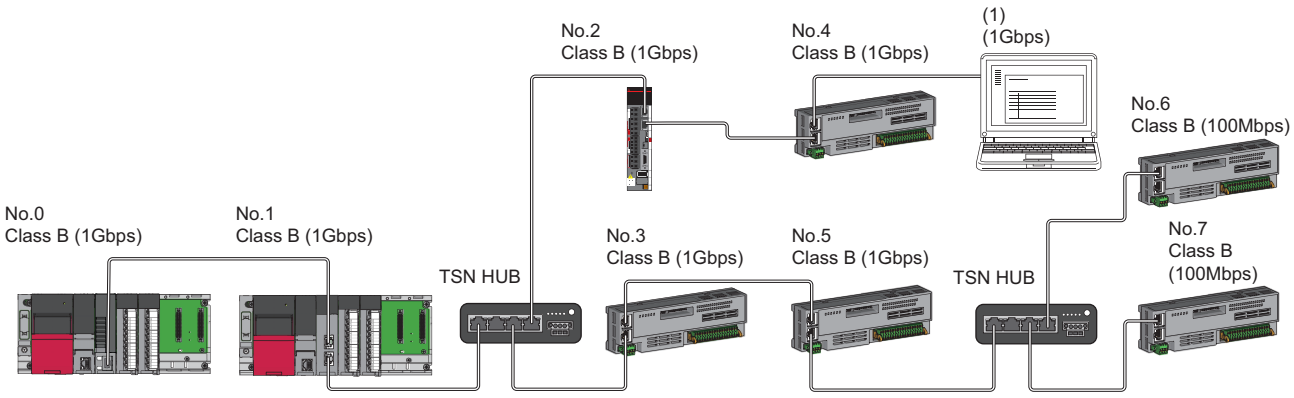
With the Safety CPU

When the Motion module is used with the Safety CPU, the safety communications are available in addition to the standard communications (cyclic transmission and transient transmission).
For details on the safety communications, refer to "Safety Communication" in the following manual.
📖MELSEC iQ-R Motion Module User's Manual (Network)

11.1 Structure of CC-Link IE TSN Class B Devices Only

The following shows the system configuration when "Connection Device Information" under "Basic Settings" is set to "CC-Link IE TSN Class B Only" in the engineering tool.

When "Connection Device Information" under "Basic Settings" of the master station is set to "CC-Link IE TSN Class B Only", up to 121 stations (one master station and 120 device stations) can be connected.

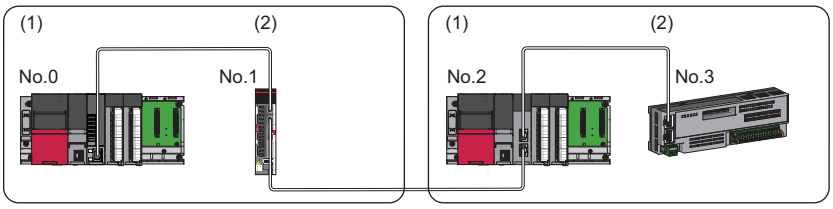


No.0: Master station
No.1: Local station
No.2, No.3, No.4, No.5, No.6, No.7: Remote station
(1) Ethernet device
Class B: CC-Link IE TSN Class B device

The availability of connection of network configuration devices varies depending on the communication mode and communication speed.

- When using unicast mode
  - ☞ Page 120 When the communication speed for the master station is set to 1Gbps
  - ☞ Page 121 When the communication speed for the master station is set to 100Mbps
- When using multicast mode
  - ☞ Page 122 When the communication speed for the master station is set to 1Gbps
  - ☞ Page 123 When the communication speed for the master station is set to 100Mbps

The following terms are used to describe the terms in the tables referenced.



No.0: Master station
No.2: Local station
No.1, No.3: Remote station
(1) Device on the master station side (The master station or a device near the master station)
(2) Device on the end side (A device far from the master station)

Restriction

- When "Network Topology" under "Basic Settings" is set to "Ring", "Network parameter error" (error code: 2221H) will occur in the Motion module.
- "Network parameter error" (error code: 2221H) will occur in the Motion module if the following settings are made when the add-on baseSystem version is "1.22" or earlier.
  - · If "Local station" is set for the "Network configuration setting"
  - · If "Multicast" is set for the "Communication mode"

Availability of connection with devices (when using unicast mode)

The following shows the case when "Communication Mode" under "Application Settings" is set to "Unicast".

When the communication speed for the master station is set to 1Gbps

The following table lists the availability of connection with a network configuration device when the "Communication Speed" for the master station is set to "1Gbps".

○: Connection available, ●: Connection available via a switching hub, ×: Connection not available

△: Connection available only when the device on the end side is a standard station.

▲: Connection available only when the device on the end side is a standard station, and is connected via a switching hub.

S: TSN hub available

H: General-purpose hub available

Device on the master station side (A device near the master station)		Device on the end side (A device far from the master station)					
		Local station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class B device)		Ethernet device	
		1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps
Master station (CC-Link IE TSN Class B device)	1Gbps	△S	×	○S	▲S*1	○SH	●SH
Local station (CC-Link IE TSN Class B device)	1Gbps	△S	×	○S	▲S*1*2	○SH	●SH
	100Mbps	×	×	×	×	×	×
Remote station (CC-Link IE TSN Class B device)	1Gbps	△S	×	○S	▲S*1*2	○SH	●SH
	100Mbps	×	×	×	△S*1*2	×	○SH

*1 For a device station with a communication speed of 100Mbps, set "Communication Period Setting" to "Low-Speed".

*2 A connection cannot be established if the total cyclic data size of all device stations on the 100Mbps device side exceeds 2K bytes. This includes the devices with a communication speed of 100Mbps that form a boundary between the communication speed of 1Gbps and 100Mbps. (☞ Page 149 Calculation of the total cyclic data size)

Precautions

When a TSN hub is used, check the TSN hub specifications on the CC-Link Partner Association website (www.cc-link.org).

When the communication speed for the master station is set to 100Mbps

The following table lists the availability of connection with a network configuration device when the "Communication Speed" for the master station is set to "100Mbps".

○: Connection available, ×: Connection not available

△: Connection available only when the device on the end side is a standard station.

S: TSN hub available

H: General-purpose hub available

Device on the master station side (A device near the master station)		Device on the end side (A device far from the master station)					
		Local station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class B device)		Ethernet device	
		1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps
Master station (CC-Link IE TSN Class B device)	100Mbps	×	△S*1	×	○S*1	×	○SH
Local station (CC-Link IE TSN Class B device)	1Gbps	×	×	×	×	×	×
	100Mbps	×	△S*1	×	○S*1	×	○SH
Remote station (CC-Link IE TSN Class B device)	1Gbps	×	×	×	×	×	×
	100Mbps	×	△S*1	×	○S*1	×	○SH

*1 For a device station with a communication speed of 100Mbps, set "Communication Period Setting" to "Basic Period" or "Normal-Speed".

Precautions

When a TSN hub is used, check the TSN hub specifications on the CC-Link Partner Association website (www.cc-link.org).

Availability of connection with devices (when using multicast mode)

The following shows the case when "Communication Mode" under "Application Settings" is set to "Multicast".

When the communication speed for the master station is set to 1Gbps

The following table lists the availability of connection with a network configuration device when the "Communication Speed" for the master station is set to "1Gbps".

○: Connection available, ●: Connection available via a switching hub, ×: Connection not available

△: Connection available only when the device on the end side is a standard station.

▲: Connection available only when the device on the end side is a standard station, and is connected via a switching hub.

S: TSN hub available

H: General-purpose hub available

Device on the master station side (A device near the master station)		Device on the end side (A device far from the master station)					
		Local station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class B device)		Ethernet device	
		1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps
Master station (CC-Link IE TSN Class B device)	1Gbps	△S*2	×	○S*2	▲S*1*2	○SH*2	●SH*2
Local station (CC-Link IE TSN Class B device)	1Gbps	△S*2	×	○S*2	▲S*1*2*3*4	○SH*2*4	●SH*2*4
	100Mbps	×	×	×	×	×	×
Remote station (CC-Link IE TSN Class B device)	1Gbps	△S*2	×	○S*2	▲S*1*2*3*4	○SH*2*4	●SH*2*4
	100Mbps	×	×	×	△S*1*2*3	×	○SH*2*4

*1 For a device station with a communication speed of 100Mbps, set "Communication Period Setting" to "Low-Speed".

*2 When the device is connected on the end side via the switching hub as shown below, communication may not be possible depending on the type of the device.
The communication will be enabled by configuring settings with the switching hub so that the multicast frame (with multicast MAC address 09:00:70:00:10:02 and 09:00:70:00:10:05) will not be transferred to the ports specified below.

Connection configurations that cannot communicate	Port prohibiting transmission of multicast frame
Device stations with communication speeds of 1Gbps and 100Mbps coexist.	Connection port of the device station with a communication speed of 100Mbps.
A local station and Ethernet device coexist.	Connection port of the Ethernet device.
The remote station and Ethernet device coexist.	

*3 A connection cannot be established if the total cyclic data size of all device stations 100Mbps device side exceeds 2K bytes. This includes the devices with a communication speed of 100Mbps that form a boundary between the communication speed of 1Gbps and 100Mbps. (☞ Page 149 Calculation of the total cyclic data size)

*4 For a local station or remote station of a device on the master station side, use a device supporting the multicast filter. (📖Manual for the device used)

Precautions

When a TSN hub is used, check the TSN hub specifications on the CC-Link Partner Association website (www.cc-link.org).

When the communication speed for the master station is set to 100Mbps

The following table lists the availability of connection with a network configuration device when the "Communication Speed" for the master station is set to "100Mbps".

○: Connection available, ●: Connection available via a switching hub, ×: Connection not available

△: Connection available only when the device on the end side is a standard station.

S: TSN hub available

H: General-purpose hub available

Device on the master station side (A device near the master station)		Device on the end side (A device far from the master station)					
		Local station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class B device)		Ethernet device	
		1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps
Master station (CC-Link IE TSN Class B device)	100Mbps	×	△S*1*2	×	○S*1*2	×	○SH*2
Local station (CC-Link IE TSN Class B device)	1Gbps	×	×	×	×	×	×
	100Mbps	×	△S*1*2	×	○S*1*2	×	○SH*2*3
Remote station (CC-Link IE TSN Class B device)	1Gbps	×	×	×	×	×	×
	100Mbps	×	△S*1*2	×	○S*1*2	×	○SH*2*3

*1 For a device station with a communication speed of 100Mbps, set "Communication Period Setting" to "Basic Period" or "Normal-Speed".

*2 When the device is connected on the end side via the switching hub as shown below, communication may not be possible depending on the type of the device.
The communication will be enabled by configuring settings with the switching hub so that the multicast frame (with multicast MAC address 09:00:70:00:10:02 and 09:00:70:00:10:05) will not be transferred to the ports specified below.

Connection configurations that cannot communicate	Port prohibiting transmission of multicast frame
A local station and Ethernet device coexist.	Connection port of the Ethernet device.
The remote station and Ethernet device coexist.	

*3 For a local station or remote station of a device on the master station side, use a device supporting the multicast filter. (Manual for the device used)

Precautions

When a TSN hub is used, check the TSN hub specifications on the CC-Link Partner Association website (www.cc-link.org).

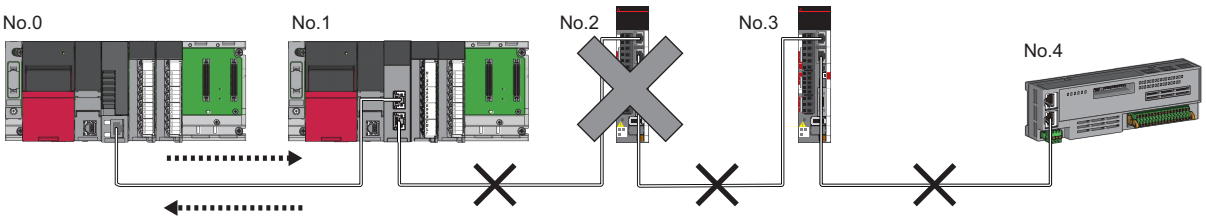
Structure of modules on CC-Link IE TSN only

Connection with modules on CC-Link IE TSN only

■Line topology

Modules are connected in a line topology. A TSN hub is not required.

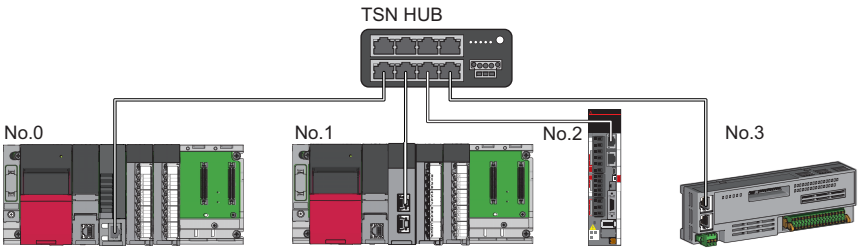
When an error occurs in a device station, the stations connected after the faulty station will be disconnected.



No.0: Master station
No.1: Local station
No.2, No.3, No.4: Remote station

■Star topology

The network is configured in a star topology via a TSN hub. This allows devices to be added easily.

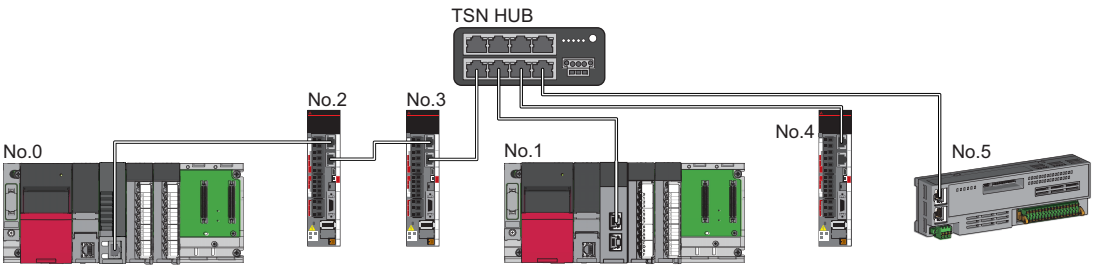


No.0: Master station
No.1: Local station
No.2, No.3: Remote station

Even when an error occurs in a device station, a data link can be continued with the stations that are operating normally.

■Coexistence of line and star topologies

Line and star topologies are mixed.



No.0: Master station
No.1: Local station
No.2, No.3, No.4, No.5: Remote station

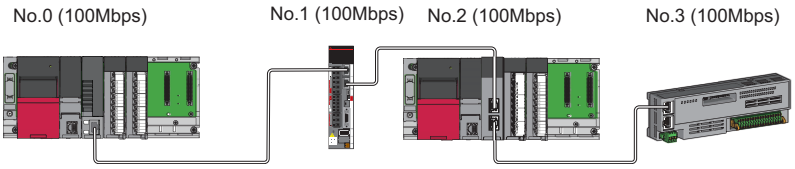
Connection with modules on CC-Link IE TSN with a communication speed of 100Mbps

This section describes the network topology when "Communication Speed" under "Application Settings" is set to "100Mbps".

■Line topology

Modules are connected in a line topology.

- Adjust the communication speed of each module.
- When connecting modules with different communication speeds, connect the modules via a TSN hub.

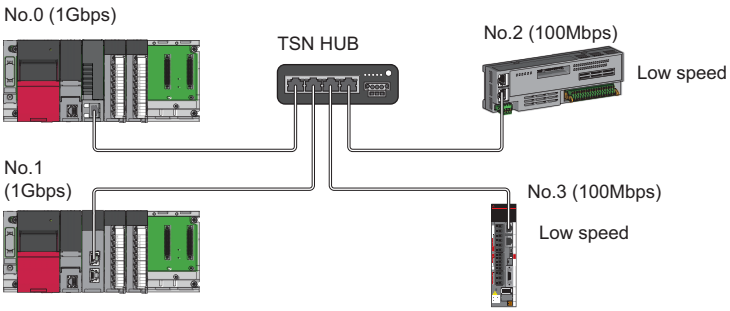


No.0: Master station
No.2: Local station
No.1, No.3: Remote station

■Star topology

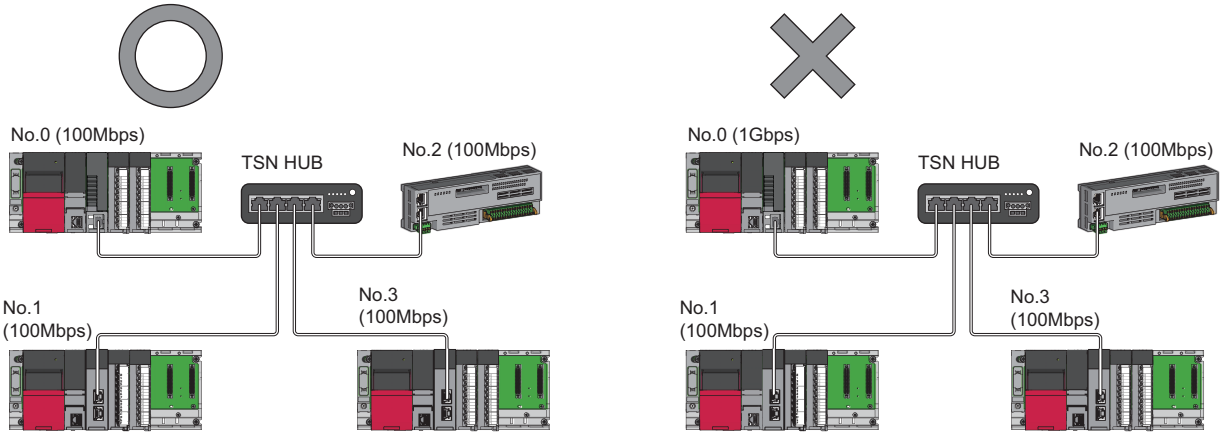
Modules are connected in a star topology via a switching hub.

- When the master station with a communication speed of 1Gbps and a remote station with a communication speed of 100Mbps exist in the structure, set "Communication Period Setting" to "Low-Speed" for the remote station with a communication speed of 100Mbps.



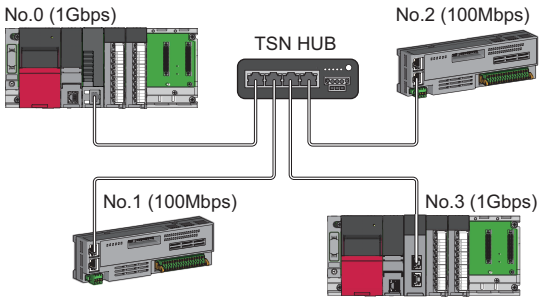
No.0: Master station
No.1: Local station
No.2, No.3: Remote station

- Connect the master station and the local station with the same communication speed.



No.0: Master station
No.1, No.3: Local station
No.2: Remote station

- When "Communication Mode" is set to "Multicast" and "Communication Speed" of the master station is set to "1Gbps", communication may not be possible depending on the type of the device if device stations with different communication speeds of 1Gbps and 100Mbps coexist on the end side via the switching hub. The communication will be enabled by configuring settings with the TSN hub so that the multicast frame (with multicast MAC address 09:00:70:00:10:02 and 09:00:70:00:10:05) will not be transferred to the device station with 100Mbps.

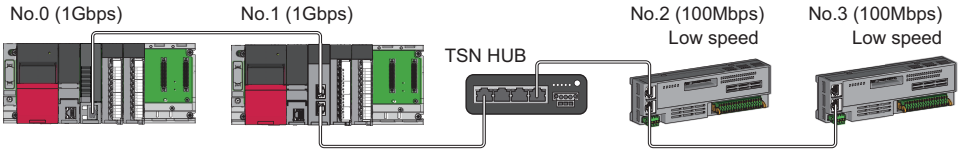


No.0: Master station
No.1, No.2: Remote station
No.3: Local station

■Coexistence of line and star topologies

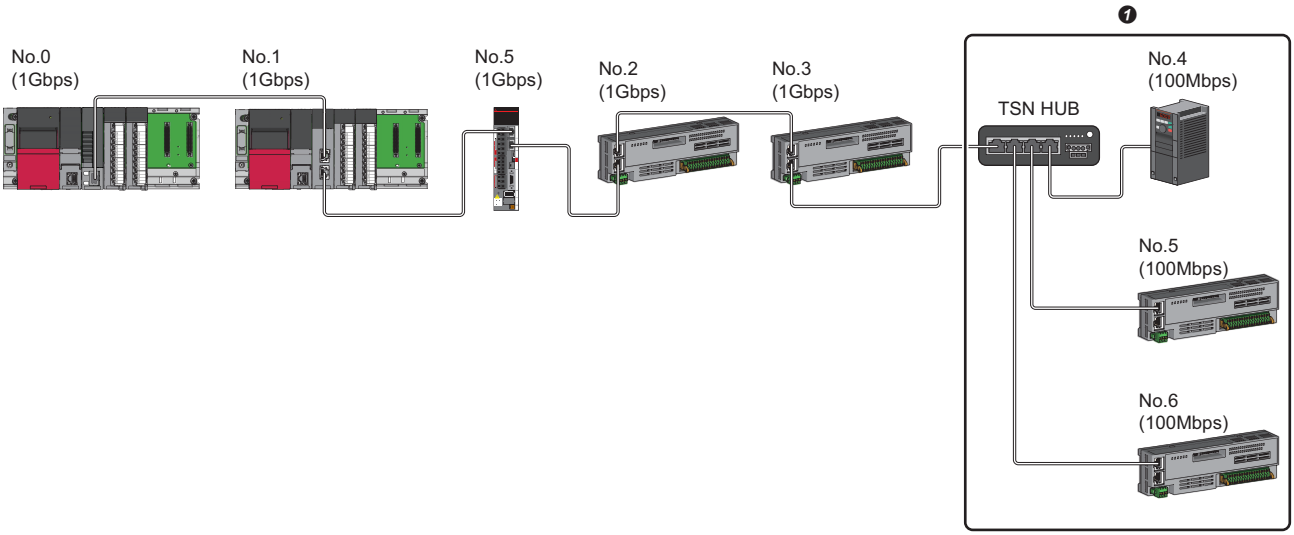
Line and star topologies can be mixed in the same network configuration.

- When the master station with a communication speed of 1Gbps and a device station with a communication speed of 100Mbps exist in the structure, set "Communication Period Setting" to "Low-Speed" for the device station with a communication speed of 100Mbps.



No.0: Master station
No.1: Local station
No.2, No.3: Remote station

- When the communication speed of the master station is 1Gbps, a connection cannot be established if the total cyclic data size of all device stations on the 100Mbps device side exceeds 2K bytes. This includes the devices with a communication speed of 100Mbps that form a boundary between the communication speed of 1Gbps and 100Mbps.



No.0: Master station
No.1: Local station
No.2, No.3, No.4, No.5, No.6, No.7: Remote station
❶ Set the total cyclic data size within 2K bytes.

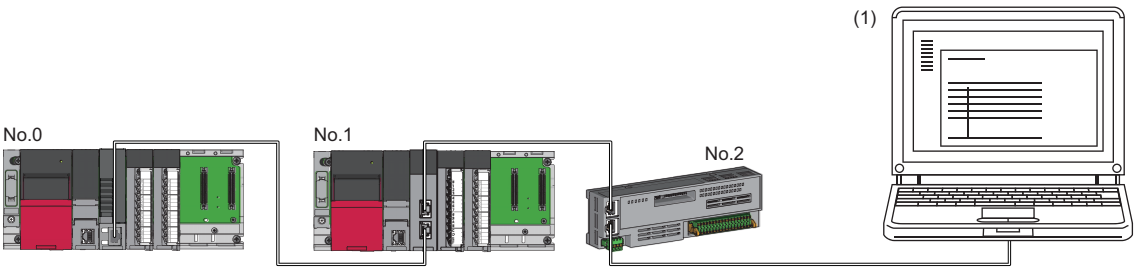
Structure of modules on CC-Link IE TSN and Ethernet devices

Connection with modules on CC-Link IE TSN and Ethernet devices

■Line topology

The network with modules and devices is configured in a line topology. A TSN hub is not required.

Connect Ethernet devices to the end of the network.



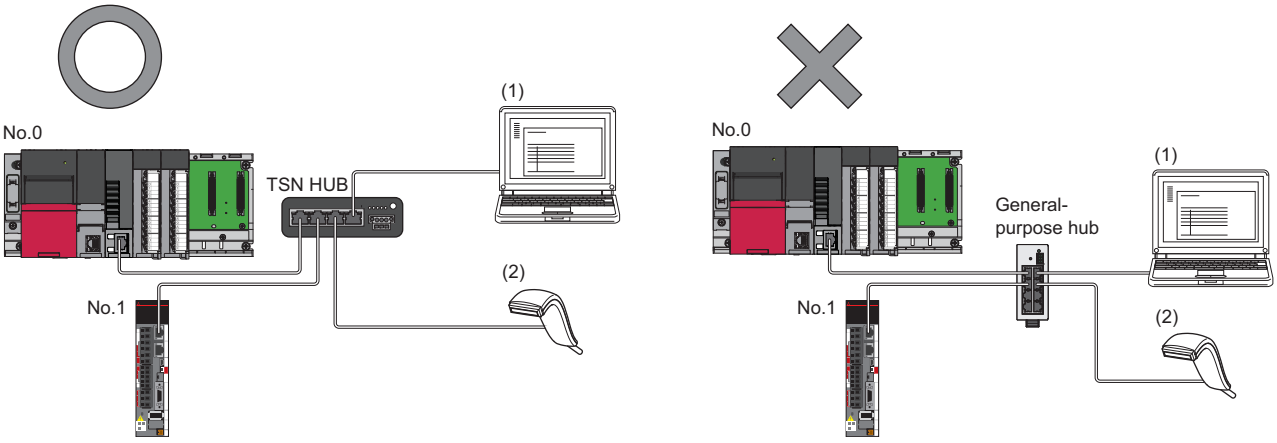
No.0: Master station
No.1: Local station
No.2: Remote station
(1) Ethernet device (such as a personal computer)

When an error occurs in a device station, the stations connected after the faulty station will be disconnected.

■Star topology

The network is configured in a star topology via a switching hub.

Device stations cannot be connected with a general-purpose hub. Line and star topologies should be mixed in the same network configuration.

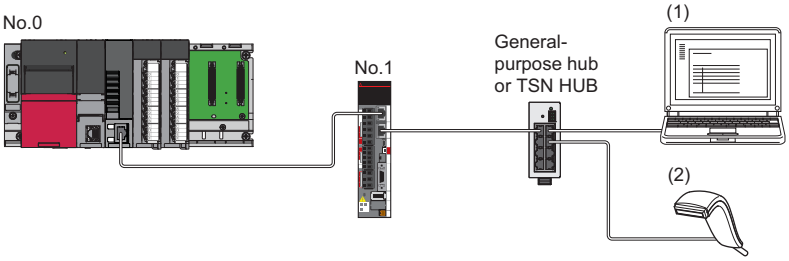


No.0: Master station
No.1: Remote station
(1), (2): Ethernet device

■Coexistence of line and star topologies

Line and star topologies can be mixed in the same network configuration.

Connect Ethernet devices to the end of the network.



No.0: Master station
No.1: Remote station
(1), (2): Ethernet device

11.2 Structure of CC-Link IE TSN Class B/A Devices

This section describes the system configuration in the following cases.

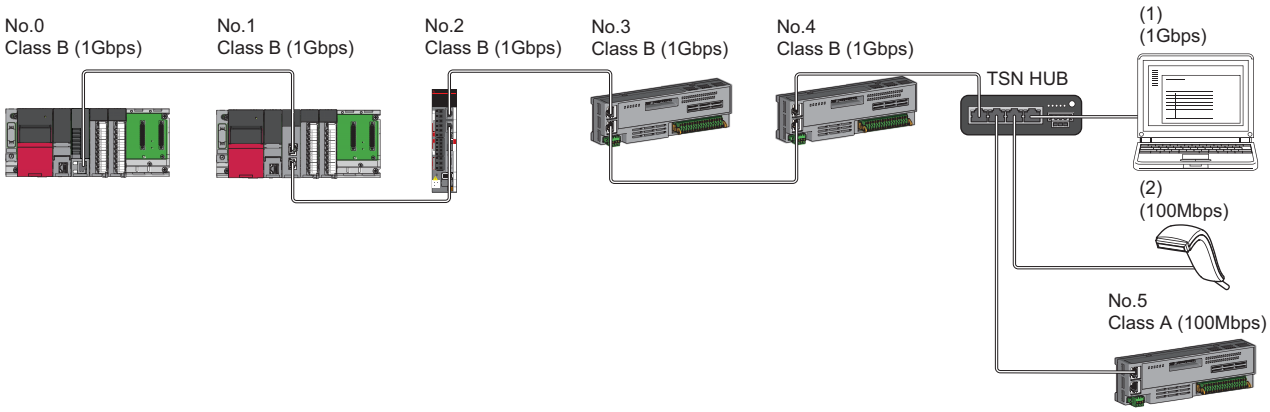
- Motion module supports the protocol version 2.0
- The CC-Link IE TSN module supports the protocol version 2.0 only
- Set "Connection Device Information" under "Basic settings" of the engineering tool to "Mixture of CC-Link IE TSN Class B/A or CC-Link IE TSN Class A only"

When "Connection Device Information" under "Basic Settings" of the master station is set to "Mixture of CC-Link IE TSN Class B/A" or "CC-Link IE TSN Class A Only", up to 121 stations (one master station and 120 device stations) can be connected.

Point

If the Motion module add-on baseSystem version is “1.18" or earlier, or if protocol version "1.0" is used in the connected CC-Link IE TSN module, refer to the following.

☞ Page 156 System configuration with CC-Link IE TSN Class B/A Devices (Protocol Version 1.0 only)
☞ Page 154 System configuration with CC-Link IE TSN Class B/A Devices (Protocol Version 2.0/1.0)

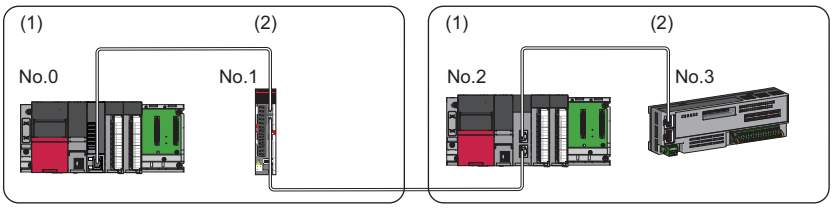


No.0: Master station
No.1: Local station
No.2 to No.5: Remote station
(1), (2) Ethernet device
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

The availability of connection of network configuration devices varies depending on the communication mode and communication speed.

- When using unicast mode
  ☞ Page 130 When the communication speed for the master station is set to 1Gbps
  ☞ Page 131 When the communication speed for the master station is set to 100Mbps
- When using multicast mode
  ☞ Page 132 When the communication speed for the master station is set to 1Gbps
  ☞ Page 133 When the communication speed for the master station is set to 100Mbps

The following terms are used to describe the terms in the tables referenced.



No.0: Master station
No.2: Local station
No.1, No.3: Remote station
(1) Device on the master station side (The master station or a device near the master station)
(2) Device on the end side (A device far from the master station)

Restriction

- When "Network Topology" under "Basic Settings" is set to "Ring", "Network parameter error" (error code: 2221H) will occur in the Motion module.
- "Network parameter error" (error code: 2221H) will occur in the Motion module if the following settings are made when the add-on baseSystem version is "1.22" or earlier.
  · If "Local station" is set for the "Network configuration setting"
  · If "Multicast" is set for the "Communication mode"

Availability of connection with devices (when using unicast mode)

The following shows the case when "Communication Mode" under "Application Settings" is set to "Unicast".

When the communication speed for the master station is set to 1Gbps

The following table lists the availability of connection with a network configuration device when the "Communication Speed" for the master station is set to "1Gbps".

○: Connection available, ●: Connection available via a switching hub, ×: Connection not available

△: Connection available only when the device on the end side is a standard station.

▲: Connection available only when the device on the end side is a standard station, and is connected via a switching hub.

S: TSN hub available

H: General-purpose hub available

Device on the master station side (A device near the master station)		Device on the end side (A device far from the master station)							
		Local station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class A device)		Ethernet device	
		1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps
Master station (CC-Link IE TSN Class B device)	1Gbps	△S	×	○S	▲S*1	○SH	▲SH*1	○SH	●SH
Local station (CC-Link IE TSN Class B device)	1Gbps	△S	×	○S	▲S*1*2	○SH	▲SH*1	○SH	●SH
	100Mbps	×	×	×	×	×	×	×	×
Remote station (CC-Link IE TSN Class B device)	1Gbps	△S	×	○S	▲S*1*2	○SH	▲SH*1	○SH	●SH
	100Mbps	×	×	×	△S*1*2	×	△SH*1*2	×	○SH
Remote station (CC-Link IE TSN Class A device)	1Gbps	×	×	×	×	○SH	▲SH*1	○SH	●SH
	100Mbps	×	×	×	×	×	△SH*1	×	○SH

*1 For a device station with a communication speed of 100Mbps, set "Communication Period Setting" to "Low-Speed".

*2 A connection cannot be established if the total cyclic data size of all device stations on the 100Mbps device side exceeds 2K bytes. This includes the devices with a communication speed of 100Mbps that form a boundary between the communication speed of 1Gbps and 100Mbps. (☞ Page 149 Calculation of the total cyclic data size)

Precautions

When a TSN hub is used, check the TSN hub specifications on the CC-Link Partner Association website (www.cc-link.org).

When the communication speed for the master station is set to 100Mbps

The following table lists the availability of connection with a network configuration device when the "Communication Speed" for the master station is set to "100Mbps".

○: Connection available, ×: Connection not available

△: Connection available only when the device on the end side is a standard station.

S: TSN hub available

H: General-purpose hub available

Device on the master station side (A device near the master station)		Device on the end side (A device far from the master station)							
		Local station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class A device)		Ethernet device	
		1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps
Master station (CC-Link IE TSN Class B device)	100Mbps	×	△S*1	×	○S*1	×	○SH*1	×	○SH
Local station (CC-Link IE TSN Class B device)	1Gbps	×	×	×	×	×	×	×	×
	100Mbps	×	△S*1	×	○S*1	×	○H	×	○SH
Remote station (CC-Link IE TSN Class B device)	1Gbps	×	×	×	×	×	×	×	×
	100Mbps	×	△S*1	×	○S*1	×	○SH*1	×	○SH
Remote station (CC-Link IE TSN Class A device)	1Gbps	×	×	×	×	×	×	×	×
	100Mbps	×	×	×	×	×	○SH	×	○SH

*1 For a device station with a communication speed of 100Mbps, set "Communication Period Setting" to "Basic Period" or "Normal-Speed".

Precautions

When a TSN hub is used, check the TSN hub specifications on the CC-Link Partner Association website (www.cc-link.org).

Availability of connection with devices (when using multicast mode)

The following shows the case when "Communication Mode" under "Application Settings" is set to "Multicast".

When the communication speed for the master station is set to 1Gbps

The following table lists the availability of connection with a network configuration device when the "Communication Speed" for the master station is set to "1Gbps".

○: Connection available, ●: Connection available via a switching hub, ×: Connection not available

△: Connection available only when the device on the end side is a standard station.

▲: Connection available only when the device on the end side is a standard station, and is connected via a switching hub.

S: TSN hub available

H: General-purpose hub available

Device on the master station side (A device near the master station)		Device on the end side (A device far from the master station)							
		Local station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class A device)		Ethernet device	
		1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps
Master station (CC-Link IE TSN Class B device)	1Gbps	△S*2	×	○S*2	▲S*1*2	○SH*2	▲SH*1*2	○SH*2	●SH*2
Local station (CC-Link IE TSN Class B device)	1Gbps	△S*2	×	○S*2	▲S*1*2*3*4	○SH*2*3	▲SH*1*2*3	○SH*2*3	●SH*2*3
	100Mbps	×	×	×	×	×	×	×	×
Remote station (CC-Link IE TSN Class B device)	1Gbps	△S*2	×	○S*2	▲S*1*2*3*4	○SH*2*3	▲SH*1*2*3*4	○SH*2*3	●SH*2*3
	100Mbps	×	×	×	△S*1*2*4	×	△SH*1*2*3*4	×	○SH*2*3
Remote station (CC-Link IE TSN Class A device)	1Gbps	×	×	×	×	○SH*2	▲SH*1*2	○SH	●SH
	100Mbps	×	×	×	×	×	△SH*1*2	×	○SH

*1 For a device station with a communication speed of 100Mbps, set "Communication Period Setting" to "Low-Speed".

*2 When the device is connected on the end side via the switching hub as shown below, communication may not be possible depending on the type of the device.
The communication will be enabled by configuring settings with the switching hub so that the multicast frame (with multicast MAC address 09:00:70:00:10:02 and 09:00:70:00:10:05) will not be transferred to the ports specified below.

Connection structure that cannot be communicated	Port that prohibits multicast frame transfer
Device stations with communication speeds of 1Gbps and 100Mbps coexist.	Connection port of the device station with a communication speed of 100Mbps
A local station and Ethernet device coexist.	The Ethernet device connection port
The local station and CC-Link IE TSN Class A remote station are mixed.	CC-Link IE TSN Class A remote station connection port

*3 For a local station or remote station of a device on the master station side, use a device supporting the multicast filter. (📖Manual for the device used)

*4 A connection cannot be established if the total cyclic data size of all device stations 100Mbps device side exceeds 2K bytes. This includes the devices with a communication speed of 100Mbps that form a boundary between the communication speed of 1Gbps and 100Mbps. (☞ Page 149 Calculation of the total cyclic data size)

Precautions

When a TSN hub is used, check the TSN hub specifications on the CC-Link Partner Association website (www.cc-link.org).

When the communication speed for the master station is set to 100Mbps

The following table lists the availability of connection with a network configuration device when the "Communication Speed" for the master station is set to "100Mbps".

○: Connection available, ×: Connection not available

△: Connection available only when the device on the end side is a standard station.

S: TSN hub available

H: General-purpose hub available

Device on the master station side (A device near the master station)		Device on the end side (A device far from the master station)							
		Local station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class A device)		Ethernet device	
		1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps
Master station (CC-Link IE TSN Class B device)	100Mbps	×	△S*1*2	×	○S*1*2	×	○SH*2	×	○SH*2
Local station (CC-Link IE TSN Class B device)	1Gbps	×	×	×	×	×	×	×	×
	100Mbps	×	△S*1*2	×	○S*1*2	×	○SH*2*3	×	○SH*2*3
Remote station (CC-Link IE TSN Class B device)	1Gbps	×	×	×	×	×	×	×	×
	100Mbps	×	△S*1*2	×	○S*1*2	×	○SH*2*3	×	○SH*2*3
Remote station (CC-Link IE TSN Class A device)	1Gbps	×	×	×	×	×	×	×	×
	100Mbps	×	×	×	×	×	○SH*2	×	○SH

*1 For a device station with a communication speed of 100Mbps, set "Communication Period Setting" to "Basic Period" or "Normal-Speed".

*2 When the device is connected on the end side via the switching hub as shown below, communication may not be possible depending on the type of the device.
The communication will be enabled by configuring settings with the switching hub so that the multicast frame (with multicast MAC address 09:00:70:00:10:02 and 09:00:70:00:10:05) will not be transferred to the ports specified below.

Connection structure that cannot be communicated	Port that prohibits multicast frame transfer
A local station and Ethernet device coexist.	Connection port of the Ethernet device
The local station and CC-Link IE TSN Class A remote station are mixed.	Connection port of CC-Link IE TSN Class A remote station

*3 For a local station or remote station of a device on the master station side, use a device supporting the multicast filter. (Manual for the device used)

Precautions

When a TSN hub is used, check the TSN hub specifications on the CC-Link Partner Association website (www.cc-link.org).

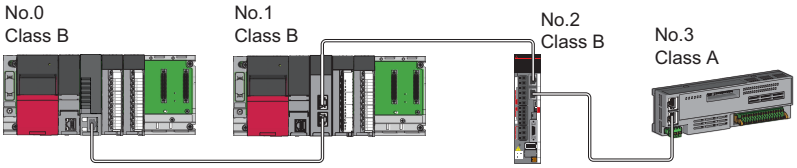
Structure of modules on CC-Link IE TSN only

Connection with modules on CC-Link IE TSN only

■Line topology

Modules are connected in a line topology.

- Connect the CC-Link IE TSN Class A device to the end of the CC-Link IE TSN Class B device.

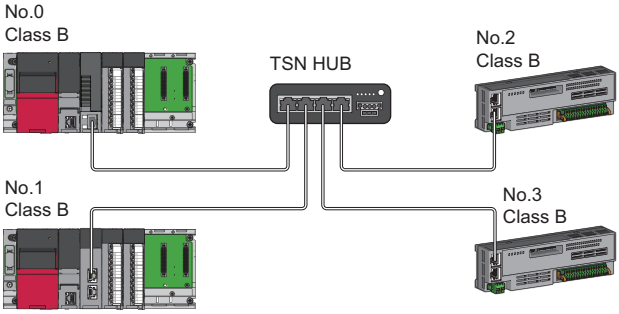


No.0: Master station
No.1: Local station
No.2, No.3: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

■Star topology

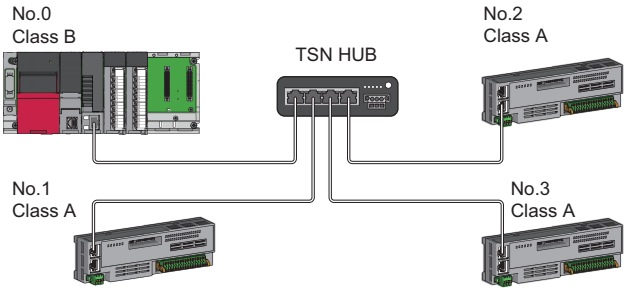
Modules or devices are connected in a star topology via a switching hub.

- When connecting a CC-Link IE TSN Class B device in a star topology, use a TSN hub.



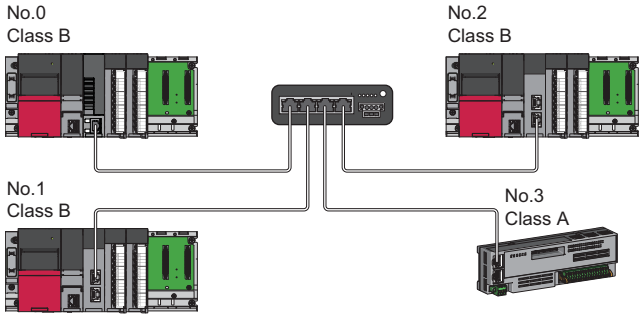
No.0: Master station
No.1: Local station
No.2, No.3: Remote station
Class B: CC-Link IE TSN Class B device

- When connecting a CC-Link IE TSN Class B device to a CC-Link IE TSN Class A device or connecting a CC-Link IE TSN Class A device to a CC-Link IE TSN Class A device in a star topology, connect them via a switching hub.



No.0: Master station
No.1, No.2, No.3: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

- When the "Communication Mode" is "Multicast", communication may not be possible depending on the communication device if a local station is connected with a CC-Link IE TSN Class A remote station as a mixture on the end side via a switching hub. The communication will be enabled by configuring settings with the switching hub so that the multicast frame (with multicast MAC address 09:00:70:00:10:02 and 09:00:70:00:10:05) will not be transferred to the CC-Link IE TSN Class A remote station port.

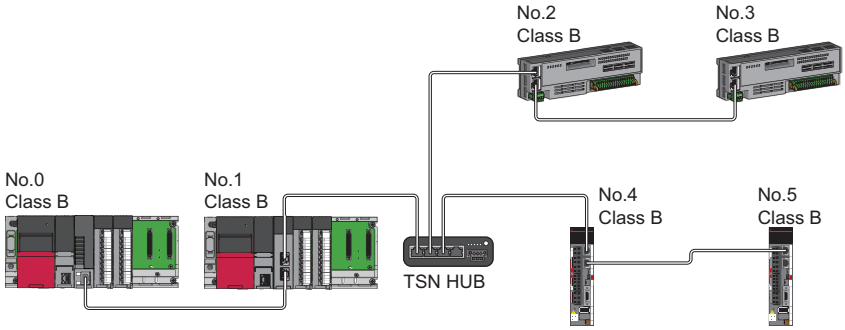


No.0: Master station
No.1, No.2: Local station
No.3: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

■Coexistence of line and star topologies

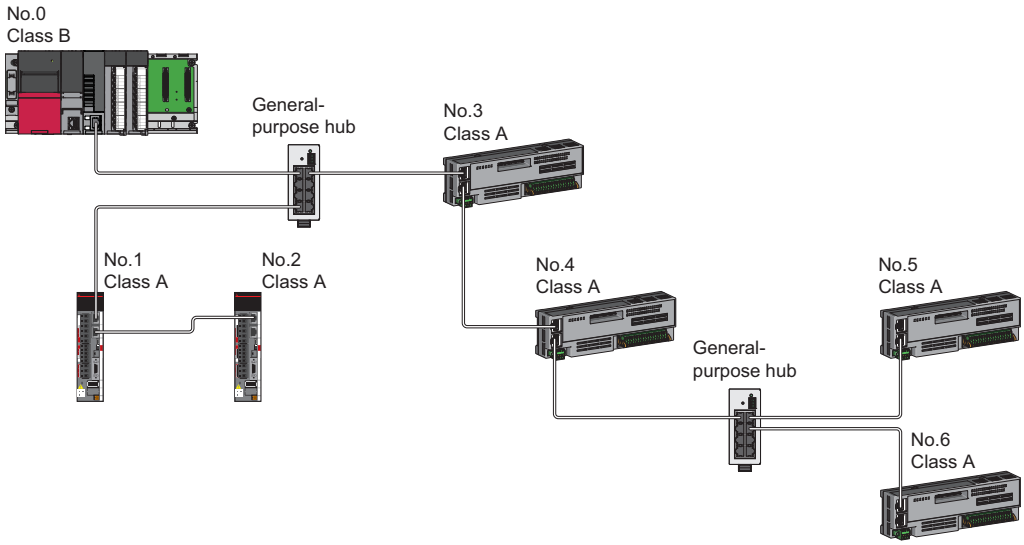
Line and star topologies can be mixed according to the availability of connection described below.

- When connecting a CC-Link IE TSN Class B device to a star topology, use a TSN hub.



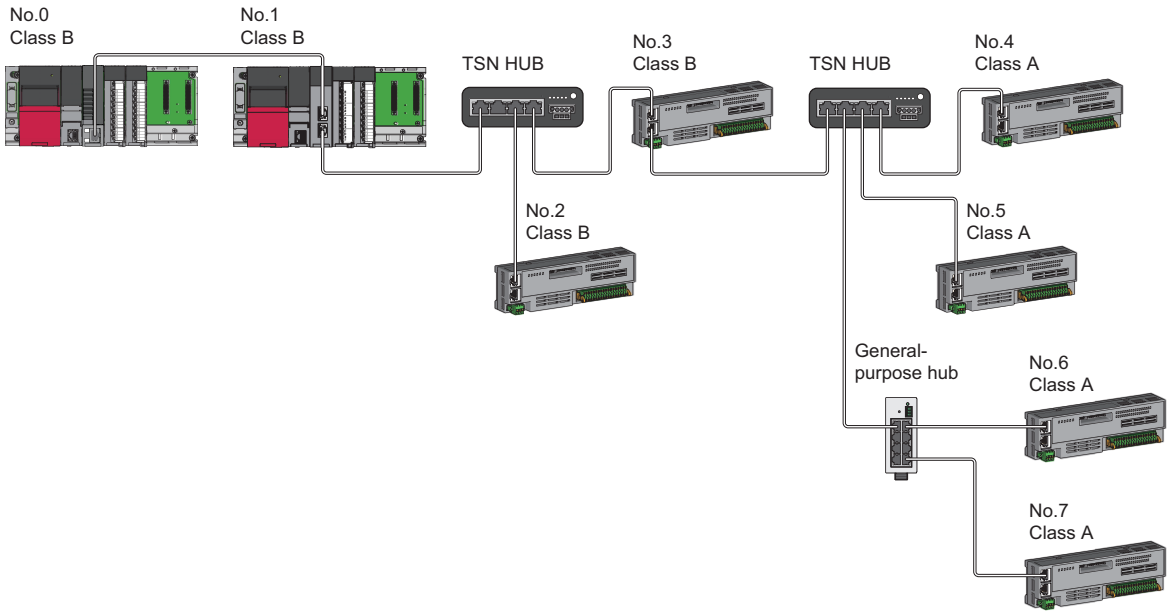
No.0: Master station
No.1: Local station
No.2, No.3, No.4, No.5: Remote station
Class B: CC-Link IE TSN Class B device

- When connecting a CC-Link IE TSN Class A device only structure in a star topology, use a general-purpose hub.



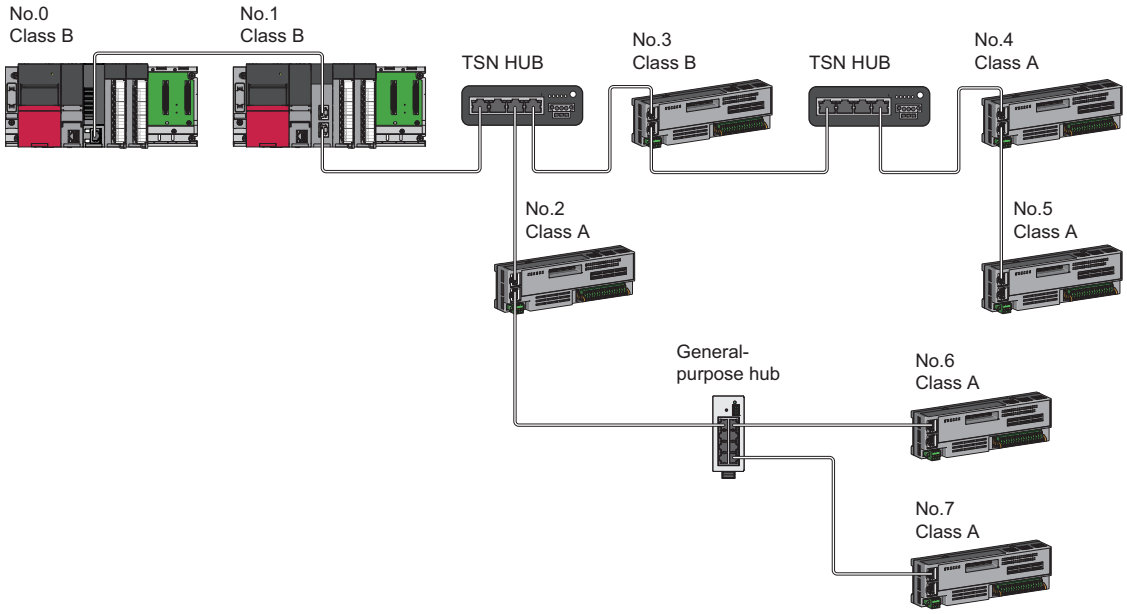
No.0: Master station
No.1, No.2, No.3, No.4, No.5, No.6: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

• In a CC-Link IE TSN Class B/A mixed structure, when connecting a CC-Link IE TSN Class B device in a star topology, connect the CC-Link IE TSN Class A device via a TSN hub.



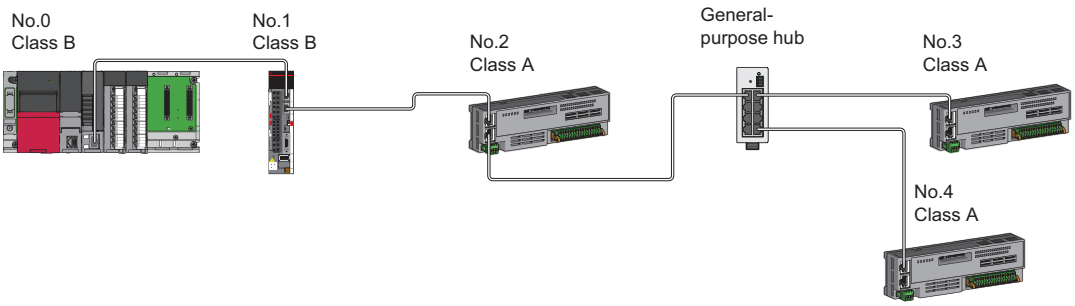
No.0: Master station
No.1: Local station
No.2, No.3, No.4, No.5, No.6, No.7: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

• In a CC-Link IE TSN Class B/A mixed structure, the CC-Link IE TSN Class A device can be connected from the TSN hub between the CC-Link IE TSN Class B devices.

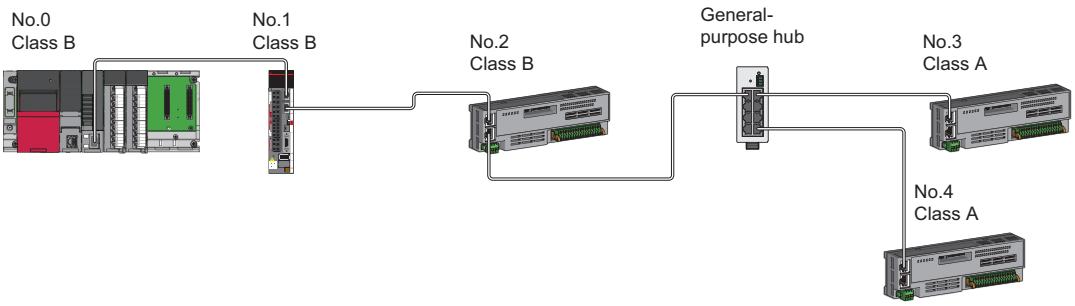


No.0: Master station
No.1: Local station
No.2, No.3, No.4, No.5, No.6, No.7: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

- In a CC-Link IE TSN Class B/A mixed structure, when connecting a CC-Link IE TSN Class B device in a line topology, connect the CC-Link IE TSN Class A device directly or via a general-purpose hub.



No.0: Master station
No.1, No.2, No.3, No.4: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device



No.0: Master station
No.1, No.2, No.3, No.4: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

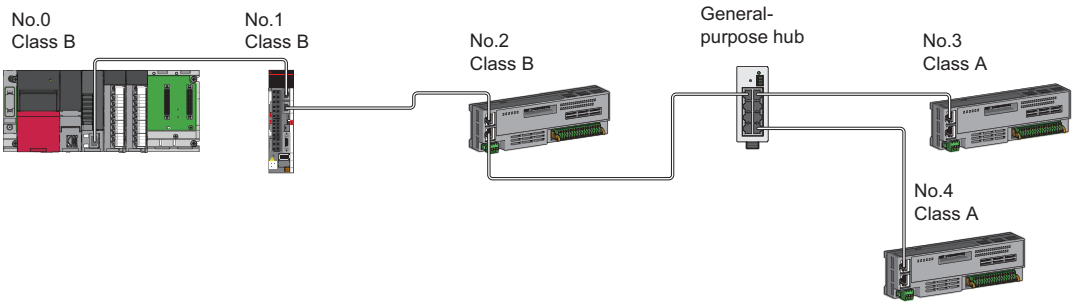
Precautions

In a CC-Link IE TSN Class B/A mixed structure, set whether to use a TSN hub in the "TSN HUB Setting" of "Connection Device Information" under "Basic settings". If the "TSN hub setting" and the system structure differ in whether a TSN hub is present, the CC-Link IE TSN Class A device may not perform a data link.

Ex.

When connecting a CC-Link IE TSN Class B device in a line topology.

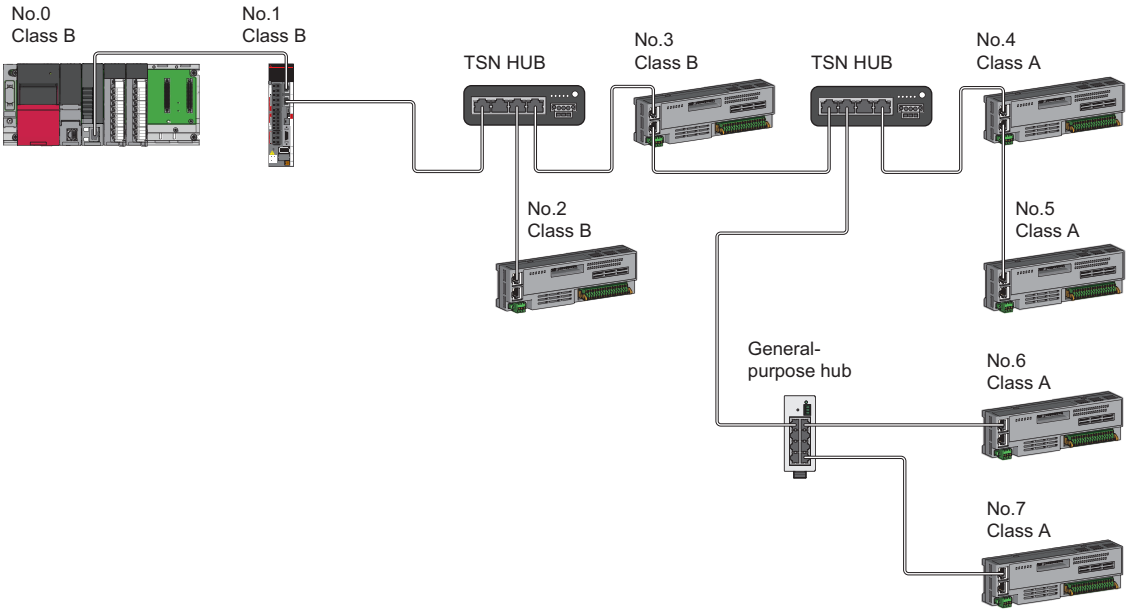
- Set "TSN HUB Setting" of "Connection Device Information" under "Basic settings" to "Not to Use TSN HUB".
- CC-Link IE TSN Class B and CC-Link IE TSN Class A devices are connected by a general-purpose hub.



Ex.

When connecting a CC-Link IE TSN Class B device in a star topology.

- Set "TSN HUB setting" under "Connection device information" in "Basic setting" to "Use TSN HUB".
- For CC-Link IE TSN Class B devices and CC-Link IE TSN Class A devices, connect these using a TSN hub.



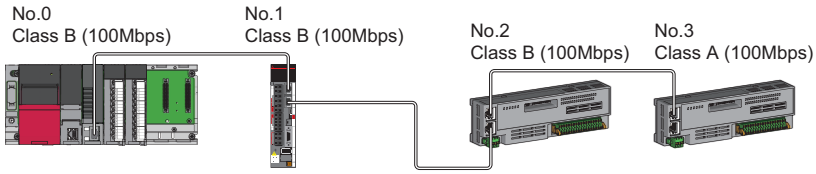
Connection with modules on CC-Link IE TSN with a communication speed of 100Mbps

This section describes the network topology when "Communication Speed" under "Application Settings" is set to "100Mbps".

■Line topology

Modules are connected in a line topology.

- Adjust the communication speed of the module.
- When connecting modules with different communication speeds, connect the modules via a switching hub.

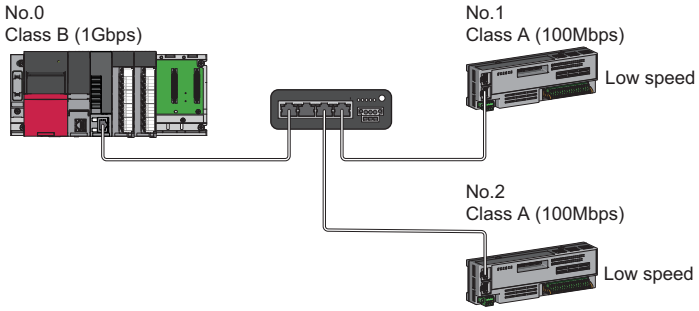


No.0: Master station
No.1: Local station
No.2, No.3: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

■Star topology

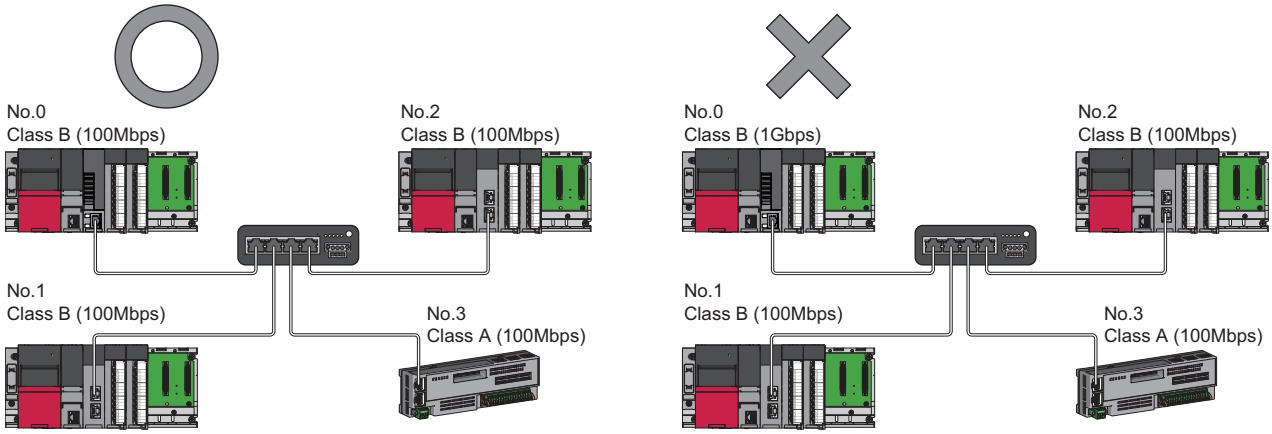
The network is configured in a star topology via a switching hub.

- When the master station with a communication speed of 1Gbps and a device station with a communication speed of 100Mbps exist in the structure, set "Communication Period Setting" to "Low-Speed" for the device station with a communication speed of 100Mbps.



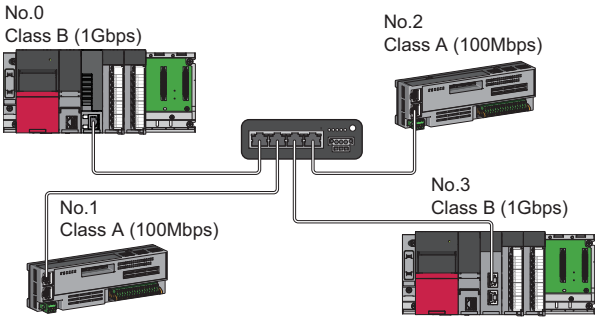
No.0: Master station
No.1, No.2: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

- Connect the master station and local station at the same communication speed.



No.0: Master station
No.1, No.2: Local station
No.3: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

- When "Communication Mode" is set to "Multicast" and the communication speed of the master station is 1Gbps, communication may not be possible depending on the type of the device if device stations with different communication speeds of 1Gbps and 100Mbps coexist on the end side via the switching hub. The communication will be enabled by configuring settings with the switching hub so that the multicast frame (with multicast MAC address 09:00:70:00:10:02 and 09:00:70:00:10:05) will not be transferred to the port of the device station with 100Mbps.

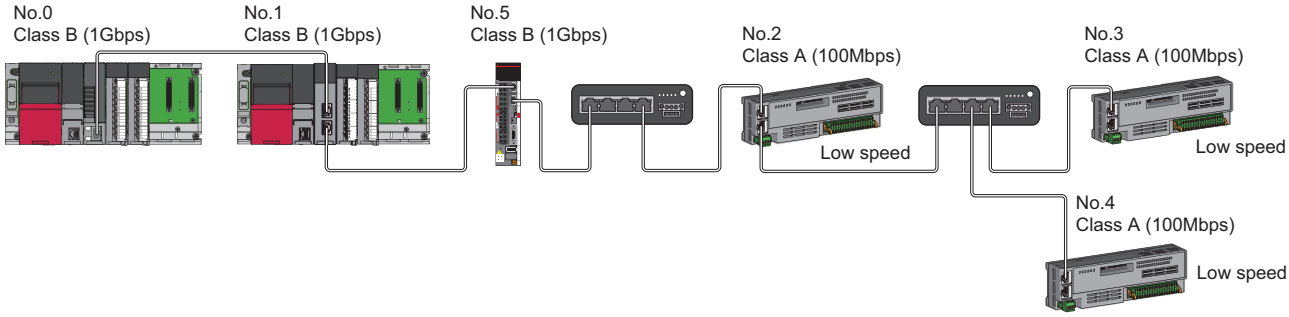


No.0: Master station
No.1, No.2: Remote station
No.3: Local station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

■Coexistence of line and star topologies

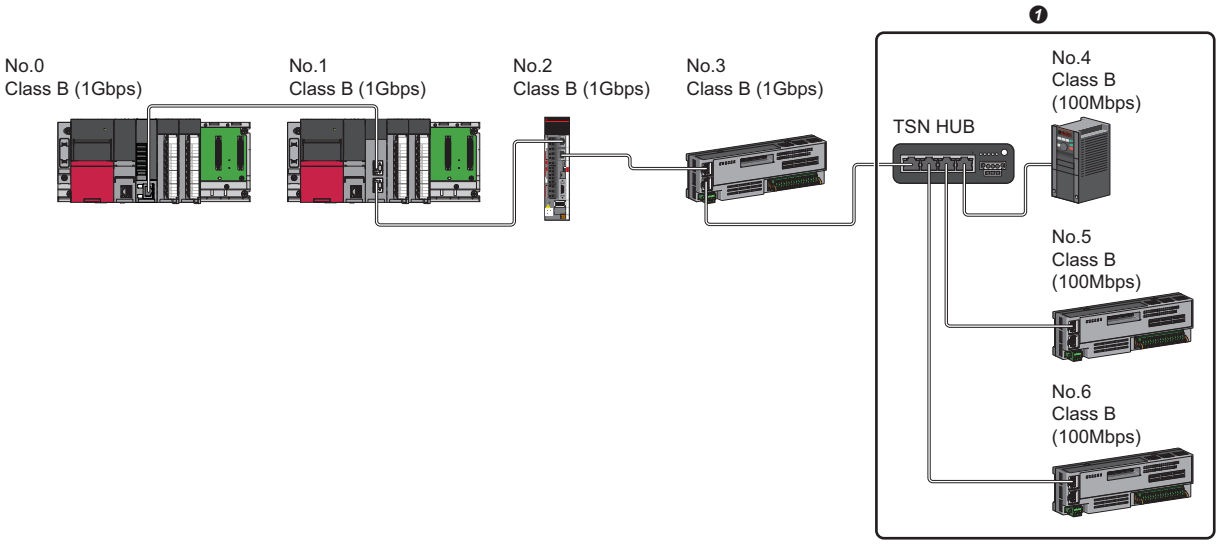
Line and star topologies can be mixed in the same network configuration.

- When the master station with a communication speed of 1Gbps and a device station with a communication speed of 100Mbps exist in the structure, set "Communication Period Setting" to "Low-Speed" for the device station with a communication speed of 100Mbps.



No.0: Master station
No.1: Local station
No.2, No.3, No.4, No.5: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

- When the communication speed of the master station is 1Gbps, a connection cannot be established if the total cyclic data size of device stations on the 100Mbps device side exceeds 2K bytes. This includes the devices with a communication speed of 100Mbps that form a boundary between the communication speed of 1Gbps and 100Mbps.



No.0: Master station
No.1: Local station
No.2 to No.6: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device
❶ Set the total cyclic data size within 2K bytes.

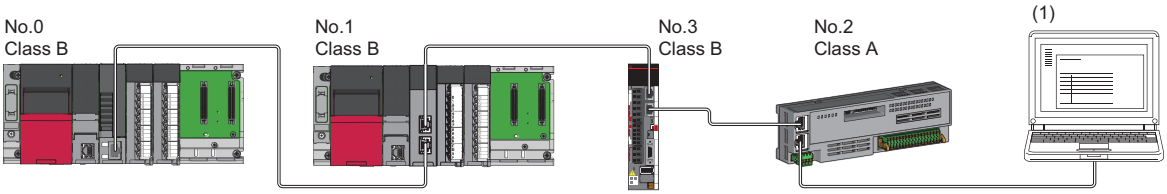
Structure of modules on CC-Link IE TSN and Ethernet devices

Connection with modules on CC-Link IE TSN and Ethernet devices

■Line topology

The network with modules and devices is configured in a line topology. A general-purpose hub is not required.

Connect Ethernet devices to the end of the network.

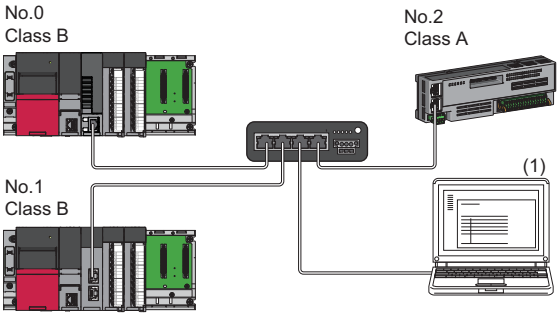


No.0: Master station
No.1: Local station
No.2, No.3: Remote station
(1) Ethernet device
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

■Star topology

Modules or Ethernet devices are connected in a star topology via a switching hub. This allows devices to be added easily.

When connecting an Ethernet device with a network communication speed of 100Mbps, a general-purpose hub is required.



No.0: Master station
No.1: Local station
No.2: Remote station
(1) Ethernet device (such as a personal computer, vision sensor, or bar code reader)
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

Point

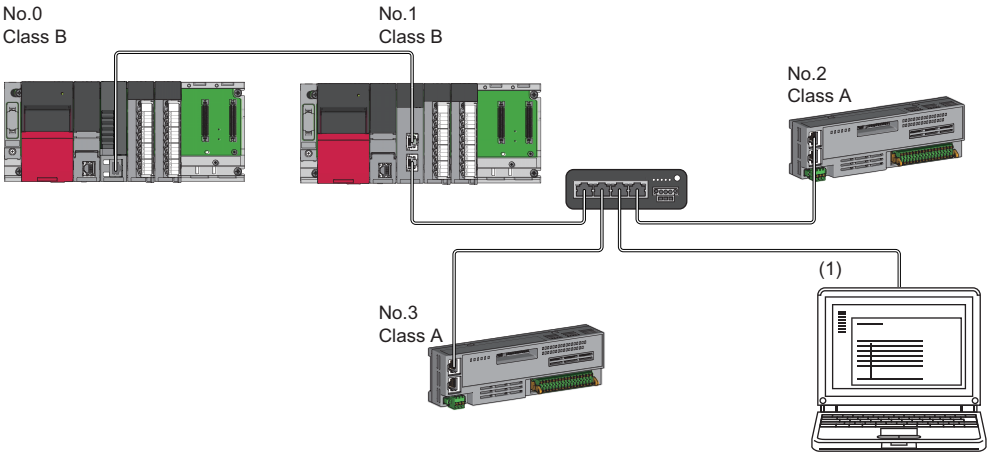
Since cyclic data is sent to an Ethernet device when "Communication Mode" is set to "Multicast" and a local station is used with an Ethernet device on the end side via a switching hub, communication may not be possible depending on the type of an Ethernet device.

The communication will be enabled by configuring settings with the TSN hub so that the multicast frame (with multicast MAC address 09:00:70:00:10:02 and 09:00:70:00:10:05) will not be transferred to the port of the Ethernet device.

■Coexistence of line and star topologies

Line and star topologies can be mixed by following these connection requirements.

- Connect Ethernet devices at the end of a line topology.
- When connecting the Ethernet device in a star topology, connect the Ethernet device to a switching hub.



No.0: Master station
No.1: Local station
No.2, No.3: Remote station
(1), (2): Ethernet device
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

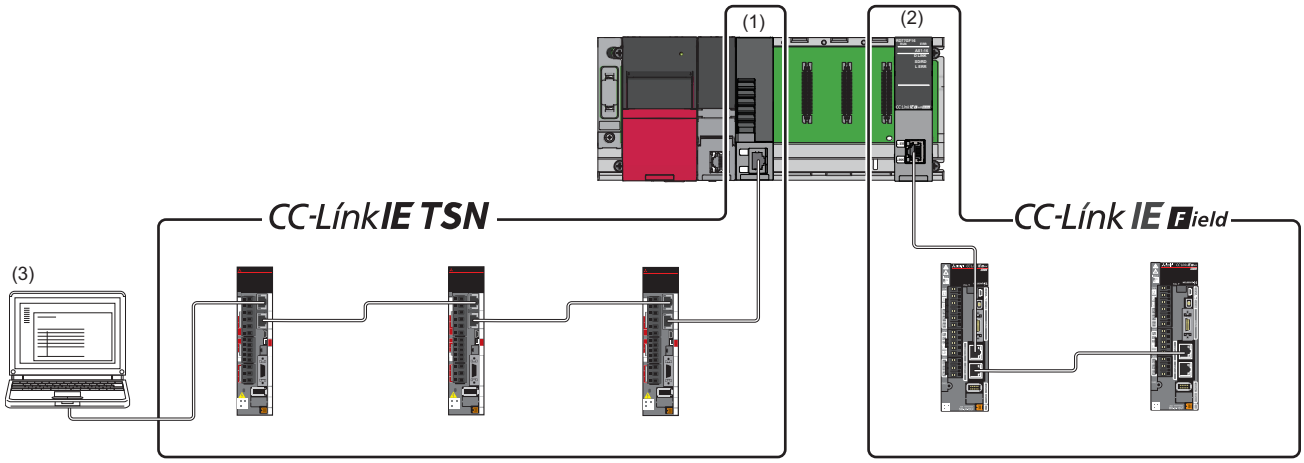
11.3 Structure of a CC-Link IE TSN and CC-Link IE Field Network

Set the Motion module and CC-Link IE Field compatible network modules to different network numbers, and mount the master station of each network to the same base unit.

Connect Ethernet devices to the end of the network.

For details on CC-Link IE Field Network, refer to the following.

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



(1) Master station (Network No.1)
(2) Master station (Network No.3)
(3) Ethernet device

Point

The communication data of the CC-Link IE TSN and CC-Link IE Field Network are transferred between master stations.

11.4 Structure when CC-Link IE TSN Communication Software is Used

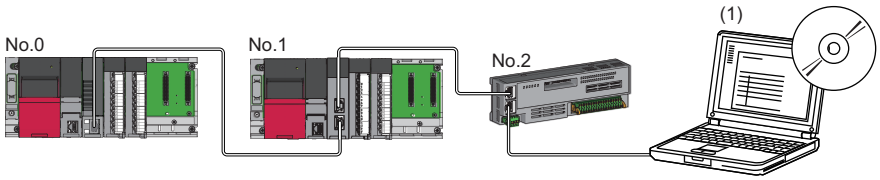
Connection specifications

CC-Link IE TSN Communication Software can be connected to a port of the CC-Link IE TSN Class B device (supporting CC-Link IE TSN) or a TSN hub.

Up to two CC-Link IE TSN Communication Software can be connected.

■Line topology

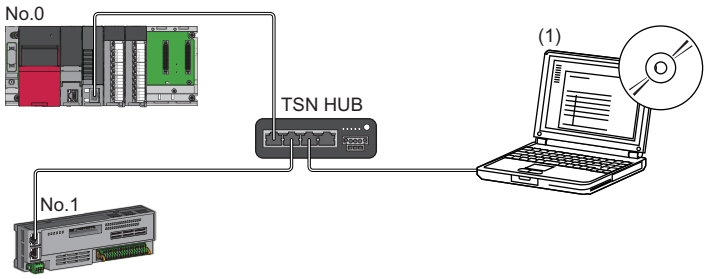
Connect a cable for CC-Link IE TSN Communication Software to the end of the network.



No.0: Master station
No.1: Local station
No.2: Remote station
(1) CC-Link IE TSN Communication Software

■Star topology

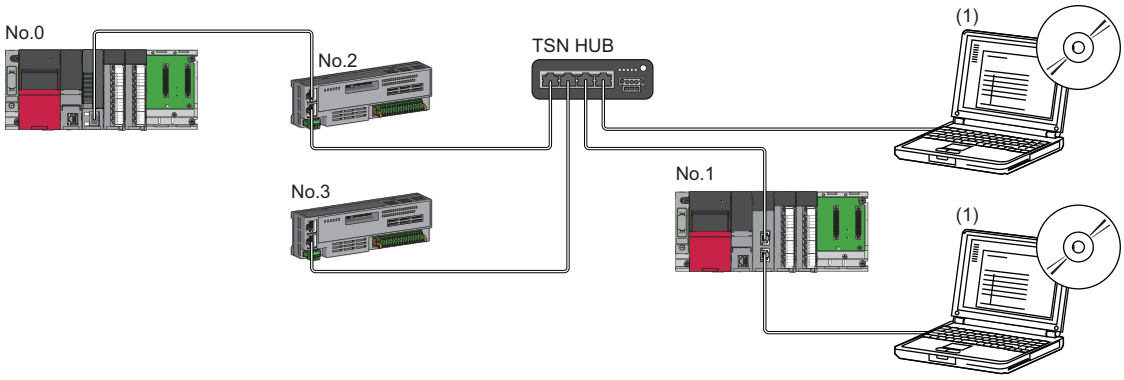
Connect a cable for CC-Link IE TSN Communication Software to a port of the TSN hub.



No.0: Master station
No.1: Remote station
(1) CC-Link IE TSN Communication Software

■Coexistence of line and star topologies

Connect a cable for CC-Link IE TSN Communication Software to a port of the TSN hub or the end of the network.



No.0: Master station
No.1: Local station
No.2, No.3: Remote station
(1) CC-Link IE TSN Communication Software

11.5 Precautions for System Configuration

Local station connection and multicast setting limitations

Local station connection and multicast setting have the following version restrictions.

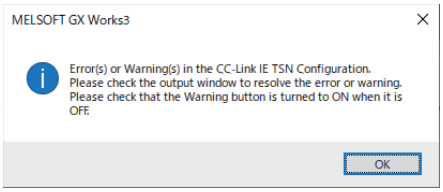
<table>
<tr><th rowspan="2">GX Works3 version</th><th colspan="3">Motion module Add-on baseSystem version</th></tr>
<tr><th>"1.19" or earlier</th><th>"1.20" to "1.22"</th><th>"1.24" or later</th></tr>
<tr><td>"1.082L" or earlier</td><td colspan="2">When there is a local station in the network configuration, a network parameter error occurs in the operation module.</td><td>If there is a device station set as the motion control station and a local station in the network configuration, an engine tool version combination error occurs in the Motion module.</td></tr>
<tr><td rowspan="2">"1.085P" or later</td><td colspan="2">When there is a local station in the network configuration or when multicast is set in communication mode, a network parameter error occurs in the Motion module.</td><td>When the following two conditions are met, a motion control station device points error occurs in the Motion module.
• A local station exists in the network configuration, or the communication mode is set to multicast.
• The motion control station RWw number of points set in the network configuration is less than 40 points (24 points if an extension module is installed). Or, if the RWr number of points is less than 40 points (28 points if an extension module is installed).</td></tr>
<tr><td>The RWr number of points of the motion control station is less than 40 points (28 points if an extension module is installed), and a value is set at the start of the RWr. If so, it will operate where the mapping *1 object value is fixed at "0" after the RWr number of points.
In addition, any motion control station TPDO other than for the corresponding station may not be updated.</td><td>—</td><td>When the following two conditions are satisfied, an engineering tool version combination error occurs in the Motion module.
• A local station exists in the network configuration, or the communication mode is set to multicast.
• The Motion control station link device start is not set.</td></tr>
</table>

*1 For details on the Motion control station PDO mapping, refer to “Devices Compatible with CC-Link IE TSN” in the following manual.
MELSEC iQ-R Motion Module User's Manual (Application for Simple Motion Mode)

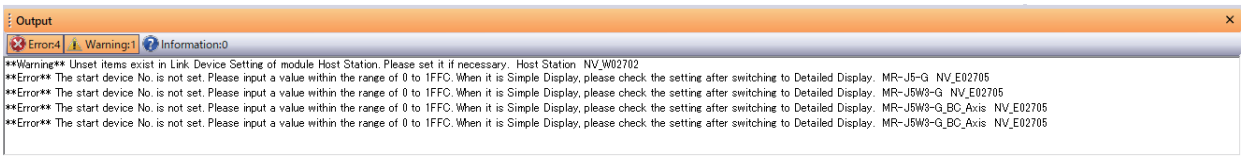
Precautions

If a project created with GX Works3 version "1.082L" or earlier is opened with GX Works3 version "1.085P" or later, the following error will occur for the link device setting of the motion control station on the "CC-Link IE TSN Configuration" window.

• Message



• "CC-Link IE TSN Configuration" screen output window

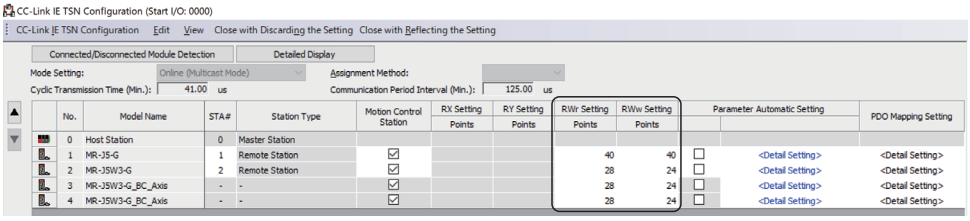


If the above error occurs, follow the following procedure to set the motion control station link device.

■Link device setting procedure

1. On the "CC-Link IE TSN Configuration" window, set the following points to the motion control station RWr and RWw settings.

Servo amplifier	RWr setting	RWw setting
Single axis servo amplifier	40 points	40 points
Multi-axis servo amplifier	28 points	24 points



Point

When the RWr and RWw points of the motion control station are less than or equal to the values set in step 1, the following occurs.

<When the Add-on baseSystem version is "1.19" or earlier>

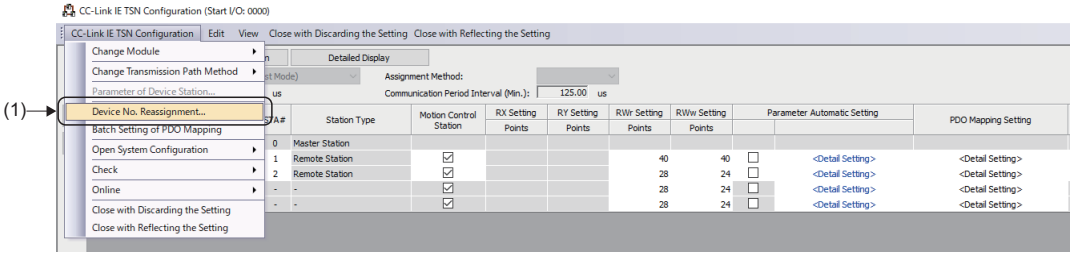
- The values of objects mapped after the RWr points are fixed at 0 for the operation. In addition, the TPDO of any motion control stations other than the corresponding stations may not be updated.

<When the Add-on baseSystem version is "1.24" or later>

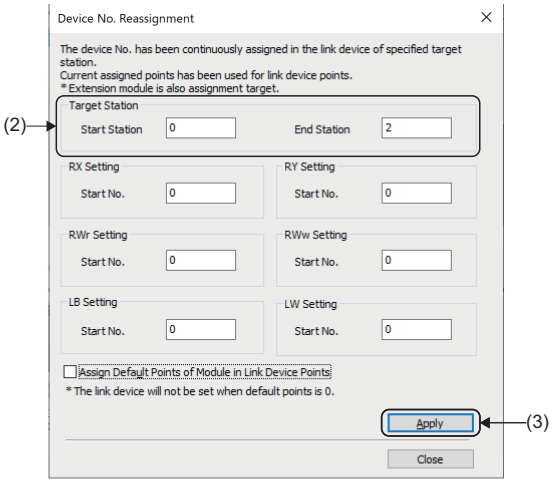
- When a local station exists in the Network configuration settings, or if the communication mode is set to multicast mode, a motion control station device points error occurs in the Motion module.

2. Set the start/end of the motion control station link device using the device reset function or manually.

- When using the device number reassignment function to set the first/last motion control station link device.
  - From the menu, select [CC-Link IE TSN Configuration] ⇨ [Device No. Reassignment] (1) to display the device No. reassignment screen.



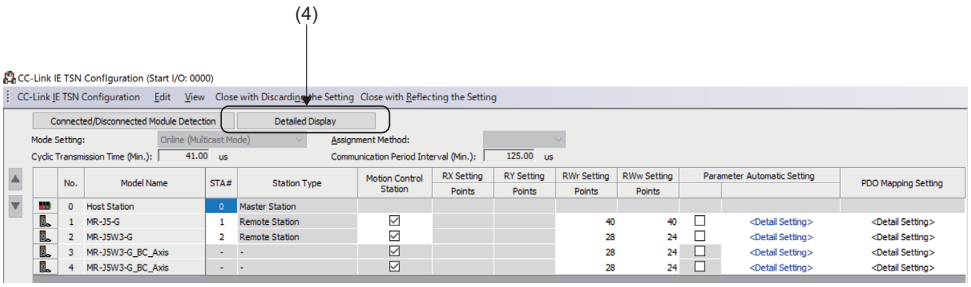
  - Select the range of station Nos. to be reassigned device numbers (start station to end station) (2), and click the [Apply] button (3). The start/end of the linked device will be set automatically.



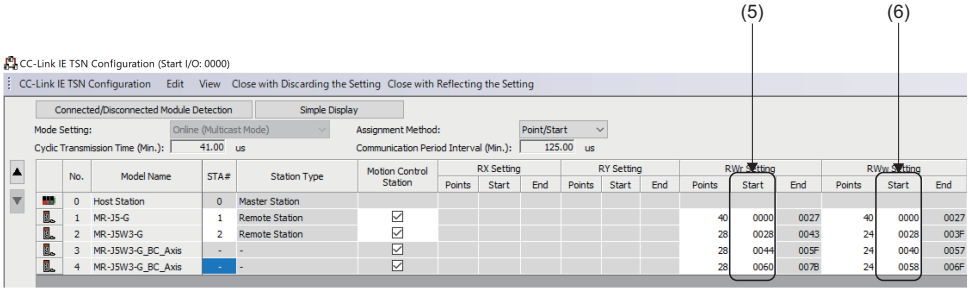
Point

When reallocating device numbers, if the station number of the standard station is included in the setting range, the device setting of the standard station will be overwritten. If a standard station is set, set the station number of the standard station to outside of the setting range, or manually set the motion control station link device start/end.

- When manually setting the motion control station link device start/end
  - Click the [Detailed Display] button (4) to switch to the details display.



  - Set the motion control station link device start in the first column of the RWr setting (5) and RWw setting (6) that are blank voluntarily.



Point

If the communication mode is unicast and a local station does not exist in the network configuration settings, the Motion module will ignore the setting of the motion control station link device start.

Devices connected to the same network

Do not connect the devices as described below. Doing so may cause the disconnection of all stations.

- A module on CC-Link IE TSN and a device having different network types (such as CC-Link IE Controller Network or CC-Link IE Field Network) other than an Ethernet device are connected to the same network.
- A module on CC-Link IE TSN and an Ethernet device (such as a personal computer), both of which are on different networks, are connected to one switching hub.

Adding a device station with no IP address setting

In line topology, do not connect the device station with no IP address setting at a place other than the end of the line. Data link may not be performed in the device stations after the device station with no IP address setting.

CC-Link IE TSN/CC-Link IE Field diagnostics

If the following operations are performed, the actual network configuration and the network map of the CC-Link IE TSN/CC-Link IE Field diagnostics may be a mismatch.

Network configuration	Operation
Star topology	• Powering off and on a device station or switching hub • Connecting/disconnecting an Ethernet cable connected to the switching hub • Disconnecting an Ethernet cable from a device station and connecting it to another device station or a switching hub • Disconnecting more than nine stations, or half the number of device stations or more in the system • Changing the network topology when adding a device station
Line topology	• Simultaneously powering off or 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 nine stations, or half the number of device stations or more in the system • Changing the network topology when adding a device station

Point

The actual network configuration and network map can be matched by executing the network map update of the CC-Link IE TSN/CC-Link IE Field diagnostics. For details, refer to "Basic Settings" in the following manual.
MELSEC iQ-R Motion Module User's Manual (Network)

Calculation of the total cyclic data size

The following shows the calculation formula of the total cyclic data size. The part of the variable surrounded by double quotes (" ") is the setting value of "CC-Link IE TSN Configuration" window.

Total cyclic data size = 256 + (146 × Number of local station) + (106 × Number of remote stations) + (Number of "RX Setting" points / 8) +(Number of "RWr Setting" points × 2) + (Number of "LB Setting" points / 8) + (Number of "LW Setting" points × 2)[byte]

12 INSTALLATION AND WIRING

12.1 SD Memory Card

SD memory card handling

- Format an SD memory card which is used with the motion system from the CPU module. If formatting an SD memory card using the function such as the format function of Windows®, an SD memory card may not be able to be used with the motion system.
- Data contained in an SD memory card may be corrupted if the power supply is turned OFF, the system is reset, or the SD memory card is removed while the card is being accessed. If the CARD ACCESS LED is ON, always stop access to the SD memory card with the SD memory card access control switch before turning OFF the power supply, resetting, or removing the SD memory card.
- The SD memory card is handled as the drive in the internal of the motion system and the engineering tool.

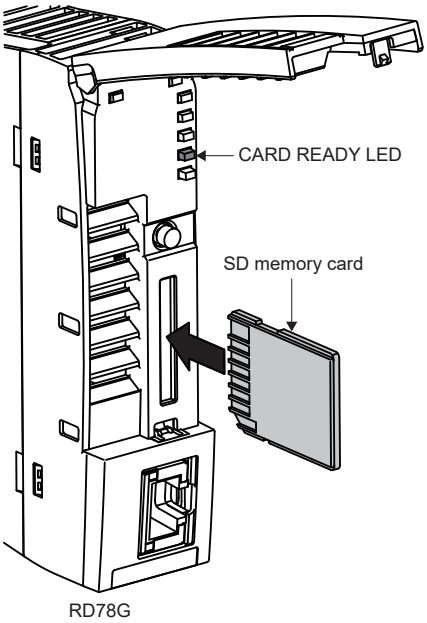
Installation and Removal of SD Memory Card

This section describes the methods for installation of an SD memory card to the Motion module, and removal.

Installation of SD memory card

When installing an SD memory card to the Motion module, take note of the SD memory card position, and install using the following procedure.

1. With the notch facing downwards, insert the SD memory card straight into the slot. After inserting check the SD memory card is inserted all the way in. If the SD memory card is not inserted properly, insufficient contact may cause an operation failure.
2. The CARD READY LED flickers until the SD memory card can be used. When the CARD READY LED is ON, the SD memory card can be used.



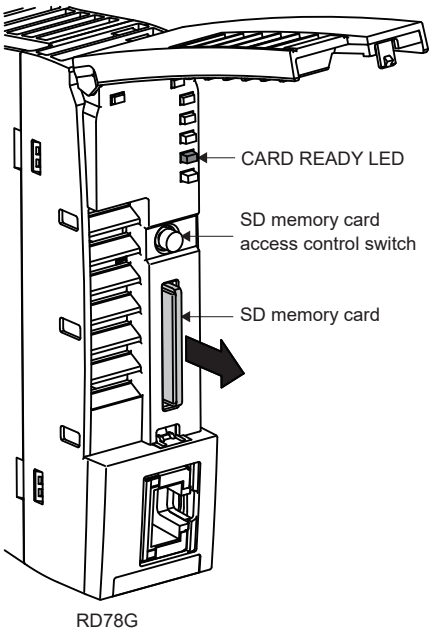
Point

- Installation of an SD memory card is registered with the event history (type: operation).
- When installing an SD memory card, the operation of SD memory card access control switch is not required.

Removal of the SD memory card

- When removing an SD memory card from the Motion module, remove the SD memory card using the following procedure.

1. Press the SD memory card access control switch for longer than 1 second to stop access of the SD memory card.
2. During the process of stopping access to the SD memory card, the CARD READY LED flickers, then turns OFF when the process is complete. Before removing, be sure to confirm that the CARD READY LED turns OFF.
3. After pushing in the SD memory card once, pull the SD memory card out straight.



Precautions

- When the SD memory card is removed without being disabled, an "SD Memory card Unload" (error code: 342FH) will occur.
- The access control operation may be rejected depending on the system status (such as initializing, installing software, high system load). In such a case, execute the access control operation again after a while.

Point

- Removal of an SD memory card is registered with the event history (type: operation).
- The access control process (CARD READY LED is flashing) may take time.
- Do not remove an SD memory card while the CARD READY LED is not turned OFF. Doing so may damage the data on the SD memory card.
- Even while the SD memory card is accessed (CARD ACCESS LED is ON), holding the SD memory card access control switch for longer than 1 second operates the SD memory card forced disable function, and the SD memory card can be stopped access (removal enabled).

Precautions

- If access to the SD memory card occurs by each function while the use of the SD memory card is stopped, the operation is the same as if the SD memory card is not inserted.

12.2 Wiring

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

This section describes the wiring method and wiring products for Ethernet cables and switching hubs.

Ethernet cable

The Motion module is connected with an Ethernet cable.

Wiring methods

The following describes connection and disconnection of the Ethernet cable.

■Connecting the cable

1. Push the Ethernet cable connector into the Motion module until it clicks. Pay attention to the direction of the connector.
2. Lightly pull it to check that it is securely connected.
3. Check whether the LINK LED of the Ethernet port connected with an Ethernet cable is on. For details about the LED display specifications, refer to the following.*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 "Checking with LED" in the following manual and take corrective actions.
MELSEC iQ-R Motion Module User's Manual (Network)

■Disconnecting the cable

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

Precautions

Be sure to follow the precautions for wiring. Otherwise, some functions may not operate normally. (It may operate normally temporarily.)

- 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, causing problems for data link.
- Check that the Ethernet cable is not disconnected or not shorted and there is no problem with the connector connection.
- When connecting the Ethernet cable, refer to the CC-Link IE TSN 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.
- Do not use Ethernet cables with broken latches. Doing so may cause the cable to unplug or malfunction.
- Hold the connector part when connecting and disconnecting the Ethernet cable. Pulling the cable connected to the module may result in malfunction or damage to the module or connector.
- The maximum station-to-station distance of the Ethernet cable is 100m (328.08ft.). However, the length may be shorter depending on the operating environment of the cable. For details, contact the manufacturer of the cable used.
- The bend radius of the Ethernet cable is limited. For details, check the specifications of the Ethernet cable for use.
- In a line topology, do not connect the device station with no IP address setting between the master station and device stations, or between device stations. A data link may not be performed in the device stations connected from the device station with no IP address setting onwards. However, if the device station with no IP address setting is connected at the end of line topology, the device stations between the master station and the device station at the end perform a data link.
- Communication with the Ethernet device may not be possible depending on the specifications of the connected Ethernet device or switching hub. If communication is not possible, reduce the communication data volume of the Ethernet device.
- When setting "Communication Speed" of the master station and local station to 100Mbps to connect a device with a communication speed of 100Mbps, enable auto-negotiation of the device.

Wiring products

Use an Ethernet cable that meets the following standards.

Communication speed	Ethernet cable	Standard	Connector
1Gbps	Category 5e or higher, straight cable (shielded, STP)	The following conditioning cables: • IEEE 802.3 (1000BASE-T) • ANSI/TIA/EIA-568-B (Category 5e)	RJ45 connector
100Mbps	Category 5 or higher, straight cable (shielded, STP)	The following conditioning cables: • IEEE 802.3 (100BASE-TX) • ANSI/TIA/EIA-568-B (Category 5)	

Cables for CC-Link IE TSN are available from Mitsubishi Electric System & Service Co., Ltd. (Catalogs for these cables are also available.)

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

Communication speed	Type	Model (Manufacturer)
1Gbps	Category 5e or higher, straight cable (double shielded, STP)	SC-E5EW series (Mitsubishi Electric System & Service Co., Ltd.)

Point

The communication error can occur with the high-frequency noise from the device except CPU unit depending on the connecting environment. The following indicates the countermeasure of the Motion module side to prevent the effect of the high-frequency noise.

Wiring connection

- Use a double-shielded type cable.
- In wiring process, keep a distance with the main circuit lines or power cables.
- Place the cable in a duct.

Switching hub

Use the following industrial switching hub for connecting Motion modules.

Term	Description	CC-Link IE TSN Class
TSN HUB*1	For the models and usage methods of the switching hubs, refer to the CC-Link Partner Association website (www.cc-link.org).	CC-Link IE TSN Class B device
General-purpose hub*2		CC-Link IE TSN Class A device

*1 Use of the following is recommended for TSN hub.

Type	Model (Manufacturer)	Reference
CC-Link IE TSN industrial managed switch	NZ2MHG-TSNT□ (Mitsubishi Electric Corporation)	CC-Link IE TSN Industrial Managed Ethernet Switch User's Manual

*2 When connecting a CC-Link IE TSN Class A device that supports protocol version 2.0 with a general-purpose hub, disable the VLAN setting of the hub.
If the VLAN setting is enabled, cyclic transmission with a CC-Link IE TSN Class A device that supports protocol version 2.0 cannot be performed.

A switching hub can be used for cascade connection.

When the switching hub is used for cascade connection, check the specifications of the switching hub used.

Precautions

- Since there are different restrictions for system configuration using a TSN hub and system configuration using a general-purpose hub, setting with an engineering tool is required. (☞ Page 117 SYSTEM CONFIGURATION)
- For switching hub restrictions, refer to the manual of each product.

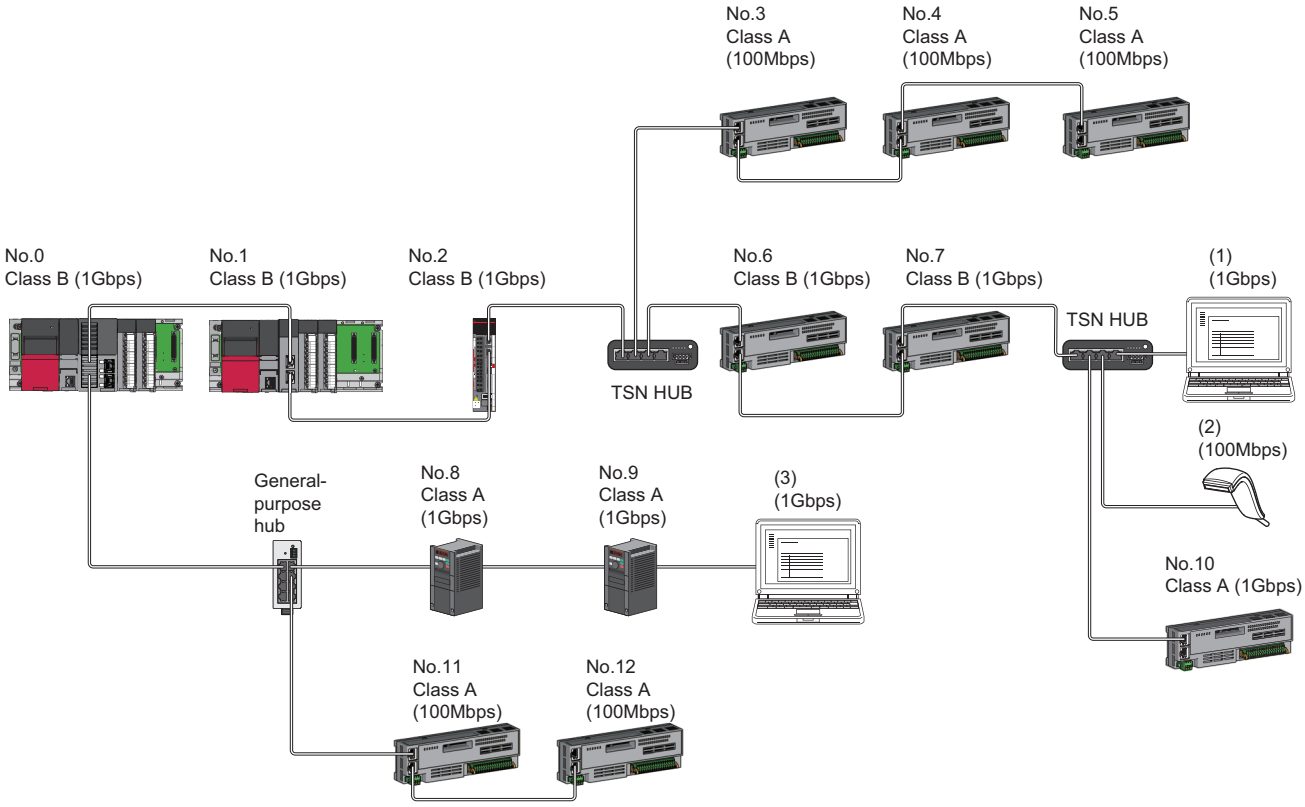
APPENDICES

Appendix 1 System configuration with CC-Link IE TSN Class B/A Devices (Protocol Version 2.0/1.0)

This section shows the system configuration in the following cases.

- Motion module supporting protocol version 2.0
- The modules on CC-Link IE TSN support the protocol version 1.0/2.0 mixed
- Set "Connection Device Information" under "Basic Settings" of the engineering tool to "Mixture of CC-Link IE TSN Class B/A or CC-Link IE TSN Class A only".

When "Connection Device Information" under "Basic Settings" of the master station is set to "Mixture of CC-Link IE TSN Class B/A or CC-Link IE TSN Class A", up to 121 devices (one master station and 120 device stations) can be connected.



No.0: Master station
No.1: Local station
No.2 to No.12: Remote station
(1), (2), (3): Ethernet device
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

Device time synchronization method and connection specifications

The following describes the time synchronization method and connection specification references according to the protocol version 2.0 compatible conditions of the network configuration device.

With protocol version 1.0: Includes devices which support the protocol version 1.0

Protocol version 2.0 only: Devices which support protocol version 2.0 only

None: Works without time synchronization.

Protocol version of the device station		Time synchronization method for each device				Connection specification reference
CC-Link IE TSN Class B device	CC-Link IE TSN Class A device	CC-Link IE TSN Class B device		CC-Link IE TSN Class A device		
		Protocol version 2.0	Protocol version 1.0	Protocol version 2.0	Protocol version 1.0	
Protocol version 2.0 only	Protocol version 2.0 only	IEEE802.1AS	—	Not available	—	☞ Page 57 Structure of CC-Link IE TSN Class B/A Devices
With protocol version 1.0		IEEE802.1AS	IEEE802.1AS	Not available	—	
Protocol version 2.0 only	With protocol version 1.0	IEEE1588	—	Not available	IEEE1588	☞ Page 156 System configuration with CC-Link IE TSN Class B/A Devices (Protocol Version 1.0 only)
With protocol version 1.0		IEEE1588	IEEE1588	Not available	IEEE1588	

Precautions

- A device station with the protocol version 1.0 may not perform a data link when the master station is operating with the protocol version 2.0. If a device station that does not support protocol version 2.0 is detected, that station does not perform data link, the event code 00C80H is registered in the master station, and the information on stations that do not support protocol version 2.0 is stored in 'Station protocol version 2.0 support status' (SW01A0 to SW01A7).
- In the system configuration with a mix of the devices that support the protocol version 2.0 and devices that support the protocol version 1.0, if the device supporting the protocol version 1.0 delays to join the network because the power-on order or startup time of the device at the system start-up varies, the master station operates with the protocol version 2.0 and the device supporting the protocol version 1.0 may not perform a data link. (Event code 00C80H is registered in the master station)

Point

The protocol in operation can be confirmed using the following buffer memory.

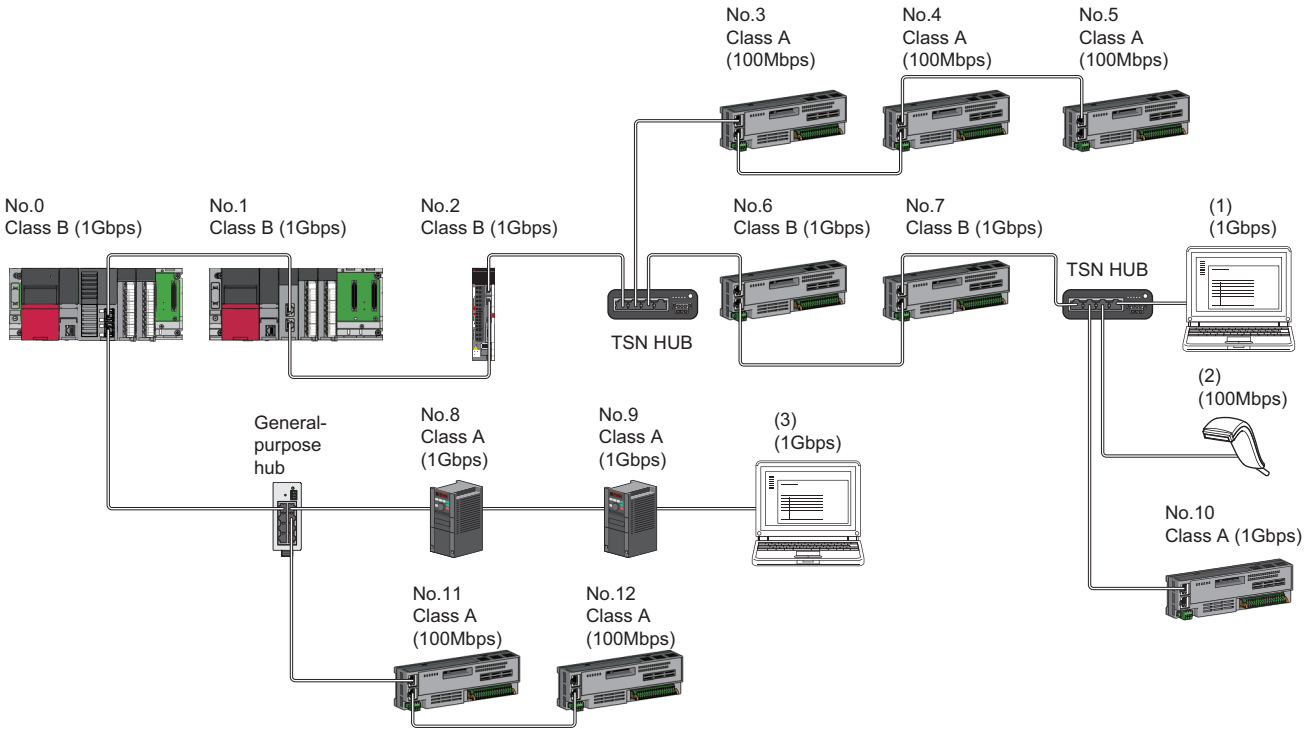
- When using PLCopen Motion control FB mode: 'protocol operation status' (Un\G1294016)
- When using Simple Motion mode: 'protocol operation status' (Un\G2894016)

Appendix 2 System configuration with CC-Link IE TSN Class B/A Devices (Protocol Version 1.0 only)

This section describes the system configuration in the following cases.

- Motion module supports protocol version 1.0
- The CC-Link IE TSN module supports the protocol version 1.0 only
- Set "Connection Device Information" under "Basic settings" of the engineering tool to "Mixture of CC-Link IE TSN Class B/A or CC-Link IE TSN Class A only"

When "Connection Device Information" under "Basic Settings" of the master station is set to "Mixture of CC-Link IE TSN Class B/A or CC-Link IE TSN Class A Only", up to 121 stations (one master station and 120 device stations) can be connected.

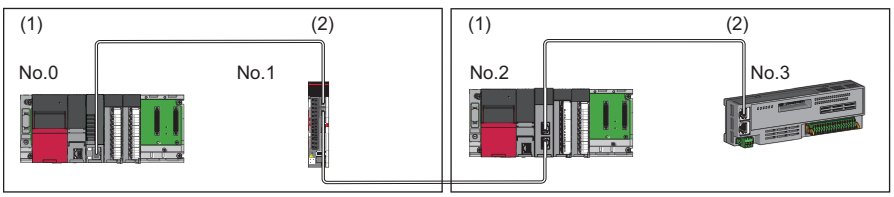


No.0: Master station
No.1: Local station
No.2 to No.12: Remote station
(1), (2), (3) Ethernet device
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

The availability of connection of network configuration devices varies depending on the communication mode and communication speed.

- When using unicast mode
  - ☞ Page 157 When the communication speed for the master station is set to 1Gbps
  - ☞ Page 158 When the communication speed for the master station is set to 100Mbps
- When using multicast mode
  - ☞ Page 159 When the communication speed for the master station is set to 1Gbps
  - ☞ Page 160 When the communication speed for the master station is set to 100Mbps

The following terms are used to describe the terms in the tables referenced.



No.0: Master station
No.1, No.3: Remote station
No.2: Local station
(1) Device on the master station side (The master station or a device near the master station)
(2) Device on the end side (A device far from the master station)

Availability of connection with devices (when using unicast mode)

The following shows the case when "Communication Mode" under "Application Settings" is set to "Unicast".

When the communication speed for the master station is set to 1Gbps

The following table lists the availability of connection with a network configuration device when the "Communication Speed" for the master station is set to "1Gbps".

○: Connection available, ●: Connection available via a switching hub, ×: Connection not available

△: Connection available only when the device on the end side is a standard station.

▲: Connection available only when the device on the end side is a standard station, and is connected via a switching hub.

S: TSN hub available

H: General-purpose hub available

Device on the master station side (A device near the master station)		Device on the end side (A device far from the master station)							
		Local station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class A device)		Ethernet device	
		1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps
Master station (CC-Link IE TSN Class B device)	1Gbps	△S	×	○S	▲S*1*3	○SH	▲SH*1*3	○SH	●SH*3
Local station (CC-Link IE TSN Class B device)	1Gbps	△S	×	○S	▲S*1*3*4	○SH*2	▲SH*1*2*3	○SH	●SH*3
	100Mbps	×	×	×	×	×	×	×	×
Remote station (CC-Link IE TSN Class B device)	1Gbps	△S	×	○S	▲S*1*3*4	○SH*2	▲SH*1*2*3	○SH	●SH*3
	100Mbps	×	×	×	△S*1*3*4	×	△SH*1*2*3*4	×	○SH*3
Remote station (CC-Link IE TSN Class A device)	1Gbps	×	×	×	×	○SH*2	▲SH*1*2*3	○SH	●SH*3
	100Mbps	×	×	×	×	×	△SH*1*2*3	×	○SH*3

*1 For a device station with a communication speed of 100Mbps, set "Communication Period Setting" to "Low-Speed".

*2 A connection cannot be made if the total cyclic data size of all devices stations on the CC-Link IE TSN Class A device side at the boundary between CC-Link IE TSN Class B and CC-Link IE TSN Class A exceeds 2K bytes. (☞ Page 79 Calculation of the total cyclic data size)

*3 When using RD78GH and the add-on baseSystem version is "1.15" or earlier, only one of P1 or P2 can be used. (To use both P1 and P2 of the master station, use a multicast mode structure.)

*4 A connection cannot be established if the total cyclic data size of all device stations 100Mbps device side exceeds 2K bytes. This includes the devices with a communication speed of 100Mbps that form a boundary between the communication speed of 1Gbps and 100Mbps. (☞ Page 79 Calculation of the total cyclic data size)

Precautions

When a TSN hub is used, check the TSN hub specifications on the CC-Link Partner Association website (www.cc-link.org).

When the communication speed for the master station is set to 100Mbps

The following table lists the availability of connection with a network configuration device when the "Communication Speed" for the master station is set to "100Mbps".

○: Connection available, ×: Connection not available

△: Connection available only when the device on the end side is a standard station.

S: TSN hub available

H: General-purpose hub available

Device on the master station side (A device near the master station)		Device on the end side (A device far from the master station)							
		Local station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class A device)		Ethernet device	
		1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps
Master station (CC-Link IE TSN Class B device)	100Mbps	×	△S*2	×	○S*2	×	○SH	×	○SH
Local station (CC-Link IE TSN Class B device)	1Gbps	×	×	×	×	×	×	×	×
	100Mbps	×	△S*2	×	○S*2	×	○SH*1	×	○SH
Remote station (CC-Link IE TSN Class B device)	1Gbps	×	×	×	×	×	×	×	×
	100Mbps	×	△S*2	×	○S*2	×	○SH*1	×	○SH
Remote station (CC-Link IE TSN Class A device)	1Gbps	×	×	×	×	×	×	×	×
	100Mbps	×	×	×	×	×	○SH*1	×	○SH

*1 A connection cannot be made if the total cyclic data size of all devices stations on the CC-Link IE TSN Class A device side at the boundary between CC-Link IE TSN Class B and CC-Link IE TSN Class A exceeds 2K bytes. (☞ Page 79 Calculation of the total cyclic data size)

*2 For a device station with a communication speed of 100Mbps, set "Communication Period Setting" to "Basic Period" or "Normal-Speed".

Precautions

When a TSN hub is used, check the TSN hub specifications on the CC-Link Partner Association website (www.cc-link.org).

Availability of connection with devices (when using multicast mode)

The following shows the case when "Communication Mode" under "Application Settings" is set to "Multicast".

When the communication speed for the master station is set to 1Gbps

The following table lists the availability of connection with a network configuration device when the "Communication Speed" for the master station is set to "1Gbps".

○: Connection available, ●: Connection available via a switching hub, ×: Connection not available

△: Connection available only when the device on the end side is a standard station.

▲: Connection available only when the device on the end side is a standard station, and is connected via a switching hub.

S: TSN hub available

H: General-purpose hub available

Device on the master station side (A device near the master station)		Device on the end side (A device far from the master station)							
		Local station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class A device)		Ethernet device	
		1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps
Master station (CC-Link IE TSN Class B device)	1Gbps	△S*4	×	○S*4	×	○SH*4	▲SH*1*4	○SH*4	●SH*4
Local station (CC-Link IE TSN Class B device)	1Gbps	△S*4	×	○S*4	×	○SH*2*3*4	▲SH*1*2*3*4	○SH*3*4	●SH*3*4
	100Mbps	×	×	×	×	×	×	×	×
Remote station (CC-Link IE TSN Class B device)	1Gbps	△S*4	×	○S*4	×	○SH*2*3*4	▲SH*1*2*3*4	○SH*3*4	●SH*3*4
	100Mbps	×	×	×	×	×	×	×	×
Remote station (CC-Link IE TSN Class A device)	1Gbps	×	×	×	×	○SH*2*4	▲SH*1*2*4	○SH*4	●SH*4
	100Mbps	×	×	×	×	×	△SH*1*2*4	×	○SH*4

*1 For a device station with a communication speed of 100Mbps, set "Communication Period Setting" to "Low-Speed".

*2 A connection cannot be made if the total cyclic data size of all devices stations on the CC-Link IE TSN Class A device side at the boundary between CC-Link IE TSN Class B and CC-Link IE TSN Class A exceeds 2K bytes. (☞ Page 79 Calculation of the total cyclic data size)

*3 For a local station or remote station of a device on the master station side, use a device supporting the multicast filter. (📖Manual for the device used)

*4 When the device is connected on the end side via the switching hub as shown below, communication may not be possible depending on the type of the device.
The communication will be enabled by configuring settings with the switching hub so that the multicast frame (with multicast MAC address 09:00:70:00:10:02 and 09:00:70:00:10:05) will not be transferred to the ports specified below.

Connection structure that cannot be communicated	Port that prohibits multicast frame transfer
Device stations with communication speeds of 1Gbps and 100Mbps coexist.	Connection port of the device station with a communication speed of 100Mbps.
A local station and Ethernet device coexist.	Connection port of the Ethernet device.
The local station and CC-Link IE TSN Class A remote station are mixed.	Connection port of CC-Link IE TSN Class A remote station.
A remote station and Ethernet device coexist.	Connection port of the Ethernet device.

Precautions

When a TSN hub is used, check the TSN hub specifications on the CC-Link Partner Association website (www.cc-link.org).

When the communication speed for the master station is set to 100Mbps

The following table lists the availability of connection with a network configuration device when the "Communication Speed" for the master station is set to "100Mbps".

○: Connection available, ×: Connection not available

△: Connection available only when the device on the end side is a standard station.

S: TSN hub available

H: General-purpose hub available

Device on the master station side (A device near the master station)		Device on the end side (A device far from the master station)							
		Local station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class B device)		Remote station (CC-Link IE TSN Class A device)		Ethernet device	
		1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps	1Gbps	100Mbps
Master station (CC-Link IE TSN Class B device)	100Mbps	×	△S*2*4	×	○S*2	×	○SH*4	×	○SH*4
Local station (CC-Link IE TSN Class B device)	1Gbps	×	×	×	×	×	×	×	×
	100Mbps	×	△S*2*4	×	○S*2	×	○SH*1*3*4	×	○SH*3*4
Remote station (CC-Link IE TSN Class B device)	1Gbps	×	×	×	×	×	×	×	×
	100Mbps	×	△S*2*4	×	○S*2	×	○SH*1*3*4	×	○SH*3*4
Remote station (CC-Link IE TSN Class A device)	1Gbps	×	×	×	×	×	×	×	×
	100Mbps	×	×	×	×	×	○SH*1*4	×	○SH*4

*1 A connection cannot be made if the total cyclic data size of all devices stations on the CC-Link IE TSN Class A device side at the boundary between CC-Link IE TSN Class B and CC-Link IE TSN Class A exceeds 2K bytes. (☞ Page 79 Calculation of the total cyclic data size)

*2 For a device station with a communication speed of 100Mbps, set "Communication Period Setting" to "Basic Period" or "Normal-Speed".

*3 For a local station or remote station of a device on the master station side, use a device supporting the multicast filter. (📖Manual for the device used)

*4 When connecting the following devices to an end side device via a switching hub, communication may not be established depending on the device used. Communication can be established by setting the switching hub so that it does not transmit the multicast frame (multicast MAC address 09:00:70:00:10:02 and 090:70:00:10:05) to the target port.

Connection structure that cannot be communicated	Port that prohibits multicast frame transfer
A local station and Ethernet device coexist.	Connection port of a general-purpose TCP/IP device
The local station and CC-Link IE TSN Class A remote station are mixed.	Connection port of CC-Link IE TSN Class A remote station

Precautions

When a TSN hub is used, check the TSN hub specifications on the CC-Link Partner Association website (www.cc-link.org).

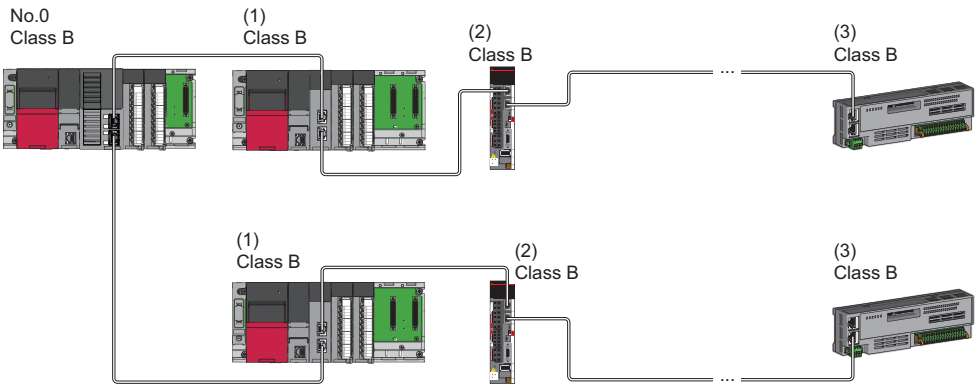
Structure of modules on CC-Link IE TSN only

Connection with modules on CC-Link IE TSN only

■Line topology

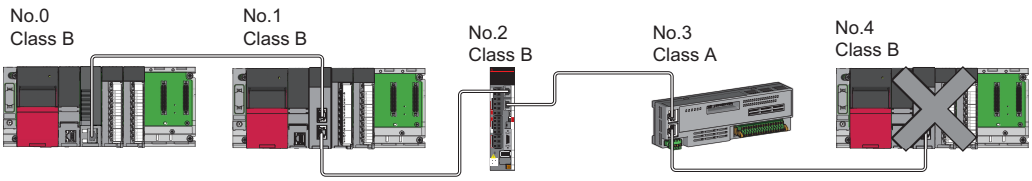
Modules are connected in a line topology.

- Up to eight CC-Link IE TSN Class B stations can be connected.
- When using RD78GH, up to eight CC-Link IE TSN Class B stations can be connected to P1 or P2 of the master station.



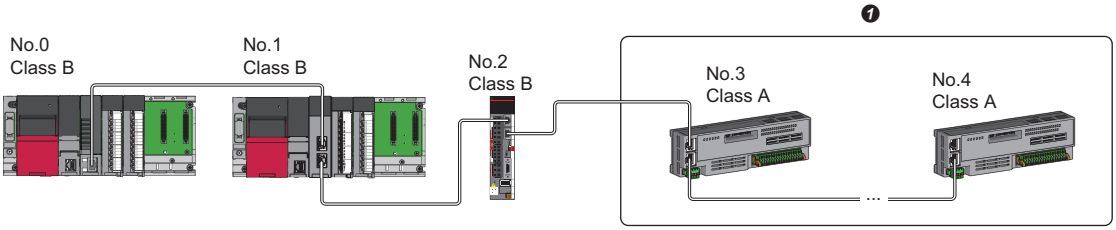
No.0: Master station
(1) Local station (1st device)
(2) Remote station (2nd device)
(3) Remote station (8th device)
Class B: CC-Link IE TSN Class B device

- The CC-Link IE TSN Class B device cannot be connected to the CC-Link IE TSN Class A device.



No.0: Master station
No.1, No.4: Local station
No.2, No.3: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

- A connection cannot be established if the total cyclic data size of all device stations on the CC-Link IE TSN Class A device side exceeds 2K bytes. This includes the CC-Link IE TSN Class A device that forms a boundary between CC-Link IE TSN Class B and CC-Link IE TSN Class A.

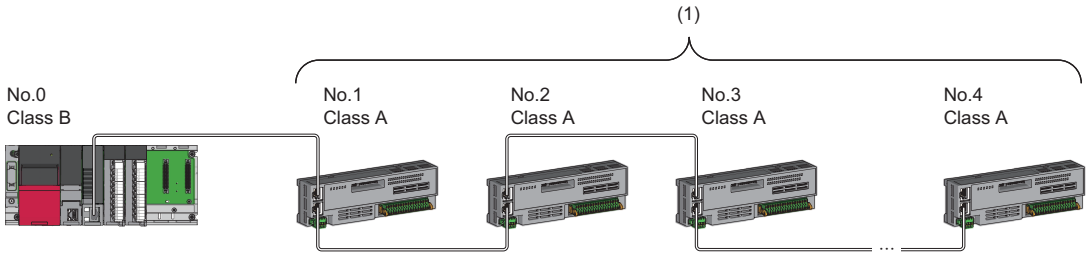


No.0: Master station
No.1: Local station
No.2, No.3, No.4: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

❶ Set the total cyclic data size within 2K bytes.

A

• When the device stations are CC-Link IE TSN Class A devices only, up to 120 device stations can be connected.

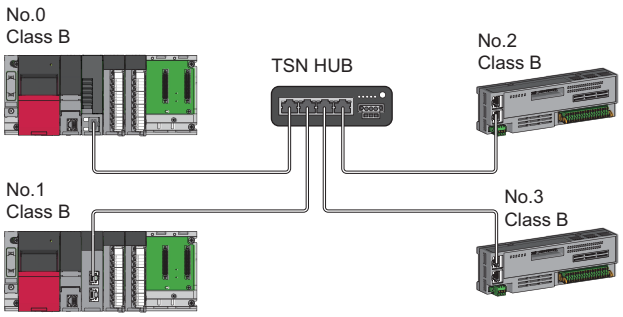


No.0: Master station
No.1 to No.4: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device
(1) Total of the device stations: Up to 120

■Star topology

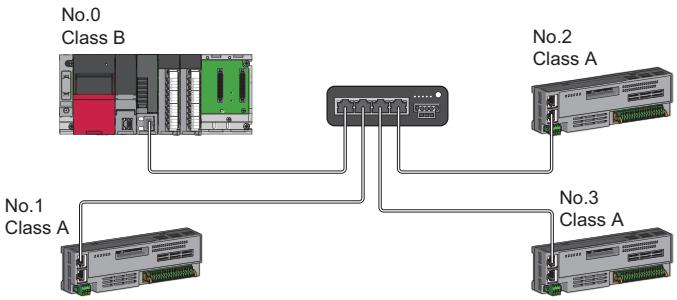
Each module is configured in a star topology via a switching hub.

• When connecting a CC-Link IE TSN Class B device in a star topology, use a TSN hub.



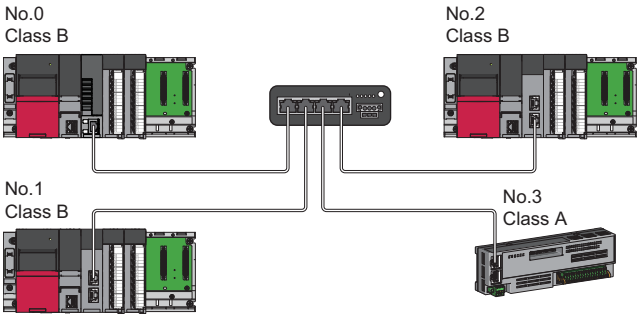
No.0: Master station
No.1: Local station
No.2, No.3: Remote station
Class B: CC-Link IE TSN Class B device

• When connecting a CC-Link IE TSN Class A device to a CC-Link IE TSN Class B device or a CC-Link IE TSN Class A device to another CC-Link IE TSN Class A device in a star topology, connect them via a switching hub.



No.0: Master station
No.1, No.2, No.3: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

- When "Communication Mode" is set to "Multicast" and the local station is used with a CC-Link IE TSN Class A remote station on the end side via a switching hub, some communication devices may not communicate. The communication will be enabled by configuring settings with the switching hub so that the multicast frame (with multicast MAC address 09:00:70:00:10:02 and 09:00:70:00:10:05) will not be transferred to the ports of CC-Link IE TSN Class A remote station.

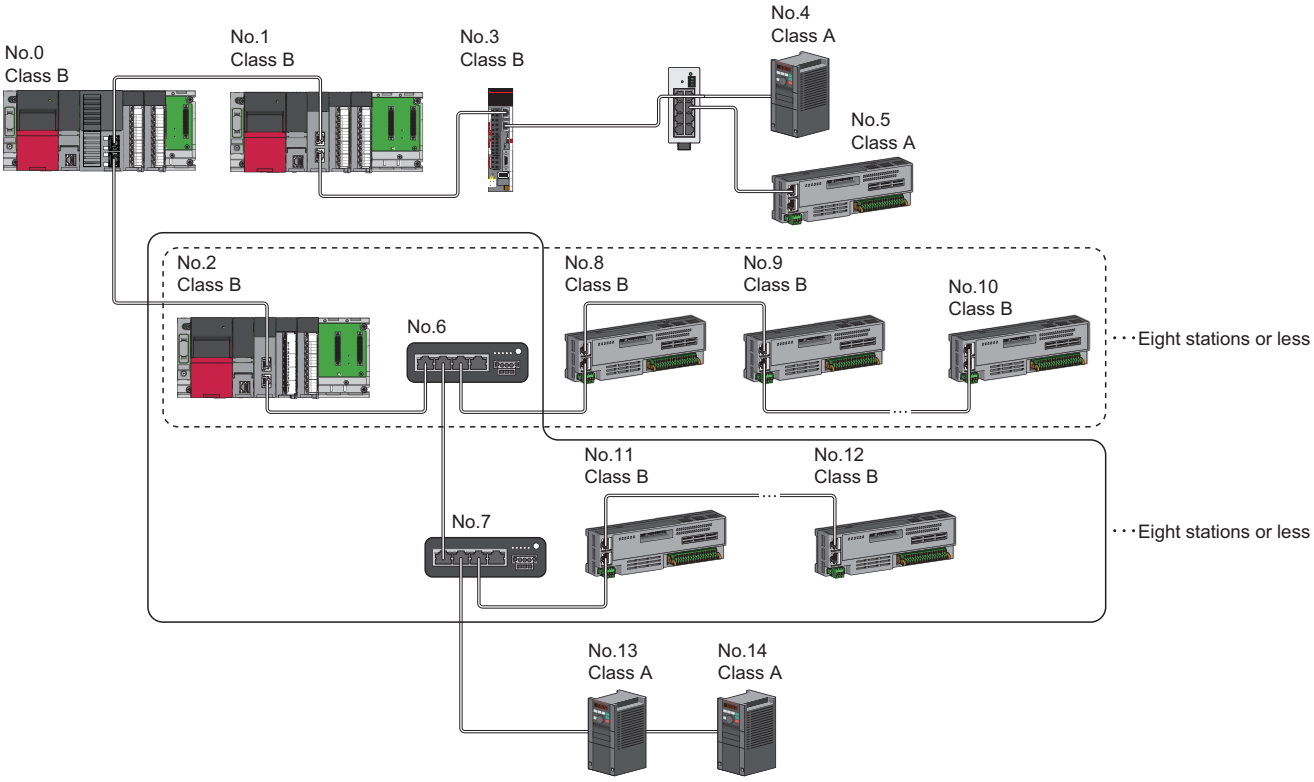


No.0: Master station
No.1, No.2: Local station
No.3: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

■Coexistence of line and star topologies

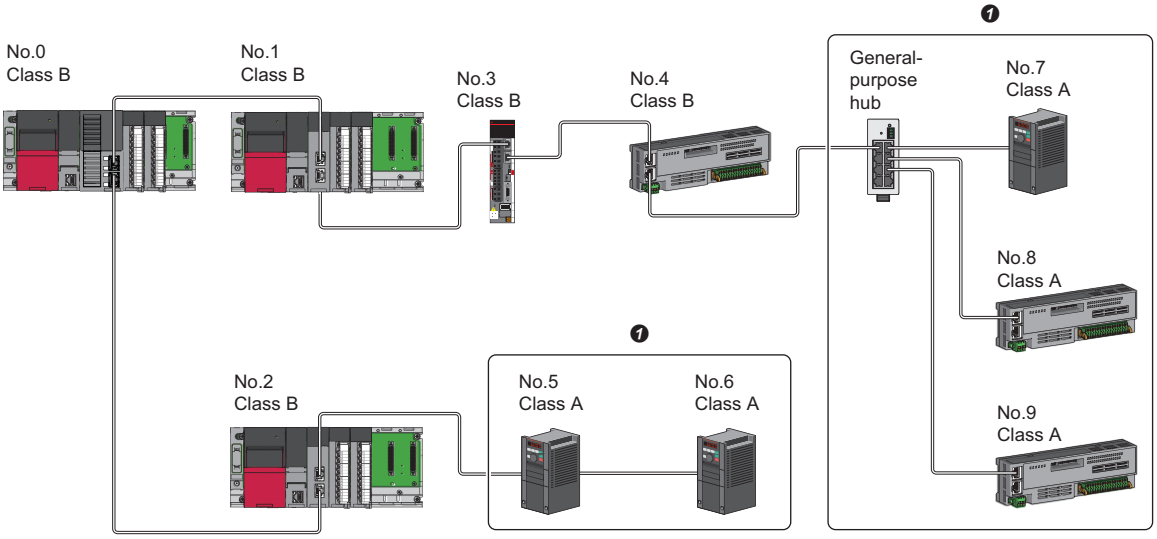
Line and star topologies can be mixed according to the connection requirements described below.

- Up to eight CC-Link IE TSN Class B device stations (including the TSN hub) can be connected from the master station to each end.
- When connecting a CC-Link IE TSN Class A device, connect to the end of a CC-Link IE TSN Class B device or to a TSN hub. A star topology is also possible using a switching hub.



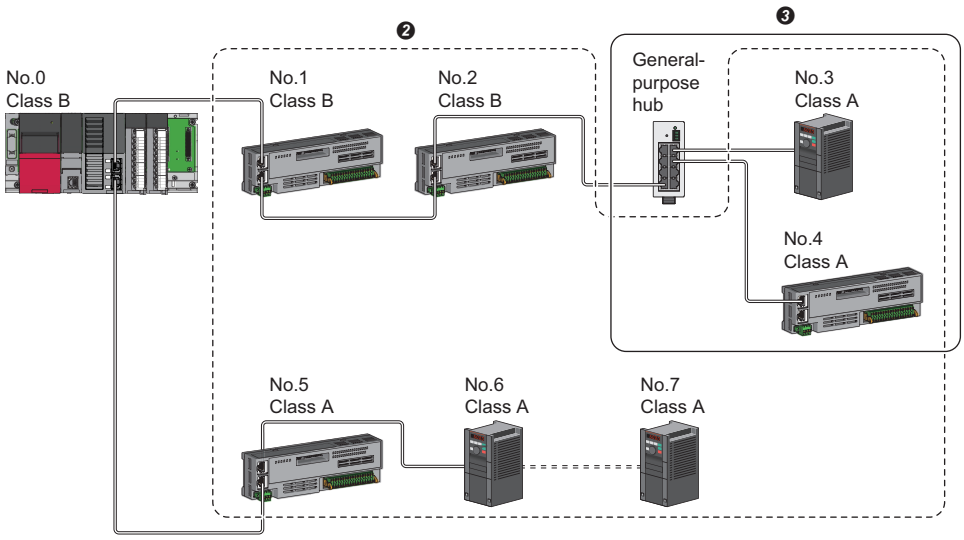
No.0: Master station
No.1, No.3, No.4, No.5, No.13, No.14: Device station
No.2: Device station (1st station)
No.6: TSN hub (2nd station)
No.7: TSN hub (3rd station)
No.8: Device station (3rd station)
No.9, No.11: Device station (4th station)
No.10, No.12: Device station (8th station)
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

• A connection cannot be made if the total cyclic data size of all device stations on the CC-Link IE TSN Class A device side at the boundary between CC-Link IE TSN Class B and CC-Link IE TSN Class A exceeds 2K bytes.



No.0: Master station
No.1, No.2: Local station
No.3, No.4, No.5, No.6, No.7, No.8, No.9: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device
❶ Set the total cyclic data size within 2K bytes.

• Up to 120 device stations can be connected by using the appropriate master station port in accordance with the CC-Link IE TSN Class.



No.0: Master station
No.1 to No.7: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device
❷ Up to 120 devices can be connected in total.
❸ Set the total cyclic data size within 2K bytes.

■Ring topology

Ring topology is not possible with "Mixture of CC-Link IE TSN Class B/A or CC-Link IE TSN Class A Only" system configuration.

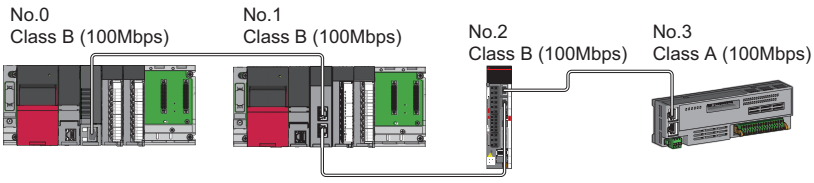
Connection with modules on CC-Link IE TSN with a communication speed of 100Mbps

This section describes the network topology when "Communication Speed" under "Application Settings" is set to "100Mbps".

■Line topology

Modules are connected in a line topology.

- Up to eight CC-Link IE TSN Class B devices can be connected.
- When using RD78GH, up to eight authentication Class B stations can be connected to P1 or P2 of the master station.
- Adjust the communication speed of the module.
- When connecting modules with different communication speeds, connect via a general-purpose hub.

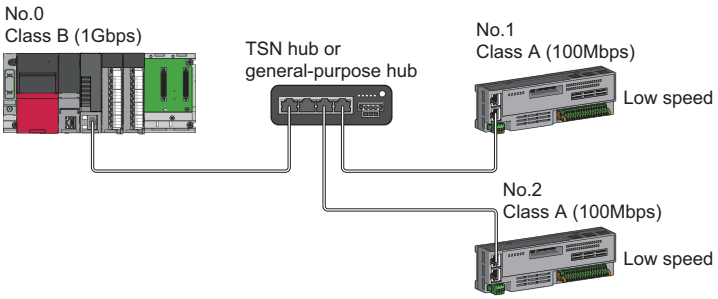


No.0: Master station
No.1: Local station
No.2, No.3: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

■Star topology

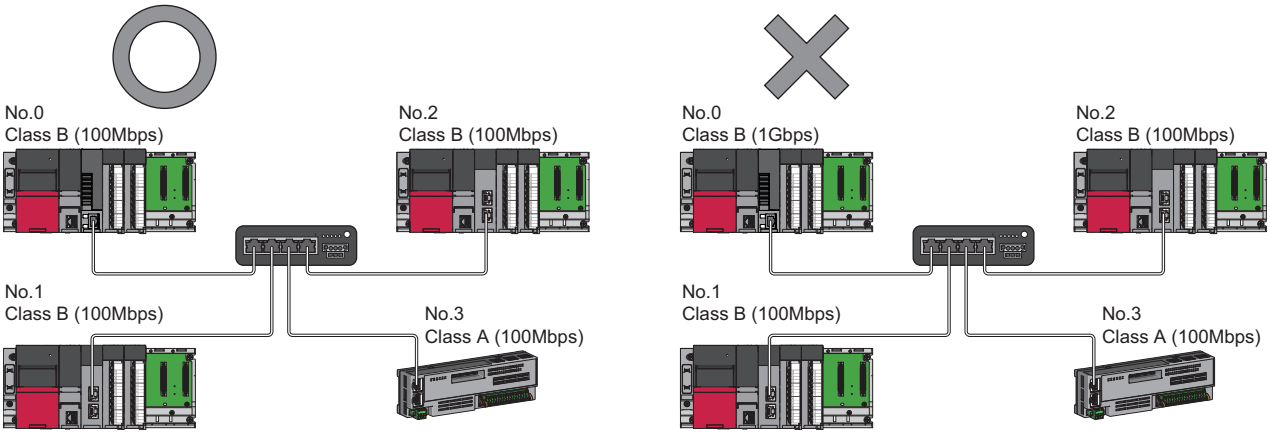
The network is configured in a star topology via a switching hub.

- When the master station with a communication speed of 1Gbps and a remote station with a communication speed of 100Mbps exist in the structure, set "Communication Period Setting" to "Low-Speed" for the remote station with a communication speed of 100Mbps.



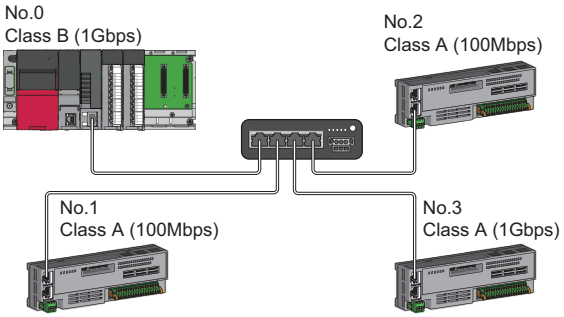
No.0: Master station
No.1, No.2: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

- Connect the master station and local station at the same communication speed.



No.0: Master station
No.1, No.2: Local station
No.3: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

- When "Communication Mode" is set to "Multicast" and the communication speed of the master station is 1Gbps, communication may not be possible depending on the type of the device if device stations with different communication speeds of 1Gbps and 100Mbps coexist on the end side via the switching hub. The communication will be enabled by configuring settings with the switching hub so that the multicast frame (with multicast MAC address 09:00:70:00:10:02 and 09:00:70:00:10:05) will not be transferred to the port of the device station with 100Mbps.

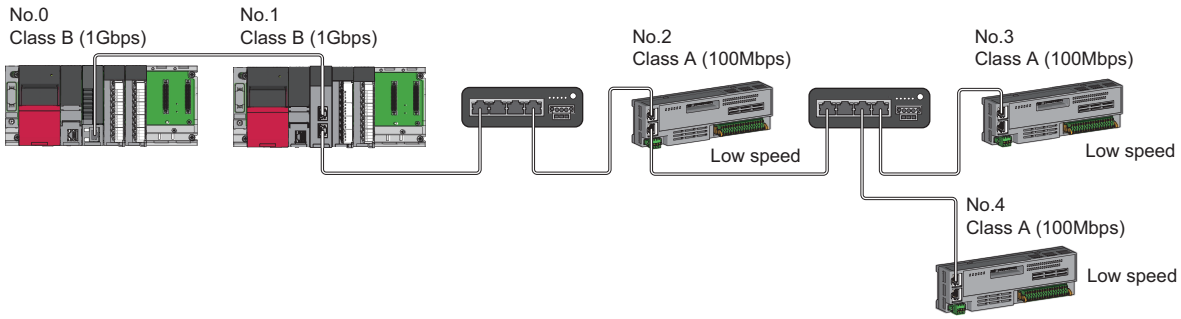


No.0: Master station
No.1, No.2, No.3: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

■Coexistence of line and star topologies

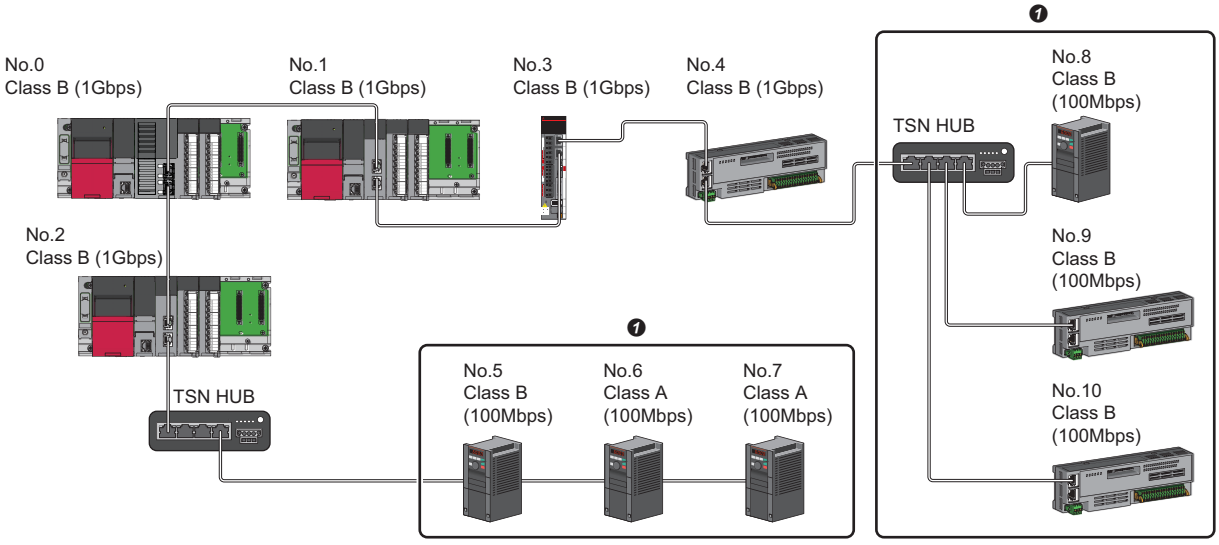
Line and star topologies can be mixed in the same network configuration.

- Up to eight CC-Link IE TSN Class B device stations (including the TSN hub) can be connected from the master station to each end.
- When the master station with a communication speed of 1Gbps and a remote station with a communication speed of 100Mbps exist in the structure, set "Communication Period Setting" to "Low-Speed" for the remote station with a communication speed of 100Mbps.



No.0: Master station
No.1: Local station
No.2, No.3, No.4: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

- When the communication speed of the master station is 1Gbps, a connection cannot be established if the total cyclic data size of all device stations on the 100Mbps device side exceeds 2K bytes. This includes the devices with a communication speed of 100Mbps that form a boundary between the communication speed of 1Gbps and 100Mbps.



No.0: Master station
No.1, No.2: Local station
No.3 to No.10: Remote station
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device
❶ Set the total cyclic data size within 2K bytes.

■Ring topology

Ring topology is not possible with "Mixture of CC-Link IE TSN Class B/A or CC-Link IE TSN Class A Only" system configuration.

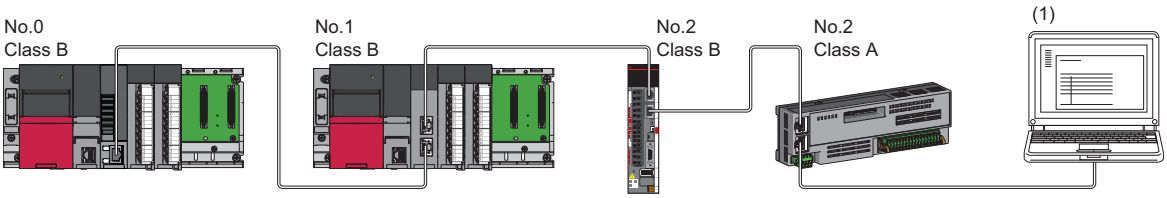
Structure of modules on CC-Link IE TSN and Ethernet devices

Connection with modules on CC-Link IE TSN and Ethernet devices

■Line topology

The network with modules and devices is configured in a line topology. A general-purpose hub is not required.

- Up to eight CC-Link IE TSN Class B devices can be connected.
- When using RD78GH, up to eight CC-Link IE TSN Class B devices can be connected to each of P1 and P2 of the master station.



No.0: Master station
No.1: Local station
No.2, No.3: Remote station
(1) Ethernet device
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

Connect Ethernet devices to the end of the network.

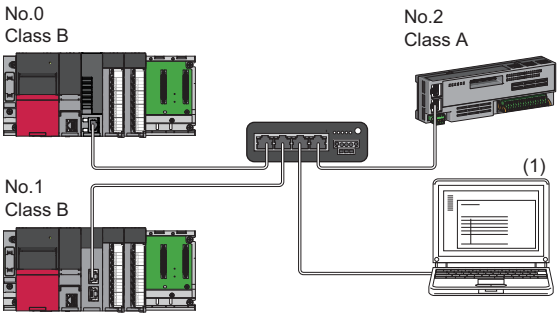
When an error occurs in a device station, the stations connected after the faulty station will be disconnected.

■Star topology

The network is configured in a star topology via a general-purpose hub. This allows devices to be added easily.

When connecting an Ethernet device with a network communication speed of 100Mbps, a general-purpose hub is required.

When using RD78GH, a general-purpose hub can be connected to each of P1 and P2 of the master station.



No.0: Master station
No.1: Local station
No.2: Remote station
(1) Ethernet device
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

Even when an error has occurred in one device station, datalink can continue in stations operating normally.

Point

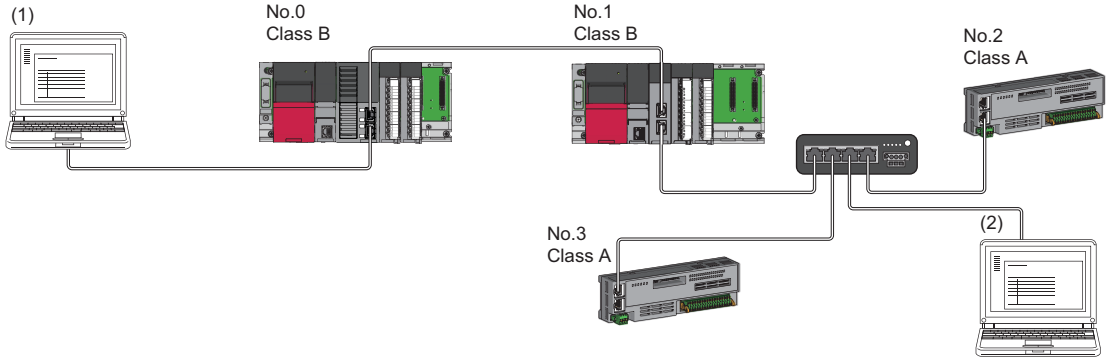
Since cyclic data is sent to an Ethernet device when "Communication Mode" is set to "Multicast" and a local station is used with an Ethernet device on the end side via a switching hub, communication may not be possible depending on the type of an Ethernet device.

The communication will be enabled by configuring settings with the TSN hub so that the multicast frame (with multicast MAC address 09:00:70:00:10:02 and 09:00:70:00:10:05) will not be transferred to the port of the Ethernet device.

■Coexistence of line and star topologies

Line and star topologies can be mixed according to the connection requirements described below.

- Up to eight CC-Link IE TSN Class B device stations (including the TSN hub) can be connected from the master station to each end.
- Connect Ethernet devices at the end of line topology.
- When connecting the Ethernet device in a star topology, connect the Ethernet device to a switching hub.



No.0: Master station
No.1: Local station
No.2, No.3: Remote station
(1), (2): Ethernet device
Class A: CC-Link IE TSN Class A device
Class B: CC-Link IE TSN Class B device

■Ring topology

Ring topology is not possible with "Mixture of CC-Link IE TSN Class B/A or CC-Link IE TSN Class A Only" system configuration.

Appendix 3 Component List

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

No.	Part name	Type	Remarks
1	Motion module	RD78G4 RD78G8 RD78G16 RD78G32 RD78G64 RD78GHV RD78GHW	RD78G□ Number of controlled axes G: Compatible with CC-Link IE TSN RD78GH□ Number of controlled axes (V: 128, W: 256) H: High performance G: Compatible with CC-Link IE TSN
2	Drive unit	—	—
3	Device station compatible with CC-Link IE TSN	—	—
4	CC-Link IE TSN Network cable	—	Cables are needed for connecting the Motion module with a drive unit/device station compatible with CC-Link IE TSN, or between drive units/ device stations compatible with CC-Link IE TSN. For details, refer to the following. ■When using PLCopen Motion control FB mode ☞ Page 83 Ethernet cable ■When using Simple Motion mode ☞ Page 152 Ethernet cable
5	Ethernet HUB	—	Switching HUBs are needed for connecting the Motion module, a drive unit, and other brand drive units in star topology. For details, refer to the following. ■When using PLCopen Motion control FB mode ☞ Page 85 Switching hub ■When using Simple Motion mode ☞ Page 153 Switching hub

Manual pulse generator

The manual pulse generator can only be used in Simple Motion mode.

The following tables lists the recommended specifications for a manual pulse generator.

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

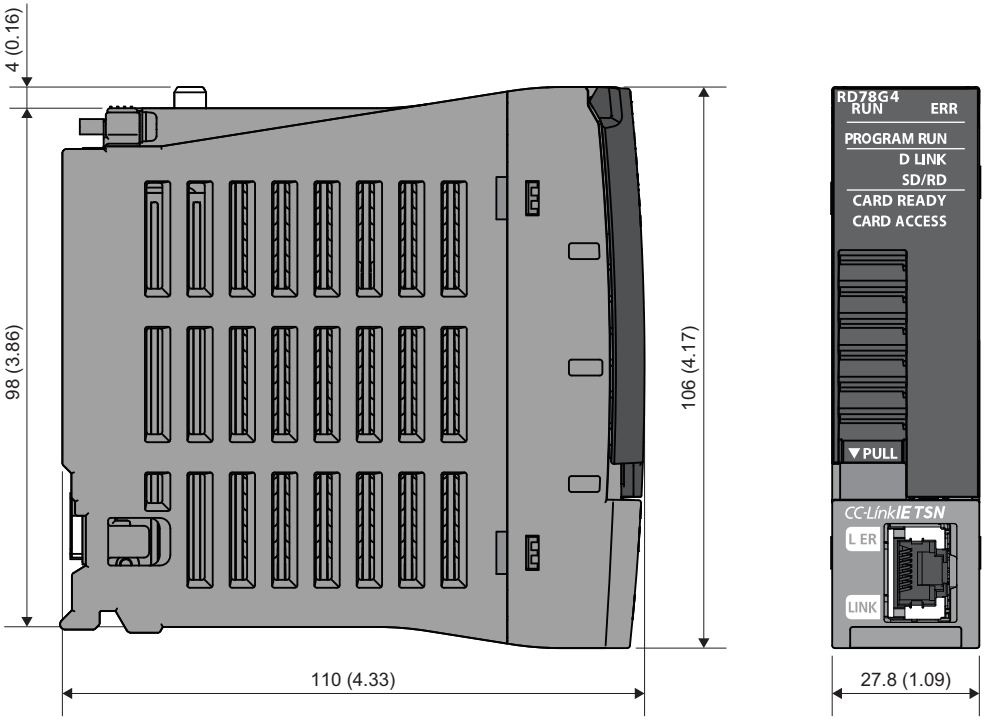
*1 When using a separate power supply, use a stabilized power supply of voltage 5V DC±0.25V DC.

Appendix 4 External Dimensions

Motion module

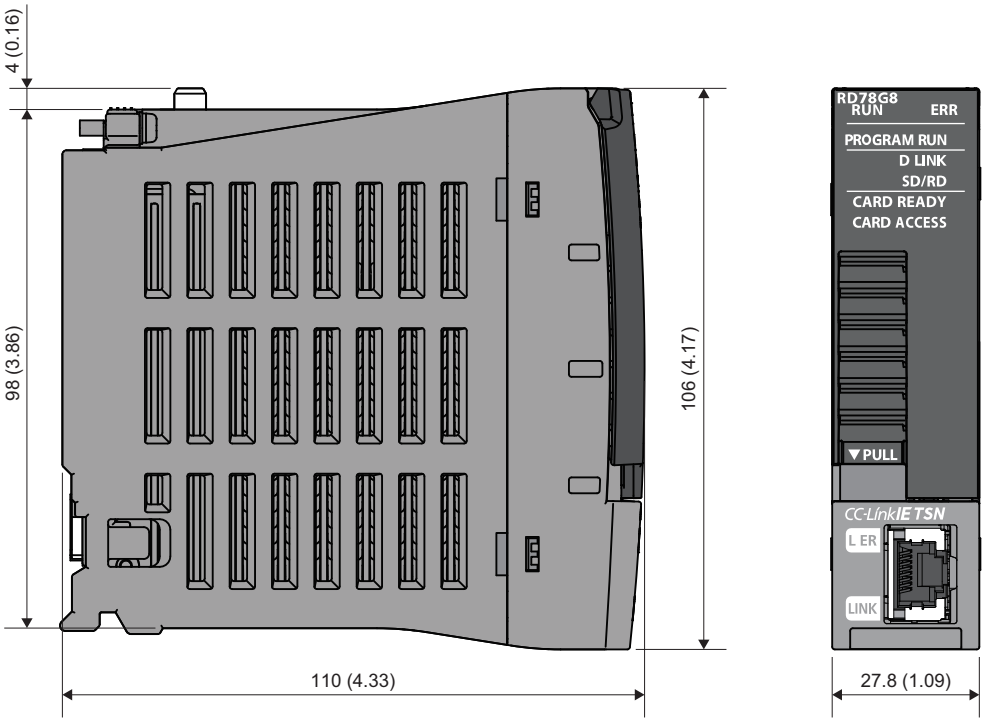
■RD78G4

[Unit: mm (inch)]



■RD78G8

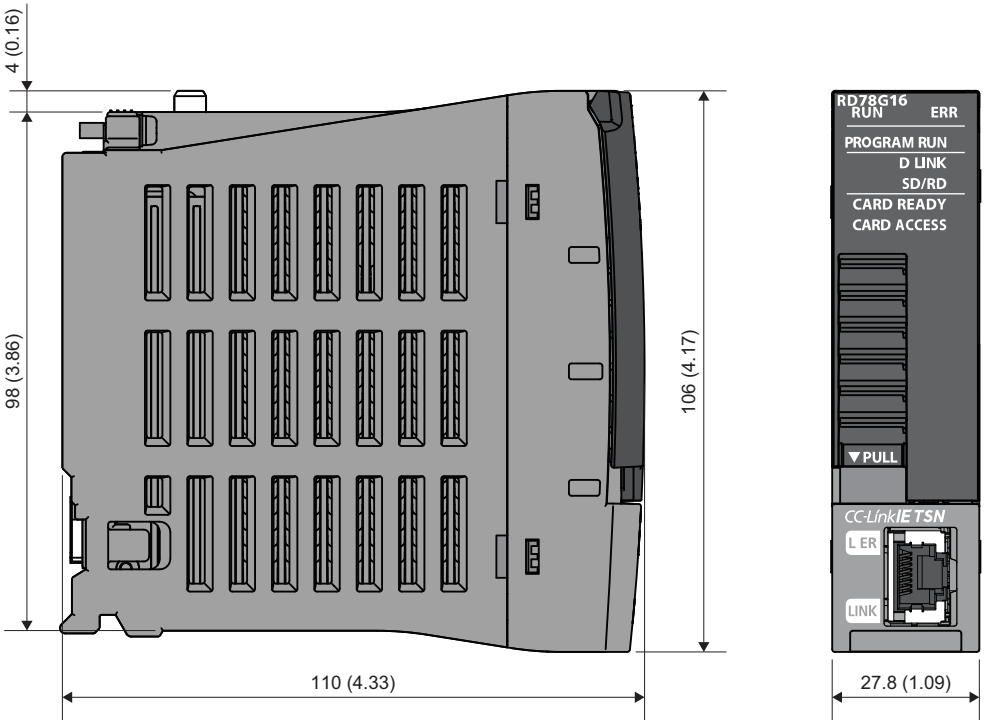
[Unit: mm (inch)]



A

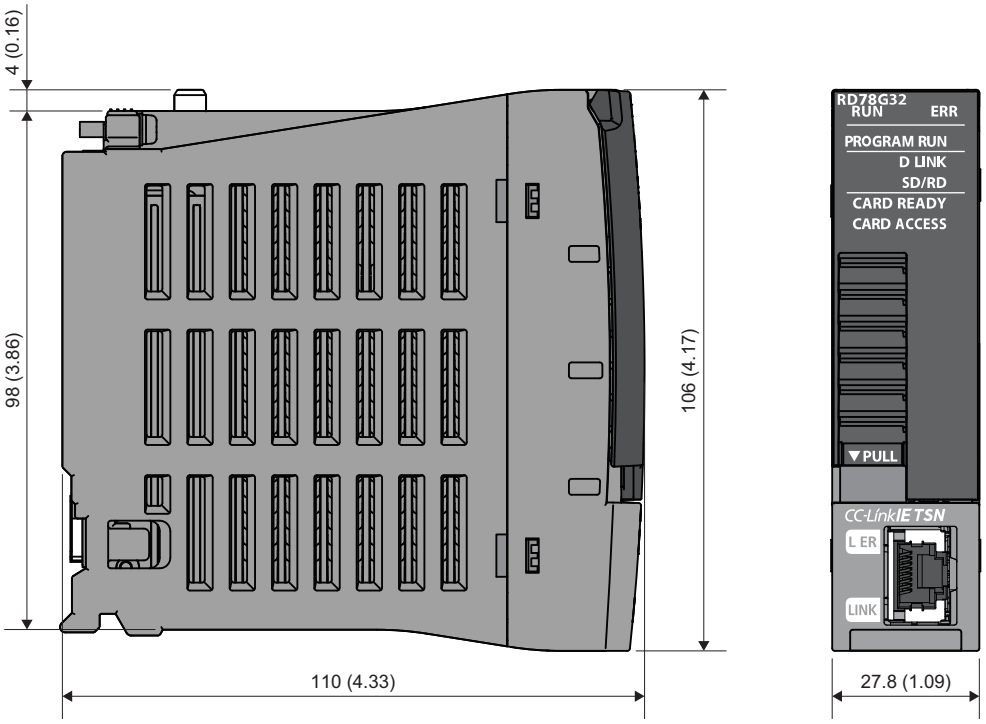
■RD78G16

[Unit: mm (inch)]



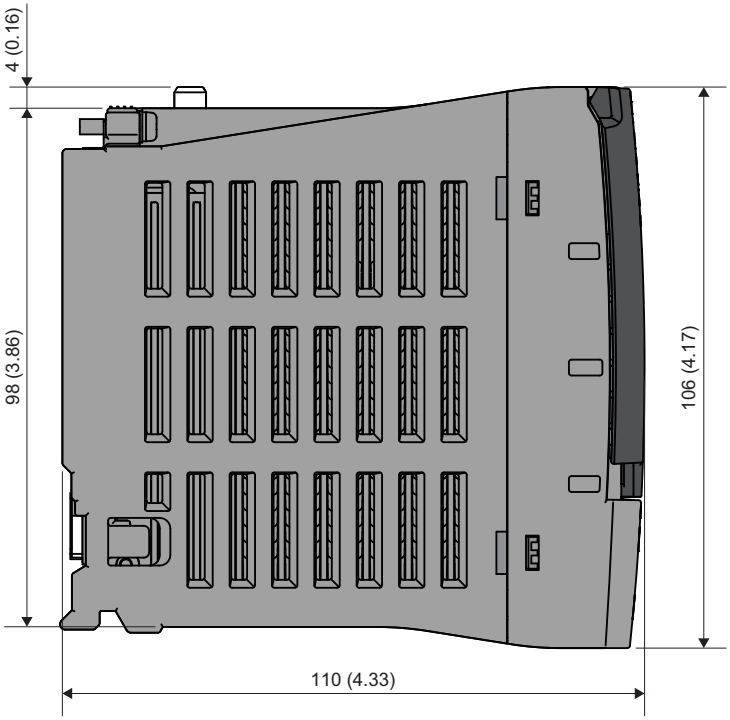
■RD78G32

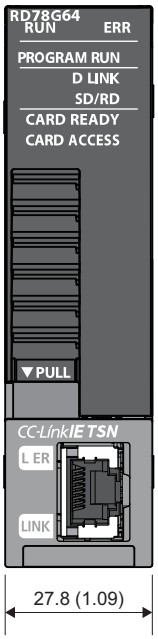
[Unit: mm (inch)]



■RD78G64

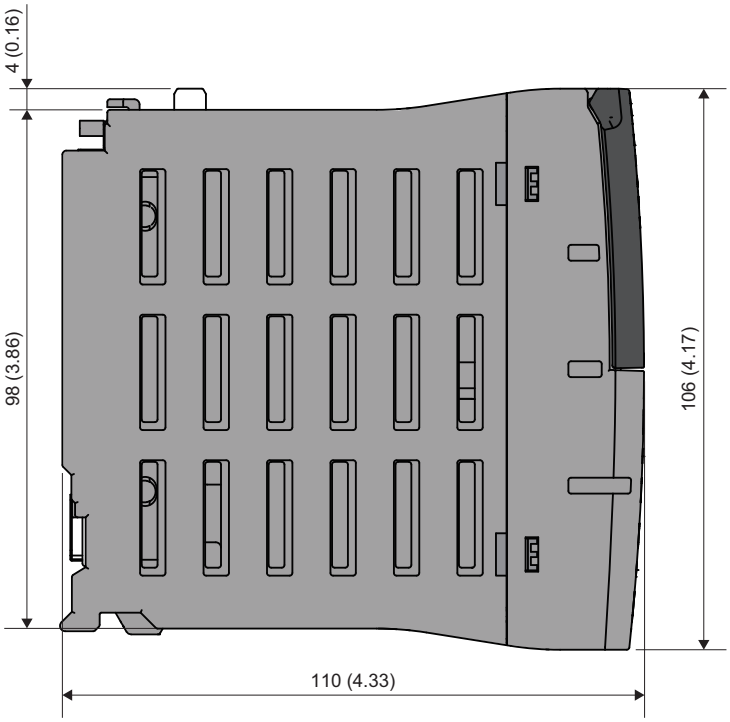
[Unit: mm (inch)]

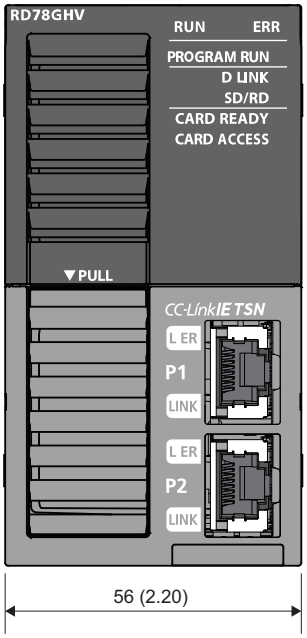




■RD78GHV

[Unit: mm (inch)]

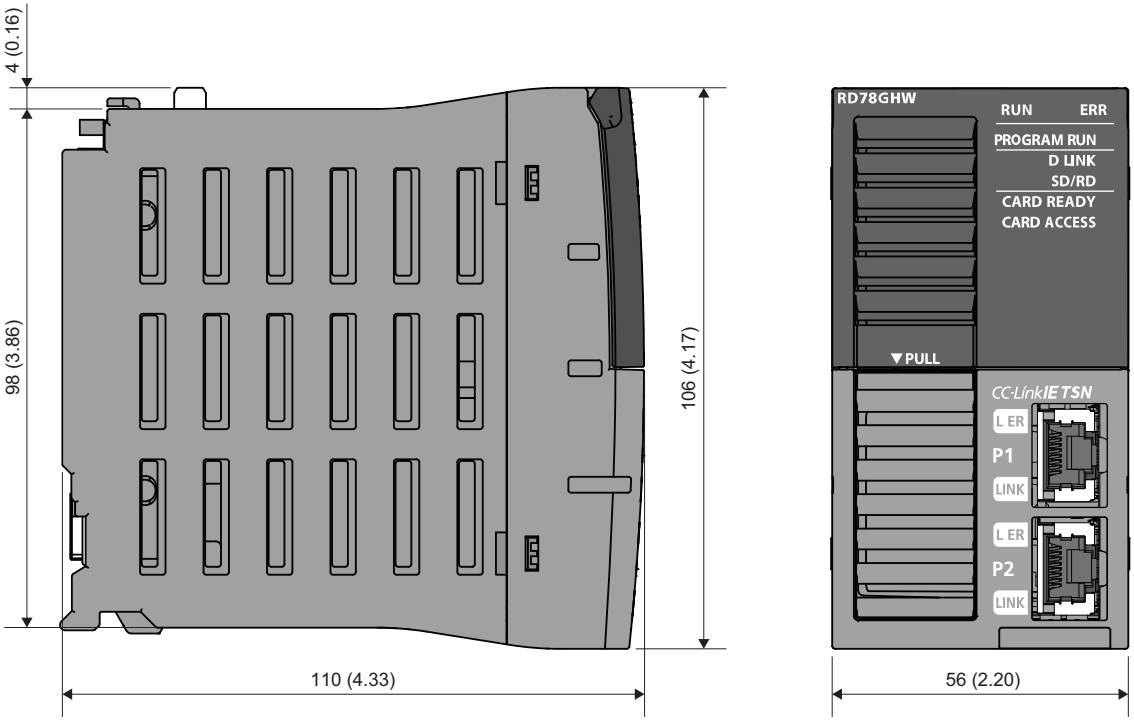




A

■RD78GHW

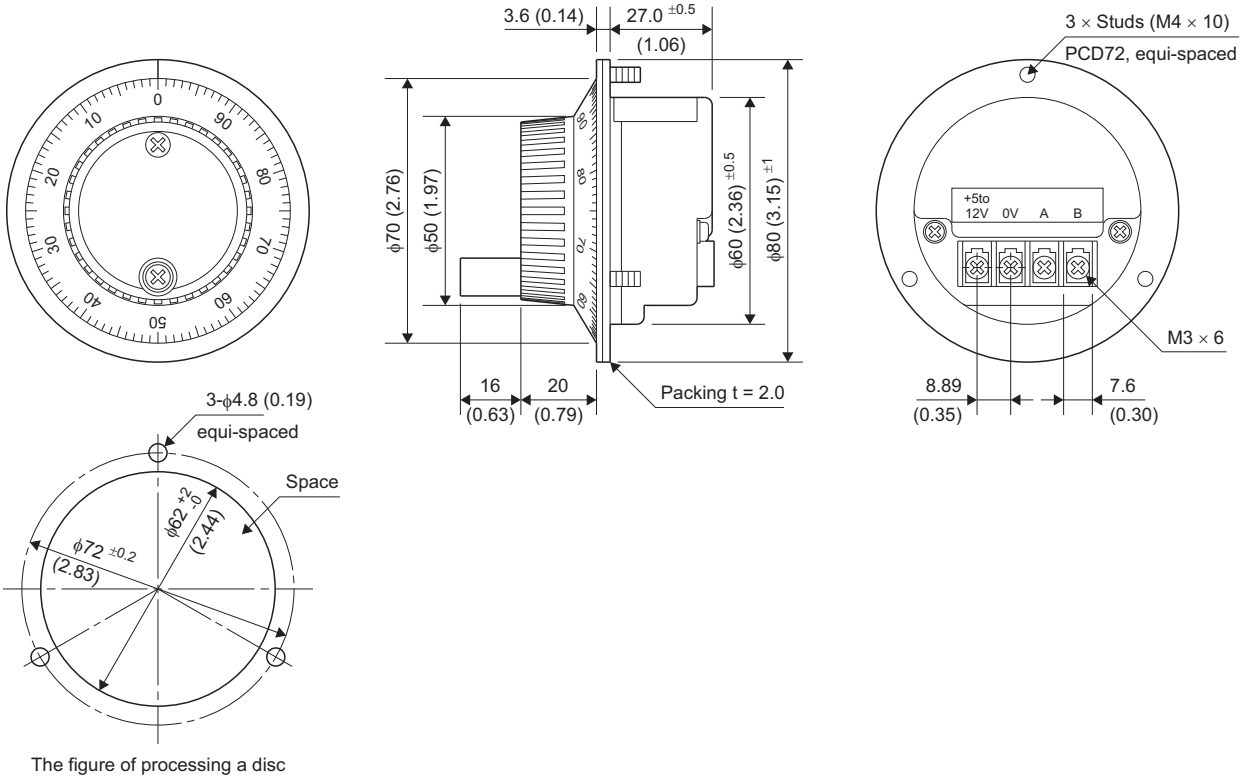
[Unit: mm (inch)]



Manual pulse generator

■MR-HDP01 (manufactured by Mitsubishi Electric Corporation)

[Unit: mm (inch)]



The figure of processing a disc

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REVISIONS

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

Revision date	*Manual number	Description
July 2019	IB(NA)-0300406ENG-A	First edition
January 2020	IB(NA)-0300406ENG-B	■Added models RD78GHV, RD78GHW ■Added or modified parts WHEN USING A HUB WITH CC-Link IE TSN, TERMS, GENERIC TERMS AND ABBREVIATIONS, FUTURE SUPPORT PLANNED, Chapter 1, 5, Section 1.1, 2.1, 2.2, 3.1, 3.2, 5.1, 5.2, 5.3, 6.2, INDEX, WARRANTY, TRADEMARKS
August 2020	IB(NA)-0300406ENG-C	■Added or modified parts WHEN USING A SWITCHING HUB WITH CC-Link IE TSN, SAFETY PRECAUTIONS, RELEVANT MANUALS, TERMS, GENERIC TERMS AND ABBREVIATIONS, FUTURE SUPPORT PLANNED, Chapter 3, 4, 5, Section 1.1, 2.1, 2.2, 3.1, 3.2, 4.1, 5.1, 5.2, 5.3, 6.1, 6.2, INDEX
August 2021	IB(NA)-0300406ENG-D	■Added or modified parts WHEN USING A SWITCHING HUB WITH CC-Link IE TSN, SAFETY PRECAUTIONS, INTRODUCTION, COMPLIANCE WITH EMC AND LOW VOLTAGE DIRECTIVES, RELEVANT MANUALS, TERMS, GENERIC TERMS AND ABBREVIATIONS, SUPPORTED MODE, COMPONENT, FUTURE SUPPORT PLANNED, Chapter 4, 5, 7, 8, 9, 10, 11, 12, Section 1.1, 2.1, 2.2, 2.3, 3.1, 3.2, 4.1, 5.1, 5.2, 5.3, 6.1, 6.2, INDEX, WARRANTY, TRADEMARKS
January 2022	IB(NA)-0300406ENG-E	■Added or modified parts RELEVANT MANUALS, TERMS, GENERIC TERMS AND ABBREVIATIONS, SUPPORTED MODE, FUTURE SUPPORT PLANNED, Chapter 4, 5, 10, 11, Section 2.2, 3.2, 4.1, 5.1, 5.2, 5.3, 5.4, 8.2, 9.1, 9.2, 9.3, 10.1, 11.1, 11.2, 11.3, 11.4, 12.1, Appendix 4, INDEX
August 2022	IB(NA)-0300406ENG-F	■Added or modified parts INTRODUCTION, RELEVANT MANUALS, TERMS, GENERIC TERMS AND ABBREVIATIONS, SUPPORTED MODE, COMPONENT, Chapter 1, 4, 5, 7, 10, 11, Section 1.1, 2.1, 2.2, 2.3, 3.1, 3.2, 4.1, 5.1, 5.2, 5.4, 5.5, 6.1, 6.2, 7.1, 8.2, 8.3, 9.1, 9.2, 9.3, 10.1, 11.1, 11.2, 11.4, 11.5, 12.1, 12.2, Appendix 1, 2, 3, 4,5 ■Delete parts FUTURE SUPPORT PLANNED
May 2023	IB(NA)-0300406ENG-G	■Added or modified parts SAFETY PRECAUTIONS, Chapter 10, Section 2.2, 3.1, 3.2, 5.1, 5.2, 6.2, 8.2, 11.1, 11.2, 12.2, Appendix 1
August 2023	IB(NA)-0300406ENG-H	■Added or modified parts TERMS, GENERIC TERMS AND ABBREVIATIONS, Section 2.2, 3.1, 3.2, 5.1, 5.2, 5.5, 6.2, 8.2, 11.5, Appendix 1
January 2024	IB(NA)-0300406ENG-J	■Added or modified parts SAFETY PRECAUTIONS, TERMS, Chapter 1, 4, 5, 7, 10, 11, Section 2.1, 2.2, 3.2, 5.1, 5.2, 5.4, 5.5, 6.1, 6.2, 8.1, 8.2, 9.3, 11.1, 11.2, 11.4, 11.5, 12.1, 12.2, Appendix 1, 2 ■Delete parts Section 1.1, 7.1
September 2024	IB(NA)-0300406ENG-K	■Added or modified parts SAFETY PRECAUTIONS, TERMS, GENERIC TERMS AND ABBREVIATIONS, Section 9.1, 9.2, Appendix 1 ■Deleted parts Appendix 6
February 2025	IB(NA)-0300406ENG-L	■Added or modified parts RELEVANT MANUALS, TERMS, COMPONENT

Japanese manual number: IB-0300405-N

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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 is 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 Motion module, its applications should be those that may not result in a serious damage even if any failure or malfunction occurs in the Motion module, and a backup or fail-safe function should operate on an external system to the Motion module when any failure or malfunction occurs.

(2) Our 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.

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IB(NA)-0300406ENG-L(2502)MEE
MODEL: RD78-U-S-E
MODEL CODE: 1XB038

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