



Mitsubishi Electric Industrial Robot
CR800-D series controller

Network Base Card

Instruction Manual

2F-DQ535-TSN

2F-DQ535

2F-DQ535-EC

2F-DQ535-EIP

2F-DQ535-PN



Safety Precautions

Always read the following precautions and the separate "Safety Manual" before starting use of the robot to learn the required measures to be taken.



CAUTION

All teaching work must be carried out by an operator who has received special training.

(This also applies to maintenance work with the power source turned ON.)

→Enforcement of safety training



CAUTION

For teaching work, prepare a work plan related to the methods and procedures of operating the robot, and to the measures to be taken when an error occurs or when restarting. Carry out work following this plan.

(This also applies to maintenance work with the power source turned ON.)

→Preparation of work plan



WARNING

Prepare a device that allows operation to be stopped immediately during teaching work.

(This also applies to maintenance work with the power source turned ON.)

→Setting of emergency stop switch



CAUTION

During teaching work, place a sign indicating that teaching work is in progress on the start switch, etc.

(This also applies to maintenance work with the power source turned ON.)

→Indication of teaching work in progress



DANGER

Provide a fence or enclosure during operation to prevent contact of the operator and robot.

→Installation of safety fence



CAUTION

Establish a set signaling method to the related operators for starting work, and follow this method.

→Signaling of operation start



CAUTION

As a principle turn the power OFF during maintenance work. Place a sign indicating that maintenance work is in progress on the start switch, etc.

→Indication of maintenance work in progress



CAUTION

Before starting work, inspect the robot, emergency stop switch and other related devices, etc., and confirm that there are no errors.

→Inspection before starting work

The points of the precautions given in the separate "Safety Manual" are given below.
Refer to the actual "Safety Manual" for details.

 **DANGER** When automatic operation of the robot is performed using multiple control devices (GOT, programmable controller, push-button switch), the interlocking of operation rights of the devices, etc. must be designed by the customer.

 **CAUTION** Use the robot within the environment given in the specifications. Failure to do so could lead to faults or a drop of reliability.
(Temperature, humidity, atmosphere, noise environment, etc.)

 **CAUTION** Transport the robot with the designated transportation posture. Transporting the robot in a non-designated posture could lead to personal injuries or faults from dropping.

 **CAUTION** Always use the robot installed on a secure table. Use in an instable posture could lead to positional deviation and vibration.

 **CAUTION** Wire the cable as far away from noise sources as possible. If placed near a noise source, positional deviation or malfunction could occur.

 **CAUTION** Do not apply excessive force on the connector or excessively bend the cable. Failure to observe this could lead to contact defects or wire breakage.

 **CAUTION** Make sure that the workpiece weight, including the hand, does not exceed the rated load or tolerable torque.
Exceeding these values could lead to errors or faults.

 **WARNING** Securely install the hand and tool, and securely grasp the workpiece. Failure to observe this could lead to personal injuries or damage if the object comes off or flies off during operation.

 **WARNING** Securely ground the robot and controller. Failure to observe this could lead to malfunctioning by noise or to electric shock accidents.

 **CAUTION** Indicate the operation state during robot operation. Failure to indicate the state could lead to operators approaching the robot or to incorrect operation.

 **WARNING** When carrying out teaching work in the robot's movement range, always secure the priority right for the robot control. Failure to observe this could lead to personal injuries or damage if the robot is started with external commands.

 **CAUTION** Keep the jog speed as low as possible, and always watch the robot. Failure to do so could lead to interference with the workpiece or peripheral devices.

**CAUTION**

After editing the program, always confirm the operation with step operation before starting automatic operation. Failure to do so could lead to interference with peripheral devices because of programming mistakes, etc.

**CAUTION**

Make sure that if the safety fence entrance door is opened during automatic operation, the door is locked or that the robot will automatically stop. Failure to do so could lead to personal injuries.

**CAUTION**

Never carry out modifications based on personal judgments, non-designated maintenance parts. Failure to observe this could lead to faults or failures.

**WARNING**

When the robot arm has to be moved by hand from an external area, do not place hands or fingers in the openings. Failure to observe this could lead to hands or fingers catching depending on the posture.

**CAUTION**

Do not stop the robot or apply emergency stop by turning the robot controller's main power OFF. If the robot controller main power is turned OFF during automatic operation, the robot accuracy could be adversely affected. Also a dropped or coasted robot arm could collide with peripheral devices.

**CAUTION**

Do not turn OFF the robot controller's main power while rewriting the robot controller's internal information, such as a program and parameter. Turning OFF the robot controller's main power during automatic operation or program/parameter writing could break the internal information of the robot controller.

**DANGER**

Do not connect the Handy GOT when using the GOT direct connection function of this product. Failure to observe this may result in property damage or bodily injury because the Handy GOT can automatically operate the robot regardless of whether the operation rights are enabled or not.

**DANGER**

Do not connect the Handy GOT to a programmable controller when using an iQ Platform compatible product with the CR800-R/Q series. Failure to observe this may result in property damage or bodily injury because the Handy GOT can automatically operate the robot regardless of whether the operation rights are enabled or not.

**DANGER**

Do not remove the SSCNET III cable while power is supplied to the multiple CPU system or the servo amplifier when using an iQ Platform compatible product with the CR800-R/Q series.
Do not look directly at light emitted from the tip of SSCNET III connectors or SSCNET III cables of the Motion CPU or the servo amplifier.
Eye discomfort may be felt if exposed to the light.
(Reference: SSCNET III employs a Class 1 or equivalent light source as specified in JIS C 6802 and IEC 60825-1 (domestic standards in Japan).)

**DANGER**

Do not remove the SSCNET III cable while power is supplied to the controller.
Do not look directly at light emitted from the tip of SSCNET III connectors or SSCNET III cables. Eye discomfort may be felt if exposed to the light.
(Reference: SSCNET III employs a Class 1 or equivalent light source as specified in JIS C 6802 and IEC60825-1 (domestic standards in Japan).)

**DANGER**

Attach the cap to the SSCNET III connector after disconnecting the SSCNET III cable. If the cap is not attached, dirt or dust may adhere to the connector pins, resulting in deterioration connector properties, and leading to malfunction.

**CAUTION**

Make sure there are no mistakes in the wiring. Connecting differently to the way specified in the manual can result in errors, such as the emergency stop not being released. In order to prevent errors occurring, please be sure to check that all functions (such as the teaching box emergency stop, customer emergency stop, and door switch) are working properly after the wiring setup is completed.

**CAUTION**

Use the network equipments (personal computer, USB hub, LAN hub, etc.) confirmed by manufacturer. The thing unsuitable for the FA environment (related with conformity, temperature or noise) exists in the equipments connected to USB. When using network equipment, measures against the noise, such as measures against EMI and the addition of the ferrite core, may be necessary. Please fully confirm the operation by customer. Guarantee and maintenance of the equipment on the market (usual office automation equipment) cannot be performed.

**CAUTION**

To maintain the safety of the robot system against unauthorized access from external devices via the network, take appropriate measures. To maintain the safety against unauthorized access via the Internet, take measures such as installing a firewall.

■ Revision History

Print date	Instruction manual No.	Revision content
2017-05-31	BFP-A3526	First print
2018-02-01	BFP-A3526-A	<ul style="list-style-type: none"> • Safety Precautions was revised. (The CR800-Q controller was added.)
2018-11-30	BFP-A3526-B	<ul style="list-style-type: none"> • Description of the EtherCAT module was added.
2022-06-30	BFP-A3526-C	<ul style="list-style-type: none"> • The description of the ferrite core installation position on the EtherCAT cable was added. • The figure of the network base card was modified. • Other mistakes were corrected and some sections were changed.
2023-04-17	BFP-A3526-D	<ul style="list-style-type: none"> • System status variables M_DIn32 and M_DOut32 were added to the I/O signals. • The HMS module model was corrected. • Other mistakes were corrected and some sections were changed.
2023-09-14	BFP-A3526-E	<ul style="list-style-type: none"> • Added the CR860 controller. • Changed some sections.
2025-05-27	BFP-A3526-F	<ul style="list-style-type: none"> • Added EtherNet/IP and PROFINET IO. • Other mistakes were corrected and some sections were changed.
2026-01-30	BFP-A3526-G	<ul style="list-style-type: none"> • Added CC-Link IE TSN. • Changed some sections.

■ Introduction

Thank you for purchasing Mitsubishi Electric industrial robot.

This instruction manual explains the network base card (2F-DQ535-TSN/2F-DQ535/2F-DQ535-EC/2F-DQ535-EIP/2F-DQ535-PN) options.

The network base card is an option which realizes various communication interfaces when the HMS Anybus-CompactCom module is mounted on the card.

The mountable modules are listed in Chapter 3.2 for reference.

Always read this manual thoroughly and understand the contents before starting use of the network base card (2F-DQ535).

The information contained in this document has been written to be accurate as much as possible. Please interpret that items not described in this document "cannot be performed."

Note that this instruction manual has been prepared for use by operators who understand the basic operations and functions of the Mitsubishi industrial robot. Refer to the separate "Instruction Manual, Detailed Explanation of Functions and Operations" for details on basic operations.

The CR800-D series indicates the CR800-D and CR860-D controllers.

*Symbols in instruction manual



DANGER

Precaution indicating cases where there is a risk of operator fatality or serious injury if handling is mistaken. Always observe these precautions to safely use the robot.



WARNING

Precaution indicating cases where the operator could be subject to fatalities or serious injuries if handling is mistaken. Always observe these precautions to safely use the robot.



CAUTION

Precaution indicating cases where operator could be subject to injury or physical damage could occur if handling is mistaken. Always observe these precautions to safely use the robot.

CONTENTS

1. BEFORE USE	1-1
1.1. Terminology	1-1
1.2. How to Use the Instruction Manual	1-3
2. FLOW OF OPERATIONS.....	2-4
2.1. Work Procedures	2-4
3. FEATURES OF NETWORK BASE CARD.....	3-5
3.1. What is a Network Base Card?	3-5
3.2. Mountable Modules.....	3-6
3.3. Features when Module is Mounted	3-7
3.3.1. Features when CC-Link IE TSN module is mounted	3-7
3.3.2. Features when CC-Link IE Field module is mounted	3-9
3.3.3. Features when EtherCAT module is mounted.....	3-10
3.3.4. Features when EtherNet/IP module is mounted.....	3-11
3.3.5. Features when PROFINET IO module is mounted	3-12
3.4. Hardware	3-13
3.4.1. Card overview	3-13
3.4.2. LED	3-13
3.5. Software configurations.....	3-18
3.5.1. For the CC-Link IE TSN module.....	3-18
3.5.2. For the CC-Link IE Field module	3-18
3.5.3. For the EtherCAT module	3-18
3.5.4. For the EtherNet/IP module	3-18
3.5.5. For the PROFINET IO module	3-18
4. CC-Link IE TSN MODULE AND 2F-DQ535-TSN CARD SPECIFICATIONS.....	4-19
4.1. Specifications list.....	4-19
4.2. List of robot parameters	4-20
4.3. Robot controller I/O signals	4-21
4.3.1. I/O signal number map.....	4-22
4.3.2. I/O register number map	4-23
4.3.3. Flow of I/O signal	4-24
4.3.4. Input/Output	4-24
4.3.5. Output signal reset pattern	4-25
4.3.6. Specifications related to robot language	4-26
5. CC-Link IE Field MODULE AND 2F-DQ535 CARD SPECIFICATIONS	5-28
5.1. Specifications list.....	5-28
5.2. List of robot parameters	5-29
5.3. Robot controller I/O signals	5-30
5.3.1. I/O signal number map (CC-Link IE Field)	5-31
5.3.2. I/O register number map (CC-Link IE Field).....	5-32
5.3.3. Flow of I/O signal	5-33
5.3.4. Input/Output	5-33
5.3.5. Output signal reset pattern	5-34
5.3.6. Specifications related to robot language	5-35
6. EtherCAT MODULE AND 2F-DQ535-EC CARD SPECIFICATIONS.....	6-37
6.1. Specification list	6-37

6.2. List of robot parameters	6-38
6.2.1. Robot controller I/O signals	6-39
6.2.2. Flow of I/O signal	6-40
6.2.3. Output signal reset pattern	6-41
6.2.4. Specifications related to robot language	6-41
7. EtherNet/IP MODULE AND 2F-DQ535-EIP CARD SPECIFICATIONS	7-42
7.1. Specification list	7-42
7.2. List of robot parameters	7-43
7.2.1. For the EtherNet/IP module	7-43
7.3. Robot controller I/O signals	7-44
7.3.1. I/O signal number map	7-44
7.3.2. Flow of I/O signal	7-46
7.3.3. Input/Output	7-46
7.3.4. Output signal reset pattern	7-47
7.3.5. Specifications related to robot language	7-48
8. PROFINET IO MODULE AND 2F-DQ535-PN CARD SPECIFICATIONS.....	8-50
8.1. Specification list	8-50
8.2. List of robot parameters	8-51
8.3. Robot controller I/O signals	8-52
8.3.1. I/O signal number map	8-52
8.3.2. Flow of I/O signal	8-52
8.3.3. Input/Output	8-52
8.3.4. Output signal reset pattern	8-53
8.3.5. Specifications related to robot language	8-54
9. ITEMS TO BE CHECKED BEFORE USING THIS PRODUCT	9-56
9.1. Checking the Product.....	9-56
9.2. Devices to be Prepared by the Customer	9-61
10.HARDWARE SETTINGS.....	10-63
10.1. Module Mounting Procedures	10-63
10.2. Hardware Setting of the Card	10-66
11.CONNECTIONS AND WIRING	11-67
11.1. Mounting Network Base Card on Robot Controller	11-67
11.1.1. CR800-D controller	11-67
11.1.2. CR860-D controller	11-68
11.2. Wiring.....	11-70
11.2.1. For the CC-Link IE TSN module.....	11-70
11.2.2. For the CC-Link IE Field module	11-71
11.2.3. For the EtherCAT module	11-73
11.2.4. For the EtherNet/IP module	11-74
11.2.5. For the PROFINET IO module	11-77
12.PROCEDURES FOR STARTING OPERATION	12-80
12.1. Setting the Parameters	12-82
12.1.1. For the CC-Link IE TSN module.....	12-82
12.1.2. For the CC-Link IE Field module	12-90
12.1.3. For the EtherCAT	12-96
12.1.4. For the EtherNet/IP	12-108

12.1.5. For the PROFINET IO	12-113
12.2. Checking the I/O Signals.....	12-133
12.2.1. For the CC-Link IE TSN module.....	12-133
12.2.2. For the CC-Link IE Field module	12-136
12.2.3. For the EtherCAT	12-139
12.2.4. For the EtherNet/IP	12-142
12.2.5. For the PROFINET IO.....	12-144
12.3. Execution of robot program	12-148
12.3.1. Setting the dedicated input/output.....	12-148
12.3.2. General-purpose input/outputss	12-148
12.3.3. Example of robot program creation (using general-purpose input/output).....	12-149
12.3.4. Sample program for input/output confirmation	12-151
13.TROUBLESHOOTING	13-153
13.1. List of Errors.....	13-153
14.APPENDIX	14-155
14.1. Displaying the Option Card Information	14-155
14.2. Pseudo-input Function	14-160
14.3. Replacing network base cards	14-161
14.3.1. Replacing the 2D-TZ535 card with the 2F-DQ535-EIP card	14-161
14.3.2. Replacing the 2D-TZ535-PN card with the 2F-DQ535-PN card.....	14-161

1. BEFORE USE

This chapter describes items to be checked and precautions to be taken before using the network base card 2F-DQ535-TSN, 2F-DQ535, 2F-DQ535-EC, 2F-DQ535-EIP, or 2F-DQ535-PN.

1.1. Terminology

Table 1-1 Terminology

Term	Explanation
CC-Link IE TSN	CC-Link IE TSN is a network that can mix information communication with IT systems while ensuring real-time control through the cyclic communication. TSN (Time Sensitive Networking) consists of multiple international standards, including time synchronization and time division methods. Adding these methods to Ethernet technology enables control communication and information communication to be mixed, which was not possible with conventional Ethernet communication.
CC-Link IE Field	CC-Link IE Field Network is an all-around field network based on Gigabit Ethernet that integrates the controller-distributed control, I/O control, safety control, and motion control. It enables flexible wiring with the topology such as star, line, or ring depending on the production line or the layout of equipment or devices. This robot controller can communicate with the master station as a slave station (intelligent device station) in CC-Link IE Field Network using I/O signals (bit device) or periodic communication (cyclic transmission) of I/O registers (word device). * Non-periodic communication (transient transmission) is not supported (as of April 2016).
EtherCAT	EtherCAT is an industrial Ethernet technology in which the frame structure and physical layer defined by the Ethernet standard IEEE 802.3 are used. Using the network base card (2F-DQ535-EC) and the EtherCAT module manufactured by HMS Industrial Network enables the process data communication in the Free-run mode. * The synchronous transmission (sync function) using Distributed Clock (DC) is not supported (as of December 2018). In this manual, the Ethernet cable used for EtherCAT is called the EtherCAT cable. Refer to the following. https://www.ethercat.org/en/technology.html
Process data	"Collection of application objects designated to be transferred cyclically or acyclically for the purpose of measurement and control" (definition in 3.3.38 in Part 5 of the EtherCAT specification)
PDO	"Structure described by mapping parameters containing one or several process data entities" (definition in 3.3.39 in Part 5 of the EtherCAT specification)
ESI	EtherCAT Slave Information Provided in an xml file. EtherCAT slave information: ESI For details, refer to specification documents such as ETG.2000 S (R) V1.0.10.
M40	Communication module manufactured by HMS Industrial Networks For details, refer to the following. < https://www.anybus.com/products/embedded-index/anybus-compactcom-modules >
ODVA	Abbreviation of Open DeviceNet Vendor Association. A non-profit organization in the United States established by development vendors to globally promote Common Industrial Protocol (CIP) technology and products incorporating this technology.

1 BEFORE USE

Term	Explanation
CIP	Abbreviation of Common Industrial Protocol, a common protocol used in the OSI application layer for industrial purposes. This protocol is common for EtherNet/IP which handles information-related information, DeviceNet which handles device-related information, and CompoNet which controls sensors and actuators.
EtherNet/IP	An industrial network standard using commercially available Ethernet communication chips and physical media. "IP" stands for Industrial Protocol. An open protocol is used in the application layer.
DeviceNet	A connection method promoted by ODVA. It is used to connect control devices and field devices such as personal computers, PLCs, sensors, and actuators.
CompoNet	A global network for sensors and actuators promoted by ODVA. This network has the following advantages which were not previously possible with conventional networks. <ul style="list-style-type: none">· High-speed response· A large number of nodes to share small amounts of data· Runs on general-purpose cables· Reduces wiring labor
PI	Abbreviation of PROFIBUS & PROFINET International
PROFINET	This is a communication standard for automation made by PI (PROFIBUS & PROFINET International) made. This is specified in the international standards IEC 61158 and IEC 61784. There are two types of PROFINET: PROFINET CBA and PROFINET IO.

1.2. How to Use the Instruction Manual

This manual is organized as follows and describes functions of the network base cards (2F-DQ535-TSN, 2F-DQ535, 2F-DQ535-EC, 2F-DQ535-EIP, and 2F-DQ535-PN). For information on the functions and operations of standard robot controllers, refer to the instruction manual included with the robot controller.

Table 1-2 Contents of the instruction manual

Chapter	Title	Description
1	Before Use	Chapter 1 describes how to use this manual (Network Base Card Instruction Manual). Please read here before actually starting to use the network base card.
2	Flow of Operations	Chapter 2 describes the operations required to configure a network system. Make sure to perform all of the required operations.
3	Features of Network Base Card	Chapter 3 describes the features of the network base card and the features when a communication module is mounted.
4	2F-DQ535-TSN Network Base Card Specifications	Chapter 4 describes the specifications of the 2F-DQ535-TSN network base card.
5	2F-DQ535 Network Base Card Specifications	Chapter 5 describes the specifications of the 2F-DQ535 network base card.
6	2F-DQ535-EC Card and EtherCAT Module Specifications	Chapter 6 describes the specifications of the 2F-DQ535-EC network base card (when the EtherCAT module is mounted).
7	2F-DQ535-EIP Network Base Card Specifications	Chapter 7 describes the specifications of the 2F-DQ535-EIP network base card (when the EtherNet/IP module is mounted).
8	2F-DQ535-PN Network Base Card Specifications	Chapter 8 describes the specifications of the 2F-DQ535-PN network base card (when the PROFINET IO module is mounted).
9	Items to Be Checked Before Using This Product	Before purchasing any of the network base cards (2F-DQ535-TSN, 2F-DQ535, 2F-DQ535-EC, 2F-DQ535-EIP, and 2F-DQ535-PN), check the version of the robot controller and that you have all the required devices.
10	Hardware Settings	This product has no hardware settings.
11	Connections and Wiring	Chapter 11 describes how to connect the network base card and the master station using cables.
12	Procedures for Starting Operation	Chapter 12 describes the procedures up to operating the network system with the module mounted.
13	Troubleshooting	Chapter 13 describes how to resolve problems that may occur when using the network base card, such as malfunctions and errors. Please refer to this chapter as needed.
14	Appendix	Chapter 14 describes the methods of displaying the network base card information with RT ToolBopx3.

2. FLOW OF OPERATIONS

The flowchart below shows the flow of operations necessary for configuring a network base card system. Use it as a reference to perform the required operations without any excess or deficiency.

2.1. Work Procedures

- 1 Determining the Network Specifications See Chapters 3 and 8 of this manual.
With an understanding of the network base card and communication module specifications, determine the interface related to the system signals using the communication module. (For example, assignment of dedicated I/O signals, specification of general-purpose I/O signals).

- 2 Checking Products See Chapter 9 of this manual.
Check the product you have purchased and prepare other products as needed.

- 3 Mounting Module onto Network Base Card See Section 10.1 of this manual.
Mount a communication module on the network base card.

- 4 Setting Hardware and Mounting onto Robot Controller See Section 10.2 of this manual.
Since the hardware has no settings, mount the network base card on the robot controller as it is.

- 5 Wiring and Connections See Chapter 11 of this manual.
Wire the network base card mounted on the robot controller to the master station using an Ethernet cable.

- 6 Setting Master Station Parameters See Chapter 12 of this manual.
Set the IP address with the master station.

- 7 Setting Robot Controller Parameters See Chapter 12 of this manual.
Set the IP address on the robot controller side.

- 8 Creating Robot Programs See Section 12.3 of this manual.
Create a robot program, and run it with automatic operation.

- 9 Troubleshooting See Chapter 13 of this manual.

- 10 Completion of Operations

3. FEATURES OF NETWORK BASE CARD

CC-Link IE TSN

CC-Link IE Field

EtherCAT

EtherNet/IP

PROFINET IO

3.1. What is a Network Base Card?

The network base card is an optional card for the robot controller.

By mounting a HMS's Anybus-CompactCom module on the card, various communication interfaces can be realized.

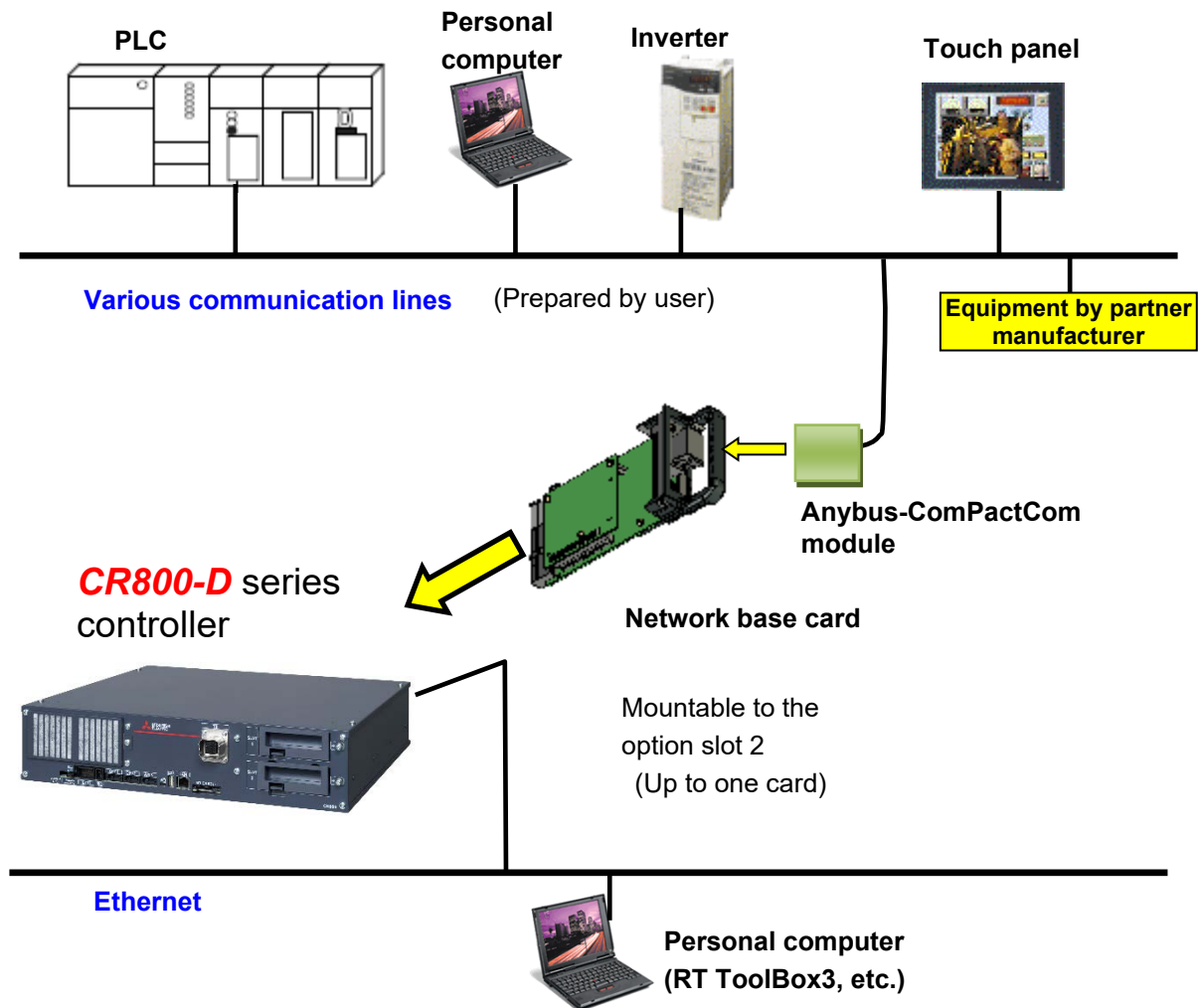


Figure 3-1 Example of configuring CC-Link IE Field with network base card

3.2. Mountable Modules

Anybus CompactCom M40 Modules (without housing) manufactured by HMS Industrial Network can be mounted.

The modules which can be mounted on the network base card are shown below.



Mountable module	2F-DQ535-TSN card	CC-Link IE TSN module (AB6714-C-106) Compatible with V .1.06.01 or later
	2F-DQ535 card	CC-Link IE Field module (AB6709-B-116, AB6709-C-118)
	2F-DQ535-EC card	EtherCAT module (AB6707-D-224, AB6707-E-224) Compatible with V.2.09.01 or later
	2F-DQ535-EIP card	EtherNet/IP module (AB6704-D-161, AB6704-E-161) Compatible with V.1.61 or later
	2F-DQ535-PN card	PROFINET IO module (AB6705-D-210, AB6705-E-210) Compatible with V.2.10 or later

3.3. Features when Module is Mounted

CC-Link IE TSN

3.3.1. Features when CC-Link IE TSN module is mounted

The following features are enabled when the CC-Link IE TSN module is mounted on the 2F-DQ535 card.

(1) Connection

Connection to CC-Link IE TSN Network is enabled.

CC-Link IE TSN is a network that can mix information communication with IT systems while ensuring real-time control through the cyclic communication. The CR800-D can be used as a CC-Link IE TSN remote station to communicate with the CC-Link IE TSN master station. In addition, CC-Link IE TSN enables the construction of a network that supports various topologies, so a flexible IoT system can be constructed.

(2) Transmission style

IEEE 802.3ab (1000BASE-T) Ethernet standard compatible, shielded twisted pair cable (Category 5e), RJ-45 connector

(3) Data

A maximum of 256-byte data communication for inputs and outputs using real-time I/O signals (bit devices) and a maximum of 512 word (1024-byte) data communication using I/O registers (word devices) is possible. The allocation can be set with parameters described later.

Example 1) 128 bits (16 bytes) for input signals, 64 words (128 bytes) for input registers, 144 bytes in total

128 bits (16 bytes) for output signals, 64 words (128 bytes) for output registers, 144 bytes in total

Example 2) 2048 bits (256 bytes) for input signals, 0 words (0 bytes) for input registers, 256 bytes in total

2048 bits (256 bytes) for output signals, 0 words (0 bytes) for output registers, 256 bytes in total

(4) The table below shows differences of the functions available when the CC-link IE TSN module is used and those available with the standard Ethernet interface of the robot controller.

No.	Function name		Explanation	CC-Link IE TSN module	Standard Ethernet interface
1	General-purpose I/O signal		Handling of data using I/O signals and I/O registers via Ethernet. *For details of the data, refer to (3) above.	●	-
2	TCP/IP communication	Communication with computer	Communication with RT ToolBox3 via Ethernet	-	●
3		Data link	Communication with other devices, such as a network vision sensor, via Ethernet	-	●
4		Real-time external control	Robot control from a personal computer, etc.	-	●

**CAUTION**

Only cyclic transmission is supported. Transient transmission is not supported.

Although two types of transmission, cyclic transmission (periodic) and transient transmission (non-periodic), are possible, this controller does not support the transient transmission (as of February 2025).

**CAUTION**

"Communication cycle interval setting" for the network that this module joins must be set to 1000 μ s or longer.

This module does not support communication when multiple cycles coexist. Since "Communication Period Setting" can only be set to "Basic Period", if this module joins a network that includes high-frequency devices, "Communication Period Interval Setting" for those devices must be 1000 μ s or longer.

CC-Link IE Field

3.3.2. Features when CC-Link IE Field module is mounted

The following features are enabled when the CC-Link IE Field module is mounted on the 2F-DQ535 card.

(1) Connection

Connection to CC-Link IE Field Network is enabled.

CC-Link IE Field Network is an all-around field network based on Gigabit Ethernet that integrates the controller-distributed control, I/O control, safety control, and motion control.

It enables flexible wiring with the topology such as star, line, or ring depending on the production line or the layout of equipment or devices.

(2) Transmission style

IEEE 802.3ab (1000BASE-T) Ethernet standard compatible, shielded twisted pair cable (Category 5e), RJ-45 connector

(3) Data

A maximum of 256-byte data communication for inputs and outputs using real-time I/O signals (bit devices) and a maximum of 512 word (1024-byte) data communication using I/O registers (word devices) is possible. The allocation can be set with parameters described later.

Example 1) 128 bits (16 bytes) for input signals, 64 words (128 bytes) for input registers, 144 bytes in total
128 bits (16 bytes) for output signals, 64 words (128 bytes) for output registers, 144 bytes in total

Example 2) 2048 bits (256 bytes) for input signals, 0 words (0 bytes) for input registers, 256 bytes in total
2048 bits (256 bytes) for output signals, 0 words (0 bytes) for output registers, 256 bytes in total

(4) The table below shows differences of the functions available when the CC-link IE Field module is used and those available with the standard Ethernet interface of the robot controller.

No.	Function name		Explanation	CC-Link IE Field module	Standard Ethernet interface
1	General-purpose I/O signal		Handling of data using I/O signals and I/O registers via Ethernet. *For details of the data, refer to (3) above.	●	-
2	TCP/IP communication	Communication with computer	Communication with RT ToolBox3 via Ethernet	-	●
3		Data link	Communication with other devices, such as a network vision sensor, via Ethernet	-	●
4		Real-time external control	Robot control from a personal computer, etc.	-	●

 CAUTION

Only cyclic transmission is supported. Transient transmission is not supported.

Although two types of transmission, cyclic transmission (periodic) and transient transmission (non-periodic), are possible, this controller does not support the transient transmission (as of April 2017).

3.3.3. Features when EtherCAT module is mounted

The following features are enabled when the EtherCAT module is mounted on the 2F-DQ535-EC card.

(1) Connection

Communication with the EtherCAT master station is enabled using the CR800-D as the EtherCAT slave station device.

(2) Transmission style

Use the IEEE 802.3ab (100BASE-T) Ethernet standard compatible, shielded twisted pair cable (Category 5e) and the RJ-45 connector.

(3) Data

RX and RY values (I/O signal 6000 to 6255) and RWw and RWr values (I/O register 6000 to 6127) are transferred as process data.

The size of the transferred data is determined by specifying the number of stations using the parameter of the robot controller. (For details, refer to "[6.2.1 Robot controller I/O signals](#)" described later.)

(4) The table below shows differences between the functions available when the EtherCAT module is used and those available with the standard Ethernet interface of the robot controller.

No.	Function name		Explanation	EtherCAT module	Standard Ethernet interface
1	General-purpose I/O signal		Handling of data using I/O signals and I/O registers by EtherCAT. * For details of the data size, refer to (3) above.	●	-
2	TCP/IP communication	Communication with computer	Communication with RT ToolBox3 via Ethernet	-	●
3		Data link	Communication with other devices, such as a network vision sensor, via Ethernet	-	●
4		Real-time external control	Robot control from a personal computer, etc.	-	●



CAUTION

The sync function is not supported.

Only the cyclic transmission in the Free-run mode is supported.

(The synchronization function by DC (Distributed Clock) of the master station is not supported.)

3.3.4. Features when EtherNet/IP module is mounted

The following features are enabled when the EtherNet/IP module is mounted on the 2F-DQ535-EIP card.

(1) Connection

Connection to EtherNet/IP network is enabled.

EtherNet/IP is one of three official network standards (DeviceNet, ControlNet, and EtherNet/IP), and uses the "Common Industrial Protocol" (CIP) application layer.

Control from a field level and the direct connection of automation products on a factory level are enabled by this common application layer, open software, and hardware interfaces.

This is also called "Industrial Ethernet".

(2) Transmission style

10/100Mbps (Semi/full duplex transmission supported)

(3) Data

Real-time I/O data (max. 2048 points each) transmission/reception is possible using UDP/IP.

(4) The table below shows differences between the functions available when the EtherNet/IP module is used and those available with the standard Ethernet interface of the robot controller.

No.	Function name		Explanation	EtherNet/IP module	Standard Ethernet interface
1	General-purpose I/O signal		Handles up to 2048 input and output signals via Ethernet.	●	-
2	TCP/IP communication	Communication with computer	Communication with RT ToolBox3 via Ethernet	-	●
3		Data link	Communication with other devices, such as a network vision sensor, via Ethernet	-	●
4		Real-time external control	Robot control from a personal computer, etc.	-	●

3.3.5. Features when PROFINET IO module is mounted

The following features are enabled when the PROFINET IO module is mounted on the 2F-DQ535-PN card.

(1) Connection

Connection to PROFINET network is enabled.

PROFINET is a strong network based on industrial Ethernet that achieves simultaneous real-time communication and IT communication using the automation communication standard developed by PI.

(2) Transmission style

10/100Mbps (Semi/full duplex transmission supported)

(3) Data

Real-time I/O data (max. 2040 points each) transmission/reception is possible.

(4) The table below shows differences between the functions available when the PROFINET IO module is used and those available with the standard Ethernet interface of the robot controller.

No.	Function name		Explanation	PROFINET IO module	Standard Ethernet interface
1	General-purpose I/O signal		Handles up to 2040 input and output signals via Ethernet.	●	-
2	TCP/IP communication	TCP/IP communication	Communication with RT ToolBox3 via Ethernet	-	●
3		Data link	Communication with other devices, such as a network vision sensor, via Ethernet	-	●
4		Real-time external control	Robot control from a personal computer, etc.	-	●

3.4. Hardware

CC-Link IE TSN	CC-Link IE Field
EtherCAT	EtherNet/IP
PROFINET IO	

The network base card hardware is explained in this section. An Anybus-CC module is mounted on the network base card.

3.4.1. Card overview

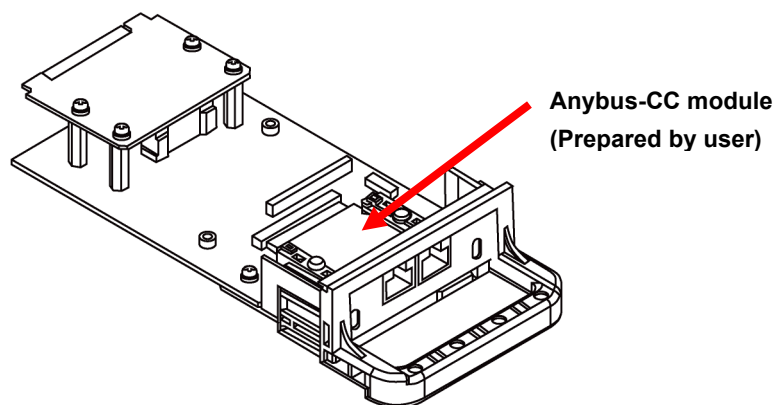


Figure 3-2 Overall view of 2F-DQ535-TSN/2F-DQ535/2F-DQ535-EC/2F-DQ535-EIP/2F-DQ535-PN cards

3.4.2. LED

There are four LEDs on the card, and the operating state of the interface card can be confirmed by the on/off state of each LED.

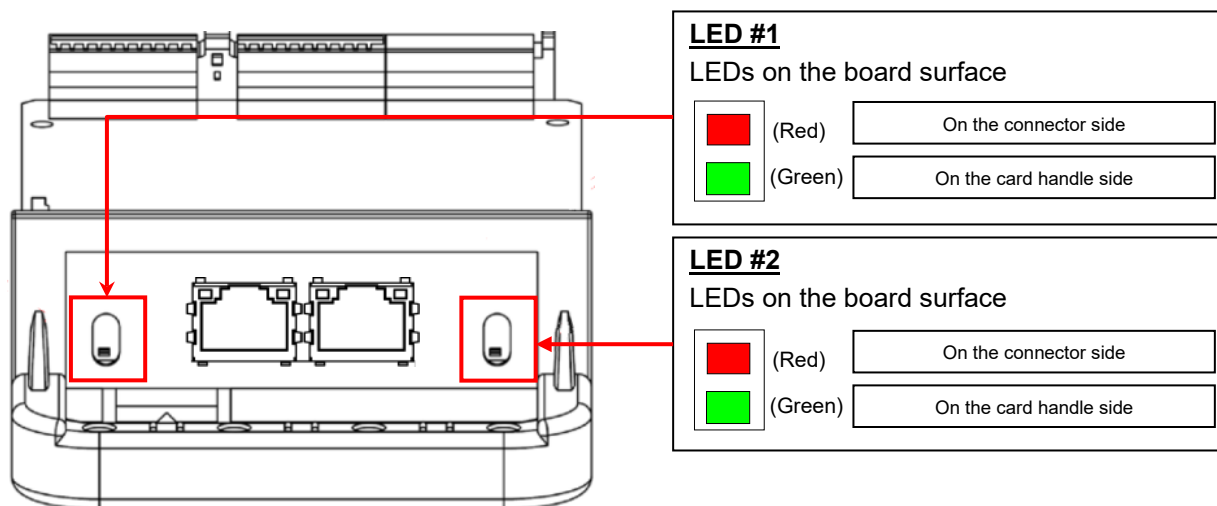


Figure 3-3 Layout of LEDs

When the card is powered, all LEDs (both LED#1 and LED#2) turn on. They remain on until the control by the robot controller software starts. (The operation is the same regardless of the type of the mounted module.) After the control by the robot controller software starts, the LED indication changes according to the module type.

3 FEATURES OF NETWORK BASE CARD

The meaning of each LED on, flash and off state is shown below.
Please confirm specifications of the HMS Co. about details.

Specifications when the CC-Link IE TSN module is mounted

LED#1 (DLINK LED): Reflects network status and CC-Link IE TSN device status.

LED#2 (Error LED): Displays Anybus status and CC-Link IE TSN communication errors.

CC-Link IE TSN

The following table describes what the combination of the two LED status indicates.

Table 3-1 LED status list(When CC-Link IE TSN module is mounted)

LED#1 status	LED#2 status	Details
Off	Off	SETUP and NWINIT The module is starting up.
Green (flash)	Off	WAIT_PROCESS The module is on but does not have a connection to the master.
Green (flash once)	Off	IDLE The module is on and connected to the master, no process data is being exchanged.
Green (on)	Off	PROCESS_ACTIVE The module is on and connected to the master, process data is being exchanged.
Off	Red (flash)	ERROR The module has detected a network error.
Off	Red (on)	IP Duplication or EXCEPTION The module has detected an IP address duplication, or the module has entered an exception state.
Red (on)	Red (on)	Fatal Event The module has entered a non recoverable state.

Specifications when the CC-Link IE Field module is mounted

CC-Link IE Field

Table 3-2 LED Status (When CC-Link IE Field module is mounted)

LED#1: Network Status LED

LED status	Details
Off	Power is not ON, or there is no IP address.
Green (on)	Online with one or more connections established (CIP Class 1 or 3).
Red (on)	IP address duplicate, FATAL error.

LED#2 : Module Status LED

LED status	Details
Off	Power is not ON.
Green (on)	Controlling with RUN state scanner.
Red (on)	Serious error (EXCEPTION state, FATAL error, etc.).

Specifications when the EtherCAT module is mounted



Table 3-3 LED Status (When EtherCAT module is mounted)

LED#1: RUN LED

Indicates the status of the EtherCAT communication.

LED status	Details
Off	The EtherCAT device is in the 'INIT' state.
Green (on)	The EtherCAT device is in the 'OPERATIONAL' state. (The communication channel is established.)
Green (flash)	The EtherCAT device is in the 'PRE-OPERATIONAL' state.
Green (flash once)	The EtherCAT device is in the 'SAFE-OPERATIONAL' state.
Green (flicker)	The EtherCAT device is in the 'BOOT' state.

After the robot controller software starts to control the card board, LED#1 operates as the "RUN" LED of the EtherCAT device.

LED#2 : ERR LED

Indicates the communication error of EtherCAT and others.

LED status	Details
Off	No error is occurring.
Red (flash)	Because the setting of the register or object is disabled, the state cannot be changed to the one sent from the master.
Red (flash once)	The application of the slave device autonomously changed the state of EtherCAT.
Red (flash twice)	The sync manager watchdog has timed out.
Red (on)	Serious error (EXCEPTION state, FATAL error, and others)
Red (flicker)	An error occurs while booting.

After the robot controller software starts to control the card board, LED#2 operates as the "ERR" LED of the EtherCAT device.

· The flash cycle and duty cycle of the flash operation conform to the EtherCAT standard ETG.1300 S (R) V1.1.0 (EtherCAT Indicator and Labeling).

· The operation before the robot controller software starts to control the board does not conform to the ETG.1300 standard.
(All the LEDs turn on.)

Specifications when the EtherNet/IP module is mounted

EtherNet/IP**Table 3-4 LED Status (When EtherNet/IP module is mounted)**

LED#1: Network Status LED

LED status	Details
Off	Power is not ON, or there is no IP address.
Green (on)	Online with one or more connections established (CIP Class 1 or 3).
Green (flash)	Online with no connection established.
Red (on)	IP address duplicate, FATAL error.
Red (flash)	One or more connection timeouts (CIP Class 1 or 3)

LED#2 : Module Status LED

LED status	Details
Off	Power is not ON.
Green (on)	Controlling with RUN state scanner.
Green (flash)	Not configured or scanner is idle.
Red (on)	Serious error (EXCEPTION state, FATAL error, etc.).
Red (flash)	Recoverable error.

**CAUTION**

The LED status of LED#1 and LED#2 changes depending on the LED test based on EtherNet/IP specifications.

The LED test based on EtherNet/IP specifications will start before a communication channel is established after the robot controller power is turned ON. Once the LED test is complete, LED#1 and LED#2 will acquire the LED status of the specifications above.

During the LED test, the LED status will change as indicated by (1) to (5) below.

- (1) LED#1 off and LED#2 green (on) for 0.25 seconds
- (2) LED#1 off and LED#2 red (on) for 0.25 seconds
- (3) LED#1 green (on) and LED#2 green (on) for 0.25 seconds
- (4) LED#1 red (on) and LED#2 green (on) for 0.25 seconds
- (5) LED#1 off and LED#2 green (on) for 0.25 seconds

Specifications when the PROFINET IO module is mounted

PROFINET IO**Table 3-5 LED Status (When PROFINET IO module is mounted)**

LED#1: Network Status LED

LED status	Details
Off	Master power is not ON or no IP address.
Green (on)	Connection with master established and in RUN state.
Green (flash once)	Connection with master established, master in STOP state or IO data bad, or IRT synchronization not finished.
Green (flash)	Used by engineering tools to identify slave stations. (DCP identify)
Red (on)	Status when major internal error occurs. * This indication will be on in combination with a red module status LED.
Red (flash once)	The station name is not set. (Station name error)
Red (flash twice)	The IP address is not set. (IP address error)
Red (flash twice)	Expected identification differs from real identification. (Setting error)

LED#2 : Module Status LED

LED status	Details
Off	Master power is not ON or module in SETUP or NW_INIT state.
Green (on)	Module has shifted from the NW_INIT state.
Green (flash once)	Diagnostic event(s) present.
Red (on)	Module in EXCEPTION state. (Exception error) Status when major internal module error occurs. (Fatal event) * This LED will be on in combination with a red Network status LED.
Alternating red/green	Firmware updating Do not power off the module. Turning the module off during this phase could cause serious damage.

! CAUTION

It takes some time for the communication line to be established after the robot controller power is turned ON.

It takes about 30 seconds to 1 minute for the communication channel to be established after the robot controller power is turned ON.

If automatic operation is started immediately after turning the power ON, L6130 (network communication error) will occur. Wait for a short time before starting automatic operation.

! CAUTION

It takes some time for the communication line to be established after the cable is connected.

It may take about one minute for the communication channel to be established after the cable is connected to the Anybus-CC module on the card.

3.5. Software configurations

The software configuration of this product is shown below.

3.5.1. For the CC-Link IE TSN module



Table 3-6 Compatible versions

Name		Version
Robot controller		Version E4 or later
Teaching pendant	R32TB	1.0 or later
	R56TB	1.0 or later
	R86TB	1.0 or later
Personal computer support software		RT ToolBox3
		1.0 or later

3.5.2. For the CC-Link IE Field module



Table 3-7 Compatible versions

Name		Version
Robot controller		Version A1 or later
Teaching pendant	R32TB	1.0 or later
	R56TB	1.0 or later
Personal computer support software		RT ToolBox3
		1.0 or later

3.5.3. For the EtherCAT module



Table 3-8 Compatible versions

Name		Version
Robot controller		Version A3b or later
Teaching pendant	R32TB	1.0 or later
	R56TB	4.0 or later
Personal computer support software		RT ToolBox3
		1.32J or later

3.5.4. For the EtherNet/IP module



Table 3-9 Compatible versions

Name		Version
Robot controller		E2 or later
Teaching pendant	R32TB	1.0 or later
	R56TB	1.0 or later
	R86TB	1.0 or later
Personal computer support software		RT ToolBox3
		1.0 or later

3.5.5. For the PROFINET IO module



Table 3-10 Compatible versions

Name		Version
Robot controller		E2 or later
Teaching pendant	R32TB	1.0 or later
	R56TB	1.0 or later
	R86TB	1.0 or later
Personal computer support software		RT ToolBox3
		1.0 or later

4. CC-Link IE TSN MODULE AND 2F-DQ535-TSN CARD SPECIFICATIONS

CC-Link IE TSN

4.1. Specifications list

The specifications which apply when the CC-Link IE TSN module is mounted on the 2F-DQ535-TSN card are shown below.

Table 4-1 2F-DQ535-TSN card specifications

Item		Specification	Remarks
Option name		2F-DQ535-TSN	
Network base interface card board model		2F-DQ535	
Mountable expansion option slot		Slot 2	
Number of cards that can be mounted in the expansion option slot		1 card (*1)	
Coexistence with other fieldbus (CC-Link / PROFIBUS / DeviceNet / FROFINET / CC-Link IE Field / EtherCAT / EtherNet/IP)		Not possible (*2)	Parallel I/O interface card (TZ368/TZ378) can coexist.
Coexistence with Parallel I/O interface card		Possible	
Coexistence with MELFA Smart Plus card		Possible	
Combined use with CC-Link IE Field Basic		Not possible	(*3)
Transmission specifications	CC-Link IE TSN Class	Class B	
	Communication method	Time division method	
	Transmission path style	Star type or line type	The star type requires an industrial switching hub (CC-Link IE TSN Class B compatible).
	Transmission speed	1Gbps/100Mbps	100Mbps is supported only for the line type.
	Transmission medium	Twisted pair cable	1000BASE-T standard-compliant Ethernet cable: Category 5e or higher, (double shielded / STP) straight cable
	Connector specifications	Shielded RJ45 connector compatible with ANSI/TIA/EIA-568-B (Category 5e)	
	Transmission distance	100m (compatible with ANSI/TIA/EIA-568-B (Category 5e))	Machine cable length
	Maximum number of networks	239	
	Number of connected nodes per network	121 units (Master station: 1 / Remote station: 120 expansion modules included)	This product is only compatible with remote stations

Item		Specification	Remarks
Transmission specifications	Communication cycle interval (minimum value)	1000 μ s(*4)	
	Communication cycle setting	"Basic Period" only	"Normal-Speed" and "Low-Speed" cannot be set.
Communication function	Cyclic communication	Yes	
Number of I/O communication points per robot controller	Send	Signal: Maximum 2048 points Register: Maximum 512 points	
	Receive	Signal: Maximum 2048 points Register: Maximum 512 points	
Start I/O number of robot controller		Address 6000 and later	I/O registers can be assigned.
MELFA BASIC	I/O signal access	M_In/M_InB/M_In8/M_InW/M_In16/M_In32 M_Out/M_OutB/M_Out8/M_Out16/M_Out32	Handled as general I/O area
RT ToolBox3	Option information read	Yes	

(*1) Installing multiple TZ535/DQ535 cards will cause an error. (Error 6110)

(*2) An error will occur if CC-Link/PROFIBUS/DeviceNet/PROFINET/CC-Link IE Field/EtherCAT/EtherNet/IP coexists. (Error 6111)

(*3) When used together, CC-Link IE TSN will be given priority. (No error occurs, and the transmission status of CC-Link IE Field Basic becomes "Unfixed")

(*4) When this module joins the network, [Communication Period Interval Setting] for all devices including high-frequency devices must be set to 1000 μ s or longer.

4.2. List of robot parameters

CC-Link IE TSN

Table 4-2 List of robot parameters related to CC-Link IE TSN

Parameter name	Initial value	Setting range	Unit	Explanation
STOP2	-1,-1	-1/ 6000 to 8047	-	Parameter which sets a dedicated input signal number for stopping the robot program. (Parameter "STOP" is fixed to "0", so "STOP2" is used with the 2F-DQ535-TSN card to define a stop signal from an external source.)
ORST6000 ORST6032 : ORST8016	00000000, 00000000, 00000000, 00000000	0/1/*	-	Set the output transmission data used in the 2F-DQ535-TSN card when resetting the signal output. For details on the setting, refer to " 4.3.5 Output signal reset pattern ".
TSNIP	192.168.3.1	0.0.0.0 to 255.255.255.255	Octet	Specify the IP address for CC-Link IE TSN.
TSNMSK	255.255.255.0	0.0.0.0 to 255.255.255.255	Octet	Specify the subnet mask for CC-Link IE TSN.
TSNGW	192.168.3.254	0.0.0.0 to 255.255.255.255	Octet	Specify the Gateway IP address for CC-Link IE TSN.
TSNINB	16	0 to 256	Byte	Set the data size in bytes for the input signals (bit devices). As 8 bits equal to 1 byte, the maximum data size for the input signals is 2048 bits, which equal to 256 bytes. Set a value in multiples of two.

Parameter name	Initial value	Setting range	Unit	Explanation
TSNOTB	16	0 to 256	Byte	Set the data size in bytes for the output signals (bit devices). As 8 bits equal to 1 byte, the maximum data size for the output signals is 2048 bits, which equal to 256 bytes. Set a value in multiples of two.
TSNDIN	64	0 to 512	Word	Set the data size for the input registers (word devices). As 1 word requires 2 bytes, the maximum data size for the input registers is 512 words. Set a value in multiples of eight.
TSNDOT	64	0 to 512	Word	Set the data size for the output registers (word devices). As 1 word requires 2 bytes, the maximum data size for the output registers is 512 words. Set a value in multiples of eight.

CAUTION

After changing the above parameters, power off the controller.

To reflect the changed parameters, always power off the controller.
Otherwise the changed parameters are not reflected.

4.3. Robot controller I/O signals

CC-Link IE TSN

The maximum data size of I/O signals (bit devices) handled in the robot controller is 2048 bits starting at address 6000 through 8047 for both input and output regardless of the CC-Link IE TSN IP address settings. The maximum data size of I/O registers (word devices) is 512 words starting at address 6000 through 6511.

The setting ranges of the I/O signals and I/O registers are limited for both input and output.

4.3.1. I/O signal number map

For the data size of the I/O signals (bit devices), set the number of bytes (1 byte = 8 bits) in the parameter for both input and output.

Set the data size from 2 to 256 bytes (1 byte is equal to 8 bits).

Table 4-3 CC-Link IE TSN signal number (bit device) table

Number of bytes	Number of points	Start	End
0	0	-	to -
2	16	6000	to 6015
4	32	6000	to 6031
6	48	6000	to 6047
8	64	6000	to 6063
10	80	6000	to 6079
12	96	6000	to 6095
14	112	6000	to 6111
16	256	6000	to 6127
18	144	6000	to 6143
20	160	6000	to 6159
22	176	6000	to 6175
24	192	6000	to 6191
26	208	6000	to 6207
28	224	6000	to 6223
30	240	6000	to 6239
32	256	6000	to 6255
34	272	6000	to 6271
36	288	6000	to 6287
38	304	6000	to 6303
40	320	6000	to 6319
42	336	6000	to 6335
44	352	6000	to 6351
46	368	6000	to 6367
48	384	6000	to 6383
50	400	6000	to 6399
52	416	6000	to 6415
54	432	6000	to 6431
56	448	6000	to 6447
58	464	6000	to 6463
60	480	6000	to 6479
62	496	6000	to 6495
64	512	6000	to 6511
66	528	6000	to 6527
68	544	6000	to 6543
70	560	6000	to 6559
72	576	6000	to 6575
74	592	6000	to 6591
76	608	6000	to 6607
78	624	6000	to 6623
80	640	6000	to 6639
82	656	6000	to 6655
84	672	6000	to 6671

Number of bytes	Number of points	Start	End
86	688	6000	to 6687
88	704	6000	to 6703
90	720	6000	to 6719
92	736	6000	to 6735
94	752	6000	to 6751
96	768	6000	to 6767
98	784	6000	to 6783
100	800	6000	to 6799
102	816	6000	to 6815
104	832	6000	to 6831
106	848	6000	to 6847
108	864	6000	to 6863
110	880	6000	to 6879
112	896	6000	to 6895
114	912	6000	to 6911
116	928	6000	to 6927
118	944	6000	to 6943
120	960	6000	to 6959
122	976	6000	to 6975
124	992	6000	to 6991
126	1008	6000	to 7007
128	1024	6000	to 7023
130	1040	6000	to 7039
132	1056	6000	to 7055
134	1072	6000	to 7071
136	1088	6000	to 7087
138	1104	6000	to 7103
140	1120	6000	to 7119
142	1136	6000	to 7135
144	1152	6000	to 7151
146	1168	6000	to 7167
148	1184	6000	to 7183
150	1200	6000	to 7199
152	1216	6000	to 7215
154	1232	6000	to 7231
156	1248	6000	to 7247
158	1264	6000	to 7263
160	1280	6000	to 7279
162	1296	6000	to 7295
164	1312	6000	to 7311
166	1328	6000	to 7327
168	1344	6000	to 7343
170	1360	6000	to 7359

Number of bytes	Number of points	Start	End
172	1376	6000	to 7375
174	1392	6000	to 7391
176	1408	6000	to 7407
178	1424	6000	to 7423
180	1440	6000	to 7439
182	1456	6000	to 7455
184	1472	6000	to 7471
186	1488	6000	to 7487
188	1504	6000	to 7503
190	1520	6000	to 7519
192	1536	6000	to 7535
194	1552	6000	to 7551
196	1568	6000	to 7567
198	1584	6000	to 7583
200	1600	6000	to 7599
202	1616	6000	to 7615
204	1632	6000	to 7631
206	1648	6000	to 7647
208	1664	6000	to 7663
210	1680	6000	to 7679
212	1696	6000	to 7695
214	1712	6000	to 7711
216	1728	6000	to 7727
218	1744	6000	to 7743
220	1760	6000	to 7759
222	1776	6000	to 7775
224	1792	6000	to 7791
226	1808	6000	to 7807
228	1824	6000	to 7823
230	1840	6000	to 7839
232	1856	6000	to 7855
234	1872	6000	to 7871
236	1888	6000	to 7887
238	1904	6000	to 7903
240	1920	6000	to 7919
242	1936	6000	to 7935
244	1952	6000	to 7951
246	1968	6000	to 7967
248	1984	6000	to 7983
250	6000	6000	to 7999
252	2016	6000	to 8015
254	2032	6000	to 8031
256	2048	6000	to 8047

4.3.2. I/O register number map

The data size for the input and output of I/O registers (word device) can be changed with the parameters. It can be set from 8 to 512 words.

Table 4-4 CC-Link IE TSN registers number (word device) table

Number of bytes	Number of points (words)	Start	End
0	0	-	to -
16	8	6000	to 6007
32	16	6000	to 6015
48	24	6000	to 6023
64	32	6000	to 6031
80	40	6000	to 6039
96	48	6000	to 6047
112	56	6000	to 6055
128	64	6000	to 6063
144	72	6000	to 6071
160	80	6000	to 6079
176	88	6000	to 6087
192	96	6000	to 6095
208	104	6000	to 6103
224	112	6000	to 6111
240	120	6000	to 6119
256	128	6000	to 6127
272	136	6000	to 6135
288	144	6000	to 6143
304	152	6000	to 6151
320	160	6000	to 6159
336	168	6000	to 6167

Number of bytes	Number of points (words)	Start	End
352	176	6000	to 6175
368	184	6000	to 6183
384	192	6000	to 6191
400	200	6000	to 6199
416	208	6000	to 6207
432	216	6000	to 6215
448	224	6000	to 6223
464	232	6000	to 6231
480	240	6000	to 6239
496	248	6000	to 6247
512	256	6000	to 6255
528	264	6000	to 6263
544	272	6000	to 6271
560	280	6000	to 6279
576	288	6000	to 6287
592	296	6000	to 6295
608	304	6000	to 6303
624	312	6000	to 6311
640	320	6000	to 6319
656	328	6000	to 6327
672	336	6000	to 6335
688	344	6000	to 6343

Number of bytes	Number of points (words)	Start	End
704	352	6000	to 6351
720	360	6000	to 6359
736	368	6000	to 6367
752	376	6000	to 6375
768	384	6000	to 6383
784	392	6000	to 6391
800	400	6000	to 6399
816	408	6000	to 6407
832	416	6000	to 6415
848	424	6000	to 6423
864	432	6000	to 6431
880	440	6000	to 6439
896	448	6000	to 6447
912	456	6000	to 6455
928	464	6000	to 6463
944	472	6000	to 6471
960	480	6000	to 6479
976	488	6000	to 6487
992	496	6000	to 6495
1008	504	6000	to 6503
1024	512	6000	to 6511

4.3.3. Flow of I/O signal

The mapping for the master and robot signals is shown below.

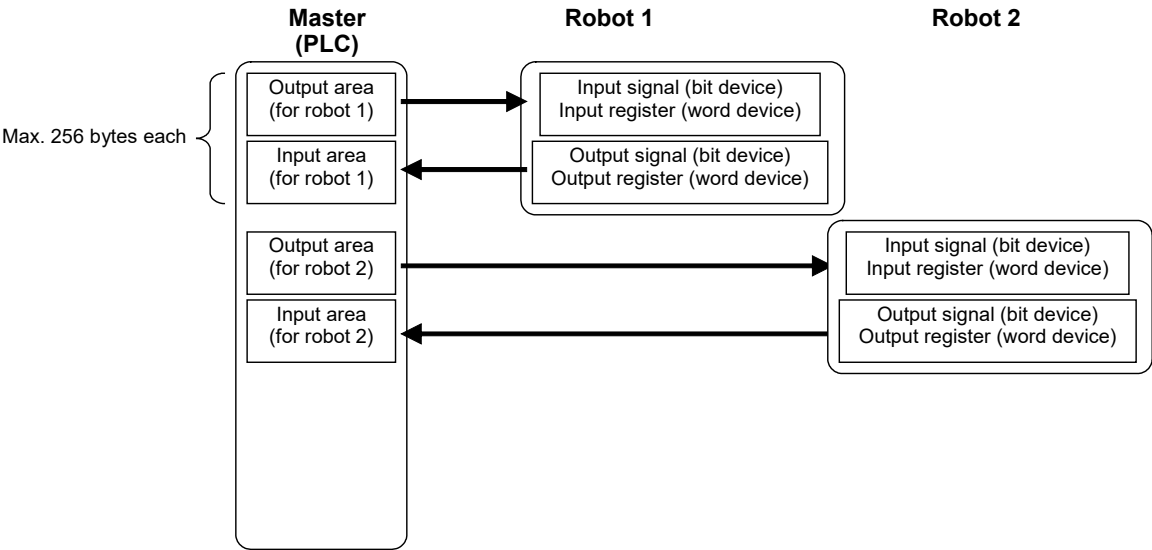


Figure 4-1 Flow of I/O signal

4.3.4. Input/Output

Dedicated inputs and outputs can be used by assigning the signal numbers of the 2F-DQ535-TSN card to the dedicated I/O signal parameters. Refer to "6 External Input/Output Functions" in the separate "Instruction Manual, Detailed Explanation of Functions and Operations" for details on using the dedicated inputs and outputs.

4.3.5. Output signal reset pattern

In the factory setting, all general-purpose output signals start at OFF (0). The status of the general-purpose output signal at power ON can be changed by changing the following parameters. These parameters are also used for the general-purpose output signal reset operation (executed with dedicated input signal, etc.) and for the reset pattern when the "Clr" instruction is executed.

The settings are [OFF], [ON] and [Hold]. A list of general-purpose output reset parameters related to the 2F-DQ535-TSN card is given below.

Table 4-5 List of output signal reset pattern parameters (No. 6000 to 8047)

Parameter name	Start number	End number	Parameter name	Start number	End number
ORST6000	6000	6031	ORST7024	7024	7055
ORST6032	6032	6063	ORST7056	7056	7087
ORST6064	6064	6095	ORST7088	7088	7119
ORST6096	6096	6127	ORST7120	7120	7151
ORST6128	6128	6159	ORST7152	7152	7183
ORST6160	6160	6191	ORST7184	7184	7215
ORST6192	6192	6223	ORST7216	7216	7247
ORST6224	6224	6255	ORST7248	7248	7279
ORST6256	6256	6287	ORST7280	7280	7311
ORST6288	6288	6319	ORST7312	7312	7343
ORST6320	6320	6351	ORST7344	7344	7375
ORST6352	6352	6383	ORST7376	7376	7407
ORST6384	6384	6415	ORST7408	7408	7439
ORST6416	6416	6447	ORST7440	7440	7471
ORST6448	6448	6479	ORST7472	7472	7503
ORST6480	6480	6511	ORST7504	7504	7535
ORST6512	6512	6543	ORST7536	7536	7567
ORST6544	6544	6575	ORST7568	7568	7599
ORST6576	6576	6607	ORST7600	7600	7631
ORST6608	6608	6639	ORST7632	7632	7663
ORST6640	6640	6671	ORST7664	7664	7695
ORST6672	6672	6703	ORST7696	7696	7727
ORST6704	6704	6735	ORST7728	7728	7759
ORST6736	6736	6767	ORST7760	7760	7791
ORST6768	6768	6799	ORST7792	7792	7823
ORST6800	6800	6831	ORST7824	7824	7855
ORST6832	6832	6863	ORST7856	7856	7887
ORST6864	6864	6895	ORST7888	7888	7919
ORST6896	6896	6927	ORST7920	7920	7951
ORST6928	6928	6959	ORST7952	7952	7983
ORST6960	6960	6991	ORST7984	7984	8015
ORST6992	6992	7023	ORST8016	8016	8047

Parameter ORST○○○○ has the initial value "00000000, 00000000, 00000000, 00000000". [OFF], [ON] and [HOLD] can be set for 32 bits using "0", "1" and "**". The start number is assigned from the left side for 32-bit data in 4 elements of 8 bits each.

For example, if ORST6000 = "**0000001, 00000000, 11110000, 00000000" is set and the general-purpose output signal is reset, the following state will result:

Output No. 6000: Holds state before output signal reset

Output No. 6007: ON

Output No. 6016 to 6019: ON

Output No. 6020 to 6031: OFF

4.3.6. Specifications related to robot language

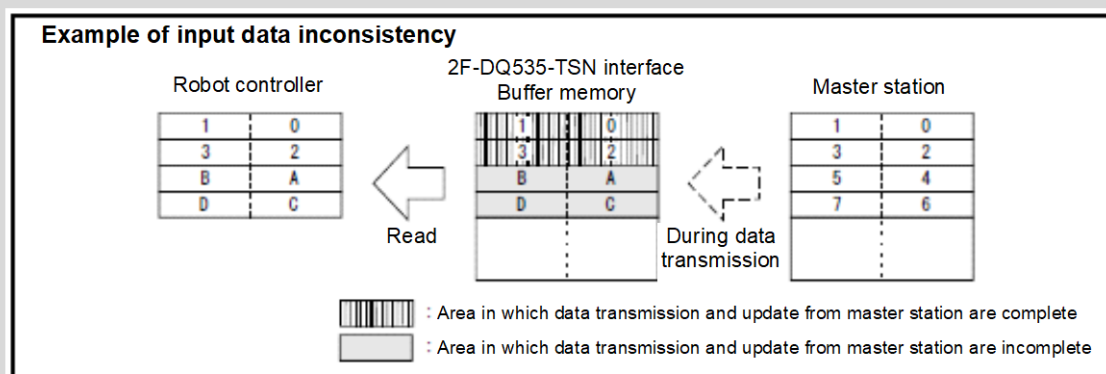
The robot language (MELFA-BASIC V/VI) used with the 2F-DQ535-TSN card is explained below.

Table 4-6 List of system status variables used for data input/output

Item	Type	Function	Read/Write
M_In	Integer 1	Reads 1 bit of data from designated input signal	Read
M_Out	Integer 1	Writes 1 bit of data to designated output signal	Write
M_Inb	Integer 1	Reads 8 bits of data from designated input signal	Read
M_Outb	Integer 1	Writes 8 bits of data to designated output signal	Write
M_Inw	Integer 1	Reads 16 bits of data from designated input signal	Read
M_Outw	Integer 1	Writes 16 bits of data to designated output signal	Write
M_In32	Integer 1	Reads 32 bits of data from designated input signal	Read
M_Out32	Integer 1	Writes 32 bits of data to designated output signal	Write
M_DIn	Integer 1	Reads word data (16-bit integer) from designated input register	Read
M_DOut	Integer 1	Writes word data (16-bit integer) to designated output register	Write
M_Din32	Integer 1	Reads double-word data (32-bit integer) from designated input register	Read
M_DOut32	Integer 1	Writes double-word data (32-bit integer) from designated output register	Write

◆◆◆ Inconsistency of input/output data ◆◆◆

If data read/write is started with the robot program before the master stations finishes data transmission, data inconsistency (state in which robot controller's input/output data is not consistent with master station side's input/output data) will occur. For example, if an application which continuously writes data to the same output address is written, in actual cases only the value written last may be notified to the partner. The following is an example of data inconsistency which occurs if data reading is executed from the robot controller while transmitting data from the master station to the buffer memory.



To prevent data inconsistency, the following type of data read/write interlock must be provided in the application (robot program or PLC ladder). An example of using the interlock when sending one-word data from the master station to the robot is given.

Table 4-7 Example of assigning master station and robot I/O signals

Meaning	Master station (*1)	Robot
Data send/receive area	Data send area	Input 6000 to 6015
PLC data write complete flag	WRTFLG	Input No. 6016
Robot data read complete flag	RDFLG	Output No. 6020

(*1) Names are given to the master station I/O signal assignments for convenience. In actual use, refer to the master station instruction manual and make arbitrary assignments of the I/O signals.

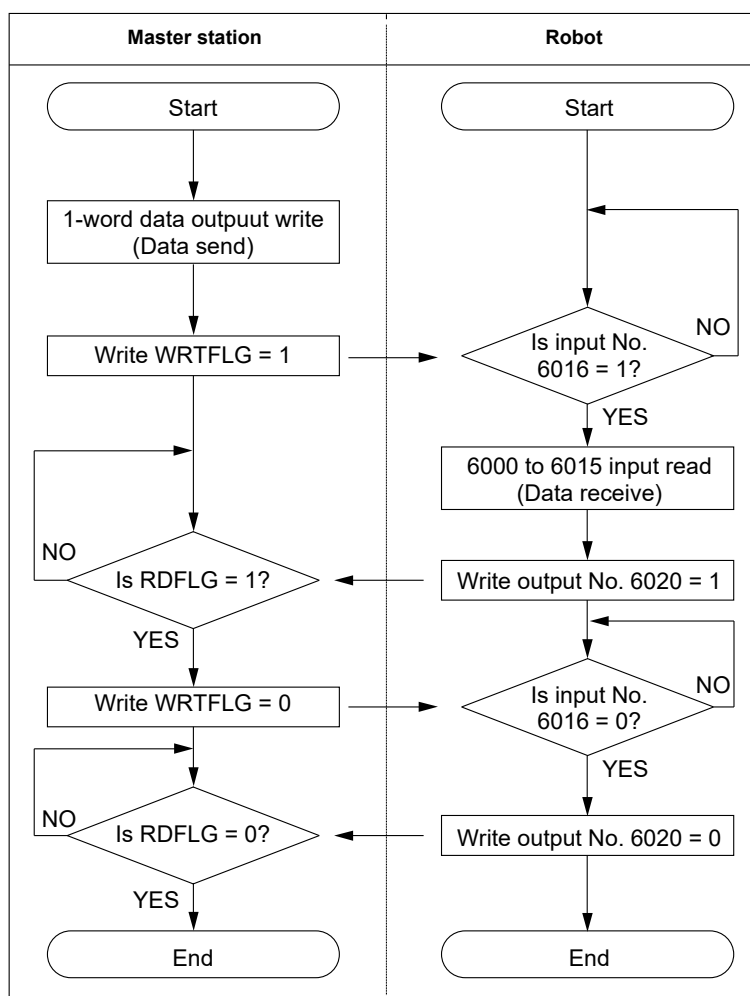


Figure 4-2 Example of using interlock

An example of the robot program corresponding to Figure 4-2 flow chart is given below. Refer to the instruction manual for the device in use for details on the master station side programs (ladder, etc.).

```

*Loop1: If M_In(6016) = 0 Then *Loop1
Mdata = M_InW(6000)
M_Out(6020) = 1
*Loop2: If M_In(6016) = 1 Then *Loop2
M_Out(6016) = 0
  
```

5. CC-Link IE Field MODULE AND 2F-DQ535 CARD SPECIFICATIONS

CC-Link IE Field

5.1. Specifications list

The specifications which apply when the CC-Link IE Field module is mounted on the 2F-DQ535 card are shown below.

Table 5-1 2F-DQ535 card specifications

Item		Specification	Remarks
Network base interface card board model		2F-DQ535	
Mountable expansion option slot		Slot 2	
Number of network base cards that can be installed at the same time		1 card (*1)	
Coexistence with other fieldbus options (CC-Link/PROFIBUS/DeviceNet)		Not possible (*2)	Parallel I/O interface card (TZ368/TZ378) can coexist.
Transmission specifications	Media access method	CSMA/CD	
	Modulation method	Base band	
	Transmission path style	Star type, line type, or ring type	A switching hub is required for the star type.
	Transmission speed	1Gbps (1000BASE-T)	
	Transmission medium	Twisted pair cable	1000BASE-T standard-compliant Ethernet cable: Category 5e or higher, (double shielded / STP) straight cable
	Connector specifications	Shielded RJ45 connector compatible with ANSI/TIA/EIA-568-B (Category 5e)	
	Transmission distance	100m (compatible with ANSI/TIA/EIA-568-B (Category 5e))	Machine cable length
	Maximum number of networks	239	
	Number of connected nodes per network	121 units (master station: 1, slave station: 120)	This product is only compatible with intelligent devices
Communication function	Cyclic communication	Yes	
Number of I/O communication points per robot controller	Send	Signal: Maximum 2048 points Register: Maximum 512 points	
	Receive	Signal: Maximum 2048 points Register: Maximum 512 points	
Start I/O number of robot controller		Address 6000 and later	I/O registers can be assigned.
MELFA BASIC VI	I/O signal access	M_In/M_InB/M_InW/M_In32 M_Out/M_OutB/M_OutW/ M_Out32/M_DIn/M_DOut/M_DIn32/M_DOut32	Used as general I/O or assigned as dedicated I/O
RT ToolBox3	Option information read	Yes	

(*1) The 2F-DQ535 card can only be mounted in slot 2.

(*2) An error will occur if CC-Link/PROFIBUS/DeviceNet coexists. (Error 6111)

5.2. List of robot parameters

CC-Link IE Field

Table 5-2 List of robot parameters related to CC-Link IE Field

Parameter name	Initial value	Setting range	Unit	Explanation
STOP2	-1,-1	-1/ 6000 to 8047	-	Parameter which sets a dedicated input signal number for stopping the robot program. (Parameter "STOP" is fixed to "0", so "STOP2" is used with the 2F-DQ535 card to define a stop signal from an external source.)
ORST6000 ORST6032 : ORST8016	00000000, 00000000, 00000000, 00000000	0/1/*	-	Set the output transmission data used in the 2F-DQ535 card when resetting the signal output. For details on the setting, refer to " 5.3.5 Output signal reset pattern ".
CFNNWNO	1	1 to 239	-	Set the network number.
CFNNDID	1	1 to 120	-	Set the station number.
CFNINB	16	0 to 256	Byte	Set the data size in bytes for the input signals (bit devices). As 8 bits equal to 1 byte, the maximum data size for the input signals is 2048 bits, which equal to 256 bytes. Set a value in multiples of two.
CFNOTB	16	0 to 256	Byte	Set the data size in bytes for the output signals (bit devices). As 8 bits equal to 1 byte, the maximum data size for the output signals is 2048 bits, which equal to 256 bytes. Set a value in multiples of two.
CFNDIN	64	0 to 512	Word	Set the data size for the input registers (word devices). As 1 word requires 2 bytes, the maximum data size for the input registers is 512 words. Set a value in multiples of eight.
CFNDOT	64	0 to 512	Word	Set the data size for the output registers (word devices). As 1 word requires 2 bytes, the maximum data size for the output registers is 512 words. Set a value in multiples of eight.



CAUTION

After changing the above parameters, power off the controller.

To reflect the changed parameters, always power off the controller.
Otherwise the changed parameters are not reflected.

5.3. Robot controller I/O signals

The maximum data size of I/O signals (bit devices) handled in the robot controller is 2048 bits starting at address 6000 through 8047 for both input and output regardless of the CC-Link IE Field node or station number. The maximum data size of I/O registers (word devices) is 512 words starting at address 6000 through 6511.

The setting ranges of the I/O signals and I/O registers are limited for both input and output.

5.3.1. I/O signal number map (CC-Link IE Field)

For the data size of the I/O signals (bit devices), set the number of bytes (1 byte = 8 bits) in the parameter for both input and output.

Set the data size from 2 to 256 bytes (1 byte is equal to 8 bits).

Table 5-3 CC-Link IE Field signal number (bit device) table

Number of bytes	Number of points	Start	End
0	0	-	to -
2	16	6000	to 6015
4	32	6000	to 6031
6	48	6000	to 6047
8	64	6000	to 6063
10	80	6000	to 6079
12	96	6000	to 6095
14	112	6000	to 6111
16	256	6000	to 6127
18	144	6000	to 6143
20	160	6000	to 6159
22	176	6000	to 6175
24	192	6000	to 6191
26	208	6000	to 6207
28	224	6000	to 6223
30	240	6000	to 6239
32	256	6000	to 6255
34	272	6000	to 6271
36	288	6000	to 6287
38	304	6000	to 6303
40	320	6000	to 6319
42	336	6000	to 6335
44	352	6000	to 6351
46	368	6000	to 6367
48	384	6000	to 6383
50	400	6000	to 6399
52	416	6000	to 6415
54	432	6000	to 6431
56	448	6000	to 6447
58	464	6000	to 6463
60	480	6000	to 6479
62	496	6000	to 6495
64	512	6000	to 6511
66	528	6000	to 6527
68	544	6000	to 6543
70	560	6000	to 6559
72	576	6000	to 6575
74	592	6000	to 6591
76	608	6000	to 6607
78	624	6000	to 6623
80	640	6000	to 6639
82	656	6000	to 6655
84	672	6000	to 6671

Number of bytes	Number of points	Start	End
86	688	6000	to 6687
88	704	6000	to 6703
90	720	6000	to 6719
92	736	6000	to 6735
94	752	6000	to 6751
96	768	6000	to 6767
98	784	6000	to 6783
100	800	6000	to 6799
102	816	6000	to 6815
104	832	6000	to 6831
106	848	6000	to 6847
108	864	6000	to 6863
110	880	6000	to 6879
112	896	6000	to 6895
114	912	6000	to 6911
116	928	6000	to 6927
118	944	6000	to 6943
120	960	6000	to 6959
122	976	6000	to 6975
124	992	6000	to 6991
126	1008	6000	to 7007
128	1024	6000	to 7023
130	1040	6000	to 7039
132	1056	6000	to 7055
134	1072	6000	to 7071
136	1088	6000	to 7087
138	1104	6000	to 7103
140	1120	6000	to 7119
142	1136	6000	to 7135
144	1152	6000	to 7151
146	1168	6000	to 7167
148	1184	6000	to 7183
150	1200	6000	to 7199
152	1216	6000	to 7215
154	1232	6000	to 7231
156	1248	6000	to 7247
158	1264	6000	to 7263
160	1280	6000	to 7279
162	1296	6000	to 7295
164	1312	6000	to 7311
166	1328	6000	to 7327
168	1344	6000	to 7343
170	1360	6000	to 7359

Number of bytes	Number of points	Start	End
172	1376	6000	to 7375
174	1392	6000	to 7391
176	1408	6000	to 7407
178	1424	6000	to 7423
180	1440	6000	to 7439
182	1456	6000	to 7455
184	1472	6000	to 7471
186	1488	6000	to 7487
188	1504	6000	to 7503
190	1520	6000	to 7519
192	1536	6000	to 7535
194	1552	6000	to 7551
196	1568	6000	to 7567
198	1584	6000	to 7583
200	1600	6000	to 7599
202	1616	6000	to 7615
204	1632	6000	to 7631
206	1648	6000	to 7647
208	1664	6000	to 7663
210	1680	6000	to 7679
212	1696	6000	to 7695
214	1712	6000	to 7711
216	1728	6000	to 7727
218	1744	6000	to 7743
220	1760	6000	to 7759
222	1776	6000	to 7775
224	1792	6000	to 7791
226	1808	6000	to 7807
228	1824	6000	to 7823
230	1840	6000	to 7839
232	1856	6000	to 7855
234	1872	6000	to 7871
236	1888	6000	to 7887
238	1904	6000	to 7903
240	1920	6000	to 7919
242	1936	6000	to 7935
244	1952	6000	to 7951
246	1968	6000	to 7967
248	1984	6000	to 7983
250	6000	6000	to 7999
252	2016	6000	to 8015
254	2032	6000	to 8031
256	2048	6000	to 8047

5.3.2. I/O register number map (CC-Link IE Field)

The data size for the input and output of I/O registers (word device) can be changed with the parameters. It can be set from 8 to 512 words.

Table 5-4 CC-Link IE Field registers number (word device) table

Number of bytes	Number of points (words)	Start	End
0	0	-	to -
16	8	6000	to 6007
32	16	6000	to 6015
48	24	6000	to 6023
64	32	6000	to 6031
80	40	6000	to 6039
96	48	6000	to 6047
112	56	6000	to 6055
128	64	6000	to 6063
144	72	6000	to 6071
160	80	6000	to 6079
176	88	6000	to 6087
192	96	6000	to 6095
208	104	6000	to 6103
224	112	6000	to 6111
240	120	6000	to 6119
256	128	6000	to 6127
272	136	6000	to 6135
288	144	6000	to 6143
304	152	6000	to 6151
320	160	6000	to 6159
336	168	6000	to 6167

Number of bytes	Number of points (words)	Start	End
352	176	6000	to 6175
368	184	6000	to 6183
384	192	6000	to 6191
400	200	6000	to 6199
416	208	6000	to 6207
432	216	6000	to 6215
448	224	6000	to 6223
464	232	6000	to 6231
480	240	6000	to 6239
496	248	6000	to 6247
512	256	6000	to 6255
528	264	6000	to 6263
544	272	6000	to 6271
560	280	6000	to 6279
576	288	6000	to 6287
592	296	6000	to 6295
608	304	6000	to 6303
624	312	6000	to 6311
640	320	6000	to 6319
656	328	6000	to 6327
672	336	6000	to 6335
688	344	6000	to 6343

Number of bytes	Number of points (words)	Start	End
704	352	6000	to 6351
720	360	6000	to 6359
736	368	6000	to 6367
752	376	6000	to 6375
768	384	6000	to 6383
784	392	6000	to 6391
800	400	6000	to 6399
816	408	6000	to 6407
832	416	6000	to 6415
848	424	6000	to 6423
864	432	6000	to 6431
880	440	6000	to 6439
896	448	6000	to 6447
912	456	6000	to 6455
928	464	6000	to 6463
944	472	6000	to 6471
960	480	6000	to 6479
976	488	6000	to 6487
992	496	6000	to 6495
1008	504	6000	to 6503
1024	512	6000	to 6511

5.3.3. Flow of I/O signal

The mapping for the master and slave signals is shown below.

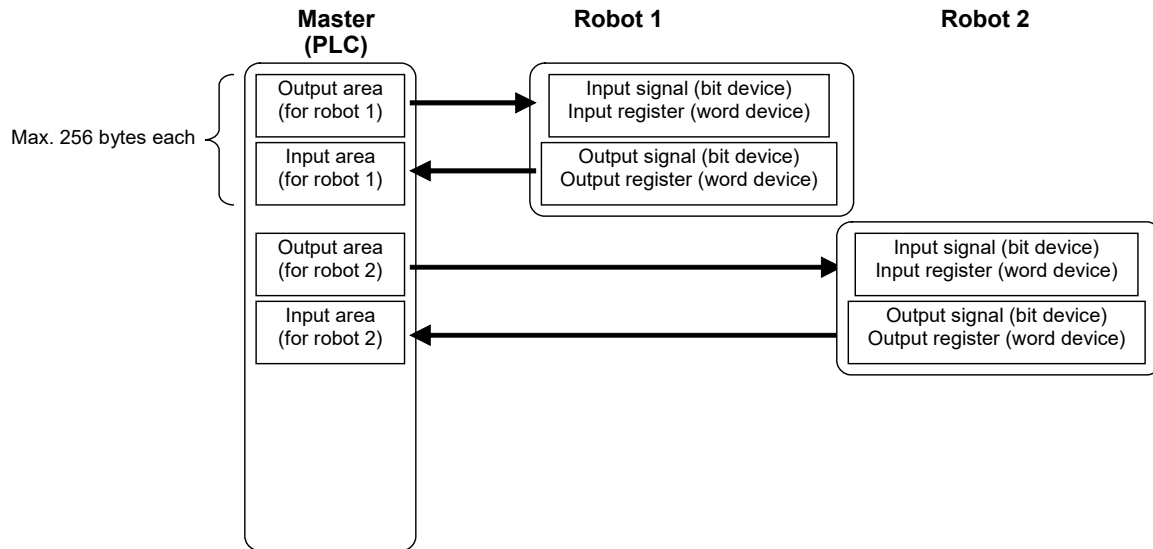


Figure 5-1 Flow of I/O signal

5.3.4. Input/Output

Dedicated inputs and outputs can be used by assigning the signal numbers of the 2F-DQ535 card to the dedicated I/O signal parameters. Refer to "6 External Input/Output Functions" in the separate "Instruction Manual, Detailed Explanation of Functions and Operations" for details on using the dedicated inputs and outputs.

5.3.5. Output signal reset pattern

In the factory setting, all general-purpose output signals start at OFF (0). The status of the general-purpose output signal at power ON can be changed by changing the following parameters. These parameters are also used for the general-purpose output signal reset operation (executed with dedicated input signal, etc.) and for the reset pattern when the "Clr" instruction is executed.

The settings are [OFF], [ON] and [Hold]. A list of general-purpose output reset parameters related to the 2F-DQ535 card is given below.

Table 5-5 List of output signal reset pattern parameters (No. 6000 to 8047)

Parameter name	Start number	End number	Parameter name	Start number	End number
ORST6000	6000	6031	ORST7024	7024	7055
ORST6032	6032	6063	ORST7056	7056	7087
ORST6064	6064	6095	ORST7088	7088	7119
ORST6096	6096	6127	ORST7120	7120	7151
ORST6128	6128	6159	ORST7152	7152	7183
ORST6160	6160	6191	ORST7184	7184	7215
ORST6192	6192	6223	ORST7216	7216	7247
ORST6224	6224	6255	ORST7248	7248	7279
ORST6256	6256	6287	ORST7280	7280	7311
ORST6288	6288	6319	ORST7312	7312	7343
ORST6320	6320	6351	ORST7344	7344	7375
ORST6352	6352	6383	ORST7376	7376	7407
ORST6384	6384	6415	ORST7408	7408	7439
ORST6416	6416	6447	ORST7440	7440	7471
ORST6448	6448	6479	ORST7472	7472	7503
ORST6480	6480	6511	ORST7504	7504	7535
ORST6512	6512	6543	ORST7536	7536	7567
ORST6544	6544	6575	ORST7568	7568	7599
ORST6576	6576	6607	ORST7600	7600	7631
ORST6608	6608	6639	ORST7632	7632	7663
ORST6640	6640	6671	ORST7664	7664	7695
ORST6672	6672	6703	ORST7696	7696	7727
ORST6704	6704	6735	ORST7728	7728	7759
ORST6736	6736	6767	ORST7760	7760	7791
ORST6768	6768	6799	ORST7792	7792	7823
ORST6800	6800	6831	ORST7824	7824	7855
ORST6832	6832	6863	ORST7856	7856	7887
ORST6864	6864	6895	ORST7888	7888	7919
ORST6896	6896	6927	ORST7920	7920	7951
ORST6928	6928	6959	ORST7952	7952	7983
ORST6960	6960	6991	ORST7984	7984	8015
ORST6992	6992	7023	ORST8016	8016	8047

Parameter ORST○○○○ has the initial value "00000000, 00000000, 00000000, 00000000". [OFF], [ON] and [HOLD] can be set for 32 bits using "0", "1" and "**". The start number is assigned from the left side for 32-bit data in 4 elements of 8 bits each.

For example, if ORST6000 = "**0000001, 00000000, 11110000, 00000000" is set and the general-purpose output signal is reset, the following state will result:

Output No. 6000: Holds state before output signal reset

Output No. 6007: ON

Output No. 6016 to 6019: ON

Output No. 6020 to 6031: OFF

5.3.6. Specifications related to robot language

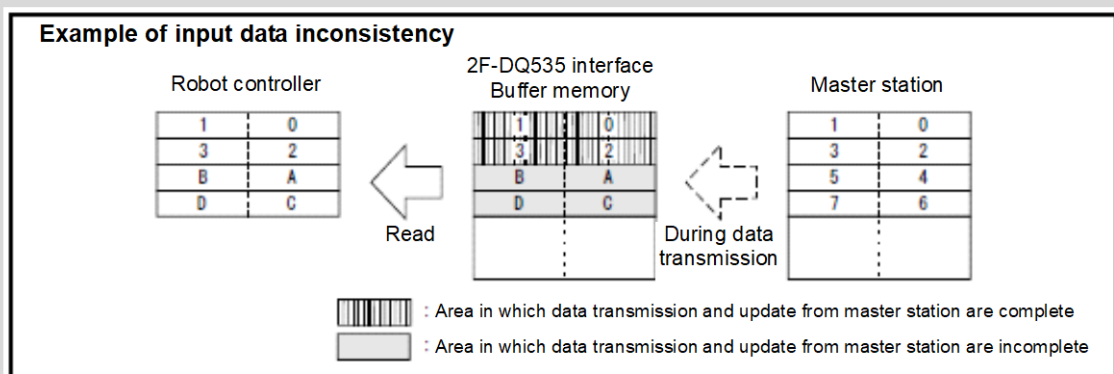
The robot language (MELFA-BASIC V/VI) used with the 2F-DQ535 card is explained below.

Table 5-6 List of system status variables used for data input/output

Item	Type	Function	Read/Write
M_In	Integer 1	Reads 1 bit of data from designated input signal	Read
M_Out	Integer 1	Writes 1 bit of data to designated output signal	Write
M_Inb	Integer 1	Reads 8 bits of data from designated input signal	Read
M_Outb	Integer 1	Writes 8 bits of data to designated output signal	Write
M_Inw	Integer 1	Reads 16 bits of data from designated input signal	Read
M_Outw	Integer 1	Writes 16 bits of data to designated output signal	Write
M_In32	Integer 1	Reads 32 bits of data from designated input signal	Read
M_Out32	Integer 1	Writes 32 bits of data to designated output signal	Write
M_DIn	Integer 1	Reads word data (16-bit integer) from designated input register	Read
M_DOut	Integer 1	Writes word data (16-bit integer) to designated output register	Write
M_Din32	Integer 1	Reads double-word data (32-bit integer) from designated input register	Read
M_DOut32	Integer 1	Writes double-word data (32-bit integer) from designated output register	Write

◆◆◆ Inconsistency of input/output data ◆◆◆

If data read/write is started with the robot program before the master stations finishes data transmission, data inconsistency (state in which robot controller's input/output data is not consistent with master station side's input/output data) will occur. For example, if an application which continuously writes data to the same output address is written, in actual cases only the value written last may be notified to the partner. The following is an example of data inconsistency which occurs if data reading is executed from the robot controller while transmitting data from the master station to the buffer memory.



To prevent data inconsistency, the following type of data read/write interlock must be provided in the application (robot program or PLC ladder). An example of using the interlock when sending one-word data from the master station to the robot is given.

Table 5-7 Example of assigning master station and robot I/O signals

Meaning	Master station (*1)	Robot
Data send/receive area	Data send area	Input 6000 to 6015
PLC data write complete flag	WRTFLG	Input No. 6016
Robot data read complete flag	RDFLG	Output No. 6020

(*1) Names are given to the master station I/O signal assignments for convenience. In actual use, refer to the master station instruction manual and make arbitrary assignments of the I/O signals.

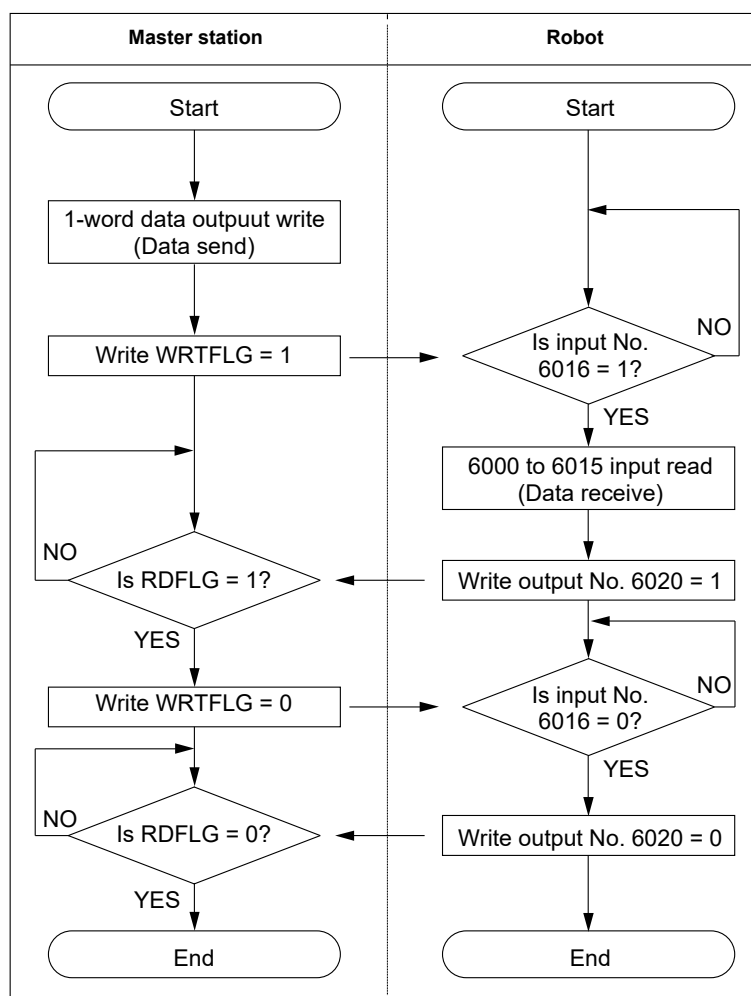


Figure 5-2 Example of using interlock

An example of the robot program corresponding to Figure 4-2 flow chart is given below. Refer to the instruction manual for the device in use for details on the master station side programs (ladder, etc.).

```

*Loop1: If M_In(6016) = 0 Then *Loop1
Mdata = M_InW(6000)
M_Out(6020) = 1
*Loop2: If M_In(6016) = 1 Then *Loop2
M_Out(6016) = 0
  
```

6. EtherCAT MODULE AND 2F-DQ535-EC CARD SPECIFICATIONS



6.1. Specification list

The specifications which apply when the EtherCAT module is mounted on the 2F-DQ535-EC card are shown below.

Table 6-1 2F-DQ535-EC card specifications

Item			Specification	Remarks
Network base interface card board model			2F-DQ535	
Mountable expansion option slot			Slot 2	
Number of network base cards that can be installed at the same time			1 card (*1)	
Coexistence with other fieldbus options (CC-Link/PROFIBUS/DeviceNet)			Not possible (*2)	Parallel I/O interface card (TZ368/TZ378) can coexist.
Transmission specifications	Media access method		CSMA/CD	Conform to IEEE 802.3
	Modulation method		Base band	
	Transmission path style		Star type, line type, or ring type	
	Transmission speed		100Mbps (100BASE-TX)	
	Transmission medium		Twisted pair cable	Category 5/5e or higher, (double shielded/STP) straight cable
	Connector specifications		RJ-45 connector × 2	
	Transmission distance		Within 100 m	Distance between nodes
	Slave station identifier setting range		1 to 65535	The value of parameter ECTDID is shown as "Configured Station Alias" to the master.
	Communication protocol	CoE	Supported	Can Open over EtherCAT
		EoE	Not supported	Ethernet over EtherCAT
		FoE		File access over EtherCAT
		FSoE		FailSafe over EtherCAT
Communication function	Cyclic transmission function		Yes	However, PdoAssign, PdoConfig, and PdoUpload are not supported.
	Synchronization function by the master		No	Only the Free-run mode is supported (DC is not supported).
Number of communication points per robot controller	Send		[Specify the number of stations: Max. 4] RX ≤ 256 (points) RY ≤ 256 (points) RW _r ≤ 128 (points) RW _w ≤ 128 (points)	Select the number of stations. One station = 64 points (I/O) or 32 points (register)
	Receive			
Start I/O number of robot controller			Address 6000 and later	I/O registers can be assigned.

Item		Specification	Remarks
MELFA BASIC VI	I/O signal access	M_In/M_InB/M_InW/M_In32 M_Out/M_OutB/M_OutW/ M_Out32/M_DIn/M_DOut/M_ DIn32/M_DOut32	Used as general I/O or assigned as dedicated I/O
RT ToolBox3	Option information read	Yes	

(*1) The 2F-DQ535-EC card can only be mounted in slot 2.

(*2) An error will occur if CC-Link/PROFIBUS/DeviceNet coexists. (Error 6111)

6.2. List of robot parameters



Table 6-2 List of robot parameters related to EtherCAT

Parameter name	Initial value	Setting range	Unit	Explanation
ECTOCS	1	1 to 4	-	Specifies the number of occupied stations as the transmission size of the I/O signal. Input the value according to the desired I/O signal mapping. For the relationship between the setting value and mapping, refer to " 6.2.1 Robot controller I/O signals " described later.
ECTCLR	0	0, 1	-	Set the I/O status at the data link error. 0: Cleared 1: Held
ECTDID	1	1 to 65535	-	Set this parameter as an identifier when verifying this slave station (CR800) on the master station side at the communication start. This value is shown as "Configured Station Alias" to the master station.



CAUTION

After changing the above parameters, power off the controller.

To reflect the changed parameters, always power off the controller.
Otherwise the changed parameters are not reflected.

6.2.1. Robot controller I/O signals

As shown below, RX, RY, RWr, and RWw data (*) of the master station correspond with the input and output signals (6000 to Max. 6255) and input and output registers (6000 to Max. 6127) of the robot.

Setting value of the number of occupied stations (ECTOCS)	Bit device (RX, RY)			Word device (RWr, RWw)		
	Usable number of points (bit)	Start	End	Usable number of points (Word)	Start	End
1	64	6000	6063	32	6000	6031
2	128	6000	6127	64	6000	6063
3	192	6000	6191	96	6000	6095
4	256	6000	6255	128	6000	6127

* Remote input RX: Data input in bit units from the slave station to the master station.

Remote output RY: Data output in bit units from the master station to the slave station.

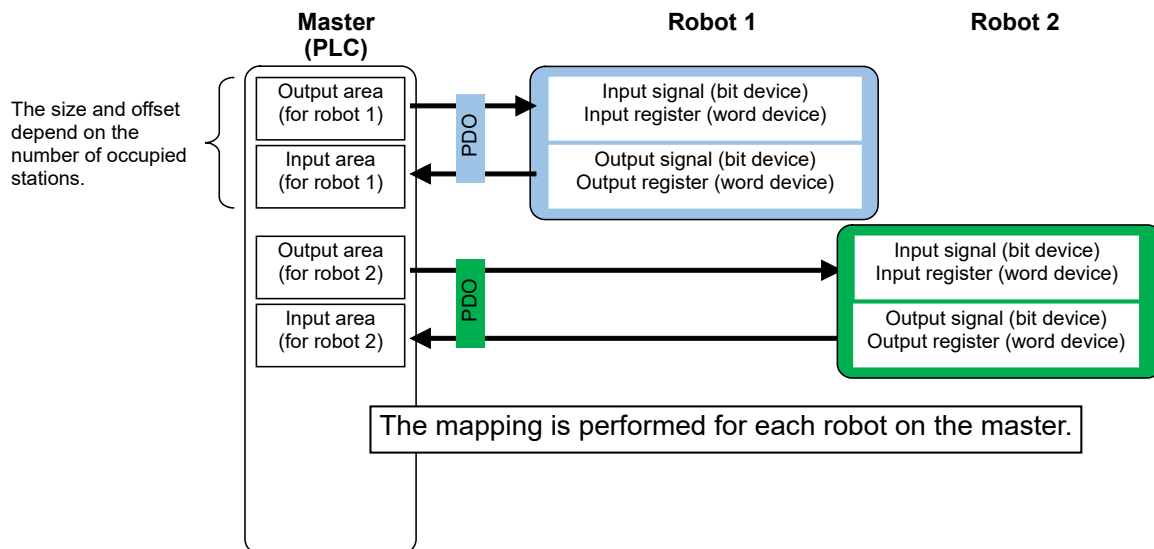
Remote register RWr: Data input in 16-bit unit (1 word) from the slave station to the master station.

Remote register RWw: Data output in 16-bit unit (1 word) from the master station to the slave station.

6.2.2. Flow of I/O signal

The CR800-D reflects its process data to the EtherCAT datagram for transferring RX, RW, RWr, and RWw values to and from the master station.

(The start and end addresses of RX, RY, RWr, and RWr are common to each RC.)



<Reference>

Conforming to the EtherCAT standard, RX, RY, RWr, and RWw values are transferred to and from the master station via PDO (Process Data Object).

The following table shows data mapping for the master and the slave.

Setting of the number of occupied stations	I/O type and address of the RC values			Value provided from the CR800-D (EtherCAT slave) (reference information for the master)				
				PDO Mapping Entry			Entry name (character string)	
		Start	End	Start	End	Data format	Start	End
1	RX	6000	6064	0x1600[1]	0x1600[8]	8 bits, unsigned	RX (6000 to 6007)	RX (6056 to 6063)
	RY	6000	6064	0x1a00[1]	0x1a00[8]	8 bits, unsigned	RY (6000 to 6007)	RY (6056 to 6063)
	RWr	6000	6031	0x1600[9]	0x1600[40]	16 bits, unsigned	RWr (6000)	RWr (6031)
	RWw	6000	6031	0x1a00[9]	0x1a00[40]	16 bits, unsigned	RWw (6000)	RWw (6031)
2	RX	6000	6127	0x1600[1]	0x1600[16]	8 bits, unsigned	RX (6000 to 6127)	RX (6120 to 6127)
	RY	6000	6127	0x1a00[1]	0x1a00[16]	8 bits, unsigned	RY (6000 to 6127)	RY (6120 to 6127)
	RWr	6000	6063	0x1600[17]	0x1600[80]	16 bits, unsigned	RWr (6000)	RWr (6063)
	RWw	6000	6063	0x1a00[17]	0x1a00[80]	16 bits, unsigned	RWw (6000)	RWw (6063)

Setting of the number of occupied stations	I/O type and address of the RC values			Value provided from the CR800-D (EtherCAT slave) (reference information for the master)				
				PDO Mapping Entry			Entry name (character string)	
		Start	End	Start	End	Data format	Start	End
3	RX	6000	6191	0x1600[1]	0x1600[24]	8 bits, unsigned	RX (6000 to 6007)	RX (6184 to 6191)
	RY	6000	6191	0x1a00[1]	0x1a00[24]	8 bits, unsigned	RY (6000 to 6007)	RY (6184 to 6191)
	RWr	6000	6095	0x1600[25]	0x1600[120]	16 bits, unsigned	RWr (6000)	RWr (6095)
	RWw	6000	6095	0x1a00[25]	0x1a00[120]	16 bits, unsigned	RWw (6000)	RWw (6095)
4	RX	6000	6255	0x1600[1]	0x1600[32]	8 bits, unsigned	RX (6000 to 6007)	RX (6248 to 6255)
	RY	6000	6255	0x1a00[1]	0x1a00[32]	8 bits, unsigned	RY (6000 to 6007)	RY (6248 to 6255)
	RWr	6000	6127	0x1600[33]	0x1600[160]	16 bits, unsigned	RWr (6000)	RWr (6127)
	RWw	6000	6127	0x1a00[33]	0x1a00[160]	16 bits, unsigned	RWw (6000)	RWw (6127)

· Note on notation of PDO: The value (integer) in brackets indicates the sub-index.

· To use the process data (RX, RY, RWr, and RWw) of the CR800-D, each data is mapped (associated) with each variable in the PLC.

The character string of the entry name is used as the display item of PDO Mapping Entry on the engineering tool. ([Described later.](#))

6.2.3. Output signal reset pattern

The operation is the same as the one when using CC-Link IE Field.

However, the range of signals is within [the signal mapping range for EtherCAT.](#)

(Refer to "[4.3.5 Output signal reset pattern](#)".)

6.2.4. Specifications related to robot language

As when CC-Link IE Field is used, the signals and register values can be read and written using the robot language (MELFA-BASIC V/VI).

However, the range of signals is within [the signal mapping range for EtherCAT.](#)

(Refer to "[4.3.6 Specifications related to robot language](#)".)

7. EtherNet/IP MODULE AND 2F-DQ535-EIP CARD SPECIFICATIONS



7.1. Specification list

The specifications which apply when the EtherNet/IP module is mounted on the 2F-DQ535-EIP card are shown below.

Table 7-1 2F-DQ535-EIP card specifications

Item		Specification	Remarks
Network base interface card board model		2F-DQ535	
Mountable slot expansion option slot		Slot 2	
Number of network base cards that can be installed at the same time		1 card (*1)	
Coexistence with other fieldbus options (CC-Link/PROFIBUS/DeviceNet)		Not possible (*2)	Parallel I/O interface card (TZ368/TZ378) can coexist.
Coexistence with Parallel I/O interface card		Possible	
Coexistence with MELFA Smart Plus card		Possible	
Combined use with CC-Link IE Field Basic		Not possible	
Transmission specifications	Media access method	CSMA/CD	
	Modulation method	Base band	
	Transmission path style	Star type, line type, or ring type	
	Transmission speed	100Mbit/s (100BASE-TX) 10Mbit/s (10BASE-T)	100BASE-TX recommended
	Transmission medium	Twisted pair cable	
	Transmission distance	Within 100 m	Distance between switching hub and node
	No. of cascade connections	No limit when	
Communication function	Cyclic transmission function	Yes	
Communication instance	Input instance	100	
	Output instance	150	
Number of communication points per robot controller	Send	Max. 2048 points	Max. 256 bytes
	Receive	Max. 2048 points	Max. 256 bytes
Start I/O number of robot controller		Address 2000 and later	Overlapping with PROFIBUS area and DeviceNet area
MELFA BASIC VI	I/O signal access	M_In/M_InB/M_In8/ M_InW/M_In16/M_In32 M_Out/M_OutB/M_Out8/ M_OutW/M_Out16/ M_Out32	Handled as general I/O area
RT ToolBox3	Option information read	Yes	

(*1) The 2F-DQ535-EIP card can only be mounted in slot 2.

(*2) An error will occur if CC-Link/PROFIBUS/DeviceNet coexists. (Error 6111)

7.2. List of robot parameters



7.2.1. For the EtherNet/IP module

Table 7-2 List of robot parameters related to EtherNet/IP

Parameter name	Initial value	Setting range	Unit	Explanation
STOP2	-1,-1	-1/ 2000 to 4047	-	Parameter which sets a dedicated input signal number for stopping the robot program. (Parameter "STOP" is fixed to "0", so "STOP2" is used with the 2F-DQ535-EIP card to define a stop signal from an external source.)
ORST2000 ORST2032 : ORST4016	00000000, 00000000, 00000000, 00000000	0/1/*	-	Set the output transmission data used in the 2F-DQ535-EIP card when resetting the signal output. For details on the setting, refer to " 7.3.4 Output signal reset pattern " for details.
EPSDLN	8	1 to 256	Byte	Set the number of I/O communication transmission bytes used with EtherNet/IP.
EPRDLN	8	1 to 256	Byte	Set the number of I/O communication reception bytes used with EtherNet/IP.
EPIP	192.168.0.200	0.0.0.0 to .255.255	Octet	Specify the IP address for EtherNet/IP. (*1)
EPMSK	255.255.255.0	0.0.0.0 to 255.255.255.255	Octet	Specify the subnet mask for EtherNet/IP. (*1)
EPGW	192.168.0.254	0.0.0.0 to 255.255.255.255	Octet	Specify the Gateway IP address for EtherNet/IP. (*1)

(*1) Set from Class A to C.



CAUTION

After changing the above parameters, power off the controller.

To reflect the changed parameters, always power off the controller.
Otherwise the changed parameters are not reflected.

7.3. Robot controller I/O signals

The maximum data size of I/O signals handled in the robot controller is 2048 points starting at address 2000 through 4047 for both input and output regardless of the node or station number.

7.3.1. I/O signal number map

The I/O signal data size is set as the number of bytes with a parameter for input and for output. (Set from 1 to 256 bytes.)

Table 7-3 EtherNet/IP signal table

Number of bytes	Number of points	Start	End
0	0	-	to -
1	8	2000	to 2007
2	16	2000	to 2015
3	24	2000	to 2023
4	32	2000	to 2031
5	40	2000	to 2039
6	48	2000	to 2047
7	56	2000	to 2055
8	64	2000	to 2063
9	72	2000	to 2071
10	80	2000	to 2079
11	88	2000	to 2087
12	96	2000	to 2095
13	104	2000	to 2103
14	112	2000	to 2111
15	120	2000	to 2119
16	256	2000	to 2127
17	136	2000	to 2135
18	144	2000	to 2143
19	152	2000	to 2151
20	160	2000	to 2159
21	168	2000	to 2167
22	176	2000	to 2175
23	184	2000	to 2183
24	192	2000	to 2191
25	200	2000	to 2199
26	208	2000	to 2207
27	216	2000	to 2215
28	224	2000	to 2223
29	232	2000	to 2231
30	240	2000	to 2239
31	248	2000	to 2247
32	256	2000	to 2255
33	264	2000	to 2263
34	272	2000	to 2271
35	280	2000	to 2279
36	288	2000	to 2287
37	296	2000	to 2295
38	304	2000	to 2303
39	312	2000	to 2311
40	320	2000	to 2319

Number of bytes	Number of points	Start	End
41	328	2000	to 2327
42	336	2000	to 2335
43	344	2000	to 2343
44	352	2000	to 2351
45	360	2000	to 2359
46	368	2000	to 2367
47	376	2000	to 2375
48	384	2000	to 2383
49	392	2000	to 2391
50	400	2000	to 2399
51	408	2000	to 2407
52	416	2000	to 2415
53	424	2000	to 2423
54	432	2000	to 2431
55	440	2000	to 2439
56	448	2000	to 2447
57	456	2000	to 2455
58	464	2000	to 2463
59	472	2000	to 2471
60	480	2000	to 2479
61	488	2000	to 2487
62	496	2000	to 2495
63	504	2000	to 2503
64	512	2000	to 2511
65	520	2000	to 2519
66	528	2000	to 2527
67	536	2000	to 2535
68	544	2000	to 2543
69	552	2000	to 2551
70	560	2000	to 2559
71	568	2000	to 2567
72	576	2000	to 2575
73	584	2000	to 2583
74	592	2000	to 2591
75	600	2000	to 2599
76	608	2000	to 2607
77	616	2000	to 2615
78	624	2000	to 2623
79	632	2000	to 2631
80	640	2000	to 2639
81	648	2000	to 2647

Number of bytes	Number of points	Start	End
82	656	2000	to 2655
83	664	2000	to 2663
84	672	2000	to 2671
85	680	2000	to 2679
86	688	2000	to 2687
87	696	2000	to 2695
88	704	2000	to 2703
89	712	2000	to 2711
90	720	2000	to 2719
91	728	2000	to 2727
92	736	2000	to 2735
93	744	2000	to 2743
94	752	2000	to 2751
95	760	2000	to 2759
96	768	2000	to 2767
97	776	2000	to 2775
98	784	2000	to 2783
99	792	2000	to 2791
100	800	2000	to 2799
101	808	2000	to 2807
102	816	2000	to 2815
103	824	2000	to 2823
104	832	2000	to 2831
105	840	2000	to 2839
106	848	2000	to 2847
107	856	2000	to 2855
108	864	2000	to 2863
109	872	2000	to 2871
110	880	2000	to 2879
111	888	2000	to 2887
112	896	2000	to 2895
113	904	2000	to 2903
114	912	2000	to 2911
115	920	2000	to 2919
116	928	2000	to 2927
117	936	2000	to 2935
118	944	2000	to 2943
119	952	2000	to 2951
120	960	2000	to 2959
121	968	2000	to 2967
122	976	2000	to 2975

EtherNet/IP

Number of bytes	Number of points	Start	End
123	984	2000	to 2983
124	992	2000	to 2991
125	1000	2000	to 2999
126	1008	2000	to 3007
127	1016	2000	to 3015
128	1024	2000	to 3023
129	1032	2000	to 3031
130	1040	2000	to 3039
131	1048	2000	to 3047
132	1056	2000	to 3055
133	1064	2000	to 3063
134	1072	2000	to 3071
135	1080	2000	to 3079
136	1088	2000	to 3087
137	1096	2000	to 3095
138	1104	2000	to 3103
139	1112	2000	to 3111
140	1120	2000	to 3119
141	1128	2000	to 3127
142	1136	2000	to 3135
143	1144	2000	to 3143
144	1152	2000	to 3151
145	1160	2000	to 3159
146	1168	2000	to 3167
147	1176	2000	to 3175
148	1184	2000	to 3183
149	1192	2000	to 3191
150	1200	2000	to 3199
151	1208	2000	to 3207
152	1216	2000	to 3215
153	1224	2000	to 3223
154	1232	2000	to 3231
155	1240	2000	to 3239
156	1248	2000	to 3247
157	1256	2000	to 3255
158	1264	2000	to 3263
159	1272	2000	to 3271
160	1280	2000	to 3279
161	1288	2000	to 3287
162	1296	2000	to 3295
163	1304	2000	to 3303
164	1312	2000	to 3311
165	1320	2000	to 3319
166	1328	2000	to 3327
167	1336	2000	to 3335

Number of bytes	Number of points	Start	End
168	1344	2000	to 3343
169	1352	2000	to 3351
170	1360	2000	to 3359
171	1368	2000	to 3367
172	1376	2000	to 3375
173	1384	2000	to 3383
174	1392	2000	to 3391
175	1400	2000	to 3399
176	1408	2000	to 3407
177	1416	2000	to 3415
178	1424	2000	to 3423
179	1432	2000	to 3431
180	1440	2000	to 3439
181	1448	2000	to 3447
182	1456	2000	to 3455
183	1464	2000	to 3463
184	1472	2000	to 3471
185	1480	2000	to 3479
186	1488	2000	to 3487
187	1496	2000	to 3495
188	1504	2000	to 3503
189	1512	2000	to 3511
190	1520	2000	to 3519
191	1528	2000	to 3527
192	1536	2000	to 3535
193	1544	2000	to 3543
194	1552	2000	to 3551
195	1560	2000	to 3559
196	1568	2000	to 3567
197	1576	2000	to 3575
198	1584	2000	to 3583
199	1592	2000	to 3591
200	1600	2000	to 3599
201	1608	2000	to 3607
202	1616	2000	to 3615
203	1624	2000	to 3623
204	1632	2000	to 3631
205	1640	2000	to 3639
206	1648	2000	to 3647
207	1656	2000	to 3655
208	1664	2000	to 3663
209	1672	2000	to 3671
210	1680	2000	to 3679
211	1688	2000	to 3687
212	1696	2000	to 3695

Number of bytes	Number of points	Start	End
213	1704	2000	to 3703
214	1712	2000	to 3711
215	1720	2000	to 3719
216	1728	2000	to 3727
217	1736	2000	to 3735
218	1744	2000	to 3743
219	1752	2000	to 3751
220	1760	2000	to 3759
221	1768	2000	to 3767
222	1776	2000	to 3775
223	1784	2000	to 3783
224	1792	2000	to 3791
225	1800	2000	to 3799
226	1808	2000	to 3807
227	1816	2000	to 3815
228	1824	2000	to 3823
229	1832	2000	to 3831
230	1840	2000	to 3839
231	1848	2000	to 3847
232	1856	2000	to 3855
233	1864	2000	to 3863
234	1872	2000	to 3871
235	1880	2000	to 3879
236	1888	2000	to 3887
237	1896	2000	to 3895
238	1904	2000	to 3903
239	1912	2000	to 3911
240	1920	2000	to 3919
241	1928	2000	to 3927
242	1936	2000	to 3935
243	1944	2000	to 3943
244	1952	2000	to 3951
245	1960	2000	to 3959
246	1968	2000	to 3967
247	1976	2000	to 3975
248	1984	2000	to 3983
249	1992	2000	to 3991
250	2000	2000	to 3999
251	2008	2000	to 4007
252	2016	2000	to 4015
253	2024	2000	to 4023
254	2032	2000	to 4031
255	2040	2000	to 4039
256	2048	2000	to 4047

7.3.2. Flow of I/O signal

The mapping for the master and slave signals is shown below.

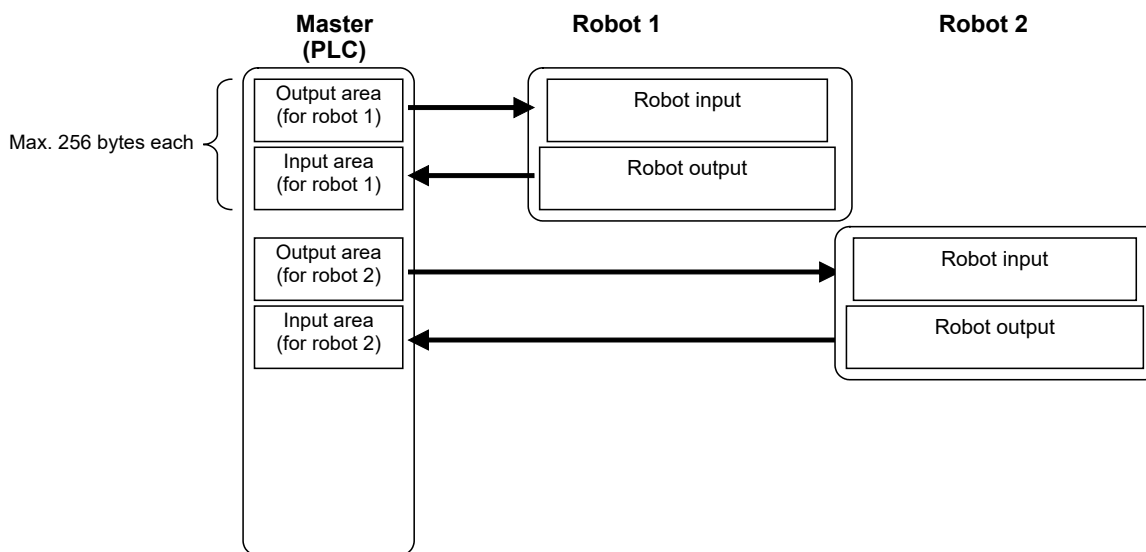


Figure 7-1 Flow of I/O signal

7.3.3. Input/Output

Dedicated inputs and outputs can be used by assigning the signal numbers of the 2F-DQ535-EIP card to the dedicated I/O signal parameters. Refer to "6 External Input/Output Functions" in the separate "Instruction Manual, Detailed Explanation of Functions and Operations" for details on using the dedicated inputs and outputs.

7.3.4. Output signal reset pattern

In the factory setting, all general-purpose output signals start at OFF (0). The status of the general-purpose output signal at power ON can be changed by changing the following parameters. These parameters are also used for the general-purpose output signal reset operation (executed with dedicated input signal, etc.) and for the reset pattern when the "Clr" instruction is executed.

The settings are [OFF], [ON] and [Hold]. A list of general-purpose output reset parameters related to the 2F-DQ535-EIP card is given below.

Table 7-4 List of output signal reset pattern parameters (No. 2000 to 4047)

Parameter name	Start number	End number	Parameter name	Start number	End number
ORST2000	2000	2031	ORST3024	3024	3055
ORST2032	2032	2063	ORST3056	3056	3087
ORST2064	2064	2095	ORST3088	3088	3119
ORST2096	2096	2127	ORST3120	3120	3151
ORST2128	2128	2159	ORST3152	3152	3183
ORST2160	2160	2191	ORST3184	3184	3215
ORST2192	2192	2223	ORST3216	3216	3247
ORST2224	2224	2255	ORST3248	3248	3279
ORST2256	2256	2287	ORST3280	3280	3311
ORST2288	2288	2319	ORST3312	3312	3343
ORST2320	2320	2351	ORST3344	3344	3375
ORST2352	2352	2383	ORST3376	3376	3407
ORST2384	2384	2415	ORST3408	3408	3439
ORST2416	2416	2447	ORST3440	3440	3471
ORST2448	2448	2479	ORST3472	3472	3503
ORST2480	2480	2511	ORST3504	3504	3535
ORST2512	2512	2543	ORST3536	3536	3567
ORST2544	2544	2575	ORST3568	3568	3599
ORST2576	2576	2607	ORST3600	3600	3631
ORST2608	2608	2639	ORST3632	3632	3663
ORST2640	2640	2671	ORST3664	3664	3695
ORST2672	2672	2703	ORST3696	3696	3727
ORST2704	2704	2735	ORST3728	3728	3759
ORST2736	2736	2767	ORST3760	3760	3791
ORST2768	2768	2799	ORST3792	3792	3823
ORST2800	2800	2831	ORST3824	3824	3855
ORST2832	2832	2863	ORST3856	3856	3887
ORST2864	2864	2895	ORST3888	3888	3919
ORST2896	2896	2927	ORST3920	3920	3951
ORST2928	2928	2959	ORST3952	3952	3983
ORST2960	2960	2991	ORST3984	3984	4015
ORST2992	2992	3023	ORST4016	4016	4047

Parameter ORST0000 has the initial value "00000000, 00000000, 00000000, 00000000". [OFF], [ON] and [HOLD] can be set for 32 bits using "0", "1" and "***". The start number is assigned from the left side for 32-bit data in 4 elements of 8 bits each.

For example, if ORST2000 = "***0000001, 00000000, 11110000, 00000000" is set and the general-purpose output signal is reset, the following state will result: Output No. 2007: ON

Output No. 2000: Holds state before output signal reset
 Output No. 2007: ON
 Output 2016 to 2019: ON
 Output 2020 to 2031: OFF

EtherNet/IP

7.3.5. Specifications related to robot language

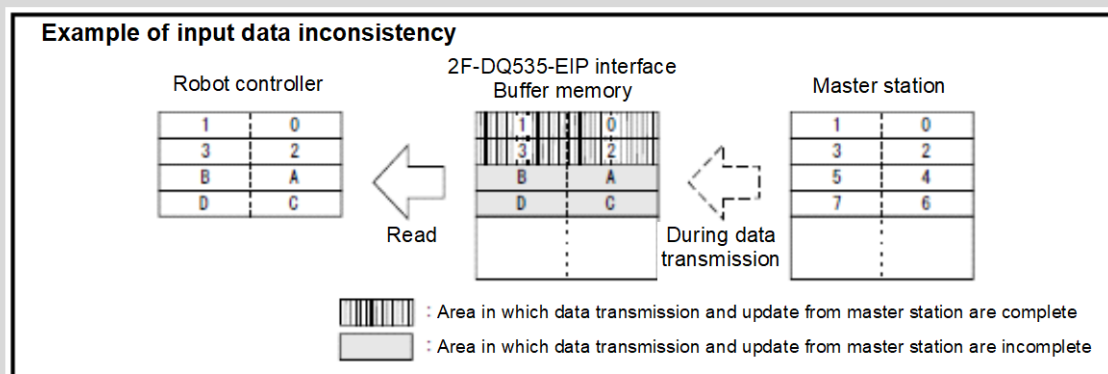
The robot language (MELFA-BASIC V/VI) used with the 2F-DQ535-EIP card is explained below.

Table 7-5 List of system status variables used for data input/output

Item	Type	Function	Read/Write
M_In	Integer 1	Reads 1 bit of data from designated input signal	Read
M_Out	Integer 1	Writes 1 bit of data to designated output signal	Write
M_Inb M_In8	Integer 1	Reads 8 bits of data from designated input signal	Read
M_Outb M_Out8	Integer 1	Writes 8 bits of data to designated output signal	Write
M_Inw M_In16	Integer 1	Reads 16 bits of data from designated input signal	Read
M_Outw M_Out16	Integer 1	Writes 16 bits of data to designated output signal	Write
M_In32	Integer 1	Reads 32 bits of data from designated input signal	Read
M_Out32	Integer 1	Writes 32 bits of data to designated output signal	Write

◆◆ Inconsistency of input/output data ◆◆

If data read/write is started with the robot program before the master station finishes data transmission, data inconsistency (state in which robot controller's input/output data is not consistent with master station side's input/output data) will occur. For example, if an application which continuously writes data to the same output address is written, in actual cases only the value written last may be notified to the partner. The following is an example of data inconsistency which occurs if data reading is executed from the robot controller while transmitting data from the master station to the buffer memory.



To prevent data inconsistency, the following type of data read/write interlock must be provided in the application (robot program or PLC ladder). An example of using the interlock when sending one-word data from the master station to the robot is given.

Table 7-6 Example of assigning master station and robot I/O signals

Meaning	Master station (*1)	Robot
Data send/receive area	Data send area	Input 2000 to 2015
PLC data write complete flag	WRTFLG	Input No. 2016
Robot data read complete flag	RDFLG	Output No. 2020

(*1) Names are given to the master station I/O signal assignments for convenience. In actual use, refer to the master station instruction manual and make arbitrary assignments of the I/O signals.

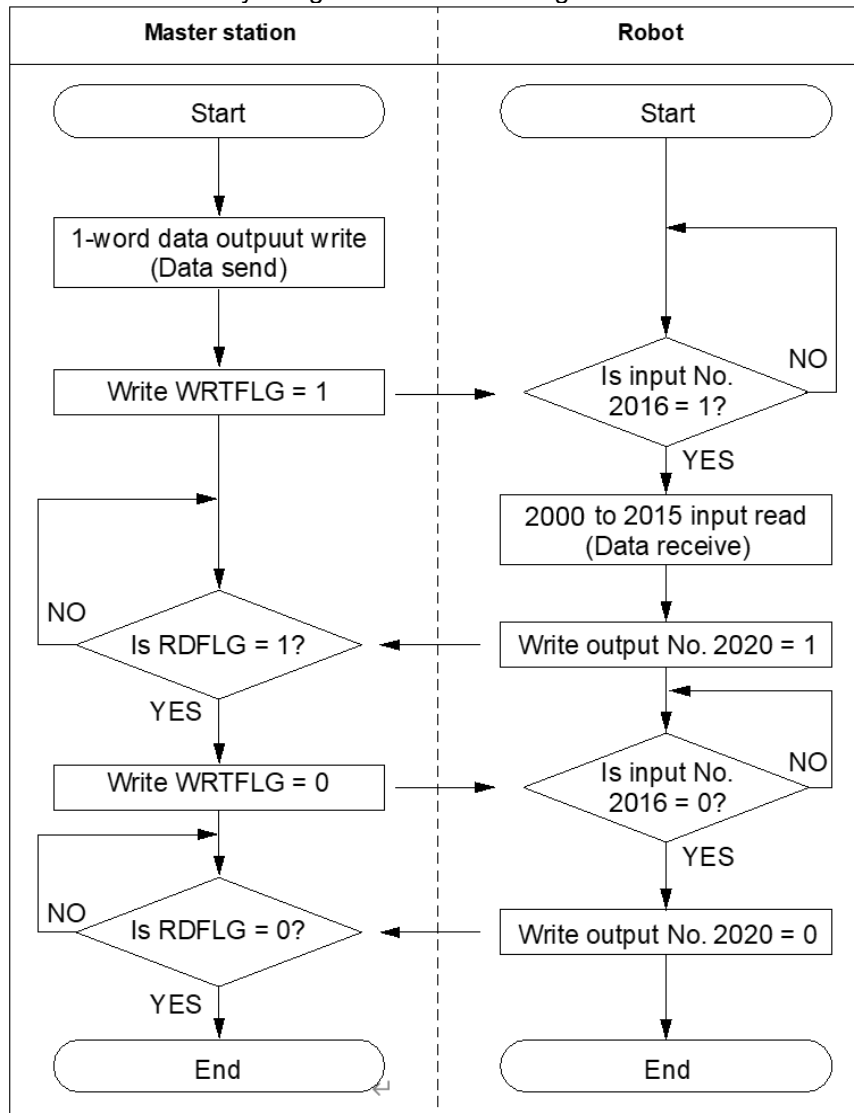


Figure 7-2 Example of using interlock

An example of the robot program corresponding to Figure 6-2 flow chart is given below. Refer to the instruction manual for the device in use for details on the master station side programs (ladder, etc.).

```

*Loop1: If M_In(2016) = 0 Then *Loop1
Mdata = M_InW(2000)
M_Out(2020) = 1
*Loop2: If M_In(2016) = 1 Then *Loop2
M_Out(2016) = 0
  
```

8. PROFINET IO MODULE AND 2F-DQ535-PN CARD SPECIFICATIONS

PROFINET IO

8.1. Specification list

The specifications which apply when the PROFINET IO module is mounted on the 2F-DQ535-PN card are shown below.

Table 8-1 2F-DQ535-PN card specifications

Item		Specification	Remarks
Network base interface card board model		2F-DQ535	
Mountable expansion option slot		Slot 2	
Number of network base cards that can be installed at the same time		1 card (*1)	
Coexistence with other fieldbus options (CC-Link/PROFIBUS/DeviceNet)		Not possible (*2)	Parallel I/O interface card (TZ368/TZ378) can coexist.
Coexistence with Parallel I/O interface card		Possible	
Coexistence with MELFA Smart Plus card		Possible	
Combined use with CC-Link IE Field Basic		Not possible	
Transmission specifications	Media access method	CSMA/CD	
	Auto-MDI/MDI-X(*3)	Yes	
	Modulation method	Base band	
	Transmission path style	Star type or line type	
	Transmission speed	100Mbit/s (100BASE-TX)	
	Transmission medium	Twisted pair cable	
	Transmission distance	100 m	Distance between switching hub and node
	No. of cascade connections	No limit when using switching hub	
Communication function	Cyclic communication	Yes	
Number of I/O communication points per robot controller	Send	Max. 2040 points	Max. 255 bytes
	Receive	Max. 2040 points	Max. 255 bytes
Start I/O number of robot controller		Address 2000 and later	Overlapping with PROFIBUS area, DeviceNet area, and EtherNet/IP area.
MELFA BASIC VI	I/O signal access	M_In/M_Inb/M_In8/M_Inw/ M_In16/M_In32 M_Out/M_Outb/M_Out8/M_Outw/ M_Out16/M_Out32	Handled as general I/O area
RT ToolBox3	Option information read	Yes	

(*1) The 2F-DQ535-EIP card can only be mounted in slot 2.

(*2) An error will occur if CC-Link/PROFIBUS/DeviceNet coexists. (Error 6111)

(*3) A function that automatically identifies straight/cross cable and configures the connection appropriately.

8.2. List of robot parameters

Table 8-2 List of robot parameters related to EtherNet/IP

Parameter name	Initial value	Setting range	Unit	Explanation
STOP2	-1,-1	-1/ 2000 to 4039	-	Parameter which sets a dedicated input signal number for stopping the robot program. (Parameter "STOP" is fixed to "0", so "STOP2" is used with the 2F-DQ535-PN card to define a stop signal from an external source.)
ORST2000 ORST2032 : ORST4016	00000000, 00000000, 00000000, 00000000	0/1/*	-	Set the output transmission data used in the 2F-DQ535 card when resetting the signal output. For details on the setting, refer to " 8.3.4 Output signal reset pattern " for details.
PNIOLN	16	8/16/32/64/128 /255	Byte	Set the number of I/O communication transmission bytes used with PROFINET IO.



CAUTION

After changing the above parameters, power off the controller.

To reflect the changed parameters, always power off the controller.
Otherwise, the changed parameters are not reflected.

8.3. Robot controller I/O signals

The maximum data size of I/O signals handled in the robot controller is 2040 points starting at address 2000 through 4039 for both input and output regardless of the PROFINET IO station.

8.3.1. I/O signal number map

The I/O signal data size is set as the number of bytes with a parameter for input and for output.
(Set 8, 16, 32, 64, 128, or 255 bytes.)

Table 8-3 PROFINET IO signal table

Number of bytes	Number of points	Start	End
8	64	2000 ~	2063
16	256	2000 ~	2127
32	256	2000 ~	2255
64	512	2000 ~	2511
128	1024	2000 ~	3023
255	2040	2000 ~	4039

8.3.2. Flow of I/O signal

The mapping for the master and slave signals is shown below.

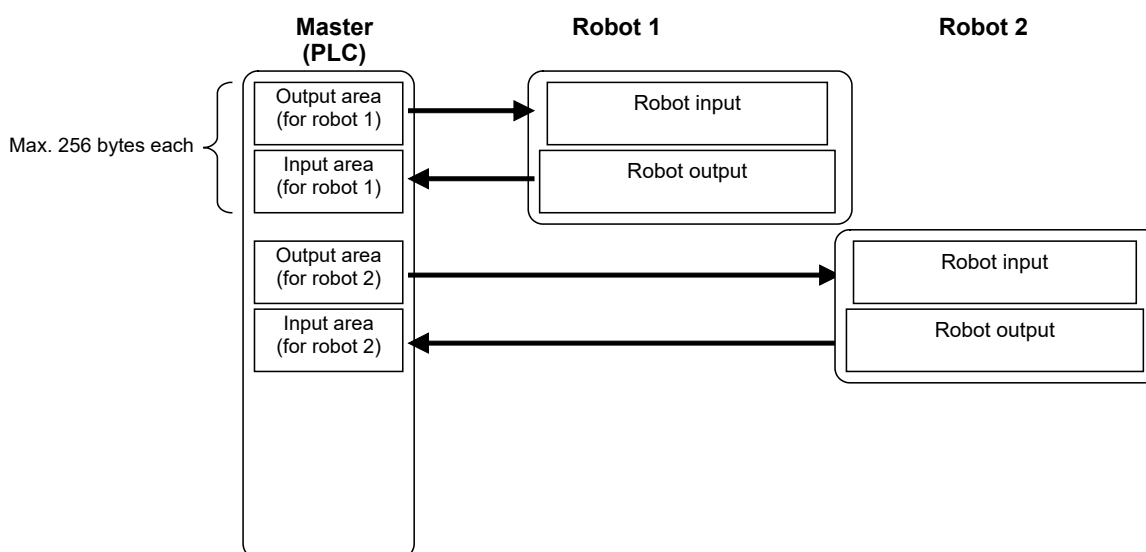


Figure 8-1 Flow of I/O signal

8.3.3. Input/Output

Dedicated inputs and outputs can be used by assigning the signal numbers of the 2F-DQ535-PN card to the dedicated I/O signal parameters. Refer to "6 External Input/Output Functions" in the separate "Instruction Manual, Detailed Explanation of Functions and Operations" for details on using the dedicated inputs and outputs.

8.3.4. Output signal reset pattern

In the factory setting, all general-purpose output signals start at OFF (0). The status of the general-purpose output signal at power ON can be changed by changing the following parameters. These parameters are also used for the general-purpose output signal reset operation (executed with dedicated input signal, etc.) and for the reset pattern when the "Clr" instruction is executed.

The settings are [OFF], [ON] and [Hold]. A list of general-purpose output reset parameters related to the 2F-DQ535-PN card is given below.

Table 8-4 List of output signal reset pattern parameters

Parameter name	Start number	End number	Parameter name	Start number	End number
ORST2000	2000	2031	ORST3024	3024	3055
ORST2032	2032	2063	ORST3056	3056	3087
ORST2064	2064	2095	ORST3088	3088	3119
ORST2096	2096	2127	ORST3120	3120	3151
ORST2128	2128	2159	ORST3152	3152	3183
ORST2160	2160	2191	ORST3184	3184	3215
ORST2192	2192	2223	ORST3216	3216	3247
ORST2224	2224	2255	ORST3248	3248	3279
ORST2256	2256	2287	ORST3280	3280	3311
ORST2288	2288	2319	ORST3312	3312	3343
ORST2320	2320	2351	ORST3344	3344	3375
ORST2352	2352	2383	ORST3376	3376	3407
ORST2384	2384	2415	ORST3408	3408	3439
ORST2416	2416	2447	ORST3440	3440	3471
ORST2448	2448	2479	ORST3472	3472	3503
ORST2480	2480	2511	ORST3504	3504	3535
ORST2512	2512	2543	ORST3536	3536	3567
ORST2544	2544	2575	ORST3568	3568	3599
ORST2576	2576	2607	ORST3600	3600	3631
ORST2608	2608	2639	ORST3632	3632	3663
ORST2640	2640	2671	ORST3664	3664	3695
ORST2672	2672	2703	ORST3696	3696	3727
ORST2704	2704	2735	ORST3728	3728	3759
ORST2736	2736	2767	ORST3760	3760	3791
ORST2768	2768	2799	ORST3792	3792	3823
ORST2800	2800	2831	ORST3824	3824	3855
ORST2832	2832	2863	ORST3856	3856	3887
ORST2864	2864	2895	ORST3888	3888	3919
ORST2896	2896	2927	ORST3920	3920	3951
ORST2928	2928	2959	ORST3952	3952	3983
ORST2960	2960	2991	ORST3984	3984	4015
ORST2992	2992	3023	ORST4016	4016	4047

Parameter ORST○○○○ has the initial value "00000000, 00000000, 00000000, 00000000". [OFF], [ON] and [HOLD] can be set for 32 bits using "0", "1" and "***". The start number is assigned from the left side.

For example, if ORST2000 = "**0000001, 00000000, 11110000, 00000000" is set and the general-purpose output signal is reset, the following state will result:

Output No. 2000: Holds state before output signal reset

Output No. 2007: ON

Output 2016 to 2019: ON

8.3.5. Specifications related to robot language

PROFINET IO

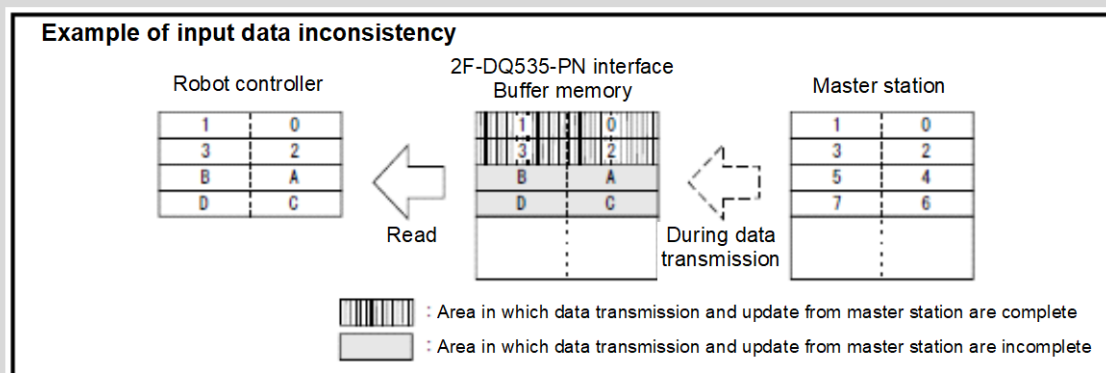
The robot language (MELFA-BASIC V/VI) used with the 2F-DQ535-PN card is explained below

Table 8-5 List of system status variables used for data input/output

Item	Type	Function	Read/Write
M_In	Integer 1	Reads 1 bit of data from designated input signal	Read
M_Out	Integer 1	Writes 1 bit of data to designated output signal	Write
M_Inb M_In8	Integer 1	Reads 8 bits of data from designated input signal	Read
M_Outb M_Out8	Integer 1	Writes 8 bits of data to designated output signal	Write
M_Inw M_In16	Integer 1	Reads 16 bits of data from designated input signal	Read
M_Outw M_Out16	Integer 1	Writes 16 bits of data to designated output signal	Write
M_In32	Integer 1	Reads 32 bits of data from designated input signal	Read
M_Out32	Integer 1	Writes 32 bits of data to designated output signal	Write

◆◆◆ Inconsistency of input/output data ◆◆◆

If data read/write is started with the robot program before the master stations finishes data transmission, data inconsistency (state in which robot controller's input/output data is not consistent with master station side's input/output data) will occur. For example, if an application which continuously writes data to the same output address is written, in actual cases only the value written last may be notified to the partner. The following is an example of data inconsistency which occurs if data reading is executed from the robot controller while transmitting data from the master station to the buffer memory.



To prevent data inconsistency, the following type of data read/write interlock must be provided in the application (robot program or PLC ladder). An example of using the interlock when sending one-word data from the master station to the robot is given.

Table 8-6 Example of assigning master station and robot I/O signals

Meaning	Master station (*1)	Robot
Data send/receive area	Data send area	Input 2000 to 2015
PLC data write complete flag	WRTFLG	Input No. 2016
Robot data read complete flag	RDFLG	Output No. 2020

(*1) Names are given to the master station I/O signal assignments for convenience. In actual use, refer to the master station instruction manual and make arbitrary assignments of the I/O signals.

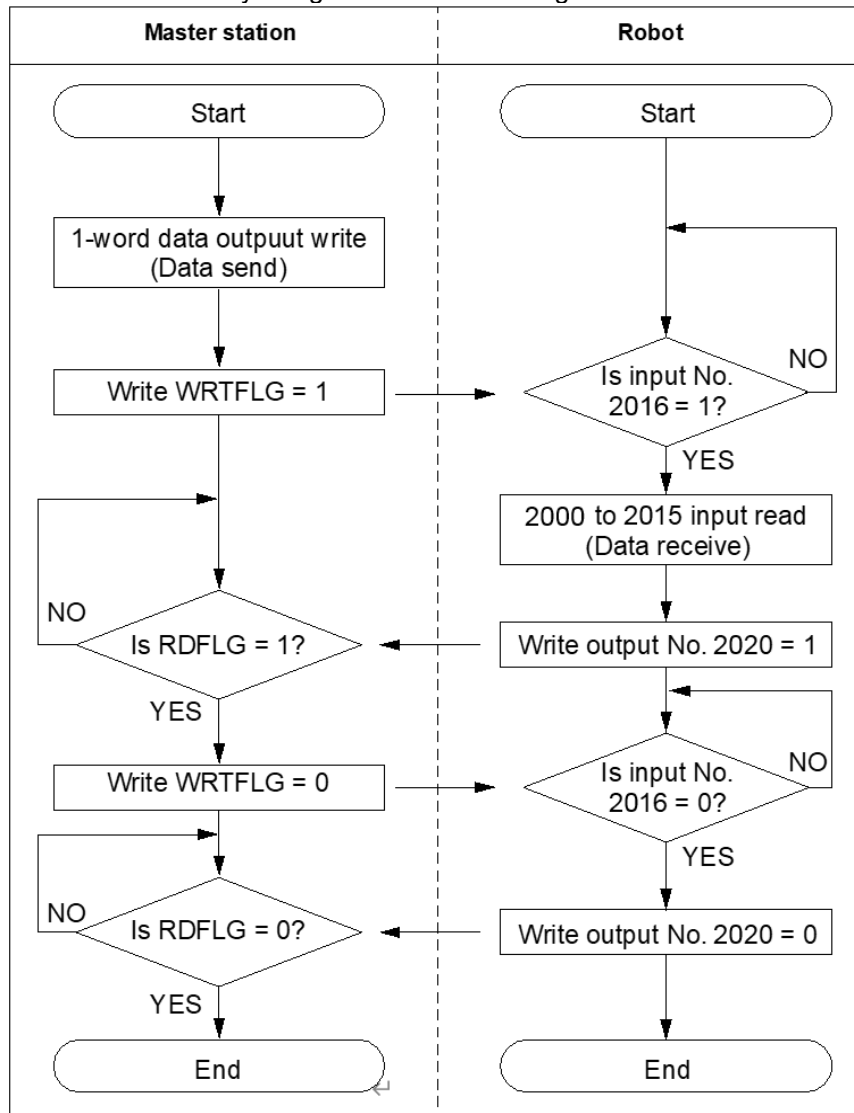


Figure 8-2 Example of using interlock

An example of the robot program corresponding to Figure 7-2 flow chart is given below. Refer to the instruction manual for the device in use for details on the master station side programs (ladder, etc.).

```

*Loop1: If M_In(2016) = 0 Then *Loop1
Mdata = M_InW(2000)
M_Out(2020) = 1
*Loop2: If M_In(2016) = 1 Then *Loop2
M_Out(2016) = 0
  
```

9. ITEMS TO BE CHECKED BEFORE USING THIS PRODUCT

9.1. Checking the Product

The product you purchased consists of the following items as standard.
Please check the items.

CC-Link IE TSN

Table 9-1 List of the standard items in the product (CC-Link IE TSN)

No.	Name	Model	Quantity
(1)	Network base card	2F-DQ535	1
(2)	Module fixing parts (module mount, screws)	-	1 set
(3)	Ferrite core	E04SR301334	2

Note1) The numbers in the table correspond with the numbers in the following figure.

Note2) Items 1 to 3 come assembled as one unit.

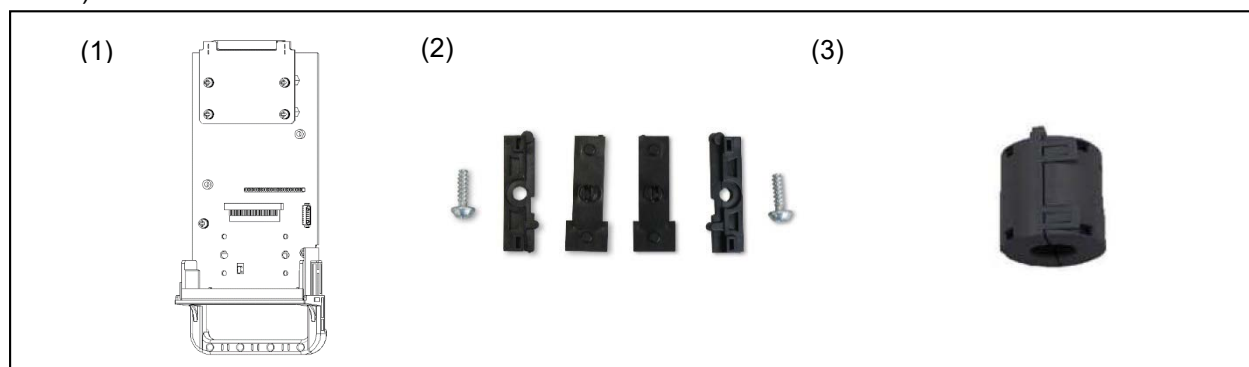


Figure 9-1 Items contained in the delivered product (CC-Link IE TSN)

CAUTION:

Install the included ferrite cores to the both sides of the CC-Link IE TSN cable.

Put the cable through the ferrite core twice and install the ferrite core within 300 mm of the connection terminal.

For details, refer to the figure below or "[11.2.1 For the CC-Link IE TSN module](#)".

If the product is used in an environment that is easily affected by noise, installing a noise filter to the power supply of the programmable controller is recommended.

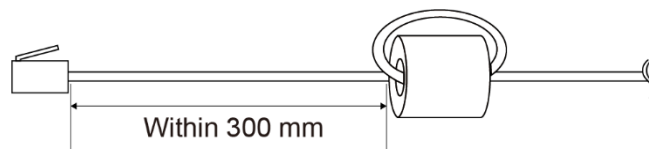


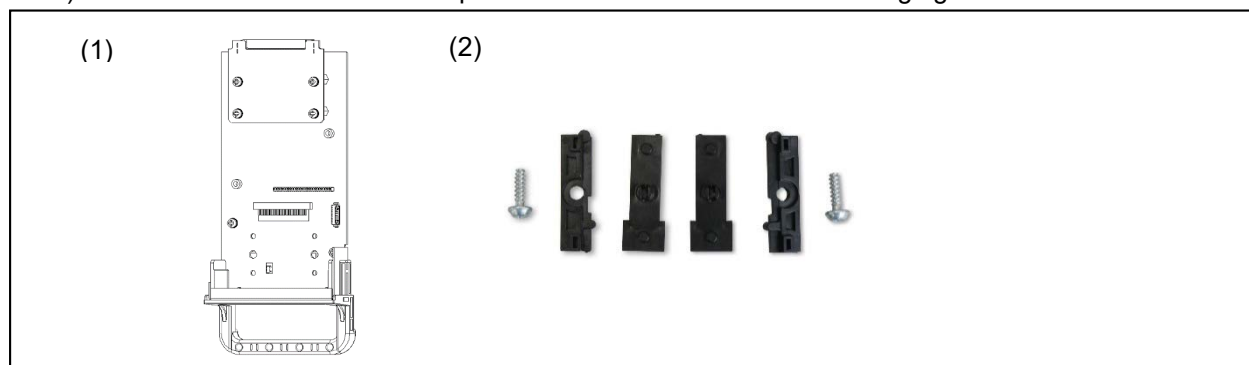
Figure 9-2 Ferrite core installation position (CC-Link IE TSN)

The product you purchased consists of the following items as standard.
Please check the items.

CC-Link IE Field**Table 9-2 List of the standard items in the product (CC-Link IE Field)**

No.	Name	Model	Quantity
(1)	Network base card	2F-DQ535	1
(2)	Module fixing parts (module mount, screws)	-	1 set

Note) The numbers in the table correspond with the numbers in the following figure.

**Figure 9-3 Items contained in the delivered product (CC-Link IE Field)**

9 ITEMS TO BE CHECKED BEFORE USING THIS PRODUCT

The product you purchased consists of the following items as standard.
Please check the items.

EtherCAT

Table 9-3 List of the standard items in the product (EtherCAT)

No.	Name	Model	Quantity
(1)	Network base card	2F-DQ535	1
(2)	Module fixing parts (module mount, screws)	-	1 set
(3)	Ferrite core	E04SR301334	2

Note) The numbers in the table correspond with the numbers in the following figure.



Figure 9-4 Items contained in the delivered product (EtherCAT)

CAUTION:

Install the included ferrite cores to the both sides of the EtherCAT cable.

Put the cable through the ferrite core twice and install the ferrite core within 300 mm of the connection terminal.

For details, refer to the figure below or "[11.2.3 For the EtherCAT module](#)".

If the product is used in an environment that is easily affected by noise, installing a noise filter to the power supply of the programmable controller is recommended.

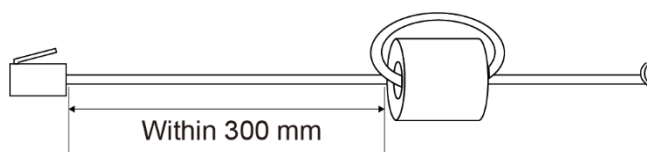


Figure 9-5 Ferrite core installation position (EtherCAT)

The product you purchased consists of the following items as standard.
Please check the items.

EtherNet/IP

Table 9-4 List of the standard items in the product (EtherNet/IP)

No.	Name	Model	Quantity
(1)	Network base card	2F-DQ535	1
(2)	Module fixing parts (Module mount and screws)	-	1 set
(3)	Ferrite core	E04SR301334	2

Note1) The numbers in the table correspond with the numbers in the following figure.



Figure 9-6 Items contained in the delivered product (EtherNet/IP)

CAUTION:

Install the included ferrite cores to the both sides of the Ethernet cable.

Put the cable through the ferrite core twice and install the ferrite core within 300 mm of the connection terminal.

For details, refer to the figure below or ["11.2.4 For the EtherNet/IP module"](#).

If the product is used in an environment that is easily affected by noise, installing a noise filter on the power supply of the programmable controller is recommended.

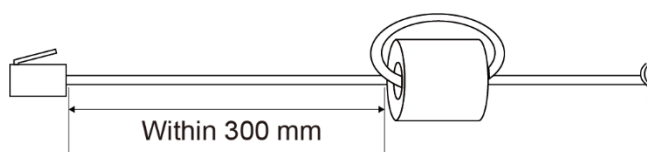


Figure 9-7 Ferrite core installation position (EtherNet/IP)

The product you purchased consists of the following items as standard.
Please check the items.

PROFINET IO

Table 9-5 List of the standard items in the product (PROFINET IO)

No.	Name	Model	Quantity
(1)	Network base card	2F-DQ535	1
(2)	Module fixing parts (Module mount and screws)	-	1 set
(3)	Ferrite core	E04SR301334	2

Note1) The numbers in the table correspond with the numbers in the following figure.

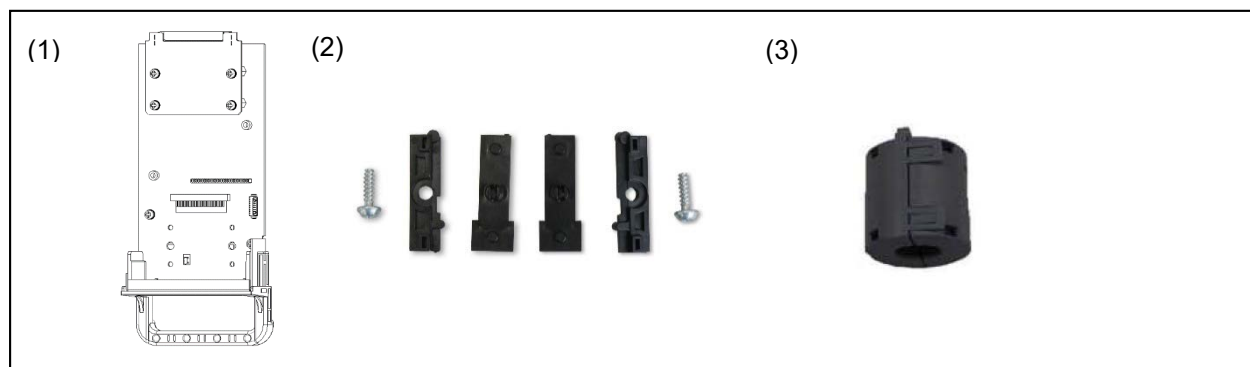


Figure 9-8 Items contained in the delivered product (PROFINET IO)

CAUTION:

Install the included ferrite cores to the both sides of the Ethernet cable.

Put the cable through the ferrite core twice and install the ferrite core within 300 mm of the connection terminal.

For details, refer to the figure below or "[11.2.5 For the PROFINET IO module](#)".

If the product is used in an environment that is easily affected by noise, installing a noise filter on the power supply of the programmable controller is recommended.

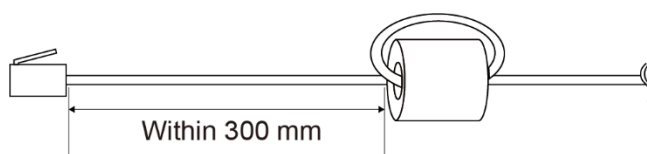


Figure 9-9 Ferrite core installation position (PROFINET IO)

9.2. Devices to be Prepared by the Customer

The devices which must be prepared by the customer to use the card are listed below.

CC-Link IE TSN

Table 9-6 Devices to be prepared by the customer (CC-Link IE TSN)

Device to be prepared	Precautions
Master station	Master station compatible with CC-Link IE TSN
Anybus CompactCom 40 module *1)	Anybus-CC CC-Link IE TSN module (AB6714-C-106)
Ethernet cable	Must conform to all necessary standards. Category 5e (CAT 5e) or higher. A shielded cable is recommended in noise environment.
Industrial switching hub (CC-Link IE TSN Class B compatible)	When connecting to a star type, use the industrial switching hub (CC-Link IE TSN Class B compatible).
Hex-lobe (Torx) screwdriver	Screwdriver for module fixing screws. Prepare a T-10 screwdriver.
Cross-point screwdriver	Used for card handle fixing screws. Prepare M3 screws.

*1) Only the Anybus CompactCom 40 module (M40, without housing) is supported..

CC-Link IE Field

EtherCAT

Table 9-7 Devices to be prepared by the customer (CC-Link IE Field/EtherCAT)

Device to be prepared	CC-Link IE Field	EtherCAT
Master station	Master station compatible with CC-Link IE Field	Master station compatible with EtherCAT
Anybus CompactCom 40 module *1)	Anybus-CC CC-Link IE Field module (AB6709-C-118)	Anybus-CC EtherCAT module (AB6707-E-224)
Ethernet cable	Must conform to all necessary standards. Category 5e (CAT 5e) or higher. A shielded cable is recommended in noise environment.	
Switching hub	Always use a switching hub when using the I/O signal function.	No restrictions.
Hex-lobe (Torx) screwdriver	Driver for module fixing part screws. Prepare a size "T-10" screwdriver.	
Cross-point screwdriver	Used for card handle fixing screws. Prepare M3 screws.	

*1) Only the Anybus CompactCom 40 module (M40, without housing) is supported.

EtherNet/IP

PROFINET IO

Table 9-8 Devices to be prepared by the customer (EtherNet/IP/PROFINET IO)

Device to be prepared	EtherNet/IP	PROFINET IO
Master station	Master station compatible with EtherNet/IP	Master station compatible with PROFINET IO
Anybus CompactCom 40 module *1)	Anybus-CC EtherNet/IP module (AB6704-E-161)	Anybus-CC PROFINET IO module (AB6705-E-210)
Ethernet cable	Must conform to each standard. Category 5e (CAT 5e) or higher. A shielded cable is recommended in noise environments.	
Switching hub	Always use a switching hub when using the I/O signal function. * This is because I/O signal data collisions increase with repeater hubs.	
Hex-lobe (Torx) screwdriver	Screwdriver for module fixing screws. Prepare a T-10 screwdriver.	
Cross-point screwdriver	Used for card handle fixing screws. Prepare M3 screws.	

*1) Only the Anybus CompactCom 40 module (M40, without housing) is supported.

10. HARDWARE SETTINGS

CC-Link IE TSN

CC-Link IE Field

EtherCAT

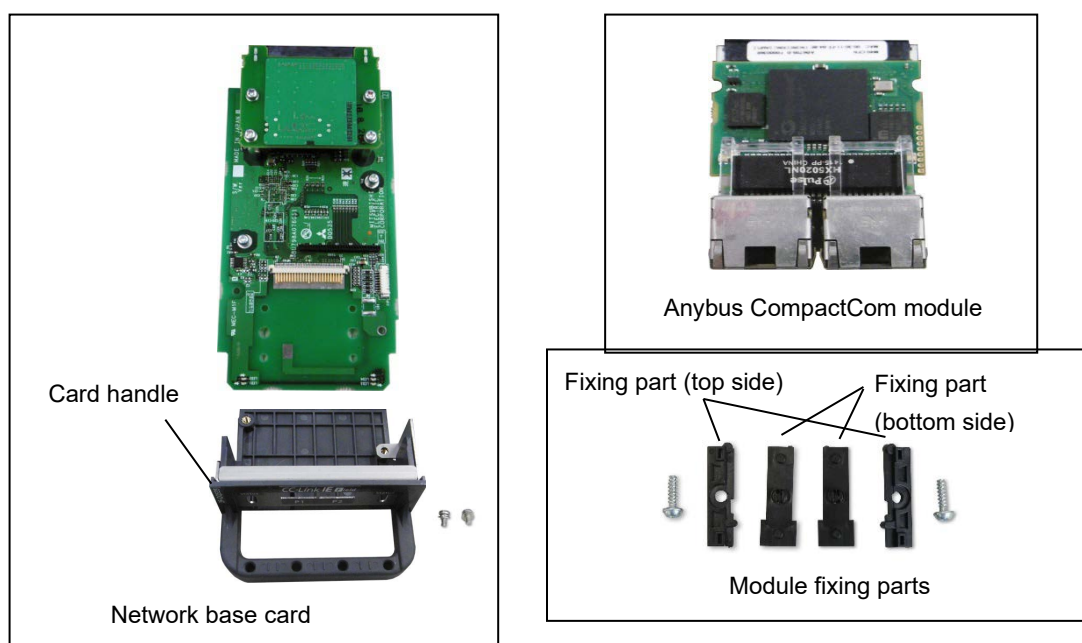
EtherNet/IP

PROFINET IO

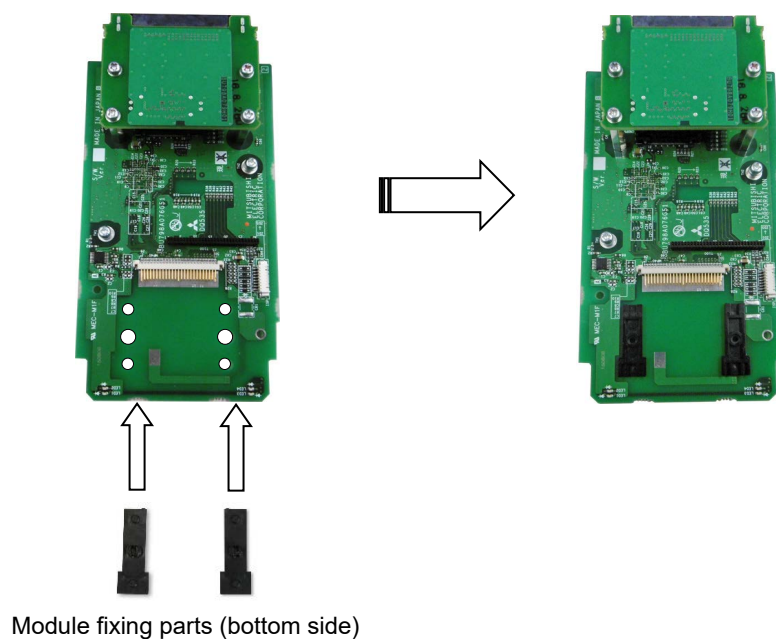
10.1. Module Mounting Procedures

The example of installing the Anybus CompactCom module on the network base card is shown below.

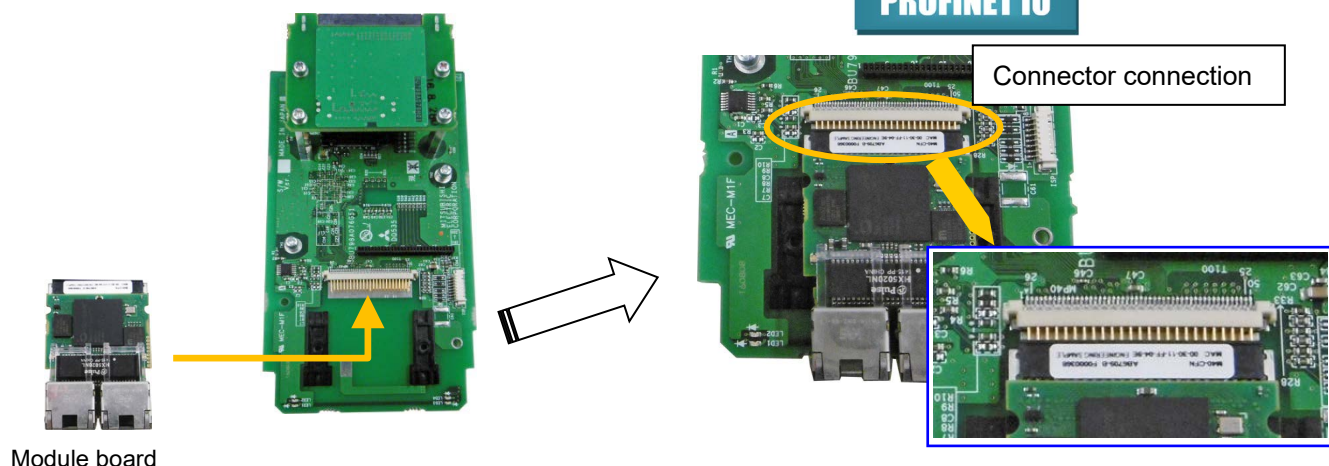
- (1) Prepare the network base card, Anybus CompactCom module, and module fixing parts.
Remove the card handle fixing screws from the network base card, and separate the card from the card handle.



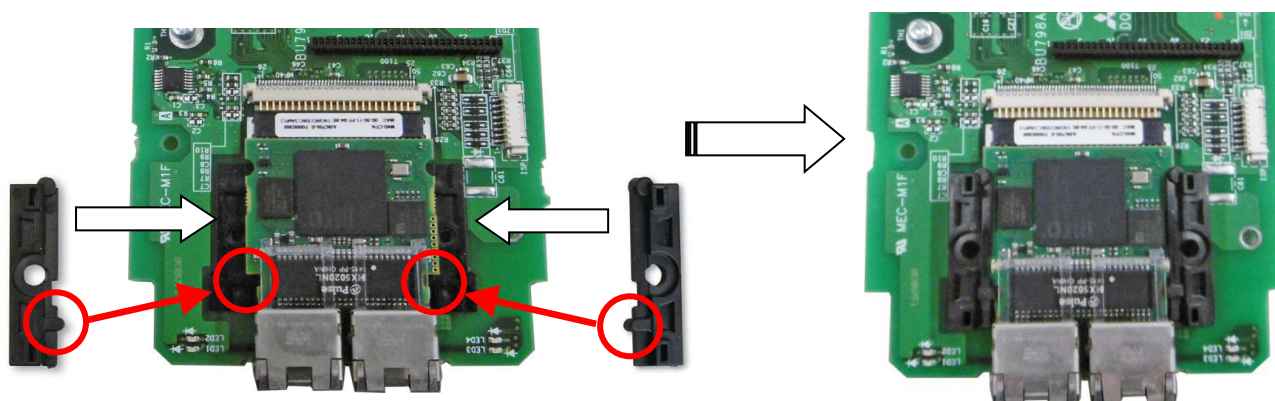
- (2) Insert the protrusions on the module fixing parts (bottom side) into the holes on the card.



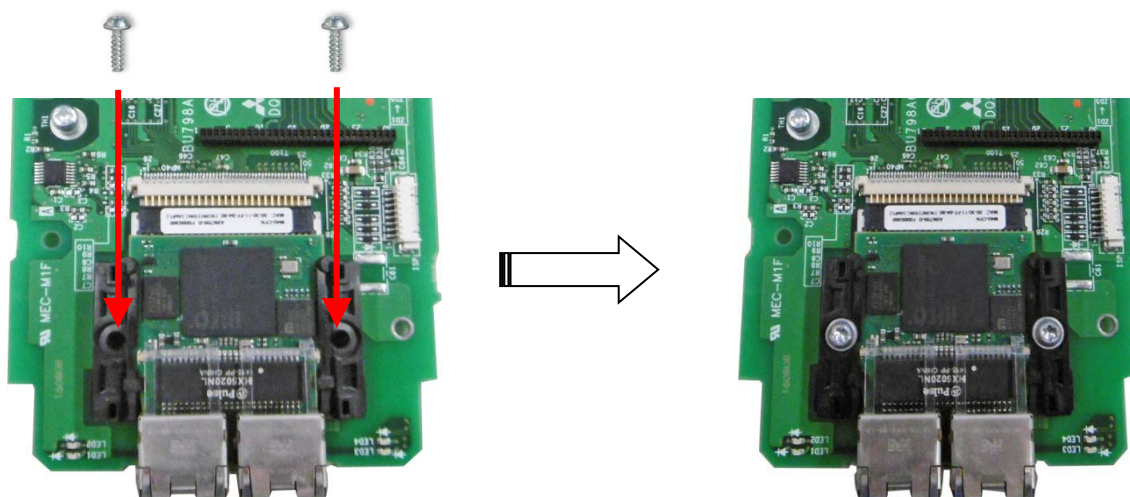
- (3) Place the module onto the fixing parts, and slide it to connect its module connector with pins on the card side.



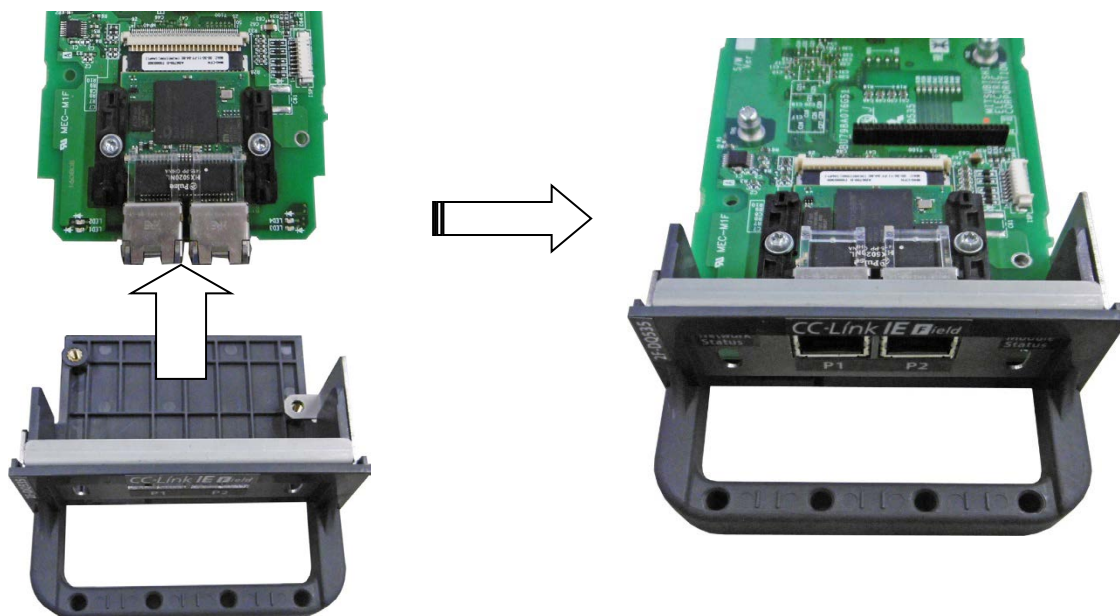
- (4) Align the protrusions on the module fixing parts (top side) with the slits on the module, and mount the module as if sandwiching it from the left, right and top. Adjust the position of the module so that the screw holes on the top fixing parts and bottom fixing parts are aligned. There may be a small opening at the connector section between the module and card, but this is not a problem.



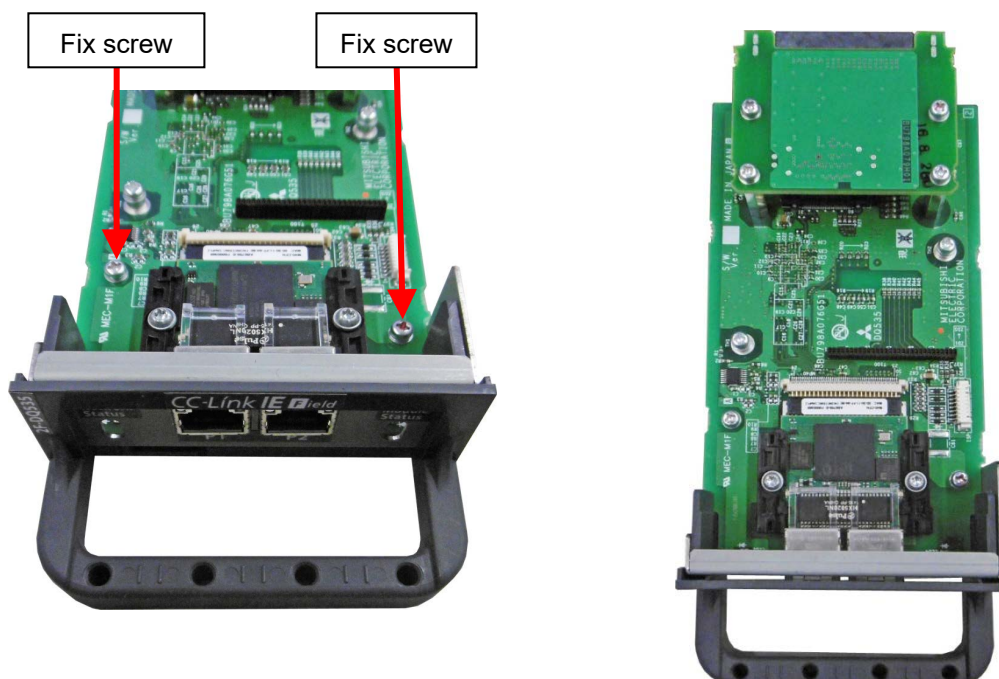
- (5) Fasten the module fixing parts with screws. Use the hex lobular driver.



- (6) Mount the card handle. Fit the handle so that the network connector of the module board fits into the hole on the card handle plate.



- (7) Fasten the card and card handle with screws. This completes the module mounting process. Tighten the screws with a cross-point driver.



10.2. Hardware Setting of the Card

CC-Link IE TSN**CC-Link IE Field****EtherCAT****EtherNet/IP****PROFINET IO**

There are no hardware settings for the 2F-DQ535-TSN, 2F-DQ535, 2F-DQ535-EC, 2F-DQ535-EIP, and 2F-DQ535-PN cards.

All settings are completed with the master station parameters and robot controller parameters.
Refer to "12.1 Setting the Parameters" for details.

11. CONNECTIONS AND WIRING



11.1. Mounting Network Base Card on Robot Controller

Only one network base card can be mounted in the option slot 2 of the robot controller. It cannot be mounted in the slot 1.

11.1.1. CR800-D controller

Remove the interface cover of option slot 2 on the front of the robot controller, and mount the interface card (2F-DQ535-TSN, 2F-DQ535, 2F-DQ535-EC, 2F-DQ535-EIP, or 2F-DQ535-PN) there.

Please use the handle of the interface card at mounting of the interface card.

To remove the interface card, pull it out while lightly lifting the removal lever upward. Grasp the handle of the interface card and pull out the card horizontally from the controller.

<CR800 controller (Front side)>

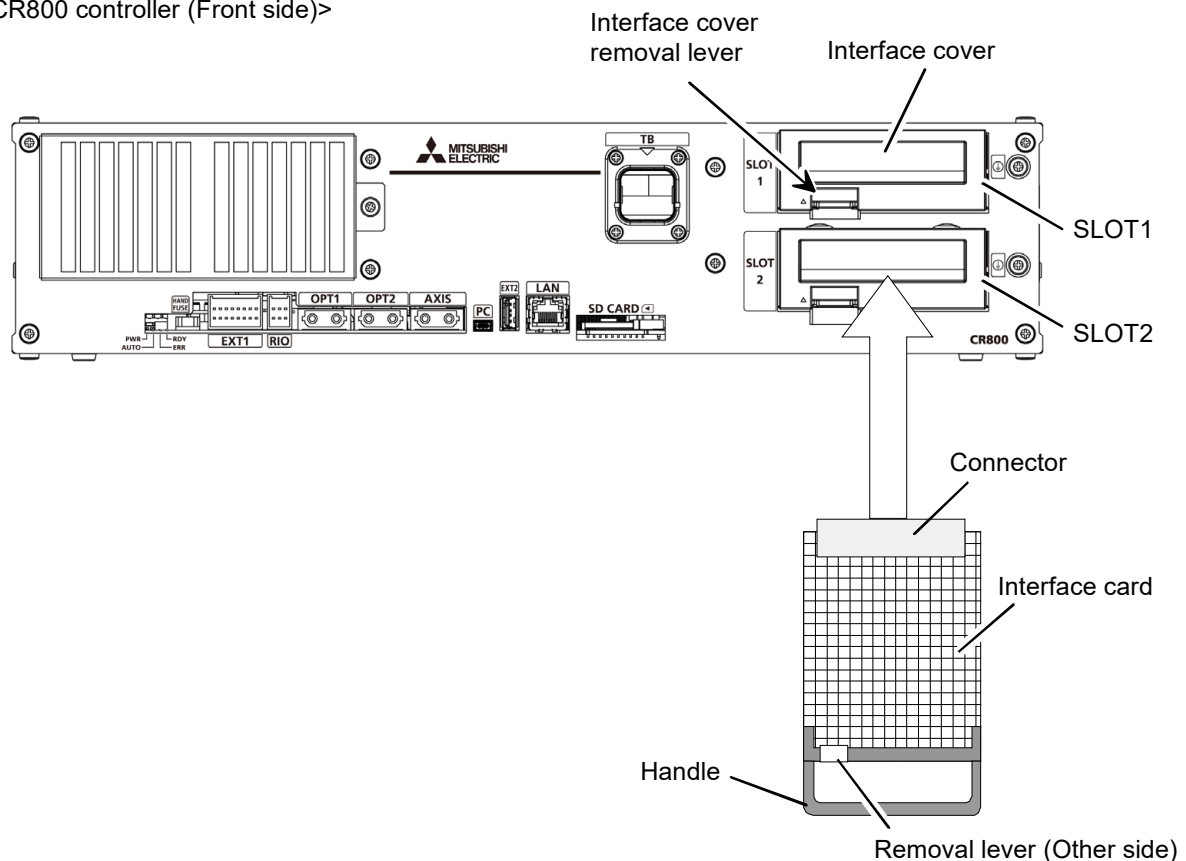


Figure 11-1 Mounting of the interface card 2F-DQ535-TSN, 2F-DQ535, 2F-DQ535-EC, 2F-DQ535-EIP, or 2F-DQ535-PN (CR800-D controller)

11.1.2. CR860-D controller

CC-Link IE TSN

CC-Link IE Field

EtherCAT

EtherNet/IP

PROFINET IO

Remove the interface cover of option slot 2 on the front of the R800CPU module, and mount the interface card (2F-DQ535-TSN, 2F-DQ535, 2F-DQ535-EC, 2F-DQ535-EIP, or 2F-DQ535-PN) there. Please use the handle of the interface card at mounting of the interface card.

To remove the interface card, pull it out after lightly moving the removal lever to the right. Grasp the handle of the interface card and pull out the card horizontally from the R800CPU module.

<CR860-D controller (Front side)>

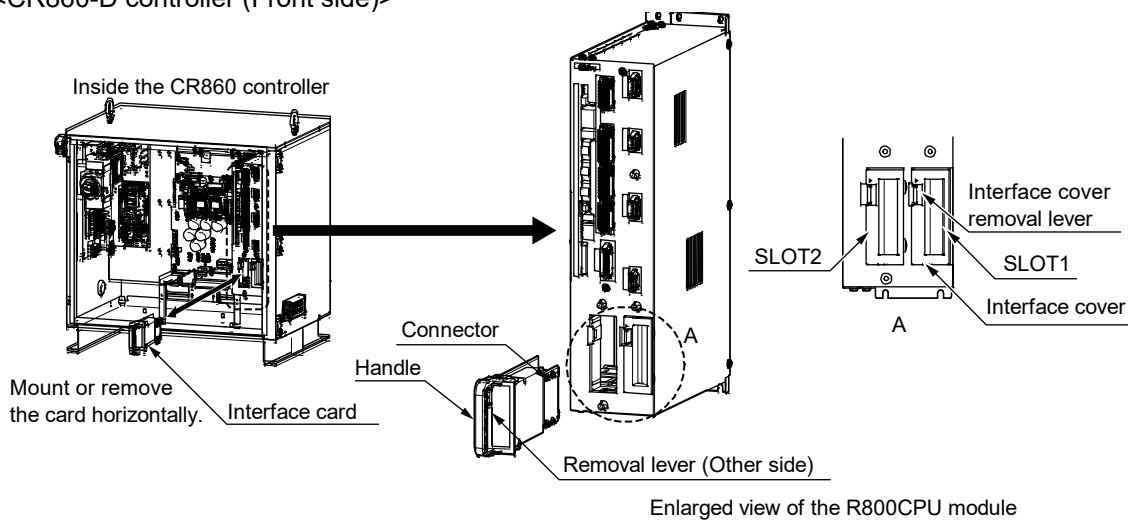


Figure 11-2 Mounting of the interface card 2F-DQ535-TSN, 2F-DQ535, 2F-DQ535-EC, 2F-DQ535-EIP, or 2F-DQ535-PN (CR860-D controller)

CC-Link IE TSN

CC-Link IE Field

EtherCAT

EtherNet/IP

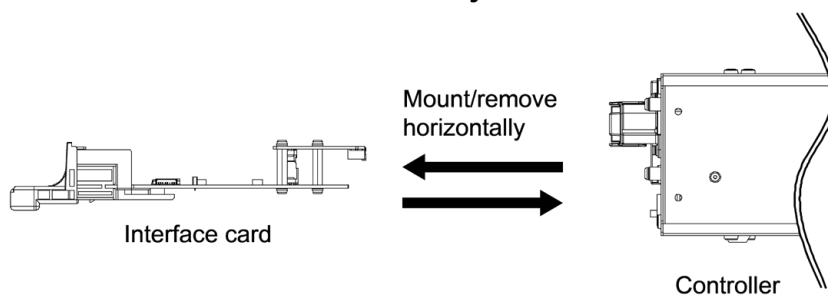
PROFINET IO

! CAUTION

Only one interface card (2F-DQ535-TSN, 2F-DQ535, 2F-DQ535-EC, 2F-DQ535-EIP, or 2F-DQ535-PN) can be mounted in option slot 2 of the robot controller. It cannot be mounted in the slot 1.

It cannot be mounted in the slot 1.

Mount or remove the interface card horizontally from or to the controller.



11.2. Wiring

CC-Link IE TSN

11.2.1. For the CC-Link IE TSN module

For information on the connection procedure, refer to the manual included with each master station. In addition, the parameter setting procedure for the master station side is described in "[12.1. Setting the Parameters](#)".

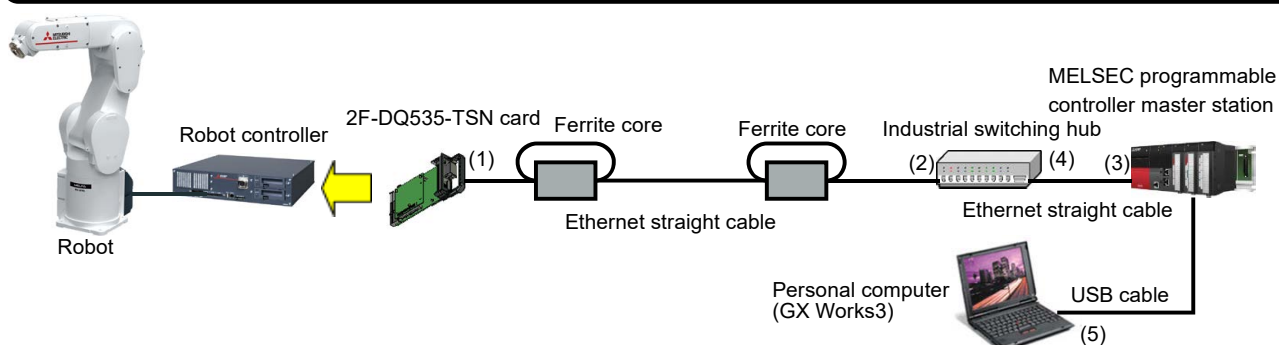
The following section shows an example of connecting the 2F-DQ535-TSN card and a Mitsubishi Electric programmable controller (MELSEC iQ-R series, RJ71GN11-T2) with an Ethernet cable on a one-to-one basis and checking the I/O signals.



CAUTION

For customers using PoE compatible products

Network base cards do not support PoE. Do not connect PoE compatible products (hubs or cables) to the network base card as it may malfunction.



Note) Pass the cable through the ferrite cores twice.

- (1) Connect a straight Ethernet cable to the 2F-DQ535-TSN card.
- (2) Connect the other end of the cable to the industrial switching hub.
Install the ferrite cores on the cable between the switching hub and node (2F-DQ535-TSN card).
- (3) Connect a straight Ethernet cable to P1 (for Ethernet) on the RJ71GN11-T2.
For star type connection, connect a straight Ethernet cable to one of the two ports.
- (4) Connect the other end of the cable to the industrial switching hub.
- (5) Connect a USB cable to the personal computer where GX Works3 (engineering software of Mitsubishi) is installed.

Check the following connections again before using the 2F-DQ535-TSN card.

Table 11-1 Checking connections

No.	Check item	Check
1	Is the 2F-DQ535-TSN card securely mounted into the controller slot?	
2	Are the Ethernet cables between the 2F-DQ535-TSN card and prepared external devices correctly connected?	

CC-Link IE Field

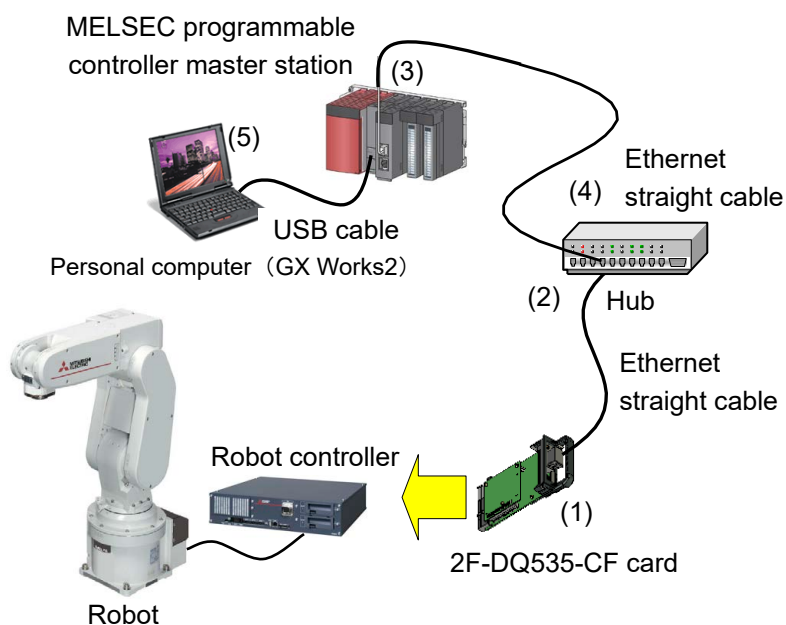
11.2.2. For the CC-Link IE Field module

For information on the connection procedure, refer to the manual included with each master station. In addition, the parameter setting procedure for the master station side is described in "[12.1. Setting the Parameters](#)".

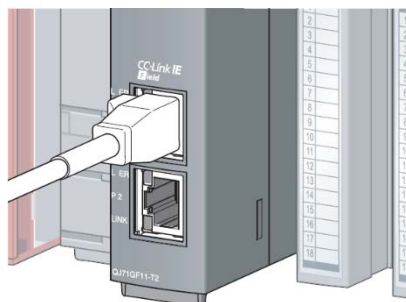
The following section shows an example of connecting the 2F-DQ535 card and a Mitsubishi Electric programmable controller (MELSEC-Q series, QJ71GF11-T2) with an Ethernet cable on a one-to-one basis.

CAUTION***For customers using PoE compatible products***

Network base cards do not support PoE. Do not connect PoE compatible products (hubs or cables) to the network base card as it may malfunction.



- (1) Connect a straight Ethernet cable to the 2F-DQ535 card on which the CC-Link IE Field module is mounted.
- (2) Connect the other connector to the hub.
- (3) Connect a straight Ethernet cable to P1 (for Ethernet) on the QJ71G11-T2. For the star type, connect the connector to either of P1 or P2.



- (4) Connect the other connector to the hub.
- (5) Connect a USB cable to the personal computer where GX Works2 (engineering software of Mitsubishi) is installed.

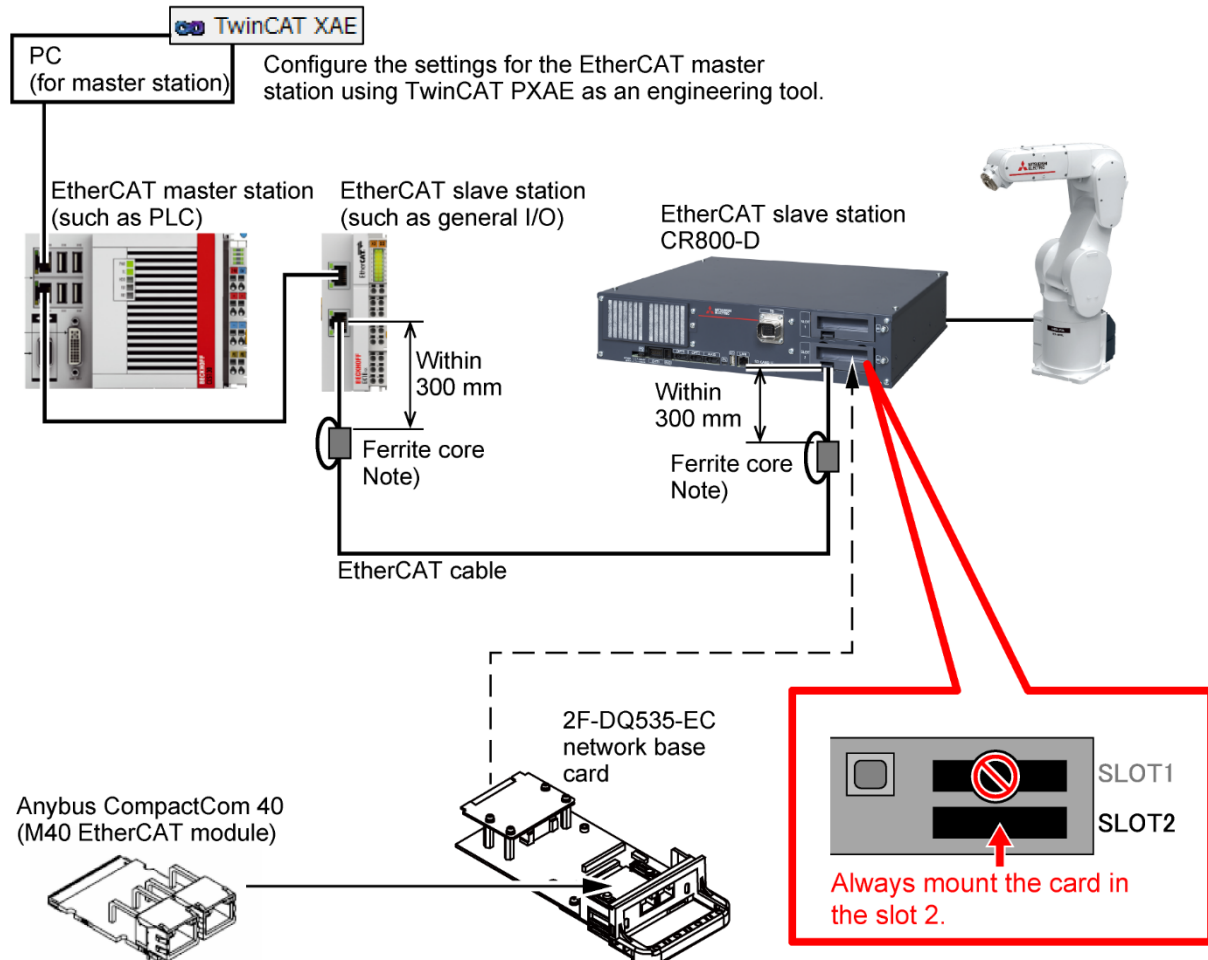
Check the following connections again before using the 2F-DQ535 card.

Table 11-2 Checking connections

No.	Check item	Check
1	Is the 2F-DQ535 card securely mounted into the controller slot?	
2	Are the Ethernet cables between the 2F-DQ535 card and prepared external devices correctly connected?	

11.2.3. For the EtherCAT module

The following shows an example of wiring and connection when operating the CR800-D as an EtherCAT slave using the 2F-DQ535-EC card with the M40 EtherCAT module.



After mounting Anybus CompactCom M40 (M40 EtherCAT module (without housing)) on the card, mount it in the slot 2 of the CR800-D. The card can be mounted only in the slot 2.

Note) Put the cable through the ferrite core twice.

In the above example, a general I/O is connected directly under the master station as a slave station, and the CR800-D is connected under the general I/O as a slave station.

*) The general I/O shown in the above figure is not necessarily used.

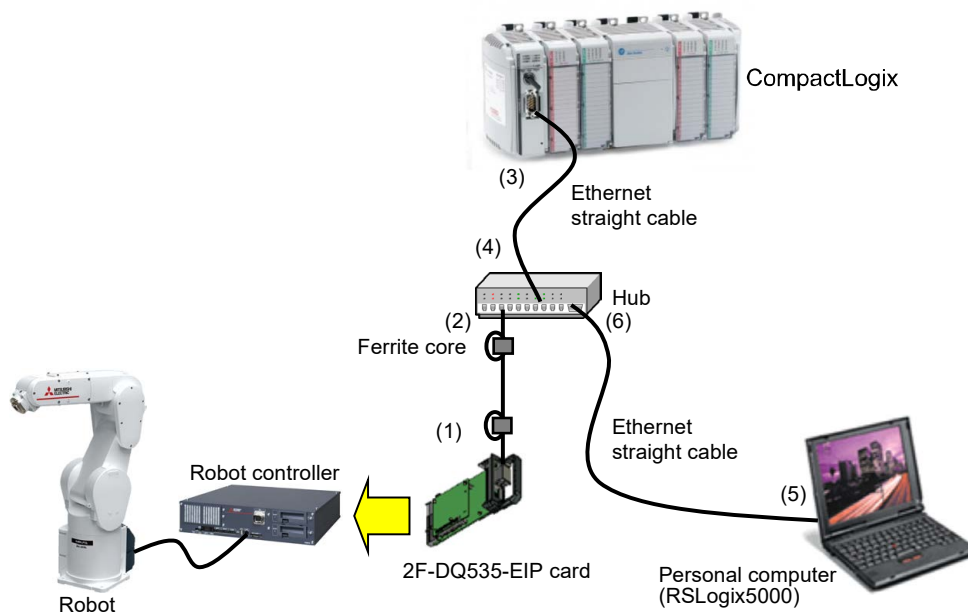
11.2.4. For the EtherNet/IP module

The following section shows an example of connecting the 2F-DQ535-EIP card and a Rockwell programmable controller (CompactLogix L35E) with an Ethernet cable on a one-to-one basis.

**CAUTION**

For customers using PoE compatible products

Network base cards do not support PoE. Do not connect PoE compatible products (hubs or cables) to the network base card as it may malfunction.

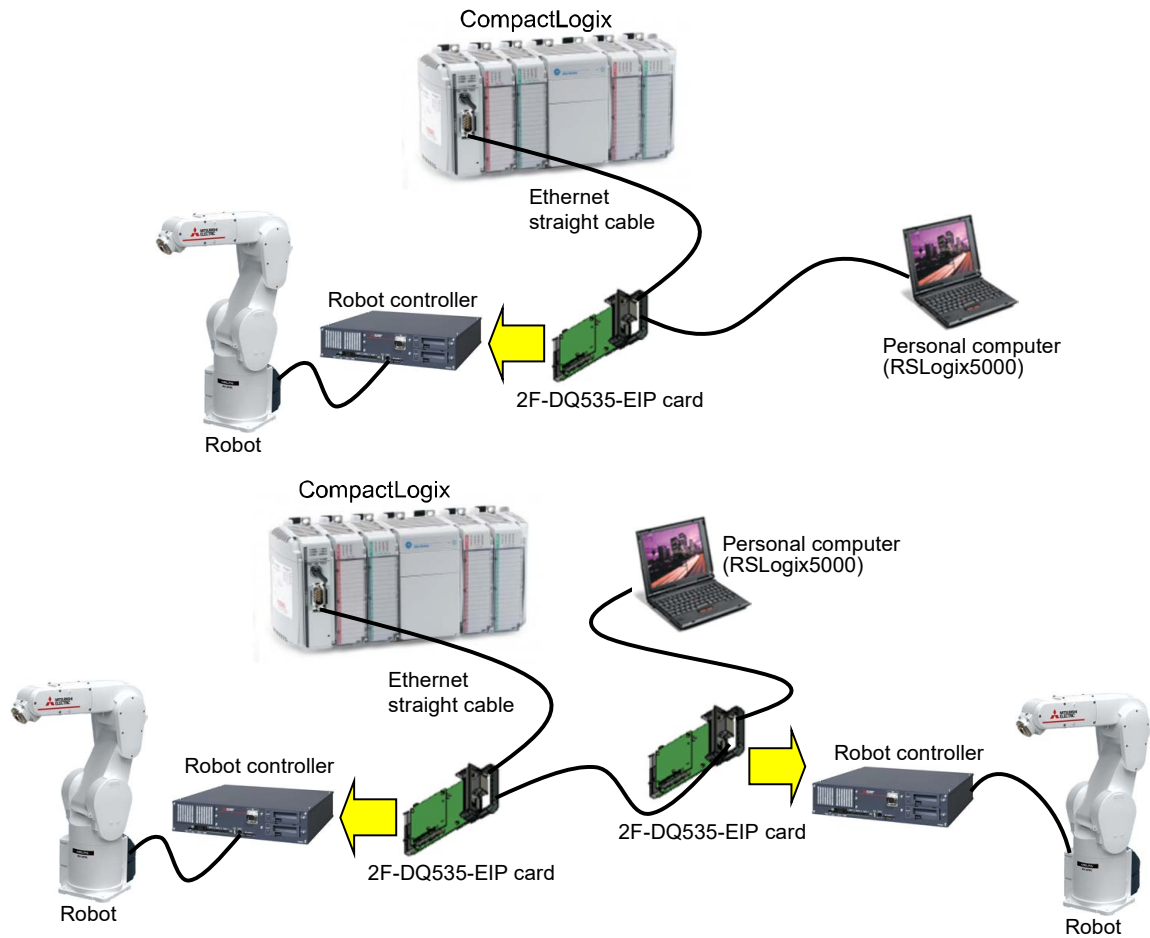


Note) Put the cable through the ferrite core twice.

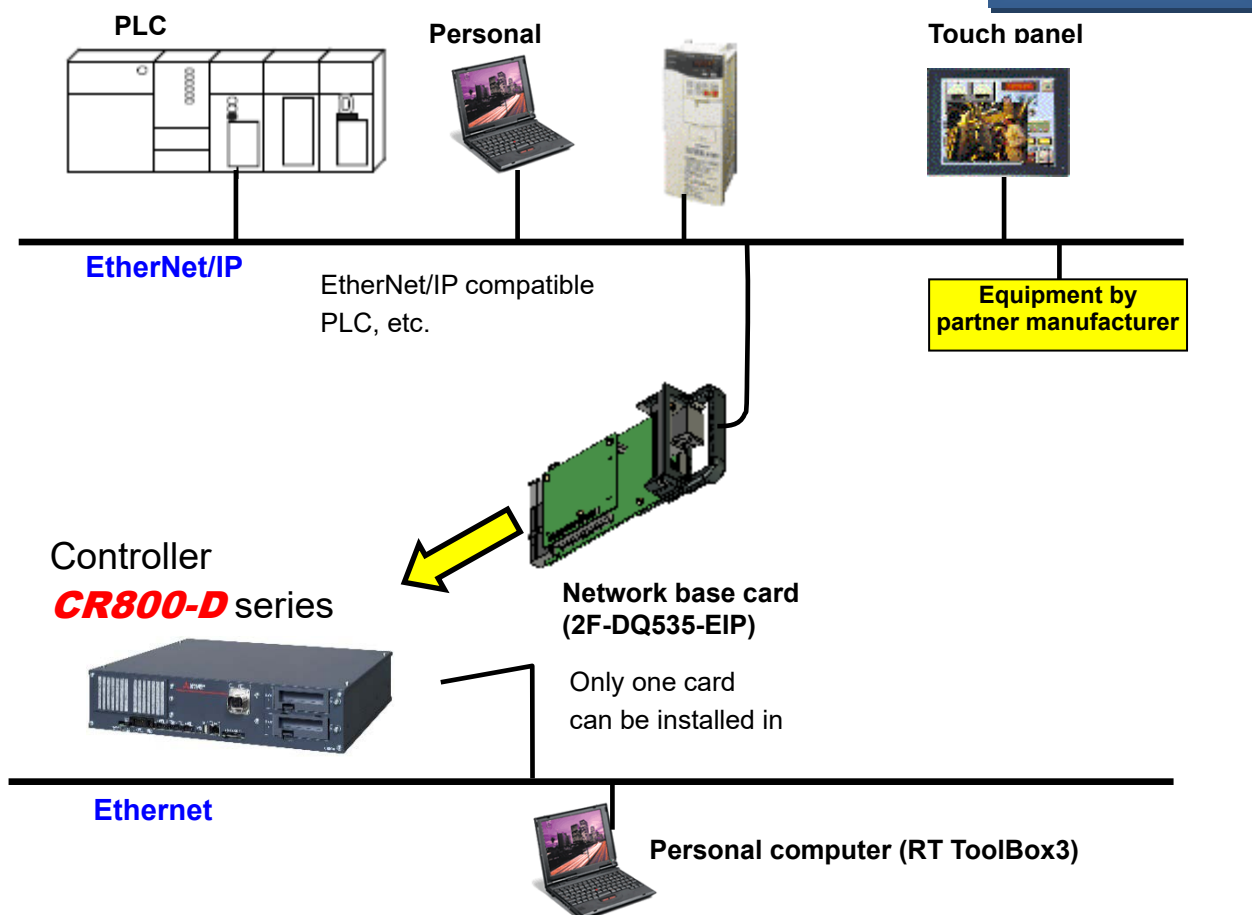
- (1) Connect a straight Ethernet cable to the 2F-DQ535-EIP card on which the EtherNet/IP module is mounted.
- (2) Connect the other end of the cable to the hub.
Connect ferrite cores to the cable between the switching hub and node (2F-DQ535-EIP card).
- (3) Connect a straight Ethernet cable to the EtherNet/IP port on the CompactLogix L35E.
- (4) Connect the other end of the cable to the hub.
- (5) Connect a straight Ethernet cable to a personal computer with RSLogix5000 (Rockwell support software) installed.
- (6) Connect the other end of the cable to the hub.

EtherNet/IP

(7) The EtherNet/IP module has two ports so it can also be connected as shown below.



Refer to the connection overview below.



Check the following connections again before using the 2F-DQ535-EIP card.

Table 11-3 Checking connections

No.	Check item	Check
1	Is the 2F-DQ535-EIP card securely inserted into the controller slot?	
2	Are the Ethernet cables between the 2F-DQ535-EIP card and prepared external devices correctly connected?	

PROFINET IO

11.2.5. For the PROFINET IO module

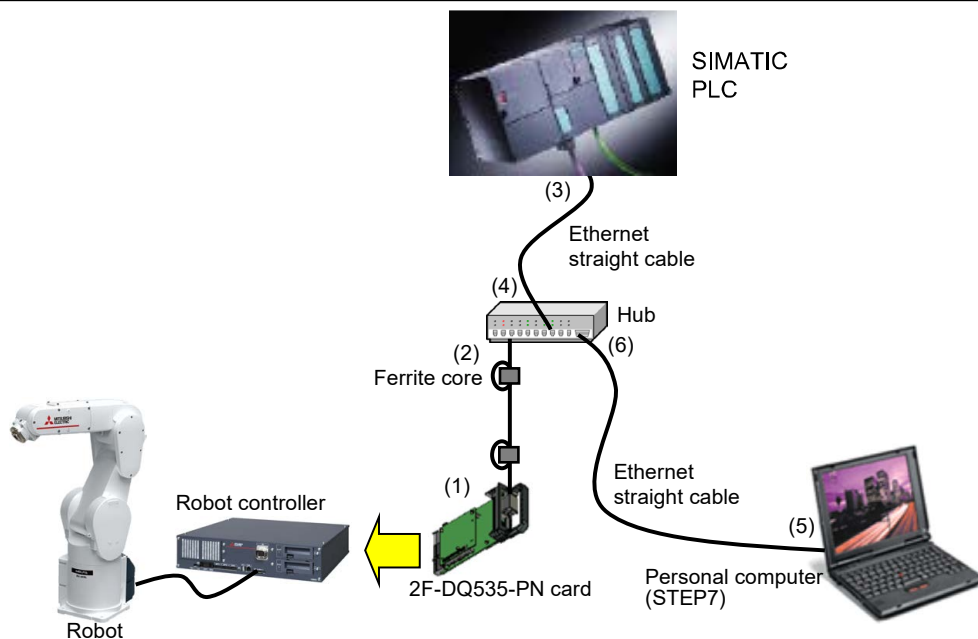
The following section shows an example of connecting the 2F-DQ535-PN card and a Siemens programmable controller (SIMATIC S7-1200) with an Ethernet cable on a one-to-one basis.



CAUTION

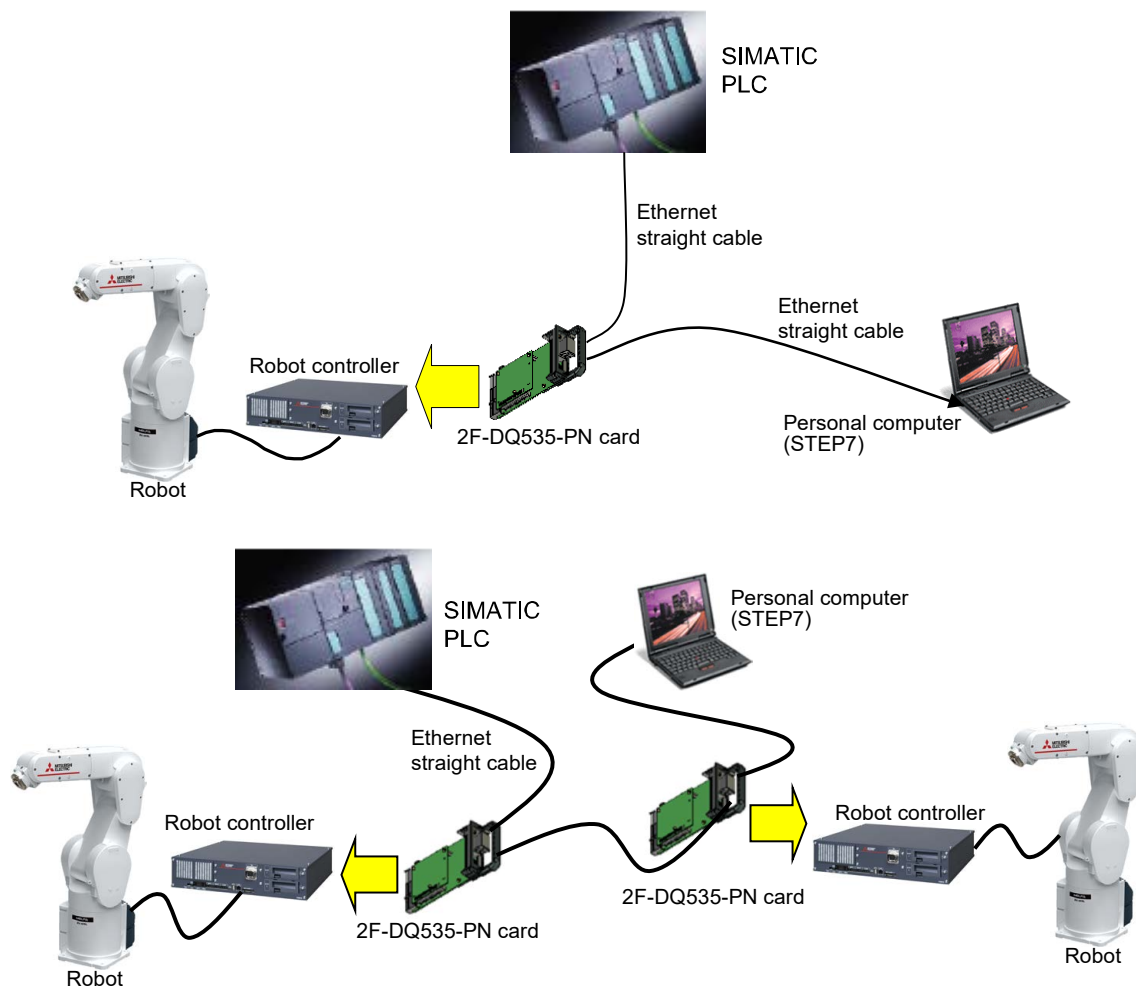
For customers using PoE compatible products

Network base cards do not support PoE. Do not connect PoE compatible products (hubs or cables) to the network base card as it may malfunction.



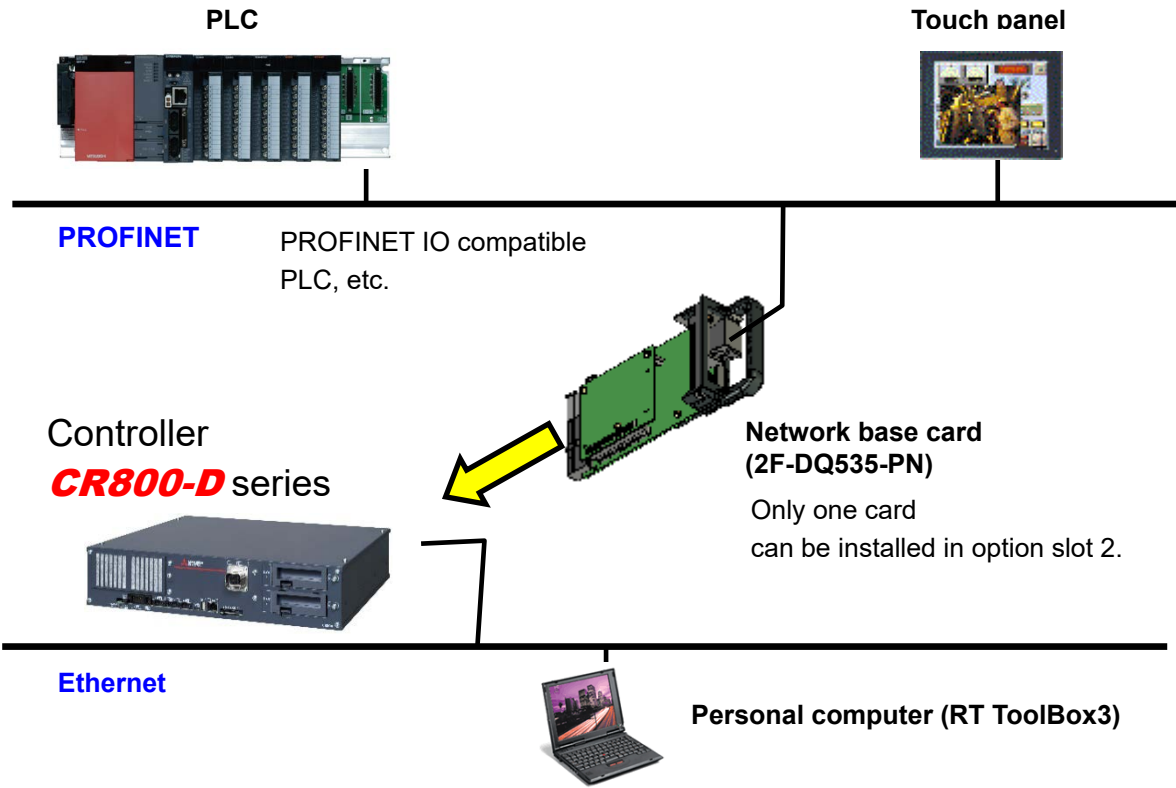
- (1) Connect a straight Ethernet cable to the 2F-DQ535-PN card on which the PROFINET module is mounted.
- (2) Connect the other end of the cable to the hub.
Connect ferrite cores to the cable between the switching hub and node (2F-DQ535-PN card).
- (3) Connect a straight Ethernet cable to the PROFINET port on the SIMATIC PLC.
- (4) Connect the other end of the cable to the hub.
- (5) Connect a straight Ethernet cable to a personal computer with STEP7 (Siemens support software) installed.
- (6) Connect the other end of the cable to the hub.

(7) The PROFINET IO module has two ports so it can also be connected as shown below.



PROFINET IO

Refer to the connection overview below.



Check the following connections again before using the 2F-DQ535-PN card.

Table 11-4 Checking connections

No.	Check item	Check
1	Is the 2F-DQ535-PN card securely inserted into the controller slot?	
2	Are the Ethernet cables between the 2F-DQ535-PN card and prepared external devices correctly connected?	

12. PROCEDURES FOR STARTING OPERATION

CC-Link IE TSN

CC-Link IE Field

EtherCAT

EtherNet/IP

PROFINET IO

The procedures for starting operation with the Anybus-CompactCom module are shown below.
In this example, the network base card and the master station are connected with an Ethernet cable, and an operation to confirm the I/O signal is performed.
For more information on the master station, refer to the manual enclosed with the master station.

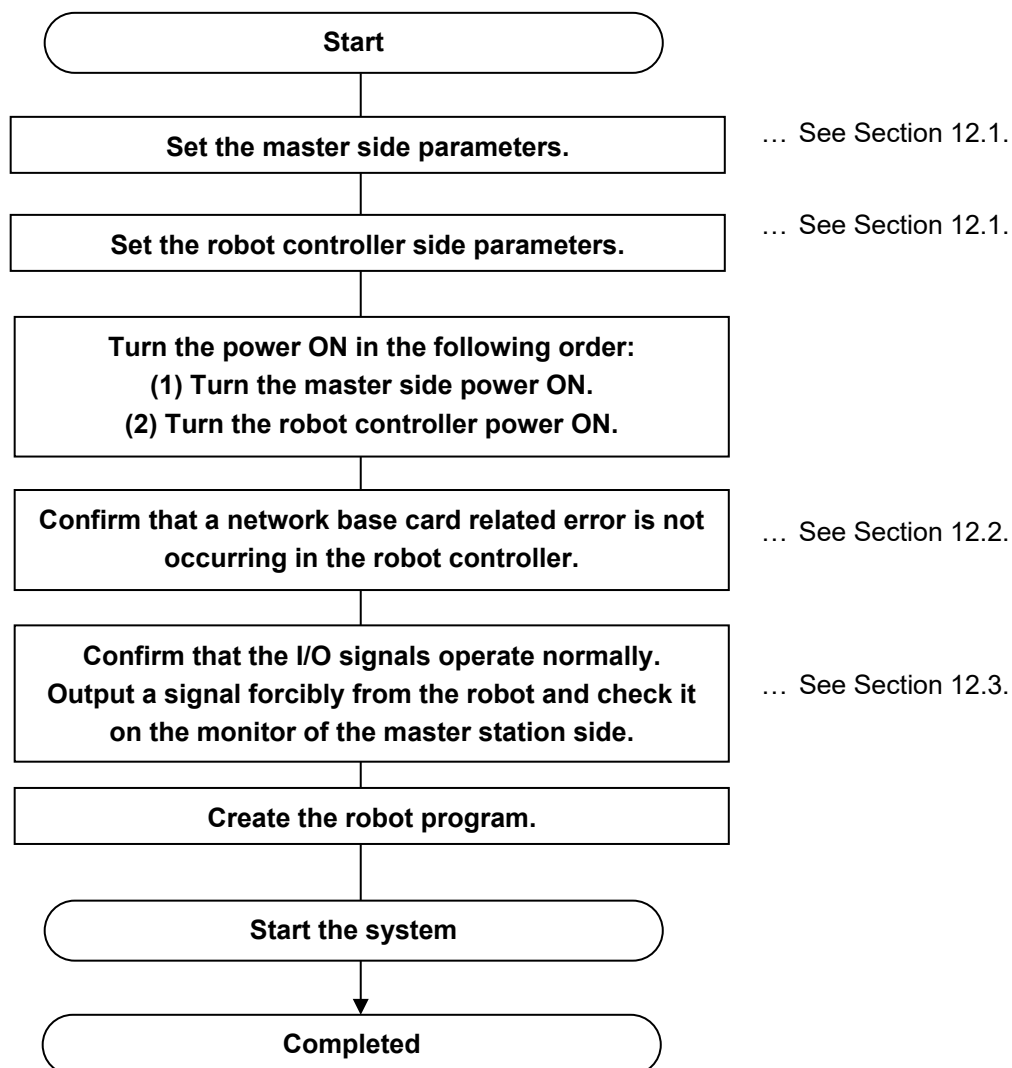


Figure 12-1 Procedures for starting operation

CC-Link IE TSN	CC-Link IE Field
EtherCAT	EtherNet/IP
PROFINET IO	

Table 12-1 Example of equipment on the master station side

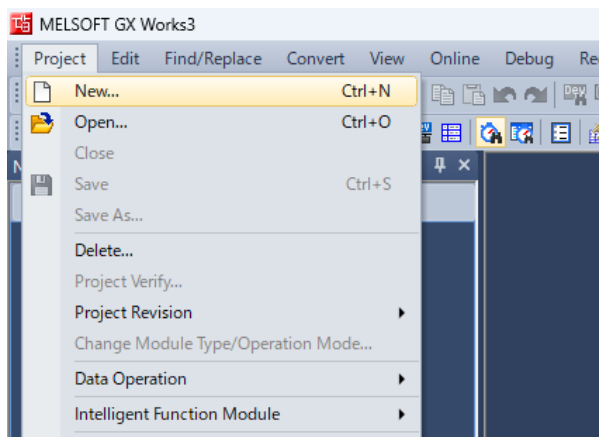
	CC-Link IE TSN	CC-Link IE Field	EtherCAT	EtherNet/IP
Master station equipment	Mitsubishi Electric MELSEC iQ-R R04CPU RJ71GN11-T2	Mitsubishi Electric MELSEC iQ Q03UDVCP QJ71GF11-T2	Beckhoff Automation CX5130 Embedded PC (TwinCAT PLC runtime)	Rockwell Automation CompactLogix L35E
Software used	GX Works3 engineering software	GX Works2 engineering software	TwinCAT XAE engineering software	RSLogix5000 software

	PROFINET IO
Master station equipment	Siemens SIMATIC S7-1200 CPU 1211C
Software used	STEP7 engineering software

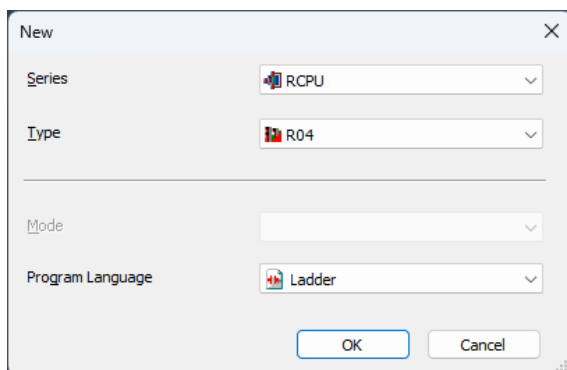
12.1. Setting the Parameters

12.1.1. For the CC-Link IE TSN module

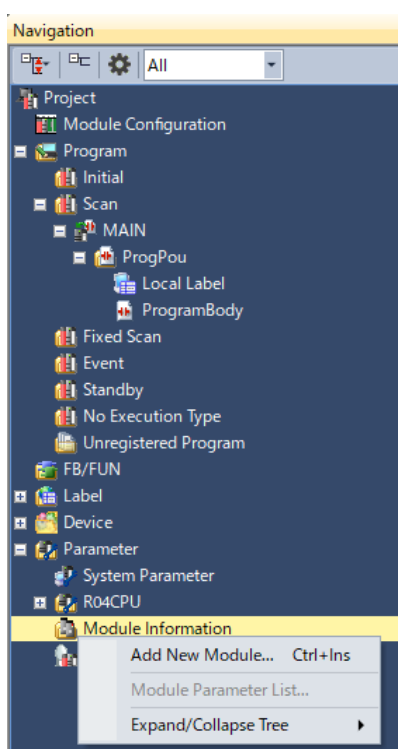
- (1) Start GX Works3 and create a new PLC project.

CC-Link IE TSN

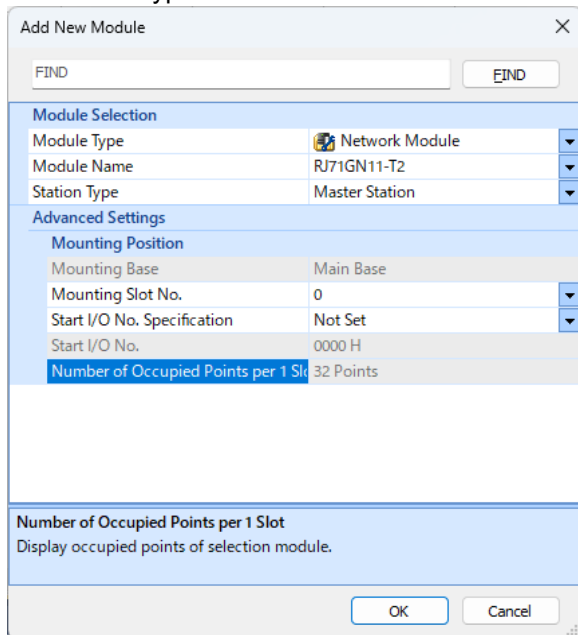
- (2) Set a CPU type. Select the type being used.



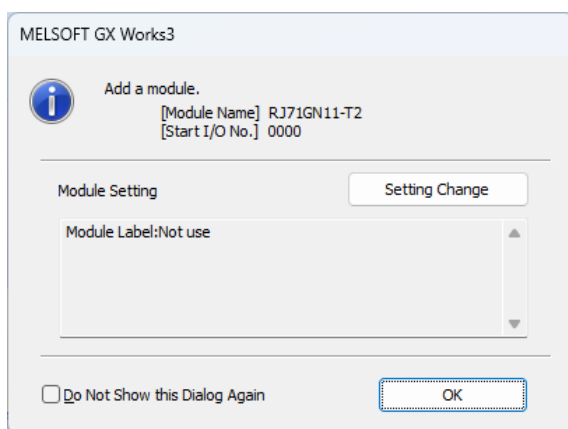
- (3) Right-click Module Information then select Add New Module.



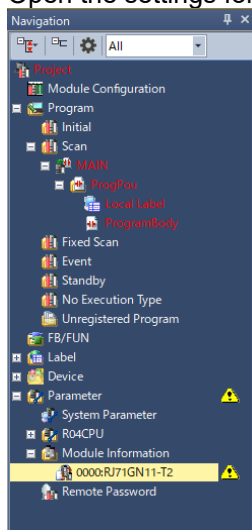
- (4) After setting the module information for the master station in Add New Module, select the OK button.
- Module Type: Network Module
 - Module Name: RJ71GN11-T2
 - Station Type: Master Station



- (5) Select the OK button on the following screen.



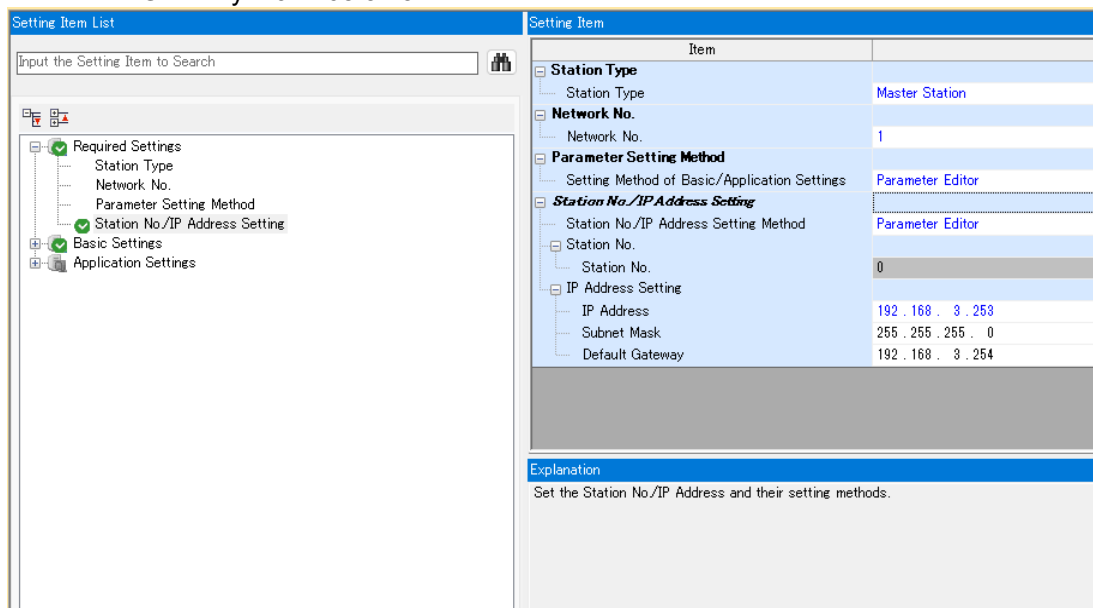
- (6) Open the settings for the CC-Link IE TSN master station (RJ71GN11-T2) from Module Information.



(7) Set "IP Address Setting" under Required Settings.

(Example)

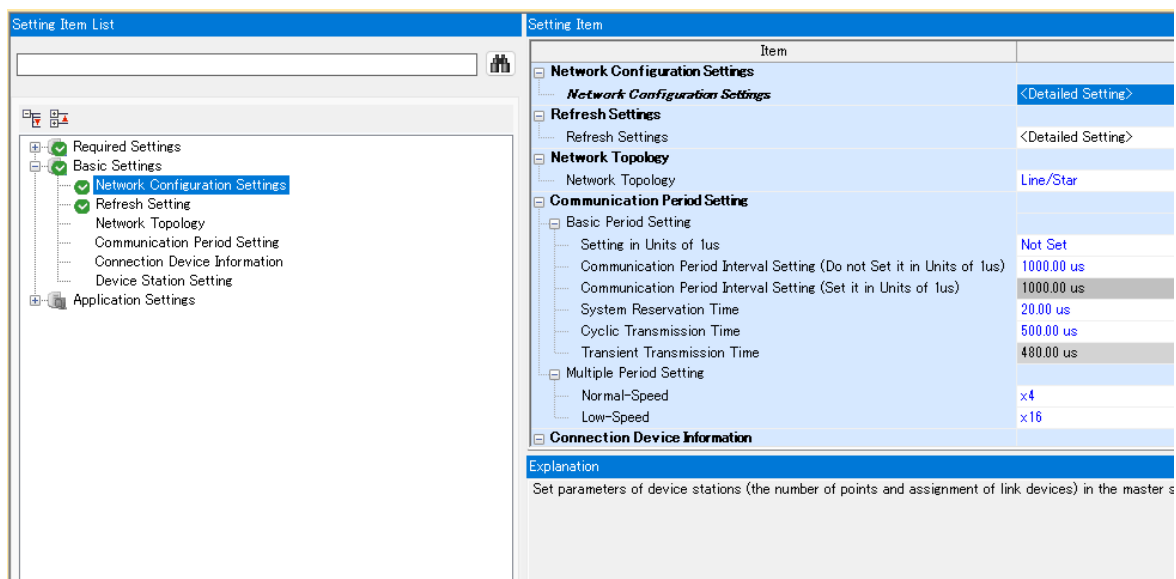
- IP Address: 192.168.3.253
- Subnet Mask: 255.255.255.0
- Default Gateway: 192.168.3.254



Item	Value
Station Type	Master Station
Network No.	1
Parameter Setting Method	Parameter Editor
Setting Method of Basic/Application Settings	Parameter Editor
Station No./IP Address Setting Method	Parameter Editor
Station No.	0
IP Address	192 . 168 . 3 . 253
Subnet Mask	255 . 255 . 255 . 0
Default Gateway	192 . 168 . 3 . 254

Explanation
Set the Station No./IP Address and their setting methods.

(8) Select "Network Configuration Settings" under Basic Settings.

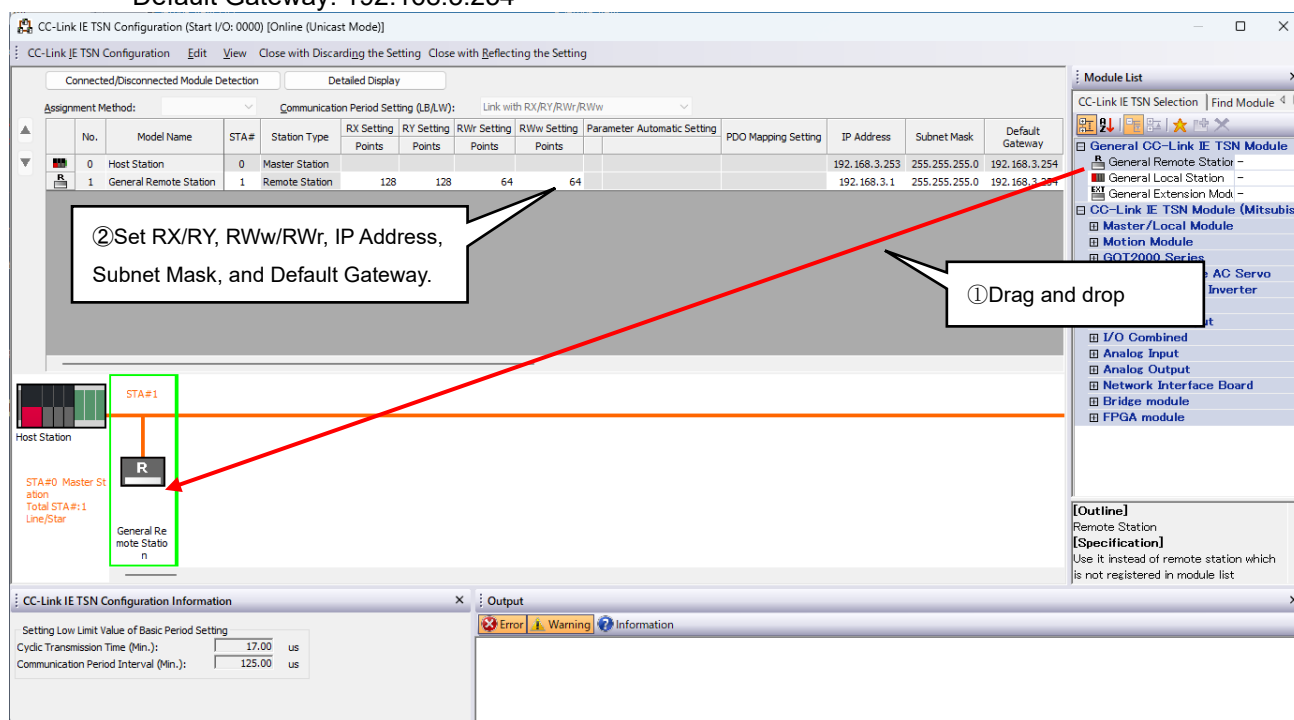


Item	Value
Network Configuration Settings	<Detailed Setting>
Refresh Settings	<Detailed Setting>
Network Topology	Line/Star
Communication Period Setting	
Basic Period Setting	
Setting in Units of 1us	Not Set
Communication Period Interval Setting (Do not Set it in Units of 1us)	1000.00 us
Communication Period Interval Setting (Set it in Units of 1us)	1000.00 us
System Reservation Time	20.00 us
Cyclic Transmission Time	500.00 us
Transient Transmission Time	480.00 us
Multiple Period Setting	
Normal-Speed	x4
Low-Speed	x16
Connection Device Information	

Explanation
Set parameters of device stations (the number of points and assignment of link devices) in the master s

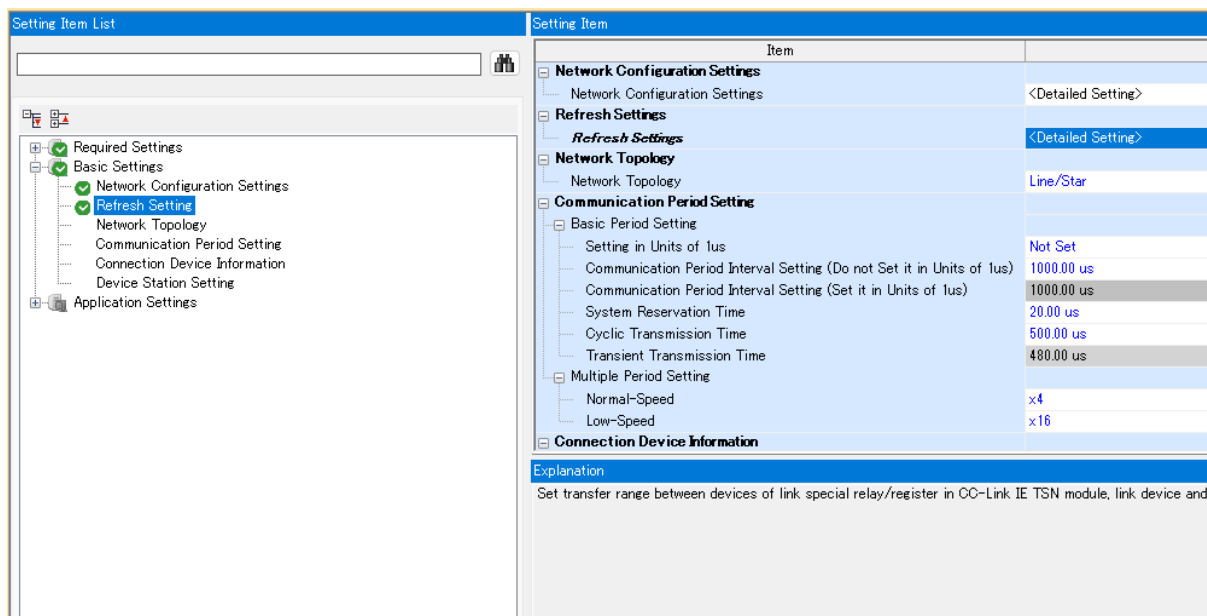
(9) Drag and drop the General Remote Station in the following Module List, and then set it as follows.
(Example)

- RX/Ry setting: Points 128/Start 0000/End 007F
- RWw/RWr setting: Points 64/Start 0000/End 003F
- IP Address: 192.168.3.1
- Subnet Mask: 255.255.255.0
- Default Gateway: 192.168.3.254



(10) Select "Close with Reflecting the Setting" on the above screen to close the screen.

(11) Set the "Refresh Settings" for the basic settings.



Set as follows

- 1) Import the 128-point output signals 6000 to 6127 of the robot into the bit devices M0 to M127 of PLC.
 - 2) Import the bit devices M2000 to M2127 of PLC into the input signals 6000 to 6127 of the robot.
 - 3) Import the output registers 6000 to 6063 of the robot into the word devices D0 to D63 of PLC.
 - 4) Import the word devices D200 to D263 of PLC into the input registers 6000 to 6063 of the robot.
- Specifically, set the refresh parameters on the PLC side as follows.

(Example)

- No.1: Link Side (Dev. Name RX/Points 128/Start 0000/End 007F)
CPU Side (Dev. Name M/Points 128/Start 0/End 127)
- No.2: Link Side (Dev. Name RY/Points 128/Start 0000/End 007F)
CPU Side (Dev. Name M/Points 128/Start 2000/End 2127)
- No.3: Link Side (Dev. Name RWr/Points 64/Start 0000/End 003F)
CPU Side (Dev. Name D/Points 64/Start 0/End 63)
- No.4: Link Side (Dev. Name RWw/Points 64/Start 0000/End 003F)
CPU Side (Dev. Name D/Points 64/Start 200/End 263)

Setting Item									
No.	Link Side				Target	CPU Side			
	Device Name	Points	Start	End		Device Name	Points	Start	End
-	SB				↔				
-	SW				↔				
1	RX	128	0000	007F	↔	Specify Dev	M	128	0 127
2	RY	128	0000	007F	↔	Specify Dev	M	128	2000 2127
3	RWr	64	0000	003F	↔	Specify Dev	D	64	0 63
4	RWw	64	0000	003F	↔	Specify Dev	D	64	200 263
5					↔				
6					↔				
7					↔				
8					↔				
9					↔				
10					↔				
11					↔				
12					↔				
13					↔				
14					↔				

CC-Link IE TSN

- (12) Press the "Apply" button in the lower-right corner of the screen to reflect the settings.

Link Side					CPU Side				
No.	Device Name	Points	Start	End	Target	Device Name	Points	Start	End
-	SB								
-	SW								
1	RX	128	00000	0007F	Specify Device	M	128	0	127
2	RY	128	00000	0007F	Specify Device	M	128	2000	2127
3	RW	64	00000	0003F	Specify Device	D	64	0	63
4	RWw	64	00000	0003F	Specify Device	D	64	200	263
5									
6									
7									
8									
9									
10									

Explanation
Select a device type (RX/RY/RW/RWw/LB/LW).

Check Restore the Default Settings Apply

- (13) For the settings that follow, refer to "MELSEC iQ-R CC-Link IE TSN User's Manual (Application)" (SH(NA)-082129ENG).

For CC-Link IE TSN modules, interpret the values shown as "Cyclic Transmission Time(Minimum value)" and "Communication Period Interval(Minimum value)" in "CC-Link IE TSN Configuration Information" as the values shown in the table below.

Item	Description
Cyclic Transmission Time(Minimum value)	Add the following value to "Cyclic Transmission Time(Minimum value)" in "CC-Link IE TSN Configuration Information" and set it accordingly. For 1 Gbit/s, add at least 13 μ s. For 100 Mbit/s, add at least 125 μ s.
Communication Period Interval(Minimum value)	Interpret "Communication Period Interval(Minimum value)" in "CC-Link IE TSN Configuration Information" as 1000 μ s.

No.	Model Name	STA#	Station Type	RX Setting Points	RY Setting Points	RW Setting Points	RWw Setting Points	Parameter Automatic Setting	PDO Mapping Setting	IP Address	Subnet Mask	Default Gateway
0	Host Station	0	Master Station							192.168.3.253	255.255.255.0	192.168.3.254
1	General Remote Station	1	Remote Station	128	128	64	64			192.168.3.1	255.255.255.0	192.168.3.254

CC-Link IE TSN Configuration Information

Setting Low Limit Value of Basic Period Setting

Cyclic Transmission Time (Min.): 17.00 us

Communication Period Interval (Min.): 125.00 us

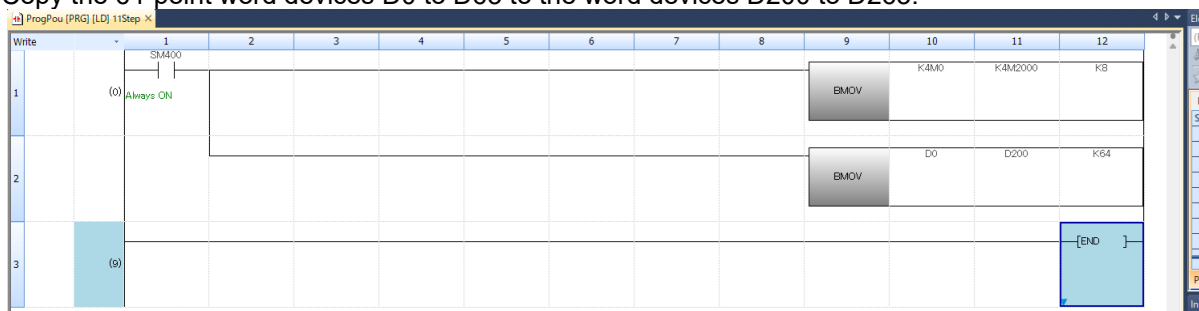
Output

Error Warning Information

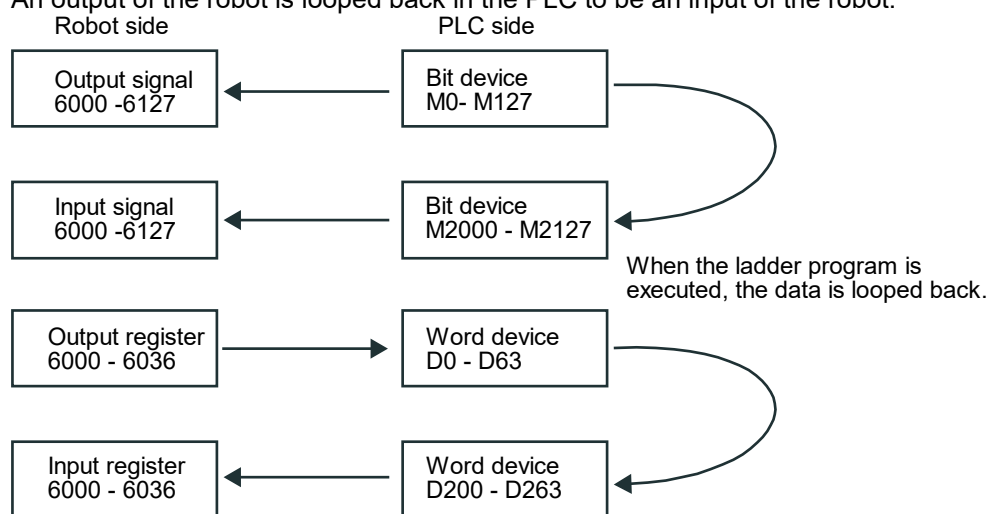
(14) Create a ladder program for the PLC side.

In this program, the input to the PLC is looped back to the output as it is.

- Copy the 128-point bit devices M0 to M127 to the bit devices M2000 to M2127.
- Copy the 64-point word devices D0 to D63 to the word devices D200 to D263.

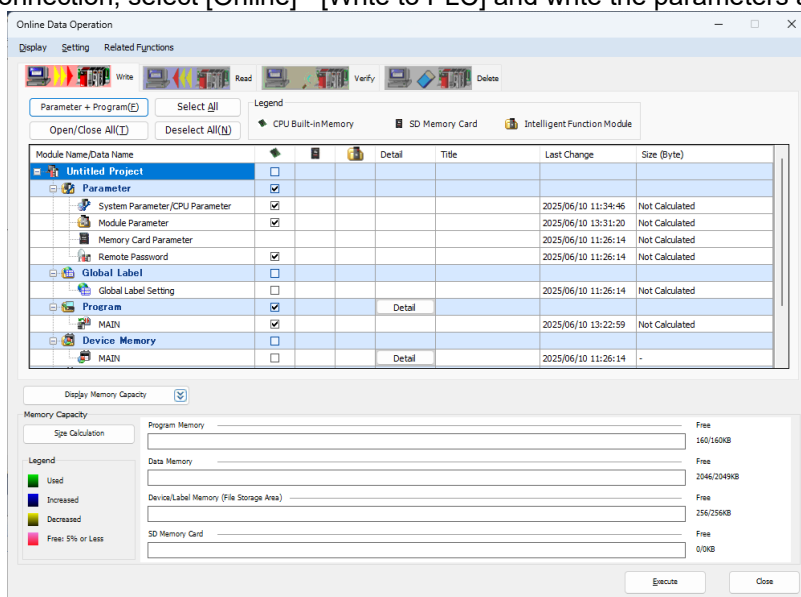


An output of the robot is looped back in the PLC to be an input of the robot.



(15) Write the parameter and program to the PLC.

After setting the connection destination of the PLC side and personal computer, such as a USB connection, select [Online] - [Write to PLC] and write the parameters and the program.

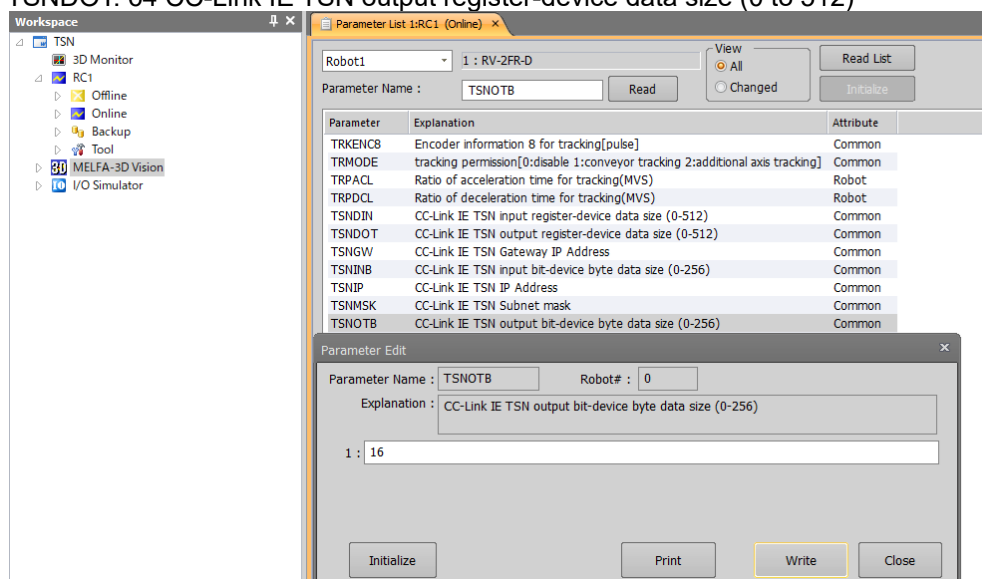


(16) Check the values of the robot controller parameters.

Power on the robot controller and check the following values of the parameters using RT ToolBox3. The robot parameters are set to factory settings. If they have not changed from the initial values, the values do not need to be checked.

(Example)

- TSNIP: 192.168.3.1 CC-Link IE TSN IP Address
- TSNMSK: 255.255.255.0 CC-Link IE TSN Subnet mask
- TSNGW: 192.168.3.254 CC-Link IE TSN Gateway IP Address
- TSNINB: 16 CC-Link IE TSN input bit-device byte data size (0 to 256) *The bit data size is the byte data size $\times 8 = 128$
- TSNOTB: 16 CC-Link IE TSN output bit-device byte data size (0 to 256) *The bit data size is the byte data size $\times 8 = 128$
- TSNDIN: 64 CC-Link IE TSN input register-device data size (0 to 512)
- TSNDOT: 64 CC-Link IE TSN output register-device data size (0 to 512)



The parameter settings and the network configuration settings (IP Address Setting. and number of points of RX/RX and RWr/RWw) must be the same as those of the PLC described in (9).

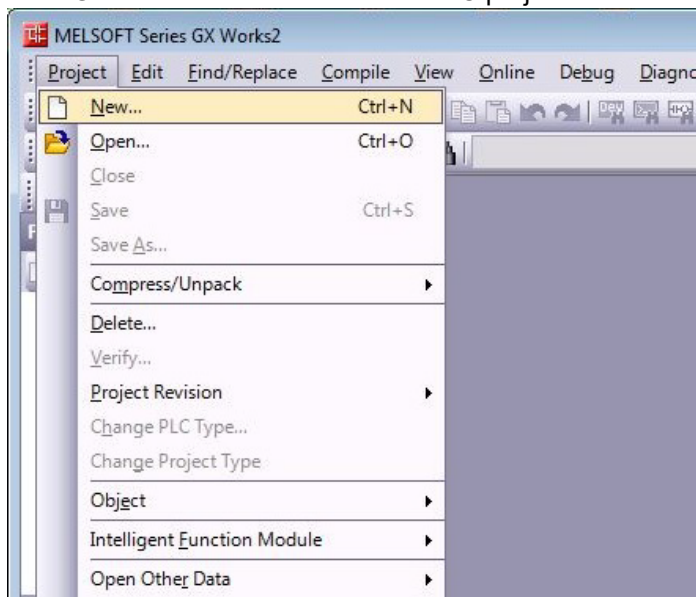
The values described in the parameter settings on the robot side above are setting examples. If the values match the network configuration settings on the PLC side, values can be changed.

12.1.2. For the CC-Link IE Field module

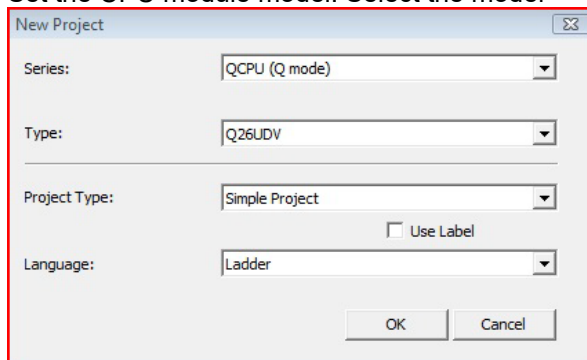
Set the parameters on the master side. If using a MELSEC-Q series programmable controller as the master, use GX Works2 (our engineering software). If using a MELSEC iQ-R series programmable controller as the master, use GX Works3.

This section explains when a MELSEC-Q series programmable controller is used as the master. If using a MELSEC iQ-R series programmable controller as the master, refer to the "GX Works3 Operating Manual".

- (1) Start GX Works2 and create a new PLC project.

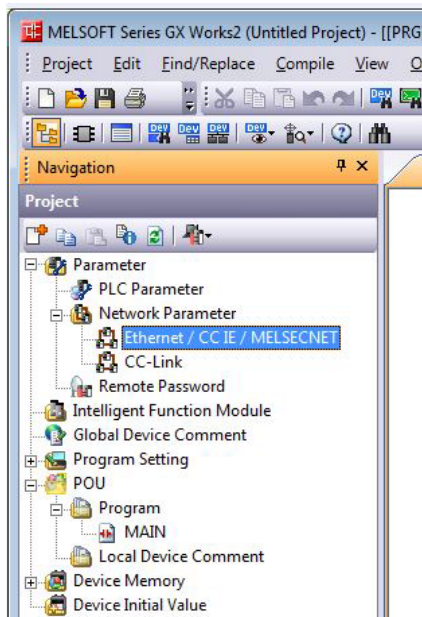


- (2) Set the CPU module model. Select the model

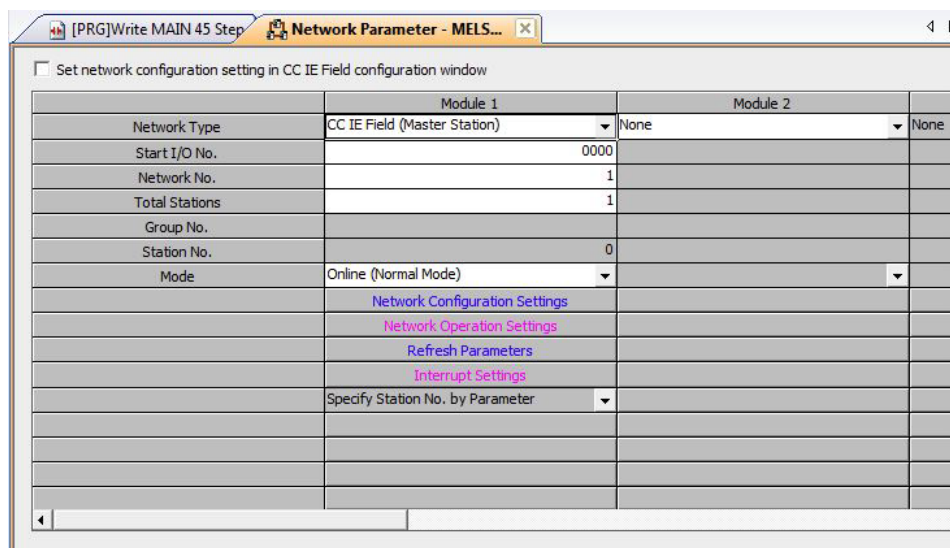


- (3) Open the parameter setting of CC-Link IE Field.

CC-Link IE Field



- (4) Set the network parameters (module 1).
- Network Type : CC IE Field (Master Station)
 - Start I/O No. : 0000
 - Network No. : 1
 - Total Stations : 1



- (5) Set the network configuration.
- Station No. : 1z
 - Station Type : Intelligent Device Station
 - RX/RX Setting : Points 128/Start 0000/End 007F
 - RWw/RWr Setting : Points 64/Start 0000/End 003F

Set up Network configuration.

Assignment Method
☐ Points/Start
☒ Start/End

The column contents for refresh device will be changed corresponding to refresh parameter setting contents.
 Please reopen the window after completing refresh parameter setting when changing refresh parameter.

Module No.	Station No.	Station Type	RX/RX Setting			RWw/RWr Setting			RX
			Points	Start	End	Points	Start	End	
0	0	Master Station							
1	1	Intelligent Device Station	128	0000	007F	64	0000	003F	M0(128)

Refresh devices that are assigned to multiple device ranges will appear in turquoise.
 Please refer to the following supplementary information for the device range contents.

Supplementary Information :

(6) Set the refresh parameters.

Set as follows:

- 1) Import the 128-point output signals 6000 to 6127 of the robot into the bit devices M0 to M127 of PLC.
 - 2) Import the bit devices M2000 to M2127 of PLC into the input signals 6000 to 6127 of the robot.
 - 3) Import the output registers 6000 to 6063 of the robot into the word devices D0 to D63 of PLC.
 - 4) Import the word devices D200 to D263 of PLC into the input registers 6000 to 6063 of the robot.
- Specifically, set the refresh parameters on the PLC side as follows.

- Transfer 1 : Link Side (Dev. Name RX/Points 128/Start 0000/End 007F)
PLC Side (Dev. Name M/Points 128/Start 0/End 127)
- Transfer 2 : Link Side (Dev. Name RY/Points 128/Start 0000/End 007F)
PLC Side (Dev. Name M/Points 128/Start 2000/End 2127)
- Transfer 3 : Link Side (Dev. Name RWr/Points 64/Start 0000/End 003F)
PLC Side (Dev. Name D/Points 64/Start 0/End 63)
- Transfer 4 : Link Side (Dev. Name RWw/Points 64/Start 0000/End 003F)
PLC Side (Dev. Name D/Points 64/Start 200/End 263)

Write MAIN 45 Step

Network Parameter - MELSECNE...

Network Parameter - CC IE Field ...

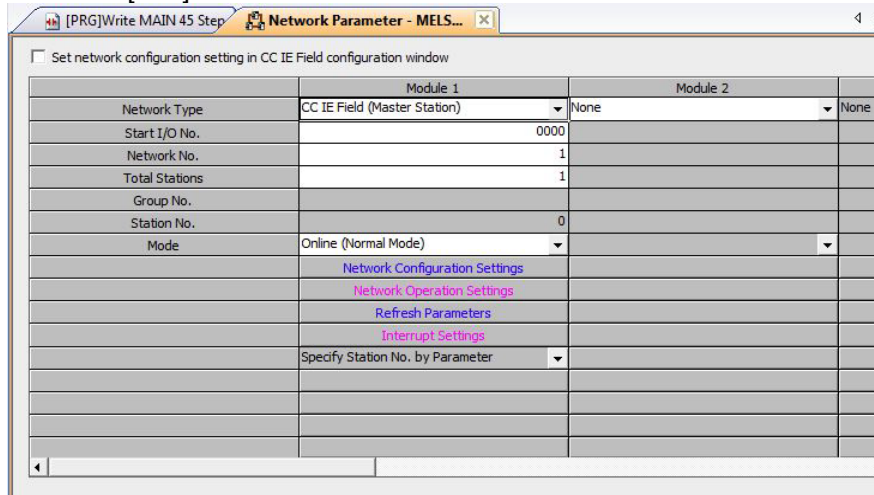
Network Parameter - CC IE ...

Assignment Method
☒ Points/Start
☐ Start/End

	Link Side					PLC Side			
	Dev. Name	Points	Start	End		Dev. Name	Points	Start	End
Transfer SB	SB				↔				
Transfer SW	SW				↔				
Transfer 1	RX	128	0000	007F	↔	M	128	0	127
Transfer 2	RY	128	0000	007F	↔	M	128	2000	2127
Transfer 3	RWr	64	0000	003F	↔	D	64	0	63
Transfer 4	RWw	64	0000	003F	↔	D	64	200	263
Transfer 5					↔				
Transfer 6					↔				
Transfer 7					↔				
Transfer 8					↔				

Default Check End Cancel

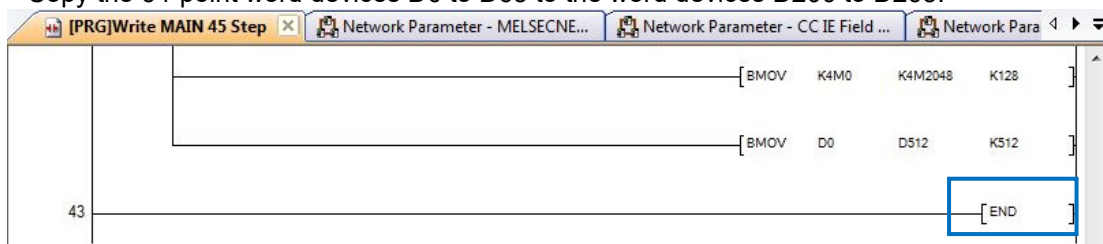
(7) Press the [End] button to close the window.



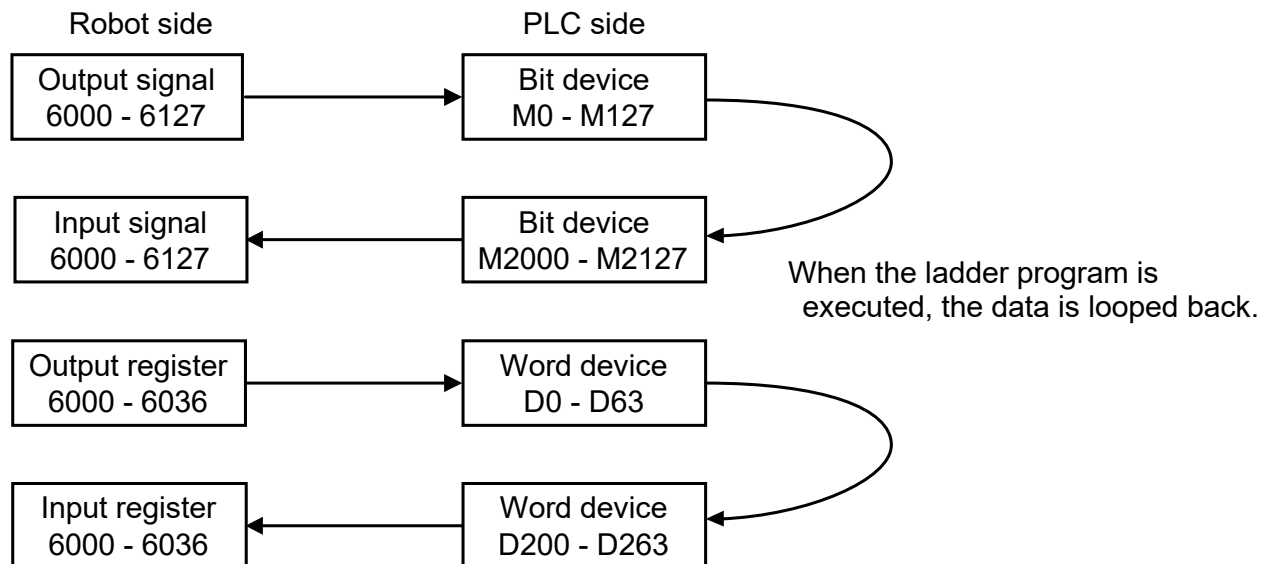
(8) Create a ladder program of the PLC side.

In this program, the input to the PLC is looped back to the output as it is.

- Copy the 128-point bit devices M0 to M127 to the bit devices M2000 to M2127.
- Copy the 64-point word devices D0 to D63 to the word devices D200 to D263.

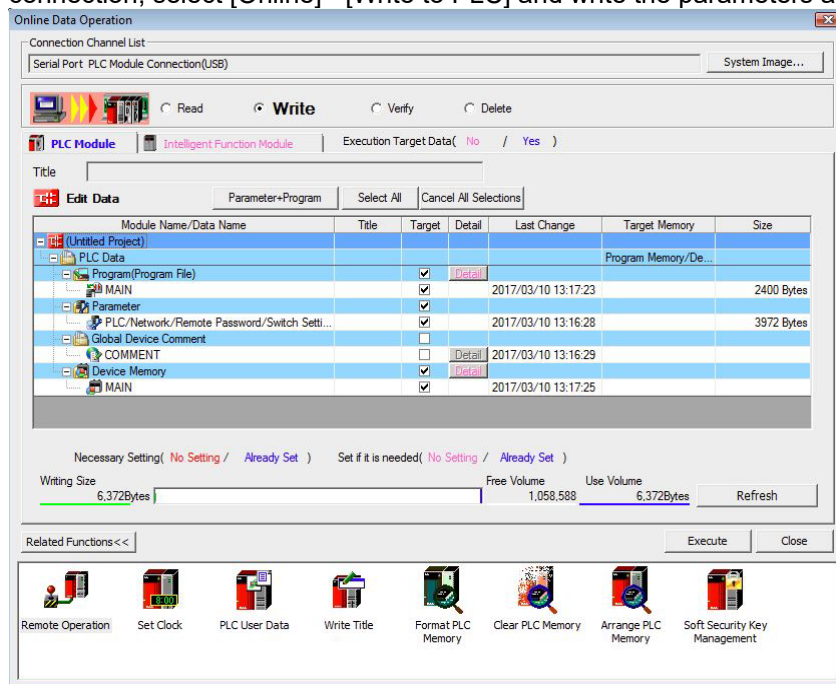


An output of the robot is looped back in the PLC to be an input of the robot.



(9) Write the parameter and program in PLC.

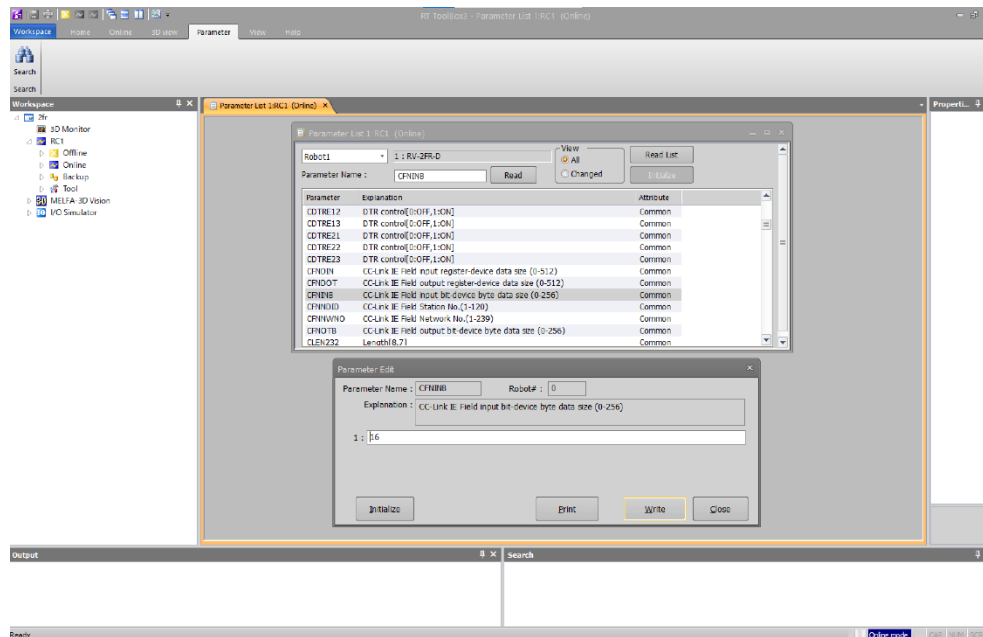
After setting the connection destination of the PLC side and personal computer, such as a USB connection, select [Online] - [Write to PLC] and write the parameters and the program.



(10) Check the values of the parameters of the robot controller.

Power on the robot controller and check the following values of the parameters by using RT ToolBox3. The parameters of the robot have been set with the factory setting. When they are not changed from the initial values, the values do not need to be checked.

- CFNNWNO : 1 CC-Link IE Field Network No. (1-239)
- CFNNDID : 1 CC-Link IE Field Station No. (1-120)
- CFNINB : 16 CC-Link IE Field input bit-device byte data size (0-256)
* The bit data size is the byte data size × 8 = 128
- CFNOTB : 16 CC-Link IE Field output bit-device byte data size (0-256)
* The bit data size is the byte data size × 8 = 128
- CFNDIN : 64 CC-Link IE Field input register-device data size (0-128)
- CFNDOT : 64 CC-Link IE Field output register-device data size (0-128)



The parameter settings and the network configuration settings (station No. and number of points of RX/RX and RWr/RWw) must be consistent with those in the PLC described in (5).

12.1.3. For the EtherCAT

The following shows how to set the parameters using Embedded PC CX5130 (PLC) by Beckhoff Automation as an example.

Select "Software" on the download page of the Mitsubishi Electric FA global website and download the ESI file.

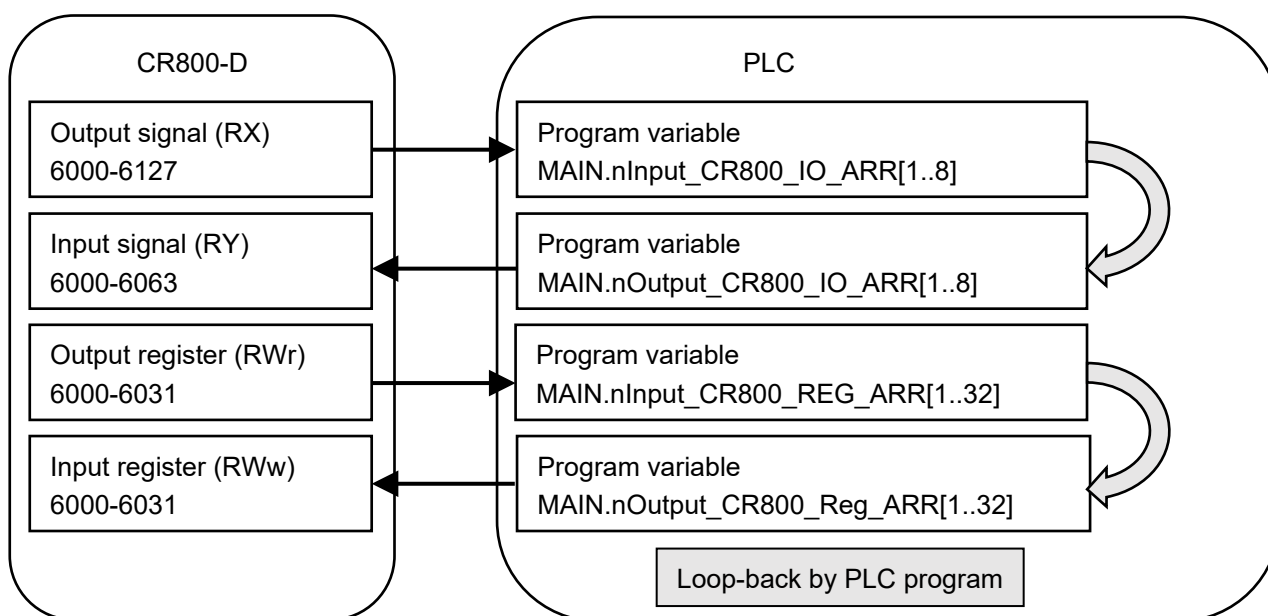
The CX5130 is used as an EtherCAT master station and the CR800-D is used as an EtherCAT slave station.

In this example, RX and RY signal values and RWw and RWr register values are exchanged between the CR800-D and the PLC as the process data.

The same connection type is used as the one described in [10.2.2 For the EtherCAT module](#).

The process data is used by the PLC program (described by ST (Structured Text)) on the EtherCAT master station.

In the PLC program, the processing in which RX and RWr received from the CR800-D are returned to RY and RWw as they are is performed as follows.



In both the CR800-D and PLC, the number of occupied stations is set to one (ECTOCS(1)), and the data for one station is looped back in the PLC side.

To configure the settings for the master station, use TwinCAT XAE in the personal computer used for setting as an engineering tool.

EtherCAT

1. [Setting PC] Installing the ESI file

Configure the settings for the EtherCAT slave based on the ESI file data on TwinCAT XAE.
Copy the ESI file for CR800-D to the directory specified by TwinCAT3.

Directory example:

C:\\TwinCAT\\3.1\\Config\\Io\\EtherCAT

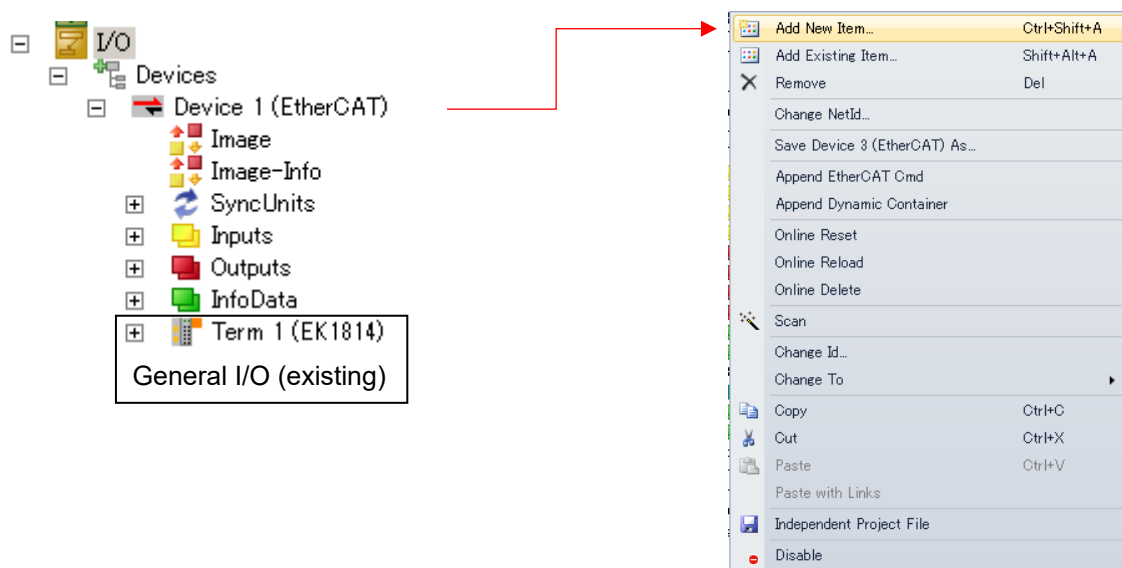
Copy the file after exiting TwinCAT XAE. After the next startup, the contents of the copied ESI file are reflected to the setting operation related to the EtherCAT slave on TwinCAT XAE.

For the description of the directory, refer to the TwinCAT manual.

2. [Master station] Adding the CR800-D (EtherCAT slave)

Under the I/O device: EtherCAT device (EtherCAT master), add the CR800-D at the downstream of the general I/O according to the connection type.

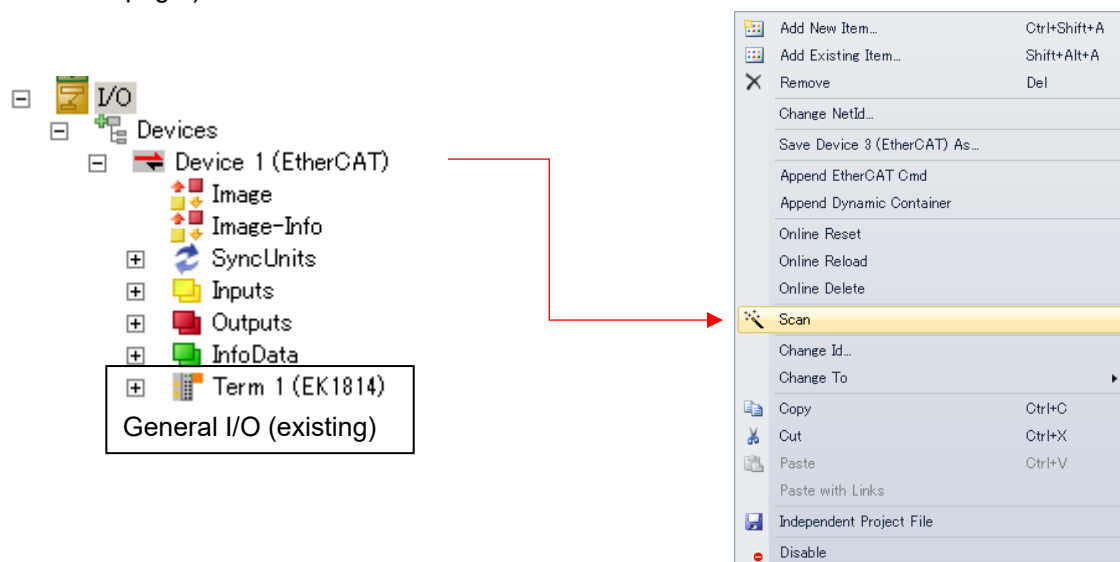
(1) Select an EtherCAT device under the I/O node, and display the context menu (right-click).



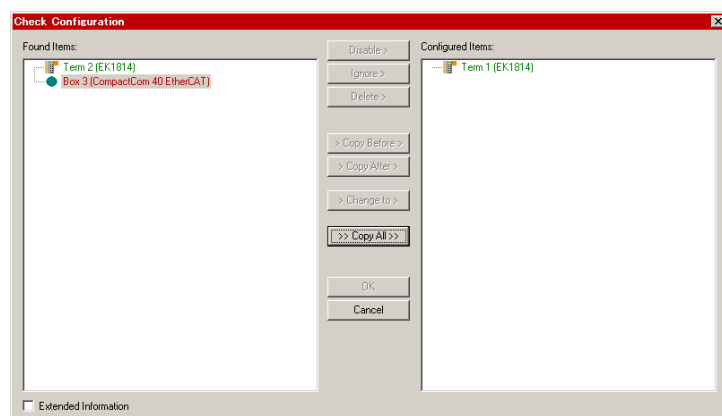
[Reference: Automatic detection]

Select "Scan" from the context menu to automatically detect slaves based on the data in the already-installed ESI file under the master device.

When the "Scan" menu is selected, "CompactCom 40 EtherCAT" in the network will be automatically added to the field of found items. (When the module is automatically detected and added, skip Step 2 on the next page.)

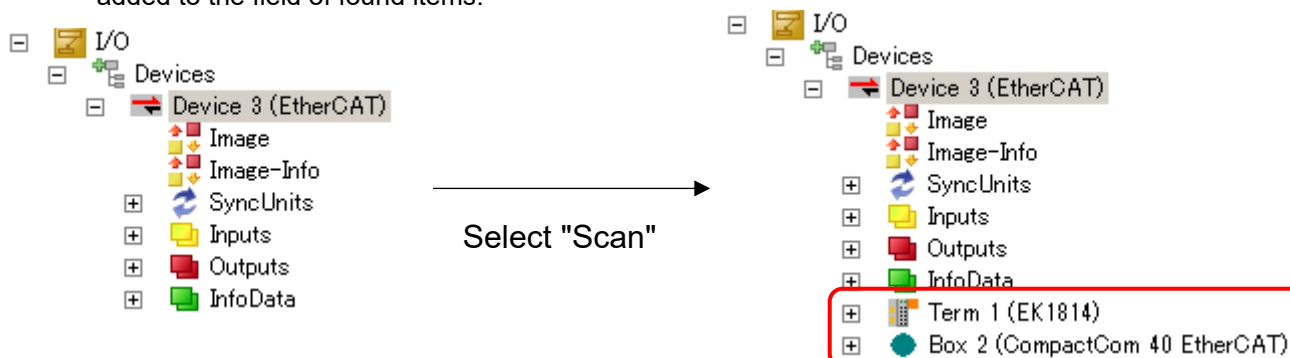


When EK1814 has already been set, the following window appears by selecting "Scan". Add "CompactCom 40 EtherCAT".



Click "CopyAll" to add the items and click "OK".

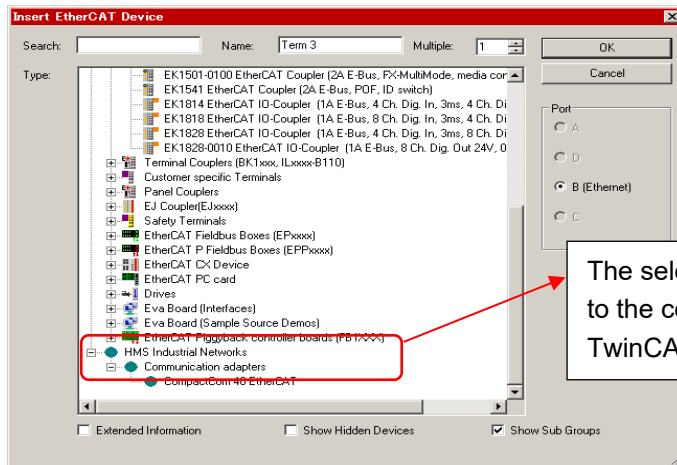
When no slave has been set under the master, all the slaves in the network will be detected and added to the field of found items.



All slaves added

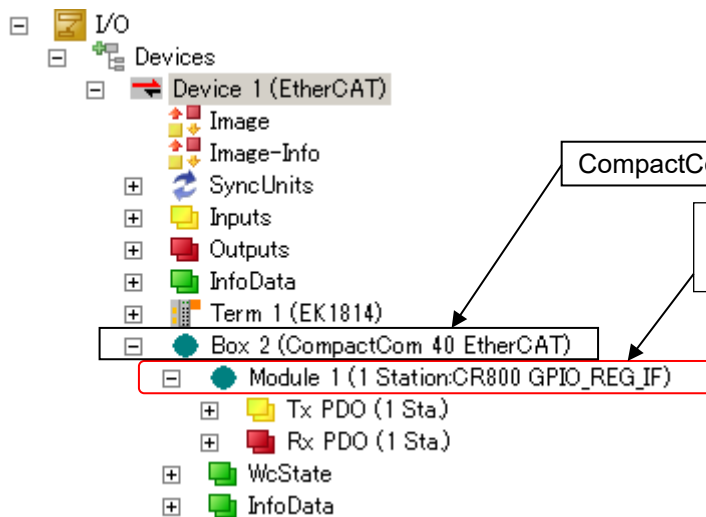
EtherCAT

(2) Select "Add New Item" and display the following window.
In the window, select "CompactCom 40 EtherCAT" and click "OK".



The selectable items for CR800-D appears according to the contents of the ESI profile added before TwinCAT3 XAE is started.

(3) "CompactCom 40 EtherCAT" is added under the EtherCAT device and at the downstream of the general I/O.



CompactCom 40 EtherCAT is added as a slave.

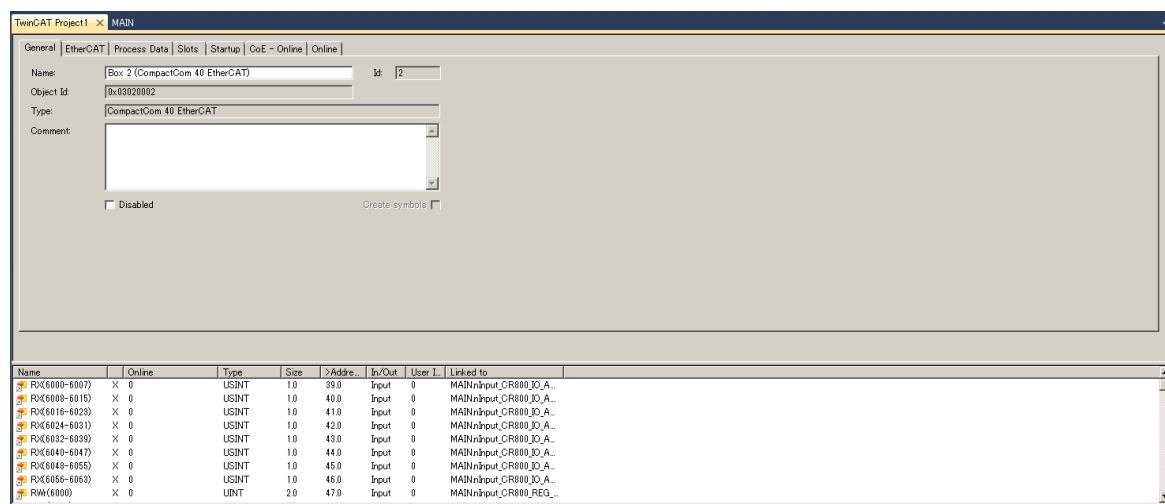
"1 Station" is set by default immediately after the

3. [Master station] Setting the number of occupied stations

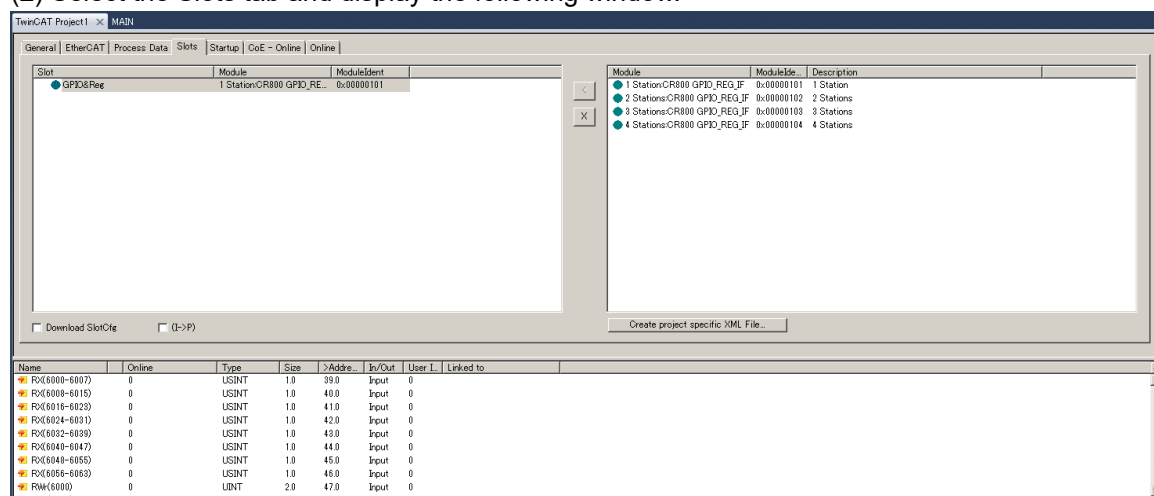
When the number of occupied stations is other than one, set the desired number of occupied stations in the PLC side according to the following.

(The number of occupied stations is set to one by default; The setting is not required to be changed in the loop-back example in this example.)

(1) Double-click the CompactCom 40 EtherCAT (the added slave under the EtherCAT device) node and display the following window in the right pane.



(2) Select the Slots tab and display the following window.



(3) Press the [x] button and delete the item (module) in the left pane.

(4) In the right pane, select the desired number of occupied stations, press [<], and add the item (module) to the left pane.

The relationships between the number of occupied stations and the selected module are as shown below.

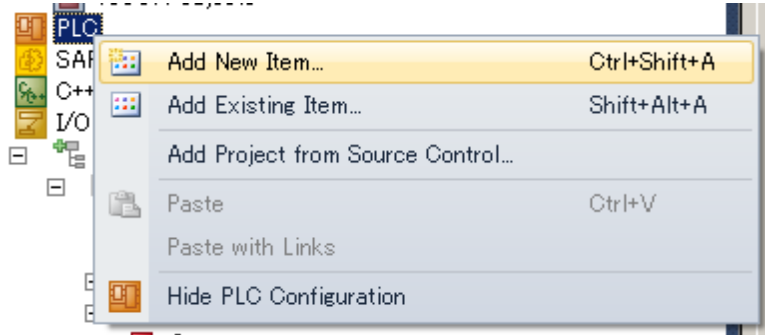
Setting of the number of occupied stations	Description in the "Module" field
1 Station (Default)	"1 Station:CR800 GPIO_REG_IF"
2 Stations	"2 Stations:CR800 GPIO_REG_IF"
3 Stations	"3 Stations:CR800 GPIO_REG_IF"
4 Stations	"4 Stations:CR800 GPIO_REG_IF"

4. [Master station] Adding a PLC program

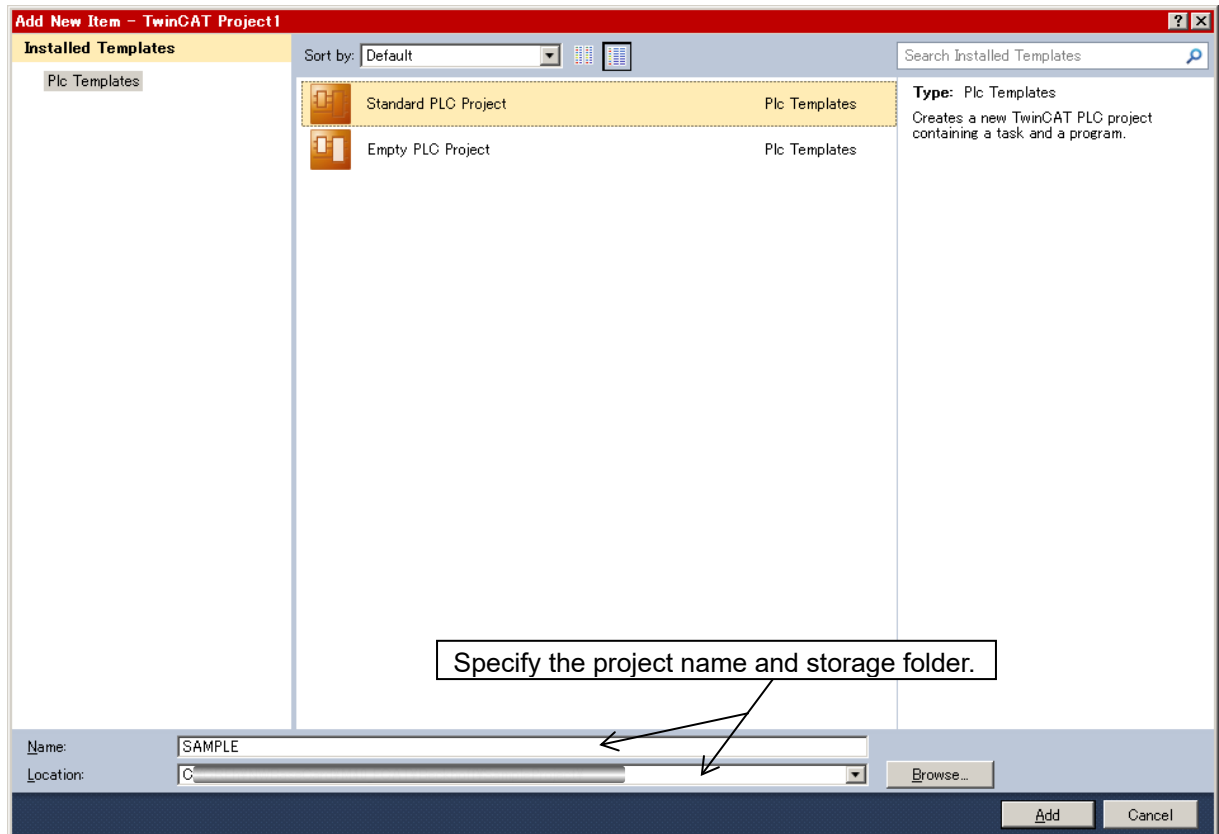
(1) Add a PLC project

When no PLC project exists in the master station, add a PLC project.

Select "Add New Item" from the context menu of the PLC node.



Add the project.

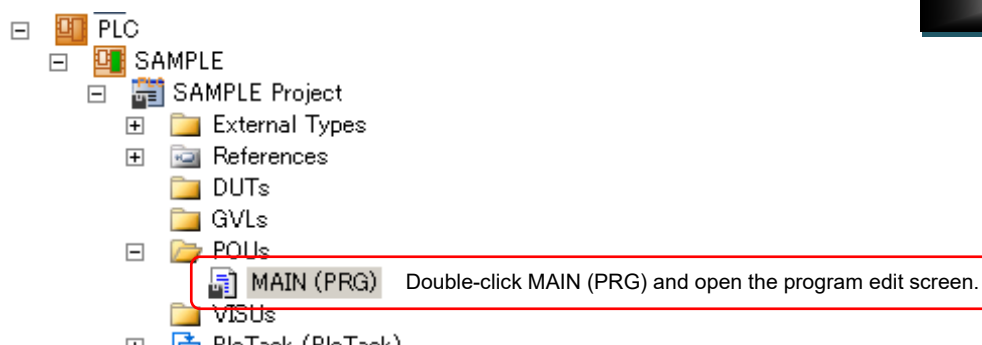


(Reference)

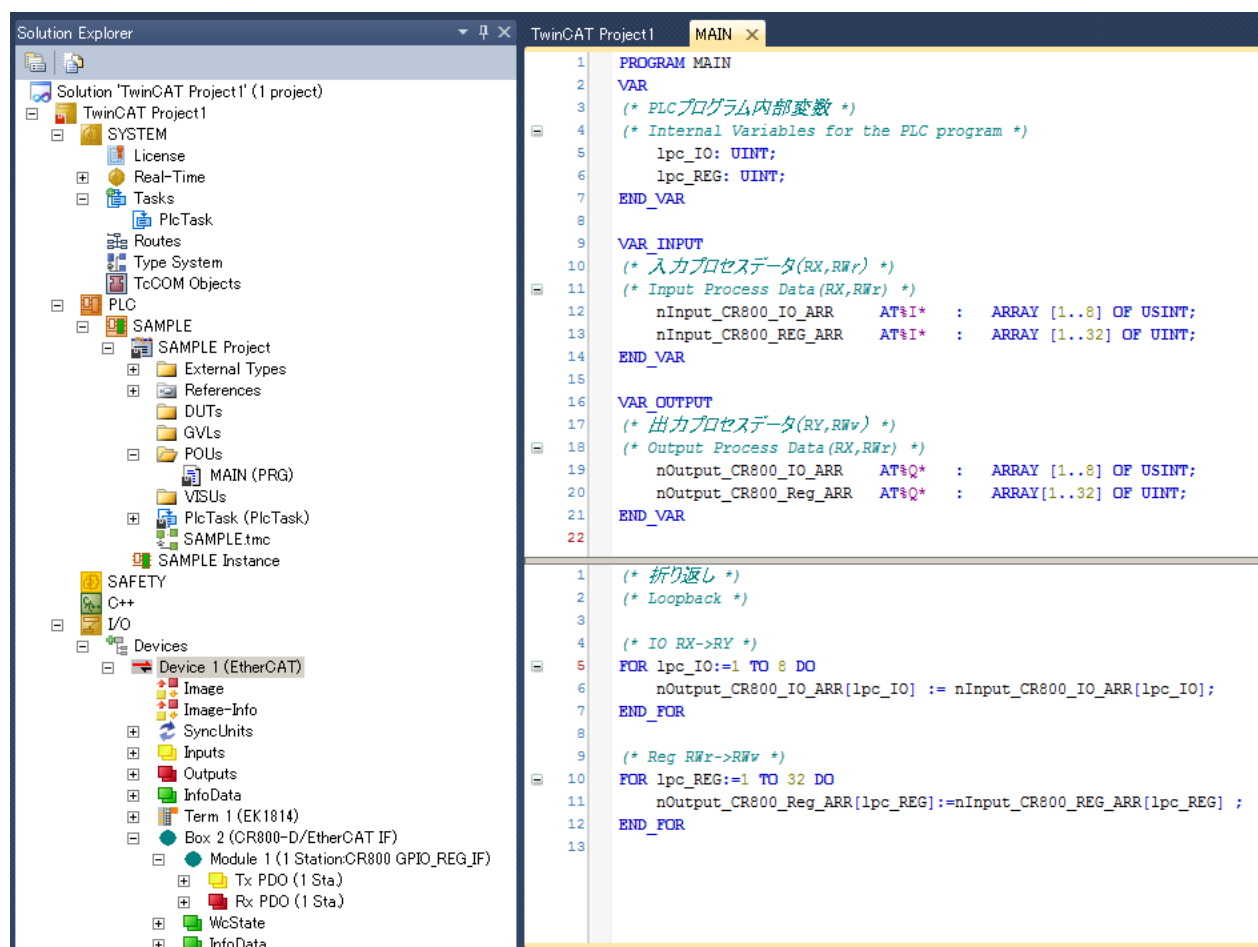
Selecting "Standard PLC Project" automatically generates a template with an empty ST (Structured Text) program and settings on a PLC program related task. In this example, select Standard PLC Project and generate a project with the project name "SAMPLE".

Add the description of the program (main) in POU in the project.

EtherCAT



Enter the program in the "MAIN" tab in the right pane.



Build the project (Press the "F7" key).
 After building the project, the input/output variable names appear under
 "SAMPLE Instance" relating to the PLC program.
 These variables are to be linked with the CR800-D process data.



- [-]  SAMPLE Instance
 - [-]  PlcTask Inputs
 - [+]  MAINnInput_CR800_IO_ARR
 - [+]  MAINnInput_CR800_REG_ARR
 - [-]  PlcTask Outputs
 - [+]  MAINnOutput_CR800_IO_ARR
 - [+]  MAINnOutput_CR800_Reg_ARR

5. [Master station] Linking the variables in the PLC program with the process data

For the loop-back operation by the PLC program, assign the variables (arrays) in the program to the CR800-D process data. The assignment details are as follows.

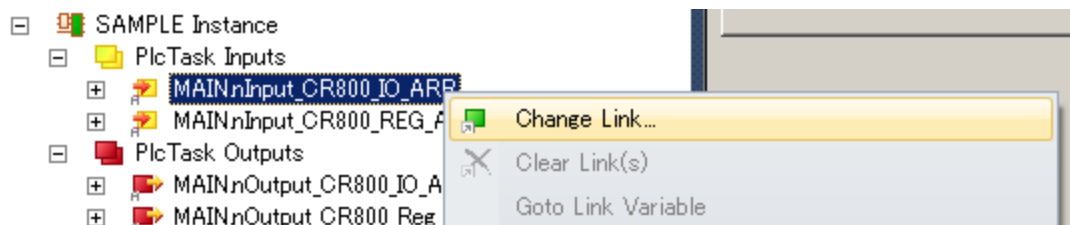
PLC program variable	CR800-D process data (I/O, register area)	
Array[(Start element)...(End element)]	Start	End
nInput_CR800_IO_ARR[1..8]	RX(6000-6007)	RX(6056-6063)
nInput_CR800_REG_ARR[1..32]	RWr(6000)	RWr(6031)
nOutput_CR800_IO_ARR[1..8]	RY(6000-6007)	RY(6056-6063)
nOutput_CR800_Reg_ARR[1..32]	RWw(6000)	RWw(6031)

In I/O (RX, RY), areas for 8 bits (8 points) are assigned to one array element.
 (Example: The 8-bit value nInput_CR800_IO_ARR[1] is assigned to RX (6000-6007) (8 bit data).)

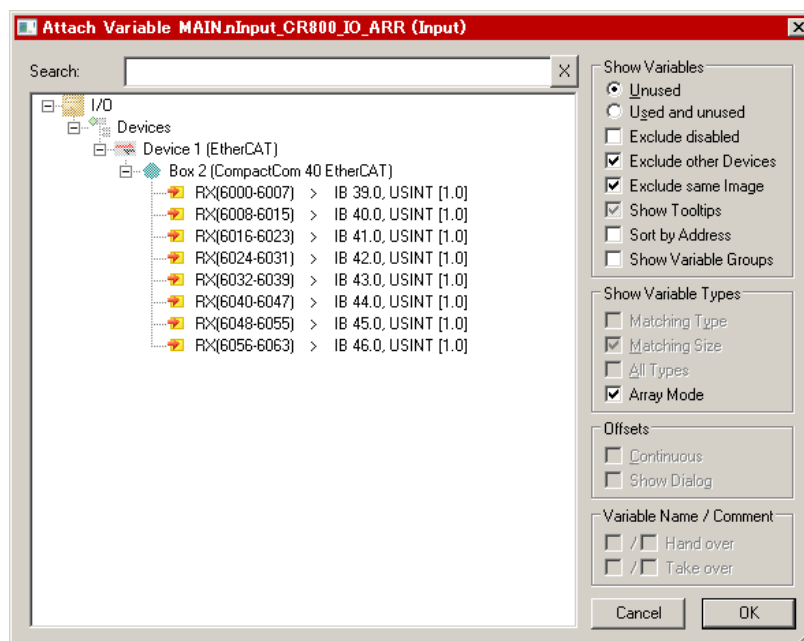
- a) Linking the byte data input to PLC with the process data RX

Link MAIN.nInput_CR800_IO_ARR[] (1 byte × 8-element array) with areas from RX (6000-6007) to RX (6056-6063) of the CompactCom 40 EtherCAT device.

Use "Change Link" in the context menu of the MAIN.nInput_CR800_IO_ARR node for operation (refer to the following).



Selecting "Change Link" displays the following window.



In the above window, select RX (6056-6063) to RX (6000-6007) in a batch, and click [OK].
(Note: "Array Mode" must be checked (for assigning arrays to multiple variables in a batch.))

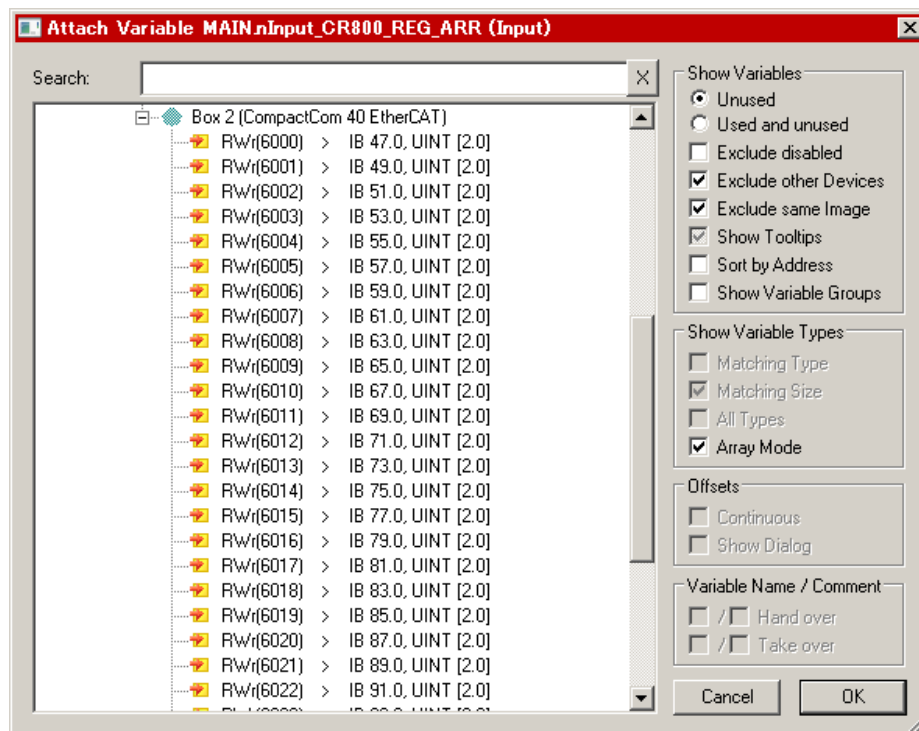
b) Linking the word data input to PLC with the process data RWr

Link MAIN.nInput_CR800_REG_ARR[] (32-element array) with RWr (6000) to RWr (6031) of the CompactCom 40 EtherCAT device.

Use "Change Link" in the context menu of the MAIN.nInput_CR800_REG_ARR node for operation (refer to the following).

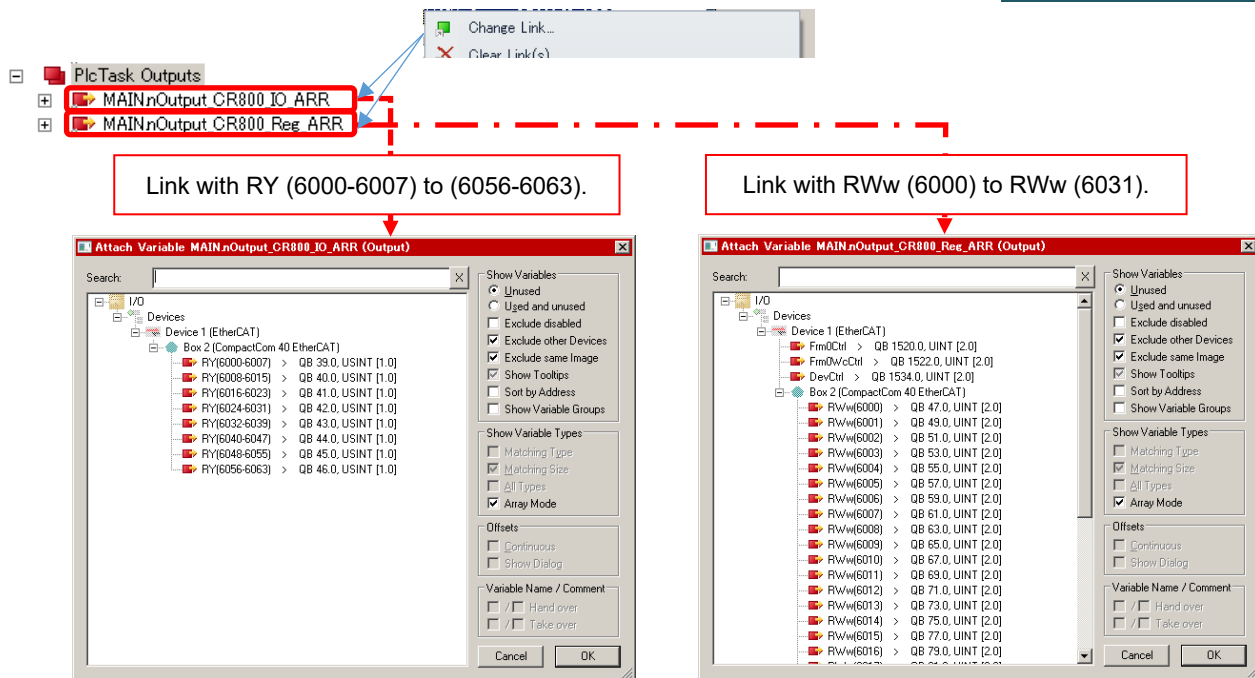


Select "Change Link" and display the following window.



In the above window, select RWr (6031) to RWr (6000) in a batch, and press [OK].
(Note: "Array Mode" must be checked (for assigning arrays to multiple variables in a batch.))

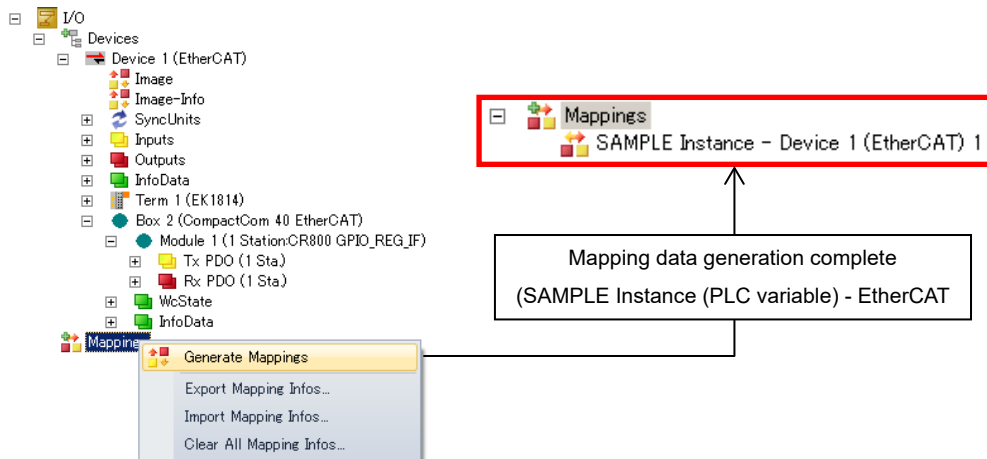
With the same method as the assignment for the input, link data with RY and RWw using the Change Link context menu.



Use the "Change Link" menu and link data with the variables of both the I/O signals and registers.

6. [Master station] Generating the mapping data

Select "Generate Mapping" from the context menu of the "Mappings" node under I/O.



Reference:

For the copy operation of data related to the processing of both the PLC program and I/O (EtherCAT), the engineering tool recalculates the (internal) transfer address for exchanging data according to the linking performed with the procedure so far.

7. [Master station] Enabling the setting

Select "Activate Configuration" and enable the settings for the PLC.



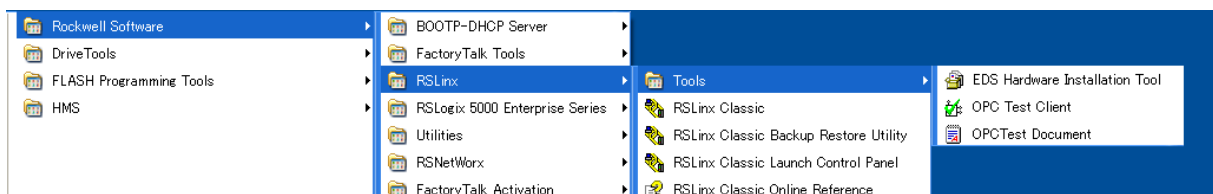
8. [CR800-D] Setting the robot parameters

When the number of occupied stations is one as in this example, the default (1) is not necessary to be changed.

(When the number of occupied stations is other than one, set the parameter ECTOCS to the desired number of occupied stations.)

12.1.4. For the EtherNet/IP

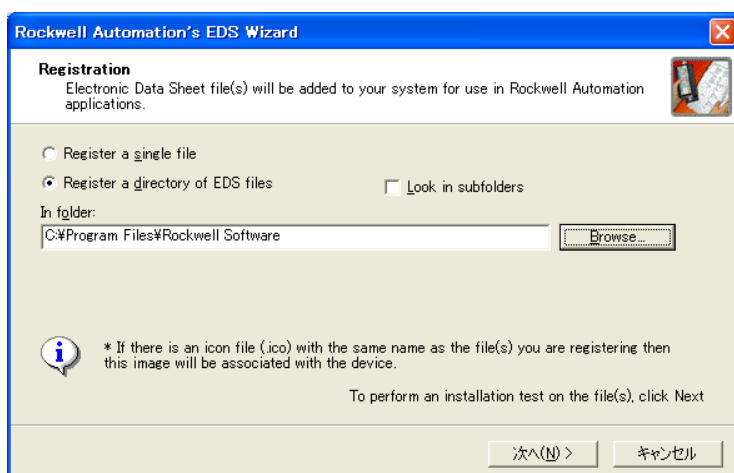
- (1) Set the IP address and upgrade the firmware version as explained in the "Installation Guide" enclosed with CompactLogix.
- (2) Select "Software" on the download page of the Mitsubishi Electric FA global website and download the EDS file.
 - a) Start the EDS Hardware Installation Tool.



- b) Click the [Add] button.



- c) Specify the folder containing the EDS file.

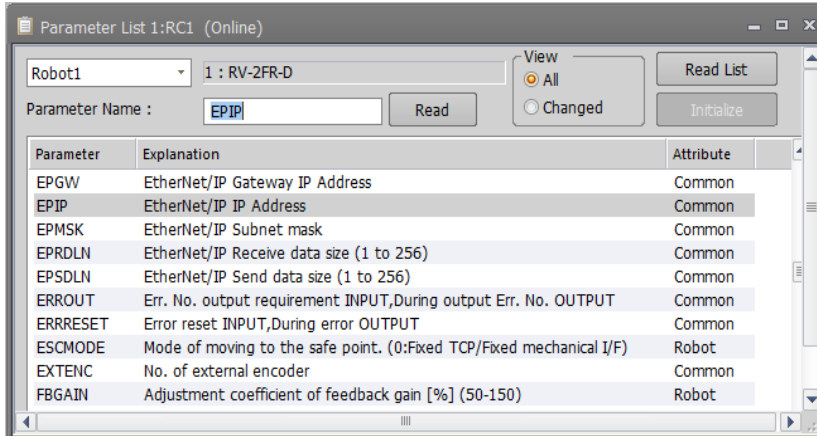


- d) Click the [Next] button to complete the process.
(If necessary, the icon which indicates that the PLC has recognized the 2F-DQ535-EIP card can be changed.)

EtherNet/IP

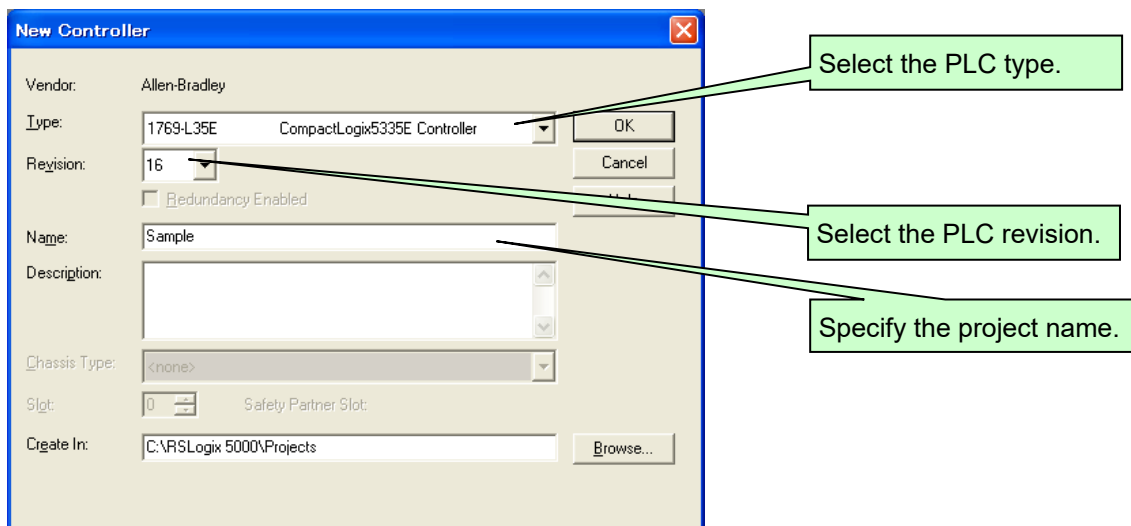
- (3) Set the IP address for the robot controller EtherNet/IP in the robot controller parameter "EPIP".

Set the IP address for EtherNet/IP in the parameter "EPIP" on the RT ToolBox3 "Parameter List" screen.

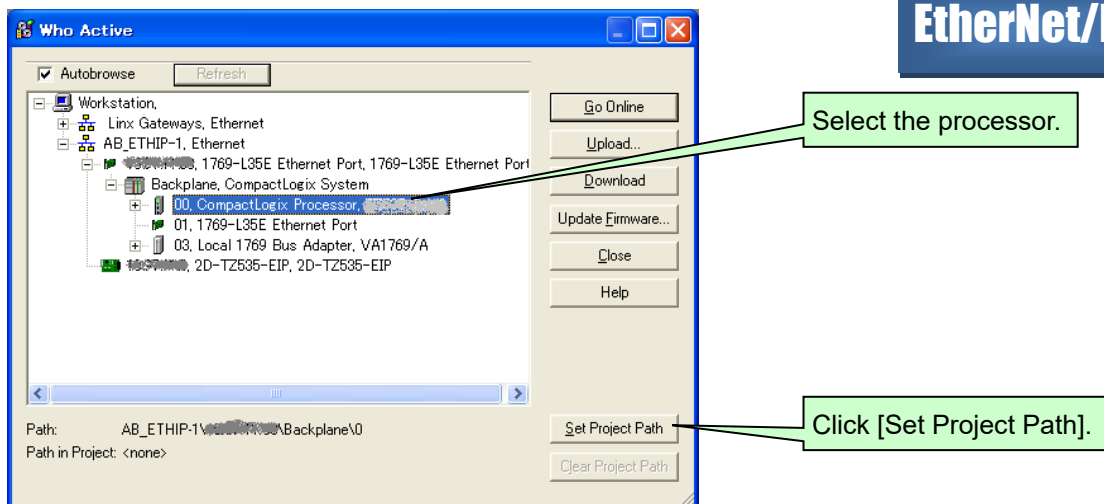


- (4) Set the system configuration using RSLogix5000.

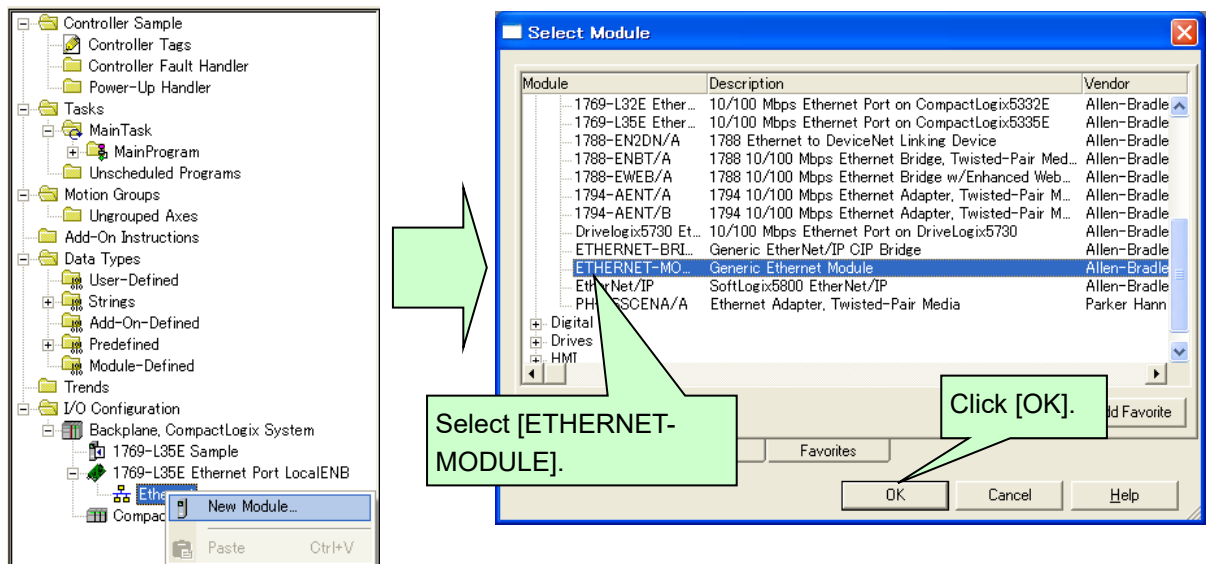
- a) Start RSLogix5000 and click [New] in the [File] menu.



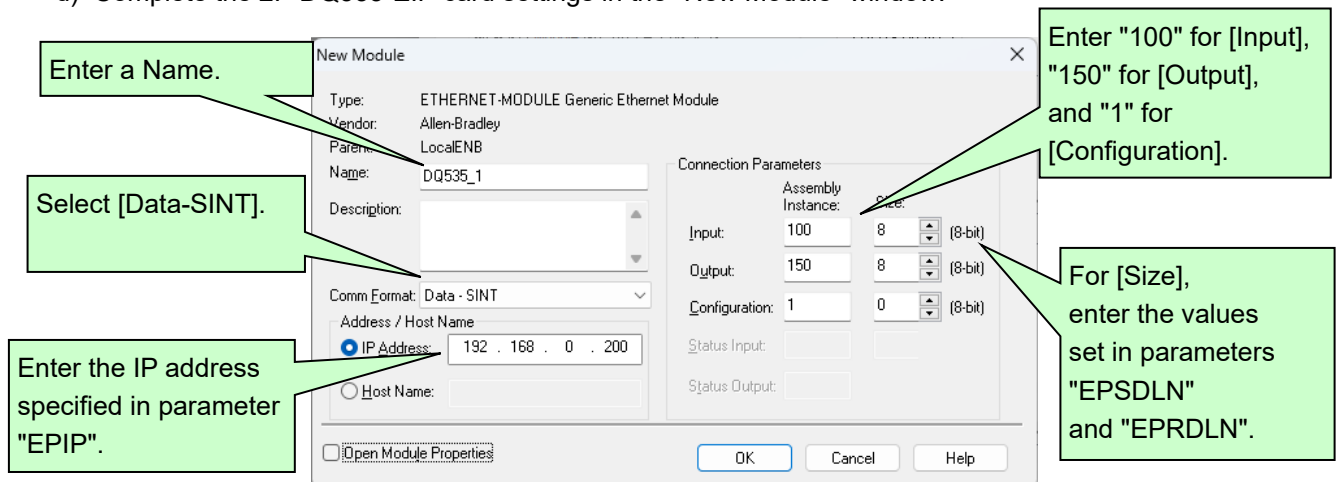
- b) Click [Who Active] in the [Communications] menu, click "CompactLogix Processor" then click [Set Project Path].



c) Right-click [Ethernet] in the project tree [I/O Configuration] then click [New Module].

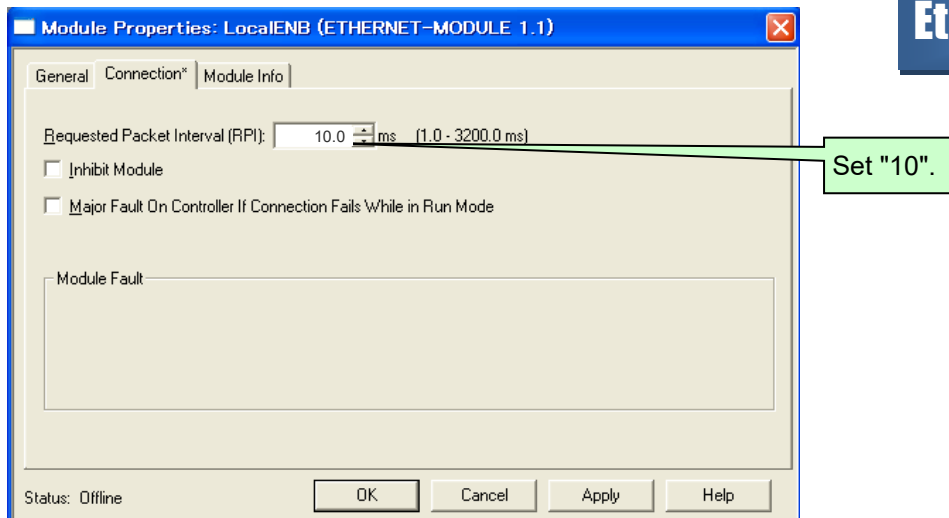


d) Complete the 2F-DQ535-EIP card settings in the "New Module" window.



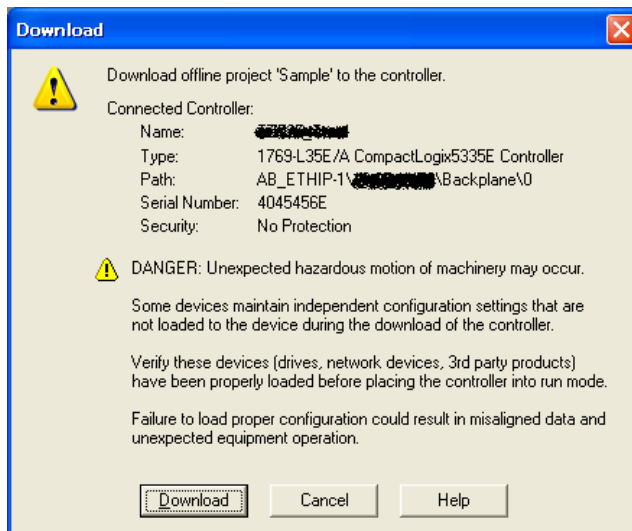
e) Set RPI.

Set RPI on the following screen.



If the above screen does not appear, right-click "ETHERNET-MODULE arbitrary name" in the project tree and click [Properties] then click the [Connection] tab.

- f) Click [Download] in the [Communications] menu then click the [Download] button.



- (6) Confirm that the status for the added "ETHERNET-MODULE" is "Running".

Click "ETHERNET-MODULE arbitrary name" in the project tree, and confirm that the "Status" indication is "Running".

If the status is not "Running" and an error is displayed, refer to the PLC help and remove the cause of the error.

The screenshot displays the project tree on the left and the status window at the bottom. The project tree shows the following structure:

- Controller sample00
 - Controller Tags
 - Controller Fault Handler
 - Power-Up Handler
 - Tasks
 - MainTask
 - MainProgram
 - Unscheduled Programs
 - Motion Groups
 - Ungrouped Axes
 - Add-On Instructions
 - Data Types
 - User-Defined
 - Strings
 - Add-On-Defined
 - Predefined
 - Module-Defined
 - Trends
 - I/O Configuration
 - Backplane, CompactLogix System
 - 1769-L35E sample00
 - 1769-L35E Ethernet Port LocalENB
 - Ethernet
 - 1769-L35E Ethernet Port LocalENB
 - ETHERNET-MODULE DQ535_1**
 - CompactBus Local

The status window at the bottom shows the following information:

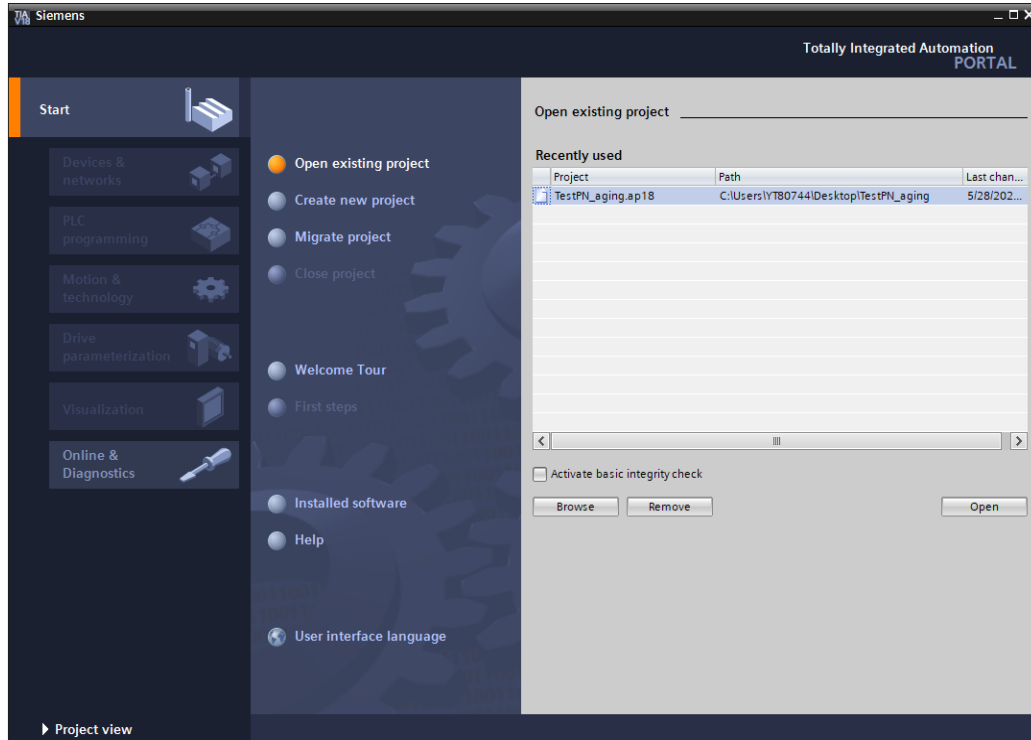
Module Defined Tags	
Description	
Status	Running
Module Fault	

A green callout box points to the 'Status' field in the status window, containing the text: "Confirm this status is 'Running'".

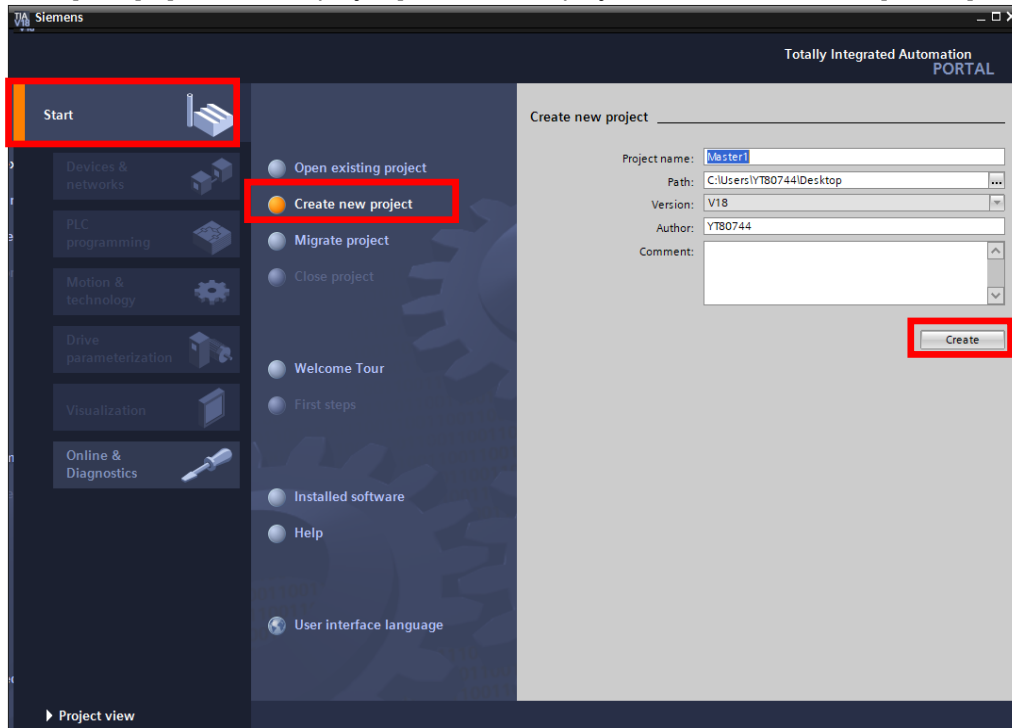
12.1.5. For the PROFINET IO

- (1) Create a new PLC project.

Start TIA Portal.



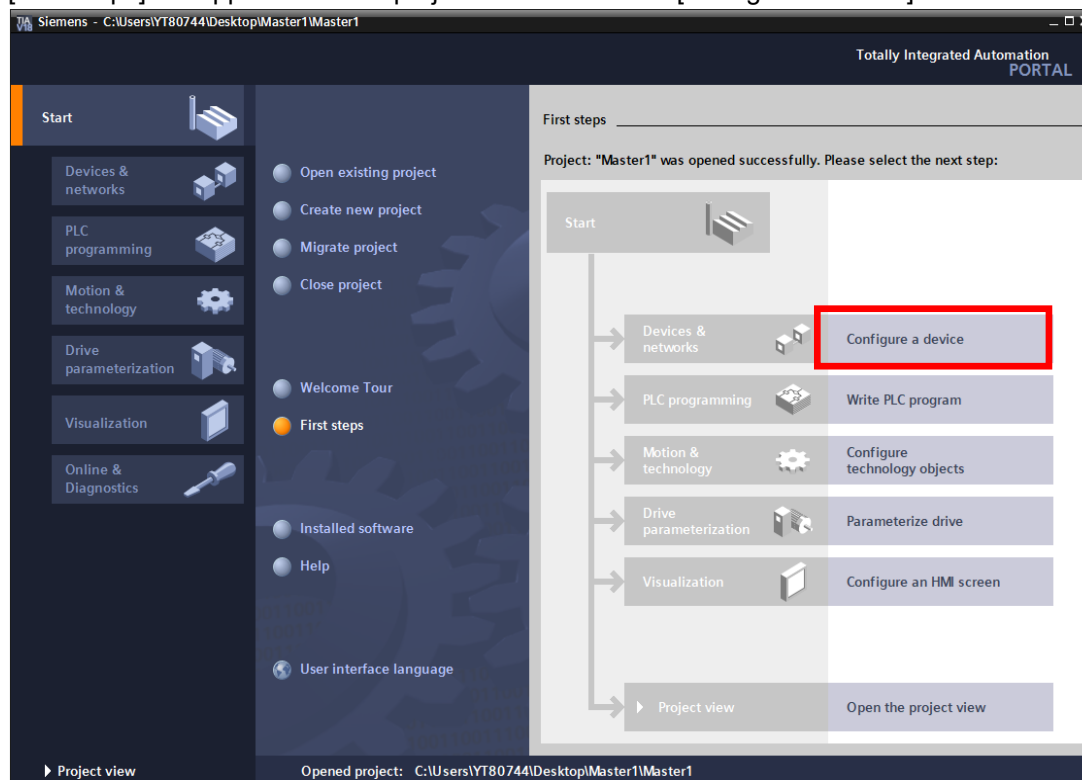
Click [Start] - [Create new project] then enter a project name and click the [Create] button.



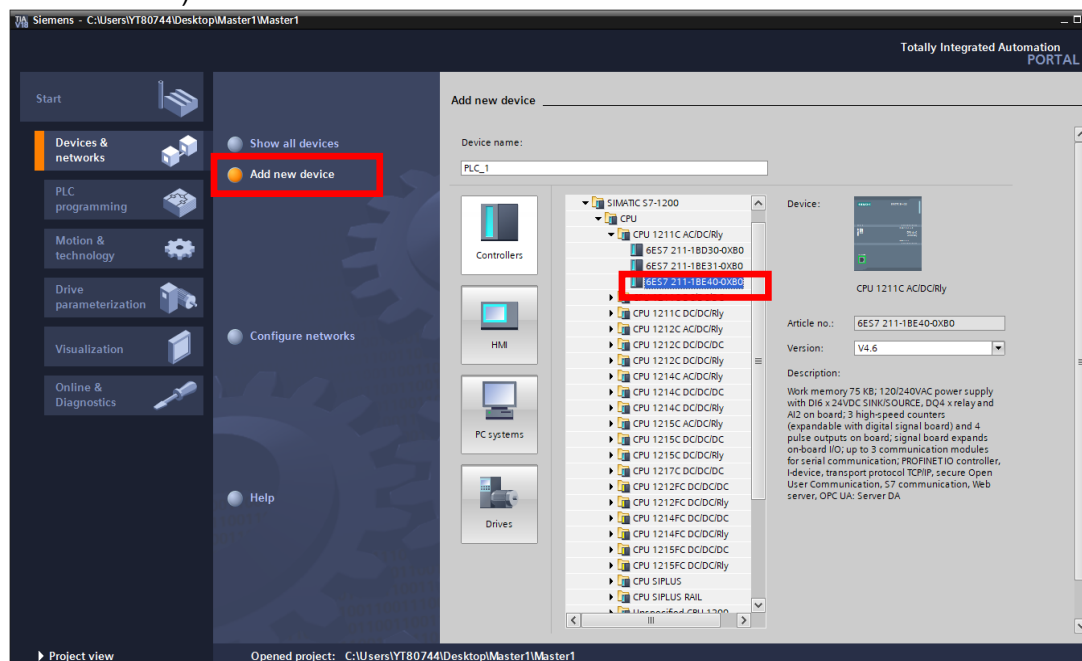
(2) Configure the initial settings for the master station.

PROFINET IO

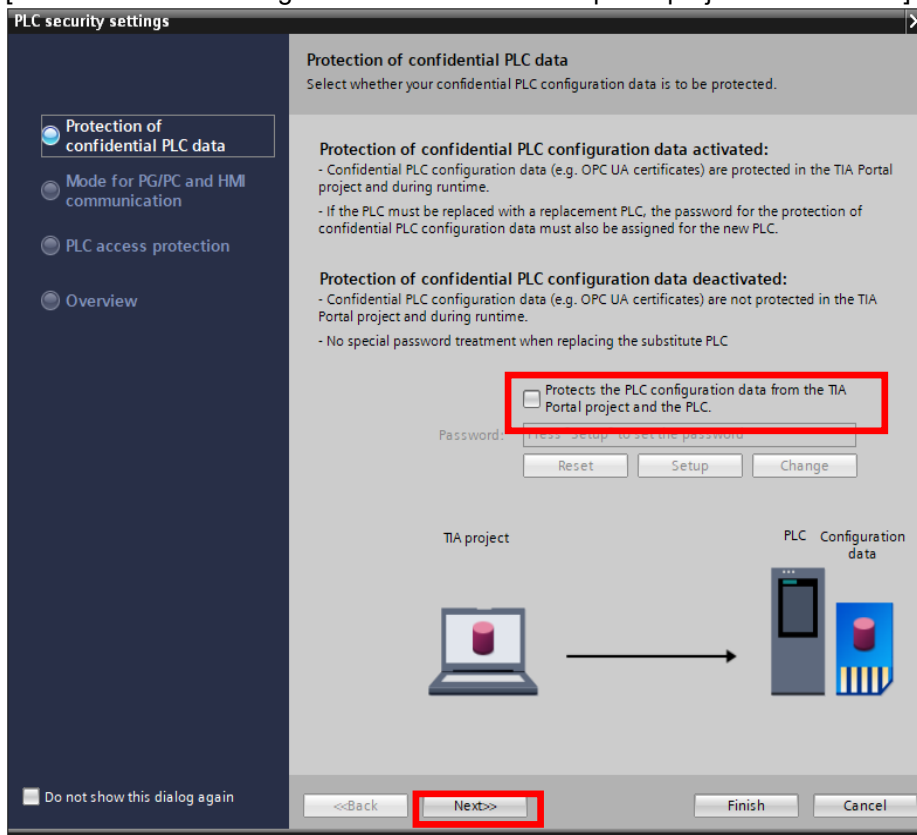
[First steps] will appear after the project is created. Click [Configure a device].



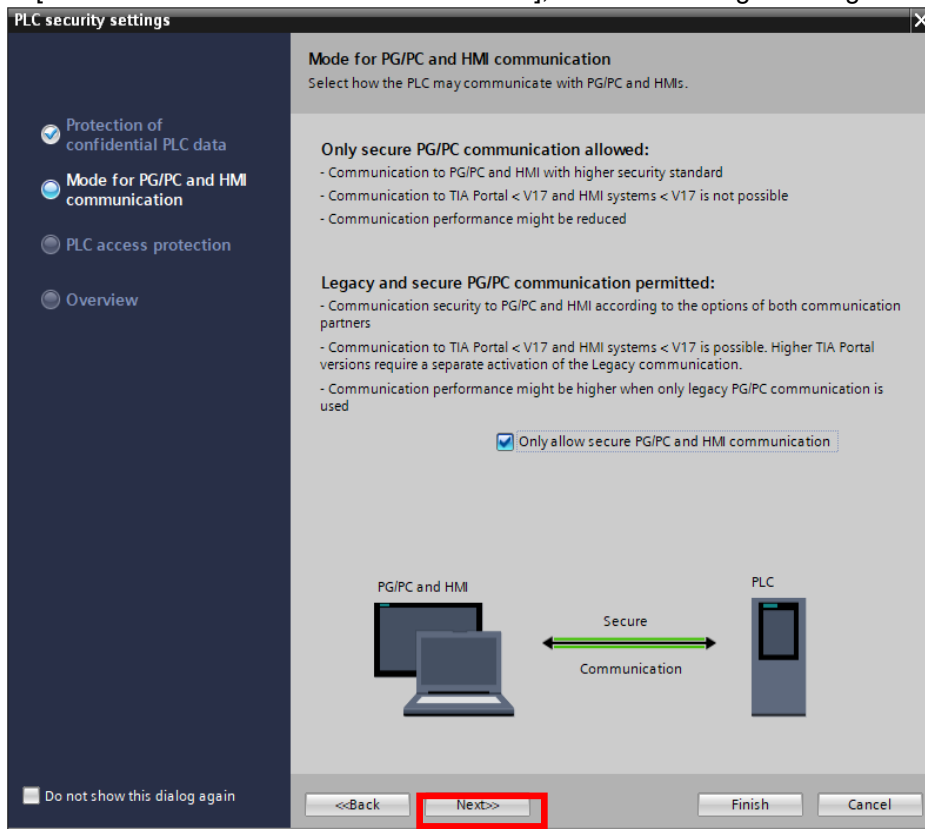
Click [Add new device] then double-click [SIMATIC***] - [CPU] - [CPU***] - [6ES7***] (select the relevant series).



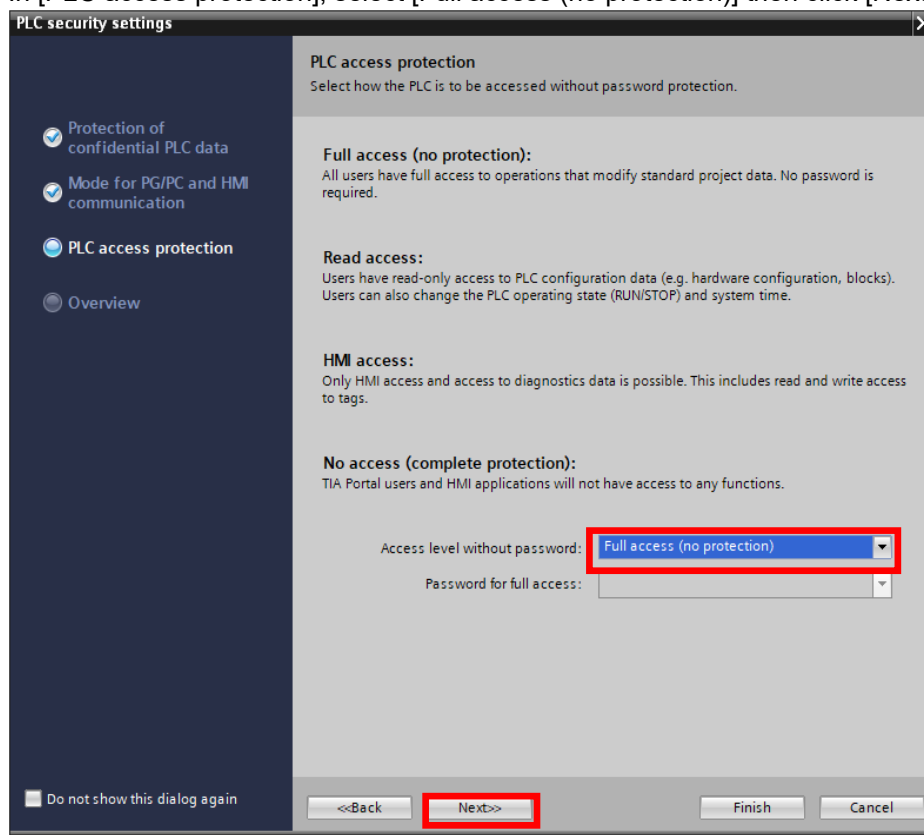
The [PLC security settings] window will appear. In [Protection of confidential PLC data], uncheck [Protects the PLC configuration data from the TIA portal project and the PLC] then click [Next].



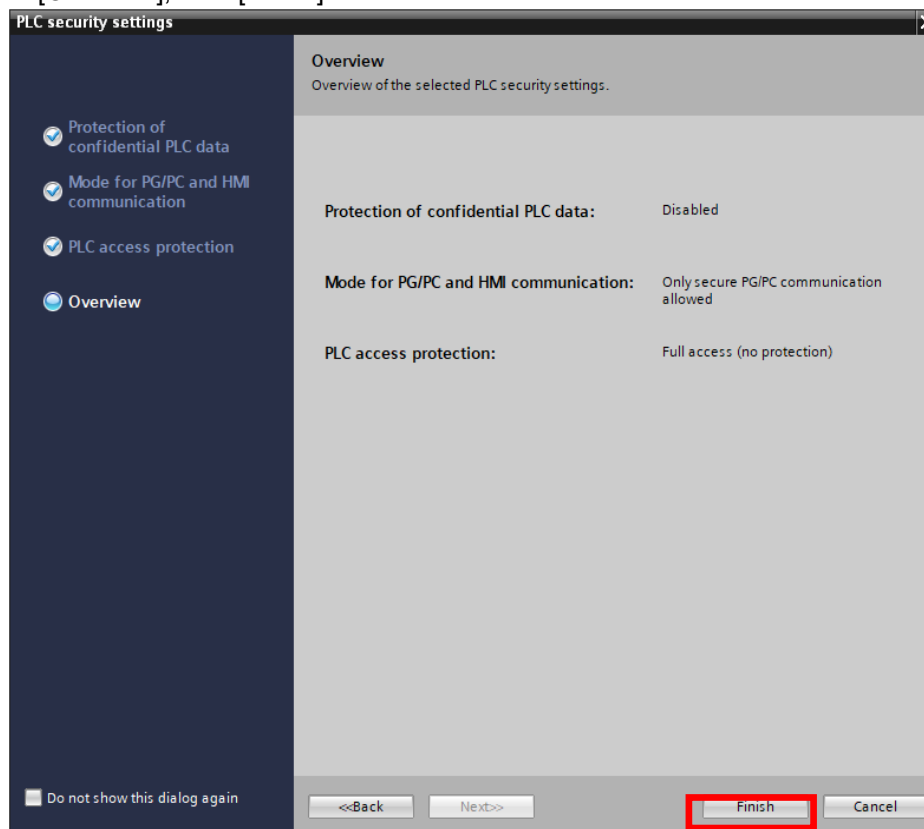
In [Mode for PG/PC and HMI communication], leave the setting unchanged and click [Next].



In [PLC access protection], select [Full access (no protection)] then click [Next].

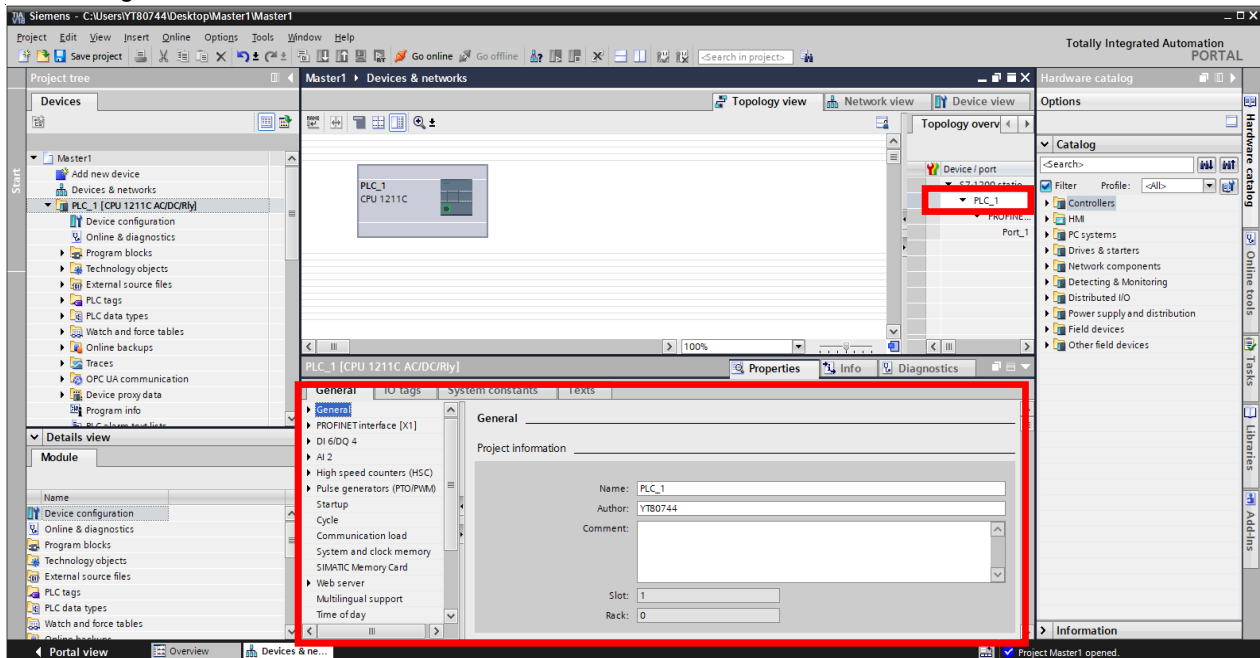


In [Overview], click [Finish].



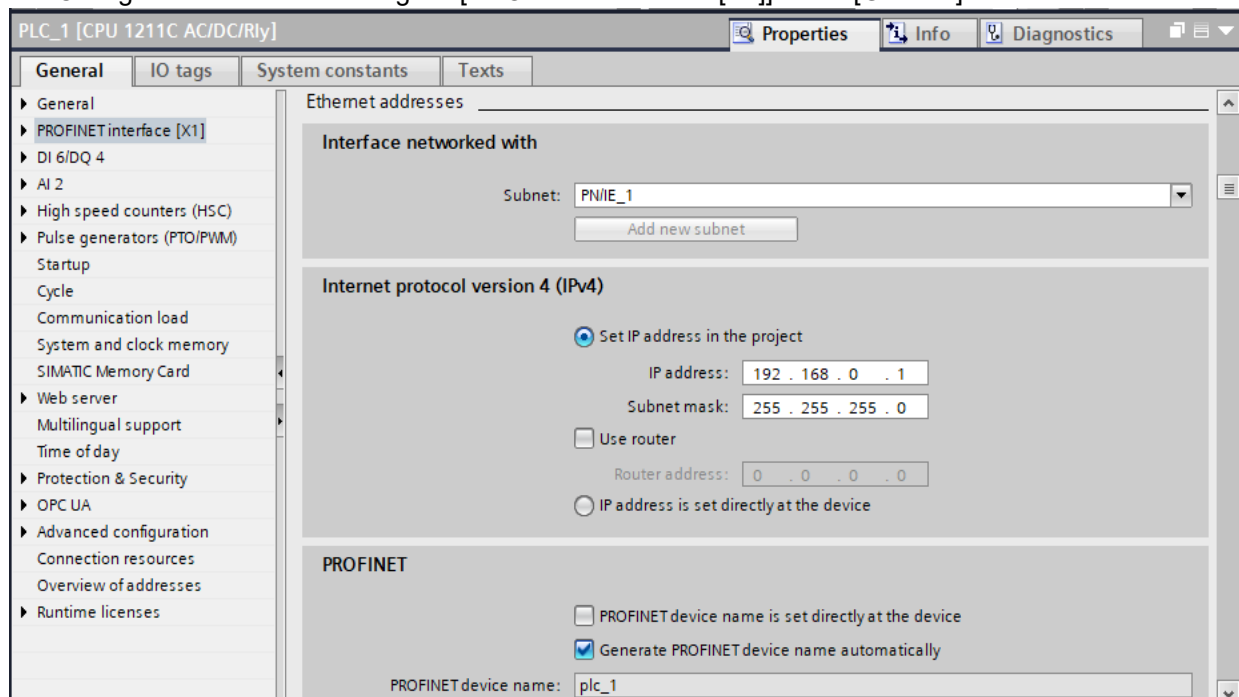
The [Devices & networks] window will appear. Click [PLC_1] in [Device / port] in the [Topology overview] tab.

[PLC_1] properties will appear in the lower half of the window where the general settings can be configured.



* If this window does not appear, click the [Topology view] tab in the upper half of the window.

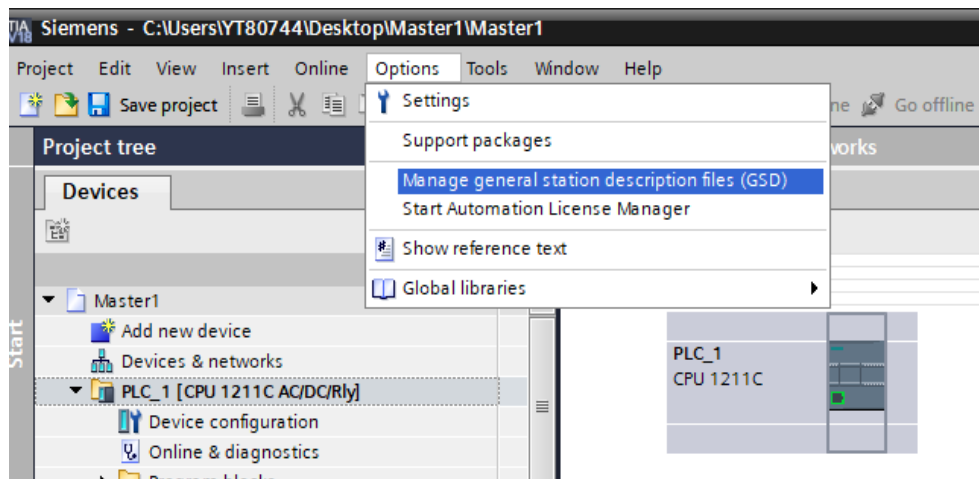
Configure the Ethernet settings in [PROFINET interface [X1]] in the [General] tab.



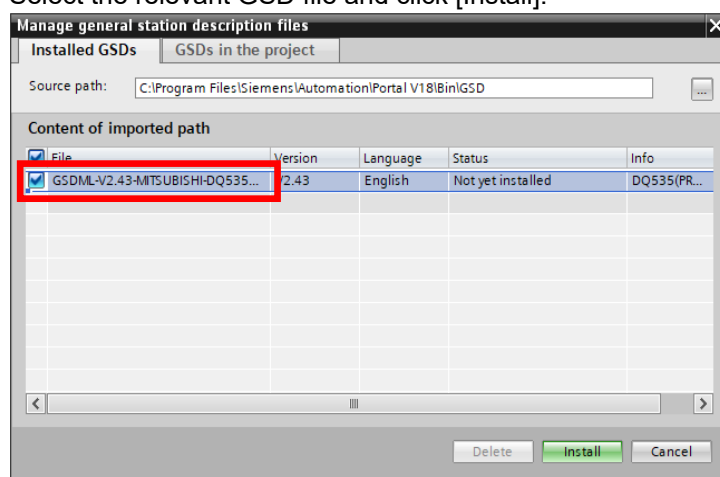
(3) Register the robot GSD file.

Select "Software" on the download page of the Mitsubishi Electric FA global website and download the GSD file.

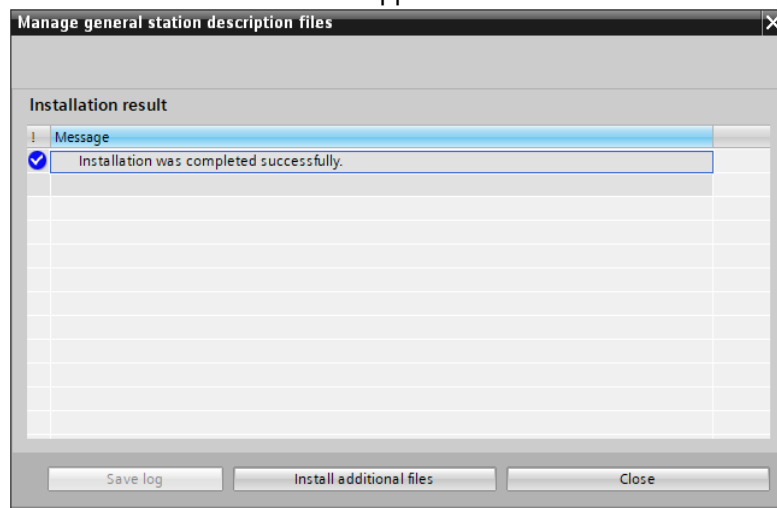
To install the robot GSD file, click [Options] - [Manage general station description files (GSD)] from the menu.



Select the relevant GSD file and click [Install].

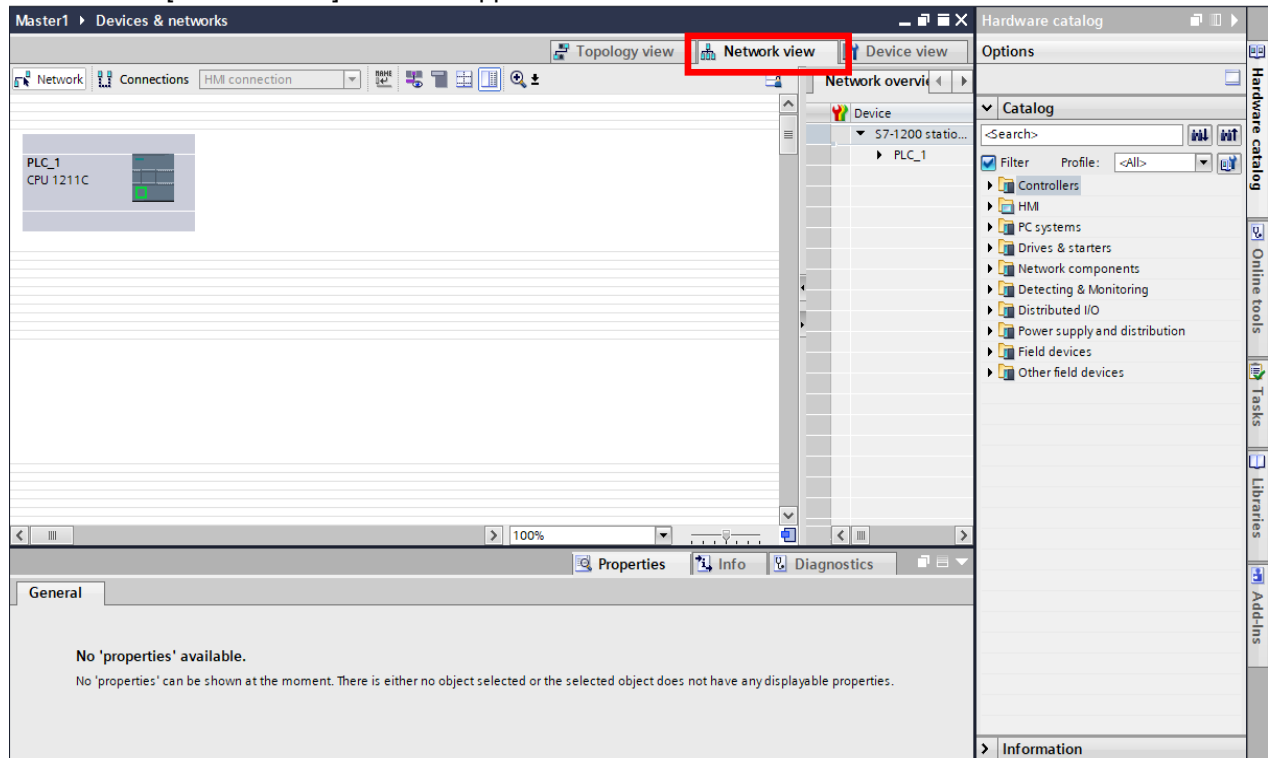


The window shown below will appear once the installation is complete.

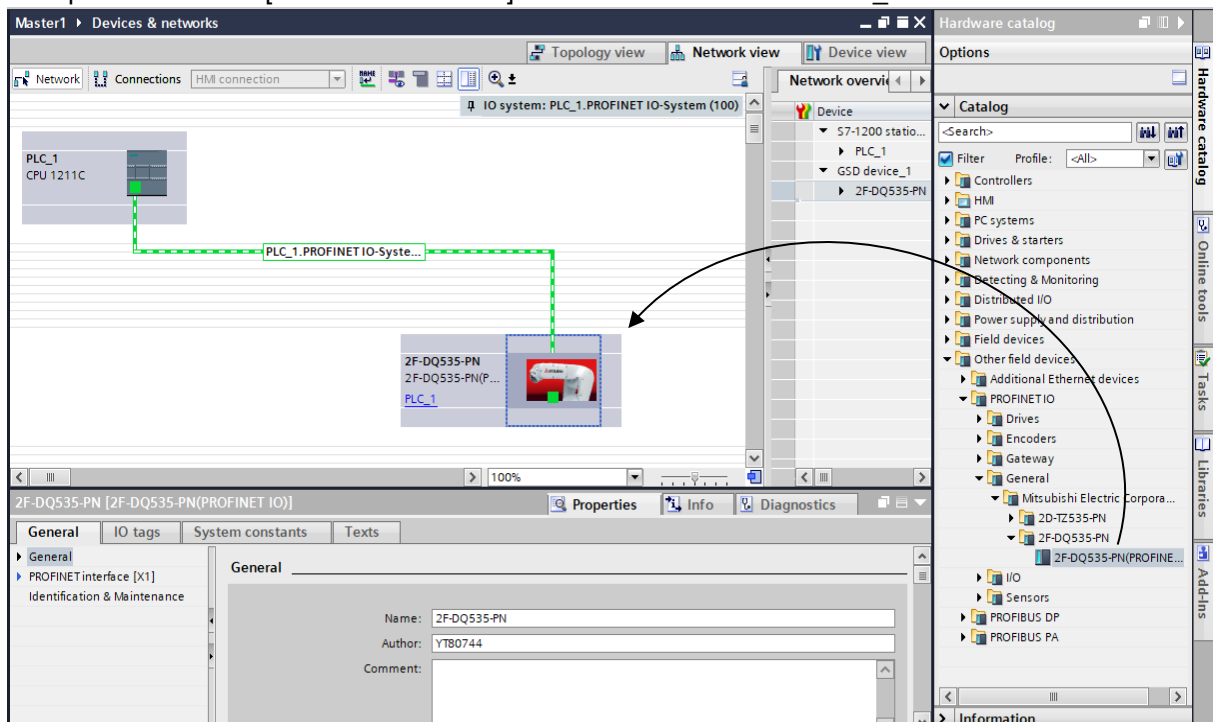


(4) Configure the robot controller parameters.

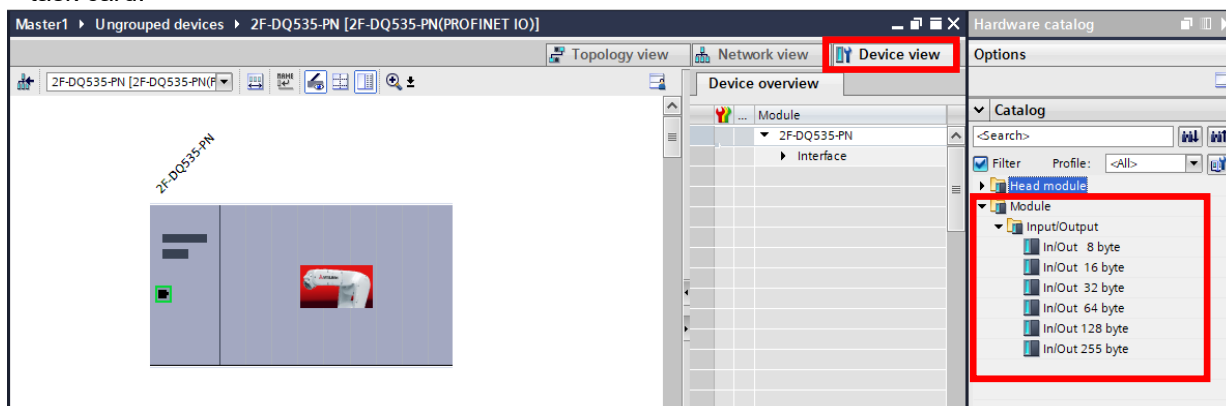
Click the [Network view] tab in the upper half of the window.



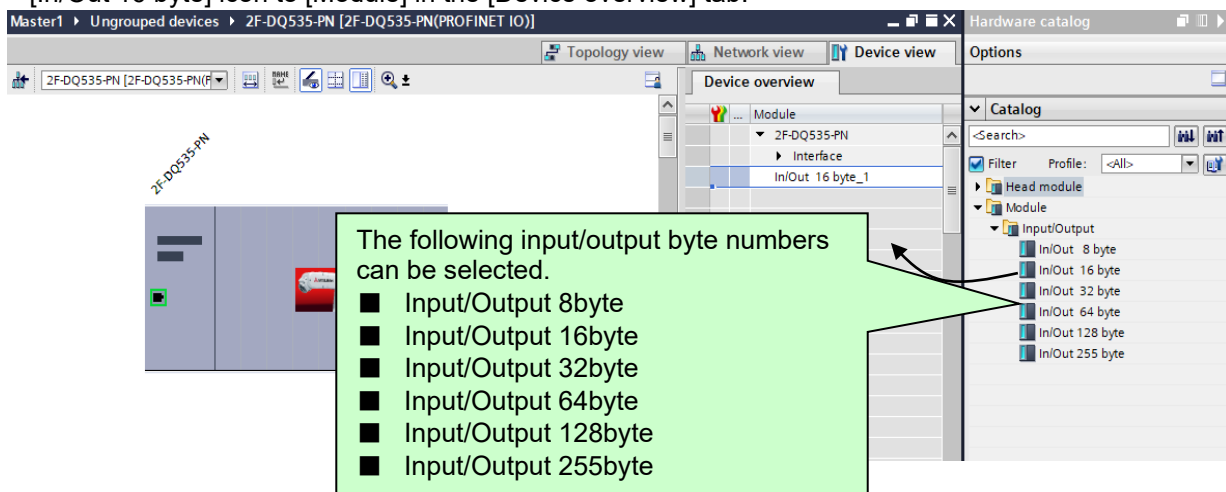
In the [Hardware catalog] task card, click [Other field devices] - [PROFINET IO] - [General] - [Mitsubishi Electric Corporation] - [2F-DQ535-PN]. An icon for Mitsubishi robots will appear. Drag and drop the icon to the [Devices & networks] window and connect it to PLC_1.



Clicking the [Device view] tab will display the module for the robot controller in the [Hardware catalog] task card.

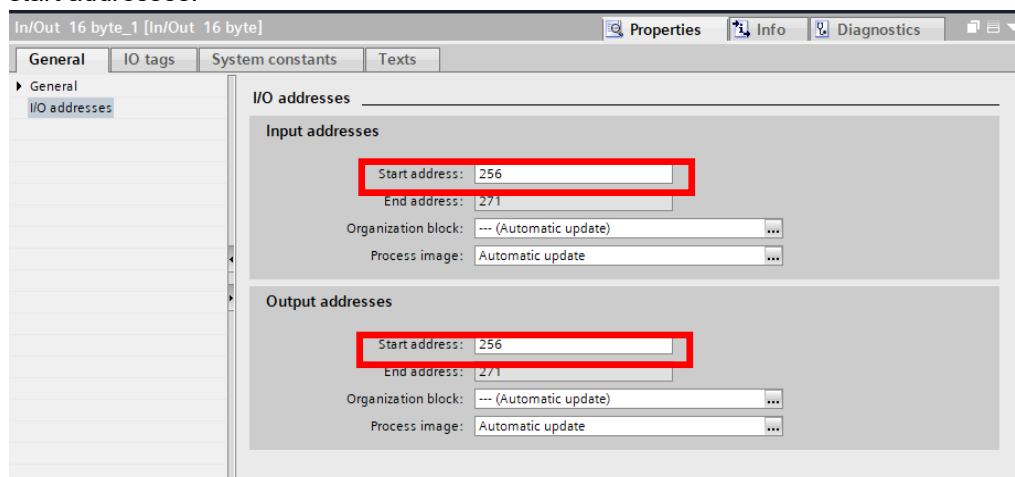


The robot controller parameter [PNIOLN] is set to "16" in the initial settings so drag and drop the [In/Out 16 byte] icon to [Module] in the [Device overview] tab.

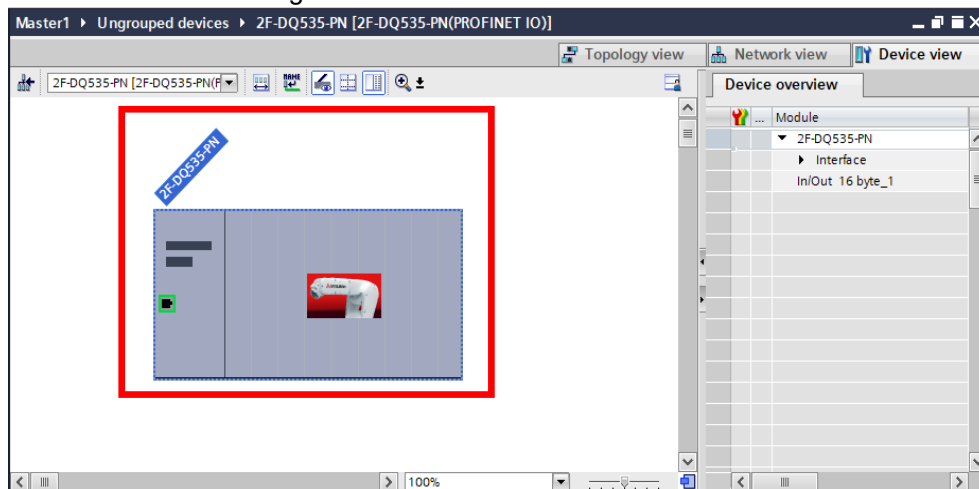


Click [In/Out 16 byte_1] added to [Module] in the [Device overview] tab.

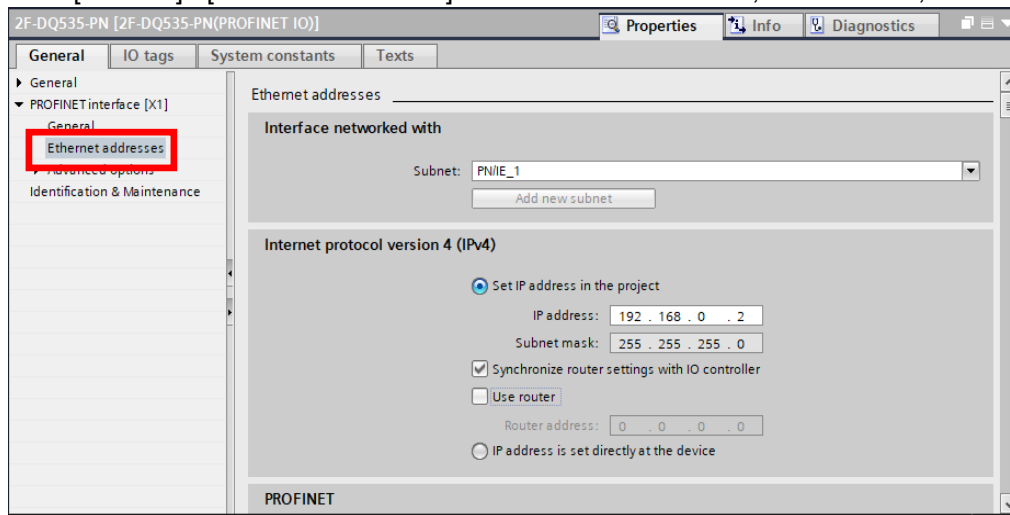
The [Properties] window will appear. Click [General] - [I/O addresses] and set the input and output start addresses.



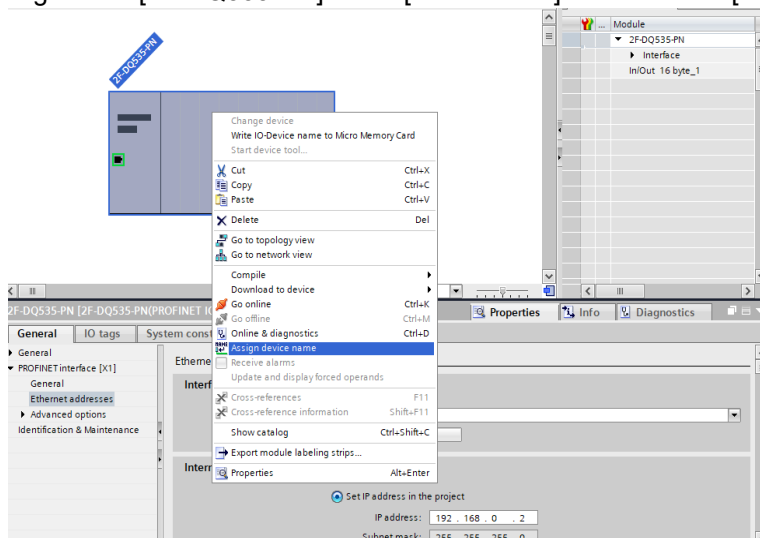
Click [2F-DQ535-PN] in the [Device view] tab to display the properties and configure the robot controller network settings.



Click [General] - [Ethernet addresses] and enter the IP address, subnet mask, and device name.

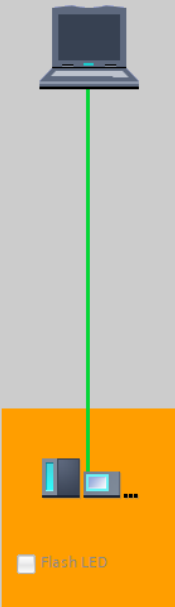


Right-click [2F-DQ535-PN] in the [Device view] tab then click [Assign device name].



Click the [Update list] button to display the nodes then select the target node and click the [Assign name] button.

Assign PROFINET device name.



Configured PROFINET device

PROFINET device name: 2fdq535-pn
Converted name: xd2fdq535-pneb5b
Device type: 2F-DQ535-PN(PROFINET IO)

Online access

Type of the PG/PC interface: PN/IE
PG/PC interface: ASIX AX88179 USB 3.0 to Gigabit Ethernet A...

Device filter

☒ Only show devices of the same type
☐ Only show devices with bad parameter settings
☐ Only show devices without names

Accessible devices in the network:

IP address	MAC address	Device	PROFINET device name	Status
192.168.0.2	00-30-11-60-4...	2F-DQ535-PN	2fdq535-pn	✓ OK

Update list Assign name

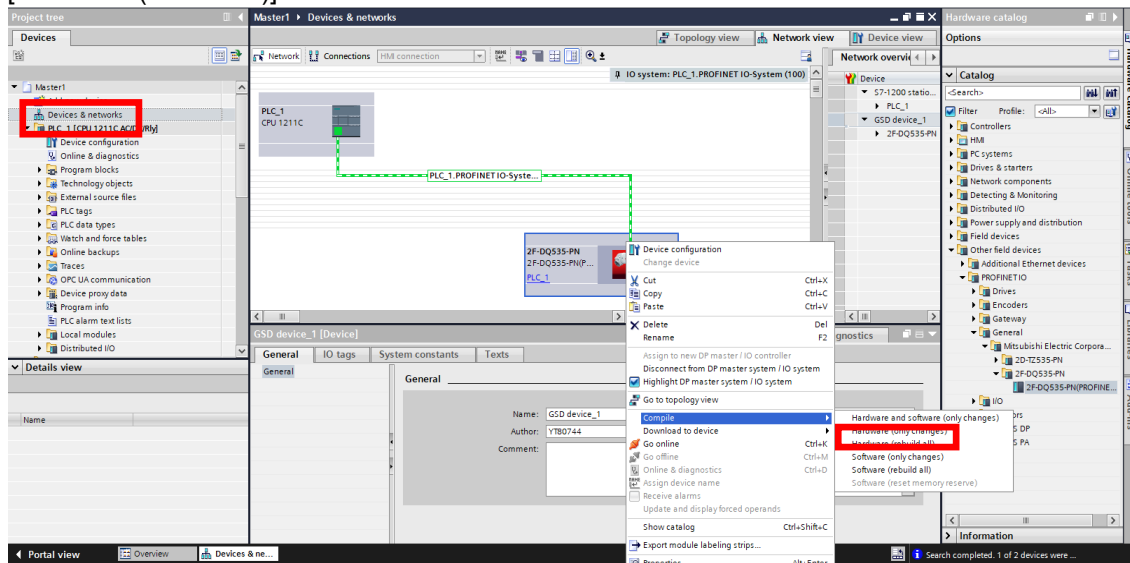
Online status information:
i Search completed. 1 of 2 devices were found.

Close

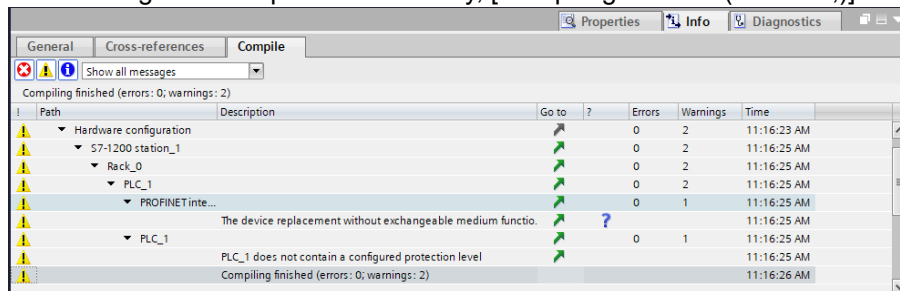
(5) Write the hardware settings to the master station.

PROFINET IO

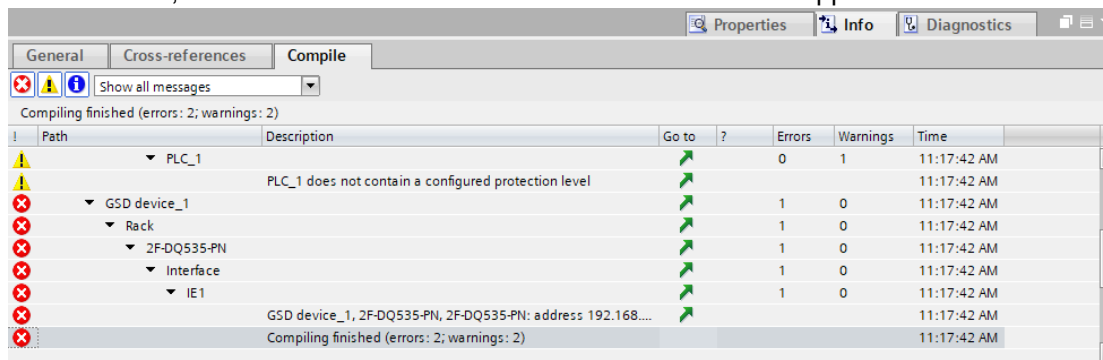
Right-click [PLC_1] in the [Devices & networks] window or [2F-DQ535-PN], then click [Compile] - [Hardware (rebuild all)].



If the settings are compiled successfully, [Compiling finished (errors: 0;)] will appear.

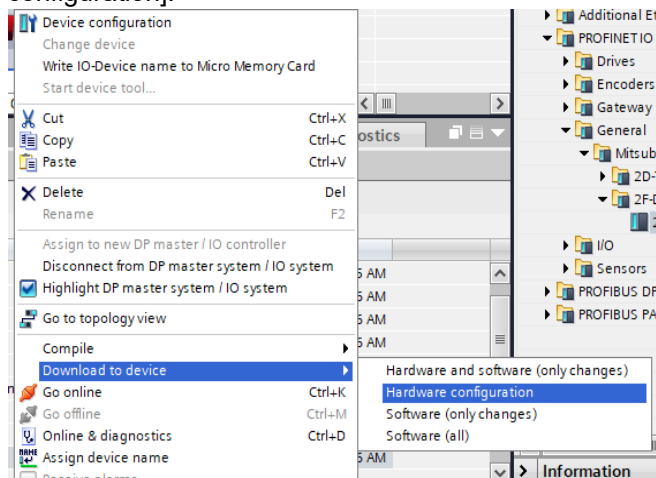


If errors occur, errors such as those shown in the screen below will appear.

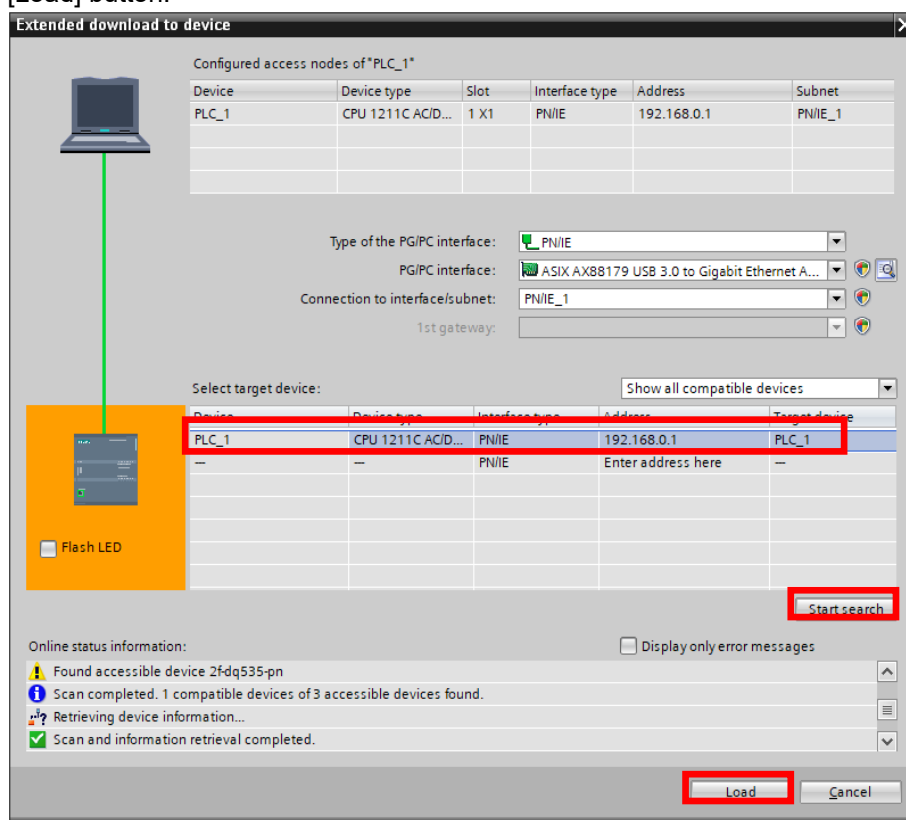


If errors occur during compiling, the software will not be written to the PLC so perform the steps in "◇◇◇◇◇ If compiling errors occur ◇◇◇◇◇" to rectify them.

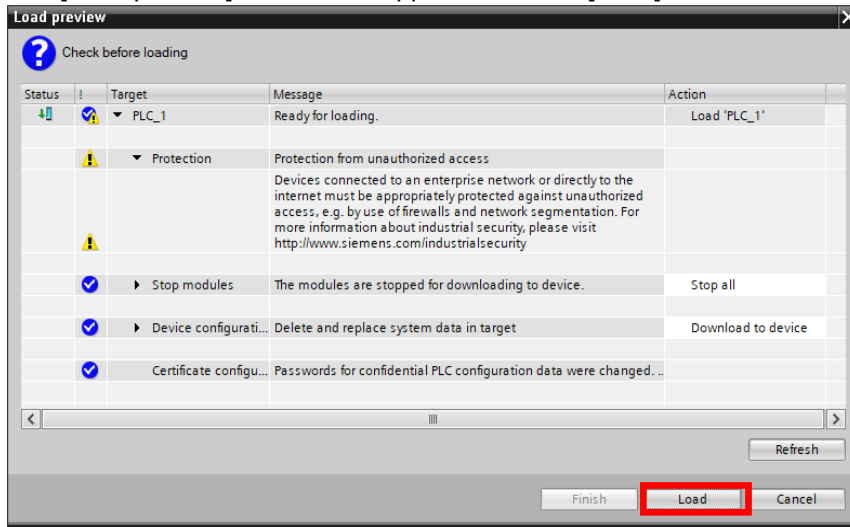
Right-click [2F-DQ535-PN] in the [Device view] tab again, then click [Download to device] - [Hardware configuration].



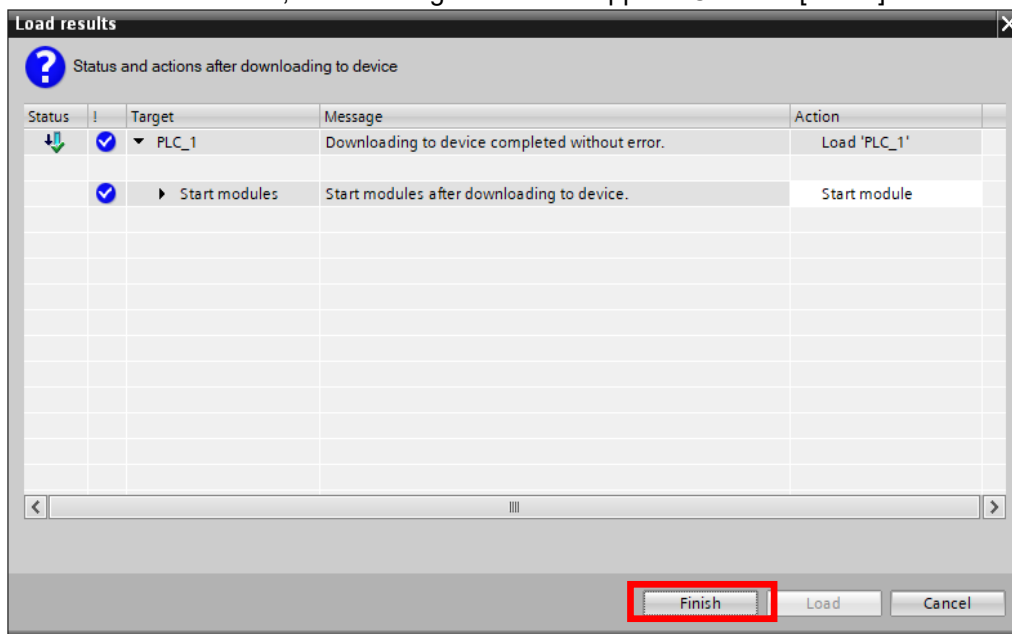
Click the [Start search] button and select [PLC_1] displayed in [Select target device], then click the [Load] button.



The [Load preview] window will appear. Click the [Load] button.



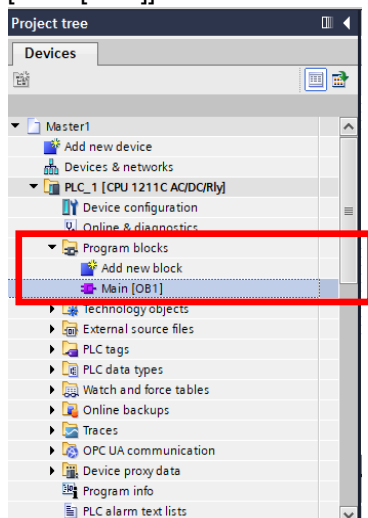
If the load is successful, the following window will appear. Click the [Finish] button.



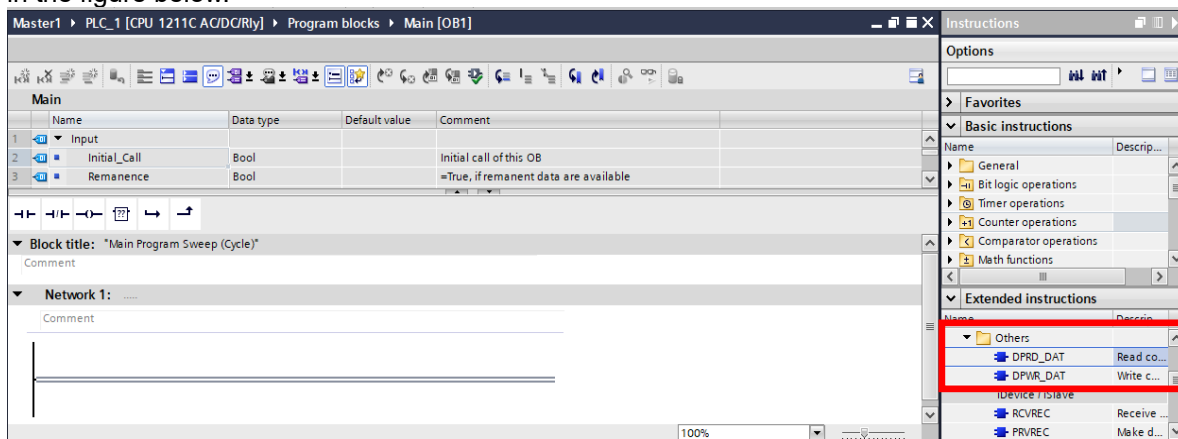
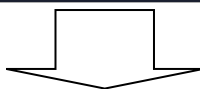
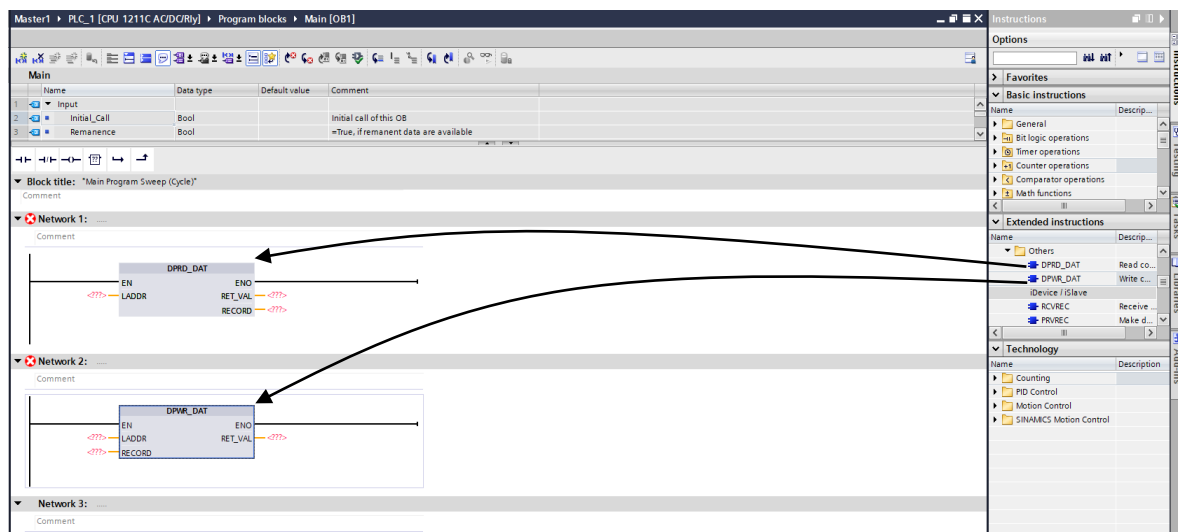
Once the data finishes loading, cycle the power of the PLC and robot controller.

(6) Create a PLC program.

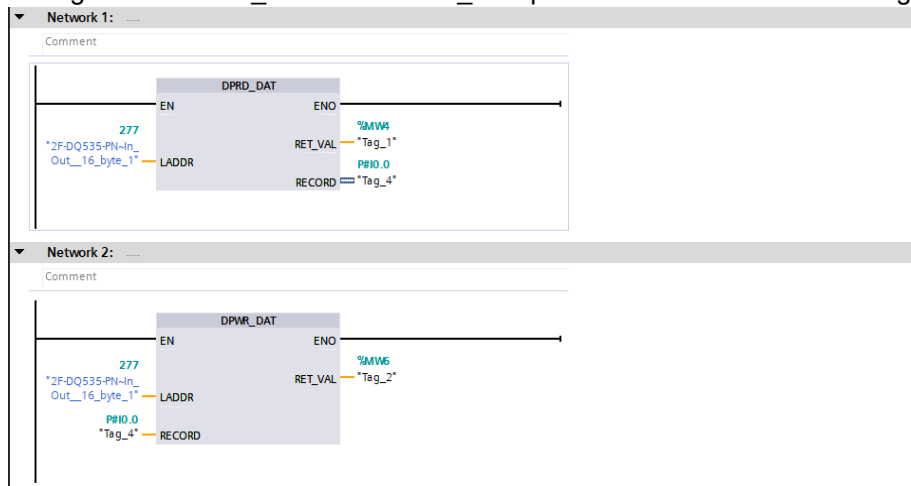
In the [Project tree] on the left side of the screen, click [PLC_1] - [Program blocks], then double-click [Main [OB1]].



The [Program blocks] window will appear. In the panel on the right, click [Instructions] - [Extended instructions] - [Distributed I/O] - [Others], then drag and drop DPRD_DAT and DPRW_DAT as shown in the figure below.



Configure the DPRD_DAT and DPWR_DAT parameters and save the settings.



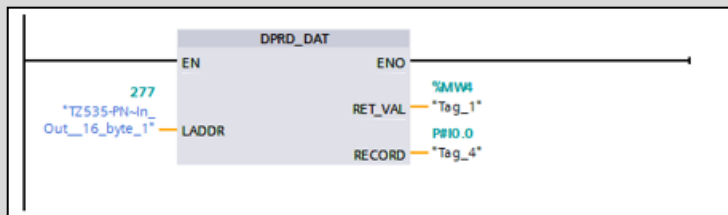
The example above is a program that returns the output signal from the robot unchanged.

◆◆◆Configuring DPRD_DAT and DPWR_DAT◆◆◆

The parameters that should be set for the instructions used in the example above are as follows.

● DPRD_DAT

Instruction to read data from the slave



LADDR: The hardware ID of the module that is the data read origin. The hardware identifier can be checked using system constants.

Specify the module added in "(4) Configure the robot controller parameters."

RET_VAL: Stores error codes when errors occur while executing instructions.

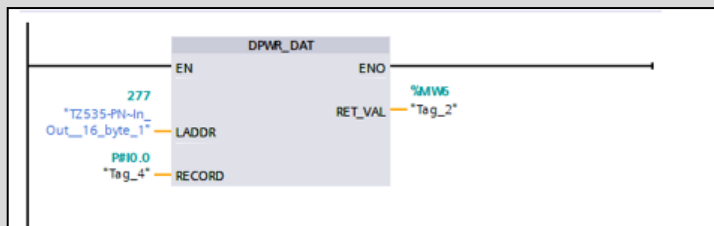
Error codes are in four-digit hexadecimal so specify the format type in 2 bytes or more.

RECORD: Stores read data.

Specify an address that is the same size as LADDR. In the figure above, LADDR is 16 bytes so a user data type must be registered.

● DPWR_DAT

Instruction to write data to the slave



LADDR: The hardware ID of the module that is the data write destination. The hardware identifier can be checked using system constants.

Specify the module added in "(4) Configure the robot controller parameters."

RET_VAL: Stores error codes when errors occur while executing instructions.

Error codes are in four-digit hexadecimal so specify the data type in 2 bytes or more.

RECORD: Writes the stored data to the module.

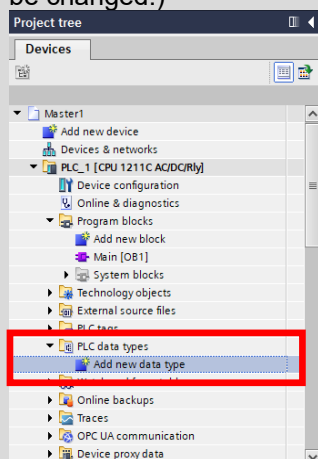
Specify a data type that is the same size as LADDR. In the figure above, LADDR is 16 bytes so a user data type of the same size (16 bytes) must be registered.

(Continued on next page)

- Registering user data types

In the [Project tree] on the left side of the screen, click [PLC_1] - [PLC data types], then double-click [Add new data type].

A data type named "User_data_type1" will be created and the setting window will appear. (The name can be changed.)



16 variables will be created for the data type "Byte". (If the selected module supports 255 bytes, 255 variables will be created.)

Consequently, it will be possible to use "User_data_type_1" as a 16-byte data type.

The screenshot shows the 'User_data_type_1' configuration window. It contains a table with the following columns: Name, Data type, Default value, Accessible f..., Writa..., Visible in ..., Setpoint, and Comment. The table has two rows: the first row is for '16Byte_0' with a 'Byte' data type and a default value of '16#0'; the second row is a placeholder '<Add new>'. The 'Accessible f...' and 'Writa...' columns have checkboxes that are checked for the first row.

	Name	Data type	Default value	Accessible f...	Writa...	Visible in ...	Setpoint	Comment
1	16Byte_0	Byte	16#0	☒	☒	☒	☐	
2	<Add new>			☐	☐	☐	☐	

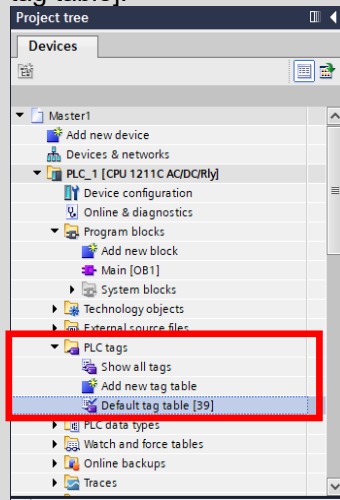


The screenshot shows the 'User_data_type_1' configuration window after 16 variables have been created. The table now contains 17 rows, from '16Byte_0' to '16Byte_15', all with a 'Byte' data type and a default value of '16#0'. The 'Accessible f...' and 'Writa...' columns have checkboxes that are checked for all rows. The 'Visible in ...' column has checkboxes that are checked for all rows. The 'Setpoint' column has checkboxes that are unchecked for all rows. The last row is a placeholder '<Add new>'. A large white arrow points from the previous screenshot to this one.

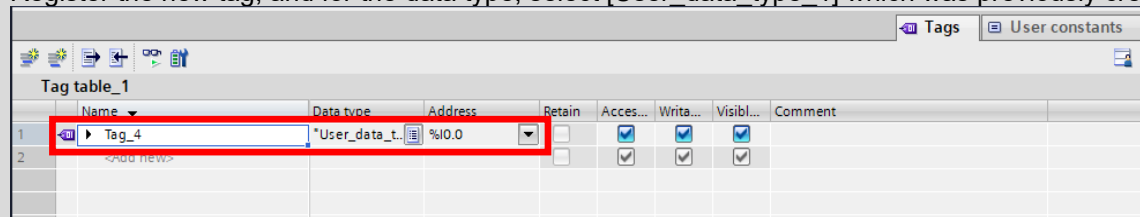
	Name	Data type	Default value	Accessible f...	Writa...	Visible in ...	Setpoint	Comment
1	16Byte_0	Byte	16#0	☒	☒	☒	☐	
2	16Byte_1	Byte	16#0	☒	☒	☒	☐	
3	16Byte_2	Byte	16#0	☒	☒	☒	☐	
4	16Byte_3	Byte	16#0	☒	☒	☒	☐	
5	16Byte_4	Byte	16#0	☒	☒	☒	☐	
6	16Byte_5	Byte	16#0	☒	☒	☒	☐	
7	16Byte_6	Byte	16#0	☒	☒	☒	☐	
8	16Byte_7	Byte	16#0	☒	☒	☒	☐	
9	16Byte_8	Byte	16#0	☒	☒	☒	☐	
10	16Byte_9	Byte	16#0	☒	☒	☒	☐	
11	16Byte_10	Byte	16#0	☒	☒	☒	☐	
12	16Byte_11	Byte	16#0	☒	☒	☒	☐	
13	16Byte_12	Byte	16#0	☒	☒	☒	☐	
14	16Byte_13	Byte	16#0	☒	☒	☒	☐	
15	16Byte_14	Byte	16#0	☒	☒	☒	☐	
16	16Byte_15	Byte	16#0	☒	☒	☒	☐	
17	<Add new>			☐	☐	☐	☐	

(Continued on next page)

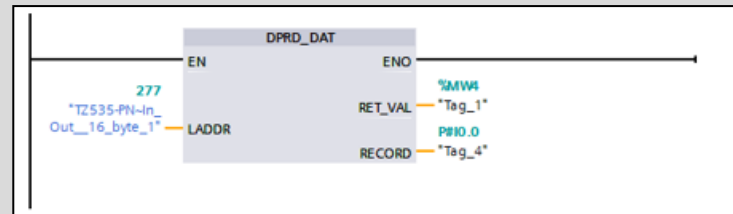
In the [Project tree] on the left side of the screen, click [PLC_1] - [PLC tags], then double-click [Add new tag table].



Register the new tag, and for the data type, select [User_data_type_1] which was previously created.



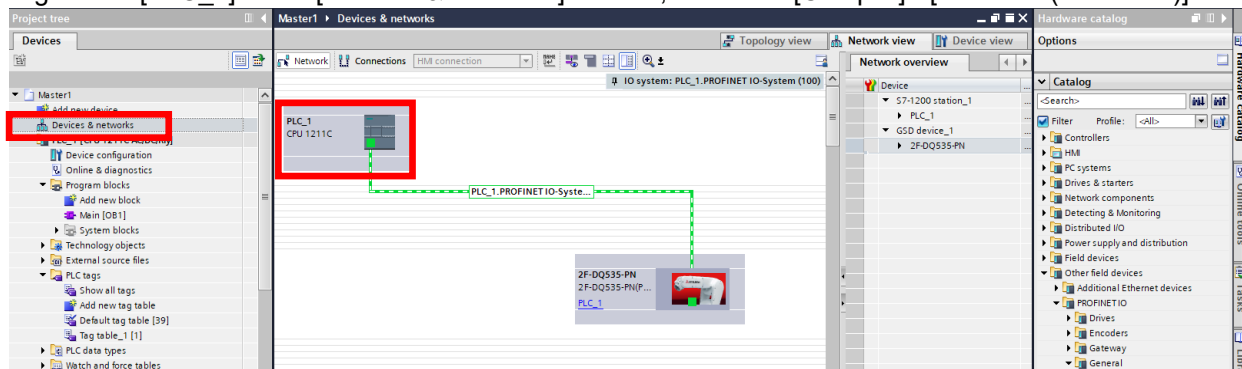
By setting the PLC tag created in the steps above in the argument of the instruction, 16-byte data can be stored.



(7) Write the PLC software to the master station.

PROFINET IO

Right-click [PLC_1] in the [Devices & networks] window, then click [Compile] - [Software (rebuild all)].



If the software is compiled successfully, [Compiling finished (errors: 0;)] will appear.

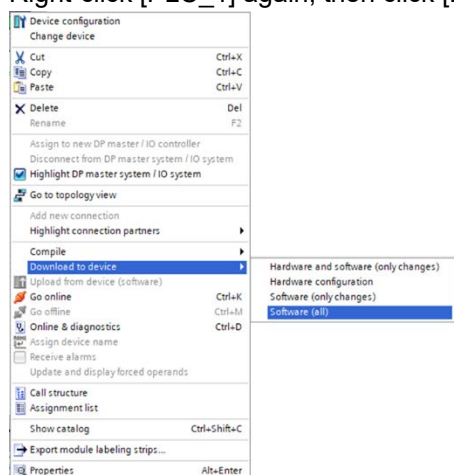
Path	Description	Go to	Errors	Warnings	Time
PLC_1			0	1	11:52:09 AM
PLC data types			0	0	11:52:09 AM
User_data_type_1 (UDT)	The data type was successfully updated.				11:52:11 AM
Program blocks			0	0	11:52:11 AM
Main (OB1)	Block was successfully compiled.				11:52:11 AM

If errors occur, errors such as those shown in the screen below will appear.

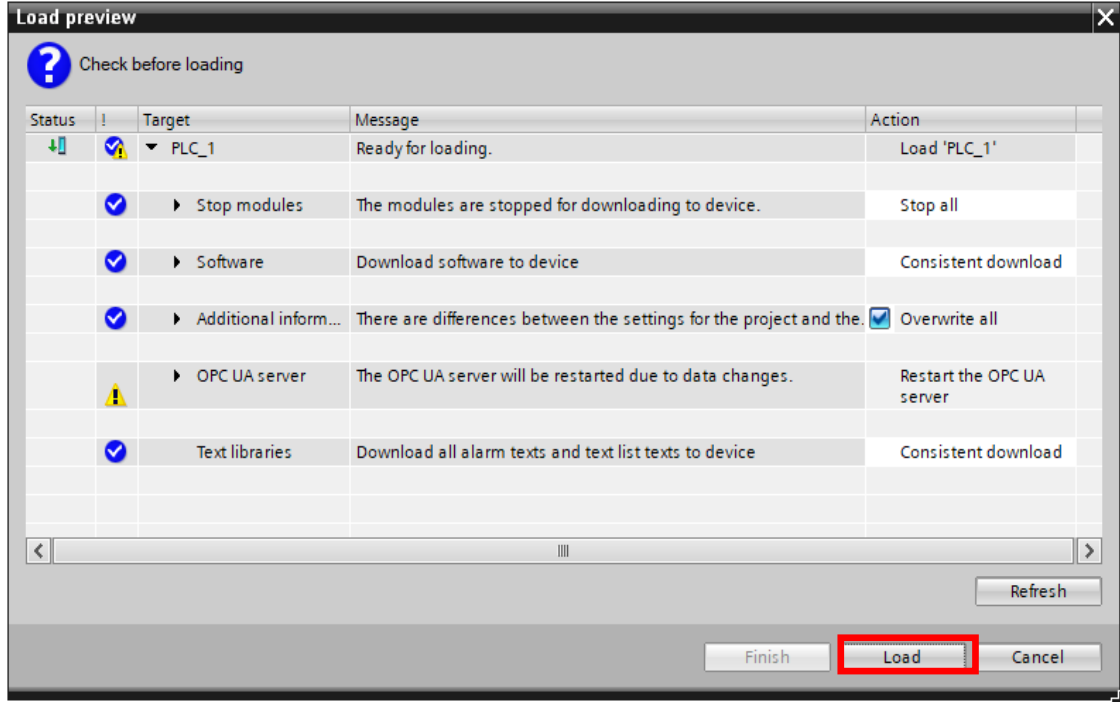
Path	Description	Go to	Errors	Warnings	Time
PLC_1			1	1	11:53:26 AM
PLC data types			0	0	11:53:27 AM
User_data_type_1 (UDT)	The data type was successfully updated.				11:53:27 AM
Program blocks			1	0	11:53:27 AM
Main (OB1)			1	0	11:53:27 AM
Network 1	The operand required at the input or output is missing or has a...		?		11:53:27 AM
	Compiling finished (errors: 1; warnings: 1)				11:53:27 AM

If errors occur during compiling, the software will not be written to the PLC so perform the steps in "◇
◆◇If compiling errors occur◆◆◇" to rectify them.

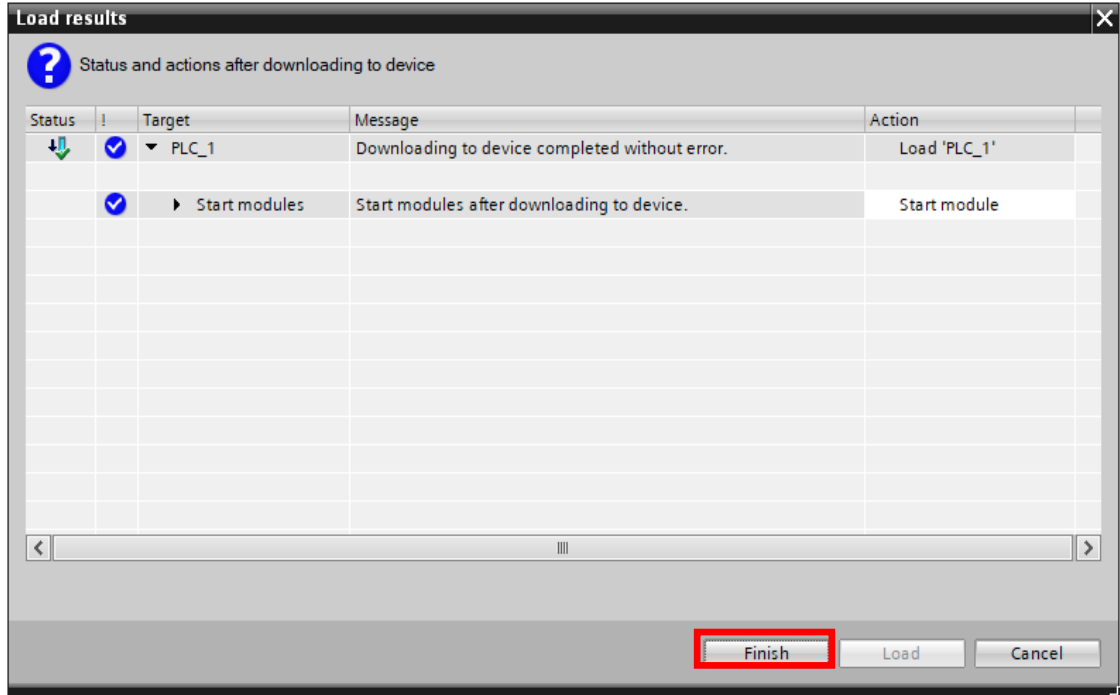
Right-click [PLC_1] again, then click [Download to device] - [Software (all)].



The [Load preview] window will appear. Click the [Load] button.



If the load is successful, the following window will appear. Click the [Finish] button.



Once the data finishes loading, cycle the power of the PLC and robot controller.

◆◆◆If compiling errors occur◆◆◆

If compiling errors occur in "(5) Write the hardware settings to the master station." or "(7) Write the PLC software to the master station.", the errors must be solved before continuing.

For more information on Siemens PLCs, refer to the manual included with the PLC.

(1) Check the displayed errors and double-click them.

Double-clicking an error will show where it has occurred.

!	Path	Description	Go to	?	Errors	Warnings	Time
✗	PLC_1				1	1	11:53:26 AM
✓	PLC data types				0	0	11:53:27 AM
✓	User_data_type_1 (UDT)	The data type was successfully updated.					11:53:27 AM
✓	Program blocks				1	0	11:53:27 AM
✗	Main (OB1)				1	0	11:53:27 AM
✗	Network 1	The operand required at the input or output is missing or has a...		?			11:53:27 AM
✗		Compiling finished (errors: 1; warnings: 1)					11:53:27 AM



Block title: "Main Program Sweep (Cycle)"

Comment

Network 1:

Comment

277

2F-DQ535-PN-In-Out_16_byte_1

LADDR

DPRD_DAT

EN

ENO

RET_VAL

RECORD

%MW4

Tag_1

<???

Network 2:

Comment

277

2F-DQ535-PN-In-Out_16_byte_1

LADDR

DPWR_DAT

EN

ENO

RET_VAL

RECORD

%MW6

Tag_2

100%

Properties Info Diagnostics

General Cross-references Compile Syntax

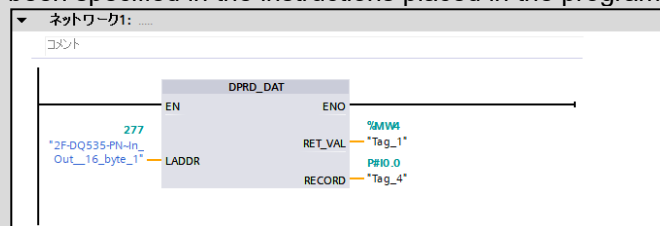
Show all messages

Compiling finished (errors: 1; warnings: 1)

| ! | Path | Description | Go to | ? | Errors | Warnings | Time |
|---|----------------|--|-------|---|--------|----------|-------------|
| ✗ | PLC_1 | | | | 1 | 1 | 11:59:18 AM |
| ✗ | Program blocks | | | | 1 | 0 | 11:59:19 AM |
| ✗ | Main (OB1) | | | | 1 | 0 | 11:59:19 AM |
| ✗ | Network 1 | The operand required at the input or output is missing or has a... | | ? | | | 11:59:19 AM |
| ✗ | | Compiling finished (errors: 1; warnings: 1) | | | | | 11:59:19 AM |

(2) Remove the cause of the errors.

The cause of the errors in this instance, is that the addresses of the inputs and outputs have not been specified in the instructions placed in the program block. Set the addresses.



(3) Return to step "(5) Write the hardware settings to the master station." or "(7) Write the PLC software to the master station." and compile the program again.

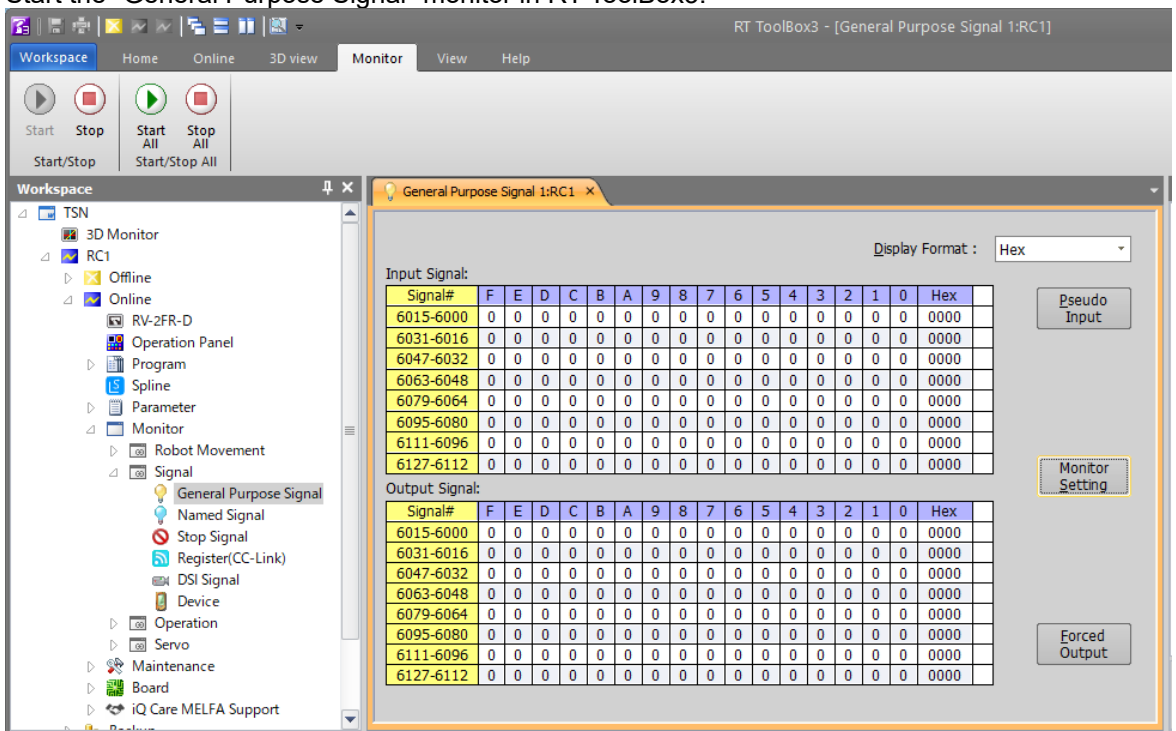
12.2. Checking the I/O Signals

12.2.1. For the CC-Link IE TSN module

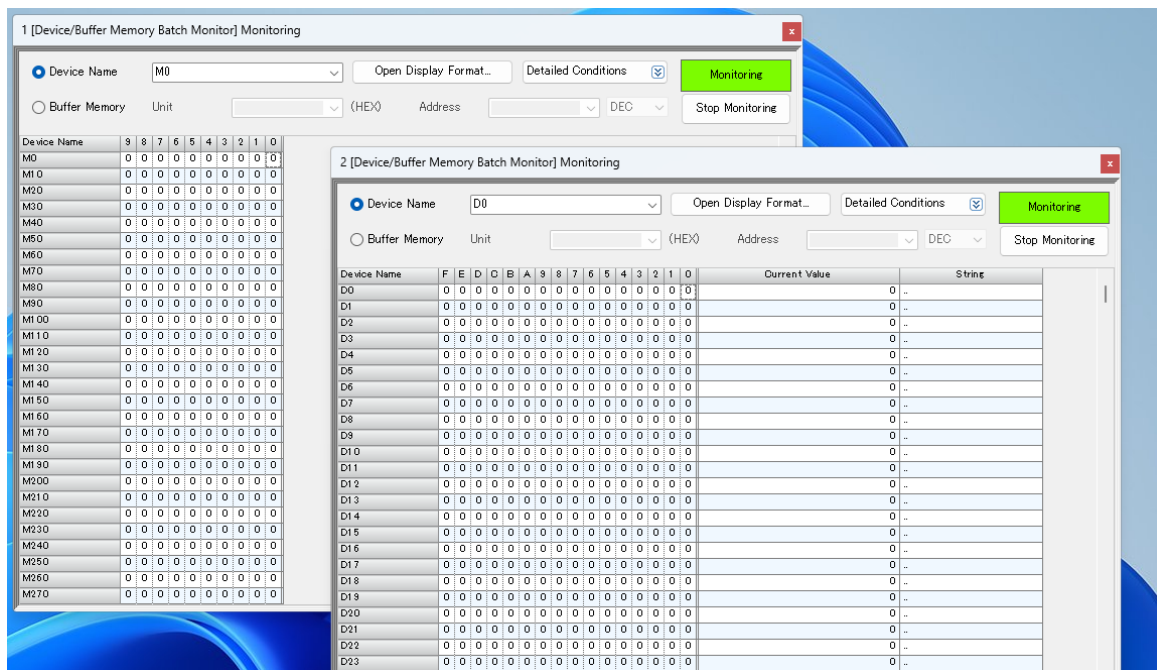
CC-Link IE TSN

Check the exchange of I/O signals using RT ToolBox3 and the GX Works3 monitor screen.

(1) Start the "General Purpose Signal" monitor in RT ToolBox3.

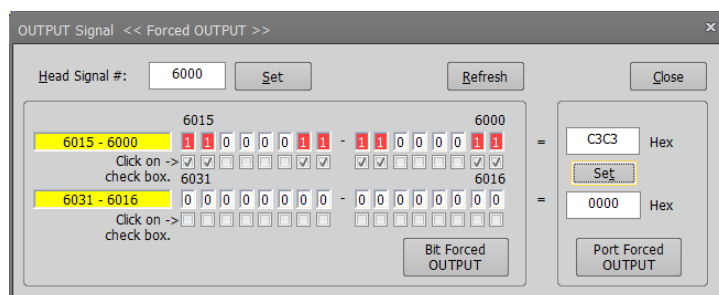
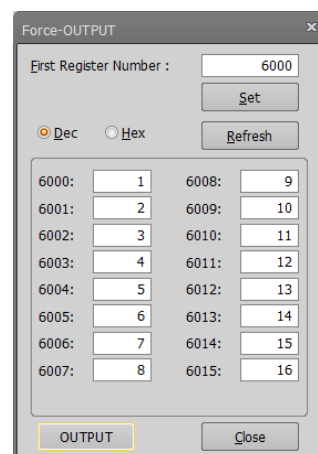


- (2) Start "Device/Buffer Memory Batch Monitor" in GX Works3.
Select [Online] - [Monitor] - [Device/Buffer Memory Batch] to open the window and specify the beginning (M0/M2000/D0/D200) of the device name to be monitored. Multiple monitors can be started at the same time and pressing the [F3] key starts monitoring.



- (3) Click the [Forced OUTPUT] button on the "General Purpose Signal" monitor or "Register(CC-Link)" monitor in RT ToolBox3 to perform an output test.

Forced output of the OUTPUT Signal and output register in the monitor window.



- (4) Confirm that output from the robot side is looped back to the PLC side and stored in the input of the robot.

The image displays four screenshots of the CC-Link IE TSN monitoring software interface, showing signal status and register data.

General Purpose Signal 1:RC1

Display Format: Hex

Input Signal:

| Signal# | F | E | D | C | B | A | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Hex |
|-----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|------|
| 6015-6000 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | C3C3 |
| 6031-6016 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 6047-6032 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 6063-6048 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 6079-6064 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 6095-6080 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 6111-6096 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 6127-6112 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |

Output Signal:

| Signal# | F | E | D | C | B | A | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Hex |
|-----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|------|
| 6015-6000 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | C3C3 |
| 6031-6016 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 6047-6032 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 6063-6048 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 6079-6064 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 6095-6080 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 6111-6096 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 6127-6112 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |

Register(CC-Link) 1:RC1

Input Register:

| No. | Dec | Hex |
|------|-----|------|
| 6000 | 1 | 0001 |
| 6001 | 2 | 0002 |
| 6002 | 3 | 0003 |
| 6003 | 4 | 0004 |
| 6004 | 5 | 0005 |
| 6005 | 6 | 0006 |
| 6006 | 7 | 0007 |
| 6007 | 8 | 0008 |
| 6008 | 9 | 0009 |
| 6009 | 10 | 000A |
| 6010 | 11 | 000B |
| 6011 | 12 | 000C |
| 6012 | 13 | 000D |
| 6013 | 14 | 000E |
| 6014 | 15 | 000F |
| 6015 | 16 | 0010 |

Output Register:

| No. | Dec | Hex |
|------|-----|------|
| 6000 | 1 | 0001 |
| 6001 | 2 | 0002 |
| 6002 | 3 | 0003 |
| 6003 | 4 | 0004 |
| 6004 | 5 | 0005 |
| 6005 | 6 | 0006 |
| 6006 | 7 | 0007 |
| 6007 | 8 | 0008 |
| 6008 | 9 | 0009 |
| 6009 | 10 | 000A |
| 6010 | 11 | 000B |
| 6011 | 12 | 000C |
| 6012 | 13 | 000D |
| 6013 | 14 | 000E |
| 6014 | 15 | 000F |
| 6015 | 16 | 0010 |

1 [Device/Buffer Memory Batch Monitor] Monitoring

Device Name: M0

Unit: (HEX)

Address: C3C3

Current Value: 0000

2 [Device/Buffer Memory Batch Monitor] Monitoring

Device Name: M2000

Unit: (HEX)

Address: C3C3

Current Value: 0000

1 [Device/Buffer Memory Batch Monitor] Monitoring

Device Name: D0

Unit: (HEX)

Address: 0001

Current Value: 0001

2 [Device/Buffer Memory Batch Monitor] Monitoring

Device Name: D200

Unit: (HEX)

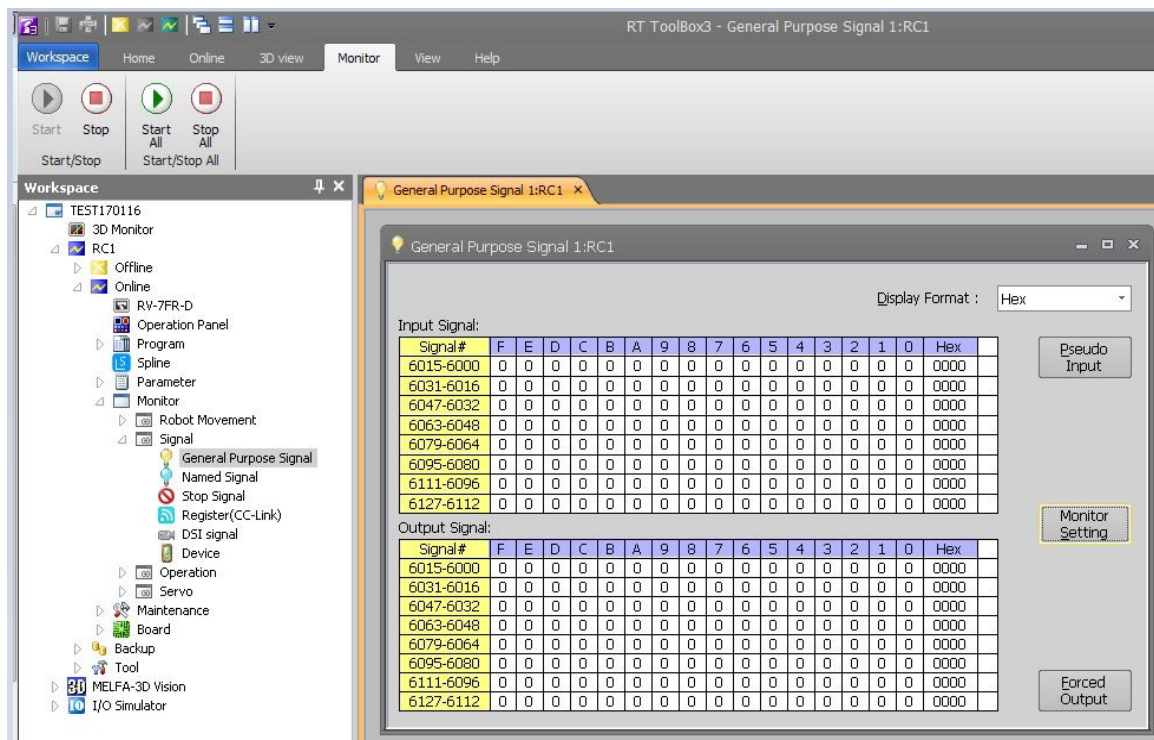
Address: 0001

Current Value: 0001

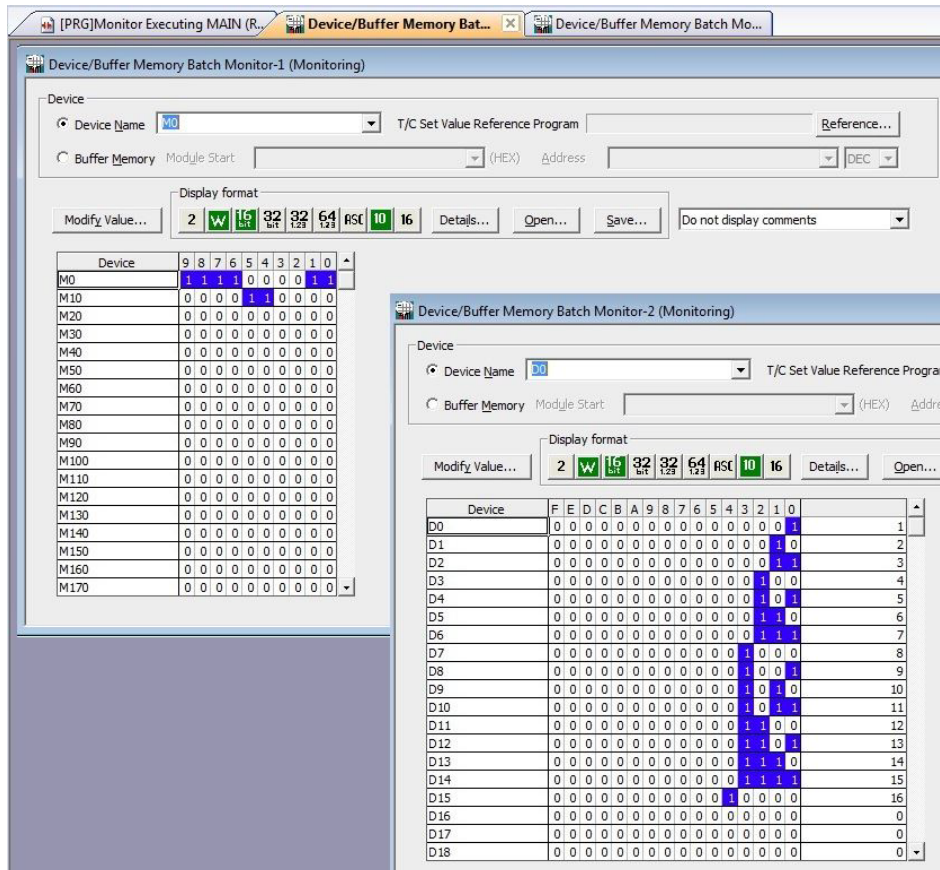
12.2.2. For the CC-Link IE Field module

Check the exchange of I/O signals using RT ToolBox3 and the GX Works2 (GX Works3 for the MELSEC iQ-R series) monitor screen.

- (1) Start the "General Purpose Signal" monitor in RT ToolBox3.

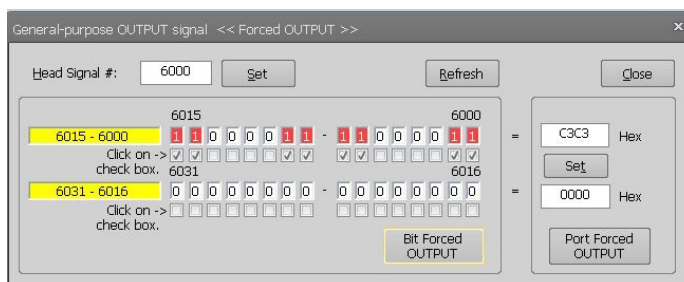
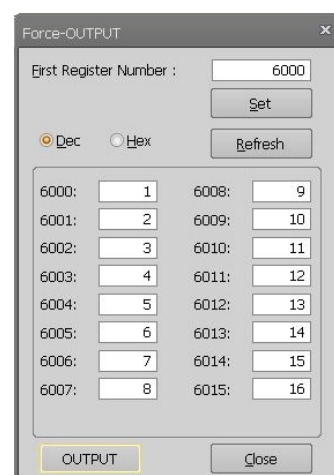


- (2) Start "Device/Buffer Memory Batch Monitor" in GX Works2.
Select [Online] - [Monitor] - [Device/Buffer Memory Batch] to open the window and specify the beginning (M0/M2000/D0/D200) of the device name to be monitored. Multiple monitors can be started at the same time and pressing the [F3] key starts monitoring.



- (3) Click the [Forced Output] button on the "General Purpose Signal" monitor or "Register(CC-Link)" monitor in RT ToolBox3 to perform an output test.

Forced output of the output signal and output register in the monitor window.



- (4) Confirm that the output from the robot is looped back in the PLC side and stored in the input of the robot.

The figure displays four screenshots of the CC-Link IE Field software interface, illustrating the process of monitoring and confirming I/O signals.

General Purpose Signal 1:RC1

Display Format: Hex

Input Signal:

| Signal# | F | E | D | C | B | A | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Hex |
|-----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|------|
| 6015-6000 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | C3C3 |
| 6031-6016 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 6047-6032 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 6063-6048 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 6079-6064 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 6095-6080 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 6111-6096 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 6127-6112 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |

Output Signal:

| Signal# | F | E | D | C | B | A | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Hex |
|-----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|------|
| 6015-6000 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | C3C3 |
| 6031-6016 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 6047-6032 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 6063-6048 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 6079-6064 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 6095-6080 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 6111-6096 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 6127-6112 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |

Register (CC-Link) 1:RC1

Input Register:

| No. | Dec | Hex |
|------|-----|------|
| 6000 | 1 | 0001 |
| 6001 | 2 | 0002 |
| 6002 | 3 | 0003 |
| 6003 | 4 | 0004 |
| 6004 | 5 | 0005 |
| 6005 | 6 | 0006 |
| 6006 | 7 | 0007 |
| 6007 | 8 | 0008 |
| 6008 | 9 | 0009 |
| 6009 | 10 | 000A |
| 6010 | 11 | 000B |
| 6011 | 12 | 000C |
| 6012 | 13 | 000D |
| 6013 | 14 | 000E |
| 6014 | 15 | 000F |
| 6015 | 16 | 0010 |

Output Register:

| No. | Dec | Hex |
|------|-----|------|
| 6000 | 1 | 0001 |
| 6001 | 2 | 0002 |
| 6002 | 3 | 0003 |
| 6003 | 4 | 0004 |
| 6004 | 5 | 0005 |
| 6005 | 6 | 0006 |
| 6006 | 7 | 0007 |
| 6007 | 8 | 0008 |
| 6008 | 9 | 0009 |
| 6009 | 10 | 000A |
| 6010 | 11 | 000B |
| 6011 | 12 | 000C |
| 6012 | 13 | 000D |
| 6013 | 14 | 000E |
| 6014 | 15 | 000F |
| 6015 | 16 | 0010 |

Device/Buffer Memory Batch Monitor-1 (Monitoring)

Device: M0

Display format: 2 W 16 32 64 RSC 10 16

| Device | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|--------|---|---|---|---|---|---|---|---|---|---|
| M0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | |
| M10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M70 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M80 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M90 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M110 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M120 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M130 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M140 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M150 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M160 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M170 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |

Device/Buffer Memory Batch Monitor-2 (Monitoring)

Device: M2048

Display format: 2 W 16 32 64 RSC 10 16

| Device | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|--------|---|---|---|---|---|---|---|---|---|---|
| M2048 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| M2058 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M2068 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M2078 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M2088 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M2098 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M2108 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M2118 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M2128 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M2138 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M2148 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M2158 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M2168 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M2178 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M2188 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M2198 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M2208 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| M2218 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |

Device/Buffer Memory Batch Monitor-1 (Monitoring)

Device: D0

Display format: 2 W 16 32 64 RSC 10 16

| Device | F | E | D | C | B | A | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|--------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| D8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| D16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| D17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |

Device/Buffer Memory Batch Monitor-2 (Monitoring)

Device: D512

Display format: 2 W 16 32 64 RSC 10 16

| Device | F | E | D | C | B | A | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|--------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D512 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| D513 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D514 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D515 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D516 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D517 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D518 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D519 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D520 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D521 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D522 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D523 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D524 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D525 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D526 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D527 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| D528 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| D529 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |

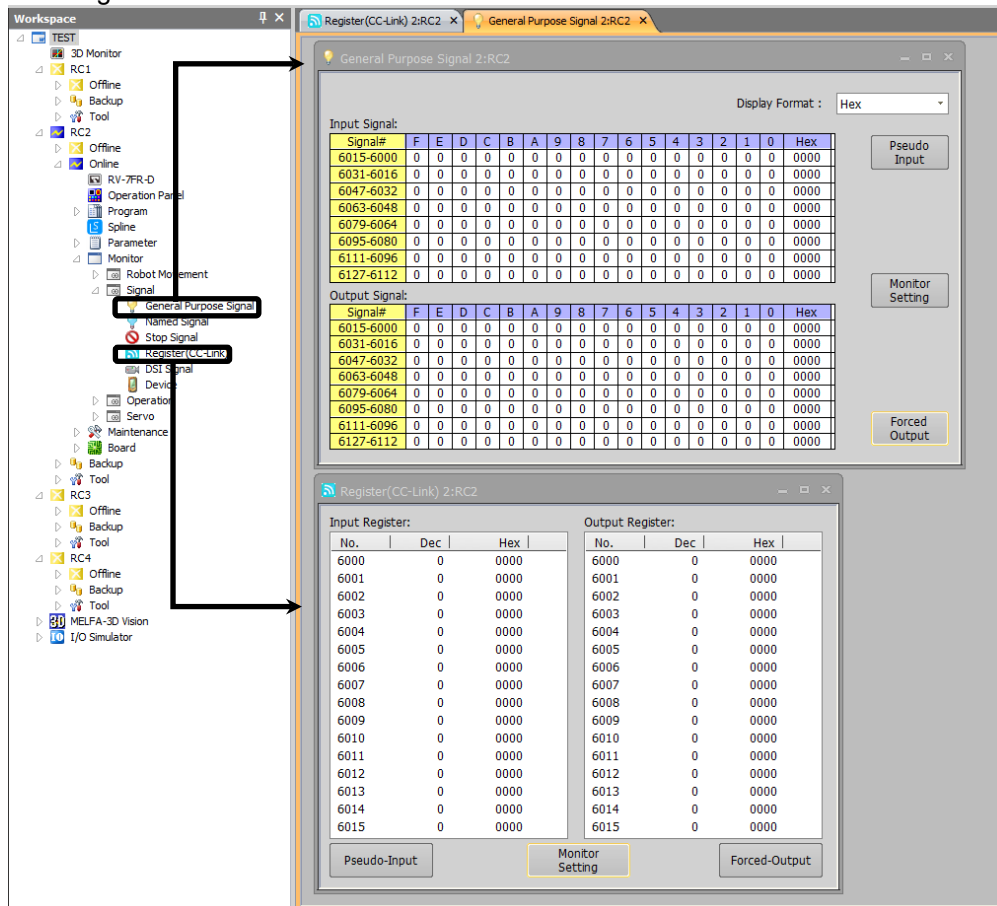
12.2.3. For the EtherCAT

EtherCAT

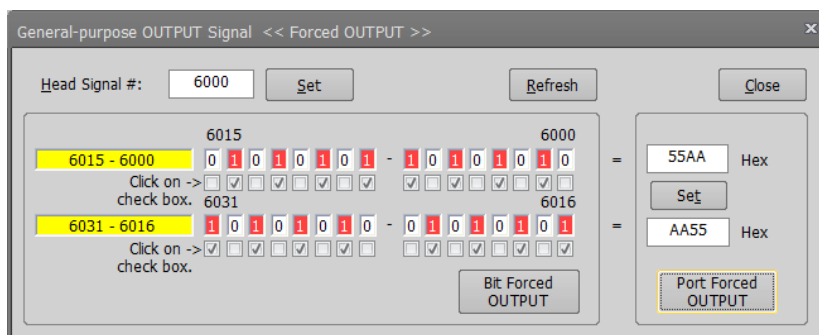
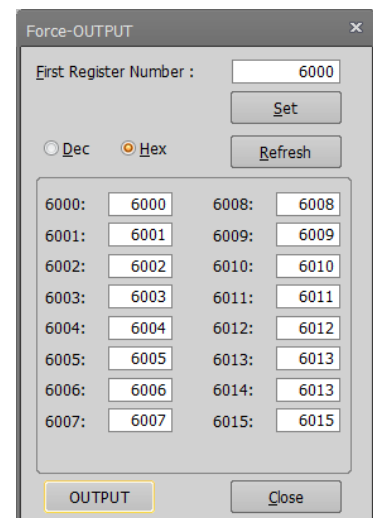
Use RT ToolBox3 and TwinCAT XAE.

(1) Click the [Forced Output] button on the "General Purpose Signal" monitor and "Register" monitor in RT ToolBox3 to perform an output test.

i) Double-click the "General Purpose Signal" node and "Register" node under "Monitor", and display the following windows.



ii) Press the "Forced Output" button on each window, and display the following windows. Then, output an appropriate signal.



(2) Confirm that the values of general signals and registers are looped back.

The screenshot displays two windows from the EtherCAT software interface.

General Purpose Signal 2:RC2 Window:

- Display Format:** Hex
- Input Signal:** A table with 16 rows (Signal# 6015-6000 to 6127-6096) and 16 columns (F, E, D, C, B, A, 9, 8, 7, 6, 5, 4, 3, 2, 1, 0). The 'Hex' column shows values: 55AA, AA55, 55AA, AA55, 0000, 0000, 0000, 0000.
- Output Signal:** A similar table with the same columns and values as the input signal.
- Buttons:** Pseudo Input, Monitor Setting, Forced Output.

Register(CC-Link) 2:RC2 Window:

- Input Register:** A table with 16 rows (No. 6000 to 6015) and 3 columns (Dec, Hex). The 'Dec' column shows values: 24576, 24577, 24578, 24579, 24580, 24581, 24582, 24583, 24584, 24585, 24592, 24593, 24594, 24595, 24596, 24597. The 'Hex' column shows values: 6000, 6001, 6002, 6003, 6004, 6005, 6006, 6007, 6008, 6009, 6010, 6011, 6012, 6013, 6014, 6015.
- Output Register:** A table with the same structure and values as the input register.
- Buttons:** Pseudo-Input, Monitor Setting, Forced-Output.

- (3) Confirm the I/O in the PLC side. Display the process data of "Module 1 (1 Station:CR800 GPIO_REG_IF)" under "CompactCom 40 EtherCAT" of TwinCAT XAE and confirm that the input value from the CR800-D has been reflected.

- ☐ ● Box 2 (CompactCom 40 EtherCAT)
- ☐ ● Module 1 (1 Station:CR800 GPIO_REG_IF)
- + Tx PDO (1 Sta)
- + Rx PDO (1 Sta)

To confirm the output (RX, RWr) from the CR800-D (input value to the PLC), double-click "Tx PDO" to display the following screen.

| TwinCAT Project1 | | | | | | | | |
|------------------|--------|----------------|-------|---------|--------|---------|-----------|---|
| Name | Online | Type | Size | Address | In/Out | User I. | Linked to | |
| Rx(6000-6007) | X | 170 (b:aa) | USINT | 1.0 | 39.0 | Input | 0 | MAINInput_CR800_JO_ARR[1] MAINInput_CR800_JO_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rx(6008-6015) | X | 85 (b:55) | USINT | 1.0 | 40.0 | Input | 0 | MAINInput_CR800_JO_ARR[2] MAINInput_CR800_JO_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rx(6016-6023) | X | 85 (b:55) | USINT | 1.0 | 41.0 | Input | 0 | MAINInput_CR800_JO_ARR[3] MAINInput_CR800_JO_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rx(6024-6031) | X | 170 (b:aa) | USINT | 1.0 | 42.0 | Input | 0 | MAINInput_CR800_JO_ARR[4] MAINInput_CR800_JO_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rx(6032-6039) | X | 170 (b:aa) | USINT | 1.0 | 43.0 | Input | 0 | MAINInput_CR800_JO_ARR[5] MAINInput_CR800_JO_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rx(6040-6047) | X | 85 (b:55) | USINT | 1.0 | 44.0 | Input | 0 | MAINInput_CR800_JO_ARR[6] MAINInput_CR800_JO_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rx(6048-6055) | X | 85 (b:55) | USINT | 1.0 | 45.0 | Input | 0 | MAINInput_CR800_JO_ARR[7] MAINInput_CR800_JO_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rx(6056-6063) | X | 170 (b:aa) | USINT | 1.0 | 46.0 | Input | 0 | MAINInput_CR800_JO_ARR[8] MAINInput_CR800_JO_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6060) | X | 24576 (b:0000) | UINT | 2.0 | 47.0 | Input | 0 | MAINInput_CR800_REG_ARR[1] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6061) | X | 24577 (b:0001) | UINT | 2.0 | 48.0 | Input | 0 | MAINInput_CR800_REG_ARR[2] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6062) | X | 24578 (b:0002) | UINT | 2.0 | 51.0 | Input | 0 | MAINInput_CR800_REG_ARR[3] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6063) | X | 24579 (b:0003) | UINT | 2.0 | 53.0 | Input | 0 | MAINInput_CR800_REG_ARR[4] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6064) | X | 24580 (b:0004) | UINT | 2.0 | 55.0 | Input | 0 | MAINInput_CR800_REG_ARR[5] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6065) | X | 24581 (b:0005) | UINT | 2.0 | 57.0 | Input | 0 | MAINInput_CR800_REG_ARR[6] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6066) | X | 24582 (b:0006) | UINT | 2.0 | 59.0 | Input | 0 | MAINInput_CR800_REG_ARR[7] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6067) | X | 24583 (b:0007) | UINT | 2.0 | 61.0 | Input | 0 | MAINInput_CR800_REG_ARR[8] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6068) | X | 24584 (b:0008) | UINT | 2.0 | 63.0 | Input | 0 | MAINInput_CR800_REG_ARR[9] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6069) | X | 24585 (b:0009) | UINT | 2.0 | 65.0 | Input | 0 | MAINInput_CR800_REG_ARR[10] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6070) | X | 24586 (b:0010) | UINT | 2.0 | 67.0 | Input | 0 | MAINInput_CR800_REG_ARR[11] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6071) | X | 24587 (b:0011) | UINT | 2.0 | 69.0 | Input | 0 | MAINInput_CR800_REG_ARR[12] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6072) | X | 24588 (b:0012) | UINT | 2.0 | 71.0 | Input | 0 | MAINInput_CR800_REG_ARR[13] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6073) | X | 24589 (b:0013) | UINT | 2.0 | 73.0 | Input | 0 | MAINInput_CR800_REG_ARR[14] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6074) | X | 24590 (b:0014) | UINT | 2.0 | 75.0 | Input | 0 | MAINInput_CR800_REG_ARR[15] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6075) | X | 24591 (b:0015) | UINT | 2.0 | 77.0 | Input | 0 | MAINInput_CR800_REG_ARR[16] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6076) | X | 24592 (b:0016) | UINT | 2.0 | 79.0 | Input | 0 | MAINInput_CR800_REG_ARR[17] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6077) | X | 24593 (b:0017) | UINT | 2.0 | 81.0 | Input | 0 | MAINInput_CR800_REG_ARR[18] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6078) | X | 24594 (b:0018) | UINT | 2.0 | 83.0 | Input | 0 | MAINInput_CR800_REG_ARR[19] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6079) | X | 24601 (b:0019) | UINT | 2.0 | 85.0 | Input | 0 | MAINInput_CR800_REG_ARR[20] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6080) | X | 24608 (b:0020) | UINT | 2.0 | 87.0 | Input | 0 | MAINInput_CR800_REG_ARR[21] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6081) | X | 24609 (b:0021) | UINT | 2.0 | 89.0 | Input | 0 | MAINInput_CR800_REG_ARR[22] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6082) | X | 24610 (b:0022) | UINT | 2.0 | 91.0 | Input | 0 | MAINInput_CR800_REG_ARR[23] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6083) | X | 24611 (b:0023) | UINT | 2.0 | 93.0 | Input | 0 | MAINInput_CR800_REG_ARR[24] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6084) | X | 24612 (b:0024) | UINT | 2.0 | 95.0 | Input | 0 | MAINInput_CR800_REG_ARR[25] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6085) | X | 24613 (b:0025) | UINT | 2.0 | 97.0 | Input | 0 | MAINInput_CR800_REG_ARR[26] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6086) | X | 24614 (b:0026) | UINT | 2.0 | 99.0 | Input | 0 | MAINInput_CR800_REG_ARR[27] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6087) | X | 24615 (b:0027) | UINT | 2.0 | 101.0 | Input | 0 | MAINInput_CR800_REG_ARR[28] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6088) | X | 24616 (b:0028) | UINT | 2.0 | 103.0 | Input | 0 | MAINInput_CR800_REG_ARR[29] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6089) | X | 24617 (b:0029) | UINT | 2.0 | 105.0 | Input | 0 | MAINInput_CR800_REG_ARR[30] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6090) | X | 24624 (b:0030) | UINT | 2.0 | 107.0 | Input | 0 | MAINInput_CR800_REG_ARR[31] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |
| Rxw(6091) | X | 24625 (b:0031) | UINT | 2.0 | 109.0 | Input | 0 | MAINInput_CR800_REG_ARR[32] MAINInput_CR800_REG_ARR_PicTask Inputs SAMPLE Instance SAMPLE |

To confirm the input (RY, RWw) to the CR800-D (output value from the PLC), double-click "Rx PDO" to display the following screen.

| Name | Online | Type | Size | >Addr. | In/Out | User I. | Linked to | |
|---------------|--------|----------------|-------|--------|--------|---------|-----------|--|
| Ry(6000-6007) | X | 170 (b:aa) | USINT | 1.0 | 39.0 | Output | 0 | MAINOutput_CR800_JO_ARR[1] MAINOutput_CR800_JO_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ry(6008-6015) | X | 85 (b:55) | USINT | 1.0 | 40.0 | Output | 0 | MAINOutput_CR800_JO_ARR[2] MAINOutput_CR800_JO_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ry(6016-6023) | X | 85 (b:55) | USINT | 1.0 | 41.0 | Output | 0 | MAINOutput_CR800_JO_ARR[3] MAINOutput_CR800_JO_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ry(6024-6031) | X | 170 (b:aa) | USINT | 1.0 | 42.0 | Output | 0 | MAINOutput_CR800_JO_ARR[4] MAINOutput_CR800_JO_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ry(6032-6039) | X | 170 (b:aa) | USINT | 1.0 | 43.0 | Output | 0 | MAINOutput_CR800_JO_ARR[5] MAINOutput_CR800_JO_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ry(6040-6047) | X | 85 (b:55) | USINT | 1.0 | 44.0 | Output | 0 | MAINOutput_CR800_JO_ARR[6] MAINOutput_CR800_JO_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ry(6048-6055) | X | 85 (b:55) | USINT | 1.0 | 45.0 | Output | 0 | MAINOutput_CR800_JO_ARR[7] MAINOutput_CR800_JO_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ry(6056-6063) | X | 170 (b:aa) | USINT | 1.0 | 46.0 | Output | 0 | MAINOutput_CR800_JO_ARR[8] MAINOutput_CR800_JO_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6060) | X | 24576 (b:0000) | UINT | 2.0 | 47.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[1] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6061) | X | 24577 (b:0001) | UINT | 2.0 | 49.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[2] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6062) | X | 24578 (b:0002) | UINT | 2.0 | 51.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[3] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6063) | X | 24579 (b:0003) | UINT | 2.0 | 53.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[4] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6064) | X | 24580 (b:0004) | UINT | 2.0 | 55.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[5] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6065) | X | 24581 (b:0005) | UINT | 2.0 | 57.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[6] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6066) | X | 24582 (b:0006) | UINT | 2.0 | 59.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[7] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6067) | X | 24583 (b:0007) | UINT | 2.0 | 61.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[8] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6068) | X | 24584 (b:0008) | UINT | 2.0 | 63.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[9] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6069) | X | 24585 (b:0009) | UINT | 2.0 | 65.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[10] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6070) | X | 24586 (b:0010) | UINT | 2.0 | 67.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[11] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6071) | X | 24587 (b:0011) | UINT | 2.0 | 69.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[12] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6072) | X | 24588 (b:0012) | UINT | 2.0 | 71.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[13] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6073) | X | 24589 (b:0013) | UINT | 2.0 | 73.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[14] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6074) | X | 24590 (b:0014) | UINT | 2.0 | 75.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[15] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6075) | X | 24591 (b:0015) | UINT | 2.0 | 77.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[16] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6076) | X | 24592 (b:0016) | UINT | 2.0 | 79.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[17] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6077) | X | 24593 (b:0017) | UINT | 2.0 | 81.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[18] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6078) | X | 24600 (b:0018) | UINT | 2.0 | 83.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[19] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6079) | X | 24601 (b:0019) | UINT | 2.0 | 85.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[20] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6080) | X | 24608 (b:0020) | UINT | 2.0 | 87.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[21] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6081) | X | 24609 (b:0021) | UINT | 2.0 | 89.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[22] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6082) | X | 24610 (b:0022) | UINT | 2.0 | 91.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[23] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6083) | X | 24611 (b:0023) | UINT | 2.0 | 93.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[24] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6084) | X | 24612 (b:0024) | UINT | 2.0 | 95.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[25] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6085) | X | 24613 (b:0025) | UINT | 2.0 | 97.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[26] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6086) | X | 24614 (b:0026) | UINT | 2.0 | 99.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[27] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6087) | X | 24615 (b:0027) | UINT | 2.0 | 101.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[28] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6088) | X | 24616 (b:0028) | UINT | 2.0 | 103.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[29] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6089) | X | 24617 (b:0029) | UINT | 2.0 | 105.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[30] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6090) | X | 24624 (b:0030) | UINT | 2.0 | 107.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[31] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |
| Ryw(6091) | X | 24625 (b:0031) | UINT | 2.0 | 109.0 | Output | 0 | MAINOutput_CR800_Reg_ARR[32] MAINOutput_CR800_Reg_ARR PicTask Outputs SAMPLE Instance SAMPLE |

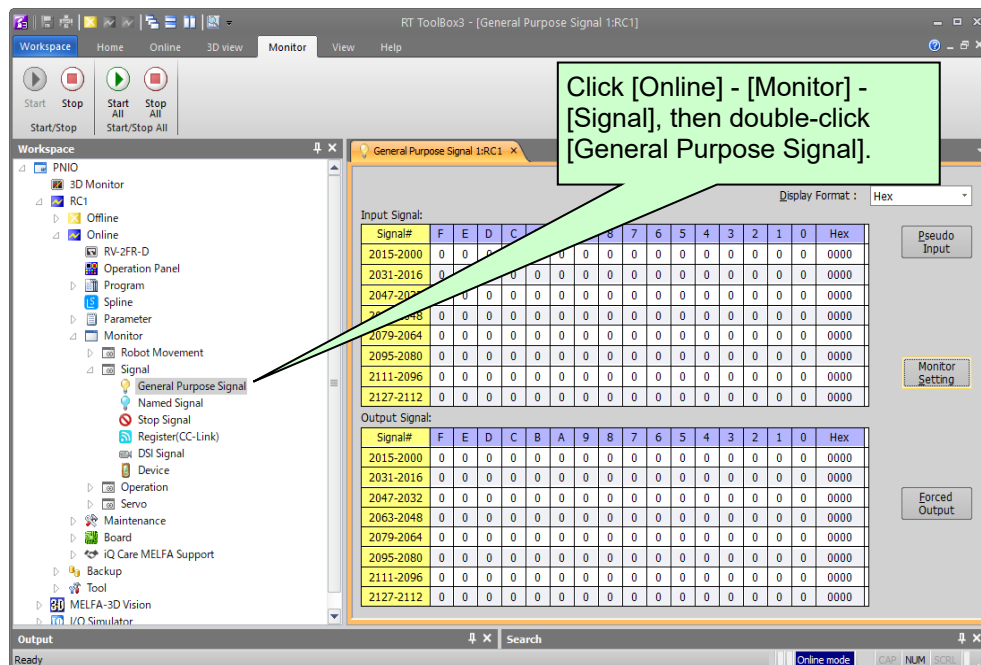
Confirm that the output from the robot is looped back in the PLC side and input to the robot.

12.2.4. For the EtherNet/IP

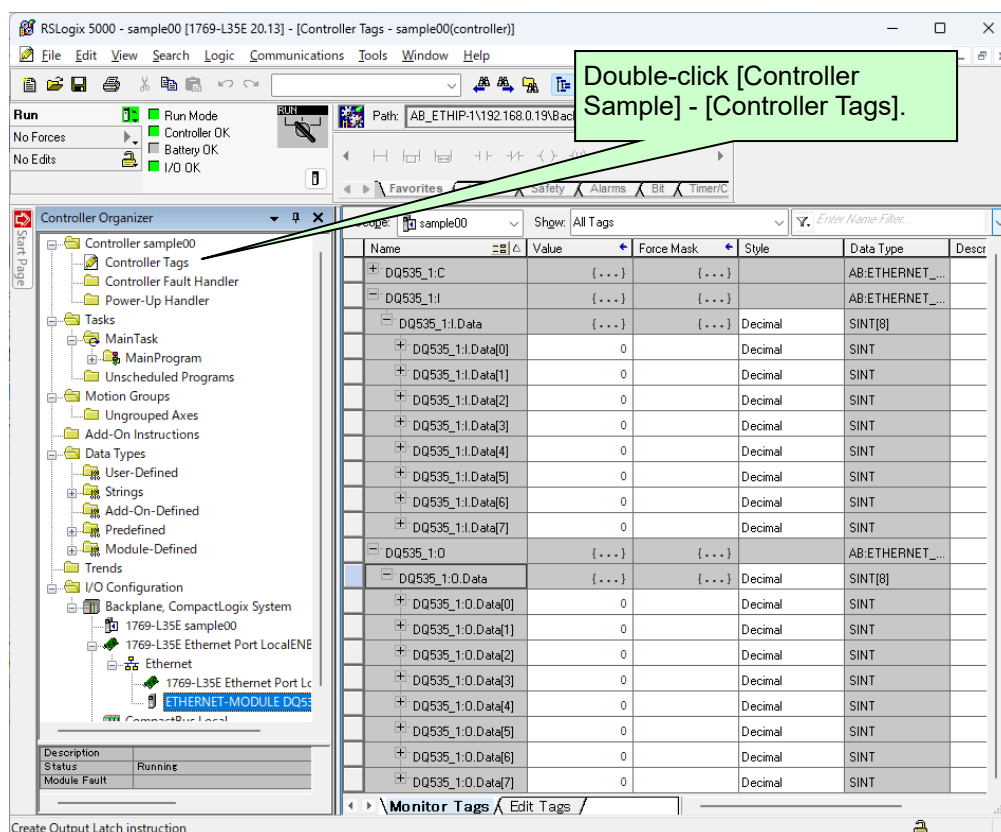
EtherNet/IP

Use the [Controller Tags] windows in RT ToolBox3 and RSLogix5000 to check the communications of the I/O signals.

- (1) Start the General-purpose signal monitor in RT ToolBox3.



- (2) Start the [Controller Tags] window in RSLogix5000.



- (3) In the General-purpose signal monitor in RT ToolBox3, click the [Forced Output] button to test the relevant outputs.

2) Check the relevant signals then click the [Bit Forced OUTPUT] button.

3) Check that the robot output is input to the master PLC.

1) Click the [Forced Output] button.

| Signal# | F | E | D | C | B | A | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Hex |
|-----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|------|
| 2015-2000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 2031-2016 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 2047-2032 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 2063-2048 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 2079-2064 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 2095-2080 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 2111-2096 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 2127-2112 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |

- (4) Output the relevant signals from the [Controller Tags] window in RSLogix5000, then check the inputs on the General-purpose signal monitor in RT ToolBox3.

1) Enter relevant data in DQ535_1: 0.

2) Check that the robot input is the specified data from the master PLC.

| Signal# | F | E | D | C | B | A | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Hex |
|-----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|------|
| 2015-2000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 2031-2016 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 2047-2032 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 2063-2048 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 2079-2064 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |
| 2095-2080 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 |

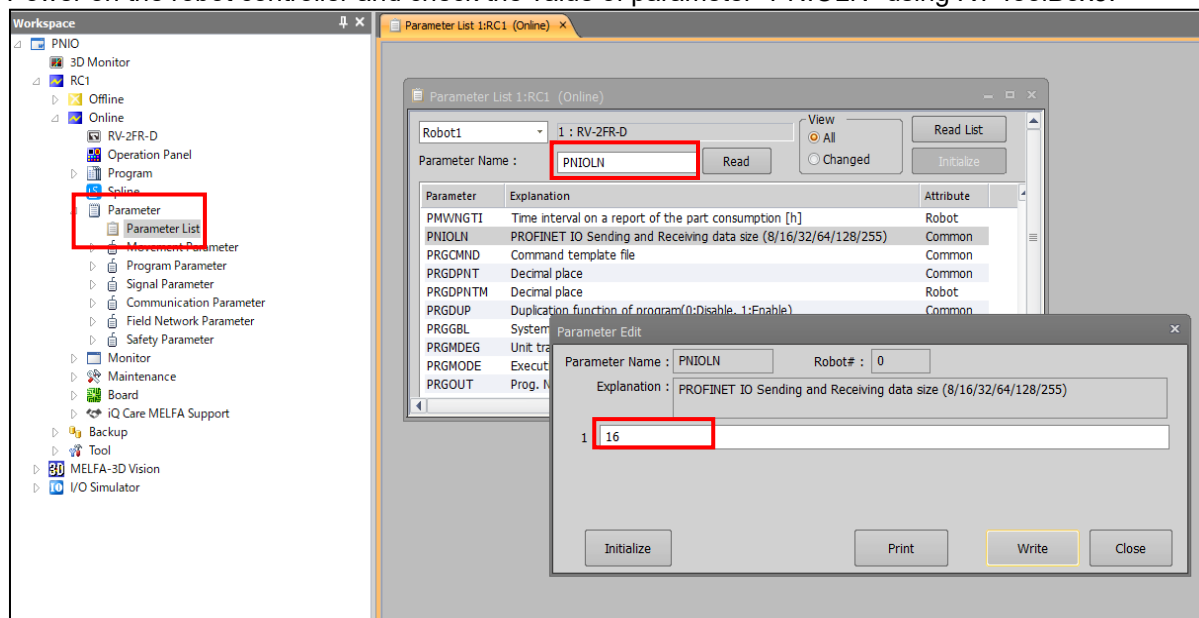
12.2.5. For the PROFINET IO

PROFINET IO

Use the [Force table] windows in RT ToolBox3 and STEP7 to check the communications of the I/O signals.

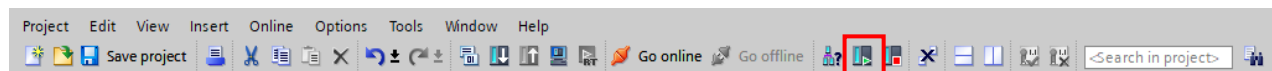
For more information on Siemens PLCs, refer to the manual included with the PLC.

- (1) Power on the robot controller and check the value of parameter "PNIOLN" using RT ToolBox3.

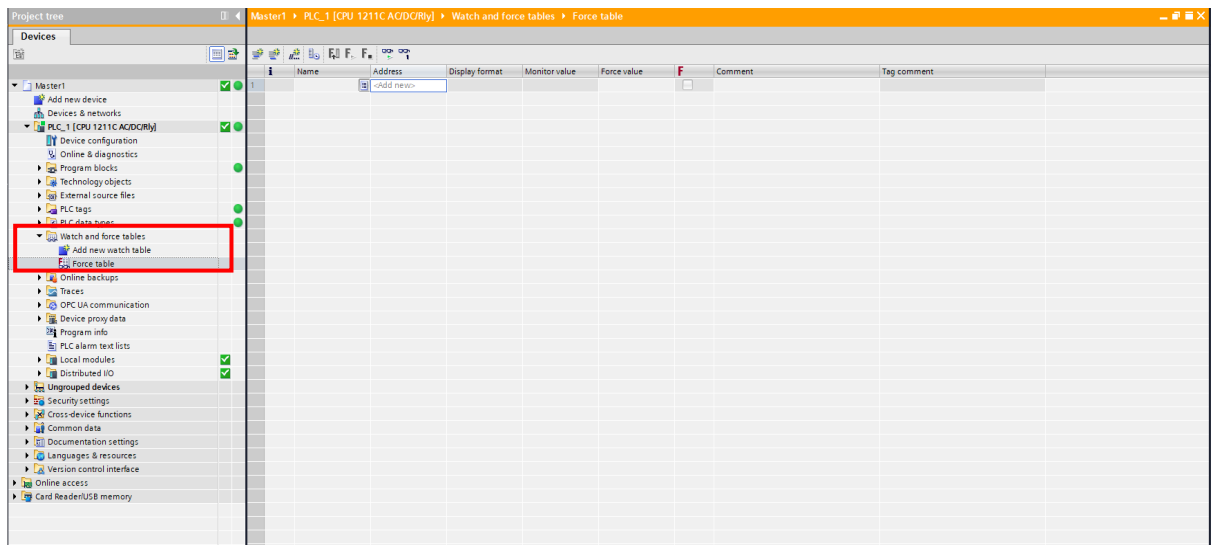


- (2) Click the [CPU Start] button at the top of the screen in STEP7. Check that the CPU status is RUN and that the ERROR and MAINT LEDs are off.

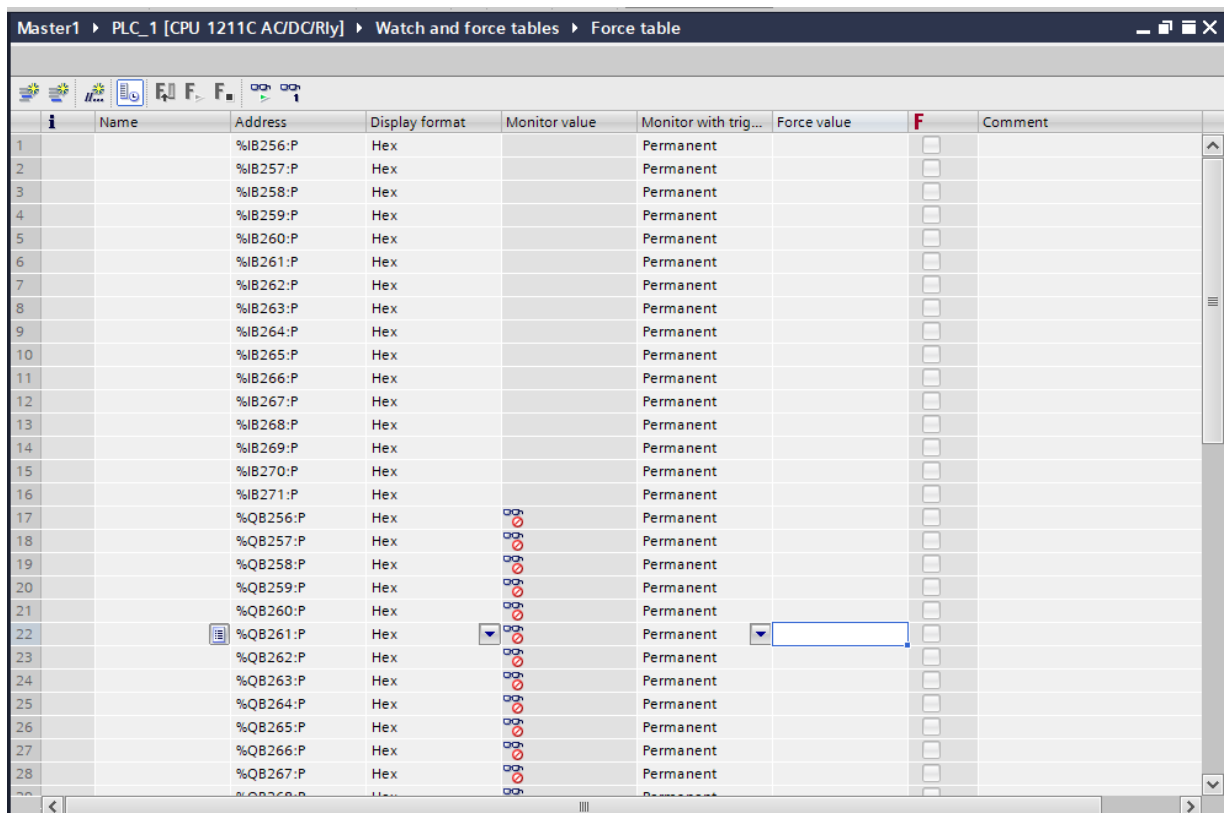
* If the LEDs are red, there is an error. Clear the error according to error code.



- (3) In the [Project tree] on the left side of the screen, click [PLC_1] - [Watch and force tables], then double-click [Force table].



- (4) Set the address for the peripheral I/O.
 * If the message "Peripheral inputs can only be monitored in extended mode." appears, right-click on the Force table window then click [Extended mode].



- (5) Output the relevant signals using the Forced output function in RT ToolBox3.

General Purpose Signal 1:RC1

Display Format : Hex

Input Signal:

| Signal# | F | E | D | C | B | A | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Hex |
|-----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|------|------|
| 2015-2000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0012 |
| 2031-2016 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 | |

Output Signal:

| Signal# | F | E | D | C | B | A | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Hex |
|-----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|------|------|
| 2015-2000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0012 |
| 2031-2016 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0000 | |

Pseudo Input

Monitor Setting

Forced Output

- (6) In the [Force table] window in STEP7, click the [Monitor all] button to check the signal information output by the robot.

Master1 > PLC_1 [CPU 1211C AC/DC/Rly] > Watch and force tables > Force table

| | Name | Address | Display format | Monitor value | Monitor with trig... | Force value | F | Comment |
|----|------|----------|----------------|---------------|----------------------|-------------|--------------------------|---------|
| 1 | | %IB256:P | Hex | 16#12 | Permanent | | ☐ | |
| 2 | | %IB257:P | Hex | 16#00 | Permanent | | ☐ | |
| 3 | | %IB258:P | Hex | 16#00 | Permanent | | ☐ | |
| 4 | | %IB259:P | Hex | 16#00 | Permanent | | ☐ | |
| 5 | | %IB260:P | Hex | 16#00 | Permanent | | ☐ | |
| 6 | | %IB261:P | Hex | 16#00 | Permanent | | ☐ | |
| 7 | | %IB262:P | Hex | 16#00 | Permanent | | ☐ | |
| 8 | | %IB263:P | Hex | 16#00 | Permanent | | ☐ | |
| 9 | | %IB264:P | Hex | 16#00 | Permanent | | ☐ | |
| 10 | | %IB265:P | Hex | 16#00 | Permanent | | ☐ | |
| 11 | | %IB266:P | Hex | 16#00 | Permanent | | ☐ | |
| 12 | | %IB267:P | Hex | 16#00 | Permanent | | ☐ | |
| 13 | | %IB268:P | Hex | 16#00 | Permanent | | ☐ | |
| 14 | | %IB269:P | Hex | 16#00 | Permanent | | ☐ | |
| 15 | | %IB270:P | Hex | 16#00 | Permanent | | ☐ | |
| 16 | | %IB271:P | Hex | 16#00 | Permanent | | ☐ | |
| 17 | | %QB256:P | Hex | 0 | Permanent | | ☐ | |
| 18 | | %QB257:P | Hex | 0 | Permanent | | ☐ | |
| 19 | | %QB258:P | Hex | 0 | Permanent | | ☐ | |
| 20 | | %QB259:P | Hex | 0 | Permanent | | ☐ | |
| 21 | | %QB260:P | Hex | 0 | Permanent | | ☐ | |

PROFINET IO

- (7) When outputting signals from the PLC to the robot using STEP7, specify the "Force value" and select the check box, then click the [Force all] button.

Master1 > PLC_1 [CPU 1211C AC/DC/Rly] > Watch and force tables > Force table

| | Name | Address | Display format | Monitor value | Monitor with trig... | Force value | F | Comment |
|----|------|----------|----------------|---------------|----------------------|-------------|-------------------------------------|---------|
| 1 | | %IB256:P | Hex | 16#00 | Permanent | | ☐ | |
| 2 | | %IB257:P | Hex | 16#00 | Permanent | | ☐ | |
| 3 | | %IB258:P | Hex | 16#00 | Permanent | | ☐ | |
| 4 | | %IB259:P | Hex | 16#00 | Permanent | | ☐ | |
| 5 | | %IB260:P | Hex | 16#00 | Permanent | | ☐ | |
| 6 | | %IB261:P | Hex | 16#00 | Permanent | | ☐ | |
| 7 | | %IB262:P | Hex | 16#00 | Permanent | | ☐ | |
| 8 | | %IB263:P | Hex | 16#00 | Permanent | | ☐ | |
| 9 | | %IB264:P | Hex | 16#00 | Permanent | | ☐ | |
| 10 | | %IB265:P | Hex | 16#00 | Permanent | | ☐ | |
| 11 | | %IB266:P | Hex | 16#00 | Permanent | | ☐ | |
| 12 | | %IB267:P | Hex | 16#00 | Permanent | | ☐ | |
| 13 | | %IB268:P | Hex | 16#00 | Permanent | | ☐ | |
| 14 | | %IB269:P | Hex | 16#00 | Permanent | | ☐ | |
| 15 | | %IB270:P | Hex | 16#00 | Permanent | | ☐ | |
| 16 | | %IB271:P | Hex | 16#00 | Permanent | | ☐ | |
| 17 | | %QB256:P | Hex | | Permanent | 16#FF | ☒ | |
| 18 | | %QB257:P | Hex | | Permanent | | ☐ | |
| 19 | | %QB258:P | Hex | | Permanent | | ☐ | |
| 20 | | %QB259:P | Hex | | Permanent | | ☐ | |
| 21 | | %QB260:P | Hex | | Permanent | | ☐ | |

12.3. Execution of robot program

CC-Link IE TSN

CC-Link IE Field

EtherCAT

EtherNet/IP

PROFINET IO

12.3.1. Setting the dedicated input/output

Set the dedicated input/output as shown below. After changing the parameters, turn the power OFF and ON once.

Refer to the separate "Instruction Manual, Detailed Explanation of Functions and Operations" for details on the settings.

Table 12-2 Setting the dedicated input/output (CC-Link IE TSN / CC-Link IE Field / EtherCAT)

| Parameter name | Input | | Output | |
|----------------|-------------------------|------|---------------------------|------|
| | Meaning | No. | Meaning | No. |
| IOENA | Operation rights enable | 6000 | Operation rights enabled | 6000 |
| START | Program start | 6001 | Program starting | 6001 |
| STOP2 | Stop | 6002 | Stopping | 6002 |
| SLOTINIT | Program reset | 6003 | Program selection enabled | 6003 |
| SRVON | Servo power ON | 6004 | Servo ON | 6004 |
| SRVOFF | Servo power OFF | 6005 | | |

Table 12-3 Setting the dedicated input/output (EtherNet/IP / PROFINET IO)

| Parameter name | Input | | Output | |
|----------------|-------------------------|------|---------------------------|------|
| | Meaning | No. | Meaning | No. |
| IOENA | Operation rights enable | 2000 | Operation rights enabled | 2000 |
| START | Program start | 2001 | Program starting | 2001 |
| STOP2 | Stop | 2002 | Stopping | 2002 |
| SLOTINIT | Program reset | 2003 | Program selection enabled | 2003 |
| SRVON | Servo power ON | 2004 | Servo ON | 2004 |
| SRVOFF | Servo power OFF | 2005 | | |

12.3.2. General-purpose input/outputss

(1) CC-Link IE TSN / CC-Link IE Field / EtherCAT

The general-purpose inputs and outputs can be accessed with the I/O system variables such as M_In and M_Out.

Note that when accessing multiple bits with a variable such as M_Inb, M_Inw, M_Outb or M_Outw, the access cannot extend over an area used by CC-Link IE Field, such as the number 5999. Always create the program to fit within the area between 6000 and 8047.

Correct example: M_In(6000), M_Inb(6010), M_Out(7000), M_Outb(7010), etc.

Incorrect example: M_Inb(5999), M_Inw(9070), M_Outb(5999), M_Outw(5999), etc.

(2) EtherNet/IP / PROFINET IO

The general-purpose inputs and outputs can be accessed with the I/O system variables such as M_In and M_Out.

Note that when accessing multiple bits with a variable such as M_Inb, M_Inw, M_Outb or M_Outw, the access cannot extend over an area used by CC-Link IE Field, such as the number 1999. Always create the program to fit within the area between 2000 and 4047.

Correct example: M_In(2000), M_Inb(2010), M_Out(3000), M_Outb(3010), etc.

Incorrect example: M_Inb(1999), M_Inw(5070), M_Outb(1999), M_Outw(1999), etc.

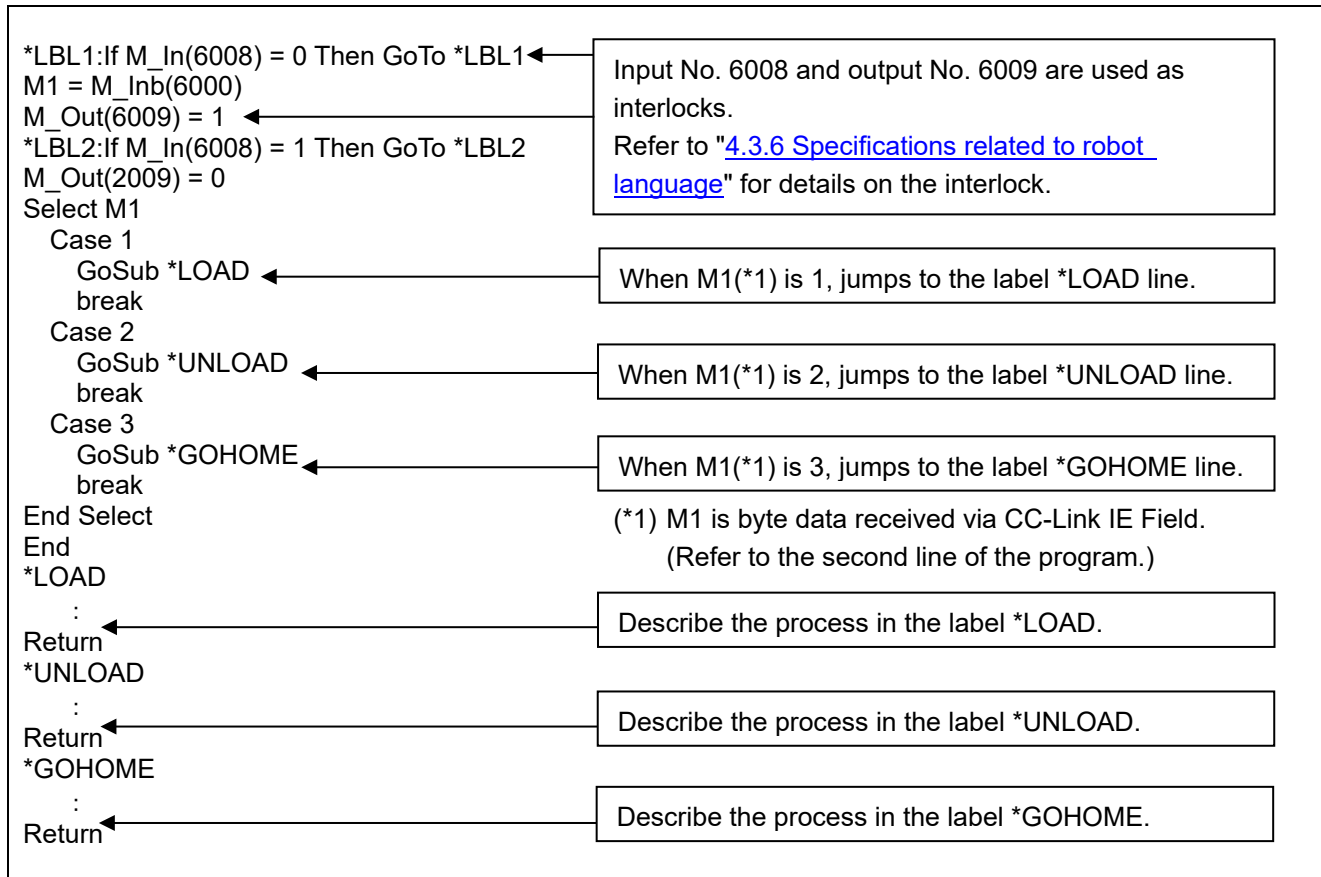
12.3.3. Example of robot program creation (using general-purpose input/output)

CC-Link IE TSN

CC-Link IE Field

EtherCAT

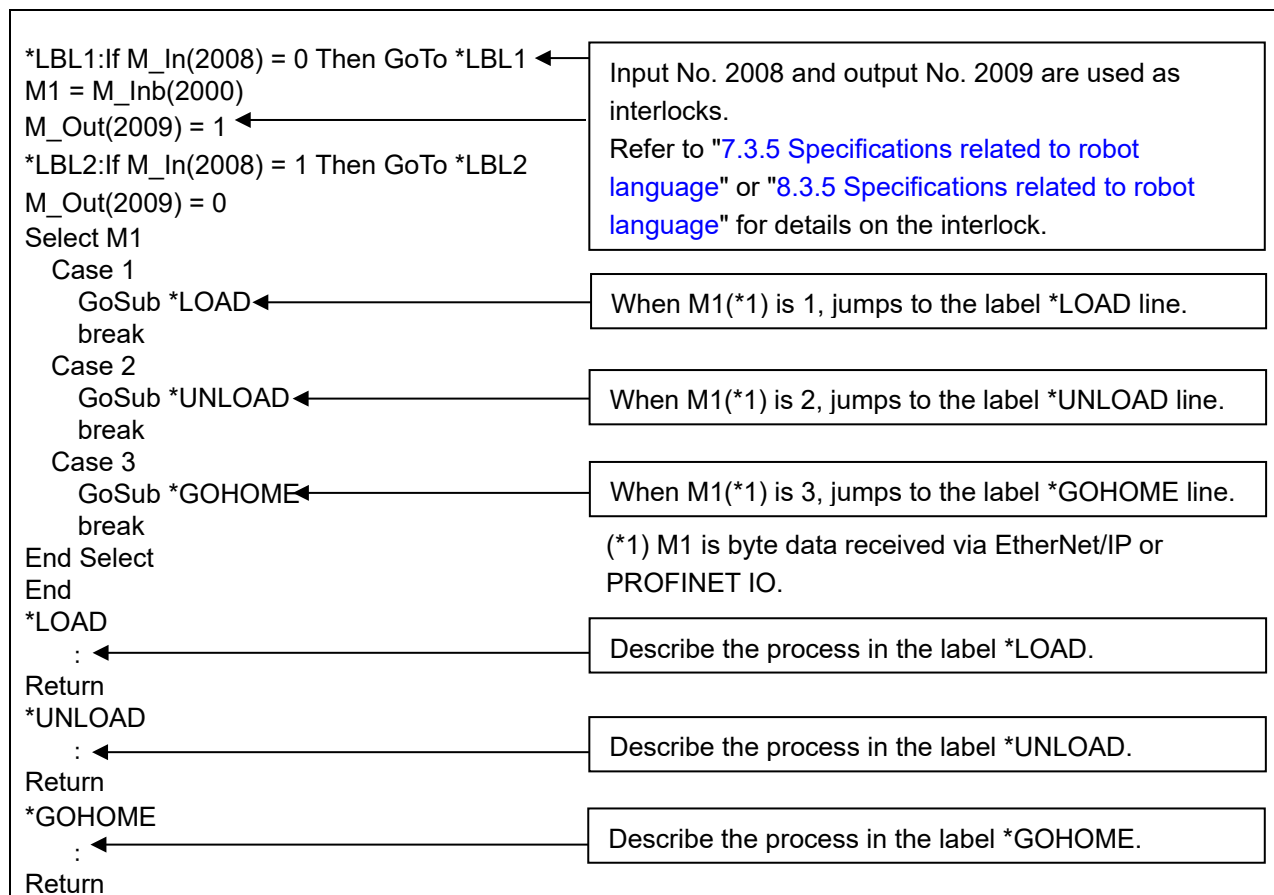
(1) For CC-Link IE TSN / CC-Link IE Field / EtherCAT



(2) For EtherNet/IP / PROFINET IO

EtherNet/IP

PROFINET IO



12.3.4. Sample program for input/output confirmation

CC-Link IE TSN

CC-Link IE Field

EtherCAT

CC-Link IE TSN / CC-Link IE Field / EtherCAT

A sample program for checking the 2F-DQ535-TSN, 2F-DQ535, or 2F-DQ535-EC card input/output is shown below.

Use this as necessary for startup adjustment, etc.

Table 12-4 Signal assignment conditions

| | |
|--|---------------------------------|
| Robot side input (master station output) | Input 6000 to 8047 (256 bytes) |
| Robot side output (master station input) | Output 6000 to 8047 (256 bytes) |

Robot program specifications

Copy all input bits to the output bits.

```
[Program example 1]
'Loop the input signal to the robot back to the output signal. (For bit checking)
For M1 = 6000 To 8047
  M_Out(M1) = M_In(M1) 'Copy with bit variable
Next M1
End

[Program example 2]
'Loop the input signal to the robot back to the output signal. (For byte checking)
For M1 = 6000 To 8040 Step 8
  M_Outb(M1) = M_Inb(M1) 'Copy with byte variable
Next M1
End

[Program example 3]
'Loop the input signal to the robot back to the output signal. (For word checking)
For M1 = 6000 To 8032 Step 16
  M_Outw(M1) = M_Inw(M1) 'Copy with word variable
Next M1
End
```

Execute this program and check the signals looped back to the master station side.

For EtherNet/IP / PROFINET IO

EtherNet/IP**PROFINET IO**

A sample program for confirming the 2F-DQ535-EIP or 2F-DQ535-PN card input/output is shown below.
Use this as necessary for startup adjustment, etc.

Table 12-5 Signal assignment conditions (For EtherNet/IP)

| | |
|--|---------------------------------|
| Robot side input (master station output) | Input 2000 to 4047 (256 bytes) |
| Robot side output (master station input) | Output 2000 to 4047 (256 bytes) |

Table 12-6 Signal assignment conditions (For PROFINET IO)

| | |
|--|---------------------------------|
| Robot side input (master station output) | Input 2000 to 4039 (255 bytes) |
| Robot side output (master station input) | Output 2000 to 4039 (255 bytes) |

Robot program specifications

Copy all input bits to the output bits.

[Program example 1]

'Loop the input signal to the robot back to the output signal. (For bit checking)

For M1 = 2000 To 4039

 M_Out(M1) = M_In(M1) 'Copy with bit variable

Next M1

End

[Program example 2]

'Loop the input signal to the robot back to the output signal. (For byte checking)

For M1 = 2000 To 4039 Step 8

 M_Outb(M1) = M_Inb(M1) 'Copy with byte variable

Next M1

End

[Program example 3]

'Loop the input signal to the robot back to the output signal. (For word checking)

For M1 = 2000 To 4032 Step 16

 M_Outw(M1) = M_Inw(M1) 'Copy with word variable

Next M1

End

Execute this program and check the signals looped back to the master station side.

13. TROUBLESHOOTING

Please read this chapter first if you suspect that some failure has occurred.

CC-Link IE TSN

CC-Link IE Field

EtherCAT

EtherNet/IP

PROFINET IO

13.1. List of Errors

◆◆◆ The meanings of the error numbers are shown below. ◆◆◆

□ 0000 *

- An error marked with an asterisk (*) requires power resetting. Perform the actions indicated in the countermeasures.
- The error type is shown with a 4-digit number.
- The errors are categorized into three types.
 - H: High-level error Servo-OFF is performed.
 - L: Low-level error Operation stops.
 - C: Warning Operation continues.

Table 13-1 List of errors related to the network base card

| Error No. | Error cause and measures | |
|-----------|--------------------------|---|
| H.6100 | Error message | Module is not mounted. |
| | Cause | A module board by HMS must be mounted in the network base card.
A module board is not mounted in the network base card. |
| | Measures | Mount a module suitable for the network base card. |
| H.6101 | Error message | Unsupported module mounted error |
| | Cause | An unsupported HMS module board is mounted in the network base card. |
| | Measures | Replace the module. |
| H.6110 | Error message | Multiple network base cards are mounted. |
| | Cause | Only one network base card can be mounted.
Two or more are currently mounted in the option slot. |
| | Measures | Mount only one network base card. |
| H.6111 | Error message | Another fieldbus card is mounted. |
| | Cause | Only one fieldbus card can be mounted.
A CC-Link card, PROFIBUS card or DeviceNet card is mounted. |
| | Measures | Mount only one fieldbus card. |
| H.6120 | Error message | Network base card error n.
(n is a number between 1 and 4.) |
| | Cause | A network base card error has been detected.
n=1: A watch dog timeout has occurred with the communication module.
n=2: An unsupported object, instance or command has been issued.
n=3: The received form is incorrect.
n=4: The I/O offset amount is incorrect.
n=5: IP address is incorrect.
n=6: Subnet mask IP address is incorrect.
n=7: Gateway IP address is incorrect. |
| | Measures | Replace the network base card.
Contact the manufacturer when replacing the card. |

CC-Link IE TSN

CC-Link IE Field

EtherCAT

EtherNet/IP

PROFINET IO

| Error No. | Error cause and measures | |
|-----------|--------------------------|---|
| L.6130 | Error message | Network communication error n.
(n is a number between 1 and 2.) |
| | Cause | Line error or invalid parameter.
This can occur if communication is not established when: (1) The robot program is started, (2) Continuous operation is attempted with direct execution from the RT ToolBox3, or (3) An execution program is started while an error is occurring.
n=1: Ethernet cable is disconnected.
n=2: IP address is not established. |
| | Measures | Check the cable and parameters. |
| H.6140 | Error message | Parameter error (parameter name) |
| | Cause | The parameter setting is invalid.
The parameter value is not within range, or the data is invalid and cannot be read. |
| | Measures | Check the parameter setting value. |
| L.6190 | Error message | Network error occurrence (error code) |
| | Cause | A network error has occurred.
(Error code) indicates an error code which occurs between the Anybus-CC Module. |
| | Measures | Check the details of the network error. |

14. APPENDIX

CC-Link IE TSN

CC-Link IE Field

EtherCAT

EtherNet/IP

PROFINET IO

14.1. Displaying the Option Card

Information

The option card information can be displayed with the RT ToolBox3 (option).
In the online state, click "Online" in the work space tree, and click "Slot n (n=1 to 3): Network Base" under "Board". The 2F-DQ535-TSN, 2F-DQ535, 2F-DQ535-EC, 2F-DQ535-EIP, or 2F-DQ535-PN card information will be read into the properties window.

*** The option card information in the properties window is not updated automatically. To update the information, go offline and then online and repeat the above steps.**

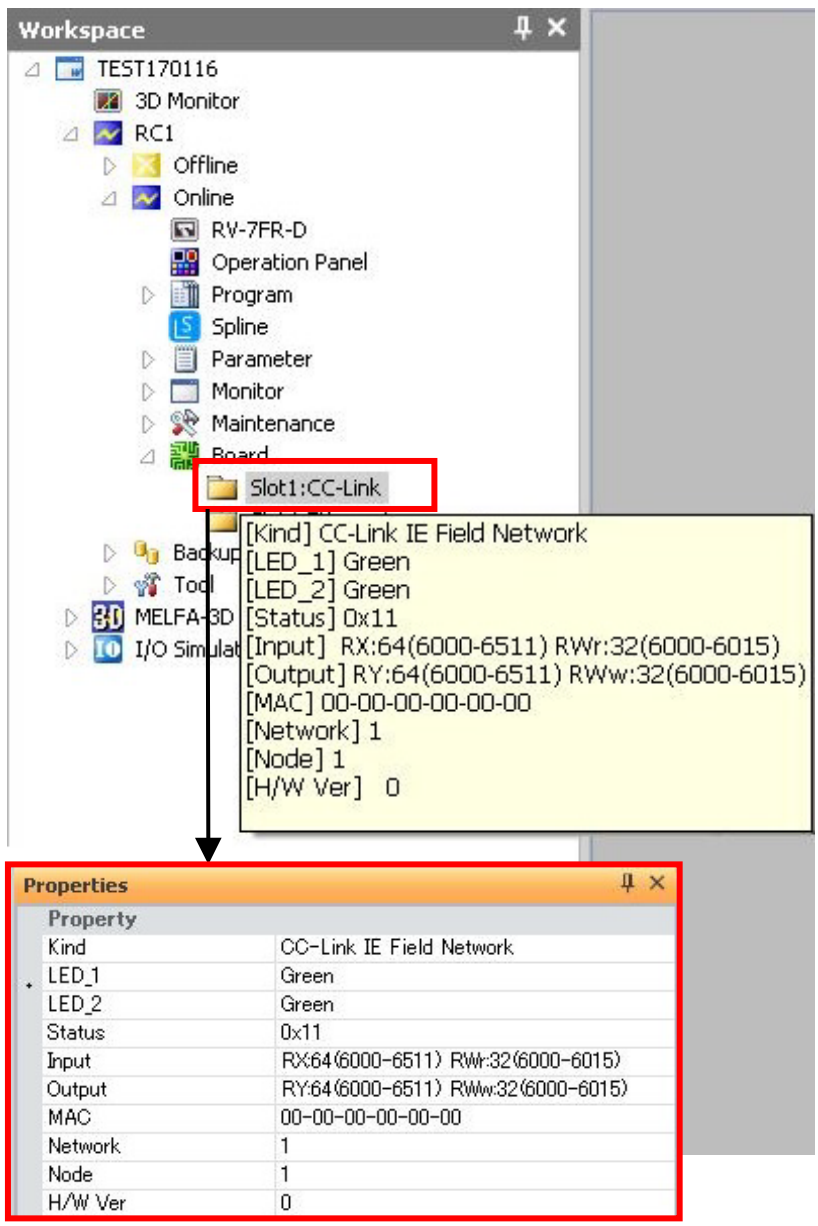


Figure 14-1 Example of option card information display on RT ToolBox3 (CC-LINK IE Field)

The following items are displayed according to the network type.

For the CC-Link IE TSN module

CC-Link IE TSN

Table 14-1 2F-DQ535-TSN card information(For CC-Link IE TSN module)

| Display item | | Display example | Meaning | Remarks |
|------------------|-----------|---|---|--|
| Card name | | CC-Link | Card name | |
| Card information | [Kind] | CC-Link IE TSN | Name of Anybus-CC module on network base card | |
| | [LED_1] | Green | DLINK LED Status | OFF: Initialization in progress or abnormality
Green: Initialization complete
Red: Abnormality (unrecoverable state) |
| | [LED_2] | Red | Error LED Status | OFF: Normal
Red: Abnormality |
| | [Input] | RX: 16 (6000 - 6127)
RW: 128 (6000 - 6063) | Number of received bytes (signal number) | |
| | [Output] | RY: 16 (6000 - 6127)
RW: 128 (6000 - 6063) | Number of send bytes (signal number) | |
| | [IP] | 192.168.3.1 | IP Address | TSNIP setting value |
| | [Subnet] | 255.255.255.0 | Subnet mask | TSNMSK setting value |
| | [Gateway] | 192.168.3.254 | Default gateway | TSNGW setting value |

For the CC-Link IE Field module

CC-Link IE Field**Table 14-2 2F-DQ535 card information(For CC-Link IE Field module)**

| Display item | | Display example | Meaning | Remarks |
|------------------|-----------|--|---|---|
| Card name | | CC-Link | Card name | |
| Card information | [Kind] | CC-Link IE Field | Name of Anybus-CC module on network base card | |
| | [LED_1] | Green | Module Status LED status | Green: Initialization complete
Red: Initialization error (failure) |
| | [LED_2] | Green | Network Status LED status | Green: In normal communication
Red: Abnormality (disconnected cable, etc.) |
| | [Status] | 0x09 or 0x11 or 0x19 | Network status | bit 0: Linked
bit 3: Linked with port 1
bit 4: Linked with port 2 |
| | [Input] | RX: 16 (6000 - 6127)
RWw: 128 (6000 - 6063) | Number of received bytes (signal number) | |
| | [Output] | RY: 16 (6000 - 6127)
RWw: 128 (6000 - 6063) | Number of send bytes (signal number) | |
| | [Network] | 1 | Network number | Setting value of CFNNWNO |
| | [Node] | 1 | Station number | Setting value of CFNNDID |

For the EtherCAT module

EtherCAT

Table 14-3 2F-DQ535-EC card information (For EtherCAT module)

| Display item | | Display example | Meaning | Remarks |
|------------------|-------------|---------------------------------------|---|--|
| Card name | | EtherCAT | Card name | |
| Card information | [Kind] | EtherCAT | Name of Anybus-CC module on network base card | |
| | [LED_1] | Green | RUN LED status | Off / Green |
| | [LED_2] | Red | ERROR LED status | Off / Red |
| | [Input] | RX:64(6000-6063)
RWr:32(6000-6031) | Remote input / Remote register | Determined by the value of parameter [ECTOCS].
ECTOCS=1
RX:64(6000-6063)
RWr:32(6000-6031)
ECTOCS=2
RX:128(6000-6127)
RWr:64(6000-6063)
ECTOCS=3
RX:192(6000-6191)
RWr:96(6000-6095)
ECTOCS=4
RX:256(6000-6255)
RWr:128(6000-6127) |
| | [Output] | RY:64(6000-6063)
RWw:32(6000-6031) | Remote output / Remote register | Determined by the value of parameter [ECTOCS].
ECTOCS=1
RY:64(6000-6063)
RWw:32(6000-6031)
ECTOCS=2
RY:128(6000-6127)
RWw:64(6000-6063)
ECTOCS=3
RY:192(6000-6191)
RWw:96(6000-6095)
ECTOCS=4
RY:256(6000-6255)
RWw:128(6000-6127) |
| | [ESM State] | Init | Status of the EtherCAT slave represented as character strings | Init / Boot / PreOp / SafeOp / Op |

For the EtherNet/IP module

EtherNet/IP

Table 14-4 2F-DQ535-EIP card information (For EtherNet/IP module)

| Display item | | Display example | Meaning | Remarks |
|------------------|-----------|---|---|--|
| Card name | | Network Base(DQ535) | Card name | |
| Card information | [Kind] | EtherNet/IP(TM) | Name of Anybus-CC module on network base card | |
| | [LED_1] | Green | Module Status LED status | |
| | [LED_2] | Green | Network Status LED status | |
| | [Status] | 0x3 or 0xb or 0x13 or 0x1b | Network status | bit 0: Linked
bit 1: IP address established
bit 3: port 1
bit 4: port 2 |
| | [Input] | RX: 16 (6000 - 6127)
RW: 128 (6000 - 6063) | Number of received bytes (signal number) | 1 (-) to 256 (2000 to 4047) |
| | [Output] | RY: 16 (6000 - 6127)
RW: 128 (6000 - 6063) | Number of send bytes (signal number) | 1 (-) to 256 (2000 to 4047) |
| | [MAC] | **_**_*_*_*_*_*_*_*_* | MAC address | |
| | [IP] | ***.*.*.*.* | IP Address | Parameter [EPIP] |
| | [Subnet] | ***.*.*.*.* | Subnet mask | Parameter [EPMSK] |
| | [Gateway] | ***.*.*.*.* | Default gateway | Parameter [EPGW] |

For the PROFINET IO module

PROFINET IO

Table 14-5 2F-DQ535-PN card information (For PROFINET IO module)

| Display item | | Display example | Meaning | Remarks |
|------------------|-----------|----------------------------|---|--|
| Card name | | Network Base(DQ535) | Card name | |
| Card information | [Kind] | PROFINET IRT | Name of Anybus-CC module on network base card | |
| | [LED_1] | Green | Module Status LED status | |
| | [LED_2] | Green | Network Status LED status | |
| | [Status] | 0x3 or 0xb or 0x13 or 0x1b | Network status | bit 0: Linked
bit 1: IP address established
bit 3: Linked with port 1
bit 4: Linked with port 2 |
| | [Input] | 16(2000 - 2127) | Number of received bytes (signal number) | 8/16/32/64/128/255 (2000 to 4039) |
| | [Output] | 16(2000 - 2127) | Number of send bytes (signal number) | 8/16/32/64/128/255 (2000 to 4039) |
| | [MAC] | **_**_*_*_*_*_*_*_*_* | MAC address | |
| | [IP] | ***.*.*.*.* | IP Address | Address set from PLC |
| | [Subnet] | ***.*.*.*.* | Subnet mask | Address set from PLC |
| | [Gateway] | ***.*.*.*.* | Default gateway | Address set from PLC |

14.2. Pseudo-input Function



The pseudo-input function for the network base card allows the pseudo input signals from RT ToolBox3. Usable cases and usage methods are explained below.

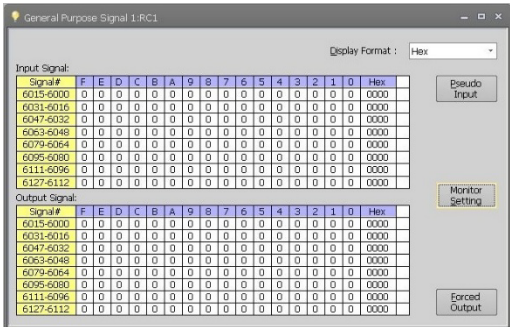
| No. | Network base card status (2F-DQ535-TSN/2F-DQ535/2F-DQ535-EC/2F-DQ535-EIP/2F-DQ535-PN) | Condition | Usability |
|-----|---|--|-----------|
| 1 | Not mounted | - | × |
| 2 | Mounted | Network cable not connected | ● |
| 3 | | Network cable connected, but a communication error occurring | ● |
| 4 | | In normal communication | ● |

● indicates usable, and × indicates not usable.

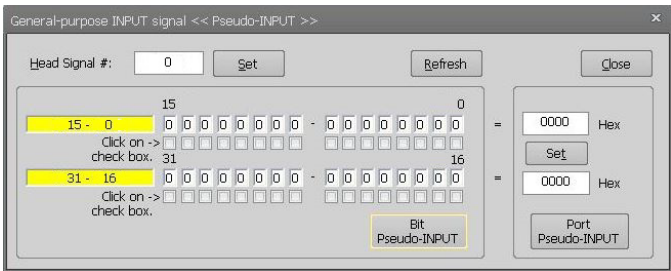
* A pseudo-input is not possible while an error is occurring.

<Usage method>

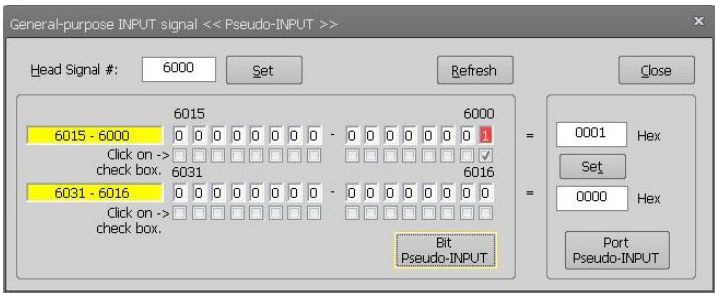
- Start RT ToolBox3.
- Click [Online] - [Monitor] - [Signal Monitor] - [General Signals] in the work space tree, and start the general-purpose signal monitor.



- Click the [Pseudo-input] button.



- Input the signal number (6000 or higher) in the "Head signal #" field and click the [Set] button.
- Select the check box for the signal to be input, and click the [Bit pseudo INPUT] button.



14.3. Replacing network base cards

This section contains information on replacing network base cards.

14.3.1. Replacing the 2D-TZ535 card with the 2F-DQ535-EIP

The EtherNet/IP logo is a blue rectangular box with the text "EtherNet/IP" in white, bold, sans-serif font.

card

Due to differences between the profiles (EDS files) of the 2D-TZ535 card and 2F-DQ535-EIP card, the following action must be performed using the EDS Hardware Installation Tool before replacement.

- Add a profile for the 2F-DQ535-EIP card.

The project file created for the 2D-TZ535 card using RSLogix5000 and RT ToolBox3 will run if it is added without modification as stated above. However, if the 2D-TZ535 card will not be used after replacement, we recommend deleting the 2D-TZ535 profile using the EDS Hardware Installation Tool, and changing the name of card in the Name (module name) field in the [New Module] window (mentioned in 12.1.4 d)) to a name for the 2F-DQ535-EIP card

14.3.2. Replacing the 2D-TZ535-PN card with the 2F-DQ535-PN

The PROFINET IO logo is a teal rectangular box with the text "PROFINET IO" in white, bold, sans-serif font.

card

Due to differences between the profiles (GSD files) of the 2D-TZ535-PN card and 2F-DQ535-PN card, the following actions must be performed using STEP7 before replacement.

- Add a GSD file for the 2F-DQ535-PN card.
- Replace the 2D-TZ535-PN GSD file placed in the project with the GSD file for the 2F-DQ535-PN card.
- Reconfigure the robot controller parameters.

For information on replacing the GSD files and configuring robot controller parameters, refer to Steps (3) to (4) in section 12.1.5.

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