Traffa

CR - 800 D Controller - Handbuch

Technisches Büro Traffa

Innovative Roboterlösungen

Der optimale Roboter für Ihre individuelle Anforderung

MITSUBISHI ELECTRIC

Mitsubishi Electric Industrial Robot

CR800-D series controller

Network Base Card
Instruction Manual

2F-DQ535
2F-DQ535-EC

MELFA

BFP-A3526-C

⚠ 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 alarms 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/CR800-Q controller. 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. 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 IEC60825-1 (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	・Safety Precautions was revised. (The CR800-Q controller was added.)
2018-11-30	BFP-A3526-B	・Description of the EtherCAT module was added.
2022-06-30	BFP-A3526-C	・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.

■ Introduction

Thank you for purchasing Mitsubishi Electric industrial robot.
This instruction manual explains the network base card (2F-DQ535/2F-DQ535-EC) option.
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.

*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

This chapter describes items to be checked and precautions to be taken before start using the 2F-DQ535/2F-DQ535-EC network base card.

1.1. Terminology

Table 1-1 Terminology

Term	Explanation
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>

1.2. How to Use the Instruction Manual

This manual is organized as follows and describes functions of the 2F-DQ535 network base card and the 2F-DQ535-EC network base card.
For information about the functions provided for standard robot controllers and how to operate them, refer to the instruction manual that comes 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 Network Base Card Specifications	Chapter 4 describes the specifications of the 2F-DQ535 network base card.
5	2F-DQ535-EC Card and EtherCAT Module Specifications	Chapter 5 describes the specifications of the 2F-DQ535-EC network base card (when the EtherCAT module is mounted).
6	Items to Be Checked Before Using This Product	Before purchasing the 2F-DQ535/2F-DQ535-EC network base card, check the required devices and the version of the robot controller.
7	Hardware Settings	This product has no hardware settings.
8	Connections and Wiring	Chapter 8 describes how to connect the network base card and the master station using cables.
9	Procedures for Starting Operation	Chapter 9 describes the procedures up to operating the network system with the module mounted.
10	Troubleshooting	Chapter 10 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.
11	Appendix	Chapter 11 describes the methods of displaying the network base card information with RT ToolBox3.

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 4 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 6 of this manual.
Check the product you have purchased and prepare other products as needed.

⬇

3 Mounting Module onto Network Base Card .... See Section 0 of this manual.
Mount a communication module on the network base card.

⬇

4 Setting Hardware and Mounting onto Robot Controller .... See Section 7.2 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 8 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 9 of this manual.
Set the IP address with the master station.

⬇

7 Setting Robot Controller Parameters .... See Chapter 9 of this manual.
Set the IP address on the robot controller side.

⬇

8 Creating Robot Programs .... See Section 9.3 of this manual.
Create a robot program, and run it with automatic operation.

⬇

9 Troubleshooting .... See Chapter エラー! 参照元が見つかりません。 of this manual.

⬇

10 Completion of Operations

3. FEATURES OF NETWORK BASE CARD

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.

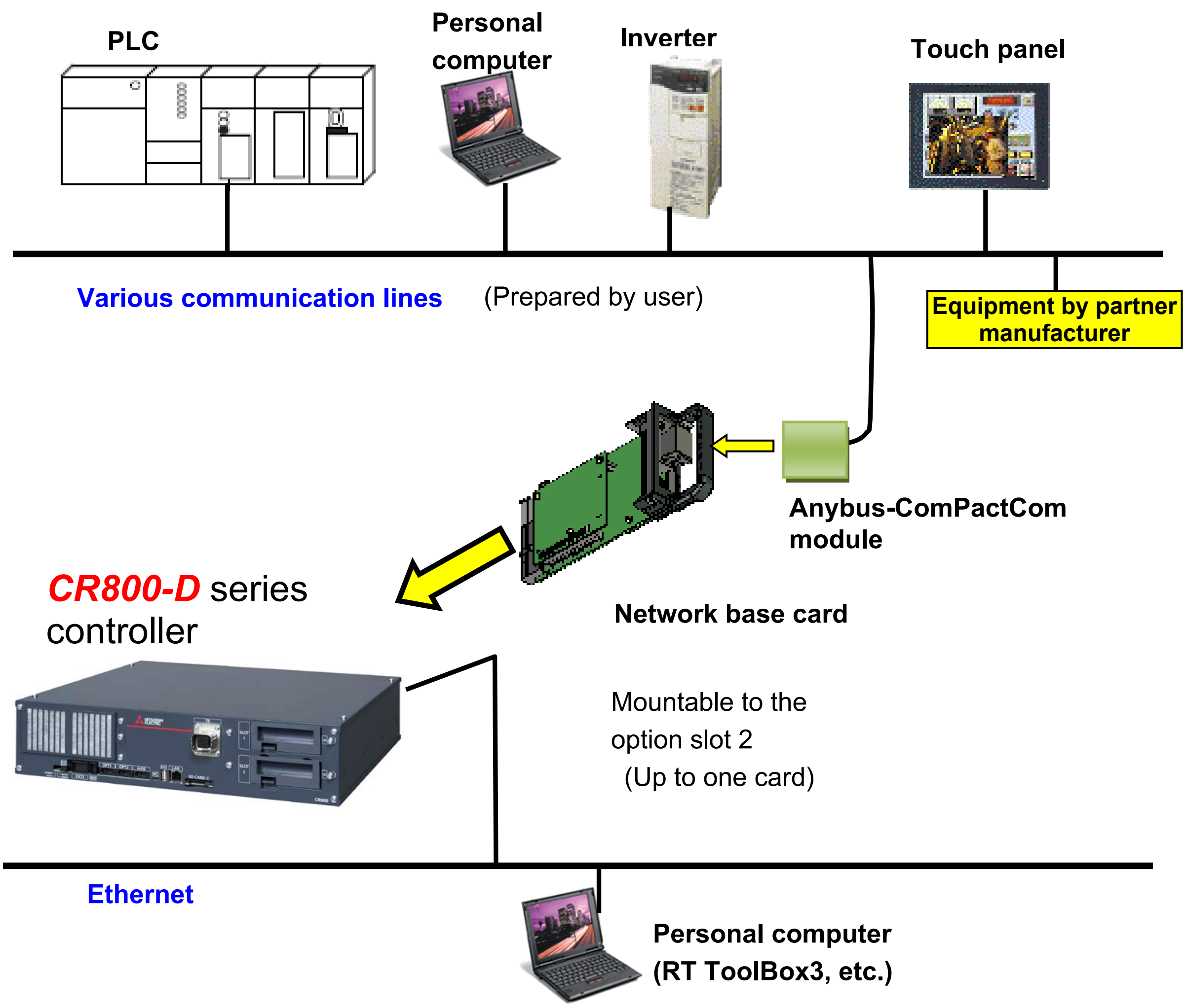


Figure 3-1 Example of configuring CC-Link IE Field with network base card

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 card	CC-Link IE Field module (AB6709)
	2F-DQ535-EC card	EtherCAT module (AB6707) Compatible with V.2.09.01 or later

CC-Link IE Field

3.3. Features when Module is Mounted

3.3.1. 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

Maximum 256-byte data communication using the real-time I/O signals (bit devices) and maximum 512-byte data communication using I/O registers (word devices) are available. 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 by Ethernet. *For details of the data, refer to (3) above.	●	–
2	TCP/IP communication	Communication with RT3	Communication with RT ToolBox3 by Ethernet	–	●
3		Data link	Communication with other devices, such as a network vision sensor, by 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).

3.3.2. Features when EtherCAT module is mounted

EtherCAT

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 "5.2.1 Robot controller I/O signals" described later.)

(4) Providing the slave information for the master station setting

The ESI file for the CR800-D is provided (included in the attached CD-ROM). Install the file in the engineering tool for the master setting.

(5) 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 RT3	Communication with RT ToolBox3 by Ethernet	–	●
3		Data link	Communication with other devices, such as a network vision sensor, by 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.)

3.4. Hardware

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

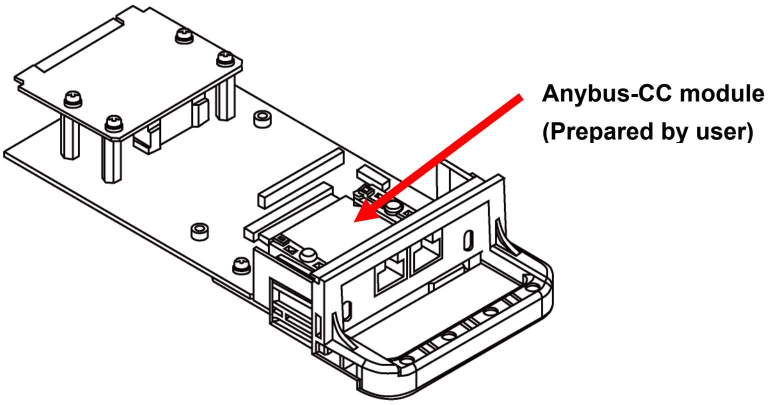


Figure 3-2 Overall view of 2F-DQ535/2F-DQ535-EC card

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.

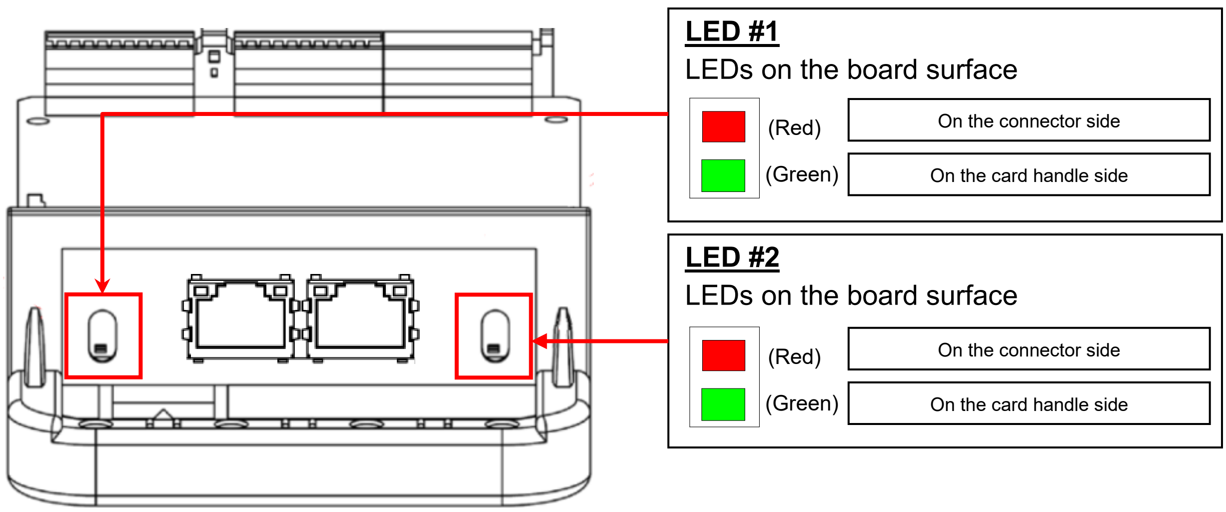


Figure 3-3 Layout of LEDs

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.

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

Table 3-1 Description of LED

Specifications when the CC-Link IE Field module is mounted

CC-Link IE Field

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 connection 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

EtherCAT

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.)

⚠ 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 configuration

The software configuration of this product is shown below.

3.5.1. For the CC-Link IE Field module

CC-Link IE Field

Table 3-2 Compatible versions

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

3.5.2. For the EtherCAT module

EtherCAT

Table 3-3 Compatible versions

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

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

4.1. Specifications list

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

Table 4-1 2F-DQ535 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.
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 (1000BASI-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)	
Communication function	Cyclic communication	Yes	
Number of I/O communication points per robot controller	Send	Max. 2048 points	Maximum 1280 bytes (shared by I/O registers)
	Receive	Max. 2048 points	Maximum 1280 bytes (shared by I/O registers)
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	Used as general I/O or assigned as dedicated I/O
RT ToolBox3	Option information read	Yes	

(*1) The 2F-DQ535 card can be mounted in the slot 2 only.
(*2) An error will occur if CC-Link/PROFIBUS/DeviceNet coexists. (Error 6111)

CC-Link IE Field

4.2. List of robot parameters

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

Parameter name	Initial value	Setting range	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 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 " 4.3.5 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	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	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	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	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.

CC-Link IE Field

4.3. 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.

CC-Link IE Field

4.3.1. 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 8 to 512 bytes (1 byte is equal to 8 bits).

Table 4-3 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
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
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

CC-Link IE Field

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

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

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

Number of bytes	Number of points	Start		End
0	0	-	to	-
8	4	6000	to	6003
16	8	6000	to	6007
24	12	6000	to	6011
32	16	6000	to	6015
40	20	6000	to	6019
48	24	6000	to	6023
56	28	6000	to	6027
64	32	6000	to	6031
72	36	6000	to	6035
80	40	6000	to	6039
88	44	6000	to	6043
96	48	6000	to	6047
104	52	6000	to	6051
112	56	6000	to	6055
120	60	6000	to	6059
128	64	6000	to	6063
136	68	6000	to	6067
144	72	6000	to	6071
152	76	6000	to	6075
160	80	6000	to	6079
168	84	6000	to	6083
176	88	6000	to	6087
184	92	6000	to	6091
192	96	6000	to	6095
200	100	6000	to	6099
208	104	6000	to	6103
216	108	6000	to	6107
224	112	6000	to	6111
232	116	6000	to	6115
240	120	6000	to	6119
248	124	6000	to	6123
256	128	6000	to	6127
264	132	6000	to	6131
272	136	6000	to	6135
280	140	6000	to	6139
288	144	6000	to	6143
296	148	6000	to	6147
304	152	6000	to	6151
312	156	6000	to	6155
320	160	6000	to	6159
328	164	6000	to	6163
336	168	6000	to	6167
344	172	6000	to	6171
352	176	6000	to	6175
360	180	6000	to	6179
368	184	6000	to	6183
376	188	6000	to	6187
384	192	6000	to	6191
392	196	6000	to	6195
400	200	6000	to	6199
408	204	6000	to	6203
416	208	6000	to	6207
424	212	6000	to	6211
432	216	6000	to	6215
440	220	6000	to	6219
448	224	6000	to	6223
456	228	6000	to	6227
464	232	6000	to	6231
472	236	6000	to	6235
480	240	6000	to	6239
488	244	6000	to	6243
496	248	6000	to	6247
504	252	6000	to	6251
512	256	6000	to	6255

CC-Link IE Field

4.3.3. Flow of I/O signal

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

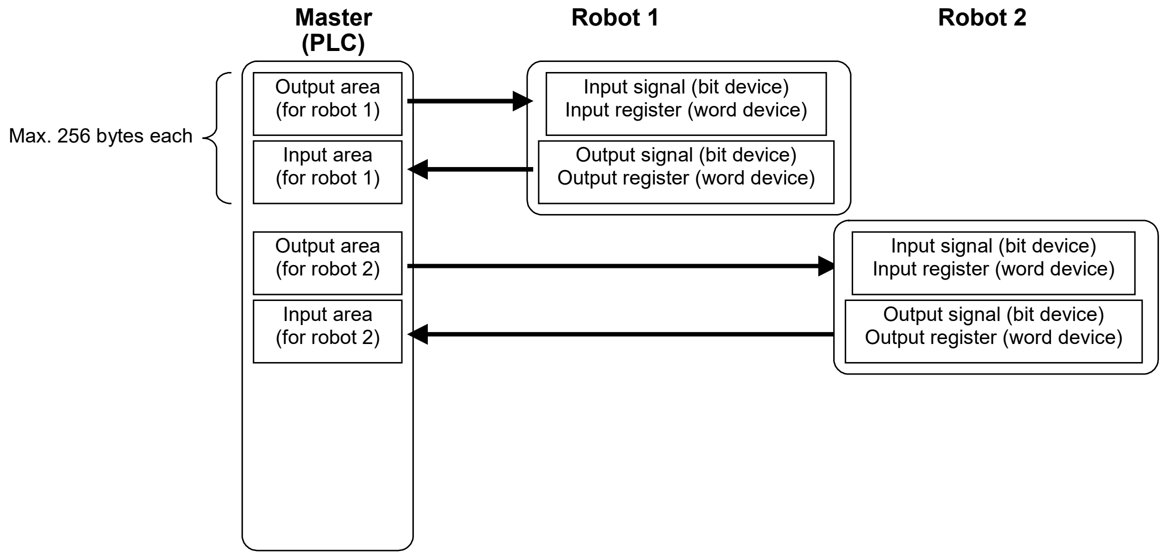


Figure 4-1 Flow of I/O signal

4.3.4. Input/Output

Dedicated inputs and outputs can be used by assigning the signal numbers of the 2F-DQ535 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 card is given below.

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

Parameter name	Start number	End number
ORST6000	6000	6031
ORST6032	6032	6063
ORST6064	6064	6095
ORST6096	6096	6127
ORST6128	6128	6159
ORST6160	6160	6191
ORST6192	6192	6223
ORST6224	6224	6255
ORST6256	6256	6287
ORST6288	6288	6319
ORST6320	6320	6351
ORST6352	6352	6383
ORST6384	6384	6415
ORST6416	6416	6447
ORST6448	6448	6479
ORST6480	6480	6511
ORST6512	6512	6543
ORST6544	6544	6575
ORST6576	6576	6607
ORST6608	6608	6639
ORST6640	6640	6671
ORST6672	6672	6703
ORST6704	6704	6735
ORST6736	6736	6767
ORST6768	6768	6799
ORST6800	6800	6831
ORST6832	6832	6863
ORST6864	6864	6895
ORST6896	6896	6927
ORST6928	6928	6959
ORST6960	6960	6991
ORST6992	6992	7023
ORST7024	7024	7055
ORST7056	7056	7087
ORST7088	7088	7119
ORST7120	7120	7151
ORST7152	7152	7183
ORST7184	7184	7215
ORST7216	7216	7247
ORST7248	7248	7279
ORST7280	7280	7311
ORST7312	7312	7343
ORST7344	7344	7375
ORST7376	7376	7407
ORST7408	7408	7439
ORST7440	7440	7471
ORST7472	7472	7503
ORST7504	7504	7535
ORST7536	7536	7567
ORST7568	7568	7599
ORST7600	7600	7631
ORST7632	7632	7663
ORST7664	7664	7695
ORST7696	7696	7727
ORST7728	7728	7759
ORST7760	7760	7791
ORST7792	7792	7823
ORST7824	7824	7855
ORST7856	7856	7887
ORST7888	7888	7919
ORST7920	7920	7951
ORST7952	7952	7983
ORST7984	7984	8015
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 a 32-bit data in 4 elements of 8 bits each.
For example, if ORST6000 = "*00000001, 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

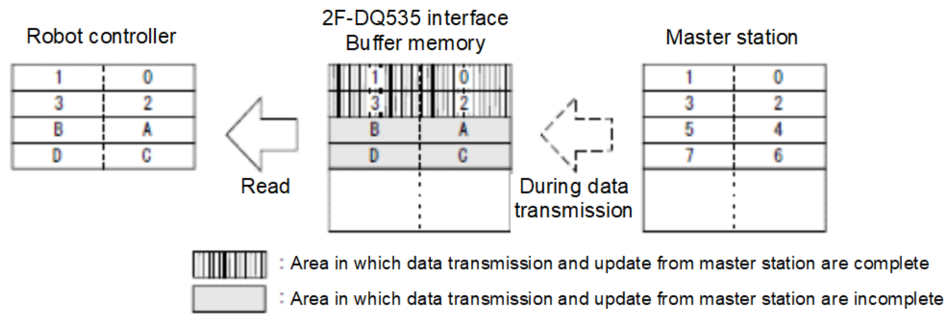
The robot language (MELFA-BASIC V/VI) used with the 2F-DQ535 card is explained below.

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

◊♦◊ 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.

Example of input data inconsistency



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.

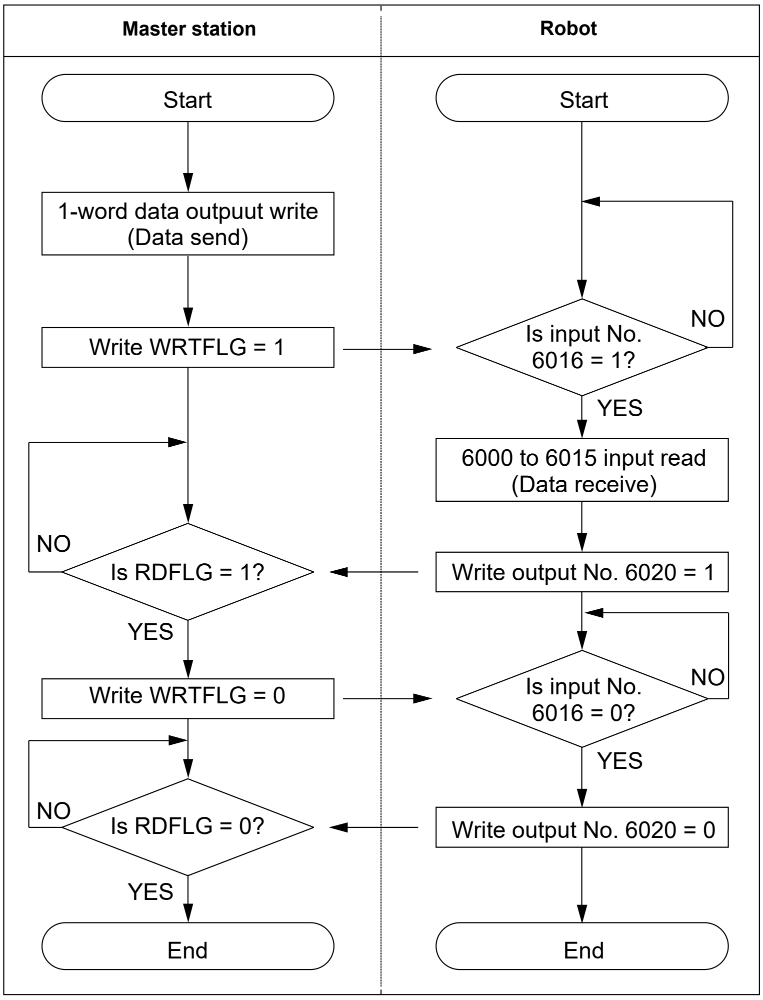


Figure 4-2 Example of using interlock

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

5.1. Specification list

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

Item			Specification	Remarks
Network base interface card board model			2F-DQ535-EC	
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.
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) RWr ≤ 128 (points) RWw ≤ 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	Used as general I/O or assigned as dedicated I/O
RT ToolBox3	Option information read	Yes	

(*1) The 2F-DQ535-EC card can be mounted in the slot 2 only.
(*2) An error will occur if CC-Link/PROFIBUS/DeviceNet coexists. (Error 6111)

5.2. List of robot parameters

Table 5-1 List of robot parameters related to EtherCAT

Parameter name	Initial value	Setting range	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 " 5.2.1 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.

5.2.1. Robot controller I/O signals

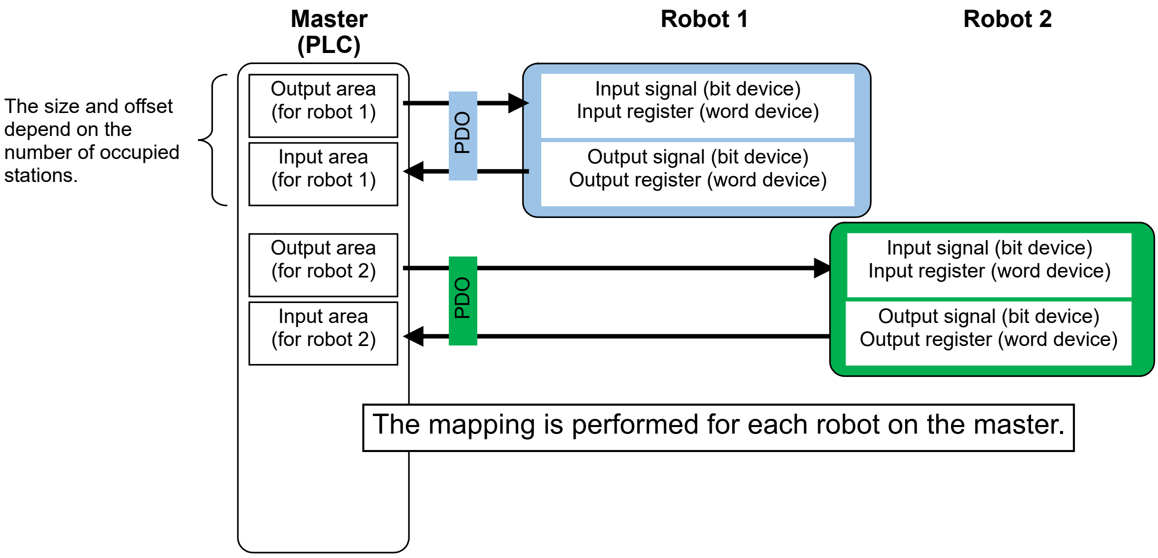
As shown below, RX, RY, RWr, and RWw data (*) of the master station correspond with the input and output signals (6000 to Max. 6255) and input and output registers (6000 to Max. 6127) of the robot.

	Bit device (RX, RY)			Word device (RWr, RWw)		
Setting value of the number of occupied stations (ECTOCS)	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.

5.2.2. 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.)

5.2.3. 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 ".)

5.2.4. 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 ".)

6. ITEMS TO BE CHECKED BEFORE USING THIS PRODUCT

6.1. Checking the Product

CC-Link IE Field

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

Table 6-1 List of the standard items in the product

No.	Name	Model	Quantity
(1)	Instruction Manual (CD-ROM)	BFP-A3544	1
(2)	Network base card	2F-DQ535	1
(3)	Module fixing parts (module mount, screws)		1 set

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

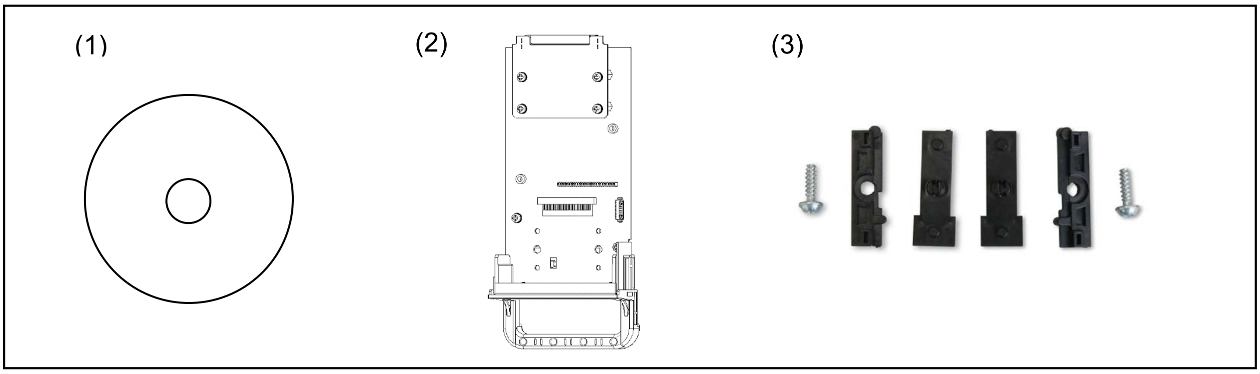


Figure 6-1 Items contained in the delivered product

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

Table 6-2 List of the standard items in the product

No.	Name	Model	Quantity
(1)	Instruction Manual (CD-ROM)	BFP-A3544	1
(2)	Network base card	2F-DQ535-EC	1
(3)	Ferrite core	E04SR301334	2
(4)	Module fixing parts (module mount, screws)		1 set

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

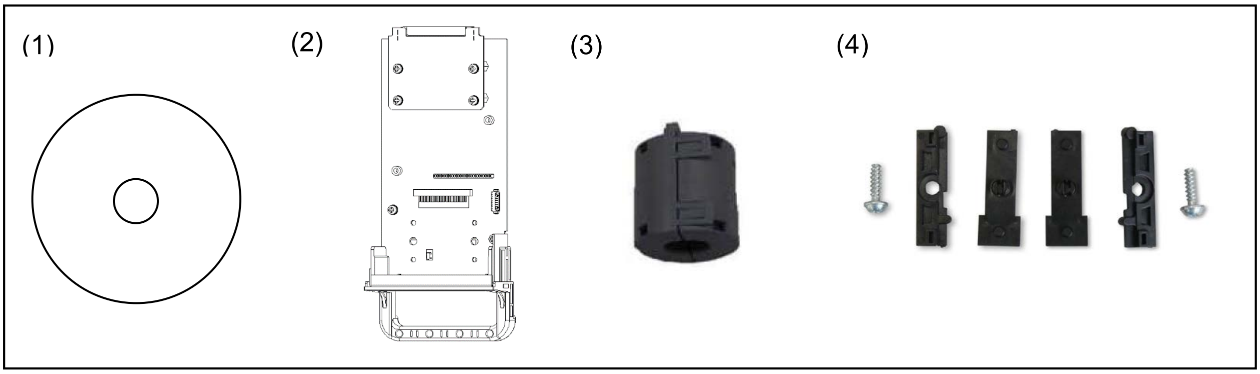


Figure 6-2 Items contained in the delivered product

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 " 8.2.2 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.

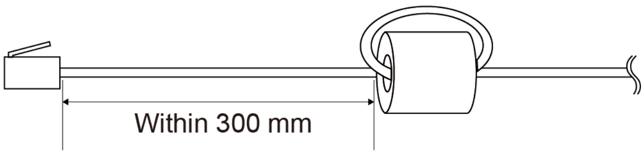


Figure 6-3 Ferrite core installation position

6.2. Devices to be Prepared by the Customer

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

Table 6-3 List of the standard items in the product

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)	Anybus-CC EtherCAT module (AB6707)
Ethernet cable	This cable must conform to each specification. Category 5e (CAT 5e) or higher. A shielded cable is recommended in noisy environment.	
Switching hub	Always use a switching hub when using the I/O signal function.	No restrictions.
Driver for hex lobular (torques) screw	Driver for module fixing part screws. Prepare a size "T-10" screwdriver.	
Cross-point driver	Used for card handle fixing screws (M3).	

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

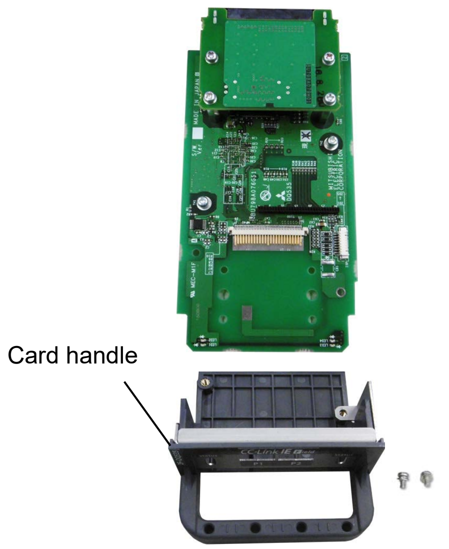
7. HARDWARE SETTINGS

CC-Link IE Field | EtherCAT

7.1. Module Mounting Procedures

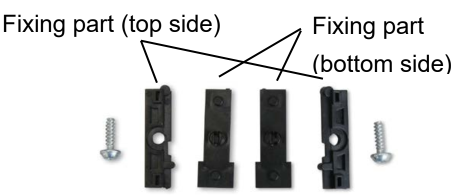
The example of installing the Anybus CompactCom module on the network base card is shown below.

(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.



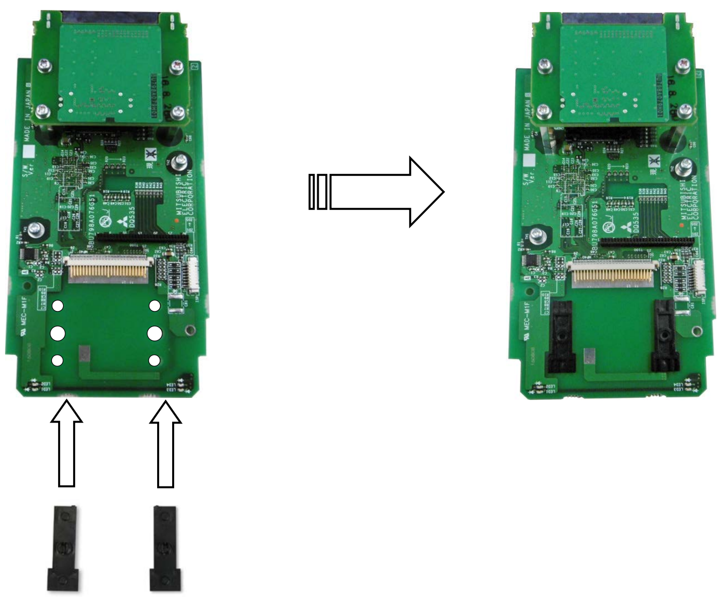
Network base card


Anybus CompactCom module

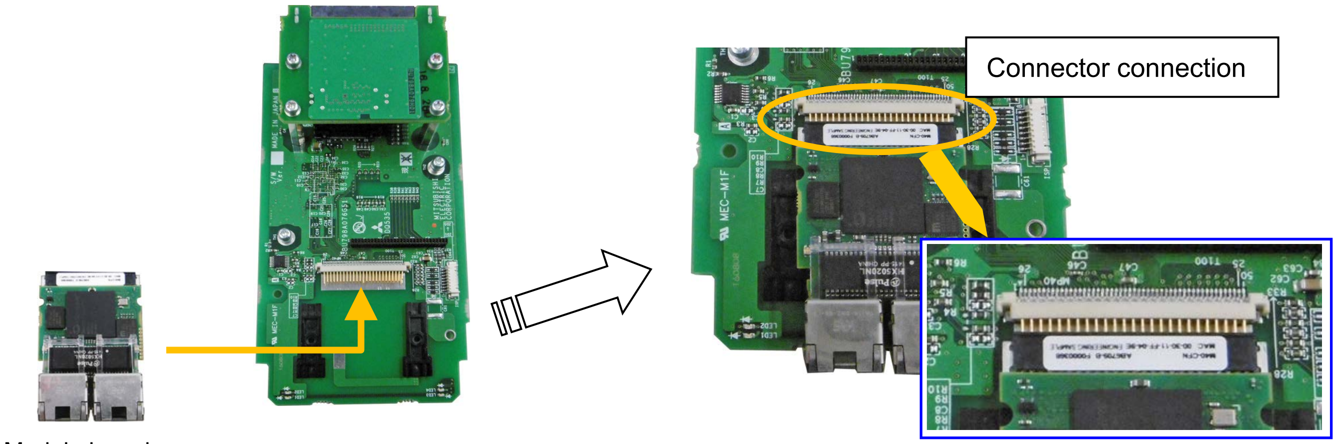


Module fixing parts

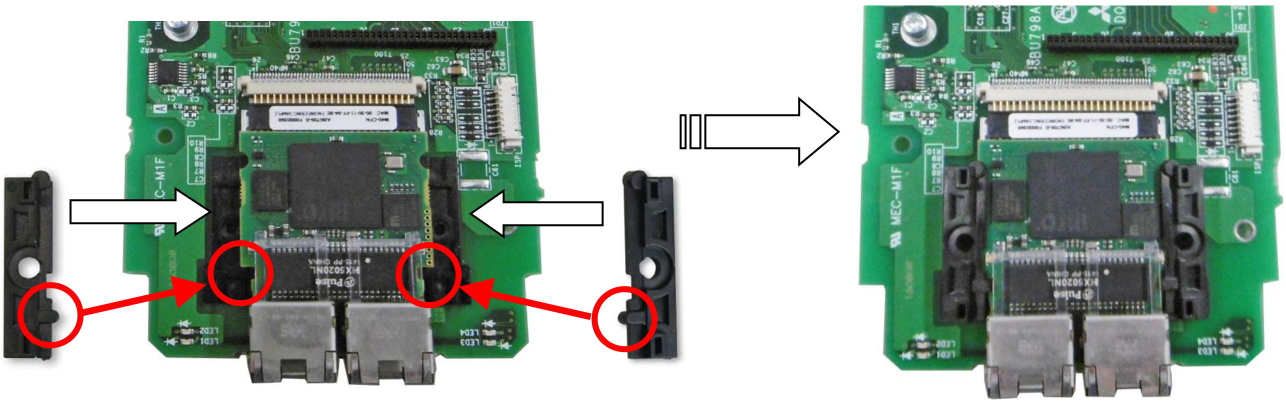
(2) Insert the protrusions on the module fixing parts (bottom side) into the holes on the card.


Module fixing parts (bottom side)

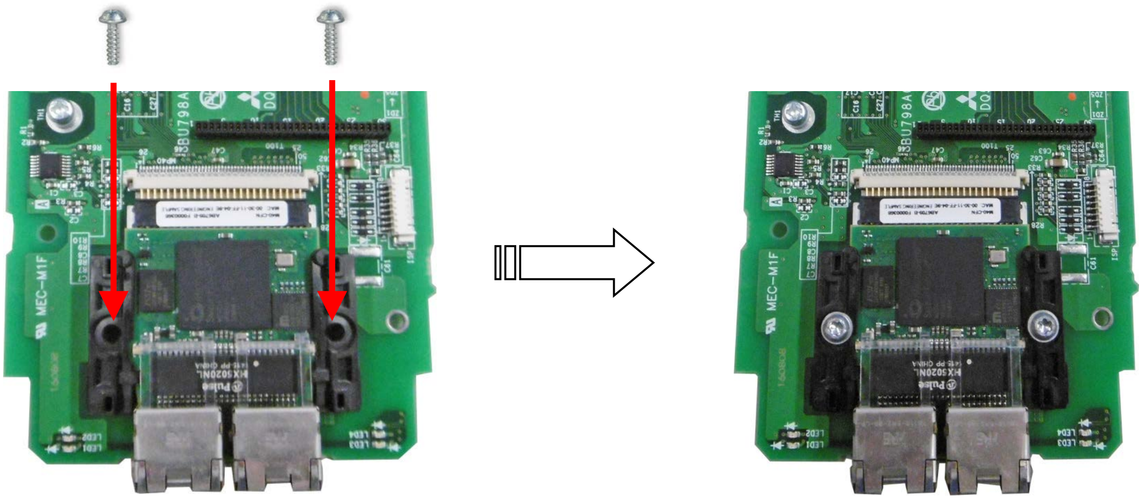
(3) Place the module onto the fixing parts, and slide it to connect its module connector with pins on the card side.



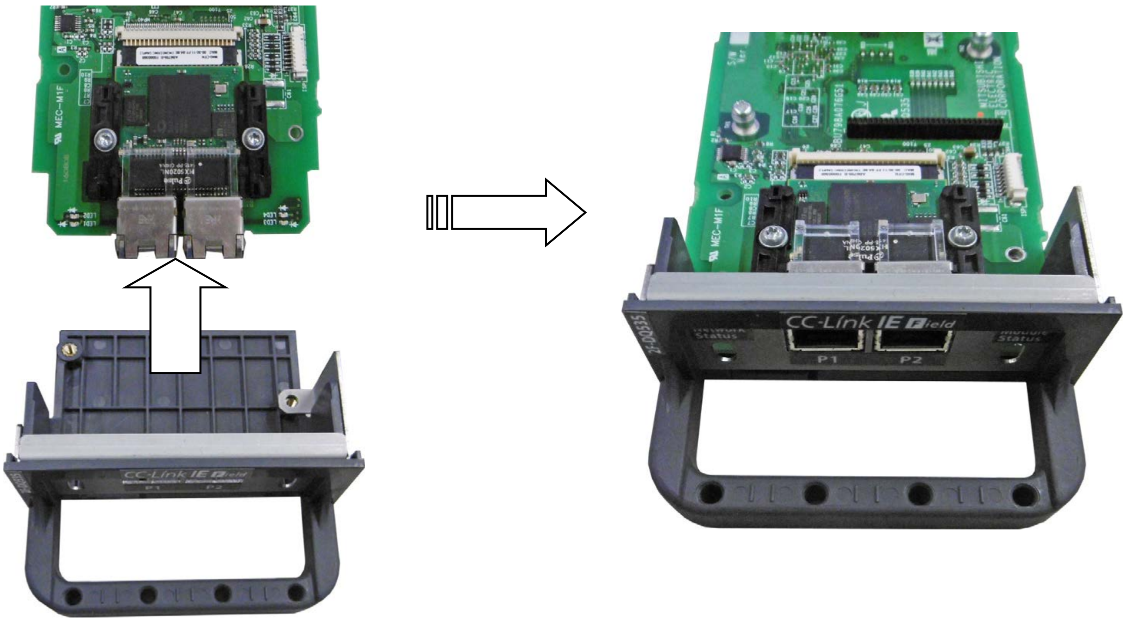
(4) Align the protrusions on the module fixing parts (top side) with the slits on the module, and mount the module as if sandwiching it from the left, right and top.
Adjust the position of the module so that the screw holes on the top fixing parts and bottom fixing parts are aligned. There may be a small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



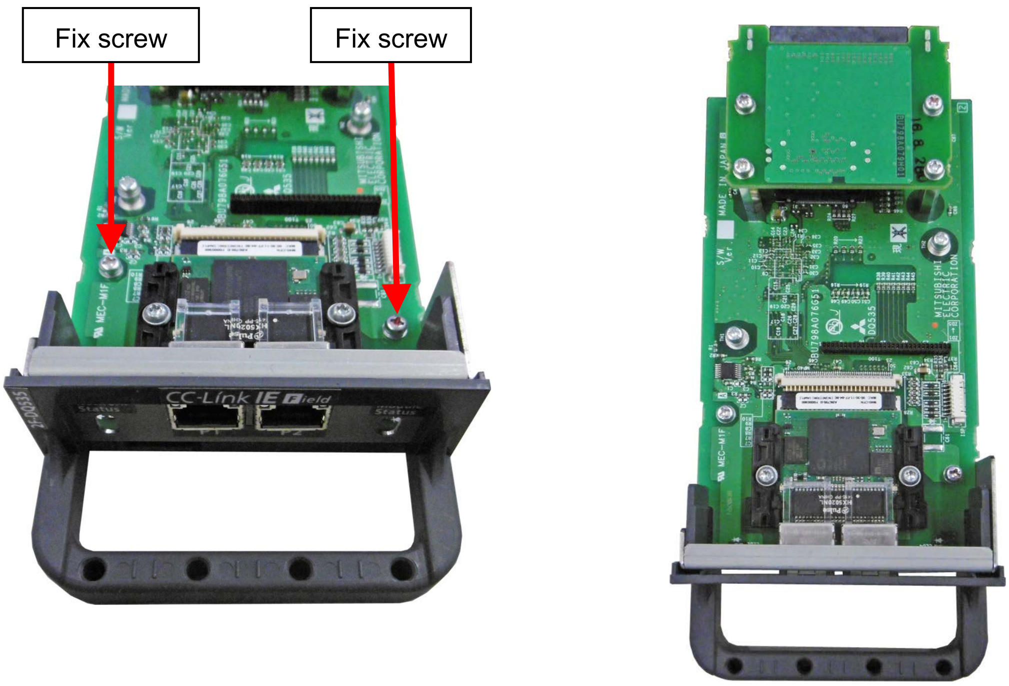
(5) Fasten the module fixing parts with screws. Use the hex lobular driver.



(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.



7.2. Hardware Setting of the Card

The 2F-DQ535 and 2F-DQ535-EC cards do not have any hardware settings.
All settings are completed with the master station parameters and robot controller parameters.
Refer to "9.1 Setting the Parameters" for details.

8. CONNECTIONS AND WIRING

CC-Link IE Field EtherCAT

8.1. 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.

8.1.1. CR800-D controller

Remove one interface cover of the option slot 2 in the robot controller front, and mount the 2F-DQ535 or 2F-DQ535-EC interface card 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)>

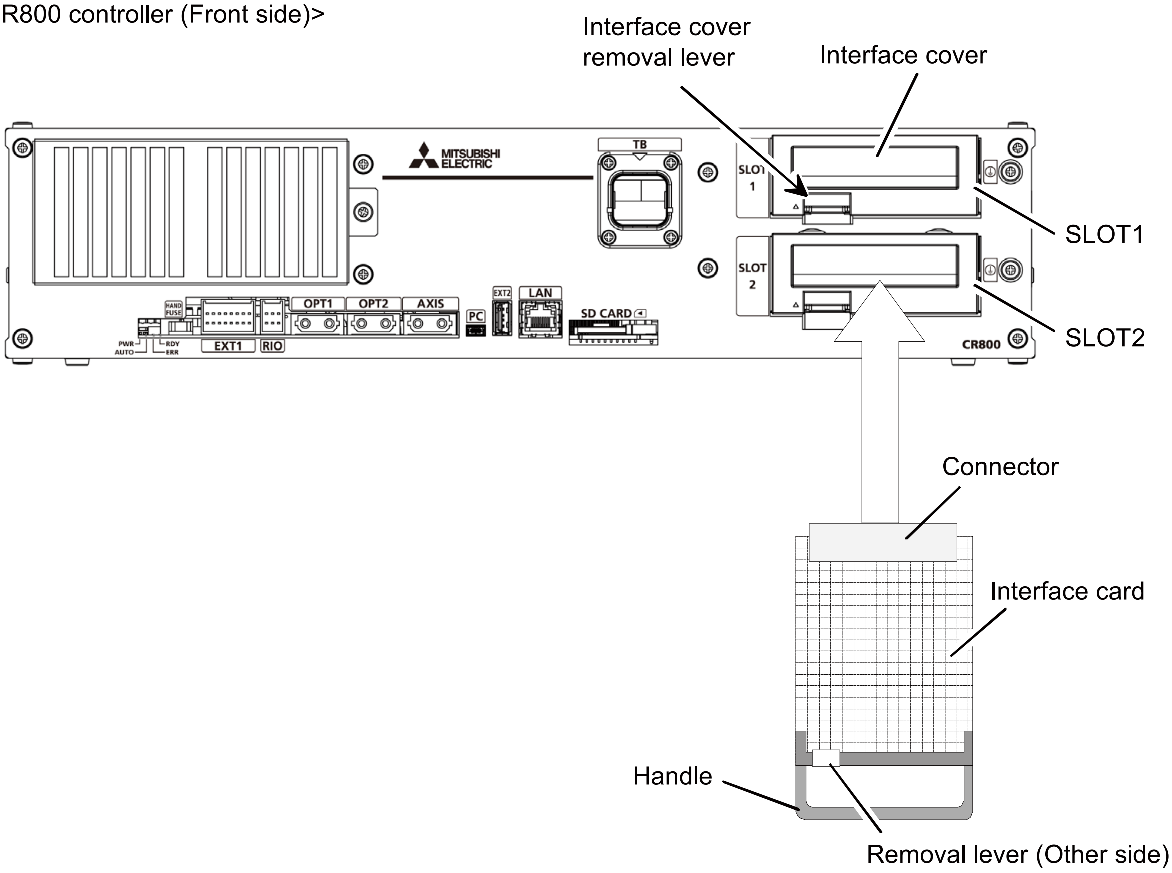
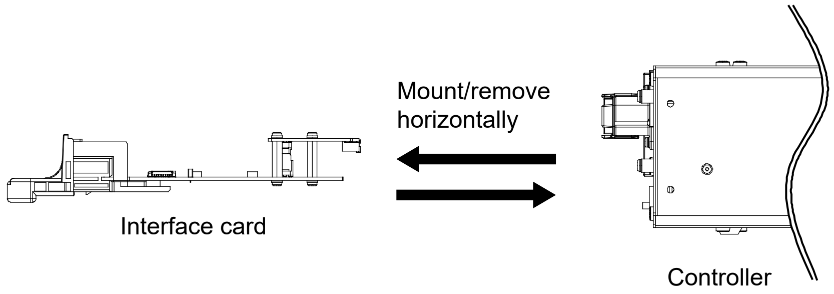


Figure 8-1 Mounting of the 2F-DQ535 or 2F-DQ535-EC interface card (CR800-D controller)

⚠ CAUTION

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

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



CC-Link IE Field

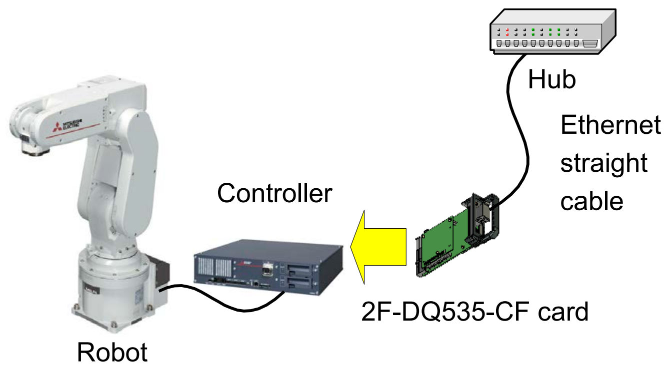
8.2. Wiring

8.2.1. For the CC-Link IE Field module

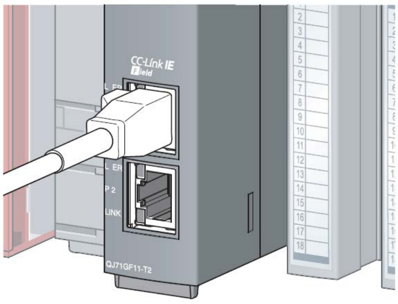
An example of connecting the 2F-DQ535 card and a Mitsubishi Electric programmable controller (MELSEC-Q series, QJ71GF11-T2) with an Ethernet cable is explained below.

(1) Connect the Ethernet straight cable connector to the 2F-DQ535 card on which the CC-Link IE Field module is mounted.

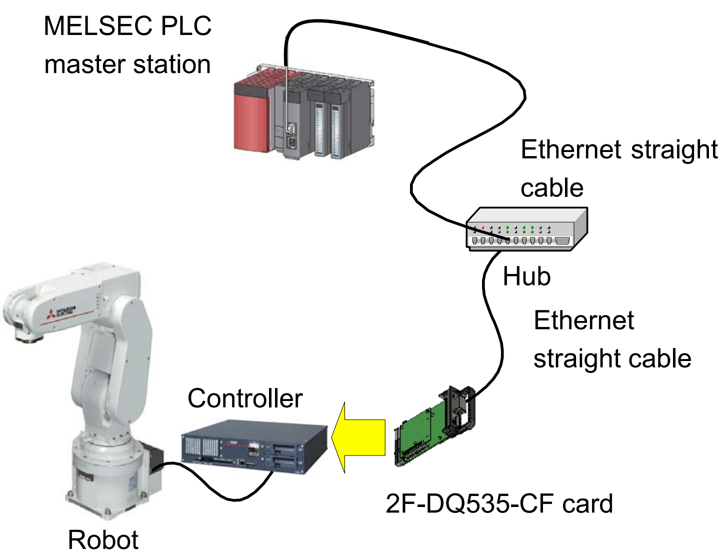
(2) Connect the other connector to the hub.



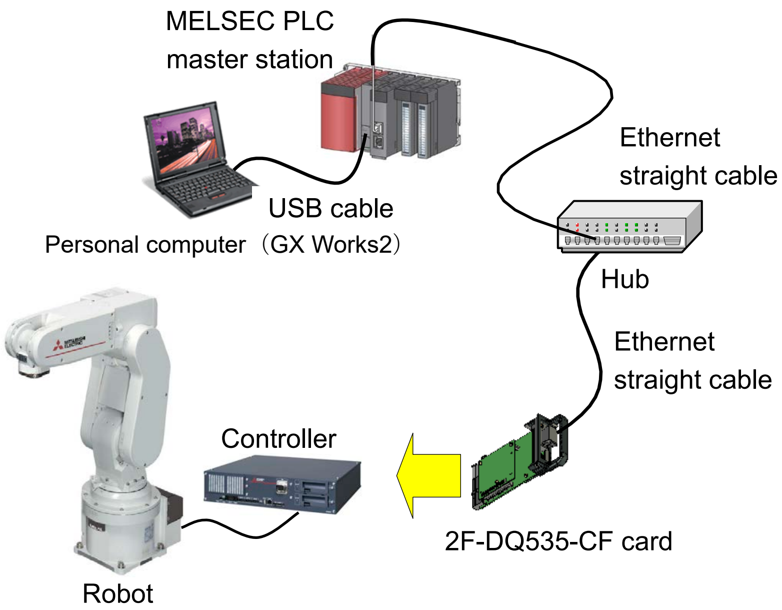
(3) Connect the Ethernet straight cable connector to the P1 (for Ethernet) on QJ71GF11-T2.
For the star type, connect the connector to either of P1 or P2.



(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.

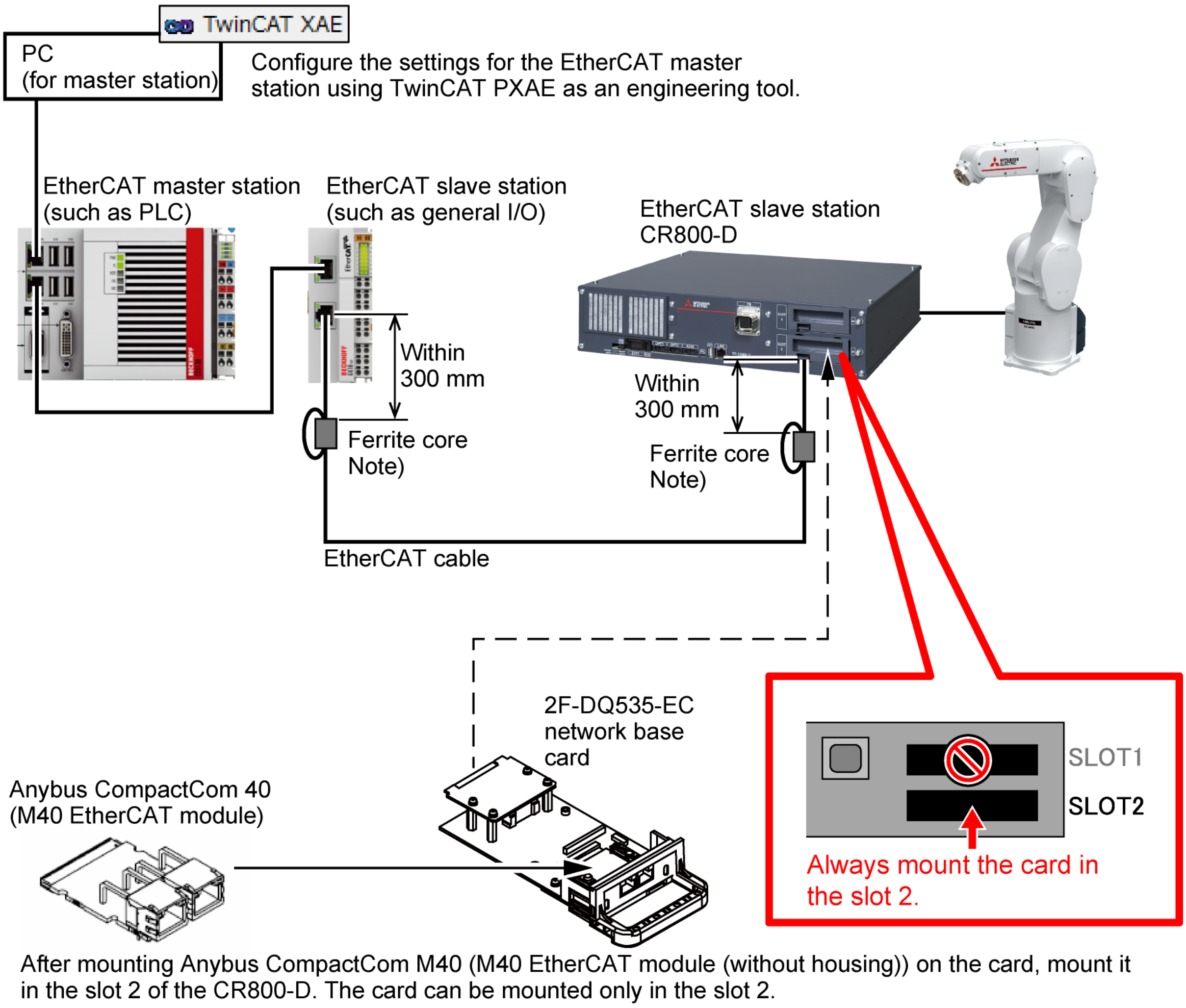
Table 8-1 Checking connections

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?	

8.2.2. For the EtherCAT module

EtherCAT

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.



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.

9. PROCEDURES FOR STARTING OPERATION

CC-Link IE Field **EtherCAT**

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.

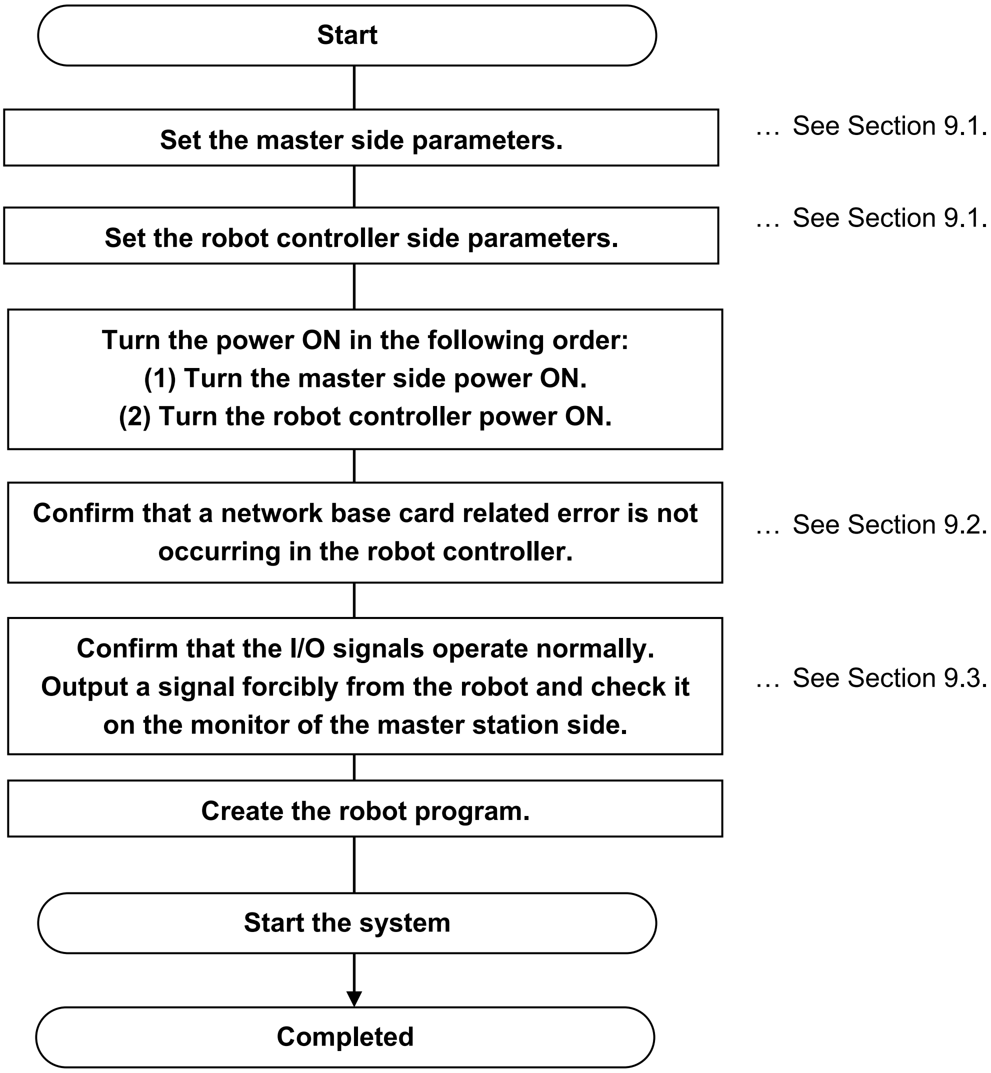


Figure 9-1 Procedures for starting operation

Table 9-1 Example of equipment on the master station side

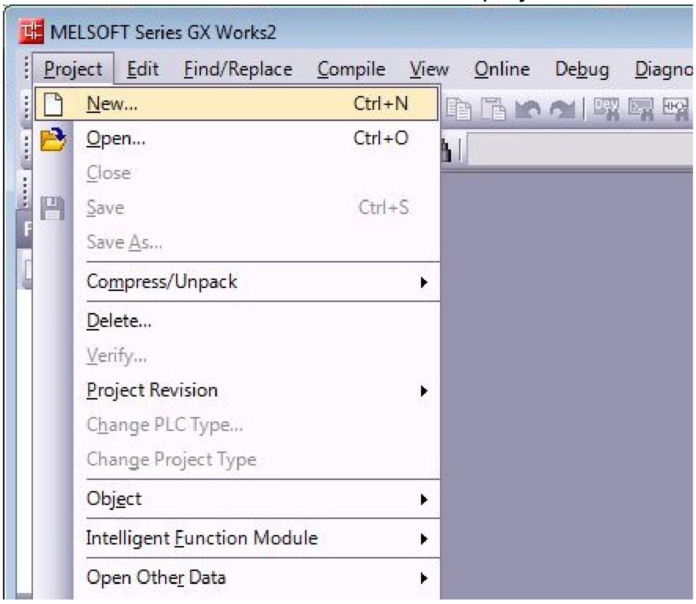
	CC-Link IE Field	EtherCAT
Master station equipment	Mitsubishi Electric MELSEC iQ Q03UDVCPU QJ71GF11-T2	Beckhoff Automation CX5130 Embedded PC (TwinCAT PLC runtime)
Software used	GX Works2 engineering software	TwinCAT XAE engineering software

CC-Link IE Field

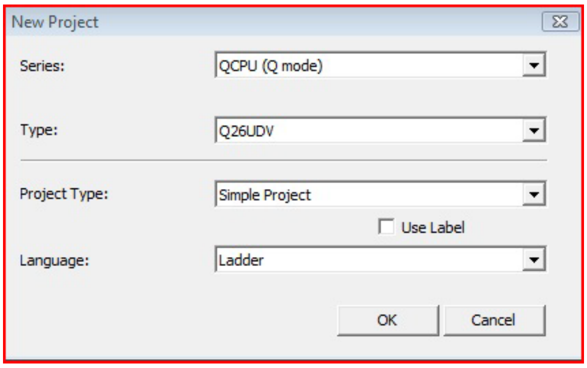
9.1. Setting the Parameters

9.1.1. For the CC-Link IE Field module

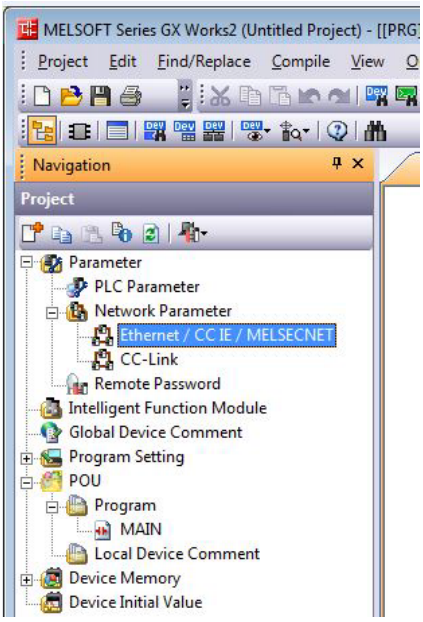
(1) Start GX Works2 and create a new PLC project.



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

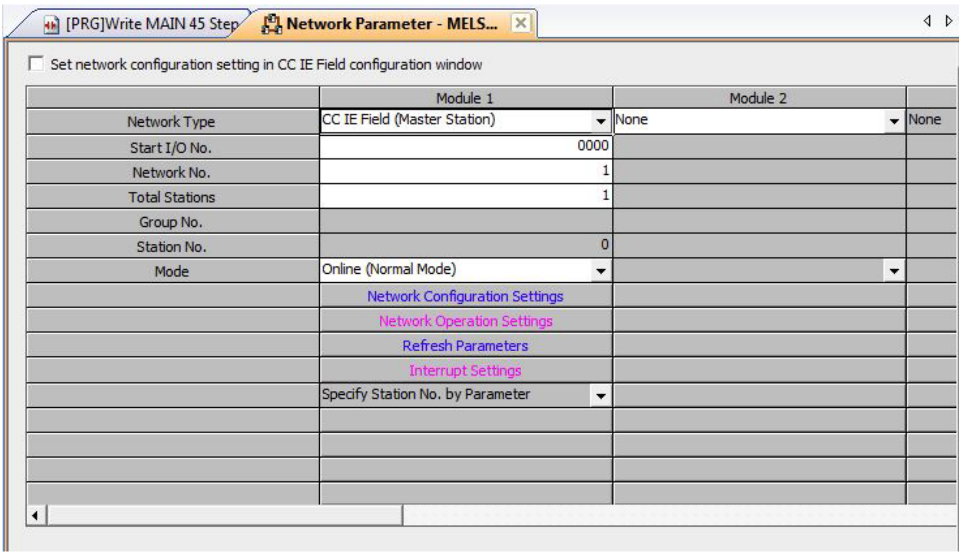


(3) Open the parameter setting of CC-Link IE Field.



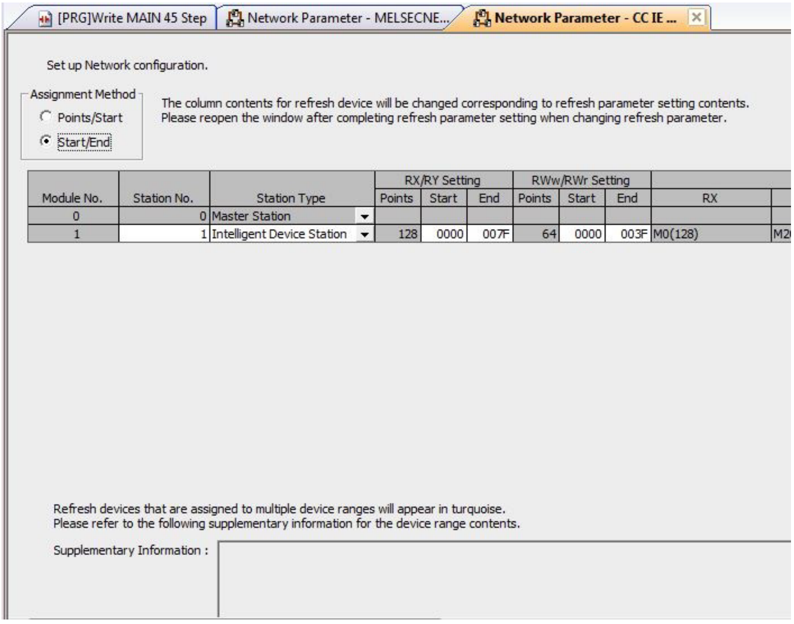
(4) Set the network parameters (module 1).

- 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/RY Setting : Points 128/Start 0000/End 007F
- RWw/RWr Setting : Points 64/Start 0000/End 003F



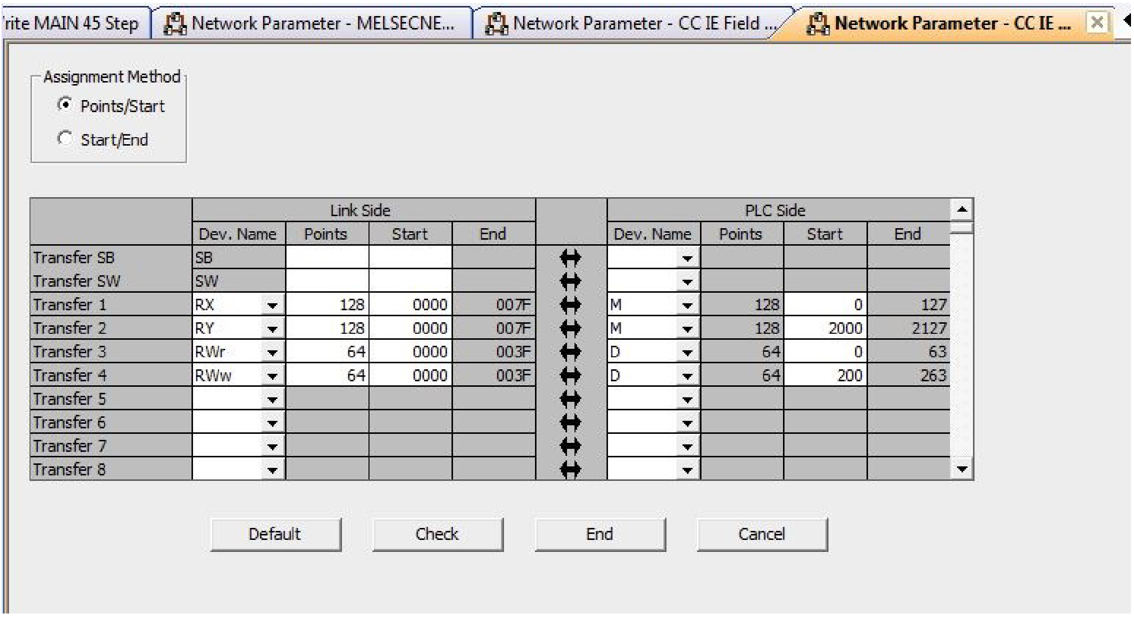
(6) Set the refresh parameters.

Set as follows:

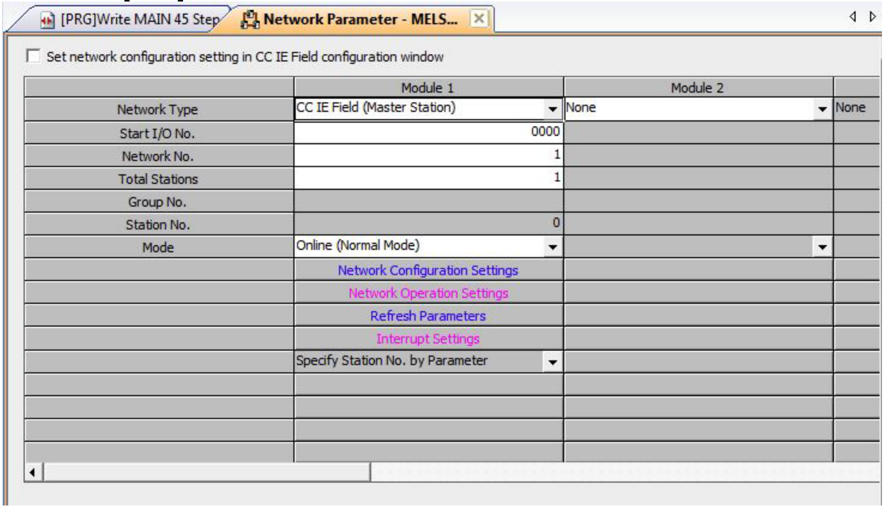
1) Import the 128-point output signals 6000 to 6127 of the robot into the bit devices M0 to M127 of PLC.
2) Import the bit devices M2000 to M2127 of PLC into the input signals 6000 to 6127 of the robot.
3) Import the output registers 6000 to 6063 of the robot into the word devices D0 to D63 of PLC.
4) 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)

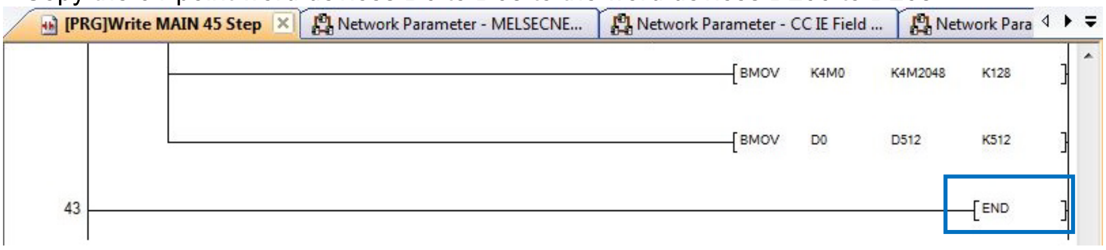


(7) Press the [End] button to close the window.

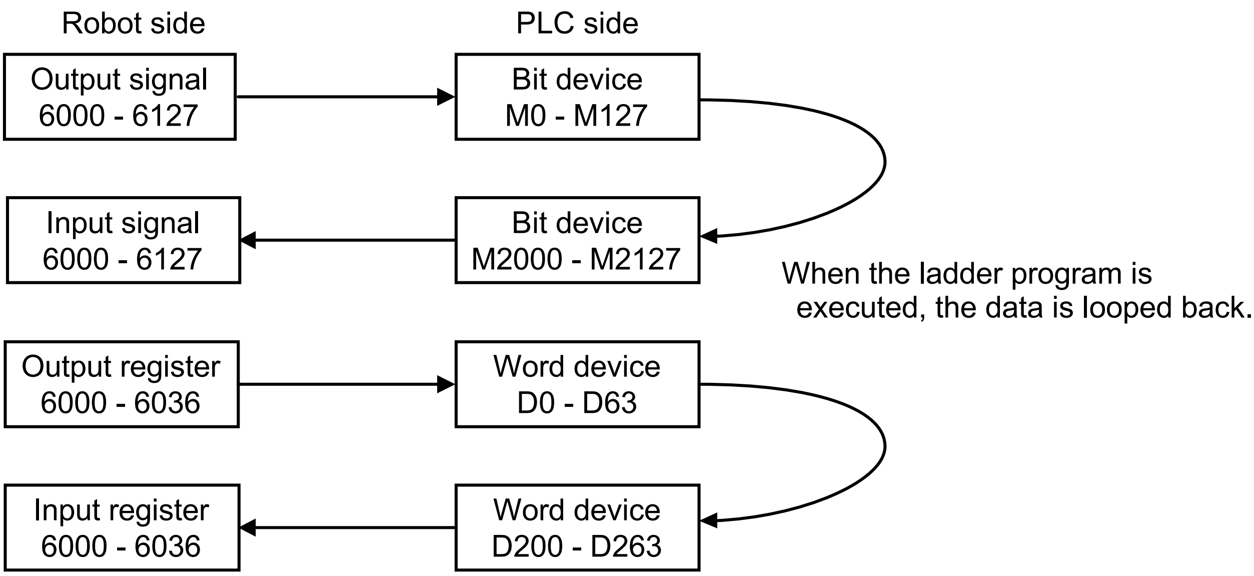


(8) Create a ladder program of the PLC side.
In this program, the input to the PLC is looped back to the output as it is.

・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.

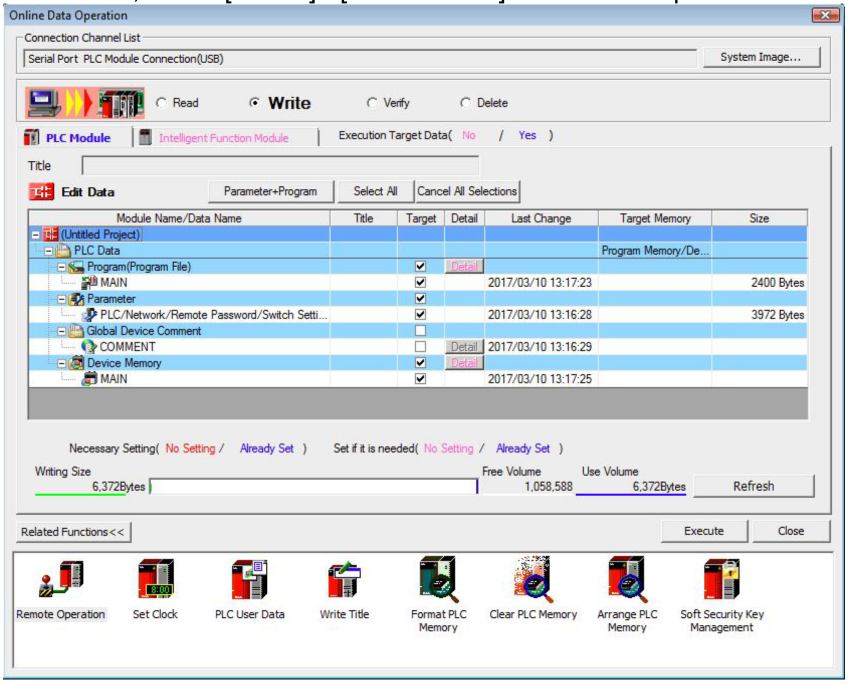


An output of the robot is looped back in the PLC to be an input of the robot.



(9) Write the parameter and program in PLC.

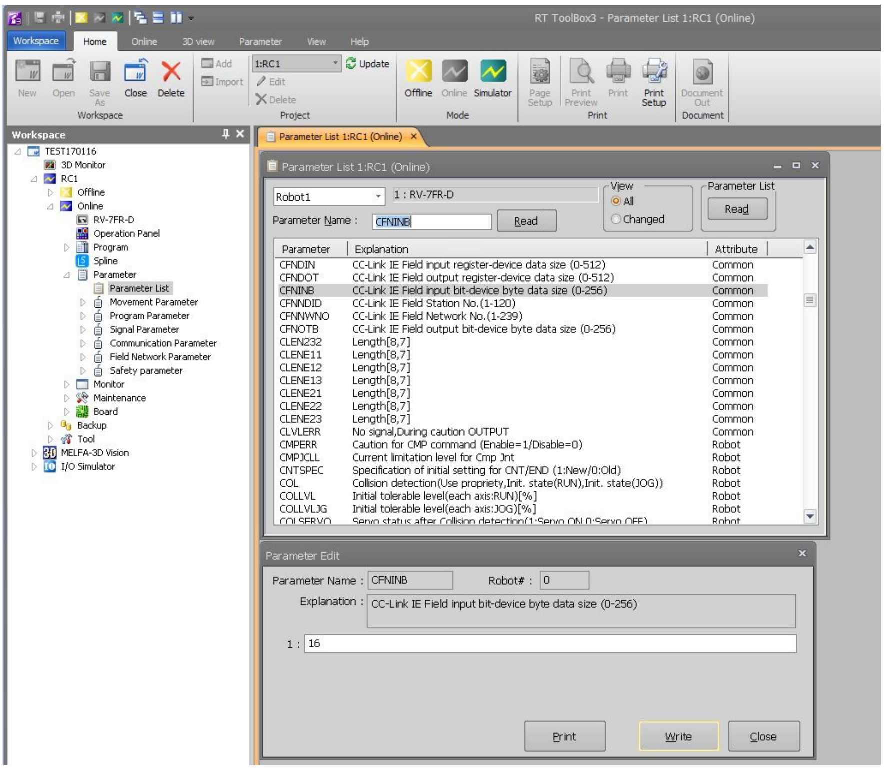
After setting the connection destination of the PLC side and personal computer, such as a USB connection, select [Online] - [Write to PLC] and write the parameters and the program.



(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/RY and RWr/RWw) must be consistent with those in the PLC described in (5).

9.1.2. For the EtherCAT

EtherCAT

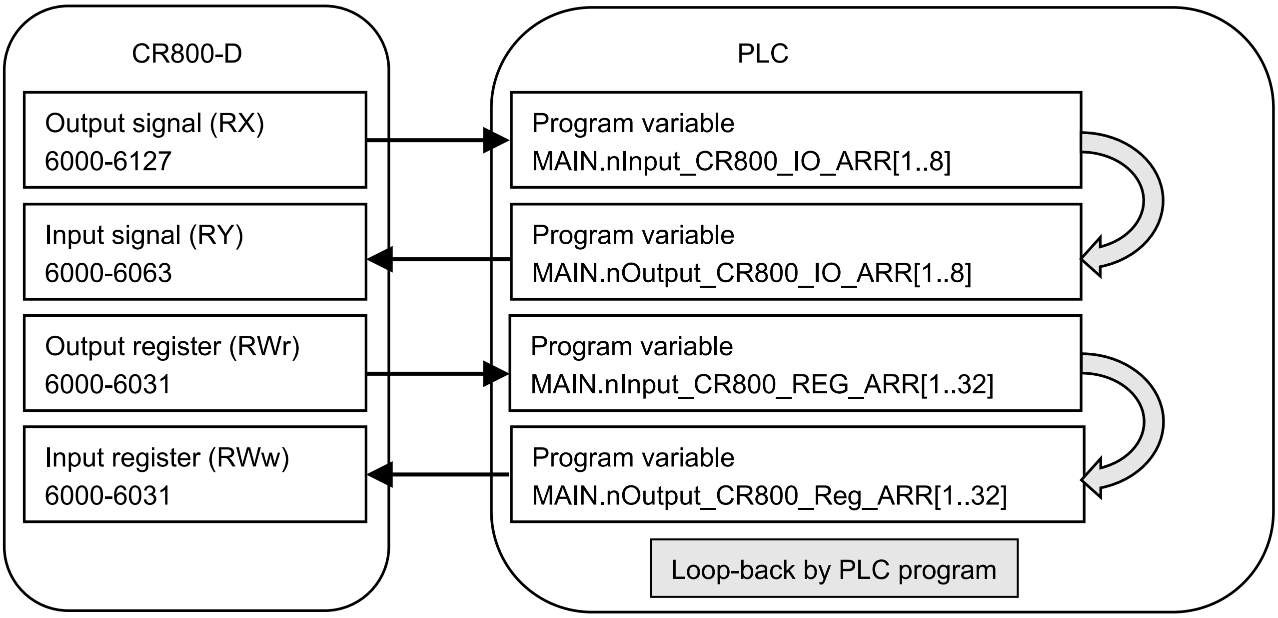
The following shows how to set the parameters using Embedded PC CX5130 (PLC) by Beckhoff Automation as an example.

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 8.2.2 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.

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.

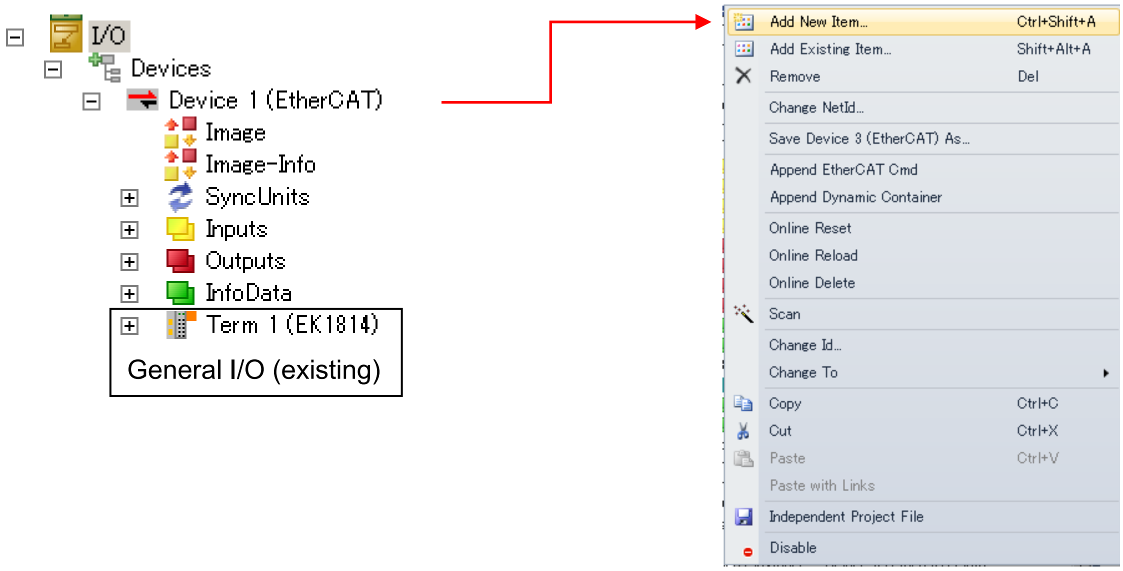
   Directory example:
   C:\\TwinCAT\3.1\Config\Io\EtherCAT

   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.

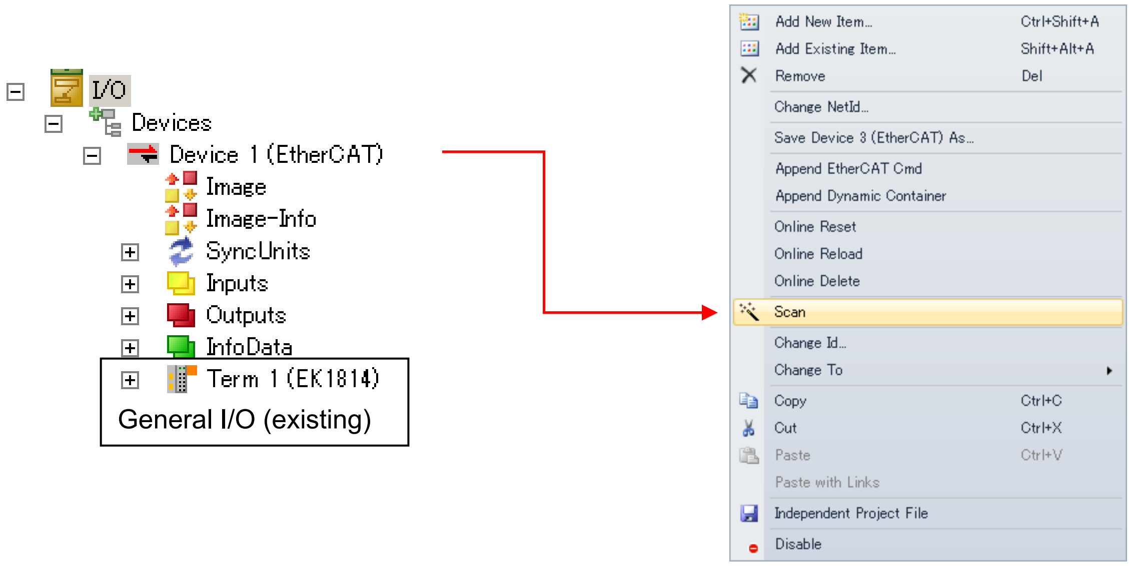
   For the description of the directory, refer to the TwinCAT manual.

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.

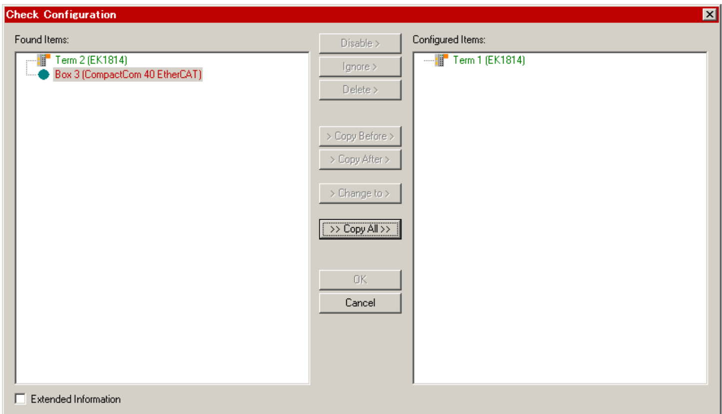
   (1) Select an EtherCAT device under the I/O node, and display the context menu (right-click).



[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.)

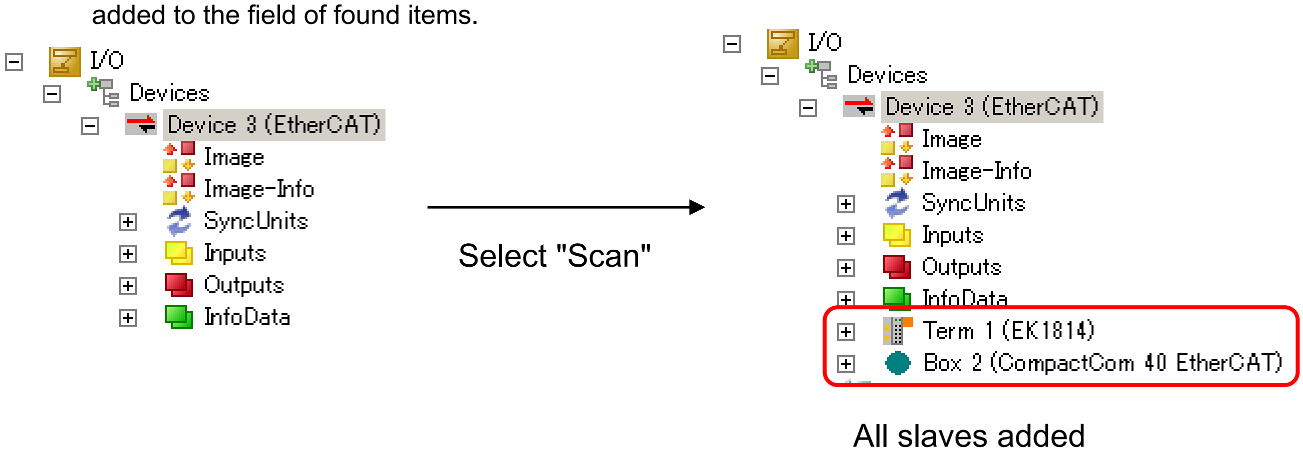


When EK1814 has already been set, the following window appears by selecting "Scan".
Add "CompactCom 40 EtherCAT".

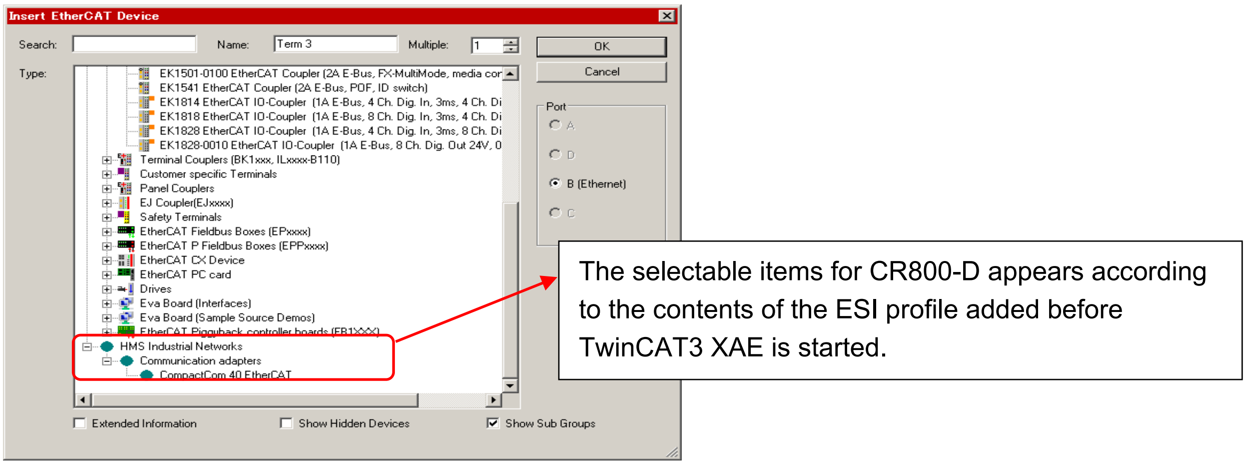


Click "CopyAll" to add the items and click "OK".

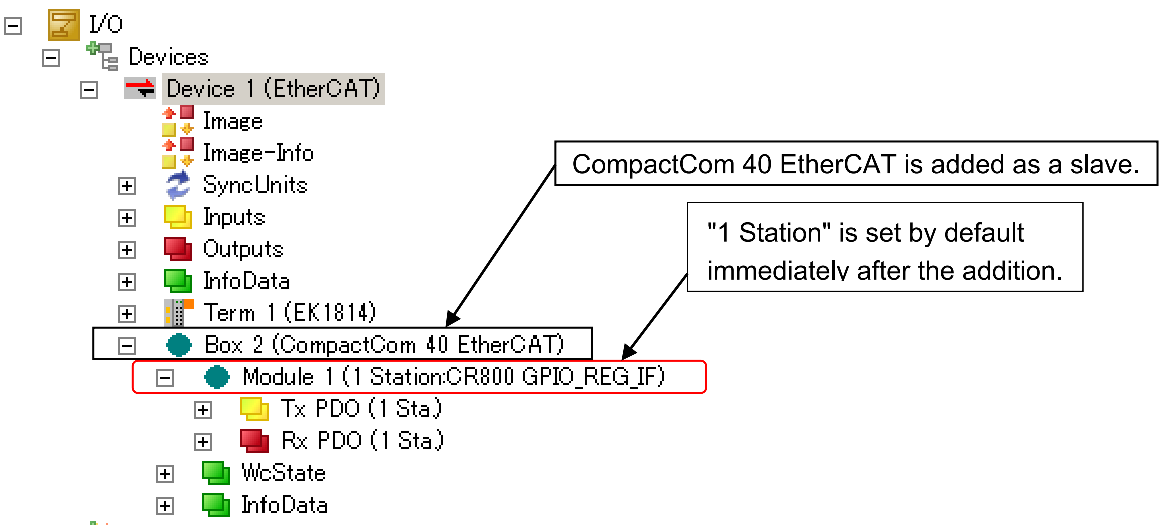
When no slave has been set under the master, all the slaves in the network will be detected and added to the field of found items.



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

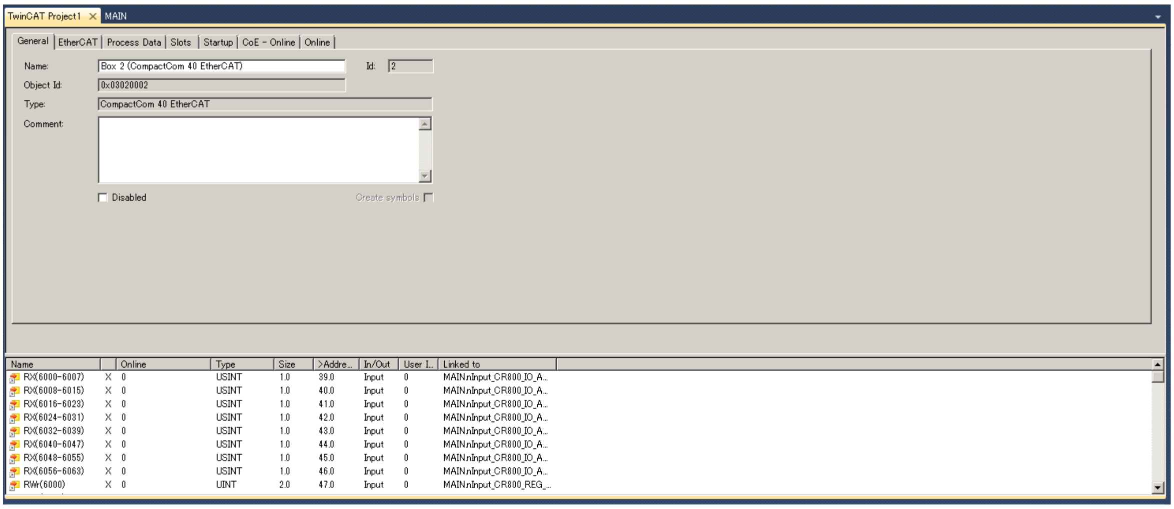


(3) "CompactCom 40 EtherCAT" is added under the EtherCAT device and at the downstream of the general I/O.

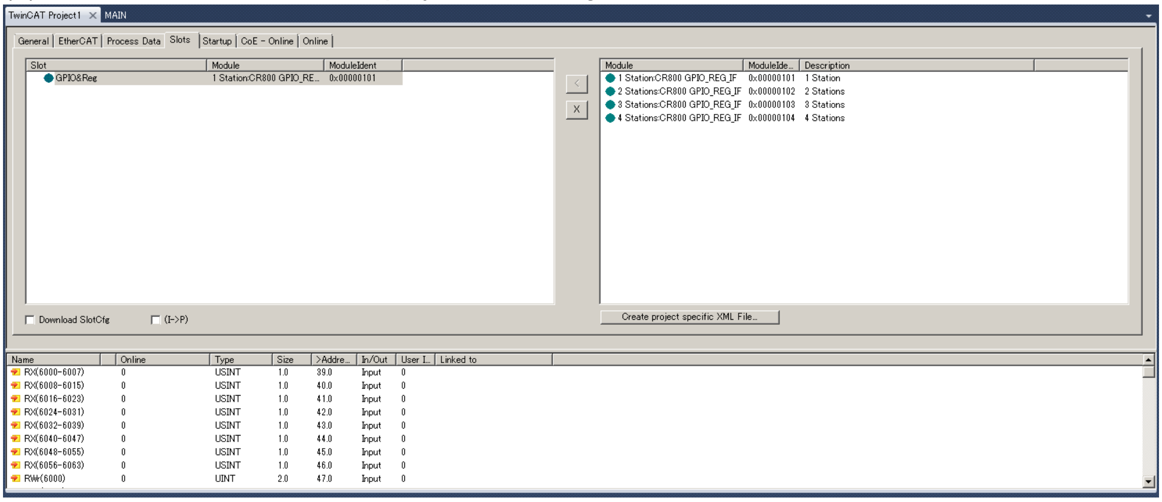


3. [Master station] Setting the number of occupied stations
   When the number of occupied stations is other than one, set the desired number of occupied stations in the PLC side according to the following.
   (The number of occupied stations is set to one by default; The setting is not required to be 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 [×] 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.

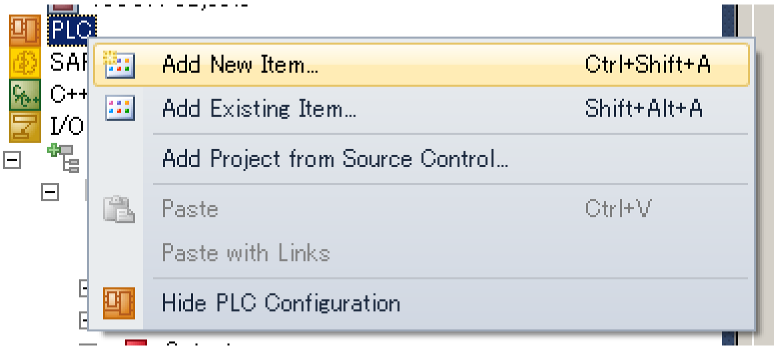
Setting of the number of occupied stations	Description in the "Module" field
1 Station (Default)	"1 Station:CR800 GPIO_REG_IF"
2 Stations	"2 Stations:CR800 GPIO_REG_IF"
3 Stations	"3 Stations:CR800 GPIO_REG_IF"
4 Stations	"4 Stations:CR800 GPIO_REG_IF"

4. [Master station] Adding a PLC program

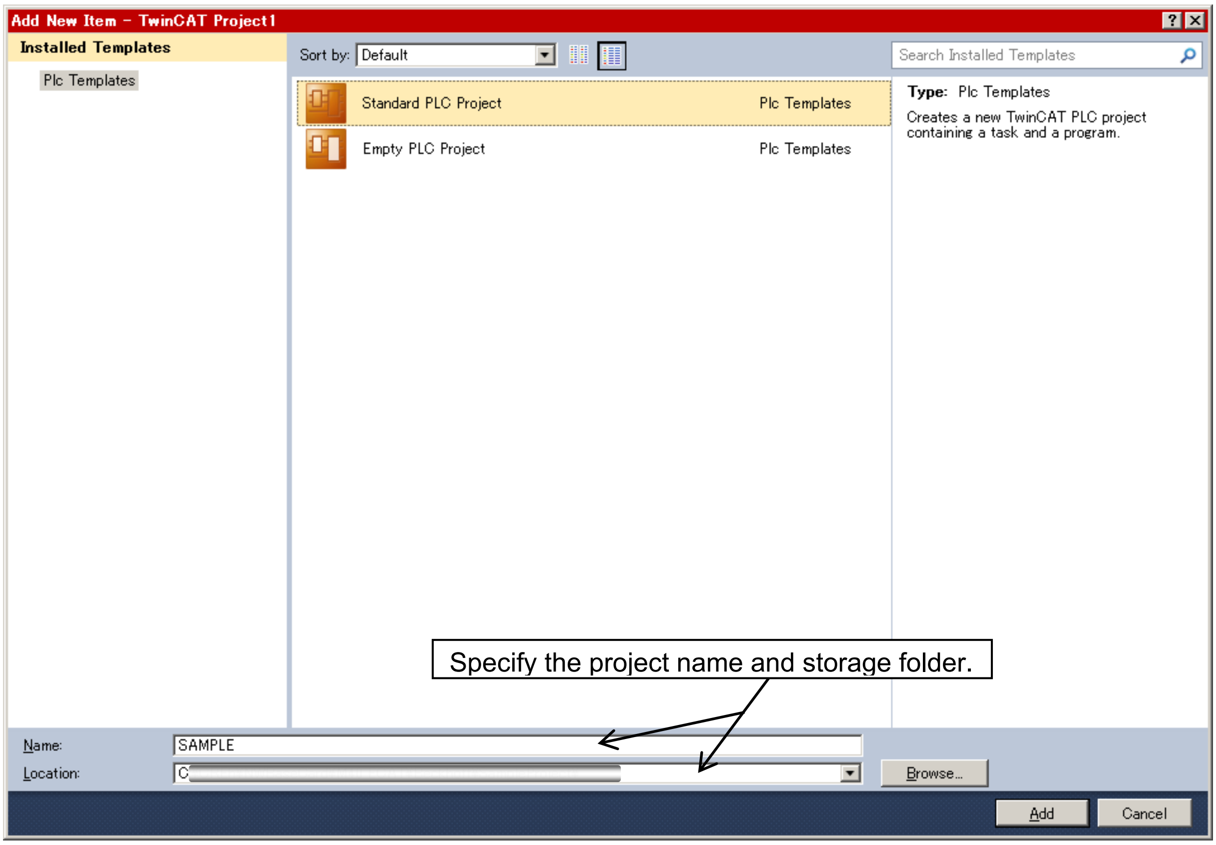
(1) Add a PLC project

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.



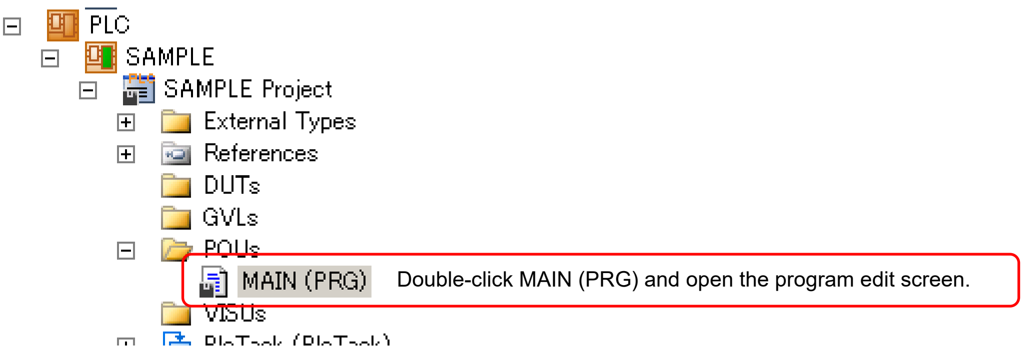
Add the project.



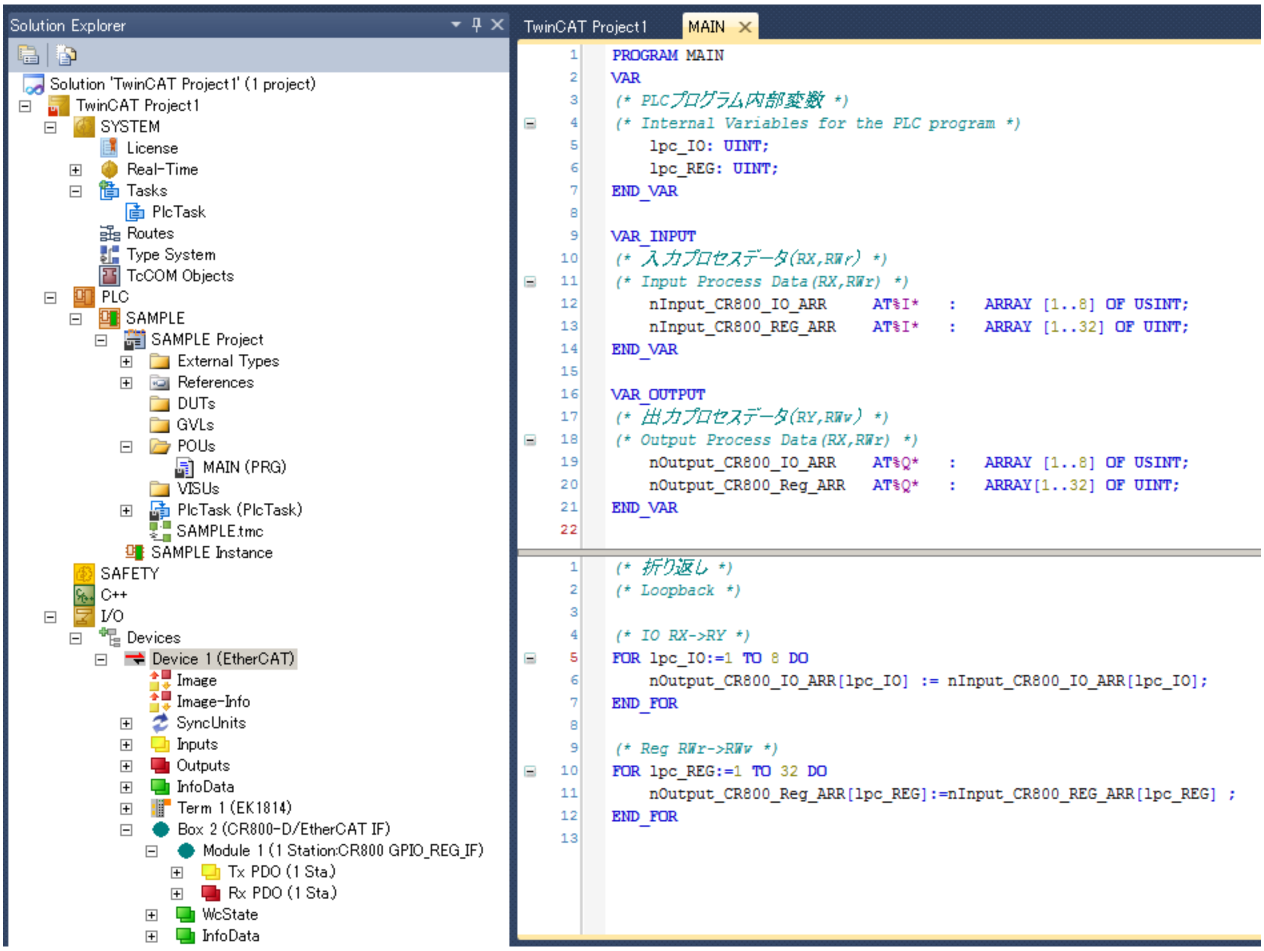
(Reference)

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".

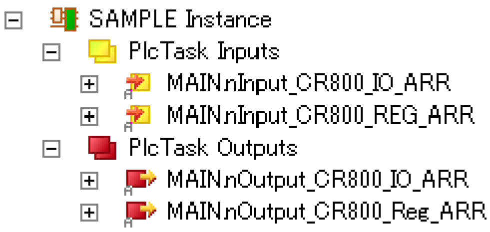
Add the description of the program (main) in POU in the project.



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.



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.

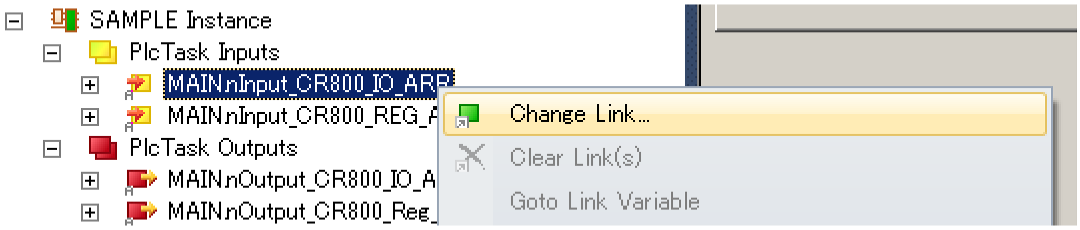
PLC program variable	**CR800-D process data (I/O, register area)**	
Array[(Start element)...(End element)]	Start	End
nInput_CR800_IO_ARR[1..8]	RX(6000-6007)	RX(6056-6063)
nInput_CR800_REG_ARR[1..32]	RWr(6000)	RWr(6031)
nOutput_CR800_IO_ARR[1..8]	RY(6000-6007)	RY(6056-6063)
nOutput_CR800_Reg_ARR[1..32]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

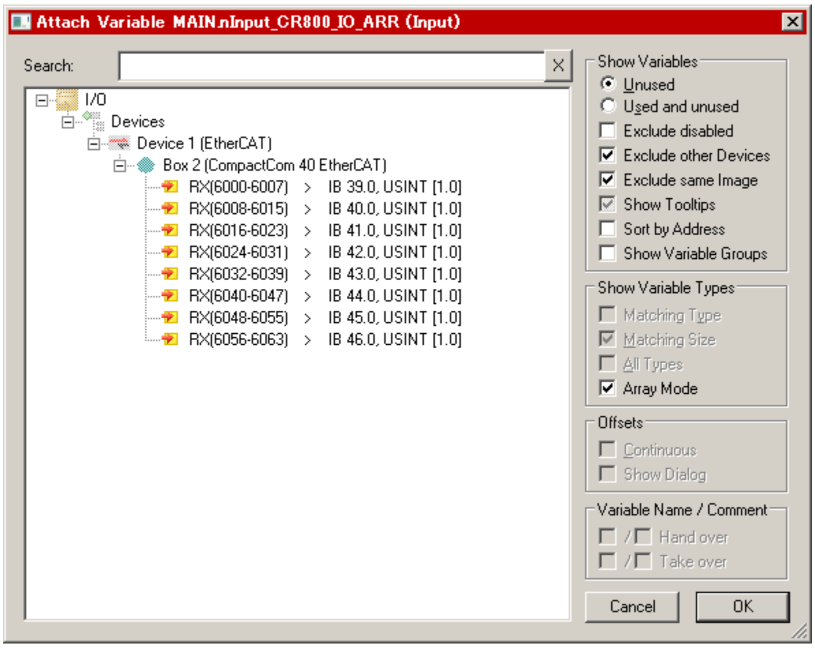
a) Linking the byte data input to PLC with the process data RX

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.



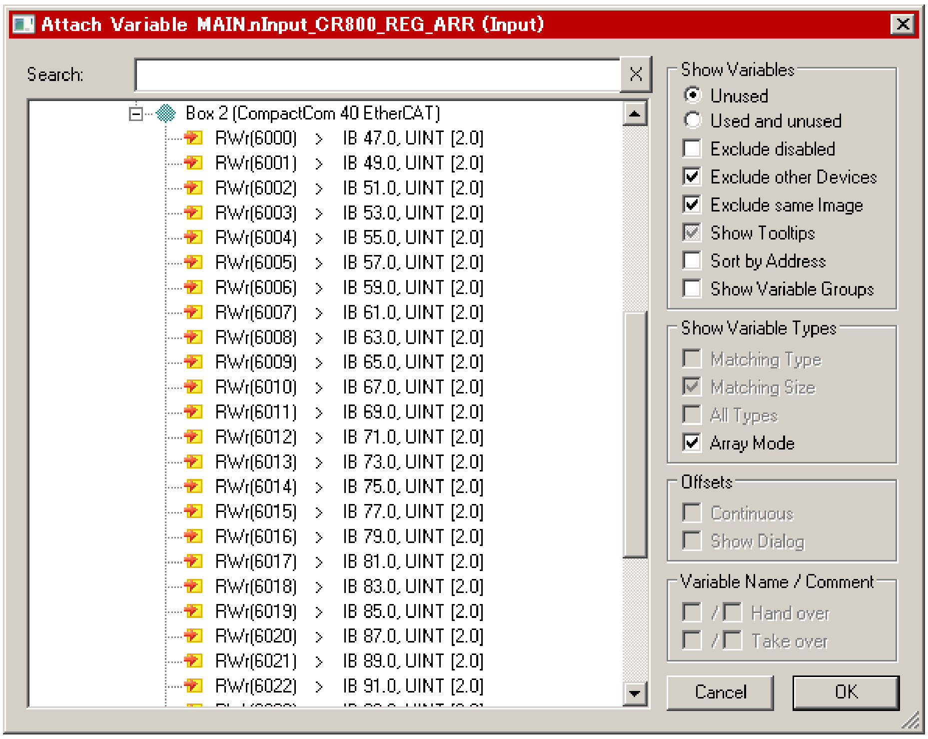
In the above window, select RX (6056-6063) to RX (6000-6007) in a batch, and click [OK].
(Note: "Array Mode" must be checked (for assigning arrays to multiple variables in a batch.))

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.

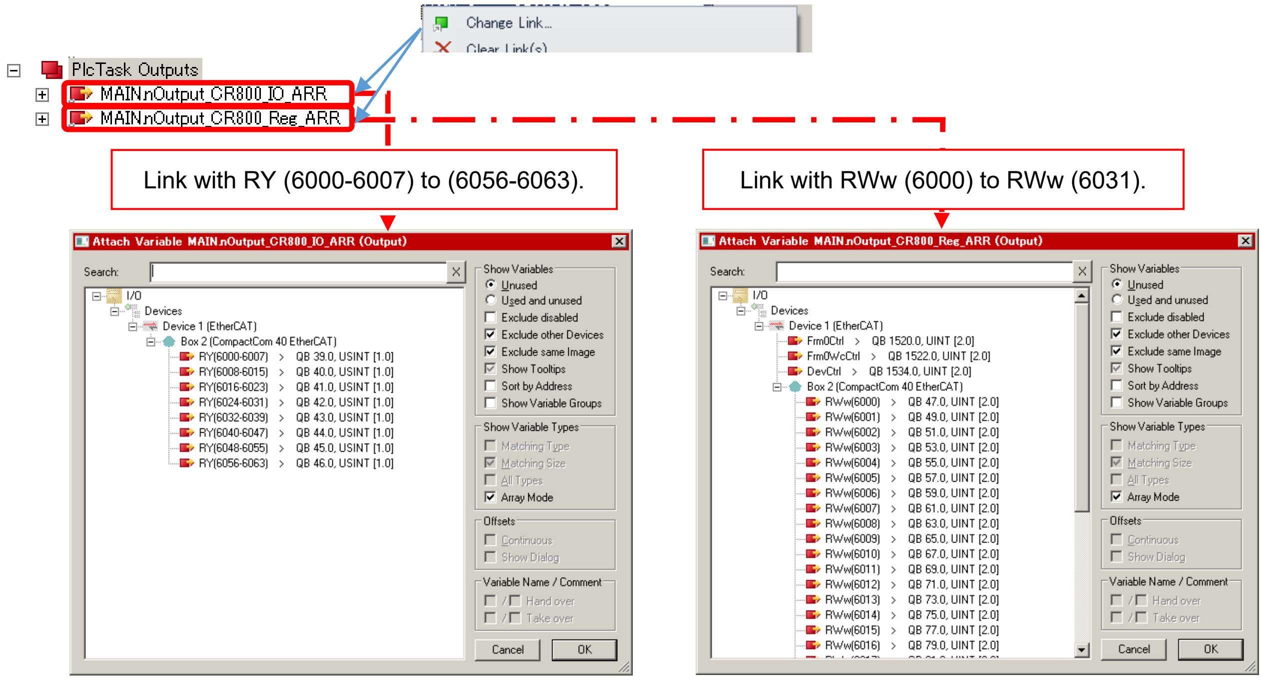
Use "Change Link" in the context menu of the MAIN.nInput_CR800_REG_ARR node for operation (refer to the following).

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.))

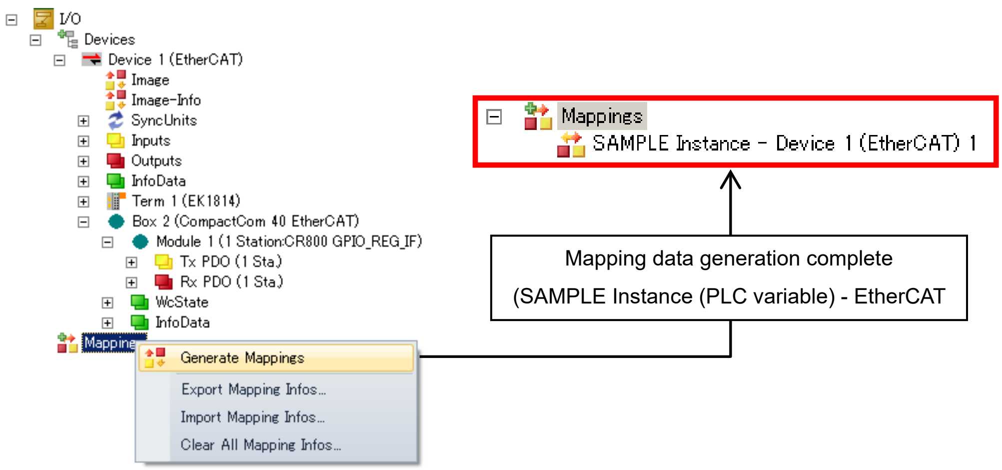
With the same method as the assignment for the input, link data with RY and RWw using the Change Link context menu.



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.)

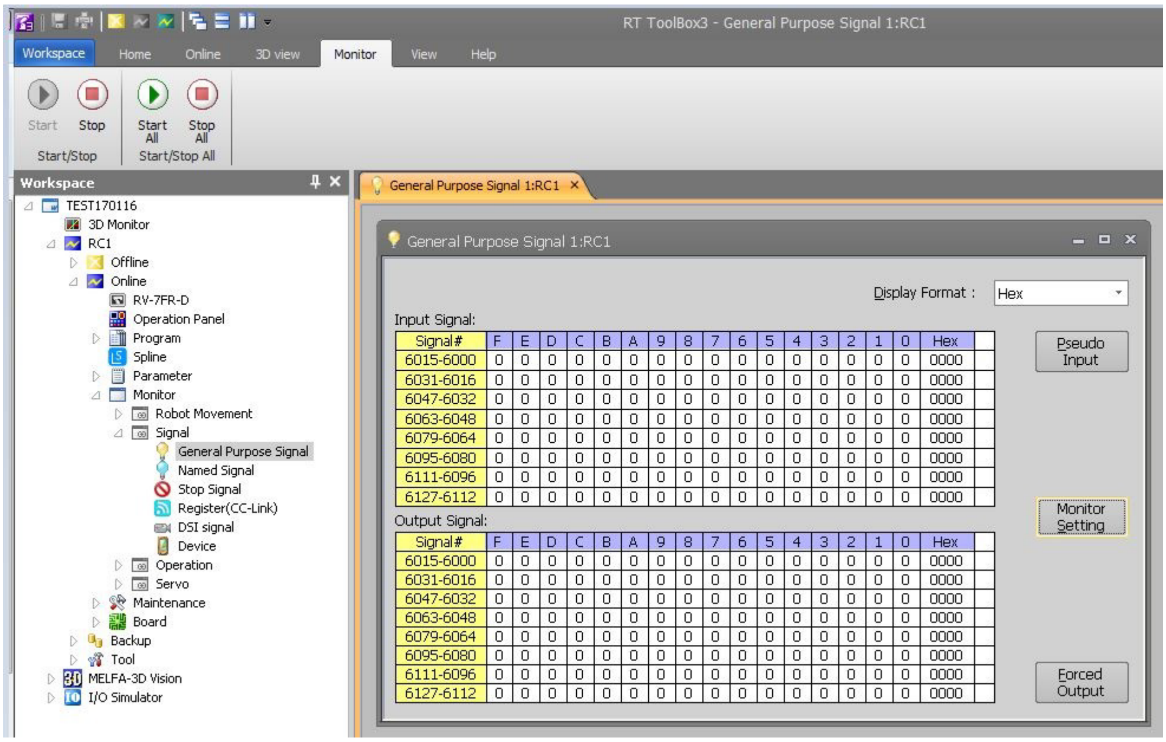
CC-Link IE Field

9.2. Checking the I/O Signals

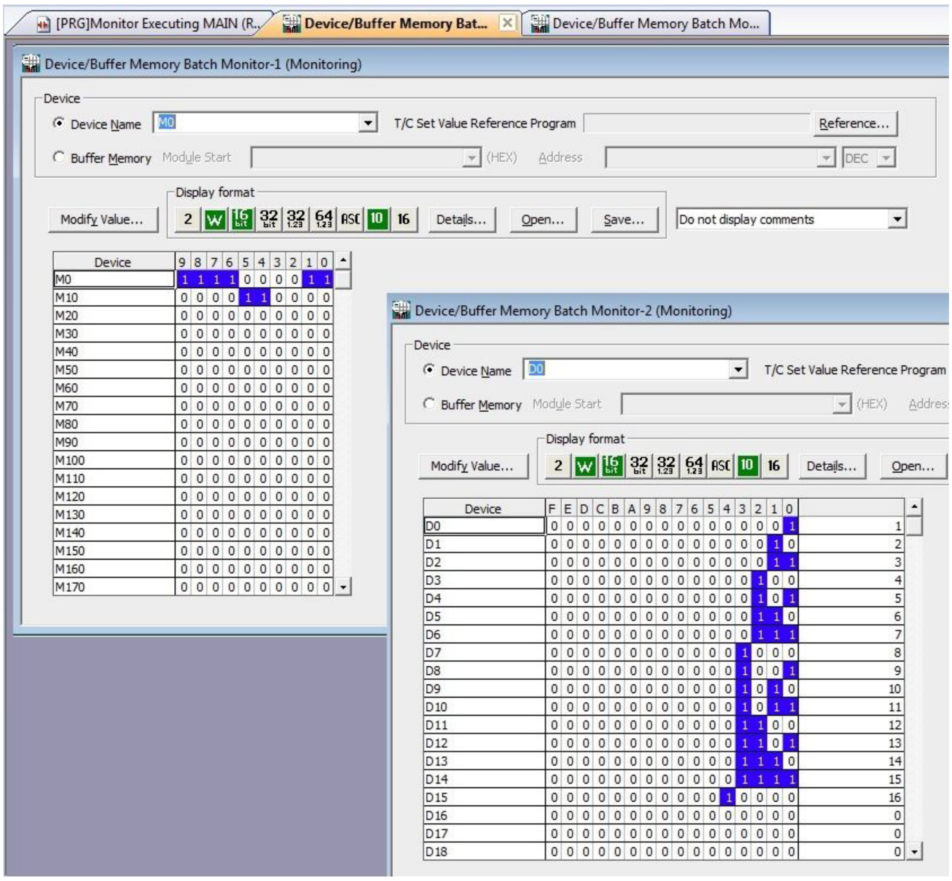
9.2.1. For the CC-Link IE Field module

Check the exchange of I/O signals using RT ToolBox3 and the GX Works2 monitor screen.

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

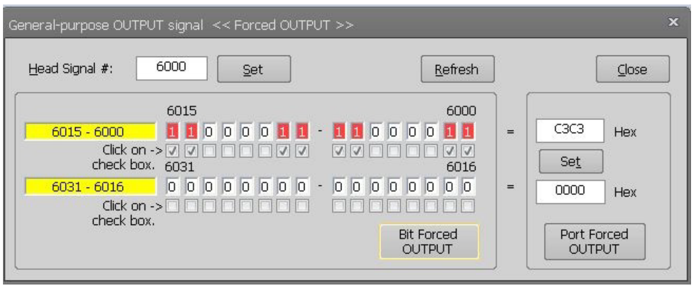


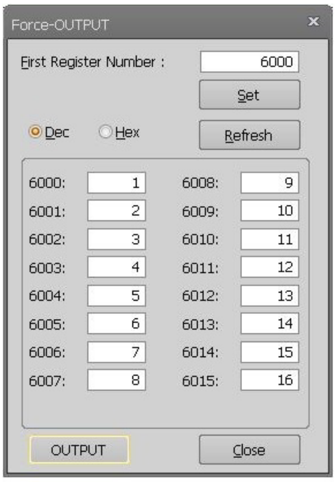
(2) Start "Device/Buffer Memory Batch Monitor" in GX Works2.
Select [Online] - [Monitor] - [Device/Buffer Memory Batch] to open the window and specify the beginning (M0/M2000/D0/D200) of the device name to be monitored. Multiple monitors can be started at the same time and pressing the [F3] key starts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



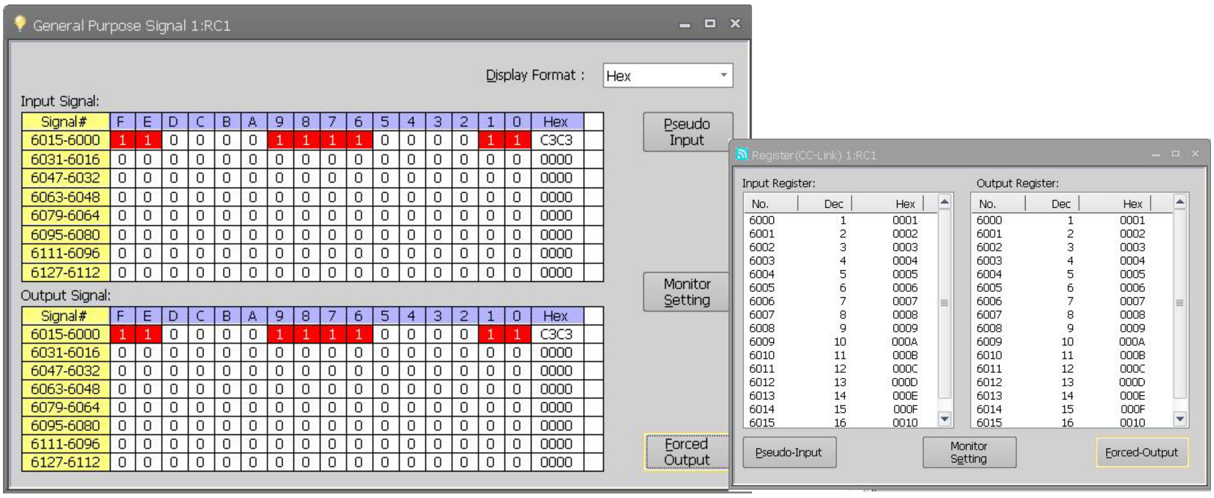
(3) Click the [Forced Output] button on the "General Purpose Signal" monitor or "Register(CC-Link)" monitor in RT ToolBox3 to perform an output test.

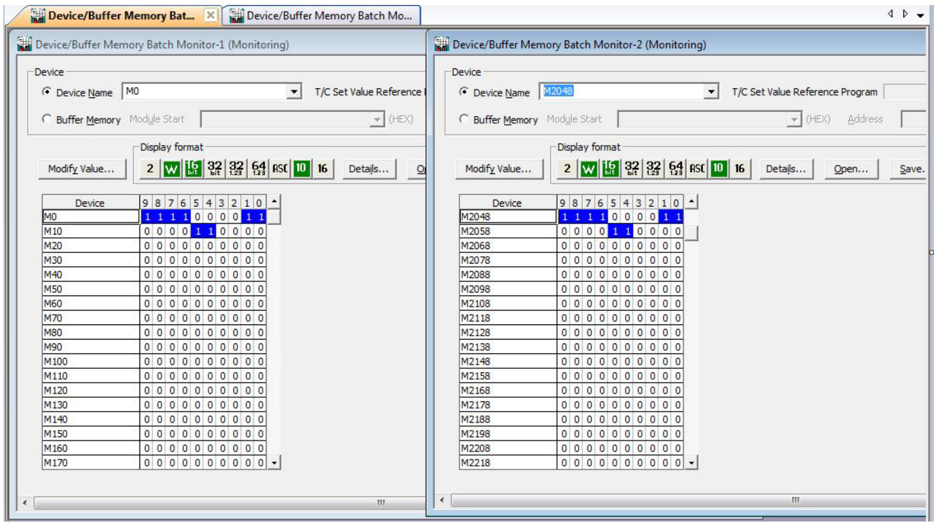
Forced output of the output signal and output register in the monitor window.

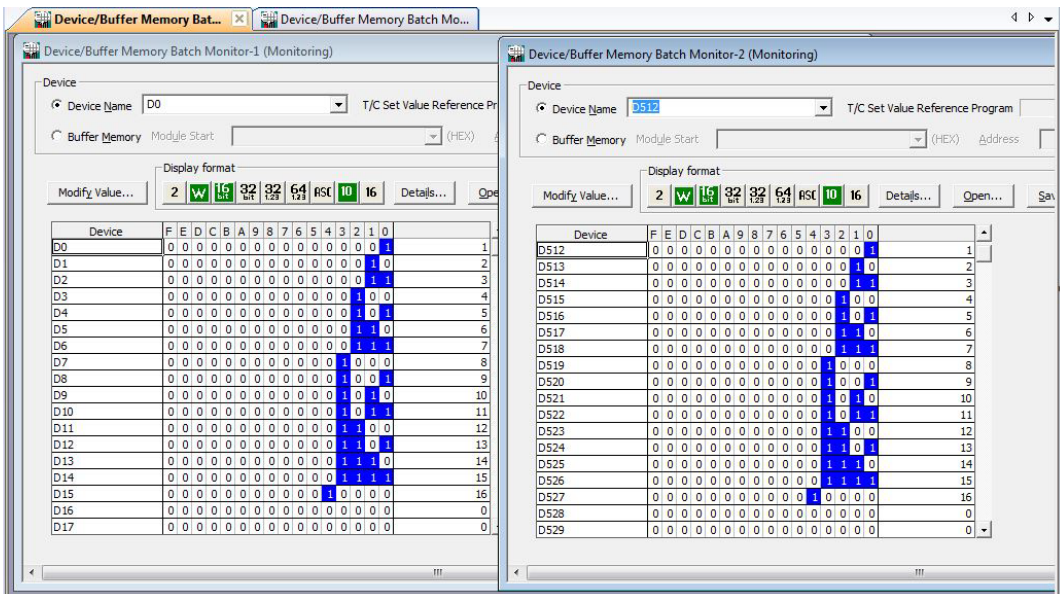




(4) Confirm that the output from the robot is looped back in the PLC side and stored in the input of the robot.







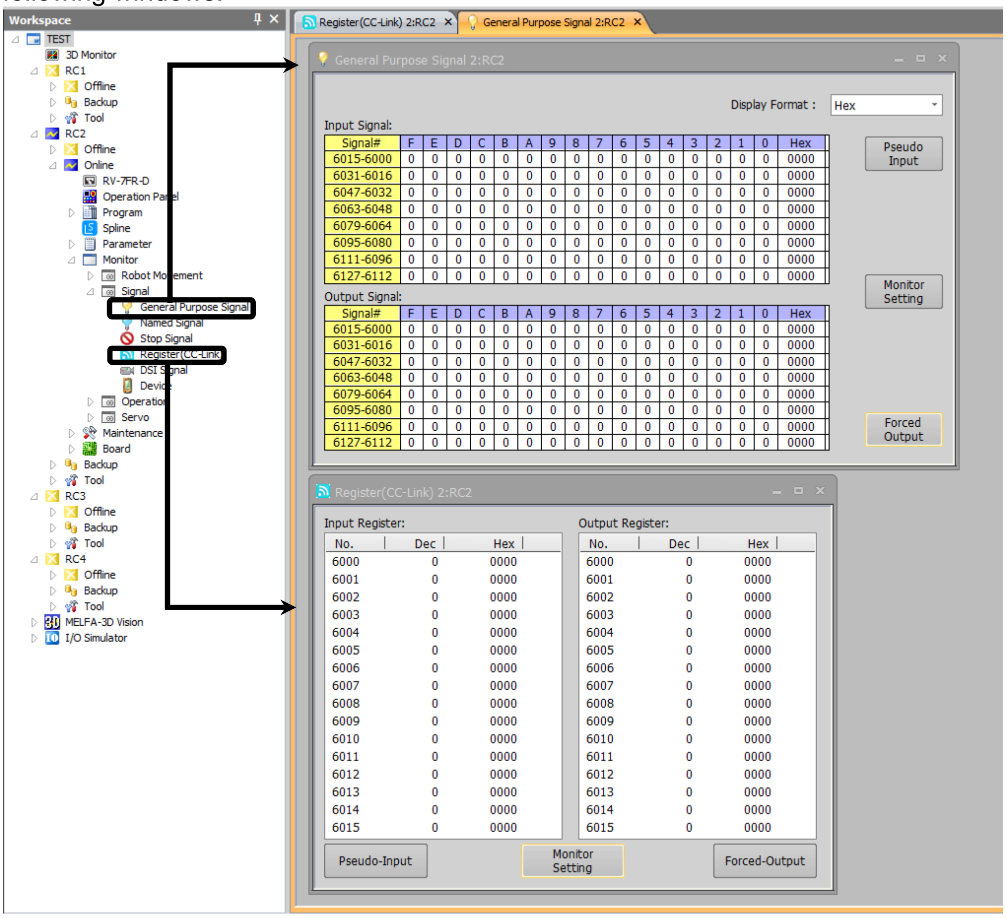
9.2.2. For the EtherCAT

EtherCAT

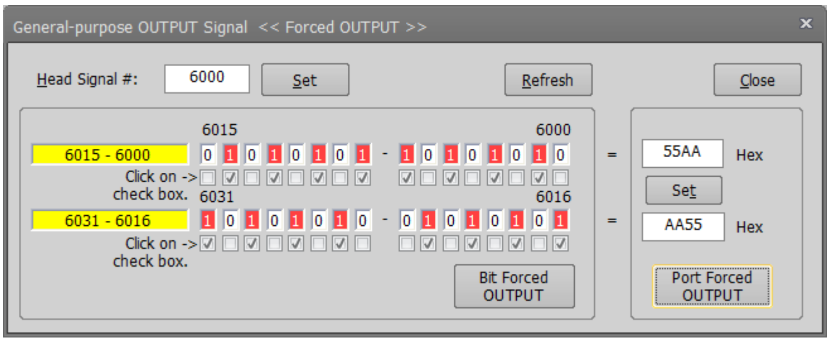
Use RT ToolBox3 and TwinCAT XAE.

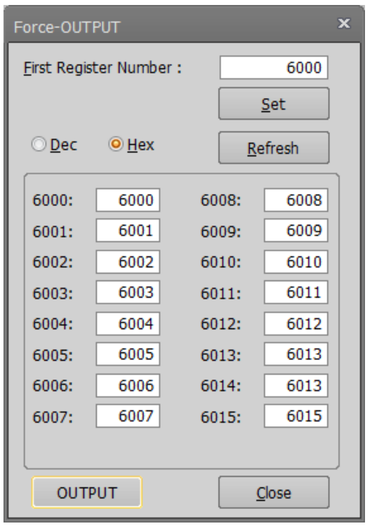
(1) Click the [Forced Output] button on the "General Purpose Signal" monitor and "Register" monitor in RT ToolBox3 to perform an output test.

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

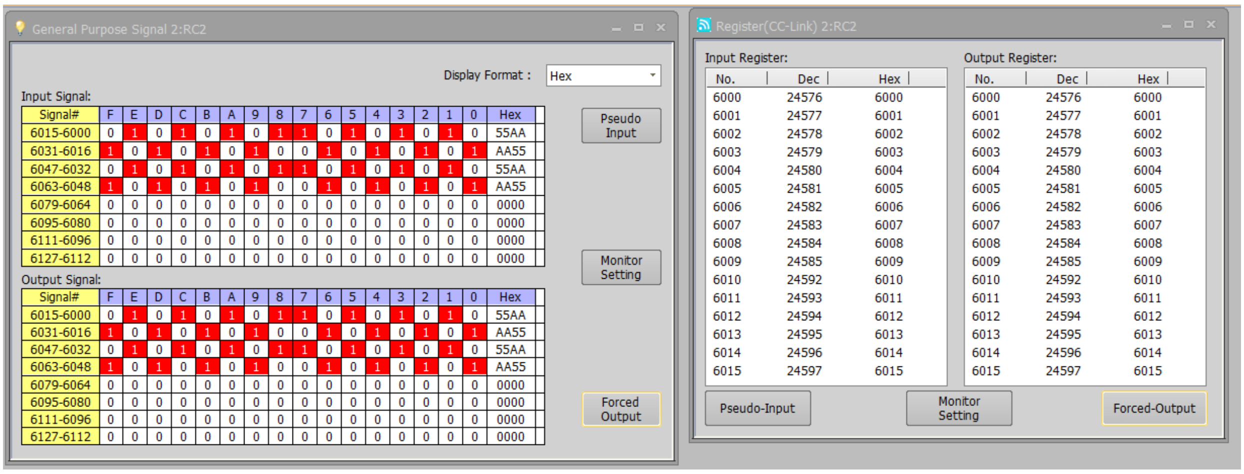


ii) Press the "Forced Output" button on each window, and display the following windows. Then, output an appropriate signal.

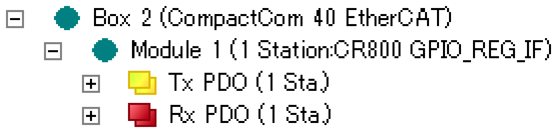




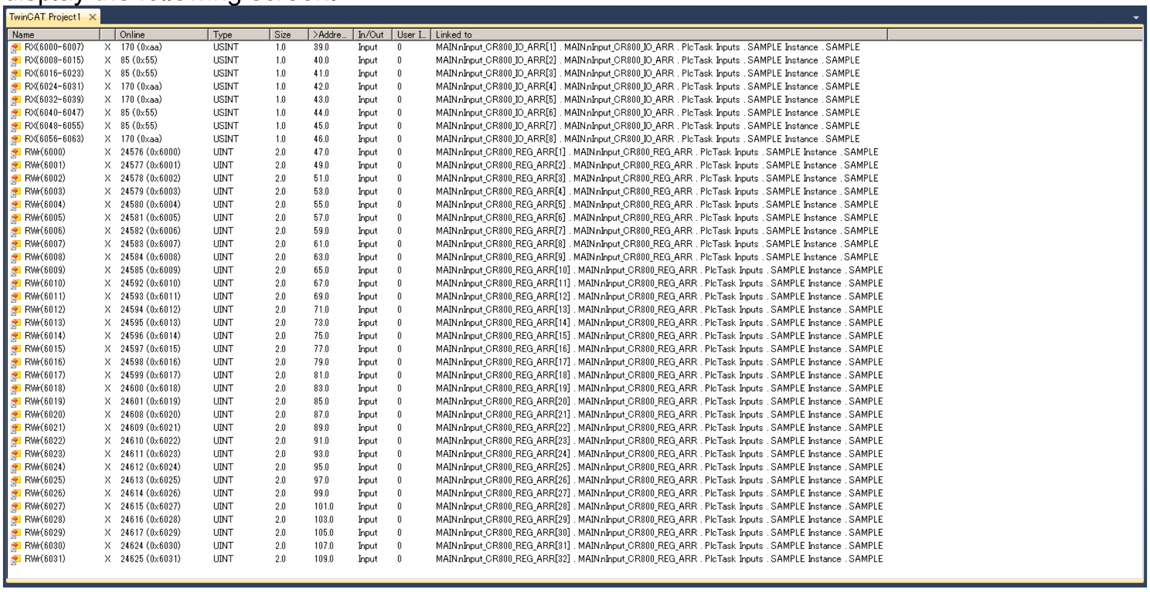
(2) Confirm that the values of general signals and registers are looped back.



(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.

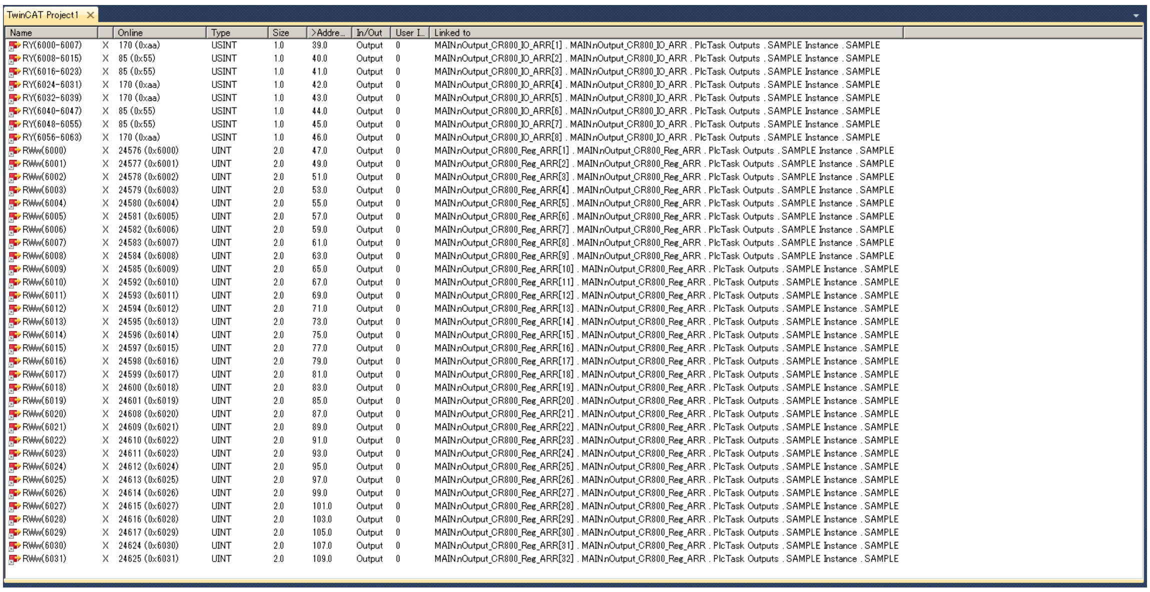


To confirm the output (RX, RWr) from the CR800-D (input value to the PLC), double-click "Tx PDO" to display the following screen.


TwinCAT Project1

Name		Online	Type	Size	>Addre...	In/Out	User I...	Linked to
RX(6000-6007)	X	170 (0xaa)	USINT	1.0	39.0	Input	0	MAIN.nInput_CR800_IO_ARR[1] . MAIN.nInput_CR800_IO_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RX(6008-6015)	X	85 (0x55)	USINT	1.0	40.0	Input	0	MAIN.nInput_CR800_IO_ARR[2] . MAIN.nInput_CR800_IO_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RX(6016-6023)	X	85 (0x55)	USINT	1.0	41.0	Input	0	MAIN.nInput_CR800_IO_ARR[3] . MAIN.nInput_CR800_IO_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RX(6024-6031)	X	170 (0xaa)	USINT	1.0	42.0	Input	0	MAIN.nInput_CR800_IO_ARR[4] . MAIN.nInput_CR800_IO_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RX(6032-6039)	X	170 (0xaa)	USINT	1.0	43.0	Input	0	MAIN.nInput_CR800_IO_ARR[5] . MAIN.nInput_CR800_IO_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RX(6040-6047)	X	85 (0x55)	USINT	1.0	44.0	Input	0	MAIN.nInput_CR800_IO_ARR[6] . MAIN.nInput_CR800_IO_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RX(6048-6055)	X	85 (0x55)	USINT	1.0	45.0	Input	0	MAIN.nInput_CR800_IO_ARR[7] . MAIN.nInput_CR800_IO_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RX(6056-6063)	X	170 (0xaa)	USINT	1.0	46.0	Input	0	MAIN.nInput_CR800_IO_ARR[8] . MAIN.nInput_CR800_IO_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6000)	X	24576 (0x6000)	UINT	2.0	47.0	Input	0	MAIN.nInput_CR800_REG_ARR[1] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6001)	X	24577 (0x6001)	UINT	2.0	49.0	Input	0	MAIN.nInput_CR800_REG_ARR[2] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6002)	X	24578 (0x6002)	UINT	2.0	51.0	Input	0	MAIN.nInput_CR800_REG_ARR[3] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6003)	X	24579 (0x6003)	UINT	2.0	53.0	Input	0	MAIN.nInput_CR800_REG_ARR[4] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6004)	X	24580 (0x6004)	UINT	2.0	55.0	Input	0	MAIN.nInput_CR800_REG_ARR[5] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6005)	X	24581 (0x6005)	UINT	2.0	57.0	Input	0	MAIN.nInput_CR800_REG_ARR[6] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6006)	X	24582 (0x6006)	UINT	2.0	59.0	Input	0	MAIN.nInput_CR800_REG_ARR[7] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6007)	X	24583 (0x6007)	UINT	2.0	61.0	Input	0	MAIN.nInput_CR800_REG_ARR[8] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6008)	X	24584 (0x6008)	UINT	2.0	63.0	Input	0	MAIN.nInput_CR800_REG_ARR[9] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6009)	X	24585 (0x6009)	UINT	2.0	65.0	Input	0	MAIN.nInput_CR800_REG_ARR[10] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6010)	X	24592 (0x6010)	UINT	2.0	67.0	Input	0	MAIN.nInput_CR800_REG_ARR[11] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6011)	X	24593 (0x6011)	UINT	2.0	69.0	Input	0	MAIN.nInput_CR800_REG_ARR[12] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6012)	X	24594 (0x6012)	UINT	2.0	71.0	Input	0	MAIN.nInput_CR800_REG_ARR[13] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6013)	X	24595 (0x6013)	UINT	2.0	73.0	Input	0	MAIN.nInput_CR800_REG_ARR[14] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6014)	X	24596 (0x6014)	UINT	2.0	75.0	Input	0	MAIN.nInput_CR800_REG_ARR[15] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6015)	X	24597 (0x6015)	UINT	2.0	77.0	Input	0	MAIN.nInput_CR800_REG_ARR[16] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6016)	X	24598 (0x6016)	UINT	2.0	79.0	Input	0	MAIN.nInput_CR800_REG_ARR[17] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6017)	X	24599 (0x6017)	UINT	2.0	81.0	Input	0	MAIN.nInput_CR800_REG_ARR[18] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6018)	X	24600 (0x6018)	UINT	2.0	83.0	Input	0	MAIN.nInput_CR800_REG_ARR[19] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6019)	X	24601 (0x6019)	UINT	2.0	85.0	Input	0	MAIN.nInput_CR800_REG_ARR[20] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6020)	X	24608 (0x6020)	UINT	2.0	87.0	Input	0	MAIN.nInput_CR800_REG_ARR[21] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6021)	X	24609 (0x6021)	UINT	2.0	89.0	Input	0	MAIN.nInput_CR800_REG_ARR[22] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6022)	X	24610 (0x6022)	UINT	2.0	91.0	Input	0	MAIN.nInput_CR800_REG_ARR[23] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6023)	X	24611 (0x6023)	UINT	2.0	93.0	Input	0	MAIN.nInput_CR800_REG_ARR[24] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6024)	X	24612 (0x6024)	UINT	2.0	95.0	Input	0	MAIN.nInput_CR800_REG_ARR[25] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6025)	X	24613 (0x6025)	UINT	2.0	97.0	Input	0	MAIN.nInput_CR800_REG_ARR[26] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6026)	X	24614 (0x6026)	UINT	2.0	99.0	Input	0	MAIN.nInput_CR800_REG_ARR[27] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6027)	X	24615 (0x6027)	UINT	2.0	101.0	Input	0	MAIN.nInput_CR800_REG_ARR[28] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6028)	X	24616 (0x6028)	UINT	2.0	103.0	Input	0	MAIN.nInput_CR800_REG_ARR[29] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6029)	X	24617 (0x6029)	UINT	2.0	105.0	Input	0	MAIN.nInput_CR800_REG_ARR[30] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6030)	X	24624 (0x6030)	UINT	2.0	107.0	Input	0	MAIN.nInput_CR800_REG_ARR[31] . MAIN.nInput_CR800_REG_ARR . PlcTask Inputs . SAMPLE Instance . SAMPLE
RWr(6031)	X	24625 (0x6031)	UINT	2.0	109.0	Input	0	MAIN.nInput_CR800_REG_ARR[32] . MAIN.nInput_CR800_REG_ARR . PlcTask 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.


TwinCAT Project1

Name		Online	Type	Size	>Addre...	In/Out	User I...	Linked to
RY(6000-6007)	X	170 (0xaa)	USINT	1.0	39.0	Output	0	MAIN.nOutput_CR800_IO_ARR[1] . MAIN.nOutput_CR800_IO_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RY(6008-6015)	X	85 (0x55)	USINT	1.0	40.0	Output	0	MAIN.nOutput_CR800_IO_ARR[2] . MAIN.nOutput_CR800_IO_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RY(6016-6023)	X	85 (0x55)	USINT	1.0	41.0	Output	0	MAIN.nOutput_CR800_IO_ARR[3] . MAIN.nOutput_CR800_IO_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RY(6024-6031)	X	170 (0xaa)	USINT	1.0	42.0	Output	0	MAIN.nOutput_CR800_IO_ARR[4] . MAIN.nOutput_CR800_IO_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RY(6032-6039)	X	170 (0xaa)	USINT	1.0	43.0	Output	0	MAIN.nOutput_CR800_IO_ARR[5] . MAIN.nOutput_CR800_IO_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RY(6040-6047)	X	85 (0x55)	USINT	1.0	44.0	Output	0	MAIN.nOutput_CR800_IO_ARR[6] . MAIN.nOutput_CR800_IO_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RY(6048-6055)	X	85 (0x55)	USINT	1.0	45.0	Output	0	MAIN.nOutput_CR800_IO_ARR[7] . MAIN.nOutput_CR800_IO_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RY(6056-6063)	X	170 (0xaa)	USINT	1.0	46.0	Output	0	MAIN.nOutput_CR800_IO_ARR[8] . MAIN.nOutput_CR800_IO_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6000)	X	24576 (0x6000)	UINT	2.0	47.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[1] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6001)	X	24577 (0x6001)	UINT	2.0	49.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[2] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6002)	X	24578 (0x6002)	UINT	2.0	51.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[3] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6003)	X	24579 (0x6003)	UINT	2.0	53.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[4] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6004)	X	24580 (0x6004)	UINT	2.0	55.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[5] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6005)	X	24581 (0x6005)	UINT	2.0	57.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[6] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6006)	X	24582 (0x6006)	UINT	2.0	59.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[7] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6007)	X	24583 (0x6007)	UINT	2.0	61.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[8] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6008)	X	24584 (0x6008)	UINT	2.0	63.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[9] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6009)	X	24585 (0x6009)	UINT	2.0	65.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[10] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6010)	X	24592 (0x6010)	UINT	2.0	67.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[11] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6011)	X	24593 (0x6011)	UINT	2.0	69.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[12] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6012)	X	24594 (0x6012)	UINT	2.0	71.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[13] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6013)	X	24595 (0x6013)	UINT	2.0	73.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[14] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6014)	X	24596 (0x6014)	UINT	2.0	75.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[15] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6015)	X	24597 (0x6015)	UINT	2.0	77.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[16] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6016)	X	24598 (0x6016)	UINT	2.0	79.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[17] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6017)	X	24599 (0x6017)	UINT	2.0	81.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[18] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6018)	X	24600 (0x6018)	UINT	2.0	83.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[19] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6019)	X	24601 (0x6019)	UINT	2.0	85.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[20] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6020)	X	24608 (0x6020)	UINT	2.0	87.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[21] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6021)	X	24609 (0x6021)	UINT	2.0	89.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[22] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6022)	X	24610 (0x6022)	UINT	2.0	91.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[23] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6023)	X	24611 (0x6023)	UINT	2.0	93.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[24] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6024)	X	24612 (0x6024)	UINT	2.0	95.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[25] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6025)	X	24613 (0x6025)	UINT	2.0	97.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[26] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6026)	X	24614 (0x6026)	UINT	2.0	99.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[27] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6027)	X	24615 (0x6027)	UINT	2.0	101.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[28] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6028)	X	24616 (0x6028)	UINT	2.0	103.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[29] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6029)	X	24617 (0x6029)	UINT	2.0	105.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[30] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6030)	X	24624 (0x6030)	UINT	2.0	107.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[31] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE
RWw(6031)	X	24625 (0x6031)	UINT	2.0	109.0	Output	0	MAIN.nOutput_CR800_Reg_ARR[32] . MAIN.nOutput_CR800_Reg_ARR . PlcTask Outputs . SAMPLE Instance . SAMPLE

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

9.3. Execution of robot program

9.3.1. 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 9-2 Setting the dedicated input/output

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		

9.3.2. General-purpose input/output

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.

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

```
*LBL1:If M_In(6008) = 0 Then GoTo *LBL1
M1 = M_Inb(6000)
M_Out(6009) = 1
*LBL2:If M_In(6008) = 1 Then GoTo *LBL2
M_Out(2009) = 0
Select M1
  Case 1
    GoSub *LOAD
    break
  Case 2
    GoSub *UNLOAD
    break
  Case 3
    GoSub *GOHOME
    break
End Select
End
*LOAD
    :
Return
*UNLOAD
    :
Return
*GOHOME
    :
Return
```

Input No. 6008 and output No. 6009 are used as interlocks.
Refer to "4.3.6 Specifications related to Robot language" for details on the interlock.

When M1(*1) is 1, jumps to the label *LOAD line.

When M1(*1) is 2, jumps to the label *UNLOAD line.

When M1(*1) is 3, jumps to the label *GOHOME line.

(*1) M1 is byte data received via CC-Link IE Field.
(Refer to the second line of the program.)

Describe the process in the label *LOAD.

Describe the process in the label *UNLOAD.

Describe the process in the label *GOHOME.

9.3.4. Sample program for input/output confirmation

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

Table 9-3 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.

Note: The signal assignment conditions are as follows for EtherCAT.

EtherCAT

Robot side input (master station output)	Input 6000 to 6255 (32 bytes)
Robot side output (master station input)	Output 6000 to 6255 (32 bytes)

10. TROUBLESHOOTING

CC-Link IE Field EtherCAT

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

10.1. 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 10-1 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.

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.
H.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.

11. APPENDIX

CC-Link IE Field **EtherCAT**

11.1. 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 or 2F-DQ535-EC 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.**

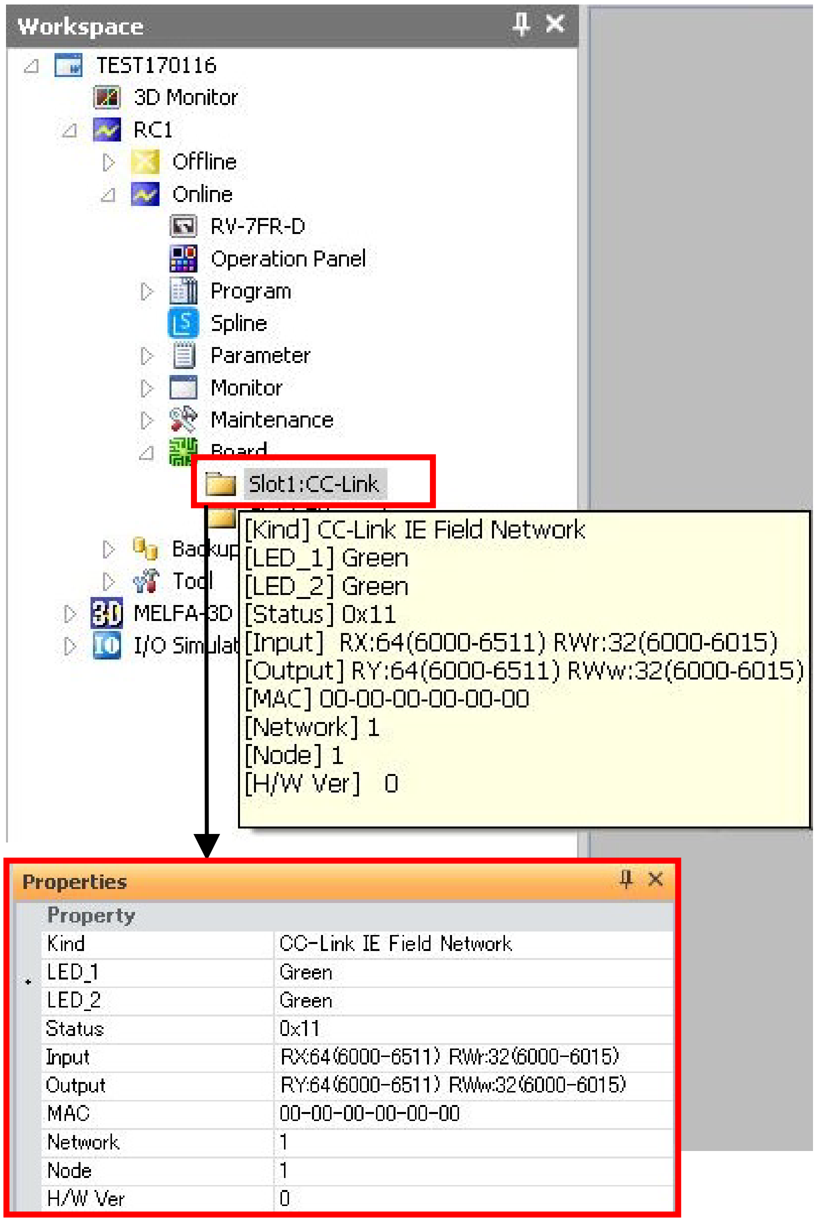


Figure 11-1 Example of option card information display on RT ToolBox3 (CC-LINK IE Field)

The following items are displayed according to the network type.

CC-Link IE Field

For the CC-Link IE Field module

Table 11-1 2F-DQ535 card information(For CC-Link IE Field module)

Display item		Display example	Meaning	Remarks
Card name		Network Base (2F-DQ535)	Card name	* CC-Link is displayed as of April 2016. (For monitoring with RT ToolBox3)
Card information	[Kind]	CC-Link IE Field	Name of Anybus-CC module on network base card	
	[LED_1]	Green	Module Status LED status	
	[LED_2]	Green	Network Status LED status	
	[Input]	RX: 16 (6000 - 6127) RWr: 16 (6000 - 6063)	Number of received bytes (signal number)	Up to 256 bytes in total of the input bit RX and input register RWr
	[Output]	RY: 16 (6000 - 6127) RWw: 16 (6000 - 6063)	Number of send bytes (signal number)	Up to 256 bytes in total of the output bit RY and output register RWw
	[Status]	0	Network status	* Not supported as of April 2016, always 0
	[MAC Address]	**-**-**-**-**-**	MAC address	* Not supported as of April 2016, always 0
	[H/W Ver]	0	Card group number	0: G51 to 6: G57 7: Use prohibited

For the EtherCAT module

EtherCAT

Table 11-2 2F-DQ535-EC card information (For EtherCAT module)

Display item		Display example	Meaning	Remarks
Card name		Network Base (2F-DQ535-EC)	Card name	
Card information	[Kind]	EtherCAT	Name of Anybus-CC module on network base card	
	[ESM State]	Init Boot PreOp SafeOp Op	Status of the EtherCAT slave represented as character strings	
	[H/W Ver]	0	Card group number	0: G51 to 6: G57 7: Use prohibited

CC-Link IE Field EtherCAT

11.2. 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 (2F-DQ535 or 2F-DQ535-EC) status	Condition	Usability
1	Not mounted		×
2	Mounted	Network cable not connected	●
3		Network cable connected, but a communication error occurring	●
4		In normal communication	●

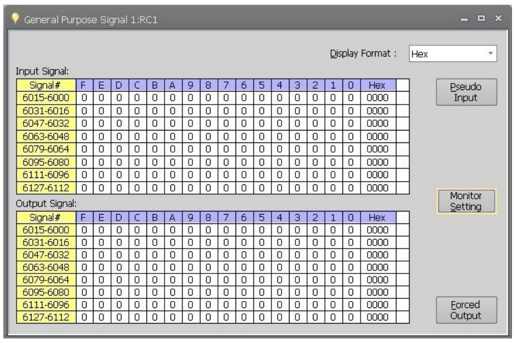
● indicates usable, and × indicates not usable.

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

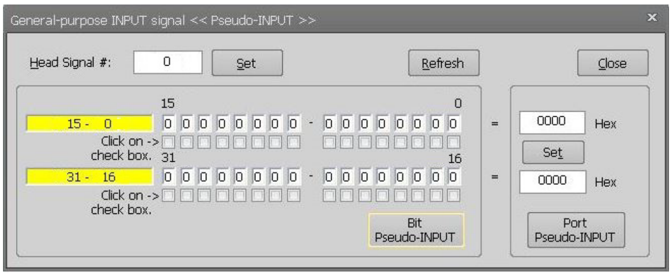
<Usage method>

(1) Start RT ToolBox3.

(2) Click [Online] - [Monitor] - [Signal Monitor] - [General Signals] in the work space tree, and start the general-purpose signal monitor.

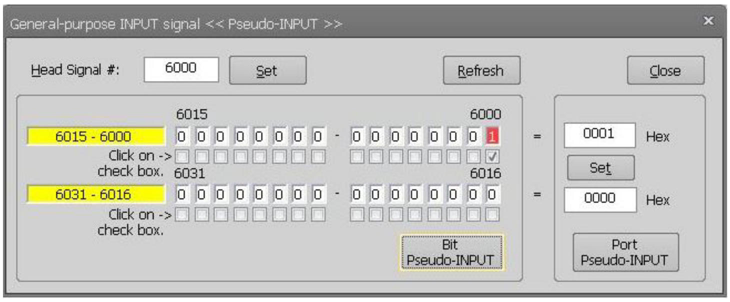


(3) Click the [Pseudo-input] button.



(4) Input the signal number (6000 or higher) in the "Head signal #" field and click the [Set] button.

(5) Select the check box for the signal to be input, and click the [Bit pseudo INPUT] button.



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