CKD

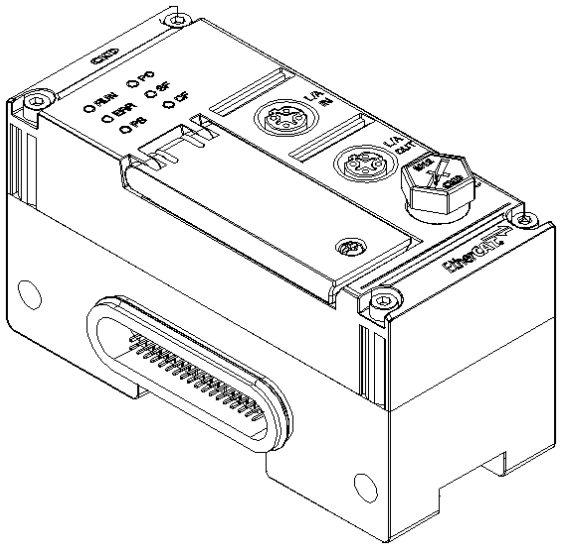
Remote I/O

RT Series

EtherCAT® Compatible Device unit

INSTRUCTION MANUAL

SM-A46343-A/3



- Read this Instruction Manual before using the product.
- Read the safety notes carefully.
- Keep this Instruction Manual in a safe and convenient place for future reference.

CKD Corporation

PREFACE

Thank you for purchasing CKD's "**RT Series**". This Instruction Manual contains basic matters such as installation and usage instructions in order to ensure optimal performance of the product. Please read this Instruction Manual thoroughly and use the product properly.
Keep this Instruction Manual in a safe place and be careful not to lose it.

Product specifications and appearances presented in this Instruction Manual are subject to change without notice.

- This product is intended to be used by persons with sufficient knowledge and experience in the following areas.
  CKD shall not be responsible for accidents caused by persons who selected or used the product without knowledge or sufficient training with respect to them.
  - Electricity (qualified electrician or equivalent)
  - The industrial network communications used
  - FA systems in general
  - Each of the systems that use manifold solenoid valves, IO-Link, etc.
- Since there are a wide variety of customer applications, it is impossible for CKD to be aware of all of them.
  Depending on the application or usage, the product may not be able to exercise its full performance or an accident may occur. It is the responsibility of the customer to check the product specifications and decide how the product shall be used in accordance with the application and usage.

SAFETY INFORMATION

When designing and manufacturing any device incorporating the product, the manufacturer has an obligation to ensure that the device is safe. To that end, make sure that the safety of the machine mechanism of the device, the pneumatic or water control circuit, and the electric system that controls such mechanism is ensured.

To ensure the safety of device design and control, observe organization standards and relevant laws and regulations, which include the following:

ISO4414, JIS B8370, JFPS2008 (the latest edition of each standard),
the High Pressure Gas Safety Act, Industrial Safety and Health Act, other safety rules, organization standards, and relevant laws and regulations.

In order to use our products safely, it is important to select, use, handle, and maintain the products properly.
Observe the warnings and precautions described in this Instruction Manual to ensure device safety.

Although various safety measures have been adopted in the product, improper handling may lead to an accident. To avoid this:

Thoroughly read and understand this Instruction Manual before using the product.

To explicitly indicate the severity and likelihood of potential harm or damage, precautions are classified into three categories: "DANGER", "WARNING", and "CAUTION".

⚠ **DANGER**	Indicates an imminent hazard. Improper handling will cause death or serious injury to people.
⚠ **WARNING**	Indicates a potential hazard. Improper handling may cause death or serious injury to people.
⚠ **CAUTION**	Indicates a potential hazard. Improper handling may cause injury to people or damage to property.

Precautions classified as "CAUTION" may still lead to serious results depending on the situation.
All precautions are equally important and must be observed.

Other general precautions and tips on using the product are indicated by the following icon.

	Indicates general precautions and tips on using the product.

Precautions on Product Use

⚠ DANGER

Do not use the product for the following applications:

- Medical devices involved in sustaining or managing people's lives or physical health
- Mechanisms and mechanical devices used for the purpose of moving and transporting people
- Important safety parts for mechanical devices

⚠ WARNING

The product must be handled by a qualified person who has extensive knowledge and experience.

The product is designed and manufactured as a device or part for general industrial machinery.

Use the product within the specifications.

The product must not be used beyond its specifications.

This product is intended for use in general industrial machinery, equipment or parts. It is not intended for use outdoors (except for products with outdoor specifications) or for use under the following conditions or environments.

- Use for applications where safety is required
- In applications for nuclear power, railroad systems, aviation, ships, vehicles, and medical equipment
- In applications for equipment that directly touches beverages or food
- For safety measures for amusement equipment, emergency shut-off circuits, press machines, or brake circuits
- Use for applications where life or assets could be significantly affected, and special safety measures are required

(An exception will be made if the customer consults with CKD prior to use and understands the specifications of the product. However, even in that case, safety measures must be taken to avoid danger in case of a possible failure.)

Never modify or additionally machine this product.

These may cause failure or malfunction. In addition, they are not covered by our warranty.

Do not handle the product or remove pipes and devices until safety is confirmed.

The product may operate in an unexpected way, causing injury to people or damage to equipment.

- Inspect and service the machine and devices only after confirming the safety of the entire system. Also, turn off the energy source (air supply or water supply) and power to the relevant facility. Release compressed air from the system and use extreme care to avoid water or electric leakage.
- Since there may be hot or live parts even after operation has stopped, use extreme care when handling the product or removing pipes and devices.
- When starting or restarting a machine or device that has pneumatic components, make sure that a safety measure (such as a pop-out prevention mechanism) is in place and system safety is secured.

Observe the warnings and cautions on the following pages to prevent accidents.

⚠ CAUTION

Use the product in a specified manner.

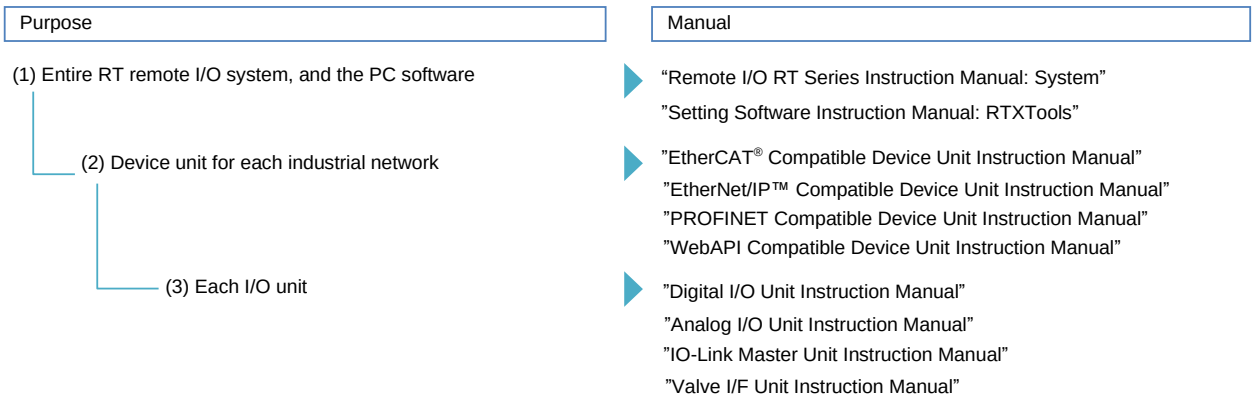
If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

CONTENTS

INSTRUCTION MANUAL FOR THIS PRODUCT

The manuals related to the Remote I/O RT Series are separated by purpose as follows.
(1) Entire RT Remote I/O system, and the PC software
(2) Device unit for each industrial network
(3) Each I/O unit

"Remote I/O RT Series Instruction Manual: System Construction" is mandatory. Other manuals are not mandatory but must be referred to according to the units used.



List of Related Instruction Manuals

Instruction Manual No.	Instruction Manual name	Description
SM-A46342-A	Remote I/O RT Series Instruction Manual: System Construction	Instruction manual for the entire remote I/O RT Series system Includes explanations of the PC software RTXTools, the power supply unit RT-XP24A01N, and the End unit RT-XEE☐N00N.
SM-A90084-A	Setting software Instruction Manual: RTXTools	Instruction manual for RTXTools: setting software
SM-A46343-A	EtherCAT® Compatible Device Unit Instruction Manual (this manual)	Instruction manual for the EtherCAT compatible device unit RT-XTECN00N
SM-A71112-A	EtherNet/IP™ Compatible Device Unit Instruction Manual	Instruction manual for the EtherNet/IP compatible device unit RT- XTENN00N
SM-A87934-A	PROFINET Compatible Device Unit Instruction Manual	Instruction manual for the PROFINET compatible device unit RT-XTEPN00N
SM-A95119-A	WebAPI Compatible Device Unit Instruction Manual	Instruction manual for the WebAPI compatible device unit RT-XTEAN00N
SM-A46344-A	IO-Link Master Unit Instruction Manual	Instruction manual for the IO-Link master unit RT-XLMSA08N
SM-A46345-A	Digital I/O Unit Instruction Manual	Instruction manual for the digital I/O unit RT-X☐DG☐☐☐☐
SM-A46347-A	Analog I/O Unit Instruction Manual	Instruction manual for the analog I/O unit RT-X☐AGA0 2N
SM-A46346-A	Valve I/F Unit Instruction Manual	Instruction manual for the valve I/F unit TVG☐P-TB-☐-KA1☐

Always read the instruction manual for each product connected to the remote I/O RT Series.
The product types that can be connected are:
- Upper MDevice units in each industrial network (connected to a device unit)
- IO-Link devices (connected to the IO-Link master unit)
- Manifold solenoid valves (connected to the valve I/F unit)
- Other sensors/actuators (connected to a digital I/O unit, analog I/O unit, or IO-Link master unit)

	A video is available to show how to assemble the units, install the software, and how the LEDs blink. If necessary, refer to the video at the following URL RT product page: https://www.ckd.co.jp/kiki/en/product/detail/1064	

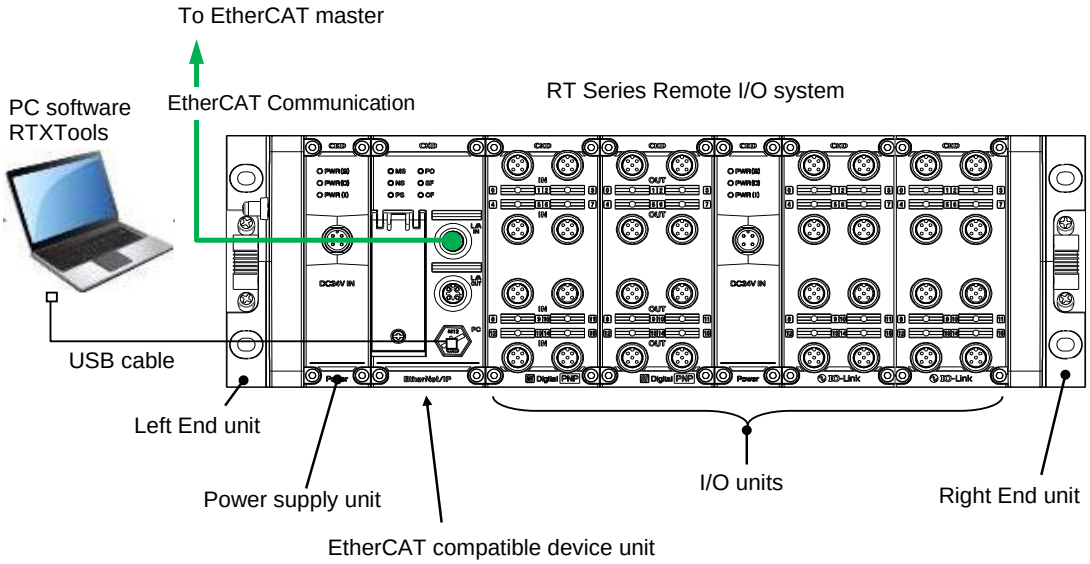
TERMS RELATED TO THE ETHERCAT COMPATIBLE DEVICE UNIT

Term	Definition
ESI file	An information file for the EtherCAT SubDevice. An XML file that describes the necessary identification, setting, and communication information of the EtherCAT SubDevice, such as the manufacturer and model number.
EtherCAT MDevice	The node that controls the network for EtherCAT.
EtherCAT SubDevice	A node that is subordinate to the MDevice in the network control of EtherCAT.
PDO	In EtherCAT, refers to the (soft) communication path when cyclic communication is performed. This specifies which SubDevice object to enter. PDO stands for Process Data Objects.
PDO entry	The object of the SubDevice that has been entered by the PDO (subjected to cyclic communication). For editable PDOs, objects in SubDevices can be added/removed from the PDO.
PDO mapping	The mapping (assignment) of objects in SubDevices to PDOs for cyclic communication with the upper MDevice.
PDO communication	Process data communication. A type of EtherCAT communication using PDOs that exchange information cyclically. Also called "PDO communication".
SDO communication	Service data object communication. A type of EtherCAT communication using SDOs that distribute information at an arbitrary timing. Also called "mailbox communication".
Sync mode	In EtherCAT communication, a mode that specifies whether or not to sync between the MDevice and SubDevices and which signals to synchronize. An EtherCAT compatible device unit supports the following two modes: - DC mode (synchronous with the Sync0 signal) - Free-run mode (async)
Object	A collection of data and parameters, with an abstract representation of a particular construct within a device.
Object dictionary	A data structure that contains descriptions of data type objects, communication objects, and application objects. Reading and writing is possible with SDO communication. In addition, the process data areas in this can be mapped (assigned) to PDO for PDO communication.
Service data object	CoE async mailbox communication, which can read and write to all object dictionaries.
Index	The address of an object.
Sub index	The sub address of an object.
Received PDO	The process data object received by the EtherCAT SubDevice.
Transmitted PDO	The process data object transmitted from an EtherCAT SubDevice.
MDP function	MDP stands for Modular Device Profile. If a single SubDevice is a modular (building block) type, the configuration of its interlinked modules (in the case of this unit, this is referred to as "I/O units") is managed as an EtherCAT system.
AL status function	AL stands for Application Layer. If the SubDevice cannot maintain the condition last requested from the MDevice, it notifies by AS Status register and writes the applicable error code to AL Status Code register. The upper MDevice can read the code and take action, such as continuing/stopping control.
Variable I/O unit	A unit in which the number of input/output bytes is variable. IO-Link master unit is explained as an example in this manual.

1. PRODUCT OVERVIEW

RT Series EtherCAT compatible device unit is a device unit in Remote I/O RT Series systems, supporting open network EtherCAT.
The device unit acts as an interface between the EtherCAT MDevice and each I/O unit.

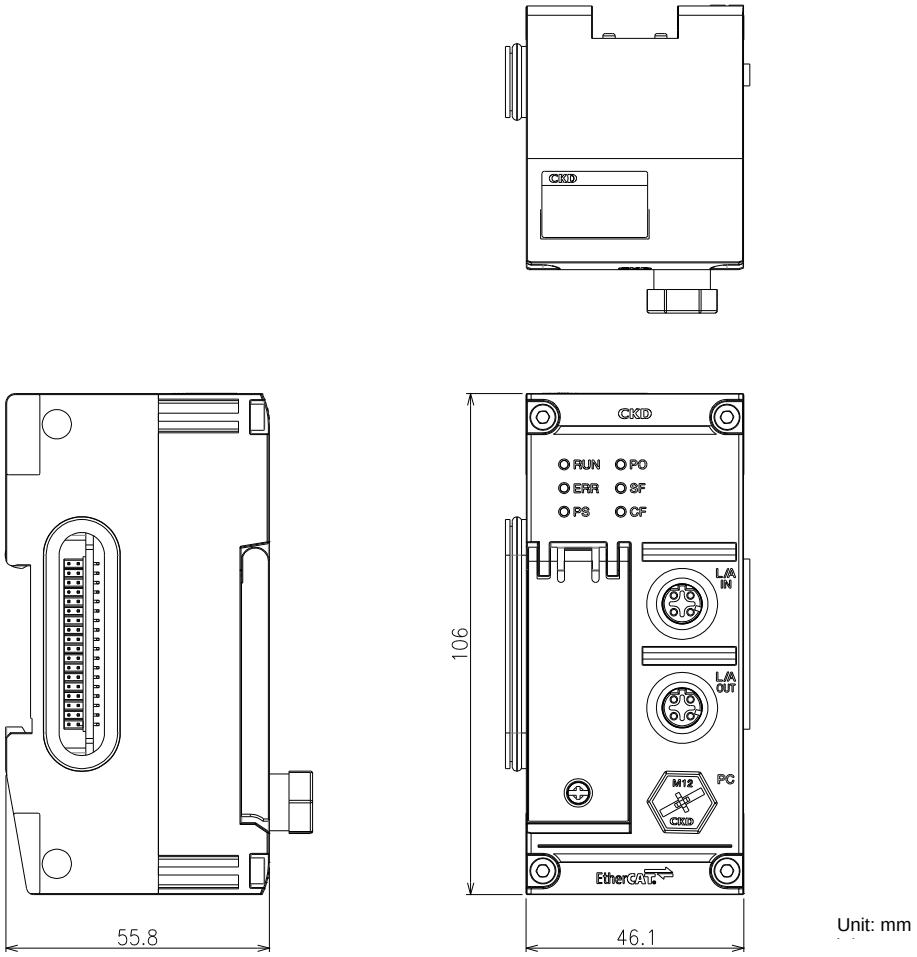
If connecting the PC software (free of charge) to the device unit via USB, it is possible to check the information and status of the entire Remote I/O RT Series system, and the settings and status of each unit.



1.1 Features

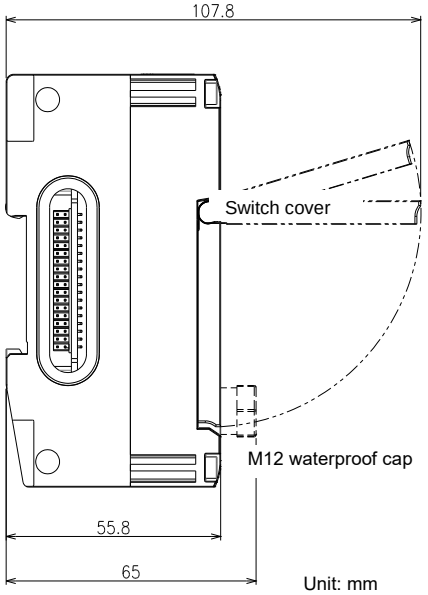
Features include:
- Supports both EtherCAT PDO communication (cyclic communication) and SDO communication (mailbox communication).
- Diagnostic information for connected units can be cyclically transmitted to the EtherCAT MDevice via PDO communication.
- Supports the EtherCAT Modular Device Profile (MDP) function.
- Supports the EtherCAT AL status function.
- Monitors the status of the internal power supply from the power supply unit (from among the power supply units on the left side toward the device unit, the closest power supply unit to itself is monitored).
- The output operation in the event of a communication error can be specified for the entire Remote I/O system.
- A device unit can log its own or connected I/O units' errors to its own non-volatile memory. In addition, it is possible to use the PC software to save the time series data to a file.

1.2 External Dimensions



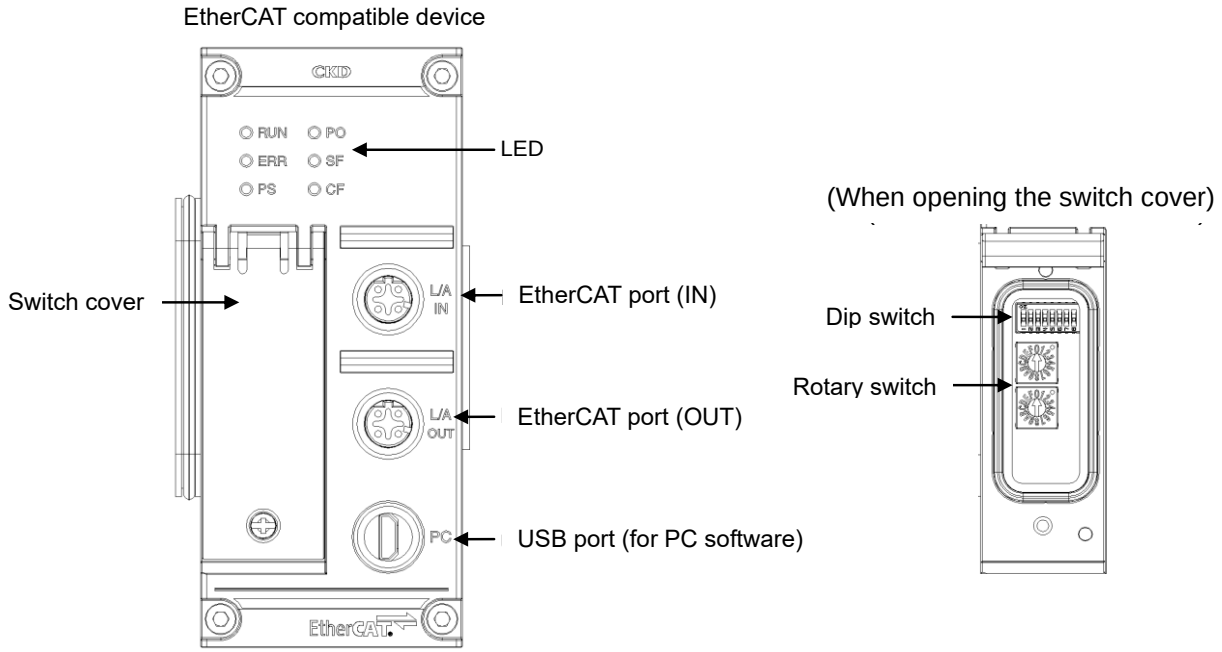
Unit: mm

(When opening the switch cover; when installing the M12 waterproof cap)



Unit: mm

1.3 Names and Functions of Each Part



■ LED

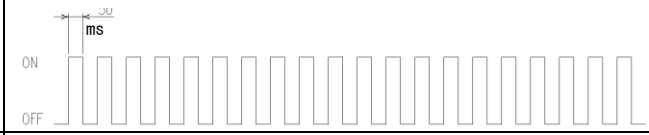
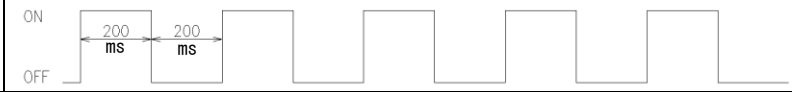
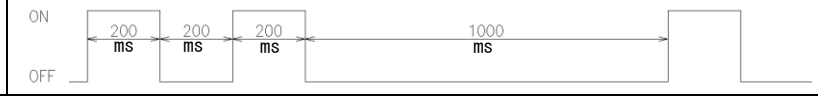
Specifications

LED name	Indication
RUN	Indicates the status of the EtherCAT State Machine.
ERR	Indicates an application watchdog timeout or local error.
L/A IN	Indicates the link status of the IN side of the connector.
L/A OUT	Indicates the link status of the OUT side of the connector.
PS	Indicates the 24 V power status for the unit/input.
PO	Indicates the 24 V power status for the output.
SF	Indicates the status of the entire Remote I/O system.
CF	Indicates a setting change or forced input/output.

Status list

Name	Status	Meaning
RUN	Off	Initializing
	Green blinking (fast)	Power is on but not in the initialization sequence
	Green blinking (slow)	Pre-operational
	Green blinking (once)	Safe operational
	Green on	Operational
ERR	Off	Normal
	Red blinking (slow)	Invalid Setting
	Red blinking (once)	Status change which has not been requested
	Red blinking (twice)	Communication error (application watchdog timeout)
L/A IN	Green blinking (fast)	LINK, ACTIVITY
	Green on	LINK, NO ACTIVITY
	Off	NO LINK, NO ACTIVITY
L/A OUT	Green blinking (fast)	LINK, ACTIVITY
	Green on	LINK, NO ACTIVITY
	Off	NO LINK, NO ACTIVITY
PS	Red blinking (fast)	Unit/input voltage is outside the range of 24 V ± 25%
	Yellow on	Unit/input voltage restored from voltage error Note) Once it occurs, it will be latched. Requires a reset by powering it off and on again or operation from the PC software.
	Green on	Unit/input voltage is normal
	Off	Power OFF state
PO	Red blinking (fast)	Output voltage is outside the range of 24 V ± 25%
	Yellow on	Output voltage restored from voltage error Note) Once it occurs, it will be latched. Requires a reset by powering it off and on again or operation from the PC software.
	Green on	The output voltage is normal
	Off	Power OFF state
SF	Red blinking (fast)	Internal bus communication error Note) Once it occurs, it will be latched. Requires a reset by powering it off and on again or operation from the PC software.
	Red blinking (slow)	Hardware error
	Red blinking (twice)	Factory setting error (the serial number of the device unit is the default value)
	Yellow on	Operation waiting
	Yellow blinking (fast)	Unit configuration error
	Green blinking (fast)	Initialized set memory (starts in system reset state) Note) Once it occurs, it will be latched. Requires a reset by powering it off and on again or operation from the PC software.
	Green blinking (slow)	Process data overflow
	Green on	Normal condition
	Off	Power OFF state
CF	Yellow on	Force I/O setting present
	Green blinking (slow)	Access from a PC possible
	Off	Power OFF state or no access state

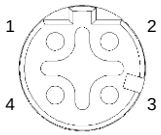
■ LED blinking statuses

Blinking status	Blinking timing
Blinking (fast)	
Blinking (slow)	
Blinking (once)	
Blinking (twice)	

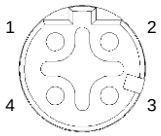
A video is available to show how the LEDs actually blink. If necessary, refer to the video at the following URL

RT product page:
https://www.ckd.co.jp/kiki/en/product/detail/1064

■ EtherCAT Port (IN)

M12(A) 4-pin female	Pin number	Description
	1	TD+ (Transmit data plus)
	2	RD+ (Receive data plus)
	3	TD- (Transmit data minus)
	4	RD- (Receive data minus)

■ EtherCAT port (OUT)

M12(A) 4-pin female	Pin number	Description
	1	TD+ (Transmit data plus)
	2	RD+ (Receive data plus)
	3	TD- (Transmit data minus)
	4	RD- (Receive data minus)

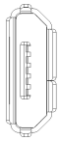
■ Waterproof cap

Always put a waterproof cap on EtherCAT ports (OUT) that are not in use.
The tightening torque is 0.1 ± 0.05 N m.
In addition, the waterproof cap (RT-CM12) must be used properly to achieve a degree of protection of IP65/IP67.
Purchase RT-CM12 separately.

■ USB port (for PC software)

⚠CAUTION

Do not leave the USB port open.
If there are no waterproof caps on the USB port, the degree of protection of the USB port is IP20. Do not allow foreign objects to get inside, and ensure that the ports are free of water, solvents, and oil during use.

Micro USB (B)	Pin number	Description
	1	VBUS
	2	DM
	3	DP
	4	ID
	5	GND

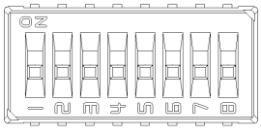
* For the unused USB port, always attach the waterproof cap that comes included as standard accessory (RT-CM12 when sold separately).

■ Dip switch

⚠WARNING

When operating each switch on the device unit, switch OFF the supplied power and set the switches with a precision screwdriver or other tool.
Not doing so can cause a failure as a result of short circuits or damage to components.

When operating a switch, make sure that only the relevant areas are in contact.
Not doing so may result in a failure.

8 Dip switches	SW	Name	Description
	1	Reserved	-
	2		
	3	Output settings in the event of a communication error / priority to hardware	Select whether the operation of all connected I/O units is specified at once by dip switch SW4 or individually by unit. Read at start-up. OFF: Set individually by unit (factory setting) ON: Specified all units at once (specified by dip switch SW4)
	4	HOLD/CLEAR	If SW4 is on, select whether the output operation (Note 2) in the event of a communication error (Note 1) is to be HOLD at the last value or to be OFF (the output value of the process data remains unchanged, and the output power is turned OFF). Read at start-up. OFF: CLEAR (the output value of the process data remains unchanged, and the output power is turned OFF) (factory setting) ON: HOLD at the last value Note 1: It indicates an industrial network communication error or an internal bus communication error. Note 2: It indicates valve I/F unit , digital output, analog output or output in DIO mode of IO-Link unit.
	5	Parameter initialization at startup	If ON at start-up, all units will be restored to the factory setting. OFF: Do not initialize (factory setting) ON: Initialize (restores factory setting for all installed units)
	6	Reserved	-
	7		

8 Dip switches	SW	Name	Description
(Continued)	8	Remote I/O system diagnostic information ON/OFF	If ON at start-up, diagnostic information for the entire Remote I/O system is added to the data transmitted to the MDevice via PDO communication. OFF: Do not add Remote I/O system diagnostic information (factory setting) ON: Add Remote I/O system diagnostic information Note: The Remote I/O system diagnostic information is in an 8-bit form consisting of the following information: - System error - Hardware error - Operation waiting - Power failure - Unit output error - Unit input error

* The set value is read only once at start-up and confirmed. .

■ Rotary switch

2 rotary switches	Value	Name	Description
 Upper digit (x16)  Lower digit (x1)	2 digits from 0 to F	EtherCAT node address	Sets the node address for an EtherCAT compatible device unit as an EtherCAT SubDevice. 0x00: Set the node address of the product on the upper MDevice side 0x01 to 0xFF: Set the node address on the product side Factory setting: 0x00 The value is read only once at start-up and confirmed. Note: For 0x00 only, the node address on EtherCAT for this product is set from the configuration tool for the upper MDevice side.

1.4 Unit Specifications

<table>
<tr><th colspan="2">Item</th><th>Description</th></tr>
<tr><td colspan="2">Type</td><td>Device unit</td></tr>
<tr><td rowspan="7">Communication specifications</td><td>Protocol</td><td>EtherCAT</td></tr>
<tr><td>Compliance standard</td><td>IEEE802.3u</td></tr>
<tr><td>Distance between nodes</td><td>Maximum of 100 m</td></tr>
<tr><td>Cable</td><td>Standard Ethernet cable
(CAT5 or higher, 100BASE-TX)</td></tr>
<tr><td>Speed</td><td>10/100 Mbps</td></tr>
<tr><td>System</td><td>Full duplex/half duplex</td></tr>
<tr><td>Supported functions</td><td>- Process Data Object (PDO) communication (cyclic communication)
- Supports mailbox (SDO) communication
- Modular Device Profile (MDP) function
- AL status (Application Layer) function</td></tr>
<tr><td colspan="2">Number of connectable I/O units</td><td>1 to 17 units</td></tr>
<tr><td colspan="2">Number of hard connectable units</td><td>The width of the entire Remote I/O system must not exceed 922.5 mm
- Input: Maximum of 505 bytes (including one byte for device unit Remote I/O system diagnostic information)
- Output: Maximum of 504 bytes
- Total input/output: Maximum of 513 bytes (including one byte for device unit Remote I/O system diagnostic information)</td></tr>
<tr><td colspan="2">Process data size limit</td><td>Process data that an EtherCAT compatible device unit can input/output to an upper MDevice has the following size limitations. If exceeded, a "process data overflow" occurs.
<table>
<tr><th>Item</th><th>Minimum size</th><th>Maximum size</th></tr>
<tr><td>Input</td><td>0 bytes</td><td>505 bytes
(504 bytes for internal bus limit
+ 1 byte for Remote I/O system diagnostic information)</td></tr>
<tr><td>Output</td><td>0 bytes</td><td>504 bytes</td></tr>
<tr><td>Total</td><td>1 byte</td><td>513 bytes
(512 bytes for internal bus limit
+ 1 byte for Remote I/O system diagnostic information)</td></tr>
</table></td></tr>
<tr><td colspan="2">Protection functions</td><td>
<table>
<tr><th rowspan="2">Protection functions</th><th colspan="3">Power line</th></tr>
<tr><th>Internal power</th><th>Unit/input</th><th>Output</th></tr>
<tr><td>Low voltage protection (reset function)</td><td>Yes</td><td>No</td><td>No</td></tr>
<tr><td>Overvoltage detection</td><td>No</td><td>Yes</td><td>Yes</td></tr>
<tr><td>Low voltage detection</td><td>No</td><td>Yes</td><td>Yes</td></tr>
</table></td></tr>
<tr><td colspan="2">Connector</td><td>M12(D) 4-pin female x 2 (BUS IN / BUS OUT)
Micro USB (B) x 1 (for PC software)</td></tr>
<tr><td colspan="2">Setting switch</td><td>Dip switch x 1: Output settings in the event of a communication error/priority to hardware, HOLD/CLEAR, Parameter initialization at startup, Remote I/O system diagnostic information ON/OFF
Rotary switch x 2: For EtherCAT node addresses</td></tr>
<tr><td colspan="2">LED</td><td>8 (RUN, ERR, L/A IN, L/A OUT, PS, PO, SF, CF)</td></tr>
<tr><td colspan="2">Working temperature range</td><td>−10°C to 55°C</td></tr>
<tr><td colspan="2">Relative humidity</td><td>30% to 85% RH</td></tr>
<tr><td colspan="2">Ambient atmosphere</td><td>No corrosive gases or heavy dust</td></tr>
<tr><td colspan="2">Installation location</td><td>Indoor use</td></tr>
<tr><td colspan="2">Altitude</td><td>Up to 2000 m</td></tr>
<tr><td colspan="2">Pollution degree</td><td>3</td></tr>
</table>

Item	Description
Degree of protection	IP65/IP67
Current consumption	Unit/input power supply: 100 mA or less (24 V equivalent) Power for output: 20 mA or less (24 V equivalent)
Size (W x H x D)	46.1 x 106 x 55.8 (mm)
Net weight	Approximately 230 g (including 2 tie rods for device unit)
Standard accessories	Tie rod for device unit x 2 (RT-TR-1) Waterproof cap for USB port 1 (RT-CM12) Note: Waterproof cap for EtherCAT port (RT-CM12) is sold separately.

Note 1: IP65/IP67 is not part of the UL certification.

2. INSTRUCTIONS FOR USE

⚠CAUTION

Thoroughly read and understand the instruction manual for the industrial network communication system used before using the device unit.

The product may operate in an unexpected way, causing injury to people or damage to equipment.

When using variable I/O units, adjust the settings so that the process data size per variable I/O unit is an even number.

If the input and/or output process data size per variable I/O unit (e.g. IO-Link master unit) is an odd bytes, adjust the settings of the variable I/O unit so that the input and output process data size is an even bytes. If the process data size is an odd number, it may become an unintended I/O status.

Instructions		Reference
Prior checking	Check the Remote I/O system structure.	"Remote I/O RT Series Instruction Manual: System Construction"
	Check the power supply units' current consumption (related to: the number of power supply units used).	
	Determine whether Remote I/O system diagnostic information is used (related to dip switch SW8 of the device unit).	"1.3 Names and Functions of Each Part"
	Check if a variable I/O unit (e.g. IO-Link master unit) is present among the I/O units.	"Remote I/O RT Series Instruction Manual: System Construction"
	If there are any variable I/O units (e.g.: IO-Link master unit), check the sizes of the parts of them that are variable. (Example: For IO-Link master units, check each output and input size of the IO-Link device that connects ports to be used as IO-Link mode.)	
	- Check the I/O size and assignment information of the Remote I/O system through PDO communication. - Design the assignment variables (arrays, structures, etc.) on the EtherCAT MDevice side.	
	Determine what the output operation will be in the event of a communication error. (Related to dip switches SW3 and SW4 on the device unit and the settings of each I/O unit.)	"1.3 Names and Functions of Each Part"
↓	↓	-
Hardware mounting, wiring, and setup	Install the EtherCAT upper MDevice.	EtherCAT upper MDevice manual
	↓	-
	- Assemble the Remote I/O system. -Mount the Remote I/O system (DIN rail mounting or direct screw mounting).	"Remote I/O RT Series Instruction Manual: System Construction"
	↓	-
	Wire the EtherCAT communication cable to the device unit.	"3.2 EtherCAT Communication Wiring"
	↓	-
	Wire the 24 V power supply to the power supply unit.	"Remote I/O RT Series Instruction Manual: System Construction"
	↓	-
	Wire each external I/O to the I/O units. Note: For an IO-Link master unit, IO-Link devices must also be connected.	"Remote I/O RT Series Instruction Manual: System Construction"
	↓	

	Instructions	Reference
	Set the following switches for the device unit. - Dip switches: Whether there will be diagnostic information; operation in the event of a communication error; etc. - Rotary switches: EtherCAT node address	"Remote I/O RT Series Instruction Manual: System Construction" "1.3 Names and Functions of Each Part"
↓	↓	-

Instructions		Reference
Settings on the EtherCAT MDevice	Install the ESI file for the product in the configuration tool on the upper MDevice side.	"6.1 Downloading and Installing the ESI File for The Product"
	↓	-
	In the MDevice-side configuration tool, set the following: - Add the product to the EtherCAT system - Set the module configuration (I/O unit configuration) - Edit the PDO entries generated from the ESI file based on the assignment of the variable I/O unit (e.g. IO-Link master unit) Note: When using variable I/O units, if the I/O size of the IO-Link device exceeds the default size, the PDO communicating I/O size of the variable I/O unit (list of PDO entries) in the configuration tool on the upper MDevice side must be edited manually. Download the settings (including the I/O unit configuration) from the configuration tool on the upper MDevice side to the product.	"Remote I/O RT Series Instruction Manual: System Construction" "5. FUNCTIONS" "6.SETTINGS TO COMMUNICATE WITH THE ETHERCAT UPPER MDEVICE"
	↓	-
	- During PDO communication: Assign the PDO on the configuration tool on the upper MDevice side. Create a variable on the EtherCAT MDevice side for PDO communication with the Remote I/O system. - During SDO communication: Create a communication program.	"6.3.2 Assignment of PDO to variables or addresses for upper program"
↓	↓	-
Checking Remote I/O system settings and status	Supply 24 V power to the power supply unit. Note: If there is more than one power supply unit, power them all on within 3 seconds.	"Remote I/O RT Series Instruction Manual: System Construction"
	↓	-
	Verify the module configuration recognized by the upper MDevice with the actual module configuration (according to the MDP function).	"5.2 Modular Device Profile (MDP) Function"
	↓	-
	Device unit settings	"4. SETTINGS"
	● If setting up from the PC software	"Remote I/O RT Series Instruction Manual: System Construction"
	Connect the PC software to the device unit with a USB cable.	
	↓	
	Check the actual Remote I/O system structure with the PC software.	
	↓	
	Set up the actual Remote I/O system structure with the PC software. Note: If the I/O unit is a variable I/O unit, set the input/output size manually or from the actual unit.	
	● If setting up with SDO communication from an upper EtherCAT MDevice	EtherCAT upper MDevice manual "**9.5.1 Setting data** area for each unit"
	Create a program to specify the index (address) of each setting and to perform a write operation via a communication command from the upper MDevice.	
	↓	-
	(If necessary) Check the output wiring, depending on the forced output setting from the PC software.	"Remote I/O RT Series Instruction Manual: System Construction"
	↓	-
	Note: Some settings require it to be powered off and on again.	-
↓	↓	-

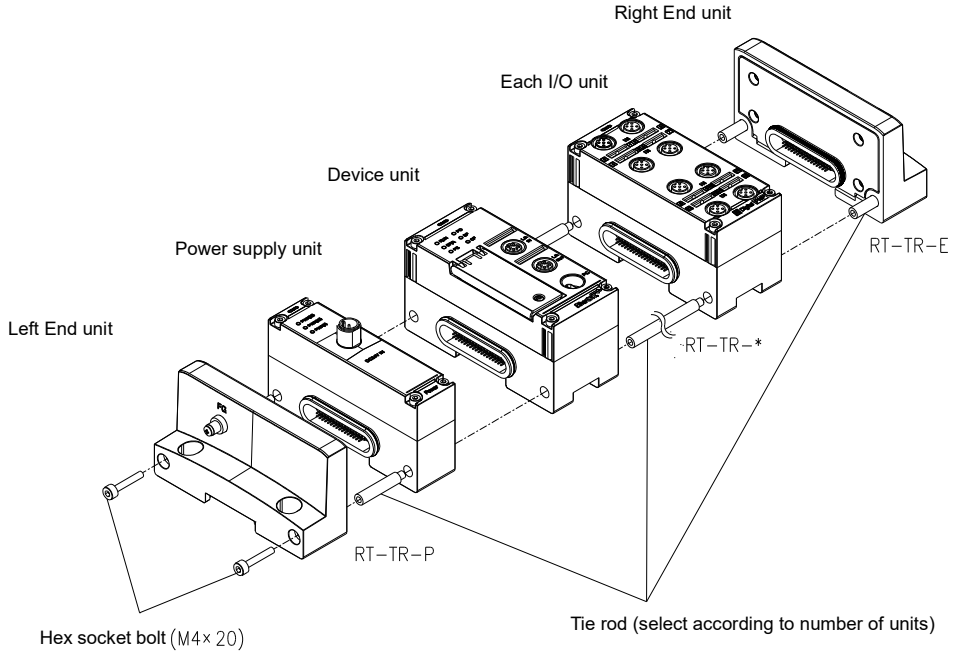
Instructions		Reference
Checking EtherCAT communication and start control from the upper MDevice	Check EtherCAT communication (e.g. check LEDs on upper MDevice and device unit, etc.).	EtherCAT upper MDevice manual "1.3 Names and Functions of Each Part" "8.TROUBLESHOOTING"
	↓	-
	Check the reading and writing of data to the Remote I/O system from the EtherCAT MDevice via PDO communication.	EtherCAT upper MDevice manual
	↓	-
	(If necessary) Check the reading and writing of data to the Remote I/O system via SDO communication.	EtherCAT upper MDevice manual "**9**.**OBJECT DICTIONARY** LIST"

3. INSTALLATION AND WIRING

3.1 Device Unit Installation

Connect device unit horizontally with power supply and I/O unit.

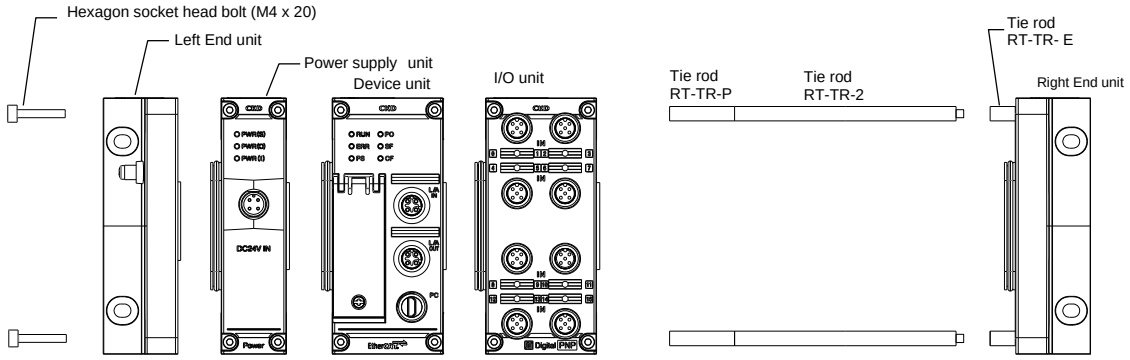
E.g.)



1 Connect the following tie rods in advance.
Select as few tie rods as possible.

Tie rod model No.	Applicable unit	Specifications
RT-TR-P	For one power supply unit	M4 x 27 mm, 2 pcs
RT-TR-1	For one device unit and one I/O unit	M4 x 46 mm, 2 pcs
RT-TR-2	For one device unit and two I/O units	M4 x 92 mm, 2 pcs
RT-TR-4	For one device unit and four I/O units	M4 x 184 mm, 2 pcs
RT-TR-8	For one device unit and eight I/O units	M4 x 368 mm, 2 pcs
RT-TR-V	For one Valve I/F unit	M4 x 32 mm, 2 pcs
RT-TR-E	For right End unit	M4 x 35 mm, 2 pcs

E.g.)



2 Connect the units together.

3 Pass the tie rods through each unit, and then push adjacent units together.

4 Tighten the left End unit with a hexagon socket head bolt (M4 x 20) (tightening torque: 1.2 N·m ± 0.05 N·m).

5 Check that all units are connected together without any gaps.

3.2 EtherCAT Communication Wiring

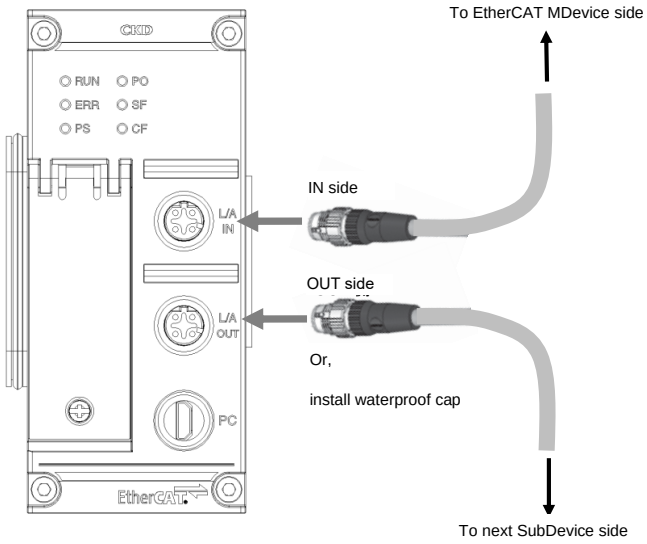
⚠WARNING

Use the specified cable for the communication cable.
Using cables other than those specified can cause communication malfunctions, and result in personal injury or damage to equipment.

Follow the steps below to connect the EtherCAT communication cable.

1 After confirming safety, stop the EtherCAT communication and turn off all peripheral equipment.

2 Refer to the following figure to wire the cables that comply with the EtherCAT specifications to the IN and OUT sides.
If no remote device is connected to the OUT side, install a waterproof cap (RT-CM12), sold separately.



For EtherCAT communication wiring, purchase a cable or connector that meets the following specifications.
Specifications: M12 plug (male), D-coding, 4-core

■ Recommended communication cable

- When connecting an EtherCAT Compatible Device unit to a MDevice or SubDevice with an RJ45 connector type

Product name	Specification	Number of cores	Cable extraction method	Length	Manufacturer	OMRON Corporation model No.
XS5W industrial Ethernet plug cable with connectors on both sides (M12 straight to RJ45)	M12 plug (D-coding, male) - RJ45	4 cores	Straight - RJ45	0.5 m	OMRON Corporation	XS5W-T421-BMC-SS
				1 m		XS5W-T421-CMC-SS
				2 m		XS5W-T421-DMC-SS
				3 m		XS5W-T421-EMC-SS
				5 m		XS5W-T421-GMC-SS
				10 m		XS5W-T421-JMC-SS

- For a wire with one open-end side

Product name	Specification	Number of cores	Cable extraction method	Length	Manufacturer	OMRON Corporation model No.
XS5H industrial Ethernet plug cable with a connector on one side (M12 straight to open-end-cable)	M12 plug (D-coding, male) – open-end-cable	4 cores	Straight to open-end-cable	0.5 m	OMRON Corporation	XS5H-T421-BM0-K
				1 m		XS5H-T421-CM0-K
				2 m		XS5H-T421-DM0-K
				3 m		XS5H-T421-EM0-K
				5 m		XS5H-T421-GM0-K
				10 m		XS5H-T421-JM0-K
				15 m		XS5H-T421-KM0-K

4. SETTINGS

⚠WARNING

Check the settings of each unit before operating.
Setting the units incorrectly can cause malfunction, and result in personal injury or damage to equipment.

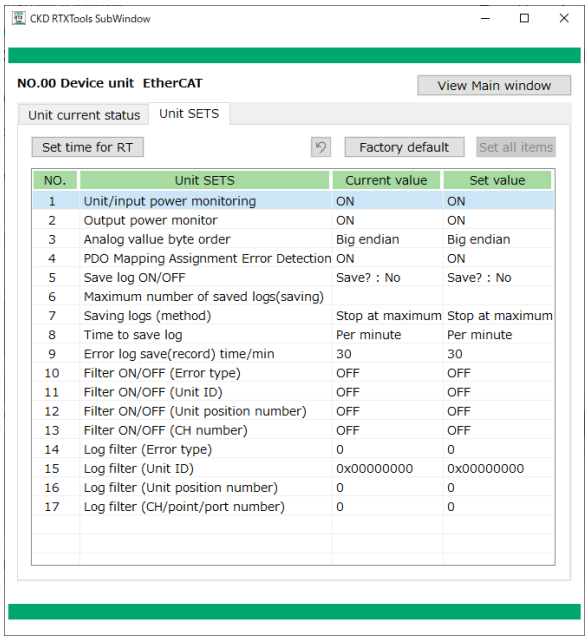
4.1 Setting Method

There are two ways to configure an EtherCAT compatible device unit: using the PC software and using industrial network communication.

4.1.1 Using PC software

On the [Unit SETS] main tab, select an EtherCAT compatible device unit and click the [Set all items]button.

[Unit SETS] tab for the EtherCAT compatible device unit



NO.	Unit SETS	Current value	Set value
1	Unit/input power monitoring	ON	ON
2	Output power monitor	ON	ON
3	Analog vallue byte order	Big endian	Big endian
4	PDO Mapping Assignment Error Detection	ON	ON
5	Save log ON/OFF	Save? : No	Save? : No
6	Maximum number of saved logs(saving)		
7	Saving logs (method)	Stop at maximum	Stop at maximum
8	Time to save log	Per minute	Per minute
9	Error log save(record) time/min	30	30
10	Filter ON/OFF (Error type)	OFF	OFF
11	Filter ON/OFF (Unit ID)	OFF	OFF
12	Filter ON/OFF (Unit position number)	OFF	OFF
13	Filter ON/OFF (CH number)	OFF	OFF
14	Log filter (Error type)	0	0
15	Log filter (Unit ID)	0x00000000	0x00000000
16	Log filter (Unit position number)	0	0
17	Log filter (CH/point/port number)	0	0

4.1.2 Using industrial network communication

Set an object for an EtherCAT compatible device unit according to the message communication commands from the upper MDevice.
Refer to "**9**. **OBJECT DICTIONARY** LIST" for more information.

4.2 List of Settings

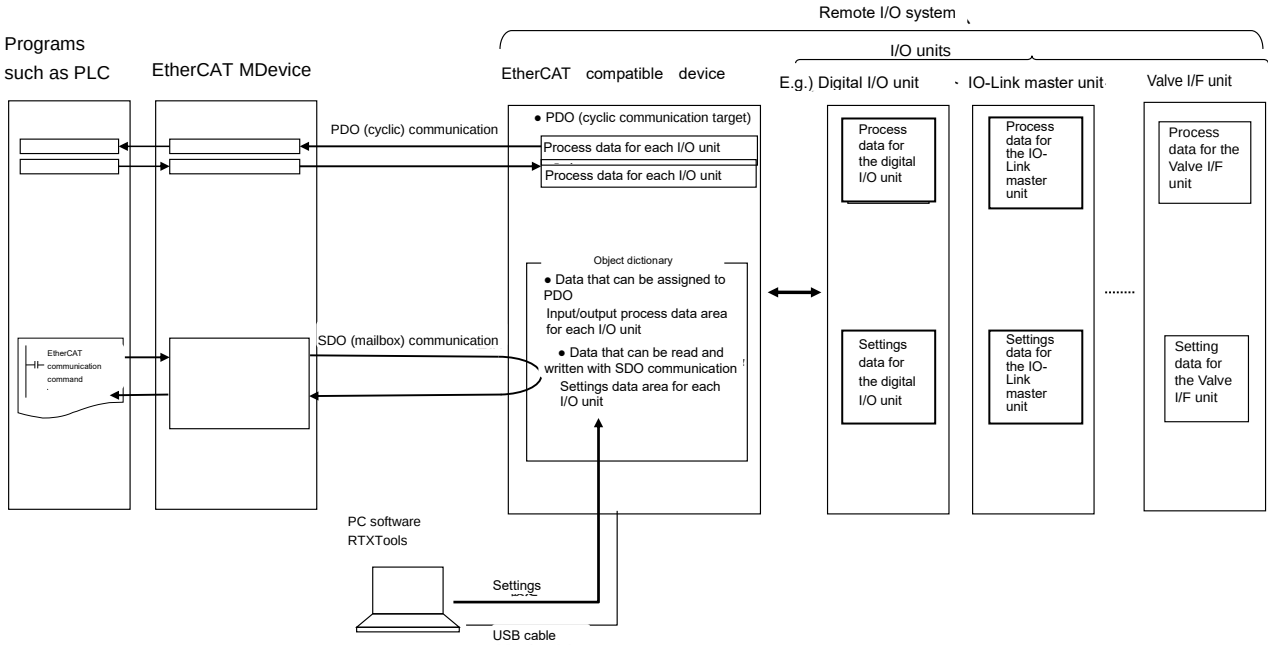
The items that can be set are as follows.

Setting	Description	Value	Factory setting	Setting required
Unit/input power monitoring	Set whether the device unit monitors the unit/input power from the power supply unit closest to itself on the left when facing it. In the event of an error, a "Unit/input power voltage error" will occur.	0: OFF (not monitored) 1: ON (monitored)	1: ON (monitored)	-
Output power supply monitor	Set whether the device unit monitors the power supply for the output from the power supply closest to itself on the left when facing it. In the event of an error, an "Output power voltage error" will occur.	0: OFF (not monitored) 1: ON (monitored)	1: ON (monitored)	-
Analog value byte order	Set the byte order used when the device unit transmits to or receives from the upper MDevice analog input or output values for the connected analog I/O units.	0: Big endian 1: Little endian	0: Big endian	-
Save log ON/OFF, number of logs saved	Set whether to save logs. Set the maximum number of entries to log.	0: Do not save 1 to 255: Maximum number to save	0: Do not save	-
Saving logs (method)	Select how to save logs from the following. - Repeat (overwrite) - Stop at maximum number	0: Repeat (overwrite) 1: Stop at maximum number	1: Stop at maximum number	-
Log saving time	Select when to save logs from the following. - Save immediately when an error occurs - Save at each set value (minutes)	0: Real-time 1 to 60: Save every 1 to 60 minutes	30: Save every 30 minutes	-
	Set the save interval when the time to save logs is "save at every set value (minutes)."			-
Type of log filter	Set whether error logging filtering (logging only errors with specified conditions) is enabled. Set the type of log filter. Save logs that have passed the filtering target filter with the following bit equal to "1". Bit 7: Enable/disable log filter error type Bit 6: Enable/disable log filter unit ID Bit 5: Enable/disable log filter unit position number Bit 4: Enable/disable log filter CH/point/port number If this setting is 0x00, all logs are saved.	0x00 to 0xFF The meaning of each bit is as follows OFF: Disabled ON: Enabled	0x00: All disabled	-
Filter ON/OF (error type)	Only log errors for the specified error type. Set the error type to filter for.	0x00 to 0xFF	0x00	-
Filter ON/OFF (unit ID)	Only log errors for the specified unit ID. Set the unit ID to filter for. However, the variable I/O unit determines a match in the top 2 bytes.	0x00000000 to 0xFFFFFFFF	0x00000000	-
Filter ON/OFF (unit position number)	Only log errors for units with a specified unit position number.	0 to 17 (device unit = 0)	0	-
Filter ON/OFF (CH/point/port number)	Only log errors for the specified CH/point/port number. Set the CH/point/port number to filter for.	0 to 31	0	-
PDO mapping allocation error detection	Set whether detect PDO mapping allocation error.	0: Do not detect 1: Detect	1: Detect	-

5. FUNCTIONS

5.1 Functions to Communicate with EtherCAT MDevice

The RT series Remote I/O systems can communicate with the EtherCAT MDevice with the following PDO (cyclic) and SDO (mailbox) communications.



5.1.1 PDO (cyclic) communication

The unit's process data is exchanged with the EtherCAT MDevice at set intervals.
The exchange target is the process data objects (Process Data Objects: PDO) for the EtherCAT compatible device unit.

5.1.2 SDO (mailbox) communication

The EtherCAT MDevice reads and writes the specified data of the unit at any time when necessary.
The reading and writing target are all the data placed in the object dictionary (Note 1) of the EtherCAT compatible device unit. It is primarily used when setting the setting data area for each I/O unit.

Note 1: Refer to "**9**. **OBJECT DICTIONARY** LIST."

For RT series Remote I/O systems, this setting using SDO communication from the upper EtherCAT MDevice can also be set from the PC software.

■ Data assigned with PDO communication (for cyclic communication)

Unit type	Example
Digital I/O unit	Digital input, digital output
Analog I/O unit	Analog input, analog output
IO-Link master unit	IO-Link COMM error flag, IO-Link input data enable flag, digital input/output, Input Data/Output Data, etc.
Valve I/F unit	Valve output

■ Data that can be read and written with SDO communication (specify object dictionary)

Unit type	Example (Note 1)
Digital I/O unit	Off_On cycle counts, signal line error detection setting, etc.
Analog I/O unit	CH enable/disable setting, max/min range, etc.
IO-Link master unit	IN size, OUT size, device verification, etc. Note: It is also possible to send and receive ISDU communication to connected IO-Link devices.
Valve I/F unit	Off_On cycle value, signal line error detection setting, etc.

Note 1: For information on the individual functions of each I/O unit, refer to the instruction manual of each I/O unit.

5.2 Modular Device Profile (MDP) Function

⚠CAUTION

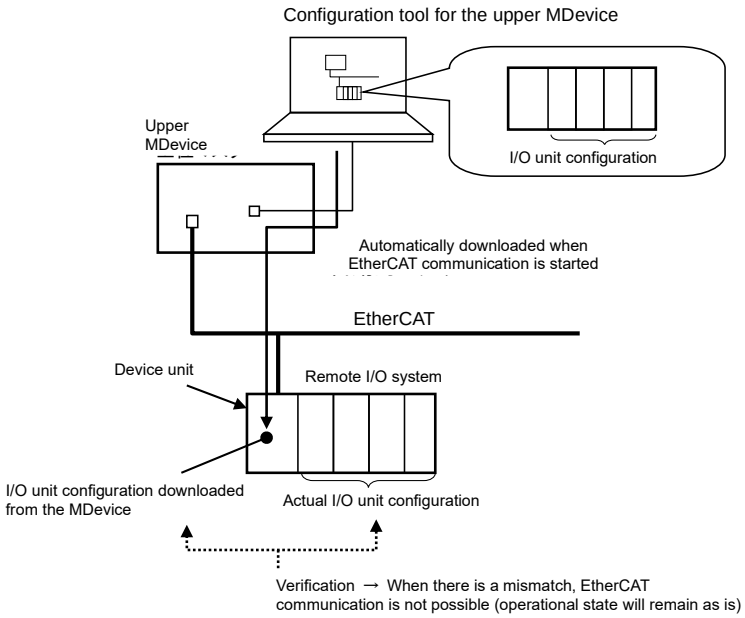
If using a variable I/O unit, the size of the PDO on the upper MDevice side is set in accordance with the size of the external device connected (to the variable I/O unit), even when the MDP verification results are consistent.

The MDP verification function is used to verify the correct unit type and location between the upper MDevice side and the Remote I/O system side. The function does not verify unit assignment size.

Even though MDP verification results are consistent, the assignment size of the variable I/O units may not be consistent between the upper MDevice side and the Remote I/O system side.

This product supports the EtherCAT Modular Device Profile (MDP) function.
MDP is a mechanism for managing interlinked modules (in the case of this product, the I/O unit configuration) as an EtherCAT system if there is a single SubDevice that is a modular (building block) type SubDevice.

To use the MDP function, the configuration of the I/O units connected to the product must be edited using the EtherCAT MDevice-side configuration tool (Note 1) and downloaded to the product with the I/O unit configuration that the upper MDevice considers correct (it is automatically downloaded when EtherCAT communication begins).
This enables EtherCAT communication with the MDevice only if the I/O unit configuration is registered with the product and verifies the actual I/O unit configuration.



Note 1: Add the product to the EtherCAT system and set the module configuration (correct I/O unit configuration) on the EtherCAT MDevice side configuration tool.
There are the following two ways to do this. Use one of the methods to add or configure settings.
- Manually adding and setting up the module configuration (I/O unit configuration) off-line
- Connecting to the actual unit online and automatically adding and setting up the module configuration (I/O unit configuration)

The registered I/O unit configuration for this product is automatically downloaded to index 0xF030 (refer to "**9.8.1 Unit ID** configuration downloaded from the MDevice ") of this product when EtherCAT communication is initiated.

5.3 Verification Function

This is the function to verify the information set at the upper network and the information collected by the EtherCAT device unit at power-up. The information is verified when the state shifts from pre-operational to safe operational.

"Setting errors" can be “MDP verification errors,” “PDO size errors,” or other errors.
For more information about each AL status code, refer to "**8.3 AL Status** Function."

AL status code	AL status error name	Description
0x0070	MDP verification error	At power-up, the actual detected I/O unit configuration (contents of index 0xF050) and the automatically downloaded I/O unit configuration (contents of index 0xF030) from the upper MDevice are different.
0x001D	Incorrect SyncManager (output data) settings	The size of the PDO and the data size on the I/O unit side mapped to the PDO (e.g., the set size for the IO-Link master unit's IO-Link mode port) are different.
0x001E	Incorrect SyncManager (input data) settings	

5.3.1 MDP verification error

At power-up, the actual detected I/O unit configuration is stored at index 0xF050 (refer to "**9.8.2 Unit ID** configuration detected by automatic recognition "). If the contents are different from the I/O unit configuration automatically downloaded from the MDevice (contents of index 0xF030), the product considers that the actual I/O unit configuration is different from the I/O unit configuration set on the MDevice side, resulting in an "AL status error (error code: 0x0070)". The state does not shift to safe operational.)

In this case, use the EtherCAT MDevice-side configuration tool to edit the I/O unit configuration again to verify the actual unit and restart EtherCAT communication, for example, by powering it off and on again. Alternatively, do so that the actual unit's configuration matches the configuration set for the EtherCAT MDevice.

5.3.2 SyncManager verification

A mismatch between the size of the PDO on the configuration tool side of the upper MDevice and the data size on the I/O unit side results in an "AL status error (error code: 0x001D or 0x001E)". (The state does not shift to safe operational.)

If a mismatch occurs, the PDO on the upper MDevice side must be edited (add or delete PDO entries). The details of the error code are as follows:

・0x001D: mismatch with the process data size of output
・0x001E: mismatch with the process data size of input, or mismatch with both the input and output

5.3.3 PDO mapping verification

When there is a mismatch between the PDO mapping information of variable I/O units and the PDO assignment information of each connected unit, and if the “PDO mapping assignment error detection” is set to “1”, the state shifts to safe operational. AL Status Code will not be generated for this occurrence.

5.4 EtherCAT Communication Sync Function

The EtherCAT compatible device unit supports two sync modes: "Free-run mode" and "DC mode".

The unit automatically operates in the sync mode of the EtherCAT MDevice.

5.4.1 Procedure for changing from DC mode to free-run mode

To change the sync mode for EtherCAT communication from DC mode to free-run mode, follow these steps:

1 Power OFF the Remote I/O system.

2 Change the sync mode for EtherCAT communication to free-run mode in the communication settings of the configuration tool for the upper MDevice.

3 Power OFF the Remote I/O system and ON again.

5.5 Remote I/O system Diagnostic Information Function

The EtherCAT compatible device unit transmits diagnostic information for the entire Remote I/O system to the upper MDevice via PDO communication.

If dip switch SW8 (Remote I/O system diagnostic information ON/OFF) for the EtherCAT compatible device unit is ON, it is transmitted to the upper MDevice. If OFF, there is no transmission to the upper MDevice.

The process data name of the function for Remote I/O system diagnostic information is displayed on the upper MDevice configuration tool, based on the ESI file, as follows.

Module name	Data size	Data	Data name on the ESI file	Data type
Diagnostic information	1 byte	Unit input error	Unit input error	BOOL
		Unit output error	Unit output error	BOOL
		Reserved	Reserve	BOOL
		Power failure	Power failure	BOOL
		Reserved	Reserve	BOOL
		Operation waiting	Operation waiting	BOOL
		Hardware error	Hardware error	BOOL
		System error	System error	BOOL

For more information about the function for Remote I/O system diagnostic information, refer to "8.1 Function for Remote I/O system Diagnostic Information" in the "Remote I/O RT Series Instruction Manual: System Construction".

6. SETTINGS TO COMMUNICATE WITH THE ETHERCAT UPPER MDEVICE

This section describes the operations required on the EtherCAT upper MDevice side for the product to perform EtherCAT communication.

For more information, refer to the EtherCAT upper MDevice manual or the manual for configuration tool on the upper MDevice side that is used.

6.1 Downloading and Installing the ESI File for The Product

1 Obtain the ESI file for the product in advance
ESI file name for this product (RT series Remote I/O system): CKD_RT_EcatMaster.xml
The latest ESI file can be downloaded from CKD's dedicated website.
RT product page: :
https://www.ckd.co.jp/kiki/en/product/detail/1064

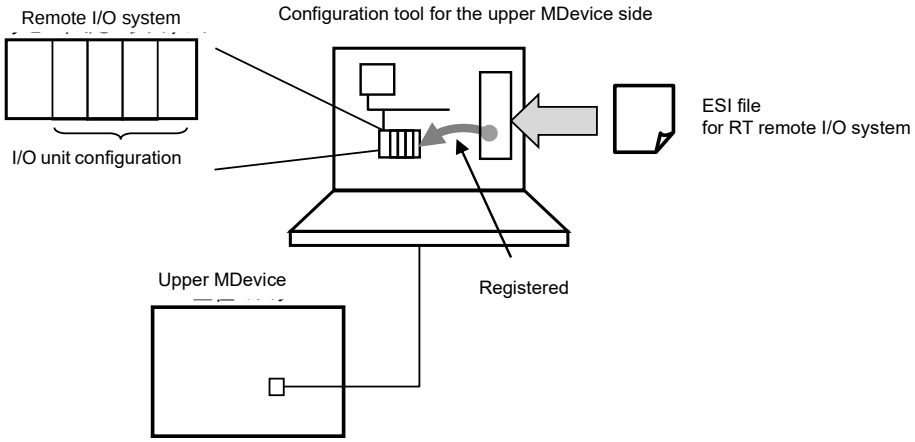
If not available, contact CKD support at the following link:
https://www.ckd.co.jp/kiki/en/support/index.html

2 Install the ESI file for this product in the configuration tool for the upper MDevice side.
For installation instructions, refer to the manual for configuration tool on the upper MDevice side.

6.2 Registering The Product in the EtherCAT System

This product supports the EtherCAT Modular Device Profile (MDP) function.

On the configuration tool on the upper MDevice side, carry out the following two settings.
- Register the product in the EtherCAT system
- Set the module configuration (I/O unit configuration)



6.2.1 Examples of a module name in the ESI file

Examples of a module name in the ESI file are as follows.

Module name in ESI file	Unit name	Main function	Model No.
RT-XTECN00N	EtherCAT compatible device unit	EtherCAT	RT-XTECN00N
Diagnostic information		Remote I/O system diagnostic information	RT-XTECN00N
RT-XADGB08A	Digital I/O unit	Input	RT-XADGB08A
RT-XADGB08B			RT-XADGB08B
RT-XADGA16A			RT-XADGA16A
RT-XADGA16B			RT-XADGA16B
RT-XADGC32A			RT-XADGC32A
RT-XADGC32B			RT-XADGC32B
RT-XBDGA16A	Digital I/O unit	Output	RT-XBDGA16A
RT-XBDGA16B			RT-XBDGA16B
RT-XBDGC32A			RT-XBDGC32A
RT-XBDGC32B			RT-XBDGC32B
RT-XAAGA02N	Analog I/O unit	Input	RT-XAAGA02N
RT-XBAGA02N		Output	RT-XBAGA02N
RT-XLMSA08N	IO-Link master unit	IO-Link master	RT-XLMSA08N
RT-XVVCN32A(Note 1)	Valve I/F unit	TVG	TVG□P-TB-□-KA1D
RT-XVVCN32B(Note 1)			TVG□P-TB-□-KA1C

Note 1: The module name for Valve I/F unit are indicated as the model No. on the software only. The actual model No. for valve manifold is TVG□P-TB-□-KA1□.

For information on how to set up the module configuration (I/O unit configuration) as an MDP compatible SubDevice, refer to the manual for the upper MDevice that is used, and the section on MDP compatible SubDevices in the manual for the configuration tool on the upper MDevice side.

6.3 EtherCAT Communication Settings

⚠CAUTION

If a variable I/O unit (e.g. IO-Link master unit) is used, the size of the basic unit of communication ("PDO") on the configuration tool side of the upper industrial network master must match the data size on the variable I/O unit side.

In the event of a mismatch, EtherCAT communication with the upper MDevice will be in a pre-operational state and cannot be moved to a safe operational state (the front RUN LED blinks (slow)).

When using variable I/O units, adjust the settings so that the process data size per variable I/O unit is an even number.

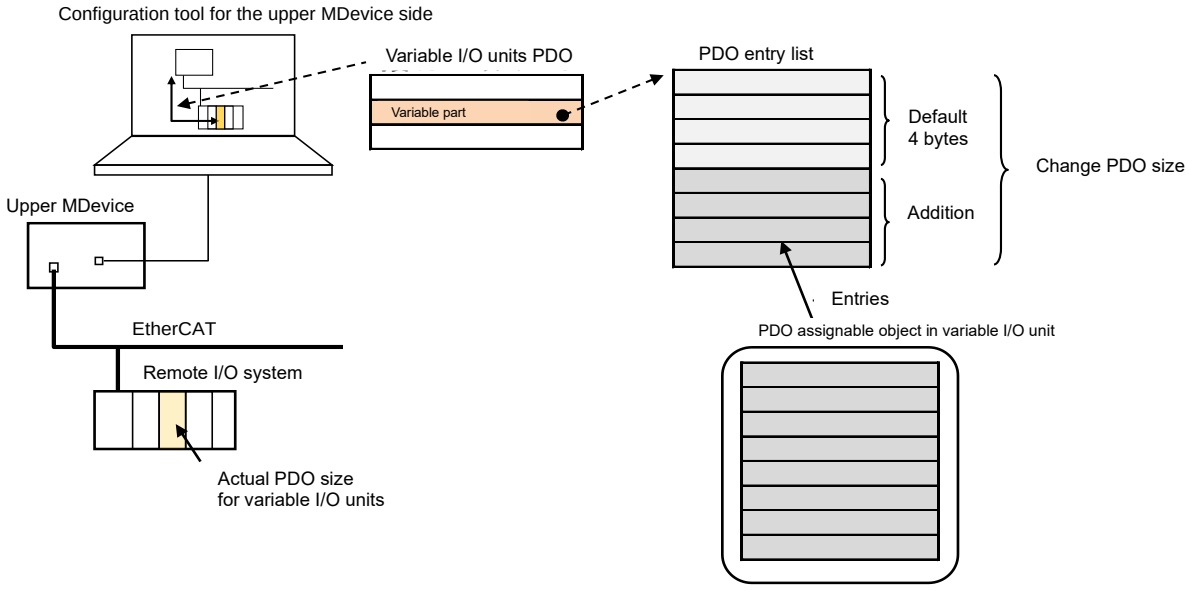
If the input and/or output process data size per variable I/O unit (e.g. IO-Link master unit) is an odd bytes, adjust the settings of the variable I/O unit so that the input and output process data size is an even bytes. If the process data size is an odd number, it may become an unintended I/O status.

6.3.1 Assignment of PDOs on the configuration tool on the upper MDevice side

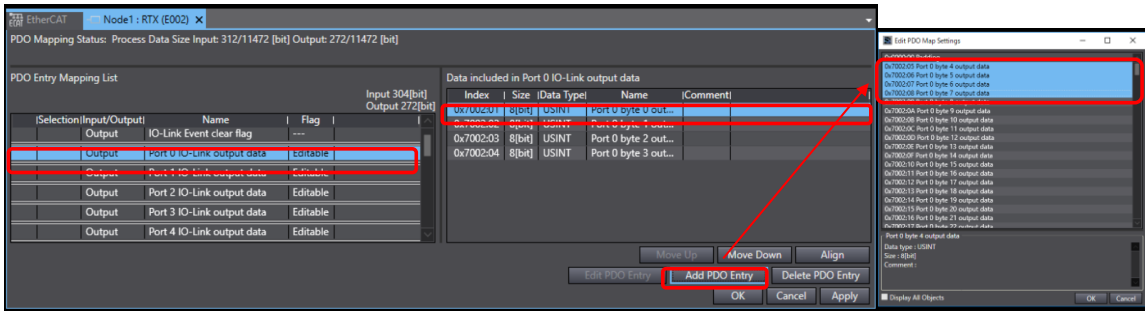
If using the PDO communication function, use the configuration tool on the upper MDevice side to assign the product PDO to the input/output for the upper program.

■ If a variable I/O unit is present and its PDO size used exceeds the default PDO size

In the configuration tool on the upper MDevice side, the PDO size must be changed by adding PDO entries to match the actual process data size.



Example: For the IO-Link master unit, when the process data size of the port-connected O-Link device which is used as IO-Link mode is 8 bytes, add 4 bytes of PDO entries (because the default size is 4 bytes).


EtherCAT
Node1 : RTX (E002)
PDO Mapping Status: Process Data Size Input: 312/11472 [bit] Output: 272/11472 [bit]
PDO Entry Mapping List
Input 304[bit]
Output 272[bit]
Selection
Input/Output
Name
Flag
Output
IO-Link Event clear flag

Output
Port 0 IO-Link output data
Editable
Output
Port 2 IO-Link output data
Editable
Output
Port 3 IO-Link output data
Editable
Output
Port 4 IO-Link output data
Editable
Data included in Port 0 IO-Link output data
Index
Size
Data Type
Name
Comment
0x7002:03
8[bit]
USINT
Port 0 byte 2 out...
0x7002:04
8[bit]
USINT
Port 0 byte 3 out...
Move Up
Move Down
Align
Edit PDO Entry
Add PDO Entry
Delete PDO Entry
OK
Cancel
Apply
Edit PDO Map Settings

6.3.2 Assignment of PDO to variables or addresses for upper program

The PDO of this product is assigned to the input/output of the upper program.
Specifically, it is assigned to a variable or address. For variables, arrays or structures are typically used.
If the SDO communication function is to be used, create a communication program.

6.3.3 Downloading module configuration (I/O unit configuration) information to this product

The module configuration (I/O unit configuration) information is downloaded to the product using the configuration tool on the upper MDevice side.

■ Data stored within the product with the correct I/O unit configuration for the upper MDevice

When the module configuration (I/O unit configuration) information is downloaded to the product, the correct connection configuration for the upper MDevice is stored in product object dictionary index 0xF030 (refer to "**9.8.1 Unit ID** configuration downloaded from the MDevice ").
The data stored in index 0xF030 is the unit ID of the I/O unit in order of unit position number (Note 1).
The product code of the I/O unit with position numbers 1 to 18 is stored in sub-indexes 1 to 18, respectively.
SDO communication can be used to read or write from the MDevice when necessary.

Note 1: The Unit ID is as follows.

Unit ID	Module name	Type	Main function	Connector	Points/CH/Port	Polarity
07000000	RTTECN00N	Device unit	EtherCAT compatible	-	-	-
2B280100	RTADGB08A	Input	Digital	M8	8 points	PNP
2B2C0100	RTADGB08B	Input	Digital	M8	8 points	NPN
2C080200	RTADGA16A	Input	Digital	M12	16 points	PNP
2C0C0200	RTADGA16B	Input	Digital	M12	16 points	NPN
2D680400	RT-XADGC32A	Input	Digital	Terminal	32 points	PNP
2D6C0400	RT-XADGC32B	Input	Digital	Terminal	32 points	NPN
2C100002	RTBDGA16A	Output	Digital	M12	16 points	PNP
2C140002	RTBDGA16B	Output	Digital	M12	16 points	NPN
2D700004	RT-XBDGC32A	Output	Digital	Terminal	32 points	PNP
2D740004	RT-XBDGC32B	Output	Digital	Terminal	32 points	NPN
51080400	RTAAGA02N	Input	Analog	M12	2 CH	-
51100004	RTBAGA02N	Output	Analog	M12	2 CH	-
D300xxyy(Note 2)	RTLMSA08N	IO-Link	Master	M12	8 ports	-
6D020004	RT-XVVCN32A(Note 1)	Valve I/F	TVG	-	32 points	PNP
6D820004	RT-XVVCN32B(Note 1)	Valve I/F	TVG	-	32 points	NPN

Note 1: The module name for Valve I/F unit are indicated as the model No. on the software only. The actual model No. for valve manifold is TVG□P-TB-□-KA1□.

Note 2: xxyy varies depending on the unit settings. (Initial setting value: 2622)

■ Detecting the I/O unit configuration at power-up

At power-up, the unit ID position numbers 0 to 17 of the current actual I/O units are stored in sub-indexes 1 to 18, respectively of index 0xF050 (refer to "**9.8.2 Unit ID** configuration detected by automatic recognition ") in the object dictionary for this product.
It is possible to read from the MDevice when necessary using SDO communication.

■ If the I/O unit configuration is different from the registered configuration

If the correct I/O unit configuration is different from the actual I/O unit configuration detected at power-up, the product will have an "AL status error (error code: 0x0070)". At this time, EtherCAT communication will be in a pre-operational state and cannot be moved to a safe operational state. Using the configuration tool on the EtherCAT upper MDevice side, the I/O unit configuration must be edited to match the actual unit and downloaded to the product.

6.3.4 Error notification from this product to the EtherCAT MDevice (via AL status function)

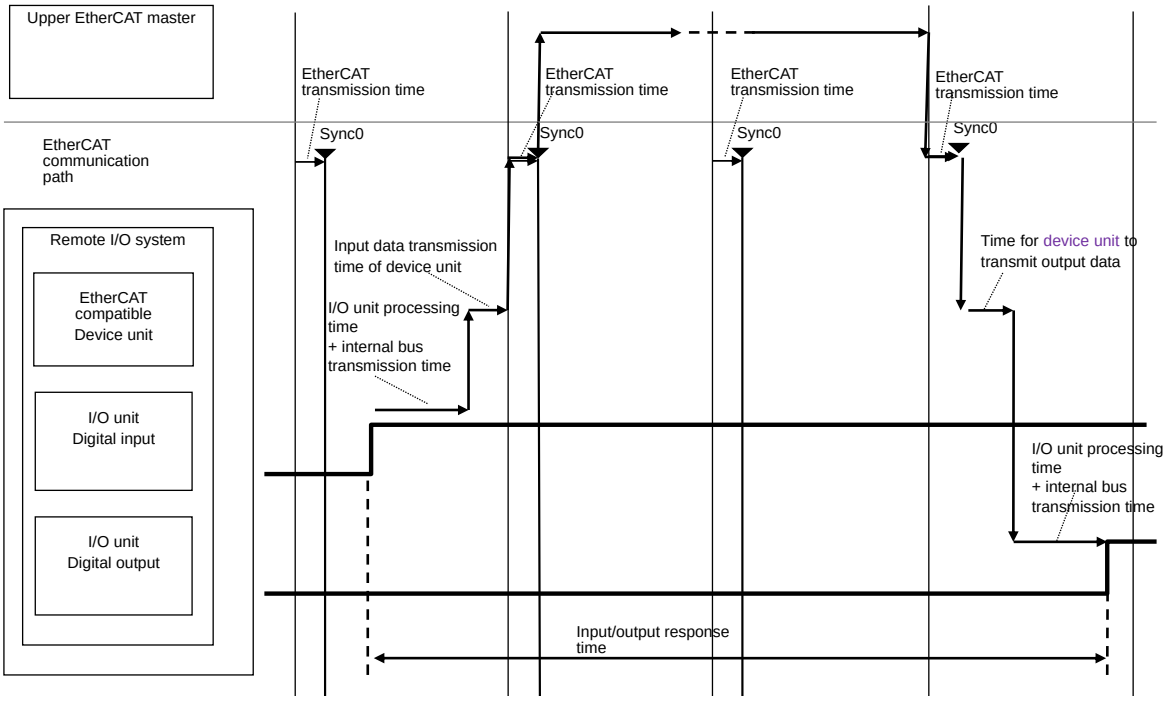
If the product has an error during operation, the AL status function notifies the EtherCAT upper MDevice of the error. Based on this, take action on the upper MDevice side, such as continuing/stopping control.

For more information on the AL status codes that this product reports, refer to "**8.3 AL Status** Function."

7. COMMUNICATION PERFORMANCE

This section describes the input/output response times of the I/O units in the Remote I/O system for EtherCAT device unit connections under the following conditions.

The figure below shows the direction to the right as the chronological order. The digital input and output lines indicate ON/OFF.
The sync mode for EtherCAT communication is in DC mode.



7.1 Calculation Method

The maximum values for the input/output response times are as follows.

Maximum input/output response time =	(EtherCAT communication cycle time) x 2
	+ EtherCAT MDevice transmission delay time
	+ Transmission jitter
	+ Maximum time for the device unit to transmit input data
	+ Maximum time for output data transmission of device unit
	+ Maximum time for processing input data specific to each I/O unit
	+ Maximum time for processing output data specific to each I/O unit
	+ Input delay time specific to each I/O unit
	+ Output delay time specific to each I/O unit

Note: The minimum value is (EtherCAT communication cycle time) x 1 when the unit has the lowest processing and delay times.

The following are the main maximum reference values for each time element.

● EtherCAT communication cycle time

Depends on the operating environment.

● EtherCAT MDevice transmission delay time

Depends on the operating environment.

● Transmission jitter

Depends on the operating environment.

● Maximum time for the device unit to transmit input data

The total of the update period for the following internal bus and the time for data transmission from the internal bus to EtherCAT.

- The update period of the internal bus varies according to the number of connections or the connected I/O unit as follows.
  - When the total number of device units and I/O units is 15 or less: 501 µs
  - When the total number of device units and I/O units is 16 or more: 1037 µs
  - (Regardless of number of units) when the IO-Link master unit is included in the configuration: 2365 µs
- Data transmission time from the internal bus to EtherCAT is a maximum of 2000 µs (varies depending on the number of connected I/O units).

● Maximum time for output data transmission of device unit

The total of the update period for the following internal buses and the time for data transmission from EtherCAT to the internal bus:

- The update period of the internal bus varies according to the number of connections or the connected I/O unit as follows.
  - When the total number of device units and I/O units is 15 or less: 501 µs
  - When the total number of device units and I/O units is 16 or more: 1037 µs
  - (Regardless of number of units) when the IO-Link master unit is included in the configuration: 2365 µs
- Data transmission time from EtherCAT to the internal bus is a maximum of 1000 µs (varies depending on the number of connected I/O units).

● Maximum time for processing input data specific to each I/O unit

The write cycle/time during which input data is written to the internal bus.
Varies depending on the I/O unit, as follows.

- Write cycle:
  - Digital input: maximum of 1000 µs (e.g. when changing settings. Otherwise, typ.300 µs)
  - Analog input: maximum of 3000 µs (almost no variation)
  - IO-Link master: maximum of 4000 µs (Note 1)

    Note 1: The maximum condition for an IO-Link master unit is 64 bytes input and 64 bytes output.
    For 38 bytes input and 34 bytes output, it is 3000 µs.
- Write time:
  - Digital input: maximum of 200 µs (almost no variation)
  - Analog input: typ.200 µs (almost no variation)
  - IO-Link master: maximum of 1400 µs (Note 2)

    Note 2: The maximum condition for an IO-Link master unit is 64 bytes input and 64 bytes output.
    For 38 bytes input and 34 bytes output, it is 900 µs.

● **Maximum time for processing output data specific to each I/O unit**

The read cycle/time during which output data is read from the internal bus.
Varies depending on the I/O unit, as follows.

- Read cycle:
  - Digital output: Maximum 1000 μs (when changing settings, etc. Otherwise, it is typ. 300 μs)
  - Analog output: Maximum 3000 μs (almost no change)
  - IO-Link master: maximum of 4000 μ s (Note 3)
  - Valve I/F: maximum of 1200 μ s (Note 4)

  Note 3: The maximum condition for an IO-Link master unit is 64 bytes input and 64 bytes output.
  For 38 bytes input and 34 bytes output, it is 3000 μ s.

  Note 4: The condition for the maximum value of the Valve I/F unit is when it is 32 points and when the settings are changed, etc.

- Read time:
  - Digital output: Maximum 200 μs (almost no change)
  - Analog output: Typ. 200 μs (almost no change)
  - IO-Link master: maximum of 1400 μ s (Note 5)
  - Valve I/F: typ.240 μ s (Note 6)

  Note 5: The maximum condition for an IO-Link master unit is 64 bytes input and 64 bytes output.
  For 38 bytes input and 34 bytes output, it is 900 μ s.

  Note 6: The condition for the Valve I/F unit “typ.” value is when it is 32 points.

● **Input delay times specific to each I/O unit**

Varies depending on the I/O unit, as follows. Each item varies depending on the settings.

- Digital input: Sampling cycle 100 μs + filter time 100 μs or above (+ input hold time)
- Analog input: Sampling cycle 1000 μs or above × average number of filters 2 times or more.
- IO-Link master: It depends on typ. 1200 μs (Note 7) or by IO-Link communication cycle time manual settings.

Note 7: When in IO-Link mode, and the communication period is 1 ms, 4 bytes input and 4 bytes output.

● **Output delay time specific to each I/O unit**

Varies depending on the I/O unit, as follows.

- Digital output: 500 μs or less when ON, 1000 μs or less when OFF
- Analog output: 150 ms or less
- IO-Link master: typ.1200 μ s (Note 8)
- Valve I/F: 500 μs or less when ON, 1000 μs or less when OFF (Note 9)

Note 8: In IO-Link mode, the communication cycle is 1 ms, 4 bytes input, 4 bytes output.

Note 9: The delay of the manifold solenoid valve itself is excluded.

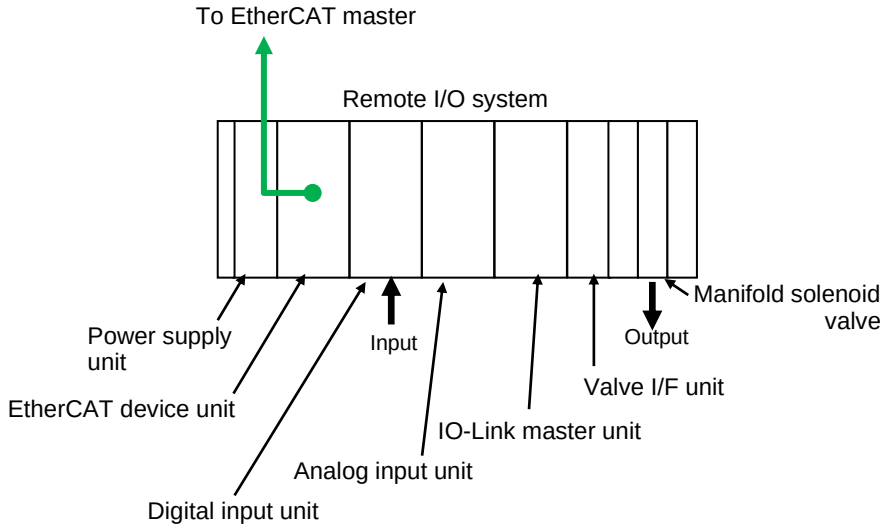
.

7.2 Example Calculation

The following is an example calculation.

- The EtherCAT communication cycle time, EtherCAT MDevice transmission delay time, and transmission jitter depend on the operating environment.
- All of the following I/O unit-specific delay settings are default.
  Input filter time setting for digital input unit: Default 0.1 ms
  Sampling cycle setting for analog input: Default 2 ms
  Averaging sampling count setting for analog input: Default twice (2 ms)

The following is an example of an RT series Remote I/O system structure.



The maximum input/output time from the input of the digital input unit to the output of the valve I/F unit is as follows, assuming the above conditions.

Total) Maximum of 12090 µs (12.1 ms)

Breakdown:
- EtherCAT communication cycle time: 500 µs
- EtherCAT MDevice transmission delay time: 10 µs
- Transmission jitter: 10 µs
- Maximum time for input data transmission of device unit: 4365 µs
- Maximum time for output data transmission of device unit: 3365 µs
- Write cycle for input data processing: 1000 µs for digital input unit only
- Write time for input data processing: 200 µs for digital input unit only
- Read cycle for output data processing: 1200 µs for valve I/F unit only
- Read time for output data processing: 240 µs valve I/F unit only
- Input delay time specific to each I/O unit: 200 µs for digital input only
- Output delay time specific to each I/O unit: 1000 µs

8. TROUBLESHOOTING

8.1 Unit Fault (Device unit diagnostic information)

The information can be read from the PC software or upper MDevice.

■ Error codes displayed in the PC software

The CH diagnostic information can be checked in the following screen of the PC software as a hexadecimal "Error code" with the corresponding bit set to 1 (ON).
- [Codes] on the [Errors] main tab
- [Error code] (in the error log)

■ Reading diagnostic information area from the upper MDevice by SDO communication

The diagnostic information for the device unit is also stored in the diagnostic information area (refer to "**9.7 Diagnostic Information** Area") of the object dictionary for the EtherCAT device unit below. It can be read from the upper MDevice via SDO communication.
For the EtherCAT compatible device unit, the following errors can be checked:

Bit	Error name	Description	"Error type" of the device unit "Remote I/O system diagnostic information"
15	Memory read/write error	Unable to read and write various memory types, or incorrect checksum.	Hardware error
14	Factory setting error	The serial number or MAC address of the device unit is the initial value.	System error
13	Unit configuration error	The device unit does not automatically recognize the connected I/O units correctly at power-up or has detected a change in the number of connected I/O units during operation.	System error
12	Process data overflow	The process data size with the upper MDevice of the device unit exceeds the maximum size below. - Input: Maximum 505 bytes (Note) - Output: Maximum 504 bytes - Total I/O: maximum 513 bytes (Note) Note: One byte for device unit Remote I/O system diagnostic information is included.	System error
10	Unit/input power voltage error	When the "unit/input power monitoring" setting is "Monitor", the device unit has detected a voltage of 24 VDC ± 25% or more from the power supply unit closest to itself on the left when facing it.	Power failure
9	Reserved	0 Fixed	-
8	Output power voltage error	When the "Output power supply monitor" setting is "Monitor", the device unit has detected a voltage of 24 VDC ± 25% or more from the power supply unit closest to itself on the left when facing it.	Power failure
7	Internal bus communication error	There is an error in the communication via the Remote I/O system's internal bus.	System error
6	Initialized set memory	Set memory was initialized and started up with the device unit's dip switch SW5 (Parameter initialization at startup) OFF.	System error
5, 4	Reserved	0 Fixed	-
3	Hardware error	An error has occurred that is suspected to be a hardware error in the device unit.	Hardware error
2	Reserved	0 Fixed	-
1	PDO mapping allocation error	PDO mapping allocation error has occurred.	System error
0	Reserved	0 Fixed	-

8.2 Troubleshooting from LED Display

8.2.1 LED is normal but conduct unintended operation

LED	Problem	Cause	Action
- Device unit RUN: Green on ERR, SF: Off - Even number (left) LED of IO-Link master unit: Green on	When the I/O unit configuration includes an IO-Link master unit, the upper MDevice cannot read and write the process data of the IO-Link device correctly when in IO-Link mode. The value of the process data is different from the value checked on the I/O monitor tab of the PC software directly connected to the Remote I/O system, or the value of the PC software is incorrect. E.g.) If the process data (PD) of the IO-Link device on port 1 is 4 bytes, they are separated by byte on the upper MDevice side and stored on ports 1 through 4.	The size of the basic unit of communication ("PDO") on the tool side of the configuration tool for the upper MDevice is not matched with the actual size of the process data (PD) of the IO-Link device.	Check the size of the process data (PD) of the IO-Link device connected in IO-Link mode. In the configuration tool on the upper MDevice side, set the size of the basic unit of communication (PDO) to match the actual process data (PD) size of the IO-Link device.

8.2.2 Troubleshooting from power supply unit LED display

■ Power supply unit LED

Power supply unit			Problem	Action
PWR(S)	PWR(O)	PWR(I)		
24 V unit/input status	24 V output status	5 V internal status		
Green on	Green on	Green on	Normal condition	-
Off	Off	Off	24 V unit/input and 24 V output are not supplied correctly.	Supply 24 V unit/input and 24 V outputs correctly.
Off	Green on	Off	24 V unit/input is not correctly supplied or the power supply unit internal fuse is blown.	Check the unit/input 24 V power supply. If the problem persists, replace the power supply unit.
Green on	Off	Green on	24 V output is not correctly supplied. Or, The internal fuse of the power supply unit is blown.	Check the output 24 V power supply. If the problem persists, replace the power supply unit.
Green on	Green on	Off	The internal IC of the power supply unit has failed.	Replace the power supply unit (Note 1).

Note 1: If replacing the power supply unit does not fix it, it may be due to a faulty I/O unit. If such is the case, contact CKD.

8.2.3 Troubleshooting from the LED display on a EtherCAT compatible device unit

■ Power monitoring LED on the device unit

Device unit PS	Problem	Cause	Action
Red blinking (fast)	Unit/input power voltage error	When the "unit/input power monitoring" setting is "monitor", the device unit has detected that the 24 VDC unit/input voltage is outside the range of 24 VDC ± 25%.	Verify that the 24 V unit/input voltage to the power supply unit is within the range of ± 10%.
Yellow on	Unit/input voltage restored from voltage error	It is latched after recovering from a voltage error in the unit/input 24 V.	Reset it using power cycle operation or PC software operation.
Off	Power OFF state	24 V for unit/input to the power supply unit is OFF or not correctly supplied.	Verify that there is 24 V for the unit/input to the power supply unit.

Device unit PO	Problem	Cause	Action
Red blinking (fast)	Output power voltage error	When the "output power supply monitoring" setting is "monitor", the device unit has detected that the 24 VDC output voltage is outside the range of 24 VDC ± 25%.	Verify that the 24 V output voltage to the power supply unit is within the range of -5 to +10%.
Yellow on	Output voltage restored from voltage error	It is latched after recovering from a voltage error in the output 24 V.	Reset it using power cycle operation or PC software operation.
Off	Power OFF state	24 V output to the power supply unit is OFF or not correctly supplied.	Verify that there is 24 V output to the power supply unit.

■ Basic LED of the device unit

Normal condition

Device unit								Problem
RUN	ERR	SF	CF	PS	PO	L/A IN	L/A OUT	
Status of the EtherCAT State Machine	Watchdog timeout or local error	Status of the entire Remote I/O system	Setting change or forced input/output	Status of the 24 V power supply for unit/input	Status of the 24 V power supply for output	Link status on the IN side of the connector	Link status on the OUT side of the connector	
Green on	Off	Green on	Off	Green on	Green on	Green blinking (fast)	Green blinking (fast)	Normal condition

Error condition

Device unit				Problem	Diagnostic information for the device unit	Cause	Action
RUN	ERR	SF	CF				
Status of the EtherCAT State Machine	Watchdog timeout or local error	Status of the entire Remote I/O system	Setting change or forced input/output				
Off	Undefined	Undefined	Undefined	Cannot connect to the upper MDevice.	-	EtherCAT initializing.	Match the process data size on the upper MDevice side with the actual process data size on the Remote I/O system.
Green blinking (fast)	Undefined	Undefined	Undefined		-	Power is on but not in the initialization sequence.	Turn the power off and on again. If the problem persists, contact CKD.
Green blinking (slow)	Undefined	Undefined	Undefined	The state is in pre-operational.	-	The module configuration (I/O unit configuration) has been downloaded to the device unit, and the I/O unit configuration of the actual device does not match the I/O unit configuration set on the upper MDevice (“MDP verification error” has occurred).	Change the I/O unit configuration on the upper MDevice side configuration tool to the same configuration as the actual device and download it to the device unit, or change the configuration of the actual device in accordance with the configuration set on the MDevice, and turn the power off and on again.
Green blinking (slow)	Red blinking	Yellow blinking (fast)	Undefined	A "Unit configuration error" has occurred.	Unit configuration error	The device unit does not automatically recognize the connected I/O units correctly when it is powered on, or it has detected a change in the number of I/O units connected during operation.	- If the actual I/O unit configuration is correct, leave the configuration as is and turn the power off and on again. - If the actual I/O unit configuration is not correct, turn OFF the power, change the I/O unit configuration, and then turn on the power. - Check the connection between the units.
						The I/O unit configuration on the upper MDevice configuration tool matches the actual configuration, but when using multiple power supply units, the power-up timing between the power supply units has shifted by 3 seconds or more.	Cycle the power-up timing to the multiple power supply units at the same time (within 3 seconds).
						The process data size of the variable I/O unit and the process data size calculated from the unit does not match.	Match the data size by the following method. - Restart - Check “process data overflow.”

Device unit				Problem	Diagnostic information for the device unit	Cause	Action
RUN	ERR	SF	CF				
Status of the EtherCAT State Machine	Watchdog timeout or local error	Status of the entire Remote I/O system	Setting change or forced input/output				
Green blinking (slow)	Red blinking (slow)	Undefined	Undefined	The state is in pre-operational.	-	The I/O unit configuration downloaded to the product from the upper MDevice configuration tool does not match the actual configuration (MDP verification error).	Match the I/O unit configuration on the upper MDevice configuration tool to the actual configuration, and then start EtherCAT communication and download the configuration information to the device unit. Note: The I/O unit configuration deemed correct by the upper MDevice is automatically downloaded to the device unit when EtherCAT communication is started.
						The I/O unit configuration has not been downloaded to the product from the configuration tool of the upper MDevice.	
						The I/O unit configuration on the upper MDevice configuration tool matches the actual configuration, but when using multiple power supply units, the power-up timing between the power supply units has shifted by 3 seconds or more.	Cycle the power-up timing to the multiple power supply units at the same time (within 3 seconds).
						The PDO on the upper MDevice side for the variable I/O unit is not suitable (PDO size error).	Change the size of the PDO on the upper MDevice side in accordance with the setting size on the variable I/O unit side (add a PDO entry or remove a PDO entry). Note: For an example of how to operate the variable I/O unit as an IO-Link master unit, refer to "4.4.1 Example of actual machine operation" in the "IO-Link Master Unit Instruction Manual".
						Other setting errors have occurred. The AL status code corresponding to the error details is stored in the AL register. For more information, refer to "**8.3 AL Status** Function".	Take action according to the AL status code.

Device unit				Problem	Diagnostic information for the device unit	Cause	Action
RUN	ERR	SF	CF				
Status of the EtherCAT State Machine	Watchdog timeout or local error	Status of the entire Remote I/O system	Setting change or forced input/output				
Green blinking (once)	Undefined	Undefined	Undefined	The state is in safe operational.	-	A transition instruction from the upper MDevice to a safe operational state has occurred.	If it occurs while the system is running, check the status of the connected upper MDevice. If there is no problem with the upper MDevice, turn the power off and on again. If the problem persists, contact CKD.
Undefined	Red blinking (2 times)	Undefined	Undefined	A communication error (application watchdog timeout) has occurred.	-	One of the following is occurring: - There is an error on the upper MDevice side. - There is a problem with the communication connection.	Check the following and turn the power off and on again. - Whether the upper MDevice is running. - Are any communication cable connectors loose?
Undefined	Undefined	Red blinking (fast)	Undefined	An internal bus communication error has occurred.	Internal bus communication error	There is a physical connection problem between the units, or there is a strong noise around the area.	Disconnect, reconnect, and power on the Remote I/O system units. If it still occurs, check the connection, improve the noise condition, or implement a workaround. If the condition still persists even after making improvements, contact CKD.
Undefined	Undefined	Red blinking (slow)	Undefined	A hardware error has occurred in the device unit.	Hardware error	There is a possible hardware error.	Turn the power off and on again. If the problem persists, replace the device unit.
Undefined	Undefined	Red blinking (slow)	Undefined	- Cannot read/write various memories. - Settings are initialized. - Cannot communicate with the EtherCAT MDevice. - Automatic recognition fails. - Cannot read log data from the PC software.	Memory read/write error	There is a possible hardware failure.	Turn the power off and on again after writing new data, or do so while the dip switch SW5 is ON. If the problem persists, contact CKD.
Undefined	Undefined	Red blinking (2 times)	Undefined	Factory setting error has occurred.	Factory setting error	The serial number of the device unit is the initial value (the serial number is always written at manufacturing). There is a possible failure.	Contact CKD.

Device unit				Problem	Diagnostic information for the device unit	Cause	Action
RUN	ERR	SF	CF				
Status of the EtherCAT State Machine	Watchdog timeout or local error	Status of the entire Remote I/O system	Setting change or forced input/output				
Undefined	Undefined	Yellow on	Undefined	Process data is fixed.	-	- Disconnection detected in digital input unit or analog input unit. - The digital output unit or analog output unit is in Manual output status. - Valve I/F unit is in a manual output state. - Changed the settings that changes the process data size on the variable I/O unit.	Turn the unit power off and then on again.
Undefined	Undefined	Green blinking (fast)	Undefined	The I/O unit setting is initialized and started. Cannot connect to the upper MDevice.	Initialized set memory	- The setting memory was initialized and started up while the device unit's dip switch SW5 (Parameter initialization at startup) was OFF. - Changed connected I/O unit (when the device unit started up, the unit ID and connection position number of the connected I/O unit did not match ones at the last start-up). . - The checksum of the setting memory in the analog I/O unit and IO-Link master unit did not match the one stored in the device unit.	Check if the configuration of the I/O unit has changed. And turn the power off and on again. If the problem persists, contact CKD. Note: To clear the error, turn the power off and on again, or a latch reset operation from the PC software.
Undefined	Undefined	Green blinking (slow)	Undefined	The process data size of some I/O units is different than expected. Some I/O units have an internal bus communication error. Cannot connect to the upper MDevice.	Process data overflow	The process data size with the upper MDevice as a device unit exceeds the maximum size below. - Input: Up to 504 bytes (not including one byte for the device unit Remote I/O system diagnostic information). - Output: Up to 504 bytes. - Total input/output: Up to 512 bytes (not including one byte for the device unit Remote I/O system diagnostic information).	Make the process data size the maximum size or lower, for example by reducing the number of I/O units or changing the I/O unit type. Following this, turn the power off and on again.
Undefined	Undefined	Undefined	Yellow on	Cannot control process data from the upper MDevice.	-	There is a unit with a forced I/O setting.	Remove the forced I/O setting from the PC software, or turn the power off and on again.
Undefined	Undefined	Undefined	Green blinking (slow)	Cannot change settings through SDO	-	Settings are also changed from the PC software at the same	Check whether the settings are changed from the PC software

Device unit				Problem	Diagnostic information for the device unit	Cause	Action
RUN	ERR	SF	CF				
Status of the EtherCAT State Machine	Watchdog timeout or local error	Status of the entire Remote I/O system	Setting change or forced input/output				
				communication.		time.	as well.

Device unit				Problem	Diagnostic information for the device unit	Cause	Action
RUN	ERR	SF	CF				
Status of the EtherCAT State Machine	Watchdog timeout or local error	Status of the entire Remote I/O system	Setting change or forced input/output				
Undefined	Undefined	Undefined	Off	Cannot be controlled from the PC software.	-	Have not accessed from the PC software for 60 seconds or more.	Ensure that the specified COM port is correct.

■ LED in data transmission/reception status of the device unit

Device unit	Problem	Cause	Action
L/A IN L/A OUT			
Off	No EtherCAT communication.	The Ethernet cable is not connected properly.	Check the Ethernet cable connection.

8.3 AL Status Function

The following is a list of the AL status code types used with this product and the details of errors.

If an AL status error occurs, the code is stored in the AL status register of the product. At the same time, error can be detected on the upper MDevice side. If it can be verified on the upper MDevice side, check the AL status code generated on the product.

Code	Description	
0x0000	Name	No error
	Description/condition	No error has occurred
	RUN LED	Undefined
	ERR LED	Normal (off)
0x0001	Name	General error
	Description/condition	- An attempt was made to add a new object dictionary to an existing index - The addition of the object dictionary was not successful - Timeout in state machine transition - Unit configuration error has occurred at OP.
	RUN LED	Undefined
	ERR LED	Setting error (red blinking (slow))
0x0002	Name	No memory
	Description/condition	Mailbox memory could not be allocated
	RUN LED	Undefined
	ERR LED	Setting error (red blinking (slow))
0x0003	Name	Invalid device setup
	Description/condition	-“Initialized set memory” is in operation. -“Process data overflow” has occurred. -“Unit configuration error” has occurred.
	RUN LED	Undefined
	ERR LED	Setting error (red blinking (slow))
0x0011	Name	Invalid state transition request
	Description/condition	An invalid state transition request for a state machine
	RUN LED	Undefined
	ERR LED	Setting error (red blinking (slow))
0x0012	Name	Unknown state transition request
	Description/condition	An undefined state transition request for a state machine
	RUN LED	Undefined
	ERR LED	Setting error (red blinking (slow))
0x0013	Name	Bootstrap not supported
	Description/condition	Bootstrap is not supported, but there was a request for a change
	RUN LED	Initialization is in progress (off) or the power is on, but it is not in the initialization sequence (green blinking (fast))
	ERR LED	Setting error (red blinking (slow))
0x0014	Name	No valid firmware
	Description/condition	No valid firmware is in the memory
	RUN LED	Initialization is in progress (off) or pre-operational (green blinking (slow))
	ERR LED	Setting error (red blinking (slow))
0x0016	Name	Invalid mailbox settings (PREOP)
	Description/condition	- Mailbox is not enabled - Mailbox is not able to be written to from the MDevice - Mailbox mode is not ONE BUFFER - Mailbox size is small - Mailbox size is large - Mailbox address is small - Mailbox address is large - The area between the incoming and outgoing mailboxes is duplicated
	RUN LED	Initialization is in progress (off) or pre-operational (green blinking (slow))
	ERR LED	Setting error (red blinking (slow))

Code	Description	
0x0018	Name	No valid inputs
	Description/condition	SubDevice does not provide valid input.
	RUN LED	Safe operational (green blinking (once) or pre-operational (green blinking (slow))
	ERR LED	Setting error (red blinking)
0x0019	Name	No valid outputs
	Description/condition	SubDevice has not received valid output.
	RUN LED	Safe operational (green blinking (once)) or operational (green on)
	ERR LED	Setting error (red blinking (slow))
0x001A	Name	Sync error
	Description/condition	Transition from SAFEOP to OP timed out with a sync error
	RUN LED	Safe operational (green blinking (once))
	ERR LED	Setting error (red blinking (slow))
0x001B	Name	SyncManager watchdog timeout
	Description/condition	Output data could not be received during the transition from SAFEOP to OP
	RUN LED	Safe operational (green blinking (once)) or operational (green on)
	ERR LED	Watchdog timeout (red blinking (twice))
0x001D	Name	Invalid SyncManager (output data) setting (PDO size error)
	Description/condition	SM settings failed. Refer to “5.3.2 SyncManager verification“.
	RUN LED	Safe operational (green blinking (once)) or operational (green on)
	ERR LED	Setting error (red blinking (slow))
0x001E	Name	Invalid SyncManager (input data) setting (PDO size error)
	Description/condition	SM settings failed. Refer to “5.3.2 SyncManager verification“.
	RUN LED	Initialization is in progress (off) or pre-operational (green blinking (slow)) Or, is safe operational (green blinking (once))
	ERR LED	Setting error (red blinking (slow))
0x001F	Name	Invalid watchdog settings
	Description/condition	The process could not be completed because of invalid watchdog settings
	RUN LED	Initialization is in progress (off) or pre-operational (green blinking (slow)) Or, is safe operational (green blinking (once))
	ERR LED	Setting error (red blinking (slow))
0x0029	Name	FreeRun needs 3Buffer Mode
	Description/condition	Attempted to run FreeRun without 3Buffer mode
	RUN LED	Pre-operational (green blinking (slow) or operational (green on)
	ERR LED	Setting error (red blinking (slow))
0x002C	Name	Fatal sync error
	Description/condition	Sync0 synchronization failed
	RUN LED	Operational (green on)
	ERR LED	Setting error (red blinking (slow))
0x002D	Name	Sync signal not received
	Description/condition	Synchronization is not working when transitioning from SAFEOP to OP
	RUN LED	Safe operational (green blinking (once))
	ERR LED	Status change by SubDevice (red blinking (once))
0x0030	Name	Invalid DC sync setting
	Description/condition	Invalid synchronization type is set
	RUN LED	Pre-operational (green blinking (slow)) Or, is safe operational (green blinking (once))
	ERR LED	Setting error (red blinking (slow))

Code	Description	
0x0036	Name	DC Sync0 cycle time
	Description/condition	The set cycle time is outside the valid range
	RUN LED	Pre-operational (green blinking (slow)) Or, is safe operational (green blinking (once))
	ERR LED	Setting error (red blinking (slow))
0x0051	Name	EEPROM error
	Description/condition	Data could not be successfully read from EEPROM
	RUN LED	Undefined
	ERR LED	Setting error (red blinking (slow))
0x0070	Name	Mismatch between detected module ID list (0xF030) and set module ID list (0xF050) (MDP verification error)
	Description/condition	Mismatched configuration of modules registered in object dictionary 0xF030 and 0xF050 Refer to “5.3.1 MDP verification error“.
	RUN LED	Pre-operational (green blinking (slow))
	ERR LED	Setting error (red blinking (slow))

9. OBJECT DICTIONARY LIST

9.1 Index Range of Object Dictionary

The index range of the object dictionary in EtherCAT is determined for each function as follows.

Index range	Description	Use in this unit
0x0000 to 0x0FFF	Data type area	Not used
0x1000 to 0x1FFF	Communication settings area	Used
0x2000 to 0x5FFF	Manufacturer-specific data area	Not used
0x6000 to 0x6FFF	Input process data area	Used
0x7000 to 0x7FFF	Output process data area	Used
0x8000 to 0x8FFF	Setting data area	Used
0x9000 to 0x9FFF	SubDevice information area	Used
0xA000 to 0xAFFF	Diagnostic information area	Used
0xB000 to 0xBFFF	Service area	Not used
0xC000 to 0xEFFF	Reserved area (not available)	Not used
0xF000 to 0xFFFF	Device area	Used

9.2 Communication Settings Area

Indicates an object consisting of identification information, error logs for EtherCAT device unit, process data, and feature settings for EtherCAT communication.

9.2.1 Identification information

Index	Sub-index	Data name	Description	Data type	Read/ write attrib.	Value	Initial value
0x1000	0	Device type	Indicates the device type of the product.	UNSIGNED32	RO	0x00011389	0x00011389
0x1008	0	Manufacture Device Name	Indicates the model No. of the product.	VisibleString	RO	0x52542D585445434E30304E	0x52542D585445434E30304E (Note 1)
0x1009	0	Manufacture Hardware Version	Indicates the hardware version of the product.	VisibleString	RO	0x312E302E30	0x312E302E30 (1.0.0)
0x100A	0	Manufacture Software Version	Indicates the software version of the product.	VisibleString	RO	0x312E302E30	0x312E302E30 (1.0.0)
0x1018	0	Identity Object	Indicates the identification information of the product.	UNSIGNED8	RO	0x4	0x4
	1	Vendor ID	Indicates the vendor ID.	UNSIGNED32	RO	0x00000634	0x00000634
	2	Product Code	Indicates the product code.	UNSIGNED32	RO	0x45430001	0x45430001
	3	Revision Number	Indicates the revision number.	UNSIGNED32	RO	0x00000001	0x00000001
	4	Serial Number	Indicates the serial number.	UNSIGNED32	RO	Unique to the product	Unique to the product
0x10F8	0	Timestamp Object		UNSIGNED64	RO	-	-

Note 1: (RT-XTECN00N)

9.2.2 EtherCAT device unit error log

Stores the error log for the EtherCAT device unit in the following Diagnosis Message area of EtherCAT.

Index	Sub-index	Data name	Description	Data type	Read/ write attrib.	Value	Initial value
0x10F3	0	Diagnosis History	Number of entries	UNSIGNED8	RO	0x05～0xFF 5～255	0x05
	1	Maximum Messages	Maximum number of error logs	UNSIGNED8	RO	0xFA	0xFA
	2	Newest Message	Sub-index number of most recent error log	UNSIGNED8	RW	0x06 to FF	0x00
	3	Newest Acknowledged Message	Most recent confirmed message.	UNSIGNED8	RW	Refer to Note 1	0x00
	4	New Messages Available	Whether there is a most recent error log	BOOLEAN	RO	0: No new log present. 1: New log present. (Note 2)	0
	5	Flags	Flags	UNSIGNED16	RO	Refer to Note 2	0x0006
	6	Diagnosis Message	EtherCAT device unit error log 1	OCTET-STRING	RO	Refer to Note 3	-
	…		…	…	…	…	…
	255	Diagnosis Message	EtherCAT device unit error log 250	OCTET-STRING	RO	Refer to Note 3	-
0x10F8	0	Timestamp Object	Number of entries	UNSIGNED8	RO	0x01	0x01
	1	Timestamp	Internal current time maintained by the EtherCAT compatible device unit	UNSIGNED64	RO	-	-

Note 1: The most recent response message number is the following values.
When reading, 0x00 is returned.
There is no response when writing 0x00.
When writing from 0x01 to 0x05, the following SDO-Abort code is returned.
0x06090030 (value range of parameter exceeded) or 0x06090032 (value of parameter written too low)
When writing from 0x06 up to the number of entries, user input will be reflected.
When writing to 0xFF with a value greater than the number of entries, the following SDO-Abort code is returned.
0x06090030 (value range of parameter exceeded) or 0x06090032 (value of parameter written too low)

Note 2: When this sub-index is 1, the error log is assumed to have been newly stored.

Note 3: The setting for whether there is a notification for error logs is the following values.
Bit0: 0
Bit1: 1 (no Info message)
Bit2: 2 (no Warning message)
Bit 3: 0 (no error message), 1 (with error message)
Bit 4: 0 (overwrite mode) fixed *1
Bit 5: 0 (not overwritten), 1 (overwritten)
Bit 6 to 15: Not used
*1: History is overwritten if more than 250 error logs are present. Therefore, on that premise, it is necessary to access the EtherCAT device unit error log 1 to 250 at sub-indexes 6 to 255.

Note 4: The error log for the EtherCAT compatible device unit is stored in sub-indexes 6 to 255 at index 0x10F3, respectively, in the following forms.

Item			Data type	Description		Value
Diag Code			UNSIGNED32	Not used, fixed at 0xE000.		0xE000 fixed
Flag			UNSIGNED16	Bit 0 to 3	0x2: There is an error message.	0x2 fixed
				Bit 4	Type of timestamp.	0: Use the timestamp of the EtherCAT device unit (*1) 1: Timestamp in DC mode (ns)
				Bit 5 to 7	Reserved	-
				Bit 8 to 15	The number of parameters after the timestamp.	0x 004 fixed
Text ID			UNSIGNED16	0x 0000: No text ID.		0x 0000 fixed
Time stamp			UNSIGNED64	Time stamp for the error log of the EtherCAT compatible device unit. When in DC mode, it is stored in ns units. Stored from 0x10F8 when in free-run mode.		Undefined
Parameters			-	-		-
1	Unit ID	Flags Unit ID	UNSIGNED16	Stores the Unit ID in the error log.		Bit 0 to 11 = 0x0007 (refers to UNSIGNED32) Bit 12 to 15 = 0
		Unit ID	UNSIGNED32	The unit ID of the error log.		0x00000000 to 0xFFFFFFFF
2	Unit position number	Flags Unit Position	UNSIGNED16	Stores the data type of the unit position number in the error log.		Bit 0 to 11 = 0x0005 (refers to UNSIGNED8) Bit 12 to 15 = 0
		Unit Position	UNSIGNED8	The unit position number for the error log. 0 to 17 (decimal)		0x00 to 0x11
3	CH/point/port number	Flags Channel	UNSIGNED16	Stores the data type of the CH/point/port number in the error log.		Bit 0 to 11 = 0x0005 (refers to UNSIGNED8) Bit 12 to 15 = 0
		Channel	UNSIGNED8	CH/point/port number of the error log.		0x00 to 0x1F
4	Error code	Flags ErrorCode	UNSIGNED16	Stores the data type of the error code in the error log.		Bit 0 to 11 = 0x0006 (refers to UNSIGNED16) Bit 12 to 15 = 0
		Error code	UNSIGNED16	Error code for the error log.		0x0000 to 0xFFFF

*1: If not operating in DC mode or if only 32-bit DC mode is supported, the time stamp (0x10F8) of the EtherCAT device unit is used.

9.2.3 Process data object

In 0x16☐☐ of the TxPDO mapping area, 0x7XX0 of the output process data area is pre-set.
In 0x1A☐☐ of the RxPDO mapping area, 0x6XX0 of the input process data area is pre-set.
Note: The above ☐☐ is the unit position number (0x00 to 0x11) x 0xE. XX is the unit position number (0x00 to 0x11).

Refer to "9.3 Input Process Data Area" for information on the input process data areas that can be assigned.
Refer to "9.4 Output Process Data Area" for information on the output process data areas that can be assigned.

■ TxPDO (MDevice to Remote I/O system) mapping settings

The output process data for I/O units other than the IO-Link master unit is assigned to 0x16☐☐.
The output process data of the IO-Link master unit is assigned to 0x16☐☐ to 0x16☐☐ + 0x9.
Note: The above ☐☐ is the unit position number (0x00 to 0x11) x 0xE.

Index	Sub-index	Data name	Description	Data type	Read/ write attrib.	Value	Initial value
0x16☐☐	0	Analog OUT 2 RxPDO Mapping	Analog output 2 CH Number of entries	UNSIGNED8	RO	0x02	0x02
	1	subIndex01	PDO entry 1	UNSIGNED32	RO	0x7XX0:01␣10	0x7XX0:01␣10
	2	subIndex02	PDO entry 2	UNSIGNED32	RO	0x7XX0:02␣10	0x7XX0:02␣10
0x16☐☐	0	Digital OUT 8 RxPDO Mapping	Digital output 8 points Number of entries	UNSIGNED8	RO	0x08	0x08
	1	subIndex01	PDO entry 1	UNSIGNED32	RO	0x7XX0:01␣01	0x7XX0:01␣01
	…	…	…	…	…	…	…
	8	subIndex08	PDO entry 8	UNSIGNED32	RO	0x7XX0:08␣01	0x7XX0:08␣01
0x16☐☐	0	Digital OUT 16 RxPDO Mapping	Digital output 16 points Number of entries	UNSIGNED8	RO	0x10	0x10
	1	subIndex01	PDO entry 1	UNSIGNED32	RO	0x7XX0:01␣01	0x7XX0:01␣01
	…	…	…	…	…	…	…
	16	subIndex16	PDO entry 16	UNSIGNED32	RO	0x7XX0:10␣01	0x7XX0:10␣01
0x16☐☐	0	Digital OUT 32 RxPDO Mapping	Digital output 32 points Number of entries	UNSIGNED8	RO	0x20	0x20
	1	subIndex01	PDO entry 1	UNSIGNED32	RO	0x7XX0:01␣01	0x7XX0:01␣01
	…	…	…	…	…	…	…
	16	subIndex32	PDO entry 32	UNSIGNED32	RO	0x7XX0:20␣01	0x7XX0:20␣01
0x16☐☐	0	Valve I/F OUT 32 RxPDO Mapping	Valve I/F unit 32 points Number of entries	UNSIGNED8	RO	0x20	0x20
	1	subIndex01	PDO entry 1	UNSIGNED32	RO	0x7XX0:01␣01	0x7XX0:01␣01
	…	…	…	…	…	…	…
	32	subIndex32	PDO entry 32	UNSIGNED32	RO	0x7XX0:20␣01	0x7XX0:20␣01
0x16☐☐	0	IO-Link Digital OUT1 TxPDO	IO-Link master unit Digital output 1 Number of entries	UNSIGNED8	RO	0x08	0x08
	1	subIndex01	PDO entry 1	UNSIGNED32	RO	0x7XX0:01␣01	0x7XX0:01␣01
	…	…	…	…	…	…	…
	8	subIndex08	PDO entry 8	UNSIGNED32	RO	0x7XX0:08␣01	0x7XX0:08␣01
0x16☐☐+ 0x1	0	IO-Link Event clear flag TxPDO	IO-Link master unit Error log cleared Number of entries	UNSIGNED8	RO	0x08	0x08
	1	subIndex01	PDO entry 1	UNSIGNED32	RO	0x7XX1:01␣01	0x7XX1:01␣01
	…	…	…	…	…	…	…
	8	subIndex08	PDO entry 8	UNSIGNED32	RO	0x7XX1:08␣01	0x7XX1:08␣01

Index	Sub-index	Data name	Description	Data type	Read/ write attrib.	Value	Initial value
0x16☐☐+ 0x2	0	Port 0 IO-Link output data TxPDO	IO-Link master unit Port 0 process data Number of entries	UNSIGNED8	RO	0x20	0x20
	1	subIndex01	PDO entry 1	UNSIGNED32	RO	0x7XX2:01 ␣08	0x7XX2:01 ␣08
	…	…	…	…	…	…	…
	32	subIndex32	PDO entry 32	UNSIGNED32	RO	0x7XX2:20 ␣08	0x7XX2:20 ␣08
…	…		…	…	…	…	…
0x16☐☐+ 0x9	0	Port 7 IO-Link output data TxPDO	IO-Link master unit Port 7 process data Number of entries	UNSIGNED8	RO	0x20	0x20
	1	subIndex01	PDO entry 1	UNSIGNED32	RO	0x7XX9:01 ␣08	0x7XX9:01 ␣08
	…	…	…	…	…	…	…
	32	subIndex32	PDO entry 32	UNSIGNED32	RO	0x7XX9:20 ␣08	0x7XX9:20 ␣08

* The "☐☐" in the above index is the unit position number (0x00 to 0x11) multiplied by 0xE (decimal 14).
* The "XX" in the above initial value is the unit position number (0x00 to 0x11).
* The two-digits following the space after the sub-index in the "value" and "Initial value" columns of the above table indicate the object size to be mapped (in bits).

■ RxPDO (Remote I/O system to MDevice) mapping settings

The input process data for I/O units other than the IO-Link master unit is assigned to 0x1A☐☐.
The input process data of the IO-Link master unit is assigned to 0x1A☐☐ to 0x1 A☐☐ + 0xD.
Note: The above ☐☐ is the unit position number (0x00 to 0x11) x 0xE.

Index	Sub-index	Data name	Description	Data type	Read/ write attrib.	Value	Initial value
0x1A☐☐	0	Diagnostic information	Remote diagnostic information Number of entries	UNSIGNED8	RO	0x08	0x08
	1	subIndex01	PDO entry 1	UNSIGNED32	RO	0x6XX0:01 ␣01	0x6XX0:01 ␣01
	…	…	…	…	…	…	…
	8	subIndex08	PDO entry 8	UNSIGNED32	RO	0x6XX0:08 ␣01	0x6XX0:08 ␣01
0x1A☐☐	0	Analog IN 2 TxPDO Mapping	Analog input 2 CH Number of entries	UNSIGNED8	RO	0x02	0x02
	1	subIndex01	PDO entry 1	UNSIGNED32	RO	0x6XX0:01 ␣10	0x6XX0:01 ␣10
	2	subIndex02	PDO entry 2	UNSIGNED32	RO	0x6XX0:02 ␣10	0x6XX0:02 ␣10
0x1A☐☐	0	Digital IN 8 TxPDO Mapping	8 digital input points Number of entries	UNSIGNED8	RO	0x08	0x08
	1	subIndex01	PDO entry 1	UNSIGNED32	RO	0x6XX0:01 ␣01	0x6XX0:01 ␣01
	…	…	…	…	…	…	…
	8	subIndex08	PDO entry 8	UNSIGNED32	RO	0x6XX0:08 ␣01	0x6XX0:08 ␣01
0x1A☐☐	0	Digital IN 16 TxPDO Mapping	16 digital input points Number of entries	UNSIGNED8	RO	0x10	0x10
	1	subIndex01	PDO entry 1	UNSIGNED32	RO	0x6XX0:01 ␣01	0x6XX0:01 ␣01
	…	…	…	…	…	…	…
	16	subIndex16	PDO entry 16	UNSIGNED32	RO	0x6XX0:10 ␣01	0x6XX0:10 ␣01

Index	Sub-index	Data name	Description	Data type	Read/ write attrib.	Value	Initial value
0x1A□□	0	Digital IN 32 TxPDO Mapping	32 digital input points Number of entries	UNSIGNED8	RO	0x20	0x20
	1	subIndex01	PDO entry 1	UNSIGNED32	RO	0x6XX0:01 ␣01	0x6XX0:01 ␣01
	…	…	…	…	…	…	…
	32	subIndex32	PDO entry 32	UNSIGNED32	RO	0x6XX0:20 ␣01	0x6XX0:20 ␣01
0x1A□□	0	IO-Link Digital IN1 RxPDO	IO-Link master unit Digital input 1 Number of entries	UNSIGNED8	RO	0x08	0x08
	1	subIndex01	PDO entry 1	UNSIGNED32	RO	0x6XX0:01 ␣01	0x6XX0:01 ␣01
	…	…	…	…	…	…	…
	8	subIndex8	PDO entry 8	UNSIGNED32	RO	0x6XX0:08 ␣01	0x6XX0:08 ␣01
0x1A□ □+ 0x1	0	IO-Link Digital IN2 RxPDO	IO-Link master unit Digital input 2 Number of entries	UNSIGNED8	RO	0x08	0x08
	1	subIndex01	PDO entry 1	UNSIGNED32	RO	0x6XX1:01 ␣01	0x6XX1:01 ␣01
	…	…	…	…	…	…	…
	8	subIndex8	PDO entry 8	UNSIGNED32	RO	0x6XX1:08 ␣01	0x6XX1:08 ␣01
0x1A□ □+ 0x2	0	IO-Link Port error flag RxPDO	IO-Link master unit Port error flag Number of entries	UNSIGNED8	RO	0x08	0x08
	1	subIndex01	PDO entry 1	UNSIGNED32	RO	0x6XX2:01 ␣01	0x6XX2:01 ␣01
	…	…	…	…	…	…	…
	8	subIndex08	PDO entry 8	UNSIGNED32	RO	0x6XX2:08 ␣01	0x6XX2:08 ␣01
0x1A□ □+ 0x3	0	IO-Link COMM error flag RxPDO	IO-Link master unit IO-Link COMM error Number of entries	UNSIGNED8	RO	0x08	0x08
	1	subIndex01	PDO entry 1	UNSIGNED32	RO	0x6XX3:01 ␣01	0x6XX3:01 ␣01
	…	…	…	…	…	…	…
	8	subIndex08	PDO entry 8	UNSIGNED32	RO	0x6XX3:08 ␣01	0x6XX3:08 ␣01
0x1A□ □+ 0x4	0	IO-Link Error log update flag RxPDO	IO-Link master unit IO-Link error log update Number of entries	UNSIGNED8	RO	0x08	0x08
	1	subIndex01	PDO entry 1	UNSIGNED32	RO	0x6XX4:01 ␣01	0x6XX4:01 ␣01
	…		…	…	…	…	…
	8	subIndex08	PDO entry 8	UNSIGNED32	RO	0x6XX4:08 ␣01	0x6XX4:08 ␣01
0x1A□ □+ 0x5	0	IO-Link Input data enable flag RxPDO	IO-Link master unit Port 0 process data Number of entries	UNSIGNED8	RO	0x20	0x20
	1	subIndex01	PDO entry 1	UNSIGNED32	RO	0x6XX5:01 ␣08	0x6XX5:01 ␣08
	…	…	…	…	…	…	…
	32	subIndex08	PDO entry 32	UNSIGNED32	RO	0x6XX5:08 ␣08	0x6XX5:08 ␣08
…	…		…	…	…	…	…
0x1A□ □+ 0xD	0	Port 7 IO-Link input data RxPDO	IO-Link master unit Port 7 process data Number of entries	UNSIGNED8	RO	0x20	0x20
	1	subIndex01	PDO entry 1	UNSIGNED32	RO	0x6XXD:01 ␣08	0x6XXD:01 ␣08
	…	…	…	…	…	…	…
	32	subIndex32	PDO entry 32	UNSIGNED32	RO	0x6XXD:20 ␣08	0x6XXD:20 ␣08

* The "□□" in the above index is the unit position number (0x00 to 0x11) multiplied by 0xE (decimal 14).
* The "XX" in the above initial value is the unit position number (0x00 to 0x11).
* The two-digit number after the space after a sub-index in the "Value" and "Initial value" columns of the above table indicates the object size to be mapped (in bits).

9.2.4 EtherCAT communication feature settings

■ Sync Manager 2/3 PDO Assignment

0x1C12 is for Sync Manager 2 PDO Assignment and 0x1C13 is for Sync Manager 3 PDO Assignment.

Index	Sub-index	Data name	Data type	Read/write attrib.	Value
0x1C12/ 1C13	0	Sync Manager 2/3 PDO Assignment Number of entries	UNSIGNED8	RW	-
	1	RxPDO Mapping Index of 1st Module with Outputs	UNSIGNED16	RW	-
	…				
	n	RxPDO Mapping Index of last Module with Outputs	UNSIGNED16	RW	-

■ Sync Manager Synchronization

0x1C32 is for Sync Manager 2 Synchronization and 0x1C33 is for Sync Manager 3 Synchronization.

Index	Sub-index	Data name	Description	Data type	Read/ write attrib.	Value	Initial value
0x1C32/ 1C33	0	1C32: Sync Manager 2 Synchronization 1C33: Sync Manager 3 Synchronization	1C32:SM output parameter 1C33:SM input parameter Number of entries	UNSIGNED8	RO	0x20	0x20
	1	Synchronization Type	Synchronization Type	UNSIGNED16	RW	(Note 1)	0x0000
	2	Cycle Time	Cycle Time	UNSIGNED32	RO	Cycle time (unit: ns) for each sync mode	0x00000000
	4	Synchronization Types supported	Synchronization Types supported	UNSIGNED16	RO	0x001F	0x001F
	5	Minimum Cycle Time	Minimum Cycle Time	UNSIGNED32	RO	0x00000000	0x00000000
	6	Calc and Copy Time	Calc and Copy Time	UNSIGNED32	RO	0x00000000	0x00000000
	8	Get Cycle Time	Get Cycle Time	UNSIGNED16	RW	0x0000	0x0000
	9	Delay Time	Delay Time	UNSIGNED32	RO	0x00000000	0x00000000
	10	Sync0 Cycle Time	Sync0 Cycle Time	UNSIGNED32	RO	0x00000000	0x00000000
	11	SM-Event Missed	SM-Event Missed	UNSIGNED16	RO	0x0000	0x0000
	12	Cycle Time Too Small	Cycle Time Too Small	UNSIGNED16	RO	0x0000	0x0000
	32	Sync Error	Sync Error	UNSIGNED8	RO	0x00	0x00

* Note 1: 0x0000: Free-run mode
0x0001: SM sync
0x0022: SM2 sync
0x0002: DC mode (sync0)
0x0003: DC mode (sync1)

9.3 Input Process Data Area

Indicates the object of each unit that can be assigned to input process data.

Index	Sub-index	Description	Data type	Read/write attrib.	Assignment to PDO	Initial value
0x6000	-	Module 0 Input Data	-	RO	-	-
…	…	…	…	…	…	…
0x601F	-	Module 31 Input Data	-	RO	-	-

9.3.1 Remote I/O system diagnostic information for the device unit

Index	Sub-index	Data name	Description	Data type	Read/write attrib.	Assignment to PDO	Initial value
0x6XX0	0	Diagnostic information	Number of Remote I/O system diagnostic information entries	UNSIGNED8	RO	-	0x08
	1	Unit input error	Unit input error	BOOL	RO	Yes	0
	2	Unit output error	Unit output error	BOOL	RO	Yes	0
	3	Reserve	Reserved	BOOL	RO	Yes	0
	4	Power failure	Power failure	BOOL	RO	Yes	0
	5	Reserve	Reserved	BOOL	RO	Yes	0
	6	Operation waiting	Operation waiting	BOOL	RO	Yes	0
	7	Hardware error	Hardware error	BOOL	RO	Yes	0
	8	System error	System error	BOOL	RO	Yes	0

* "XX" in the above Index is the unit position number (0x00 to 0x11).

9.3.2 Analog input 2 CH unit

Index	Sub-index	Data name	Description	Data type	Read/write attrib.	Assignment to PDO	Initial value
0x6XX0	0	Analog input	Number of analog input entries	UNSIGNED8	RO	-	0x02
	1	Channel 0	Analog input CH0	WORD	RO	Yes	0x0000
	2	Channel 1	Analog input CH1	WORD	RO	Yes	0x0000

* "XX" in the above Index is the unit position number (0x00 to 0x11).

9.3.3 Digital input unit M 8 x 8 type

Index	Sub-index	Data name	Description	Data type	Read/write attrib.	Assignment to PDO	Initial value
0x6XX0	0	Digital input	Number of digital input entries	UNSIGNED8	RO	-	0x08
	1	Point 0	Digital input CH0	BOOLEAN	RO	Yes	0
	…	…	…	…	…	…	…
	8	Point 7	Digital input CH7	BOOLEAN	RO	Yes	0

* "XX" in the above Index is the unit position number (0x00 to 0x11).

9.3.4 Digital input unit M 12 x 8 type

Index	Sub-index	Data name	Description	Data type	Read/write attrib.	Assignment to PDO	Initial value
0x6XX0	0	Digital input	Number of digital input entries	UNSIGNED8	RO	-	0x10
	1	Point 0	Digital input Point 0	BOOLEAN	RO	Yes	0
	…	…	…	…	…	…	…
	16	Point 15	Digital input Point 15	BOOLEAN	RO	Yes	0

* "XX" in the above Index is the unit position number (0x00 to 0x11).

9.3.5 Digital input unit Push-in terminal block type

Index	Sub-index	Data name	Description	Data type	Read/write attrib.	Assignment to PDO	Initial value
0x6XX0	0	Digital input	Number of digital input entries	UNSIGNED8	RO	-	0x20
	1	Point 0	Digital input Point 0	BOOLEAN	RO	Yes	0
	…	…	…	…	…	…	…
	32	Point 32	Digital input Point 31	BOOLEAN	RO	Yes	0

* "XX" in the above Index is the unit position number (0x00 to 0x11).

9.3.6 IO-Link master unit

Index	Sub-index	Data name	Description	Data type	Read/write attrib.	Assignment to PDO	Initial value
0x6XX0	0	IO-Link Digital input 1	Number of digital input 1 entries	UNSIGNED8	RO	-	0x08
	1	Port 0 Digital IN 1	Port 0 Digital input 1	BOOLEAN	RO	Yes	0
	…	…	…	…	…	…	…
	8	Port 7 Digital IN 1	Port 7 digital input 1	BOOLEAN	RO	Yes	0
0x6XX1	0	IO-Link Digital input 2	Number of digital input 2 entries	UNSIGNED8	RO	-	0x08
	1	Port 0 Digital IN 2	Port 0 Digital input 2	BOOLEAN	RO	Yes	0
	…	…	…	…	…	…	…
	8	Port 7 Digital IN 2	Port 7 Digital input 2	BOOLEAN	RO	Yes	0
0x6XX2	0	IO-Link Port error flag	Number of port error flag entries	UNSIGNED8	RO	-	0x08
	1	Port 0 Error flag	Port 0 Port error flag	BOOLEAN	RO	Yes	0
	…	…	…	…	…	…	…
	8	Port 7 Error flag	Port 7 Port error flag	BOOLEAN	RO	Yes	0
0x6XX3	0	IO-Link COMM error	Number of IO-Link error flag entries	UNSIGNED8	RO	-	0x08
	1	Port 0 COMM error flag	Port 0 IO-Link error flag	BOOLEAN	RO	Yes	0
	…	…	…	…	…	…	…
	8	Port 7 COMM error flag	Port 7 IO-Link error flag	BOOLEAN	RO	Yes	0
0x6XX4	0	IO-Link Error log update flag	Number of error log update flag entries	UNSIGNED8	RO	-	0x08
	1	Port 0 Error log update flag	Port 0 Error log update flag	BOOLEAN	RO	Yes	0
	…	…	…	…	…	…	…
	8	Port 7 Error log update flag	Port 7 Error log update flag	BOOLEAN	RO	Yes	0
0x6XX5	0	IO-Link Input data enable flag	Number of IO-Link input data enable flag entries	UNSIGNED8	RO	-	0x08
	1	Port 0 Input data enable flag	Port 0 IO-Link input data enable flag	BOOLEAN	RO	Yes	0
	…	…	…	…	…	…	…
	8	Port 7 Input data enable flag	Port 7 IO-Link input data enable flag	BOOLEAN	RO	Yes	0
0x6XX6	0	Port 0 IO-Link input data	Port 0 Number of process data input byte entries	UNSIGNED8	RO	-	0x20
	1	Port 0 byte 0 input data	Port 0 Process data input byte 0	BYTE	RO	Yes	0x00
	…	…	…	…	…	…	…
	32	Port 0 byte 31 input data	Port 0 Process data input byte 31	BYTE	RO	Yes	0x00

Index	Sub-index	Data name	Description	Data type	Read/write attrib.	Assignment to PDO	Initial value
0x6XX7	0	Port 1 IO-Link input data	Port 1 Number of process data input byte entries	UNSIGNED8	RO	-	0x20
	1	Port 1 byte 0 input data	Port 1 Process data input byte 0	BYTE	RO	Yes	0x00
	…	…	…	…	…	…	…
	32	Port 1 byte 31 input data	Port 1 Process data input byte 31	BYTE	RO	Yes	0x00
0x6XX8	0	Port 2 IO-Link input data	Port 2 Number of process data input byte entries	UNSIGNED8	RO	-	0x20
	1	Port 2 byte 0 input data	Port 2 process data input byte 0	BYTE	RO	Yes	0x00
	…	…	…	…	…	…	…
	32	Port 2 byte 31 input data	Port 2 Process data input byte 31	BYTE	RO	Yes	0x00
0x6XX9	0	Port 3 IO-Link input data	Port 3 Number of process data input byte entries	UNSIGNED8	RO	-	0x20
	1	Port 3 byte 0 input data	Port 3 Process data input byte 0	BYTE	RO	Yes	0x00
	…	…	…	…	…	…	…
	32	Port 3 byte 31 input data	Port 3 Process data input byte 31	BYTE	RO	Yes	0x00
0x6XXA	0	Port 4 IO-Link input data	Port 4 Number of process data input byte entries	UNSIGNED8	RO	-	0x20
	1	Port 4 byte 0 input data	Port 4 Process data input byte 0	BYTE	RO	Yes	0x00
	…	…	…	…	…	…	…
	32	Port 4 byte 31 input data	Port 4 Process data input byte 31	BYTE	RO	Yes	0x00
0x6XXB	0	Port 5 IO-Link input data	Port 5 Number of process data input byte entries	UNSIGNED8	RO	-	0x20
	1	Port 5 byte 0 input data	Port 5 Process data input byte 0	BYTE	RO	Yes	0x00
	…	…	…	…	…	…	…
	32	Port 0 byte 31 input data	Port 5 Process data input byte 31	BYTE	RO	Yes	0x00
0x6XXC	0	Port 6 IO-Link input data	Port 6 Number of process data input byte entries	UNSIGNED8	RO	-	0x20
	1	Port 6 byte 0 input data	Port 6 Process data input byte 0	BYTE	RO	Yes	0x00
	…	…	…	…	…	…	…
	32	Port 6 byte 31 input data	Port 6 Process data input byte 31	BYTE	RO	Yes	0x00
0x6XXD	0	Port 7 IO-Link input data	Port 7 Number of process data input byte entries	UNSIGNED8	RO	-	0x20
	1	Port 7 byte 0 input data	Port 7 Process data input byte 0	BYTE	RO	Yes	0x00
	…	…		…	…	…	…
	32	Port 7 byte 31 input data	Port 7 Process data input byte 31	BYTE	RO	Yes	0x00

* "XX" in the above Index is the unit position number (0x00 to 0x11).

9.4 Output Process Data Area

Indicates the object for each unit that can be assigned to the output process data.

Index	Sub-index	Description	Data type	Read/write attrib.	Assignment to PDO	Initial value
0x7000	0	Module 0 Output Data			-	-
…	…	…	…	…	…	…
0x701F	0	Module 31 Output Data			-	-

9.4.1 Analog output 2 CH unit

Index	Sub-index	Data name	Description	Data type	Read/write attrib.	Assignment to PDO	Initial value
0x7XX0	0	Analog output	Number of analog output entries	UNSIGNED8	RO	-	0x02
	1	Channel 0	Analog output CH0	WORD	RW	Yes	0x0000
	2	Channel 1	Digital output CH1	WORD	RW	Yes	0x0000

* "XX" in the above Index is the unit position number (0x00 to 0x11).

9.4.2 Digital output unit M 8 x 8 type

Index	Sub-index	Data name	Description	Data type	Read/write attrib.	Assignment to PDO	Initial value
0x7XX0	0	Digital output	Number of digital output entries	UNSIGNED8	RO	-	0x08
	1	Point 0	Digital output Point 0	BOOLEAN	RW	Yes	0
	…	…	…	…	…	…	…
	8	Point 7	Digital output Point 7	BOOLEAN	RW	Yes	0

* "XX" in the above Index is the unit position number (0x00 to 0x11).

9.4.3 Digital output unit M 12 x 8 type

Index	Sub-index	Data name	Description	Data type	Read/write attrib.	Assignment to PDO	Initial value
0x7XX0	0	Digital output	Number of digital output entries	UNSIGNED8	RO	-	0x10
	1	Point 0	Digital output Point 0	BOOLEAN	RW	Yes	0
	…	…	…	…	…	…	…
	16	Point 15	Digital output Point 15	BOOLEAN	RW	Yes	0

* "XX" in the above Index is the unit position number (0x00 to 0x11).

9.4.4 Digital output 16-point unit Push-in terminal block type

Index	Sub-index	Data name	Description	Data type	Read/write attrib.	Assignment to PDO	Initial value
0x7XX0	0	Digital output	Number of digital output entries	UNSIGNED8	RO	-	0x20
	1	Point 0	Digital output Point 0	BOOLEAN	RW	Yes	0
	…	…	…	…	…	…	…
	32	Point 31	Digital output Point 31	BOOLEAN	RW	Yes	0

* "XX" in the above Index is the unit position number (0x00 to 0x11).

9.4.5 Valve I/F 32-point unit

Index	Sub-index	Data name	Description	Data type	Read/write attrib.	Assignment to PDO	Initial value
0x7XX0	0	Valve output	Number of valve output entries	UNSIGNED8	RO	-	0x20
	1	Point 0	Valve output Point 0	BOOLEAN	RW	Yes	0
	…	…	…	…	…	…	…
	32	Point 31	Valve output Point 31	BOOLEAN	RW	Yes	0

* "XX" in the above Index is the unit position number (0x00 to 0x11).

9.4.6 IO-Link master unit

Index	Sub-index	Data name	Description	Data type	Read/write attrib.	Assignment to PDO	Initial value
0x7XX0	0	IO-Link Digital output 1	Number of digital output 1 entries	UNSIGNED8	RO	-	0x08
	1	Port 0 Digital OUT 1	Port 0 digital output 1	BOOLEAN	RW	Yes	0
	…	…	…	…	…	…	…
	8	Port 7 Digital OUT 1	Port 7 digital output 1	BOOLEAN	RW	Yes	0
0x7XX1	0	IO-Link Event clear flag	Number of error log clear flag entries	UNSIGNED8	RO	-	0x08
	1	Port 0 Event clear flag	Port 0 error log clear flag	BOOLEAN	RW	Yes	0
	…	…	…	…	…	…	…
	8	Port 7 Event clear flag	Port 7 error log clear flag	BOOLEAN	RW	Yes	0
0x7XX2	0	Port 0 IO-Link output data	Number of port 0 process data output entries	UNSIGNED8	RO	-	0x20
	1	Port 0 byte 0 output data	Port 0 process data output byte 0	BYTE	RW	Yes	0x00
	…	…	…	…	…	…	…
	32	Port 0 byte 31 output data	Port 0 process data output byte 31	BYTE	RW	Yes	0x00
0x7XX3	0	Port 1 IO-Link output data	Number of port 1 process data output entries	UNSIGNED8	RO	-	0x20
	1	Port 1 byte 0 output data	Port 1 process data output byte 0	BYTE	RW	Yes	0x00
	…	…	…	…	…	…	…
	32	Port 1 byte 31 output data	Port 1 process data output byte 31	BYTE	RW	Yes	0x00
0x7XX4	0	Port 2 IO-Link output data	Number of port 2 process data output entries	UNSIGNED8	RO	-	0x20
	1	Port 2 byte 0 output data	Port 2 process data output byte 0	BYTE	RW	Yes	0x00
	…	…	…	…	…	…	…
	32	Port 2 byte 31 output data	Port 2 process data output byte 31	BYTE	RW	Yes	0x00
0x7XX5	0	Port 3 IO-Link output data	Number of port 3 process data output entries	UNSIGNED8	RO	-	0x20
	1	Port 3 byte 0 output data	Port 3 process data output byte 0	BYTE	RW	Yes	0x00
	…	…	…	…	…	…	…
	32	Port 3 byte 31 output data	Port 3 process data output byte 31	BYTE	RW	Yes	0x00
0x7XX6	0	Port 4 IO-Link output data	Number of port 4 process data output entries	UNSIGNED8	RO	-	0x20
	1	Port 4 byte 0 output data	Port 4 process data output byte 0	BYTE	RW	Yes	0x00

Index	Sub-index	Data name	Description	Data type	Read/write attrib.	Assignment to PDO	Initial value
	…	…	…	…	…	…	…
	32	Port 4 byte 31 output data	Port 4 process data output byte 31	BYTE	RW	Yes	0x00
0x7XX7	0	Port 5 IO-Link output data	Number of port 5 process data output entries	UNSIGNED8	RO	-	0x20
	1	Port 5 byte 0 output data	Port 5 process data output byte 0	BYTE	RW	Yes	0x00
	…	…	…	…	…	…	…
	32	Port 5 byte 31 output data	Port 5 process data output byte 31	BYTE	RW	Yes	0x00
0x7XX8	0	Port 6 IO-Link output data	Number of port 6 process data output entries	UNSIGNED8	RO	-	0x20
	1	Port 6 byte 0 output data	Port 6 process data output byte 0	BYTE	RW	Yes	0x00
	…	…	…	…	…	…	…
	32	Port 6 byte 31 output data	Port 6 process data output byte 31	BYTE	RW	Yes	0x00
0x7XX9	0	Port 7 IO-Link output data	Number of port 7 process data output entries	UNSIGNED8	RO	-	0x20
	1	Port 7 byte 0 output data	Port 7 process data output byte 0	BYTE	RW	Yes	0x00
	…	…	…	…	…	…	…
	32	Port 7 byte 31 output data	Port 7 process data output byte 31	BYTE	RW	Yes	0x00

* "XX" in the above Index is the unit position number (0x00 to 0x11).

9.5 Setting Data Area

Objects related to the function settings of the Remote I/O system.
There are the following three types of setting data areas.

Index	Sub-index	Description
0x8XX0	-	Setting data area for each unit. Varies by unit.
0x8XX1	-	ISDU communication area to IO-Link devices via IO-Link master unit
0x8XXF	-	Module XX Configuration(Undefined)

* "XX" in the above Index is the unit position number (0x00 to 0x11).

■ "Setting change failed" notification (unit common index)

All I/O units and device unit will set the [Setting change failed] to 0 when the setting change using SDO communication is successful. They will set the [Setting change failed] to 1 when a setting change using SDO communication fails.
Therefore, use this [Setting change failed] as a result of successful/failed setting changes using SDO communication.
The index number for the [Setting change failed] differs depending on the I/O unit as follows.
This value is updated within 2 seconds of requesting a setting change.

9.5.1 Setting data area for each unit

■ Settings for the device unit

Index	Sub-index	Data name	Description	Data type	Read/ write attrib.	Value	Initial value
0x8XX0	0	Setting (EtherCAT Device)	Number of entries	UNSIGNED8	RO	0x10	0x10
	1	Control power monitoring	Unit/input power monitoring	BOOLEAN	RW	0: OFF (not monitored) 1: ON (monitored)	1
	2	Output power supply monitor	Output power supply monitor	BOOLEAN	RW	0: OFF (not monitored) 1: ON (monitored)	1
	3	Analog byte order	Byte order of analog value	BOOLEAN	RW	0: Big endian 1: Little endian	0
	4	PDO mapping allocation error detection	Error detection for PDO mapping allocation	BOOLEAN	RW	0：OFF 1：ON	1
	6	Maximum number of saved logs	Maximum number of saved logs	BYTE	RW	0x00: Do not save 0x01 to 0xFF: Maximum number to save	0x00
	7	Saving logs (method)	Saving logs (method)	BOOLEAN	RW	0: Repeat (overwrite) 1: Stop at maximum number	1
	9	Time to save log	Time to save log	BYTE	RW	0x00: Real-time 0x 1 to 3C: Save every 1 to 60 minutes	0x1E
	10	Log filter	Type of log filter	BYTE	RW	(Note1)	0x00

Index	Sub-index	Data name	Description	Data type	Read/ write attrib.	Value	Initial value
	11	Log filter details (error code specification)	Log filter (error type)	BYTE	RW	(Note1)	0x00
	12	Log filter details (unit specification)	Log filter (unit ID)	UNSIGNED32	RW	0x00000000 to 0xFFFFFFFF	0x00000000
	13	Log filter details (unit position designation)	Log filter (unit position number)	BYTE	RW	0x00 to 0x11	0
	14	Log filter details (CH/point/port number)	Log filter (CH/point/port number)	BYTE	RW	0x00 to 0x1F	0x00
	15	Output power supply ON time	ON time of output power supply (sec)	UNSIGNED32	RO	-	-
	16	Setting change failed	Notification of failed setting changes	BOOLEAN	RO	0: Setting change successful 1: Setting change failed	0

* "XX" in the above Index is the unit position number (0x00 to 0x11).

Note 1: Refer to for “8.3.6 Error log settings” of “Remote I/O RT Series Instruction Manual: System Construction” for details.

■ Settings for the analog input 2 CH unit

Index	Sub-index	Data name	Description	Data type	Read/ write attrib.	Value	Initial value
0x8XX0	0	Setting (AI2)	Number of entries	UNSIGNED8	RO	0x58	0x58
	1	Power line error detection CH 0	Error detection of power line CH0	BOOLEAN	RW	0: Disable 1: Enable	1
	2	Power line error detection CH 1	Error detection of power line CH1	BOOLEAN	RW	0: Disable 1: Enable	1
	17	Averaging sampling count	Counts of average sampling	BYTE	RW	0x00: Twice 0x01: Four times 0x02: Eight times 0x03: Sixteen times	0x00
	18	Sampling period	Sampling period	WORD	RW	0x0001 (1 ms) to 0xFFFF (65535 ms)	0x0001
	19	Data format CH 0	Data format CH0	BYTE	RW	Note 1	0x01
	20	Data format CH 1	Data format CH1	BYTE	RW	Same as above	Same as above
	23	Input range CH 0	Input range CH0	BYTE	RW	Note 2	0x00
	24	Input range CH 1	Input range CH1	BYTE	RW	Same as above	Same as above
	27	Max range error CH 0	Max range error CH0	BOOLEAN	RW	0: Disable 1: Enable	1
	28	Max range error CH 1	Max range error CH1	BOOLEAN	RW	Same as above	Same as above
	35	Min range error CH 0	Min range error CH0	BOOLEAN	RW	0: Disable 1: Enable	1
	36	Min range error CH 1	Min range error CH1	BOOLEAN	RW	Same as above	Same as above
	43	User set value upper limit error CH 0	Upper limit error with user set value CH0	BOOLEAN	RW	0: Disable 1: Enable	0
	44	User set value upper limit error CH 1	Upper limit error with user set value CH1	BOOLEAN	RW	Same as above	Same as above
	51	User set value lower limit error CH 0	Lower limit error with user set value CH0	BOOLEAN	RW	0: Disable 1: Enable	0
	52	User set value lower limit error CH 1	Lower limit error with user set value CH1	BOOLEAN	RW	Same as above	Same as above
	59	User set value upper limit error threshold CH 0	Threshold for upper limit error with user set value CH0	WORD	RW	(Note 3)	0x0000
	60	User set value upper limit error threshold CH 1	Threshold for upper limit error with user set value CH1	WORD	RW	Note 3)	0x0000
	63	User set value lower limit error threshold CH 0	Threshold for lower limit error with user set value CH0	WORD	RW	Note 3)	0x0000
	64	User set value lower limit error threshold CH 1	Threshold for lower limit error with user set value CH1	WORD	RW	Note 3)	0x0000
	67	Sensor power CH 0	Input power ON/OFF CH0	BOOLEAN	RW	0: OFF (not supplied) 1: ON (supplied)	1
	68	Sensor power CH 1	Input power ON/OFF CH1	BOOLEAN	RW	Same as above	Same as above
	75	Measured hysteresis CH 0	Measured hysteresis CH0	BOOLEAN	RW	0: OFF 1: ON	0
	76	Measured hysteresis CH 1	Measured hysteresis CH1	BOOLEAN	RW	Same as above	Same as above
	63	Enable/Disable CH 0	Enable/Disable of CH CH0	BOOLEAN	RW	0: Disable 1: Enable	1
	84	Enable/Disable CH 1	Enable/Disable of CH CH1	BOOLEAN	RW	Same as above	Same as above
	88	Setting change failed	Notification of failed setting changes	BOOLEAN	RO	0: Setting change successful 1: Setting change failed	0

* "XX" in the above Index is the unit position number (0x00 to 0x11).

Note 1: The values for the data format setting are as follows:
0x00: Offset 12 (12 bit)
0x01: Offset 16 (16 bit)
0x02: Signed magnitude A (12 bit)
0x03: Signed magnitude B (16 bit)
0x04: Signed magnitude C (16 bit)
0x05: Signed magnitude D (16 bit)
0x06: Signed magnitude E (16 bit)
0x07: Signed 2's complement (16 bit)

Note 2: The values for the input range setting are as follows.
0x00: DC -10 V to +10 V
0x01: DC -5 V to +5 V
0x02: DC 0 V to 10 V
0x03: DC 0 V to 5 V
0x04: DC 1 V to 5 V
0x0A: DC -20 mA to +20 mA
0x0B: DC 4 mA to 20 mA
0x0C: DC 0 mA to 20 mA

Note 3: Refer to “7.1.1 Analog Input” of “Analog I/O Unit Instruction Manual “ for the valid setting value for the combination of data format and input range.

■ Settings for the digital input unit M8 x 8 type

Index	Sub-index	Data name	Description	Data type	Read/write attrib.	Value	Initial value
0x8XX0	0	Setting (DI8)	Number of entries	UNSIGNED8	RO	0x41	0x41
	1	Power line error detection connector 0	Error detection of power line Connector 0	BOOLEAN	RW	0: Disable 1: Enable	1
	…	…	…	…	…	…	…
	8	Power line error detection connector 7	Error detection of power line Connector 7	BOOLEAN	RW	Same as above	Same as above
	9	ON count threshold (Input) point 0	Threshold of input Off_On cycle Point 0	UINT32	RW	0x000000 to 0xFFFFFF No count when 0x000000	0x000000
	…	…	…	…	…	…	…
	16	ON count threshold (Input) point 7	Threshold of input Off_On cycle Point 7	UINT32	RW	Same as above	Same as above
	25	On Operating Cycle point 0	Off_On cycle value Point 0	UINT32	RO	0x000000 to 0xFFFFFF	0x000000
	…	…	…	…	…	…	…
	32	On Operating Cycle point 7	Off_On cycle value Point 7	UINT32	RO	Same as above	Same as above
	41	Input filter time point 0	Input filter time Point 0	BIT3	RW	0: 0.1 ms 1: 1 ms 2: 5 ms 3: 10 ms 4: 20 ms	0
	…	…	…	…	…	…	…
	48	Input filter time point 7	Input filter time Point 7	BIT3	RW	Same as above	Same as above
	57	Input hold time point 0	Input hold time Point 0	BIT2	RW	0: 1 ms 1: 15 ms 2: 100 ms 3: 200 ms	0
	…	…	…	…	…	…	…
	64	Input hold time point 7	Input hold time Point 7	BIT2	RW	Same as above	Same as above

Index	Sub-index	Data name	Description	Data type	Read/write attrib.	Value	Initial value
	65	Setting change failed	Notification of failed setting changes	BOOLEAN	RO	0: Setting change successful 1: Setting change failed	0

* "XX" in the above Index is the unit position number (0x00 to 0x11).

■ Settings for the digital input unit M12 x 8 type

Index	Sub-index	Data name	Description	Data type	Read/write attrib.	Value	Initial value
0x8XX0	0	Setting(DI16)	Number of entries	UNSIGNED8	RO	0x49	0x49
	1	Power line error detection connector 0	Error detection of power line Connector 0	BOOLEAN	RW	0: Disable 1: Enable	1
	…	…	…	…	…	…	…
	8	Power line error detection connector 7	Error detection of power line Connector 7	BOOLEAN	RW	Same as above	Same as above
	9	ON count threshold (Input) point 0	Threshold of input Off_On cycle Point 0	UINT32	RW	0x000000 to 0xFFFFFF No count when 0x000000	0x000000
	…	…	…	…	…	…	…
	24	ON count threshold (Input) point 15	Threshold of input Off_On cycle Point 15	UINT32	RW	Same as above	Same as above
	25	On Operating Cycle point 0	Off_On cycle value Point 0	UINT32	RO	0x000000 to 0xFFFFFF	0x000000
	…	…	…	…	…	…	…
	40	On Operating Cycle point 15	Off_On cycle value Point 15	UINT32	RO	Same as above	Same as above
	41	Input filter time point 0	Input filter time Point 0	BIT3	RW	0: 0.1 ms 1: 1 ms 2: 5 ms 3: 10 ms 4: 20 ms	0
	…	…	…	…	…	…	…
	56	Input filter time point 15	Input filter time Point 15	BIT3	RW	Same as above	Same as above
	57	Input hold time point 0	Input hold time Point 0	BIT2	RW	0: 1 ms 1: 15 ms 2: 100 ms 3: 200 ms	0
	…	…	…	…	…	…	…
	72	Input hold time point 15	Input hold time Point 15	BIT2	RW	Same as above	Same as above
	73	Setting change failed	Notification of failed setting changes	BOOLEAN	RO	0: Setting change successful 1: Setting change failed	0

* "XX" in the above Index is the unit position number (0x00 to 0x11).

■ Settings for the digital input unit Push-in terminal block type

Index	Sub-index	Data name	Description	Data type	Read/write attrib.	Value	Initial value
0x8XX0	0	Setting(DI32)	Number of entries	UNSIGNED8	RO	0x89	0x89
	1	Power line error detection block 0	Error detection of power line Block 0	BIT2	RW	0: Disable 1: Detect at restart only (disconnection) 2: Any time detect	1
	…	…	…	…	…	…	…
	8	Power line error detection block 7	Error detection of power line Block 7	BIT2	RW	Same as above	Same as above
	9	ON count threshold (Input) point 0	Threshold of input Off_On cycle Point 0	UINT32	RW	0x000000 to 0xFFFFFF No count when 0x000000	0x000000
	…	…	…	…	…	…	…
	40	ON count threshold (Input) point 31	Threshold of input Off_On cycle Point 31	UINT32	RW	Same as above	Same as above
	41	On Operating Cycle point 0	Off_On cycle value Point 0	UINT32	RO	0x000000 to 0xFFFFFF	0x000000
	…	…	…	…	…	…	…
	72	On Operating Cycle point 31	Off_On cycle value Point 31	UINT32	RO	Same as above	Same as above
	73	Input filter time point 0	Input filter time Point 0	BIT3	RW	0: 0.1 ms 1: 1 ms 2: 5 ms 3: 10 ms 4: 20 ms	0
	…	…	…	…	…	…	…
	104	Input filter time point 31	Input filter time Point 31	BIT3	RW	Same as above	Same as above
	105	Input hold time point 0	Input hold time Point 0	BIT2	RW	0: 1 ms 1: 15 ms 2: 100 ms 3: 200 ms	0
	…	…	…	…	…	…	…
	121	Input hold time point 16	Input hold time Point 16	BIT2	RW	2: 100 ms 3: 200 ms	2
	…	…	…	…	…	…	…
	136	Input hold time point 31	Input hold time Point 31	BIT2	RW	Same as above	Same as above
	137	Setting change failed	Notification of failed setting changes	BOOLEAN	RO	0: Setting change successful 1: Setting change failed	0

* "XX" in the above Index is the unit position number (0x00 to 0x11).

■ Settings for the analog output 2 CH unit

Index	Sub-index	Data name	Description	Data type	Read/ write attrib.	Value	Initial value
0x8XX0	0	Setting(AO2)	Number of entries	UNSIGNED8	RO	0x56	0x56
	1	Power line error detection CH 0	Error detection of power line CH0	BOOLEAN	RW	0: Disable 1: Enable	1
	2	Power line error detection CH 1	Error detection of power line CH1	BOOLEAN	RW	Same as above	Same as above
	9	Power line error recovery operation CH 0	Recovery operation at power line error CH0	BOOLEAN	RW	0: Auto 1: Manual	0
	10	Power line error recovery operation CH 1	Recovery operation at power line error CH1	BOOLEAN	RW	Same as above	Same as above
	17	Data format CH 0	Data format CH0	BYTE	RW	Note 1	0x01
	18	Data format CH 1	Data format CH1	BYTE	RW	Same as above	Same as above
	21	Output range CH 0	Output range CH0	BYTE	RW	Note 2	0x02
	22	Output range CH 1	Output range CH1	BYTE	RW	Same as above	Same as above
	25	Max range error CH 0	Max range error CH0	BOOLEAN	RW	0: Disable 1: Enable	1
	26	Max range error CH 1	Max range error CH1	BOOLEAN	RW	Same as above	Same as above
	33	Min range error CH 0	Min range error CH0	BOOLEAN	RW	0: Disable 1: Enable	1
	34	Min range error CH 1	Min range error CH1	BOOLEAN	RW	Same as above	Same as above
	41	User set value upper limit error CH 0	Upper limit error with user set value CH0	BOOLEAN	RW	0: Disable 1: Enable	0
	42	User set value upper limit error CH 1	Upper limit error with user set value CH1	BOOLEAN	RW	Same as above	Same as above
	49	User set value lower limit error CH 0	Lower limit error with user set value CH0	BOOLEAN	RW	0: Disable 1: Enable	0
	50	User set value lower limit error CH 1	Lower limit error with user set value CH1	BOOLEAN	RW	Same as above	Same as above
	57	User set value upper limit error threshold CH 0	Threshold for upper limit error with user set value CH0	WORD	RW	(Note 3)	
	58	User set value upper limit error threshold CH 1	Threshold for upper limit error with user set value CH1	WORD	RW	(Note 3)	
	61	User set value lower limit error threshold CH 0	Threshold for lower limit error with user set value CH0	WORD	RW	(Note 3)	
	62	User set value lower limit error threshold CH 1	Threshold for lower limit error with user set value CH1	WORD	RW	(Note 3)	
	65	Load power CH 0	ON/OFF of load power CH0	BOOLEAN	RW	0: OFF 1: ON	1
	66	Load power CH 1	ON/OFF of load power CH1	BOOLEAN	RW	Same as above	Same as above
	73	Customized output value at communication error CH 0	Customized output value in the event of a communication error CH0	WORD	RW	0x0000 to 0xFFFF	0x0000
	74	Customized output value at communication error CH 1	Customized output value in the event of a communication error CH1	WORD	RW	Same as above	Same as above
	77	Communication error operation CH 0	Operation setting in the event of a communication error CH0	BYTE	RW	0x00: OFF 0x01: User 0x02: HOLD	0x02
	78	Communication error operation CH 1	Operation setting in the event of a communication error CH1	BYTE	RW	Same as above	Same as above
	81	Enable/Disable CH 0	Enable/Disable of CH CH0	BOOLEAN	RW	0: Disable 1: Enable	1
	82	Enable/Disable CH 1	Enable/Disable of CH CH1	BOOLEAN	RW	Same as above	Same as above

Index	Sub-index	Data name	Description	Data type	Read/write attrib.	Value	Initial value
0x8XX0 (Continued)	86	Setting change failed	Notification of failed setting changes	BOOLEAN	RO	0: Setting change successful 1: Setting change failed	0

* "XX" in the above Index is the unit position number (0x00 to 0x11).

Note 1: The data format settings have the following values.

0x00: Offset 12 (12 bit)
0x01: Offset 16 (16 bit)
0x02: Signed magnitude A (12 bit)
0x03: Signed magnitude B (16 bit)
0x04: Signed magnitude C (16 bit)
0x06: Signed magnitude E (16 bit)
0x07: Signed 2's complement (16 bit)

Note 2: The values for the output range setting are as follows.

0x02: DC 0 V to 10 V
0x03: DC 0 V to 5 V
0x04: DC 1 V to 5 V
0x0B: DC 4 mA to 20 mA
0x0C: DC 0 mA to 20 mA

Note 3: Refer to “7.1.2 Analog Output” of “Analog I/O Unit Instruction Manual “ for the valid setting value for the combination of data format and output range.

■ Settings for the digital output unit M12 x 8 type

Index	Sub-index	Data name	Description	Data type	Read/write attrib.	Value	Initial value
0x8XX0	0	Setting(DO16)	Number of entries	UNSIGNED8	RO	0x51	0x51
	1	Signal line error detection point 0	Error detection of signal line Point 0	BOOLEAN	RW	0: Disable; 1: Enable	1
	…	…	…	…	…	…	…
	16	Signal line error detection point 15	Error detection of signal line Point 15	BOOLEAN	RW	Same as above	Same as above
	17	Signal line error recovery operation point 0	Recovery operation at signal line error Point 0	BOOLEAN	RW	0: Auto 1: Manual	0
	…	…	…	…	…	…	…
	32	Signal line error recovery operation point 15	Recovery operation at signal line error Point 15	BOOLEAN	RW	Same as above	Same as above
	33	ON count threshold (Output) point 0	Threshold of output Off_On cycle Point 0	UINT32	RW	0x000000 to 0xFFFFFF No count when 0x00000	0x00000
	…	…	…	…	…	…	…
	48	ON count threshold (Output) point 15	Threshold of output Off_On cycle point 15	UINT32	RW	Same as above	Same as above
	49	On Operating Cycle point 0	Off_On cycle value Point 0	UINT32	RO	0x000000 to 0xFFFFFF	0x00000
	…	▪	…	…	…	…	…
	64	On Operating Cycle point 15	Off_On cycle value point 15	UINT32	RO	Same as above	Same as above
	65	Communication error operation point 0	Operation setting in the event of a communication error Point 0	BIT2	RW	0x00: OFF 0x01: ON 0x02: HOLD	0x02
	…	…	…	…	…	…	…
	80	Communication error operation point 15	Operation setting in the event of a communication error Point 15	BIT2	RW	Same as above	Same as above
	81	Setting change failed	Notification of failed setting changes	BOOLEAN	RO	0: Setting change successful 1: Setting change failed	0

* "XX" in the above Index is the unit position number (0x00 to 0x11).

■ Settings for the digital output unit Push-in terminal block type

Index	Sub-index	Data name	Description	Data type	Read/write attrib.	Value	Initial value
0x8XX0	0	Setting(DO32)	Number of entries	UNSIGNED8	RO	0x51	0x51
	1	Signal line error detection point 0	Error detection of signal line Point 0	BOOLEAN	RW	0: Disable; 1: Enable	1
	…	…	…	…	…	…	…
	32	Signal line error detection point 31	Error detection of signal line Point 31	BOOLEAN	RW	Same as above	Same as above
	33	Signal line error recovery operation point 0	Recovery operation at signal line error Point 0	BOOLEAN	RW	0: Auto 1: Manual	0
	…	…	…	…	…	…	…
	64	Signal line error recovery operation point 31	Recovery operation at signal line error Point 31	BOOLEAN	RW	Same as above	Same as above
	65	ON count threshold (Output) point 0	Threshold of output Off_On cycle Point 0	UINT32	RW	0x000000 to 0xFFFFFF No count when 0x00000	0x00000
	…	…	…	…	…	…	…
	96	ON count threshold (Output) point 31	Threshold of output Off_On cycle point 31	UINT32	RW	Same as above	Same as above
	97	On Operating Cycle point 0	Off_On cycle value Point 0	UINT32	RO	0x000000 to 0xFFFFFF	0x00000
	…	…	…	…	…	…	…
	128	On Operating Cycle point 31	Off_On cycle value point 31	UINT32	RO	Same as above	Same as above
	129	Communication error operation point 0	Operation setting in the event of a communication error Point 0	BIT2	RW	0x00: OFF 0x01: ON 0x02: HOLD	0x02
	…	…	…	…	…	…	…
	160	Communication error operation point 31	Operation setting in the event of a communication error Point 31	BIT2	RW	Same as above	Same as above
	161	Setting change failed	Notification of failed setting changes	BOOLEAN	RO	0: Setting change successful 1: Setting change failed	0

* "XX" in the above Index is the unit position number (0x00 to 0x11).

■ Settings for the valve I/F unit 32-point unit

Index	Sub-index	Data name	Description	Data type	Read/write attrib.	Value	Initial value
0x8XX0	0	Setting(VALVE32)	Number of entries	UNSIGNED8	RO	0xA1	0xA1
	1	Signal line error detection point 0	Signal line error detection setting Point 0	BOOLEAN	RW	0: Disable 1: Enable	0
	…	…	…	…	…	…	…
	32	Signal line error detection point 31	Signal line error detection setting Point 31	BOOLEAN	RW	Same as above	Same as above
	33	Signal line error recovery operation point 0	Signal line error recovery operation setting Point 0	BOOLEAN	RW	0: Disable 1: Enable	0
	…	…	…	…	…	…	…
	64	Signal line error recovery operation point 31	Signal line error recovery operation setting Point 31	BOOLEAN	RW	Same as above	Same as above
	65	ON count threshold (Output) point 0	Output Off_On cycle threshold setting Point 0	UINT32	RW	The set value multiplied by 10 is used as the actual threshold.	0X00000000
	…	…	…	…	…	No count when 0X00000000	…
	96	ON count threshold (Output) point 31	Output Off_On cycle threshold setting 31	UINT32	RW	…	Same as above
	97	On Operating Cycle point 0	Off_On cycle value Point 0	UINT32	RO	Same as above	0x00000
	…	▪	…	…	…	…	…
	128	On Operating Cycle point 31	Off_On cycle value 31	UINT32	RO	Same as above	Same as above
	129	Communication error operation point 0	Operation setting in the event of a communication error Point 0	BIT2	RW	0x00 : OFF 0x01 : ON 0x02 : HOLD	0x02
	…	…	…	…	…	…	…
	160	Communication error operation point 31	Operation setting in the event of a communication error Point 31	BIT2	RW	Same as above	Same as above
	161	Setting change failed	Notification of failed setting changes	BOOLEAN	RO	0: Setting change successful 1: Setting change failed	0

* "XX" in the above Index is the unit position number (0x00 to 0x11).

■ Settings for the IO-Link master unit

Index	Sub-index	Data name	Description	Data type	Read/write attrib.	Value	Initial value
0x8XX0	0	Setting(IO-Link)	Number of entries	UNSIGNED8	RO	0x61	0x61
	1	Device ID port 0	Port 0 Device ID	UINT32	RW	0x000000 to 0xFFFFFF	0x000000
	2	Vendor ID port 0	Port 0 Vendor ID	WORD	RW	0x000000 to 0xFFFFFF	0x0000
	3	Revision port 0	Port 0 Revision	BYTE	RW	0x00 to 0xFF	0x00
	5	Input size port 0	Port 0 Input size	WORD	RW	0x00 to 0x20	0x04
	6	Output size port 0	Port 0 Output size	WORD	RW	0x00 to 0x20	0x04
	7	Serial number port 0	Port 0 Serial number	VisibleString	RW	ASCII code of up to 16 characters	0x00 (null)
	8	Connector 0 operation settings for each port	Port 0 operation by port (Note 1)	WORD	RW	0x0000 to 0xFFFF(Note1)	0x0F01
	9	Cycle time port 0	Port 0 IO-Link communication cycle time	BYTE	RW	0x00: Auto 0x0A to 0xFF: Manual setting	0x00
	10	Input filter time port 0	Port 0 Input filter time	BYTE	RW	0x00: 0.1 ms 0x01: 1 ms 0x02: 5 ms 0x03: 10 ms 0x04: 20 ms	0x00
	11	Input hold time port 0	Port 0 Input hold time	BYTE	RW	0x00: 1 ms 0x01: 15 ms 0x02: 100 ms 0x03: 200 ms	0x00
	13 to 23	Same as port 0	Port 1 settings	Same as above	Same as above	Same as above	Same as above
	25 to 35	Same as port 0	Port 2 settings	Same as above	Same as above	Same as above	Same as above
	37 to 47	Same as port 0	Port 3 settings	Same as above	Same as above	Same as above	Same as above
	49 to 59	Same as port 0	Port 4 settings	Same as above	Same as above	Same as above	Same as above
	61 to 71	Same as port 0	Port 5 settings	Same as above	Same as above	Same as above	Same as above
	73 to 83	Same as port 0	Port 6 settings	Same as above	Same as above	Same as above	Same as above
	85 to 95	Same as port 0	Port 7 settings	Same as above	Same as above	Same as above	Same as above
	97	Setting change failed	Notification of failed setting changes	BOOLEAN	RO	0: Setting change successful 1: Setting change failed	0

* "XX" in the above Index is the unit position number (0x00 to 0x11).

Note 1: The bit assignment for the operation settings by port is as follows.

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Reserved	Reserved	Reserved	Signal line error recovery operation	Signal line error detection	Power line error detection	Communication error operation	

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Port-to-port sync	Exp/Imp Setting	Restore settings	Device verification		Select operation mode		

The values for the above operation settings by port are as follows.

Operation setting name by port	Value	Factory setting
Select operation mode	0(000): Disable mode, 1(001): IO-Link mode, 2(010): Digital input mode (PNP), 3(011): Digital input mode (NPN), 4(100): Digital force mode (PNP), 5(101): Digital output mode (NPN)	1(001): IO-Link mode
Device verification	0: Do not verify, 1: 3 types verification, 2: 4 types verification	0: Do not verify
Restore settings	0: Do not restore, 1: Restore	0: Do not restore
Exp/Imp Setting	0: Do not back up, 1: Back up	0: Do not back up
Port-to-port sync	0: Do not sync, 1: Sync	0: Do not sync
Communication error operation	0(00): OFF, 1(01): ON, 2(11): HOLD	2: HOLD
Power line error detection	0: Disable, 1: Enable	1: Enable
Signal line error detection	0: Disable, 1: Enable	1: Enable

9.5.2 ISDU communication area to IO-Link devices via IO-Link master unit

The area where ISDU communication (acyclic communication regarding IO-Link communication) is sent and received for IO-Link devices by specifying the index/subindex of the service data of the IO-Link device via the IO-Link master unit.
The device unit uses this data to send ISDU communication to the target IO-Link master unit.

There are two ways to read and write the ISDU communication area to this IO-Link device:
- SDO communication command from an upper EtherCAT MDevice
- Operation from the [ISDU] tab in the PC software

The ISDU communication areas for reading and writing are as follows:

Index	Sub-index	Data name	Description	Data type	Read/ write attrib.	Value	Initial value
0x8XX1	0	ISDU	Number of entries	UNSIGNED8	RO	14	0x0E
	1	Write Target Port	Write target port	BIT 3	RW	0 to 7	0
	3	Write Index	Write index number	WORD	RW	0 to 65535	0
	4	Write Subindex	Write sub-index number	BYTE	RW	0 to 255	0
	5	Write Size	Write size (bytes)	BYTE	RW	1 to 231	0
	6	Write Data	Write data	ARRAY_OF_SINT	RW	“■Write/read data reference”	0”
	7	Write State	Write status	BYTE	RW	”■Write/read status reference”	0
	9	Write Return Code	Write response code	UINT32	RO	”■Write/read response code reference”	0
	10	Read Target Port	Read target port	BIT 3	RW	0 to 7	0
	12	Read Index	Read index number	WORD	RW	0 to 65535	0
	13	Read Subindex	Read sub-index number	BYTE	RW	0 to 255	0
	14	Read Size	Read size (bytes)	BYTE	RO	0 to 231	0
	15	Read Data	Read data	ARRAY_OF_SINT	RO	”■Write/read data reference”	0
	16	Read State	Read status	BYTE	RW	”■Write/read status reference”	0
	18	Read Return Code	Read response code	UINT32	RO	”■Write/read response code reference”	0

* "XX" in the above Index is the unit position number (0x00 to 0x11).

■ Write Data

Binary data from 0 to 232 bytes. An array of SINT (byte size signed integer) type with element numbers from 0 to a maximum of 231.

■ Read Data

Binary data of 232 bytes. An array of SINT (byte size signed integer) type with element numbers from 0 to 231. Zero padding will be made for excess data toward the read target.

■ Write State/ Read State

The user and device unit write the values according to the status.

Value	Meaning, condition, and timing of value
0	Initial value
1	ISDU transmission instruction. User writes. When 1 is written from the MDevice to the device unit, ISDU communication is generated and sent to the designated IO-Link master. When a user writes a value other than 1, it moves to an error termination status (3 below).
2	Sending ISDU. Device unit writes.
3 (Note 1)	Error termination. Status is indicated in the write (read) response code. Device unit writes.
4 (Note 1)	Normal termination. Status is indicated in the write (read) response code. Device unit writes.

Note 1: When 3 or 4, the user can write 1.

■ Write Return Code / Read Return Code

The device unit writes the termination status when a series of processing is complete.

23	22	21	20	19	18	17		16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
General Error					ISDU Status				ISDU Additional Code								ISDU Error Code							

Name	Role
General Error	Indicates an error other than the ISDU communication response Value: Error details 0: No error 1: Parameter error. Occurs when the value is outside the specification 2: ISDU communication response timeout 3: Abnormal 4 to 15: Undefined
ISDU Status	0: Target port is not in IO-Link mode. Or, an IO-Link COMM error has occurred 2: Successful (I-Service making an ISDU response is "0101" or "1101") 3: Failed (I-Service making an ISDU response is "0100" or "1100")
ISDU Additional Code	Same as Additional Code for ISDU communication
ISDU Error Code	Same as Error Code for ISDU communication

■ Write procedures for ISDU communication area

Follow these steps:

1 Set the desired write destination for [Write Target Port], [Write Index], [Write Subindex].

2 Set the size to be written to [Write Size].

3 Set the data to be written to [Write Data].

4 Set [Write State] to "1".

5 Wait until [Write State] is "3" or "4".
This value is typically updated within 2 seconds of setting [Write State] to "1".

6 When [Write State] changes to "3" or "4", check its value and [Write Return Code].

■ Read procedures for ISDU communication areas

Follow these steps:

1 Set the desired read destination for [Read Target Port], [Read Index], [Read SubIndex].

2 Set [Read State] to "1".

3 Wait until [Read State] is "3" or "4".
This value is typically updated within 2 seconds of setting [Read State] to 1.

4 When [Read State] changes to "3" or "4", check its value and [Read Return Code].

5 If [Read State] is "4" and [Read Return Code] indicates no errors, read the data from [Read Data] for the [Read Size].

9.5.3 Module XX Configuration (Undefined)

The area where to read and write the settings for the new unit which has not indicated.
The Device unit reads or writes to the target unit using this data.

The read/write area for the unit settings is as follows.

Index	Sub-index	Data name	Description	Data type	Read/ write attrib.	Value	Initial value
8XXF	0	Module XX Configuration	Number of entries	UNSIGNED8	RO	12	12
	1	Write Address	Write address	WORD	RW	0-65535	0
	2	Write Size	Write size	BYTE	RW	1-128	0
	3	Write Data	Write data	ARRAY_OF_SINT	RW	“■Write Data / Read Data”	0
	4	Write State	Write status	BYTE	RW	“Write State / Read State”	0
	5	Write Return Code	Write response code	BYTE	RO	”■Write Return Code”	0
	6	Read Address	Read address	WORD	RW	0-65535	0
	8	Read Size	Read size	BYTE	RW	1-128	0
	10	Read Data	Read data	ARRAY_OF_SINT	RO	“■Write Data / Read Data”	0
	11	Read State	Read status	BYTE	RW	“■Write State / Read State”	0
	12	Read Return Code	Read response code	BYTE	RO	”■Read Return Code”	0

■ Write Data / Read Data

Binary data from 0 to 128 bytes. An array of SINT (byte size signed integer) type with element numbers from 0 to a maximum of 231.

■ Write State / Read State

The user and device unit write the values according to the state.

Value	Meaning, condition, and timing of value
0	Initial value
1	Setting reading and writing instruction. User writes. When the user enters a value other than 1, the system goes into an abnormal completion state (3 below).
2	Setting reading and writing in progress. Device unit writes.
3 (Note 1)	Abnormal completion. State is indicated in the "■Write Return Code ■Read Return Code." Device unit writes.
4 (Note 1)	Normal completion. State is indicated in the "■Write Return Code ■Read Return Code." Device unit writes.

Note 1: When 0, 3, or 4, the user can write 1.

■ Write Return Code

The device unit writes the completion state when a series of write processing is complete.

Value	Meaning, condition, and timing of value
0	No error
1	Cancel. When setting changes are canceled.
2	Error. When value exceeds range.
3	When response timeout or communication error occurs.

■ Read Return Code

The device unit writes the completion state when a series of read processing is complete.

Value	Meaning, condition, and timing of value
0x40	No error
0x50	Error. When value exceeds range.
0x03	When response timeout or communication error occurs.

■ Write procedures for new unit setting

Follow these steps:

1 Set the desired address for [Write Address].

2 Set the desired data size for [Write Size].

3 Set the desired data for [Write Data].

4 Set the [Write State] to "1",

5 Wait until the [Write State] is "3" or "4".
This value is typically updated within 2 seconds of setting the [Write State] to "1".

6 When the [Write State] changes to "3" or "4", check its value and the [Write Return Code].

■ Read procedures for new unit

Follow these steps:

1 Set the desired read address for [Read Address].

2 Set the desired size for [Read Size].

3 Set the [Read State] to "1".

4 Wait until the [Read State] is "3" or "4".
This value is typically updated within 2 seconds of setting the [Read State] to "1".

5 When the [Read State] changes to "3" or "4", check the [Read State] and [Read Return Code].

6 If the [Read State] is "4" and the [Read Return Code] indicates no errors, read the [Read Size] data from the [Read Data].

9.6 Remote Device Information Area

Area where information as modular devices in the Remote I/O system is registered.

Index	Sub-index	Description	Data type	Read/write attrib.	Value
0x9XX0	0	Number of entries	UNSIGNED8	RO	0x02
	1	Unit ID	DWORD	RO	
	2	Number of input/output points (Note 1)	WORD	RO	

* "XX" in the above Index is the unit position number (0x00 to 0x11).

Note 1: The value for the number of input/output points is obtained from the lower three bits of byte 3 (common part) of the unit ID.

9.7 Diagnostic Information Area

Area relates to the diagnostic information of the Remote I/O system.
Diagnostic information includes following two types.

Index	Sub-Index	Description
0xAXX0	—	Diagnostic information area of each unit.
0xAXX1	—	Diagnostic information area of each CH/point/port.
0xAXX2	-	Diagnostic information of a specific I/O unit is saved in this area.

* "XX" in the above Index is the unit position number (0x00 to 0x11).

Indicates unit diagnostic information for the unit, CH/point/port diagnostic information, and diagnostic information for specific I/O units.

Index	Sub-index	Data name	Description	Data type	Read/write attrib.	Value	Initial value
0xAXX0	0	Unit Diagnosis	Number of entries	UNSIGNED8	RO	0x01	0x01
	1	Unit Diagnosis	Unit diagnostic information	WORD	RO	0x0000 to 0xFFFF	0x0000
0xAXX1	0	Diagnosis (Points Channel Port)	Number of entries	UNSIGNED8	RO	n	n
	1	Diagnosis 0	CH/point/port diagnostic information 0	WORD	RO	0x0000 to 0xFFFF	0x0000
	…	…	…	…	…	…	…
	N	Diagnosis n-1	CH/point/port diagnostic information n-1	WORD	RO	0x0000 to 0xFFFF	0x0000
0xAXX2	0	Specific Diagnosis	Number of entries	UNSIGNED8	RO	m	m
	1	Specific Diagnosis 0	Module Specific Diagnosis	-	-	-	-
	…	…	…	…	…	…	…
	n	Specific Diagnosis m	Module Specific Diagnosis	-	-	-	-

* "XX" in the above Index is the unit position number (0x00 to 0x11). n is the CH/point/port number of the target unit.

* m is the diagnostic information specific to a unit.

The "unit diagnostic information" stores diagnostic information of each unit (16 bit). Unit diagnostic information is data where CH/point/port diagnostic information (16 bits) is logically added (OR) for all CH/points/ports of a relevant unit.
"CH/point/port diagnostic information" stores diagnostic information (16 bit) for each CH/point/port.
"Module Specific Diagnosis" stores unit-specific diagnostic information. For units that use "Module Specific Diagnosis", refer to "9.7.1 Module Specific Diagnosis".

9.7.1 Module Specific Diagnosis

Diagnostic information for a specific I/O unit is stored in this area.

■ Error log of IO-Link master unit

Currently, the only unit that uses "Module Specific Diagnosis" is the IO-Link master unit. Therefore, diagnostic information specific to the IO-Link master unit is stored here.
Stores up to six error logs (event codes for IO-Link devices or error response logs in ISDU communication) in the IO-Link master unit.

There are two ways to read this data:

- Read the relevant object dictionary by an SDO communication command from the upper EtherCAT MDevice
- Check in the PC software [error log] window

The error log data is automatically erased in the IO-Link master unit when it is read in SDO communication or with the PC software.

Index	Sub-index	Data name	Description	Data type	Read/ write attrib.	Value	Initial value
0xAXX2	0	IO-Link Device Error	Number of entries	UNSIGNED8	RO	0x08	0x08
	1	Read Target Port	Target port to read	BIT 3	RW	000	000
	3	Read Complete	Read completed (Note 1)	BOOLEAN	RO	0	0
	5	IO-Link Device Error1	IO-Link error log 1 (Note 2)	UNSIGNED32	RO	0x00000000	0x00000000
	6	IO-Link Device Error2	IO-Link error log 2 (Note 2)	UNSIGNED32	RO	0x00000000	0x00000000
	7	IO-Link Device Error3	IO-Link error log 3 (Note 2)	UNSIGNED32	RO	0x00000000	0x00000000
	8	IO-Link Device Error4	IO-Link error log 4 (Note 2)	UNSIGNED32	RO	0x00000000	0x00000000
	9	IO-Link Device Error5	IO-Link error log 5 (Note 2)	UNSIGNED32	RO	0x00000000	0x00000000
	10	IO-Link Device Error6	IO-Link error log 6 (Note 2)	UNSIGNED32	RO	0x00000000	0x00000000

* "XX" in the above Index is the unit position number (0x00 to 0x11).

Note 1: The value of “Read Complete” is as follows. The device unit writes the completion state when a series of write processing is complete.
0: Reading
1: Read completed. Or Timeout the response waiting time.

Note 2: The bit assignment for the IO-Link error log is as follows:
The top row is for an IO-Link device event, and the bottom row is for an error response of the ISDU communication. For more information on each piece of data, refer to the IO-Link communication specifications.

Bit 31	…	Bit 24	Bit 23	…	Bit 16	Bit 15	…	Bit 8	Bit 7	…	Bit 1	Bit 0
Event Code						Event Qualifier			0	IOLDEP(注 3)		
Additional Code			Error Code			I-Service			0	IOLDEP(注 3)		

The above Event Code may contain unique values for the product.

Note 3: Details of “OLDEP(IOLink Device Error Pattern)” is as follows.
00: No error during IO-Link communication
01: Diagnosis
10: ISDU

Examples of event codes that occur on the IO-Link master unit are as follows:

Event code	Description	Remarks
0xFFF3	No device IDs to be verified are registered.	-
0xFFFB	The IO-Link device is not connected.	-
0xFFFC	Serial number verification error.	During this error, the IO-Link communication is stopped at PREOPERATE.
0xFFFE	The device ID of the IO-Link device is different.	During this error, the IO-Link communication is stopped at PREOPERATE.
0xFFFF	The restoration destination device ID is different.	The storage data ID and device ID are different during the restoration.

*

* For other event occur on the IO-Link master unit, refer to the IO-Link specification for the connected IO-Link device.

* By setting the number of the port to be read to a read target port, the error log data is automatically retrieved.
Error log data is typically updated within two seconds of setting the target port as the read target port.
It is possible to check whether there is an error log from the IO-Link device by means of the "Error log update" in the process data.

Follow these steps to read event.

1 Set the desired port number for [Read Target Port].

2 Wait until the [Read Complete] is “1“ .
This value is typically updated within 2 seconds of setting the target port to [Read Target Port].

3 When the [Read Complete] changes to “1“, check the value and [IO-Link Device Error].
* Whether there is an error log from the IO-Link device can be checked with [error log update] of the process data.

9.8 Device Area

Indicates information about the module configuration.

Index	Sub-index	Description	Data type	Read/write attrib.	Value	Initial value
0xF000	0	Number of entries	UNSIGNED8	RO	0x02	0x02
	1	Index distance	UNSIGNED16	RO	0x010	0x010
	2	Maximum number of modules	UNSIGNED16	RO	0x12	0x12
0xF030	-	Configured Module Ident List	-	R(W)	-	
0xF050	-	Detected Module Ident List	-	RO	-	

9.8.1 Unit ID configuration downloaded from the MDevice (Configured Module Ident List)

This is the I/O unit configuration considered correct by the upper MDevice according to the Modular Device Profile (MDP) feature. It is automatically downloaded to the following index when EtherCAT communication is started.

Index	Sub-index	Data name	Description	Data type	Read/ write attrib.	Value	Initial value
0xF030	0	Configured Module Ident List	Number of entries I/O unit configuration downloaded from the MDevice	UNSIGNED8	RO	0x01 to 0x12	Undefined
	1	Configured module ident of the module 1	Unit ID for I/O unit with position number 1 Configured module ident of the module 1	UNSIGNED32	RO	Refer to “Unit ID” (Note 1)	Undefined
	…	…	…	…	…	…	Undefined
	18	Configured module ident of the module 18	Unit ID for I/O unit with position number 17 Configured module ident of the module 17	UNSIGNED32	RO	Refer to “Unit ID” (Note 1)	Undefined

* Note 1: Refer to the table of “Note 1: Unit ID” of “6.3.3 Downloading module configuration (I/O unit configuration) information to this product “.

9.8.2 Unit ID configuration detected by automatic recognition (Detected Module Ident List)

Actual I/O unit configuration detected by the device unit at power-up. It is stored at the following index:

Index	Sub-index	Data name	Description	Data type	Read/ write attrib.	Value	Initial value
0xF050	0	Detected Module Ident List	Number of entries Auto-recognized actual I/O unit configuration	UNSIGNED8	RO	0x01 to 0x12	Undefined
	1	Module Ident of the module detected on position 1	Unit ID for I/O unit with position number 1 Module Ident of the module detected on position 1	UNSIGNED32	RO	Refer to “Unit ID” (Note 1)	Undefined
	…	…	…	…	…	…	Undefined
	18	Module Ident of the module detected on position 18	Unit ID for I/O unit with position number 18 Module Ident of the module detected on position 18	UNSIGNED32	RO	Refer to “Unit ID” (Note 1)	Undefined

* Note 1: Refer to the table of “Note 1: Unit ID” of “6.3.3 Downloading module configuration (I/O unit configuration) information to this product “.

10. APPENDIX: DIAGNOSTIC INFORMATION LIST FOR THE PRODUCT

This section lists the operations performed by the EtherCAT compatible device unit in the event of an error and when recovering from one.

10.1 Device Unit Diagnostic Information

The lists of diagnostic information are as follows.

Error	When	LED	LED status	State and countermeasures
Memory read/write error	On occurrence	SF(Device)	Red blinking (slow)	Does not communicate with the upper MDevice. (pre-operational state) No automatic recognition.
	On recovery	SF(Device)	Green on	May recover by turning the power off and on again. If the problem persists, contact CKD.
Factory setting error	On occurrence	SF(Device)	Red blinking (twice)	(No specific behavior.)
	On recovery	SF(Device)	Green on	Factory setting is written and restored after powering it off and on again. Contact CKD.
Unit configuration error	On occurrence	LED of all unit	Red on	Automatic recognition failed. If the LEDs do not light up red, the assignment size of the variable I/O unit is recognized as 0.
		SF(Device)	Yellow blinking (fast)	Does not communicate with the upper MDevice (pre-operational state).
	On recovery	SF(Device)	Green on	May recover by reviewing the unit configuration and connections between units.
Process data overflow	On occurrence	SF(Device)	Green blinking (slow)	Does not communicate with the upper MDevice
	On recovery	SF(Device)	Green on	Will recover by reviewing the unit configuration and making the process data size 512 bytes or less in the total IN/OUT.
Unit/input power voltage error	On occurrence	PS (Device)	Red blinking (fast)	The behavior of each unit becomes unstable or the power turns OFF.
	On recovery	PS (Device)	Yellow on (Note 1)	May recover by reviewing the voltage of the power supplied
Output power voltage error	On occurrence	Output unit	Yellow on	(No specific behavior.)
		PS (Device)	Red blinking (fast)	
	On occurrence	PS (Device)	Yellow on (Note 1)	May recover by reviewing the voltage of the power supplied
Internal bus communication error	On occurrence	SF(Device)	Red blinking (fast)	(No specific behavior.) Communication is unstable due to electromagnetic waves or other influences.
	On recovery	SF(Device)	Green on	May recover by reviewing the connections between the units or eliminating external influences.
Initialized set memory	On occurrence	SF(Device)	Green blinking (fast)	- Does not communicate with the upper MDevice (pre-operational state) - Each I/O unit may operate unintentionally.
	On recovery	SF(Device)	Green on	Will recover by turning the power off and on again.
Hardware error	On occurrence	SF(Device)	Red blinking (slow)	(No specific behavior) Contact CKD.
	On recovery	SF(Device)	Green on	If there are no other errors, the SF LED on the device unit lights green.
PDO mapping allocation error	On occurrence	Does not affect to LED		Communicates with the upper MDevice. Refer to “5.3.3 PDO mapping verification“.
	On recovery			

10.2 Other Errors

10.2.1 Communication error (application watchdog timeout)

Error	When	LED	LED status	State and countermeasures
Communication error (application watchdog timeout)	On occurrence	ERR (Device)	Red blinking (twice)	EtherCAT communication cannot be started normally.
	On recovery	ERR (Device)	Off	May recover by reviewing the EtherCAT communication path and the EtherCAT MDevice settings.
Setting error	On occurrence	ERR (Device)	Red blinking	Does not communicate with the upper MDevice. The AL status register in the device unit stores the AL status code corresponding to a setting error.
	On recovery	ERR (Device)	Off	May recover by reviewing the EtherCAT MDevice settings, unit configuration, or the unit settings.

11. WARRANTY PROVISIONS

11.1 Warranty Conditions

■ Warranty coverage

If the product specified herein fails for reasons attributable to CKD within the warranty period specified below, CKD will promptly provide a replacement for the faulty product or a part thereof or repair the faulty product at one of CKD's facilities free of charge.
However, when the following items apply, they are excluded from the scope of this warranty.

- Failure caused by handling or use of the product under conditions and in environments not conforming to those stated in the catalog, the Specifications, or the Instruction Manual.
- Failure caused by use of the product exceeding its durability (cycles, distance, time, etc.) or caused by consumable parts. (Note1)
- Failure caused by incorrect use such as careless handling or improper management.
- Failure not caused by the product.
- Failure caused by use not intended for the product
- Failure caused by modifications/alterations or repairs not carried out by CKD
- Failure that could have been avoided if the customer's machinery or device, into which the product is incorporated, had functions and structures generally provided in the industry
- Failure caused by reasons unforeseen at the level of technology available at the time of delivery
- Failure caused by acts of nature and disasters beyond control of CKD.

Note 1: For details on the durability and consumable parts, contact your nearest CKD sales office.

The warranty stated herein covers only the delivered product itself. Any loss or damage induced by failure of the delivered product is excluded from this warranty.

■ Confirmation of product compatibility

It is the responsibility of the customer to confirm compatibility of the product with any system, machinery, or device used by the customer.

■ Others

The terms and conditions of this warranty stipulate basic matters.
When the terms and conditions of the warranty described in individual specification drawings or the Specifications are different from those of this warranty, the specification drawings or the Specifications shall have a higher priority.

11.2 Warranty Period

The product specified herein is warranted for one (1) year from the date of delivery to the location specified by the customer.