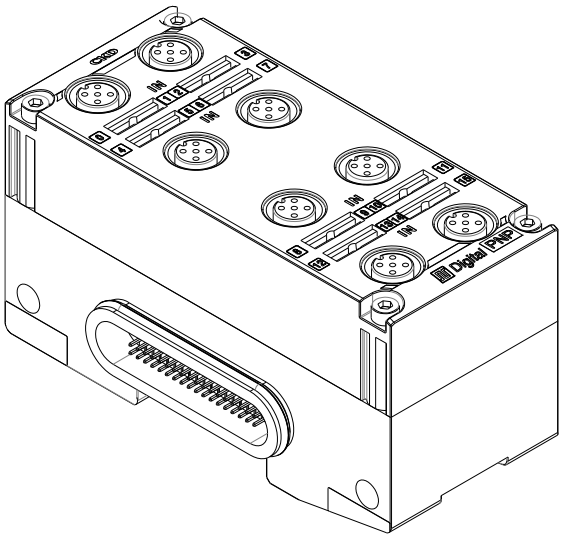
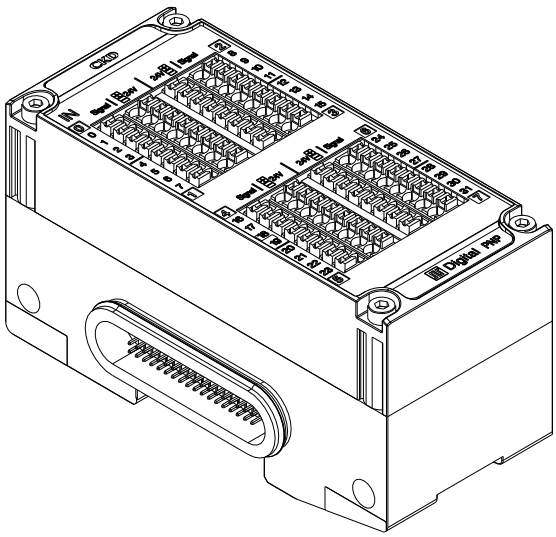
Remote I/O
RT Series

Digital I/O Unit

INSTRUCTION MANUAL

SM-A46345-A/2





- 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:

ISO 4414, JIS B 8370, JFPS 2008 (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 facilities.

- 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.

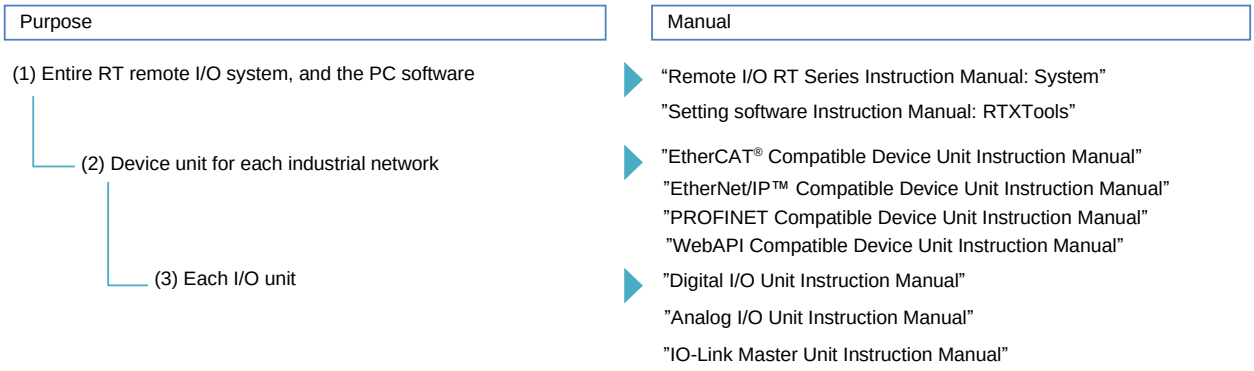
If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

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	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 (this 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 master 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	

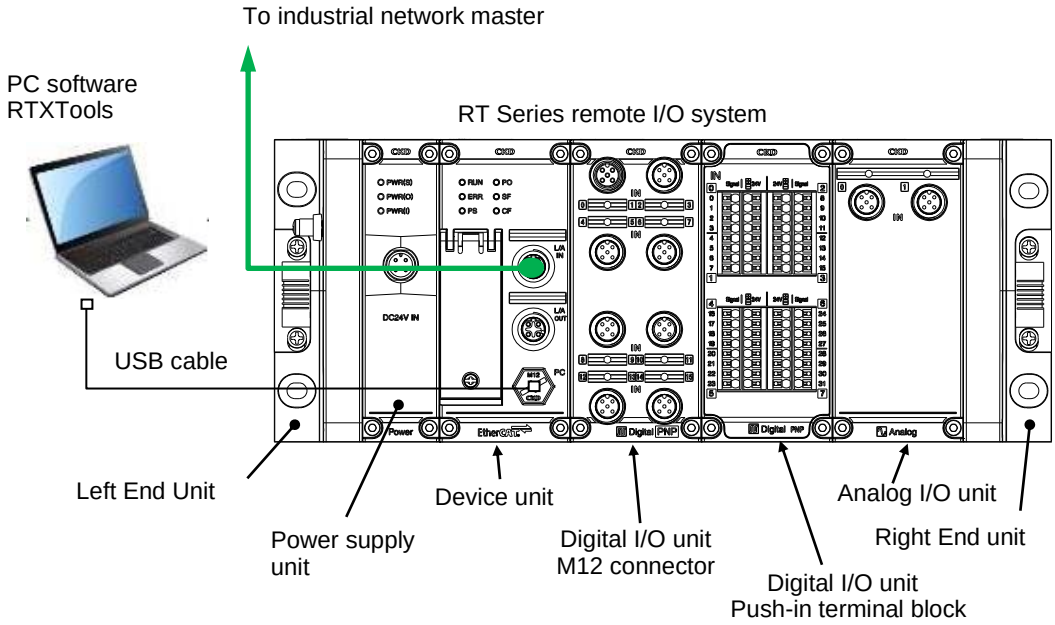
TERMS RELATED TO THE DIGITAL I/O UNIT

Term	Definition
Power line error	Refers to a short circuit, disconnection, or overheating in the digital input unit's power lines.
Signal line error	Refers to a short circuit, disconnection, or overheating in the digital output unit's signal lines.

1. PRODUCT OVERVIEW

An RT Series digital I/O unit is an I/O unit that performs contact input and output with sensors, actuators, and so on in remote I/O RT Series systems.

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, and the settings and status of each unit.



1.1 Features

Features include the following:

1.1.1 Digital input unit

- The input filtering function can eliminate switch chattering, or data loss due to noise, etc.
- The input hold time function ensures that even momentary signal changes can be transmitted to the higher level (master).
- It can count the number of times the input signal changes from OFF to ON, and output an alert when the threshold is exceeded.

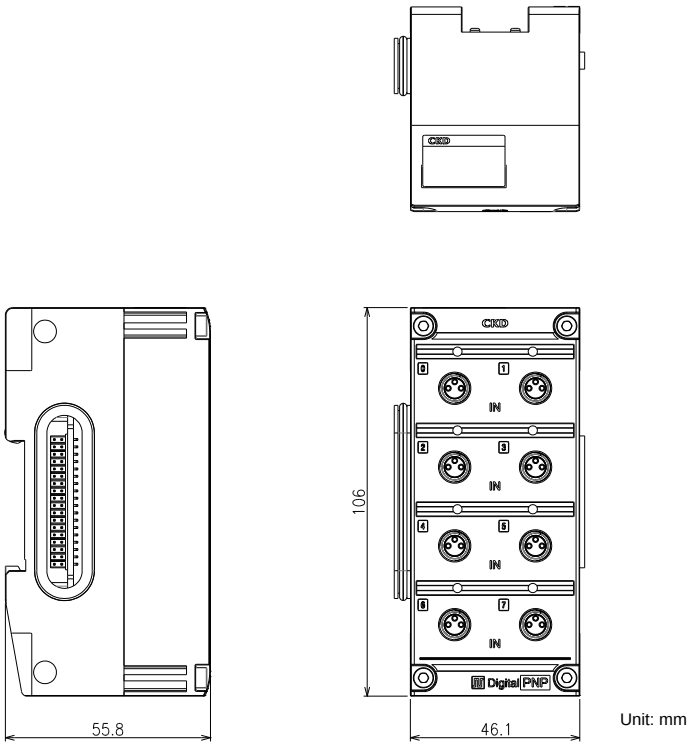
1.1.2 Digital output unit

- It can count the number of times the output signal changes from OFF to ON, and output an alert when the threshold is exceeded.
- It is possible to specify what output operation to perform in the event of a communication error either for the entire remote I/O or separately for each I/O unit.

1.2 External Dimensions

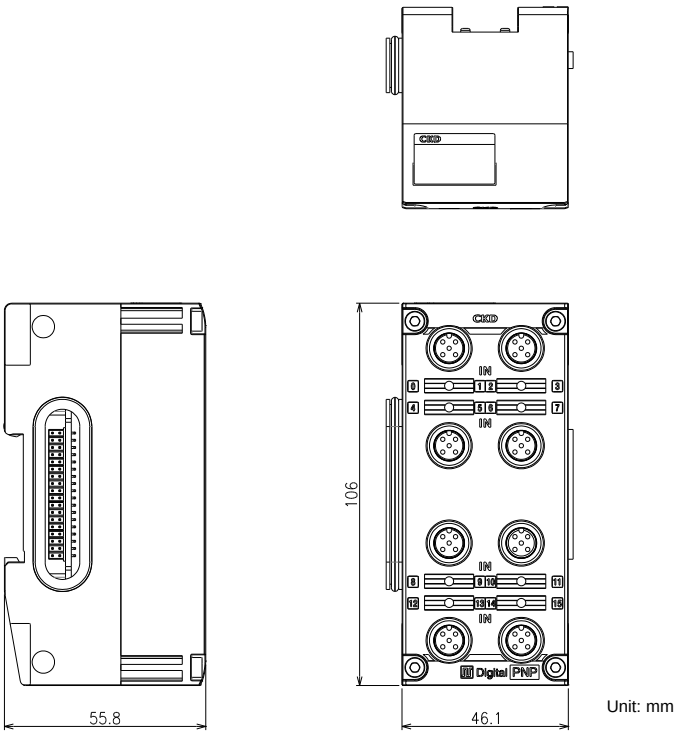
1.2.1 Digital input unit

■ M8 connectors x 8 type



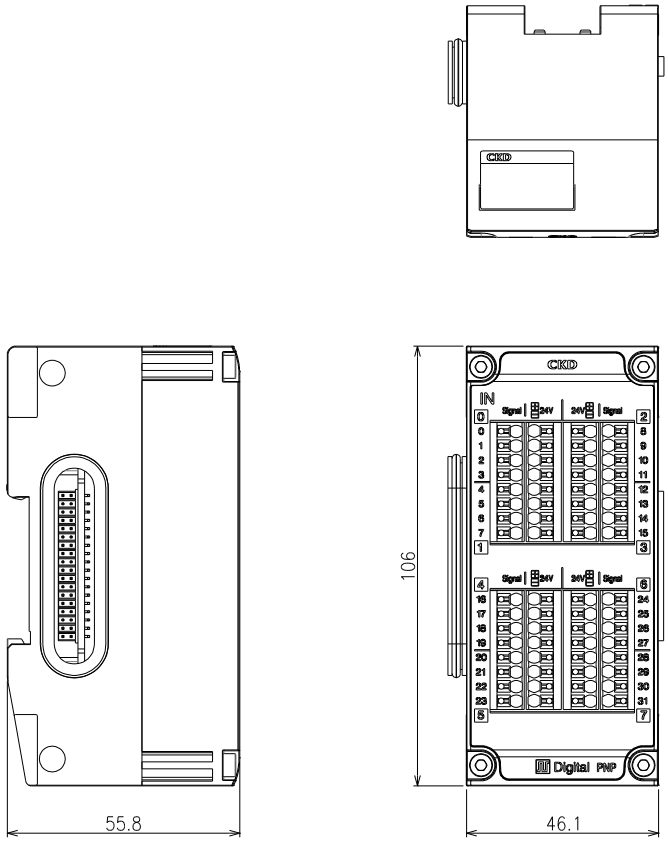
Unit: mm

■ M12 connectors x 8 type



Unit: mm

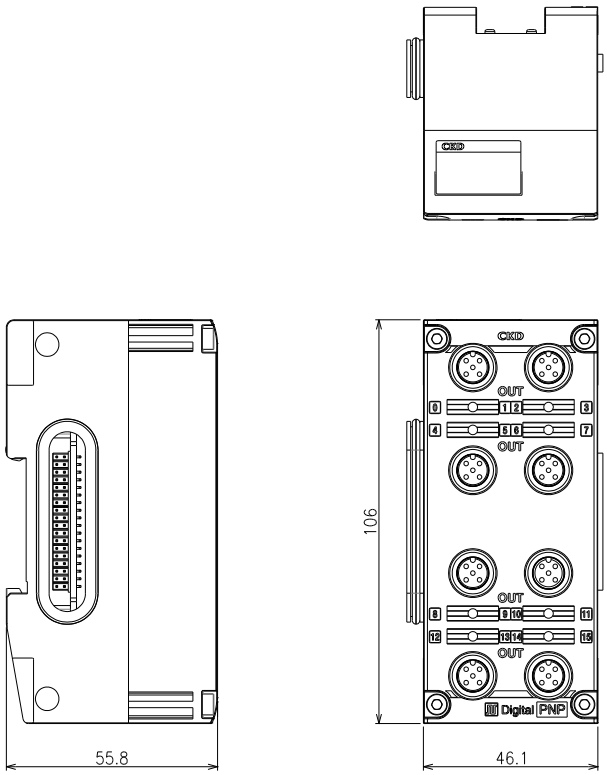
■ Push-in terminal block type



Unit : mm

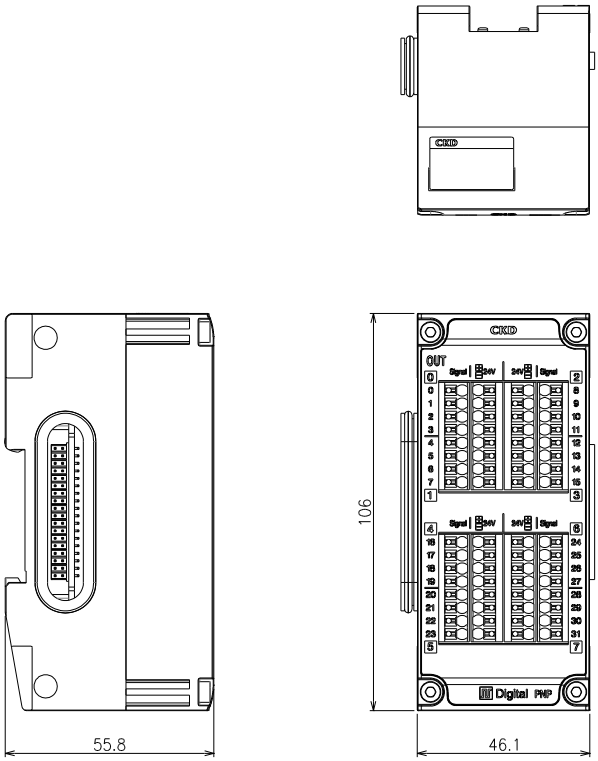
1.2.2 Digital output unit

■ M12 connectors x 8 type



Unit: mm

■ Push-in terminal block type

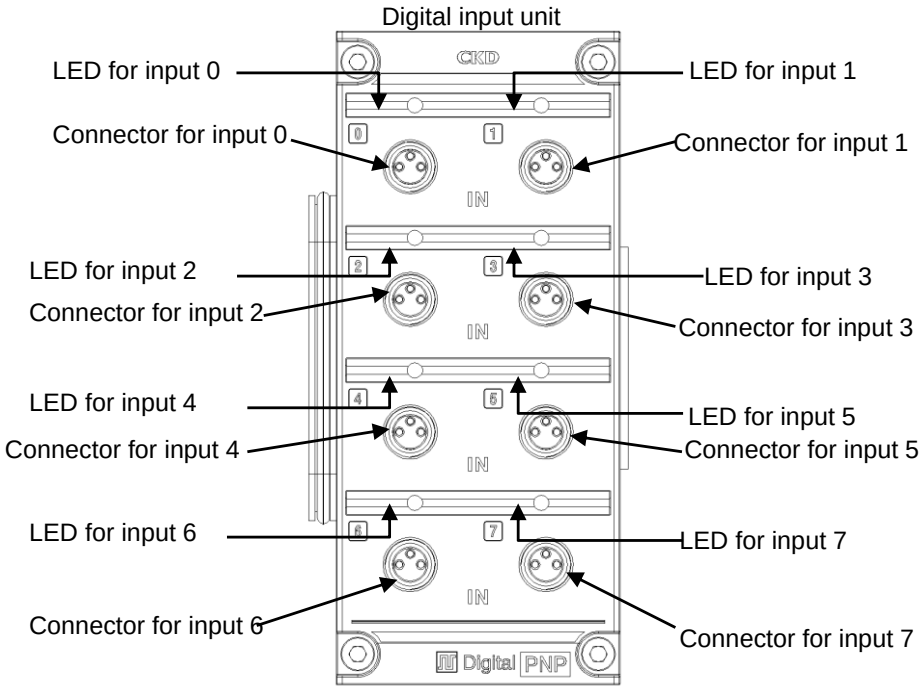


Unit : mm

1.3 Names and Functions of Each Part

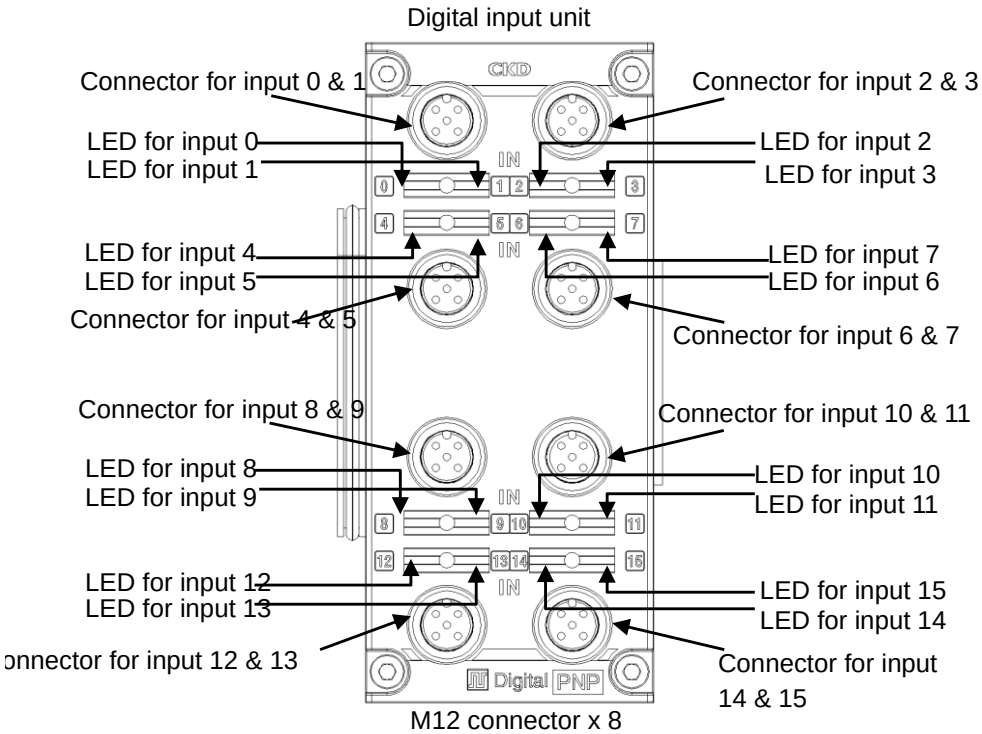
1.3.1 Digital input unit

■ M8 connectors x 8 type



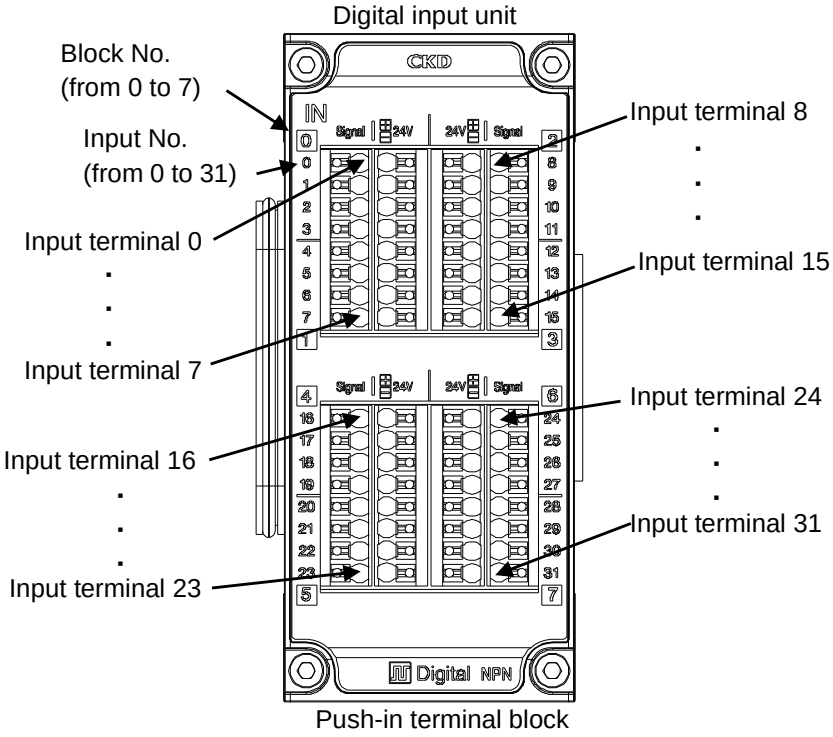
M8 connector x 8

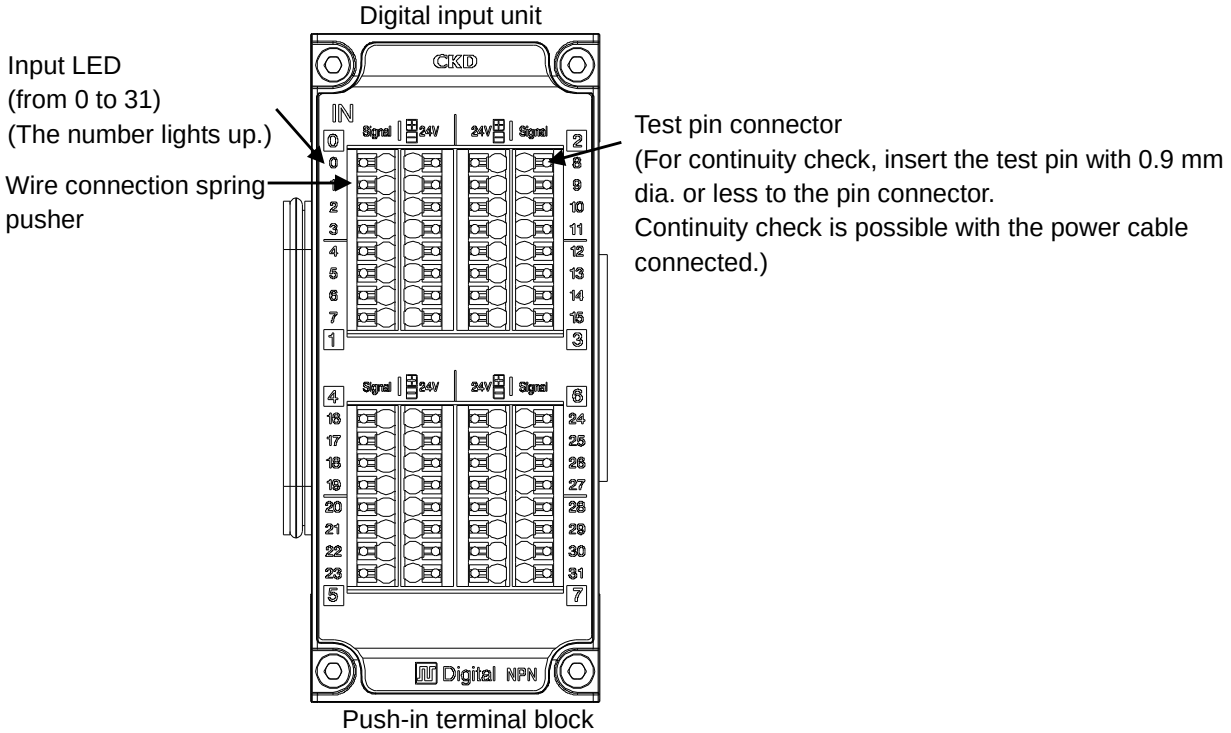
■ M12 connectors x 8 type



M12 connector x 8

■ Push-in terminal block type





■ LEDs

Specification list

Unit's number of points	Name	Description
8-point input	0 to 7	Indicates the status of each digital input point.
16-point input	0 to 15	Indicates the status of each digital input point.
32-point input	0 to 31	Indicates the status of each digital input point.

Status list

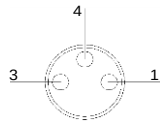
Status	Meaning
Red on	Internal bus communication disconnected
Red blinking (fast)	Hardware error
Red blinking (slow)	Power line error detection or disconnection detection (power line error detection is given priority)
Yellow blinking (fast)	Off_On cycle threshold over detection
Green on	Input ON
Off	Power is OFF, or input is OFF

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

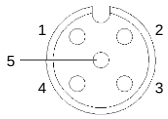
RT product page : https://www.ckd.co.jp/kiki/en/product/detail/1064/

■ Connectors

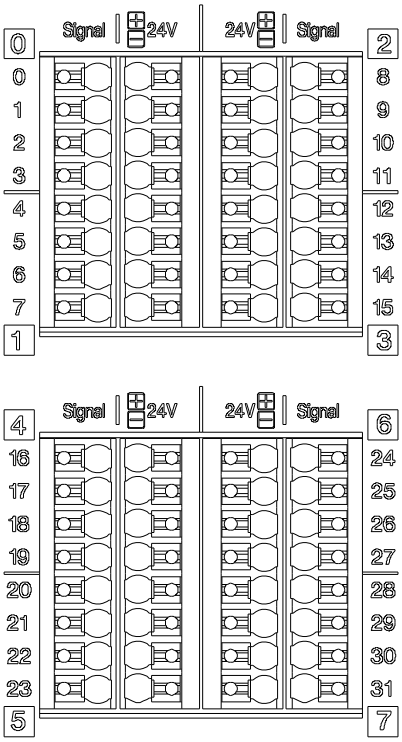
M8 connector

M8(A) 3-pin female	Pin number	Description
	1	Unit/input 24 V (+)
	3	Unit/input 24 V (-)
	4	Input 1

M12 connector

M12(A) 5-pin female	Pin number	Description
	1	Unit/input 24 V (+)
	2	Input 2
	3	Unit/input 24 V (-)
	4	Input 1
	5	FG (connected to FG of internal bus for improving noise resistance)

Push-in terminal block

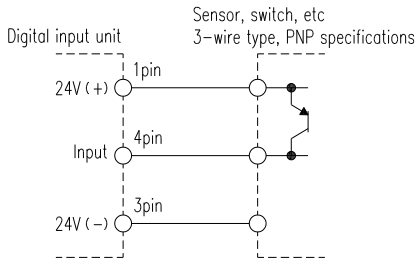
Push-in terminal block	Block No.	Input No.	Description	
			Signal	24V , 24V
	0	0	Input 0	Unit/input 24 V (+)
		1	Input 1	Unit/input 24 V (-)
		2	Input 2	Unit/input 24 V (+)
		3	Input 3	Unit/input 24 V (-)
	1	4	Input 4	Unit/input 24 V (+)
		5	Input 5	Unit/input 24 V (-)
		6	Input 6	Unit/input 24 V (+)
		7	Input 7	Unit/input 24 V (-)
	2	8	Input 8	Unit/input 24 V (+)
		9	Input 9	Unit/input 24 V (-)
		10	Input 10	Unit/input 24 V (+)
		11	Input 11	Unit/input 24 V (-)
	3	12	Input 12	Unit/input 24 V (+)
		13	Input 13	Unit/input 24 V (-)
		14	Input 14	Unit/input 24 V (+)
		15	Input 15	Unit/input 24 V (-)
	4	16	Input 16	Unit/input 24 V (+)
		17	Input 17	Unit/input 24 V (-)
		18	Input 18	Unit/input 24 V (+)
		19	Input 19	Unit/input 24 V (-)
	5	20	Input 20	Unit/input 24 V (+)
		21	Input 21	Unit/input 24 V (-)
		22	Input 22	Unit/input 24 V (+)
		23	Input 23	Unit/input 24 V (-)
	6	24	Input 24	Unit/input 24 V (+)
		25	Input 25	Unit/input 24 V (-)
		26	Input 26	Unit/input 24 V (+)
		27	Input 27	Unit/input 24 V (-)
	7	28	Input 28	Unit/input 24 V (+)
		29	Input 29	Unit/input 24 V (-)
		30	Input 30	Unit/input 24 V (+)
		31	Input 31	Unit/input 24 V (-)

■ External wiring

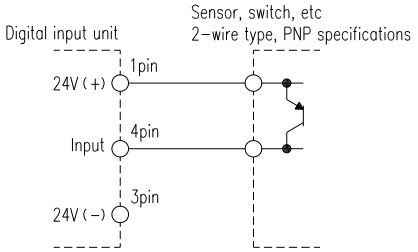
For M8 connectors

Digital input (PNP)

When connecting to a 3-wire system

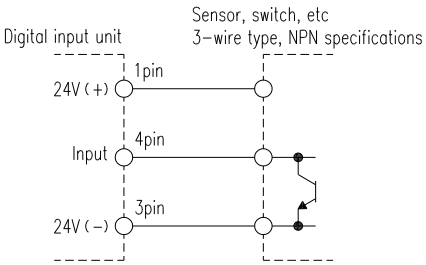


When connecting to a 2-wire system

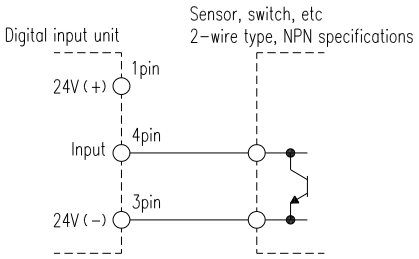


Digital input (NPN)

When connecting to a 3-wire system



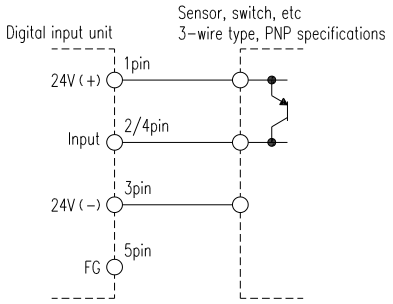
When connecting to a 2-wire system



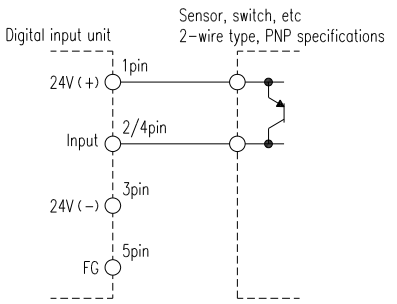
For M12 connectors

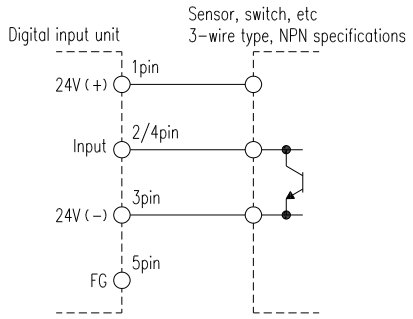
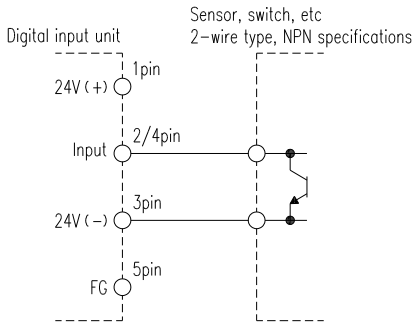
Digital input (PNP)

When connecting to a 3-wire system

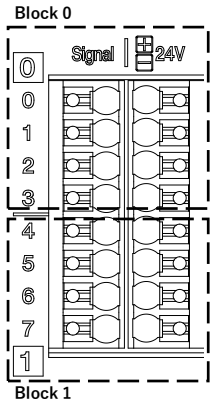
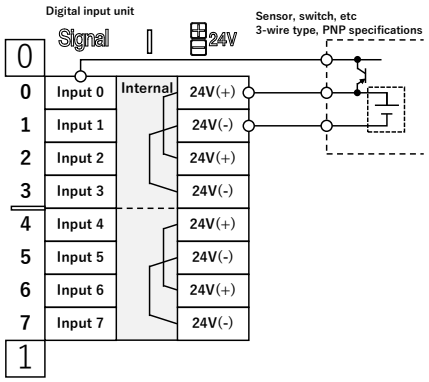
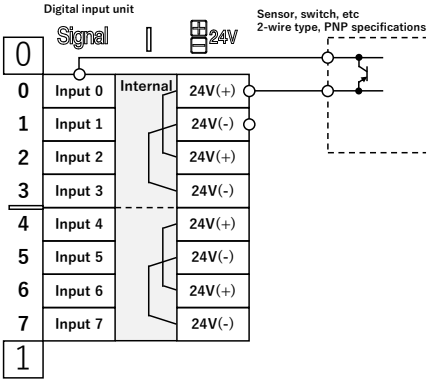


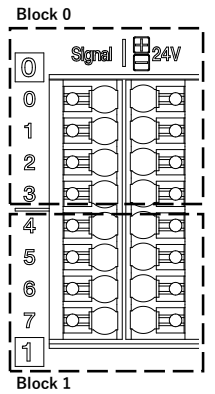
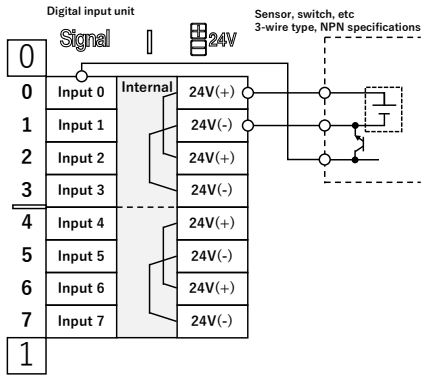
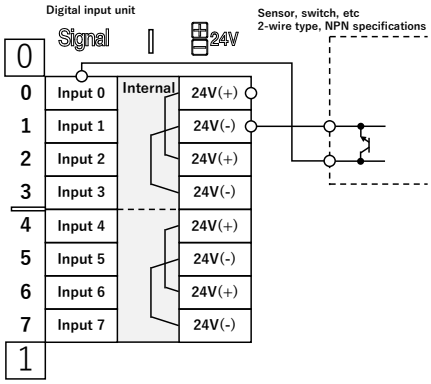
When connecting to a 2-wire system



Digital input (NPN)	
When connecting to a 3-wire system	**When connecting to a 2-wire system**
	

For Push-in terminal blocks

Digital input (PNP)		
Appearance	**When connecting to a 3-wire system**	**When connecting to a 2-wire system**
	 **The power supply is common to each block. Wire the block 1 to 7 same as the block 0.**	 **The power supply is common to each block. Wire the block 1 to 7 same as the block 0.**

Digital input (NPN)		
Appearance	**When connecting to a 3-wire system**	**When connecting to a 2-wire system**
	 **The power supply is common to each block. Wire the block 1 to 7 same as the block 0.**	 **The power supply is common to each block. Wire the block 1 to 7 same as the block 0.**

■ Recommended cables

For M8 connectors

Product name	Specifications	Number of cores	Cable extraction method	Manufacturer	OMRON Corporation model No.
XS3 cable with round waterproof connector at one end (M8 straight - open-end-cable)	M8 plug (male) - open-end-cable, robot cable, screw fixing type	3 cores	Straight to open-end-cable	OMRON Corporation	XS3H-M321-☐

For M12 connectors

Product name	Specifications	Number of cores	Cable extraction method	Manufacturer	OMRON Corporation model No.
XS2H cable with round waterproof connector at one end (M12 straight to open-end-cable)	M12 plug (male) to open-end-cable, for DC	4 cores	Straight to open-end-cable	OMRON Corporation	XS2H-D421-☐
XS2H cable with round waterproof connector at one end (M12 straight to open-end-cable)	M12 plug (male) to open-end-cable, for DC	5 cores	Straight to open-end-cable	OMRON Corporation	XS2H-D521-☐

For Push-in terminal block

Applicable cable:
- Cross-sectional area of the connected cable: AWG28 to 16 (0.08 mm^2 to 1.5 mm^2)
- Length of stripped wire: 8 mm to 9 mm

Recommended ferrules:
i.e. Manufactured by Phoenix Contact

Item code	Model No.	Cross-sectional area
AI0.25-8YE	32 03 03 7	0.25 mm^2
AI0.34-8TQ	32 03 06 6	0.34 mm^2
AI0.5-8WH	32 00 01 4	0.5 mm^2
AI0.75-8GY	32 00 51 9	0.75 mm^2
AI-TWIN2×0.5-8WH	32 00 93 3	2×0.5 mm^2

Recommended crimping pliers

Model No.	Manufacturer
CRIMPFOX 6	Phoenix Contact Corporation

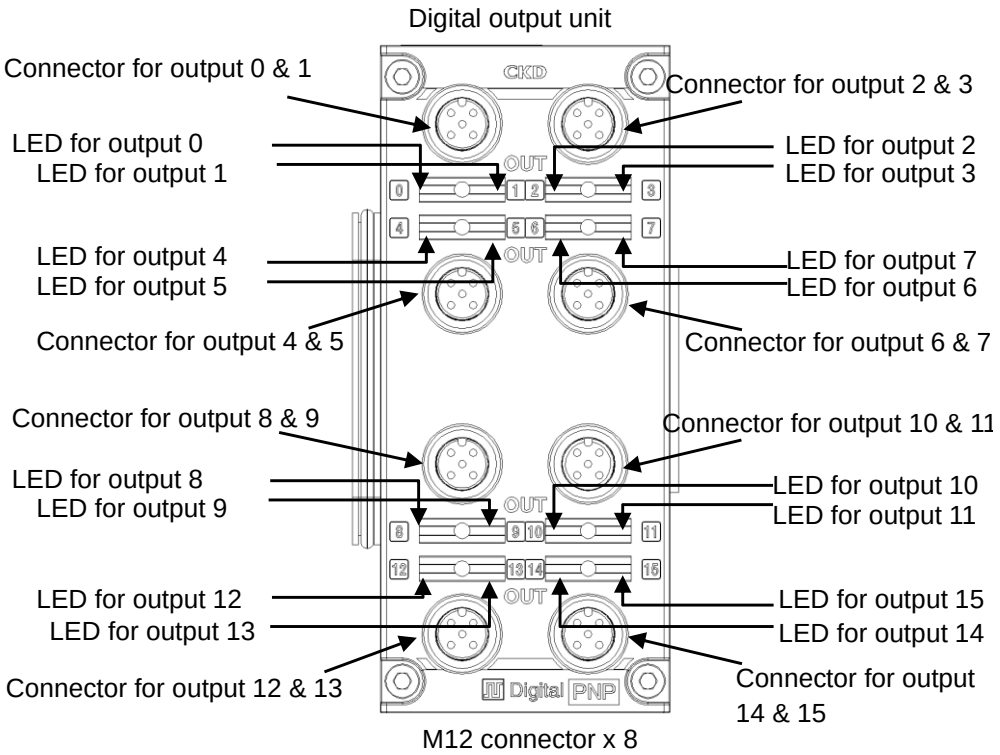
■ Waterproof cap

Always put a waterproof cap on unused M8 or M12 connectors.
A waterproof cap must be used properly to achieve a degree of protection of IP65/IP67.
One of the following can be purchased separately:

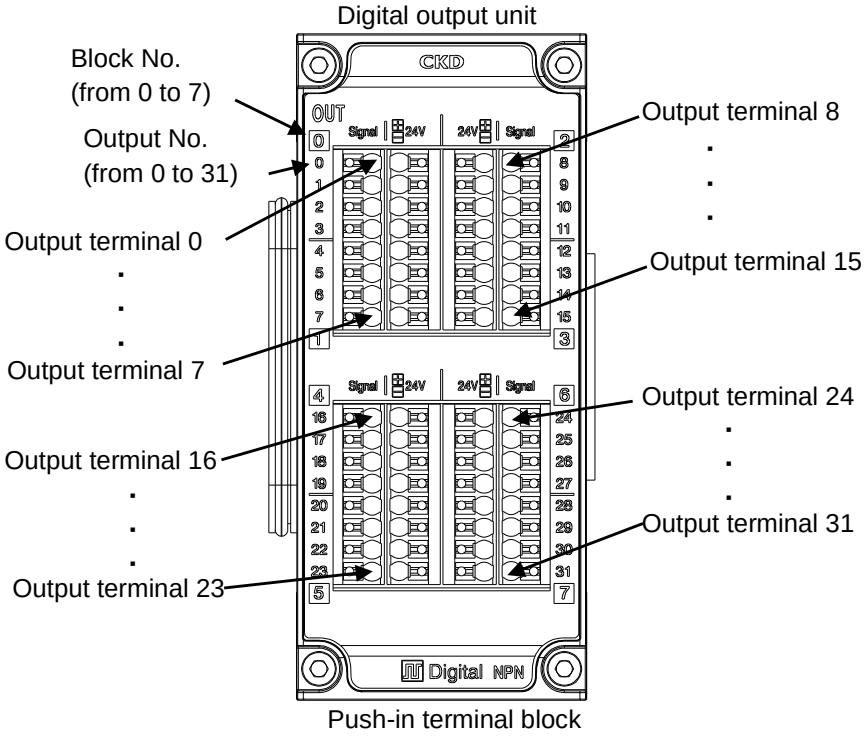
Specifications	Model No.
1 cap for M8 connector	RT-CM8
1 cap for M12 connector	RT-CM12

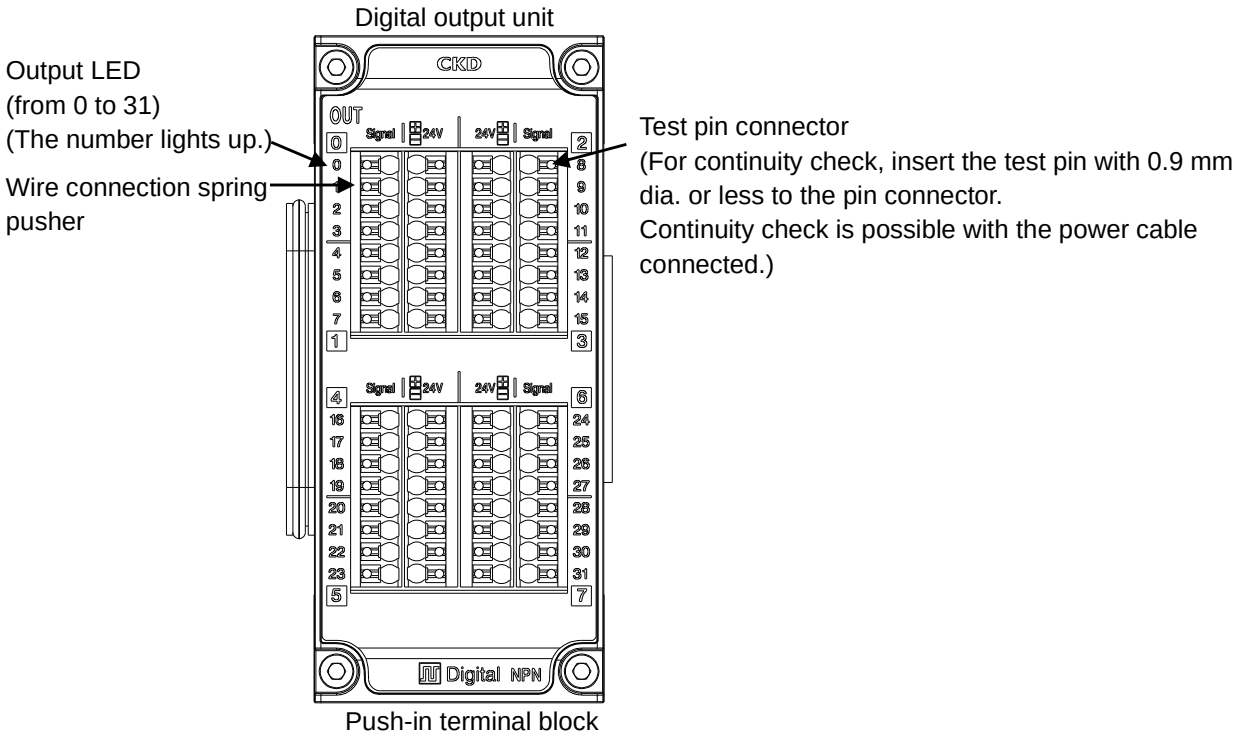
1.3.2 Digital output unit

■ M12 connectors x 8 type



■ Push-in terminal block type





■ LEDs

Specification list

Unit's number of points	Name	Description
16-point of output	0 to 15	Indicates the status of each digital output point.
32-point of output	0 to 31	Indicates the status of each digital output point.

Status list

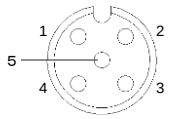
Status	Meaning
Red on	Internal bus communication disconnected
Red blinking (fast)	Hardware error
Red blinking (slow)	Signal line error detection
Yellow on	Output power supply voltage error (detected by the device unit)
Yellow blinking (fast)	Off_On cycle threshold over detection
Green on	Output ON
Off	Power is OFF, or output is OFF

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

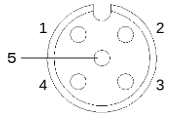
RT product page : https://www.ckd.co.jp/kiki/en/product/detail/1064/

■ Connectors

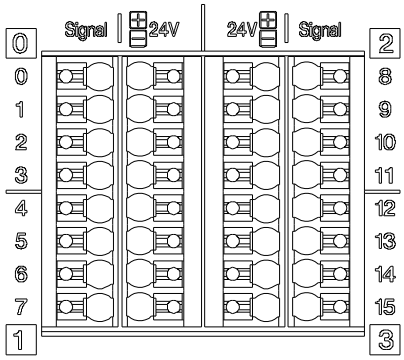
For M12 connectors PNP

M12(A) 5-pin female	Pin number	Description
	1	N.C.
	2	Output 2
	3	Output 24 V (-)
	4	Output 1
	5	FG (connected to FG of internal bus for improving noise resistance)

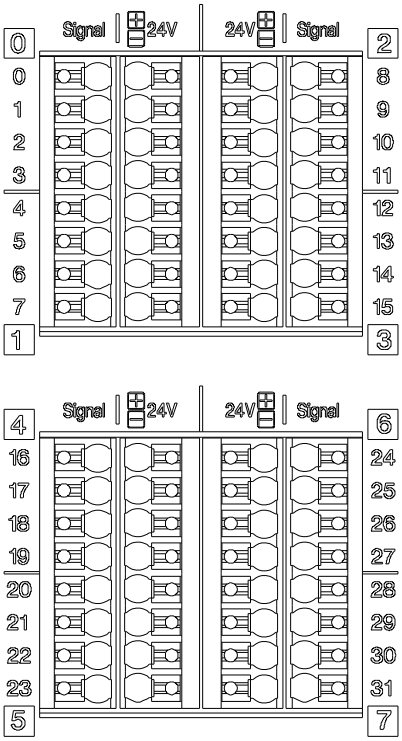
For M12 connectors NPN

M12(A) 5-pin female	Pin number	Description
	1	Output 24 V (+)
	2	Output 2
	3	N.C.
	4	Output 1
	5	FG (connected to FG of internal bus for improving noise resistance)

■ Push-in terminal block type PNP

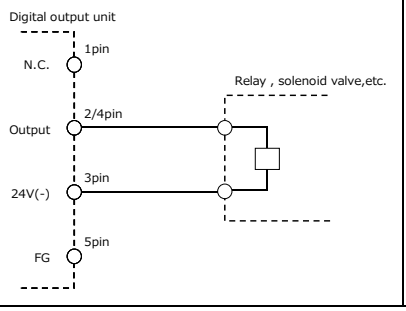
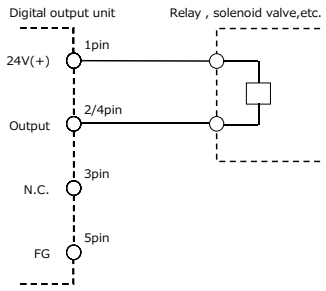
Push-in terminal block	Block No.	Output No.	Description	
			Signal	24V, 24V
	0	0	Output 0	N.C.
		1	Output 1	Output 24 V (-)
		2	Output 2	N.C.
		3	Output 3	Output 24 V (-)
	1	4	Output 4	N.C.
		5	Output 5	Output 24 V (-)
		6	Output 6	N.C.
		7	Output 7	Output 24 V (-)
	2	8	Output 8	N.C.
		9	Output 9	Output 24 V (-)
		10	Output 10	N.C.
		11	Output 11	Output 24 V (-)
	3	12	Output 12	N.C.
		13	Output 13	Output 24 V (-)
		14	Output 14	N.C.
		15	Output 15	Output 24 V (-)
	4	16	Output 16	N.C.
		17	Output 17	Output 24 V (-)
		18	Output 18	N.C.
		19	Output 19	Output 24 V (-)
	5	20	Output 20	N.C.
		21	Output 21	Output 24 V (-)
		22	Output 22	N.C.
		23	Output 23	Output 24 V (-)
	6	24	Output 24	N.C.
		25	Output 25	Output 24 V (-)
		26	Output 26	N.C.
		27	Output 27	Output 24 V (-)
	7	28	Output 28	N.C.
		29	Output 29	Output 24 V (-)
		30	Output 30	N.C.
		31	Output 31	Output 24 V (-)

■ Push-in terminal block type NPN

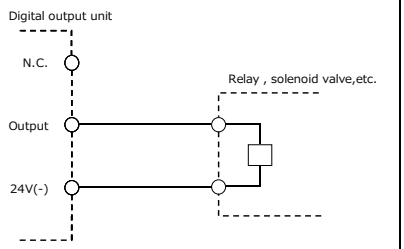
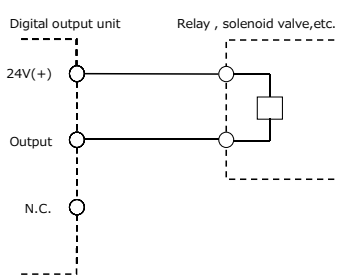
Push-in terminal block	Block No.	Output No.	Description	
			Signal	24V 24V
	0	0	Output 0	Output 24 V (+)
		1	Output 1	N.C.
		2	Output 2	Output 24 V (+)
		3	Output 3	N.C.
	1	4	Output 4	Output 24 V (+)
		5	Output 5	N.C.
		6	Output 6	Output 24 V (+)
		7	Output 7	N.C.
	2	8	Output 8	Output 24 V (+)
		9	Output 9	N.C.
		10	Output 10	Output 24 V (+)
		11	Output 11	N.C.
	3	12	Output 12	Output 24 V (+)
		13	Output 13	N.C.
		14	Output 14	Output 24 V (+)
		15	Output 15	N.C.
	4	16	Output 16	Output 24 V (+)
		17	Output 17	N.C.
		18	Output 18	Output 24 V (+)
		19	Output 19	N.C.
	5	20	Output 20	Output 24 V (+)
		21	Output 21	N.C.
		22	Output 22	Output 24 V (+)
		23	Output 23	N.C.
	6	24	Output 24	Output 24 V (+)
		25	Output 25	N.C.
		26	Output 26	Output 24 V (+)
		27	Output 27	N.C.
	7	28	Output 28	Output 24 V (+)
		29	Output 29	N.C.
		30	Output 30	Output 24 V (+)
		31	Output 31	N.C.

■ External wiring

For M12 connectors

Digital output (PNP)	Digital output (NPN)
	

For Push-in terminal blocks

Digital output (PNP)	Digital output (NPN)
	

■ Recommended cables

For M12 connectors

Product name	Specifications	Number of cores	Cable extraction method	Manufacturer	OMRON Corporation model No.
XS2H cable with round waterproof connector at one end (M12 straight to open-end-cable)	M12 plug (male) - open-end-cable, for DC	4 cores	Straight to open-end-cable	OMRON Corporation	XS2H-D421-☐
XS2H cable with round waterproof connector at one end (M12 straight to open-end-cable)	M12 plug (male) - open-end-cable, for DC	5 cores	Straight to open-end-cable	OMRON Corporation	XS2H-D521-☐

For Push-in terminal block

Applicable cable:
- Cross-sectional area of the connected cable: AWG28 to 16 (0.08 mm^2 to 1.5 mm^2)
- Length of stripped wire: 8 mm to 9 mm

Recommended ferrules:
i.e. Manufactured by Phoenix Contact

Item code	Model No.	Cross-sectional area
AI0.25-8YE	32 03 03 7	0.25 mm^2
AI0.34-8TQ	32 03 06 6	0.34 mm^2
AI0.5-8WH	32 00 01 4	0.5 mm^2
AI0.75-8GY	32 00 51 9	0.75 mm^2
AI-TWIN2×0.5-8WH	32 00 93 3	2×0.5 mm^2

Recommended crimping pliers

Model No.	Manufacturer
CRIMPFOX 6	Phoenix Contact Corporation

■ Waterproof cap

Always put a waterproof cap on unused M12 connectors.
A waterproof cap (RT-CM12) must be used properly to achieve a degree of protection of IP65/IP67.
RT-CM12 is available for purchase separately.

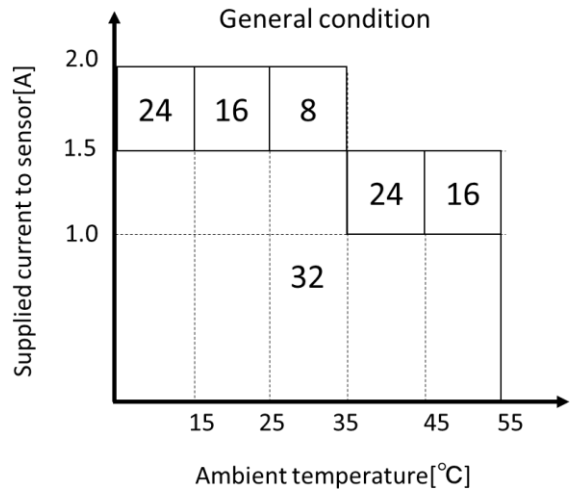
1.4 Unit Specifications

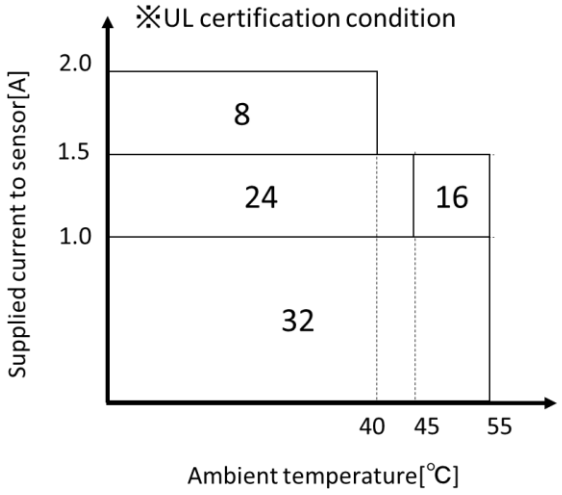
1.4.1 Digital input unit

<table>
<tr><th colspan="2">Item</th><th colspan="6">Description</th></tr>
<tr><td colspan="2">Type</td><td colspan="6">Digital input unit</td></tr>
<tr><td colspan="2">Model No.</td><td>RT-XADGB08A</td><td>RT-XADGB08B</td><td>RT-XADGA16A</td><td>RT-XADGA16B</td><td>RT-XADGC32A</td><td>RT-XADGC32B</td></tr>
<tr><td rowspan="6">Input specifications</td><td>Number of input points</td><td colspan="2">8 points</td><td colspan="2">16 points</td><td colspan="2">32 points</td></tr>
<tr><td>Input format</td><td>PNP</td><td>NPN</td><td>PNP</td><td>NPN</td><td>PNP</td><td>NPN</td></tr>
<tr><td>Input connector</td><td colspan="2">M8(A) 3-pin female</td><td colspan="2">M12(A) 5-pin female</td><td colspan="2">Push-in terminal block</td></tr>
<tr><td>Number of points per connector</td><td colspan="2">1 point</td><td colspan="2">2 points</td><td colspan="2">-</td></tr>
<tr><td>Number of connectors</td><td colspan="2">8 connectors</td><td colspan="2">8 connectors</td><td colspan="2">-</td></tr>
<tr><td>Supplied power (For unit/input)</td><td colspan="6">24 VDC ± 10% 2 A
Note: However, the control part operates with a 5-V or 3.3-V supply (internal power supply).</td></tr>
<tr><td>Maximum supplied current to sensor Note 1</td><td colspan="6">- For 8 points and 8 connectors (M8 connector type), 0.5 A per connector
- For 16 points (8 connectors), 0.5 A per connector
- For 32 points, 0.3 A per block
- 2 A per unit</td></tr>
<tr><td>Protection functions</td><td colspan="6">
<table>
<tr><th rowspan="2">Protection functions</th><th colspan="2">Power line</th></tr>
<tr><th>Unit/input</th><th>Internal power supply</th></tr>
<tr><td>Short circuit protection and detection</td><td>Yes</td><td>No</td></tr>
<tr><td>Disconnection detection</td><td>Yes</td><td>No</td></tr>
<tr><td>Overcurrent protection</td><td>Yes</td><td>No</td></tr>
<tr><td>Overheating protection and detection</td><td>Yes</td><td>No</td></tr>
<tr><td>Overvoltage protection</td><td>Yes</td><td>No</td></tr>
<tr><td>Low voltage protection (reset function)</td><td>No</td><td>Yes</td></tr>
</table>
</td></tr>
<tr><td>Input resistance</td><td colspan="5">5.6 kΩ</td><td>Approx. 4.5 kΩ</td></tr>
<tr><td>Rated input voltage</td><td colspan="6">24 VDC</td></tr>
<tr><td>Rated input current</td><td colspan="5">5 mA or less</td><td>5.3 mA typ.</td></tr>
<tr><td>ON voltage / ON current</td><td colspan="5">15 V or more / 5.2 mA or more
(When NPN input, between input terminal and +24 V) (when PNP input, between input terminal and -24 V)</td><td>15 V or more / 3.3 mA or more (When NPN input, between input terminal and +24 V) (when PNP input, between input terminal and -24 V)</td></tr>
<tr><td>OFF voltage / OFF current</td><td colspan="6">5 V or less /2 mA or less
(When NPN input, between input terminal and +24 V) (when PNP input, between input terminal and -24 V)</td></tr>
<tr><td>Sampling cycle</td><td colspan="6">100μs</td></tr>
<tr><td>Response time Note 2</td><td colspan="5" rowspan="2">ON: Delay is less than 0.8 ms; OFF: Delay is less than 0.8 ms</td><td>[Point 0 to 15]
ON: Delay is less than 0.8 ms;
OFF: Delay is less than 0.8 ms</td></tr>
<tr><td>[Point 16 to 31]
ON: Delay is less than 50 ms;
OFF: Delay is less than 50 ms</td></tr>
<tr><td>Disconnection detection current</td><td>2-wire type</td><td colspan="3">0.08 mA/point</td><td rowspan="2">Detect at restart only
(disconnection)：0.085 mA/block
Any time detect：6 mA/block</td></tr>
<tr><td>3-wire type</td><td colspan="3">0.08 mA /connector</td></tr>
<tr><td colspan="2">LEDs</td><td colspan="6">Same as the number of points</td></tr>
</table>

Item	Description					
Type	Digital input unit					
Model No.	RT-XADGB08A	RT-XADGB08B	RT-XADGA16A	RT-XADGA16B	RT-XADGC32A	RT-XADGC32B
Working temperature range	-10°C to 55°C					
Relative humidity	30% to 85% RH					
Ambient atmosphere	No corrosive gases or heavy dust					
Installation location	Indoor use					
Altitude	Up to 2000 m					
Pollution degree	3					
Degree of protection Note 3	IP65/IP67 (when connected to other units)				IP40 (when connected to other units)	
Current consumption	Unit/input power supply: 110 mA or less (24 V equivalent) Output power supply: 5 mA or less (24 V equivalent)				Unit/input power supply: 220 mA or less (24 V equivalent) Output power supply: 5 mA or less (24 V equivalent)	
Size (W x H x D)	46.1 x 106 x 55.8 (mm)					
Net weight	Approx. 245 g (including RT-TR-1)				Approx. 205 g (including RT-TR-1)	
Standard accessories	RT-TR-1 (Two tie rods for I/O unit), QR label					

Note 1: RT-XADGA16A/B : If the ambient temperature exceeds 40°C but is 55°C or less, use at a maximum of 1.5 A/unit.
RT-XADGB08A/B : If the ambient temperature exceeds 45°C but is 55°C or less, use at a maximum of 1.5 A/unit.
RT-XADGC32A/B : The maximum number of ON points is limited depending on the ambient temperature and supplied current to sensor. Refer to the following table (Left: General condition, Right: UL certification condition).





Note 2: The response time does not include the internal bus communication time.
Note 3: IP65/IP67/IP40 are not part of the UL certification.

1.4.2 Digital output unit

<table>
<tr><th colspan="2">Item</th><th colspan="4">Description</th></tr>
<tr><td colspan="2">Type</td><td colspan="4">Digital output unit</td></tr>
<tr><td colspan="2">Model No.</td><td>RT-XBDGA16A</td><td>RT-XBDGA16B</td><td>RT-XBDGC32A</td><td>RT-XBDGC32B</td></tr>
<tr><td rowspan="9">Output specifications</td><td>Number of output points</td><td colspan="2">16 points</td><td colspan="2">32 points</td></tr>
<tr><td>Output format</td><td>PNP</td><td>NPN</td><td>PNP</td><td>NPN</td></tr>
<tr><td>Output connector</td><td colspan="2">M12(A) 5-pin female</td><td colspan="2">Push-in terminal block</td></tr>
<tr><td>Number of points per connector</td><td colspan="2">2 points</td><td colspan="2">-</td></tr>
<tr><td>Number of connectors</td><td colspan="2">8 connectors</td><td colspan="2">-</td></tr>
<tr><td>Supplied power (For unit/input)</td><td colspan="4">24 VDC ± 10% 2 A
Note: However, the control part operates with a 5-V or 3.3-V supply (internal power supply).</td></tr>
<tr><td>Supplied power (For output)</td><td colspan="4">24 VDC ± 10% 2 A</td></tr>
<tr><td>Maximum load current Note 1</td><td colspan="4">- For 16 points (8 connectors), 0.5 A per connector
- For 32 points, 0.5 A per point
- 2 A per unit</td></tr>
<tr><td>Protection functions</td><td colspan="4">
<table>
<tr><th rowspan="2">Protection functions</th><th colspan="2">Power line</th></tr>
<tr><th>For output</th><th>Internal power supply</th></tr>
<tr><td>Short circuit protection and detection</td><td>Yes</td><td>No</td></tr>
<tr><td>Disconnection detection</td><td>Yes</td><td>No</td></tr>
<tr><td>Overcurrent protection</td><td>Yes</td><td>No</td></tr>
<tr><td>Overheating protection and detection</td><td>Yes</td><td>No</td></tr>
<tr><td>Overvoltage protection</td><td>Yes</td><td>No</td></tr>
<tr><td>Low voltage protection (reset function)</td><td>No</td><td>Yes</td></tr>
<tr><td>Counter-electromotive force protection</td><td>Yes</td><td>No</td></tr>
</table>
</td></tr>
<tr><td>Response time</td><td colspan="4">ON: Delay is less than 0.5 ms; OFF: Delay is less than 1.0 ms
Note: The response time does not include the internal bus communication time.</td></tr>
<tr><td>Disconnection detection current</td><td colspan="4">0.08 mA/point</td></tr>
<tr><td>Leakage current</td><td colspan="4">0.1 mA or less</td></tr>
<tr><td>Residual voltage</td><td colspan="4">1.5 V or less</td></tr>
<tr><td colspan="2">LEDs</td><td colspan="4">Same as the number of points</td></tr>
<tr><td colspan="2">Working temperature range</td><td colspan="4">-10°C to 55°C</td></tr>
<tr><td colspan="2">Relative humidity</td><td colspan="4">30% to 85% RH</td></tr>
<tr><td colspan="2">Ambient atmosphere</td><td colspan="4">No corrosive gases or heavy dust</td></tr>
<tr><td colspan="2">Installation location</td><td colspan="4">Indoor use</td></tr>
<tr><td colspan="2">Altitude</td><td colspan="4">Up to 2000 m</td></tr>
<tr><td colspan="2">Pollution degree</td><td colspan="4">3</td></tr>
<tr><td colspan="2">Degree of protection Note 2</td><td colspan="2">IP65/IP67 (when connected to other units)</td><td colspan="2">IP40 (when connected to other units)</td></tr>
<tr><td colspan="2">Current consumption</td><td colspan="2">Unit/input power supply: 20 mA or less (24 V equivalent)
Output power supply: 45 mA or less (24 V equivalent)</td><td colspan="2">Unit/input power supply: 25 mA or less (24 V equivalent)
Output power supply: 80 mA or less (24 V equivalent)</td></tr>
<tr><td colspan="2">Size (W x H x D)</td><td colspan="4">46.1 mm x 106 mm x 55.8 mm</td></tr>
<tr><td colspan="2">Mass</td><td colspan="2">Approx. 245 g (including RT-TR-1)</td><td colspan="2">Approx. 205 g (including RT-TR-1)</td></tr>
<tr><td colspan="2">Standard accessories</td><td colspan="4">RT-TR-1 (Two tie rods for I/O unit), QR label</td></tr>
</table>

Note 1: RT-XBDGC32A/B： If the ambient temperature exceeds 25°C but is 55°C or less, use at a maximum of 1.5 A/unit .
(If the output is less than 0.5 A each for)
Note 2: IP65/IP67/IP40 are not part of the UL certification.

2. INSTRUCTIONS FOR USE

2.1 Digital Input Unit

Instructions		Reference
Prior checking	-	-
↓	↓	-
Hardware installation and wiring	Connect the digital input unit to the remote I/O.	Remote I/O RT Series Instruction Manual: System Construction
	↓	-
	Connect the external input devices.	"1.3 Names and Functions of Each Part"
↓	↓	-
Digital input unit's settings	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
	↓	-
	Connect the PC software to the device unit with a USB cable.	"3.1.3 List of settings" Remote I/O RT Series Instruction Manual: System Construction
	↓	
	Configure the point-each, connector-each and block-each settings of the digital input unit via the PC software (or the industrial network's message communication).	
	↓	
	Transfer the settings to the device unit by clicking the "Set all items" button in the PC software.	
↓	↓	-
Checking the I/O assignment	Check the digital input unit's I/O assignment to the upper master.	"4.1 Digital Input Unit"
↓	↓	-
Forced input settings	Configure the forced output settings using the PC software, and check the changes in the digital input unit's LEDs and digital input values.	Remote I/O RT Series Instruction Manual: System Construction
↓	↓	-
Checking the input operation	Check the digital input unit's LEDs.	"6.1.2 Troubleshooting from the LED display"

2.2 Digital Output Unit

Instructions		Reference
Prior checking	Check the settings regarding if the output operation is specified individually for each unit in the event of a communication error.	"3.2.3 List of settings"
↓	↓	-
Hardware installation and wiring	Connect the digital output unit to the remote I/O.	Remote I/O RT Series Instruction Manual: System Construction
	↓	-
	Connect the external output devices.	"1.3 Names and Functions of Each Part"
↓	↓	-
Digital output unit's settings	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
	↓	-
	Connect the PC software to the device unit with a USB cable.	"3.2.3 List of settings" Remote I/O RT Series Instruction Manual: System Construction
	↓	
	Configure the point-each settings of the digital output unit via the PC software (or the industrial network's message communication).	
	↓	
	Transfer the settings to the device unit by clicking the "Set all items" button in the PC software.	
↓	↓	-
Checking the I/O assignment	Check the digital output unit's I/O assignment to the upper master.	"4.2 Digital Output Unit"
↓	↓	-
Forced output settings	Configure the forced output settings using the PC software, and check the changes in the digital output unit's LEDs and digital output values.	Remote I/O RT Series Instruction Manual: System Construction
↓	↓	-
Checking the output operation	Check the digital output unit's LEDs.	6.2.2 Troubleshooting from the LED display"

3. SETTINGS

⚠ WARNING

Check the settings of each unit before operating the system.
If the units have incorrect settings, they may malfunction. This could result in injury to people or damage to equipment.

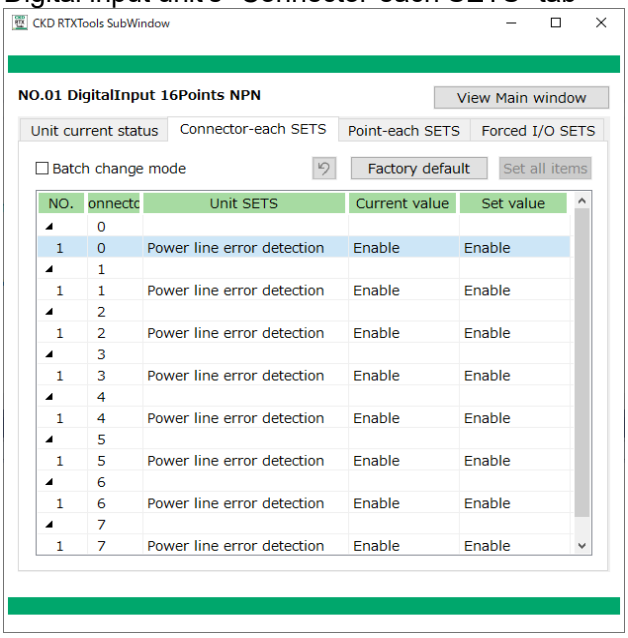
3.1 Digital Input Unit's Setting Method

There are two ways to configure a digital input unit's setting: using the PC software and using industrial network communication.

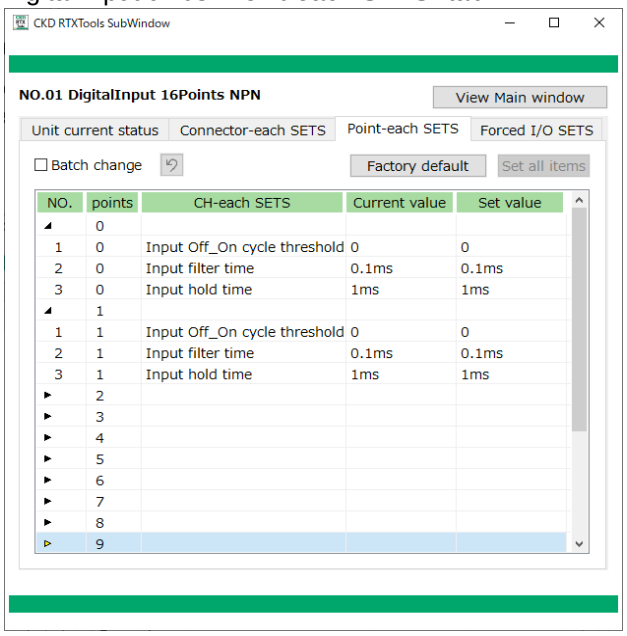
3.1.1 Using PC software

1. Select the digital input unit in the "Unit Configuration" main tab and click the "Settings" button.
2. For M8 and M12 connector, select the "Point-each SETS " or "Connector-each SETS " tab.
   For Push-in terminal block, select the "Point-each SETS" or "Block-each SETS" tab.

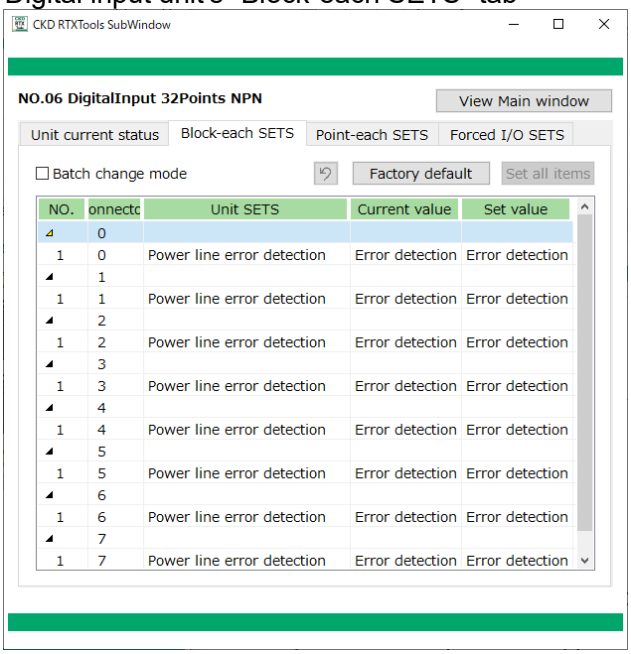
Digital input unit's "Connector-each SETS" tab



Digital input unit's "Point-each SETS" tab



Digital input unit's "Block-each SETS" tab



3.1.2 Using industrial network communication

Message communication commands from the upper master are used to set up the digital input unit's objects.
E.g.) In the case of EtherCAT, SDO communication commands are used to set up the digital input unit's object dictionary.

3.1.3 List of settings

The following settings can be configured for each point:

Point-each setting	Description	Value	Factory setting	Setting required
Input Off_On cycle threshold	This is a threshold for monitoring the number of times the output has changed from OFF to ON. The set value multiplied by 10 is used as the threshold.	0x000000 to 0xFFFFFF There is no counting when it is 0	0	-
Input filter time	Sets the input filter time.	0: 0.1 ms 1: 1 ms 2: 5 ms 3: 10 ms 4: 20 ms	0: 0.1 ms	-
Input hold time	Sets the input hold time.	0: 1 ms 1: 15 ms 2: 100 ms 3: 200 ms Note: Only following can be set for points 16 to 31 of the Push-in terminal block type. 2：100 ms 3：200 ms	0: 1 ms 2：100 ms(Note) Note: For Push-in terminal block type points 16 to 31	-

The following can be set for each connector with the M8 and M12 connector:

Connector-each setting	Description	Value	Factory setting	Setting required
Power line error detection	Enable or disable power line error detection. Configure error detection individually for each connector. Note: If the external device is a reed switch (e.g., a switch), the disconnection detection current will be less than 0.08 mA, and it will trigger a false detection even when connected. In this case, set "Power line error detection" to "Disable". Set it to "Disable" for unused connectors as well.	0: Disable 1: Enable	1: Enable	-

The following can be set for each block with the Push-in terminal block:

Block-each setting	Description	Value	Factory setting	Setting required
Power line error detection	Sets whether the “Power line error detection” is disabled and when to enable the detection. Configure error detection individually for each block. Note: If the external device is a reed switch (e.g., a switch), it may trigger a false detection even when connected. In this case, set "Power line error detection" to "Disable". Set it to "Disable" for unused blocks as well. Followings are the thresholds to detect disconnection. ・Detect at restart only (disconnection)： 30 kΩ to 300 kΩ ・Any time detect： 1 mA to 10 mA (2.4 kΩ to 24 kΩ at 24V)	0: Disable 1: Detect at restart only (disconnection) 2: Any time detect	2: Any time detect	-

3.2 Digital Output Unit's Setting Method

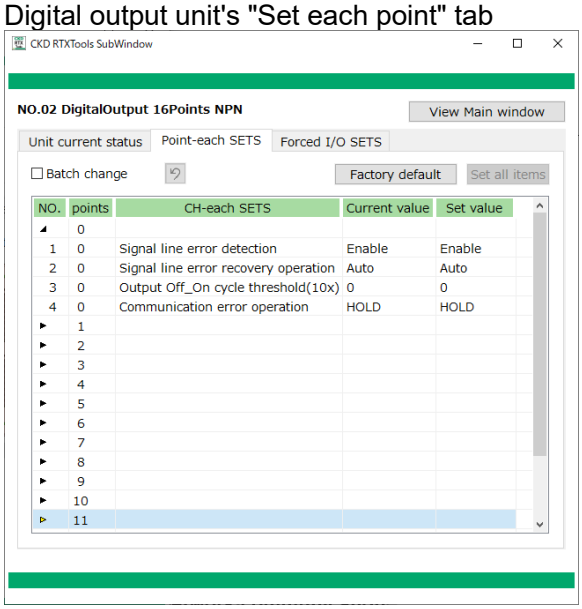
There are two ways to configure a digital output unit’s settings: using the PC software and using industrial network communication.

3.2.1 Using PC software

1 Select the digital output unit on the "Unit Configuration" main tab and click the "Settings" button.

2 Select the "Point-each SETS" tab.

Digital output unit's "Set each point" tab



3.2.2 Using industrial network communication

Message communication commands from the upper master are used to set up the digital output unit's objects.
E.g.) In the case of EtherCAT, SDO communication commands are used to set up the output unit's object dictionary.

3.2.3 List of settings

The following can be set for each point:

Point-each setting	Description	Value	Factory setting	Setting required
Signal line error detection	Enable or disable signal line error detection. Configure error detection individually for each connector. Note: For unused connectors, set "Signal line error detection" to "Disable".	0: Disable 1: Enable	1: Enable	-
Signal line error recovery operation	Set whether to maintain the same behavior as during the signal line error when it has been recovered from, or return to normal from the most recent data update after recovery. Configure the error recovery operation individually for each connector. If it maintains the same behavior as during the error, it will wait for the user to turn the power off and on again.	0: Auto (Do not maintain the same behavior as during the error) 1: Manual (Maintain the same behavior as during the error)	0: Auto (Do not maintain the same behavior as during the error)	-
Output Off_On cycle threshold	This is a threshold for monitoring the number of times the output has changed from OFF to ON. The set value multiplied by 10 is used as the threshold.	0x000000 to 0xFFFFFF There is no counting when it is 0	0	-
Communication error operation	If the device unit's DIP switch setting SW3 is OFF (set individually for each unit), then in the digital output unit, set the output operation in the event of a communication error (upper communication or internal bus communication).	0: OFF 1: ON 2: HOLD (Maintain the output state)	2: HOLD	-

4. I/O ASSIGNMENT

4.1 Digital Input Unit

The table below shows the cyclic communication area assigned to the upper master for a digital input unit.

4.1.1 Description of the process data assignment

The I/O assignment size varies depending on how many input points the unit has.

■ For a digital input unit with 8 input points

Data	Description	Size	Module name in the ESI file
Digital input	This is the value that was inputted digitally. ON is 1 OFF is 0	Fixed at 1 byte	Model No. of each unit

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
State of input 7	State of input 6	State of input 5	State of input 4	State of input 3	State of input 2	State of input 1	State of input 0

■ For a digital input unit with 16 input points

Data	Description	Size	Module name in the ESI file
Digital input	This is the value that was inputted digitally. ON is 1 OFF is 0	Fixed at 2 bytes	Model No. of each unit

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
State of input 15	State of input 14	State of input 13	State of input 12	State of input 11	State of input 10	State of input 9	State of input 8

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
State of input 7	State of input 6	State of input 5	State of input 4	State of input 3	State of input 2	State of input 1	State of input 0

■ For a digital input unit with 32 input points

Data	Description	Size	Module name in the ESI file
Digital input	This is the value that was inputted digitally. ON is 1 OFF is 0	Fixed at 4 bytes	Model No. of each unit

Bit31	Bit30	Bit29	Bit28	Bit27	Bit26	Bit25	Bit24
State of input 31	State of input 30	State of input 29	State of input 28	State of input 27	State of input 26	State of input 25	State of input 24

Bit23	Bit22	Bit21	Bit20	Bit19	Bit18	Bit17	Bit16
State of input 23	State of input 22	State of input 21	State of input 20	State of input 19	State of input 18	State of input 17	State of input 16

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
State of input 15	State of input 14	State of input 13	State of input 12	State of input 11	State of input 10	State of input 9	State of input 8

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
State of input 7	State of input 6	State of input 5	State of input 4	State of input 3	State of input 2	State of input 1	State of input 0

4.1.2 Process data name

In the upper configuration tool, the following is displayed based on the ESI file:
E.g.)

Unit model No. (Module name)	Data size	Data	Data name in the ESI file for EtherCAT	Data type
RT-XADGA16A	2 bytes	Input 0	Point 0	BOOL
		…	…	…
		Input 15	Point 15	BOOL

4.2 Digital Output Unit

The table below shows the cyclic communication area assigned to the upper master for a digital output unit.

4.2.1 Description of the process data assignment

The I/O assignment size varies depending on the number of output points the unit has.

■ For a digital output unit with 16 output points

Data	Description	Size	Module name in the ESI file
Digital output	This is the value that was outputted digitally. ON is 1 OFF is 0	Fixed at 2 bytes	Model No. of each unit

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
State of output 15	State of output 14	State of output 13	State of output 12	State of output 11	State of output 10	State of output 9	State of output 8

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
State of output 7	State of output 6	State of output 5	State of output 4	State of output 3	State of output 2	State of output 1	State of output 0

■ For a digital output unit with 32 output points

Data	Description	Size	Module name in the ESI file
Digital output	This is the value that was outputted digitally. ON is 1 OFF is 0	Fixed at 4 bytes	Model No. of each unit

Bit31	Bit30	Bit29	Bit28	Bit27	Bit26	Bit25	Bit24
State of output 31	State of output 30	State of output 29	State of output 28	State of output 27	State of output 26	State of output25	State of output24

Bit23	Bit22	Bit21	Bit20	Bit19	Bit18	Bit17	Bit16
State of output 23	State of output 22	State of output 21	State of output 20	State of output 19	State of output 18	State of output 17	State of output 16

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
State of output 15	State of output 14	State of output 13	State of output 12	State of output 11	State of output 10	State of output 9	State of output 8

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
State of output 7	State of output 6	State of output 5	State of output 4	State of output 3	State of output 2	State of output 1	State of output 0

4.2.2 Process data name

In the upper configuration tool, the following is displayed based on the ESI file:

E.g.)

Unit model No. (Module name)	Data size	Data	Data name in the ESI file for EtherCAT	Data type
RT-XBDGA16A	2 bytes	Output 0	Point 0	BOOL
		…	…	…
		Output 15	Point 15	BOOL

5. FUNCTIONS

5.1 Digital Input Unit

5.1.1 Function list

Function	Description	Related settings
Power line error detection	Detects short circuits, disconnections, and overheating in the digital input unit's power lines (pin 1 line of each connector). Whether detection is performed depends on the "Power line error detection" setting. For M8 and M12 connector, the disconnection detection function only works at start-up. For Push-in terminal block, the disconnection detection function can be selected from [Detect at restart only] or [Any time detect].	[Power line error detection]
Input filtering	Sets the time before ON or OFF of the digital input unit's input signal is confirmed. Choose from 0.1 ms, 1 ms, 5 ms, 10 ms, or 20 ms.	[Input filter time]
Input hold time	Sets the minimum hold time after the digital input unit's input signal has been confirmed ON or OFF. Choose from 1 ms, 15 ms, 100 ms, or 200 ms. For points 16 to 31 of Push-in terminal block, choose from 100 ms or 200 ms.	[Input hold time]
Off_On cycle counts/over detection	Counts the number of times the digital input unit's input signal has changed from OFF to ON. The counted number is stored in non-volatile memory once every 30 minutes (Note 1). It can also detect when the set threshold is exceeded. Note 1: For EtherCAT communication, the Off_On cycle count value can be found by reading the object dictionary's Off_On cycle count value.	[Input Off_On cycle threshold]
Forced input setting	Forces the digital input unit's input signal to be either ON or OFF (regardless of the actual input value) from the PC software.	-
Point diagnostic information for the unit	The diagnostic information for each of the digital input unit's points. 16 bits per point, and each bit corresponds to an error type. If an error is detected, the corresponding bit is 1 (ON). The information can be read from the PC software or upper master. The types of errors are as follows: Bit: Error description (genre of device diagnostics) 15: Power line error (power supply) 14: Over Off_On cycle threshold (unit input) 13: Hardware error (hardware) 12: Hold forcibly non-output (disconnection detection) (user operation waiting)	-

5.2 Digital Output Unit

5.2.1 Function list

Function	Description	Related settings
Signal line error detection	Detects short circuits, disconnections, and overheating in the digital output unit's signal lines. Whether detection is performed depends on the "Signal line error detection" setting.	[Signal line error detection]
Signal line error recovery operation setting	Specifies whether to maintain the same behavior as during the signal line error when it has been recovered from, or return to normal from the most recent data update after recovery. If it maintains the same behavior as during the error, it will wait for the user to turn the power off and on again.	
Off_On cycle counts/ over detection	Counts the number of times the digital output unit's output signal has changed from OFF to ON. The counted number is stored in non-volatile memory once every 30 minutes (Note 1). It can also trigger an alarm when the set threshold is exceeded. Note 1: For EtherCAT communication, the Off_On cycle count value can be found by reading the object dictionary's Off_On cycle count value.	[Output Off_On cycle threshold]
Forced output setting	Forces the digital output unit's output signal to be either ON or OFF (regardless of the actual output) from the PC software.	-
Communication error operation setting	If the device unit's DIP switch setting SW3 is OFF (set individually for each unit), the output operation in the event of a communication (upper communication or internal bus communication) error can be specified individually on the Digital output unit side.	[Communication error operation]
Point diagnostic information for the unit	This is diagnostic information for each of the digital output unit's points. 16 bits per point, and each bit corresponds to an error type. If an error is detected, the corresponding bit is 1 (ON). The information can be read from the PC software or upper master. The types of errors are as follows: Bit: Error description (genre of device diagnostics) 15: Signal line error (unit output) 14: Over Off_On cycle threshold (unit output) 13: Hardware error (hardware) 12: On signal line error recovery, same behavior maintained as during error (operation waiting)	-

6. TROUBLESHOOTING

6.1 Digital Input Unit

6.1.1 Unit errors (Point diagnostic information)

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

■ Error codes displayed in the PC software

The point diagnostic information can be found on the following screen of the PC software as a hexadecimal "error code" with the corresponding bit set to 1 (ON).

- "Code" in the "Error" main tab
- "Error Code" (in the error log)

■ Reading the diagnostic information area with message communication from the upper master

(For EtherCAT) The point diagnostic information is also stored in the diagnostic information area below in the object dictionary of the EtherCAT device unit. It can be read point-by-point from the upper master via SDO communication.

Index	Sub-Index	Description	Data type	Reading/writing attributes	Value	Initial value
0xAXX1	0	Number of entries	UNSIGNED8	RO	8,16,32 (number of input points)	n
	1	Point diagnostic information 0	WORD	RO	0x0000-0xFFFF	0
	n	Point diagnostic information n-1	WORD	RO	0x0000-0xFFFF	0

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

For digital input units, the following errors can be found:

Bit	Error name	Description	Point-specific / unit	"Error type" in the device unit's "Remote I/O diagnostic information"
15	Power line error detection	1 (ON) when the digital input unit's "Power line error detection" setting is "Enable", “Detect at restart only”, “Any time detect” and a power line (pin 1 line of each connector) supplying an external input device has an error (short circuit, disconnection, or overheating).	Point-specific	Power supply
14	Off_On cycle threshold over detection	1 (ON) when the count of the number of times the digital input unit's input signal has changed from OFF to ON exceeds the set threshold.	Point-specific	Unit input error
13	Hardware error	1 (ON) when the digital input unit has a hardware error.	Unit	Hardware error
12	Hold forcibly non-output	1 (ON) when the digital input unit detects a disconnection at start-up. If a disconnection is detected, the input is forcibly kept OFF. (Even if there is an ON input, it will be OFF in the process data.) The system is waiting for the user to turn the power off and on again.	Point-specific	Operation waiting
11 to 0	**Reserved**	Fixed at 0.	-	-

6.1.2 Troubleshooting from the LED display

■ Normal condition

Digital input unit LEDs for each point	Problem
Green on	Input ON.
Off	Power is OFF, or input is OFF.

Device unit EtherCAT compatible example	Digital input unit LEDs for each point	Problem	Cause	Action
CF: Yellow on	Green on or off: depends on the forced output settings	Digital inputs are not updated.	Currently forcing input from the PC software.	Cancel the forced input from the PC software.

■ Error condition

Digital input unit LEDs for each point	Problem	Point diagnostic information	Cause	Action
Red on	When the PC software is connected to the device unit, the "Unit Configuration" main tab is not displayed, and the "Error" main tab is displayed instead.	-	The digital input unit is disconnected from the internal bus communication. The device unit has failed to automatically recognize the digital input unit at start-up. (The device unit has a "unit configuration error" (system error).)	- Check the connection between the units. - Check that the number of I/O units connected to the device unit is 17 or less.
	The unit configuration cannot be checked from the upper master's configuration tool.			
	The digital input unit cannot be controlled via the upper master.		The digital input unit is disconnected from the internal bus communication.	- Check whether there is a process data overflow in the device unit. - If the problem persists, contact CKD.
Red blinking (fast)	A hardware error has occurred. At the moment, all digital inputs are OFF (not updated).	Hardware error (Hardware error)	A hardware error has occurred in the digital input unit.	- Turn the power OFF then ON again. - If the problem persists, contact CKD.
Red blinking (slow)	An error has been detected in one of the digital input unit's power lines (pin 1 wire on each connector). At the moment, the digital input for that connector is OFF (not updated).	Power line error detection (unit input error)	A short circuit, disconnection, or overheating has been detected in one of the digital input unit's power lines when its "Power line error detection" setting is "Enable", “Detect at restart only”, or “Any time detect”	Check the digital input unit's power lines.
Off (but no power line error)	A power line disconnection was detected at start-up. At the moment, the digital input for that connector is OFF (not updated).	Hold forcibly non-output (operation waiting)	A power line disconnection was detected when the digital input unit started up. Note: If the external input device is a reed switch (e.g., a switch), it may trigger a false detection even when connected.	Turn the power OFF then ON again. Note: If the external input device is a reed switch (e.g., a switch), set "Power line error detection" to "Disable." However, this will also disable detection of overcurrent, etc. The protection functions are always enabled regardless of the setting.
Yellow blinking (fast)	The number of times the digital input unit's input signal has changed from OFF to ON has exceeded the set threshold.	Off_On cycle threshold over detection (unit input error)	The number of times the digital input unit's input signal has changed from OFF to ON has exceeded the set threshold when its "Off_On cycle threshold setting” is not "0."	Do one of the following: - Change the threshold setting. - Clear the count value from the PC software.

6.2 Digital Output Unit

6.2.1 Unit errors (Point diagnostic information)

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

■ Error codes displayed in the PC software

The point diagnostic information can be found on the following screen of the PC software as a hexadecimal "error code" with the corresponding bit set to 1 (ON).
- "Code" in the "Error" main tab
- "Error Code" (in the error log)

■ Reading the diagnostic information area with message communication from the upper master

(For EtherCAT) The point diagnostic information is also stored in the diagnostic information area below in the object dictionary of the EtherCAT device unit. It can be read point-by-point from the upper master via SDO communication.

Index	Sub-Index	Description	Data type	Reading/writing attributes	Value	Initial value
0xAXX1	0	Number of entries	UNSIGNED8	RO	16,32 (number of outputs)	n
	1	Point diagnostic information 0	WORD	RO	0x0000-0xFFFF	0
	n	Point diagnostic information n-1	WORD	RO	0x0000-0xFFFF	0

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

For digital output units, the following errors can be found:

Bit	Error name	Description	Point-specific / unit	"Error type" in the device unit's "Remote I/O diagnostic information"
15	Signal line error detection	1 (ON) when the digital output unit's "Signal line error detection" setting is "Enable" and a signal line to an external output device has an error (short circuit, disconnection, or overheating).	Point-specific	Unit output error
14	Off_On cycle threshold over detection	1 (ON) when the count of the number of times the digital output unit's input signal has changed from OFF to ON exceeds the set threshold.	Point-specific	Unit output error
13	Hardware error	1 (ON) when the digital output unit has a hardware error.	Unit	Hardware error
12	On signal line error recovery, same behavior maintained as during error	When the digital output unit's "Signal line error recovery operation" setting is ON (Manual), the same behavior as during the signal line error is maintained even after recovery from it. The system is waiting for the user to turn the power off and on again.	Point-specific	Operation waiting
11 to 0	Reserved	Fixed at 0.	-	-

6.2.2 Troubleshooting from the LED display

■ Normal condition

Digital output unit LEDs for each point	Problem
Green on	Output is ON.
Off	Power is OFF, or output is OFF.

Device unit EtherCAT compatible example	Digital output unit LEDs for each point	Problem	Cause	Action
ERR: Red blinking (twice)	Off	A communication error has occurred in the device unit. At the moment, all digital outputs are OFF.	The device unit's DIP switch setting SW3 is OFF (set individually for each unit), and the digital output unit's “Communication error operation setting” is "0" (OFF).	If wanting the digital output to be something other than OFF, set the digital output unit's “Communication error operation setting” to "1" (ON) or "2" (HOLD).
			The device unit's DIP switch setting SW3 is ON (apply setting to all units at once) and SW4 is OFF (CLEAR).	Review the settings of the digital output unit and the device unit's DIP switches related to the functions for setting the communication error output. If wanting to maintain the digital output value and to do likewise with the other I/O units as well, set the device unit's DIP switch setting SW4 to ON (HOLD).
SF: Red blinking (fast) or indeterminate	The LEDs for each point are red on)	An internal bus error has occurred in the device unit. At the moment, all digital outputs are OFF.	The device unit's DIP switch setting SW3 is OFF (set individually for each unit), and the digital output unit's “Communication error operation setting” is "0" (OFF).	If wanting the digital output to be something other than OFF, set the digital output unit's “Communication error operation setting” to "1" (ON) or "2" (HOLD).
CF: Yellow on	The LEDs for each point are determined by the forced output's instructions	Digital outputs are not updated.	The output is being forced from the PC software.	Cancel the forced output from the PC software.

■ Error condition

Digital output unit LEDs for each point	Problem	Point diagnostic information	Cause	Action
Red on	When the PC software is connected to the device unit, the "Unit Configuration" tab is not displayed, and the "Error" main tab is displayed instead.	-	The digital output unit is disconnected from the internal bus communication. The device unit has failed to automatically recognize the digital output unit at start-up. (The device unit has a "unit configuration error" (system error).)	- Check the connection between the units. - Check that the number of I/O units connected to the device unit is 17 or less.
	The RT remote I/O's unit configuration cannot be checked from the upper master's configuration tool.			
	The digital output unit cannot be controlled via the upper master.		The digital output unit is disconnected from the internal bus communication.	Check whether there is a process data overflow in the device unit. If the problem persists, contact CKD.
Red blinking (fast)	A hardware error has occurred. At the moment, all digital outputs are OFF (not updated).	Hardware error (Hardware error)	A hardware error has occurred in the digital output unit.	- Turn the power OFF then ON again. - If the problem persists, contact CKD.
Red blinking (slow)	An error has been detected in one of the digital output unit's signal lines. At the moment, the digital output for that connector is OFF (not updated).	Signal line error detection (unit input error)	A short circuit, disconnection, or overheating has been detected in one of the digital output unit's signal lines when its "Signal line error detection" setting is "Enable."	Check the digital output unit's signal lines. For unused connectors, set "Signal line error detection" to "0" (disabled).
-	An error in one of the digital output unit's signal lines has been recovered from. However, the digital output is still OFF (not updated).	On manual output (operation waiting)	When the digital output unit's "Signal line error recovery operation" setting is "ON" (Manual), the same behavior as during the signal line error is maintained even after recovery from it.	Turn the power OFF then ON again.
Yellow on	An error in the output power supply voltage has been detected.	Output power supply voltage error Note: This is not included in the point diagnostic information for a digital output unit.	This occurs if the device unit detects an "output power supply voltage error".	Check the output power supply voltage to the power supply unit closest to the device unit.
Yellow blinking (fast)	The number of times the digital output unit's output signal has changed from OFF to ON has exceeded the set threshold.	Off_On cycle threshold over detection (unit input error)	The number of times the digital output unit's output signal has changed from OFF to ON has exceeded the set threshold when its "Off_On cycle threshold setting" is not "0".	Do one of the following: - Change the threshold setting. - Clear the count value from the PC software.

7. APPENDIX: LIST OF INPUT/OUTPUT OPERATIONS IN THE EVENT OF AN ERROR IN THE PRODUCT

This section lists the operations a digital I/O unit performs when an error occurs, and when one is recovered from.

7.1 Communication Error

■ On occurrence

Upper communication error

<table>
<tr><th colspan="4">Device unit</th><th colspan="2">Operation performed by digital I/O unit</th></tr>
<tr><th colspan="2">DIP switch setting SW3 (output settings in the event of a communication error / priority to hardware)</th><th colspan="2">DIP switch setting SW4 (HOLD/CLEAR)</th><th>Digital input unit</th><th>Digital output unit</th></tr>
<tr><td rowspan="2">ON</td><td rowspan="2">Set for all units at once</td><td>ON</td><td>Hold all outputs (HOLD)</td><td rowspan="3">(There is no special behavior.)</td><td>Holds the last output.</td></tr>
<tr><td>OFF</td><td>Clear all outputs (CLEAR)</td><td>Outputs OFF.</td></tr>
<tr><td>OFF</td><td>Set individually for each unit</td><td colspan="2">-</td><td>Depends on the digital output unit's "Communication error operation setting" (OFF/ON/HOLD specification).</td></tr>
</table>

Internal bus communication error

<table>
<tr><th colspan="4">Device unit</th><th colspan="2">Operation performed by digital I/O unit</th></tr>
<tr><th colspan="2">DIP switch setting SW3 (output settings in the event of a communication error / priority to hardware)</th><th colspan="2">DIP switch setting SW4 (HOLD/CLEAR)</th><th>Digital input unit</th><th>Digital output unit</th></tr>
<tr><td rowspan="2">ON</td><td rowspan="2">Set for all units at once</td><td>ON</td><td>Hold all outputs (HOLD)</td><td rowspan="3">Uses the last input value as it is.</td><td>Holds the last output.</td></tr>
<tr><td>OFF</td><td>Clear all outputs (CLEAR)</td><td>Outputs OFF.</td></tr>
<tr><td>OFF</td><td>Set individually for each unit</td><td colspan="2">-</td><td>Depends on the digital output unit's "Communication error operation setting" (OFF/ON/HOLD specification).</td></tr>
</table>

■ On recovery

Upper communication error

<table>
<tr><th colspan="4">Device unit</th><th colspan="2">Operation performed by digital I/O unit</th></tr>
<tr><th colspan="2">DIP switch setting SW3 (output settings in the event of a communication error / priority to hardware)</th><th colspan="2">DIP switch setting SW4 (HOLD/CLEAR)</th><th>Digital input unit</th><th>Digital output unit</th></tr>
<tr><td rowspan="2">ON</td><td rowspan="2">Set for all units at once</td><td>ON</td><td>Hold all outputs (HOLD)</td><td rowspan="3">Does not recover automatically.</td><td rowspan="3">Does not recover automatically.</td></tr>
<tr><td>OFF</td><td>Clear all outputs (CLEAR)</td></tr>
<tr><td>OFF</td><td>Set individually for each unit</td><td colspan="2">-</td></tr>
</table>

Internal bus communication error

Device unit				Operation performed by digital I/O unit	
DIP switch setting SW3 (output settings in the event of a communication error / priority to hardware)		DIP switch setting SW4 (HOLD/CLEAR)		Digital input unit	Digital output unit
ON	Set for all units at once	ON	Hold all outputs (HOLD)	Does not recover.	Does not recover.
		OFF	Clear all outputs (CLEAR)		
OFF	Set individually for each unit	-			

7.2 Digital Input Unit

7.2.1 Power line error

■ On occurrence

Digital input unit's settings Power line error detection setting	Operation performed by digital input unit
Enable	Change inputs to OFF regardless of the actual input value.
Detect at restart only	
Any time detect	
Disable	

■ On recovery

Digital input unit's settings Power line error detection setting	Operation performed by digital input unit
Enable	Recovers automatically. However, when recovering from disconnection, it changes inputs to OFF regardless of the actual input value.
Detect at restart only	
Any time detect	Recovers automatically.
Disable	

7.2.2 Disconnection (hold forced OFF)

■ On occurrence

Digital input unit's settings Power line error detection setting	Operation performed by digital input unit
Enable	Change inputs to OFF regardless of the actual input value.
Detect at restart only	
Any time detect	
Disable	

■ On recovery

Digital input unit's settings Power line error detection setting	Operation performed by digital input unit
Enable	Change inputs to OFF regardless of the actual input value. Recovers automatically if the power is turned Off then ON again.
Detect at restart only	
Any time detect	Recovers automatically.
Disable	

7.3 Digital Output Unit

7.3.1 Signal line error

■ On occurrence

Digital output unit's settings Signal line error detection setting	Operation performed by digital output unit
Enable	Change outputs to OFF regardless of the actual input value.(Depends on protection functions)
Disable	

■ On recovery

Digital output unit's settings Signal line error detection setting	Operation performed by digital output unit
Enable	Depends on the "Signal line error recovery operation setting" (Auto/Manual specification).
Disable	

7.4 Memory Error

■ On occurrence

Operation performed by digital I/O unit	
Digital input unit	Digital output unit
Changes all connectors' inputs to OFF.	Changes all connectors' outputs to OFF.

8. WARRANTY PROVISIONS

8.1 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.

8.2 Warranty Period

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