CKD

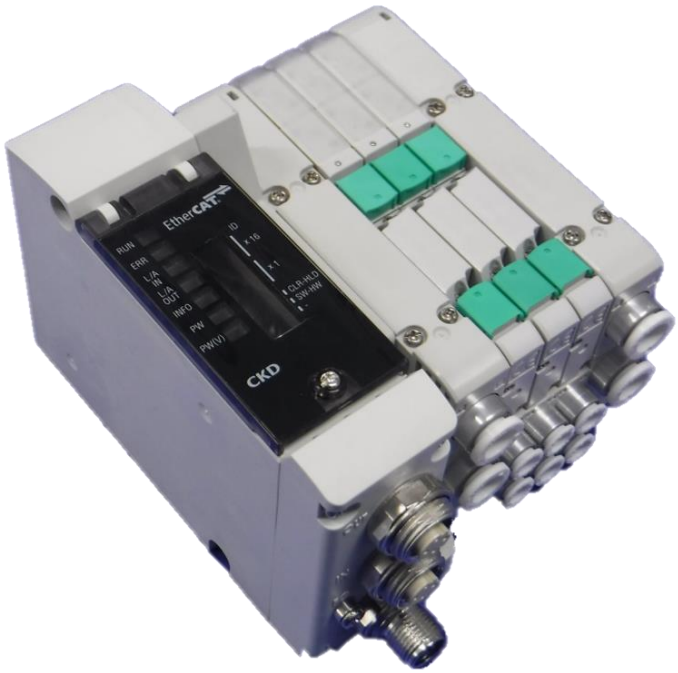
Serial Transmission Device

TVG series JA3*
(OPP8-A2EC／OPP8-A2EC-P)

EtherCAT Compatible

INSTRUCTION MANUAL

SM-A75434-A



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 serial transmission device**. 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.

- The product, which uses control valves such as solenoid valves, motor valves, and air operated valves, is intended for users who have basic knowledge about materials, fluids, piping, and electricity. CKD shall not be responsible for accidents caused by persons who selected or used the product without knowledge or sufficient training with respect to control valves.
- 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 due to fluid, piping, or other conditions. 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 fluid control circuit, and the electric system that controls such mechanism is ensured.

To ensure the safety of device design and control, observe organization standards, 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 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, customer's 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 a 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

⚠ 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. In addition, never modify or additionally machine this product.

The product is intended for use in devices or parts for general industrial machinery. It is not intended for use outdoors or in the conditions or environment listed below.

(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.)

- In applications for nuclear power, railroad system, aviation, ship, vehicle, medical equipment, and equipment that directly touches beverage or food.
- For special applications that require safety including amusement equipment, emergency shut-off circuit, press machine, brake circuit, and safety measures.
- For applications where life or properties may be adversely affected, and special safety measures are required.

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

- Inspect and service the machine and devices 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 incorporates pneumatic components, make sure that a safety measure (such as a pop-out prevention mechanism) is in place and system safety is secured.

CONTENTS

1. PRODUCT OVERVIEW

1.1 System Overview

1.1.1 System features

Make sure to read the instruction manual for each product.
This Instruction Manual describes the device OPP8-A2EC-* (JA3*) for TVG.
For the MainDevice and other SubDevice units that are connected in the same system, refer to the instruction manuals issued by each manufacturer.
For manifold solenoid valves, make sure to read both this Instruction Manual and the solenoid valve's instruction manual to fully understand the functions and performance in order to use them correctly.

■ OPP8-A2EC-* (JA3*)

This is a device for TVG which can be connected to the open industrial Ethernet network EtherCAT.
Features include the following:

- The device is connected to PLC with only a network cable (Category 5 or higher), allowing significant reduction in wiring man-hours.
- The unit power and the valve power are separated, ensuring easy maintenance.
- The device output status in the event of a communication error can be set by switches. (Hold / All points OFF)
- The device is available in +COM or -COM specification.

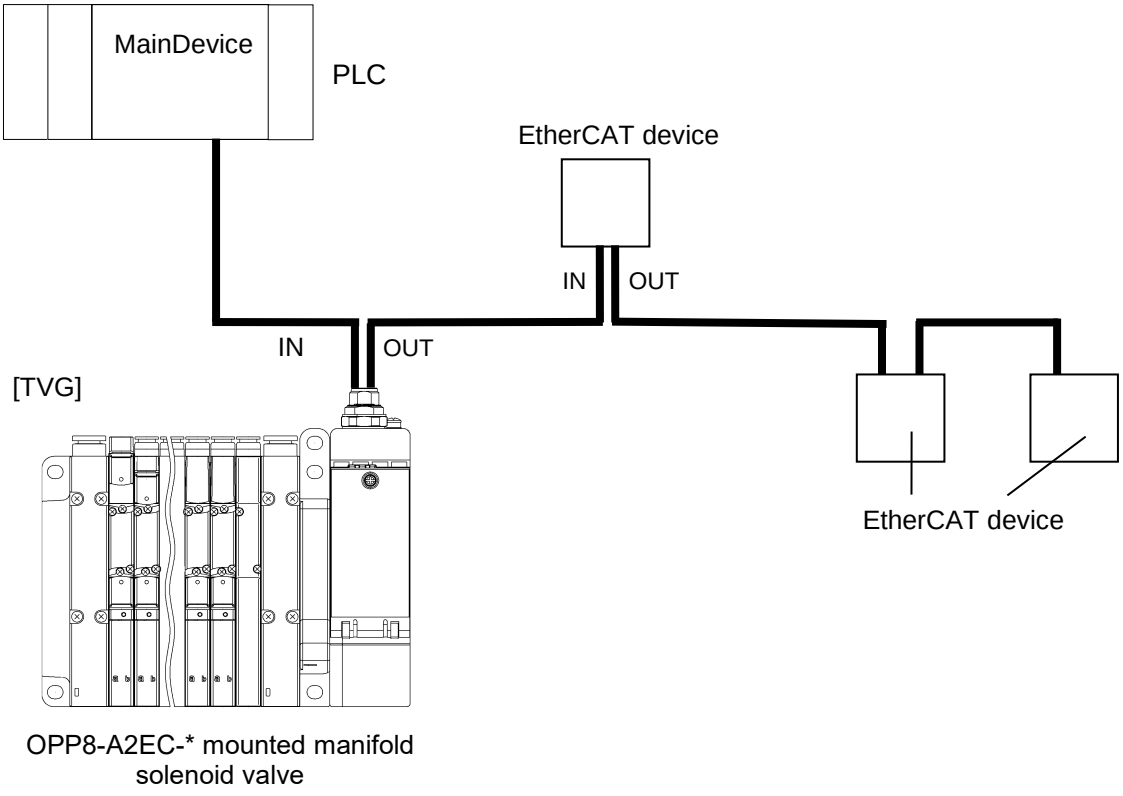
1.1.2 System structure

This system mainly consists of a PLC, MainDevice, OPP8-A2EC-* mounted manifold solenoid valve, and peripheral equipment (EtherCAT device).

■ Examples of PLC and MainDevice combination

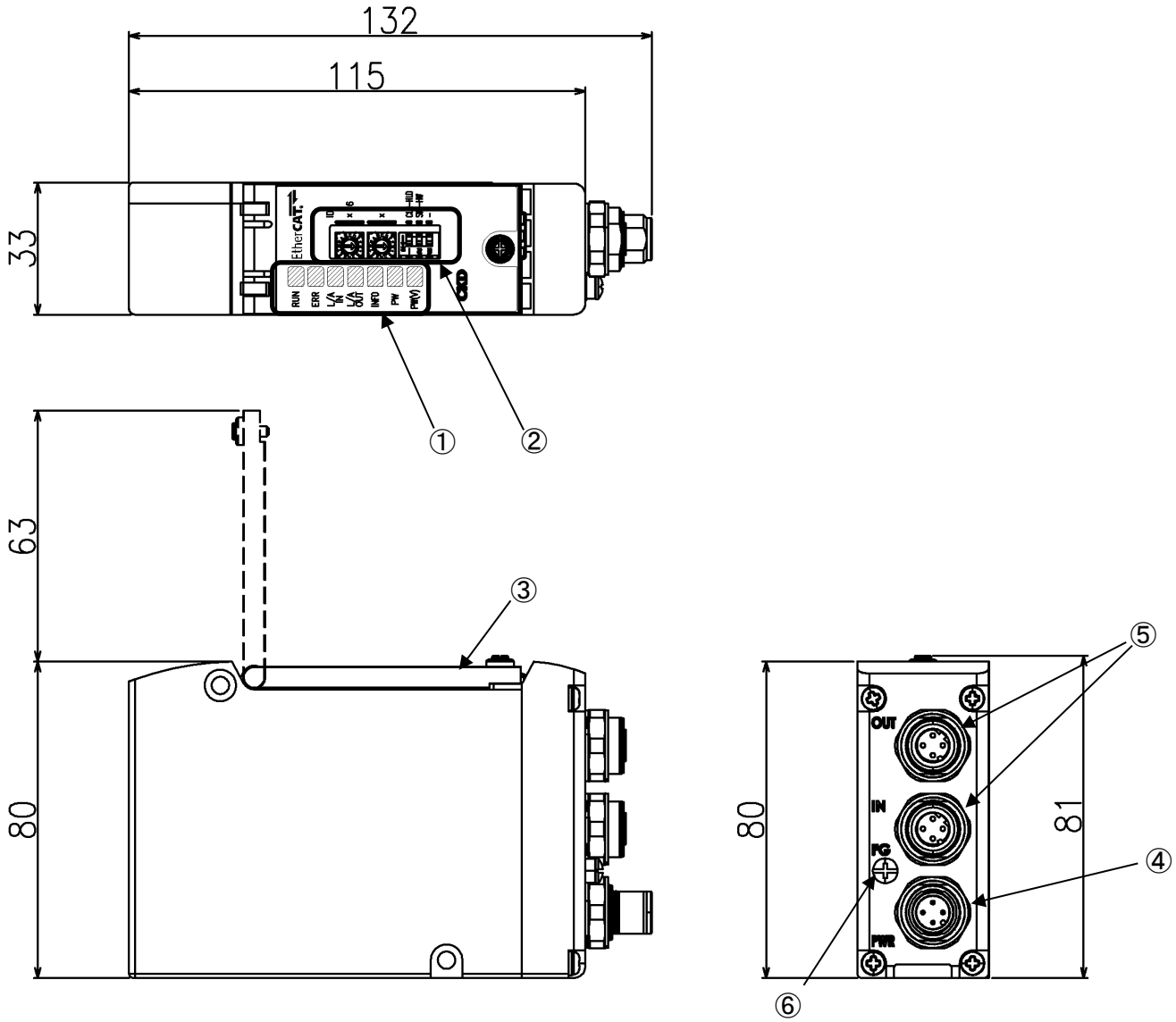
PLC manufacturer	Compatible PLC	MainDevice model
Omron Corporation	NJ Series	NJ301/NJ501
Beckhoff Automation GmbH & Co. KG	TwinCAT PLC	
Other MainDevice compatible with EtherCAT		

Example of basic structure of the system



1.2 Part Name

1.2.1 Parts of the device



No.	Part name	Description
①	LED indicator	Indicates the status of the device and network with RUN, ERR, L/A IN,L/A OUT, PW, and PW(V).
②	Switches	Rotary switch: Sets the node address of the device. DIP switch: Sets the action taken in the event of a communication error.
③	Cover	Protects the LEDs and setting switches.
④	Unit/valve power plug (M12 x 1 port [PWR] A-code: 4 pins)	Connects the unit/valve power socket.
⑤	Network connector socket (M12 × 2 ports [IN, OUT] D-cord: 4 pins)	IN: Receives EtherCAT communication from the previous device. OUT: Sends EtherCAT communication to the next device. * If this product is the end device in the EtherCAT network, a network plug is not connected to OUT.
⑥	FG terminal	Connects FG(frame grounding) to the terminal.

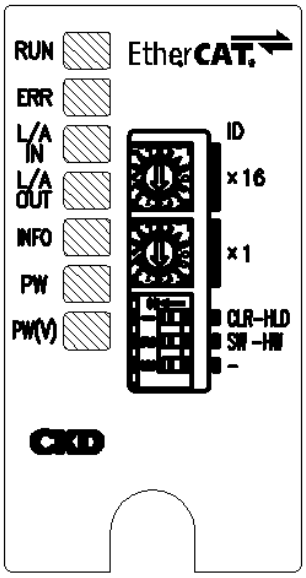
1.2.2 Switches and LED indicators

⚠CAUTION

Discharge static electricity from your body before touching the product.
Static electricity may cause damage to the product.

■ Switches

The switches are used to set the node address of the device and the action taken on the output in the event of a communication error.
This device operates according to the switch settings when the power is turned on.



Switch	Settings
Rotary switch	Set the node address of the device between 01 to FF (Hex) [1 to 255 (Dec)]. Set the upper digit with x16, and the lower digit with x1. Refer to "3.1.1 Node address setting" for details.
DIP switch	Set the output status in the event of a communication error. Refer to "3.1.2 Other switch setting" for details.

■ LED indicators

The LEDs indicate the status of the product and network.
Refer to the following table for the description of LED indicators.

Part name	Function	Status	
RUN	EtherCAT state	Off Green blinking Green single flash Green fast blinking Green on	INIT PRE-OPERATIONAL SAFE-OPERATIONAL BOOTSTRAP OPERATIONAL
ERR	Communication status	Off Red double flash Red blinking	Normal communication Communication error (Timeout) Communication error
L/A IN	Link status of EtherCAT IN	Off Green on Green fast blinking	No link Neither link nor activity Link and activity detected
L/A OUT	Link status of EtherCAT OUT	Off Green on Green fast blinking	No link Neither link nor activity Link and activity detected
INFO	Device	Red blinking	・Valve power OFF ・Detected switch operation during device operation ・Maintenance notice Refer to "3.5.1 Maintenance parameters" for details.
PW	Unit power status	Off Green on	Unit power OFF Unit power ON
PW(V)	Valve power status Note 1	Off Green on	Valve power OFF Valve power ON

Note 1: This indicator is disable when the unit power is off.

1.3 Specifications

1.3.1 Communication specifications

Item	Specifications
Communication protocol	EtherCAT (asynchronous)
Baud rate	Full-duplex 100 Mbps
Communication media	Ethernet cable (Category 5 or higher) Shielded twisted pair cable
Number of connecting nodes	Maximum of 65,535 nodes
Network topology	Daisy chain
Distance between nodes	Maximum of 100 m

1.3.2 Device specifications

The product must be used within the following specifications.

Item		Specifications	
Model		OPP8-A2EC (JA3C)	OPP8-A2EC-P (JA3D)
Unit power voltage		21.6 VDC to 26.4 VDC (24 VDC ±10%)	
Unit power current consumption		90 mA or less (at 24.0 VDC with all points ON)	
Valve power voltage		22.8 VDC to 26.4 VDC (24 VDC +10%, -5%)	
Valve power current consumption		10 mA or less (with all points OFF) 15 mA or less (under no load with all points ON)	
Output type		+COM (NPN)	-COM (PNP)
Number of output point		32 points	
Node address setting		With switches: 01 to FF (Hex) [1 to 255 (Dec)] With MainDevice: 01 to FFFF (Hex) [1 to 65535 (Dec)] Note 1	
Output setting when communication error occurs		Hold (all outputs are maintained)/ Clear (all points OFF)	
Insulation resistance		Between external terminals and case: 30 MΩ or more with 500 VDC	
Withstand voltage		Between external terminals and case: 500 VAC for 1 minute	
Shock resistance		294.0 m/s^2 for 3 times in 3 directions	
Storage ambient temperature		-20°C to 70°C	
Storage humidity		30% to 85% RH (no dew condensation)	
Ambient temperature		-5°C to 55°C	
Ambient humidity		30% to 85% RH (no dew condensation)	
Atmosphere		No corrosive gas	
Communication protocol		EtherCAT (asynchronous Note 2)	
Baud rate/ Communication method		Full-duplex 100 Mbps	
EtherCAT connector		M12, D-code: 4 pins	
Output insulation		Photo coupler insulation	
Max. load current		40 mA/1 point	
Leakage current		0.1 mA or less	
Residual voltage		0.5 V or less	
Fuse		Valve power: 24V, 3A/ Unit power: 24V, 2A (Both fuses are non-replaceable)	
Operation indicator		LED (communication status, unit power, valve power Note 3)	
Degree of protection		IP65 / IP67	
Vibration resistance	Durability	10 Hz to 55 Hz to 10 Hz, 1 octave/min., 15 sweeps each in X, Y, Z directions with 0.75 mm half-amplitude or 98.0 m/s^2, whichever smaller.	
	Malfunction	10 Hz to 55 Hz to 10 Hz, 1 octave/min., 4 sweeps each in X, Y, Z directions with 0.5 mm half-amplitude or 68.6 m/s^2, whichever smaller.	

Note 1: Device follows address restrictions from the MainDevice. To set the node address from the MainDevice, set the rotary switch to "00".

Note 2: Synchronization with other devices is not supported. It is not recommended to use the product in an environment that requires precise time management

(The device does not support DC mode and SM mode).

Note 3: Status can be monitored when the unit power is supplied with the voltage within the specified range.

* For the delay time, refer to the instruction manual for the MainDevice. Transmission delay as a system varies depending on the PLC scan time and other devices connected to the same network.
* For the response time of the solenoid valve, check the solenoid valve specifications.
* Solenoid valve Off time is delayed by approximately 20 msec due to the surge absorbing circuit integrated in the device.

2. INSTALLATION

2.1 Mounting

⚠CAUTION

Before handling an EtherCAT device, touch a grounded metal part to discharge static electricity from your body.
Static electricity may cause damage to the product.

Do not apply tension or shocks to the power cable or network cable.
If the wiring is long, the cable weight or shocks may cause an unexpected force and result in damage to the connector or device.
Take appropriate measures; for example, secure the wiring to the machine or device midway.

When wiring, be careful of the following points to prevent problems caused by noise.

- If noise could have an effect, prepare power for each manifold solenoid valve and wire independently.
- Wire the power cable as short as possible.
- Wire the power cables for the product separately from the power cables for noise-generating devices such as inverter motors.
- Wire the power cable and network cable away from other power lines as much as possible.

Wire the power cable and network cable properly within its specifications.
Incorrect wiring may cause the device to malfunction or break.

Check that cables and connectors are securely connected before turning on the power.

1 Connect the network and power cable.
Check both this Instruction Manual and instruction manuals for PLC and each unit in the system and connect them properly.
Incorrect connection may cause not only a system failure but also serious fault to the other devices.

2 Keep 200 mm or more away from high-voltage lines and power lines or wire the high-voltage lines and power lines in metal tubing and ground it before mounting this device.

2.2 Wiring

2.2.1 Connecting and wiring to the network connector socket

⚠WARNING

Turn off the power before wiring.
An electric shock may occur by touching the electrical wiring connection (bare live part).

Do not touch live parts with bare hands.
An electric shock may occur.

Thoroughly read and understand this Instruction Manual before working on electrical wiring.

⚠CAUTION

Check the working voltage and polarity before wiring and energizing.

Take measures against lightning surges on the device side.
The product has no resistance to lightning surges.

Use a dedicated network cable that complies with EtherCAT specifications.

Provide sufficient bending radius for the network cable and do not bend it forcibly.

Separate the network cable from power lines and high-voltage lines.

When the network plug is not used, make sure to cover it with water-resistant cap.

Although the EtherCAT network uses a standard Ethernet cable and has flexible wiring methods, there are limits depending on the wiring material and equipment (MainDevice, hub, and other devices) used. Always understand their specifications thoroughly before wiring. For more information, refer to the instruction manuals issued by the MainDevice manufacturer or ETG (EtherCAT Technology Group).
The network plug is not supplied with the product. Separately purchase a network plug that satisfies the specifications.
By wiring the network cable to a network plug, that plug can be connected to the network connector socket on the device.

Recommended cable with plug [Cat.5e]
<Recommended M12 network cable with RJ45 connector [Cat.5e]>

Manufacturer	Model
HARTING Co., Ltd.	09 45 700 50**
Omron Corporation	XS5W-T421-*MC-K

<Recommended assembly type M12 connector: D code 4Pin>

Manufacturer	Model
HARTING Co., Ltd.	21 03 281 1405

<Recommended assembly type RJ45 connector>

Manufacturer	Model
HARTING Co., Ltd.	09 45 151 1100

<Recommended cable [Cat.5e]>

Manufacturer	Model
HARTING Co., Ltd.	09 45 600 01**

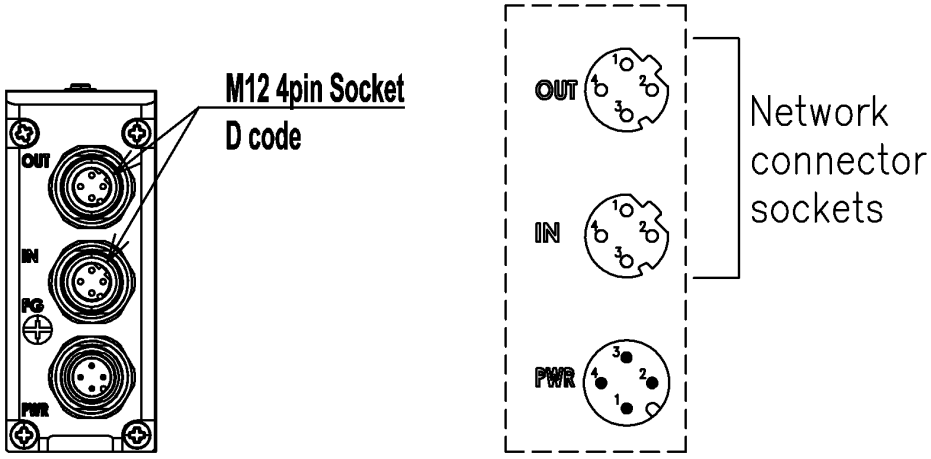
・* differs depending on the cable specifications.

■ Connecting the network cable

Follow the steps below to connect the network cables to the network socket.

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

2 Refer to the following figure to wire the EtherCAT compliant cable to the M12 connector socket.



Port	Pin	Signal	Function
IN/OUT	1	TD+	Transmission data, plus
	2	RD+	Reception data, plus
	3	TD-	Transmission data, minus
	4	RD-	Reception data, minus

2.2.2 Connecting and wiring to the unit/valve power plug

⚠CAUTION

Always check the polarity and rated voltage thoroughly before connecting cables.

Calculate the current consumption to select the power cable.

Consider the voltage drop due to cables when selecting and wiring the cables if power is supplied to more than one device from one power supply.

Take measures to secure the specified power supply voltage if voltage drop cannot be avoided.

For example, wire the power cables in multiple systems or install other power supplies to secure the specified power supply voltage.

Install a terminal block if multi-drop wiring of the power cables is needed.

Install the terminal block so that it comes before the power plug.

In this product, the unit power and the valve power supply are separated. In addition, each power supply is connected by an M12 connector (socket).
* Power connector is not supplied with the product. Separately purchase a power connector that satisfies the specifications.

Unit power
This electrical power is for operating the device. Use 21.6 VDC to 26.4 VDC power with the least noise.

Valve power
This electrical power is for operating the solenoid valve. Use 22.8 VDC to 26.4 VDC power with the least noise.

Recommended power socket
<Recommended M12 connector (socket)-loose wire type power cable>

Manufacturer	Model
Omron Corporation	XS2F-D421-*8*-*

・ * differs depending on the cable specifications.

<Recommended M12 connector (socket)>

Manufacturer	Model
HARTING Co., Ltd.	21 03 212 2305

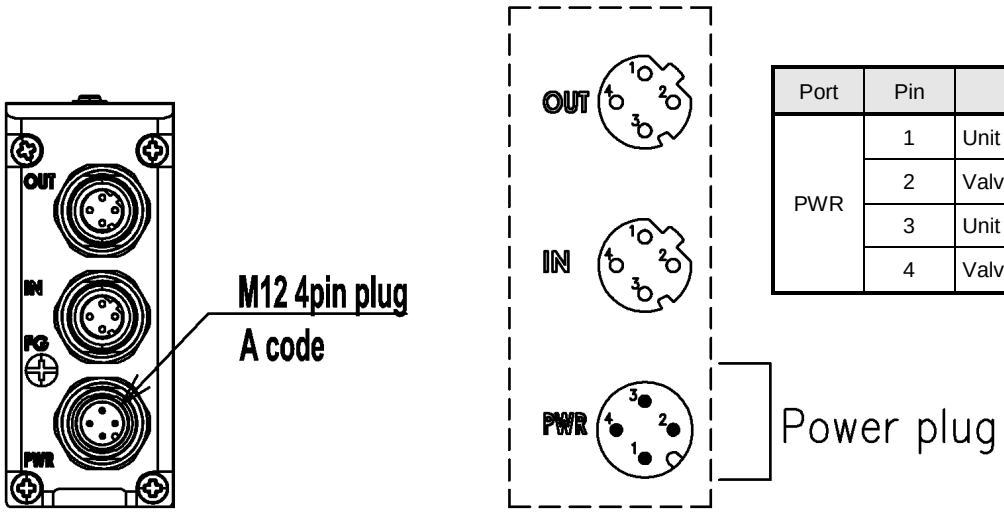
Cable size: AWG22 to 18, outside diameter of compatible cable: 6 to 8 dia.

■ Connecting the power cables

Follow the steps below to connect the unit/valve power cables to the power plug.

1 After confirming safety, turn off the power to be connected to the device.

2 Refer to the figure below and wire the cables to the correct terminals on the power plug (24 V to 24 V, 0 V to 0 V).

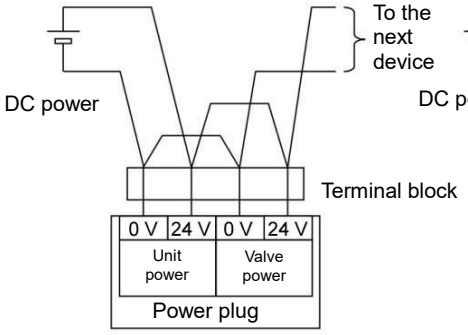


Port	Pin	Function
PWR	1	Unit power: 24V
	2	Valve power: 24V
	3	Unit power: 0V
	4	Valve power: 0V

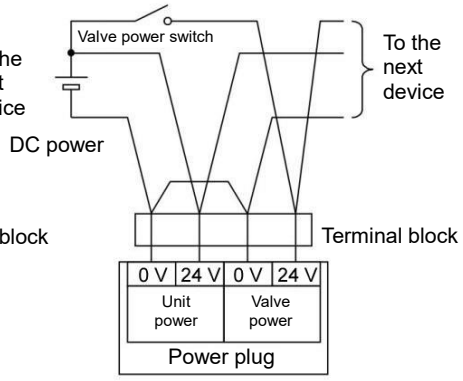
■ Wiring the power cable

Figures 1 to 3 are examples of the wiring for the power plug.
Change the circuit configuration as necessary.

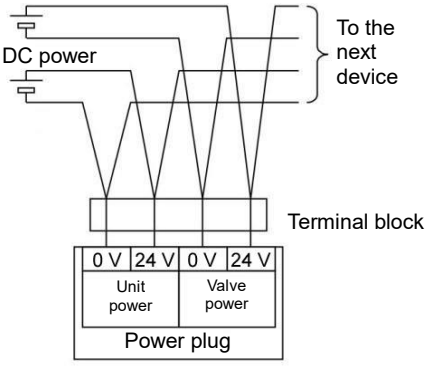
1. Common connection for unit power and valve power



2. Connection for turning on/off valve power



3. Separate connection for unit power and valve power



3. USAGE

⚠WARNING

Consult CKD about the specifications before using the product outside the designated specifications or for special applications.

⚠CAUTION

Thoroughly read and understand the instruction manual for the network system to be used before using the serial transmission device.

Check the address setting value of serial transmission device carefully before use.
Improper address setting value may cause valves or cylinders to malfunction.

Be careful of the surroundings and ensure safety before turning on or off the power.
The system or solenoid valve (cylinder) may operate suddenly.

3.1 Switch settings

⚠CAUTION

Discharge static electricity from your body before touching the product.
Static electricity may cause damage to the product.

Set switches while unit power is turned off.
Since switch settings are read when the power is turned on, changes made to the settings after turning on the power are not recognized.

Keep the cover of serial transmission device closed except when setting the switches.
The cover may become damaged or foreign matters may enter inside and cause unexpected failure.

Be careful not to allow any foreign matter to enter inside when setting the switches.
Unexpected failure may result.

Do not handle switches roughly.
Switches are precision devices and can be easily damaged.

Do not touch the internal circuit board when setting the switches.
The internal circuit board can be easily damaged.

3.1.1 Node address setting

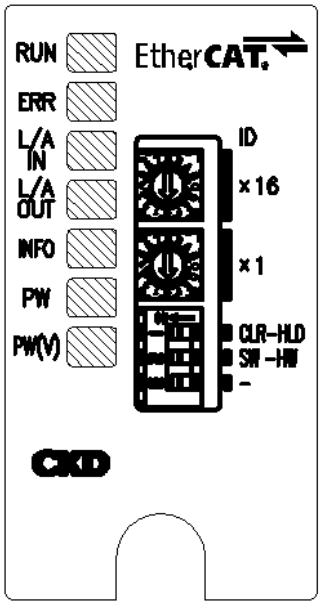
Set the device node address (ID).
The factory setting of the rotary switch is "00".
To set the node address from the MainDevice unit, set the rotary switch to "00".
The node address setting is read when the power is turned on.

Switch	ID. [node address] x16, x1
Setting range	01 to FF (Hex) [1 to 255 (Dec)]

The node address cannot be set in duplicate.

x16: Upper digit		
Setting (hexadecimal)	⇔	Decimal
0	⇔	0
1	⇔	16
2	⇔	32
3	⇔	48
4	⇔	64
5	⇔	80
6	⇔	96
7	⇔	112
8	⇔	128
9	⇔	144
A	⇔	160
B	⇔	176
C	⇔	192
D	⇔	208
E	⇔	224
F	⇔	240

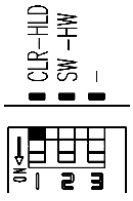
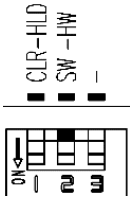
x1: Lower digit		
Setting (hexadecimal)	⇔	Decimal
0	⇔	0
1	⇔	1
2	⇔	2
3	⇔	3
4	⇔	4
5	⇔	5
6	⇔	6
7	⇔	7
8	⇔	8
9	⇔	9
A	⇔	10
B	⇔	11
C	⇔	12
D	⇔	13
E	⇔	14
F	⇔	15



Example: Setting the node address to 71 (decimal)
Since 71 = 64+7 and 64 is 4 and 7 is 7 according to the table above, set the upper digit to 4 and lower digit to 7 (47 in hexadecimal).

3.1.2 Other switch settings

Set the output status in the event of a communication error.

Switch	Settings
CLR-HLD (DIP switch no.1) [Output mode setting] 	Sets the output status in the event of a communication error (such as disconnection and timeout). This switch is enabled when the SW-HW switch is OFF. ON: Clear (all points OFF) OFF: Hold (hold all points output)
SW-HW (DIP switch No.2) [Operation mode setting] 	Sets the operation mode in the event of a communication error. ON: Software setting (set by index [2100:05]) OFF: Hardware setting (set by switches)

* DIP switch No. 3 has no function.

3.2 Setting with ESI File

In order for an EtherCAT device to participate in a network, an ESI file containing the device's communication specifications must be installed in the setting tool. For details on installing the ESI file, refer to the instruction manual issued by the Device manufacturer. Use the latest ESI file to ensure a suitable network configuration.

ESI file name (for OPP8-2EC-*): CKD_OPP8_ (*).xml
(The ESI file above contains data for six models.)
(*) contains the version number of the device.
Use the ESI file that matches the version of the device to be used.

3.2.1 Registering the device

Before starting, check the node address and specifications (model name) of the device to be used and install the corresponding ESI file.
Refer to the following table for device specifications and ESI file and set accordingly.

Specifications and the model’s name in the ESI file

Item	Specifications	
Model	OPP8-A2EC (JA3C)	OPP8-A2EC-P (JA3D)
Device name	OPP8-2EC	OPP8-2EC-P
Output type	+COM (NPN)	-COM (PNP)
Number of output point	32 points	
Model name in the ESI file	CKD_OPP8_v0101.xml	

3.3 Correspondence between Device Output Number and PLC Address Number

3.3.1 PLC address correspondence table

This correspondence table uses Omron's PLC as an example.

OPP8-A2EC, OPP8-A2EC-P (32-point output)

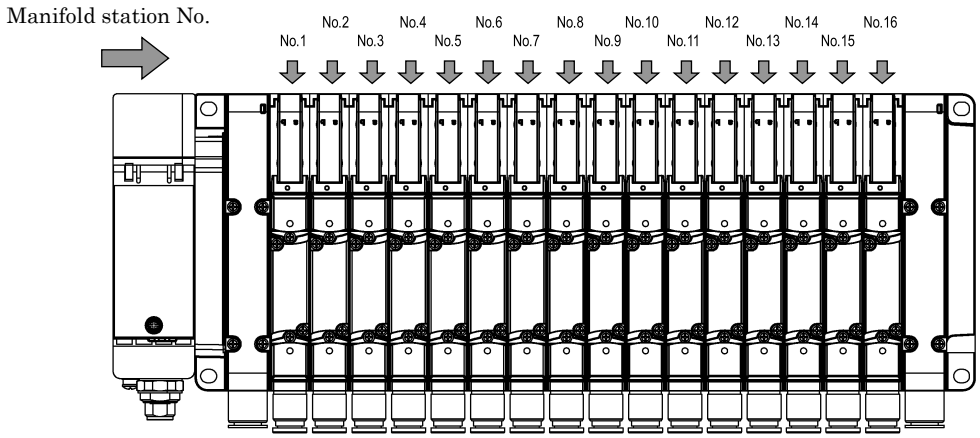
PLC memory assigned address	Output Bit 00 to 15																Output Bit 16 to 31													
	1-word (1st) output data																2-word (2nd) output data													
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Device I/O No.	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**
Solenoid output No.	S 1	S 2	S 3	S 4	S 5	S 6	S 7	S 8	S 9	S 10	S 11	S 12	S 13	S 14	S 15	S 16	S 17	S 18	S 19	S 20	S 21	S 22	S 23	S 24	S 25	S 26	S 27	S 28	S 29	S 30	S 31	S 32

3.3.2 Example of valve number array corresponding to solenoid output number

In the table below, each valve number (Valve No.) consists of a number (the station number) and an alphabet (a for a-side solenoid and b for b-side solenoid). For example, “1a” refers to 1st station a-side solenoid. Also, “V” stands for “Vacant.”
Manifold stations are numbered in order from left to right with the piping port towards the user (refer to the figure below).
As appearance and maximum number of stations differ depending on the solenoid valve model, check individual specifications.

<OPP8-A2EC, OPP8-A2EC-P (32-point output)>

The figure below is an example of mounting sixteen stations of double-solenoid type manifold valves.



Standard wiring (Double wiring)

- Single solenoid valve

Solenoid output No.	s1	s2	s3	s4	s5	s6	s7	s8	s9	s10	s11	s12	s13	s14	s15	s16
Valve No.	1a	(V)	2a	(V)	3a	(V)	4a	(V)	5a	(V)	6a	(V)	7a	(V)	8a	(V)

Solenoid output No.	s17	s18	s19	s20	s21	s22	s23	s24	s25	s26	s27	s28	s29	s30	s31	s32
Valve No.	9a	(V)	10a	(V)	11a	(V)	12a	(V)	13a	(V)	14a	(V)	15a	(V)	16a	(V)

- Double solenoid valve

Solenoid output No.	s1	s2	s3	s4	s5	s6	s7	s8	s9	s10	s11	s12	s13	s14	s15	s16
Valve No.	1a	1b	2a	2b	3a	3b	4a	4b	5a	5b	6a	6b	7a	7b	8a	8b

Solenoid output No.	s17	s18	s19	s20	s21	s22	s23	s24	s25	s26	s27	s28	s29	s30	s31	s32
Valve No.	9a	9b	10a	10b	11a	11b	12a	12b	13a	13b	14a	14b	15a	15b	16a	16b

- Mixed (both single and double solenoid valves are mounted) [example]

Solenoid output No.	s1	s2	s3	s4	s5	s6	s7	s8	s9	s10	s11	s12	s13	s14	s15	s16
Valve No.	1a	(V)	2a	(V)	3a	3b	4a	4b	5a	(V)	6a	(V)	7a	7b	8a	(V)

Solenoid output No.	s17	s18	s19	s20	s21	s22	s23	s24	s25	s26	s27	s28	s29	s30	s31	s32
Valve No.	9a	(V)	10a	10b	11a	11b	12a	12b	13a	(V)	14a	14b	15a	15b	16a	(V)

Designation of Single Solenoid and Double Solenoid Arrangement

- Single solenoid valve

Solenoid output No.	s1	s2	s3	s4	s5	s6	s7	s8	s9	s10	s11	s12	s13	s14	s15	s16
Valve No.	1a	2a	3a	4a	5a	6a	7a	8a	9a	10a	11a	12a	13a	14a	15a	16a

Solenoid output No.	s17	s18	s19	s20	s21	s22	s23	s24	s25	s26	s27	s28	s29	s30	s31	s32
Valve No.	17a	18a	19a	20a	21a	22a	23a	24a	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)

- Double solenoid valve

Solenoid output No.	s1	s2	s3	s4	s5	s6	s7	s8	s9	s10	s11	s12	s13	s14	s15	s16
Valve No.	1a	1b	2a	2b	3a	3b	4a	4b	5a	5b	6a	6b	7a	7b	8a	8b

Solenoid output No.	s17	s18	s19	s20	s21	s22	s23	s24	s25	s26	s27	s28	s29	s30	s31	s32
Valve No.	9a	9b	10a	10b	11a	11b	12a	12b	13a	13b	14a	14b	15a	15b	16a	16b

- Mixed (both single and double solenoid valves are mounted) [example]

Solenoid output No.	s1	s2	s3	s4	s5	s6	s7	s8	s9	s10	s11	s12	s13	s14	s15	s16
Valve No.	1a	2a	3a	3b	4a	4b	5a	6a	7a	7b	8a	9a	10a	10b	11a	11b

Solenoid output No.	s17	s18	s19	s20	s21	s22	s23	s24	s25	s26	s27	s28	s29	s30	s31	s32
Valve No.	12a	13a	14a	14b	15a	15b	16a	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)	(V)

3.4 Programming

The MainDevice handles this unit as a SubDevice (OPP8-A2EC-* for 32-point output).

There are two types of data: The PDO (Process Data Objects) output data sent from the MainDevice to a SubDevice and the input data sent from the device to the MainDevice. This product is an output device that receives output data from the MainDevice and output to the valve.

Refer to the instruction manual issued by the PLC manufacturer when programming.
Refer to the following table to program the I/O mapping.
The setting made to specify which action to take on the output in the event of an error is a unique function of this device. This output status setting does not affect the program.

Output data mapping

Output point	Output data	Output Bit 00-15																Output Bit 16-31													
32 points	2 words	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**
		00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

3.5 Parameters

Several parameters are available for monitoring and setting the device. Use the parameters according to the intended use.

3.5.1 Maintenance parameters

Parameter name	Maintenance Monitor Setting
Index	2001:01
Description	Sets the parameter monitoring function. The monitoring result is indicated in the index [2001: 02]. Bit / When Bit is 1 0(LSB) / Valve power monitoring: Enable 3 / Switch operation monitoring: Enable 4 / Energization time monitoring: Enable 7(MSB) / Monitoring Output On Count and Output On Time: Enable

Parameter name	Maintenance Monitor
Index	2001:02
Terms of use	The index [2001:01] needs to be enabled.
Description	The result of parameter monitoring is indicated. INFO LED blinks red when any Bit of the following table is set to 1. Bit / When Bit is 1 0(LSB) / The valve power is off. 3 / The switch was operated while the product was in operation. 4 / The energization time exceeds the threshold. [2001:04] ≧ [2001:03] 7(MSB) / The Output On Count or the Output ON Time exceeds the threshold. This bit is associated with the value of the index below. Output On Count Over Detecting: [2101:03] [2101:04] Output On Time Over Detecting: [2102:03] [2102:04]

Parameter name	Energizing Time Threshold
Index	2001:03
Description	Sets the threshold of energizing time in seconds.

Parameter name	Energizing Time
Index	2001:04
Description	Indicates the energizing time in seconds. The value is saved every 3 minutes.

3.5.2 Output parameter

Parameters ending in bit 00 to 15, bit 16 to 31 or No. 0 to 31 can be set individually for each solenoid output No. The table below shows the relationship between the solenoid output No. and the parameter name.

Solenoid output No.	Parameter name	
	Bit 00 to 15	No.0 to 15
s1	0(LSB)	No.0
s2	1	No.1
s3	2	No.2
s4	3	No.3
s5	4	No.4
s6	5	No.5
s7	6	No.6
s8	7	No.7
s9	8	No.8
s10	9	No.9
s11	10	No.10
s12	11	No.11
s13	12	No.12
s14	13	No.13
s15	14	No.14
s16	15 (MSB)	No.15

Solenoid output No.	Parameter name	
	Bit 16 to 31	No.16 to 31
s17	0(LSB)	No.16
s18	1	No.17
s19	2	No.18
s20	3	No.19
s21	4	No.20
s22	5	No.21
s23	6	No.22
s24	7	No.23
s25	8	No.24
s26	9	No.25
s27	10	No.26
s28	11	No.27
s29	12	No.28
s30	13	No.29
s31	14	No.30
s32	15 (MSB)	No.31

Parameter name	Output Forced Enable Bit 00-15 Output Forced Enable Bit 16-31
Index	2100:01 2100:02
Description	Sets the forced output function Enable/ Disable. When enabled, PDO (process Data Objects) from the MainDevice unit is ignored and the valve is forcibly turned ON/OFF according to the values of the indexes [2100: 03] and [2100: 04]. Value: 0 — Meaning: Disable Value: 1 — Meaning: Enable

Parameter name	Output Forced Value Bit 00-15 Output Forced Value Bit 16-31
Index	2100:03 2100:04
Terms of use	The indexes [2100: 01] and [2100: 02] need to be enabled.
Description	The valve can be turned on and off forcibly. Value: 0 — Meaning: Output OFF Value: 1 — Meaning: Output ON

<table>
<tr><td>Parameter name</td><td>Output Fault Mode</td></tr>
<tr><td>Index</td><td>2100:05</td></tr>
<tr><td>Description</td><td>Sets the operation mode in the event of a communication error.
The index value can be changed with the SH-HW switch.
<table>
<tr><th>SW-HW Switch status</th><th>Value</th><th>Operation in the event of a communication error</th></tr>
<tr><td>ON</td><td>0x0000</td><td>Set according to the value of [2100: 06] to [2100:09]</td></tr>
<tr><td>OFF</td><td>0x0001</td><td>Set by CLR-HLD switch
Refer to “3.1.2 Other switch setting” for details.</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Parameter name</td><td>Output Fault Action Bit 00-15
Output Fault Action Bit 16-31</td></tr>
<tr><td>Index</td><td>2100:06
2100:07</td></tr>
<tr><td>Terms of use</td><td>The index [2100: 05] needs to be set to 0x0001.</td></tr>
<tr><td>Description</td><td>Set the action taken in the event of a communication error.
<table>
<tr><th>Value</th><th>Meaning</th></tr>
<tr><td>0</td><td>Set by the value of [2100:08] and [2100:09]</td></tr>
<tr><td>1</td><td>Holds the final output status.</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Parameter name</td><td>Output Fault Value Bit 00-15
Output Fault Value Bit 16-31</td></tr>
<tr><td>Index</td><td>2100:08
2100:09</td></tr>
<tr><td>Terms of use</td><td>The indexes [2100: 06] and [2100: 07] need to be set to 0.</td></tr>
<tr><td>Description</td><td>Set the action taken in the event of a communication error.
<table>
<tr><th>Value</th><th>Meaning</th></tr>
<tr><td>0</td><td>Output OFF</td></tr>
<tr><td>1</td><td>Output ON</td></tr>
</table></td></tr>
</table>

Parameter name	Output On Count Over Enable 0-15 Output On Count Over Enable 16-31
Index	2101:01 2101:02
Description	Sets whether to monitor the valve's output ON Count. The monitoring results are indicated in the indexes [2101:03] and [2101:04]. Value: 0 — Disable; 1 — Enable

Parameter name	Output On Count Over Detecting Bit 00-15 Output On Count Over Detecting Bit 16-31
Index	2101:03 2101:04
Terms of use	The indexes [2101:01] and [2101:02] need to be enabled.
Description	Indicates whether the Output ON Count exceeds the threshold. 0 — Output ON Count does not exceed the threshold. [2101:07 to 26] < [2101:05] 1 — Output ON count exceeds the threshold. [2101:07 to 26] ≧ [2101:05]

Parameter name	Output On Count Threshold
Index	2101:05
Description	Sets the threshold of Output ON Count.

Parameter name	Output On Count No.0-31
Index	2101: 07 to 2101: 26
Description	Indicates the Output ON Count. The value is saved every 3 minutes.

Parameter name	Output On Time Over Enable 0-15 Output On Time Over Enable 16-31
Index	2102:01 2102:02
Description	Sets whether to monitor the output ON time [2102:07] to [2102:26]. The monitoring results are indicated in the indexes [2102:03] and [2102:04]. Value: 0 — Disable Value: 1 — Enable

Parameter name	Output On Time Over Detecting Bit 00-15 Output On Time Over Detecting Bit 16-31
Index	2102:03 2102:04
Terms of use	The indexes [2102:01] and [2102:02] need to be enabled.
Description	Indicates whether output ON time exceeds the threshold. Value: 0 — Output ON time does not exceed the threshold. [2102:07 to 26] ＜[2102:05] Value: 1 — Output ON time exceeds the threshold. [2102:07 to 26] ≧ [2102:05]

Parameter name	Output On Time Threshold
Index	2102:05
Description	Sets the threshold of output ON time in seconds.

Parameter name	Output On Time No.0-31
Index	2102:07 to 2102:26
Description	Indicates the output ON time in seconds. The value is saved every 3 minutes.

4. MAINTENANCE AND INSPECTION

⚠WARNING

Turn off the power, stop the supply of compressed air and make sure that there is no residual pressure before performing maintenance.

Do not disassemble, modify, or repair the product.
These may cause failure or malfunction.

⚠CAUTION

Plan and perform daily and periodic inspections so that maintenance can be managed properly.
If maintenance is not properly managed, the product's functions may deteriorate significantly and this may lead to faults (such as short service life, damage, and malfunction) or accidents.
Do not drop or apply excessive vibrations or shocks to the product.
These may cause damage because parts inside the product are made to precise specifications.

4.1 Periodic Inspection

This section describes the cleaning and inspection of the device for daily maintenance and what to do when replacing the device. In order to use the product under optimum conditions, clean and inspect the product periodically.

■ Cleaning

1. For daily cleaning, wipe the product with a soft dry cloth.
2. When stains cannot be removed by wiping with a dry cloth, moisten the cloth with diluted neutral detergent (2%), wring it out well, and wipe off the stains.
3. Objects such as rubber, vinyl, or tape may stain the device if they are left in contact with the device for a long period.
Remove such objects when cleaning if they are leaving stain on the product.

■ Inspection

Perform inspection once or twice a year.
Conduct inspections at a shorter interval if using the product in an environment where temperature or humidity is extremely high or in a dusty environment.

<Inspection item>
Inspect the following items to make sure that each item satisfies the criteria.
If any item does not meet the criteria, improve the surrounding environment or adjust the device.

Inspection item	Description	Criteria	Inspection method
Environment	Is the surrounding and in-panel temperature appropriate?	Refer to "1.3.2 Device specifications".	Thermometer
	Is the surrounding and in-panel humidity appropriate?	Refer to "1.3.2 Device specifications".	Hygrometer
	Is there any dust on the device?	No dust	Visual inspection
Installation	Is the device fixed securely?	No looseness	Hexagonal wrench
	Is the power cable connector fully inserted?	No looseness	Visual inspection
	Is the network cable connector fully inserted?	No looseness	Visual inspection
	Is the connection cable not broken?	No abnormality in appearance	Visual inspection

■ Checking the device before/after replacing

Each unit (MainDevice and device) is a component that constitutes a part of a network.
If any unit fails, immediately perform recovery work to prevent the entire network from being affected. To restore the network function as fast as possible, it is recommended to prepare spare devices.

<Inspection item>
If a fault is detected and the device is replaced with a new one, check if the new device has no abnormality.
Also, confirm the device settings.

<Settings for replacement device>
For the switches on the replacement device, confirm the specifications and set the same settings as the previous one.

4.2 Removing and Mounting

⚠WARNING

Turn off the power and completely release the pressure before removing or adding a manifold solenoid valve.

Thoroughly read and understand this Instruction Manual before removing and adding the manifold solenoid valve.

Do not touch the electrical wiring connection (bare live part).
An electric shock may occur.

Do not touch live parts with bare hands.
An electric shock may occur.

⚠CAUTION

Check the device node address and the setting made to specify which action to take on the output in the event of communication error, before turning on the unit power.

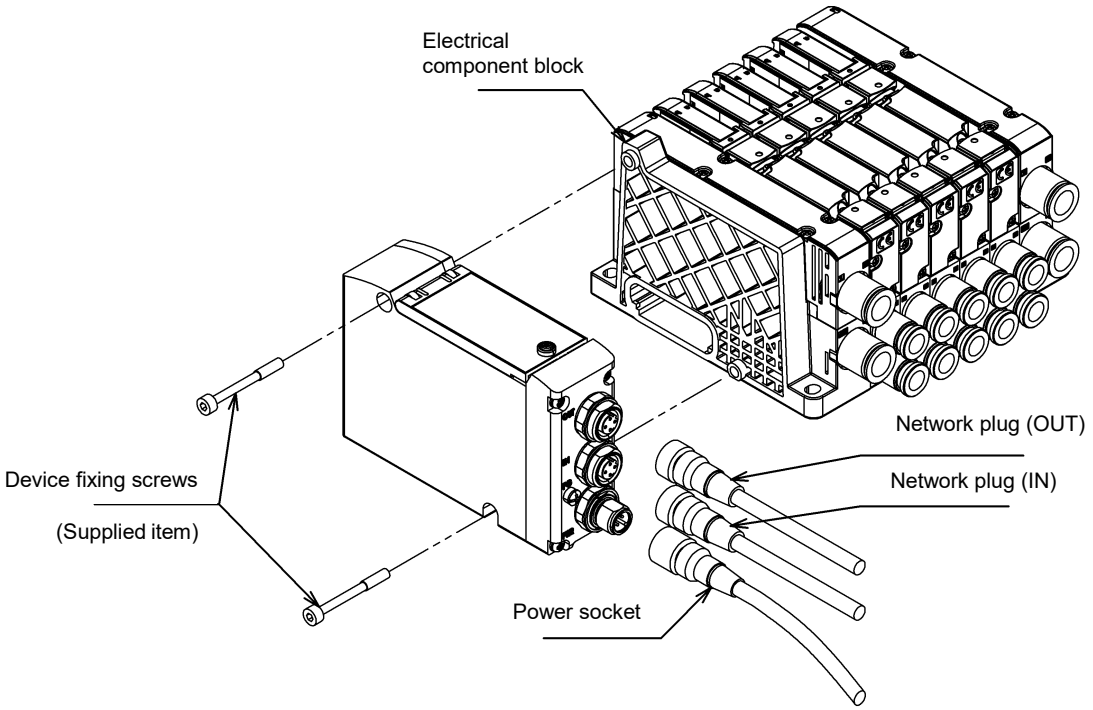
Do not attach or detach the plug while the power is turned on.
These may cause failure or malfunction.

Do not pull out the device by pulling the cable or connector.
A cable disconnection or damage may occur.

Fully loosen the plug fixing screws before removing the plug.
After inserting the plug, tighten the plug fixing screws securely.

4.2.1 Removing the product (device)

1. After confirming safety, stop network communication as necessary and turn off all peripheral equipment.
2. After confirming safety, turn off the unit power and valve power as necessary.
3. Remove the network plug and the power socket.
4. Remove the device fixing screws.
5. Hold and pull out the product slowly.



4.2.2 Mounting the product (device)

1. Set the node address of the product.
2. Hold the product and insert it slowly by matching the connectors on the electrical component block and the side of the device.
3. Check that the product and the electrical component block are properly connected, and tighten the device fixing screws firmly.
   (Appropriate tightening torque: 1.2 N·m)
4. Turn off the power (for unit/valve) and connect the network plug and power socket.
   The system may start operating suddenly if the plug and socket are connected while the power is turned on.
   Be careful of the surroundings and secure safety before connecting the connectors.
   [Network plug] Reference tightening torque: 0.6 N·m (Since it varies depending on the plug, consult the plug manufacturer.)
   [Power socket] Reference tightening torque: 0.45 N·m (Since it varies depending on the socket, consult the socket manufacturer.)
5. Confirm safety and turn on each power.

5. Troubleshooting

5.1 Problems, Causes, and Solutions

Troubleshooting for this device must be performed not only for the single unit but for the entire system. The system may start operating suddenly depending on the communication state. Use extreme care and ensure safety during maintenance.

■ Fault 1: PW, PW(V) does not light up.

- Check that the power cable is properly connected and in good condition.
- Check that the supplied power voltage is used within the specified range.
- Check the system and restart(turn off the power and turn on again) the product. If it does not recover, replace the device as it is damaged by a blown fuse inside or such.

■ Fault 2: ERR LED is blinking.

- Check that the power to PLC is turned on.
- Check that there are no problems (such as damage or disconnection) with the network cable or connector connection.
- Check that the network cable is compatible with EtherCAT.
- Check that transmission distance is compatible with EtherCAT.
- Check that there are no noise-generating devices or high-voltage lines near the communication line.

■ Fault 3: INFO LED is blinking.

- Check that the valve power is turned on.
- Check that the switch settings are correct then turn off the power and turn on again.
- A notification has been issued from the Maintenance Monitor (index [2001:02]).

■ Fault 4: RUN LED does not light up.

- Check that the product name in the configuration matches the name of this product.
- Check that the IN and OUT cable connections are correct. Do not connect between INs or OUTs.
- Check the node address setting status (incorrect or duplicate). If the setting has been changed, turn off the power and turn on again.

■ Fault 5: The device does not perform according to the specified output mode setting when a communication error occurs.

- Turn off the power and turn on again after setting the switches.

6. WARRANTY PROVISIONS

6.1 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, following failures are excluded from 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 this Instruction Manual.
- Failure caused by use of the product exceeding its durability (cycles, distance, time, etc.) or caused by consumable parts.
- 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 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.
- Failure caused by incorrect use such as careless handling or improper management.
- 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.

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 equipment 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.

6.2 Warranty period

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