

GX-series

EtherCAT Slave Units

USER'S MANUAL

OMRON

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GX-series EtherCAT Slave Units

User's Manual

Revised September 2010

Introduction

Thank you for purchasing a GX-series EtherCAT Slave Unit.

This manual contains information you need to know to use the EtherCAT Slave Unit.

Before use, please make sure that you thoroughly read the manual and have a full understanding of the products functions and performance.

After you finished reading this manual, please keep it in a convenient place.

Intended Readers

This manual is intended for the following individuals.

Those having electrical knowledge (certified electricians or individuals having equivalent knowledge) and also being qualified for one of the following:

- Introducing FA equipment
- Designing FA systems
- Managing FA sites

How to Read the Manual

Page Structure


This manual's page structure consists of the following.


Chapter title → 4 Installation and Wiring

Clause title → **4-4 Connecting an External Device**
Indicates the clause title of the current page.

Section title → **4-4-1 Connecting to a Screw Terminal Block**

Operation procedure number → **1**
Indicates operation procedure.

Icon (Refer to the following section.) →  **Precautions for Correct Use**



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4 Installation and Wiring

4-4-2 Connecting to e-CON Connector Terminals

Connect the dedicated e-CON connector to the cables of the external device to be connected and then connect it to the connector terminal.

Checking the e-CON connector and cable wire size

The wire size and sheath diameter of applicable cables vary by the type of e-CON connector. Use the next table to check that the e-CON connectors to be used conform to the wire size and sheath diameter of the cables of the connected device.

● Tyco Electronics connectors

Model	Housing color	Applicable wire range
1-1473562-4	Orange	Sheath diameter: 0.8 to 0.9 mm
1-1473562-4	Red	Sheath diameter: 0.9 to 1.0 mm
1-1473562-4	Yellow	Sheath diameter: 1.0 to 1.15 mm
1-1473562-4	Blue	Sheath diameter: 1.15 to 1.35 mm
4-1473562-4	Green	Sheath diameter: 1.35 to 1.60 mm

Cross-sectional area: 0.08 to 0.5 mm²

● Sumitomo 3M connectors

Model	Housing color	Applicable wire range
37104-3101-000FL	Red	AWG26 (0.14mm ²) to AWG24 (0.2mm ²) Sheath diameter: 0.8 to 1.0 mm
37104-3122-000FL	Yellow	AWG26 (0.14mm ²) to AWG24 (0.2mm ²) Sheath diameter: 1.0 to 1.2 mm
37104-3163-000FL	Orange	AWG26 (0.14mm ²) to AWG24 (0.2mm ²) Sheath diameter: 1.2 to 1.6 mm
37104-2124-000FL	Green	AWG22 (0.3mm ²) to AWG20 (0.5mm ²) Sheath diameter: 1.0 to 1.2 mm
37104-2165-000FL	Blue	AWG22 (0.3mm ²) to AWG20 (0.5mm ²) Sheath diameter: 1.2 to 1.6 mm
37104-2206-000FL	Gray	AWG22 (0.3mm ²) to AWG20 (0.5mm ²) Sheath diameter: 1.6 to 2.0 mm

● Panasonic Electric Works connectors

Model	Housing color	Applicable wire range
AXF12142	Red	AWG22 (0.3mm ²) to AWG20 (0.5mm ²) Sheath diameter: 1.2 to 2.0 mm
AXF12146	Yellow	AWG28 (0.08mm ²) to AWG24 (0.2mm ²) Sheath diameter: 0.7 to 1.2 mm

● OMRON connectors

Model	Specification	Applicable wire range
XN2A-1430	Spring clamp-type	AWG28 (0.08mm ²) to AWG20 (0.5mm ²) Sheath diameter: 1.0 mm max.

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Clause title → **4-4 Connecting an External Device**
Indicates the chapter title of the current page.

Indexes → **4**
Indicates the chapter number of the current page.

Section title → **4-4-2 Connecting to e-CON Connector Terminals**
Indicates the section title of the current page.

Icon

The meanings of the icons used in this manual are as follows.



Precautions for Safe Use

Indicates precautions on what to do and what not to do to ensure using the product safely.



Precautions for Correct Use

Indicates precautions on what to do and what not to do to ensure proper operation and performance.



Reference

This explains useful tips and reference information when using the product.

Structure of This Manual

This manual consists of the following chapters.

Chapters		Contents
Chapter 1	EtherCAT Network	Explains about the EtherCAT features and the network configuration.
Chapter 2	EtherCAT Slave Unit	Overviews the GX-series EtherCAT Slave Unit and its various types.
Chapter 3	Basic Usage Procedures	Explains the setup method and usage procedures by using simple system setup examples.
Chapter 4	Installation and Wiring	Explains how to install Slave Units, and how to connect and wire the EtherCAT network and power supply.
Chapter 5	EtherCAT Communications	Explains the details of EtherCAT communications.
Chapter 6	Basic Specifications of Slave Units	Explains the common specifications for all Slave Units.
Chapter 7	Digital I/O Slave Unit	Gives an overview about the Digital I/O Slave Unit and explains names and functions of components consisting the Slave Unit. It also contains internal circuit diagrams, wiring diagrams and mounting dimensions.
Chapter 8	Analog I/O Slave Unit	Gives an overview about the Analog I/O Slave Unit and explains names and functions of components consisting the Slave Unit. It also contains internal circuit diagrams, wiring diagrams and mounting dimensions.
Chapter 9	Encoder Input Slave Unit	Gives an overview about the Encoder Input Slave Unit and explains names and functions of components consisting the Slave Unit. It also contains internal circuit diagrams, wiring diagrams and mounting dimensions.
Chapter 10	Expansion Unit	Gives an overview about the Expansion Unit and explains names and functions of components consisting the Expansion Unit. It also contains internal circuit diagrams, wiring diagrams and mounting dimensions.
Chapter 11	Troubleshooting and Maintenance	This contains troubleshooting and inspection methods intended for individuals to handle abnormalities and conduct regular inspections.
Appendix	Appendix	Contains the object overview and explains the precautions.

Read and Understand this Manual

Please read and understand this manual before using the product. Please consult your OMRON representative if you have any questions or comments.

Warranty and Limitations of Liability

WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

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In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

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Application Considerations

SUITABILITY FOR USE

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products.

At the customer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.

The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

- Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this manual.
- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
- Systems, machines, and equipment that could present a risk to life or property.

Please know and observe all prohibitions of use applicable to the products.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

PROGRAMMABLE PRODUCTS

OMRON shall not be responsible for the user's programming of a programmable product, or any consequence thereof.

Disclaimers

CHANGE IN SPECIFICATIONS

Product specifications and accessories may be changed at any time based on improvements and other reasons.

It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

PERFORMANCE DATA

Performance data given in this manual is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON Warranty and Limitations of Liability.

ERRORS AND OMISSIONS

The information in this manual has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.

Safety Precautions

Labels and Meanings to Ensure Safe Usage

To ensure safe usage of the EtherCAT Slave Unit, the precautions in this manual are displayed with the following labels and symbols.

The precautions explained in this section describe important information regarding safety. These precautions must be followed without fail.



WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. Additionally, there may be severe property damage.



Caution

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.

Symbols



⊘ This symbol indicates a prohibited item (an item you must not do).

The specific instruction is indicated using text inside the ⊘. The symbol shown to the left indicates "disassembly prohibited".



△ This symbol indicates caution (warnings included).

The specific instruction is indicated using text inside the △. The symbol shown to the left indicates "typical cautions".



● This symbol means it is a compulsory item (an item that must be done).

The specific instruction is indicated using text inside the ●. The symbol shown to the left indicates "typical compulsory items".

WARNING

Do not attempt to take any Unit apart and do not touch the interior of any Unit while the power is being supplied. Also, do not turn ON the power supply while the cover is open.
Doing any of these may result in electric shock.



Do not attempt to disassemble, repair, or modify any Units.
Doing any of these may result in electric shock.



Do not input voltages or currents exceeding the rated range to the Unit.
Using voltages or currents exceeding the rated range may cause Unit failure or fire.



Provide safety measures in external circuits (i.e., not in the Units), including the following items, to ensure safety in the system if an abnormality occurs due to malfunction of the PLC or another external factor affecting the PLC operation. ("PLC" includes CPU Units, other Units mounted in the PLC, and Remote I/O Terminals.)
Not doing so may result in serious accidents.



Emergency stop circuits, interlock circuits, limit circuits, and similar safety measures must be provided in external control circuits, not in the Units.

The PLC will turn OFF all outputs when its self-diagnosis function detects any error or when a severe failure alarm (FALS) instruction is executed. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.

The Slave Unit outputs may remain ON or OFF due to deposits on or burning of the output relays, or destruction of the output transistors. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.

When the 24-VDC output (service power supply) is overloaded or short-circuited, the voltage may drop and result in the outputs being turned OFF. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.

Implement proper measures as part of your communications system or in your program to ensure safety in the system even when a communications error or malfunction occurs during remote I/O communication.

The CPU Unit refreshes I/O even when the program is stopped (i.e., even in PROGRAM mode). Confirm safety thoroughly in advance before changing the status of any part of memory allocated to I/O Units, Special I/O Units, or CPU Bus Units. Any changes to the data allocated to any Unit specifically the Special I/O Units/ CPU Bus Units may result in unexpected operation of the loads connected to the Unit.



- Transferring I/O memory data to the CPU Unit with a Programming Device (PC tool).
- Changing present values in memory with a Programming Device.
- Force-setting/-resetting bits with a Programming Device.
- Transferring I/O memory files from a memory card or EM file memory to the CPU Unit.
- Transferring I/O memory from a host computer or from another PLC on a network.

Fail-safe measures must be taken by the customer to ensure safety in the event of incorrect, missing, or abnormal signals caused by broken signal lines, momentary power interruptions, or other causes. Not doing so may result in serious accidents.



Precautions for Safe Use

Observe the following precautions when using the Unit.

● Power Supply

- Always use the power supply voltage specified in this manual. An incorrect voltage may result in malfunction or burning.
- Take appropriate measures to ensure that the specified power with the rated voltage and frequency is supplied. Be particularly careful in places where the power supply is unstable. An incorrect power supply may result in malfunction.
- Always turn OFF the power supply to the PLC, Slave Units and other Units before attempting any of the following. Not turning OFF the power supply may result in malfunction or electric shock.
 - Assembling any Units (Expansion Units).
 - Removing or attaching the terminal blocks or connectors to Slave Unit.
 - Replacing parts (e.g., relays).
 - Setting the DIP switches and rotary switches.
 - Connecting cables or wiring the system.

● Installation

- Before touching a Unit, be sure to first touch a grounded metallic object in order to discharge any static build-up. Not doing so may result in malfunction or damage.
- Make sure that the terminal blocks, communications cables, and other items with locking devices are properly locked into place. Improper locking may result in malfunction.
- Mount the Units securely using DIN track.
- Make sure that all Slave Unit mounting screws and cable connector screws are tightened to the torque specified in this manual. Incorrect tightening torque may result in malfunction.
- Make sure that all terminal block screws are tightened to the torque specified in this manual. Incorrect tightening torque may result in fire, malfunction, or failure.
- Always use the specified communications cables and connectors.
- Do not extend connection distances or the number of connected nodes beyond the ranges given in the specifications.
- When there are multiple systems, keep the cables unbundled and separated by at least 5 mm to prevent unstable operation due to interference.

● Wiring

- Turn the power on after checking that the wiring and switch settings are correct.
- Use the correct wire tools to wire the Unit.
- Confirm the polarity of all terminals before wiring them.
- Do not allow foreign matter to enter the Units when wiring and installing the Units.
- Observe the following precautions when wiring the communications cable.
 - Separate the communications cables from the power lines or high-tension lines.
 - Do not bend the communications cables past their natural bending radius.
 - Do not pull on the communications cables.
 - Do not place heavy objects on top of the communications cables.
 - Always lay communications cable inside ducts.
- Turn OFF the power of PLC and all the Slave Units before wiring the communication cables.
- Do not apply voltages to the Input Slave Units in excess of the rated input voltage. Excess voltage or loads may result in burning.

- Do not apply voltages or connect loads to the Outputs Slave Units in excess of the maximum switching capacity. Excess voltage or loads may result in burning.

● **Handling**

- When transporting the product, use special packing boxes, and protect it from being exposed to excessive vibration or impact during transportation.
- Do not bend cables past their natural bending radius or pull on cables.
- After replacing Units, resume operation only after transferring to the new CPU Unit and/or Special I/O Units the contents of the DM Area, HR Area, and other data required for resuming operation. Not doing so may result in unexpected operation.
- Check the user program for proper execution before actually running it on the Unit. Not checking the program may result in unexpected operation.
- When replacing relays or other parts, be sure to confirm that the ratings of the new part are correct. Not doing so may result in malfunction or burning.
- Confirm that no adverse effect will occur in the system before attempting any of the following.
 - Changing the operating mode of the PLC.
 - Setting/resetting any bit in memory.
 - Changing the present value of any word or any set value in memory.
- Do not use thinner when cleaning. Use commercially available alcohol.

● **External Circuits**

- Install external breakers and take other safety measures against short-circuiting in external wiring.

Precautions for Correct Use

- Wire all connections correctly according to instructions in this manual. Failure to install them may result in serious accidents.
- Do not operate the control system in the following locations:
 - Location subject to direct sunlight.
 - Locations subject to temperatures or humidity outside the range specified in the specifications.
 - Locations subject to condensation as the result of severe changes in temperature.
 - Location subject to corrosive or flammable gases.
 - Location subject to dust (especially iron dust) or salts.
 - Location subject to exposure to water, acid, oil, chemicals, etc.
 - Locations subject to shock or vibration.
- Confirm voltage specifications when wiring communications, the power supply, and I/O crossovers. Incorrect wire may result in malfunction.
- Wire all connections correctly according to instructions in this manual.
- Use the correct wiring materials to wire the Unit.
- Take appropriate and sufficient countermeasures when installing systems in the following locations:
 - Locations subject to static electricity or other forms of noise.
 - Locations subject to strong electromagnetic fields.
 - Locations subject to possible exposure to radioactivity.
 - Locations close to power supplies.
- Do not drop any Unit or subject any Unit to excessive shock or vibration. Otherwise, Unit failure or malfunction may occur.

Conformance to EC Directives

Applicable Directives

- EMC Directives
- Low Voltage Directive

Concepts

● EMC Directives

The OMRON products described in this manual are designed so that they individually comply with the related EMC Directives so that they can be more easily built into other devices or the overall machine. The actual products have been checked for conformity to EMC Directives (See note)*. Whether the products conform to the standards in the system used by the customer, however, cannot be checked by OMRON and must be checked by the customer. EMC-related performance of the OMRON devices that comply with EC Directives will vary depending on the configuration, wiring, and other conditions of the equipment or control panel on which the OMRON devices are installed. The customer must, therefore, perform the final check to confirm that devices and the overall machine conform to EMC standards.

* Note: Applicable EMC (Electromagnetic Compatibility) standards are as follows:

EMS (Electromagnetic Susceptibility): EN 61131-2 and EN 61000-6-2

EMI (Electromagnetic Interference): EN 61131-2 and EN61000-6-4

(Radiated emission: 10-m regulations)

● Low Voltage Directive

Always ensure that devices operating at voltages of 50 to 1,000 VAC and 75 to 1,500 VDC meet the required safety standards.

Applicable standard: EN 61131-2

Conformance to EC Directives

The OMRON products described in this manual comply with the related EMC Directives. To ensure that the machine or device in which the products are used complies with EC Directives, the products must be installed as follows:

- The products must be installed within a control panel.
- A DC power supply with reinforced insulation or double insulation that can maintain a stable output even if the input is interrupted for 10 ms must be used for communications power, internal power, and I/O power. The OMRON S8JX-series Power Supply is recommended. (See note.)*
- Products complying with EC Directives also conform to the Emission Standards (EN 61131-2 and EN 61000-6-4). Radiated emission characteristics (10-m regulations) may vary depending on the configuration of the control panel used, other devices connected to the control panel, wiring, and other conditions. You must therefore confirm that the overall machine or equipment complies with EC Directives.
- Conformance with the EC Directives was confirmed with a system configuration using I/O wiring lengths of less than 30 m.

* Note: Conformance with the EMC Directive was confirmed when using the recommended power supply.

Trademarks

- EtherCAT^(R) is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.
- Windows is a registered trademark of Microsoft Corporation in the USA.
- SYSMAC is a registered trademark for Programmable Controllers made by OMRON Corporation.
- CX-One is a registered trademark for Programming Software made by OMRON Corporation.

Other system names and product names that appear in this manual are the trademarks or registered trademarks of the relevant companies.

Related Manuals

The following manuals also deal with EtherCAT. Refer to them for details.

Man No.	Name of manuals	Contents
W487	SYSMAC CJ Series Position Control Units Operation Manual	Explains the setup and operation procedures of the EtherCAT Position Control Units (CJ1W-NCx81/x82) which functions as a master.
W446	CX-Programmer Operation Manual	Explains the operations method of the Windows-based programming tool CX-Programmer.

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1

EtherCAT Network

This chapter explains the overview of EtherCAT network.

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1-1 Overview of EtherCAT Networks

EtherCAT (Ethernet Control Automation Technology) is a high-performance industrial network system based on Ethernet system and can realize faster and more efficient communications. Each node achieves a short cycle time by transmitting Ethernet frames at high speed. Additionally, although EtherCAT is a unique communication protocol, it employs standard Ethernet technology in the physical layer and is thus highly versatile; for example, commercially available Ethernet cables can be used. Moreover, can demonstrate its full effect not only in large-scale control systems that require fast process speed and system integration, but also in small- and medium-scale control systems.

1-1-1 Features of EtherCAT

EtherCAT has the following features.

- **Extremely high-speed communications with speed of 100 Mbps**

It dramatically shortens the I/O response time from generation of input signals to transmission of output signals. It makes the best use of the optimized Ethernet frame band, and transmits with the high-speed repeat method, thereby allowing transmitting various types of data at high efficiency.

- **Employment of standard Ethernet technology**

EtherCAT is a global open network that employs standard Ethernet technology in the physical layer. For this reason, commercially available Ethernet cables, connectors, tools, and other general-purpose products can be used.

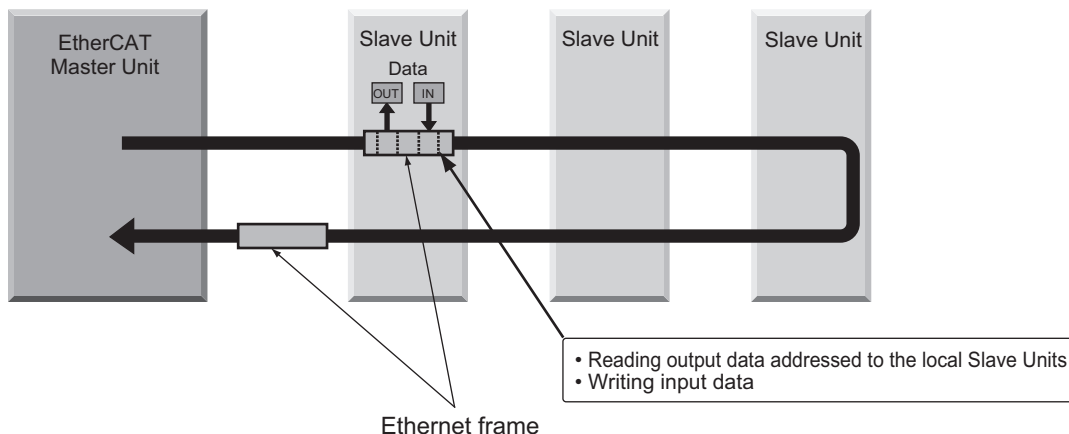
1-1-2 Structure of EtherCAT

EtherCAT does not transmit data to each node on a network, but gets Ethernet frames through each node.

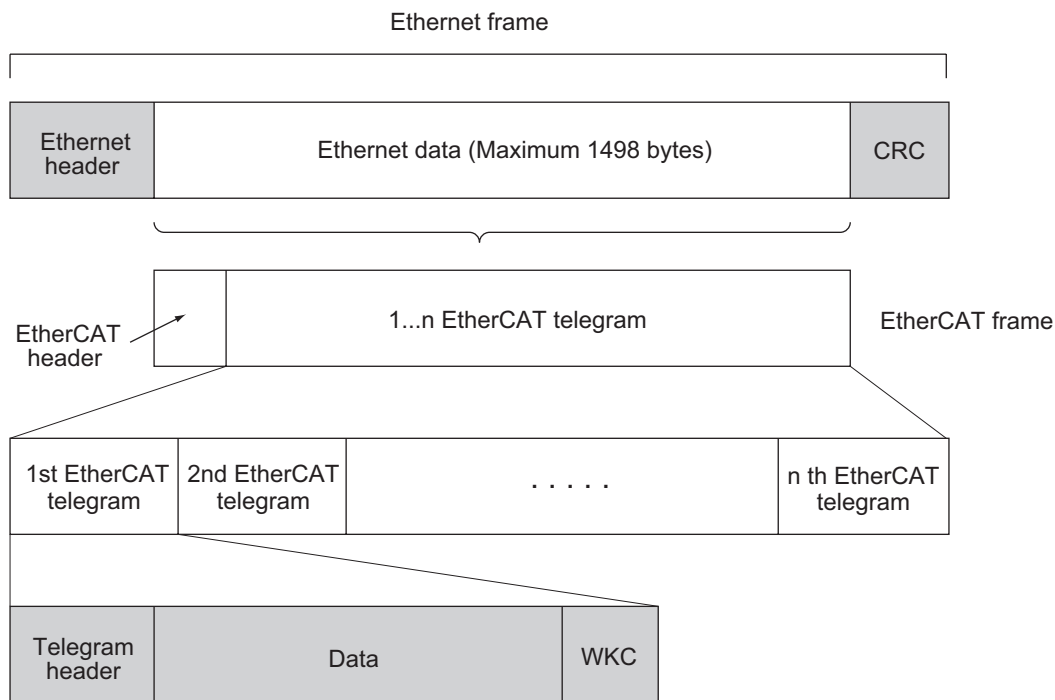
At passing, each node reads and writes data in Units of several nanoseconds in its own area within a frame.

Ethernet frames sent from the EtherCAT Master Unit go through all the EtherCAT Slave Units without stopping on the way. Once they reach the final Slave Unit, they are sent back from the final Slave Unit, pass through all Slave Units again, and return to the EtherCAT Master Unit.

With this structure, EtherCAT secures high-speed and real-time data transmission.



It is the "EtherCAT telegram" stored directly in an Ethernet frame that exchanges data regularly between the EtherCAT Master Unit and Slave Units.
 Each "EtherCAT telegram" is configured with telegram header (data length, including address of one or more Slave Units, etc.), data, working counter (check bit).
 When an Ethernet frame is compared to a "train", an EtherCAT telegram can be considered as "railway car."



WKC : Working counter

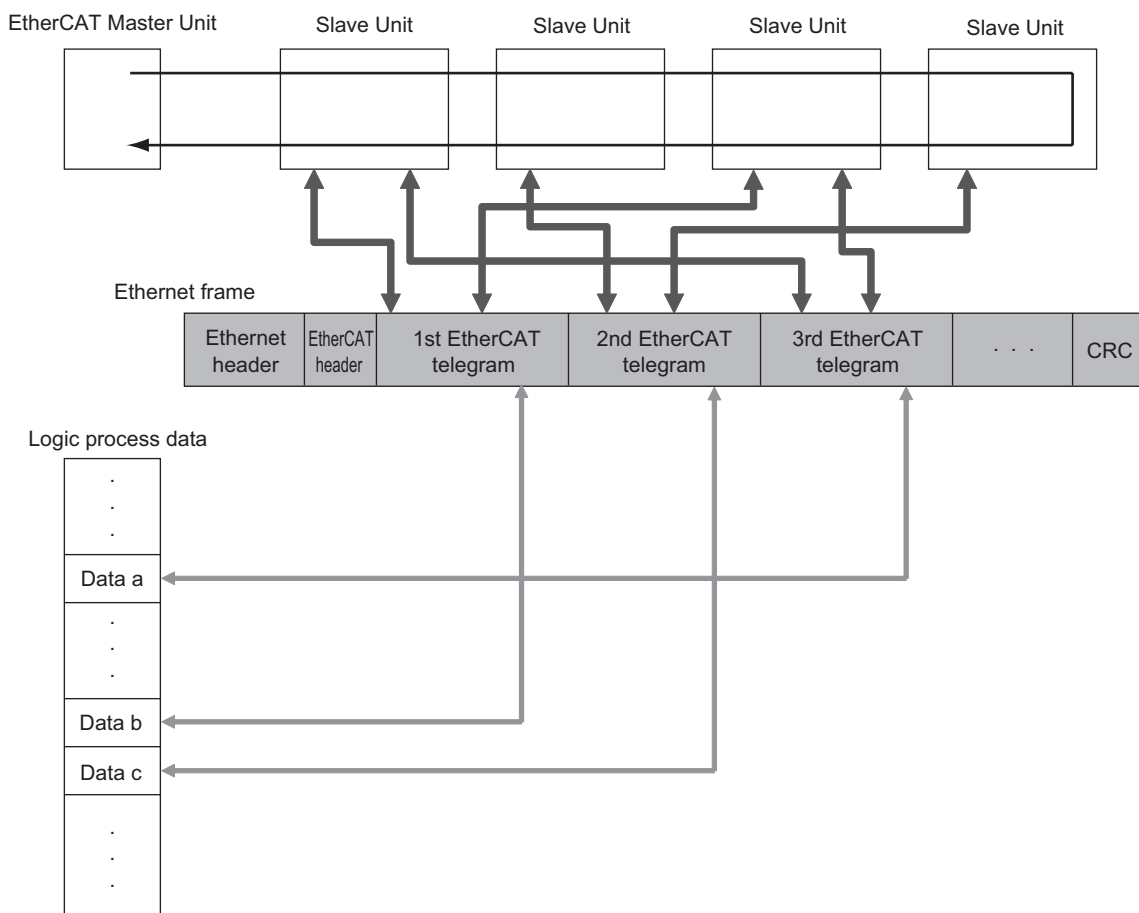
1-1-3 Communications types of EtherCAT

EtherCAT provides the following two types of communication functions.

PDO communications are always updating data per communication cycle on EtherCAT, while SDO communications are processed in between those updates.

Process data communications functions (PDO communications)

This communication function is used to transfer process data in real time in a fixed-cycle. By mapping logical process data space to each node by the EtherCAT Master Unit, it achieves fixed-cycle communications among the EtherCAT Master Unit and Slave Units.



Mailbox communications functions (SDO communications)

It refers to message communications.

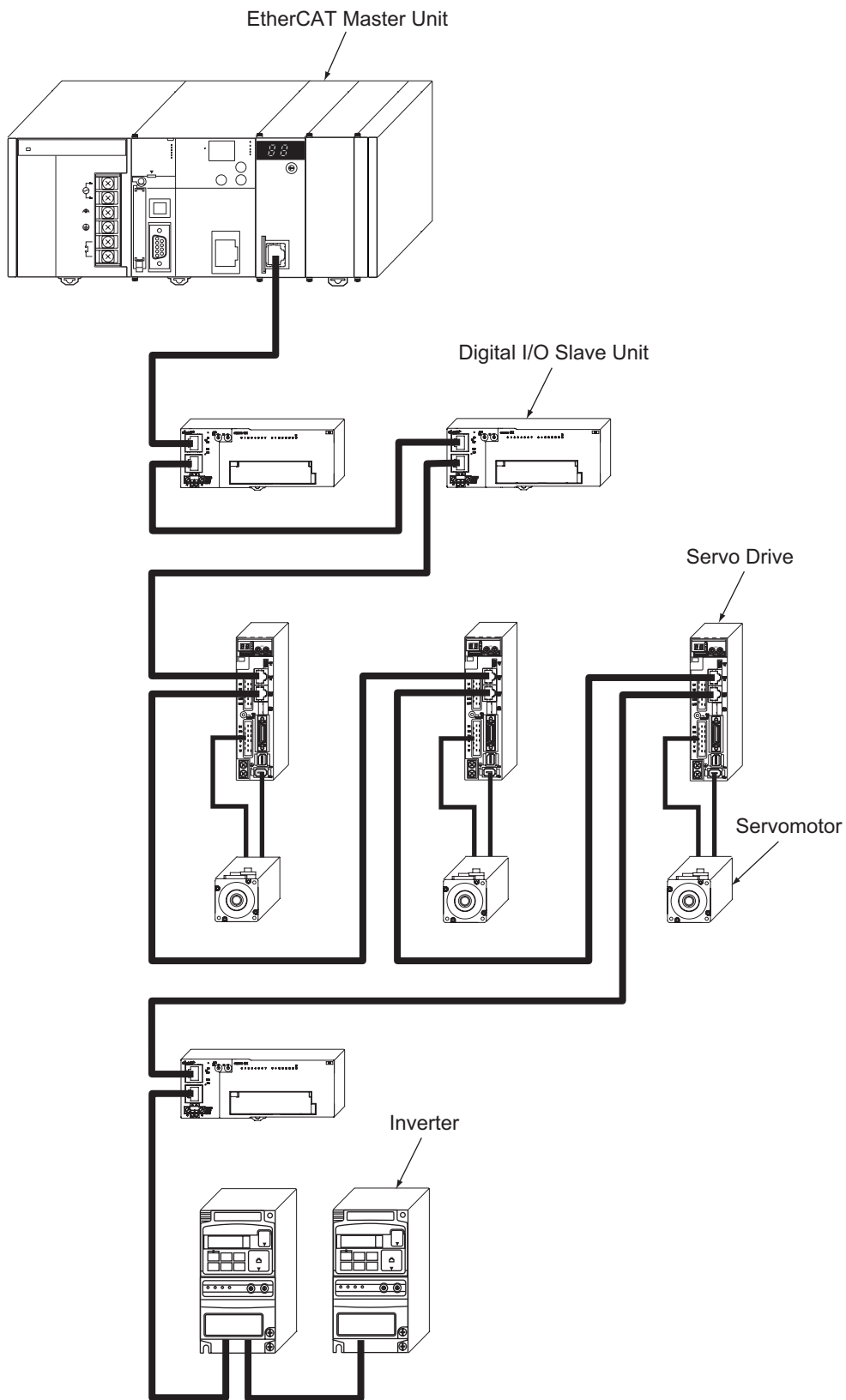
At any timing, the EtherCAT Master Unit transmits commands to Slave Units and the Slave Units return responses to the EtherCAT Master Unit.

It performs the following data communications:

- Read and write process data
- Make Slave Unit setting
- Monitor Slave Unit state

1-1-4 Connection Examples of EtherCAT

This section explains the connection examples of EtherCAT network.

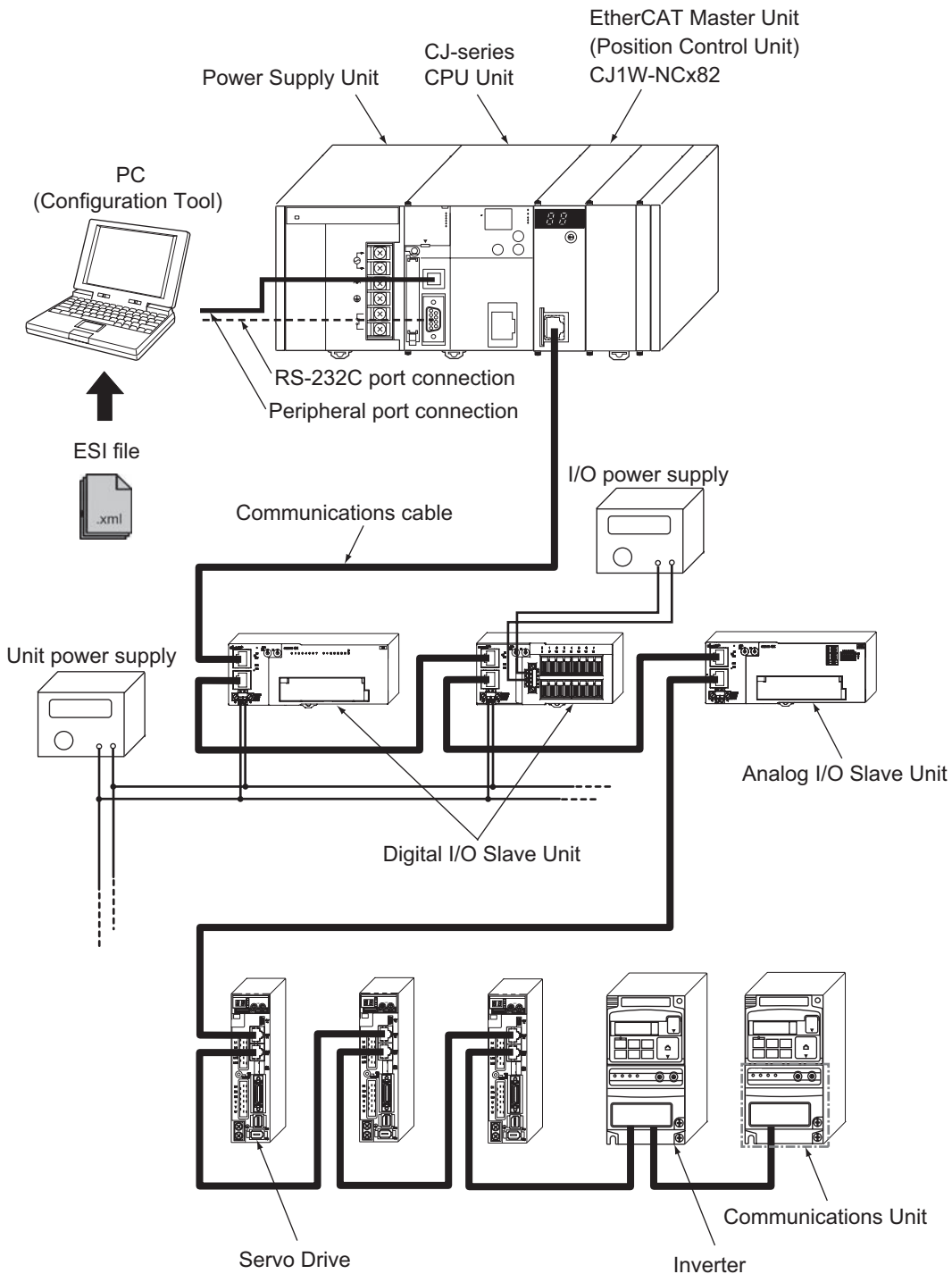


1-2 Configuration Elements of EtherCAT Network

This section explains the configuration devices and usages of EtherCAT network.

1-2-1 Configuration Devices of EtherCAT Network

The devices composing an EtherCAT network are shown in the figure below.



1-2-2 Overview of Configuration Devices

The overview of each configuration device is as follows:

EtherCAT Master Unit

Administers the EtherCAT network, monitors the state of Slave Units, exchanges I/O data with Slave Units.

EtherCAT Slave Unit

Outputs data received from the EtherCAT Master Unit through the EtherCAT network, or sends input data to the EtherCAT Slave Unit through the EtherCAT network.
There are Digital I/O Slave Unit and Analog I/O Slave Unit.

Communications Unit

By mounting to an inverter and other devices, it is possible to serve as a Slave Unit in the EtherCAT network.

Configuration Tool

It is a PC software for making setting of the EtherCAT network and each Slave Unit.
It can be used either by connecting to the EtherCAT Master Unit or as a substitute of the EtherCAT Master Unit.

Communications cable

Uses cables of Ethernet category 5 (100BASE-TX) or higher, with double-shield (aluminum tape and braided shielding), which are connected straight.

ESI (EtherCAT Slave Information) file

Describes information specific to EtherCAT Slave Units in XML format.
By reading this file into the Configuration Tool, it is possible to perform various settings such as mapping of Slave Units to I/O memory easily.

Unit power supply

Provides power for communications of each Slave Unit and internal operations.
Separate them from the I/O power supply when wiring.

I/O power supply

Provides power for input/output operations of external devices connected to Slave Units.
Separate from Unit power supply when wiring.

2

EtherCAT Slave Unit

This chapter explains the overview of EtherCAT Slave Unit.

2-1 Overview of EtherCAT Slave Unit	2-2
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2-2 Types of EtherCAT Slave Units	2-3
2-2-1 Slave Units List	2-3
2-2-2 Installation, I/O Connection, and Power Supply Methods for Each Slave Unit .	2-6

2-1 Overview of EtherCAT Slave Unit

This section explains the overview of EtherCAT Slave Unit.

2-1-1 Slave Units Usage

Slave Units supported by this manual are largely classified into the following types by their intended purposes.

- **Digital I/O Slave Unit**

Inputs and outputs digital ON/OFF signals.

- **Analog I/O Slave Unit**

Performs AD or DA conversion for analog signals of 0 to 5 V, 4 to 20 mA, and so on and inputs or outputs them.

- **Encoder Input Slave Unit**

Performs conversion for pulse input signals from an encoder.

- **Expansion Unit**

Mounted on a Digital I/O Slave Unit in order to expand the number of I/O points.

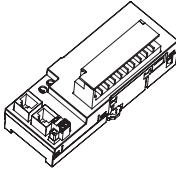
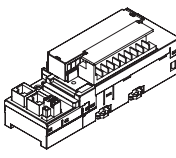
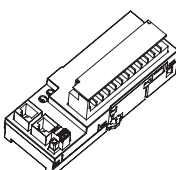
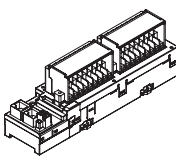
Note, however, Expansion Units can only be mounted on Digital I/O Slave Units with 2-tier terminal block and 16 points.

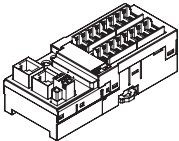
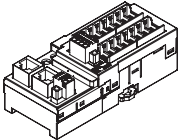
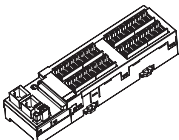
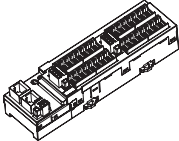
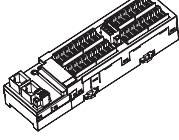
2-2 Types of EtherCAT Slave Units

This section explains the types of EtherCAT Slave Units and mounting, connection and power supply methods.

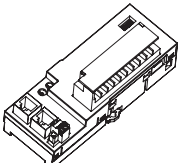
2-2-1 Slave Units List

Digital I/O Slave Unit

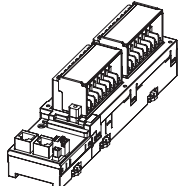
Type	Appearance	I/O points	Model	Features
Models with 2-tier terminal block		16 inputs (NPN)	GX-ID1611	<ul style="list-style-type: none"> Equipped with a removable screw terminal block Possible to mount an Expansion Unit
		16 inputs (PNP)	GX-ID1621	
		16 outputs (NPN)	GX-OD1611	
		16 outputs (PNP)	GX-OD1621	
		Relay 16 outputs	GX-OC1601	
			8 inputs and 8 outputs (NPN)	
8 inputs and 8 outputs (PNP)	GX-MD1621			
Models with 3-tier terminal block		16 inputs (NPN)	GX-ID1612	
		16 inputs (PNP)	GX-ID1622	
		16 outputs (NPN)	GX-OD1612	
		16 outputs (PNP)	GX-OD1622	
		8 inputs and 8 outputs (NPN)	GX-MD1612	
		8 inputs and 8 outputs (PNP)	GX-MD1622	

Type	Appearance	I/O points	Model	Features
e-CON Connectors		16 inputs (NPN)	GX-ID1618	<ul style="list-style-type: none"> Equipped with an e-CON connector Expansion Unit cannot be mounted
		16 inputs (PNP)	GX-ID1628	
		16 outputs (NPN)	GX-OD1618	
		16 outputs (PNP)	GX-OD1628	
		8 inputs and 8 outputs (NPN)	GX-MD1618	
		8 inputs and 8 outputs (PNP)	GX-MD1628	
		32 inputs (NPN)	GX-ID3218	
		32 inputs (PNP)	GX-ID3228	
		32 outputs (NPN)	GX-OD3218	
		32 outputs (PNP)	GX-OD3228	
		16 inputs and 16 outputs (NPN)	GX-MD3218	
		16 inputs and 16 outputs (PNP)	GX-MD3228	

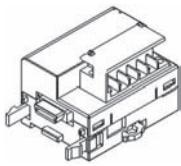
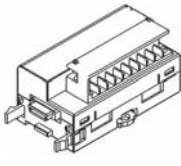
Analog I/O Slave Unit

Type	Appearance	I/O points	Model	Features
Models with screw terminal blocks		4 inputs	GX-AD0471	<ul style="list-style-type: none"> Equipped with a removable screw terminal block Possible to switch input and output range (voltage and current)
		2 outputs	GX-DA0271	

Encoder Input Slave Unit

Type	Appearance	I/O points	Model	Features
Models with screw terminal blocks		2 inputs (5 V and 24 V voltage input)	GX-EC0211	<ul style="list-style-type: none"> Equipped with a removable screw terminal block With 2 latch inputs/1 reset input
		2 inputs (Line driver input)	GX-EC0241	

Expansion Unit

Type	Appearance	I/O points	Model	Features
Models with 2-tier terminal block		8 inputs (NPN)	XWT-ID08	<ul style="list-style-type: none"> Can be connected to the following Digital I/O Slave Unit GX-ID1611/ID1621/O D1611/OD1621/OC16 01 Can connect only 1 Expansion Unit per Slave Unit
		8 inputs (PNP)	XWT-ID08-1	
		8 outputs (NPN)	XWT-OD08	
		8 outputs (PNP)	XWT-OD08-1	
		16 inputs (NPN)	XWT-ID16	
		16 inputs (PNP)	XWT-ID16-1	
		16 outputs (NPN)	XWT-OD16	
		16 outputs (PNP)	XWT-OD16-1	

2-2-2 Installation, I/O Connection, and Power Supply Methods for Each Slave Unit

Digital I/O Slave Unit

Type	Model	Slave Unit installation method	I/O connection method	Internal power supply	External power supply
Models with 2-tier terminal block	GX-ID1611 GX-ID1621 GX-OD1611 GX-OD1621 GX-OC1601 GX-MD1611 GX-MD1621		M3 screw terminal block		I/O power supply must be supplied externally for connected devices.
	Models with 3-tier terminal block				
e-CON connectors	GX-ID1618 GX-ID1628	DIN track	e-CON Connectors	Shared with unit power supply	Shared with unit power supply*
	GX-OD1618 GX-OD1628				I/O power supply must be supplied externally for connected devices.
	GX-MD1618 GX-MD1628				Only inputs are shared with unit power supply.*
	GX-ID3218 GX-ID3228				Shared with unit power supply*
	GX-OD3218 GX-OD3228				I/O power supply must be supplied externally for connected devices.
	GX-MD3218 GX-MD3228				Only inputs are shared with unit power supply.*

* Power for external I/O (sensors and actuators) is also supplied from the unit power supply.

For this reason, make sure to add current consumption of external I/O when examining output current of the unit power supply.

Analog I/O Slave Unit

Type	Model	Slave Unit installation method	I/O connection method	Internal power supply	External power supply
Models with screw terminal blocks	GX-AD0471	DIN track	M3 screw terminal block	Shared with unit power supply	Not necessary
	GX-DA0271				

Encoder Input Slave Unit

Type	Model	Slave Unit installation method	I/O connection method	Internal power supply	External power supply
Models with screw terminal blocks	GX-EC0211	DIN track	M3 screw terminal block	Shared with unit power supply	I/O power supply must be supplied externally for connected devices.
	GX-EC0241				

Expansion Unit

Type	Model	Slave Unit installation method	I/O connection method	Internal power supply	External power supply
Models with 2-tier terminal block	XWT-ID08 (-1)	DIN track	M3 screw terminal block	Shared with unit power supply	Varies depending on the type of mounted Digital I/O Slave Unit (Refer to "10-1-2 I/O Power Supply" in Page 10 - 3.)
	XWT-OD08 (-1)				
	XWT-ID16 (-1)				
	XWT-OD16 (-1)				

3

Basic Usage Procedures

This chapter explains the procedure of using EtherCAT Slave Units based on specific setting examples.

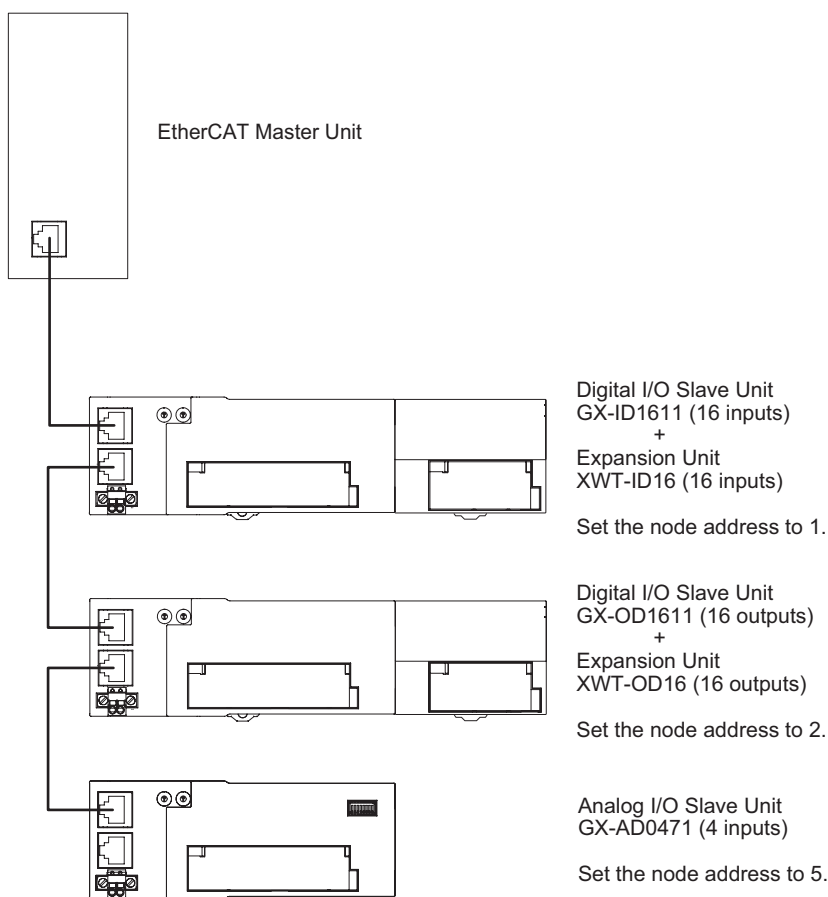
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3-1-1	System Setting Examples	3-2
3-1-2	Basic Procedure	3-3
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3-4-1	Checking Unit Displays	3-6
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3-1 Setup Examples and Basic Procedure

This section explains the setup method by using simple system setting examples.

3-1-1 System Setting Examples

Connect each of the following Slave Units to the EtherCAT Master Unit and make the settings.



Although it is not shown in the figure above, supply the unit power and the I/O power separately.



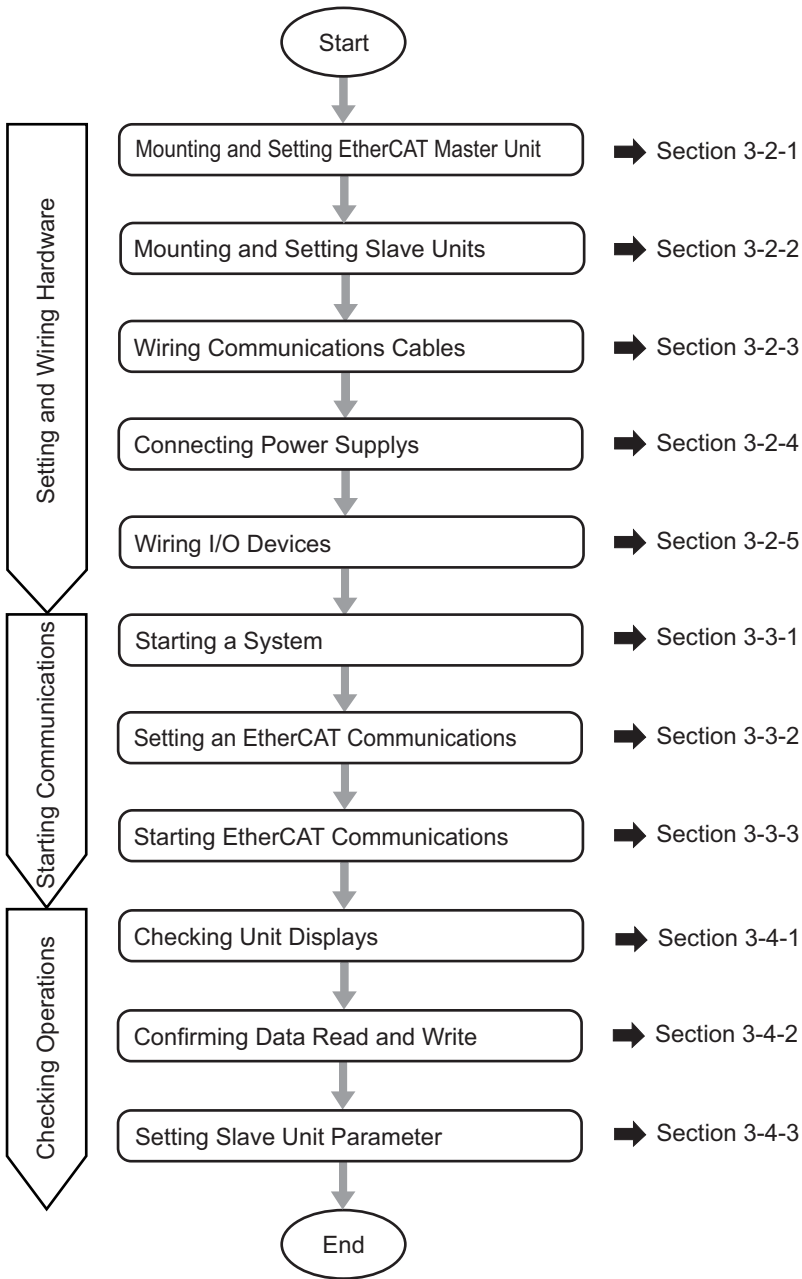
Reference

The setting example explained here is the basic setting of GX-series EtherCAT Slave Units. If more detailed settings are required in actual operation, refer to the manual of the EtherCAT Master Unit or pages on this manual explaining the detail for each Slave Unit (Chapter 7 to Chapter 10).

Moreover, if your system configuration includes Slave Units other than our products, make the setting upon referring to the manual of the relevant Slave Units.

3-1-2 Basic Procedure

This is the flow of the procedures explained in the following sections.



3-2 Setting and Wiring Hardware

Make settings and wiring of the EtherCAT Master Unit and Slave Units, and power supply.

3-2-1 Mounting and Setting EtherCAT Master Unit

Mount the EtherCAT Master Unit at the prescribed location and make settings of Unit No. and so on. For the detailed explanation, refer to the manual of the EtherCAT Master Unit to be used.

3-2-2 Mounting and Setting Slave Units

Mount each Slave Unit at the prescribed location and make settings of node address and so on. For details, refer to each item below.

- **Mounting**

"4-1 Mounting Slave Units" in page 4 - 2

- **Setting**

Pages in Chapter 6 to Chapter 10 which explain the general specification and details of each type of Slave Units.

3-2-3 Wiring Communications Cables

Wire communications cables to the EtherCAT Master Unit and each Slave Unit. For wiring method, refer to "4-2 Connecting to EtherCAT Network" in page 4 - 4.

3-2-4 Connecting Power Supplies

Connect the unit power supply to the EtherCAT Master Unit and Slave Units. In addition, connect the I/O power supply to each Slave Unit as required. For the connection method, refer to "4-3 Connecting to Unit Power Supply and I/O Power Supply" in page 4 - 8 or the wiring diagram of each Slave Unit (in pages explaining the details).

3-2-5 Wiring I/O Devices

Connect input and output devices to each Slave Unit as required. For the connection method, refer to "4-4 Connecting an External Device" in page 4 - 12 or the wiring diagram of each Slave Unit (in pages explaining the details).

3-3 Starting Communications

Start the system, allocate I/O data of Slave Units, and then start the EtherCAT communications.
For operational state and details of it, refer to "5-3 Communications State Transitions" in page 5 - 4.

3-3-1 Starting a System

Turn ON the power supply to each Unit.

- (1) Unit power supply of EtherCAT Master Units
- (2) Unit power supply of Slave Units (When the power is supplied, Slave Unit's [PWR] indicator is lit.)
- (3) I/O power supply of Slave Units

Note that there are no restrictions on the order of turning ON the power supplies.

3-3-2 Setting EtherCAT Communications

The following communications are performed in EtherCAT.

- **PDO communications (remote I/O communications)**

Allocate I/O data of Slave Units to the EtherCAT Master Unit (PDO mapping) and perform PDO communication (remote I/O communications).

For the detailed explanation of I/O data of each Slave Unit, refer to "I/O Data Allocation (PDO Mapping)" in Chapter 7 to Chapter 9.

Note that the ESI file are used to allocate I/O data.

For the detailed explanation of the procedure, refer to the manual of the EtherCAT Master Unit to be used and the manual of the Configuration Tool.

- **SDO communications (message communications)**

For the method of using, refer to the manual of the EtherCAT Master Unit to be used.

Refer to "Appendix A - 1 Object Dictionary" for the detailed explanation of objects implemented on GX-series EtherCAT Slave Units.

Note that the SDO communications can be used in the pre-operational state or more.

3-3-3 Starting EtherCAT Communications

Shift to the operational state (EtherCAT communications possible) to start the EtherCAT communications.

For how to shift to the operational state, refer to the manual of the EtherCAT Master Unit to be used.

3-4 Checking Operations

Confirm that the LED indicators of the EtherCAT Master Unit and Slave Units are normal status and that I/O data is correctly read and written.

Moreover, make parameter settings for Slave Units as required.

3-4-1 Checking Unit Displays

- **EtherCAT Master Unit**

Refer to the manual of the EtherCAT Master Unit to be used.

- **EtherCAT Slave Units**

Check that the status indicator of each Slave Unit is as follows.

LED	State
PWR	ON
L/A IN	Flickering
L/A OUT	Flickering (turned OFF for the terminal Slave Unit only)
RUN	ON
ERR	OFF

3-4-2 Confirming Data Read and Write

Use the Configuration Tool to read IN data and OUT data of the EtherCAT Master Unit in order to check that the I/O data is correctly read and written.

3-4-3 Setting Slave Unit Parameter

Make parameter settings for each Slave Unit as required via the SDO communications.

For the details of parameters that can be set, refer to the pages explaining details of each Slave Unit in Chapter 7 to Chapter 9.

4

Installation and Wiring

This chapter explains the mounting and wiring methods of the EtherCAT Slave Unit.

4

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4-1 Mounting Slave Units

This section explains the mounting methods of Slave Units to the DIN track.

4-1-1 Mounting Preparation

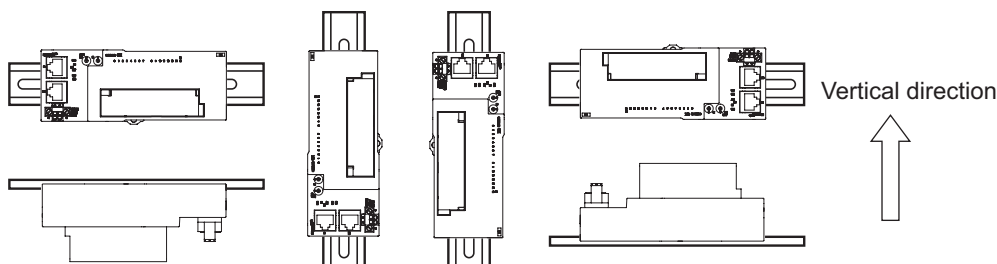
Prepare the following devices.

Product name	Model	Comment
35-mm DIN track	PFP-50N	Length 50 cm
	PFP-100N	Length 100 cm
	PFP-100N2	Length 100 cm
End plate	PFP-M	2 end plates are required for each Slave Unit.

4-1-2 Mounting Direction

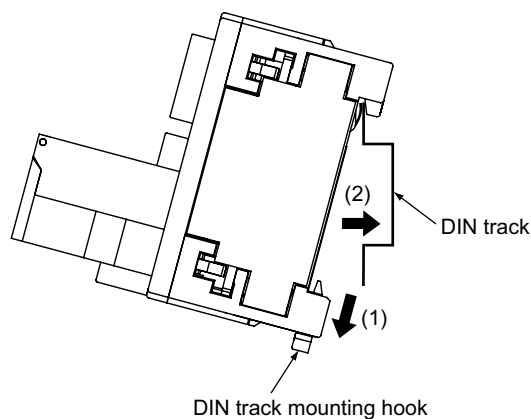
There are no restrictions in the orientation unless otherwise specified in the instruction pages for the Slave Unit.

Mounting is possible in any of the following 6 orientations.

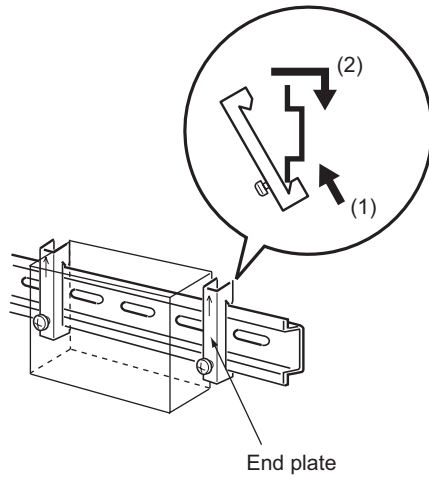


4-1-3 Mounting Method

- 1** Hook the top side of groove on backside of the Slave Unit to the top side of the DIN track, lower the DIN track mounting hook, engage the Slave Unit to the track, and press up the mounting hook to fix it.



- 2** Hook the bottom side of the end plate to the bottom side of the DIN track and then hook the top side.
Attach an end plate on each side of the Unit.



Precautions for Safe Use

After the operation, make sure to check that the Slave Unit is securely mounted.

4-1-4 Removal Method

Loosen the screws on the end plate and remove the end plate from the DIN track. Then pull down the DIN track mounting hook to release the lock. Pull out the Slave Unit straight toward you.

4-2 Connecting to EtherCAT Network

This section explains how to lay down EtherCAT network.

4-2-1 Precautions for Network Connection

Observe the precautions below when laying down the EtherCAT network.

Precautions at laying down network

- When laying down an EtherCAT network, take sufficient safety measures and construct the network according to the standards. We recommend to request specialized constructors familiar with the safety measures and standards to perform the laying operation.
- Do not lay down EtherCAT network devices near any devices generating noise. If there is no choice but to lay them down in a noisy environment, make sure to take noise measures such as housing each device in metal cases.

Precautions at laying down communications cables

- Check the following items for communications cables to be used.
 - Are there any disconnected cables?
 - Are any cables short-circuited?
 - Are there any problems in connector connections?
- To connect a cable to communications connector of each device, insert it securely until the connector of the communications cable is locked.
- Lay down and wire the communications cables separately from high-voltage electrical power lines.
- Do not lay down the cables near devices generating noise.
- Do not lay down the cables in high-temperature and high-humidity environment.
- Use the cables in locations without powder dust and oil mist.
- There is a limit to the bending radius of communications cables. Check the specification of communications cables to be used for the information on bending radius.

4-2-2 Preparation for Connecting Network

Prepare the following devices.

Product name	Comment
Twisted-pair cable (Cables with connectors below are also allowed.)	100BASE-TX (Category 5 or higher) Double-shield (aluminum tape + braided shielding)
RJ45 connector	Category 5 or higher Shielded



Precautions for Correct Use

- The maximum cable length between connected nodes is 100 m. Note that some cables do not guarantee 100 m. In general, if the conductors are strand wire, the transmission performance will be lower than solid wire and the operation at 100-m distance cannot be guaranteed. Confirm details with the cable manufacturer.
- When selecting connectors, check that the cables to be used conform to connectors. Items to be checked include conductor size, conductor wire type (solid wire/twisted wire, 2/4 pairs), and outer diameter.

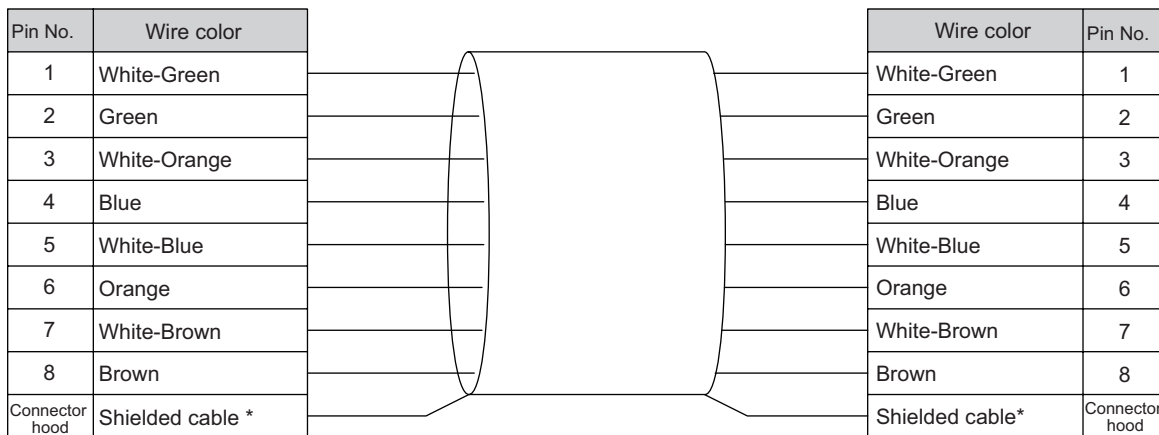
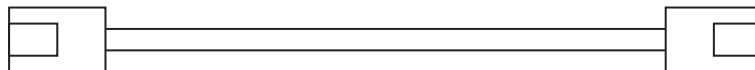


Reference

We recommend cables with double, aluminum tape and braided shielding, taking noise resistance into consideration.

4-2-3 Connecting Communications Cables and Connectors

Connect a communications cable and a connector by wiring them straight as shown below.



* Connect both ends of cable shielded wires to the connector hoods.



Reference

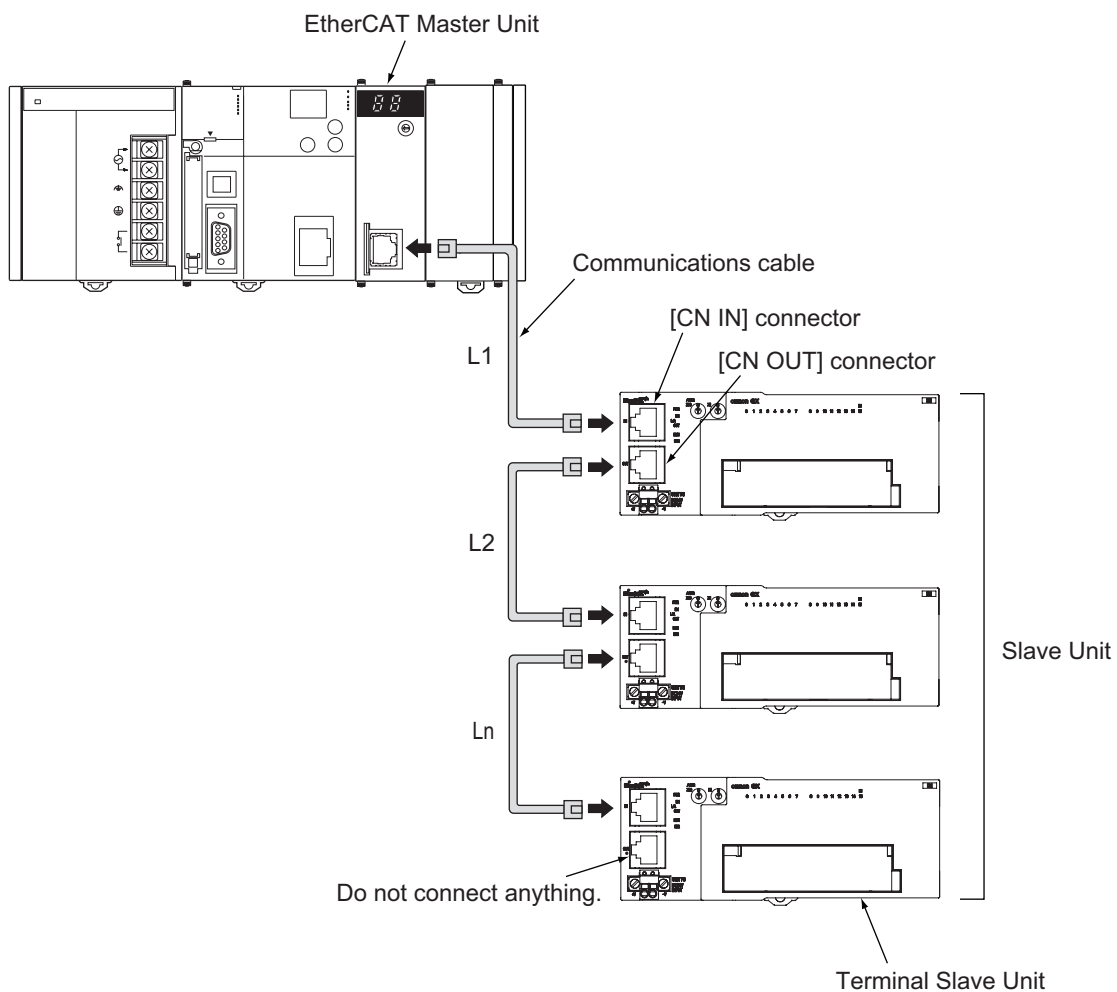
There are 2 types of wiring standards for Ethernet cables : "T568A" and "T568B."
 The figure above shows a wiring method conforming to the standard "T568A". The wiring method conforming to the standard "T568B" can also be used.

4-2-4 Connecting to Communications Cables

EtherCAT networks allow free wiring in any connection forms. Connection before and after the GX-series EtherCAT Slave Units shall be made in daisy chain connection.

Connect the communications cable from the EtherCAT Master Unit to the [CN IN] connector of the Slave Units. Connect another the communications cable from the [CN OUT] connector of the first Slave Unit to the [CN IN] connector of the next Slave Unit.

Note that nothing should be connected to the [CN OUT] connector of the Slave Unit at the terminal end of the network.



Precautions for Correct Use

- The cable length between each Slave Unit (L1, L2, ... Ln) must be within 100 m.
- Connect cables securely until communications cable connectors click and are fixed in place.
- When you wire the communications cables, observe their specifications (bending radius and so on) defined by the cable manufacturer.

4-3 Connecting to Unit Power Supply and I/O Power Supply

The following power supplies are required to operate the EtherCAT network.

- Unit power supply: For communication and internal operation of Slave Units.
- I/O power supply: For input/output operation of external I/O devices of each Slave Unit.

This section explains how to supply the unit power supply and I/O power supply.

4-3-1 Precautions at Supplying Unit Power and I/O Power

When supplying the unit power supply and I/O power supply, take the followings into consideration for allowable current of cables and connectors, voltage drop, and layout of power supplies.

- **Consideration to cable voltage drop**

The power supply voltage of a Slave Unit farthest to the power supply must be within the allowable variation range.

- **Supplying unit power supply and I/O power supply from multiple sources**

When the unit power and I/O power are supplied from multiple power supplies instead of from one power supply, the line current, voltage drop, and cable size can be reduced. Moreover, it is effective to secure safety of the system at power supply errors.

- **If power supply errors occur**

Consideration on layout and grouping of power supplies differ by whether you want to stop the entire system or not when a power supply error occurs.

If you want to avoid stopping the entire system, we recommend to set power supplies at several locations and supply power to groups of Slave Units, or take similar measures.

This has also the effects of reducing voltage drop and cable size and so on.

4-3-2 Unit Power Supply Specifications

Use a general purpose power supply that satisfies the following specifications.

Item	Specification
Output voltage	24 VDC \pm 10%
Output ripple	600 mVp-p
Output current	Has the capacity to supply power more than the total current consumption of each Slave Unit
Isolation	Between output and AC power supply as well as between output and chassis ground

We recommend S8JX series power supplies made by OMRON for the unit power supply for Slave Units.

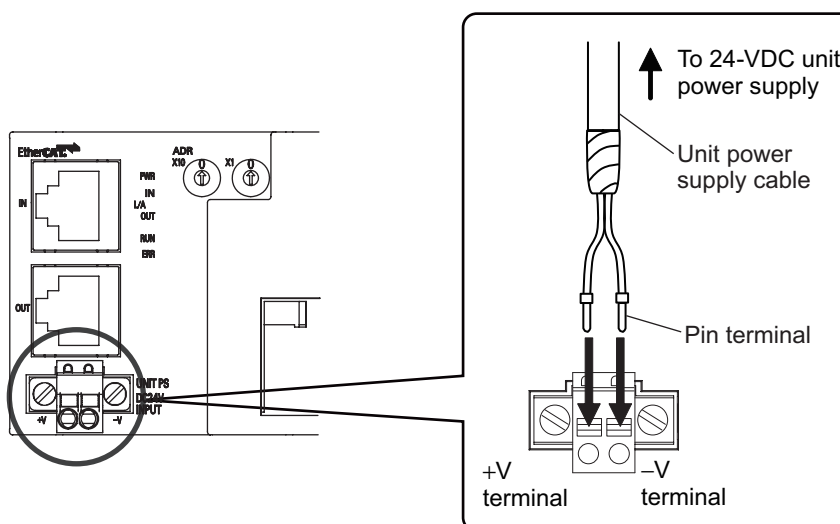


Precautions for Correct Use

- The I/O power supply for the input section of the e-CON connector type Slave Units is shared with the unit power supply. To calculate the output current of the unit power supply, be sure to use "unit power supply current consumption" to which "input current" and "input connection device supply current" have been added.
- Use a power supply with sufficient capacity considering the inrush current at startup.

4-3-3 Connecting the Unit Power Supply

Connect a cable from the 24-VDC unit power supply to the unit power supply connector on each Slave Unit, and supply power to individual Slave Units.



Mount a pin terminal, or equivalent to the unit power supply cable so that it will not be displaced.

● **Recommended product**

The following pin terminals are recommended for the unit power supply cables.

Model	Applicable wire size	Crimping tool	Manufacturer
AI0,5-10WH	0.5 mm/AWG20	CRIMPFOX UD6 (Product No. 1204436) or CRIMPFOX ZA3 series	Phoenix Contact Co., Ltd.
H0.5/16 orange	0.5 mm/AWG20	Crimper PZ1.5 (Product No. 900599)	Weidmueller Japan Co., Ltd.

Also, the following screwdriver is recommended for removing pin terminals.

Model	Manufacturer
XW4Z-00C	OMRON

4-3-4 Connecting the I/O Power Supply

● **Units with screw terminal blocks**

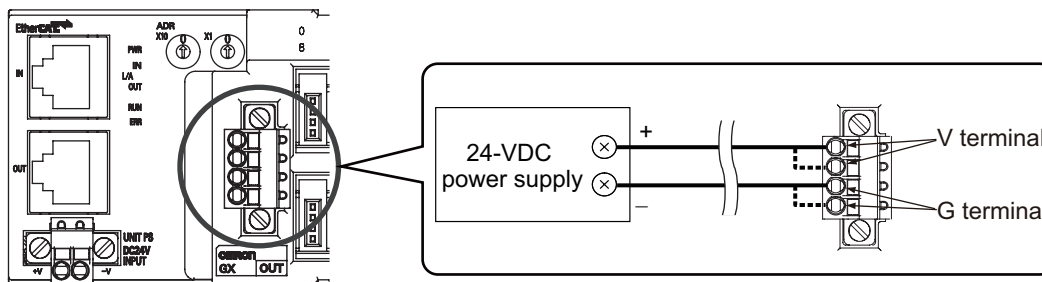
It supplies the 24-VDC I/O power to the I/O power supply terminal on each Slave Unit. For the locations of I/O power supply terminals, see the terminal layout diagrams for each Slave Unit or wiring diagrams in Chapter 7 to Chapter 10. Moreover, for how to connect power supplies to terminals, refer to "4-4-1 Connecting to a Screw Terminal Block" in Page 4 - 12.

● **Units with e-CON connectors**

The following e-CON connector type Slave Units (Output Slave Units and output sections of Input/Output Slave Units) are equipped with I/O power supply connectors to supply I/O power to external devices.

- GX-OD1618/OD1628/MD1618 (output section only)/MD1628 (output section only)
- GX-OD3218/OD3228/MD3218 (output section only)/MD3228 (output section only)

To connect external devices to these Slave Units, supply the 24-VDC I/O power to the I/O power supply connector.



Mount a pin terminal, or equivalent to the power supply cable so that it will not be displaced.

● Recommended product

The following pin terminals are recommended for the unit power supply cables.

Model	Applicable wire size	Crimping tool	Manufacturer
AI0,5-10WH	0.5 mm/AWG20	CRIMPFOX UD6 (Product No. 1204436) or CRIMPFOX ZA3 series	Phoenix Contact Co., Ltd.
H0.5/16 orange	0.5 mm/AWG20	Crimper PZ1.5 (Product No. 900599)	Weidmueller Japan Co., Ltd.

Also, the following screwdriver is recommended for removing pin terminals.

Model	Manufacturer
XW4Z-00C	OMRON

4-4 Connecting an External Device

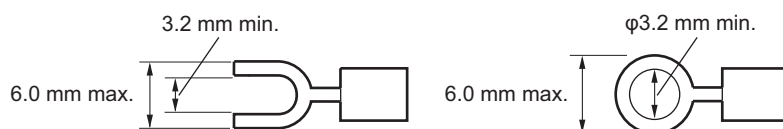
Connect an external device to the I/O terminal of a Slave Unit.

The method of connection differs between Units with screw terminal blocks and Units with e-CON connectors.

4-4-1 Connecting to a Screw Terminal Block

After mounting a crimp terminal to the cable of the external device to be connected, connect it to the terminal block.

- 1 Mount the following crimp terminal to the signal line of the cable.**



- 2 Connect the signal line to the terminal block.**

Tighten the terminal block screws to the appropriate tightening torque of 0.5 N • m.

The terminal block is removable; remove the left and right screws if it is necessary to remove the terminal block to connect the signal line.



Precautions for Correct Use

To remove the terminal block from the Slave Unit, loosen the left and right mounting screws alternately. When mounting the terminal block as well, tighten the left and right screws alternately.

If you tighten or loosen only one of the screws all the way without tightening or loosening the other screw using an electric screwdriver, the terminal block will be distorted and cracked.

4-4-2 Connecting to e-CON Connector Terminals

Connect the dedicated e-CON connector to the cables of the external device to be connected and then connect it to the connector terminal.

Checking the e-CON connector and cable wire size

The wire size and sheath diameter of applicable cables vary by the type of e-CON connector. Use the next table to check that the e-CON connectors to be used conform to the wire size and sheath diameter of the cables of the connected device.

● Tyco Electronics connectors

Model	Housing color	Applicable wire range	
3-1473562-4	Orange	Sheath diameter: 0.6 to 0.9 mm	Cross-sectional area: 0.08 to 0.5 mm ²
1-1473562-4	Red	Sheath diameter: 0.9 to 1.0 mm	
1473562-4	Yellow	Sheath diameter: 1.0 to 1.15 mm	
2-1473562-4	Blue	Sheath diameter: 1.15 to 1.35 mm	
4-1473562-4	Green	Sheath diameter: 1.35 to 1.60 mm	

● Sumitomo 3M connectors

Model	Housing color	Applicable wire range
37104-3101-000FL	Red	AWG26 (0.14mm ²) to AWG24 (0.2mm ²) Sheath diameter: 0.8 to 1.0 mm
37104-3122-000FL	Yellow	AWG26 (0.14mm ²) to AWG24 (0.2mm ²) Sheath diameter: 1.0 to 1.2 mm
37104-3163-000FL	Orange	AWG26 (0.14mm ²) to AWG24 (0.2mm ²) Sheath diameter: 1.2 to 1.6 mm
37104-2124-000FL	Green	AWG22 (0.3mm ²) to AWG20 (0.5mm ²) Sheath diameter: 1.0 to 1.2 mm
37104-2165-000FL	Blue	AWG22 (0.3mm ²) to AWG20 (0.5mm ²) Sheath diameter: 1.2 to 1.6 mm
37104-2206-000FL	Gray	AWG22 (0.3mm ²) to AWG20 (0.5mm ²) Sheath diameter: 1.6 to 2.0 mm

● Panasonic Electric Works connectors

Model	Housing color	Applicable wire range
AXF12142	Red	AWG22 (0.3mm ²) to AWG20 (0.5mm ²) Sheath diameter: 1.2 to 2.0 mm
AXF12146	Yellow	AWG28 (0.08mm ²) to AWG24 (0.2mm ²) Sheath diameter: 0.7 to 1.2 mm

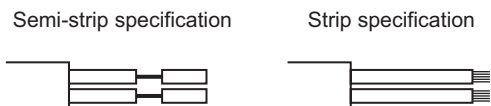
● OMRON connectors

Model	Specification	Applicable wire range
XN2A-1430	Spring clamp type	AWG28 (0.08mm ²) to AWG20 (0.5mm ²) Sheath diameter: 1.5 mm max.

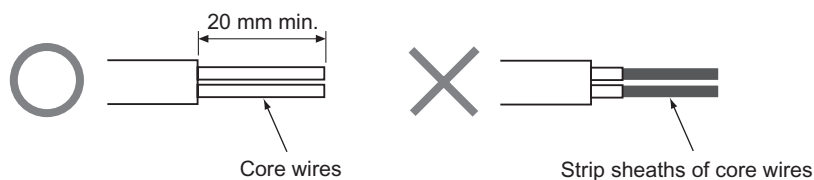
Processing external devices cables

● Using Tyco Electronics, Sumitomo 3M or Panasonic Electric Works connectors

Cables of connected devices are normally cut in semi-strip or strip specification as shown in the next figures.

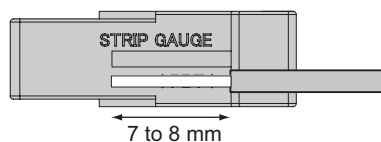


When the cables are prepared this way, an e-CON connector cannot be attached. First cut the end and remove the cable sheath as shown in the following diagram. (Do not strip the sheaths of the core wires.)



● Using OMRON connectors

Align the cable with the STRIP GAUGE described on the side of the connector. Remove 7 to 8 mm of the wiring sheath, and twist the exposed wires several times.



Inserting wires into the cable connector

Insert the cable wire of the extend device to the cable connector.

Make sure that the terminal numbers printed on the connector cover matches the colors of wires as shown in the next table.

Terminal number	NPN Slave Unit		PNP Slave Unit	
	3-wire sensor	2-wire sensor	3-wire sensor	2-wire sensor
1	Brown (red)	–	Brown (red)	Brown (white)
2	–	–	–	–
3	Blue (black)	Blue (black)	Blue (black)	–
4	Black (white)	Brown (white)	Black (white)	Blue (black)

Notes Wire colors have been changed according to revisions in the JIS standards for photoelectric sensors and proximity sensors.

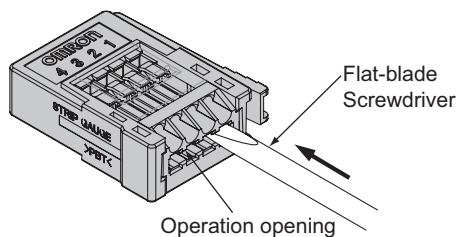
The colors in parentheses are the wire colors prior to the revisions.

● Using Tyco Electronics, Sumitomo 3M or Panasonic Electric Works connectors

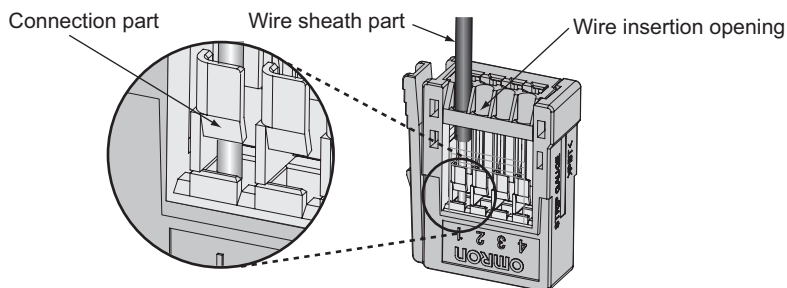
- 1** Insert the wire all the way to the wire insertion opening on the cover of the cable connector.
- 2** Use a pliers, or equivalent to press the cover into the body. At this point, press the cover straight in such that the cover is horizontal to the body.

● Using OMRON connectors

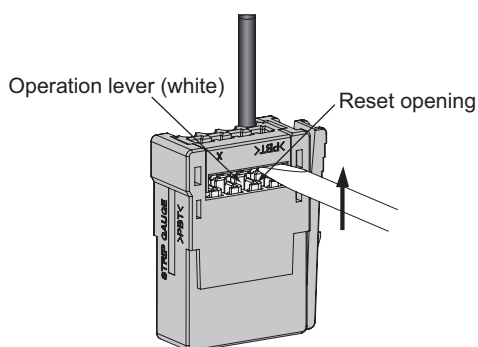
- 1** Use a flat-blade screwdriver to push the operation lever inside the connector's operation opening until it locks, as shown in the following diagram.



- 2** Insert the wire all the way to the back of the wire insertion opening.
Check that the sheath of the wire is inserted into the wire insertion opening, and that the end of the conductor has passed through the connection part.



- 3** Insert a screwdriver into the reset opening and pull back the operation lever lightly.
A click will be heard and the operation lever will return to its normal position.



- 4** Lightly pull the wire to confirm that it is connected properly.



Precautions for Correct Use

To remove a wire, push in the operation lever, check that the operation lever has locked, and then pull out the wire. Also, after removing the wire, always return the operation lever to its normal position.

5

EtherCAT Communications

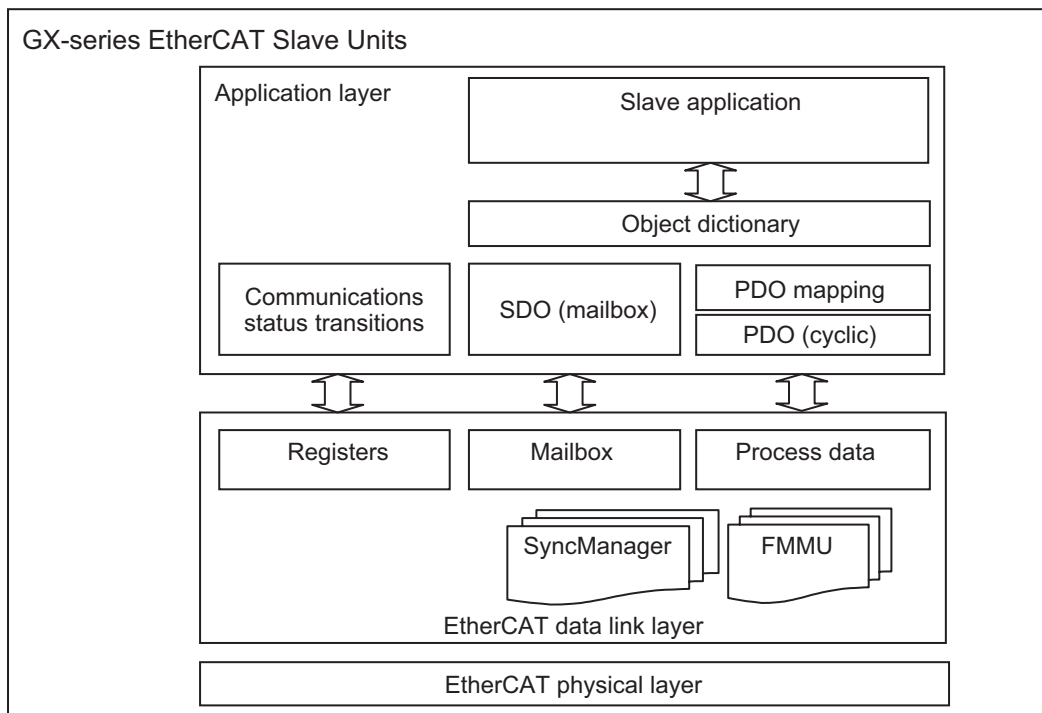
This chapter explains the overview of EtherCAT communications.

5-1	Structure of CAN application protocol over EtherCAT (CoE)	5-2
5-2	EtherCAT Slave Information File (ESI File)	5-3
5-3	Communications State Transitions	5-4
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5-1 Structure of CAN application protocol over EtherCAT (CoE)

Normally, multiple protocols can be transferred by EtherCAT. But GX-series EtherCAT Slave Units use "CAN application protocol over EtherCAT (CoE)", a communication interface to be applied for EtherCAT devices, as the device profile of the open network standard "CAN application protocol."

The figure below shows the structure of CoE in GX-series EtherCAT Slave Units.



CAN application protocol has two types of object dictionaries, PDO (Process Data Object) and SDO (Service Data Object) .

PDO is composed of object dictionaries that can be mapped. The process data is defined by PDO mapping.

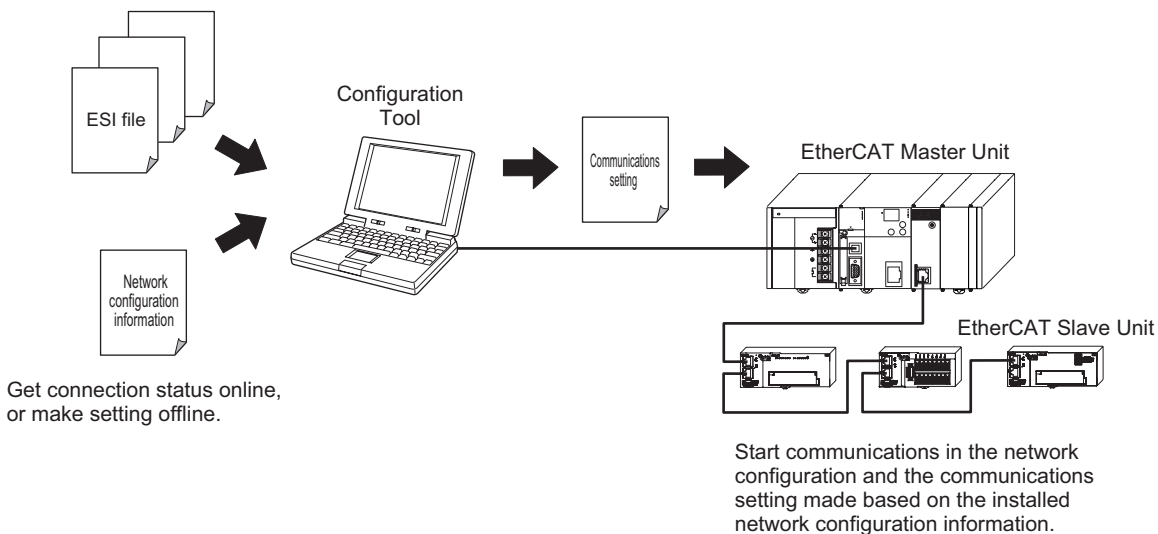
PDO is primarily used in PDO communications for regularly exchanging process data.

Moreover, SDO is able to read and write all object dictionaries and is used in non-fixed-cycle type SDO (event type messages) communications.

By using the CoE interface to set object SDO and PDO dictionaries, EtherCAT can provide EtherCAT devices with the same device profile as CAN application protocol.

5-2 EtherCAT Slave Information File (ESI File)

An EtherCAT Slave Information (ESI) file contains the setting information of an EtherCAT Slave Unit. Various EtherCAT communications setting can be defined from the ESI files of connected Slave Units and the network connection information. A communications setting is created in an ESI file by using the network setting software (Configuration Tool). Then it is transferred to the EtherCAT Master Unit to establish a communications network.

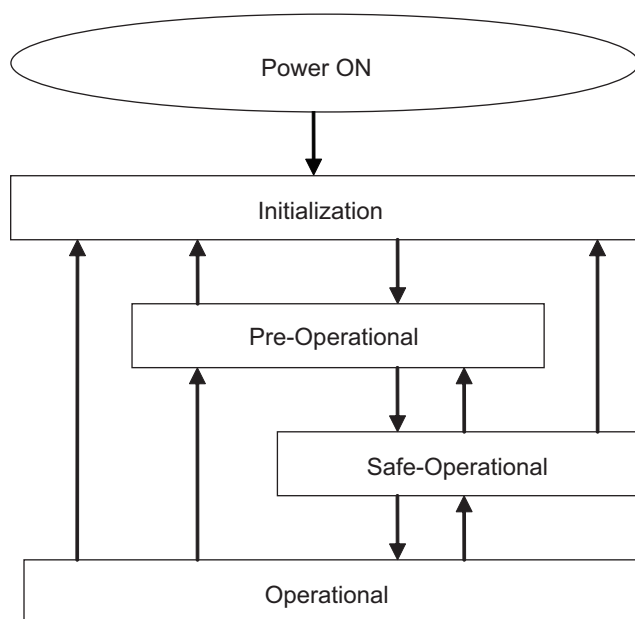


5-2 EtherCAT Slave Information File (ESI File)

5-3 Communications State Transitions

The EtherCAT State Machine (ESM) indicates the state transition model of EtherCAT Slave Unit communications control. It is controlled by EtherCAT Master Unit.

The following figure shows the communications state transitions from power ON.

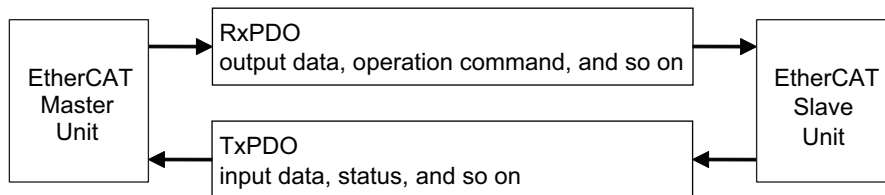


State	SDO communications	PDO transmission	PDO reception	Contents
Initialization (Init)	Not possible.	Not possible.	Not possible.	Communications are being initialized. Communications are not possible.
Pre-Operational (Pre-Op)	Possible	Not possible.	Not possible.	SDO (message) communications are possible in this state. This state is entered after initialization has been completed. It is used to initialize network settings.
Safe-Operational (Safe-Op)	Possible	Possible	Not possible.	In this state, PDO transmissions are possible in addition to SDO (message) communications. PDO sendings can be used to send information such as status from the Slave Unit.
Operational (Op)	Possible	Possible	Possible	Normal communication state PDO communications can be used to control the I/O data.

5-4 Process Data Objects (PDO)

5-4-1 Overview

The process data objects (PDO) are used for real-time data transfer via cyclic communications. There are two types in PDO: RxPDO that receives data from the EtherCAT Master Unit and TxPDO that sends the present value from a EtherCAT Slave Unit to the EtherCAT Master Unit.



It is possible to hold multiple objects in the EtherCAT application layer so that various process data of EtherCAT Slave Units can be transferred. The details of process data are described in PDO Mapping Objects and Sync Manager PDO Assignment Objects.

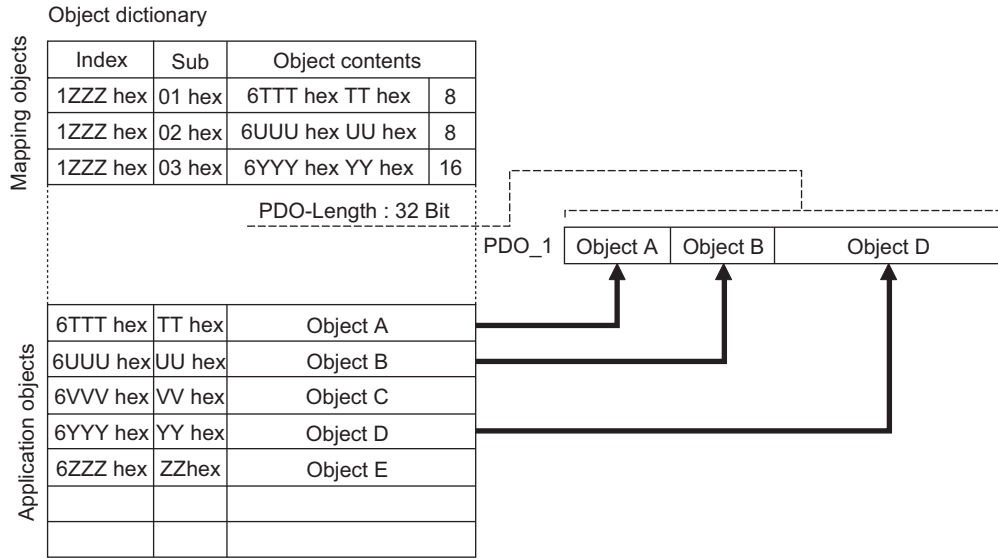
GX-series EtherCAT Slave Units support PDO mapping for I/O control.

5-4-2 PDO Mapping Settings

The PDO mapping indicates the mapping for application objects (realtime process data) between the object dictionary and PDO.

The number of mapped objects is described in sub-index 0 of the mapping table. In this mapping table, indexes 1600 hex to 17FF hex are used for RxPDO and 1A00 hex to 1BFF hex are used for TxPDO.

The figure below shows an example of PDO mapping.

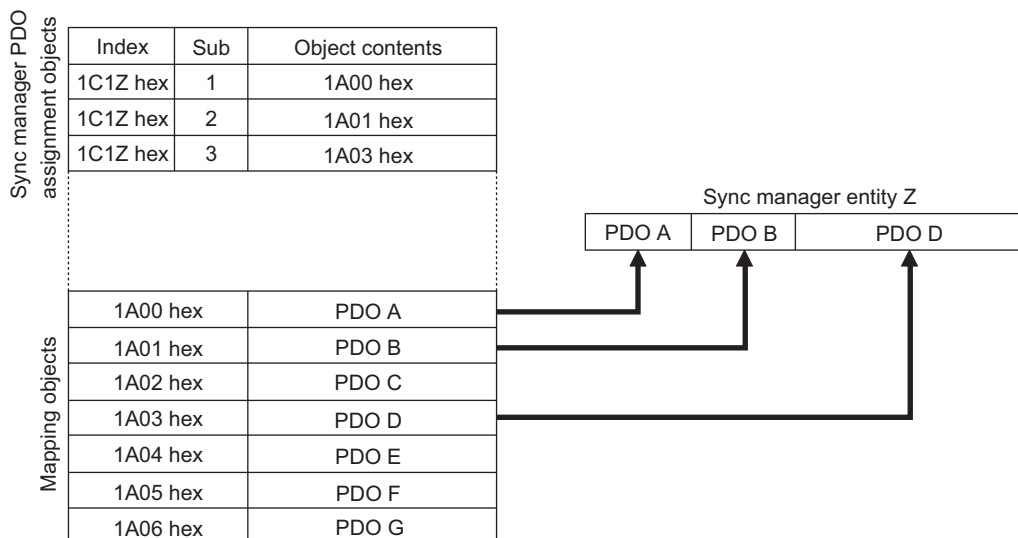


5-4-3 Sync Manager PDO Assignment Settings

A sync manager channel consists of several PDOs. The sync manager PDO assignment objects describe how these PDOs are related to the Sync Manager.

The number of PDOs is given in sub-index 0 of the sync manager PDO assignment table. In this table, index 1C12 hex is for RxPDOs and 1C13 hex is for TxPDOs.

The figure below shows an example of sync manager PDO mapping.



5-4-4 Fixed PDO Mapping

The tables below show the details of fixed PDO mapping for GX-series EtherCAT Slave Units. Note that it is not possible to change fixed PDO details.

● **PDO mapping for Digital I/O Slave Unit**

Fixed PDO mapping of a Digital I/O Slave Unit is determined by the number of inputs and/or outputs per Unit and whether or not Expansion Units are connected.

1st RxPDO (1700 hex)	8 outputs of Slave Unit	Write output 16-bit (6300 hex)	
	8 outputs of Expansion Unit only		
	16 outputs of Slave Unit only		
	16 outputs of Expansion Unit only		
	16 outputs of Slave Unit and 8 outputs of Expansion Unit (24 outputs in total)	Write output 32-bit (6320 hex)	
	32 outputs of Slave Unit only		
1st TxPDO (1B00 hex)	16 outputs of Slave Unit and 16 outputs of Expansion Unit (32 outputs in total)	Read input 16-bit (6100 hex)	
	8 inputs of Slave Unit		
	8 inputs of Expansion Unit only		
	16 inputs of Slave Unit only		
	16 inputs of Expansion Unit only		
	16 inputs of Slave Unit and 8 inputs of Expansion Unit (24 inputs in total)		Read input 32-bit (6120 hex)
	32 inputs of Slave Unit only		
16 inputs of Slave Unit and 16 inputs of Expansion Unit (32 inputs in total)			

● **PDO mapping for Analog I/O Slave Unit**

1st RxPDO (1700 hex)	Write analogue output 16-bit (6411 hex) *1
1st TxPDO (1B00 hex)	Read analogue input 16-bit (6401 hex) *2

*1 Analog Output Slave Unit only

*2 Analog Input Slave Unit only

● PDO mapping for Encoder Input Slave Unit

1st RxPDO (1700 hex)	Instruction Bits (4020 hex)
2nd RxPDO (1701 hex)	Preset Value (4011 hex)
1st TxPDO (1B00 hex)	Position Value (4010 hex)
2nd TxPDO (1B01 hex)	Latch Value A (4012 hex)
3rd TxPDO (1B02 hex)	Latch Value B (4013 hex)
4th TxPDO (1B03 hex)	Status Bits (4030 hex)

5-5 Service Data Object (SDO)

5-5-1 Overview

GX-series EtherCAT Slave Units support the SDO communications.

The EtherCAT Master Unit is able to make parameter settings and monitor status by reading and writing data from and to entries in object dictionaries via the SDO communications.

5-5-2 Abort Codes

The table below shows abort codes of SDO communications errors.

Code	Meaning
05030000 hex	Toggle bit not changed
05040000 hex	SDO protocol timeout
05040001 hex	Client/Server command specifier not valid or unknown
05040005 hex	Out of memory
06010000 hex	Unsupported access to an object
06010001 hex	Attempt to read a write only object
06010002 hex	Attempt to write to a read only object
06020000 hex	The object does not exist in the object directory.
06040041 hex	The object cannot be mapped into the PDO.
06040042 hex	The number and length of the objects to be mapped would exceed the PDO length.
06040043 hex	General parameter incompatibility reason
06040047 hex	General internal incompatibility in the device.
06060000 hex	Access failed due to a hardware error.
06070010 hex	Data type does not match, length of service parameter does not match.
06070012 hex	Data type does not match, length of service parameter too high.
06070013 hex	Data type does not match, length of service parameter too low.
06090011 hex	Sub-index does not exist.
06090030 hex	Value range of parameter exceeded (only for write access)
06090031 hex	Value of parameter written too high
06090032 hex	Value of parameter written too low
06090036 hex	Maximum value is less than minimum value.
08000000 hex	General error
08000020 hex	Data cannot be transferred or stored to the application.
08000021 hex	Data cannot be transferred or stored to the application because of local control.
08000022 hex	Data cannot be transferred or stored to the application because of the present device state.
08000023 hex	Object dictionary dynamic generation fails or no object dictionary is present.

5-6 EtherCAT Master Unit - Slave Unit Communications

This section explains the communication modes between the Master Unit and GX-series EtherCAT Slave Unit.

5-6-1 FREE RUN Mode

In the FREE RUN mode, a Slave Unit operates asynchronously with the EtherCAT Master Unit.

The Digital I/O Slave Units and Analog I/O Slave Units operate in the FREE RUN mode.

Note that Slave Unit's internal processing time varies by the Slave Unit type, refer to the explanation on each Slave Unit in Chapter 7 to Chapter 8.

(Digital I/O Slave Units: ON delay, OFF delay, Analog I/O Slave Units: Cycle time)

To calculate the input and output response time* of the entire system, refer to the relevant values in the manual of the host system (EtherCAT Master or CPU Unit) to be used.

* This is the time which takes for an input signal from an Input Slave Unit to be processed by the PLC of the Master Unit and output to an Output Slave Unit.

5-6-2 DC Mode

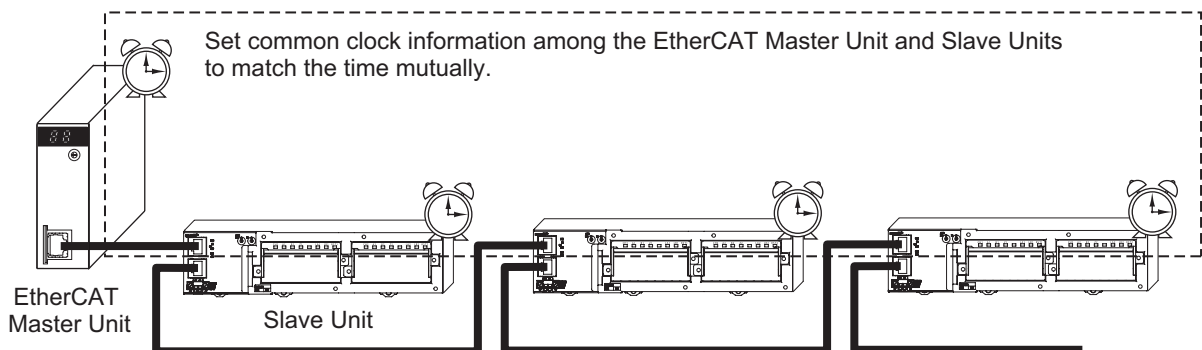
In the DC mode, a Slave Unit operates synchronously with the EtherCAT Master Unit.

A mechanism called distributed clock (DC), where the EtherCAT Master Unit and Slave Units share the same clock, is used for synchronization.

Each of DC mode-ready Slave Units connected to EtherCAT shares the clock information.

By generating interrupt signals and executing input/output processing inside each Slave Unit according to the clock, it becomes possible to synchronize the input/output timing with other Slave Units.

The DC mode supported by Encoder Input Slave Units is DC mode 1.



- **Communications cycle**

The communications cycle is determined by setting output frequency of Sync0 signal (interrupt signal in DC mode 1).

125 μ s, 250 μ s, 500 μ s, 1 ms, 2 ms, 4 ms

The settings are performed on the EtherCAT Master Unit side. For the setting method, refer to the manual of the EtherCAT Master Unit to be used.

5-7 Emergency Messages

GX-series EtherCAT Slave Units are able to notify emergency messages to the EtherCAT Master Unit by using the SDO communications if they detect errors.

5-7-1 Emergency Message Notification

It is possible to set whether or not to notify emergency messages via the SDO communications. Target indexes are sub-index 05 hex: (Flags) in 10F3 hex (Diagnostic History).

The setting values are shown in the table below.

Set value	Emergency message notification
0000 hex	Not notify.
0001 hex	Notify.

When the power to it is turned on, a Slave Unit always starts up in the "Notify" setting. If you want to use a Slave Unit in the "Not notify" setting, set it to "Not notify" each time you turn on the power. Note that an emergency message cannot be sent during an EtherCAT communications errors are occurring.

An emergency message is composed of 8-byte data as shown below.

Byte	0	1	2	3	4	5	6	7
Contents	Emergency error code *		Error register (Object 1001 hex)	Reserved				

* Error codes common to EtherCAT are used.

For contents of emergency message, refer to "11-1-3 Emergency Error Code" in page 11 - 11.

5-7-2 Diagnosis History

GX-series EtherCAT Slave Units are able to store up to 8 emergency messages in EEPROM within the Slave Units, and read the saved messages via the SDO communications. Indexes to be read are sub-indexes 06 hex to 13 hex (Diagnosis messages 1 to 8) among 10F3 hex (Diagnosis History).

Diagnosis history is stored from Diagnosis message 1. If 8 errors are stored in order up to Diagnosis message 8, the 9th error onward are saved from Diagnosis message 1 again.

History is saved even if emergency messages cannot be sent to the EtherCAT Master Unit due to EtherCAT communications errors or emergency messages are set to "Not notify."

Note that the history is not saved while errors related to EEPROM are occur.

6

Basic Specifications of Slave Units

This chapter explains EtherCAT communication specifications, Slave Units performance specifications, and the specifications of common areas.

6-1 EtherCAT Communications Specifications	6-2
6-2 General Specifications	6-3
6-3 Specifications of Common Areas	6-4
6-3-1 Status Indicators	6-4
6-3-2 Node Address Setting Switches	6-6
6-3-3 Communications Connectors	6-7
6-3-4 Unit Power Supply Connector	6-7

6-1 EtherCAT Communications Specifications

This section explains the communications specifications of the GX-series EtherCAT Slave Unit.

Item	Specification
Communication protocol	Dedicated protocol for EtherCAT
Modulation	Base band
Baud rate	100 Mbps
Physical layer	100BASE-TX (IEEE802.3)
Connectors	RJ45 × 2 (Shielded) CN IN: EtherCAT input CN OUT: EtherCAT output
Topology	Daisy chain
Communications media	Category 5 or higher (cable with double, aluminum tape and braided shielding is recommended.)
Communications distance	Distance between nodes (Slave Units): 100 m max.
Noise immunity	Conforms to IEC 61000-4-4, 1 kV or higher
Node address setting method	Set with decimal rotary switch or Configuration Tool
Node address range	1 to 99: Set with rotary switch 1 to 65535: Set with Configuration Tool
Indicator	PWR × 1 L/A IN (Link/Activity IN) × 1 L/A OUT (Link/Activity OUT) × 1 RUN × 1 ERR × 1
Process data	Fixed PDO mapping
PDO size/node	2 bit to 256 byte
Mailbox	Emergency messages, SDO requests, SDO responses, and SDO information
SYNCHRONIZATION mode	Digital I/O Slave Unit and Analog I/O Slave Unit: Free Run mode (asynchronous) Encoder Input Slave Unit: DC mode 1

6-2 General Specifications

This section explains the general specifications of the GX-series EtherCAT Slave Unit.

Item	Specification
Unit power supply voltage	20.4 to 26.4 VDC (24 VDC -15% to +10%)
I/O power supply voltage	20.4 to 26.4 VDC (24 VDC -15% to +10%)
Noise immunity	Conforms to IEC 61000-4-4, 2 kV (power line).
Vibration resistance	Malfunction 10 to 60 Hz with amplitude of 0.7 mm, 60 to 150Hz and 50 m/s ² in each of X, Y, and Z directions for 80 minutes <GX-OC1601 Relay Output Unit only> 10 to 55 Hz with double-amplitude of 0.7 mm
Shock resistance	150 m/s ² with amplitude of 0.7 mm <GX-OC1601 Relay Output Unit only> 100 m/s ² (3 times each in 6 directions on 3 axes)
Dielectric strength	600 VAC (between isolated circuits)
Insulation resistance	20 MΩ or more (between isolated circuits)
Ambient operating temperature	-10 to 55 °C
Ambient operating humidity	25% to 85% (with no condensation)
Ambient operating atmosphere	No corrosive gases
Storage temperature	-25 to 65 °C
Storage humidity	25% to 85% (with no condensation)
Terminal block screws tightening torque*	M3 wiring screws: 0.5 N • m M3 terminal block mounting screws: 0.5 N • m
Mounting method	35-mm DIN track mounting

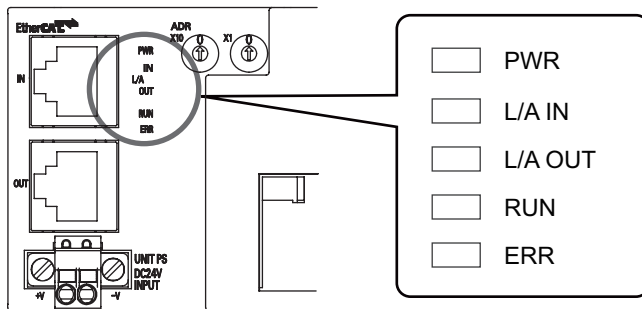
* Applicable only to 2-tier terminal block and 3-tier terminal block type Slave Units.

6-3 Specifications of Common Areas

This section explains the specifications of indicator, switches, and connectors commonly mounted in each Slave Unit.

6-3-1 Status Indicators

It indicates the current state of an EtherCAT Slave Unit.



[PWR] indicator

Indicates the unit power supply state.

Color	State	Contents
Green	OFF	Unit power OFF state
	ON	The unit power (24 VDC) is supplied to the Slave Unit.

[L/A IN] indicator

Indicates the communication state (input side).

Color	State	Contents
Green	OFF	Link not established in physical layer
	Flickering	In operation after establishing link
	ON	Link established in physical layer

[L/A OUT] indicator

Indicates the communication state (output side).

Color	State	Contents
Green	OFF	Link not established in physical layer
	Flickering	In operation after establishing link
	ON	Link established in physical layer

[RUN] indicator

It indicates the operation state.

Color	State	Contents
Green	OFF	Init state
	Blinking	Pre-Operational state
	Single flash	Safe-Operational state
	ON	Operational state

For details on each state, refer to "5-3 Communications State Transitions" in page 5 - 4.

[ERR] indicator

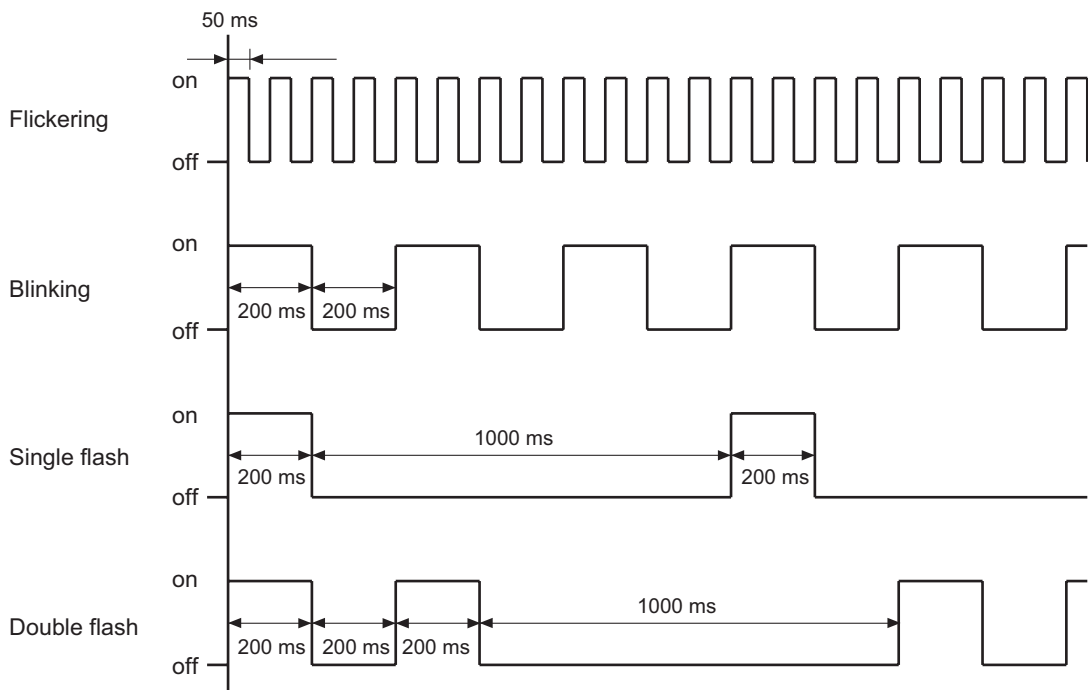
It indicates the information of an error.

Color	State	Contents
Red	OFF	No error
	Blinking	Communications setting error
	Single flash	Synchronization error or communications data error
	Double flash	Application WDT timeout
	Flickering	Boot error
	ON	PDI WDT timeout



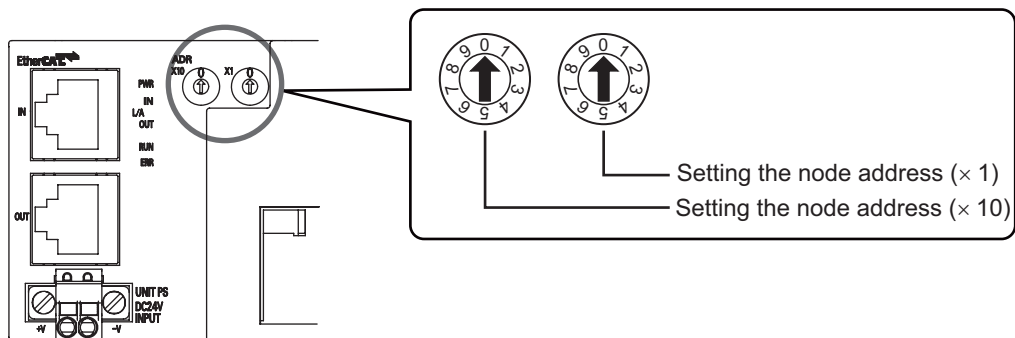
Reference

The timing of each flashing state of indicator is as follows.



6-3-2 Node Address Setting Switches

These switches are used to set node addresses of Slave Units in the EtherCAT network (decimal). The 10s digit is set on the left rotary switch and the 1s digit is set on the right rotary switch. Setting range is 00 to 99. (Default setting: 00)



Note that the node address set values vary as shown below when the EtherCAT Master Unit is made by OMRON or by other manufacturers.

Set value for switch	Set value for node address	
	OMRON EtherCAT Master Unit	EtherCAT Master Unit from another manufacturer
00	Set value according to Configuration Tool (1 to 65535)	Set value according to Configuration Tool (settings by these switches are irrelevant)
01 to 99	Set value by these switches	

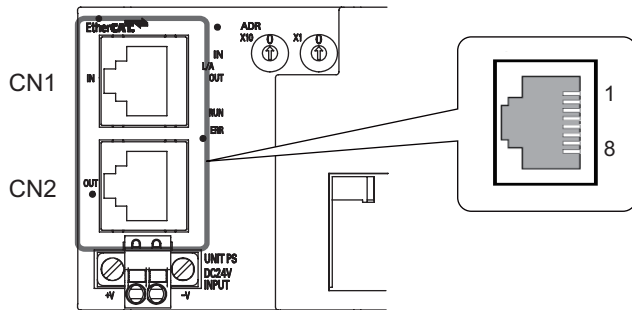


Precautions for Correct Use

- The switch settings are read only once when the power supply is turned ON. Even if the settings are changed after turning the power supply ON, they are not reflected in the control. They become effective when the power supply is turned ON the next time.
- If node addresses overlap, an error occurs and the operation stops.

6-3-3 Communications Connectors

The Connectors are used to connect the communications cables.



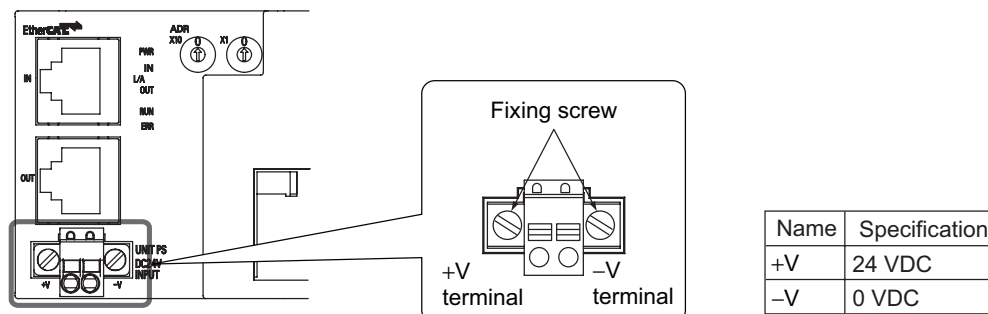
The specifications are shown below.

- Electrical characteristics: Conforms to the IEEE 802.3 standard.
- Connector structure: RJ45 8-pin modular connector (conforms to ISO 8877)
- Terminal arrangement

Pin No.	Signal name	Abbreviation
1	Send data +	TD +
2	Send data -	TD -
3	Receive data +	RD +
4	Not used	-
5	Not used	-
6	Receive data -	RD -
7	Not used	-
8	Not used	-
Hood	Frame ground	FG

6-3-4 Unit Power Supply Connector

The Connector is used to connect the unit power supply (24 VDC).



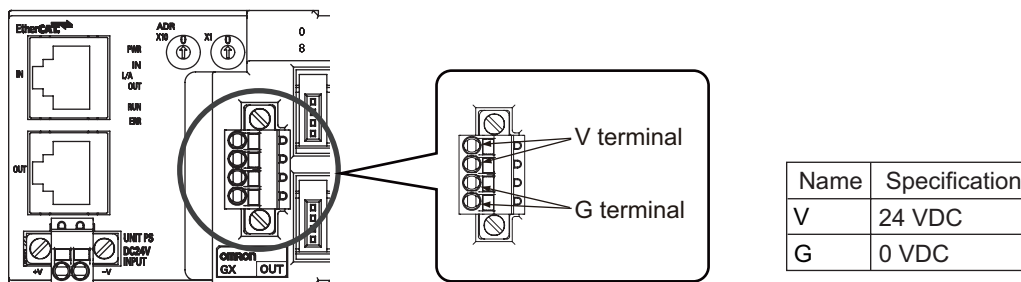
- Connector type: Spring connection connector with fixing screw (2-pin)
- Supported pin terminal diameter: 0.25 mm² to 0.5 mm²/AWG24 to AWG20
(Pin terminal with isolation sleeve used)

For types of recommended pin terminals, refer to "4-3-3 Connecting the Unit Power Supply" in page 4 - 9.

6-3-5 I/O Power Supply Connector

Connect I/O power supply for external device operation (24 VDC). It is mounted in the following e-CON connector type Slave Units with output contacts.

GX-OD1618/OD1628/MD1618/MD1628/OD3218/OD3228/MD3218/MD3228



- Connector type: Spring connection connector with fixing screw (4-pin)
- Supported pin terminal diameter: 0.25 mm² to 0.5 mm²/AWG24 to AWG20 (Pin terminal with isolation sleeve used)

For types of recommended pin terminals, refer to "4-3-4 Connecting the I/O Power Supply" in page 4 - 10.

7

Digital I/O Slave Unit

This chapter explains the overview of the Digital I/O Slave Unit.

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7-4-11	e-CON Connector Type 32-point Input Slave Unit GX-ID3218/ID3228	7-59
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7-1 Digital I/O Slave Unit

Digital I/O Slave Units refer to slaves with processing functions for digital I/O data (ON/OFF signals). Moreover, this Slave Unit has the input filter function (input only) and the output setting function at communications error (output only).

7-2 I/O Data Allocation (PDO Mapping)

I/O data of Digital I/O Slave Units are allocated to the input/output areas of the I/O memory of the EtherCAT Master Unit, respectively.

For the detailed explanation of allocation method, refer to the manual of EtherCAT Master Unit to be connected.

7-2-1 Input Data Allocation

Input data of Digital I/O Slave Units consists of 2 types: Input data of the Slave Unit and input data of Expansion Unit (if mounted). The data is allocated in this order in units of bytes.

Input data allocation example

● 8-point Input Slave Unit

Offset (byte)	7 bit	0 bit
0	Input data of the Slave Unit (7 to 0 bit)	
+1	Reserved	

● 16-point Input Slave Unit

Offset (byte)	7 bit	0 bit
0	Input data of the Slave Unit (7 to 0 bit)	
+1	Input data of the Slave Unit (15 to 8 bit)	

● 32-point Input Slave Unit

Offset (byte)	7 bit	0 bit
0	Input data of the Slave Unit (7 to 0 bit)	
+1	Input data of the Slave Unit (15 to 8 bit)	
+2	Input data of the Slave Unit (23 to 16 bit)	
+3	Input data of the Slave Unit (31 to 24 bit)	

● 8-point Expansion Unit

Offset (byte)	7 bit	0 bit
0	Input data of the Expansion Unit (7 to 0 bit)	
+1	Reserved	

● **16-point Expansion Unit**

Offset (byte)	7 bit	0 bit
0	Input data of the Expansion Unit (7 to 0 bit)	
+1	Input data of the Expansion Unit (15 to 8 bit)	

● **16-point Input Slave Unit and 8-point Expansion Unit**

Offset (byte)	7 bit	0 bit
0	Input data of the Slave Unit (7 to 0 bit)	
+1	Input data of the Slave Unit (15 to 8 bit)	
+2	Input data of the Expansion Unit (7 to 0 bit)	
+3	Reserved	

● **16-point Input Slave Unit and 16-point Expansion Unit**

Offset (byte)	7 bit	0 bit
0	Input data of the Slave Unit (7 to 0 bit)	
+1	Input data of the Slave Unit (15 to 8 bit)	
+2	Input data of the Expansion Unit (7 to 0 bit)	
+3	Input data of the Expansion Unit (15 to 8 bit)	

7-2-2 Output Data Allocation

Output data of Digital I/O Slave Units consists of 2 types: Output data of the Slave Unit and output data of Expansion Unit (if mounted). The data is allocated in this order in units of bytes.

Output data allocation example

● 8-point Output Slave Unit

Offset (byte)	7 bit	0 bit
0	Output data of the Slave Unit (7 to 0 bit)	
+1	Reserved	

● 16-point Output Slave Unit

Offset (byte)	7 bit	0 bit
0	Output data of the Slave Unit (7 to 0 bit)	
+1	Output data of the Slave Unit (15 to 8 bit)	

● 32-point Output Slave Unit

Offset (byte)	7 bit	0 bit
0	Output data of the Slave Unit (7 to 0 bit)	
+1	Output data of the Slave Unit (15 to 8 bit)	
+2	Output data of the Slave Unit (23 to 16 bit)	
+3	Output data of the Slave Unit (31 to 24 bit)	

● 8-point Expansion Unit

Offset (byte)	7 bit	0 bit
0	Output data of the Expansion Unit (7 to 0 bit)	
+1	Reserved	

● **16-point Expansion Unit**

Offset (byte)	7 bit	0 bit
0	Output data of the Expansion Unit (7 to 0 bit)	
+1	Output data of the Expansion Unit (15 to 8 bit)	

● **16-point Output Slave Unit and 8-point Expansion Unit**

Offset (byte)	7 bit	0 bit
0	Output data of the Slave Unit (7 to 0 bit)	
+1	Output data of the Slave Unit (15 to 8 bit)	
+2	Output data of the Expansion Unit (7 to 0 bit)	
+3	Reserved	

● **16-point Output Slave Unit and 16-point Expansion Unit**

Offset (byte)	7 bit	0 bit
0	Output data of the Slave Unit (7 to 0 bit)	
+1	Output data of the Slave Unit (15 to 8 bit)	
+2	Output data of the Expansion Unit (7 to 0 bit)	
+3	Output data of the Expansion Unit (15 to 8 bit)	

7-3 Functions of Digital I/O Slave Units

Digital I/O Slave Units have the following convenient functions, in addition to the I/O signal processing.

7-3-1 Input Filter

Overview of functions

- **Purpose**

This function prevents data changes and unstable data, which may be caused by fluctuation of input data and unstable contact state due to chattering and noise.

- **Applicable Slave Unit**

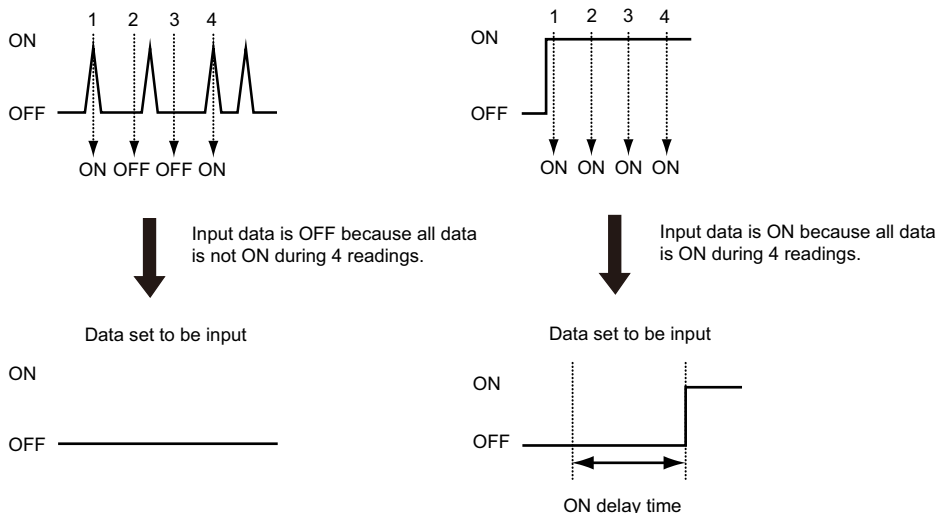
Slave Units with digital inputs and Expansion Units (GX-IDxxxx, input section of GX-MDxxxx, XWT-IDxx (-1))

- **Details of functions**

This function reads inputs (ON/OFF) within a certain set time and turn ON the inputs if they are all same (all ON or all OFF), and turn them OFF if not.

Note that this function works for all inputs of Slave Units and Expansion Units at the same time.

When the input shifts from OFF to ON (or ON to OFF), it is read 4 times from that point at an interval of 1/4 of the set time. When all read results are ON (or OFF), the input is turned ON (or OFF).



The settable time of reading is 0 ms, 0.5 ms, 1 ms (default set value), 2 ms, 4 ms, 8 ms, 16 ms, or 32 ms.

Note that when this function is used, the timing when the contact actually turns ON (or OFF) is delayed for the set time (ON delay time).

The ON delay time is expressed by "input delay time (time required to read input) + input filter time." Moreover, if the input filter is used for the Expansion Units as well, the ON delay time becomes longer because the input delay time is longer than when only Slave Unit is used.

Setting method

The settings are made using the SDO communication.

The target index is 3000 hex.

For the set values, refer to the information in the corresponding index of "Appendix A-1 Object Dictionary" in Page A - 15.

7-3-2 Error Mode Output

Overview of functions

- **Purpose**

This function provides selection whether to hold or clear the outputs if signals from the EtherCAT Master Unit cannot be received any longer due to communications errors.

- **Applicable Slave Unit**

Slave Units with digital outputs and Expansion Units (GX-ODxxxx, GX-OC1601, output section of GX-MDxxxx, XWT-ODxx (-1))

- **Details of functions**

Sets whether to hold or clear the output at communications errors.

It is possible to make setting for each contact. (Default setting: Clear all outputs)

Setting method

The settings are made using the SDO communication.

The target index is set as follows according to the number of outputs of a single Slave Unit (including Expansion Units mounted).

Total output capacity	Output Unit capacity	Expansion Unit Output capacity	Applicable index
8 points	8 points	–	6306 hex
	–	8 points	
16 points	16 points	–	
	–	16 points	
24 points	16 points	8 points	6326 hex
32 points	16 points	16 points	
	32 points	–	

For the set value, refer to the information of the corresponding index of "Appendix A-1 Object Dictionary" in Page A - 17.

7-4 Specifications for Each Slave Unit

This section shows the specification of Digital I/O Slave Units, names and functions of each part, internal circuit diagram, and wiring diagram.

Refer to the following corresponding page to each model.

Type	Model	Reference page			
		Specification	Names and functions	Internal circuits diagram	Wiring diagram
2-tier terminal block type	GX-ID1611 GX-ID1621	7-10	7-11	7-12	7-13
	GX-OD1611 GX-OD1621	7-14	7-15	7-16	7-17
	GX-OC1601	7-18	7-19	7-21	7-21
	GX-MD1611 GX-MD1621	7-22	7-24	7-25	7-26
3-tier terminal block type	GX-ID1612 GX-ID1622	7-28	7-29	7-30	7-31
	GX-OD1612 GX-OD1622	7-33	7-34	7-35	7-36
	GX-MD1612 GX-MD1622	7-38	7-40	7-41	7-42
e-CON connector type	GX-ID1618 GX-ID1628	7-44	7-45	7-46	7-47
	GX-OD1618 GX-OD1628	7-48	7-49	7-50	7-51
	GX-MD1618 GX-MD1628	7-53	7-55	7-56	7-57
	GX-ID3218 GX-ID3228	7-59	7-60	7-62	7-63
	GX-OD3218 GX-OD3228	7-64	7-65	7-66	7-67
	GX-MD3218 GX-MD3228	7-69	7-71	7-72	7-73

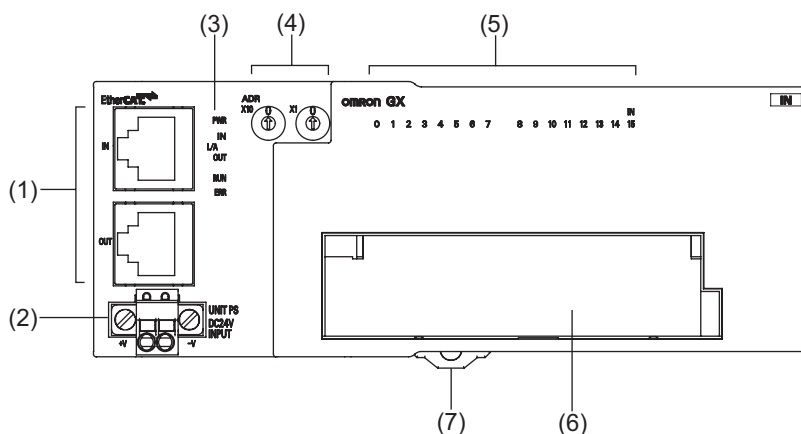
7-4-1 2-tier Terminal Block Type 16-point Input Slave Unit GX-ID1611/ID1621

Specification

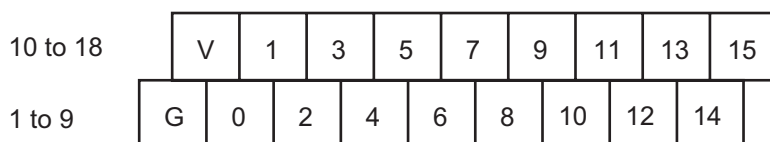
Item	Specification	
	GX-ID1611	GX-ID1621
Input capacity	16 points	
Internal I/O common	NPN	PNP
ON voltage	15 VDC min. (between each input terminal and the V terminal)	15 VDC min. (between each input terminal and the G terminal)
OFF voltage	5 VDC max. (between each input terminal and the V terminal)	5 VDC max. (between each input terminal and the G terminal)
OFF current	1.0 mA max.	
Input current	6.0 mA max./input (at 24-VDC) 3.0 mA max./input (at 17-VDC)	
ON delay	0.1 ms max.	
OFF delay	0.2 ms max.	
Input filter value	Without filter, 0.5 ms, 1 ms, 2 ms, 4 ms, 8 ms, 16 ms, 32 ms (Default setting: 1 ms)	
Number of circuits per common	16 inputs/common	
Input indicators	LED display (yellow)	
Isolation method	Photocoupler isolation	
I/O power supply method	Supply by I/O power supply	
Unit power supply current consumption	90 mA max. (for 20.4 to 26.4-VDC power supply voltage)	
I/O power supply current consumption	5 mA max. (for 20.4 to 26.4-VDC power supply voltage)	
Weight	180 g max.	
Expansion functions	Enabled	
Short-circuit protection function	No	

Notes For the I/O power supply current value to V and G terminals, refer to "A-4 I/O Power Supply Current" in Page A - 33.

Names and functions



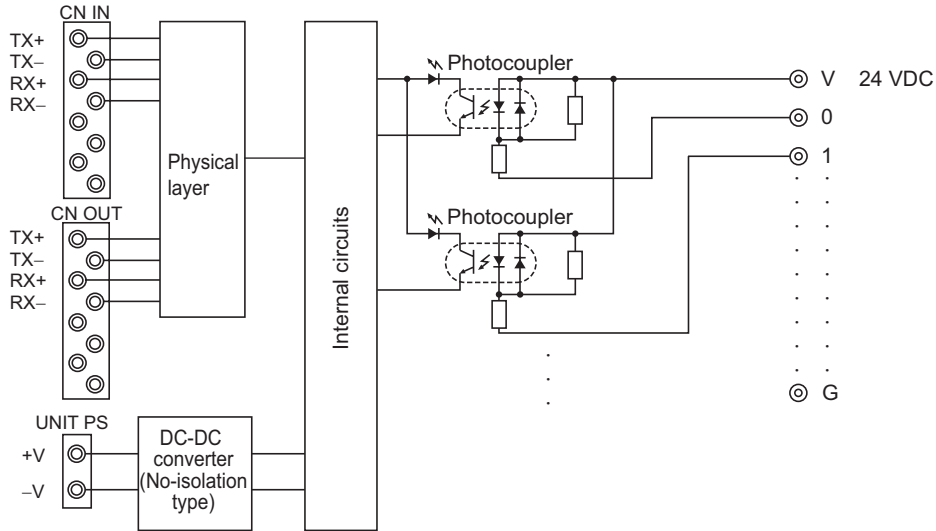
● Terminal arrangement diagram



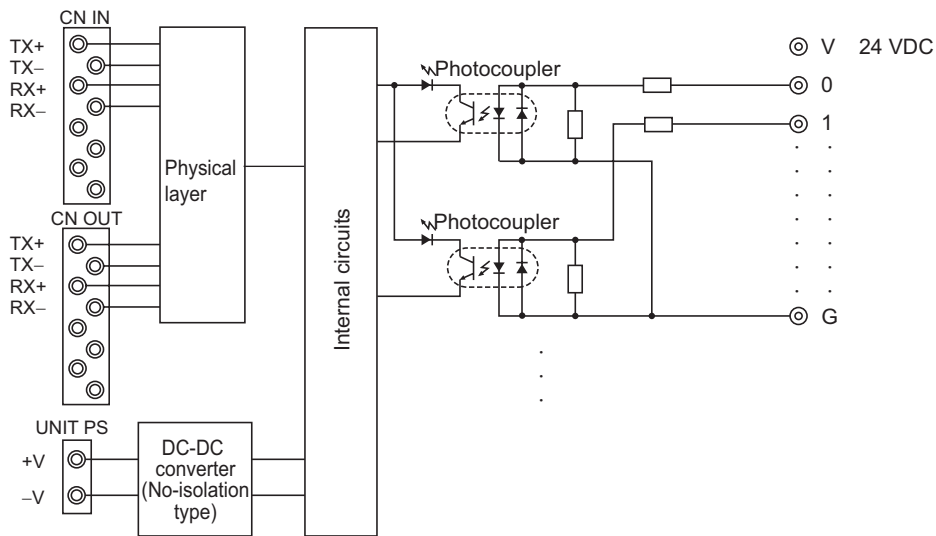
No.	Name	Function
(1)	Communications connectors	Refer to "6-3 Specifications of Common Areas" in Page 6 - 4.
(2)	Unit power supply connector	
(3)	Status indicators	
(4)	Node Address setting Switches	
(5)	Input indicators (0 to 15)	Indicates the state of an input contact (ON/OFF). Not lit: Contact OFF (input OFF state) Lit in yellow: Contact ON (input ON state)
(6)	Terminal block	Connects external devices and the I/O power supply. V, G: I/O power supply terminals 0 to 15: Input terminals
(7)	DIN track mounting hook	Fixes a Slave Unit to a DIN track.

Internal circuits diagram

● GX-ID1611 (NPN)

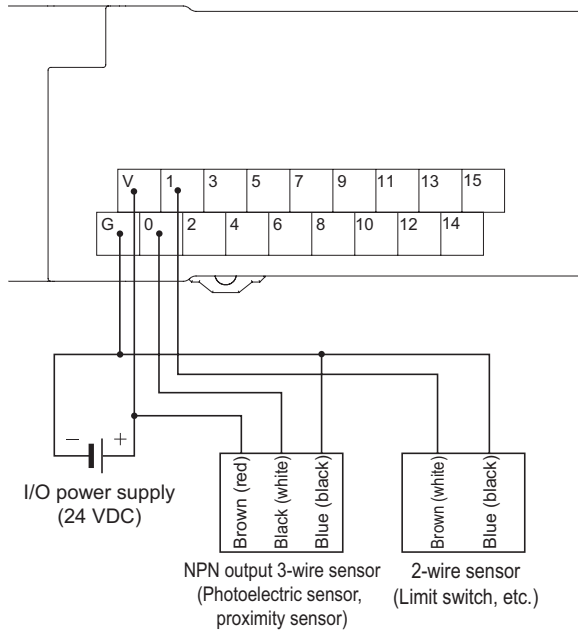


● GX-ID1621 (PNP)

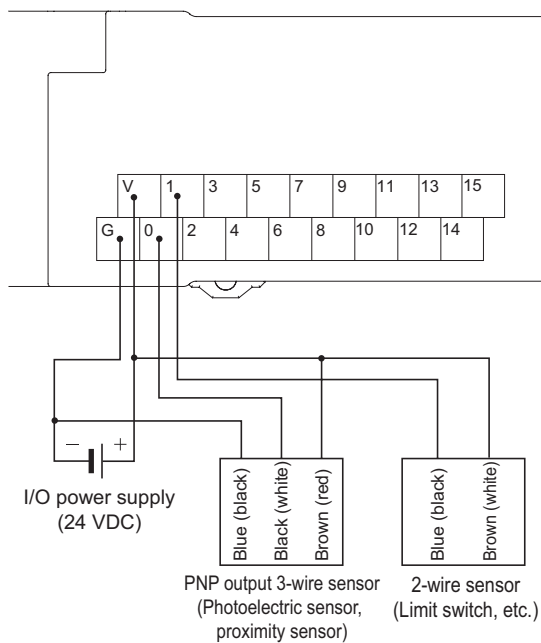


Wiring diagram

● GX-ID1611 (NPN)



● GX-ID1621 (PNP)



Reference

Wire colors have been changed according to revisions in the JIS standards for photoelectric and proximity sensors. The colors in parentheses are the wire colors prior to the revisions.

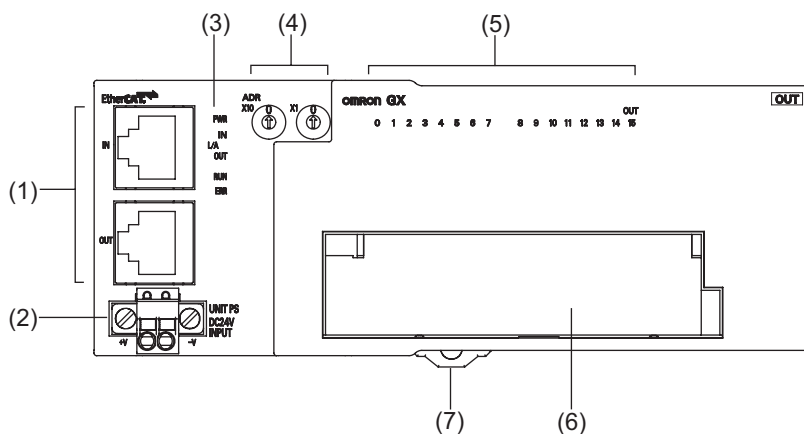
7-4-2 2-tier Terminal Block Type 16-point Output Slave Unit GX-OD1611/OD1621

Specification

Item	Specification	
	GX-OD1611	GX-OD1621
Output capacity	16 points	
Rated current (ON current)	0.5 A/output, 4.0 A/common	
Internal I/O common	NPN	PNP
Residual voltage	1.2 V max. (0.5 ADC, between each output terminal and the G terminal)	1.2 V max. (0.5 ADC, between each output terminal and the V terminal)
Leakage current	0.1 mA max.	
ON delay	0.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	16 points/common	
Output indicators	LED display (yellow)	
Isolation method	Photocoupler isolation	
I/O power supply method	Supply by I/O power supply	
Unit power supply current consumption	90 mA max. (for 20.4 to 26.4-VDC power supply voltage)	
I/O power supply current consumption	5 mA max. (for 20.4 to 26.4-VDC power supply voltage)	
Weight	180 g max.	
Expansion functions	Enabled	
Error Mode Output	Select either hold or clear.	
Short-circuit protection function	No	

Notes For the I/O power supply current value to V and G terminals, refer to "A-4 I/O Power Supply Current" in Page A - 33.

Names and functions



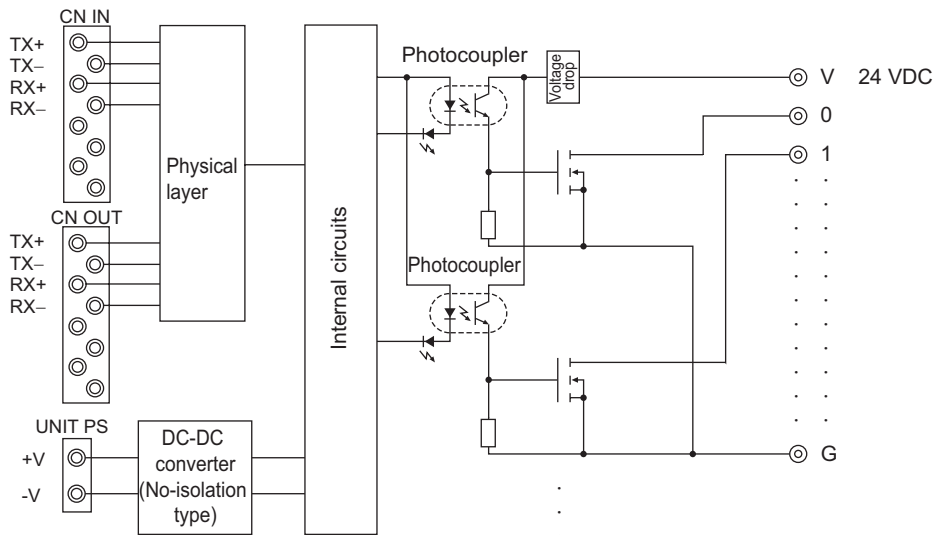
● Terminal arrangement diagram



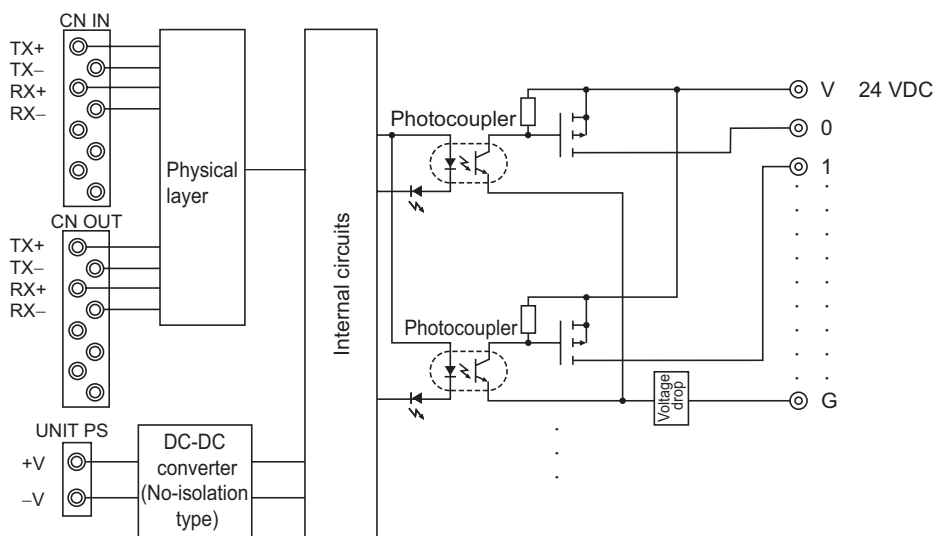
No.	Name	Function
(1)	Communications connectors	Refer to "6-3 Specifications of Common Areas" in Page 6 - 4.
(2)	Unit power supply connector	
(3)	Status indicators	
(4)	Node Address setting Switches	
(5)	Output indicators (0 to 15)	Indicates the state of an output contact (ON/OFF). Not lit: Contact OFF (output OFF state) Lit in yellow: Contact ON (output ON state)
(6)	Terminal block	Connects external devices and the I/O power supply. V, G: I/O power supply terminals 0 to 15: Output terminals
(7)	DIN track mounting hook	Fixes a Slave Unit to a DIN track.

Internal circuits diagram

● GX-OD1611 (NPN)

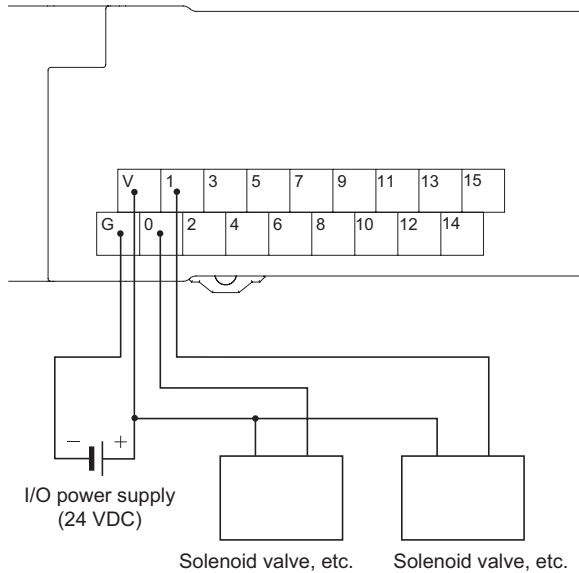


● GX-OD1621 (PNP)

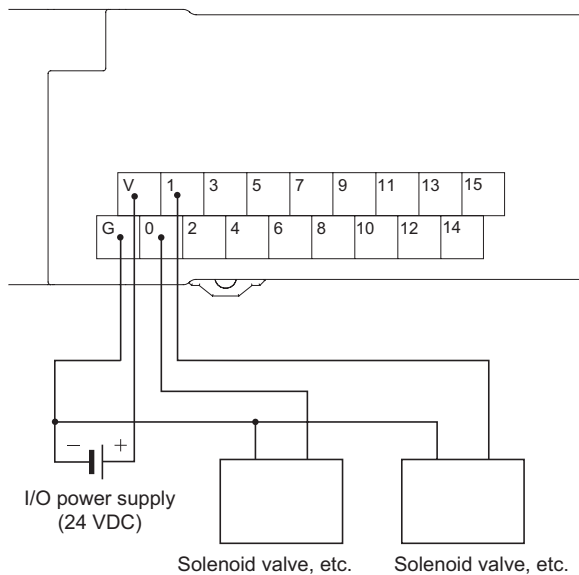


Wiring diagram

● GX-OD1611 (NPN)



● GX-OD1621 (PNP)



Precautions for Correct Use

When using an inductive load, such as a solenoid valve, either use a built-in diode for absorbing the counterelectromotive force or install an external diode.

7-4-3 2-tier Terminal Block Relay Type 16-point Output Slave Unit GX-OC1601

Specification

Item	Specification
Output capacity	16 points
Mounted relays	NY-5W-K-IE (Fujitsu Component) *
Rated load	Resistance load 250 VAC 2 A/output, common 8 A 30 VDC 2 A/output, common 8 A
Rated ON current	3 A/output
Maximum contact voltage	250 VAC, 125 VDC
Maximum contact current	3 A/output
Maximum switching capacity	750 VAAC, 90 WDC
Minimum applicable load (reference value)	5 VDC 1mA
Mechanical service life	20,000,000 operations min.
Electrical service life	100,000 operations min.
Number of circuits per common	8 points/common
Output indicators	LED display (yellow)
Isolation method	Relay isolation
I/O power supply method	The relay drive power is supplied from the unit power supply.
Unit power supply current consumption	210 mA max. (for 20.4 to 26.4-VDC power supply voltage)
Weight	290 g max.
Expansion functions	Enabled
Error Mode Output	Select either hold or clear.
Short-circuit protection function	No

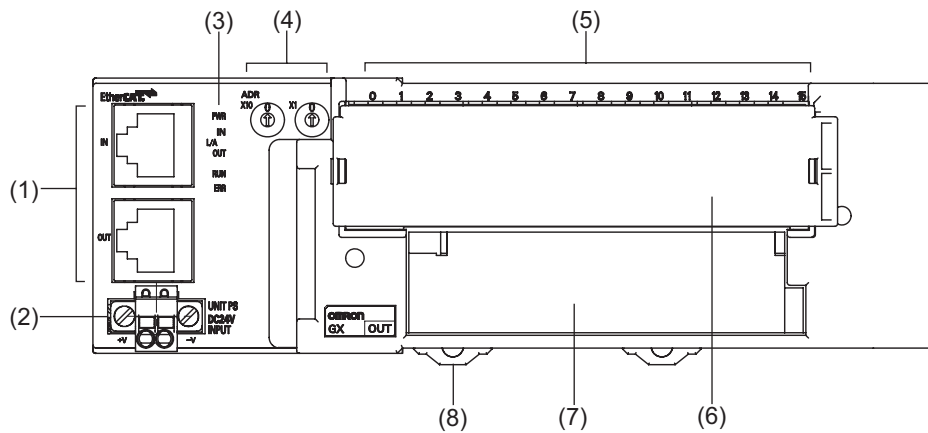
* For the specification of individual relay, refer to the data sheet disclosed by manufacturers.



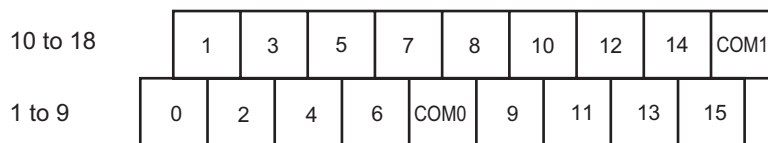
Precautions for Correct Use

- With a current of between 2 and 3 A (8 to 10 A per common), either ensure that the number of points per common that simultaneously turn ON does not exceed 4 or ensure that the ambient temperature does not exceed 45°C. There are no restrictions if the current does not exceed 2 A (8 A per common).
- The rated current is the value for assuring normal operation, but not for assuring durability of the relays. The relay service life depends greatly on factors such as the operating temperature, the type of load, and switching conditions. The actual relay must be checked under actual operating conditions.

Names and functions



● Terminal arrangement diagram



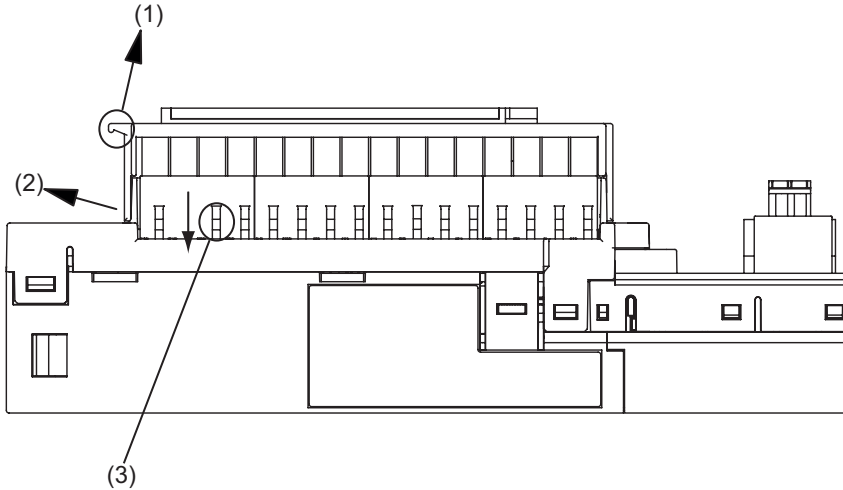
No.	Name	Function
(1)	Communications connectors	Refer to "6-3 Specifications of Common Areas" in Page 6 - 4.
(2)	Unit power supply connector	
(3)	Status indicators	
(4)	Node Address setting Switches	
(5)	Output indicators (0 to 15)	Indicates the state of an output contact (ON/OFF). Not lit: Contact OFF (output OFF state) Lit in yellow: Contact ON (output ON state)
(6)	Output relay	Switches a contact.
(7)	Terminal block	Connects external devices and the I/O power supply. COM0, COM1: Common terminals 0 to 15: Output terminals
(8)	DIN track mounting hook	Fixes a Slave Unit to a DIN track.



Reference

Replacing relays

To replace output section relays, first remove the cover using the following procedure.



- (1) Grab the handle with a finger and bend it upward.
- (2) The side deflects in the direction of the arrow and the hook is removed.
- (3) Press down the relay socket lever in the arrow direction using a driver and so on. The relay pops up from the socket and can be removed.

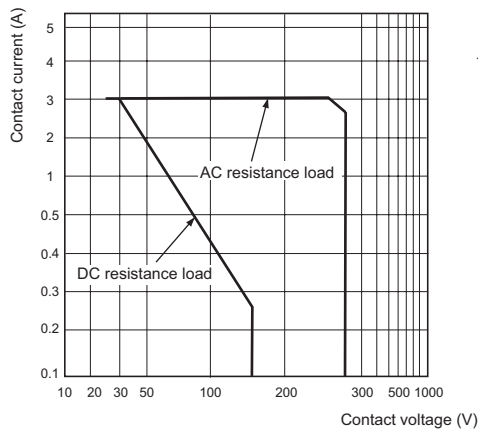


Reference

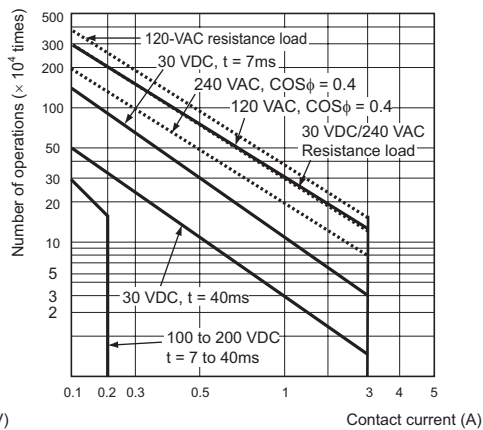
Relay actual measurement data

The graphs below show the actual measurement values of relay characteristics sampled from the production lines. There is some variation in relay characteristics, so use this data for reference only.

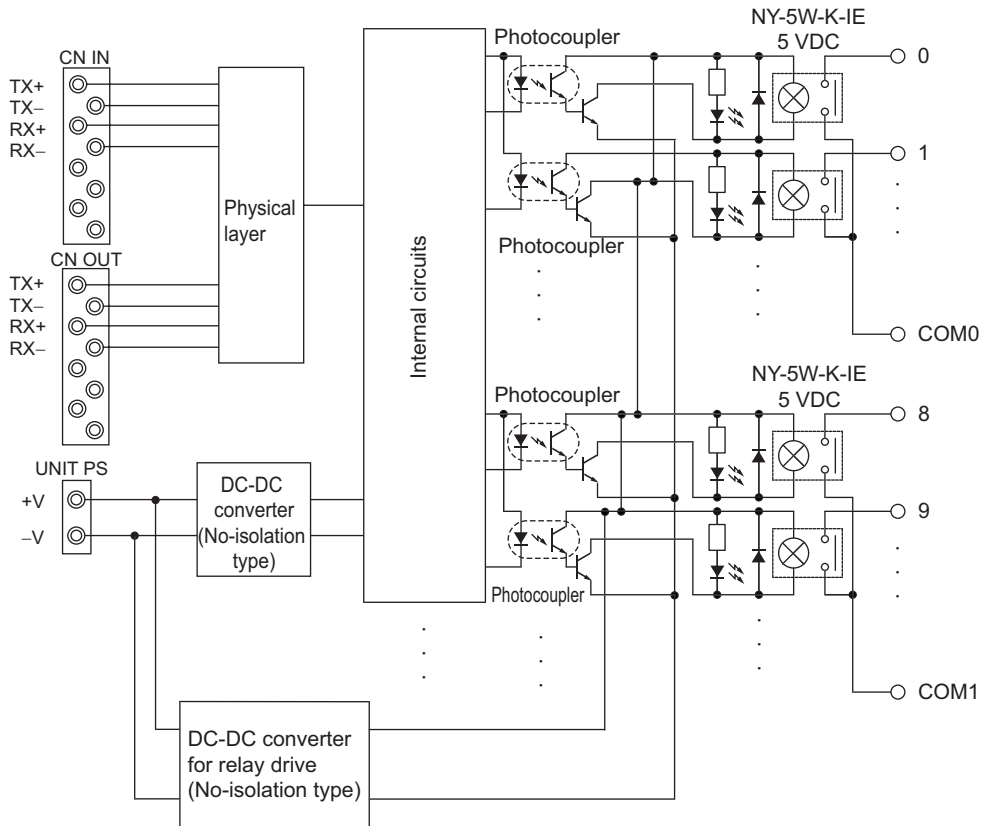
● Maximum switching capacity



● Durability curve



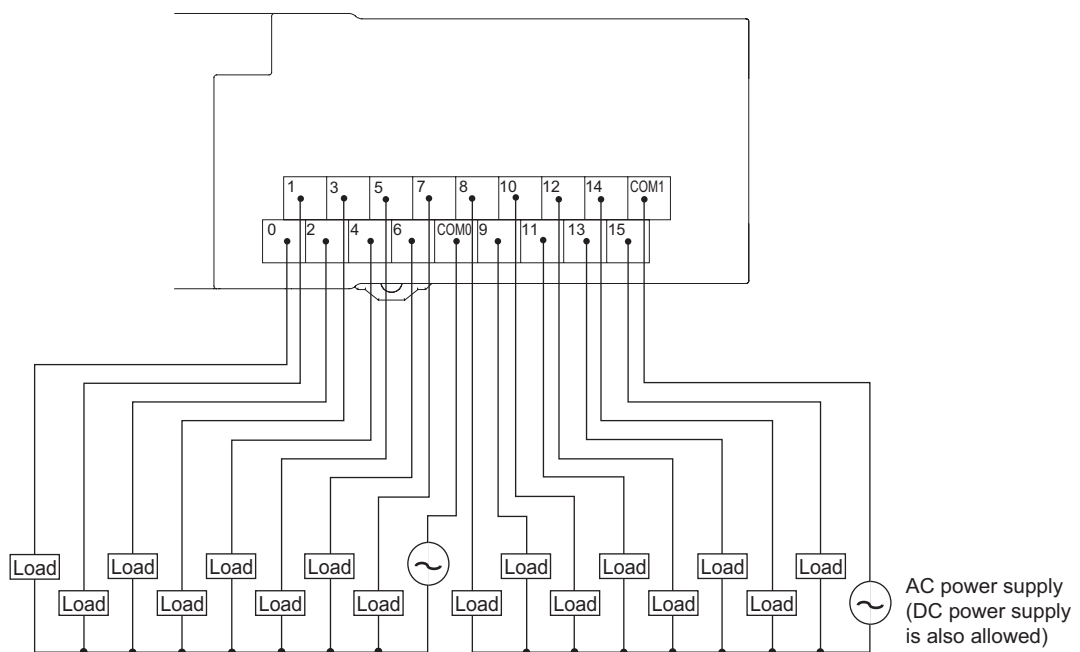
Internal circuits diagram



7-4 Specifications for Each Slave Unit

7

Wiring diagram



7-4-3 2-tier Terminal Block Relay Type 16-point Output Slave Unit GX-OC1601

7-4-4 2-tier Terminal Block Type 8-point Input and 8-point Output Slave Unit GX-MD1611/MD1621

Specification

● Common to input section and output section

Item	Specification	
	GX-MD1611	GX-MD1621
Internal I/O common	NPN	PNP
I/O indicators	LED display (yellow)	
Unit power supply current consumption	80 mA max. (for 20.4 to 26.4-VDC power supply voltage)	
Weight	190 g max.	
Expansion functions	No	
Short-circuit protection function	No	

● Input section

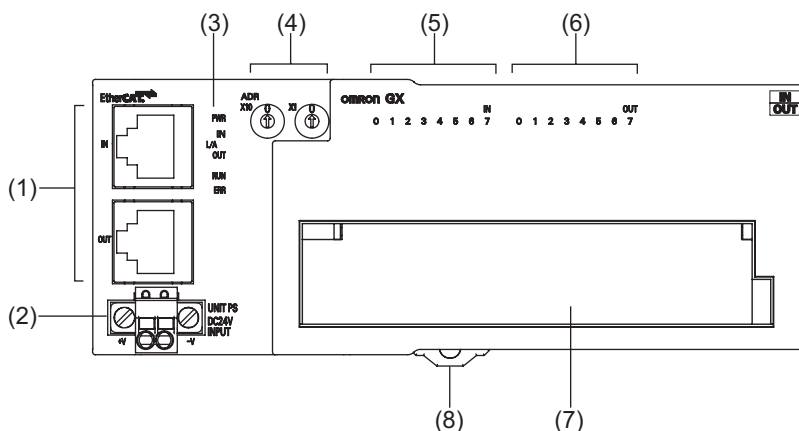
Item	Specification	
	GX-MD1611	GX-MD1621
Input capacity	8 points	
ON voltage	15 VDC min. (between each input terminal and the V terminal)	15 VDC min. (between each input terminal and the G terminal)
OFF voltage	5 VDC max. (between each input terminal and the V terminal)	5 VDC max. (between each input terminal and the G terminal)
OFF current	1.0 mA max.	
Input current	6.0 mA max./input (at 24-VDC) 3.0 mA max./input (at 17-VDC)	
ON delay	0.1 ms max.	
OFF delay	0.2 ms max.	
Input filter value	Without filter, 0.5 ms, 1 ms, 2 ms, 4 ms, 8 ms, 16 ms, 32 ms (Default setting: 1 ms)	
Number of circuits per common	8 points/common	
Isolation method	Photocoupler isolation	
I/O power supply method	Supply by I/O power supply	
I/O power supply current consumption	5 mA max. (for 20.4 to 26.4-VDC power supply voltage)	

● Output section

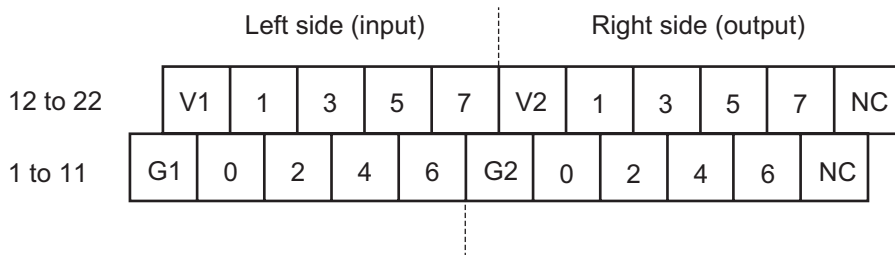
Item	Specification	
	GX-MD1611	GX-MD1621
Output capacity	8 points	
Rated output current	0.5 A/output, 2.0 A/common	
Residual voltage	1.2 V max. (0.5 ADC, between each output terminal and the G terminal)	1.2 V max. (0.5 ADC, between each output terminal and the V terminal)
Leakage current	0.1 mA max.	
ON delay	0.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	8 points/common	
Isolation method	Photocoupler isolation	
I/O power supply method	Supply by I/O power supply	
I/O power supply current consumption	5 mA max. (for 20.4 to 26.4-VDC power supply voltage)	
Error Mode Output	Select either hold or clear.	

Notes For the I/O power supply current value to V and G terminals ,refer to "A-4 I/O Power Supply Current" in Page A - 33.

Names and functions



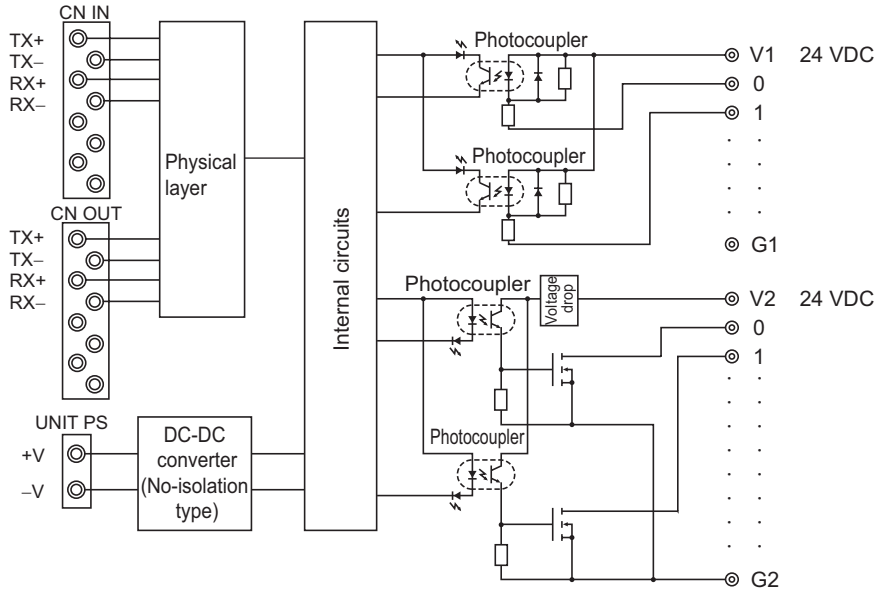
● Terminal arrangement diagram



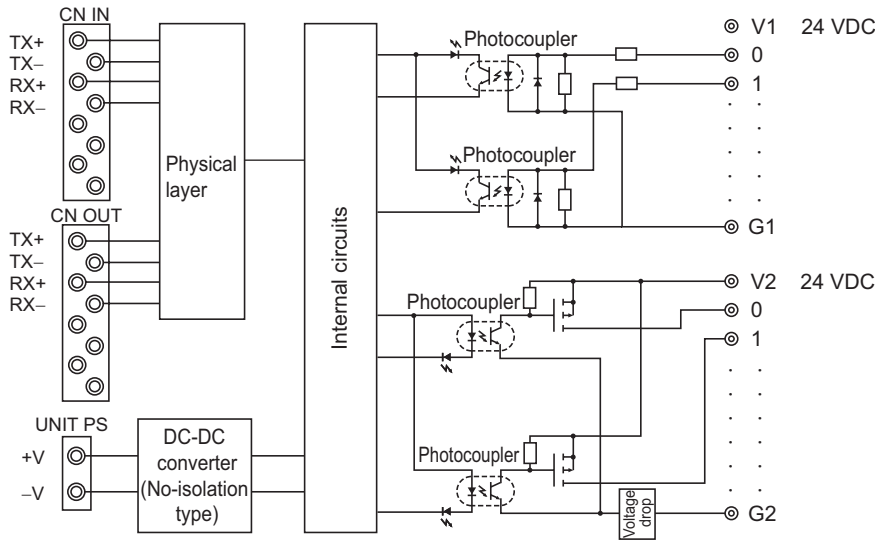
No.	Name	Function
(1)	Communications connectors	Refer to "6-3 Specifications of Common Areas" in Page 6 - 4.
(2)	Unit power supply connector	
(3)	Status indicators	
(4)	Node Address setting Switches	
(5)	Input indicators (0 to 7)	Indicates the state of an input contact (ON/OFF). Not lit: Contact OFF (input OFF state) Lit in yellow: Contact ON (input ON state)
(6)	Output indicators (0 to 7)	Indicates the state of an output contact (ON/OFF). Not lit: Contact OFF (output OFF state) Lit in yellow: Contact ON (output ON state)
(7)	Terminal block	Connects external devices and the I/O power supply. <Left side> V1, G1: Input side I/O power supply terminals 0 to 7: Input terminals <Right side> V2, G2: Output side I/O power supply terminals 0 to 7: Output terminals
(8)	DIN track mounting hook	Fixes a Slave Unit to a DIN track.

Internal circuits diagram

● GX-MD1611 (NPN)

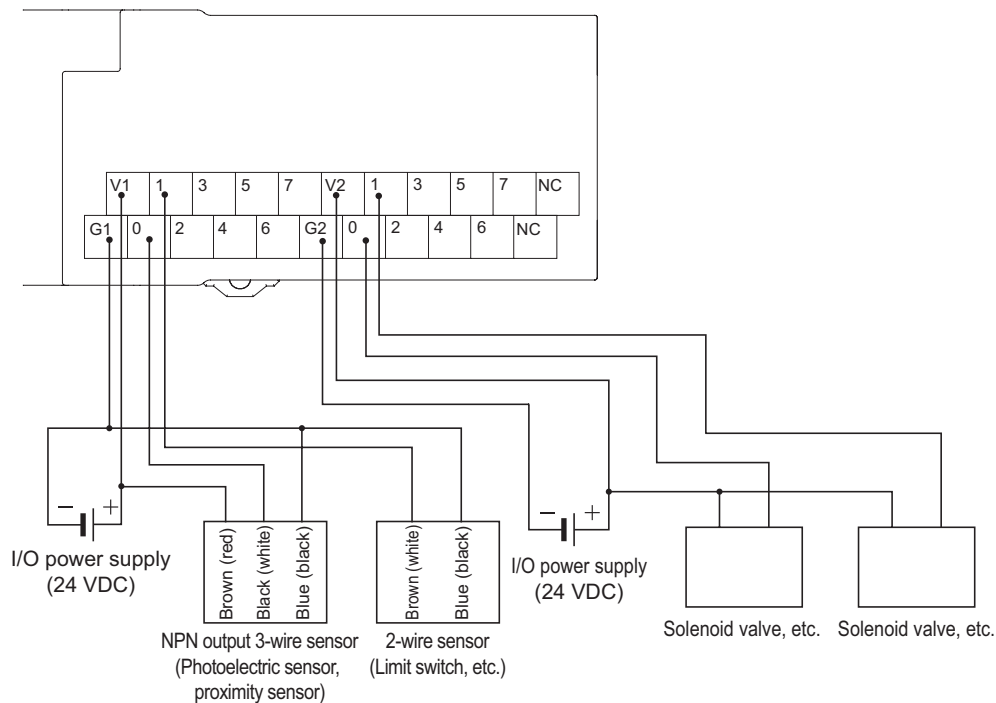


● GX-MD1621 (PNP)

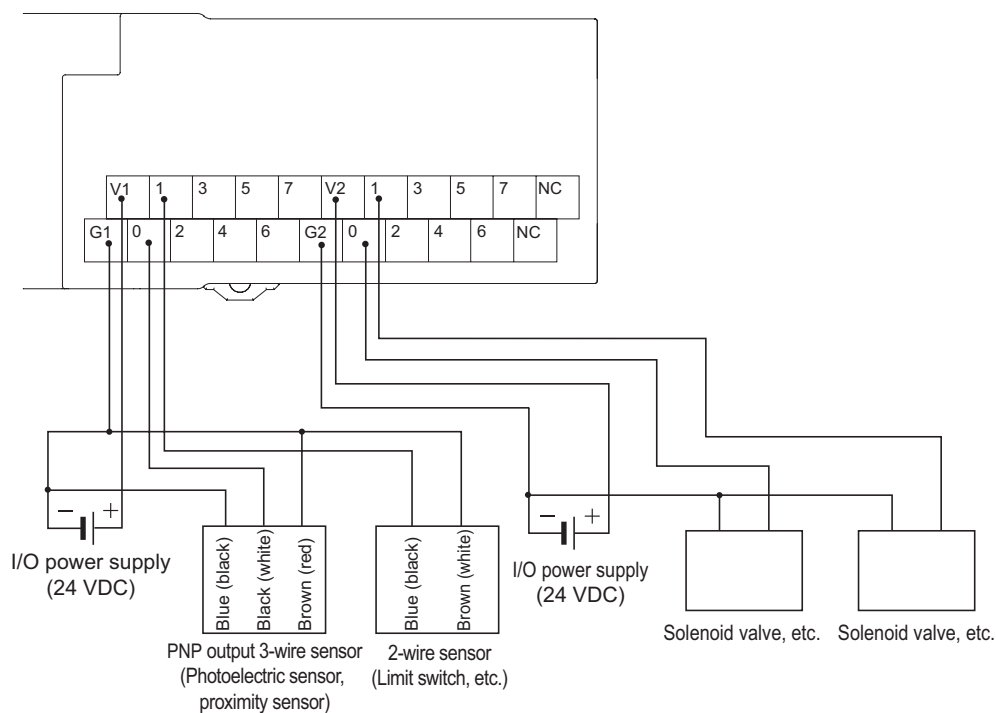


Wiring diagram

● GX-MD1611 (NPN)



● GX-MD1621 (PNP)





Precautions for Correct Use

- The V1 and V2 terminals as well as the G1 and G2 terminals of the I/O power supply are not connected internally. Supply power separately for V1-G1 and V2-G2.
 - When using an inductive load, such as a solenoid valve, either use a built-in diode for absorbing the counterelectromotive force or install an external diode.
 - Do not wire NC terminals.
-



Reference

Wire colors have been changed according to revisions in the JIS standards for photoelectric and proximity sensors. The colors in parentheses are the wire colors prior to the revisions.

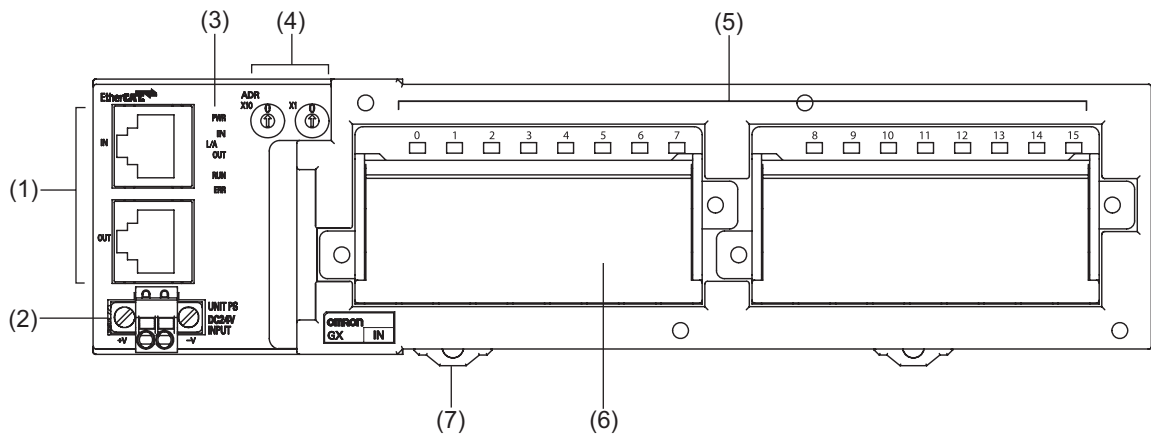
7-4-5 3-tier Terminal Block Type 16-point Input Slave Unit GX-ID1612/ID1622

Specification

Item	Specification	
	GX-ID1612	GX-ID1622
Input capacity	16 points	
Internal I/O common	NPN	PNP
ON voltage	15 VDC min. (between each input terminal and the V terminal)	15 VDC min. (between each input terminal and the G terminal)
OFF voltage	5 VDC max. (between each input terminal and the V terminal)	5 VDC max. (between each input terminal and the G terminal)
OFF current	1.0 mA max.	
Input current	6.0 mA max./input (at 24-VDC) 3.0 mA max./input (at 17-VDC)	
ON delay	0.1 ms max.	
OFF delay	0.2 ms max.	
Input filter value	Without filter, 0.5 ms, 1 ms, 2 ms, 4 ms, 8 ms, 16 ms, 32 ms (Default setting: 1 ms)	
Number of circuits per common	8 points/common	
Input indicators	LED display (yellow)	
Isolation method	Photocoupler isolation	
I/O power supply method	Supply by I/O power supply	
Input device supply current	100 mA/point	
Unit power supply current consumption	90 mA max. (for 20.4 to 26.4-VDC power supply voltage)	
I/O power supply current consumption	5 mA max. (for 20.4 to 26.4-VDC power supply voltage)	
Weight	370 g max.	
Expansion functions	No	
Short-circuit protection function	No	

Notes For the I/O power supply current value to V and G terminals ,refer to "A-4 I/O Power Supply Current" in Page A - 33.

Names and functions



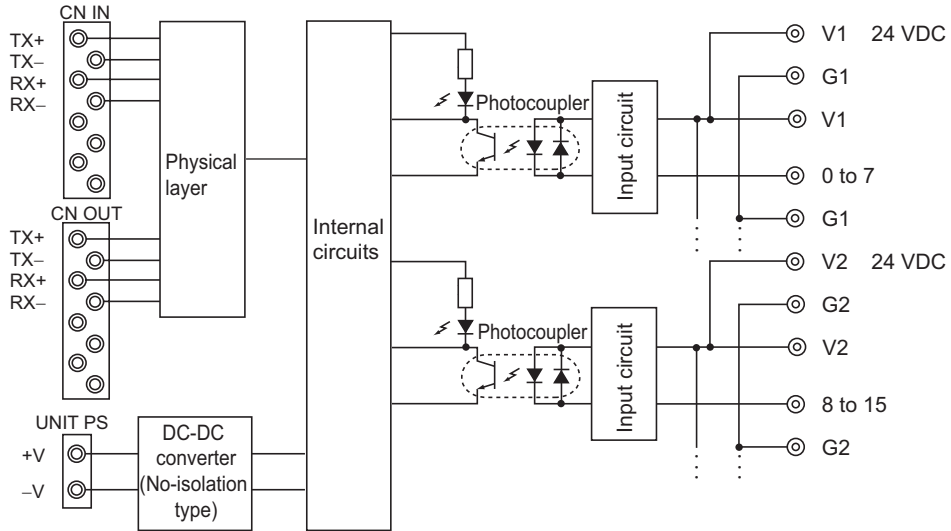
● Terminal arrangement diagram

1 to 9	NC	0	1	2	3	4	5	6	7	NC	8	9	10	11	12	13	14	15
10 to 18	V1	V1	V1	V1	V1	V1	V1	V1	V1	V2	V2	V2	V2	V2	V2	V2	V2	V2
19 to 27	G1	G1	G1	G1	G1	G1	G1	G1	G1	G2	G2	G2	G2	G2	G2	G2	G2	G2

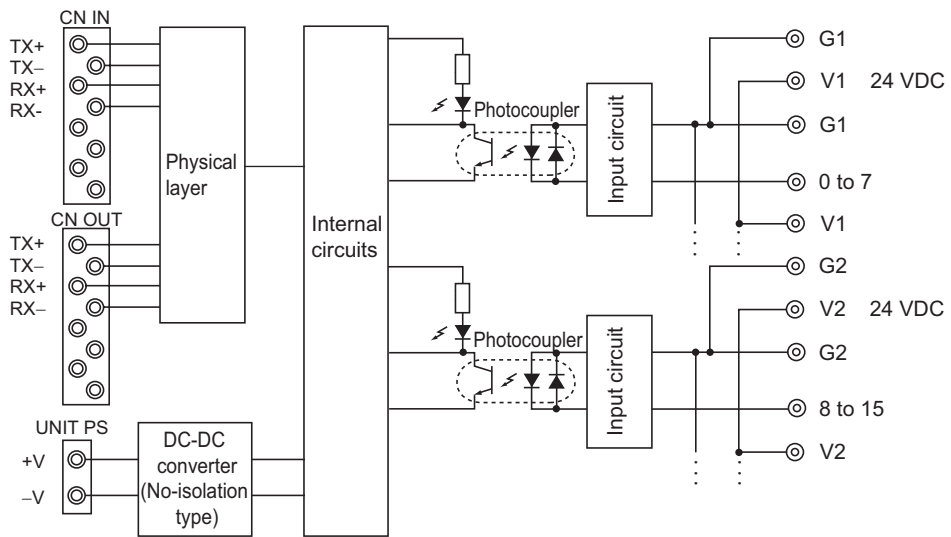
No.	Name	Function
(1)	Communications connectors	Refer to "6-3 Specifications of Common Areas" in Page 6 - 4.
(2)	Unit power supply connector	
(3)	Status indicators	
(4)	Node Address setting Switches	
(5)	Input indicators (0 to 15)	Indicates the state of an input contact (ON/OFF). Not lit: Contact OFF (input OFF state) Lit in yellow: Contact ON (input ON state)
(6)	Terminal block	Connects external devices and the I/O power supply. <Left side> V1, G1: I/O power supply terminals 0 to 7: Input terminals <Right side> V2, G2: I/O power supply terminals 8 to 15: Input terminals
(7)	DIN track mounting hook	Fixes a Slave Unit to a DIN track.

Internal circuits diagram

● GX-ID1612 (NPN)

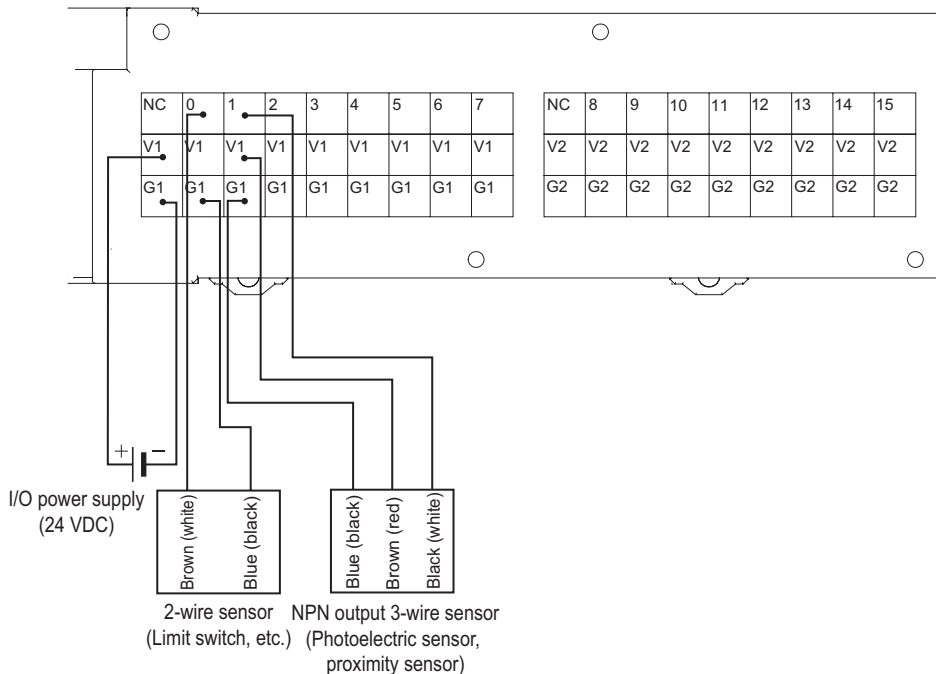


● GX-ID1622 (PNP)

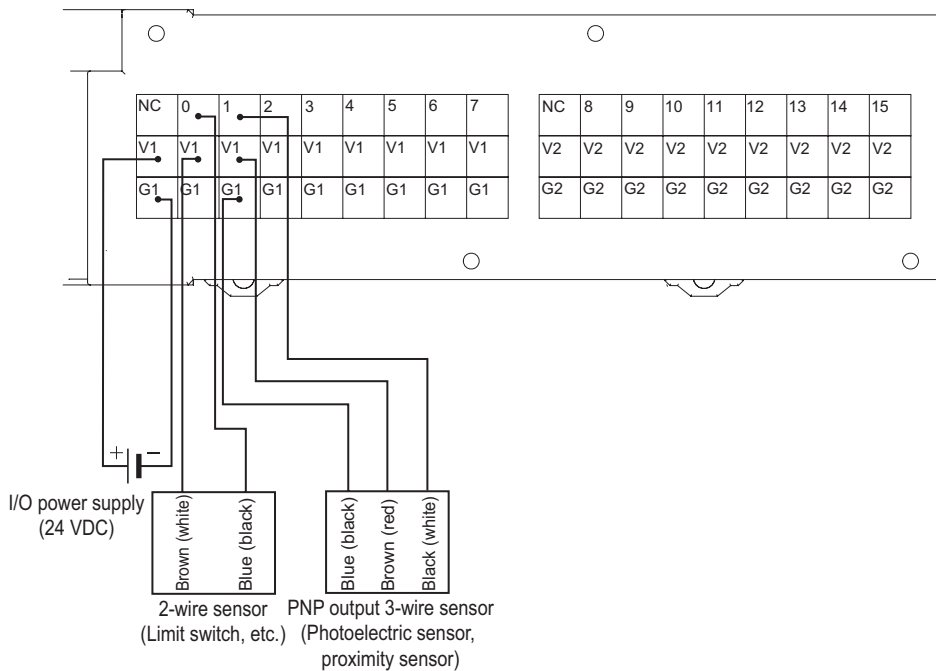


Wiring diagram

● GX-ID1612 (NPN)



● GX-ID1622 (PNP)





Precautions for Correct Use

- The V1 and V2 terminals as well as the G1 and G2 terminals of the I/O power supply are not connected internally. Supply power separately for V1-G1 and V2-G2.
 - Do not wire NC terminals.
-



Reference

Wire colors have been changed according to revisions in the JIS standards for photoelectric and proximity sensors. The colors in parentheses are the wire colors prior to the revisions.

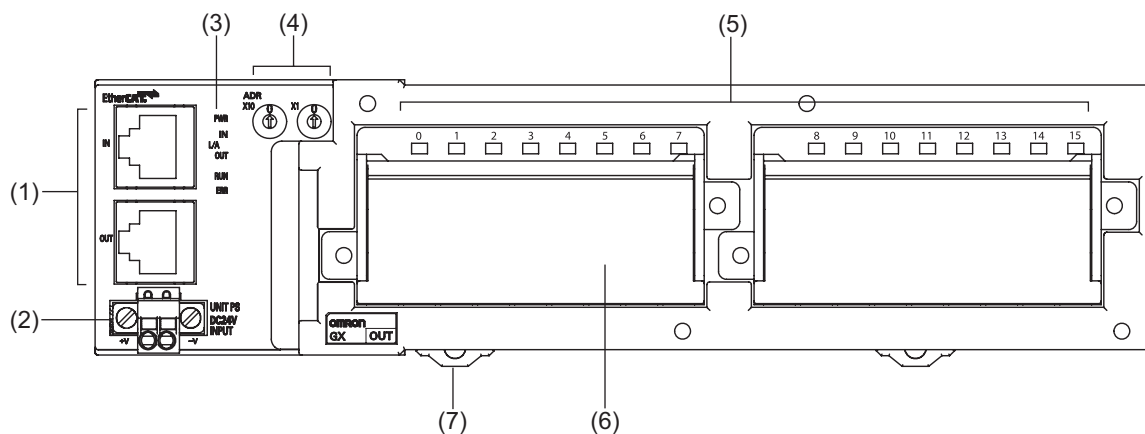
7-4-6 3-tier Terminal Block Type 16-point Output Slave Unit GX-OD1612/OD1622

Specification

Item	Specification	
	GX-OD1612	GX-OD1622
Output capacity	16 points	
Rated current (ON current)	0.5 A/output, 4.0 A/common	
Internal I/O common	NPN	PNP
Residual voltage	1.2 V max. (0.5 ADC, between each output terminal and the G terminal)	1.2 V max. (0.5 ADC, between each output terminal and the V terminal)
Leakage current	0.1 mA max.	
ON delay	0.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	8 points/common	
Output indicators	LED display (yellow)	
Isolation method	Photocoupler isolation	
I/O power supply method	Supply by I/O power supply	
Output device supply current	100 mA/point	
Unit power supply current consumption	90 mA max. (for 20.4 to 26.4-VDC power supply voltage)	
I/O power supply current consumption	5 mA max. (for 20.4 to 26.4-VDC power supply voltage)	
Weight	370 g max.	
Expansion functions	No	
Error Mode Output	Select either hold or clear.	
Short-circuit protection function	No	

Notes For the I/O power supply current value to V and G terminals, refer to "A-4 I/O Power Supply Current" in Page A - 33.

Names and functions



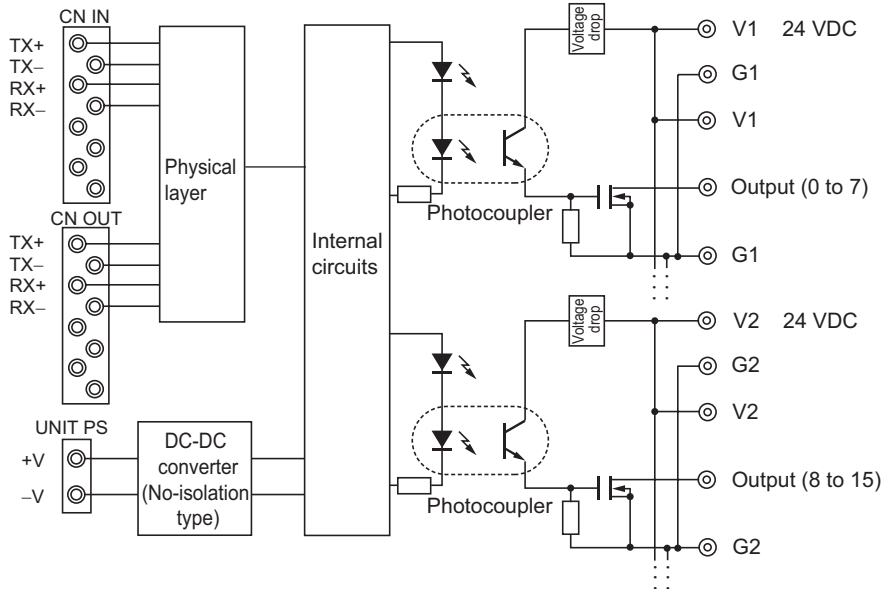
● Terminal arrangement diagram

1 to 9	NC	0	1	2	3	4	5	6	7	NC	8	9	10	11	12	13	14	15
10 to 18	V1	V1	V1	V1	V1	V1	V1	V1	V1	V2	V2	V2	V2	V2	V2	V2	V2	V2
19 to 27	G1	G1	G1	G1	G1	G1	G1	G1	G1	G2	G2	G2	G2	G2	G2	G2	G2	G2

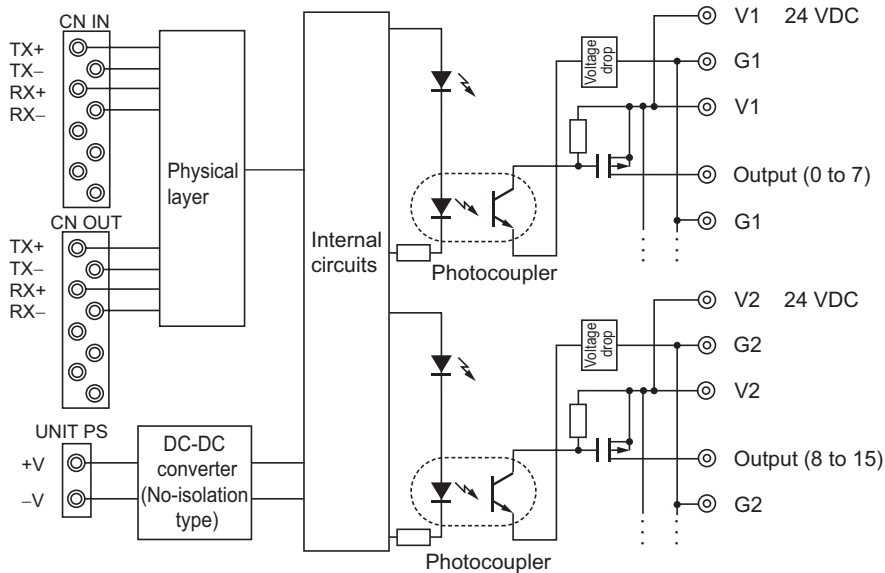
No.	Name	Function
(1)	Communications connectors	Refer to "6-3 Specifications of Common Areas" in Page 6 - 4.
(2)	Unit power supply connector	
(3)	Status indicators	
(4)	Node Address setting Switches	
(5)	Output indicators (0 to 15)	Indicates the state of an output contact (ON/OFF). Not lit: Contact OFF (output OFF state) Lit in yellow: Contact ON (output ON state)
(6)	Terminal block	Connects external devices and the I/O power supply. <Left side> V1, G1: I/O power supply terminals 0 to 7: Output terminals <Right side> V2, G2: I/O power supply terminals 8 to 15: Output terminals
(7)	DIN track mounting hook	Fixes a Slave Unit to a DIN track.

Internal circuits diagram

● GX-OD1612 (NPN)

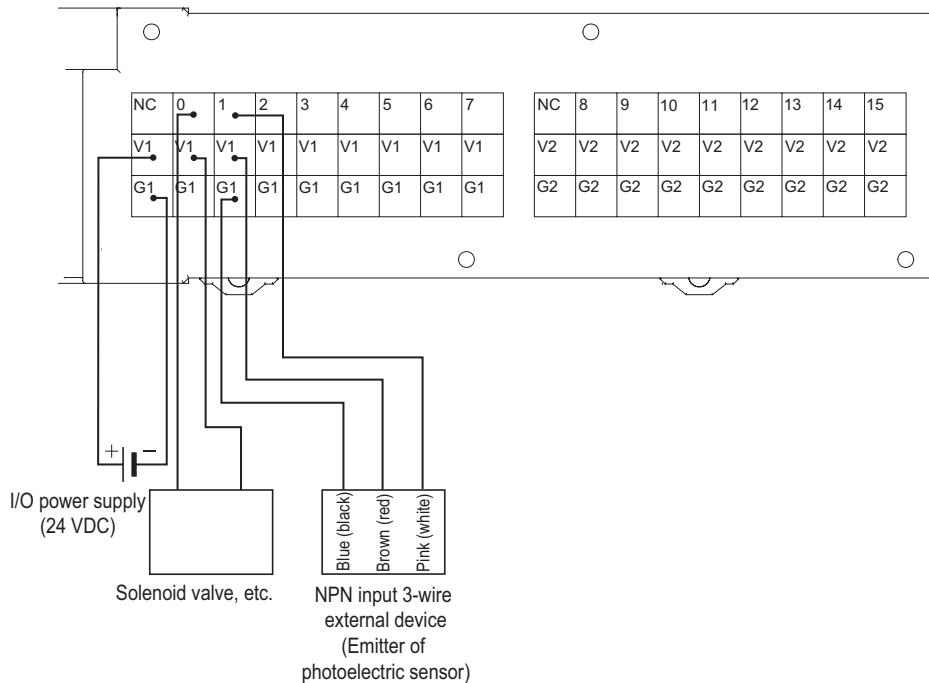


● GX-OD1622 (PNP)

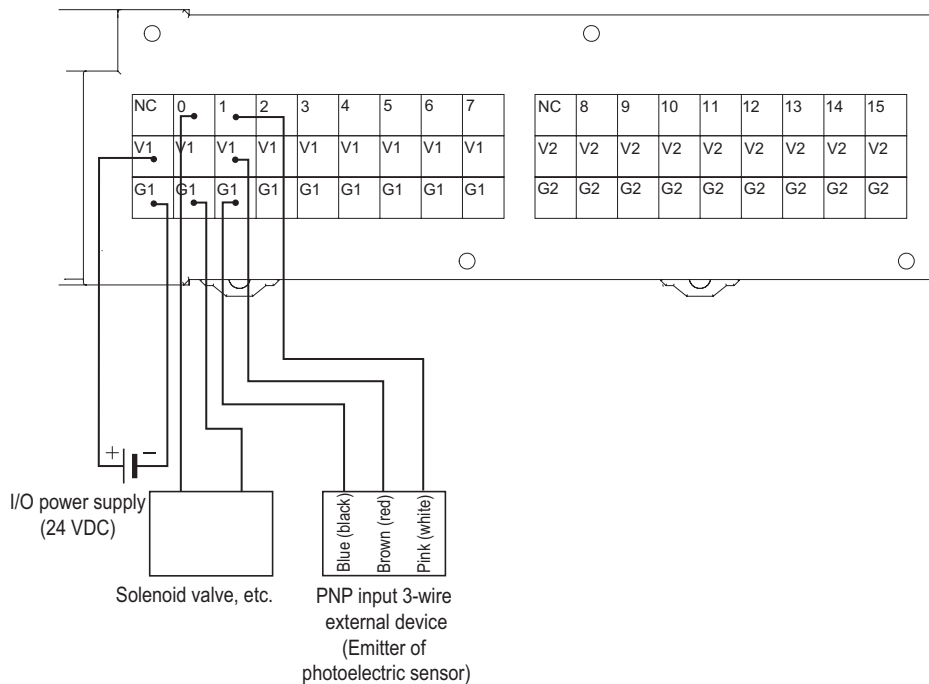


Wiring diagram

● GX-OD1612 (NPN)



● GX-OD1622 (PNP)





Precautions for Correct Use

- The V1 and V2 terminals as well as the G1 and G2 terminals of the I/O power supply are not connected internally. Supply power separately for V1-G1 and V2-G2.
 - Use a maximum current of 500 mA for each V1, V2, G1, and G2 terminals aside from the I/O power supply terminals.
 - When using an inductive load, such as a solenoid valve, either use a built-in diode for absorbing the counterelectromotive force or install an external diode.
 - Do not wire NC terminals.
-



Reference

Wire colors have been changed according to revisions in the JIS standards for photoelectric and proximity sensors. The colors in parentheses are the wire colors prior to the revisions.

7-4-7 3-tier Terminal Block Type 8-point Input and 8-point Output Slave Unit GX-MD1612/MD1622

Specification

● Common to input section and output section

Item	Specification	
	GX-MD1612	GX-MD1622
Internal I/O common	NPN	PNP
I/O indicators	LED display (yellow)	
Unit power supply current consumption	90 mA max. (for 20.4 to 26.4-VDC power supply voltage)	
Weight	370 g max.	
Expansion functions	No	
Short-circuit protection function	No	

● Input section

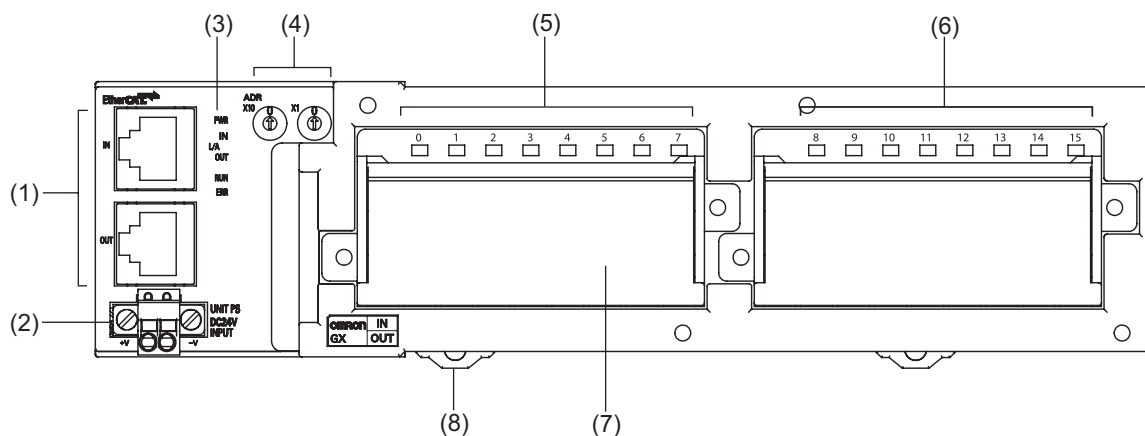
Item	Specification	
	GX-MD1612	GX-MD1622
Input capacity	8 points	
ON voltage	15 VDC min. (between each input terminal and the V terminal)	15 VDC min. (between each input terminal and the G terminal)
OFF voltage	5 VDC max. (between each input terminal and the V terminal)	5 VDC max. (between each input terminal and the G terminal)
OFF current	1.0 mA max./input	
Input current	6.0 mA max./input (at 24-VDC) 3.0 mA max./input (at 17-VDC)	
ON delay	0.1 ms max.	
OFF delay	0.2 ms max.	
Input filter value	Without filter, 0.5 ms, 1 ms, 2 ms, 4 ms, 8 ms, 16 ms, 32 ms (Default setting: 1 ms)	
Number of circuits per common	8 points/common	
Isolation method	Photocoupler isolation	
I/O power supply method	Supply by I/O power supply	
Input device supply current	100 mA/point	
I/O power supply current consumption	5 mA max. (for 20.4 to 26.4-VDC power supply voltage)	

● Output section

Item	Specification	
	GX-MD1612	GX-MD1622
Output capacity	8 points	
Rated output current	0.5 A/output, 2.0 A/common	
Residual voltage	1.2 V max. (0.5 ADC, between each output terminal and the G terminal)	1.2 V max. (0.5 ADC, between each output terminal and the V terminal)
Leakage current	0.1 mA max.	
ON delay	0.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	8 points/common	
Isolation method	Photocoupler isolation	
I/O power supply method	Supply by I/O power supply	
Output device supply current	100 mA/point	
I/O power supply current consumption	5 mA max. (for 20.4 to 26.4-VDC power supply voltage)	
Error Mode Output	Select either hold or clear.	

Notes For the I/O power supply current value to V and G terminals, refer to "A-4 I/O Power Supply Current" in Page A - 33.

Names and functions



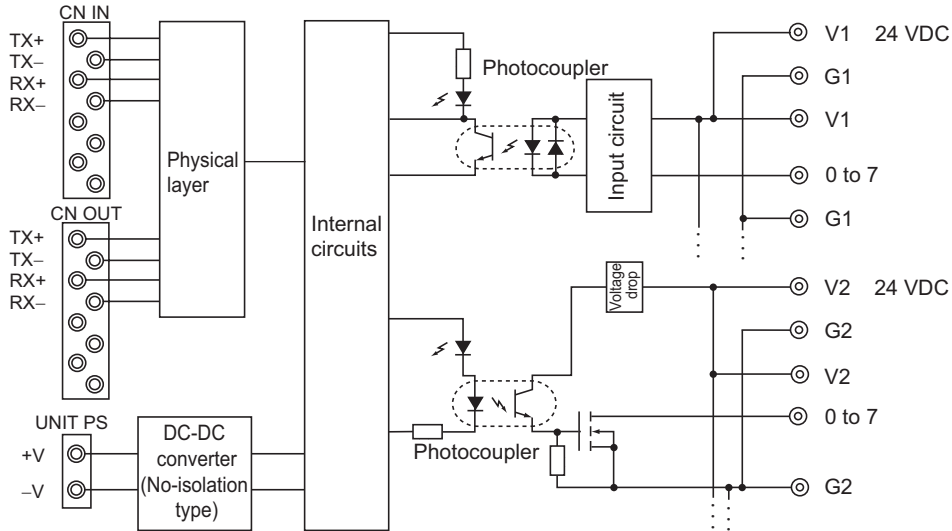
● Terminal arrangement diagram

1 to 9	NC	0	1	2	3	4	5	6	7	NC	0	1	2	3	4	5	6	7
10 to 18	V1	V1	V1	V1	V1	V1	V1	V1	V1	V2	V2	V2	V2	V2	V2	V2	V2	V2
19 to 27	G1	G1	G1	G1	G1	G1	G1	G1	G1	G2	G2	G2	G2	G2	G2	G2	G2	G2

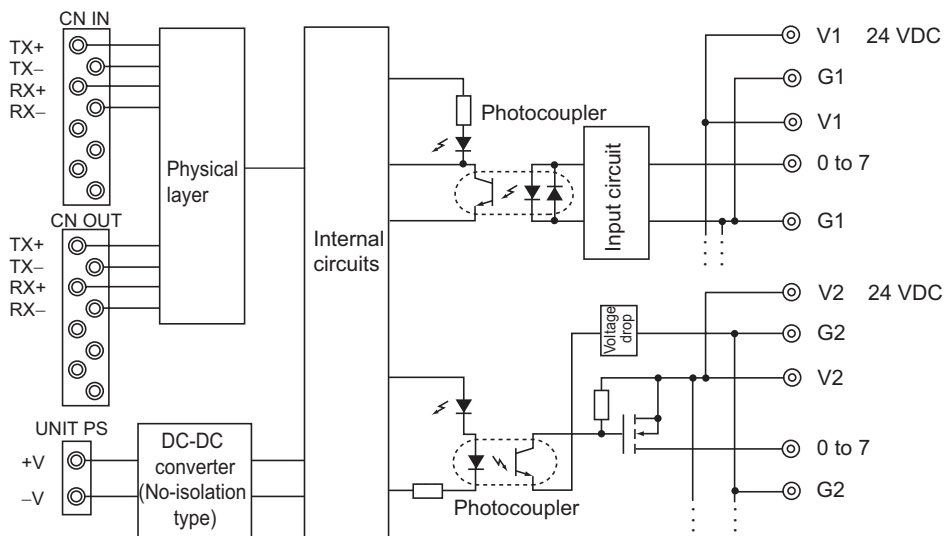
No.	Name	Function
(1)	Communications connectors	Refer to "6-3 Specifications of Common Areas" in Page 6 - 4.
(2)	Unit power supply connector	
(3)	Status indicators	
(4)	Node Address setting Switches	
(5)	Input indicators (0 to 7)	Indicates the state of an input contact (ON/OFF). Not lit: Contact OFF (input OFF state) Lit in yellow: Contact ON (inputON state)
(6)	Output indicators (0 to 7)	Indicates the state of an output contact (ON/OFF). Not lit: Contact OFF (output OFF state) Lit in yellow: Contact ON (output ON state)
(7)	Terminal block	Connects external devices and the I/O power supply. <Left side> V1, G1: Input side I/O power supply terminals 0 to 7: Input terminals <Right side> V2, G2: Output side I/O power supply terminals 0 to 7: Output terminals
(8)	DIN track mounting hook	Fixes a Slave Unit to a DIN track.

Internal circuits diagram

● GX-MD1612 (NPN)

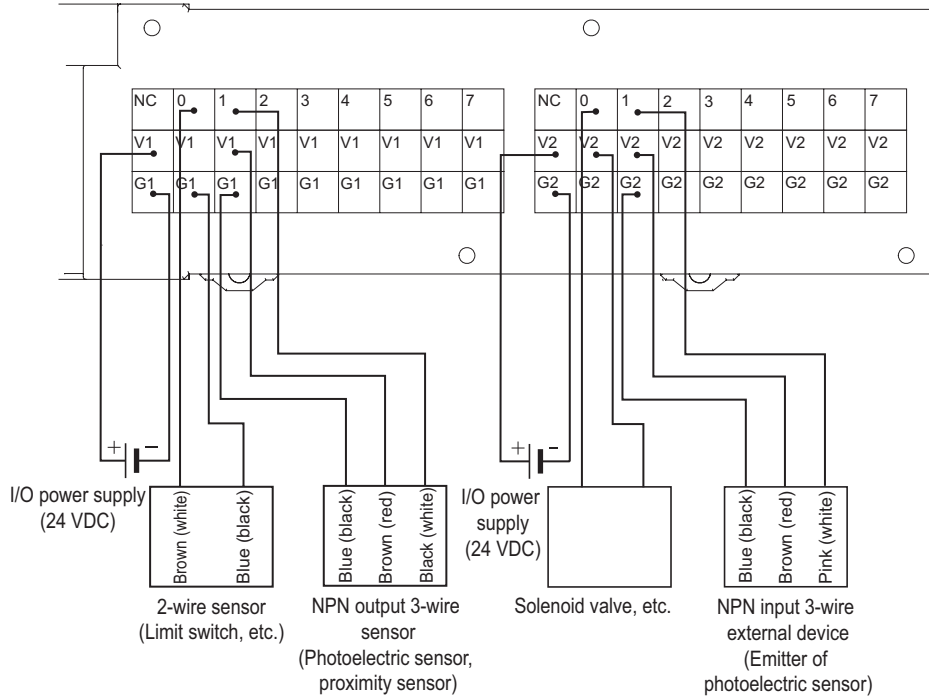


● GX-MD1622 (PNP)

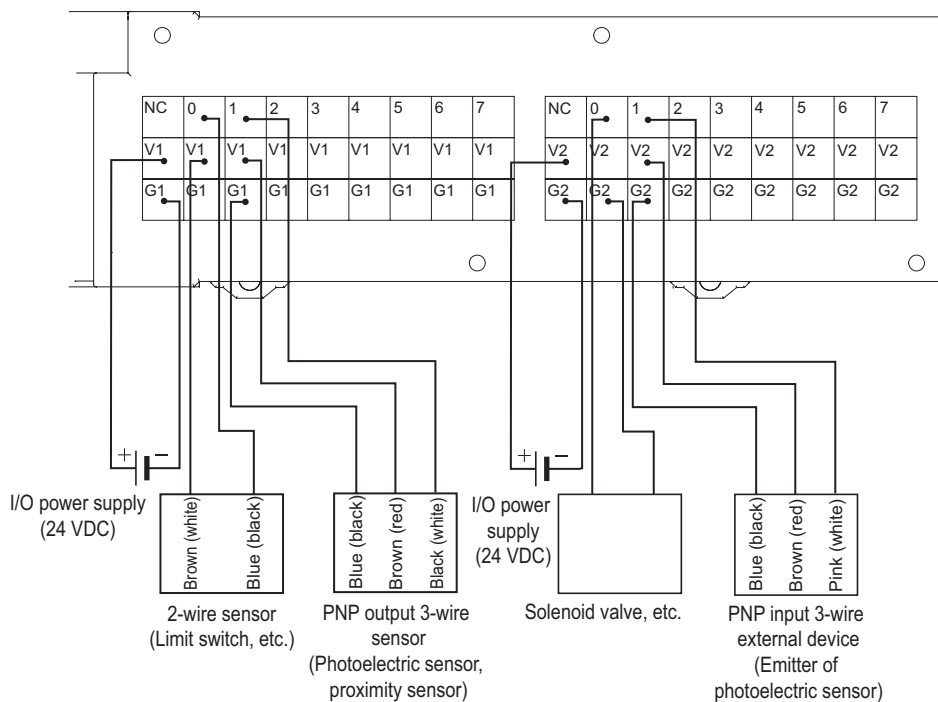


Wiring diagram

● GX-MD1612 (NPN)



● GX-MD1622 (PNP)





Precautions for Correct Use

- The V1 and V2 terminals as well as the G1 and G2 terminals of the I/O power supply are not connected internally. Supply power separately for V1-G1 and V2-G2.
 - Use a maximum current of 500 mA for each V1, V2, G1, and G2 terminals aside from the I/O power supply terminals.
 - When using an inductive load, such as a solenoid valve, either use a built-in diode for absorbing the counterelectromotive force or install an external diode.
 - Do not wire NC terminals.
-



Reference

Wire colors have been changed according to revisions in the JIS standards for photoelectric and proximity sensors. The colors in parentheses are the wire colors prior to the revisions.

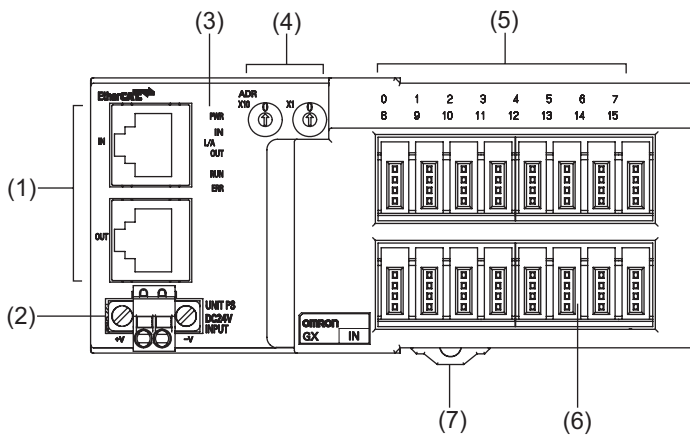
7-4-8 e-CON Connector Type 16-point Input Slave Unit GX-ID1618/ID1628

Specification

Item	Specification	
	GX-ID1618	GX-ID1628
Input capacity	16 points	
Internal I/O common	NPN	PNP
ON voltage	15 VDC min. (between each input terminal and the V terminal)	15 VDC min. (between each input terminal and the G terminal)
OFF voltage	5 VDC max. (between each input terminal and the V terminal)	5 VDC max. (between each input terminal and the G terminal)
OFF current	1.0 mA max.	
Input current	6.0 mA max./input (at 24-VDC) 3.0 mA max./input (at 17-VDC)	
ON delay	0.1 ms max.	
OFF delay	0.2 ms max.	
Input filter value	Without filter, 0.5 ms, 1 ms, 2 ms, 4 ms, 8 ms, 16 ms, 32 ms (Default setting: 1 ms)	
Number of circuits per common	16 points/common	
Input indicators	LED display (yellow)	
Isolation method	No isolation	
I/O power supply method	Supplied from unit power supply	
Input device supply current	100 mA/point	
Unit power supply current consumption	150 mA max. (for 20.4 to 26.4-VDC power supply voltage)	
Weight	140 g max.	
Expansion functions	No	
Short-circuit protection function	Available (Operates at 50 mA/point min.)	

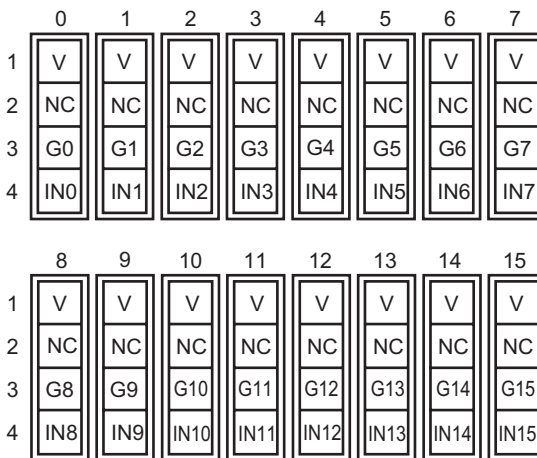
Notes For the I/O power supply current value to V and G terminals ,refer to "A-4 I/O Power Supply Current" in Page A - 33.

Names and functions

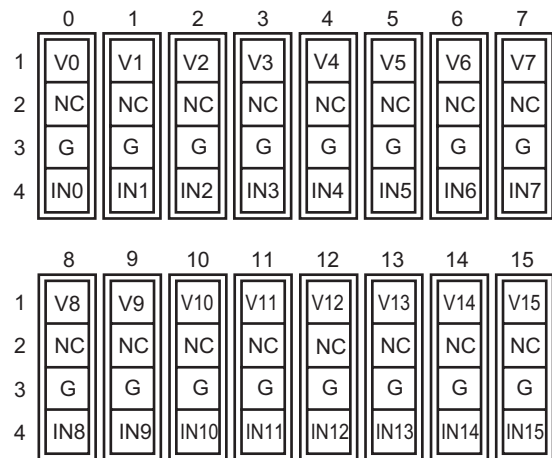


Terminal arrangement diagram

• GX-ID1618



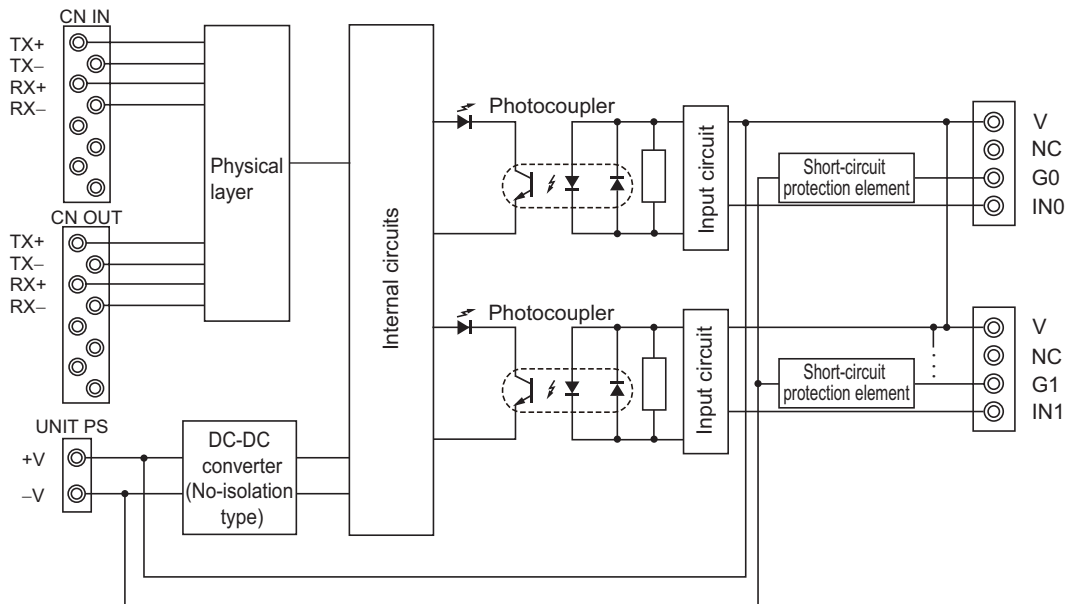
• GX-ID1628



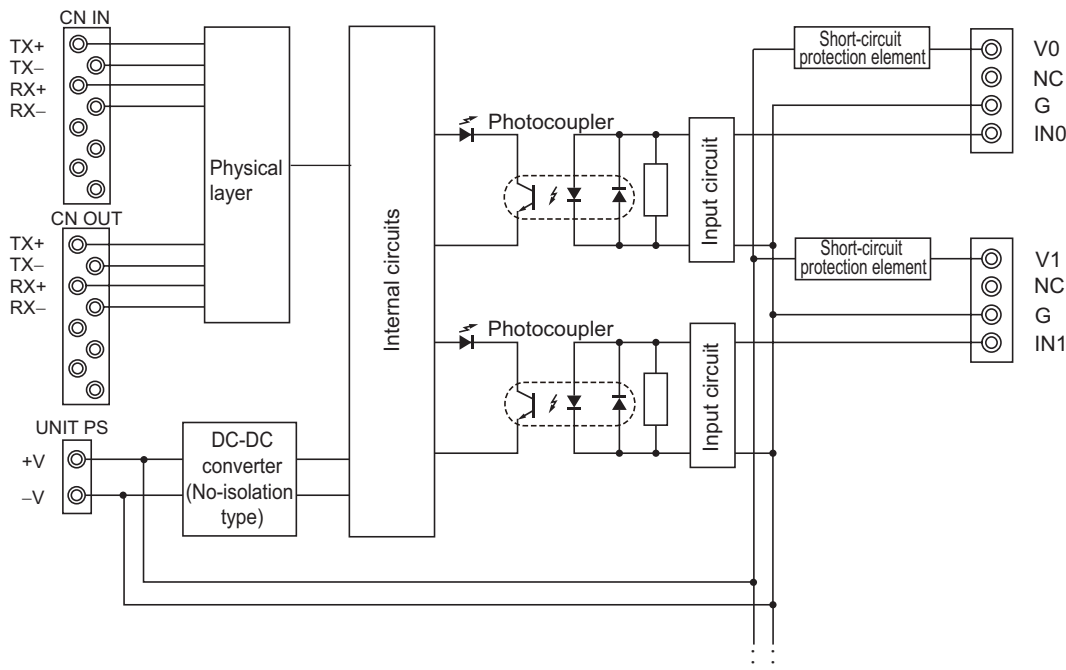
No.	Name	Function
(1)	Communications connectors	Refer to "6-3 Specifications of Common Areas" in Page 6 - 4.
(2)	Unit power supply connector	
(3)	Status indicators	
(4)	Node Address setting Switches	
(5)	Input indicators (0 to 15)	Indicates the state of an input contact (ON/OFF). Not lit: Contact OFF (input OFF state) Lit in yellow: Contact ON (input ON state)
(6)	I/O connectors (0 to 15)	Connects an external device.
(7)	DIN track mounting hook	Fixes a Slave Unit to a DIN track.

Internal circuits diagram

● GX-ID1618 (NPN)

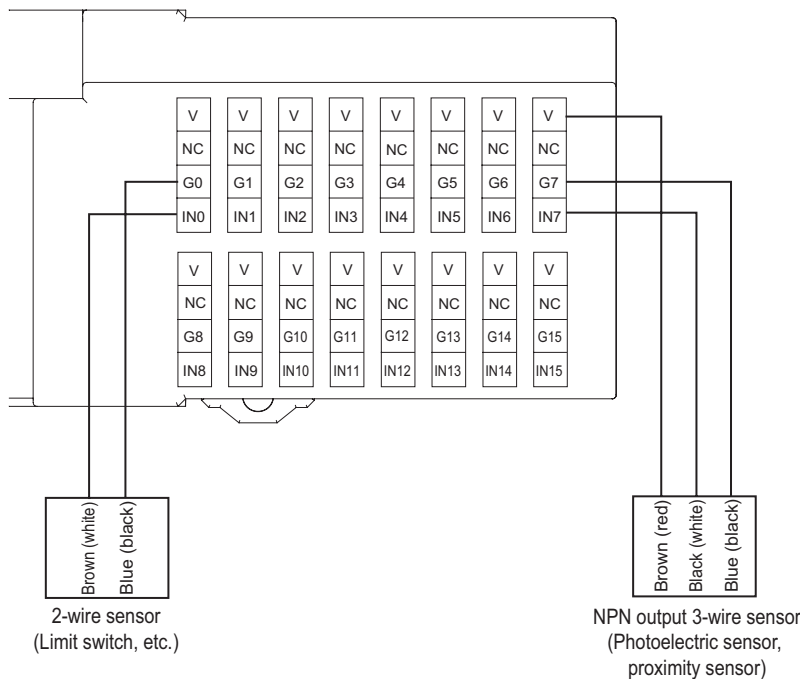


● GX-ID1628 (PNP)

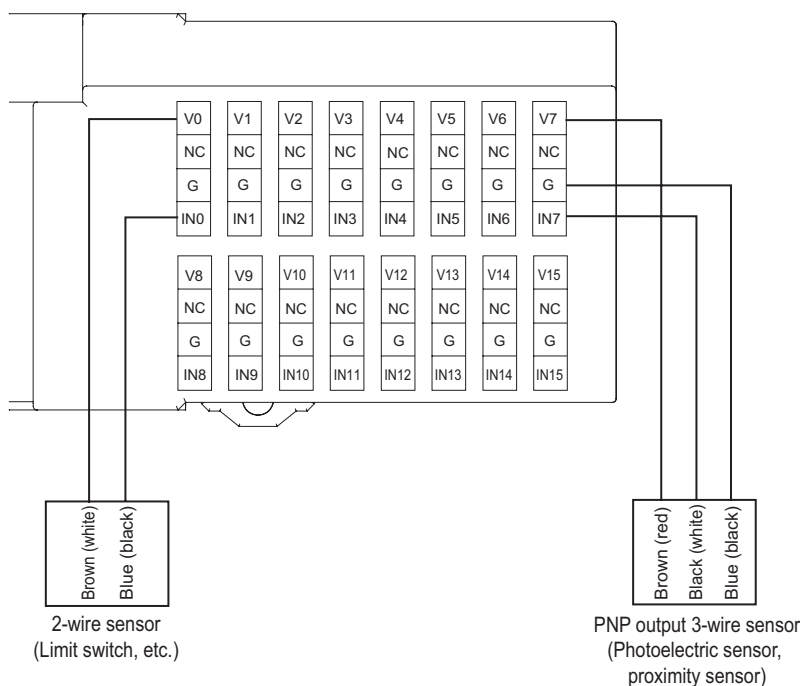


Wiring diagram

● GX-ID1618 (NPN)



● GX-ID1628 (PNP)



Reference

Wire colors have been changed according to revisions in the JIS standards for photoelectric and proximity sensors. The colors in parentheses are the wire colors prior to the revisions.

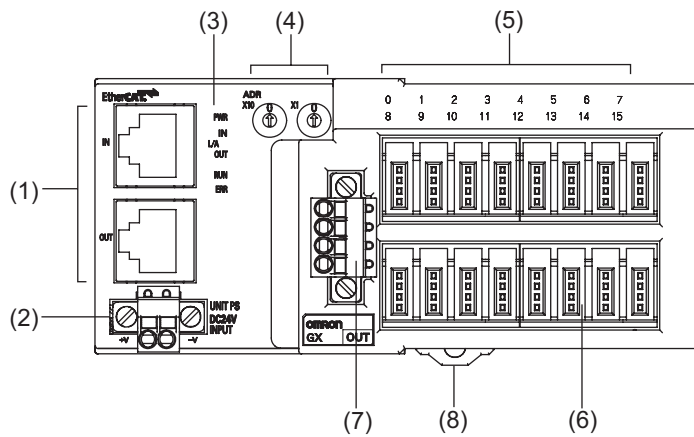
7-4-9 e-CON Connector Type 16-point Output Slave Unit GX-OD1618/OD1628

Specification

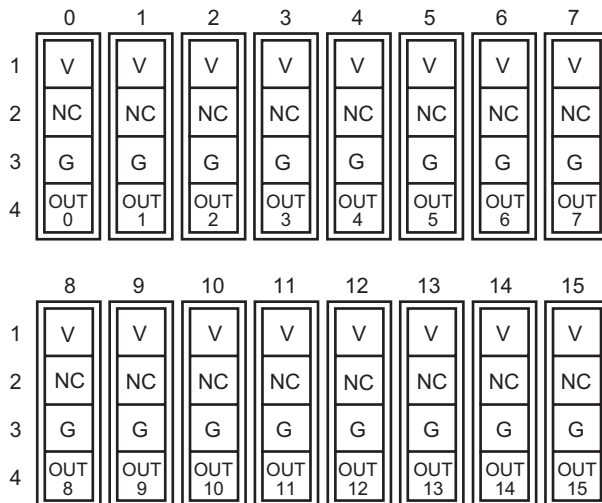
Item	Specification	
	GX-OD1618	GX-OD1628
Output capacity	16 points	
Rated current (ON current)	0.5 A/output, 4.0 A/common	
Internal I/O common	NPN	PNP
Residual voltage	1.2 V max. (0.5 ADC, between each output terminal and the G terminal)	1.2 V max. (0.5 ADC, between each output terminal and the V terminal)
Leakage current	0.1 mA max.	
ON delay	0.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	16 points/common	
Output indicators	LED display (yellow)	
Isolation method	Photocoupler isolation	
I/O power supply method	Supply by I/O power supply	
Output device supply current	100 mA/point	
Unit power supply current consumption	80 mA max. (for 20.4 to 26.4-VDC power supply voltage)	
Weight	130 g max.	
Expansion functions	No	
Error Mode Output	Select either hold or clear.	
Short-circuit protection function	No	

Notes For the I/O power supply current value to V and G terminals ,refer to "A-4 I/O Power Supply Current" in Page A - 33.

Names and functions



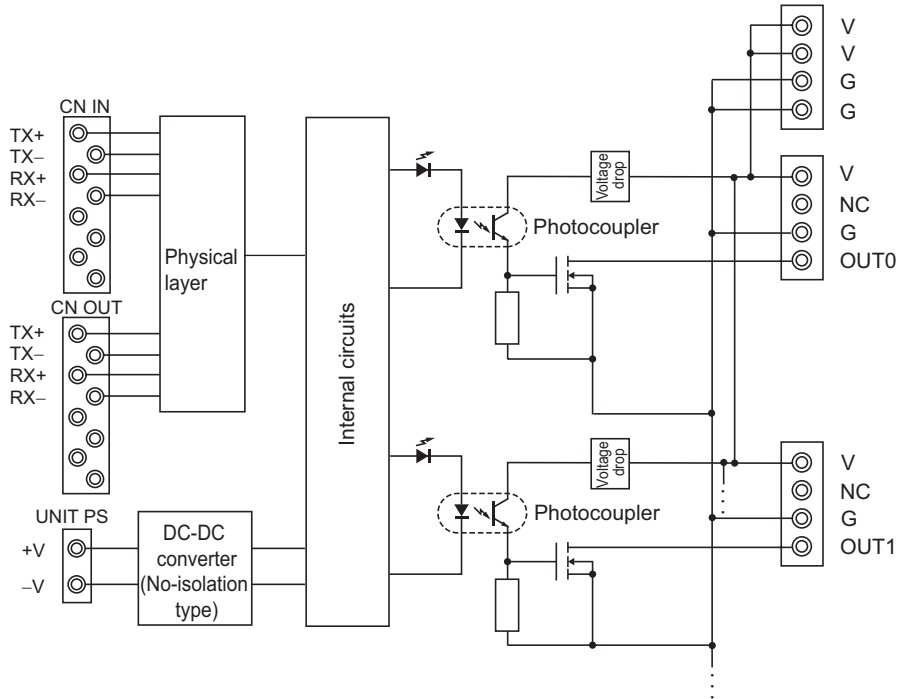
● Terminal arrangement diagram



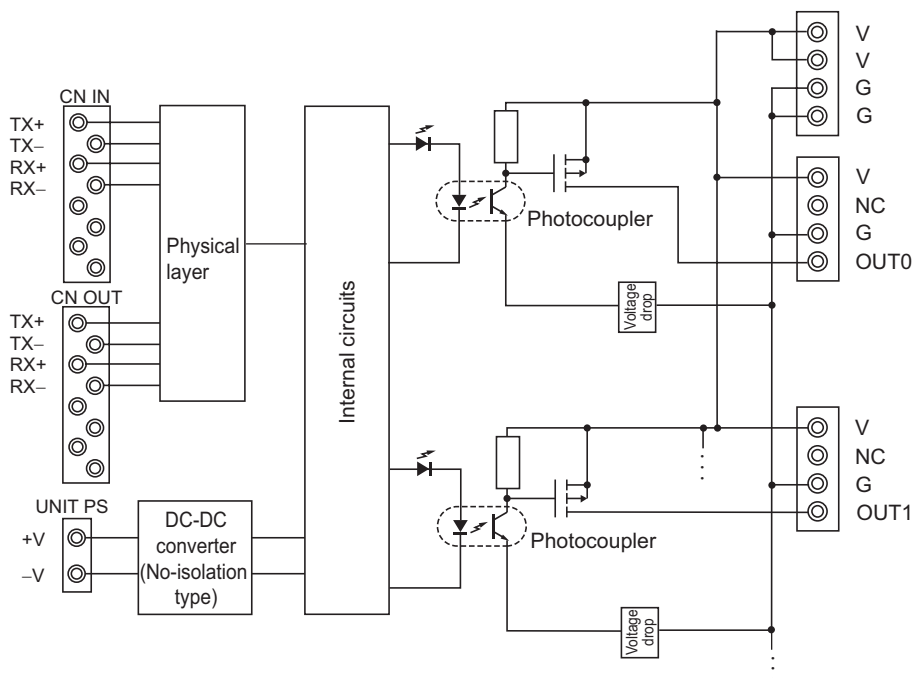
No.	Name	Function
(1)	Communications connectors	Refer to "6-3 Specifications of Common Areas" in Page 6 - 4.
(2)	Unit power supply connector	
(3)	Status indicators	
(4)	Node Address setting Switches	
(5)	Output indicators (0 to 15)	Indicates the state of an output contact (ON/OFF). Not lit: Contact OFF (output OFF state) Lit in yellow: Contact ON (output ON state)
(6)	I/O connectors (0 to 15)	Connects an external device.
(7)	I/O power supply connector	Supplies the I/O power.
(8)	DIN track mounting hook	Fixes a Slave Unit to a DIN track.

Internal circuits diagram

● GX-OD1618 (NPN)

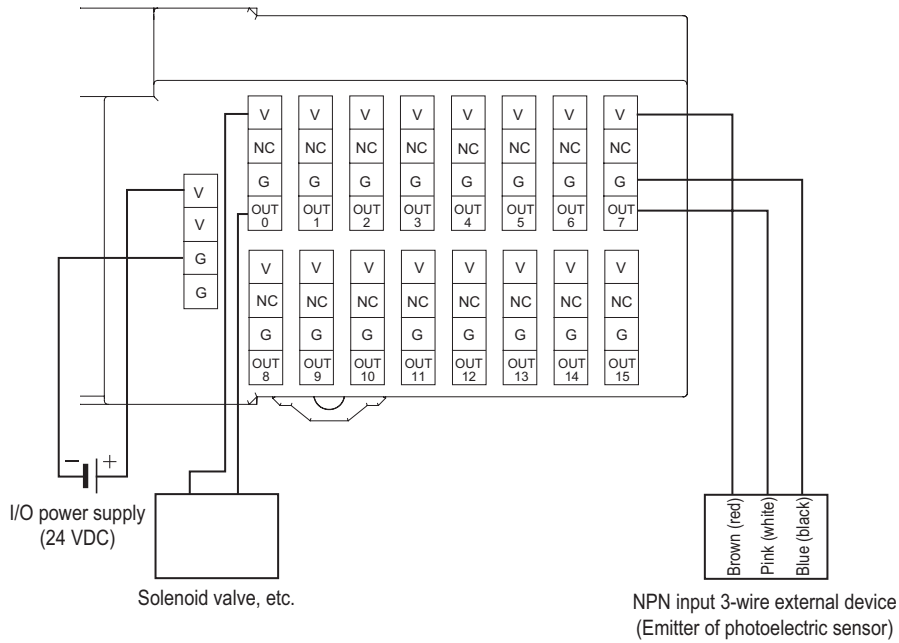


● GX-OD1628 (PNP)

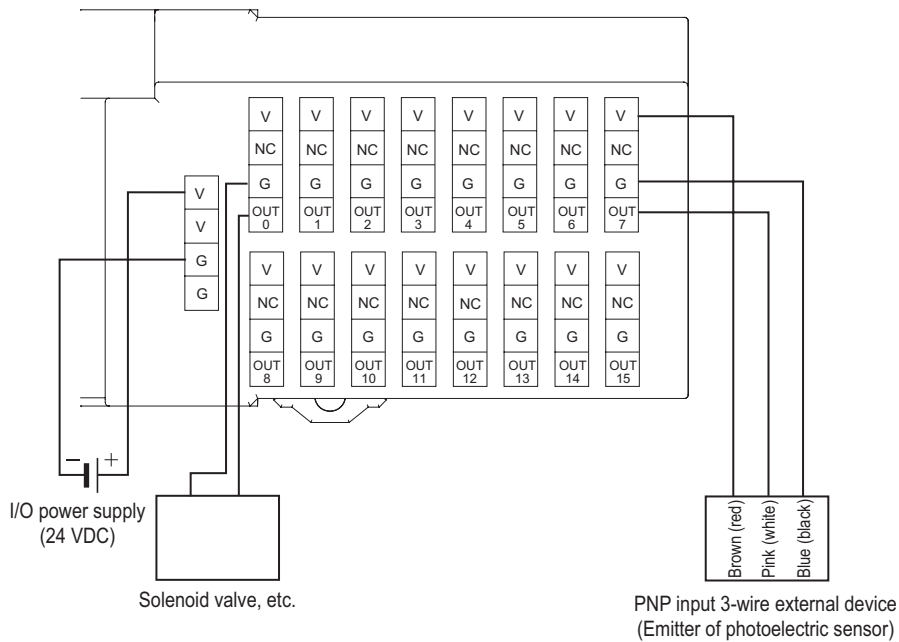


Wiring diagram

● GX-OD1618 (NPN)



● GX-OD1628 (PNP)





Precautions for Correct Use

- The I/O power supply connectors are equipped with two sets of V and G terminals. One set of terminals is used for the I/O power supply for the unit, and the other set is used for the I/O power supply to the next unit. Use a maximum current of 4 A per terminal.
 - When using an inductive load, such as a solenoid valve, either use a built-in diode for absorbing the counterelectromotive force or install an external diode.
-



Reference

Wire colors have been changed according to revisions in the JIS standards for photoelectric and proximity sensors. The colors in parentheses are the wire colors prior to the revisions.

7-4-10 e-CON Connector Type 8-point Input and 8-point Output Slave Unit GX-MD1618/MD1628

Specification

● Common to input section and output section

Item	Specification	
	GX-MD1618	GX-MD1628
Internal I/O common	NPN	PNP
I/O indicators	LED display (yellow)	
Unit power supply current consumption	120 mA max. (for 20.4 to 26.4-VDC power supply voltage)	
Weight	140 g max.	
Expansion functions	No	
Short-circuit protection function	Available at input section only (Operates at 50 mA/point min.)	

● Input section

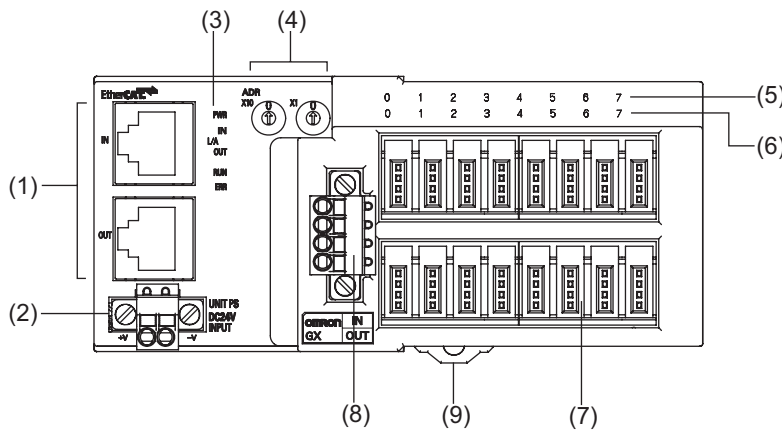
Item	Specification	
	GX-MD1618	GX-MD1628
Input capacity	8 points	
ON voltage	15 VDC min. (between each input terminal and the V terminal)	15 VDC min. (between each input terminal and the G terminal)
OFF voltage	5 VDC max. (between each input terminal and the V terminal)	5 VDC max. (between each input terminal and the G terminal)
OFF current	1.0 mA max.	
Input current	6.0 mA max./input (at 24-VDC) 3.0 mA max./input (at 17-VDC)	
ON delay	0.1 ms max.	
OFF delay	0.2 ms max.	
Input filter value	Without filter, 0.5 ms, 1 ms, 2 ms, 4 ms, 8 ms, 16 ms, 32 ms (Default setting: 1 ms)	
Number of circuits per common	8 points/common	
Isolation method	No-isolation	
I/O power supply method	Supplied from unit power supply	
Input device supply current	100 mA/point	
I/O power supply current consumption	5 mA max. (for 20.4 to 26.4-VDC power supply voltage)	

● Output section

Item	Specification	
	GX-MD1618	GX-MD1628
Output capacity	8 points	
Rated output current	0.5 A/output, 2.0 A/common	
Residual voltage	1.2 V max. (0.5 ADC, between each output terminal and the G terminal)	1.2 V max. (0.5 ADC, between each output terminal and the V terminal)
Leakage current	0.1 mA max.	
ON delay	0.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	8 points/common	
Isolation method	Photocoupler isolation	
I/O power supply method	Supply by I/O power supply	
Output device supply current	100 mA/point	
I/O power supply current consumption	5 mA max. (for 20.4 to 26.4-VDC power supply voltage)	
Error Mode Output	Select either hold or clear.	

Notes For the I/O power supply current value to V and G terminals ,refer to "A-4 I/O Power Supply Current" in Page A - 33.

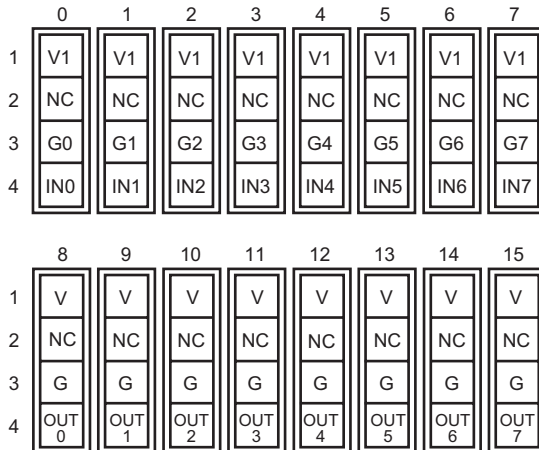
Names and functions



Terminal arrangement diagram

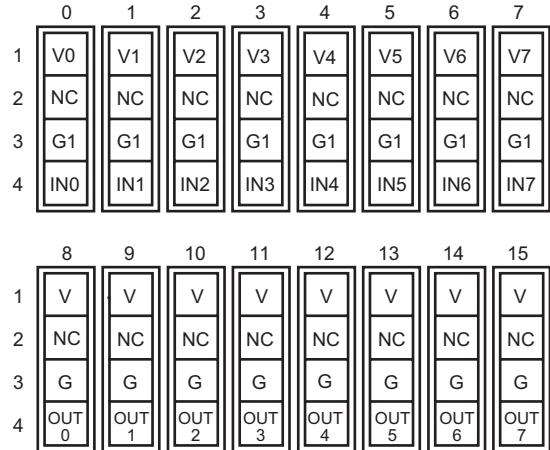
• GX-MD1618

Top side: input Bottom side: output



• GX-MD1628

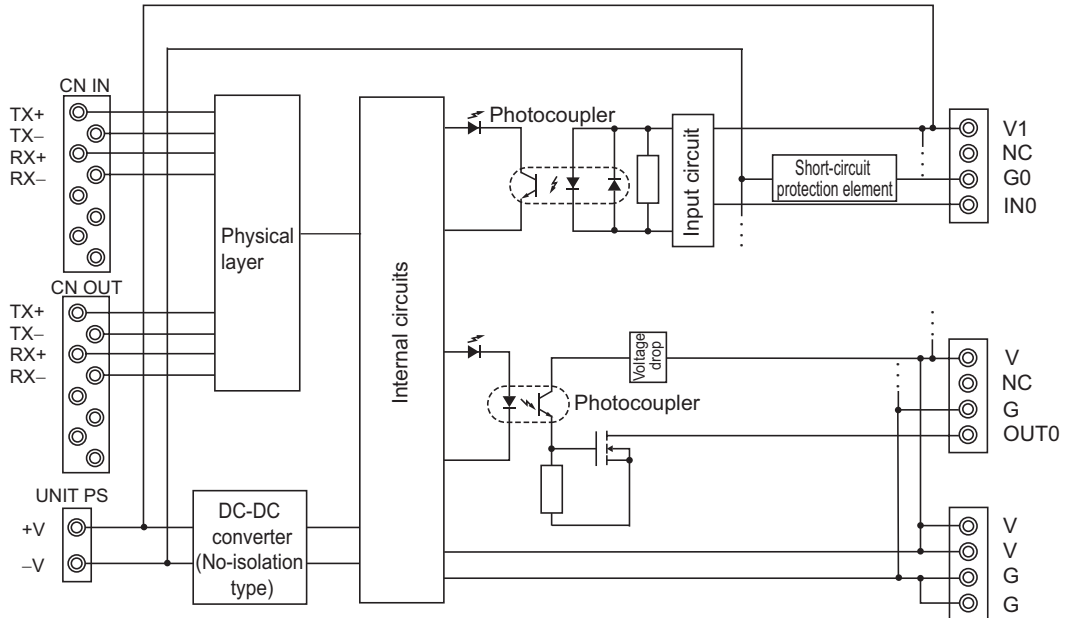
Top side: input Bottom side: output



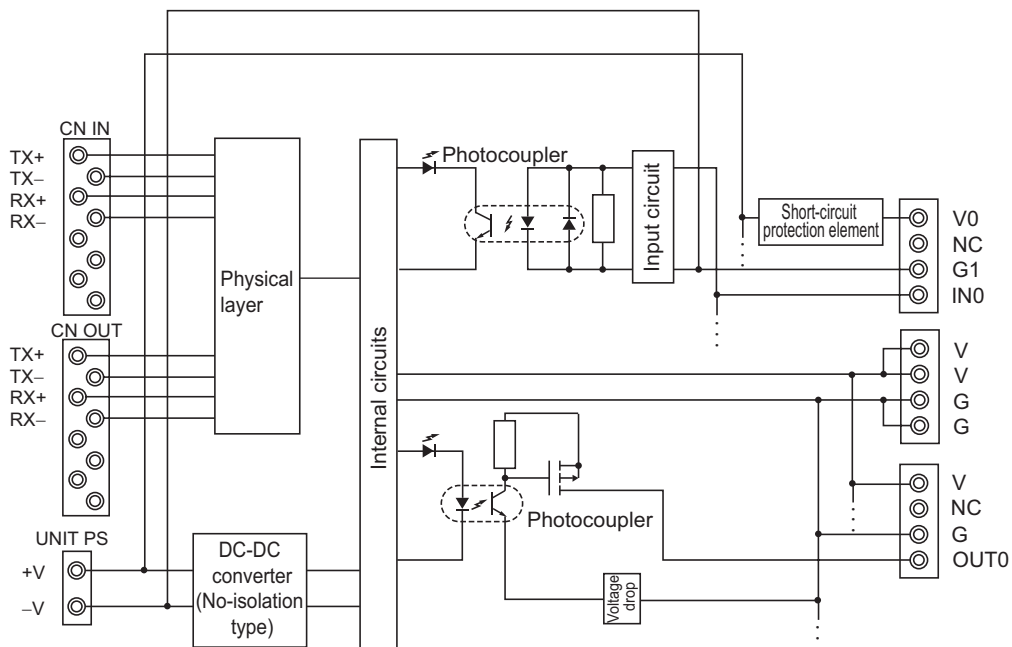
No.	Name	Function
(1)	Communications connectors	Refer to "6-3 Specifications of Common Areas" in Page 6 - 4.
(2)	Unit power supply connector	
(3)	Status indicators	
(4)	Node Address setting Switches	
(5)	Input indicators (0 to 7)	Indicates the state of an input contact (ON/OFF). Not lit: Contact OFF (input OFF state) Lit in yellow: Contact ON (input ON state)
(6)	Output indicators (0 to 7)	Indicates the state of an output contact (ON/OFF). Not lit: Contact OFF (output OFF state) Lit in yellow: Contact ON (output ON state)
(7)	I/O connectors (0 to 15)	Connects an external device. <Top side> For input device <Bottom side> For output device
(8)	I/O power supply connector	Supplies the I/O power. (For output device)
(9)	DIN track mounting hook	Fixes a Slave Unit to a DIN track.

Internal circuits diagram

● GX-MD1618 (NPN)

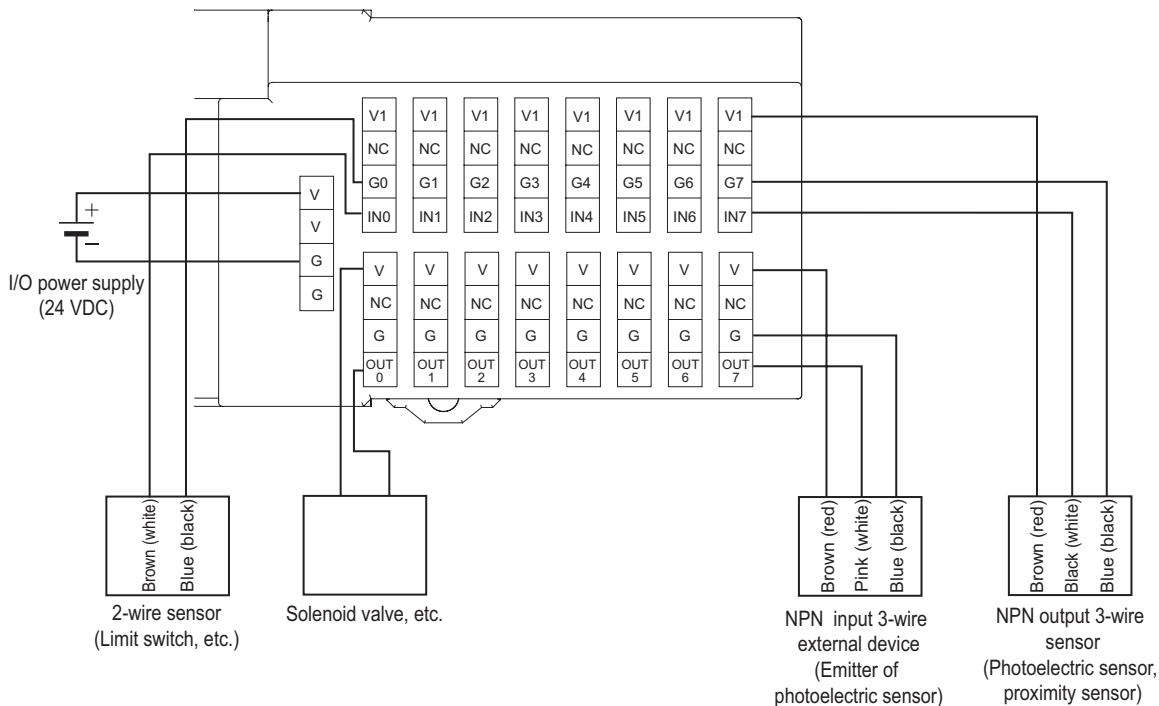


● GX-MD1628 (PNP)

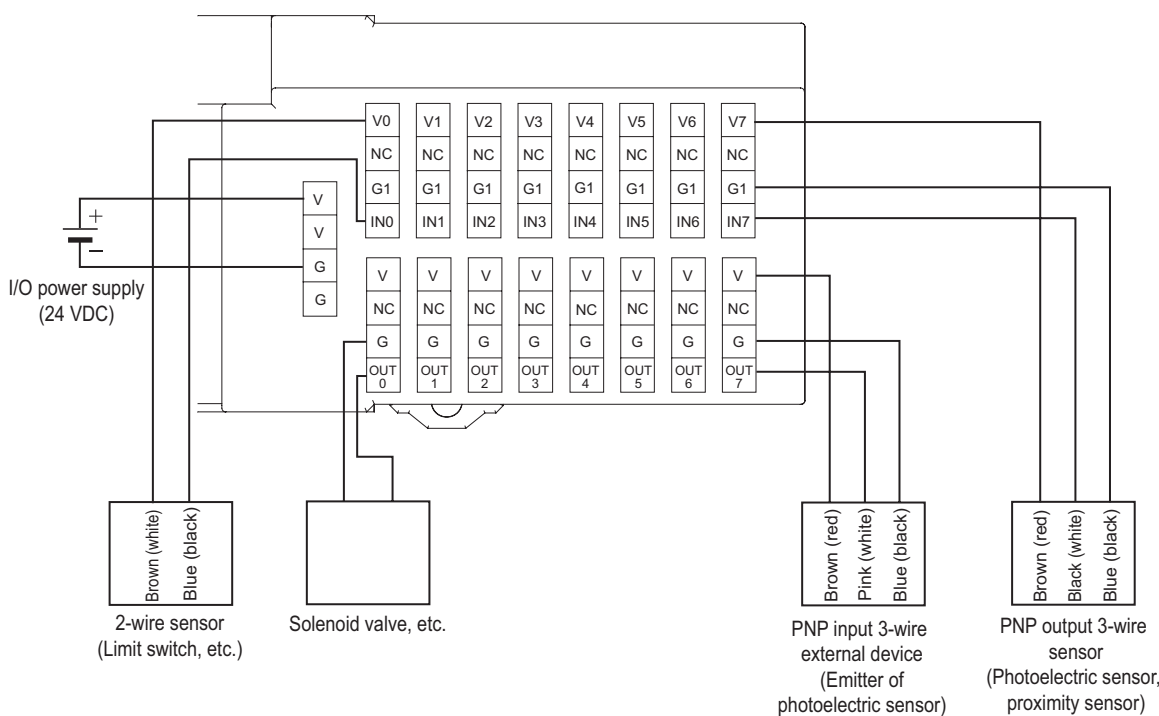


Wiring diagram

● GX-MD1618 (NPN)



● GX-MD1628 (PNP)



7-4 Specifications for Each Slave Unit

7

7-4-10 e-CON Connector Type 8-point Input and 8-point Output Slave Unit
GX-MD1618/MD1628



Precautions for Correct Use

- The I/O power supply connectors are equipped with two sets of V and G terminals. One set of terminals is used for the I/O power supply for the unit, and the other set is used for the I/O power supply to the next unit. Use a maximum current of 4 A per terminal.
 - When using an inductive load, such as a solenoid valve, either use a built-in diode for absorbing the counterelectromotive force or install an external diode.
-



Reference

Wire colors have been changed according to revisions in the JIS standards for photoelectric and proximity sensors. The colors in parentheses are the wire colors prior to the revisions.

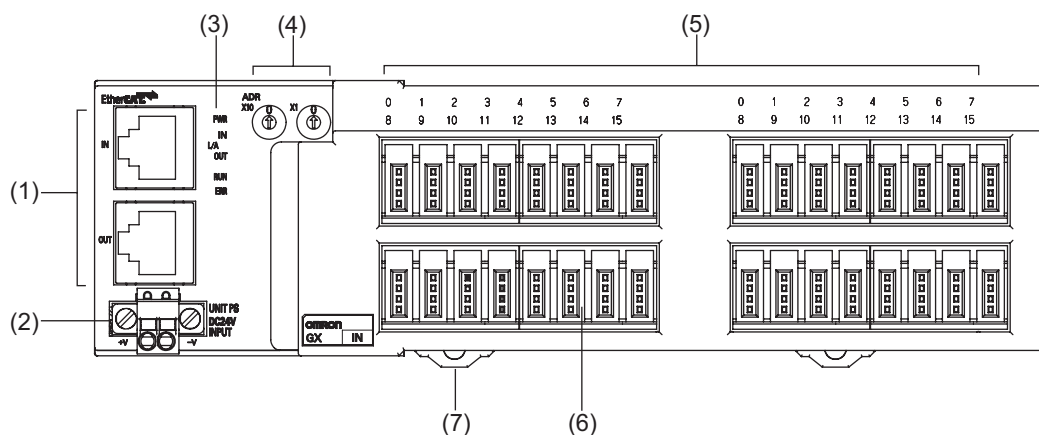
7-4-11 e-CON Connector Type 32-point Input Slave Unit GX-ID3218/ID3228

Specification

Item	Specification	
	GX-ID3218	GX-ID3228
Input capacity	32 points	
Internal I/O common	NPN	PNP
ON voltage	15 VDC min. (between each input terminal and the V terminal)	15 VDC min. (between each input terminal and the G terminal)
OFF voltage	5 VDC max. (between each input terminal and the V terminal)	5 VDC max. (between each input terminal and the G terminal)
OFF current	1.0 mA max.	
Input current	6.0 mA max./input (at 24-VDC) 3.0 mA max./input (at 17-VDC)	
ON delay	0.1 ms max.	
OFF delay	0.2 ms max.	
Input filter value	Without filter, 0.5 ms, 1 ms, 2 ms, 4 ms, 8 ms, 16 ms, 32 ms (Default setting: 1 ms)	
Number of circuits per common	32 points/common	
Input indicators	LED display (yellow)	
Isolation method	No isolation	
I/O power supply method	Supplied from unit power supply	
Input device supply current	100 mA/point	
Unit power supply current consumption	230 mA max. (for 20.4 to 26.4-VDC power supply voltage)	
Weight	220 g max.	
Expansion functions	No	
Short-circuit protection function	Available (Operates at 50 mA/point min.)	

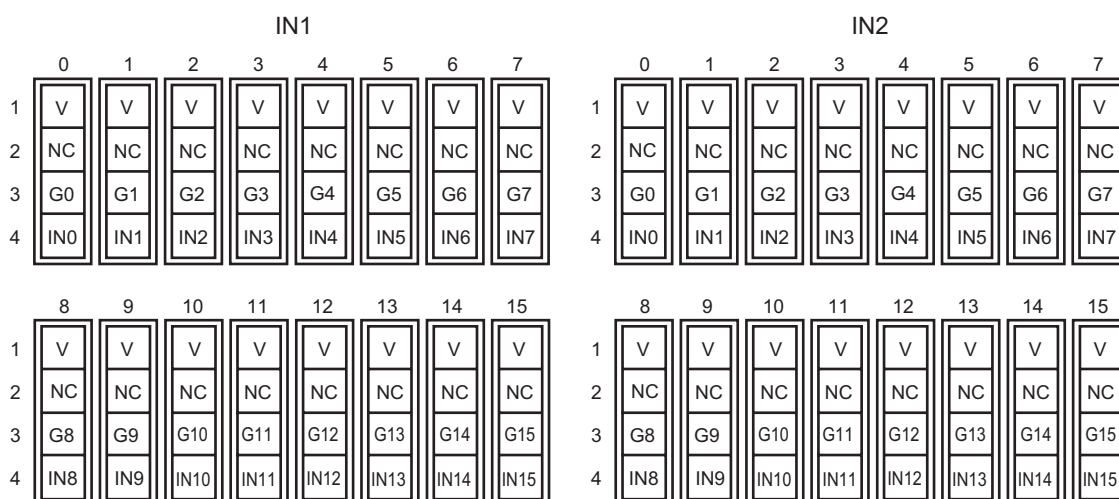
Notes For the I/O power supply current value to V and G terminals, refer to "A-4 I/O Power Supply Current" in Page A - 33.

Names and functions

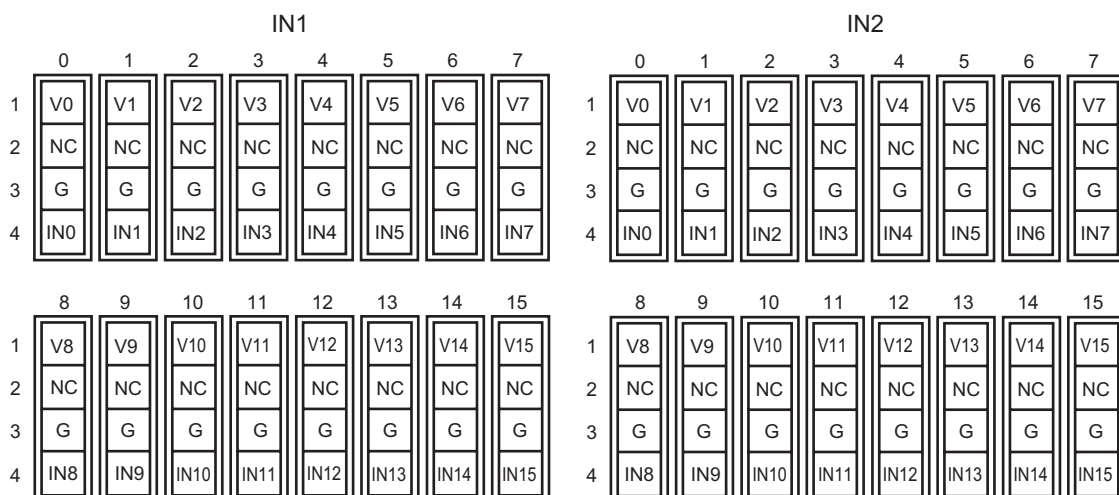


● Terminal arrangement diagram

- GX-ID3218



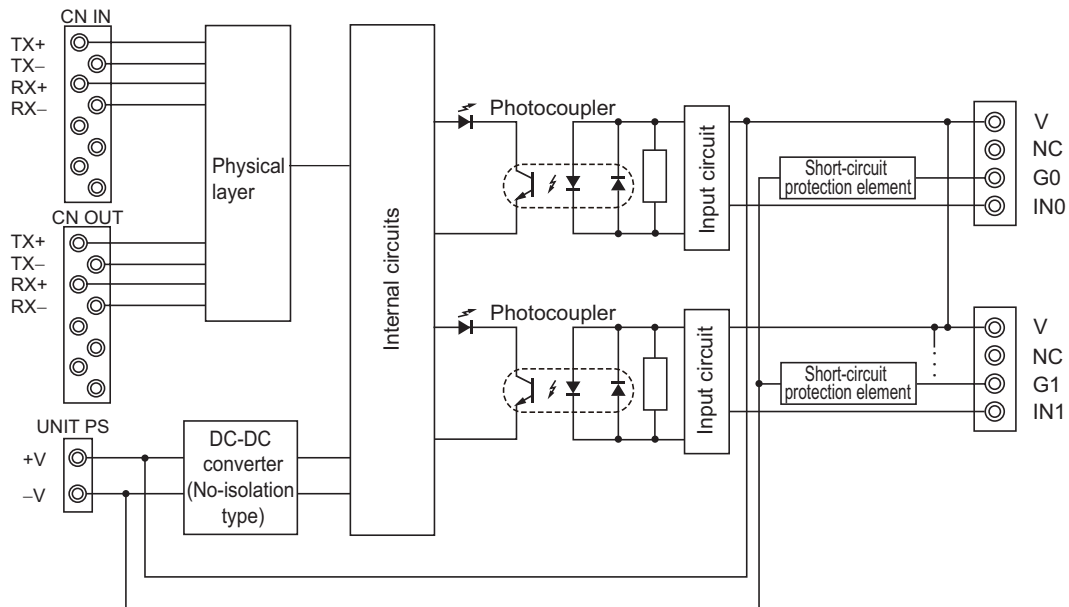
- GX-ID3228



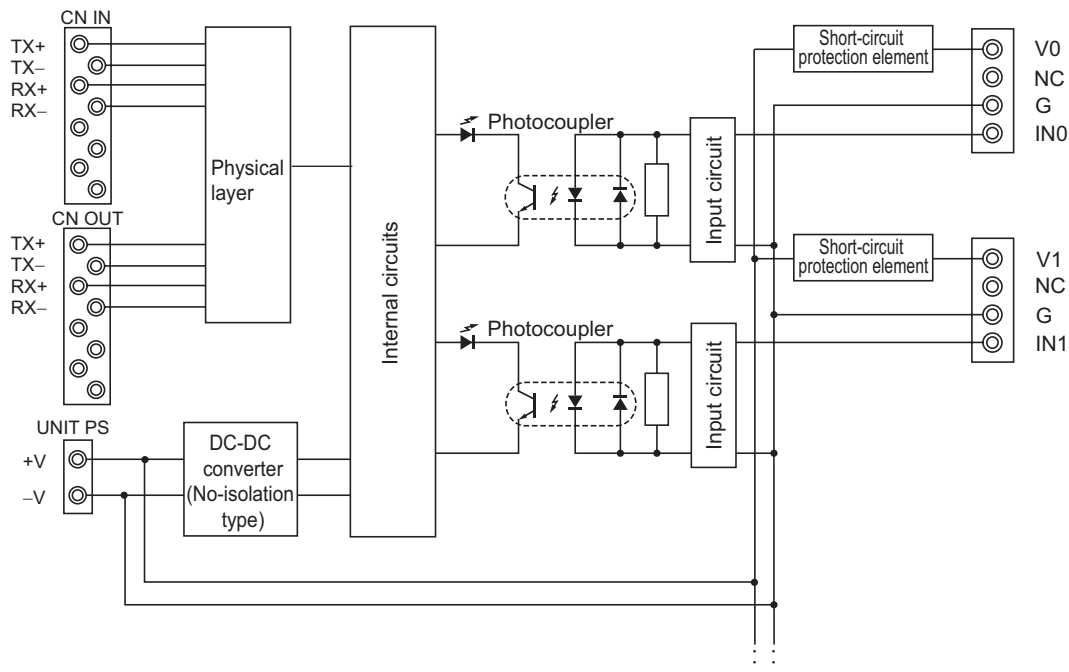
No.	Name	Function
(1)	Communications connectors	Refer to "6-3 Specifications of Common Areas" in Page 6 - 4.
(2)	Unit power supply connector	
(3)	Status indicators	
(4)	Node Address setting Switches	
(5)	Input indicators (IN1 0 to 15, IN2 0 to 15)	Indicates the state of an input contact (ON/OFF). Not lit: Contact OFF (input OFF state) Lit in yellow: Contact ON (input ON state)
(6)	I/O connectors (0 to 15 × 2)	Connects an external device.
(7)	DIN track mounting hook	Fixes a Slave Unit to a DIN track.

Internal circuits diagram

● GX-ID3218 (NPN)

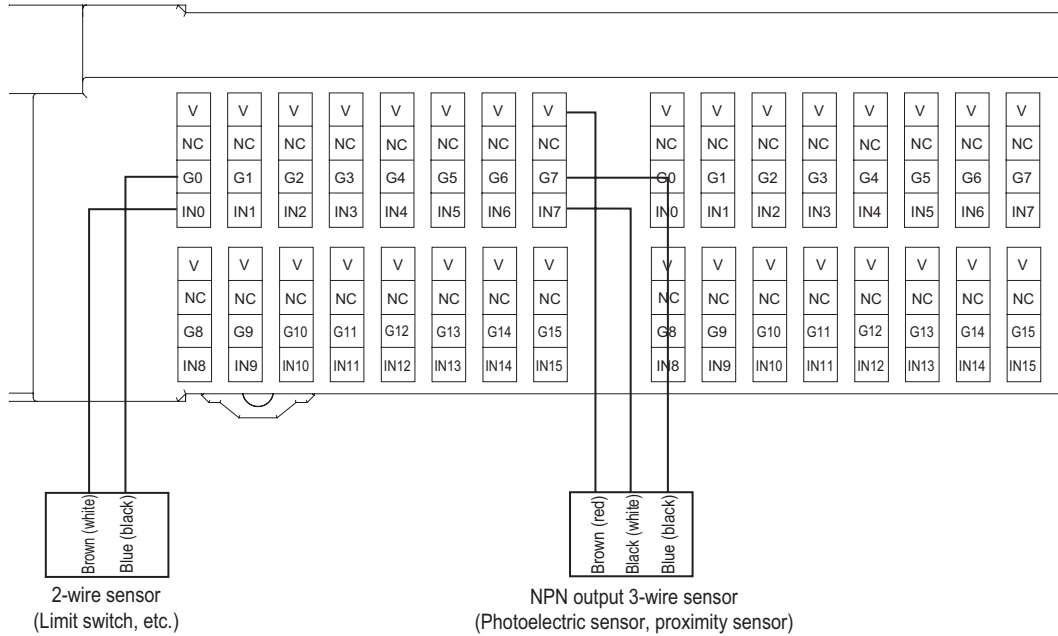


● GX-ID3228 (PNP)

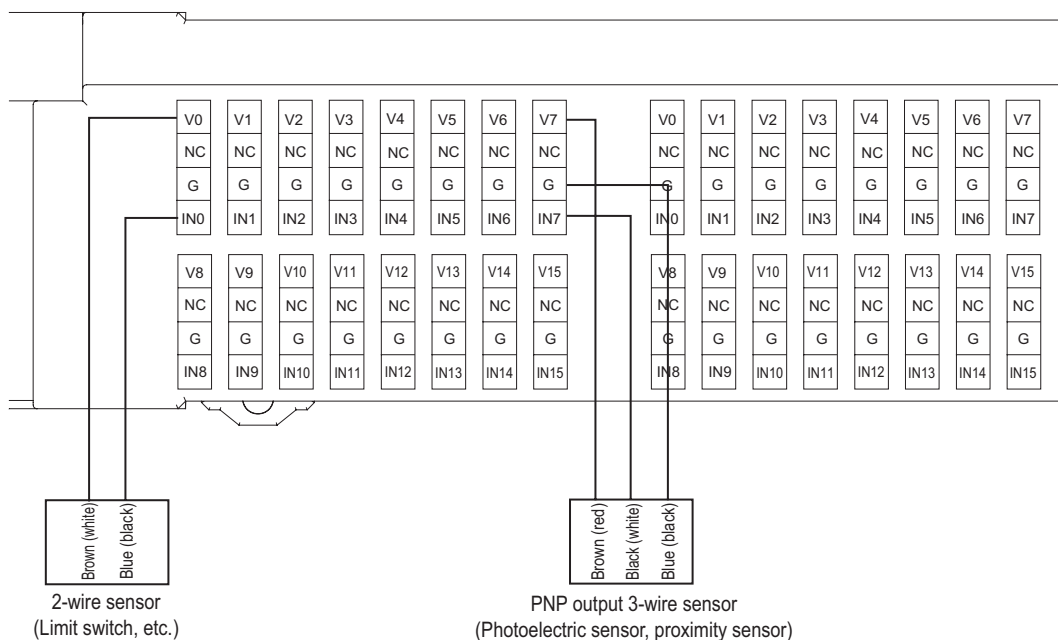


Wiring diagram

● GX-ID3218 (NPN)



● GX-ID3228 (PNP)



Reference

Wire colors have been changed according to revisions in the JIS standards for photoelectric and proximity sensors. The colors in parentheses are the wire colors prior to the revisions.

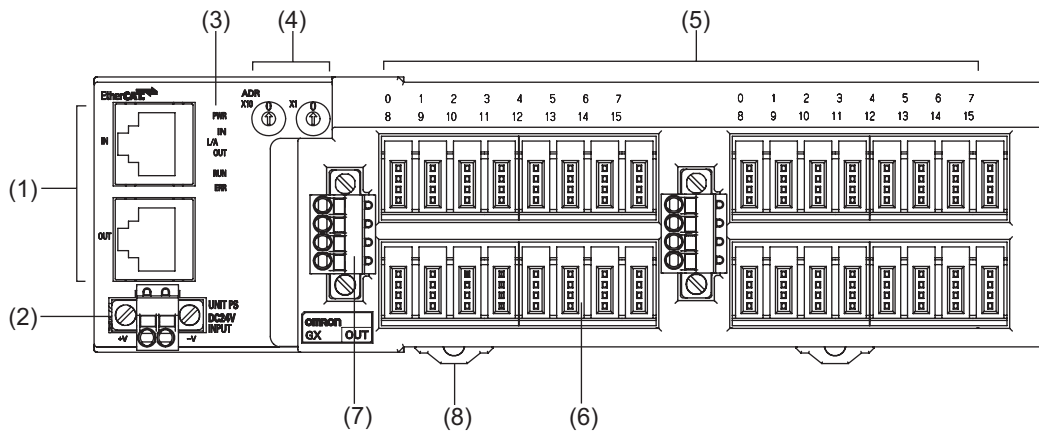
7-4-12 e-CON Connector Type 32-point Output Slave Unit GX-OD3218/OD3228

Specification

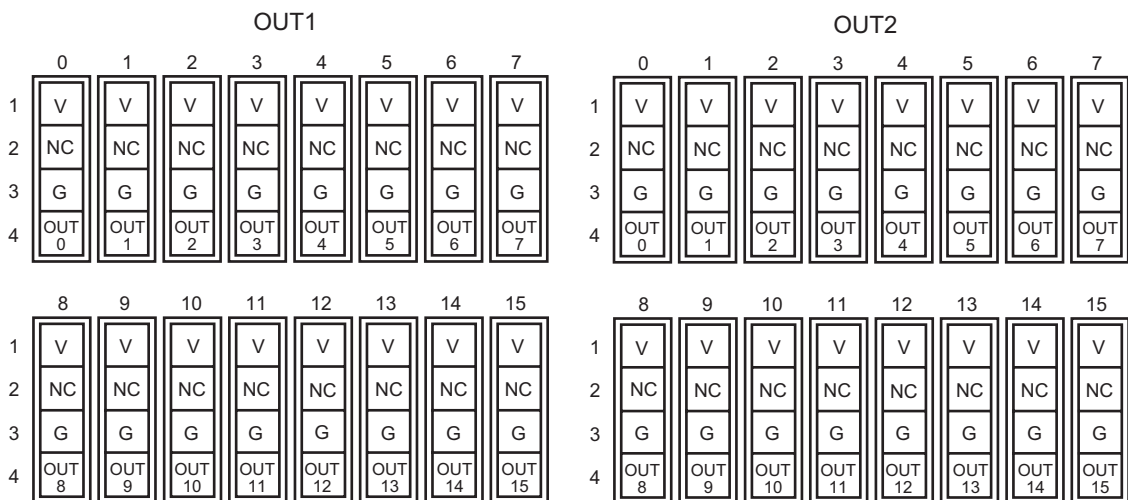
Item	Specification	
	GX-OD3218	GX-OD3228
Output capacity	32 points	
Rated current (ON current)	0.5 A/output, 4.0 A/common	
Internal I/O common	NPN	PNP
Residual voltage	1.2 V max. (0.5 ADC, between each output terminal and the G terminal)	1.2 V max. (0.5 ADC, between each output terminal and the V terminal)
Leakage current	0.1 mA max.	
ON delay	0.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	16 points/common	
Output indicators	LED display (yellow)	
Isolation method	Photocoupler isolation	
I/O power supply method	Supply by I/O power supply	
Output device supply current	100 mA/point	
Unit power supply current consumption	100 mA max. (for 20.4 to 26.4-VDC power supply voltage)	
Weight	210 g max.	
Expansion functions	No	
Error Mode Output	Select either hold or clear.	
Short-circuit protection function	No	

Notes For the I/O power supply current value to V and G terminals ,refer to "A-4 I/O Power Supply Current" in Page A - 33.

Names and functions



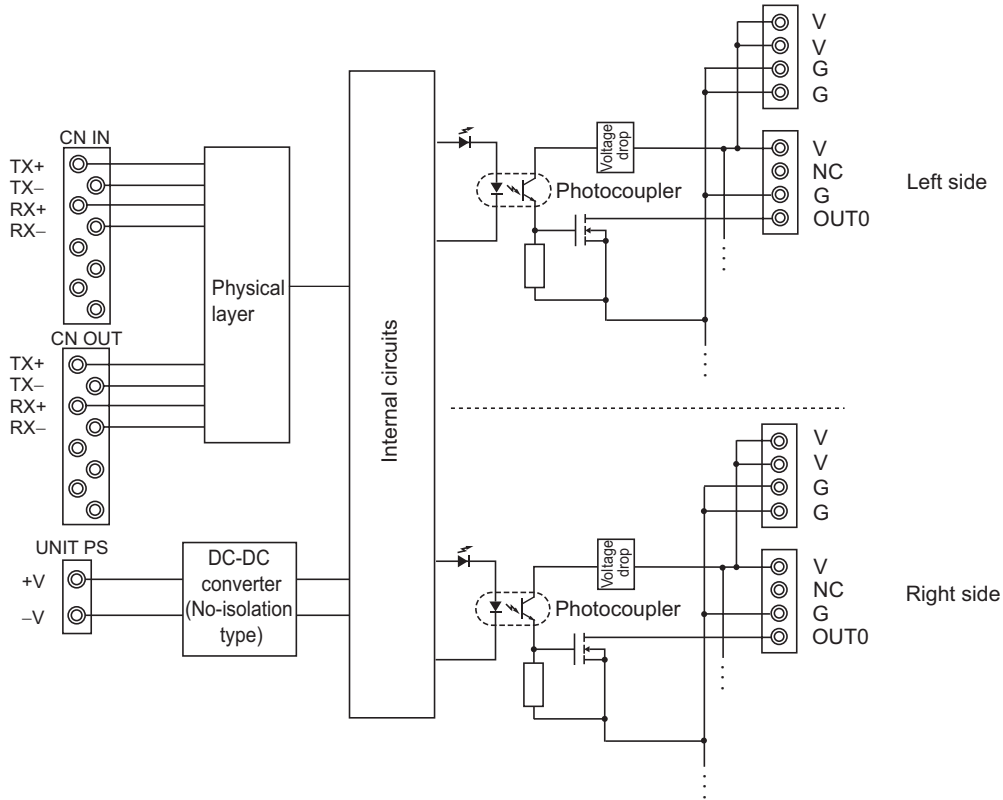
● Terminal arrangement diagram



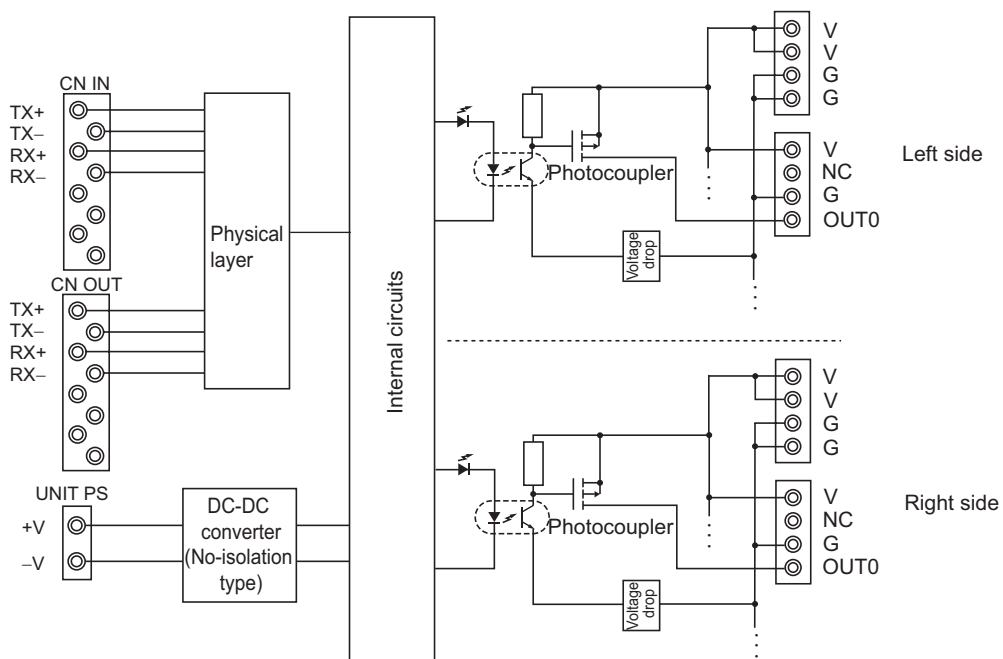
No.	Name	Function
(1)	Communications connectors	Refer to "6-3 Specifications of Common Areas" in Page 6 - 4.
(2)	Unit power supply connector	
(3)	Status indicators	
(4)	Node Address setting Switches	
(5)	Output indicators (OUT1 0 to 15, OUT2 0 to 15)	Indicates the state of an output contact (ON/OFF). Not lit: Contact OFF (output OFF state) Lit in yellow: Contact ON (output ON state)
(6)	I/O connectors (0 to 15 × 2)	Connects an external device.
(7)	I/O power supply connectors (× 2)	Supplies the I/O power.
(8)	DIN track mounting hook	Fixes a Slave Unit to a DIN track.

Internal circuits diagram

● GX-OD3218 (NPN)

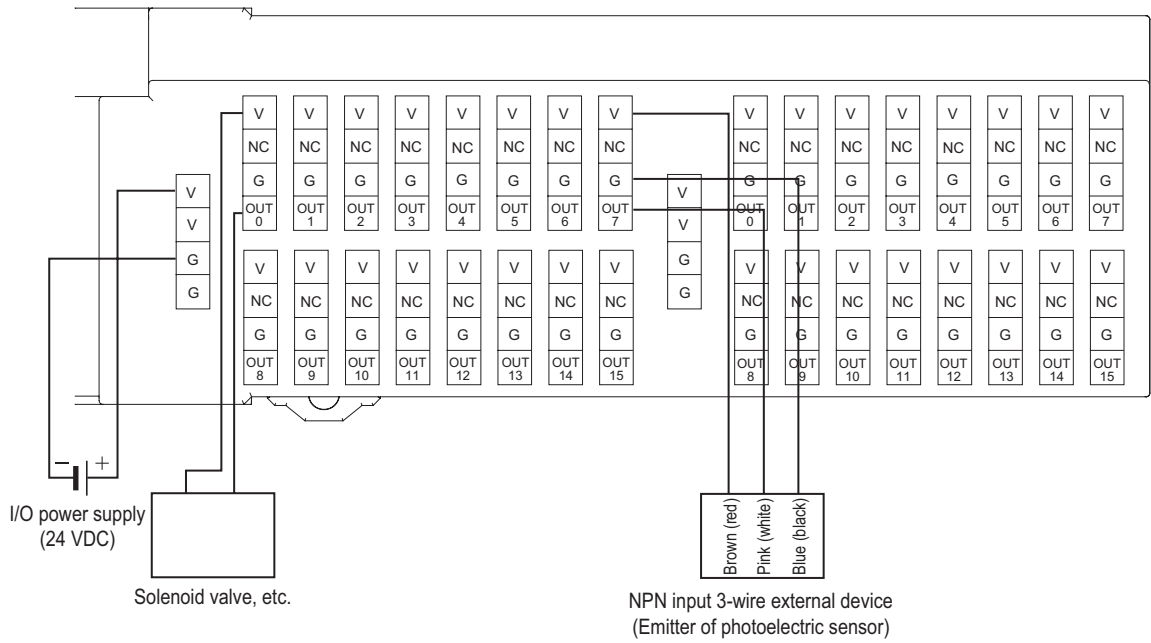


● GX-OD3228 (PNP)

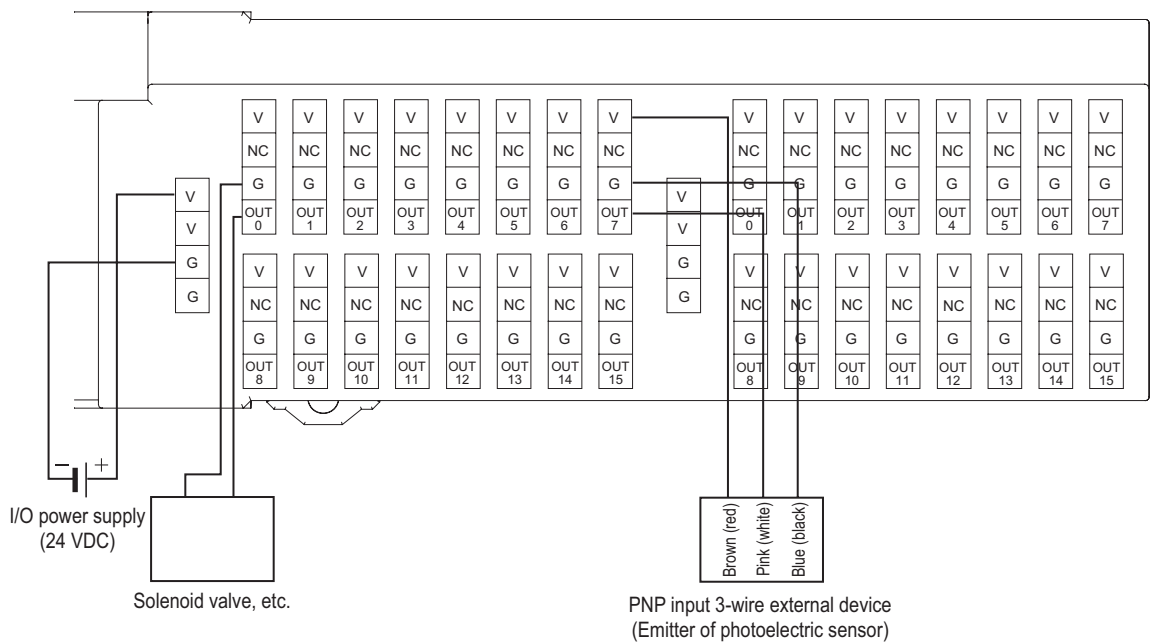


Wiring diagram

● GX-OD3218 (NPN)



● GX-OD3228 (PNP)





Precautions for Correct Use

- The I/O power supply connectors on the left and right are equipped with two sets of V and G terminals. One set of terminals is used for the I/O power supply for the unit, and the other set is used for the I/O power supply to the next unit. Use a maximum current of 4 A per terminal.
 - When using an inductive load, such as a solenoid valve, either use a built-in diode for absorbing the counterelectromotive force or install an external diode.
-



Reference

Wire colors have been changed according to revisions in the JIS standards for photoelectric and proximity sensors. The colors in parentheses are the wire colors prior to the revisions.

7-4-13 e-CON Connector Type 16-point Input and 16-point Output Slave Unit GX-MD3218/MD3228

Specification

● Common to input section and output section

Item	Specification	
	GX-MD3218	GX-MD3228
Internal I/O common	NPN	PNP
I/O indicators	LED display (yellow)	
Unit power supply current consumption	150 mA max. (for 20.4 to 26.4-VDC power supply voltage)	
Weight	220 g max.	
Expansion functions	No	
Short-circuit protection function	Available at input section only (Operates at 50 mA/point min.)	

● Input section

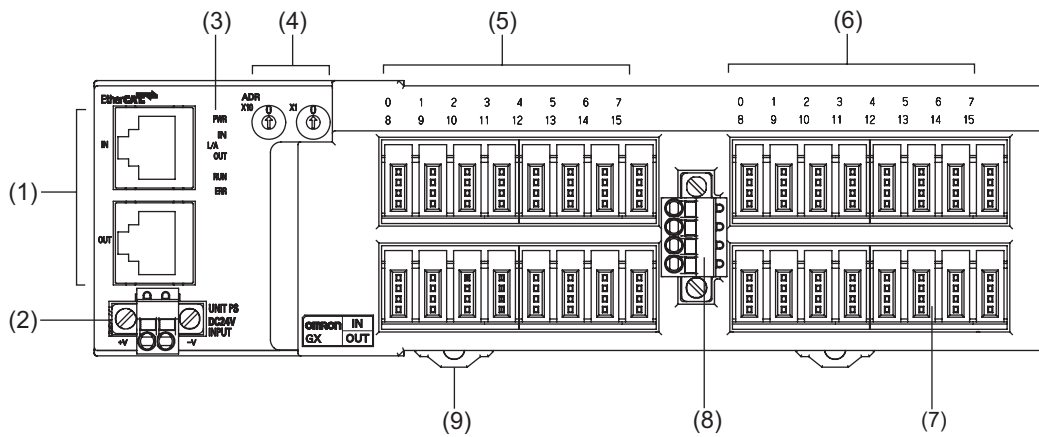
Item	Specification	
	GX-MD3218	GX-MD3228
Input capacity	16 points	
ON voltage	15 VDC min. (between each input terminal and the V terminal)	15 VDC min. (between each input terminal and the G terminal)
OFF voltage	5 VDC max. (between each input terminal and the V terminal)	5 VDC max. (between each input terminal and the G terminal)
OFF current	1.0 mA max.	
Input current	6.0 mA max./input (at 24-VDC) 3.0 mA max./input (at 17-VDC)	
ON delay	0.1 ms max.	
OFF delay	0.2 ms max.	
Input filter value	Without filter, 0.5 ms, 1 ms, 2 ms, 4 ms, 8 ms, 16 ms, 32 ms (Default setting: 1 ms)	
Number of circuits per common	16 points/common	
Isolation method	No-isolation	
I/O power supply method	Supplied from unit power supply	
Input device supply current	100 mA/point	
I/O power supply current consumption	5 mA max. (for 20.4 to 26.4-VDC power supply voltage)	

● Output section

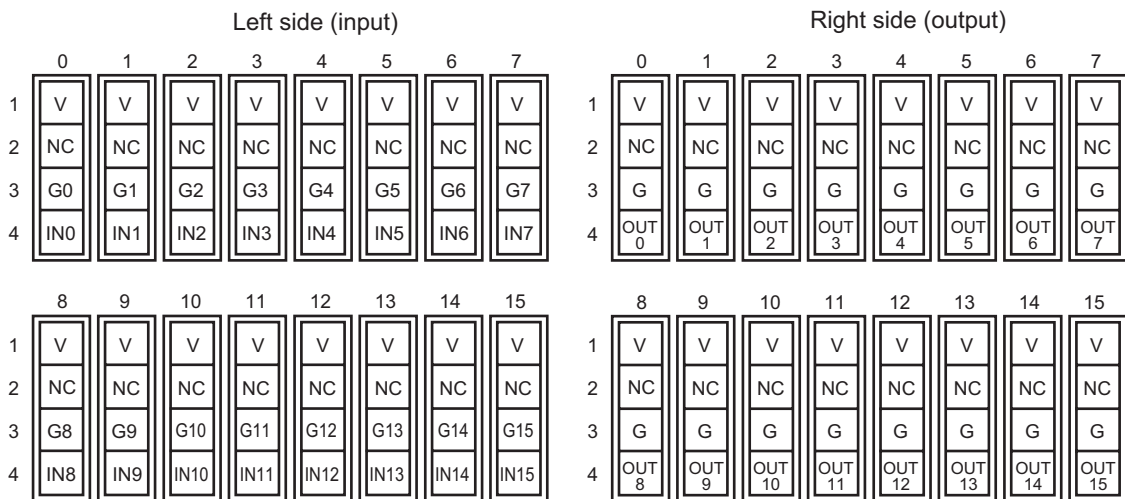
Item	Specification	
	GX-MD3218	GX-MD3228
Output capacity	16 points	
Rated output current	0.5 A/output, 2.0 A/common	
Residual voltage	1.2 V max. (0.5 ADC, between each output terminal and the G terminal)	1.2 V max. (0.5 ADC, between each output terminal and the V terminal)
Leakage current	0.1 mA max.	
ON delay	0.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	16 points/common	
Isolation method	Photocoupler isolation	
I/O power supply method	Supply by I/O power supply	
Output device supply current	100 mA/point	
I/O power supply current consumption	5 mA max. (for 20.4 to 26.4-VDC power supply voltage)	
Error Mode Output	Select either hold or clear.	

Notes For the I/O power supply current value to V and G terminals ,refer to "A-4 I/O Power Supply Current" in Page A - 33.

Names and functions



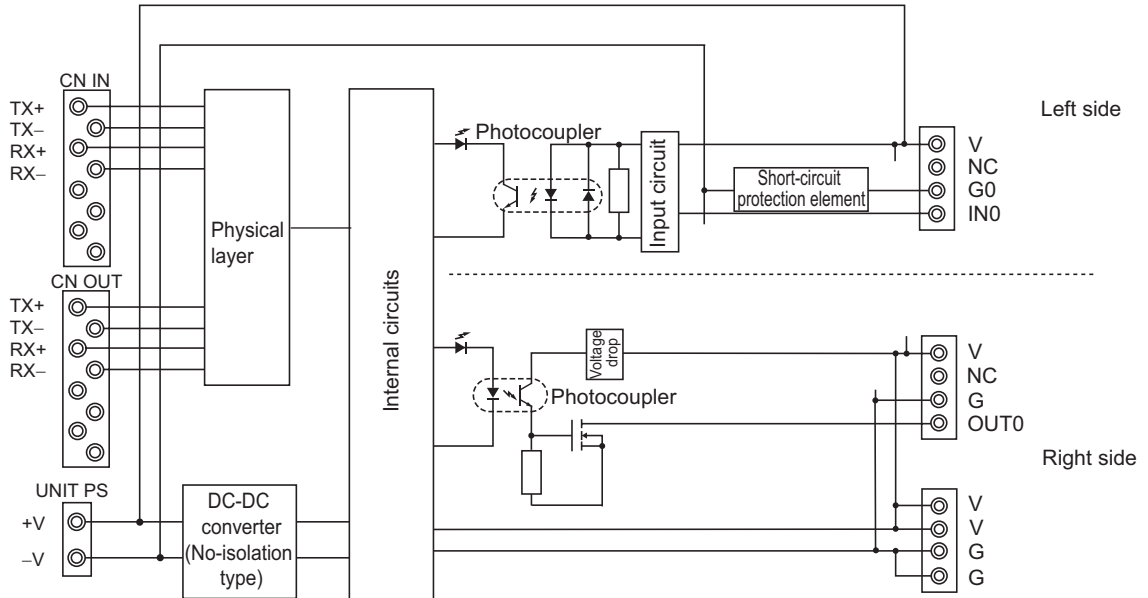
Terminal arrangement diagram



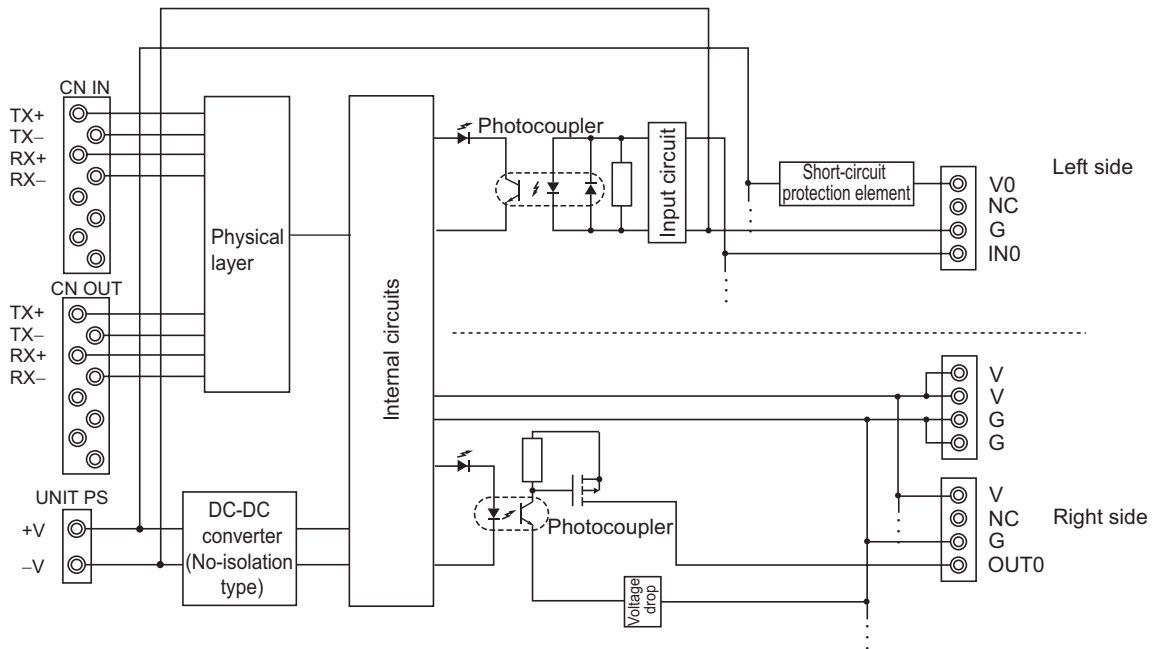
No.	Name	Function
(1)	Communications connectors	Refer to "6-3 Specifications of Common Areas" in Page 6 - 4.
(2)	Unit power supply connector	
(3)	Status indicators	
(4)	Node Address setting Switches	
(5)	Input indicators (0 to 15)	Indicates the state of an input contact (ON/OFF). Not lit: Contact OFF (input OFF state) Lit in yellow: Contact ON (input ON state)
(6)	Output indicators (0 to 15)	Indicates the state of an output contact (ON/OFF). Not lit: Contact OFF (output OFF state) Lit in yellow: Contact ON (output ON state)
(7)	I/O connectors (1 to 16 × 2)	Connects an external device. <Left side> For input device <Right side> For output device
(8)	I/O power supply connector	Supplies the I/O power. (For output device)
(9)	DIN track mounting hook	Fixes a Slave Unit to a DIN track.

Internal circuits diagram

● GX-MD3218 (NPN)

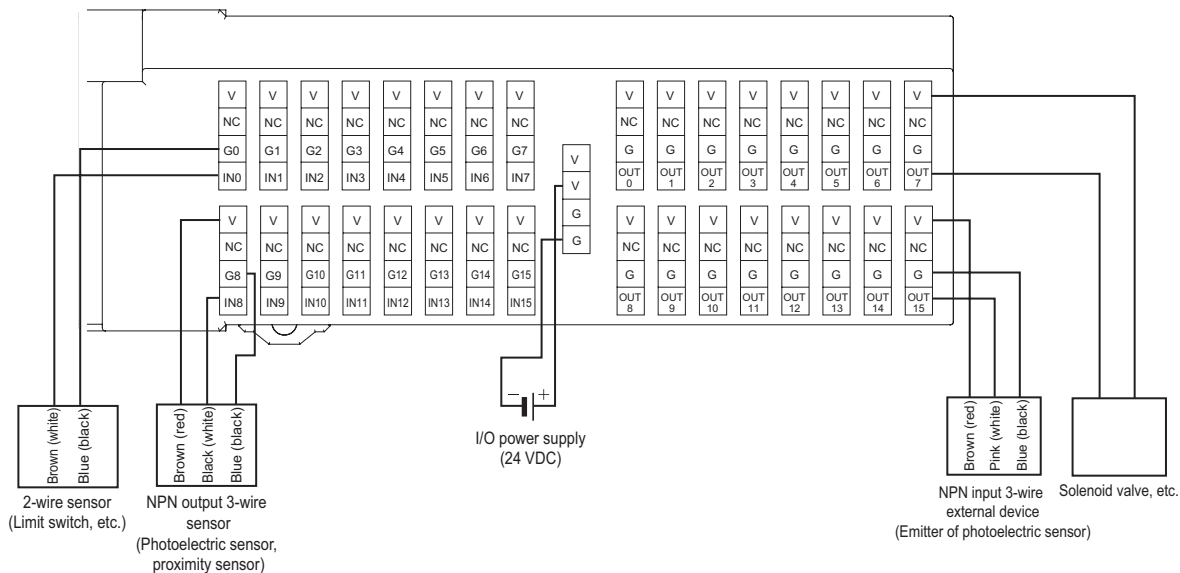


● GX-MD3228 (PNP)

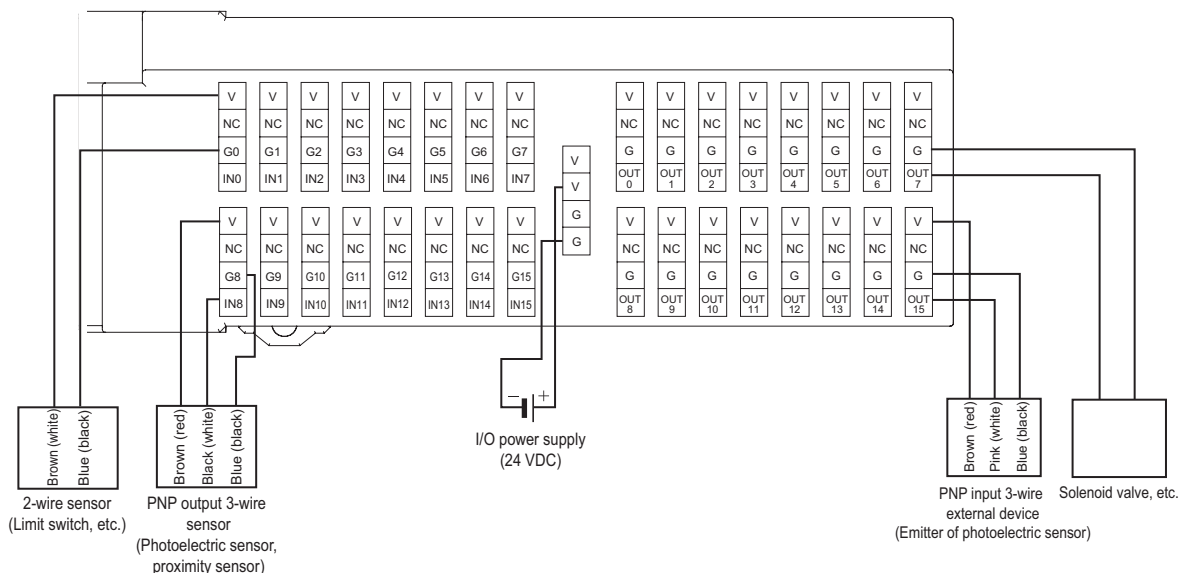


Wiring diagram

● GX-MD3218 (NPN)



● GX-MD3228 (PNP)



7-4 Specifications for Each Slave Unit

7

7-4-13 e-CON Connector Type 16-point Input and 16-point Output Slave Unit
GX-MD3218/MD3228



Precautions for Correct Use

- The I/O power supply connectors are equipped with two sets of V and G terminals. One set of terminals is used for the I/O power supply for the unit, and the other set is used for the I/O power supply to the next unit. Use a maximum current of 4 A per terminal.
 - When using an inductive load, such as a solenoid valve, either use a built-in diode for absorbing the counterelectromotive force or install an external diode.
-



Reference

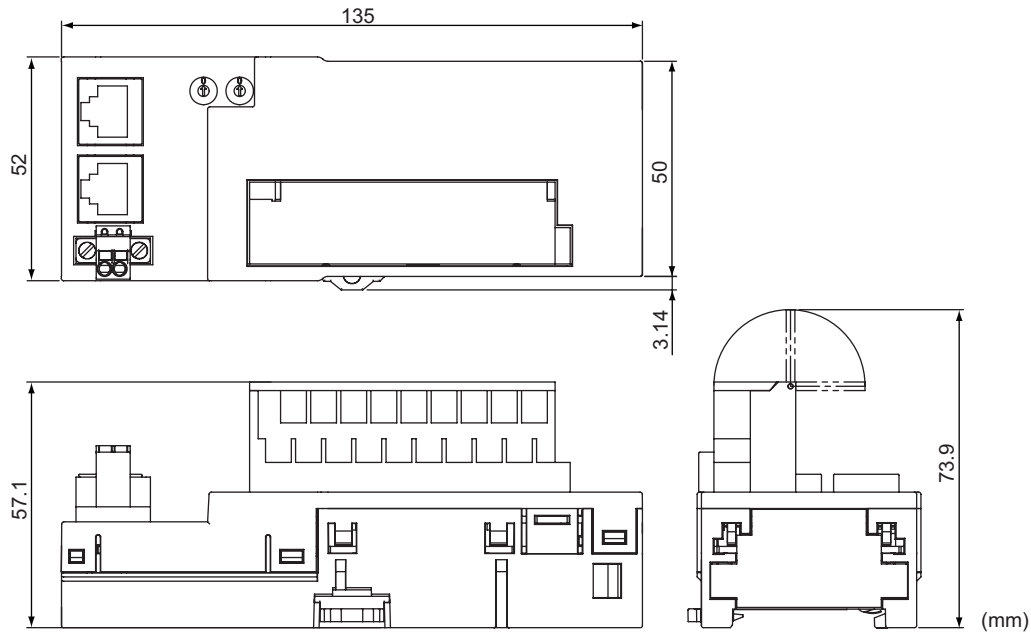
Wire colors have been changed according to revisions in the JIS standards for photoelectric and proximity sensors. The colors in parentheses are the wire colors prior to the revisions.

7-5 Mounting Dimensions

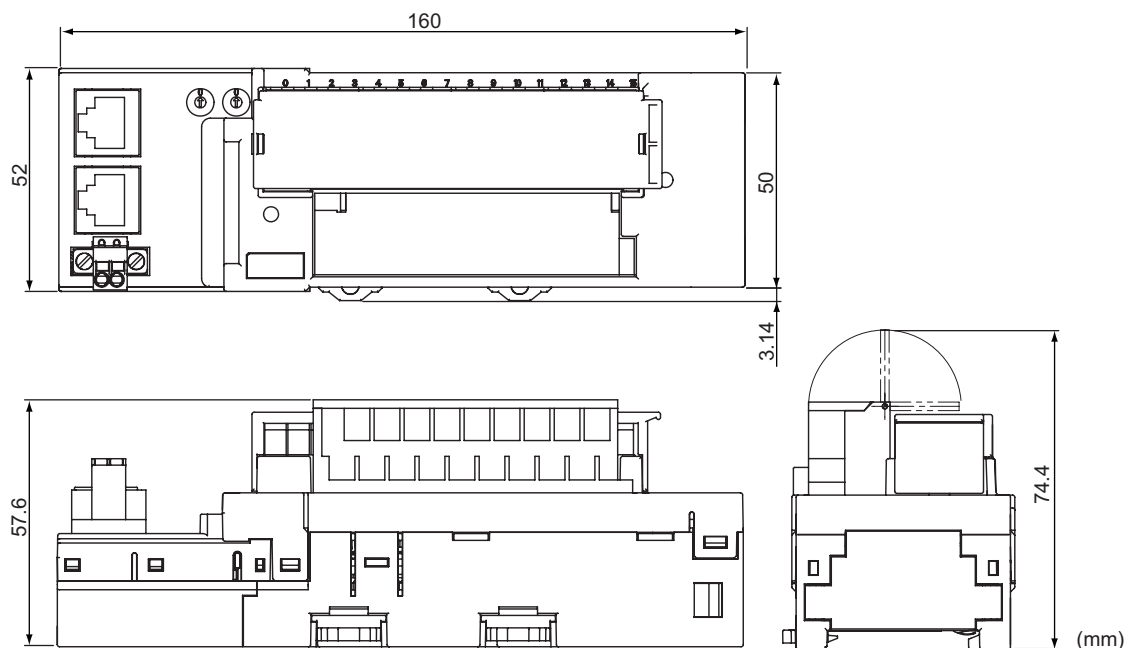
The mounting dimensions of a Digital I/O Slave Unit are shown below.

7-5-1 2-tier Terminal Block Type

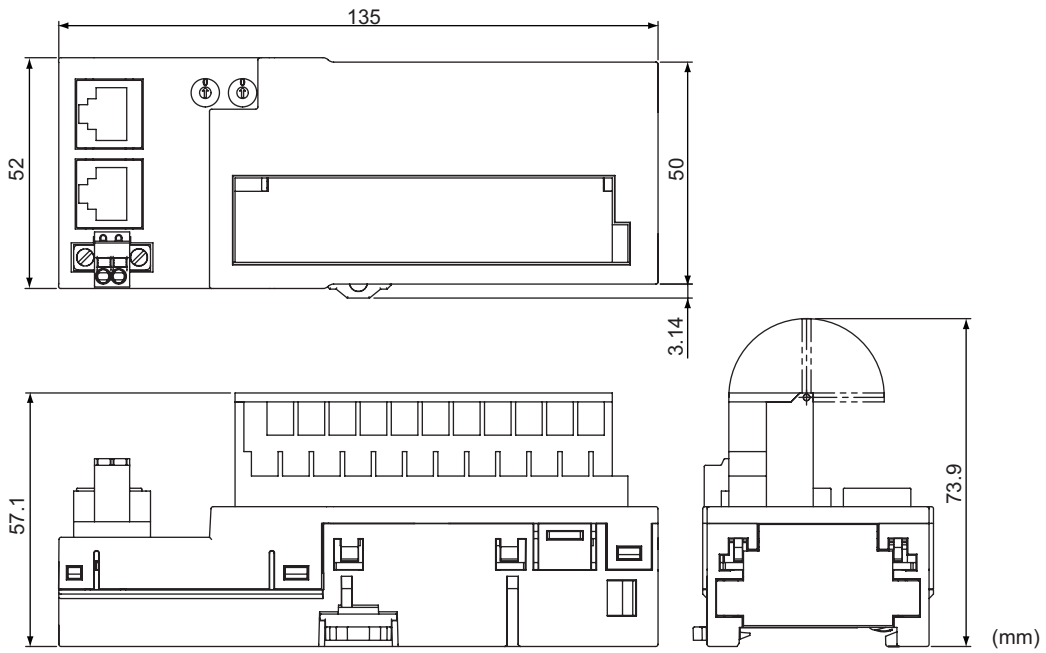
- GX-ID1611/ID1621/OD1611/OD1621



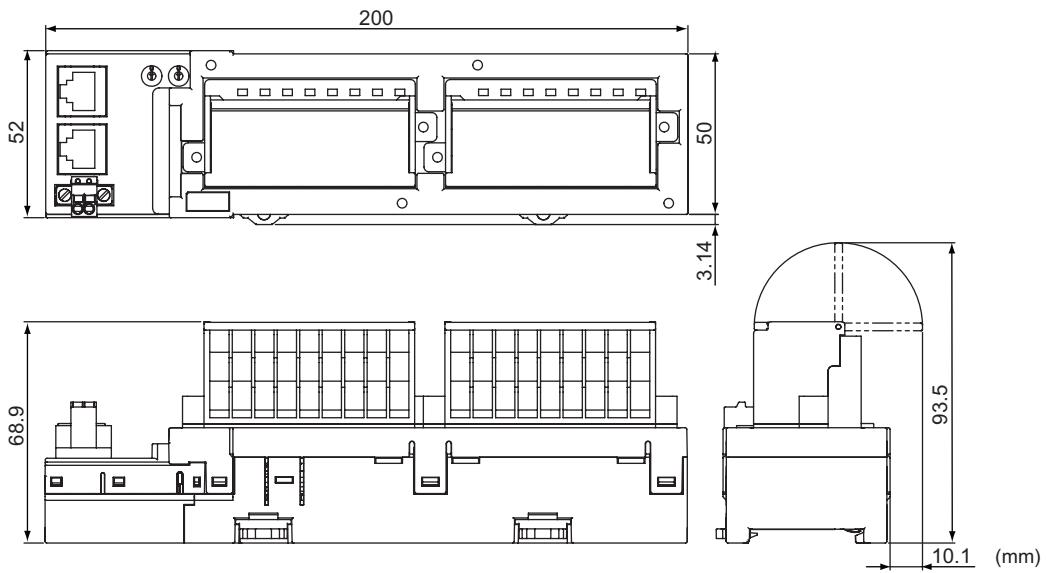
- GX-OC1601



● GX-MD1611/MD1621

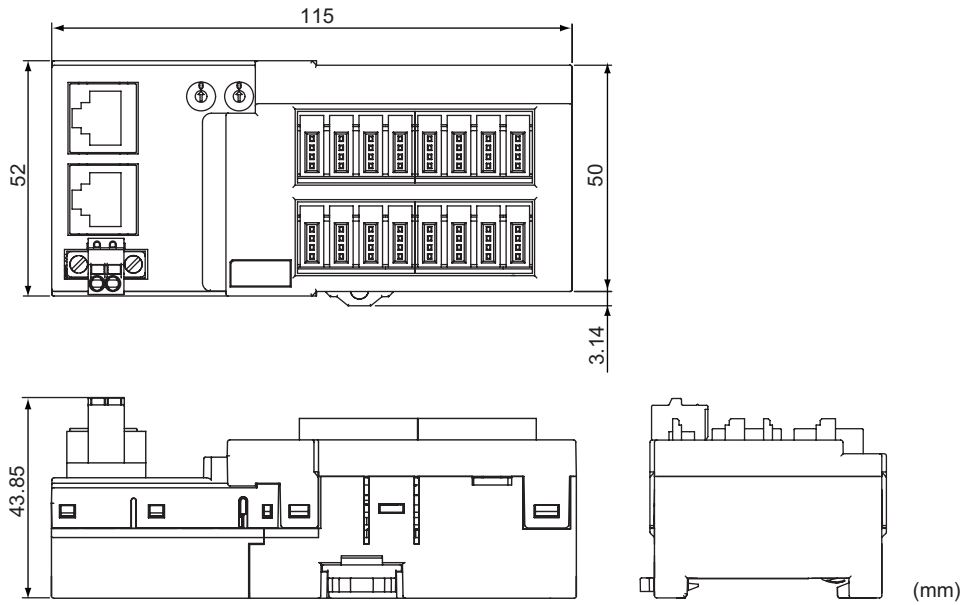


7-5-2 3-tier Terminal Block Type

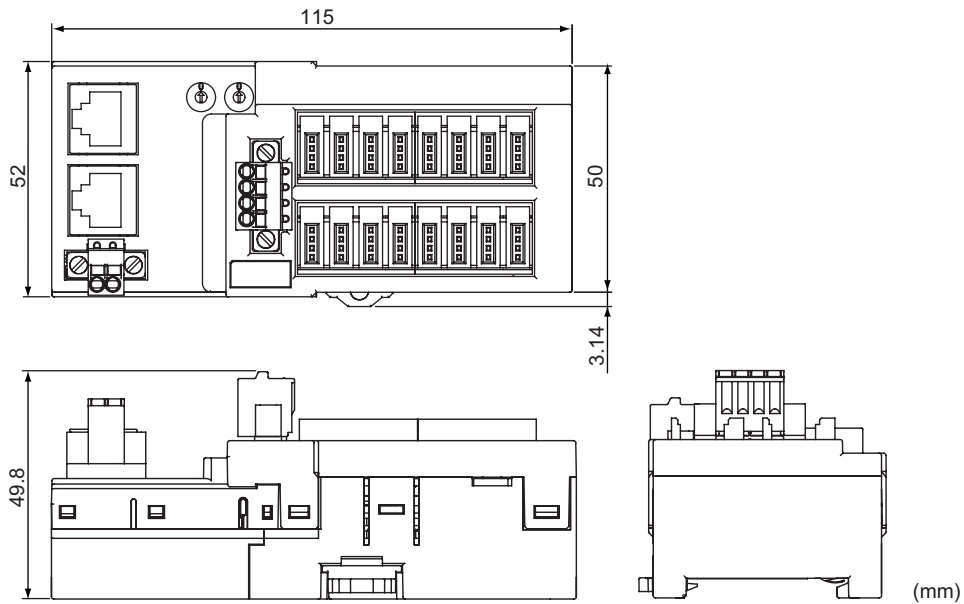


7-5-3 e-CON Connector Type

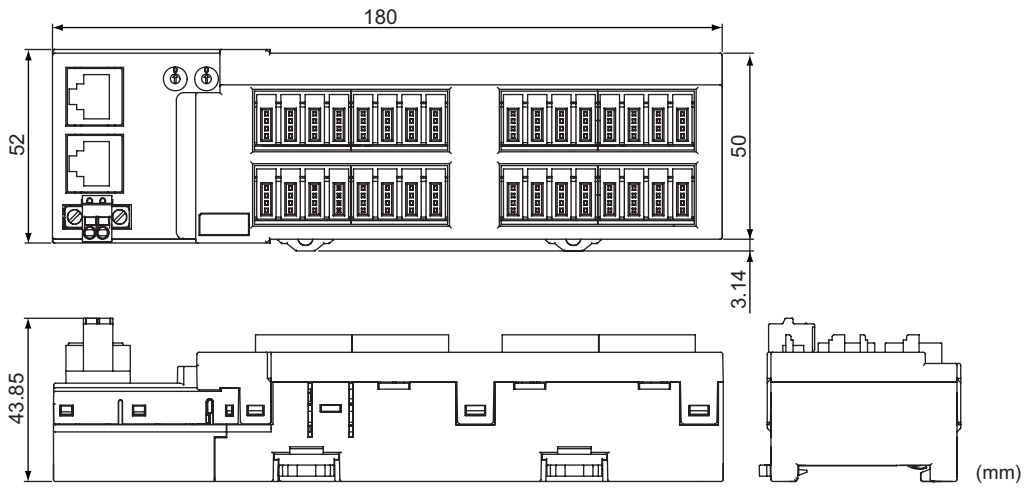
● **GX-ID1618/ID1628**



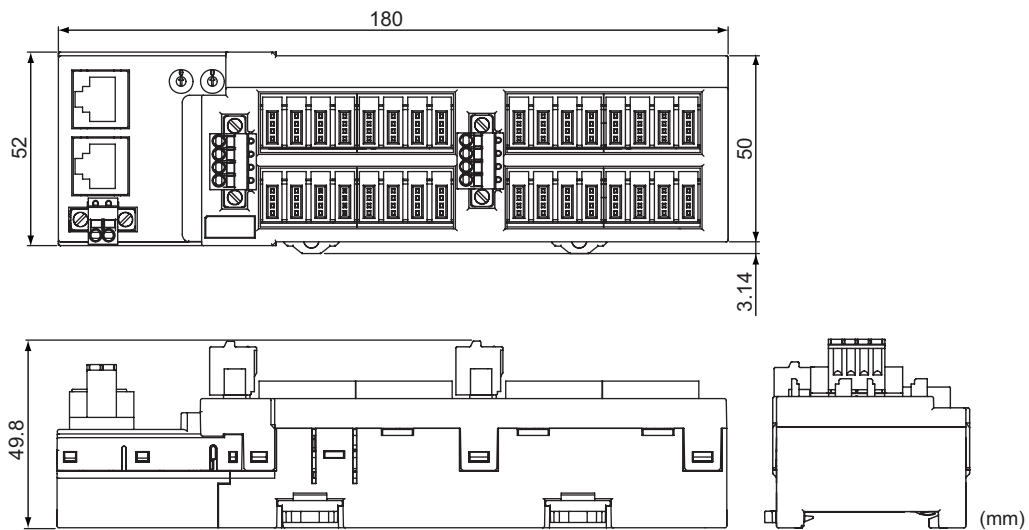
● **GX-OD1618/OD1628/MD1618/MD1628**



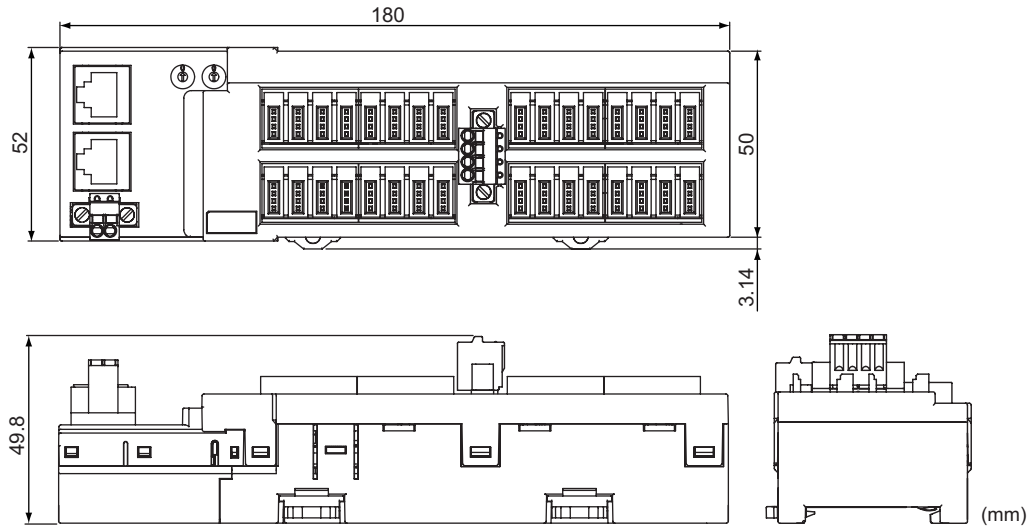
● GX-ID3218/ID3228



● GX-OD3218/OD3228



● GX-MD3218/MD3228



8

Analog I/O Slave Unit

This chapter explains the overview of the Analog I/O Slave Unit.

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8-1 Analog I/O Slave Unit

Analog I/O Slave Units refer to slaves with processing functions for analog I/O data (voltage value/current value).

Other functions of the Slave Unit include the Moving Average and User Adjustment.

8-2 Overview of the Analog Input Slave Unit

Analog Input Slave Unit convert (AD conversion) analog input signals such as 1 to 5 V and 4 to 20 mA to digital data (binary values) and store them in the EtherCAT Master Unit.

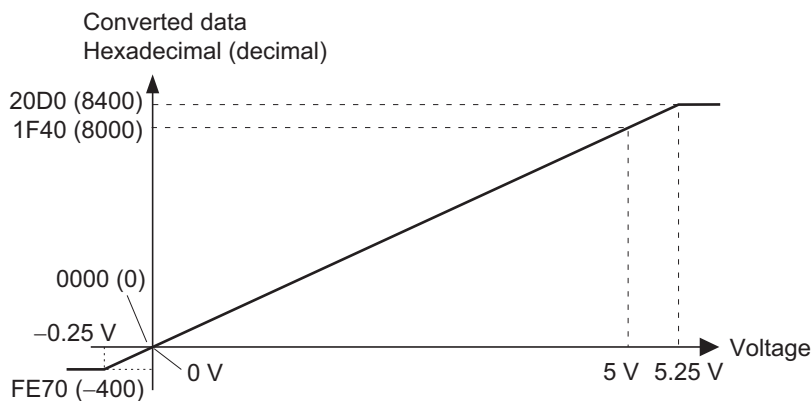
8-2-1 Input Range and Converted Data

Input analog signals are converted to digital data in the following manner using a set input range. If the input data exceeds the data range for which conversion is possible, the converted data is fixed to the maximum or minimum value of the range.

Input Range and Converted Data

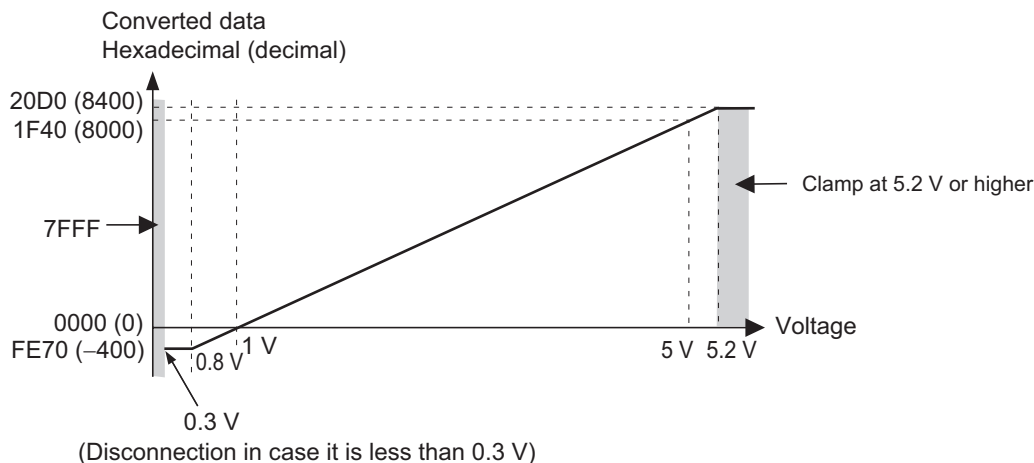
- **Input range 0 to 5 V**

Voltage of 0 to 5 V is converted to data from 0000 to 1F40 hex (0 to 8000). The input data range for which conversion is possible is -0.25 to 5.25 V and here the output data is FE70 to 20D0 hex (-400 to 8400). When input data is a negative voltage, it is expressed as the two's complement (hexadecimal) and the output data for a disconnected line is the same as for an input of 0 V (0000 hex).



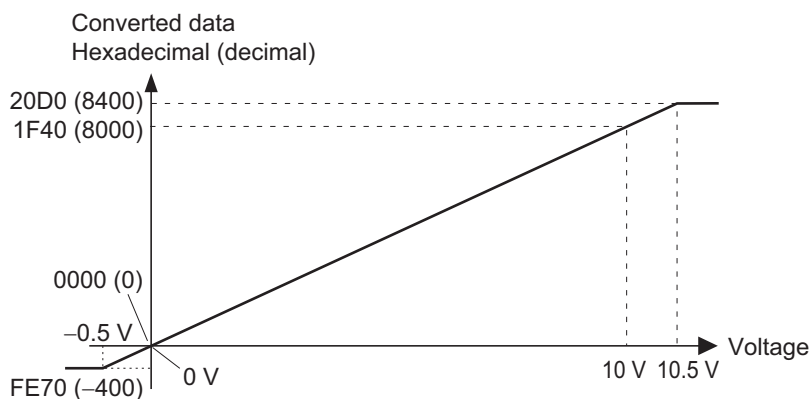
● **Input range 1 to 5 V**

Voltage of 1 to 5 V is converted to data from 0000 to 1F40 hex (0 to 8000). The input data range for which conversion is possible is 0.8 to 5.2 V and here the output data is FE70 to 20D0 hex (-400 to +8400). If the input voltage drops below the input range to lower than 0.3 V due to disconnection and so on, the disconnected line detection is activated and the data is set to 7FFF hex.



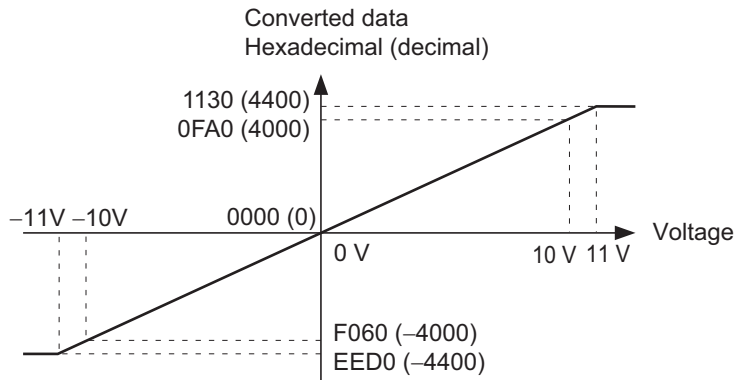
● **Input range 0 to 10 V**

Voltage of 0 to 10 V is converted to data from 0000 to 1F40 hex (0 to 8000). The input data range for which conversion is possible is -0.5 to 10.5 V and here the output data is FE70 to 20D0 hex (-400 to +8400). When input data is a negative voltage, it is expressed as the two's complement (hexadecimal) and the output data for a disconnected line is the same as for an input of 0 V (0000 hex).



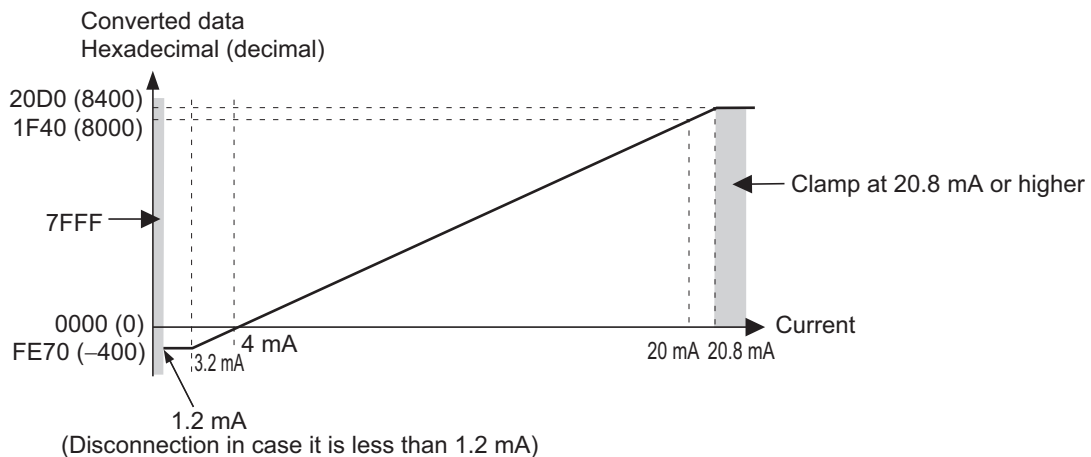
● Input range –10 to +10 V

Voltage of –10 to +10 V is converted to data from F060 to 0F40 hex (–4000 to +4000). The input data range for which conversion is possible is –11 to +11 V and here the output data is EED0 to 1130 hex (–4400 to +4400). When input data is a negative voltage, it is expressed as the two's complement (hexadecimal) and the output data for a disconnected line is the same as for an input of 0 V (0000 hex).



● Input range 4 to 20mA

Current of 4 to 20 mA is converted to data from 0000 to 1F40 hex (0 to 8000). The input data range for which conversion is possible is 3.2 to 20.8 mA and here the output data is FE70 to 20D0 hex (–400 to +8400). If the input current drops below the input range to lower than 1.2 mA due to disconnection and so on, the disconnected line detection is activated and the data is set to 7FFF hex.



Input range settings

The input range is set using the input range switch (DIP switch) of a Slave Unit or by SDO communications.

When SDO communication is used for the setting, the target index is 3101 hex.

For the set value, refer to the corresponding index of "Appendix A-1 Object Dictionary" in Page A - 20.

For how to set with the input range switch, refer to "Names and functions" in Page 8 - 20.

8-2-2 I/O Data Allocation (PDO Mapping)

An Analog Input Slave Unit has input data only, and is allocated to the IN area of the I/O memory of the EtherCAT Master Unit.

For the detailed explanation of allocation method, refer to the manual of EtherCAT Master Unit to be connected.

Input data allocation

Input data of an Analog Input Slave Unit is analog input data (for 4 channels).

Offset (byte)	7 bit	0 bit
0	Analog input data for CH1	
+1	Analog input data for CH2	
+2	Analog input data for CH3	
+3	Analog input data for CH4	
+4		
+5		
+6		
+7		

8-3 Function of the Analog Input Slave Unit

An Analog Input Slave Units has the following convenient functions, in addition to the I/O signal processing.

8-3-1 AD Conversion Available Point Setting

Overview of functions

- **Purpose**

This function sets to skip processing unused points, and enhances the speed of refresh cycles of analog input.

- **Details of functions**

Normally in this Unit, the values for the four input points are converted in sequence. The setting can be changed, so that unused points are not converted.

By reducing the number of conversion points, the conversion cycle speed is increased.

Whether AD conversion is enabled or disabled is settable for each point. (Default setting: Enable for all channels)

Notes Regardless of this setting, an Analog Input Slave Unit uses four points of data allocation area.

Setting method

Set by SDO communications.

The target index is 3100 hex.

For the set values, refer to the information in the corresponding index of "Appendix A-1 Object Dictionary" in Page A - 20.

The table below shows the analog conversion time by the number of AD conversion available points.

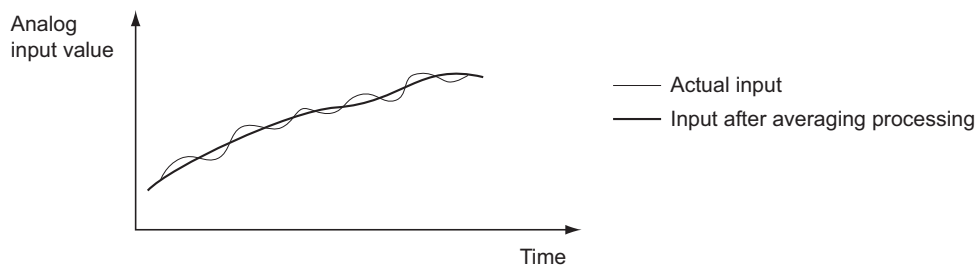
Enabled channel	Conversion time [μ s]
1 point	500
2 points	1000
3 points	1500
4 points	2000

8-3-2 Moving Average

Overview of functions

● Purpose

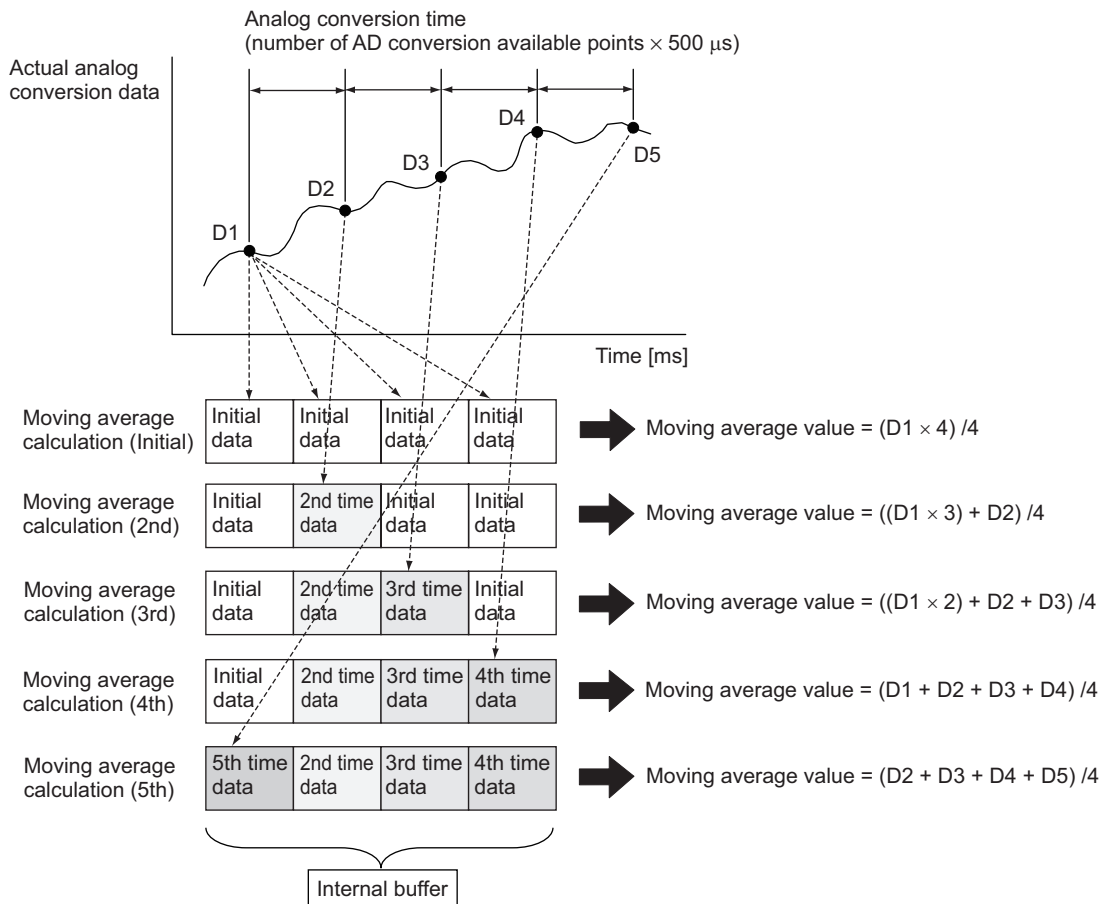
The function averages the inputs if they fluctuate minutely due to noise and so on as shown in the figure below, and obtains smooth input values.



● Details of functions

This function is used to calculate the average value of analog inputs during a period of up to 64 ms, and generate it as converted data.

The processing contents in the unit when the sampling count is set to 4 are as follows.
At the initial calculation, the initial data is stored in all processing buffers to perform the moving average processing.



Settings are made by the "moving average processing time."

The moving average processing time is calculated as number of sampling data items required for single processing multiplied by analog conversion time (number of A/D conversion enabled channels × 500 μs).

Note that if 0 is set, the processing is not performed. (Default setting: 0).

[Setting example of moving average processing time]

When the number of A/D conversion enabled channels is to be set to 4 and the number of sampling data items to 4

Moving average processing time = $4 \times (4 \times 500 \mu\text{s}) = 8,000 \mu\text{s}$ (Set value: 1F40 hex)

Setting method

Set by SDO communication.

The target index is 3132 hex.

For the details, refer to the information in the corresponding index of "Appendix A-1 Object Dictionary" in Page A - 22.

8-3-3 Disconnected Line Detection

Overview of functions

- **Purpose**

The function detects a disconnection of analog input signal line.

Note that this function is valid only when the input range is "1 to 5 V" or "4 to 20 mA."

- **Details of functions**

If any analog input signal line (voltage/current inputs) of the points that are enabled by the "AD Conversion Available Point Setting" is disconnected, the disconnected line detection flag of that point (target index: 3136 hex) is turned ON.

If the moving average is enabled, the function works to detect a disconnected line in moving average processing results.

The AD converted data at disconnected line detection is 7FFF hex.

If the input returns to the convertible range again, this function is automatically cancelled and normal conversion data is input.

The table below shows details of the disconnected line detection flag.

Bits	State
0	1: CH1 disconnected / 0: CH1 normal
1	1: CH2 disconnected / 0: CH2 normal
2	1: CH3 disconnected / 0: CH3 normal
3	1: CH4 disconnected / 0: CH4 normal
4 to 15	Reserved

8-3-4 User adjustment

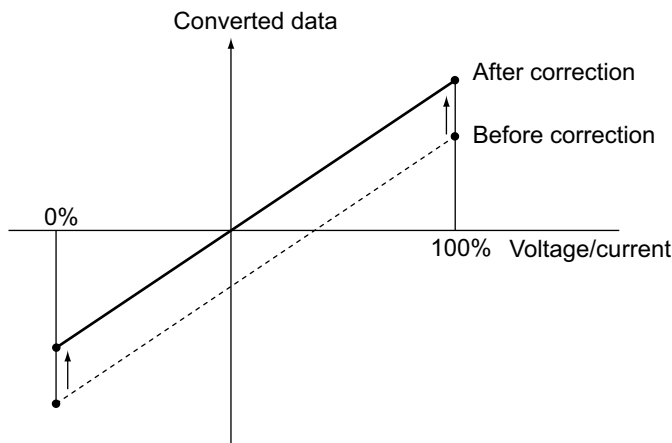
Overview of functions

- **Purpose**

If final input voltage and current deviates due to characteristics of input devices and methods of connection, correct the "deviation" and adjust inputs.

- **Details of functions**

This function corrects conversion values of input voltages and currents at 2 points, 0% and 100%, as shown in the figure below.



The correctable range is from -5% to $+5\%$ each of the minimum and maximum input values. The correctable range for each input range is as follows.

Input range	Low limit	High limit
0 to 5 V	-0.25 to $+0.25$ V	4.75 to 5.25 V
1 to 5 V	0.8 to 1.2 V	4.8 to 5.2 V
0 to 10 V	-0.5 to $+0.5$ V	9.5 to 10.5 V
-10 to $+10$ V	-11 to -9.0 V	9.0 to 11 V
4 to 20 mA	3.2 to 4.8 mA	19.2 to 20.8 mA

Setting method

Set by SDO communication.

The target indexes are as follows.

- Upper limit correction: 3112 hex Analogue input Adjustment High Execute (user adjustment execution (upper limit))
- Lower limit correction: 3115 hex Analogue input Adjustment Low Execute (user adjustment execution (lower limit))

For the correction procedure, refer to the information in the corresponding index of "Appendix A-1 Object Dictionary" in Page A - 21.

8-4 Overview of the Analog Output Slave Unit

An Analog Output Slave Unit converts (DA conversion) digital data (binary value) stored in the EtherCAT Master Unit to analog signals such as 1 to 5 V and 4 to 20 mA and output them.

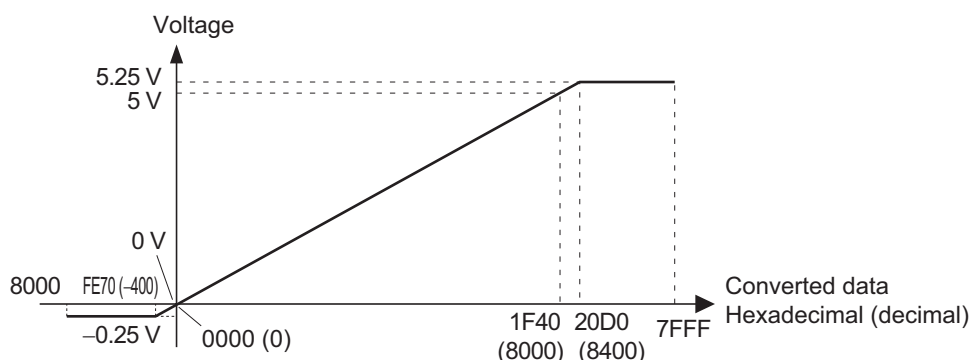
8-4-1 Output Range and Converted Data

Digital data that is output is converted to analog data using a set output range as shown below. If the output data exceeds the data range for which conversion is possible, the converted data is fixed at the maximum or minimum value of the range.

Output Range and Converted Data

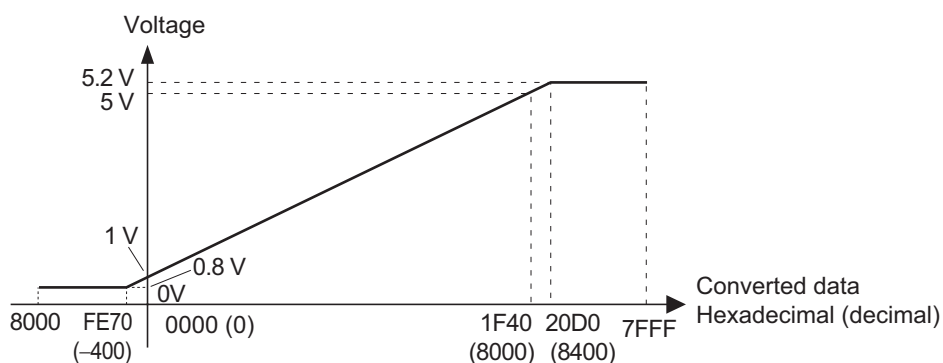
● Output range 0 to 5 V

Data from 0000 to 1F40 hex (0 to 8000) is converted to voltage from 0 to 5 V and output. The output data range for which conversion is possible is FE70 to 20D0 hex (–400 to +8400) and here the output data is –0.25 to +5.25 V.



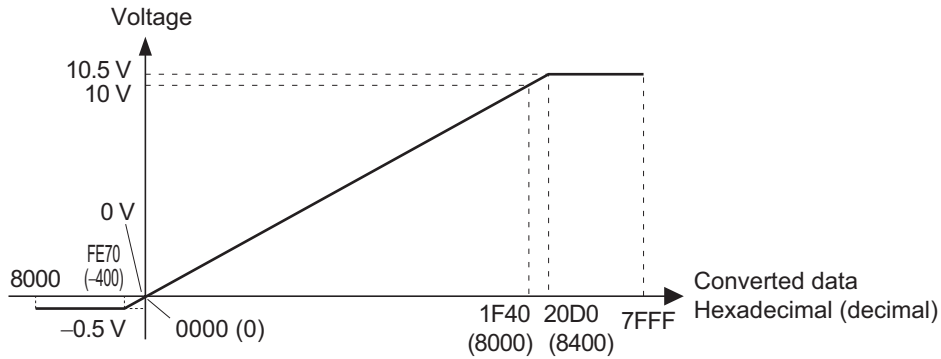
● Output range 1 to 5 V

Data from 0000 to 1F40 hex (0 to 8000) is converted to voltage from 1 to 5 V and output. The output data range for which conversion is possible is FE70 to 20D0 hex (–400 to +8400) and here the output data is 0.8 to 5.2 V.



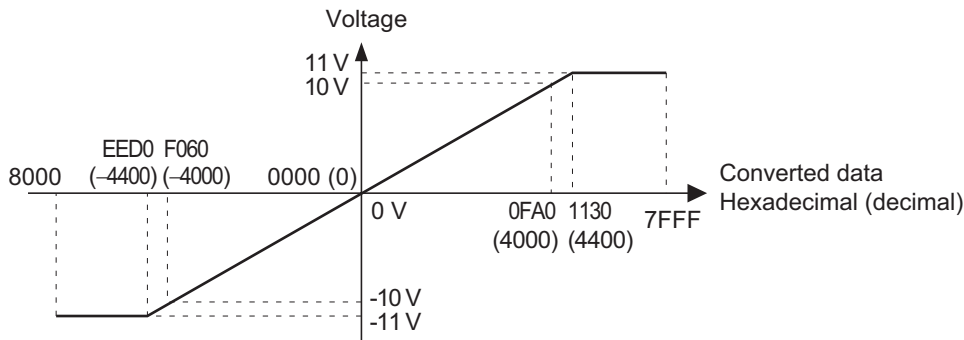
● Output range 0 to 10 V

Data from 0000 to 1F40 hex (0 to 8000) is converted to voltage from 0 to 10 V and output. The output data range for which conversion is possible is FE70 to 20D0 hex (−400 to +8400) and here the output data is −0.5 to +10.5 V.



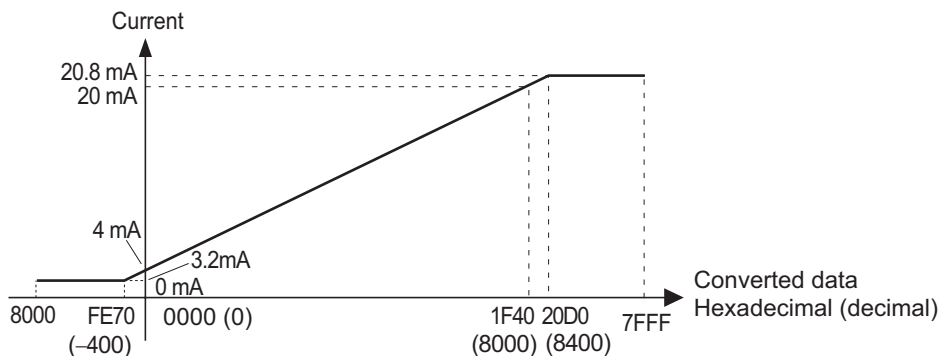
● Output range −10 to +10 V

Data from F060 to 0FA0 hex (−4000 to +4000) is converted to voltage from −10 to +10 V and output. The output data range for which conversion is possible is EED0 to 1130 hex (−4400 to +4400) and here the output data is −11 to +11 V. Negative voltages are specified as two's complements (hexadecimal).



● Output range 4 to 20 mA

Data from 0000 to 1F40 hex (0 to 8000) is converted to voltage from 4 to 20 mA and output. The output data range for which conversion is possible is FE70 to 20D0 hex (−400 to +8400) and here the output data is 3.2 to 20.8 mA.



Output range setting

The output range is set using the output range setting switch (DIP switch) of a Slave Unit or by SDO communications.

When SDO communication is used for the setting, the target index is 3201 hex.

For the set value, refer to the corresponding index of "Appendix A-1 Object Dictionary" in Page A - 23.

For how to set with the output range switch, refer to "Names and functions" in Page 8 - 23.

8-4-2 I/O Data Allocation (PDO Mapping)

An Analog Output Slave Unit has output data only and is allocated to the OUT area of the I/O memory of the EtherCAT Master Unit.

For the detailed explanation of allocation method, refer to the manual of EtherCAT Master Unit to be connected.

Output data allocation

Output data of an Analog Output Slave Unit is analog data (for 2 channels).

Offset (byte)	7 bit	0 bit
0	Analog output data for CH1	
+1		
+2	Analog output data for CH2	
+3		

8-5 Function of the Analog Output Slave Unit

An Analog Output Slave Unit has the following convenient functions, in addition to the output signal processing.

8-5-1 DA Conversion Available Point Setting

Overview of functions

- **Purpose**

This function sets to skip processing unused points, and enhances the speed of refresh cycles of analog output.

- **Details of functions**

Normally in this Unit, the values for two input points are converted in sequence. The setting can be changed, so that unused points are not converted.

By reducing the number of conversion points, the conversion cycle speed is increased.

Whether DA conversion is enabled or disabled is settable for each point. (Default setting: Enable all channels)

Notes Regardless of this setting, an Analog Output Slave Unit uses two points of data allocation area.

Setting method

Set by SDO communications.

The target index is 3200 hex.

For the set values, refer to the information in the corresponding index of "Appendix A-1 Object Dictionary" in Page A - 23.

The table below shows the analog conversion time by the number of DA conversion available points.

Enabled channel	Conversion time [μ s]
1 point	500
2 points	1000

8-5-2 Analog Output Fault Action

Overview of functions

- **Purpose**

This function outputs set values if a communications error occurs.

- **Details of functions**

It is possible to set a value to be output when a communications error occurs for each point. Select an output value from the following 5 patterns.

Output pattern	Contents
Hold Last State	Holds and outputs the value immediately before the error occurred.
Low Limit	Outputs the values in the following table according to the output range.
High Limit	Outputs the values in the following table according to the output range.
User Count	Outputs the value specified by users.
Zero Count (Default setting)	Outputs the 0000 hex values of each output range.

- Output value corresponding to the output range and output pattern

Output range	Hold Last State	Low Limit	High Limit	User Count	Zero Count
0 to 5 V	Hold	-0.25 V	5.25 V	Specified value by a user from -0.25 to 5.25 V	0 V
1 to 5 V		0.8 V	5.2 V	Specified value by a user from 0.8 to 5.2 V	1 V
0 to 10 V		-0.5 V	10.5 V	Specified value by a user from -0.5 to 10.5 V	0 V
-10 to +10 V		-11 V	11 V	Specified value by a user from -11 to 11 V	0 V
4 to 20 mA		3.2 mA	20.8 mA	Specified value by a user from 3.2 to 20.8 mA	4 mA

Setting method

Set by SDO communications.

The target index is 3240 hex.

For the set values, refer to the information in the corresponding index of "Appendix A-1 Object Dictionary" in Page A - 25.

8-5-3 User Adjustment

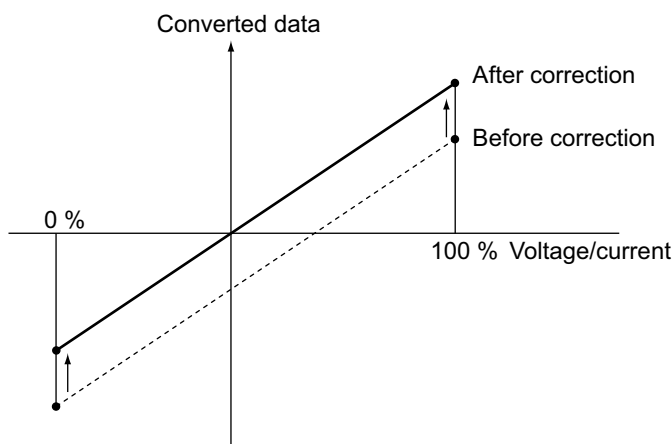
Overview of functions

- **Purpose**

If final output voltage and current deviates due to characteristics of output devices and methods of connection, correct the "deviation" and adjust outputs.

- **Details of functions**

This function corrects conversion values of output voltages and currents at 2 points, 0% and 100%, as shown in the figure below.



The correctable range is from -5% to $+5\%$ each of the minimum and maximum values of outputs. The correctable range for each output range is as follows.

Output range	Low limit	High limit
0 to 5 V	-0.25 to $+0.25$ V	4.75 to 5.25 V
1 to 5 V	0.8 to 1.2 V	4.8 to 5.2 V
0 to 10 V	-0.5 to $+0.5$ V	9.5 to 10.5 V
-10 to $+10$ V	-11 to -9.0 V	9.0 to 11 V
4 to 20 mA	3.2 to 4.8 mA	19.2 to 20.8 mA

Setting method

Set by SDO communications.

The target indexes are as follows.

- Upper limit correction: 3212 hex Analogue input Adjustment High Execute (user adjustment execution (upper limit))
- Lower limit correction: 3215 hex Analogue input Adjustment Low Execute (user adjustment execution (lower limit))

For the correction procedure, refer to the information in the corresponding index of "Appendix A-1 Object Dictionary" in page A-24.

8-6 Overview of Each Slave Unit Type

This section shows the specification of Analog I/O Slave Units, names and functions of each part, internal circuit diagram, and wiring diagram.

Refer to the following corresponding page to each model.

Type	Model	Reference page			
		Specification	Names and functions	Internal circuits diagram	Wiring diagram
4-point Input Slave Unit	GX-AD0471	8-19	8-20	8-22	8-22
2-point Output Slave Unit	GX-DA0271	8-23	8-23	8-25	8-26

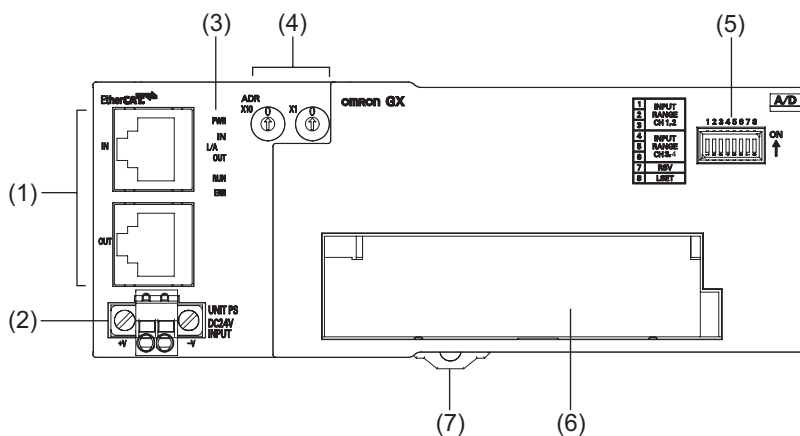
8-6-1 4-point Input Slave Unit GX-AD0471

Specification

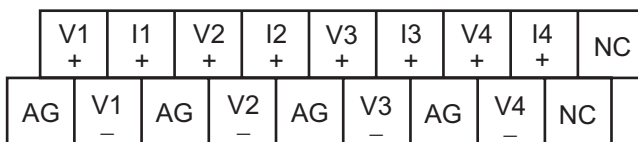
Item	Specification	
	Voltage input	Current input
Input capacity	4 points (possible to set number of enabled points)	
Input range	0 to 5 V 1 to 5 V 0 to 10 V -10 to +10 V	4 to 20 mA
Input range setting method	Input range switch: Common to input CH1/CH2, common to input CH3/CH4 SDO communications: Possible to set input CH1 to CH4 separately	
Maximum signal input	±15 V	±30 mA
Input impedance	1 MΩ min.	Approx. 250 Ω
Resolution	1/8000 (full scale)	
Overall accuracy	25°C	±0.3% FS
	-10 to 55°C	±0.6% FS
Analog conversion cycle	500 μs/input When 4 points are used: 2 ms max.	
AD converted data	Other than ±10 V: 0000 to 1F40 hex full scale (0 to 8000) ±10 V: F060 to 0FA0 Hex full scale (-4000 to +4000) AD conversion range: ±5% FS of the above data ranges.	
Isolation method	Photocoupler isolation (between input and communications lines) No isolation between input signal wires	
Unit power supply current consumption	120 mA max. (for 20.4 to 26.4-VDC power supply voltage)	
Weight	180 g max.	
Accessories	Four short-circuit metal fixtures (for current input) *	

* Short-circuit metal fixtures are used for current input only, but store in a safe place when using for voltage inputs as well.

Names and functions



● Terminal arrangement diagram



No.	Name	Function
(1)	Communications connectors	Refer to "Specifications of Common Areas" in Page 6 - 4.
(2)	Unit power supply connector	
(3)	Status indicators	
(4)	Node Address setting Switches	
(5)	Input range setting Switches	DIP switches for setting input range (Refer to the following section.)
(6)	Terminal block	Terminal block for analog input signals V1 to V4: Voltage input terminals I1 to I4: Current input terminals AG: Analog GND NC: Not used
(7)	DIN track mounting hook	Fixes a Slave Unit to a DIN track.

- Input range setting switches

Set input range by combination of individual DIP switches.

To enable settings of these switches, it is necessary to turn Pin8 (input range setting method) ON in advance.

Pin No.	Setting	Specification
1	Setting of input CH1/CH2 range (common)	Set by combination of DIP switches (see the next table)
2		
3		
4	Setting of input CH3/CH4 range (common)	
5		
6		
7	Always OFF	Make sure to keep it OFF. The operation cannot be guaranteed when it is set to ON.
8	Input range setting method	OFF: Setting by SDO communications ON: Setting by the switches (Pin1 to Pin6)



Precautions for Correct Use

- When setting a range with these switches, the same input ranges are set for inputs CH1 and CH2 as well as inputs CH3 and CH4, respectively. To set a different range for inputs CH1 to CH4, use the SDO communications to make the settings.
- Pin7 must be used in the OFF state.
- To set a range using these switches, make sure to turn Pin8 ON. If it is turned OFF, the DIP switch settings will not be reflected.
- The settings of this switch are read only once when the power is turned ON.

- Setting of input CH1/CH2 range (Pin1 to Pin3)

Input range	Pin1	Pin2	Pin3
0 to 5 V	OFF	OFF	OFF
1 to 5 V	ON	OFF	OFF
0 to 10 V	OFF	ON	OFF
-10 to +10 V	ON	ON	OFF
4 to 20 mA	OFF	OFF	ON

- Setting of input CH3/CH4 range (Pin4 to Pin6)

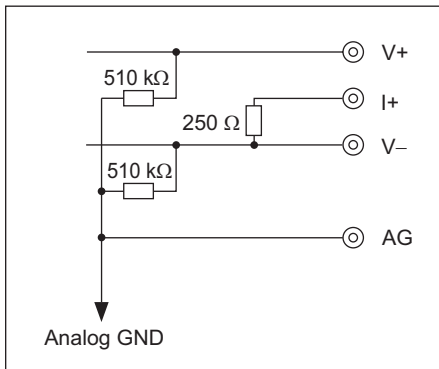
Input range	Pin4	Pin5	Pin6
0 to 5 V	OFF	OFF	OFF
1 to 5 V	ON	OFF	OFF
0 to 10 V	OFF	ON	OFF
-10 to +10 V	ON	ON	OFF
4 to 20 mA	OFF	OFF	ON



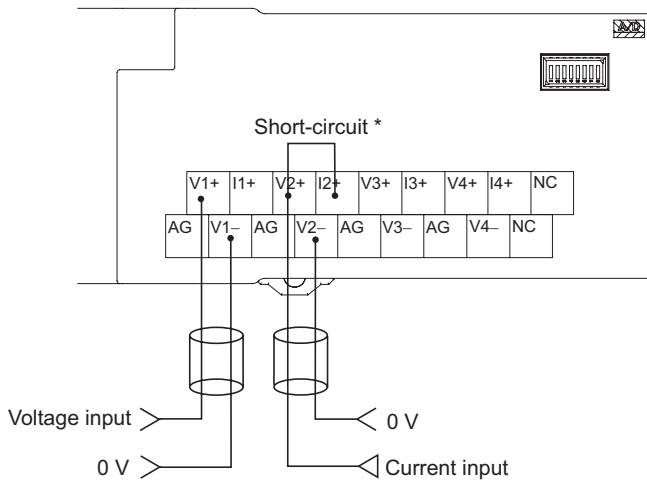
Precautions for Correct Use

Do not set the DIP switches or Pins other than as specified in the tables above.

Internal circuits diagram



Wiring diagram



* Short-circuit the "V positive" terminal and "I positive" terminal at current input. Use the attached short-circuit metal fixture to short-circuit these terminals.



Precautions for Correct Use

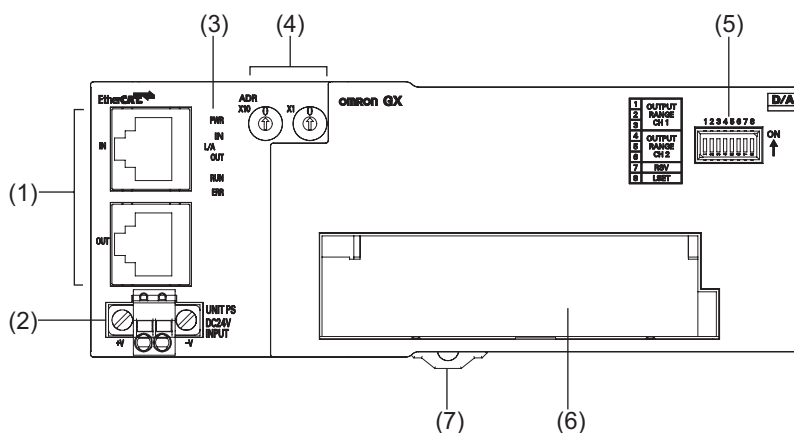
Do not wire NC terminals.

8-6-2 2-point Output Slave Unit GX-DA0271

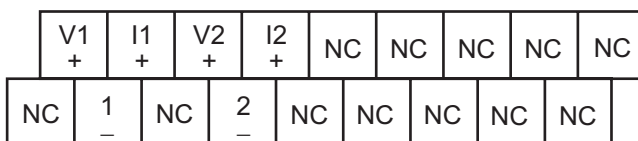
Specification

Item	Specification	
	Voltage output	Current output
Output capacity	2 points (possible to set number of enabled points)	
Output range	0 to 5 V 1 to 5 V 0 to 10 V -10 to +10 V	4 to 20 mA
Output range setting method	Output range switch, SDO communications: Possible to set outputs CH1 and CH2 separately.	
External output allowable load resistance	5 k Ω min.	600 Ω max.
Resolution	1/8000 (full scale)	
Overall accuracy	25°C	$\pm 0.4\%$ FS
	-10 to 55°C	$\pm 0.8\%$ FS
Analog conversion cycle	500 μ s/input When 2 points are used: 1 ms max.	
DA converted data	Other than ± 10 V: 0000 to 1F40 hex full scale (0 to 8000) ± 10 V: F060 to 0FA0 hex full scale (-4000 to +4000) DA conversion range: $\pm 5\%$ FS of the above data ranges	
Isolation method	Photocoupler isolation (between output and communications lines) No isolation between output signal wires	
Unit power supply current consumption	150 mA max. (for 20.4 to 26.4-VDC power supply voltage)	
Weight	190 g max.	

Names and functions



● Terminal arrangement diagram



No.	Name	Function
(1)	Communications connectors	Refer to "Specifications of Common Areas" in Page 6 - 4.
(2)	Unit power supply connector	
(3)	Status indicators	
(4)	Node Address setting Switches	
(5)	Output range setting Switches	DIP switches for setting output range (Refer to the following section.)
(6)	Terminal block	Terminal block for analog output signals V1+, V2+: Voltage output positive terminals I1+, I2+: Current output positive terminals 1-, 2-: Voltage/current output negative terminals NC: Not used
(7)	DIN track mounting hook	Fixes a Slave Unit to a DIN track.

• Output range setting switches

Set output range by combination of individual DIP switches.

To enable settings of these switches, it is necessary to turn Pin8 (output range setting method) ON in advance.

Pin No.	Setting	Specification
1	Setting of output CH1 range	Set by combination of DIP switches (see the next table)
2		
3		
4		
5	Setting of output CH2 range	
6		
7	Always OFF	Make sure to keep it OFF. The operation cannot be guaranteed when it is set to ON.
8	Output range setting method	OFF: Setting by SDO communications ON: Setting by these switches (Pin1 to Pin6)



Precautions for Correct Use

- Pin7 must be used in the OFF state.
- To set a range using these switches, make sure to turn Pin8 ON. If it is turned OFF, the DIP switch settings will not be reflected.
- The settings of this switch are read only once when the power is turned ON.

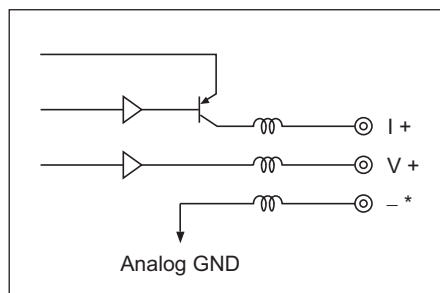
- Setting of output CH1 range (Pin1 to Pin3)

Output range	Pin1	Pin2	Pin3
0 to 5 V	OFF	OFF	OFF
1 to 5 V	ON	OFF	OFF
0 to 10 V	OFF	ON	OFF
-10 to +10 V	ON	ON	OFF
4 to 20 mA	OFF	OFF	ON

- Setting of output CH2 range (Pin4 to Pin6)

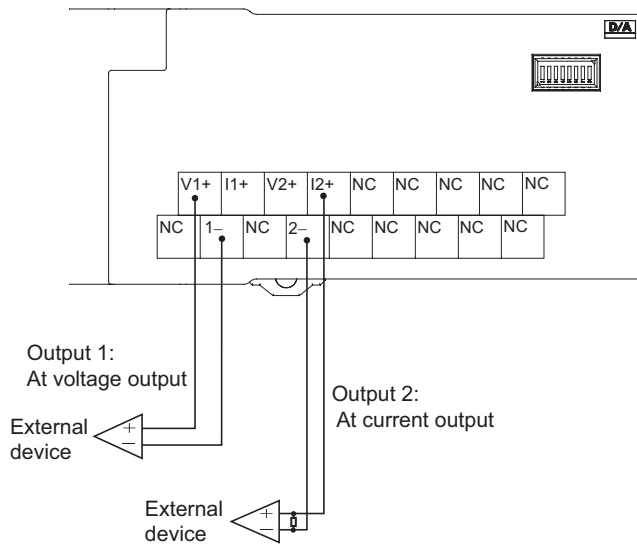
Output range	Pin4	Pin5	Pin6
0 to 5 V	OFF	OFF	OFF
1 to 5 V	ON	OFF	OFF
0 to 10 V	OFF	ON	OFF
-10 to +10 V	ON	ON	OFF
4 to 20 mA	OFF	OFF </tr	

Internal circuits diagram



* Negative terminals of output CH1 and output CH2 are internally connected.

Wiring diagram

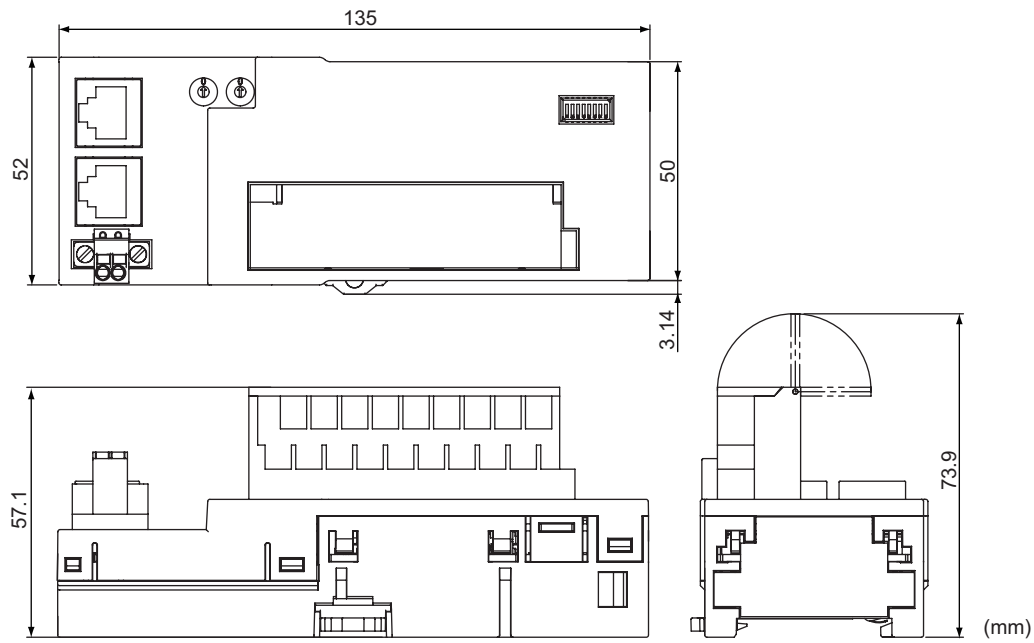


Precautions for Correct Use

Do not wire NC terminals.

8-7 Mounting Dimensions

The mounting dimensions of an Analog I/O Slave Unit are shown below.



9

Encoder Input Slave Unit

This chapter explains the overview of Encoder Input Slave Unit.

9-1 Encoder Input Slave Unit	9-2
9-2 I/O Data Allocation	9-3
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9-1 Encoder Input Slave Unit

An Encoder Input Slave Unit has 5 V and 24 V open collector input function or line driver input function. The open collector input can be measured up to 500 kHz and the line driver input up to 4 MHz.

9-2 I/O Data Allocation

I/O data of Encoder Input Slave Units are allocated to the input/output areas of the I/O memory of the EtherCAT Master Unit, respectively.

The ESI file are used to allocate I/O data.

For the detailed explanation of allocation method, refer to the manual of EtherCAT Master Unit to be connected.

9-2-1 Input Data Allocation

Encoder Input Slave Unit stores the counter present value, external latch value A, external latch value B and the counter status as input data, and can allocate required data to Input area.

The details of each data type are as follows.

Data	Size	Detail
Counter present value	8 bytes	Used to monitor counter data.
External latch value A	8 bytes	Stores the counter value (latch value A) latched by external latch A.
External latch value B	8 bytes	Stores the counter value (latch value B) latched by external latch B.
Counter status	2 bytes	Status flag to check the counter status.

The data allocation is as follows when using the default settings.

● Counter status + counter present value data + external latch A data + external latch B data (size = 26 bytes)

Offset (byte)	D07	D06	D05	D04	D03	D02	D01	D00
0	CRUN1	CERR1	Reserved	EXLB1	EXLA1	EXRES1	RACK1	PACK1
+1	CRUN2	CERR2	Reserved	EXLB2	EXLA2	EXRES2	RACK2	PACK2
+2								(LL)
+3								(LH)
+4	CH1 Present value data							(HL)
+5								(HH)
+6								(LL)
+7								(LH)
+8	CH2 Present value data							(HL)
+9								(HH)
+10								(LL)
+11								(LH)
+12	CH1 Latch A data							(HL)
+13								(HH)
+14								(LL)
+15								(LH)
+16	CH2 Latch A data							(HL)
+17								(HH)
+18								(LL)
+19								(LH)
+20	CH1 Latch B data							(HL)
+21								(HH)
+22								(LL)
+23								(LH)
+24	CH2 Latch B data							(HL)
+25								(HH)

0 to +1: Counter status

Abbreviations used for the counter status information description have the following meanings.

Abbreviation	Status name	Operation
PACKn	Present value preset execution completed	Soft switch "Present value preset execution" completion flag 0→1: Preset execution completed 1→0: Soft switch "Present value preset execution" is set to 0
RACKn	Present value internal reset execution completed	Soft switch "Present value internal reset execution" completion flag 0→1: Reset execution completed 1→0: Soft switch "Present value reset execution" is set to 0
EXRESn	External reset generation flag	1: Turned ON at reset generation by external input/phase Z 0: Soft switch "present value external reset generation flag clear" is changed from 0 to 1
EXLAN	External latch A generation flag	1: Turned ON with external latch A event generation 0: Soft switch "external latch A generation flag clear" is changed from 0 to 1
EXLBn	External latch B generation flag	1: Turned ON with external latch B event generation 0: Soft switch "external latch B generation flag clear" is changed from 0 to 1
CERRn	Present value preset set value error	0: No setting error 1: Setting error generation
CRUNn	Counter operation state	0: Counter stopped 1: Counter operating

9-2-2 Output Data Allocation

Encoder Input Slave Unit stores the soft switch and the preset command value as output data, and can allocate required data to Output area.

The details of each data type are as follows.

Data	Size	Detail
Soft switch	4 bytes	Used to control the Encoder Input Slave Unit.
Preset command value	8 bytes	Specifies the value to be written over the counter present value data at preset execution.

The data allocation is as follows when using the default settings.

● **Soft switch + preset command value (size = 12 bytes)**

Offset (byte)	D07	D06	D05	D04	D03	D02	D01	D00
0	Reserved	Reserved	Reserved	Reserved	Reserved	INPRES1	PSET1	CENB1
+1	Reserved	EXLBC1	EXLAC1	EXRESC1	Reserved	EXLBE1	EXLAE1	EXRESE1
+2	Reserved	Reserved	Reserved	Reserved	Reserved	INPRES2	PSET2	CENB2
+3	Reserved	EXLBC2	EXLAC2	EXRESC2	Reserved	EXLBE2	EXLAE2	EXRESE2
+4								(LL)
+5	CH1 Preset command value							(LH)
+6								(HL)
+7								(HH)
+8								(LL)
+9	CH2 Preset command value							(LH)
+10								(HL)
+11								(HH)

0 to +3: Soft switch

Abbreviations used in soft switch description have the following meanings.

Abbreviation	Status name	Operation	Detection
CENBn	Count possible/not possible	1: Count possible command 0: Count not possible command	Level
PSETn	Present value preset execution	0→1: Start preset of present value 1→0: Clear present value preset execution completion flag	Edge
INPRESn	Present value internal reset execution	0→1: Start resetting present value 1→0: Clear present value internal reset execution completion flag	Edge
EXRESEn	Present value external reset enabled	1: Enabled 0: Disabled	Level
EXLAE n	External latch A enabled	1: Enabled 0: Disabled	Level
EXLBE n	External latch B enabled	1: Enabled 0: Disabled	Level
EXRESCn	Clear present value external reset generation flag	0→1: Clear flag	Edge
EXLACn	Clear external latch A generation flag	0→1: Clear flag	Edge
EXLBCn	Clear external latch B generation flag	0→1: Clear flag	Edge

9-3 Function of the Encoder Input Slave Units

This section explains the function of Encoder Input Slave Units.

9-3-1 Count Mode

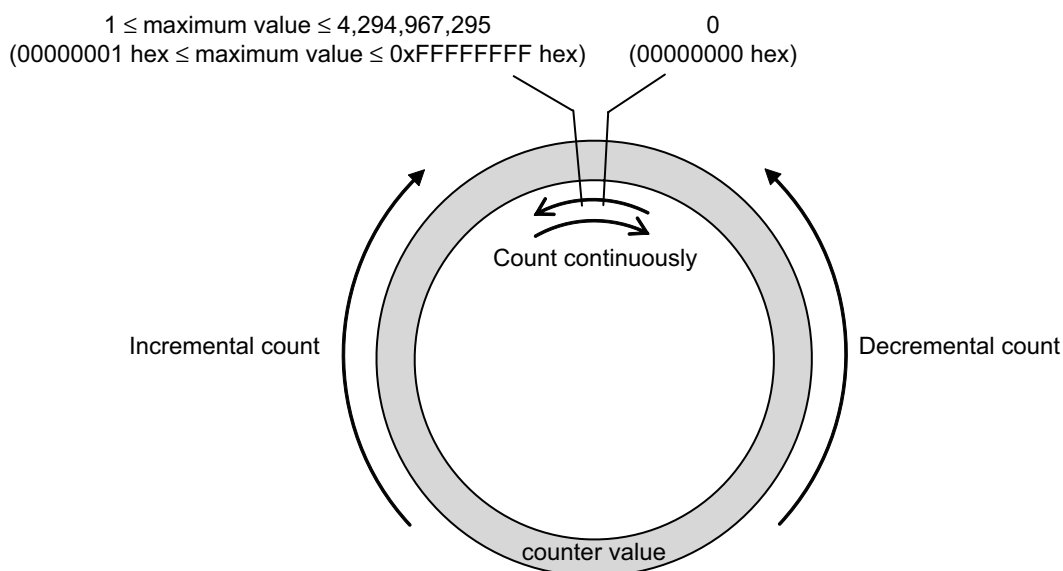
The Count Mode is run by the Circular Counter.

9-3-2 Circular Counter

Set the maximum Circular Counter value and perform incremental/decremental count in the range from 0 to the maximum value or from the maximum value to 0.

The maximum value can be set in the range from 1 to 4,294,967,295 (FFFFFFFF hex).

Note that if 0 is set, the maximum value becomes FFFFFFFF hex.



If the counter value exceeds the maximum value, the counter value returns to 0 to continue count operation.

If the counter value becomes less than 0, the counter value returns to the maximum value to continue count operation.

Setting method

The settings are made using the SDO communications.

The target index is 4003 hex.

For the details, refer to the information in the corresponding index of "Appendix A-1 Object Dictionary" in Page A - 27.



Precautions for Safe Use

- If the maximum Circular Counter value is changed while the counter is stopped or operating, restart (stop → operate) the counter in order to reflect the change to the count operation.
- If the set value is read without restarting, the set value after change can be read, but the actual count operation is performed with the set value before change.

9-3-3 Input Signal Types

The input method of Encoder Input Slave Units is explained below.

Note that SDO communications are used for setting an input method. (Default setting: Phase A/B phase difference pulse input (Multiplication × 4))

The target index is 4002 hex.

For the set values, refer to the information in the corresponding index of "Appendix A-1 Object Dictionary" in Page A - 27.

● **Phase A/B phase difference pulse input (Multiplication × 1/2/4)**

(1) Multiplication × 1

Count at signal change of phase A when phase B signal is turned OFF.

The count is incremented at rise of phase A and decremented at fall of phase A.

(2) Multiplication × 2

It is used to heighten resolution of encoder input compared to Multiplication × 1.

The counter operation is performed at rise and fall of phase A signals.

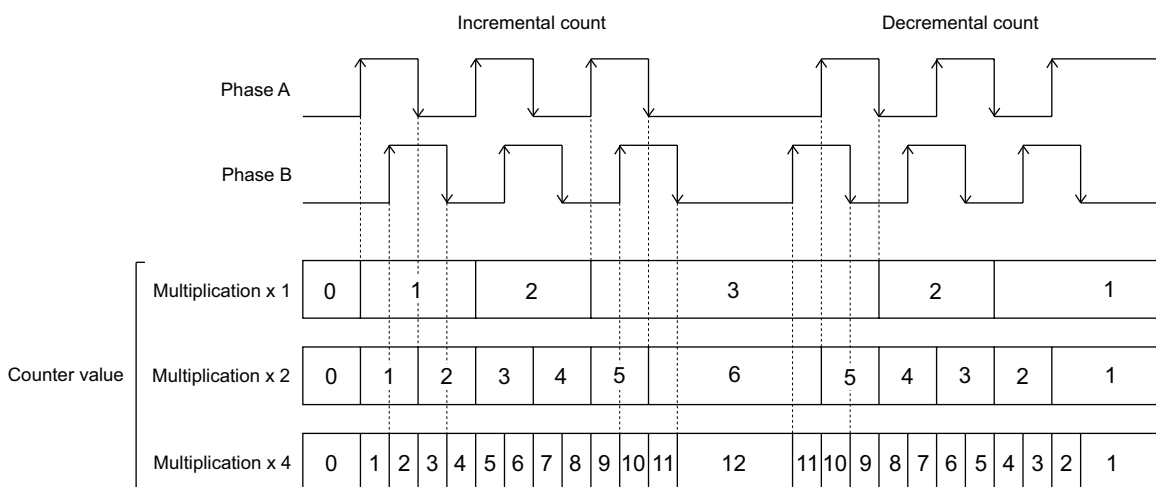
The count is incremented if phase A is advanced from phase B and decremented if phase A is delayed from phase B.

(3) Multiplication × 4

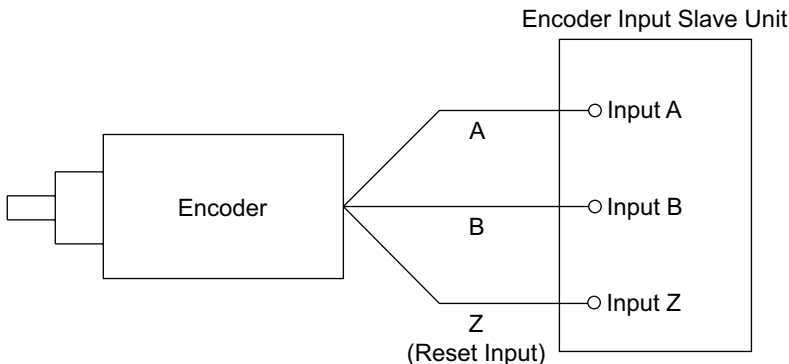
It is used to further heighten resolution of encoder input from Multiplication × 2.

The counter operation is performed at rise and fall of phase A/B signals.

The count is incremented if phase A is advanced from phase B and decremented if phase A is delayed from phase B.

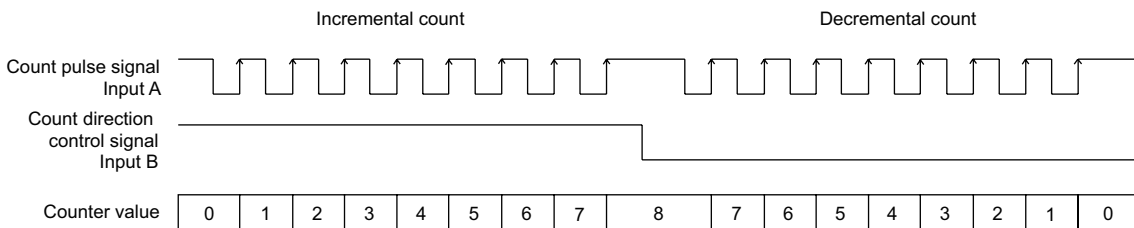


When phase A/B phase difference pulse is input, the connection with external input devices becomes as follows.

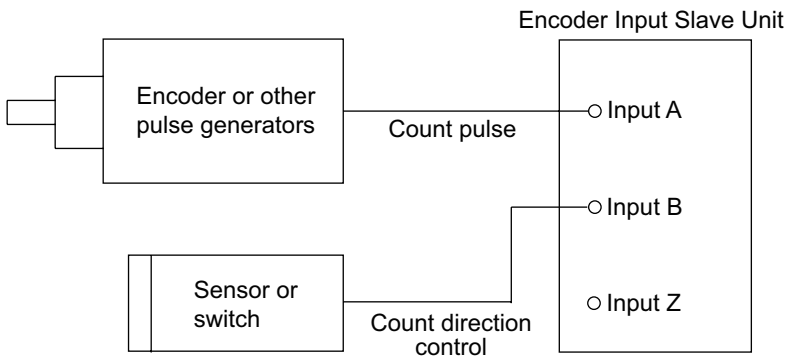


● **Code + pulse input**

Input A is count pulse signal and input B is count direction control signal. The count is incremented at rise of phase A when input B is ON and decremented at rise of phase A when input B is OFF.

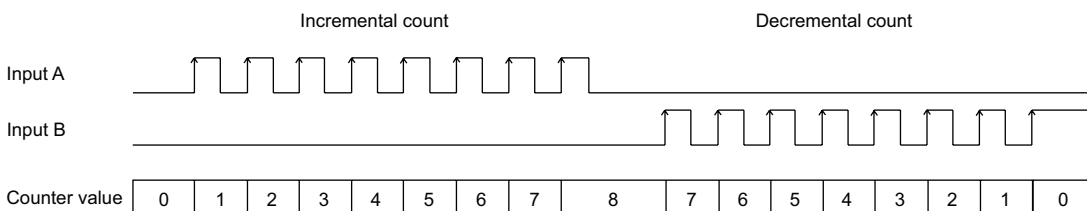


When code and pulses are input, the connection with external input devices becomes as follows.

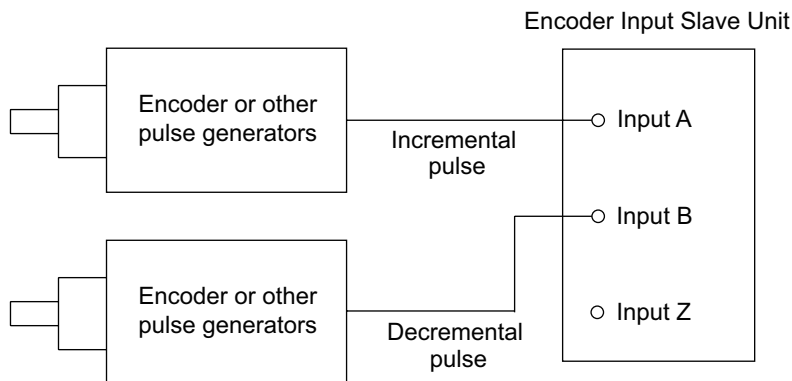


● **Incremental/decremental pulse input**

The count is incremented at rise of input A pulse and decremented at rise of input B pulse.



When incremental/decremental pulses are input, the connection with external input devices becomes as follows.



Precautions for Safe Use

- If the input method is changed while the counter is stopped or operating, restart (stop → operate) the counter in order to reflect the change to the count operation.
- If the set value is read without restarting, the set value after change can be read, but the actual count operation is performed with the set value before change.

9-3-4 Encoder Direction Setting

There are two following types for the encoder directions of an Encoder Input Slave Unit.

- Forward direction at CW (clockwise rotation seen from the shaft of the connected encoder)
- Forward direction at CCW (counterclockwise rotation seen from the shaft of the connected encoder)



Note that SDO communications are used to set encoder direction. (Default setting: Forward direction at CW)

The target index is 4001 hex.

For the set values, refer to the information in the corresponding index of "Appendix A-1 Object Dictionary" in Page A - 26.



Precautions for Safe Use

- If the encoder direction setting is changed while the counter is stopped or operating, restart (stop → operate) the counter in order to reflect the change to the count operation.
- If the set value is read without restarting, the set value after change can be read, but the actual count operation is performed with the set value before change.

9-3-5 Counter Reset

It is possible to reset counter value for each channel using the elements shown below.

- **Counter reset bit**

The counter of each channel is reset to 0 by changing soft switch "present value internal reset execution" allocated to each channel from 0 to 1 in the output data (Slave Unit → EtherCAT Master Unit) area.

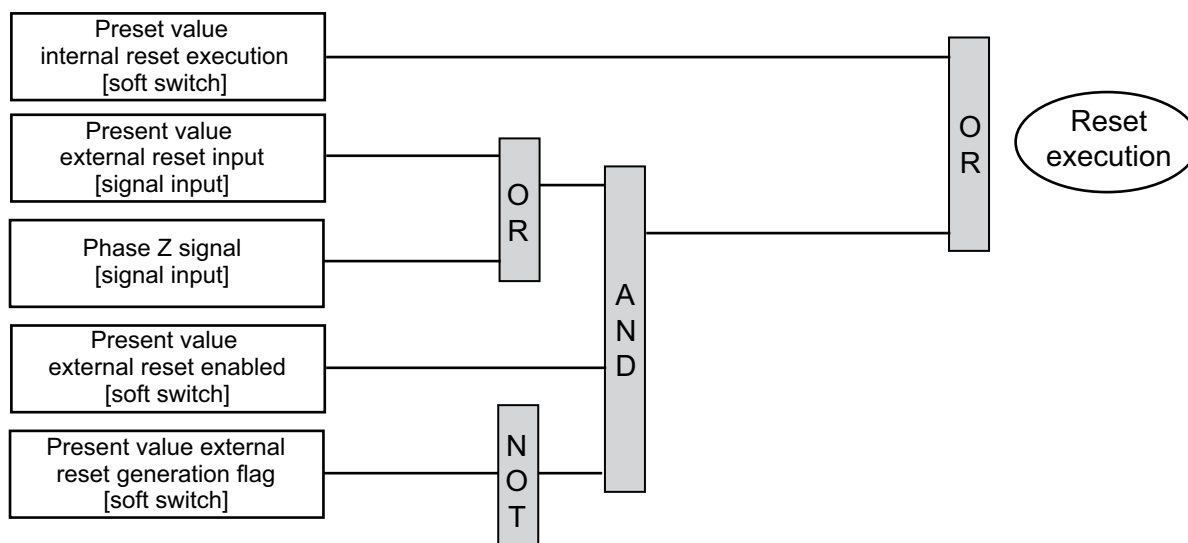
- **External control input**

The counter is reset to 0 at rise of the present value external reset input signal or phase Z input signal.

However, it is necessary to set the soft switch "present value external reset enabled" to 1.

If the counter value is reset via input of the present value external reset or phase Z, the "external reset generation flag" is turned ON. By changing "clear present value external reset generation flag" from 0 to 1, "external reset generation flag" is cleared, enabling the next reset reception.

The counter reset conditions are shown in the figure below.



Precautions for Safe Use

While the counter function is stopped, external reset is disabled.

For this reason, if the reset function is to be used while the counter function is stopped, use the present value internal reset execution (soft switch).

9-3-6 Counter Preset

It is possible to preset counter value for each channel using the elements shown below.

- **Counter preset bit**

The counter present value is overwritten by "preset command value" by changing soft switch "present value preset execution" allocated to each channel from 0 to 1 in the output data (Slave Unit → EtherCAT Master Unit) area.

- **Preset command value**

Set "preset command value" allocated to each channel in output data (Slave Unit → EtherCAT Master Unit) area or via SDO communications. (Default setting: 0)

When SDO communications are used, the target index is 4011 hex.

For the details, refer to the information in the corresponding index of "Appendix A-1 Object Dictionary" in Page A - 27.

9-3-7 Counter value latch

The counter value is latched for each channel using the elements shown below.

It is possible to latch two values at the same time.

- **External control input (latch A)**

The present counter value is acquired/stored at the rise of latch A of external control input. However, it is necessary to set the soft switch "external latch A enabled" to "enabled." *

- **External control input (latch B)**

The present counter value is acquired/stored at the rise of latch B of external control input. However, it is necessary to set the soft switch "external latch B enabled" to "enabled." *

For both latch A and B inputs, when latch is generated via latch input, the "external latch generation flag" changes from 0 to 1 and the counter value is stored in objects (latch value A/latch value B) as latch A/latch B data.

By changing "clear external latch generation flag" from 0 to 1, it is possible to clear the "external latch generation flag."

When the "external latch generation flag" is cleared, the next latch input becomes enabled.

If it is desired to use latched counter values (latch values) in a ladder program, select PDO mapping to which latch data is allocated.

* To use SDO communications, acquire/store the present counter value at the rise of latch A/B of external control input, regardless of the status of the soft switch "external latch A/B enabled."

9-4 Specifications for Each Slave Unit

This section shows the specification of Encoder Input Slave Units, names and functions of each part, internal circuit diagram, and wiring diagram.

Refer to the following corresponding page to each model.

Type	Model	Reference page			
		Specification	Names and functions	Internal circuits diagram	Wiring diagram
Open collector input type	GX-EC0211	9-14	9-16	9-19	9-20
Line driver Input type	GX-EC0241	9-22	9-24	9-27	9-28

9-4-1 Open collector input type GX-EC0211

Specification

● Slave Unit specifications

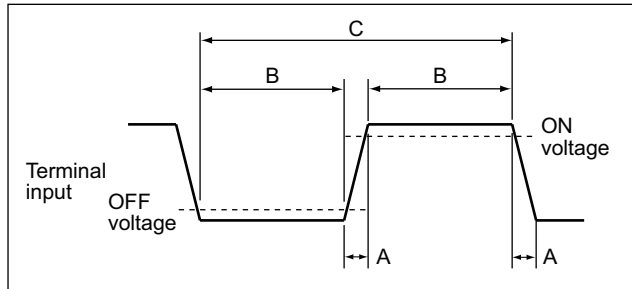
Item	Specification
Counter point	2 points
Input signal	Counter phase A Counter phase B Counter phase Z Latch input (A/B) Counter reset input
Counter enabled status display	LED display (green)
Input indicators	LED display (yellow)
Unit power supply current consumption	130 mA max. (for 20.4 to 26.4 VDC power supply voltage)
Weight	390 g max.

● Pulse input specifications

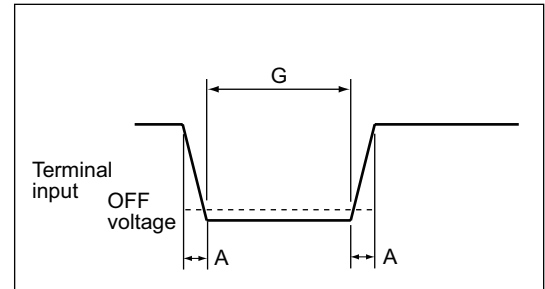
Item	Specification			
	Counter phase A/B		Counter phase Z	
Input voltage	20.4 to 26.4 VDC (24 VDC -15 to +10%)	4.5 to 5.5 VDC (5 VDC \pm 5%)	20.4 to 26.4 VDC (24 VDC -15 to +10%)	4.5 to 5.5 VDC (5 VDC \pm 5%)
Input current	8.4 mA (at 24 VDC)	8.6 mA (at 5 VDC)	8.4 mA (at 24 VDC)	8.6 mA (at 5 VDC)
ON voltage	19.6 V min.	4.5 V min.	18.6 V min.	4.5 V min.
OFF voltage	4 V max.	1.5 V max.	4 V max.	1.5 V max.
Input restriction resistance	2.7 k Ω	430 Ω	2.7 k Ω	430 Ω
Maximum response frequency	Single phase 500 kHz (phase difference Multiplication \times 4, 125 kHz)		125 kHz	
Filter switching	NA		NA	

● Pulse input timing specifications

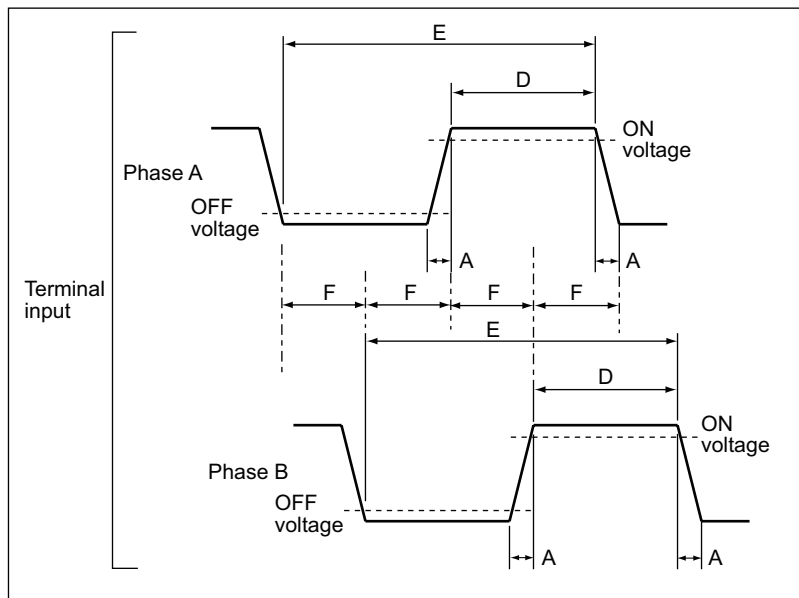
Counter input phase A/B
Input pulse duty: 50%



Counter input phase Z



Relationship between phase A and phase B at phase difference pulse input



Timing condition						
A	B	C	D	E	F	G
<0.3 μs	>1 μs	>2 μs	>4 μs	>8 μs	>2 μs	>4 μs

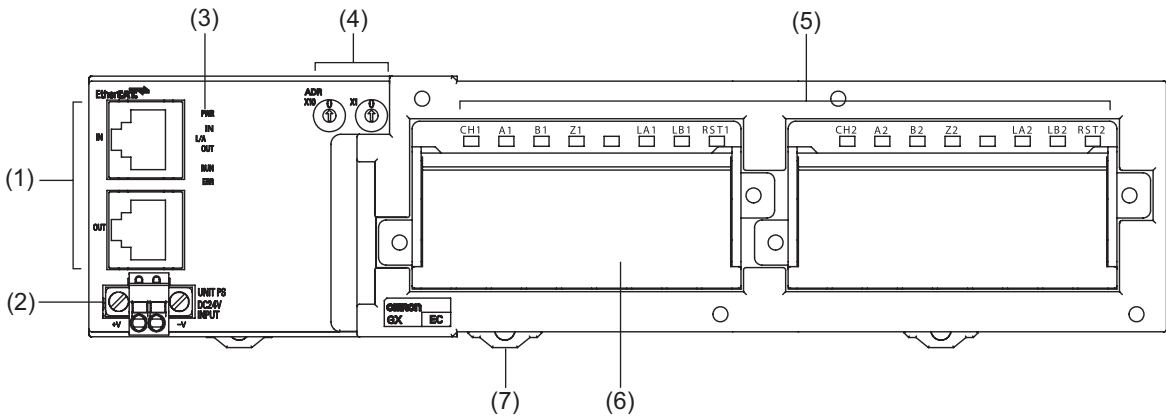
 Precautions for Correct Use

In order to satisfy the counter input specifications, it is necessary to pay attention to the type of output driver of the encoder to be used, the length of encoder cable, and frequency of count pulse.

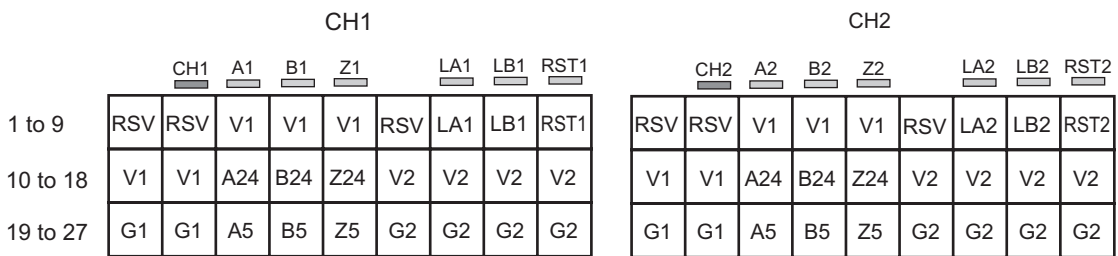
● Latch/reset input specifications

Item	Specification	
	Latch input (A/B)	Reset input
Internal I/O common	NPN	
Input voltage	20.4 to 26.4 VDC (24 VDC -15 to +10%)	20.4 to 26.4 VDC (24 VDC -15 to +10%)
Input impedance	4.0 kΩ	3.3 kΩ
Input current	5.5 mA (at 24 VDC)	7 mA (at 24 VDC)
ON voltage/ON current	17.4 VDC min./3 mA min.	14.4 VDC min./3 mA min.
OFF voltage/OFF current	5 VDC max./1 mA max.	5 VDC max./1 mA max.
ON response time	3 μs max.	15 μs max.
OFF response time	3 μs max.	90 μs max.

Names and functions



● Terminal/input display LED layout diagram



No.	Name	Function
(1)	Communications connectors	Refer to "6-3 Specifications of Common Areas" Page 6 - 4.
(2)	Unit power supply connector	
(3)	Status indicators	
(4)	Node address switches	
(5)	Input indicators	The indicators show the status of the inputs of each channel. For details, refer to the next section "Input indicators".
(6)	Terminal block	Connects external devices and the I/O power supply. For details, refer to the next section "Terminal block".
(7)	DIN track mounting hook	Fixes a Slave Unit to a DIN track.

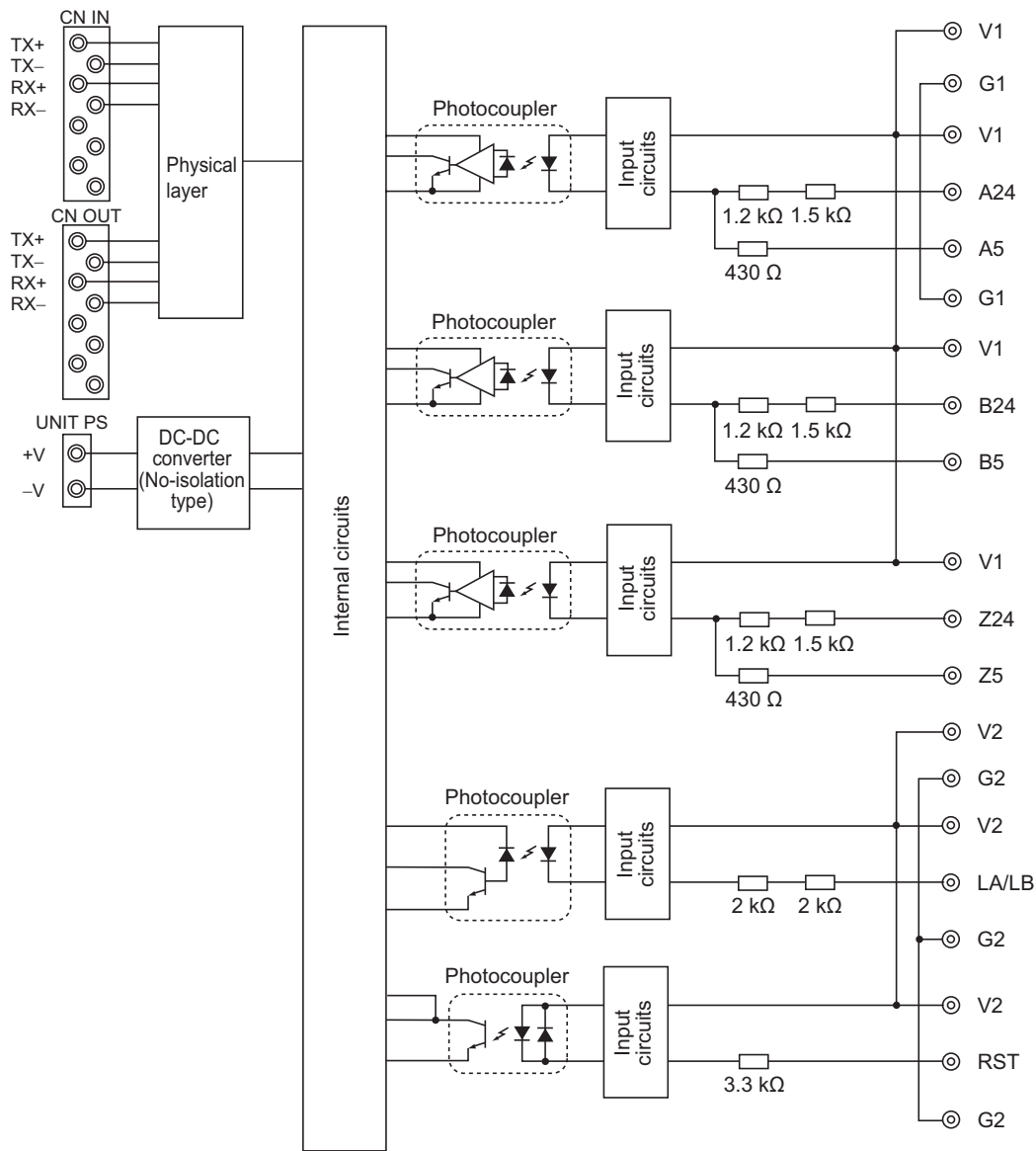
- Input indicators

CH1			CH2		
Name	State	Contents	Name	State	Contents
CH1	Lit green.	Counter operating	CH2	Lit green.	Counter operating
	OFF	Counter stopped		OFF	Counter stopped
A1	Lit yellow.	Input A (phase A signal/count pulse signal/incremental count signal) available	A2	Lit yellow.	Input A (phase A signal/count pulse signal/incremental count signal) available
	OFF	Input A (phase A signal/count pulse signal/incremental count signal) not available		OFF	Input A (phase A signal/count pulse signal/incremental count signal) not available
B1	Lit yellow.	Input B (phase B signal/count direction control signal/decremental count signal) available	B2	Lit yellow.	Input B (phase B signal/count direction control signal/decremental count signal) available
	OFF	Input B (phase B signal/count direction control signal/decremental count signal) not available		OFF	Input B (phase B signal/count direction control signal/decremental count signal) not available
Z1	Lit yellow.	Phase Z input available	Z2	Lit yellow.	Phase Z input available
	OFF	Phase Z input not available		OFF	Phase Z input not available
LA1	Lit yellow.	External latch input A available	LA2	Lit yellow.	External latch input A available
	OFF	External latch input A not available		OFF	External latch input A not available
LB1	Lit yellow.	External latch input B available	LB2	Lit yellow.	External latch input B available
	OFF	External latch input B not available		OFF	External latch input B not available
RST1	Lit yellow.	External reset input available	RST2	Lit yellow.	External reset input available
	OFF	External reset input not available		OFF	External reset input not available

- Terminal block

CH	Terminal block number	Terminal name	Contents
CH1 CH2	1	RSV	-
	2	RSV	-
	3	V1	Encoder power supply input (power supply input at twisted-pair wiring)
	4	V1	Encoder power supply input (power supply input at twisted-pair wiring)
	5	V1	Encoder power supply input (power supply input at twisted-pair wiring)
	6	RSV	-
	7	LA1/LA2	Latch A input
	8	LB1/LB2	Latch B input
	9	RST1/RST2	Reset input
	10	V1	Encoder power supply input
	11	V1	Encoder power supply output
	12	A24	Phase A input (24 V)
	13	B24	Phase B input (24 V)
	14	Z24	Phase Z input (24 V)
	15	V2	Sensor power supply input
	16	V2	Sensor power supply output
	17	V2	Sensor power supply output
	18	V2	Sensor power supply output
	19	G1	Encoder power supply input
	20	G1	Encoder power supply output
	21	A5	Phase A input (5 V)
	22	B5	Phase B input (5 V)
	23	Z5	Phase Z input (5 V)
	24	G2	Sensor power supply input
	25	G2	Sensor power supply output
	26	G2	Sensor power supply output
	27	G2	Sensor power supply output

Internal circuits diagram

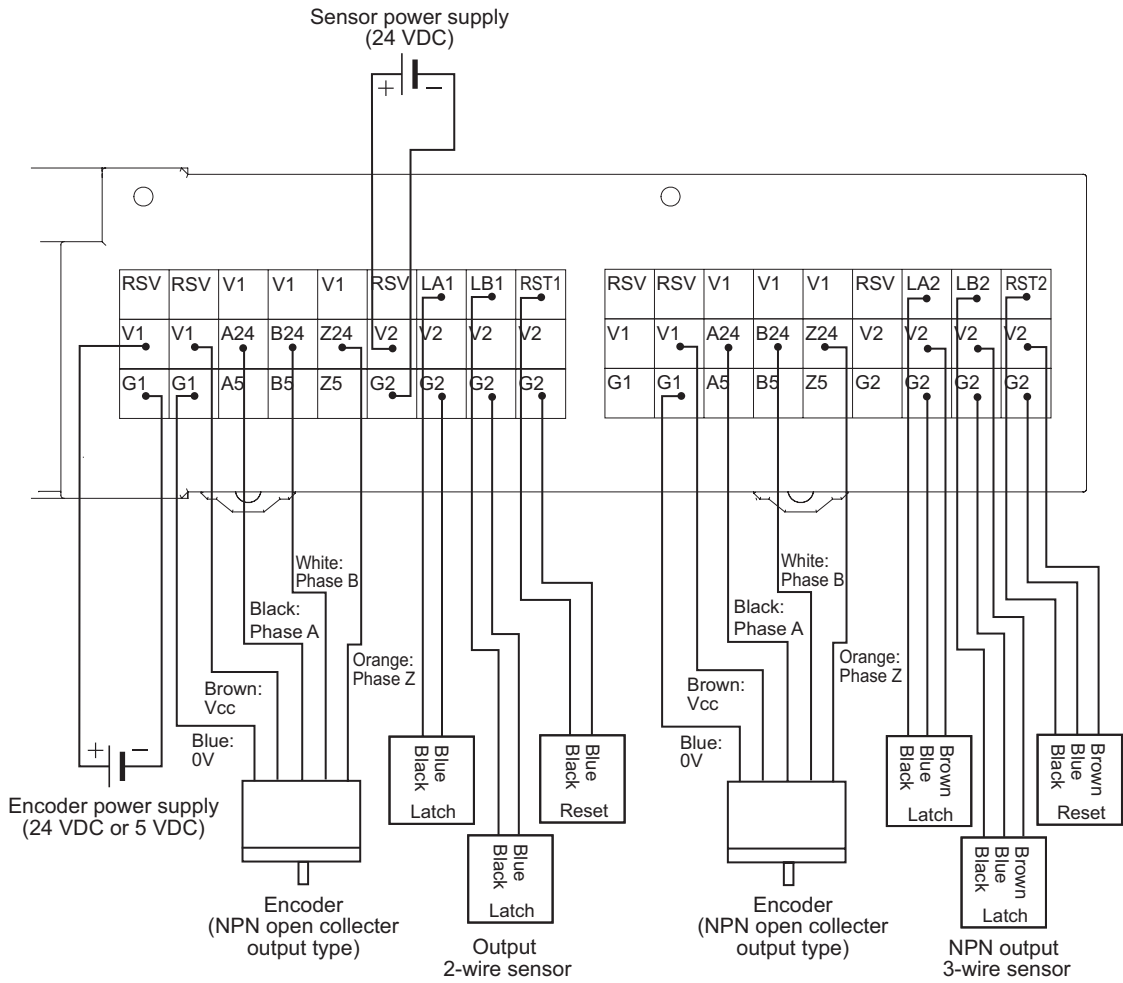


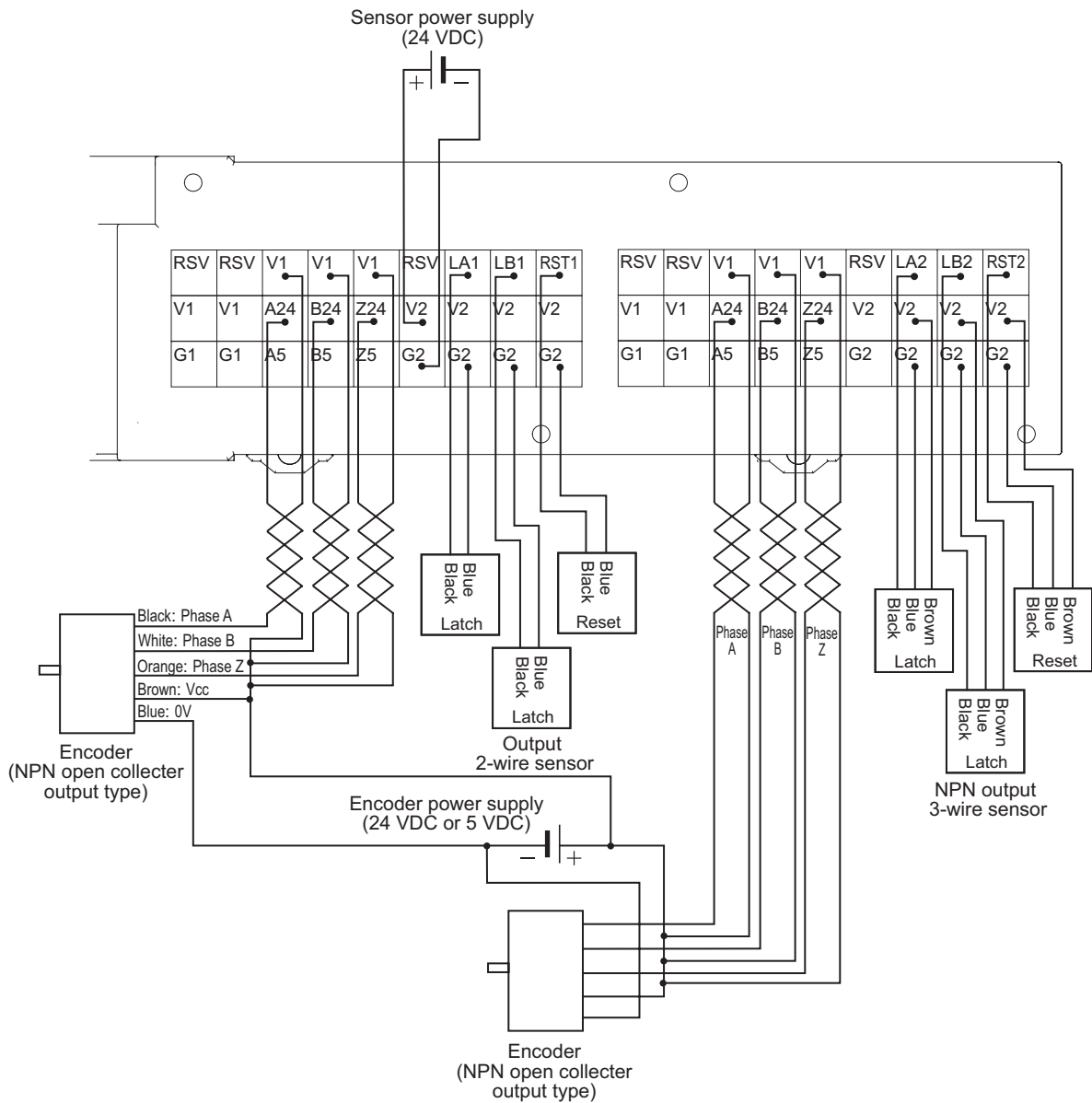
9-4 Specifications for Each Slave Unit



9-4-1 Open collector input type GX-EC0211

Wiring diagram





Precautions for Correct Use

- Use shielded cable and ground the shield to 100 Ω or less when wiring pulse input A/B/Z with external control inputs.
- Wiring of pulse input A/B/Z shall be as short as possible and separated from wiring with many noises such as power lines.
- Use stabilizing power supply separate from other inputs/outputs for Encoder Input Slave Units as much as possible.
- Do not wire anything to RSV terminals.

9-4-2 Line Driver Input Type GX-EC0241

Specification

● Slave Unit specifications

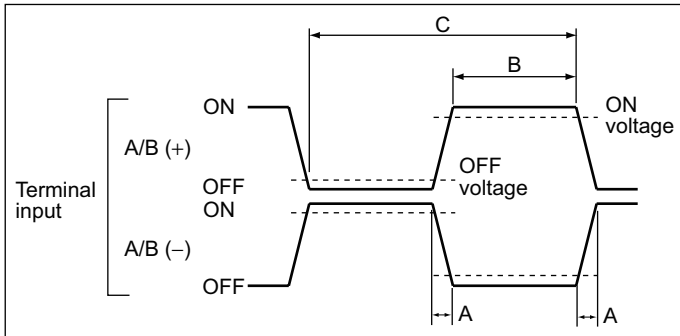
Item	Specification
Counter point	2 points
Input signal	Counter phase A Counter phase B Counter phase Z Latch input (A/B) Counter reset input
Counter enabled status display	LED display (green)
Input indicators	LED display (yellow)
Unit power supply current consumption	100 mA max. (for 20.4 to 26.4 VDC power supply voltage)
Weight	390 g max.

● Pulse input specifications

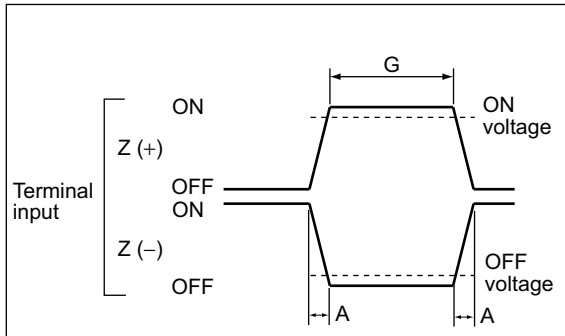
Item	Specification	
	Counter phase A/B	Counter phase Z
Input voltage	EIA standard RS-422-A line driver level	
Input impedance	120 Ω \pm 5%	
gH level input voltage	0.1 V	
gL level input voltage	-0.1 V	
Hysteresis voltage	60 mV	
Maximum response frequency	Single phase 4 MHz (phase difference Multiplication \times 4, 1 MHz)	1 MHz
Filter switching	NA	

● Pulse input timing specifications

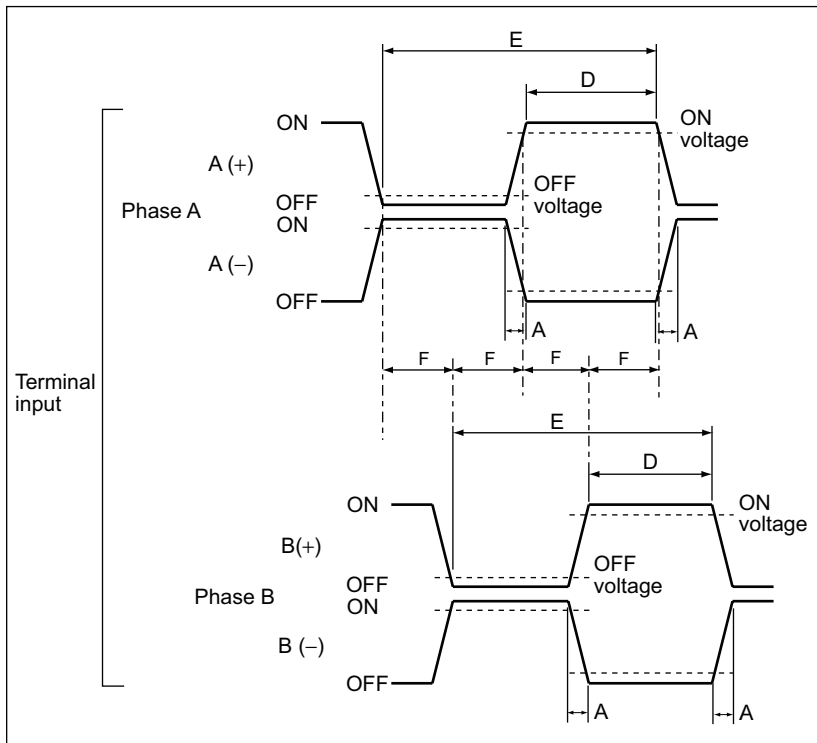
Counter input phase A/B
Input pulse duty: 50%



Counter input phase Z



Relationship between phase A and phase B at phase difference pulse input



Timing condition						
A	B	C	D	E	F	G
<25 ns	>125 ns	>250 ns	>0.5 μs	>1 μs	>0.25 μs	>0.5 μs



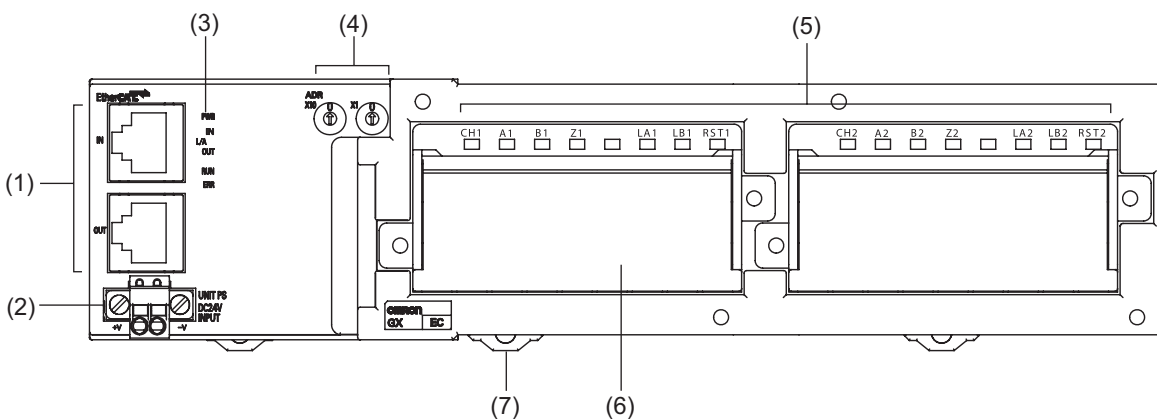
Precautions for Correct Use

In order to satisfy the counter input specifications, it is necessary to pay attention to the type of output driver of the encoder to be used, the length of encoder cable, and frequency of count pulse.

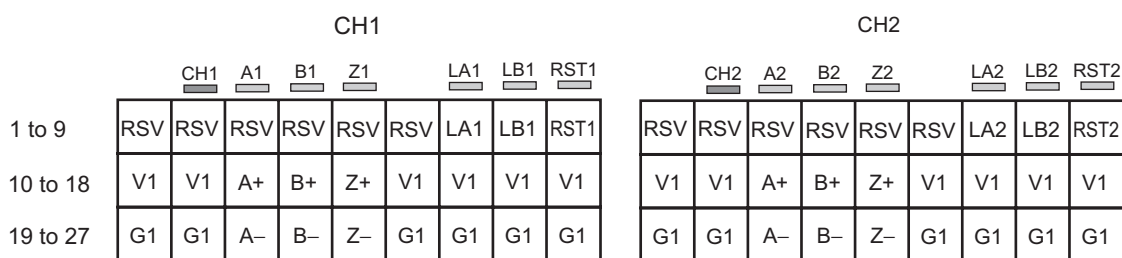
● Latch/reset input specifications

Item	Specification	
	Latch input (A/B)	Reset input
Internal I/O common	PNP	
Input voltage	20.4 to 26.4 VDC (24 VDC -15 to +10%)	20.4 to 26.4 VDC (24 VDC -15 to +10%)
Input impedance	4.0 kΩ	3.3 kΩ
Input current	5.5 mA (at 24 VDC)	7 mA (at 24 VDC)
ON voltage/ON current	17.4 VDC min./3 mA min.	14.4 VDC min./3 mA min.
OFF voltage/OFF current	5 VDC max./1 mA max.	5 VDC max./1 mA max.
ON response time	3 μs max.	15 μs max.
OFF response time	3 μs max.	90 μs max.

Names and Functions



● Terminal/input display LED layout diagram



No.	Name	Function
(1)	Communications connectors	Refer to "6-3 Specifications of Common Areas" Page 6 - 4.
(2)	Unit power supply connector	
(3)	Status indicators	
(4)	Node address switches	
(5)	Input indicators	The indicators show the status of the inputs of each channel. For details, refer to the next section "Input indicators".
(6)	Terminal block	Connects external devices and the I/O power supply. For details, refer to the next section "Terminal block".
(7)	DIN track mounting hook	Fixes a Slave Unit to a DIN track.

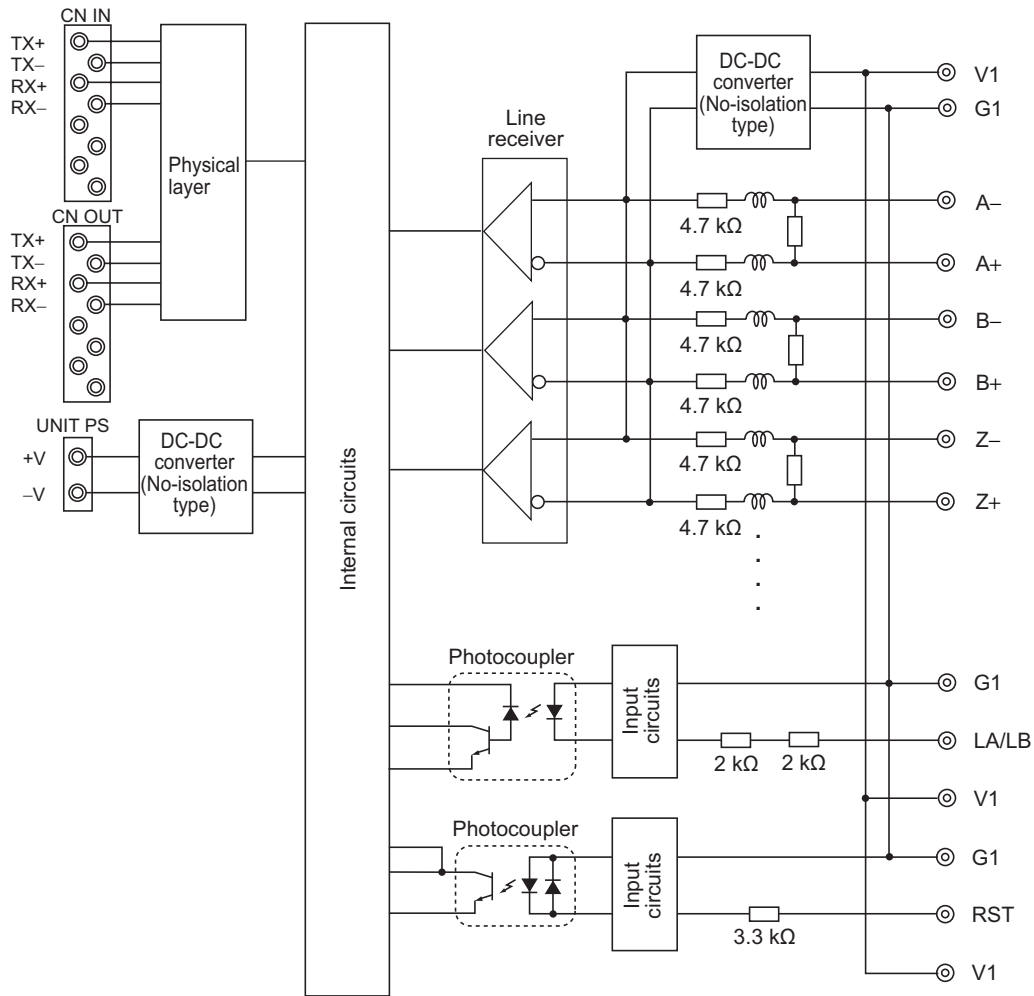
- Input indicators

CH1			CH2		
Name	State	Contents	Name	State	Contents
CH1	Lit green.	Counter operating	CH2	Lit green.	Counter operating
	OFF	Counter stopped		OFF	Counter stopped
A1	Lit yellow.	Input A (phase A signal/count pulse signal/incremental count signal) available	A2	Lit yellow.	Input A (phase A signal/count pulse signal/incremental count signal) available
	OFF	Input A (phase A signal/count pulse signal/incremental count signal) not available		OFF	Input A (phase A signal/count pulse signal/incremental count signal) not available
B1	Lit yellow.	Input B (phase B signal/count direction control signal/decremental count signal) available	B2	Lit yellow.	Input B (phase B signal/count direction control signal/decremental count signal) available
	OFF	Input B (phase B signal/count direction control signal/decremental count signal) not available		OFF	Input B (phase B signal/count direction control signal/decremental count signal) not available
Z1	Lit yellow.	Phase Z input available	Z2	Lit yellow.	Phase Z input available
	OFF	Phase Z input not available		OFF	Phase Z input not available
LA1	Lit yellow.	External latch input A available	LA2	Lit yellow.	External latch input A available
	OFF	External latch input A not available		OFF	External latch input A not available
LB1	Lit yellow.	External latch input B available	LB2	Lit yellow.	External latch input B available
	OFF	External latch input B not available		OFF	External latch input B not available
RST1	Lit yellow.	External reset input available	RST2	Lit yellow.	External reset input available
	OFF	External reset input not available		OFF	External reset input not available

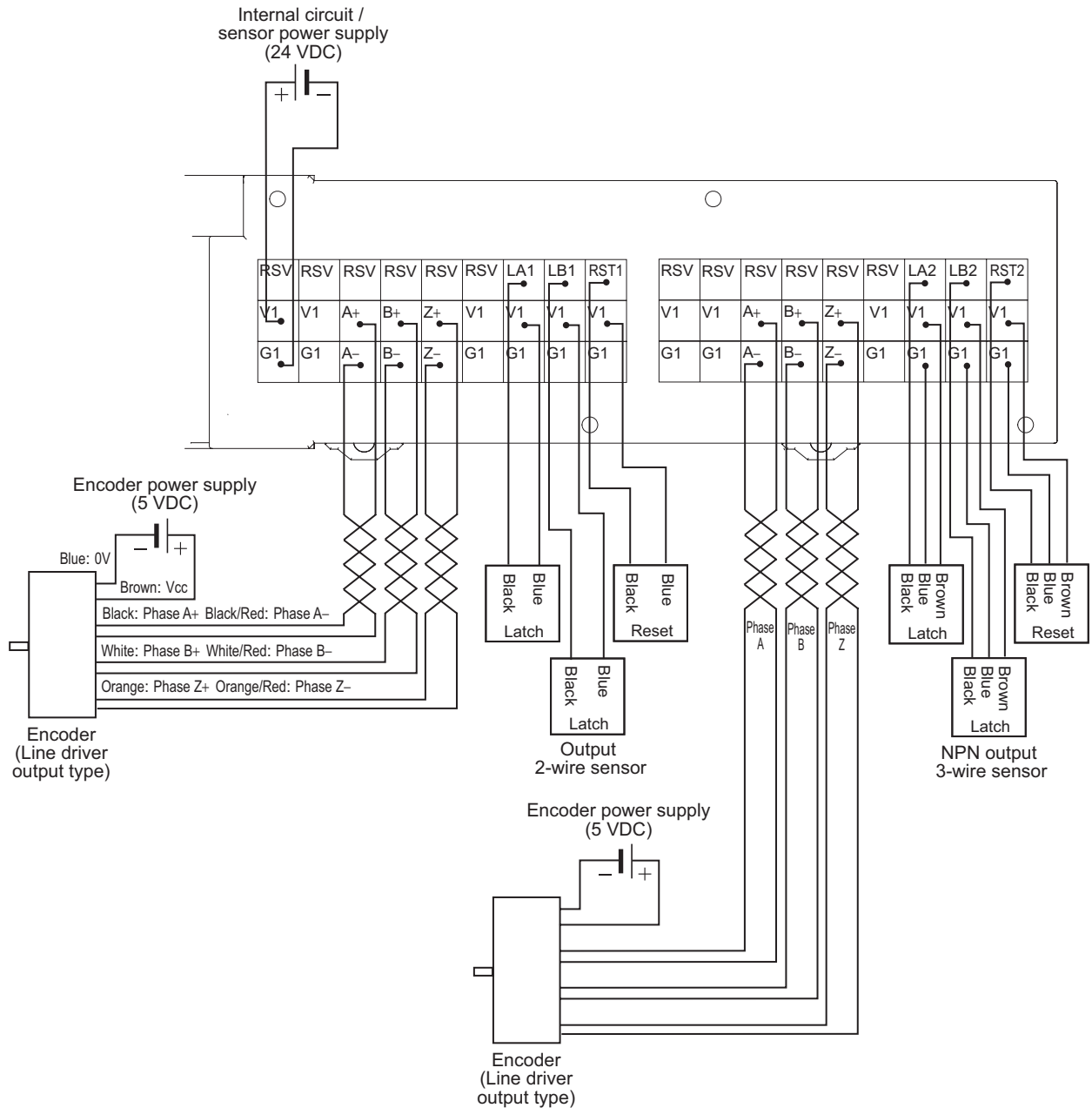
- Terminal block

CH	Terminal block number	Terminal name	Contents
CH1 CH2	1	RSV	-
	2	RSV	-
	3	RSV	-
	4	RSV	-
	5	RSV	-
	6	RSV	-
	7	LA1/LA2	Latch A input
	8	LB1/LB2	Latch B input
	9	RST1/RST2	Reset input
	10	V1	Internal circuit/sensor power supply input
	11	V1	(Spare)
	12	A+	Phase A input (+)
	13	B+	Phase B input (+)
	14	Z+	Phase Z input (+)
	15	V1	(Spare)
	16	V1	Sensor power supply output
	17	V1	Sensor power supply output
	18	V1	Sensor power supply output
	19	G1	Internal circuit/sensor power supply input
	20	G1	(Spare)
	21	A-	Phase A input (-)
	22	B-	Phase B input (-)
	23	Z-	Phase Z input (-)
	24	G1	(Spare)
	25	G1	Sensor power supply output
	26	G1	Sensor power supply output
	27	G1	Sensor power supply output

Internal circuits diagram



Wiring diagram

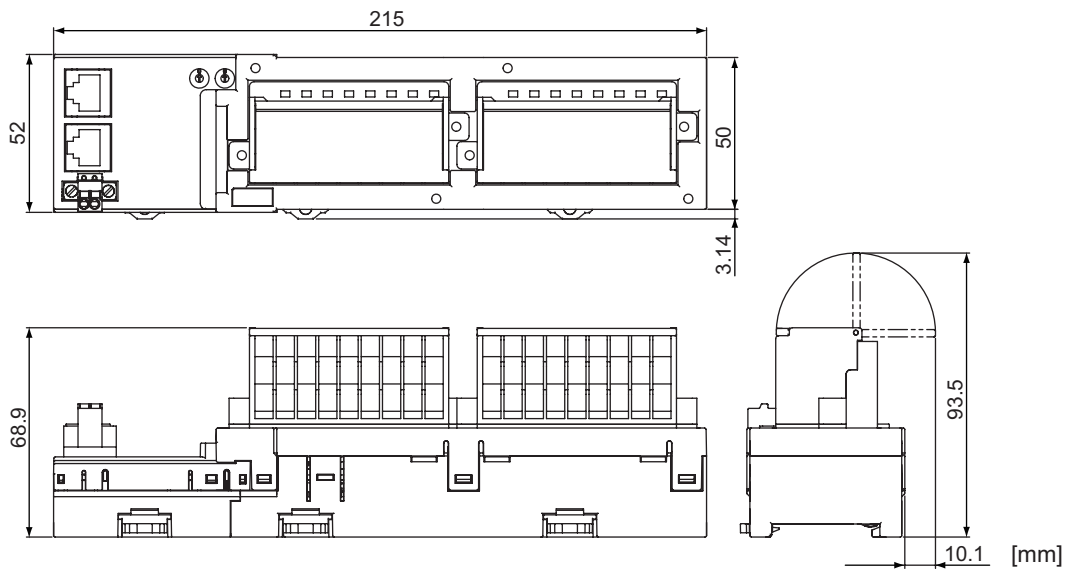


Precautions for Correct Use

- Use shielded cable and ground the shield to 100 Ω or less when wiring pulse input A/B/Z with external control inputs.
- Wiring of pulse input A/B/Z shall be as short as possible and separated from wiring with many noises such as power lines.
- Use stabilizing power supply separate from other inputs/outputs for Encoder Input Slave Units as much as possible.
- Do not wire anything to RSV terminals.

9-5 Mounting Dimensions

The mounting dimensions of an Encoder Input Slave Unit are shown below.



10

Expansion Unit

This chapter overviews the Expansion Unit.

10-1 Overview of the Expansion Unit	10-2
10-1-1 Connecting Expansion Units	10-2
10-1-2 I/O Power Supply	10-3
10-2 Specifications of Expansion Unit	10-4
10-2-1 8-point Input Expansion Unit XWT-ID08/ID08-1	10-5
10-2-2 8-point Output Expansion Unit XWT-OD08/OD08-1	10-8
10-2-3 16-point Input Expansion Unit XWT-ID16/ID16-1	10-11
10-2-4 16-point Output Expansion Unit XWT-OD16/OD16-1	10-14
10-3 Mounting Dimensions	10-17

10-1 Overview of the Expansion Unit

One Expansion Unit can be added to a Digital I/O Slave Unit (GX-ID 1611/ID1621/OD1611/OD1621/OC1601) (2-tier terminal block type 16-point Slave Unit)

The use of Expansion Units enables flexible I/O capacity expansion.

This section explains how to connect the Expansion Unit and supply the unit power.

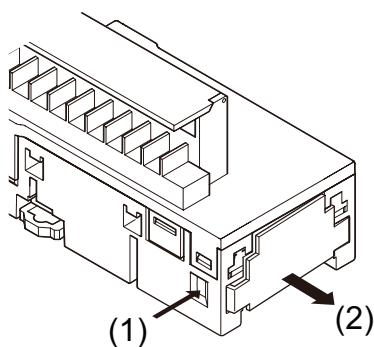
The Expansion Unit provides the same functions available through the Digital I/O Slave Unit.

For details, refer to "7-3 Functions of Digital I/O Slave Units" in page 7 - 7.

10-1-1 Connecting Expansion Units

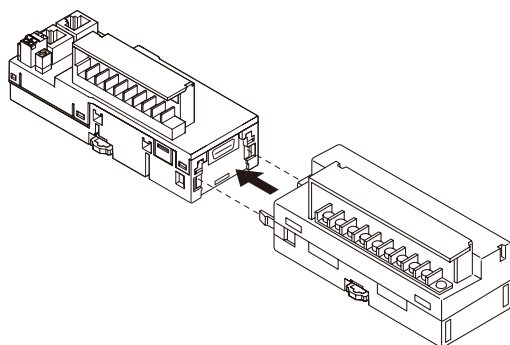
1 Remove the cover from the right side of the Digital I/O Slave Unit.

- (1) Depress the catch and remove one side of the cover.
- (2) Pull out the cover to remove it entirely.



2 Connect the Expansion Unit to the Slave Unit.

Press the Expansion Unit and Digital I/O Slave Unit together until they click into place with the connectors properly mated.



Precautions for Correct Use

Always turn the main power OFF when connecting the Expansion Unit.

10-1-2 I/O Power Supply

The I/O power supply method when an Expansion Unit is connected differs in cases. In some cases I/O power can be supplied only to Slave Unit.

In the other cases, it must be supplied to both the Slave Unit and the Expansion Unit.

These differences depend on the I/O combination. Refer to the following table for the correct supply.

Expansion Unit Slave Unit		Input		Output	
		XWT-ID08(-1)	XWT-ID16(-1)	XWT-OD08(-1)	XWT-OD16(-1)
Input	GX-ID1611	Power is supplied only to the Slave Unit.		Power is supplied to both the Slave Unit and Expansion Unit.	
	GX-ID1621	Power supply to the Expansion Unit is not required.			
Output	GX-OD1611	Power is supplied to both the Slave Unit and Expansion Unit.		Power is supplied to both the Slave Unit and Expansion Unit.	
	GX-OD1621				
	GX-OC1601				

10-2 Specifications of Expansion Unit

The chart below shows the Expansion Unit specifications, component names and functions, internal circuits and wiring diagram.

Refer to the following corresponding page to each model.

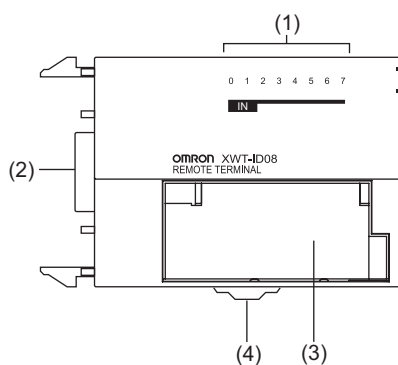
Model	Reference page			
	Specification	Names and functions	Internal circuits diagram	Wiring diagram
XWT-ID08 XWT-ID08-1	10-5	10-5	10-6	10-7
XWT-OD08 XWT-OD08-1	10-8	10-8	10-9	10-10
XWT-ID16 XWT-ID16-1	10-11	10-11	10-12	10-13
XWT-OD16 XWT-OD16-1	10-14	10-14	10-15	10-16

10-2-1 8-point Input Expansion Unit XWT-ID08/ID08-1

Specification

Item	Specification	
	XWT-ID08	XWT-ID08-1
Internal I/O common	NPN	PNP
I/O capacity	8 inputs	
ON voltage	15 VDC min. (between each input terminal and the V terminal)	15 VDC min. (between each input terminal and the G terminal)
OFF voltage	5 VDC max. (between each input terminal and the V terminal)	5 VDC max. (between each input terminal and the G terminal)
OFF current	1.0 mA max.	
Input current	6.0 mA max./input (at 24-VDC) 3.0 mA max./input (at 17-VDC)	
ON delay time	1.5 ms max.	
OFF delay time	1.5 ms max.	
Number of circuits per common	8 inputs/common	
Isolation method	Photocoupler isolation	
Input indicators	LED display (yellow)	
Weight	80g max.	

Names and functions



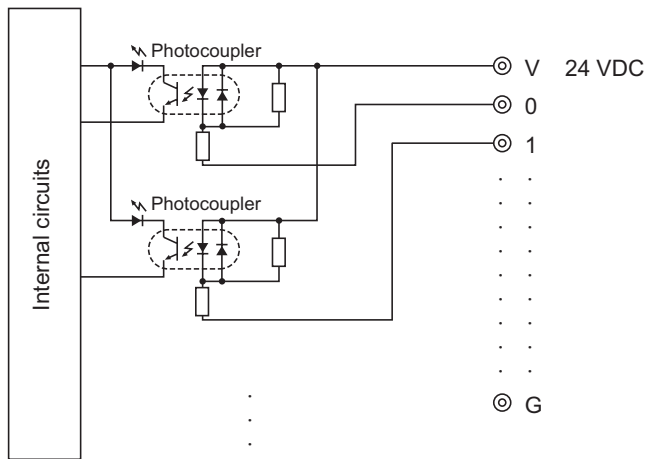
● Terminal arrangement diagram



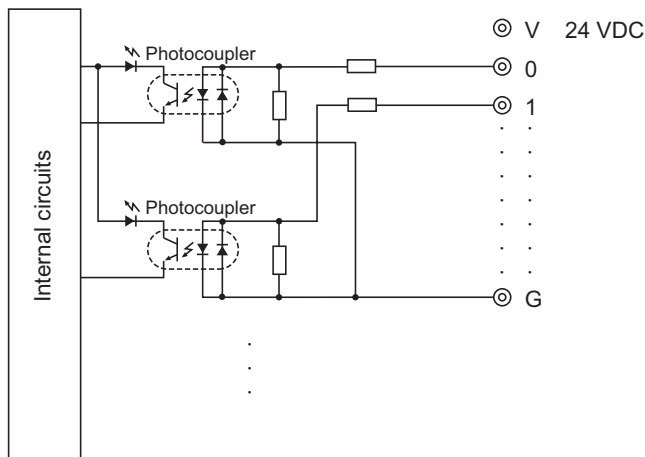
No.	Name	Function
(1)	Input indicators (0 to 7)	Indicates the state of each input contact (ON/OFF). Not lit: Contact OFF (input OFF state) Lit in yellow: Contact ON (input ON state)
(2)	Slave connector	Connects the connector on the right side of the Slave Unit.
(3)	Terminal block	Connects external devices and the I/O power supply. V, G: I/O power supply terminals 0 to 7: Input terminals
(4)	DIN track mounting hook	Fixes a Slave Unit to a DIN track.

Internal circuits diagram

● XWT-ID08 (NPN)

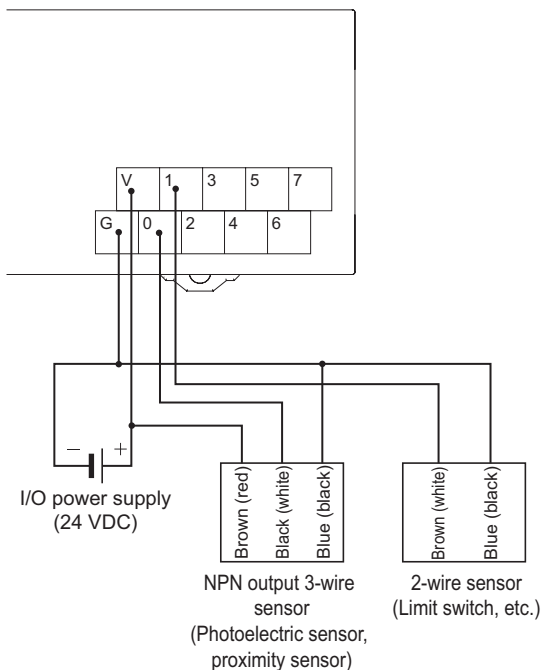


● XWT-ID08-1 (PNP)

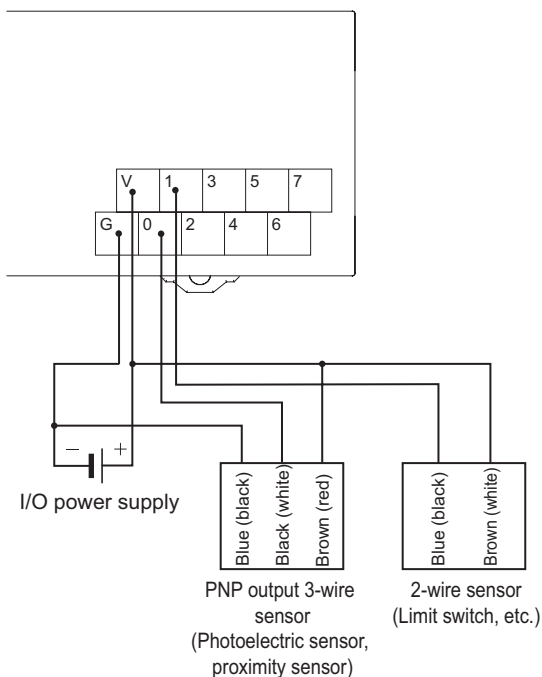


Wiring diagram

● XWT-ID08 (NPN)



● XWT-ID08-1 (PNP)



Reference

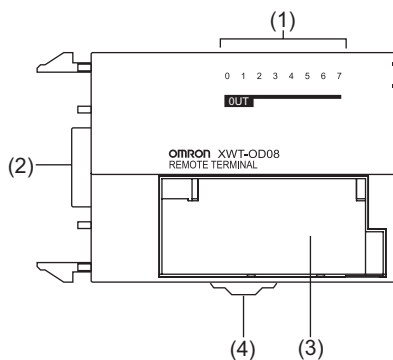
Wire colors have been changed according to revisions in the JIS standards for photoelectric and proximity sensors.
The colors in parentheses are the wire colors prior to the revisions.

10-2-2 8-point Output Expansion Unit XWT-OD08/OD08-1

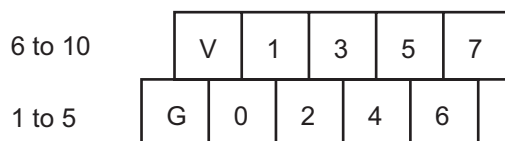
Specification

Item	Specification	
	XWT-OD08	XWT-OD08-1
Internal I/O common	NPN	PNP
I/O capacity	8 outputs	
Rated output current	0.5 A/output, 2.0 A/common	
Residual voltage	1.2 V max. (0.5 ADC, between each output terminal and the G terminal)	1.2 V max. (0.5 ADC, between each output terminal and the V terminal)
Leakage current	0.1 mA max.	
ON delay time	0.5 ms max.	
OFF delay time	1.5 ms max.	
Number of circuits per common	8 inputs/common	
Isolation method	Photocoupler isolation	
Output indicators	LED display (yellow)	
Error Mode Output	Select either hold or clear.	
Weight	80g max.	

Names and functions



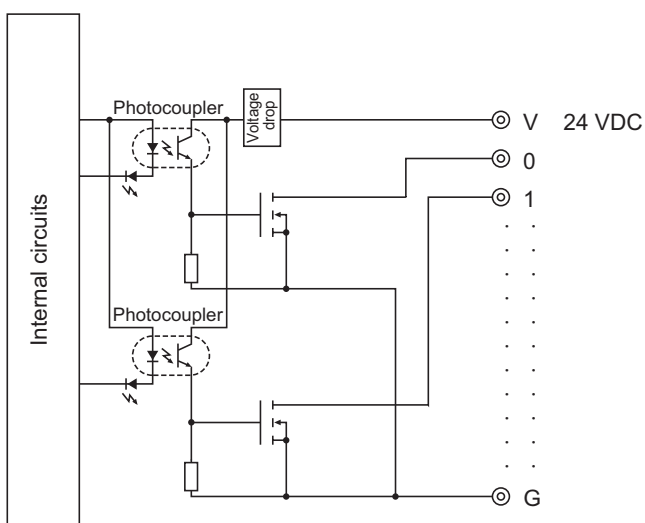
● Terminal arrangement diagram



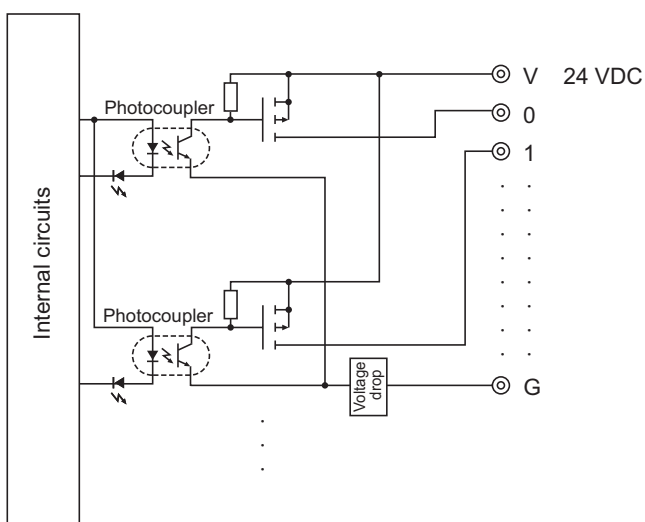
No.	Name	Function
(1)	Output indicators (0 to 7)	Indicates the state of each output contact (ON/OFF). Not lit: Contact OFF (output OFF state) Lit in yellow: Contact ON (output ON state)
(2)	Slave connector	Connects the connector on the right side of the Slave Unit.
(3)	Terminal block	Connects external devices and the I/O power supply. V, G: I/O power supply terminals 0 to 7: Output terminals
(4)	DIN track mounting hook	Fixes a Slave Unit to a DIN track.

Internal circuits diagram

● XWT-OD08 (NPN)

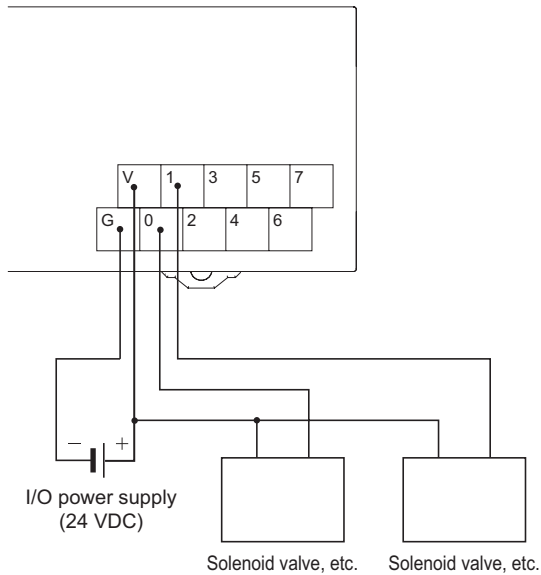


● XWT-OD08-1 (PNP)

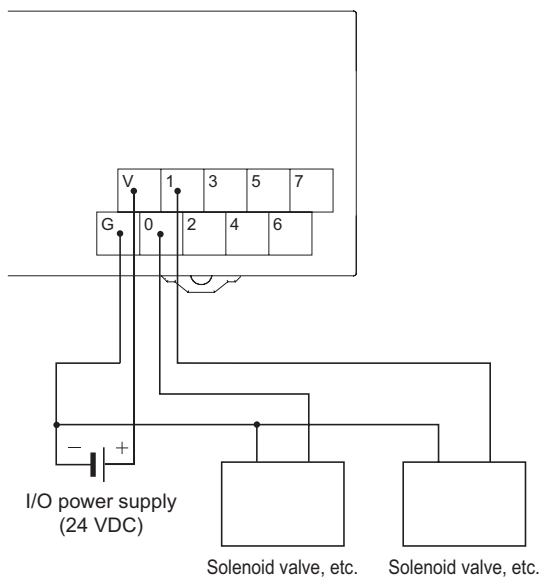


Wiring diagram

● XWT-OD08 (NPN)



● XWT-OD08-1 (PNP)



Precautions for Correct Use

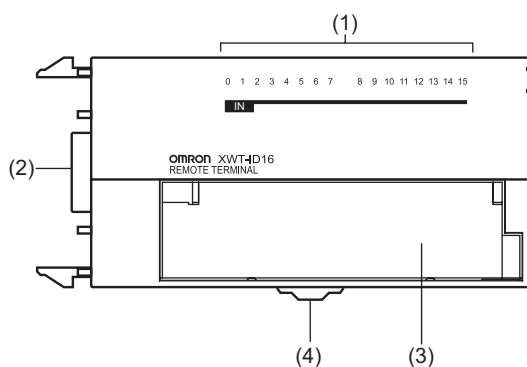
When using an inductive load, such as a solenoid valve, either use a built-in diode for absorbing the counterelectromotive force or install an external diode.

10-2-3 16-point Input Expansion Unit XWT-ID16/ID16-1

Specification

Item	Specification	
	XWT-ID16	XWT-ID16-1
Internal I/O common	NPN	PNP
I/O capacity	16 inputs	
ON voltage	15 VDC min. (between each input terminal and the V terminal)	15 VDC min. (between each input terminal and the G terminal)
OFF voltage	5 VDC max. (between each input terminal and the V terminal)	5 VDC max. (between each input terminal and the G terminal)
OFF current	1.0 mA max.	
Input current	6.0 mA max./input (at 24-VDC) 3.0 mA max./input (at 17-VDC)	
ON delay time	1.5 ms max.	
OFF delay time	1.5 ms max.	
Number of circuits per common	16 inputs/common	
Isolation method	Photocoupler isolation	
Input indicators	LED display (yellow)	
Weight	120g max.	

Names and functions



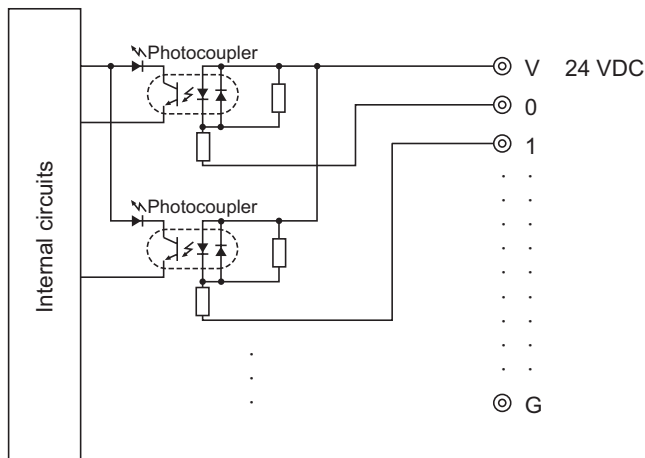
● Terminal arrangement diagram



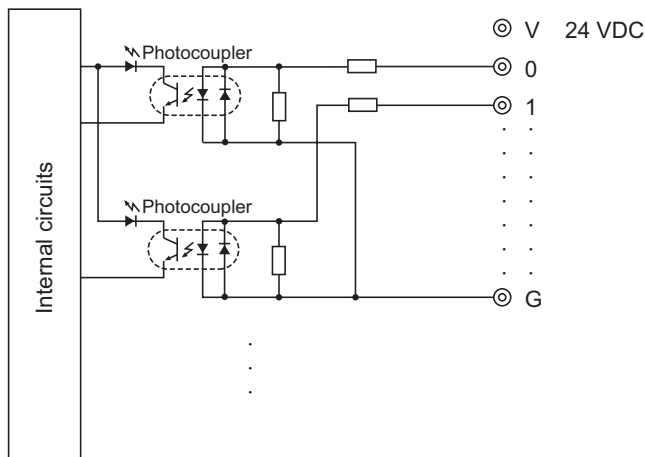
No.	Name	Function
(1)	Input indicators (0 to 15)	Indicates the state of each input contact (ON/OFF). Not lit: Contact OFF (input OFF state) Lit in yellow: Contact ON (input ON state)
(2)	Slave connector	Connects the connector on the right side of the Slave Unit.
(3)	Terminal block	Connects external devices and the I/O power supply. V, G: I/O power supply terminals 0 to 15: Input terminals
(4)	DIN track mounting hook	Fixes a Slave Unit to a DIN track.

Internal circuits diagram

● XWT-ID16 (NPN)

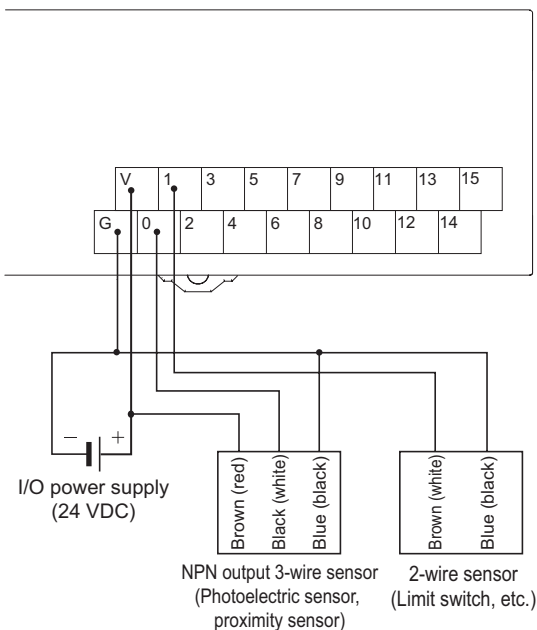


● XWT-ID16-1 (PNP)

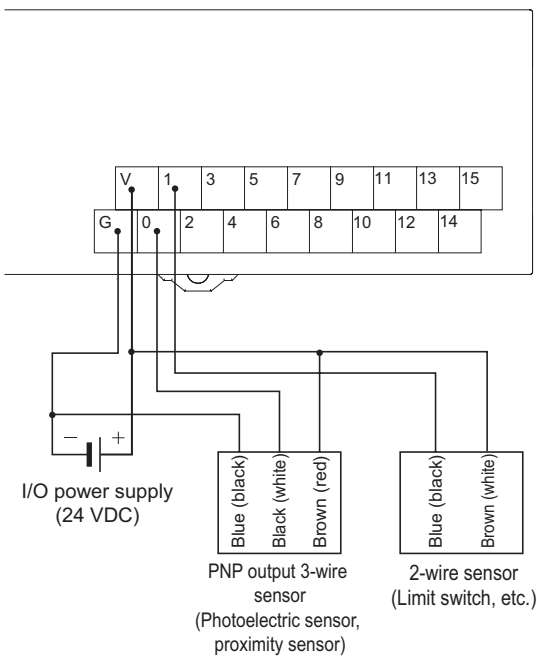


Wiring diagram

● XWT-ID16 (NPN)



● XWT-ID16-1 (PNP)



Reference

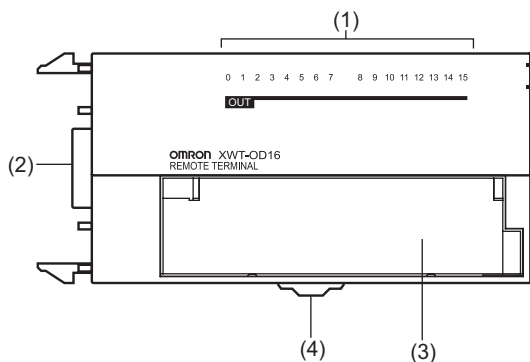
Wire colors have been changed according to revisions in the JIS standards for photoelectric and proximity sensors.
The colors in parentheses are the wire colors prior to the revisions.

10-2-4 16-point Output Expansion Unit XWT-OD16/OD16-1

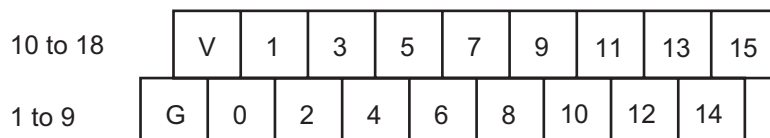
Specification

Item	Specification	
	XWT-OD16	XWT-OD16-1
Internal I/O common	NPN	PNP
I/O capacity	16 outputs	
Rated output current	0.5 A/output, 4.0 A/common	
Residual voltage	1.2 V max. (0.5 ADC, between each output terminal and the G terminal)	1.2 V max. (0.5 ADC, between each output terminal and the V terminal)
Leakage current	0.1 mA max.	
ON delay time	0.5 ms max.	
OFF delay time	1.5 ms max.	
Number of circuits per common	16 inputs/common	
Isolation method	Photocoupler isolation	
Output indicators	LED display (yellow)	
Error Mode Output	Select either hold or clear.	
Weight	120g max.	

Names and functions



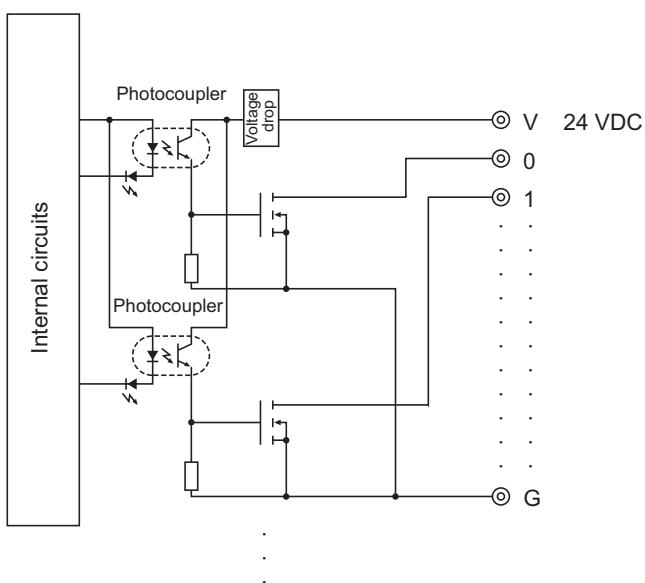
● Terminal arrangement diagram



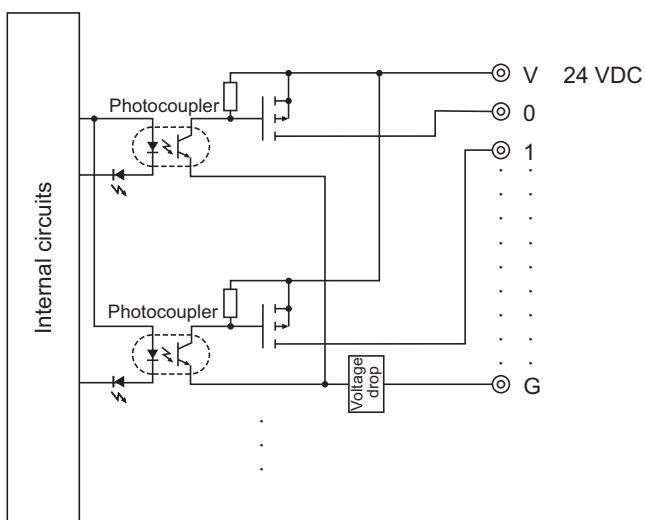
No.	Name	Function
(1)	Output indicators (0 to 15)	Indicates the state of each output contact (ON/OFF). Not lit: Contact OFF (output OFF state) Lit in yellow: Contact ON (output ON state)
(2)	Slave connector	Connects the connector on the right side of the Slave Unit.
(3)	Terminal block	Connects external devices and the I/O power supply. V, G: I/O power supply terminals 0 to 15: Output terminals
(4)	DIN track mounting hook	Fixes a Slave Unit to a DIN track.

Internal circuits diagram

● XWT-OD16 (NPN)

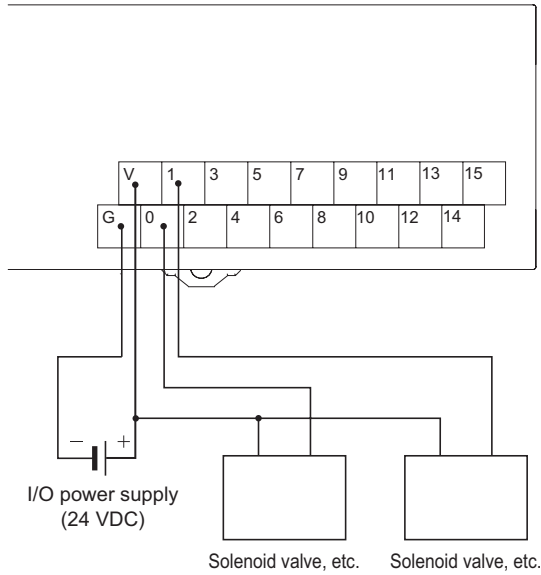


● XWT-OD16-1 (PNP)

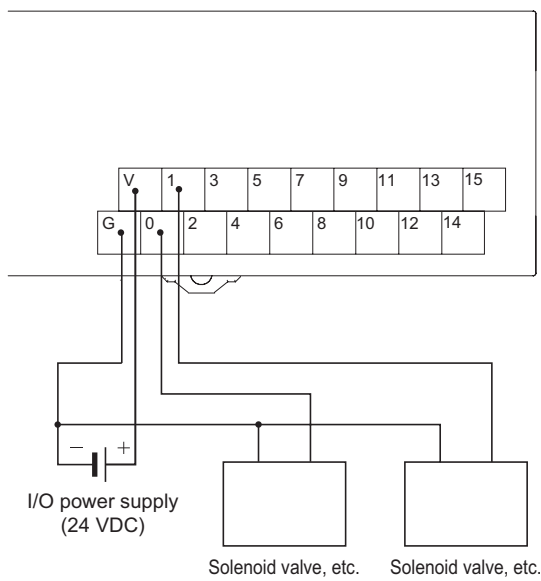


Wiring diagram

● XWT-OD16 (NPN)



● XWT-OD16-1 (PNP)



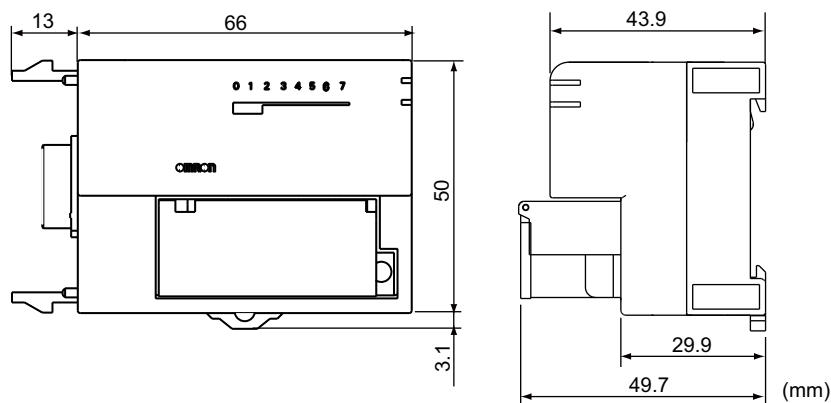
Precautions for Correct Use

When using an inductive load, such as a solenoid valve, either use a built-in diode for absorbing the counterelectromotive force or install an external diode.

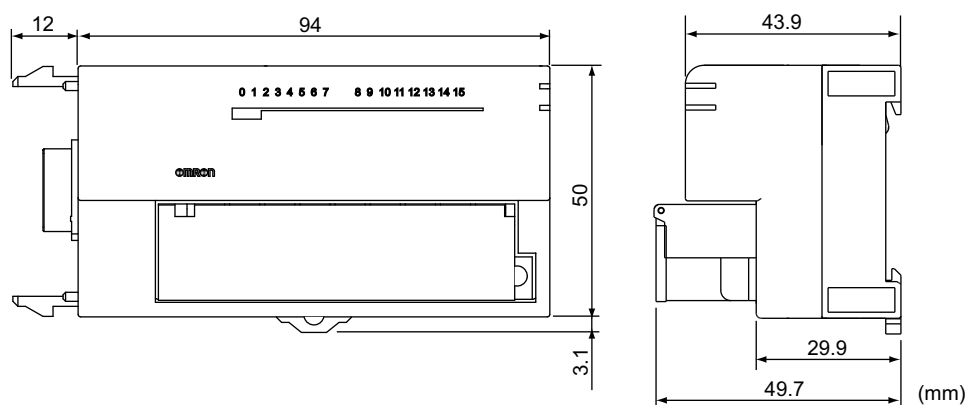
10-3 Mounting Dimensions

The mounting dimensions of the Expansion Unit are shown below.

● **XWT-ID08/ID08-1/OD08/OD08-1**



● **XWT-ID16/ID16-1/OD16/OD16-1**



11

Troubleshooting and Maintenance

This chapter explains actions to be taken at errors, troubleshooting, and equipment maintenance.

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11-1 Troubleshooting

11-1-1 Errors that Can be Checked with Status Indicator and Actions to Take

Errors can be notified by status indicators on Slave Units.

In this section, the states of status indicator are indicated using the following abbreviations.

Abbreviation	Definition
On	ON
Off	OFF
F	Flickering (ON (50 ms) - OFF (50 ms) flashing)
B	Blinking (ON (200 ms) - OFF (200 ms) flashing)
SF	Single flash (ON (200 ms) - OFF (1000 ms) flashing)
DF	Double flash (ON (200 ms) - OFF (200 ms) - ON (200 ms) - OFF (1000 ms) flashing)
-	Unknown

For details on definition of each state, refer to "6-3-1 Status Indicators" in page 6 - 4.

● Errors of Slave Unit

[PWR] indicator	[L/A IN] [L/A OUT] LED	[RUN] indicator	[ERR] indicator	Description	Cause	Actions
On	F	On	Off	EtherCAT communication is in progress.	EtherCAT communication is being executed.	PDO communications or both PDO and SDO communications are being executed. State is normal.
Off	Off	Off	Off	Power supply error	The power is not properly supplied to the Slave Unit.	After removing the following factors of power supply shutdown, restart the Slave Unit according to the specification of connected EtherCAT Master Unit. <ul style="list-style-type: none"> • Are the power supply cables wired correctly? • Are the power supply cables disconnected? • Is the power supply voltage within the specification range? • Is the power supply capacity sufficient? • Is the power supply malfunctioning?

[PWR] indicator	[L/A IN] [L/A OUT] LED	[RUN] indicator	[ERR] indicator	Description	Cause	Actions
On	-	Off	On	Hardware error	A hardware failure occurred.	If the error does not clear even after the power is turned ON again, the Slave Unit hardware is damaged. Replace the Slave Unit.
			F			The Expansion Unit is disconnected.
			B			
On	-	-	B	Illegal switch setting	A range setting switch or other switch setting is illegal.	Check the switch settings then restart the Slave Unit according to the specification of connected EtherCAT Master Unit.
				EEPROM data error	EEPROM data error	Use the Configuration Tool or SDO communications to restore the default data and restart the Slave Unit according to the specification of connected EtherCAT Master Unit.
				Sync manager setting error	The sync manager setting is illegal.	Change to the correct settings.
				Hardware error	A hardware failure occurred.	If the problem is not resolved even after the measures described above are taken, the Slave Unit hardware may be damaged. Replace the applicable Slave Unit.

● Errors of EtherCAT Network

[PWR] indicator	[L/A IN] [L/A OUT] LED	[RUN] indicator	[ERR] indicator	Description	Cause	Actions
On	On	–	–	Link established in physical layer	Operation standby status after establishing link in physical layer.	–
On	Off	–	–	Link not established in physical layer	A link in physical layer has not been established.	After checking the following items, restart the Slave Unit according to the specification of connected EtherCAT Master Unit. <ul style="list-style-type: none"> • Is the communications cable wired correctly? • Are any cables disconnected or loose in the part that connects to the connector? • Is the cable length appropriate? • Is the communications cable of the recommended specification?
					The host master has not been started.	Check that EtherCAT Master Unit is operating correctly. If using an OMRON EtherCAT Master Unit, check the EtherCAT Master Unit mode and Slave Unit node addresses. If using EtherCAT Master Unit from another manufacturer, refer to the user's manual for that Master Unit.
					A hardware failure occurred.	If the problem is not resolved even after the measures described above are taken, the Slave Unit hardware may be damaged. Replace the applicable Slave Unit.

[PWR] indicator	[L/A IN] [L/A OUT] LED	[RUN] indicator	[ERR] indicator	Description	Cause	Actions
On	-	-	DF	Process data communications timeout *	A communications error occurred.	After checking the following items, restart the Slave Unit according to the specification of connected EtherCAT Master Unit. [Item about communication cable] <ul style="list-style-type: none"> Is the communications cable wired correctly? Are any cables disconnected or loose in the part that connects to the connector? Is the cable length appropriate? Is the communications cable of the recommended specification? [Item about power supply] <ul style="list-style-type: none"> Is the power supply voltage within the specification range? Is the power supply capacity sufficient?
					Malfunction due to noise	<ul style="list-style-type: none"> If there are devices in the vicinity that generate noise, take necessary measures against the noise to protect the EtherCAT Master Unit and Slave Units and the communications cable. The noise resistance deteriorates if a cable other than those of the recommended specification is used. Use the communications cable of the recommended specification.
				Link in physical later OFF	Communications cable disconnection occurred.	Check to see if the cable is disconnected or loose in the part that connects to the connector.

[PWR] indicator	[L/A IN] [L/A OUT] LED	[RUN] indicator	[ERR] indicator	Description	Cause	Actions
On	–	SF	–	Safe-Operational state	It is commanded from the EtherCAT Master Unit to shift to the Safe-Operational state.	If the trouble occurred during operating the system, check the state of the connected EtherCAT Master Unit.
On	–	B	–	Pre-Operational state	It is commanded from the EtherCAT Master Unit to shift to the Pre-Operational state.	
On	–	Off	–	Init state	It is commanded from the EtherCAT Master Unit to shift to the Init state.	

* Due to the EtherCAT specification, a communication timeout does not occur with those Slave Units that only handle input data.

● Errors of Encoder Input Slave Unit

[PWR] indicator	[L/A IN] [L/A OUT] LED	[RUN] indicator	[ERR] indicator	Description	Actions
On	–	B	B	Synchronization frequency (Sync0 frequency) setting error	After checking the following items, restart the Slave Unit according to the specification of connected EtherCAT Master Unit. <ul style="list-style-type: none"> Set the correct synchronization frequency.
On	–	B	SF	Synchronization error (at synchronization start)	After checking the following items, restart the Slave Unit according to the specification of connected EtherCAT Master Unit. <ul style="list-style-type: none"> Is the communications cable wired correctly? Is the communications cable exposed to excessive noise? Review set time of Sync Not Received Timeout Setting (synchronization error setting).
On	–	SF	SF	Communications synchronization error	After checking the following items, restart the Slave Unit according to the specification of connected EtherCAT Master Unit. <ul style="list-style-type: none"> Is the communications cable wired correctly? Is the communications cable exposed to excessive noise? Review set time of Communication Error Setting .

[PWR] indicator	[L/A IN] [L/A OUT] LED	[RUN] indicator	[ERR] indicator	Description	Actions
On	–	SF	SF	Synchronization error (in operation)	<p>After checking the following items, restart the Slave Unit according to the specification of connected EtherCAT Master Unit.</p> <ul style="list-style-type: none"> • Is the communications cable wired correctly? • Is the communications cable exposed to excessive noise? • Review set time of Communication Error Setting . <p>If this does not improve, the Slave Unit hardware may be damaged. Replace the applicable Slave Unit.</p>

11-1-2 Errors Unique to Each Slave Unit

Slave Unit type	Symptom	Cause	Measures
All models other than Encoder Input Slave Units	Some functions are not reflected even after parameters have been set.	The functions enabled by reclosing were changed.	Turn ON Slave Unit power supply again after changing the setting.
Slave Units to which Expansion Units can be mounted	I/O communications stopped after mounting or removing an Expansion Unit and turning ON the power.	The number of I/O points increase or decrease when Expansion Units are mounted or removed. The number of I/O points may not conform to the I/O data assigned to the EtherCAT Master Unit.	Allocate I/O data again to the EtherCAT Master Unit.
	The [PWR] indicator lights red after mounting or removing an Expansion Unit online.	Expansion Units cannot be mounted or removed online.	Turn OFF the power supply before mounting or removing Expansion Units.

Slave Unit type	Symptom	Cause	Measures
Slave Units with digital inputs	Although a connected device is ON, nothing is input and Slave Unit's input indicator does not turn ON either.	The I/O power is not supplied.	Check that the I/O power is supplied.
		I/O power supply voltage is outside the rated range.	Set the I/O power supply voltage within the rated voltage.
		Wiring with the connected device is incorrect.	Check the wiring with the connected device.
		Terminal block screws are loosened. (Terminal block type only)	Check if terminal block screws are loosened.
		A connected device is disconnected.	Check the wiring with the connected device.
		A connected device is defective.	Replace the connected device.
	A connected device is ON and Slave Unit's input indicator is turned ON, but nothing is input.	A communications error occurred.	Check if a communications error occurred.
There is a delay with the ON and OFF timing for input values.	An input filter may be set.	Set the input filter value to 0. Alternatively, change the input filter to an appropriate value.	
Slave Units with digital outputs	When the output is ON, nothing is output although the output indicator is turned ON.	The I/O power is not supplied.	Check that the I/O power is supplied.
		I/O power supply voltage is outside the rated range.	Set the I/O power supply voltage within the rated voltage.
		Wiring with the connected device is incorrect.	Check the wiring with the connected device.
		Terminal block screws are loosened. (Terminal block type only)	Check if terminal block screws are loosened.
		A connected device is disconnected.	Check the wiring with the connected device.
		A connected device is defective.	Replace the connected device.
	Although the output is ON, nothing is output and Slave Unit's output indicator does not turn ON either.	A communications error occurred.	Check if a communications error occurred.
	Cannot hold outputs when communications errors occur.	The Unit is set to clear outputs at communications errors.	Change the setting to hold outputs at communications errors.
	Cannot clear outputs when communications errors occur.	The Unit is set to hold outputs at communications errors.	Change the setting to clear outputs at communications errors.

Slave Unit type	Symptom	Cause	Measures
Analog I/O Slave Units	The analog data values are different from expected or the analog data error is too large.	The user adjustment error is too large.	Execute user adjustment again.
	Even if the I/O range setting is changed, expected analog input value is not set. Alternatively, expected analog value is not output.	Setting changes are not reflected unless the unit power supply is turned ON again after making changes.	Turn ON the unit power supply again after changing the setting.
	The I/O range cannot be set with the range setting switch.	The Pin8 is turned OFF (to allow the setting via SDO communications). This is the default setting.	Turn Pin8 ON (to allow the setting via range setting switch).
Analog input Slave Unit	The disconnection indication does not clear.	The sensor is disconnected.	Restore the sensor connection. Check the connected sensor and input type.
	Disconnection is not detected.	Disconnection can not be detected for ranges other than 1 to 5 V and 4 to 20 mA.	Check that the input range is correct.
	A disconnection is detected even though it is not disconnected.	The connected sensor does not conform to the input range set on the Unit.	Check the type of connected sensor and the range setting on the Slave Unit again.
		The user adjustment error is too large.	Execute user adjustment again.
	The conversion cycle is too long.	The number of AD conversion points is set to maximum (4 points).	Reduce the number of points if some inputs are unnecessary, and execute conversion again.
	User adjustment is not accepted.	Attempted to make adjustment with inputs outside the compensation range.	Enter a voltage (current) within the compensation range with the input device and make adjustment again. If a voltage (current) within the compensation range cannot be entered, check the method being used to connect the input device.
Analog output Slave Unit	Cannot hold expected outputs when communications errors occur.	The output value that is set for communications errors is incorrect.	Change the setting to hold outputs for communications errors.
	The conversion cycle is too long.	The number of DA conversion points is set to maximum (2 points).	Reduce the number of points if some outputs are unnecessary, and execute conversion again.
	User adjustment is not accepted.	Attempted to make adjustment with values outside the compensation range.	Use a voltage (current) within the setting range to make adjustment again. If the final output cannot be adjusted within the correctable range, check the method being used to connect to the output device.

Slave Unit type	Symptom	Cause	Measures
Encoder Input Slave Unit	The count pulse cannot be detected.	Input wiring is wrong.	Check wiring of input A and input B.
		The I/O power is not supplied.	Check that the I/O power is supplied.
		I/O power supply voltage is outside the rated range.	Set the I/O power supply voltage within the rated voltage.
		A connected device is disconnected.	Check the wiring with the connected device.
		A connected device is defective.	Replace the connected device.
		The setting of counter input method is wrong.	Set the correct counter input method and restart the Slave Unit.
	The pulse is not counted accurately.	The pulse frequency exceeds the maximum frequency of the Slave Unit specification. Or, the frequency exceeds the maximum value of set mode.	Set the pulse frequency within the Slave Unit specification or the mode maximum value.
		The setting of counter input method is wrong.	Set the correct counter input method and restart the Slave Unit.
	The counter value is not reset even the present value external reset signal or phase Z pulse are input.	Input wiring is wrong.	Check input wiring.
		The soft switch "present value external reset enabled" is set to 0 (disabled).	Set the soft switch "present value external reset enabled" to 1 (enabled).
		Counting is not possible. (The count value cannot be reset with external input when counting is not possible.)	Change to count possible status. If it is necessary to reset because counting is not possible, reset with the soft switch "present value internal reset execution."
	Although the soft switch "present value external reset enabled" is enabled, the counter value cannot be reset even if signals are input.	After resetting the counter value externally, the "external reset generation flag" changes from 0 to 1. After that, external reset cannot be performed until the flag is cleared.	Change the soft switch "clear present value external reset generation flag" from 0 to 1. At the rise from 0 to 1, the "external reset generation flag" changes from 1 to 0 and external reset is enabled.
	The counter value cannot be latched even if external control input (latch A/B) signals are input.	The soft switch "external latch A/B enabled" is set to 0 (disabled).	Set the soft switch "external latch A/B enabled" to 1 (enabled).
	Although the soft switch "external latch A/B enabled" is enabled, the counter value cannot be latched even if signals are input.	After latching the counter value, the "external latch A/B generation flag" changes from 0 to 1. After that, it is not possible to latch until the flag is cleared.	Change the soft switch "clear external latch A/B generation flag" from 0 to 1. At the rise from 0 to 1, the "external latch A/B generation flag" changes from 1 to 0 and latch is enabled.

Slave Unit type	Symptom	Cause	Measures
Encoder Input Slave Unit	Some functions are not reflected even after parameters have been set.	Parameters that are enabled at the timing that the count status changes from disabled to enabled were changed.	When the count is enabled, execute the count enable command after the count disable command. When the count is disabled, execute the count enable command.
	At preset execution, "present value preset execution completion" is not turned ON, but "present value preset set value error" is turned ON.	It is attempted to preset with a counter value greater than the maximum Circular Counter value.	Reset the preset command value to equal to or less than the maximum Circular Counter value and execute the preset again. Moreover, "present value preset set value error" is turned OFF when the present value internal reset is executed or external reset is generated.

11-1-3 Emergency Error Code

The table below shows types of emergency error codes used in GX-series EtherCAT Slave Units and corresponding error contents.

Error codes common to GX-series EtherCAT Slave Units

Error code	Name of error	Contents	Diagnosis history	Notification to EtherCAT Master Unit	Measures
5530 hex	EEPROM timeout error	During EtherCAT communications, timeout was detected when writing data to EEPROM.	Not saved	Can be notified	Write the data again.
6140 hex	Slave Unit information verification error	At turning ON the power supply, a verification error occurred on the Slave Unit information stored in the Slave Unit.	Saved	Cannot be notified	If the error occurs even after restarting the power supply, the Slave Unit is damaged. Replace the Slave Unit.
6330 hex	EEPROM checksum error	Error of EEPROM data within the Slave Units	Saved	Can be notified	There is an error in the EEPROM data. Initialize EEPROM using the Configuration Tool or SDO communications and restart the Slave Units . (Target indexes: 1011 hex Restore default parameters (parameter restore))

Error code	Name of error	Contents	Diagnosis history	Notification to EtherCAT Master Unit	Measures
7030 hex	Communications area hardware error	A hardware error occurred in the EtherCAT communications area.	Saved	Cannot be notified	If the error occurs even after restarting the power supply, the Slave Units is damaged. Replace the Slave Units.

Error codes unique to Digital I/O Slave Unit

Error code	Name of error	Contents	Diagnosis history	Notification to EtherCAT Master Unit	Measures
5020 hex	Expansion Unit hardware error (Only for Slave Units that can connect Expansion Units)	Expansion Unit hardware errors	Saved	Cannot be notified	The Expansion Unit is disconnected. Check the Expansion Unit connection. If the error is displayed again, the Expansion Unit is damaged. Replace the Expansion Unit.

Error codes unique to Analog I/O Slave Unit

Error code	Name of error	Contents	Diagnosis history	Notification to EtherCAT Master Unit	Measures
5600 hex	DIP switch setting error	A range setting switch setting is illegal.	Saved	Can be notified	Set the range setting switch correctly and restart the Slave Unit.
7010 hex	Analog hardware error	Hardware error in the analog conversion area	Saved	Cannot be notified	If the error is still displayed after restarting the power supply, the Slave Unit is damaged. Replace the Slave Unit.

11-2 Equipment Maintenance

This section describes routine equipment maintenance, in particular cleaning methods, inspection methods, and handling methods when replacing Slave Units.

11-2-1 Cleaning

Perform the following cleaning regularly to ensure the equipment is kept in the best condition possible.

- Wipe the equipment over with a soft, dry cloth when doing daily cleaning.
- If dirt remains even after wiping with a soft, dry cloth, wipe over with a cloth that has been wet with a sufficiently diluted detergent (2%) and wrung dry.
- Units will become stained if items such as rubber or vinyl products or adhesive tape are left on the Unit for a long period. Remove such items during regular cleaning.



Precautions for Correct Use

Never use benzene, thinners, or other volatile solvents, or chemical cloths.
The unit coating may change if these products are used.

11-2-2 Inspections

Always perform periodic inspections to ensure the equipment is kept in the best possible condition.

Periodic inspections should occur every 6 months to a year.

Periodic inspections should occur more frequently, however, for Units that are used in environments subject to high temperatures, high humidity, or a lot of dust.

Materials required for inspections

The following materials are required to perform periodic inspections.

- **Materials used regularly**
 - Phillips screwdrivers and flat-blade screwdrivers
 - Screwdrivers for communications connectors
 - Testers (or digital voltmeters)
 - Industrial alcohol and pure cotton cloth
- **Materials sometimes required**
 - Synchroscope
 - Pen oscilloscope
 - Thermometer and hygrometer

Inspection item

Periodically inspect the following items to ensure that they do not deviate from the criteria.

If the items deviate from the criteria, adjust the environment so the criteria are met or adjust the Unit itself.

Inspection item	Inspection details	Criteria	Inspection method
Environment	Are the ambient and in-panel temperatures appropriate?	-10 to 55°C	Thermometer
	Is the ambient and in-panel humidity appropriate?	25 to 85% (with no condensation)	Hygrometer
	Has dust collected?	No dust	Visual inspection
Installation	Has the Slave Unit been secured?	No looseness	Phillips screwdriver
	Are the communications cable connectors inserted properly?	No looseness	Visual inspection
	Are the external wiring screws loose?	No looseness	Phillips screwdriver
	Are the connection cables damaged?	No visible damage	Visual inspection

11-2-3 Handling when Replacing Units

Networks are constructed from an EtherCAT Master Unit and Slave Units.

If a Unit is malfunctioning, the entire network will be affected. The malfunctioning Unit must be replaced quickly.

To restore network functions as quickly as possible, it is recommended that spare Units are kept on hand ready to replace malfunctioning Units immediately.

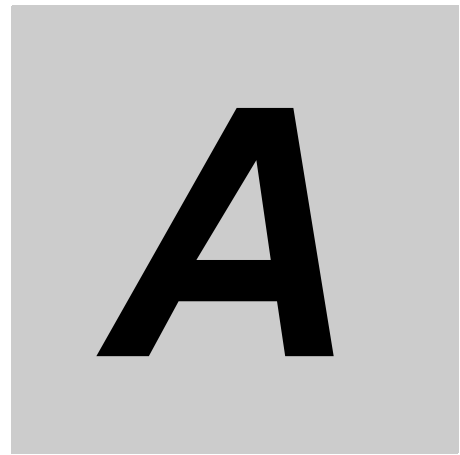
Precautions when replacing Units

Heed the following precautions when replacing nodes after a periodic inspection has revealed a problem.

- Check that the new Unit does not have errors after replacement.
- If returning malfunctioning devices for repair, attach a detailed description of the malfunction to the device and send the device to the OMRON representative listed at the end of this manual or to your OMRON representative.
- If contacts are defective, wipe them with a clean pure cotton cloth that has been soaked in industrial alcohol.

Settings after Unit replacement

After replacing a Unit, make the switch and other settings the same as before the Unit was replaced.



Appendix

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A-1 Object Dictionary

A-1-1 Object Dictionary Area

The CAN application protocol over EtherCAT (CoE) protocol uses the object dictionary of CAN application protocol as its base. Each object is assigned with an index of four-digit hexadecimal value. The indexes are configured in the areas below.

Indexes	Area	Contents
0000 hex-0FFF hex	Data Type area	Definitions of data types
1000 hex-1FFF hex	CoE Communications area	Definitions of variables that can be used by all servers for designated communications
2000 hex-2FFF hex	Manufacturer Specific area 1	Variables defined for all OMRON products
3000 hex-5FFF hex	Manufacturer Specific area 2	Variables defined for GX-series EtherCAT Slave Units
6000 hex-9FFF hex	Device Profile area	Variables defined for CiA401 generic I/O module device profiles (profile specifying the CAN application protocol interface for devices with digital I/Os and analog I/Os)
A000 hex-FFFF hex	Reserved area	Area reserved for future use

A-1-2 Data Types

This profile uses the following data types.

Data Types	Code	Size	Range
Boolean	BOOL	1 bit	true(1), false(0)
Unsigned8	U8	1 byte	0 to 255
Unsigned16	U16	2 bytes	0 to 65535
Unsigned32	U32	4 bytes	0 to 4294967295
Integer8	INT8	1 byte	-128 to 127
Integer16	INT16	2 bytes	-32768 to 32767
Integer32	INT32	4 bytes	-2147483648 to 2147483647
Visible string	VS	-	-

A-1-3 Object Description Format

In this manual, objects are described in the following format.

Object description format

<Index>	<Object name>		
Range: <Setting range>	Unit: <Unit>	Default: <Default setting>	Attribute: <Data attribute>
Size: <Size>	Access: <Access>		PDO map: <Possible/Not possible>

Object description format with sub-indexes

<Index>	<Object name>		
Sub-index 0			
Range: <Setting range>	Unit: <Unit>	Default: <Default setting>	Attribute: <Data attribute>
Size: <Size>	Access: <Access>		PDO map: <Possible/Not possible>
.			
.			
.			
Sub-index N			
Range: <Setting range>	Unit: <Unit>	Default: <Default setting>	Attribute: <Data attribute>
Size: <Size>	Access: <Access>		PDO map: <Possible/Not possible>

The following values are indicated within the pointed brackets <>.

Indexes	: An object index given by a four-digit hexadecimal number
Object name	: The object name
Range	: The possible range of settings
Unit	: Physical unit
Default	: Default value set before product shipment
Attribute	: The timing when a change is updated in a writable object
	A: Always enabled
	B: Timing of count stop → operation (Encoder Input Slave Unit only)
	C: Timing of pre-operational state → safe-operational state
	R: Updated after the power supply is reset
	-: Read only
Size	: The object size is given in bytes
Access	: Indicates whether the object is read only, or read and write
	RO: Read only
	RW: Read and write
PDO map	: Indicates the PDO mapping possibility

A-1-4 Communication Objects

1000 hex	Device type		
Range: –	Unit: –	Default: 00***** hex	Attribute: –
Size: 4 bytes (U32)	Access: RO	PDO map: Not possible	

- Indicates the CoE device profile number.

Bits	Name	Contents
0-15	Device profile number	Differ by Slave Unit types*
16-23	Type	Differ by Slave Unit types*
25-31	Mode	0: Manufacturer specific

1001 hex	Error register		
Range: –	Unit: –	Default: 00 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	

- Indicates the error type that occurs in a Slave Unit.
- The error kind is allocated in each bit as follows.
It becomes "0:There is no error" and "1:The error is occurring".

Bits	Name	Bits	Name
0	Generic error	4	Communications error
1	Current error	5	Device profile specific error
2	Voltage error	6	(Reserved)
3	Temperature error	7	Manufacturer specific error

1008 hex	Manufacturer device name		
Range: –	Unit: –	Default: Differ by Slave Unit types*	Attribute: –
Size: 20 bytes (VS)	Access: RO	PDO map: Not possible	

- Indicates the Slave Unit model number.

1009 hex	Manufacturer hardware version		
Range: –	Unit: –	Default: Differ by Slave Unit types*	Attribute: –
Size: 20 bytes (VS)	Access: RO	PDO map: Not possible	

- Indicates the version of the Slave Unit hardware.

100A hex	Manufacturer software version		
Range: –	Unit: –	Default: Differ by Slave Unit types*	Attribute: –
Size: 20 bytes (VS)	Access: RO	PDO map: Not possible	

- Indicates the version of the Slave Unit software.

* The default settings of device type, device name, hardware version, and software version vary by the Slave Unit Types.

Slave Unit	Model		DeviceType	Manufacturer device name	Manufacturer hardware version	Manufacturer software version
	Expansion Unit					
GX-ID1611 /ID1621	–		00010191 hex	"GX-ID1611 "	space (20 hex) of 20 characters	"V1.00 " (space (20 hex) of 15 characters)
	XWT-ID08 (-1)		00010191 hex	/"GX-ID1621 "		
	XWT-ID16 (-1)		00010191 hex	(space (20 hex) of 11 characters)		
	XWT-OD08 (-1)		00010191 hex			
	XWT-OD16 (-1)		00010191 hex			

Model		DeviceType	Manufacturer device name	Manufacturer hardware version	Manufacturer software version
Slave Unit	Expansion Unit				
GX-OD1611 /OD1621	–	00020191 hex	"GX-OD1611 " /"GX-OD1621 " (space (20 hex) of 11 characters)	space (20 hex) of 20 characters	"V1.00 " (space (20 hex) of 15 characters)
	XWT-ID08 (–1)	00020191 hex			
	XWT-ID16 (–1)	00020191 hex			
	XWT-OD08 (–1)	00020191 hex			
	XWT-OD16 (–1)	00020191 hex			
GX-OC1601	–	00020191 hex	"GX-OC1611 " (space (20 hex) of 11 characters)		
	XWT-ID08 (–1)	00020191 hex			
	XWT-ID16 (–1)	00020191 hex			
	XWT-OD08 (–1)	00020191 hex			
	XWT-OD16 (–1)	00020191 hex			
GX-MD1611 /MD1621	–	00030191 hex	"GX-MD1611 " /"GX-MD1621 " (space (20 hex) of 11 characters)		
GX-ID1612 /ID1622	–	00010191 hex	"GX-ID1612 " /"GX-ID1622 " (space (20 hex) of 11 characters)		
GX-OD1612 /OD1622	–	00020191 hex	"GX-OD1612 " /"GX-OD1622 " (space (20 hex) of 11 characters)		
GX-MD1612 /MD1622	–	00030191 hex	"GX-MD1612 " /"GX-MD1622 " (space (20 hex) of 11 characters)		
GX-ID1618 /ID1628	–	00010191 hex	"GX-ID1618 " /"GX-ID1628 " (space (20 hex) of 11 characters)		
GX-OD1618 /OD1628	–	00020191 hex	"GX-OD1618 " /"GX-OD1628 " (space (20 hex) of 11 characters)		
GX-MD1618 /MD1628	–	00030191 hex	"GX-MD1618 " /"GX-MD1628 " (space (20 hex) of 11 characters)		
GX-ID3218 /ID3228	–	00010191 hex	"GX-ID3218 " /"GX-ID3228 " (space (20 hex) of 11 characters)		
GX-OD3218 /OD3228	–	00020191 hex	"GX-OD3218 " /"GX-OD3228 " (space (20 hex) of 11 characters)		
GX-MD3218 /MD3228	–	00030191 hex	"GX-MD3218 " /"GX-MD3228 " (space (20 hex) of 11 characters)		
GX-AD0471	–	00040191 hex	"GX-AD0471 " (space (20 hex) of 11 characters)		
GX-DA0271	–	00080191 hex	"GX-DA0271 " (space (20 hex) of 11 characters)		
GX-EC0211	–	00010000 hex	"GX-EC0211 " (space (20 hex) of 11 characters)		
GX-EC0241	–	00010000 hex	"GX-EC0241 " (space (20 hex) of 11 characters)		

1011 hex	Store parameters		
Sub-index 0: Number of entries			
Range: –	Unit: –	Default: 01 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-index 1: Store parameters			
Range: –	Unit: –	Default: 00000001 hex	Attribute: A
Size: 4 bytes (U32)	Access: RW	PDO map: Not possible	

- Resets the parameters to their default values.
- The parameter is reset only when a specific value is written to sub-index 1. This prevents parameter values from being accidentally overwritten.
- The specific value is "load".

MSB		LSB	
d	a	o	l
64 hex	61 hex	6F hex	6C hex

- The ABORT code is displayed if a value other than the specific is written.
- A value 0000 0001 hex (command valid) is indicated when reading.

1018 hex	Identity object		
Sub-index 0: Number of entries			
Range: –	Unit: –	Default: 04 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-index 1: Vendor ID			
Range: –	Unit: –	Default: 00000083 hex	Attribute: –
Size: 4 bytes (U32)	Access: RO	PDO map: Not possible	
Sub-index 2: Product code			
Range: –	Unit: –	Default: Differ by Slave Unit types*	Attribute: –
Size: 4 bytes (U32)	Access: RO	PDO map: Not possible	
Sub-index 3: Revision number			
Range: –	Unit: –	Default: Differ by Slave Unit types*	Attribute: –
Size: 4 bytes (U32)	Access: RO	PDO map: Not possible	
Sub-index 4: Serial number			
Range: –	Unit: –	Default: Each Unit	Attribute: –
Size: 4 bytes (U32)	Access: RO	PDO map: Not possible	

- Indicates the device information.
- Sub-index 1(Vendor ID) gives the manufacturer identifier.
- Sub-index 2 (Product Code) gives the value assigned to each Slave Unit type.
- Sub-index 3 (Revision number) gives the Unit revision number.
 - Bits 0 to 15: Minor revision number of the device
 - Bits 16 to 31: Major revision number of the device
- Sub-index 4 (Serial number) gives a serial number for each product.

* The table below shows the identity object values by Slave Unit types.

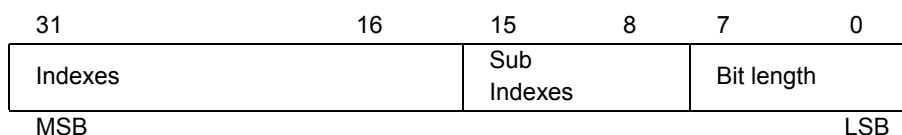
Type	Model		Product Code (hex)	Revision Number (hex)	Model		Product Code (hex)	Revision Number (hex)
	Slave Unit	Expansion Unit			Slave Unit	Expansion Unit		
2-tier terminal block	GX-ID1611	-	0000000E	00010000	GX-ID1621	-	00000017	00010000
		XWT-ID08	0000000F	00010000		XWT-ID08	00000018	00010000
		XWT-ID08-1	00000013	00010000		XWT-ID08-1	0000001C	00010000
		XWT-ID16	00000010	00010000		XWT-ID16	00000019	00010000
		XWT-ID16-1	00000014	00010000		XWT-ID16-1	0000001D	00010000
		XWT-OD08	00000011	00010000		XWT-OD08	0000001A	00010000
		XWT-OD08-1	00000015	00010000		XWT-OD08-1	0000001E	00010000
		XWT-OD16	00000012	00010000		XWT-OD16	0000001B	00010000
	XWT-OD16-1	00000016	00010000	XWT-OD16-1	0000001F	00010000		
	GX-OD1611	-	00000020	00010000	GX-OD1621	-	00000029	00010000
		XWT-ID08	00000021	00010000		XWT-ID08	0000002A	00010000
		XWT-ID08-1	00000025	00010000		XWT-ID08-1	0000002E	00010000
		XWT-ID16	00000022	00010000		XWT-ID16	0000002B	00010000
		XWT-ID16-1	00000026	00010000		XWT-ID16-1	0000002F	00010000
		XWT-OD08	00000023	00010000		XWT-OD08	0000002C	00010000
		XWT-OD08-1	00000027	00010000		XWT-OD08-1	00000030	00010000
		XWT-OD16	00000024	00010000		XWT-OD16	0000002D	00010000
	XWT-OD16-1	00000028	00010000	XWT-OD16-1	00000031	00010000		
	GX-OC1601	-	00000046	00010000		-	00000046	00010000
		XWT-ID08	00000047	00010000		XWT-ID08	00000047	00010000
		XWT-ID08-1	0000004B	00010000		XWT-ID08-1	0000004B	00010000
		XWT-ID16	00000048	00010000		XWT-ID16	00000048	00010000
		XWT-ID16-1	0000004C	00010000		XWT-ID16-1	0000004C	00010000
		XWT-OD08	00000049	00010000		XWT-OD08	00000049	00010000
		XWT-OD08-1	0000004D	00010000		XWT-OD08-1	0000004D	00010000
		XWT-OD16	0000004A	00010000		XWT-OD16	0000004A	00010000
	XWT-OD16-1	0000004E	00010000	XWT-OD16-1	0000004E	00010000		
	GX-MD1611	-	00000032	00010000	GX-MD1621	-	00000033	00010000
3-tier terminal block	GX-ID1612	-	00000034	00010000	GX-ID1622	-	00000035	00010000
	GX-OD1612	-	00000036	00010000	GX-OD1622	-	00000037	00010000
	GX-MD1612	-	00000038	00010000	GX-MD1622	-	00000039	00010000
e-CON Connectors	GX-ID1618	-	0000003A	00010000	GX-ID1628	-	0000003B	00010000
	GX-OD1618	-	0000003C	00010000	GX-OD1628	-	0000003D	00010000
	GX-MD1618	-	0000003E	00010000	GX-MD1628	-	0000003F	00010000
	GX-ID3218	-	00000040	00010000	GX-ID3228	-	00000041	00010000
	GX-OD3218	-	00000042	00010000	GX-OD3228	-	00000043	00010000
	GX-MD3218	-	00000044	00010000	GX-MD3228	-	00000045	00010000
Analog I/O Slave Unit	GX-AD0471	-	0000004F	00010000	GX-DA0271	-	00000050	00010000
Encoder Input Slave Unit	GX-EC0211	-	00000051	00010000	GX-EC0241	-	00000051	00010000

10F3 hex	Diagnosis history		
Sub-index 0: Number of entries			
Range: -	Unit: -	Default: 0D hex	Attribute: -
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-index 1: Maximum messages (Maximum Number of messages)			
Range: -	Unit: -	Default: 00 hex	Attribute: -
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-index 2: Newest message			
Range: -	Unit: -	Default: -	Attribute: -
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-index 5: Flags			
Range: 0000 hex- 0001 hex	Unit: -	Default: 0001 hex	Attribute: -
Size: 2 bytes (U16)	Access: RW	PDO map: Not possible	
Sub-index 6 to 13: Diagnosis message 1 to 8			
Range: -	Unit: -	Default: -	Attribute: -
Size: 23 bytes (VS)	Access: RO	PDO map: Not possible	

- This object indicates up to 8 diagnosis histories. It also sets whether to notify emergency messages or not.
- Sub-index 1 (Maximum Messages) gives the number of error messages.
- Sub-index 2 (Newest Messages) gives the sub-index number the latest message in the diagnosis history.
- Sub-index 5 (Flags) is the control flag of diagnosis history. It specifies whether or not to notify error messages via emergency messages. Setting 0001 hex means to notify. It is set to 0001 hex (Emergency notify) when power is turned ON. If you want to set "Emergency not notify", it is set to 0000 hex from the EtherCAT Master Unit.
- Sub-indexes 6 to 13 (Diagnosis messages 1 to 8) indicate the diagnosis history. From sub-index 6 (Diagnosis message 1) to sub-index 13 (Diagnosis message 8) are stored 8 errors. The 9th error and onward are stored from the sub-index 6 (Diagnosis message 1) again.

A-1-5 PDO Mapping Object

Indexes 1600 hex to 17FF hex are used for Receive PDO mapping, and indexes 1A00 hex to 1BFF hex are used for Transmit PDO mapping. Sub-indexes after sub-index 1 provide information about the application object being mapped.



- Bits 0 to 7 : Bit length of the mapped object.
(For example, for 32 bits, 20 hex is given.)
- Bits 8 to 15 : Sub-index of the mapped object.
- Bits 16 to 31 : Index of the mapped object.

The following indexes describes the specific objects by Slave Unit types.

Digital I/O Slave Unit

1700 hex	1st RxPDO mapping parameter (Receive PDO 1st mapping)		
Sub-index 0: Number of objects			
Range: –	Unit: –	Default: Differ by Slave Unit types*	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-index 1: 1st object (Output object 1)			
Range: –	Unit: –	Default: Differ by Slave Unit types*	Attribute: –
Size: 4 bytes (U32)	Access: RO	PDO map: Not possible	

- This object gives the mapping for an application that uses digital output functions.

1B00 hex	1st TxPDO mapping parameter (Transmit PDO 1st mapping)		
Sub-index 0: Number of objects			
Range: –	Unit: –	Default: Differ by Slave Unit types*	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-index 1: 1st object (Input object 1)			
Range: –	Unit: –	Default: Differ by Slave Unit types*	Attribute: –
Size: 4 bytes (U32)	Access: RO	PDO map: Not possible	

- This object gives the mapping for an application that uses digital input functions.

* The default settings of 1st RxPDO mapping parameter and 1st TxPDO mapping parameter are as follows.

Type	Model		1st RxPDO mapping parameter		1st TxPDO mapping parameter	
	Slave Unit	Expansion Unit	Number of objects	1st object	Number of objects	1st object
2-tier terminal block	GX-ID1611/ID1621	–	–	–	01 hex	61000110 hex
		XWT-ID08 (–1)	–	–	01 hex	61200120 hex
		XWT-ID16 (–1)	–	–	01 hex	61200120 hex
		XWT-OD08 (–1)	01 hex	63000110 hex	01 hex	61000110 hex
		XWT-OD16 (–1)	01 hex	63000110 hex	01 hex	61000110 hex
	GX-OD1611/OD1621	–	01 hex	63000110 hex	–	–
		XWT-ID08 (–1)	01 hex	63000110 hex	01 hex	61000110 hex
		XWT-ID16 (–1)	01 hex	63000110 hex	01 hex	61000110 hex
		XWT-OD08 (–1)	01 hex	63200120 hex	–	–
		XWT-OD16 (–1)	01 hex	63200120 hex	–	–
	GX-OC1601	–	01 hex	63000110 hex	–	–
		XWT-ID08 (–1)	01 hex	63000110 hex	01 hex	61000110 hex
		XWT-ID16 (–1)	01 hex	63000110 hex	01 hex	61000110 hex
		XWT-OD08 (–1)	01 hex	63200120 hex	–	–
XWT-OD16 (–1)		01 hex	63200120 hex	–	–	
GX-MD1611/MD1621	–	01 hex	63000110 hex	01 hex	61000110 hex	
3-tier terminal block	GX-ID1612/ID1622	–	–	–	01 hex	61000110 hex
	GX-OD1612/OD1622	–	01 hex	63000110 hex	–	–
	GX-MD1612/MD1622	–	01 hex	63000110 hex	01 hex	61000110 hex
e-CON Connectors	GX-ID1618/ID1628	–	–	–	01 hex	61000110 hex
	GX-OD1618/OD1628	–	01 hex	63000110 hex	–	–
	GX-MD1618/MD1628	–	01 hex	63000110 hex	01 hex	61000110 hex
	GX-ID3218/ID3228	–	–	–	01 hex	61200120 hex
	GX-OD3218/OD3228	–	01 hex	63200120 hex	–	–
	GX-MD3218/MD3228	–	01 hex	63000110 hex	01 hex	61000110 hex

Analog I/O Slave Unit

1700 hex	1st RxPDO mapping parameter (Receive PDO 1st mapping)		
Sub-index 0: Number of objects			
Range: –	Unit: –	Default: 02 hex	Attribute: –
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-index 1: 1st object (Output object 1)			
Range: –	Unit: –	Default: 64110110 hex	Attribute: –
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible
Sub-index 2: 2nd object (Output object 2)			
Range: –	Unit: –	Default: 64110210 hex	Attribute: –
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible

- This object gives the mapping for an analog output application. It is mapped only to Analog Output Slave Units.

1B00 hex	1st TxPDO mapping parameter (Transmit PDO 1st mapping)		
Sub-index 0: Number of objects			
Range: –	Unit: –	Default: 04 hex	Attribute: –
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-index 1: 1st object (Input object 1)			
Range: –	Unit: –	Default: 64010110 hex	Attribute: –
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible
Sub-index 2: 2nd object (Input object 2)			
Range: –	Unit: –	Default: 64010210 hex	Attribute: –
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible
Sub-index 3: 3rd object (Input object 3)			
Range: –	Unit: –	Default: 64010310 hex	Attribute: –
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible
Sub-index 4: 4th object (Input object 4)			
Range: –	Unit: –	Default: 64010410 hex	Attribute: –
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible

- This object gives the mapping for an analog input application. It is mapped only to Analog Input Slave Units.

Encoder Input Slave Unit

1700 hex	1st RxPDO mapping parameter (Receive PDO 1st mapping)		
Sub-index 0: Number of objects			
Range: –	Unit: –	Default: 02 hex	Attribute: –
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-index 1: 1st object (Output object 1)			
Range: –	Unit: –	Default: 40200110 hex	Attribute: –
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible
Sub-index 2: 2nd object (Output object 2)			
Range: –	Unit: –	Default: 40200210 hex	Attribute: –
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible

- Mapping for soft switch command from the EtherCAT Master Unit to Slave Units.

1701 hex	2nd RxPDO mapping parameter (Receive PDO 2nd mapping)		
Sub-index 0: Number of objects			
Range: –	Unit: –	Default: 02 hex	Attribute: –
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-index 1: 1st object (Output object 1)			
Range: –	Unit: –	Default: 40110120 hex	Attribute: –
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible
Sub-index 2: 2nd object (Output object 2)			
Range: –	Unit: –	Default: 40110220 hex	Attribute: –
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible

- Mapping for preset command value setting.

1B00 hex	1st TxPDO mapping parameter (Transmit PDO 1st mapping)		
Sub-index 0: Number of objects			
Range: –	Unit: –	Default: 02 hex	Attribute: –
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-index 1: 1st object (Input object 1)			
Range:–	Unit: –	Default: 40100120 hex	Attribute: –
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible
Sub-index 2: 2nd object (Input object 2)			
Range: –	Unit: –	Default: 40100220 hex	Attribute: –
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible

- Mapping for counter present value reading.

1B01 hex	2nd TxPDO mapping parameter (Transmit PDO 2nd mapping)		
Sub-index 0: Number of objects			
Range: –	Unit: –	Default: 02 hex	Attribute: –
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-index 1: 1st object (Input object 1)			
Range:–	Unit: –	Default: 40120120 hex	Attribute: –
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible
Sub-index 2: 2nd object (Input object 2)			
Range: –	Unit: –	Default: 40120220 hex	Attribute: –
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible

- Mapping for preset command value setting.

1B02 hex	3rd TxPDO mapping parameter (Transmit PDO 3rd mapping)		
Sub-index 0: Number of objects			
Range: –	Unit: –	Default: 02 hex	Attribute: –
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-index 1: 1st object (Input object 1)			
Range:–	Unit: –	Default: 40130120 hex	Attribute: –
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible
Sub-index 2: 2nd object (Input object 2)			
Range: –	Unit: –	Default: 40130220 hex	Attribute: –
Size: 4 bytes (U32)	Access: RO		PDO map: Not possible

- Mapping for latch value A/B reading.

1B03 hex	4th TxPDO mapping parameter (Transmit PDO 4th mapping)		
Sub-index 0: Number of objects			
Range: –	Unit: –	Default: 02 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-index 1: 1st object (Input object 1)			
Range: –	Unit: –	Default: 40300108 hex	Attribute: –
Size: 4 bytes (U32)	Access: RO	PDO map: Not possible	
Sub-index 2: 2nd object (Input object 2)			
Range: –	Unit: –	Default: 40300208 hex	Attribute: –
Size: 4 bytes (U32)	Access: RO	PDO map: Not possible	

- Mapping for status notification from a Slave Unit to the EtherCAT Master Unit.

A-1-6 Sync Manager Communication Object

The communication memory of EtherCAT is set by the objects from 1C00 hex to 1C13 hex.

1C00 hex	Sync manager communication type		
Sub-index 0: Number of used sync manager channels			
Range: –	Unit: –	Default: 04 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-index 1: Communication type SM0			
Range: –	Unit: –	Default: 01 hex	Attribute: –
Size: 4 bytes (U8)	Access: RO	PDO map: Not possible	
Sub-index 2: Communication type SM1			
Range: –	Unit: –	Default: 02 hex	Attribute: –
Size: 4 bytes (U8)	Access: RO	PDO map: Not possible	
Sub-index 3: Communication type SM2			
Range: –	Unit: –	Default: 03 hex	Attribute: –
Size: 4 bytes (U8)	Access: RO	PDO map: Not possible	
Sub-index 4: Communication type SM3			
Range: –	Unit: –	Default: 04 hex	Attribute: –
Size: 4 bytes (U8)	Access: RO	PDO map: Not possible	

- The sync manager has the following settings.
 - SM0 : Mailbox receive (EtherCAT Master Unit to Slave Unit)
 - SM1 : Mailbox transmit (EtherCAT Slave Unit to Master Unit)
 - SM2 : Process data output (EtherCAT Master Unit to Slave Unit)
 - SM3 : Process data input (EtherCAT Slave Unit to Master Unit)

1C10 hex	Sync manager 0 PDO assignment		
Sub-index 0: Number of assigned PDOs			
Range: 00 hex	Unit: –	Default: 00 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	

- It indicates the number of PDO mappings used by this sync manager.
- Mailbox reception sync manager does not have PDOs.

1C11 hex	Sync manager 1 PDO assignment		
Sub-index 0: Number of assigned PDOs			
Range: 00 hex	Unit: –	Default: 00 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	

- It indicates the number of PDO mappings used by this sync manager.
- Mailbox transmit sync manager does not have PDOs.

1C12 hex	Sync manager 2 PDO assignment		
Sub-index 0: Number of assigned RxPDOs			
Range: 00 hex to 08 hex	Unit: –	Default: Differ by Slave Unit types*	Attribute: –
Size: 1 byte (U8)	Access: RW*	PDO map: Not possible	
Sub-index 1 to 8: Assigned PDO 1 to 8 (Receive PDO mapping setting 1 to 8)			
Range: 1600 hex to 17FF hex	Unit: –	Default: Differ by Slave Unit types*	Attribute: –
Size: 2 bytes (U16)	Access: RW*	PDO map: Not possible	

- * "RO" is set if there is no RxPDO.
- It indicates the RxPDOs used by this sync manager.

1C13 hex	Sync manager 3 PDO assignment		
Sub-index 0: Number of assigned TxPDOs			
Range: 00 hex to 08 hex	Unit: –	Default: Differ by Slave Unit types*	Attribute: –
Size: 1 byte (U8)	Access: RW*	PDO map: Not possible	
Sub-index 1 to 8: Assigned PDO 1 to 8 (Transmit PDO mapping setting 1 to 8)			
Range: 1A00 hex to 1BFF hex	Unit: –	Default: Differ by Slave Unit types*	Attribute: –
Size: 2 bytes (U16)	Access: RW*	PDO map: Not possible	

- * "RO" is set if there is no TxPDO.
- It indicates the TxPDOs used by this sync manager.

* The default settings of Sync manager 2 PDO assignment and Sync manager 3 PDO assignment are as follows.

- Digital I/O Slave Unit

Model		Sync manager 2 PDO assignment		Sync manager 3 PDO assignment	
Slave Unit	Expansion Unit	Number of assigned RxPDOs	Assigned PDO 1	Number of assigned TxPDOs	Assigned PDO 1
GX-ID1611/ID1621	–	00 hex	–	01 hex	1B00 hex
	XWT-ID08 (–1)	00 hex	–	01 hex	1B00 hex
	XWT-ID16 (–1)	00 hex	–	01 hex	1B00 hex
	XWT-OD08 (–1)	01 hex	1700 hex	01 hex	1B00 hex
	XWT-OD16 (–1)	01 hex	1700 hex	01 hex	1B00 hex
GX-OD1611/OD1621	–	01 hex	1700 hex	00 hex	–
	XWT-ID08 (–1)	01 hex	1700 hex	01 hex	1B00 hex
	XWT-ID16 (–1)	01 hex	1700 hex	01 hex	1B00 hex
	XWT-OD08 (–1)	01 hex	1700 hex	00 hex	–
	XWT-OD16 (–1)	01 hex	1700 hex	00 hex	–
GX-OC1601	–	01 hex	1700 hex	00 hex	–
	XWT-ID08 (–1)	01 hex	1700 hex	01 hex	1B00 hex
	XWT-ID16 (–1)	01 hex	1700 hex	01 hex	1B00 hex
	XWT-OD08 (–1)	01 hex	1700 hex	00 hex	–
	XWT-OD16 (–1)	01 hex	1700 hex	00 hex	–
GX-MD1611 /MD1621	–	01 hex	1700 hex	01 hex	1B00 hex
GX-ID1612 /ID1622	–	00 hex	–	01 hex	1B00 hex
GX-OD1612 /OD1622	–	01 hex	1700 hex	00 hex	–
GX-MD1612 /MD1622	–	01 hex	1700 hex	01 hex	1B00 hex
GX-ID1618 /ID1628	–	00 hex	–	01 hex	1B00 hex
GX-OD1618 /OD1628	–	01 hex	1700 hex	00 hex	–
GX-MD1618 /MD1628	–	01 hex	1700 hex	01 hex	1B00 hex

Model		Sync manager 2 PDO assignment		Sync manager 3 PDO assignment	
Slave Unit	Expansion Unit	Number of assigned RxPDOs	Assigned PDO 1	Number of assigned TxPDOs	Assigned PDO 1
GX-ID3218 /ID3228	–	00 hex	–	01 hex	1B00 hex
GX-OD3218 /OD3228	–	01 hex	1700 hex	00 hex	–
GX-MD3218 /MD3228	–	01 hex	1700 hex	01 hex	1B00 hex

• Analog I/O Slave Unit

Model	Sync manager 2 PDO assignment		Sync manager 3 PDO assignment	
	Number of assigned RxPDOs	Assigned PDO 1	Number of assigned TxPDOs	Assigned PDO 1
GX-AD0471	00 hex	–	01 hex	1B00 hex
GX-DA0271	01 hex	1700 hex	00 hex	–

• Encoder Input Slave Unit

Model	Sync manager 2 PDO assignment			Sync manager 3 PDO assignment				
	Number of assigned RxPDOs	Assigned PDO		Number of assigned TxPDOs	Assigned PDO			
		1	2		1	2	3	4
GX-EC0211 /EC0241	02 hex	1700 hex	1701 hex	04 hex	1B00 hex	1B01 hex	1B02 hex	1B03 hex

A-1-7 Manufacturer Specific Objects

This section explains the CiA401 generic I/O module device profile implemented in GX-series EtherCAT Slave Units and the objects specially mounted in GX-series EtherCAT Slave Units.

All Slave Units

• Manufacturer Specific area 1

2100 hex	Error History Clear		
Range: –	Unit: –	Default: 00000000 hex	Attribute: A
Size: 4 bytes (U32)	Access: RW		PDO map: Not possible

- This object clears diagnosis history of 10F3 hex (Diagnosis History).
- It clears the history only when specific values are written. The specific value is "elc!".

MSB		LSB	
l	c	l	e
6C hex	63 hex	6C hex	65 hex

Writing values other than this is invalid.

2200 hex	Communication error setting		
Range: 00 hex to 0F hex	Unit: number of sequences	Default: 01 hex	Attribute: C
Size: 1 byte (U8)	Access: RW	PDO map: Not possible	

- Object mounted only on Slave Units operating in the DC mode.
- The number of sequences for detecting communications errors is set with this object.
- The setting range is from 00 to 0F hex and the number of detections is "the set number of times + 1."
- Rewriting value is possible at operation in the DC mode, but the operation is performed with the value set when shifting from the pre-operational state to safe-operational state. Note that at this point, the rewritten value is read.

Note: With the default setting of 01 hex, an error is detected if communications errors occur twice in a row.

2201 hex	Sync Not Received Timeout Setting		
Range: 0000 hex to 0258 hex	Unit: s	Default: 0000 hex	Attribute: C
Size: 2 bytes (U16)	Access: RW	PDO map: Not possible	

- Object mounted only on Slave Units operating in the DC mode.
- This object is used to set the standby time until the first synchronization interrupt signal (SYNC0) is input after shifting to the safe-operational state (state where a DC mode is confirmed).
- If the first interrupt signal (SYNC0) is not input at all within this setting time, a synchronization error occurs.
- The setting range is from 0000 hex to 0258 hex (600s) and operation is performed at 120s when 0000 hex is set.
- Rewriting value is possible at operation in the DC mode, but the operation is performed with the value set when shifting from the pre-operational state to safe-operational state. Note that at this point, the rewritten value is read.

Digital I/O Slave Unit

● Manufacturer Specific area 2

3000 hex	Input_Time_Constant (All Inputs) (Input filter)		
Sub-index 0: Filter Constant			
Range: 00 hex to 07 hex	Unit: –	Default: 02 hex	Attribute: R
Size: 1 byte (U8)	Access: RW	PDO map: Not possible	

- Sets the input filter.
- It is implemented in all Slave Units with input points (including Expansion Units if they are connected).

Set value	Filter set value [ms]
00 hex	0
01 hex	0.5
02 hex	1
03 hex	2
04 hex	4
05 hex	8
06 hex	16
07 hex	32

● Device Profile area

6000 hex	Read input 8-bit (Digital input 8-bit)		
Sub-index 0: Number of inputs 8-bit			
Range: 00 hex to 04 hex	Unit: –	Default: Differ by Slave Unit types*	Attribute: –
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-index 1: Read input 01 hex to 08 hex (Inputs 0ch to 7ch)			
Range: 00 hex to FF hex	Unit: –	Default: –	Attribute: –
Size: 1 byte (U8)	Access: RO		PDO map: Not possible*
Sub-index 2: Read input 09 hex to 10 hex (Inputs 8ch to 15ch)			
Range: 00h to FFh	Unit: –	Default: –	Attribute: –
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-index 3: Read input 11 hex to 18 hex (inputs 16ch to 23ch)			
Range: 00 hex to FF hex	Unit: –	Default: –	Attribute: –
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-index 4: Read input 19 hex to 20 hex (Inputs 24ch to 31ch)			
Range: 00 hex to FF hex	Unit: –	Default: –	Attribute: –
Size: 1 byte (U8)	Access: RO		PDO map: Not possible

- Digital input values are stored in units of 1 byte (8 bits).
- It is implemented in all Slave Units with input points (including Expansion Units if they are connected).

6100 hex	Read input 16-bit (Digital input 16-bit)		
Sub-index 0: Number of inputs 16-bit			
Range: –	Unit: –	Default: 01 hex	Attribute: –
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-index 1: Read input 01 hex to 10 hex (Inputs 0ch to 15ch)			
Range: 0000 hex to FFFF hex	Unit: –	Default: –	Attribute: –
Size: 2 bytes (U16)	Access: RO		PDO map: Possible

- Digital input values are stored in units of 2 byte (16 bits).

6120 hex	Read input 32-bit (Digital input 32-bit)		
Sub-index 0: Number of inputs 16-bit			
Range: –	Unit: –	Default: 01 hex	Attribute: –
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-index 1: Read input 01 hex to 20 hex (Inputs 0ch to 31ch)			
Range: 00000000 hex to FFFFFFFF hex	Unit: –	Default: –	Attribute: –
Size: 4 bytes (U32)	Access: RO		PDO map: Possible

- Digital input values are stored in units of 4 byte (32 bits).

6200 hex	Write output 8-bit (Digital output 8-bit)		
Sub-index 0: Number of outputs 8-bit			
Range: 00 hex to 04 hex	Unit: –	Default: Differ by Slave Unit types**	Attribute: –
Size: 1 byte (U8)	Access: RW	PDO map: Not possible	
Sub-index 1: Write output 01 hex to 08 hex (Output 0ch to 7ch)			
Range: 00 hex to FF hex	Unit: –	Default: –	Attribute: A
Size: 1 byte (U8)	Access: RW	PDO map: Not possible*	
Sub-index 2: Write output 09 hex to 10 hex (Outputs 8ch to 15ch)			
Range: 00 hex to FF hex	Unit: –	Default: –	Attribute: A
Size: 1 byte (U8)	Access: RW	PDO map: Not possible	
Sub-index 3: Write output 11 hex to 18 hex (Outputs 16ch to 23ch)			
Range: 00 hex to FF hex	Unit: –	Default: –	Attribute: A
Size: 1 byte (U8)	Access: RW	PDO map: Not possible	
Sub-index 4: Write output 19 hex to 20 hex (Outputs 24ch to 31ch)			
Range: 00 hex to FF hex	Unit: –	Default: –	Attribute: A
Size: 1 byte (U8)	Access: RW	PDO map: Not possible	

- Digital output values are controlled in units of 1 byte (8 bits).
- It is implemented in all Slave Units with output points (including Expansion Units if they are connected).

6300 hex	Write output 16-bit (Digital output 16-bit)		
Sub-index 0: Number of outputs 16-bit			
Range: –	Unit: –	Default: 01 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-index 1: Write output 01 hex to 10 hex (Outputs 0ch to 15ch)			
Range: 0000 hex to FFFF hex	Unit: –	Default: –	Attribute: A
Size: 2 bytes (U16)	Access: RW	PDO map: Possible	

- Digital output values are controlled in units of 2 byte (16 bits).

6306 hex	Error mode output 16-bit		
Sub-index 0: Number of outputs 16-bit			
Range: –	Unit: –	Default: 01 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-index 1: Error mode output 01 hex to 10 hex (Outputs 0ch to 15ch Error mode output)			
Range: 0000 hex to FFFF hex	Unit: –	Default: 0000 hex	Attribute: A
Size: 2 bytes (U16)	Access: RW	PDO map: Not possible	

- Sets whether the data is cleared to 0 or retained at an error occurrence or at a node stop, in units of 2 bytes (16 bits).

Bits	15	14	•••••	1	0
Contents	OUT15 setting	OUT14 setting	•••••	OUT1 setting	OUT0 setting

Setting 0: Clear to 0, 1: Retain the value at error occurrence

6320 hex	Write output 32-bit (Digital output 32-bit)		
Sub-index 0: Number of outputs 32-bit			
Range: –	Unit: –	Default: 01 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-index 1: Write output 01 hex to 20 hex (Inputs 0ch to 31ch)			
Range: 00000000 hex to FFFFFFFF hex	Unit: –	Default: –	Attribute: A
Size: 4 bytes (U32)	Access: RW	PDO map: Not possible	

- Digital output values are stored in units of 4 bytes (32 bits).

6326 hex	Error mode output 32-bit		
Sub-index 0: Number of outputs 32-bit			
Range: –	Unit: –	Default: 01 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-index 1: Error mode output 01 hex to 20 hex (Outputs 0ch to 31ch Error mode output)			
Range: 00000000 hex to FFFFFFFF hex	Unit: –	Default: 00000000 hex	Attribute: A
Size: 4 bytes (U32)	Access: RW	PDO map: Possible	

- Sets whether the data is cleared to 0 or retained at an error occurrence or at a node stop, in units of 4 bytes (32 bits).

Bits	31	30	• • • • •	1	0
Contents	OUT31 setting	OUT30 setting	• • • • •	OUT1 setting	OUT0 setting

Setting 0: Clear to 0, 1: Retain the value at error occurrence

Objects of Device Profile areas that are implemented in a Digital I/O Slave Unit is determined by the number of inputs and/or outputs per Slave Unit and whether or not Expansion Units are connected. The following table shows the objects of Device Profile area that are implemented in Digital I/O Slave Unit and the number of sub-indexes.

Type	Model		Number of supported sub-indexes No: Not supported								
	Slave Unit	Expansion Unit	Indexes	6000 hex	6100 hex	6120 hex	6200 hex	6300 hex	6306 hex	6320 hex	6326 hex
			Object Name I/O units capacity	Read input 8-bit	Read input 16-bit	Read input 32-bit	Write output 8-bit	Write output 16-bit	Error mode output 16-bit	Write output 32-bit	Error mode output 32-bit
2-tier terminal block	GX-ID1611 /ID1621	–	16 inputs	3	2	No	No	No	No	No	No
		XWT-ID08 (-1)	24 inputs	5	No	2	No	No	No	No	No
		XWT-ID16 (-1)	32 inputs	5	No	2	No	No	No	No	No
		XWT-OD08 (-1)	16 inputs and 8 outputs	3	2	No	3	2	2	No	No
		XWT-OD16 (-1)	16 inputs and 16 outputs	3	2	No	3	2	2	No	No
	GX-OD1611 /OD1621	XWT-ID08 (-1)	8 inputs and 16 outputs	3	2	No	3	2	2	No	No
		XWT-ID16 (-1)	16 inputs and 16 outputs	3	2	No	3	2	2	No	No
		–	16 outputs	No	No	No	3	2	2	No	No
		XWT-OD08 (-1)	24 outputs	No	No	No	5	No	No	2	2
		XWT-OD16 (-1)	32 outputs	No	No	No	5	No	No	2	2
	GX-OC1611	XWT-ID08 (-1)	8 inputs and 16 outputs	3	2	No	3	2	2	No	No
		XWT-ID16 (-1)	16 inputs and 16 outputs	3	2	No	3	2	2	No	No
		–	16 outputs	No	No	No	3	2	2	No	No
		XWT-OD08 (-1)	24 outputs	No	No	No	5	No	No	2	2
		XWT-OD16 (-1)	32 outputs	No	No	No	5	No	No	2	2
GX-MD1611 /MD1621	–	8 inputs and 8 outputs	3	2	No	3	2	2	No	No	
3-tier terminal block	GX-ID1612 /ID1622	–	16 inputs	3	2	2	No	No	No	No	No
	GX-OD1612 /OD1622	–	16 outputs	No	No	No	3	2	2	No	No
	GX-MD1612 /MD1622	–	8 inputs and 8 outputs	3	2	No	3	2	2	No	No
e-CON Connectors	GX-ID1618 /ID1628	–	16 inputs	3	2	2	No	No	No	No	No
	GX-OD1618 /OD1628	–	16 outputs	No	No	No	3	2	2	No	No
	GX-MD1618 /MD1628	–	8 inputs and 8 outputs	3	2	No	3	2	2	No	No
	GX-ID3218 /ID3228	–	32 inputs	5	No	2	No	No	No	No	No
	GX-OD3218 /OD3228	–	32 outputs	No	No	No	5	No	No	2	2
	GX-MD3218 /MD3228	–	16 inputs and 16 outputs	3	2	No	3	2	2	No	No

Analog Input Slave Unit

● Manufacturer Specific area 2

3100 hex	Analogue input available Channel choice		
Sub-index 0: available Channel choice			
Range: 0000 hex to 000F hex	Unit: –	Default: 000F hex	Attribute: R
Size: 2 bytes (U16)	Access: RW	PDO map: Not possible	

- Sets whether to have AD conversion for each point.

Bits	Setting description
0	1: CH1 enabled, 0: CH1 disabled
1	1: CH2 enabled, 0: CH2 disabled
2	1: CH3 enabled, 0: CH3 disabled
3	1: CH4 enabled, 0: CH4 disabled
4 to 15	Reserved *

- * Bits 4 to 15 are set to 0 and these values cannot be changed.

3101 hex	Analogue input Range		
Sub-index 0: Num of channel			
Range: –	Unit: –	Default: 04 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-indexes 1 to 4: CH1 to 4 Input Range			
Range: 00 hex, 01 hex, 02 hex, 03 hex, 07 hex	Unit: –	Default: 01 hex	Attribute: R
Size: 1 byte (U8)	Access: RW	PDO map: Not possible	

- Sets the input range for each point.
- The settable values are as follows. No other values can be set.

Set value	Range
00 hex	10 to +10 V
01 hex	0 to 5 V
02 hex	0 to 10 V
03 hex	4 to 20 mA
07 hex	1 to 5 V

3110 hex	Analogue input Adjustment High Value (User adjustment compensation value (maximum))		
Sub-index 0: Num of channel			
Range: –	Unit: –	Default: 04 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-indexes 1 to 4: CH1 to 4 Adj. High Value			
Range: –	Unit: –	Default: 0000 hex	Attribute: –
Size: 2 bytes (INT16)	Access: RO	PDO map: Not possible	

- Stores the upper limit of user adjustment.

3112 hex	Analogue input Adjustment High Execute (User adjustment execution (maximum))		
Sub-index 0: Num of channel			
Range: –	Unit: –	Default: 04 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-indexes 1 to 4: CH1 to 4 Adj. High (CH0 to 3 user adjustment execution)			
Range: –	Unit: –	Default: 00000000 hex	Attribute: R
Size: 4 bytes (U32)	Access: RW	PDO map: Not possible	

- This object executes user adjustment. It writes upper adjustment value.
- To adjust, enter a voltage (or current) equivalent to 100% from a connected device to the terminal of input point you want to adjust. (Set the input range in advance.)
- If you reset, it returns to the default setting.
- The value is adjusted or reset only when the specific value is written to sub-indexes 1 to 4. This prevents erroneous execution and resetting. The specific values are:
 "save" for execution, "rset" for resetting.

MSB		LSB	
e	v	a	s
65 hex	76 hex	61 hex	73 hex
t	e	s	r
74 hex	65 hex	73 hex	72 hex

Writing values other than the above is invalid.

- A value 0000 0000 hex is indicated when reading.

3113 hex	Analogue input Adjustment Low Value (User adjustment compensation value (minimum))		
Sub-index 0: Num of channel			
Range: –	Unit: –	Default: 04 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-indexes 1 to 4: CH1 to 4 Adj. Low Value			
Range: –	Unit: –	Default: 0000 hex	Attribute: –
Size: 2 bytes (INT16)	Access: RO	PDO map: Not possible	

- Stores the lower limit of user adjustment.

3115 hex	Analogue input Adjustment Low Execute (User adjustment execution (minimum))		
Sub-index 0: Num of channel			
Range: –	Unit: –	Default: 04 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-indexes 1 to 4: CH1 to 4 Adj. Low (CH0 to 3 user adjustment execution)			
Range: –	Unit: –	Default: 00000000 hex	Attribute: R
Size: 4 bytes (U32)	Access: RW	PDO map: Not possible	

- This object executes user adjustment. It writes lower adjustment value.
- To adjust, enter a voltage (or current) equivalent to 0% from a connected device to the terminal of the input point you want to adjust. (Set the input range in advance.)
- If you reset, it returns to the default setting.
- The value is adjusted or reset only when the specific value is written to sub-indexes 1 to 4. This prevents erroneous execution and resetting. The specific values are:
 "save" for execution, "rset" for resetting.

MSB		LSB	
e	v	a	s
65 hex	76 hex	61 hex	73 hex
t	e	s	r
74 hex	65 hex	73 hex	72 hex

Writing values other than the above is invalid.

- A value 0000 0000 hex is indicated when reading.

3132 hex	Analogue input Moving Average		
Sub-index 0: Num of channel			
Range: –	Unit: –	Default: 04 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-indexes 1 to 4: CH1 to 4 Moving Average			
Range: 0000 hex to FA00 hex	Unit: –	Default: 0000 hex	Attribute: R
Size: 2 bytes (U16)	Access: RW	PDO map: Not possible	

- This object sets moving average setting value of each point.

3136 hex	Analogue input Disconnection status		
Sub-index 0: Num of channel			
Range: –	Unit: –	Default: 01 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-index 1: Disconnection status			
Range: 0000 hex to 000F hex	Unit: –	Default: 0000 hex	Attribute: –
Size: 2 bytes (INT16)	Access: RO	PDO map: Not possible	

- This object detects disconnection on each point.

Bits	State
0	1: CH1 disconnected, 0: CH1 normal
1	1: CH2 disconnected, 0: CH2 normal
2	1: CH3 disconnected, 0: CH3 normal
3	1: CH4 disconnected, 0: CH4 normal
4 to 15	Reserved

● Device Profile area

6401 hex	Read analogue input 16-bit		
Sub-index 0: Num of channel			
Range: –	Unit: –	Default: 04 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-indexes 1 to 4: CH1 to 4 Input 16-bit (Channel 0 to 3 input)			
Range: *	Unit: –	Default: 0000 hex	Attribute: –
Size: 2 bytes (INT16)	Access: RO	PDO map: Possible	

* This is equal to the set input range.

- This object indicates input of each point.

Analog Output Slave Unit

● Manufacturer Specific area 2

3200 hex	Analogue output available Channel choice		
Sub-index 0: available Channel choice			
Range: 0000 hex to 0003 hex	Unit: –	Default: 0003 hex	Attribute: R
Size: 2 bytes (U16)	Access: RW	PDO map: Not possible	

- Sets whether to have DA conversion for each point.

Bits	D/A conversion enabled channel
0	1: CH1 enabled, 0: CH1 disabled
1	1: CH2 enabled, 0: CH2 disabled
2 to 15	Reserved

3201 hex	Analogue output Range		
Sub-index 0: Num of channel			
Range: –	Unit: –	Default: 02 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-indexes 1 to 2: CH1 to 2 Output Range			
Range: 00 hex, 01 hex, 03 hex, 04 hex, 06 hex	Unit: –	Default: 04 hex	Attribute: R
Size: 1 byte (U8)	Access: RW	PDO map: Not possible	

- Sets the output range for each point.
- The settable values are as follows. No other values can be set.

Set value	Range
00 hex	4 to 20 mA
01 hex	0 to 10 V
03 hex	–10 to +10 V
04 hex	0 to 5 V
06 hex	1 to 5 V

3210 hex	Analogue output Adjustment High Value (User adjustment compensation value (maximum))		
Sub-index 0: Num of channel			
Range: –	Unit: –	Default: 02 hex	Attribute: –
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-indexes 1 to 2: CH1 to 2 Adj. High Value			
Range: –	Unit: –	Default: 0000 hex	Attribute: –
Size: 2 byte (INT16)	Access: RO		PDO map: Not possible

- Stores the upper limit of user adjustment. The user upper adjustment value is stored.

3212 hex	Analogue output Adjustment High Execute (User adjustment execution (maximum))		
Sub-index 0: Num of channel			
Range: –	Unit: –	Default: 02 hex	Attribute: –
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-indexes 1 to 2: CH1 to 2 Adj. High			
Range: –	Unit: –	Default: 00000000 hex	Attribute: R
Size: 4 bytes (U32)	Access: RW		PDO map: Not possible

- This object executes user adjustment. It writes upper adjustment value.
- Execute the command when a count value which makes the actual output voltage 100% is written by the EtherCAT Master Unit to the data area of the point to adjust. (Adjustment at 100% is highly recommended, but a lower value is acceptable.)
- If you reset, it returns to the default setting.
- The values is adjusted or reset only when the specific value is written to sub-indexes 1 to 2. This prevents erroneous execution and resetting. The specific values are:
 "save" for execution, "rset" for resetting.

MSB		LSB	
e	v	a	s
65 hex	76 hex	61 hex	73 hex
t	e	s	r
74 hex	65 hex	73 hex	72 hex

Writing values other than the above is invalid.

- A value of 0000 0000 hex is indicated when reading.

Notes: Always adjust the lower limit first. If the lower limit is adjusted without adjusting the upper limit 100%, the lower limit adjustment may have an error.

3213 hex	Analogue output Adjustment Low Value (User adjustment compensation value (minimum))		
Sub-index 0: Num of channel			
Range: –	Unit: –	Default: 02 hex	Attribute: –
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-indexes 1 to 2: CH1 to 2 Adj. Low Value			
Range: –	Unit: –	Default: 0000 hex	Attribute: –
Size: 2 byte (INT16)	Access: RO		PDO map: Not possible

- Stores the lower limit of user adjustment.

3215 hex	Analogue output Adjustment Low Execute (User adjustment execution (minimum))		
Sub-index 0: Num of channel			
Range: –	Unit: –	Default: 02 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-indexes 1 to 2: CH1 to 2 Adj. Low			
Range: –	Unit: –	Default: 00000000 hex	Attribute: R
Size: 4 bytes (U32)	Access: RW	PDO map: Not possible	

- This object executes user adjustment. It writes lower adjustment value.
- Be sure to execute the command only when a count value which makes the actual output voltage 0% is written by the EtherCAT Master Unit to the data area of the point to adjust. (Always adjust at 0%.)
- If you reset, it returns to the default setting.
- The value is adjusted or reset only when the specific value is written to sub-indexes 1 to 2. This prevents erroneous execution and resetting. The specific values are:
"save" for execution, "rset" for resetting.

MSB		LSB	
e	v	a	s
65 hex	76 hex	61 hex	73 hex
t	e	s	r
74 hex	65 hex	73 hex	72 hex

Writing values other than the above is invalid.

- A value of 0000 0000 hex is indicated when reading.

3240 hex	Analogue output Fault Action		
Sub-index 0: Num of channel			
Range: –	Unit: –	Default: 02 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-indexes 1 to 2: CH1 to 2 Error Mode			
Range: 00 hex, 01 hex, 02 hex, 03 hex, 04 hex	Unit: –	Default: 04 hex	Attribute: R
Size: 1 byte (U8)	Access: RW	PDO map: Not possible	

- Selects a value to output at a communications error for each point.

Set value	Range
00 hex	Hold Last State (Hold and output.)
01 hex	Low Limit (Output the lower limit.)
02 hex	High Limit (Output the upper limit.)
03 hex	User Count (Output a user specified value.)
04 hex	Zero Count (Output a value of 0000 hex in the setting range.)

3241 hex	Analogue output Fault Value		
Sub-index 0: Num of channel			
Range: –	Unit: –	Default: 02 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-indexes 1 to 2: CH1 to 2 Error Mode			
Range: *	Unit: –	Default: 0000 hex	Attribute: R
Size: 1 byte (INT16)	Access: RW	PDO map: Not possible	

* This is equal to the set output range.

- Sets an analog value to output at a communications error.
- The setting is enabled only when "User Count (Output a user specified value) is selected in the 3240 hex "Analogue Output Fault Action" (analog output mode at errors).

● Device Profile area

6411 hex	Write analogue output 16-bit		
Sub-index 0: Num of channel			
Range: –	Unit: –	Default: 05 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-indexes 1 to 2: CH1 to 2 Input 16-bit			
Range: *	Unit: –	Default: 0000 hex	Attribute: A
Size: 2 bytes (INT16)	Access: RW	PDO map: Possible	

* This is equal to the set output range.

- Sets the output for each point.

Encoder Input Slave Unit

● Manufacturer Specific area 2

4000 hex	Count Mode		
Sub-index 0: Num of channel			
Range: –	Unit: –	Default: 02 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-indexes 1 to 2: CH1 to 2 Count Mode			
Range: –	Unit: –	Default: 00 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	

- It stores the Count Mode.
- The Count Mode is fixed to 00 hex (Circular Counter).

4001 hex	Encoder Direction		
Sub-index 0: Num of channel			
Range: –	Unit: –	Default: 02 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-indexes 1 to 2: CH1 to 2 Pulse Direction			
Range: 0 (false), 1 (true)	Unit: –	Default: 0 (false)	Attribute: B
Size: 1 bit (BOOL)	Access: RW	PDO map: Not possible	

- Set the count direction.

Set value	Count direction
0 (false)	Forward direction at CW (clockwise rotation seen from the shaft of the connected encoder)
1 (true)	Forward direction at CCW (counterclockwise rotation seen from the shaft of the connected encoder)

4002 hex	Encoder Input Setting		
Sub-index 0: Num of channel			
Range: –	Unit: –	Default: 02 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-indexes 1 to 2: CH1 to 2 Pulse Input Setting			
Range: 00 hex to 04 hex	Unit: –	Default: 02 hex	Attribute: B
Size: 1 byte (U8)	Access: RW	PDO map: Not possible	

- Set the input method.

Set value	Range
00 hex	Phase A/B pulse (Multiplication × 1 cycle)
01 hex	Phase A/B pulse (Multiplication × 2 cycle)
02 hex	Phase A/B pulse (Multiplication × 4 cycle)
03 hex	Code + pulse (Multiplication × 1 cycle)
04 hex	Incremental/decremental pulse

4003 hex	Max Count Setting		
Sub-index 0: Num of channel			
Range: –	Unit: –	Default: 02 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-indexes 1 to 2: CH1 to 2 Max Count Setting			
Range: 00000000 hex to FFFFFFFF hex	Unit: –	Default: 00000000 hex	Attribute: B
Size: 4 byte (U32)	Access: RW	PDO map: Not possible	

- This object is used to specify the maximum value of the counter.
- It operates as FFFFFFFF hex if 0 is set.

4010 hex	Encoder Input Setting		
Sub-index 0: Num of channel			
Range: –	Unit: –	Default: 02 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-indexes 1 to 2: CH1 to 2 Position Value			
Range: 00000000 hex to FFFFFFFF hex	Unit: –	Default: 00000000 hex	Attribute: –
Size: 4 byte (U32)	Access: RO	PDO map: Possible	

- The present counter value is stored.

4011 hex	Preset Value		
Sub-index 0: Num of channel			
Range: –	Unit: –	Default: 02 hex	Attribute: –
Size: 1 byte (U8)	Access: RO	PDO map: Not possible	
Sub-indexes 1 to 2: CH1 to 2 Preset Value			
Range: 00000000 hex to FFFFFFFF hex	Unit: –	Default: 00000000 hex	Attribute: A
Size: 4 byte (U32)	Access: RW	PDO map: Possible	

- This object is used to specify the preset command value.

4012 hex	Latch Value A		
Sub-index 0: Num of channel			
Range: –	Unit: –	Default: 02 hex	Attribute: –
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-indexes 1 to 2: CH1 to 2 Latch Value A			
Range: 00000000 hex to FFFFFFFF hex	Unit: –	Default: 00000000 hex	Attribute: –
Size: 4 byte (U32)	Access: RO		PDO map: Possible

- The value of latch A is stored.

4013 hex	Latch Value B		
Sub-index 0: Num of channel			
Range: –	Unit: –	Default: 02 hex	Attribute: –
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-indexes 1 to 2: CH1 to 2 Latch Value B			
Range: 00000000 hex to FFFFFFFF hex	Unit: –	Default: 00000000 hex	Attribute: –
Size: 4 byte (U32)	Access: RO		PDO map: Possible

- The value of latch B is stored.

4020 hex	Instruction Bits		
Sub-index 0: Num of channel			
Range: –	Unit: –	Default: 02 hex	Attribute: –
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-indexes 1 to 2: CH1 to 2 Instruction Bits			
Range: –	Unit: –	Default: 0000 hex	Attribute: A
Size: 2 byte (U16)	Access: RW		PDO map: Possible

- The soft switch setting is specified.

4030 hex	Status Bits		
Sub-index 0: Num of channel			
Range: –	Unit: –	Default: 02 hex	Attribute: –
Size: 1 byte (U8)	Access: RO		PDO map: Not possible
Sub-indexes 1 to 2: CH1 to 2 Status Bits			
Range: –	Unit: –	Default: 0000 hex	Attribute: –
Size: 2 byte (U16)	Access: RO		PDO map: Possible

- Status bit is stored.

A-2 Current Consumption Summary

A-2-1 Digital I/O Slave Unit

Model	Unit power supply current consumption	Model	Unit power supply current consumption
GX-ID1611	80 mA max. at 24 VDC 90 mA max. at 20.4 VDC	GX-ID1621	80 mA max. at 24 VDC 90 mA max. at 20.4 VDC
GX-OD1611	80 mA max. at 24 VDC 90 mA max. at 20.4 VDC	GX-OD1621	80 mA max. at 24 VDC 90 mA max. at 20.4 VDC
GX-OC1601	180 mA max. at 24 VDC 210 mA max. at 20.4 VDC		
GX-MD1611	80 mA max. at 24 VDC 80 mA max. at 20.4 VDC	GX-MD1621	80 mA max. at 24 VDC 80 mA max. at 20.4 VDC
GX-ID1612	80 mA max. at 24 VDC 90 mA max. at 20.4 VDC	GX-ID1622	80 mA max. at 24 VDC 90 mA max. at 20.4 VDC
GX-OD1612	80 mA max. at 24 VDC 90 mA max. at 20.4 VDC	GX-OD1622	80 mA max. at 24 VDC 90 mA max. at 20.4 VDC
GX-MD1612	80 mA max. at 24 VDC 90 mA max. at 20.4 VDC	GX-MD1622	80 mA max. at 24 VDC 90 mA max. at 20.4 VDC
GX-ID1618	150 mA max. at 24 VDC 150 mA max. at 20.4 VDC	GX-ID1628	150 mA max. at 24 VDC 150 mA max. at 20.4 VDC
GX-OD1618	70 mA max. at 24 VDC 80 mA max. at 20.4 VDC	GX-OD1628	70 mA max. at 24 VDC 80 mA max. at 20.4 VDC
GX-MD1618	110 mA max. at 24 VDC 120 mA max. at 20.4 VDC	GX-MD1628	110 mA max. at 24 VDC 120 mA max. at 20.4 VDC
GX-ID3218	220 mA max. at 24 VDC 230 mA max. at 20.4 VDC	GX-ID3228	220 mA max. at 24 VDC 230 mA max. at 20.4 VDC
GX-OD3218	90 mA max. at 24 VDC 100 mA max. at 20.4 VDC	GX-OD3228	90 mA max. at 24 VDC 100 mA max. at 20.4 VDC
GX-MD3218	140 mA max. at 24 VDC 150 mA max. at 20.4 VDC	GX-MD3228	140 mA max. at 24 VDC 150 mA max. at 20.4 VDC

A-2-2 Analog I/O Slave Unit

Model	Unit power supply current consumption	Model	Unit power supply current consumption
GX-AD0471	110 mA max. at 24 VDC 120 mA max. at 20.4 VDC	GX-DA0271	140 mA max. at 24 VDC 150 mA max. at 20.4 VDC

A-2-3 Encoder Input Slave Unit

Model	Unit power supply current consumption	Model	Unit power supply current consumption
GX-EC0211	100 mA max. at 24 VDC 130 mA max. at 20.4 VDC	GX-EC0241	90 mA max. at 24 VDC 100 mA max. at 20.4 VDC

A-2-4 Expansion Unit

Model	Unit power supply current consumption	Model	Unit power supply current consumption
XWT-ID08	5 mA max.	XWT-ID08-1	5 mA max.
XWT-OD08	5 mA max.	XWT-OD08-1	5 mA max.
XWT-ID16	10 mA max.	XWT-ID16-1	10 mA max.
XWT-OD16	10 mA max.	XWT-OD16-1	10 mA max.

A-3 Precautions with Connecting Two-wire DC Sensors

When using a two-wire DC sensor with a DC input type Slave Unit, check that the following conditions have been met. Failure to meet these conditions may result in operating errors.

A-3-1 Relation between ON Voltage of a Unit with DC Inputs and Sensor Residual Voltage

$$V_{ON} \leq V_{CC} - V_R$$

V_{CC} : I/O power supply voltage (The allowable power supply voltage range is 20.4 to 26.4 V, so 20.4 V will be used here to allow for the worst possible conditions.)

V_{ON} : ON voltage for a Unit with DC inputs

V_R : Sensor's output residual voltage

It is sometimes possible to satisfy the above equation by adjusting the I/O power supply voltage (V_{CC}) to 26.4 V.

A-3-2 Relation between ON Current of a Unit with DC Inputs and Sensor Control Output

$$I_{OUT} (\text{min}) \leq I_{ON} \leq I_{OUT} (\text{max})$$

I_{OUT} : Sensor control output (load current)

I_{ON} : ON current of a Unit with DC inputs

I_{ON} is calculated as follows:

$$I_{ON} = (V_{CC} - V_R - V_F) / R_{IN}$$

V_F : Internal residual voltage of a Unit with DC inputs

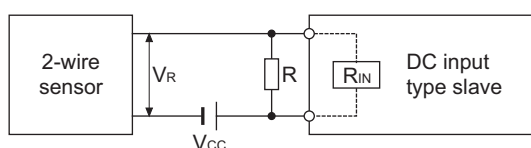
R_{IN} : Input impedance of a Unit with DC inputs

When I_{ON} is smaller than $I_{OUT} (\text{min})$, connect a bleeder resistor R .

The bleeder resistor constant can be calculated using the following equation.

$$R \leq (V_{CC} - V_R) / (I_{OUT} (\text{min}) - I_{ON})$$

$$\text{Power } W \geq (V_{CC} - V_R)^2 / R \times 4 \text{ [allowable margin]}$$



A-3-3 Relation between OFF Current of a Unit with DC Inputs and Sensor Leakage Current

$$I_{OFF} \geq I_{leak}$$

I_{OFF} : OFF current of a Unit with DC inputs

I_{leak} : Sensor's leakage current

Connect a bleeder resistor if the sensor's leakage current is greater than the OFF current of a Unit with DC inputs.

The bleeder resistor constant can be calculated using the following equation.

$$R \leq (I_{OFF} \times R_{IN} + V_F) / (I_{leak} - I_{OFF})$$

$$\text{Power } W \geq (V_{CC} - V_R)^2 / R \times 4 \text{ [allowable margin]}$$

A-4 I/O Power Supply Current

The I/O power supply current to be supplied to the V and G terminals of each Digital I/O Slave Unit is provided by the following equation.

The points to which I/O power must be supplied are divided into small blocks. The I/O power supply currents supplied to these points are calculated in block units.

For example, in a GX-ID1612 Unit, the points are divided into two blocks. One includes 8 points on the left: Inputs 0 to 7. The other contains 8 points on the right: Inputs 8 to 15. Currents are calculated for each block.

● In case of Input Slave Units

The I/O power supply current supplied to V and G terminals
 = input current (for number of points used) + current supplied to connected input devices (for number of points used) * + I/O power supply current consumption

*This value does not apply to 2-tier terminal block type Slave Units.

Calculate using I/O power supply current supplied to V and G terminals
 = input current (for number of points used) + I/O power supply current consumption.

● In case of Output Slave Units

The I/O power supply current supplied to V and G terminals
 = rated output current (for number of points used) * + current supplied to connected input devices (for number of points used) + I/O power supply current consumption

* Compare with the restricted value for common and apply whichever value is the smallest.

(Example)

In case of having seven 30-mA sensors connected to the GX-ID1612

I/O power supply current supplied to V and G terminals
 = (6 mA × 7 points) + (30 mA × 7 points) + 5 mA = 257 mA

A-5 EtherCAT Terminology

Use the following list of EtherCAT terms for reference.

Term	Abbreviation	Description
object	–	Abstract representation of a particular component within a device, which consists of data, parameters, and methods.
object dictionary	OD	Data structure addressed by Index and Sub-index that contains description of data type objects, communication objects and application objects.
service data object	SDO	CoE asynchronous mailbox communications where all objects in the object dictionary can be read and written.
index	–	Address of an object within an application process.
subindex	–	Sub-address of an object within the object dictionary.
Process data	–	Collection of application objects designated to be transferred cyclically or acyclically for the purpose of measurement and control.
Process data object	PDO	Structure described by mapping parameters containing one or several process data entities.
Receive PDO	RxPDO	A process data object received by an EtherCAT Slave Unit.
Transmit PDO	TxPDO	A process data object sent from an EtherCAT Slave Unit.
sync manager	SM	Collection of control elements to coordinate access to concurrently used objects.
distributed clock	DC	Clock distribution mechanism used to synchronize EtherCAT Slave Units and the EtherCAT Master Units (Among GX-series EtherCAT Slave Units, only encoder input slaves support this function.)
device profile	–	Collection of device dependent information and functionality providing consistency between similar devices of the same device type.
fieldbus memory management unit	FMMU	Function which establishes single or multiple communications between logical address and physical memory
physical device internal interface	PDI	A series of elements to access data link services from the application layer.
CAN in Automation	CiA	CiA is the international users' and manufacturers' group that develops and supports higher-layer protocols.
CAN application protocol over EtherCAT	CoE	A CAN application protocol service implemented on EtherCAT.
EEPROM	EEPROM	Electrically erasable PROM. (Writable ROM)
EtherCAT Technology Group	ETG	The ETG is a global organization in which OEM, End Users and Technology Providers join forces to support and promote the further technology development.
EtherCAT slave controller	ESC	A controller for EtherCAT slave communication.
EtherCAT state machine	ESM	An EtherCAT communication state machine.
EtherCAT slave information	ESI	An XML file that contains setting information for an EtherCAT Slave Unit.

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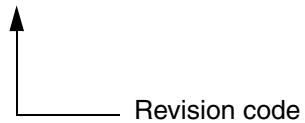
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Revision History

A manual revision code appears as a suffix to the catalog number on the front cover of the manual.

Cat. No. W488-E1-02



The following table outlines the changes made to the manual during each revision. Page numbers refer to the previous version.

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