Cat. No. W481-E1-02

ERT1 Series

EtherNet/IP Slave Units

OPERATION MANUAL

OMRON

ERT1 Series
EtherNet/IP Slave Units

Operation Manual

Revised November 2010

Notice:

OMRON products are manufactured for use according to proper procedures by a qualified operator and only for the purposes described in this manual.

The following conventions are used to indicate and classify precautions in this manual. Always heed the information provided with them. Failure to heed precautions can result in injury to people or damage to property.

⚠ DANGER Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. Additionally, there may be severe property damage.

⚠ 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.

OMRON Product References

All OMRON products are capitalized in this manual. The word “Unit” is also capitalized when it refers to an OMRON product, regardless of whether or not it appears in the proper name of the product.

The abbreviation “Ch,” which appears in some displays and on some OMRON products, often means “word” and is abbreviated “Wd” in documentation in this sense.

The abbreviation “PLC” means Programmable Controller. “PC” is used, however, in some Programming Device displays to mean Programmable Controller.

Visual Aids

The following headings appear in the left column of the manual to help you locate different types of information.

Note Indicates information of particular interest for efficient and convenient operation of the product.

1,2,3... 1. Indicates lists of one sort or another, such as procedures, checklists, etc.

Trademarks and Copyrights

EtherNet/IP is a registered trademark of the ODVA (Open DeviceNet Vendor Association).

Ethernet is a trademark of the Xerox Corporation.

Microsoft, Windows, Windows NT, Windows 2000, Windows XP, and Windows Vista are registered trademarks of the Microsoft Corporation.

Other names of systems or products that appear in this document are trademarks or registered trademarks of the respective company.

TABLE OF CONTENTS

About this Manual:

This manual describes the installation and operation of ERT1-series EtherNet/IP Slave Units, and includes the sections described below.

Please read this manual carefully and be sure you understand the information provided before attempting to install or operate an ERT1-series EtherNet/IP Slave Unit. Be sure to read the precautions provided in the following section.

Precautions provides precautions for using the ERT1-series EtherNet/IP Slave Units.

Section 1 describes the features and models of EtherNet/IP Slave Units

Section 2 describes the overall procedure that is used to set up and start an EtherNet/IP system.

Section 3 provide the basic specifications of the EtherNet/IP Slave Units

Section 4 describes the Digital I/O Slave Units for EtherNet/IP.

Section 5 describes the Environment-resistive Slave Units for EtherNet/IP.

Section 6 describes the Smart Functions supported by the EtherNet/IP Slave Units.

Section 7 describes troubleshooting and maintenance for the EtherNet/IP Slave Units.

Relevant Manuals

The following table lists manuals that contain information relevant to EtherNet/IP Slave Units.

Manual number	Model	Name	Contents
W481	ERT1 Series	ERT1 Series EtherNet/IP Slave Units Operation Manual (this manual)	Provides information on operating and installing EtherNet/IP Slave Units.
W465	CS1W-EIP21 CJ1W-EIP21 CJ2H-CPU6□-EIP	EtherNet/IP Units Operation Manual	Provides information on operating and installing EtherNet/IP Units, including details on basic settings, tag data links, and FINS communications. Refer to the *Communications Commands Reference Manual* (W342) for details on FINS commands that can be sent to CS-series and CJ-series CPU Units when using the FINS communications service. Refer to the *Ethernet Units Operation Manual Construction of Applications* (W421) for details on constructing host applications that use FINS communications.
W342	CS1G/H-CPU□□H CS1G/H-CPU-□□V1 CS1W-SCU21 CS1W-SCB21/41 CJ2H-CPU6□-EIP CJ2H-CPU6□ CJ1G/H-CPU□□H CJ1G-CPU□□ CJ1W-SCU41	Communications Commands Reference Manual	Describes the C-series (Host Link) and FINS communications commands used when sending communications commands to CS-series and CJ-series CPU Units.
W463	CXONE-AL□□C-V3 CXONE-AL□□D-V3	CX-One Ver. 3.0 Setup Manual	Describes the setup procedures for the CX-One. Information is also provided on the operating environment for the CX-One.

⚠ WARNING Failure to read and understand the information provided in this manual may result in personal injury or death, damage to the product, or product failure. Please read each section in its entirety and be sure you understand the information provided in the section and related sections before attempting any of the procedures or operations given.

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.

OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NON-INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

LIMITATIONS OF LIABILITY

OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY.

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

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR, OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.

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.

PRECAUTIONS

This section provides general precautions for using the ERT1-series EtherNet/IP Slave Units.

The information contained in this section is important for the safe and reliable application of EtherNet/IP Slave Units. You must read this section and understand the information contained before attempting to set up or operate an EtherNet/IP Slave Unit.

1 Intended Audience

This manual is intended for the following personnel, who must also have knowledge of electrical systems (an electrical engineer or the equivalent).

- Personnel in charge of installing FA systems.
- Personnel in charge of designing FA systems.
- Personnel in charge of managing FA systems and facilities.

2 General Precautions

The user must operate the product according to the performance specifications described in the operation manuals.

Before using the product under conditions which are not described in the manual or applying the product to nuclear control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement machines, safety equipment, and other systems, machines, and equipment that may have a serious influence on lives and property if used improperly, consult your OMRON representative.

Make sure that the ratings and performance characteristics of the product are sufficient for the systems, machines, and equipment, and be sure to provide the systems, machines, and equipment with double safety mechanisms.

This manual provides information for programming and operating the Unit. Be sure to read this manual before attempting to use the Unit and keep this manual close at hand for reference during operation.

⚠ WARNING It is extremely important that a PLC and all PLC Units be used for the specified purpose and under the specified conditions, especially in applications that can directly or indirectly affect human life. You must consult with your OMRON representative before applying a PLC System to the above-mentioned applications.

3 Safety Precautions

⚠ WARNING Do not attempt to take any Unit apart while the power is being supplied. Doing so may result in electric shock.

⚠ WARNING Do not touch any of the terminals or terminal blocks while the power is being supplied. Doing so may result in electric shock.

⚠ WARNING Do not attempt to disassemble, repair, or modify any Units. Any attempt to do so may result in malfunction, fire, or electric shock.

⚠ **WARNING** Provide safety measures in external circuits (i.e., not in the Programmable Controller), 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. 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.
- The PLC outputs may remain ON or OFF due to destruction of the output transistors. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.
- Data input and output errors may occur when a photocoupler reaches the end of its service life. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.

⚠ **WARNING** Do not use the indicators on the EtherNet/IP Slave Units for safety-related applications. Safety functions may be lost, occasionally resulting in serious injury.

4 Operating Environment Precautions

⚠ **Caution** Install the EtherNet/IP Slave Units correctly as described in this manual.

⚠ **Caution** Do not install the EtherNet/IP Slave Units in the following locations.

- Locations 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.
- Locations subject to corrosive or flammable gases.
- Locations subject to dust (especially iron dust) or salts.
- Locations subject to exposure to water, oil, or chemicals.
- Locations subject to shock or vibration.

⚠ **Caution** 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.

⚠**Caution** Install the EtherNet/IP Slave Units securely using M5 screws and tighten them to a torque of 1.47 to 1.96 N·m. Do not over tighten the screws. Doing so may damage them.

⚠**Caution** Do not use the EtherNet/IP Slave Units where they would be continually subjected to water or water spray.

⚠**Caution** Take appropriate measures to ensure that the specified power with the rated voltage is supplied in places where the power supply is unstable, or implement safety measures using a voltage monitor.

⚠**Caution** Tighten the screws on the switch cover to a torque of 0.4 to 0.5 N·m. The specified degree of protection may not be achieved if the screws are loose.

⚠**Caution** When attaching the switch cover, wipe it clean of dust, dirt, contamination, water, and other matter before attaching it. The specified degree of protection may not be achieved if the cover is not clean.

⚠**Caution** Use the specified connectors and cables for wiring.

⚠**Caution** Do not bend the cable past its natural bending radius and do not pull on the cable with excessive force.

⚠**Caution** Use the specified DC power supply.

⚠**Caution** Do not exceed the specified communications distance or the specified number of nodes.

⚠**Caution** Do not use organic solvents to clean the EtherNet/IP Slave Units. They may dissolve or discolor the surface.

5 Application Precautions

Observe the following precautions when using the EtherNet/IP Slave Units.

- Do not attempt to disassemble, repair, or modify the EtherNet/IP Slave Units.
- Do not drop any Unit or subject any Unit to excessive shock or vibration. Otherwise, Unit failure or malfunction may occur.
- Tighten connector screws securely.
- Separate the communications cables from the power lines or high-voltage lines.
- Check wiring and switch settings completely before turning ON the power supply.
- Make sure that the power supply voltage, terminal polarity, communications paths, power supply wiring, and I/O voltages are within specifications. Mistakes in any of these can cause EtherNet/IP Slave Unit failure.
- Turn OFF the power supply to the PLC and all slaves and turn OFF all communications power supplies before connecting or disconnecting communications cables.

- For the Unit power supplies and output power supplies, use power supply units can will supply a stable output even if the input power is interrupted for up to 10 ms. The power supply must also have reinforced or double insulation.
- Do not place any objects on the cables.
- When transporting the Unit, use special packing boxes and protect it from being exposed to excessive vibration or impact during transportation.

6 Conformance to EC Directives

6-1 Applicable Directives

- EMC Directives
- Low Voltage Directive

6-2 Concepts

EMC Directives

OMRON devices that comply with EC Directives also conform to the related EMC standards 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 standards (see the following note). Whether the products conform to the standards in the system used by the customer, however, 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 EN 61000-6-4
(Radiated emission: 10-m regulations)

Low Voltage Directive

Always ensure that devices operating at voltages of 50 to 1,000 V AC and 75 to 1,500 V DC meet the required safety standards for the PLC (EN61131-2).

6-3 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:

1,2,3...

1. The products must be installed within a control panel.
2. 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 S82J-series Power Supply is recommended. (See note.)
3. 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.

4. 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.

SECTION 1
Features and Slave Units

This section describes the features and models of EtherNet/IP Slave Units

1-1 Feature of EtherNet/IP Slave Units

1-1-1 Overview

EtherNet/IP is an industrial multi-vendor network that uses Ethernet components. The EtherNet/IP specifications are open standards managed by the ODVA (Open DeviceNet Vendor Association), just like DeviceNet.

EtherNet/IP is not just a network between controllers; it is also used as a field network. The EtherNet/IP Slave Unit have the following features.

High-speed, High-capacity Data Exchange through Tag Data Links

The EtherNet/IP protocol supports implicit communications, which allows cyclic communications (called tag data links in this manual) with EtherNet/IP devices.

The default settings for remote I/O communications with the PLC are the same as for previous Slaves, whereby real I/O is allocated for each node address. One difference with previous Slaves is that an area for Smart Slave status information can be allocated to the Smart Slaves within the IN Area of the Master. This is in addition to real I/O. (Settings are performed using the Network Configurator or explicit messages.)

Tag Data Link (Cyclic Communications) Cycle Time

Tag data links (cyclic communications) can operate at the cyclic period specified for each application, regardless of the number of nodes. Data is exchanged over the network at the refresh cycle set for each connection, so the communications refresh cycle will not increase even if the number of nodes is increased, i.e., the synchronicity of the connection's data is preserved.

Since the refresh cycle can be set for each connection, each application can communicate at its ideal refresh cycle. For example, a processes interlocks can be transferred at high speed while the production commands and the status monitor information are transferred at low speed.

Note The communications load to the nodes must be within the Units' allowed communications bandwidth.

Note The CIP (Common Industrial Protocol) is a shared industrial protocol for the OSI application layer. The CIP is used in networks such as EtherNet/IP, ControlNet, and DeviceNet. Data can be routed easily between networks that are based on the CIP, so a transparent network can be easily configured from the field device level to the host level.

The CIP has the following advantages.

- Destination nodes are specified by a relative path, without fixed routing tables.
- The CIP uses the producer/consumer model. Nodes in the network are arranged on the same level and it is possible to communicate with required devices whenever it is necessary.
  The consumer node will receive data sent from a producer node when the connection ID in the packet indicates that the node requires the data. Since the producer can send the same data with the same characteristics in a multicast (either multicast or unicast can be selected), the time required for the transfer is fixed and not dependent on the number of consumer nodes.

1-1-2 Features

EtherNet/IP Slaves have the following features.

Common Features

Node Addresses Set Using Rotary Switches

Node addresses are set using rotary switches, which are clearer than the previous DIP switch settings.

Automatically Detected Baud Rate

Smart Slaves do not require the baud rate to be set. The Smart Slave automatically operates at the baud rate of the switching hub.

I/O Power Status Monitor

The I/O Power Status Monitor is used to detect whether the I/O power supply is connected and provide notification in the Status Area. The Configurator or explicit messages can be used to read the information.

Input Filter (Input Units Only)

The input filter is used to read the input value several times during the set interval and remove irregular data caused by noise and switch chattering.

This function can also be used to create ON/OFF delays.

These settings are made by using the Network Configurator.

Detection Functions (Standard Feature)

Detection results can be read by using explicit messages if the sensor short-circuit/disconnected and external load short-circuit/disconnected detection functions are used. The error location can be rapidly specified and restored.

Features of Screw-less Clamp Terminals

Labor-saving Clamp Terminal Block

For I/O wiring, a screw-less clamp terminal block is provided. Wiring is reduced by the use of ferrules that can be easily inserted and then later removed by simply pressing a release button.

Features of Environment-resistive Terminals

Dust-proof and Waterproof Construction (IP67) for High Resistance to Environment

The environment-resistive construction enables usage in locations subject to oil and water splashes (IP67). An environment-resistive box is not required, enabling greater downsizing and reducing wiring labor.

No Power Supply Wiring for Input Devices

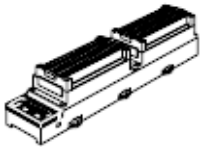
Power for communications, internal circuits, and input devices is shared, making wiring necessary only for the communications power supply.

1-2 EtherNet/IP Slaves

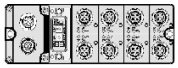
The EtherNet/IP Slaves are classified into the following categories.

- General-purpose Slaves
  Slaves with digital I/O functions using standard connectors for communications cables.
- Environment-resistive Slaves
  Slaves with I/O functions using round waterproof connectors for communications cables.

1-2-1 General-purpose Slaves

Name	Appearance	I/O points	Model number	Remarks
Screw-less Clamp Terminal with Transistors		32 input points (PNP)	ERT1-ID32SLH-1	With detection function
		16 input points/16 output points (PNP)	ERT1-MD32SLH-1	
		32 output points (PNP)	ERT1-OD32SLH-1	

1-2-2 Environment-resistive Slaves

Name	Appearance	I/O points	Model number	Remarks
Environment-resistive Terminals		16 input points (PNP)	ERT1-HD16CH-1	Waterproof, oil-proof, and spatter-proof construction (IP67). Equipped with detection functions.
		16 output points (PNP)	ERT1-WD16CH-1	

1-2-3 Slave Compatibilty with Omron Controllers

PLC Type	ERT1-ID32SLH-1	ERT1-OD32SLH-1	ERT1-MD32SLH-1	ERT1-HD16CH-1	ERT1-WD16CH-1
CJ2M-CPU3□	Yes	Yes	Yes	Yes	Yes
CJ2H-CPU6□-EIP	Yes	Yes	Yes	Yes	Yes
CJ1, NSJ with CJ1W-EIP21	Yes	Yes	Yes	Yes	Yes
CS1 with CS1W-EIP21	Yes	Yes	Yes	Yes	Yes
NJ501-1□00	Yes	Yes	Yes	Yes	Yes
CP1E	No	No	No	No	No
CP1L	No	No	No	No	No
CP1H	No	No	No	No	No

SECTION 2
System Startup Procedure

This section describes the overall procedure that is used to set up and start an EtherNet/IP system.

2-1 Overview of System Startup Procedure

This section explains the overall procedure for using EtherNet/IP using a basic example.

2-1-1 Basic Procedure

The basic procedure is given below. For details on settings and connections, refer to the *Operation Manual* for the Master Unit, as well as the detailed descriptions of individual Slaves.

■ **Preparations**

↓

■ **Setting IP addresses**

↓

■ **Setting tag data links**

↓

■ **Checking operation**

Preparations

The following Units are used in this example.

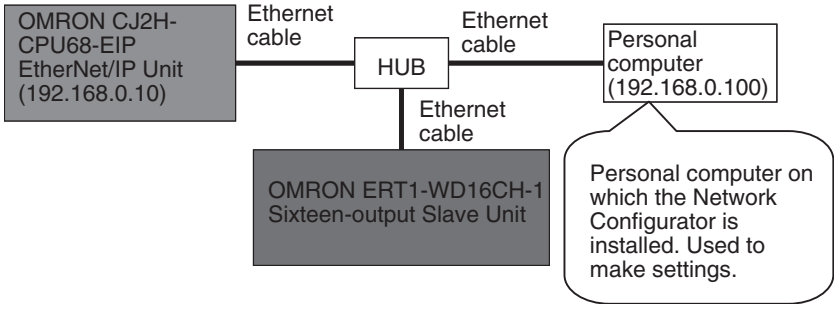
EtherNet/IP Unit: CJ2H-CPU68-EIP

EtherNet/IP Slave Unit: ERT1-WD16CH-1

If tag data links are used, a switching hub must be installed. Select a switching hub that is capable of handling the type of communications being performed over the network.

Refer to *2-2 Recommended Network Devices*.

The network devices and IP addresses that are used in the following procedures are shown below. All of the devices have a subnet mask of 255.255.255.0, and are set to the same network address.



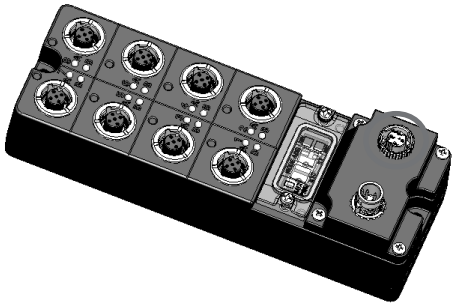
1. Network Configurator Initial Settings

Start the Network Configurator. Refer to *Common Procedure 2. Starting the Network Configurator*.

Install the EDS files for the Slave Units. Refer to *Common Procedure 3. Installing the EDS Files*.

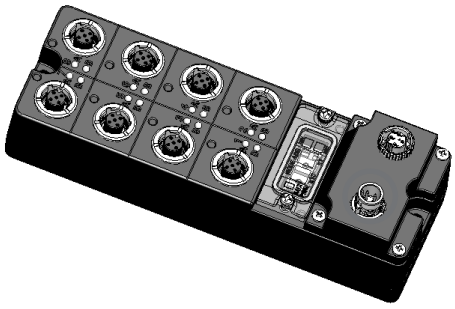
2. Connecting the Slave Units

- Connecting the Ethernet Cable
  Align the polarizing key, insert the connector on the Ethernet cable into the Ethernet connector on the Slave Unit, and then tighten the lock nut.

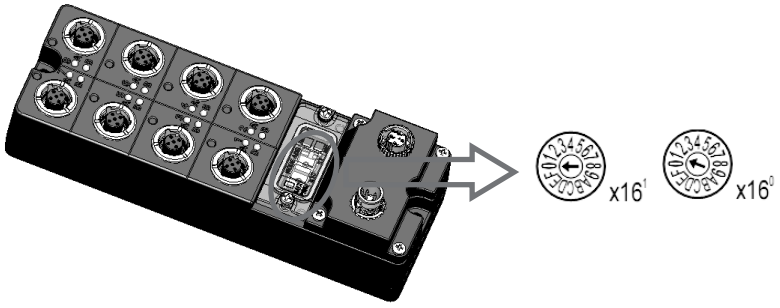


- Connecting the Power Cable
  Align the polarizing key, insert the connector of the power cable into the power connector on the Slave Unit, and then tighten the lock nut. The Slave Unit requires a 24-VDC power supply.

  Note Do not turn ON the power to the Slave Unit yet.



- Rotary Switches
  The relationship between the rotary switches on the Slave Unit and the IP address is shown below.



Rotary switches	IP address
00	BOOTP/software setting
01 to FE	192.168.250.n (n = 01 to FE hex: Rotary switch setting)
FF	Restores the default setting. (To restore the default setting, set the switches to FF hex, cycle the power supply, and then set the switches to 00 hex.)

- Slave Default Settings

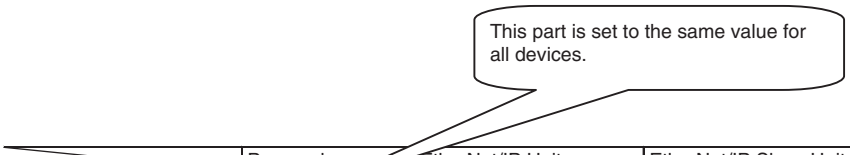
  The default settings are as follows:

  - Rotary switches: 00
  - IP address: BOOTP

The IP address will be as follows when the rotary switches are set to 01 to FE hex: 192.168.250.n (n = Decimal equivalent of value set on rotary switches).

2-1-2 Setting IP Addresses

Set the slave IP address for each device. Set same network address for all devices. The following shows an example of setting the IP addresses for use in this procedure.



	Personal computer	EtherNet/IP Unit	EtherNet/IP Slave Unit
IP address	192.168.0.100	192.168.0.10	192.168.0.20
Subnet mask	255.255.255.0	255.255.255.0	255.255.255.0
Default gateway	Not set.	Not set (0.0.0.0).	Not set.

Note After an IP address has been set, check whether the setting is correct by connecting the personal computer to the device, and then entering "ping *IP_address*" from the personal computer. For the EtherNet/IP Unit in the above example, enter "ping 192.168.0.10." The setting is correct if the following is returned.

```
Pinging 192.168.0.10 with 32 bytes of data:

Reply from 192.168.0.10: bytes=32 time=1ms TTL=255
Reply from 192.168.0.10: bytes=32 time=1ms TTL=255
Reply from 192.168.0.10: bytes=32 time<1ms TTL=255
Reply from 192.168.0.10: bytes=32 time<1ms TTL=255

Ping statistics for 192.168.0.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

1,2,3... 1. Setting the IP Address of the Personal Computer

Set the IP address of the personal computer.

2. Setting the IP Address of the EtherNet/IP Unit

Set the IP address of the EtherNet/IP Unit. Refer to *Common Procedure 6-1*. Address Setting for OMRON EtherNet/IP Units.

3. Setting the IP Addresses of the EtherNet/IP Slave Units

The IP address of an EtherNet/IP Slave Unit can be set using any of the following three methods.

- Setting the IP address with a CIP message (Network Configurator)
- Setting the IP address with a BOOTP/DHCP server
- Setting the IP address with the rotary switches

■ Setting the IP Address with a CIP Message (Network Configurator)

The Network Configurator can be used to set IP addresses.

This method involves first using the rotary switches to set an initial IP address, and then using the Network Configurator to set the desired IP address.

1,2,3... 1. Set the rotary switches (hexadecimal) on the Slave Unit to the initial IP address.

The initial IP address will be 192.168.250.n (where n is the value to which the rotary switches are set).

(If the rotary switches are set to 0A, the initial IP address will be 192.168.250.10.)

After setting the rotary switches, turn ON the power to the Slave Unit.

2. Check to be sure the initial IP address is correct.
3. Step III: Set the IP address using the Network Configurator.

Refer to *Common Procedure 4. Connecting the Network Configurator Online* and *Common Procedure 6-2 Setting IP Addresses Using the Network Configurator*.

4. Set the rotary switches to 00 and then turning the cycle the power supply.

Operation will start with the new IP address.

■ Setting the IP Address with the BOOTP/DHCP Server

This method involves first using the rotary switches to set an initial IP address, and then using the Network Configurator and the BOOTP/DHCP server to set the desired IP addresses.

1,2,3... 1. Set the rotary switches to 00.
2. Set the IP address using the BOOTP/DHCP server.

Refer to *Common Procedure 6-3. Setting IP Address Using the BOOTP Server*.

■ Setting the IP Address with the Rotary Switches

1,2,3... 1. Set the rotary switches (hexadecimal) on the Slave Unit to the desired IP address.

The initial IP address will be 192.168.250.n (where n is the value to which the rotary switches are set).

(If the rotary switches are set to 0A, the initial IP address will be 192.168.250.10.)

After setting the rotary switches, turn ON the power to the Slave Unit.

2-1-3 Setting Tag Data Links

Set data links using the OMRON Network Configurator.

■ Connecting to the Network

Refer to *Common Procedure 4. Connecting the Network Online*.

■ Uploading the Network Configuration

Refer to *Common Procedure 5. Uploading the Current Network Configuration*.

■ Setting Tag Data Links

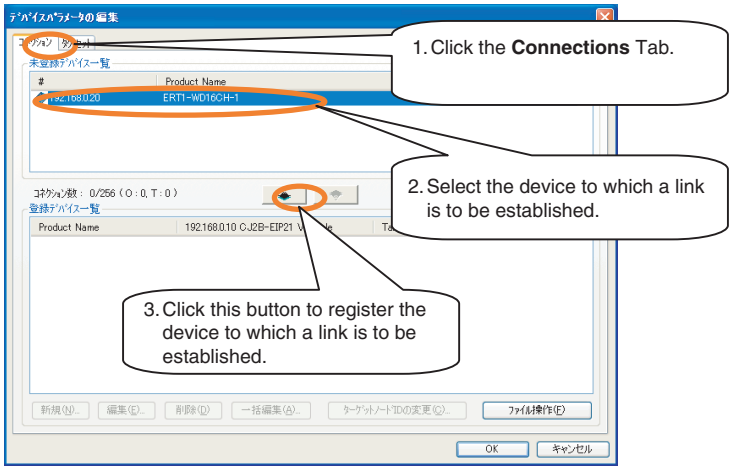
Set the tag data links.

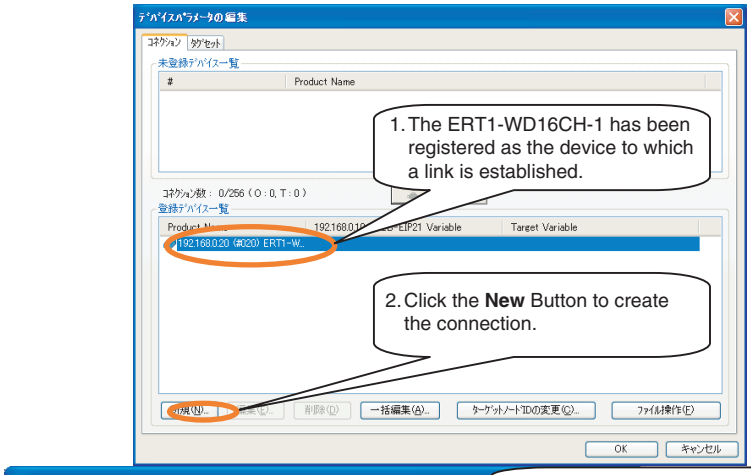
1,2,3... 1. Refer to *Common Procedure 7-2. Registering a Tag Set with the PLC*.

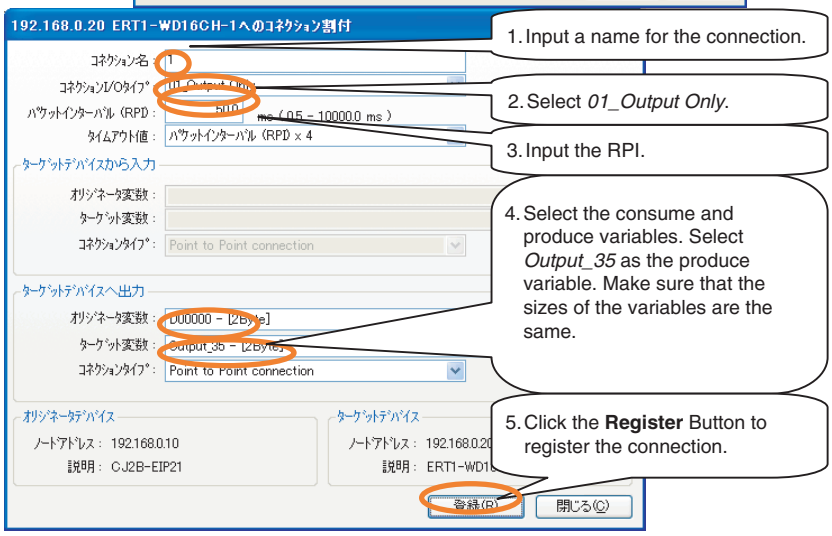
Create a 2-byte output tag.

2. Set a connection.

The subsequent steps are performed using the CJ2B-EIP21 Edit Device Parameters Dialog Box.

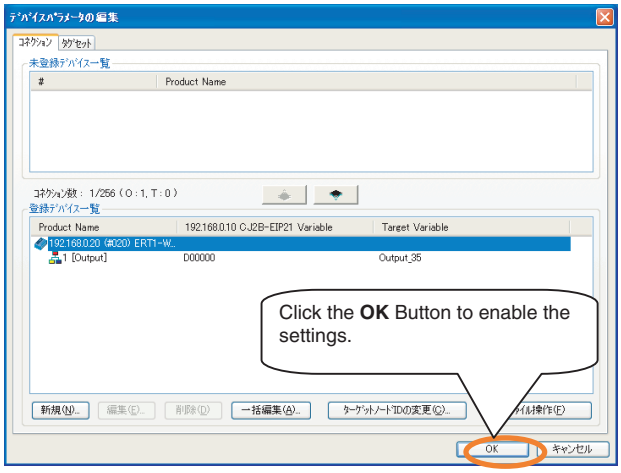




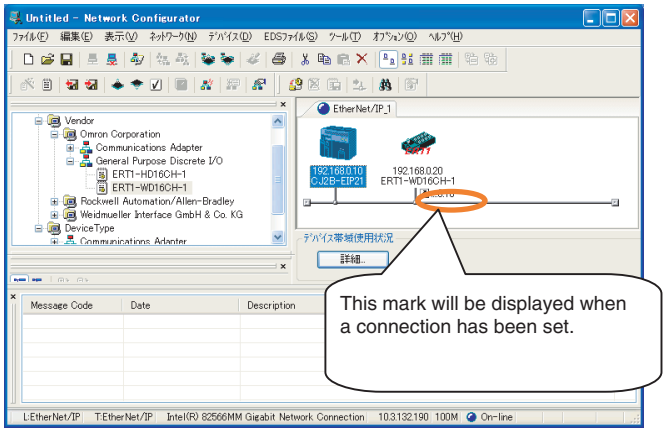


The Edit Connection Dialog Box will not be closed. If no further connections are to be set, click the **Close** Button.

The connection will appear in the list of registered devices.



After a connection has been set, a window like the one shown below will be displayed.



When the above window is displayed, setting the connection has been completed.

3. Write the connection settings to the devices.

   Refer to *Common Procedure 7-4. Downloading Connection Settings to Devices*.

2-1-4 Checking Operation

Make sure that tag data link is operating normally.

■ EtherNet/IP Unit

Check the display and indicators on the EtherNet/IP Unit. The following status indicates that tag data link is operating normally.

- MS indicator: Lit green.
- NS indicator: Lit green.
- 7-segment display: Shows the rightmost digits of the EtherNet/IP Unit node address in hexadecimal (0A would be displayed for address 192.168.0.10).

■ EtherNet/IP Slave Unit

Check the indicators on the Slave Unit. The following status indicates that tag data link is operating normally.

- MS indicator: Lit green.

- NS indicator: Lit green.

2-1-5 Common Operating Procedures

This section provides the procedures that are used to set up and start an EtherNet/IP Unit.

Common Procedure 1. Configuration Used in Common Procedures

Common Procedure 2. Starting the Network Configurator

Common Procedure 3. Installing EDS Files

Common Procedure 4. Connecting the Network Online

Common Procedure 5. Uploading the Current Network Configuration

Common Procedure 6. Setting IP Addresses

- Common Procedure 6-1. Setting IP Addresses for OMRON EtherNet/IP Units
- Common Procedure 6-2. Setting IP Addresses Using the Network Configurator
- Common Procedure 6-3. Setting IP Addresses Using the BOOTP Server
  - Common Procedure 6-3-1. Enabling BOOTP from the Network Configurator
  - Common Procedure 6-3-2. Setting IP Addresses Using the BOOTP Server

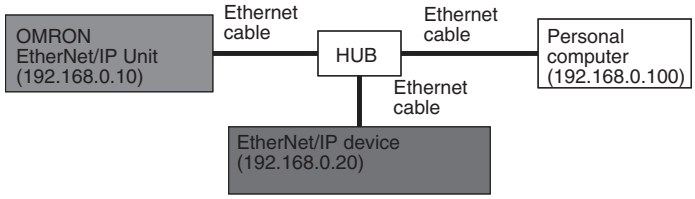
Common Procedure 7. Setting Tag Data Links

- Common Procedure 7-1. Setting the I/O Sizes of Devices
- Common Procedure 7-2. Registering Tag Sets in the PLC
  - Common Procedure 7-2-1. Setting Tag Sets Using Physical Addresses
  - Common Procedure 7-2-2. Setting a Tag Using a Symbol
  - Common Procedure 7-2-3. Combining Tags Into a Single Tag Set
- Common Procedure 7-3.Setting Connections
- Common Procedure 7-4.Downloading Connection Settings to Devices
  - Common Procedure 7-4-1. Downloading the Same Connection Settings to All of the Devices in the Network Configurator
  - Common Procedure 7-4-2. Downloading Connection Settings to Selected Devices

Common Procedure 1. Configuration Used in Common Procedures

The following figure shows the configuration and IP addresses used in the common procedures.

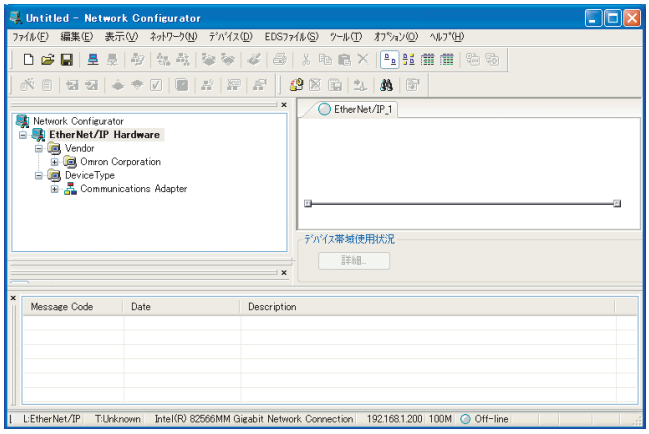
The subnet mask is set to 255.255.255.0 and the same network address is set for all devices.



Common Procedure 2. Starting the Network Configurator

Select ***All Programs*** – ***OMRON*** – ***CX-One*** – ***Network Configurator for EtherNet/IP*** – ***Network Configurator*** from the Windows Start Menu. The Network Configurator will start.

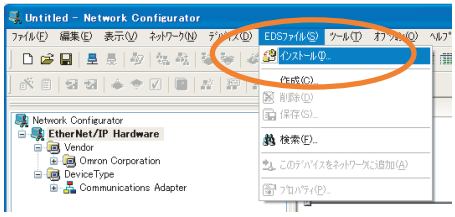
The following window will be displayed.



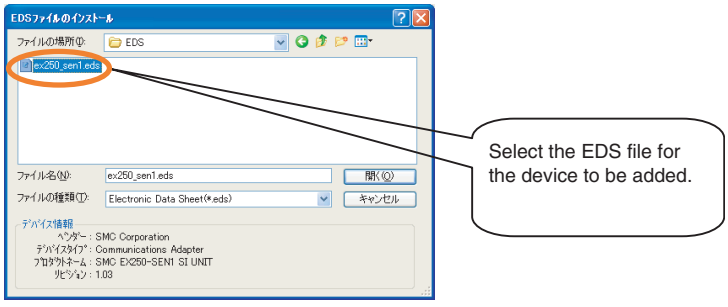
Common Procedure 3. Installing EDS Files

EDS is an acronym for Electronic Data Sheet. An EDS file contains network device information. The OVDA requires that every EtherNet/IP device has an EDS file. Contact the manufacturer of the device to obtain an EDS file. Use the following procedure to install the EDS file.

1,2,3... 1. Using the Network Configurator, select ***EDS File*** – ***Install*** to install the EDS file for the device to be connected.

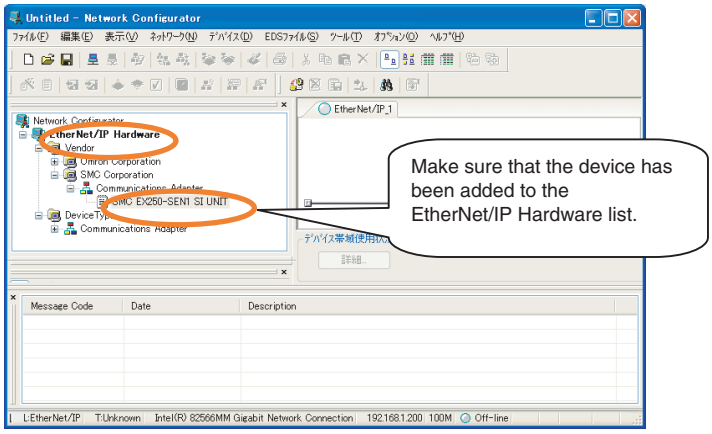


2. Select the EDS file of the device to be installed, and then click the **Open** Button



3. If there is also a device icon to be installed, click the **Yes** Button to start the installation. If there is no icon, click the **No** Button.

When the EDS file has been installed, the device will have been added as shown in the following window.

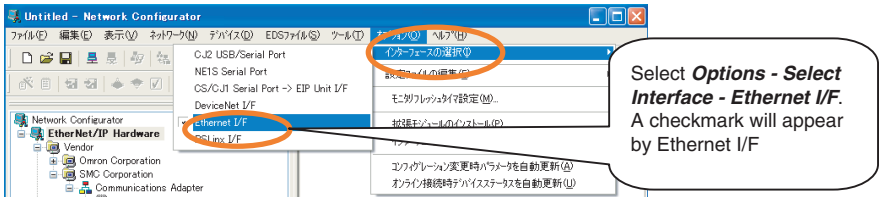


Common Procedure 4. Connecting the Network Online

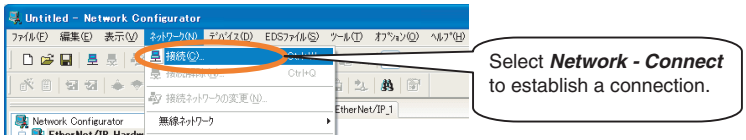
This section describes how to connect the Network Configurator online through Ethernet (i.e., through the EtherNet/IP Unit).

Note Make sure that each device is connected via an Ethernet cable as described in *Common Procedure 1*, and that each device has the same network address.

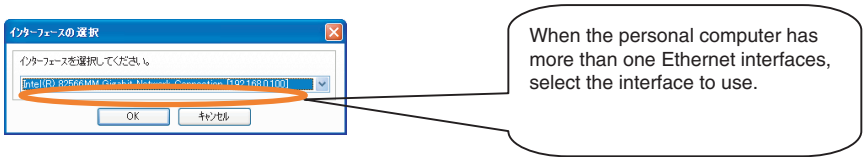
1,2,3... 1. Select the interface for the Network Configurator (select online connection from the personal computer).
Select ***Options*** – ***Select Interface*** – ***Ethernet I/F***.



2. Establish an online connection.
Select ***Network*** – ***Connect***.

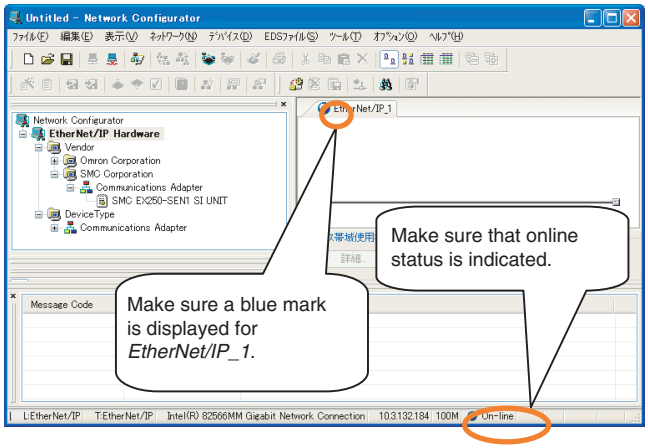


Select the Ethernet interface of the personal computer being used.



In the following diagram, TCP 2 indicates the EtherNet/IP network. Click the **OK** Button.

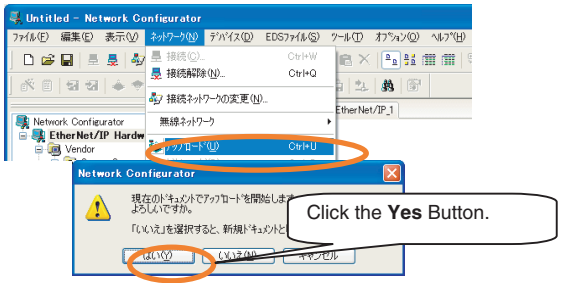
After the connection has been established, the following window will be displayed.



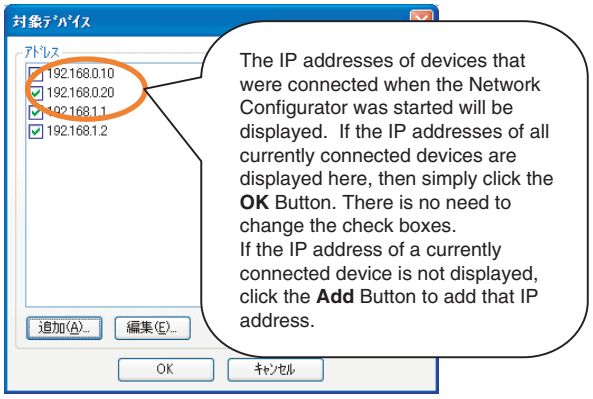
Common Procedure 5. Uploading the Current Network Configuration

This section explains the procedure for uploading the configuration information from the devices connected to the EtherNet/IP network.

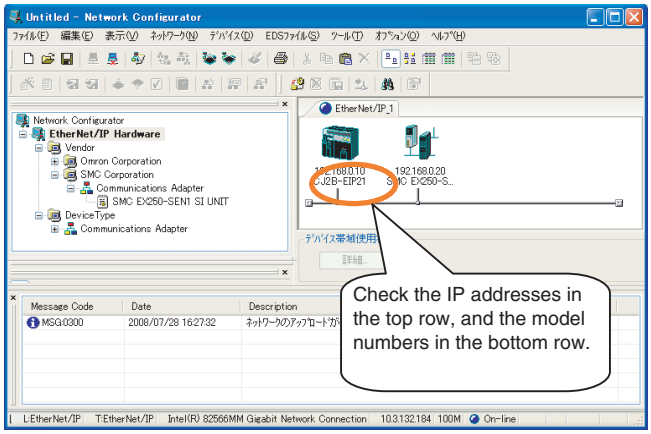
Select ***Network*** – ***Upload*** to start uploading the configuration of the current network.



If the IP address of a connected device does not appear in the IP addresses displayed in this dialog box, click the **Add** Button and register that IP address. There may also be instances where the IP address of an unconnected device is displayed. If that occurs, just click the **OK** Button.



After the configuration information has been uploaded, the following window will be displayed. Check whether all of the connected EtherNet/IP devices are displayed in the window.



Common Procedure 6. Setting IP Addresses

This section explains three ways of setting IP addresses:

- Setting IP addresses for OMRON EtherNet/IP Units
- Setting the IP addresses using the Network Configurator (CIP messages)
- Setting the IP addresses using the BOOTP server

Common Procedure 6-1. Setting IP Addresses for OMRON EtherNet/IP Units

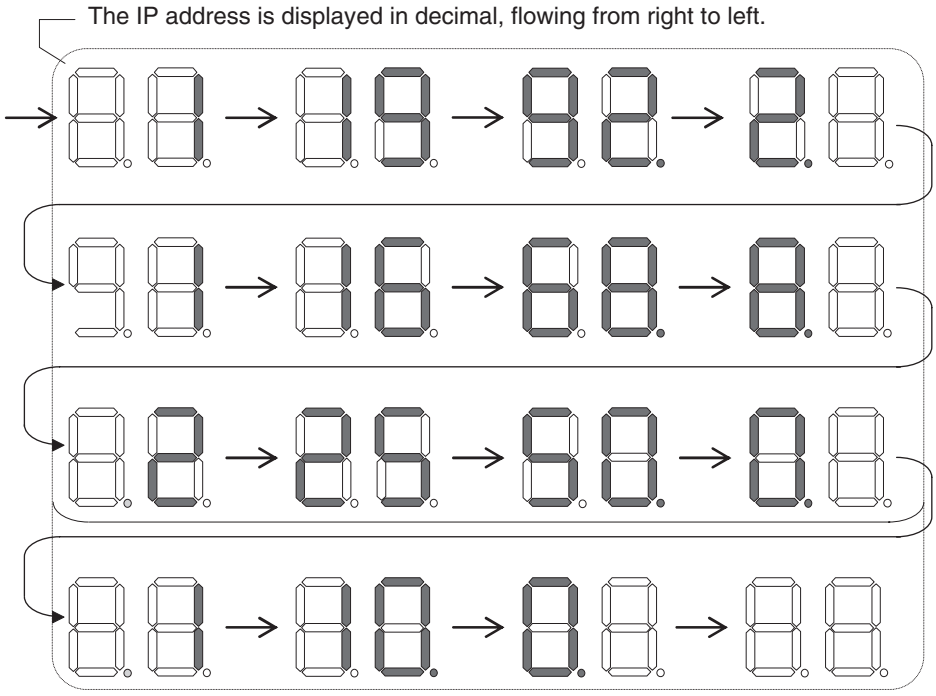
Use the following procedure to set the IP address of the OMRON EtherNet/IP Unit (CJ1W-EIP21, CS1W-EIP21, or CJ2B-EIP21).

1,2,3... 1. Check the current IP address of the EtherNet/IP Unit.
Use the 7-segment display to check the IP address.

7-segment display

When the power is turned ON or the Unit is restarted, all of the segments of the display will flash twice, and then the display will flash “IP” twice. Then, the IP address set for the EtherNet/IP Unit will be displayed once only, flowing from the right to the left.

Example 1: Displaying IP Address 192.168.250.10



2. Set the address of the EtherNet/IP Unit

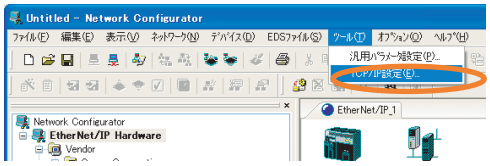
   Refer to *Common Procedure 4. Connecting the Network Online*. For details on setting IP addresses using the Network Configurator (CIP messages), refer to *Common Procedure 6-2*. When setting the IP addresses using a BOOTP server, refer to *Common Procedure 6-3*.

3. Operation after Completing the Setting

   If an F3 error occurs after setting the IP address, set the node switches on the front of the EtherNet/IP Unit to the hexadecimal equivalent of the low-order digit of the IP address.

Common Procedure 6-2. Setting IP Addresses Using the Network Configurator

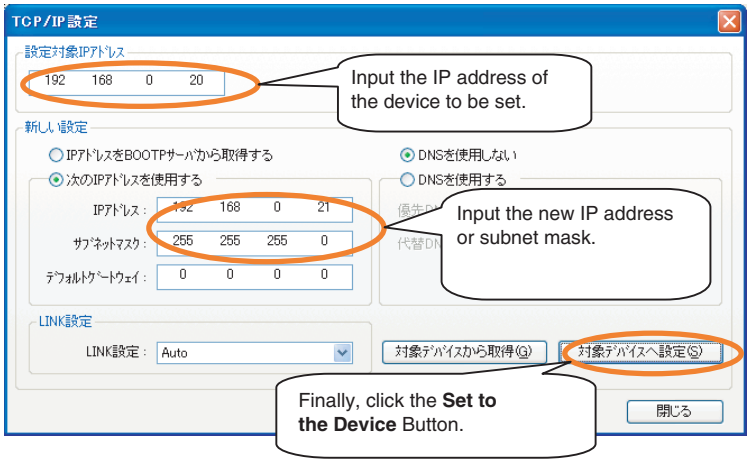
1,2,3... 1. Select ***Tools*** – ***Setup TCP/IP Configuration*** to open the Setup TCP/IP Configuration Dialog Box.



2. Input the IP address of the device that is to be changed in the *Target IP Address Box*.

   Click the **Get from the Device** Button to get the current settings.

   Change the IP address or subnet mask, and then click the **Set to the Device** Button. The new settings will be written to the device.



When the settings have been completed, the following message will be displayed.

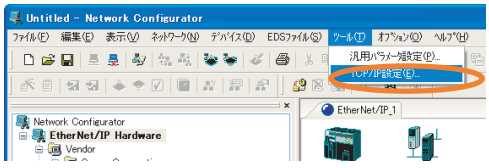
Note If the following message is displayed, perform the steps given below.

- Check whether the device supports IP address setting using the Network Configurator (IP address setting with CIP messages). If this method is not supported, use a different method to set the IP address.
- Repeat the above setting procedure from the very beginning. The IP address that was set for the device with the Network Configurator using a CIP message may not be enabled.

Common Procedure 6-3. Setting IP Addresses Using the BOOTP Server

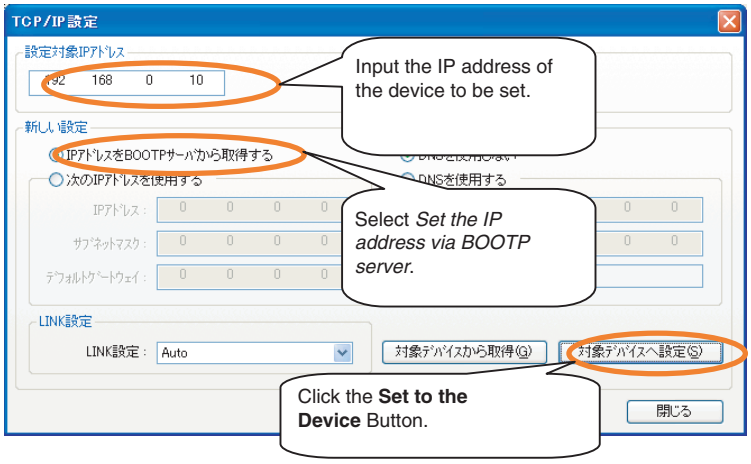
Common Procedure 6-3-1. Enabling BOOTP from the Network Configurator

1,2,3... 1. Select ***Tools*** – ***Setup TCP/IP Configuration*** to open the Setup TCP/IP Configuration Dialog Box.



2. Input the current IP address of the device to be set in *Target IP Address* Box.

   In the *New Configuration* Area, select the *Set the IP address via BOOTP server* Option, and then click the **Set to the Device** Button.



When the settings have been completed, the following message will be displayed.

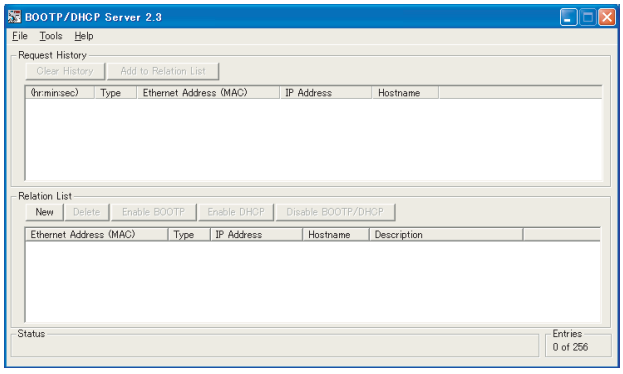
Note If a message like the one shown below is displayed, perform the steps given below.

Repeat the above setting procedure from the very beginning.

Common Procedure 6-3-2. IP Address Setting Using the BOOTP Server

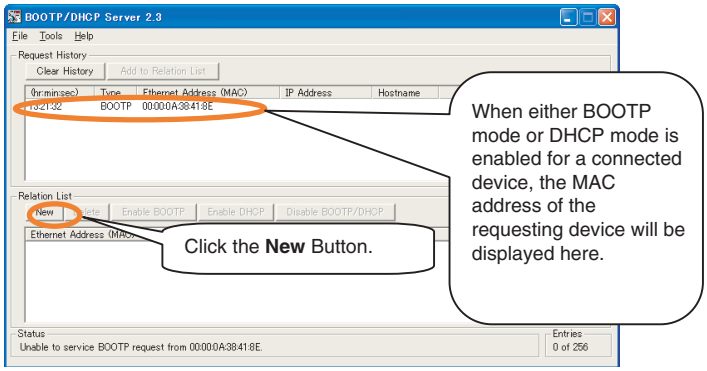
This procedure uses the BOOTP_DHCP Server distributed by Rockwell Automation, Inc., as the BOOTP server. (This server can be downloaded from http://www.ab.com/networks/bootp.html.)

1,2,3... 1. Select ***All Programs*** – ***Rockwell Software*** – ***BOOTP-DHCP Server*** from the Windows Start Button to start the BOOTP server.



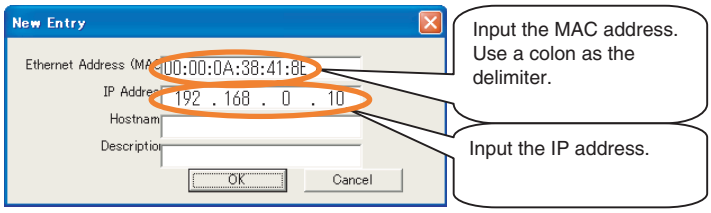
2. Connect those devices in either BOOTP or DHCP mode to the computer.

   For details on how to set BOOTP or DHCP mode, refer to the manual for each device.

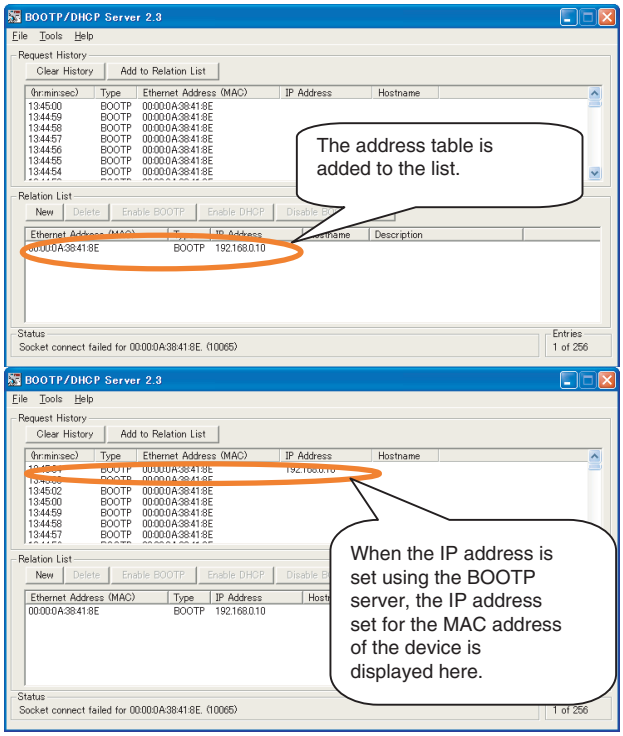


3. Adding to the Relation List

   Check the MAC address of the device to be added. Click the **New** Button in the dialog box. A table is created listing MAC addresses and the corresponding IP addresses assigned to the devices.



After the new entry has been registered, it will be added to the list as shown in the following diagram.



This completes setting the IP address using the BOOTP server.

Note To change the setting so that the IP address is no longer set using the BOOTP server, click the **Disable BOOTP/DHCP** Button. Subsequently, even if the device is turned OFF and then ON again, the IP address will not be set by the BOOTP server, and the device will start with the previous IP address.

Common Procedure 7. Setting Tag Data Links

Common Procedure 7-1. Setting the I/O Sizes of Devices

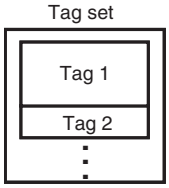
Depending on the device, the I/O sizes may either be fixed or symbol. For details on setting the device I/O sizes, refer to the manual for each device.

Common Procedure 7-2. Registering Tag Sets in the PLC.

Set the tag set in the PLC that is to function as the master. The tag set size must be the same as the device I/O size of the communications partner.

Two methods of registering a tag set are provided: using the physical addresses *(Common Procedure 7-2-1)*, and using symbols *(Common Procedure 7-2-2)*

Note The following diagram illustrates the relationship between tag sets and tags.

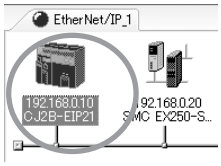


- A tag set contains one or more tags.
- The size of a tag set will be equal to the total of the sizes of all of the tags in the tag set.

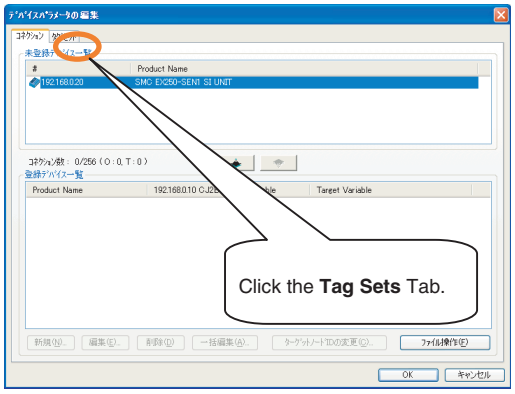
Common Procedure 7-2-1. Setting Tag Sets Using Physical Addresses

Use the following procedure to directly set physical addresses (e.g., in the CIO or DM Area) in the CPU Unit a PLC in the tag set.

1,2,3... 1. Double-click the icon for the EtherNet/IP Unit (CJ2B-EIP21 in the figure).



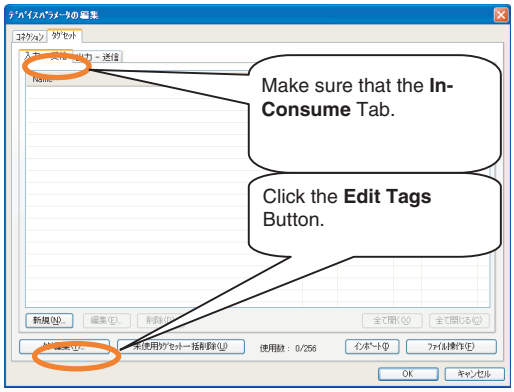
The Edit Device Parameters Dialog Box for the EtherNet/IP Unit will be displayed.



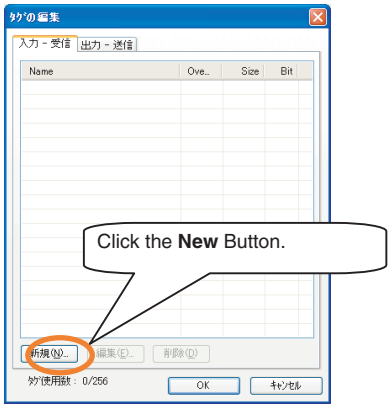
2. Register the tags.

Set the input tags first. An input tag receives the data that is output from the target.

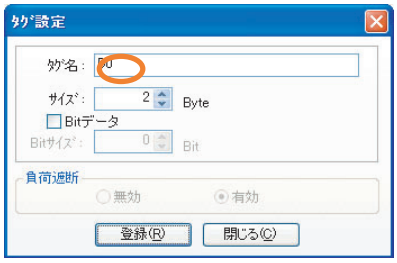
Click the **In-Consume** Tab, and then click the **Edit Tags** Button.



The Edit Tags Dialog Box will be displayed. Click the **New** Button.



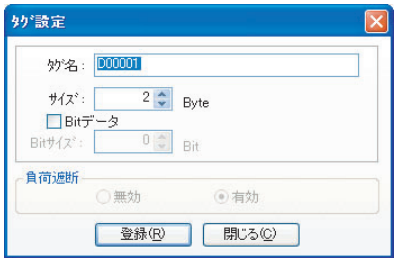
Set the tag name and size. Set the size in increments of 2 bytes. The input size must be the same as the output size of the target device. Click the **Register** Button to register the tag.



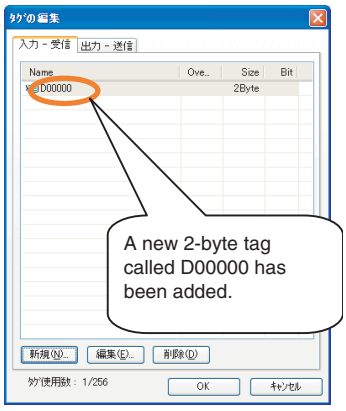
The tag name depends on the physical address, as shown below. *Addresses that do not appear in the following table cannot be specified. Also, the number of EM banks varies with the CPU Unit of the PLC.

Physical address		Address (text to input in *Name* Field)
CIO Area		0000 to 6143
Holding Area		H000 to H511
Work Area		W000 to W511
DM Area		D00000 to D32767
EM Area	Bank 0	E0_00000 to E0_32767
	to	to
	Bank 24	E18_00000 to E18_32767

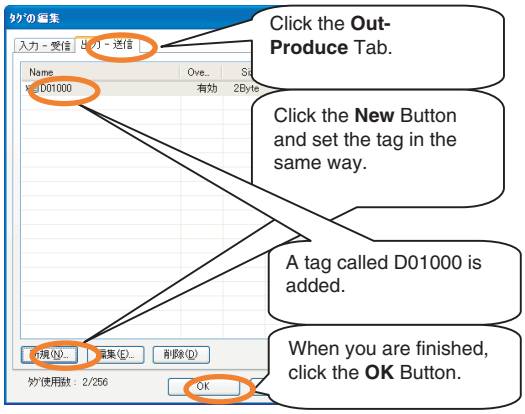
The Edit Tag Dialog Box shown below will be displayed. When you are finished registering tags, click the **Close** Button.



A tag will be registered.

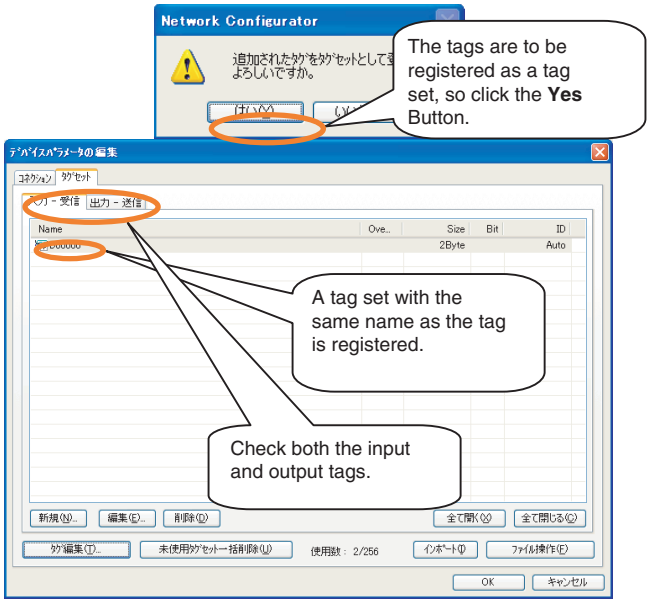


In the same way, set the output tag.



3. Register the tag set.

   A message will be displayed asking if the registered tags are to be registered as a tag set. Click the **Yes** Button.



Common Procedure 7-2-2. Setting Tags Using Symbols

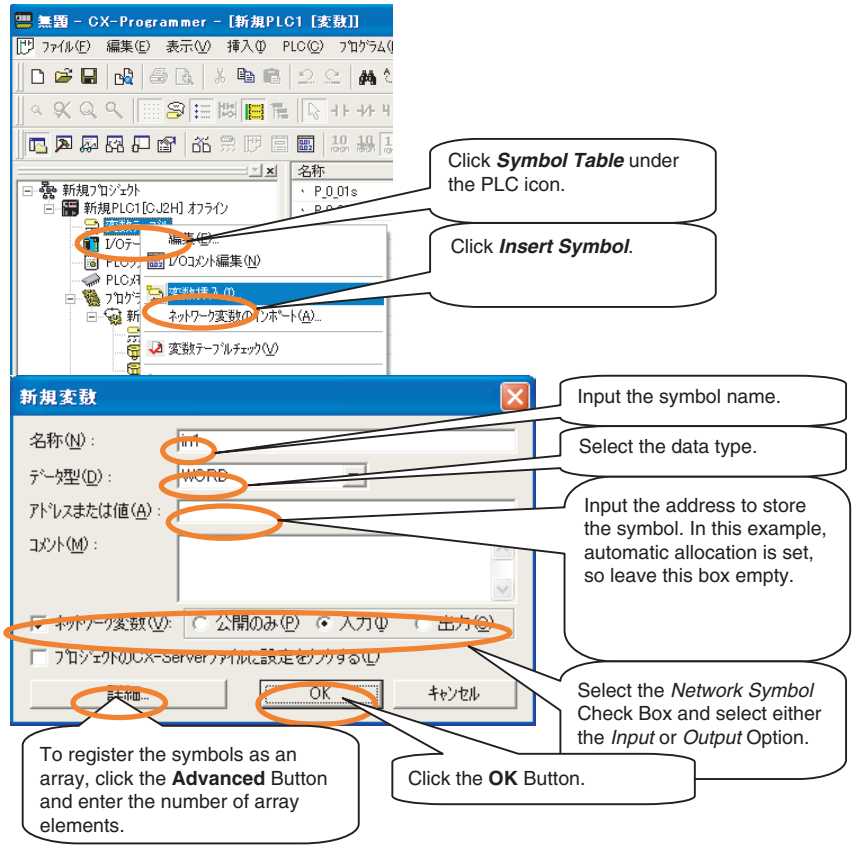
Use the following procedure to use CX-Programmer to create a symbol, which can then loaded as a tag by the Network Configurator.

1,2,3...

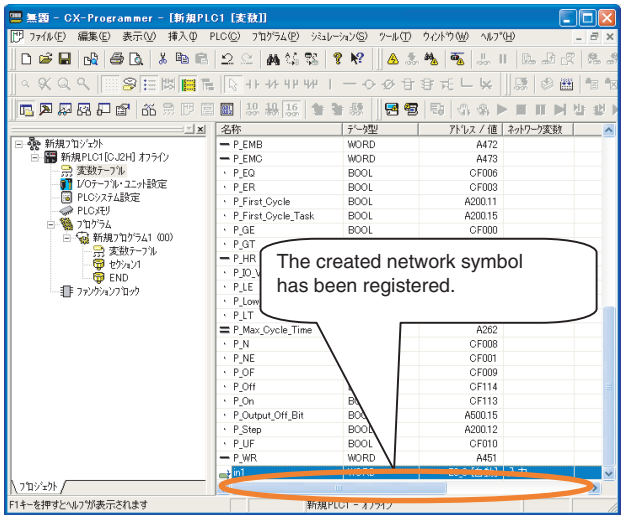
1. Register the symbol with the CX-Programmer.

   Start the CX-Programmer specifying the model number of the CPU Unit you are using.

2. Register the symbol.



When a network symbol has been created, a window like the one shown below will be displayed.

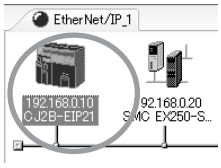


For example, the symbols shown below are created.

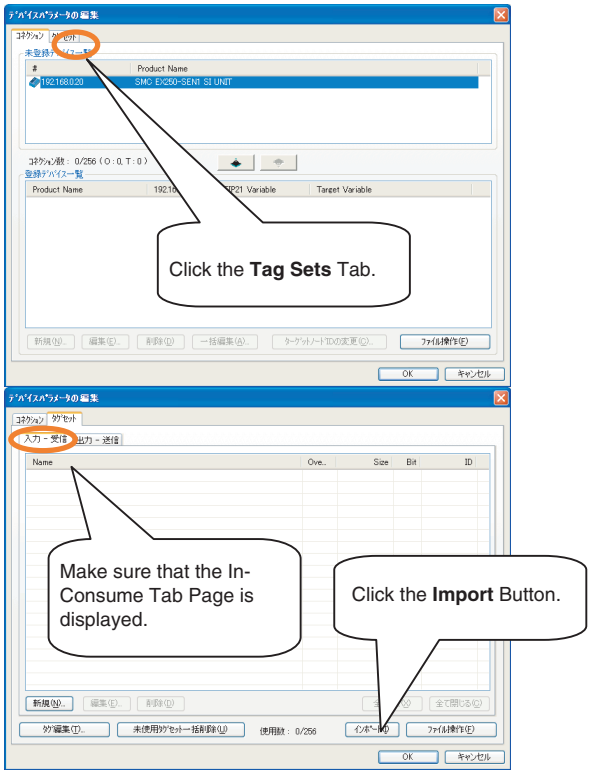
3. Import the symbol to the Network Configurator.

   Start the Network Configurator while CX-Programmer is running.

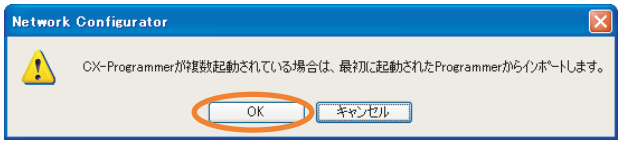
   Double-click the icon for the EtherNet/IP Unit (CJ2B-EIP21 in the diagram).



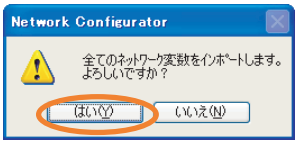
The Edit Device Parameters Dialog Box for the EtherNet/IP Unit will be displayed.



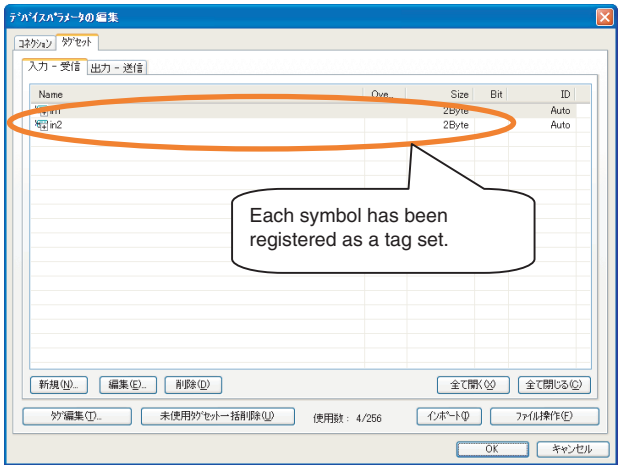
A message like the one shown below will be displayed. Click the **OK** Button.



A message like the one shown below will be displayed. Click the **Yes** Button.



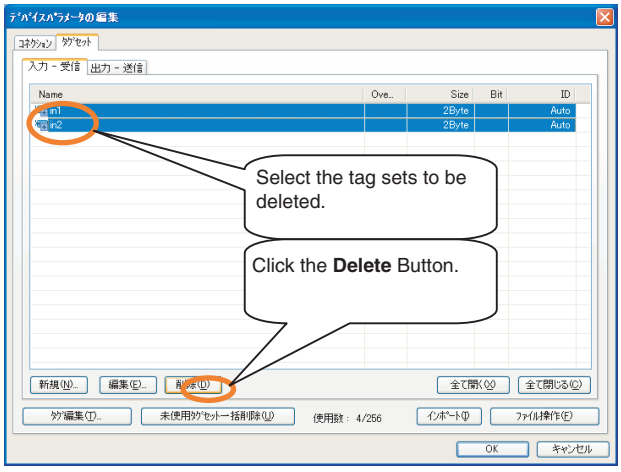
A dialog box like the one shown below will be displayed. Each network symbol has been registered as a tag set.



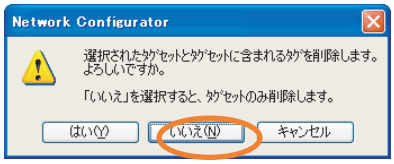
Common Procedure 7-2-3. Combining Multiple Tags Into a Single Tag Set

The procedure shows how to combine more than one tag into a tag set.

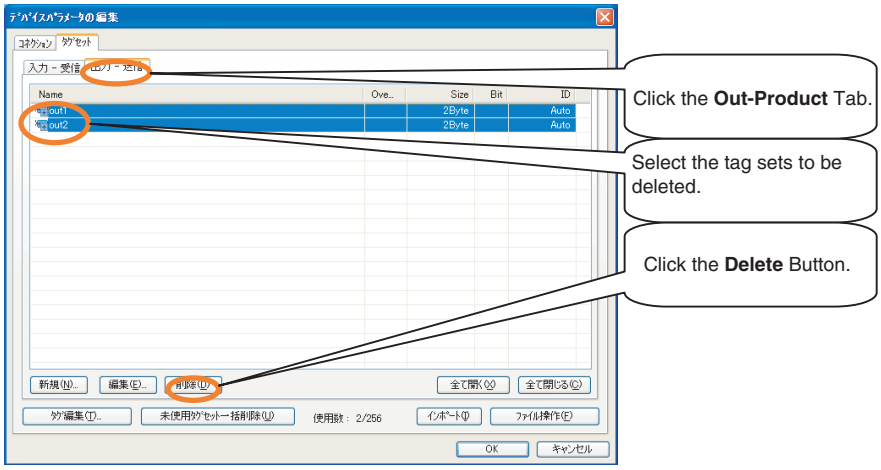
Delete the tag sets without deleting the tags.



A warning message like the one shown below will be displayed. When only the tag sets are to be deleted, click the **No** Button.

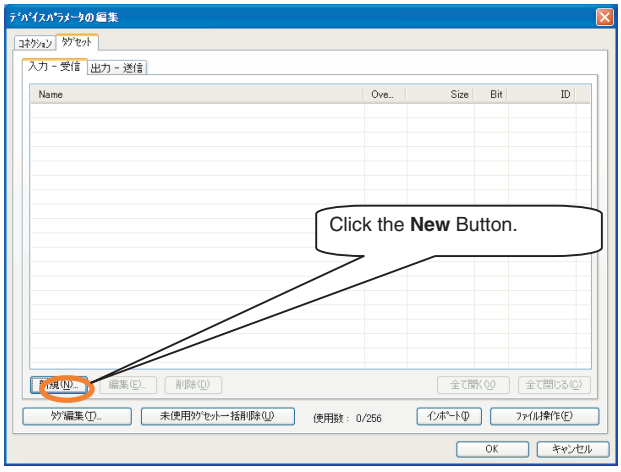


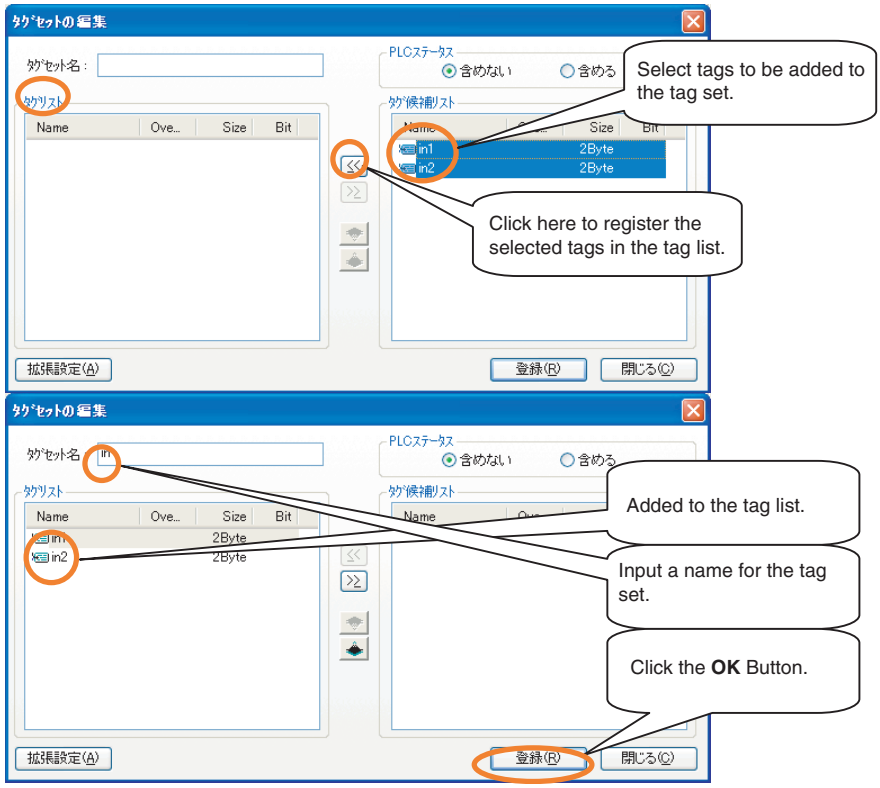
Also delete the output tag sets.



The tag sets will be deleted.

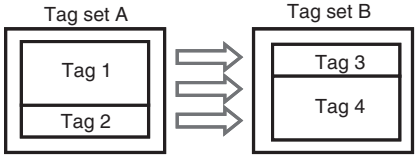
Create a new tag set into which the tags will be combined.



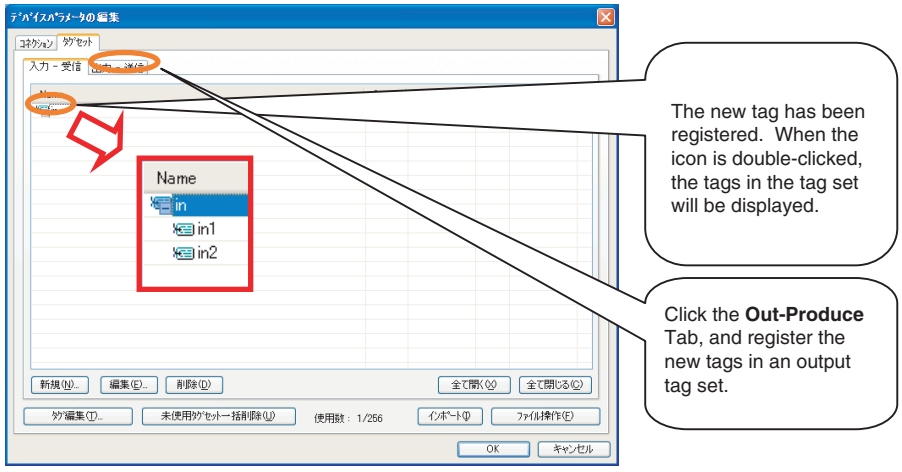


A message will appear asking whether another tag set is to be created. If no other tag sets are to be created, click the **Close** Button.

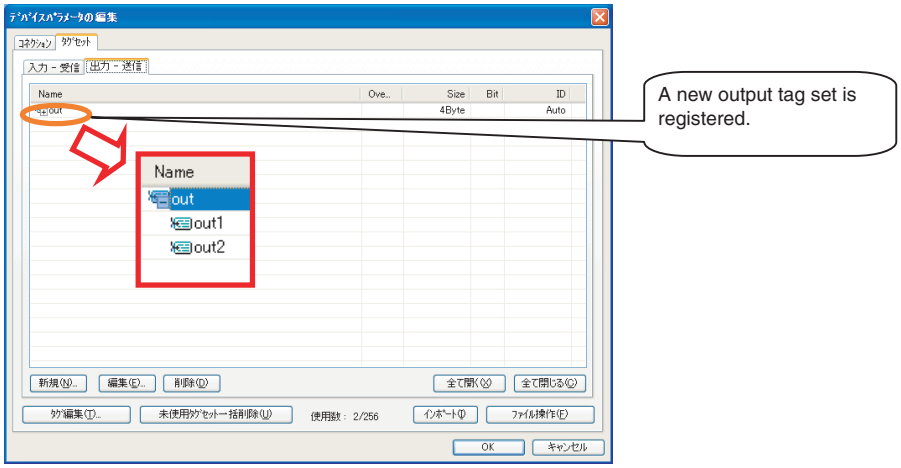
Note When tag data links operate, data is sent in the order in which the tags are registered in the tag set. When combining tags into a tag set, pay attention to the order and size of the tags.



The new tag set has been registered.



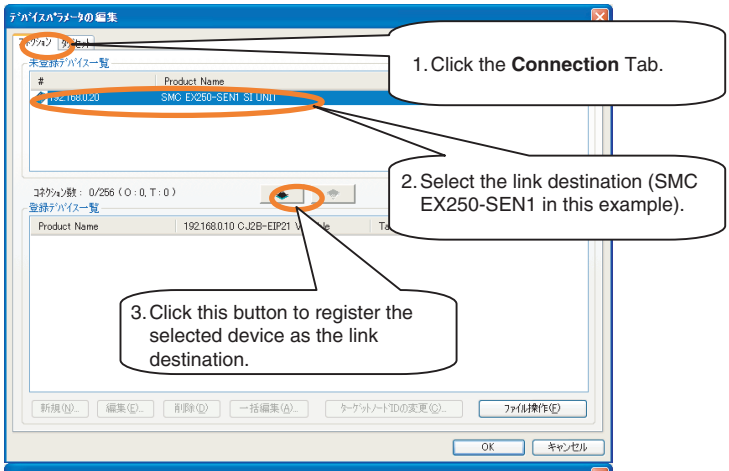
Also register the output tag set.

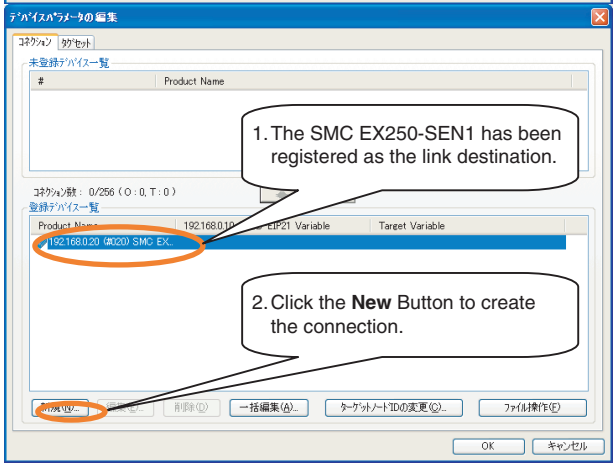


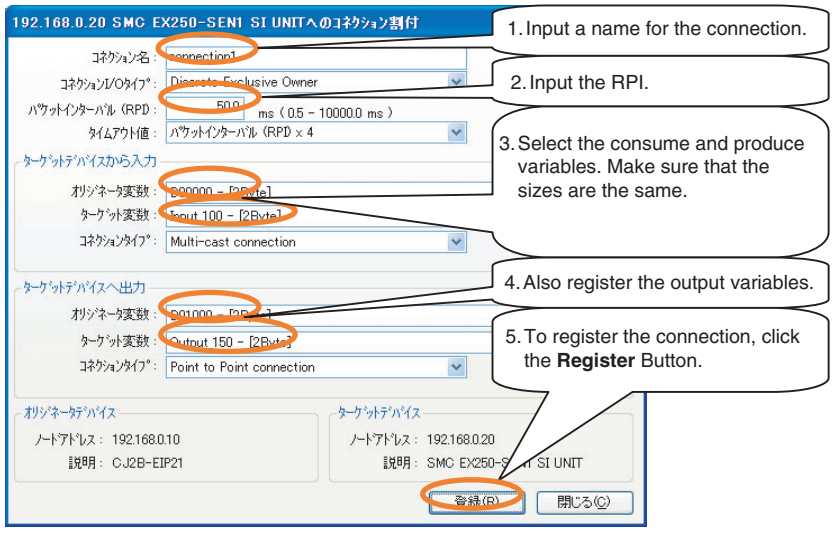
This completes the combining tags into a tag set.

Common Procedure 7-3. Setting Connections

This procedure is performed using the CJ2B-EIP21 Edit Device Parameters Dialog Box.

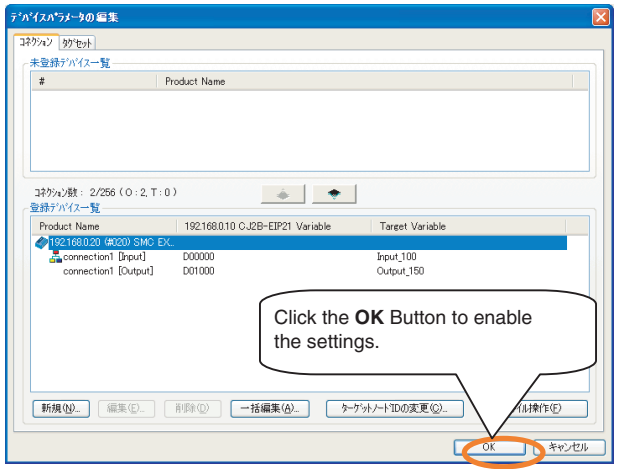




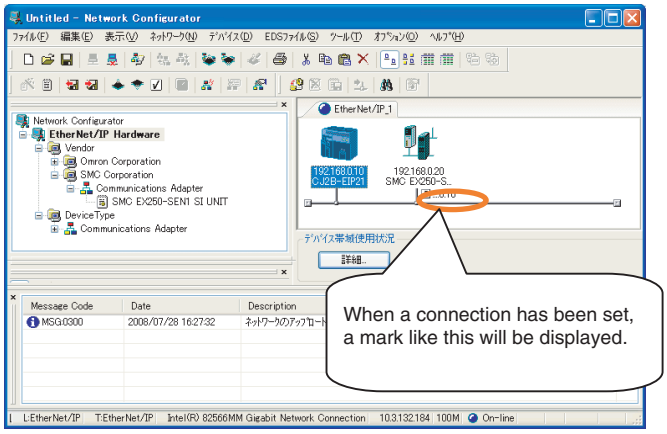


The dialog box for making connections will not close. If no more connections are to be created, click the **Close** Button.

The new connection will be displayed in the Registered Device List.



After the connection settings have been made, a window like the one shown below will be displayed.



This completes the connection settings.

Common Procedure 7-4. Downloading the Connection Settings to a Device.

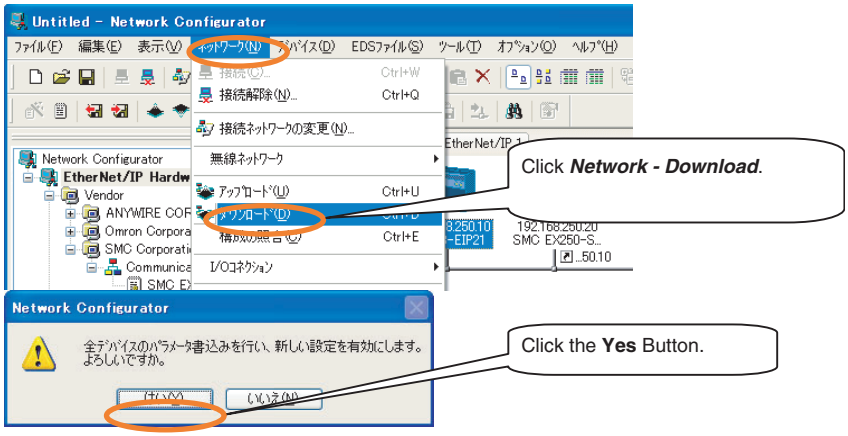
This section explains how the connection settings made with the Network Configurator are downloaded to the devices and enabled.

Either of the following two methods can be used.

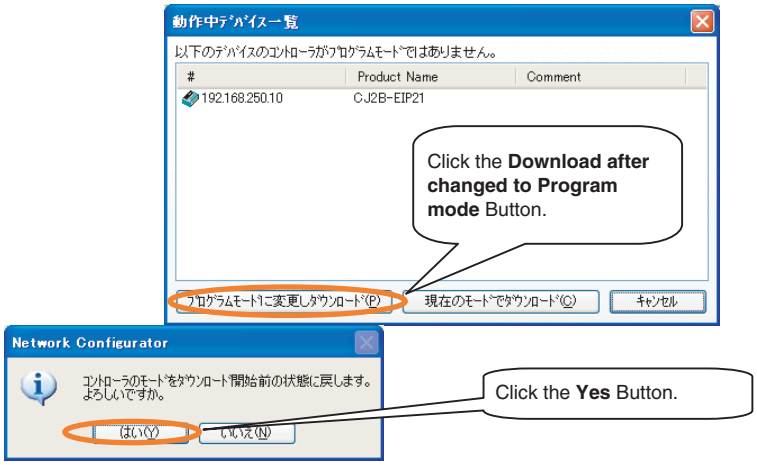
- Downloading the same connection settings to all devices in the Network Configurator
- Downloading connection settings only to selected devices

Common Procedure 7-4-1 Downloading the Same Connection Settings to all Devices in the Network Configurator

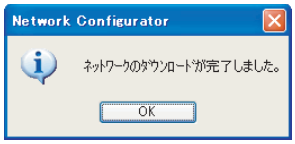
Use the following procedure to download the same connection settings to all of the devices displayed in the window.



Depending on the status of the connected PLC, a window like the one shown below may be displayed.



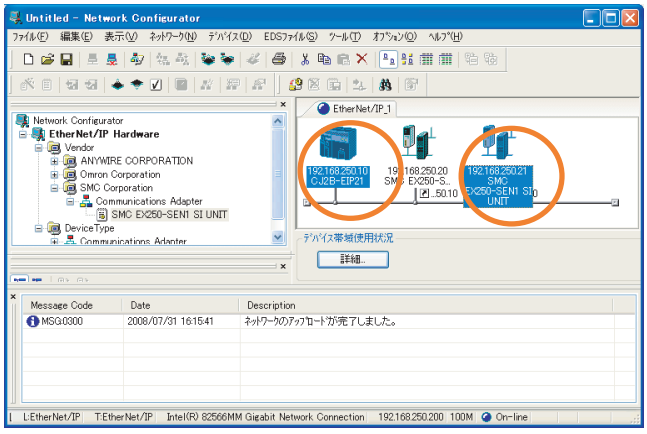
After the connection settings have been downloaded, a message like the one shown below will be displayed. Click the **OK** Button.



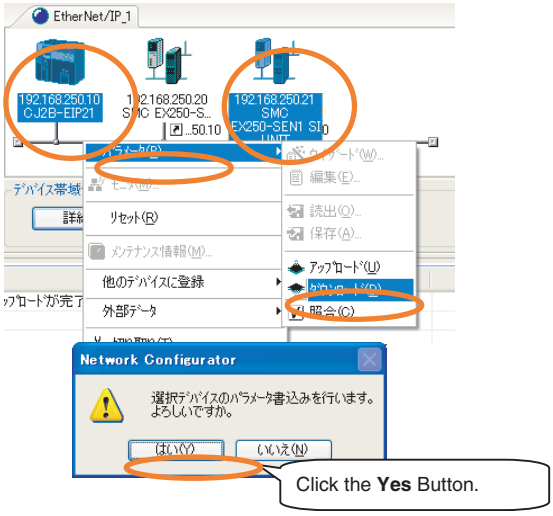
Common Procedure 7-4-2 Downloading Connection Settings to Selected Devices

From the devices displayed in the window, select those to which the connection settings are to be downloaded.

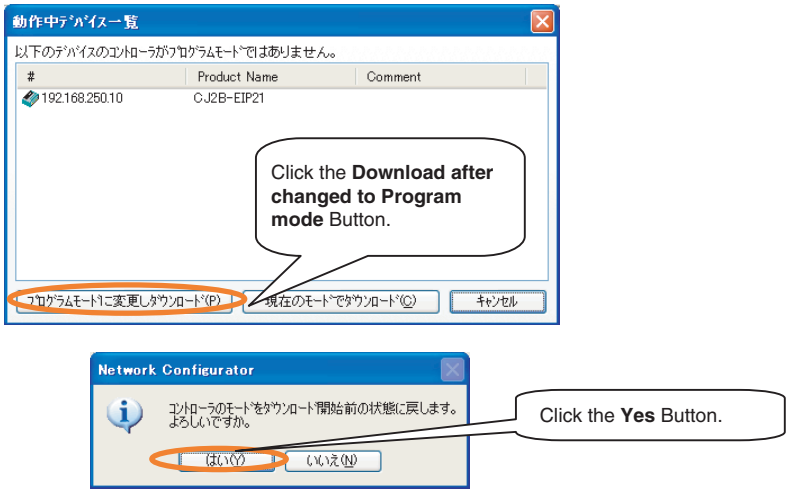
Select devices from among those displayed in the window. In the following example, the device on the left and device on the right are selected.



Right-click and select ***Parameter*** – ***Download***.



Depending on the status of the connected PLC, a window like the one shown below may be displayed.

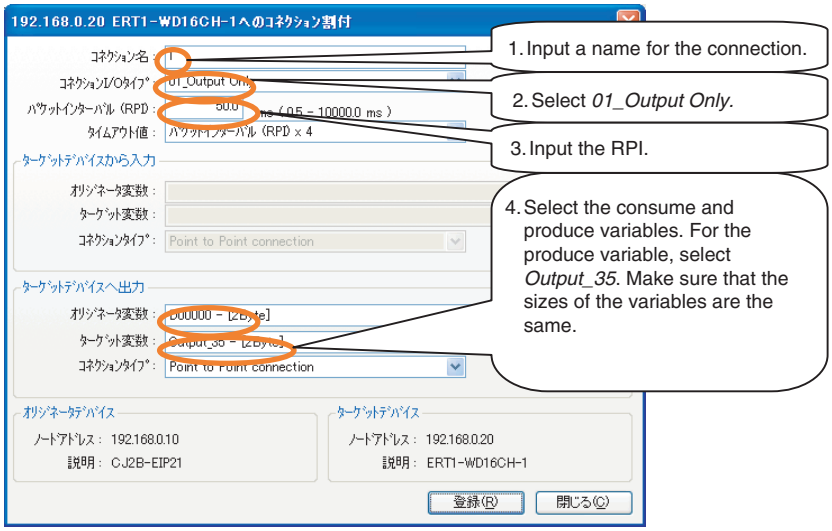


After the connection settings have been downloaded, a message like the one shown below will be displayed. Click the **OK** Button.

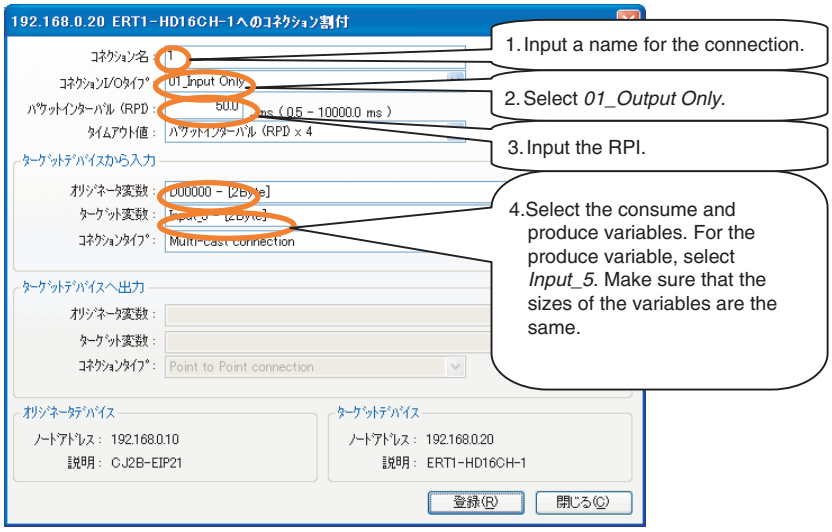
2-1-6 Edit Connection Dialog Boxes

The following figures show examples of connection settings for various EtherNet/IP Slave Units.

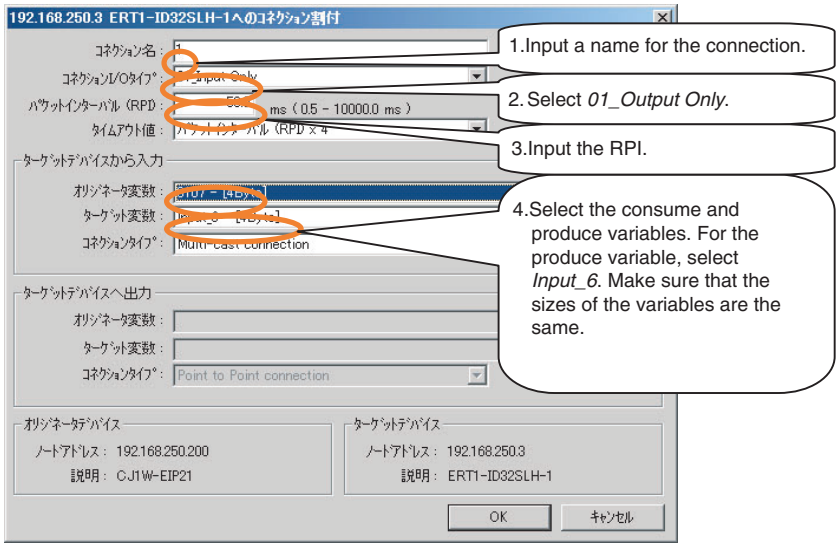
- ERT1-WD16CH-1



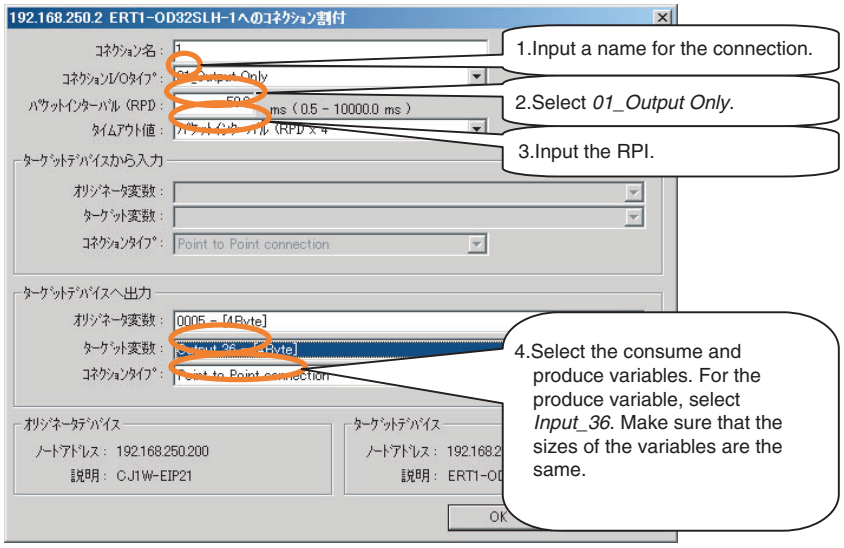
- ERT1-HD16CH-1



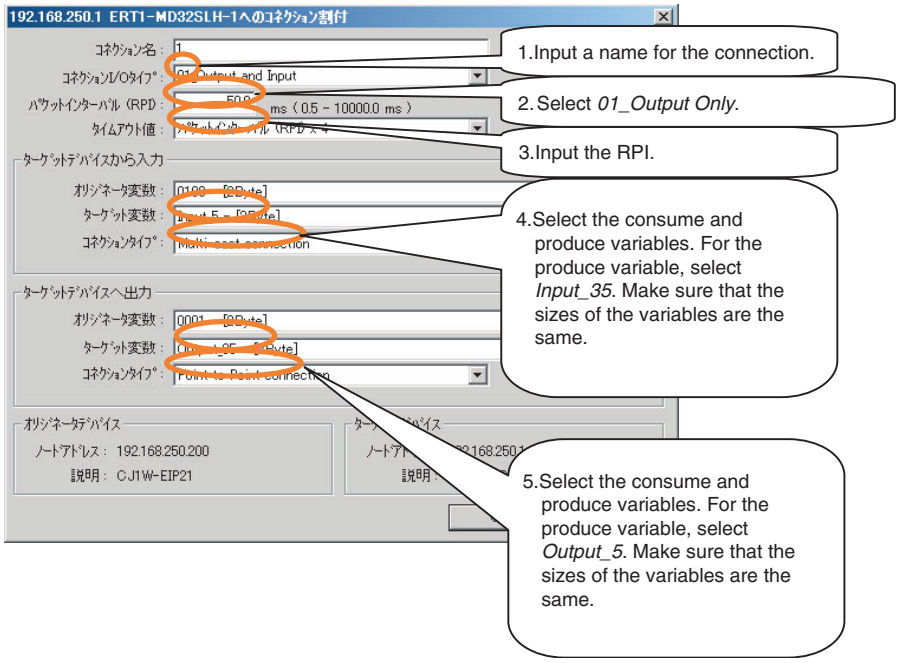
- ERT1-ID32SLH-1



- ERT1-OD32SLH-1



- ERT1-MD32SLH-1



2-2 Recommended Network Devices

The following table shows the devices recommended for use with the EtherNet/IP.

Part	Maker	Model number	Inquires
Switching Hub	Cisco Systems, Inc.	Consult the manufacturer.	Cisco Systems, Inc. Main Corporate HQ
	Contec USA, Inc.	Consult the manufacturer.	CONTEC USA Inc.
	Phoenix Contact	Consult the manufacturer.	Phoenix Contact USA Customer Service
Twisted-pair cable	100BASE-TX		
	Fujikura	F-LINK-E 0.5mm × 4P	Fujikura America, Inc.
	EtherNet/IP compliant cable		---
Connectors (Modular plug)	STP Plug		
	Panduit Corporation	MPS588	Panduit Corporation US Headquarters
Boots	Tsuko Company	MK boot (IV) LB	Tsuko Company Japan Headquarters

Note (1) Always use a switching hub when using tag data links in the network.

(2) If a repeater hub is used for EtherNet/IP tag data links (cyclic communications), the network's communications load will increase, data collisions will occur frequently, and stable communications will be impossible.

2-2-1 Network Devices Manufactured by OMRON

The following network devices are manufactured by OMRON for EtherNet/IP networks.

Name	Model	Function	Number of ports	Error detection output
Switching hub	W4S1-03B	Packet priority control (QoS): EtherNet/IP control data priority Failure detection: Broadcast Storm, LSI error detection, 10/100Base-TX, Auto-Negotiation	3	None
	W4S1-05B		5	None
	W4S1-05C		5	Provided

SECTION 3
Basic Specifications of Slave Units

This section provide the basic specifications of the EtherNet/IP Slave Units

3-1 Basic Specifications of Slave Units

This section gives the specifications that are the same for all Slave Units. For specifications that vary with the Slave Unit, refer to the section for each Slave Unit.

3-1-1 Communications Specifications

Item		Specifications
Communications protocol		EtherNet/IP
Type		100Base-TX (See note.)
Transfer specifications	**Media access method**	CSMA/CD
	Modulation method	Baseband
	Transmission paths	Star form
	Baud rate	100 Mbit/s (100Base-TX)
	Transmission media	Shielded twisted-pair (STP) cable Categories: 100 Ω at 5, 5e or higher
	Transmission distance	100 m (distance between hub and node)
	Number of cascade connections	There is no limitation when a switching hub is used.

Note If tag data links are being used, use 100Base-TX.

3-1-2 Performance Specifications

Item	Specifications
Unit power supply voltage	20.4 to 25 VDC
I/O power supply voltage	20.4 to 26.4 VDC (24 VDC, −15 to +10%)
Noise immunity	Power lines: Conforms to IEC 61000-4-4 2 kV. Conforms to the following EC Directives: IEC 61000-4-2 IEC 61000-4-3 IEC 61000-4-5 IEC 61000-4-6
Vibration resistance	10 to 60 Hz with 0.35-mm amplitude 10 times each up, down, right, and left 60 to 150 Hz, 50 m/s^2
Shock resistance	Maximum acceleration of 150 m/s^2 3 times each up, down, right, and left
Insulation resistance	20 MΩ min. (at 250 VDC) between current-carrying circuits and non-current-carrying circuits
Ambient temperature	−10 to 55°C
Ambient humidity	25% to 85% (with no condensation)
Storage temperature	−25 to 65°C
Mounting	Mounted on 35-mm DIN Track, or secured with M5 screws (depending on model)

3-1-3 Communications Indicators

The communications indicators have the following meanings.

MS (Module Status): Indicates the status of the node with a two-color LED (green/red).

NS (Network Status): Indicates the status of communications with a two-color LED (green/red).

Name	Indicator status	Node/communications status	Meaning
MS	Lit green.	Normal status	The Unit is operating normally.
	Lit red.	Fatal error	A hardware error has occurred in the Unit. The watchdog timer has timed-out.
	Flashing red.	Non-fatal error	There is an error in the switch settings.
	Not lit.	Power OFF or Startup	The power supply is OFF, the Unit is being reset, or the Unit is being initialized.
NS	Lit green.	Online and participating	Tag data link communications have been established and normal communications are in progress.
	Flashing green.	Online but not participating	Normal communications are in progress, but tag data link communications have not been established.
	Lit red.	Fatal communications error	The address is set out of range. The same address has been set for more than one node.
	Flashing red.	Non-fatal communications error	Communications has timed out.
	Not lit.	Power OFF or offline	The power supply is OFF or the cable is not connected.

Note When flashing, indicators are lit for 0.5 s and not lit for 0.5 s.

SECTION 4
Digital I/O Slave Units

This section describes the Digital I/O Slave Units for EtherNet/IP.

4-1 Status Areas

A Digital I/O Slave Unit has two internal status areas: the Generic Status Area and the I/O Status Area. The status flags in these areas are turned ON and OFF based on the threshold values set by the user for each function in that Unit.

4-1-1 Generic Status Area

The Digital I/O Slave Unit's Generic Status Area contains the following 16 bits.

Bit	Content	Description
00	I/O Power Supply Status Flag 1 OFF: I/O power is ON ON: I/O power is not ON.	Turns ON when I/O power is not being supplied to terminal block 1.
01	I/O Power Supply Status Flag 2 OFF: I/O power is ON ON: I/O power is not ON.	Turns ON when I/O power is not being supplied to terminal block 2.
02	Reserved	---
03	Reserved	---
04	Power or Load Short-circuit Detection Flag OFF: Normal ON: Short-circuit	Turns ON when there is a short in the power supply or load connection to the connected devices, including wiring mistakes and connected device failure.
05	Disconnection Flag OFF: Connected ON: Disconnected	Turns ON when the sensor power supply is not connected or the load is disconnected due to a wiring error, failure in the connected device, etc.
06	Reserved	---
07	Reserved	---
08	EEPROM Data Error Flag OFF: Normal ON: Error occurred	Turns ON when there is an error in the EEPROM data.
09	Reserved	---
10	Reserved	---
11	Reserved	---
12	Reserved	---
13	Reserved	---
14	Reserved	---
15	Reserved	---

4-1-2 I/O Status Area

The I/O Status Area for a Digital I/O Slave Unit consists of the following 8 bytes (64 bits). The I/O Status Area indicates the short-circuit and disconnection error status for each terminal.

Byte offset	Data							
	Bit 07	06	05	04	03	02	01	00
0	Power or Load Short-circuit Detection Flags for Terminal Block 1							
	07	06	05	04	03	02	01	00
1	Power or Load Short-circuit Detection Flags for Terminal Block 1							
	15	14	13	12	11	10	09	08
2	Power or Load Short-circuit Detection Flags for Terminal Block 2							
	07	06	05	04	03	02	01	00
3	Power or Load Short-circuit Detection Flags for Terminal Block 2							
	15	14	13	12	11	10	09	08
4	Disconnection Flags for Terminal Block 1							
	07	06	05	04	03	02	01	00
5	Disconnection Flags for Terminal Block 1							
	15	14	13	12	11	10	09	08
6	Disconnection Flags for Terminal Block 2							
	07	06	05	04	03	02	01	00
7	Disconnection Flags for Terminal Block 2							
	15	14	13	12	11	10	09	08

4-2 Screw-less Clamp Terminals

The screw-less clamp terminal has a structure designed for clamping to a terminal block. It is a reduced-wiring, labor-saving Slave that can make wiring easy by simply inserting ferrules (with sleeves). The Unit and terminal block can be detached, making it possible to replace the Unit in the event of a failure without removing the wiring.

A detection function is also provided to help quickly discover short-circuits and disconnections for sensors or other devices.

4-2-1 Wiring to a Screw-less Clamp Terminal Block

Screw-less clamp terminals provide clamp-type terminal blocks that allow wiring without screws. When connecting a sensor or an external device, a ferrule must be attached to the cable for the sensor or device. The following ferrules are applicable.

Manufacturer	Model	
Phoenix Contact	AI-0.5-10	0.5 mm^2 (AWG 20)
	AI-0.75-10	0.75 mm^2 (AWG 18)
	AI-1.5-10	1.25 mm^2 (AWG 16)
	AI-2.5-10	2.0 mm^2 (AWG 14)
Nihon Weidmuller	H 0.5/16 D	0.5 mm^2 (AWG 20)
	H 0.75/16 D	0.75 mm^2 (AWG 18)
	H 1.5/16 D	1.25 mm^2 (AWG 16)
	H 2.5/16 D	2.0 mm^2 (AWG 15)

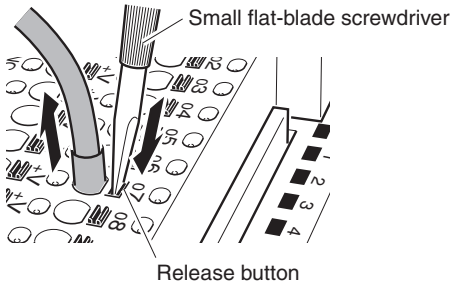
Wiring to a Clamp Terminal Block

Insertion

Insert the ferrule all the way to the end in any terminal hole.

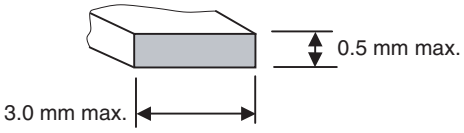
Removal

Pull out the power line while pressing down with a small flat-blade screwdriver on the release button above the terminal hole.



Screwdriver Used to Remove Ferrules

You will need a screwdriver that is consistently thin for the entire length.



Recommended Screwdriver Model

Model	Manufacturer
SZF1	Phoenix Contact

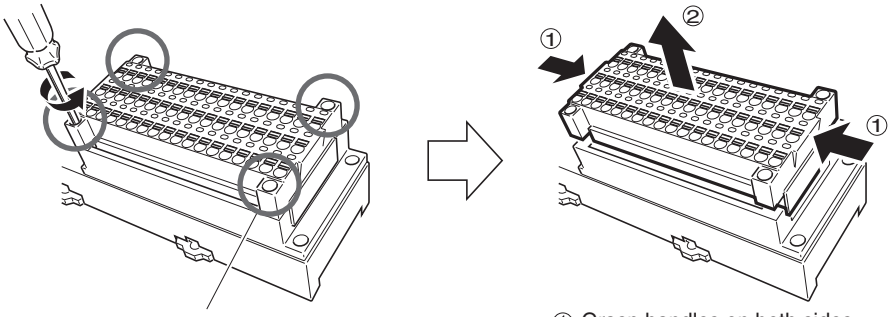
Removing and Mounting a Clamp Terminal Block

Removal

Use a flat-blade screwdriver to loosen the four screws on the top of the terminal block, and then grasp the handles on both sides and remove the terminal block.

Mounting

Grasp the handles on both sides of the terminal block, and insert the terminal block firmly in place. Then use a flat-blade screwdriver to tighten the four screws on the top of the terminal block.



Note Tighten the screws to a torque of 0.2 to 0.25 N·m.

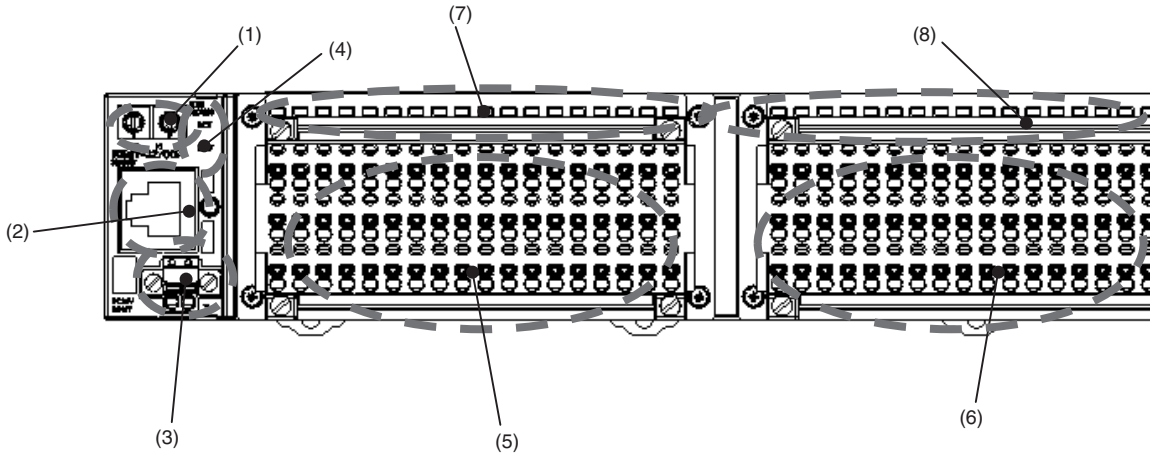
4-2-2 Thirty-two-point Input Units (with Screw-less clamps)

ERT1-ID32SLH-1

Input Specifications

Item	Specifications
Input points	32 points
Internal I/O common	PNP
ON voltage	15 V DC min. (between each input terminal and 0 V)
OFF voltage	5 V DC max. (between each input terminal and 0 V)
OFF current	1.0 mA max.
Input current	6.0 mA max. at 24 V DC 3.0 mA max. at 17 V DC
ON delay time	1.5 ms max.
OFF delay time	1.5 ms max.
Number of circuits	16 points with one common circuit
Isolation method	Photocoupler isolation
Input indicators	LEDs (yellow)
Power supply short-circuit protection	Operates at 50 mA/point min.
Disconnection detection	Operates at 0.2 mA/point max.
Current consumption	Communications power supply (including internal circuits): 110 mA max.
Connection forms	Screw-less clamp terminal blocks (orange)
Mounting	35-mm DIN Track mounting
Weight	485 g max.
Standard accessories	FKMCP1.52STF3.5AUSOO (Phoenix Contacts) (connector with lock screws)

Component Names and Functions



(1) Rotary Switches

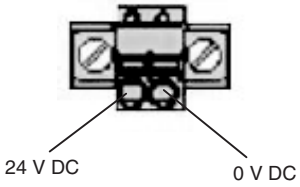
These switches are used to set the node address.

(2) Ethernet Connector

The network communications cable is connected to this connector.

(3) Power Supply Connector

The communications and Unit power supply is connected to this connector.



Terminal	Specification
+	24 V DC
–	0 V DC

Applicable Ferrules

Manufacturer	Model	Applicable wire size
Phoenix Contact	AI-0.5-10	0.5 mm^2 (AWG 20)
Nihon Weidmuller	H 0.5/16 D	0.5 mm^2 (AWG 20)

(4) Communications Indicators: MS and NS

These indicators show the Unit communications status and network communications status.

(5) and (6) Terminal Blocks 1 and 2

The input devices and input power supply are connected to these terminal blocks.

(7) and (8) Input Indicators

These indicators show the ON/OFF status of the inputs and the error status of connected devices.

Indicators

Communications Indicators

Refer to *3-1-3 Communications Indicators*.

I/O Indicators

The meanings of the input indicators are given in the following table.

Indicator name	Status	Color	Meaning (main error)
0 to 15	▭	Yellow	Lit yellow when input is ON.
	✳	Red	Flashing red when the load is disconnected. Automatically reset when the load is connected.
	▭	Red	Lit red when the load is short-circuited. Automatically reset when the short-circuit is removed.
	■	OFF	Not lit when input is OFF.
I/O	▭	Green	Lit green when I/O power is being supplied.
	■	OFF	Not lit when I/O power is not being supplied.

Setting the Node Address

The rotary switches are used to set the lower digits of the IP address.

Setting method	Two hexadecimal digits
Setting range	01 to FE

Rotary Switch Settings

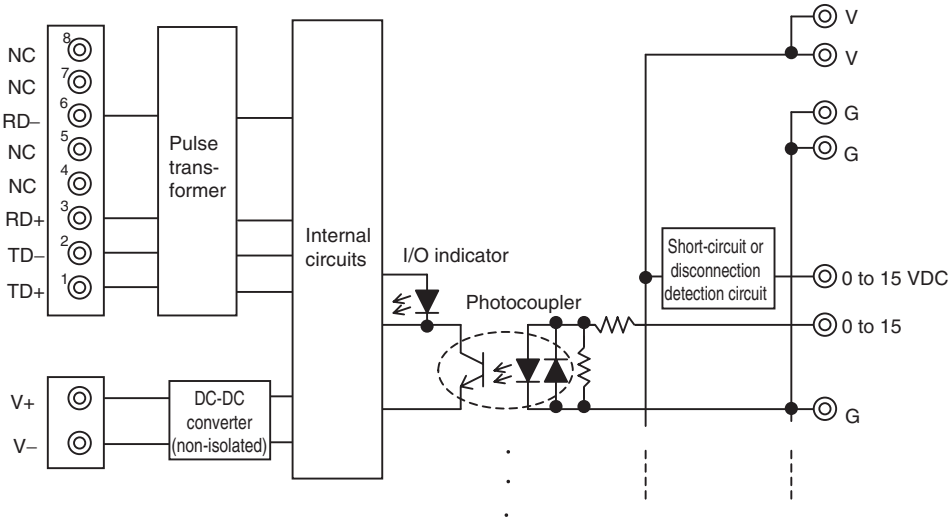
00 hex: BOOTP or tool setting enabled (factory setting)

01 to FE hex: Setting on rotary switches is lower 8 bits of IP address. (Default setting of upper 24 bits: 192.168.250.)

FF hex: Restores default setting.

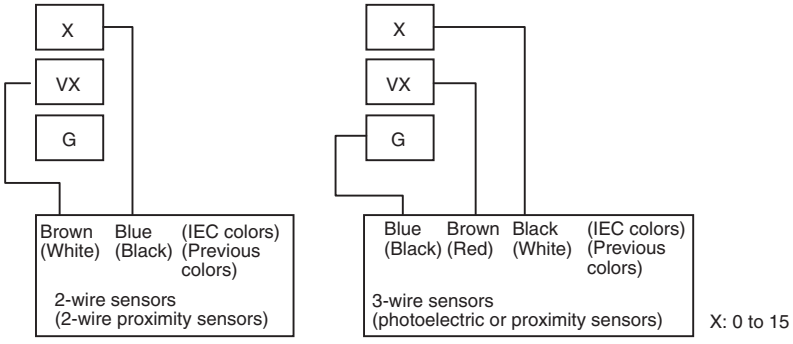
(To restore the default setting, set the switches to FF hex, cycle the power supply, and then set the switches to 00 hex.)

Internal Circuits

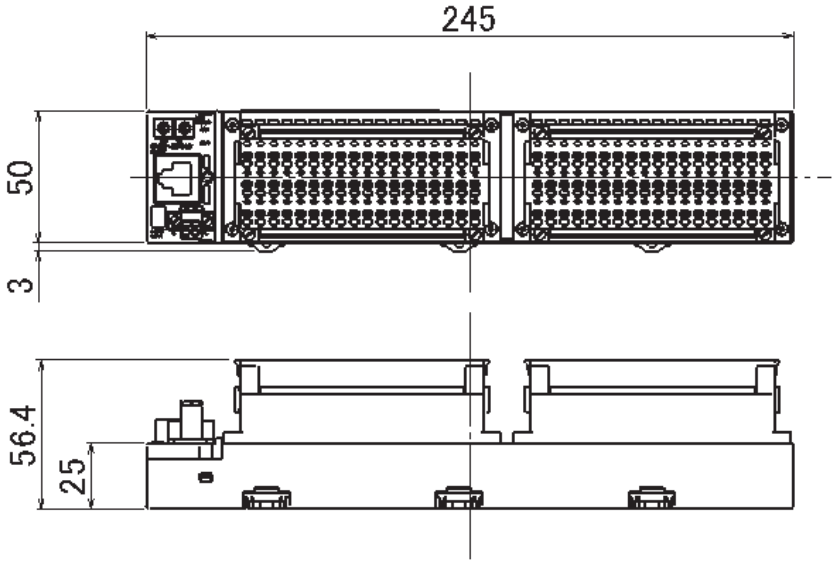


Wiring

NC	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	NC
V	V0	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V
G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G



Dimensions



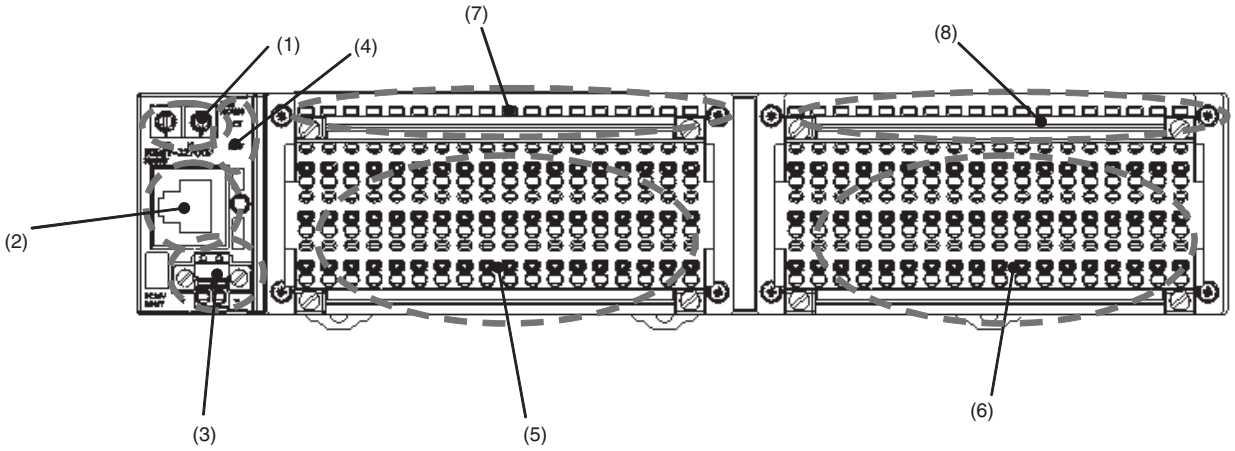
4-2-3 Thirty-two-point Output Units (with Screw-less Clamps)

ERT1-OD32SLH-1

Output Specifications

Item	Specification
Output points	32 points
Internal I/O common	PNP
Output current	0.5 A/point, 4.0 A/common
Residual voltage	1.2 V max. (0.5 A DC, between each output terminal and the V terminal)
Leakage current	0.3 mA max. (24 V DC, between each output terminal and the V terminal)
ON delay	0.5 ms max.
OFF delay	1.5 ms max.
Number of circuits per common	16 outputs/common
Isolation method	Photocoupler
Output indicators	LED (yellow)
Power supply short-circuit protection	Operates when output current is exceeded.
Disconnection detection	Operates at current consumption of 3 mA/point max. (Not detected at 3 mA or less.)
Output handling for communications errors	Select either hold or clear from Network Configurator.
Current consumption	Communications power supply (including internal circuits): 120 mA max.
Connection forms	Screw-less clamp terminal blocks (yellow)
Mounting	35-mm DIN Track mounting
Weight	485 g max.
Standard accessories	FKMCP1.52STF3.5AUSOO (Phoenix Contacts) (connector with lock screws)

Component Names and Functions



(1) Rotary Switches

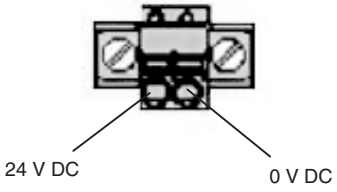
These switches are used to set the node address.

(2) Ethernet Connector

The network communications cable is connected to this connector.

(3) Power Supply Connector

The communications and Unit power supply is connected to this connector.



Terminal	Specification
+	24 V DC
–	0 V DC

Applicable Ferrules

Manufacturer	Model	Applicable wire size
Phoenix Contact	AI-0.5-10	0.5 mm^2 (AWG 20)
Nihon Weidmuller	H 0.5/16 D	0.5 mm^2 (AWG 20)

(4) Communications Indicators: MS and NS

These indicators show the Unit communications status and network communications status.

(5) and (6) Terminal Blocks 1 and 2

The output devices and output power supply are connected to these terminal blocks.

(7) and (8) Output Indicators

These indicators show the ON/OFF status of the outputs and the error status of connected devices.

Indicators

Communications Indicators

Refer to *3-1-3 Communications Indicators*.

I/O Indicators

The meanings of the input indicators are given in the following table.

Indicator name	Status	Color	Meaning (main error)
0 to 15		Yellow	Lit yellow when output is ON.
		Red	Flashing red when the load is disconnected. Automatically reset when the load is connected.
		Red	Lit red when the load is short-circuited. Automatically reset when the short-circuit is removed.
		OFF	Not lit when output is OFF.
I/O		Green	Lit green when I/O power is being supplied.
		OFF	Not lit when I/O power is not being supplied.

Setting the Node Address

The rotary switches are used to set the lower digits of the IP address.

Setting method	Two hexadecimal digits
Setting range	01 to FE

Rotary Switch Settings

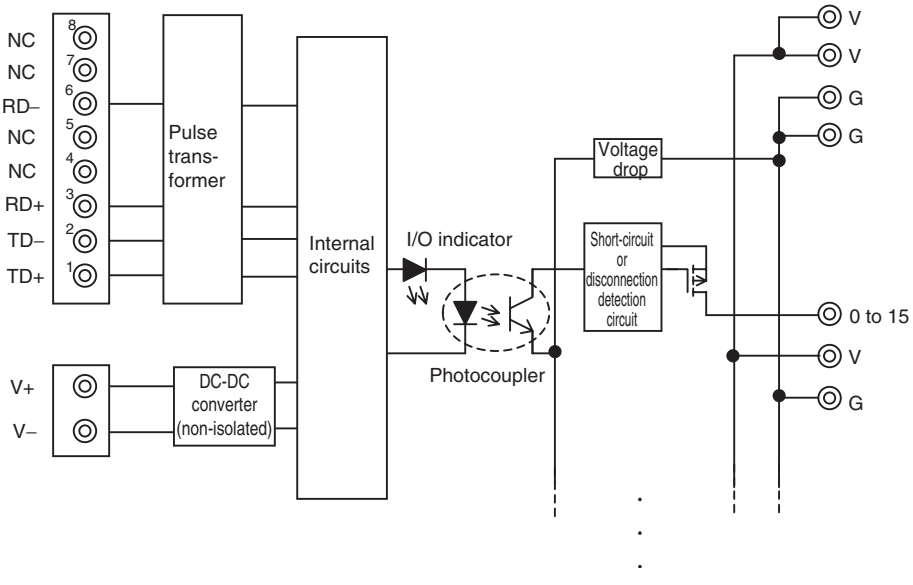
00 hex: BOOTP or tool setting enabled (factory setting)

01 to FE hex: Setting on rotary switches is lower 8 bits of IP address. (Default setting of upper 24 bits: 192.168.250.)

FF hex: Restores default setting.

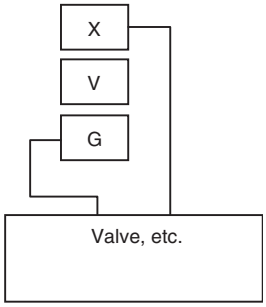
(To restore the default setting, set the switches to FF hex, cycle the power supply, and then set the switches to 00 hex.)

Internal Circuits



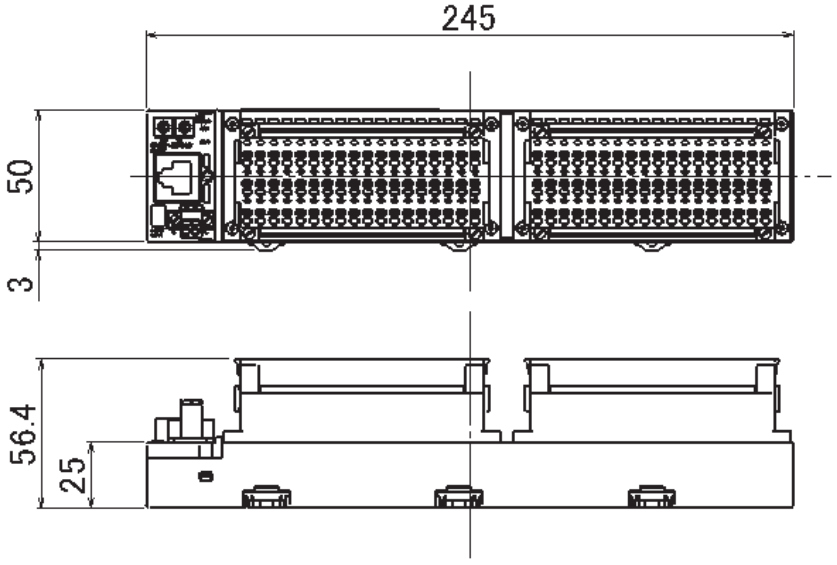
Wiring

NC	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	NC
V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V
G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G



X: 0 to 15

Dimensions



4-2-4 Sixteen-point Input and Sixteen-point Output Units (with Screw-less clamps)

ERT1-MD32SLH-1

Common Specifications

Item	Specifications
Current consumption	Communications power supply (including internal circuits): 110 mA max.
Mounting	35-mm DIN Track mounting
Weight	485 g max.
Standard accessories	FKMCP1.52STF3.5AUSOO (Phoenix Contacts) (connector with lock screws)

Input Specifications

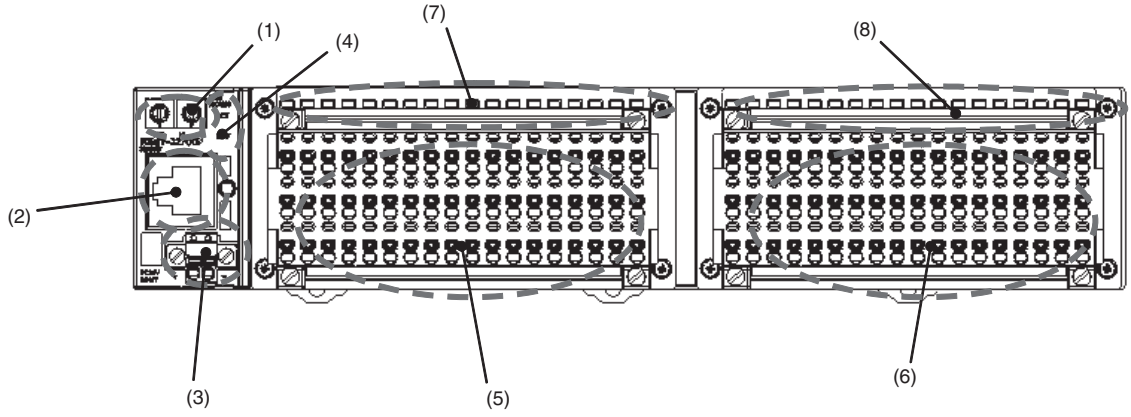
Item	Specifications
Input points	16 points
Internal I/O common	PNP
ON voltage	15 V DC min. (between each input terminal and 0 V)
OFF voltage	5 V DC max. (between each input terminal and 0 V)
OFF current	1.0 mA max.

Item	Specifications
Input current	6.0 mA max. at 24 V DC 3.0 mA max. at 17 V DC
ON delay time	1.5 ms max.
OFF delay time	1.5 ms max.
Number of circuits	16 points with one common circuit
Isolation method	Photocoupler isolation
Input indicators	LEDs (yellow)
Power supply short-circuit	Operates at 50 mA/point min.
Disconnection detection	Operates at 0.2 mA/point max.
Connection forms	Screw-less clamp terminal blocks (orange)

Output Specifications

Item	Specification
Output points	16 points
Internal I/O common	PNP
Output current	0.5 A/point, 4.0 A/common
Residual voltage	1.2 V max. (0.5 A DC, between each output terminal and the V terminal)
Leakage current	0.3 mA max. (24 V DC, between each output terminal and the V terminal)
ON delay	0.5 ms max.
OFF delay	1.5 ms max.
Number of circuits per common	16 outputs/common
Isolation method	Photocoupler
Output indicators	LEDs (yellow)
Power supply short-circuit protection	Operates when output current is exceeded.
Disconnection detection	Operates at current consumption of 3 mA/point max. (Not detected at 3 mA or less.)
Output handling for communications errors	Select either hold or clear from Network Configurator.
Connection forms	Screw-less clamp terminal blocks (yellow)

Component Names and Functions



(1) Rotary Switches

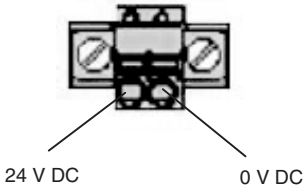
These switches are used to set the node address.

(2) Ethernet Connector

The network communications cable is connected to this connector.

(3) Power Supply Connector

The communications and Unit power supply is connected to this connector.



Terminal	Specification
+	24 V DC
–	0 V DC

Applicable Ferrules

Manufacturer	Model	Applicable wire size
Phoenix Contact	AI-0.5-10	0.5 mm^2 (AWG 20)
Nihon Weidmuller	H 0.5/16 D	0.5 mm^2 (AWG 20)

(4) Communications Indicators: MS and NS

These indicators show the Unit communications status and network communications status.

(5) and (6) Terminal Blocks 1 and 2

The I/O devices and output power supply are connected to these terminal blocks.

(7) and (8) I/O Indicators

These indicators show the ON/OFF status of the I/O and the error status of connected devices.

Indicators

Communications Indicators

Refer to *3-1-3 Communications Indicators*.

I/O Indicators

The meanings of the input indicators are given in the following table.

Indicator name	Status	Color	Meaning (main error)
0 to 15	▭	Yellow	Lit yellow when input or output is ON.
	◪	Red	Flashing red when the load is disconnected. Automatically reset when the load is connected.
	▭	Red	Lit red when the load is short-circuited. Automatically reset when the short-circuit is removed.
	■	OFF	Not lit when input or output is OFF.
I/O	▭	Green	Lit green when I/O power is being supplied.
	■	OFF	Not lit when I/O power is not being supplied.

Setting the Node Address

The rotary switches are used to set the lowe

Setting method	Two hexadecimal digits
Setting range	01 to FE

Rotary Switch Settings

00 hex: BOOTP or tool setting enabled (factory setting)

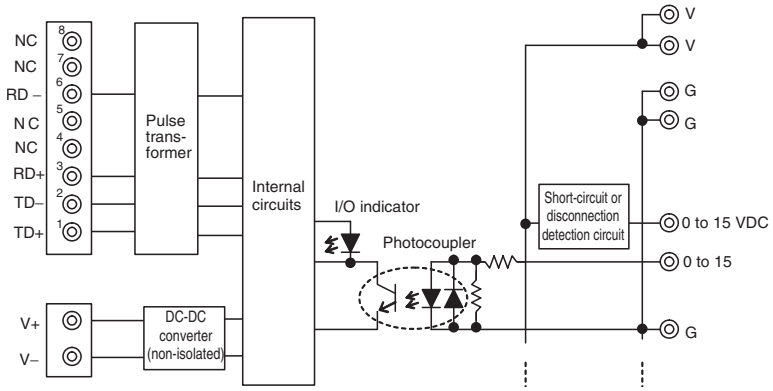
01 to FE hex: Setting on rotary switches is lower 8 bits of IP address. (Default setting of upper 24 bits: 192.168.250.)

FF hex: Restores default setting.

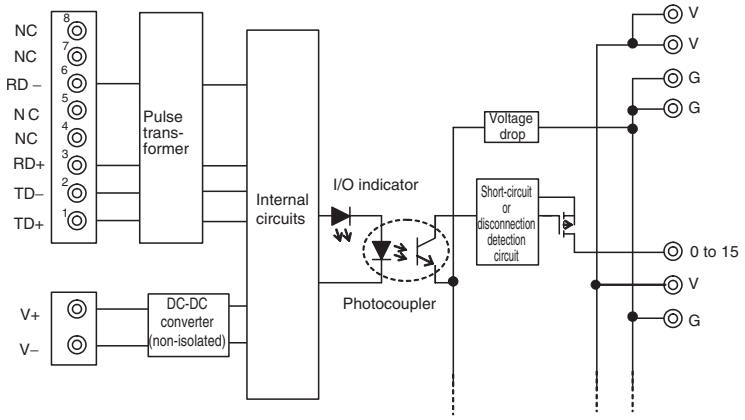
(To restore the default setting, set the switches to FF hex, cycle the power supply, and then set the switches to 00 hex.)

Internal Circuits

Inputs



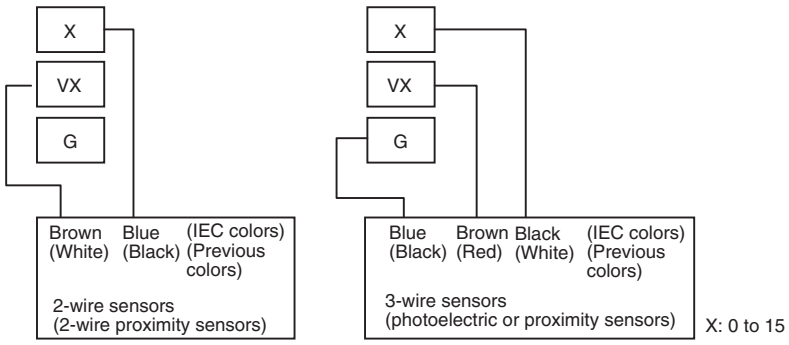
Outputs



Wiring

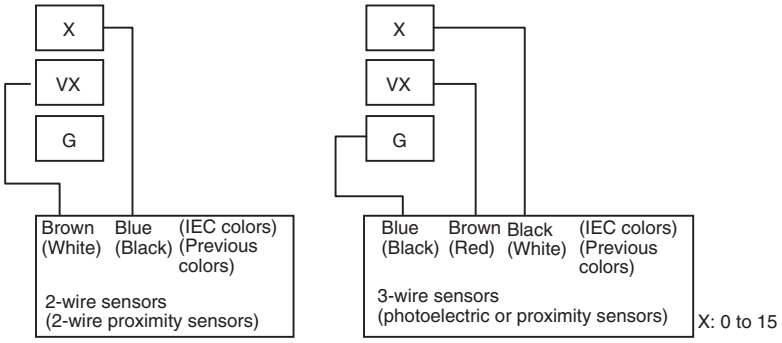
Inputs

NC	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	NC
V	V0	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V
G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G

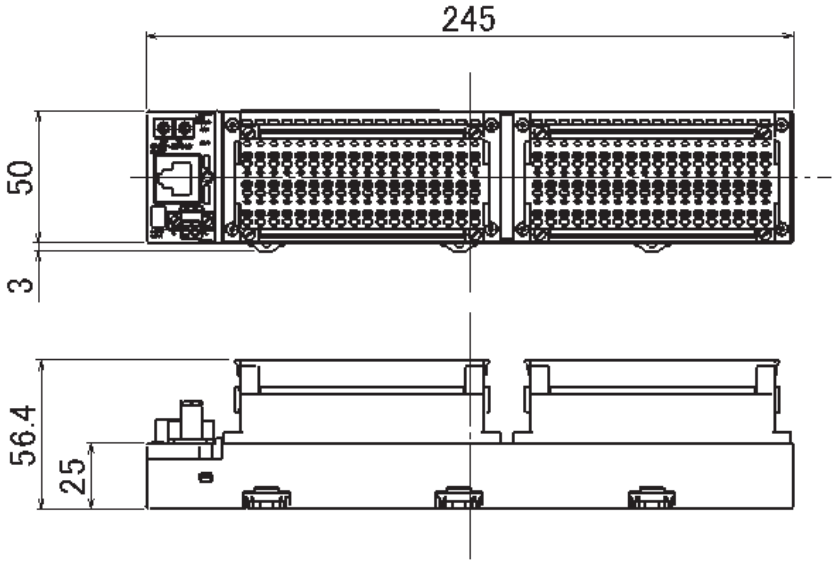


Outputs

NC	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	NC
V	V0	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V
G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G



Dimensions



SECTION 5
Environment-resistive Slave Units

This section describes the Environment-resistive Slave Units for EtherNet/IP.

5-1 Status Areas

An Environment-resistive Slave Unit has two internal status areas: the Generic Status Area and the I/O Status Area. The status flags in these areas are turned ON and OFF based on the threshold values set by the user for each function in that Unit.

5-1-1 Generic Status Area

The Environment-resistive Slave Unit's Generic Status Area contains the following 16 bits. These bits indicate minor errors in the Unit.

Bit	Content	Description
00	I/O Power Supply Status Flag OFF: I/O power is ON. ON: I/O power is not ON.	Turns ON when I/O power is not being supplied.
01	Reserved	---
02	Reserved	---
03	Reserved	---
04	Power or Load Short-circuit Detection Flag OFF: Normal ON: Short-circuit	Turns ON when there is a short in the power supply or load connection to the connected devices, including wiring mistakes and connected device failure.
05	Disconnection Flag OFF: Connected ON: Disconnected	Turns ON when the sensor power supply is not connected or the load is disconnected due to a wiring error, failure in the connected device, etc.
06	Reserved	---
07	Reserved	---
08	EEPROM Data Error Flag OFF: Normal ON: Error occurred	Turns ON when there is an error in the EEPROM data.
09	Reserved	---
10	Reserved	---
11	Reserved	---
12	Reserved	---
13	Reserved	---
14	Reserved	---
15	Reserved	---

5-1-2 I/O Status Area

The I/O Status Area for an Environment-resistive Slave Unit consists of the following 8 bytes (64 bits). The I/O Status Area indicates the short-circuit and disconnection error status for each terminal.

Byte offset	Data							
	Bit 07	06	05	04	03	02	01	00
0	Power or Load Short-circuit Detection Flags for Terminal Block 1							
	07	06	05	04	03	02	01	00
1	Power or Load Short-circuit Detection Flags for Terminal Block 1							
	15	14	13	12	11	10	09	08

Byte offset	Data							
	Bit 07	**06**	**05**	**04**	**03**	**02**	**01**	**00**
2	Power or Load Short-circuit Detection Flags for Terminal Block 2							
	07	06	05	04	03	02	01	00
3	Power or Load Short-circuit Detection Flags for Terminal Block 2							
	15	14	13	12	11	10	09	08
4	Disconnection Flags for Terminal Block 1							
	07	06	05	04	03	02	01	00
5	Disconnection Flags for Terminal Block 1							
	15	14	13	12	11	10	09	08
6	Disconnection Flags for Terminal Block 2							
	07	06	05	04	03	02	01	00
7	Disconnection Flags for Terminal Block 2							
	15	14	13	12	11	10	09	08

5-2 Environment-resistive Slave Units

The Environment-resistive Slave Units are designed to be easily connected with M12 connectors that lock by turning them 1/8 of a turn for less wiring.

5-2-1 Mounting in Control Panels

Use screws to mount a Waterproof Terminal in a control panel. These Terminals cannot be mounted on a DIN Track.

Drill the mounting holes in the control panel according to the dimensions shown in the dimensions diagrams and secure the Terminal with M5 screws. The appropriate tightening torque is 1.47 to 1.96 N·m.

Installation Direction

The Terminal can be mounted in any direction. Any one of the following 6 directions is acceptable.

5-2-2 Environment-resistive Terminals with 16 Transistor Inputs (IP67)

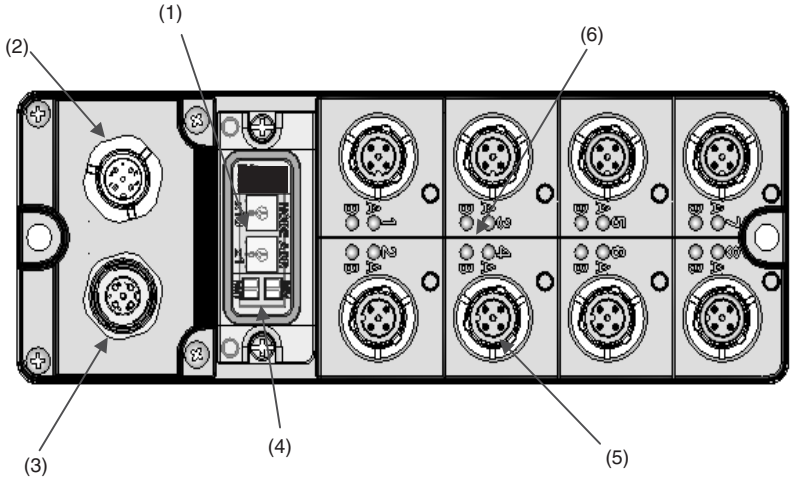
ERT1-HD16CH-1

Input Specifications

Item	Specifications
Input points	16 points
Internal I/O common	PNP
ON voltage	15 V DC min. (between each input terminal and 0 V)
OFF voltage	5 V DC max. (between each input terminal and 0 V)
OFF current	1.0 mA max.
Input current	6.0 mA max. at 24 V DC 3.0 mA max. at 17 V DC
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
Input indicators	LEDs (yellow)
Power supply short-circuit protection	Operates at 50 mA/point min.
Disconnection detection	Operates at 0.2 mA/point max.

Item	Specifications
Current consumption	Communications power supply (including internal circuits): 110 mA max.
Connection forms	M12 connector: Smart Click (connectors that lock easily with 1/8 of a turn)
Weight	445 g max.
Standard accessories	None

Component Names and Functions



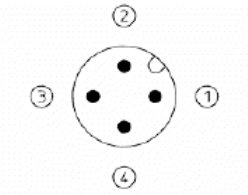
(1) Rotary Switches

These switches are used to set the node address

(2) Ethernet Connector

The network communications cable is connected to this connector.

This is a Smart-click D-coding M12 connector (connector that locks easily with 1/8 of a turn).

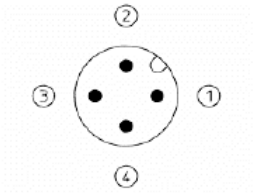


Pin	Signal
1	TD+
2	RD+
3	TD−
4	RD−

(3) Power Supply Connector

The power supply is connected to this connector.

This is a Smart-click D-coding M12 connector (connector that locks easily with 1/8 of a turn).



Pin	Signal
1	V+ (24 V: for internal circuits and inputs)
2	NC
3	V– (0 V: for internal circuits and inputs)
4	NC

(4) Communications Indicators: MS and NS

These indicators show the Unit communications status and network communications status.

(5) Input Connectors

The input devices are connected to these connectors.

(6) Input Indicators

These indicators show the ON/OFF status of the inputs and the error status of connected devices.

Indicators

Communications Indicators

Refer to *3-1-3 Communications Indicators*.

Input Indicators

These indicators show the ON/OFF status of the inputs and the error status of connected devices.

Indicator	Color	Status	Meaning (main error)
1-A		Lit yellow.	Input 0 is ON.
		Not lit.	Input 0 is OFF.
		Lit red.	Connector 1 is short-circuited.
		Flashing red.	Connector 1 is disconnected.
1-B		Lit yellow.	Input 1 is ON.
		Not lit.	Input 1 is OFF.
		Lit red.	---
		Flashing red.	---
2-A		Lit yellow.	Input 2 is ON.
		Not lit.	Input 2 is OFF.
		Lit red.	Connector 2 is short-circuited.
		Flashing red.	Connector 2 is disconnected.
2-B		Lit yellow.	Input 3 is ON.
		Not lit.	Input 3 is OFF.
		Lit red.	---
		Flashing red.	---

Indicator	Color	Status	Meaning (main error)
3-A		Lit yellow.	Input 4 is ON.
		Not lit.	Input 4 is OFF.
		Lit red.	Connector 3 is short-circuited.
		Flashing red.	Connector 3 is disconnected.
3-B		Lit yellow.	Input 5 is ON.
		Not lit.	Input 5 is OFF.
		Lit red.	---
		Flashing red.	---
4-A		Lit yellow.	Input 6 is ON.
		Not lit.	Input 6 is OFF.
		Lit red.	Connector 4 is short-circuited.
		Flashing red.	Connector 4 is disconnected.
4-B		Lit yellow.	Input 7 is ON.
		Not lit.	Input 7 is OFF.
		Lit red.	---
		Flashing red.	---
5-A		Lit yellow.	Input 8 is ON.
		Not lit.	Input 8 is OFF.
		Lit red.	Connector 5 is short-circuited.
		Flashing red.	Connector 5 is disconnected.
5-B		Lit yellow.	Input 9 is ON.
		Not lit.	Input 9 is OFF.
		Lit red.	---
		Flashing red.	---
6-A		Lit yellow.	Input 10 is ON.
		Not lit.	Input 10 is OFF.
		Lit red.	Connector 6 is short-circuited.
		Flashing red.	Connector 6 is disconnected.
6-B		Lit yellow.	Input 11 is ON.
		Not lit.	Input 11 is OFF.
		Lit red.	---
		Flashing red.	---
7-A		Lit yellow.	Input 12 is ON.
		Not lit.	Input 12 is OFF.
		Lit red.	Connector 7 is short-circuited.
		Flashing red.	Connector 7 is disconnected.
7-B		Lit yellow.	Input 13 is ON.
		Not lit.	Input 13 is OFF.
		Lit red.	---
		Flashing red.	---

Indicator	Color	Status	Meaning (main error)
8-A		Lit yellow.	Input 4 is ON.
		Not lit.	Input 14 is OFF.
		Lit red.	Connector 8 is short-circuited.
		Flashing red.	Connector 8 is disconnected.
8-B		Lit yellow.	Input 15 is ON.
		Not lit.	Input 15 is OFF.
		Lit red.	---
		Flashing red.	---

Setting the Node Address

The rotary switches are used to set the lower digits of the IP address.

Setting method	Two hexadecimal digits
Setting range	01 to FE

Rotary Switch Settings

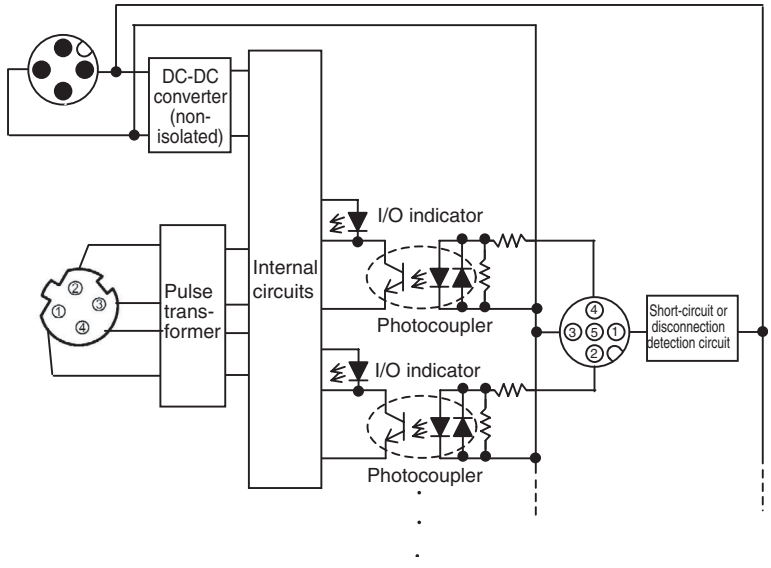
00 hex: BOOTP or tool setting enabled (factory setting)

01 to FE hex: Setting on rotary switches is lower 8 bits of IP address. (Default setting of upper 24 bits: 192.168.250.)

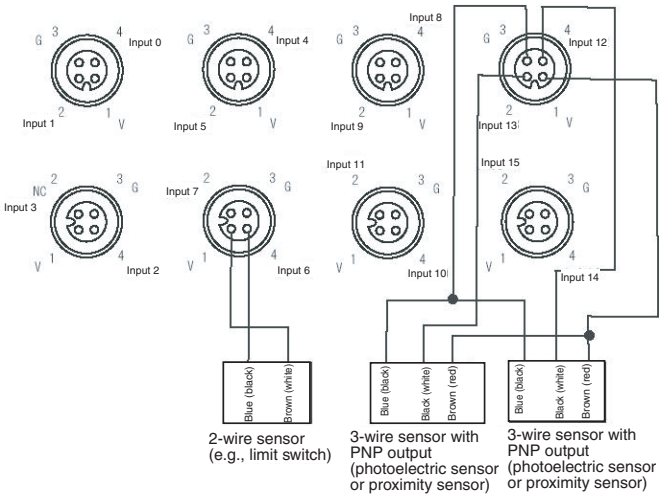
FF hex: Restores default setting.

(To restore the default setting, set the switches to FF hex, cycle the power supply, and then set the switches to 00 hex.)

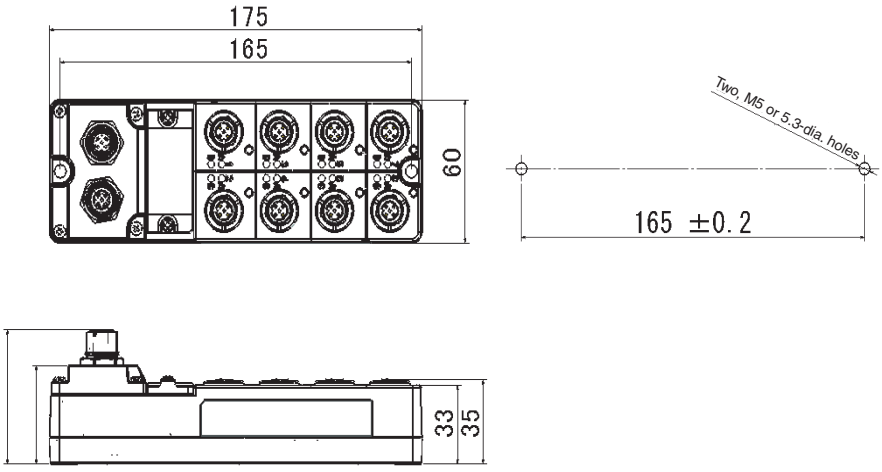
Internal Circuits



Wiring



Dimensions



5-2-3 Environment-resistive Terminals with 16 Transistor Outputs (IP67)

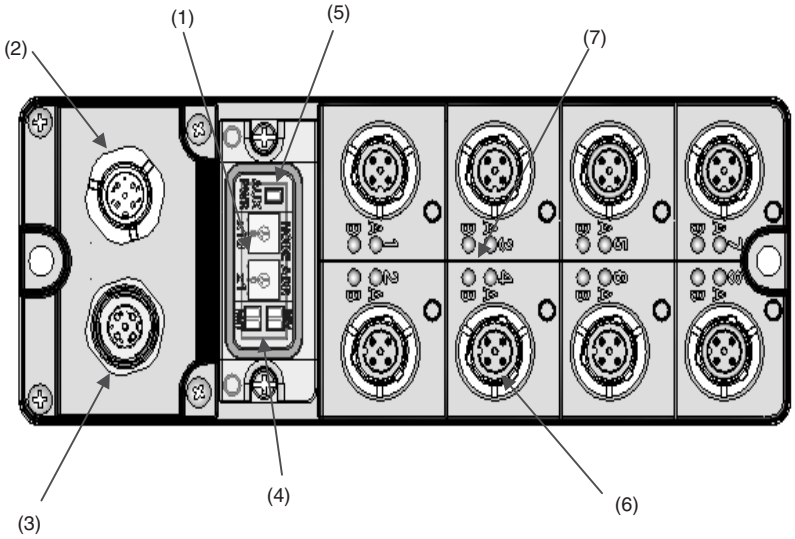
ERT1-WD16CH-1

Output Specifications

Item	Specification
Output points	16 points
Internal I/O common	PNP
Output current	0.5 A/point, 4.0 A/common
Residual voltage	1.2 V max. (0.5 A DC, between each output terminal and the V terminal)
Leakage current	0.3 mA max. (24 V DC, between each output terminal and the V terminal)
ON delay	0.5 ms max.
OFF delay	1.5 ms max.
Number of circuits per common	16 outputs/common
Isolation method	Photocoupler

Item	Specification
Output indicators	LEDs (yellow)
Power supply short-circuit protection	Operates when output current is exceeded.
Disconnection detection	Operates at current consumption of 3 mA/point max. (Not detected at 3 mA or less.)
Output handling for communications errors	Select either hold or clear from Network Configurator.
Current consumption	Communications power supply (including internal circuits): 120 mA max.
Connection forms	M12 connector: Smart Click (connectors that lock easily with 1/8 of a turn)
Mounting	35-mm DIN Track mounting
Weight	435 g max.
Standard accessories	None

Component Names and Functions



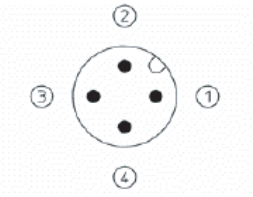
(1) Rotary Switches

These switches are used to set the node address.

(2) Ethernet Connector

The network communications cable is connected to this connector.

This is a Smart-click D-coding M12 connector (connector that locks easily with 1/8 of a turn).

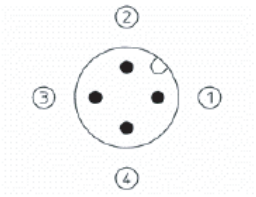


Pin	Signal
1	TD+
2	RD+
3	TD−
4	RD−

(3) Power Supply Connector

The power supply is connected to this connector.

This is a Smart-click D-coding M12 connector (connector that locks easily with 1/8 of a turn).



Pin	Signal
1	V+ (24 V: for internal circuits)
2	24 V (for outputs)
3	V− (0 V: for internal circuits)
4	0 V (for outputs)

(4) Communications Indicators: MS and NS

These indicators show the Unit communications status and network communications status.

(5) Output Power Indicator

This indicator shows the status of the output power supply.

(6) Output Connectors

The output devices are connected to these connectors.

(7) Output Indicators

These indicators show the ON/OFF status of the outputs and the error status of connected devices.

Indicators

Communications Indicators

Refer to *3-1-3 Communications Indicators*.

Output Indicators

These indicators show the ON/OFF status of the outputs and the error status of connected devices.

Indicator	Color	Status	Meaning (main error)
1-A		Lit yellow.	Output 0 is ON.
		Not lit.	Output 0 is OFF.
		Lit red.	Output 0 is short-circuited.
		Flashing red.	Output 0 is disconnected.
1-B		Lit yellow.	Output 1 is ON.
		Not lit.	Output 1 is OFF.
		Lit red.	Output 1 is short-circuited.
		Flashing red.	Output 1 is disconnected.
2-A		Lit yellow.	Output 2 is ON.
		Not lit.	Output 2 is OFF.
		Lit red.	Output 2 is short-circuited.
		Flashing red.	Output 2 is disconnected.

Indicator	Color	Status	Meaning (main error)
2-B		Lit yellow.	Output 3 is ON.
		Not lit.	Output 3 is OFF.
		Lit red.	Output 3 is short-circuited.
		Flashing red.	Output 3 is disconnected.
3-A		Lit yellow.	Output 4 is ON.
		Not lit.	Output 4 is OFF.
		Lit red.	Output 4 is short-circuited.
		Flashing red.	Output 4 is disconnected.
3-B		Lit yellow.	Output 5 is ON.
		Not lit.	Output 5 is OFF.
		Lit red.	Output 5 is short-circuited.
		Flashing red.	Output 5 is disconnected.
4-A		Lit yellow.	Output 6 is ON.
		Not lit.	Output 6 is OFF.
		Lit red.	Output 6 is short-circuited.
		Flashing red.	Output 6 is disconnected.
4-B		Lit yellow.	Output 7 is ON.
		Not lit.	Output 7 is OFF.
		Lit red.	Output 7 is short-circuited.
		Flashing red.	Output 7 is disconnected.
5-A		Lit yellow.	Output 8 is ON.
		Not lit.	Output 8 is OFF.
		Lit red.	Output 8 is short-circuited.
		Flashing red.	Output 8 is disconnected.
5-B		Lit yellow.	Output 9 is ON.
		Not lit.	Output 9 is OFF.
		Lit red.	Output 9 is short-circuited.
		Flashing red.	Output 9 is disconnected.
6-A		Lit yellow.	Output 10 is ON.
		Not lit.	Output 10 is OFF.
		Lit red.	Output 10 is short-circuited.
		Flashing red.	Output 10 is disconnected.
6-B		Lit yellow.	Output 11 is ON.
		Not lit.	Output 11 is OFF.
		Lit red.	Output 11 is short-circuited.
		Flashing red.	Output 11 is disconnected.
7-A		Lit yellow.	Output 12 is ON.
		Not lit.	Output 12 is OFF.
		Lit red.	Output 12 is short-circuited.
		Flashing red.	Output 12 is disconnected.

Indicator	Color	Status	Meaning (main error)
7-B		Lit yellow.	Output 13 is ON.
		Not lit.	Output 13 is OFF.
		Lit red.	Output 13 is short-circuited.
		Flashing red.	Output 13 is disconnected.
8-A		Lit yellow.	Output 14 is ON.
		Not lit.	Output 14 is OFF.
		Lit red.	Output 14 is short-circuited.
		Flashing red.	Output 14 is disconnected.
8-B		Lit yellow.	Output 15 is ON.
		Not lit.	Output 15 is OFF.
		Lit red.	Output 15 is short-circuited.
		Flashing red.	Output 15 is disconnected.

Output Power Indicator

This indicator shows the status of the output power supply.

AUX (external power supply)		Lit green.	Output power is being supplied.
		Not lit.	Output power is not being supplied.

Setting the Node Address

The rotary switches are used to set the lower digits of the IP address.

Setting method	Two hexadecimal digits
Setting range	01 to FE

Rotary Switch Settings

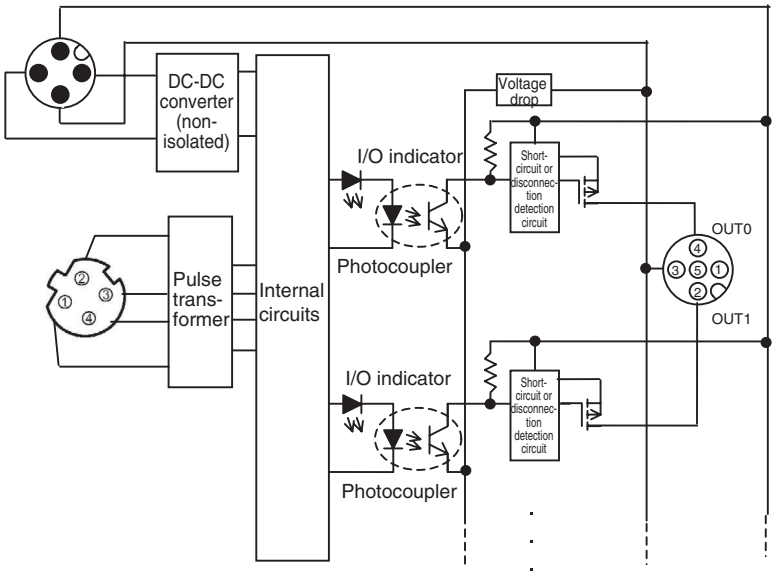
00 hex: BOOTP or tool setting enabled (factory setting)

01 to FE hex: Setting on rotary switches is lower 8 bits of IP address. (Default setting of upper 24 bits: 192.168.250.)

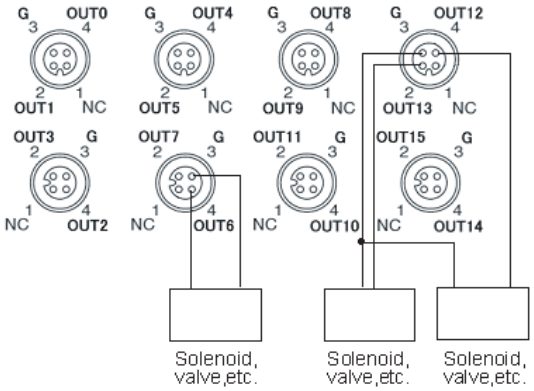
FF hex: Restores default setting.

(To restore the default setting, set the switches to FF hex, cycle the power supply, and then set the switches to 00 hex.)

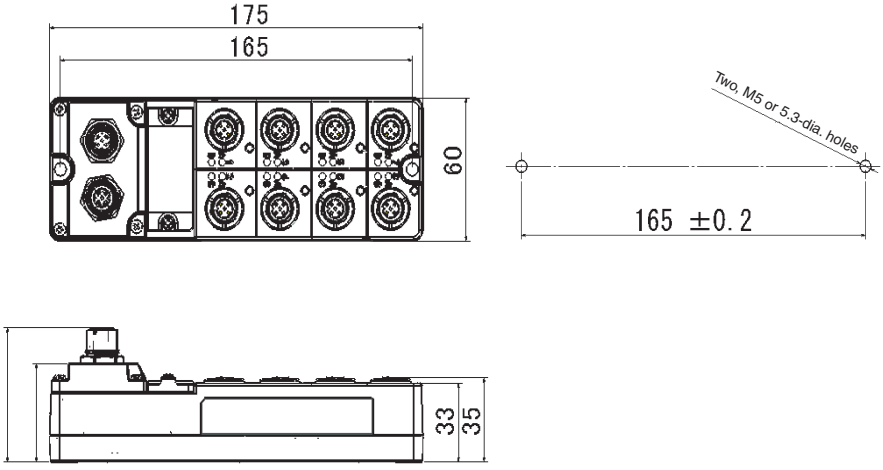
Internal Circuits



Wiring



Dimensions



SECTION 6
Smart Functions

This section describes the Smart Functions supported by the EtherNet/IP Slave Units.

6-1 Functions Common to All Slave Units

This section describes the functions common to all EtherNet/IP Slave Units and the procedures for using these functions.

6-1-1 Automatic Baud Rate Detection

Description

The EtherNet/IP Slave Units are automatically set to the same baud rate as the hub. It is not necessary to set the baud rate separately for any Slave Unit.

The baud rate is set when communications is established with the hub after the power is turned ON. The baud rate setting is stored in memory until the power is turned ON again or until the Master Unit baud rate setting is changed.

6-1-2 Hold/Clear Outputs

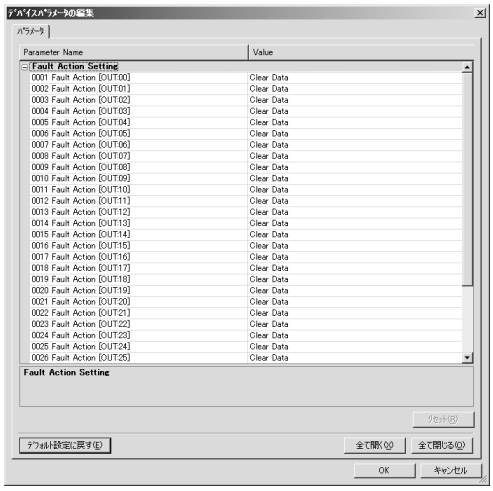
Description

Output Units can be set to hold or clear outputs when an error occurs.

Procedure Using Network Configurator

1,2,3...

1. Turn ON the power to the EtherNet/IP Slave Unit.
2. Double-click the icon of the Slave Unit to set in the Network Edit Device Parameters Window to open the Configuration Window. (Alternatively, right-click the icon and select ***Parameters - Edit*** from the pop-up menu.)
3. The fault action (holding or clearing an output for a communications error) will be displayed for each output in the *Fault Action Setting* Group. Select *Hold Last State* or *Clear Data* for the terminals and then click the **OK** Button.



Clear	Clears all output data from the Master Unit to 0 when a communications error occurs.
Hold	Holds all output data from the Master Unit at its current status when a communications error occurs.

6-1-3 I/O Power Status Monitor

Description

Outputs can be set to be held or cleared when an error occurs in the Output Unit.

Checking Using the Status Areas

Refer to bits 0 and 1 in *4-1-1 Generic Status Area*.

6-1-4 Input Filter (Input Units Only)

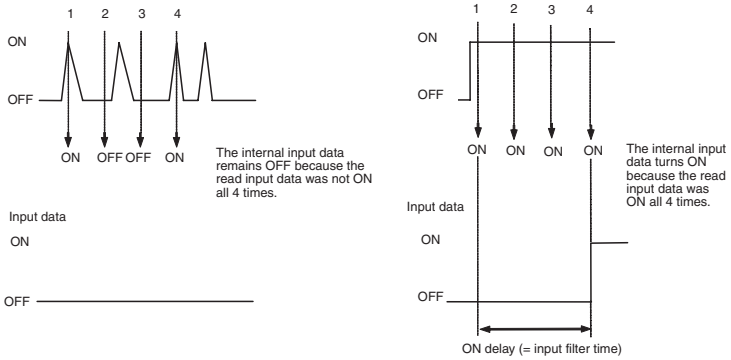
Description

An input value is read more than once during a set time interval. The input value can be set to be enabled only when all the read values are the same. This function operates for all input points in one Slave Unit.

The following settings are possible:
No delay (no filter), or 4, 8, 16, 32, 64, 128, or 256 ms.

OFF-ON Delay

When the input data turns ON, the input data is read 4 times at a set time (1/4 of the time setting). The internal input data turns ON only when all four values are ON. The ON timing is delayed by the value of the input time constant.

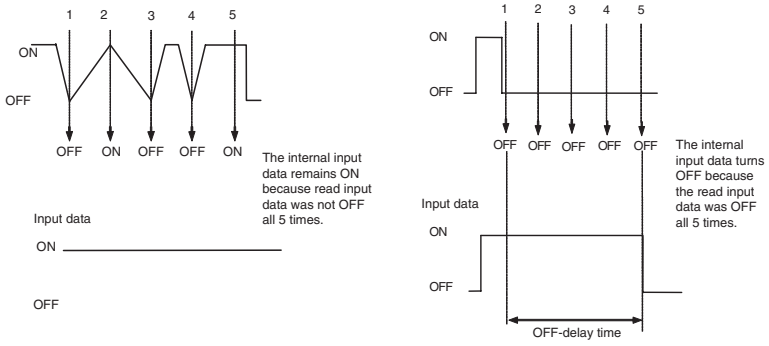


ON-OFF Delay

When the input data turns OFF, the input data is read 5 times at a set interval (1/5 of the OFF response time setting). The internal input data turns OFF only when all values are OFF. The OFF timing is delayed by the value of the OFF response time.

This function can also be used to implement an OFF delay.

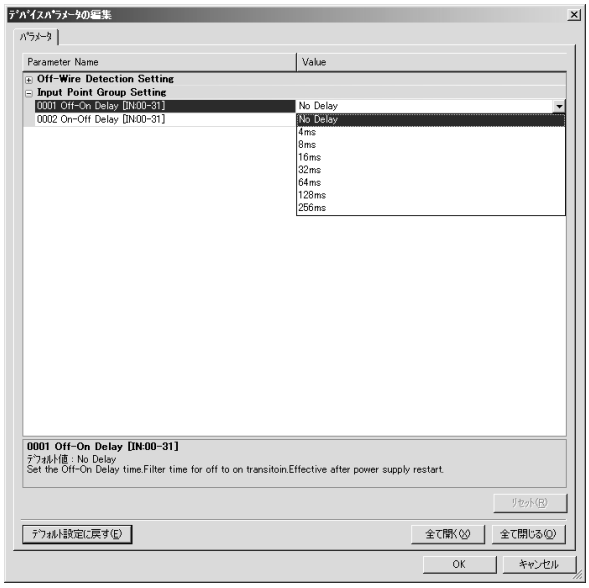
To enable reading pulses shorter than the communications cycle time, set the OFF response time to a value longer than the communications cycle time. (The input may remain ON if the input pulse interval is too short.)



Settings Using the Network Configurator

1,2,3...

1. Turn ON the power supply to the EtherNet/IP Slave Unit.
2. Double-click the icon of the Slave Unit to set in the Network Configuration Window to open the Edit Device Parameters Window. (Alternatively, right-click the icon and select ***Parameters - Edit*** from the pop-up menu.)
3. Select an input in the *Input Point Group Setting* Group and set the Off-On Delay or On-Off delay from the pull-down menu.



6-1-5 Power Short-circuit Detection (Input)

Description

This function monitors the sensor power supply current. If the current is 50 mA or higher per input contact, a power short-circuit is detected.

The Slave Unit I/O indicator can be used to check whether a power short-circuit has been detected. When a power short-circuit is detected, a flag in a status area in the Slave Unit turns ON to notify the Master Unit. The notification details can be read using explicit messages. When the cause of the short-circuit is removed, the Slave Unit is automatically reset, and the power output to the connector that had the short-circuit is turned ON again.

Setting Using the Status Areas

Refer to bit 4 in *4-1-1 Generic Status Area* and to *4-1-2 I/O Status Area*.

6-1-6 Load Short-circuit Detection (Output)

Description

This function monitors the load current for the output section and detects an load short-circuit if the current per contact (or common) exceeds a specific value. When a load short-circuit is detected, all Unit outputs are turned OFF to prevent damage to the Unit's output circuits.

The I/O power for the Unit turns OFF if a short-circuit is detected for even just one of the contacts being used.

When a load short-circuit is detected, a flag in a status area in the Slave Unit turns ON to notify the Master Unit. The notification details can be read using explicit messages.

When the cause of the short-circuit is removed, the Slave Unit is automatically reset, and the power output to the connector for which the short-circuit was detected is turned ON again.

Checking Using the Status Areas

Refer to bit 4 in *4-1-1 Generic Status Area* and to *4-1-2 I/O Status Area*.

SECTION 7
Troubleshooting and Maintenance

This section describes troubleshooting and maintenance for the EtherNet/IP Slave Units.

7-1 Indicator Meanings and Troubleshooting

MS and NS indicators	Meaning		Remarks
MS: Lit green NS: Lit green	Remote I/O communications or message communications are in progress.	Remote I/O communications are being executed.	Either remote I/O communications, message communications, or both are being executed. Status is normal.
MS: Lit green NS: Not lit	Offline	It is not possible to go online.	If only certain Slave Units show this status, check the cable connections.
MS: Lit green NS: Flashing green	Waiting for a connection.	Waiting for a connection with the Master Unit to be established.	---
MS: Lit red NS: Not lit	Watchdog timer error	A watchdog timer error has occurred in the Slave Unit.	Replace the Slave Unit.
MS: Flashing red NS: Not lit	Illegal switch setting	The setting of the IP address switches is illegal.	Correct the switch setting and then restart the Slave Units.
MS: Lit green NS: Lit red	Configuration error	• The same IP address has been used more than once.	Check that each IP address is used only once and then restart the Slave Units.
MS: Lit green NS: Flashing red	Communications time-out	---	Check the following items then restart the Slave Units: • Is the cable length OK? • Is the cable disconnected or loose? • Is there too much noise?

7-2 Troubleshooting

7-2-1 Indicators Are Lit or Flashing Red

Problem	Cause and possible corrections
MS indicator is lit red.	• The Slave Unit is malfunctioning. Replace the Slave Unit.
MS indicator is flashing red.	• The rotary switch or other setting is illegal. Check the switch settings then restart the Slave Unit. • There is an error in the Slave Unit's EEPROM memory data. To restore the default setting, set the rotary switches to FF hex, cycle the power supply, and then set the rotary switches to 00 hex. Replace the Slave Unit if the MS indicator keeps flashing red even after the data has been returned to the default settings.
The NS indicator lights red without flashing green.	Check the following item and then restart the Slave Unit. • Check the node addresses of all nodes and change the settings as required so that each node has a unique node address.

Problem	Cause and possible corrections
NS indicator remains not lit and status does not change.	The Slave Unit is not participating in the network. • Check that all Slave Unit connectors are connected correctly. • Check that the Master Unit is operating correctly. If using an OMRON Master Unit, check the Master Unit mode and the Slave Unit node addresses. • If using a Master from another manufacturer, refer to the user's manual for that Master. • Check that the communications cable is wired correctly. • Check that the power supply cable and power supply are wired correctly and that the settings are correct. • Check connector wiring to make sure that the communications cable and power supply cables are not disconnected.
NS indicator remains lit green and status does not change.	Check the following items and take corrective measures based on the Master Unit indicator display. • Check that the Master Unit is operating correctly. Refer to the manual for the Master Unit. • Check that the tag data links are set correctly. • Reset the tag data links.

7-2-2 Troubleshooting by Slave Unit Type

Model	Problem	Cause
All Slave Units	The MS and NS indicators do not light green.	Refer to *7-2-1 Indicators Are Lit or Flashing Red.*
Slave Units with outputs	Cannot hold outputs when communications errors occur.	The Unit is set to clear outputs for communications errors. Change the setting to hold outputs for communications errors.
	Cannot clear outputs when communications errors occur.	Change the setting to clear outputs for communications errors.
Slave Units with inputs	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 No Display. Alternatively, change the input filter to an appropriate value.
Slave Units with Unconnected Line Detection Function	The Unconnected Line Detection Status Flag turned ON for an unused input.	Unconnected line detection is enabled for an unused input. Disable unconnected line detection for that input.
	The Unconnected Line Detection Status Flag turned ON even though the sensor power supply was connected.	Current consumption is low. (Output current: 3 mA max.) Disable unconnected line detection for that input (so that the unconnected line detection function does not operate.)
Slaves with Disconnected Line Detection	The Disconnected Line Detection Status Flag turned ON for an unused output.	Disconnected line detection is enabled for an unused output. Disable disconnected line detection for that output.
	The Disconnected Line Detection Status Flag turned ON even though the external load was connected.	Current consumption is low. (Output current: 3 mA max.) Disable disconnected line detection for that output (so that the disconnected line detection function does not operate.)

7-3 Maintenance and Replacement

This section describes the routine cleaning and inspection recommended as regular maintenance, as well as the Unit replacement procedure required if an EtherNet/IP Unit needs to be replaced.

7-3-1 Cleaning

Clean the EtherNet/IP Unit regularly as described below in order to keep the network in its optimal operating condition.

- Wipe the Unit daily with a dry, soft cloth.
- When a spot can't be removed with a dry cloth, dampen the cloth with a neutral cleanser (2% solution), wring out the cloth, and wipe the Unit.
- A smudge may remain on the Unit from gum, vinyl, or tape that was left on for a long time. Remove the smudge when cleaning.

⚠ **Caution** Never use volatile solvents such as paint thinner, benzene, or chemical wipes. These substances could damage the surface of the Unit.

7-3-2 Inspection

Be sure to inspect the system periodically to keep it in its optimal operating condition. In general, inspect the system once every 6 to 12 months, but inspect more frequently if the system is used with high temperature or humidity or under dirty/dusty conditions.

Inspection Equipment

Prepare the following equipment before inspecting the system.

Normally Required Equipment

Have a standard and Phillips-head screwdriver, multimeter, alcohol, and a clean cloth.

Occasionally Required Equipment

Depending on the system conditions, a synchroscope, oscilloscope, thermometer, or hygrometer (to measure humidity) might be needed.

Inspection Procedure

Check the items in the following table and correct any items that are below standard.

Item		Standard	Inspection
Environmental conditions	Ambient and cabinet temperature	Refer to specifications for each Slave Unit.	Thermometer
	Ambient and cabinet humidity	Refer to specifications for each Slave Unit.	Hygrometer
	Dust/dirt accumulation	None	Visual
Installation	Are the Units secure?	No looseness	Phillips screwdriver
	Are the Ethernet cable connectors fully inserted?	No looseness	Phillips screwdriver
	Are the external wiring screws tight?	No looseness	Phillips screwdriver
	Are the cables in good condition?	No external abnormalities	Visual

7-3-3 Unit Replacement Procedure

The network consists of the EtherNet/IP Unit and EtherNet/IP Slave Units. The entire network is affected when a Unit is faulty. A faulty Unit must be repaired or replaced quickly.

Precautions

Observe the following precautions when replacing a faulty Unit.

- After replacement, verify that there are no errors with the new Unit.
- When a Unit is being returned for repair, attach a sheet of paper detailing the problem and return the Unit to your OMRON dealer.
- If there is a faulty contact, try wiping the contact with a clean, lint-free cloth dampened with alcohol.

Settings Required after Unit Replacement

After a Unit has been replaced, make sure that the switches and other settings on the new Unit are the same as those on the previous Unit.

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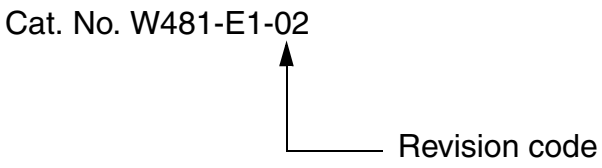
Revision History

A manual revision code appears as a suffix to the catalog number on the front cover of the manual.



The following table outlines the changes made to the manual during each revision. Page numbers refer to the previous version.

Revision code	Date	Revised content
01	April 2009	Original production
02	November 2010	Corrected mistakes.

Terms and Conditions of Sale

1. Offer; Acceptance. These terms and conditions (these "Terms") are deemed part of all quotes, agreements, purchase orders, acknowledgments, price lists, catalogs, manuals, brochures and other documents, whether electronic or in writing, relating to the sale of products or services (collectively, the "Products") by Omron Electronics LLC and its subsidiary companies ("Omron"). Omron objects to any terms or conditions proposed in Buyer's purchase order or other documents which are inconsistent with, or in addition to, these Terms.
2. Prices; Payment Terms. All prices stated are current, subject to change without notice by Omron. Omron reserves the right to increase or decrease prices on any unshipped portions of outstanding orders. Payments for Products are due net 30 days unless otherwise stated in the invoice.
3. Discounts. Cash discounts, if any, will apply only on the net amount of invoices sent to Buyer after deducting transportation charges, taxes and duties, and will be allowed only if (i) the invoice is paid according to Omron's payment terms and (ii) Buyer has no past due amounts.
4. Interest. Omron, at its option, may charge Buyer 1-1/2% interest per month or the maximum legal rate, whichever is less, on any balance not paid within the stated terms.
5. Orders. Omron will accept no order less than $200 net billing.
6. Governmental Approvals. Buyer shall be responsible for, and shall bear all costs involved in, obtaining any government approvals required for the importation or sale of the Products.
7. Taxes. All taxes, duties and other governmental charges (other than general real property and income taxes), including any interest or penalties thereon, imposed directly or indirectly on Omron or required to be collected directly or indirectly by Omron for the manufacture, production, sale, delivery, importation, consumption or use of the Products sold hereunder (including customs duties and sales, excise, use, turnover and license taxes) shall be charged to and remitted by Buyer to Omron.
8. Financial. If the financial position of Buyer at any time becomes unsatisfactory to Omron, Omron reserves the right to stop shipments or require satisfactory security or payment in advance. If Buyer fails to make payment or otherwise comply with these Terms or any related agreement, Omron may (without liability and in addition to other remedies) cancel any unshipped portion of Products sold hereunder and stop any Products in transit until Buyer pays all amounts, including amounts payable hereunder, whether or not then due, which are owing to it by Buyer. Buyer shall in any event remain liable for all unpaid accounts.
9. Cancellation; Etc. Orders are not subject to rescheduling or cancellation unless Buyer indemnifies Omron against all related costs or expenses.
10. Force Majeure. Omron shall not be liable for any delay or failure in delivery resulting from causes beyond its control, including earthquakes, fires, floods, strikes or other labor disputes, shortage of labor or materials, accidents to machinery, acts of sabotage, riots, delay in or lack of transportation or the requirements of any government authority.
11. Shipping; Delivery. Unless otherwise expressly agreed in writing by Omron:
    a. Shipments shall be by a carrier selected by Omron; Omron will not drop ship except in "break down" situations.
    b. Such carrier shall act as the agent of Buyer and delivery to such carrier shall constitute delivery to Buyer;
    c. All sales and shipments of Products shall be FOB shipping point (unless otherwise stated in writing by Omron), at which point title and risk of loss shall pass from Omron to Buyer; provided that Omron shall retain a security interest in the Products until the full purchase price is paid;
    d. Delivery and shipping dates are estimates only; and
    e. Omron will package Products as it deems proper for protection against normal handling and extra charges apply to special conditions.
12. Claims. Any claim by Buyer against Omron for shortage or damage to the Products occurring before delivery to the carrier must be presented in writing to Omron within 30 days of receipt of shipment and include the original transportation bill signed by the carrier noting that the carrier received the Products from Omron in the condition claimed.
13. Warranties. (a) Exclusive Warranty. Omron's exclusive warranty is that the Products will be free from defects in materials and workmanship for a period of twelve months from the date of sale by Omron (or such other period expressed in writing by Omron). Omron disclaims all other warranties, express or implied. (b) Limitations. OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, ABOUT NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OF THE PRODUCTS. BUYER ACKNOWLEDGES THAT IT ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. Omron further disclaims all warranties and responsibility of any type for claims or expenses based on infringement by the Products or otherwise of any intellectual property right. (c) Buyer Remedy. Omron's sole obligation hereunder shall be, at Omron's election, to (i) replace (in the form originally shipped with Buyer responsible for labor charges for removal or replacement thereof) the non-complying Product, (ii) repair the non-complying Product, or (iii) repay or credit Buyer an amount equal to the purchase price of the non-complying Product; provided that in no event shall Omron be responsible for warranty, repair, indemnity or any other claims or expenses regarding the Products unless Omron's analysis confirms that the Products were properly handled, stored, installed and maintained and not subject to contamination, abuse, misuse or inappropriate modification. Return of any Products by Buyer must be approved in writing by Omron before shipment. Omron Companies shall not be liable for the suitability or unsuitability or the results from the use of Products in combination with any electrical or electronic components, circuits, system assemblies or any other materials or substances or environments. Any advice, recommendations or information given orally or in writing, are not to be construed as an amendment or addition to the above warranty. See http://www.omron247.com or contact your Omron representative for published information.
14. Limitation on Liability; Etc. OMRON COMPANIES SHALL NOT BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR PRODUCTION OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED IN CONTRACT, WARRANTY, NEGLIGENCE OR STRICT LIABILITY. Further, in no event shall liability of Omron Companies exceed the individual price of the Product on which liability is asserted.
15. Indemnities. Buyer shall indemnify and hold harmless Omron Companies and their employees from and against all liabilities, losses, claims, costs and expenses (including attorney's fees and expenses) related to any claim, investigation, litigation or proceeding (whether or not Omron is a party) which arises or is alleged to arise from Buyer's acts or omissions under these Terms or in any way with respect to the Products. Without limiting the foregoing, Buyer (at its own expense) shall indemnify and hold harmless Omron and defend or settle any action brought against such Companies to the extent based on a claim that any Product made to Buyer specifications infringed intellectual property rights of another party.
16. Property; Confidentiality. Any intellectual property in the Products is the exclusive property of Omron Companies and Buyer shall not attempt to duplicate it in any way without the written permission of Omron. Notwithstanding any charges to Buyer for engineering or tooling, all engineering and tooling shall remain the exclusive property of Omron. All information and materials supplied by Omron to Buyer relating to the Products are confidential and proprietary, and Buyer shall limit distribution thereof to its trusted employees and strictly prevent disclosure to any third party.
17. Export Controls. Buyer shall comply with all applicable laws, regulations and licenses regarding (i) export of products or information; (iii) sale of products to "forbidden" or other proscribed persons; and (ii) disclosure to non-citizens of regulated technology or information.
18. Miscellaneous. (a) Waiver. No failure or delay by Omron in exercising any right and no course of dealing between Buyer and Omron shall operate as a waiver of rights by Omron. (b) Assignment. Buyer may not assign its rights hereunder without Omron's written consent. (c) Law. These Terms are governed by the law of the jurisdiction of the home office of the Omron company from which Buyer is purchasing the Products (without regard to conflict of law principles). (d) Amendment. These Terms constitute the entire agreement between Buyer and Omron relating to the Products, and no provision may be changed or waived unless in writing signed by the parties. (e) Severability. If any provision hereof is rendered ineffective or invalid, such provision shall not invalidate any other provision. (f) Setoff. Buyer shall have no right to set off any amounts against the amount owing in respect of this invoice. (g) Definitions. As used herein, "including" means "including without limitation"; and "Omron Companies" (or similar words) mean Omron Corporation and any direct or indirect subsidiary or affiliate thereof.

Certain Precautions on Specifications and Use

1. Suitability of Use. Omron Companies shall not be responsible for conformity with any standards, codes or regulations which apply to the combination of the Product in the Buyer's application or use of the Product. At Buyer's request, Omron will provide applicable third party certification documents identifying ratings and limitations of use which apply to the Product. This information by itself is not sufficient for a complete determination of the suitability of the Product in combination with the end product, machine, system, or other application or use. Buyer shall be solely responsible for determining appropriateness of the particular Product with respect to Buyer's application, product or system. Buyer shall take application responsibility in all cases but the following is a non-exhaustive list of applications for which particular attention must be given:
   (i) Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this document.
   (ii) Use in consumer products or any use in significant quantities.
   (iii) 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.
   (iv) Systems, machines and equipment that could present a risk to life or property. Please know and observe all prohibitions of use applicable to this Product.
   NEVER USE THE PRODUCT FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY OR IN LARGE QUANTITIES WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON'S PRODUCT IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.
2. Programmable Products. Omron Companies shall not be responsible for the user's programming of a programmable Product, or any consequence thereof.
3. Performance Data. Data presented in Omron Company websites, catalogs and other materials 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 user must correlate it to actual application requirements. Actual performance is subject to the Omron's Warranty and Limitations of Liability.
4. 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 part numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the Product may be changed without any notice. When in doubt, special part numbers may be assigned to fix or establish key specifications for your application. Please consult with your Omron's representative at any time to confirm actual specifications of purchased Product.
5. Errors and Omissions. Information presented by Omron Companies has been checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical or proofreading errors or omissions.

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