Panasonic

PROGRAMMABLE CONTROLLER

FP7 CPU Unit

User's Manual

EtherNetIP Communication

WUME-FP7CPUEIP-01

2019.05 | panasonic.net/id/pidsx/global

SAFETY PRECAUTIONS

To prevent accidents or personal injuries, please be sure to comply with the following items.
Prior to installation, operation, maintenance and check, please read this manual carefully for proper use.
Before using, please fully understand the knowledge related to the equipment, safety precautions and all other precautions.
Safety precautions are divided into two levels in this manual: Warning and Caution.

⚠ WARNING **Incorrect operation may lead to death or serious injury.**

- Take appropriate safety measures to the external circuit of the product to ensure the security of the whole system in case of abnormalities caused by product failure or external.
- Do not use this product in areas with inflammable gases.
  Otherwise it may lead to an explosion.
- Do not put this product into a fire.
  Otherwise it could cause damage to the battery or other electronic parts.
- Do not impact, charge or heat the lithium battery, and do not put it into a fire.
  Otherwise it may lead to fire or damage.

⚠ CAUTION **Incorrect operation may lead to injury or material loss.**

- To prevent the excessive exothermic heat or smoke generation of the product, a certain margin is required for guaranteed characteristics and performance ratings of relative products.
- Do not decompose or transform it.
  Otherwise it will lead to the excessive exothermic heat or smoke generation of the product.
- Do not touch terminal blocks during power-on.
  Otherwise it may result in an electric shock.
- Set an emergency stop and interlock circuit in the external devices.
- Connect wires and connectors reliably.
  Otherwise it may lead to the excessive exothermic heat or smoke generation of the product.
- Do not undertake construction (such as connection and disconnection) while the power supply is on.
  It could lead to an electric shock.
- If the equipment is used in a manner not specified by the Panasonic, the protection provided by the equipment may be impaired.
- This product has been developed/produced for industrial use only.

Description on Copyright and Trademarks

Introduction

Thank you for buying a Panasonic product. Before you use the product, please carefully read the installation instructions and the user's manual, and understand their contents in detail to use the product properly.

Types of Manual

- There are different types of user's manual for the FP7 series, as listed below. Please refer to a relevant manual for the unit and purpose of your use.
- The manuals can be downloaded on our website:
  https://industrial.panasonic.com/ac/e/dl_center/manual/

Unit name or purpose of use	Manual name	Manual code
FP7 Power Supply Unit	FP7 CPU Unit User's Manual (Hardware)	WUME-FP7CPUH
FP7 CPU Unit	FP7 CPU Unit Command Reference Manual	WUME-FP7CPUPGR
	FP7 CPU Unit User's Manual (Logging Trace Function)	WUME-FP7CPULOG
	FP7 CPU Unit User's Manual (Security Function)	WUME-FP7CPUSEC
Instructions for Built-in LAN Port	FP7 CPU Unit Users Manual (LAN Port Communication)	WUME-FP7LAN
	FP7 CPU Unit User's Manual (Ethernet Add-ons)	WUME-FP7CPUETEX
	FP7 CPU Unit User's Manual (EtherNet IP communication)	WUME-FP7CPUEIP
Instructions for Built-in COM Port	FP7 series User's Manual (SCU communication)	WUME-FP7COM
FP7 Extension Cassette (Communication) (RS-232C/RS-485 type)		
FP7 Extension Cassette (Communication) (Ethernet type)	FP7 series User's Manual (Communication cassette Ethernet type)	WUME-FP7CCET
FP7 Extension (Function) Cassette Analog Cassette	FP7 Analog Cassette User's Manual	WUME-FP7FCA
FP7 Digital Input/Output Unit	FP7 Digital Input/Output Unit User's Manual	WUME-FP7DIO
FP7 Analog Input Unit	FP7 Analog Input Unit User's Manual	WUME-FP7AIH
FP7 Analog Output Unit	FP7 Analog Output Unit User's Manual	WUME-FP7AOH
FP7 Thermocouple Multi-analog Input Unit	FP7 Thermocouple multi-analog input unit FP7 RTD input unit User's Manual	WUME-FP7TCRTD
FP7 RTD Input Unit		
FP7 High-speed Counter Unit	FP7 High-speed counter Unit User's Manual	WUME-FP7HSC
FP7 Pulse Output Unit	FP7 Pulse Output Unit User's Manual	WUME-FP7PG
FP7 Positioning Unit	FP7 Positioning Unit User's Manua	WUME-FP7POSP
FP7 Serial Communication Unit	FP7 series User's Manual (SCU communication)	WUME-FP7COM
PHLS System	PHLS System User's Manual	WUME-PHLS
Programming Software FPWIN GR7	FPWIN GR7 Introduction Guidance	WUME-FPWINGR7

Contents of the Changes in EtherNet/IP Communication Function Manual

The following functions have been added to improve the easy usability of the EtherNet/IP function.

Use the following version for using the added functions.

FP7 CPU UNIT : Ver.4.11 or later
FPWIN GR7(S) : Ver.2.10 or later

■ Improved items of EtherNet/IP Setting Tool functions

- The following setting items have been added to the EtherNet/IP basic configuration. This setting is available when the version of the FP7 CPU unit is Ver.4.11 or later.

  - RUN/IDLE bit operation of cyclic communication

For details, refer to 8.1.2 Cyclic Communication State Tables of EtherNet/IP.

Table of Contents

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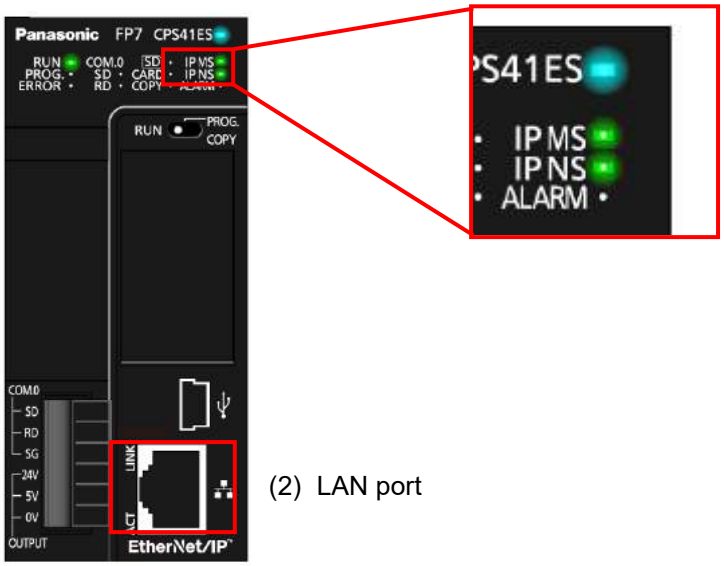
Introduction of EtherNet/IP Function

1.1 Introduction of EtherNet/IP Function

FP7 supports a new function "EtherNet/IP function".

This chapter describes the related names and functions, applicable models and the required versions for using this function.

Names and Parts



(1) Operation indicator LED

(2) LAN port

Name	Description
Operation indicator LED	MS These LEDs display the operating condition of the unit. NS Displays the communication status of network. For details of the lighting states of MS and NS, refer to “14.1 Lighting State of LED for EtherNet/IP Setting“ for EtherNet/IP Setting.
LAN port	Port for connecting to EtherNet LAN. The EtherNet/IP communication is performed using the LAN port.

Models on which the EtherNet/IP function is usable

The EtherNet/IP function is available for the following four models.

Use the EDS files for each model stored in the version Ver.2.8 of GR7(s) or later.

The EDS files are also stored in the following folder.

Storage location: C:\ProgramData\Panasonic-ID SUNX Control\EIP

Note) The ProgramData folder is a hidden folder.

The EDS files can be downloaded from our website.

- AFP7CPS31E
- AFP7CPS41E
- AFP7CPS31ES
- AFP7CPS41ES

Version of FP7 CPU unit on which the EtherNet/IP function is usable

Use the following version for using the EtherNet/IP function.

- FP7 CPU unit: Ver.4.00 or later

2

Description of EtherNet/IP Communication Function

2.1 What is EtherNet/IP?

EtherNet/IP (Ethernet Industrial Protocol) is an industrial multi-vendor realtime Ethernet system for executing the communication protocol for CIP (Common Industrial Protocol) control in an application layer on standard Ethernet.

For information on CIP, refer to the documents of ODVA.

Use the following versions for using the FP7 EtherNet/IP function.

① FP7 CPU unit: Ver.4.00 or later

② FPWIN GR7(S): Ver.2.8 or later

【Point】

- The EtherNet/IP communication and Ethernet communication (such as the communication with GR7(S)) can be used simultaneously.

2.2 Cyclic Communication Function

The cyclic communication is a function for connecting from a scanner device to an adapter device and sending data mutually in a specified cycle after completing the connection.

The scanner device is a controller such as PLC.

The adapter device is a device such as a robot controller, encoder or IO device.

Scan list is a list that defines the connections between the scanner device and multiple adapter devices.

A constant cycle is called RPI (Requested Packet Interval).

The side which opens the connection of the cyclic communication is called originator, and the side which the connection is opened is called target.

The scanner device can be used as the adapter device.

2.3 Definitions of Terms

The following terms are used in this manual and the EtherNet/IP setting tool.

Term	Description
Scan list	The scan list is the connection settings with adapter devices registered for a scanner device. The scanner device is connected with adapter devices according to the scan list.
EDS file (Electric data sheet)	An EDS file contains the information on the communication for registering adapter devices in the scan list. EDS files are provided for each product by each vendor. The EDS files of each adapter device should be registered for constructing the scan list with the setting tool.
Originator and Target	The side which connects the connection of the cyclic communicationo is called originator. The side which the connection of the cyclic communicationo is connected is called target.
Node number	Node numbers can be set when an adapter device is registered in the scan list. Numbers that do not overlap are allocated in the scan list as node numbers. Node numbers are not used in the cyclic communication, however, as each adapter is recognized by these numbers, they are used for monitoring the communication state of each node or controlling the start/stop of the communication.
Connection setting	The details of the connections of adapters registered in the scan list are set.
Node Name	Arbitrary node names can be given.
Device name	This is the device name of an adapter. The device name is registered in the EDS file.
Connection name	The type of the connection manager registered in the EDS file is selected by the name. By selecting this, the application type (communication method) is changed.
Application type	The communication method can be selected by the application type. The following communication methods are available; 1 : Exclusive Owner (Two-way communication) 2 : Input Only 3 : Listen Only For a normal adapter device, select 1 (Two-way communication). Although "Exclusive Owner" and "Input Only" are independent connections, "Listen Only" can be connected only when either of the above connection is established, and it will be automatically cut if the above independent connection is disconnected. Also, it will be reconnected automatically when the above independent connection is reconnected. Although the FP7 can be used as an adapter, it can be connected only when "Input Only" is selected.

Term	Description
Compatibility check	A method for verifying the revision of a used EDS file and the information that the device actually used has is selected. Three verification methods are available. The default is "Follow Adapter Rule". 1 : Check 2 : Not Check 3 : Follow Adapter Rule
Communication method	Either instance communication (number specifications) or tag communication (symbol name specification) is displayed. For connecting from a scanner to adapters, there are methods which establish the connection by specifying numbers or by specifying symbols. Even when connecting by specifying symbols, numbers are assigned to packets during the actual cyclic communication. When selecting a connection, the methods available for the connection are displayed. When using the FP7 as an adapter, the both methods can be used, however, in the case of instance method, the selectable instance numbers are 100 to 199.
Send trigger	The transmission timing is selected from Cyclic or COS (Change of state). However, COS depends on devices. COS is basically a cyclic communication, however, it also performs transmission when sent data changes. The FP7 does not support COS.
COS transmission disable time	Although COS performs transmission when sent data changes, transmission is not performed even if the unit detects the data change within this time.
Timeout period	In the cyclic communication, the timeout is judged on a receiver side to send transmission data as UDP packet. The timeout period is selected from 4, 8, 16, 32, 64, 128, 256 and 512 times of RPI. The timeout period should be 10 msec or more. RPI can be specified for T>O direction and O>T direction separately, so each timeout period may be different values.
Input setting (T>O)	This is the setting for the transmission from a target to the FP7 (originator).
RPI (Requested Packet Interval)	Set the transmission interval for the cyclic communication.Set a value within the communication capacity of the adapter. The usable RPI range depends on devices. For the FP7, it is 0.5 ms to 10 s (by 0.5 ms).

Term	Description
Connection type	Select a communication method that is selectable for the selected connection. 1 : 1:1 communicaion (Point to Point) 2 : Multicast communication (Multicast) The point-to-point communication is a 1 to 1 communication between the connection source and destination. Transmission packet is received by the source device or destination device only. Other devices connected to the same HUB does not receive the transmission packet. In the mutlicast communication, transmission data is sent as multicast packet. By connecting multiple sources to the same connection, single multicast packet can be received by the multiple connection sources. The multicast packet is basically received by all the devices connected to the same HUB which includes the devices unrelated to the communication, and it leads to an unnecessary communication load. Therefore, set not to exceed 100% with the load factor caclulation of the setting tool when using the mutlicast communication. Also, it is recommended to use a HUB with a multicast filter.
Instance ID/Tag name	Set an instance ID or tag name according to the communication method of the selected connection.
Data size	Set the communication data size according to the communication setting of each adapter device. Set this as well as changing the setting for the scanner, otherwise the communication cannot be performed as it does not match the setting of adapters.
Refresh method	There are the following two refresh operations. 1 : Transfers the data sent to adapters to send buffers from allocated operation memories. 2 : Transfers the data sent from adapters to allocated operation memories from receive buffers. The refresh method can be selected from three types, Batch, Divice and Instruction.
Parameter change	Parameters that can be changed by EDS can be changed.
PPS performance index (Packet per sec)	This is an index of sent/received packets processed in one second.
Normal packet and large packet	The packet whose size is within 504 bytes is called normal packet. The packet whose size is 505 bytes to 1444 bytes is called larget packet. The amximum communication performance varies according to the data size used for communication. Performance index of FP7 When the size is 504 bytes or less: Max. 10000 pps When the size is 505 bytes or more: Max. 5000 pps

Term	Description
Protocol used for cyclic communication	The cyclic commuication is performed using UDP. The used port number is 2222.
Heartbeat	In the case of InputOnly or ListenOnly, data is sent from the target, however, a packet called heartbeat whose size is 0 is also sent from the originator (FP7). For the RPI of this heartbeat, the value 16 times of the target is used automatically. Heartbeat is used for confirming the continuation of connection on the target side. It is used for detect the timeout.
Forward open	This is a command for opening the connection of EtherNet/IP and sent using TCP. The used port number is 44818.
Large forward open	This is a command for opening the connection when sending/receiving data whose size is larger than 504 bytes.
RUN/IDLE bit	This bit indicates the operation state (RUN/IDLE) of a device that is sent from a scanner or adapter duuring the cyclic communication. RUN : 1 IDLE : 0 When the RUN/IDLE bit does not become a RUN state, the adapter device may not operate properly. For details, refer to “8.1.2 Cyclic Communication State Tables of EtherNet/IP”.

【Note】

- Do not use "2222" and "44818" for the port numbers set to the connections of Ethernet communication.

3

Examples of Network Configuration Using Cyclic Communication Function

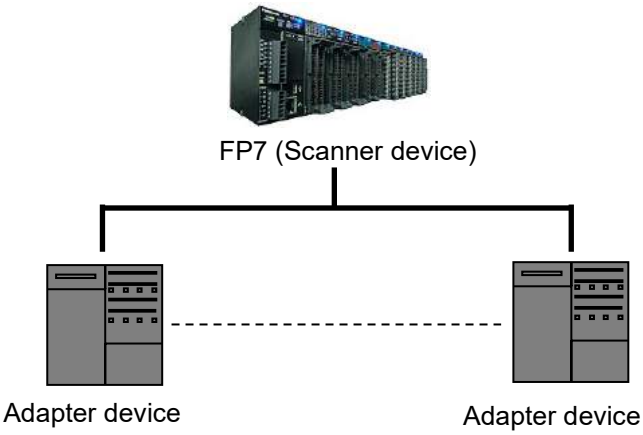
3.1 Examples of Network Configuration Using Cyclic Communication Function

Examples of the representative network configuration using the cyclic communication function are as follows.

Besides the following examples, flexible configurations are available.

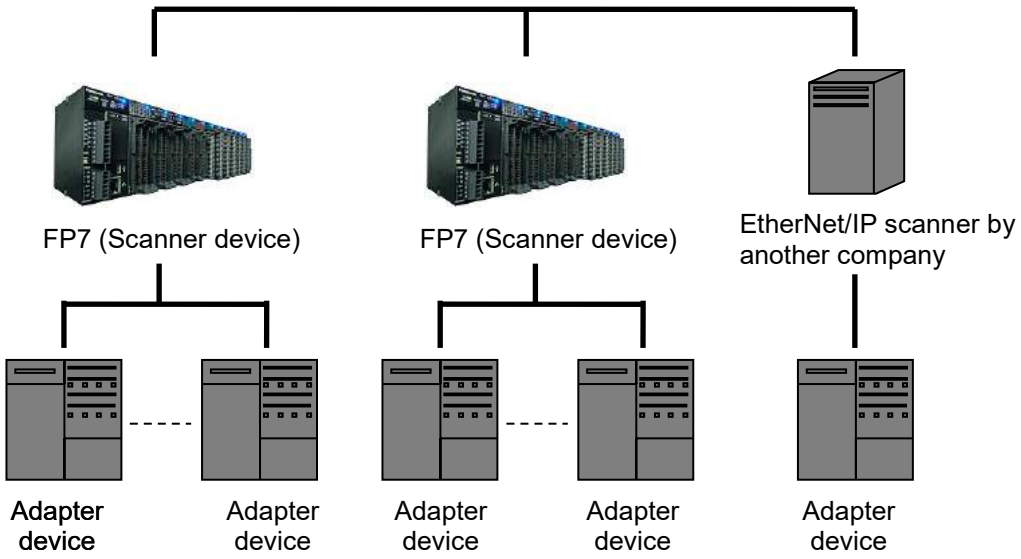
3.1.1 Connecting One Adapter Device or Multiple Adapter Devices to One FP7 CPU

The network is configured connecting one scanner device to multiple adapter devices as below.



3.1.2 Linking FP7 CPUs in Multiple Blocks

The network is configured using multiple blocks of the configuration (above 2.1.1) and linking each FP7 CPUs.



4

Overview of System Configuration Method

4.1 Overview of System Configuration Method

The system configuration is reviewed and selected by the following procedures.

1. **Selection of used adapters**

   Select adapter devices according to applications.

2. **Review of system configuration**

   Review the configurations of the system and network.

   Besides the network configuration for the EtherNet/IP communication, review how Ethernet communications other than the EtehrNet/IP communication is performed.

3. **Selection of Ethernet switch HUB**

   Select a HUB considering the network configuration and the functions of HUB.

   The used Ethernet switch HUB should be 100 Mpbs or more.

   Some HUBs have the following functions.

Switching HUB:	Transfers only the data related to devices from the destination.
Multicast filter function:	Controls the multicast packet transmission to adapters or scanners. This is used to suppress the communication load factor during the multicast communication of PLC link.
QOS function (Quality of Service):	Classifies or groups application data, and transfers data according to the priority of each group. The cyclic communication data of the EtherNet/IP communication can be transferred in preference to other Ethernet communication data. To make the priority of the cyclic communication of the EtherNet/IP communication higher, set the port number of UDP to 2222.

Note)

A switching HUB can be activated in a few seconds after the power supply turns ON, however, a switch with functions such as the multicast filter function or QOS function (Quality of Service) is called a managed switch, and it takes several tens of seconds to be activated after the power supply turns ON. Those differences should be considered in the system design.

5

Ethernet and EtherNet/IP Specifications of FP7

5.1 Number of Connections for Each Communication

The number of connections for each communication is limited.

Communication	Maximum number of connections
Ethernet communication	Max. 216 connections
EtherNet/IP communication	Max. 256 connections (including I/O map connections)
UCMM message communication	Max. 256 connections

*For the whole FP7, the total number of connections for Ethernet communication and EtherNet/IP communication should be 272 or less.

Number of connections of Ethernet communication
+ EtherNet/IP communication ≤ 272 connections

5.2 Performance and Functions of FP7

For using the EtherNet/IP function on the FP7, the following functions can be used.

5.2.1 IGMP Query

With this function, the FP7 checks periodically in which host group each EtherNet/IP device is registered on a LAN.

This function can be used when an Ethernet switch HUB with the multicast filter function and any devices which send an IGMP query do not exist in the network.

5.2.2 TTL

TTL (Time To Live) is used to set the hierarchies of the network in which transmission packets can live when sending multicast packets to another scanner.

5.2.3 Multicast

Data of one target can be sent to multiple originators.

6

EtherNet/IP Setting Method

6.1 Setting Method of Cyclic Communication

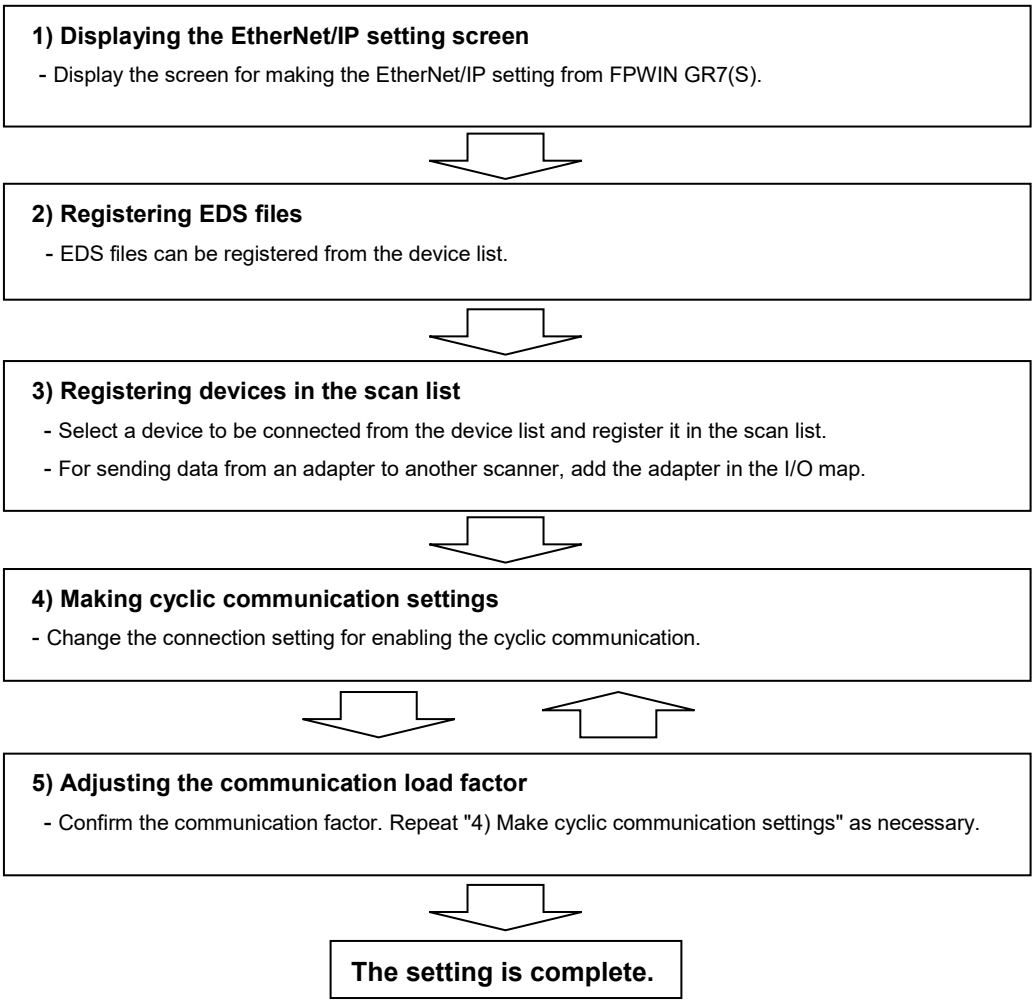
This chapter describes the procedures for making the cyclic communication setting of EtherNet/IP.

The EtherNet/IP setting is made from "EtherNet/IP Setting" of FPWIN GR7(S).

The EDS file for each EtherNet/IP device is necessary for registering the setting.

The EDS files for EtherNet IP devices are available on the site of each vendor.

Once the EDS file is registered, the registration is not required from the next time.



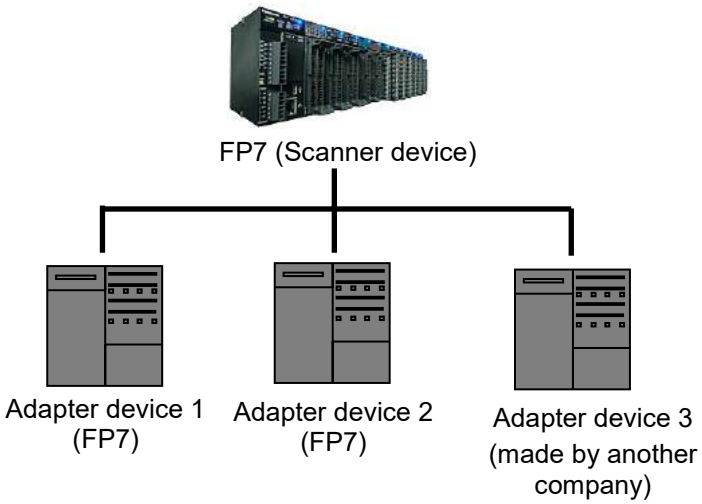
6.2 How to Use EtherNet/IP Setting Tool

For details of various operation methods of the EtherNet/IP tool, refer to 7. EtherNet/IP Setting Tool.

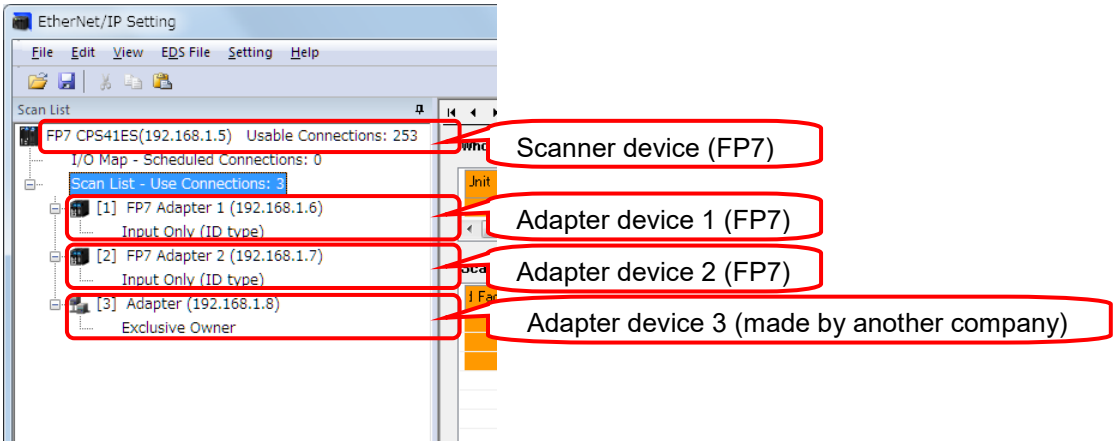
6.3 Setting Example of One Scanner Device and Multiple Adapter Devices

For configuring the system of one scanner device (FP7) and multiple adapter devices, the settings are as follows.

■ **System configuration**



■ **EtherNet/IP setting content**

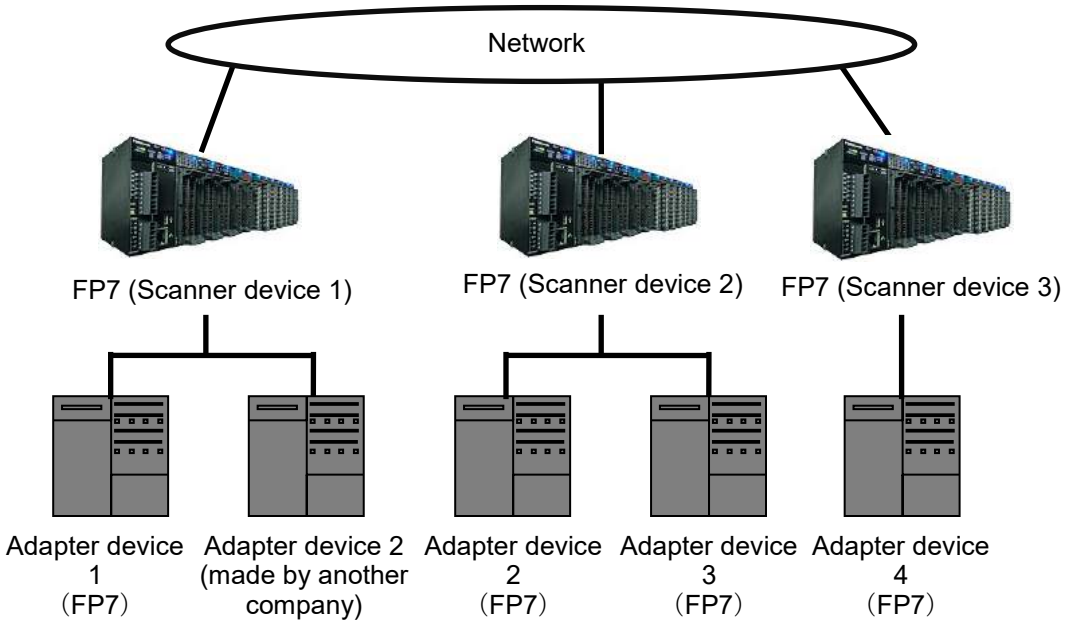


The detailed settings for each adapter device should be made in accordance with the system configuration.

6.4 Setting Example of Multiple Scanner Devices and Multiple Adapter Devices

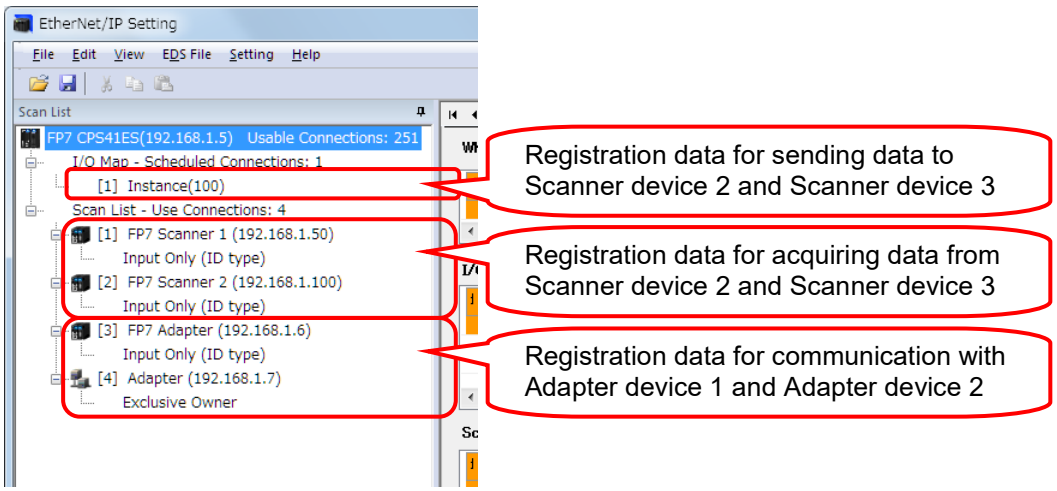
For configuring the system of multiple scanner devices (FP7) and multiple adapter devices, the settings are as follows.

■ **System configuration**



■ **EtherNet/IP setting content**

Setting content of Scanner device 1



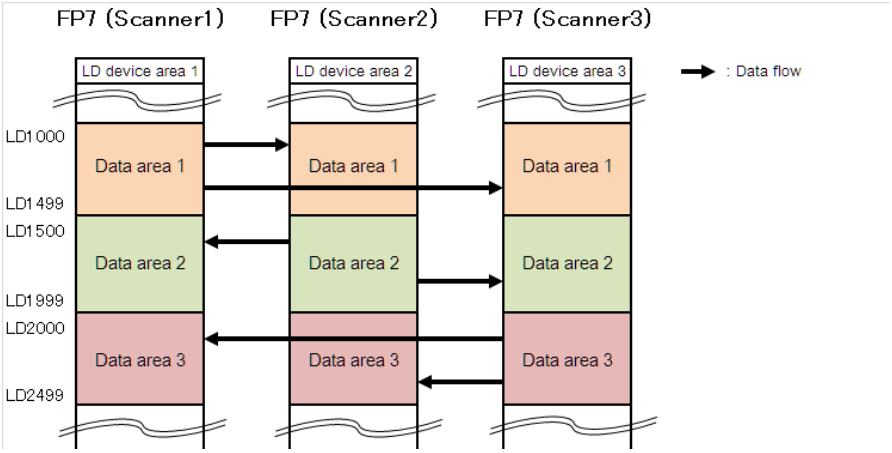
Make the same settings for the scanner devices 2 and 3.

6.5 Method of PLC Link

The method for making a link between PLCs is as follows.

6.5.1 What is PLC Link (Data Sharing between PLCs)?

By linking data between PLCs as below, data can be shared between multiple scanner devices.

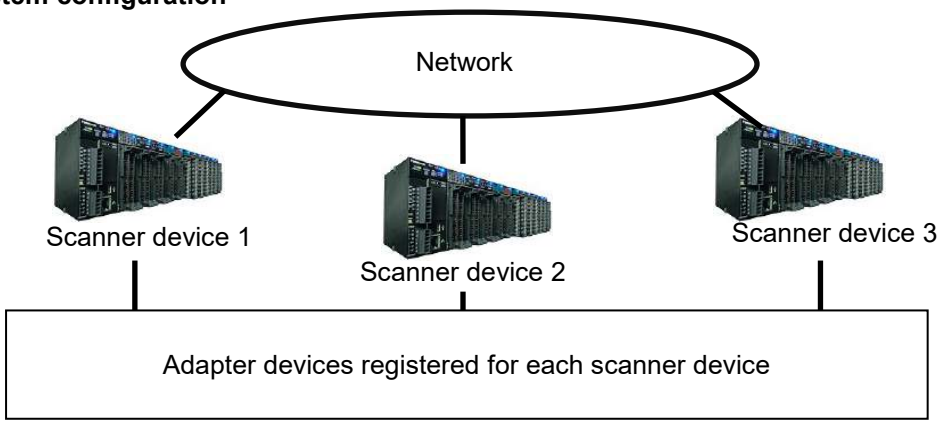


6.5.2 Setting Method of PLC Link

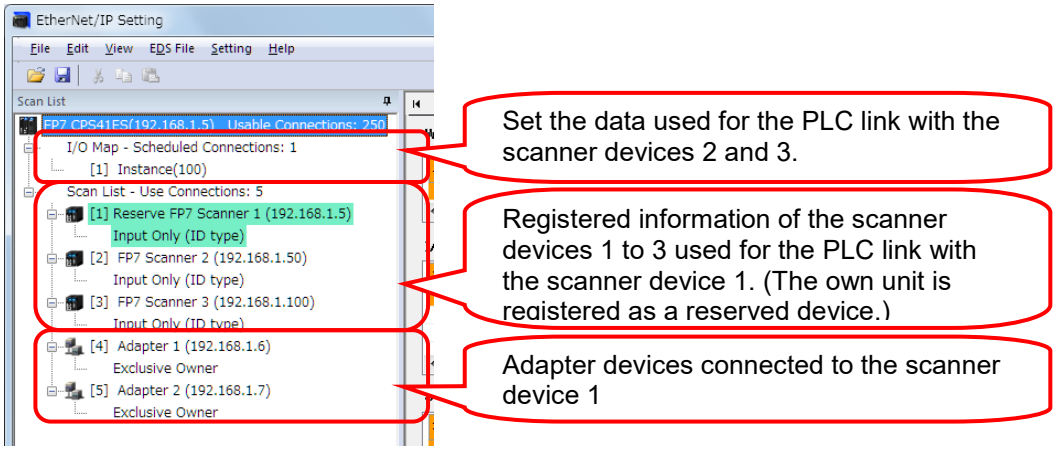
For performing the PLC link, register scanner devices to be linked in the scan list and data to be linked in the I/O map.

Example) When setting the PLC link using the scanner devices 1 to 3 of the following system configuration

■ **System configuration**



■ EtherNet/IP setting: Scan list



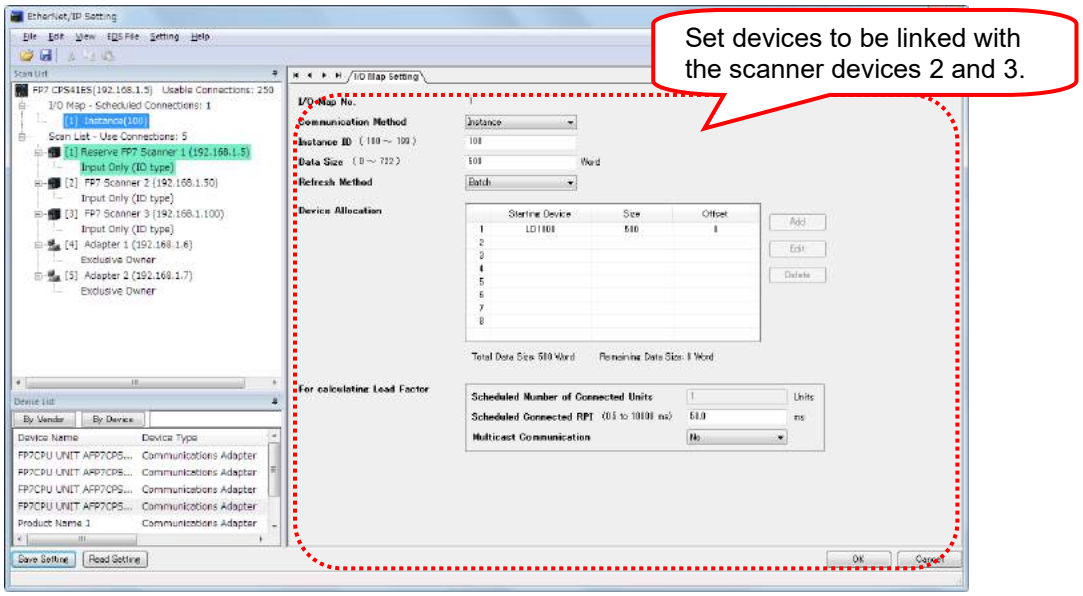
【Point】

- To easily manage the PLC link and adapter settings, make the PLC link setting as follows.

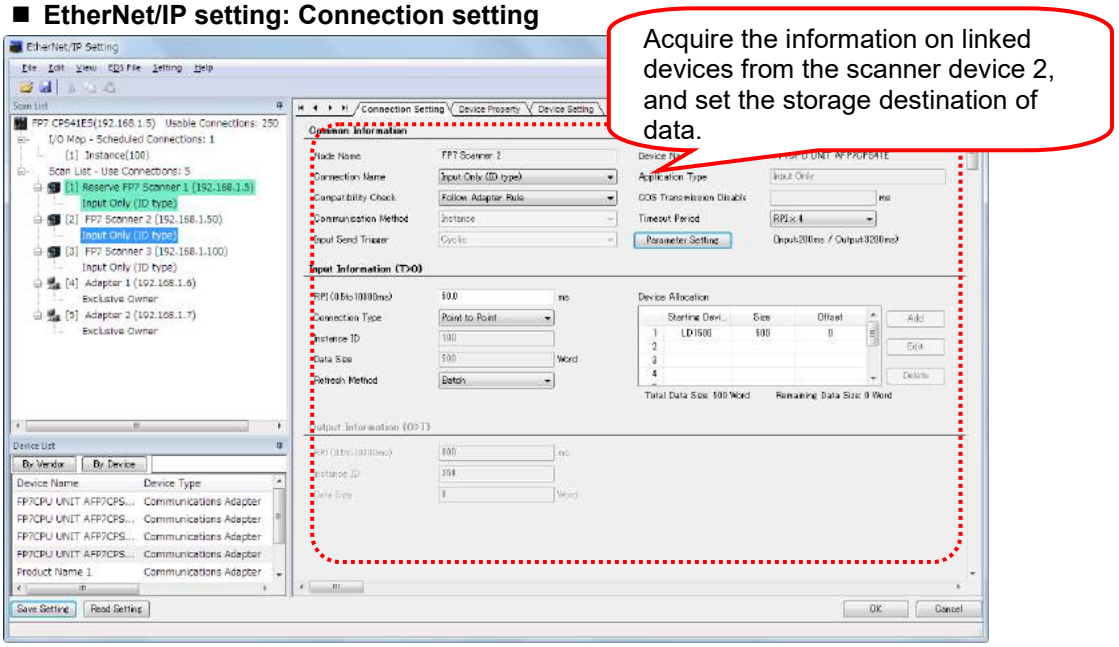
(1) First, register scanner devices including the own unit.
However, the home unit is registered as an invalid (reserved) device as it does not communication with itself.

(2) Register the adapter device connected to the own unit after the scanner devices that the PLC link is set.
Registering scanner devices (including the own unit) and adapter devices in this order makes the node number of each scanner device correspond with the contents of the scanner devices 2 and 3.

■ EtherNet/IP setting: I/O map



■ EtherNet/IP setting: Connection setting



Make the setting for the scanner device 3 as well.

7

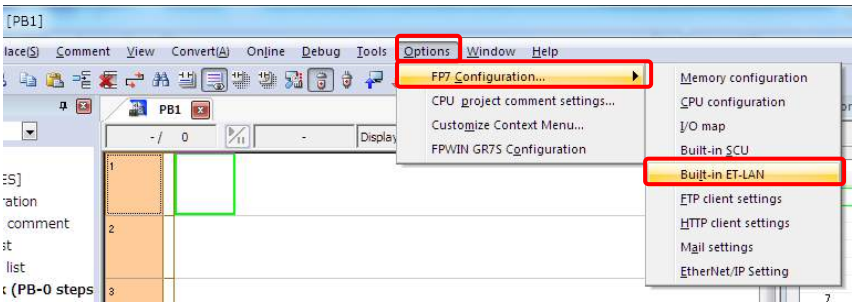
EtherNet/IP Setting Tool

7.1 Selection for Using EtherNet/IP Function

For using the EtherNet/IP function, it is necessary to set "EtherNet/IP function" to "Use" in the Built-in ET-LAN setting dialog box.

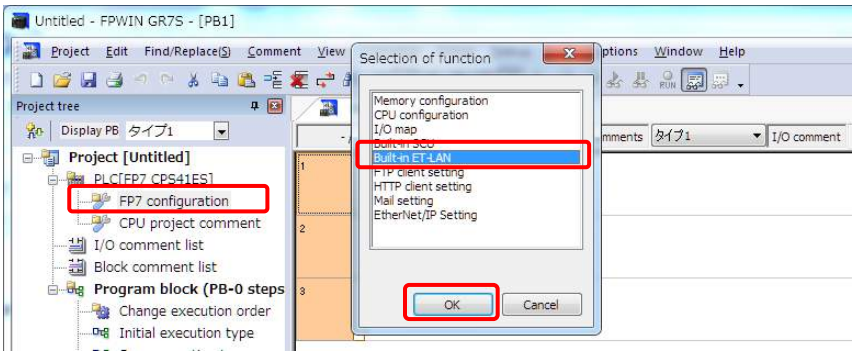
7.1.1 How to Display the Built-in ET-LAN Setting Dialog Box

7.1.1.1 Starting Method from the Menu of GR7



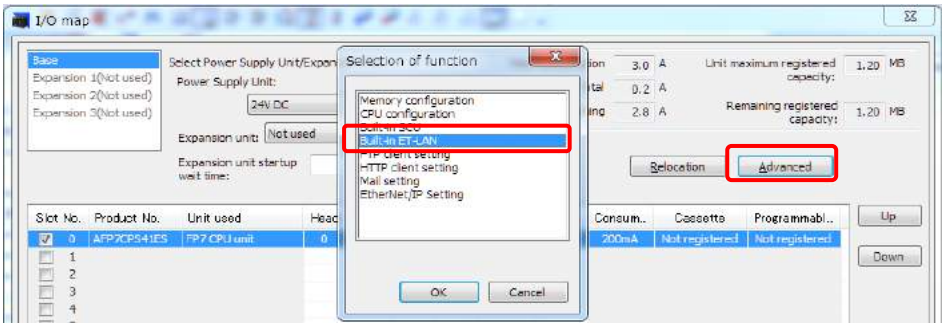
Select "Options" > "FP7 Configuration" > "Built-in ET-LAN".

7.1.1.2 Starting Method from the Project Tree of GR7



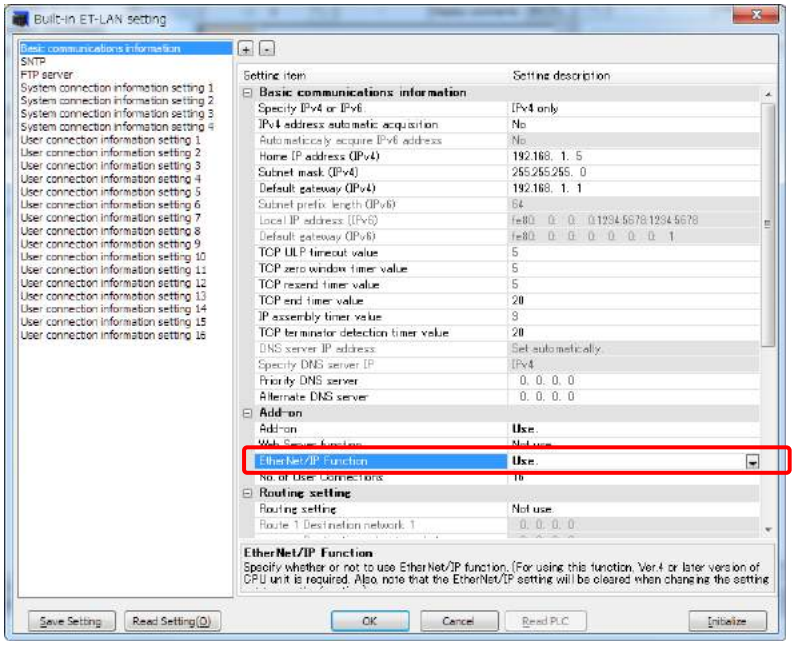
Double-click "FP7 Configuration", and select "Built-in ET-LAN" and press the OK button.

7.1.1.3 Starting Method from I/O Map Setting Screen



Select "Advanced" button of the I/O map setting screen > “Built-in ET-LAN” and press the OK button.

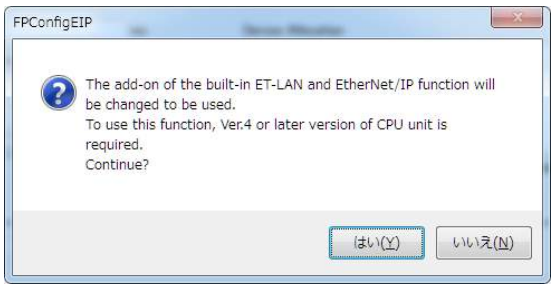
7.1.2 How to Change the Built-in ET-LAN Setting Dialog Box



"Add-on" should be set to "Use" in advance for changing "EtherNet/IP Function" to "Use".

* For setting "Add-on" to "Use", the version of the CPU unit should be V3.0 or later.
* For setting "EtherNet/IP Function" to "Use", the version of the CPU unit should be Ver.4.0 or later.

If the EtherNet/IP setting is made when "EtherNet/IP Function" of the Built-in ET-LAN dialog box is set to "Not use", the following message appears on the completion of the setting.



Selecting "Yes" changes the setting of "EtherNet/IP Function" to "Use" automatically.
* For setting "EtherNet/IP Function" to "Use", the version of the CPU unit should be Ver.4.0 or later.

7.1.3 Restrictions and Precautions on Setting EtherNet/IP Function

■ **Precautions on setting EtherNet/IP Function**

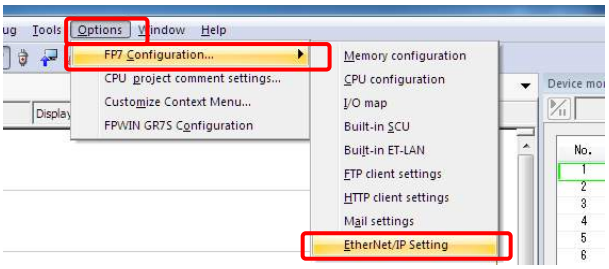
- If the setting of "EtherNet/IP Function" is changed to "Not use", the EtherNet/IP setting information will be cleared.

* When the setting for Add-on is changed to "Not use", the EtherNet/IP setting information will also be cleared like a case where the EtherNet/IP function is changed.

7.2 How to Display the EtherNet/IP Setting Screen

This chapter describes how to display the EtherNet/IP setting screen.

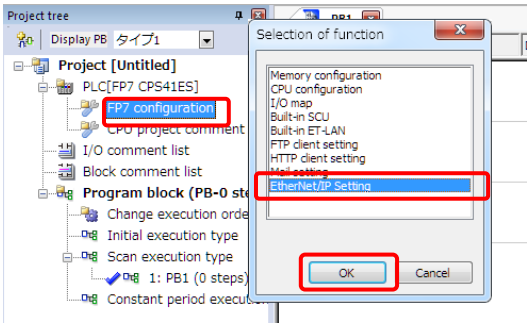
7.2.1 Starting Method from Menu



Starting method from the menu of GR7

Select "Options" > "FP7 Configuration" > "EtherNet/IP setting".

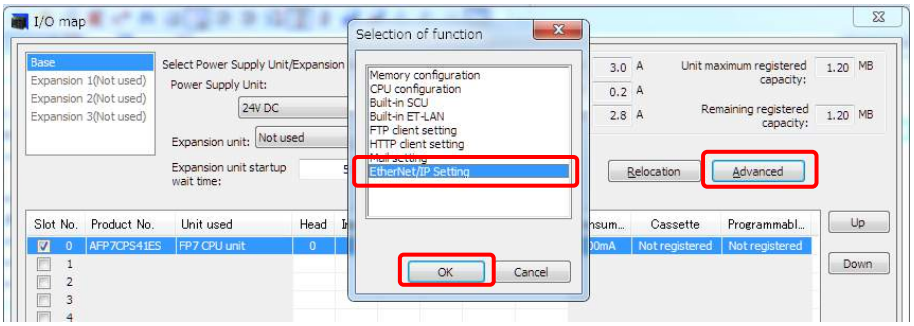
7.2.2 Starting Method from Tree Display Area



Starting method from the project tree of GR7

Double-click "FP7 Configuration", and select "EtherNet/IP setting" and press the OK button.

7.2.3 Starting Method from I/O Map Setting Screen



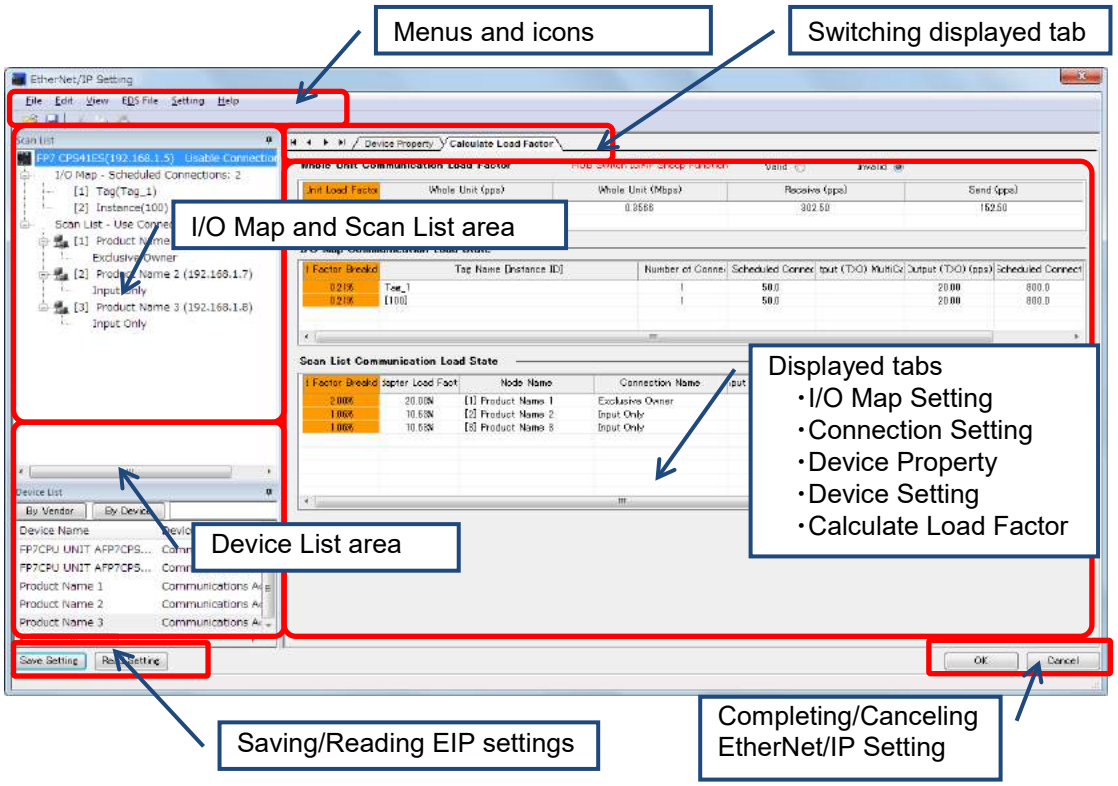
Starting Method from I/O Map Setting Screen

Select "Advanced" button of the I/O map setting screen > "EtherNet/IP setting" and press the OK button.

7.3 How to Operate EtherNet/IP Setting Tool

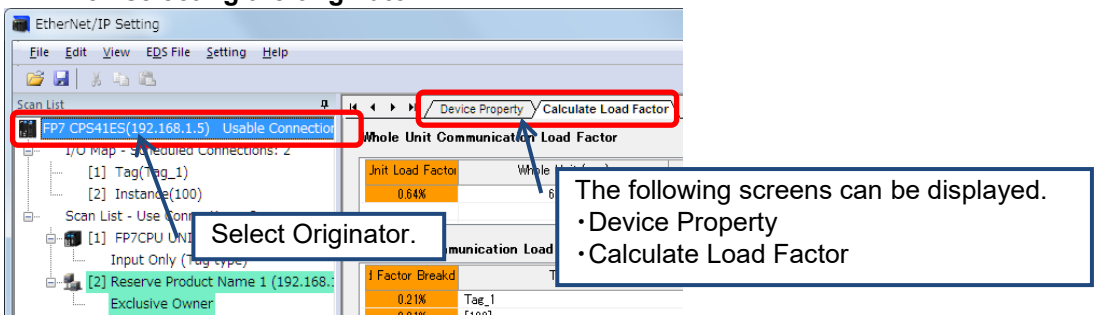
7.3.1 Structure of EtherNet/IP Setting Screen

This chapter describes the display contents of the EtherNet/IP setting screen.

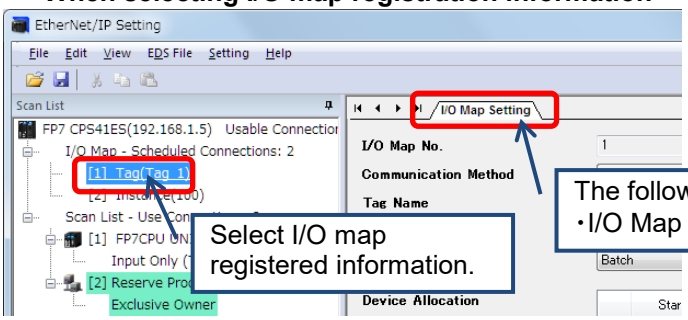


The items that can be selected by switching the display tabs vary according to the contents selected in the I/O map and scan list area.

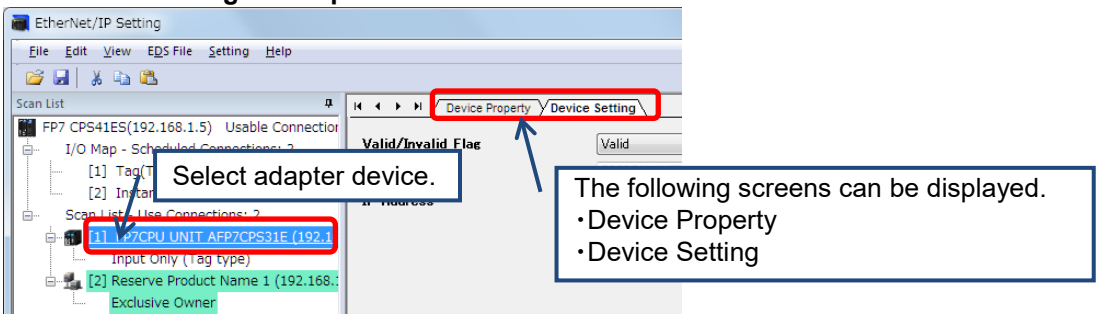
■ **When selecting the originator**



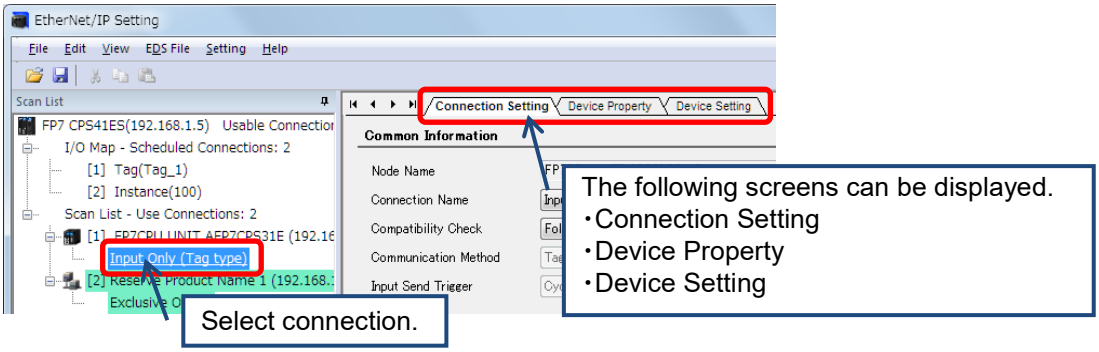
■ **When selecting I/O map registration information**



■ **When selecting an adapter device**



■ **When selecting the connection of an adapter device**



7.3.2 EtherNet/IP Setting Procedure

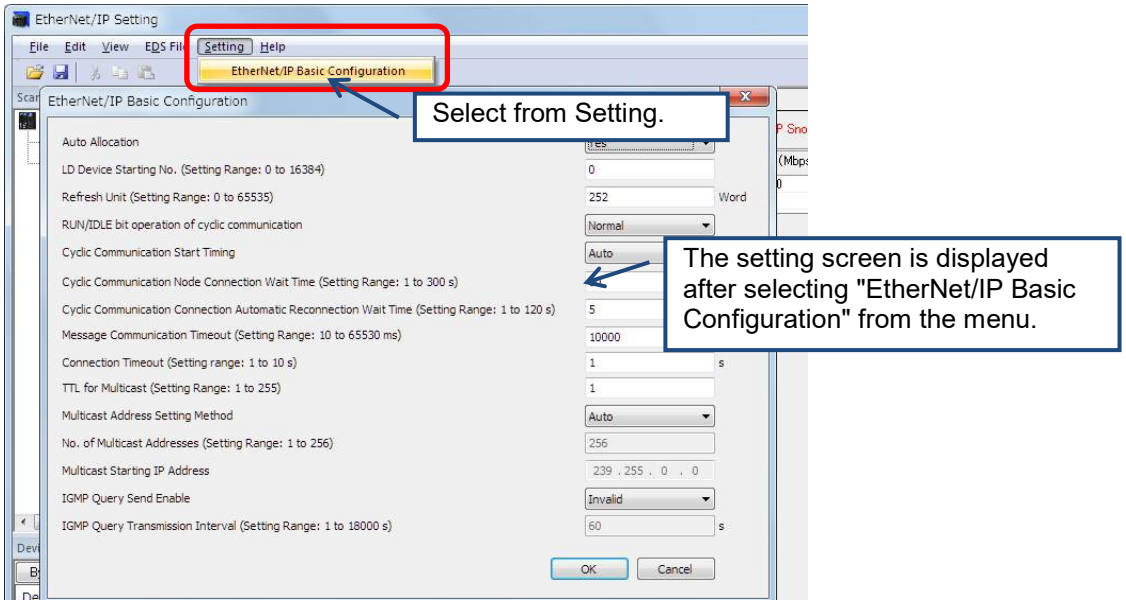
The procedure of the EtherNet/IP setting is described below.

7.3.2.1 EtherNet/IP Basic Configuration

Make the EtherNet/IP basic configuration.

■ **Procedure of displaying the screen (Start from the menu of EtherNet/IP setting)**

Select "Setting" > "EtherNet/IP Basic Cofiguration".



Auto Allocation(*1)	: Set whether to use the automatic allocation of devices or not. When setting "Auto Allocation" to "Yes", the device allocation for the I/O map setting and connection setting is automatically performed.
LD Device Starting No.	: Set the starting device number to be allocated at the time of the device automatic allocation.
Refresh Unit	: Set the number of data that can be refreshed by one scan.
RUN/IDLE bit operation of cyclic communication (*2)	: Set Normal or Limited.
Cyclic Communication Start Timing	: Set Auto or Manual.
Cyclic Communication Node Connection Wait Time	: Set the period of time during which retry is repeated without error determination.
Cyclic Communication Connection Automatic	: Set the period of time during which reconnection is retried after the occurrence of connection timeout.

Reconnection Wait Time	
Message Communication Timeout	: Set the timeout period of message communication.
Connection Timeout	: Set the connection timeout period.
TTL for Multicast	: Operation setting for performing multicast transmission as an adapter.
Multicast Address Setting Method	: Set Auto or Specify.
No. of Multicast Addresses	: Set the number of multicast addresses. This item is valid when Multicast Address Setting Method is specified.
Multicast Starting IP Address	: Set the starting IP address of multicast. This item is valid when Multicast Address Setting Method is specified.
IGMP Query Send Enable	: Set whether to make IGMP query transmission valid or invalid.
IGMP Query Transmission Interval	: Set the interval of IGMP query transmission.

*1: For allocating devices manually, set Auto Allocation to "No".

*2: For details of the operation of the RUN/IDLE bit in the cyclic communication, refer to “8.1.2 Cyclic Communication State Tables of EtherNet/IP”.

7.3.2.2 Registering EDS Files in Device List

■ **In Device List, registered EDS files can be confirmed, deleted and new EDS files can be added.**

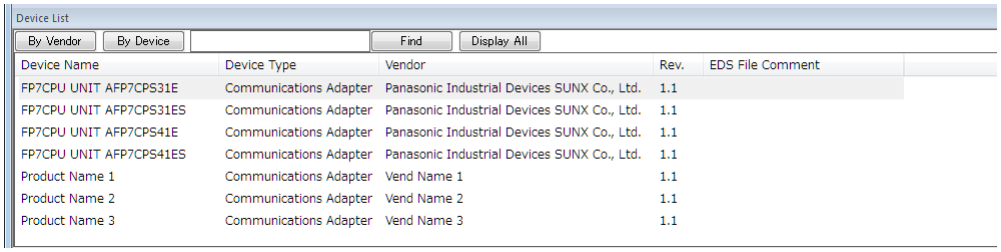
Only the explanation about the addition of EDS files is described in this chapter.

The EDS files for EtherNet IP devices are available on the site of each vendor.

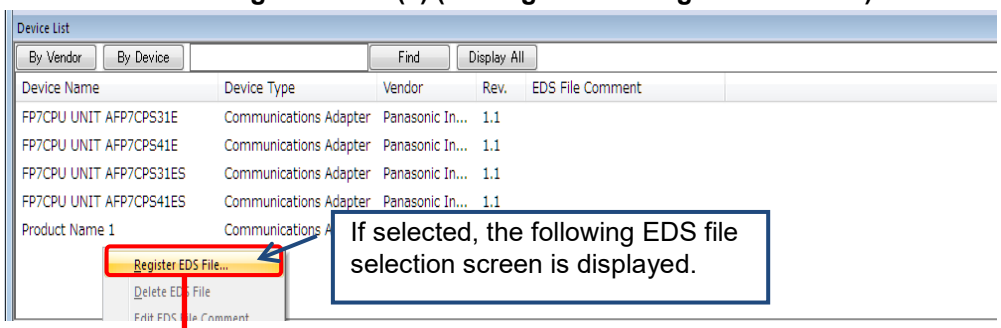
Once the EDS file is registered, the registration is not required from the next time.

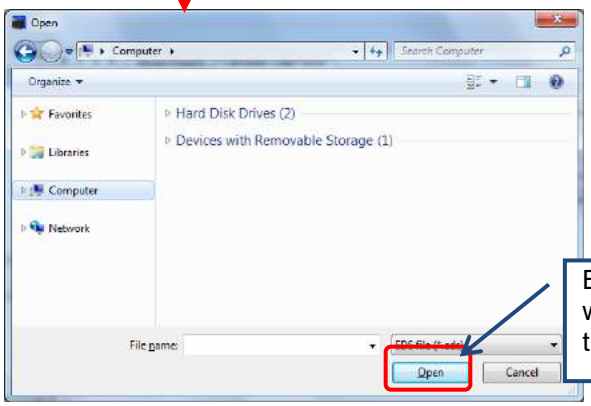
* For details of the operations other than the addition of EDS files, refer to 7.3.3 How to Use Device List.

Device List



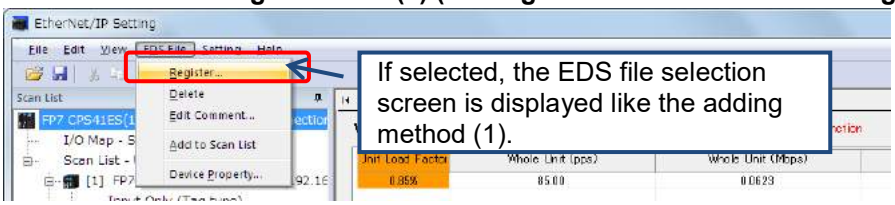
■ **Method of adding EDS files (1) (Adding from the right-click menu)**





* EDS files for EtherNet/IP devices manufactured by Panasonic cannot be added.

■ **Method of adding EDS files (2) (Adding from the EtherNet/IP setting menu)**



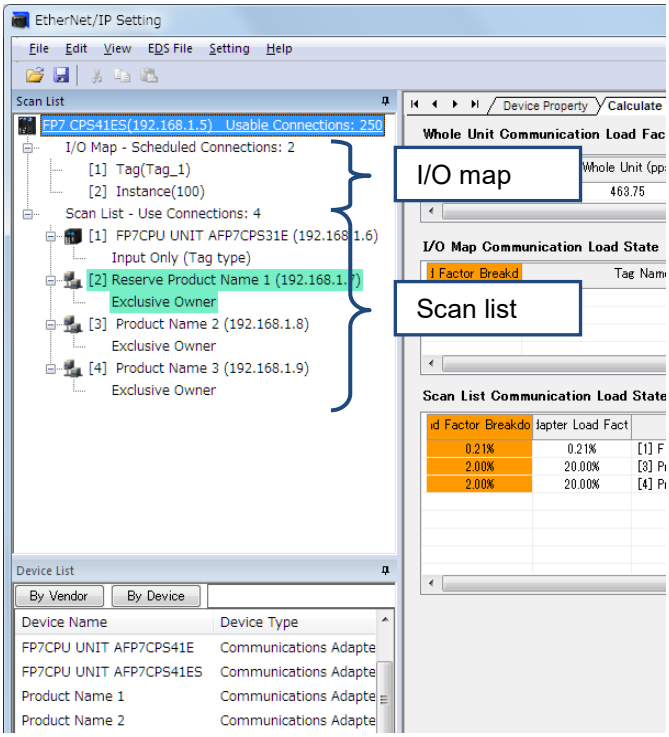
* EDS files for EtherNet/IP devices manufactured by Panasonic cannot be added.

7.3.2.3 How to Use I/O Map and Scan List

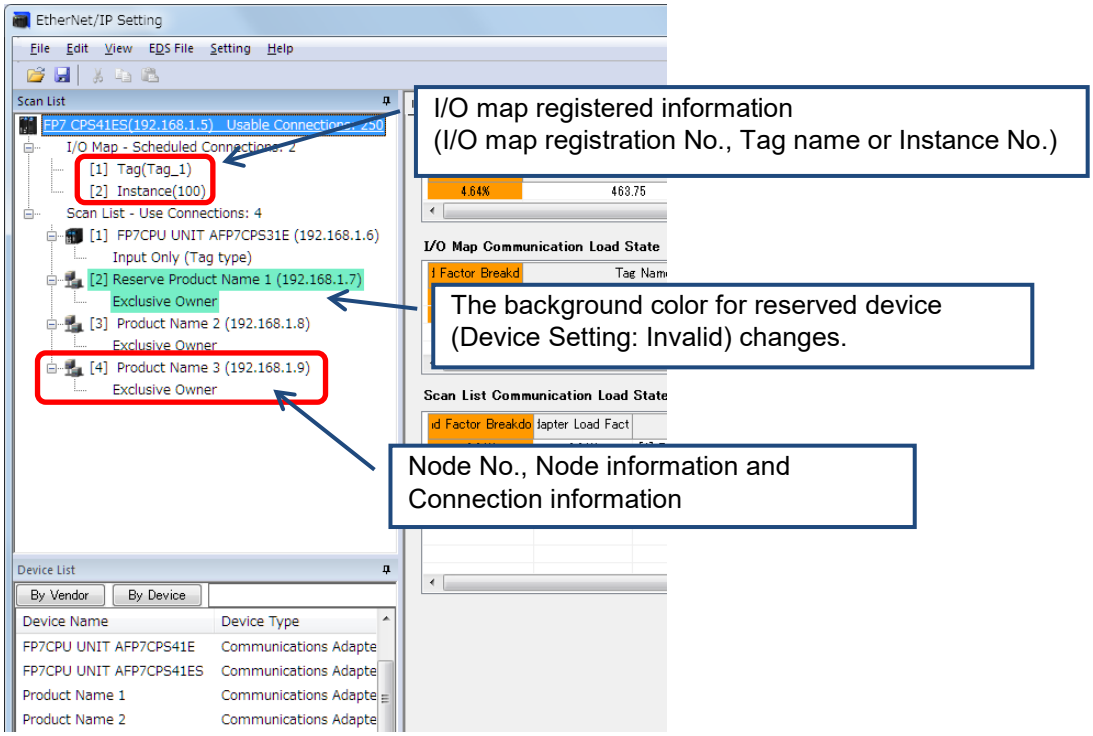
Scan list is registered in the I/O map and Scan List window.

7.3.2.3.1 Configuration of I/O Map and Scan List

The configuration of the I/O Map and Scan List window is as follows.



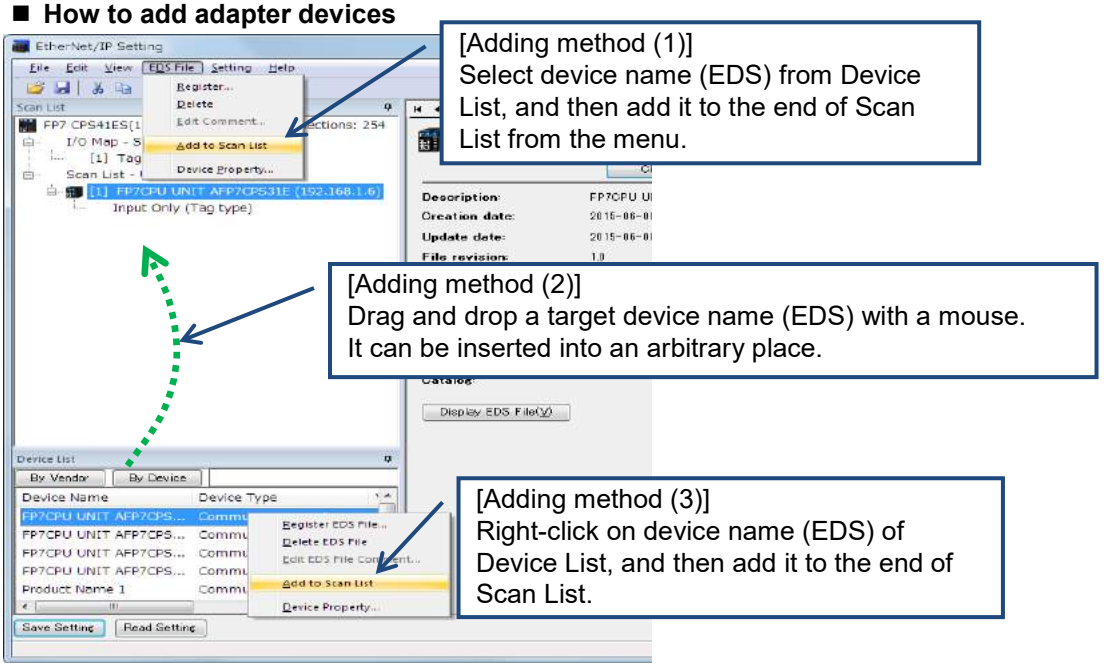
The contents displayed in the I/O Map and Scan List window are as follows.



7.3.2.3.2 Registering Adapter Devices

Adapter devices can be registered by the following three operations.

■ **How to add adapter devices**

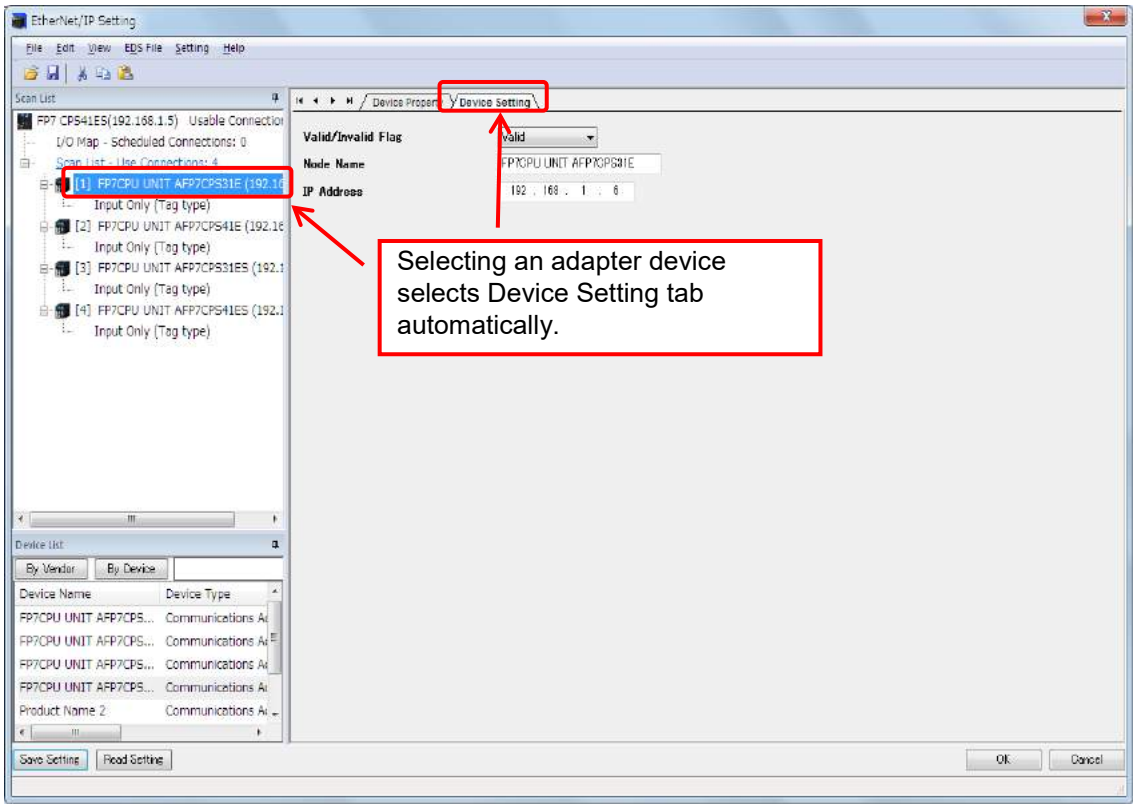


* If an adapter device is dragged and dropped to a node that is already registered, it will be registered after the node.

* For details of the operations other than registering adapter devices, refer to 7.3.4.1 Editing Scan List.

7.3.2.4 How to Use “Device Setting” Tab

Settings are made from the Device Setting tab after registering an adapter device.



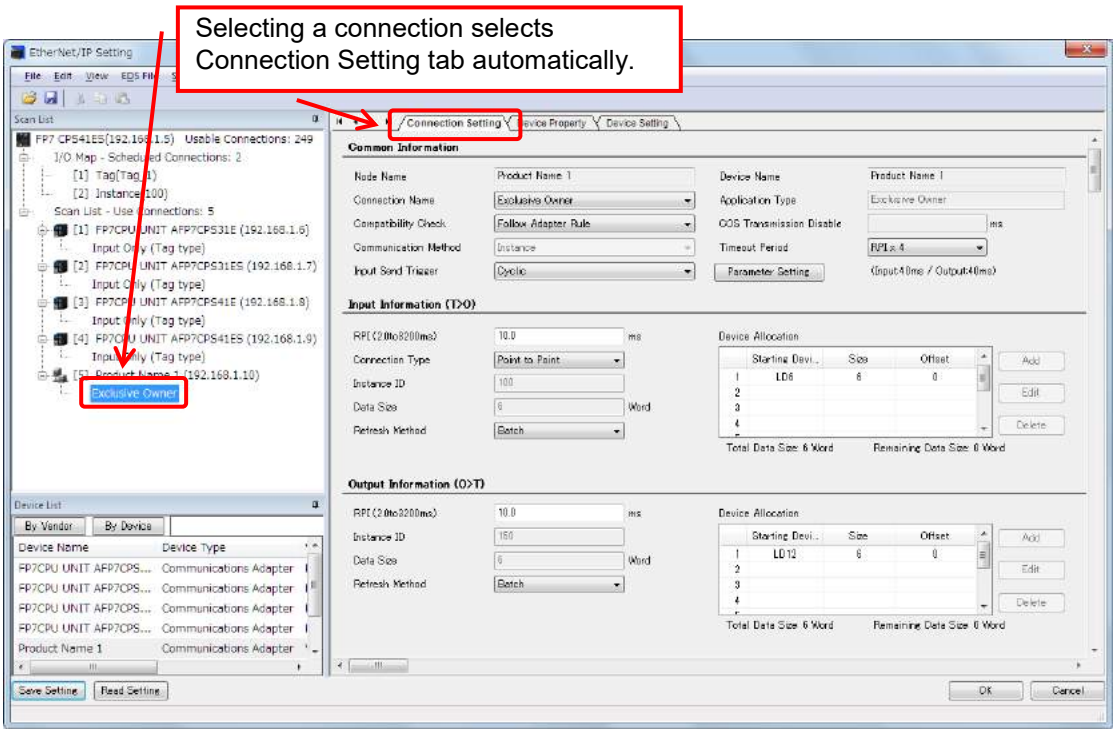
Valid/Invalid Flag : Set whether to make the communication with nodes valid or invalid.
When this is set to Invalid, the adapter is treated as a reserved device.

Node Name : Specify the node name of the device.
The specified node name is displayed in the scan list.

IP Address : Set the IP address of a destination device.

7.3.2.5 How to Use "Connection Setting" Tab

Set from the Connection Setting tab.



Common Information

Node Name : The node name where the connection is registered is displayed.

Device Name : The device name where the connection is registered is displayed.

Connection Name : Set from the connection settings registered in EDS files.

Application Type : The application type of a selected connection setting is displayed.

Compatibility Check : Set the compatibility check of models to "Check", "Not Check" or "Follow Adapter Rule".

COS Transmission Disable : Transmission disable time (RPI of input information x 1/4) is displayed when "Input Send Trigger" is set to "Change of State (COS)".

Communication Method : The communication method (Instance or Tag) of the currently specified connection setting is displayed.

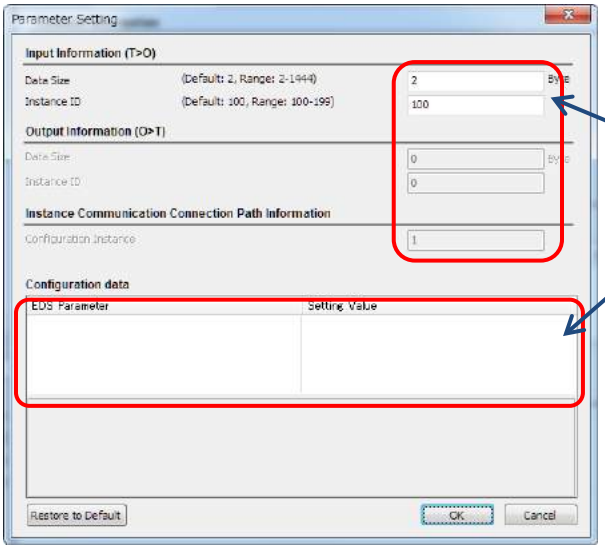
Timeout Period : Set the communication timeout period of cyclic communication.

Selectable items

RPI x 4 / RPI x 8 / RPI x 16 / RPI x 32
RPI x 64 / RPI x 128 / RPIx 256 / RPI x 512

Input Send Trigger : Set a data communication method with scanners.

Parameter Setting : The following screen is displayed by pressing the "Parameter Setting" button. Parameters defined in EDS files can be set.



Parameter information defined in EDS files can be set.

* Parameter information that can be changed in the EDS file is displayed.

7.3.2.5.1 Device Allocation

Set the device to be allocated to Send or Receive.

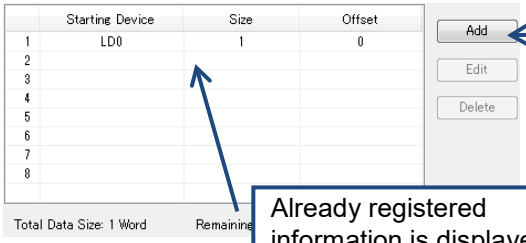
Up to eight device allocations can be registered for send or receive of each connection.

The maximum number of words that is available for device allocation is 16kw in total.

(Allocation cannot be performed beyond 16384 words.)

*** For allocating devices manually, set Auto Allocation of EtherNet/IP Basic Configuration to "No".**

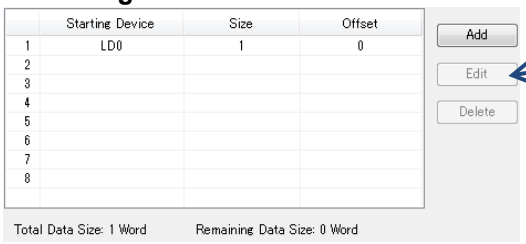
■ **Adding device allocation**



Add button:
Adds device allocation settings.
* For the setting method, refer to "Setting Method of Device Allocation".

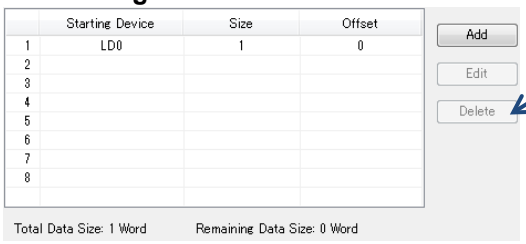
Already registered information is displayed.

■ **Editing device allocation**



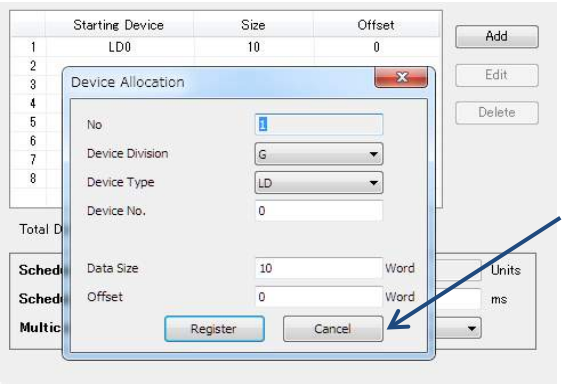
Edit button:
Corrects the currently selected setting that is already registered.
* For the setting method, refer to "Setting Method of Device Allocation".

■ **Deleting device allocation**



Delete button:
Deletes the currently selected device allocation setting.

■ **Setting method of Device Allocation**



Register button:
Registers the current setting.

Cancel button:
Cancels the setting.

No : A registration number is displayed.

Device Division : Select the set device division from G (Global) or L (Local).

Device Type : Select Device Type from WX, WY, WR, WL, DT and LD.

Device No. : Set the starting number of the device.

PB No. : Set the PB number of the local device.
The setting is necessary when Device Division is set to L.

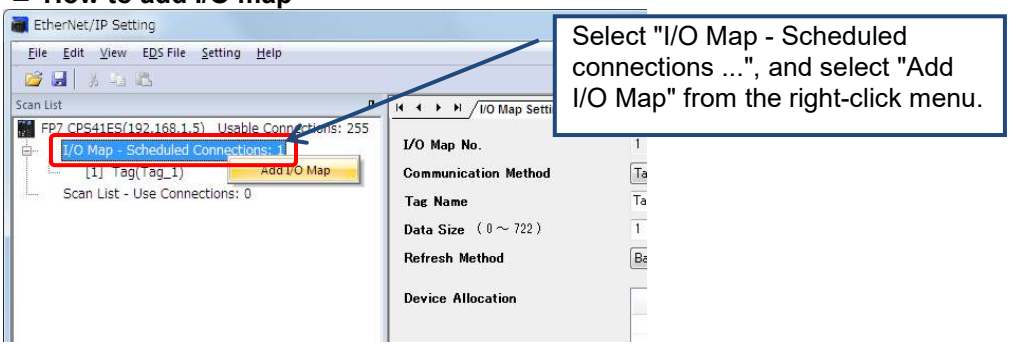
Data Size : Set a data size secured from the device number.

Offset : Set the destination of allocation of sent or received data with offsets.

7.3.2.6 Adding I/O Map Registered Information

Edit the I/O map to be operated as an adapter.

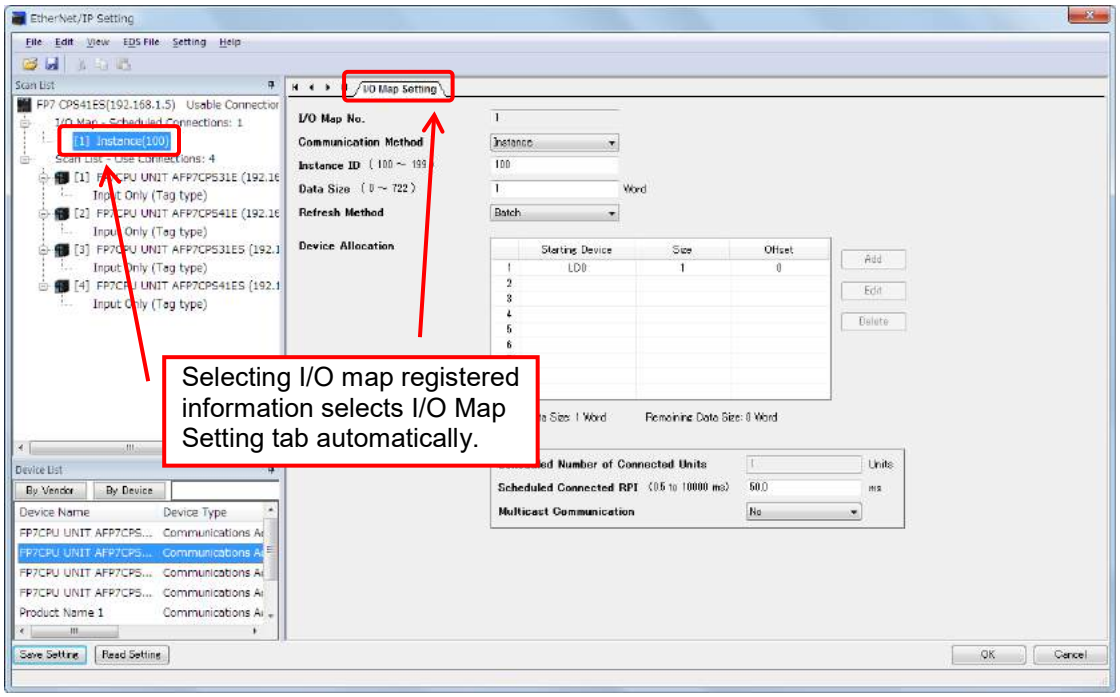
■ **How to add I/O map**



* For details of the operation other than adding I/O maps, refer to“7.3.4.2 Editing I/O Map“.

7.3.2.7 Setting I/O Map Registered Information

Set I/O map registered information.



I/O Map No.	: The I/O map number currently being set.
Communication Method	: Select a communication method with another scanner from Instance or Tag.
Instance ID	: Set an instance ID. This set when Communication Method is set to Instance.
Tag Name	: Set a tag name. This set when Communication Method is set to Tag.
Data Size	: Set the data size to be sent to another scanner.
Refresh Method	: Select the setting method for sent data from Batch, Divide and Instruction.
Standby Refresh Cycle Setting	: Set a setting cycle of sent data.
Device Allocation	: Set the device to be allocated to sent data.

Scheduled Number of Connected Units	: Set the scheduled number of units to be connected from other scanners.
Scheduled Connected RPI	: Set an RPI value to be used at the time of connection.
Multicast Communication	: Select Yes or No for Multicast Communication.

* The specified instance ID (or tag name) and data size should be the same as those specified in a destination scanner.

* The set values of Scheduled Number of Connected Units, Scheduled Connected RPI and Multicast Communication are used for calculating a communication load factor.

* For information on the setting procedure of device allocation, refer to “7.3.2.5.1 Device Allocation”.

7.3.2.8 How to Use "Calculate Load Factor" Tab

■ **Overview of the calculation of load factor**

The load factor is the ratio of the number of actually used packets to the maximum number of packets which the EtherNet/IP unit can send/receive in one second by cyclic communication.

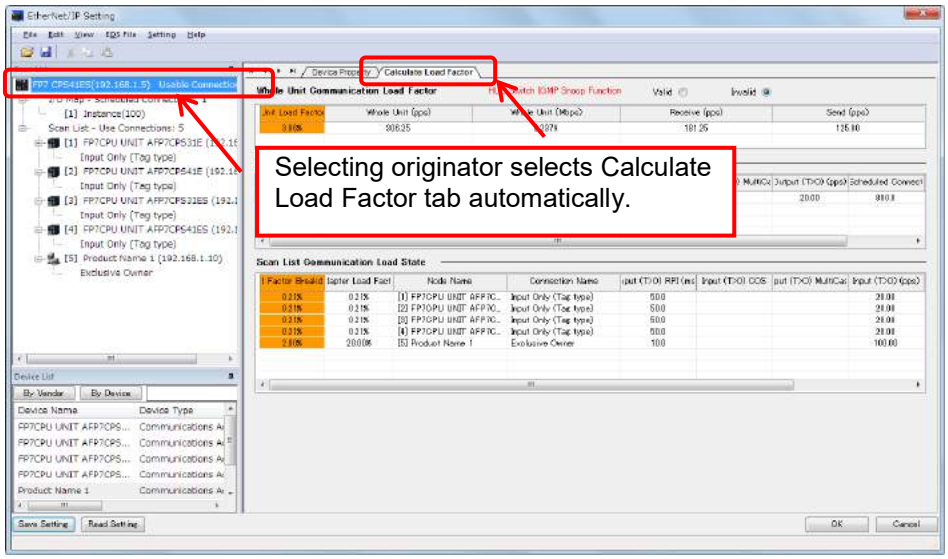
Packets other than by cyclic communication or unnecessary received packets are not considered for calculating the load factor.

Determines the check box for selecting whether to enable or disable the IGMP snoop function for HUB, and calculates load factors.

Reserved nodes are not included in the calculation of load factor.

The adapter communication load factor is displayed only when an EDS file exists.

7.3.2.8.1 Display of Load Factor Calculation



Whole Unit Communication Load Factor	: The sum of the load factors of the whole unit is displayed.
I/O Map Communication Load State	: The load factor calculated from the I/O map setting is displayed.
Scan List Communication Load State	: The load factor calculated from the connection setting is displayed.
HUB Switch IGMP Snoop Function	: Set whether to make this function valid or invalid for calculating the load factor. When this is set to Invalid, the title is displayed in red.

* When the load factor is 100% or more, it is displayed in red.
When the adapter load factor is 100% or more, the title is displayed in red.
When the Multicast is enabled, the title background is displayed in yellow.

■ **Whole Unit Communication Load Factor**

Unit Load Factor : The communication load factor (%) of the whole unit is displayed.

Whole Unit (pps) : The communication volume per second used for the whole system(*1) is displayed in pps.

Whole Unit (Mbps) : The communication volume per second used for the whole system is displayed in Mbps.

Receive (pps) : The communication volume per second in the receiving direction used for the whole system(*2) is displayed in pps.

Send (pps) : The communication volume per second in the sending direction used for the whole system(*3) is displayed in pps.

*1: The sum of reception (pps) and transmission (pps)
*2: The sum of I/O map communication output T>O (pps) and scan list input T>O (pps)
*3: The sum of I/O map communication input O<T (pps) and scan list output O<T (pps)

■ **I/O Map Communication Load Factor State**

Load Factor Breakdown : The breakdown of the load factor for each tag name [instance name] is displayed.

Tag Name [Instance ID] : Tag names [instance names] are displayed.

Scheduled Number of Connected Units : The scheduled number of connected units is displayed.

Output (T>O)

- Scheduled Connected RPI : Scheduled connected RPI (communication interval) is displayed.
- MultiCast : When communication data is sent through multicasting, '•' is displayed.
- (pps) : The communication volume (pps) calculated by the output (T>O) scheduled connected RPI is displayed.

Input (O>T)

- Scheduled Connected RPI : Values calculated by multiplying output (T>O) RPI by 16 is displayed. (*1)
- (pps) : Communication volumes (pps) calculated by multiplying output (T>O) RPI by 16 is displayed.

*If the value calculated by multiplying RPI (ms) by 16 is 10s or more, the RPI is calculated as 10s.

■ **Scan List Communication Load State**

Load Factor Breakdown : The breakdown of the unit load factor for each adapter is displayed.

Adapter Load Factor : The load factor calculated from the communication band defined in EDS files of each adapter and scanner is displayed.

Node Name : Node names of adapters and scanners are displayed.

Connection Name : Connection names of adapters and scanners are displayed.

Input (T>O)

RPI	: The RPI (communication interval) in the receiving direction of connection settings is displayed.
COS	: For the connection setting in which "Input Send Trigger" is set to "Change of State", '●' is displayed.
MultiCast	: For the connection setting in which "Connection Type" is set to "Multicast", '●' is displayed.
(pps)	: The communication volume (pps) per second in the receiving direction is displayed.

Output (O>T)

RPI	: The RPI (communication interval) in the sending direction of connection settings is displayed.
(pps)	: The communication volume (pps) per second in the sending direction is displayed.

■ **HUB Switch IGMP Snoop Function**

Select whether to make this function valid or invalid for calculating the load factor.

When selecting "Invalid", "HUB Switch IGMP Snoop Function" is displayed in red.

Even when you use a switch equipped with the IGMP snoop function, this function should be set to "Valid".

* For outputting IGMP queries to FP7, "7.3.2.1 EtherNet/IP Basic Configuration" should be set.

* If the adapter load factor exceeds 100% when setting the multicast communication, change the set value of RPI longer or use a HUB that the IGMP snoop function is enabled.

7.3.3 How to Use Device List

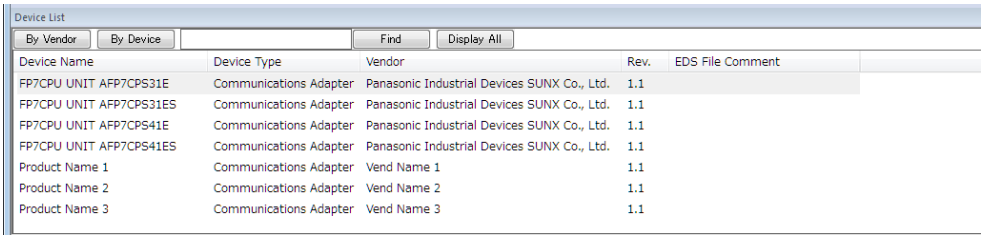
In Device List, registered EDS files can be confirmed, deleted and new EDS files can be added.

The EDS files for EtherNet IP devices are available on the site of each vendor.

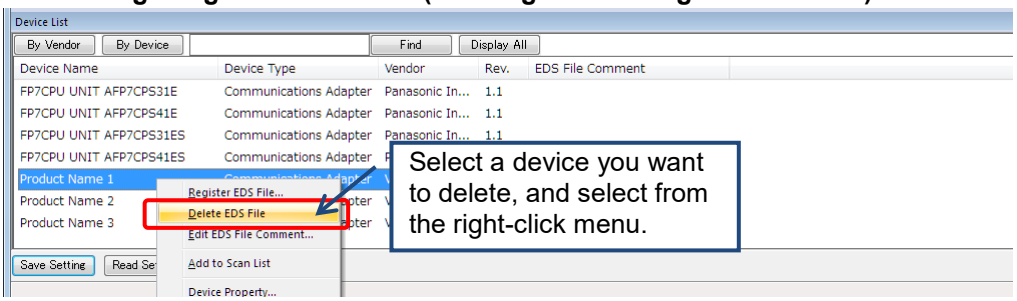
Once the EDS file is registered, the registration is not required from the next time.

* For details of how to add EDS files to Device List, refer to 7.3.2.2 Registering EDS Files in Device List.

Device List

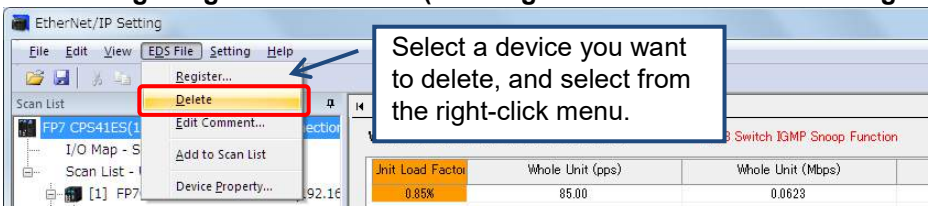


■ **Deleting a regsitered EDS file (Deleting from the right-click menu)**



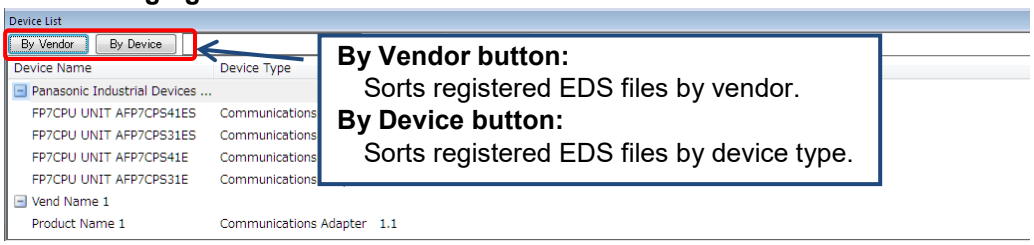
* EtherNet/IP devices manufactured by Panasonic cannot be deleted.

■ **Deleting a regsitered EDS file (Deleting from the EtherNet/IP setting menu)**



* EtherNet/IP devices manufactured by Panasonic cannot be deleted.

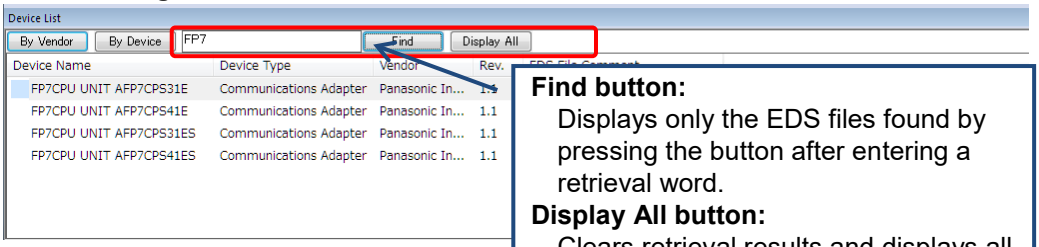
■ Rearranging EDS files



By Vendor button:
Sorts registered EDS files by vendor.

By Device button:
Sorts registered EDS files by device type.

■ Searching EDS files



Find button:
Displays only the EDS files found by pressing the button after entering a retrieval word.

Display All button:
Clears retrieval results and displays all registered EDS files.

7.3.4 How to Use I/O Map and Scan List Screen

In this chapter, operation methods of I/O map and scan list screen are described.

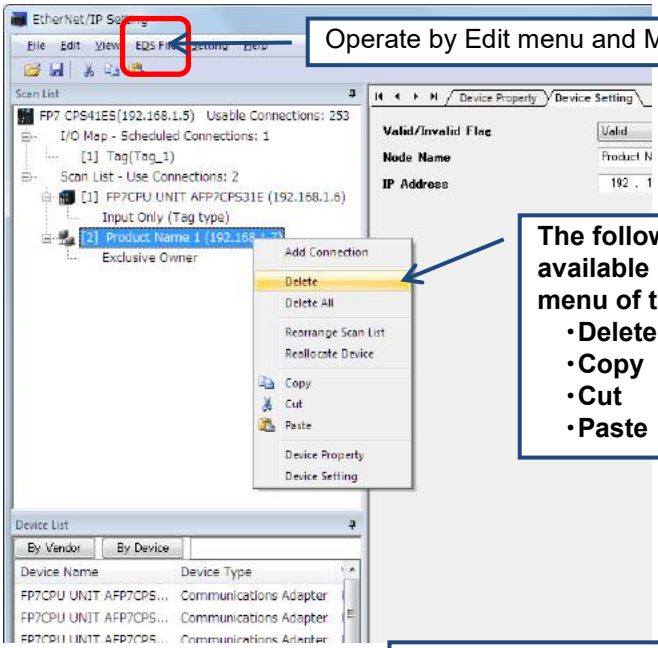
For details of screen structures, refer to 7.3.2.3.1 Configuration of I/O Map and Scan List.

7.3.4.1 Editing Scan List

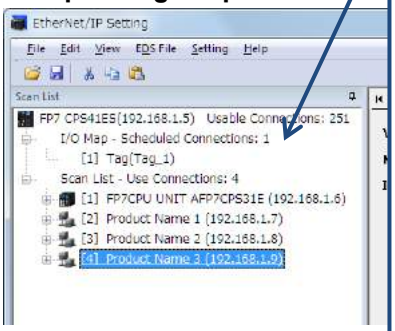
Edit the scan list.

* For details of how to add adapter devices to the scan list, refer to 7.3.2.3.2 Registering Adapter Devices.

■ **Editing adapter devices (deleting, moving and copying)**



■ **Operating adapter devices**



The following operations are available on Scan List.

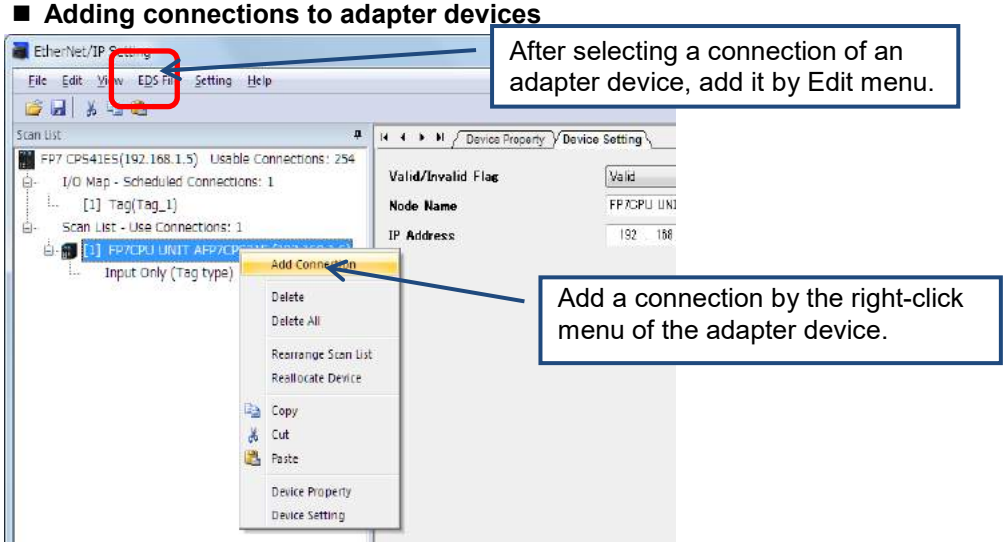
Plural selection (Range selection):
Select an adapter device while pressing the Shift key.

Plural selection (Optional selection):
Select an adapter device while pressing the Ctrl key.

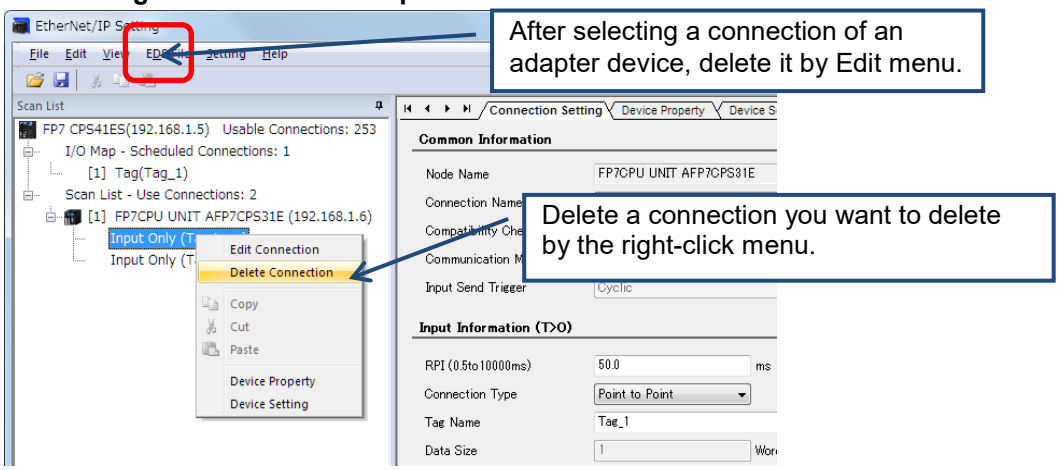
Move:
Drag an adapter device to a destination with a mouse.

Move (Plural):
Select multiple adapters with the Shift or Ctrl key, and drag them to a destination.
* Operate while pressing the Shift or Ctrl key.

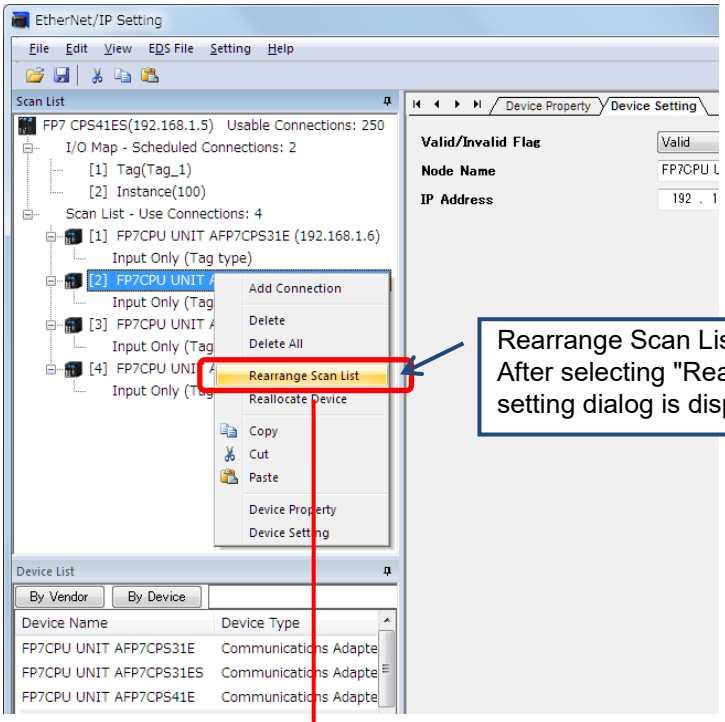
■ Adding connections to adapter devices



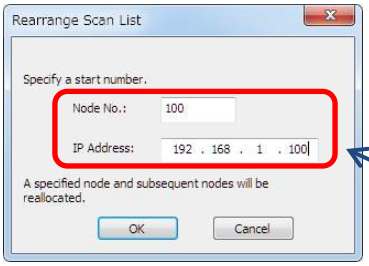
■ Deleting connections of adapter devices



■ Rearrange Scan List



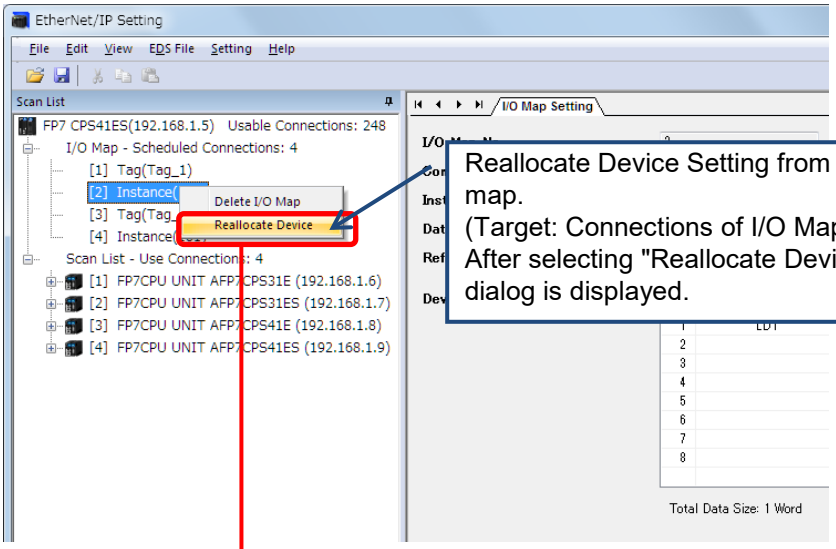
Rearrange Scan List from the selected node. After selecting "Rearrange Scan List", the setting dialog is displayed.



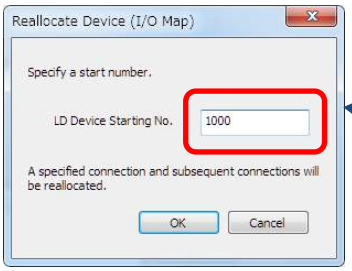
Rearrange the list from the node No. (100) and IP address (192.168.1.100) as starting numbers.

Target of rearrangement:
- Node No. of Scan List [2]
- Node No. of Scan List [3]
- Node No. of Scan List [4]

■ Reallocating devices (I/O Map)



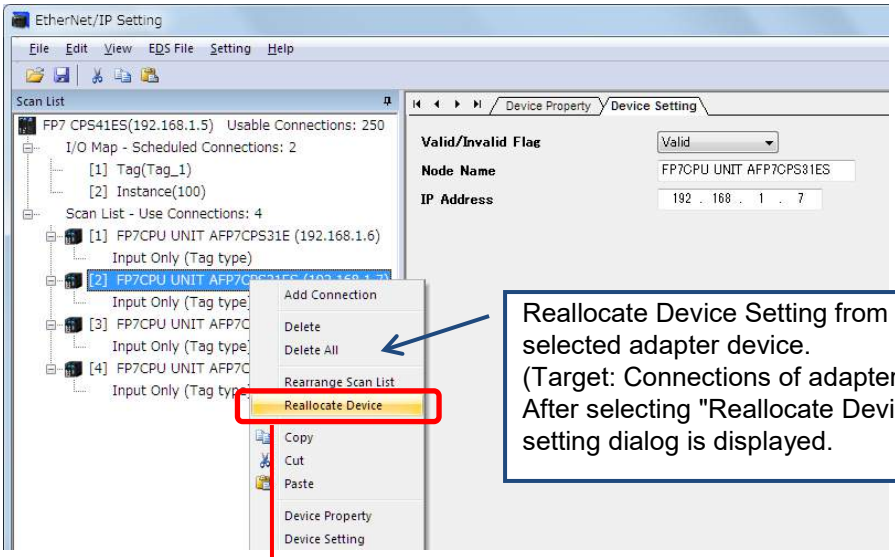
Reallocate Device Setting from the selected I/O map.
(Target: Connections of I/O Map)
After selecting "Reallocate Device", the setting dialog is displayed.



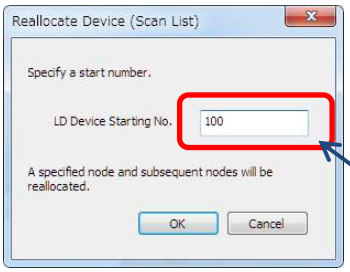
Allocate devices from the LD device starting No. (1000) as a starting number.

Target of reallocation:
- ・Connection of I/O map [2]
- ・Connection of I/O map [3]
- ・Connection of I/O map [4]

■ Reallocating devices (Adapter devices)



Reallocate Device Setting from the selected adapter device.
(Target: Connections of adapter devices)
After selecting "Reallocate Device", the setting dialog is displayed.



Allocate devices from the LD device starting No. (100) as a starting number.

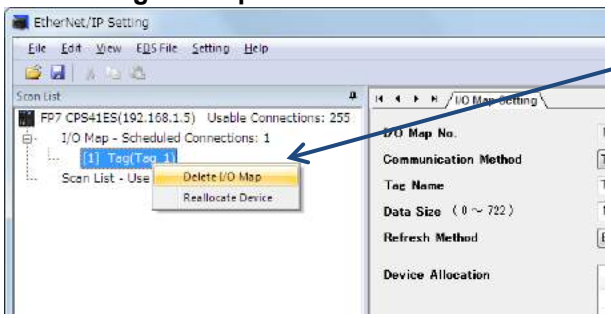
Target of reallocation:
- Node No. of Scan List [2]
- Node No. of Scan List [3]
- Node No. of Scan List [4]

7.3.4.2 Editing I/O Map

Edit the I/O map to be operated as an adapter.

* For details of how to add I/O maps, refer to 7.3.2.6 Adding I/O Map Registered Information.

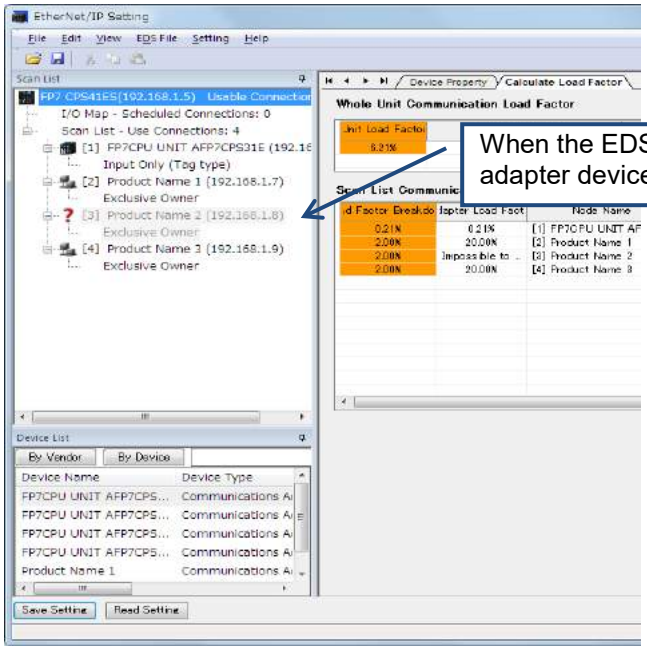
■ **Deleting I/O map**



Select "Delete I/O Map" by the right-click menu of the I/O map to be deleted.

7.3.4.3 When EDS Files are Unregistered

When EDS files of adapter devices registered in the scan list are not registered in the device list, they are shown on the scan list as below.



When the EDS file of an adapter device is unregistered

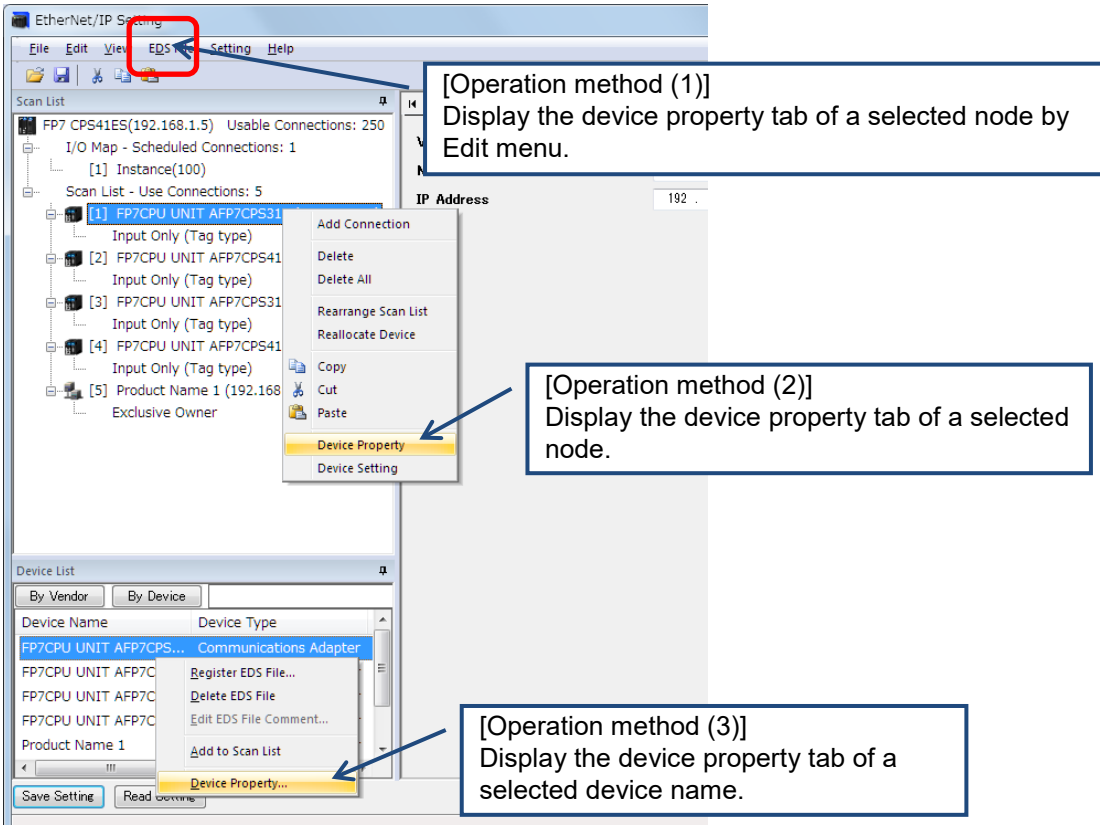
7.3.5 How to Use Device Property Setting

In this chapter, the Device Property window is described.

7.3.5.1 Device Property Setting

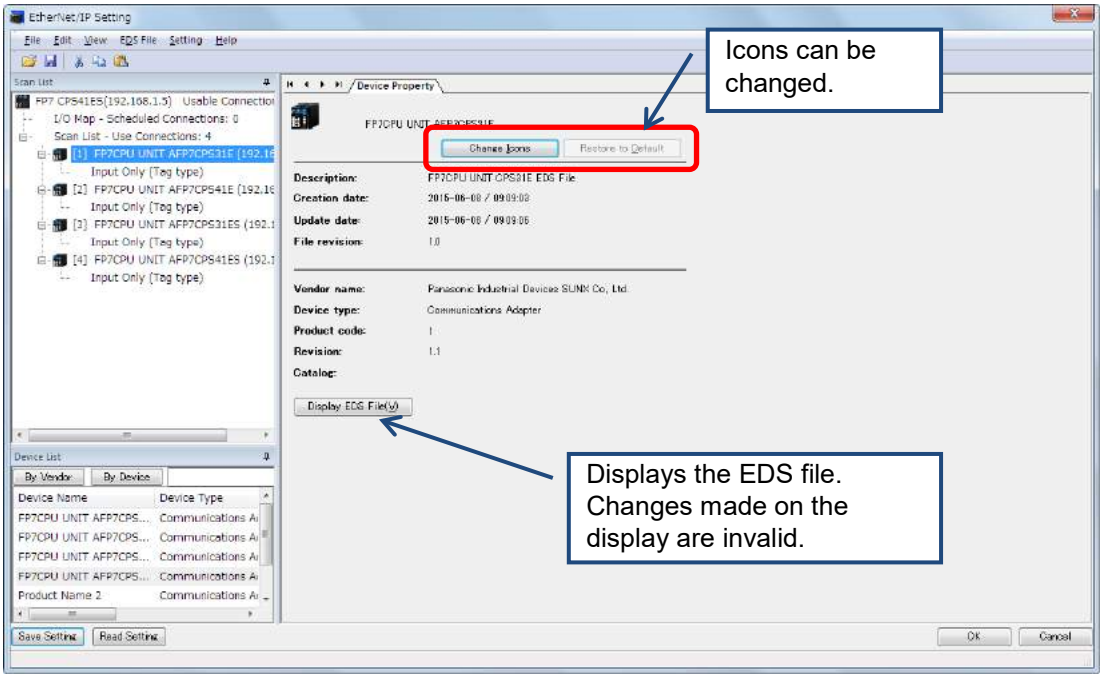
The Device Property can be displayed by the following three methods.

■ **Displaying Device Property tab**



■ Device Property

Displays the information on the EDS file corresponding to a selected node or device name.



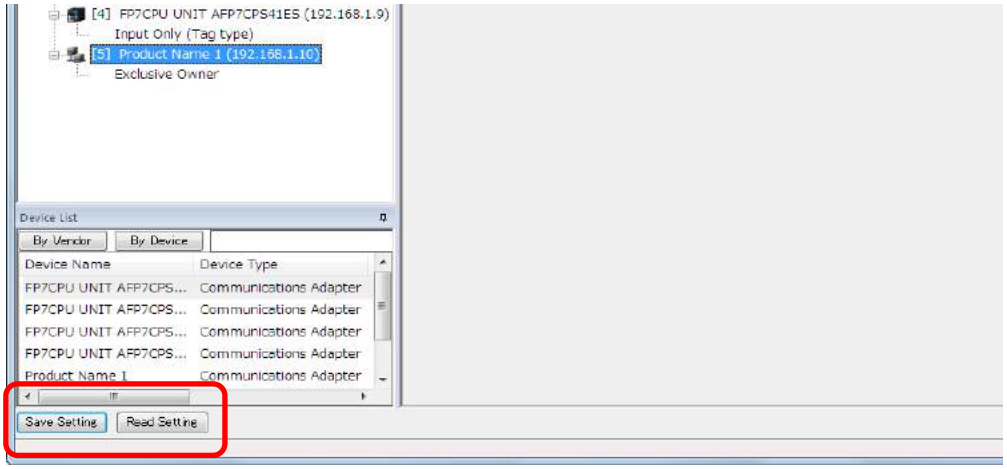
Icon	: The device icon is displayed. When EDS files are unregistered, "?" is displayed.
Device Name	: Displays the device name.
Description	: Displays the text.
Creation date	: Displays the creation date of an EDS file.
Update date	: Displays the last update date of an EDS file.
File revision	: Displays the file revision.
Vendor name	: Displays the vendor name.
Device type	: Displays the device type.
Product code	: Displays the product code.
Revision	: Displays the revision.
Catalog	: Displays the catalog number.

* The displayed contents for the device name to catalog are the information defined in the corresponding EDS file.

7.3.6 How to Use "Save Setting" and "Read Setting"

This function is used to save the settings on the EtherNet/IP setting screen to a file.

Saved settings can be read as necessary.



7.3.7 Migration of Device Database

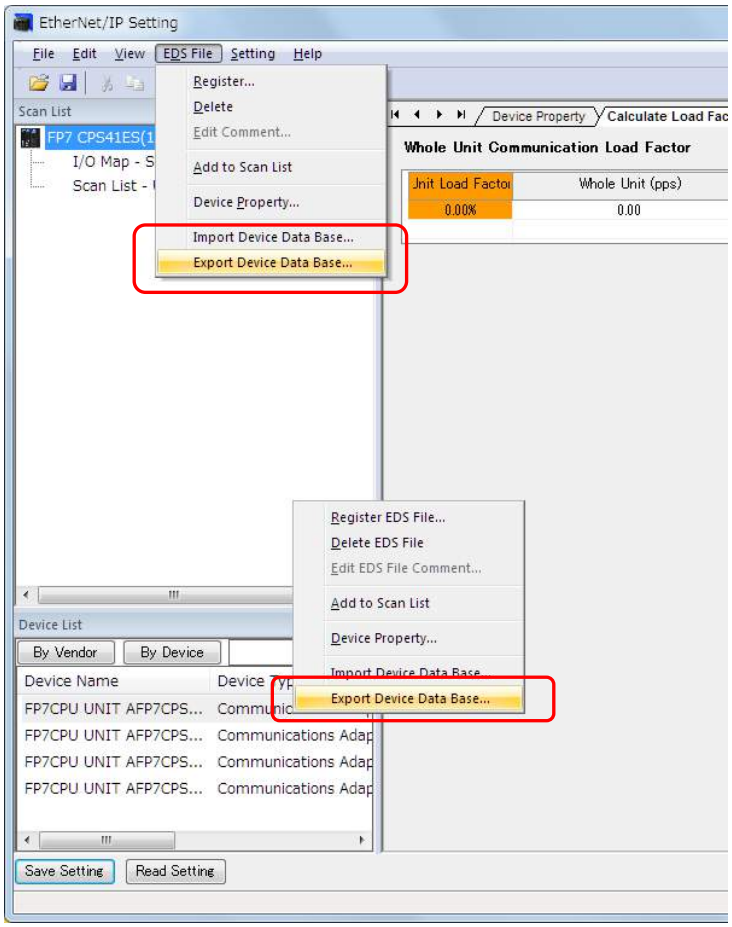
Registration information of EDS files can be exported or imported.

7.3.7.1 Export of Device Database

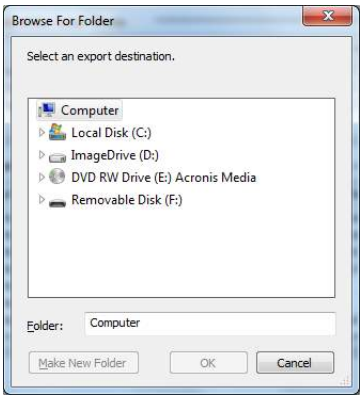
The procedure of the export function is described below.

1. **Select "Export Device Data Base".**

   Select from the "EDS File" menu or the light-click menu of the device list.



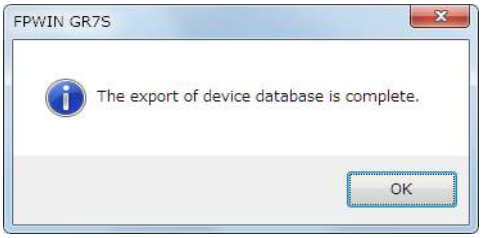
2. Select an output destination of the device database.



If you want to create a new folder, create a folder by "Create a New Folder".

* As registered EDS files, icon files, device database files are output to the selected folder, specify an empty folder if you specify an arbitrary storage destination.

3. The export is complete.



7.3.7.2 Import of Device Database

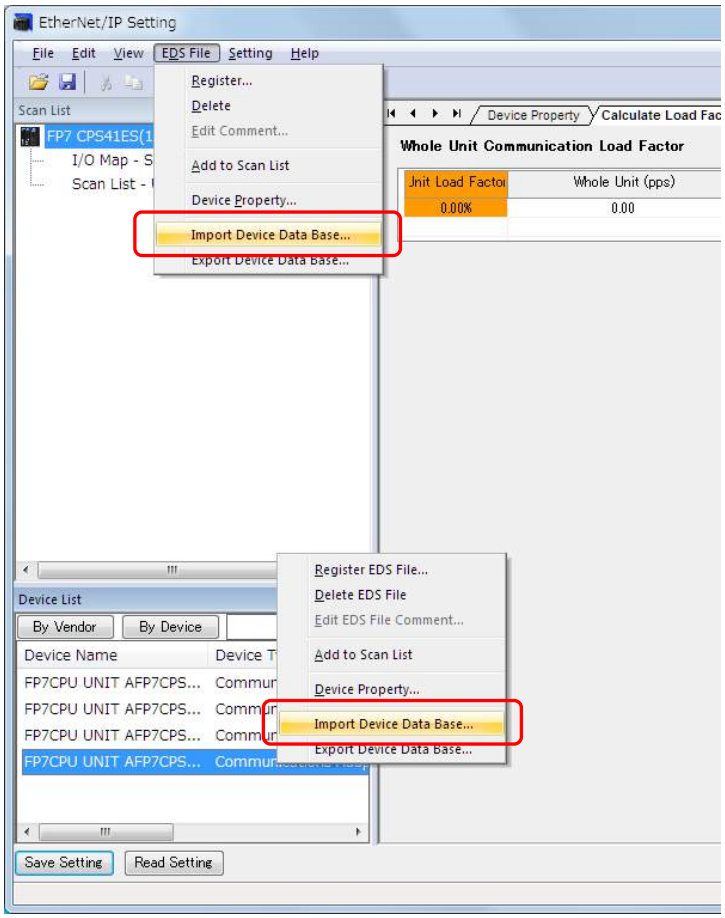
The procedure of the import function is described below.

Note)

Once the import is performed, the registered information of the device list will be overwritten by the contents of the imported device database. We recommend to export and store the registered information before performing the import.

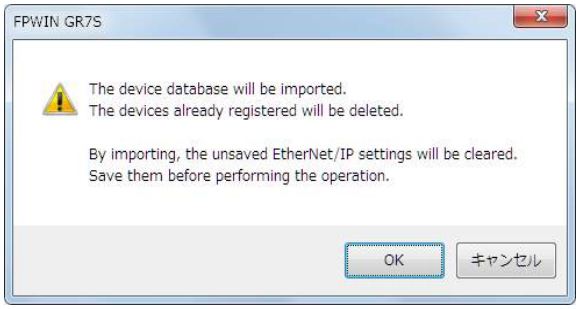
1. **Select "Import Device Data Base".**

   Select from the "EDS File" menu or the light-click menu of the device list.



After the selection, the following notes on the import operation is displayed.

If no problem, select "OK". Otherwise, select "Cancel".

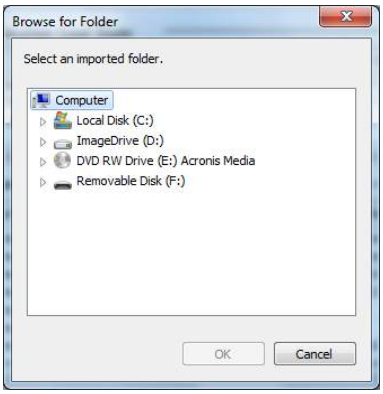


Note)

Always save the EtherNet/IP setting before import.
As the EtherNet/IP setting is finished after importing database, the information that is still in the middle of change operation will be cleared.

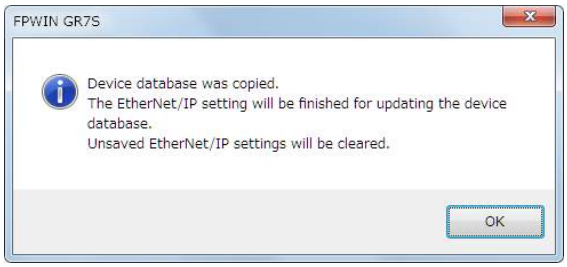
2. Select an import folder.

Specify the folder in which the device database to be imported is stored.



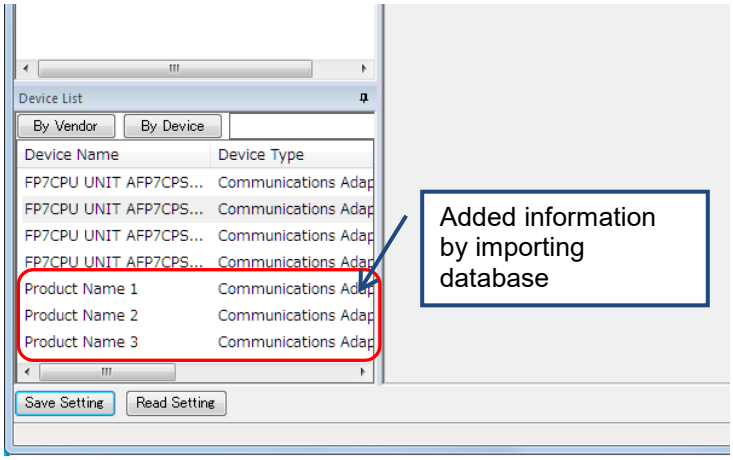
3. Reactivate the EtherNet/IP setting screen.

As the EtherNet/IP setting is automatically finished after selection "OK", display the EtherNet/IP setting screen again.



4. The import is complete.

When the EtherNet/IP screen is displayed again, the registered contents of the device list has been changed to the imported contents.



7.3.7.3 When You Want to Restore the Registration Information Before Import

If you need to restore the previous registration information after the completion of import, import folders stored in the following folder.

* AppData (Application Data for Windows XP) folder is a hidden folder.

For Windows7

C:\Users\(Account name of PC)\AppData\Roaming\Panasonic-ID SUNX Control\EIP\backup

For WindowsXP

C:\Documents and Setting\(Account name of PC)\Application Data\Panasonic-ID SUNX Control\EIP\backup

This folder is backup data before reflecting imported data.

If the import operation fails, registration information will not be backed up.

When the information has been backed up manually, import the backed-up folder.

8

Control Data

8.1 Types of Control Data

There are two types of control data, unit annunciation relays (from X6B) and communication state tables.

8.1.1 Unit Annunciation Relays

There are the following unit annunciation relays.

Annunciation device	Description
X6B	EtherNet/IP preparation done = 1, Other s = 0
X6C	Cyclic communication: All nodes communicating normally =1, Others = 0
X6D	Cyclic communication: All nodes stop =1, Others = 0
X6E	Communication abnormal node exists = 1, None = 0
X6F	EtherNet/IP Start/Stop controllable = 1, Uncontrollable = 0

Note)

Unit annunciation relay numbers vary according to the base numbers of the unit I/O map registration.

8.1.2 RUN/IDLE Bit

The RUN/IDLE bit indicates the operation state of a device that is sent from a scanner or adapter during the cyclic communication. 1 is sent for the RUN state, and 0 is sent for the IDEL state.

When the operation state of a scanner is IDLE, an adapter device connected to that scanner may not operate normally.

As for adapter devices, it may not be sent depending on the settings of EDS files.

■ **Operation of FP7**

On the FP7, the RUN/IDLE bit becomes the run state in the following cases

The condition that the RUN/IDLE bit becomes the RUN state varies according to the setting of "RUN/IDLE bit operation of cyclic communication" of the EtherNet/IP basic configuration (Normal or Limited).

- Normal

When the following two conditions are met, it becomes the RUN state.

In other conditions, it is in the IDLE state.

(1) The FP7 operation mode is RUN mode.

(2) It is communicating with all nodes registered in the scan list except the FP7 normally.

• Limited

A value corresponding to the FP7 operation mode is set regardless of the communication state with adapters registered in the scan list.

RUN mode : RUN

PROG mode : IDLE

Note)

Only the normal operation is available when the version of the FP7 CPU unit is older than Ver.4.10.

■ Method of selecting RUN/IDLE bit operation of cyclic communication

Set "RUN/IDLE bit operation of cyclic communication" in the EtherNet/IP basic configuration according to the use situation.

• Normal

Select for performing the EtherNet/IP communication with all adapters registered in the scan list.

Note)

When communication cannot be performed with all adapter devices (except FP7) registered in the scan list normally with this setting, there are cases where the adapter devices that is communicating normally cannot operate normally as the RUN/IDLE bit is sent as IDLE.

• Limited

Select this setting for the use in situations where a part of devices in the scan list are activated and the others are stopped such as a test operation.

* e.g. Communication cannot be performed because the power supply of an adapter is OFF.

Besides this setting, the similar operation can be performed by the following method.

(1) Register only the adapter devices that you want to activate in the scan list.

(2) Set the other adapter devices in the scan list to be disabled.

8.1.3 Cyclic Communication State Tables of EtherNet/IP

There the following types of cyclic communication state tables.

Table type	Description
Cyclic communication registration node table	Bit corresponding to the node number that the connection is regsitered =1, Invalid node = 0
Cyclic communication normal node table	When the first refresh is complete after connection establishment = 1, Other states = 0
Cyclic communication stop node table	Bit corresponding to the node to be stopped when the stop request processing is complete = 1, Others = 0
Cyclic communication abnormal node table	Node that the cyclic commuication error occurs =1, Others = 0
Cyclic communication: RUN/IDLE bit monitor	Bit corresponding to the node number of FP7 that connection is registered. When the following two conditions are met, it turns ON (1). In other conditions, it turns OFF (0). ・Communicating with the target node (FP7) normally. ・Communicating with all nodes except FP7 normally when the target node (FP7) is in RUN mode. Note) The communication condition with the FP7 node connected to the source is not reflected.

8.1.4 Read by ETSTAT Instruction

Communication state tables can be read by the ETSTAT instruction and monitored.

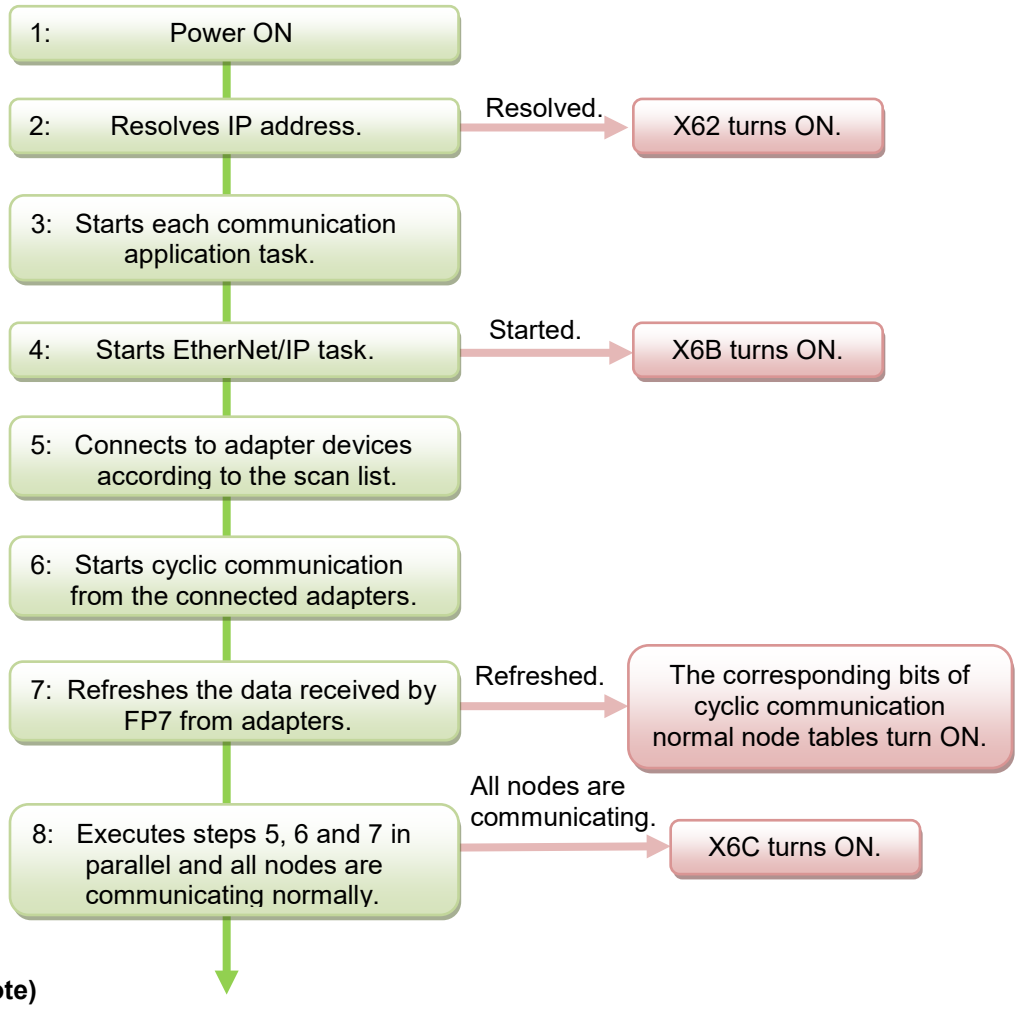
For details, refer to “9.1.1 Information Acquisition of EtherNet/IP (ETSTAT)”.

8.2 Startup Operation of Cyclic Communication

There are the following two startup methods of cyclic communication.

1. Automatic start
2. Start by Instructions: Start/Stop communication

When automatically starting the FP7 that the scan list has been registered, it operates in the following order after the power turns on.



Note)

- Precautions when starting the system which uses the EtherNet/IP function at high speed:

  When the power supply of an Ethernet switch is turned ON at the same time as the start of the system, a normal switch (unmanaged) is activated in a few seconds. However, as for a managed switch, it takes several tens of seconds. Until the switch is activated, the EtherNet/IP communication cannot be started.

  For starting the system at high speed, turn on the power supply of the Ethernet switch in advance, and start the system.

8.3 Abnormality Judgement and Operation

Abnormality judgement is performed on the following contents.

Abnormality judgement	Details
Connection timeout period	The timeout period when FP7 sends a forward open command and connects to adapter devices. When a response to the forward open command is not returned within the set time, it determines that the timeout occurs. By setting this period short, it is possible to make the reconnection time shorter when the power is turned on again.
Cyclic communication start wait time (Abnormality judgement when starting cyclic communication)	If connection is not established when starting the cyclic communication, the operation is retried after the connection timeout period, however, the communication abnormal node flag is set after the elapse of this time. The abnormality judgement is not performed before this time passes. The reconnection is retried automatically even after the determination of the communication abnormal node.
Cyclic communication abnormality judgement time (Abnormality judgement after connection)	When the timeout occurs during the transmission from an adapter while the cyclic communication is performed properly, the reconnection is retried automatically, however, it judges as a communication error when the reconnection is not established within this set time. The reconnection is retried automatically even after the determination of the communication abnormal node. By setting this time short, it is possible to judge communication errors quickly.

9

High-level Instructions

9.1 High-level Instructions Used for EtherNet/IP Control

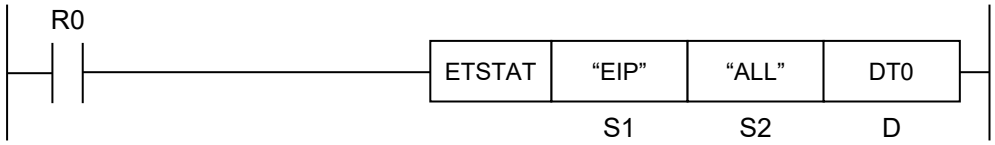
High-level instructions that can be used for EtherNet/IP control are as follows.

List of instructions

Instruction	Application
ETSTAT	Information acquisition of EtherNet/IP
EIPNDST	EtherNet/IP node status acquisition instruction
EIPSTART	Cyclic communication start request
EIPSTOP	Cyclic communication stop request
EIP_IN	EtherNet/IP input refresh
EIP_OT	EtherNet/IP output refresh

9.1.1 Information Acquisition of EtherNet/IP (ETSTAT)

■ **Instruction format**



Note) A target unit for the instruction is specified with UNITSEL beforehand.

■ **Operation unit (i)**

There is no operation unit.

■ **List of operands**

Operand	Description
S1	Specify the type to be read with the starting address or a character constant.
S2	Specify the target to be read with the starting address or a character constant.
D	Specify the starting address of destination.

■ **Available devices (●: Available)**

Operand	16-bit device											32-bit device			Integer			Real number		String	Index modifier
	WX	WY	WR	WL	WS	SD	DT	LD	UM	WI	WO	TS CS	TE CE	IX	K	U	H	SF	DF	" "	
S1	●	●	●	●			●	●												●	●
S2	●	●	●	●			●	●												●	●
D	●	●	●	●			●	●													●

■ Processing

- Reads the parameter information or status information specified by [S1] and [S2], and stores it in the area starting with [D].
- The number of words in the storage area varies according to the type of read data and the target.

■ Precautions during programming

- When specifying a device for an operand in which character constant can be specified, set string data beforehand with SSET instruction.
- When specifying string data, the number of characters should not exeeced 256.
- Upper and lower case characters can be used for operands which character constant can be specified.
  ("Abcd", "ABCD" and "abcd" are synonymous, however, the file names are differentiated.)
- A target unit for the instruction is specified with UNITSEL beforehand.
- This instruction is not available in interrupt programs.

■ Operands [S1] [S2] settings

Setting item	Settings		
S1	Read type	For specifying the read of the EtherNet/IP communication state	Specify "EIP".
S2	Read target	For specifying the communication state of EtherNet/IP	Specify "ALL" or "ALL + Number".
		For specifying the cyclic communication registration node table	Specify "NODE".
		For specifying the cyclic communication normal node table	Specify "NORMAL".
		For specifying the cyclic communication stop node table	Specify "STOP".
		For specifying the cyclic communication abnormal node table	Specify "ERR".
		For specifying the RUN/IDLE bit monitor (PLC standby flag)	Specify "PLC".
D	Read destination	Specify the destination device address to which the state is read out.	

■ Restrictions on combinations of operands [S1] and [S2]

"A" in the table below indicates the available combinations. An operation error occurs when other combinations are specified.

		S2					
		ALL	NODE	NORMAL	STOP	ERR	PLC
S1	EIP	○	○	○	○	○	○

Read content 1 (In the case of S1; "EIP", S2; "ALL" or "ALL + Number": 1 to 81 words)

Name	No. of words	Description
Max. registration node number	1	Registered maximum node number
Cyclic communication registration node table	0 to 16 (*1) (*2)	Node that connection is registered
Cyclic communication normal node table	0 to 16 (*1) (*2)	Node that the cyclic communication is performed normally
Cyclic communication stop node table	0 to 16 (*1) (*2)	Node that the cyclic communication stops
Cyclic communication abnormal node table	0 to 16 (*1) (*2)	Node that the cyclic communication error occurs
RUN/IDLE bit monitor (PLC standby flag)	0 to 16 (*1) (*2)	RUN/IDLE bit monitor of 32-bit header

Read content 2 (In the case of S1; "EIP", S2; "NODE": 1 to 17 words)

Name	No. of words	Description
Max. registration node number	1	Registered maximum node number
Cyclic communication registration node table	0 to 16 (*1)	Node that connection is registered

Read content 3 (In the case of S1; "EIP", S2; "Normal": 1 to 17 words)

Name	No. of words	Description
Max. registration node number	1	Registered maximum node number
Cyclic communication normal node table	0 to 16 (*1)	Node that the cyclic communication is performed normally

Read content 4 (In the case of S1; "EIP", S2; "STOP": 1 to 17 words)

Name	No. of words	Description
Max. registration node number	1	Registered maximum node number
Cyclic communication stop node table	0 to 16 (*1)	Node that the cyclic communication stops

Read content 5 (In the case of S1; "EIP", S2; "ERR": 1 to 17 words)

Name	No. of words	Description
Max. registration node number	1	Registered maximum node number
Cyclic communication abnormal node table	0 to 16 (*1)	Node that the cyclic communication error occurs

Read content 6 (In the case of S1; "EIP", S2; "PLC": 1 to 17 words)

Name	No. of words	Description
Max. registration node number	1	Registered maximum node number
RUN/IDLE bit monitor of 32-bit header	0 to 16 (*1)	RUN/IDLE bit monitor of 32-bit header

*1: The number of words varies according to the registered maximum node number.

Max. node number	No. of valid words
0	0
1 to 16	1
17 to 32	2
33 to 48	3
49 to 64	4
:	:
225 to 239	15
241 to 256	16

*2: When specifying "ALL + Number" for S2, the number of valid words is the specified number.

The numbers are 1 to 16.

Allocation of bit numbers and node numbers of each table and monitor

	Correspondence table of node numbers															
Bit No.	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Node No.	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
:	:															
Node No.	256	255	254	253	252	251	250	249	248	247	246	245	244	243	242	241

Setting example

Example 1) When specifying the reading of EtherNet/IP communication state

S1	S2	D
"EIP"	"ALL"	DT20

	Value	
DT20	15	Max. registration node number
DT21	0111 1111 1111 1111	Cyclic communication registration node table (Node nos. 1 to 16)
DT22	0111 1000 1011 1111	Cyclic communication normal node table (Node nos. 1 to 16)
DT23	0000 0111 0100 0000	Cyclic communication stop node table (Node nos. 1 to 16)
DT24	0000 0000 0100 0000	Cyclic communication abnormal node table (Node nos. 1 to 16)
DT25	0000 0000 0000 1111	RUN/IDLE bit monitor (PLC standby flag) (Node nos. 1 to 16)

Example 2) When specifying the reading of EtherNet/IP communication state

S1	S2	D
"EIP"	"ALL"	DT20

	Value	
DT20	0	Max. registration node number

Example 3) When specifying the reading of cyclic communication registration node table

S1	S2	D
"EIP"	"ALL+2"	DT20

	Value	
DT20	15	Max. registration node number
DT21	1st word	Cyclic communication registration node table (Node nos. 1 to 16)
DT22	2nd word	Cyclic communication registration node table (Node nos. 17 to 32)
DT23	1st word	Cyclic communication normal node table (Node nos. 1 to 16)
DT24	2nd word	Cyclic communication normal node table (Node nos. 17 to 32)
DT25	1st word	Cyclic communication stop node table (Node nos. 1 to 16)
DT26	2nd word	Cyclic communication stop node table (Node nos. 17 to 32)
DT27	1st word	Cyclic communication abnormal node table (Node nos. 1 to 16)
DT28	2nd word	Cyclic communication abnormal node table (Node nos. 17 to 32)
DT29	1st word	RUN/IDLE bit monitor (PLC standby flag) (Node nos. 1 to 16)
DT30	2nd word	RUN/IDLE bit monitor (PLC standby flag) (Node nos. 1 to 32)

Example 4) When fixing the number of valid words (The communication states of node numbers 1 to 16 are displayed.)

S1	S2	D
"EIP"	"ALL+1"	DT20

	Value	
DT20	100	Max. registration node number
DT21	1st word	Cyclic communication registration node table (Node nos. 1 to 16)
DT22	1st word	Cyclic communication normal node table (Node nos. 1 to 16)
DT23	1st word	Cyclic communication stop node table (Node nos. 1 to 16)
DT24	1st word	Cyclic communication abnormal node table (Node nos. 1 to 16)
DT25	1st word	RUN/IDLE bit monitor (PLC standby flag) (Node nos. 1 to 16)

Example 5) When specifying the reading of cyclic communication registration node table

S1	S2	D
"EIP"	"NODE"	WX100

	Value	
WX100	40	Max. registration node number
WX101	1111 1111 1111 1111	Cyclic communication registration node table (Node nos. 1 to 16)
WX102	1111 1111 1111 1111	Cyclic communication registration node table (Node nos. 17 to 32)
WX103	0000 0000 1111 1111	Cyclic communication registration node table (Node nos. 33 to 48)

Example 6) When specifying the reading of cyclic communication normal node table

S1	S2	D
"EIP"	"NORMAL"	WY100

	Value	
WY100	7	Max. registration node number
WY101	0000 0000 0111 1111	Cyclic communication normal node table (Node nos. 1 to 16)

Example 7) When specifying the reading of cyclic communication stop node table

S1	S2	D
"EIP"	"STOP"	WR100

	Value	
WR100	8	Max. registration node number
WR101	0000 0000 1111 1111	Cyclic communication stop node table (Node nos. 1 to 16)

Example 8) When specifying the reading of cyclic communication abnormal node table

S1	S2	D
"EIP"	"ERR"	WR100

	Value	
WR100	5	Max. registration node number
WR101	0000 0000 0000 1000	Cyclic communication abnormal node table (Node nos. 1 to 16)

Example 9) When specifying the reading of RUN/IDLE bit monitor (PLC standby flag)

S1	S2	D
"EIP"	"PLC"	WR2000

	Value	
WR2000	50	Max. registration node number
WR2001	1111 1111 1111 1111	RUN/IDLE bit monitor (Node nos. 1 to 16)
WR2002	1111 1111 1111 1111	RUN/IDLE bit monitor (Node nos. 17 to 32)
WR2003	1111 1111 1111 1111	RUN/IDLE bit monitor (Node nos. 33 to 48)
WR2004	0000 0000 0000 0011	RUN/IDLE bit monitor (Node nos. 49 to 64)

■ Flag operation

Name	Description
Latest error (S7) Hold error (S8)	Set when the read area is out of the range. Set when the read type (S1) is set to an item other than "IPv4", "IPv6", "FTPc", "HTTPc", "SMTPc" or "EIP" Set when the target to be read (S2) is set to an item other than "MAC", "CONNECT", "IDx", "LOGx", IDALL", "LOGALL", "ALL", "NODE", "NORMAL", "STOP", "ERR" or "PLC". Set when a combination other than the combinations listed in the restrictions on combination is specified for the type (S1) and target (S2) to be read. Set when the unit specified by UNITSEL is not an Ethernet unit. Set when executed in an interrupt program.

9.1.2 EtherNet/IP Node Status Acquisition Instruction (EIPNDST)

■ Instruction format

Note) A target unit for the instruction is specified with UNITSEL beforehand.

■ Operation unit (i)

There is no operation unit.

■ List of operands

Operand	Description
S	Specify the node number of an EtherNet/IP device whose status is acquired.
D1	Specify the device address for setting the acquired status.
D2	Specify the device address for setting execution resutls of instructions.

■ Available devices (●: Available)

Operand	16-bit device											32-bit device			Integer			Real number		String	Index modifier
	WX	WY	WR	WL	WS	SD	DT	LD	UM	WI	WO	TS CS	TE CE	IX	K	U	H	SF	DF	" "	
S	●	●	●	●			●	●								●	●				●
D1	●	●	●	●			●	●													●
D2	●	●	●	●			●	●													●

■ Processing

- Stores the status fo the node number specified by S in the device specified by D1, and stores the execution result in D2.
- Acquires the node status when the trigger (execution condition) turns on.

■ Precautions during programming

- Call this instruction after X6B (EtherNet/IP preapration done) turns ON. If it is called before X6B turns ON, the EtherNet/IP communication preparation incomplete error is returned.
- EIPNDST instruction cannot be executed simultaneously. A multiple execution error occurs. The next execution must be executed after confirming the completion of an instruction.

■ Operand [S] setting

Specify node numbers in the range of 1 to 256.

■ Operand [D1] setting

The results of read node statuses are set as follows.

Bit	Name	Definition
0	Owned	Turns ON when FP7 is a target and connected from an originator.
1	Reserved	It is always 0.
2	Configured	Turns ON when the settings of EtherNet/IP device are different from the factory default settings.
3	Reserved	It is always 0.
4 to 7	Extended Device Status	Shows the detailed status of EtherNet/IP device. It is a vendor-specific status or a status according to CIP.
8	Minor Recoverable Fault	Stores the error information of EtherNet/IP devices. Error contents vary depending on vendors. Recoverable Fault : Recoverable Unrecoverable Fault: Unrecoverable
9	Minor Unrecoverable Fault	
10	Major Recoverable Fault	
11	Major Unrecoverable Fault	
12 to 15	Reserved	It is always 0.

Field definition of Extended Device Status

Bits 4 to 7	Name
0000	During self-testing operation or unknown *
0001	During the update of firmware *
0010	More than one I/O connection is in the fault state. *
0011	No I/O connection has been established.
0100	Setting error of non-volatile memory. *
0101	Major fault. The bit 10 or 11 is ON. *
0110	More than one I/O connection is established and there is more than one connection that receives RUN mode.
0111	More than one I/O connection is established and all received connections are in the Idle mode.
1000	Reserved *
1001	
1010 to 1111	Peculiar to vendors or products. *

*The FP7 does not return this data.

■ Operand [D2] setting

The following execution result codes are set.

Name	Value	Description
Normal end	0	The acquisition of a specified node status is complete.
In progress	1	The acquisition of a specified node is in progress.
Timeout	2	Communication timeout (10 seconds)
Multiple executions	3	Multiple executions of EIPNDST instruction
Communication error	4	In the case of communication errors
CIP error	5	In the case of CIP errors
EtherNet/IP communication preparation incomplete	6	When the pareparation of EtherNet/IP communication is incomplete.

- D2+1: CIP general status, D2+2: CIP extended status

	Value	Description
D2+1	1 to 255	CIP general status *
D2+2	0 to 65535	CIP extended status *

* When the execution result is other values than "5", "0" is stored in D2+1 and D2+2.

* For details of the CIP general status and CIP extended status, refer to the specifications of CIP.

■ Usage example

Example 1) Acquires the node status of node number 1.

- EtherNet/IP configuration setting

The EtherNet/IP devices that the node status is acquired should be registered in the scan list.

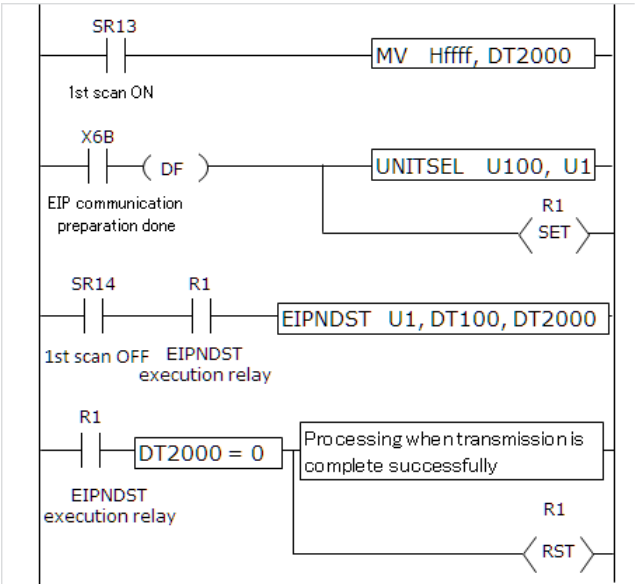
Node	IP address	Valid/Invalid flag
1	192.168.1.6	Invalid
2	192.168.1.7	Valid

There is no problem even if the valid/invalid flag is invalid when acquiring the node status. Select valid or invalid to determine whether to perform the cyclic communication or not.

- Ethernet unit setting by the UNITSEL instruction

UNITSEL	U100	U1
	S1	S2

- The acquisition result of the node status is stored in DT100 and the execution result is in DT2000. When the operation is complete successfully, 0 is stored in DT2000, and the node status is stored in DT100 and subsequent DTs.



■ Flag operation

Name	Description
Latest error (S7) Hold error (S8)	To be set when the unit specified by UNITSEL is not an Ethernet unit.
	To be set when the EtherNet/IP function is set to Not Use in the Ethernet unit configuration.
	To be set in case of out-of-range in indirect access (index modiication).
	To be set when executed in an interrupt program.
	To be set when the node specified by S does not exist.
	To be set when three-word device cannot be assured from the device of D2.

9.1.3 Cyclic Communication Start Request (EIPSTART)

■ **Instruction format**

Note) A target unit for the instruction is specified with UNITSEL beforehand.

■ **Operation unit (i)**

There is no operation unit.

■ **List of operands**

Operand	Description
S	Specify the starting address storing the start request node number table.
n	Specify the device address storing the maximum node number (1-256) or a constant.
D	Specify the device address storing execution results.

■ **Available devices (●: Available)**

Operand	16-bit device											32-bit device			Integer			Real number		String	Index modifier
	WX	WY	WR	WL	WS	SD	DT	LD	UM	WI	WO	TS CS	TE CE	IX	K	U	H	SF	DF	" "	
S	●	●	●	●			●	●													●
n	●	●	●	●			●	●								●	●				●
D	●	●	●	●			●	●													●

■ **Processing**

- Starts the node on which the start request is made within the maximum node number specified by [n] from the start request node number table specified by [S].

■ Operand [S] setting

Specify the starting address storing the start request node number table.

The number of valid words for the start request node number table becomes variable (1 to 16 words) according to the maximum node number specified by [n].

Max. node No.	No. of valid words
0	0
1 to 16	1
17 to 32	2
33 to 48	3
49 to 64	4
:	:
225 to 239	15
241 to 256	16

The bit corresponding to the node number on which the start request is made turns ON (1).

	Correspondence table of node numbers															
Bit No.	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Node No.	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
:	:															
Node No.	256	255	254	253	252	251	250	249	248	247	246	245	244	243	242	241

■ Operand [n] setting

Specify the device address storing the maximum node number or a constant.

■ Operand [D] setting

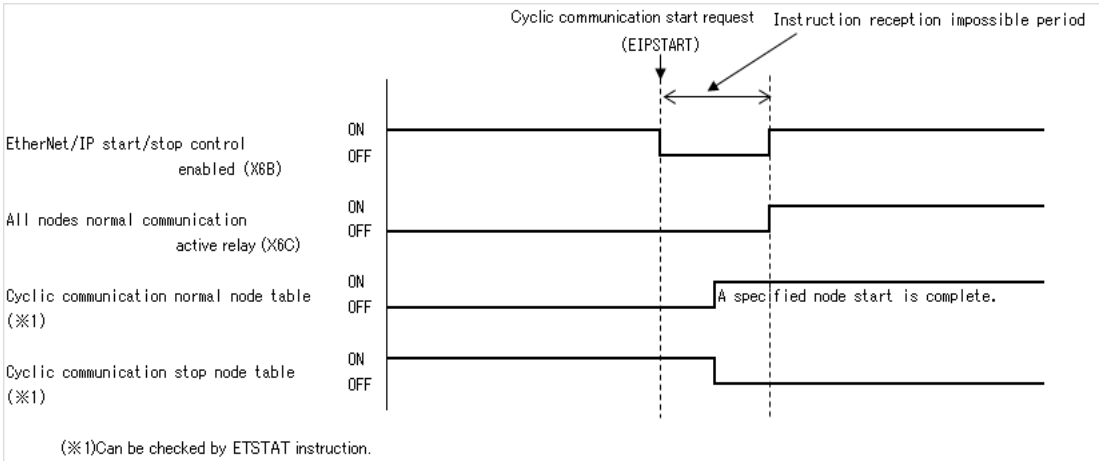
Specify the device address storing execution results.

Max. node number	Execution result	Description
Normal end	0	The specified node start is complete.
In progress	1	The specified node start processing is in progress.
Start failed	2	The specified node start failed.
Multiple executions	3	Multiple starts of EIPSTART instruction or EIPSTOP instruction.

■ Relay operation

Executes the cyclic communication start request instruction, turns ON the cyclic communication normal node table of a specified node and turns OFF the cyclic communication stop node table when the specified node starts normally.

Relay operation when the cyclic communication start request is made on a stopped node



■ Flag operation

Name	Description
Latest error (S7) Hold error (S8)	To be set when the unit specified by UNITSEL is not an Ethernet unit.
	To be set when the EtherNet/IP function is set to Not Use in the Ethernet unit configuration.
	To be set when executed in an interrupt program.
	To be set when the value of [n] exceeds 256.
	To be set when the value of [S] + [Number of valid words of n] is out of the device range.
	To be set in case of out-of-range in indirect access (index modiication).

9.1.4 Cyclic Communication Stop Request (EIPSTART)

■ Instruction format

Note) A target unit for the instruction is specified with UNITSEL beforehand.

■ Operation unit (i)

There is no operation unit.

■ List of operands

Operand	Description
S	Specify the starting address storing the stop request node number table.
n	Specify the device address storing the maximum node number (1-256) or a constant.
D	Specify the device address storing execution results.

■ Available devices (●: Available)

Operand	16-bit device											32-bit device			Integer			Real number		String	Index modifier
	WX	WY	WR	WL	WS	SD	DT	LD	UM	WI	WO	TS CS	TE CE	IX	K	U	H	SF	DF	" "	
S	●	●	●	●			●	●													●
n	●	●	●	●			●	●								●	●				●
D	●	●	●	●			●	●													●

■ Processing

- Stops the node on which the stop request is made within the maximum node number specified by [n] from the stop request node number table specified by [S].

■ Operand [S] setting

Specify the starting address storing the stop request node number table.

The number of valid words for the stop request node number table becomes variable (1 to 16 words) according to the maximum node number specified by [n].

Max. node number	No. of valid words
0	0
1 to 16	1
17 to 32	2
33 to 48	3
49 to 64	4
:	:
225 to 239	15
241 to 256	16

The bit corresponding to the node number on which the stop request is made turns ON (1).

	Correspondence table of node numbers															
Bit No.	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Node No.	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
:	:															
Node No.	256	255	254	253	252	251	250	249	248	247	246	245	244	243	242	241

■ Operand [n] setting

Specify the device address storing the maximum node number or a constant.

■ Operand [D] setting

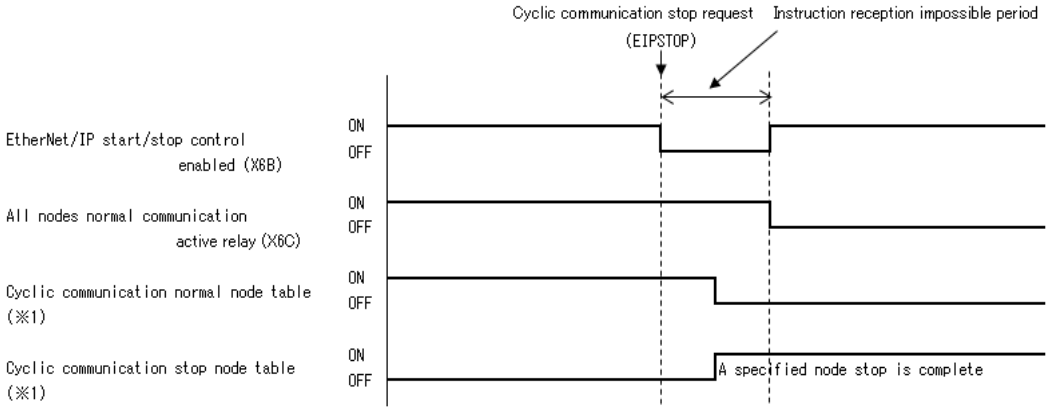
Specify the device address storing execution results.

Max. node number	Execution result	Description
Normal end	0	The specified node stop is complete
In progress	1	The specified node stop processing is in progress.
Start failed	2	The specified node stop failed.
Multiple executions	3	Multiple starts of EIPSTART instruction or EIPSTOP instruction.

■ **Relay operation**

Executes the cyclic communication stop request instruction, turns ON the cyclic communication stop node table of a specified node and turns OFF the cyclic communication normal node table when the specified node stops normally.

Relay operation when the cyclic communication stop request is made on a started node



(※1)Can be checked by ETSTAT instruction.

■ **Flag operation**

Name	Description
Latest error (S7) Hold error (S8)	To be set when the unit specified by UNITSEL is not an Ethernet unit.
	To be set when the EtherNet/IP function is set to Not Use in the Ethernet unit configuration.
	To be set when executed in an interrupt program.
	To be set when the value of [n] exceeds 256.
	To be set when the value of [S] + [Number of valid words of n] is out of the device range.
	To be set in case of out-of-range in indirect access (index modiication).

9.1.5 EtherNet/IP Input Refresh (EIP_IN)

■ **Instruction format**

Note) A target unit for the instruction is specified with UNITSEL beforehand.

■ **Operation unit (i)**

There is no operation unit.

■ **List of operands**

Operand	Description
S1	Specify the target node number of the input refresh.
S2	Specify the target connection number of the input refresh.
D	Specify the device address storing refresh results.

■ **Available devices (●: Available)**

Operand	16-bit device											32-bit device			Integer			Real number		String	Index modifier
	WX	WY	WR	WL	WS	SD	DT	LD	UM	WI	WO	TS CS	TE CE	IX	K	U	H	SF	DF	" "	
S1	●	●	●	●			●	●								●	●				●
S2	●	●	●	●			●	●								●	●				●
D	●	●	●	●			●	●													●

■

■ **Processing**

- This instruction refreshes data only when new data is received for the target connection of the refresh.
- (Input refresh: Data is copied to the device allocated from the receive buffer.)

■ **Precautions during programming**

- Call this instruction after X6B (EtherNet/IP preapration done) turns ON. If it is called before X6B turns ON, the EtherNet/IP communication preparation incomplete error is returned.
- Do not execute this instruction continuously in one scan from the viewpoint of suppressing the load.
- Execute the refresh instruction after confirming that the communication of a specified connection is performed normally using the cyclic communication normal node table.

■ Operand [S1] setting

Specify a node number to be refreshed.

An error occurs when a value over the maximum value specified by the scan list is specified.

An error also occurs when a reserved node is specified.

	Setting value
Scan list	1 to 256

■ Operand [S2] setting

Specify a connection number to be refreshed.

(Specify a relative number within nodes for the connection number.)

An error occurs when a value over the maximum value specified by the scan list is specified.

	Setting value
Connection No.	1 to 256

■ Operand [D] setting

- Specify the device address storing refresh results.
- When there is no new received data, the refresh operatio is not performed.

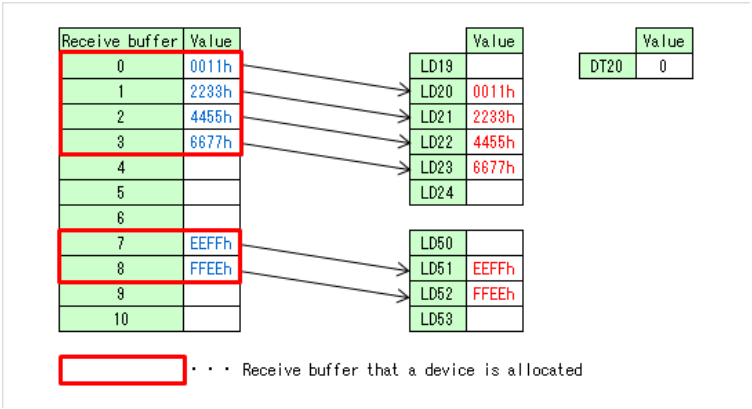
Execution result	Description
0	Refresh operation is complete successfully.
1	No data is received. Refresh is not performed.
2	EtherNet/IP communication preparation incomplete

Example 1) When refreshing data from the receive buffer of the connection number 1 of the node number 1 (The refresh is complete normally.)

S1	S2	D
1	1	DT20

EtherNet/IP configuration setting

Setting item	Settings
Node number	1
Connection	1
Input Information (T>O)	LD20 to LD23
Device allocation	LD51 to LD52

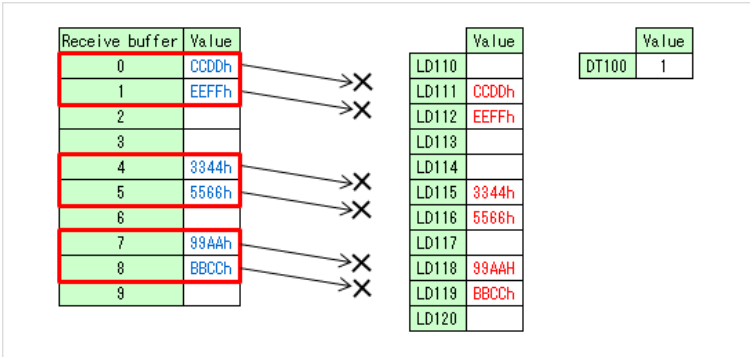


Example 2) When refreshing data from the receive buffer of the connection 2 of the node number 5 (When there is no new data)

S1	S2	D
5	2	DT100

EtherNet/IP configuration setting

Setting item	Settings
Node number	5
Connection	2
Input Information (T>O) Device allocation	LD111 to LD112
	LD115 to LD116
	LD118 to LD119



Example 3) When refreshing data by the periodical interrupt processing when the scan time is long and RPI is short (When acquiring every received data)

One scan time: 10 ms

RPI: 500 us

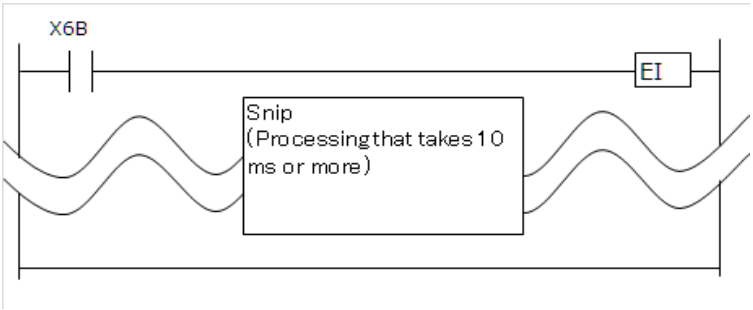
- When the processing time of one scan is longer than the setting time of RPI, the refresh cannot be executed during the processing.
  As countermeasures against it, perform the periodical interrupt processing using the same value as that of RPI and performs the refresh by the interrupt processing.
- If the interrupt cycle is set to the same value as that of RPI, the refresh instruction may be executed while writing to the receive buffer and the operation may fail.

Perform the processing after confirming the refresh result.

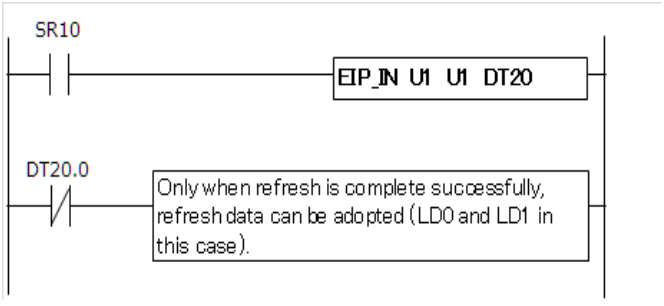
EtherNet/IP configuration setting

Setting item	Settings
Node number	1
Connection	1
Input Information (T>O) Device allocation	LD0 to LD1

Every scan execution type program block (Main processing)
(Ladder that takes 10 ms or more for one step)



Fixed cycle execution type (0.1 ms) program block
(0.5-ms cyclic program)



■ **Flag operation**

Name	Description
Latest error (S7) Hold error (S8)	To be set when the unit specified by UNITSEL is not an Ethernet unit.
	To be set when the EtherNet/IP function is set to Not Use in the Ethernet unit configuration.
	To be set in case of out-of-range in indirect access (index modiication).
	To be set when an out-of-range value is specified for parameters.
	To be set when the node or connection specified by S1 and S2 does not exist.
	Use this instruction only for the connections in which the refresh method of the EtherNet/IP setting is set to Instruction.
	An operation error occurs when the connection that other refresh method other than that has been specified is specified.
	To be set when the connection that the number of input data is 0 is specified.
	To be set when the connection that the number of refreshed data is 0 is specified.

9.1.6 EtherNet/IP Output Refresh (EIP_OT)

■ **Instruction format**

Note) A target unit for the instruction is specified with UNITSEL beforehand.

■ **Operation unit (i)**

There is no operation unit.

■ **List of operands**

Operand	Description
S1	Specify a target node number of output fresh.
S2	Specify a target connection number of output refresh.
D	Specify the device address storing refresh results.

■ **Available devices (●: Available)**

Operand	16-bit device											32-bit device			Integer			Real number		String	Index modifier
	WX	WY	WR	WL	WS	SD	DT	LD	UM	WI	WO	TS CS	TE CE	IX	K	U	H	SF	DF	" "	
S1	●	●	●	●			●	●								●	●				●
S2	●	●	●	●			●	●								●	●				●
D	●	●	●	●			●	●													●

■ **Processing**

- This instruction executes the output refresh for connections to be refreshed.
- (Output refresh: Data is copied to the send buffer form an allocated device.)

■ **Precautions during programming**

- Call this instruction after X6B (EtherNet/IP preapration done) turns ON. If it is called before X6B turns ON, the EtherNet/IP communication preparation incomplete error is returned.
- Do not execute this instruction continuously in one scan from the viewpoint of suppressing the load.
- Execute the refresh instruction after confirming that the communication of a specified connection is performed normally using the cyclic communication normal node table.

■ Operand [S1] setting

Specify the node number that data is set to the send buffer.

The I/O map is used for sending data to a destination scanner device (PLC).

	Setting value
I/O map	0
Scan list	1 to 256

■ Operand [S2] setting

Specify a connection number to be refreshed.

(Specify a relative number within nodes for the connection number.)

	Setting value
I/O map number or connection number	1 to 256

■ Operand [D] setting

Specify the device address storing refresh results.

If this instruction is executed in cycles faster than RPI, the output refresh may not be performed.

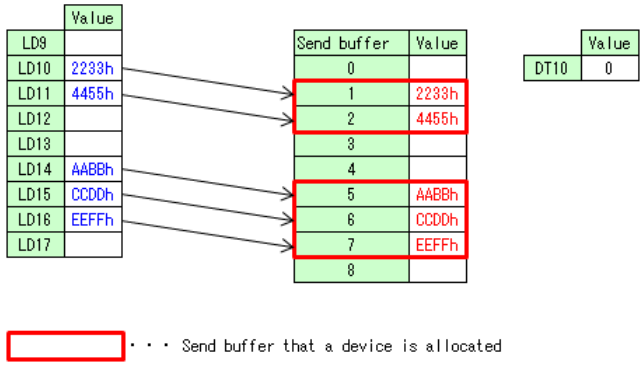
Execution result	Description
0	Refresh operation is complete successfully.
1	Refresh is not performed.
2	EtherNet/IP communication preparation incomplete

Example 1) When performing the output refresh for the send buffer of the I/O map number 1 (Normal end)

S1	S2	D
0	1	DT10

EtherNet/IP configuration setting

Setting item	Settings
I/O map number	1
Device allocation	LD10 to LD11
	LD14 to LD16

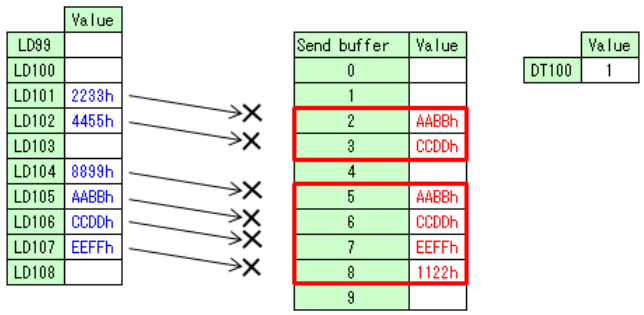


Example 2) When performing the output refresh for the send buffer of the connection number 5 of the node number 2 (Abnormal end)

S1	S2	D
2	5	DT100

EtherNet/IP configuration setting

Setting item	Settings
Node number	2
Connection	5
Output Information (O>T)	LD101 to LD102
Device Allocation	LD104 to LD107



■ **Flag operation**

Name	Description
Latest error (S7) Hold error (S8)	To be set when the unit specified by UNITSEL is not an Ethernet unit.
	To be set when the EtherNet/IP function is set to Not Use in the Ethernet unit configuration.
	To be set in case of out-of-range in indirect access (index modiication).
	To be set when an out-of-range value is specified for parameters.
	To be set when the I/O map or node/connection specified by S1 and S2 does not exist.
	Use this instruction only for the connections in which the refresh method of the EtherNet/IP setting is set to Instruction.
	An operation error occurs when the connection that other refresh method other than that has been specified is specified.
	To be set when the connection that the number of output data is 0 is specified.
	To be set when the connection that the number of refreshed data is 0 is specified.

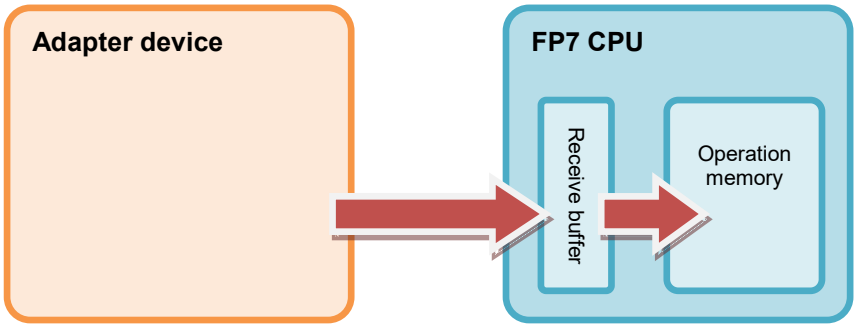
10

Data Refresh of Cyclic Communication

10.1 What is Data Refresh?

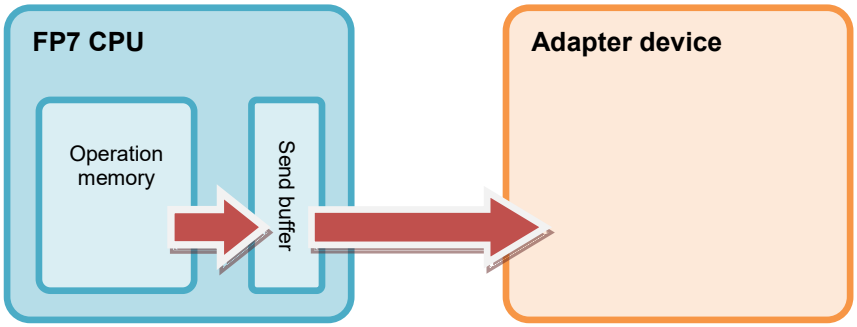
10.1.1 Input Refresh T>O Direction

Data is refreshed as follows at the time of input.



10.1.2 Output Refresh O>T Direction

Data is refreshed as follows at the time of output.



10.2 Data Refresh Method

There are the following data refresh methods.

Abnormality judgement	Details
Batch refresh	In refresh processing at the beginning of scan, if there is incoming data in the receive buffer for cyclic communication in the case of input direction, it is copied to the operation memory. In the case of output direction, if there is a space in the send buffer for cyclic communication, data is copied from the operation memory. The batch refresh processing is always performed for all the specified connections.
Division refresh	Data is copied at the same timing as the batch refresh, however, if the number of transferred words exceeds the number of words specified for the refresh capacity in the basic setup, the refresh processing will be interrupted and data will be refreshed in the next scan. As the number of transferred data during one scan can be limited, it is possible to suppress and smooth the fluctuation of scanning due to the transfer processing. However, the response time of connections postponed to subsequent scan processings becomes long.
Instruction refresh	Data is not copied automatically like batch refresh and division refresh. Data can be refreshed by the EIP_IN instruction for the input refresh, and by the EIP_OT instruction for the output refresh. Concrete usage example When a scan time is long, received data in the input direction of the RPI shorter than the scan time is surely loaded. The EIP_IN instruction is executed in an interrupt program of a fixed cycle.

10.3 Delay Time of Transmission Data

When data sent to an adapter device from the FP7 is received or controlled by the adapter device, a delay occurs in the FP7 and adapter device.

■ Delay time of FP7

A delay caused by the transmission cycle of an adapter device and the FP7 refresh timing occurs.

The delay time on the FP7 side depends on the scan time of the FP7 and the RPI value of the EtherNet/IP communication.

Pattern	Relation between scan time and RPI	Delay time
1	Scan time < RPI and Scan time x 4 ≥ RPI	Scan time
2	Scan time < RPI and Scan time x 4 < RPI	Larger value of scan time x 4 or RPI x 1/16
3	Scan time ≠ RPI	Scan time (RPI)
4	Scan time > RPI	RPI

■ Delay time of adapter devices

The delay time of an adapter device is the total of the delays caused by reception processing and output control to output devices.

Delay time of adapter = Delay by reception processing + Delay by output control to output device

* The delay time of adapter device varies depending on devices.

  Refer to manuals of adapter devices.

10.4 Delay Time of Reception Data

When data sent to the FP7 from an adapter device is received, a delay occurs in the adapter device and FP7.

■ Delay time of adapter devices

The delay time of an adapter device is the total of the delays caused by input processing and transmission processing.

Delay time of adapter = Delay by input processing + Delay by transmission processing

* The delay time of adapter device varies depending on devices.

  Refer to manuals of adapter devices.

■ Delay time of FP7 (scanner)

A delay caused by the transmission cycle of an adapter device and the FP7 refresh timing occurs.

The delay time on the FP7 side depends on the scan time of the FP7 and the RPI value of the EtherNet/IP communication.

Pattern	Relation between scan time and RPI	Delay time
1	Scan time < RPI	Scan time
2	Scan time ≠ RPI	Scan time (RPI) x 2
3	Scan time > RPI	RPI

11

Cyclic Communication Load Factor

11.1 Calculation Method of Load Factor

The communication load factor is a value obtained by dividing the number of communication packets that an EtherNet/IP device sends/receives per second by a cyclic communication allowable communication band (the number of packets that can be sent/received per second).

Note) The load factors of FP7 and each adapter device should be 100% or less.

■ **Load factor of FP7**

$$\text{Unit communication load factor} = \frac{\textit{Number of communication packets sent/received per second (pps)}}{\textit{Cyclic communication allowable communication band (pps)}} \times 100\%$$

Calculation procedure 1) Calculating the number of communication packets sent/received per second (pps)

Calculate from RPI. * pps = 1000 ÷ RPI [ms]

When the COS (Change of State) trigger is set, it calculated as a communication cycle RPI x 1/4.

Example 1) For the connection that RPI is 0.5 [ms]

1000 ÷ 0.5 = 2000 pps

Example 2) For the connection that RPI is 0.5 [ms] and the COS trigger is set

1000 ÷ (0.5 x (1/4)) = 500 pps

Calculation procedure 2) Calculating the cyclic communication allowable communication band (pps)

Calculate from the data size per packet *2 and EDS information [Capacity] for FP7.

FP7_EDS [Capacity] definition

2 to 510 bytes: 10000 pps

511 to 1450 bytes: 5000 pps

*2. Connection transmission/reception data size = Raw data size + 32-bit header size *3

*3. Without 32-bit header: 2 bytes

With 32-bit header: 6 bytes

Example 3) When the connection transmission raw data size is 256 bytes without 32-bit header

(256 + 2) = 258 bytes $\leq$ 510 $\Rightarrow$ 10000 pps

Example 4) When the connection transmission raw data size is 512 bytes with 32-bit header

(256 + 6) = 518 bytes $\geq$ 511 $\Rightarrow$ 5000 pps

Calculation procedure 3) Calculating the uni communication load factor from the number of sent/received packets (pps) and sent/received data size

Example 5) When the sent data size is 256 bytes and the received data size is 36 bytes

No. of sent packets (2000 pps) ÷ 10000 pps x 100% = 20%

No. of received packets (125 pps) ÷ 10000 pps x 100% = 1.25%

⇒ The unit communication load factor is (20% + 1.25% = 21.25%).

■ Load factor of adapter

The load factor is calculated from the EDS information [Capacity] of each adapter and scanner.

When EDS information is not registered, "Impossible to calculate" is displayed.

$$\text{Adapter communication load factor} = \frac{\textit{Number of communication packets sent/received per second (pps)}}{\textit{Cyclic communication allowable communication band (pps)}} \times 100\%$$

Calculation procedure 1-1) Calculating the number of communication packets sent/received per second (pps) *4

The calculation method is the same as the calculation procedure 1) of unit load factor.

*4. When the IGMP snoop function is "Invalid" and the connection type is "Point to Point", multicast communication packets (pps) are added.

Calculation procedure 1-2) Calculating multicast communication packets (pps)

The calculation method is the same as the calculation procedure 1) of unit load factor.

Packets that "Multicast communication" is set to "Yes" in the I/O map setting and the connection type is "MultiCast" in the connection setting are to be calculated.

Calculation procedure 2) Calculating the cyclic communication allowable communication band (pps)

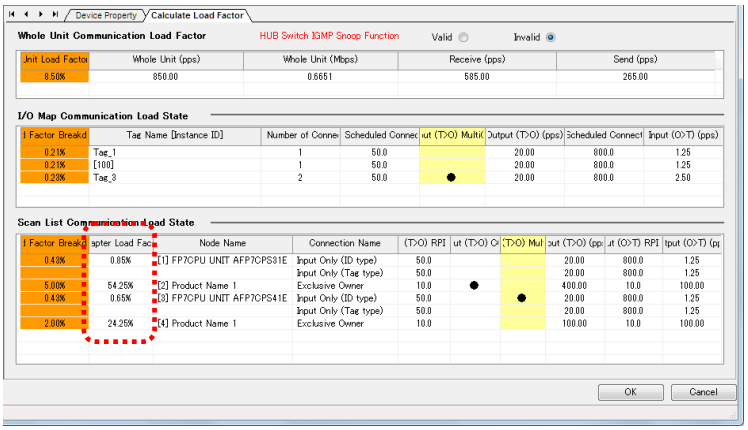
Calculate from the data size per packet *2 and EDS information [Capacity] for adapters and scanners.

The calculation method is the same as the calculation procedure 2) of unit load factor.

Calculation procedure 3) Calculating the uni communication load factor from the number of sent/received packets (pps) and sent/received data size

The calculation method is the same as the calculation procedure 3) of unit load factor.

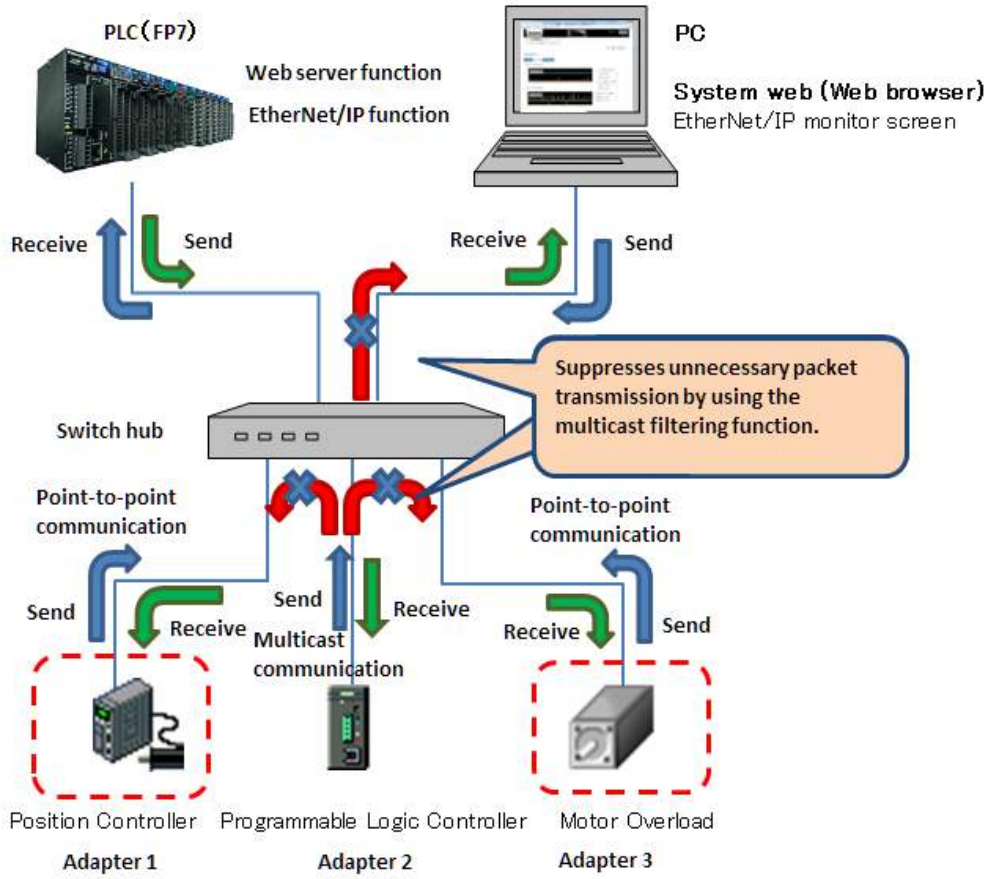
<Load factor calculation screen of EtherNet/IP setting tool>



11.2 PLC Link and Ethernet Switch

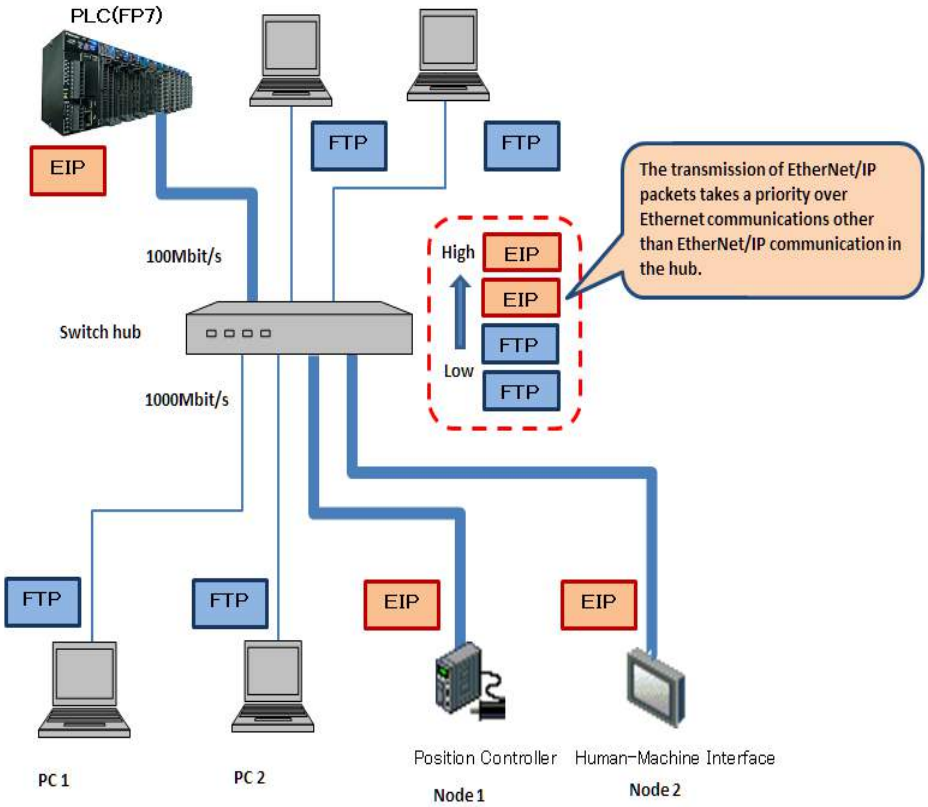
■ **Multicast filter function**

This function is used to suppress unnecessary multicast packet transmission.



■ **QOS (Quality of Service) function**

The transmission of EtherNet/IP packets takes a priority over Ethernet communications other than EtherNet/IP communication in the hub.



12

Other Ethernet Communications

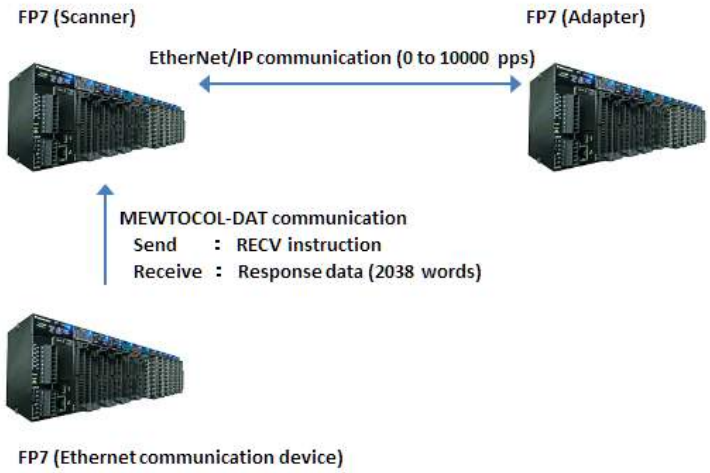
12.1 Performance of Other Ethernet Communications at the Time of Cyclic Communication

As the EtherNet/IP communication takes a priority over other Ethernet communications, the baud rates of other Ethernet communications are decreased when the EtherNet/IP communication is performed simultaneously.

The following information serves as a standard in the determination of the decrease in baud rate.

MEWTOCOL-DAT (1)

■ **System configuration**



The connection settings used for the EtherNet/IP communication are as follows.

Send/Receive	Details
No. of connections	66
Application type	Input Only (ID type)
RPI	*2
Data size per connection (*1)	Connections 1 to 65 252 words Connection 66 4 words
Connection type	Point to Point
Refresh method	Batch

*1: The total data size of 66 connections is 16384 words (the maximum value that device allocation is available).

*2: RPI is measured with the following settings.

pps	RPI	
0 pps	The EtherNet/IP function is set to Invalid.	
2500 pps	Connections 1 to 3	29 ms
	Connections 4 to 66	28 ms
5000 pps	Connection 1	15 ms
	Connections 2 to 66	14 ms
7500 pps	Connections 1 to 3	10 ms
	Connections 4 to 66	9 ms
10000 pps	Connections 1 to 65	7 ms
	Connection 66	8 ms

The Ethernet communication (MEWTOCOL-DAT) between FP7 (Ethernet communication device) and FP7 (Scanner) is performed as follows.

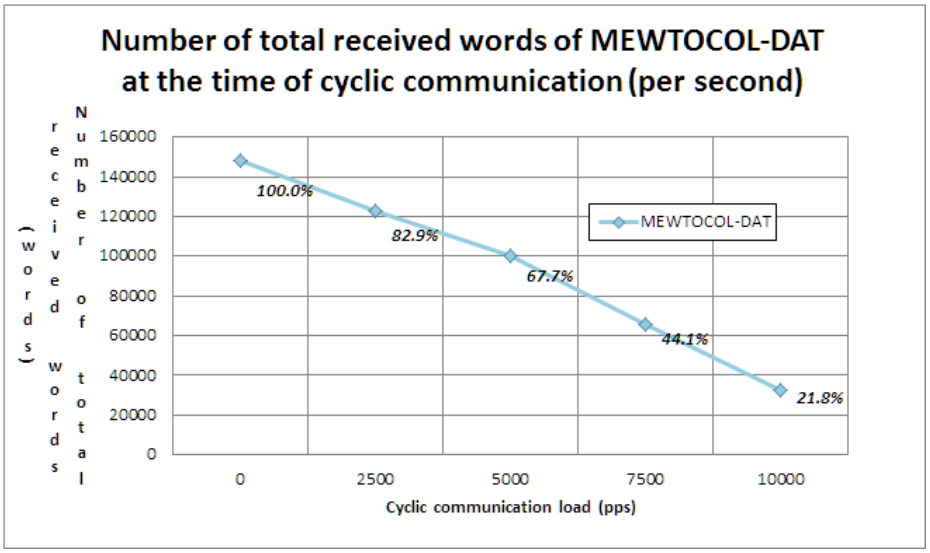
Send/Receive	Details
Communication protocol	MEWTOCOL-DAT
Number of connections	1
Send (*3)	RECV instruction is issued. (2038 words are requested.)
Receive (*4)	Response data for RECV instruction is sent. (Response data of 2038 words is received.)

*3: FP7 (Ethernet communication device) to FP7 (Scanner)

*4: FP7 (Scanner) to FP7 (Ethernet communication device)

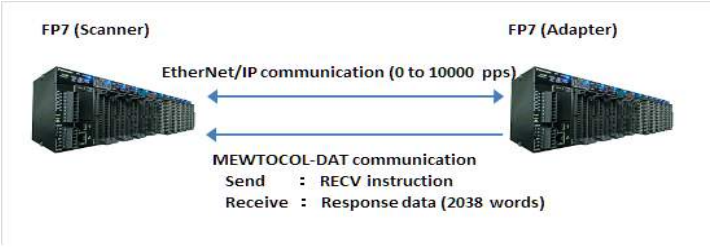
■ **Decrease in baud rate due to increase in PPS**

As a result of performing Ethernet communication from FP7 (Ethernet communication device) during the EtherNet/IP communication between FP7 (scanner) and FP7 (adapter), the baud rate is decreased as follows.



MEWTOCOL-DAT (2)

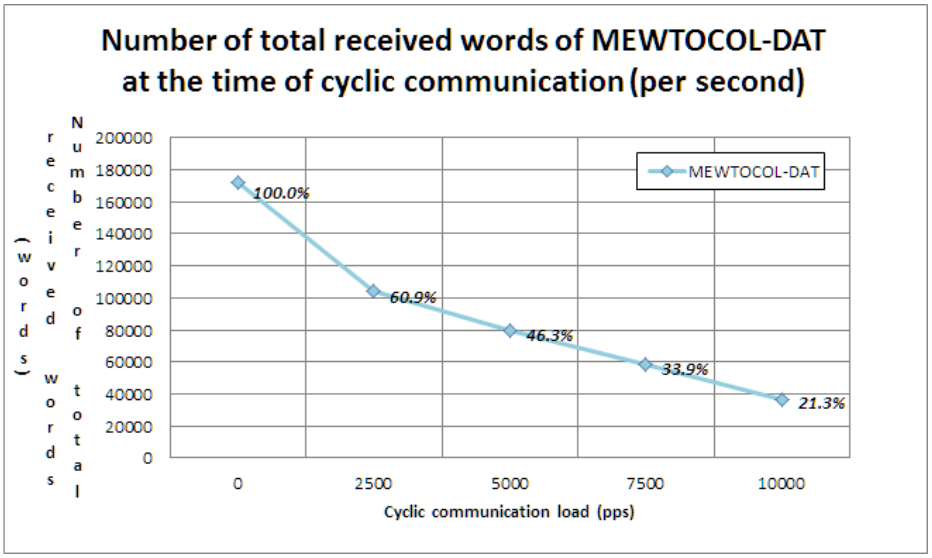
■ System configuration



* The setting contents of EtherNet/IP communication and MEWTOCOL-DAT communication are the same as those of the above "EMWTOCOL-DAT (1)".

■ Decrease in baud rate due to increase in PPS

As a result of performing Ethernet communication from FP7 (scanner) during the EtherNet/IP communication between FP7 (scanner) and FP7 (adapter), the baud rate is decreased as follows.



13

Communication Status Monitoring with System Web

13.1 Overview of FP7 System Web

■ What is FP7 System Web?

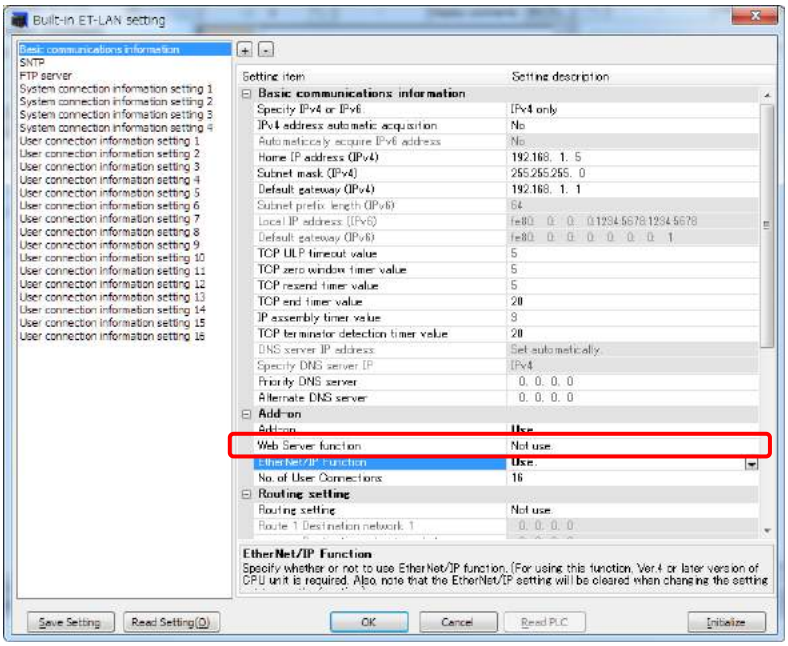
The FP7 system web is a content prepared for the FP7 CPU unit as standard.

The basic information and operation state of FP7 can be monitored on a browser by using this function.

■ For using the FP7 system web

For using the system web function, the web server function in the built-in ET-LAN setting of FP7 configuration should be set to "Use System Only" or "Use System and Customer".

For details of the starting method of the built-in ET-LAN setting dialog, refer to “7.1.1 How to Display the Built-in ET-LAN Setting Dialog Box”.



■ Notes concerning FP7 system web

In this manual, the system web screens other than the EtherNet/IP communication state monitor are omitted.

■ Screen configuration

Screen configuration of FP7 system web

① Administrator mode	: Displays the logged-in user level.
1) For administrator	: Administrator mode (Blue)
2) For user	: No indication
② Logout	: Returns to the login screen.
③ System menu	: The menu for selecting functions.
1) FP7	: Links to our product (FP7) site. (https://www3.panasonic.biz/ac/e/fasys/plc/plc/fp7/index.jsp)
2) CPU status indication	: Displays the FP7 model information, operation state and system monitor area.
3) Error indication	: Displays unit errors and error alarm relays.
4) Data monitor	: Monitors the data of a specified device.
④ Drawing area	: Displays the screen of a selected function.
⑤ Language	: Switches the language between Japanese and English.

13.2 Starting System Web Screen

It is necessary to access and log in the FP7 web server for starting the FP7 system web screen.

Enter a user ID (root) and password (pass) on the login screen. *

■ **How to access the FP7 web server**

IP address/sys/

Example) 192.168.1.224/sys/

http://192.168.1.224/sys/index.html is displayed.

*** When the FP7 unit is password-protected, you can only log in with a registered ID and password.**

1. **Enter "User ID" and "Password" on the start-up screen and click the Login button.**

- **When entering Login ID or Password failed**

  The following error message is displayed until the third try.

  “User ID or Password is invalid.”

  The following error message is displayed from the fourth try.

  (The system is restored when the unit is rebooted or one hour elapses.)

  “FP7 was locked because it had failed in log in three times.
  Please reboot FP7.”

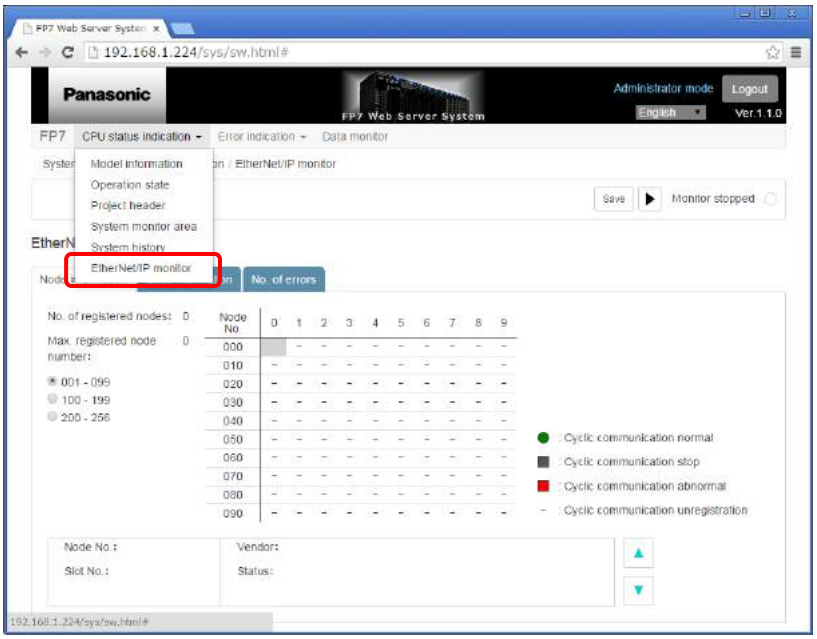
- **When the entered login ID and password are correct**

  The initial screen (CPU status indication > Model information) is displayed.

13.3 Overview of EtherNet/IP Monitor

It shows the EtherNet/IP communication state using the tabs of node information, load information and number of errors.

Select "CPU status indication" > "EtherNet/IP monitor" in the system menu as shown below.



13.4 CPU Status Indication > EtherNet/IP Monitor

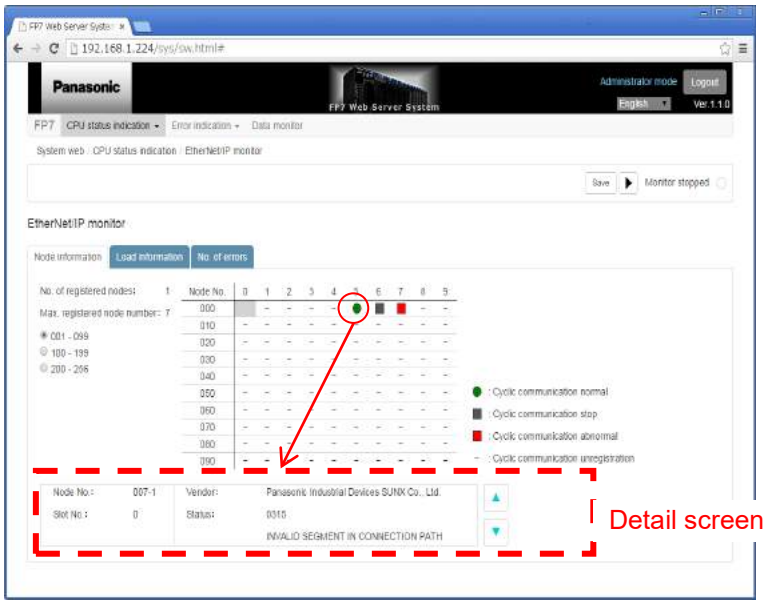
Display the EtherNet/IP monitor of FP7.

Common function to each screen

- "Save" button

Saves the displayed EtherNet/IP monitor information. (CSV format)

1. **When selecting "Node information" tab**



- **Node information (EtherNet/IP operation status monitor)**

  It shows the following information.

  1) No. of registered nodes: (0 to 256)

  2) Max. registered node number: (0 to 256)

  3) Operation state of each node: (Cyclic communication: ● Normal/■ Stop/■ Abnormal/- Unregistration)

  Clicking the list display shows detail information (the following items) in the lower part of the screen.

  Node No., Slot No., Vendor, Status: Code and its content

  When more than one error occurs within one node, the display is switched with "▲" and "▼" buttons.

  The list display is switched by selecting a node range (No. 001-099, 100-199, or 200-256).

- **Monitor executing/stopped button**

  Update processing is performed only once. It returns to the monitoring-stopped state after updating data.

2. When selecting "Load information"

- **Load information (EtherNet/IP operation status monitor)**

  It shows the following information.

  1) Cyclic communication: No. of received packets (per second)

  2) Cyclic communication: No. of transmitted packets (per second)

  3) Communication other than cyclic communication: No. of received packets (per second)

  4) Communication other than cyclic communication: No. of transmitted packets (per second)

  5) Number of receive buffer overflows (Total)

  6) Number of received error packets (Total)

  7) No. of failed transmitted packets (Total)

  It shows the following information graphically.

  - No. of received packets (per second): ● Cyclic / ● Others

  - No. of transmitted packets (per second): ● Cyclic / ● Others

  Horizontal axis: Scaled at the interval of one second. Shifted to the left after displaying the whole graph.

  Vertical axis: Automatically adjusted according to the number of packets.

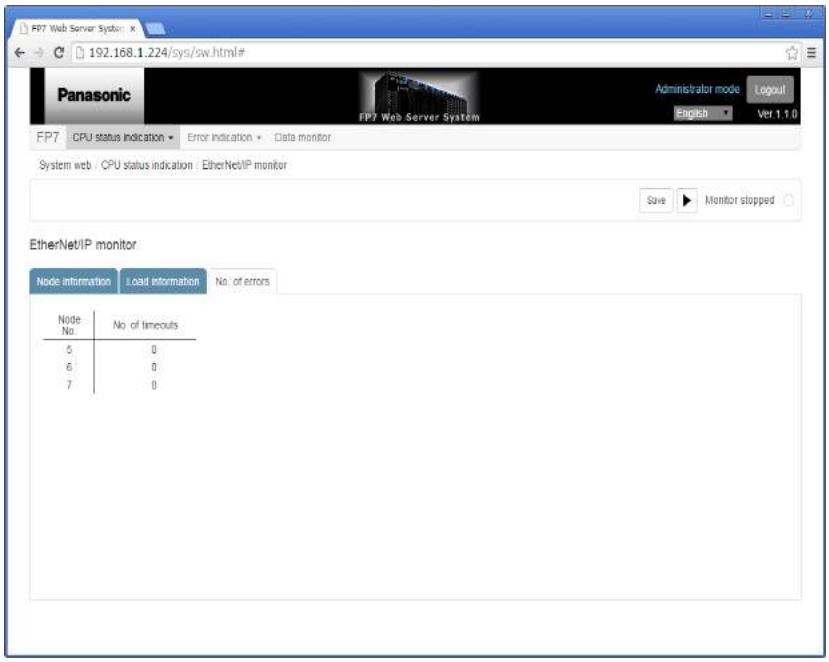
  * The graph is reset by switching the tab or starting monitoring.

- **Monitor executing/stopped button**

  In the case of Monitor executing: Updates and displays data at the interval of one second.

  In the case of Monitor stopped: Stops the update processing.

3. When selecting "No. of errors"



- **No. of errors (EtherNet/IP operation status monitor)**

  It shows the following information.

  1) Node No.

  2) No. of timeouts

  * The number of communication errors is displayed for each node. The display varies according to the number of registered nodes.

- **Monitor executing/stopped button**

  Update processing is performed only once. It returns to the monitoring-stopped state after updating data.

14
LED Display

14.1 Lighting State of LED for EtherNet/IP Setting

The state of the EtherNet/IP communication can be confirmed from the LED lighting state.

14.1.1 Lighting Patterns When Starting PLC

The lighting-up of the indicator is checked when the PLC starts.

The lighting-up of the indicator is checked after the PLC is powered on and after all the LEDs other than MS and NS turn on and turn off.

The procedure of checking the lighting-up of the indicator is as follows.

After the check, the indicator varies according to the state of the EtherNet/IP setting.

Example) For FP7 (CPS41ES)

Order of checking the lighting-up of indicator

Procedure	MS	NS	Lighting state
1			MS: Green ON, NS: OFF, Turns ON for 0.25 seconds.
2			MS: Green ON, NS: OFF, Turns ON for 0.25 seconds.
3			MS: Green ON, NS: Green ON, Turns ON for 0.25 seconds.
4			MS: Green ON, NS: Red ON, Turns ON for 0.25 seconds.
5			MS: Green ON, NS: OFF

14.1.2 Lighting Patterns When PLC is Operating

The state of the PLC can be confirmed from the lighting state of the LEDs when the PLC is operating.

The PLC states indicated by the LEDs are as follows.

Example) For FP7 (CPS41ES)

MS (Module status indicator)

LED	Lighting state	PLC state
	OFF	The EtherNet/IP function is disabled.
	ON	The EtherNet/IP function is activated.
	Flashing	This state does not exist.
	ON	Unrecoverable fault occurs.
	Flashing	Recoverable fault occurs. (such as a setting that load factor exceeds)

NS (Network status indicator)

LED	Lighting state	PLC state
	OFF	The EtherNet/IP function is disabled or IP address is not established.
	ON	More than one connection is established.
	Flashing	Connection is not established or IP address is acquired.
	ON	IP address duplication is detected.
	Flashing	This state does not exist.

When LED is flashing, the lighting state changes between ON and OFF at the interval of 0.5 seconds.

15

List of Cyclic Communication Errors

15.1 Cyclic Communication: List of Abnormal Statuses

The details of status numbers when cyclic communication errors occur are as follows.

Abnormal status (exadecimal)	Status name
0100	CONNECTION IN USE OR DUPLICATE FORWARD OPEN
0103	TRANSPORT CLASS AND TRIGGER COMBINATION NOT SUPPORTED
0106	OWNERSHIP CONFLICT
0107	TARGET CONNECTION NOT FOUND
0108	INVALID NETWORK CONNECTION PARAMETER
0109	INVALID CONNECTION SIZE
0110	TARGET FOR CONNECTION NOT CONFIGURED
0111	RPI NOT SUPPORTED.
0112	RPI VALUE(S) NOT ACCEPTABLE
0113	OUT OF CONNECTIONS
0114	VENDOR ID OR PRODUCT CODE MISMATCH
0115	DEVICE TYPE MISMATCH
0116	REVISION MISMATCH
0117	INVALID PRODUCED OR CONSUMED APPLICATION PATH
0118	INVALID OR INCONSISTENT CONFIGURATION APPLICATION PATH
0119	NON-LISTEN ONLY CONNECTION NOT OPENED
011A	TARGET OBJECT OUT OF CONNECTIONS
011B	THE PRODUCTION INHIBIT TIME IS GREATER THAN THE RPI
011C	TRANSPORT CLASS NOT SUPPORTED
011D	PRODUCTION TRIGGER NOT SUPPORTED
011E	DIRECTION NOT SUPPORTED
011F	INVALID ORIGINATOR TO TARGET NETWORK CONNECTION FIXVAR
0120	INVALID TARGET TO ORIGINATOR NETWORK CONNECTION FIXVAR
0121	INVALID ORIGINATOR TO TARGET NETWORK CONNECTION PRIORITY
0122	INVALID TARGET TO ORIGINATOR NETWORK CONNECTION PRIORITY
0123	INVALID ORIGINATOR TO TARGET NETWORK CONNECTION TYPE
0124	INVALID TARGET TO ORIGINATOR NETWORK CONNECTION TYPE
0125	INVALID ORIGINATOR TO TARGET NETWORK CONNECTION REDUNDANT_OWNER
0126	INVALID CONFIGURATION SIZE
0127	INVALID ORIGINATOR TO TARGET SIZE
0128	INVALID TARGET TO ORIGINATOR SIZE
0129	INVALID CONFIGURATION APPLICATION PATH

012A	INVALID CONSUMING APPLICATION PATH
012B	INVALID PRODUCING APPLICATION PATH
012C	CONFIGURATION SYMBOL DOES NOT EXIST
012D	CONSUMING SYMBOL DOES NOT EXIST
012E	PRODUCING SYMBOL DOES NOT EXIST
012F	INCONSISTENT APPLICATION PATH COMBINATION
0130	INCONSISTENT CONSUME DATA FORMAT
0131	INCONSISTENT PRODUCE DATA FORMAT
0132	NULL FORWARD OPEN FUNCTION NOT SUPPORTED
0133	CONNECTION TIMEOUT MULTIPLIER NOT ACCEPTABLE
0203	CONNECTION TIMED OUT
0204	UNCONNECTED REQUEST TIMED OUT
0205	PARAMETER ERROR IN UNCONNECTED REQUEST SERVICE
0206	MESSAGE TOO LARGE FOR UNCONNECTED_SEND SERVICE
0207	UNCONNECTED ACKNOWLEDGE WITHOUT REPLY
0301	NO BUFFER MEMORY AVAILABLE
0302	NETWORK BANDWIDTH NOT AVAILABLE FOR DATA
0303	NO CONSUMED CONNECTION ID FILTER AVAILABLE
0304	NOT CONFIGURED TO SEND SCHEDULED PRIORITY DATA
0305	SCHEDULE SIGNATURE MISMATCH
0306	SCHEDULE SIGNATURE VALIDATION NOT POSSIBLE
0311	PORT NOT AVAILABLE
0312	LINK ADDRESS NOT VALID
0315	INVALID SEGMENT IN CONNECTION PATH
0316	FORWARD CLOSE SERVICE CONNECTION PATH MISMATCH
0317	SCHEDULING NOT SPECIFIED
0318	LINK ADDRESS TO SELF INVALID
0319	SECONDARY RESOURCES UNAVAILABLE
031A	RACK CONNECTION ALREADY ESTABLISHED
031B	MODULE CONNECTION ALREADY ESTABLISHED
031C	MISCELLANEOUS
031D	REDUNDANT CONNECTION MISMATCH
031E	NO MORE USER CONFIGURABLE LINK CONSUMER RESOURCES AVAILABLE IN THE PRODUCING MODULE
031F	NO USER CONFIGURABLE LINK CONSUMER RESOURCES CONFIGURED IN THE PRODUCING MODULE
0800	NETWORK LINK OFFLINE
0810	NO TARGET APPLICATION DATA AVAILABLE
0811	NO ORIGINATOR APPLICATION DATA AVAILABLE
0812	NODE ADDRESS HAS CHANGED SINCE THE NETWORK WAS SCHEDULED
0813	NOT CONFIGURED FOR OFF-SUBNET MULTICAST
0814	INVALID PRODUCE/CONSUME DATA FORMAT

16
Appendix

16.1 Supported Data Types

The following table shows the data types supported by the FP0H control unit.
The names and data codes of the supported data types are prescribed by the Common Industrial Protocol (CIP).

Supported data type	Data size	Data code	Description
BOOL	1 byte	C1	Boolean logic with logical values TRUE and FALSE
SINT	1 byte	C2	Signed 8-bit integer value
INT	2 bytes	C3	Signed 16-bit integer value
DINT	4 bytes	C4	Signed 32-bit integer value
LINT	8 bytes	C5	Signed 64-bit integer value
USINT	1 byte	C6	Unsigned 8-bit integer value
UINT	2 bytes	C7	Unsigned 16-bit integer value
UDINT	4 bytes	C8	Unsigned 32-bit integer value
ULINT	8 bytes	C9	Unsigned 64-bit integer value
REAL	4 bytes	CA	32-bit floating-point value
LREAL	8 bytes	CB	64-bit floating-point value
STRING	Variable according to the size of character string	D0	Character string (1-byte character)
BYTE	1 byte	D1	Bit string: 8 bits
WORD	2 bytes	D2	Bit string: 16 bits
DWORD	4 bytes	D3	Bit string: 32 bits
LWORD	8 bytes	D4	Bit string: 64 bits

Record of changes

Manual No.	Date	Record of Changes
-	Sep. 2015	-
WUME-FP7CPUEIP-01	May 2019	Revised Edition "Types of Manuals" added "Chapter 16: Appendix" added

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