FANUC Series 30*i*-MODEL B
FANUC Series 31*i*-MODEL B
FANUC Series 32*i*-MODEL B
FANUC Series 35*i*-MODEL B
FANUC Power Motion *i*-MODEL A
FANUC Series 0*i*-MODEL F

Industrial Ethernet

CONNECTION MANUAL

B-64013EN/03

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In this manual we have tried as much as possible to describe all the various matters.
However, we cannot describe all the matters which must not be done, or which cannot be done, because there are so many possibilities.
Therefore, matters which are not especially described as possible in this manual should be regarded as "impossible".

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SAFETY PRECAUTIONS

"SAFETY PRECAUTIONS" describes the safety precautions related to the use of CNC units, to ensure safe operation of machines fitted with FANUC CNC units. Read this section carefully before attempting to use any function described in this manual.
Users should also read the relevant descriptions in the Operator's Manual of the CNC to become fully familiar with the functions to be used.

Contents

DEFINITION OF WARNING, CAUTION, AND NOTE s-1
GENERAL WARNINGS AND CAUTIONS s-2
GENERAL WARNINGS FOR CNC APPLICATION DEVELOPMENT s-3

DEFINITION OF WARNING, CAUTION, AND NOTE

This manual includes safety precautions for protecting the user and preventing damage to the machine. Precautions are classified into Warnings and Cautions according to their bearing on safety. Also, supplementary information is described as Notes. Read the Warnings, Cautions, and Notes thoroughly before attempting to use the machine.

⚠ **WARNING**
Applied when there is a danger of the user being injured or when there is a danger of both the user being injured and the equipment being damaged if the approved procedure is not observed.

⚠ **CAUTION**
Applied when there is a danger of the equipment being damaged, if the approved procedure is not observed.

NOTE
The Note is used to indicate supplementary information other than Warning and Caution.

- Read this manual carefully, and store it in a safe place.

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GENERAL WARNINGS AND CAUTIONS

⚠ WARNING

1 Before operating the machine, thoroughly check the entered data. Operating the machine with incorrectly specified data may result in the machine behaving unexpectedly, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.

2 Never attempt to machine a workpiece without first checking the programmed value, compensation value, current position, and external signal settings. Also, never attempt to machine a workpiece without first checking the operation of the machine. Before starting a production run, ensure that the machine is operating correctly by performing a trial run using, for example, the single block, feedrate override, or machine lock function, or by operating the machine with neither a tool nor workpiece mounted. Failure to confirm the correct operation of the machine may result in the machine behaving unexpectedly, possibly causing damage to the workpiece and/or machine itself, or injury to the user.

3 Ensure that the specified feedrate is appropriate for the intended operation. Generally, for each machine, there is a maximum allowable feedrate. The appropriate feedrate varies with the intended operation. Refer to the manual provided with the machine to determine the maximum allowable feedrate. If a machine is turn at other than the correct speed, unexpected load may be applied to the machine, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.

4 When using a tool compensation function, thoroughly check the direction and amount of compensation.
Operating the machine with incorrectly specified data may result in the machine behaving unexpectedly, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.

5 The parameters for the CNC and PMC are factory-set. Usually, there is no need to change them. When, however, there is no alternative other than to change a parameter, ensure that you fully understand the function of the parameter before making any change.
A failure to set a parameter correctly may result in the machine behaving unexpectedly, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.

⚠ CAUTION

1 Immediately after switching on the power, do not touch any of the keys on the MDI unit until the position display or alarm screen appears on the CNC unit.
Some of the keys on the MDI panel are dedicated to maintenance or other special operations. Pressing any of these keys may place the CNC unit in other than its normal state. Starting the machine in this state may cause it to behave unexpectedly.

2 The operator's manual for the CMC describes all the basic functions of the CNC, including the optional functions. The selected optional functions vary with the machine. Some functions described in this manual may not, therefore, be supported by your machine. Check the machine specifications before using the optional functions.

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⚠ **CAUTION**

3 Some machine operations and screen functions are implemented by the machine tool builder. For an explanation of their usage and related notes, refer to the manual provided by the machine tool builder.
For example:
- On some machines, executing a tool function causes the tool change unit to operate. When executing a tool function on such a machine, stand well clear of the tool change unit. Otherwise, there is a danger of injury to the operator.
- Many auxiliary functions trigger physical operations, such as rotation of the spindle. Before attempting to use an auxiliary function, therefore, ensure that you are fully aware of the operation to be triggered by that function.

NOTE

Command programs, parameters, and variables are stored in nonvolatile memory in the CNC. Generally, the contents of memory are not lost by a power on/off operation. However, the contents of memory may be erased by mistake, or important data in nonvolatile memory may have to be erased upon recovering from a failure.
To enable the restoration of data as soon as possible if such a situation arises, always make a backup of the data in advance.

GENERAL WARNINGS FOR CNC APPLICATION DEVELOPMENT

⚠ **WARNING**

Be careful enough for the following warnings when you develop two or more applications or use networks.
If you neglect them, there is a danger of the user being injured or there is a danger of both the user being injured and the equipment being damaged.

1 Be careful enough if you write an identical CNC data, an identical PMC data or a series of related data set by two or more above applications including network functions. Because they are executed based on each individual cycles (in other words, asynchronous cycles), there is a possibility that the data will be written in an unexpected order.
Therefore, do NOT write above data in the following cases.
- Applications and network functions
- Two or more applications
- Two or more network functions

Data, applications and network functions of interest are listed in below. However, all may not be listed completely because new features will be added in the future.

2 Be careful enough that you must prevent PMC signals in the same byte from being written by the following two or more applications including network functions. While an application reads and writes one byte of PMC signals, other applications may write the same byte.

3 Be careful enough if you process a PMC signal set that is related to a CNC function by using the following two or more applications including network functions. Because they are executed based on each individual cycles (in other words, asynchronous cycles), there is a possibility that the CNC may receive the PMC signal set in an unexpected order.

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⚠ **WARNING**

4 Generally, when multi-byte data are read or written at once among the following two or more applications including network functions, the coherency of the read multi-byte data (in other words, reading all latest data at once) is not guaranteed. To ensure the coherency of the multi-byte data, prepare flags to notify the completion of reading or writing process that is separated from the entity of the data and make the handshaking process to access the data by using the flags.

Data List Table

Category	Data
General data for CNC	Parameter, Tool compensation value and related data, Work zero offset value and related data, Workpiece coordinate system shift value and related data, Macro variable, P-CODE variable, Program and related data, Tool management function data, Tool life management data, Error compensation related data , Overtravel check (Interference check) related data , Software operator's panel related data
PMC data	PMC signal, PMC parameter
Data for Laser, Punch press or Wire cut	Tool data for punch press and related data, Safety zone data and related data, Laser cutting condition data and related data, Laser oscillator setting data and related data, Wire consumption compensation data, Guide position compensation data, Workpiece leveling data
Other data	Parameters for Data Server, Parameters for network setting

List Table of Applications and Network Functions

Category	Functions
Applications	PMC Ladder, Macro Executor, C Language Executor, FANUC PICTURE, FOCAS2
Network functions	FL-net, EtherNet/IP, PROFINET, Modbus/TCP, PROFIBUS-DP, DeviceNet, CC-Link

5 CNC has functions that read or write PMC signals in other than the G/F address. Be careful enough if the above mentioned applications and network read or write PMC signals used by these functions. When reading or writing the same PMC signal, applications or CNC functions may work in an unexpected manner.
For the relevant CNC functions, refer to "LIST OF FUNCTIONS USING PMC SIGNALS OTHER THAN G/F ADDRESS " in Appendix in the CONNECTION MANUAL (FUNCTION) of the relevant CNC.

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ADDITIONAL INFORMATION

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I. GENERAL

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1 GENERAL

This chapter explains the organization of this manual and how to read this manual.

1.1 ORGANIZATION

This manual consists of the following parts:

SAFETY PRECAUTIONS
This section describes the precautions to be observed when reading this manual.

I. GENERAL
This part describes the chapter organization, applicable models, and related manuals.

II. COMMON
This part describes the common matters for using Industrial Ethernet.

III. FUNCTION
This part describes each function of Industrial Ethernet in detail.

Ⅳ. CONNECTION
This part describes how to connect Industrial Ethernet.

Ⅴ. MAINTENANCE
This part describes hardware information and maintenance information common to Industrial Ethernet.

APPENDIX
This section describes additional information such as the related to troubleshooting and EtherNet/IP Adapter Safety function.

1.2 APPLICABLE MODELS

This Connection Manual covers the following models.
The abbreviations in the following table are sometimes used in text descriptions.

<table>
<tr><th>Model name</th><th colspan="3">Abbreviation</th></tr>
<tr><td>FANUC Series 30i-MODEL B</td><td>Series 30i -B</td><td rowspan="4">Series 30i/31i/32i -B</td><td rowspan="5">Series 30i/31i/32i/35i -B</td></tr>
<tr><td>FANUC Series 31i-MODEL B</td><td rowspan="2">Series 31i -B</td></tr>
<tr><td>FANUC Series 31i-MODEL B5</td></tr>
<tr><td>FANUC Series 32i-MODEL B</td><td>Series 32i -B</td></tr>
<tr><td>FANUC Series 35i-MODEL B</td><td>Series 35i -B</td><td>Series 35i -B</td></tr>
<tr><td>FANUC Power Motion i-MODEL A</td><td>Power Motion i -A</td><td>Power Motion i -A</td><td>PMi -A</td></tr>
<tr><td>FANUC Series 0i-MODEL F</td><td>Series 0i -F</td><td>Series 0i -F</td><td>Series 0i -F</td></tr>
</table>

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1.3 RELATED MANUALS

The table below lists manuals related to this manual.
Refer to these manuals when you use this manual. This manual is indicated by an asterisk(*).

Manual name	Specification number	
Related to Series 30*i*/31*i*/32*i*-B		
DESCRIPTIONS	B-64482EN	
CONNECTION MANUAL (HARDWARE)	B-64483EN	
CONNECTION MANUAL (FUNCTION)	B-64483EN-1	
OPERATOR'S MANUAL (Common to Lathe System/Machining Center System)	B-64484EN	
OPERATOR'S MANUAL (For Lathe System)	B-64484EN-1	
OPERATOR'S MANUAL (For Machining Center System)	B-64484EN-2	
MAINTENANCE MANUAL	B-64485EN	
PARAMETER MANUAL	B-64490EN	
Related to Series 35*i*-B		
DESCRIPTIONS	B-64522EN	
CONNECTION MANUAL (HARDWARE)	B-64523EN	
CONNECTION MANUAL (FUNCTION)	B-64523EN-1	
OPERATOR'S MANUAL	B-64524EN	
MAINTENANCE MANUAL	B-64525EN	
PARAMETER MANUAL	B-64530EN	
Related to Power Motion *i*-A		
DESCRIPTIONS	B-64572EN	
CONNECTION MANUAL (HARDWARE)	B-64573EN	
CONNECTION MANUAL (FUNCTION)	B-64573EN-1	
OPERATOR'S MANUAL	B-64574EN	
MAINTENANCE MANUAL	B-64575EN	
PARAMETER MANUAL	B-64580EN	
Related to Series 0*i*-F		
DESCRIPTIONS	B-64602EN	
CONNECTION MANUAL (HARDWARE)	B-64603EN	
CONNECTION MANUAL (FUNCTION)	B-64603EN-1	
CONNECTION MANUAL (FUNCTION) (For Series 0*i*-PF)	B-64623EN	
OPERATOR'S MANUAL (Common to Lathe System/Machining Center System)	B-64604EN	
OPERATOR'S MANUAL (For Series 0*i*-PF)	B-64624EN	
OPERATOR'S MANUAL (For Lathe System)	B-64604EN-1	
OPERATOR'S MANUAL (For Machining Center System)	B-64604EN-2	
MAINTENANCE MANUAL	B-64605EN	
PARAMETER MANUAL	B-64610EN	
PARAMETER MANUAL (For Series 0*i*-PF)	B-64630EN	
PMC		
PMC PROGRAMMING MANUAL	B-64513EN	
Network		
PROFIBUS-DP Board CONNECTION MANUAL	B-63993EN	
Industrial Ethernet CONNECTION MANUAL	B-64013EN	*
Fast Ethernet / Fast Data Server OPERATOR'S MANUAL	B-64014EN	
DeviceNet Board CONNECTION MANUAL	B-64043EN	
FL-net Board CONNECTION MANUAL	B-64163EN	
CC-Link Board CONNECTION MANUAL	B-64463EN	
Dual Check Safety		
Dual Check Safety CONNECTION MANUAL	B-64483EN-2	
Machine Remote Diagnosis		
Machine Remote Diagnosis Package OPERATOR'S MANUAL	B-63734EN	

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II. COMMON

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1 INTRODUCTION

⚠ **WARNING**

To use the Industrial Ethernet, fully understand the instructions described in this manual before making the setting. If you make the setting without fully understanding them, the machine may behave unexpectedly when started, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.

After making the communication setting for the first time or changing any communication setting, conduct communication tests thoroughly.

⚠ **CAUTION**

1 If connecting to communication devices made by other companies, thoroughly read the manuals supplied with the communication devices made by the other companies and sufficiently conduct connection tests beforehand.

2 Be sure to read through this part, "COMMON".

1.1 TERMINOLOGY

Industrial Ethernet

Refers to industrial communication functions that use standard Ethernet technologies.

The CNC can perform IO communication with communication partner devices by using Industrial Ethernet.

In this manual, it refers specifically to the FL-net function, the EtherNet/IP function, the Modbus/TCP function, and PROFINET function.

DI and DO

In this manual, a signal to input to the CNC is referred to as DI, and a signal to output from the CNC is referred to as DO, unless otherwise noted.

Data directions are as follows:

- DI : Communication partner device -> CNC
- DO : Communication partner device <- CNC

If communication is to be performed between CNCs, for example, between CNC1 and CNC2, the data directions are as follows:

- CNC1(DO) -> CNC2(DI)
- CNC1(DI) <- CNC2(DO)

Hardware option

In this manual, this term refers to the Ethernet hardware offered as CNC options.

Industrial Ethernet operates on a hardware option.

The existing Ethernet function and the Data Server function also operate on a hardware option.

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1.2 DETAILED DESCRIPTIONS OF COMMUNICATION FUNCTIONS

For detailed descriptions of the communication functions contained in this manual, see to the following:

<table>
<tr><th colspan="2">Communication function</th><th colspan="2">Detailed description</th></tr>
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NOTE
The Modbus/TCP Client function is not supported.

1.3 GENERAL STARTUP PROCEDURE

This section describes the general startup procedure for starting communication.

Procedure

1 Set the combination of hardware option and communication function
There are several types of hardware option available, from which a selection can be made.
If multiple communication functions are to be used at the same time, they can be operated on the same hardware option, and they can be operated on different hardware options.
For how to decide the combination of a hardware option and a communication function, see Chapter 2, "HARDWARE OPTIONS AND COMMUNICTION FUNCTIONS".

2 Set a communication function
By referring to the appropriate chapter of Part III, "FUNCTION", set communication parameters on the setting screen of that communication function.

3 Connect to a communication partner device
By referring to Chapter 2, "CABLE CONNECTION", of Part IV, "CONNECTION", and the manual supplied with the communication partner device, connect to the communication partner device.

4 If failing to start communication
- For details of the maintenance information and corrective actions dependent on the communication function, see the descriptions of the appropriate maintenance screen and log screen given in the chapters of Part III, "FUNCTION".
- For details of the maintenance information and corrective actions common to the communication functions, refer to Chapter 2, "SOFTWARE MAINTENANCE INFORMATION", of Part V, "MAINTENANCE", and Appendix, "TROUBLESHOOTING".

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2 HARDWARE OPTIONS AND COMMUNICATION FUNCTIONS

This chapter describes the settings for combining hardware options and communication functions.

2.1 HARDWARE OPTION TYPES

There are two types of hardware option:

Type	Description
Multi-function Ethernet	Fast Ethernet circuit mounted on the main board of the LCD-mounted type Series 30*i*/31*i*/32*i*/35*i*-B and the LCD-mounted type Power Motion *i*-A. (Connector name: CD38B)
Fast Ethernet board	Option board mounted in the optional slots (slot1 to slot4). (Connector name: CD38R)

NOTE

Note the following on hardware options:

- The maximum number of hardware options that can be mounted is 3, including Multi-function Ethernet and/or Fast Ethernet boards. For the stand-alone type Series 35*i*-B, the stand-alone type Power Motion *i*-A, and Series 0*i*-F, however, the maximum number of hardware options that can be mounted is 2.
- For Multi-function Ethernet, the Data Server function cannot be used.
- For the Series 35*i*-B and the Power Motion *i*-A, the Data Server function cannot be used.
- For the stand-alone type CNC and Series 0*i*-F, Multi-function Ethernet cannot be used.

2.2 TYPES OF SOFTWARE OPTION FOR COMMUNICATION FUNCTIONS

Operable communication functions and their related software options and NC parameters are as listed below.
For details of the related NC parameters, see Section 4.2, "PARAMETERS RELATED TO HARDWARE OPTIONS."
For the sake of subsequent descriptions, communication functions are divided into categories A, B, and C.

Software options for communication functions

Communication function	Related software option (Enclosed in parentheses is the end of the ordering drawing number.)	Related NC parameter	Category
Ethernet function	Ethernet function option (S707)	No.970	A
Modbus/TCP function (NOTE 1)	Modbus/TCP Server function option (R968)		
Data Server function	Data Server function option (S737)		
FL-net function (NOTE2)	FL-net function option (J692)	No.971	B
	FL-net PORT2 function option (R694)	No.972	

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Communication function	Related software option (Enclosed in parentheses is the end of the ordering drawing number.)	Related NC parameter	Category
PROFINET function (NOTE3)	PROFINET IO Device function option (R972)	No.973	
	PROFINET IO Controller function option (R971)	No.974	C
EtherNet/IP function (NOTE2)	EtherNet/IP Scanner function option (R966)	No.975, 976	B
	EtherNet/IP Scanner PORT2 function option (R973)		
	EtherNet/IP Adapter function option (R967)		
	EtherNet/IP Adapter PORT2 function option (R974)		

NOTE

1 If the Modbus/TCP function is to be used, the Ethernet function option (S707) is also required.

2 Each Port2 function option is a software option for operating the same function on different hardware options at the same time by using two hardware options. For example, if the EtherNet/IP Scanner function option (R966) and the EtherNet/IP Scanner PORT2 function option (R973) are specified, the EtherNet/IP Scanner function can be operated on different hardware options at the same time.

3 If the PROFINET IO Controller function is to be used, either of the following series of the PROFINET function software is required:
- For the Series 30*i*/31*i*/32*i*/35*i*-B and the Power Motion *i*-A : Series 658R
- For the Series 0*i*-F : Series 658U

Operating conditions for combining communication functions

Operating conditions for combining communication functions are described below.

Communication function combination	Operating conditions
Combination of communication functions in category A Example) Ethernet function and Data Server function	This combination must always be operated on the same hardware option. The functions cannot be operated on separate hardware options.
Combination of communication functions in category B Example) PROFINET IO Device function and EtherNet/IP function	This combination cannot be operated on the same hardware option. If the functions are to be used at the same time, they must always be operated on different hardware options.
Combination of communication functions in category C and other communication functions Example) PROFINET IO Controller function and Ethernet function	
Combination of communication functions in categories A and B Example) Ethernet function and EtherNet/IP function	This combination can be operated on the same hardware option or on different hardware options. Note, however, that the Data Server function and a communication function in category B cannot be operated on the same hardware option. For example, if the Ethernet function, the Data Server function, and the EtherNet/IP function are to be used, the Ethernet function and the Data Server function must be operated on the same hardware option, and the EtherNet/IP function must be operated on a different hardware option.

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Notes on the EtherNet/IP function

The EtherNet/IP function has four types of software option in total, to which the following notes apply:

- The Scanner function and the Adapter function can be operated on the same hardware option.
- The EtherNet/IP function can be operated on up to two hardware options.
- If the EtherNet/IP function is to be operated on two hardware options, the Ethernet function in category A must always be operated on one hardware option.
  Thus, if the Data Server function is to be operated, the EtherNet/IP function can be operated on up to one hardware option only.

Notes on the PROFINET IO Controller function

The PROFINET IO Controller function cannot be operated with other communication functions on the same hardware option.

2.3 SETTING HARDWARE OPTION AND COMMUNICATION FUNCTION COMBINATIONS

If a hardware option and a communication function are to be combined, it is necessary to set what combination they are to be used in, using parameters Nos. 970 to 976.
The setting method is described below.

NOTE

When the power is turned off and on after parameters Nos. 970 to 976 are changed, alarm PW0050, "POWER MUST BE OFF (INITIALISED COMMUNICATION)" or alarm SR2038, "WRONG COMMUNICATION COMBINATION" may occur.
If alarm PW0050 occurs, turn the CNC off and on again.
If alarm SR2038 occurs, the settings of NC parameters are wrong. Check the settings, referring to Section 2.2, "ALARM AND DIAGNOSIS DATA", of Part V, "MAINTENANCE".

2.3.1 If the Hardware Options on Which to Operate Communication Functions Are Automatically Decided

If the following hardware option condition is satisfied, and one of software option conditions 1 to 3 is satisfied, no values need be set for parameters Nos. 970 to 976; communication functions will be operated with all parameters being left 0 (initial value).

Item	Conditions for automatic discrimination	
Hardware option		Only one hardware option is used. Example 1) In the LCD-mounted type CNC, only Multi-function Ethernet is mounted. Example 2) In the stand-alone type CNC, only one fast Ethernet board is mounted.
Software option	1	Only software options in category A are specified. Example) Only the Ethernet function option (S707) and the Modbus/TCP Server function option (R968) are specified.
	2	Only one software option in category B or category C is specified. Example) Only the EtherNet/IP Scanner function option（R966) is specified.
	3	Software options in category A other than the Data Server function option (S737) are specified, and one software option in category B is specified. Example) Only the Ethernet function option (S707) and the EtherNet/IP Scanner function option (R966) are specified.

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2.3.2 If Setting the Hardware Options on Which to Operate Communication Functions

This subsection describes the procedure for setting the hardware options on which to operate communication functions, using parameters Nos. 970 to 976.

Procedure

1 Make the settings for preventing unnecessary communication functions from being operated.
For the NC parameters related to unnecessary communication functions, set -1 (not operated), referring to the table, "Software options for communication functions", in Section 2.2, "TYPES OF SOFTWARE OPTION FOR COMMUNICATION FUNCTIONS".
Settings described here must be made even if a software option is specified but the corresponding communication function is not used.

Example)

If only the Ethernet function option (S707), EtherNet/IP Scanner function option（R966), and PROFINET IO Device function option (R972) are specified, and the PROFINET IO Device function is not used

No.970= 0, **No.971= -1**, **No.972= -1**, **No.973= -1**, **No.974= -1**, No.975= 0, No.976= 0

2 Make the settings for operating communication functions.
Set the values indicating the hardware options on which to operate communication functions or operating conditions for the related NC parameters, referring to Section 4.2, "PARAMETERS RELATED TO HARDWARE OPTIONS". At this time, check that "Operating conditions for combining communication functions" in Section 2.2, "TYPES OF SOFTWARE OPTION FOR COMMUNICATION FUNCTIONS", are satisfied.

2-1 If operating two communication functions on the same hardware option

Example)

If, after Example) in 1 of Procedure, operating the Ethernet function and the EtherNet/IP Scanner function on Multi-function Ethernet

No.970= 1, No.971= -1, No.972= -1, No.973= -1, No.974= -1, **No.975= 10**, **No.976= -1**

2-2 If operating two communication functions on different hardware options

Example)

If, after Example) in 1 of Procedure, operating the Ethernet function on Multi-function Ethernet and operating the EtherNet/IP Scanner function on the fast Ethernet board mounted in slot 1

No.970= 1, No.971= -1, No.972= -1, No.973= -1, No.974= -1, **No.975= -1**, **No.976= 13**

3 Turn off the power to the CNC, check that the hardware options that have been set are mounted in the CNC, and then turn on the power to the CNC again.

NC parameter setting examples

NC parameter setting examples are given below.
Setting examples are also contained in each of the manuals listed in the "Industrial Ethernet" row of the table in Section 1.2, "DETAILED DESCRIPTIONS OF COMMUNICATION FUNCTIONS". Refer to the manuals, if required.

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If operating only a single communication function

Example	Function to use	Hardware option on which to operate it	NC parameter
1	Ethernet function	Multi-function Ethernet	No.970= 1 No.974= -1 No.971= -1 No.975= -1 No.972= -1 No.976= -1 No.973= -1
2	Data Server function	Fast Ethernet board mounted in slot 1	No.970= 3 No.974= -1 No.971= -1 No.975= -1 No.972= -1 No.976= -1 No.973= -1
3	FL-net function	Multi-function Ethernet	No.970= -1 No.974= -1 No.971= 1 No.975= -1 No.972= -1 No.976= -1 No.973= -1
4	PROFINET IO Controller function	Multi-function Ethernet	No.970= -1 No.974= 1 No.971= -1 No.975= -1 No.972= -1 No.976= -1 No.973= -1
5	PROFINET IO Device function	Multi-function Ethernet	No.970= -1 No.974= -1 No.971= -1 No.975= -1 No.972= -1 No.976= -1 No.973= 1
6	EtherNet/IP Scanner function	Multi-function Ethernet	No.970= -1 No.974= -1 No.971= -1 No.975= -1 No.972= -1 No.976=11 No.973= -1
7	EtherNet/IP Adapter function	Multi-function Ethernet	No.970= -1 No.974= -1 No.971= -1 No.975= -1 No.972= -1 No.976= 21 No.973= -1

If operating two communication functions on the same hardware option

Example	Function to use	Hardware option on which to operate it	NC parameter
1	Ethernet function Data Server function	Fast Ethernet board mounted in slot 1	No.970= 3 No.974= -1 No.971= -1 No.975= -1 No.972= -1 No.976= -1 No.973= -1
2	Ethernet function FL-net function	Multi-function Ethernet	No.970= 1 No.974= -1 No.971= 1 No.975= -1 No.972= -1 No.976= -1 No.973= -1
3	Ethernet function PROFINET IO Device function	Multi-function Ethernet	No.970= 1 No.974= -1 No.971= -1 No.975= -1 No.972= -1 No.976= -1 No.973= 1
4	Ethernet function EtherNet/IP Scanner function	Multi-function Ethernet	No.970= 1 No.974= -1 No.971= -1 No.975= 10 No.972= -1 No.976= -1 No.973= -1
5	Ethernet function EtherNet/IP Adapter function	Multi-function Ethernet	No.970= 1 No.974= -1 No.971= -1 No.975= 20 No.972= -1 No.976= -1 No.973= -1

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If operating two communication functions on different hardware options

Example	Function to use	Hardware option on which to operate it	NC parameter
1	Ethernet function	Fast Ethernet board mounted in slot 1	No.970= 3 No.974= -1 No.971= 1 No.975= -1
	FL-net function	Multi-function Ethernet	No.972= -1 No.976= -1 No.973= -1
2	Ethernet function	Fast Ethernet board mounted in slot 1	No.970= 3 No.974= 1 No.971= -1 No.975= -1
	PROFINET IO Controller function	Multi-function Ethernet	No.972= -1 No.976= -1 No.973= -1
3	Ethernet function	Fast Ethernet board mounted in slot 1	No.970= 3 No.974= -1 No.971= -1 No.975= -1
	PROFINET IO Device function	Multi-function Ethernet	No.972= -1 No.976= -1 No.973= 1
4	Ethernet function	Fast Ethernet board mounted in slot 1	No.970= 3 No.974= -1 No.971= -1 No.975= -1
	EtherNet/IP Scanner function	Multi-function Ethernet	No.972= -1 No.976= 11 No.973= -1
5	Ethernet function	Fast Ethernet board mounted in slot 1	No.970= 3 No.974= -1 No.971= -1 No.975= -1
	EtherNet/IP Adapter function	Multi-function Ethernet	No.972= -1 No.976= 21 No.973= -1

2.4 SCREENS OF COMMUNICATION FUNCTIONS

Each communication function has three types of screen, setting screen, maintenance screen, and log screen.
When the setting of hardware option and communication function combinations is completed, the screens of the communication functions to use can be displayed.

NOTE

If alarm PW0050 or alarm SR2038 occurs, the setting of hardware option and communication function combinations has not been completed, and the screens of communication functions cannot be displayed. If this occurs, check the settings, referring to Section 2.3, "SETTING HARDWARE OPTION AND COMMUNICATION FUNCTION COMBINATIONS".

2.4.1 Displaying Screens

Note that the screens of the EtherNet/IP function and the PROFINET function must be displayed in a different way depending on the operating condition, as described below.
For how to display the screens of the other communication functions, refer to the appropriate ones of the manuals listed in Section 1.2, "DETAILED DESCRIPTIONS OF COMMUNICATION FUNCTIONS".

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Operating condition 1) Operating a function on the same hardware option together with the Ethernet function

Communication function	How to display the screen
EtherNet/IP Scanner function EtherNet/IP Adapter function PROFINET IO Device function	- Setting screen, maintenance screen Function key SYSTEM -> Soft key [ETHERNET] - Log screen Function key ? MESSAGE -> Soft key [ETHER LOG]

Operating condition 2) Operating a function on a hardware option different from that of the Ethernet function

Communication function	How to display the screen
EtherNet/IP Scanner function	- Setting screen, maintenance screen Function key SYSTEM -> Soft key [EtherNet/IP]
EtherNet/IP Adapter function	- Log screen Function key ? MESSAGE -> Soft key [Eth/IP LOG]
PROFINET IO Controller function	- Setting screen, maintenance screen Function key SYSTEM -> Soft key [PRFNET CNTRLR] - Log screen Function key ? MESSAGE -> Soft key [PRFNET CNTRLR]
PROFINET IO Device function	- Setting screen, maintenance screen Function key SYSTEM -> Soft key [PRFNET DEVICE] - Log screen Function key ? MESSAGE -> Soft key [PRFNET DEVICE]

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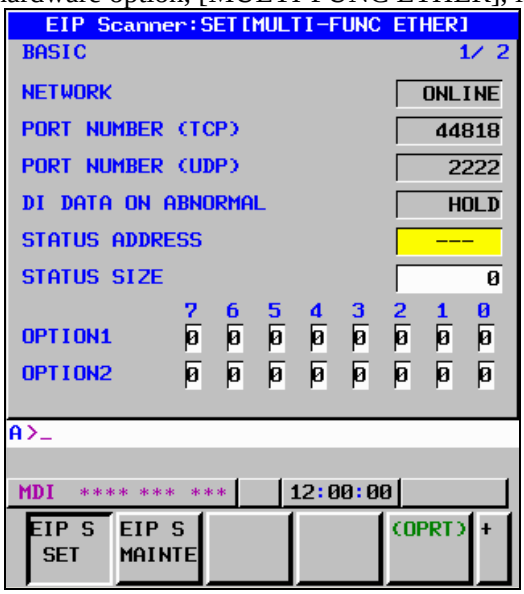
2.4.2 Checking Selected Hardware Options

In the title of the setting screen, maintenance screen, and log screen of each communication function, the selected hardware options can be checked.
In the following example, the hardware option, [MULTI-FUNC ETHER], is selected.



Title display	Description
[MULTI-FUNC ETHER]	Fast Ethernet circuit mounted on the main board of the LCD-mounted type Series 30*i*/31*i*/32*i*/35*i*-B and the LCD-mounted type Power Motion *i*-A
[BOARD(SLOT1)]	Fast Ethernet board mounted in option slot 1
[BOARD(SLOT2)]	Fast Ethernet board mounted in option slot 2
[BOARD(SLOT3)]	Fast Ethernet board mounted in option slot 3
[BOARD(SLOT4)]	Fast Ethernet board mounted in option slot 4

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3 SETTING COMMUNICATION FUNCTIONS

This chapter contains the information necessary for setting the EtherNet/IP function, Modbus/TCP function, and PROFINET function.

3.1 DI/DO DATA AND STATUS DATA

Communication parameters include the setting items for allocating DI/DO data and status data (data for monitoring the communication state) to a PMC area, in addition to the setting items dependent on the communication specifications of each Industrial Ethernet circuit.
This section describes the allocation of DI/DO data and status data to a PMC area.

> ⚠ **WARNING**
> Before allocating DI/DO data and status data to a PMC area, fully understand the instructions written in "GENERAL WARNINGS FOR CNC APPLICATION DEVELOPMENT" in "SAFETY PRECAUTIONS" at the beginning of this manual, and in this section.
> Allocate the PMC area so that multiple communication functions do not write it.
> Immediately after setting all communication parameters including those for allocation to the PMC area, make sure that DI/DO data and status data operate correctly in the status in which safety is ensured before starting operation.
> If operation is started without checking the above, the machine may behave unexpectedly, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.

3.1.1 Allocating PMC Areas

To allocate a PMC area in the setting screen of each communication function, specify it as follows:

```
Input format)
    <Path number>:<PMC address>
```

For example, for R0500 on the second path of the PMC, input "2:R500".
If <Path number> is omitted (R500), the first path is assumed (1:R0500).
If the <:> key is not available, it can be substituted with the </> key or the <EOB> key. ":" is optional.
To clear "<Path number>:<PMC address>" previously set, input " " (blank). ("---" will be displayed). In this case, it is assumed that no PMC area is used.

> ⚠ **CAUTION**
> 1 In the PMC area, the R, X, and Y areas, and E area in volatile memory are all set to 0 immediately after power-on.
> 2 The D area in the PMC area is allocated to nonvolatile memory. In addition, the E area in the PMC area is normally allocated to volatile memory. However, it can also be used as nonvolatile memory by setting the option.
> When the area is used as nonvolatile memory, the contents of the area are retained even after the power is turned off. So, special attention should be paid not to cause an unpredictable operation when the power is turned on next time.

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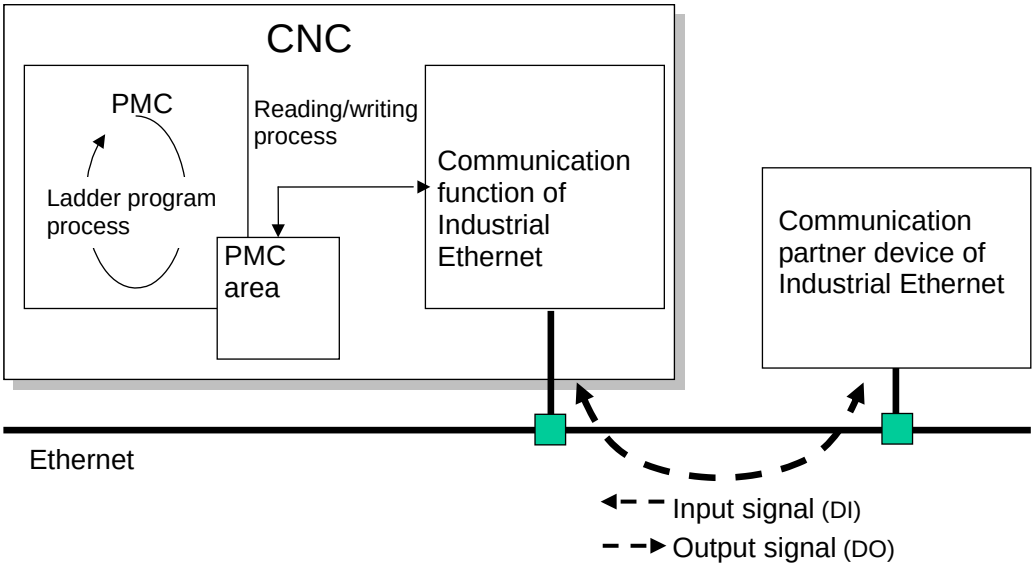
3.1.2 Creating a Ladder Program

DI/DO data and status data allocated to a PMC area are processed by a ladder program.
The following provides notes on creating a ladder program required to construct a safety system.

> ⚠ **CAUTION**
> 1 The time after the power is turned on until communication is actually started may vary depending on the system configuration of the CNC and the state of the communication partner device.
> If it is necessary to strictly determine whether communication starts, it is not sufficient to determine it with time and status data only. Determine it with a method such as checking with actual DI data.
> 2 Create a ladder program in such a way that the system will be operated safely even if a communication error occurs.

Input signal (DI) and output signal (DO)

An output signal from the CNC is written by the ladder program into the PMC data area. The reading/writing process of a communication function reads the signal and sends it to the Ethernet network. An input signal also flows a similar route in the opposite direction.



Input signal (DI) and output signal (DO)

Ladder program process and reading/writing process by a communication function

Processing by the ladder program and the reading/writing process by a communication function operate asynchronously with one another.
Processing by the ladder program can operate independently of reading/writing process by a communication function, so the ladder program can be repeatedly executed at high-speed.

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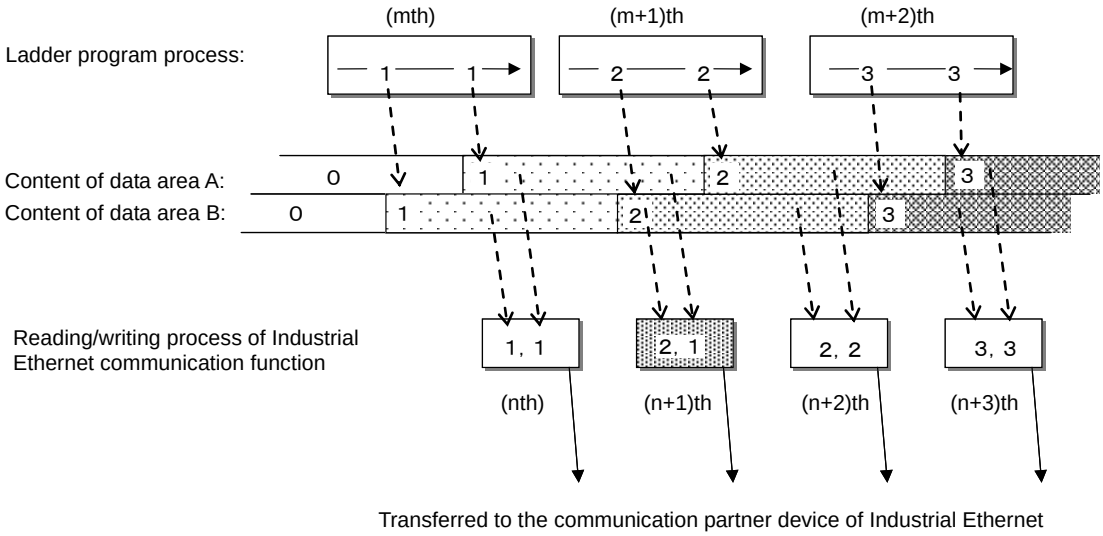
The following figure shows a time chart of the internal operation of the CNC with signals output from the ladder program.



Time chart

The upper part of the figure indicates that processing by the ladder program is performed periodically and writing to data area A or data area B is performed in the ladder program.

The middle part indicates how data area A and data area B in the PMC are updated in this case. There are differences in the timing in which data is written to data area A or data area B even in the same execution cycle of the ladder program, so data area A and data area B are not updated at the same time.

The lower part indicates that the reading/writing process by communication functions is cyclically made to read data in data area A and data area B. Since data area A and data area B are not updated at the same time, for example, in the case of (n+1)th refreshing, the data written by one execution of the ladder program cannot be read as one set.

Conversely, when input signals from communication partner devices are processed in the ladder program, the data written by one execution of writing may not be read by one execution of the ladder program.

> ⚠ **CAUTION**
> Reading/writing process by a communication function is made asynchronously with the execution of the ladder program. Therefore, keep the following in mind when creating a ladder program.
> <1> When an input signal from the communication function to be written in the specified PMC address is read from two points in the ladder program, even if the ladder program can be executed in one cycle, there is no guarantee that the same value can be read.
> <2> When the ladder program writes an output signal to the communication partner device in the specified PMC address, the signal may be transferred to the communication partner device before the ladder program is completely executed.

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Concurrency of data

When DI data or DO data is handled with the ladder program, the concurrency of long data (4-byte data) and word data (2-byte data) is guaranteed (there are no data segmentation) under the corresponding constraints.

> ⚠ **CAUTION**
> If the following constraints are not satisfied, the concurrency of long data or word data is not guaranteed.

> **NOTE**
> To guarantee the concurrency of long data (4-byte data) and word data (2-byte data), it is necessary to set the data unit on the setting screen of a communication function. For the setting method, see the following subsections in Part III, "FUNCTION":
> EtherNet/IP Scanner function)
> - Subsection 1.3.6, “SIMPLE Setting Screen” in Chapter 1, “EtherNet/IP SCANNER FUNCTION”
>
> EtherNet/IP Adapter function)
> - Subsection 2.3.5, “BASIC Screen and ALLOCATION Screen” in Chapter 2 , “EtherNet/IP ADAPTER FUNCTION”
>
> Modbus/TCP Server function and PROFINET IO Controller function)
> - There is no setting item for setting the data unit of two bytes, and the data unit is always set to two bytes.
>
> PROFINET IO Device function)
> - Subsection 5.4.1.2, “Setting screen of the PROFINET IO Device function” in Chapter 5, “PROFINET IO DEVICE FUNCTION”

Concurrency of long data (4-byte data)

To guarantee the concurrency of data, satisfy the following three conditions.

<1> In the ladder program, the following commands are used in units of four bytes.
MOVD, MOVN, XMOVB, SETND, XCHGD, DSCHB, TBLRD, TBLWD, DSEQD, DSNED, DSGTD, DSLTD, DSGED, DSLED, DMAXD, DMIND, EQD, NED, GTD, LTD, GED, LED, RNGD, COMPB, EOR, AND, OR, NOT, EORD, ANDD, ORD, NOTD, SHLD, SHRD, ROLD, RORD, BSETD, BRSTD, BTSTD, BPOSD, BCNTD, CODB, DCNVB, DECB, TBCDD, FBCDD, ADDB, SUBB, MULB, DIVB, NUMEB, ADDSD, SUBSD, MULSD, DIVSD, MODSD, INCSD, DECSD, ABSSD, NEGSD

<2> When DI data or DO data is assigned at the setting screen of a communication function, the value of items "ADDRESS" and "SIZE" are aligned with 4-byte boundaries.
Example) ADDRESS/SIZE 1:R0000/4, 1:R0004/8, 1:R0008/12, 1:E0000/16

<3> At the setting screen of the communication function, the data unit of four bytes is specified.

Concurrency of word data (2-byte data)

To guarantee the concurrency of data, satisfy the following three conditions.

<1> In the ladder program, the following commands are used in units of two bytes.
MOVW, MOVN, XMOVB, SETNW, XCHGW, DSCHB, TBLRW, TBLWW, DSEQW, DSNEW, DSGTW, DSLTW, DSGEW, DSLEW, DMAXW, DMINW, EQW, NEW, GTW, LTW, GEW, LEW, RNGW, COMPB, EOR, AND, OR, NOT, EORW, ANDW, ORW, NOTW, SHLW, SHRW, ROLW, RORW, BSETW, BRSTW, BTSTW, BPOSW, BCNTW, CODB, DCNVB, DECB, TBCDW, FBCDW, ADDB, SUBB, MULB, DIVB, NUMEB, ADDSW, SUBSW, MULSW, DIVSW, MODSW, INCSW, DECSW, ABSSW, NEGSW

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<2> When DI data or DO data is assigned to at the setting screen of a communication function, the value of items "ADDRESS" and "SIZE" are aligned with 2-byte boundaries.
Example) ADDRESS/SIZE 1:R0000/2, 2:R0002/4, 3:R0004/6, 1:E0002/8

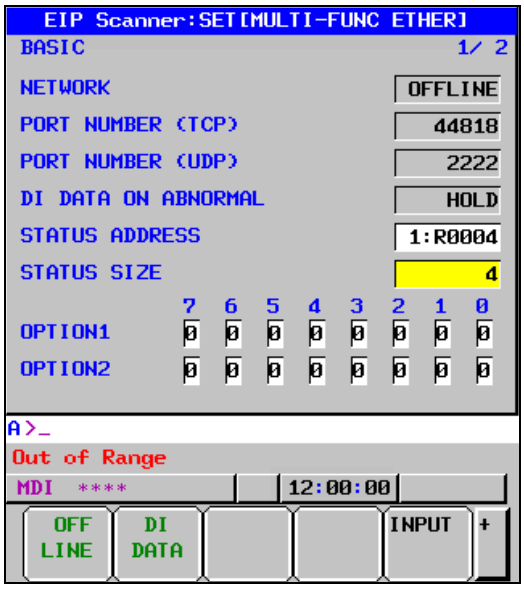
<3> At the setting screen of communication functions, the data unit of two bytes is specified.

Concurrency of byte data (1-byte data)

There are no special constraints. The concurrency is always guaranteed in 1-byte data.

3.2 ERROR MESSAGES THAT MAY OCCUR DURING COMMUNICATION PARAMETER SETTING

This section describes the common error messages that may occur while communication parameters are being set on the setting screen of each communication function.



Error message	Meaning and corrective action
Communication Software is not found	Check whether the communication software is installed.
Ethernet board is not found	Check whether the Fast Ethernet board is mounted.
Software Version Error	The version of the communication software does not match. Check the software version.
Out of Range	The value of the numerical parameter is out of range.
Wrong Character(s)	A wrong character is used in the character parameter.
Format Error	The IP address input does not match the input format.
too many figures	In the numerical parameter input, the numerical value has too many digits.
Data was rejected	The parameter has some kind of error. Check the setting conditions for setting items.
Reading from SRAM failed	The SRAM may be destroyed.
Writing into SRAM failed	The SRAM may be destroyed.
DHCP is available	If the DHCP function is enabled, parameters cannot be set through manual input from the setting screen. To set parameters through manual input, disable the DHCP function.
Error(xxxx)	Another error. Report on the displayed message.

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3.3 BACKING UP AND RESTORING COMMUNICATION PARAMETERS

After the completion of communication parameter setting, communication parameters can be backed up as a batch, and previously backed up communication parameters can be restored as a batch.
As the input/output device to which to back up communication parameters and from which to restore them, the memory card or USB memory can be used. To select an input/output device, use parameter No. 20. For details of this parameter, see Section 4.1, "PARAMETERS RELATED TO DATA INPUT/OUTPUT".

⚠ WARNING

When [RESTORE] is executed for communication parameters, the communication parameters including the allocation of a PMC area to each communication function are all restored. When [ALL RESTORE] is executed for communication parameters, the communication parameters valid for embedded Ethernet, Fast Ethernet/Fast Data Server, PROFIBUS-DP master/slave, DeviceNet master/slave, FL-net, CC-Link remote device, EtherNet/IP Scanner/Adapter, Modbus/TCP Server, and PROFINET IO Controller/IO Device are all restored. When the unsolicited messaging function is enabled, the allocation of macro variables is also restored.
For this reason, immediately after executing [RESTORE] or [ALL RESTORE] for communication parameters, fully understand instructions written in "GENERAL WARNINGS FOR CNC APPLICATION DEVELOPMENT" in "SAFETY PRECAUTIONS" at the beginning of this manual, Section 2.1, "DI/DO DATA AND STATUS DATA", and carefully check the setting of the communication parameters of the relevant communication functions before starting operation.
For any communication function for which any PMC area or macro variable is allocated, make sure that DI/DO data, status data, and macro variable operate correctly before starting operation.
If operation is started without checking the above, the machine may behave unexpectedly, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.

⚠ CAUTION

While an external input/output device such as the memory card or USB memory is being accessed, do not turn the power to the CNC off or remove the external input/output device. Doing so may damage the external input/output device.

NOTE

1 A backup or restore operation for communication parameters can only be performed in the MDI mode, EDIT mode, or emergency stop state.

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NOTE

2 When the 8-level data protection function is enabled and either the Ethernet function or the Data Server function is enabled, whether communication parameters can be backed up and restored depends on the setting of the Ethernet function in the 8-level data protection function. Note the following:
- The EtherNet/IP function is subject to the 8-level data protection function regardless of whether it is operated on the same hardware option as that on which the Ethernet function is operated.
- The PROFINET IO Device function is subject to the 8-level data protection function only if it is operated on the same hardware option as that on which the Ethernet function is operated.

3 It is not possible to backup and restore the communication parameters by using devices other than the memory card and the USB memory.

Screen displaying procedure

Screens of communication functions can be displayed in the way described in Subsection 2.4.1, "Displaying Screens".

The following lists the soft keys and screens displayed depending on the communication function and the operating condition described in Subsection 2.4.1, "Displaying Screens". (*: Procedure example in this section)

Communication function	Operating condition	Soft key to be displayed	Screen to be displayed
EtherNet/IP Scanner function	1	[ETHERNET] ->[EIP S SET]	EtherNet/IP Scanner function setting screen
	*2	[EtherNet/IP] ->[EIP S SET]	
EtherNet/IP Adapter function	1	[ETHERNET] ->[EIP A SET]	EtherNet/IP Adapter function setting screen
	2	[EtherNet/IP] ->[EIP A SET]	
Modbus/TCP Server function	1	[ETHERNET] ->[COMMON]	Common screen of the Ethernet function setting screen
PROFINET IO Controller function	2	[PRFNET CNTRLR] ->[PN C SET]	PROFINET IO Controller function setting screen
PROFINET IO Device function	1	[ETHERNET] ->[PN D SET]	PROFINET IO Device function setting screen
	2	[PRFNET DEVICE] ->[PN D SET]	

Read soft keys [EtherNet/IP] and [EIP S SET] and "Setting screen of EtherNet/IP Scanner function" in this section as appropriate soft keys and screen, according to the communication function and the operating condition.

Procedure

1 Press function key .

2 Soft key [EtherNet/IP] appears. When the soft key does not appear, press the continue key.

3 Press soft key [EtherNet/IP], and then soft key [EIP S SET]. The "EtherNet/IP Scanner function setting screen" appears.

4 Press soft key [(OPRT)], and then soft key [+]. The soft keys [BACKUP], [RESTORE], [ALL BACKUP], and [ALL RESTORE] for backing up or restoring settings appear.

5 Press the soft key [BACKUP], [RESTORE], [ALL BACKUP], or [ALL RESTORE]. The soft keys [EXECUTE] and [CANCEL] appear.

6 Enter the name of a file to be backed up or restored in the key-in buffer, and press the soft key [EXECUTE]. The operation selected at the above step is executed.
The character string "EXECUTING" blinks during execution.

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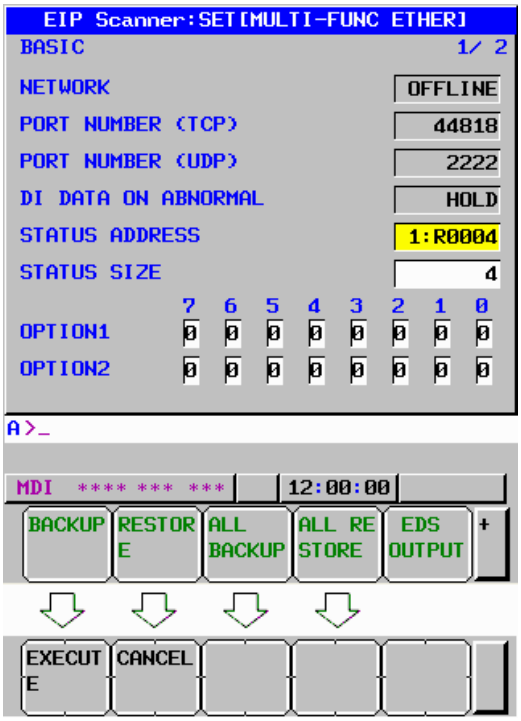

Operation

BACKUP

The communication parameters for each communication function are saved from the SRAM of the CNC main unit to the input/output device.
If a file name is specified in the key-in buffer, the specified file name is used. If no file name is specified, the appropriate one of the following standard file names is used.

Standard file name	Communication function saved
EIPADAPT.MEM	EtherNet/IP Scanner function
EIPSCANR.MEM	EtherNet/IP Adapter function
ETHERBRD.MEM	Modbus/TCP Server function
PNCNTRLR.MEM	PROFINET IO Controller function
PNDEVICE.MEM	PROFINET IO Device function

RESTORE

The communication parameters for each communication function are read from the input/output device and saved to the SRAM of the CNC main unit.
If a file name is specified in the key-in buffer, the specified file name is used. If no file name is specified, the appropriate one of the above-mentioned standard file names is used.

ALL BACKUP

All valid communication parameters for embedded Ethernet, Fast Ethernet/Fast Data Server, PROFIBUS-DP master/slave, DeviceNet master/slave, FL-net, CC-Link remote device, EtherNet/IP Scanner/Adapter, Modbus/TCP Server, and PROFINET IO Controller/IO Device are saved from the SRAM of the CNC main unit to the input/output device.
If a file name is specified in the key-in buffer, the specified file name is used. If no file name is specified, the file name "NETWORK.MEM" is used.

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ALL RESTORE

All valid communication parameters for embedded Ethernet, Fast Ethernet/Fast Data Server, PROFIBUS-DP master/slave, DeviceNet master/slave, FL-net, CC-Link remote device, EtherNet/IP Scanner/Adapter, Modbus/TCP Server, and PROFINET IO Controller/IO Device are read from the input/output device and saved to the SRAM of the CNC main unit.
However, if a communication function related to a valid communication parameter is disabled in the CNC, that parameter is not saved to the SRAM.
If a file name is specified in the key-in buffer, the specified file name is read from the memory card. If no file name is specified, the file name "NETWORK.MEM" is used.

NOTE
When communication parameters are restored, an alarm condition occurs that requires power-off.

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4 RELATED NC PARAMETERS

This chapter lists the common NC parameters related to communication functions.

4.1 PARAMETERS RELATED TO DATA INPUT/OUTPUT

0020	I/O CHANNEL : Input/output device selection, or interface number for a foreground input/output device

[Input type] Setting input
[Data byte] Byte
[Valid data range] 4: Selects the memory card as the input/output device.
17: Selects the USB memory as the input/output device.

4.2 PARAMETERS RELATED TO HARDWARE OPTIONS

0970	Select a hardware option that operates the Ethernet function, Data Server function, or Modbus/TCP Server function
0971	Select a hardware option that operates the first FL-net function
0972	Select a hardware option that operates the second FL-net Port2 function
0973	Select a hardware option that operates the PROFINET IO Device function
0974	Select a hardware option that operates the PROFINET IO Controller function

NOTE
When these parameters are set, the power must be turned off before operation is continued.

[Input type] Parameter input
[Data byte] Byte
[Valid data range] -1 to 6: Select a hardware option that operates each communication function.

Value	Hardware option
-1	Not operated
0	Unsetting (initial value)
1	Multi-function Ethernet (NOTE)
2	Reserved
3	Fast Ethernet board mounted in slot 1
4	Fast Ethernet board mounted in slot 2
5	Fast Ethernet board mounted in slot 3
6	Fast Ethernet board mounted in slot 4

NOTE
1 For Multi-function Ethernet, the Data Server function cannot be used.
If the Data Server function option (S737) is specified, do not set Multi-function Ethernet for parameter No. 970.
2 For the stand-alone type CNC and the Series 0*i*-F, do not set Multi-function Ethernet for parameter Nos. 970 to 974.

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0975	EtherNet/IP function operating condition selection 1

NOTE
When this parameter is set, the power must be turned off before operation is continued.

[Input type] Parameter input
[Data byte] Byte
[Valid data range] -1, 0, 10, 20, 30:
Selects the operating condition for the EtherNet/IP function if operating the EtherNet/IP function on the same hardware option together with the Ethernet function.

Value	Operating condition	
	Function to operate	Hardware option
-1	Not operated	
0	Unsetting (initial value)	
10	Scanner function only	Same hardware option as that specified for parameter No. 970
20	Adapter function only	
30	Both Scanner function and Adapter function	

NOTE
Set the hardware option on which to operate the communication function for parameter No. 970.
If the Ethernet function option (S707) is not specified or if the Data Server function option (S737) is specified, set -1 (Not operated) for this parameter.

0976	EtherNet/IP function operating condition selection 2

NOTE
When this parameter is set, the power must be turned off before operation is continued.

[Input type] Parameter input
[Data byte] Byte
[Valid data range] -1, 0, 11 to 16, 21 to 26, 31 to 36
Selects the operating condition for the EtherNet/IP function if operating the EtherNet/IP function on a hardware option different from that of the Ethernet function.

Value	Operating condition	
	Function to operate	Hardware option
-1	Not operated	
0	Unsetting (initial value)	
11	Scanner function only	Multi-function Ethernet
12		Reserved
13		Fast Ethernet board mounted in slot 1
14		Fast Ethernet board mounted in slot 2
15		Fast Ethernet board mounted in slot 3
16		Fast Ethernet board mounted in slot 4

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Value	Operating condition	
	Function to operate	Hardware option
21	Adapter function only	Multi-function Ethernet
22		Reserved
23		Fast Ethernet board mounted in slot 1
24		Fast Ethernet board mounted in slot 2
25		Fast Ethernet board mounted in slot 3
26		Fast Ethernet board mounted in slot 4
31	Both Scanner function and Adapter function	Multi-function Ethernet
32		Reserved
33		Fast Ethernet board mounted in slot 1
34		Fast Ethernet board mounted in slot 2
35		Fast Ethernet board mounted in slot 3
36		Fast Ethernet board mounted in slot 4

NOTE
For the stand-alone type CNC and the Series 0*i*-F, do not set Multi-function Ethernet for parameter No. 976.

4.3 PARAMETERS RELATED TO PMC

	#7	#6	#5	#4	#3	#2	#1	#0
11937	**P24**	**P23**	**P22**	**P21**	**P14**	**P13**	**P12**	**P11**
11938	**P44**	**P43**	**P42**	**P41**	**P34**	**P33**	**P32**	**P31**
11939					**P54**	**P53**	**P52**	**P51**

NOTE
1 When these parameters are set, the power must be turned off before operation is continued.
2 For the Modbus/TCP Server function, the X/Y area in the PMC cannot be allocated.

[Input type] Parameter input
[Data byte] Bit
When the following bits are "1", the X/Y areas of the PMC corresponding to the specified bit become available in communication functions. Two or more bits can be specified at the same time.

Parameter		Addresses usable in communication functions
P11	No.11937#0	X0 to127/Y0 to 127 in the first PMC
P12	No.11937#1	X200 to 327/Y200 to 327 in the first PMC
P13	No.11937#2	X400 to 527/Y400 to 527 in the first PMC
P14	No.11937#3	X600 to 727/Y600 to 727 in the first PMC
P21	No.11937#4	X0 to 127/Y0 to 127 in the 2nd PMC
P22	No.11937#5	X200 to 327/Y200 to 327 in the 2nd PMC
P23	No.11937#6	X400 to 527/Y400 to 527 in the 2nd PMC
P24	No.11937#7	X600 to 727/Y600 to 727 in the 2nd PMC
P31	No.11938#0	X0 to 127/Y0 to 127 in the 3rd PMC
P32	No.11938#1	X200 to 327/Y200 to 327 in the 3rd PMC
P33	No.11938#2	X400 to 527/Y400 to 527 in the 3rd PMC
P34	No.11938#3	X600 to 727/Y600 to 727 in the 3rd PMC
P41	No.11938#4	X0 to 127/Y0 to 127 in the 4th PMC
P42	No.11938#5	X200 to 327/Y200 to 327 in the 4th PMC
P43	No.11938#6	X400 to 527/Y400 to 527 in the 4th PMC

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Parameter		Addresses usable in communication functions
P44	No.11938#7	X600 to 727/Y600 to 727 in the 4th PMC
P51	No.11939#0	X0 to 127/Y0 to 127 in the 5th PMC
P52	No.11939#1	X200 to 327/Y200 to 327 in the 5th PMC
P53	No.11939#2	X400 to 527/Y400 to 527 in the 5th PMC
P54	No.11939#3	X600 to 727/Y600 to 727 in the 5th PMC

NOTE

1 Any communication function cannot be allocated to an X or Y area allocated to I/O Link or I/O Link *i*.

2 When using I/O Link *i*, allocate a communication function to X and Y areas that are not used by any I/O device of I/O Link *i* and set these parameters for these areas.

3 When the default setting is made for I/O Link, that is, when all of parameters Nos. 11910 to 11912 are set to 0, I/O Link is allocated to the X0 to X127/Y0 to Y127, X200 to X327/Y200 to Y327, and X400 to X527/Y400 to Y527 areas of the 1st path PMC. In this case, for the 1st PMC, a communication function can be allocated to the X600 to X727/Y600 to Y727 areas.
When using I/O Link with other than the default setting, allocate a communication function to an area to which no I/O Link channel is allocated. Then, set these parameters to the area to which the communication function is allocated.
Example)
Setting for allocating channel 1 of I/O Link to the X0 to X127/Y0 to Y127 areas for the 1st path PMC and allocating DI/DO of a communication function to the X200 to X327/Y200 to Y327 areas
No.11910=100, No.11911=0, No.11912=0, No.11937#1=1

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III. FUNCTION

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1 EtherNet/IP SCANNER FUNCTION

NOTE
Before using the EtherNet/IP Scanner function, be sure to read Part II, "COMMON".

1.1 OVERVIEW

This section gives an outline of both the EtherNet/IP Adapter and Scanner functions.

1.1.1 Introduction

EtherNet/IP is an industrial network using Ethernet. The specification of EtherNet/IP is managed by ODVA (Open DeviceNet Vendor Association) and its globalization and standardization are promoted. Therefore, EtherNet/IP has been adopted by many vendors, and it is possible to connect to various types of industrial devices. Moreover, EtherNet/IP devices can be used together with general-purpose Ethernet devices because a standard Ethernet technology is used.

NOTE
This chapter is intended for the person who has basic knowledge about EtherNet/IP. Therefore, it does not cover a basic matter of EtherNet/IP. For details of EtherNet/IP, refer to the Web site (http://www.odva.org) of ODVA that manages the specification.

1.1.2 Terminology

Connection

To exchange DI/DO data using EtherNet/IP, first a communication path called a connection is established. When a connection is established successfully, the DI/DO data can be exchanged.
Up to 32 connections can be created for each of the EtherNet/IP Scanner and Adapter functions.

Adapter and scanner

A scanner sends a connection request to an adapter. An adapter responds to a connection request from a scanner.
The scanner notifies the adapter of the communication setting when it sends a connection request.
The CNC supports the Scanner function and Adapter function.
The EtherNet/IP function mentioned in the description below represents both the EtherNet/IP Adapter and Scanner functions.

EDS file

In EtherNet/IP, device information is given with a text file called an EDS file. The EDS file contains the communication setting the adapter can accept and information related to scanner communication control.
A scanner setting tool reads this EDS file and acquires these information items.
The EtherNet/IP function allows you to output an EDS file to a memory card or USB memory by operating the screen.

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Implicit messaging and Explicit messaging

In EtherNet/IP, there are two types of communications; one is to send DI/DO data to a device regularly, and the other is to send a request to a remote device and receive a response. The former is called Implicit messaging and the latter is called Explicit messaging.

In Implicit messaging, DI/DO data is sent regularly to a remote device based on the communication setting made when the connection is established. There are Class 0 and Class 1 according to the communication procedure. The CNC supports Class 1. Implicit messaging uses UDP of Ethernet technology and can be unicast (Point-To-Point) or multicast.

Explicit messaging is communication of the server/client type. A client sends a request to read or write data to a server. The server returns a value based on the request from the client and updates its own value using the received value. There are Class 2 to Class 6 according to the communication procedure. The CNC EtherNet/IP Adapter function supports a Class 3 server. Explicit messaging uses TCP of Ethernet technology and can only be unicast (Point-To-Point).

Originator and target

In Class 1 (Implicit messaging) communication, first, a connection is established. A scanner sends a connection request and an adapter responds to this request. Therefore, a scanner may also be called the originator of a connection, and an adapter may also be called the target of a connection.

The CNC EtherNet/IP Scanner function supports Class 1 originators.

The CNC EtherNet/IP Adapter function supports Class 1 targets.

Client and server

In Class 3 (Explicit messaging) communication, a client sends a request to read or write data to a server, and the server returns a value based on the request from the client and updates its own value using the received value.

The CNC EtherNet/IP Adapter function supports a Class 3 server which reads and writes DI/DO signals.

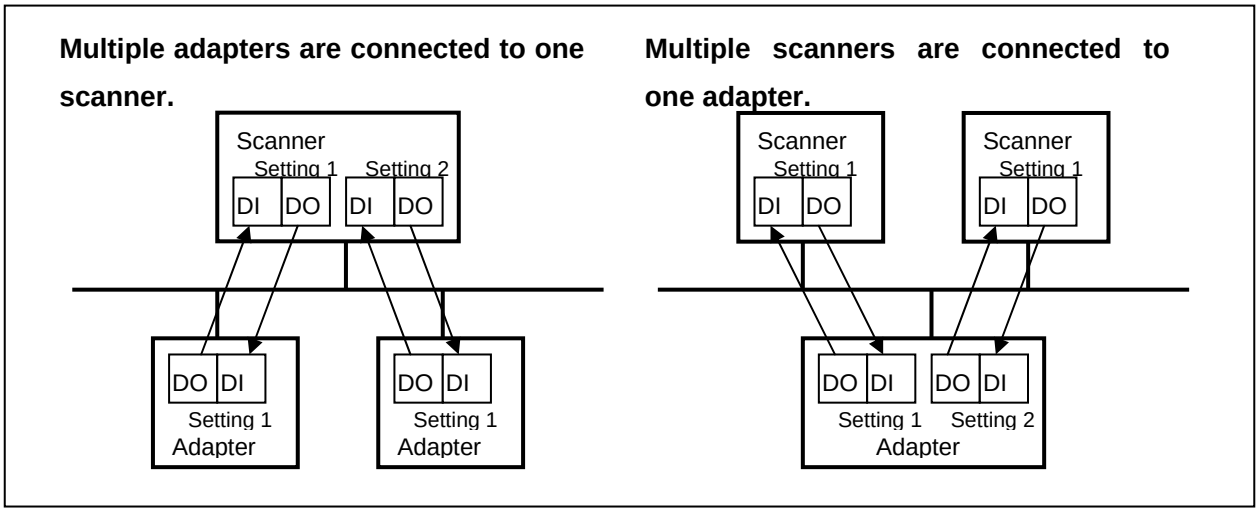
RPI and API

In Class 1 communication, a scanner specifies an interval at which to send and receive DI/DO data. The interval the scanner requests is called RPI (Requested Packet Interval).

On the other hand, the interval at which DI/DO data is sent and received in actual communication is called API (Actual Packet Interval).

Network configurations of I/O transport

Both adapters and scanners can have multiple settings. In each setting, the location of the DI/DO area and send interval can be specified. An adapter or scanner can communicate with different devices for individual settings.



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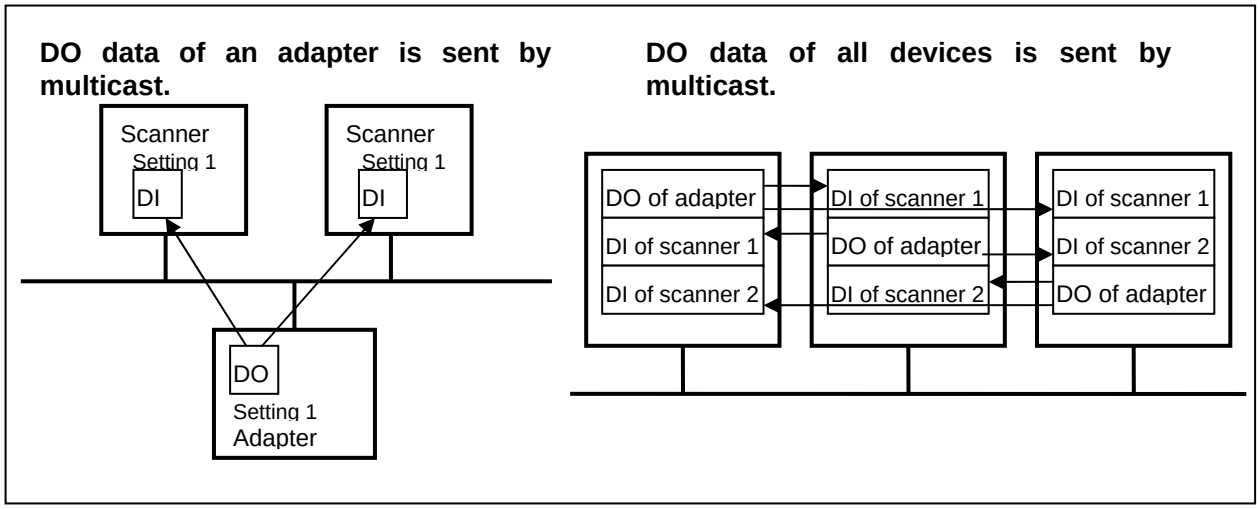
Moreover, one DO area of an adapter can be sent to multiple scanners. In this case, multicast is used. When devices support both the Adapter and Scanner functions, they can all read the signals from other devices by executing DO multicast in all devices.



Online and offline

The CNC EtherNet/IP Scanner function is placed in either of the two states, online and offline.
When the power is turned on, the CNC is started up online and starts communication according to the stored settings.
To change settings, change STATE from ONLINE to OFFLINE. When OFFLINE is set, communications being executed are all terminated. When settings are changed, the POWER MUST BE OFF alarm is issued. When you have changed the settings, turn the power off, then on again. Then, the CNC is placed online and the new settings take effect.

Types of communication

In Class 1 communication, there are the following four types of communication. The EtherNet/IP Scanner function supports Exclusive Owner, Input Only, and Listen Only.

Type of communication	Description
Exclusive Owner	Both of DO data from a scanner to an adapter and DI data from an adapter to a scanner are exchanged. To prevent double writing, multiple scanners cannot write the same area in an adapter.
Input Only	Only DI data from an adapter to a scanner is exchanged.
Listen Only	Only DI data from an adapter to a scanner is exchanged. Listen Only is effective only when another Exclusive Owner or Input Only connection is established.
Redundant Owner	Both of DO data from a scanner to an adapter and DI data from an adapter to a scanner are exchanged. Unlike Exclusive Owner, Redundant Owner allows multiple scanners to write the same area in an adapter.

In one-to-one communication, Exclusive Owner is used. When an adapter notifies many scanners of its DO signals, Input Only is used. Listen Only is for special purposes including monitors and is not used usually.

Fixed/variable data size

In EtherNet/IP communication, whether the data size is fixed or variable is specified in a connection request. When the size is fixed, data of the specified size is always exchanged. When the size is variable, the data size can be changed up to the specified size. Normally, data of the fixed size is exchanged in Implicit messaging, and data of the variable size is exchanged in Explicit messaging.

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Transport type

In Class 1 communication, the mode in which to connect a destination device is specified. Multicast and unicast (Point-to-Point) are available. The EtherNet/IP Scanner function supports multicast and unicast for receiving data and unicast for sending data.

Transport type	Description
Multicast	The same data is sent to multiple destination devices.
Unicast (Point-To-Point)	Data is sent to one destination device.

Header format

In Class 1 communication, there are the following four types of send data formats: 32-bit header format, modeless format, heartbeat format, and zero length data format.
For the EtherNet/IP Scanner function, they are called Run/Idle, modeless, heartbeat, and zero length, respectively.
The EtherNet/IP Scanner function supports Run/Idle, modeless, and heartbeat.

Type of header	Description
Run/Idle	A 2-byte sequence counter and a 4-byte header are added to the beginning of data. The 4-byte header contains a Run/Idle notification.
Modeless	A 2-byte sequence counter is added to the beginning of data. No Run/Idle notification can be sent.
Heartbeat	This type can be used when the data size is 0. Only a 2-byte sequence counter is sent. No Run/Idle notification can be sent.
Zero length	This type can be used when the data size is variable. A 2-byte sequence counter is added to the beginning of data. Whether to send Run or Idle depends on the size of data to be sent. When the size is 0, Idle is sent. When it is 1 or more, Run is sent.

Priority

The priority of processing in Class 1 communication is specified. There are four types of priority settings: urgent, scheduled, high, and low from the highest to the lowest. When scheduled is specified, data is sent regularly at the interval specified by RPI. For other priority settings, there are no quantitative criteria.
The EtherNet/IP Scanner function supports all priority settings for receiving data and scheduled for sending data.

Production trigger

A production trigger specifies the timing at which to send data from an adapter. Usually, a scanner uses a cyclic trigger, and can also use the same trigger the adapter uses.
The EtherNet/IP Scanner function supports all adapter production triggers, but only supports a cyclic trigger as a scanner production trigger.

Type of trigger	Description
Cyclic	Data is sent regularly according to the RPI value.
Change of state	Data is sent regularly according to the RPI value. In addition, data is sent immediately when the status of the device changes.
Application	Data is sent regularly according to the RPI value. In addition, data can be sent at a desired timing.

Allocation setting

For the CNC Adapter function, data areas exchanged with a scanner are specified by a setting called an allocation setting. The PMC data area is used. Up to four allocation settings can be specified.

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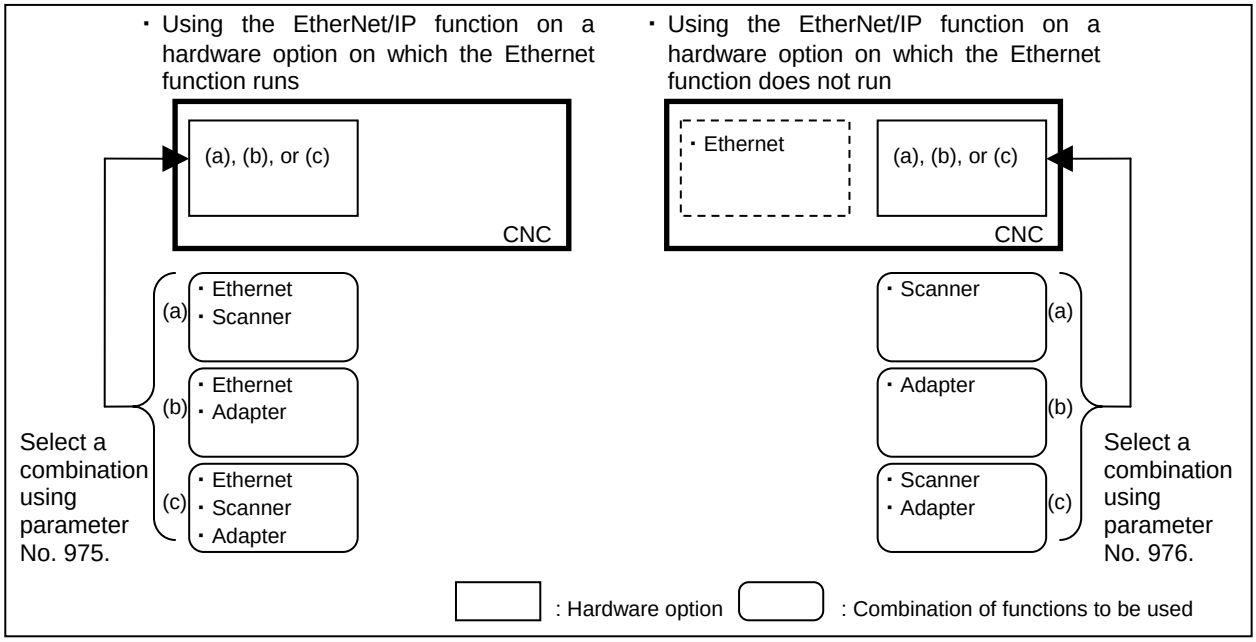
1.1.3 Operation of the EtherNet/IP Function

This subsection explains operation of the EtherNet/IP function in the CNC.

- The EtherNet/IP Adapter and Scanner functions can be used together on the same hardware option.
- The EtherNet/IP function can be used on one or two hardware options.
  When the EtherNet/IP function is used on two hardware options, the Ethernet function runs on one hardware option, and it does not run on the other hardware option.
- Before using the EtherNet/IP function on a hardware option on which the Ethernet function runs, use parameter No. 975 to specify a combination of functions including the Adapter and/or Scanner functions and parameter No. 970 to specify the hardware option to be used.
  Before using the EtherNet/IP function on a hardware option on which the Ethernet function does not run, use parameter No. 976 to specify a combination of the Adapter and/or Scanner functions and the hardware option to be used.
- The EtherNet/IP function can be used together with the Data Server functions, FL-net functions, and PROFINET functions. However, the function cannot be used together with these functions on the same hardware option. Use different hardware options.

Using the EtherNet/IP function on one hardware option

The EtherNet/IP function can be used on a hardware option on which the Ethernet function runs or on a hardware option on which the Ethernet function does not run.



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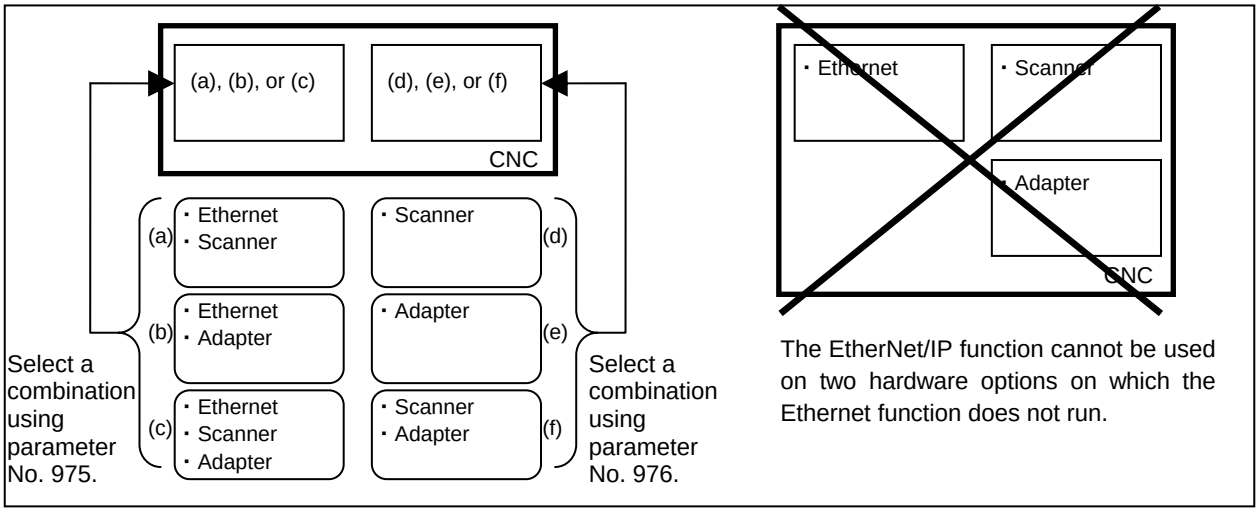
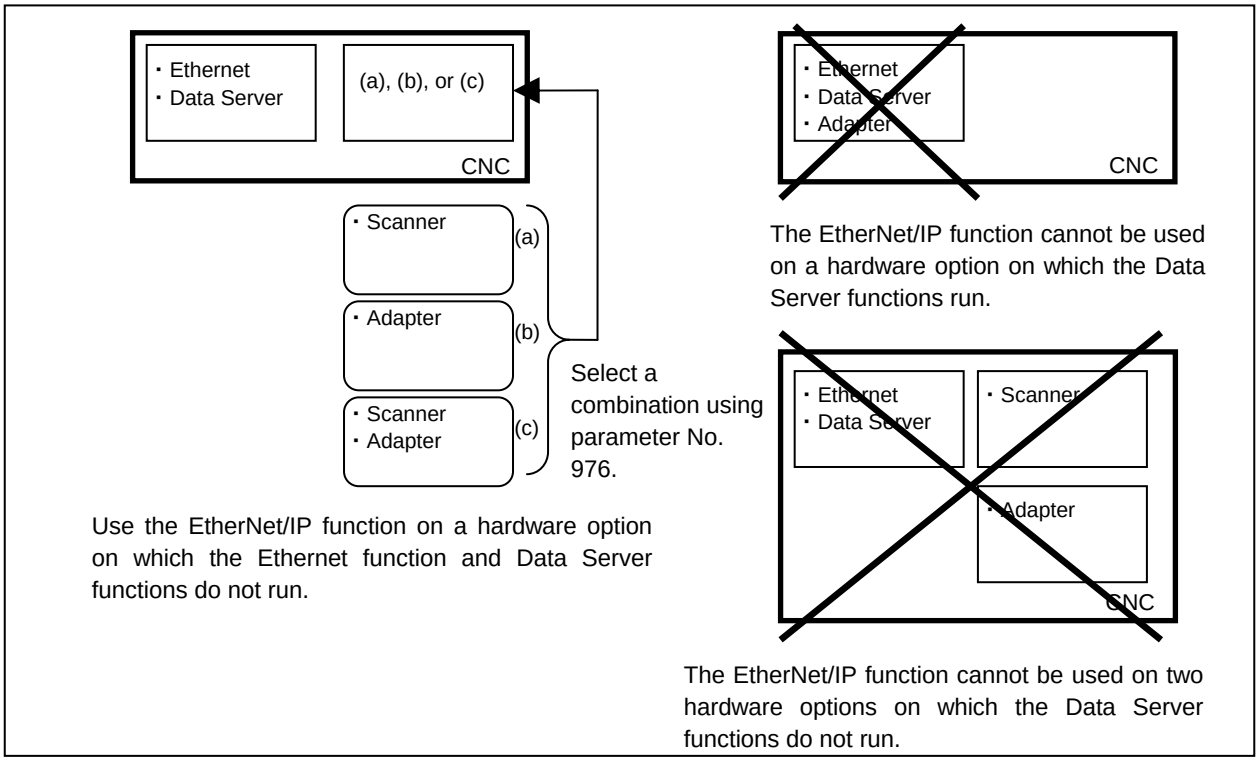
Using the EtherNet/IP function on two hardware options

The EtherNet/IP function can be used on two hardware options, one on which the Ethernet function runs and the other on which the Ethernet function does not run.



Using the EtherNet/IP function together with the Data Server functions

The Data Server functions run on a hardware option on which the Ethernet function runs, and the EtherNet/IP function runs on another hardware option. Therefore, when the EtherNet/IP function is used together with the Data Server functions, the function is used on a hardware option on which the Ethernet function does not run. The EtherNet/IP function cannot be used on two hardware options.



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1.2 SPECIFICATION

This section explains the specifications of the EtherNet/IP Adapter and Scanner functions.

1.2.1 Software Options

To use the EtherNet/IP function, the software options listed below are required.

Function to be used	Number of hardware options to be used	Required software option(s)
Scanner function	1	- EtherNet/IP Scanner function option (R966)
	2	- EtherNet/IP Scanner function option (R966) - EtherNet/IP Scanner PORT2 function option (R973) - Ethernet function option (S707)
Adapter function	1	- EtherNet/IP Adapter function option (R967)
	2	- EtherNet/IP Adapter function option (R967) - EtherNet/IP Adapter PORT2 function option (R974) - Ethernet function option (S707)

NOTE

To use the EtherNet/IP function on two hardware options, the Ethernet function must run on one of these hardware options. For this reason, the Ethernet function option (S707) is required.

1.2.2 Lists of Specifications

Specification related to the CNC

Item	Description
Combination with other functions	Functions that can be used on the same hardware option or another hardware option simultaneously - Ethernet function (S707) - Modbus/TCP Server function (R968) Functions that can be used on another hardware option simultaneously - Data Server functions (S737) - FL-net functions (J692) - PROFINET IO Controller function (R971) - PROFINET IO Device function (R972) For details of how to use the EtherNet/IP function together with other functions, see Chapter 2, "HARDWARE OPTIONS AND COMMUNICATION FUNCTIONS" in Part II, "COMMON".

NOTE

Note the following points when using the EtherNet/IP and Ethernet functions on the same hardware option:

1. Up to five FOCAS2/Ethernet function clients can be connected.
2. In the CNC, the EtherNet/IP function is executed with priority higher than other Ethernet functions including FOCAS2/Ethernet functions and CNC screen display function. For this reason, to use the EtherNet/IP and Ethernet functions on the same hardware option, it is necessary to give a margin enough for processing the EtherNet/IP function. Otherwise, time to process other Ethernet functions cannot be assigned, and these functions may not be executed normally.

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Specification related to the EtherNet/IP Scanner function

Item	Description
Communication type	Class 1 originator
PMC area that can be allocated	- DI: R, D, E, and X areas - DO: R, D, E, and Y areas - Status: R, D, and E areas
Maximum number of communication settings	32
Maximum data size per communication setting	256 bytes
RPI range	4 to 10,000 ms (Unit: 1 ms)
Bridge to DeviceNet	Not supported.
Redundant Owner	Not supported.
Fixed/variable size	The fixed size is supported. No variable size is supported.
Transport type	DI (T => O) Multicast and unicast (Point-to-Point) are supported. DO (O => T) Unicast (Point-to-Point) is supported. Multicast is not supported.
Header format	DI (T => O) Run/Idle, modeless, and heartbeat are supported. Zero length is not supported. DO (O => T) Run/Idle, modeless, and heartbeat are supported. Zero length is not supported.
Priority	DI (T => O) Urgent, scheduled, high, and low are supported. DO (O => T) Scheduled is supported. Urgent, high, and low are not supported.
Production trigger	DI (T => O) Cyclic, change of state, and application are supported. DO (O => T) Cyclic is supported. Change of state and application are not supported.

Specification related to the EtherNet/IP Adapter function

Item	Description
Communication type	Class 1 target, Class 3 server
PMC area that can be allocated	- DI: R, D, E, and X areas - DO: R, D, E, and Y areas - Status: R, D, and E areas
Maximum number of allocation settings	4
Maximum data size per allocation setting	256 bytes
Maximum number of connections	32
RPI range	4 to 10,000 ms (Unit: 1 ms)
Bridge to DeviceNet	Not supported.

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Specification related to communication

Item	Description
IP address	Enter a desired IP address from the screen of the CNC. The following methods are also available when the Ethernet and EtherNet/IP functions are operated on the same hardware option: - Acquire the CNC IP address from the DHCP server. In this case, once the IP address is acquired from the DHCP server, it can also be used after that. - Acquire the IP address of each destination adapter device from the DNS server.
Port number	Class 1: 2222 (Fixed) Class 3: 44818 (Fixed)

1.2.3 Unit of Data and Concurrency of Data

The unit of I/O data can be selected from byte (1 byte), word (2 bytes), and long (4 bytes).

> ⚠ **WARNING**
> Set an appropriate unit of data according to the communication destination device and data to be exchanged. Communication with an inappropriate value may cause data segmentation. If data longer than long data (4-byte data) is handled, data segmentation may occur.
> To handle long data (4 bytes) or word data (2 bytes), for notes on creating a ladder program, see Subsection 3.1.2, "Creating a Ladder Program" in Part II, "COMMON".
> Data segmentation may result in the machine behaving unexpectedly, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.

The unit of data and its corresponding restrictions on the PMC address and size are listed below.

Unit of data	Restriction on the PMC address	Restriction on the size
Byte (1 byte)	None	None
Word (2 bytes)	Aligned with 2-byte boundaries (even address only)	Aligned with 2-byte boundaries (even size only)
Long (4 bytes)	Aligned with 4-byte boundaries (the address must be dividable by 4.)	Aligned with 4-byte boundaries (the size must be dividable by 4.)

The concurrency of data is secured by the specified unit of data. That is, when the unit of data is byte, word, and long, the concurrency is secured within 1-byte data, 2-byte data, and 4-byte data, respectively, and no data segmentation occurs.

1.2.4 Conversion of Endian

When the unit of data is word (2 bytes) or long (4 bytes), whether to convert endian with the concurrency of data guaranteed can be specified. When endian is not converted, the data is treated as little-endian. When endian is converted, the data is treated as big-endian.
When the unit of data is byte (1 byte), endian is not converted.

> ⚠ **WARNING**
> Before starting operation, make sure that an appropriate value is specified for the setting item for selecting conversion of endian and data is exchanged in the correct order.
> If operation is started without checking the above, the machine may behave unexpectedly, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.

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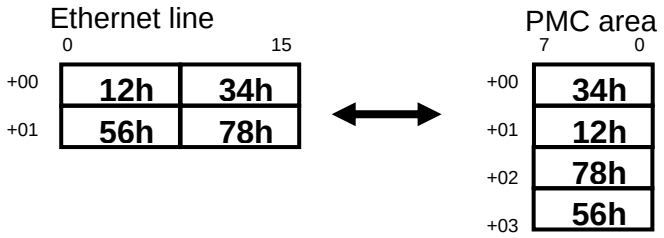
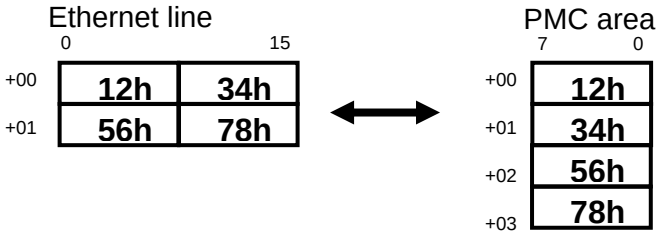
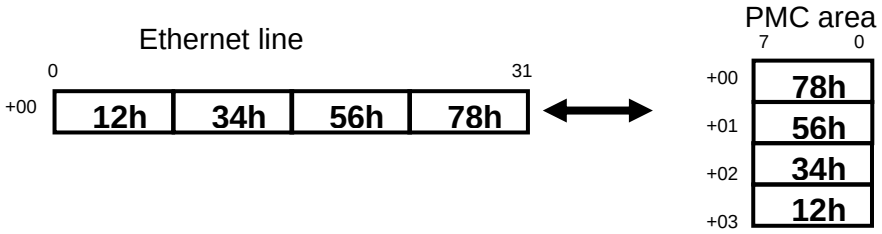
When the unit of data is word (2 bytes) and endian is not converted



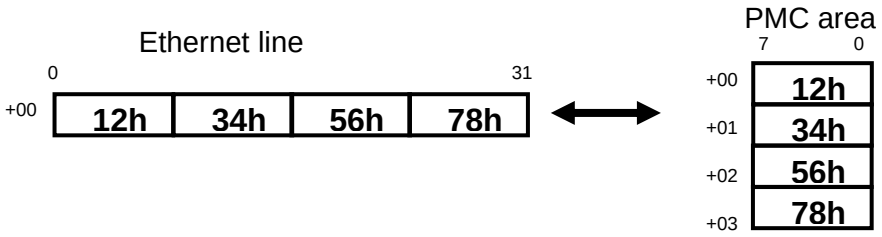
When the unit of data is word (2 bytes) and endian is converted



When the unit of data is long (4 bytes) and endian is not converted



When the unit of data is long (4 bytes) and endian is converted



1.2.5 Examples of Settings for Using Multiple Communication Functions Simultaneously

Use parameters Nos. 975 and 976 to specify a combination of the hardware option(s) on which to run the EtherNet/IP function, and Scanner and Adapter functions to be used.
For details of how to set these CNC parameters, see Chapter 2, "HARDWARE OPTIONS AND COMMUNICATION FUNCTIONS" in Part II, "COMMON".
Examples of setting CNC parameters for several combinations are listed below.

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Ex.	Functions to be used	Hardware option(s) to be used	CNC parameters
1	Ethernet function EtherNet/IP Scanner function EtherNet/IP Adapter function	Multi-function Ethernet	No.970= 1 No.974= -1 No.971= -1 No.975= 30 No.972= -1 No.976= -1 No.973= -1
2	Ethernet function EtherNet/IP Adapter function	Multi-function Ethernet	No.970= 1 No.974= -1 No.971= -1 No.975= 20 No.972= -1 No.976= 13 No.973= -1
	EtherNet/IP Scanner function	Fast Ethernet board (slot 1)	
3	Ethernet function	Multi-function Ethernet	No.970= 1 No.974= -1 No.971= -1 No.975= -1 No.972= -1 No.976= 33 No.973= -1
	EtherNet/IP Scanner function EtherNet/IP Adapter function	Fast Ethernet board (slot 1)	
4	Ethernet function EtherNet/IP Scanner function	Multi-function Ethernet	No.970= 1 No.974= -1 No.971= -1 No.975= 10 No.972= -1 No.976= 14 No.973= -1
	EtherNet/IP Scanner function	Fast Ethernet board (slot 2)	
5	Ethernet function EtherNet/IP Scanner function EtherNet/IP Adapter function	Multi-function Ethernet	No.970= 1 No.974= -1 No.971= -1 No.975= 30 No.972= -1 No.976= 34 No.973= -1
	EtherNet/IP Scanner function EtherNet/IP Adapter function	Fast Ethernet board (slot 2)	
6	Ethernet function Data Server functions	Fast Ethernet board (slot 1)	No.970= 3 No.974= -1 No.971= -1 No.975= -1 No.972= -1 No.976= 34 No.973= -1
	EtherNet/IP Scanner function EtherNet/IP Adapter function	Fast Ethernet board (slot 2)	
7	EtherNet/IP Scanner function EtherNet/IP Adapter function	Multi-function Ethernet	No.970= -1 No.974= -1 No.971= -1 No.975= -1 No.972= -1 No.976= 31 No.973= -1

1.2.6 Operation on a Hardware Option on which the Ethernet Function Runs or Does Not Run

There are the differences listed below depending on whether the EtherNet/IP function runs on a hardware option on which the Ethernet function runs.

Function	Running on a hardware option on which the Ethernet function runs	Running on a hardware option on which the Ethernet function does not run
DHCP/DNS functions	Available	Unavailable
Functions provided by FOCAS2 and other Ethernet functions	Available	Unavailable

Operation of other functions is explained below.

Backup and restore operations

Backup and restore operations can be performed from two setting screens; one used when the EtherNet/IP function runs on a hardware option on which the Ethernet function runs and the other used when the EtherNet/IP function runs on a hardware option on which the Ethernet function does not run. Both settings are backed up and restored regardless of which screen is used for performing backup and restore operations.

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The following table lists screens for performing backup and restore operations and data to be backed up and restored.

Screen for performing backup and restore operations	Data to be backed up and restored				
	Operation on a hardware option on which the Ethernet function runs		Operation on a hardware option on which the Ethernet function does not run		Settings of the Ethernet function
	Settings of the Scanner function	Settings of the Adapter function	Settings of the Scanner function	Settings of the Adapter function	
Scanner setting screen	✓		✓		✓
Adapter setting screen		✓		✓	✓

8-level data protection

The EtherNet/IP function follows the settings made for the items in "Ethernet setting data <ETHER NET SETTING>" for the 8-level data protection function. The settings contain both of the settings for operation on a hardware option on which the Ethernet function runs and the settings for operation on which a hardware option on which the Ethernet function does not run.
When the Ethernet and Data Server functions are disabled, the settings for the EtherNet/IP function are not subject to 8-level data protection.

1.3 SETTING

The EtherNet/IP Scanner function can be used on one or two hardware options. The setting screens of these hardware options are independent of each other. Specify required settings for the relevant hardware option(s).

Procedure for displaying the screen

To display the setting screen, follow the instructions in Subsection 2.4.1, "Displaying Screens" in Part II, "COMMON".
This section explains procedures using examples when the EtherNet/IP Scanner function runs on a hardware option on which the Ethernet function runs. When the EtherNet/IP Scanner function runs on a hardware option on which the Ethernet function does not run, read soft key [ETHERNET] as [EtherNet/IP].

1.3.1 Procedure for Setting the Scanner

Up to 32 communication settings can be specified for one hardware option. One connection is created according to one communication setting.
The following two methods are available for setting the scanner:

1. Set up the scanner on the CNC screen.
2. Use a commercially available scanner setting tool such as RSNetWorx for EtherNet/IP of Rockwell Automation, Inc.

For details of the method for setting the scanner using RSNetWorx for EtherNet/IP, see Subsection 1.6.5, "Setting the Scanner Using a Non-FANUC Tool".

The flow of setup operations on the CNC screen is listed below.

	Operation	Description
1	Set the IP address.	Set the IP address on the COMMON screen (BASIC).

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	Operation	Description
2	If STATE is ONLINE, change it to OFFLINE.	When STATE is ONLINE, the CNC is executing communication according to the stored settings, and settings cannot be changed. To change settings, change STATE to OFFLINE. When OFFLINE is set, all communications are terminated.
3	Select a communication setting.	Select a communication setting you want to change from 32 communication settings.
4	If STATE of the communication setting is ENABLE, change it to DISABLE.	When STATE is ENABLE, the setting is effective for communication; when it is DISABLE, the setting is not effective for communication. To change values, change STATE to DISABLE.
5	Change values on the SIMPLE setting screen.	Use the SIMPLE setting screen to set items for which values must be specified.
6	Change values on the DETAIL setting screen if necessary.	The DETAIL setting screen allows you to specify detail settings. In many cases, the CNC can execute communication only according to the settings specified on the SIMPLE setting screen.
7	Change STATE of the communication setting to ENABLE.	When the values have been changed, change STATE to ENABLE. When STATE is changed to ENABLE, the CNC confirms the settings.
8	Repeat steps 2 to 7 if necessary.	If you want to change another communication setting, repeat these steps.
9	Turn the power off, then on again.	When the power is turned off, then on again, the CNC is placed online and starts communication according to the new settings.

1.3.2 Setting the IP Address

The following two methods are available for setting the IP address:

1. Enter a desired IP address from the screen of the CNC.
2. Acquire the IP address from the DHCP server. (Available only when the EtherNet/IP function is used on a hardware option on which the Ethernet function runs)

Select a setting method according to operation of the network.

Entering a desired IP address from the screen of the CNC

Enter values in IP ADDRESS, SUBNET MASK, and ROUTER IP ADDRESS according to the instructions in Subsection 1.3.3, "COMMON Screen".

Acquiring the IP address from the DHCP server

The IP address can also be acquired from the DHCP server when the EtherNet/IP function is used on a hardware option on which the Ethernet function runs.
For details of how to acquire the IP address from the DHCP server, refer to "Fast Ethernet/Fast Data Server OPERATOR'S MANUAL (B-64014EN)".

For acquiring the IP address from the DHCP server, either of the following procedures can be selected:

- Every time the power is turned on, the setting is acquired from the DHCP server.
- When the setting is acquired from the DHCP server, it is saved. When the power is turned on next time and after, the saved setting is used, and the setting is not acquired from the DHCP server.

For details of the setting, see "BASIC setting screen" in Subsection 1.3.5, "BASIC Setting Screen and LIST Screen".

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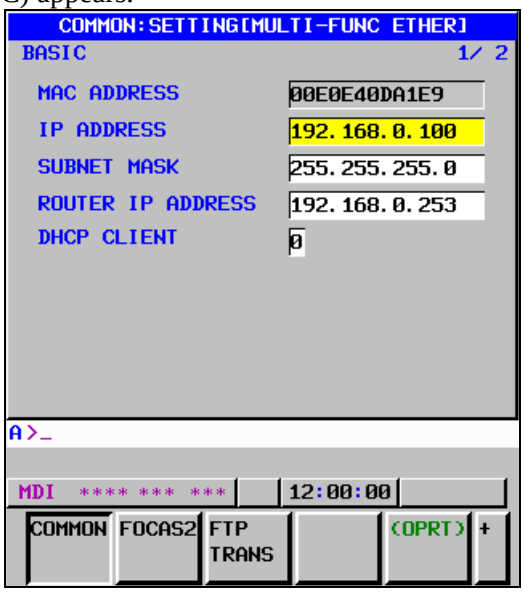
1.3.3 COMMON Screen

Set the IP address and other items.

Procedure

1 Press function key SYSTEM.
2 Soft key [ETHERNET] appears. When the soft key does not appear, press the continue key.
3 Press soft key [ETHERNET]. The Ethernet function setting screen appears.
4 Press soft key [COMMON]. When the soft key does not appear, press the continue key. The COMMON screen (BASIC) appears.



COMMON screen (BASIC)

Setting items

Item	Description
IP ADDRESS	Specify the IP address of the hardware option. (Example: "192.168.0.100")
SUBNET MASK	Specify a mask address for the IP addresses of the network. (Example: "255.255.255.0")
ROUTER IP ADDRESS	Specify the IP address of the router. Specify this item when the network contains a router. (Example: "192.168.0.253")
DHCP CLIENT	If the Ethernet and EtherNet/IP Scanner functions are operated on the same hardware option, the value of bit 6 (DHC) of parameter No. 904, related to the DHCP client function, is displayed, and another value can be set.

Display item

Item	Description
MAC ADDRESS	MAC address of the hardware option

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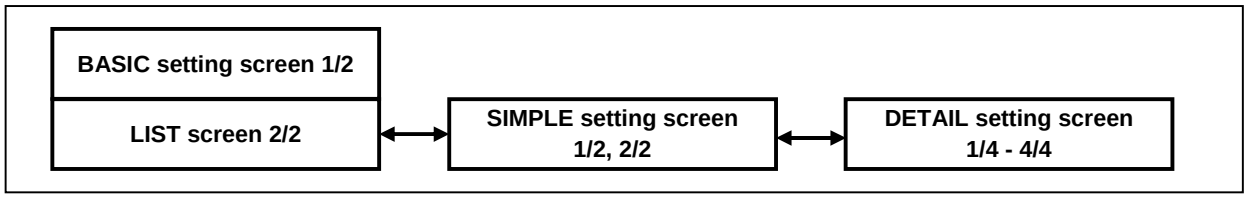
1.3.4 Configuration of the EtherNet/IP Scanner Setting Screens

This subsection explains the setting screens for operating the EtherNet/IP Scanner function.
The configuration of the setting screens is shown below.



Configuration of the setting screens for the EtherNet/IP Scanner function

Use the BASIC setting screen to set general items related to the EtherNet/IP Scanner function.
The LIST screen shows a list of the communication settings. You can select a communication setting for which you want to change values and move to the SIMPLE setting screen.
Use the SIMPLE setting screen to set items required for communicating with an adapter device. You can move to the DETAIL setting screen.
Use the DETAIL setting screen to specify a communication setting in detail if necessary.
The following subsections detail these screens.

NOTE
1 Before changing a parameter on an EtherNet/IP Scanner setting screen, set the MDI mode or emergency stop state.
2 If the Change protection level of the Ethernet function is higher than the Operation level in the 8-level data protection function, no settings can be changed. This rule applies to both operation on a hardware option on which the Ethernet function runs and that on a hardware on which the function does not run.

1.3.5 BASIC Setting Screen and LIST Screen

Procedure

1 Press function key SYSTEM.
2 Soft key [ETHERNET] appears. When the soft key does not appear, press the continue key.
3 Press soft key [ETHERNET]. The Ethernet function setting screen appears.
4 Press soft key [EIP S SET]. When the soft key does not appear, press the continue key.
5 The BASIC setting screen (page 1) appears. Use page keys PAGE ⇧ PAGE ⇩ to display a desired page.

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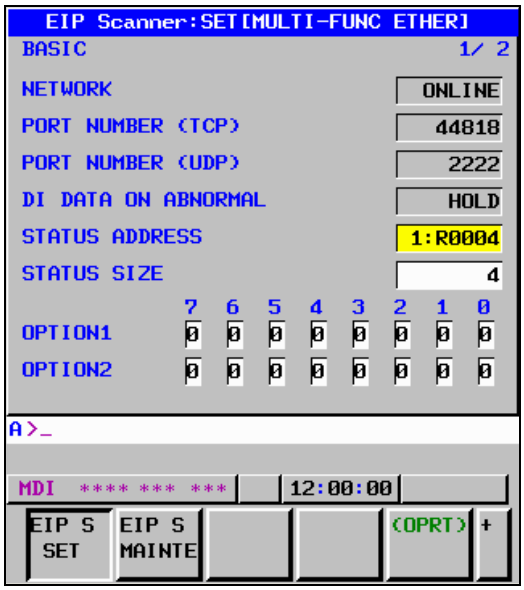
BASIC setting screen

The BASIC setting screen is displayed on page 1. Specify items common to the EtherNet/IP Scanner function.



EtherNet/IP Scanner setting screen (BASIC)

Setting items

Item	Description
NETWORK Default: ONLINE	The EtherNet/IP Scanner function is placed in either of the two states, "ONLINE" and "OFFLINE". ONLINE: Communication is executed according to the stored settings. No settings can be changed. OFFLINE: All communications of the EtherNet/IP Scanner function on the target hardware option are terminated. Settings can be changed. When the power is turned on, the CNC is automatically placed "ONLINE". To change settings, change the status to "OFFLINE" from the screen. To change the status from "OFFLINE" to "ONLINE", turn the power off, then on again. Use soft keys for setting. Press soft keys [(OPRT)] and [OFFLINE], then select [EXECUTE].
DI DATA ON ABNORMAL Default: HOLD	Specify operation to be performed when the update of data in the DI area stops. HOLD: If an error occurs in communication with an adapter and the corresponding DI area is not updated, data in the DI area is held (nothing is performed). CLEAR: If an error occurs in communication with an adapter and the corresponding DI area is not updated, the DI area is cleared to 0. Use soft keys for setting. Press soft keys [(OPRT)] and [DI DATA], then select [HOLD] or [CLEAR].
STATUS ADDRESS Default: ---	Specify the start address of the PMC R, E, or D area for storing the status of the EtherNet/IP Scanner function. For details of the status, see "Status" described below. If you do not want to use the status, specify " "(blank). "---" is displayed in "STATUS ADDRESS" and 0 is displayed in "STATUS SIZE". The valid setting range depends on the effective PMC area. It also depends on the setting of "STATUS SIZE".
STATUS SIZE Default: 0 Valid settings: 0, 1, 4, 7, 10, and 13	Specify the size of the PMC area for storing the status. Data to be output to the PMC area can be determined according to the size. If you do not want to use the status, specify 0. "---" is displayed in "STATUS ADDRESS" and 0 is displayed in "STATUS SIZE".

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Item	Description
OPTION1 Default: 00000000	Bits 0-1: Specify operation to be performed when the DHCP client function (bit 6 of parameter No. 904) is used to acquire the local IP address, subnet mask, router IP address, DNS server IP addresses 1 and 2, and local domain from the DHCP server. These option bits are valid only when set on the screen displayed by pressing soft key [ETHERNET]. Bit 0: The parameters acquired by the DHCP client function are: 0: Not saved in nonvolatile memory (SRAM). 1: Saved in nonvolatile memory. When the parameters are successfully saved, bit 1 is automatically set to 1. Bit 1: The DHCP client function is: 0: Enabled. 1: Disabled. (This bit cannot be set manually.) Bit 2: Specifies data to be output to an EDS file when both the Scanner and Adapter functions are enabled. 0: An EDS file for the Scanner function is output when data is output from the Scanner function setting screen; an EDS file for the Adapter function is output when data is output from the Adapter function setting screen. 1: An EDS file containing data of both the Scanner and Adapter functions is output regardless of the screen from which data is output. Bits 3-7: Reserved. (Must be 0.)
OPTION2 Default: 00000000	Bit 0: When the power is turned on next time, all parameters of the EtherNet/IP Scanner function are: 0: Not initialized. 1: Initialized. (NOTE 5) Bits 1-7: Reserved. (Must be 0.)

⚠ **WARNING**

Before allocating the PMC area, be sure to read Section 3.1, "DI/DO DATA AND STATUS DATA" in Part II, "COMMON".

NOTE

1 When an item other than "NETWORK" is changed, the POWER MUST BE OFF alarm is issued. To have the changes take effect, turn the power off, then on again.

2 After "NETWORK" is changed to "OFFLINE", values on other setting screens can be changed.

3 The following items are shared with the EtherNet/IP Adapter and Scanner functions on the same hardware option. When both the EtherNet/IP Adapter and Scanner functions are enabled, the value changed for either of them is reflected to the other.
- DI DATA ON ABNORMAL
- OPTION1

4 When "NETWORK" is changed to "OFFLINE", all communications of the Scanner function on the target hardware option are terminated. When both the Scanner and Adapter functions are enabled, the communications of the Adapter function are not terminated even if "NETWORK" is changed to "OFFLINE".

5 When initialization is executed by setting bit 0 of OPTION2 to 1, all items are returned to their defaults and any changes are lost. Carefully set this bit.

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Display items

Item	Description
PORT NUMBER (TCP)	The standard EtherNet/IP TCP port number (44818) is displayed.
PORT NUMBER (UDP)	The standard EtherNet/IP UDP port number (2222) is displayed.

Operations

Changing NETWORK to OFFLINE

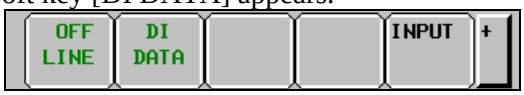
1 Press soft key [(OPRT)]. Soft key [OFFLINE] appears.

2 Press soft key [OFFLINE]. Soft keys [EXECUTE] and [CANCEL] appear.

3 Press soft key [EXECUTE].

Changing the setting for DI DATA ON ABNORMAL

1 Press soft key [(OPRT)]. Soft key [DI DATA] appears.



2 Press soft key [DI DATA]. Soft keys [HOLD] and [CLEAR] appear.

3 Press the soft key corresponding to the value you want to set.

Status

The status is detected by the EtherNet/IP Scanner function. The first byte indicates the status of the entire Scanner function. The second and subsequent bytes indicate the status of each communication setting. Data of eight communication settings uses 3 bytes. Use STATUS SIZE to specify the number of communication settings for which data is to be output to the PMC area.

STATUS SIZE	Description
0	The status is not output.
1	Only the status of the entire Scanner function is output.
4, 7, 10, or 13	The status of the entire Scanner function and the status of 8, 16, 24, or 32 communication settings are output.

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		Status							
		#7	#6	#5	#4	#3	#2	#1	#0
Status address	+0	OPE	-	-	-	-	-	-	ERR
	+1	ENA08	ENA07	ENA06	ENA05	ENA04	ENA03	ENA02	ENA01
	+2	CON08	CON07	CON06	CON05	CON04	CON03	CON02	CON01
	+3	IN08	IN07	IN06	IN05	IN04	IN03	IN02	IN01
	+4	ENA16	ENA15	ENA14	ENA13	ENA12	ENA11	ENA10	ENA09
	. . .	. . .							
	+9	IN24	IN23	IN22	IN21	IN20	IN19	IN18	IN17
	+10	ENA32	ENA31	ENA30	ENA29	ENA28	ENA27	ENA26	ENA25
	+11	CON32	CON31	CON30	CON29	CON28	CON27	CON26	CON25
	+12	IN32	IN31	IN30	IN29	IN28	IN27	IN26	IN25

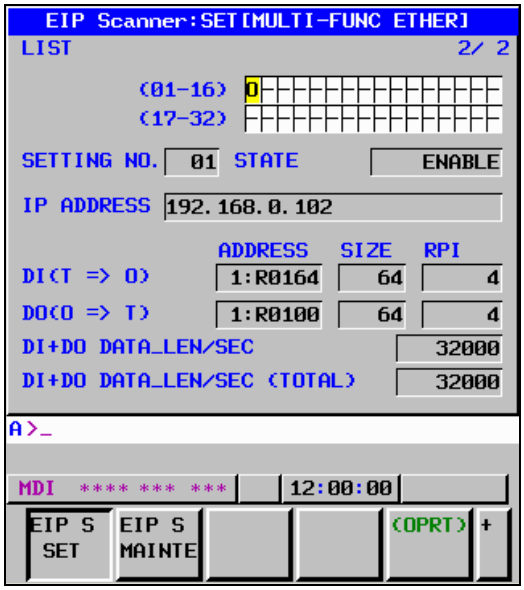
The last two digits of each signal name indicate the number of the corresponding communication setting. This number is represented as xx in the table below.

Signal	Description
ERR	An error occurs. (MS: RECOVERABLE FAULT or UNRECOVERABLE FAULT error)
OPE	Communication is normally operating (MS: DEVICE OPERATIONAL).
ENAxx	Item "STATUS" of communication setting xx is "ENABLE".
CONxx	The device specified for communication setting xx is being connected.
INxx	The device specified for communication setting xx is being connected and the DI area is updated by receive data.

Signal "ENAxx" indicates whether the setting is enabled.
When the power to the CNC is turned on, the Scanner function attempts to establish a connection with each communication setting for which the setting is enabled, that is, signal "ENAxx" is 1. When the connection is established, signal "CONxx" is set to 1. After the connection is established, when the input signal is received from the remote device and the DI area in the CNC is updated, signal "INxx" is set to 1. If the connection is disconnected for some reason, signals "CONxx" and "INxx" are set to 0.

LIST screen

The LIST screen is displayed on page 2. The screen shows an outline of the communication setting selected by the cursor. You can change the STATE value (ENABLE or DISABLE). You can also move to the SIMPLE setting screen.



EtherNet/IP Scanner setting screen (LIST)

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Setting items

Item	Description
STATE Default: DISABLE	Status of the communication setting ("ENABLE", "DISABLE", or "ERROR"). ENABLE: The communication setting is enabled. Communication is executed according to the setting. No settings can be changed. DISABLE or ERROR: The communication setting is disabled and communication is not executed. Settings can be changed. On this screen, "STATE" can be changed to ENABLE or DISABLE. When "STATE" is changed to ENABLE, the settings are confirmed. When there is no problem, "STATE" is set to "ENABLE". If a setting error is found, "STATE" is set to "ERROR". If "STATE" is set to "ERROR", correct the setting and change "STATE" to ENABLE. Use soft keys for setting. Press soft keys [(OPRT)] and [STATE], then select [ENABLE] or [DISABLE].

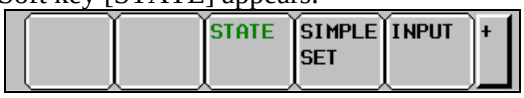
Display items

Item	Description
LIST	The status of each communication setting is displayed. The value corresponds to the STATE setting. O: Enabled -: Disabled E: Error
SETTING NO.	Number of the communication setting specified by the cursor
IP ADDRESS	IP address of the communication setting specified by the cursor
ADDRESS, SIZE, RPI	Address, size, and RPI of the communication setting specified by the cursor. The values of each of DI(T=>O) and DO(O=>T) are displayed.
DI+DO DATA_LEN/SEC	Data length per second that is exchanged with the adapter for the communication setting specified by the cursor. Both DI and DO lengths are counted. The unit is bytes/second. When STATE is not ENABLE, the value is 0.
DI+DO DATA_LEN/SEC (TOTAL)	Total of the "DI+DO DATA_LEN/SEC" values for all communication settings. The unit is bytes/second.

Operations

Changing the STATE setting

1 Press soft key [(OPRT)]. Soft key [STATE] appears.

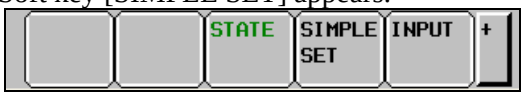


2 Press soft key [STATE]. Soft keys [ENABLE] and [DISABLE] appear.

3 Press the soft key corresponding to the value you want to set.

Moving to the SIMPLE setting screen

1 Press soft key [(OPRT)]. Soft key [SIMPLE SET] appears.



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2 Move the cursor to select a communication setting and press soft key [SIMPLE SET]. The SIMPLE setting screen appears.

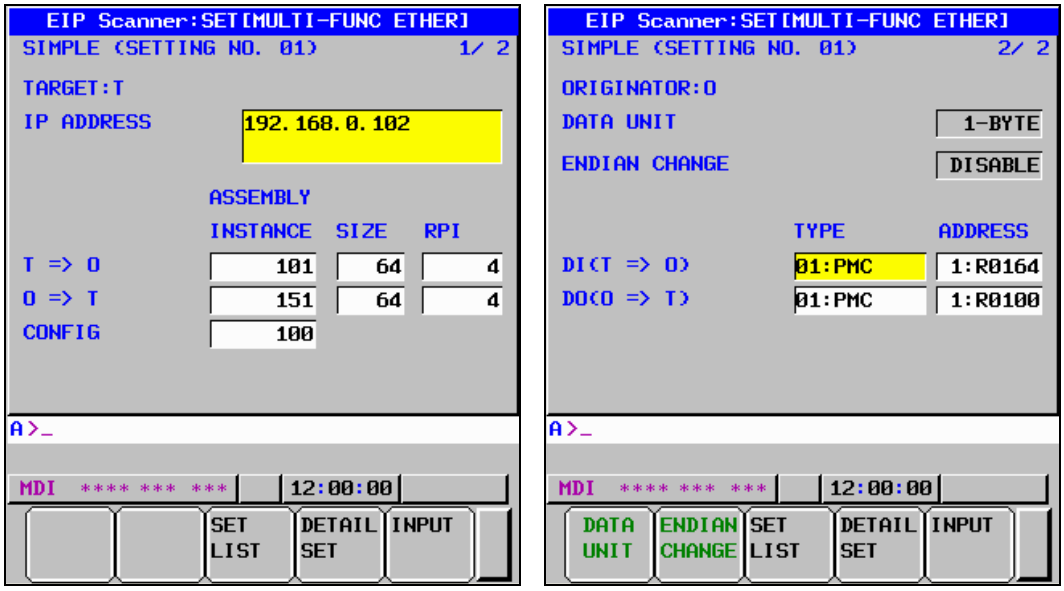
1.3.6 SIMPLE Setting Screen

Make settings required for communicating with an adapter device.
Page 1 contains settings related to the target, which is the destination device. Page 2 contains settings related to the CNC, which acts as the originator.

Procedure

1 On the LIST screen, move the cursor to select a communication setting.
2 Press soft keys [(OPRT)] and [SIMPLE SET] to move to the SIMPLE setting screen.
3 Use page keys [PAGE ⇧] [PAGE ⇩] to display a desired page.
4 Enter values in all setting items.
5 If necessary, move to the DETAIL setting screen by pressing soft key [DETAIL SET] and make detail settings.
6 Press soft key [SET LIST] to return to the LIST screen.

NOTE
When "NETWORK" is "ONLINE" or "STATE" is "ENABLE", the values of setting items are displayed only and cannot be changed. To change values, set "NETWORK" to "OFFLINE" and "STATE" to "DISABLE".



EtherNet/IP Scanner setting screen (SIMPLE 1/2, 2/2)

Setting items

Item	Description
IP ADDRESS Default: Blank (SP)	Specify the IP address of a destination adapter device with which to execute communication. When the EtherNet/IP Scanner function is used on a hardware option on which the Ethernet function runs, the DNS client function can be used to specify the device with its host name. For details of the DNS function, refer to "Fast Ethernet/Fast Data Server OPERATOR'S MANUAL (B-64014EN)".

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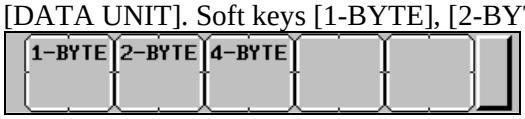
Item	Description
ASSEMBLY INSTANCE Default: 0 Valid settings: 0 to 65535, and blank (SP)	Specify the input instance number, output instance number, and configuration instance number of the assembly class of the adapter device. When this item is not used, specify a blank (SP). In T => O and O => T, T means the target (adapter) and O means the originator (scanner).
SIZE Default: 0 Valid setting range: 0 to 256	Specify the size (in bytes) of an area for storing input/output data.
RPI Default: 32 Valid setting range: 4 to 10000	Specify an interval at which to send data (packet) in EtherNet/IP communication. For T => O, specify an interval at which the target (adapter) sends data. For O => T, specify an interval at which the originator (scanner) sends data. The unit is milliseconds.
DATA UNIT Default: 1-BYTE	Specify 1, 2, or 4 bytes as the unit of data. Use soft keys for setting. Press soft keys [(OPRT)] and [DATA UNIT], then select [1-BYTE], [2-BYTE], or [4-BYTE]. For details of the unit of data, see Subsection 1.2.3, "Unit of Data and Concurrency of Data".
ENDIAN CHANGE Default: DISABLE	Specify whether to convert endian. DISABLE: Endian is not converted. ENABLE: Endian is converted. Use soft keys for setting. Press soft keys [(OPRT)] and [ENDIAN CHANGE], then select [ENABLE] or [DISABLE]. For details of endian conversion, see Subsection 1.2.4, "Conversion of Endian".
TYPE Default: 0 Valid settings: 0 and 1	Specify the type of area for storing DI/DO data. 00:UNUSED DI/DO data is not stored. Specify this value when the input/output data size is 0. 01:PMC DI/DO data is stored in the PMC area.
ADDRESS Default: ---	Specify the area for storing DI/DO data. When "TYPE" is "00:UNUSED", no value can be set. When "TYPE" IS "01:PMC", specify the start address of the PMC area for storing DI/DO data. The R, D, or E area can be specified. The X area can also be specified for DI, and the Y area can also be specified for DO. The valid setting range depends on the actual range of the PMC R/E/D/X/Y area. While considering the "SIZE" setting, specify a value so that the area is within the PMC area range. To allocate the PMC X/Y area, also set parameters Nos. 11937 to 11939. For details of these parameters, see Section 4.3, "PARAMETERS RELATED TO PMC" in Part II, "COMMON".

⚠ **WARNING**
Before allocating the PMC area, be sure to read Section 3.1, "DI/DO DATA AND STATUS DATA" in Part II, "COMMON".

Operations

Changing the DATA UNIT setting

1 On page 2, press soft key [DATA UNIT]. Soft keys [1-BYTE], [2-BYTE], and [4-BYTE] appear.



2 Press the soft key corresponding to the value you want to set.

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Changing the ENDIAN CHANGE setting

1 On page 2, press soft key [ENDIAN CHANGE]. Soft keys [ENABLE] and [DISABLE] appear.

2 Press the soft key corresponding to the value you want to set.

Returning to the LIST screen

Press soft key [SET LIST] to return to the LIST screen.

Moving to the DETAIL setting screen

Press soft key [DETAIL SET] to move to the DETAIL setting screen.

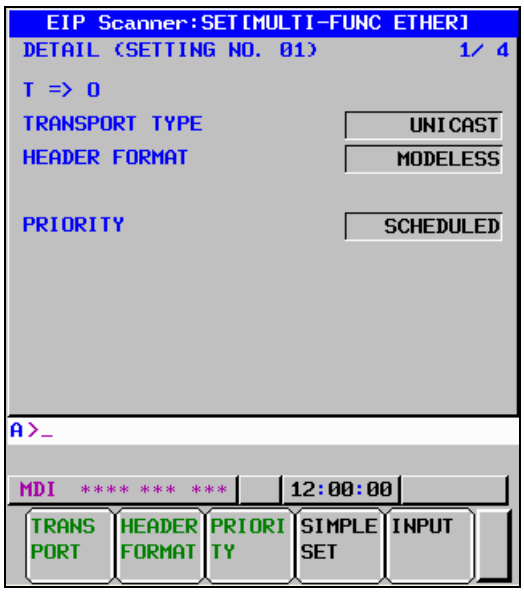
1.3.7 DETAIL Setting Screen

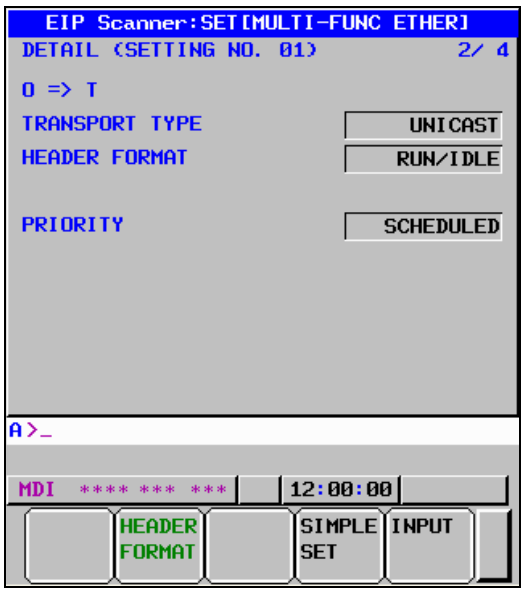
Make detail settings required for communicating with an adapter device.
Page 1 contains settings related to data transport from the target to the originator. Page 2 contains settings related to data transport from the originator to the target. Page 3 contains settings related to the target electronic keys. Page 4 contains settings related to the entire communication.

Procedure

1 On the SIMPLE setting screen, press soft key [DETAIL SET] to move to the DETAIL setting screen.
2 Use page keys [PAGE ⇧] [PAGE ⇩] to display a desired page.
3 Enter values in required setting items.
4 Press soft key [SIMPLE SET] to return to the SIMPLE Setting screen.

> **NOTE**
> When "NETWORK" is "ONLINE" or "STATE" is "ENABLE", the values of setting items are displayed only and cannot be changed. To change values, set "NETWORK" to "OFFLINE" and "STATE" to "DISABLE".





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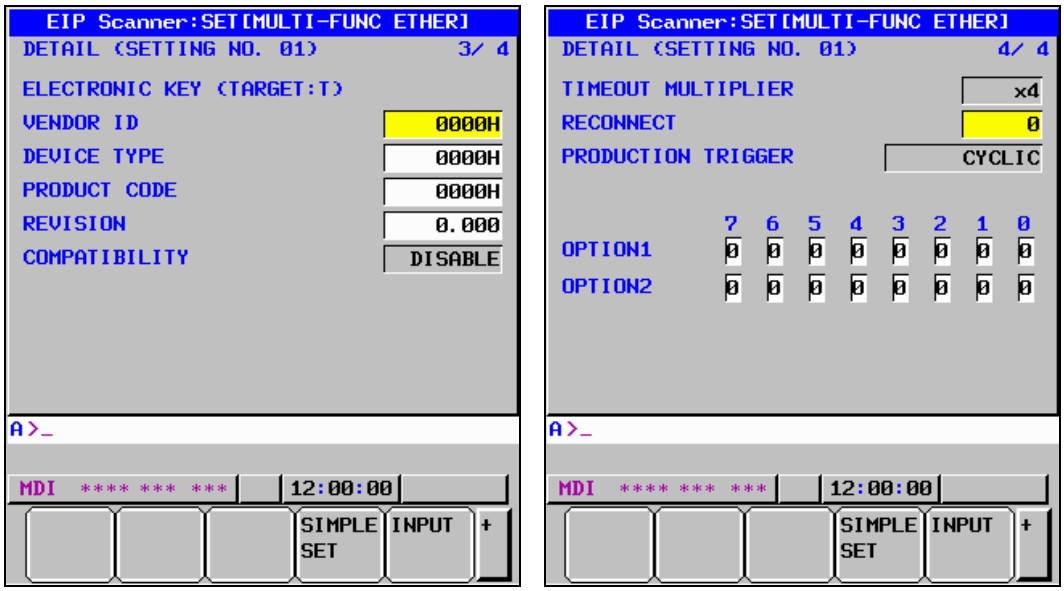

EtherNet/IP Scanner setting screen (DETAIL 1/4, 2/4, 3/4, 4/4)

Setting items

Item	Description
TRANSPORT TYPE Default: UNICAST	Specify the one-to-many or one-to-one mode for data transport between the target (adapter) and originator (scanner). MULTICAST: One-to-many mode UNICAST: One-to-one mode (also called Point-to-Point) The value can be changed only for the T => O direction. For the O => T direction, the value is fixed to "UNICAST". Use soft keys for setting. Press soft key [TRANSPORT], then select [MULTICAST] or [UNICAST].
HEADER FORMAT Default: T => O MODELESS O => T HEARTBEAT	Specify a header format used for data transport. RUN/IDLE: The 32-bit Run/Idle flag is used. MODELESS: The Run/Idle flag is not used and the size is 1 or more. HEARTBEAT: The Run/Idle flag is not used and the size is 0. When the O => T header format has not been changed from the default, the format is automatically changed to RUN/IDLE if the referenced size is 1 or more or to HEARTBEAT if the size is 0. When a value is specified from the screen, the specified value is used after that. Use soft keys for setting. Press soft key [HEADER FORMAT], then select [RUN/IDLE], [MODELESS], or [HEARTBEAT]. This setting depends on the adapter device. The following combinations are frequently used: Exclusive Owner T => O: MODELESS O => T: RUN/IDLE Input Only or Listen Only T => O: MODELESS O => T: HEARTBEAT

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Item	Description
PRIORITY Default: SCHEDULED	Specify the priority of EtherNet/IP data transport processing. LOW: Data is sent with low priority. HIGH: Data is sent with high priority. SCHEDULED: Data is sent regularly at the interval specified for RPI. URGENT: Data is sent with urgent priority. The value can be changed only for the priority of T => O data transport. For the priority of O => T data transport, the value is fixed to "SCHEDULED". Use soft keys for setting. Press soft key [PRIORITY], then select [LOW], [HIGH], [SCHEDULE], or [URGENT].
ELECTRONIC KEY	If you want to specify the destination adapter device to avoid connecting an unintended adapter device, specify values for [VENDOR ID] to [COMPATIBILITY] below. If you do not want to specify an adapter device, keep them to the defaults. The adapter device compares electronic key information sent from the scanner device in a connection request with the adapter device information it has. If they are not the same, the adapter device refuses the connection request.
VENDOR ID Default: 0000H Valid setting range: 0000H to FFFFH	Specify the vendor ID of the adapter device. Specify 0 if no device information check is required.
DEVICE TYPE Default: 0000H Valid setting range: 0000H to FFFFH	Specify the device type of the adapter device. Specify 0 if no device information check is required.
PRODUCT CODE Default: 0000H Valid setting range: 0000H to FFFFH	Specify the product code of the adapter device. Specify 0 if no device information check is required.
REVISION Default: 0.000 Valid setting range: 0.0 to 127.255	Specify the revision of the adapter device. Use the following format: <major-number>.<minor-number> Specify 0.0 if no device information check is required.
COMPATIBILITY Default: DISABLE	Specify whether to check compatibility when comparing the specified electronic key information with the adapter device information. DISABLE (when all electronic key items have not been changed from the defaults): Electronic key information is not sent to the adapter device. Therefore, it is not compared with the adapter device information. DISABLE (when at least one item has been changed from the default): Electronic key information is sent to the adapter device and compared with the adapter device information, and comparing is executed with no compatibility. The connection is established only when the values of all items are the same as those in the adapter device information. ENABLE: Electronic key information is sent to the adapter device and compared with the adapter device information, and comparing is executed with compatibility. When the adapter device determines that there is compatibility, the connection can be established even if any electronic key information item is not the same as that in the adapter device information. To enable the adapter device to determine whether there is compatibility, specify the correct values for "VENDOR ID", "PRODUCT CODE", and the major number of "REVISION". Use soft keys for setting. Press soft key [COMPATIBILTY], then select [ENABLE] or [DISABLE].

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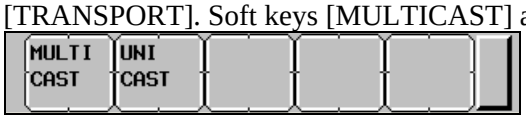
Item	Description
TIMEOUT MULTIPLIER Default: x4 Valid setting range: x4 to x512	Specify a multiplier used for calculating the timeout period for the sending/receiving of DI/DO data. Timeout period = RPI value of DI(T=>O) × timeout multiplier When the RPI value is 10 ms and the timeout multiplier is x4, if no data is received within 40 ms after the last data reception, a timeout is assumed and the connection is disconnected. Use soft keys for setting. Press soft key [TIMEOUT], then select [x4] to [x512].
RECONNECT Default: 0 Valid settings: 0 to 60 and blank	Specify the time until a reconnection request is issued after the connection is disconnected for some reason. The unit is seconds. If reconnection fails, a reconnection request is issued again after the specified time. ---: No reconnection is made. To specify this value, enter " " (blank). 0 to 60: A reconnection request is issued when the specified time has elapsed. Value 0 (default) means 10 seconds.
PRODUCTION TRIGGER Default: CYCLIC	Specify the timing at which the adapter device sends data. CYCLIC: The adapter device sends data regularly according to the specified RPI value. CHANGE STATE: The adapter device sends data regularly according to the specified RPI value. It also sends data when the value of a DO signal changes. APPLICATION: The adapter device sends data regularly according to the specified RPI value. It can also send data at a desired timing. The timing at which the scanner (CNC) sends data is fixed to "CYCLIC". Use soft keys for setting. Press soft key [PRODCT TRIGER], then select [CYCLIC], [CHANGE STATE], or [APPLICATION].
OPTION1 Default: 00000000	Bits 0-7: Reserved. (Must be 0.)
OPTION2 Default: 00000000	Bits 0-7: Reserved. (Must be 0.)

Operations

Changing the TRANSPORT TYPE setting

1 On page 1, press soft key [TRANSPORT]. Soft keys [MULTICAST] and [UNICAST] appear.



2 Press the soft key corresponding to the value you want to set.

Changing the HEADER FORMAT setting

1 On page 1 or 2, press soft key [HEADER FORMAT]. Soft keys [RUN/IDLE], [MODELESS] and [HEARTBEAT] appear.

2 Press the soft key corresponding to the value you want to set.

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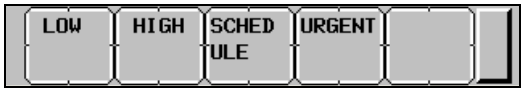
Changing the PRIORITY setting

1 On page 1, press soft key [PRIORITY]. Soft keys [LOW], [HIGH], [SCHEDULE], and [URGENT] appear.



2 Press the soft key corresponding to the value you want to set.

Changing the COMPATIBILITY setting

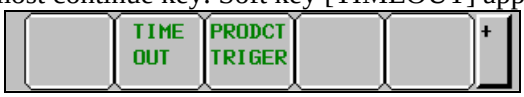
1 On page 3, press the rightmost continue key. Soft key [COMPATIBILTY] appears.

2 Press soft key [COMPATIBILTY]. Soft keys [ENABLE] and [DISABLE] appear.

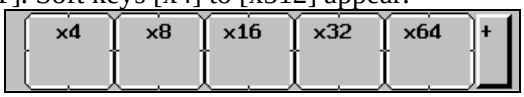
3 Press the soft key corresponding to the value you want to set.

Changing the TIMEOUT MULTIPLIER setting

1 On page 4, press the rightmost continue key. Soft key [TIMEOUT] appears.



2 Press soft key [TIMEOUT]. Soft keys [x4] to [x512] appear.



3 Press the soft key corresponding to the value you want to set.

Changing the PRODUCTION TRIGGER setting

1 On page 4, press the rightmost continue key. Soft key [PRODCT TRIGER] appears.

2 Press soft key [PRODCT TRIGER]. Soft keys [CYCLIC], [CHANGE STATE], and [APPLICATION] appear.

3 Press the soft key corresponding to the value you want to set.

Returning to the SIMPLE setting screen

Press soft key [SIMPLE SET] to return to the SIMPLE setting screen.

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1.3.8 Outputting an EDS File

This subsection explains the method for outputting an EDS file to a memory card or USB memory.
For details of data to be output to an EDS file and the default file name, see Subsection 2.1.2, "EDS File".

A memory card or USB memory is available as the input/output device to which to output an EDS file. To select an input/output device, use parameter No. 20. For details of this parameter, see Section 4.1, "PARAMETER RELATED TO DATA INPUT/OUTPUT" in Part II, "COMMON".

> ⚠ **CAUTION**
> While an external input/output device such as a memory card or USB memory is being accessed, do not turn the power to the CNC off or remove the external input/output device. Doing so may damage the external input/output device.

> **NOTE**
> 1 An EDS file can be output only in the MDI or EDIT mode, or emergency stop state.
> 2 When the 8-level data protection function is enabled, whether an EDS file can be output depends on the setting for the Ethernet function for the 8-level data protection function.
> 3 Any input/output device other than a memory card or USB memory cannot be used to output an EDS file.

Procedure

1 Press function key

.
2 Soft key [ETHERNET] appears. When the soft key does not appear, press the continue key.
3 Press soft key [ETHERNET]. The Ethernet function setting screen appears.
4 Press soft key [EIP S SET]. The EtherNet/IP Scanner setting screen appears. When the soft key does not appear, press the continue key.
5 Press soft key [(OPRT)], then soft key [+]. The soft key for outputting an EDS file [EDS OUTPUT] appears.
6 Press soft key [EDS OUTPUT]. Soft keys [EXECUTE] and [CANCEL] appear.
7 Enter the file name of an EDS file in the key-in buffer and press soft key [EXECUTE]. The EDS file is output. When no file name is specified, the default file name is used. "EXECUTING" blinks during execution.

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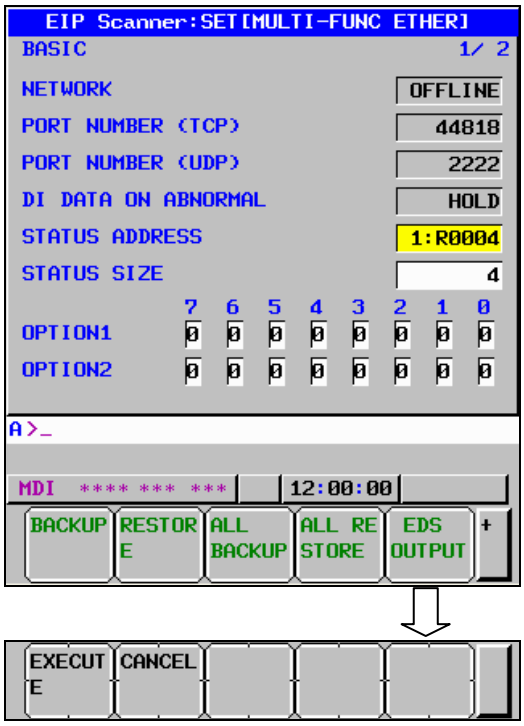

1.3.9 Initializing a Communication Setting

On the LIST screen, the communication setting selected by the cursor can be initialized.

Procedure

1 Press function key SYSTEM.
2 Soft key [ETHERNET] appears. When the soft key does not appear, press the continue key.
3 Press soft key [ETHERNET]. The Ethernet function setting screen appears.
4 Press soft key [EIP S SET]. The EtherNet/IP Scanner setting screen appears. When the soft key does not appear, press the continue key.
5 Use page keys PAGE ⇧ PAGE ⇩ to display the LIST screen on page 2.
6 Press soft key [(OPRT)], then soft key [+] twice. The soft key for initialization [INITIALIZE] appears.
7 Move the cursor and select a communication setting you want to initialize.
8 Press soft key [INITIALIZE]. Soft keys [EXECUTE] and [CANCEL] appear.
9 Press soft key [EXECUTE]. The selected communication setting is initialized.

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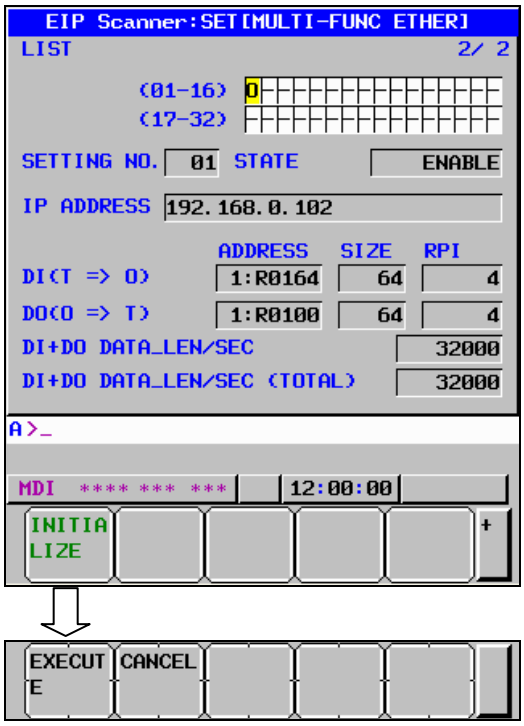

1.3.10 Sorting Communication Settings

Thirty two communication settings can be sorted in ascending order of IP addresses.

NOTE

Once communication settings are sorted, they cannot be arranged in the previous order.

⚠ CAUTION

Whether to enable or disable the setting, whether the connection is established, and other information for each communication setting can be output as the status to the PMC area in ascending order of communication setting numbers. When the communication settings are sorted and the order in which they are arranged is changed, the order in which their information is output as the status is also changed, resulting in a loss of consistency with the ladder program.

Procedure

1. Press function key SYSTEM.
2. Soft key [ETHERNET] appears. When the soft key does not appear, press the continue key.
3. Press soft key [ETHERNET]. The Ethernet function setting screen appears.
4. Press soft key [EIP S SET]. The EtherNet/IP Scanner setting screen appears. When the soft key does not appear, press the continue key.
5. Use page keys PAGE ⇧ PAGE ⇩ to display the LIST screen on page 2.
6. Press soft key [(OPRT)], then soft key [+] twice. The soft key for sorting [SORT] appears.
7. Press soft key [SORT]. Soft keys [EXECUTE] and [CANCEL] appear.
8. Press soft key [EXECUTE]. The 32 communication settings are sorted in ascending order of IP addresses.

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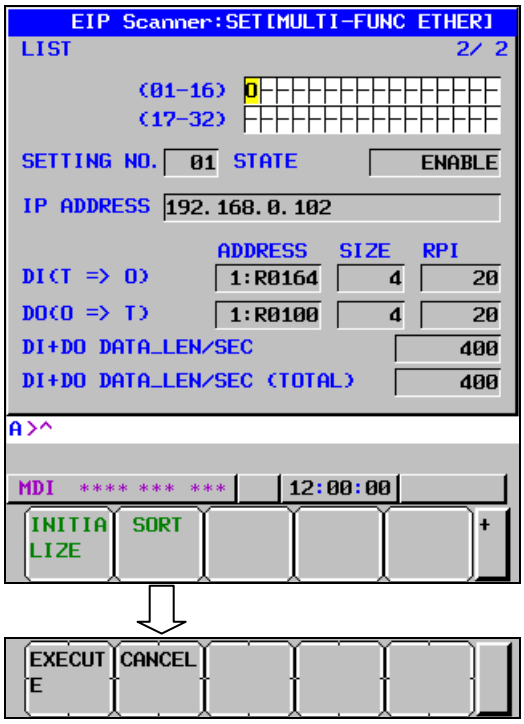


1.4 MAINTENANCE

The EtherNet/IP Scanner function can be used on one or two hardware options. Like the setting screens, the maintenance screens of these hardware options are independent of each other. On the screen for each hardware option, perform required operations.

Procedure for displaying the screen

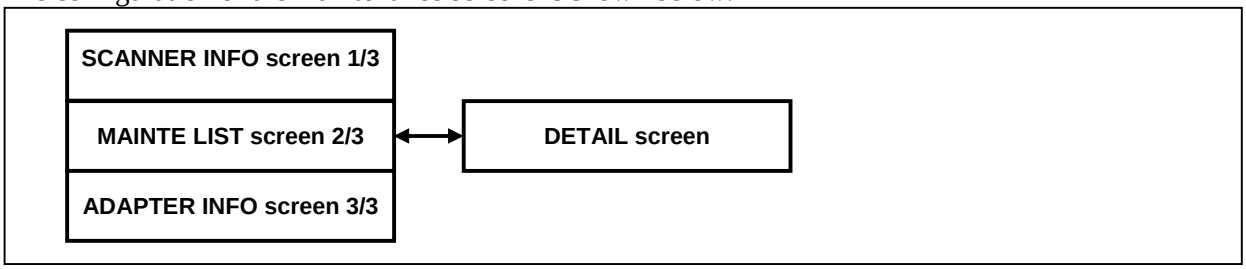
To display the maintenance screen, follow the instructions in Subsection 2.4.1, "Displaying Screens" in Part II, "COMMON".

This section explains procedures using examples when the EtherNet/IP Scanner function runs on a hardware on which the Ethernet function runs. When the EtherNet/IP Scanner function runs on a hardware option on which the Ethernet function does not run, read soft key [ETHERNET] as [EtherNet/IP].

1.4.1 Configuration of the EtherNet/IP Scanner Maintenance Screens

This subsection explains the maintenance screens for the EtherNet/IP Scanner function.

The configuration of the maintenance screens is shown below.



Configuration of the maintenance screens for the EtherNet/IP Scanner function

The SCANNER INFO screen allows you to confirm information related to the CNC Scanner function.

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The MAINTE LIST screen shows a list of information of an adapter being connected. From this screen, you can move to the DETAIL screen.
The DETAIL screen allows you to confirm detailed information of an adapter being connected.
The ADAPTER INFO screen allows you to confirm information of an adapter device that is acquired by specifying an IP address.

NOTE
As maintenance screens, the PING screen, COM STATE screen, and TASK STATE screen common to Industrial Ethernet are also provided.
For details of these screens, see Chapter 2, "SOFTWARE MAINTENANCE INFORMATION" in Part V, "MAINTENANCE".

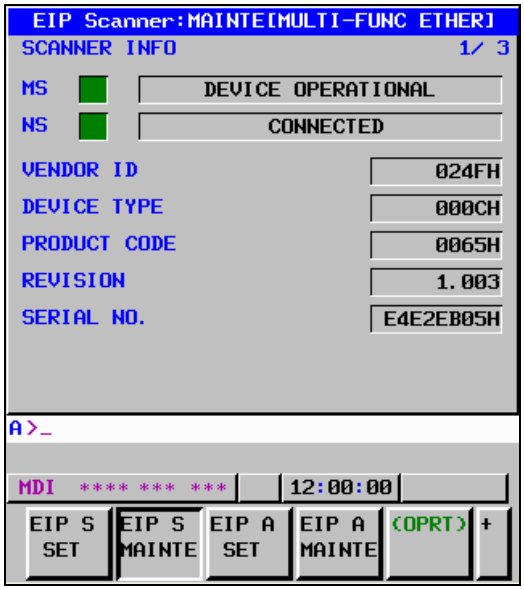
1.4.2 SCANNER INFO Screen, MAINTE LIST Screen, and ADAPTER INFO Screen

Procedure

1 Press function key SYSTEM.
2 Soft key [ETHERNET] appears. When the soft key does not appear, press the continue key.
3 Press soft key [ETHERNET]. The Ethernet function setting screen appears.
4 Press soft key [EIP S MAINTE]. When the soft key does not appear, press the continue key.
5 The SCANNER INFO screen (page 1) appears. Use page keys PAGE ⇧ PAGE ⇩ to display a desired page.

SCANNER INFO screen

The SCANNER INFO screen is displayed on page 1. This screen allows you to confirm information related to the CNC Scanner function, including the MS and NS LED information, vendor ID, and device type.



EtherNet/IP Scanner maintenance screen (SCANNER INFO)

Display items

Item	Description
MS	The indication of the Module Status LED and its meaning are displayed.
NS	The indication of the Network Status LED and its meaning are displayed.
VENDOR ID	The vendor ID of the scanner is displayed in hexadecimal.

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Item	Description
DEVICE TYPE	The device type of the scanner is displayed in hexadecimal.
PRODUCT CODE	The product code of the scanner is displayed in hexadecimal.
REVISION	The revision of the scanner is displayed.
SERIAL NO.	The serial number of the scanner is displayed in hexadecimal.

The indications of the MS LED and their meanings are listed below.

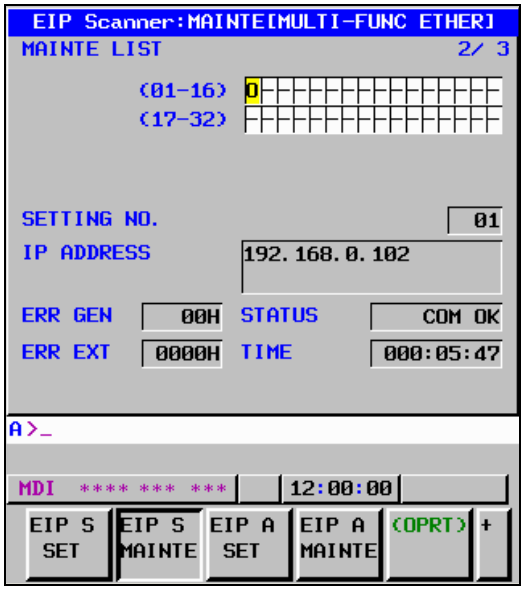
Indication of the MS LED	Meaning
Off	DISABLE FUNCTION
Flashing (green)	STANDBY
On (green)	DEVICE OPERATIONAL
Flashing (red)	RECOVERABLE FAULT
On (red)	UNRECOVERABLE FAULT

The indications of the NS LED and their meanings are listed below.

Indication of the NS LED	Meaning
Off (MS is also off)	---
Off	NO IP ADDRESS
Flashing (green)	NO CONNECTIONS
On (green)	CONNECTED
On (red)	DUPLICATE IP ADDRESS

MAINTE LIST screen

The MAINTE LIST screen is displayed on page 2. The screen shows the status of the communication setting selected by the cursor.



EtherNet/IP Scanner maintenance screen (MAINTE LIST)

Display items

Item	Description
MAINTE LIST	The status of each communication setting is displayed. O: I/O communication is in progress. E: A communication error occurs. I/O communication is not executed. -: The communication setting is in the disabled state.
SETTING NO.	Number of the communication setting.
IP ADDRESS	IP address of the communication setting. When the host name is specified on the SIMPLE setting screen, the converted IP address is displayed.

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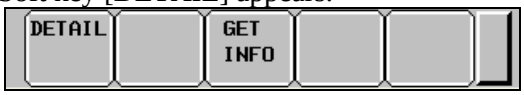
Item	Description
STATUS	Status of the communication setting. The string in parentheses indicates the corresponding symbol displayed in MAINTE LIST. COM OK (O): I/O communication is in progress. COM ERROR (E): A communication error occurs. I/O communication is not executed. DISABLE (-): The communication setting is in the disabled state.
ERR GEN	When "COM ERROR" is displayed for "STATUS", the error codes indicating the cause are displayed. The error codes are defined in the EtherNet/IP specification. For details of the error codes and their meanings, see Subsection 1.6.3, "EtherNet/IP Error Codes".
ERR EXT	
TIME	The time during which the device is connected is displayed in format HHH:MM:SS. The maximum value is 999:59:59.

Operations

Moving to the DETAIL screen

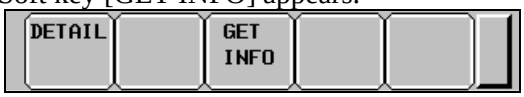
1 Press soft key [(OPRT)]. Soft key [DETAIL] appears.



2 Press soft key [DETAIL] to move to the DETAIL screen.

Moving to the ADAPTER INFO screen and acquiring information

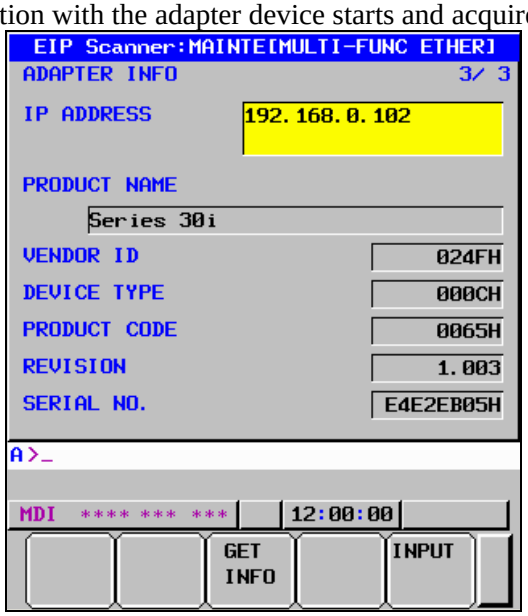
1 Press soft key [(OPRT)]. Soft key [GET INFO] appears.



2 Press soft key [GET INFO] to move to the ADAPTER INFO screen and acquire information.

ADAPTER INFO screen

The ADAPTER INFO screen is displayed on page 3. Enter a value in item "IP ADDRESS" and press soft key [GET INFO]. Communication with the adapter device starts and acquired information is displayed.



EtherNet/IP Scanner maintenance screen (ADAPTER INFO)

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> ⚠ **CAUTION**
> Depending on the adapter device, I/O data transport may stop when information is acquired from this screen during I/O data transport. Acquire information from this screen only for confirming the destination device at the startup of the network. Do not acquire information from this screen during I/O data transport after the start of operation.

Setting item

Item	Description
IP ADDRESS	Specify the IP address or host name of the adapter device for which to acquire information.

Display items

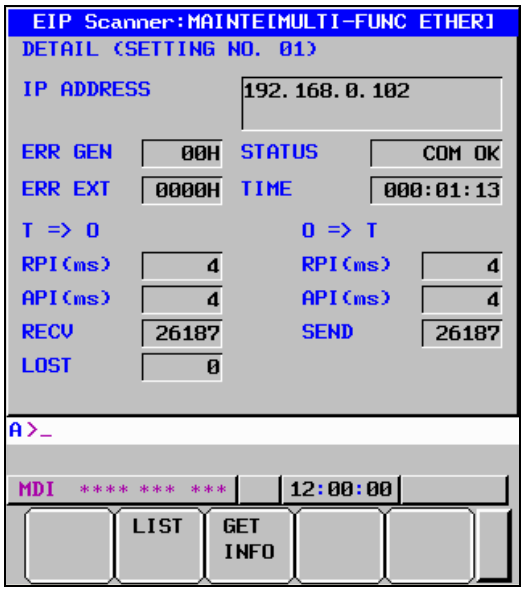
Item	Description
PRODUCT NAME	The acquired product name is displayed. "GET INFO ERROR" is displayed if acquisition fails.
VENDOR ID	The acquired vendor ID is displayed.
DEVICE TYPE	The acquired device type is displayed.
PRODUCT CODE	The acquired product code is displayed.
REVISION	The acquired revision is displayed.
SERIAL NO.	The acquired serial number is displayed.

1.4.3 DETAIL Screen

The DETAIL screen shows detailed information of a connected adapter.

Procedure

1 On the MAINTE LIST screen, move the cursor and select a communication setting.
2 Press soft key [DETAIL] to move to the DETAIL screen.



EtherNet/IP Scanner maintenance screen (DETAIL)

Display items

Item	Description
IP ADDRESS	IP address specified for the selected communication setting.

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Item	Description
STATUS	Same as those displayed on the MAINTE LIST screen.
ERR GEN	
ERR EXT	
TIME	
RPI(ms)	The value specified for RPI on the SIMPLE setting screen is displayed. The unit is milliseconds.
API(ms)	API (Actual Packet Interval) is the interval at which the EtherNet/IP Scanner function actually receives and sends DI/DO data. O => T means the DO data sending interval, and T => O means the DI data receiving interval. The unit is milliseconds.
RECV	The number of packets the EtherNet/IP Scanner function normally received is displayed. The display data range is from 0 to 65535. When the value exceeds 65535, it returns to 0.
LOST	The number of packets the EtherNet/IP Scanner function could not receive normally is displayed. The display data range is from 0 to 65535. When the value exceeds 65535, it returns to 0.
SEND	The number of packets the EtherNet/IP Scanner function sent is displayed. The display data range is from 0 to 65535. When the value exceeds 65535, it returns to 0.

Operations

Returning to the MAINTE LIST screen

Press soft key [LIST] to return to the MAINTE LIST screen.

Moving to the ADAPTER INFO screen

Press soft key [GET INFO] to move to the ADAPTER INFO screen and acquire information.

1.4.4 LOG Screen

The LOG screen shows log data related to the EtherNet/IP Adapter and Scanner functions.

Procedure

1 Press function key .

2 Perform either of the following operations:
- To display log data of the EtherNet/IP function running on a hardware option on which the Ethernet function runs, press soft key [ETHER LOG]. The "LOG screen" for Ethernet appears.
- To display log data of the EtherNet/IP function running on a hardware option on which the Ethernet function does not run, press soft key [Eth/IP LOG]. The "LOG screen" for EtherNet/IP appears.

When the soft key does not appear, press the continue key.

3 Press soft key [ETHERNET/IP]. Log data related to the EtherNet/IP function is displayed.

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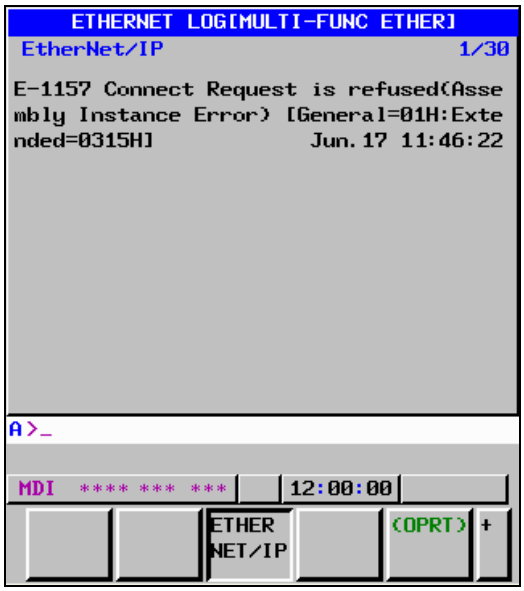

EtherNet/IP function LOG screen

The latest log data is displayed at the top of the screen. At the right end of log data, the date and time when the log data occurred are displayed. The date and time are displayed in format "MMM.DD hh:mm:ss", where MMM represents a month, DD represents a day, hh represents hours, mm represents minutes, and ss represents seconds.

Operation

To clear the log data, press soft key [(OPRT)], then [CLEAR].

> **NOTE**
> The log information of the EtherNet/IP function is stored in volatile memory, and it is cleared when the power to the CNC is turned off.
> Check log information before turning the power off when an error occurs.

The following table lists main log messages.
In item "A/S", "A" means an Adapter function log message and "S" means a Scanner function log message.
XX indicates a general error code and YY indicates an extended error code. For details of these error codes, see Subsection 1.6.3, "EtherNet/IP Error Codes".

Error code	Log message	A/S	Meaning
E-1107	EtherNet/IP function and FL-net function cannot be used at the same time	A S	The setting is made so that the EtherNet/IP and FL-net functions run on the same hardware. Confirm the values of parameters Nos. 970 to 972.
E-1109	All Connections of EtherNet/IP Adapter are busy [General=XXH:Extended=YYH]	A	A connection request sent from the scanner was refused because the maximum number (32) of connections exceeded.
	All Connections of EtherNet/IP Adapter are busy [General=XXH:Extended=YYH:Scanner]	S	A connection request sent to the adapter was refused because all connections of the adapter were being used.
E-110A	Connect Request from EtherNet/IP Scanner is refused [General=XXH:Extended=YYH]	A	An unacceptable connection request was sent from the scanner.
E-110B	Connect Request from EtherNet/IP Scanner is refused (RPI Error) [General=XXH:Extended=YYH]	A	An unacceptable connection request was sent from the scanner. The RPI specified from the scanner is beyond the acceptable value range (4 to 10,000 ms).

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Error code	Log message	A/S	Meaning
E-110C	Connect Request from EtherNet/IP Scanner is refused (DI/DO Size Error) [General=XXH:Extended=YYH]	A	An unacceptable connection request was sent from the scanner. The DI or DO size specified from the scanner is different from the size specified in the allocation setting.
E-110D	Connect Request from EtherNet/IP Scanner is refused (Assembly Instance Error) [General=XXH:Extended=YYH]	A	An unacceptable connection request was sent from the scanner. An instance of the Assembly object specified from the scanner is not found in the Adapter function. An instance of the Assembly object is created when the allocation setting is enabled. Check whether the allocation setting is enabled.
E-110E	[Connection has timed out. (Adapter:UU)]	A	The connection with allocation setting number UU timed out.
	[Connection has timed out. (Scanner:VV)]	S	The connection with communication setting number VV timed out.
E-110F	[Connection has closed. (Adapter:UU)]	A	The connection with allocation setting number UU was closed.
	[Connection has closed. (Scanner:VV)]	S	The connection with communication setting number VV was closed.
E-1151	Response from EtherNet/IP Adapter was not received [General=XXH:Extended=YYH]	S	Although a connection request was sent to the adapter, no response was received. Check whether the power to the adapter is on and whether the adapter is connected to the network correctly.
E-1152	Error Response from EtherNet/IP Adapter was received [General=XXH:Extended=YYH]	S	An error response was received from the adapter.
E-1153	Connect Request is refused [General=XXH:Extended=YYH]	S	A connection request from the scanner was refused by the adapter.
E-1154	Connect Request is refused (DI/DO Size Error) [General=XXH:Extended=YYH]	S	A connection request from the scanner was refused by the adapter. The DI/DO size specified by the scanner is different from the size for the adapter.
E-1155	Connect Request is refused (RPI Error) [General=XXH:Extended=YYH]	S	A connection request from the scanner was refused by the adapter. The RPI specified by the scanner cannot be accepted with the adapter.
E-1156	Connect Request is refused (Electronic Key Mismatch) [General=XXH:Extended=YYH]	S	A connection request from the scanner was refused by the adapter. The electronic key data specified by the scanner is different from the data of the adapter.
E-1157	Connect Request is refused (Assembly Instance Error) [General=XXH:Extended=YYH]	S	A connection request from the scanner was refused by the adapter. The assembly instance specified by the scanner is not found in the adapter.

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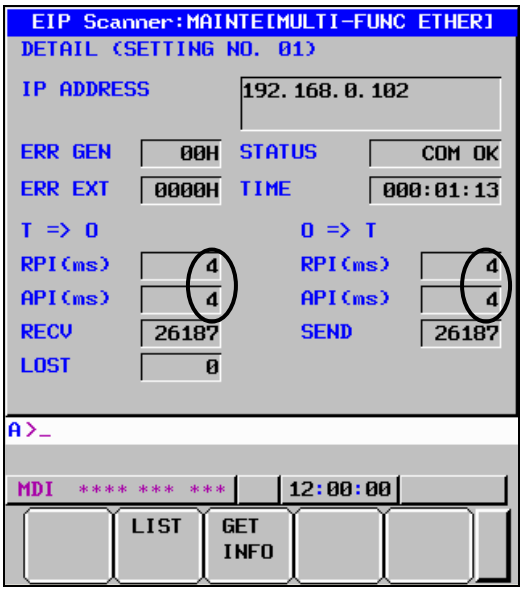
1.5 COMMUNICATION CONDITIONS

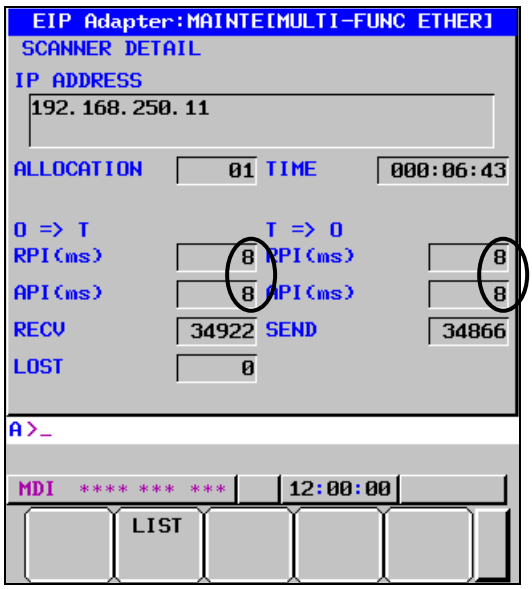
For stable EtherNet/IP communication, it is important to use devices with the setting with which the communication load does not exceed the performance of these devices.
This section gives guidelines for using both the EtherNet/IP Adapter and Scanner functions under appropriate load.

1.5.1 RPI and API

RPI (Requested Packet Interval) is a setting for a data sending interval in EtherNet/IP communication. API (Actual Packet Interval) indicates an interval at which the EtherNet/IP function actually sends and receives data. These values can be checked on the DETAIL Scanner maintenance screen and SCANNER DETAIL Adapter maintenance screen.



EtherNet/IP Scanner maintenance screen (DETAIL)



EtherNet/IP Adapter maintenance screen (SCANNER DETAIL)

	Direction	Meanings of RPI and API	Judgment of the values
Scanner maintenance screen	**T => O**	RPI: Setting for the adapter data sending interval API: Interval at which the scanner receives data from the adapter	Reception from the remote device is: RPI = API: In time RPI < API: Not in time
	O => T	RPI: Setting for the scanner data sending interval API: Interval at which the scanner sends data to the adapter	Sending from the local CNC is: RPI = API: In time RPI < API: Not in time
Adapter maintenance screen	**O => T**	RPI: Setting for the scanner data sending interval API: Interval at which the adapter receives data from the scanner	Reception from the remove device is: RPI = API: In time RPI < API: Not in time
	T => O	RPI: Setting for the adapter data sending interval API: Interval at which the adapter sends data to the scanner	Sending from the local CNC is: RPI = API: In time RPI < API: Not in time

Confirm that the API and RPI values are almost the same. If the API and RPI values are greatly different or the API value changes periodically and is unstable, processing of the CNC may not be in time.

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If reception from the remote device is not in time as listed in the above table, send processing of the remote device may not be in time and/or receive processing of the local CNC may not be in time. If sending from the local CNC is not in time, send processing of the local CNC may not be in time. In this case, specify a greater value for RPI to give a margin.

There is another method for confirming the load; first set a value smaller than the required value for RPI, then confirm that API is not greatly different from RPI. With this method, it can be confirmed whether there is still margin in processing when RPI is set to the required value.
The minimum value of RPI is 4 ms. A value smaller than this value cannot be specified.

NOTE

In the CNC, the EtherNet/IP function is executed with priority higher than other Ethernet functions including FOCAS2/Ethernet functions and CNC screen display function. For this reason, to use the EtherNet/IP function together with other Ethernet functions, it is necessary to give a margin enough for processing the EtherNet/IP function. Otherwise, time to process other Ethernet functions cannot be assigned, and these functions may not be executed normally.

1.5.2 Estimating the Communication Load

This subsection explains the method for estimating the load based on the communication settings.
When running the EtherNet/IP function on two hardware options, check the communication load individually on these hardware options.

The communication load can be estimated based on the RPI and data size values specified for the connections. These connections include both connections created by the Adapter function and those created by the Scanner function.
For stable communication, set the RPI value so that the following conditional expression is satisfied.

For all connections created by the Adapter and Scanner functions

$$\text{Total of } \left(\frac{\text{DI size (bytes)} + 180}{\text{DI RPI (ms)}} + \frac{\text{DO size (bytes)} + 180}{\text{DO RPI (ms)}} \right) \leqq 300$$

When the size is 0, do not omit the relevant item, and add the 180/RPI value.

Example) When only the Scanner function is used
- DI/DO = 8/8 bytes, RPI = 8 ms, 2 units
- DI/DO = 12/12 bytes, RPI = 30 ms, 10 units
- DI/DO = 32/0 bytes, RPI = 30 ms, 2 units

$$\left(\frac{8+180}{8} + \frac{8+180}{8} \right) \times 2 + \left(\frac{12+180}{30} + \frac{12+180}{30} \right) \times 10 + \left(\frac{32+180}{30} + \frac{0+180}{30} \right) \times 2 = 248.1$$

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NOTE

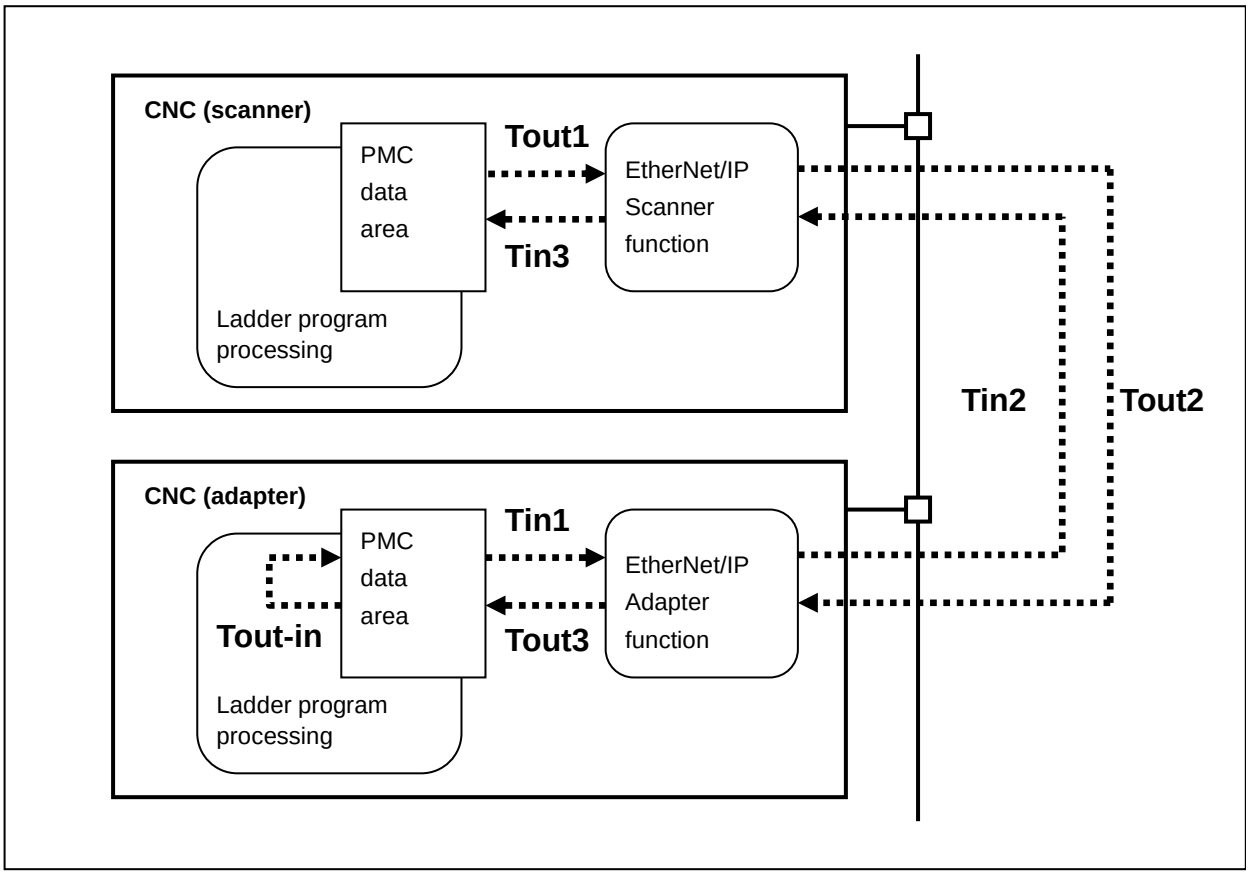
The communication load estimated according to the above conditional expression is just a standard value and does not guarantee performance. When other Ethernet functions including the FOCAS2/Ethernet functions and CNC screen display function are used in addition to the EtherNet/IP function, give an enough margin for the setting to use these functions.

1.5.3 Input/Output Response Time

This subsection explains the input/output response time seen from the scanner when the CNC is used for both an adapter and scanner.

The input/output response time seen from the scanner is the total time of the following sequence; an output signal is set by the ladder program in the scanner, the adapter is notified of the signal value, the ladder program in the adapter performs input/output processing, the scanner is notified of an input signal, and the ladder program in the scanner recognizes the input signal.

Input/output response time seen from the scanner = Tout1 + Tout2 + Tout3 + Tout-in + Tin1 + Tin2 + Tin3



Scanner output data reading time (Tout1)

Time from when the ladder program sets an output signal in the PMC data area until the value of the signal is passed to the EtherNet/IP Scanner function. When O => T RPI is smaller than 32 ms, this time is the same as RPI. When O => T RPI is 32 ms or longer, the time is fixed to 32 ms.

Scanner output processing time (Tout2)

Time from when the EtherNet/IP Scanner function receives the value of the signal until the EtherNet/IP Adapter function receives the value sent by the Scanner function via the network. The EtherNet/IP Scanner function sends a signal to the network at intervals of API (RPI).

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It takes Ethernet transmission time until data sent to the network is received by the adapter, but the time can be estimated to be almost 0. Therefore, the maximum value is API (RPI).

Adapter input data writing time (Tout3)

Time from when the EtherNet/IP Adapter function receives data from the network until the CNC copies the data in the PMC data area.
The CNC copies data in the PMC data area immediately when it receives the data. Therefore, the time can be estimated to be almost 0.

Adapter ladder program processing time (Tout-in)

The ladder program runs in a cycle that is a multiple of 4 or 8 ms according to its size.
The actual time can be measured with "SCAN TIME" on the PMC STATUS screen.

Adapter output data reading time (Tin1)

Time from when the ladder program sets an output signal in the PMC data area until the value of the signal is passed to the EtherNet/IP Adapter function.
When RPI is smaller than 32 ms, this time is the same as RPI. When RPI is 32 ms or longer, the time is fixed to 32 ms.

Adapter output processing time (Tin2)

Time from when the EtherNet/IP Adapter function receives the value of the signal until the EtherNet/IP Scanner function receives the value sent from the Adapter function via the network.
The EtherNet/IP Adapter function sends a signal to the network at intervals of API (RPI).
It takes Ethernet transmission time until data sent to the network is received by the scanner, but the time can be estimated to be almost 0. Therefore, the maximum value is API (RPI).

Scanner input data writing time (Tin3)

Time from when the EtherNet/IP Scanner function receives data from the network until the CNC passes the data to the PMC data area in which the ladder program processes the data.
The CNC copies data in the PMC data area immediately when it receives the data. Therefore, the time can be estimated to be almost 0.

NOTE

1 In the CNC, the time from when the ladder program sets a value in a signal until the data is sent to the Ethernet line is as follows:
- Scanner function: Tout1 + Tout2
- Adapter function: Tin1 + Tin2

In both cases, the maximum value is determined as follows:
- When RPI is smaller than 32 ms: RPI × 2 (ms)
- When RPI is 32 ms or longer: RPI + 32 (ms)

2 When a connection is not established in Class 1 communication, the Tout1 value is fixed to 32 ms. Therefore, while Class 1 communication is not being executed, a value is updated every 32 ms when it is read in Explicit messaging. A value is reflected in the PMC data area immediately when it is written in Explicit messaging.

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1.6 APPENDIX

1.6.1 Examples of Connecting CNCs

This subsection explains examples of connections when both EtherNet/IP dapters and scanners are on CNCs.

1.6.1.1 Example of configuration (1)

This subsection explains parameter settings and other information to connect one EtherNet/IP scanner and two EtherNet/IP adapters.

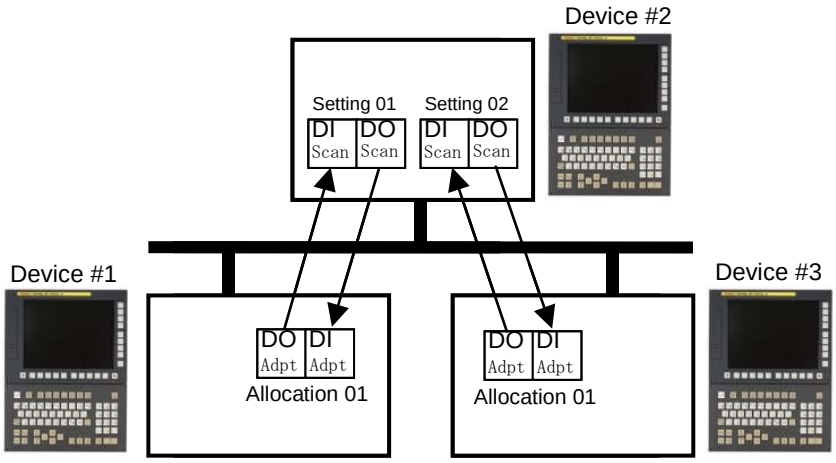
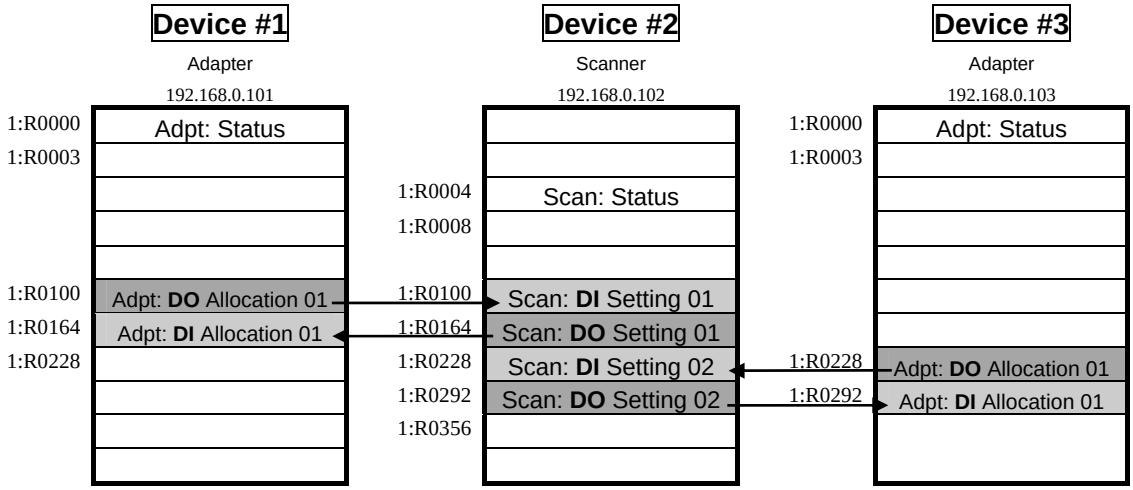


Fig. 1-1 Example of EtherNet/IP configuration (1)

Diagram of data exchange

In the above example, devices #1 and #3 act as an EtherNet/IP adapter and device #2 acts as an EtherNet/IP scanner. Therefore, device #2 can read DO data of the other two devices.



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Example of parameter setting

Parameters for device #1

Item of the Adapter function	Setting
DI DATA ON ABNORMAL	HOLD
STATUS ADDRESS	1:R0000
STATUS SIZE	3
OPTION1	00000000
OPTION2	00000000
ALLOCATION01	ENABLE
DI TYPE	01
DI ADDRESS	1:R0164
DI SIZE	64
DO TYPE	01
DO ADDRESS	1:R0100
DO SIZE	64
OPTION	00000000

Parameters for device #3

Item of the Adapter function	Setting
DI DATA ON ABNORMAL	HOLD
STATUS ADDRESS	1:R0000
STATUS SIZE	3
OPTION1	00000000
OPTION2	00000000
ALLOCATION01	ENABLE
DI TYPE	01
DI ADDRESS	1:R0292
DI SIZE	64
DO TYPE	01
DO ADDRESS	1:R0228
DO SIZE	64
OPTION	00000000

The default is hatched.

Parameters for device #2

Item of the Scanner function	Setting	Item of the Scanner function	Setting
DI DATA ON ABNORMAL	HOLD		
STATUS ADDRESS	1:R0004		
STATUS SIZE	4		
OPTION1	00000000		
OPTION2	00000000		
SETTING NO. 01	ENABLE	SETTING NO. 02	ENABLE
IP ADDRESS	192.168.0.101	IP ADDRESS	192.168.0.103
T => O ASSEMBLY INSTANCE	101	T => O ASSEMBLY INSTANCE	101
T => O SIZE	64	T => O SIZE	64
T => O RPI	4	T => O RPI	4
O => T ASSEMBLY INSTANCE	151	O => T ASSEMBLY INSTANCE	151
O => T SIZE	64	O => T SIZE	64
O => T RPI	4	O => T RPI	4
CONFIG	100	CONFIG	100
DATA UNIT	1-BYTE	DATA UNIT	1-BYTE
ENDIAN CHANGE	DISABLE	ENDIAN CHANGE	DISABLE
DI(T => O) TYPE	01	DI(T => O) TYPE	01
DI(T => O) ADDRESS	1:R0100	DI(T => O) ADDRESS	1:R0228
DO(O => T) TYPE	01	DO(O => T) TYPE	01
DO(O => T) ADDRESS	1:R0164	DO(O => T) ADDRESS	1:R0292
T => O TRANSPORT TYPE	UNICAST	T => O TRANSPORT TYPE	UNICAST
T => O HEADER FORMAT	MODELESS	T => O HEADER FORMAT	MODELESS
T => O PRIORITY	SCHEDULED	T => O PRIORITY	SCHEDULED
O => T TRANSPORT TYPE	UNICAST	O => T TRANSPORT TYPE	UNICAST
O => T HEADER FORMAT	RUN/IDLE	O => T HEADER FORMAT	RUN/IDLE
O => T PRIORITY	SCHEDULED	O => T PRIORITY	SCHEDULED
ELECTRONIC KEY VENDOR ID	0000H	ELECTRONIC KEY VENDOR ID	0000H
ELECTRONIC KEY DEVICE TYPE	0000H	ELECTRONIC KEY DEVICE TYPE	0000H
ELECTRONIC KEY PRODUCT CODE	0000H	ELECTRONIC KEY PRODUCT CODE	0000H
ELECTRONIC KEY REVISION	0.000	ELECTRONIC KEY REVISION	0.000

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Item of the Scanner function	Setting	Item of the Scanner function	Setting
ELECTRONIC KEY COMPATIBILITY	DISABLE	ELECTRONIC KEY COMPATIBILITY	DISABLE
TIMEOUT MULTIPLIER	x4	TIMEOUT MULTIPLIER	x4
RECONNECT	0	RECONNECT	0
PRODUCTION TRIGGER	CYCLIC	PRODUCTION TRIGGER	CYCLIC
OPTION1	00000000	OPTION1	00000000
OPTION2	00000000	OPTION2	00000000

The default is hatched.

1.6.1.2 Example of configuration (2)

This subsection explains parameter settings and other information to connect two EtherNet/IP scanners and one EtherNet/IP adapter.

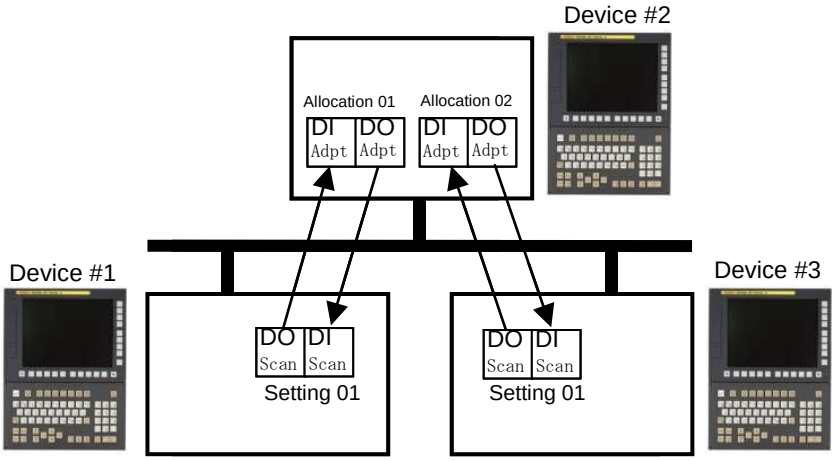
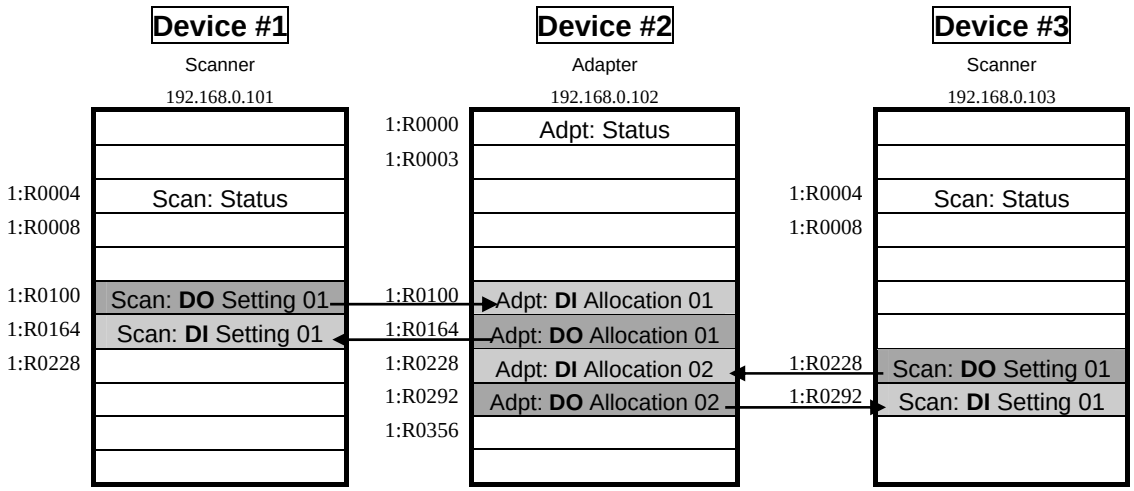


Fig. 1-2 Example of EtherNet/IP configuration (2)

Diagram of data exchange

In the above example, devices #1 and #3 act as an EtherNet/IP scanner and device #2 acts as an EtherNet/IP adapter. Therefore, device #2 can read DO data of the other two devices.



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Example of parameter setting

Parameters for device #1

Item of the Scanner function	Setting
DI DATA ON ABNORMAL	HOLD
STATUS ADDRESS	1:R0004
STATUS SIZE	4
OPTION1	00000000
OPTION2	00000000
SETTING NO. 01	ENABLE
IP ADDRESS	192.168.0.102
T => O ASSEMBLY INSTANCE	101
T => O SIZE	64
T => O RPI	4
O => T ASSEMBLY INSTANCE	151
O => T SIZE	64
O => T RPI	4
CONFIG	100
DATA UNIT	1-BYTE
ENDIAN CHANGE	DISABLE
DI(T => O) TYPE	01
DI(T => O) ADDRESS	1:R0164
DO(O => T) TYPE	01
DO(O => T) ADDRESS	1:R0100
T => O TRANSPORT TYPE	UNICAST
T => O HEADER FORMAT	MODELESS
T => O PRIORITY	SCHEDULED
O => T TRANSPORT TYPE	UNICAST
O => T HEADER FORMAT	RUN/IDLE
O => T PRIORITY	SCHEDULED
ELECTRONIC KEY VENDOR ID	0000H
ELECTRONIC KEY DEVICE TYPE	0000H
ELECTRONIC KEY PRODUCT CODE	0000H
ELECTRONIC KEY REVISION	0.000
ELECTRONIC KEY COMPATIBILITY	DISABLE
TIMEOUT MULTIPLIER	x4
RECONNECT	0
PRODUCTION TRIGGER	CYCLIC
OPTION1	00000000
OPTION2	00000000

Parameters for device #3

Item of the Scanner function	Setting
DI DATA ON ABNORMAL	HOLD
STATUS ADDRESS	1:R0004
STATUS SIZE	4
OPTION1	00000000
OPTION2	00000000
SETTING NO. 01	ENABLE
IP ADDRESS	192.168.0.102
T => O ASSEMBLY INSTANCE	102
T => O SIZE	64
T => O RPI	4
O => T ASSEMBLY INSTANCE	152
O => T SIZE	64
O => T RPI	4
CONFIG	100
DATA UNIT	1-BYTE
ENDIAN CHANGE	DISABLE
DI(T => O) TYPE	01
DI(T => O) ADDRESS	1:R0292
DO(O => T) TYPE	01
DO(O => T) ADDRESS	1:R0228
T => O TRANSPORT TYPE	UNICAST
T => O HEADER FORMAT	MODELESS
T => O PRIORITY	SCHEDULED
O => T TRANSPORT TYPE	UNICAST
O => T HEADER FORMAT	RUN/IDLE
O => T PRIORITY	SCHEDULED
ELECTRONIC KEY VENDOR ID	0000H
ELECTRONIC KEY DEVICE TYPE	0000H
ELECTRONIC KEY PRODUCT CODE	0000H
ELECTRONIC KEY REVISION	0.000
ELECTRONIC KEY COMPATIBILITY	DISABLE
TIMEOUT MULTIPLIER	x4
RECONNECT	0
PRODUCTION TRIGGER	CYCLIC
OPTION1	00000000
OPTION2	00000000

The default is hatched.

Parameters for device #2

Item of the Adapter function	Setting	Item of the Adapter function	Setting
DI DATA ON ABNORMAL	HOLD		
STATUS ADDRESS	1:R0000		
STATUS SIZE	3		
OPTION1	00000000		
OPTION2	00000000		
ALLOCATION01	ENABLE	ALLOCATION02	ENABLE
DI TYPE	01	DI TYPE	01

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Item of the Adapter function	Setting	Item of the Adapter function	Setting
DI ADDRESS	1:R0100	DI ADDRESS	1:R0228
DI SIZE	64	DI SIZE	64
DO TYPE	01	DO TYPE	01
DO ADDRESS	1:R0164	DO ADDRESS	1:R0292
DO SIZE	64	DO SIZE	64
OPTION	00000000	OPTION	00000000

The default is hatched.

1.6.1.3 Example of configuration (3)

This subsection explains parameter settings and other information to send own DO data to the other devices.

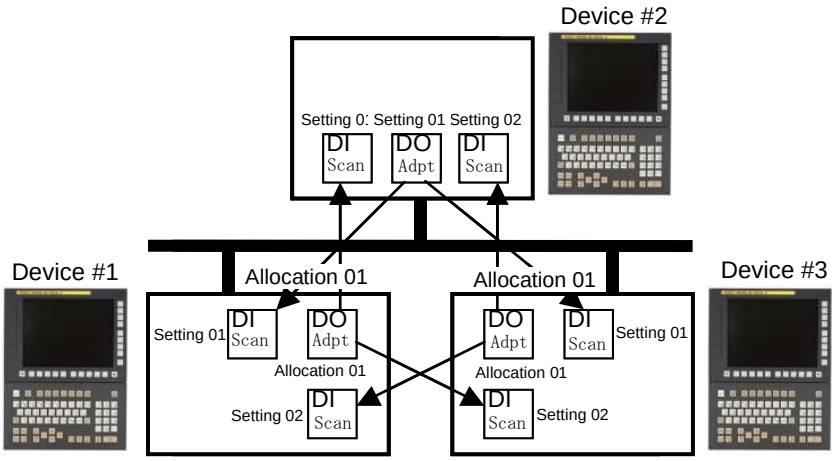
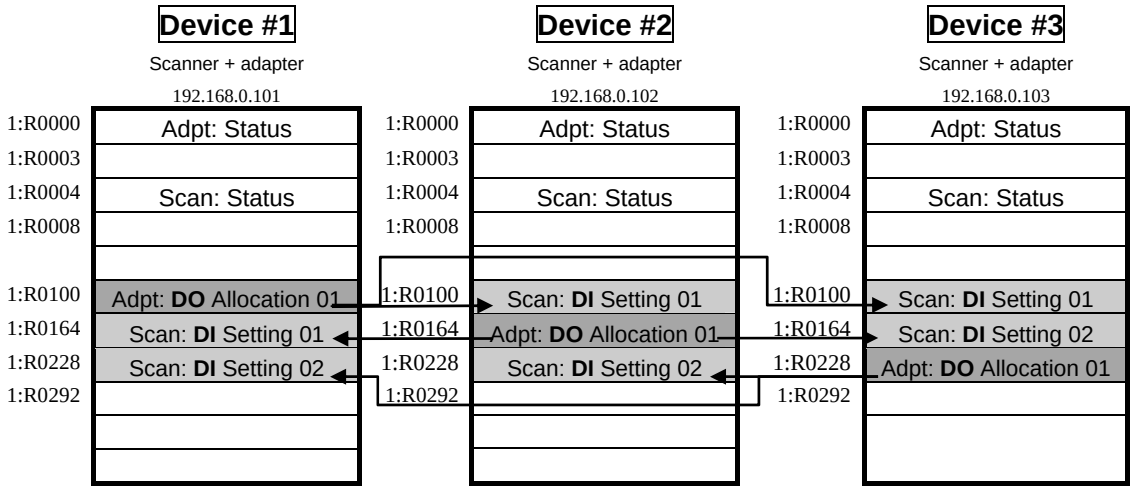


Fig. 1-3 Example of EtherNet/IP configuration (3)

Diagram of data exchange

In the above example, all devices act as an EtherNet/IP scanner and EtherNet/IP adapter and send DO data by multicast. Therefore, all devices can read DO data of the other devices.



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Example of parameter setting

Parameters for device #1

Item of the Adapter function	Setting	Item of the Adapter function	Setting
DI DATA ON ABNORMAL	HOLD	ALLOCATION01	ENABLE
STATUS ADDRESS	1:R0000	DI TYPE	00
STATUS SIZE	3	DI ADDRESS	---
OPTION1	00000000	DI SIZE	0
OPTION2	00000000	DO TYPE	01
		DO ADDRESS	1:R0100
		DO SIZE	64
		OPTION	00000000

Item of the Scanner function	Setting	Item of the Scanner function	Setting
DI DATA ON ABNORMAL	HOLD		
STATUS ADDRESS	1:R0004		
STATUS SIZE	4		
OPTION1	00000000		
OPTION2	00000000		
SETTING NO. 01	ENABLE	SETTING NO. 02	ENABLE
IP ADDRESS	192.168.0.102	IP ADDRESS	192.168.0.103
T => O ASSEMBLY INSTANCE	101	T => O ASSEMBLY INSTANCE	101
T => O SIZE	64	T => O SIZE	64
T => O RPI	4	T => O RPI	4
O => T ASSEMBLY INSTANCE	254	O => T ASSEMBLY INSTANCE	254
O => T SIZE	0	O => T SIZE	0
O => T RPI	4	O => T RPI	4
CONFIG	100	CONFIG	100
DATA UNIT	1-BYTE	DATA UNIT	1-BYTE
ENDIAN CHANGE	DISABLE	ENDIAN CHANGE	DISABLE
DI(T => O) TYPE	01	DI(T => O) TYPE	01
DI(T => O) ADDRESS	1:R0164	DI(T => O) ADDRESS	1:R0228
DO(O => T) TYPE	00	DO(O => T) TYPE	00
DO(O => T) ADDRESS	---	DO(O => T) ADDRESS	---
T => O TRANSPORT TYPE	MULTICAST	T => O TRANSPORT TYPE	MULTICAST
T => O HEADER FORMAT	MODELESS	T => O HEADER FORMAT	MODELESS
T => O PRIORITY	SCHEDULED	T => O PRIORITY	SCHEDULED
O => T TRANSPORT TYPE	UNICAST	O => T TRANSPORT TYPE	UNICAST
O => T HEADER FORMAT	HEARTBEAT	O => T HEADER FORMAT	HEARTBEAT
O => T PRIORITY	SCHEDULED	O => T PRIORITY	SCHEDULED
ELECTRONIC KEY VENDOR ID	0000H	ELECTRONIC KEY VENDOR ID	0000H
ELECTRONIC KEY DEVICE TYPE	0000H	ELECTRONIC KEY DEVICE TYPE	0000H
ELECTRONIC KEY PRODUCT CODE	0000H	ELECTRONIC KEY PRODUCT CODE	0000H
ELECTRONIC KEY REVISION	0.000	ELECTRONIC KEY REVISION	0.000
ELECTRONIC KEY COMPATIBILITY	DISABLE	ELECTRONIC KEY COMPATIBILITY	DISABLE
TIMEOUT MULTIPLIER	x4	TIMEOUT MULTIPLIER	x4
RECONNECT	0	RECONNECT	0
PRODUCTION TRIGGER	CYCLIC	PRODUCTION TRIGGER	CYCLIC
OPTION1	00000000	OPTION1	00000000
OPTION2	00000000	OPTION2	00000000

The default is hatched.

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Parameters for device #2

Item of the Adapter function	Setting	Item of the Adapter function	Setting
DI DATA ON ABNORMAL	HOLD	ALLOCATION01	ENABLE
STATUS ADDRESS	1:R0000	DI TYPE	00
STATUS SIZE	3	DI ADDRESS	---
OPTION1	00000000	DI SIZE	0
OPTION2	00000000	DO TYPE	01
		DO ADDRESS	1:R0164
		DO SIZE	64
		OPTION	00000000

Item of the Scanner function	Setting	Item of the Scanner function	Setting
DI DATA ON ABNORMAL	HOLD		
STATUS ADDRESS	1:R0004		
STATUS SIZE	4		
OPTION1	00000000		
OPTION2	00000000		
SETTING NO. 01	ENABLE	SETTING NO. 02	ENABLE
IP ADDRESS	192.168.0.101	IP ADDRESS	192.168.0.103
T => O ASSEMBLY INSTANCE	101	T => O ASSEMBLY INSTANCE	101
T => O SIZE	64	T => O SIZE	64
T => O RPI	4	T => O RPI	4
O => T ASSEMBLY INSTANCE	254	O => T ASSEMBLY INSTANCE	254
O => T SIZE	0	O => T SIZE	0
O => T RPI	4	O => T RPI	4
CONFIG	100	CONFIG	100
DATA UNIT	1-BYTE	DATA UNIT	1-BYTE
ENDIAN CHANGE	DISABLE	ENDIAN CHANGE	DISABLE
DI(T => O) TYPE	01	DI(T => O) TYPE	01
DI(T => O) ADDRESS	1:R0100	DI(T => O) ADDRESS	1:R0228
DO(O => T) TYPE	00	DO(O => T) TYPE	00
DO(O => T) ADDRESS	---	DO(O => T) ADDRESS	---
T => O TRANSPORT TYPE	MULTICAST	T => O TRANSPORT TYPE	MULTICAST
T => O HEADER FORMAT	MODELESS	T => O HEADER FORMAT	MODELESS
T => O PRIORITY	SCHEDULED	T => O PRIORITY	SCHEDULED
O => T TRANSPORT TYPE	UNICAST	O => T TRANSPORT TYPE	UNICAST
O => T HEADER FORMAT	HEARTBEAT	O => T HEADER FORMAT	HEARTBEAT
O => T PRIORITY	SCHEDULED	O => T PRIORITY	SCHEDULED
ELECTRONIC KEY VENDOR ID	0000H	ELECTRONIC KEY VENDOR ID	0000H
ELECTRONIC KEY DEVICE TYPE	0000H	ELECTRONIC KEY DEVICE TYPE	0000H
ELECTRONIC KEY PRODUCT CODE	0000H	ELECTRONIC KEY PRODUCT CODE	0000H
ELECTRONIC KEY REVISION	0.000	ELECTRONIC KEY REVISION	0.000
ELECTRONIC KEY COMPATIBILITY	DISABLE	ELECTRONIC KEY COMPATIBILITY	DISABLE
TIMEOUT MULTIPLIER	x4	TIMEOUT MULTIPLIER	x4
RECONNECT	0	RECONNECT	0
PRODUCTION TRIGGER	CYCLIC	PRODUCTION TRIGGER	CYCLIC
OPTION1	00000000	OPTION1	00000000
OPTION2	00000000	OPTION2	00000000

The default is hatched.

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Parameters for device #3

Item of the Adapter function	Setting	Item of the Adapter function	Setting
DI DATA ON ABNORMAL	HOLD	ALLOCATION01	ENABLE
STATUS ADDRESS	1:R0000	DI TYPE	00
STATUS SIZE	3	DI ADDRESS	---
OPTION1	00000000	DI SIZE	0
OPTION2	00000000	DO TYPE	01
		DO ADDRESS	1:R0228
		DO SIZE	64
		OPTION	00000000

Item of the Scanner function	Setting	Item of the Scanner function	Setting
DI DATA ON ABNORMAL	HOLD		
STATUS ADDRESS	1:R0004		
STATUS SIZE	4		
OPTION1	00000000		
OPTION2	00000000		
SETTING NO. 01	ENABLE	SETTING NO. 02	ENABLE
IP ADDRESS	192.168.0.101	IP ADDRESS	192.168.0.102
T => O ASSEMBLY INSTANCE	101	T => O ASSEMBLY INSTANCE	101
T => O SIZE	64	T => O SIZE	64
T => O RPI	4	T => O RPI	4
O => T ASSEMBLY INSTANCE	254	O => T ASSEMBLY INSTANCE	254
O => T SIZE	0	O => T SIZE	0
O => T RPI	4	O => T RPI	4
CONFIG	100	CONFIG	100
DATA UNIT	1-BYTE	DATA UNIT	1-BYTE
ENDIAN CHANGE	DISABLE	ENDIAN CHANGE	DISABLE
DI(T => O) TYPE	01	DI(T => O) TYPE	01
DI(T => O) ADDRESS	1:R0100	DI(T => O) ADDRESS	1:R0164
DO(O => T) TYPE	00	DO(O => T) TYPE	00
DO(O => T) ADDRESS	---	DO(O => T) ADDRESS	---
T => O TRANSPORT TYPE	MULTICAST	T => O TRANSPORT TYPE	MULTICAST
T => O HEADER FORMAT	MODELESS	T => O HEADER FORMAT	MODELESS
T => O PRIORITY	SCHEDULED	T => O PRIORITY	SCHEDULED
O => T TRANSPORT TYPE	UNICAST	O => T TRANSPORT TYPE	UNICAST
O => T HEADER FORMAT	HEARTBEAT	O => T HEADER FORMAT	HEARTBEAT
O => T PRIORITY	SCHEDULED	O => T PRIORITY	SCHEDULED
ELECTRONIC KEY VENDOR ID	0000H	ELECTRONIC KEY VENDOR ID	0000H
ELECTRONIC KEY DEVICE TYPE	0000H	ELECTRONIC KEY DEVICE TYPE	0000H
ELECTRONIC KEY PRODUCT CODE	0000H	ELECTRONIC KEY PRODUCT CODE	0000H
ELECTRONIC KEY REVISION	0.000	ELECTRONIC KEY REVISION	0.000
ELECTRONIC KEY COMPATIBILITY	DISABLE	ELECTRONIC KEY COMPATIBILITY	DISABLE
TIMEOUT MULTIPLIER	x4	TIMEOUT MULTIPLIER	x4
RECONNECT	0	RECONNECT	0
PRODUCTION TRIGGER	CYCLIC	PRODUCTION TRIGGER	CYCLIC
OPTION1	00000000	OPTION1	00000000
OPTION2	00000000	OPTION2	00000000

The default is hatched.

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1.6.2 Supported Classes and Instances

The supported classes and instances are listed below. When item "A" is checked, the corresponding class is supported by the Adapter function; when item "S" is checked, the corresponding class is supported by the Scanner function.

Name	A	S	Class	Instance(s)
Identity	✓	✓	01h	01h
Message Router	✓	✓	02h	01h
Assembly	✓		04h	64h, 65h, 66h, 67h, 68h, 97h, 98h, 99h, 9Ah, FEh, FFh
Connection Manager	✓	✓	06h	01h
Connection Configuration		✓	F3h	01h
Port	✓	✓	F4h	01h
TCP/IP	✓	✓	F5h	01h
Ethernet Link	✓	✓	F6h	01h

The relationships between allocation setting numbers and Assembly object instances for the Adapter function are shown below.

Allocation setting number	Output Assembly (T -> O)	Input Assembly (O -> T)		
	Exclusive Owner, Input Only, Listen Only	Exclusive Owner	Input Only	Listen Only
1	65h (101) Size: 1 to 256 bytes	97h (151) Size: 1 to 256 bytes	FEh (254) Size: 0 bytes	FFh (255) Size: 0 bytes
2	66h (102) Size: 1 to 256 bytes	98h (152) Size: 1 to 256 bytes		
3	67h (103) Size: 1 to 256 bytes	99h (153) Size: 1 to 256 bytes		
4	68h (104) Size: 1 to 256 bytes	9Ah (154) Size: 1 to 256 bytes		

Allocation setting number	Configuration Assembly
1	64h (100) Size: 0 bytes
2	
3	
4	

1.6.3 EtherNet/IP Error Codes

The following table lists EtherNet/IP error codes that may be displayed on the maintenance and LOG screens and their meanings.

ERR GEN (Hex)	ERR EXT (Hex)	Detected by	Description
01	0100	Adapter	The connection is in use.
01	0103	Adapter	Class 1 communication or the specified production trigger is not supported.
01	0106	Adapter	An existing Exclusive Owner connection is found.
01	0107	Adapter	An attempt was made to close a closed connection.
01	0108	Adapter	The specified transport type is not supported.
01	0109	Adapter	The specified DI/DO size or header format is wrong.
01	0110	Adapter	The specified assembly instance is not set.
01	0111 0112	Adapter	The specified RPI is not supported.

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ERR GEN (Hex)	ERR EXT (Hex)	Detected by	Description
01	0113	Scanner Adapter	No more connections can be created.
01	0114	Adapter	The value of the specified electronic key is different from the vendor ID or the product code.
01	0115	Adapter	The value of the specified electronic key is different from the device type.
01	0116	Adapter	The value of the specified electronic key is different from the revision.
01	0117	Adapter	The specified DI or DO assembly instance is wrong.
01	0118	Adapter	The specified configuration assembly instance is wrong.
01	0119	Adapter	A Listen Only connection cannot be created because a connection other than Listen Only is not found.
01	011A	Adapter	No more connections can be created.
01	011B	Adapter	The RPI of the DI (T ⇒ O) is smaller than the Production Inhibit Time.
01	011C	Adapter	Class 1 communication is not supported.
01	011D	Adapter	The specified production trigger is not supported.
01	011F	Adapter	The fixed-size communication of the DO (O ⇒ T) is not supported.
01	0120	Adapter	The fixed-size communication of the DI(T⇒O) is not supported.
01	0121	Adapter	The priority of the specified DO (O ⇒ T) is not supported.
01	0122	Adapter	The priority of the specified DI(T⇒O) is not supported.
01	0123	Adapter	The transport type (unicast) of the DO (O ⇒ T) is not supported.
01	0124	Adapter	The transport type of the specified DI (T ⇒ O) is not supported.
01	0125	Adapter	Types of communication other than Redundant Owner are not supported.
01	0126	Adapter	The size of a detailed setting related to the specified configuration is wrong.
01	0127	Adapter	The size or the header format of the specified DO (O ⇒ T) is wrong.
01	0128	Adapter	The size or the header format of the specified DI(T⇒O) is wrong.
01	0129	Adapter	The specified configuration assembly instance is wrong.
01	012A	Adapter	The specified DO (O ⇒ T) assembly instance is wrong.
01	012B	Adapter	The specified DI(T⇒O) assembly instance is wrong.
01	012F	Adapter	The specified DI/DO assembly instance combination is wrong.
01	0133	Adapter	The specified timeout multiplier is not supported.
01	0203	Scanner Adapter	The connection timed out.
01	0204	Scanner	An unconnected request such as a connection request timed out.
01	0205	Adapter	An unconnected request parameter is invalid.
01	0206	Scanner	An unconnected message is too large.
01	0207	Scanner	Unconnected ACK with no response.
01	0301	Scanner Adapter	The buffer memory is unavailable.
01	0302	Scanner Adapter	A network bandwidth is not found for data.
01	0303	Scanner Adapter	No receive connection ID filter is available.
01	0304	Scanner Adapter	The setting is not made to send data in the scheduled priority mode.
01	0311	Scanner	No port is available.
01	0312	Scanner	The link address is invalid.
01	0315	Scanner Adapter	The segment type or value in the connection path is invalid.
01	0316	Adapter	The connection path in a request to close a connection is invalid.
01	0317	Scanner Adapter	Schedule is not specified.
01	0318	Scanner	The link address to the local device is invalid.

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ERR GEN (Hex)	ERR EXT (Hex)	Detected by	Description
01	0319	Adapter	The secondary resource is unavailable.
01	031A	Adapter	A rack connection has already been established.
01	031B	Adapter	A module connection has already been established.
01	031C	Scanner Adapter	Other errors.
01	031D	Adapter	There is an inconsistency between redundant connections.
01	031E	Adapter	In the sending device, there is no available user-configurable receive link resource anymore.
01	031F	Adapter	In the sending device, there is no user-configurable receive link resource.
01	0800	Scanner	The network link is offline.
01	0810	Adapter	No available target application data is found.
01	0811	Scanner	No available originator application data is found.
01	0812	Scanner	The node address was changed after network scheduling.
01	0813	Adapter	The setting is not made for off-subnet multicast.

NOTE

If an error code with "Adapter" as "Detected by" is displayed on the maintenance and LOG screens of the EtherNet/IP Scanner function, this means that the EtherNet/IP Scanner function sends a connection request to an adapter device and the adapter device returns the error code.

1.6.4 Setting a Scanner Using an EDS File

This subsection explains the method for checking the contents of an EDS file for an adapter manually and setting values on Scanner setting screens.

1.6.4.1 Structure of an EDS file

An EDS file is divided into sections. One section consists of multiple fields. In each field, a parameter is set. The parameter ends with a semicolon (;). One field can contain more than one parameter. In this case, a separator (,) is placed between parameters. A string from a character "$" to the end of line is a comment.

```
$comment
[section-name-1]
    field-name-1 = parameter;
    field-name-2 = parameter-1, parameter-2, parameter-3;
        …
[section-name-2]
    …
```

1.6.4.2 Section [Device]

Section [Device] contains device information of an adapter.
Enter these values in "ELECTRONIC KEY" on the DETAIL setting screen.
If it is not necessary to check the adapter device information, there is no need to change any value in "ELECTRONIC KEY" from its default.

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Input item on the setting screen	Field name in an EDS file
VENDOR ID	VendCode
DEVICE TYPE	ProdType
PRODUCT CODE	ProdCode
REVISION	MajRev
	MinRev

Example)

```
[Device]
VendCode = 591;
ProdType = 12;
ProdCode = 101;
MajRev = 1;
MinRev = 3;
```

For EDS file data shown above, set values listed below in ELECTRONIC KEY.

Input item on the setting screen	Setting
VENDOR ID	591 (decimal)/24F (hexadecimal)
DEVICE TYPE	12 (decimal)/C (hexadecimal)
PRODUCT CODE	101 (decimal)/65 (hexadecimal)
REVISION	1.3

1.6.4.3 Section [Connection Manager]

Section [Connection Manager] contains settings related to connections that can be created by the adapter device.
When this section contains multiple fields, check the connection name set for the 13th parameter to determine a field in which settings are to be used.

Fifteen parameters set in a field correspond to input items on Scanner setting screens as listed below.

Input item on setting screens	EDS file parameter	Meaning	Remarks
None	1st parameter Bits 0-6	Bit 0: Class 0	Communication class. The Scanner function supports only Class 1.
		Bit 1: Class 1	
		Bit 2: Class 2	
		Bit 3: Class 3	
		Bit 4: Class 4	
		Bit 5: Class 5	
		Bit 6: Class 6	
PRODUCTION TRIGGER	1st parameter Bits 16-18	Bit 16: CYCLIC	
		Bit 17: CHANGE STATE	
		Bit 18: APPLICATION	
None	1st parameter Bits 24-27	Bit 24: Listen Only	Type of communication. The Scanner function does not support Redundant Owner.
		Bit 25: Input Only	
		Bit 26: Exclusive Owner	
		Bit 27: Redundant Owner	
None	2nd parameter Bits 0-3	Bit 0: O=>T fixed size	Assembly data size: fixed or variable. The Scanner function supports only the fixed size.
		Bit 1: O=>T variable size	
		Bit 2: T=>O fixed size	
		Bit 3: T=>O variable size	
O => T HEADER FORMAT	2nd parameter Bits 8-10	0: MODELESS	
		3: HEARTBEAT	
		4: RUN/IDLE	

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Input item on setting screens	EDS file parameter	Meaning	Remarks
T => O HEADER FORMAT	2nd parameter Bits 12-14	0: MODELESS 3: HEARTBEAT 4: RUN/IDLE	
O => T TRANSPORT TYPE	2nd parameter Bits 16-19	Bit 16: NULL Bit 17: MULTICAST Bit 18: UNICAST	The Scanner function supports only UNICAST.
T => O TRANSPORT TYPE	2nd parameter Bits 20-23	Bit 20: NULL Bit 21: MULTICAST Bit 22: UNICAST	In an EDS file, the bit corresponding to any supported transport type can be set. On the setting screen, select and set one of transport types supported by the adapter.
O => T PRIORITY	2nd parameter Bits 24-27	Bit 24: LOW Bit 25: HIGH Bit 26: SCHEDULED Bit 27: URGENT	The Scanner function supports only SCHEDULED.
T => O PRIORITY	2nd parameter Bits 28-31	Bit 28: LOW Bit 29: HIGH Bit 30: SCHEDULED Bit 31: URGENT	
O => T RPI	3rd parameter	Numeric value (unit: μs) ParamN	When ParamN or an empty string is set, specify the RPI value.
O => T SIZE	4th parameter	Numeric value (unit: bytes) ParamN	ParamN or an empty string indicates that the input size must be specified for the adapter device. First, specify the value for the adapter device, then specify the same value for the Scanner function.
None	5th parameter		Format for O => T
T => O RPI	6th parameter	Numeric value (unit: μs) ParamN	When ParamN or an empty string is set, specify the RPI value.
T => O SIZE	7th parameter	Numeric value (unit: bytes) ParamN	ParamN or an empty string indicates that the output size must be specified for the adapter device. First, specify the value for the adapter device, then specify the same value for the Scanner function.
None	8th parameter		Format for T => O
None	9th parameter	Configuration #1 size	These parameters cannot be specified from any setting screen. If necessary, use a non-FANUC setting tool.
None	10th parameter	Configuration #1 format	
None	11th parameter	Configuration #2 size	
None	12th parameter	Configuration #2 format	
None	13th parameter	Connection name	Name of a connection
None	14th parameter	Help string	Help string for the connection
O => T ASSEMBLY INSTANCE	15th parameter	Numeric value (hexadecimal)	1-byte value following the first 2C
T => O ASSEMBLY INSTANCE	15th parameter	Numeric value (hexadecimal)	1-byte value following the second 2C
CONFIG ASSEMBLY INSTANCE	15th parameter	Numeric value (hexadecimal)	1-byte value following 24

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Example)

```
[Connection Manager]
Connection1 =
        0x04010002,
        0x44640405,
        Param1, Param2, ,
        Param3, Param4, ,
        , ,
        , ,
        "class1 - exclusive owner",
        "",
        "20 04 24 64 2C 97 2C 65";
```

For communication with the above EDS file setting, specify values listed below on Scanner setting screens.

Item	Screen	Value
PRODUCTION TRIGGER	DETAIL 4/4	CYCLIC
O => T HEADER FORMAT	DETAIL 2/4	RUN/IDLE
T => O HEADER FORMAT	DETAIL 1/4	MODELESS
O => T TRANSPORT TYPE	DETAIL 2/4	UNICAST
T => O TRANSPORT TYPE	DETAIL 1/4	UNICAST(Select from between UNICAST and MULTICAST)
O => T PRIORITY	DETAIL 2/4	SCHEDULED (fixed value)
T => O PRIORITY	DETAIL 1/4	SCHEDULED
O => T RPI	SIMPLE 1/2	Specify a required communication interval.
O => T SIZE	SIMPLE 1/2	Specify the size appropriate for the adapter device.
T => O RPI	SIMPLE 1/2	Specify a required communication interval.
T => O SIZE	SIMPLE 1/2	Specify the size appropriate for the adapter device.
O => T ASSEMBLY INSTANCE	SIMPLE 1/2	151 (decimal)
T => O ASSEMBLY INSTANCE	SIMPLE 1/2	101 (decimal)
CONFIG ASSEMBLY INSTANCE	SIMPLE 1/2	100 (decimal)

On the SIMPLE setting screen (2/2), also specify items related to the CNC including the PMC address.

1.6.5 Setting the Scanner Using a Non-FANUC Tool

1.6.5.1 Overview

The Scanner function is set from the CNC Scanner setting screens, and it can also be set from software for personal computers RSNetWorx for EtherNet/IP (called RSNetWorx below) released by Rockwell Automation, Inc.
When detailed settings related to the configuration are required for an adapter, they cannot be specified from the Scanner setting screens. Use RSNetWorx. Detailed settings related to the configuration are required when the following condition is satisfied:

- In a field for communication in the [Configuration Manager] section in the EDS file for an adapter, values are set for the 9th to 12th parameters.

When these parameters are empty, the Scanner function can be set using either of the Scanner setting screens and RSNetWorx.
RSNetWorx operation was confirmed with revision 11.00.00 (CPR 9 SR5).

Follow the procedure below to use RSNetWorx for setup:

1. Create settings on RSNetWorx.
2. Transfer the settings from RSNetWorx to the CNC.
3. Set the PMC address on the CNC.

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The following Technical Report explains the methods for connecting frequently used non-FANUC adapter devices. Refer to the Technical Report when required:

Technical Report NO.TMN12/076
EtherNet/IP Scanner Function Adapter Device Connection Guide (A-94408EN)

NOTE

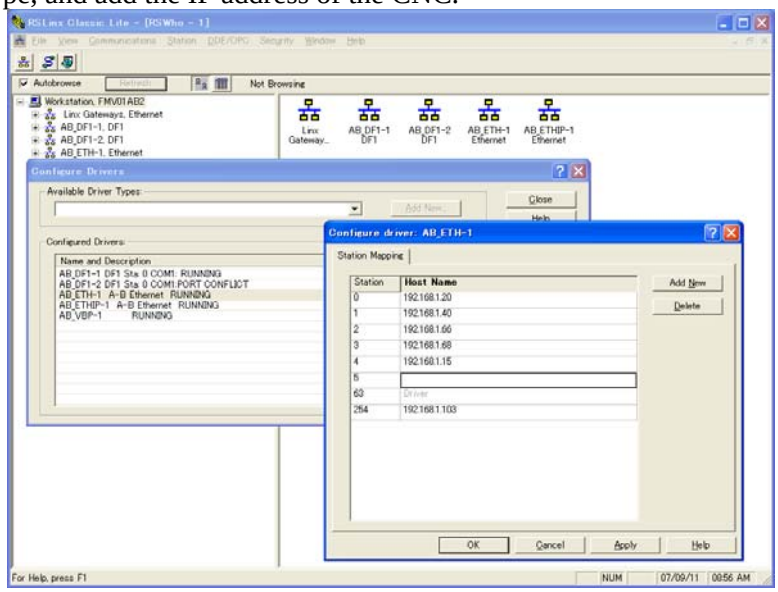
1 When a CNC acting as a scanner and a CNC acting as an adapter are connected in the same network, RSNetWorx cannot be used to set the Scanner function. Set the Scanner function from the CNC Scanner setting screens as described in Subsection 1.6.1, "Examples of Connecting CNCs".
2 When the settings are transferred from RSNetWorx to the CNC, CNC communication settings are overwritten sequentially from communication setting No. 1.

1.6.5.2 Operations

This subsection explains the procedure for setting the Scanner function using RSNetWorx.
For details of the operation procedure for software released by Rockwell Automation, Inc., refer to the relevant manual provided by Rockwell Automation, Inc.

Creating settings on RSNetWorx

1. Use software for personal computers released by Rockwell Automation, Inc., RSLinx, to set the IP address of the CNC for driver AB_ETH. This operation enables RSNetWorx to communicate with the CNC.
   Form the RSLinx menu, select Communications, then Configure Drivers. Select Ethernet Devices for the drive type, and add the IP address of the CNC.



RSLinx driver setting screen

2. Start RSNetWorx.
3. Register the EDS file for the adapter device and CNC Scanner function.
   From the RSNetWorx menu, select Tools, then EDS Wizard, and register the file according to the instructions displayed on the screen.
   When the EDS file has been registered, the relevant device is added to the tree on the left side of the screen.

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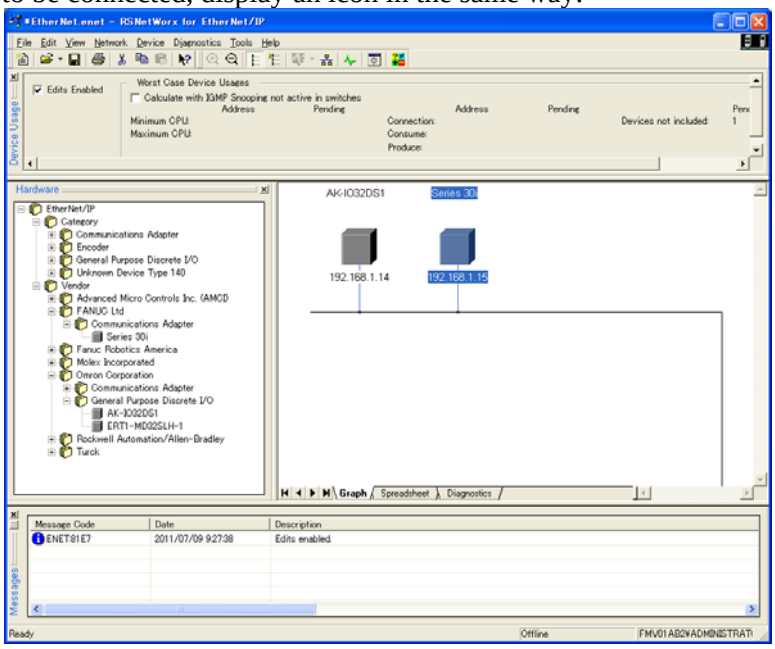
NOTE

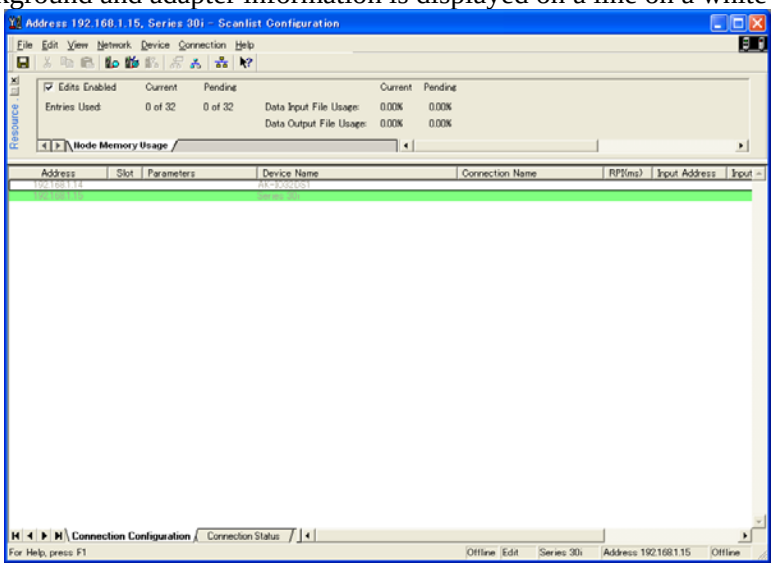
To register an EDS file for the CNC, use an EDS file for the Scanner function. An EDS file for the Adapter function and an EDS file for both the Scanner and Adapter functions cannot be used.
For details of outputting an EDS file, see Subsection 1.3.8, "Outputting an EDS File".

4. In the tree on the left side of the RSNetWorx screen, double-click CNC (Series 30i). Enter the IP address and click the OK button. An icon (gray cube) appears on the right side of the screen. For the adapter device to be connected, display an icon in the same way.



RSNetWorx for EtherNet/IP

5. Right-click the CNC (Series 30i) icon. From the displayed pop-up menu, select Scanlist Configuration. The Scanlist Configuration screen appears. Scanner information is displayed on a line on a green background and adapter information is displayed on a line on a white background.



Scanlist Configuration screen

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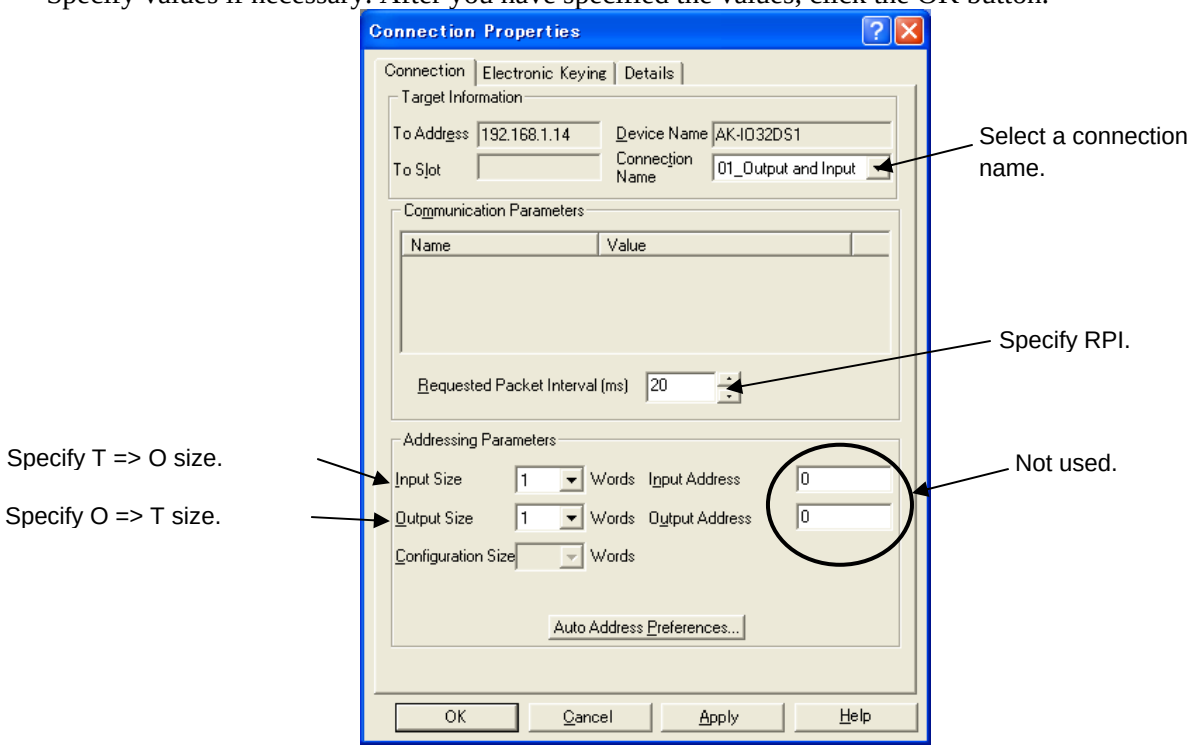
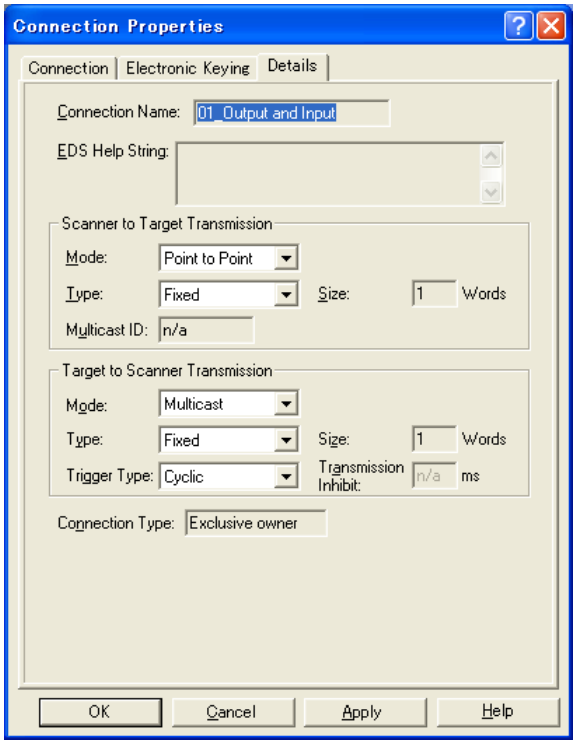
6. Double-click the line of the adapter which is to communicate with the scanner CNC. The Connection Properties screen appears.
   Specify values if necessary. After you have specified the values, click the OK button.





7. Save the settings on the Scanlist Configuration screen and close the screen.

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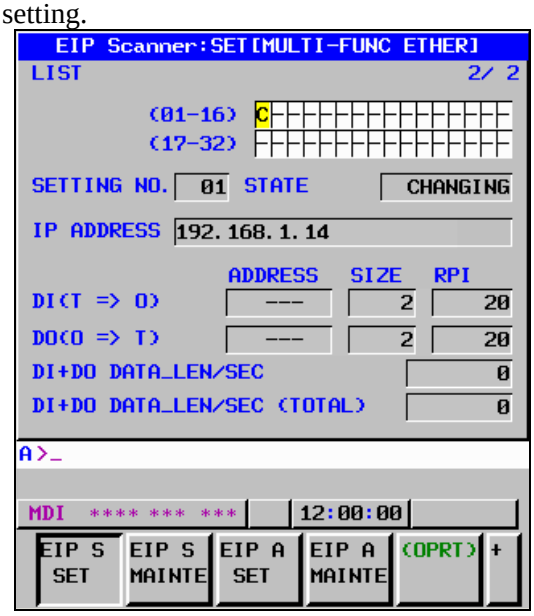
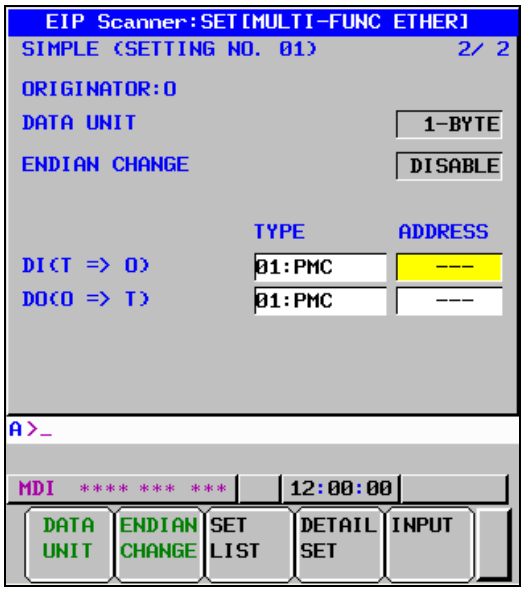
Transferring the settings from RSNetWorx to the CNC

8. Change the NETWORK setting from ONLINE to OFFLINE on the BASIC Scanner setting screen on the CNC.
9. On the RSNetWorx screen, right-click the CNC icon and select Download To Device. A confirmation dialog box appears. Click the YES button.
10. Under LIST on the LIST screen, "C" is displayed for a communication setting specified on RSNetWorx. "CHANGING" is displayed for STATE. This value means that since values are set from a setting tool, but required items such as the PMC address are not set, the communication setting is disabled as the setting.



Setting the PMC address on the CNC

11. On the LIST screen, move the cursor to the communication setting indicated with "C". Press soft keys [(OPRT)], then [SIMPLE SET]. The SIMPLE setting screen appears.
12. On page 2 of the SIMPLE setting screen, specify the addresses in the PMC area.
13. Return to the LIST screen and change STATE of the communication setting to "ENABLE". "O" is displayed under LIST.



14. Turn the power to the CNC off, then on again.

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NOTE

After a detailed setting related to the configuration is set on RSNetWorx, when STATE for the relevant communication setting is changed to "ENABLE, "T" is displayed under LIST. For this communication setting, the detailed setting related to the configuration is saved.
For any detailed setting related to the configuration, the value cannot be displayed or changed on the CNC screen. If you want to delete the communication setting, initialize it. Any detailed setting related to the configuration cannot be deleted simply by changing the value of an item displayed on the screen. For details of the initialization procedure, see Subsection 1.3.9, "Initializing a Communication Setting".

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2 EtherNet/IP ADAPTER FUNCTION

NOTE

Before using the EtherNet/IP Adapter function, be sure to read the following part and sections:

- Part II, "COMMON"
- Sections 1.1, "OVERVIEW", 1.2, "SPECIFICATION", and 1.5, "COMMUNICATION CONDITIONS" in Chapter 1, "EtherNet/IP SCANNER FUNCTION" in Part III, "FUNCTION"

2.1 OVERVIEW

For an outline of the entire EtherNet/IP function, see Section 1.1, "OVERVIEW".

2.1.1 Allocation Setting and Scanner Setting

In a CNC allocation setting, specify I/O areas to be used for exchanging data with a scanner. More specifically, specify the addresses and sizes of the PMC area. Up to four allocation settings can be specified for one hardware option.

An example of specification for using two allocation settings is shown below.

Allocation setting number		PMC address	Size
1	DI	1:R1000	8
	DO	1:R1008	8
2	DI	1:R2000	16
	DO	1:R2016	16
3	DI	<Not used>	<Not used>
	DO	<Not used>	<Not used>
4	DI	<Not used>	<Not used>
	DO	<Not used>	<Not used>

To specify data to be exchanged with an adapter, a scanner uses the number of internal data in the adapter. This number includes 101, 151, 102, and 152 in the following figure. These internal data numbers are called Assembly object instances.
In the CNC, an allocation setting and corresponding Assembly object instances are fixed and this correspondence is contained in the relevant EDS file.
A scanner setting tool can acquire each allocation setting and its corresponding Assembly object instances in the CNC by reading the EDS file. The scanner setting tool specifies an allocation setting number as a connection used for communication. With this operation, the Assembly object instances are determined and a scanner device uses the number to communicate with the CNC.
For this reason, when a scanner device is set using an EDS file, the data areas in a destination CNC can be specified with an allocation setting number.

A general setting procedure for EtherNet/IP communication is shown below:
<1>On the CNC screen, specify values for each allocation setting.
<2>Output an EDS file in the CNC.
<3>Use a scanner setting tool to read the EDS file created in step <2>.
<4>On the scanner setting tool, select a CNC allocation setting used for communication. Make settings for the scanner if necessary.

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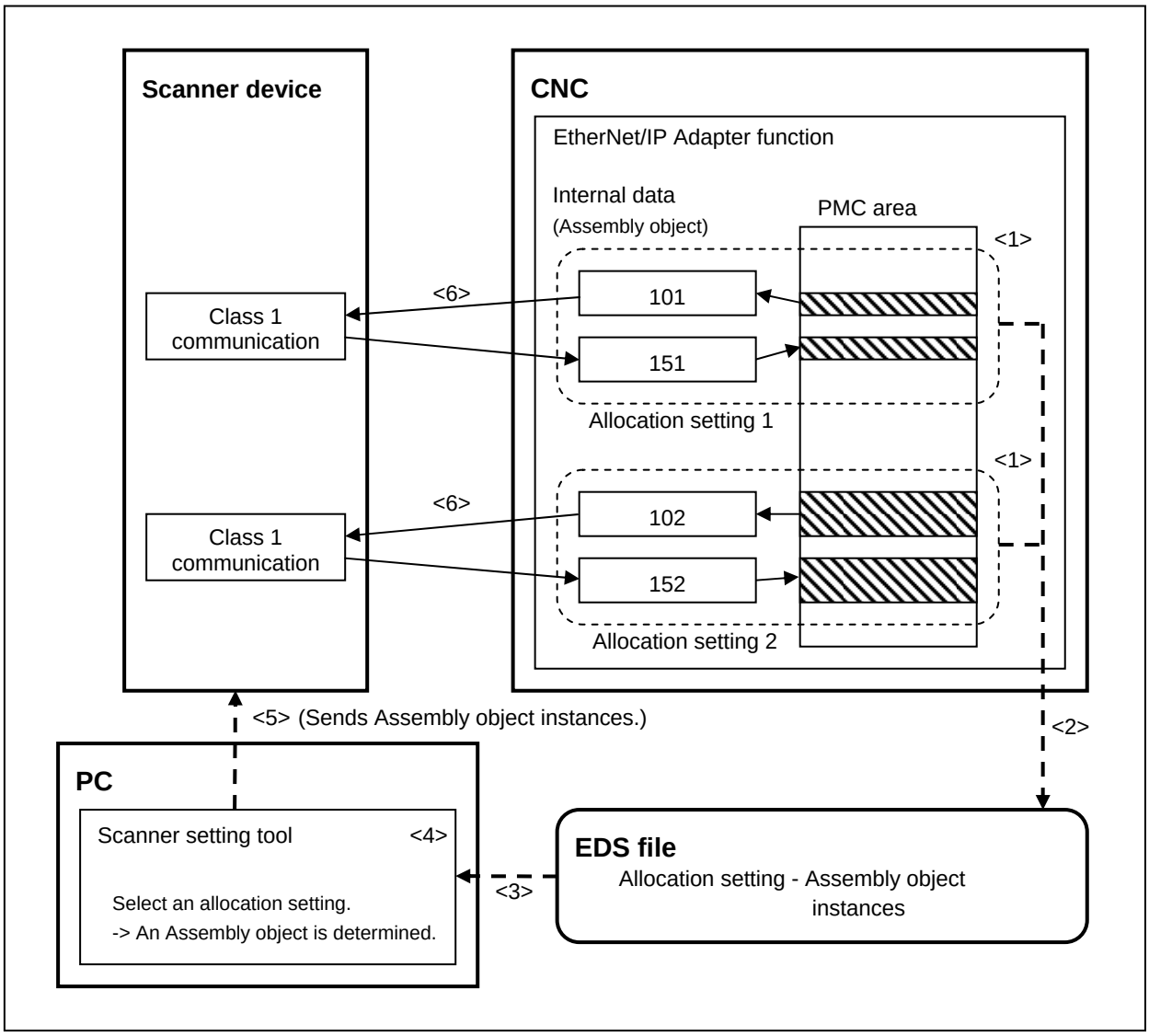
<5>Transfer the EtherNet/IP setting from the scanner setting tool to the scanner device. The scanner device is notified of the Assembly object instances corresponding to the specified CNC allocation setting.

<6>The scanner device uses the Assembly object instances to create a connection to the CNC and exchange DI/DO data.



NOTE

1 This chapter covers steps <1> and <2> in the figure. For details of steps <3> to <5>, refer to the manual of the scanner device you want to use.

2 In either of the following cases, specify the Assembly object instances corresponding to each allocation setting on the scanner and scanner setting tool:
- To set the scanner without using an EDS file
- To execute Class 3 communication with the CNC

3 For details of Assembly object instances, see Subsection 1.6.2, "Supported Classes and Instances".

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2.1.2 EDS File

An EDS file is a text file which contains the communication setting the adapter can accept and information related to scanner communication control.

When both the Adapter and Scanner functions are enabled, data to be output to an EDS file can be selected from either of the following two types.

No.	Data to be output to an EDS file	Default file name(s)	Selected by
1	For the Scanner function when output from the Scanner function setting screen or for the Adapter function when output from the Adapter function setting screen	EDS file for the Scanner function: "FSCNC101.EDS" EDS file for the Adapter function: "F_CNC101.EDS"	Setting bit 2 of OPTION1 on the BASIC setting screen to 0
2	For both the Scanner and Adapter functions regardless of the screen from which data is output	"FWCNC101.EDS"	Setting bit 2 of OPTION1 on the BASIC setting screen to 1

When either of the Adapter and Scanner functions is enabled, data for the enabled function is output to the EDS file.

When you want to output data for the Adapter function to an EDS file, you can select whether to output standard data or data corresponding to each allocation setting.

Data for the Adapter function	EDS file output after	Description
Standard	All allocation settings are disabled.	This file is available for general purposes. Allocation setting data is not reflected.
Corresponding to each allocation setting	At least one allocation setting is enabled.	Allocation setting data is reflected. Fewer items are required to be specified on a scanner setting tool, which makes setting easy.

Data for the Adapter function in an EDS file

Standard data and data corresponding to each allocation setting are the same except how connections are set.
The following explains how connections are set.

Standard data

The following connection settings are saved regardless of allocation settings in the CNC.
[Four types of allocation settings, Nos. 01 to 04] × [Three types of communication, Exclusive Owner, Input Only, and Listen Only] = Total of 12 types
The EDS file does not contain DI/DO data sizes. On a scanner setting tool, specify these sizes according to the allocation settings in the CNC.

Data corresponding to each allocation setting

Data corresponds to each allocation setting in the CNC. The setting of the connection in each allocation setting for which STATE is ENABLE is saved.
Only when each type of communication is valid according to the DI/DO sizes set in each allocation setting in the CNC, it is saved.

DI/DO sizes in an allocation setting	Exclusive Owner	Input Only	Listen Only
DI size: 1 or more DO size: 1 or more	✓	✓	✓
DI size: 0 DO size: 1 or more		✓	✓
DI size: 1 or more DO size: 0	✓		

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The EDS file contains the DI/DO sizes specified in each allocation setting in the CNC. Therefore, it is not necessary to specify these sizes on a scanner setting tool.

An EDS file which contains standard data can be used for any CNC and your desired settings can be made. However, on a scanner setting tool, the allocation setting numbers, communication types, and DI/DO sizes must be specified according to the allocation settings in the CNC.
When an EDS file which contains data corresponding to each allocation setting is used, the setting on a scanner setting tool is easier since the allocation settings in the CNC are reflected. However, the EDS file cannot be used for another CNC when the allocation settings are different.
Use an EDS file of the type appropriate for your purpose.

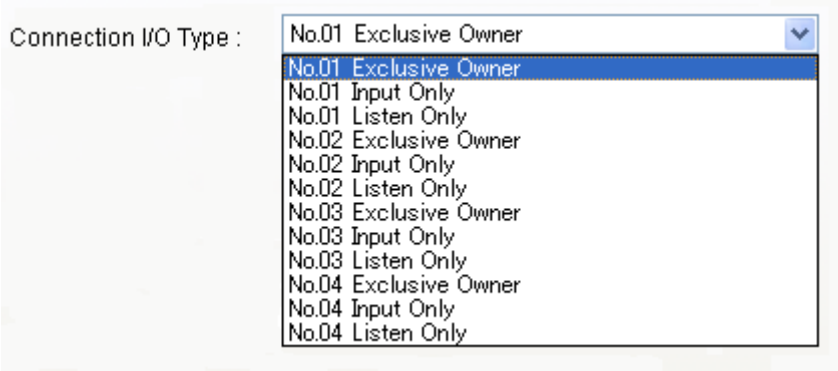
NOTE

The values of ProdCode and MajRev, MinRev are the same in an EDS file containing standard data and that containing data corresponding to each allocation setting. A scanner setting tool may not be able to distinguish between these types of EDS files when these values are the same in the files.

Selecting a connection on a scanner setting tool

On a scanner setting tool, connection settings in an EDS file are displayed under items including "Connection I/O Type" and "Connection Name".

Sample screen on a scanner setting tool



A connection name displayed on a scanner setting tool is explained below.

Select an allocation setting and type of communication that are to be used for communication with the target adapter.

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2.1.3 Explicit Messaging

There are Explicit messaging which starts communication after a connection is established (connected) and that which starts communication without establishing a connection (unconnected). The CNC supports both Explicit messaging. This subsection covers only unconnected Explicit messaging, which is generally used.

In Explicit messaging (Class 3), PMC areas can be read and written like Implicit messaging (Class 1).
In the CNC (Explicit messaging server), PMC areas to be read and written are specified in an allocation setting.
In an Explicit messaging client, areas to be read and written are specified using classes and instances. To read or write a CNC PMC area, specify an Assembly object instance. For the relationships between allocation settings and Assembly object instances, see Subsection 1.6.2, "Supported Classes and Instances".

The procedure for reading and writing a PMC area in Explicit messaging is shown below:

1. On a CNC ALLOCATION screen, specify an allocation setting for the PMC area.
2. Confirm the Assembly object instances corresponding to the specified allocation setting.
   Example) Allocation setting No. 1 DO(T->O): 65h, DI(O->T): 97h
3. In an Explicit messaging client, execute Get_Attribute_Sigle (read) or Set_Attribute_Single (write) for an instance (such as 65h or 97h) in the Assembly class (04h) that correspond to the allocation setting.

2.2 SPECIFICATION

For details of the specification of the Adapter function, see Section 1.2, "SPECIFICATION".

2.3 SETTING

The EtherNet/IP Adapter function can be used on one or two hardware options. The setting screens of these hardware options are independent of each other. Set required items for the relevant hardware option(s).

Procedure for displaying the screen

To display the setting screen, follow the instructions explained in Subsection 2.4.1, "Displaying Screens" in Part II, "COMMON".
This section explains procedures using examples when the EtherNet/IP Adapter function runs on a hardware option on which the Ethernet function runs. When the EtherNet/IP Adapter function runs on a hardware option on which the Ethernet function does not run, read soft key [ETHERNET] as [EtherNet/IP].

2.3.1 Procedure for Setting the Adapter

Up to four allocation settings can be specified for one hardware option.

The flow of setup operations is listed below.

	Operation	Description
1	Set the IP address.	Set the IP address on the COMMON screen (BASIC).
2	Specify items on the BASIC screen on page 1.	Specify the status and other items if necessary.
3	Specify items on the ALLOCATION screen on pages 2 to 5.	Specify items required for allocation settings Nos. 1 to 4.

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	Operation	Description
4	Turn the power off, then on again.	When the power is turned off, then on again, the new settings take effect.

2.3.2 Setting the IP Address

The following two methods are available for setting the IP address:

1. Enter a desired IP address from the screen of the CNC.
2. Acquire the IP address from the DHCP server. (Available only when the EtherNet/IP function is used on a hardware option on which the Ethernet function runs)

Select a setting method according to operation of the network.

Entering a desired IP address from the screen of the CNC

Enter values in IP ADDRESS, SUBNET MASK, and ROUTER IP ADDRESS according to the instructions in Subsection 2.3.3, "COMMON Screen".

Acquiring the IP address from the DHCP server

The IP address can also be acquired from the DHCP server when the EtherNet/IP function is used on a hardware option on which the Ethernet function runs.
For details of how to acquire the IP address from the DHCP server, refer to "Fast Ethernet/Fast Data Server OPERATOR'S MANUAL (B-64014EN)".

For acquiring the IP address from the DHCP server, either of the following procedures can be selected:

- Every time the power is turned on, the setting is acquired from the DHCP server.
- When the setting is acquired from the DHCP server, it is saved. When the power is turned on next time and after, the saved setting is used, and the setting is not acquired from the DHCP server.

For details of the setting, see "BASIC screen" in Subsection 2.3.5, "BASIC Screen and ALLOCATION Screens".

2.3.3 COMMON Screen

Set the IP address and other items.

Procedure

1 Press function key

.

2 Soft key [ETHERNET] appears. When the soft key does not appear, press the continue key.

3 Press soft key [ETHERNET]. The "Ethernet setting screen" appears.

4 Press soft key [COMMON]. When the soft key does not appear, press the continue key. The COMMON screen (BASIC) appears.

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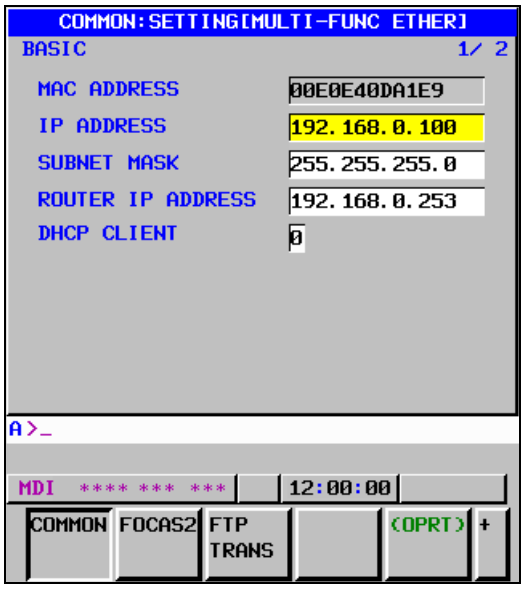

COMMON screen (BASIC)

Setting items

Item	Description
IP ADDRESS	Specify the IP address of the hardware option. (Example of specification format: "192.168.0.100")
SUBNET MASK	Specify a mask address for the IP addresses of the network. (Example of specification format: "255.255.255.0")
ROUTER IP ADDRESS	Specify the IP address of the router. Specify this item when the network contains a router. (Example of specification format: "192.168.0.253")
DHCP CLIENT	If the Ethernet and EtherNet/IP Adapter functions are operated on the same hardware option, the value of bit 6 (DHC) of parameter No. 904, related to the DHCP client function, is displayed, and another value can be set. With the EtherNet/IP Adapter Safety function, the DHCP client function cannot be used.

Display item

Item	Description
MAC ADDRESS	MAC address of the hardware option

2.3.4 Configuration of the EtherNet/IP Adapter Setting Screens

This subsection explains the setting screens for operating the EtherNet/IP Adapter function.
The configuration of the setting screens is shown below.

Configuration of the setting screens for the EtherNet/IP Adapter function

Use the BASIC screen to set general items related to the EtherNet/IP Adapter function.
One page of the ALLOCATION screen corresponds to one allocation. Up to four allocation settings can be specified.

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NOTE

1 Before changing a parameter on an EtherNet/IP Adapter setting screen, set the MDI mode or emergency stop state.

2 If the Change protection level of the Ethernet function is higher than the Operation level in the 8-level data protection function, no settings can be changed. This rule applies to both operation on a hardware option on which the Ethernet function runs and that on a hardware option on which the function does not run.

2.3.5 BASIC Screen and ALLOCATION Screen

Procedure

1 Press function key SYSTEM.

2 Soft key [ETHERNET] appears. When the soft key does not appear, press the continue key.

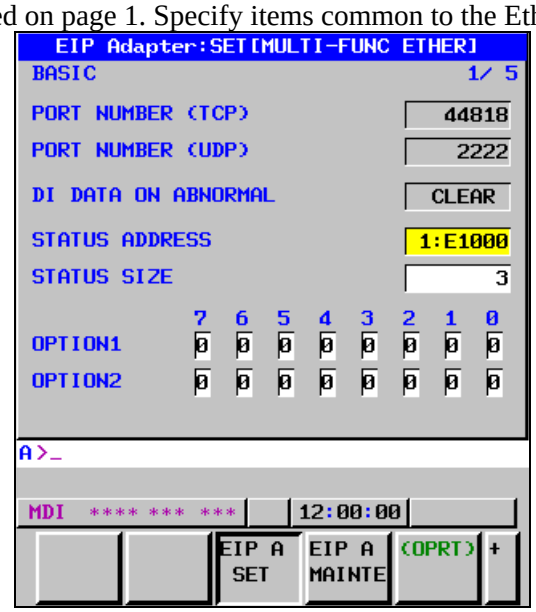
3 Press soft key [ETHERNET]. The "Ethernet setting screen" appears.

4 Press soft key [EIP A SET]. When the soft key does not appear, press the continue key.

5 The BASIC setting screen (page 1) appears. Use page keys PAGE ↑ PAGE ↓ to display a desired page.

BASIC screen

The BASIC screen is displayed on page 1. Specify items common to the EtherNet/IP Adapter function.



EtherNet/IP Adapter setting screen (BASIC)

Setting items

Item	Description
DI DATA ON ABNORMAL Default: HOLD	Specify operation to be performed when the update of data in the DI area stops. HOLD: Data in the DI area is held (nothing is performed). CLEAR: The DI area is cleared to 0. Use soft keys for setting. Press soft keys [(OPRT)] and [DI DATA], then select [HOLD] or [CLEAR].

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Item	Description
STATUS ADDRESS Default: ---	Specify the start address of the PMC R, E, or D area for storing the status of the EtherNet/IP Adapter function. If you do not want to use the status, specify " " (blank). "---" is displayed in "STATUS ADDRESS" and 0 is displayed in "STATUS SIZE". The valid setting range depends on the effective PMC area. It also depends on the setting of "STATUS SIZE".
STATUS SIZE Default: 0 Valid settings: 0, 1, and 3	Specify the size of the PMC area for storing the status. Data to be output to the PMC area can be determined according to the size. If you do not want to use the status, specify 0. "---" is displayed in "STATUS ADDRESS" and 0 is displayed in "STATUS SIZE".
OPTION1 Default: 00000000	Bits 0-1: Specify operation to be performed when the DHCP client function (bit 6 of parameter No. 904) is used to acquire the local IP address, subnet mask, router IP address, DNS server IP addresses 1 and 2, and local domain from the DHCP server. These option bits are valid only when set on the screen displayed by pressing soft key [ETHERNET]. Bit 0: The parameters acquired by the DHCP client function are: 0: Not saved in nonvolatile memory (SRAM). 1: Saved in nonvolatile memory. When the parameters are successfully saved, bit 1 is automatically set to 1. Bit 1: The DHCP client function is: 0: Enabled. 1: Disabled. (This bit cannot be set manually.) Bit 2: Specifies data to be output to an EDS file when both the Scanner and Adapter functions are enabled. 0: An EDS file for the Scanner function is output when data is output from the Scanner function setting screen; an EDS file for the Adapter function is output when data is output from the Adapter function setting screen. 1: An EDS file containing data of both the Scanner and Adapter functions is output regardless of the screen from which data is output. Bits 3-7: Reserved. (Must be 0.)
OPTION2 Default: 00000000	Bit 0: When the power is turned on next time, the basic and allocation settings of the EtherNet/IP Adapter function are: 0: Not initialized. 1: Initialized. (NOTE 3) Bits 1-7: Reserved. (Must be 0.)

⚠ **WARNING**
Before allocating the PMC area, be sure to read Section 3.1, "DI/DO DATA AND STATUS DATA" in Part II, "COMMON".

NOTE
1 When a setting is changed, the POWER MUST BE OFF alarm is issued. To have the changes take effect, turn the power off, then on again.
2 The following items are shared with the EtherNet/IP Adapter and Scanner functions on the same hardware option. When both the EtherNet/IP Adapter and Scanner functions are enabled, the value changed for either of them is reflected to the other.
- DI DATA ON ABNORMAL
- OPTION1

3 When initialization is executed by setting bit 0 of OPTION2 to 1, all items are returned to their defaults and any changes are lost. Carefully set this bit.

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Display items

Item	Description
PORT NUMBER (TCP)	The standard EtherNet/IP TCP port number (44818) is displayed.
PORT NUMBER (UDP)	The standard EtherNet/IP UDP port number (2222) is displayed.

Status

The status is detected by the EtherNet/IP Adapter function. When STATUS SIZE is 1, only the 1st byte is output to the PMC area; when it is 3, all information is output to the area.

		Status							
		#7	#6	#5	#4	#3	#2	#1	#0
Status address	+0	OPE	-	-	-	-	-	-	ERR
	+1	-	-	-	-	ENA4	ENA3	ENA2	ENA1
	+2	-	-	-	-	IN4	IN3	IN2	IN1

The last one digit of each signal name indicates the number of the corresponding allocation setting. This number is represented as x in the table below.

Signal	Description
ERR	An error occurs. (MS: RECOVERABLE FAULT or UNRECOVERABLE FAULT)
OPE	Communication is normally operating. (MS: DEVICE OPERATIONAL)
ENAx	Item "STATE" of allocation setting x is "ENABLE".
INx	An Exclusive Owner connection is being connected to allocation setting x.

> ⚠ **CAUTION**
> When IN1 to IN4 in the status is 1, the value of the DI signal is not always valid. Check the actual signal value to see whether communication is being executed.

Operation

Changing the setting for DI DATA ON ABNORMAL

1 Press soft key [(OPRT)]. Soft key [DI DATA] appears.

2 Press soft key [DI DATA]. Soft keys [HOLD] and [CLEAR] appear.

3 Press the soft key corresponding to the value you want to set.

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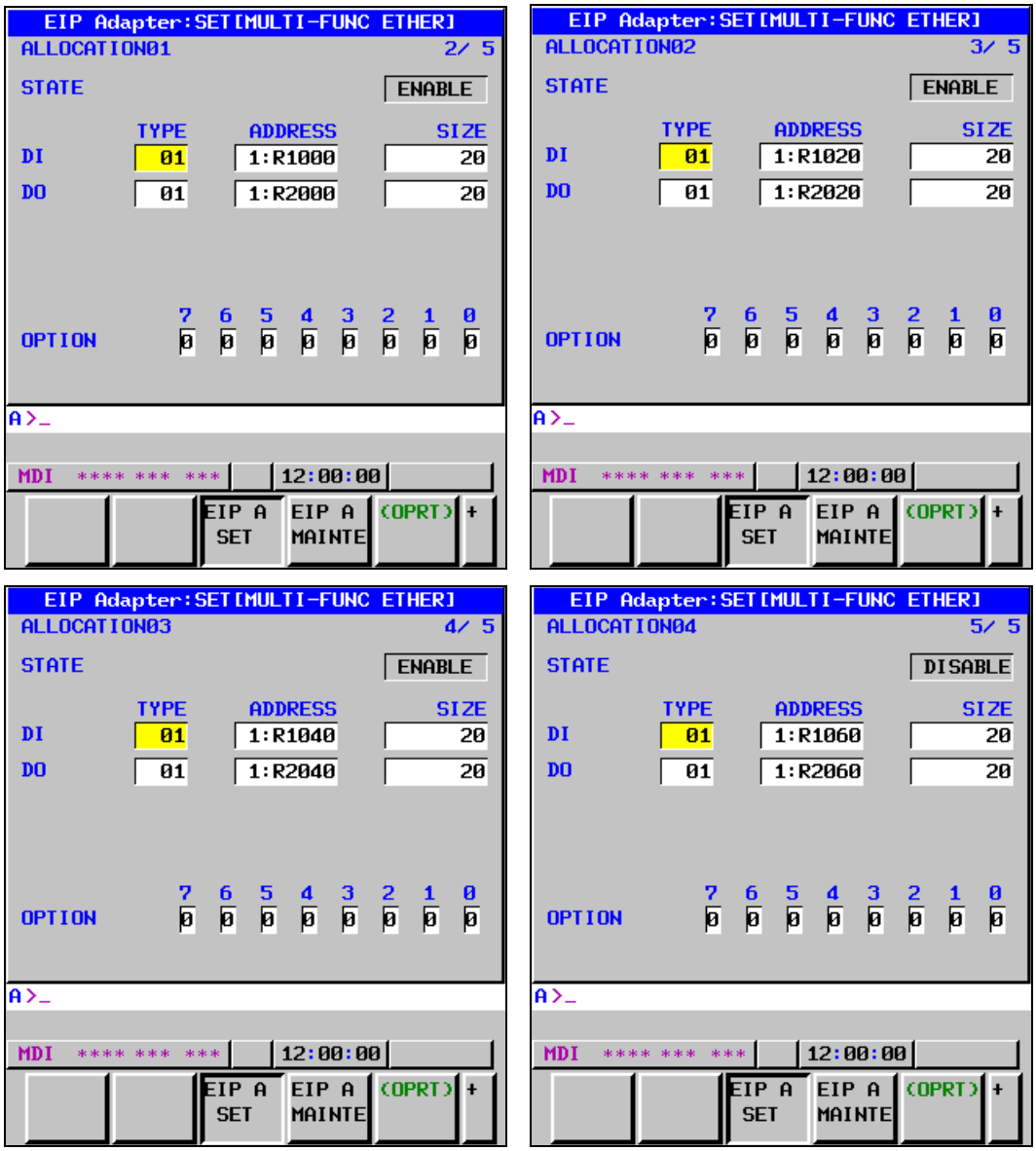
ALLOCATION screen

The ALLOCATION screen is displayed on pages 2 to 5. Pages 2 to 5 correspond to allocation setting 1 to 4, respectively.



EtherNet/IP Adapter setting screen (ALLOCATION)

Setting items

Item	Description
STATE Default: DISABLE	Specify whether to use the allocation setting displayed on the screen. ENABLE: The allocation setting is used. DISABLE: The allocation setting is not used. When STATE is ENABLE, no settings can be changed. If an attempt is made to change a setting, the message "Change ENABLE into DISABLE" appears. To change settings, first change "STATE" to "DISABLE". After you have changed the settings, change "STATE" to "ENABLE". When "STATE" is changed to "ENABLE", the consistency of the setting is checked. If there is a problem, a message appears and STATE is kept to "DISABLE". The consistency of the setting is also checked at the startup of the CNC. If there is a problem, "STATE" is automatically changed to "DISABLE". Use soft keys for setting. Press soft keys [(OPRT)] and [STATE], then select [ENABLE] or [DISABLE]

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<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>TYPE
Default: 0
Valid settings: 0 and 1</td><td>Specify the type of area for storing DI/DO data.
0: DI/DO data is not used. (ADDRESS and SIZE cannot be set.)
1: DI/DO data is allocated in the PMC area.
When "TYPE" is changed, "ADDRESS" is initialized to "---" and "SIZE" is initialized to 0.
When " " (blank) is specified in "ADDRESS" or 0 is specified in "SIZE", 0 is displayed in "TYPE", "---" is displayed in "ADDRESS", and 0 is displayed in "SIZE". The allocation setting is in the unused state.</td></tr>
<tr><td>ADDRESS
Default: ---</td><td>Specify the address of the area for storing DI/DO data.
When "TYPE" is 0, no value can be set.
When "TYPE" is 1, specify the start address of the PMC area for storing DI/DO data. The R, D, or E area can be specified. The X area can also be specified for DI, and the Y area can also be specified for DO.
The valid setting range depends on the actual range of the PMC R/E/D/X/Y area.
While considering the "SIZE" setting, specify a value so that the area is within the PMC area range.
To allocate the PMC X/Y area, also set parameters Nos. 11937 to 11939. For details of these parameters, see Section 4.3, "PARAMETERS RELATED to PMC" in Part II, "COMMON".</td></tr>
<tr><td>SIZE
Default: 0
Valid setting range: 0 to 256</td><td>Specify the size (in bytes) of the area for storing DI/DO data.
When "TYPE" is 0, no value can be set.
When "TYPE" is 1, specify the size of the PMC area for storing DI/DO data.
While considering the "ADDRESS" setting, specify a value so that the area is within the PMC area range.</td></tr>
<tr><td>OPTION
Default: 00000000</td><td>Bits 0-1: Unit of DI/DO data
<table>
<tr><th>Bit 1</th><th>Bit 0</th><th>Unit of unit</th></tr>
<tr><td>0</td><td>0</td><td>Byte</td></tr>
<tr><td>0</td><td>1</td><td>Word (2 bytes)</td></tr>
<tr><td>1</td><td>0</td><td>Long (4 bytes)</td></tr>
<tr><td>1</td><td>1</td><td>Setting error</td></tr>
</table>
- When the unit of data is set to word, the values specified for ADDRESS and SIZE must be in word units.
Example) ADDRESS/SIZE = R1000/2, R1002/4, E1004/6
- When the unit of data is set to long, the values specified for ADDRESS and SIZE must be in long units.
Example) ADDRESS/SIZE = R1000/4, R1004/8, E1008/12
For details of the unit of data, see Subsection 1.2.3, "Unit of Data and Concurrency of Data".
Bit 2: Conversion of endian
0: Endian is not converted.
1: Endian is converted.
For details of conversion of endian, See Subsection 1.2.4, "Conversion of Endian".
Bits 3-7: Reserved. (Must be 0.)</td></tr>
</table>

⚠ WARNING

Before allocating the PMC area, be sure to read Section 3.1, "DI/DO DATA AND STATUS DATA" in Part II, "COMMON".

NOTE

When a setting is changed, the POWER MUST BE OFF alarm is issued. To have the changes take effect, turn the power off, then on again.

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Operation

Changing the STATE setting

1 Press soft key [(OPRT)]. Soft key [STATE] appears.

2 Press soft key [STATE]. Soft keys [ENABLE] and [DISABLE] appear.

3 Press the soft key corresponding to the value you want to set.

Consistency of an allocation setting

When "STATE" is changed to "ENABLE", the consistency of the setting is checked.
If any of the following conditions is satisfied, there is a problem with the setting and STATE cannot be changed to ENABLE:

- For both DI/DO, "TYPE" is 0 to set the setting in the unused state.
- Although a value is set in "TYPE", "ADDRESS" is "---" and "SIZE" is 0.
- A DI/DO range is beyond the current memory type range.
- Both bits 0 and 1 of OPTION are 1.
- Although bit 0 of OPTION is 1, the "ADDRESS" or "SIZE" setting is not in word units.
- Although bit 1 of OPTION is 1, the "ADDRESS" or "SIZE" setting is not in long units.

2.3.6 Outputting an EDS File

This subsection explains the method for outputting an EDS file to a memory card or USB memory.
For details of data to be output to an EDS file and the default file names, see Subsection 2.1.2, "EDS File".

A memory card or USB memory is available as the input/output device to which to output an EDS file. To select an input/output device, use parameter No. 20. For details of this parameter, see Section 4.1, "PARAMETER RELATED TO DATA INPUT/OUTPUT" in Part II, "COMMON".

> ⚠ **CAUTION**
> While an external input/output device such as a memory card or USB memory is being accessed, do not turn the power to the CNC off or remove the external input/output device. Doing so may damage the external input/output device.

> **NOTE**
> 1 An EDS file can be output only in the MDI or EDIT mode, or emergency stop state.
> 2 When the 8-level data protection function is enabled, whether an EDS file can be output depends on the setting for the Ethernet function for the 8-level data protection function.
> 3 Any input/output device other than a memory card or USB memory cannot be used to output an EDS file.

Procedure

1 Press function key .

2 Soft key [ETHERNET] appears. When the soft key does not appear, press the continue key.

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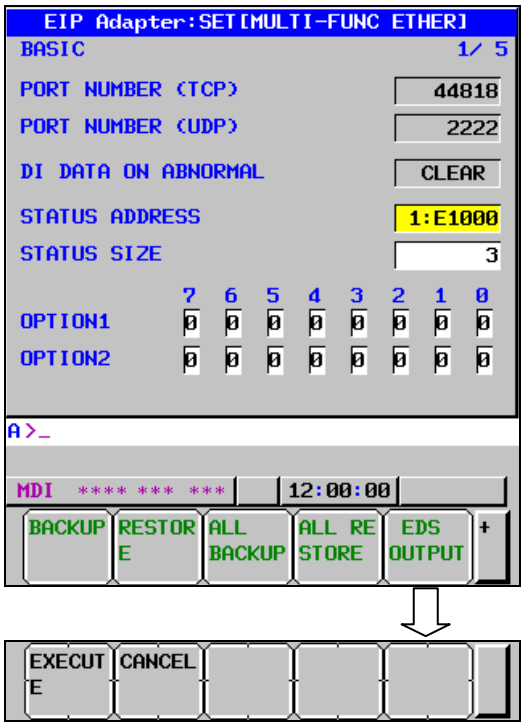
3 Press soft key [ETHERNET]. The "Ethernet setting screen" appears.
4 Press soft key [EIP A SET]. The EtherNet/IP Adapter setting screen appears. When the soft key does not appear, press the continue key.
5 Press soft key [(OPRT)], then soft key [+]. The soft key for outputting an EDS file [EDS OUTPUT] appears.
6 Press soft key [EDS OUTPUT]. Soft keys [EXECUTE] and [CANCEL] appear.
7 Enter the file name of an EDS file in the key-in buffer and press soft key [EXECUTE]. The EDS file is output. When no file name is specified, "F_CNC101.EDS" is used. "EXECUTING" blinks during execution.



2.4 MAINTENANCE

The EtherNet/IP Adapter function can be used on one or two hardware options. Like the setting screens, the maintenance screens of these hardware options are independent of each other. On the screen for each hardware option, perform required operations.

Procedure for displaying the screen

To display the maintenance screen, follow the instructions in Subsection 2.4.1, "Displaying Screens" in Part II, "COMMON".

This section explains procedures using examples when the EtherNet/IP Adapter function runs on a hardware option on which the Ethernet function runs. When the EtherNet/IP Adapter function runs on a hardware option on which the Ethernet function does not run, read soft key [ETHERNET] as [EtherNet/IP].

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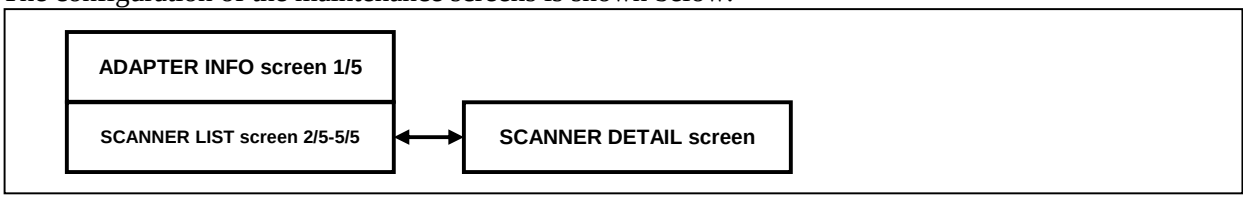
2.4.1 Configuration of the EtherNet/IP Adapter Maintenance Screens

This subsection explains the maintenance screens for the EtherNet/IP Adapter function.
The configuration of the maintenance screens is shown below.



Configuration of the maintenance screens for the EtherNet/IP Adapter function

The ADAPTER INFO screen allows you to confirm information including the MS and NS LED indications, vendor ID, and device type.
The SCANNER LIST screen shows a list of information of scanners being connected. From this screen, you can move to the SCANNER DETAIL screen.
The SCANNER DETAIL screen allows you to confirm detailed information including RPI and API of a scanner.

NOTE
As maintenance screens, the PING screen, COM STATE screen, and TASK STATE screen common to Industrial Ethernet are also provided.
For details of these screens, see Chapter 2, "SOFTWARE MAINTENANCE INFORMATION" in Part V, "MAINTENANCE".

2.4.2 ADAPTER INFO and SCANNER LIST Screens

Procedure

1 Press function key SYSTEM.
2 Soft key [ETHERNET] appears. When the soft key does not appear, press the continue key.
3 Press soft key [ETHERNET]. The "Ethernet setting screen" appears.
4 Press soft key [EIP A MAINTE]. When the soft key does not appear, press the continue key.
5 Use page keys PAGE ↑ PAGE ↓ to display a desired page.

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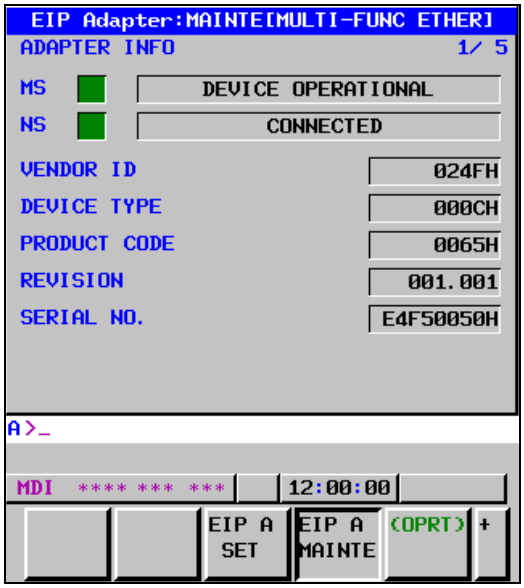
ADAPTER INFO screen

The ADAPTER INFO screen is displayed on page 1. This screen shows information related to the EtherNet/IP Adapter function.



EtherNet/IP Adapter maintenance screen (ADAPTER INFO)

Display items

Item	Description
MS	The indication of the Module Status LED and its meaning are displayed.
NS	The indication of the Network Status LED and its meaning are displayed.
VENDOR ID	The vendor ID of the adapter is displayed in hexadecimal.
DEVICE TYPE	The device type of the adapter is displayed in hexadecimal.
PRODUCT CODE	The product code of the adapter is displayed in hexadecimal.
REVISION	The revision of the adapter is displayed. major-revision.minor-revision
SERIAL NO.	The serial number of the adapter is displayed in hexadecimal.

The indications of the MS LED and their meanings are listed below.

Indication of the MS LED	Meaning
Off	DISABLE FUNCTION
Flashing (green)	STANDBY
On (green)	DEVICE OPERATIONAL
Flashing (red)	RECOVERABLE FAULT
On (red)	UNRECOVERABLE FAULT

The indications of the NS LED and their meanings are listed below.

Indication of the NS LED	Meaning
Off (MS is also off)	---
Off	NO IP ADDRESS
Flashing (green)	NO CONNECTIONS
On (green)	CONNECTED
Flashing (red)	CONNECTION TIMEOUT
On (red)	DUPLICATE IP ADDRESS

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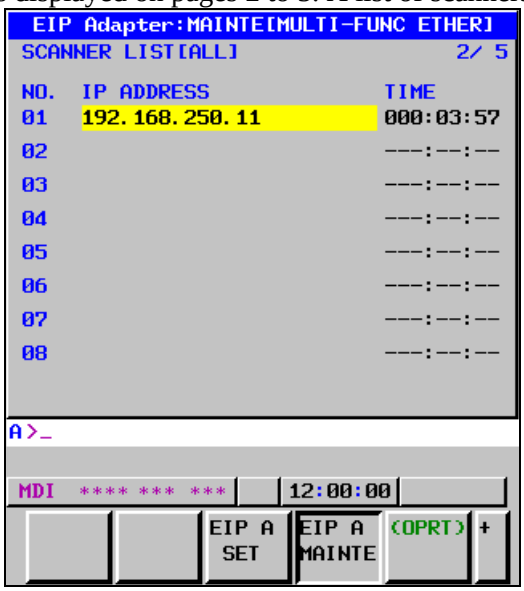
SCANNER LIST screen

The SCANNER LIST screen is displayed on pages 2 to 5. A list of scanners being connected is displayed.



EtherNet/IP Adapter maintenance screen (SCANNER LIST)

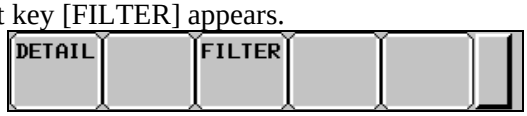
Display items

Item	Description
SCANNER LIST	The IP addresses of the scanners being connected to the adapter are displayed in a list. The scanners displayed in the list can be changed according to an allocation setting by pressing soft key [FILTER].
IP ADDRESS	IP address of a scanner being connected.
TIME	The time during which the scanner is connected is displayed in format HHH:MM:SS. When the connection time exceeds 999:59:59, the display is not updated from 999:59:59.

Operations

Changing the scanners displayed in the list according to an allocation setting

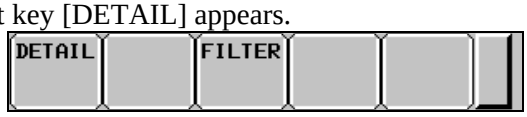
1 Press soft key [(OPRT)]. Soft key [FILTER] appears.



2 Each time soft key [FILTER] is pressed, the end of the title changes as follow:
[ALL] -> [ALLOCATION01] -> [ALLOCATION02] -> [ALLOCATION03] -> [ALLOCATION04] -> [ALL] ->
Only the scanners connected to the allocation setting displayed in brackets are displayed in the list.
The connections for connected Explicit messaging are displayed when [ALL] is specified.

Moving to the SCANNER DETAIL screen

1 Press soft key [(OPRT)]. Soft key [DETAIL] appears.



2 Move the cursor and select the IP address of a scanner. Then, press soft key [DETAIL] to move to the SCANNER DETAIL screen.

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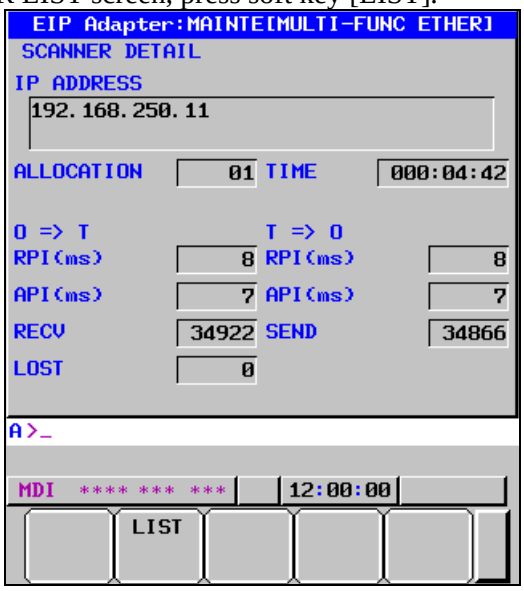
2.4.3 SCANNER DETAIL Screen

Procedure

1 On the SCANNER LIST screen, move the cursor and select a scanner for which to display detailed information.
2 Press soft key [(OPRT)], then [DETAIL]. The SCANNER DETAIL screen appears.
3 To return to the SCANNER LIST screen, press soft key [LIST].



EtherNet/IP Adapter function maintenance screen (SCANNER DETAIL)

Display items

Item	Description
IP ADDRESS	IP address of the scanner. When the connection is disconnected while the SCANNER DETAIL screen is being displayed, the message "Disconnected" appears to the right of the IP address. In this case, the value of each item is not updated. Return to the SCANNER LIST screen and select a scanner again.
TIME	Same as that displayed on the SCANNER LIST screen.
ALLOCATION	Number of the allocation setting of the EtherNet/IP Adapter function that the scanner uses for the connection.
RPI(ms)	Interval at which to send and receive DI/DO data that the scanner requests to the EtherNet/IP Adapter function. The unit is milliseconds. O => T (originator => target): Interval at which to receive DI data in the direction from the scanner to the adapter. T => O (target => originator): Interval at which to send DO data in the direction from the adapter to the scanner.
API(ms)	Interval at which the EtherNet/IP Adapter function actually receives and sends DI/DO data. The unit is millisecond. O => T means the DI data receiving interval, and T => O means the DO data sending interval.
RECV	Number of packets the EtherNet/IP Adapter function received normally. The display range is from 0 to 65535. When the value exceeds 65535, it returns to 0.
LOST	Number of packets the EtherNet/IP Adapter function could not receive normally. The display range is from 0 to 65535. When the value exceeds 65535, it returns to 0.
SEND	Number of packets the EtherNet/IP Adapter function sends normally. The display range is from 0 to 65535. When the value exceeds 65535, it returns to 0.

2.4.4 LOG Screen

The LOG screen is common to the Adapter and Scanner functions. see Subsection 1.4.4, "LOG Screen".

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3 Modbus/TCP SERVER FUNCTION

⚠ **WARNING**

Only when a partner client device sends data and the Modbus/TCP Server function of CNC receives it, the data is checked and processed by CNC. Even if the communication of the client happens to stop unexpectedly, the Modbus/TCP Server function does not detect such situations.
So, do not use the Modbus/TCP Server function for data exchange application concerned with machine safety.
For example, even if the client attempts to send the "STOP" data at some timing, it is not guaranteed that it always reaches CNC. Thus, it is very dangerous to build the system concerned with machine safety by using Modbus/TCP Server function.
If the data exchange concerned with machine safety fails, the machine may behave unexpectedly, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.

NOTE

1 If using the Modbus/TCP Server function, be sure to read Part II, "COMMON".
2 The Modbus/TCP Server function can also be used on the following Ethernet hardware.
- Embedded Ethernet (embedded Ethernet port) of Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A, and Series 0*i*-F
- Fast Ethernet board of Series 30*i*/31*i*/32*i*-A

The description in this chapter assumes that the function is used on the hardware options of Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A, and Series 0*i*-F, but basically, this also applies if the above-mentioned Ethernet hardware is used. For notes on using the above-mentioned Ethernet hardware, see Section 3.6, "IF USING THE FUNCTION ON OTHER ETHERNET HARDWARE".

3.1 OVERVIEW

This section provides an overview of the Modbus/TCP Server function.

Modbus/TCP data model

The following four kinds of data formats, each called a "Table", are defined for the Modbus/TCP data model.

Table name	Object type (data type)	Type of READ/WRITE
Discrete input	Single bit	READ only
Coils	Single bit	READ-WRITE
Input Registers	16-bit word	READ only
Holding Registers	16-bit word	READ-WRITE

NOTE

1 For the CNC Modbus/TCP Server function, only "Holding Registers" can be used.
"Discrete input", "Coils", and "Input Registers" cannot be used.

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NOTE
2 "READ" means the input of data as viewed from the Modbus/TCP client, and "WRITE" means the data of output as viewed from the client.

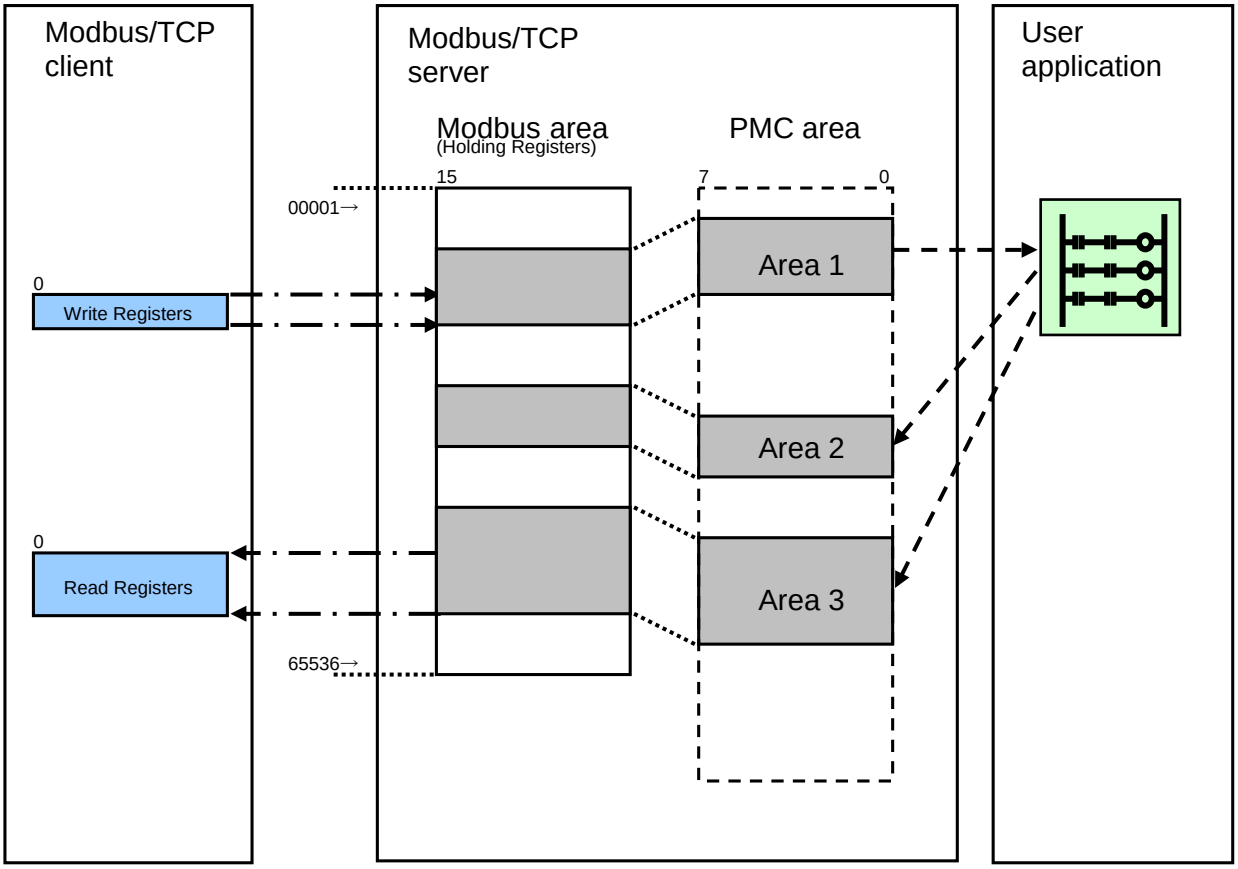
Modbus/TCP function codes

For the Modbus/TCP Server function of the CNC, the following function codes are supported.

Function code name	Code number	Maximum data size
Read Holding Registers	03h	READ: 125 words
Write Multiple Registers	10h	WRITE: 123 words
Read/Write Multiple Registers	17h	READ: 125 words / WRITE: 121 words

Modbus area (Holding Registers)

For the Modbus/TCP Server function, the Modbus area (Holding Registers) of 65536 words (131072 bytes) is prepared.
And the Modbus area can be allocated to the PMC area.
Because of this, the data accessed from the Modbus/TCP client device to the Modbus area can be posted to the PMC area, and the user application (Ladder program etc.) can accessed the Modbus area through the PMC area.
This allocation can be set in up to three areas.
The Modbus/TCP area is a data area in word units, and can take address values of 1 to 65536.



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3.2 SPECIFICATIONS

This section describes the specifications of the Modbus/TCP Server function of the CNC.

3.2.1 Specification List

The following is a list of specifications of the Modbus/TCP Server function of the CNC.

Item	Description
Required software option	- Modbus/TCP Server function option (R968) - Ethernet function option (S707)
Combination with other functions	Functions that can be used at the same time on the same hardware option or different hardware options - FL-net function (J692) - EtherNet/IP Scanner function (R966) - EtherNet/IP Adapter function (R967) - PROFINET IO Device function (R972) Functions that can be used at the same time on the same hardware option - Ethernet function (S707) - Data Server function (S737) Functions that can be used at the same time on different hardware options - PROFINET IO Controller function (R971) For details of combining it with other functions, see Chapter 2, "HARDWARE OPTIONS AND COMMUNICTION FUNCTIONS" in Part II, "COMMON".
PMC area that can be allocated	- DI : R, E, and D areas - DO : R, E, and D areas - Status : R and E area
Maximum DI/DO data size	Depends on the effective PMC area.
Port number (TCP)	502 (standard value)
Function specification	- "Automatic TCP connection management" is supported. This means that the user application (ladder program) need not take TCP connection into consideration. - "Non-priority connection pool" is supported. This means that if there are requests from more Modbus/TCP clients than a certain number, connections will be terminated in order of the oldest to the newest. (NOTE 1) ("Priority connection pool" is not supported.) - "Access control service" is not supported. This means that no client devices require authentication (user name or password) to access the FANUC Modbus/TCP Server function.
Maximum number of clients that can connect to a single CNC at the same time	10

NOTE

1 Use the function within the maximum number of clients that can be connected to a single CNC at the same time.
If there are connection requests from more clients than the maximum number, the communication with the oldest client will be disconnected. Thus, a client that wants to keep a connection must reconnect if disconnected, assuming that it may be disconnected from the server.

2 If the 8-level data protection function is enabled, whether the Modbus/TCP Server function can be set depends on the settings of the 8-level data protection function.

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NOTE

3 The Modbus/TCP Server function must always be operated on the same hardware option as that on which the Ethernet function is operated, and its communication parameters are included in the Ethernet function.
For information about the Ethernet function and for hardware information not contained in this manual, refer to the Fast Ethernet/Fast Data Server OPERATOR'S MANUAL (B-64014EN).

3.2.2 Unit of Data and Concurrency of Data

The unit of I/O data can be word (2 bytes) only.
The concurrency of word (2-byte) data is guaranteed, and there will never be data segmentation. The concurrency of long (4-byte) data cannot be guaranteed.

⚠ WARNING

If data longer than word data (2-byte data) is handled, data segmentation may occur.
To handle word data (2 bytes), for notes on creating a ladder program, see Subsection 3.1.2, "Creating a Ladder Program" in Part II, "COMMON".
Data segmentation may result in the machine behaving unexpectedly, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.

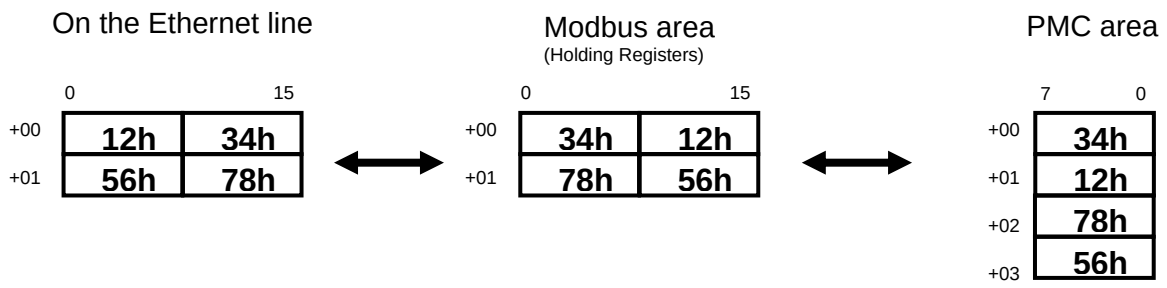
3.2.3 Conversion of Endian

The byte arrangement in the Modbus area (Holding Registers) is little endian when endian is not converted to make it easy for the ladder program to handle it.
With the appropriate setting item on the setting screen of the Modbus/TCP Server function, the byte arrangement can be changed to big endian.

⚠ WARNING

Before starting operation, make sure that an appropriate value is specified for the setting item for selecting conversion of endian and data is exchanged in the correct order.
If operation is started without checking the above, the machine may behave unexpectedly, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.

When endian is not converted



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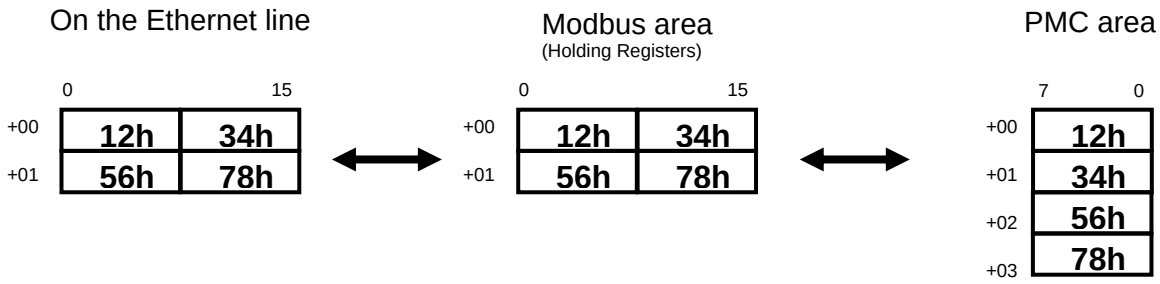
When endian is converted



3.2.4 Setting Examples If Using Multiple Communication Functions at the Same Time

This subsection provides examples of setting parameters Nos. 970 to 976 if using multiple communication functions, in addition to the Modbus/TCP Server function.
For details of how to set parameters Nos. 970 to 976, see Chapter 2, "HARDWARE OPTIONS AND COMMUNICTION FUNCTIONS" in Part II, "COMMON".

Ex.	Function to use	Hardware option on which to operate it	NC parameters
1	Modbus/TCP Server function Ethernet function Data Server function	Fast Ethernet board mounted in slot 1	No.970= 3 No.974= -1 No.971= -1 No.975= -1 No.972= -1 No.976= -1 No.973= -1

3.3 SETTING

This section describes the setting of the Modbus/TCP Server function.

Procedure

1 Press function key SYSTEM.
2 Soft key [ETHERNET] appears. When the soft key does not appear, press the continue key.
3 Press soft key [ETHERNET] to display the setting screen of the Ethernet function.
4 Press soft key [COMMON] or [Modbus SET]. When the soft key does not appear, press the continue key.

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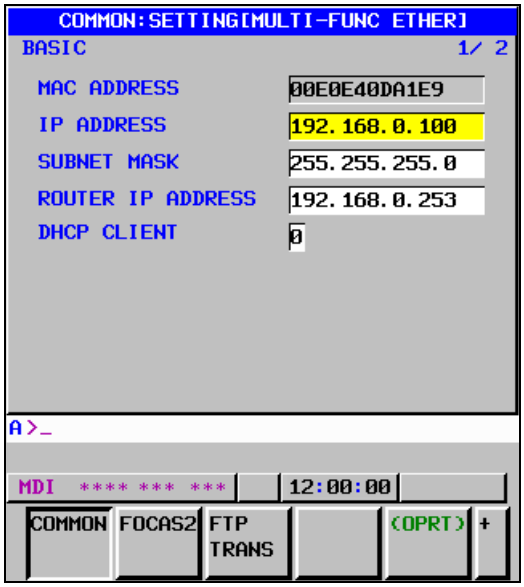
3.3.1 COMMON Screen

In the above-mentioned procedure, press soft key [COMMON] to display the COMMON screen (BASIC).



COMMON screen (BASIC)

Setting items

Item	Description
IP ADDRESS	Specify the IP address of the hardware option. (Example of specification format: "192.168.0.100")
SUBNET MASK	Specify the mask address for the IP addresses of the network. (Example of specification format: "255.255.255.0")
ROUTER IP ADDRESS	Specify the IP address of the router. Specify this item if the network contains a router. (Example of specification format: "192.168.0.253")
DHCP CLIENT	The value of bit 6 (DHC) of parameter No. 904, related to the DHCP client function, is displayed, and another value can be set.

Display item

Item	Description
MAC ADDRESS	MAC address of the hardware option

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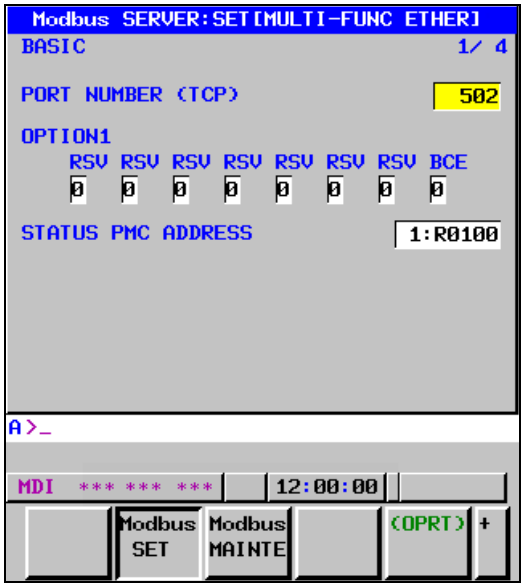
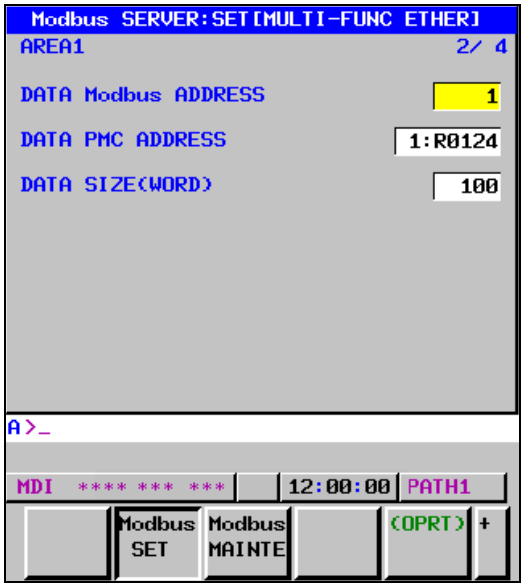
3.3.2 Setting Screen of the Modbus/TCP Server Function

In the above-mentioned procedure, press soft key [Modbus SET] to display the setting screen of the Modbus/TCP Server function.



Setting screen 1 (BASIC) of the Modbus/TCP Server function



Setting screen 2 (areas 1 to 3) of the Modbus/TCP Server function

Setting items

Item	Description
PORT NUMBER (TCP)	Specify the port number for using the Modbus/TCP Server function. The setting range is from 0 to 65535. Usually, set 502. When 0 is set, the Modbus/TCP Server function is not operated.
OPTION1	Bit 0: BCE The byte arrangement in the Modbus area is assumed to be 0: little endian 1: big endian Bits 1 to 7: RSV Be sure to set 0.
STATUS PMC ADDRESS	Specify the top address in the E/R area of the PMC in which to store the status. The setting range depends on the effective PMC area. A 1-byte area is used.
DATA Modbus ADDRESS	Specify the top address in the Modbus area (Holding registers) used to exchange I/O with the Modbus/TCP client. The setting range is 1 to 65536. For details of the endian of the data in the Modbus area (Holding Registers), see Subsection 3.2.3, "Conversion of Endian".
DATA PMC ADDRESS	Specify the top address in E/R/D area of the PMC used to exchange I/O with the Modbus/TCP client. The setting range depends on the effective PMC area. Only the even-numbered address can be set.
DATA SIZE	Specify the data size (unit: word size) used to exchange I/O with the Modbus/TCP client. The setting range depends on the effective PMC area. If not exchange I/O with the area, specify 0 for this parameter.

⚠ **WARNING**
Before allocating the PMC area, be sure to read Section 3.1, "DI/DO DATA AND STATUS DATA" in Part II, "COMMON".

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NOTE
1 For the changed parameters to take effect, turn the CNC power off and back on.
2 Set the Modbus areas for areas 1 to 3 so that they do not overlap. If any overlap, different actions are taken for READ and WRITE, as follows:
For READ, area n where n is the largest is given priority, and data is read from that area.
For WRITE, the same value is written to all the overlapping areas.

Status

The status (1 byte) is detected by the Modbus/TCP Server function.

		Status							
		#7	#6	#5	#4	#3	#2	#1	#0
Status PMC address	**+0**	**COM**	**INT**	**-**	**-**	**-**	**-**	**-**	**ERR**

Bit	Name	Description
#0	ERR	Unrecoverable error 0: The Modbus/TCP Server function is operating correctly. 1: An unrecoverable error occurred in the Modbus/TCP Server function.
#1-5	-	Reserved
#6	INT	Initialization completion 0: The initialization of the Modbus/TCP Server function is not completed. 1: The initialization of the Modbus/TCP Server function is completed.
#7	COM	Communicating 0: Not communicating with a Modbus/TCP client. 1: Communicating with one or more Modbus/TCP clients.

3.4 MAINTENANCE

This section describes the maintenance of the Modbus/TCP Server function.

3.4.1 Maintenance Screen of the Modbus/TCP Server Function

The connection status of the client connected to the Modbus/TCP Server can be checked on this screen.

Procedure

1 Press function key .
2 Soft key [ETHERNET] appears. When the soft key does not appear, press the continue key.
3 Press soft key [ETHERNET], and then soft key [Modbus MAINTE] appears on the setting screen of the Ethernet function.
4 Press soft key [Modbus MAINTE], and then the maintenance screen (CLIENT LIST) of the Modbus/TCP Server function is displayed.

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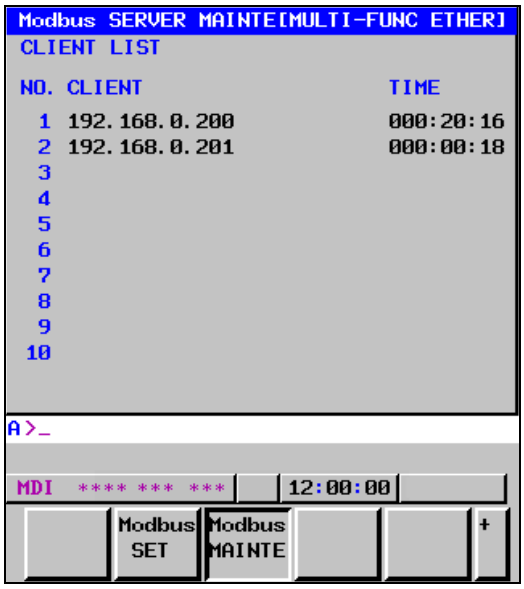

Maintenance screen (CLIENT LIST) of the Modbus/TCP Server function

Display items

Item	Description
CLIENT	The IP addresses of the Modbus/TCP clients connected to this Modbus/TCP Server are displayed. (Example of display format: "192.168.0.200") They are displayed in the order in which the clients are connected.
TIME	The connecting times of the Modbus/TCP clients connected to this Modbus/TCP Server are displayed. The displayed times are updated automatically. The display format for a time of hour (hhh), minute (mm) and second (ss) is "hhh:mm:ss". The maximum value is "999:59:59", and if the maximum value is exceeded, the time will not be updated from "999:59:59".

3.4.2 Log Screen of the Modbus/TCP Server Function

The log related to the Modbus/TCP Server function can be checked.

Procedure

1 Press function key .
2 Soft key [ETHER LOG] appears. When the soft key does not appear, press the continue key.
3 Press soft key [ETHER LOG], and then soft key [Modbus] appears on the log screen of the Ethernet function.
4 Press soft key [Modbus], and then the log screen of the Modbus/TCP Server function appears.

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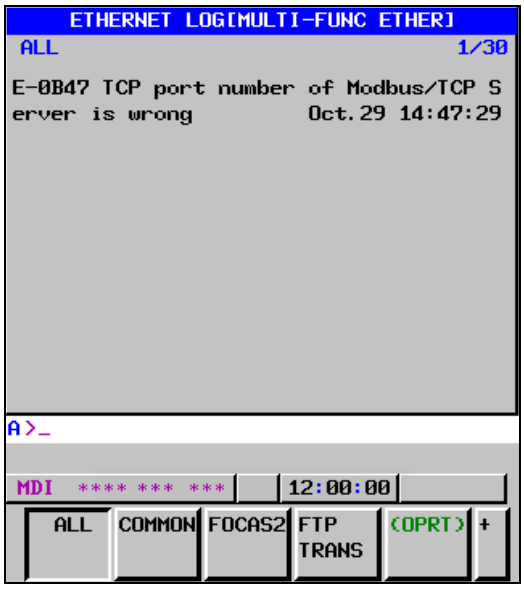

Log screen of the Modbus/TCP Server Function

The latest log information is displayed at the top of the screen. At the right end of a log item, the occurrence date and time of the log item is indicated. Date and time data is indicated in the format "MMM.DD hh:mm:ss", where MMM represents a month, DD represents a day, hh represents hour, mm represents minute, and ss represents second.

Operation

To clear the log information, press soft key [(OPRT)] then soft key [CLEAR].

> **NOTE**
> The log information for the Modbus/TCP Server function is stored in volatile memory and it is lost when the power of CNC is turned off. If an error occurs, check the log information before turning the power off.

The following lists major log messages.

Error code	Log message	Meaning and action to be taken
E-0B47	TCP port number of Modbus/TCP Server is wrong	A value outside the valid setting range may be set.
E-0B48	Status PMC address of Modbus/TCP Server is out of range	A value outside the valid setting range may be set.
E-0B49	Data PMC address of Modbus/TCP Server is wrong	An odd-numbered address may be set.
E-0B4A	Data PMC address of Modbus/TCP Server is out of range	A value outside the valid setting range may be set.
E-0B4B	Modbus area of Modbus/TCP Server is out of range	A value outside the valid setting range may be set.
E-1001	All Modbus communication paths are busy	The number of connected communication parties (Modbus/TCP clients) exceeded the maximum number of connectable clients. Connections to communication parties (Modbus/TCP clients) will be terminated in order of the oldest to the newest.
E-1003	Version number of Modbus packet is wrong	Specify a correct version number according to the protocol of Modbus/TCP.
E-1004	Length of Modbus packet is wrong	Specify a correct size according to the protocol of Modbus/TCP.

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Error code	Log message	Meaning and action to be taken
E-100B	Function code of Modbus packet is wrong	The specified function code may not be supported. For details of supported function codes, see "Modbus/TCP function codes" in Section 3.1, "OVERVIEW".
E-1015 E-1016	Data address of Modbus packet is wrong	Specify a correct data address according to the protocol of Modbus/TCP.
E-1017 E-1018 E-1019	Data value of Modbus packet is wrong	Specify a correct data address according to the protocol of Modbus/TCP.
E-101A	Data address that client requested is out of range (1-3)	If the function is used on embedded Ethernet (embedded Ethernet port), no PMC area is assigned to the Modbus area requested from the connected communication party (Modbus/TCP client). Assign a PMC area.
E-XXXX	(No message)	Internal error. Report the error number to FANUC.

3.5 RELATED NC PARAMETER

	#7	#6	#5	#4	#3	#2	#1	#0
14882							MOD	

[Input type] Parameter input
[Data type] Bit

NOTE
When this parameter is set, the power must be turned off before operation is continued.

#1 MOD The Modbus/TCP Server function is used
0: on a hardware option.
1: on embedded Ethernet (embedded Ethernet port).

3.6 IF USING THE FUNCTION ON OTHER ETHERNET HARDWARE

This section contains notes on using the Modbus/TCP Server function on the following Ethernet hardware.

- Embedded Ethernet (embedded Ethernet port) of Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A, and Series 0*i*-F
- Fast Ethernet board of Series 30*i*/31*i*/32*i*-A

NOTE
The function cannot be used on the embedded Ethernet of Series 30*i*/31*i*/32*i*-A.

Setting screen, maintenance screen, and log screen

The following describes how to display each screen depending on the Ethernet hardware used.
Basically, the screen examples in this chapter apply although there may be some minor differences in layout. For a description of the setting method, see the "Detailed description" column of the table.

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Ethernet hardware	How to display the screen	Detailed description
Embedded Ethernet (embedded Ethernet port) of Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A, and Series 0*i*-F	- Setting screen, maintenance screen Function key SYSTEM -> Soft key [EMBED PORT]	- Section 3.3 - Subsection 3.4.1 of Section 3.4
	- Log screen Function key ? MESSAGE -> Soft key [EMBED LOG]	- Subsection 3.4.2 of Section 3.4
Fast Ethernet board of Series 30*i*/31*i*/32*i*-A	- Setting screen, maintenance screen Function key SYSTEM -> Soft key [ETHER BOARD]	- Section 3.3 - Subsection 3.4.1 of Section 3.4
	- Log screen Function key ? MESSAGE -> Soft key [BOARD LOG]	- Subsection 3.4.2 of Section 3.4

3.6.1 For the Embedded Ethernet of Series 30*i*/31*i*/32*i*/35*i*-B, PM*i*-A, and Series 0*i*-F

This subsection contains notes on using the function on the embedded Ethernet (embedded Ethernet port) of Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A, and Series 0*i*-F.
The following lists the specifications different from those if using the function on a hardware option.

Item	Description
Ethernet hardware on which the function can be operated	Embedded Ethernet (embedded Ethernet port)
Required software option	Only the Modbus/TCP Server function option (R968) is required. The Ethernet function option (S707) is not required.
Combination with other functions	The function can be operated at the same time as the function of embedded Ethernet. For information about the embedded Ethernet functions and for hardware information not contained in this manual, refer to Chapters "CONTROL UNIT HARDWARE" and "EMBEDDED ETHERNET FUNCTIONS" of the maintenance manual of the CNC used.
Maximum number of clients that can connect to a single CNC at the same time	3

NOTE

1 The function cannot be operated on the PCMCIA LAN card.
It cannot be operated on a hardware option and on embedded Ethernet at the same time. Switch it between them, using bit 1 (MOD) of parameter No. 14882.

2 A Modbus/TCP client device can access only a Modbus area with a PMC area allocated. If a client device attempts to access a Modbus area with no PMC area allocated, an address error (Exception Code = 0x02, Exception Name = ILLIGAL DATA ADDRESS) is returned to the client device.
Be sure to allocate a PMC area to the Modbus area to be accessed by a client device.

3 After the communication parameters of the Modbus/TCP Server function are changed, it is possible to restart the COMMON screen for the changes to take effect, instead of turning the power off and then back on.

4 Settings of communication parameters are not subject to the 8-level data protection function.

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NOTE
5 Communication parameters of the Modbus/TCP Server function that is operated on embedded Ethernet are included in the embedded Ethernet parameters.
6 The communication speed is lower than on a hardware option.

3.6.2 For the Fast Ethernet Board of Series 30*i*/31*i*/32*i*-A

Basically, the specifications that apply to the hardware options of Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A, and Series 0*i*-F also apply.

NOTE
1 Parameters Nos. 970 to 976 and bit 1 (MOD) of parameter No. 14880 cannot be used. The function must always be operated on a fast Ethernet board.
2 Settings of communication parameters are not subject to the 8-level data protection function.

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4 PROFINET IO CONTROLLER FUNCTION

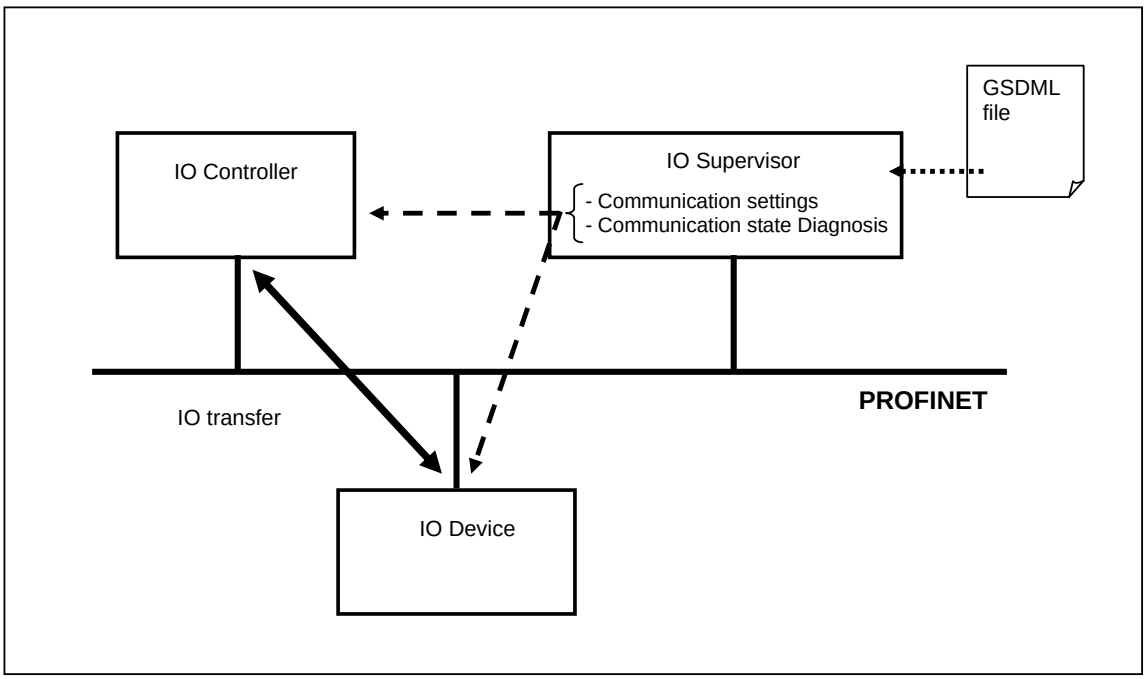
NOTE
If using the PROFINET IO Controller function, be sure to read Part II, "COMMON".

4.1 OVERVIEW

This section provides an overview of the PROFINET function.

4.1.1 Introduction

PROFINET is an industrial network using Ethernet. It enables IO communication between IO Controller and IO Device. The communication standard is managed by PI (PROFIBUS & PROFINET International).



Overview of PROFINET

4.1.2 Terminology

Terms related to the PROFINET function are described below.

IO Controller
This is a device that starts IO transfer.
In PROFIBUS, it is equivalent to a class 1 master function.

IO Device
This device communicates with an IO Controller.
In PROFIBUS, it is equivalent to a slave function.

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IO Supervisor

In general, this is an instrument such as a PC (personal computer) and an HMI (human machine interface).
It is used to make the communication settings for and diagnose a PROFINET system, and is usually supplied from an IO Controller device manufacturer.
In PROFIBUS, it is equivalent to a class 2 master function.

NOTE

To use the IO Controller function for a FANUC CNC, the FANUC-specified IO Supervisor is required.
The FANUC-specified IO Supervisor is written as "Setting tool".
At present, the FANUC-specified Setting tool is the following product, supplied from Molex, Inc.
The product name, order number, and supplier of the FANUC-specified Setting tool are as follows.

Product name)
PROFINET Configuration Tool (PFN-CT) for FANUC CORPORATION
(May be abbreviated to "PFN-CT".)

Order number)
FAC-PFN-CON-CNF

Supplier)
- In Japan : Sales office of Okaya Electronics Corp.
- Outside of Japan : Sales office of Molex, Inc. in your area

GSDML (General Station Description Makeup Language) file

This is a file in XML form in that contains device information about a IO Device.
A GSDML file is necessary for making settings with an IO Supervisor.

NOTE

For how to get the GSDML file for each IO Device, contact the manufacturer of that IO Device.
If using the PROFINET IO Device function for a FANUC CNC, contact your sales representative for how to get the GSDML file.

I&M (Identification and Maintenance) data

This data is used to identify and maintain an IO Device.
An IO Supervisor and an IO Controller can get this data from an IO Device by way of communication.

IP parameters

The IP address, the subnet mask, and the router IP address are collectively called IP parameters.

CHANGE MODE

This mode allows the changing of the PROFINET parameters of the CNC.

PROTECT MODE

This mode protects (prohibits) the changing of the PROFINET parameters of the CNC.

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4.2 SPECIFICATIONS

This section describes the specifications of the PROFINET IO Controller function of the CNC.

4.2.1 Specification List

The following is a list of specifications of the PROFINET IO Controller function of the CNC.

Item	Description
PROFINET IO Conformance class	CC-A
Required software	PROFINET function software - For the Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A : 658R series - For the Series 0*i*-F : 658U series
Required software option	PROFINET IO Controller function option (R971)
Combination with other functions	Functions that can be used at the same time on different hardware options - Ethernet function (S707) - Modbus/TCP Server function (R968) - Data Server function (S737) - FL-net function (J962) - EtherNet/IP Scanner function (R966) - EtherNet/IP Adapter function (R967) - PROFINET IO Device function (R972) Functions that can be used at the same time on the same hardware option are not provided.
PMC area that can be allocated	- DI : R, E, D, and X areas - DO : R, E, D, and Y areas - Status : R and E areas
Maximum number of IO Devices that can be connected	48 Depending on the number of modules per IO Device and other factors, it may not be possible to connect up to 48 Devices.
Maximum DI/DO data size per IO Device	1024 bytes /1024 bytes
Maximum total size of DI/DO data of all IO Devices	12288 bytes /12288 bytes
DI/DO update time	2 ms or greater 2 ms is the minimum value that applies when the number of connected IO Devices and the DI/DO size are small. For details, see Section 4.5, "UPDATING DI/DO DATA".
Response when an alarm is received from an IO Device	Automatic operation
UDP port number	34962 to 34964 (fixed)

NOTE

1 A FANUC CNC does not support SNMP (Simple Network Management Protocol), and cannot make diagnosis of a CNC network using SNMP.

2 If the PROFINET IO Controller function is used, communication via a router and the DHCP/DNS function cannot be used.

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4.2.2 Unit of Data and Concurrency of Data

The unit of I/O data can be word (2 bytes) only.
The concurrency of word (2-byte) data is guaranteed, and there will never be data segmentation. The concurrency of long (4-byte) data cannot be guaranteed.

NOTE
"Unit of Data", as used here, is equivalent to the "Data type" of a module to configure in an IO Device. Check the data type of each module with the IO Device manufacturer.

⚠ WARNING
The data types of modules that are supported by the PROFINET IO Controller function of the CNC are byte, word (two bytes), and long (four bytes). For modules whose data type is long (four bytes) and for modules whose data type is byte and whose data size is larger than a word (two bytes), data segmentation may occur.
For an explanation of notes on creating a ladder program for guaranteeing the concurrency of data, see Subsection 3.1.2, "Creating a Ladder Program" in Part II, "COMMON".
Data segmentation may result in the machine behaving unexpectedly, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.

4.2.3 Conversion of Endian

The signal order of I/O data can be selected from the big-endian and the little-endian.
(Default setting: Big-endian)
For how to set the conversion of endian, see "Setting of endian conversion" in Subsection 4.6.1.7, "Setting of IO Devices".

⚠ WARNING
Before starting operation, make sure that an appropriate value is specified for the setting item for selecting the conversion of endian and data is exchanged in the correct order.
If operation is started without checking the above, the machine may behave unexpectedly, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.

NOTE
The actual signal order depends on the data type (byte, word, or long) of the module to configure in the IO Device and the specifications of the IO Device. Check the specifications of each IO Device with the manufacturer of that IO Device.

For the actual signal order due to the endian conversion, the relation between "On the Ethernet line" and the PMC area of the CNC is as follows.

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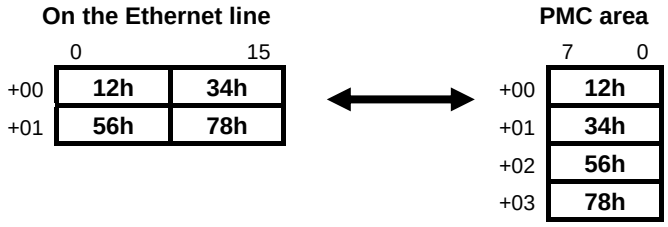
If the data type of the module is byte

If the big-endian is selected

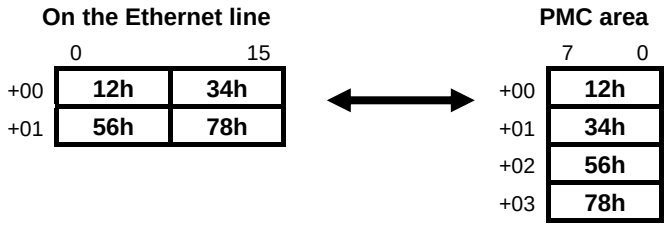


If the little-endian is selected

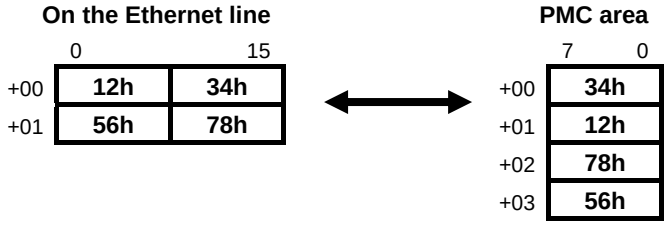
The relation is the same as that when the big-endian is selected.

If the data type of the module is word

If the big-endian is selected

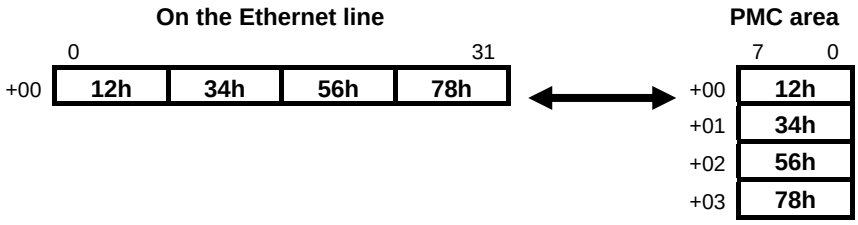


If the little-endian is selected

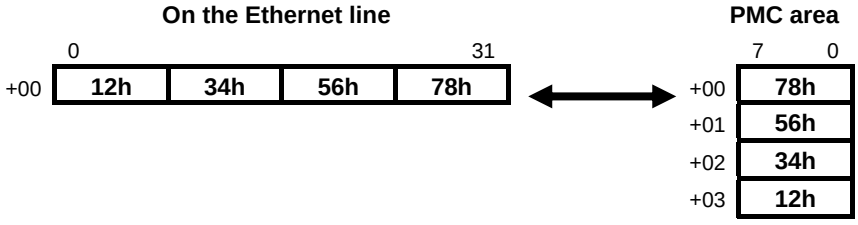


If the data type of the module is long

If the big-endian is selected



If the little-endian is selected



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4.2.4 Setting Examples If Using Multiple Communication Functions at the Same Time

This subsection provides examples of setting parameters Nos. 970 to 976 if using multiple communication functions, in addition to the PROFINET IO Controller function.
For details of how to set parameters Nos. 970 to 976, see Chapter 2, "HARDWARE OPTIONS AND COMMUNICTION FUNCTIONS" in Part II, "COMMON".

Ex.	Function to use	Hardware option on which to operate it	NC parameter
1	PROFINET IO Controller function	Multi-function Ethernet	No.970= 3 No.974= 1 No.971= -1 No.975= -1 No.972= -1 No.976= -1 No.973= 4
	Ethernet function Data Server function	Fast Ethernet board mounted in slot 1	
	PROFINET IO Device function	Fast Ethernet board mounted in slot 2	
2	PROFINET IO Controller function	Multi-function Ethernet	No.970= 3 No.974= 1 No.971= 4 No.975= -1 No.972= -1 No.976= -1 No.973= 3
	Ethernet function PROFINET IO Device function	Fast Ethernet board mounted in slot 1	
	FL-net function	Fast Ethernet board mounted in slot 2	

4.3 SETTING

This section describes the setting of the PROFINET IO Controller function.

NOTE

1 To make the settings of the PROFINET IO Controller function, either set the CNC to the emergency stop state or change the CNC mode to the MDI mode, and change the setting item "MODE" on the setting screen of the PROFINET IO Controller to "CHANGE MODE".
2 To prevent the settings from being changed unintentionally, change the setting item "MODE" on the CNC screen to "PROTECT MODE" after completing settings.
For details of the setting item "MODE", see Subsection 4.3.2.2, "Setting screen of the PROFINET IO Controller function".
3 To make the settings of the PROFINET IO Controller function, use the FANUC-specified Setting tool (PFN-CT). For details of the Setting tool (PFN-CT), see Subsection 4.6.1, "PROFINET Configuration Tool (PFN-CT) for FANUC CORPORATION".

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4.3.1 Procedure for Making Settings

This subsection describes the procedure for making settings.

4.3.1.1 Making new settings

This subsection describes the procedure of making new settings.

Step	Description
1	• Setting of the IP parameters for the CNC In the CNC, set the IP parameters and restart the CNC. → See Subsection 4.3.2.1, "COMMON screen".
2	• Registration of the CNC in the Setting tool In the Setting tool, register the CNC. → See Subsection 4.6.1.3, "Registration of the CNC in the Setting tool".
3	• Installation of the GSDML file In the Setting tool, install the GSDML file of each IO Device. → See Subsection 4.6.1.4, "Installation of the GSDML file".
4	• Confirmation of IO Devices on the network In the Setting tool, confirm the IO Devices connected on the network. → See Subsection 4.6.1.5, "Confirmation of IO Devices on the network". If device names are not set for any of the connected IO Devices, set the device names. → See Subsection 4.6.1.6, "Setting of the device names for IO Devices".
5	• Setting of IO Devices In the Setting tool, make the settings for operating IO Devices. The device names to set here must match the ones that are set in step 4. → See Subsection 4.6.1.7, "Setting of IO Devices".
6	• Downloading of the settings In the Setting tool, download all the settings to the CNC. → See Subsection 4.6.1.8, "Downloading of settings".
7	• Allocation of the PMC area In the CNC, allocate the PMC area for DI/DO data and status data. → See Subsections 4.3.2.2, "Setting screen of the PROFINET IO Controller function" and 4.3.3, "PMC Allocation".

After the above settings are made, restarting the CNC causes communication to start with each IO Device.

4.3.1.2 Changing the settings of IO Devices

Start with step 5, "Setting of IO Devices", in Subsection 4.3.1.1, "Making new settings".

4.3.1.3 Adding new IO Devices

Start with step 3, "Installation of the GSDML file", in Subsection 4.3.1.1, "Making new settings".
If the GSDML file of the IO Device to add has already been installed, start with step 4, "Confirmation of IO Devices on the network".

4.3.1.4 If the Ethernet parameters of the CNC are changed

The Ethernet parameters of the CNC are changed in either of the following cases:

- You change the IP parameters on the COMMON screen of CNC
- You change the hardware option of the CNC, so that its MAC address is changed

In either case, perform step 2, "Registration of the CNC in the Setting tool", in Subsection 4.3.1.1, "Making new settings", first and then perform step 6, "Downloading of the settings".

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Perform other steps, if necessary.

4.3.2 Setting Screen of the CNC

This subsection describes the setting screen of the CNC.

Procedure

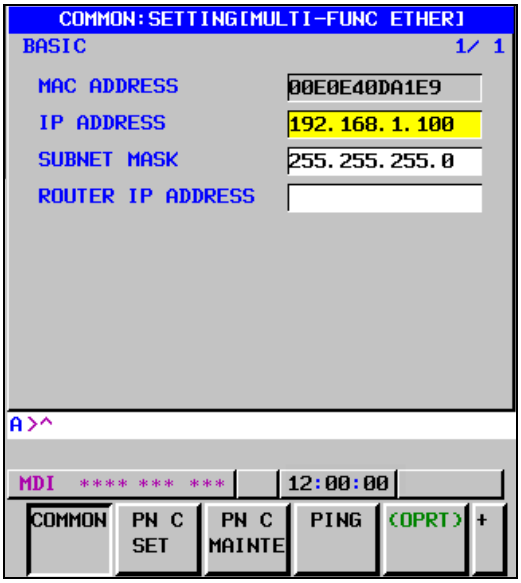
1 Press function key SYSTEM.

2 Soft key [PRFNET CNTRLR] appears. When soft key does not appear, press the continue key.

3 Press soft key [PRFNET CNTRLR]. Soft keys [COMMON], [PN C SET], [PN C MAINTE], [PING], "COM STATE", and "TASK STATE" appear.

4.3.2.1 COMMON screen

In the above-mentioned procedure, press soft key [COMMON] to display the COMMON screen (BASIC). On this screen, IP parameters can be checked.



COMMON screen (BASIC)

Setting items

Item	Description
IP ADDRESS	IP address of the hardware option. (Example of specification format: "192.168.0.100")
SUBNET MASK	Mask address for the IP addresses of the network. (Example of specification format: "255.255.255.0")
ROUTER IP ADDRESS	IP address of the router. Leave the item blank because PROFINET communication via a router is not supported.

Display item

Item	Description
MAC address	MAC address of the hardware option

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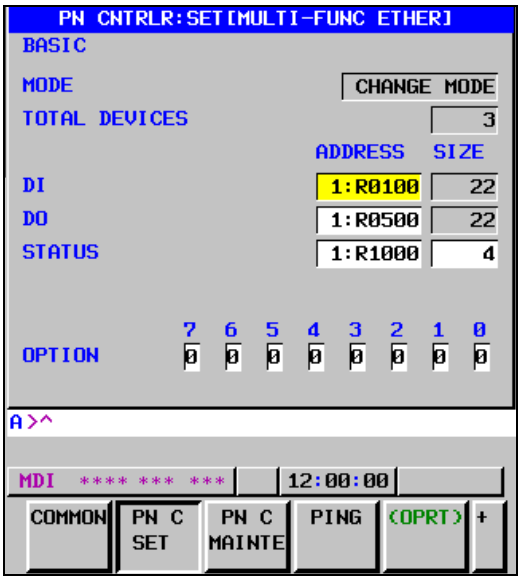
4.3.2.2 Setting screen of the PROFINET IO Controller function

In the above-mentioned procedure, press soft key [PN C SET] to display the setting screen (basic screen) of the PROFINET IO Controller function.



Setting screen of the PROFINET IO Controller function (BASIC)

Display item

The following display items are decided by the setting with the Setting tool.

Item	Description
TOTAL DEVICES	Number of IO Devices to connect.
DI/DO SIZE	Size of the area in which to store the DI/DO data of all IO Devices.

Setting items

Item	Description
MODE	Select the mode of the PROFINET IO Device function. - "CHANGE MODE" In this mode, settings can be changed from the Setting tool or the setting screen of the PROFINET IO Controller function. - "PROTECT MODE" In this mode, settings can not be changed from the Setting tool or the setting screen of the PROFINET IO Controller function.
DI/DO ADDRESS	Specify the top address of the PMC area in which to store the DI/DO data of all IO Devices. The specifiable PMC area is the R, E, D, X (DI only), or Y (DO only) area. Only a PMC address that is a multiple of 4 can be specified. For an explanation of the allocation of DI/DO data to the PMC, see Subsection 4.3.3.1, "DI/DO". If the X/Y address of the PMC is to be assigned, it is necessary to set parameters Nos. 11937 to 11939 also. For details of these NC parameters, see Section 4.3, "PARAMETERS RELATED TO PMC" in Part II, "COMMON".
STATUS ADDRESS	Specify the top address of the PMC area in which to store the status. The specifiable PMC area is the R or E area. For details of the notified status, see Subsection 4.3.3.2, "Status".
STATUS SIZE	Specify the size of the PMC area for storing the status. Setting range: 0 to 49 (byte). The status of the specified size is notified. For details of the notified status, see Subsection 4.3.3.2, "Status".

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<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>OPTION</td><td>Bit 0: The next time the power is turned on, all settings of the PROFINET IO Controller function are
0: Not initialized.
1: Initialized.
Bit 1: Specify the action to take on the data in the DI area of the IO Device when the communication is disconnected.
0: Clear the DI area to zero.
1: Hold the data in the DI area.
"When the communication is disconnected" above is when any of the status signals (+0 to +48) in Subsection 4.3.3.2, "Status", changes.
The action taken if the bit is set to 0 (Clear the DI area to zero) is as follows.
<table>
<tr><th>Signal</th><th>Change</th><th>Description</th></tr>
<tr><td>SF</td><td>0→1</td><td>The DI areas of all IO Devices are cleared to zero.</td></tr>
<tr><td>CONxx</td><td>1→0</td><td rowspan="3">Only the DI area of IO Device xx is cleared to zero.</td></tr>
<tr><td>RAPxx</td><td>1→0</td></tr>
<tr><td>IOxx</td><td>1→0</td></tr>
</table>
Bit 2-7: Reserved (Must be 0)</td></tr>
</table>

⚠ WARNING

1 Before allocating the PMC area, be sure to read Section 3.1, "DI/DO DATA AND STATUS DATA" in Part II, "COMMON".

2 When the communication is disconnected, the DI area depends on the setting of bit 1 of "OPTION". When the communication is connected again, the data sent from the IO Device is reflected in the DI area of the IO Device. This means that if zero data is sent from the IO Device immediately after the communication is connected again, the DI area of the IO Device is cleared to zero.

Operation

Changing the setting for MODE

The setting for MODE can be changed.

1 Press soft key [(OPRT)] to display soft key [MODE].

2 Press soft key [MODE] to display soft keys [CHANGE MODE] and [PROTECT MODE].

3 Press the soft key of the desired mode.

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4.3.3 PMC Allocation

This subsection describes the allocation of DI/DO data and the status to the PMC.

4.3.3.1 DI/DO

This subsection describes the allocation of DI/DO data to the PMC.

Allocation rules

DI/DO data is allocated per each module configured with the Setting tool, with data items being moved forward in ascending order of IO Device numbers to fill spaces, if necessary.
The top address of each module is always a 2-byte boundary, regardless of the data type or the data size.
Top address examples) 1:R0000, 2:R0002, 3:R0004, 1:E0002

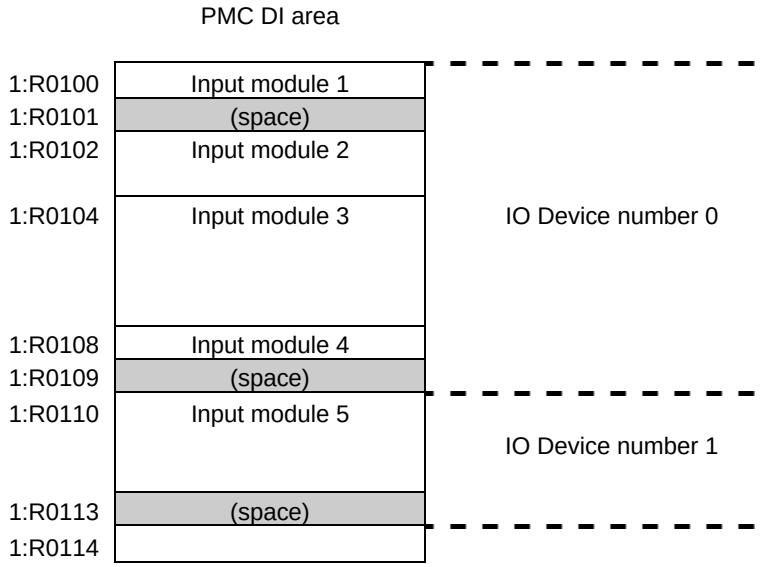
The following shows a DI area example for a case in which two IO Devices are used and input modules of various data types are set.

Input modules configured with the Setting tool)

IO Device		Module name	Data type	Data size
"Number"	IO Device number			
001	0	Input module 1	Byte	1 byte
		Input module 2	Word	2 bytes
		Input module 3	Long	4 bytes
		Input module 4	Byte	1 byte
010	1	Input module 5	Byte	3 bytes

"DI ADDRESS" on the setting screen of the PROFINET IO Controller function)
1:R0100

Results of allocation)



The allocation of the DO area where output modules are configured is the same as that shown above.

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⚠ CAUTION

1 If the size of a module is an odd number, a 1-byte space is inserted. This space is treated as follows.
DI : Zero data is entered in a 1-byte space.
DO : Even if data is set in a 1-byte space, it is not output to the IO Device.

2 If a module whose data type is long is allocated to a 2-byte boundary of PMC addresses, data segmentation may occur. To prevent data segmentation from occurring on this module, it is necessary to allocate it to a 4-byte boundary of PMC addresses.
If you want to prevent data segmentation on a module whose data type is long, insert a module whose data byte is byte or word into a sequence of modules and make adjustments so that this module is allocated to a 4-byte boundary.

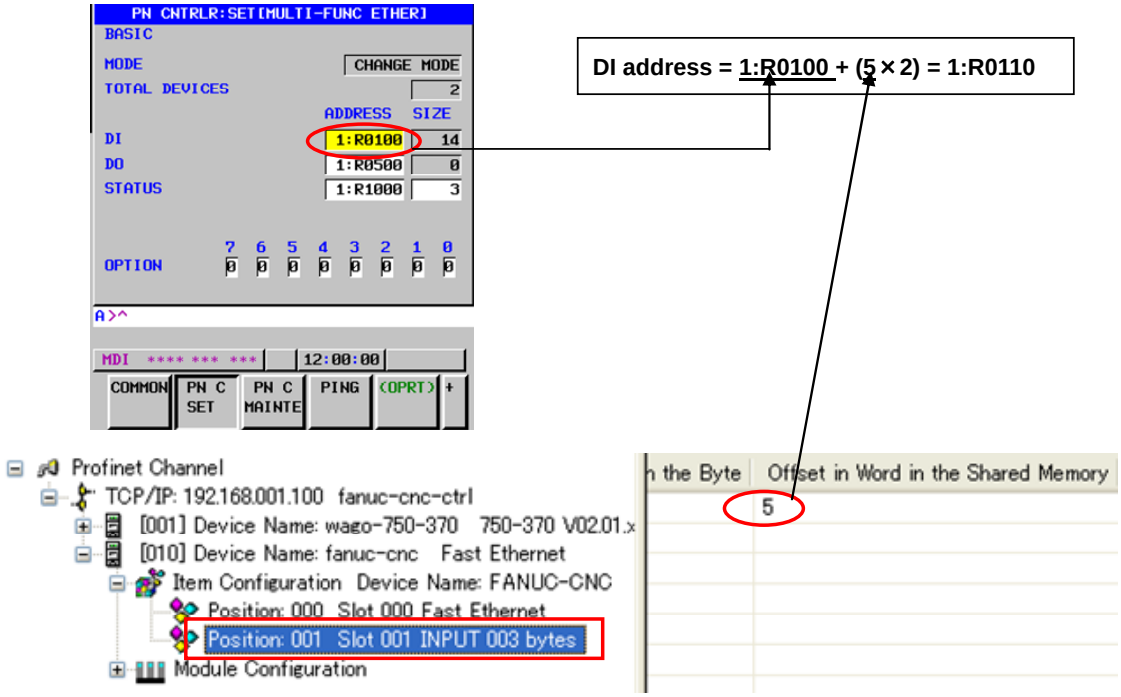
Calculating the DI/DO addresses of each module if using the Setting tool (PFN-CT)

The following describes how to calculate the DI/DO addresses of each module if using the Setting tool (PFN-CT).

DI or DO addresses of each module = X + (Y × 2)
X: In the CNC, "DI/DO ADDRESS" on the setting screen of the PROFINET IO Controller function
Y: In the Setting tool, the value of "Offset in Word in the Shared Memory" in "Position" of each module of the "Profinet Channel" screen

Calculation example)

The following is an example of calculating the DI address of the input module "INPUT 003 bytes" implemented in slot 001 of the IO Device "fanuc-cnc" ("Number" = 010 and IO Device number = 1) of two IO Devices.



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4.3.3.2 Status

This subsection describes the allocation of the status to the PMC.

		Status							
		#7	#6	#5	#4	#3	#2	#1	#0
Address	+0	SW		–	–	–	–	BF	SF
	+1	–	–	–	–	–	IO00	RAP00	CON00
	...	...							
	+48	–	–	–	–	–	IO47	RAP47	CON47

Status (+0)

This is the status of the entire PROFINET IO Controller function.

Bit	Name	Description
#0	SF	System error 0: The PROFINET IO Controller function operates normally. 1: An unrecoverable fault occurs in the PROFINET IO Controller function.
#1	BF	Bus fault 0: Communication with all IO Devices has been established. 1: One or more IO Devices exist with which communication has not been established.
#2-6	–	Reserved (zero is notified)
#7	SW	System wake up 0: The system of the PROFINET IO Controller function has not started. 1: The system of the PROFINET IO Controller function has started. The other status bits become effective after SW is changed to 1.

Status (+1 to +48)

This is the status of each IO Device.
In the following description, "xx" (= 0 to 47) means an IO Device number.

Bit	Name	Description
#0	CONxx	Connection with the IO Device 0: The IO Device is not connected. 1: The IO Device is connected.
#1	RAPxx	Application ready signal from the IO Device 0: The application ready signal is not notified from the IO Device. 1: The application ready signal is notified from the IO Device. This signal becomes 0 if the communication with the corresponding IO Device is disconnected.

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<table>
<tr><th>Bit</th><th>Name</th><th>Description</th></tr>
<tr><td>#2</td><td>IOxx</td><td>DI/DO communication
0: The CNC is not communicating with the IO Device about DI/DO data.
1: The CNC is communicating with the IO Device about DI/DO data.
It is checked that those of the following status bits in the PROFINET standard that meet the DI/DO size conditions of each IO Device are 1, and IOxx is set to 1.
<table>
<tr><th>DI/DO size conditions</th><th>Status bits to check</th></tr>
<tr><td>DI size > 0 and
DO size > 0</td><td>• Bits 2, 4, and 5 of the APDU status
• Bit 7 of the IOPS status
• Bit 7 of the IOCS status</td></tr>
<tr><td>DI size > 0 and
DO size = 0</td><td>• Bits 2, 4, and 5 of the APDU status
• Bit 7 of the IOPS status</td></tr>
<tr><td>DI size = 0 and
DO size > 0</td><td>• Bits 2, 4, and 5 of the APDU status
• Bit 7 of the IOCS status</td></tr>
</table>
The meaning of each status bit is as follows.
<table>
<tr><th>Status</th><th>Description</th></tr>
<tr><td>Bit 2 of the APDU status</td><td>This bit indicates that the data of the input frame is effective.</td></tr>
<tr><td>Bit 4 of the APDU status</td><td>This bit indicates that the control application of the IO Device is in the "RUN" state.</td></tr>
<tr><td>Bit 5 of the APDU status</td><td>This bit indicates that the IO Device is in normal operation.</td></tr>
<tr><td>Bit 7 of the IOPS status</td><td>This bit indicates that the data of the input module is effective.
If multiple input modules are connected, there is IOPS for each input module, and IOxx becomes 1 only if the data of all input modules is effective.</td></tr>
<tr><td>Bit 7 of the IOCS status</td><td>This bit indicates that the data of the output module was correctly processed on the IO Device.
If multiple output modules are connected, there is IOCS for each output module, and IOxx becomes 1 only if the data of all output modules was correctly processed.</td></tr>
</table>
For details of the status in the PROFINET standard, see Subsection 4.6.2.3, "Status".</td></tr>
<tr><td>#3-7</td><td>–</td><td>Reserved (zero is notified)</td></tr>
</table>

4.4 MAINTENANCE

This section describes the maintenance of the PROFINET IO Controller function.

4.4.1 Maintenance Screen of the PROFINET IO Controller Function

The maintenance information about the PROFINET IO Controller function can be checked.

NOTE

The maintenance screen includes the PING screen, communication state screen, and task state screen common to the communication functions.
For details of these screens, see Chapter 2, "SOFTWARE MAINTENANCE INFORMATION" in Part V, "MAINTENANCE".

Procedure

1 Press function key .

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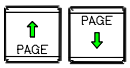
2 Soft key [PRFNET CNTRLR] appears. When the soft key does not appear, press the continue key.
3 Press soft key [PRFNETCNTRLR]. Soft keys [COMMON], [PN C SET], [PN C MAINTE], [PING], [COM STATE], and [TASK STATE] appear.
4 Press soft key [PN C MAINTE] to display the maintenance screen of the PROFINET IO Controller function.

Composition of the screen

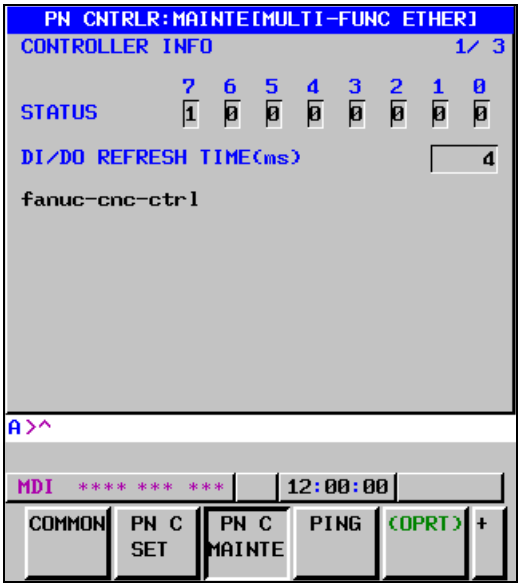
The composition of the maintenance screen of the PROFINET IO Controller function is as follows.

- CONTROLLER INFO screen
- DEVICE INFO screen (2 pages)

It is possible to switch between the pages by using the page keys  .

CONTROLLER INFO screen

The first page is the CONTROLLER INFO screen.



Maintenance screen of the PROFINET IO Controller function (CONTROLLER INFO)

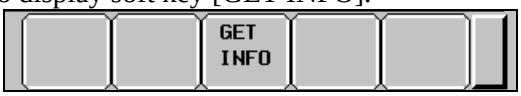
Display items

Display item	Description
STATUS	This is the status of the IO Controller function. The contents are the same as those of status (+0) in Subsection 4.3.3.2 "Status".
DI/DO REFRESH TIME	This indicates the interval at which to refresh the DI/DO data allocated to the PMC area of all IO Devices. The unit is the millisecond. If the DI/DO size is small, this time will be equal to the minimum value of "Refresh Period" in all IO Devices that is set with the Setting tool. For details, see Section 4.5, "UPDATING DI/DO DATA".
(Details)	Detailed information is displayed by performing an information getting operation. For an explanation of the information getting operation, see "Operation" below.

Operation

Getting the detailed information about the IO Controller

1 Press soft key [(OPRT)] to display soft key [GET INFO].



2 Input any of the following first and then press soft key [GET INFO].

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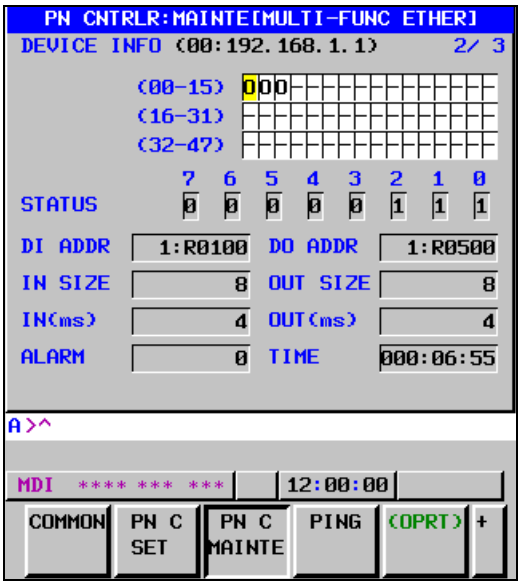
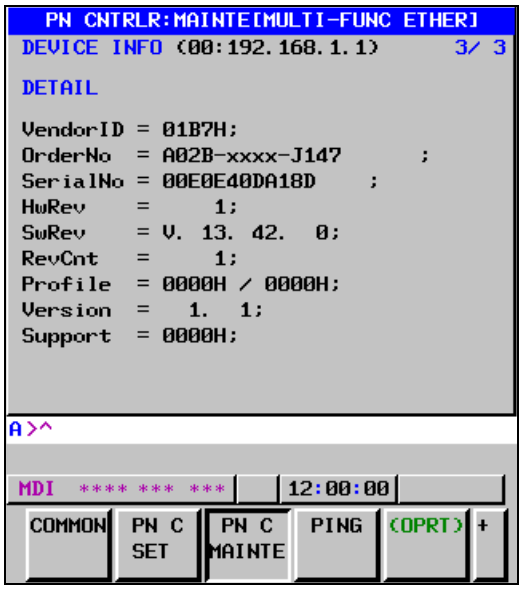
<table>
<tr><th>Input value</th><th>Display item</th><th>Description</th></tr>
<tr><td>None or a value other than those below</td><td>Device name</td><td>The device name of the IO Controller function that is set with the Setting tool is displayed.
Up to 240 characters can be displayed.
Default name: fanuc-cnc-ctrl</td></tr>
<tr><td>1</td><td>Equipment information</td><td>The following equipment information is displayed.
<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>VendorID</td><td>This is 16-bit identification information that uniquely identifies the maker.
01B7H: FANUC CORPORATION</td></tr>
<tr><td>DeviceID</td><td>This is 16-bit identification information that is defined by the maker independently.
0101H: PROFINET IO Controller for FANUC CNC</td></tr>
<tr><td>Minimum DI/DO Refresh Time(ms)</td><td>This is the minimum value of "Refresh Period" in all IO Devices that is set with the Setting tool.</td></tr>
</table></td></tr>
<tr><td>C</td><td></td><td>The detailed information is cleared.
"C" may be input in either upper or lower case.</td></tr>
</table>

DEVICE INFO screen

The second page is the DEVICE INFO screen. The third page is the DETAIL screen of DEVICE INFO.





Maintenance screen of the PROFINET IO Controller function (DEVICE INFO)

Display items

Item	Description
Table of (00 - 47)	When an IO Device is selected with the cursor, the IO Device number and the IP address of the IO Device are displayed in the upper part of the table. The state of communication is displayed in the table as follows. O: Communication is in progress. E: A communication error has occurred. -: The connection setting is invalid. (In this case, the IP address is not displayed.)
STATUS	This is the status of the IO Device selected with the cursor. The contents are the same as those of status (+1 to +48) in Subsection 4.3.3.2, "Status".

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Item	Description
DI ADDR/DO ADDR	This is the top address of the PMC area where DI/DO data of the IO Device selected with the cursor is allocated. If the PMC address is invalid, "---" is displayed.
IN SIZE/OUT SIZE	These are the input/output sizes of the IO Device selected with the cursor. The unit is the byte. These sizes do not include any spaces that are set if a module with an odd number size is configured. The directions of input/output data are as follows. - Input: IO Device → IO Controller (DI) - Output: IO Controller → IO Device (DO) If the IO Device is disconnected, "---" is displayed for both "IN SIZE" and "OUT SIZE".
IN (ms)/OUT (ms)	These are the measured values of the transmission interval of output frames (DO data) and the reception interval of input frames (DI data) during the IO transfer of the IO Device selected with the cursor. The unit is the millisecond. The transmission and reception intervals can be changed from the Setting tool.
ALARM	This is the total number of alarm frames received from the IO Device selected with the cursor. Even if the communication is disconnected, this value is not cleared.
TIME	The continuous time in which DI/DO communication is performed with the IO Device selected with the cursor is displayed in a format of HHH:MM:SS. The maximum displayable value is 999:59:59. If the DI/DO communication is disconnected, the value returns to 000:00:00. The time in which DI/DO communication is performed is the time in which the status IO is 1.
DETAIL	Detailed information about the IO Device selected with the cursor is displayed by performing an information getting operation. For an explanation of the information getting operation, see "Operation" below. Performing an information getting operation causes the following to appear to the right of "DETAIL". GETTING INFO: Information is being acquired. GET INFO ERROR: Acquiring information fails. If the information getting operation is not performed or if the information getting operation is successful, nothing is displayed.

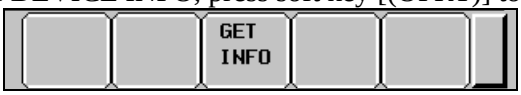
NOTE

The "Number" on the Setting tool is different from the IO Device number on this screen. Thus, to search for the IO Device for which a communication error is indicated on this screen, search for the IO Device that has the identical device name or IP address, not the IO Device number on this screen.

Operation

Getting the detailed information about the IO Device

1 On the DETAIL screen of DEVICE INFO, press soft key [(OPRT)] to display soft key [GET INFO].



2 Input any of the following first and then press soft key [GET INFO].

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Input value	Display item	Description
None or a value other than those below	Device name	The device name of each IO Device that is set with the Setting tool is displayed. Up to 240 characters can be displayed.
1	Equipment information	Equipment information (I&M data) is displayed. Equipment information is gotten by communicating with the IO Device. The specification for getting equipment information is either of the following fixed values. Slot number: 0 Sub slot number: 1 For details, see Subsection 4.6.2.4, "I&M data".
C		The detailed information is cleared. "C" may be input in either upper or lower case.

Either of the following messages may be displayed if "GET INFO ERROR" is displayed.

Message	Description
Device is not set	The IO Device is not set. Return to page 2, and confirm that a valid IO Device is selected with the cursor in the table (00 - 47).
Device is not connected	The IO Device is not connected. Return to page 2, and confirm that the IO Device selected with the cursor in the table (00 - 47) is in the "O" state (communication is in progress).

4.4.2 Log Screen of the PROFINET IO Controller Function

A log related to the PROFINET IO Controller function is displayed.

Procedure

1 Press function key .

2 Press soft key [PRFNET CNTRLR]. Soft keys [ALL], [COMMON], and [PRFNET CNTRLR] appear.

3 Press the desired one of the following soft keys to display the corresponding log screen.

(1) Soft key [ALL]
This soft key displays all log information.

(2) Soft key [COMMON]
This soft key displays the log information related to the basic Ethernet function.

(3) Soft key [PRFNET CNTRLR]
This soft key displays the log information related to the PROFINET IO Controller function.

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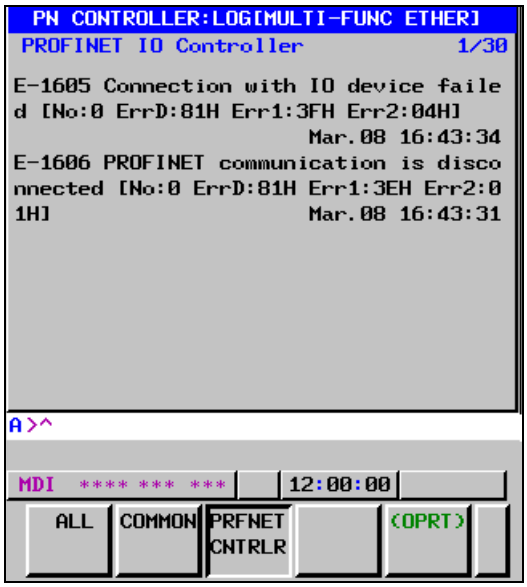

Log screen of the PROFINET IO Controller function

The latest log information is displayed at the top of the screen. At the right end of a log item, the occurrence date and time of the log item is indicated. Date and time data is indicated in the format "MMM.DD hh:mm:ss", where MMM represents a month, DD represents a day, hh represents hour, mm represents minute, and ss represents second.

Operation

To clear the log information, press soft key [(OPRT)] then soft key [CLEAR].

> **NOTE**
> The log information for the PROFINET IO Controller function is stored in volatile memory and it is lost when the CNC is turned off. If an error occurs, check the log information before turning the power off.

The following lists major log message:

Error code	Log message	Meaning and action to be taken
E-0B01	The own IP address is not set	Set the IP address.
E-0B03	Subnet mask is not set	Set the subnet mask.
E-1600	The received parameter for PROFINET IO Controller function is wrong	The received parameters for the PROFINET IO Controller function are wrong. For an explanation of the reason, see E-1612 or E-1613 notified at the same time.
E-1601	Cannot save parameter for PROFINET IO Controller function [U:V:W:X:Y:Z]	The received parameters for the PROFINET IO Controller function were not saved, because they included a wrong parameter. Set the parameters for PROFINET IO Controller function correctly. [U:V:W:X:Y:Z] at the end of the message means detailed information for the error, and the wrong parameter is indicated with one of the following numbers, at the position of X. （The others are internal error codes.） 1410: The IP address is wrong. 1411: The subnet mask is wrong. 1412: The router IP address is wrong. 1436 to 1441: The DI area of the PMC is wrong. 1443 to 1448: The DO area of the PMC is wrong.

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Error code	Log message	Meaning and action to be taken
E-1603	The parameter for PROFINET IO Controller function is protected [U:V:W:X:Y:Z]	The received parameters for the PROFINET IO Controller function were not updated, because parameter protection was enabled. To disable parameter protection, perform the following operations: • Change "MODE" to "CHANGE MODE" on the setting screen of the PROFINET IO Controller function. • Set the CNC to the emergency stop state or change the CNC mode to the MDI mode. ([U:V:W:X:Y:Z] at the end of the message are internal error codes.)
E-1605	Connection with IO device failed [No:W ErrD:XH Err1:YH Err2:ZH]	The connection with the IO Device failed. [No:W ErrD:XH Err1:YH Err2:ZH] at the end of the message means the following. W : IO Device number X : ErrorDecode (hexadecimal) Y : ErrorCode1 (hexadecimal) Z : ErrorCode2 (hexadecimal) X to Z are error codes in the PROFINET standard. For details, see Subsection 4.6.2.1, "Error Code".
E-1606	PROFINET communication is disconnected [No:W ErrD:XH Err1:YH Err2:ZH]	The PROFINET communication is disconnected. [No:W ErrD:XH Err1:YH Err2:ZH] at the end of the message means the following. W : IO Device number X : ErrorDecode (hexadecimal) Y : ErrorCode1 (hexadecimal) Z : ErrorCode2 (hexadecimal) X to Z are error codes in the PROFINET standard. For details, see Subsection 4.6.2.1, "Error Code".
E-1607	larm was received from IO Device [No:V Type:WH Slot:X SubSlot:Y Prio:Z]	The alarm was received from the IO Device. [No:V Type:WH Slot:X SubSlot:Y Prio:Z] at the end of the message means the following. V : IO Device number W : Alarm type (hexadecimal) X : Slot number Y : Sub slot number Z : Priority W to Z are alarms in the PROFINET standard. For details, see Subsection 4.6.2.1, "Alarms".
E-1608	Cannot get information for IO Device [No:W ErrD:XH Err1:YH Err2:ZH]	The collection of the information for the IO Device failed. [No:W ErrD:XH Err1:YH Err2:ZH] at the end of the message means the following. W : IO Device number X : ErrorDecode (hexadecimal) Y : ErrorCode1 (hexadecimal) Z : ErrorCode2 (hexadecimal) X to Z are error codes in the PROFINET standard. For details, see Subsection 4.6.2.1, "Error Code".

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Error code	Log message	Meaning and action to be taken
E-1609	APDU status received from IO Device has changed [No:X APDU:YH]	The APDU status received from the IO Device has changed. [No:X APDU:YH] at the end of the message means the following. X : IO Device number Y : APDU status after it changes (hexadecimal) The APDU status is a status in the PROFINET standard. For details, see Subsection 4.6.2.3, "Status".
E-1610	[PROFINET Data is not set]	Data is not set for the following reasons. • No data has ever been set from the Setting tool. • Setting data was initialized with bit 0 of "OPTION" on the setting screen of the PROFINET IO Controller function. • While data was being downloaded from the Setting tool, the power of the CNC was turned off or the Ethernet cable is disconnected.
E-1612	[Number of devices is over(X)]	The number of IO Devices that were set exceeded 48. X means the following. X: Number of IO Devices that were set
	[Device No. is over(X)]	The IO Device number of the IO Device that was set exceeded 47. X means the following. X: IO Device number of the IO Device that was set
	[DI size is over(X:Y)]	The DI size per IO Device that was set exceeded 1024 bytes. X and Y mean the following. X: IO Device number Y: DI size that was set
	[DO size is over(X:Y)]	The DO size per IO Device that was set exceeded 1024 bytes. X and Y mean the following. X: IO Device number Y: DO size that was set
	[Total DI size is over(X)]	The total DI size that was set exceeded 12288 bytes. X means the following. X: Total DI size that was set
	[Total DO size is over(X)]	The total DO size that was set exceeded 12288 bytes. X means the following. X: Total DO size that was set
E-1613	[WriteSize:X RemainSize:Y]	The maximum data size that can be set was exceeded. X and Y mean the following. X: Writing size Y: Remaining size Delete any unnecessary IO Devices or modules.

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Error code	Log message	Meaning and action to be taken
E-1614	[IP address is incompatible(XH:YH)]	The IP address that was set on the COMMON screen is different from the IP address that was set with the Setting tool. In this case, the IP address that was set on the COMMON screen is used for operation. X and Y mean the following. X : IP address that was set on the COMMON screen (hexadecimal) Y : IP address that was set with the Setting tool (hexadecimal)
	[Subnet mask is incompatible(XH:YH)]	The subnet mask that was set on the COMMON screen is different from the subnet mask that was set with the Setting tool. X means the following. In this case, the subnet mask that was set on the COMMON screen is used for operation. X and Y mean the following. X : Subnet mask that was set on the COMMON screen (hexadecimal) Y : Subnet mask that was set with the Setting tool (hexadecimal)
E-1615	[Device is not set]	Not a single valid IO Device has been enabled. Enable one or more IO Devices with the Setting tool.
(Other)	(Other)	Contact us, describing the information on the log screen.

The following log messages do not indicate errors.

Error code	Log message	Meaning
E-1604	The parameter for PROFINET IO Controller function was saved [result]	The received parameters for the PROFINET IO Controller were saved in the CNC correctly. [result] at the end of the message means the following. • Changed(TotalSize:X RemainSize:Y) The data has been refreshed. Turn off the power to the CNC and back on. X and Y mean the following. X : Total size in the CNC in which data was stored Y : Remaining size in the CNC in which data can be stored • Unchanged The data that had been stored in the CNC was the same as the received data.
E-1609	APDU status received from IO Device has changed [No:X APDU:YH]	The APDU status received from the IO Device has changed. This log message is displayed even if the status has changed to the one indicating normal operation. [No:X APDU:YH] at the end of the message means the following. X : IO Device number Y : APDU status after it changes (hexadecimal) The APDU status is a status in the PROFINET standard. For details, see Subsection 4.6.2.3, "Status".

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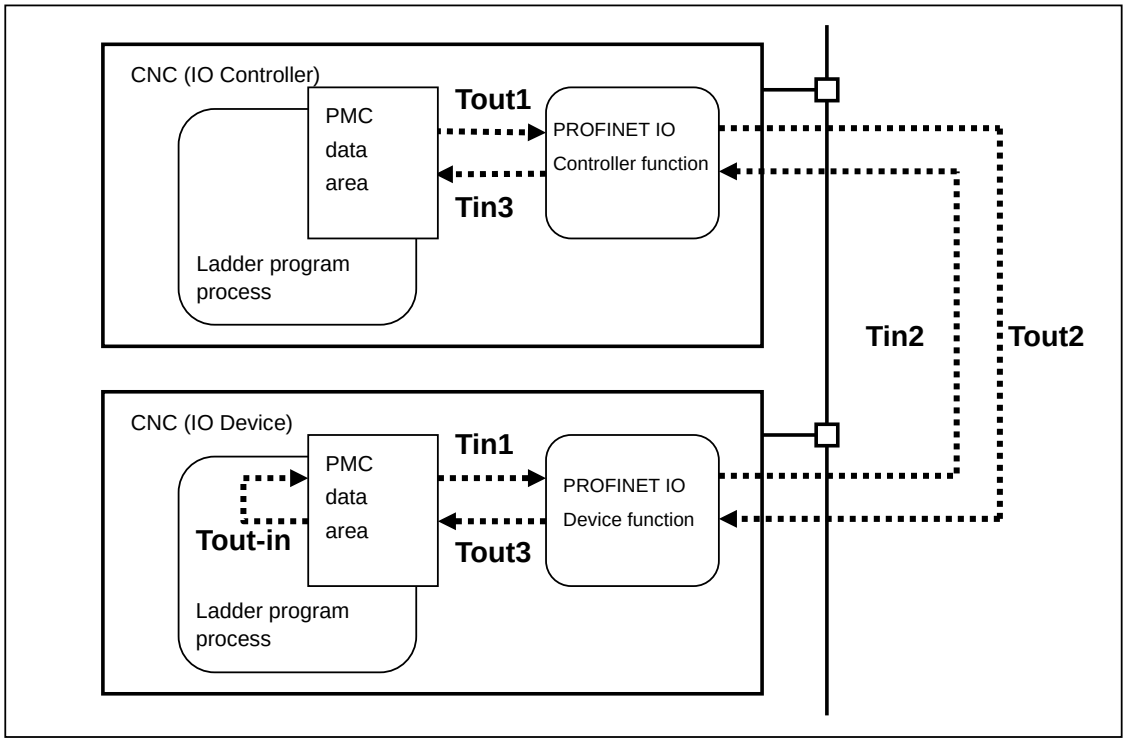
Error code	Log message	Meaning
E-1611	[Download is starting...]	Downloading from the Setting tool started. Upon completion of downloading, one of messages E-1600 to E-1604 is displayed. If this log message is not displayed even though the download operation is performed, confirm the connection of the Ethernet cable and the setting of the IP address.

⚠ **CAUTION**
Once log message E-1611 is displayed, do not turn off the power to the CNC or pull out the Ethernet cable until one of messages E-1600 to E-1604 is displayed, because downloading is in progress. Otherwise, the setting data may be damaged.
If you accidentally turn off the power or pull out the cable, perform the download operation again from the Setting tool.

4.5 UPDATING DI/DO DATA

4.5.1 Input/Output Response Time

This subsection describes the input/output response time as seen from the IO Controller if both IO Controller and IO Devices are FANUC CNCs.
The input/output response time as seen from the IO Controller is the total time of the following sequence: an output signal is set by the ladder program in the IO Controller, the signal value is posted to the IO Device, input/output processing is performed by the ladder program of the IO Device, the value is posted to the IO Controller, and the ladder program of the IO Controller recognizes it as an input signal again.
Input/output response time as seen from the IO Controller
= Tout1 + Tout2 + Tout3 + Tout-in + Tin1 + Tin2 + Tin3



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In the IO Controller, internal update time of output signal (Tout1)

This is the time in which the output signal that is set in the PMC data area by the ladder program process is updated in the PROFINET IO Controller function.
This time can be measured with "DI/DO REFRESH TIME (ms)" on the CONTROLLER INFO screen of the maintenance screen of the PROFINET IO Controller function.

In the IO Controller, communication update time of output signal (Tout2)

This is the time in which the PROFINET IO Controller function updates the output signal in the PROFINET IO Device function by way of communication.
This time can be changed with the "Refresh Period" for each IO Device on the Setting tool, and can be measured with "OUT (ms)" on the DEVICE INFO screen of the maintenance screen of the PROFINET IO Controller function or with "OUT (ms)" on the maintenance screen of the PROFINET IO Device function.

In the IO Device, internal update time of output signal (Tout3)

This is the time in which the output signal received by the PROFINET IO Device function is updated in the PMC data area.
This time can be measured with "DI(ms)" on the maintenance screen of the PROFINET IO Device function.

In the IO Device, ladder program processing time (Tout-in)

The ladder program operates in a cycle that is a multiple of 4 ms or 8 ms depending on the size of the ladder program.
This time can be measured with "SCAN TIME" on the PMC STATUS screen.

In the IO Device, internal update time of input signal (Tin1)

This is the time in which the input signal that is set in the PMC data area by the ladder program process is updated in the PROFINET IO Device function.
This time can be measured with "DO(ms)" on the maintenance screen of the PROFINET IO Device function.

In the IO Device, communication update time of input signal (Tin2)

This is the time in which the PROFINET IO Device function updates the input signal in the PROFINET IO Controller function by way of communication.
This time can be changed with the "Refresh Period" for each IO Device on the Setting tool, and can be measured with "IN (ms)" on the DEVICE INFO screen of the maintenance screen of the PROFINET IO Controller function or with "IN (ms)" on the maintenance screen of the PROFINET IO Device function.

In the IO Controller, internal update time of input signal (Tin3)

This is the time in which the PROFINET IO Controller function updates the received input signal in the PMC data area processed by the ladder program.
This time can be measured with "DI/DO REFRESH TIME (ms)" on the CONTROLLER INFO screen of the maintenance screen of the PROFINET IO Controller function.

4.5.2 DI/DO Refresh Time

This subsection describes how to estimate the DI/DO refresh time of each IO Device that shows the processing performance of the PROFINET IO Controller function for the CNC.

The DI/DO refresh time of each IO Device can be estimated as follows.

DI/DO refresh time of each IO Device ＝ X + Y

X: This is the "Refresh Period" of each IO Device that is set with the Setting tool.
This becomes equal to Tout2 or Tin2 in Subsection 4.5.1, "Input/Output Response".

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Y: This is the internal update time of the PROFINET IO Controller function for the CNC. This becomes equal to Tout1 or Tin3 in Subsection 4.5.1, "Input/Output Response".

If the total DI/DO size is small, "Y" becomes equal to the minimum value of "Refresh Period" in all IO Devices that are set with the Setting tool.
The following are examples of the estimated DI/DO refresh time of each IO Device if three IO Devices are connected.

IO Device	X	Y	DI/DO refresh time of each IO Device
IO Device 1	1ms	1ms	2ms
IO Device 2	4ms		5ms
IO Device 3	8ms		9ms

On the other hand, if the total DI/DO size is large, the actual measurement value of "Y" will not be as described above.
If the minimum value of "Refresh Period" in all IO Devices that are set with the Setting tool is 1 ms, the relation between the total size of the DI/DO and the actual measurement value of "Y" is roughly as follows.

Total DI/DO size	Actual measurement value of "Y"
128 bytes /128 bytes	1ms
256 bytes /256 bytes	2ms
1024 bytes /1024 bytes	4ms
6144 bytes / 6144 bytes	17ms
12288 bytes /12288 bytes	34ms

If the minimum value of "Refresh Period" in all IO Devices that are set with the Setting tool is larger than the applicable one of the actual measurement values in the above table, the actual measurement value of "Y" becomes the minimum value of "Refresh Period".

NOTE
The smaller the value of the "Refresh Period" of each IO Device, which is set with the Setting tool, the faster the DI/DO communication, but the higher the load on the network. Thus, refrain from reducing the "Refresh Period" carelessly.

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4.6 APPENDIX

4.6.1 PROFINET Configuration Tool (PFN-CT) for FANUC CORPORATION

This subsection describes the FANUC-specified Setting tool, "PROFINET Configuration Tool (PFN-CT) for FANUC CORPORATION".

NOTE

1 Not all functions described in the manual of the Setting tool, "PFN-CT User Manual.pdf", can be used with the FANUC PROFINET IO Controller function. Only the functions described in this manual can be used.
For example, the following functions described in the manual of the Setting tool are not supported.
- Subsection 1.2.3, “Automatic IO-Device detection”
- Subsection 1.3.1.5, “configure the IP address for an IO-Device”
- Subsection 1.3.1.6, “Identify an IO-Device on the network”
- "Connection Mode", described in Subsection 1.4.3.1, "connection information tab"
- "Set Value" and "Dismiss Modification", described in Subsection 1.4.3.2, "I/O data tab"

2 Note the following about the number to indicate the IO Device.
- "Number" in the Setting tool
  Set this number on "Device Designation" on the IO Device properties screen, described in Subsection 4.6.1.7, "Setting of IO Devices". With the Setting tool, numbers 000 to 127 can be set, but number 048 or greater cannot be set in the CNC.
  The setting of the IO Device specified with "Number" can be switched between Enable and Disable. For how to do this, see "Switching the setting of an IO Device between enable and disable" in Subsection 4.6.1.10, "Other operations".
- IO Device number in the CNC
  This is the number allocated if settings are downloaded to the CNC, and in the CNC, it is displayed on the DEVICE INFO screen of the maintenance screen of the PROFINET IO Controller function. This number is always a serial number, unlike the numbers in "Number".
  The following are examples of numbers in "Number" in the Setting tool and the IO Device numbers in the CNC.

"Number" in the Setting tool	Enable/Disable	IO Device numbers in the CNC
001	Enable	0
010	Enable	1
024	Disable	
047	Enable	2

3 The operation and the screen related to the Setting tool described in this manual are examples for Windows 7.
Only the main setting method of the Setting tool (PFN-CT) and other matters are described in this manual. For details, see the manual supplied with the Setting tool.

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4.6.1.1 Operating environment

The operating environment of the personal computer in which to install the Setting tool is as follows.

Item	Operating environment
OS	Windows 7, 8.0, 8.1 (32-bit, 64-bit) Windows XP (32-bit)
CPU, RAM	Must meet the conditions recommended for the OS used.
HDD size used	Execution program : Approx. 100 MB Setting data : Approx. 10 MB per project
Drive	• CD-ROM drive required The Setting tool is provided in a form of CD-ROM.
Communication	• Ethernet port The communication between the Setting tool and CNC uses the Ethernet.

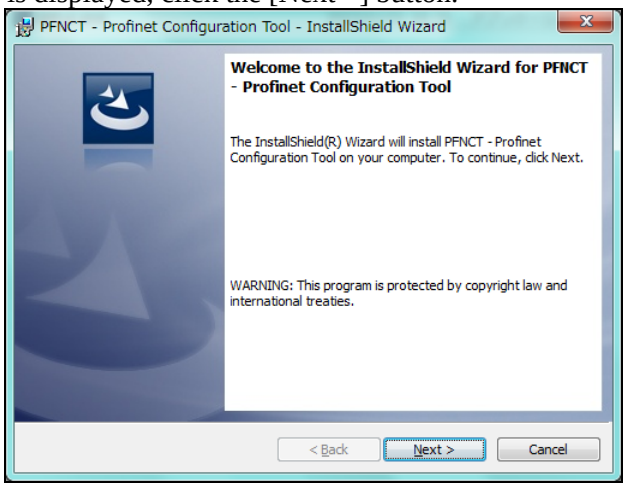
4.6.1.2 When using the Setting tool for the first time

Install the Setting tool in the personal computer according to the following procedure.

NOTE
To install the Setting tool, the serial number is necessary. The serial number is printed for "S/N" on the CD-ROM label.

Procedure

1 Insert the installation CD-ROM into the drive of the personal computer, and execute "setup.exe" in the installation CD-ROM.
The following screen is displayed, click the [Next >] button.



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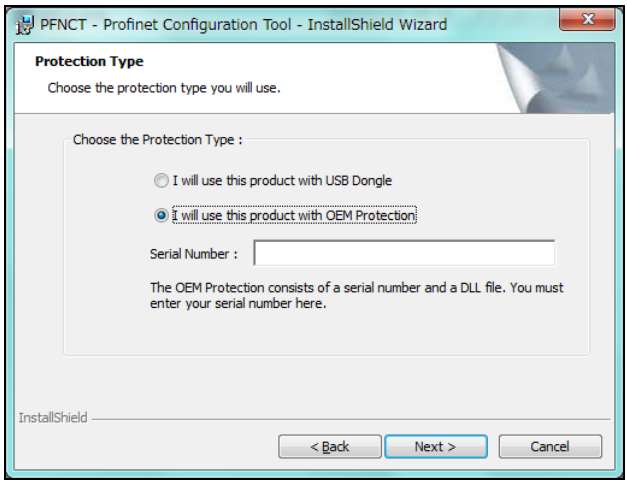
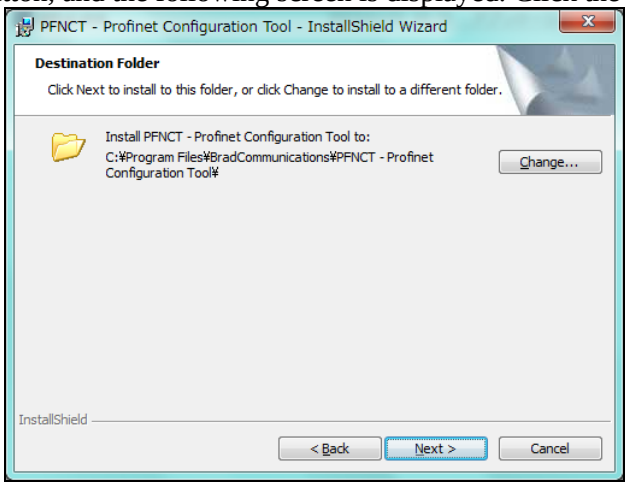
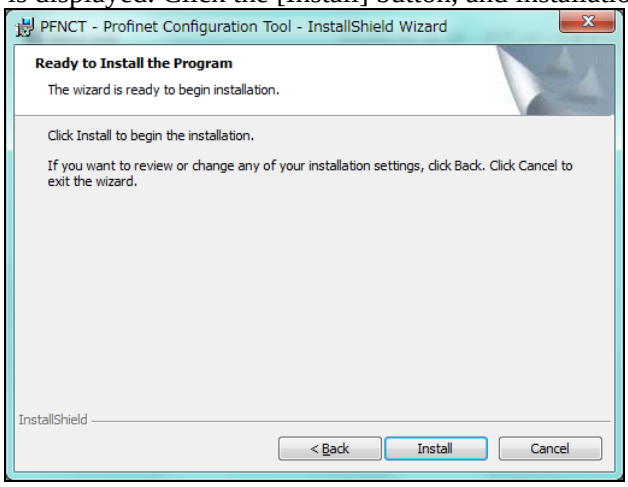
2 The following screen is displayed. Select "I will use this product with OEM Protection". Then, input the serial number in the "Serial Number" field.



Click the [Next >] button, and the following screen is displayed. Click the [Next >] button again.



3 The following screen is displayed. Click the [Install] button, and installation starts.



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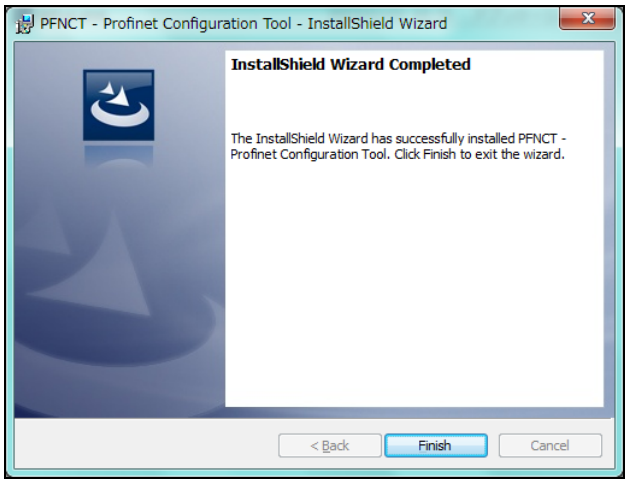


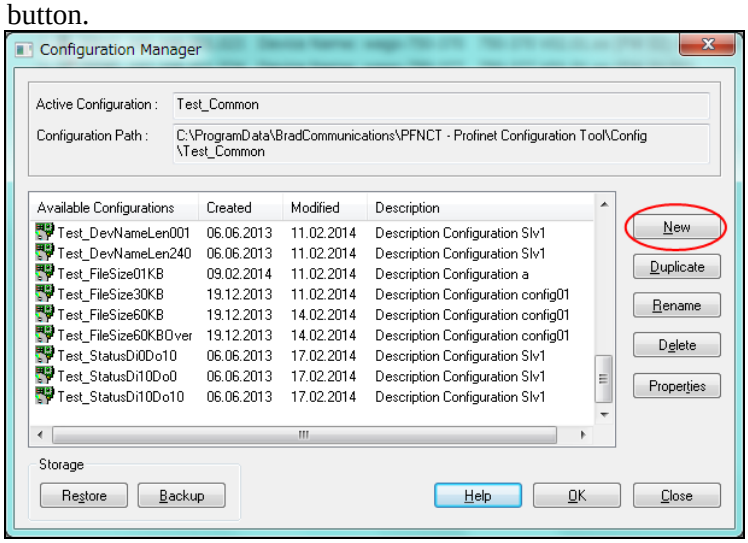
When installation is completed, the above screen is displayed. Click the [Finish] button to finish.

4.6.1.3 Registration of the CNC in the Setting tool

This subsection describes how to register the CNC in the Setting tool.

Procedure

1 Select the menu [File] -> [Configuration Manager] to display the "Configuration Manager" screen. Click the [New] button.



If the Setting tool is started for the first time since it was installed, the "Add New Target" screen of step 3 is displayed.

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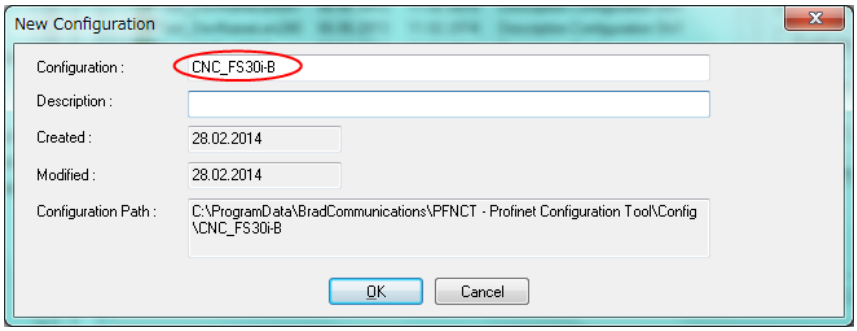
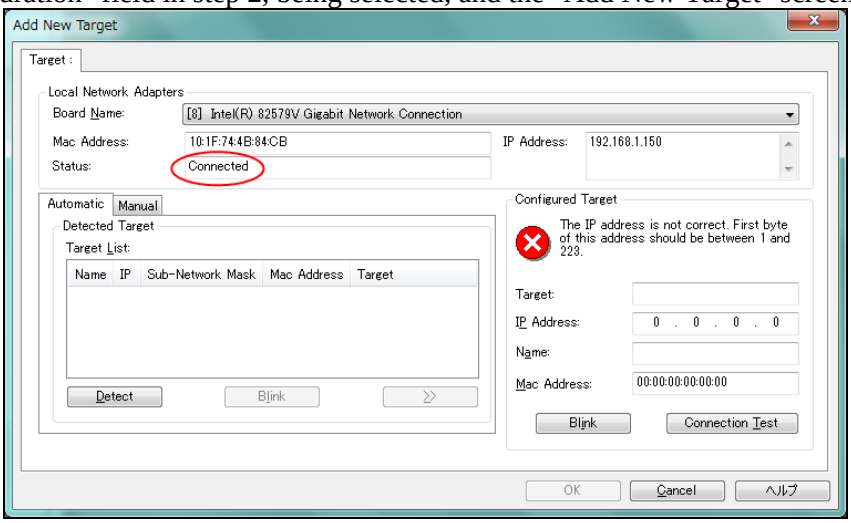
2 The "New Configuration" screen is displayed. Input the configuration name in the "Configuration" field.

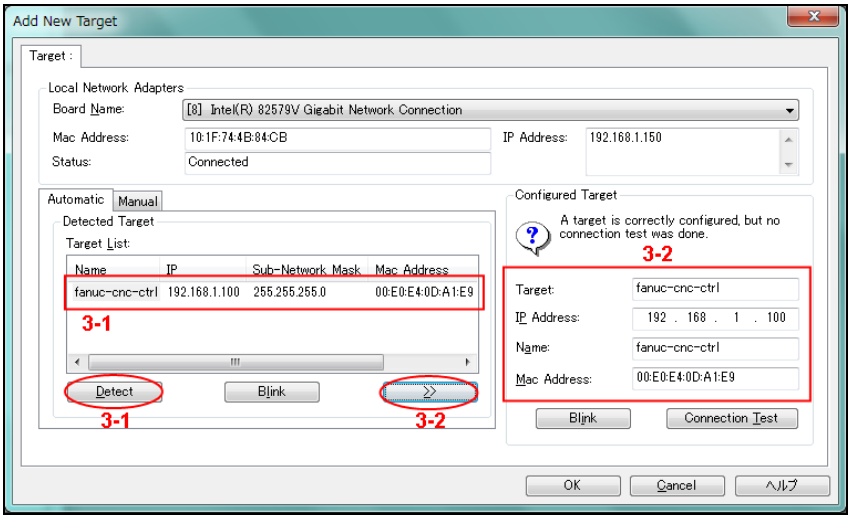


Click the [OK] button to return to the "Configuration Manager" screen.

3 On the "Configuration Manager" screen, click the [OK] button, with the configuration name, input in the "Configuration" field in step 2, being selected, and the "Add New Target" screen is displayed.



Confirm that "Status" is shown as "Connected" on this screen.
If "Status" is not shown as "Connected", confirm that the Ethernet cable is correctly connected to the Ethernet port selected for "Board Name".



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3-1 Connect the CNC to the network, and click the [Detect] button to confirm that "fanuc-cnc-ctrl" is detected.
At this time, confirm also that the IP address that is set on the COMMON screen of the CNC is detected.

3-2 Click the [>>] button, with "fanuc-cnc-ctrl" being selected. Confirm that the content of the selected CNC is displayed in "Configured Target".
Click the [OK] button to finish.

4.6.1.4 Installation of the GSDML file

This subsection describes how to install the GSDML file in the Setting tool.

Procedure

1 Select the menu [Library] -> [Add] to display the "GSDML Management" screen.

Click the [Next >] button, and install the GSDML file according to the instructions on the screen.

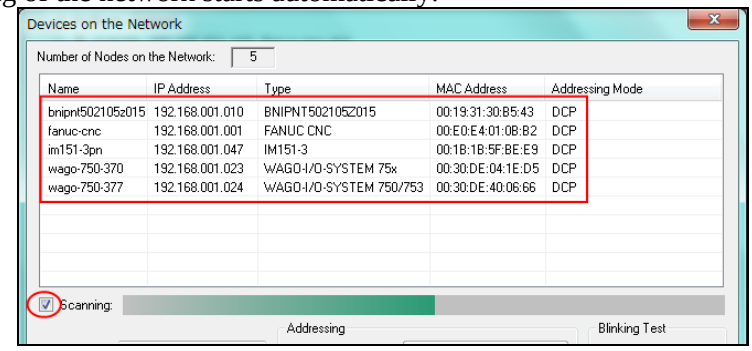
2 Confirm that the installed IO Device has been added to the tree of the tab "Device Library".

4.6.1.5 Confirmation of IO Devices on the network

This subsection describes how to confirm the IO Devices connected on the network.

Procedure

1 Select the menu [Library] -> [Online Action], and the "Devices on the Network" screen is displayed, and the scanning of the network starts automatically.



2 After the IO Devices are detected on this screen, remove the check on the "Scanning" check box to stop the scanning.

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If the target IO Device is not detected, confirm whether the Ethernet cable is correctly connected.
If device names are not set for any of the detected IO Devices in the "Name" column, set the device names according to Subsection 4.6.1.6, "Setting of the device names for IO Devices".

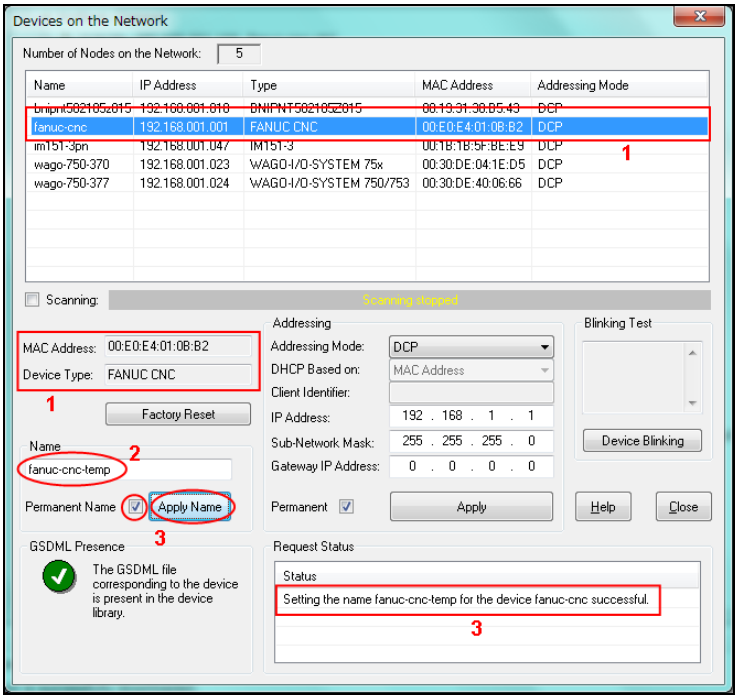
> ⚠ **CAUTION**
> Do not leave the "Scanning" check box checked, because the load on the network increases during the scanning of the network.

> **NOTE**
> 1 If no device name is set for an IO Device in the "Name" column, IO communication with the IO Device cannot be performed.
> 2 If two or more IO Devices of the same model are detected on the network, you need to check their MAC addresses to distinguish between them before setting their device names in the "Name" column.
> 3 It is not necessary to set IP addresses in the "IP Address" column, because the IP addresses that are allocated with "Setting of the IP address and the device name" in Subsection 4.6.1.7, "Setting of IO Devices" are used.

4.6.1.6 Setting of the device names for IO Devices

This subsection describes how to set the device names for the IO Devices that are detected as in Subsection 4.6.1.5, "Confirmation of IO Devices on the network".

Setting of the device name



Procedure

1 Select an IO Device from the list of detected IO Devices. Confirm that the "MAC Address" and the "Device Type" of the IO Device are selected.

2 In the "Name" field, input the device name to set.

3 Check the "Permanent Name" check box, and click the [Apply Name] button.

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When the setting of the device name is successful, "Setting the name (device name) successful" is displayed below "Status".

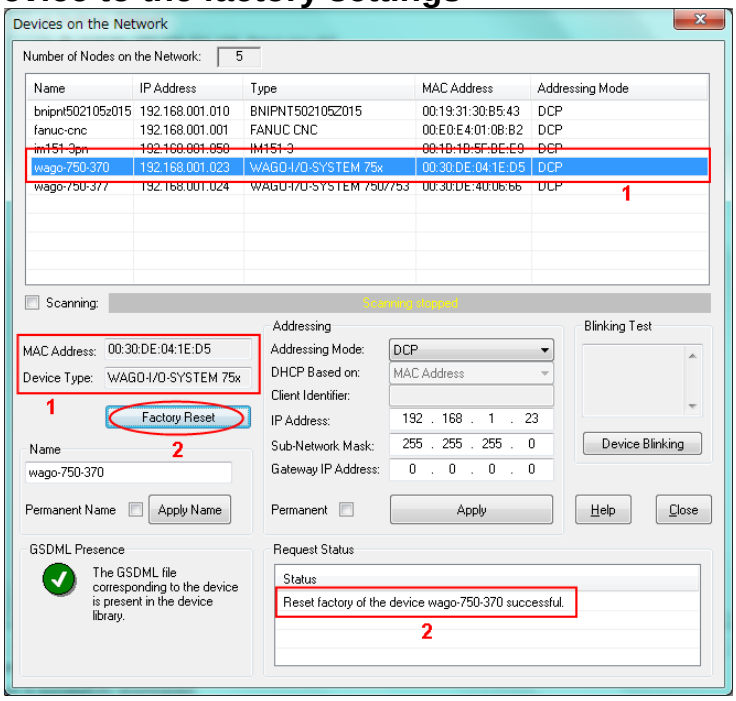
NOTE

1 The device name must be unique on the network.
IO Devices to which the same name is given cannot perform IO communication.

2 If the "Permanent Name" check box is not checked, the device name will not be stored in the nonvolatile memory of the IO Device. When the IO Device is restarted, this setting is no longer effective.

By checking the "Scanning" check box to perform scanning again, the changed device name can be confirmed.

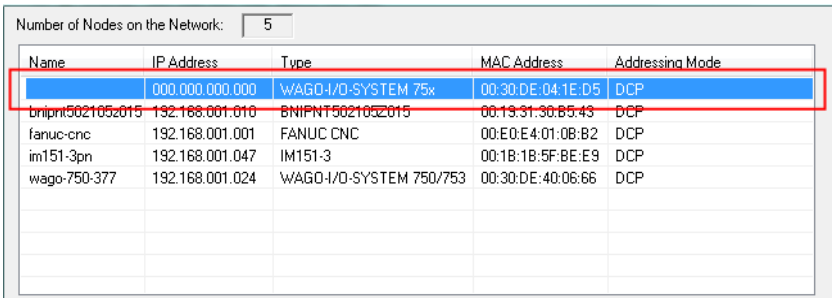
Returning an IO Device to the factory settings



Procedure

1 Select an IO Device from the list of detected IO Devices. Confirm that the "MAC Address" and the "Device Type" of the IO Device are selected.

2 Click the [Factory Reset] button.
When the operation for returning it to the factory settings is successful, "Reset factory of the device (device name) successful" is displayed.
By checking the "Scanning" check box to perform scanning again, the factory settings can be confirmed.



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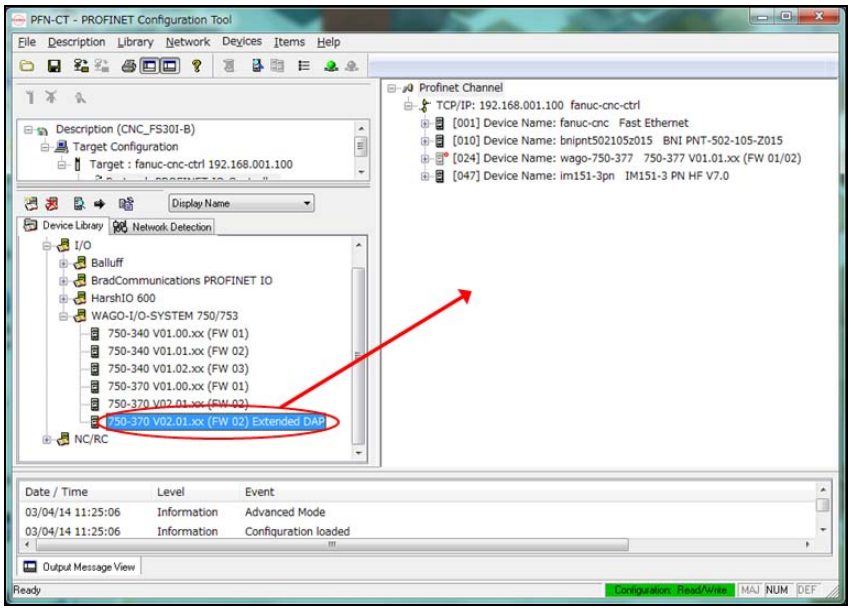
NOTE

If an IO Device is returned to the factory settings, the "Name" (device name) and "IP Address" of the IO Device are no longer effective. For an explanation of the factory settings of the parameters specific to an IO Device, see the IO Device manual or confirm them with the IO Device manufacturer.

4.6.1.7 Setting of IO Devices

This subsection describes the setting for operating an IO Device.
First, select the DAP (Device Family) of an IO Device from "Device Library", and drag and drop it in the "Profinet Channel" screen on the right.
If the IO Device has already been set in the "Profinet Channel" screen, double-click the IO Device in the "Profinet Channel" screen.



NOTE

The DAP (device family) of the IO Device to select may be subdivided according to model and so on. For details, see the IO Device manual or confirm this with IO Device manufacturer.

The IO Device properties screen is displayed. Make settings as described below.

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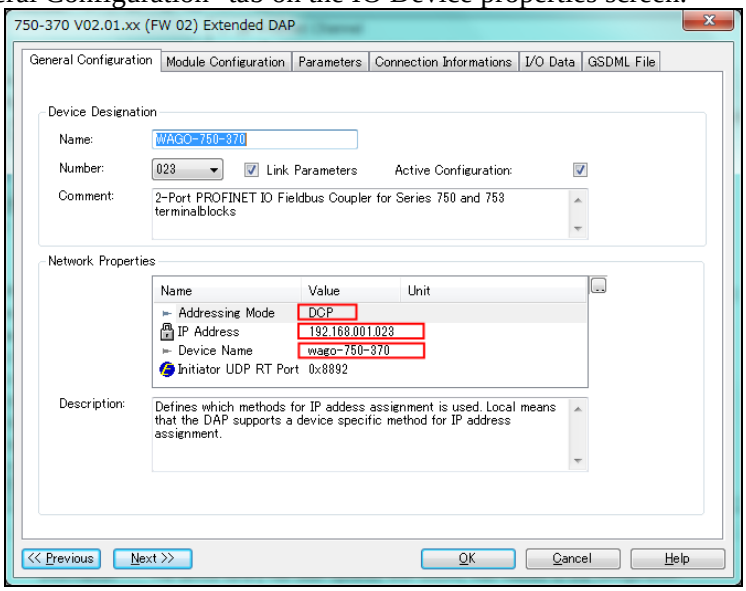
Setting of the IP address and the device name

Procedure

1 Select the "General Configuration" tab on the IO Device properties screen.



2 Confirm the "Addressing Mode" below "Network Properties" is "DCP", and set the device name in the "Device Name" field below "Network Properties".
"WWW.XXX.YYY.ZZZ" in the "IP Address" field below "Network Properties" is automatically allocated with the "ZZZ" being determined from "Number" on "Device Designation". If this is appropriate, use it without any modification.

NOTE

1 The "Device Name" below "Network Properties" must match the device name that is set as in Subsection 4.6.1.6, "Setting of the device names for IO Devices".
2 If you want to set 48 or greater for the "ZZZ" of "WWW.XXX.YYY.ZZZ" in the "IP Address" field below "Network Properties", remove the check for the "Link Parameters" check box of "Device Designation".

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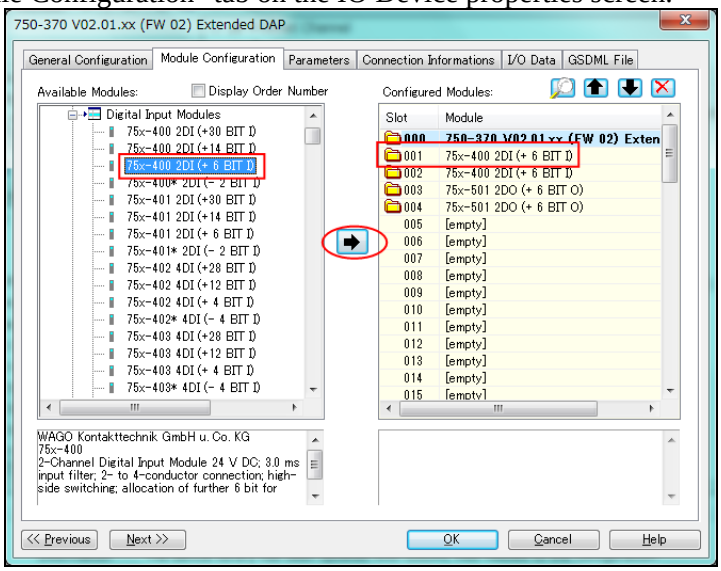
Setting of modules

Procedure

1 Select the "Module Configuration" tab on the IO Device properties screen.



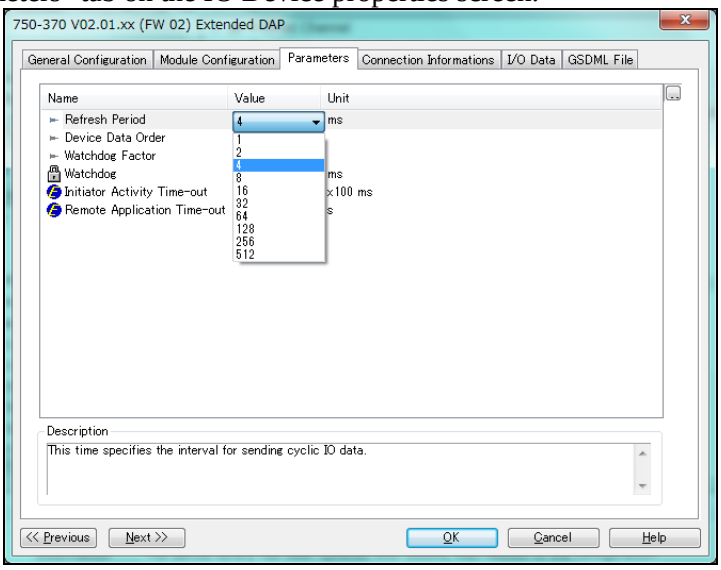
2 Select the necessary module from "Available Modules", and click the [⇒] button to add it to "Configured Modules".
To add more modules, repeat this operation.

> **NOTE**
> The setting of a module may depend on the original specifications for the IO Device.
> For details, see the IO Device manual or confirm it with the IO Device manufacturer.

Setting of the refresh period

Procedure

1 Select the "Parameters" tab on the IO Device properties screen.



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2 Select a refresh period from the list box of "Refresh Period".

NOTE

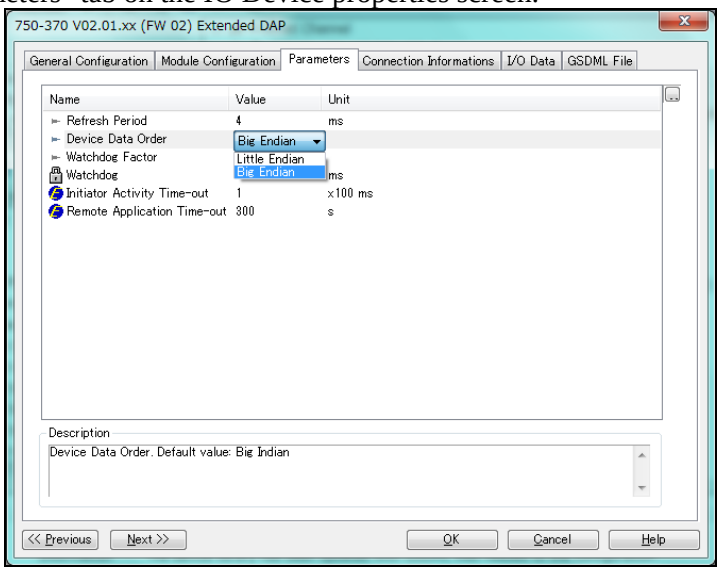
1 Not all the refresh periods displayed in the list box of "Refresh Period" may be supported by the IO Device.
For an explanation of the refresh periods supported by the IO Device, see the IO Device manual or confirm them with the IO Device manufacturer.

2 See also Section 4.5, "UPDATING DI/DO DATA" when setting the refresh period.

Setting of endian conversion

Procedure

1 Select the "Parameters" tab on the IO Device properties screen.



2 Select between Big Endian and Little Endian in the list box of "Device Data Order".
For an explanation of endian conversion, see Subsection 4.2.3, "Conversion of Endian".

Setting of the special parameters for an IO Device

NOTE

The special parameters for an IO Device mean the parameters in the original specifications for the IO Device. Generally, such parameters can be set for each module.
For details, see the IO Device manual or confirm it with the IO Device manufacturer.

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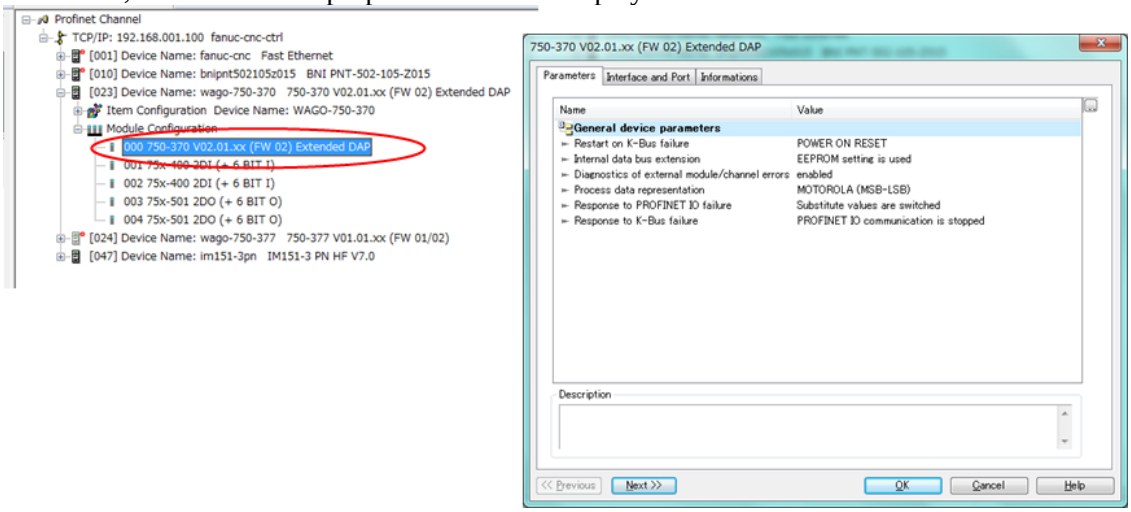
Procedure

1 In the tree of the "Profinet Channel" screen, double-click a module in "Module Configuration" for an IO Device, and the module properties screen is displayed.



2 Double-click a setting item in the "Parameters" tab, and another setting screen is displayed, where setting items can be set.

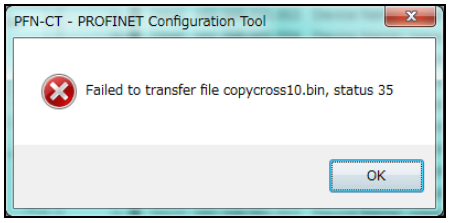
4.6.1.8 Downloading of settings

This subsection describes how to download settings to the CNC.

Procedure

1 Select the menu [File] -> [Download Configuration] to start downloading all settings to the CNC.

2 If downloading terminates normally, "The configuration is successfully downloaded" is displayed.
If downloading fails, the following dialog box is displayed. For details, see Subsection 4.6.1.11, "List of status codes".



NOTE

It may take up to about 150 seconds for downloading to be completed from the download operation, depending on the operation environment of the personal computer and the number of IO Devices that are set and the number of modules that are configured.

⚠ CAUTION

1 If the download operation is executed during IO communication, IO data may be delayed.
Perform the download operation in the state in which safety is ensured properly.

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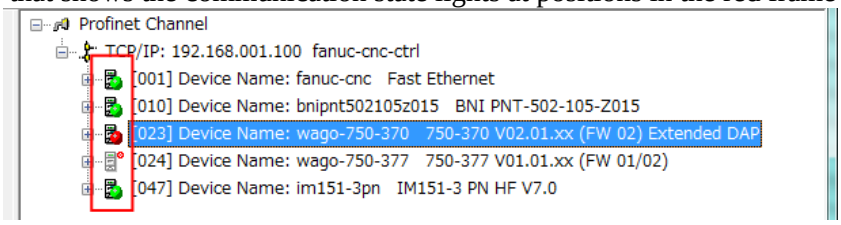
> ⚠ **CAUTION**
> 2 Once the download operation is started, do not turn off the power to the CNC or pull out the Ethernet cable until the message "The configuration is successfully downloaded" is displayed. Otherwise, the setting data may be damaged.
> If, when the power to the CNC is turned on, it is detected that the setting data is damaged, the message "E-1610 [PROFINET Data is not set]" is displayed on the log screen of the PROFINET IO Controller for the CNC. If this happens, perform the download operation again.

4.6.1.9 Confirmation of the IO Device communication state

This subsection describes how to confirm the IO Device communication state.

Procedure

1 Select the menu [Devices] -> [Start Console Diagnostic] to place the Setting tool in the diagnosis state.
The lamp ○ that shows the communication state lights at positions in the red frame below.

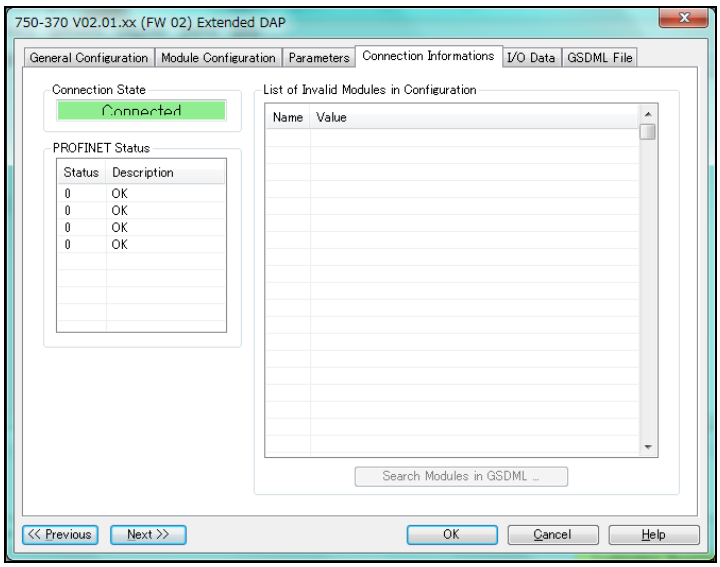


The meaning of the lamp that shows the connection state is as follows.

- Lighting green: Communication is normal.
- Lighting red: Communication is in error.

2 On the "Profinet Channel" screen, double-click the IO Device to diagnose, and the properties screen of the IO Device is displayed.
Select the "Connection Informations" tab to confirm the connection state.

If communication is normal



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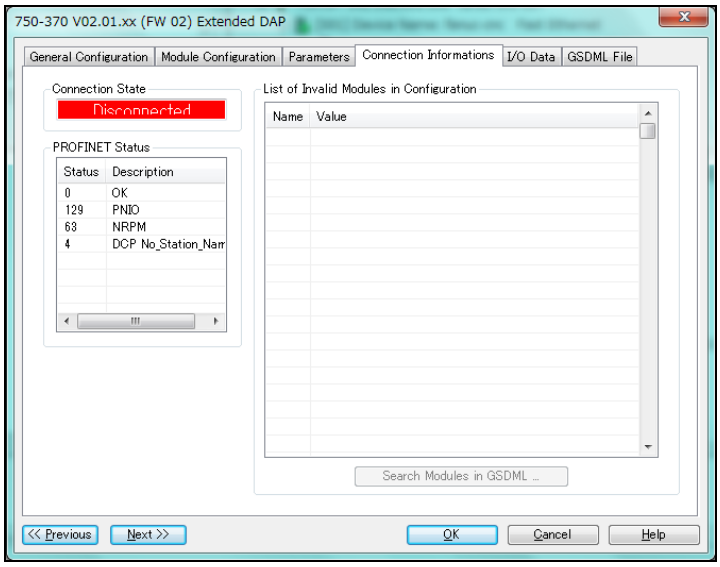
If communication is in error



> ⚠ **CAUTION**
> Do not leave the Setting tool in the diagnosis state, because the load on the network increases when the Setting tool is in the diagnosis state.

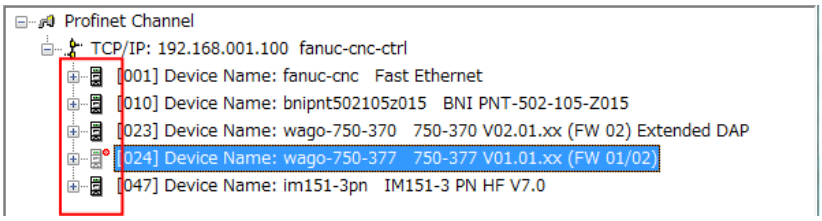
> **NOTE**
> The numbers under "PROFINET Status" are error codes in the PROFINET standard, ErrorCode, ErrorDecode, ErrorCode1, and ErrorCode2, from top to bottom. For details, see Subsection 4.6.2.1, "Error Code".

4.6.1.10 Other operations

This subsection describes other operations.

Switching the setting of an IO Device between enable and disable

Right-click, with an IO Device being selected on the "Profinet Channel" screen, and from the menu, select "Enable/Disable Device" to switch the setting between enable and disable.
The following example shows the "Profinet Channel" screen where only the setting of the IO Device whose Number is 024 is disabled.



Deleting an IO Device

Right-click, with an IO Device being selected on the "Profinet Channel" screen, and from the menu, select "Delete", and the IO Device is deleted.

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4.6.1.11 List of status codes

This subsection describes the meanings of the status codes that may be displayed during the operation of the Setting tool, as well as the actions to take.
The "Error code on log screen" column of the table contains the error codes that may be displayed on the log screen of the PROFINET IO Controller function for the CNC.

Error number	Meaning and action to be taken	Error code on log screen
33	A timeout occurred during downloading. Retry the download operation.	(None)
34	The data to download exceeded the size that can be stored in the CNC. Delete any unnecessary IO Devices or modules.	E-1600 E-1613
35	The number of IO Devices that were set exceeded 48. Delete any unnecessary IO Device.	E-1600 E-1612
37	48 or greater is set for the "Number" of an IO Device.	
38	The DI size per IO Device that was set exceeded 1024 bytes. Delete any unnecessary input modules, or replace any with those with smaller input sizes.	
39	The DO size per IO Device that was set exceeded 1024 bytes. Delete any unnecessary output modules, or replace any with those with smaller output sizes.	
40	The total DI size that was set exceeded 12288 bytes. Delete any unnecessary input modules, or replace any with those with smaller input sizes.	
41	The total DO size that was set exceeded 12288 bytes. Delete any unnecessary output modules, or replace any with those with smaller output sizes.	
42	A wrong IP parameter (IP address, subnet mask, or router IP address) is detected. Review the setting of the IP parameter.	E-1601
43	The DI area of the PMC is wrong. Clear "DI ADDRESS" on the setting screen of the PROFINET IO Controller function for the CNC, then download again. Review the DI area of the PMC, and then set "DI ADDRESS". This status code is also displayed if the DI area of the PMC is insufficient.	
44	The DO area of the PMC is wrong. Clear "DO ADDRESS" on the setting screen of the PROFINET IO Controller function for the CNC, then download again. Review the DO area of the PMC, and then set "DO ADDRESS". This status code is also displayed if the DO area of the PMC is insufficient.	
46	The function is not supported by the CNC.	(None)
48	The parameter protection of the CNC is enabled. To disable parameter protection, perform the following operations on the CNC: • On the setting screen of the PROFINET IO Controller function, change "MODE" to "CHANGE MODE". • Change the CNC mode to the MDI mode or set the CNC to the emergency stop state.	E-1603
52	Downloading failed for some cause or other. Restart the CNC and the Setting tool, and retry downloading. If downloading still fails, contact us, describing the information on the log screen.	(Undefined)
56	It was not possible to change the device name or the IP parameters because communication was in progress.	(None)
(Other)	Contact us.	(Undefined)

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4.6.2 Supplement to the PROFINET Standard

This subsection contains a supplement to the PROFINET standard.

4.6.2.1 Error Code

This subsection describes the error codes in the PROFINET standards: ErrorCode, ErrorDecode, ErrorCode1, and ErrorCode2.

The meaning of "ErrorCode" is as follows.

- If 0 : Normal
- If other than 0 : Abnormal

The other error codes are abbreviated as follows.
- ErrorDecode: ErrD
- ErrorCode1 : Err1
- ErrorCode2 : Err2

ErrD (hexadecimal)	Err1 (hexadecimal)	Err2 (hexadecimal)	Meaning and action to be taken
81	02	0B	The IO Device does not support the refresh period that is set with the IO Controller. See "Setting of the refresh period" of Subsection 4.6.1.7, "Setting of IO Devices" to correct the refresh period.
81	3F	03	An IO Device that has the same device name exists on the network. See Subsection 4.6.1.5, "Confirmation of IO Devices on the network" and Subsection 4.6.1.6, "Setting of the device names for IO Devices" to correct the device name.
81	3F	04	No device name is set for the IO Device. Or, the IO Device for which a connection request is made cannot be found on the network. First, confirm that the Ethernet cable is connected. Next, see Subsection 4.6.1.5, "Confirmation of IO Devices on the network" and Subsection 4.6.1.6, "Setting of the device names for IO Devices" to correct the device name.
81	3F	05	No IP address is set for the IO Device. Or, the IO Device for which a connection request is made cannot be found on the network. Take an action similar to that for "ErrD=81, Err1=3F, and Err2=04".
81	3E	01	A timeout occurred after a connection was made. Confirm that the Ethernet cable is connected.
(Other)			This is an internal error code. Contact us.

4.6.2.2 Alarms

This subsection describes the alarms in the PROFINET standard.
These alarms are used to notify the IO Controller of any errors and changes that IO Devices may detect.

Alarm type

Alarm type (hexadecimal)	Meaning
0000	Reserved
0001	Diagnosis

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Alarm type (hexadecimal)	Meaning
0002	Process
0003	Pulling
0004	Plugging
0005	Status
0006	Update
0007	Media Redundancy
0008	Control by the IO Supervisor
0009	Released
000A	Plugging of a wrong submodule
000B	Recovery of a submodule
000C	Disappearance of diagnosis
000D	Multicast communication mismatch notification
000E	Port data change notification
000F	Synchronous data change notification
0010	Isochronous mode problem notification
0011	Network component problem notification
0012	Time data change notification
0013 to 001D	Reserved
001E	Upload and retrieval notification
001F	Module pulling
0020 to 007F	Manufacturer-specific portion
0080 to 00FF	Reserved for profiles
0100 to FFFF	Reserved

Alarm priority

Alarm priority	Meaning
5	Low priority
6	High priority

4.6.2.3 Status

This subsection describes the status in the PROFINET standard.

APDU status

This is the status (1 byte) that indicates the state of the input/output frame.

Bit	Name	Meaning
#0	State	0: IOCR is in the "backup" state. 1: IOCR is in the "primary" state. IOCR means a channel for IO communication, and this bit is usually 1.
#1	Redundancy	0: One AR exists. 1: Not a single AR exists. AR means a channel at the application level, and this bit is usually 0.
#2	DataValid	0: The frame data is invalid. 1: The frame data is valid.
#3	Reserved	
#4	ProviderState	0: The control application of the provider (sender) is in the STOP state. 1: The control application of the provider (sender) is in the RUN state.
#5	StationProblem Indicator	0: A problem is detected. 1: Normal operation
#6	Reserved	
#7		

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IOPS and IOCS

This is the status (1 byte) that is provided for each module in the input/output frame.
IOPS: State of the send data when the IO Controller/IO Device is a provider (sender)
IOCS: State of the receive data when the IO Controller/IO Device is a consumer (receiver)

Bit	Name	Meaning
#0	Extension	0: End of a module 1: Not the end of a module
#1	Reserved	
#2		
#3		
#4		
#5	Instance	If DataState is BAD, one of the following is set. 0x00: Detected by a Subslot 0x01: Detected by a Slot 0x02: Detected by the IO Device 0x03: Detected by the IO Controller
#6		
#7	DataState	0: BAD The data is invalid, so the data to be transferred should be ignored, and the prescribed value (zero data, valid data received last, or default data) should be used. 1: GOOD The data is valid.

4.6.2.4 I&M data

This subsection describes the I&M (Identification and Maintenance) data in the PROFINET standard.
The "Display on the screen" column of the table contains the names of the displays on the DEVICE INFO screen of the maintenance screen of the PROFINET IO Controller function.

I&M data

Display on the screen	Name	Meaning
VendorID	Vendor ID	Vendor ID. 16-bit identification that uniquely identifies the maker.
OrderNo	Order ID	Order number. (20 characters maximum)
SerialNo	Serial Number	Serial number. (16 characters maximum)
HwRev	Hardware Revision	Hardware version.
SwRev	Software Revision	Software version. This is displayed as "W.X.Y.Z", and means the following. **Item** / **Meaning** W: Character that indicates the software type (1 character) V or R: Officially released version P : Prototype U : Under test T : Test device X: Version of functional enhancement Y: Version of bug fix Z: Version of internal change
RevCnt	Revision Counter	Revision counter.
Profile	Profile ID and Profile Specific Type	Information for the application profile. This is displayed as "XXXXH / YYYYH", and means the following. XXXXH: Application profile ID (hexadecimal) YYYYH: Type of a special application profile (hexadecimal)

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Display on the screen	Name	Meaning
Version	I&M Version	Version of the I&M functions supported by the IO Device.
Support	I&M Supported	Bits 0 to 15 of this parameter (hexadecimal) indicate whether the I&Mn data (where n = 0 to 15) defined in the PROFINET standard is valid or invalid.

NOTE

1 The I&M0 data means "Vendor ID" to "I&M Supported" in the above table, and the IO Device must implement this data. The I&M1 data to the I&M15 data are optional.
The PROFINET IO Controller function for the FANUC CNC can get only the I&M0 data.

2 For details of the I&M data that is gotten, confirm with the IO Device manufacturer.

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5 PROFINET IO DEVICE FUNCTION

NOTE
If using the PROFINET IO Device function, be sure to read the following.
- Part II, "COMMON"
- Section 4.1, "OVERVIEW", in Chapter 4, "PROFINET IO CONTROLLER FUNCTION", in Part III, "FUNCTION"

5.1 OVERVIEW

For an overview of the PROFINET function, see Section 4.1, "OVERVIEW".

5.2 SPECIFICATIONS

This section describes the specifications of the PROFINET IO Device function of the CNC.

5.2.1 Specification List

The following is a list of specifications of the PROFINET IO Device function of the CNC.

Item	Description
PROFINET IO Conformance class	CC-A
Required software option	PROFINET IO Device function option (R972)
Combination with other functions	Functions that can be used at the same time on the same hardware option or different hardware options: - Ethernet function (S707) - Modbus/TCP Server function (R968) Functions that can be used at the same time on different hardware options - Data Server function (S737) - FL-net function (J692) - EtherNet/IP Scanner function (R966) - EtherNet/IP Adapter function (R967) - PROFINET IO Controller function (R971) For details of combining it with other functions, see Chapter 2, "HARDWARE OPTIONS AND COMMUNICTION FUNCTIONS" in Part II, "COMMON".
PMC area that can be allocated	- DI : R, E, D, and X areas - DO : R, E, D, and Y areas - Status : R and E areas
Maximum DI/DO data size	256 bytes/256 bytes
DI/DO update time	4 ms or greater 4 ms is the minimum that applies if only the PROFINET IO Device function is used on a hardware option.
UDP port number	34962 to 34964 (fixed)

NOTE
1 If the Ethernet function and the PROFINET IO Device function are operated on the same hardware option at the same time, the number of FOCAS2/Ethernet clients that can be connected to a single CNC is limited to 5.
In addition, the machine remote diagnosis functions cannot be used for this condition.

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NOTE
2 A FANUC CNC does not support SNMP (Simple Network Management Protocol), and cannot make diagnosis of a CNC network using SNMP.
3 If the PROFINET IO Device function is used, communication via a router and the DHCP/DNS function cannot be used.

5.2.2 Unit of Data and Concurrency of Data

The unit of I/O data can be selected from byte (1 byte), word (2 bytes), and long (4 bytes).

⚠ **WARNING**
Set an appropriate unit of data according to the communication destination device and data to be exchanged. Communication with an inappropriate value may cause data segmentation. If data longer than long data (4-byte data) is handled, data segmentation may occur.
To handle long data (4 bytes) or word data (2 bytes), for notes on creating a ladder program, see Subsection 3.1.2, "Creating a Ladder Program" in Part II, "COMMON".
Data segmentation may result in the machine behaving unexpectedly, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.

The unit of data, the restriction of the PMC address, and the restriction of the size are as follows.

Unit of data	Restriction of PMC address	Restriction of size
Byte (1 byte)	N.A.	N.A.
Word (2 bytes)	Only addresses in 2-byte units (even-numbered) can be specified.	Only sizes in 2-byte units (even numbered) can be specified.
Long (4 bytes)	Only addresses in 4-byte units (which can be divided by 4) can be specified.	Only sizes in 4-byte units (which can be divided by 4) can be specified.

For a specified unit of data, the concurrency of data is guaranteed. This means that concurrency is guaranteed within 1-byte data if the unit of data is byte, within 2-byte data if it is word, and within 4-byte data if it is long, and there are no data segmentation.

5.2.3 Conversion of Endian

When the unit of data is word (2 bytes) or long (4 bytes), whether to convert endian with the concurrency of data guaranteed can be specified. When endian is not converted, the data is treated as little-endian. When endian is converted, the data is treated as big-endian.
When the unit of data is byte (1 byte), endian is not converted.

⚠ **WARNING**
Before starting operation, make sure that an appropriate value is specified for the setting item for selecting conversion of endian and data is exchanged in the correct order.
If operation is started without checking the above, the machine may behave unexpectedly, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.

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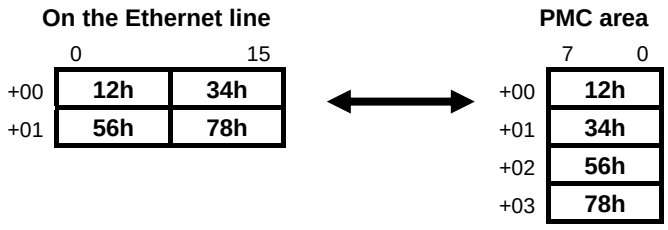
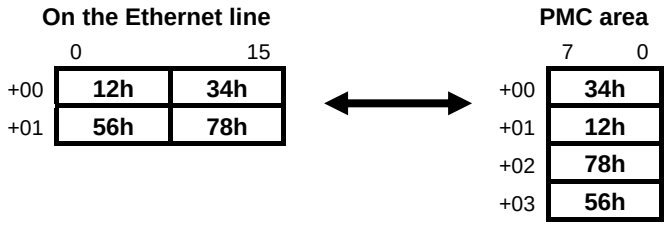
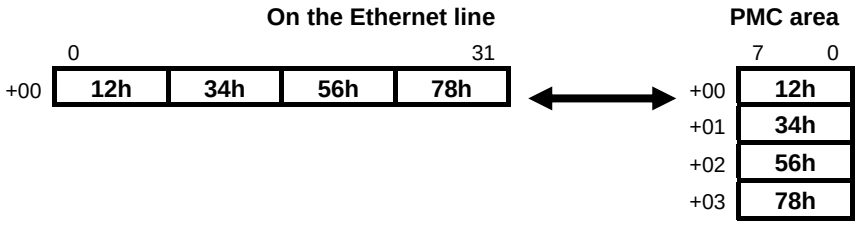
When the unit of data is word (2 bytes) and endian is not converted



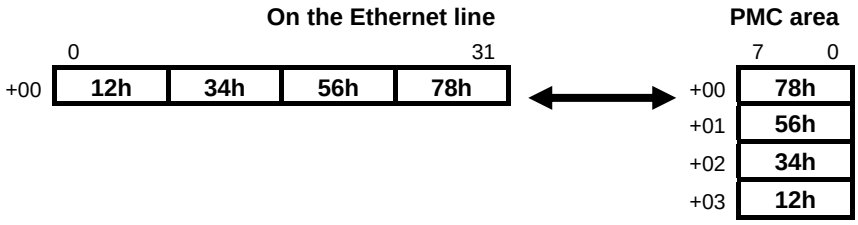
When the unit of data is word (2 bytes) and endian is converted



When the unit of data is long (4 bytes) and endian is not converted



When the unit of data is long (4 bytes) and endian is converted



5.2.4 Setting Examples If Using Multiple Communication Functions at the Same Time

This subsection provides examples of setting parameters Nos. 970 to 976 if using multiple communication functions, in addition to the PROFINET IO Device function.
For details of how to set parameters Nos. 970 to 976, see Chapter 2, "HARDWARE OPTIONS AND COMMUNICTION FUNCTIONS" in Part II, "COMMON".

Ex.	Function to use	Hardware option on which to operate it	NC parameter
1	PROFINET IO Device function	Multi-function Ethernet	No.970= 3 No.974= -1 No.971= 4 No.975= -1 No.972= -1 No.976= -1 No.973= 1
	Ethernet function Data Server function	Fast Ethernet board mounted in slot 1	
	FL-net function	Fast Ethernet board mounted in slot 2	

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Ex.	Function to use	Hardware option on which to operate it	NC parameter	
2	PROFINET IO Device function Ethernet function	Multi-function Ethernet	No.970= 1 No.971= 3	No.974= -1 No.975= -1
	FL-net function	Fast Ethernet board mounted in slot 1	No.972= 4	No.976= -1
	FL-net PORT2 function	Fast Ethernet board mounted in slot 2	No.973= 1	

5.3 SETTING

This section describes the setting of the PROFINET IO Device function.
The PROFINET IO Device function is usually set from the IO Supervisor.

NOTE

1 If you change the settings of the PROFINET IO Device function, set the CNC to the emergency stop state or change the CNC mode to the MDI mode, and change the PROFINET parameter mode to the "CHANGE MODE" on the setting screen of the PROFINET IO Device function.
If the Ethernet function and the PROFINET IO Device function are operated at the same time on the same hardware option, release the parameter protection of the Ethernet function in the 8-level data protection function.

2 To prevent the setting from being changed unintentionally, change the mode to "PROTECT MODE" after completing the setting.
For details of the setting item "MODE", see Subsection 5.4.1, "Checking the Settings".

5.3.1 Setting from the IO Supervisor

This subsection describes the general setting procedures.
Refer to the manual supplied with the IO Supervisor when actually using the IO Supervisor.

1 In the IO Supervisor, install the GSDML file of the CNC (IO Device).
2 In the IO Supervisor, set the device name for the CNC, the IP parameters for the CNC, and CNC-specific parameters such as PMC assignment, and transfer these parameters to the IO Controller.

The above steps are for the settings in the IO Controller, and the following steps are for the settings in the CNC.

3 Set the device name and the IP parameters to the CNC by operating the IO Supervisor.
Then, turn the CNC off and back on.
4 After the CNC restarts, the other parameters are automatically set in the CNC. Then, turn the CNC off and back on.
5 When the CNC restarts, the communication with the IO Controller starts.

NOTE

1 In steps 3 and 4, it is recommended to check the updated settings before turning the CNC off.
Check that each parameter is updated in accordance with Subsection 5.4.1, "Checking the Settings".

2 If the mode is "CHANGE MODE", the communication parameters stored in the nonvolatile memory of the CNC may be changed via the network due to a setting request from the IO Supervisor and the IO Controller.
To prevent settings from being changed inadvertently, change the mode to "PROTECT MODE" after completing the setting.

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NOTE

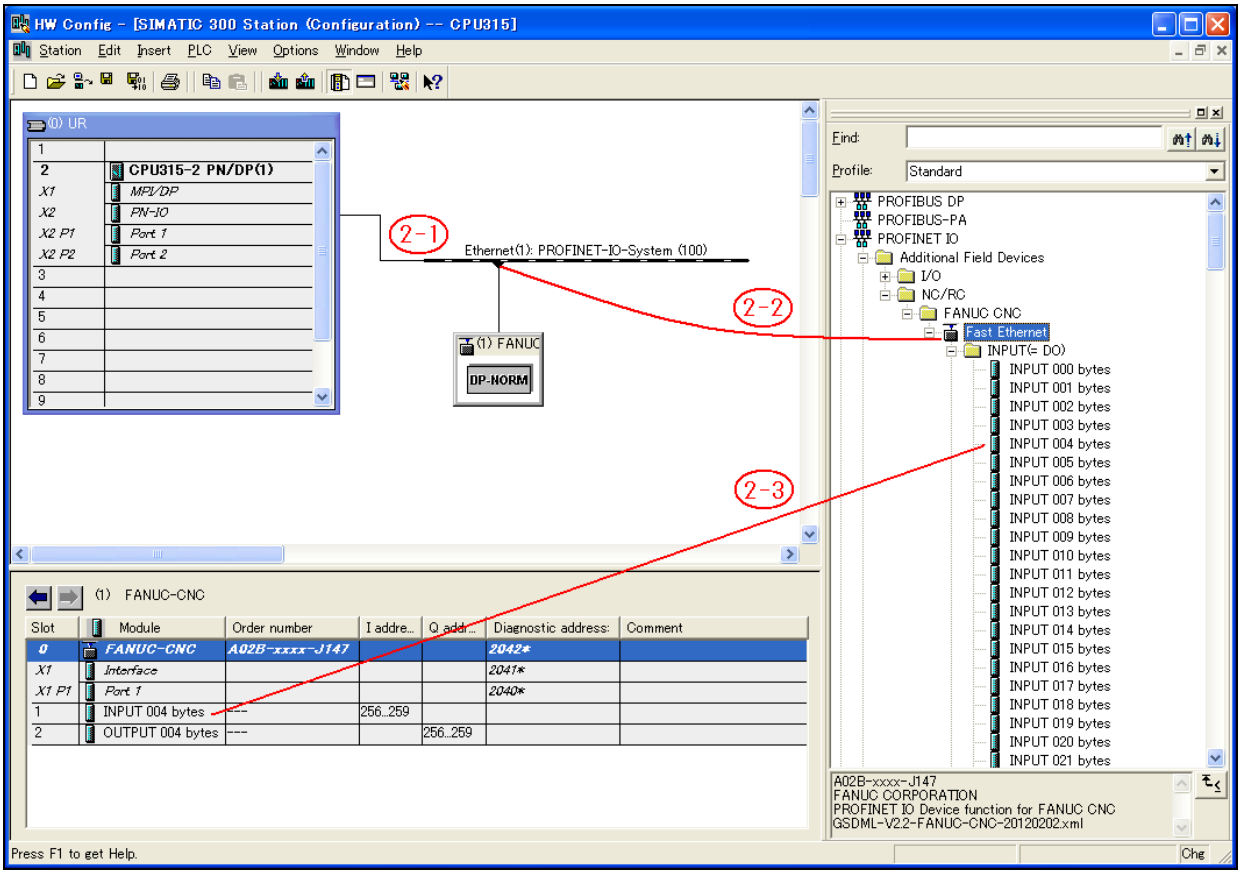
3 If the communication partner (IO Controller) is a FANUC CNC, the FANUC-specified Setting tool, "PROFINET Configuration Tool (PFN-CT) for FANUC CORPORATION" (made by Molex, Inc.), must be used as an IO Supervisor. If the communication party (IO Controller) is a FANUC CNC, see Chapter 4, "PROFINET IO CONTROLLER FUNCTION".

5.3.1.1 Example of using STEP7 of Siemens AG

This subsection briefly describes an example of using STEP7 (Version 5.5) of Siemens AG.
For details of how to use STEP7, refer to the manual supplied with STEP7 of Siemens AG.

First, display the "HW Config" screen.

1 Select the menu [Options] -> [Install GSD File…] from the "HW Config" screen, and install the GSDML file of the CNC (IO Device) from the "Install GSD Files" screen.



2-1 Select "PN-IO" in the UR (Universal Rack) window on the main screen of the "HW Config" screen, and select the menu [Insert] -> [PROFINET IO System] to add the network "PROFINET-IO-System".

2-2 On the device tree on the right of the "HW Config" screen, select [PROFINET IO] -> [Additional Field Devices] -> [NC/RC] -> [FANUC CNC] -> [Fast Ethernet] sequentially, and then drag & drop [Fast Ethernet] into the network "PROFINET-IO-System". This causes the CNC to be added as an IO Device.
At this point, the IP parameters are automatically assigned, and the default name "FANUC-CNC" is assigned as the device name.

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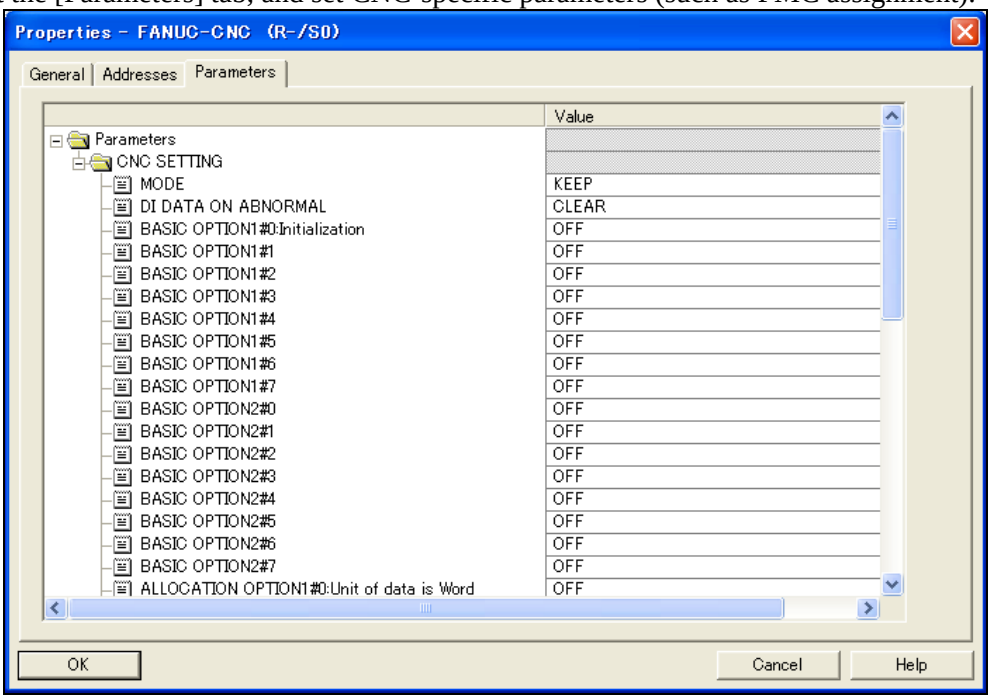
If you want to change the IP parameters or the device name, you can change them on the "Properties" screen. The "Properties" screen is displayed by double-clicking the IO Device added to the network "PROFINET-IO-System".

2-3 The items [INPUT xxx bytes] (xxx: 0 to 256) are displayed by selecting [PROFINET IO] -> [Additional Field Devices] -> [NC/RC] -> [FANUC CNC] -> [Fast Ethernet] -> [INPUT(=DO)] sequentially on the device tree on the right of the "HW Config" screen. Select the item [INPUT xxx bytes] that corresponds to the item of the input bytes of the IO Device, and drag & drop it into the "Slot1" of "FANUC-CNC" in the lower part of the "HW Config" screen.
Similarly, select the one from the items [OUTPUT xxx bytes] (xxx: 0 to 256) that corresponds to the item of the output bytes of the IO Device, and drag & drop it into the "Slot2" of "FANUC-CNC" in the lower part of the "HW Config" screen.

2-4 Double-click the "Slot0" of "FANUC-CNC" in the lower part of the "HW Config" screen, and display the "Properties" screen, shown below.
Select the [Parameters] tab, and set CNC-specific parameters (such as PMC assignment).



For details of CNC-specific parameters, see the setting items in Subsection 5.4.1.2, "Setting screen of the PROFINET IO Device function".
Note that for "MODE", a selection can be made between "PROTECT" ("PROTECT MODE") and "KEEP" (keep the present mode). If it is not necessary to change the mode, select "KEEP" (keep the present mode). The mode cannot be changed from "PROTECT MODE" to "CHANGE MODE".
Click the [OK] button after completing the setting.

2-5 Double-click the network "PROFINET-IO-System" on the main screen of the "HW Config" screen in order to display the "PROFINET IO-System Properties" screen, shown below.
Select the [Update Time] tab, and confirm that "Update Time" of "FANUC-CNC" is 4 ms.
If you want to set "Update Time" to a value greater than 4 ms, first change "Mode" row from "Automatic" to "Fixed update time", and then change it to a value greater than 4 ms.

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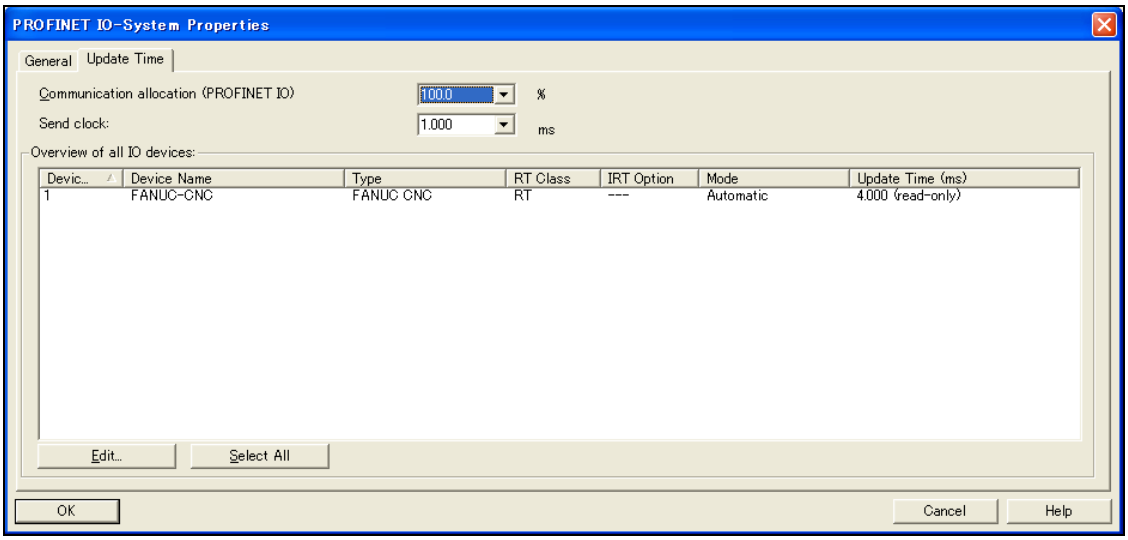
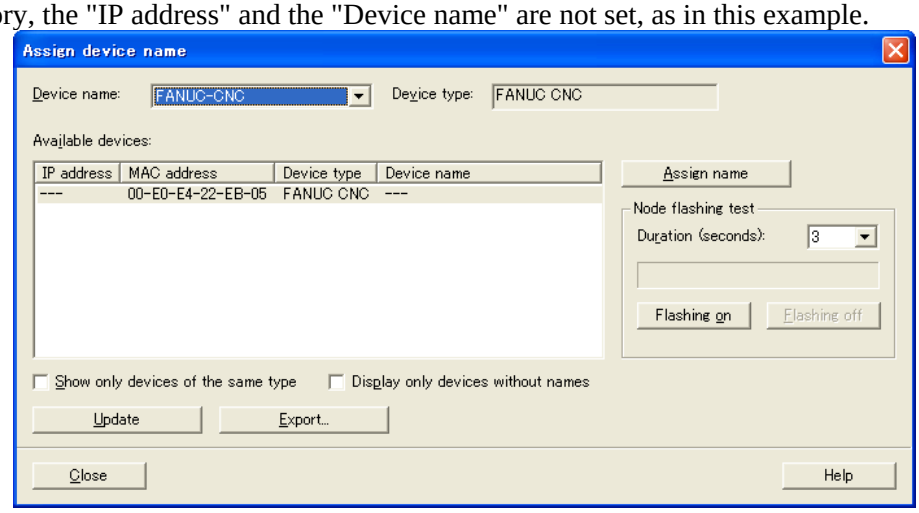


Click the [OK] button after completing the setting.

2-6 After completing the setting of all IO Devices, select the menu [Station] -> [Save and Compile] on the "HW Config" screen to preserve the parameters.
Select the menu [PLC] -> [Download] in order to transfer the parameters to the IO Controller.

The above steps are for the settings in the IO Controller, and the following steps are for the settings in the CNC.

3 Select the menu [PLC] -> [Ethernet] -> [Assign Device Name] on the "HW Config" screen in order to display the "Assign device name" screen. When this screen is displayed, IO Devices on the network are automatically detected.
The following shows a screen example when "FANUC CNC" is detected. For a CNC shipped from the factory, the "IP address" and the "Device name" are not set, as in this example.



Check that the device name set in step 2-2 is selected in the list box "Device name" in the upper part of this screen, and then click the [Assign name] button. The device name and the IP parameters set in step 2-2 are automatically set in the CNC. Then, turn the CNC off and back on.

4 When CNC restarts, the other setting parameters are automatically set in the CNC. Then, turn the CNC off and back on.

5 When the CNC restarts, the communication with the IO Controller starts.

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5.4 MAINTENANCE

This section describes the maintenance of the PROFINET IO Device function.

Screen displaying procedure

Screens of communication functions can be displayed in the way described in Subsection 2.4.1, "Displaying Screens" in Part II, "COMMON".
The procedure in this section is an example in which the PROFINET IO Device function is operated on a hardware option different from that on which the Ethernet function is operated. If the function is operated on the same hardware option as that on which the Ethernet function is operated, read soft key [PRFNET DEVICE] as [ETHERNET].

5.4.1 Checking the Settings

Settings can be checked on the CNC screen.

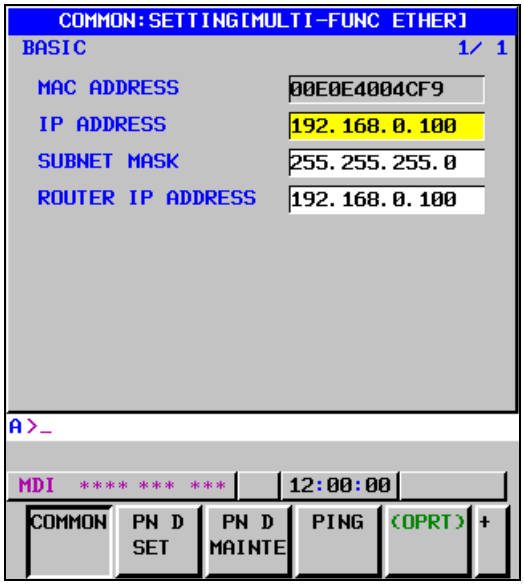
> **NOTE**
> It is possible to set the PROFINET IO Device function from the CNC screen. For PROFINET, however, an IO Device is set from the IO Supervisor and the IO Controller.
> Thus, use the CNC screen to check parameters but not to make settings.

Procedure

1 Press function key SYSTEM.
2 Soft key [PRFNET DEVICE] appears. When soft key does not appear, press the continue key.
3 Press soft key [PRFNET DEVICE]. Soft keys [COMMON], [PN D SET], [PN D MAINTE], [PING], "COM STATE", and "TASK STATE" appear.
4 Press soft key [COMMON] or [PN D SET] to check the setting items on that screen.

5.4.1.1 COMMON screen

In the above-mentioned procedure, press soft key [COMMON] to display the COMMON screen (BASIC). On this screen, IP parameters can be checked.



COMMON screen (BASIC)

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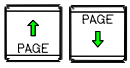
Setting items

Item	Description
IP ADDRESS	IP address of the hardware option. (Example of specification format: "192.168.0.100")
SUBNET MASK	Mask address for the IP addresses of the network. (Example of specification format: "255.255.255.0")
ROUTER IP ADDRESS	Same address as the IP address according to the recommendation of the PROFINET standard. When the PROFINET IO Device function is used, the communication that uses the router is not supported. (Example of specification format: "192.168.0.100")

Display item

Item	Description
MAC address	MAC address of the hardware option

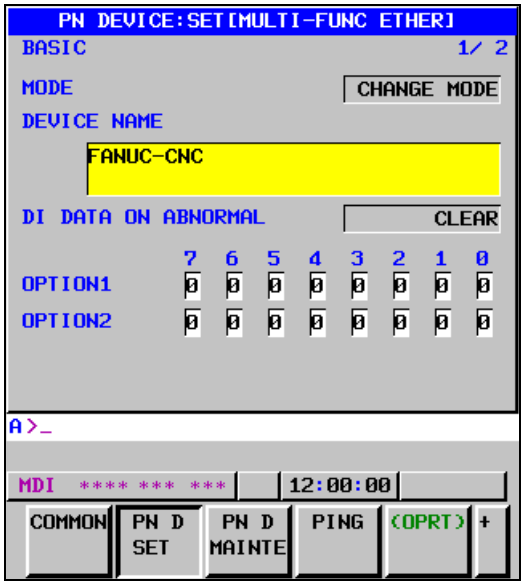
5.4.1.2 Setting screen of the PROFINET IO Device function

In the above-mentioned procedure, press soft key [PN D SET] to display the setting screen of the PROFINET IO Device function.
The setting screen of the PROFINET IO Device function consists of page 1, the BASIC screen, and page 2, the ALLOCATION screen.
It is possible to switch between pages using the page keys 

.

BASIC screen

The first page is the BASIC screen.



Setting screen of the PROFINET IO Device function (BASIC)

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Setting items

Items enclosed in " and " are the "CNC-specific parameters" to be set on the IO Supervisor. On the IO Supervisor, the items enclosed in " and " appear.

Item	Description
MODE "MODE"	Select the mode of the PROFINET IO Device function. - "CHANGE MODE" In this mode, the communication parameters can be changed. - "PROTECT MODE" In this mode, the communication parameter cannot be changed.
DEVICE NAME	Device name according to the PROFINET standard (NOTE) On the CNC screen, a name of up to 63 characters can be set. Make sure that device name matches the device name that is set on the IO Supervisor. On the IO Supervisor, a name of up to 240 characters can be set, but up to 64 characters can be displayed on this screen.
DI DATA ON ABNORMAL "DI DATA ON ABNORMAL"	Set the action to be taken on the data in the DI area if an abnormal status is detected. HOLD: Hold the data in the DI area. CLEAR: Clear the DI area to zero. To set it on the CNC screen, press soft keys [(OPRT)] and [DI DATA], and then select [HOLD] or [CLEAR]. By default, [CLEAR] is selected. The term abnormal status, as used here, refers to a change in any of the status signals. For details of the status, see the subsequent section on the status. - Change of SF from 0 to 1 - Change of BF from 0 to 1 - Change of IO from 1 to 0 - Change of EI from 1 to 0
OPTION1 "BASIC OPTION1 #0 to #7"	Bit 0: When the power supply is turned on next time, the basic settings and allocation settings of the PROFINET IO Device function are 0: not initialized. 1: initialized. Bits 1-7: Reserved (Must be zero)
OPTION2 "BASIC OPTION2 #0 to #7"	Bits 0-7: Reserved (Must be zero)

NOTE
The device name must be unique on the network.

Operation

Changing the setting for MODE

The setting for MODE can be changed.

1 Press soft key [(OPRT)] to display soft key [MODE].

2 Press soft key [MODE] to display soft keys [CHANGE MODE] and [PROTECT MODE].

3 Press the soft key of the desired mode.

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Changing the setting for DI DATA ON ABNORMAL

The setting for DI DATA ON ABNORMAL can be changed.

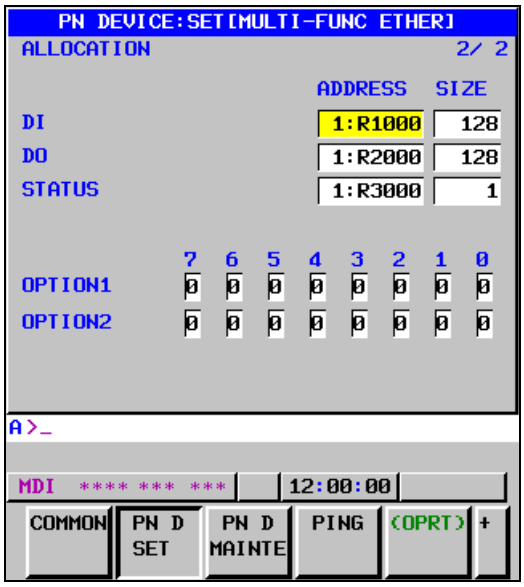
1 Press soft key [(OPRT)] to display soft key [DI DATA].

2 Press soft key [DI DATA] to display soft keys [HOLD] and [CLEAR].

3 Press the soft key of the desired action.

ALLOCATION screen

The second page is the ALLOCATION screen.



Setting screen of the PROFINET IO Device function (ALLOCATION)

Setting items

Items enclosed in " and " are the "CNC-specific parameters" to be set on the IO Supervisor. On the IO Supervisor, the items enclosed in " and " appear.

Item	Description
DI/DO ADDRESS "DI/DO PATH" "DI/DO AREA" "DI/DO ADDRESS"	Address of the area in which DI/DO data is to be stored. On the IO Supervisor, specify a PMC path number for "DI/DO PATH", a PMC area for "DI/DO AREA", and a PMC address number for "DI/DO ADDRESS". The setting range depends on the effective range of the R, E, D, X (DI only), or Y (DO only) area of the PMC. If the X/Y address of the PMC is to be assigned, it is necessary to set parameters Nos. 11937 to 11939 also. For details of these NC parameters, see Section 4.3, "PARAMETERS RELATED TO PMC" in Part II, "COMMON".
DI/DO SIZE	Size of the area in which DI/DO data is to be stored. [INPUT xxx bytes] (xxx: 0 to 256) selected on the IO Supervisor is the DO size. Similarly, [OUTPUT xxx bytes] (xxx: 0 to 256) is the DI size. The setting range is 0 to 256 (bytes).

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<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>STATUS ADDRESS
"STATUS PATH"
"STATUS AREA"
"STATUS ADDRESS"</td><td>Top address of the R or E area of the PMC in which the status is to be stored.
On the IO Supervisor, specify a PMC path number for "STATUS PATH", a PMC area for "STATUS AREA", and a PMC address number for "STATUS ADDRESS".
The setting range depends on the effective range of the R or E area of the PMC.</td></tr>
<tr><td>STATUS SIZE
"STATUS SIZE"</td><td>Size of the PMC area in which the status is to be stored.
Setting range: 0 to 1 (byte).</td></tr>
<tr><td>OPTION1
"ALLOCATION
OPTION 1#0 to #7"</td><td>Bits 0-1: Unit of data of DI/DO data
<table>
<tr><th>Bit 1</th><th>Bit 0</th><th>Unit of data</th></tr>
<tr><td>0</td><td>0</td><td>The unit of data is byte.</td></tr>
<tr><td>0</td><td>1</td><td>The unit of data is word (2 bytes).</td></tr>
<tr><td>1</td><td>0</td><td>The unit of data is long (4 bytes).</td></tr>
<tr><td>1</td><td>1</td><td>Setting error</td></tr>
</table>
- If the unit of data is word, the address and the size must be set in word units.
Example) address/size = R1000/2, R1002/4, E1004/6
- If the unit of data is long, the address and the size must be set in long units.
Example) ADDRESS/SIZE = R1000/4, R1004/8, E1008/12
For details of units of data, see Subsection 5.2.2, "Unit of Data and Concurrency of Data".
Bit 2: Endian conversion is
0: not performed.
1: performed.
For details of endian conversion, see Subsection 5.2.3, "Conversion of Endian".
Bits 3-7: Reserved (Must be 0)</td></tr>
<tr><td>OPTION2
"ALLOCATION
OPTION2 #0 to #7"</td><td>Bits 0-7: Reserved (Must be 0)</td></tr>
</table>

⚠ WARNING
Before allocating the PMC area, be sure to read Section 3.1, "DI/DO DATA AND STATUS DATA" in Part II, "COMMON".

Status

This is the status detected by the PROFINET IO Device function.

		Status							
		#7	#6	#5	#4	#3	#2	#1	#0
Status address	+0	SW	IO	EI	-	-	-	BF	SF

Bit	Name	Description
#0	SF	System fault 0: The PROFINET IO Device function operates normally. 1: An unrecoverable fault occurs in the PROFINET IO Device function.
#1	BF	Bus fault 0: The communication is established. 1: The communication is not established yet, or the communication error occurs.
#2-4	-	Reserved
#5	EI	Effective DI data 0: The CNC receives ineffective DI data from the IO Controller. 1: The CNC receives effective DI data from the IO Controller.
#6	IO	DI/DO communication 0: The CNC is not communicating with the IO Controller about DI/DO data. 1: The CNC is communicating with the IO Controller about DI/DO data.

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Bit	Name	Description
#7	SW	System wake up 0: The system of the PROFINET IO Device function has not started. 1: The system of the PROFINET IO Device function has started. The other bits are effective after SW is changed to 1.

NOTE

1 Immediately after the power is turned on, all bits are 0.

2 If the EI bit is 1, the IO Controller is transmitting effective DI data. If the IO bit is 1 and the EI bit is 0, the DI data is ineffective though the CNC receives DI data from the IO Controller.
Thus, handle the received DI data after the ladder program checks that the EI bit is 1.

5.4.2 Maintenance Screen of the PROFINET IO Device Function

The maintenance information of the PROFINET IO Device function can be checked.

NOTE

The maintenance screen includes the PING screen, communication state screen, and task state screen common to the communication functions.
For details of these screens, see Chapter 2, "SOFTWARE MAINTENANCE INFORMATION" in Part V, "MAINTENANCE".

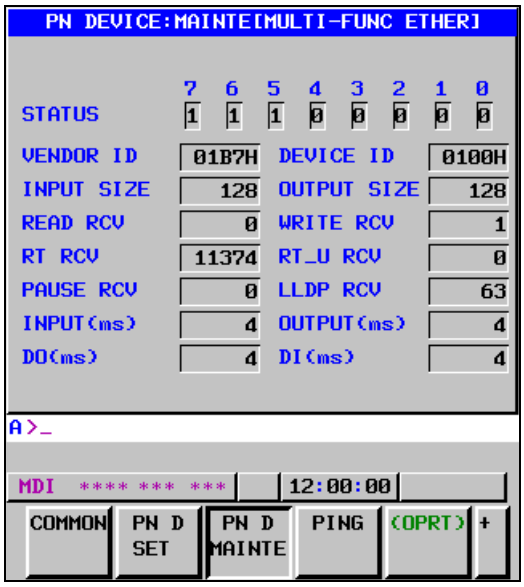
Procedure

1 Press function key SYSTEM.

2 Soft key [PRFNET DEVICE] appears. When the soft key does not appear, press the continue key.

3 Press soft key [PRFNET DEVICE]. Soft keys [COMMON], [PN D SET], [PN D MAINTE], [PING], [COM STATE], and [TASK STATE] appear.

4 Press soft key [PN D MAINTE] to display the maintenance screen of the PROFINET IO Device function.



Maintenance screen of the PROFINET IO Device function

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Display items

Display item	Description
STATUS	This is information (8 bits) that shows the state. The contents are the same as the status in Subsection 5.4.1.2, "Setting screen of the PROFINET IO Device function". In case of Bit 7(SW)=1, Bit 6(IO)=1, Bit 5(EI)=1, and Bit 4-Bit 0=0: The CNC communicates with the IO Controller normally about DI/DO data. In case of Bit 7(SW)=1, Bit 6(IO)=1, and Bit 5-Bit 0=0: The CNC communicates with the IO Controller, but the DI data updated in the PMC area contains an invalid value. Check the state of the IO Controller. In case of others: An abnormal status occurs. Check the following items and the contents of the log screen. - Check that the Ethernet cable is correctly connected. - Check that the device name for the CNC set in the IO Controller matches the device name set in the CNC. - Check that the PMC assignment is correct. - Check that POWER MUST BE OFF alarm (PW0000) does not appear.
VENDOR ID	This is the identification information (16 bits) that uniquely identifies the maker. 01B7H: FANUC CORPORATION
DEVICE ID	This is the identification information (16 bits) defined by the maker. 0100H: PROFINET IO Device for FANUC CNC
INPUT SIZE/OUTPUT SIZE	This is the input size/output size requested from the IO Controller. (Unit: Byte) If no connection to the IO Controller is made, "---" is displayed in "INPUT SIZE"/"OUTPUT SIZE". The direction of the input/output data is as follows. - Input: IO Device => IO Controller (DO for CNC) - Output: IO Controller => IO Device (DI for CNC)
READ RCV	The number of receptions of data reading frames is counted. This frame is used to read data other than IO transfer.
WRITE RCV	The number of receptions of data writing frames is counted. This frame is used to write data other than IO transfer.
RT RCV	The number of receptions of output frames (DI data) of IO transfer is counted.
RT_U RCV	This is used for the PROFINET enhancing frame in the future. It is 0 usually.
PAUSE RCV	The number of receptions of PAUSE frame is counted. This frame is used to direct the transmission to be stopped temporarily.
LLDP RCV	The number of receptions of LLDP (Link Layer Discovery Protocol) frame is counted. This frame is used to get the information of the device near on the network.
INPUT (ms)/OUTPUT (ms)	These are intervals when the input frame (DO data) of IO transfer is transmitted, and the output frame (DI data) is received. (Unit: ms)
DO(ms)/DI(ms)	This is the time to update DI/DO data to the PMC area. (Unit: ms)

Operation

Press soft key [(OPRT)] then soft key [CLEAR], and each counter is cleared.

5.4.3 Log Screen of the PROFINET IO Device Function

A log related to the PROFINET IO Device function is displayed.

Procedure

1 Press function key .

2 Press soft key [PRFNET DEVICE]. Soft keys [ALL], [COMMON], and [PRFNET DEVICE] appear.

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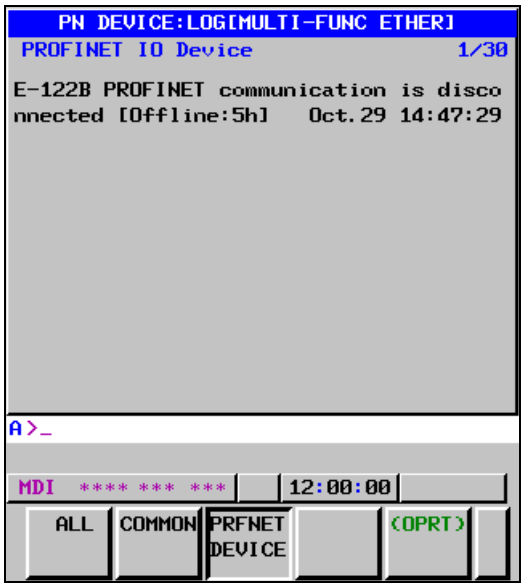
3 Press soft key [PRFNET DEVICE], and then a log related to the PROFINET IO Device function is displayed.



Log screen of the PROFINET IO Device function

The latest log information is displayed at the top of the screen. At the right end of a log item, the occurrence date and time of the log item is indicated. Date and time data is indicated in the format "MMM.DD hh:mm:ss", where MMM represents a month, DD represents a day, hh represents hour, mm represents minute, and ss represents second.

Operation

To clear the log information, press soft key [(OPRT)] then soft key [CLEAR].

> **NOTE**
> The log information for the PROFINET IO Device function is stored in volatile memory and it is lost when the CNC is turned off. If an error occurs, check the log information before turning the power off.

The following lists major log message:

Error code	Log message	Meaning and action to be taken
E-1200	The received parameter for PROFINET IO Device function is wrong	The received parameters for the PROFINET IO Device function are wrong. Set the parameters for PROFINET IO Device function correctly by using the IO Supervisor as follows. • Set "Update Time" of CNC to 4 ms or greater. • Set "INPUT xxx bytes" for "Slot1" of CNC. • Set "OUTPUT xxx bytes" for "Slot2" of CNC.

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Error code	Log message	Meaning and action to be taken
E-1201	Cannot save parameter for PROFINET IO Device function [X:Y:Z]	The received parameters for the PROFINET IO Device function were not saved, because they contained a wrong parameter. Set the parameters for PROFINET IO Device function correctly. The last [X:Y:Z] of the message means detailed information on the error, and the wrong parameter is indicated at the position of Z as one of the following numbers. (X and Y are internal error codes, and are not used.) 1233: "ALLOCATION OPTION1" is wrong 1236: "DI PATH" is wrong 1237: "DI AREA" is wrong 1238: "DI ADDRESS" is wrong 1239: "OUTPUT xxx bytes" is wrong 1240: "DI ADDRESS" is not 2-byte boundaries 1241: "DI ADDRESS" is not 4-byte boundaries 1243: "DO PATH" is wrong 1244: "DO AREA" is wrong 1245: "DO ADDRESS" is wrong 1246: "INTPUT xxx bytes" is wrong 1247: "DO ADDRESS" is not 2-byte boundaries 1248: "DO ADDRESS" is not 4-byte boundaries 1250: "STATUS PATH" is wrong 1251: "STATUS AREA" is wrong 1252: "STATUS ADDRESS" is wrong 1253: "STATUS SIZE" is wrong
E-1202	Setting DI/DO size is not equal to the I/O size of PROFINET transmission	The DI/DO size set on the setting screen of the PROFINET IO Device function differs from the I/O size used to transfer with PROFINET that is set on the IO Supervisor. Make sure that these sizes match. When you change the I/O size from the IO Supervisor, this log message may appear. If this occurs, turn the CNC off and back on.
E-1203	The parameter for PROFINET IO Device function is protected	The received parameter for the PROFINET IO Device function was not updated, because the parameter protection was enabled. To disable parameter protection, perform the following operations: • Change the "MODE" to the "CHANGE MODE" on the setting screen of the PROFINET IO Device function. • Set the CNC to the emergency stop state or change the CNC mode to the MDI mode. • If the PROFINET IO Device function and the Ethernet function are operated at the same time on the same hardware option, release the parameter protection of the Ethernet function in the 8-level data protection function.
E-1204	The parameter for PROFINET IO Device function was saved	The received parameter for the PROFINET IO Device function was saved. Check the parameters on the setting screen of the PROFINET IO Device function. Then, turn the CNC off and back on.

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Error code	Log message	Meaning and action to be taken
E-122A E-122B	PROFINET communication is disconnected	PROFINET communication is disconnected. In case of E-122A: The communication is disconnected before it is established. In case of E-122B: The communication is disconnected after it is established. Check that the Ethernet cable is correctly connected. Check the diagnostic information on the IO Controller when the trouble cannot be removed. This log message also appears if the IO Controller restarts.

5.5 UPDATING DI/DO DATA

5.5.1 Input/Output Response Time

For an explanation of the input/output response time, see Subsection 4.5.1, "Input/Output Response Time".

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IV. CONNECTION

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1 SETTING

This chapter provides information required to install hardware options for the Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A and Series 0*i*-F.

1.1 SPECIFICATIONS

When you use the Industrial Ethernet, specify the control unit with Multi-function Ethernet (LCD mounted type CNC) or Fast Ethernet board.

Ordering information of Fast Ethernet board	A02B-0323-J147
Drawing number of printed circuit board	A20B-8101-0770
Applicable models	Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A

Ordering information of Fast Ethernet board	A02B-0338-J147
Drawing number of printed circuit board	A20B-8101-0770
Applicable models	Series 0*i*-F

NOTE
1 Refer to the order list of each CNC, for ordering information for the control unit with Multi-function Ethernet. In case of Series 0*i*-F (LCD mounted type CNC), you can not use the Multi-function Ethernet.
2 When using the optional board, observe the installation condition (environmental condition inside the cabinet) of the CNC control unit where the board is installed.

The table below indicates the amount of heat output by the Fast Ethernet/Fast Data Server. For the amount of heat output by the main CNC unit and other optional units, refer to the CONNECTION MANUAL (HARDWARE) of the CNC.

Name	Power source capacity	Amount of heat
Fast Ethernet board	0.1A	3W

NOTE
For the control unit with Multi-function Ethernet (LCD mounted type CNC), refer to the CONNECTION MANUAL of the CNC.

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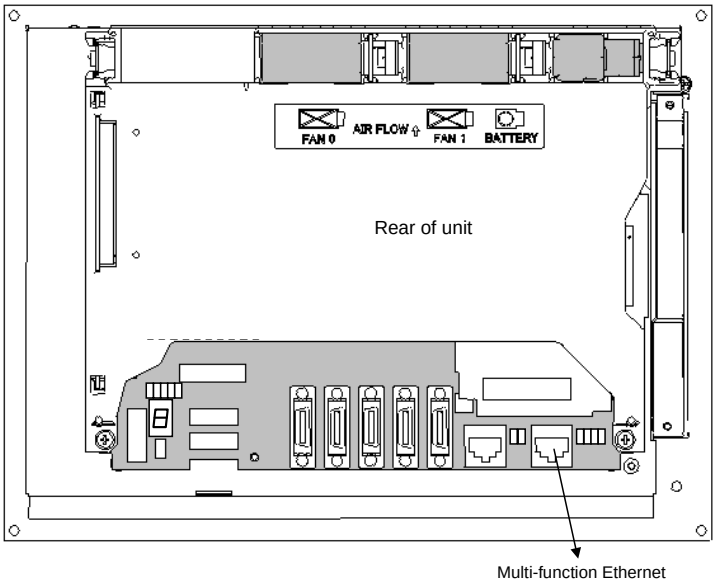
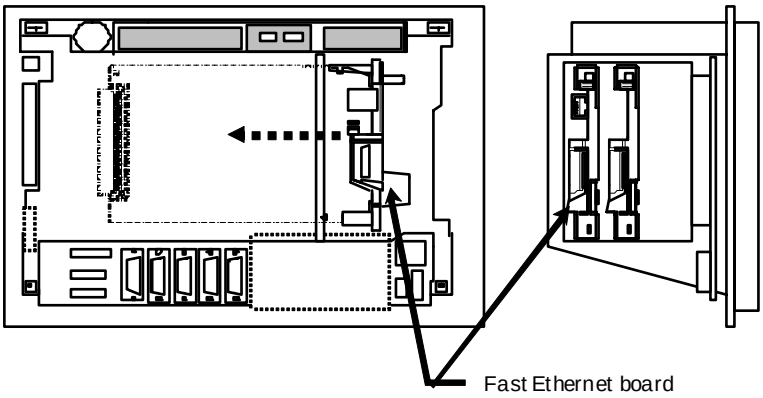
1.2 INSTALLATION

1.2.1 Installation on an LCD-mounted Type Unit

For the control unit with Multi-function Ethernet, the printed circuit board of Fast Ethernet is installed on the main board.



The Fast Ethernet board is installed in an optional slot of the control unit. It occupies one slot. No restriction is imposed on installation in the optional slot.



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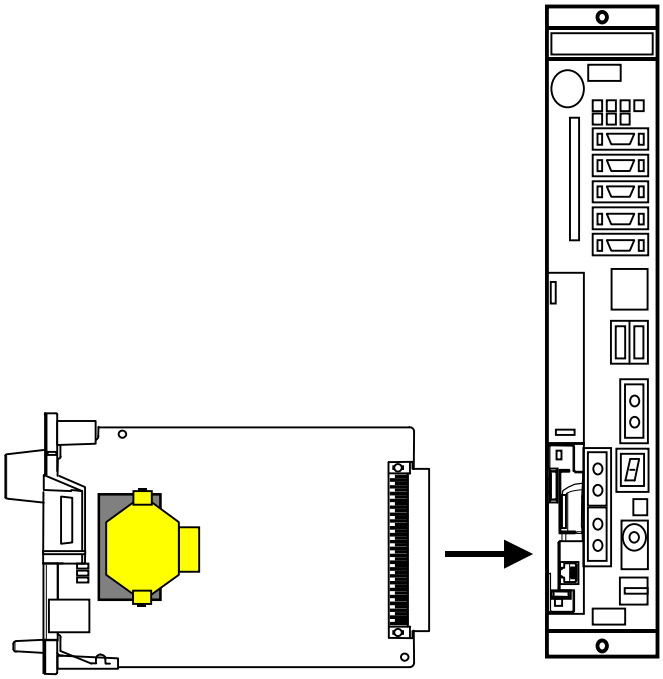
1.2.2 Installation on a Stand-alone Type Unit

The Fast Ethernet board is installed in the optional slot of the control unit. One slot is occupied. No restriction is imposed on installation in the optional slot.



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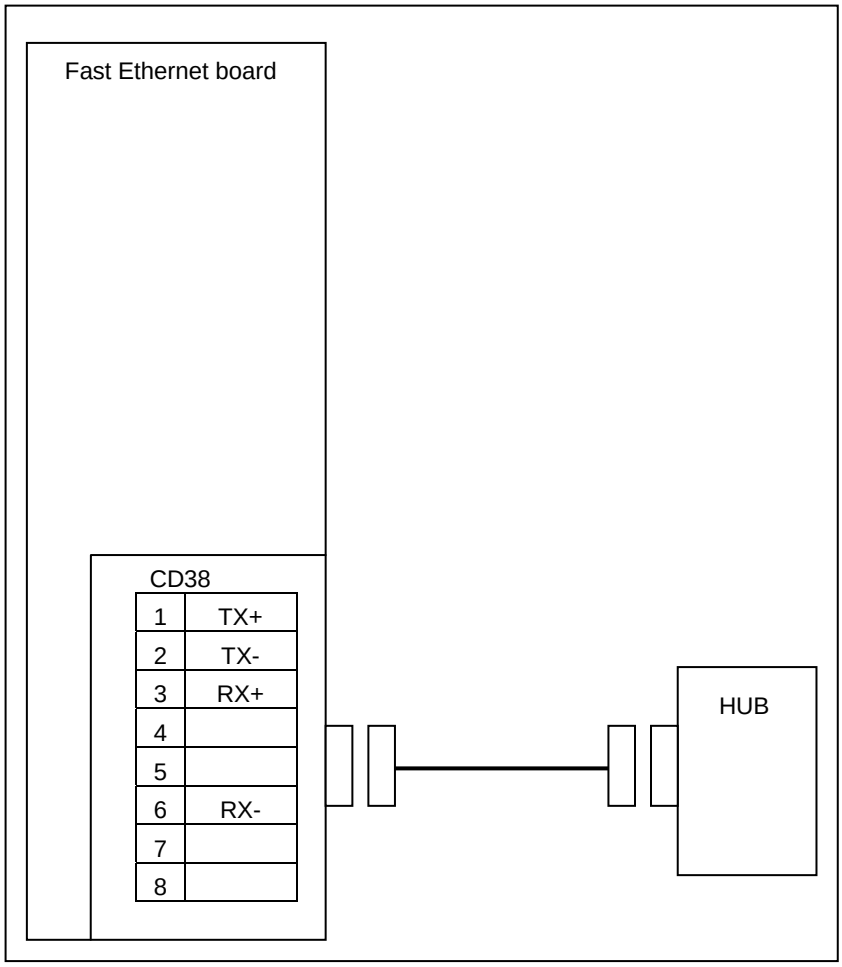
1.2.3 Total Connection Diagram



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2 CABLE CONNECTION

This chapter provides information relating to the Ethernet connection.

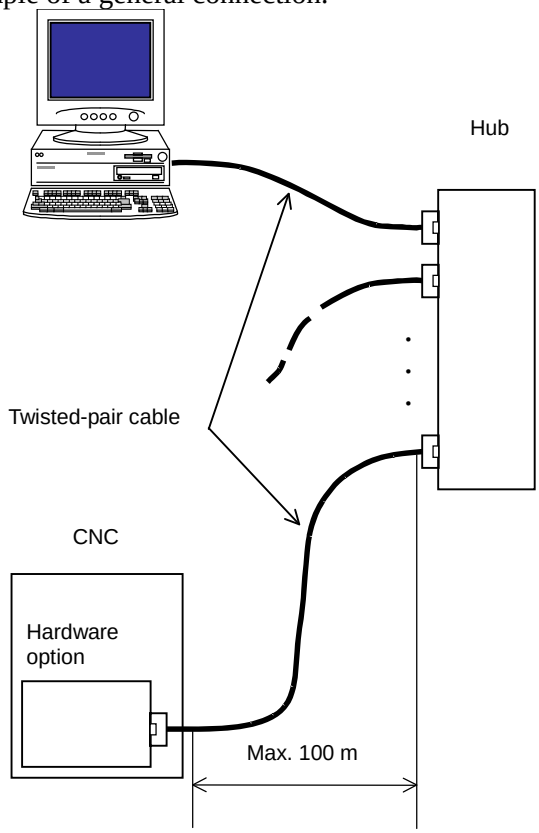
⚠ CAUTION

1 Before connecting or disconnecting the cable to or from a hardware option, make sure that the power to the CNC is turned off.

2 Please inquire of each manufacturer about the construction of network or the condition of using the equipment except the hardware option (hub, transceiver, cable, etc.). When configuring your network, you must take other sources of electrical noise into consideration to prevent your network from being influenced by electrical noise. Make sure that network wiring is sufficiently separated from power lines and other sources of electrical noise such as motors, and ground each of the devices as necessary. Also, a high and insufficient ground impedance may cause interference during communications. After installing the machine, conduct a communications test before you actually start operating the machine.
We cannot ensure operation that is influenced by network trouble caused by a device other than the hardware option.

2.1 CONNECTING TO Ethernet

The hardware option is provided with a 100BASE-TX interface. Prepare a hub for connecting to the Ethernet trunk.
The following shows an example of a general connection.



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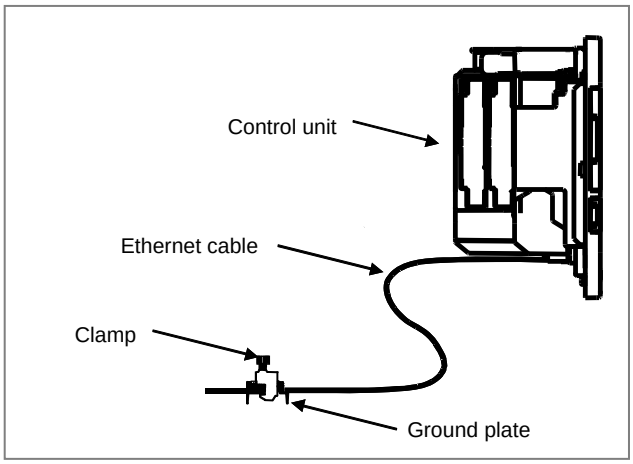
NOTE

1 The cable length shall be within 100 m (50 m for a FANUC-recommended cable for a movable part). Do not make the cable longer than necessary.

2 An Ethernet cable needs clamping to make system operation stable. For details of clamping, see Subsection 2.5.2, “Clamping and Shielding Cables.” The clamp for grounding the shield of the cable can also fix the cable.

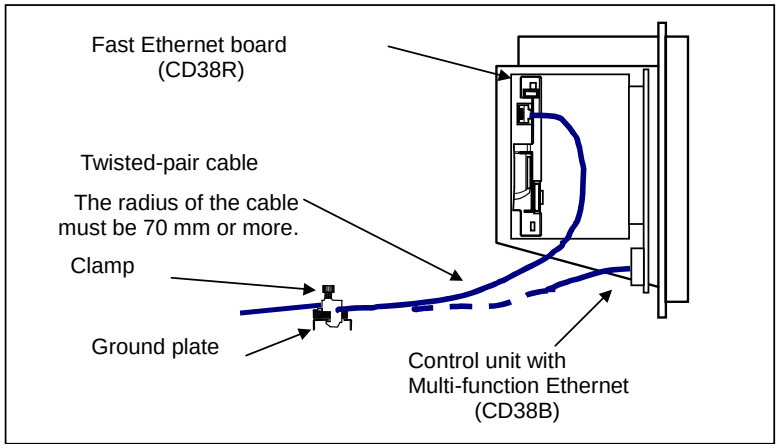


3 Some of the units (hub, transceiver, etc.) required to build a network are not dust-proof. They should be enclosed in a dust-proof cabinet. Using them in an atmosphere with dust or oil mist may lead to a communication error or failure.

2.2 LEADING OUT THE Ethernet CABLE

(1) LCD-mounted type

Select the control unit with Multi-function Ethernet or Fast Ethernet board. For the location of the connector, see Section 1.1, "COMPONENT LAYOUT" in Part V, "MAINTENANCE."



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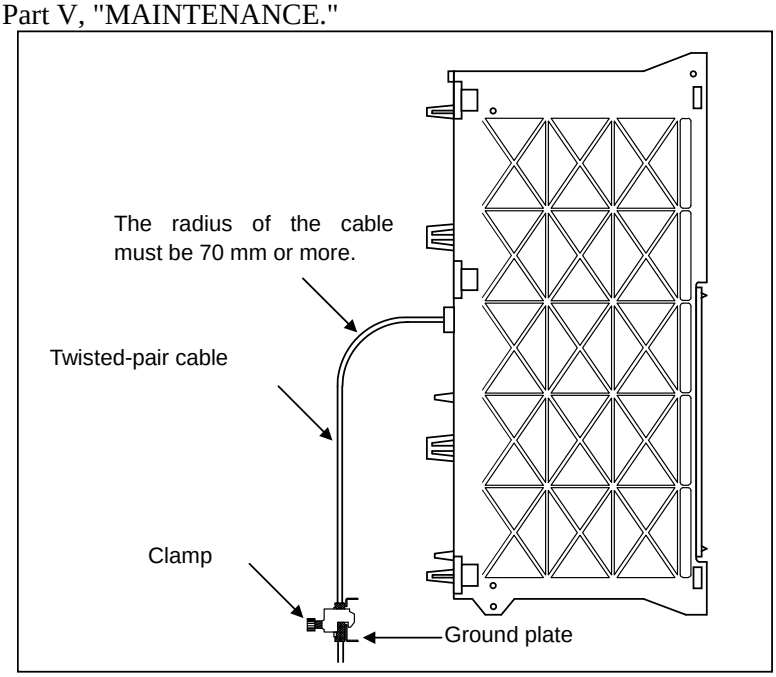
(2) Stand-alone type
Select the Fast Ethernet board. For the location of the connector, see Section 1.1, "COMPONENT LAYOUT" in Part V, "MAINTENANCE."



2.3 RJ-45 CONNECTOR PIN ASSIGNMENTS

Pin No.	Signal	Description
1	TX+	Send +
2	TX-	Send -
3	RX+	Receive +
4		Not used
5		Not used
6	RX-	Receive -
7		Not used
8		Not used

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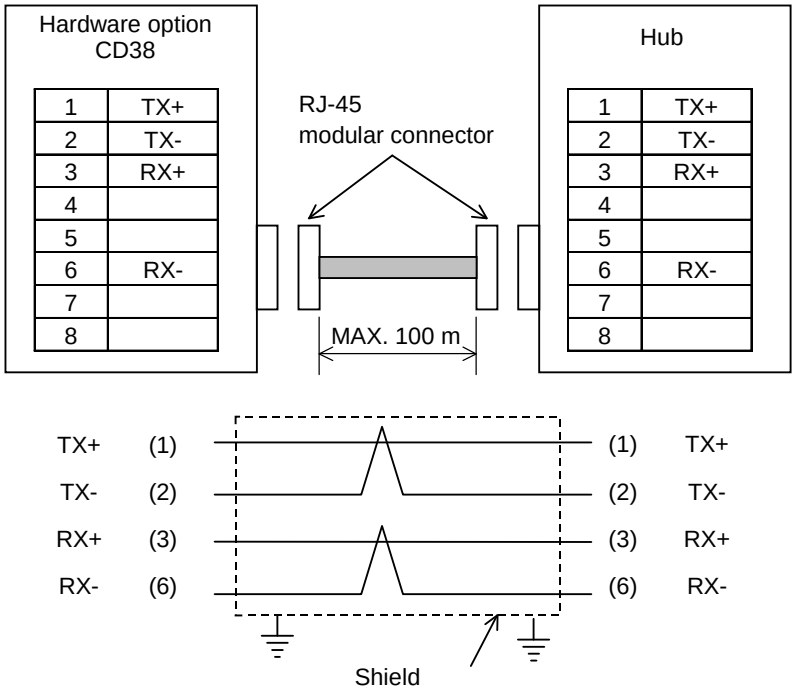
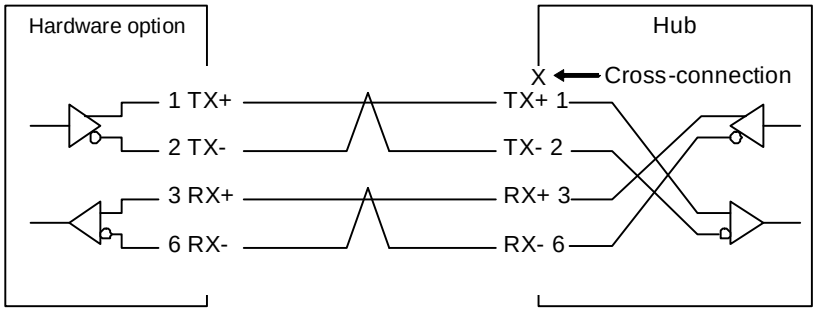
2.4 TWISTED-PAIR CABLE SPECIFICATION

2.4.1 Cable Connection

The cable used for connection between the 100BASE-TX interface of the hardware option and the hub is connected as follows:



- Keep the total cable length within 100 m.
  Do not extend the cable more than is necessary.
- The figure above shows the cable connection when cables are cross-connected in the hub.
  "X" is usually indicated at the port of the hub to signify that cables are cross-connected in the hub.



2.4.2 Cable Materials

> ⚠ **CAUTION**
> Many types of unshielded cables (UTP cables) are commercially available as 100BASE-TX twisted-pair cables. You should, however, use group shielded Category 5 twisted-pair cables (STP cables) to improve the resistance to electrical noise in an FA environment.

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Recommended cables

Manufacturer	Specification	Remarks
FURUKAWA ELECTRIC CO., LTD.	DTS5087C-4P	Twisted-pair cable
NISSEI ELECTRIC CO., LTD.	F-4PFWMF	Solid wire

Inquiries

Manufacturer	Contact address	Remarks
FURUKAWA ELECTRIC CO., LTD. Sales Headquarters	2-6-1 Marunouchi, Chiyoda-ku. Tokyo 100-8322 TEL: 03-3286-3126 FAX: 03-3286-3979	
NISSEI ELECTRIC CO., LTD. Machida Branch	3F MU Bldg., 1-9-1 Minami-narise, Machida City, Tokyo 194-0045 TEL: 0427-29-2531 FAX: 0427-29-3375	A finished cable with connectors at both ends can be offered.
Overseas Sales Office	IWATANI International Corporation Tokyo Head Office 21-8 Nishi-shinbashi 3-chome, Minato-ku, TOKYO, 105-8458, JAPAN TEL: 03-5405-5810 FAX: 03-5405-5666 Telex: 2524256 IWATYO J	

NOTE
The recommended cables listed above cannot be connected to movable parts.

Recommended cables (for movable parts)

Manufacturer	Specification	Remarks
Oki Electric Cable Co., Ltd.	AWG26 4P TPMC-C5-F(SB)	Dedicated to FANUC
Shinko Electric Industrial Co., Ltd.	FNC-118	

Specification
- Electric characteristics:
  Conforms to EIA/TIA 568A Category 3 and Category 5.
  From the viewpoint of attenuation performance, ensure that the length to the hub is 50 m or less.
- Structure:
  Group shielded (braided shield). A drain wire is available.
  The conductor is an AWG26 annealed copper twisted wire, with a sheath thickness of 0.8 mm and an outer diameter of 6.7 mm ±0.3 mm.
- Fire retardancy:
  UL1581 VW-1
- Oil resistance:
  Conforms to the FANUC internal standards (equivalent to the conventional oil-resistant electric cables).
- Flexing resistance:
  1,000,000 times or more with a bending radius of 50 mm (U-shaped flex test)
- UL style No.:
  AWM 20276 (80°C/30V/VW-1)

NOTE
Be sure to use the connector TM21CP-88P(03) manufactured by HIROSE ELECTRIC CO., LTD. for this cable.

Inquiries

Manufacturer	Contact address	Remarks
Oki Electric Cable Co., Ltd.	Nagano Sales Office TEL: 0266-27-1597	
Shinko Electric Industrial Co., Ltd.	Tokyo Sales Office TEL: 03-3492-0073	

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Cable assembly

Oki Electric Cable Co., Ltd. can also supply the cable assembly mentioned above.
Contact Oki Electric directly to determine the specifications (length, factory test, packing, and so forth) for purchase.

2.4.3 Connector Specification

Use an 8-pin modular connector (RJ-45) with the twisted-pair cable for the Ethernet connection. The following connector must be used.

Specification	Manufacturer	Remarks
TM21CP-88P(03)	HIROSE ELECTRIC CO., LTD.	Note

NOTE

Information about TM21CP-88P(03):
Connector (standard product of the manufacturer)
Drawing number: A63L-0001-0823#P
Manufacturer: HIROSE ELECTRIC CO., LTD.
Manufacturer type number: TM21CP-88P (03)
Conforms to EIA/TIA 568A Category 3 and Category 5.
For assembly with a cable, contact HIROSE ELECTRIC CO., LTD. directly.
(From HIROSE ELECTRIC CO., LTD., "TM21CP-88P(03) Connection Procedure Manual (Technical Specification No. ATAD-E2367)" is available as a technical document.

2.5 ELECTRICAL NOISE COUNTERMEASURES

2.5.1 Separating Signal Lines

For signal line separation, refer to the description of noise protection in the Connection Manual (Hardware) of the CNC. The wiring for the Ethernet cable is of group C.

2.5.2 Clamping and Shielding Cables

Clamp an Ethernet twisted-pair cable according to the method shown in the figure below, as with other cables that need to be shielded. Clamping cables provides cable support and shielding and is extremely important to the stable operation of the system. Be sure to clamp the cable.
Peel off part of the cable jacket as shown in the figure to expose the outer coating of the shield, and press this outer coating against the ground plate with the clamp fixtures.
The machine manufacturer must prepare the ground plate and install it as follows:

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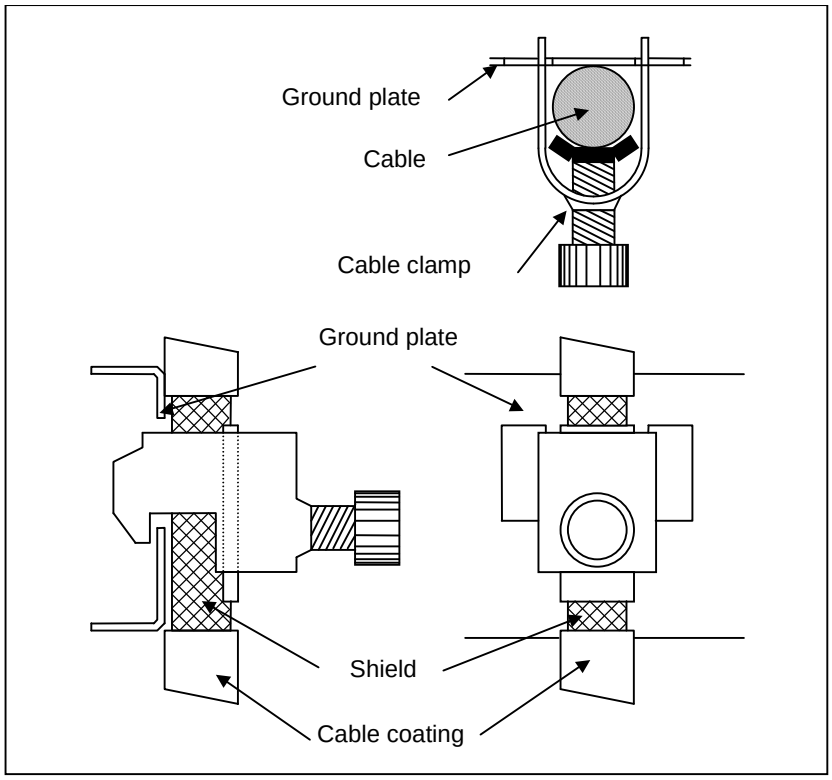

NOTE

To ensure the stable operation of the system, be sure to clamp and shield the cables.

Connect the hardware option and the hub with a twisted-pair cable. Shield the cable with clamp fixtures. This shielding is extremely important to the stable operation of the system. Be sure to shield the cable. Shield both ends of each cable at locations as near to the CNC and hub connectors as possible. When the CNC and hub are contained in the same power magnetics cabinet and the cable is short, shield the cable only at the hub side.

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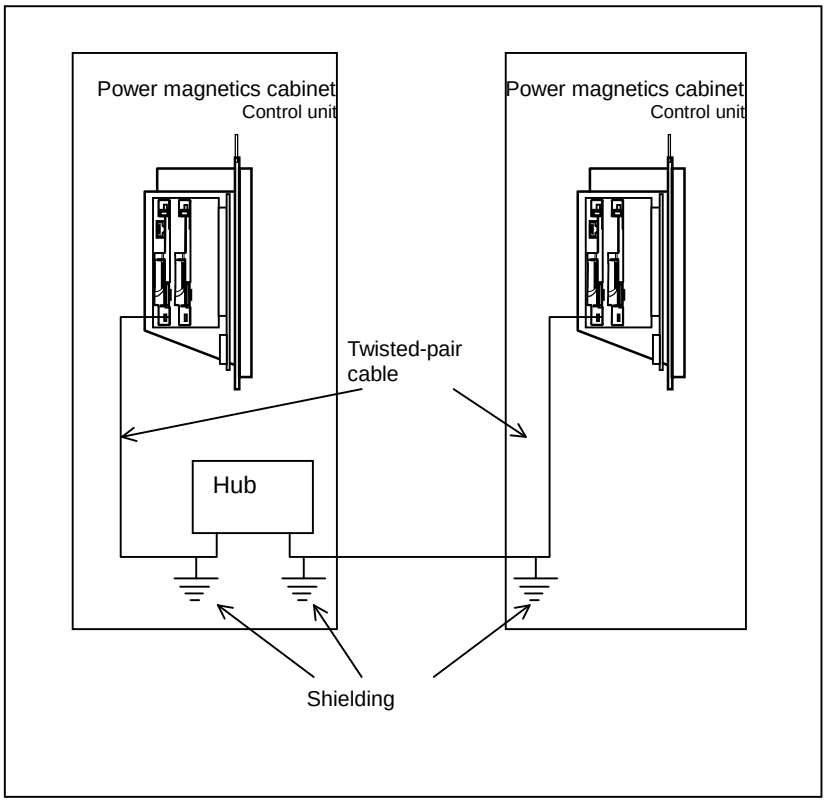
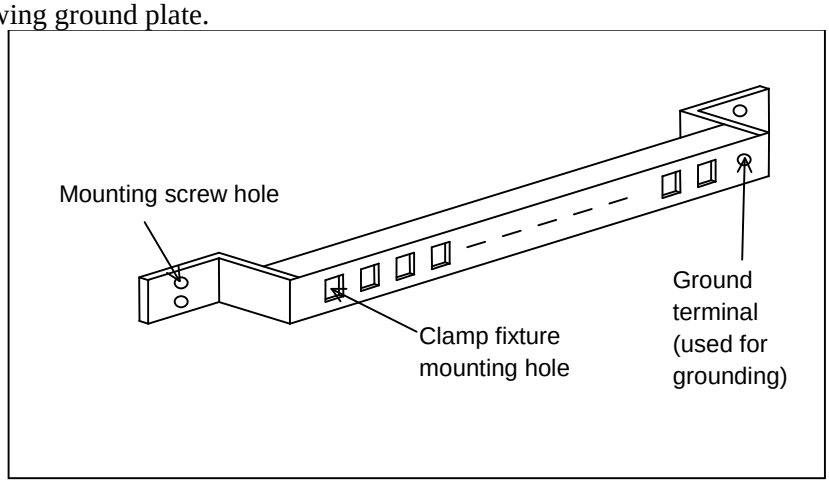
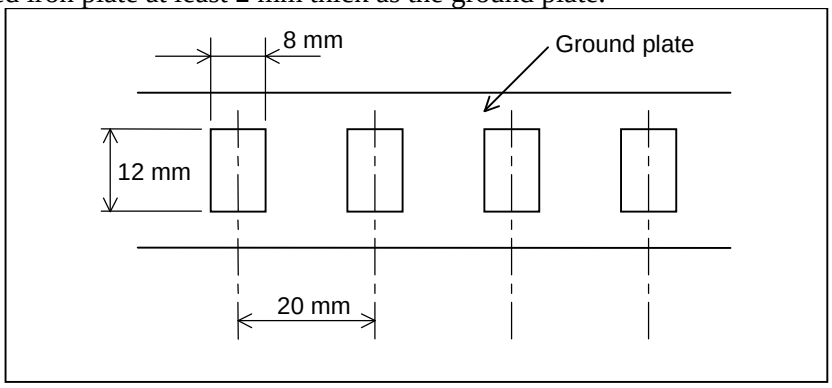


Example of shielding of twisted-pair cable
(LCD-mounted type)

Prepare the following ground plate.



Use a nickel-plated iron plate at least 2 mm thick as the ground plate.



Ground plate holes

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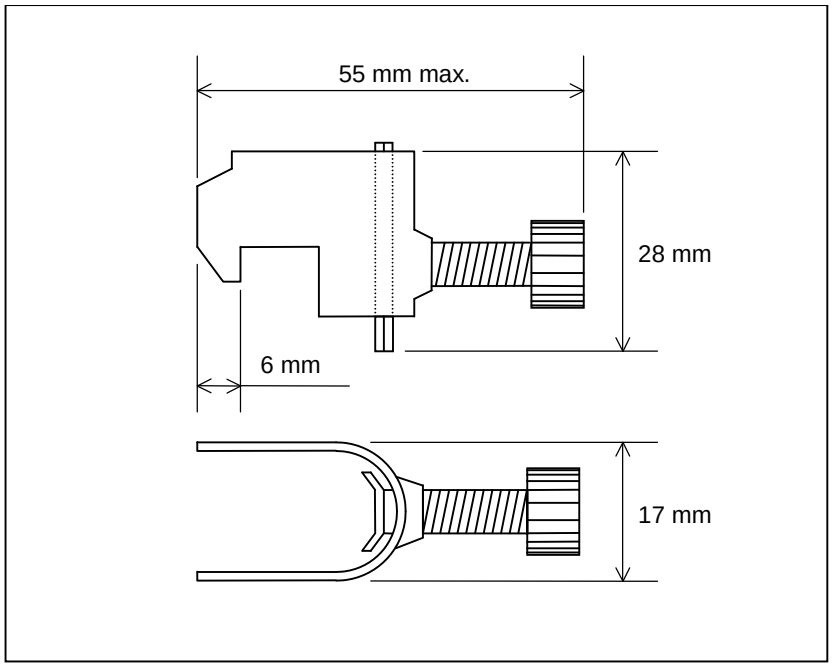

External dimensions of clamp fixture

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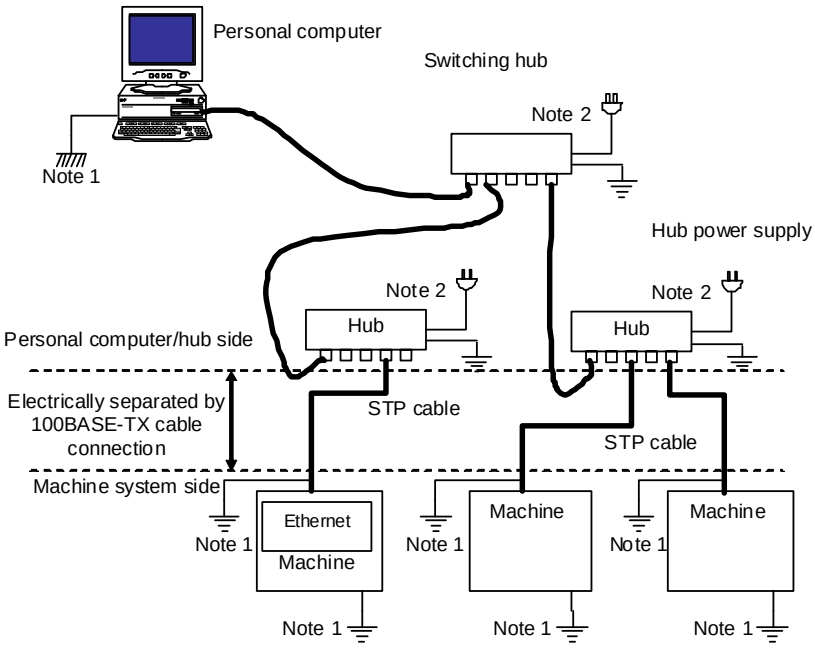
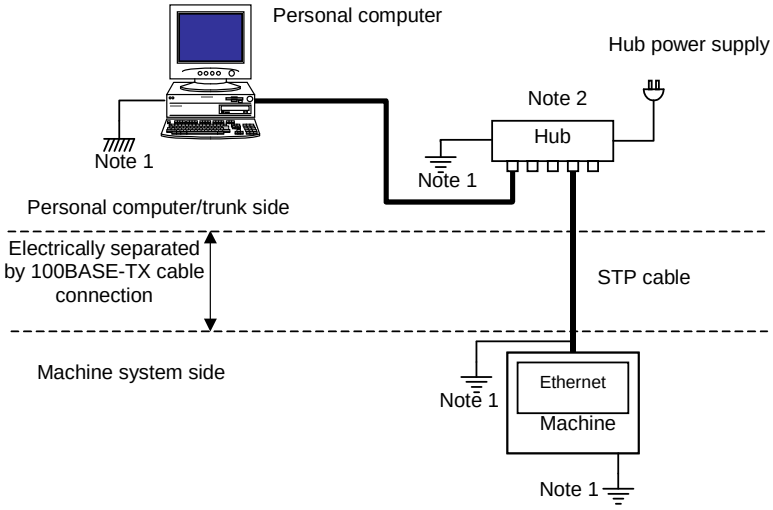
2.5.3 Grounding the Network

Even if the grounding condition on the machine side is satisfied, the communication line can pick up noise from the machine, depending on the machine installation condition and environment, thus resulting in a communication error. To protect against such noise, the machine side should be separated and insulated from the Ethernet trunk cable and personal computer. Examples of connection are given below.



Large-scale network



Small-scale network

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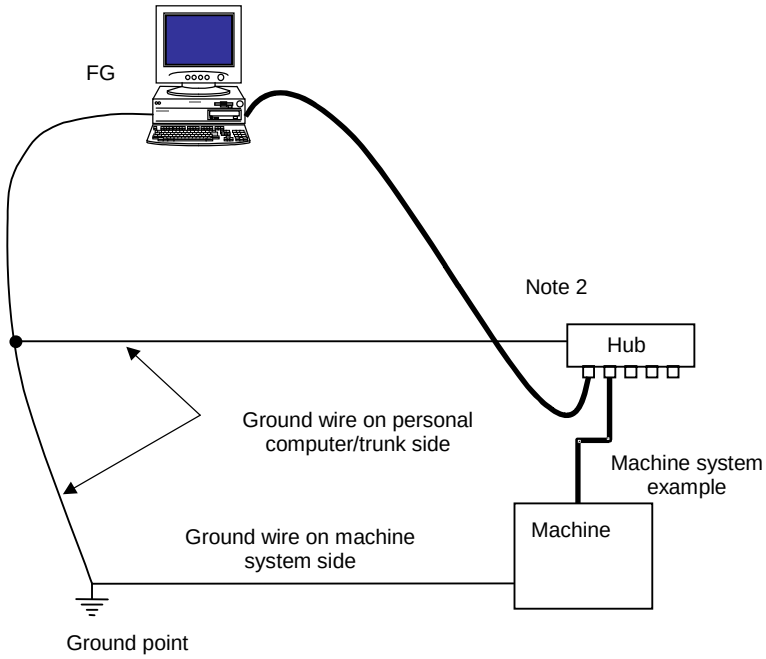
NOTE

1 The ground on the personal computer/hub side and the ground on the machine system side must be separated into different paths. If it is impossible to separate the grounds because there is only one ground point, connect the ground cable on the personal computer/trunk side and the ground cable on the machine system side to the ground point independently (see the figure below). The grounding resistance must be 100 ohms or less (Class D grounding). The thickness of the ground cable must the same as or more than the thickness of the AC power cable. A thickness of at least 5.5 mm^2 is necessary.

2 Note that the number of allowable hub-to-hub connections depends on the type of hub.

3 There is a possibility that normal communication cannot be made due to the effect of noise even if the above insulation and separation are provided using the 100BASE-TX. Under the worst environment condition, consider separating the machine side and the personal computer side completely using the 100BASE-FX (optical fiber media).



Wiring on a single ground point

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2.6 CHECK ITEMS AT INSTALLATION

The following table lists check items at installation.

Check item		Description	Check
Ethernet cable			
	Type	Use cables that satisfy all the following conditions:	
		1) Shielded	
		2) Twisted-pair cable	
		3) Category 5	
	Length	The cable length shall be within 100 m (50 m for a FANUC-recommended cable for a movable part).	
	Connection	For a twisted-pair cable, the following pins shall be paired:	
		1) Pin No. 1 (TX+) - pin No. 2 (TX-)	
		2) Pin No. 3 (RX+) - pin No. 6 (RX-)	
	Separation	The Ethernet cables shall be bound separately from the following cables or covered with an electromagnetic shield:	
		1) Group A: AC power lines, power lines for motors, and others	
		2) Group B: DC power lines (24 VDC) and others	
	Shielding	For a shielded cable, the part of which outer coating is peeled off and exposed shall be fixed to the ground plate with a clamp fixture.	
	Clamping	The ground plate shall be located as near to the CNC as possible (to make the cable between the ground plate and CNC less likely to be affected by noise).	
	Connectors	Any cable connector shall not be pulled (to prevent poor contact of the connector).	
	Wiring	No cable shall be laid under a heavy object.	
	Bending radius	The bending radius shall be at least four times as long as the diameter of the cable.	
	For movable part	For a movable part, a cable for a movable part shall be used.	
CNC and cabinet			
	CNC grounding	The CNC ground (frame ground) shall be connected properly and the length of the ground wire shall be within 300 mm.	
	Ground plate	The ground plate shall be connected to the AC ground of the cabinet with wire.	
	Mounting	The Fast Ethernet board shall be inserted in a CNC slot properly.	
Hub			
	Use conditions	The "cautions on use" of the hub shall be observed (a terminating resistor shall be mounted properly if required).	
	Grounding	The hub shall be grounded.	
	Cabinet	The hub shall be installed in an enclosed cabinet.	
	Vibration	The hub shall be installed so that it is not affected by vibration.	
	Cable bending radius	The bending radius shall be at least four times as long as the diameter of the cable.	

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V. MAINTENANCE

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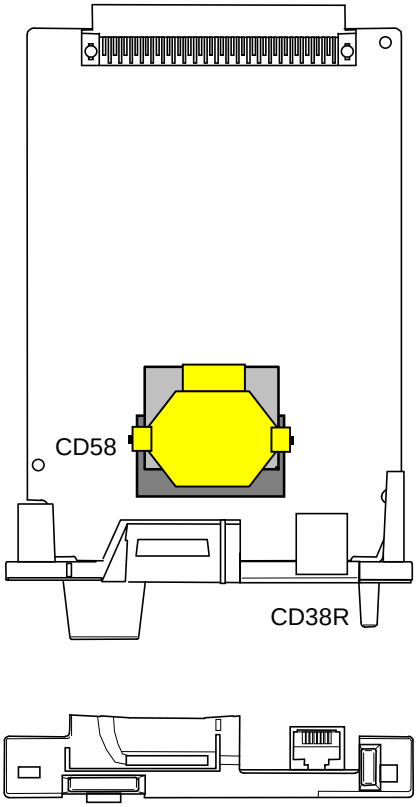
1 HARDWARE MAINTENANCE INFORMATION

This chapter provides hardware maintenance information related to the hardware option of Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A, or Series 0*i*-F.

1.1 COMPONENT LAYOUT

Fast Ethernet board (common to LCD-mounted type/Stand-alone type)



Name	PCB drawing No.	Remarks
Fast Ethernet board	A20B-8101-0770	

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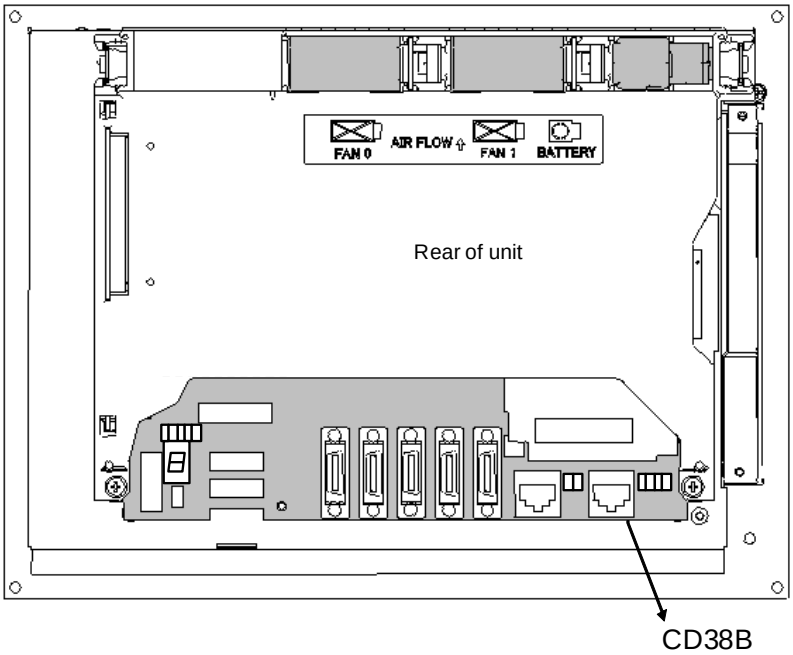
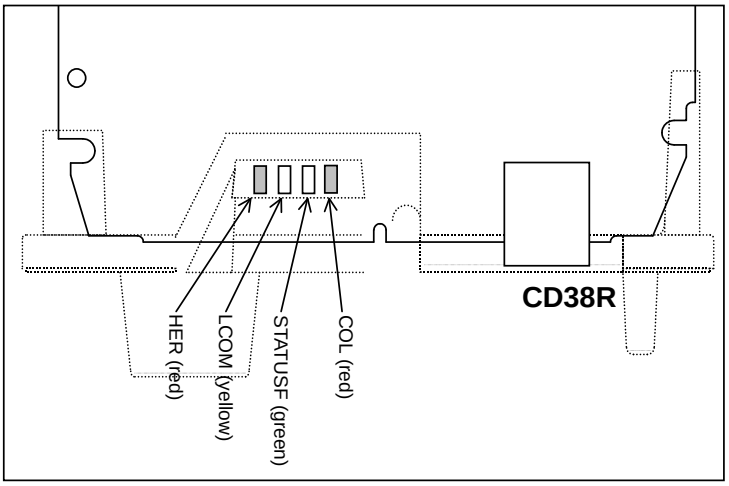
Control unit with Multi-function Ethernet (LCD-mounted type)



1.2 LED INDICATIONS AND MEANINGS

The board provides one green LED (STATUSF) and one yellow LED (LCOM) for status indication, and two red LEDs (HER, COL).
The figure below shows the locations of these LEDs. The table below explains the LED lighting state.

Fast Ethernet board (common to LCD-mounted type/Stand-alone type)



NOTE
The face plate is indicated using dotted lines.

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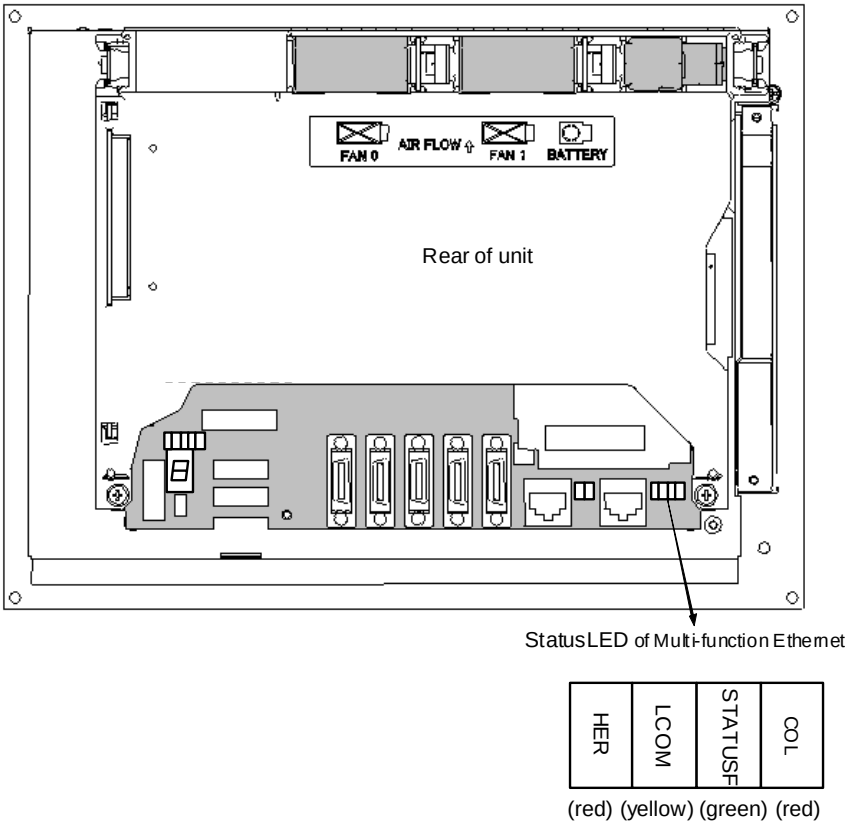
Control unit with Multi-function Ethernet (LCD-mounted type)



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In the following explanations, the LED lighting states are expressed as follows:
□: Off ■: On ☆: Blinking

LED display transition for STATUSF (during power-on)

LED display	Status	Meaning
□	Power-off	
■	Immediately after power-on	Initial state entered immediately after power-on. If the board is stopped in this condition, the cause is one of the following: → The CNC communication software may not be running normally. Check whether the communication software is installed properly. → The hardware option may be faulty. Replace the Fast Ethernet board (main board when Multi-function Ethernet is used).
☆	Start completion	The board has started normally.

LED display for STATUSF (during normal operation)

LED display	Status	Meaning
☆	Normal status	The board is operating normally.

LED display for LCOM

LED display	Status	Meaning
□	Not connected to hub	The board is not connected to the hub properly. The LED stays off also when the power to the hub is off. Check whether the board is connected to the hub properly.
■	Connected to hub	The board is connected to the hub.
☆	Transmission/reception in progress	Data is being transmitted or received.

LED display for COL

LED display	Status	Meaning
□	Normal status	The board is operating normally.
■ ☆	Collision occurs. (Data collision occurs.)	In the half duplex communication mode, this LED is on or blinks at short intervals if traffic of Ethernet communication is high or ambient noise is high. In the full duplex communication mode, the LED does not light.

LED display for HER

LED display	Status	Meaning
□	Normal status	The board is operating normally.
■	Error detected in the Ethernet circuit on the main board or option board.	The cause may be the faulty Fast Ethernet board (main board when Multi-function Ethernet is used) or a malfunction due to noise.
☆	Error detected in the software	

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2 SOFTWARE MAINTENANCE INFORMATION

This chapter provides software maintenance information common to the communication functions.

2.1 CONFIRMATION WITH THE MAINTENANCE SCREEN

This section describes the method of confirmation with the maintenance screen.

Displaying the screen

To display the communication function screen, follow the procedure described in Subsection 2.4.1, "Displaying Screens" in Part II, "COMMON."
This section provides an example of the procedure used when the EtherNet/IP Scanner function operates on a different hardware option from that for the Ethernet function.
Read soft key [EtherNet/IP] in the procedure in this section as another soft key depending on the communication function or operating condition.

Procedure

1 Press the function key

.

2 Soft keys [EtherNet/IP appears. When there is no soft keys, press the continue key.

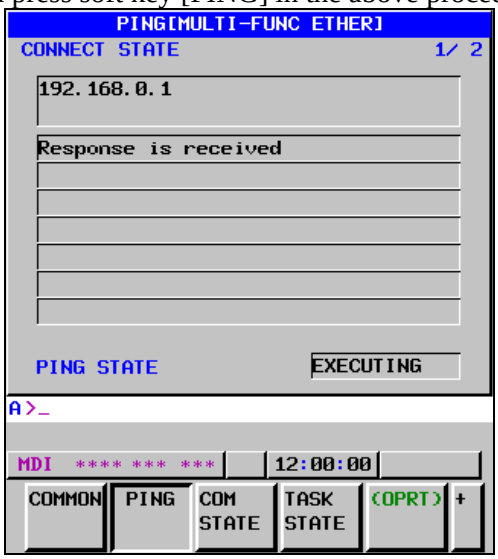
3 Press soft key [EtherNet/IP] to display the soft keys [PING], [COM STATE], and [TASK STATE]. When there is no soft keys, press the continue key.
See the following subsections depending on the maintenance information you want to confirm.

2.1.1 Ethernet Connection Confirmation

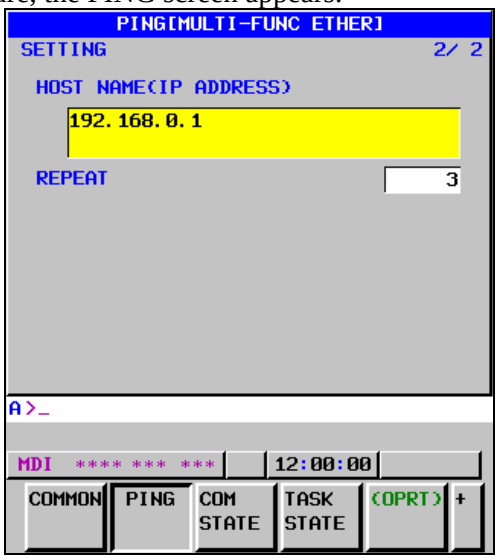
By transmitting the PING command, the CNC can check that a connection is made with the communication destination.

PING screen (connection state confirmation, setting)

When you press soft key [PING] in the above procedure, the PING screen appears.



PING (CONNECT STATE) screen



PING (SETTING) screen

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Operation

The following is the operation procedure for sending the PING command to a desired destination.

1 On the PING (SETTING) screen, set [HOST NAME (IP ADDRESS)] for the destination address and [REPEAT].

2 After pressing soft key [(OPRT)], press soft key [PING EXEC] to send the PING command to the set destination.

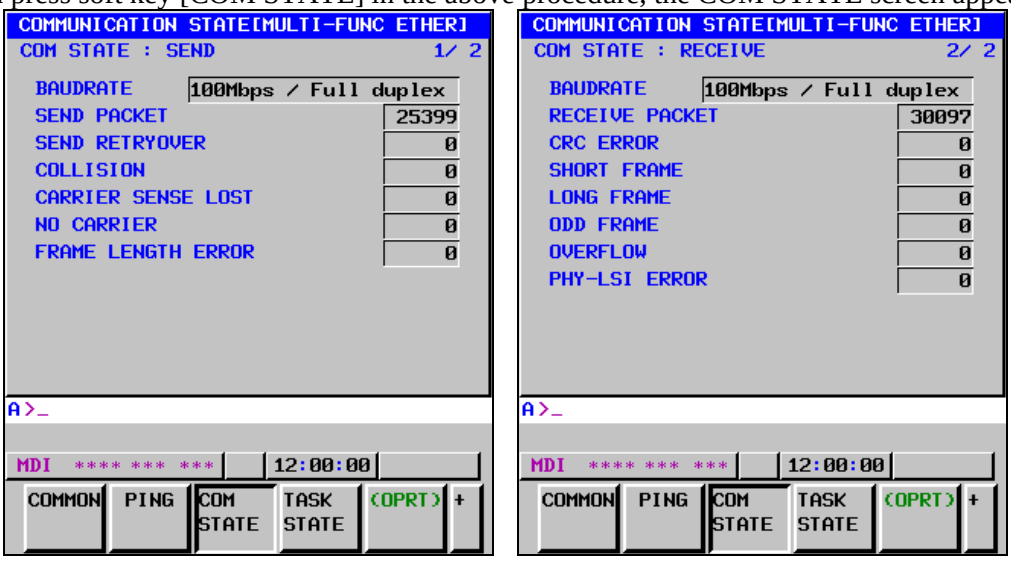
3 To cancel the transmission of the PING command halfway, press soft key [PING CANCEL].

2.1.2 Communication State Confirmation

The communication state of the hardware option detected by hardware can be checked.

COM STATE (SEND / RECEIVE) screen

When you press soft key [COM STATE] in the above procedure, the COM STATE screen appears.



COM STATE screen

Display item

Display item	Description
BAUDRATE	Displays the communication rate and mode. Communication rate: 100 Mbps or 10 Mbps Communication mode: Full duplex or Half duplex -------- : Not connected to HUB
SEND PACKET	Displays the number of sent packets.
SEND RETRYOVER COLLISION CARRIER SENSE LOST NO CARRIER FRAME LENGTH ERROR	Displays the number of errors detected during packet sending.
RECEIVE PACKET	Displays the number of received packets.
CRC ERROR SHORT FRAME LONG FRAME ODD FRAME OVERFLOW PHY-LSI ERROR	Displays the number of errors detected during packet reception.

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Operation

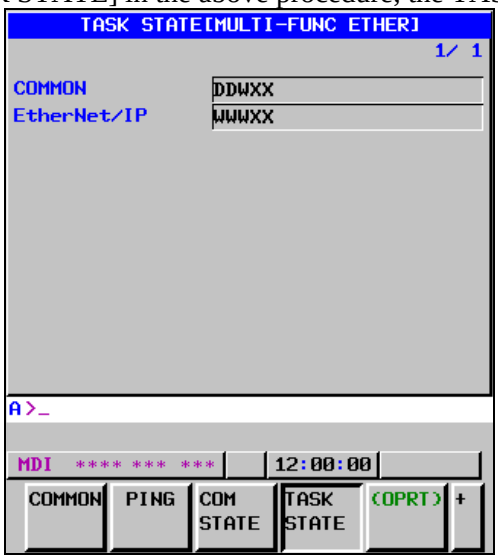
To clear the number of sent packets, number of received packets, and number of errors of each type, press soft key [(OPRT)], then soft key [CLEAR].

2.1.3 Communication Software Confirmation

The operation status of software running on the hardware option can be checked.

TASK STATE screen

When you press soft key [TASK STATE] in the above procedure, the TASK STATE screen appears.



TASK STATE screen

Display item

The meaning of each symbol is indicated below.

Display item	Symbol and meaning	Function that can be checked
COMMON	W: Data being processed (1) D: Data being processed (2) E: Start of software X: Not executed yet	Operation status of the basic function
Modbus SERVER	C: Waiting for connection from the host W: Data being processed (1) D: Data being processed (2) N: Modbus/TCP Server function incapable of being executed E: Start of software X: Not executed yet Number : Number of sockets currently connected	Operation status of the Modbus/TCP Server functions
EtherNet/IP	W: Data being processed (1) D: Data being processed (2) N: EtherNet/IP function incapable of being executed E: Start of software X: Not executed yet	Operation status of the EtherNet/IP functions

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Display item	Symbol and meaning	Function that can be checked
PN CONTROLLER	W: Data being processed (1) D: Data being processed (2) N: PROFINET IO Controller function incapable of being executed E: Start of software X: Not executed yet	Operation status of the PROFINET IO Controller functions
PN DEVICE	W: Data being processed (1) D: Data being processed (2) N: PROFINET IO Device function incapable of being executed E: Start of software X: Not executed yet	Operation status of the PROFINET IO Device functions

NOTE
When the Modbus/TCP Server function operates, the display items related to the Ethernet function are also indicated.

2.2 ALARM AND DIAGNOSIS DATA

When you set a combination of a hardware option and a communication function, the following alarms may be displayed.
In this case, please confirm the diagnosis data and take the countermeasure.

Number	Message	Description
PW0050 (NOTE)	POWER MUST BE OFF (INITIALIZED COMMUNICATION)	When the power was turned on, the hardware option was initialized. Turn the power off, then on again to enable the communication function.
SR2038	WRONG COMMUNICATION COMBINATION	The combination of the hardware option and communication function is invalid. Details of an illegal combination are notified to diagnosis data Nos.4400 and 4401.

NOTE
Alarm PW0050 may be issued when a Fast Ethernet board is added or replaced or when the power is turned on after a communication function software option is changed.

		#7	#6	#5	#4	#3	#2	#1	#0
Diagnosis	4400			BD4	BD3	BD2	BD1		MFE

When an alarm SR2038 occurs, the detail information of wrong hardware option is indicated.

#0 MFE Multi-function Ethernet
#2 BD1 Fast Ethernet board mounted in slot1
#3 BD2 Fast Ethernet board mounted in slot2
#4 BD3 Fast Ethernet board mounted in slot3
#5 BD4 Fast Ethernet board mounted in slot4

NOTE
When an alarm SR2038 does not occur, all bits are "0".

Diagnosis	4401	Detailed number of alarm SR2038

When an alarm SR2038 occurs, the information is indicated.

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Number	Description
0	The combination of the hardware option and communication function is correct.
1	The number of mounted the hardware option exceeds limitation. The number of the hardware options that can be mounted is up to three.
2	The hardware option that diagnosis data No.4400 indicates doesn't exist. Confirm the hardware option specified for parameter Nos.970 to 976.
3	In the hardware option that diagnosis data No.4400 indicates, the working communication function is not specified. Parameter Nos.970 to 976 are wrong though the hardware option exists. Specify "-1" for parameter Nos.970 to 976 When not using it.
4	In the hardware option that diagnosis data No. 4400 indicates, two or more of Data Server functions, FL-net functions, EtherNet/IP functions, and PROFINET functions are specified simultaneously. The Data Server functions, FL-net functions, EtherNet/IP functions, and PROFINET functions are mutually exclusive. Specify parameters Nos. 970 to 976 so that these communication functions operate in different hardware options.
5	In the hardware option that diagnosis data No.4400 indicates, a software option of necessary communication function is not effective. For parameter No. 970, the hardware option specified for parameter Nos. 971, 972, or 973 is specified. Alternatively, a hardware option is specified for parameter No. 970 and parameter No. 975 is set to ”10”, ”20”, or ”30”.
6	In the hardware option that diagnosis data No.4400 indicates, a software option of necessary communication function is not effective.
7	In the hardware option that diagnosis data No.4400 indicates, the necessary software is not installed. Install the Fast Ethernet function software or PROFINET function software mentioned below. Fast Ethernet function software) • For the Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A : 658K series • Series 0*i*-F : 658B series PROFINET function software) • Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A : 658R series • Series 0*i*-F : 658U series

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APPENDIX

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A TROUBLESHOOTING

This appendix describes troubleshooting related to hardware option communication.

A.1 CHECKING COMMUNICATION WITH A HUB

(1) Make sure that the STP cable between the hub and the hardware option is connected.
(2) Make sure that cables are properly wired.
- Though communication is carried out when the cable pair at the send and receive sides is not properly mounted, communications errors may occur more frequently.

(3) Make sure that a hub for 100BASE-TX is used.
- Use a hub for 100BASE-TX because high-speed IO communication cannot be performed with a hub for 10BASE-T.

(4) Make sure that the LCOM LED on the hardware option is lit at all times.
- The LCOM LED will not light if the hardware option is not connected to the hub or if the hub is not ON.

(5) Make sure that the LED (LINK indicator LED) on the connected hub is lit at all times.
- Some hubs do not have a LINK indicator LED.
- The LINK indicator LED will not light if the hub is not connected to the hardware option or the CNC is not ON.

(6) Make sure that a hub for full duplex communication only is not used.
- The hardware option automatically detects the communication speed and communication mode (full duplex or half duplex) by using the auto negotiation function. In communication with a hub that does not have the auto negotiation function, the hardware option recognizes the communication speed correctly but regards the communication mode as half duplex communication.
  As a result, when an attempt is made to communicate with a hub for full duplex communication only that does not have the auto negotiation function, there is a discrepancy in communication mode, so correct communication cannot sometimes be performed.

- For details on how to connect, see Part IV "CONNECTION."

A.2 CHECKING SETTINGS

The following describes how to check the minimum settings needed for communications.

NOTE
For details on IP addresses, subnet mask and other set values, consult with the network administrator.

- Checking settings on the CNC device
  (1) Make sure that the MAC address of the hardware option is displayed.
  - This address is appended to each board before shipment from the factory, and is automatically displayed in the Setting screen. This address need not be set by the user.

  (2) Make sure that the IP address is set.
  (3) Make sure that the subnet mask is set.
  (4) When a router is used, make sure that the router IP address is set.

- Checking settings on the communication destination device
  (1) Make sure that the IP address is set.

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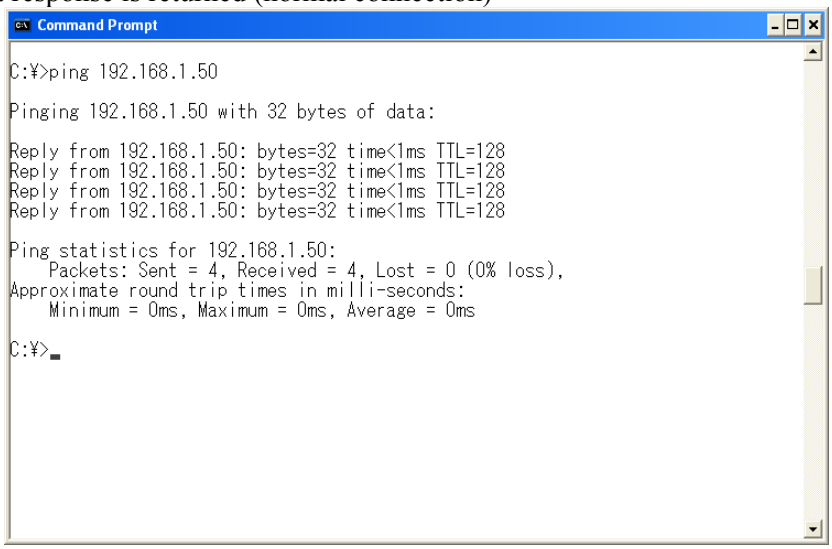
(2) Make sure that the subnet mask is set.
(3) When a router is used, make sure that the router IP address is set.

- For details on how to set, see the chapters in Part III, "FUNCTION."

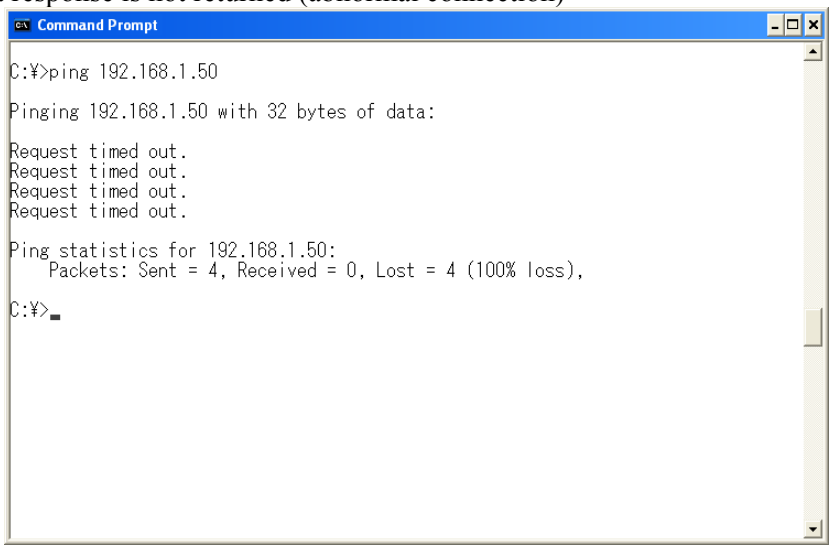
A.3 CHECKING COMMUNICATION

This section describes how to check the communication status between the CNC device and the communication destination device. If communication with the CNC device sometimes fails or is not possible, first replace the communication destination device with a personal computer and make sure that the communication path is normal. The "ping" command is used to check communication.
In the following example, the communication destination device is replaced with a personal computer running Windows XP.

- Checking the communication path
  Open the DOS window, and enter 'ping "IP address of CNC"'. If a response is returned from the CNC device, the hardware option is connected to the CNC device.
  (1) When a response is returned (normal connection)



  (2) When a response is not returned (abnormal connection)



  When a response is not returned, probable causes are either the hardware connection or a software setting, or both. Check the hardware connections and software settings again.

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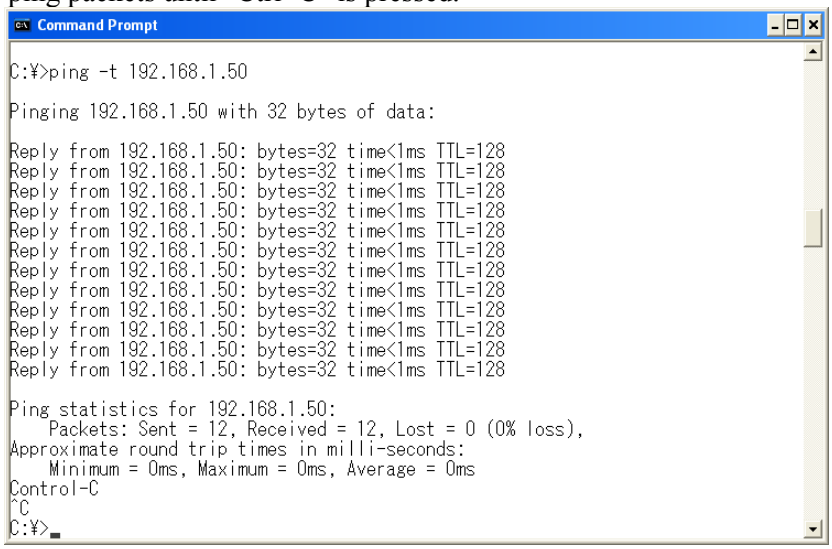
- Checking IP addresses for duplication
  IP addresses can be checked for duplication by the procedure described below.
  (1) Disconnect the Ethernet cable from the CNC device to isolate it from the network.
  (2) Execute a ping command on another personal computer as described in "• Checking the communication path."
  Since the CNC device is disconnected from the network, no response should be returned. If a response is returned, the IP address is in use on another unit. Therefore, the IP address cannot be used on the CNC device from which the cable was disconnected.

> ⚠ **CAUTION**
> The purpose of this check is to check for a duplicate IP address. It does not assure that the IP address is left non-duplicated because a unit having the same IP address may be turned on after the check or the same address may be set later.
> When setting an IP addressing, ask the network manager about duplication.

- Checking for influence of electrical noise
  The "ping" command "-t" option is used for checking for the influence of electrical noise. This option sends ping packets until "Ctrl+C" is pressed.



1. <u>About the influence of electrical noise from peripheral machinery (devices)</u>
   (1) Turn the CNC device is mounted ON to enable communications.
   (2) Press the EMERGENCY STOP button on the machine with the servo/spindle amplifier OFF, and issue the "ping" command from the personal computer.
   (3) Count the number of lost packets (packets for which a response was not returned).
   If a lost packet occurs in this state, the machine is probably being affected by electrical influence from peripheral machines.
   Countermeasure:
   Pin-point the source of the electrical noise, and check the wiring again to prevent the influence of electrical noise.

2. <u>About the influence of electrical noise from mounted machinery</u>
   (1) Start up the machine in the same way as 1 above.
   (2) Cancel the emergency stop on the machine with the servo/spindle amplifier ON, and issue the "ping" command from the personal computer.
   (3) Count the number of lost packets.

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If more lost packets than in 1 above are occurring, a probable cause is the influence of electrical noise on the machine itself. General probable causes are the state of the ground on the machine or on the communicating party.

Countermeasure:

Check the state of the ground on the machine or on the communicating party, and insulate the communications trunk with the machine.

- For the method of checking the operating status and communication status of the hardware option, see Part V “MAINTENANCE” as well.

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B EtherNet/IP ADAPTER SAFETY FUNCTION

NOTE
Before using the EtherNet/IP Adapter Safety function, be sure to read Part II, "COMMON".

B.1 OVERVIEW

This section describes an overview of the EtherNet/IP Adapter Safety function.

B.1.1 Introduction

The EtherNet/IP Adapter Safety function makes it possible for the EtherNet/IP Adapter function to handle safety signals. The communication standard is based on CIP-Safety managed by the ODVA (Open DeviceNet Vendor Association). This function enables the CNC to exchange safety signals with an EtherNet/IP Scanner device that supports CIP-Safety.

The EtherNet/IP Adapter Safety function is an additional function of the dual check safety (DCS) function. It operates on two CPUs as well as the dual check safety function. Please refer to "Dual Check Safety CONNECTION MANUAL (B-64483EN-2)" for details of the dual check safety function.

The sending device transmits cross-checked safety signals with inspection data added to them. The receiving device ensures the safety of communication by confirming the inspection data and cross-checking the received safety signals.

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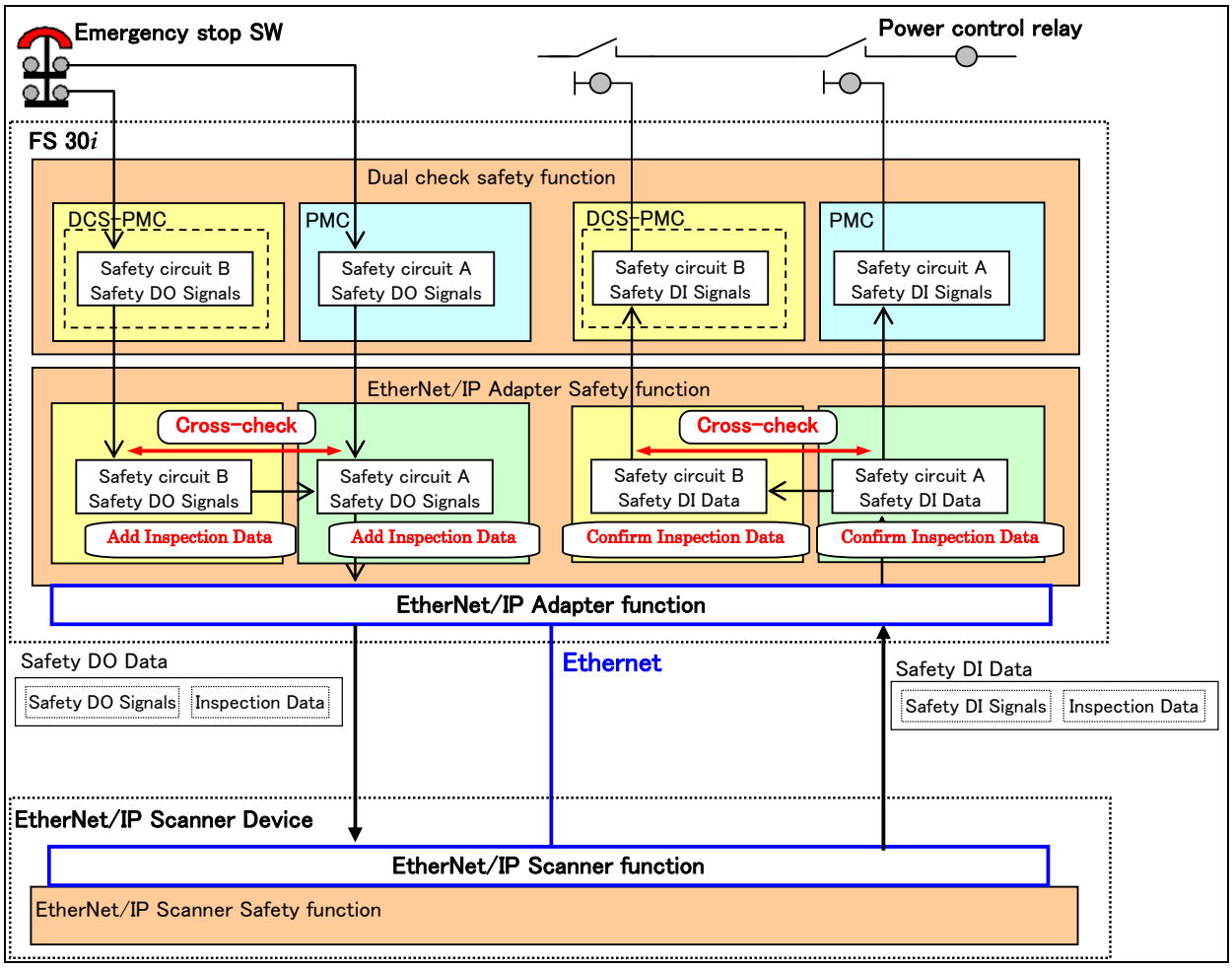

B.1.2 Terminology

Safety Signal

A safety signal is an I/O signal that is exchanged with another device to guarantee safety.

Run_Idle flag

The Run_Idle flag represents the state of the sending device. This flag is sent to the receiving device together with the safety signal. The value 1 (Run) means that the sending device is operating normally. The value 0 (Idle) means that it is not operating normally.

SNCT

SNCT stands for Safety Network Configuration Tool. It is a PC tool used to configure the safety-related settings for the scanner and adapter.
With the EtherNet/IP Adapter Safety function, the tool is used to set a TUNID for the CNC.

SNN

SNN stands for Safety Network Number. It is used to uniquely identify a safety network in the safety system.
A different value is used for each safety network. An SNN is part of a TUNID. When a TUNID is set for the CNC, an SNN is set as well.

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NOTE
Assign a different SNN to a different safety network. The user must ensure that an SNN uniquely identifies a safety network in the safety system.
If the same SNN is assigned to a different safety network, there is a possibility that safety networks cannot be distinguished when the device for another safety network is used by mistake.

TUNID

TUNID stands for Target Unique Node Identifier. It is a number used to uniquely identify an adapter in the safety system.
A TUNID consists of the SNN of the safety network to which an adapter belongs and the IP address of that adapter. An SNCT is used to set a TUNID for an adapter.
An adapter compares the TUNID stored in it and the TUNID included in the safety connection request from the scanner. If they are different, the adapter rejects the request. This prevents the adapter from being used in the wrong network or with the wrong IP address.

SCID

SCID stands for Safety Configuration Identifier. It is a number used to verify that the safety configuration of an adapter has not been changed.
An SCID consists of a CRC value for adapter safety configuration and the date when the CRC value was created.
An adapter compares the SCID stored in it and the SCID included in the safety connection request from the scanner. If they are different, the adapter rejects the request. This guarantees that the safety configuration of the adapter has not been changed.

NOTE
You can also choose not to use the SCID. If you choose not to use it, you must guarantee that the configurations related to the adapter safety are not changed.

B.1.3 Safety State

The safety state is a state in which safety communication cannot be done because of an error detected in a test.
In the EtherNet/IP Adapter Safety function, two CPUs (ETH-CPU as Path A and CNC-CPU as Path B) execute tests independently. If an error is detected in either of the paths, the safety state occurs.

Causes of the safety state

There are two kinds of cause of the safety state.

(i) An error is detected in a test for securing safety.
The following tests are executed for securing safety.
- Safety software code test
- CPU test
- RAM area test
- Safety parameter test
- Safety DI/DO data error detection
- Safety DI/DO signal cross-check
- Watchdog test in which two paths (Path A and Path B) check each other's behavior

(ii) A communication error is detected that is considered to be attributable to a cause other than the CNC.
One of the following phenomena is detected.
- A timeout occurs at the beginning of safety communication.
- A timeout occurs when safety data is received.
- The value of the Run_Idle flag sent from the scanner is Idle.

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Safety signal in the safety state

For either cause, the behavior of the safety signal in the safety state is as follows.

1) The DCS-PMC and PMC areas to which the safety DI signal is allocated are cleared to 0. Any safety DI signal received in the safety state is discarded, keeping these areas cleared to 0.
2) The value 0 is sent for the safety DO signal, and Idle is sent as the value of the Run_Idle flag. The values of the DCS-PMC and PMC areas to which the safety DO signal is allocated are not sent.

CNC status in the safety state

When the cause is (i), the CNC status is as follows.

1) The PW alarm is generated. (Alarm PW0510, "Eth/IP Adapter Safety error (ETH)", for Path A and alarm PW0509, "Eth/IP Adapter Safety error (CNC)", for Path B)
2) The MCC off signal (*DCALM) is set to "0". (*DCALM: <F0748.7> (PMC) for Path A and <F000.7> (DCS PMC) for Path B)
   If a value is set in the MCC off timer (parameter No. 1948), the MCC off signal (*DCALM) is set to "0" after the time set for the timer elapses after the PW alarm is generated.

When the cause is (ii), the CNC status can be selected from the following two choices.

a) The CNC status is the same as when the cause is (i).
b) The PW alarm is not generated, and the MCC off signal (*DCALM) is not set to "0".

To specify which status to apply, use bit 1 (NST) of parameter No. 13952 or 13992.
If b) is selected, please prepare the always ON signal in the safety DI signal. By confirming the value of this signal, the ladder program of DCS can detect the communication error caused by power supply down of the scanner, etc. Ensure that, if a communication error is detected, the ladder program of the DCS generates an alarm and turns off the MCC as necessary.

B.1.4 Safety Precautions

SCID in the CNC

In the CNC, the safety configuration is set from the CNC screen using parameters. The value of the SCID can be selected from the following two choices.

1) The value of the SCID is always set to 0. (The SCID is not used.)
2) The value of the SCID is created using the safety parameters of the CNC. (The SCID is used.)

When creating the value of the SCID using the safety parameters of the CNC, follow the procedure described below.

1. In the CNC, set the safety parameters related to the EtherNet/IP Adapter Safety function.
2. To put the changed values into effect, turn the power off and then back on.
3. When the power is turned on, the CNC compares the stored CRC value and the CRC value created from the current parameter values. If the values are different, the CRC value created from the current parameters is saved as the new CRC value. The update date is also saved.
4. The CRC and date values of the SCID are displayed on the CNC screen. Read the values on the screen, and set them in the SNCT screen.
5. Instruct the safety scanner to use the SCID value. The scanner passes the SCID value to the CNC when it makes a safety connection request. The CNC compares the stored value and the passed value. If the values are the same, the CNC accepts the request. Otherwise, the request is rejected.

The safety parameters used to create the SCID value are the following parameters, which are listed in Subsection B.3.2, "Safety Parameter"

Nos. 13952 to 13957, 13992 to 13994

Precautions

For safe use, observe the following precautions.

- When replacing the safety device, check that the new device is configured correctly and that it operates normally.

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- Before connecting the safety device to the safety network, reset (clear) the existing settings of the device.
- If the SCID is not used, the user has the responsibility to verify that the settings of both the safety scanner and the adapter are correct.
- Assign a different SNN value to a different safety network. The user must ensure that the SNN uniquely identifies a safety network in the safety system.
- Note that the scanner having the automatic SNN setting feature may be used only when the safety system is not used as a means to ensure safety.
- When the setting of the scanner for safety communication is completed using the SNCT, check that the scanner notifies the adapter about the setting and that the adaptor operates normally.
- Manage the IP addresses of all safety devices connected to the safety network. Before connecting a safety device to the safety network, check that there is no IP address overlap.

B.2 SPECIFICATIONS

This section describes the specifications of the EtherNet/IP Adapter Safety function.

B.2.1 List of Specifications

Specifications for the CNC

Item	Description
Required software options	- EtherNet/IP Adapter Safety function (R976) - EtherNet/IP Adapter function (R967) - Dual Check Safety function (S661)
Combination with other functions	Functions that can be used simultaneously on the same or another hardware option - Ethernet function (S707) - Modbus/TCP Server function (R968) - EtherNet/IP Scanner function (R966) Functions that can be used simultaneously on another hardware option - DataServer function (S737) - FL-net function (J692) - PROFINET IO Controller function (R971) - PROFINET IO Device function (R972) Function that cannot be used simultaneously - Safety function by FL-net (S851)

NOTE

If the Ethernet function and the EtherNet/IP function are used on the same hardware option, the number of FOCAS2/Ethernet clients that can be connected to a single CNC is limited to 5.

Specifications for the EtherNet/IP Adapter Safety function

Item	Description
Communication type	Class 0 target - Single Cast Consumer / Single Cast Producer - Multi Cast Producer Class 3 server
Safety Open Type	- Type 2a - Type 2b
PMC area that can be allocated	DCS-PMC : R / X / Y PMC : R / X / Y / E
Maximum number of allocation settings	1
Maximum number of connections	1 for DI / 1 for DO

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Item	Description
Maximum allocation setting signal size	Safety DI signals / Safety DO signals = 8 / 8 Bytes (64 / 64 bits)
RPI range	32 ms or more (setting unit: 4 ms)
DHCP	The DHCP client function is disabled.
Bridge to DeviceNet	Not supported

NOTE
As the RPI, specify a value equal to or larger than 32 that can be divided by 4. A value that cannot be divided by 4 cannot be used for communication.

The instance values of the assembly object are as follows

DO assembly (T→O)	
Produce Data (T → O)	**Time Coordination message (O → T)**
301h to 308h / (769 to 776) - To be determined by the safety DO signal size. 300h + Safety DO signals (1 to 8 bytes)	400h (1024) - Fixed value (NULL instance)
DI assembly (O→T)	
Time Coordination message (T → O)	**Consume Data (O → T)**
400h (1024) - Fixed value (NULL instance)	381h to 388h / (897 to 904) - To be determined by the safety DI signal size. 380 h + Safety DI signals (1 to 8 bytes)
Configuration assembly	
400h (1024) - Fixed value (NULL instance) There is no configuration data for the EtherNet/IP Adapter Safety function.	

NOTE
If the safety DI signal is not used, the DI assembly is not used.

Specifications for communication

Item	Description
IP address	Enter a desired IP address from the CNC screen. Use the same screen as that for the EtherNet/IP Adapter function.
Port number	Class 0: 2222 (fixed) Class 3: 44818 (fixed)

B.2.2 Treatment of the Safety Signal

The value of the safety DO signal is passed to the EtherNet/IP safety function from two paths, DCS-PMC and PMC. These values are ANDed bit by bit, and the results are transmitted to the safety scanner.

DCS-PMC value	PMC value	Value transmitted to the safety scanner
0	0	0
0	1	0
1	0	0
1	1	1

As for the safety DI signal, the value received from the safety scanner is set to the DCS-PMC and PMC as is.

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> ⚠ **CAUTION**
> A safety DI/DO signal can be used only as a flag in which each bit has an independent meaning. You cannot use a safety DI/DO signal as byte-type or word-type numeric data in which a combination of multiple bits has a meaning.

B.3 SETTING

This section describes how to set the EtherNet/IP Adapter Safety function.

B.3.1 Setting Procedure

The EtherNet/IP Adapter Safety function operates on the EtherNet/IP Adapter function. The setting procedure is as follows.

1. By using parameters, specify the hardware option on which the EtherNet/IP Adapter function is to operate.
2. In the setting screen of the EtherNet/IP Adapter function, set the IP address and other necessary items.
3. By using parameters, set the EtherNet/IP Adapter Safety function.
4. By using the SNCT, set the safety PLC.

To specify the hardware option on which the EtherNet/IP Adapter function operates, see Section 4.2, "PARAMETERS RELATED TO HARDWARE OPTIONS" in Part II, "COMMON".
For information about how to set the IP address and other items, see Section 2.4, "SCREEN OF COMMUNICATION FUNCTIONS" in Part II, "COMMON", and Subsection 2.3.3, "COMMON Screen" in Part III, "FUNCTION".
For the setting of the safety parameters of the EtherNet/IP Adapter Safety function, see Subsection B.3.2, "Safety Parameter".
For the setting of the safety PLC using the SNCT, see Section B.5, "SAFETY PLC CONFIGURATION USING THE SNCT".
The allocation setting of the EtherNet/IP Adapter function for safety communication is not necessary.

B.3.2 Safety Parameter

To enter a safety parameter, use the parameter screen of the CNC. Note that the safety parameters are protected by the safety parameter password (parameter No. 3225). The values of the safety parameters cannot be changed, except when the same value as the safety parameter password is set for the safety parameter keyword (parameter No. 3226).
For details of the safety parameter password and keyword, parameter data types, and representation of parameters, refer to "Dual Check Safety CONNECTION MANUAL (B-64483EN-2)".
The safety parameters of the EtherNet/IP Adapter Safety function are described below. The factory-set default values are all 0.

> **NOTE**
> The value of a changed safety parameter takes effect when you turn the power off and then back on.
> To prevent an unauthorized person from changing the safety parameters, set a value for the safety parameter password.

	#7	#6	#5	#4	#3	#2	#1	#0
13952		CDT	SCI			HWS	NST	ASE
13992		CDT	SCI			HWS	NST	ASE

[Input type] Parameter input

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[Data type] Bit

#0 ASE EtherNet/IP Adapter Safety function is:
0: Disabled.
1: Enabled.

#1 NST If the safety state occurs because a communication error attributable to the scanner is detected in safety communication:
0: The PW alarm is generated and the MCC signal (*DCALM) is set to "0".
1: The PW alarm is not generated and the MCC signal (*DCALM) is not set to "0".

#2 HWS When the EtherNet/IP Adapter function operates on two hardware options using the EtherNet/IP adapter PORT2 function, the EtherNet/IP Adapter Safety function operates on:
0: The same hardware option as the Ethernet function. (Specified in parameter No. 0975.)
1: A hardware option different from that of the Ethernet function. (Specified in parameter No. 0976.)

#5 SCI SCID is:
0: Not used.
1: Used.

#6 CDT The date of the SCID is:
0: Actual value
1: Fixed value (2009/01/01 06:00:00)
This bit is valid only when bit 5 (SCI) is set to 1.

NOTE
You need to set the same value in parameter Nos. 13952 and 13992. If different values are set when the EtherNet/IP Adapter Safety function is enabled (bit 0 of parameter No. 13952 or bit 0 of parameter No. 13992 is set to 1), an error is detected in the safety parameter test executed at power-on, causing the safety state.

13953 **Safety DI signal address for the EtherNet/IP Adapter Safety function (CNC-CPU)**

[Input type] Parameter input
[Data type] 2-word
Specify the start address of the DCS PMC area to store the safety DI signal received via the EtherNet/IP Adapter Safety function on the CNC-CPU side. Enter the address type and then the address number. The address number is expressed as a six-digit number preceded by a zero-padded prefix.
If the safety DI signal is not used, set 0.

Address type	Value
X address area	1
R address area	2

The setting examples of the parameter are shown below.

Set address	Address type	Address number	Value set in the parameter
Not used	----	----	0
X0040	1	40	1000040
R0200	2	200	2000200

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NOTE
1 If you specify an address for which an area to store the safety DI signal cannot be allocated, an error is detected in the safety parameter test executed at power-on, causing the safety state.
2 To use the X address area, you also need to set parameter Nos. 11937 to 11939. For details, see Section 4.3, "PARAMETERS RELATED TO PMC" in Part II, "COMMON".

13954 **Safety DO signal address for the EtherNet/IP Adapter Safety function (CNC-CPU)**

[Input type] Parameter input
[Data type] 2-word

Specify the start address of the DCS PMC area to store the safety DO signal sent via the EtherNet/IP Adapter Safety function on the CNC-CPU side. Enter the address type and then the address number. The address number is expressed as a six-digit number preceded by a zero-padded prefix.

Address type	Value
Y address area	1
R address area	2

The setting examples of the parameter are shown below.

Set address	Address type	Address number	Value set in the parameter
Y0040	1	40	1000040
R0208	2	208	2000208

NOTE
1 If you specify an address for which an area to store the safety DO signal cannot be allocated, an error is detected in the safety parameter test executed at power-on, causing the safety state.
2 The value 0 cannot be set.
3 To use the Y address area, you also need to set parameter Nos. 11937 to 11939. For details, see Section 4.3, "PARAMETERS RELATED TO PMC" in Part II, "COMMON".

13955 **Safety DI signal size for the EtherNet/IP Adapter Safety function (CNC-CPU / ETH-CPU)**

[Input type] Parameter input
[Data type] Byte
[Unit of data] Byte (8 bit)
[Valid data range] 0, 1 to 8

Specify the safety DI signal size in the range of 1 to 8 bytes.
When the safety DI signal is not used, set 0.
This parameter is common to the CNC-CPU side and ETH-CPU side.

NOTE
If an out-of-range value is specified, an error is detected in the safety parameter test executed at power-on, causing the safety state.

13956 **Safety DO signal size for the EtherNet/IP Adapter Safety function (CNC-CPU / ETH-CPU)**

[Input type] Parameter input
[Data type] Byte

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[Unit of data] Byte (8 bit)
[Valid data range] 1 to 8
Specify the safety DO signal size in the range of 1 to 8 bytes.
This parameter is common to the CNC-CPU side and ETH-CPU side.

NOTE
1 If an out-of-range value is specified, an error is detected in the safety parameter test executed at power-on, causing the safety state.
2 The value 0 cannot be set.

13957 **Safety communication start timer after power-on for the EtherNet/IP Adapter Safety function**

[Input type] Parameter input
[Data type] Word
[Unit of data] Second
[Valid data range] 0, 1 to 255
[Unit of data] The safety state occurs if safety communication is not established with the other-end device within the time specified in this parameter after the power is turned on.
When the timer is not used, set 0. In that case, the CNC continues to wait until it receives a safety communication connection request from the scanner.

NOTE
If an out-of-range value is specified, an error is detected in the safety parameter test executed at power-on, causing the safety state.

13993 **Safety DI signal address for the EtherNet/IP Adapter Safety function (ETH-CPU)**

[Input type] Parameter input
[Data type] 2-word
Specify the start address of the PMC area to store the safety DI signal received via the EtherNet/IP Adapter Safety function on the ETH-CPU side. Enter the PMC path number, the address type, and then the address number. The PMC path number is expressed as a one-digit number, the address type is expressed as a two-digit number, and the address number is expressed as a six-digit number.
When the safety DI signal is not used, set 0.

PMC path number	Value
First PMC	1
Second PMC	2
Third PMC	3
Fourth PMC	4
Fifth PMC	5

Address type	Value
X address area	1
R address area	2
E address area	4

The setting examples of the parameter are shown below.

Set address	PMC path number	Address type	Address number	Value set in the parameter
Not used	----	----	----	0
X0040 of the first PMC	1	1	40	101000040

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Set address	PMC path number	Address type	Address number	Value set in the parameter
R0200 of the third PMC	3	2	200	302000200
E1000 of the fifth PMC	5	4	1000	504001000

NOTE
1 If you specify an address for which an area to store the safety DI signal cannot be allocated, an error is detected in the safety parameter test executed at power-on, causing the safety state.
2 To use the X address area, you also need to set parameter Nos. 11937 to 11939. For details, see Section 4.3, "PARAMETERS RELATED TO PMC" in Part II, "COMMON".

13994 **Safety DO signal address for the EtherNet/IP Adapter Safety function (ETH-CPU)**

[Input type] Parameter input
[Data type] 2-word

Specify the start address of the PMC area to store the safety DO signal sent via the EtherNet/IP Adapter Safety function on the ETH-CPU side. Enter the PMC path number, the address type, and then the address number. The PMC path number is expressed as a one-digit number, the address type is expressed as a two-digit number, and the address number is expressed as a six-digit number.

PMC path number	Value
First PMC	1
Second PMC	2
Third PMC	3
Fourth PMC	4
Fifth PMC	5

Address type	Value
Y address area	1
R address area	2
E address area	4

The setting examples of the parameter are shown below.

Set address	PMC path number	Address type	Address number	Value set in the parameter
Y0040 of the first PMC	1	1	40	101000040
R0208 of the third PMC	3	2	208	302000208
E1008 of the fifth PMC	5	4	1008	504001008

NOTE
1 If you specify an address for which an area to store the safety DO signal cannot be allocated, an error is detected in the safety parameter test executed at power-on, causing the safety state.
2 The value 0 cannot be set.
3 To use the Y address area, you also need to set parameter Nos. 11937 to 11939. For details, see Section 4.3, "PARAMETERS RELATED TO PMC" in Part II, "COMMON".

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> ⚠ **WARNING**
> Before allocating the PMC area, be sure to read Section 3.1, "DI/DO DATA AND STATUS DATA" in Part II, "COMMON".

B.3.3 Backing up and Restoring Settings

This section describes how to back up the settings of the EtherNet/IP Adapter Safety function and how to restore the backed up settings.

The following parameters can be backed up and restored by inputting and outputting the parameters on the parameter screen.

- Parameters for specifying the hardware option where the EtherNet/IP Adapter function operates (Nos.0970, 0975, and 0976)
- Safety parameters for setting the EtherNet/IP Adapter Safety function (Nos. 13952 to 13957, and 13992 to 13994)
- Parameters to be set when using the X/Y area of the PMC (Nos. 11937 to 11939)

To restore the safety parameters (Nos. 13952 to 13957 and Nos. 13992 to 13994), the same value as the safety parameter password (parameter No. 3225) needs to be set for the safety parameter keyword (parameter No. 3226). For details, refer to the "Dual Check Safety CONNECTION MANUAL".

The IP addresses and other items that are set in the setting screen of the EtherNet/IP Adapter function can be backed up and restored using the same screen.

The TUNIDs that are set using the SNCT cannot be backed up and restored. First, restore the other parameters, and then set TUNIDs again using the SNCT.

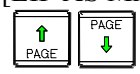
B.4 MAINTENANCE

This section describes the maintenance screen of EtherNet/IP Adapter Safety function.
The configuration of the maintenance screen is as follows.

Screen name	Page number	Description
ADAPTER INFO screen	1/4	Information, such as the MS and NS LEDs, vendor ID, and device type, is displayed.
SAFETY INFO screen	2/4	The device status and error information of the power-on test and self-test are displayed.
SAFETY DI CONNECTION screen	3/4	The status of the safety DI connection is displayed.
SAFETY DO CONNECTION screen	4/4	The status of the safety DO connection is displayed.

B.4.1 ADAPTER INFO Screen

Procedure

1 Press function key .
2 Soft key [DUAL CHECK] appears. When the soft key does not appear, press the continue key.
3 Press Soft key [EIP AS MAINTE]. When the soft key does not appear, press the continue key.
4 Use page keys  to display a desired page.

ADAPTER INFO screen

The ADAPTER INFO screen is displayed on page 1. Information about the EtherNet/IP Adapter Safety function is displayed in this screen.

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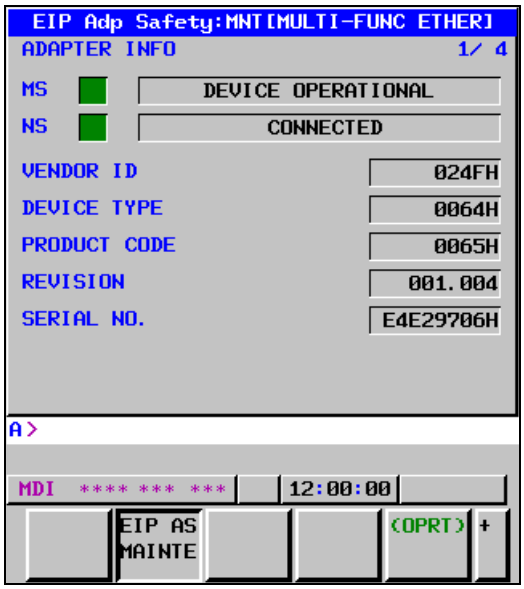

EtherNet/IP Adapter Safety Maintenance screen (ADAPTER INFO)

Display items

Display item	Description
MS	The indication of the Module Status LED and its meaning are displayed. (See the following table.)
NS	The indication of the Network Status LED and its meaning are displayed. (See the following table.)
VENDOR ID	The vendor ID of the adapter is displayed in hexadecimal.
DEVICE TYPE	The device type of the adapter is displayed in hexadecimal.
PRODUCT CODE	The product code of the adapter is displayed in hexadecimal.
REVISION	The revision of the adapter is displayed. The format is "major revision.minor revision".
SERIAL NO.	The serial number of the adapter is displayed in hexadecimal.

The indications of the MS LED and their meanings are as follows.

Indication of the MS LED	Display string	Meaning
Off (black)	DISABLE FUNCTION	The EtherNet/IP function has not been started.
Blinking (green)	STANDBY	Neither safety DI communication nor safety DO communication is connected.
On (green)	DEVICE OPERATIONAL	Safety DI communication or safety DO communication has started.
Blinking (red)	RECOVERABLE FAULT	A recoverable error has occurred.
On (red)	UNRECOVERABLE FAULT	An unrecoverable error has occurred.
Blinking (red/green)	• WAITING FOR TUNID • SELF TEST	• Waiting for the TUNID to be set by the SNCT. • A self-test is in progress.

The indications of the NS LED and their meanings are as follows.

Indication of the NS LED	Display string	Meaning
Off (MS is off)	---	---
Off (black)	NO IP ADDRESS	An IP address is not set.
Blinking (green)	NO CONNECTIONS	EtherNet/IP communication is not in progress.
On (green)	CONNECTED	EtherNet/IP communication is in progress.
Blinking (red)	CONNECTION TIMEOUT	EtherNet/IP communication has timed out.
On (red)	DUPLICATE IP ADDRESS	There is a duplicate IP address.
Blinking rapidly (red/green)	TUNID RECEIVED	A TUNID setting request from the SNCT is being processed.

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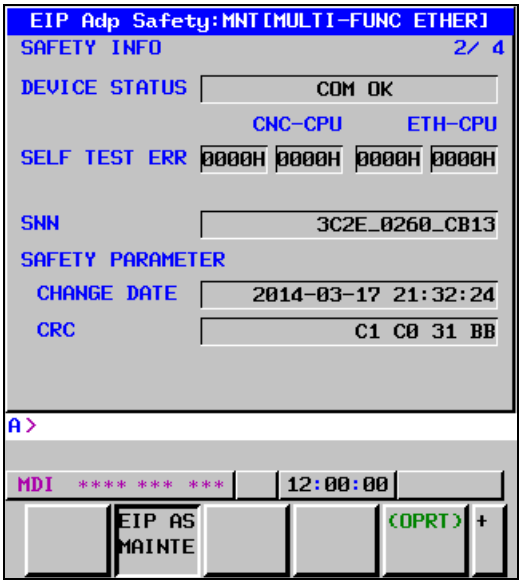
> ⚠ **CAUTION**
> LEDs are not reliable indicators and not guaranteed to provide accurate information. They should be used only for general diagnostic purposes during verification or troubleshooting. Do not use LEDs as operational indicators.

B.4.2 SAFETY INFO Screen

The SAFETY INFO screen is displayed on page 2. The device status, the contents of the self-test error, and SNN are displayed.
When the SCID is used, the CRC and the change date of the safety parameter are displayed.



EtherNet/IP Adapter Safety Maintenance screen (SAFETY INFO)

Display items

Display item	Description
DEVICE STATUS	The status of the safety device is displayed as a character string. One of the following is displayed.

Display string	Meaning
SELF TEST	Processing the self-test during power-on.
STANDBY	Waiting for a safety communication start request from the scanner.
SELF TEST ERROR	An error has been detected in the self-test during power-on.
COM OK (Communication OK)	Executing safety communication with the scanner.
RECOVERABLE FAULT	A recoverable error has been detected.
UNRECOVERABLE FAULT	An unrecoverable error has been detected.
WAITING FOR TUNID	No TUNID is set. Waiting for the TUNID to be set by the SNCT.

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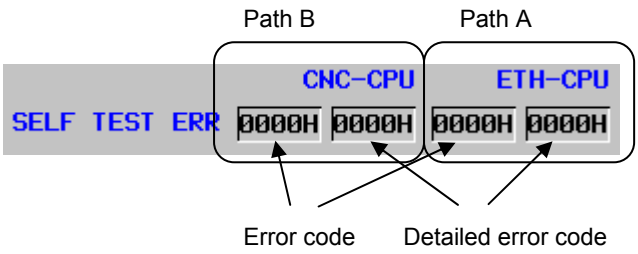
Display item	Description
SELF TEST ERR	If an error is detected in the self-test, the error code and the detailed error code are displayed for both CNC-CPU (Path B) and ETH-CPU (Path A) individually. When there is no error, 0000H is displayed. 
SNN	The SNN set to this CNC is displayed in hexadecimal. When no SNN is set, "FFFF_FFFF_FFFF" is displayed.
SAFETY PARAMETER CHANGE DATE CRC	When the SCID is used, the change date and the CRC value of the safety parameter are displayed. When the SCID is not used, they are not displayed.

The meaning of the error code and the detailed error code displayed in SELF TEST ERR is shown below.

Error code	Meaning	Detailed error code and meaning
000DH	(At power-on) There is no SRAM.	0000H : (None)
000EH	(At power-on) The other path is not operating.	0000H : (None)
000FH	(At power-on) Another safety function is operating.	0001H : Safety function by FL-net
0021H	(At power-on) The CPU test failed.	0000H : (None)
0022H	(At power-on) The RAM area test failed.	0000H to FFFFH : Offset position where the damage to the RAM area is detected
0023H	(At power-on) Invalid safety parameter setting	0001H to 00FFH : The bit of the safety parameter where the error has been detected is turned on. Bit 0 : No.13952, No.13992 Bit 1 : No.13953 Bit 2 : No.13993 Bit 3 : No.13955 Bit 4 : No.13954 Bit 5 : No.13994 Bit 6 : No.13956 Bit 7 : No.13957
0024H	(At power-on) The safety parameter test failed.	0000H to FFFFH : Offset position where the damage to the safety parameter is detected
002AH	(At power-on) An unrecoverable error has occurred.	0001H to FFFFH : Error code of safety stack initialization
0040H	The safety software code test failed.	0000H : (None)
0041H	The CPU test failed.	0000H : (None)
0042H	The RAM area test failed.	0000H to FFFFH : Offset position where the damage to the RAM area is detected
0044H	The safety parameter test failed.	0000H to FFFFH : Offset position where the damage to the safety parameter is detected
0045H	An error has been detected in the safety DI data.	0001H to FFFFH : Error code of the safety DI connection
0046H	The safety DI signal cross-check failed.	0000H to 0007H : Offset position where the safety DI signal inconsistency is detected (unit: byte)
0047H	An error has been detected in the safety DO data.	0001H to FFFFH : Error code of the safety DO connection

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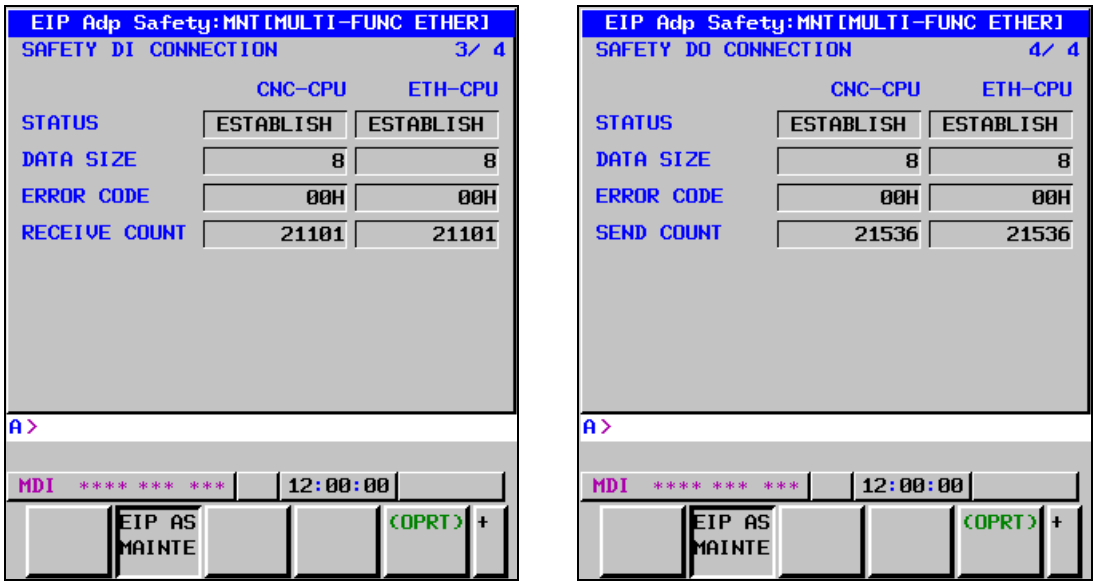
Error code	Meaning	Detailed error code and meaning
0048H	The safety DO signal cross-check failed.	0000H to 0007H : Offset position where the safety DO signal inconsistency is detected (unit: byte)
0049H	A timeout of the watchdog timer of the other path has been detected.	0000H : (None)
004AH	An unrecoverable error has occurred.	0001H to FFFFH : Error code of safety stack cycle processing
004BH	An unrecoverable error has occurred.	0001H to FFFFH : Error file ID
004CH	An unrecoverable error has occurred.	0001H to FFFFH : Device status
004DH	A safety communication start timeout has been detected.	0001H to 00FFH : Value set in parameter No. 13957
004EH	A safety communication receiving timeout has been detected.	0001H : DI 0002H : DO
004FH	The scanner is found to be idle.	0000H : (None)

When the error code is 0045H (An error has been detected in the safety DI data) or 0047H (An error has been detected in the safety DO data), the meanings of the detailed error codes are as follows.

Detailed error code	Meaning
0002H	CRC error: A CRC error has been detected in received data.
0003H	Packet error: An error other than a CRC error has been detected in received data.
0004H	Data error: An inconsistency of the signal between two paths has been detected.
0005H	Stack error: A communication stack internal error has been detected.

B.4.3 SAFETY DI/DO CONNECTION Screen

The Safety DI CONNECTION screen is displayed on page 3, and the Safety DO CONNECTION screen is displayed on page 4.
The status, data size, and related information of both CNC-CPU (Path B) and ETH-CPU (Path A) for the safety DI connection and safety DO connection are displayed.



EtherNet/IP Adapter Safety Maintenance screen (SAFETY DI/DO CONNECTION)

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Display items

Display item	Description
STATUS	The status of the safety DI connection and safety DO connection is displayed as a character string. One of the followings is displayed. UNESTABLISH, INITIALIZE, ESTABLISH, ERROR
DATA SIZE	The data size of the safety DI connection and safety DO connection is displayed.
ERROR CODE	When the STATUS is ERROR in the safety DI connection or safety DO connection, the error code is displayed. 00H : No error 01H : Timeout 02H : CRC error 03H : Packet error 04H : Data error 05H : Communication stack error
RECEIVE COUNT	The number of packets received in the safety DI connection and the number of the packets sent in the safety DO connection are displayed. The display range is 0 to 65535. When the number exceeds 65535, it returns to 0.
SEND COUNT	

B.4.4 Error Output

The EtherNet/IP Adapter Safety function stores error information in non-volatile memory. This error information can be output to a file.
If an error occurs and its cause cannot be found from the error code displayed on the maintenance screen, output the error information to a file and send it to FANUC, as instructed in this subsection.

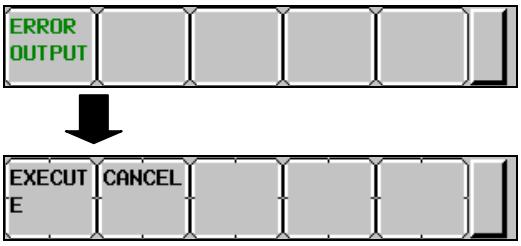
A memory card or USB memory can be used as the input/output device to which to output the error information. Use parameter No. 0020 to select the input/output device. For details of this parameter, see Section 4.1, "PARAMETERS RELATED TO DATA INPUT/OUTPUT" in Part II, "COMMON".

> ⚠ **CAUTION**
> While an external input/output device such as the memory card or USB memory is being accessed, do not turn off the power of the CNC or remove the external input/output device. Doing so may damage the external input/output device.

Procedure

1 Press function key

.
2 Soft key [DUAL CHECK] appears. When the soft key does not appear, press the continue key.
3 Press Soft key [EIP AS MAINTE]. When the soft key does not appear, press the continue key.
4 Press Soft key [(OPRT)]. Soft key [ERROR OUTPUT] appears.
5 Press Soft key [ERROR OUTPUT]. Soft keys [EXECUTE] and [CANCEL] appear.
6 Enter the file name of the error information file in the key-in buffer and press soft key [EXECUTE]. The error information file is output. When no file name is specified, the default file name "EIPASAFE.ERR" is used. "EXECUTING" blinks during execution.



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B.4.5 LOG Screen

The LOG screen shows log data related to the EtherNet/IP Adapter Safety functions.

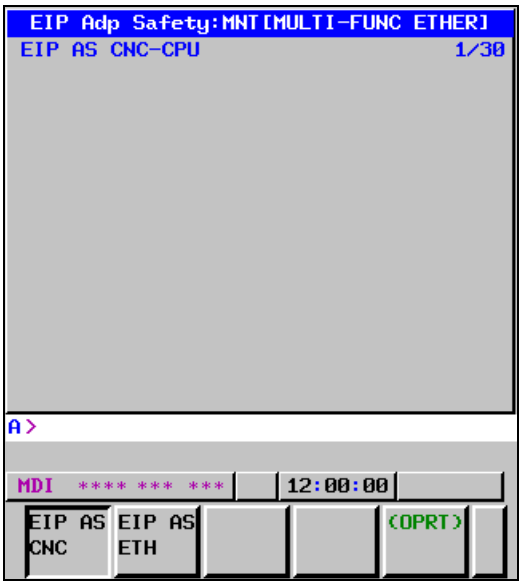
Procedure

1 Press function key ? MESSAGE .

2 Soft key [SAFETY COMM] appears. When the soft key does not appear, press the continue key.

3 Do one of the following:

- Path B: To display the log for the CNC-CPU, press [EIP AS CNC].
- Path A: To display the log for the ETH-CPU, press [EIP AS ETH].



EtherNet/IP Adapter Safety log screen

Operation

To clear the log, press soft key [(OPRT)] and then soft key [CLEAR].

The messages displayed on the log screen and their meanings are as follows.

Error No.	Log message	Meaning and action
E-1521	CPU Test error is detected	A CPU error occurred at power-on.
E-1522	RAM Area Test error is detected	The memory read/write operation failed at power-on.
E-1523	Safety Parameter Test error is detected	The setting of the safety parameter is incorrect. Set the correct value as instructed in Subsection B.3.2, "Safety Parameter". The value in brackets shows the logical sum of the bits corresponding to the incorrect safety parameter. Bit 0 : Nos. 13952, 13992 Bit 1 : No. 13953 Bit 2 : No. 13993 Bit 3 : No. 13955 Bit 4 : No. 13954 Bit 5 : No. 13994 Bit 6 : No. 13956 Bit 7 : No. 13957

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Error No.	Log message	Meaning and action
E-1524	Safety Parameter Test error is detected	Damage to the safety parameter that is used in the safety software was detected at power-on.
E-152A	Critical error is detected	A critical error was detected in the safety software at power-on.
E-1540	Safety Software Code Test error is detected	Damage to the safety software code was detected during operation.
E-1541	CPU Test error is detected	A CPU error was detected during operation.
E-1542	RAM Area Test error is detected	A memory read/write error was detected during operation.
E-1544	Safety Parameter Test error is detected	Damage to the safety parameter that is used in the safety software was detected during operation.
E-1545	Safety DI Data Test error is detected	The received safety DI data is damaged. Check the communication environment for noise.
E-1546	Safety DI Cross-check error is detected	The value of the safety DI signal that is allocated to the PMC area has been different from that allocated to the DCS-PMC area longer than the fixed time.
E-1547	Safety DO Data Test error is detected	An error was detected in the safety DO data.
E-1548	Safety DO Cross-check error is detected	The value of the safety DO signal that is allocated to the PMC area has been different from that allocated to the DCS-PMC area longer than the fixed time.
E-1549	Watch dog error is detected	The other path stopped operating.
E-154A E-154B E-154C	Critical error is detected	A critical error was detected in the safety software during operation.
E-154D	Communication startup timeout error is detected	The safety communication did not start when the time specified in parameter No. 13957 passed.
E-154E	Communication is disconnected	The safety connection has been disconnected. The meaning of the value in brackets is as follows. 1: Safety DI connection 2: Safety DO connection
E-154F	Scanner device changed into idle state	The scanner device is in idle state. Check the status of the scanner.

B.5 SAFETY PLC CONFIGURATION USING THE SNCT

This section describes the setting procedure that uses RsLogix5000, the SNCT from Rockwell Automation Inc., by using Rockwell Automation's Guard Logix PLC as the EtherNet/IP safety scanner and the CNC as the adapter to accomplish communication.

First, read the documentation provided with Rockwell Automation's Guard Logix PLC and follow its instructions. The following procedure should be used for reference when connecting the CNC to a Guard Logix PLC as an EtherNet/IP safety function adapter.

> ⚠ **CAUTION**
> The procedure described in this document focuses on the setting method and does not include any safety precautions. The operator must read manuals provided by Rockwell Automation and examine them carefully. Before using the procedure, take precautions as needed.

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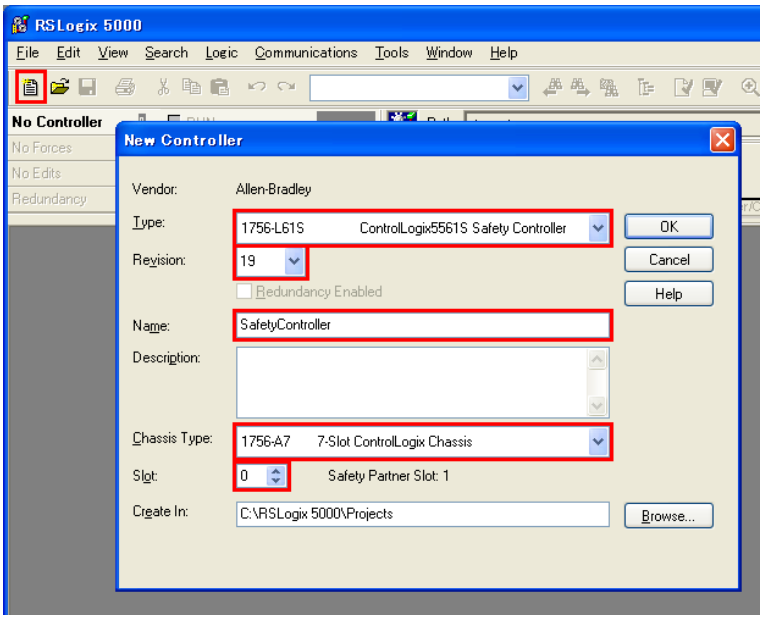
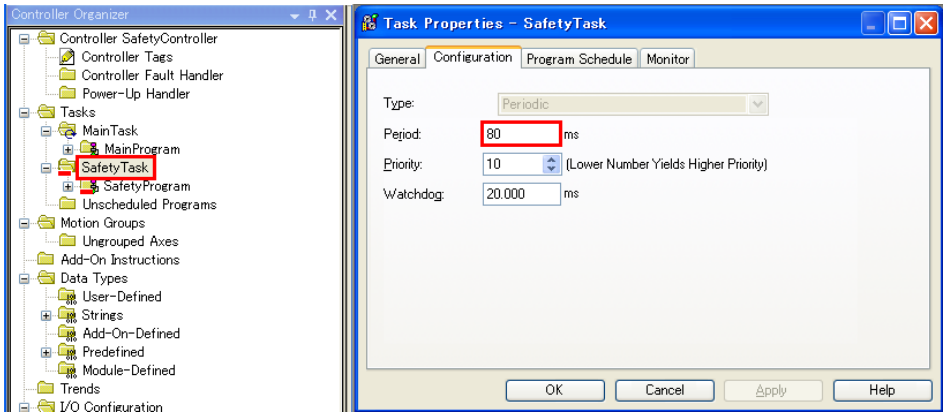
B.5.1 Creating a Project

(1) Start RSLogix5000.
(2) Click the "New" button on the main toolbar to display "New Controller" dialog.
(3) In "Name", enter a desired project name.
In the "Type", "Revision", "Chassis Type", and "Slot" fields, enter appropriate values that are consistent with the safety PLC controller.
Click the "OK" button to create the project.



B.5.2 Setting the Operating Cycle of the Safety Task

(1) Display the properties of "SafetyTask" in "Tasks".
(2) Select the "Configuration" tab, and set the operating cycle of the safety task in "Period". The minimum value is 32. Specify a multiple of 4.



NOTE
If you change this value, the "Safety DO Requested Packet Interval (RPI) (ms)" is also changed accordingly for all the safety I/O modules connected to this safety PLC.

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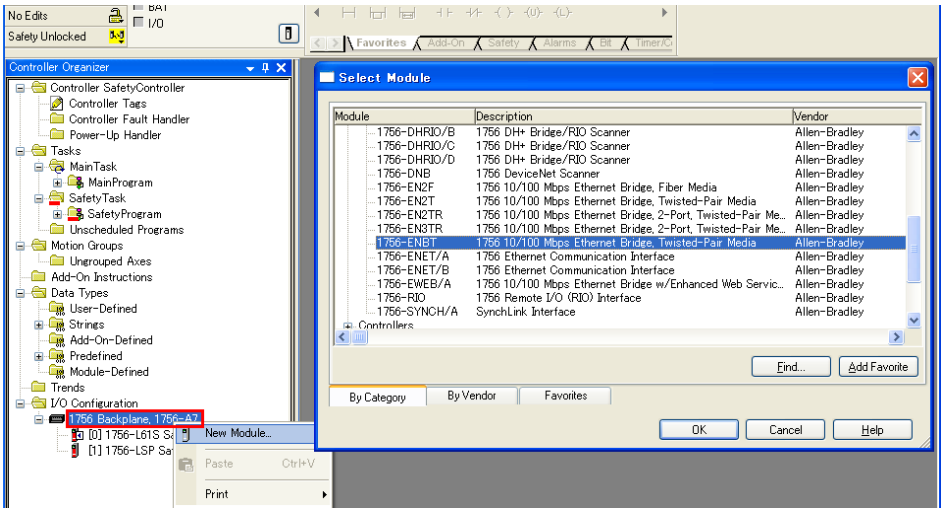
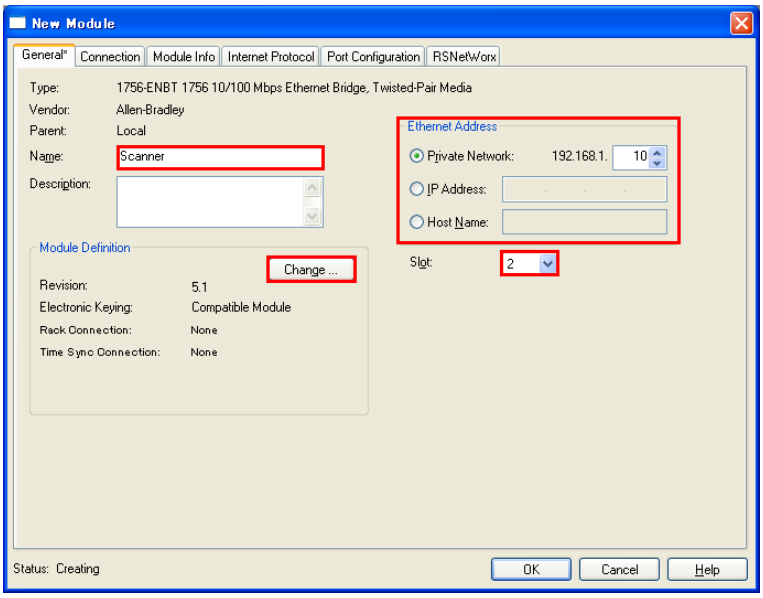
B.5.3 Adding an EtherNet/IP Communication Module

The EtherNet/IP communication module that is installed in the safety PLC is added to the project. This module communicates with CNC.

(1) In the left tree, right-click Backplane. Click "New Module..." to display the "Select Module" dialog.
(2) Select the same module as the EtherNet/IP communication module installed in the safety PLC, and click the "OK" button to display the "New Module" dialog.



(3) In the "Ethernet Address", "Module Definition", and "Slot" fields in the "General" tab, enter appropriate values that are consistent with the EtherNet/IP communication module.
(4) In "Name", enter a desired name. Then, click the "OK" button.



B.5.4 Adding a CNC

A CNC is added as a communication partner of the safety PLC.

(1) In the left tree of the screen, right-click the previously added EtherNet/IP communication module and click "New Module..." to display the "Select Module" dialog.

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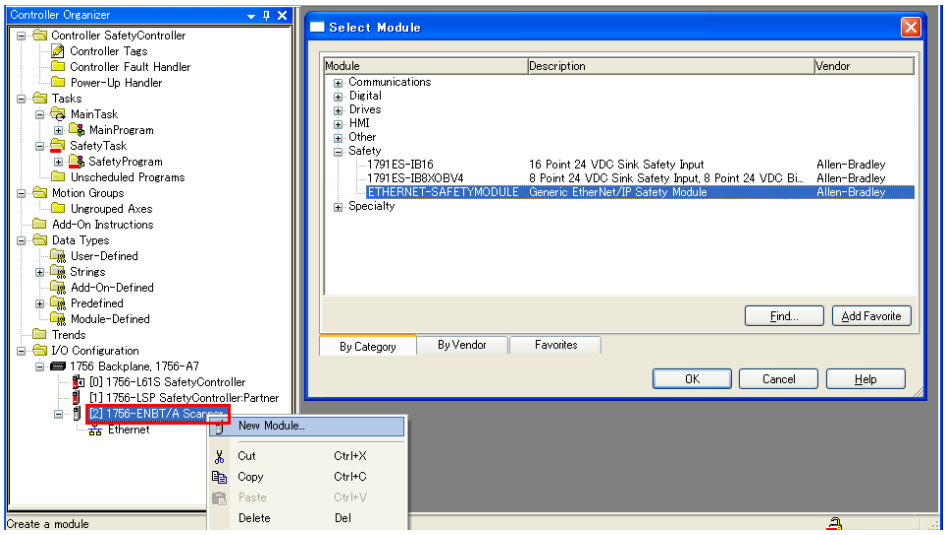
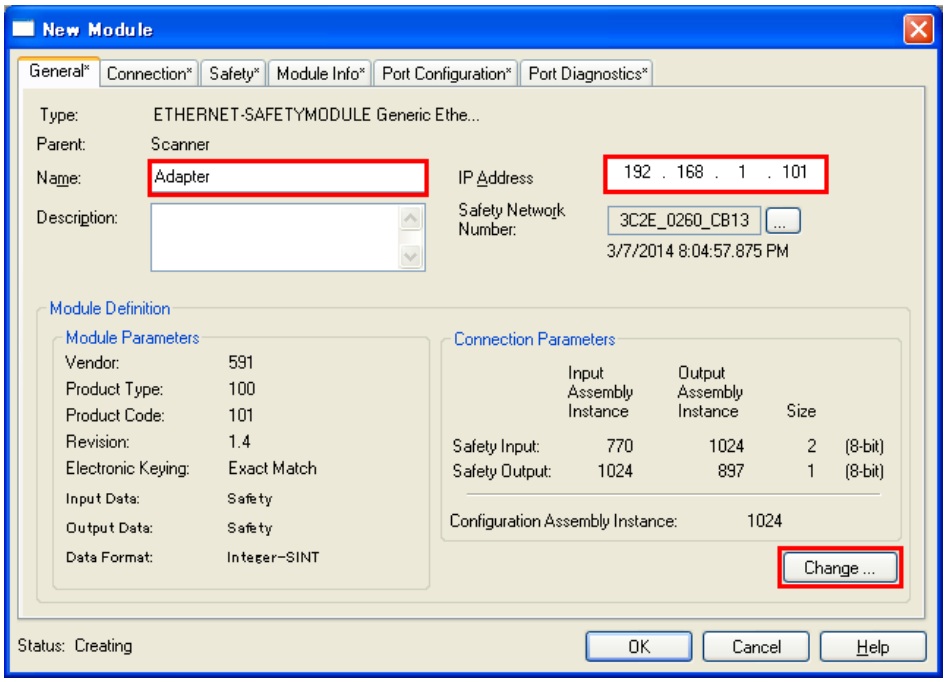
(2) Select "Generic EtherNet/IP Safety Module" under "Safety", and click the "OK" button to display the "New Module" dialog.



(3) Open the "General" tab, and enter a desired name in "Name".
(4) In "IP Address", set the same value as the IP address specified in the COMMON screen of the CNC.
(5) To change the SNN, see Subsection B.5.5, "Changing the SNN". Basically, you do not need to change the SNN.
(6) Click the "Change..." button to display the "Module Definition" dialog. Set values in the "Module" tab and "Connection" tab.



(7) Set the "Module" tab of the "Module Definition" dialog as follows.
The values of the major revision and minor revision differ depending on the software version. Set the value displayed in "Revision" in Subsection B.4.1, "ADAPTER INFO Screen".

Item name	Value
Vendor	591
Product Type	100
Product Code	101

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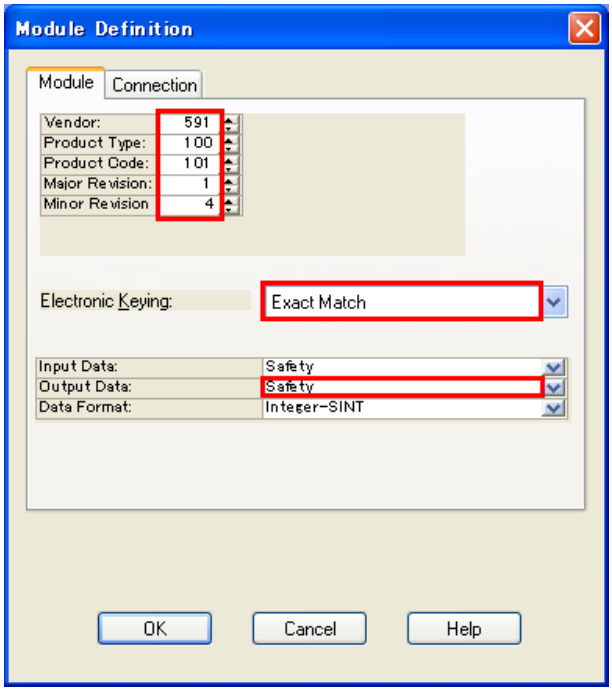
Item name	Value
Major Revision	1
Minor Revision	4
Electronic Keying	“Exact Match” or “Compatible Module”
Input Data	“Safety”
Output Data	"Safety" (When the safety DI signal is not used, set "None".)
Data Format	Integer-SINT (Select SINT, which is set in bytes as with PMC data.)



(8) Set the "Connection" tab of the "Module Definition" dialog as follows.

Item name	Input Assembly Instance	Output Assembly Instance	Size (8-bit)
Safety Input	768 + Safety DO signal size	1024	Safety DO signal size
Safety Output	1024	896 + Safety DI signal size	Safety DI signal size

Item name	Value
Configuration Assembly Instance	1024

The following figure shows an example in which the safety DI signal size is set to 1 byte (parameter No. 13955 = 1) and the safety DO signal size is set to 2 bytes (parameter No. 13956 = 2).

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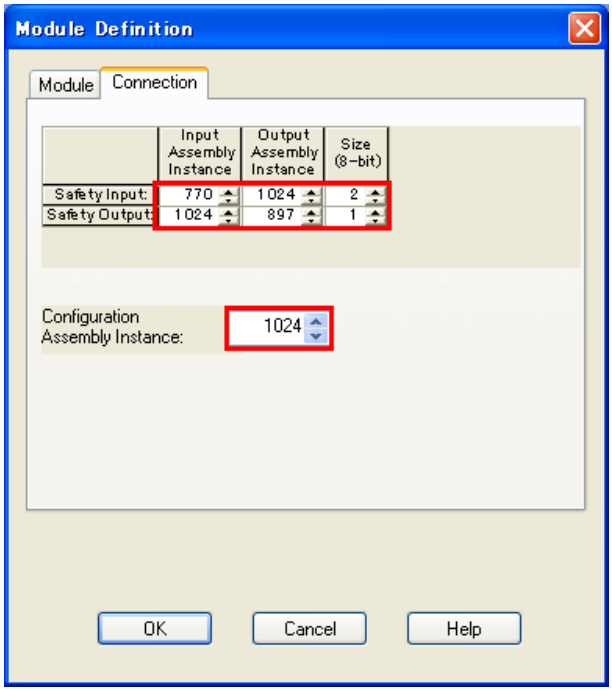


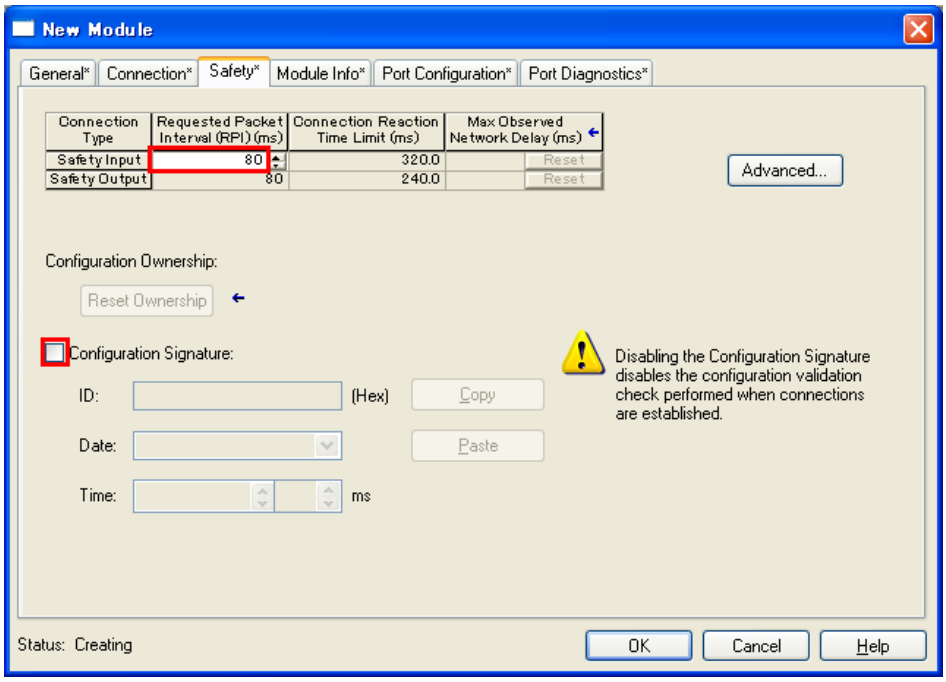
(9) In the "Module Definition" dialog, click the "OK" button to return to the "New Module" dialog.

(10) Open the "Safety" tab.

In "Requested Packet Interval (RPI) (ms)" of Safety Input, set the interval at which the safety DO signal is to be sent from the CNC to the safety PLC. The minimum value is 32. Specify a multiple of 4.

In "Requested Packet Interval (RPI) (ms)" of Safety Output, the value specified in "Period" in Subsection B.5.2, "Setting the Operating Cycle of the Safety Task" is set.

When the SCID is not used, clear the "Configuration Signature" check box. When the SCID is used, see Subsection B.5.6, "Setting the Configuration Signature When Using the SCID".



(11) Click the "OK" button to complete the addition of the CNC.

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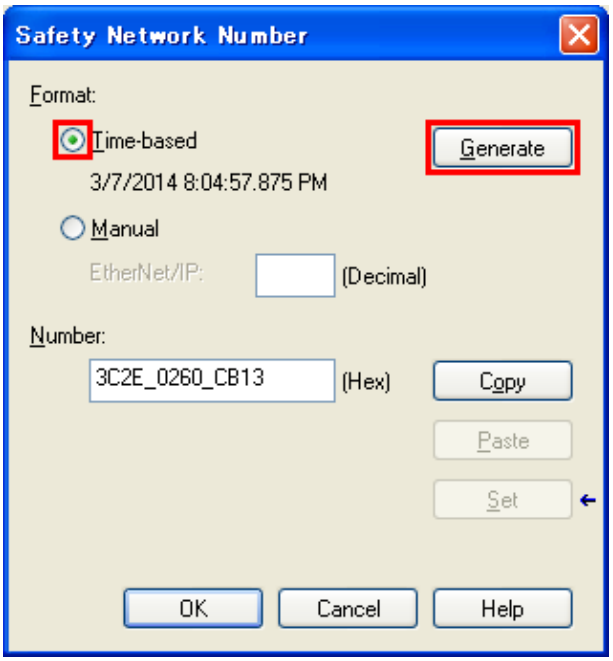
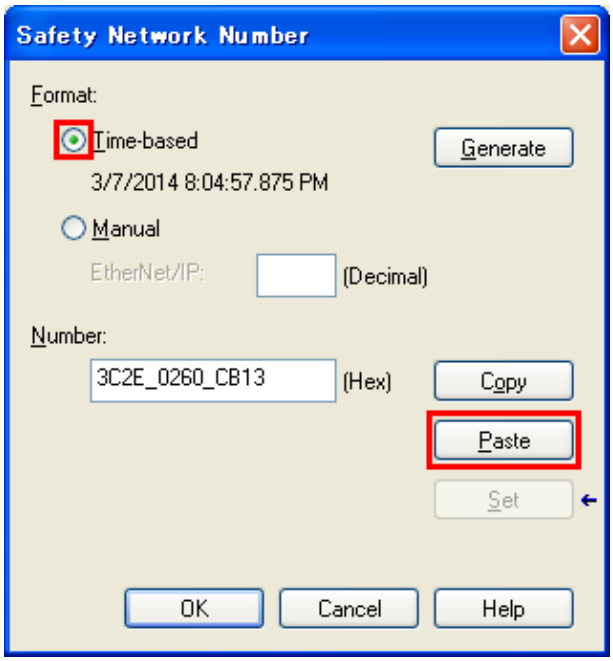
B.5.5 Changing the SNN

This subsection describes how to change the SNN.

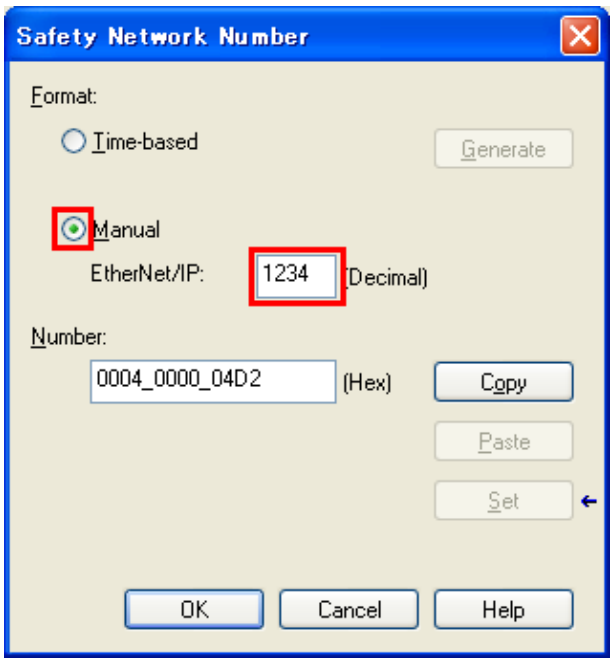
There are two SNN formats: time-based format and manual format.

(a) When the time-based format is selected, select the "Time-based" radio button. Also, the time-based format supports two methods: one is to generate a new SNN from the present time and the other is to paste a copied SNN.
   (i) To generate an SNN, click the "Generate" button.
   (ii) To paste an SNN, copy a desired hexadecimal SNN in advance and click the "Paste" button.





(b) When the manual format is selected, select the "Manual" radio button. Set a desired value in the range of 1 to 9999.



Click the "OK" button to complete the change of the SNN.

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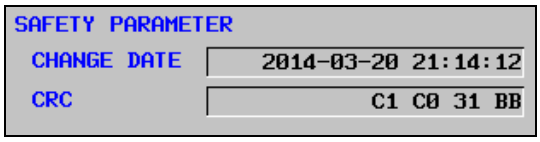
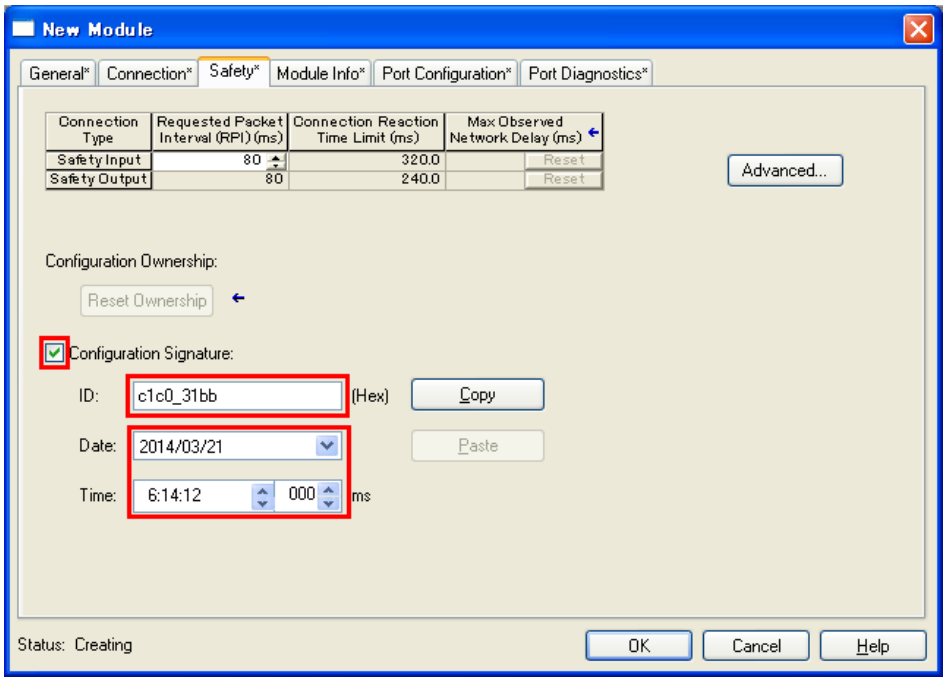
B.5.6 Setting the Configuration Signature When Using the SCID

This subsection describes the items you need to set in addition to the procedure in Subsection B.5.4, "Adding a CNC" when you use the SCID by setting bit 5 (SCI) of safety parameter No. 13952 and 13992 to 1.
Suppose that the change date and CRC of the safety parameter are displayed in Subsection B.4.2, "SAFETY INFO Screen" as follows.



(1) Check the "Configuration Signature" check box in the "Safety" tab.
(2) In "ID", enter the CRC value of the safety parameter.
(3) In "Date" and "Time", enter the date and time when the safety parameter is changed. Enter 0 for ms. Note that you need to modify the time difference due to the time zone. To view the time difference, double-click the taskbar clock and open the Time Zone tab (the operation may differ depending on the OS in use). If the time difference is GMT+09:00, set the time 9 hours ahead of the change date of the CNC. In this example, the change date of the CNC is set to March 20, 2014, 21:14:12. So, set March 21, 2014, 06:14:12, which is 9 hours ahead.



(4) Click the "OK" button.

B.5.7 Downloading the Settings

The procedures described above complete the setup of the safety PLC. Download the settings to the safety PLC.

(1) Set the key switch of the safety PLC controller to PROG.
(2) If you cannot find the path to the safety PLC in the pull-down menu, click the "Who Active" button and add the path. To add a path, you need to set RSLinx in advance so that a path can be added.

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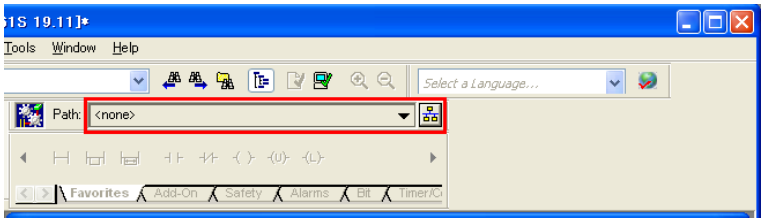
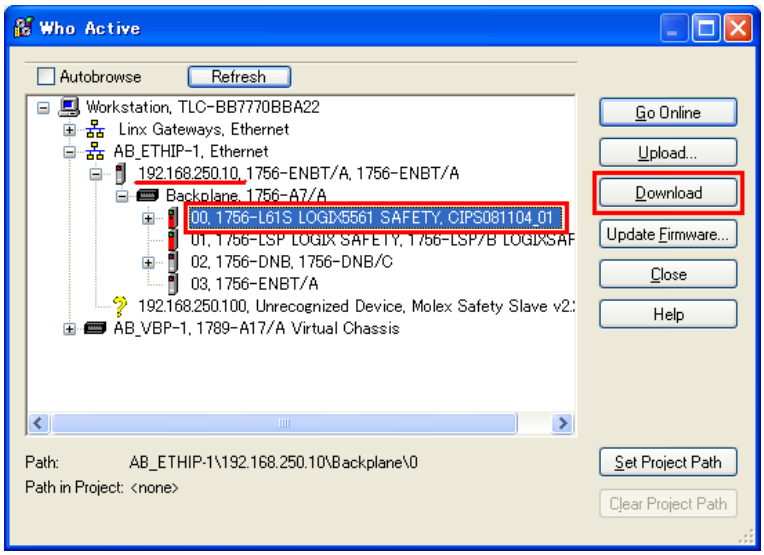
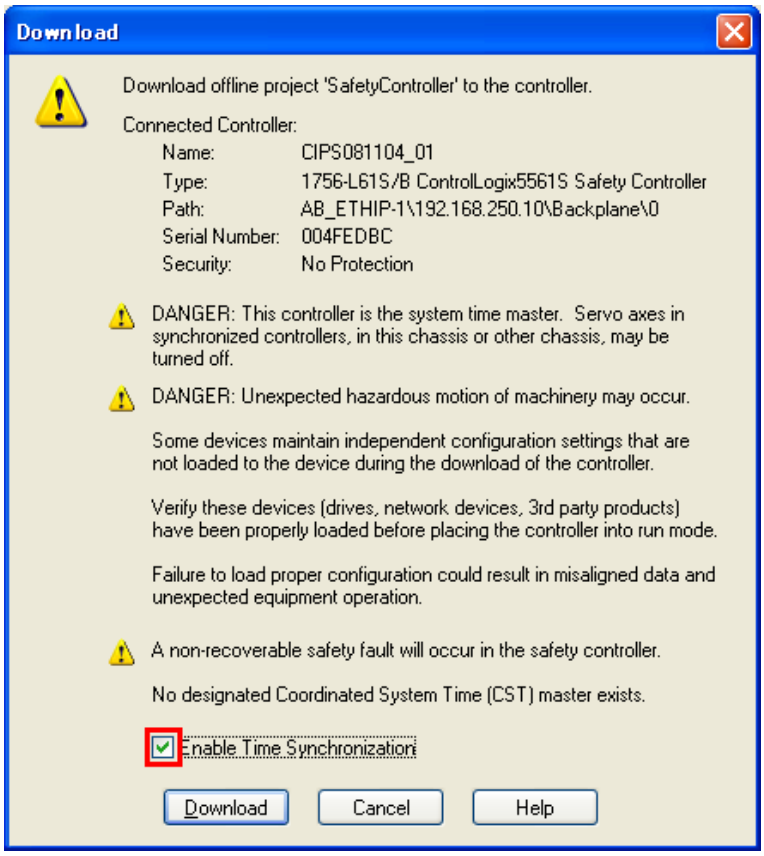


(3) Select the path to the safety controller, and click the "Download" button to download the settings to the safety PLC.



(4) Check the "Enable Time Synchronization" check box, and then click the "Download" button.



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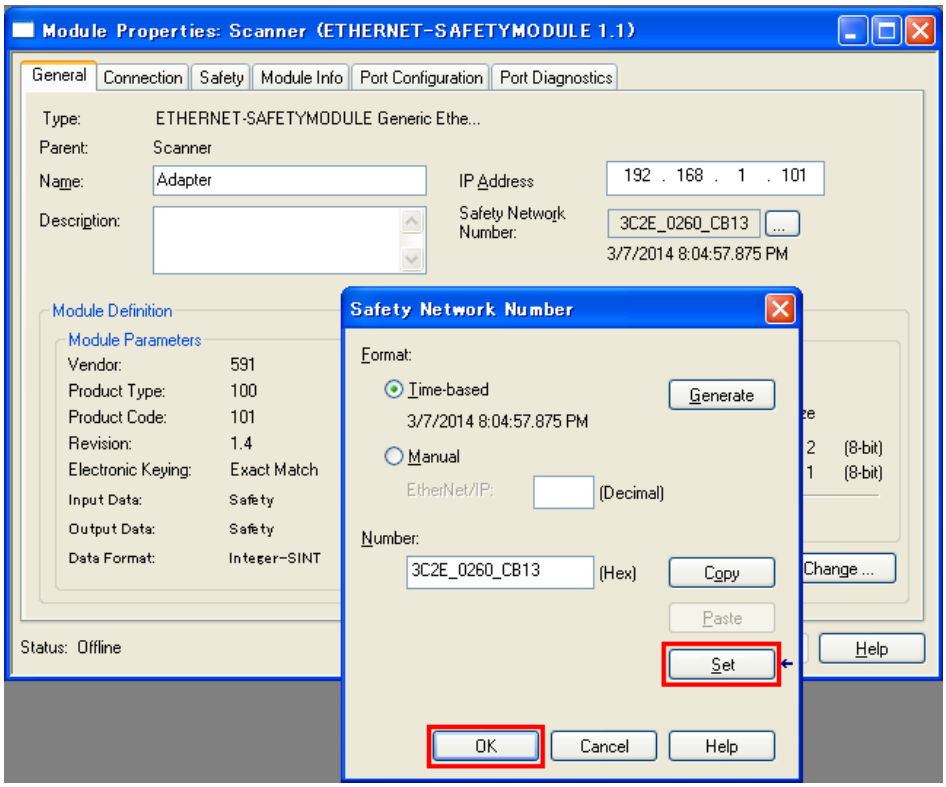
B.5.8 Setting the TUNID

Set the TUNID for the CNC.
When the TUNID is not set, "FFFF_FFFF_FFFF" is displayed as the SNN in Subsection B.4.2, "SAFETY INFO Screen". When the TUNID is set, the valid SNN included in the TUNID is displayed as the SNN.
If a CNC for which the TUNID is already set is used in another network, reset the old TUNID first, as instructed in Subsection B.5.9, "Resetting the TUNID", and then set a new TUNID.

(1) Place RSLogix5000 online.
(2) In the left tree of RSLogix5000, double-click the CNC to display the properties screen.
(3) If you click the "..." button next to "Safety Network Number" in the "General" tab, "Safety Network Number" dialog appears.
(4) If the CNC returns an error response (code 16#080d) when the safety PLC attempts to start safety communication with the CNC, the "Set" button is enabled, in which case click the "Set" button. If the "Set" button is disabled, make sure that the "Inhibit Connection" check box in the "Connection" tab is cleared and see Subsection B.5.10, "Main Error Causes".



(5) When the confirmation dialog appears, read the message in the dialog and click "Yes".
(6) Check that the SNN displayed in Subsection B.4.2, "SAFETY INFO Screen" is the same as "Safety Network Number" in the "General" tab.
(7) Click the "OK" button to close the "Safety Network Number" dialog.
Check that the CNC is communicating with the safety PLC. If safety communication is in progress, "COM OK" is displayed as the device status in Subsection B.4.2, "SAFETY INFO Screen".

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B.5.9 Resetting the TUNID

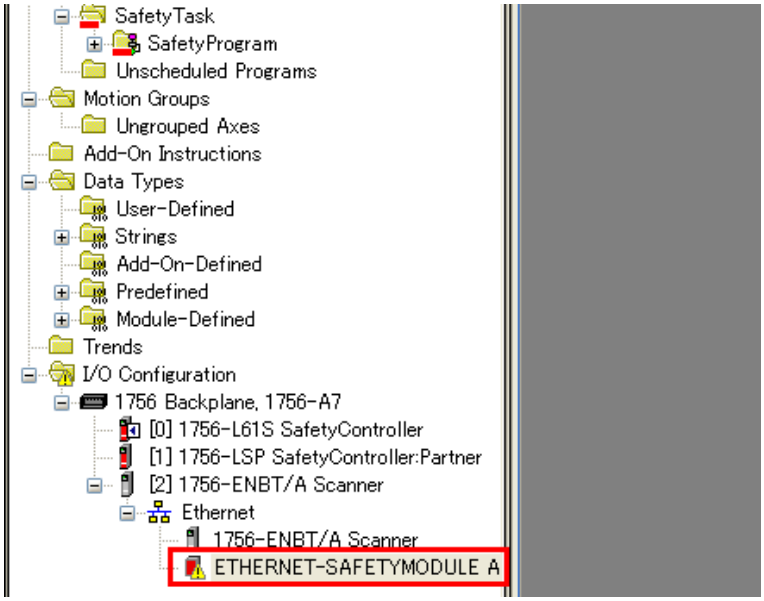
The procedure for resetting the TUNID that is set for the CNC is as follows.

(1) In the left tree of RSLogix5000, double-click the CNC whose TUNID you want to reset and display the properties screen.
(2) When the CNC is engaged in safety communication, the safety communication stops. Check the "Inhibit Connection" check box in the "Connection" tab and click the "Apply" button.
(3) Click the "Reset Ownership" button in the "Safety" tab. Check that the SNN in Subsection B.4.2, "SAFETY INFO Screen" has changed to "FFFF_FFFF_FFFF".
(4) Set a new TUNID as instructed in Subsection B.5.8, "Setting the TUNID".

NOTE
Even if you execute "Reset Ownership" for the CNC, the settings of the safety parameters and IP address are not reset. You need to use the parameter screen to change the safety parameters and the setting screen of the EtherNet/IP Adapter function to change the IP address.

B.5.10 Main Error Causes

If communication fails to be established normally between the safety PLC and CNC when RSLogix5000 is placed online, the ⚠ mark is displayed next to the device causing the error in the tree on the left side of the screen.



You can check the detected error by opening the properties dialog of the device and seeing the Module Fault section in the "Connection" tab.

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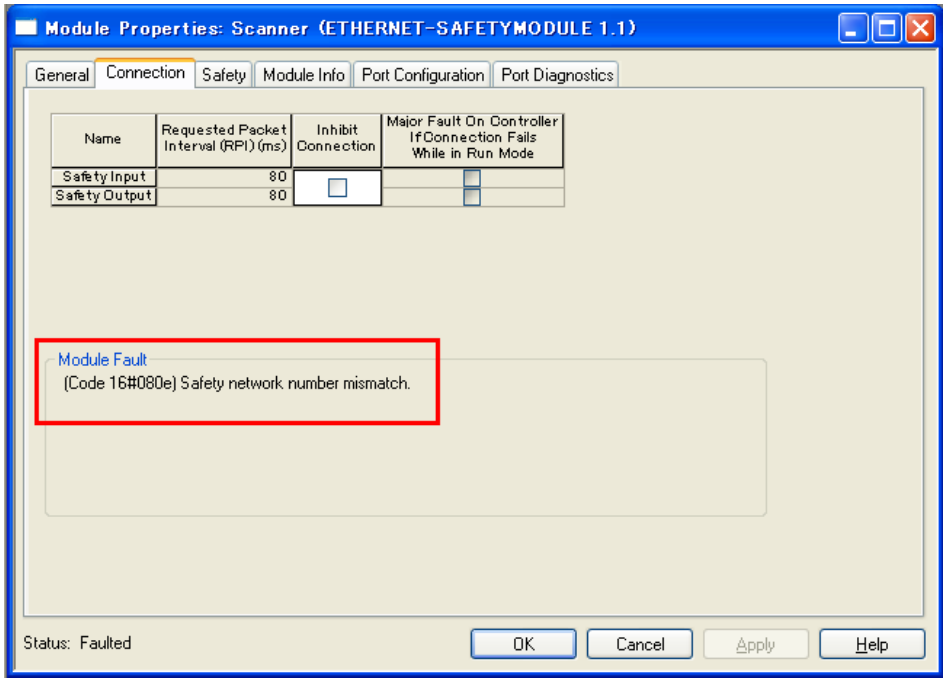

If the error concerns the CNC, solve the problem according to the following table.

Error code	Main error cause and action
(Code 16#0106)	The CNC is already engaged or was engaged in communication with another safety PLC. Perform the reset procedure as instructed in Subsection B.5.9, "Resetting the TUNID".
(Code 16#0109)	The setting of "Size (8bit)" is incorrect. See Subsection B.5.4, "Adding a CNC", and check the set value and the value specified in safety parameter No. 13955 or 13956.
(Code 16#0112)	The setting of "Requested Packet Interval (RPI) (ms)" is incorrect. Check that a value equal to or larger than 32 ms that can be divided by 4 is set in "Requested Packet Interval (RPI) (ms)".
(Code 16#0114)	The setting of "Vendor" or "Product Code" is incorrect. See Subsection B.5.4, "Adding a CNC", and check the set value.
(Code 16#0115)	The setting of "Product Type" is incorrect. See Subsection B.5.4, "Adding a CNC", and check the set value.
(Code 16#0116)	The setting of "Major/Minor Revision" is incorrect. See Subsection B.5.4, "Adding a CNC", and check the set value.
(Code 16#0118)	The setting of "Configuration Assembly Instance" is incorrect. See Subsection B.5.4, "Adding a CNC", and check the set value.
(Code 16#0204)	Communication cannot be established with the EtherNet/IP Adapter Safety function. Check the IP address of the CNC specified in the setting screen of the EtherNet/IP Adapter function and the IP address of the CNC specified by referring to Subsection B.5.4, "Adding a CNC".
(Code 16#0315)	The setting of "Input/Output Assembly Instance" is incorrect. See Subsection B.5.4, "Adding a CNC", and check the set value.
(Code 16#080c)	The setting of "Configuration Signature" is incorrect. See Subsection B.5.6, "Setting the Configuration Signature When Using the SCID", and check the set value.
(Code 16#080d)	No TUNID is set for the CNC. See Subsection B.5.8, "Setting the TUNID", and check the set value.
(Code 16#080e)	Another TUNID is already set for the CNC. See Subsection B.5.9, "Resetting the TUNID", and check the set value.

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ADDITIONAL INFORMATION

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FANUC Series 30*i*/31*i*/32*i*/35*i*–MODEL B,
FANUC Power Motion *i*–MODEL A, FANUC Series 0*i*-MODEL F
Industrial Ethernet CONNECTION MANUAL

1. Type of applied technical documents

Name	FANUC Series 30*i*–MODEL B FANUC Series 31*i*–MODEL B FANUC Series 32*i*–MODEL B FANUC Series 35*i*–MODEL B FANUC Power Motion *i*–MODEL A FANUC Series 0*i*–MODEL F Industrial Ethernet CONNECTION MANUAL
Spec.No./Version	B-64013EN/03

2. Summary of change

Group	Name / Outline	New, Add, Correct, Delete	Applicable Date
Basic Function			
Optional Function	The PROFINET IO Device Safety function is added.	Add	Immediately
Unit			
Maintenance parts			
Notice			
Correction			
Another			

Edit	Date	Design	Description
Date	2015.10.19	Design A.Hiramatsu	Apprv.

Title	FANUC Series 30*i*/31*i*/32*i*/35*i*-MODEL B, Power Motion *i*-MODEL A, FANUC Series 0*i*-MODEL F Industrial Ethernet CONNECTION MANUAL
Draw No.	B-64013EN/03-1
FANUC CORPORATION	Sheet 1/36

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The relation between this manual and Industrial Ethernet CONNECTION MANUAL (B-64013EN/03)

This manual	Industrial Ethernet CONNECTION MANUAL (B-64013EN/03)
Subsection 4.1.2, "Terminology" in Chapter 4, "PROFINET IO CONTROLLER FUNCTION"	Replace this Subsection with Subsection 4.1.2, "Terminology" in Part III, "FUNCTION".
Subsection 5.2.1, "Specification List" in Chapter 5, "PROFINET IO DEVICE FUNCTION"	Replace this Subsection with Subsection 5.2.1, "Specification List" in Part III, "FUNCTION".
Subsection 5.3.1, "Setting from the IO Supervisor" in Chapter 5, "PROFINET IO DEVICE FUNCTION"	Replace this Subsection with Subsection 5.3.1, "Setting from the IO Supervisor" in Part III, "FUNCTION".
Subsection 5.4.3, "Log Screen of the PROFINET IO Device Function" in Chapter 5, "PROFINET IO DEVICE FUNCTION"	Replace this Subsection with Subsection 5.4.3, "Log Screen of the PROFINET IO Device Function" in Part III, "FUNCTION".
Chapter C, "PROFINET IO DEVICE SAFETY FUNCTION"	Add this Chapter to Part, "APPENDIX" as Chapter C.

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4.1.2 Terminology

Terms related to the PROFINET function are described below.

IO Controller

This is a device that starts IO transfer.
In PROFIBUS, it is equivalent to a class 1 master function.

IO Device

This device communicates with an IO Controller.
In PROFIBUS, it is equivalent to a slave function.

IO Supervisor

In general, this is an instrument such as a PC (personal computer) and an HMI (human machine interface).
It is used to make the communication settings for and diagnose a PROFINET system, and is usually supplied from an IO Controller device manufacturer.
In PROFIBUS, it is equivalent to a class 2 master function.

NOTE

To use the IO Controller function for a FANUC CNC, the FANUC-specified IO Supervisor is required.
The FANUC-specified IO Supervisor is written as "Setting tool".
At present, the FANUC-specified Setting tool is the following product, supplied from Molex, Inc.
The product name, order number, and supplier of the FANUC-specified Setting tool are as follows.

Product name)
PROFINET Configuration Tool (PFN-CT) for FANUC CORPORATION
(May be abbreviated to "PFN-CT".)

Order number)
FAC-PFN-CON-CNF

Supplier)
- In Japan : Sales office of Okaya Electronics Corp.
- Outside of Japan : Sales office of Molex, Inc. in your area

GSDML (General Station Description Makeup Language) file

This is a file in XML form in that contains device information about an IO Device.
A GSDML file is necessary for making settings with an IO Supervisor.

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NOTE

For how to get the GSDML file for each IO Device, contact the manufacturer of that IO Device.
If using the PROFINET IO Device function for a FANUC CNC, contact your sales representative for how to get the GSDML file.

Slot
Module

These are terminology used when a hardware configuration of the IO device is shown.
For the general PROFINET IO Device, the hardware that is called a module is mounted on the slot, and IO communication is executed.
The slot is a place to mount the module, and is usually allocated with the slot number of the 0-origin.
The module is various as follows.

- A communication module that supports the communication function
- A input/output module to input and output the DI/DO signal
- A safety module that supports the safety communication function

For a FANUC CNC, neither a physical slot nor a module exists, and the following logical slots and modules are defined.

Slot	Module	Description
0	Communication module	It is the hardware option of a FANUC CNC. In the IO Supervisor, the specific information of the communication module is displayed. Moreover, the settings for the standard module of a FANUC CNC (CNC-specific parameter settings such as PMC assignment) are done from the setting screen of this module.
1	Input module (Standard module)	It is the input/output module to input and output the DI/DO signal of a FANUC CNC. In the setting by the IO supervisor, select the input/output module according to input/output size used. The input/output module for a FANUC CNC is assigned to the PMC area.
2	Output module (Standard module)	
3	Safety module	It is the input/output module that supports the safety communication function of a FANUC CNC. In the setting by the IO supervisor, select the safety module according to input/output size used. The safety module of a FANUC CNC is assigned to the PMC area.

NOTE

The safety module is used by the PROFINET IO Device safety function. For details, see the Chapter C, "PROFINET IO DEVICE SAFETY FUNCTION" in APPENDIX.

Input/output update time

This time is the interval when the input/output frame is transmitted or received in IO transfer.
This time is set by the IO Supervisor.

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NOTE

"Input/output update time" is called by the IO Supervisor as follows.

- Setting tool of a FANUC CNC : Refresh Period
- STEP7 of Siemens AG : Update Time

I&M (Identification and Maintenance) data

This data is used to identify and maintain an IO Device.
An IO Supervisor and an IO Controller can get this data from an IO Device by way of communication.

IP parameters

The IP address, the subnet mask, and the router IP address are collectively called IP parameters.

CHANGE MODE

This mode allows the changing of the PROFINET parameters of the CNC.

PROTECT MODE

This mode protects (prohibits) the changing of the PROFINET parameters of the CNC.

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5.1.2 Specification List

The following is a list of specifications of the PROFINET IO Device function of the CNC.

Item	Description
PROFINET Version	V2.2
PROFINET IO Conformance class	CC-A
Required software option	PROFINET IO Device function option (R972)
Combination with other functions	Functions that can be used at the same time on the same hardware option or different hardware options: - Ethernet function (S707) - Modbus/TCP Server function (R968) Functions that can be used at the same time on different hardware options - Data Server function (S737) - FL-net function (J692) - EtherNet/IP Scanner function (R966) - EtherNet/IP Adapter function (R967) - PROFINET IO Controller function (R971) For details of combining it with other functions, see Chapter 2, "HARDWARE OPTIONS AND COMMUNICTION FUNCTIONS" in Part II, "COMMON".
PMC area that can be allocated	- DI : R, E, D, and X areas - DO : R, E, D, and Y areas - Status : R and E areas
Maximum DI/DO data size	256 bytes/256 bytes
DI/DO update time	4 ms or greater 4 ms is the minimum that applies if only the PROFINET IO Device function is used on a hardware option.
UDP port number	34962 to 34964 (fixed)

NOTE

1 If the Ethernet function and the PROFINET IO Device function are operated on the same hardware option at the same time, the followings are limited.
- The number of FOCAS2/Ethernet clients that can be connected to a single CNC is limited to 5.
- The machine remote diagnosis functions cannot be used.
- The request to return an IO Device to the factory settings (Reset Factory Settings) from the IO Supervisor and the IO Controller is not supported.

2 A FANUC CNC does not support SNMP (Simple Network Management Protocol), and cannot make diagnosis of a CNC network using SNMP.

3 If the PROFINET IO Device function is used, communication via a router and the DHCP/DNS function cannot be used.

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5.3.1 Setting from the IO Supervisor

This subsection describes the general setting procedures.
Refer to the manual supplied with the IO Supervisor when actually using the IO Supervisor.

1 In the IO Supervisor, install the GSDML file of the CNC (IO Device).
2 In the IO Supervisor, set the device name for the CNC, the IP parameters for the CNC, and CNC-specific parameters such as PMC assignment, and transfer these parameters to the IO Controller.

The above steps are for the settings in the IO Controller, and the following steps are for the settings in the CNC.

3 Set the device name and the IP parameters to the CNC by operating the IO Supervisor.
4 The other parameters are automatically set in the CNC. Then, turn the CNC off and back on.
5 When the CNC restarts, the communication with the IO Controller starts.

NOTE

1 In step 4, it is recommended to check the updated settings before turning the CNC off.
Check that each parameter is updated in accordance with Subsection 5.4.1, "Checking the Settings".
2 If the mode is "CHANGE MODE", the communication parameters stored in the nonvolatile memory of the CNC may be changed via the network due to a setting request from the IO Supervisor and the IO Controller.
To prevent settings from being changed inadvertently, change the mode to "PROTECT MODE" after completing the setting.
3 If the communication partner (IO Controller) is a FANUC CNC, the FANUC-specified Setting tool, "PROFINET Configuration Tool (PFN-CT) for FANUC CORPORATION" (made by Molex, Inc.), must be used as an IO Supervisor. If the communication party (IO Controller) is a FANUC CNC, see Chapter 4, "PROFINET IO CONTROLLER FUNCTION".
4 When the request to return the IO Device to the factory settings (Reset Factory Settings) from the IO Supervisor and the IO Controller is received, the all parameters for the PROFINET IO Device (the device name, the IP parameters, and CNC-specific parameters) are cleared, and the communication is disconnected.
In this case, set the parameters for the PROFINET IO Device (the device name, the IP parameters, and CNC-specific parameters) again to restart the communication, and turn the CNC off and back on.

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NOTE

5 There are the following notes for condition <1> or condition <2>.

Condition)

<1> When the Ethernet function and the PROFINET IO Device function are operated on the same hardware option at the same time

<2> When Fast Ethernet function software and Embedded Ethernet function software are the following software

- For the Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A:
  Edition 16 or earlier of Series 658K, Edition 13 or earlier of Series 658M
- For Series 0*i*-F:
  Edition 03 or earlier of Series 658B, Edition 03 or earlier of Series 658A

Note)

- After steps 3, it is necessary to turn the CNC off and back on.
- When the request to return the IO Device to the factory settings (Reset Factory Settings) from the IO Supervisor and the IO Controller is received, the request is disregarded and the communication is disconnected completely. Once after the communication is disconnected, it is connected again.

6 Use the GSDML file according to the following conditions.

Condition of Fast Ethernet function software	GSDML file
- For Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A: Edition 16 or earlier of Series 658K - For Series 0*i*-F: Edition 03 or earlier of Series 658B	GSDML-V2.2-FANUC-CNC-20120214.xml
- For Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A: Edition 17 or later of Series 658K - For Series 0*i*-F: Edition 04 or later of Series 658B	GSDML-V2.3-FANUC-CNC-20150713.xml

5.3.1.1 Example of using STEP7 of Siemens AG

This subsection briefly describes an example of using STEP7 (Version 5.5) of Siemens AG.
For details of how to use STEP7, refer to the manual supplied with STEP7 of Siemens AG.

First, display the "HW Config" screen.

1 Select the menu [Options] -> [Install GSD File…] from the "HW Config" screen, and install the GSDML file of the CNC (IO Device) from the "Install GSD Files" screen.

The "HW Config" screen is shown below.

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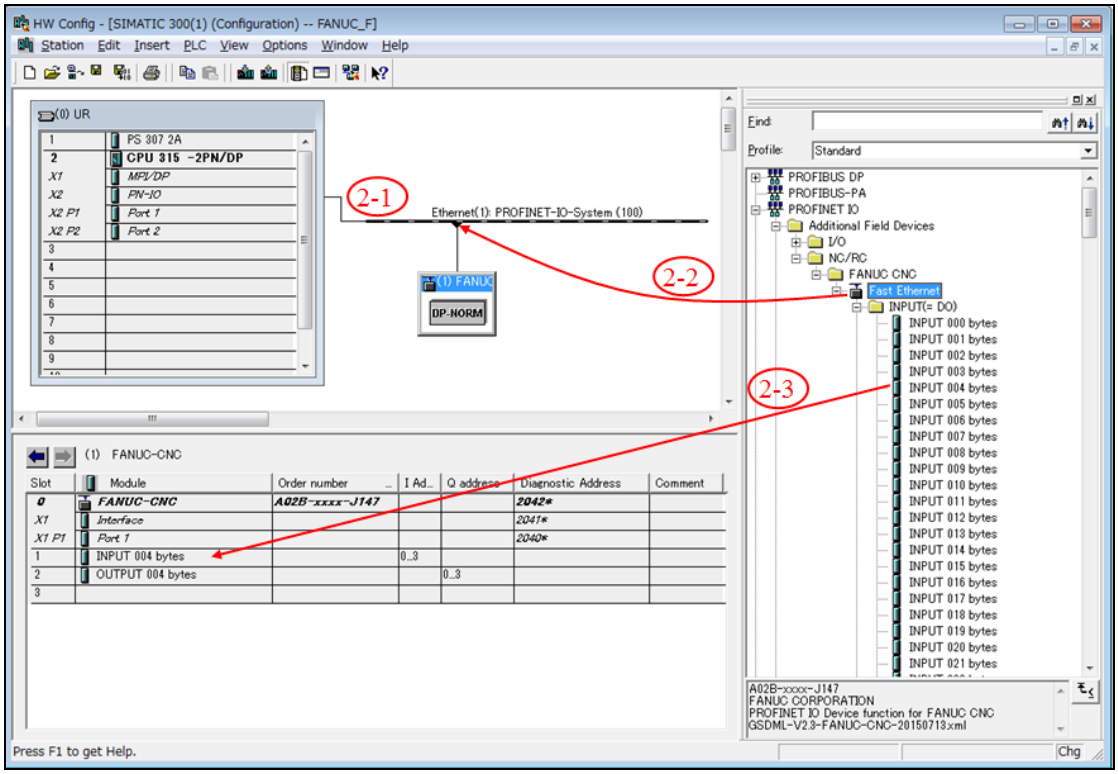

2-1 Select "PN-IO" in the UR (Universal Rack) window on the main screen of the "HW Config" screen, and select the menu [Insert] -> [PROFINET IO System] to add the network "PROFINET-IO-System".

2-2 On the device tree on the right of the "HW Config" screen, select [PROFINET IO] -> [Additional Field Devices] -> [NC/RC] -> [FANUC CNC] -> [Fast Ethernet] sequentially, and then drag & drop [Fast Ethernet] into the network "PROFINET-IO-System". This causes the CNC to be added as an IO Device.
At this point, the IP parameters are automatically assigned, and the default name "FANUC-CNC" is assigned as the device name.
If you want to change the IP parameters or the device name, you can change them on the "Properties" screen. The "Properties" screen is displayed by double-clicking the IO Device added to the network "PROFINET-IO-System".

2-3 The items [INPUT xxx bytes] (xxx: 0 to 256) are displayed by selecting [PROFINET IO] -> [Additional Field Devices] -> [NC/RC] -> [FANUC CNC] -> [Fast Ethernet] -> [INPUT(=DO)] sequentially on the device tree on the right of the "HW Config" screen. Select the item [INPUT xxx bytes] that corresponds to the item of the input bytes of the IO Device, and drag & drop it into the "Slot1" of "FANUC-CNC" in the lower part of the "HW Config" screen.
Similarly, select the one from the items [OUTPUT xxx bytes] (xxx: 0 to 256) that corresponds to the item of the output bytes of the IO Device, and drag & drop it into the "Slot2" of "FANUC-CNC" in the lower part of the "HW Config" screen.

NOTE
Do not set "Slot3".
Set "Slot3" when you use the PROFINET IO Device Safety function in APPENDIX.

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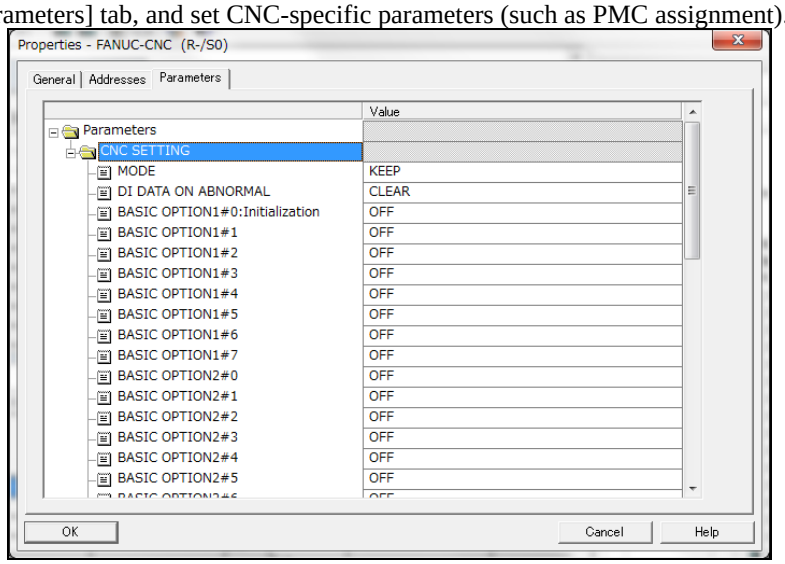
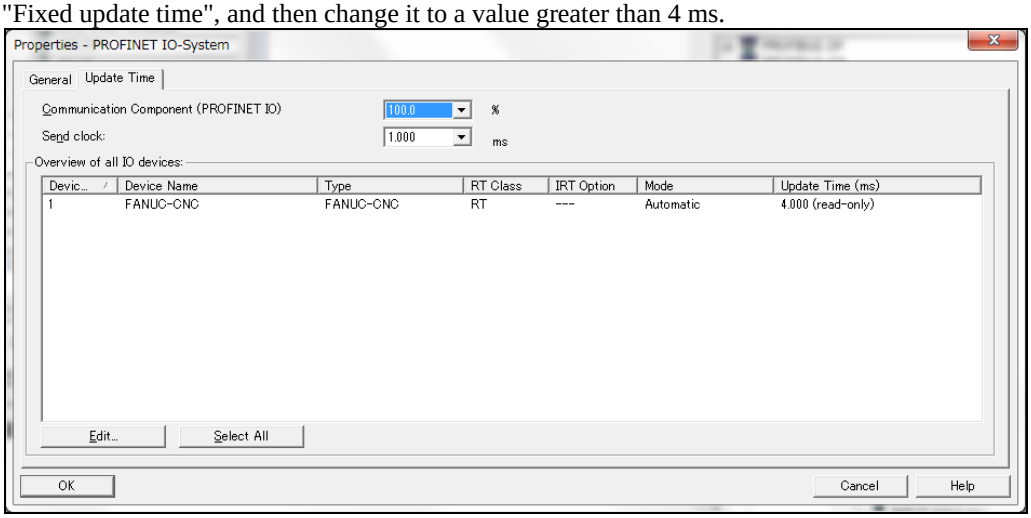
2-4 Double-click the "Slot0" of "FANUC-CNC" in the lower part of the "HW Config" screen, and display the "Properties" screen, shown below.
Select the [Parameters] tab, and set CNC-specific parameters (such as PMC assignment).



For details of CNC-specific parameters, see the setting items in Subsection 5.4.1.2, "Setting screen of the PROFINET IO Device function".
Note that for "MODE", a selection can be made between "PROTECT" ("PROTECT MODE") and "KEEP" (keep the present mode). If it is not necessary to change the mode, select "KEEP" (keep the present mode). The mode cannot be changed from "PROTECT MODE" to "CHANGE MODE".
Click the [OK] button after completing the setting.

2-5 Double-click the network "PROFINET-IO-System" on the main screen of the "HW Config" screen in order to display the "PROFINET IO-System Properties" screen, shown below.
Select the [Update Time] tab, and confirm that "Update Time" of "FANUC-CNC" is 4 ms.
If you want to set "Update Time" to a value greater than 4 ms, first change "Mode" row from "Automatic" to "Fixed update time", and then change it to a value greater than 4 ms.



Click the [OK] button after completing the setting.

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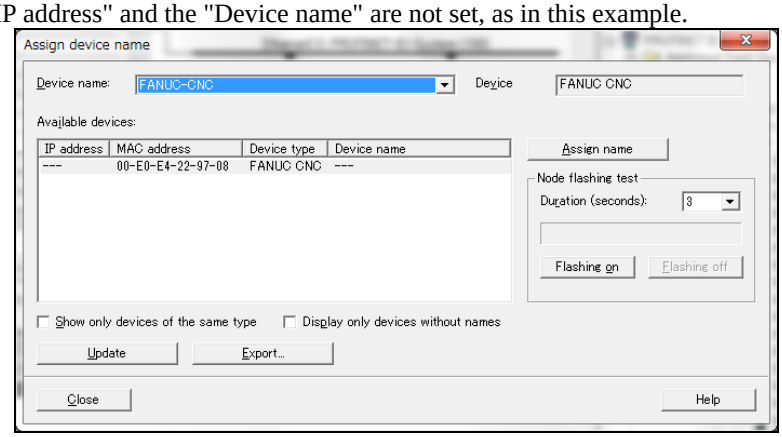
2-6 After completing the setting of all IO Devices, select the menu [Station] -> [Save and Compile] on the "HW Config" screen to preserve the hardware configuration.
Select the menu [PLC] -> [Download] in order to transfer the hardware configuration to the IO Controller.

The above steps are for the settings in the IO Controller, and the following steps are for the settings in the CNC.

3 Select the menu [PLC] -> [Ethernet] -> [Assign Device Name] on the "HW Config" screen in order to display the "Assign device name" screen. When this screen is displayed, IO Devices on the network are automatically detected.
The following shows a screen example when "FANUC CNC" is detected. For a CNC shipped from the factory, the "IP address" and the "Device name" are not set, as in this example.



Check that the device name set in step 2-2 is selected in the list box "Device name" in the upper part of this screen, and then click the [Assign name] button. The device name and the IP parameters set in step 2-2 are automatically set in the CNC.

4 When CNC restarts, the other setting parameters are automatically set in the CNC. Then, turn the CNC off and back on.

5 When the CNC restarts, the communication with the IO Controller starts.

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5.4.3 Log Screen of the PROFINET IO Device Function

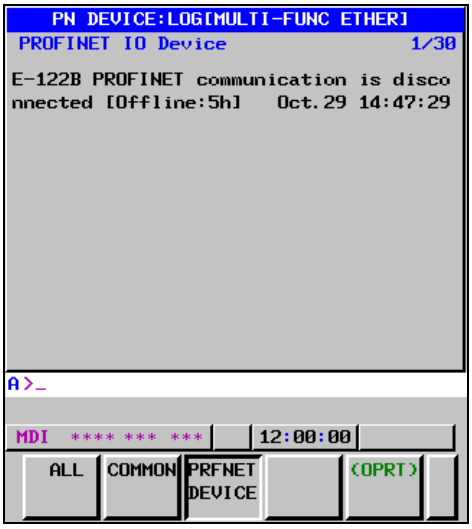
A log related to the PROFINET IO Device function is displayed.

Procedure

1 Press function key .

2 Press soft key [PRFNET DEVICE]. Soft keys [ALL], [COMMON], and [PRFNET DEVICE] appear.

3 Press soft key [PRFNET DEVICE], and then a log related to the PROFINET IO Device function is displayed.



Log screen of the PROFINET IO Device function

The latest log information is displayed at the top of the screen. At the right end of a log item, the occurrence date and time of the log item is indicated. Date and time data is indicated in the format "MMM.DD hh:mm:ss", where MMM represents a month, DD represents a day, hh represents hour, mm represents minute, and ss represents second.

Operation

To clear the log information, press soft key [(OPRT)] then soft key [CLEAR].

> **NOTE**
> The log information for the PROFINET IO Device function is stored in volatile memory and it is lost when the CNC is turned off. If an error occurs, check the log information before turning the power off.

The following lists major log message:

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Error code	Log message	Meaning and action to be taken
E-1200	The received parameter for PROFINET IO Device function is wrong	The received parameters for the PROFINET IO Device function are wrong. Set the parameters for PROFINET IO Device function correctly by using the IO Supervisor as follows. • Set "Input/output update time" of CNC to 4 ms or greater. • Set "INPUT xxx bytes" for "Slot1" of CNC. • Set "OUTPUT xxx bytes" for "Slot2" of CNC.
E-1201	Cannot save parameter for PROFINET IO Device function [X:Y:Z]	The received parameters for the PROFINET IO Device function were not saved, because they contained a wrong parameter. Set the parameters for PROFINET IO Device function correctly. The last [X:Y:Z] of the message means detailed information on the error, and the wrong parameter is indicated at the position of Z as one of the following numbers. (X and Y are internal error codes, and are not used.) 1233: "ALLOCATION OPTION1" is wrong 1236: "DI PATH" is wrong 1237: "DI AREA" is wrong 1238: "DI ADDRESS" is wrong 1239: "OUTPUT xxx bytes" is wrong 1240: "DI ADDRESS" is not 2-byte boundaries 1241: "DI ADDRESS" is not 4-byte boundaries 1243: "DO PATH" is wrong 1244: "DO AREA" is wrong 1245: "DO ADDRESS" is wrong 1246: "INTPUT xxx bytes" is wrong 1247: "DO ADDRESS" is not 2-byte boundaries 1248: "DO ADDRESS" is not 4-byte boundaries 1250: "STATUS PATH" is wrong 1251: "STATUS AREA" is wrong 1252: "STATUS ADDRESS" is wrong 1253: "STATUS SIZE" is wrong
E-1202	Setting DI/DO size is not equal to the I/O size of PROFINET transmission	The DI/DO size set on the setting screen of the PROFINET IO Device function differs from the I/O size used to transfer with PROFINET that is set on the IO Supervisor. Make sure that these sizes match. When you change the I/O size from the IO Supervisor, this log message may appear. If this occurs, turn the CNC off and back on.

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Error code	Log message	Meaning and action to be taken
E-1203	The parameter for PROFINET IO Device function is protected	The received parameter for the PROFINET IO Device function was not updated, because the parameter protection was enabled. To disable parameter protection, perform the following operations: • Change the "MODE" to the "CHANGE MODE" on the setting screen of the PROFINET IO Device function. • Set the CNC to the emergency stop state or change the CNC mode to the MDI mode. • If the PROFINET IO Device function and the Ethernet function are operated at the same time on the same hardware option, release the parameter protection of the Ethernet function in the 8-level data protection function.
E-1204	The parameter for PROFINET IO Device function was saved	The received parameter for the PROFINET IO Device function was saved. Check the parameters on the setting screen of the PROFINET IO Device function. Then, turn the CNC off and back on.
E-122A E-122B	PROFINET communication is disconnected	PROFINET communication is disconnected. In case of E-122A: The communication is disconnected before it is established. In case of E-122B: The communication is disconnected after it is established. Check that the Ethernet cable is correctly connected. Check the diagnostic information on the IO Controller when the trouble cannot be removed. This log message also appears if the IO Controller restarts.

The following is the log message of the received request. These do not indicate errors.

Error code	Log message	Meaning and action to be taken
E-1210	[Reset Factory Settings is received]	The request to return the IO Device to the factory settings (Reset Factory Settings) is received.
E-1211	[LED Blink is received]	The request to blink LED is received.

NOTE

When the Fast Ethernet function software is the following, Error Code E-1210 and E-1211 are displayed.

- For the Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A:
  Edition 17 or later of Series 658K
- For Series 0*i*-F:
  Edition 04 or later of Series 658B

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C PROFINET IO DEVICE SAFETY FUNCTION

NOTE

Before using the PROFINET IO Device Safety function, be sure to read the followings.

- Part II, "COMMON"
- Chapter 5, "PROFINET IO DEVICE FUNCTION" in Part III, "FUNCTION"

C.1 OVERVIEW

This section describes an overview of the PROFINET IO Device Safety function.

C.1.1 Introduction

The PROFINET IO Device Safety function makes it possible for the PROFINET IO Device function to handle safety signals. The communication standard is based on the Safety standard PROFIsafe managed by PI (PROFIBUS & PROFINET International). This function enables the CNC to exchange safety signals with a PROFINET IO Controller that supports PROFIsafe.

The PROFINET IO Device Safety function is an additional function of the dual check safety (DCS) function. It operates on two CPUs as well as the dual check safety function. For details of the dual check safety function, refer to "Dual Check Safety CONNECTION MANUAL (B-64483EN-2)".

The sending device transmits cross-checked safety signals with inspection data added to them. The receiving device ensures the safety of communication by confirming the inspection data and cross-checking the received safety signals.

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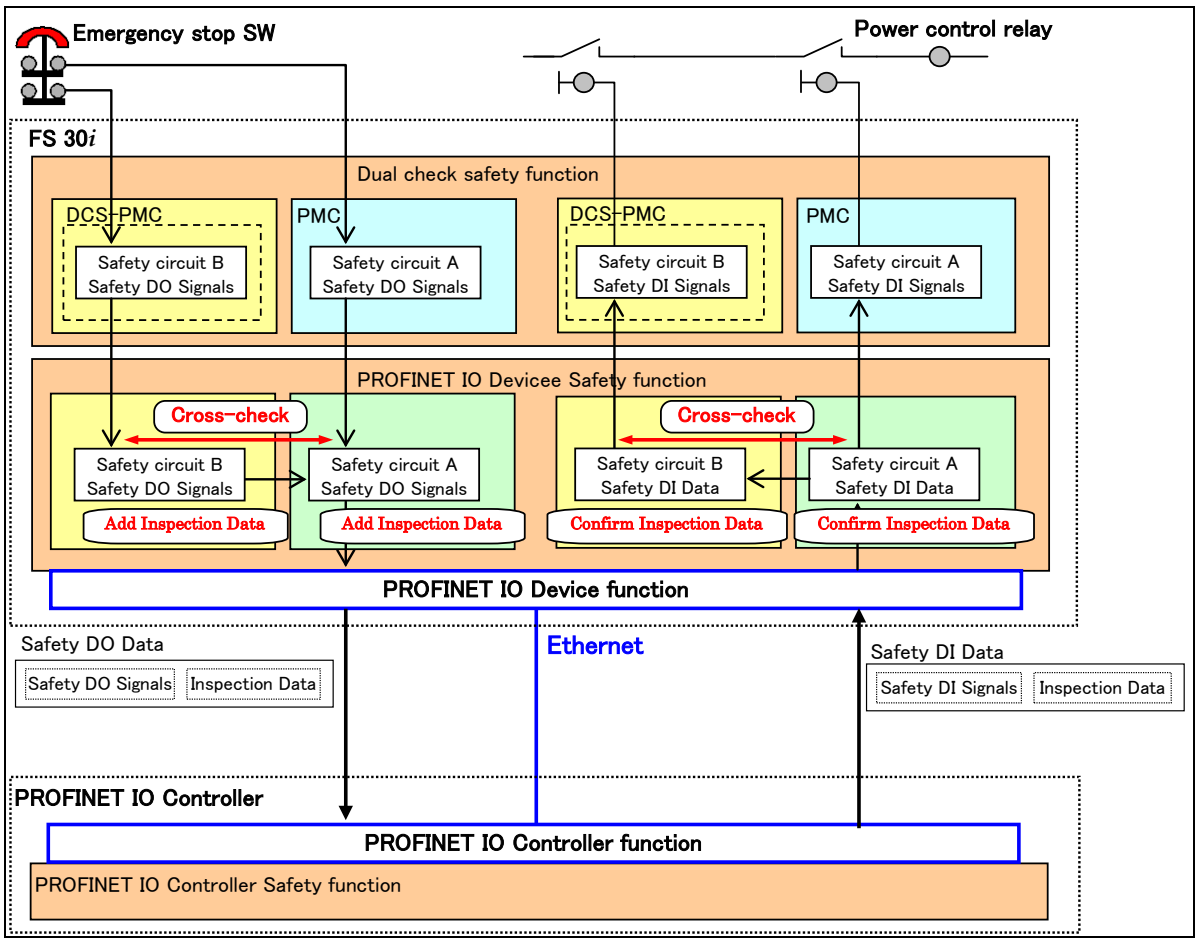

C.1.2 Terminology

For terminology except the following, see Subsection 4.1.2, "Terminology" in Part III, "FUNCTION".

Safety Signal

A safety signal is an I/O signal that is exchanged with another device to guarantee safety.

Safety Parameter

A safety parameter is a parameter for safety function set on the parameter screen of CNC.

F-Parameter

F-Parameter is a parameter for PROFIsafe set on the IO Supervisor.
This parameter is set on each safety module.

Safety module
Standard module

The input/output module that supports the safety communication function is called a safety module.
The input/output module that does not support the safety communication function is called a standard module for convenience' sake.

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C.1.3 Safety State

In the PROFINET IO Device Safety function, two CPUs (ETH-CPU as Path A and CNC-CPU as Path B) execute tests independently. If an error is detected in either of the paths, the safety state occurs.

What is the safety state?

The safety state is a state in which safety communication cannot be done, because the error of tests for securing safety or the communication timeout are detected.
The behavior of the safety signal in the safety state is as follows.

- The DCS-PMC and PMC areas to which the safety DI signal is allocated are cleared to 0. Any safety DI signal received in the safety state is discarded, keeping these areas cleared to 0.
- The value 0 is sent for the safety DO signal. The values of the DCS-PMC and PMC areas to which the safety DO signal is allocated are not sent.

Causes of the safety state

There are two kinds of cause of the safety state.

(i) When the following errors detected in a test for securing safety
- F-Parameter is wrong
- Safety software code test
- CPU test
- RAM area test
- Safety parameter test
- Safety DI/DO signal cross-check
- Watchdog test in which two paths (Path A and Path B) check each other's behavior

(ii) When the following communication errors is detected that is considered to be attributable to a cause other than the CNC
- A timeout occurs at the starting of safety communication.
- A timeout occurs when the data is received during safety communication.
- The data received from the IO Controller is wrong.

NOTE
When the safety state occurs, see the log screen of the PROFINET IO Device Safety function.

CNC status in the safety state

When the cause is (i), the CNC status is as follows.

1) The PW alarm is generated.
   The PW alarm for Path A : PW0512 PRNT IO Device Safety error (ETH)
   The PW alarm for Path B : PW0511 PRNT IO Device Safety error (CNC)
2) The MCC off signal (*DCALM) is set to "0".
   The MCC off signal (*DCALM) for Path A : <F0748.7> (PMC)
   The MCC off signal (*DCALM) for Path B : <F0000.7> (DCS-PMC)
   If a value is set in the MCC off timer (parameter No.1948), the MCC off signal (*DCALM) is set to "0" after the time set for the timer elapses after the PW alarm is generated.

When the cause is (ii), the CNC status can be selected from the following two choices.

a) The CNC status is the same as when the cause is (i).
b) The PW alarm is not generated, and the MCC off signal (*DCALM) is not set to "0".

To specify which status to apply, use bit 1 (CTA) of parameter No. 13771 or 13772.

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If b) is selected, please prepare the always ON signal in the safety DI signal received from IO Controller. By confirming the value of this signal, the ladder program of DCS can detect the communication error caused by power supply down of the IO Controller, etc. Ensure that, if a communication error is detected, the ladder program of the DCS generates an alarm and turns off the MCC as necessary.

C.1.4 Safety Precautions

For safe use, observe the following precautions.

Precautions

- When replacing a PROFIsafe device, check that the new device is configured correctly and that it operates normally.
- When using a PROFIsafe device for the first time, clear (reset) the settings of a PROFIsafe device first of all.
- Before connecting a PROFIsafe device to the safety network, check that neither the device name nor the IP address of all PROFIsafe devices connected with the safety network overlap.

C.2 SPECIFICATIONS

This section describes the specifications of the PROFINET IO Device Safety function of the CNC.

C.2.1 List of Specifications

The following is a list of specifications of the PROFINET IO Device Safety function of the CNC.

Item	Description
Required software option	- PROFINET IO Device Safety function (R977) - PROFINET IO Device function (R972) - Dual Check Safety function (S661)
Combination with other functions	Functions that can be used at the same time on the same hardware option or different hardware options: - Ethernet function (S707) - Modbus/TCP Server function (R968) Functions that can be used at the same time on different hardware options - Data Server function (S737) - FL-net function (J692) - EtherNet/IP Scanner function (R966) - EtherNet/IP Adapter function (R967) - PROFINET IO Controller function (R971) Function that cannot be used simultaneously - Safety function by FL-net (S851) - EtherNet/IP Adapter Safety function (R976)
PMC area that can be allocated	For DCS-PMC : - DI : R and X areas - DO : R and Y areas For PMC : - DI : R, E, and X areas - DO : R, E, and Y areas
Maximum DI/DO data size	8 bytes/8 bytes This size is a size of the safety data supported by the safety module.

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Item	Description
DI/DO update time	4 ms or greater 4 ms is the minimum that applies if only the PROFINET IO Device Safety function is used on a hardware option.

NOTE
For Note, see "Note" of Subsection 5.2.1, "List of Specifications" in Part III, "FUNCTION".

C.2.2 Unit of Data and Concurrency of Data

The unit of I/O data can be byte (1 byte) only.
The concurrency of byte (1 byte) data is guaranteed.

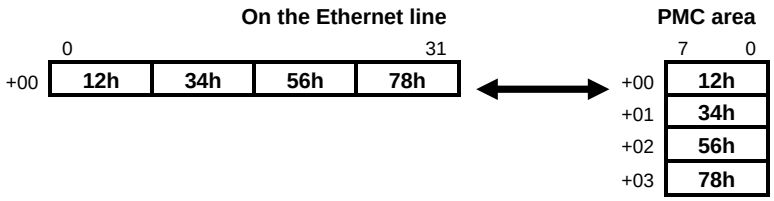
⚠ WARNING
Data segmentation may result in the machine behaving unexpectedly, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.

C.2.3 Order of Data

This subsection describes the order of data.

⚠ WARNING
Before starting operation, make sure that an appropriate value is exchanged in the correct order.
If operation is started without checking the above, the machine may behave unexpectedly, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.

Example when data size is 4 bytes



C.3 SETTING

This section describes the setting of the PROFINET IO Device Safety function.

C.3.1 Setting from the IO Supervisor

This subsection describes the general setting procedures.
Refer to the manual supplied with the IO Supervisor when actually using the IO Supervisor.

1 In the IO Supervisor, install the GSDML file of the CNC (IO Device).
2 In the IO Supervisor, set the IO Controller Safety function.

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3 In the IO Supervisor, set the device name for the CNC, the IP parameters for the CNC, and the F-Parameter of the safety module for the CNC.
When using the safety module and the standard module at the same time, set the standard module (CNC-specific parameters such as PMC assignment) in this procedure.
4 In the IO Supervisor, create the safety program.
5 In the IO Supervisor, transfer the setting parameters and the safety program to the IO Controller.

The above steps are for the settings in the IO Controller, and the following steps are for the settings in the CNC.

6 In the CNC, set the safety parameter.
7 Set the device name and the IP parameters to the CNC by operating the IO Supervisor.
8 The other parameters are automatically set in the CNC. Then, turn the CNC off and back on.
9 When the CNC restarts, the safety communication with the IO Controller starts.

C.3.1.1 F-Parameter

This subsection describes the F-Parameter of the safety module for the CNC.

Setting Items

Item	Description
F_SIL	Specify the Safety Integrated Level of the International Standard IEC61508. Setting range: "SIL3" (fixed)
F_CRC_Length	Specify the length of the inspection data (CRC) used by the safety communication. Setting range: "3-Byte-CRC" (fixed)
F_Block_ID	Specify the ID that shows the type of the parameter block. Setting range: 0 to 7 Specify the standard setting 0.
F_Par_Version	Specify the version of F-Parameter. Setting range: "1" (fixed)
F_Source_Add	Specify the address of the IO Controller on the safety network. Setting range: 1 to 65534
F_Dest_Add	Specify the address of the IO Device on the safety network. Setting range: 1 to 65534
F_WD_Time	Specify the maximum watchdog time for IO Device in the safety communication. Setting range: 1 to 10000 (Unit: ms) When the safety data is not transmitted from the IO Controller exceeding this time, the safety communication becomes abnormal. Set 150 of the standard value to this parameter usually. Then, set 4 ms of the standard value to "Input/output update time". When you want to set this parameter strictly, see the following "Calculating the minimum value of F_WD_Time".

NOTE
1 "F_Source_Add" and "F_Dest_Add" must be unique on the safety network.
2 "Input/output update time" is called by the IO Supervisor as follows.
- STEP7 of Siemens AG : Update Time

Calculating the minimum value of F_WD_Time

The calculating the minimum value of "F_WD_Time" for the CNC is as follows.

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Minimum value of "F_WD_Time" (ms) = A + (X × 2) + (4 + Y × 2)

A: The maximum delay time of the IO Controller processing
X: The "Input/output update time" set by the IO Supervisor (4 ms to 512 ms)
Y: The time according to the following X
- For X <= 32 ms : Y = X
- For X > 32 ms : Y = 32 ms

NOTE

The maximum delay time of the IO Controller processing contains the followings.
- The internal processing time of the IO Controller
- The safety program create by user

For the maximum delay time of the IO Controller processing, confirm with the IO Controller manufacturer.

C.3.1.2 Example of using STEP7 of Siemens AG

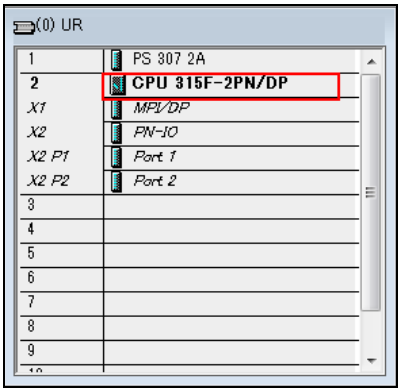
This subsection briefly describes an example of using STEP7 (Version 5.5) of Siemens AG.
- STEP7 (Version 5.5)
- S7 Distributed Safety (Version 5.4)

For details of how to use these, refer to the manual supplied with these of Siemens AG.

First, display the "HW Config" screen.

1 Select the menu [Options] -> [Install GSD File…] from the "HW Config" screen, and install the GSDML file of the CNC (IO Device) from the "Install GSD Files" screen.

2-1 Confirm that the head of "Slot2" in the UR (Universal Rack) window on the main screen of the "HW Config" screen is the safety CPU. When it is not the safety CPU, select the right-click menu "Replace Object Insert" on the head of "Slot2", and select the safety CPU.



2-2 Double-click the safety CPU to in order display the "Properties" screen.
Select the [Protection] tab, and set the following "Protection level".

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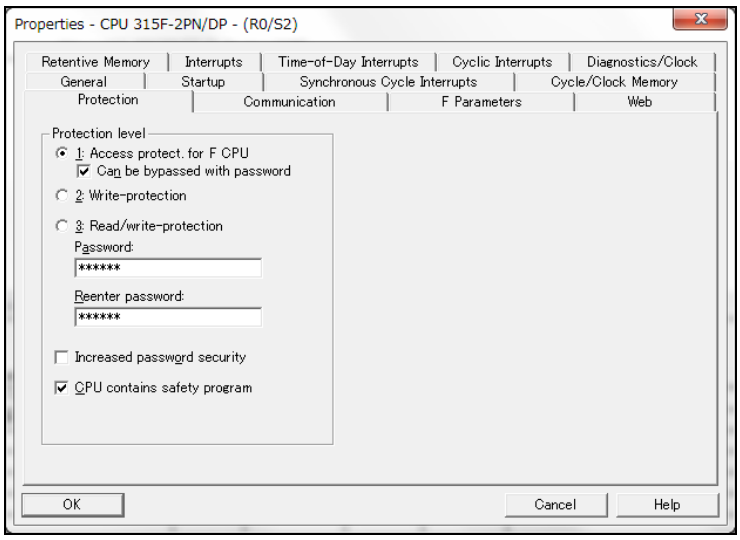
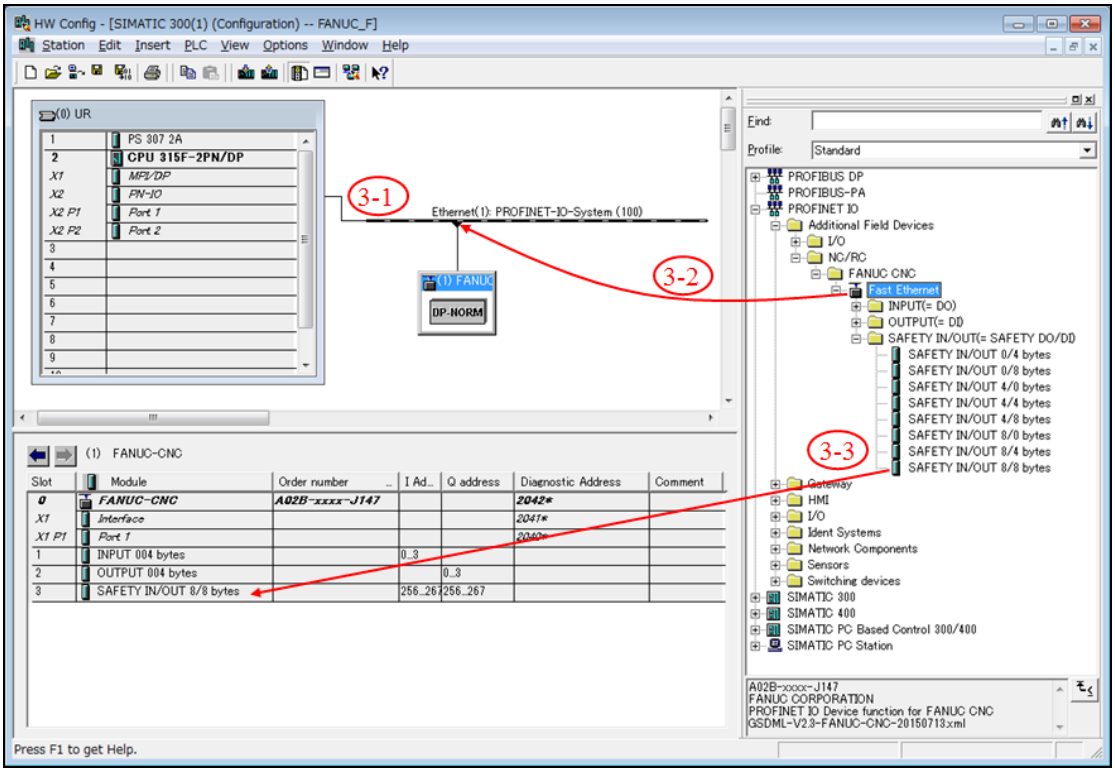


When the F-Parameter and the safety program are edited, the input of password is requested.
FC(Function Call), FB(Function Block), and DB(Data Block) necessary to create the safety program are automatically generated by selecting "CPU contains safety program".

The "HW Config" screen is shown below.



3-1 Select "PN-IO" in the UR (Universal Rack) window on the main screen of the "HW Config" screen, and select the menu [Insert] -> [PROFINET IO System] to add the network "PROFINET-IO-System".

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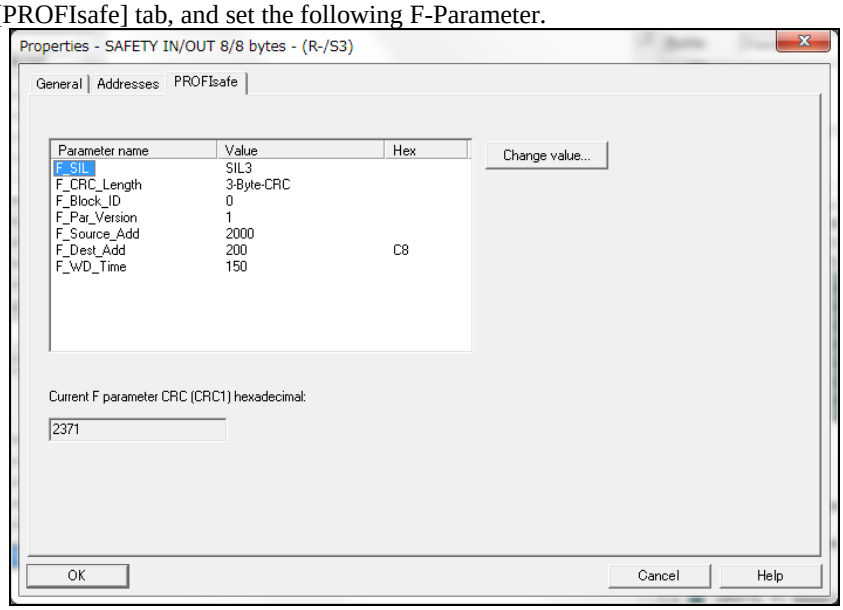
3-2 On the device tree on the right of the "HW Config" screen, select [PROFINET IO] -> [Additional Field Devices] -> [NC/RC] -> [FANUC CNC] -> [Fast Ethernet] sequentially, and then drag & drop [Fast Ethernet] into the network "PROFINET-IO-System". This causes the CNC to be added as an IO Device.
At this point, the IP parameters are automatically assigned, and the default name "FANUC-CNC" is assigned as the device name.
If you want to change the IP parameters or the device name, you can change them on the "Properties" screen. The "Properties" screen is displayed by double-clicking the IO Device added to the network "PROFINET-IO-System".

3-3 The safety module [SAFETY IN/OUT x/x bytes] (x: 0, 4, 8) are displayed by selecting [PROFINET IO] -> [Additional Field Devices] -> [NC/RC] -> [FANUC CNC] -> [Fast Ethernet] -> [SAFETY IN/OUT(= SAFETY DO/DI)] on the device tree on the right of the "HW Config" screen. Select the safety module used from them, and drag & drop it into the "Slot3" of "FANUC-CNC" in the lower part of the "HW Config" screen.

3-4 Double-click the added safety module to in order display the "Properties" screen.
Select the [PROFIsafe] tab, and set the following F-Parameter.



For the F-Parameter, see Subsection C.3.1.1, "F-Parameter".

3-5 When using the standard module, see the step 2-3 and 2-4 of Subsection 5.3.1.1, "Example of using STEP7 of Siemens AG".

3-6 Double-click the network "PROFINET-IO-System" on the main screen of the "HW Config" screen in order to display the "PROFINET IO-System Properties" screen, shown below.
Select the [Update Time] tab, and confirm that "Update Time" of "FANUC-CNC" is 4 ms.
If you want to set "Update Time" to a value greater than 4 ms, first change "Mode" row from "Automatic" to "Fixed update time", and then change it to a value greater than 4 ms.

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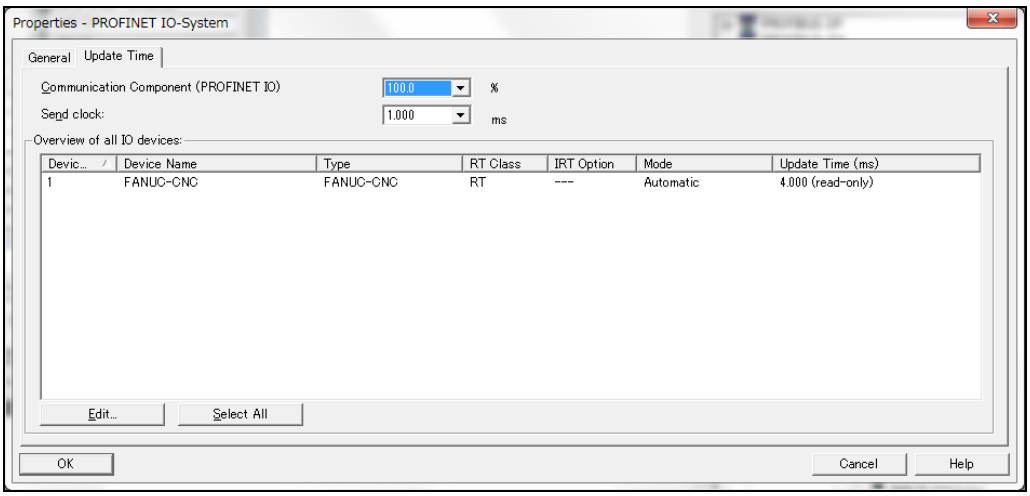

Click the [OK] button after completing the setting.

3-7 After completing the setting of all IO Devices, select the menu [Station] -> [Save and Compile] on the "HW Config" screen to preserve the hardware configuration.
At this time, FC(Function Call), FB(Function Block), and DB(Data Block) necessary to create the safety program are automatically generated.

4 Create the safety program.
For details of the safety program, refer to the manual supplied with Siemens AG.

NOTE

When you create the safety program of Siemens AG, we recommend using the following of DB(Data Block).

- ACK_REI
  This is the signal to restart the safety communication.
  When the abnormality occurs once in the safety communication, the IO Controller of Siemens AG doesn't restart the safety communication until this signal becomes 1 even if you remove an abnormal cause.
- DIAG
  This is the variable that stores the diagnostic information for the safety communication.

5-1 Select the menu [PLC] -> [Download] of the "HW Config" screen in order to transfer the hardware configuration to the IO Controller.

5-2 Select the menu [Options] -> [Edit safety program] of the "SIMATIC Manager" screen to in order display the "Safety Program" screen.

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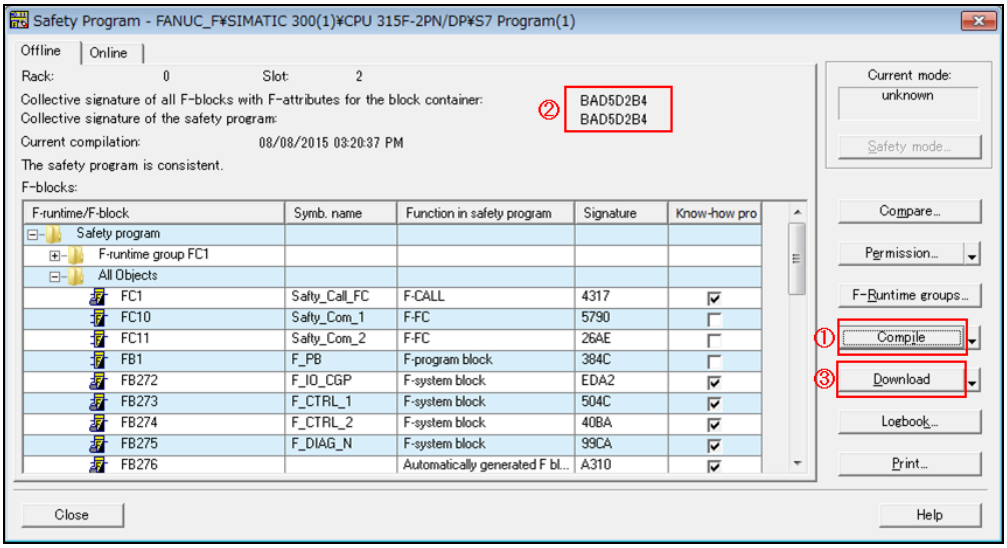


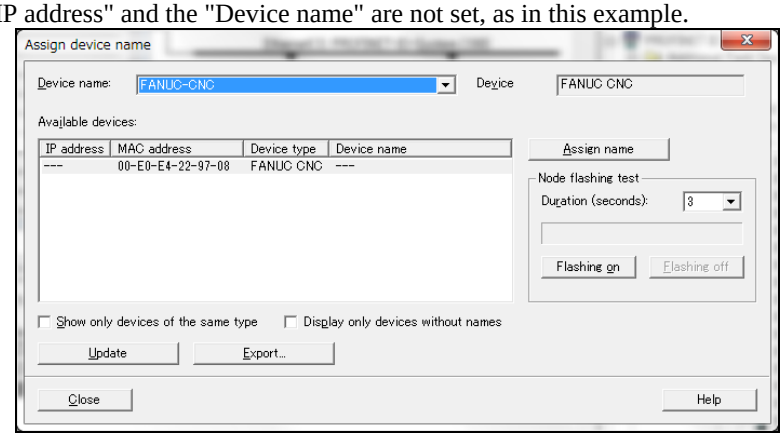
Transfer the safety program to the IO Controller according to the following procedures.

1. Compile the safety program, and confirm that the compilation ends normally.
2. Confirm that two "Collective signature" is the same values.
3. Transfer the safety program to the IO Controller.

The above steps are for the settings in the IO Controller, and the following steps are for the settings in the CNC.

6 In the CNC, set the safety parameter.
For details of the safety parameter, see Subsection C.3.2.1, "Safety parameter".

7 Select the menu [PLC] -> [Ethernet] -> [Assign Device Name] on the "HW Config" screen in order to display the "Assign device name" screen. When this screen is displayed, IO Devices on the network are automatically detected.
The following shows a screen example when "FANUC CNC" is detected. For a CNC shipped from the factory, the "IP address" and the "Device name" are not set, as in this example.



Check that the device name set in step 3-2 is selected in the list box "Device name" in the upper part of this screen, and then click the [Assign name] button. The device name and the IP parameters set in step 3-2 are automatically set in the CNC.

8 When CNC restarts, the other setting parameters are automatically set in the CNC. Then, turn the CNC off and back on.

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9 When the CNC restarts, the communication with the IO Controller starts.

C.3.2 Setting in the CNC

This subsection describes the setting in the CNC.

C.3.2.1 Safety parameter

To enter a safety parameter, use the parameter screen of the CNC.

NOTE

1 The safety parameters are protected by the safety parameter password (parameter No. 3225). The values of the safety parameters cannot be changed, except when the same value as the safety parameter password (parameter No. 3225) is set for the safety parameter keyword (parameter No. 3226).
For details of the safety parameter password (parameter No. 3225) and the safety parameter keyword (parameter No. 3226), see "Dual Check Safety CONNECTION MANUAL (B-64483EN-2)".
To prevent an unauthorized person from changing the safety parameters, the administrator of the safety parameters must set a value except 0 for the safety parameter password (parameter No. 3225).

2 The factory-set default values of the safety parameter are all 0.
The value of a changed safety parameter takes effect when you turn the power off and then back on.

The safety parameters are as follows.

	#7	#6	#5	#4	#3	#2	#1	#0
13771							CTA	PDS
13772							CTA	PDS

[Input type] Parameter input
[Data type] Bit

#0 PDS PROFINET IO Device Safety function is:
0: Disabled.
1: Enabled.

#1 CTA If the safety state occurs because a communication error attributable to the IO Controller is detected in safety communication:
0: The PW alarm is generated and the MCC signal (*DCALM) is set to "0".
1: The PW alarm is not generated and the MCC signal (*DCALM) is not set to "0".

NOTE

You need to set the same value in parameter Nos. 13771 and 13772. For example, when the bit 0 of parameter No. 13771 and the bit 0 of parameter No. 13772 are different, an error is detected in the safety parameter test executed at power-on, causing the safety state.

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13773	Safety communication start timer after power-on for the PROFINET IO Device Safety function

[Input type] Parameter input
[Data type] Word
[Unit of data] Second
[Valid data range] 0, 1 to 255
[Unit of data] The safety state occurs if safety communication is not established with the other-end device within the time specified in this parameter after the power is turned on.
When the timer is not used, set 0. In that case, the CNC continues to wait until it receives a safety communication connection request from the IO Controller.

NOTE
If an out-of-range value is specified, an error is detected in the safety parameter test executed at power-on, causing the safety state.

13774	Safety DI signal size for the PROFINET IO Device Safety function (CNC-CPU / ETH-CPU)

[Input type] Parameter input
[Data type] Word
[Unit of data] Byte
[Valid data range] 0, 4, 8
Specify the safety DI signal size.
When the safety DI signal is not used, set 0.
This parameter is common to the CNC-CPU side and ETH-CPU side.
It is necessary to match this parameter to the output size of the safety module set in the IO Supervisor.

NOTE
If an out-of-range value is specified, an error is detected in the safety parameter test executed at power-on, causing the safety state.

13775	Safety DO signal size for the PROFINET IO Device Safety function (CNC-CPU / ETH-CPU)

[Input type] Parameter input
[Data type] Word
[Unit of data] Byte
[Valid data range] 0, 4, 8
Specify the safety DO signal size.
When the safety DO signal is not used, set 0.
This parameter is common to the CNC-CPU side and ETH-CPU side.
It is necessary to match this parameter to the input size of the safety module set in the IO Supervisor.

NOTE
If an out-of-range value is specified, an error is detected in the safety parameter test executed at power-on, causing the safety state.

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13776	Safety DI signal address for the PROFINET IO Device Safety function (ETH-CPU)

[Input type] Parameter input
[Data type] 2-word

Specify the start address of the PMC area to store the safety DI signal received via the PROFINET IO Device Safety function on the ETH-CPU side.
Enter the PMC path number, the address type, and then the address number.
The PMC path number is expressed as a one-digit number, the address type is expressed as a two-digit number, and the address number is expressed as a six-digit number.
When the safety DI signal is not used, set 0.

PMC path number	Value
First PMC	1
Second PMC	2
Third PMC	3
Fourth PMC	4
Fifth PMC	5

Address type	Value
X address area	1
R address area	2
E address area	4

The setting examples of the parameter are shown below.

Set address	PMC path number	Address type	Address number	Value set in the parameter
Not used	----	----	----	0
X0040 of the first PMC	1	1	40	101000040
R0200 of the third PMC	3	2	200	302000200
E1000 of the fifth PMC	5	4	1000	504001000

NOTE

1 When the PMC area obtained by adding this parameter to the safety DI signal size (No.13774) is the out-of-range, an error is detected in the safety parameter test executed at power-on, causing the safety state.
2 To use the X address area, you also need to set parameter Nos. 11937 to 11939. For details, see Section 4.3, "PARAMETERS RELATED TO PMC" in Part II, "COMMON".
3 For Series 0*i*-F, the path of PMC is from the first PMC to the 3rd PMC.

13777	Safety DI signal address for the PROFINET IO Device Safety function (CNC-CPU)

[Input type] Parameter input
[Data type] 2-word

Specify the start address of the DCS-PMC area to store the safety DI signal received via the PROFINET IO Device Safety function on the CNC-CPU side.
Enter the address type and then the address number.
The address number is expressed as a six-digit number preceded by a zero-padded prefix.
If the safety DI signal is not used, set 0.

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Address type	Value
X address area	1
R address area	2

The setting examples of the parameter are shown below.

Set address	Address type	Address number	Value set in the parameter
Not used	----	----	0
X0040	1	40	1000040
R0200	2	200	2000200

NOTE

1 When the PMC area obtained by adding this parameter to the safety DI signal size (No.13774) is the out-of-range, an error is detected in the safety parameter test executed at power-on, causing the safety state.

2 To use the X address area, you also need to set parameter Nos. 11937 to 11939. For details, see Section 4.3, "PARAMETERS RELATED TO PMC" in Part II, "COMMON".

13778 **Safety DO signal address for the PROFINET IO Device Safety function (ETH-CPU)**

[Input type] Parameter input

[Data type] 2-word

Specify the start address of the PMC area to store the safety DO signal sent via the PROFINET IO Device Safety function on the ETH-CPU side.

Enter the PMC path number, the address type, and then the address number.

The PMC path number is expressed as a one-digit number, the address type is expressed as a two-digit number, and the address number is expressed as a six-digit number.

When the safety DO signal is not used, set 0.

PMC path number	Value
First PMC	1
Second PMC	2
Third PMC	3
Fourth PMC	4
Fifth PMC	5

Address type	Value
Y address area	1
R address area	2
E address area	4

The setting examples of the parameter are shown below.

Set address	PMC path number	Address type	Address number	Value set in the parameter
Not used	----	----	----	0
Y0040 of the first PMC	1	1	40	101000040
R0208 of the third PMC	3	2	208	302000208
E1008 of the fifth PMC	5	4	1008	504001008

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NOTE

1 When the PMC area obtained by adding this parameter to the safety DO signal size (No.13775) is the out-of-range, an error is detected in the safety parameter test executed at power-on, causing the safety state.
2 To use the Y address area, you also need to set parameter Nos. 11937 to 11939. For details, see Section 4.3, "PARAMETERS RELATED TO PMC" in Part II, "COMMON".
3 For Series 0*i*-F, the path of PMC is from the first PMC to the 3rd PMC.

13779 **Safety DO signal address for the PROFINET IO Device Safety function (CNC-CPU)**

[Input type] Parameter input
[Data type] 2-word

Specify the start address of the DCS PMC area to store the safety DO signal sent via the PROFINET IO Device Safety function on the CNC-CPU side. Enter the address type and then the address number.
The address number is expressed as a six-digit number preceded by a zero-padded prefix.
When the safety DO signal is not used, set 0.

Address type	Value
Y address area	1
R address area	2

The setting examples of the parameter are shown below.

Set address	Address type	Address number	Value set in the parameter
Not used	----	----	0
Y0040	1	40	1000040
R0208	2	208	2000208

NOTE

1 When the PMC area obtained by adding this parameter to the safety DO signal size (No.13775) is the out-of-range, an error is detected in the safety parameter test executed at power-on, causing the safety state.
2 To use the Y address area, you also need to set parameter Nos. 11937 to 11939. For details, see Section 4.3, "PARAMETERS RELATED TO PMC" in Part II, "COMMON".

13780 **DI/DO F-Address for the PROFINET IO Device Safety function**

[Input type] Parameter input
[Data type] 2-word
[Valid data range] 0, 1 to 65534
[Unit of data] Specify the address of the IO Device on the safety network.
When the safety DI/DO signal is not used, set 0.
This parameter must be unique on the safety network.
This parameter is common to the CNC-CPU side and ETH-CPU side.
It is necessary to match this parameter to "F_Dest_Add" set in the IO Supervisor.

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NOTE
If an out-of-range value is specified, an error is detected in the safety parameter test executed at power-on, causing the safety state.

13782	DO Cross-check timer for the PROFINET IO Device Safety function

[Input type] Parameter input
[Data type] Word
[Unit of data] msec
[Valid data range] 0 to 2000
[Unit of data] The CNC-CPU and the ETH-CPU mutually observe that the safety DO signal sent from the DCS-PMC area and the safety DO signal sent from the DCS-PMC are the same values.
When time that are not the same values exceed this timer value, causing the safety state.
When the timer value is 28 or less, 28 msec is applied.
This parameter is common to the CNC-CPU side and ETH-CPU side.

NOTE
If an out-of-range value is specified, an error is detected in the safety parameter test executed at power-on, causing the safety state.

C.4 MAINTENANCE

This section describes the maintenance of PROFINET IO Device Safety function.

C.4.1 Log Screen of the PROFINET IO Device Safety Function

A log related to the PROFINET IO Device Safety function is displayed.

NOTE
1 The log information for the PROFINET IO Device Safety function is stored in non-volatile memory and it is not lost when the CNC is turned off.
2 If an error cause cannot be found from the log information, output the maintenance information to the file and send it to FANUC according to the operation of this subsection. The log information and other maintenance information are stored in the output file.

Procedure

1 Press function key

.
2 Soft key [SAFETY COMM] appears. When the soft key does not appear, press the continue key.
3 Do one of the following:
- Path B: To display the log for the CNC-CPU, press soft key [PN DS CNC].
- Path A: To display the log for the ETH-CPU, press soft key [PN DS ETH].

The following example is when soft key [PN DS CNC] is pressed.

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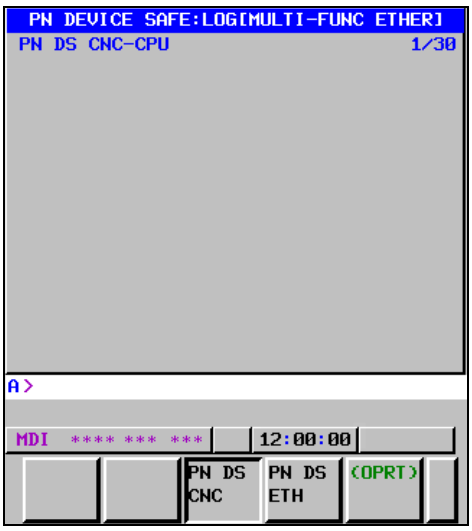


Log screen of the PROFINET IO Device Safety function

The latest log information is displayed at the top of the screen. At the right end of a log item, the occurrence date and time of the log item is indicated. Date and time data is indicated in the format "MMM.DD hh:mm:ss", where MMM represents a month, DD represents a day, hh represents hour, mm represents minute, and ss represents second.

Operation

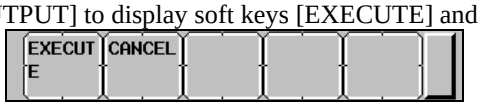
Output of the maintenance information

The maintenance information can be output to the file.
A memory card or USB memory can be used as the input/output device to which to output the maintenance information. Use parameter No.20 to select the input/output device. For details of this parameter, see Section 4.1, "PARAMETERS RELATED TO DATA INPUT/OUTPUT" in Part II, "COMMON".

> ⚠ **CAUTION**
> While an external input/output device such as the memory card or USB memory is being accessed, do not turn off the power of the CNC or remove the external input/output device. Doing so may damage the external input/output device.

1 Press soft key [(OPRT)] to display soft key [MAINTE OUTPUT].

2 Press soft key [MAINTE OUTPUT] to display soft keys [EXECUTE] and [CANCEL].



3 Enter the file name of the maintenance information in the key-in buffer and press soft key [EXECUTE]. The error information file is output. When no file name is specified, the default file name "PNDSAFE.MNT" is used.
"EXECUTING" blinks during execution.

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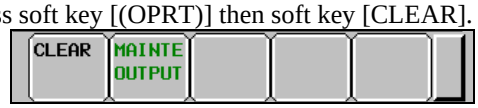
Clear of the log information

To clear the log information, press soft key [(OPRT)] then soft key [CLEAR].



Log information

The following lists major log message:

Error code	Log message	Meaning and action to be taken
E-170E	Other path is disabled	Other path is disabled. Confirm the followings. • The Software that supports the PROFINET IO Device Safety function must be installed. • The parameters Nos. 970 to 976 must be set correctly.
E-170F	Two or more safety functions cannot be executed	Two or more safety functions cannot be executed at the same time. Adjust the enabled safety function to one. The meaning of the value in brackets is as follows. 1: The Safety function by FL-net is is enabled. 2: The EtherNet/IP Adapter Safety function is enabled.
E-1721	CPU test error is detected	A CPU error occurred at power-on. Contact us.
E-1722	RAM area test error is detected	The memory read/write operation failed at power-on. Contact us.
E-1723	Safety parameter test error is detected	The setting of the safety parameter is incorrect. See Subsection C.3.2.1, "Safety parameter", and set the correct value. The value in brackets shows the logical sum of the bits corresponding to the incorrect safety parameter. Bit 0 : Nos. 13771, 13772 Bit 1 : No. 13777 Bit 2 : No. 13776 Bit 3 : No. 13774 Bit 4 : No. 13779 Bit 5 : No. 13778 Bit 6 : No. 13775 Bit 7 : No. 13773 Bit 8 : No. 13780 Bit 9 : No. 13782
E-1724	Safety parameter test error is detected	Damage to the safety parameter that is used in the safety software was detected at power-on. Contact us.
E-172A	Critical error is detected	An unrecoverable error was detected in the safety software at power-on. Contact us.
E-1740	Safety Software Code Test error is detected	Damage to the safety software code was detected during operation. Contact us.
E-1741	CPU Test error is detected	A CPU error was detected during operation. Contact us.
E-1742	RAM Area Test error is detected	A memory read/write error was detected during operation. Contact us.

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Error code	Log message	Meaning and action to be taken
E-1743	Safety Parameter Test error is detected	Damage to the safety parameter that is used in the safety software was detected during operation Contact us.
E-1744	F-Parameter is wrong	F-Parameter is wrong. Confirm the followings. • "F_Dest_Add" set in the IO Supervisor must be equal the parameter No.13780. • The input size of the safety module set in the IO Supervisor must be equal to the parameter No.13775. • The output size of the safety module set in the IO Supervisor must be equal to the parameter No.13774.
E-1745	Safety DI Data Test error is detected	Perhaps, there is an error in receive data from the IO Controller or the IO Controller has detected the error. Confirm the maintenance information on IO Controller side.
E-1746	Safety DI Cross-check error is detected	The value of the safety DI signal that is allocated to the PMC area has been different from that allocated to the DCS-PMC area longer than the fixed time. Confirm that other functions except the PROFINET IO Device Safety function are not rewrite the values of the safety DI signal.
E-1748	Safety DO Cross-check error is detected	The value of the safety DO signal that is allocated to the PMC area has been different from that allocated to the DCS-PMC area longer than the fixed time. Confirm the followings. • Confirm that other functions except the PROFINET IO Device Safety function are not rewrite the values of the safety DO signal. • When the ladder programs rewrite the safety DO signal of the PMC area and the DCS-PMC, confirm that the ladder programs are made to update the same value in the time set by the parameter No.13782.
E-1749	Watch dog error is detected	The other path stopped operating. Contact us.
E-174A	Critical error is detected	An unrecoverable error was detected in the safety software during operation. Contact us.
E-174D	Communication startup timeout error is detected	The safety communication did not start when the time set to parameter No. 13773 passed. Confirm the connection with the IO Controller.
E-174E	Communication is disconnected	The safety communication has been disconnected, because a timeout occurs in the safety communication with the IO Controller.

The following log messages do not indicate errors.

Error code	Log message	Meaning and action to be taken
E-1701	Safety function is started	The safety function is started.
E-1702	Safety communication is started	The safety communication is started.

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Error code	Log message	Meaning and action to be taken
E-1703	Safety communication is starting	The safety communication is starting. If the safety communication is not starting after this log message is displayed, confirm the followings. • Confirm the processing for the safety program of the IO Controller to start the safety communication. • Confirm "F_WD_Time" are larger than the calculation value by "Calculating the minimum value of F_WD_Time" of Subsection C.3.1.1, "F-Parameter".

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FANUC Series 30*i*/31*i*/32*i*/35*i*–MODEL B,
FANUC Power Motion *i*–MODEL A, FANUC Series 0*i*-MODEL F
Industrial Ethernet CONNECTION MANUAL

1. Type of applied technical documents

Name	FANUC Series 30*i*–MODEL B FANUC Series 31*i*–MODEL B FANUC Series 32*i*–MODEL B FANUC Series 35*i*–MODEL B FANUC Power Motion *i*–MODEL A FANUC Series 0*i*–MODEL F Industrial Ethernet CONNECTION MANUAL
Spec.No./Version	B-64013EN/03

2. Summary of change

Group	Name / Outline	New, Add, Correct, Delete	Applicable Date
Basic Function			
Optional Function	- PROFINET Configuration Tool of FANUC is available. - The notes concerning the EtherNet/IP Adapter Safety function and the PROFINET IO Device Safety function are added.	Add	Immediately
Unit			
Maintenance parts			
Notice			
Correction			
Another			

Edit	Date	Design	Description
Date	2015.12.11	Design A.Hiramatsu	Apprv.

Title	FANUC Series 30*i*/31*i*/32*i*/35*i*-MODEL B, Power Motion *i*-MODEL A, FANUC Series 0*i*-MODEL F Industrial Ethernet CONNECTION MANUAL
Draw No.	B-64013EN/03-2
FANUC CORPORATION	Sheet 1/60

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The relation Industrial Ethernet CONNECTION MANUAL (B-64013EN/03) and between this manual

1. Replace Chapter 4, "PROFINET IO CONTROLLER FUNCTION" in Part III, "FUNCTION" of B-64013JA/03 with Chapter 4, "PROFINET IO CONTROLLER FUNCTION" of this manual.

2. Replace the NOTE of "Specifications for the EtherNet/IP Adapter Safety function" of Subsection B.2.1, "List of Specifications" in Part, "APPENDIX" of B-64013EN/03 with the following NOTE.

NOTE

1 As the RPI, specify a value equal to or larger than 32 that can be divided by 4. A value that cannot be divided by 4 cannot be used for communication.

2 Of the I/O Link, I/O Link *i*, and the communication function, only one of them can be assigned to the X/Y area of the DCS-PMC.
The communication function mentioned here is the PROFIBUS-DP master function, the EtherNet/IP Adaptor Safety function or PROFINET IO Device Safety function.
If I/O Link or I/O Link *i* is assigned to the X/Y area of DCS-PMC, use the R area of DCS-PMC for EtherNet/IP Adaptor Safety function.

3. Replace the NOTE of Subsection C.2.1, "List of Specifications" of B-64013EN/03-1 with the following NOTE.

NOTE

1 For Note, see "Note" of Subsection 5.2.1, "List of Specifications" in Part III, "FUNCTION".

2 Of the I/O Link, I/O Link *i*, and the communication function, only one of them can be assigned to the X/Y area of the DCS-PMC.
The communication function mentioned here is the PROFIBUS-DP master function, the EtherNet/IP Adaptor Safety function or PROFINET IO Device Safety function.
If I/O Link or I/O Link *i* is assigned to the X/Y area of DCS-PMC, use the R area of DCS-PMC for PROFIENT IO Device Safety function.

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4 PROFINET IO CONTROLLER FUNCTION

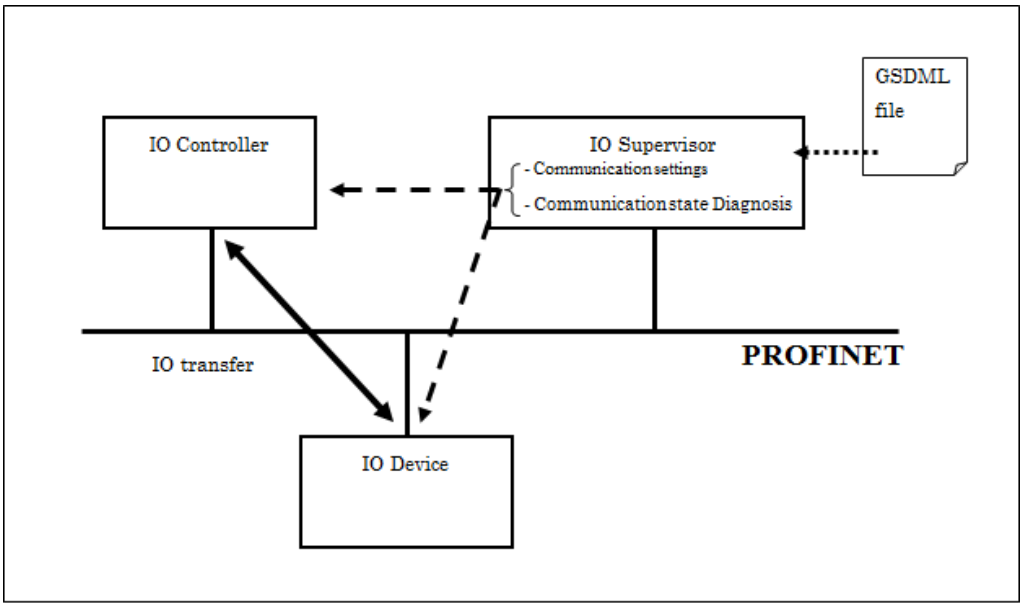
NOTE
If using the PROFINET IO Controller function, be sure to read Part II, "COMMON".

4.1 OVERVIEW

This section provides an overview of the PROFINET function.

4.1.1 Introduction

PROFINET is an industrial network using Ethernet. It enables IO communication between IO Controller and IO Device. The communication standard is managed by PI (PROFIBUS & PROFINET International).



Overview of PROFINET

4.1.2 Terminology

Terms related to the PROFINET function are described below.

IO Controller
This is a device that starts IO transfer.
In PROFIBUS, it is equivalent to a class 1 master function.

IO Device
This device communicates with an IO Controller.
In PROFIBUS, it is equivalent to a slave function.

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IO Supervisor

In general, this is an instrument such as a PC (personal computer) and an HMI (human machine interface).
It is used to make the communication settings for and diagnose a PROFINET system, and is usually supplied from an IO Controller device manufacturer.
In PROFIBUS, it is equivalent to a class 2 master function.

NOTE

1 To use the IO Controller function for a FANUC CNC, the IO Supervisor of FANUC is required.
The IO Supervisor of FANUC is PROFINET Configuration Tool included in CNC Setting tool.
The product name and order number of PROFINET Configuration Tool are as follows.

No.	Product name	Order number	Version
1	FANUC CNC Setting Tool	A08B-9510-J540	Version 2.0 or later
2	FANUC CNC Setting Tool (10 users)	A08B-9510-J541	
3	FANUC CNC Setting Tool (20 users)	A08B-9510-J542	
4	FANUC CNC Setting Tool (Site license)	A08B-9510-J543	

2 PROFINET Configuration Tool cannot be newly installed for the Update version "FANUC CNC Setting Tool (Update)" (Order number: A08B-9510-J544). When you update PROFINET Configuration Tool by the Update version, use the serial number enclosed with No.1-4. Because the serial number of PROFINET Configuration Tool is not enclosed with the Update version.
3 The PROFINET Configuration Tool is written as "Setting tool".
For details, see Subsection 4.6.1, "PROFINET Configuration Tool".

GSDML (General Station Description Makeup Language) file

This is a file in XML form in that contains device information about an IO Device.
A GSDML file is necessary for making settings with an IO Supervisor.

NOTE

For how to get the GSDML file for each IO Device, contact the manufacturer of that IO Device.
If using the PROFINET IO Device function for a FANUC CNC, contact your sales representative for how to get the GSDML file.

Slot
Module

These are terminology used when a hardware configuration of the IO device is shown.
For the general PROFINET IO Device, the hardware that is called a module is mounted on the slot, and IO communication is executed.
The slot is a place to mount the module, and is usually allocated with the slot number of the 0-origin.
The module is various as follows.

- A communication module that supports the communication function
- A input/output module to input and output the DI/DO signal
- A safety module that supports the safety communication function

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For a FANUC CNC, neither a physical slot nor a module exists, and the following logical slots and modules are defined.

Slot	Module	Description
0	Communication module	It is the hardware option of a FANUC CNC. In the IO Supervisor, the specific information of the communication module is displayed. Moreover, the settings for the standard module of a FANUC CNC (CNC-specific parameter settings such as PMC allocation) are done from the setting screen of this module.
1	Input module (Standard module)	It is the input/output module to input and output the DI/DO signal of a FANUC CNC. In the setting by the IO supervisor, select the input/output module according to input/output size used. The input/output module for a FANUC CNC is assigned to the PMC area.
2	Output module (Standard module)	
3	Safety module	It is the input/output module that supports the safety communication function of a FANUC CNC. In the setting by the IO supervisor, select the safety module according to input/output size used. The safety module of a FANUC CNC is assigned to the PMC area.

NOTE

The safety module is used by the PROFINET IO Device safety function. For details, see the Chapter C, "PROFINET IO DEVICE SAFETY FUNCTION" in APPENDIX.

Input/output update time

This time is the interval when the input/output frame is transmitted or received in IO transfer.
This time is set by the IO Supervisor.

NOTE

"Input/output update time" is called by the IO Supervisor as follows.

- Setting tool of a FANUC CNC : Refresh Period
- STEP7 of Siemens AG : Update Time

I&M (Identification and Maintenance) data

This data is used to identify and maintain an IO Device.
An IO Supervisor and an IO Controller can get this data from an IO Device by way of communication.

IP parameters

The IP address, the subnet mask, and the router IP address are collectively called IP parameters.

CHANGE MODE

This mode allows the changing of the PROFINET parameters of the CNC.

PROTECT MODE

This mode protects (prohibits) the changing of the PROFINET parameters of the CNC.

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4.2 SPECIFICATIONS

This section describes the specifications of the PROFINET IO Controller function of the CNC.

4.2.1 Specification List

The following is a list of specifications of the PROFINET IO Controller function of the CNC.

Item	Description
PROFINET IO Conformance class	CC-A
Required software	PROFINET function software - For the Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A : 658R series - For the Series 0*i*-F : 658U series
Required software option	PROFINET IO Controller function option (R971)
Combination with other functions	Functions that can be used at the same time on different hardware options - Ethernet function (S707) - Modbus/TCP Server function (R968) - Data Server function (S737) - FL-net function (J962) - EtherNet/IP Scanner function (R966) - EtherNet/IP Adapter function (R967) - PROFINET IO Device function (R972) Functions that can be used at the same time on the same hardware option are not provided.
PMC area that can be allocated	- DI : R, E, D, and X areas - DO : R, E, D, and Y areas - Status : R and E areas
Maximum number of IO Devices that can be connected	48 Depending on the number of modules per IO Device and other factors, it may not be possible to connect up to 48 Devices.
Maximum DI/DO data size per IO Device	1024 bytes /1024 bytes
Maximum total size of DI/DO data of all IO Devices	12288 bytes /12288 bytes
DI/DO update time	2 ms or greater 2 ms is the minimum value that applies when the number of connected IO Devices and the DI/DO size are small. For details, see Section 4.5, "UPDATING DI/DO DATA".
Response when an alarm is received from an IO Device	Automatic operation
UDP port number	34962 to 34964 (fixed)

NOTE

1 A FANUC CNC does not support SNMP (Simple Network Management Protocol), and cannot make diagnosis of a CNC network using SNMP.

2 If the PROFINET IO Controller function is used, communication via a router and the DHCP/DNS function cannot be used.

4.2.2 Unit of Data and Concurrency of Data

The unit of I/O data can be word (2 bytes) only.

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The concurrency of word (2-byte) data is guaranteed, and there will never be data segmentation. The concurrency of long (4-byte) data cannot be guaranteed.

NOTE

"Unit of Data", as used here, is equivalent to the "Data type" of a module to configure in an IO Device. Check the data type of each module with the IO Device manufacturer.

⚠ WARNING

The data types of modules that are supported by the PROFINET IO Controller function of the CNC are byte, word (two bytes), and long (four bytes). For modules whose data type is long (four bytes) and for modules whose data type is byte and whose data size is larger than a word (two bytes), data segmentation may occur.
For an explanation of notes on creating a ladder program for guaranteeing the concurrency of data, see Subsection 3.1.2, "Creating a Ladder Program" in Part II, "COMMON".
Data segmentation may result in the machine behaving unexpectedly, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.

4.2.3 Conversion of Endian

The signal order of I/O data can be selected from the big-endian and the little-endian.
(Default setting: Big-endian)
For how to set the conversion of endian, see "Setting of endian conversion" in Subsection 4.6.1.7, "Setting of IO Devices".

⚠ WARNING

Before starting operation, make sure that an appropriate value is specified for the setting item for selecting the conversion of endian and data is exchanged in the correct order.
If operation is started without checking the above, the machine may behave unexpectedly, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.

NOTE

The actual signal order depends on the data type (byte, word, or long) of the module to configure in the IO Device and the specifications of the IO Device. Check the specifications of each IO Device with the manufacturer of that IO Device.

For the actual signal order due to the endian conversion, the relation between "On the Ethernet line" and the PMC area of the CNC is as follows.

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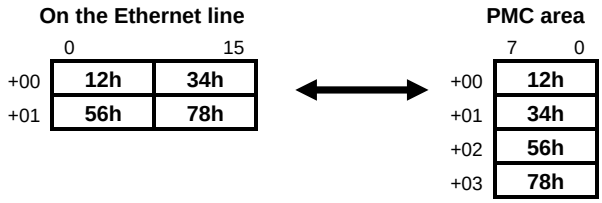
If the data type of the module is byte

If the big-endian is selected

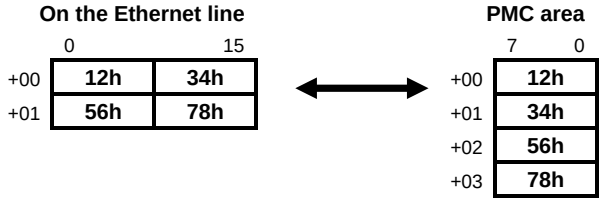


If the little-endian is selected

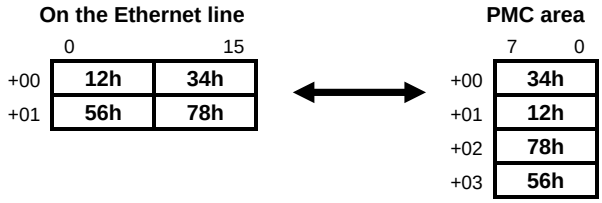
The relation is the same as that when the big-endian is selected.

If the data type of the module is word

If the big-endian is selected

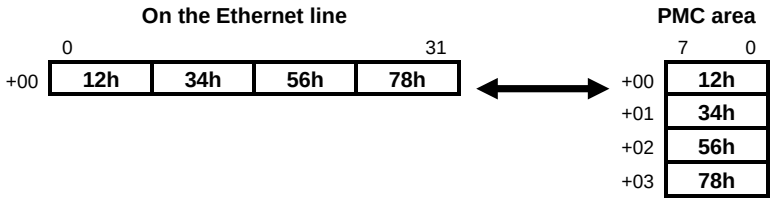


If the little-endian is selected

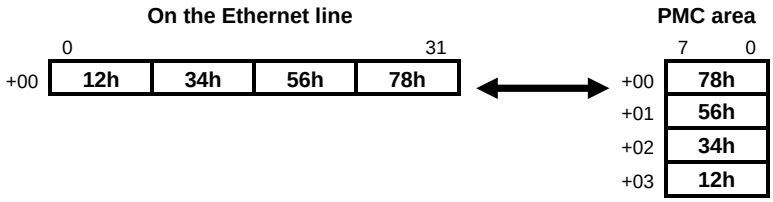


If the data type of the module is long

If the big-endian is selected



If the little-endian is selected



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4.2.4 Setting Examples If Using Multiple Communication Functions at the Same Time

This subsection provides examples of setting parameters Nos. 970 to 976 if using multiple communication functions, in addition to the PROFINET IO Controller function.
For details of how to set parameters Nos. 970 to 976, see Chapter 2, "HARDWARE OPTIONS AND COMMUNICTION FUNCTIONS" in Part II, "COMMON".

Ex.	Function to use	Hardware option on which to operate it	NC parameter
1	PROFINET IO Controller function	Multi-function Ethernet	No.970= 3 No.974= 1 No.971= -1 No.975= -1 No.972= -1 No.976= -1 No.973= 4
	Ethernet function Data Server function	Fast Ethernet board mounted in slot 1	
	PROFINET IO Device function	Fast Ethernet board mounted in slot 2	
2	PROFINET IO Controller function	Multi-function Ethernet	No.970= 3 No.974= 1 No.971= 4 No.975= -1 No.972= -1 No.976= -1 No.973= 3
	Ethernet function PROFINET IO Device function	Fast Ethernet board mounted in slot 1	
	FL-net function	Fast Ethernet board mounted in slot 2	

4.3 SETTING

This section describes the setting of the PROFINET IO Controller function.

NOTE

1. To make the settings of the PROFINET IO Controller function, either set the CNC to the emergency stop state or change the CNC mode to the MDI mode, and change the setting item "MODE" on the setting screen of the PROFINET IO Controller to "CHANGE MODE".
2. To prevent the settings from being changed unintentionally, change the setting item "MODE" on the CNC screen to "PROTECT MODE" after completing settings.
   For details of the setting item "MODE", see Subsection 4.3.2.2, "Setting screen of the PROFINET IO Controller function".
3. To make the settings of the PROFINET IO Controller function of CNC, use the Setting tool of FANUC. For details of the Setting tool, see Subsection 4.6.1, "PROFINET Configuration Tool".

4.3.1 Procedure for Making Settings

This subsection describes the procedure for making settings.

4.3.1.1 Making new settings

This subsection describes the procedure of making new settings.

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NOTE

When the Setting tool and CNC are made online, step 1 is necessary work. When Step 1 is not done, and when the Setting tool and CNC is in offline, the work that can be set is step 2, 3, 5, and 6. Step 1, 4, and 7 can be done after step 2, 3, 5, and 6.

Step	Description
1	• Setting of the IP parameters for the CNC In the CNC, set the IP parameters and restart the CNC. → See Subsection 4.3.2.1, "COMMON screen".
2	• Registration of the CNC in the Setting tool In the Setting tool, register the CNC. → See Subsection 4.6.1.3, "Registration of the CNC in the Setting tool".
3	• Installation of the GSDML file In the Setting tool, install the GSDML file of each IO Device. → See Subsection 4.6.1.4, "Installation of the GSDML file".
4	• Confirmation of IO Devices on the network In the Setting tool, confirm the IO Devices connected on the network. → See Subsection 4.6.1.5, "Confirmation of IO Devices on the network". If device names are not set for any of the connected IO Devices, set the device names. → See Subsection 4.6.1.6, "Setting of the device names for IO Devices".
5	• Setting of IO Devices In the Setting tool, make the settings for operating IO Devices. The device names to set here must match the ones that are set in step 4. → See Subsection 4.6.1.7, "Setting of IO Devices".
6	• Allocation of the PMC area In the Setting tool, allocate the PMC area for DI/DO data and status data. → See Subsections 4.6.1.8, "Setting and Checking of PMC Allocation" and 4.3.3, "PMC Allocation".
7	• Downloading of the settings In the Setting tool, download all the settings to the CNC. → See Subsection 4.6.1.9, "Downloading of settings".

After the above settings are made, restarting the CNC causes communication to start with each IO Device.

4.3.1.2 Changing the settings of IO Devices

Start with step 5, "Setting of IO Devices", in Subsection 4.3.1.1, "Making new settings".

4.3.1.3 Adding new IO Devices

Start with step 3, "Installation of the GSDML file", in Subsection 4.3.1.1, "Making new settings".
If the GSDML file of the IO Device to add has already been installed, start with step 4, "Confirmation of IO Devices on the network".

4.3.1.4 If the Ethernet parameters of the CNC are changed

The Ethernet parameters of the CNC are changed in either of the following cases:

- You change the IP parameters on the COMMON screen of CNC
- You change the hardware option of the CNC, so that its MAC address is changed

In either case, perform step 2, "Registration of the CNC in the Setting tool", in Subsection 4.3.1.1, "Making new settings", first and then perform step 7, "Downloading of the settings".

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Perform other steps, if necessary.

4.3.2 Setting Screen of the CNC

This subsection describes the setting screen of the CNC.

Procedure

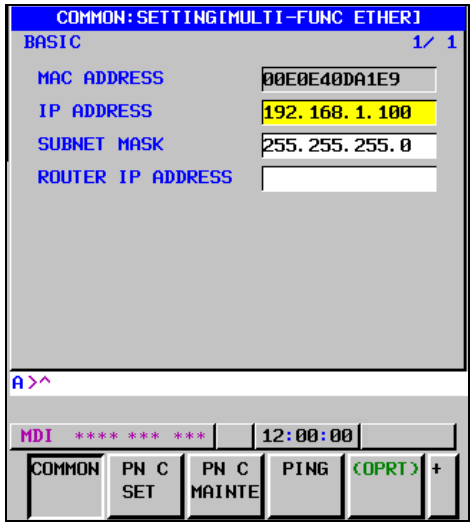
1 Press function key SYSTEM.

2 Soft key [PRFNET CNTRLR] appears. When soft key does not appear, press the continue key.

3 Press soft key [PRFNET CNTRLR]. Soft keys [COMMON], [PN C SET], [PN C MAINTE], [PING], "COM STATE", and "TASK STATE" appear.

4.3.2.1 COMMON screen

In the above-mentioned procedure, press soft key [COMMON] to display the COMMON screen (BASIC). On this screen, IP parameters can be set.



COMMON screen (BASIC)

Setting items

Item	Description
IP ADDRESS	IP address of the hardware option. (Example of specification format: "192.168.0.100")
SUBNET MASK	Mask address for the IP addresses of the network. (Example of specification format: "255.255.255.0")
ROUTER IP ADDRESS	IP address of the router. Leave the item blank because PROFINET communication via a router is not supported.

Display item

Item	Description
MAC address	MAC address of the hardware option

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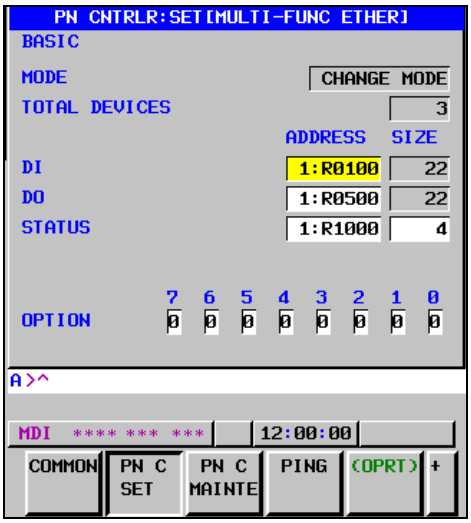
4.3.2.2 Setting screen of the PROFINET IO Controller function

In the above-mentioned procedure, press soft key [PN C SET] to display the setting screen (basic screen) of the PROFINET IO Controller function.

> **NOTE**
> The setting items other than the setting item "MODE" on the setting screen (basic screen) of the PROFINET IO Controller function can be set by the Setting tool.



Setting screen of the PROFINET IO Controller function (BASIC)

Display item

The following display items are decided by the setting with the Setting tool.

Item	Description
TOTAL DEVICES	Number of IO Devices to connect.
DI/DO SIZE	Size of the area in which to store the DI/DO data of all IO Devices.

Setting items

Item	Description
MODE	Select the mode of the PROFINET IO Device function. - "CHANGE MODE" In this mode, settings can be changed from the Setting tool or the setting screen of the PROFINET IO Controller function. - "PROTECT MODE" In this mode, settings can not be changed from the Setting tool or the setting screen of the PROFINET IO Controller function.
DI/DO ADDRESS	Specify the top address of the PMC area in which to store the DI/DO data of all IO Devices. The specifiable PMC area is the R, E, D, X (DI only), or Y (DO only) area. Only a PMC address that is a multiple of 4 can be specified. For an explanation of the allocation of DI/DO data to the PMC, see Subsection 4.3.3.1, "DI/DO". If the X/Y address of the PMC is to be assigned, it is necessary to set parameters Nos. 11937 to 11939 also. For details of these NC parameters, see Section 4.3, "PARAMETERS RELATED TO PMC" in Part II, "COMMON".

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Item	Description
STATUS ADDRESS	Specify the top address of the PMC area in which to store the status. The specifiable PMC area is the R or E area. For details of the notified status, see Subsection 4.3.3.2, "Status".–
STATUS SIZE	Specify the size of the PMC area for storing the status. Setting range: 0 to 49 (byte). The status of the specified size is notified. For details of the notified status, see Subsection 4.3.3.2, "Status".
OPTION	Bit 0: The next time the power is turned on, all settings of the PROFINET IO Controller function are 0: Not initialized. 1: Initialized. Bit 1: Specify the action to take on the data in the DI area of the IO Device when the communication is disconnected. 0: Clear the DI area to zero. 1: Hold the data in the DI area. "When the communication is disconnected" above is when any of the status signals (+0 to +48) in Subsection 4.3.3.2, "Status", changes. The action taken if the bit is set to 0 (Clear the DI area to zero) is as follows. Bit 2-7: Reserved (Must be 0)

Signal	Change	Description
SF	0→1	The DI areas of all IO Devices are cleared to zero.
CONxx	1→0	Only the DI area of IO Device xx is cleared to zero.
RAPxx	1→0	
IOxx	1→0	

⚠ **WARNING**

1 Before allocating the PMC area, be sure to read Section 3.1, "DI/DO DATA AND STATUS DATA" in Part II, "COMMON".

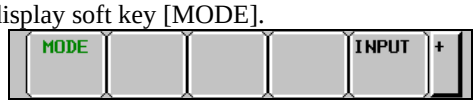
2 When the communication is disconnected, the DI area depends on the setting of bit 1 of "OPTION". When the communication is connected again, the data sent from the IO Device is reflected in the DI area of the IO Device. This means that if zero data is sent from the IO Device immediately after the communication is connected again, the DI area of the IO Device is cleared to zero.

Operation

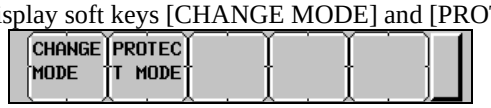
Changing the setting for MODE

The setting for MODE can be changed.

1 Press soft key [(OPRT)] to display soft key [MODE].



2 Press soft key [MODE] to display soft keys [CHANGE MODE] and [PROTECT MODE].



3 Press the soft key of the desired mode.

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4.3.3 PMC Allocation

This subsection describes the allocation of DI/DO data and the status to the PMC.

4.3.3.1 DI/DO

This subsection describes the allocation of DI/DO data to the PMC.

Allocation rules

DI/DO data is allocated per each module configured with the Setting tool, with data items being moved forward in ascending order of IO Device numbers to fill spaces, if necessary.
The top address of each module is always a 2-byte boundary, regardless of the data type or the data size.
Top address examples) 1:R0000, 2:R0002, 3:R0004, 1:E0002

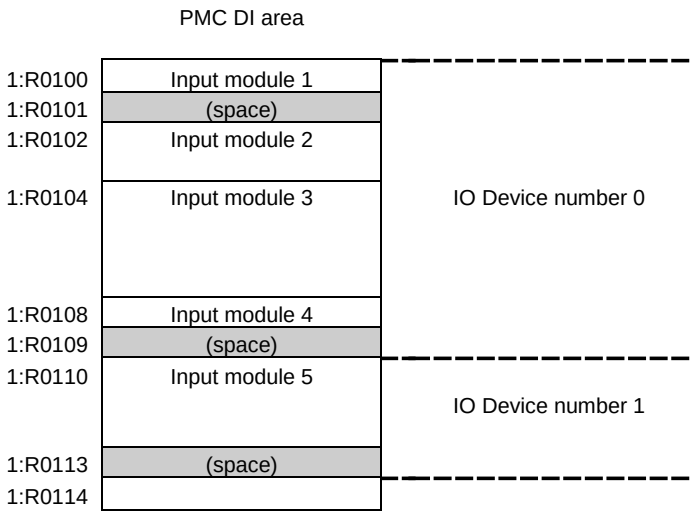
The following shows a DI area example for a case in which two IO Devices are used and input modules of various data types are set.

Input modules configured with the Setting tool)

IO Device		Module name	Data type	Data size
"Number"	IO Device number			
001	0	Input module 1	Byte	1 byte
		Input module 2	Word	2 bytes
		Input module 3	Long	4 bytes
		Input module 4	Byte	1 byte
010	1	Input module 5	Byte	3 bytes

"DI ADDRESS" on the setting screen of the PROFINET IO Controller function)
1:R0100

Results of allocation)



The allocation of the DO area where output modules are configured is the same as that shown above.

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⚠ **CAUTION**

1 If the size of a module is an odd number, a 1-byte space is inserted. This space is treated as follows.
DI : Zero data is entered in a 1-byte space.
DO : Even if data is set in a 1-byte space, it is not output to the IO Device.

2 If a module whose data type is long is allocated to a 2-byte boundary of PMC addresses, data segmentation may occur. To prevent data segmentation from occurring on this module, it is necessary to allocate it to a 4-byte boundary of PMC addresses.
If you want to prevent data segmentation on a module whose data type is long, insert a module whose data byte is byte or word into a sequence of modules and make adjustments so that this module is allocated to a 4-byte boundary.

Calculating the DI/DO addresses of each module if using the Setting tool

The following describes how to calculate the DI/DO addresses of each module if using the Setting tool.

NOTE

The calculation value can be checked by the Setting tool. For checking, see "Checking of PMC Allocation" in Subsection 4.6.1.8, "Setting and Checking of PMC Allocation".

DI or DO addresses of each module = X + (Y × 2)
X: In the Setting tool, DI/DO address of "FANUC Parameters" tab of the "TCP/IP" screen
Y: In the Setting tool, the value of "Offset in Word in the Shared Memory" in "Position" of each module of the "Profinet Channel" screen

Calculation example)

The following is an example of calculating the DI address of the input module "INPUT 003 bytes" implemented in slot 001 of the IO Device "fanuc-cnc" ("Number" = 010 and IO Device number = 1) of two IO Devices.

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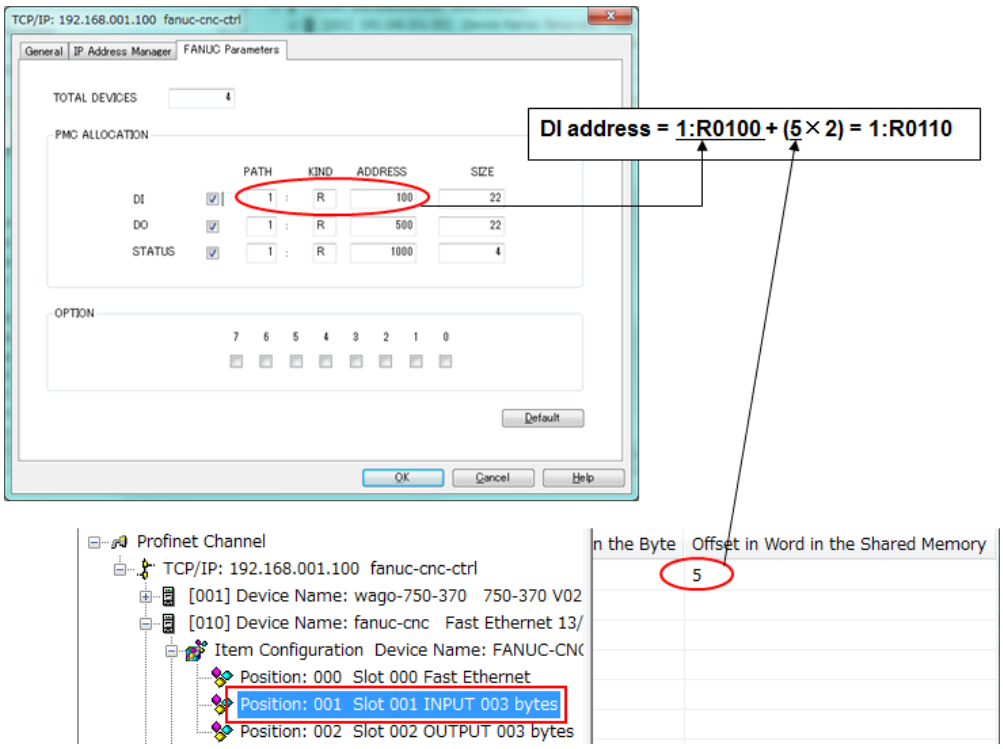

4.3.3.2 Status

This subsection describes the allocation of the status to the PMC.

		Status							
		#7	#6	#5	#4	#3	#2	#1	#0
Address	+0	SW		–	–	–	–	BF	SF
	+1	–	–	–	–	–	IO00	RAP00	CON00
	...	...							
	+48	–	–	–	–	–	IO47	RAP47	CON47

Status (+0)

This is the status of the entire PROFINET IO Controller function.

Bit	Name	Description
#0	SF	System error 0: The PROFINET IO Controller function operates normally. 1: An unrecoverable fault occurs in the PROFINET IO Controller function.
#1	BF	Bus fault 0: Communication with all IO Devices has been established. 1: One or more IO Devices exist with which communication has not been established.
#2-6	–	Reserved (zero is notified)
#7	SW	System wake up 0: The system of the PROFINET IO Controller function has not started. 1: The system of the PROFINET IO Controller function has started. The other status bits become effective after SW is changed to 1.

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Status (+1 to +48)

This is the status of each IO Device.
In the following description, "xx" (= 0 to 47) means an IO Device number.

Bit	Name	Description
#0	CONxx	Connection with the IO Device 0: The IO Device is not connected. 1: The IO Device is connected.
#1	RAPxx	Application ready signal from the IO Device 0: The application ready signal is not notified from the IO Device. 1: The application ready signal is notified from the IO Device. This signal becomes 0 if the communication with the corresponding IO Device is disconnected.
#2	IOxx	DI/DO communication 0: The CNC is not communicating with the IO Device about DI/DO data. 1: The CNC is communicating with the IO Device about DI/DO data. It is checked that those of the following status bits in the PROFINET standard that meet the DI/DO size conditions of each IO Device are 1, and IOxx is set to 1.

DI/DO size conditions	Status bits to check
DI size > 0 and DO size > 0	• Bits 2, 4, and 5 of the APDU status • Bit 7 of the IOPS status • Bit 7 of the IOCS status
DI size > 0 and DO size = 0	• Bits 2, 4, and 5 of the APDU status • Bit 7 of the IOPS status
DI size = 0 and DO size > 0	• Bits 2, 4, and 5 of the APDU status • Bit 7 of the IOCS status

The meaning of each status bit is as follows.

Status	Description
Bit 2 of the APDU status	This bit indicates that the data of the input frame is effective.
Bit 4 of the APDU status	This bit indicates that the control application of the IO Device is in the "RUN" state.
Bit 5 of the APDU status	This bit indicates that the IO Device is in normal operation.
Bit 7 of the IOPS status	This bit indicates that the data of the input module is effective. If multiple input modules are connected, there is IOPS for each input module, and IOxx becomes 1 only if the data of all input modules is effective.
Bit 7 of the IOCS status	This bit indicates that the data of the output module was correctly processed on the IO Device. If multiple output modules are connected, there is IOCS for each output module, and IOxx becomes 1 only if the data of all output modules was correctly processed.

For details of the status in the PROFINET standard, see Subsection 4.6.2.3, "Status".

#3-7	–	Reserved (zero is notified)

4.4 MAINTENANCE

This section describes the maintenance of the PROFINET IO Controller function.

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4.4.1 Maintenance Screen of the PROFINET IO Controller Function

The maintenance information about the PROFINET IO Controller function can be checked.

> **NOTE**
> The maintenance screen includes the PING screen, communication state screen, and task state screen common to the communication functions.
> For details of these screens, see Chapter 2, "SOFTWARE MAINTENANCE INFORMATION" in Part V, "MAINTENANCE".

Procedure

1. Press function key SYSTEM.
2. Soft key [PRFNET CNTRLR] appears. When the soft key does not appear, press the continue key.
3. Press soft key [PRFNETCNTRLR]. Soft keys [COMMON], [PN C SET], [PN C MAINTE], [PING], [COM STATE], and [TASK STATE] appear.
4. Press soft key [PN C MAINTE] to display the maintenance screen of the PROFINET IO Controller function.

Composition of the screen

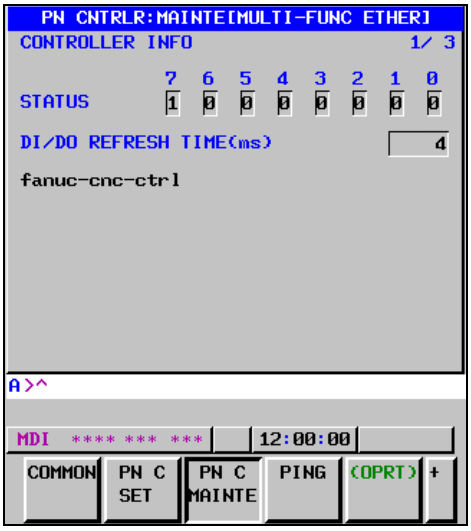
The composition of the maintenance screen of the PROFINET IO Controller function is as follows.

- CONTROLLER INFO screen
- DEVICE INFO screen (2 pages)

It is possible to switch between the pages by using the page keys PAGE ↑ PAGE ↓.

CONTROLLER INFO screen

The first page is the CONTROLLER INFO screen.



Maintenance screen of the PROFINET IO Controller function (CONTROLLER INFO)

Display items

Display item	Description
STATUS	This is the status of the IO Controller function.

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Display item	Description
	The contents are the same as those of status (+0) in Subsection 4.3.3.2 "Status".
DI/DO REFRESH TIME	This indicates the interval at which to refresh the DI/DO data allocated to the PMC area of all IO Devices. The unit is the millisecond. If the DI/DO size is small, this time will be equal to the minimum value of "Refresh Period" in all IO Devices that is set with the Setting tool. For details, see Section 4.5, "UPDATING DI/DO DATA".
(Details)	Detailed information is displayed by performing an information getting operation. For an explanation of the information getting operation, see "Operation" below.

Operation

Getting the detailed information about the IO Controller

1 Press soft key [(OPRT)] to display soft key [GET INFO].

2 Input any of the following first and then press soft key [GET INFO].

Input value	Display item	Description
None or a value other than those below	Device name	The device name of the IO Controller function that is set with the Setting tool is displayed. Up to 240 characters can be displayed. Default name: fanuc-cnc-ctrl
1	Equipment information	The following equipment information is displayed. **Item** / **Description** VendorID: This is 16-bit identification information that uniquely identifies the maker. 01B7H: FANUC CORPORATION DeviceID: This is 16-bit identification information that is defined by the maker independently. 0101H: PROFINET IO Controller for FANUC CNC Minimum DI/DO Refresh Time(ms): This is the minimum value of "Refresh Period" in all IO Devices that is set with the Setting tool.
C		The detailed information is cleared. "C" may be input in either upper or lower case.

DEVICE INFO screen

The second page is the DEVICE INFO screen. The third page is the DETAIL screen of DEVICE INFO.

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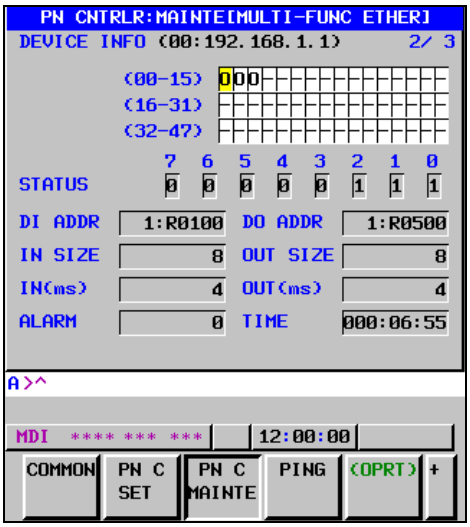

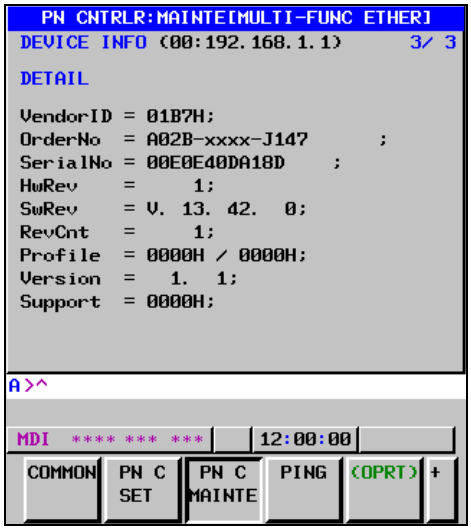

Maintenance screen of the PROFINET IO Controller function (DEVICE INFO)

Display items

Item	Description
Table of (00 - 47)	When an IO Device is selected with the cursor, the IO Device number and the IP address of the IO Device are displayed in the upper part of the table. The state of communication is displayed in the table as follows. O: Communication is in progress. E: A communication error has occurred. -: The connection setting is invalid. (In this case, the IP address is not displayed.)
STATUS	This is the status of the IO Device selected with the cursor. The contents are the same as those of status (+1 to +48) in Subsection 4.3.3.2, "Status".
DI ADDR/DO ADDR	This is the top address of the PMC area where DI/DO data of the IO Device selected with the cursor is allocated. If the PMC address is invalid, "---" is displayed.
IN SIZE/OUT SIZE	These are the input/output sizes of the IO Device selected with the cursor. The unit is the byte. These sizes do not include any spaces that are set if a module with an odd number size is configured. The directions of input/output data are as follows. - Input: IO Device → IO Controller (DI) - Output: IO Controller → IO Device (DO) If the IO Device is disconnected, "---" is displayed for both "IN SIZE" and "OUT SIZE".
IN (ms)/OUT (ms)	These are the measured values of the transmission interval of output frames (DO data) and the reception interval of input frames (DI data) during the IO transfer of the IO Device selected with the cursor. The unit is the millisecond. The transmission and reception intervals can be changed from the Setting tool.
ALARM	This is the total number of alarm frames received from the IO Device selected with the cursor. Even if the communication is disconnected, this value is not cleared.
TIME	The continuous time in which DI/DO communication is performed with the IO Device selected with the cursor is displayed in a format of HHH:MM:SS. The maximum displayable value is 999:59:59. If the DI/DO communication is disconnected, the value returns to 000:00:00. The time in which DI/DO communication is performed is the time in which the status IO is 1.

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Item	Description
DETAIL	Detailed information about the IO Device selected with the cursor is displayed by performing an information getting operation. For an explanation of the information getting operation, see "Operation" below. Performing an information getting operation causes the following to appear to the right of "DETAIL". GETTING INFO: Information is being acquired. GET INFO ERROR: Acquiring information fails. If the information getting operation is not performed or if the information getting operation is successful, nothing is displayed.

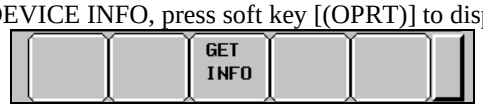
NOTE

The "Number" on the Setting tool is different from the IO Device number on this screen. Thus, to search for the IO Device for which a communication error is indicated on this screen, search for the IO Device that has the identical device name or IP address, not the IO Device number on this screen.

Operation

Getting the detailed information about the IO Device

1 On the DETAIL screen of DEVICE INFO, press soft key [(OPRT)] to display soft key [GET INFO].



2 Input any of the following first and then press soft key [GET INFO].

Input value	Display item	Description
None or a value other than those below	Device name	The device name of each IO Device that is set with the Setting tool is displayed. Up to 240 characters can be displayed.
1	Equipment information	Equipment information (I&M data) is displayed. Equipment information is gotten by communicating with the IO Device. The specification for getting equipment information is either of the following fixed values. Slot number: 0 Sub slot number: 1 For details, see Subsection 4.6.2.4, "I&M data".
C		The detailed information is cleared. "C" may be input in either upper or lower case.

Either of the following messages may be displayed if "GET INFO ERROR" is displayed.

Message	Description
Device is not set	The IO Device is not set. Return to page 2, and confirm that a valid IO Device is selected with the cursor in the table (00 - 47).
Device is not connected	The IO Device is not connected. Return to page 2, and confirm that the IO Device selected with the cursor in the table (00 - 47) is in the "O" state (communication is in progress).

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4.4.2 Log Screen of the PROFINET IO Controller Function

A log related to the PROFINET IO Controller function is displayed.

Procedure

1 Press function key [?/MESSAGE].

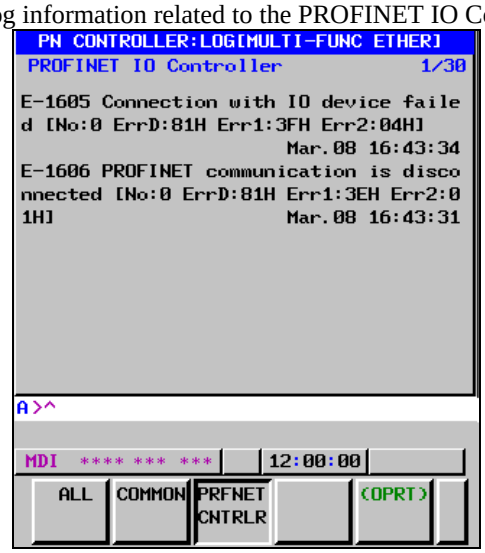
2 Press soft key [PRFNET CNTRLR]. Soft keys [ALL], [COMMON], and [PRFNET CNTRLR] appear.

3 Press the desired one of the following soft keys to display the corresponding log screen.

(1) Soft key [ALL]
This soft key displays all log information.

(2) Soft key [COMMON]
This soft key displays the log information related to the basic Ethernet function.

(3) Soft key [PRFNET CNTRLR]
This soft key displays the log information related to the PROFINET IO Controller function.



Log screen of the PROFINET IO Controller function

The latest log information is displayed at the top of the screen. At the right end of a log item, the occurrence date and time of the log item is indicated. Date and time data is indicated in the format "MMM.DD hh:mm:ss", where MMM represents a month, DD represents a day, hh represents hour, mm represents minute, and ss represents second.

Operation

To clear the log information, press soft key [(OPRT)] then soft key [CLEAR].

> **NOTE**
> The log information for the PROFINET IO Controller function is stored in volatile memory and it is lost when the CNC is turned off. If an error occurs, check the log information before turning the power off.

The following lists major log message:

Error code	Log message	Meaning and action to be taken
E-0B01	The own IP address is not set	Set the IP address.
E-0B03	Subnet mask is not set	Set the subnet mask.

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Error code	Log message	Meaning and action to be taken
E-1600	The received parameter for PROFINET IO Controller function is wrong	The received parameters for the PROFINET IO Controller function are wrong. For an explanation of the reason, see E-1612 or E-1613 notified at the same time.
E-1601	Cannot save parameter for PROFINET IO Controller function [U:V:W:X:Y:Z]	The received parameters for the PROFINET IO Controller function were not saved, because they included a wrong parameter. Set the parameters for PROFINET IO Controller function correctly. [U:V:W:X:Y:Z] at the end of the message means detailed information for the error, and the wrong parameter is indicated with one of the following numbers, at the position of X. （The others are internal error codes.） 1410: The IP address is wrong. 1411: The subnet mask is wrong. 1412: The router IP address is wrong. 1436 to 1441: The DI area of the PMC is wrong. 1443 to 1448: The DO area of the PMC is wrong. 1450 to 1453: The Status area of the PMC is wrong.
E-1603	The parameter for PROFINET IO Controller function is protected [U:V:W:X:Y:Z]	The received parameters for the PROFINET IO Controller function were not updated, because parameter protection was enabled. To disable parameter protection, perform the following operations: • Change "MODE" to "CHANGE MODE" on the setting screen of the PROFINET IO Controller function. • Set the CNC to the emergency stop state or change the CNC mode to the MDI mode. ([U:V:W:X:Y:Z] at the end of the message are internal error codes.)
E-1605	Connection with IO device failed [No:W ErrD:XH Err1:YH Err2:ZH]	The connection with the IO Device failed. [No:W ErrD:XH Err1:YH Err2:ZH] at the end of the message means the following. W : IO Device number X : ErrorDecode (hexadecimal) Y : ErrorCode1 (hexadecimal) Z : ErrorCode2 (hexadecimal) X to Z are error codes in the PROFINET standard. For details, see Subsection 4.6.2.1, "Error Code".
E-1606	PROFINET communication is disconnected [No:W ErrD:XH Err1:YH Err2:ZH]	The PROFINET communication is disconnected. [No:W ErrD:XH Err1:YH Err2:ZH] at the end of the message means the following. W : IO Device number X : ErrorDecode (hexadecimal) Y : ErrorCode1 (hexadecimal) Z : ErrorCode2 (hexadecimal) X to Z are error codes in the PROFINET standard. For details, see Subsection 4.6.2.1, "Error Code".

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Error code	Log message	Meaning and action to be taken
E-1607	larm was received from IO Device [No:V Type:WH Slot:X SubSlot:Y Prio:Z]	The alarm was received from the IO Device. [No:V Type:WH Slot:X SubSlot:Y Prio:Z] at the end of the message means the following. V : IO Device number W : Alarm type (hexadecimal) X : Slot number Y : Sub slot number Z : Priority W to Z are alarms in the PROFINET standard. For details, see Subsection 4.6.2.1, "Alarms".
E-1608	Cannot get information for IO Device [No:W ErrD:XH Err1:YH Err2:ZH]	The collection of the information for the IO Device failed. [No:W ErrD:XH Err1:YH Err2:ZH] at the end of the message means the following. W : IO Device number X : ErrorDecode (hexadecimal) Y : ErrorCode1 (hexadecimal) Z : ErrorCode2 (hexadecimal) X to Z are error codes in the PROFINET standard. For details, see Subsection 4.6.2.1, "Error Code".
E-1609	APDU status received from IO Device has changed [No:X APDU:YH]	The APDU status received from the IO Device has changed. [No:X APDU:YH] at the end of the message means the following. X : IO Device number Y : APDU status after it changes (hexadecimal) The APDU status is a status in the PROFINET standard. For details, see Subsection 4.6.2.3, "Status".
E-1610	[PROFINET Data is not set]	Data is not set for the following reasons. • No data has ever been set from the Setting tool. • Setting data was initialized with bit 0 of "OPTION" on the setting screen of the PROFINET IO Controller function. • While data was being downloaded from the Setting tool, the power of the CNC was turned off or the Ethernet cable is disconnected.
E-1612	[Number of devices is over(X)]	The number of IO Devices that were set exceeded 48. X means the following. X: Number of IO Devices that were set
	[Device No. is over(X)]	The IO Device number of the IO Device that was set exceeded 47. X means the following. X: IO Device number of the IO Device that was set
	[DI size is over(X:Y)]	The DI size per IO Device that was set exceeded 1024 bytes. X and Y mean the following. X: IO Device number Y: DI size that was set
	[DO size is over(X:Y)]	The DO size per IO Device that was set exceeded 1024 bytes. X and Y mean the following. X: IO Device number Y: DO size that was set

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Error code	Log message	Meaning and action to be taken
	[Total DI size is over(X)]	The total DI size that was set exceeded 12288 bytes. X means the following. X: Total DI size that was set
	[Total DO size is over(X)]	The total DO size that was set exceeded 12288 bytes. X means the following. X: Total DO size that was set
E-1613	[WriteSize:X RemainSize:Y]	The maximum data size that can be set was exceeded. X and Y mean the following. X: Writing size Y: Remaining size Delete any unnecessary IO Devices or modules.
E-1614	[IP address is incompatible(XH:YH)]	The IP address that was set on the COMMON screen is different from the IP address that was set with the Setting tool. In this case, the IP address that was set on the COMMON screen is used for operation. X and Y mean the following. X : IP address that was set on the COMMON screen (hexadecimal) Y : IP address that was set with the Setting tool (hexadecimal)
	[Subnet mask is incompatible(XH:YH)]	The subnet mask that was set on the COMMON screen is different from the subnet mask that was set with the Setting tool. X means the following. In this case, the subnet mask that was set on the COMMON screen is used for operation. X and Y mean the following. X : Subnet mask that was set on the COMMON screen (hexadecimal) Y : Subnet mask that was set with the Setting tool (hexadecimal)
E-1615	[Device is not set]	Not a single valid IO Device has been enabled. Enable one or more IO Devices with the Setting tool.
(Other)	(Other)	Contact us, describing the information on the log screen.

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The following log messages do not indicate errors.

Error code	Log message	Meaning
E-1604	The parameter for PROFINET IO Controller function was saved [result]	The received parameters for the PROFINET IO Controller were saved in the CNC correctly. [result] at the end of the message means the following. • Changed(TotalSize:X RemainSize:Y) The data has been refreshed. Turn off the power to the CNC and back on. X and Y mean the following. X : Total size in the CNC in which data was stored Y : Remaining size in the CNC in which data can be stored • Unchanged The data that had been stored in the CNC was the same as the received data. • Changed(FANUC Parameters) The data of "FANUC Parameters" screen has been refreshed. Turn off the power to the CNC and back on. • Unchanged(FANUC Parameters) The data that had been stored in the CNC was the same as the data of "FANUC Parameters" screen.
E-1609	APDU status received from IO Device has changed [No:X APDU:YH]	The APDU status received from the IO Device has changed. This log message is displayed even if the status has changed to the one indicating normal operation. [No:X APDU:YH] at the end of the message means the following. X : IO Device number Y : APDU status after it changes (hexadecimal) The APDU status is a status in the PROFINET standard. For details, see Subsection 4.6.2.3, "Status".
E-1611	[Download is starting...]	Downloading from the Setting tool started. Upon completion of downloading, one of messages E-1600 to E-1604 is displayed. If this log message is not displayed even though the download operation is performed, confirm the connection of the Ethernet cable and the setting of the IP address.

⚠ **CAUTION**

Once log message E-1611 is displayed, do not turn off the power to the CNC or pull out the Ethernet cable until one of messages E-1600 to E-1604 is displayed, because downloading is in progress. Otherwise, the setting data may be damaged.

If you accidentally turn off the power or pull out the cable, perform the download operation again from the Setting tool.

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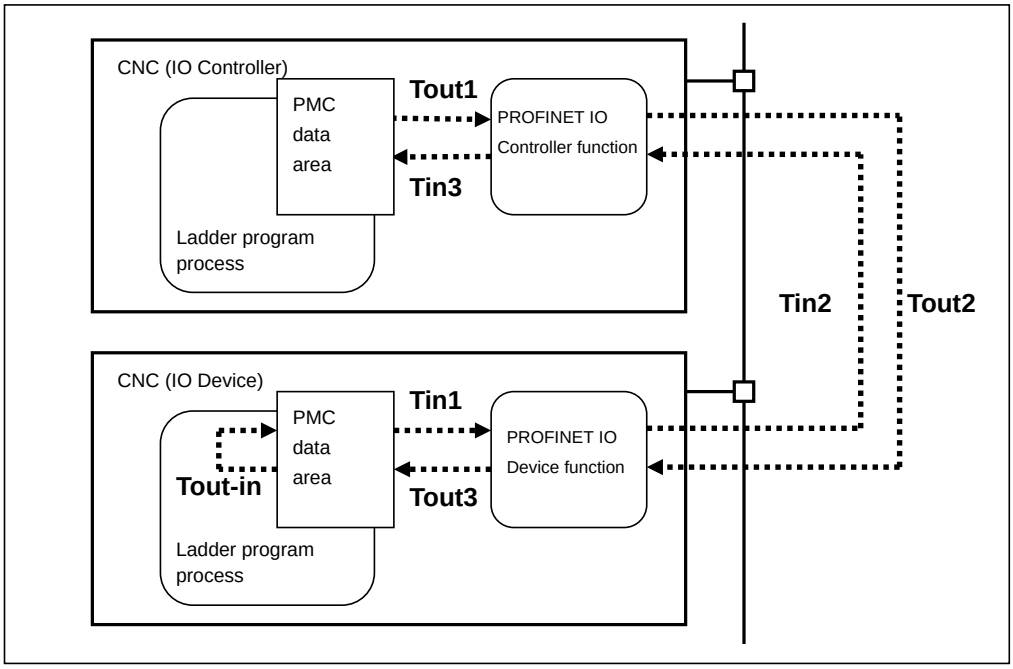
4.5 UPDATING DI/DO DATA

4.5.1 Input/Output Response Time

This subsection describes the input/output response time as seen from the IO Controller if both IO Controller and IO Devices are FANUC CNCs.
The input/output response time as seen from the IO Controller is the total time of the following sequence: an output signal is set by the ladder program in the IO Controller, the signal value is posted to the IO Device, input/output processing is performed by the ladder program of the IO Device, the value is posted to the IO Controller, and the ladder program of the IO Controller recognizes it as an input signal again.
Input/output response time as seen from the IO Controller
= Tout1 + Tout2 + Tout3 + Tout-in + Tin1 + Tin2 + Tin3



In the IO Controller, internal update time of output signal (Tout1)

This is the time in which the output signal that is set in the PMC data area by the ladder program process is updated in the PROFINET IO Controller function.
This time can be measured with "DI/DO REFRESH TIME (ms)" on the CONTROLLER INFO screen of the maintenance screen of the PROFINET IO Controller function.

In the IO Controller, communication update time of output signal (Tout2)

This is the time in which the PROFINET IO Controller function updates the output signal in the PROFINET IO Device function by way of communication.
This time can be changed with the "Refresh Period" for each IO Device on the Setting tool, and can be measured with "OUT (ms)" on the DEVICE INFO screen of the maintenance screen of the PROFINET IO Controller function or with "OUT (ms)" on the maintenance screen of the PROFINET IO Device function.

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In the IO Device, internal update time of output signal (Tout3)

This is the time in which the output signal received by the PROFINET IO Device function is updated in the PMC data area.
This time can be measured with "DI(ms)" on the maintenance screen of the PROFINET IO Device function.

In the IO Device, ladder program processing time (Tout-in)

The ladder program operates in a cycle that is a multiple of 4 ms or 8 ms depending on the size of the ladder program.
This time can be measured with "SCAN TIME" on the PMC STATUS screen.

In the IO Device, internal update time of input signal (Tin1)

This is the time in which the input signal that is set in the PMC data area by the ladder program process is updated in the PROFINET IO Device function.
This time can be measured with "DO(ms)" on the maintenance screen of the PROFINET IO Device function.

In the IO Device, communication update time of input signal (Tin2)

This is the time in which the PROFINET IO Device function updates the input signal in the PROFINET IO Controller function by way of communication.
This time can be changed with the "Refresh Period" for each IO Device on the Setting tool, and can be measured with "IN (ms)" on the DEVICE INFO screen of the maintenance screen of the PROFINET IO Controller function or with "IN (ms)" on the maintenance screen of the PROFINET IO Device function.

In the IO Controller, internal update time of input signal (Tin3)

This is the time in which the PROFINET IO Controller function updates the received input signal in the PMC data area processed by the ladder program.
This time can be measured with "DI/DO REFRESH TIME (ms)" on the CONTROLLER INFO screen of the maintenance screen of the PROFINET IO Controller function.

4.5.2 DI/DO Refresh Time

This subsection describes how to estimate the DI/DO refresh time of each IO Device that shows the processing performance of the PROFINET IO Controller function for the CNC.

The DI/DO refresh time of each IO Device can be estimated as follows.

DI/DO refresh time of each IO Device ＝ X + Y

X: This is the "Refresh Period" of each IO Device that is set with the Setting tool.
This becomes equal to Tout2 or Tin2 in Subsection 4.5.1, "Input/Output Response Time".

Y: This is the internal update time of the PROFINET IO Controller function for the CNC.
This becomes equal to Tout1 or Tin3 in Subsection 4.5.1, "Input/Output Response Time ".

If the total DI/DO size is small, "Y" becomes equal to the minimum value of "Refresh Period" in all IO Devices that are set with the Setting tool.
The following are examples of the estimated DI/DO refresh time of each IO Device if three IO Devices are connected.

IO Device	X	Y	DI/DO refresh time of each IO Device
IO Device 1	1ms	1ms	2ms
IO Device 2	4ms		5ms
IO Device 3	8ms		9ms

On the other hand, if the total DI/DO size is large, the actual measurement value of "Y" will not be as described above.

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If the minimum value of "Refresh Period" in all IO Devices that are set with the Setting tool is 1 ms, the relation between the total size of the DI/DO and the actual measurement value of "Y" is roughly as follows.

Total DI/DO size	Actual measurement value of "Y"
128 bytes /128 bytes	1ms
256 bytes /256 bytes	2ms
1024 bytes /1024 bytes	4ms
6144 bytes / 6144 bytes	17ms
12288 bytes /12288 bytes	34ms

If the minimum value of "Refresh Period" in all IO Devices that are set with the Setting tool is larger than the applicable one of the actual measurement values in the above table, the actual measurement value of "Y" becomes the minimum value of "Refresh Period".

NOTE

The smaller the value of the "Refresh Period" of each IO Device, which is set with the Setting tool, the faster the DI/DO communication, but the higher the load on the network. Thus, refrain from reducing the "Refresh Period" carelessly.

4.6 APPENDIX

4.6.1 PROFINET Configuration Tool

This subsection describes the PROFINET Configuration Tool.

Note to use

NOTE

1 When you use the PROFINET IO Controller function, Do not see "PFN-CT User Manual.pdf" displayed by the menu [Help] -> [About] of the Setting tool but see this manual. Only the functions described in this manual can be used.

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NOTE

2 Note the following about the number to indicate the IO Device.

- "Number" in the Setting tool
  Set this number on "Device Designation" on the IO Device properties screen, described in Subsection 4.6.1.7, "Setting of IO Devices". With the Setting tool, numbers 000 to 127 can be set, but number 048 or greater cannot be set in the CNC.
  The setting of the IO Device specified with "Number" can be switched between Enable and Disable. For how to do this, see "Enable¥Disable Device" in Subsection 4.6.1.11, "Operations that relates to IO Device".
- IO Device number in the CNC
  This is the number allocated if settings are downloaded to the CNC, and in the CNC, it is displayed on the DEVICE INFO screen of the maintenance screen of the PROFINET IO Controller function. This number is always a serial number, unlike the numbers in "Number".
  The following are examples of numbers in "Number" in the Setting tool and the IO Device numbers in the CNC.

"Number" in the Setting tool	Enable/Disable	IO Device numbers in the CNC
001	Enable	0
010	Enable	1
024	Disable	
047	Enable	2

3 The operation and the screen related to the Setting tool described in this manual are examples for Windows 7.

4.6.1.1 Operating environment

The operating environment of the personal computer in which to install the Setting tool is as follows.

Item	Operating environment
OS	Windows 7, 8.0, 8.1 (32-bit, 64-bit) Windows XP (32-bit)
CPU, RAM	Must meet the conditions recommended for the OS used.
HDD size used	Execution program : Approx. 100 MB Setting data : Approx. 10 MB per project
Drive	• CD-ROM drive required The Setting tool is provided in a form of CD-ROM.
Communication	• Ethernet port The communication between the Setting tool and CNC uses the Ethernet.

4.6.1.2 When using the Setting tool for the first time

NOTE

1 To install the Setting tool, the serial number is necessary. The serial number is a number printed on "PROFINET Configuration Tool" in space enclosed with the installation CD-ROM.

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NOTE

2 While installing, when "WSEPNIO PROFINET IO Driver" is requested to be installed, install this driver. ("WSEPNIO PROFINET IO Driver" is included in installation CD-ROM.)
You can confirm whether this driver was installed by "Local Area Connection Properties" of Windows.

Installation Folder

The installation folder and the storage file of default are as follows.

OS	The installation folder and the storage file
Windows 7 or later	C:/Program Files/FANUC/PFNCT • The exe file and the dll file to execute the Setting tool are stored.
	C:/ProgramData/FANUC/PFNCT • Made configuration file and GSDML file are stored.
Windows XP	C:/Program Files/FANUC/PFNCT • The exe file and the dll file to execute the Setting tool are stored.
	C:/Documents and Settings/All Users/Application Data/FANUC/PFNCT • Made configuration file and GSDML file are stored.

Update or reinstalling of the Setting tool

When the Setting tool has already been installed in the personal computer, and when you install the Setting tool is installed, the message to direct uninstallation is displayed.
When you update or reinstall the Setting tool, install it after uninstalling the Setting tool

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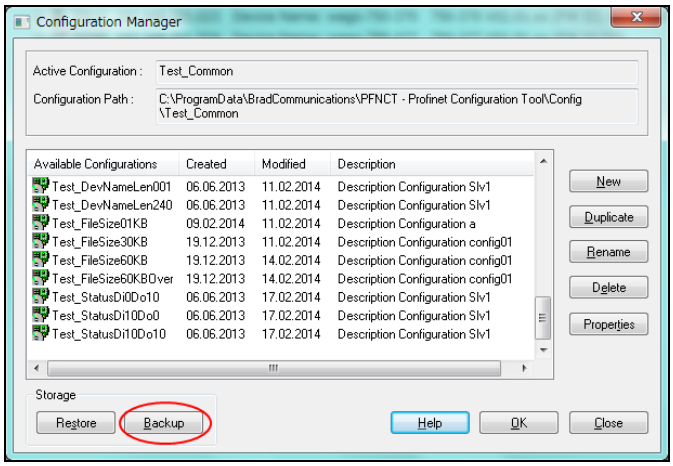
NOTE

When the Setting tool "PROFINET Configuration Tool (PFN-CT) for FANUC CORPORATION" of the Molex is installed in the personal computer, uninstall the Setting tool of the Molex after backing up the configuration data.
And, restore the configuration data backed up after the Setting tool of FANUC is installed.
The backup/restore procedure is as follows.

The backup/restore procedure:
Select the menu [File] -> [Configuration Manager] to display the "Configuration Manager" screen.

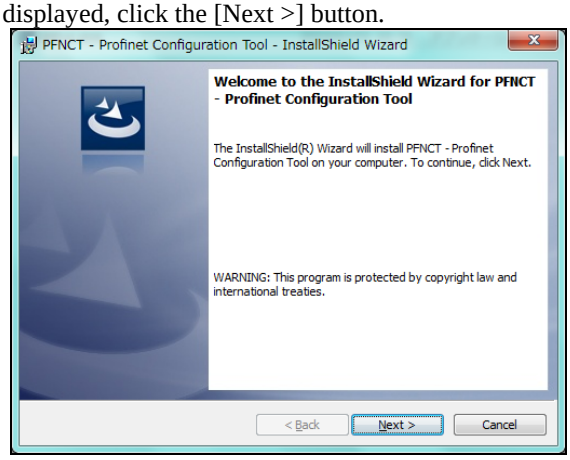


Click the [Backup] button, with configuration name for backup being selected to make the backup file (Extension : apa).
After installing the Setting tool of FANUC, restore the backup file (Extension: apa) by the [Restore] button of this screen.

Installation Procedure

Install the Setting tool in the personal computer according to the following procedure.

1 Insert the installation CD-ROM into the drive of the personal computer, and execute "PROFINET_Configuration_Tool/setup.exe" in the installation CD-ROM.
The following screen is displayed, click the [Next >] button.



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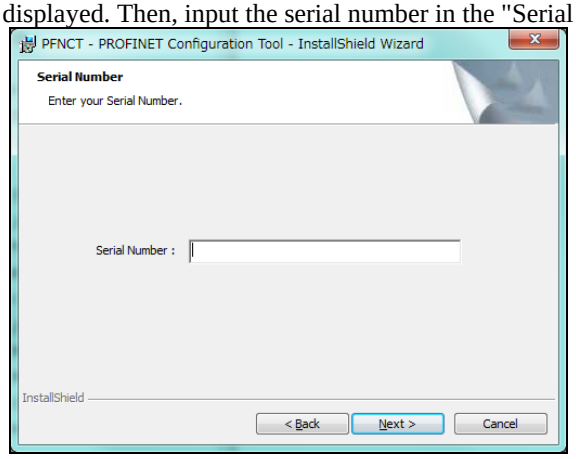
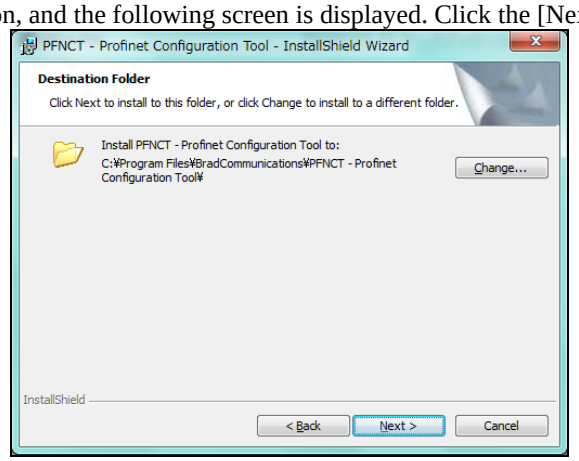
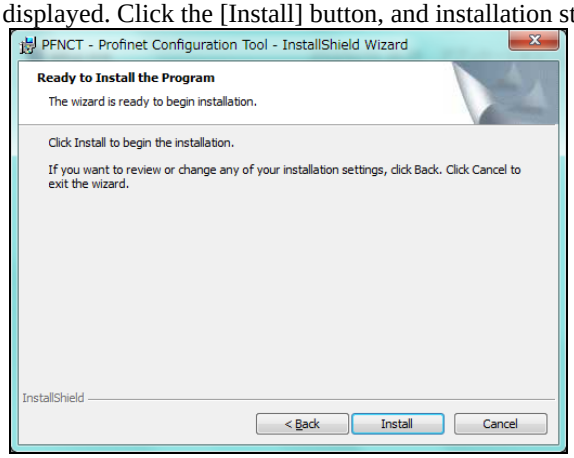
2 The following screen is displayed. Then, input the serial number in the "Serial Number" field.



Click the [Next >] button, and the following screen is displayed. Click the [Next >] button again.



3 The following screen is displayed. Click the [Install] button, and installation starts.



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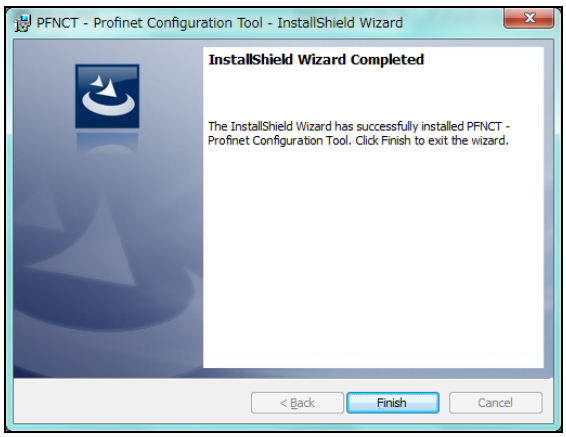
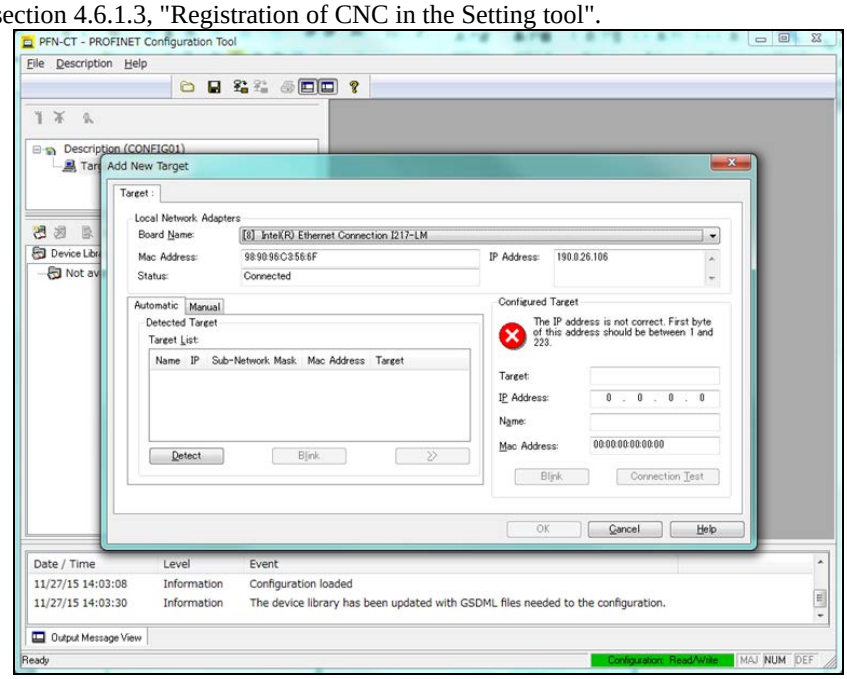


When installation is completed, the above screen is displayed. Click the [Finish] button to finish.

Starting the Setting tool

The Setting tool can be started by selecting the menu [start] -> [All Programs] -> [FANUC] -> [PFN-CT] -> [PFN-CT - PROFINET Configuration Tool] on Windows.

When starting for the first time, it is displayed as follows. Once after closing the "Add New Target" screen, go to the next Subsection 4.6.1.3, "Registration of CNC in the Setting tool".



Quitting the Setting tool

The Setting tool can be quitted by selecting the menu [File] -> [Exit].

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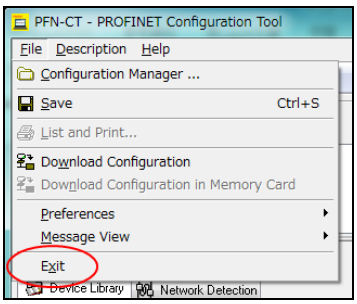
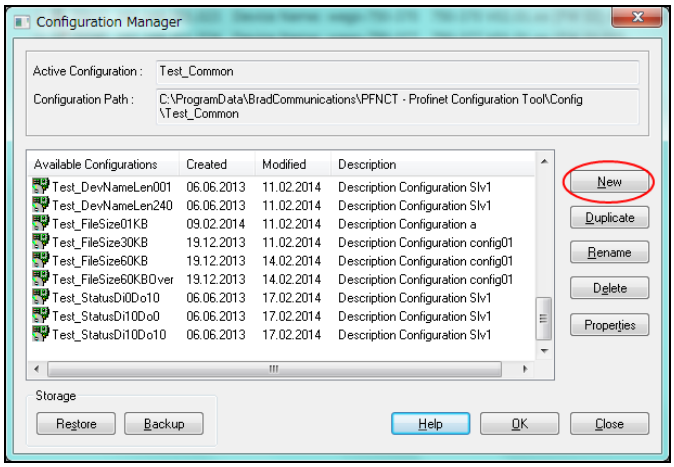


4.6.1.3 Registration of the CNC in the Setting tool

This subsection describes how to register the CNC in the Setting tool.

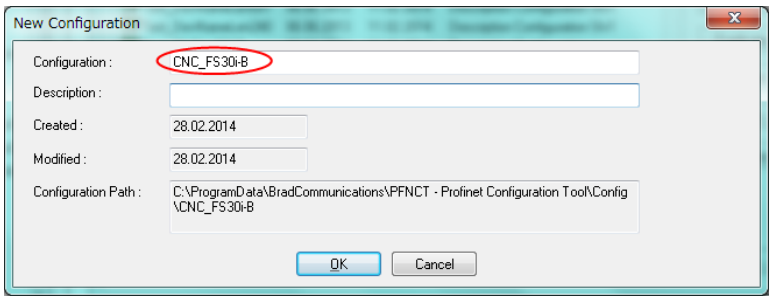
Procedure

1 Select the menu [File] -> [Configuration Manager] to display the "Configuration Manager" screen. Click the [New] button.



If the Setting tool is started for the first time since it was installed, the "Add New Target" screen of step 3 is displayed.

2 The "New Configuration" screen is displayed. Input the configuration name in the "Configuration" field.



Click the [OK] button to return to the "Configuration Manager" screen.

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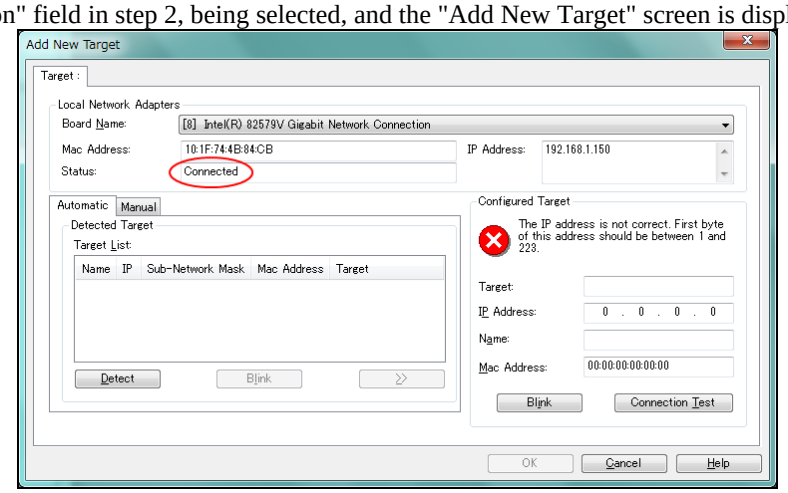
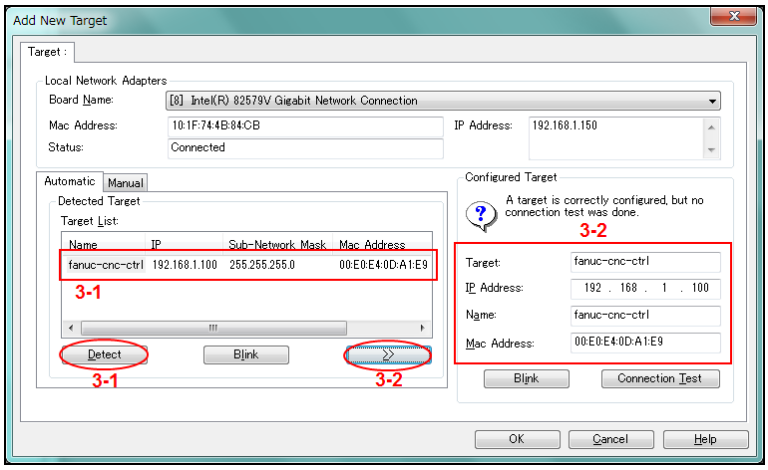
3 On the "Configuration Manager" screen, click the [OK] button, with the configuration name, input in the "Configuration" field in step 2, being selected, and the "Add New Target" screen is displayed.



Confirm that "Status" is shown as "Connected" on this screen.
If "Status" is not shown as "Connected", confirm that the Ethernet cable is correctly connected to the network adapter selected for "Board Name".



3-1 Connect the CNC to the network, and click the [Detect] button to confirm that "fanuc-cnc-ctrl" is detected.
At this time, confirm also that the IP address that is set on the COMMON screen of the CNC is detected.

3-2 Click the [>>] button, with "fanuc-cnc-ctrl" being selected. Confirm that the content of the selected CNC is displayed in "Configuration Target".
Click the [OK] button to finish.

When setting in the off-line with CNC

When setting in the off-line with CNC, select the "Manual" tab in the procedure-3 to do the following procedures.

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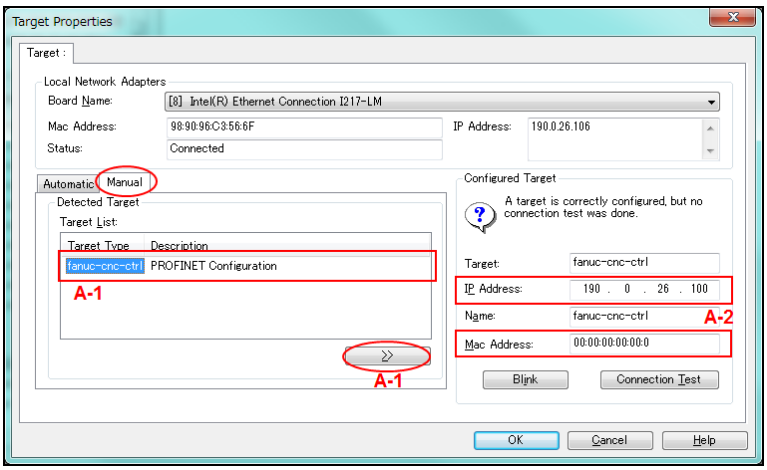


A-1 Click the [>>] button, with "fanuc-cnc-ctrl" being selected. Confirm that the content of the selected CNC is displayed in "Configuration Target".
At this time, nothing is input to "IP Address" and "Mac Address".

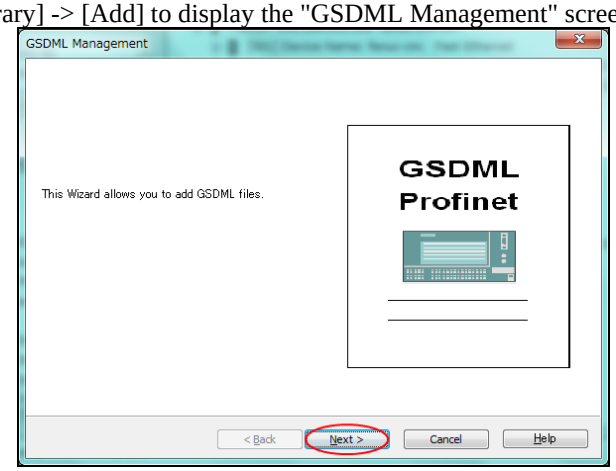
A-2 Input a temporary value to "IP Address" and "Mac Address" of "Configuration Target".
Click the [OK] button to finish.

4.6.1.4 Installation of the GSDML file

This subsection describes how to install the GSDML file in the Setting tool.

Procedure

1 Select the menu [Library] -> [Add] to display the "GSDML Management" screen.



Click the [Next >] button, and install the GSDML file according to the instructions on the screen.

2 Confirm that the installed IO Device has been added to the tree of the tab "Device Library".

4.6.1.5 Confirmation of IO Devices on the network

This subsection describes how to confirm the IO Devices connected on the network.

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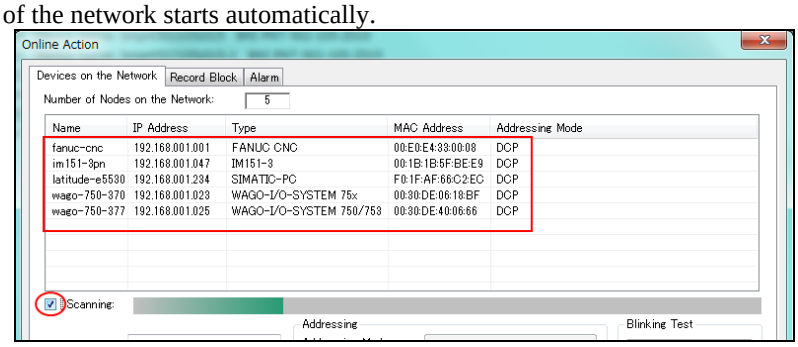
Procedure

1 Select the menu [Library] -> [Online Action], and the "Devices on the Network" screen is displayed, and the scanning of the network starts automatically.



2 After the IO Devices are detected on this screen, remove the check on the "Scanning" check box to stop the scanning.
If the target IO Device is not detected, confirm whether the Ethernet cable is correctly connected.
If device names are not set for any of the detected IO Devices in the "Name" column, set the device names according to Subsection 4.6.1.6, "Setting of the device names for IO Devices".

> ⚠ **CAUTION**
> Do not leave the "Scanning" check box checked, because the load on the network increases during the scanning of the network.

> **NOTE**
> 1 If no device name is set for an IO Device in the "Name" column, IO communication with the IO Device cannot be performed.
> 2 If two or more IO Devices of the same model are detected on the network, you need to check their MAC addresses to distinguish between them before setting their device names in the "Name" column.
> 3 It is not necessary to set IP addresses in the "IP Address" column, because the IP addresses that are allocated with "Setting of the IP address and the device name" in Subsection 4.6.1.7, "Setting of IO Devices" are used.
> 4 The screens of the "Record Block" tab and "Alarm" tab are unsupported.

4.6.1.6 Setting of the device names for IO Devices

This subsection describes how to set the device names for the IO Devices that are detected as in Subsection 4.6.1.5, "Confirmation of IO Devices on the network".

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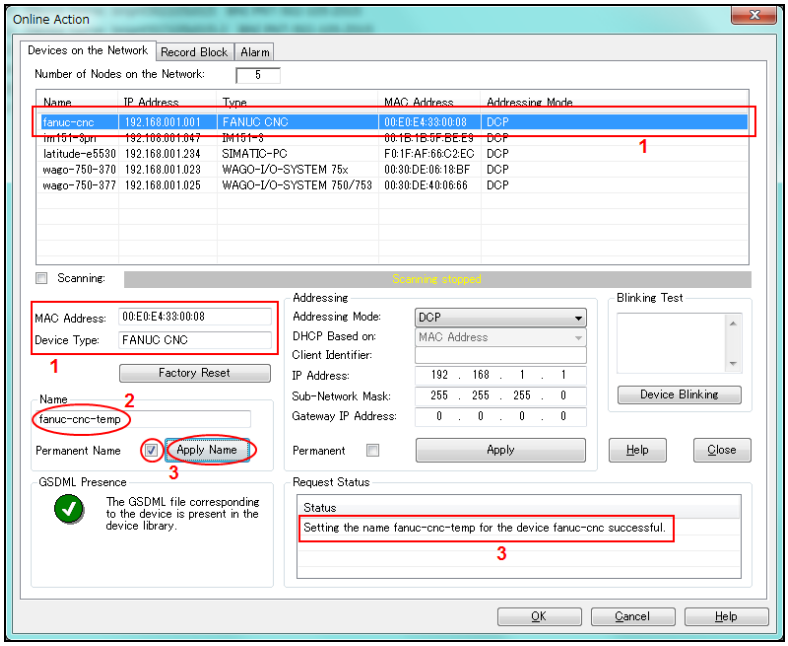
Setting of the device name



Procedure

1 Select an IO Device from the list of detected IO Devices. Confirm that the "MAC Address" and the "Device Type" of the IO Device are selected.

2 In the "Name" field, input the device name to set.

3 Check the "Permanent Name" check box, and click the [Apply Name] button.
When the setting of the device name is successful, "Setting the name (device name) successful" is displayed below "Status".

NOTE

1 The device name must be unique on the network.
IO Devices to which the same name is given cannot perform IO communication.
2 If the "Permanent Name" check box is not checked, the device name will not be stored in the nonvolatile memory of the IO Device. When the IO Device is restarted, this setting is no longer effective.
3 The item of "Addressing" is not used.

By checking the "Scanning" check box to perform scanning again, the changed device name can be confirmed.

Naming rules for a device name

The Naming rules for a device name are as follows.

- The 1 or more labels are separated by "."(Period).
- The label length is 1-63.
- The total length is 1-240.
- The allowed characters are "a-z", "0-9", and "-".
- The labels do not start with "-".
- The labels do not end with "-".

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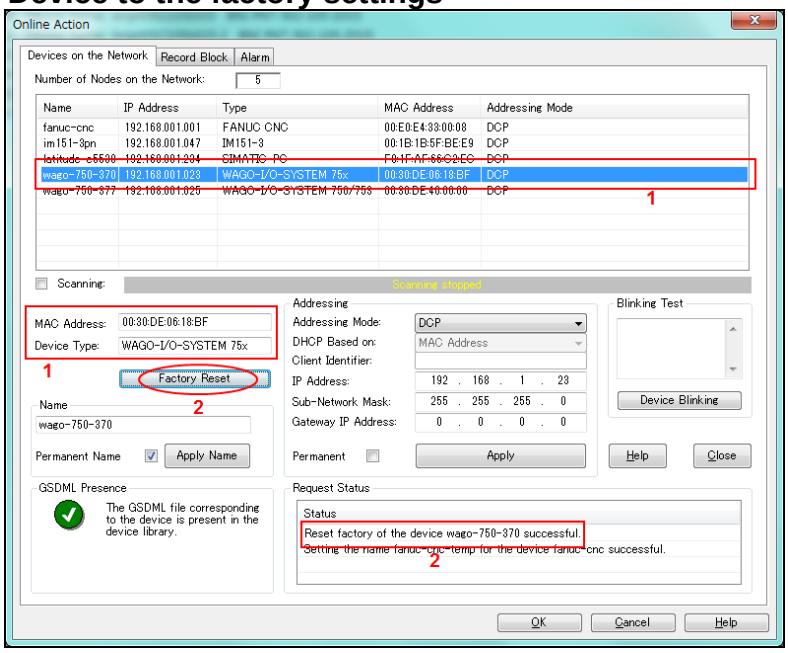
- The first label does not start with "port-xyz" or "port-xyz-abcde" with a, b, c, d, e, x, y, z = 0-9.

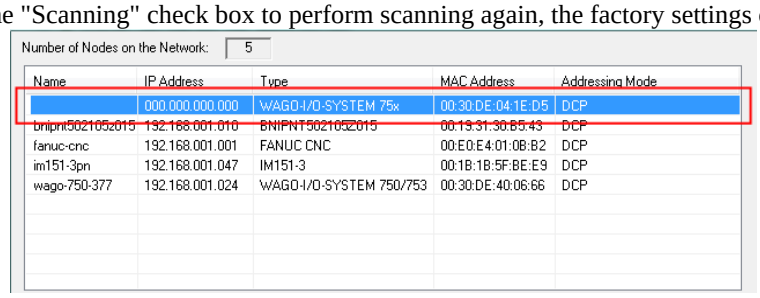
Returning an IO Device to the factory settings



Procedure

1 Select an IO Device from the list of detected IO Devices. Confirm that the "MAC Address" and the "Device Type" of the IO Device are selected.

2 Click the [Factory Reset] button.
When the operation for returning it to the factory settings is successful, "Reset factory of the device (device name) successful" is displayed.
By checking the "Scanning" check box to perform scanning again, the factory settings can be confirmed.



NOTE
If an IO Device is returned to the factory settings, the "Name" (device name) and "IP Address" of the IO Device are no longer effective. For an explanation of the factory settings of the parameters specific to an IO Device, see the IO Device manual or confirm them with the IO Device manufacturer.

4.6.1.7 Setting of IO Devices

This subsection describes the setting for operating an IO Device.

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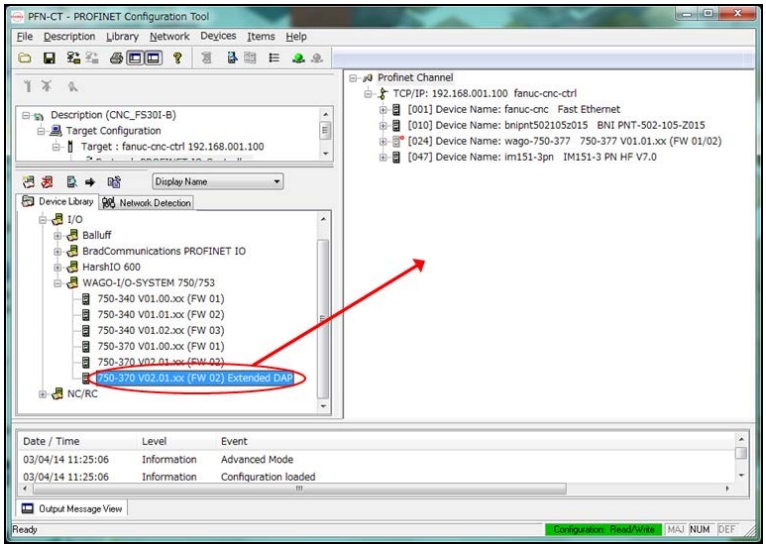
First, select the DAP (Device Access Point) of an IO Device from "Device Library", and drag and drop it in the "Profinet Channel" screen on the right.
If the IO Device has already been set in the "Profinet Channel" screen, double-click the IO Device in the "Profinet Channel" screen.



NOTE

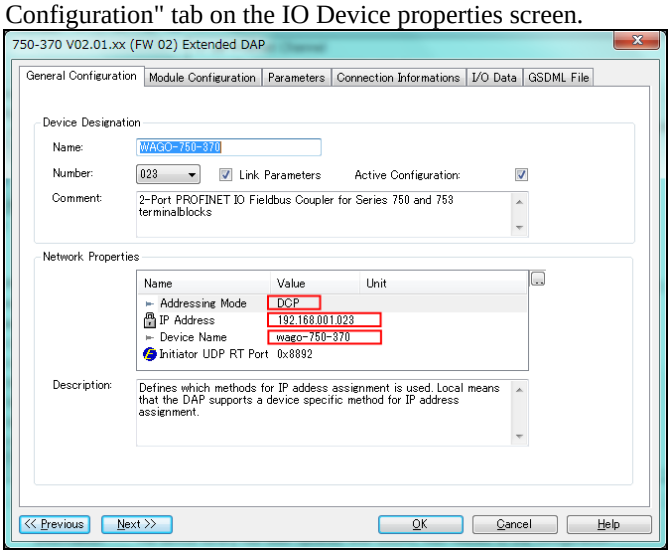
The DAP (Device Access Point) of the IO Device to select may be subdivided according to model and so on. For details, see the IO Device manual or confirm this with IO Device manufacturer.

The IO Device properties screen is displayed. Make settings as described below.

Setting of the IP address and the device name

Procedure

1 Select the "General Configuration" tab on the IO Device properties screen.



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2 Confirm the "Addressing Mode" below "Network Properties" is "DCP", and set the device name in the "Device Name" field below "Network Properties".
"WWW.XXX.YYY.ZZZ" in the "IP Address" field below "Network Properties" is automatically allocated with the "ZZZ" being determined from "Number" on "Device Designation". If this is appropriate, use it without any modification.

NOTE

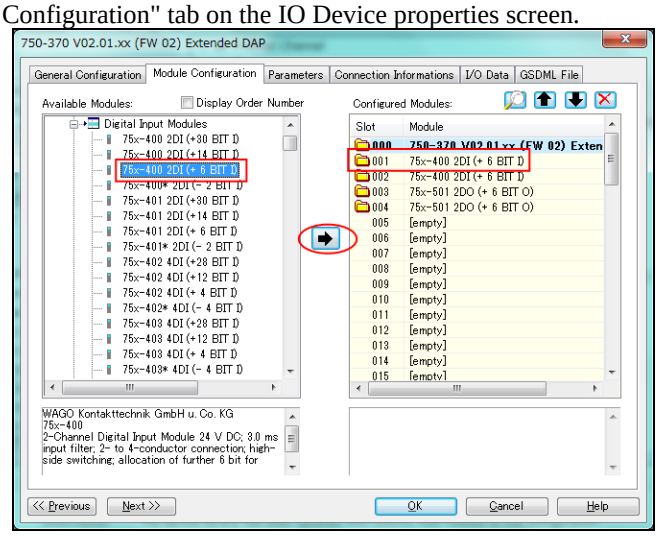
1 The "Device Name" below "Network Properties" must match the device name that is set as in Subsection 4.6.1.6, "Setting of the device names for IO Devices". For Naming rules for a device name, see "Naming rules for a device name" in Subsection 4.6.1.6, "Setting of the device names for IO Devices".

2 The "Link Parameters" of "Device Designation" is the check box to link the "Number" of "Device Designation" with the "IP Address" of "Network Properties". If you do not link these, remove the check for the "Link Parameters" check box of "Device Designation".

Setting of modules

Procedure

1 Select the "Module Configuration" tab on the IO Device properties screen.



2 Select the necessary module from "Available Modules", and click the [⇒] button to add it to "Configured Modules".
To add more modules, repeat this operation.

3 Double-click the module that is displayed. When the "Parameters" tab exist in the displayed screen, select "Parameters" tab to display the setting screen.
Set the parameters if necessary.

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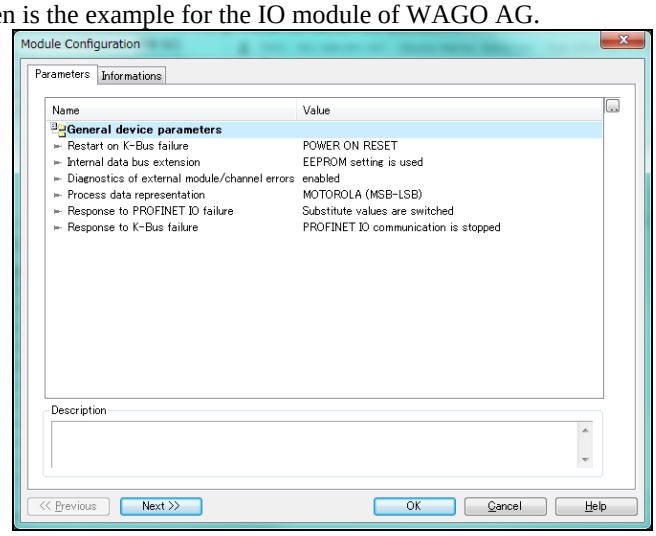
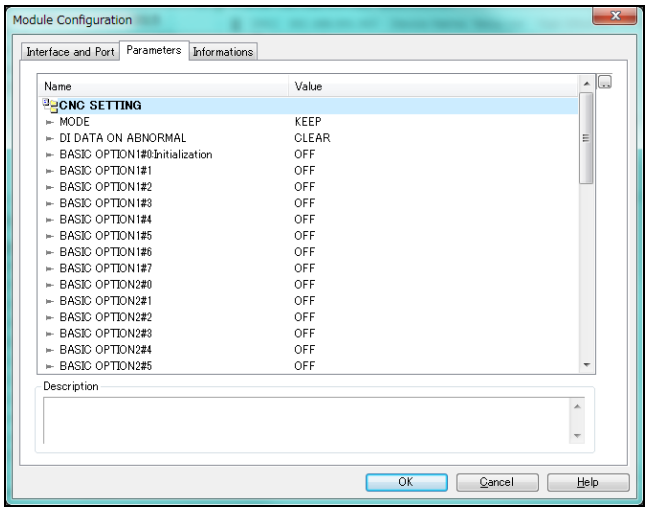
NOTE

The setting of a module may depend on the original specifications for the IO Device.
For details, see the IO Device manual or confirm it with the IO Device manufacturer.

The following screen is the example for the IO module of WAGO AG.



When FANUC CNC is IO Device, double-click the "Fast Ethernet", and select "Parameters" tab to display the setting screen.



For details of setting items, see Subsection 5.4.1.2, "Setting screen of the PROFINET IO Device function".

Setting of the Input/output update time

Procedure

1 Select the "Parameters" tab on the IO Device properties screen.

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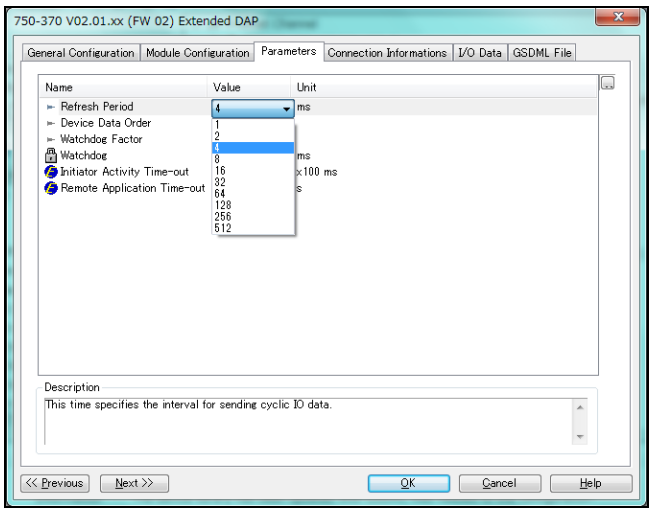


2 Select an Input/output update time from the list box of "Refresh Period".

NOTE

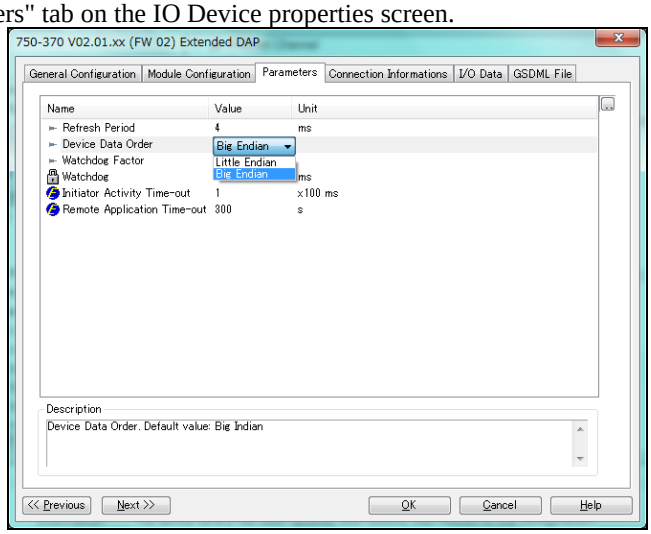
1 Not all the Input/output update time displayed in the list box of "Refresh Period" may be supported by the IO Device.
For an explanation of the Input/output update time supported by the IO Device, see the IO Device manual or confirm them with the IO Device manufacturer.

2 See also Section 4.5, "UPDATING DI/DO DATA" when setting the "Refresh Period".

Setting of endian conversion

Procedure

1 Select the "Parameters" tab on the IO Device properties screen.



2 Select between Big Endian and Little Endian in the list box of "Device Data Order".
For an explanation of endian conversion, see Subsection 4.2.3, "Conversion of Endian".

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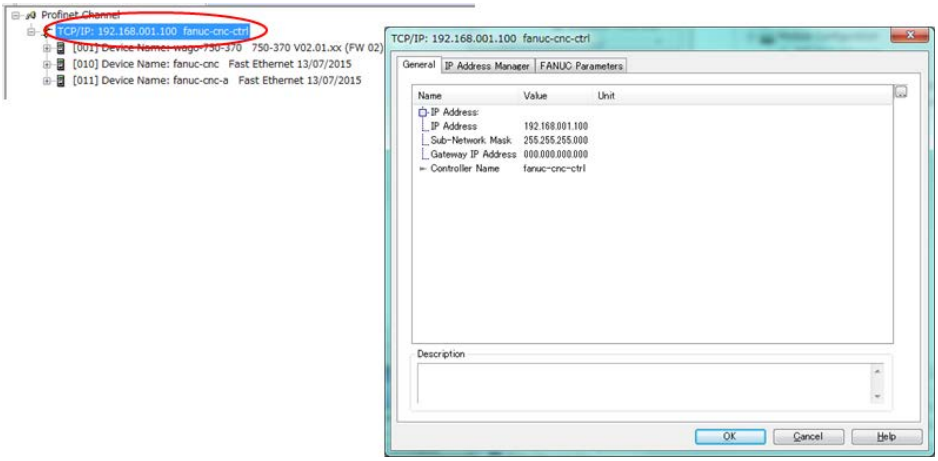
4.6.1.8 Setting and Checking of PMC Allocation

This subsection describes the setting and the checking of PMC allocation.

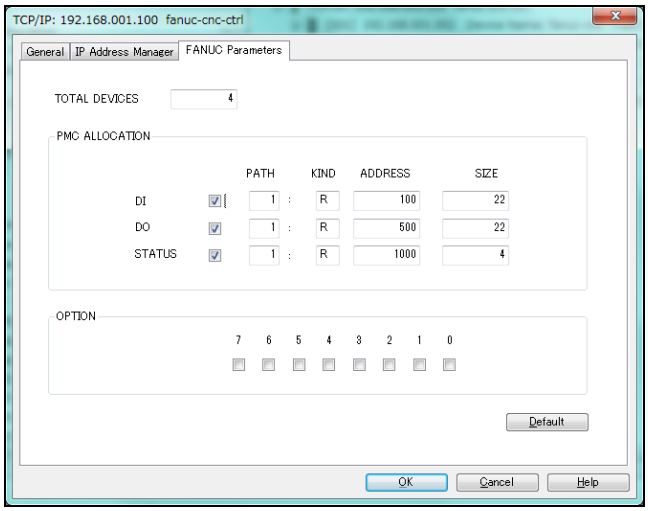
Setting of PMC Allocation

Procedure

1 In the tree of the "Profinet Channel" screen, double-click the "TCP/IP: (IP Address)" to display "TCP/IP" screen.



2 Select the "FANUC Parameters" tab to display the "FANUC Parameters" screen, and set the PMC allocatoin.



For details of setting items, see subsection 4.3.2.2, "Setting screen of the PROFINET IO Controller function".

Operation

When the [Default] button is clicked, all setting items of the "FANUC Parameters" screen are cleared.

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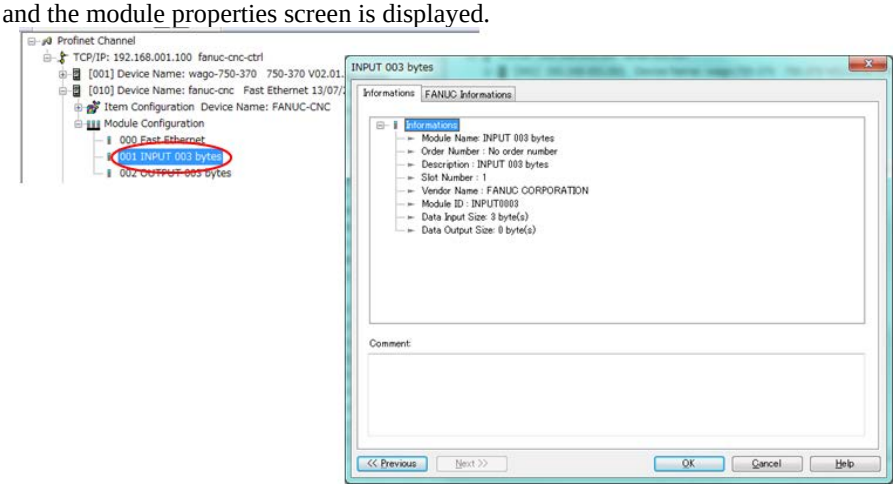
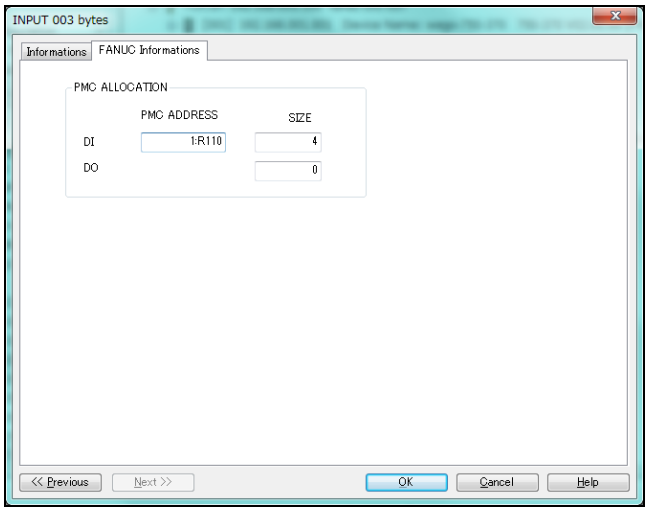
Checking of PMC Allocation

Procedure

1 In the tree of the "Profinet Channel" screen, double-click a module in "Module Configuration" for an IO Device, and the module properties screen is displayed.



2 Select the "FANUC Informations" tab to display the "FANUC Informations" screen, then the PMC allocation of the selected module can be checkd.



Display items

Item	Description
DI/DO PMC ADDRESS, SIZE	These are the top address and size of the PMC area in which to store the DI/DO data of the selected module. "PMC ADDRESS" and "SIZE" correspond to the rule described in subsection 4.3.3.1, "DI/DO". When the selected module is "DI SIZE=0" or "DO SIZE=0", "PMC ADDRESS" is not displayed.

4.6.1.9 Downloading of settings

This subsection describes how to download settings to the CNC.

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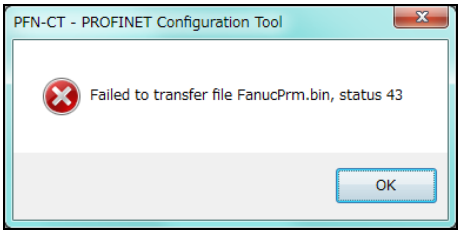
Procedure

1 Select the menu [File] -> [Download Configuration] to start downloading all settings to the CNC.

2 If downloading terminates normally, "The configuration is successfully downloaded" is displayed.
If downloading fails, the following dialog box is displayed. For details, see Subsection 4.6.1.12, "List of status codes".



NOTE

It may take up to about 150 seconds for downloading to be completed from the download operation, depending on the operation environment of the personal computer and the number of IO Devices that are set and the number of modules that are configured.

⚠ CAUTION

1 If the download operation is executed during IO communication, IO data may be delayed.
Perform the download operation in the state in which safety is ensured properly.

2 Once the download operation is started, do not turn off the power to the CNC or pull out the Ethernet cable until the message "The configuration is successfully downloaded" is displayed. Otherwise, the setting data may be damaged.
If, when the power to the CNC is turned on, it is detected that the setting data is damaged, the message "E-1610 [PROFINET Data is not set]" is displayed on the log screen of the PROFINET IO Controller for the CNC. If this happens, perform the download operation again.

4.6.1.10 Confirmation of the IO Device communication state

This subsection describes how to confirm the IO Device communication state.

⚠ CAUTION

Do not leave the Setting tool in the diagnosis state, because the load on the network increases when the Setting tool is in the diagnosis state.

Procedure

1 Select the menu [Devices] -> [Start Console Diagnostic] to place the Setting tool in the diagnosis state.
The lamp ○ that shows the communication state lights at positions in the red frame below.

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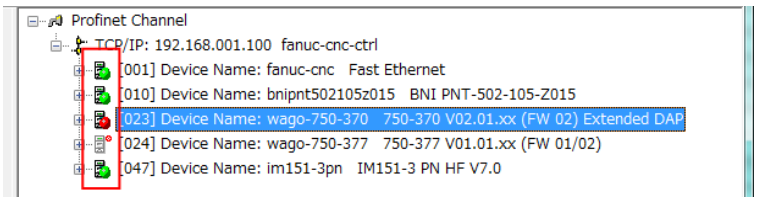


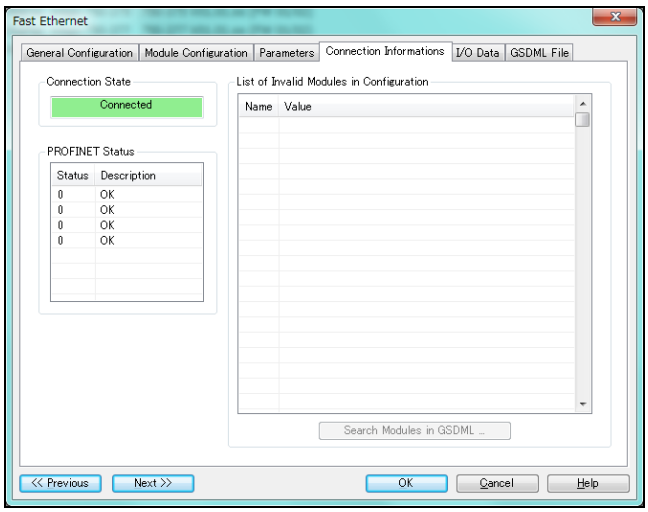
The meaning of the lamp that shows the connection state is as follows.

- Lighting green: Communication is normal.
- Lighting red: Communication is in error.

2 On the "Profinet Channel" screen, double-click the IO Device to diagnose to display the properties screen of the IO Device.

Confirmation of communication state

Select the "Connection Informations" tab to display the "Connection Informations" screen, then the connection state can be confirmed.



Display items

Item	Description
Connection State	It is communication state. - Connected : The communication is normal. - Disconnected : The communication is in error.
PROFINET Status	These are the status in PROFINET standard. These are error codes (hexadecimal) in the PROFINET standard, ErrorCode, ErrorDecode, ErrorCode1, and ErrorCode2, from top to bottom. For details, see Subsection 4.6.2.1, "Error Code".
List of Invalid Module in Configuration	Unsupported.

Confirmation of IO Data information

Select the "I/O Data" tab to display the "I/O Data" screen, then the IO Data information can be confirmed.

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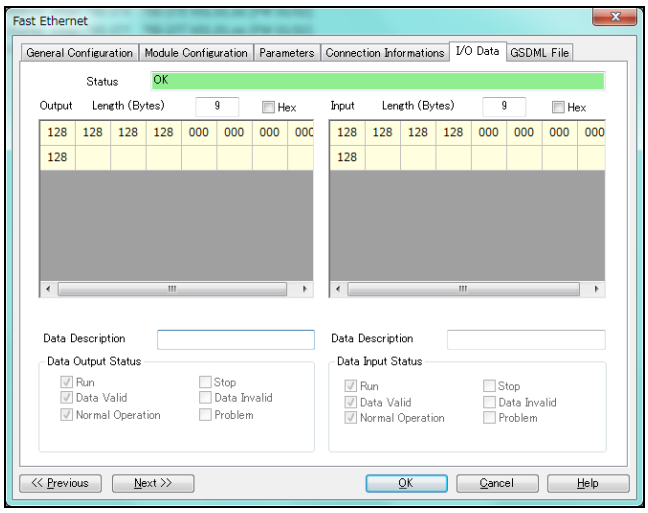

Display items

Item	Description
Status	It is communication state. - OK : The communication is normal. - Not OK : The communication is in error. When the communication is in error, confirm the cause by "PROFINET Status" of the "Connection Informations" screen.
Output/Input Length(Bytes)	These are the data length and the data value of input/output frame. The data displayed here is the data of the frame on the line, and the structure of the frame corresponds to the PROFINET standard. Note that the frame data and the data stored in PMC area is not the same.
Data Description	Unsupported.
Data Output/Input Status	It is the APDU status in PROFINET standard. The meaning is the same with "APDU status" of subsection 4.6.2.3, "Status".

Item	Meaning
RUN	The control application of the provider (sender) is in the RUN state.
STOP	The control application of the provider (sender) is in the STOP state.
Data Valid	The frame data is valid.
Data Invalid	The frame data is invalid.
Normal Operation	Normal operation
Problem	A problem is detected.

4.6.1.11 Operations that relates to IO Device

This subsection describes the operation of the following menu.
This menu is displayed when right-clicking with the selected IO Device on the "Profinet Channel" screen.

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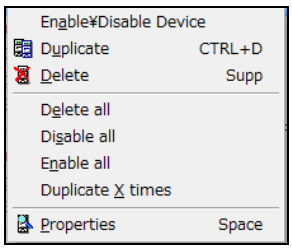
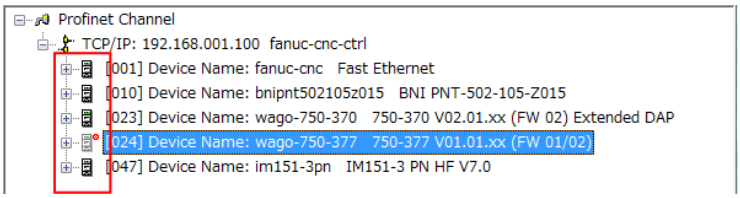


Operation

Enable¥Disable Device

The selected IO Device is switched between "Enable" and "Disable".
The following example shows the "Profinet Channel" screen where only the setting of the IO Device whose Number is 024 is disabled.



The setting of the "Disable" IO Device is not downloaded to CNC.

Other Operations

Item	Description
Duplicate	The selected IO Device is copied.
Delete	The selected IO Device is deleted.
Delete all	All IO Devices are deleted.
Disable all	All IO Devices are switched to "Disable".
Enable all	All IO Devices are switched to "Enable".
Duplicate X times	The selected IO Device is copied in X times.
Properties	The properties screen in Subsection 4.6.1.7, "Setting of IO Devices" is displayed.

4.6.1.12 List of status codes

This subsection describes the meanings of the status codes that may be displayed during the operation of the Setting tool, as well as the actions to take.
The "Error code on log screen" column of the table contains the error codes that may be displayed on the log screen of the PROFINET IO Controller function for the CNC.

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Error number	Meaning and action to be taken	Error code on log screen
33	A timeout occurred during downloading. Retry the download operation.	(None)
34	The data to download exceeded the size that can be stored in the CNC. Delete any unnecessary IO Devices or modules.	E-1600 E-1613
35	The number of IO Devices that were set exceeded 48. Delete any unnecessary IO Device.	E-1600 E-1612
37	48 or greater is set for the "Number" of an IO Device.	
38	The DI size per IO Device that was set exceeded 1024 bytes. Delete any unnecessary input modules, or replace any with those with smaller input sizes.	
39	The DO size per IO Device that was set exceeded 1024 bytes. Delete any unnecessary output modules, or replace any with those with smaller output sizes.	
40	The total DI size that was set exceeded 12288 bytes. Delete any unnecessary input modules, or replace any with those with smaller input sizes.	
41	The total DO size that was set exceeded 12288 bytes. Delete any unnecessary output modules, or replace any with those with smaller output sizes.	
42	A wrong IP parameter (IP address, subnet mask, or router IP address) is detected. Review the setting of the IP parameter.	E-1601
43	The DI area of the PMC is wrong. Review the DI area of the PMC. This status code is also displayed if the DI area of the PMC is insufficient. In the Setting tool, correct "PATH, KIND, ADDRESS" of DI on the "FANUC Parameters" screen, then download again. When the download doesn't end normally though the PMC area range is normal, download once after doing the operation "Disable all" in the Setting tool. And, download again after doing the operation "Enable all" or "Enable¥Disable Device".	
44	The DO area of the PMC is wrong. Review the DO area of the PMC. This status code is also displayed if the DO area of the PMC is insufficient. In the Setting tool, correct "PATH, KIND, ADDRESS" of DO on the "FANUC Parameters" screen, then download again. When the download doesn't end normally though the PMC area range is normal, download once after doing the operation "Disable all" in the Setting tool. And, download again after doing the operation "Enable all" or "Enable¥Disable Device".	
46	The function is not supported by the CNC.	(None)
48	The parameter protection of the CNC is enabled. To disable parameter protection, perform the following operations on the CNC: • On the setting screen of the PROFINET IO Controller function, change "MODE" to "CHANGE MODE". • Change the CNC mode to the MDI mode or set the CNC to the emergency stop state.	E-1603
49	The Status area of the PMC is wrong. Review the Status area of the PMC. This status code is also displayed if the Status area of the PMC is insufficient. In the Setting tool, correct the "PATH, KIND, ADDRESS" of STATUS on the "FANUC Parameters" screen, then download again.	E-1601

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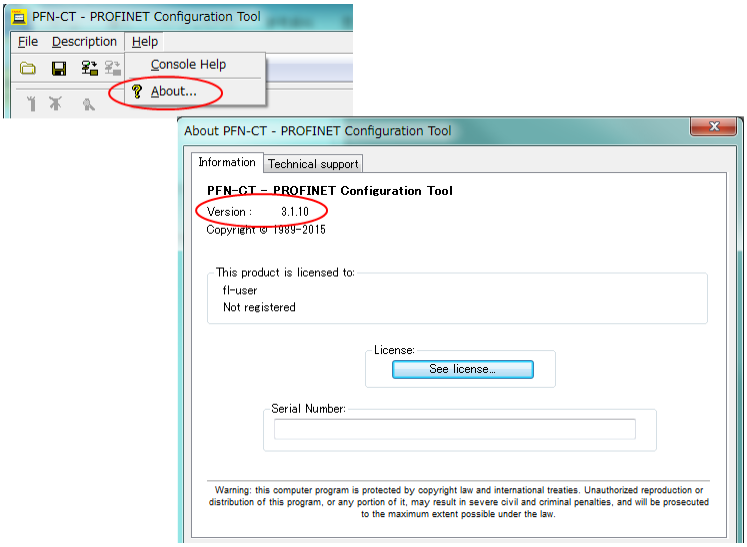
Error number	Meaning and action to be taken	Error code on log screen
52	The requirements to set the PMC allocation from the Setting tool are not satisfied. When you set the PMC allocation from the Setting tool, confirm the followings. **Item** / **Requirements** PROFINET function Software: - Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A: Edition 02 or later of Series 658R - Series 0*i*-F: Edition 02 or later of Series 658U Embedded Ethernet software: - Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A: Edition 15 or later of Series 658M - Series 0*i*-F: Edition 05 or later of Series 658A When these requirements are not satisfied, set the PMC allocation by the setting screen of the PROFINET IO Controller function in CNC. Because the settings of the PMC allocation is not downloaded. If downloading fails by excluding the above, restart the CNC and the Setting tool, and retry downloading. If downloading still fails, contact us, describing the information on the log screen.	(Undefined)
56	It was not possible to change the device name or the IP parameters because communication was in progress.	(None)
(Other)	Contact us.	(Undefined)

4.6.1.13 Version of Setting tool and Revision record

This subsection describes the version checking of the Setting tool and the Revision record.

Procedure

1 Select the menu [Help] -> [About] to display the "Information" screen, then the version of the Setting tool can be confirmed.



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Version of Setting tool and Revision record

Version of Setting tool	Revision record
V3.1.10	• First edition

4.6.1.14 Difference with the Setting tool of Molex

This subsection describes the difference with the Setting tool of Molex "PROFINET Configuraition Tool (PFN-CT) for FANUC CORPORATION".

NOTE
The screen shown in Subsection 4.6.1.8, "Setting and Checking of PMC Allocation" is not displayed for the Setting tool of the Molex. Set the PMC allocation by the setting screen of the PROFINET IO Controller function in CNC.

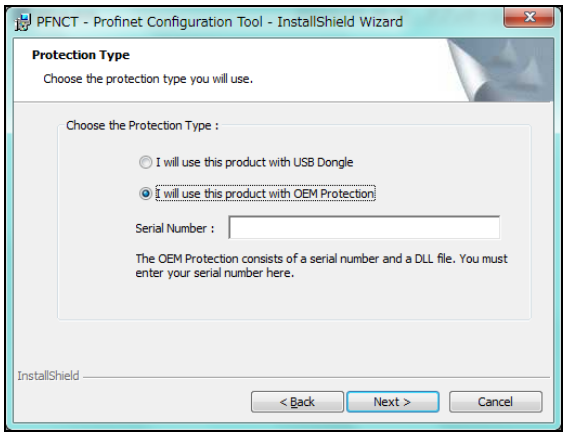
Installation Folder

The installation folder and the storage file of default are as follows.

OS	インストールフォルダおよび格納ファイル
Windows 7 or later	C:/Program Files/BradCommunications/PFNCT - Profinet Configuration Tool • The exe file and the dll file to execute the Setting tool are stored.
	C:/ProgramData/BradCommunications/PFNCT - Profinet Configuration Tool • Made configuration file and GSDML file are stored.
Windows XP	C:/Program Files/BradCommunications/PFNCT - Profinet Configuration Tool • The exe file and the dll file to execute the Setting tool are stored.
	C:/Documents and Settings/All Users/Application Data/BradCommunications/PFNCT - Profinet Configuration Tool • Made configuration file and GSDML file are stored.

Serial Number

The serial number is printed for "S/N" on the installation CD-ROM label.
When the following screen is displayed in the installation, select "I will use this product with OEM Protection".
Then, input the serial number in the "Serial Number" field.



Making new settings

This subsection describes the procedure of making new settings.

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Step	Description
1	• Setting of the IP parameters for the CNC In the CNC, set the IP parameters and restart the CNC. → See Subsection 4.3.2.1, "COMMON screen".
2	• Registration of the CNC in the Setting tool In the Setting tool, register the CNC. → See Subsection 4.6.1.3, "Registration of the CNC in the Setting tool".
3	• Installation of the GSDML file In the Setting tool, install the GSDML file of each IO Device. → See Subsection 4.6.1.4, "Installation of the GSDML file".
4	• Confirmation of IO Devices on the network In the Setting tool, confirm the IO Devices connected on the network. → See Subsection 4.6.1.5, "Confirmation of IO Devices on the network". If device names are not set for any of the connected IO Devices, set the device names. → See Subsection 4.6.1.6, "Setting of the device names for IO Devices".
5	• Setting of IO Devices In the Setting tool, make the settings for operating IO Devices. The device names to set here must match the ones that are set in step 4. → See Subsection 4.6.1.7, "Setting of IO Devices".
6	• Downloading of the settings In the Setting tool, download all the settings to the CNC. → See Subsection 4.6.1.9, "Downloading of settings".
7	• Allocation of the PMC area In the CNC, allocate the PMC area for DI/DO data and status data. → See Subsections 4.3.2.2, "Setting screen of the PROFINET IO Controller function" and 4.3.3, "PMC Allocation".

After the above settings are made, restarting the CNC causes communication to start with each IO Device.

Calculating the DI/DO addresses of each module if using the Setting tool

The following describes how to calculate the DI/DO addresses of each module if using the Setting tool.

DI or DO addresses of each module = X + (Y × 2)

X: In the CNC, DI/DO address on the setting screen of the PROFINET IO Controller function

Y: In the Setting tool, the value of "Offset in Word in the Shared Memory" in "Position" of each module of the "Profinet Channel" screen

Calculation example)

The following is an example of calculating the DI address of the input module "INPUT 003 bytes" implemented in slot 001 of the IO Device "fanuc-cnc" ("Number" = 010 and IO Device number = 1) of two IO Devices.

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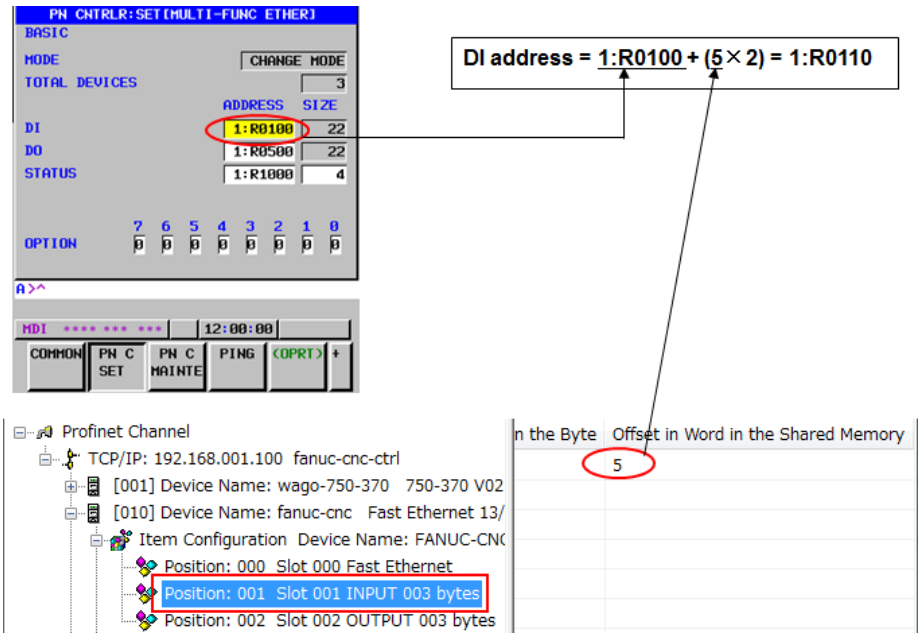

Status codes

Error number	Meaning and action to be taken	Error code on log screen
43	The DI area of the PMC is wrong. Clear "DI ADDRESS" on the setting screen of the PROFINET IO Controller function for the CNC, then download again. Review the DI area of the PMC, and then set "DI ADDRESS". This status code is also displayed if the DI area of the PMC is insufficient.	E-1601
44	The DO area of the PMC is wrong. Clear "DO ADDRESS" on the setting screen of the PROFINET IO Controller function for the CNC, then download again. Review the DO area of the PMC, and then set "DO ADDRESS". This status code is also displayed if the DO area of the PMC is insufficient.	
52	Downloading failed for some cause or other. Restart the CNC and the Setting tool, and retry downloading. If downloading still fails, contact us, describing the information on the log screen.	(Undefined)

4.6.2 Supplement to the PROFINET Standard

This subsection contains a supplement to the PROFINET standard.

4.6.2.1 Error Code

This subsection describes the error codes in the PROFINET standards: ErrorCode, ErrorDecode, ErrorCode1, and ErrorCode2.

The meaning of "ErrorCode" is as follows.

- If 0 : Normal
- If other than 0 : Abnormal

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The other error codes are abbreviated as follows.
- ErrorDecode : ErrD
- ErrorCode1 : Err1
- ErrorCode2 : Err2

ErrD (hexadecimal)	Err1 (hexadecimal)	Err2 (hexadecimal)	Meaning and action to be taken
81	02	0B	The IO Device does not support the Input/output update time that is set with the IO Controller. See "Setting of the Input/output update time" of Subsection 4.6.1.7, "Setting of IO Devices" to correct the "refresh period".
81	3F	03	An IO Device that has the same device name exists on the network. See Subsection 4.6.1.5, "Confirmation of IO Devices on the network" and Subsection 4.6.1.6, "Setting of the device names for IO Devices" to correct the device name.
81	3F	04	No device name is set for the IO Device. Or, the IO Device for which a connection request is made cannot be found on the network. First, confirm that the Ethernet cable is connected. Next, see Subsection 4.6.1.5, "Confirmation of IO Devices on the network" and Subsection 4.6.1.6, "Setting of the device names for IO Devices" to correct the device name.
81	3F	05	No IP address is set for the IO Device. Or, the IO Device for which a connection request is made cannot be found on the network. Take an action similar to that for "ErrD=81, Err1=3F, and Err2=04".
81	3E	01	A timeout occurred after a connection was made. Confirm that the Ethernet cable is connected.
(Other)			This is an internal error code. Contact us.

4.6.2.2 Alarms

This subsection describes the alarms in the PROFINET standard.
These alarms are used to notify the IO Controller of any errors and changes that IO Devices may detect.

Alarm type

Alarm type (hexadecimal)	Meaning
0000	Reserved
0001	Diagnosis
0002	Process
0003	Pulling
0004	Plugging
0005	Status
0006	Update
0007	Media Redundancy
0008	Control by the IO Supervisor
0009	Released
000A	Plugging of a wrong submodule
000B	Recovery of a submodule
000C	Disappearance of diagnosis

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Alarm type (hexadecimal)	Meaning
000D	Multicast communication mismatch notification
000E	Port data change notification
000F	Synchronous data change notification
0010	Isochronous mode problem notification
0011	Network component problem notification
0012	Time data change notification
0013 to 001D	Reserved
001E	Upload and retrieval notification
001F	Module pulling
0020 to 007F	Manufacturer-specific portion
0080 to 00FF	Reserved for profiles
0100 to FFFF	Reserved

Alarm priority

Alarm priority	Meaning
5	Low priority
6	High priority

4.6.2.3 Status

This subsection describes the status in the PROFINET standard.

APDU status

This is the status (1 byte) that indicates the state of the input/output frame.

Bit	Name	Meaning
#0	State	0: IOCR is in the "backup" state. 1: IOCR is in the "primary" state. IOCR means a channel for IO communication, and this bit is usually 1.
#1	Redundancy	0: One AR exists. 1: Not a single AR exists. AR means a channel at the application level, and this bit is usually 0.
#2	DataValid	0: The frame data is invalid. 1: The frame data is valid.
#3	Reserved	
#4	ProviderState	0: The control application of the provider (sender) is in the STOP state. 1: The control application of the provider (sender) is in the RUN state.
#5	StationProblem Indicator	0: A problem is detected. 1: Normal operation
#6	Reserved	
#7		

IOPS and IOCS

This is the status (1 byte) that is provided for each module in the input/output frame.
IOPS: State of the send data when the IO Controller/IO Device is a provider (sender)
IOCS: State of the receive data when the IO Controller/IO Device is a consumer (receiver)

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Bit	Name	Meaning
#0	Extension	0: End of a module 1: Not the end of a module
#1 #2 #3 #4	Reserved	
#5 #6	Instance	If DataState is BAD, one of the following is set. 0x00: Detected by a Subslot 0x01: Detected by a Slot 0x02: Detected by the IO Device 0x03: Detected by the IO Controller
#7	DataState	0: BAD The data is invalid, so the data to be transferred should be ignored, and the prescribed value (zero data, valid data received last, or default data) should be used. 1: GOOD The data is valid.

4.6.2.4 I&M data

This subsection describes the I&M (Identification and Maintenance) data in the PROFINET standard.
The "Display on the screen" column of the table contains the names of the displays on the DEVICE INFO screen of the maintenance screen of the PROFINET IO Controller function.

I&M data

Display on the screen	Name	Meaning
VendorID	Vendor ID	Vendor ID. 16-bit identification that uniquely identifies the maker.
OrderNo	Order ID	Order number. (20 characters maximum)
SerialNo	Serial Number	Serial number. (16 characters maximum)
HwRev	Hardware Revision	Hardware version.
SwRev	Software Revision	Software version. This is displayed as "W.X.Y.Z", and means the following. Item: W — Character that indicates the software type (1 character) V or R: Officially released version P : Prototype U : Under test T : Test device Item: X — Version of functional enhancement Item: Y — Version of bug fix Item: Z — Version of internal change
RevCnt	Revision Counter	Revision counter.
Profile	Profile ID and Profile Specific Type	Information for the application profile. This is displayed as "XXXXH / YYYYH", and means the following. XXXXH: Application profile ID (hexadecimal) YYYYH: Type of a special application profile (hexadecimal)
Version	I&M Version	Version of the I&M functions supported by the IO Device.
Support	I&M Supported	Bits 0 to 15 of this parameter (hexadecimal) indicate whether the I&Mn data (where n = 0 to 15) defined in the PROFINET standard is valid or invalid.

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NOTE

1 The I&M0 data means "Vendor ID" to "I&M Supported" in the above table, and the IO Device must implement this data. The I&M1 data to the I&M15 data are optional.
The PROFINET IO Controller function for the FANUC CNC can get only the I&M0 data.

2 For details of the I&M data that is gotten, confirm with the IO Device manufacturer.

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FANUC Series 30*i*/31*i*/32*i*/35*i*–MODEL B,
FANUC Power Motion *i*–MODEL A, FANUC Series 0*i*-MODEL F
Industrial Ethernet CONNECTION MANUAL

1. Type of applied technical documents

Name	FANUC Series 30*i*–MODEL B FANUC Series 31*i*–MODEL B FANUC Series 32*i*–MODEL B FANUC Series 35*i*–MODEL B FANUC Power Motion *i*–MODEL A FANUC Series 0*i*–MODEL F Industrial Ethernet CONNECTION MANUAL
Spec.No./Version	B-64013EN/03

2. Summary of change

Group	Name / Outline	New, Add, Correct, Delete	Applicable Date
Basic Function			
Optional Function	The PMC multiple allocation of PROFINET IO Controller function is available.	Add	Immediately
Unit			
Maintenance parts			
Notice			
Correction			
Another			

Edit	Date	Design	Description
Date		2017.03.08	Design A.Hiramatsu Apprv. Inoue

Title	FANUC Series 30*i*/31*i*/32*i*/35*i*-MODEL B, Power Motion *i*-MODEL A, FANUC Series 0*i*-MODEL F Industrial Ethernet CONNECTION MANUAL
Draw No.	B-64013EN/03-3
FANUC CORPORATION	Sheet 1/95

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The relation Industrial Ethernet CONNECTION MANUAL (B-64013EN/03) and between this manual

Replace Chapter 4, "PROFINET IO CONTROLLER FUNCTION" in Part III, "FUNCTION" of B-64013JA/03 with Chapter 4, "PROFINET IO CONTROLLER FUNCTION" of this manual.

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4 PROFINET IO CONTROLLER FUNCTION

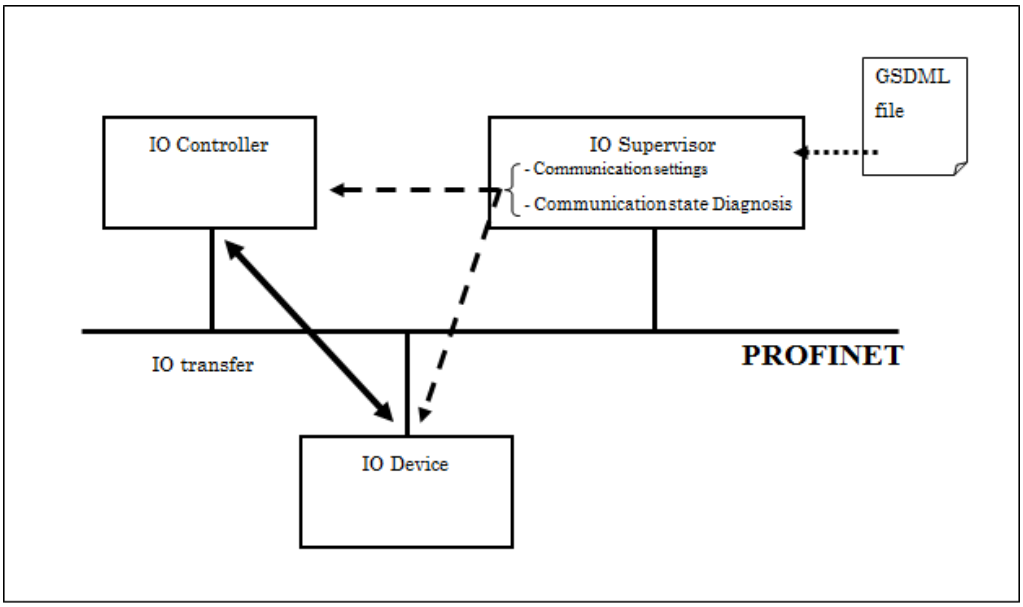
NOTE
If using the PROFINET IO Controller function, be sure to read Part II, "COMMON".

4.1 OVERVIEW

This section provides an overview of the PROFINET function.

4.1.1 Introduction

PROFINET is an industrial network using Ethernet. It enables IO communication between IO Controller and IO Device. The communication standard is managed by PI (PROFIBUS & PROFINET International).



Overview of PROFINET

4.1.2 Terminology

Terms related to the PROFINET function are described below.

IO Controller
This is a device that starts IO transfer.
In PROFIBUS, it is equivalent to a class 1 master function.

IO Device
This device communicates with an IO Controller.
In PROFIBUS, it is equivalent to a slave function.

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IO Supervisor

In general, this is an instrument such as a PC (personal computer) and an HMI (human machine interface).
It is used to make the communication settings for and diagnose a PROFINET system, and is usually supplied from an IO Controller device manufacturer.
In PROFIBUS, it is equivalent to a class 2 master function.

NOTE

1 To use the IO Controller function for a FANUC CNC, the IO Supervisor of FANUC is required.
The IO Supervisor of FANUC is PROFINET Configuration Tool included in CNC Setting tool.
The product name and order number of PROFINET Configuration Tool are as follows.

No.	Product name	Order number	Version
1	FANUC CNC Setting Tool	A08B-9510-J540	Version 2.0 or later
2	FANUC CNC Setting Tool (10 users)	A08B-9510-J541	
3	FANUC CNC Setting Tool (20 users)	A08B-9510-J542	
4	FANUC CNC Setting Tool (Site license)	A08B-9510-J543	

2 PROFINET Configuration Tool cannot be newly installed for the Update version "FANUC CNC Setting Tool (Update)" (Order number: A08B-9510-J544). When you update PROFINET Configuration Tool by the Update version, use the serial number enclosed with No.1-4. Because the serial number of PROFINET Configuration Tool is not enclosed with the Update version.
3 The PROFINET Configuration Tool is written as "Setting tool".
For details, see Subsection 4.6.1, "PROFINET Configuration Tool".

GSDML (General Station Description Makeup Language) file

This is a file in XML form in that contains device information about an IO Device.
A GSDML file is necessary for making settings with an IO Supervisor.

NOTE

For how to get the GSDML file for each IO Device, contact the manufacturer of that IO Device.
If using the PROFINET IO Device function for a FANUC CNC, contact your sales representative for how to get the GSDML file.

Slot
Module

These are terminology used when a hardware configuration of the IO Device is shown.
For the general PROFINET IO Device, the hardware that is called a module is mounted on the slot, and IO communication is executed.
The slot is a place to mount the module, and is usually allocated with the slot number of the 0-origin.
The module is various as follows.

- A communication module that supports the communication function
- A input/output module to input and output the DI/DO signal
- A safety module that supports the safety communication function

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For a FANUC CNC, neither a physical slot nor a module exists, and the following logical slots and modules are defined.

Slot number	Module	Description
0	Communication module	It is the hardware option of a FANUC CNC. In the IO Supervisor, the specific information of the communication module is displayed. Moreover, the settings for the standard module of a FANUC CNC (CNC-specific parameter settings such as PMC allocation) are done from the setting screen of this module.
1	Input module (Standard module)	It is the input/output module to input and output the DI/DO signal of a FANUC CNC. In the setting by the IO supervisor, select the input/output module according to input/output size used. The input/output module for a FANUC CNC is assigned to the PMC area.
2	Output module (Standard module)	
3	Safety module	It is the input/output module that supports the safety communication function of a FANUC CNC. In the setting by the IO supervisor, select the safety module according to input/output size used. The safety module of a FANUC CNC is assigned to the PMC area.

NOTE

The safety module is used by the PROFINET IO Device safety function. For details, see the Chapter C, "PROFINET IO DEVICE SAFETY FUNCTION" in APPENDIX.

Group Slot

When allocating the PMC area for each slot, there is a possibility that the setting items of the PMC allocation become enormous, because the maximum number of a slot in the PROFINET standard is 32767 per 1 IO Device.

Therefore, the grouping of a slot is introduced in FANUC CNC. The grouping of a slot means that grouping of multiple slots, and assigning the number to a grouped slot newly. The grouped slot is called "Group Slot", and the newly assigned number is called the group slot number. The PMC allocation should be done for each group slot.

The following shows a example when slot numbers 0 and 1 are grouped into group slot number 0 and when slot numbers 2 and 3 are grouped into group slot number 1 in DI data of IO Device number 0.

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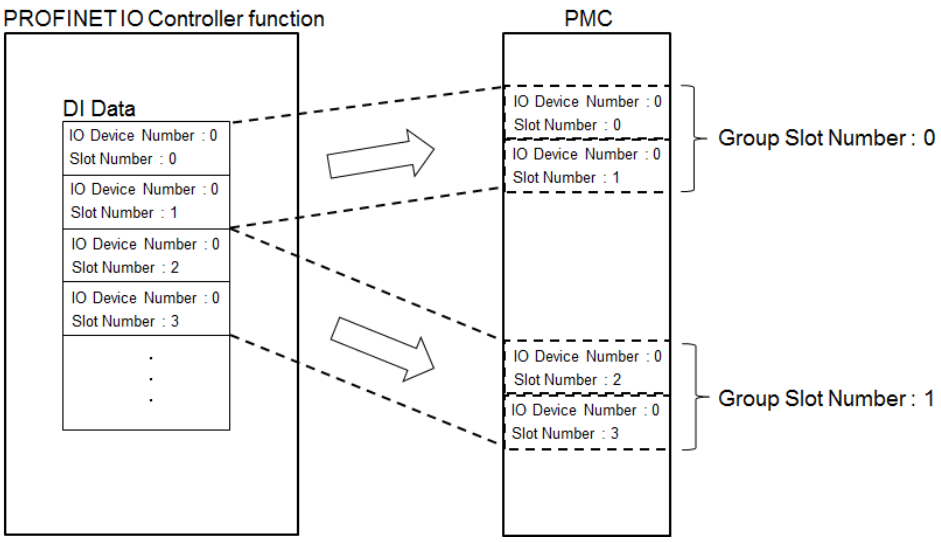


In the case of DO data, the data is transferred from the PMC area to the DO data area within the PROFINET IO Controller function. The data transfer direction is the opposite of the above figure, but the group slot concept is the same as above.

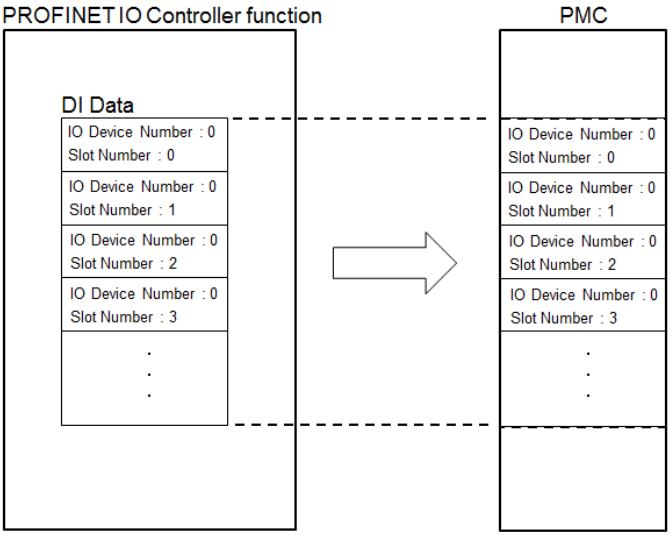
NOTE

When grouping slots, note the followings.

- The group slot number is assigned automatically.
- Slots of different IO Devices cannot be grouped together.

PMC Single Allocation Mode

In this mode, DI/DO data of all IO Devices can be allocated to one PMC area.
The following shows a example when the DI data of all IO Devices is continuously allocated to one PMC area.



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In the case of DO data, the data is transferred from the PMC area to the DO data area within the PROFINET IO Controller function. The data transfer direction is the opposite of the above figure, but the PMC allocation concept is the same as above.

PMC Multiple Allocation Mode

In this mode, multiple group slots can be created as shown in the example of "Group Slot", and the PMC area can be allocated for each group slot.

Error Log

In the PMC multiple allocation mode of FANUC CNC, the detected error codes in the PROFINET standard can be stored in the PMC area.
The log of the error code stored in the PMC area is called "Error Log".

Alarm Log

In the PMC multiple allocation mode of FANUC CNC, the detected alarms in the PROFINET standard can be stored in the PMC area.
The log of the alarm stored in the PMC area is called "Alarm Log".

Input/output update time

This time is the interval when the input/output frame is transmitted or received in IO transfer.
This time is set by the IO Supervisor.

NOTE
"Input/output update time" is called by the IO Supervisor as follows.
- Setting tool of a FANUC CNC : Refresh Period
- STEP7 of Siemens AG : Update Time

I&M (Identification and Maintenance) data

This data is used to identify and maintain an IO Device.
An IO Supervisor and an IO Controller can get this data from an IO Device by way of communication.

IP parameters

The IP address, the subnet mask, and the router IP address are collectively called IP parameters.

CHANGE MODE

This mode allows the changing of the PROFINET parameters of the CNC.

PROTECT MODE

This mode protects (prohibits) the changing of the PROFINET parameters of the CNC.

4.2 SPECIFICATIONS

This section describes the specifications of the PROFINET IO Controller function of the CNC.

4.2.1 Specification List

The following is a list of specifications of the PROFINET IO Controller function of the CNC.

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Item	Description
PROFINET IO Conformance class	CC-A
Required software	PROFINET function software - For the Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A : PROFINET_Configuration_Tool series - For the Series 0*i*-F : 658U series
Required software option	PROFINET IO Controller function option (R971)
Combination with other functions	Functions that can be used at the same time on different hardware options - Ethernet function (S707) - Modbus/TCP Server function (R968) - Data Server function (S737) - FL-net function (J962) - EtherNet/IP Scanner function (R966) - EtherNet/IP Adapter function (R967) - PROFINET IO Device function (R972) Functions that can be used at the same time on the same hardware option are not provided.
PMC area that can be allocated	For PMC: - DI : R, E, D, and X areas - DO : R, E, D, and Y areas - Status : R and E areas For DCS-PMC: - DI : R and X areas - DO : R and Y areas When using DCS-PMC, Dual Check Safety function (S661) is required.
Maximum number of IO Devices that can be connected	48 Depending on the number of modules per IO Device and other factors, it may not be possible to connect up to 48 Devices.
Maximum number of Group Slots can be configured	48 When PMC allocation expansion of the PROFINET IO Controller function (R979) is enabled, this is 256. For example, when equally assigning the number of group slots to 8 IO devices, the number of group slots that can be set per IO Device is as follows. - When R979 is disabled: 6 (= 48/8) - When R979 is enabled : 32 (= 256/8)
Maximum DI/DO data size per IO Device	1024 bytes /1024 bytes
Maximum total size of DI/DO data of all IO Devices	12288 bytes /12288 bytes
DI/DO update time	2 ms or greater 2 ms is the minimum value that applies when the number of connected IO Devices and the DI/DO size are small. For details, see Section 4.5, "UPDATING DI/DO DATA".
Response when an alarm is received from an IO Device	Automatic operation
UDP port number	34962 to 34964 (fixed)

NOTE

1 A FANUC CNC does not support SNMP (Simple Network Management Protocol), and cannot make diagnosis of a CNC network using SNMP.

2 If the PROFINET IO Controller function is used, communication via a router and the DHCP/DNS function cannot be used.

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4.2.2 Unit of Data and Concurrency of Data

The unit of I/O data can be word (2 bytes) only.
The concurrency of word (2-byte) data is guaranteed, and there will never be data segmentation. The concurrency of long (4-byte) data cannot be guaranteed.

NOTE
"Unit of Data", as used here, is equivalent to the "Data type" of a module to configure in an IO Device. Check the data type of each module with the IO Device manufacturer.

⚠ WARNING
The data types of modules that are supported by the PROFINET IO Controller function of the CNC are byte, word (two bytes), and long (four bytes). For modules whose data type is long (four bytes) and for modules whose data type is byte and whose data size is larger than a word (two bytes), data segmentation may occur.
For an explanation of notes on creating a ladder program for guaranteeing the concurrency of data, see Subsection 3.1.2, "Creating a Ladder Program" in Part II, "COMMON".
Data segmentation may result in the machine behaving unexpectedly, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.

4.2.3 Conversion of Endian

The signal order of I/O data can be selected from the big-endian and the little-endian.
(Default setting: Big-endian)
For how to set the conversion of endian, see "Setting of endian conversion" in Subsection 4.6.1.7, "Setting of IO Devices".

⚠ WARNING
Before starting operation, make sure that an appropriate value is specified for the setting item for selecting the conversion of endian and data is exchanged in the correct order.
If operation is started without checking the above, the machine may behave unexpectedly, possibly causing damage to the tool, machine, and/or workpiece, or injury to the user.

NOTE
The actual signal order depends on the data type (byte, word, or long) of the module to configure in the IO Device and the specifications of the IO Device. Check the specifications of each IO Device with the manufacturer of that IO Device.

For the actual signal order due to the endian conversion, the relation between "On the Ethernet line" and the PMC area of the CNC is as follows.

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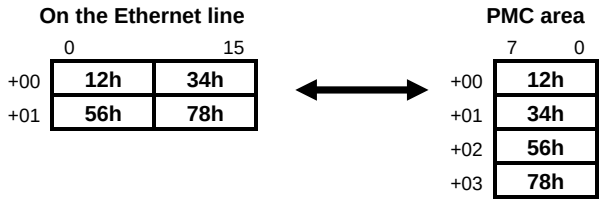
If the data type of the module is byte

If the big-endian is selected

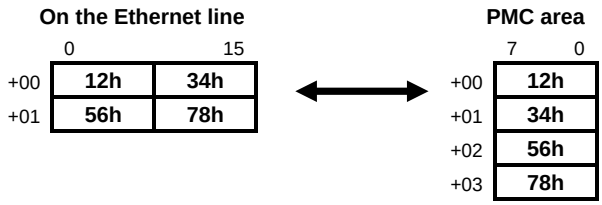


If the little-endian is selected

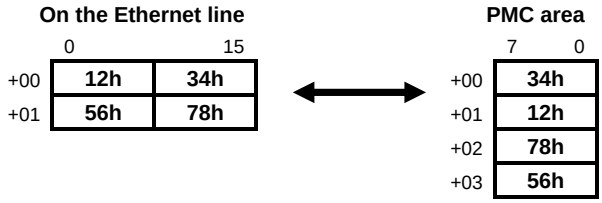
The relation is the same as that when the big-endian is selected.

If the data type of the module is word

If the big-endian is selected

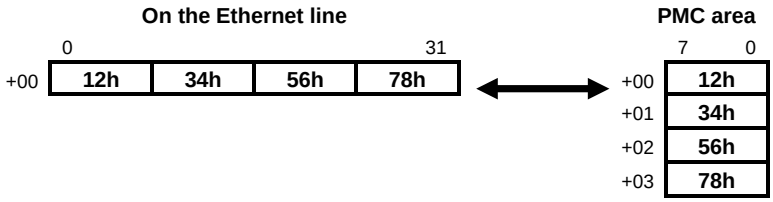


If the little-endian is selected

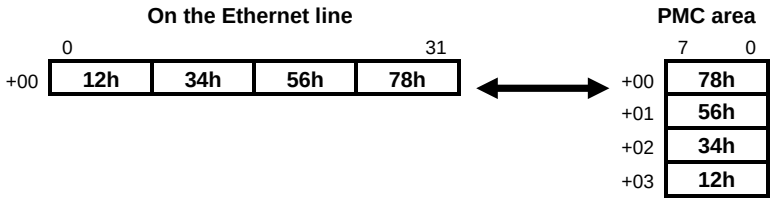


If the data type of the module is long

If the big-endian is selected



If the little-endian is selected



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4.2.4 Setting Examples If Using Multiple Communication Functions at the Same Time

This subsection provides examples of setting parameters Nos. 970 to 976 if using multiple communication functions, in addition to the PROFINET IO Controller function.
For details of how to set parameters Nos. 970 to 976, see Chapter 2, "HARDWARE OPTIONS AND COMMUNICTION FUNCTIONS" in Part II, "COMMON".

Ex.	Function to use	Hardware option on which to operate it	NC parameter
1	PROFINET IO Controller function	Multi-function Ethernet	No.970= 3 No.974= 1 No.971= -1 No.975= -1 No.972= -1 No.976= -1 No.973= 4
	Ethernet function Data Server function	Fast Ethernet board mounted in slot 1	
	PROFINET IO Device function	Fast Ethernet board mounted in slot 2	
2	PROFINET IO Controller function	Multi-function Ethernet	No.970= 3 No.974= 1 No.971= 4 No.975= -1 No.972= -1 No.976= -1 No.973= 3
	Ethernet function PROFINET IO Device function	Fast Ethernet board mounted in slot 1	
	FL-net function	Fast Ethernet board mounted in slot 2	

4.3 SETTING

This section describes the setting of the PROFINET IO Controller function.

NOTE

1 To make the settings of the PROFINET IO Controller function, either set the CNC to the emergency stop state or change the CNC mode to the MDI mode, and change the setting item "MODE" on the setting screen of the PROFINET IO Controller to "CHANGE MODE".
2 To prevent the settings from being changed unintentionally, change the setting item "MODE" on the CNC screen to "PROTECT MODE" after completing settings.
For details of the setting item "MODE", see Subsection 4.3.2.2, "Setting screen of the PROFINET IO Controller function".
3 To make the settings of the PROFINET IO Controller function of CNC, use the Setting tool of FANUC. For details of the Setting tool, see Subsection 4.6.1, "PROFINET Configuration Tool".

4.3.1 Procedure for Making Settings

This subsection describes the procedure for making settings.

4.3.1.1 Making new settings

This subsection describes the procedure of making new settings.

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NOTE

When the Setting tool and CNC are made online, step 1 is necessary work. When Step 1 is not done, and when the Setting tool and CNC is in offline, the work that can be set is step 2, 3, 5, and 6. Step 1, 4, and 7 can be done after step 2, 3, 5, and 6.

Step	Description
1	• Setting of the IP parameters for the CNC In the CNC, set the IP parameters and restart the CNC. → See Subsection 4.3.2.1, "COMMON screen".
2	• Registration of the CNC in the Setting tool In the Setting tool, register the CNC. → See Subsection 4.6.1.3, "Registration of the CNC in the Setting tool".
3	• Installation of the GSDML file In the Setting tool, install the GSDML file of each IO Device. → See Subsection 4.6.1.4, "Installation of the GSDML file".
4	• Confirmation of IO Devices on the network In the Setting tool, confirm the IO Devices connected on the network. → See Subsection 4.6.1.5, "Confirmation of IO Devices on the network". If device names are not set for any of the connected IO Devices, set the device names. → See Subsection 4.6.1.6, "Setting of the device names for IO Devices".
5	• Setting of IO Devices In the Setting tool, make the settings for operating IO Devices. The device names to set here must match the ones that are set in step 4. → See Subsection 4.6.1.7, "Setting of IO Devices".
6	• Allocation of the PMC area In the Setting tool, allocate the PMC area for DI/DO data and status data. → See Subsections 4.6.1.8, "Setting and Checking of PMC Allocation" and 4.3.3, "PMC Allocation".
7	• Downloading of the settings In the Setting tool, download all the settings to the CNC. → See Subsection 4.6.1.9, "Downloading of settings".

After the above settings are made, restarting the CNC causes communication to start with each IO Device.

4.3.1.2 Changing the settings of IO Devices

Start with step 5, "Setting of IO Devices", in Subsection 4.3.1.1, "Making new settings".

4.3.1.3 Adding new IO Devices

Start with step 3, "Installation of the GSDML file", in Subsection 4.3.1.1, "Making new settings".
If the GSDML file of the IO Device to add has already been installed, start with step 4, "Confirmation of IO Devices on the network".

4.3.1.4 If the Ethernet parameters of the CNC are changed

The Ethernet parameters of the CNC are changed in either of the following cases:

- You change the IP parameters on the COMMON screen of CNC
- You change the hardware option of the CNC, so that its MAC address is changed

In either case, perform step 2, "Registration of the CNC in the Setting tool", in Subsection 4.3.1.1, "Making new settings", first and then perform step 7, "Downloading of the settings".

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Perform other steps, if necessary.

4.3.2 Setting Screen of the CNC

This subsection describes the setting screen of the CNC.

Procedure

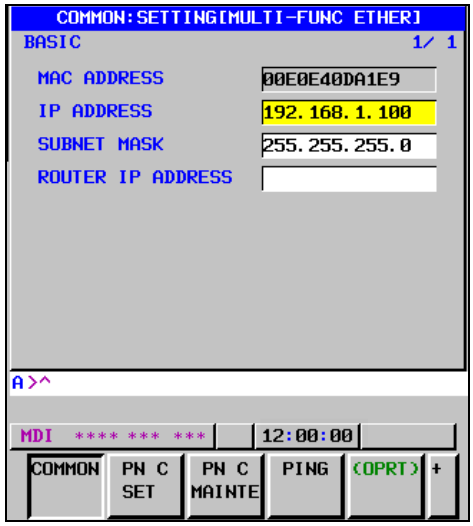
1 Press function key SYSTEM.

2 Soft key [PRFNET CNTRLR] appears. When soft key does not appear, press the continue key.

3 Press soft key [PRFNET CNTRLR]. Soft keys [COMMON], [PN C SET], [PN C MAINTE], [PING], "COM STATE", and "TASK STATE" appear.

4.3.2.1 COMMON screen

In the above-mentioned procedure, press soft key [COMMON] to display the COMMON screen (BASIC). On this screen, IP parameters can be set.



COMMON screen (BASIC)

Setting items

Item	Description
IP ADDRESS	IP address of the hardware option. (Example of specification format: "192.168.0.100")
SUBNET MASK	Mask address for the IP addresses of the network. (Example of specification format: "255.255.255.0")
ROUTER IP ADDRESS	IP address of the router. Leave the item blank because PROFINET communication via a router is not supported.

Display item

Item	Description
MAC address	MAC address of the hardware option

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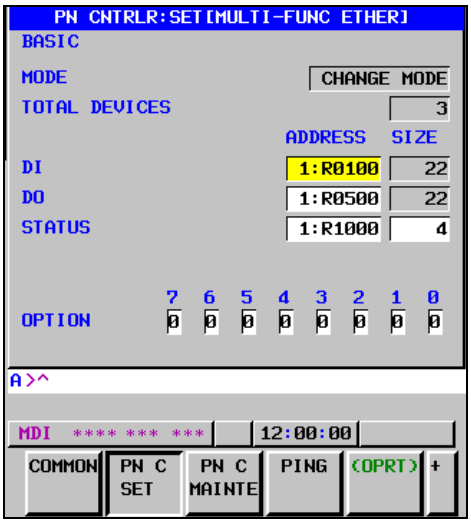
4.3.2.2 Setting screen of the PROFINET IO Controller function

In the above-mentioned procedure, press soft key [PN C SET] to display the setting screen (basic screen) of the PROFINET IO Controller function.

> **NOTE**
> The setting items other than the setting item "MODE" on the setting screen (basic screen) of the PROFINET IO Controller function can be set by the Setting tool.



Setting screen of the PROFINET IO Controller function (BASIC)

Display item

The following display items are decided by the setting with the Setting tool.

Item	Description
TOTAL DEVICES	Number of IO Devices to connect.
DI/DO SIZE	Size of the area in which to store the DI/DO data of all IO Devices.

Setting items

Item	Description
MODE	Select the mode of the PROFINET IO Device function. - "CHANGE MODE" In this mode, settings can be changed from the Setting tool or the setting screen of the PROFINET IO Controller function. - "PROTECT MODE" In this mode, settings cannot be changed from the Setting tool or the setting screen of the PROFINET IO Controller function.

Confirmation items

The following confirmation items can be set from this screen, but normally, set from the Setting tool.

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Setting items

Item	Description
DI/DO ADDRESS	- PMC Single Allocation Mode Specify the top address of the PMC area in which to store the DI/DO data of all IO Devices. Only a PMC address that is a multiple of 4 can be specified. The specifiable PMC area is the R, E, D, X (DI only), or Y (DO only) area. The specifiable DCS-PMC area is the R, X (DI only), or Y (DO only) area. Specify 9 for the PMC path number of DCS-PMC. If the X/Y address of the PMC is to be assigned, it is necessary to set parameters Nos. 11937 to 11939 also. For details of these NC parameters, see Section 4.3, "PARAMETERS RELATED TO PMC" in Part II, "COMMON". When using DCS-PMC, Dual Check Safety function (S661) is required. For an explanation of the allocation of DI/DO data to the PMC, see Subsection 4.3.3.1.1, "PMC Single Allocation Mode". - PMC Multiple Allocation Mode "---" is displayed. DI/DO address cannot be specified. Specify the DI/DO address of each group slot from the Setting tool.
STATUS ADDRESS	Specify the top address of the PMC area in which to store the status. The specifiable PMC area is the R or E area. For details of the notified status, see Subsection 4.3.3.2, "Status".–
STATUS SIZE	Specify the size of the PMC area for storing the status. Setting range: 0 to 49 (byte). The status of the specified size is notified. For details of the notified status, see Subsection 4.3.3.2, "Status".

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Item	Description
OPTION	Bit 0: The next time the power is turned on, all settings of the PROFINET IO Controller function are 0: Not initialized. 1: Initialized. Bit 1: Specify the action to take on the data in the DI area of the IO Device when the communication is disconnected. 0: Clear the DI area to zero. 1: Hold the data in the DI area. "When the communication is disconnected" above is when any of the status signals (+0 to +48) in Subsection 4.3.3.2, "Status", changes. The action taken if the bit is set to 0 (Clear the DI area to zero) is as follows. <table><tr><th>Signal</th><th>Change</th><th>Description</th></tr><tr><td>SF</td><td>0→1</td><td>The DI areas of all IO Devices are cleared to zero.</td></tr><tr><td>CONxx</td><td>1→0</td><td rowspan="3">Only the DI area of IO Device xx is cleared to zero.</td></tr><tr><td>RAPxx</td><td>1→0</td></tr><tr><td>IOxx</td><td>1→0</td></tr></table>Bit 2: Specify PMC Single Allocation Mode or PMC Multiple Allocation Mode. 0: PMC Single Allocation Mode 1: PMC Multiple Allocation Mode If you change this bit, PMC allocation mode will switch when the power is turned on next time. **NOTE** The PMC allocation mode is switched by download from the Setting tool. After it is downloaded from the Setting tool, do not switch this bit on the setting screen (basic screen) of the PROFINET IO Controller function. If this bit is switched after it is downloaded from the Setting tool, the DI/DO refresh with the PMC area is not started. Then, "E-1618 DI/DO Refresh is not started(XH)" is displayed on the log screen of the PROFINET IO Controller function. Bit 3-7: Reserved (Must be 0)

⚠ WARNING

1 Before allocating the PMC area, be sure to read Section 3.1, "DI/DO DATA AND STATUS DATA" in Part II, "COMMON".

2 When the communication is disconnected, the DI area depends on the setting of bit 1 of "OPTION". When the communication is connected again, the data sent from the IO Device is reflected in the DI area of the IO Device. This means that if zero data is sent from the IO Device immediately after the communication is connected again, the DI area of the IO Device is cleared to zero.

Operation

Changing the setting for MODE

The setting for MODE can be changed.

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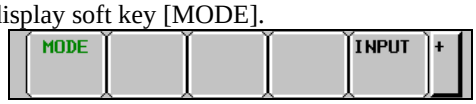
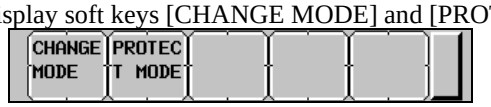
1 Press soft key [(OPRT)] to display soft key [MODE].



2 Press soft key [MODE] to display soft keys [CHANGE MODE] and [PROTECT MODE].



3 Press the soft key of the desired mode.

4.3.3 PMC Allocation

This subsection describes the allocation of DI/DO data and the status to the PMC.

4.3.3.1 DI/DO

This subsection describes the allocation of DI/DO data to the PMC.

4.3.3.1.1 PMC Single Allocation Mode

Allocation rules

DI/DO data is allocated per each module configured with the Setting tool, and is continuously allocated in descending order of the IO Device numbers.
The top address of each module is always a 2-byte boundary, regardless of the data type or the data size.
Top address examples) 1:R0000, 2:R0002, 3:R0004, 1:E0002

The following shows a DI area example for a case in which two IO Devices are used and input modules of various data types are set.

Configuration examples with the Setting tool)

IO Device		Slot number	Module name	Data type	Data size
"Number"	IO Device number				
001	0	0	Input module 1	Byte	1 byte
		1	Input module 2	Word	2 bytes
		2	Input module 3	Long	4 bytes
		3	Input module 4	Byte	1 byte
010	1	0	Input module 5	Byte	3 bytes

"DI ADDRESS" on the setting screen of the PROFINET IO Controller function)
1:R0100

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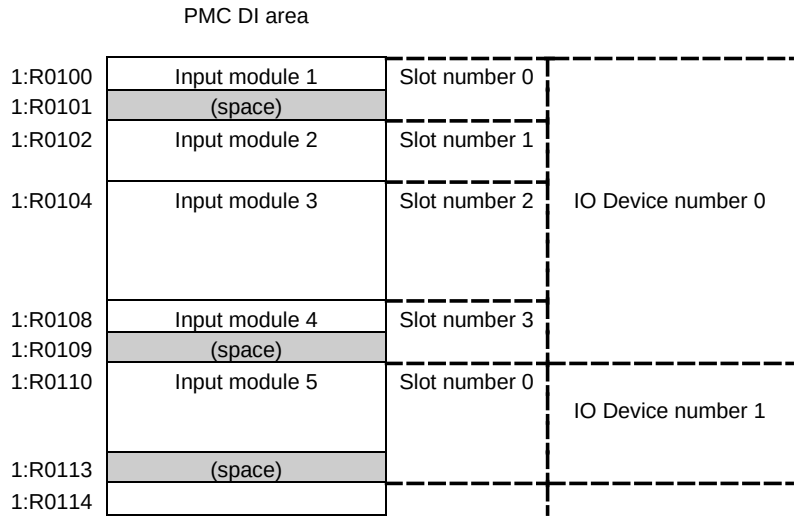
Results of allocation)



The allocation of the DO area where output modules are configured is the same as that shown above.

⚠ CAUTION

1 If the size of a module is an odd number, a 1-byte space is inserted. This space is treated as follows.
DI : Zero data is entered in a 1-byte space.
DO : Even if data is set in a 1-byte space, it is not output to the IO Device.

2 If a module whose data type is long is allocated to a 2-byte boundary of PMC addresses, data segmentation may occur. To prevent data segmentation from occurring on this module, it is necessary to allocate it to a 4-byte boundary of PMC addresses.
If you want to prevent data segmentation on a module whose data type is long, insert a module whose data byte is byte or word into a sequence of modules and make adjustments so that this module is allocated to a 4-byte boundary.

Calculating the DI/DO addresses of each module if using the Setting tool

The following describes how to calculate the DI/DO addresses of each module if using the Setting tool.

NOTE

The calculation value can be checked by the Setting tool. For checking, see "Checking of PMC Allocation for DI/DO" in Subsection 4.6.1.8.1, "PMC Single Allocation Mode".

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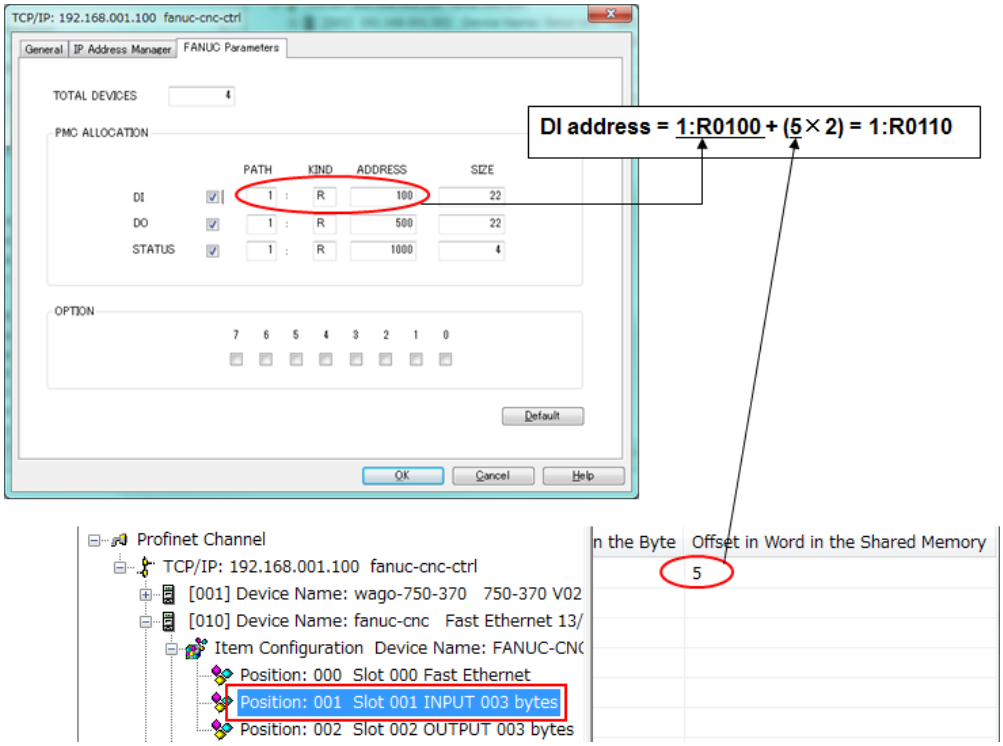
DI or DO addresses of each module = X + (Y × 2)

X: In the Setting tool, DI/DO address of "FANUC Parameters" tab of the "TCP/IP" screen

Y: In the Setting tool, the value of "Offset in Word in the Shared Memory" in "Position" of each module of the "Profinet Channel" screen

Calculation example)

The following is an example of calculating the DI address of the input module "INPUT 003 bytes" implemented in slot 001 of the IO Device "fanuc-cnc" ("Number" = 010 and IO Device number = 1) of two IO Devices.



4.3.3.1.2 PMC Multiple Allocation Mode

Allocation rules

DI/DO data is allocated to each group slot with the Setting tool.

The top address of each module is always a 2-byte boundary, regardless of the data type or the data size.

Top address examples) 1:R0000, 2:R0002, 3:R0004, 1:E0002

The following shows a DI area example for a case in which two IO Devices and three group slots are used, and input modules of various data types are set.

Configuration examples with the Setting tool)

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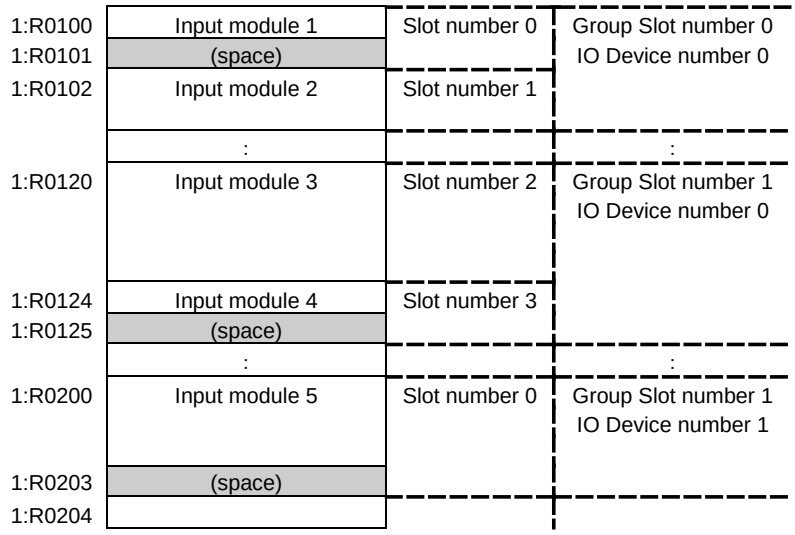
Group Slot number	IO Device "Number"	IO Device number	Slot number	DI address	Module name	Data type	Data size
0	001	0	0	1:R0100	Input module 1	Byte	1 byte
			1		Input module 2	Word	2 bytes
1			2	1:R0120	Input module 3	Long	4 bytes
			3		Input module 4	Byte	1 byte
2	010	1	0	1:R0200	Input module 5	Byte	3 bytes

Results of allocation)

PMC DI area



The allocation of the DO area where output modules are configured is the same as that shown above.

⚠ **CAUTION**

1 If the size of a module is an odd number, a 1-byte space is inserted. This space is treated as follows.
DI : Zero data is entered in a 1-byte space.
DO : Even if data is set in a 1-byte space, it is not output to the IO Device.

2 If a module whose data type is long is allocated to a 2-byte boundary of PMC addresses, data segmentation may occur. To prevent data segmentation from occurring on this module, it is necessary to allocate it to a 4-byte boundary of PMC addresses.

4.3.3.2 Status

This subsection describes the allocation of the status to the PMC.

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		Status							
		#7	#6	#5	#4	#3	#2	#1	#0
Address	+0	SW		–	–	–	–	BF	SF
	+1	–	–	–	–	–	IO00	RAP00	CON00
	...	...							
	+48	–	–	–	–	–	IO47	RAP47	CON47

Status (+0)

This is the status of the entire PROFINET IO Controller function.

Bit	Name	Description
#0	SF	System error 0: The PROFINET IO Controller function operates normally. 1: An unrecoverable fault occurs in the PROFINET IO Controller function.
#1	BF	Bus fault 0: Communication with all IO Devices has been established. 1: One or more IO Devices exist with which communication has not been established.
#2-6	–	Reserved (zero is notified)
#7	SW	System wake up 0: The system of the PROFINET IO Controller function has not started. 1: The system of the PROFINET IO Controller function has started. The other status bits become effective after SW is changed to 1.

Status (+1 to +48)

This is the status of each IO Device.
In the following description, "xx" (= 0 to 47) means an IO Device number.

Bit	Name	Description
#0	CONxx	Connection with the IO Device 0: The IO Device is not connected. 1: The IO Device is connected.
#1	RAPxx	Application ready signal from the IO Device 0: The application ready signal is not notified from the IO Device. 1: The application ready signal is notified from the IO Device. This signal becomes 0 if the communication with the corresponding IO Device is disconnected.

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Bit	Name	Description
#2	IOxx	DI/DO communication 0: The CNC is not communicating with the IO Device about DI/DO data. 1: The CNC is communicating with the IO Device about DI/DO data. It is checked that those of the following status bits in the PROFINET standard that meet the DI/DO size conditions of each IO Device are 1, and IOxx is set to 1.
#3-7	–	Reserved (zero is notified)

DI/DO size conditions	Status bits to check
DI size > 0 and DO size > 0	• Bits 2, 4, and 5 of the APDU status • Bit 7 of the IOPS status • Bit 7 of the IOCS status
DI size > 0 and DO size = 0	• Bits 2, 4, and 5 of the APDU status • Bit 7 of the IOPS status
DI size = 0 and DO size > 0	• Bits 2, 4, and 5 of the APDU status • Bit 7 of the IOCS status

The meaning of each status bit is as follows.

Status	Description
Bit 2 of the APDU status	This bit indicates that the data of the input frame is effective.
Bit 4 of the APDU status	This bit indicates that the control application of the IO Device is in the "RUN" state.
Bit 5 of the APDU status	This bit indicates that the IO Device is in normal operation.
Bit 7 of the IOPS status	This bit indicates that the data of the input module is effective. If multiple input modules are connected, there is IOPS for each input module, and IOxx becomes 1 only if the data of all input modules is effective.
Bit 7 of the IOCS status	This bit indicates that the data of the output module was correctly processed on the IO Device. If multiple output modules are connected, there is IOCS for each output module, and IOxx becomes 1 only if the data of all output modules was correctly processed.

For details of the status in the PROFINET standard, see Subsection 4.6.2.3, "Status".

4.3.3.3 Error Log

This subsection describes the allocation of the error log to the PMC.

NOTE
The PMC allocation of the error log is supported only in the PMC multiple alloaction mode and can be set only from the Setting tool.

The first 4 bytes are the storage information of the error log, and the error log is stored in ring form after the fifth byte.
The error log is stored in ascending order of the log number, and after the error log of the maximum number of logs is stored, it returns to the log number 0.

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Address		Error Log		
	+0	Maximum number of logs (1 byte)		
	+1	Size per log (1 byte)		
	+2	Next stored log number (1 byte)		
	+3	Reserved (1 byte)		
	+4+(0×12)	Log number 0	Date and Time	Year (1 byte)
	+5+(0×12)			Month (1 byte)
	+6+(0×12)			Day (1 byte)
	+7+(0×12)			Hour (1 byte)
	+8+(0×12)			Minute (1 byte)
	+9+(0×12)			Second (1 byte)
	+10+(0×12)		IO Device number (1 byte)	
	+11+(0×12)		Reserved (1 byte)	
	+12+(0×12)		ErrorCode (1 byte)	
	+13+(0×12)		ErrorDecode (1 byte)	
	+14+(0×12)		ErrorCode1 (1 byte)	
	+15+(0×12)		ErrorCode2 (1 byte)	
	...	...		
	+4+(N×12)	Log number N	Date and Time	Year (1 byte)
	+5+(N×12)			Month (1 byte)
	+6+(N×12)			Day (1 byte)
	+7+(N×12)			Hour (1 byte)
	+8+(N×12)			Minute (1 byte)
	+9+(N×12)			Second (1 byte)
	+10+(N×12)		IO Device number (1 byte)	
	+11+(N×12)		Reserved (1 byte)	
	+12+(N×12)		ErrorCode (1 byte)	
	+13+(N×12)		ErrorDecode (1 byte)	
	+14+(N×12)		ErrorCode1 (1 byte)	
	+15+(N×12)		ErrorCode2 (1 byte)	

Error Log (+0 to +3)

This is the storage information of the error log.

Item	Description
Maximum number of logs	This is the maximum number of logs stored in a ring. Range: 0 to 255 Example) When the setting item "Error Log Size" on the "Fanuc Parameters" screen of the Setting tool is 128 bytes Maximum number of logs = integer value ((128 - 4) / 12) = 10
Size per log	This is the size per log. Range: 12 bytes (fixed)
Next stored log number	This is the log number N to be stored next time. Range: 0 to ("Maximum number of logs" – 1)

Error Log (+4+(0×12) to +4+(N×12))

This is an error log stored in a ring form.

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Item	Description
Date and Time	This is the occurrence date and time of the error log. Year: 0 to 255 (Under the year 3-digit) Month: 1 to 12 Day: 1 to 31 Hour: 0 to 23 Minute: 0 to 59 Second: 0 to 59
IO Device number	This is the IO Device number where the error occurred.
ErrorCode ErrorDecode ErrorCode1 ErrorCode2	These are error codes in the PROFINET standard. For details, see Subsection 4.6.2.1, "Error Code".

4.3.3.4 Alarm Log

This subsection describes the allocation of the alarm log to the PMC.

NOTE
The PMC allocation of the alarm log is supported only in the PMC multiple alloaction mode and can be set only from the Setting tool.

The first 4 bytes are the storage information of the alarm log, and the alarm log is stored in ring form after the fifth byte.
The alarm log is stored in ascending order of the log number, and after the alarm log of the maximum number of logs is stored, it returns to the log number 0.

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Address	Alarm Log		
+0	Maximum number of logs (1 byte)		
+1	Size per log (1 byte)		
+2	Next stored log number (1 byte)		
+3	Reserved (1 byte)		
+4+(0×28)	Log number 0	Date and Time	Year (1 byte)
+5+(0×28)			Month (1 byte)
+6+(0×28)			Day (1 byte)
+7+(0×28)			Hour (1 byte)
+8+(0×28)			Minute (1 byte)
+9+(0×28)			Second (1 byte)
+10+(0×28)		IO Device number (1 byte)	
+11+(0×28)		Reserved (1 byte)	
+12+(0×28)		ModuleIdentNumber (4 byte)	
+16+(0×28)		SubModuleIdentNumber (4 byte)	
+20+(0×28)		SlotNumber (4 byte)	
+22+(0×28)		SubSlotNumber (4 byte)	
+24+(0×28)		AlarmType (4 byte)	
+26+(0×28)		AlarmPriority (4 byte)	
+28+(0×28)		AlarmSpecifier (4 byte)	
+30+(0×28)		Reserved (2 byte)	
...	...		
+4+(N×28)	Log number N	Date and Time	Year (1 byte)
+5+(N×28)			Month (1 byte)
+6+(N×28)			Day (1 byte)
+7+(N×28)			Hour (1 byte)
+8+(N×28)			Minute (1 byte)
+9+(N×28)			Second (1 byte)
+10+(N×28)		IO Device number (1 byte)	
+11+(N×28)		Reserved (1 byte)	
+12+(N×28)		ModuleIdentNumber (4 byte)	
+16+(N×28)		SubModuleIdentNumber (4 byte)	
+20+(N×28)		SlotNumber (4 byte)	
+22+(N×28)		SubSlotNumber (4 byte)	
+24+(N×28)		AlarmType (4 byte)	
+26+(N×28)		AlarmPriority (4 byte)	
+28+(N×28)		AlarmSpecifier (4 byte)	
+30+(N×28)		Reserved (2 byte)	

Alarm Log (+0 to +3)

This is the storage information of the alarm log.

Item	Description
Maximum number of logs	This is the maximum number of logs stored in a ring. Range: 0 to 255 Example) When the setting item "Alarm Log Size" on the "Fanuc Parameters" screen of the Setting tool is 256 bytes Maximum number of logs = integer value ((256 - 4) / 28) = 9
Size per log	This is the size per log.

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Item	Description
	Range: 28 bytes (fixed)
Next stored log number	This is the log number N to be stored next time. Range: 0 to ("Maximum number of logs" – 1)

Alarm Log (+4+(0×28) to +4+(N×28))

This is an alarm log stored in a ring form.

Item	Description
Date and Time	This is the occurrence date and time of the alarm log. Year: 0 to 255 (Under the year 3-digit) Month: 1 to 12 Day: 1 to 31 Hour: 0 to 23 Minute: 0 to 59 Second: 0 to 59
IO Device number	This is the IO device number where the alarm occurred.
ModuleIdentNumber SubModuleIdentNumber SlotNumber SubSlotNumber AlarmPriority AlarmType AlarmSpecifier	These are alarms in the PROFINET standard. For details, see Subsection 4.6.2.2, "Alarms". 2-byte data and 4-byte data are stored as the big-endian. The user data part is not stored in the PMC.

4.4 MAINTENANCE

This section describes the maintenance of the PROFINET IO Controller function.

4.4.1 Maintenance Screen of the PROFINET IO Controller Function

The maintenance information about the PROFINET IO Controller function can be checked.

NOTE

The maintenance screen includes the PING screen, communication state screen, and task state screen common to the communication functions.
For details of these screens, see Chapter 2, "SOFTWARE MAINTENANCE INFORMATION" in Part V, "MAINTENANCE".

Procedure

1 Press function key SYSTEM.
2 Soft key [PRFNET CNTRLR] appears. When the soft key does not appear, press the continue key.
3 Press soft key [PRFNETCNTRLR]. Soft keys [COMMON], [PN C SET], [PN C MAINTE], [PING], [COM STATE], and [TASK STATE] appear.
4 Press soft key [PN C MAINTE] to display the maintenance screen of the PROFINET IO Controller function.

Composition of the screen

The composition of the maintenance screen of the PROFINET IO Controller function is as follows.

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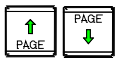
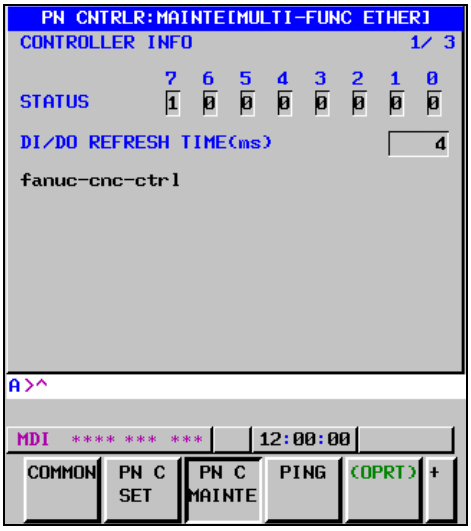
- CONTROLLER INFO screen
- DEVICE INFO screen (2 pages)

It is possible to switch between the pages by using the page keys  .

CONTROLLER INFO screen

The first page is the CONTROLLER INFO screen.



Maintenance screen of the PROFINET IO Controller function (CONTROLLER INFO)

Display items

Display item	Description
STATUS	This is the status of the IO Controller function. The contents are the same as those of status (+0) in Subsection 4.3.3.2 "Status".
DI/DO REFRESH TIME	This indicates the interval at which to refresh the DI/DO data allocated to the PMC area of all IO Devices. The unit is the millisecond. If the DI/DO size is small, this time will be equal to the minimum value of "Refresh Period" in all IO Devices that is set with the Setting tool. For details, see Section 4.5, "UPDATING DI/DO DATA".
(Details)	Detailed information is displayed by performing an information getting operation. For an explanation of the information getting operation, see "Operation" below.

Operation

Getting the detailed information about the IO Controller

1 Press soft key [(OPRT)] to display soft key [GET INFO].

2 Input any of the following first and then press soft key [GET INFO].

Input value	Display item	Description
None or a value other than those below	Device name	The device name of the IO Controller function that is set with the Setting tool is displayed. Up to 240 characters can be displayed. Default name: fanuc-cnc-ctrl

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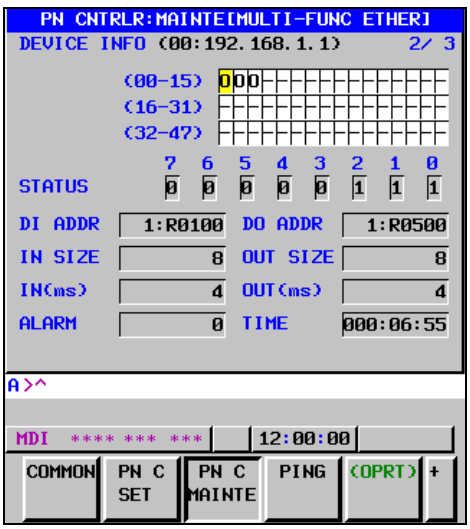
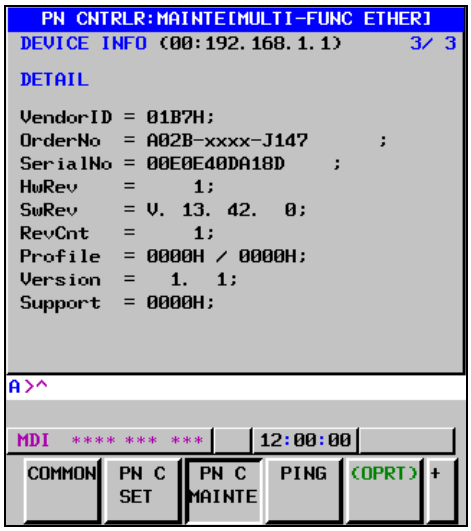
Input value	Display item	Description
1	Equipment information	The following equipment information is displayed. **Item** / **Description** VendorID: This is 16-bit identification information that uniquely identifies the maker. 01B7H: FANUC CORPORATION DeviceID: This is 16-bit identification information that is defined by the maker independently. 0101H: PROFINET IO Controller for FANUC CNC Minimum DI/DO Refresh Time(ms): This is the minimum value of "Refresh Period" in all IO Devices that is set with the Setting tool. PMC Allocation Mode: This is the PMC allocation mode in operation. Single: PMC Single Allocaton Mode Multiple: PMC Multiple Allocaton Mode PMC Allocation Expansion: This is the Enable/Disable of PMC allocation expansion of the PROFINET IO Controller function (R979). Number of Group Slots: This is the number of group slots in operation. This is 0 in PMC single allocation mode.
C		The detailed information is cleared. "C" may be input in either upper or lower case.

DEVICE INFO screen

The second page is the DEVICE INFO screen. The third page is the DETAIL screen of DEVICE INFO.





Maintenance screen of the PROFINET IO Controller function (DEVICE INFO)

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Display items

Item	Description
Table of (00 - 47)	When an IO Device is selected with the cursor, the IO Device number and the IP address of the IO Device are displayed in the upper part of the table. The state of communication is displayed in the table as follows. O: Communication is in progress. E: A communication error has occurred. -: The connection setting is invalid. (In this case, the IP address is not displayed.)
STATUS	This is the status of the IO Device selected with the cursor. The contents are the same as those of status (+1 to +48) in Subsection 4.3.3.2, "Status".
DI ADDR/DO ADDR	- PMC Single Allocation Mode This is the top address of the PMC area where DI/DO data of the IO Device selected with the cursor is allocated. If the PMC address is invalid, "---" is displayed. - PMC Multiple Allocation Mode "---" is displayed.
IN SIZE/OUT SIZE	These are the input/output sizes of the IO Device selected with the cursor. The unit is the byte. These sizes do not include any spaces that are set if a module with an odd number size is configured. The directions of input/output data are as follows. - Input: IO Device → IO Controller (DI) - Output: IO Controller → IO Device (DO) If the IO Device is disconnected, "---" is displayed for both "IN SIZE" and "OUT SIZE".
IN (ms)/OUT (ms)	These are the measured values of the transmission interval of output frames (DO data) and the reception interval of input frames (DI data) during the IO transfer of the IO Device selected with the cursor. The unit is the millisecond. The transmission and reception intervals can be changed from the Setting tool.
ALARM	This is the total number of alarm frames received from the IO Device selected with the cursor. Even if the communication is disconnected, this value is not cleared.
TIME	The continuous time in which DI/DO communication is performed with the IO Device selected with the cursor is displayed in a format of HHH:MM:SS. The maximum displayable value is 999:59:59. If the DI/DO communication is disconnected, the value returns to 000:00:00. The time in which DI/DO communication is performed is the time in which the status IO is 1.
DETAIL	Detailed information about the IO Device selected with the cursor is displayed by performing an information getting operation. For an explanation of the information getting operation, see "Operation" below. Performing an information getting operation causes the following to appear to the right of "DETAIL". GETTING INFO: Information is being acquired. GET INFO ERROR: Acquiring information fails. If the information getting operation is not performed or if the information getting operation is successful, nothing is displayed.

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NOTE
The "Number" on the Setting tool is different from the IO Device number on this screen. Thus, to search for the IO Device for which a communication error is indicated on this screen, search for the IO Device that has the identical device name or IP address, not the IO Device number on this screen.

Operation

Getting the detailed information about the IO Device

1 On the DETAIL screen of DEVICE INFO, press soft key [(OPRT)] to display soft key [GET INFO].

2 Input any of the following first and then press soft key [GET INFO].

Input value	Display item	Description
None or a value other than those below	Device name	The device name of each IO Device that is set with the Setting tool is displayed. Up to 240 characters can be displayed.
1	Equipment information	Equipment information (I&M data) is displayed. Equipment information is gotten by communicating with the IO Device. The specification for getting equipment information is either of the following fixed values. Slot number: 0 Sub slot number: 1 For details, see Subsection 4.6.2.4, "I&M data".
C		The detailed information is cleared. "C" may be input in either upper or lower case.

Either of the following messages may be displayed if "GET INFO ERROR" is displayed.

Message	Description
Device is not set	The IO Device is not set. Return to page 2, and confirm that a valid IO Device is selected with the cursor in the table (00 - 47).
Device is not connected	The IO Device is not connected. Return to page 2, and confirm that the IO Device selected with the cursor in the table (00 - 47) is in the "O" state (communication is in progress).

4.4.2 Log Screen of the PROFINET IO Controller Function

A log related to the PROFINET IO Controller function is displayed.

Procedure

1 Press function key .

2 Press soft key [PRFNET CNTRLR]. Soft keys [ALL], [COMMON], and [PRFNET CNTRLR] appear.

3 Press the desired one of the following soft keys to display the corresponding log screen.

(1) Soft key [ALL]
This soft key displays all log information.

(2) Soft key [COMMON]
This soft key displays the log information related to the basic Ethernet function.

(3) Soft key [PRFNET CNTRLR]

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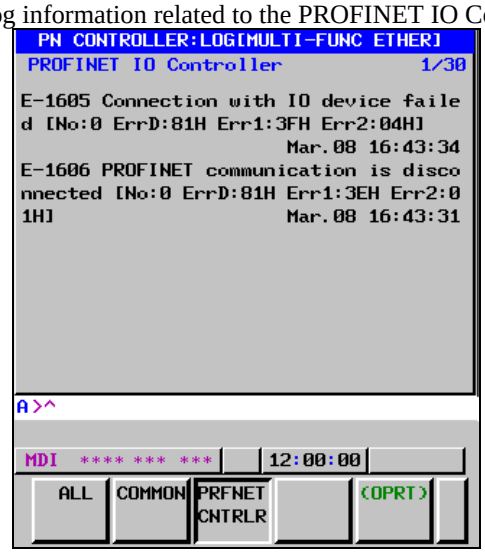
This soft key displays the log information related to the PROFINET IO Controller function.



Log screen of the PROFINET IO Controller function

The latest log information is displayed at the top of the screen. At the right end of a log item, the occurrence date and time of the log item is indicated. Date and time data is indicated in the format "MMM.DD hh:mm:ss", where MMM represents a month, DD represents a day, hh represents hour, mm represents minute, and ss represents second.

Operation

To clear the log information, press soft key [(OPRT)] then soft key [CLEAR].

> **NOTE**
> The log information for the PROFINET IO Controller function is stored in volatile memory and it is lost when the CNC is turned off. If an error occurs, check the log information before turning the power off.

The following lists major log message:

Error code	Log message	Meaning and action to be taken
E-0B01	The own IP address is not set	Set the IP address.
E-0B03	Subnet mask is not set	Set the subnet mask.
E-1600	The received parameter for PROFINET IO Controller function is wrong	The received parameters for the PROFINET IO Controller function are wrong. For an explanation of the reason, see E-1612 or E-1613 notified at the same time.

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Error code	Log message	Meaning and action to be taken
E-1601	Cannot save parameter for PROFINET IO Controller function [U:V:W:X:Y:Z]	The received parameters for the PROFINET IO Controller function were not saved, because they included a wrong parameter. Set the parameters for PROFINET IO Controller function correctly. [U:V:W:X:Y:Z] at the end of the message means detailed information for the error, and the wrong parameter is indicated with one of the following numbers, at the position of U, X, and Z. （The others are internal error codes.） - Value of X when U = 1 1410: The IP address is wrong. 1411: The subnet mask is wrong. 1412: The router IP address is wrong. 1436 to 1441: The DI area of the PMC is wrong. 1443 to 1448: The DO area of the PMC is wrong. 1450 to 1453: The Status area of the PMC is wrong. 1472 to 1477: The Error Log area of the PMC is wrong. 1479 to 1484: The Alarm Log area of the PMC is wrong. - Value of X when U = 3 1486 to 1490: The DI area of the PMC of group slot number Z is wrong. 1493 to 1497: The DO area of the PMC of group slot number Z is wrong.
E-1603	The parameter for PROFINET IO Controller function is protected [U:V:W:X:Y:Z]	The received parameters for the PROFINET IO Controller function were not updated, because parameter protection was enabled. To disable parameter protection, perform the following operations: • Change "MODE" to "CHANGE MODE" on the setting screen of the PROFINET IO Controller function. • Set the CNC to the emergency stop state or change the CNC mode to the MDI mode. ([U:V:W:X:Y:Z] at the end of the message are internal error codes.)
E-1605	Connection with IO device failed [No:W ErrD:XH Err1:YH Err2:ZH]	The connection with the IO Device failed. [No:W ErrD:XH Err1:YH Err2:ZH] at the end of the message means the following. W : IO Device number X : ErrorDecode (hexadecimal) Y : ErrorCode1 (hexadecimal) Z : ErrorCode2 (hexadecimal) X to Z are error codes in the PROFINET standard. For details, see Subsection 4.6.2.1, "Error Code".

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Error code	Log message	Meaning and action to be taken
E-1606	PROFINET communication is disconnected [No:W ErrD:XH Err1:YH Err2:ZH]	The PROFINET communication is disconnected. [No:W ErrD:XH Err1:YH Err2:ZH] at the end of the message means the following. W : IO Device number X : ErrorDecode (hexadecimal) Y : ErrorCode1 (hexadecimal) Z : ErrorCode2 (hexadecimal) X to Z are error codes in the PROFINET standard. For details, see Subsection 4.6.2.1, "Error Code".
E-1607	larm was received from IO Device [No:V Type:WH Slot:X SubSlot:Y Prio:Z]	The alarm was received from the IO Device. [No:V Type:WH Slot:X SubSlot:Y Prio:Z] at the end of the message means the following. V : IO Device number W : Alarm type (hexadecimal) X : Slot number Y : Sub slot number Z : Priority W to Z are alarms in the PROFINET standard. For details, see Subsection 4.6.2.1, "Alarms".
E-1608	Cannot get information for IO Device [No:W ErrD:XH Err1:YH Err2:ZH]	The collection of the information for the IO Device failed. [No:W ErrD:XH Err1:YH Err2:ZH] at the end of the message means the following. W : IO Device number X : ErrorDecode (hexadecimal) Y : ErrorCode1 (hexadecimal) Z : ErrorCode2 (hexadecimal) X to Z are error codes in the PROFINET standard. For details, see Subsection 4.6.2.1, "Error Code".
E-1609	APDU status received from IO Device has changed [No:X APDU:YH]	The APDU status received from the IO Device has changed. [No:X APDU:YH] at the end of the message means the following. X : IO Device number Y : APDU status after it changes (hexadecimal) The APDU status is a status in the PROFINET standard. For details, see Subsection 4.6.2.3, "Status".
E-1610	[PROFINET Data is not set]	Data is not set for the following reasons. • No data has ever been set from the Setting tool. • Setting data was initialized with bit 0 of "OPTION" on the setting screen of the PROFINET IO Controller function. • While data was being downloaded from the Setting tool, the power of the CNC was turned off or the Ethernet cable is disconnected.
E-1612	[Number of devices is over(X)]	The number of IO Devices that were set exceeded 48. X means the following. X: Number of IO Devices that were set
	[Device No. is over(X)]	The IO Device number of the IO Device that was set exceeded 47. X means the following. X: "Number" of IO Device

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Error code	Log message	Meaning and action to be taken
	[DI size is over(X:Y)]	The DI size per IO Device that was set exceeded 1024 bytes. X and Y mean the following. X: "Number" of IO Device Y: DI size that was set
	[DO size is over(X:Y)]	The DO size per IO Device that was set exceeded 1024 bytes. X and Y mean the following. X: "Number" of IO Device Y: DO size that was set
	[Total DI size is over(X)]	The total DI size that was set exceeded 12288 bytes. X means the following. X: Total DI size that was set
	[Total DO size is over(X)]	The total DO size that was set exceeded 12288 bytes. X means the following. X: Total DO size that was set
E-1613	[WriteSize:X RemainSize:Y]	The download data exceeded the size that can be stored in the CNC. X and Y mean the following. X: Internal writing size Y: Remaining size Delete any unnecessary IO Devices or modules.
E-1614	[IP address is incompatible(XH:YH)]	The IP address that was set on the COMMON screen is different from the IP address that was set with the Setting tool. In this case, the IP address that was set on the COMMON screen is used for operation. X and Y mean the following. X : IP address that was set on the COMMON screen (hexadecimal) Y : IP address that was set with the Setting tool (hexadecimal)
	[Subnet mask is incompatible(XH:YH)]	The subnet mask that was set on the COMMON screen is different from the subnet mask that was set with the Setting tool. X means the following. In this case, the subnet mask that was set on the COMMON screen is used for operation. X and Y mean the following. X : Subnet mask that was set on the COMMON screen (hexadecimal) Y : Subnet mask that was set with the Setting tool (hexadecimal)
E-1615	[Device is not set]	Not a single valid IO Device has been enabled. Enable one or more IO Devices with the Setting tool.

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Error code	Log message	Meaning and action to be taken
E-1616	[Embedded Ethernet Software is old(X)]	Embedded Ethernet software is old. X means the following. X: Detailed information code <table><tr><th>X</th><th>Detailed information</th></tr><tr><td>1</td><td>CNC started in PMC single allocation mode, but the Embedded Ethernet software does not support PMC single allocation mode. The requirements for PMC single allocation mode are as follows. - Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A: Edition 15 or later of Series 658M - Series 0*i*-F: Edition 05 or later of Series 658A</td></tr><tr><td>2 or 3</td><td>CNC started in PMC multiple allocation mode, but the Embedded Ethernet software does not support PMC multiple allocation mode. The requirements for PMC multiple allocation mode are as follows. - Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A: Edition 19 or later of Series 658M - Series 0*i*-F: Edition 09 or later of Series 658A</td></tr></table>
	[Number of Group Slots is over(W:X)]	The number of configured group slot is wrong. W and X mean the following. W: Number of configured group slot X: Detailed information code <table><tr><th>X</th><th>Detailed information</th></tr><tr><td>1</td><td>The maximum number of group slots that can be configured exceeds 48. To configure more than 49 group slots, PMC allocation expansion of PROFINET IO Controller function (R979) is required. If this error occurs, it is possible that the parameter with group slot number of 49 or more was restored by restore operation of the communication parameters.</td></tr><tr><td>2</td><td>The maximum number of group slots that can be configured exceeds 256.</td></tr></table> Then, retry the download operation in the Setting tool.
E-1617	[Status Size is over(X)]	The set status size exceeded 49 bytes (maximum value). X means the following. X: Set status size
	[Error Log Size is over(X)]	The set error log size exceeded 3064 bytes (maximum value). X means the following. X: Set error log size
	[Alarm Log Size is over(X)]	The set alarm log size exceeded 7144 bytes (maximum value). X means the following. X: Set alarm log size

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Error code	Log message	Meaning and action to be taken
E-1618	[DI/DO Refresh is not started(XH)]	DI/DO refresh with the PMC area is not started. X means the following. X: Detailed information code (hexadecimal) Two or more Bits might become 1. X: #0 — E-1615 occurred. X: #1 — CNC started in PMC multiple allocation mode, but no group slot is configured. X: #2 — CNC started in PMC single allocation mode, but at least one group slot is configured. Then, retry the download operation in the Setting tool.
E-1631 E-1635	(Undefined)	For the status area, error log area, or alarm log area, the following error was detected. • A PMC parameters out of range were restored by restore operation of the communication parameters. Then, retry the download operation in the Setting tool.
E-1632 E-1680	(Undefined)	For the DI/DO area, the following error was detected. • The parameters Nos. 11937 to 11939 are not set. Or the DI/DO area set by the parameters Nos. 11937 to 11939 and the area of I/O Link or I/O Link *i* overlap. • A PMC parameters out of range were restored by restore operation of the communication parameters. Then, retry the download operation in the Setting tool.
E-16A2	(Undefined)	The PROFINET software does not support the Setting tool V3.2.7 or later. The requirements for the Setting tool V3.2.7 or later are as follows. - Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A: Edition 04 or later of Series 658R - Series 0*i*-F: Edition 04 or later of Series 658U
E-16F0	(Undefined)	A fatal error was detected. Then, remove the errors notified on this log screen, and after setting Bit 0 (Initialized) of "OPTION" on the setting screen of the PROFINET IO Controller function to 1, restart CNC. Next, retry the download operation in the Setting tool.
(Other)	(Other)	Contact us, describing the information on the log screen.

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The following log messages do not indicate errors.

Error code	Log message	Meaning
E-1604	The parameter for PROFINET IO Controller function was saved [result]	The received parameters for the PROFINET IO Controller were saved in the CNC correctly. [result] at the end of the message means the following. • Changed(TotalSize:X RemainSize:Y) The data has been refreshed. Turn off the power to the CNC and back on. X and Y mean the following. X : Total size in the CNC in which data was stored Y : Remaining size in the CNC in which data can be stored • Unchanged The data that had been stored in the CNC was the same as the received data. • Changed(FANUC Parameters) The data of "FANUC Parameters" screen has been refreshed. Turn off the power to the CNC and back on. • Unchanged(FANUC Parameters) The data that had been stored in the CNC was the same as the data of "FANUC Parameters" screen.
E-1609	APDU status received from IO Device has changed [No:X APDU:YH]	The APDU status received from the IO Device has changed. This log message is displayed even if the status has changed to the one indicating normal operation. [No:X APDU:YH] at the end of the message means the following. X : IO Device number Y : APDU status after it changes (hexadecimal) The APDU status is a status in the PROFINET standard. For details, see Subsection 4.6.2.3, "Status".
E-1611	[Download is starting...]	Downloading from the Setting tool started. Upon completion of downloading, one of messages E-1600 to E-1604 is displayed. If this log message is not displayed even though the download operation is performed, confirm the connection of the Ethernet cable and the setting of the IP address.

⚠ CAUTION

Once log message E-1611 is displayed, do not turn off the power to the CNC or pull out the Ethernet cable until one of messages E-1600 to E-1604 is displayed, because downloading is in progress. Otherwise, the setting data may be damaged.
If you accidentally turn off the power or pull out the cable, perform the download operation again from the Setting tool.

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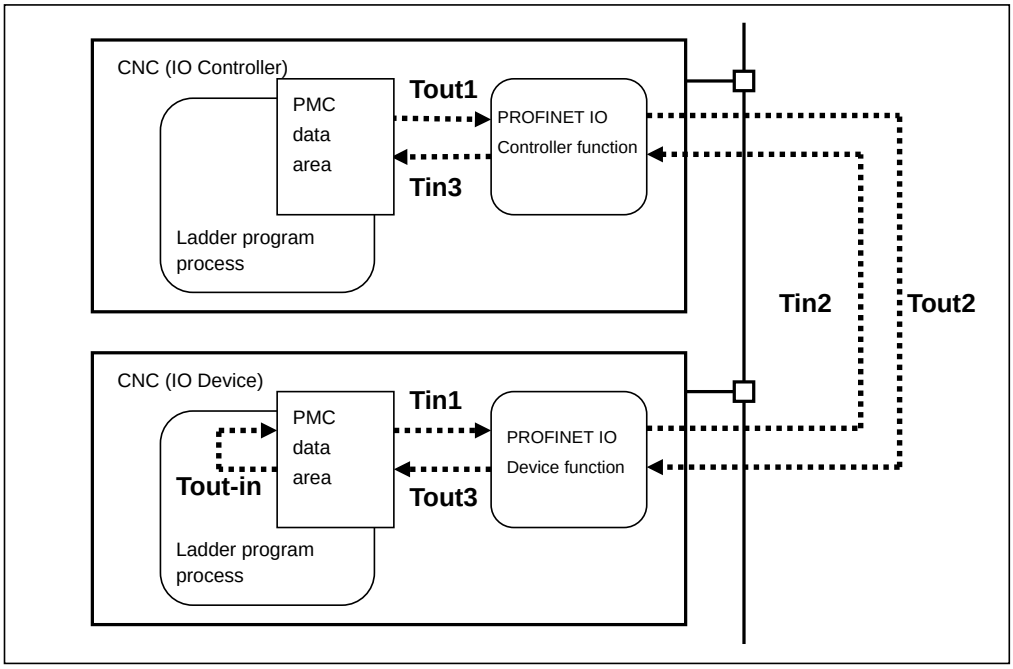
4.5 UPDATING DI/DO DATA

4.5.1 Input/Output Response Time

This subsection describes the input/output response time as seen from the IO Controller if both IO Controller and IO Devices are FANUC CNCs.
The input/output response time as seen from the IO Controller is the total time of the following sequence: an output signal is set by the ladder program in the IO Controller, the signal value is posted to the IO Device, input/output processing is performed by the ladder program of the IO Device, the value is posted to the IO Controller, and the ladder program of the IO Controller recognizes it as an input signal again.
Input/output response time as seen from the IO Controller
= Tout1 + Tout2 + Tout3 + Tout-in + Tin1 + Tin2 + Tin3



In the IO Controller, internal update time of output signal (Tout1)

This is the time in which the output signal that is set in the PMC data area by the ladder program process is updated in the PROFINET IO Controller function.
This time can be measured with "DI/DO REFRESH TIME (ms)" on the CONTROLLER INFO screen of the maintenance screen of the PROFINET IO Controller function.

In the IO Controller, communication update time of output signal (Tout2)

This is the time in which the PROFINET IO Controller function updates the output signal in the PROFINET IO Device function by way of communication.
This time can be changed with the "Refresh Period" for each IO Device on the Setting tool, and can be measured with "OUT (ms)" on the DEVICE INFO screen of the maintenance screen of the PROFINET IO Controller function or with "OUT (ms)" on the maintenance screen of the PROFINET IO Device function.

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In the IO Device, internal update time of output signal (Tout3)

This is the time in which the output signal received by the PROFINET IO Device function is updated in the PMC data area.
This time can be measured with "DI(ms)" on the maintenance screen of the PROFINET IO Device function.

In the IO Device, ladder program processing time (Tout-in)

The ladder program operates in a cycle that is a multiple of 4 ms or 8 ms depending on the size of the ladder program.
This time can be measured with "SCAN TIME" on the PMC STATUS screen.

In the IO Device, internal update time of input signal (Tin1)

This is the time in which the input signal that is set in the PMC data area by the ladder program process is updated in the PROFINET IO Device function.
This time can be measured with "DO(ms)" on the maintenance screen of the PROFINET IO Device function.

In the IO Device, communication update time of input signal (Tin2)

This is the time in which the PROFINET IO Device function updates the input signal in the PROFINET IO Controller function by way of communication.
This time can be changed with the "Refresh Period" for each IO Device on the Setting tool, and can be measured with "IN (ms)" on the DEVICE INFO screen of the maintenance screen of the PROFINET IO Controller function or with "IN (ms)" on the maintenance screen of the PROFINET IO Device function.

In the IO Controller, internal update time of input signal (Tin3)

This is the time in which the PROFINET IO Controller function updates the received input signal in the PMC data area processed by the ladder program.
This time can be measured with "DI/DO REFRESH TIME (ms)" on the CONTROLLER INFO screen of the maintenance screen of the PROFINET IO Controller function.

4.5.2 DI/DO Refresh Time

This subsection describes how to estimate the DI/DO refresh time of each IO Device that shows the processing performance of the PROFINET IO Controller function for the CNC.

The DI/DO refresh time of each IO Device can be estimated as follows.

DI/DO refresh time of each IO Device ＝ X + Y

X: This is the "Refresh Period" of each IO Device that is set with the Setting tool.
This becomes equal to Tout2 or Tin2 in Subsection 4.5.1, "Input/Output Response Time".

Y: This is the internal update time of the PROFINET IO Controller function for the CNC.
This becomes equal to Tout1 or Tin3 in Subsection 4.5.1, "Input/Output Response Time ".

If the total DI/DO size is small, "Y" becomes equal to the minimum value of "Refresh Period" in all IO Devices that are set with the Setting tool.
The following are examples of the estimated DI/DO refresh time of each IO Device if three IO Devices are connected.

IO Device	X	Y	DI/DO refresh time of each IO Device
IO Device 1	1ms	1ms	2ms
IO Device 2	4ms		5ms
IO Device 3	8ms		9ms

On the other hand, if the total DI/DO size is large, the actual measurement value of "Y" will not be as described above.

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If the minimum value of "Refresh Period" in all IO Devices that are set with the Setting tool is 1 ms, the relation between the total size of the DI/DO and the actual measurement value of "Y" is roughly as follows.
R979 is the option for PMC allocation expansion of PROFINET IO Controller function.

Total DI/DO size	Actual measurement value of "Y"		
	PMC Single Allocation Mode	PMC Multiple Allocation Mode	
		R979 : Disable	R979 : Enable
128 バイト / 128 バイト	1ms	2ms	1ms
256 バイト / 256 バイト	2ms	3ms	2ms
1024 バイト / 1024 バイト	4ms	13ms	6ms
6144 バイト / 6144 バイト	17ms	40ms	14ms
12288 バイト / 12288 バイト	34ms	73ms	24ms

If the minimum value of "Refresh Period" in all IO Devices that are set with the Setting tool is larger than the applicable one of the actual measurement values in the above table, the actual measurement value of "Y" becomes the minimum value of "Refresh Period".

NOTE

The smaller the value of the "Refresh Period" of each IO Device, which is set with the Setting tool, the faster the DI/DO communication, but the higher the load on the network. Thus, refrain from reducing the "Refresh Period" carelessly.
When the communication becomes unstable or the display update of the maintenance screen of PROFINET IO Controller function becomes slow, take the following countermeasures.

- Set "Refresh Period" of IO Device, which does not need to reduce DI/DO refresh time, to 16 ms or more and as large as possible.
- Reduce the number of IO Devices to be connected.

4.6 APPENDIX

4.6.1 PROFINET Configuration Tool

This subsection describes the PROFINET Configuration Tool.

Note to use

NOTE

1 The Setting tool's manual can be seen by the [Help] button on each screen of the Setting tool. Only the functions described in the manual can be used.

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NOTE

2 Note the following about the number to indicate the IO Device.

- "Number" in the Setting tool
  Set this number on "Device Designation" on the IO Device properties screen, described in Subsection 4.6.1.7, "Setting of IO Devices". With the Setting tool, numbers 000 to 127 can be set, but number 048 or greater cannot be set in the CNC.
  The setting of the IO Device specified with "Number" can be switched between Enable and Disable. For how to do this, see "Enable¥Disable Device" in Subsection 4.6.1.11, "Operations that relates to IO Device".
- IO Device number in the CNC
  This is the number allocated if settings are downloaded to the CNC, and in the CNC, it is displayed on the DEVICE INFO screen of the maintenance screen of the PROFINET IO Controller function. This number is always a serial number, unlike the numbers in "Number".
  The following are examples of numbers in "Number" in the Setting tool and the IO Device numbers in the CNC.

"Number" in the Setting tool	Enable/Disable	IO Device numbers in the CNC
001	Enable	0
010	Enable	1
024	Disable	
047	Enable	2

3 The operation and the screen related to the Setting tool described in this manual are examples for Windows 7.

4.6.1.1 Operating environment

The operating environment of the personal computer in which to install the Setting tool is as follows.

Item	Operating environment
OS	Windows 7, 8.0, 8.1, 10 (32-bit, 64-bit) Windows XP (32-bit)
CPU, RAM	Must meet the conditions recommended for the OS used.
HDD size used	Execution program : Approx. 100 MB Setting data : Approx. 10 MB per project
Drive	• CD-ROM drive required The Setting tool is provided in a form of CD-ROM.
Communication	• Ethernet port The communication between the Setting tool and CNC uses the Ethernet.

NOTE

For Windows XP (32-bit), only the administrator user is supported.

4.6.1.2 When using the Setting tool for the first time

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NOTE

1 To install the Setting tool, the serial number is necessary. The serial number is a number **printed** on "PROFINET Configuration Tool" in space enclosed with the installation CD-ROM.

2 While installing, when "WSEPNIO PROFINET IO Driver" is requested to be installed, install this driver. ("WSEPNIO PROFINET IO Driver" is included in installation CD-ROM.)
You can confirm whether this driver was installed by "Local Area Connection Properties" of Windows.

Installation Folder

The installation folder and the storage file of default are as follows.

OS	The installation folder and the storage file
Windows 7 or later	C:/Program Files/FANUC/PFNCT • The exe file and the dll file to execute the Setting tool are stored.
	C:/Users/Public/Documents/FANUC/PFNCT • Made configuration file and GSDML file are stored.
Windows XP	C:/Program Files/FANUC/PFNCT • The exe file and the dll file to execute the Setting tool are stored.
	C:/Documents and Settings/All Users¥Documents/FANUC¥PFNCT • Made configuration file and GSDML file are stored.

Update or reinstalling of the Setting tool

When the Setting tool has already been installed in the personal computer, and when you install the Setting tool is installed, the message to direct uninstallation is displayed.
When you update or reinstall the Setting tool, install it after uninstalling the Setting tool

NOTE

1 When you use the PMC single allocation mode under the following conditions, use the Setting tool V3.1.10.

Item	Conditions
PROFINET function software	- Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A: Edition 02 or earlier of Series 658R - Series 0*i*-F: Edition 02 or earlier of Series 658U

2 When reusing the configuration data of the Setting tool V3.1.10 with the Setting tool V3.2.7 or later, Before uninstalling the Setting tool V3.1.10, do the following "When reusing the configuration data of the Setting tool V3.1.10 with the Setting tool V3.2.7 or later".

3 The configuration data of the Setting tool V3.1.10 operates only in PMC single allocation mode.

When reusing the configuration data of the Setting tool V3.1.10 with Setting tool V3.2.7 or later

In the Setting tool V3.2.7 or later and the Setting tool V3.1.10, the installation folder of the configuration data is different as follows and the configuration data needs to be copied.

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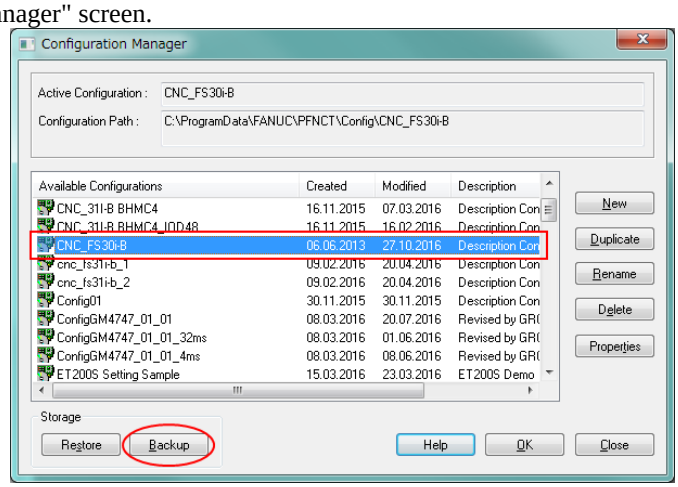
Setting tool	OS	The installation folder of configuration data
V3.2.7 or later	Windows 7 or later	C:/Users/Public/Documents/FANUC/PFNCT
	Windows XP	C:/Documents and Settings/All Users¥Documents/FANUC/PFNCT
V3.1.10	Windows 7 or later	C:/ProgramData/FANUC/PFNCT
	Windows XP	C:/Documents and Settings/All Users/Application Data/FANUC/PFNCT

There are the following two procedures.

- Procedure A:
  When copying only the selected configuration data by using Backup/Restore operation of "Configuration Manager" screen
- Procedure B:
  When copying all configuration data at once using a batch file

Procedure A

1 In the Setting tool V3.1.10, select the menu [File] -> [Configuration Manager] to display the "Configuration Manager" screen.



In the "Configuration Manager" screen, click the [Backup] button with the reused configuration data selected, and create a backup file (extension: apa) once in an arbitrary place. In the example, it is a case to back up the configuration name "CNC_FS30i-B".
If there are multiple configuration data to be reused, repeat this operation.

2 After uninstalling the Setting tool V3.1.10, install the Setting tool V3.2.7 or later.
Next, start the Setting tool V3.2.7 or later in the PMC single allocation mode by selecting the menu [start] -> [All Programs] -> [FANUC] -> [PFN-CT] -> [PFNCT - PROFINET Configuration Tool - PMC Single Allocation Mode].

3 In the Setting tool V3.2.7 or later, select the menu [File] -> [Configuration Manager] to display the "Configuration Manager" screen.

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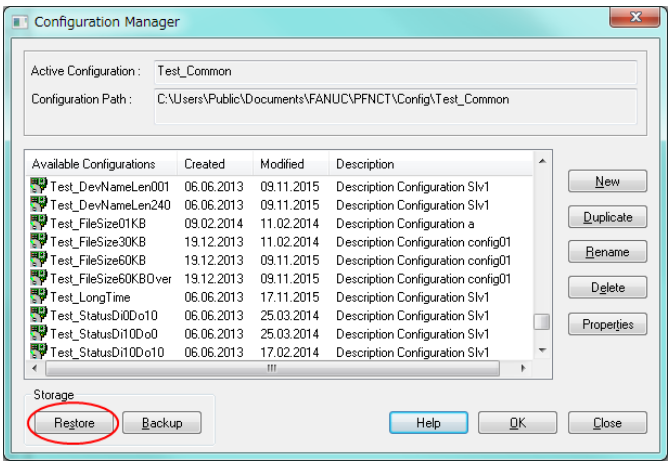

In the "Configuration Manager" screen, click the "Restore" button and select the backup file created in procedure-1 to restore the backup file to the installation folder of the Setting tool V3.2.7 or later.
If there are multiple backup files, repeat this operation

Procedure B

1 After uninstalling the Setting tool V3.1.10, install the Setting tool V3.2.7 or later.
Even if you uninstall the Setting tool V3.1.10, the folder where the configuration data is stored will not be deleted.

2 Execute one of the following batch files of "PROFINET_Configuration_Tool_Vxxx/AdditionalFiles" in the installation CD-ROM.
- Windows 7 or later : PFN-CT_Win7orLater_DataCopy.bat
- Windows XP : PFN-CT_WinXP_DataCopy.bat

Examples of PFN-CT_Win7orLater_FolderCopy.bat)

```
@echo off
echo ****************************************************************************
echo *          Batch file to copy the configuration data of PFN-CT             *
echo *                        [For Windows 7 or Later]                          *
echo *                             Version 1.0                                  *
echo *                                                                          *
echo *    Copyright(c) 2016      FANUC Corporation  All rights reserved.        *
echo ****************************************************************************
echo.
setlocal
set Src=C:¥ProgramData¥FANUC¥PFNCT
set Dst=C:¥Users¥Public¥Documents¥FANUC¥PFNCT
set /p Copy="Do you copy the configuration data to the new folder ? (Y/N)"
if /i "%Copy%" == "Y" (
        xcopy "%Src%¥CONFIG" "%Dst%¥CONFIG" /d /e /f /y
        xcopy "%Src%¥GSDML Library¥gsdml" "%Dst%¥GSDML Library¥gsdml" /d /e /f /y
)
endlocal
pause
```

When the batch file is double-clicked, the command prompt is displayed as follows.

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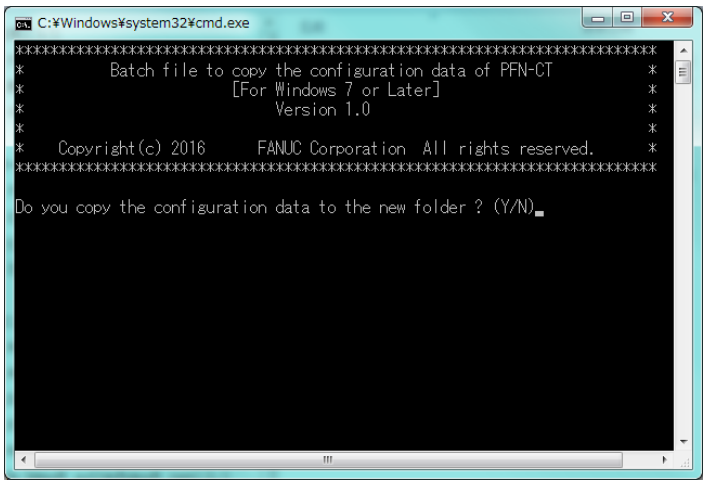


When "Y" is input, the copy of the configuration data starts.
When "N" is input, the copy of the configuration data is canceled.

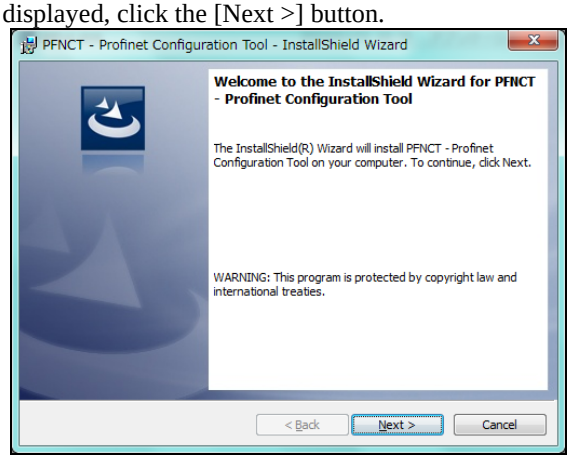
NOTE

1 When using the batch file, note that all the configuration data including the GSDML file are copied at once.
2 If the installation folder is not C drive, edit the drive letter of "Src" and "Dst" on the batch file.

Installation Procedure

Install the Setting tool in the personal computer according to the following procedure.

1 Insert the installation CD-ROM into the drive of the personal computer, and execute "PROFINET_Configuration_Tool_Vxxx/setup.exe" in the installation CD-ROM.
The following screen is displayed, click the [Next >] button.



2 The following screen is displayed. Then, input the serial number in the "Serial Number" field.

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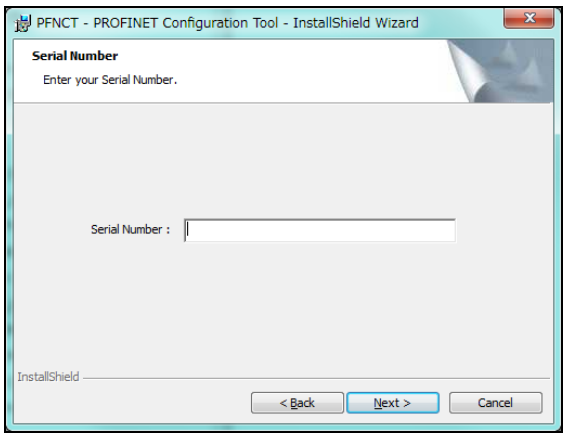
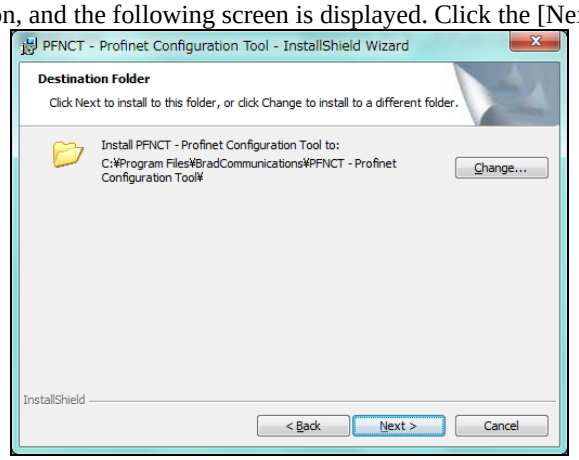
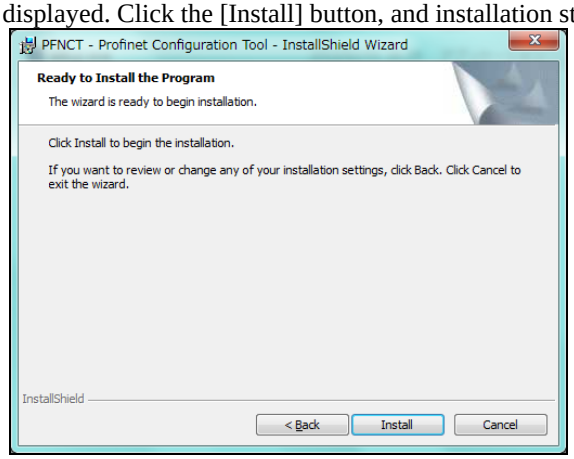


Click the [Next >] button, and the following screen is displayed. Click the [Next >] button again.



3 The following screen is displayed. Click the [Install] button, and installation starts.



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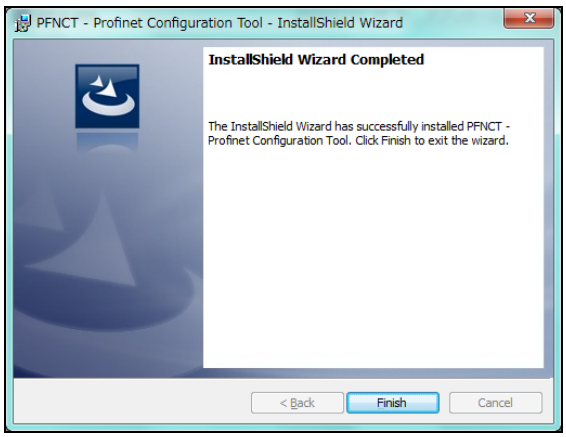


When installation is completed, the above screen is displayed. Click the [Finish] button to finish.

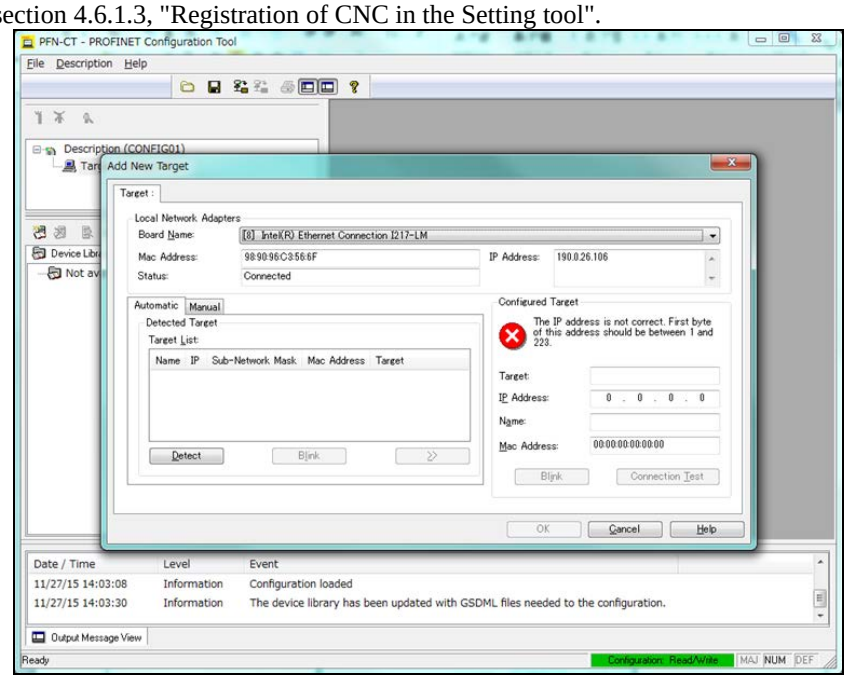
Starting the Setting tool

The Setting tool can be started by selecting the menu [start] -> [All Programs] -> [FANUC] -> [PFN-CT] -> [(PMC allocation mode's name)] on Windows.

PMC allocation mode's name)

- PFNCT - PROFINET Configuration Tool - PMC Single Allocation Mode
- PFNCT - PROFINET Configuration Tool - PMC Multiple Allocation Mode

When starting for the first time, it is displayed as follows. Once after closing the "Add New Target" screen, go to the next Subsection 4.6.1.3, "Registration of CNC in the Setting tool".



Notes on starting the Setting tool

If you have already created/edited the configuration data, the Setting tool will start with the configuration data created/edited last selected. In this case, the configuration data created in PMC

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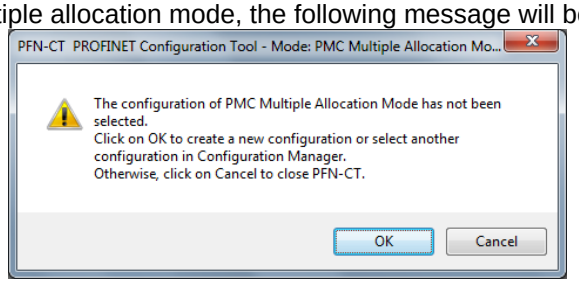
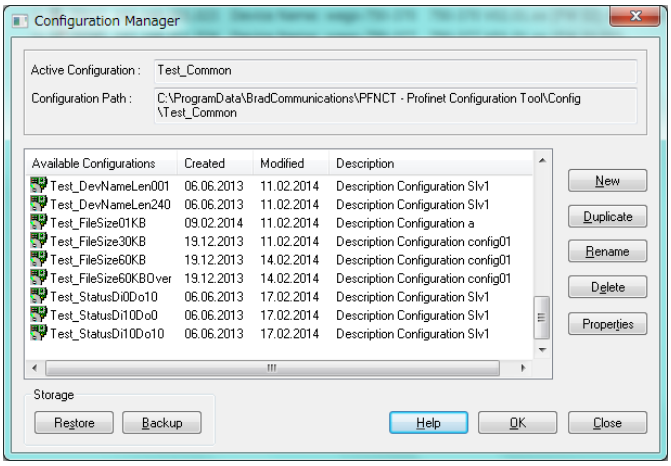
single allocation mode cannot be opened with PMC multiple allocation mode. Or, the configuration data created in PMC multiple allocation mode cannot be opened with PMC single allocation mode.

For example, if the configuration data created in the PMC single allocation mode is selected and is opened with the PMC multiple allocation mode, the following message will be displayed.

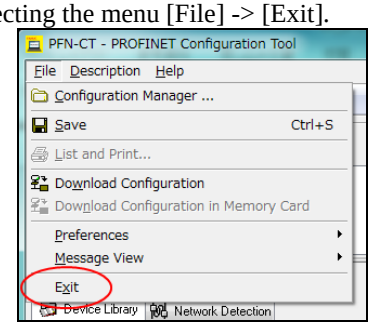




In this case, click the [OK] button and select the configuration data created in PMC multiple allocation mode from the "Configuration Manager" screen.
This is the same as when the configuration data created in PMC multiple allocation mode is selected and opened with PMC single allocation mode.

Quitting the Setting tool

The Setting tool can be quitted by selecting the menu [File] -> [Exit].



4.6.1.3 Registration of the CNC in the Setting tool

This subsection describes how to register the CNC in the Setting tool.

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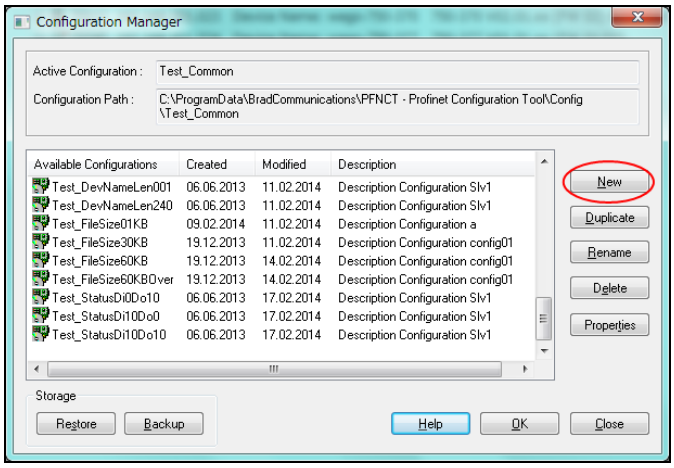
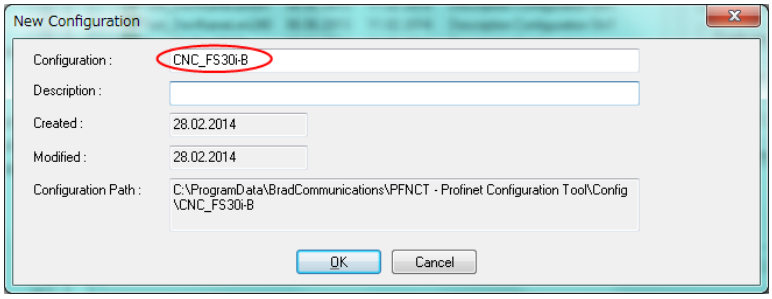
Procedure

1 Select the menu [File] -> [Configuration Manager] to display the "Configuration Manager" screen. Click the [New] button.



If the Setting tool is started for the first time since it was installed, the "Add New Target" screen of step 3 is displayed.

2 The "New Configuration" screen is displayed. Input the configuration name in the "Configuration" field.



Click the [OK] button to return to the "Configuration Manager" screen.

3 On the "Configuration Manager" screen, click the [OK] button, with the configuration name, input in the "Configuration" field in step 2, being selected, and the "Add New Target" screen is displayed.

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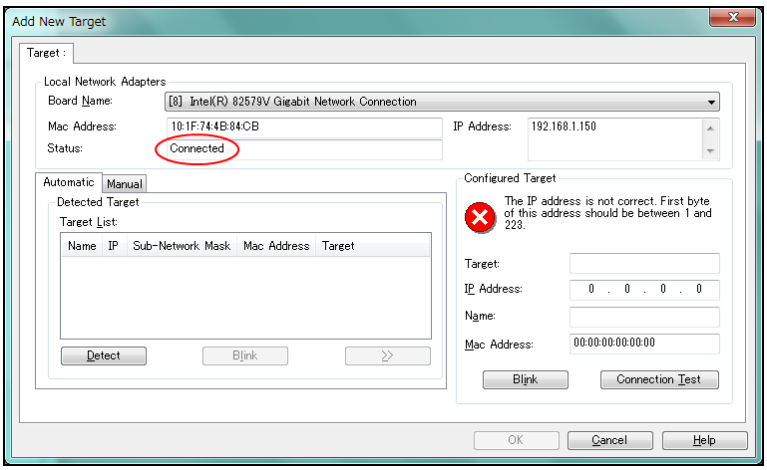
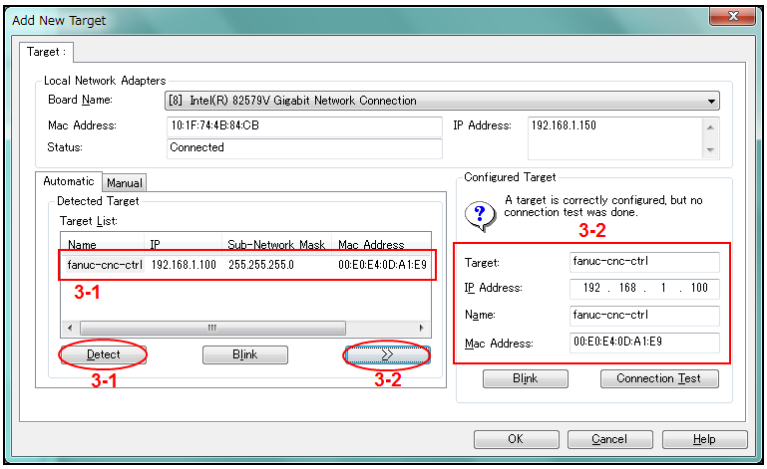


Confirm that "Status" is shown as "Connected" on this screen.
If "Status" is not shown as "Connected", confirm that the Ethernet cable is correctly connected to the network adapter selected for "Board Name".



3-1 Connect the CNC to the network, and click the [Detect] button to confirm that "fanuc-cnc-ctrl" is detected.
At this time, confirm also that the IP address that is set on the COMMON screen of the CNC is detected.

3-2 Click the [>>] button, with "fanuc-cnc-ctrl" being selected. Confirm that the content of the selected CNC is displayed in "Configuration Target".
Click the [OK] button to finish.

When setting in the off-line with CNC

When setting in the off-line with CNC, select the "Manual" tab in the procedure-3 to do the following procedures.

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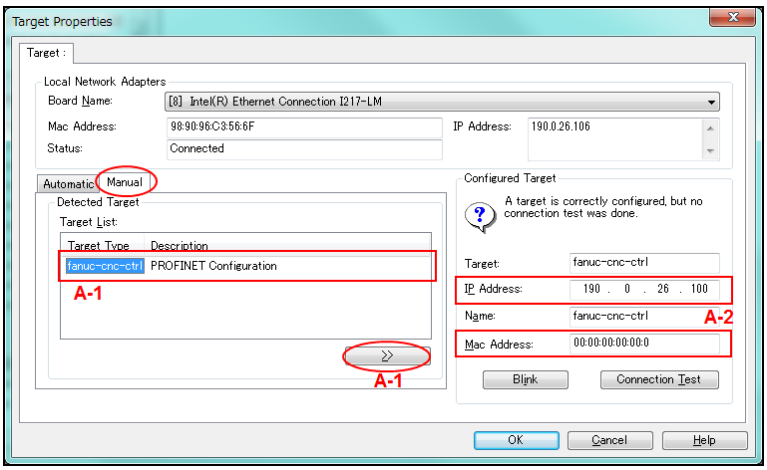


A-1 Click the [>>] button, with "fanuc-cnc-ctrl" being selected. Confirm that the content of the selected CNC is displayed in "Configuration Target".
At this time, nothing is input to "IP Address" and "Mac Address".

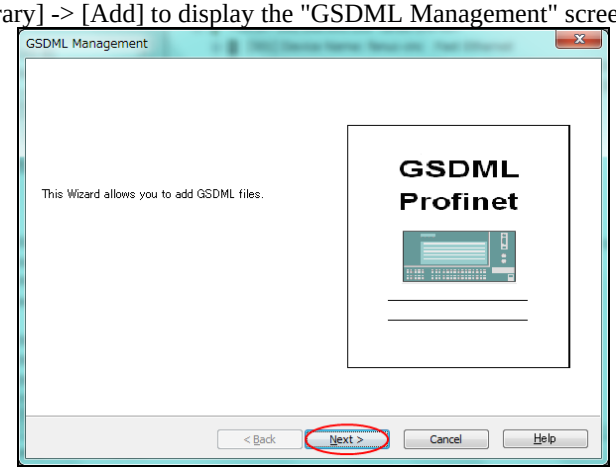
A-2 Input a temporary value to "IP Address" and "Mac Address" of "Configuration Target".
Click the [OK] button to finish.

4.6.1.4 Installation of the GSDML file

This subsection describes how to install the GSDML file in the Setting tool.

Procedure

1 Select the menu [Library] -> [Add] to display the "GSDML Management" screen.



Click the [Next >] button, and install the GSDML file according to the instructions on the screen.

2 Confirm that the installed IO Device has been added to the tree of the tab "Device Library".

4.6.1.5 Confirmation of IO Devices on the network

This subsection describes how to confirm the IO Devices connected on the network.

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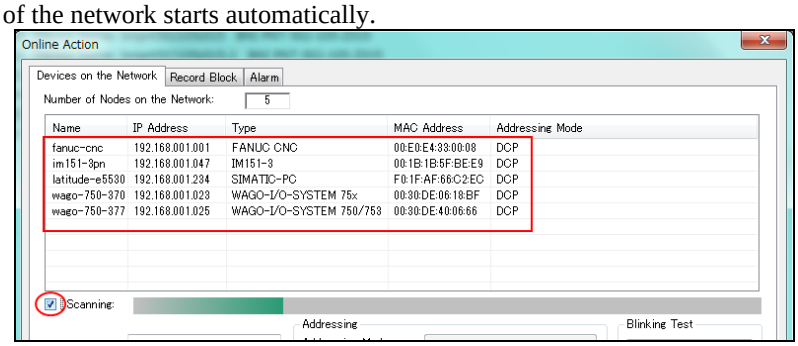
Network scanning

Procedure

1 Select the menu [Library] -> [Online Action], and the "Devices on the Network" screen is displayed, and the scanning of the network starts automatically.



2 After the IO Devices are detected on this screen, remove the check on the "Scanning" check box to stop the scanning.
If the target IO Device is not detected, confirm whether the Ethernet cable is correctly connected.
If device names are not set for any of the detected IO Devices in the "Name" column, set the device names according to Subsection 4.6.1.6, "Setting of the device names for IO Devices".

> ⚠ **CAUTION**
> Do not leave the "Scanning" check box checked, because the load on the network increases during the scanning of the network.

> **NOTE**
> 1 If no device name is set for an IO Device in the "Name" column, IO communication with the IO Device cannot be performed.
> 2 If two or more IO Devices of the same model are detected on the network, you need to check their MAC addresses to distinguish between them before setting their device names in the "Name" column.
> 3 It is not necessary to set IP addresses in the "IP Address" column, because the IP addresses that are allocated with "Setting of the IP address and the device name" in Subsection 4.6.1.7, "Setting of IO Devices" are used.
> 4 The screens of the "Record Block" tab and "Alarm" tab are unsupported.

Blinking indication of IO Device's LED (Device Blinking)

This is a function to send a command for blinking the IO Device's LED to the IO Device.
For example, it is assumed that many remote IO devices with the same shape and indistinct appearance are mounted on the machine. In this case, by using this function to blink the LED of the remote IO device, you can visually check the position where the selected remote IO device is mounted.

Procedure

1 Select an IO Device from the list of detected IO Devices, and click the [Device Blinking] button.

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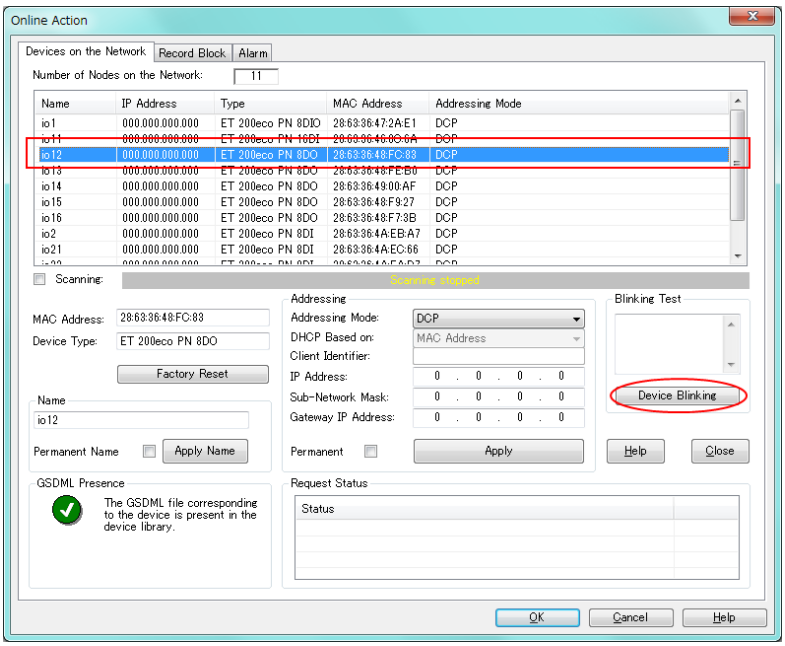
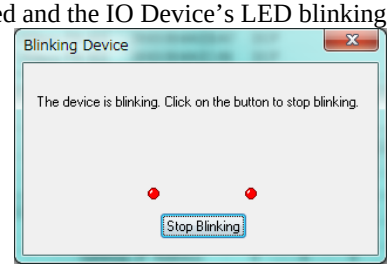


The following screen is displayed and the IO Device's LED blinking starts.



2 When you stop the IO Device's LED blinking, click the [Stop Blinking] button.

NOTE

When the IO Device is FANUC CNC, there is no LED that lights when this function is executed, and "E-1211 LED Blink is received" is displayed on the log screen of PROFINET IO Device function.
For details of the IO Device's LED, see the IO Device manual or confirm this with IO Device manufacturer.

4.6.1.6 Setting of the device names for IO Devices

This subsection describes how to set the device names for the IO Devices that are detected as in Subsection 4.6.1.5, "Confirmation of IO Devices on the network".

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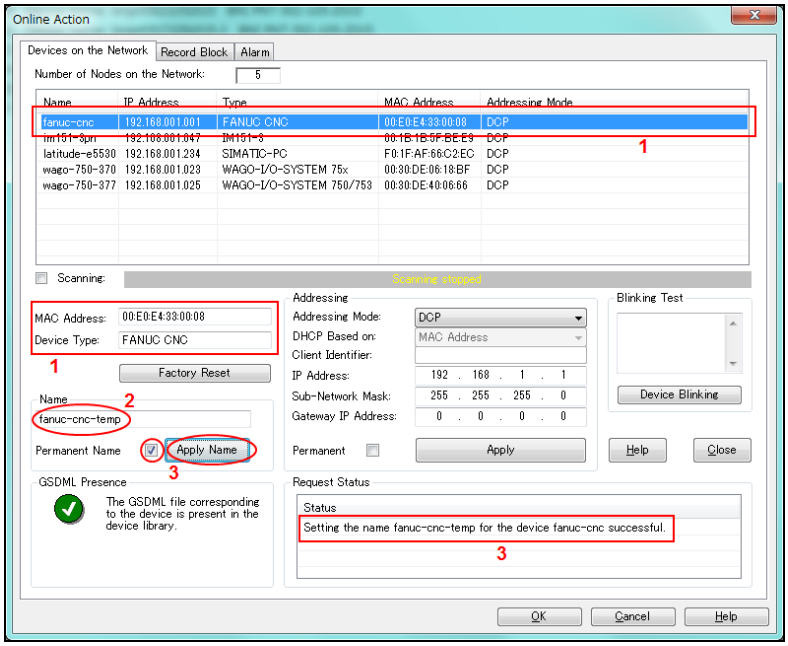
Setting of the device name



Procedure

1 Select an IO Device from the list of detected IO Devices. Confirm that the "MAC Address" and the "Device Type" of the IO Device are selected.

2 In the "Name" field, input the device name to set.

3 Check the "Permanent Name" check box, and click the [Apply Name] button.
When the setting of the device name is successful, "Setting the name (device name) successful" is displayed below "Status".

NOTE

1 The device name must be unique on the network.
IO Devices to which the same name is given cannot perform IO communication.
2 If the "Permanent Name" check box is not checked, the device name will not be stored in the nonvolatile memory of the IO Device. When the IO Device is restarted, this setting is no longer effective.
3 The item of "Addressing" is not used.

By checking the "Scanning" check box to perform scanning again, the changed device name can be confirmed.

Naming rules for a device name

The Naming rules for a device name are as follows.

- The 1 or more labels are separated by "."(Period).
- The label length is 1-63.
- The total length is 1-240.
- The allowed characters are "a-z", "0-9", and "-".
- The labels do not start with "-".
- The labels do not end with "-".

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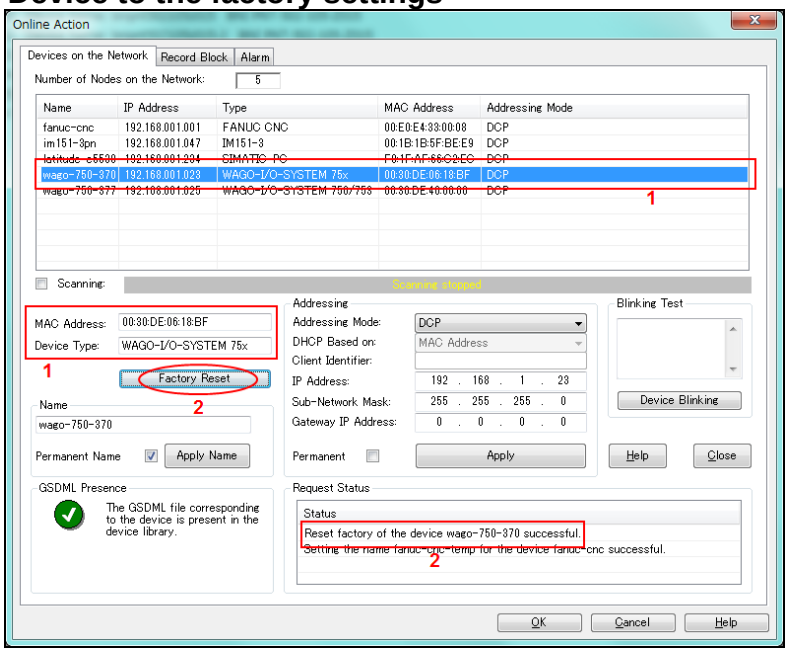
- The first label does not start with "port-xyz" or "port-xyz-abcde" with a, b, c, d, e, x, y, z = 0-9.

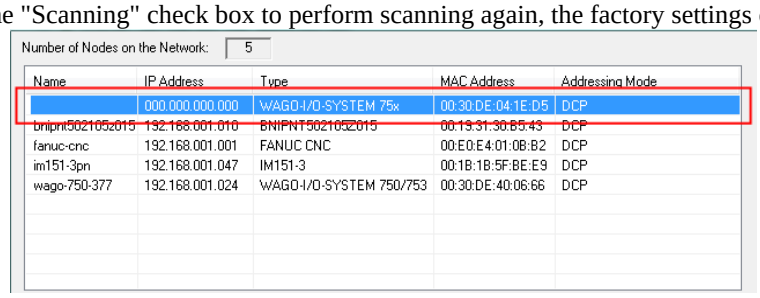
Returning an IO Device to the factory settings



Procedure

1 Select an IO Device from the list of detected IO Devices. Confirm that the "MAC Address" and the "Device Type" of the IO Device are selected.

2 Click the [Factory Reset] button.
When the operation for returning it to the factory settings is successful, "Reset factory of the device (device name) successful" is displayed.
By checking the "Scanning" check box to perform scanning again, the factory settings can be confirmed.



NOTE

If an IO Device is returned to the factory settings, the "Name" (device name) and "IP Address" of the IO Device are no longer effective. For an explanation of the factory settings of the parameters specific to an IO Device, see the IO Device manual or confirm them with the IO Device manufacturer.

4.6.1.7 Setting of IO Devices

This subsection describes the setting for operating an IO Device.

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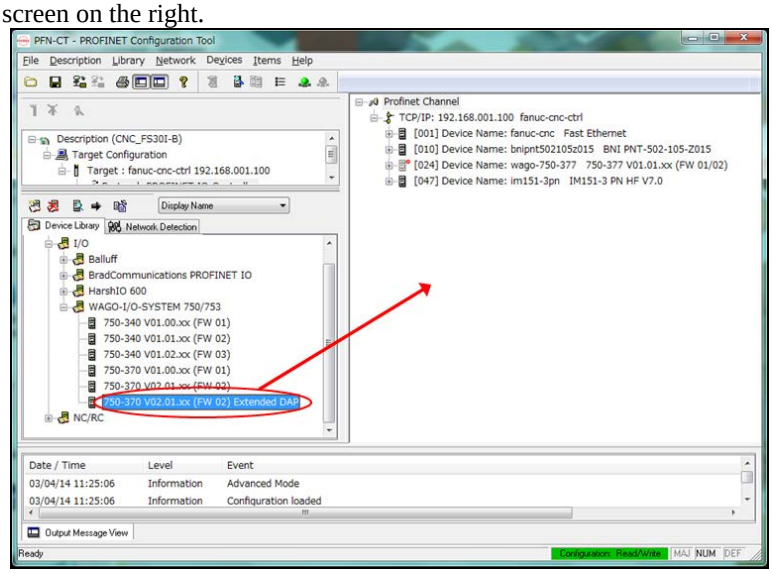
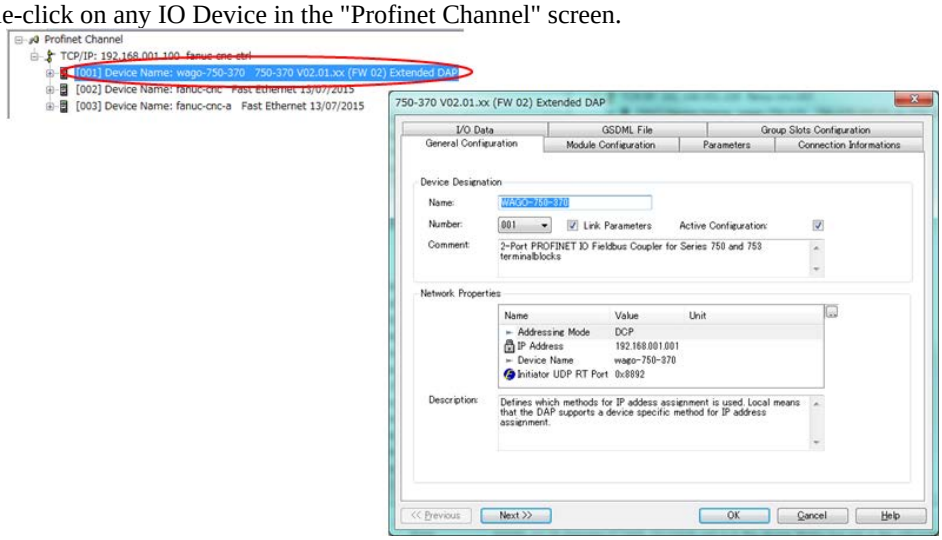
First, select the DAP (Device Access Point) of an IO Device from "Device Library", and drag and drop it in the "Profinet Channel" screen on the right.



NOTE

The DAP (Device Access Point) of the IO Device to select may be subdivided according to model and so on. For details, see the IO Device manual or confirm this with IO Device manufacturer.

Next, double-click on any IO Device in the "Profinet Channel" screen.



The IO Device properties screen is displayed. Make settings as described below.

Setting of the IP address and the device name

Procedure

1 Select the "General Configuration" tab on the IO Device properties screen.

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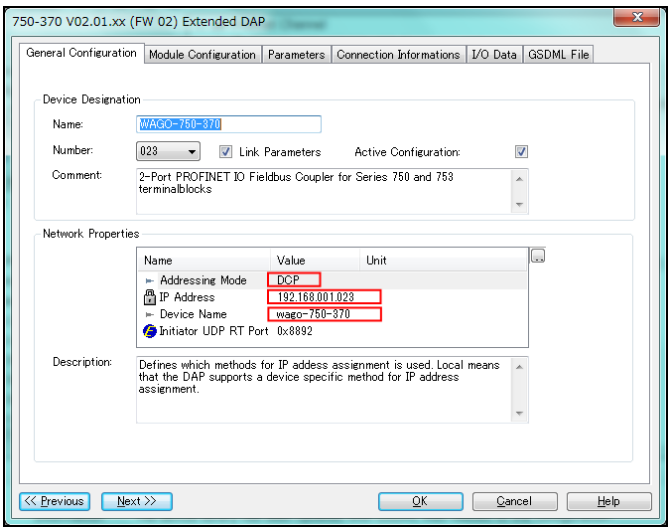

2 Confirm the "Addressing Mode" below "Network Properties" is "DCP", and set the device name in the "Device Name" field below "Network Properties".
"WWW.XXX.YYY.ZZZ" in the "IP Address" field below "Network Properties" is automatically allocated with the "ZZZ" being determined from "Number" on "Device Designation". If this is appropriate, use it without any modification.

NOTE

1 The "Device Name" below "Network Properties" must match the device name that is set as in Subsection 4.6.1.6, "Setting of the device names for IO Devices". For Naming rules for a device name, see "Naming rules for a device name" in Subsection 4.6.1.6, "Setting of the device names for IO Devices".

2 The "Link Parameters" of "Device Designation" is the check box to link the "Number" of "Device Designation" with the "IP Address" of "Network Properties". If you do not link these, remove the check for the "Link Parameters" check box of "Device Designation".

Setting of modules

Procedure

1 Select the "Module Configuration" tab on the IO Device properties screen.

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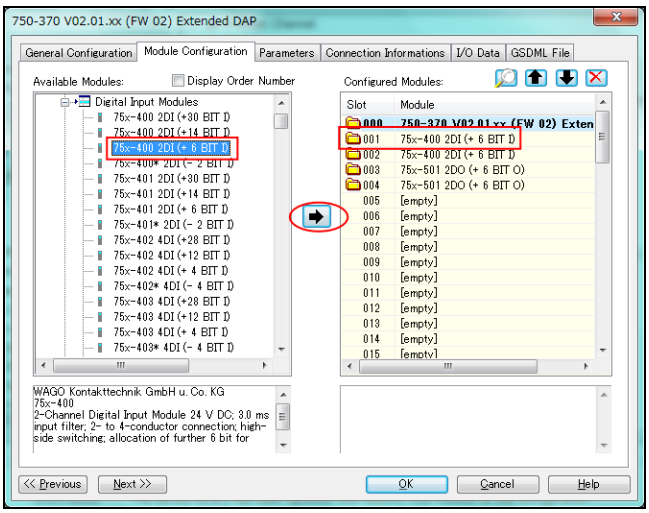


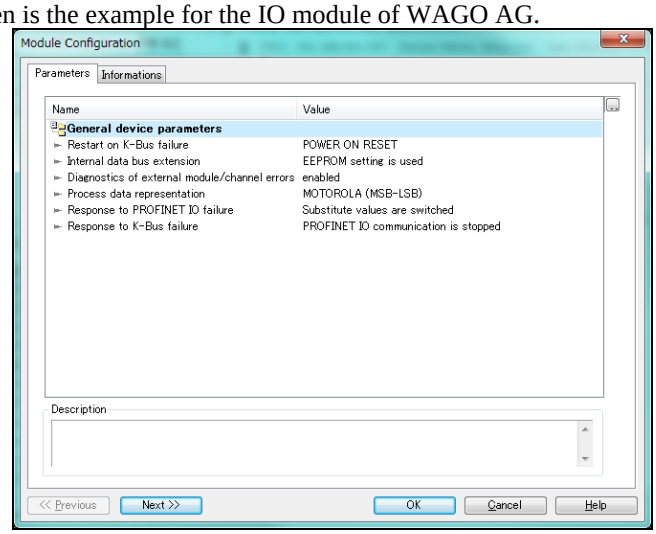
2 Select the necessary module from "Available Modules", and click the [⇒] button to add it to "Configured Modules".
To add more modules, repeat this operation.

3 Double-click the module that is displayed. When the "Parameters" tab exist in the displayed screen, select "Parameters" tab to display the setting screen.
Set the parameters if necessary.

NOTE

The setting of a module may depend on the original specifications for the IO Device.
For details, see the IO Device manual or confirm it with the IO Device manufacturer.

The following screen is the example for the IO module of WAGO AG.



When FANUC CNC is IO Device, double-click the "Fast Ethernet", and select "Parameters" tab to display the setting screen.

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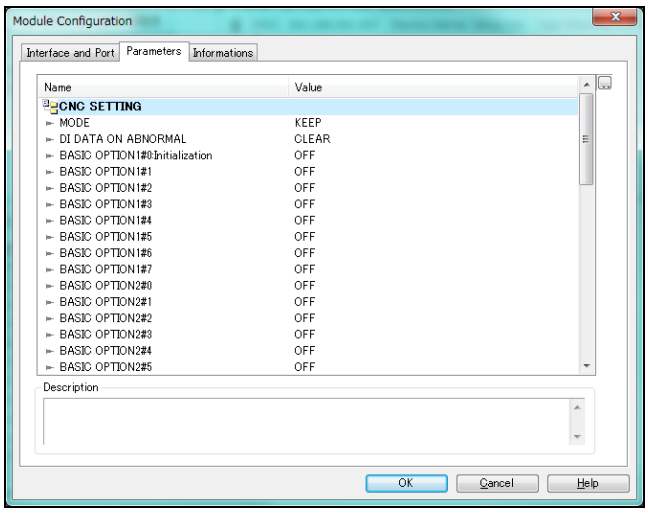
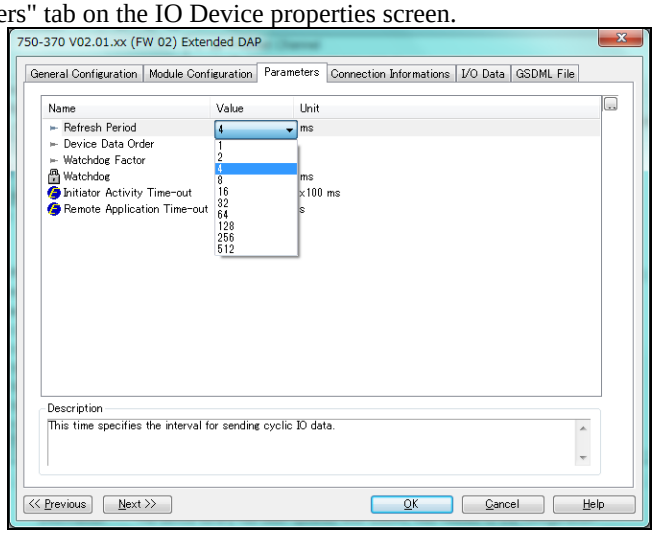


For details of setting items, see Subsection 5.4.1.2, "Setting screen of the PROFINET IO Device function".

Setting of the Input/output update time

Procedure

1 Select the "Parameters" tab on the IO Device properties screen.



2 Select an Input/output update time from the list box of "Refresh Period".

NOTE

1 Not all the Input/output update time displayed in the list box of "Refresh Period" may be supported by the IO Device.
For an explanation of the Input/output update time supported by the IO Device, see the IO Device manual or confirm them with the IO Device manufacturer.

2 See also Section 4.5, "UPDATING DI/DO DATA" when setting the "Refresh Period".

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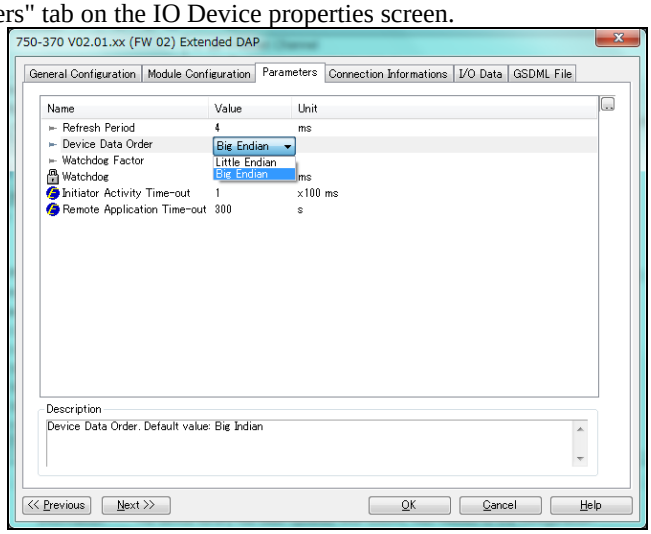
Setting of endian conversion

Procedure

1 Select the "Parameters" tab on the IO Device properties screen.



2 Select between Big Endian and Little Endian in the list box of "Device Data Order".
For an explanation of endian conversion, see Subsection 4.2.3, "Conversion of Endian".

4.6.1.8 Setting and Checking of PMC Allocation

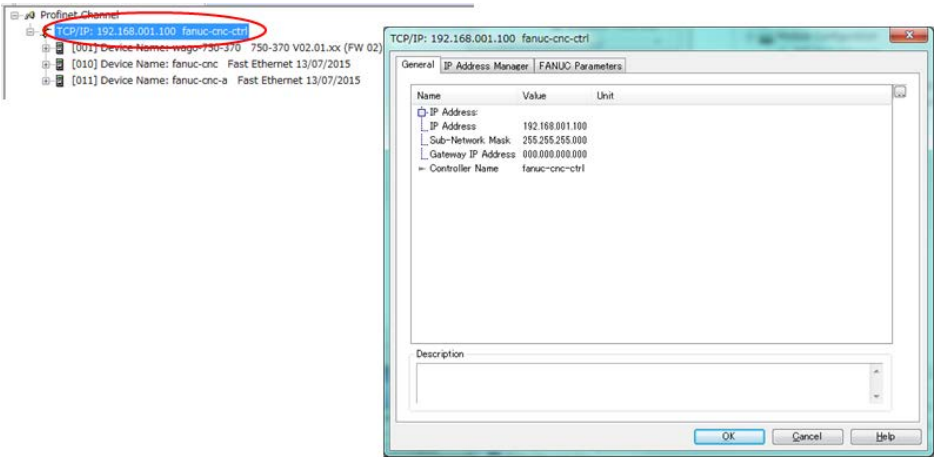
This subsection describes the setting and the checking of PMC allocation.

4.6.1.8.1 PMC Single Allocation Mode

Setting of PMC Allocation for DI/DO and Status

Procedure

1 In the tree of the "Profinet Channel" screen, double-click the "TCP/IP: (IP Address)" to display "TCP/IP" screen.



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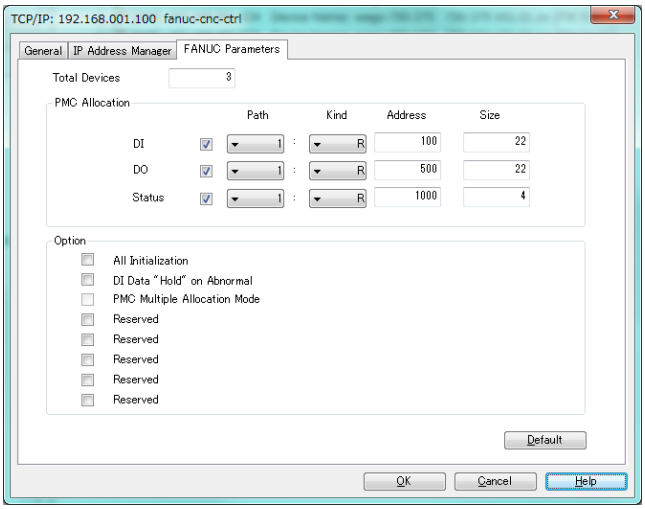
2 Select the "FANUC Parameters" tab to display the "FANUC Parameters" screen, and set the PMC allocatoin.



Display item

Item	Description
Total Devices	Number of IO Devices to connect.
DI/DO Size	Size of the area in which to store the DI/DO data of all IO Devices.

Setting items

Item	Description
DI/DO Path, Kind, Address	Specify the top address of the PMC area in which to store the DI/DO data of all IO Devices. - Path: PMC path number - Kind: PMC area - Address: PMC address number Only a PMC address that is a multiple of 4 can be specified. The specifiable PMC area is the R, E, D, X (DI only), or Y (DO only) area. The specifiable DCS-PMC area is the R, X (DI only), or Y (DO only) area. Specify 9 for the PMC path number of DCS-PMC. If the X/Y address of the PMC is to be assigned, it is necessary to set parameters Nos. 11937 to 11939 also. For details of these NC parameters, see Section 4.3, "PARAMETERS RELATED TO PMC" in Part II, "COMMON". When using DCS-PMC, Dual Check Safety function (S661) is required. For an explanation of the allocation of DI/DO data to the PMC, see Subsection 4.3.3.1.1, "PMC Single Allocation Mode".
Status Path, Kind, Address	Specify the top address of the PMC area in which to store the status. - Path: PMC path number - Kind: PMC area - Address: PMC address number The specifiable PMC area is the R or E area. For details of the notified status, see Subsection 4.3.3.2, "Status".–

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Item	Description
Status Size	Specify the size of the PMC area for storing the status. Setting range: 0 to 49 (byte). The status of the specified size is notified. For details of the notified status, see Subsection 4.3.3.2, "Status".
Option	Bit 0: The next time the power is turned on, all settings of the PROFINET IO Controller function are 0: Not initialized. 1: Initialized. Bit 1: Specify the action to take on the data in the DI area of the IO Device when the communication is disconnected. 0: Clear the DI area to zero. 1: Hold the data in the DI area. "When the communication is disconnected" above is when any of the status signals (+0 to +48) in Subsection 4.3.3.2, "Status", changes. The action taken if the bit is set to 0 (Clear the DI area to zero) is as follows. Bit 2: Specify PMC Single Allocation Mode or PMC Multiple Allocation Mode. 0: PMC Single Allocation Mode 1: PMC Multiple Allocation Mode If you change this bit, PMC allocation mode will switch when the power is turned on next time. This bit cannot be changed from the Setting tool. Bit 3-7: Reserved (Must be 0)

Signal	Change	Description
SF	0→1	The DI areas of all IO Devices are cleared to zero.
CONxx	1→0	Only the DI area of IO Device xx is cleared to zero.
RAPxx	1→0	
IOx□	1→0	

⚠ **WARNING**

1 Before allocating the PMC area, be sure to read Section 3.1, "DI/DO DATA AND STATUS DATA" in Part II, "COMMON".

2 When the communication is disconnected, the DI area depends on the setting of bit 1 of "Option". When the communication is connected again, the data sent from the IO Device is reflected in the DI area of the IO Device. This means that if zero data is sent from the IO Device immediately after the communication is connected again, the DI area of the IO Device is cleared to zero.

Operation

When the [Default] button is clicked, all setting items of the "FANUC Parameters" screen are cleared.

Checking of PMC Allocation for DI/DO

Procedure

1 In the tree of the "Profinet Channel" screen, double-click a slot in "Module Configuration" for an IO Device, and the slot properties screen is displayed.

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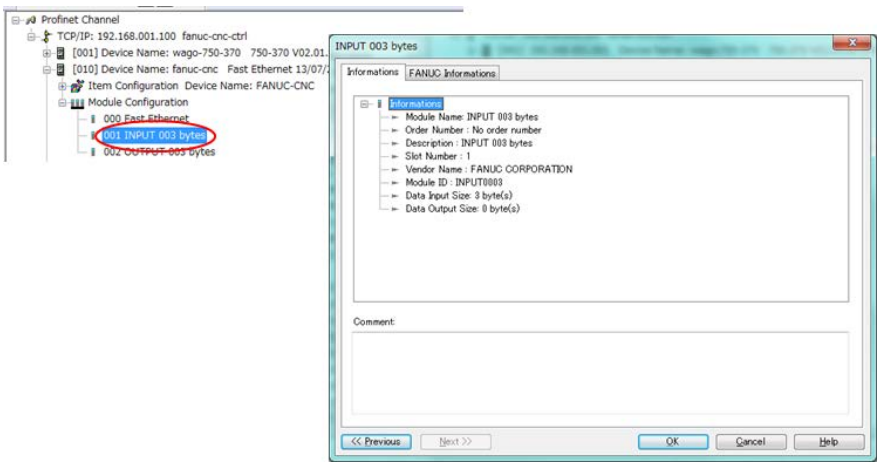
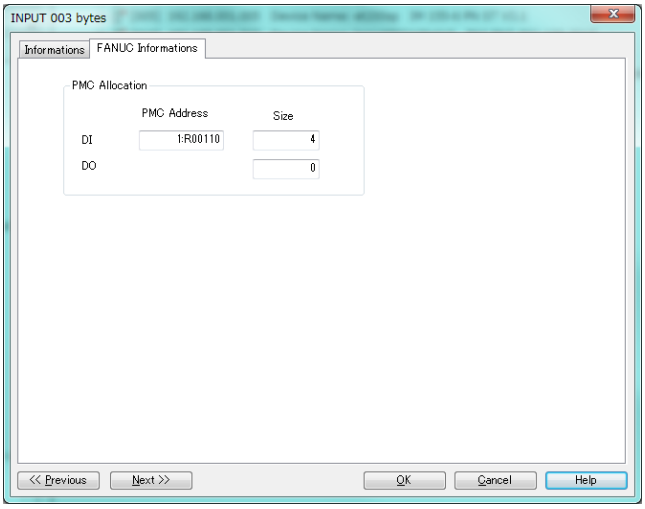


2 Select the "FANUC Informations" tab to display the "FANUC Informations" screen, then the PMC allocation of the selected slot can be checkd.



NOTE

When the selected slot is "DI Size=0", "DI PMC Address" is not displayed. This is the same for "DO PMC Address".

Display items

Item	Description
DI/DO PMC Address, Size	These are the top address and size of the PMC area in which to store the DI/DO data of the selected slot. "PMC Address " and "Size" correspond to the rule described in subsection 4.3.3.1.1, "PMC Single Allocation Mode".

4.6.1.8.2 PMC Multiple Allocation Mode

Setting of PMC Allocation for Status, Error Log and Alarm Log

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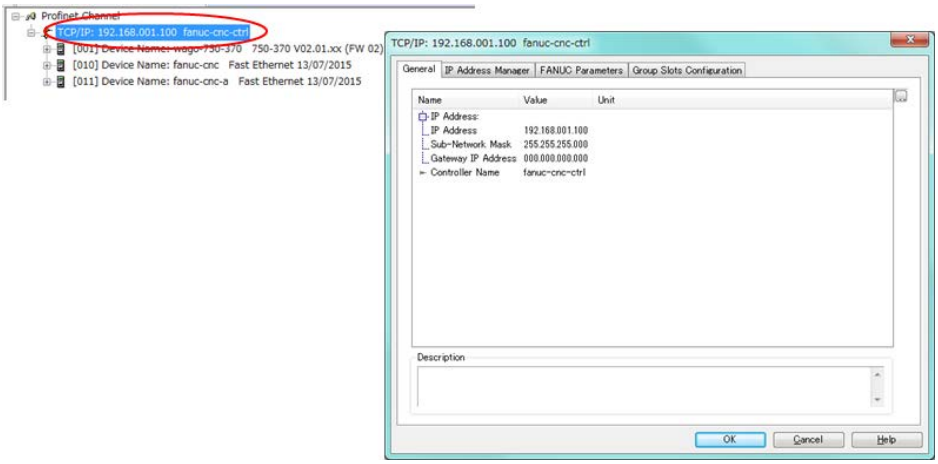
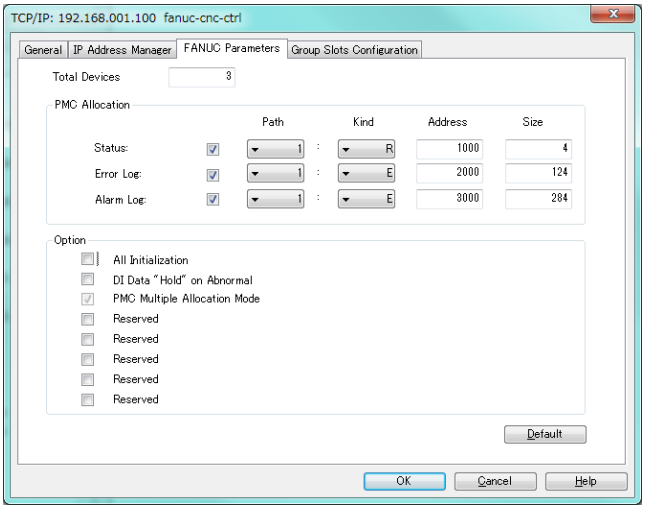
Procedure

1 In the tree of the "Profinet Channel" screen, double-click the "TCP/IP: (IP Address)" to display "TCP/IP" screen.



2 Select the "FANUC Parameters" tab to display the "FANUC Parameters" screen, and set the PMC allocatoin.



Display item

Item	Description
Total Devices	Number of IO Devices to connect.

Setting items

Item	Description
Status Path, Kind, Address	Specify the top address of the PMC area in which to store the status. - Path: PMC path number - Kind: PMC area - Address: PMC address number The specifiable PMC area is the R or E area. For details of the notified status, see Subsection 4.3.3.2, "Status".–

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Item	Description
Status Size	Specify the size of the PMC area for storing the status. Setting range: 0 to 49 (byte). The status of the specified size is notified. For details of the notified status, see Subsection 4.3.3.2, "Status".
Error Log Path, Kind, Address	Specify the top address of the PMC area in which to store the error log. - Path: PMC path number - Kind: PMC area - Address: PMC address number Only a PMC address that is a multiple of 4 can be specified. The specifiable PMC area is the R, E or D area. For details of the notified error log, see Subsection 4.3.3.3, "Error Log".
Error Log Size	Specify the size of the PMC area for storing the error log. Setting range: 0 to 3064 (byte). The error log of the specified size is notified. For details of the notified error log, see Subsection 4.3.3.3, "Error Log".
Alarm Log Path, Kind, Address	Specify the top address of the PMC area in which to store the alarm log. - Path: PMC path number - Kind: PMC area - Address: PMC address number Only a PMC address that is a multiple of 4 can be specified. The specifiable PMC area is the R, E or D area. For details of the notified alarm log, see Subsection 4.3.3.4, "Alarm Log".
Alarm Log Size	Specify the size of the PMC area for storing the alarm log. Setting range: 0 to 7144 (byte). The alarm log of the specified size is notified. For details of the notified alarm log, see Subsection 4.3.3.4, "Alarm Log".
Option	Bit 0: The next time the power is turned on, all settings of the PROFINET IO Controller function are 0: Not initialized. 1: Initialized. Bit 1: Specify the action to take on the data in the DI area of the IO Device when the communication is disconnected. 0: Clear the DI area to zero. 1: Hold the data in the DI area. "When the communication is disconnected" above is when any of the status signals (+0 to +48) in Subsection 4.3.3.2, "Status", changes. The action taken if the bit is set to 0 (Clear the DI area to zero) is as follows. Signal / Change / Description SF / 0→1 / The DI areas of all IO Devices are cleared to zero. C□Nxx / 1→0 / Only the DI area of IO Device xx is cleared to zero. RAPxx / 1→0 IOx□ / 1→0 Bit 2: Specify PMC Single Allocation Mode or PMC Multiple Allocation Mode. 0: PMC Single Allocation Mode 1: PMC Multiple Allocation Mode If you change this bit, PMC allocation mode will switch when the power is turned on next time. This bit cannot be changed from the Setting tool. Bit 3-7: Reserved (Must be 0)

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⚠ **WARNING**

1 Before allocating the PMC area, be sure to read Section 3.1, "DI/DO DATA AND STATUS DATA" in Part II, "COMMON".

2 When the communication is disconnected, the DI area depends on the setting of bit 1 of "Option". When the communication is connected again, the data sent from the IO Device is reflected in the DI area of the IO Device. This means that if zero data is sent from the IO Device immediately after the communication is connected again, the DI area of the IO Device is cleared to zero.

Operation

When the [Default] button is clicked, all setting items of the "FANUC Parameters" screen are cleared.

Setting and Checking of PMC Allocation for DI/DO

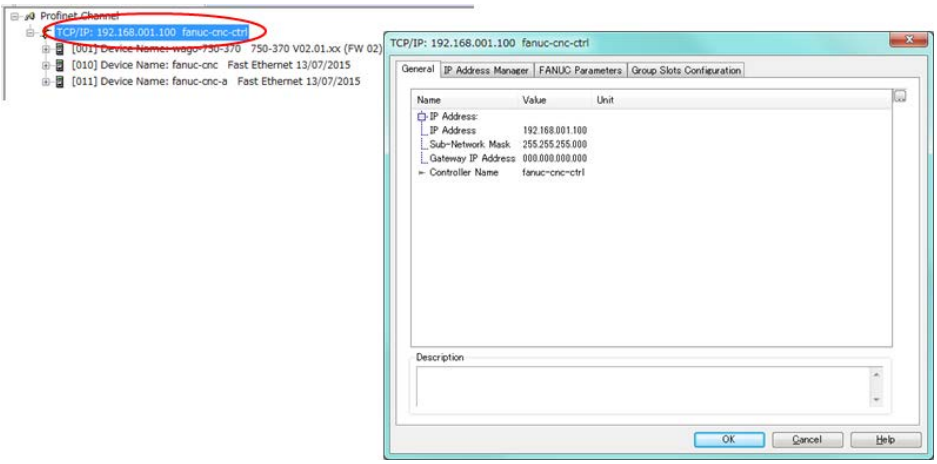
There are the following three procedures.

- Procedure A: When displaying the PMC allocation of all IO Devices
- Procedure B: When displaying only the PMC allocation of the selected IO Device
- Procedure C: When displaying only the PMC allocation of the selected slot

Procedure A

This describes the procedure when displaying the PMC allocation of all IO Device.

1 In the tree of the "Profinet Channel" screen, double-click the "TCP/IP: (IP Address)" to display "TCP/IP" screen.



2 Select the "Group Slots Configuration" tab to display the "Group Slots Configuration" screen, then the PMC allocation can be checkd.
The following shows an example when no PMC allocation is set.

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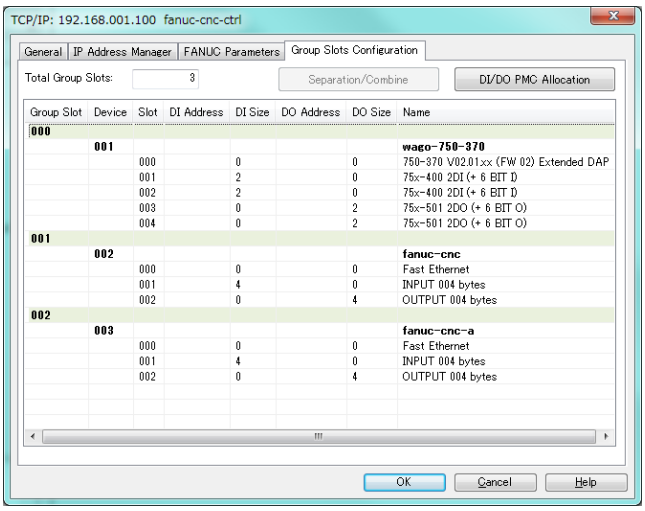
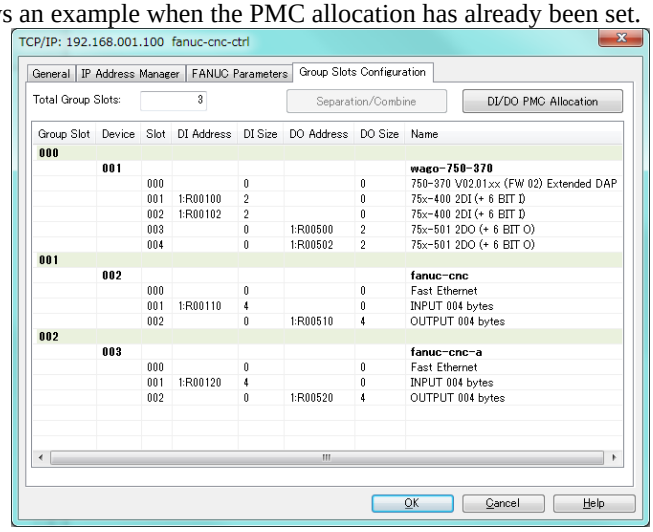


The following shows an example when the PMC allocation has already been set.



NOTE

When the slot is "DI Size=0", "DI Address" is not displayed. This is the same for "DO Address".

Display item

Item	Description
Total Group Slots	This is the total number of group slots of all IO devices.
Group Slot	This is the group slot number.
Device	This is the "Number" of IO Device.
Slot	This is the slot number.
DI/DO Address, Size	These are the top address and size of the PMC area in which to store the DI/DO data of the slot.
Name	This is the device name or module name.

3 On the "Group Slots Configuration" screen, select one of the slots in the group slot to set the DI/DO address and click the [DI/DO PMC Allocation] button.

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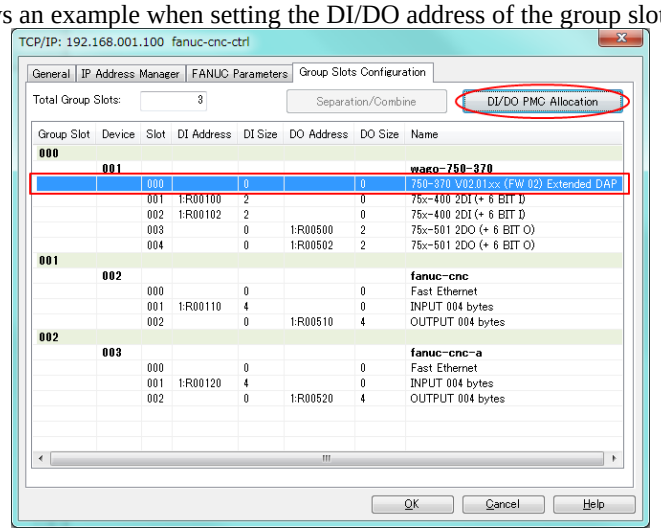
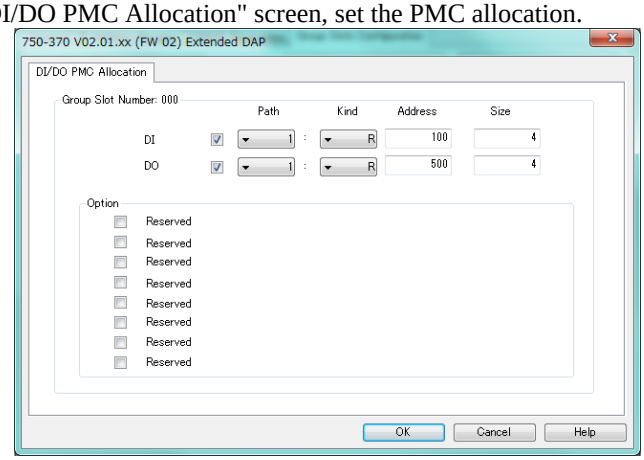
The following shows an example when setting the DI/DO address of the group slot number 0.



On the displayed "DI/DO PMC Allocation" screen, set the PMC allocation.



Display item

Item	Description
Group Slot Number	This is the group slot number.
DI/DO Size	These are the size of the PMC area in which to store the DI/DO data of the group slot.

Setting items

Item	Description
DI/DO Path, Kind, Address	Specify the top address of the PMC area in which to store the DI/DO data of all IO Devices. - Path: PMC path number - Kind: PMC area - Address: PMC address number Only even PMC address can be specified. The specifiable PMC area is the R, E, D, X (DI only), or Y (DO only) area. The specifiable DCS-PMC area is the R, X (DI only), or Y (DO only) area. Specify 9 for the PMC path number of DCS-PMC. If the X/Y address of the PMC is to be assigned, it is necessary to set parameters

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Item	Description
	Nos. 11937 to 11939 also. For details of these NC parameters, see Section 4.3, "PARAMETERS RELATED TO PMC" in Part II, "COMMON". When using DCS-PMC, Dual Check Safety function (S661) is required. For an explanation of the allocation of DI/DO data to the PMC, see Subsection 4.3.3.1.2, "PMC Multiple Allocation Mode".
Option	Bit 0-7: Reserved (Must be 0)

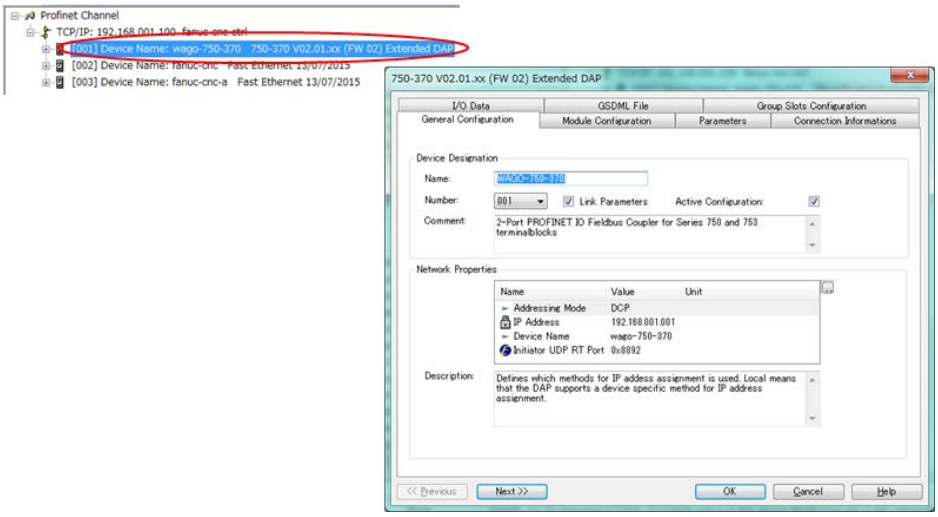
NOTE

When the top DI/DO address of the PMC area in the group slot is set on the "DI/DO PMC Allocation" screen, the DI/DO address of each slot in the group slot is automatically allocated and displayed on the "Group Slots Configuration" screen.

Procedure B

This describes the procedure when displaying only the PMC allocation of the selected IO Device.

1 In the tree of the "Profinet Channel" screen, double-click on any IO Device to display the IO Device properties screen



2 Select the "Group Slots Configuration" tab to display the "Group Slots Configuration" screen, then the PMC allocation can be checkd.
The following shows an example when the PMC allocation has already been set.

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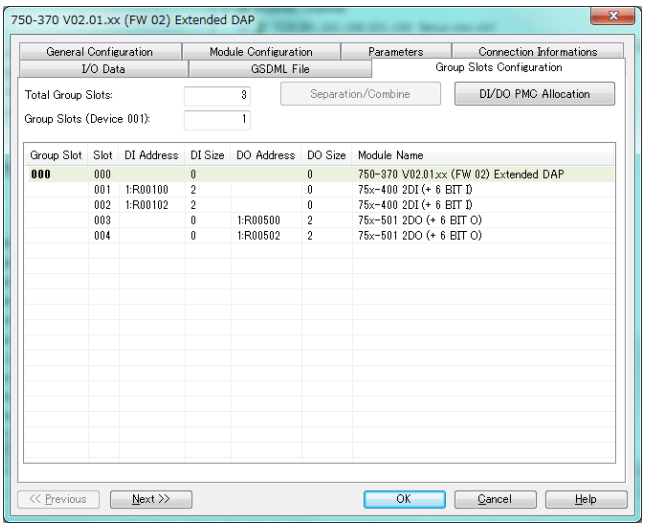


Display item

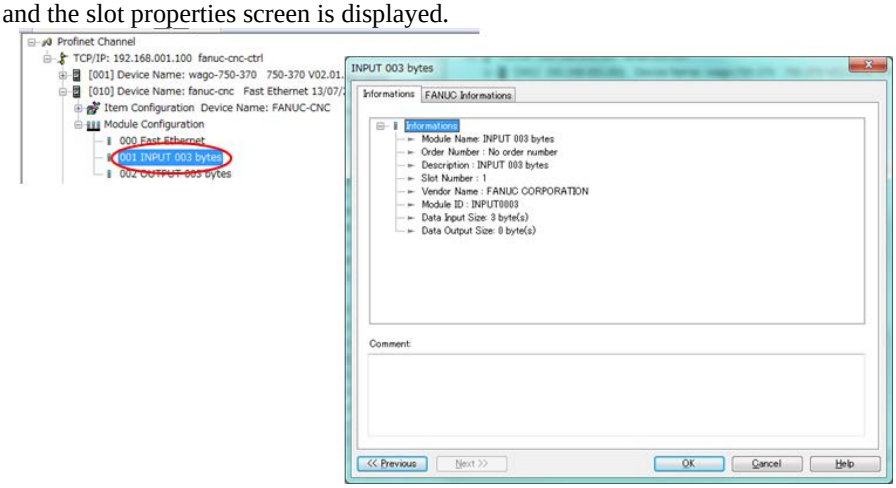
Item	Description
Total Group Slots	This is the total number of group slots of all IO devices.
Group Slots (Device xxx)	This is the number of group slots of "Number" = xxx of the selected IO device.
Group Slot	This is the group slot number.
Slot	This is the slot number.
DI/DO Address, Size	These are the top address and size of the PMC area in which to store the DI/DO data of the slot.
Module Name	This is the module name.

3 On the "Group Slots Configuration" screen, select one of the slots in the group slot to set the DI/DO address and click the [DI/DO PMC Allocation] button to display "DI/DO PMC Allocation" screen.
The setting procedure of "DI/DO PMC Allocation" screen is the same as the procedure A-3.

Procedure C

This describes the procedure when displaying only the PMC allocation of the selected slot.

1 In the tree of the "Profinet Channel" screen, double-click a slot in "Module Configuration" for an IO Device, and the slot properties screen is displayed.



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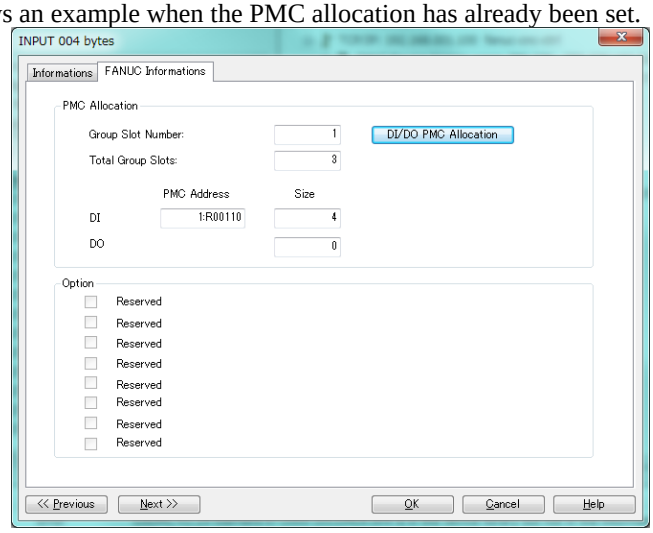
2 Select the "FANUC Informations" tab to display the "FANUC Informations" screen, then the PMC allocation of the selected slot can be checkd.
The following shows an example when the PMC allocation has already been set.



NOTE
When the selected slot is "DI Size=0", "DI PMC Address" is not displayed. This is the same for "DO PMC Address".

Display item

Item	Description
Group Slot Number	This is the group slot number.
Total Group Slots	This is the total number of group slots of all IO devices.
DI/DO PMC Address, Size	These are the top address and size of the PMC area in which to store the DI/DO data of the slot.

3 On the "FANUC Informations" screen, select one of the slots to set the DI/DO address and click the [DI/DO PMC Allocation] button to display "DI/DO PMC Allocation" screen.
The setting procedure of "DI/DO PMC Allocation" screen is the same as the procedure A-3.

Operation

Group slot separation

The selected slot in the group slot is separated as a new group slot.
The operation method is the same for both Procedure A and Procedure B.

1 On the "Group Slots Configuration" screen, select the top slot that you want to separate in the group slot and click the "Separation" button to separate the group slot.
The following is an example when separating slot number 3 or later in group slot number 0 as a new group slot.

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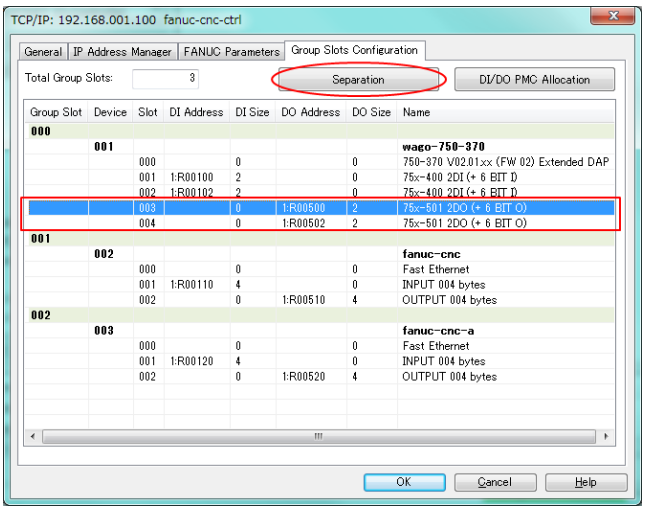
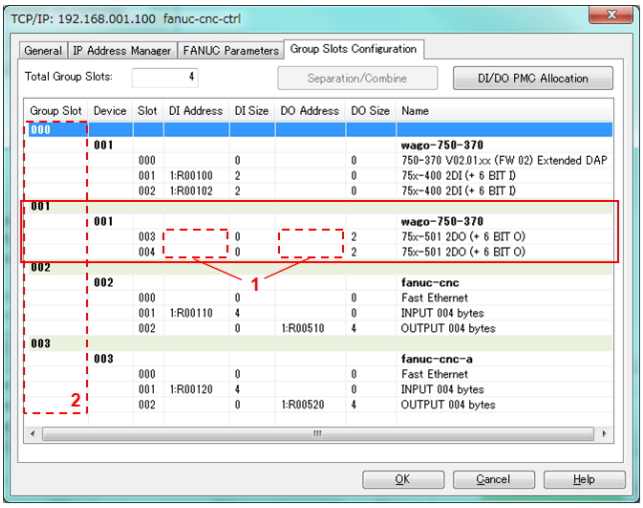


Before group slot separation



After group slot separation

Then, the DI/DO address of the new group slot is cleared and all group slot numbers are automatically reassigned with consecutive numbers.
The example shows the followings.

- As the dotted line-1, the DI/DO address of the new group slot number 1 is cleared.
- As the dotted line-2, all group slot numbers are reassigned from "0-2" (before group slot separation) to "0-3" (after group slot separation).

NOTE
Group slots are separated only within the same IO Device.

Group slot combine

The selected group slot number n is combined with group slot number n-1.
The operation method is the same for both Procedure A and Procedure B.

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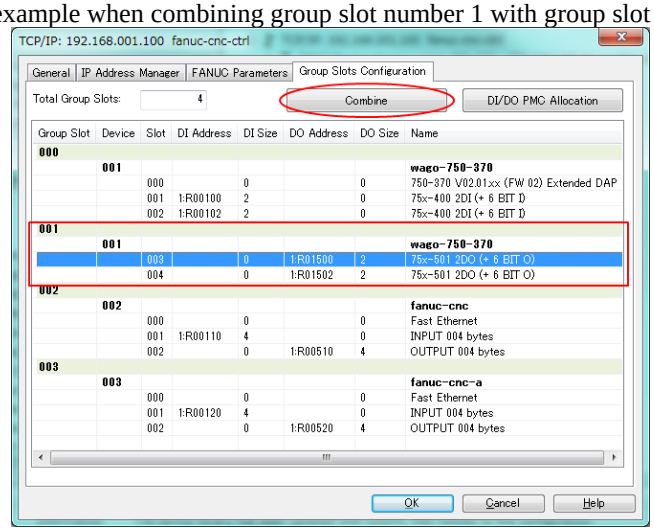
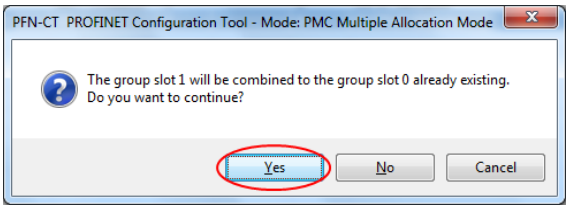
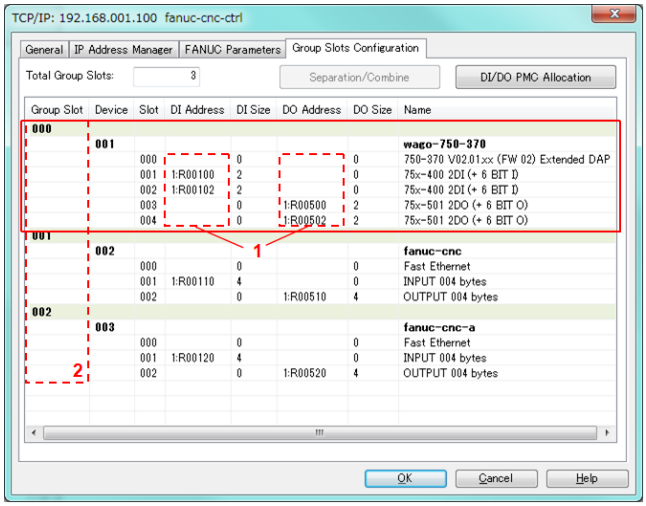
1 On the "Group Slots Configuration" screen, select the top slot of the group slot that you want to combine and click the [Combine] button.
The following is an example when combining group slot number 1 with group slot number 0.



Before group slot combine

2 The following confirmation message will be displayed, so click the [Yes] button to combine the group slots.





After group slot combine

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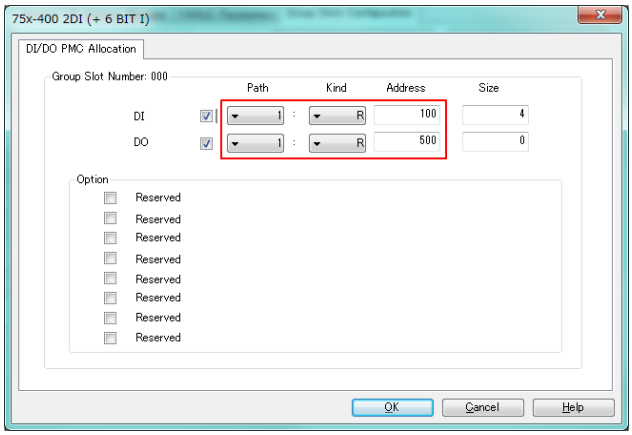
Then, the DI/DO address of each slot in the group slot after combine is automatically reallocated with the top DI/DO address of the group slot before combine. And, all group slot numbers are automatically reassigned with consecutive numbers.
The example is when group slot number 0 before combine is "DI/DO address = 1:R100/1:R500" as shown below.



The example shows the followings.

- As the dotted line-1, each slot of the group slot number 0 after combine is reallocated with "DI/DO address = 1:R100/1: R500" as the top address.
- As the dotted line-2, all group slot numbers are reassigned from "0-3" (before group slot combine) to "0-2" (after group slot combine).

NOTE
Cannot combine group slots of different IO Devices.

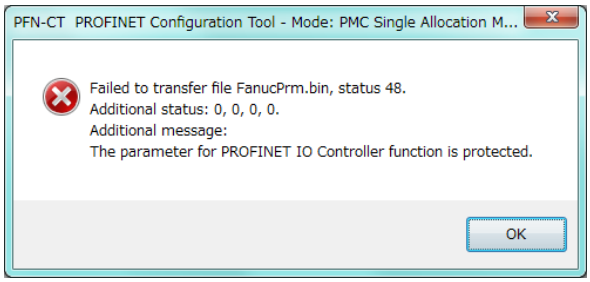
4.6.1.9 Downloading of settings

This subsection describes how to download settings to the CNC.

Procedure

1 Select the menu [File] -> [Download Configuration] to start downloading all settings to the CNC.

2 If downloading terminates normally, "The configuration is successfully downloaded" is displayed.
If downloading fails, the following dialog box is displayed. For details, see Subsection 4.6.1.12, "List of status codes".



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NOTE

It may take up to about 150 seconds for downloading to be completed from the download operation, depending on the operation environment of the personal computer and the number of IO Devices that are set and the number of modules that are configured.

⚠ CAUTION

1 If the download operation is executed during IO communication, IO data may be delayed.
Perform the download operation in the state in which safety is ensured properly.

2 Once the download operation is started, do not turn off the power to the CNC or pull out the Ethernet cable until the message "The configuration is successfully downloaded" is displayed. Otherwise, the setting data may be damaged.
If, when the power to the CNC is turned on, it is detected that the setting data is damaged, the message "E-1610 [PROFINET Data is not set]" is displayed on the log screen of the PROFINET IO Controller for the CNC. If this happens, perform the download operation again.

4.6.1.10 Confirmation of the IO Device communication state

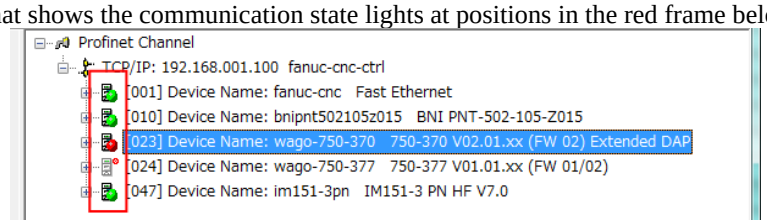
This subsection describes how to confirm the IO Device communication state.

⚠ CAUTION

Do not leave the Setting tool in the diagnosis state, because the load on the network increases when the Setting tool is in the diagnosis state.

Procedure

1 Select the menu [Devices] -> [Start Console Diagnostic] to place the Setting tool in the diagnosis state.
The lamp ○ that shows the communication state lights at positions in the red frame below.



The meaning of the lamp that shows the connection state is as follows.

- Lighting green: Communication is normal.
- Lighting red: Communication is in error.

2 On the "Profinet Channel" screen, double-click the IO Device to diagnose to display the properties screen of the IO Device.

Confirmation of communication state

Select the "Connection Informations" tab to display the "Connection Informations" screen, then the connection state can be confirmed.

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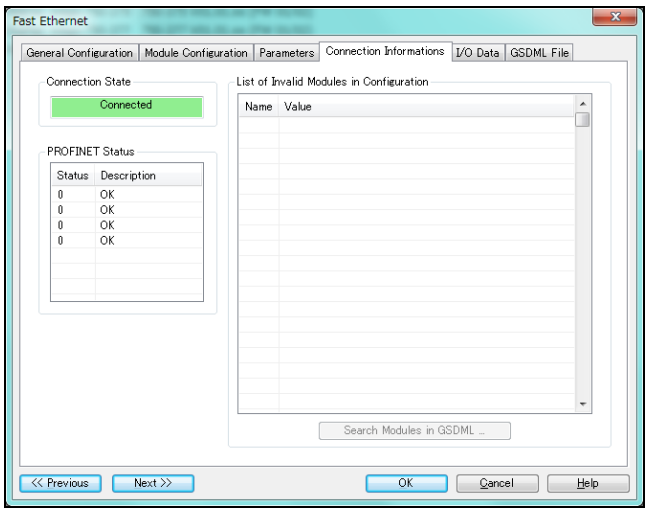
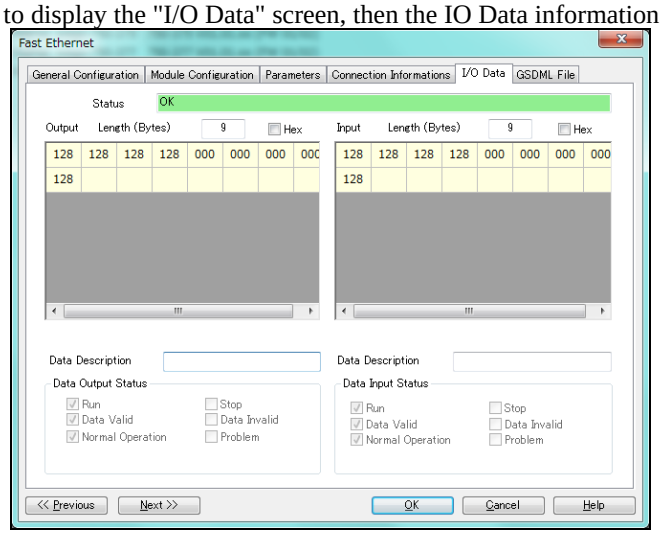


Display items

Item	Description
Connection State	It is communication state. - Connected : The communication is normal. - Disconnected : The communication is in error.
PROFINET Status	These are the status in PROFINET standard. These are error codes (hexadecimal) in the PROFINET standard, ErrorCode, ErrorDecode, ErrorCode1, and ErrorCode2, from top to bottom. For details, see Subsection 4.6.2.1, "Error Code".
List of Invalid Module in Configuration	Unsupported.

Confirmation of IO Data information

Select the "I/O Data" tab to display the "I/O Data" screen, then the IO Data information can be confirmed.



Edit	Date	Design	Description

Date	2017.03.08	Design	A.Hiramatsu	Apprv.	Inoue

Title	FANUC Series 30*i*/31*i*/32*i*/35*i*-MODEL B, Power Motion *i*-MODEL A, FANUC Series 0*i*-MODEL F Industrial Ethernet CONNECTION MANUAL
Draw No.	B-64013EN/03-3
FANUC CORPORATION	Sheet 78/95

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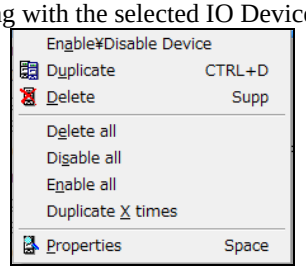
Display items

Item	Description
Status	It is communication state. - OK : The communication is normal. - Not OK : The communication is in error. When the communication is in error, confirm the cause by "PROFINET Status" of the "Connection Informations" screen.
Output/Input Length(Bytes)	These are the data length and the data value of input/output frame. The data displayed here is the data of the frame on the line, and the structure of the frame corresponds to the PROFINET standard. Note that the frame data and the data stored in PMC area is not the same.
Data Description	Unsupported.
Data Output/Input Status	It is the APDU status in PROFINET standard. The meaning is the same with "APDU status" of subsection 4.6.2.3, "Status".

Item	Meaning
RUN	The control application of the provider (sender) is in the RUN state.
STOP	The control application of the provider (sender) is in the STOP state.
Data Valid	The frame data is valid.
Data Invalid	The frame data is invalid.
Normal Operation	Normal operation
Problem	A problem is detected.

4.6.1.11 Operations that relates to IO Device

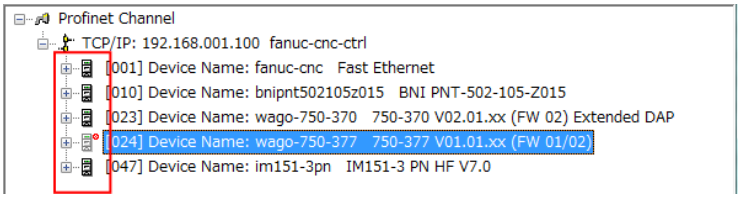
This subsection describes the operation of the following menu.
This menu is displayed when right-clicking with the selected IO Device on the "Profinet Channel" screen.



Operation

Enable¥Disable Device

The selected IO Device is switched between "Enable" and "Disable".
The following example shows the "Profinet Channel" screen where only the setting of the IO Device whose Number is 024 is disabled.



The setting of the "Disable" IO Device is not downloaded to CNC.

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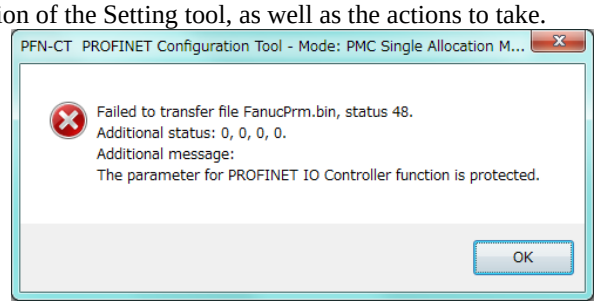
Other Operations

Item	Description
Duplicate	The selected IO Device is copied.
Delete	The selected IO Device is deleted.
Delete all	All IO Devices are deleted.
Disable all	All IO Devices are switched to "Disable".
Enable all	All IO Devices are switched to "Enable".
Duplicate X times	The selected IO Device is copied in X times.
Properties	The properties screen in Subsection 4.6.1.7, "Setting of IO Devices" is displayed.

4.6.1.12 List of status codes

This subsection describes the meanings of the status, Additional status, and Additional message that may be displayed during the operation of the Setting tool, as well as the actions to take.



The "Error code on log screen" column of the table contains the error codes that may be displayed on the log screen of the PROFINET IO Controller function in CNC.

Status codes

Error number	Meaning and action to be taken	Error code on log screen
33	A timeout occurred during downloading. Or, a fatal error has occurred in CNC. In this case, the details of the error are notified to the log screen of PROFINET IO Controller function. Remove the errors, retry the download operation. Additional status: (Not used) Additional message: (Not used)	(Undefined)
34	The data to download exceeded the size that can be stored in the CNC. Delete any unnecessary IO Devices or modules. Additional status: (Not used) Additional message: (Not used)	E-1600 E-1613
35	The number of IO Devices that were set exceeded 48. Delete any unnecessary IO Device. Additional status: (Not used) Additional message: Number of Devices is over(X). X means the following. X: Number of IO Devices that were set.	E-1600 E-1612

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Error number	Meaning and action to be taken	Error code on log screen
37	48 or greater is set for the "Number" of an IO Device. Additional status: (Not used) Additional message: Device No. is over(X). X means the following. X: "Number" of IO Device	E-1600 E-1612
38	The DI size per IO Device that was set exceeded 1024 bytes. Delete any unnecessary input modules, or replace any with those with smaller input sizes. Additional status: (Not used) Additional message: DI size is over(X:Y). X and Y mean the following. X: "Number" of IO Device Y: DI size that was set	E-1600 E-1612
39	The DO size per IO Device that was set exceeded 1024 bytes. Delete any unnecessary output modules, or replace any with those with smaller output sizes. Additional status: (Not used) Additional message: DO size is over(X:Y). X and Y mean the following. X: "Number" of IO Device Y: DO size that was set	E-1600 E-1612
40	The total DI size that was set exceeded 12288 bytes. Delete any unnecessary input modules, or replace any with those with smaller input sizes. Additional status: (Not used) Additional message: Total DI size is over(X). X means the following. X: Total DI size that was set	E-1600 E-1612
41	The total DO size that was set exceeded 12288 bytes. Delete any unnecessary output modules, or replace any with those with smaller output sizes. Additional status: (Not used) Additional message: Total DO size is over(X). X means the following. X: Total DO size that was set	E-1600 E-1612

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Error number	Meaning and action to be taken	Error code on log screen
42	A wrong IP parameter (IP address, subnet mask, or router IP address) is detected. Review the setting of the IP parameter. Additional status: (Not used) Additional message: A wrong IP parameter is detected(X). X means the following. 1410: The IP address is wrong. 1411: The subnet mask is wrong. 1412: The router IP address is wrong.	E-1601
43	The DI area of the PMC is wrong. Review the DI area of the PMC. This status code is also displayed if the DI area of the PMC is insufficient. Additional status: (Not used) Additional message: DI area is wrong(X). X means the following. X: Detailed information code	E-1601

X	Detailed information
1436	The PMC path number is out of range. If the PMC path number is specified as 9, Dual Check Safety function (S661) is required.
1437	The PMC area is out of range. If the X area is specified as the DI, the parameters Nos. 11937 to 11939 are not set. For details of these NC parameters, see Section 4.3, "PARAMETERS RELATED TO PMC" in Part II, "COMMON".
1438 or 1439	The area specified by the address number and size is out of the range of the PMC area.
1441	The address number is not a multiple of 4.

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Error number	Meaning and action to be taken	Error code on log screen
44	The DO area of the PMC is wrong. Review the DO area of the PMC. This status code is also displayed if the DO area of the PMC is insufficient. Additional status: (Not used) Additional message: DO area is wrong(X). X means the following. X: Detailed information code **X** — **Detailed information** 1443 — The PMC path number is out of range. If the PMC path number is specified as 9, Dual Check Safety function (S661) is required. 1444 — The PMC area is out of range. If the Y area is specified as the DO, the parameters Nos. 11937 to 11939 are not set. For details of these NC parameters, see Section 4.3, "PARAMETERS RELATED TO PMC" in Part II, "COMMON". 1445 or 1446 — The area specified by the address number and size is out of the range of the PMC area. 1448 — The address number is not a multiple of 4.	E-1601
46	The function is not supported by the CNC. Additional status: (Not used) Additional message: (Not used)	(None)
48	The parameter protection of the CNC is enabled. To disable parameter protection, perform the following operations on the CNC: • On the setting screen of the PROFINET IO Controller function, change "MODE" to "CHANGE MODE". • Change the CNC mode to the MDI mode or set the CNC to the emergency stop state. Additional status: (Not used) Additional message: The parameter for PROFINET IO Controller function is protected.	E-1603
49	The status area of the PMC is wrong. Review the status area of the PMC. This status code is also displayed if the status area of the PMC is insufficient. Additional status: (Not used) Additional message: Status area is wrong(X). X means the following. X: Detailed information code **X** — **Detailed information** 1450 — The PMC path number is out of range. 1451 — The PMC area is out of range. 1452 or 1453 — The area specified by the address number and size is out of the range of the PMC area.	E-1601
50	See the additional status codes below.	

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Error number	Meaning and action to be taken	Error code on log screen
52	The requirements to set the PMC allocation from the Setting tool are not satisfied. When you set the PMC allocation from the Setting tool, confirm the followings. - When the Setting tool is PMC Single allocation mode or the Setting tool is V 3.1.10 **Item** / **Requirements** PROFINET function software: - Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A: Edition 02 or later of Series 658R - Series 0*i*-F: Edition 02 or later of Series 658U Embedded Ethernet software: - Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A: Edition 15 or later of Series 658M - Series 0*i*-F: Edition 05 or later of Series 658A When these requirements are not satisfied, set the PMC allocation by the setting screen of the PROFINET IO Controller function in CNC. Because the settings of the PMC allocation is not downloaded. - When the Setting tool is PMC multiple allocation mode **Item** / **Requirements** PROFINET function software: - Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A: Edition 04 or later of Series 658R - Series 0*i*-F: Edition 04 or later of Series 658U Embedded Ethernet software: - Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A: Edition 19 or later of Series 658M - Series 0*i*-F: Edition 09 or later of Series 658A If downloading fails by excluding the above, restart the CNC and the Setting tool, and retry downloading. If downloading still fails, contact us, describing the information on the log screen.	(Undefined)
56	It was not possible to change the device name or the IP parameters because communication was in progress.	(None)
(Other)	Contact us.	(Undefined)

Additional status codes

Error number	Meaning and action to be taken	Error code on log screen
1, 0, 0, 0	Embedded Ethernet software in CNC is old. Check the detailed information on Additional message. Additional message : Embedded Ethernet Software is old(X). X means the following. X: Detailed information code **X** / **Detailed information** 1: CNC started in PMC single allocation mode, but the Embedded Ethernet software does not support PMC single allocation mode. The requirements for PMC single allocation mode are as follows.	E-1616

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Error number	Meaning and action to be taken	Error code on log screen
	<table><tr><td></td><td>- Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A: Edition 15 or later of Series 658M - Series 0*i*-F: Edition 05 or later of Series 658A When these requirements are not satisfied, set the PMC allocation by the setting screen of the PROFINET IO Controller function in CNC. Because the settings of the PMC allocation is not downloaded.</td></tr><tr><td>2 or 3</td><td>CNC started in PMC multiple allocation mode, but the Embedded Ethernet software does not support PMC multiple allocation mode. The requirements for PMC multiple allocation mode are as follows. - Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A: Edition 19 or later of Series 658M - Series 0*i*-F: Edition 09 or later of Series 658A</td></tr></table>	
2, 0, 0, 0	The number of configured group slot is wrong. Review the number of configured group. W and X mean the following. W: Number of configured group slot X: Detailed information code <table><tr><th>X</th><th>Detailed information</th></tr><tr><td>1</td><td>The maximum number of group slots that can be configured exceeds 48. To configure more than 49 group slots, PMC allocation expansion of PROFINET IO Controller function (R979) is required. If this error occurs, it is possible that the parameter with group slot number of 49 or more was restored by restore operation of the communication parameters.</td></tr><tr><td>2</td><td>The maximum number of group slots that can be configured exceeds 256.</td></tr></table>	E-1616
10, 0, 0, 0	The set status size exceeded 49 bytes (maximum value). Additional message： Status size is over(X). X means the following. X: Set status size	E-1617
11, 0, 0, 0	The set error log size exceeded 3064 bytes (maximum value). Additional message： Error Log Size is over(X) X means the following. X: Set error log size	E-1617
12, 0, 0, 0	The set alarm log size exceeded 7144 bytes (maximum value). Additional message： Alarm Log size is over(X). X means the following. X: Set alarm log size	E-1617
20 0, 0, 0	The error log area of the PMC is wrong. Review the error log area of the PMC. This status code is also displayed if the error log area of the PMC is insufficient.	E-1601

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Error number	Meaning and action to be taken	Error code on log screen
	Additional message： Error Log area is wrong(X). X means the following. X: Detailed information code <table><tr><th>X</th><th>Detailed information</th></tr><tr><td>1472</td><td>The PMC path number is out of range.</td></tr><tr><td>1473</td><td>The PMC area is out of range.</td></tr><tr><td>1474 or 1475</td><td>The area specified by the address number and size is out of the range of the PMC area.</td></tr><tr><td>1477</td><td>The address number is not a multiple of 4.</td></tr></table>	
21, 0, 0, 0	The alarm log area of the PMC is wrong. Review the alarm log area of the PMC. This status code is also displayed if the alarm log area of the PMC is insufficient. Additional message： Alarm Log area is wrong(X). X means the following. X: Detailed information code <table><tr><th>X</th><th>Detailed information</th></tr><tr><td>1479</td><td>The PMC path number is out of range.</td></tr><tr><td>1480</td><td>The PMC area is out of range.</td></tr><tr><td>1481 or 1482</td><td>The area specified by the address number and size is out of the range of the PMC area.</td></tr><tr><td>148□</td><td>The address number is not a multiple of 4.</td></tr></table>	E-1601
22 0, 0, 0	The DI area of the PMC of group slot is wrong. Review the DO area of the PMC. This status code is also displayed if the DI area of the PMC is insufficient. Additional message： DI area of Group Slot No.W is wrong(X). X：Detailed information code W and X means the following. W: Group slot number X: Detailed information code <table><tr><th>X</th><th>Detailed information</th></tr><tr><td>1486</td><td>The PMC path number is out of range. If the PMC path number is specified as 9, Dual Check Safety function (S661) is required.</td></tr><tr><td>1487</td><td>The PMC area is out of range. If the X area is specified as the DI, the parameters Nos. 11937 to 11939 are not set. For details of these NC parameters, see Section 4.3, "PARAMETERS RELATED TO PMC" in Part II, "COMMON".</td></tr><tr><td>1488 or 1489</td><td>The area specified by the address number and size is out of the range of the PMC area.</td></tr></table>	E-1601

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Error number	Meaning and action to be taken	Error code on log screen
	1490 The address number is not a multiple of 2.	
23, 0, 0, 0	The DO area of the PMC of group slot is wrong. Review the DO area of the PMC. This status code is also displayed if the DO area of the PMC is insufficient. Additional message : DO area of Group Slot No.W is wrong(X). X : Detailed information code W and X means the following. W: Group slot bnumber X: Detailed information code X: Detailed information code 1493: The PMC path number is out of range. If the PMC path number is specified as 9, Dual Check Safety function (S661) is required. 1494: The PMC area is out of range. If the Y area is specified as the DO, the parameters Nos. 11937 to 11939 are not set. For details of these NC parameters, see Section 4.3, "PARAMETERS RELATED TO PMC" in Part II, "COMMON". 1495 or 1496: The area specified by the address number and size is out of the range of the PMC area. 1497: The address number is not a multiple of 2.	E-1601
-1, 0, 0, 0	Contact us. Additional message : Unknown Error.	(Undefined)

4.6.1.13 Version of Setting tool and Revision record

This subsection describes the version checking of the Setting tool and the Revision record.

Procedure

1 Select the menu [Help] -> [About] to display the "Information" screen, then the version of the Setting tool can be confirmed.

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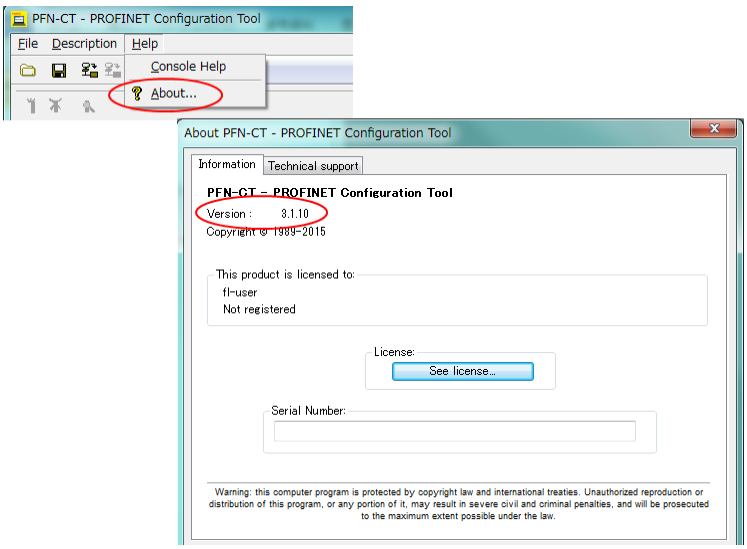

Version of Setting tool and Revision record

<table>
<tr><th>Version of Setting tool</th><th>Revision record</th></tr>
<tr><td>V3.2.7</td><td>1. PMC multiple allocation mode is supported.
2. In PMC multiple allocation mode, the acquisition of the error log and the alarm log is supported.
3. DCS-PMC allocation of DI/DO address is supported.
4. Blinking indication of IO Device's LED (Device Blinking) is supported.
5. Additional status and additional message is supported.
6. Connection with BOSCH IO device (Model: S67-PN-BK-DI8-M8) is supported.
7. A computer user who is not an administrator is supported.
8. GSDML V 2.33 is supported.
9. GSDML file with file name of "⋯-000000.xml" format is supported.

The software requirements of 1 to 3 are as follows.
<table>
<tr><th>Item</th><th>Requirements</th></tr>
<tr><td>PROFINET function software</td><td>- Series 30i/31i/32i/35i-B, Power Motion i-A:
Edition 04 or later of Series 658R
- Series 0i-F:
Edition 04 or later of Series 658U</td></tr>
<tr><td>Embedded Ethernet software</td><td>- Series 30i/31i/32i/35i-B, Power Motion i-A:
Edition 19 or later of Series 658M
- Series 0i-F:
Edition 09 or later of Series 658A</td></tr>
</table>
The software requirements of 4 to 9 are as follows.
<table>
<tr><th>Item</th><th>Requirements</th></tr>
<tr><td>PROFINET function software</td><td>- Series 30i/31i/32i/35i-B, Power Motion i-A:
Edition 04 or later of Series 658R
- Series 0i-F:
Edition 04 or later of Series 658U</td></tr>
</table></td></tr>
<tr><td>V3.1.10</td><td>• First edition</td></tr>
</table>

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4.6.1.14 Difference with the Setting tool of Molex

This subsection describes the difference with the Setting tool of Molex "PROFINET Configuraition Tool (PFN-CT) for FANUC CORPORATION".

> **NOTE**
> The screen shown in Subsection 4.6.1.8, "Setting and Checking of PMC Allocation" is not displayed for the Setting tool of the Molex. Set the PMC allocation by the setting screen of the PROFINET IO Controller function in CNC.

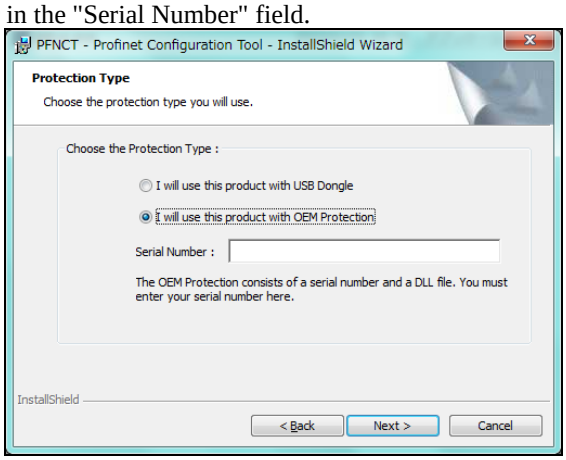
Installation Folder

The installation folder and the storage file of default are as follows.

OS	The installation folder and the storage file
Windows 7 or later	C:/Program Files/BradCommunications/PFNCT - Profinet Configuration Tool • The exe file and the dll file to execute the Setting tool are stored.
	C:/ProgramData/BradCommunications/PFNCT - Profinet Configuration Tool • Made configuration file and GSDML file are stored.
Windows XP	C:/Program Files/BradCommunications/PFNCT - Profinet Configuration Tool • The exe file and the dll file to execute the Setting tool are stored.
	C:/Documents and Settings/All Users/Application Data/BradCommunications/PFNCT - Profinet Configuration Tool • Made configuration file and GSDML file are stored.

Serial Number

The serial number is printed for "S/N" on the installation CD-ROM label.
When the following screen is displayed in the installation, select "I will use this product with OEM Protection".
Then, input the serial number in the "Serial Number" field.



Making new settings

This subsection describes the procedure of making new settings.

Step	Description
1	• Setting of the IP parameters for the CNC In the CNC, set the IP parameters and restart the CNC. → See Subsection 4.3.2.1, "COMMON screen".

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Step	Description
2	• Registration of the CNC in the Setting tool In the Setting tool, register the CNC. → See Subsection 4.6.1.3, "Registration of the CNC in the Setting tool".
3	• Installation of the GSDML file In the Setting tool, install the GSDML file of each IO Device. → See Subsection 4.6.1.4, "Installation of the GSDML file".
4	• Confirmation of IO Devices on the network In the Setting tool, confirm the IO Devices connected on the network. → See Subsection 4.6.1.5, "Confirmation of IO Devices on the network". If device names are not set for any of the connected IO Devices, set the device names. → See Subsection 4.6.1.6, "Setting of the device names for IO Devices".
5	• Setting of IO Devices In the Setting tool, make the settings for operating IO Devices. The device names to set here must match the ones that are set in step 4. → See Subsection 4.6.1.7, "Setting of IO Devices".
6	• Downloading of the settings In the Setting tool, download all the settings to the CNC. → See Subsection 4.6.1.9, "Downloading of settings".
7	• Allocation of the PMC area In the CNC, allocate the PMC area for DI/DO data and status data. → See Subsections 4.3.2.2, "Setting screen of the PROFINET IO Controller function" and 4.3.3, "PMC Allocation".

After the above settings are made, restarting the CNC causes communication to start with each IO Device.

Calculating the DI/DO addresses of each module if using the Setting tool

The following describes how to calculate the DI/DO addresses of each module if using the Setting tool.

DI or DO addresses of each module = X + (Y × 2)

X: In the CNC, DI/DO address on the setting screen of the PROFINET IO Controller function

Y: In the Setting tool, the value of "Offset in Word in the Shared Memory" in "Position" of each module of the "Profinet Channel" screen

Calculation example)

The following is an example of calculating the DI address of the input module "INPUT 003 bytes" implemented in slot 001 of the IO Device "fanuc-cnc" ("Number" = 010 and IO Device number = 1) of two IO Devices.

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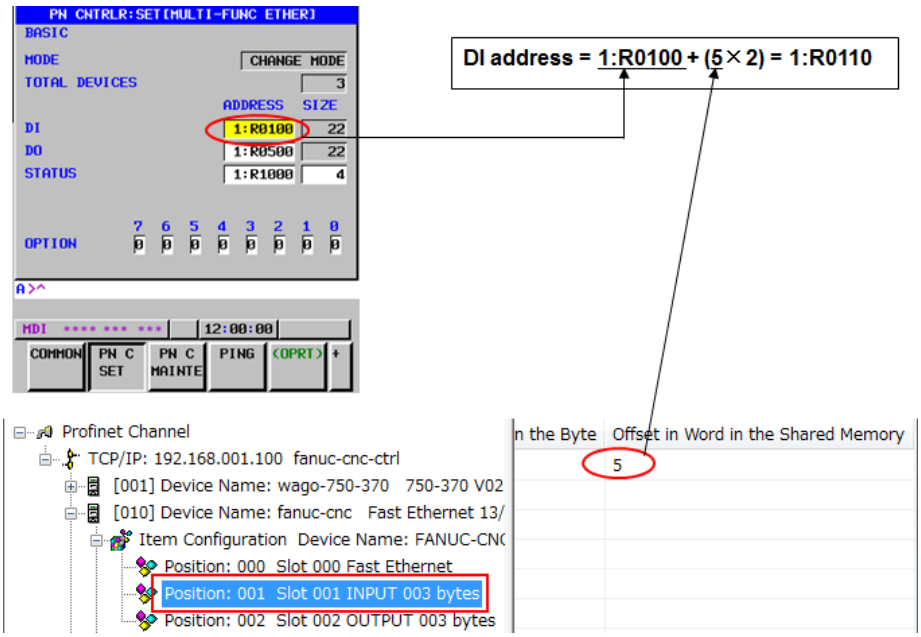

Status codes

Error number	Meaning and action to be taken	Error code on log screen
43	The DI area of the PMC is wrong. Clear "DI ADDRESS" on the setting screen of the PROFINET IO Controller function for the CNC, then download again. Review the DI area of the PMC, and then set "DI ADDRESS". This status code is also displayed if the DI area of the PMC is insufficient.	E-1601
44	The DO area of the PMC is wrong. Clear "DO ADDRESS" on the setting screen of the PROFINET IO Controller function for the CNC, then download again. Review the DO area of the PMC, and then set "DO ADDRESS". This status code is also displayed if the DO area of the PMC is insufficient.	
52	Downloading failed for some cause or other. Restart the CNC and the Setting tool, and retry downloading. If downloading still fails, contact us, describing the information on the log screen.	(Undefined)

4.6.2 Supplement to the PROFINET Standard

This subsection contains a supplement to the PROFINET standard.

4.6.2.1 Error Code

This subsection describes the error codes in the PROFINET standards: ErrorCode, ErrorDecode, ErrorCode1, and ErrorCode2.

The meaning of "ErrorCode" is as follows.

- If 0 : Normal
- If other than 0 : Abnormal

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The other error codes are abbreviated as follows.
- ErrorDecode : ErrD
- ErrorCode1 : Err1
- ErrorCode2 : Err2

ErrD (hexadecimal)	Err1 (hexadecimal)	Err2 (hexadecimal)	Meaning and action to be taken
81	02	0B	The IO Device does not support the Input/output update time that is set with the IO Controller. See "Setting of the Input/output update time" of Subsection 4.6.1.7, "Setting of IO Devices" to correct the "refresh period".
81	3F	03	An IO Device that has the same device name exists on the network. See Subsection 4.6.1.5, "Confirmation of IO Devices on the network" and Subsection 4.6.1.6, "Setting of the device names for IO Devices" to correct the device name.
81	3F	04	No device name is set for the IO Device. Or, the IO Device for which a connection request is made cannot be found on the network. First, confirm that the Ethernet cable is connected. Next, see Subsection 4.6.1.5, "Confirmation of IO Devices on the network" and Subsection 4.6.1.6, "Setting of the device names for IO Devices" to correct the device name.
81	3F	05	No IP address is set for the IO Device. Or, the IO Device for which a connection request is made cannot be found on the network. Take an action similar to that for "ErrD=81, Err1=3F, and Err2=04".
81	3E	01	A timeout occurred after a connection was made. Confirm that the Ethernet cable is connected.
(Other)			In the following cases, ErrD, Err1, and Err2 are error codes transmitted from the IO Device. Err1(hexadecimal): 01-04, 06-15, 28, 3D, 40-42 For error codes transmitted from IO Device, see the IO Device manual or confirm it with the IO Device manufacturer. This is an internal error code. Contact us.

4.6.2.2 Alarms

This subsection describes the alarms in the PROFINET standard.
These alarms are used to notify the IO Controller of any errors and changes that IO Devices may detect.

ModuleIdentNumber
SubModuleIdentNumber

This is the module identification number and the submodule identification number.

SlotNumber
SubSlotNumber

This is the slot number and subslot number.

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Alarm type

Alarm type (hexadecimal)	Meaning
0000	Reserved
0001	Diagnosis
0002	Process
0003	Pulling
0004	Plugging
0005	Status
0006	Update
0007	Media Redundancy
0008	Control by the IO Supervisor
0009	Released
000A	Plugging of a wrong submodule
000B	Recovery of a submodule
000C	Disappearance of diagnosis
000D	Multicast communication mismatch notification
000E	Port data change notification
000F	Synchronous data change notification
0010	Isochronous mode problem notification
0011	Network component problem notification
0012	Time data change notification
0013 to 001D	Reserved
001E	Upload and retrieval notification
001F	Module pulling
0020 to 007F	Manufacturer-specific portion
0080 to 00FF	Reserved for profiles
0100 to FFFF	Reserved

Alarm priority

Alarm priority	Meaning
5	Low priority
6	High priority

Alarm specifier

Bit	Name	Meaning
#0 - #10	SequenceNumber	Sequence Number
#11	ChannelDiagnosis	0: Not Channel Diagnosis exists 1: Channel Diagnosis exists
#12	ManufacturerSpecificDiagnosis	0: Not Manufacturer Specific Diagnosis exists 1: Manufacturer Specific Diagnosis exists
#13	SubmoduleDiagnosisState	0: Not Submodule Diagnosis State exists 1: Submodule Diagnosis State exists
#14	Reserved	
#15	ARDiagnosisState	0: Not AR Diagnosis State exists 1: AR Diagnosis State exists

NOTE

The alarm is transmitted from the IO Device. For details of the alarms, see the IO Device manual or confirm it with the IO Device manufacturer.

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4.6.2.3 Status

This subsection describes the status in the PROFINET standard.

APDU status

This is the status (1 byte) that indicates the state of the input/output frame.

Bit	Name	Meaning
#0	State	0: IOCR is in the "backup" state. 1: IOCR is in the "primary" state. IOCR means a channel for IO communication, and this bit is usually 1.
#1	Redundancy	0: One AR exists. 1: Not a single AR exists. AR means a channel at the application level, and this bit is usually 0.
#2	DataValid	0: The frame data is invalid. 1: The frame data is valid.
#3	Reserved	
#4	ProviderState	0: The control application of the provider (sender) is in the STOP state. 1: The control application of the provider (sender) is in the RUN state.
#5	StationProblem Indicator	0: A problem is detected. 1: Normal operation
#6	Reserved	
#7		

IOPS and IOCS

This is the status (1 byte) that is provided for each module in the input/output frame.
IOPS: State of the send data when the IO Controller/IO Device is a provider (sender)
IOCS: State of the receive data when the IO Controller/IO Device is a consumer (receiver)

Bit	Name	Meaning
#0	Extension	0: End of a module 1: Not the end of a module
#1	Reserved	
#2		
#3		
#4		
#5	Instance	If DataState is BAD, one of the following is set. 0x00: Detected by a Subslot 0x01: Detected by a Slot 0x02: Detected by the IO Device 0x03: Detected by the IO Controller
#6		
#7	DataState	0: BAD The data is invalid, so the data to be transferred should be ignored, and the prescribed value (zero data, valid data received last, or default data) should be used. 1: GOOD The data is valid.

4.6.2.4 I&M data

This subsection describes the I&M (Identification and Maintenance) data in the PROFINET standard.
The "Display on the screen" column of the table contains the names of the displays on the DEVICE INFO screen of the maintenance screen of the PROFINET IO Controller function.

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I&M data

Display on the screen	Name	Meaning
VendorID	Vendor ID	Vendor ID. 16-bit identification that uniquely identifies the maker.
OrderNo	Order ID	Order number. (20 characters maximum)
SerialNo	Serial Number	Serial number. (16 characters maximum)
HwRev	Hardware Revision	Hardware version.
SwRev	Software Revision	Software version. This is displayed as "W.X.Y.Z", and means the following. **Item** / **Meaning** W: Character that indicates the software type (1 character) V or R: Officially released version P : Prototype U : Under test T : Test device X: Version of functional enhancement Y: Version of bug fix Z: Version of internal change
RevCnt	Revision Counter	Revision counter.
Profile	Profile ID and Profile Specific Type	Information for the application profile. This is displayed as "XXXXH / YYYYH", and means the following. XXXXH: Application profile ID (hexadecimal) YYYYH: Type of a special application profile (hexadecimal)
Version	I&M Version	Version of the I&M functions supported by the IO Device.
Support	I&M Supported	Bits 0 to 15 of this parameter (hexadecimal) indicate whether the I&Mn data (where n = 0 to 15) defined in the PROFINET standard is valid or invalid.

NOTE

1 The I&M0 data means "Vendor ID" to "I&M Supported" in the above table, and the IO Device must implement this data. The I&M1 data to the I&M15 data are optional.
The PROFINET IO Controller function for the FANUC CNC can get only the I&M0 data.

2 The I&M data is transmitted from the IO Device. For details of the I&M data, see the IO Device manual or confirm it with the IO Device manufacturer.

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FANUC Series 30*i*/31*i*/32*i*/35*i*–MODEL B,
FANUC Power Motion *i*–MODEL A, FANUC Series 0*i*-MODEL F
Industrial Ethernet CONNECTION MANUAL

1. Type of applied technical documents

Name	FANUC Series 30*i*–MODEL B FANUC Series 31*i*–MODEL B FANUC Series 32*i*–MODEL B FANUC Series 35*i*–MODEL B FANUC Power Motion *i*–MODEL A FANUC Series 0*i*–MODEL F Industrial Ethernet CONNECTION MANUAL
Spec.No./Version	B-64013EN/03

2. Summary of change

Group	Name / Outline	New, Add, Correct, Delete	Applicable Date
Basic Function			
Optional Function	The mode not checking APDU status has been added	Add	Immediately
Unit			
Maintenance parts			
Notice			
Correction			
Another			

Edit	Date	Design	Description
Date		2018.03.01	Design R.Imada Apprv.

Title	FANUC Series 30*i*/31*i*/32*i*/35*i*-MODEL B, Power Motion *i*-MODEL A, FANUC Series 0*i*-MODEL F Industrial Ethernet CONNECTION MANUAL
Draw No.	B-64013EN/03-4
FANUC CORPORATION	Sheet 1/27

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The relation between Industrial Ethernet CONNECTION MANUAL (B-64013EN/03) and this manual

This manual	Industrial Ethernet CONNECTION MANUAL (B-64013EN/03)
Subsection 4.3.2.2, " Setting screen of the PROFINET IO Controller function " in Chapter 4, "PROFINET IO CONTROLLER FUNCTION"	Replace this Subsection with Subsection 4.3.2.2, " Setting screen of the PROFINET IO Controller function " in Part III, "FUNCTION". - The mode not checking APDU status is added to “Option” Bit3 of “Setting items”.
Subsection 4.3.3.2, " Status" in Chapter 4, "PROFINET IO CONTROLLER FUNCTION"	Replace this Subsection with Subsection 4.3.3.2, " Status " in Part III, "FUNCTION". - The description of “Status (+1 to +48)”Bit2 is changed. The checking status is changed according to bit 3 of "OPTION" on the setting screen of the PROFINET IO Controller function.
Subsection 4.6.1.8, " Setting and Checking of PMC Allocation " in Chapter 4, "PROFINET IO CONTROLLER FUNCTION"	Replace this Subsection with Subsection 4.6.1.8, " Setting and Checking of PMC Allocation " in Part III, "FUNCTION". - Subsection 4.6.1.8.1 " PMC Single Allocation Mode" The mode not checking APDU status is added to “Option” Bit3 of “Setting items”. - Subsection 4.6.1.8.2 " PMC Multiple Allocation Mode" The mode not checking APDU status is added to “Option” Bit3 of “Setting items”.
Subsection 4.6.1.13, " Version of Setting tool and Revision record" in Chapter 4, "PROFINET IO CONTROLLER FUNCTION"	Replace this Subsection with Subsection 4.6.1.13, " Version of Setting tool and Revision record " in Part III, "FUNCTION". - Added to Revision record of Setting tool “V3.2.11”.

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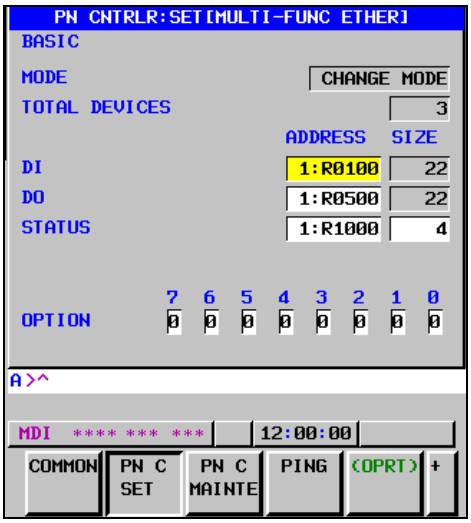
4.3.2.2 Setting screen of the PROFINET IO Controller function

In the above-mentioned procedure, press soft key [PN C SET] to display the setting screen (basic screen) of the PROFINET IO Controller function.

> **NOTE**
> The setting items other than the setting item "MODE" on the setting screen (basic screen) of the PROFINET IO Controller function can be set by the Setting tool.



Setting screen of the PROFINET IO Controller function (BASIC)

Display item

The following display items are decided by the setting with the Setting tool.

Item	Description
TOTAL DEVICES	Number of IO Devices to connect.
DI/DO SIZE	Size of the area in which to store the DI/DO data of all IO Devices.

Setting items

Item	Description
MODE	Select the mode of the PROFINET IO Device function. - "CHANGE MODE" In this mode, settings can be changed from the Setting tool or the setting screen of the PROFINET IO Controller function. - "PROTECT MODE" In this mode, settings cannot be changed from the Setting tool or the setting screen of the PROFINET IO Controller function.

Confirmation items

The following confirmation items can be set from this screen, but normally, set from the Setting tool.

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Setting items

Item	Description
DI/DO ADDRESS	- PMC Single Allocation Mode Specify the top address of the PMC area in which to store the DI/DO data of all IO Devices. Only a PMC address that is a multiple of 4 can be specified. The specifiable PMC area is the R, E, D, X (DI only), or Y (DO only) area. The specifiable DCS-PMC area is the R, X (DI only), or Y (DO only) area. Specify 9 for the PMC path number of DCS-PMC. If the X/Y address of the PMC is to be assigned, it is necessary to set parameters Nos. 11937 to 11939 also. For details of these NC parameters, see Section 4.3, "PARAMETERS RELATED TO PMC" in Part II, "COMMON". When using DCS-PMC, Dual Check Safety function (S661) is required. For an explanation of the allocation of DI/DO data to the PMC, see Subsection 4.3.3.1.1, "PMC Single Allocation Mode". - PMC Multiple Allocation Mode "---" is displayed. DI/DO address cannot be specified. Specify the DI/DO address of each group slot from the Setting tool.
STATUS ADDRESS	Specify the top address of the PMC area in which to store the status. The specifiable PMC area is the R or E area. For details of the notified status, see Subsection 4.3.3.2, "Status".
STATUS SIZE	Specify the size of the PMC area for storing the status. Setting range: 0 to 49 (byte). The status of the specified size is notified. For details of the notified status, see Subsection 4.3.3.2, "Status".

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Item	Description
OPTION	Bit 0: The next time the power is turned on, all settings of the PROFINET IO Controller function are 0: Not initialized. 1: Initialized. Bit 1: Specify the action to take on the data in the DI area of the IO Device when the communication is disconnected. 0: Clear the DI area to zero. 1: Hold the data in the DI area. "When the communication is disconnected" above is when any of the status signals (+0 to +48) in Subsection 4.3.3.2, "Status", changes. The action taken if the bit is set to 0 (Clear the DI area to zero) is as follows. Signal / Change / Description SF / 0→1 / The DI areas of all IO Devices are cleared to zero. CONxx / 1→0 / Only the DI area of IO Device xx is cleared to zero. RAPxx / 1→0 IOxx / 1→0 Bit 2: Specify PMC Single Allocation Mode or PMC Multiple Allocation Mode. 0: PMC Single Allocation Mode 1: PMC Multiple Allocation Mode If you change this bit, PMC allocation mode will switch when the power is turned on next time. **NOTE** The PMC allocation mode is switched by download from the Setting tool. After it is downloaded from the Setting tool, do not switch this bit on the setting screen (basic screen) of the PROFINET IO Controller function. If this bit is switched after it is downloaded from the Setting tool, the DI/DO refresh with the PMC area is not started. Then, "E-1618 DI/DO Refresh is not started(XH)" is displayed on the log screen of the PROFINET IO Controller function. Bit 3: The APDU status error of DI data for all IO devices is 0: checked. 1: not checked. For details of the APDU status, see Subsection 4.6.2.3, "Status". Bit 4-7: Reserved (Must be 0)

⚠ WARNING

1 Before allocating the PMC area, be sure to read Section 3.1, "DI/DO DATA AND STATUS DATA" in Part II, "COMMON".

2 When the communication is disconnected, the DI area depends on the setting of bit 1 of "OPTION". When the communication is connected again, the data sent from the IO Device is reflected in the DI area of the IO Device. This means that if zero data is sent from the IO Device immediately after the communication is connected again, the DI area of the IO Device is cleared to zero.

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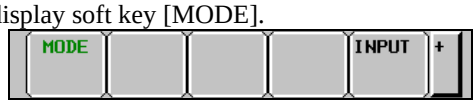
Operation

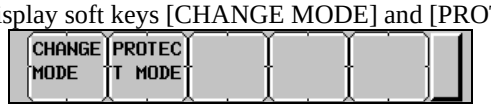
Changing the setting for MODE

The setting for MODE can be changed.

1 Press soft key [(OPRT)] to display soft key [MODE].



2 Press soft key [MODE] to display soft keys [CHANGE MODE] and [PROTECT MODE].



3 Press the soft key of the desired mode.

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4.3.2.4 Status

This subsection describes the allocation of the status to the PMC.

		Status							
		#7	#6	#5	#4	#3	#2	#1	#0
Address	+0	SW		–	–	–	–	BF	SF
	+1	–	–	–	–	–	IO00	RAP00	CON00
	...	...							
	+48	–	–	–	–	–	IO47	RAP47	CON47

Status (+0)

This is the status of the entire PROFINET IO Controller function.

Bit	Name	Description
#0	SF	System error 0: The PROFINET IO Controller function operates normally. 1: An unrecoverable fault occurs in the PROFINET IO Controller function.
#1	BF	Bus fault 0: Communication with all IO Devices has been established. 1: One or more IO Devices exist with which communication has not been established.
#2-6	–	Reserved (zero is notified)
#7	SW	System wake up 0: The system of the PROFINET IO Controller function has not started. 1: The system of the PROFINET IO Controller function has started. The other status bits become effective after SW is changed to 1.

Status (+1 to +48)

This is the status of each IO Device.
In the following description, "xx" (= 0 to 47) means an IO Device number.

Bit	Name	Description
#0	CONxx	Connection with the IO Device 0: The IO Device is not connected. 1: The IO Device is connected.
#1	RAPxx	Application ready signal from the IO Device 0: The application ready signal is not notified from the IO Device. 1: The application ready signal is notified from the IO Device. This signal becomes 0 if the communication with the corresponding IO Device is disconnected.

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Bit	Name	Description
#2	IOxx	DI/DO communication 0: The CNC is not communicating with the IO Device about DI/DO data. 1: The CNC is communicating with the IO Device about DI/DO data. If the following status bits in the PROFINET standard are 1, IOxx is set to 1. The condition depends on the OPTION Bit 3 setting and the DI/DO size.

- Bit 3 of "OPTION" on the setting screen of the PROFINET IO Controller function is “0”

DI/DO size conditions	Status bits to check
DI size > 0 and DO size > 0	• Bits 2, 4, and 5 of the APDU status • Bit 7 of the IOPS status • Bit 7 of the IOCS status
DI size > 0 and DO size = 0	• Bits 2, 4, and 5 of the APDU status • Bit 7 of the IOPS status
DI size = 0 and DO size > 0	• Bits 2, 4, and 5 of the APDU status • Bit 7 of the IOCS status

- Bit 3 of "OPTION" on the setting screen of the PROFINET IO Controller function is “1”

DI/DO size conditions	Status bits to check
DI size > 0 and DO size > 0	• Bit 7 of the IOPS status • Bit 7 of the IOCS status
DI size > 0 and DO size = 0	• Bit 7 of the IOPS status
DI size = 0 and DO size > 0	• Bits 2, 4, and 5 of the APDU status • Bit 7 of the IOCS status

The meaning of each status bit is as follows.

Status	Description
Bit 2 of the APDU status	This bit indicates that the data of the input frame is effective.
Bit 4 of the APDU status	This bit indicates that the control application of the IO Device is in the "RUN" state.
Bit 5 of the APDU status	This bit indicates that the IO Device is in normal operation.
Bit 7 of the IOPS status	This bit indicates that the data of the input module is effective. If multiple input modules are connected, there is IOPS for each input module, and IOxx becomes 1 only if the data of all input modules is effective.
Bit 7 of the IOCS status	This bit indicates that the data of the output module was correctly processed on the IO Device. If multiple output modules are connected, there is IOCS for each output module, and IOxx becomes 1 only if the data of all output modules was correctly processed.

NOTE

When bit 3 of "OPTION" on the setting screen of the PROFINET IO Controller function is set to 1 and this bit "IOxx" is 1, DI data is reflected to the DI area of the PMC even if the APDU status is error. When the APDU status is error, the meaning of DI data depends on the specification of each IO Devices.
For details of the specification of IO Devices, see the IO Device manual or ask for IO Device manufacturer.

For details of the status in the PROFINET standard, see Subsection 4.6.2.3, "Status".

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Bit	Name	Description
#3-7	–	Reserved (zero is notified)

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4.6.1.8 Setting and Checking of PMC Allocation

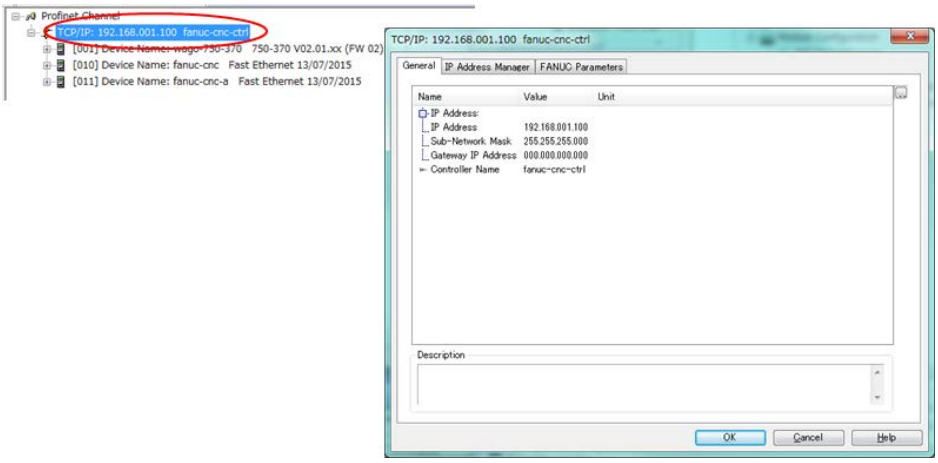
This subsection describes the setting and the checking of PMC allocation.

4.6.1.8.1 PMC Single Allocation Mode

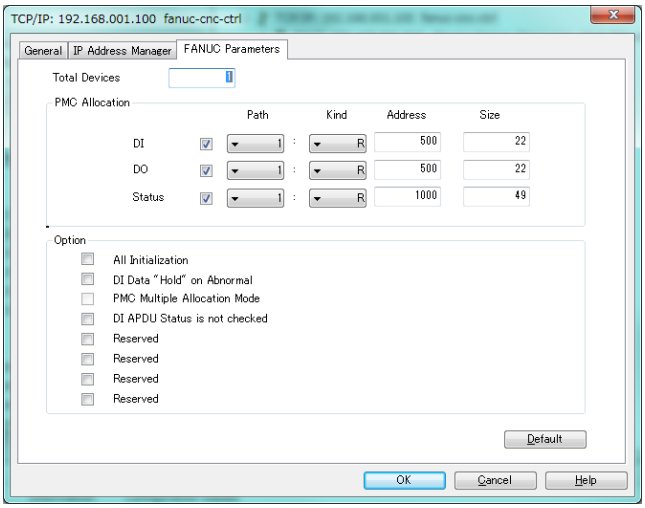
Setting of PMC Allocation for DI/DO and Status

Procedure

1 In the tree of the "Profinet Channel" screen, double-click the "TCP/IP: (IP Address)" to display "TCP/IP" screen.



2 Select the "FANUC Parameters" tab to display the "FANUC Parameters" screen, and set the PMC allocatoin.



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Display item

Item	Description
Total Devices	Number of IO Devices to connect.
DI/DO Size	Size of the area in which to store the DI/DO data of all IO Devices.

Setting items

Item	Description
DI/DO Path, Kind, Address	Specify the top address of the PMC area in which to store the DI/DO data of all IO Devices. - Path: PMC path number - Kind: PMC area - Address: PMC address number Only a PMC address that is a multiple of 4 can be specified. The specifiable PMC area is the R, E, D, X (DI only), or Y (DO only) area. The specifiable DCS-PMC area is the R, X (DI only), or Y (DO only) area. Specify 9 for the PMC path number of DCS-PMC. If the X/Y address of the PMC is to be assigned, it is necessary to set parameters Nos. 11937 to 11939 also. For details of these NC parameters, see Section 4.3, "PARAMETERS RELATED TO PMC" in Part II, "COMMON". When using DCS-PMC, Dual Check Safety function (S661) is required. For an explanation of the allocation of DI/DO data to the PMC, see Subsection 4.3.3.1.1, "PMC Single Allocation Mode".
Status Path, Kind, Address	Specify the top address of the PMC area in which to store the status. - Path: PMC path number - Kind: PMC area - Address: PMC address number The specifiable PMC area is the R or E area. For details of the notified status, see Subsection 4.3.3.2, "Status".
Status Size	Specify the size of the PMC area for storing the status. Setting range: 0 to 49 (byte). The status of the specified size is notified. For details of the notified status, see Subsection 4.3.3.2, "Status".

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Item	Description
Option	Bit 0: The next time the power is turned on, all settings of the PROFINET IO Controller function are 0: Not initialized. 1: Initialized. Bit 1: Specify the action to take on the data in the DI area of the IO Device when the communication is disconnected. 0: Clear the DI area to zero. 1: Hold the data in the DI area. "When the communication is disconnected" above is when any of the status signals (+0 to +48) in Subsection 4.3.3.2, "Status", changes. The action taken if the bit is set to 0 (Clear the DI area to zero) is as follows. <table><tr><th>Signal</th><th>Change</th><th>Description</th></tr><tr><td>SF</td><td>0→1</td><td>The DI areas of all IO Devices are cleared to zero.</td></tr><tr><td>CONxx</td><td>1→0</td><td rowspan="3">Only the DI area of IO Device xx is cleared to zero.</td></tr><tr><td>RAPxx</td><td>1→0</td></tr><tr><td>IOx□</td><td>1→0</td></tr></table>Bit 2: Specify PMC Single Allocation Mode or PMC Multiple Allocation Mode. 0: PMC Single Allocation Mode 1: PMC Multiple Allocation Mode If you change this bit, PMC allocation mode will switch when the power is turned on next time. This bit cannot be changed from the Setting tool. Bit 3: The APDU statuses error of DI data of all IO devices are 0: checked. 1: not checked. For details of the APDU status, see Subsection 4.6.2.3, "Status". Bit 4-7: Reserved (Must be 0)

⚠ **WARNING**

1 Before allocating the PMC area, be sure to read Section 3.1, "DI/DO DATA AND STATUS DATA" in Part II, "COMMON".

2 When the communication is disconnected, the DI area depends on the setting of bit 1 of "Option". When the communication is connected again, the data sent from the IO Device is reflected in the DI area of the IO Device. This means that if zero data is sent from the IO Device immediately after the communication is connected again, the DI area of the IO Device is cleared to zero.

Operation

When the [Default] button is clicked, all setting items of the "FANUC Parameters" screen are cleared.

Checking of PMC Allocation for DI/DO

Procedure

1 In the tree of the "Profinet Channel" screen, double-click a slot in "Module Configuration" for an IO Device, and the slot properties screen is displayed.

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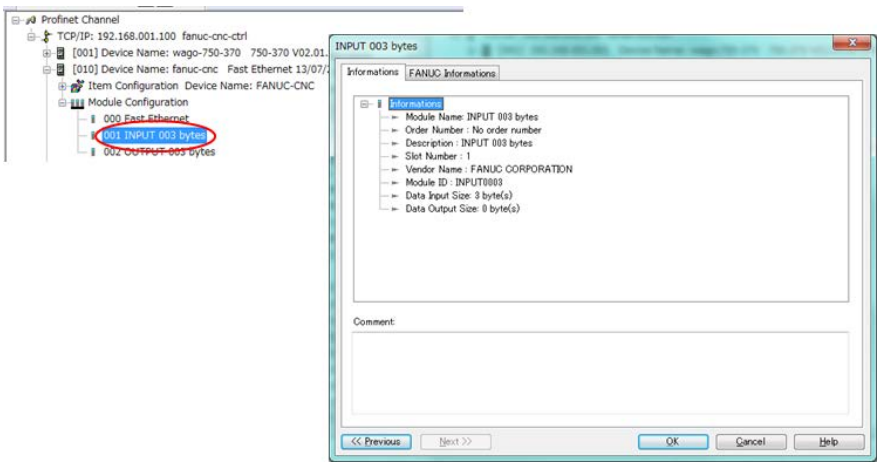
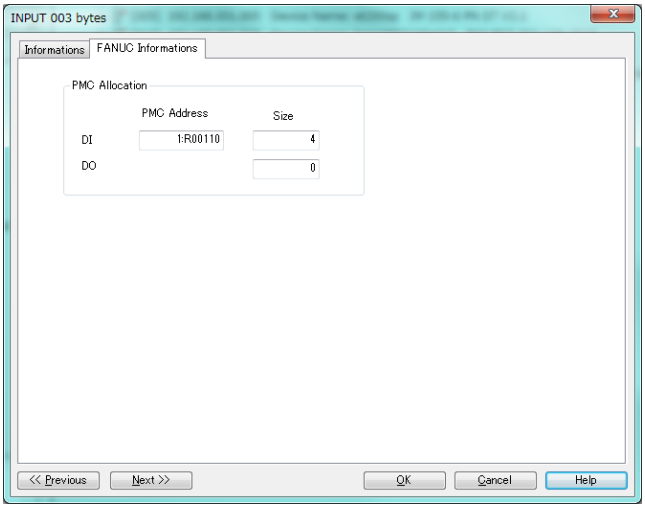


2 Select the "FANUC Informations" tab to display the "FANUC Informations" screen, then the PMC allocation of the selected slot can be checkd.



NOTE

When the selected slot is "DI Size=0", "DI PMC Address" is not displayed. This is the same for "DO PMC Address".

Display items

Item	Description
DI/DO PMC Address, Size	These are the top address and size of the PMC area in which to store the DI/DO data of the selected slot. "PMC Address " and "Size" correspond to the rule described in subsection 4.3.3.1.1, "PMC Single Allocation Mode".

4.6.1.8.2 PMC Multiple Allocation Mode

Setting of PMC Allocation for Status, Error Log and Alarm Log

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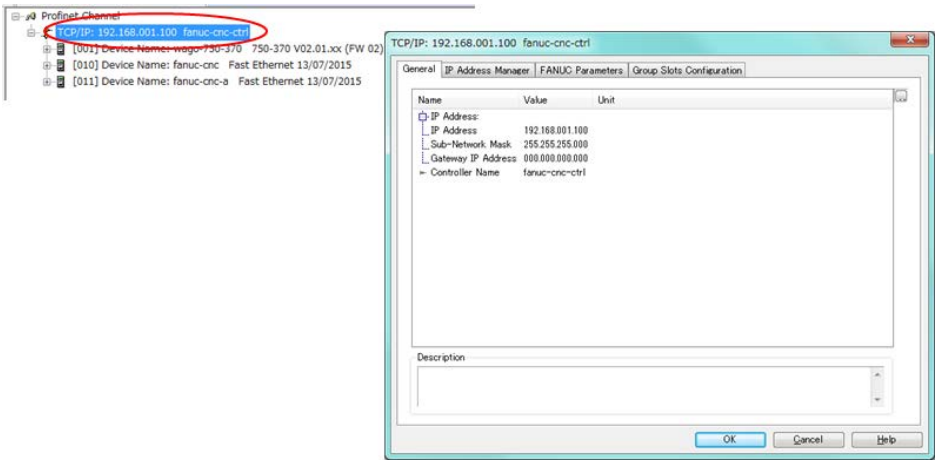
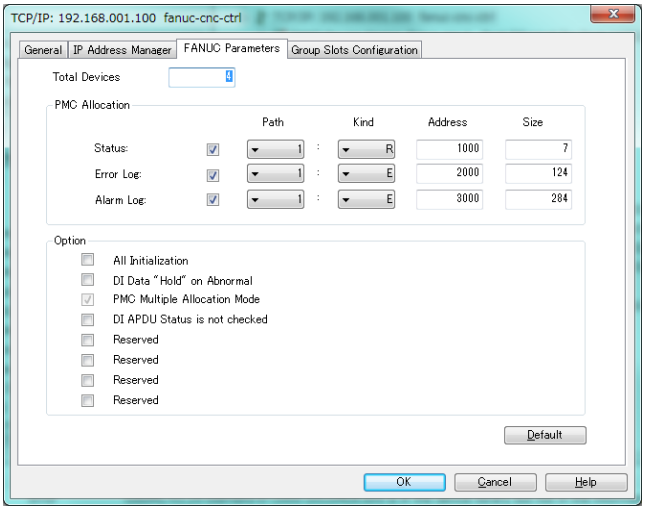
Procedure

1 In the tree of the "Profinet Channel" screen, double-click the "TCP/IP: (IP Address)" to display "TCP/IP" screen.



2 Select the "FANUC Parameters" tab to display the "FANUC Parameters" screen, and set the PMC allocatoin.



Display item

Item	Description
Total Devices	Number of IO Devices to connect.

Setting items

Item	Description
Status Path, Kind, Address	Specify the top address of the PMC area in which to store the status. - Path: PMC path number - Kind: PMC area - Address: PMC address number The specifiable PMC area is the R or E area. For details of the notified status, see Subsection 4.3.3.2, "Status".

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Item	Description
Status Size	Specify the size of the PMC area for storing the status. Setting range: 0 to 49 (byte). The status of the specified size is notified. For details of the notified status, see Subsection 4.3.3.2, "Status".
Error Log Path, Kind, Address	Specify the top address of the PMC area in which to store the error log. - Path: PMC path number - Kind: PMC area - Address: PMC address number Only a PMC address that is a multiple of 4 can be specified. The specifiable PMC area is the R, E or D area. For details of the notified error log, see Subsection 4.3.3.3, "Error Log".
Error Log Size	Specify the size of the PMC area for storing the error log. Setting range: 0 to 3064 (byte). The error log of the specified size is notified. For details of the notified error log, see Subsection 4.3.3.3, "Error Log".
Alarm Log Path, Kind, Address	Specify the top address of the PMC area in which to store the alarm log. - Path: PMC path number - Kind: PMC area - Address: PMC address number Only a PMC address that is a multiple of 4 can be specified. The specifiable PMC area is the R, E or D area. For details of the notified alarm log, see Subsection 4.3.3.4, "Alarm Log".
Alarm Log Size	Specify the size of the PMC area for storing the alarm log. Setting range: 0 to 7144 (byte). The alarm log of the specified size is notified. For details of the notified alarm log, see Subsection 4.3.3.4, "Alarm Log".

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Item	Description
Option	Bit 0: The next time the power is turned on, all settings of the PROFINET IO Controller function are 0: Not initialized. 1: Initialized. Bit 1: Specify the action to take on the data in the DI area of the IO Device when the communication is disconnected. 0: Clear the DI area to zero. 1: Hold the data in the DI area. "When the communication is disconnected" above is when any of the status signals (+0 to +48) in Subsection 4.3.3.2, "Status", changes. The action taken if the bit is set to 0 (Clear the DI area to zero) is as follows. <table><tr><th>Signal</th><th>Change</th><th>Description</th></tr><tr><td>SF</td><td>0→1</td><td>The DI areas of all IO Devices are cleared to zero.</td></tr><tr><td>C□Nxx</td><td>1→0</td><td rowspan="3">Only the DI area of IO Device xx is cleared to zero.</td></tr><tr><td>RAPxx</td><td>1→0</td></tr><tr><td>IOx□</td><td>1→0</td></tr></table>Bit 2: Specify PMC Single Allocation Mode or PMC Multiple Allocation Mode. 0: PMC Single Allocation Mode 1: PMC Multiple Allocation Mode If you change this bit, PMC allocation mode will switch when the power is turned on next time. This bit cannot be changed from the Setting tool. Bit 3: The APDU statuses error of DI data of all IO devices are 0: checked. 1: not checked. For details of the APDU status, see Subsection 4.6.2.3, "Status". Bit 4-7: Reserved (Must be 0)

⚠ **WARNING**

1 Before allocating the PMC area, be sure to read Section 3.1, "DI/DO DATA AND STATUS DATA" in Part II, "COMMON".

2 When the communication is disconnected, the DI area depends on the setting of bit 1 of "Option". When the communication is connected again, the data sent from the IO Device is reflected in the DI area of the IO Device. This means that if zero data is sent from the IO Device immediately after the communication is connected again, the DI area of the IO Device is cleared to zero.

Operation

When the [Default] button is clicked, all setting items of the "FANUC Parameters" screen are cleared.

Setting and Checking of PMC Allocation for DI/DO

There are the following three procedures.

- Procedure A: When displaying the PMC allocation of all IO Devices
- Procedure B: When displaying only the PMC allocation of the selected IO Device
- Procedure C: When displaying only the PMC allocation of the selected slot

Procedure A

This describes the procedure when displaying the PMC allocation of all IO Device.

1 In the tree of the "Profinet Channel" screen, double-click the "TCP/IP: (IP Address)" to display "TCP/IP" screen.

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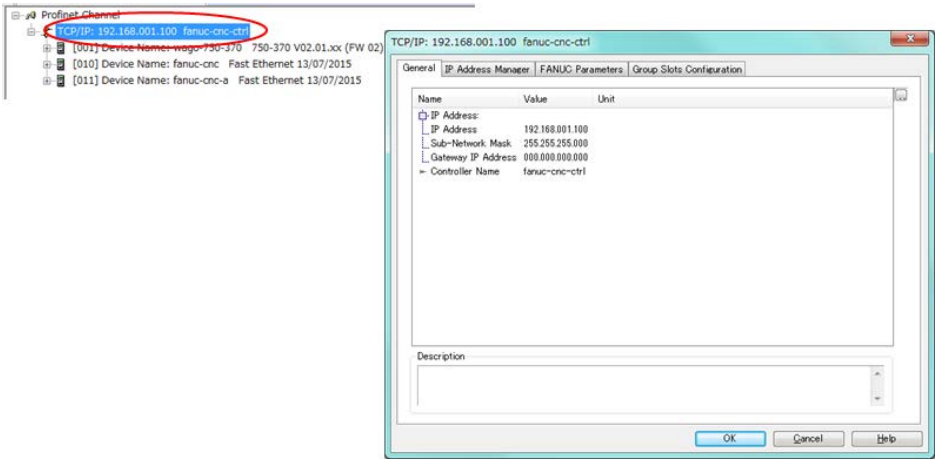
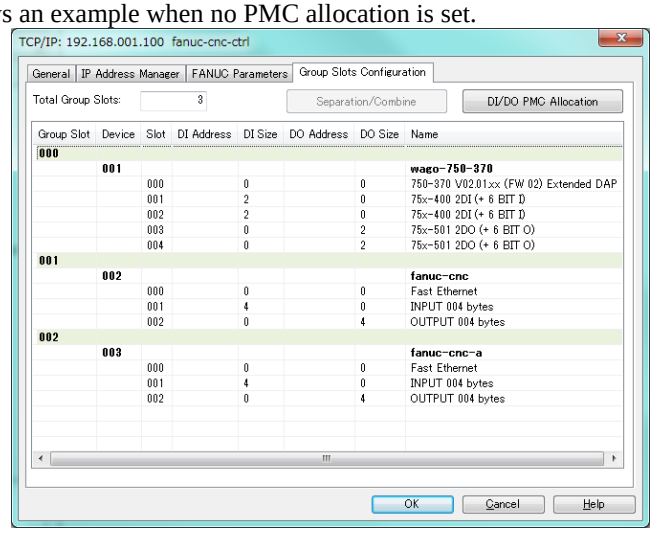


2 Select the "Group Slots Configuration" tab to display the "Group Slots Configuration" screen, then the PMC allocation can be checkd.
The following shows an example when no PMC allocation is set.



The following shows an example when the PMC allocation has already been set.

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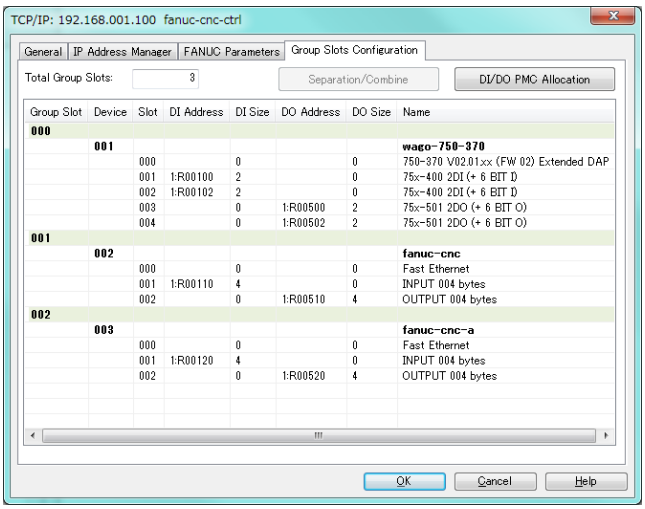


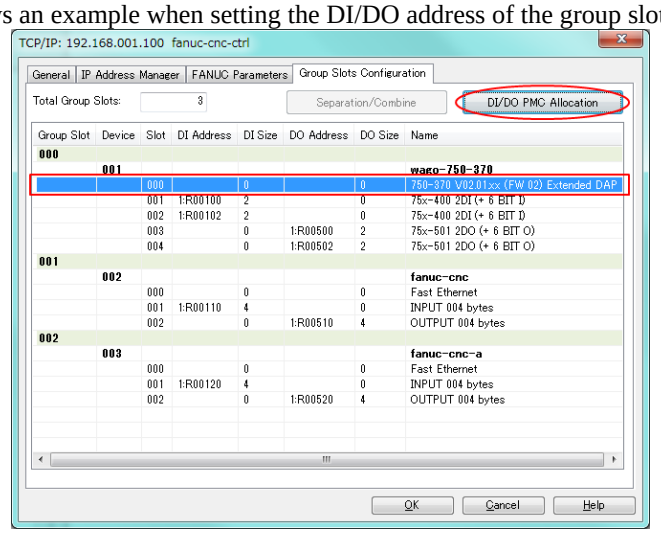
NOTE

When the slot is "DI Size=0", "DI Address" is not displayed. This is the same for "DO Address".

Display item

Item	Description
Total Group Slots	This is the total number of group slots of all IO devices.
Group Slot	This is the group slot number.
Device	This is the "Number" of IO Device.
Slot	This is the slot number.
DI/DO Address, Size	These are the top address and size of the PMC area in which to store the DI/DO data of the slot.
Name	This is the device name or module name.

3 On the "Group Slots Configuration" screen, select one of the slots in the group slot to set the DI/DO address and click the [DI/DO PMC Allocation] button.
The following shows an example when setting the DI/DO address of the group slot number 0.



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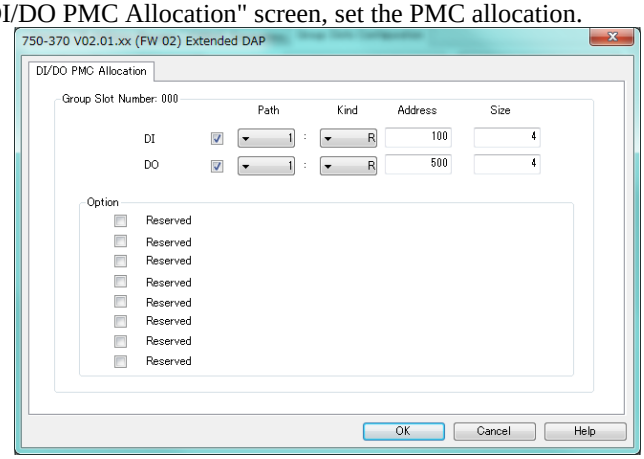
On the displayed "DI/DO PMC Allocation" screen, set the PMC allocation.



Display item

Item	Description
Group Slot Number	This is the group slot number.
DI/DO Size	These are the size of the PMC area in which to store the DI/DO data of the group slot.

Setting items

Item	Description
DI/DO Path, Kind, Address	Specify the top address of the PMC area in which to store the DI/DO data of all IO Devices. - Path: PMC path number - Kind: PMC area - Address: PMC address number Only even PMC address can be specified. The specifiable PMC area is the R, E, D, X (DI only), or Y (DO only) area. The specifiable DCS-PMC area is the R, X (DI only), or Y (DO only) area. Specify 9 for the PMC path number of DCS-PMC. If the X/Y address of the PMC is to be assigned, it is necessary to set parameters Nos. 11937 to 11939 also. For details of these NC parameters, see Section 4.3, "PARAMETERS RELATED TO PMC" in Part II, "COMMON". When using DCS-PMC, Dual Check Safety function (S661) is required. For an explanation of the allocation of DI/DO data to the PMC, see Subsection 4.3.3.1.2, "PMC Multiple Allocation Mode".
Option	Bit 0-7: Reserved (Must be 0)

NOTE

When the top DI/DO address of the PMC area in the group slot is set on the "DI/DO PMC Allocation" screen, the DI/DO address of each slot in the group slot is automatically allocated and displayed on the "Group Slots Configuration" screen.

Procedure B

This describes the procedure when displaying only the PMC allocation of the selected IO Device.

1 In the tree of the "Profinet Channel" screen, double-click on any IO Device to display the IO Device properties screen

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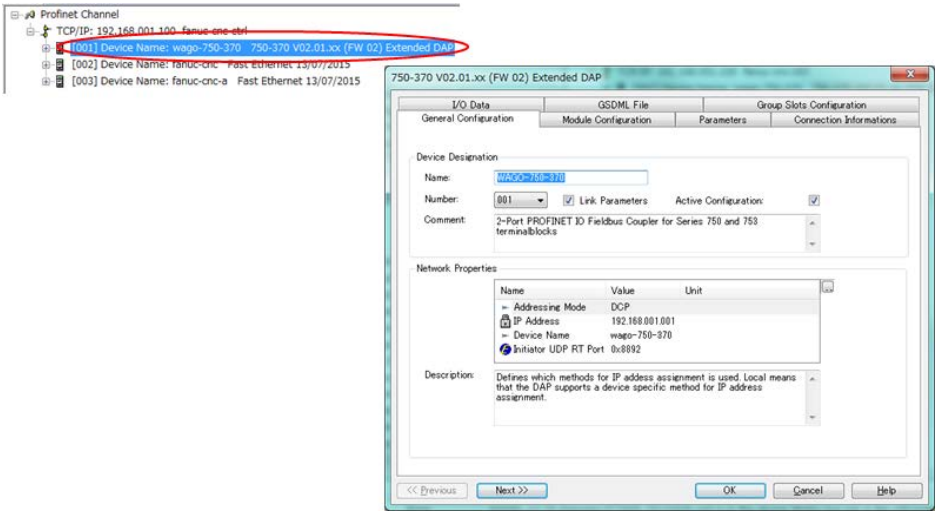
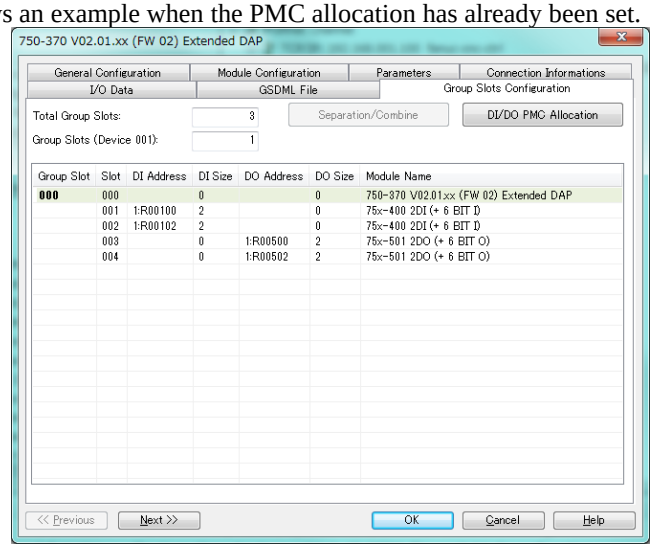


2 Select the "Group Slots Configuration" tab to display the "Group Slots Configuration" screen, then the PMC allocation can be checkd.
The following shows an example when the PMC allocation has already been set.



Display item

Item	Description
Total Group Slots	This is the total number of group slots of all IO devices.
Group Slots (Device xxx)	This is the number of group slots of "Number" = xxx of the selected IO device.
Group Slot	This is the group slot number.
Slot	This is the slot number.
DI/DO Address, Size	These are the top address and size of the PMC area in which to store the DI/DO data of the slot.
Module Name	This is the module name.

3 On the "Group Slots Configuration" screen, select one of the slots in the group slot to set the DI/DO address and click the [DI/DO PMC Allocation] button to display "DI/DO PMC Allocation" screen.
The setting procedure of "DI/DO PMC Allocation" screen is the same as the procedure A-3.

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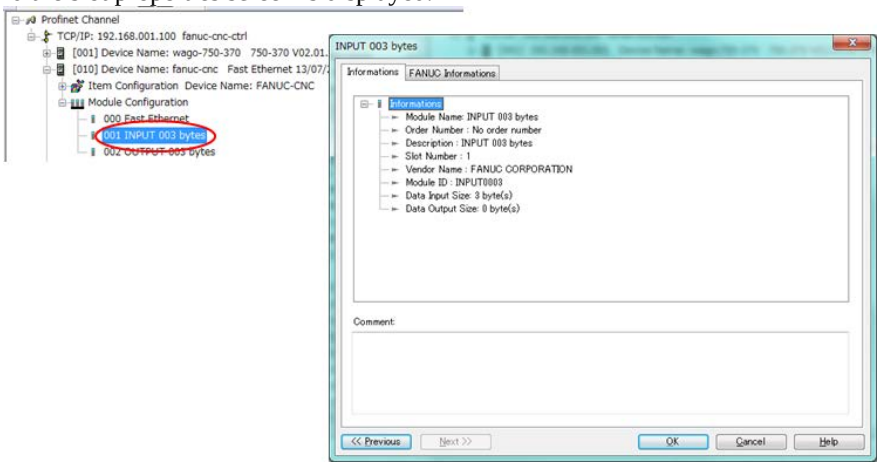
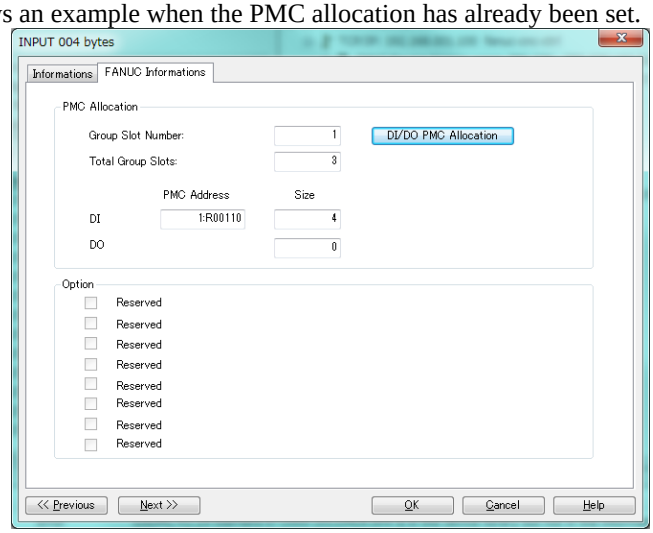
Procedure C

This describes the procedure when displaying only the PMC allocation of the selected slot.

1 In the tree of the "Profinet Channel" screen, double-click a slot in "Module Configuration" for an IO Device, and the slot properties screen is displayed.



2 Select the "FANUC Informations" tab to display the "FANUC Informations" screen, then the PMC allocation of the selected slot can be checkd.
The following shows an example when the PMC allocation has already been set.



NOTE

When the selected slot is "DI Size=0", "DI PMC Address" is not displayed. This is the same for "DO PMC Address".

Display item

Item	Description
Group Slot Number	This is the group slot number.
Total Group Slots	This is the total number of group slots of all IO devices.
DI/DO PMC Address, Size	These are the top address and size of the PMC area in which to store the DI/DO data of the slot.

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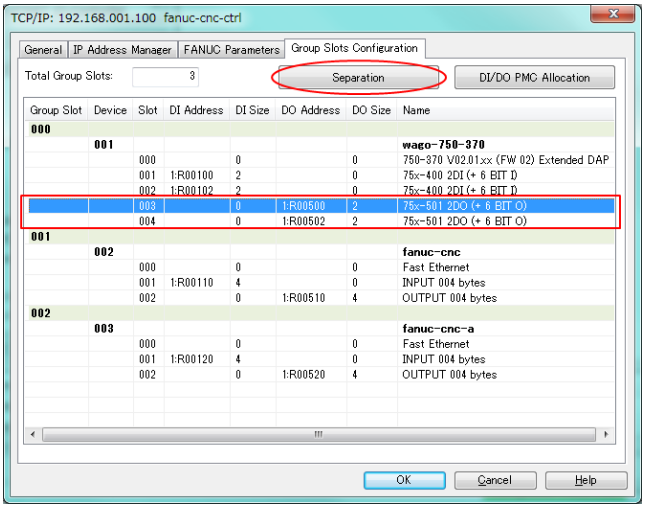
3 On the "FANUC Informations" screen, select one of the slots to set the DI/DO address and click the [DI/DO PMC Allocation] button to display "DI/DO PMC Allocation" screen.
The setting procedure of "DI/DO PMC Allocation" screen is the same as the procedure A-3.

Operation

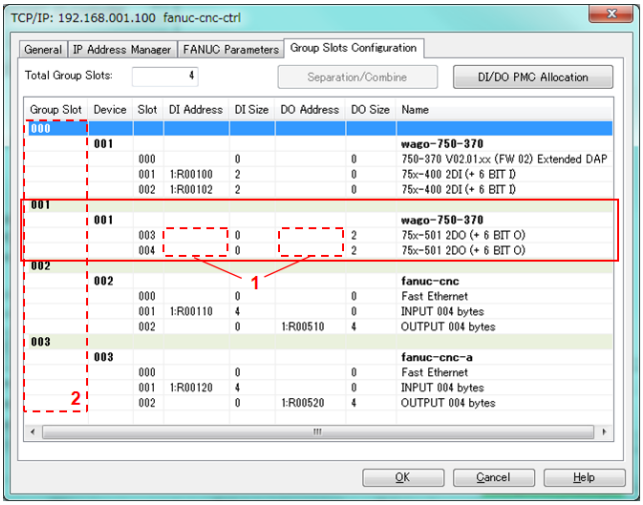
Group slot separation

The selected slot in the group slot is separated as a new group slot.
The operation method is the same for both Procedure A and Procedure B.

1 On the "Group Slots Configuration" screen, select the top slot that you want to separate in the group slot and click the "Separation" button to separate the group slot.
The following is an example when separating slot number 3 or later in group slot number 0 as a new group slot.



Before group slot separation



After group slot separation

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Then, the DI/DO address of the new group slot is cleared and all group slot numbers are automatically reassigned with consecutive numbers.
The example shows the followings.

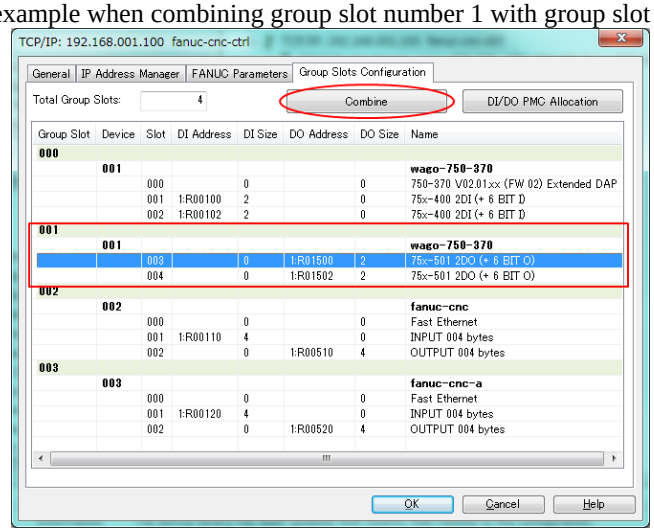
- As the dotted line-1, the DI/DO address of the new group slot number 1 is cleared.
- As the dotted line-2, all group slot numbers are reassigned from "0-2" (before group slot separation) to "0-3" (after group slot separation).

NOTE
Group slots are separated only within the same IO Device.

Group slot combine

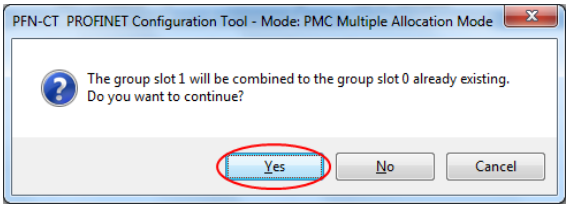
The selected group slot number n is combined with group slot number n-1.
The operation method is the same for both Procedure A and Procedure B.

1 On the "Group Slots Configuration" screen, select the top slot of the group slot that you want to combine and click the [Combine] button.
The following is an example when combining group slot number 1 with group slot number 0.



Before group slot combine

2 The following confirmation message will be displayed, so click the [Yes] button to combine the group slots.



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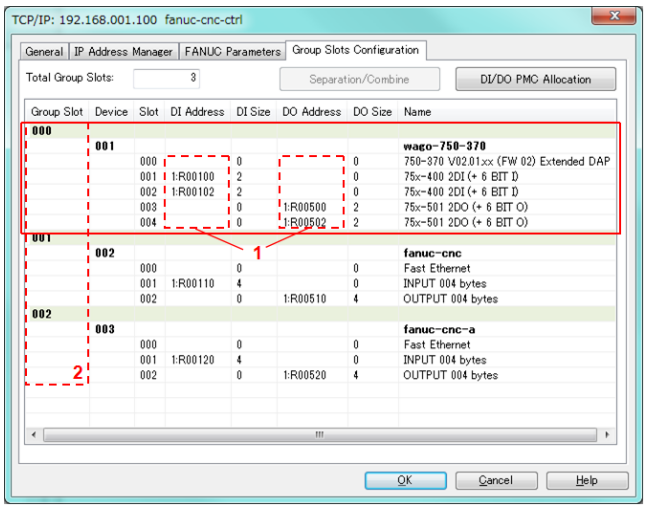
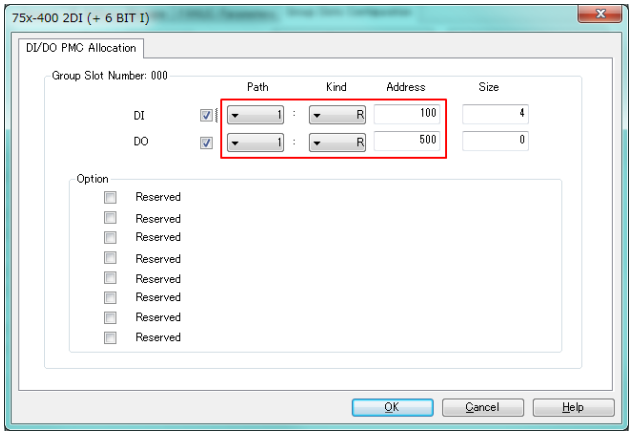


After group slot combine

Then, the DI/DO address of each slot in the group slot after combine is automatically reallocated with the top DI/DO address of the group slot before combine. And, all group slot numbers are automatically reassigned with consecutive numbers.
The example is when group slot number 0 before combine is "DI/DO address = 1:R100/1:R500" as shown below.



The example shows the followings.

- As the dotted line-1, each slot of the group slot number 0 after combine is reallocated with "DI/DO address = 1:R100/1: R500" as the top address.
- As the dotted line-2, all group slot numbers are reassigned from "0-3" (before group slot combine) to "0-2" (after group slot combine).

NOTE
Cannot combine group slots of different IO Devices.

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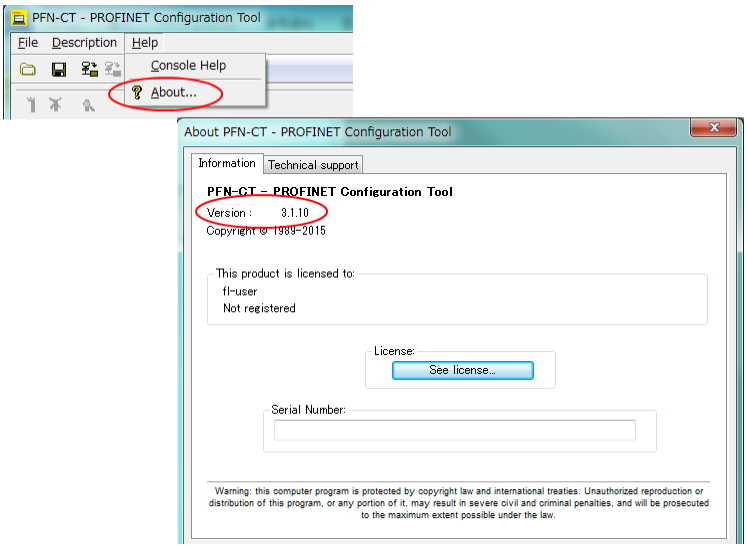
4.6.1.13 Version of Setting tool and Revision record

This subsection describes the version checking of the Setting tool and the Revision record.

Procedure

1 Select the menu [Help] -> [About] to display the "Information" screen, then the version of the Setting tool can be confirmed.



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Version of Setting tool and Revision record

<table>
<tr><th>Version of Setting tool</th><th>Revision record</th></tr>
<tr><td>V3.2.11</td><td>1. The mode not checking APDU status is supported.
2. The setting of data type “Long” of GSDML files is supported.
3. Connection with Beckhoff IO device (Model: EK9300) is supported.

The software requirement of 1 is as follows.
<table>
<tr><th>Item</th><th>Requirements</th></tr>
<tr><td>PROFINET function software</td><td>- Series 30i/31i/32i/35i-B, Power Motion i-A:
Edition 05 or later of Series 658R
- Series 0i-F:
Edition 05 or later of Series 658U</td></tr>
</table></td></tr>
<tr><td>V3.2.7</td><td>1. PMC multiple allocation mode is supported.
2. In PMC multiple allocation mode, the acquisition of the error log and the alarm log is supported.
3. DCS-PMC allocation of DI/DO address is supported.
4. Blinking indication of IO Device’s LED (Device Blinking) is supported.
5. Additional status and additional message is supported.
6. Connection with BOSCH IO device (Model: S67-PN-BK-DI8-M8) is supported.
7. A computer user who is not an administrator is supported.
8. GSDML V 2.33 is supported.
9. GSDML file with file name of "⋯-000000.xml" format is supported.

The software requirements of 1 to 3 are as follows.
<table>
<tr><th>Item</th><th>Requirements</th></tr>
<tr><td>PROFINET function software</td><td>- Series 30i/31i/32i/35i-B, Power Motion i-A:
Edition 04 or later of Series 658R
- Series 0i-F:
Edition 04 or later of Series 658U</td></tr>
<tr><td>Embedded Ethernet software</td><td>- Series 30i/31i/32i/35i-B, Power Motion i-A:
Edition 19 or later of Series 658M
- Series 0i-F:
Edition 09 or later of Series 658A</td></tr>
</table>
The software requirements of 4 to 9 are as follows.
<table>
<tr><th>Item</th><th>Requirements</th></tr>
<tr><td>PROFINET function software</td><td>- Series 30i/31i/32i/35i-B, Power Motion i-A:
Edition 04 or later of Series 658R
- Series 0i-F:
Edition 04 or later of Series 658U</td></tr>
</table></td></tr>
<tr><td>V3.1.10</td><td>• First edition</td></tr>
</table>

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FANUC Series 30*i*/31*i*/32*i*/35*i*-MODEL B
FANUC Power Motion *i*-MODEL A
FANUC Series 0*i*-MODEL F
EtherNet/IP EDA Support

1. Type of applied technical documents

Name	FANUC Series 30*i*-MODEL A/B FANUC Series 31*i*-MODEL A/B FANUC Series 32*i*-MODEL A/B FANUC Series 35*i*-MODEL B FANUC Power Motion *i*-MODEL A FANUC Series 0*i*-MODEL F Industrial Ethernet CONNECTION MANUAL
Spec.No./Version	B-64013EN/03

2. Summary of change

Group	Name / Outline	New, Add, Correct, Delete	Applicable Date
Basic Function			
Optional Function	In EtherNet/IP Adapter function, the EDA (Enhanced Data Access) has been supported.	Add	Immediately
Unit			
Maintenance parts			
Notice			
Correction			
Another			

Edit	Date	Design	Description
Date	13-Mar-2018	Design	Ikki	Apprv.

Title	FS30i/31i/32i/35i-B, PMi-A, FS0i-F EtherNet/IP EDA Support
Draw No.	**B-64013EN/03-5**
FANUC CORPORATION	Sheet 1/14

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APPLIED SOFTWARE

Following software is required to use the EtherNet/IP EDA function.

Embedded Ethernet software

Model	Series	Edition
Series 30*i*/31*i*/32*i*/35*i*-MODEL B (STEP1 / STEP2) Power Motion *i*-MODEL A	658M	21 or later
Series 30*i*/31*i* -MODEL B (CPU card D)	658V	02 or later
Series 0*i*-MODEL F (STEP1 / STEP2)	658A	11 or later

Fast Ethernet software

Model	Series	Edition
Series 30*i*/31*i*/32*i*/35*i*-MODEL B (STEP1 / STEP2) Series 30*i*/31*i* -MODEL B (CPU card D) Power Motion *i*-MODEL A	658K	21 or later
Series 0*i*-MODEL F (STEP1 / STEP2)	658B	06 or later

CNC system software

Model	Series	Edition
Series 30i-MODEL B (STEP2)	G303/G313/G323/G333/G353	01 or later
Series 30i-MODEL B (CPU card D)	G30L/G31L/G32L/G33L/G35L	01 or later
Series 30i-MODEL B (STEP1)	G30A/G31A/G32A/G33A/G35A	01 or later
	G301/G311/G321/G331/G351	97 or later
Series 31i-MODEL B5 (STEP2)	G423/G433/G483/G4H3/G424	01 or later
Series 31i-MODEL B5 (CPU card D)	G42L/G43L/G48L/G4HL	01 or later
Series 31i-MODEL B5 (STEP1)	G42A/G43A	01 or later
	G421/G431	97 or later
	G422/G481	17 or later
Series 31i-MODEL B (STEP2)	G403/G413/G453/G4G3/G404	01 or later
Series 31i-MODEL B (CPU card D)	G40L/G41L/G45L/G4GL	01 or later
Series 31i-MODEL B (STEP1)	G40A/G41A	01 or later
	G401/G411	97 or later
	G402/G451	17 or later
Series 32i-MODEL B (STEP2)	G503/G513/G523	01 or later
Series 32i-MODEL B (STEP1)	G50A/G51A	01 or later
	G501/G511	97 or later
	G521	17 or later
Series 35i-MODEL B	G601/G611	29 or later
Series 0i-MODEL TF (STEP2)	D6G2/D7G2	01 or later
Series 0i-MODEL TF (STEP1)	D6G1	35 or later
Series 0i-MODEL MF (STEP2)	D4G2/D5G2	01 or later
Series 0i-MODEL MF (STEP1)	D4G1	35 or later
Power Motion i-MODEL A	88H0	31 or later

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PMC system software

Model	Series	Edition
Series 30*i*/31*i*/32*i*/35*i*-MODEL B (STEP2) Power Motion *i*-MODEL A	40A7	01 or later
Series 30*i*/31*i* -MODEL B (CPU card D)	40A6	01 or later
Series 30*i*/31*i*/32*i*/35*i*-MODEL B (STEP1) Power Motion *i*-MODEL A	40A5	28 or later
Series 0*i*-MODEL F (STEP2)	40B3	01 or later
Series 0*i*-MODEL F (STEP1)	40B2	10 or later

Rockwell Automation software

Name	Description
Studio 5000 Logix Designer	Setting tool for the PLC of Rockwell Automation, Logix Controller.
AOP "FANUC CNC EDA"	Additional module (Add-On Profile) for setting up FANUC CNC on Studio 5000.

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The relation between this manual and Industrial Ethernet CONNECTION MANUAL (B-64013EN/03)

This manual	Industrial Ethernet CONNECTION MANUAL (B-64013EN/03)
Chapter D, "EtherNet/IP EDA Function"	Add to "APPENDIX" as chapter D, "EtherNet/IP EDA Function".

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D EtherNet/IP EDA FUNCTION

NOTE
Before using the EtherNet/IP EDA function, be sure to read Chapter 2, "EtherNet/IP ADAPTER FUNCTION" in Part III "FUNCTION".

D.1 OVERVIEW

EDA function (Enhanced Data Access function) is a functionality that supports the settings of Logix Controller, which is the PLC of Rockwell Automation, for the EtherNet/IP Adapter function and the EtherNet/IP Adapter Safety function.

When the EDA function is enabled, CNC can output to the XML file the communication settings required to communicate with EtherNet/IP, and the PMC address name in the PMC area set for communication. If a symbol is defined in that PMC area, the symbol name is output instead of the PMC address name.
Studio 5000, which is the setting tool for Logix Controller, is equipped with an additional module called AOP (Add-On Profile), that enables easy communication setting with various devices.

Studio 5000, which is installed with the AOP "FANUC CNC EDA", can read the XML file output by CNC, create tags with the name of the PMC address name or the symbol name, and associate this with the communication setting.

EDA function can be enabled / disabled for each allocation setting.
When the EDA function is enabled, the allocation setting enables communication with only the Logix Controller specified by using the XML file.

D.1.1 Flow of the Setting Procedure

(1) From the setting window of CNC, specify the EtherNet/IP Adapter function and the EtherNet/IP Adapter Safety function.
(2) If necessary, define the symbol name relating to the DI / DO area of the PMC used for the EtherNet/IP Adapter function and the EtherNet/IP Adapter Safety function.
(3) Turn off the power of CNC, and turn the power on again.
(4) Output XML file from the EtherNet/IP Adapter function setting screen.
(5) Let Studio 5000 read the XML file, and specify the settings of Logix Controller.
(6) Logix Controller will be able to communicate with CNC and EtherNet/IP.

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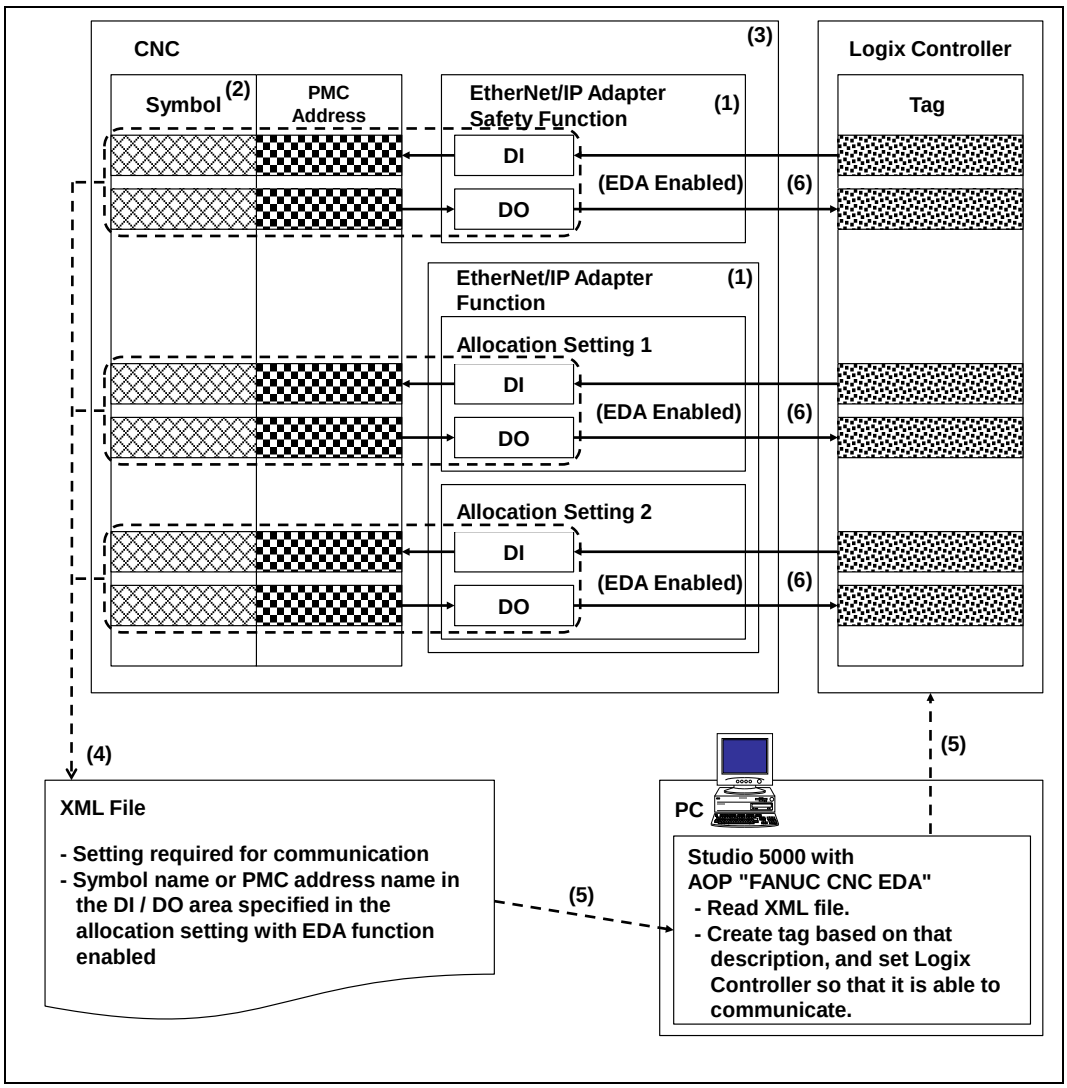

Edit	Date	Design	Description

Date	13-Mar-2018	Design	Ikki	Apprv.

Title	FS30i/31i/32i/35i-B, PMi-A, FS0i-F EtherNet/IP EDA Support
Draw No.	B-64013EN/03-5
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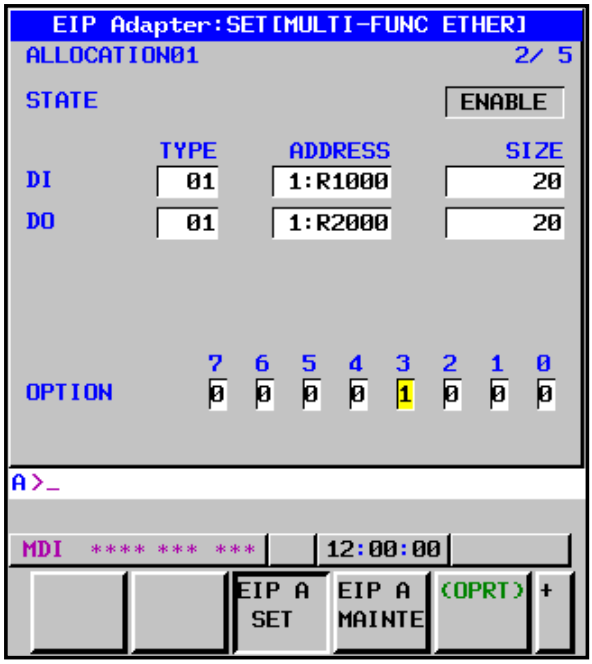
D.2 SETTING

This section explains about the settings using EDA function for EtherNet/IP Adapter function and the EtherNet/IP Adapter Safety function.

D.2.1 EtherNet/IP Adapter Function

Whether to use EDA function or not can be specified for each allocation setting.
In each allocation setting screen, bit 3 which specifies the setting to enable / disable the EDA function, is added as an option.
When using EDA function to communicate with Logix Controller by EtherNet/IP communication, in addition to the existing setting, set 1 for bit 3, which is the option for the allocation setting screen.



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Item	Description
Option Default setting: 00000000	Bit 0-1: Unit of data for DI / DO data Bit 3: EDA function is: 0: Not used. 1: Used.

Bit1	Bit0	Unit of Data
0	0	Unit of data is BYTE.
0	1	Unit of data is WORD (2 bytes).
1	0	Unit of data is LONG (4 bytes).
1	1	Setting error

- If the unit of data is BYTE, symbol information of BOOL type and BYTE type is output to the XML file.
- If the unit of data is WORD, symbol information of BOOL type and WORD type is output to the XML file.
- If the unit of data is LONG, symbol information of BOOL type and DWORD type is output to the XML file.

NOTE

1 When these parameters are set, the power must be turned off before operation is continued.

2 AOP does not support Input Only. Due to this, when DI type is 0 and Input Only (setting without using DI) is used, an error occurs when importing the XML file with AOP.

D.2.2 EtherNet/IP Adapter Safety Function

The bit 3 (EDA) of safety parameters Nos. 13952 and 13992, which specifies to enable / disable the EDA function, is added.
When using EDA function to establish EtherNet/IP safety communication with Logix Controller, you are required to use SCID (Safety Configuration IDentifier). In addition to the existing setting, set 1 for bits 3 (EDA) and 5 (SCI) of safety parameters Nos. 13952 and 13992.

	#7	#6	#5	#4	#3	#2	#1	#0
13952			SCI		EDA			
13992			SCI		EDA			

[Input type] Parameter input
[Data type] Bit

#3 EDA EDA function is:
0: Disabled.
1: Enabled.

#5 SCI SCID is:
0: Not used.
1: Used.

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NOTE

1 When these parameters are set, the power must be turned off before operation is continued.
2 If bit 5 (SCI) of safety parameters Nos. 13952 and 13992 are set to 0 and SCID is set as "Not used," an error occurs when importing the XML file with AOP.
3 If safety parameters Nos. 13953, 13955 and 13993 are set to 0 and Input Only (setting without using safety DI signal) is used, an error occurs when importing the XML file with AOP.
4 For the EtherNet/IP Adapter Safety function, only the BOOL type symbol information is output to the XML file.

D.2.3 Definition of Symbol Name

When not defining the symbol, the tag name of the tag created by Studio 5000 after reading the XML file will be created from the name of the PMC address in DI / DO area. For example, if "R1000" is set for the DI address and 3 bytes for the DI size of the allocation setting with the EDA function enabled, "R1000," "R1001," and "R1002" will be output to the XML file as the tag name. When defining the symbol, an optional tag name can be output to the XML file. For example, in addition to the above setting, if symbol name "ABC" is defined for R1001 as a BYTE type symbol, "R1000," "ABC," and "R1002" will be output to the XML file as the tag name.

For the details on how to define the symbol name, refer to the "PMC PROGRAMMING MANUAL (B-64513EN)" and the "FANUC LADDER-III Operator Manual (B-66234EN)".

NOTE

1 In the EtherNet/IP Adapter function, the symbol name of the global symbol allocated in the DI / DO address will be used for the EDA function.
2 In the EtherNet/IP Adapter Safety function, the symbol name of the global symbol allocated in the safety DI / DO signal address (ETH-CPU) will be used for the EDA function.
3 When outputting the symbol name to the XML file with the EDA function enabled, make sure to allocate the first PMC to the DI / DO address of the EtherNet/IP Adapter function and also to the safety DI / DO signal address (ETH-CPU) of the EtherNet/IP Adapter Safety function. The 2nd to the 5th PMC or the DCS-PMC cannot be allocated.

D.2.3.1 Limitations

Tag Name

There are limitations for the tag name of Logix Controller as shown below. Therefore, the symbol names of PMC are required to follow these limitations when defining.
In addition, "Snnnn" ("S" is an alphabet, "nnnn" is a number with 4 digits or more, example: R1000, E2000, etc.) cannot be used as the symbol name because these names are used as the tag names created automatically by the EDA function.

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1. The characters that can be used for the symbol name are alphanumeric characters and "_" (underscore).
2. A numeric character cannot be used as the first character of the symbol name.
3. The "_" (underscore) cannot be used as the last character of a symbol name.
4. Two or more "_" (underscore) cannot be used in a row.
5. A symbol name matching with the following system keywords of Studio 5000 cannot be used. (Not case-sensitive)

   ABS, ACOS, ACS, AND, ASIN, ASN, ATAN, ATN, BEGIN_NT_RUNG, BY, CASE, COS, DEG, DO, ELSE, ELSIF, END_CASE, END_FOR, END_IF, END_NT_RUNG, END_REPEAT, END_WHILE, EXIT, FOR, FRD, GOTO, IF, LN, LOG, MOD, NOT, OF, OR, RAD, REPEAT, RETURN, SIN, SQR, SQRT, TAN, THEN, THIS, TO, TOD, TRN, TRUNC, UNTIL, WHILE, XOR

Number of Tags

There is an upper limit for the number of tags that can be registered by the XML file to the controller tag of Studio 5000.
In order not to exceed the number of tags that can be registered to Logix Controller, each DI / DO data of the allocation setting must fulfill the conditions shown below.

$$\frac{\text{Size of DI}}{\text{Size of data unit}} + \text{Number of BOOL type symbols defined in the DI area} \leq 512$$

$$\frac{\text{Size of DO}}{\text{Size of data unit}} + \text{Number of BOOL type symbols defined in the DO area} \leq 510$$

NOTE
If the conditions are not fulfilled and the number of tags exceed the upper limit, an error will occur when importing the XML file with AOP.

D.2.4 XML File Output

This section explains the procedures for the XML file output operations on the EtherNet/IP Adapter setting screen and the procedure to output the CNC information used for the setting of Logix Controller to the XML file.

Among each allocation setting of EtherNet/IP Adapter function and the settings of EtherNet/IP Adapter Safety function, only the setting information with the EDA function enabled will be output to the XML file.
When operating EtherNet/IP Adapter function on two hardware options at the same time using the EtherNet/IP Adapter PORT2 function, the contents of the XML files output from each EtherNet/IP Adapter setting screen will be different. When using EDA function on both options, output XML file from each EtherNet/IP Adapter setting screen.
A memory card or a USB memory can be used as the input/output device to output the XML file. Use parameter No. 0020 to select the input/output device. For details of this parameter, refer to Section 4.1, "PARAMETERS RELATED TO DATA INPUT/OUTPUT" in Part II, "COMMON".

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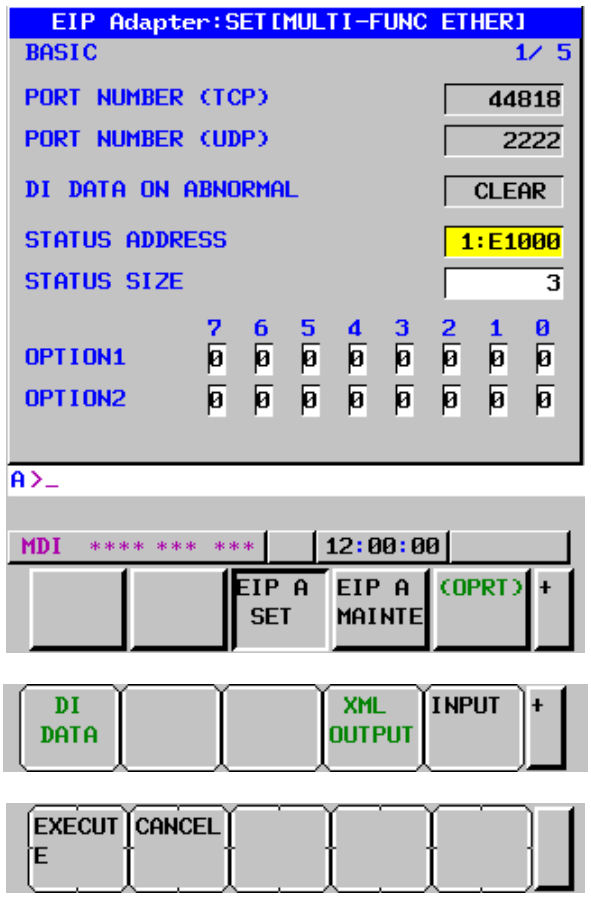
Procedure

1. Specify the settings for EtherNet/IP Adapter function and the EtherNet/IP Adapter Safety function, and define the symbol name of PMC.
2. Turn off the power of CNC, and turn on the power again.
3. Move to the first page of the EtherNet/IP Adapter setting screen, and press soft key [(OPRT)]. The soft key [XML OUTPUT] appears.
4. Press soft key [XML OUTPUT]. The soft keys [EXECUTE] and [CANCEL] appear.
5. Enter the file name of the XML file in the key-in buffer and press soft key [EXECUTE]. The communication setting of the EtherNet/IP function is output to the XML file. If the file name is not specified, "ETHIPCFG.XML" is used as the file name.



Edit	Date	Design	Description
Date	13-Mar-2018	Design	Ikki	Apprv.

Title	FS30i/31i/32i/35i-B, PMi-A, FS0i-F EtherNet/IP EDA Support
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NOTE

1. XML file output can only be executed in the MDI mode, EDIT mode, or emergency stop state.
2. When the 8-level data protection function is enabled, whether the XML file can be output or not depends on the setting of the Ethernet function in the 8-level data protection function.
3. If the setting of both the EtherNet/IP Adapter function and the EtherNet/IP Adapter Safety function are set not to use the EDA function, the soft key [XML OUTPUT] will not appear.
4. When an error is detected while outputting the XML file, the message "Data is Wrong" appears. Output the XML file again after reviewing the setting.

D.3 ABOUT THE SETTING USING AOP

This section explains only the changing points when performing communication setting with the CNC using AOP for FANUC CNC instead of the generic EtherNet/IP Module on Studio 5000. For the details on the setting procedures of Studio 5000, refer to the manuals provided by Rockwell Automation.

⚠ **CAUTION**
The procedure described in this document focuses on the setting method and does not include any safety precautions. The operator must read manuals provided by Rockwell Automation and examine them carefully. Before using the procedure, take precautions as needed.

D.3.1 Adding a CNC

A CNC is added as a communication partner of Logix Controller.

For the XML files output from CNC to the input/output device (a memory card or a USB memory), enable access from the PC by means of a card reader or a USB port.

1. In the left tree of the screen, right-click the previously added EtherNet/IP communication module of Logix Controller and click "New Module..." to display the "Select Module" dialog. Search for "FANUC CNC EDA" as a new module, select it, and click the "Create" button to display the "New Module" dialog.
2. Open the "General" tab, and enter a desired name in "Name" text box.
3. In the "Ethernet Address" group box, set the same value as the IP address specified in the COMMON screen of the CNC.
4. Click the "Change..." button to display the "Module Definition" dialog. Set values in the "General" tab and the "Connection" tab.

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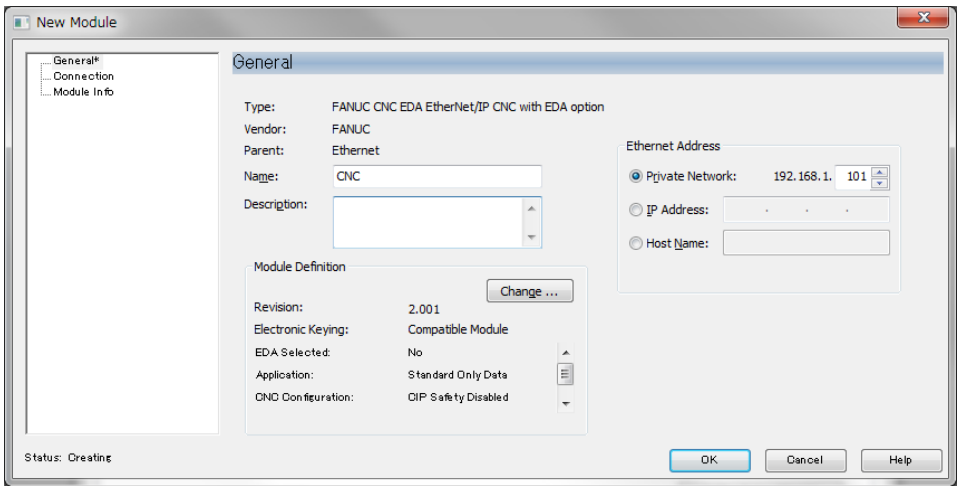

5. Set values in the "General" tab of the "Module Definition" dialog.

Item Name	Description
Revision	The revision of the EtherNet/IP function, displayed as the revision in the Adapter information screen is specified.
Electronic Keying	Upon start of communication, the checking method for the electronic keying of CNC is specified. "Compatible Module" Communication is enabled when electronic keying is compatible. "Exact Match" Communication is enabled when electronic keying is matching exactly.
Application	The communication function used for communication is specified. "Standard Only Data" Communicate only with EtherNet/IP Adapter function "Standard+Safety Data" Communicate with EtherNet/IP Adapter function and EtherNet/IP Adapter Safety function "Safety Only Data" Communicate only with EtherNet/IP Adapter Safety function
CNC Configuration	EtherNet/IP Adapter Safety function on the hardware option of the communication destination is: "CIP Safety Disabled" Disabled. "CIP Safety Enabled" Enabled.
Import Tags from EDA File	XML file output by the EDA function is: "Yes" Used. "No" Not used.

Select "Yes" for "Import Tags from EDA File."
Press the "Browse" button, specify the XML file output from CNC using the EDA function, and import that XML file.

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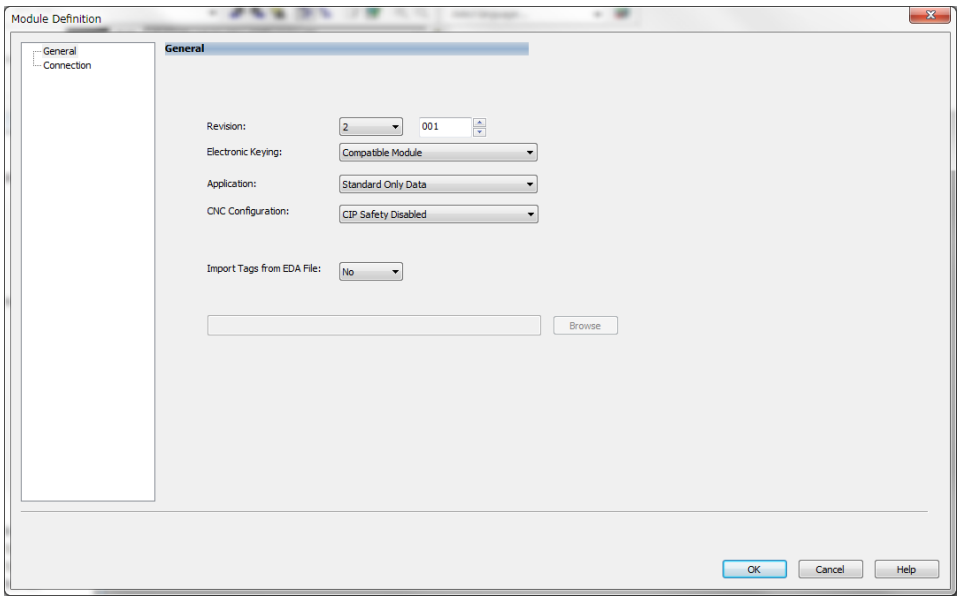
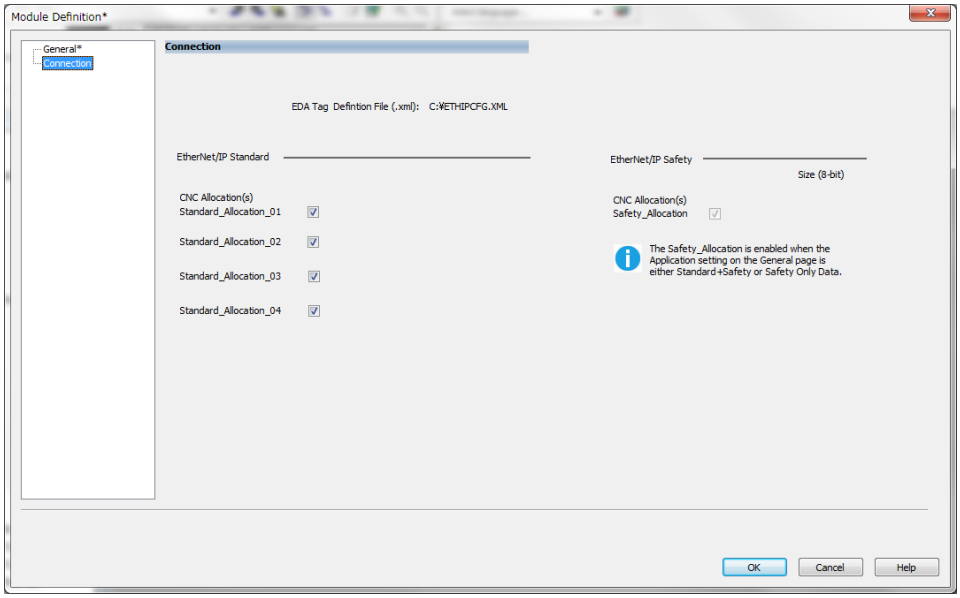


6. Set "Connection" tab of the "Module Definition" dialog.

Item Name	Description
CNC Allocation(s)	When "Standard Only Data" or "Standard+Safety Data" is selected for "Application", turn on the allocation setting check box of the communication destination among the allocation settings 01 to 04 of the EtherNet/IP Adapter function. Two or more check boxes can be turned on.



7. For the other setting methods, perform the settings following the same procedures as when not using the AOP.

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FANUC Series 30*i*/31*i*/32*i*/35*i*-MODEL B
FANUC Power Motion *i*-MODEL A
FANUC Series 0*i*-MODEL F
Support of EtherNet/IP Message Communication

1. Type of applied technical documents

Name	FANUC Series 30*i*-MODEL A/B FANUC Series 31*i*-MODEL A/B FANUC Series 32*i*-MODEL A/B FANUC Series 35*i*-MODEL B FANUC Power Motion *i*-MODEL A FANUC Series 0*i*-MODEL F Industrial Ethernet CONNECTION MANUAL
Spec.No./Version	B-64013EN/03

2. Summary of change

Group	Name / Outline	New, Add, Correct, Delete	Applicable Date
Basic Function			
Optional Function	In EtherNet/IP Scanner function, the Message communication has been supported.	Add	Immediately
Unit			
Maintenance parts			
Notice			
Correction			
Another			

Edit	Date	Design	Description
Date	13-Mar-2018	Design	Ikki
Apprv.			

Title	FS30i/31i/32i/35i-B, PMi-A, FS0i-F Support of EtherNet/IP Message Communication
Draw No.	**B-64013EN/03-6**
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APPLIED SOFTWARE

Following software is required to use the EtherNet/IP message communication function.

Embedded Ethernet software

Model	Series	Edition
Series 30*i*/31*i*/32*i*/35*i*-MODEL B (STEP1 / STEP2) Power Motion *i*-MODEL A	658M	21 or later
Series 30*i*/31*i* -MODEL B (CPU card D)	658V	02 or later
Series 0*i*-MODEL F (STEP1 / STEP2)	658A	11 or later

Fast Ethernet software

Model	Series	Edition
Series 30*i*/31*i*/32*i*/35*i*-MODEL B (STEP1 / STEP2) Series 30*i*/31*i* -MODEL B (CPU card D) Power Motion *i*-MODEL A	658K	21 or later
Series 0*i*-MODEL F (STEP1 / STEP2)	658B	06 or later

CNC system software

Model	Series	Edition
Series 30i-MODEL B (STEP2)	G303/G313/G323/G333/G353	05 or later
Series 30i-MODEL B (CPU card D)	G30L/G31L/G32L/G33L/G35L	04 or later (plan)
Series 30i-MODEL B (STEP1)	G30A/G31A/G32A/G33A/G35A	05 or later
Series 31i-MODEL B5 (STEP2)	G423/G433/G483/G4H3/G424	05 or later
Series 31i-MODEL B5 (CPU card D)	G42L/G43L/G48L/G4HL	04 or later (plan)
Series 31i-MODEL B5 (STEP1)	G42A/G43A	05 or later
	G422/G481	24 or later
Series 31i-MODEL B (STEP2)	G403/G413/G453/G4G3/G404	05 or later
Series 31i-MODEL B (CPU card D)	G40L/G41L/G45L/G4GL	04 or later (plan)
Series 31i-MODEL B (STEP1)	G40A/G41A	05 or later
	G402/G451	24 or later
Series 32i-MODEL B (STEP2)	G503/G513/G523	05 or later
Series 32i-MODEL B (STEP1)	G50A/G51A	05 or later
	G521	24 or later
Series 35i-MODEL B	G601/G611	30 or later
Series 0i-MODEL TF (STEP2)	D6G2/D7G2	07 or later
Series 0i-MODEL TF (STEP1)	D6G1	42 or later
Series 0i-MODEL MF (STEP2)	D4G2/D5G2	07 or later
Series 0i-MODEL MF (STEP1)	D4G1	42 or later
Power Motion i-MODEL A	88H0	33 or later

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The relation between this manual and Industrial Ethernet CONNECTION MANUAL (B-64013EN/03)

This manual	Industrial Ethernet CONNECTION MANUAL (B-64013EN/03)
Subsection 1.1.4, "Operation of the Message Communication Function"	Add this subsection to Part III, "FUNCTION" as Subsection 1.1.4, "Operation of the Message Communication Function".
Subsection 1.2.1, "Software Options"	Replace Subsection 1.2.1, "Software Options" in Part III, "FUNCTION" with this subsection.
Subsection 1.2.2, "Lists of Specifications"	Add the description of this subsection to Subsection 1.2.2, "Lists of Specifications" in Part III, "FUNCTION".
Subsection 1.3.4, "Configuration of the EtherNet/IP Scanner Setting Screens"	Replace Subsection 1.3.4, "Configuration of the EtherNet/IP Scanner Setting Screens" in Part III, "FUNCTION" with this subsection.
Subsection 1.3.11, "EtherNet/IP MESSAGING Setting Screen"	Add this subsection to Part III, "FUNCTION" as Subsection 1.3.11, "EtherNet/IP MESSAGING Setting Screen".
Subsection 1.6.3, "EtherNet/IP Error Codes"	Add the description of this subsection to Subsection 1.6.3, "EtherNet/IP Error Codes" in Part III, "FUNCTION".
Subsection 1.6.6, "Examples of Message Communication"	Add this subsection to Part III, "FUNCTION" as Subsection 1.6.6, "Examples of Message Communication".

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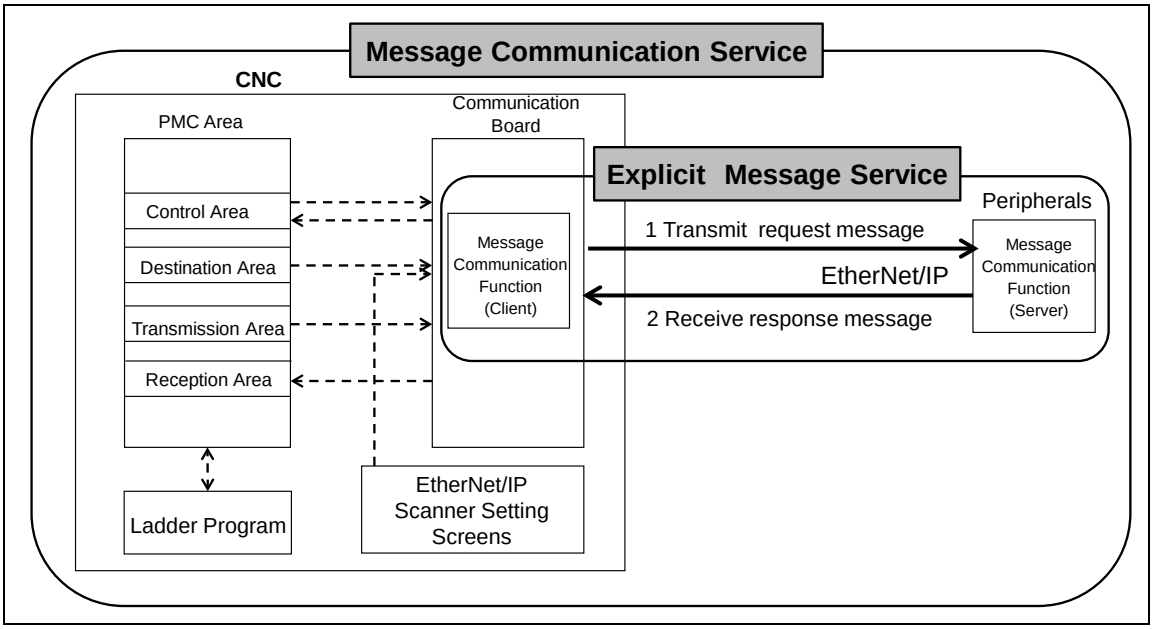
1.1.4 Operation of the Message Communication Function

EtherNet/IP message communication function provides CNCs with the ability to act as a client of the unconnected Explicit messaging service in transmitting request messages and receiving response messages.
This function enables CNCs to read or write parameters of communication partners who serve the message communication server function, and to request the communication partner to process jobs. Available parameters and jobs depend on the specifications of the communication partner.
PMC areas are used for exchanging the data of message communication service.
Specific ladder programs are required when controlling the Explicit messaging service, specifying the request message target, creating a request message to transmit, or receiving a received response message.
If the communication partners are specified in the settings on the EtherNet/IP Scanner setting screens (SIMPLE setting screens with setting number 01 to 32), the request message destination can be specified with those partners as well as with the IP addresses of the request message destinations.



The following PMC areas are used for message communication service:

Control area: area for the data to control message communication.
Destination area: area for the target to transmit a message to.
Transmission area: area where a ladder program stores the request message to send.
Reception area: area where response messages received by message communication function are stored.

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NOTE
EtherNet/IP message communication function disallows multiple messages to be simultaneously sent and received. Issue a next message communication service after an ongoing message communication service is completed.

1.2.1 Software Options

The table below shows software options for EtherNet/IP function.

Function to be used	Number of hardware options to be used	Required software option(s)
Scanner function	1	- EtherNet/IP Scanner function option (R966)
	2	- EtherNet/IP Scanner function option (R966) - EtherNet/IP Scanner PORT2 function option (R973) - Ethernet function option (S707)
Adapter function	1	- EtherNet/IP Adapter function option (R967)
	2	- EtherNet/IP Adapter function option (R967) - EtherNet/IP Adapter PORT2 function option (R974) - Ethernet function option (S707)
Message communication function	1	- EtherNet/IP Scanner function option (R966)
EDA function	1	- EtherNet/IP Adapter function option (R967)

NOTE
To use the EtherNet/IP function on two hardware options, the Ethernet function must run on one of these hardware options. For this reason, the Ethernet function option (S707) is required.

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1.2.2 Lists of Specifications

Message Communication Specification

Item	Description
Transmission Type	Unconnected Explicit messaging
Server / Client	Client
PMC area that can be allocated	- Control area: R and E areas - Destination area: R, E and D areas - Transmission area: R, E and D areas - Reception area: R and E areas
Size of the areas available to applications	450 or less bytes
Number of destinations to be registered	64 or less

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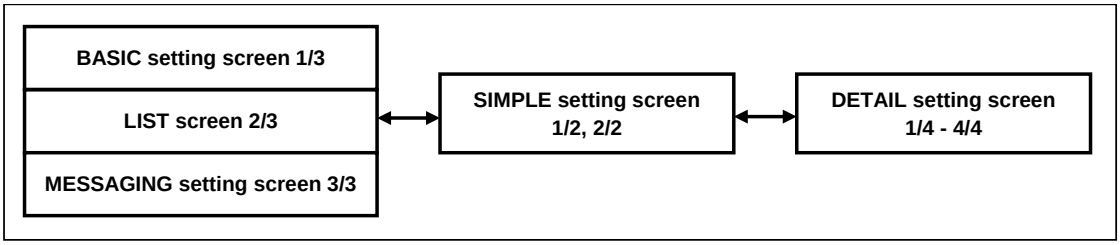
1.3.4 Configuration of the EtherNet/IP Scanner Setting Screens

This subsection describes the setting screens for operating the EtherNet/IP Scanner function. The figure below shows the configuration of the setting screens.



Configuration of the setting screens for the EtherNet/IP Scanner function

Set general items relating to the EtherNet/IP Scanner function on the BASIC setting screen.
The LIST screen lists communication settings. Selecting a communication setting to modify moves you to the SIMPLE setting screen.
On the SIMPLE setting screen, make settings necessary for I/O communication with an adapter device. Selecting a setting on the SIMPLE setting screen moves you to the DETAIL setting screen.
On the DETAIL setting screen, make detailed settings for I/O communication, if necessary.
Make settings for the message communication function on the MESSAGING setting screen, if necessary.

The following subsections describe those screens in detail.

NOTE

1. Before changing a parameter on an EtherNet/IP Scanner setting screen, set the MDI mode or emergency stop state.
2. If the Change protection level of the Ethernet function is higher than the Operation level in the 8-level data protection function, no settings can be changed. This rule applies to both operation on a hardware option on which the Ethernet function runs and that on a hardware on which the function does not run.

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1.3.11 EtherNet/IP MESSAGING Setting Screen

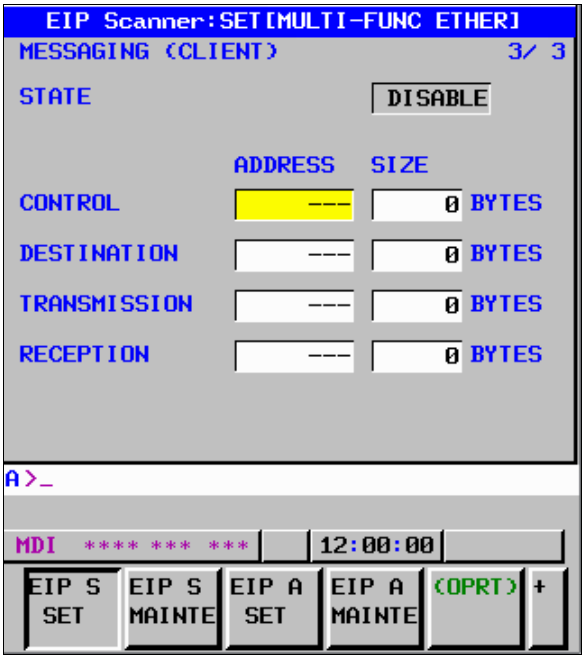
This section describes the setting screen for operating the EtherNet/IP message communication function.

Procedure

1 Press the function key SYSTEM.
2 Soft key [ETHERNET] appears. When the soft key does not appear, press the continue key.
3 Press soft key [ETHERNET] to display the Ethernet Setting screen.
4 Press soft key [EIP S SET]. When the soft key does not appear, press the continue key.
5 Press page keys PAGE ↑ PAGE ↓ to display the MESSAGING setting screen.

MESSAGING setting screen

Specify items regarding the EtherNet/IP message communication function.



MESSAGING setting screen

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Setting items

Item	Description
STATE Default: DISABLE	EtherNet/IP message communication function is: DISABLE: disabled. ENABLE: enabled. When STATE is "DISABLE", values in the control area, destination area, transmission area, and reception area can be modified. When STATE is "ENABLE", those values cannot be modified.
CONTROL Default: ---- / 0 bytes Valid setting range: 0, 2 bytes	Specify the start address of the control area in the PMC area. R/E areas of the PMC can be used as the control area. SIZE has a fixed value of two (2). When SIZE has the default, specifying ADDRESS sets SIZE to 2 automatically. To reset the value to default, set ADDRESS to space or set SIZE to zero (0).
DESTINATION Default: ---- / 0 bytes Valid setting range: 0, 8 to 512 bytes	If settings for destination servers are made on the EtherNet/IP Scanner setting screens (SIMPLE setting screens with setting numbers 01 to 32), the destination area does not have to be set. Specify the start address of the destination area in the PMC area. R/E/D areas of the PMC can be used as the destination area. Set SIZE to the size of the destination area in byte. A valid value falls between 8 and 512. This value can be calculated by multiplying 8 (bytes) and the number of destinations to be registered. When SIZE has the default, specifying ADDRESS sets SIZE to 8 automatically. When ADDRESS is not specified, SIZE cannot be set. To reset the value to default, set ADDRESS to space or set SIZE to zero (0).
TRANSMISSION Default: ---- / 0 bytes Valid setting range: 0, 18 to 468 bytes	Specify the start address of the transmission area in the PMC area. R/E/D areas of the PMC can be used as the transmission area. Set SIZE to the size of the transmission area in byte. A valid value falls between 18 and 468. This value can be calculated by adding 18 and the maximum request data size. When SIZE has the default, specifying ADDRESS sets SIZE to 18 automatically. When ADDRESS is not specified, SIZE cannot be set. To reset the value to default, set ADDRESS to space or set SIZE to zero (0).
RECEPTION Default: ---- / 0 bytes Valid setting range: 0, 6 to 456 bytes	Specify the start address of the reception area in the PMC area. R/E areas of the PMC can be used as the reception area. Set SIZE to the size of the reception area in byte. A valid value falls between 6 and 456. This value can be calculated by adding 6 and the maximum response data size from the destination. When SIZE has the default, specifying ADDRESS sets SIZE to 6 automatically. When ADDRESS is not specified, SIZE cannot be set. To reset the value to default, set ADDRESS to space or set SIZE to zero (0).

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NOTE

1 When a setting is changed, the POWER MUST BE OFF alarm is issued. To have the changes take effect, turn power off, then on again.
2 When STATE is changed from "DISABLE" to "ENABLE", all the settings of each area will be checked. If not all areas are allocated to the PMC area, STATE cannot be set to "ENABLE".
3 If STATE is set to "ENABLE" when power is turned on, all the settings of each area will be checked. If not all areas are allocated to the PMC area, STATE will be set to "DISABLE" and the POWER MUST BE OFF alarm will be issued.
4 When making settings of the EtherNet/IP function with the FANUC CNC setting tool, setting items on the message communication setting screens are initialized. In this case, after making settings for the EtherNet/IP function with the Setting tool, specify the initialized items on the message communication setting screens.

⚠ **WARNING**

Before allocating the PMC area, be sure to read Section 3.1, "DI/DO DATA AND STATUS DATA" in Part II, "COMMON".

Operations

Changing the STATE setting

1 Press soft key [(OPRT)]. Soft key [STATE] appears.

2 Press soft key [STATE]. Soft key [ENABLE] and [DISABLE] appear.

3 Press the soft key corresponding to the value you want to set.

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1.3.8.1 Control area

This area stores signals to control message communication. The area has a size of two bytes.

Offset	#7	#6	#5	#4	#3	#2	#1	#0
+0	REQ							

REQ <Rxxx.7>
[Name] Signal to request the message transmission
[Classification] Input signal
[Function] Requests the message transmission.
[Operation] After verifying the signal RES is "0" and preparing a request message in the transmission area, the ladder program sets this signal to "1".
When the message communication function verifies that this signal is set to "1" while the signal RES is "0", the function sends the request message to the communication partner and stores the response message in the reception area.
The ladder program verifies that the response message in the reception area, and set this signal "0".

Offset	#7	#6	#5	#4	#3	#2	#1	#0
+1	RES	RES_CODE						

RES <Rxxx+1.7>
[Name] Signal to notify the reception of the message
[Classification] Output signal
[Function] This signal indicates that the message is stored in the reception area.
[Output condition] Storing the response message in the reception area, the message communication function sets the signal RES_CODE to a value, and this signal, "1".
The ladder program verifies the message in the reception area and set the signal REQ to "0".
The message communication function verifies that the signal REQ is set to "0", and sets this signal to "0".

RES_CODE <Rxxx+1.0> to <Rxxx+1.6>
[Name] Signal to notify the response code of the response message
[Classification] Output signal
[Function] This signal indicates the result of the message communication service.
[Output condition] The message communication function set this signal to a value, and the signal RES, "1".
Verifying the response message in the reception area, the ladder program does this signal.
The message communication function sets the signal RES to "0", and this signal, zero (0).

RES_CODE	Description
0	The message communication service terminated successfully.
1	An error response is returned for the Explicit message service.
2	The communication partner specified does not exist on the network.
3	An Explicit message service got no response and a timeout occurred.
20	The destination (IP address, port number, or slot number) is invalid.
30	The service code is invalid.
31	The reserved area is invalid.
32	The option is invalid.

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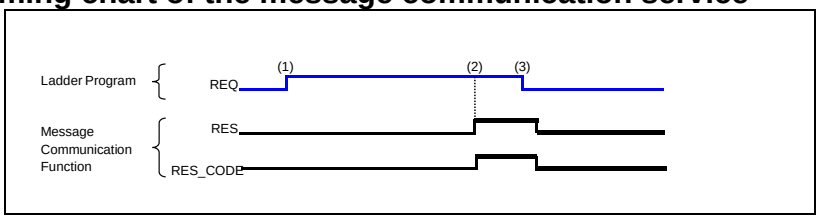
RES_CODE	Description
33	The destination number is invalid.
34	The class ID is invalid.
35	The instance ID is invalid.
36	The attribute ID is invalid.
37	Error in the request data size is invalid. The data size exceeds the size of the reception area.
40	Since more than one additional statuses are received, statuses later than the second cannot be stored.
41	Error in the size of the reception area. Not all of the response data can be stored.

Timing chart of the message communication service



(1) After verifying the signal RES is "0", the ladder program prepares a request message in the transmission area, and then, sets the signal REQ to "1".
After verifying that the signal REQ is set to "1", the message communication function performs message communication. After storing the response message to the reception area, the function sets the signal RES_CODE to a value, and the signal RES, "1".

(2) After verifying that the signal RES is "1", the ladder program reads the signal RES_CODE from the control area and the response message from the reception area.

(3) The ladder program sets the signal REQ to "0".
After verifying that the signal REQ is "0", the message communication function sets both the signal RES and RES_CODE to "0".

1.3.8.2 Destination area

This area stores destinations of the message.

Offset	#7	#6	#5	#4	#3	#2	#1	#0
+0	Destination information [1]							
+8	Destination information [2]							
+16	Destination information [3]							
...	...							
+8(N-1)	Destination information [N]							

In the destination area, the destination information to identify the message destination is stored in array. This area can hold up to 64 pieces of destination information.
The communication partner who is to be the destination of the message can be specified by selecting destination information in the array. To select an entry of the array, select an array index number.

The size of the destination area is calculated by multiplying 8 (bytes) and the number of the array entries.
For example, when the array has N entries, enter the value of 8 * N (bytes) to the size of the destination area on the MESSAGING setting screen.

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Destination information

Destination information has data to identify the destination to which the message is transmitted.

Offset	#7	#6	#5	#4	#3	#2	#1	#0
+0	IP address [0] (high byte)							
+1	IP address [1]							
+2	IP address [2]							
+3	IP address [3] (low byte)							
+4	Port number							
+5								
+6	Slot number							
+7								

Data is stored in little-endian format.

Specify an IP address to identify the communication partner.
If needed, specify the port number and slot number besides the IP address.

To communicate with a device with an IP address of 192.168.1.101, store the values of 192, 168, 1, and 101 to the corresponding offsets starting from +0 to +3.

Port number and slot number are required when sending an Explicit message service to a specific I/O module among multiple modules inserted to slots in the partner device.
For example, when the IP address is 192.168.2.201, and the slot number to which the target I/O module is inserted is three (3), store the values of 192, 168, 2, 201, 1, 0, 3, and 0, to the corresponding offsets starting from +0 to +7.

Port number

The Port number is equivalent to the Port Number in the Port Segment of the CIP.
Set this area to zero (0) when port number and slot number are not used.
When they are used, normally, specify one (1) to indicate a backplane port.
Valid setting range: 0 to 65535

Slot number

The Slot number is equivalent to the Link Address in the Port Segment of the CIP.
Set the port number to zero (0) when port number and slot number are not used.
Valid setting range: 0 to 255

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1.3.8.3 Transmission area

This area stores the request message the ladder program sends.

Offset	#7	#6	#5	#4	#3	#2	#1	#0
+0	Service code							
+1	Reserved area							
+2	Option							
+3	Destination number							
+4	Class ID							
+5								
+6								
+7								
+8	Instance ID							
+9								
+10								
+11								
+12	Attribute ID							
+13								
+14								
+15								
+16	Request data size							
+17								
+18	Request data							
...	...							

Data is stored in little-endian format.

Service code

Specify the service code of the Explicit message service to request
Valid setting range: 00_{Hex} to $7F_{Hex}$

Reserved area

This is a reserved area for future use. Set this area to zero (0).

Option

Specify the option.

Bit 0 (Destination area use flag); this flag indicates whether the destination area is used.
Set how to specify the destination to which the request message is transmitted.

0: The IP address of the communication partner specified in a setting on the EtherNet/IP Scanner setting screen (SIMPLE setting screens with setting number 01 to 32) is used.
1: An IP address stored in the destination area is used.

Bit 1 to 7
These bits are reserved for future use. Set them to zero (0).

Destination number

Specify the destination to which the request message is sent.

When the Destination area use flag is "0",
set the setting number of a setting for the destination made beforehand on the EtherNet/IP Scanner setting screen (SIMPLE).

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Valid setting range: 1 to 32

When the Destination area use flag is "1",
specify the array index number of the destination information array in the destination area. The number falls between 1 and the number of the array entries specified in the size of the destination area on the MESSAGING setting screen.
For example, to use the destination information of the first array entry, specify one (1).
Valid setting range: 1 to 64 (maximum)

Class ID

The Class ID is used to specify the application path of the Explicit message service.
This ID is equivalent to the Class ID of the Logical Segment in the CIP.
Valid setting range: 1 to $FFFFFFFE_{Hex}$

Instance ID

The Instance ID is used to specify the application path of the Explicit message service.
This ID is equivalent to the Instance ID of the Logical Segment in the CIP.
Valid setting range: 0 to $FFFFFFFE_{Hex}$

Attribute ID

The Attribute ID is used to specify the application path of the Explicit message service.
This ID is equivalent to the Attribute ID of the Logical Segment in the CIP.
When this ID is not used, set the Attribute ID to zero (0) or $FFFFFFFF_{Hex}$.
Valid setting range: 0 to $FFFFFFFF_{Hex}$

Request data size

Specify the size of the request data in byte.
Set this area to zero (0) if the request data are not used.
Valid setting range: 0 to 450 bytes

Request data

Store the request data of the Explicit message service in this area.

1.3.8.4 Reception area

This area stores the response message received by the message communication function.

Offset	#7	#6	#5	#4	#3	#2	#1	#0
+0	General status							
+1	Reserved area							
+2	Additional status							
+3								
+4	Response data size							
+5								
+6	Response data							
...								

Data is stored in little-endian format.

General status

The general statuses for an Explicit message service.

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When an Explicit messaging service succeeds, the status "00 Hex" is stored in this area; otherwise, a value other than "00 Hex" is stored.
For the details of the general status, see Subsection 1.6.3, "CIP General Status".

Additional status

When the response has effective statuses other than the general status, the value of the additional status is stored in this area.
When the response has two or more additional statuses, this area stores only the first additional status and the subsequent additional statuses will be displayed on the EtherNet/IP LOG screen.

Error No.	Log message	Meaning
E-1170	[D=nn, S=xxH, G=xxH, E=xxxxH,xxxxH,...,xxxxH]	Two or more additional statuses are received. D = Destination number S = Service code G = General status E = Additional statuses (maximum 10)

Response data size

This area stores the size of the response data stored in the reception area.
When this area has a value of zero (0), no response data are stored.
If the reception area whose size is specified on the EtherNet/IP Scanner setting screen (MESSAGING) is not big enough to store all the received data, the following message will appear on the EtherNet/IP LOG screen.

Error No.	Log message	Meaning
E-1171	[D=nn, S=xxH, Storeable=nnn, Received=nnn]	The reception area is not big enough to store all the received data. D = Destination number S = Service code Storeable = the maximum size of the data to store Data range: 0 to 450 bytes Received = the size of the received data Data range: 1 or more bytes (more than Storeable)

Response data

When the Response data size is 1 or more, the received response data is stored in this area.

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1.6.3 EtherNet/IP Error Codes

CIP General Status

Value	Status name	Description
00_{Hex}	Success	The service completed successfully.
01_{Hex}	Connection failure	Failed to connect with the partner device.
02_{Hex}	Resource unavailable	Resource is insufficient to execute service.
03_{Hex}	Invalid parameter value	Invalid parameters for the request data are specified.
04_{Hex}	Path segment error	Unable to identify the application path.
05_{Hex}	Path destination unknown	The application path points unknown destination.
06_{Hex}	Partial transfer	Not all of the request data were sent.
07_{Hex}	Connection lost	The connection with the partner device is disconnected.
08_{Hex}	Service not supported	The partner device rejects the service.
09_{Hex}	Invalid attribute value	Invalid Attribute ID
$0A_{Hex}$	Attribute list error	Error code from Get/Set_Attribute_List service
$0B_{Hex}$	Already in requested mode/state	The destination the application path specifies has already been set in requested mode by the service.
$0C_{Hex}$	Object state conflict	The destination the application path specifies cannot execute the requested service while in the current mode/state
$0D_{Hex}$	Object already exists	The object which is requested to be created already exists.
$0E_{Hex}$	Attribute not settable	The specified attribute is read-only.
$0F_{Hex}$	Privilege violation	Failed to check privileges.
10_{Hex}	Device state conflict	The partner device cannot execute the requested service while in the current mode/state.
11_{Hex}	Reply data too large	Unable to receive the response message because its size is too large.
12_{Hex}	Fragmentation of a primitive value	Specified operations will fragment primitive values.
13_{Hex}	Not enough data	Insufficient request data
14_{Hex}	Attribute not supported	The partner device rejects the specified attribute.
15_{Hex}	Too much data	Too much request data
16_{Hex}	Object does not exist	The specified object does not exist in the partner device.
17_{Hex}	Service fragmentation sequence not in progress	The fragmentation sequence of this service is currently not active to this data.
18_{Hex}	No stored attribute data	The specified attribute is not stored.
19_{Hex}	Store operation failure	The specified attribute is not stored because of service failure.
$1A_{Hex}$	Routing failure, request packet too large	Unable to root the service request packet because it is too large.
$1B_{Hex}$	Routing failure, response packet too large	Unable to root the service response packet because it is too large.
$1C_{Hex}$	Missing attribute list entry data	Attributes required to execute the request are missing from the attribute list.
$1D_{Hex}$	Invalid attribute value list	The service returned the status information of invalid attributes as well as the list of attributes to be provided.
$1E_{Hex}$	Embedded service error	Error occurred in an embedded service.
$1F_{Hex}$	Vendor specific error	Error specific to the vendor occurred.
20_{Hex}	Invalid parameter	Invalid parameters are specified in the request data.
21_{Hex}	Write-once value or medium already written	Data can be written only once.
22_{Hex}	Invalid Reply Received	Received an invalid response message.

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Value	Status name	Description
23_{Hex}	Buffer Overflow	Failed to receive the data because it is larger than the receiving buffer.
24_{Hex}	Message Format Error	The partner device rejects the format of the request message.
25_{Hex}	Key Failure in path	The specified electronic key was unable to match to the partner device.
26_{Hex}	Path Size Invalid	The size of the application path is too short or long.
27_{Hex}	Unexpected attribute in list	The specified attribute currently cannot be set.
28_{Hex}	Invalid Member ID	The specified member does not exist.
29_{Hex}	Member not settable	The specified member is read-only.
$2A_{Hex}$	Group 2 only server general failure	Error occurred in DeviceNet Group 2 only server.
$2B_{Hex}$	Unknown Modbus Error	Unknown Modbus Exception Code cannot be converted in CIP.
$2C_{Hex}$	Attribute not gettable	The specified member is write-only.
$2D_{Hex}$	Instance Not Deletable	Unable to delete the specified instance.
$2E_{Hex}$	Service Not Supported for Specified Path	The object supports the service but the specified application path does not.
$D0\text{-}FF_{Hex}$	Reserved for Object Class specific errors	Error specific to the object class occurred.

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1.6.6 Examples of Message Communication

1.6.6.1 Get_Attribute_All (successful example)

This subsection describes an example procedure to get the information of instance 1 (=Instance ID 01_{Hex}) of an Identity Object (=Class ID 01_{Hex}) from two devices that have the IP Address 192.168.1.101 and 192.168.1.102 by issuing Get_Attribute_All service.

1. The operator uses the EtherNet/IP Scanner setting screen (MESSAGING) to allocate all the four areas in the PMC area.

Example)

Control area	1:R1000/2 byte
Destination area	1:D0000/16 byte
Transmission area	1:R2000/18 byte
Reception area	1:R3000/100 byte

2. The ladder program or the operator stores the IP addresses 192.168.1.101 and 192.168.1.102 to the destination area.

Example)

Signal	Description	Values to Set
D0000	Destination information [1]	192
D0001		168
D0002		1
D0003		101
D0004		0
D0005		0
D0006		0
D0007		0
D0008	Destination information [2]	192
D0009		168
D0010		1
D0011		102
D0012		0
D0013		0
D0014		0
D0015		0

3. The ladder program verifies that the RES of the control area is zero (0).

Offset	#7	#6	#5	#4	#3	#2	#1	#0
R1000	REQ=0							
R1001	RES=0	RES_CODE						

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4. The ladder program stores the transmission message to the transmission area.

Example)

Signal	Description	Values to Set
R2000	Service code	01_{Hex}
R2001	Reserved area	0
R2002	Option	1
R2003	Destination number	1
R2004	Class ID	01_{Hex}
R2005		00_{Hex}
R2006		00_{Hex}
R2007		00_{Hex}
R2008	Instance ID	01_{Hex}
R2009		00_{Hex}
R2010		00_{Hex}
R2011		00_{Hex}
R2012	Attribute ID	0
R2013		0
R2014		0
R2015		0
R2016	Request data size	0
R2017		0

5. The ladder program set the signal REQ in the control area to one (1).
Since the destination area use flag is set to one (1) and the Destination number, one (1), the message communication function issues a Get_Attribute_All service to the device whose IP address is 192.168.1.101.

Offset	#7	#6	#5	#4	#3	#2	#1	#0
R1000	REQ=1							
R1001	RES=0	RES_CODE						

6. The ladder program waits until the Explicit message service completes and the signal RES in the control area turns to one (1).
The program verifies the Explicit message service is successful and that the RES_CODE has a value of zero (0).

Offset	#7	#6	#5	#4	#3	#2	#1	#0
R1000	REQ=1							
R1001	RES=1	RES_CODE=0						

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7. The ladder program reads out the information in the reception area and verifies the response data of the Explicit message service.
The following are merely example values which might be stored after receiving a response. The values to be set depend on the specification of the communication partner.

Signal	Description		Stored Values
R3000	General status		00_{Hex}
R3001	Reserved area		0
R3002	Additional status		0
R3003			0
R3004	Response data size		28
R3005			0
R3006	Response data	Vendor ID (=$024F_{Hex}$)	$4F_{Hex}$
R3007			02_{Hex}
R3008		Device type (=$000C_{Hex}$)	$0C_{Hex}$
R3009			00_{Hex}
R3010		Product code (=0065_{Hex})	65_{Hex}
R3011			00_{Hex}
R3012		Major revision	02_{Hex}
R3013		Minor revision	01_{Hex}
R3014		Status (=0064_{Hex})	64_{Hex}
R3015			00_{Hex}
R3016		Serial number (=12345678_{Hex})	78_{Hex}
R3017			56_{Hex}
R3018			34_{Hex}
R3019			12_{Hex}
R3020		Product name (="Series 30i")	$0A_{Hex}$ (=10 characters)
R3021			53_{Hex} (=S)
R3022			65_{Hex} (=e)
R3023			72_{Hex} (=r)
R3024			69_{Hex} (=i)
R3025			65_{Hex} (=e)
R3026			73_{Hex} (=s)
R3027			20_{Hex} (=)
R3028			33_{Hex} (=3)
R3029			30_{Hex} (=0)
R3030			69_{Hex} (=i)
R3031		Condition	255
R3032		Configuration Consistency Value	0
R3033		Heartbeat Interval	0

8. The ladder program set the signal REQ in the control area to zero (0).

Offset	#7	#6	#5	#4	#3	#2	#1	#0
R1000	REQ=0							
R1001	RES=1	RES_CODE=0						

9. The message communication function turns the signal RES and RES_CODE to zero (0).

Offset	#7	#6	#5	#4	#3	#2	#1	#0
R1000	REQ=0							
R1001	RES=0	RES_CODE=0						

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10. Set the Destination number to two (2) and repeat the steps 4. through 9.
    A Get_Attribute_All service is issued to the device with the IP address 192.168.1.102.

1.6.6.2 Setting destination with the EtherNet/IP Scanner setting screen

When using the EtherNet/IP Scanner setting screen (SIMPLE) instead of the destination area, replace the steps 1, 2, and 3 of the procedure in the Subsection 1.6.6.1, "Get_Attribute_All (successful example)" with the following steps with the same step number, and perform the replaced procedure.

1. The operator uses the EtherNet/IP MESSAGING setting screen to allocate all the four areas in the PMC.

Example)

Control area	1:R1000/2 byte
Destination area	---- /0 byte
Transmission area	1:R2000/18 byte
Reception area	1:R3000/100 byte

2. The operator specifies the IP address 192.168.1.101 and 192.168.1.102 on the SIMPLE setting screens with setting numbers 01 and 02 respectively.

3. The ladder program stores the transmission message to the transmission area.

Example)

Signal	Description	Values to Set
R2000	Service code	01_{Hex}
R2001	Reserved area	0
R2002	Option	0
R2003	Destination number	1
R2004	Class ID	01_{Hex}
R2005		00_{Hex}
R2006		00_{Hex}
R2007		00_{Hex}
R2008	Instance ID	01_{Hex}
R2009		00_{Hex}
R2010		00_{Hex}
R2011		00_{Hex}
R2012	Attribute ID	0
R2013		0
R2014		0
R2015		0
R2016	Request data size	0
R2017		0

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1.6.6.3 Get_Attribute_All (failed example)

This subsection describes the steps how to handle a timeout error.
Before performing the procedure in the Subsection 1.6.6.1, "Get_Attribute_All (successful example)", replace the steps 6, 7, and 8 with the following steps with the same step number.

6. The ladder program waits until the Explicit message service completes and the signal RES in the control area turns to one (1).
   The program verifies the Explicit message service has failed and that the RES_CODE has a value other than zero (0).

Offset	#7	#6	#5	#4	#3	#2	#1	#0
R1000	REQ=1							
R1001	RES=1	RES_CODE=1						

7. The ladder program reads out the information in the reception area and verifies the response data of the Explicit message service.
   If a timeout occurs, the General status has a value of 01_{Hex}, and the Additional status, a value of 0204_{Hex}.

Signal	Description	Stored Values
R3000	General status	01_{Hex}
R3001	Reserved area	0
R3002	Additional status	04_{Hex}
R3003		02_{Hex}
R3004	Response data size	0
R3005		0

8. If needed, handle the timeout error.
   The ladder program set the signal REQ in the control area to zero (0).

Offset	#7	#6	#5	#4	#3	#2	#1	#0
R1000	REQ=0							
R1001	RES=1	RES_CODE=1						

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FANUC Series 30*i*/31*i*/32*i*/35*i*-MODEL B
FANUC Power Motion *i*-MODEL A
FANUC Series 0*i*-MODEL F
Support of allocation to DCS-PMC in EtherNet/IP function

1. Type of applied technical documents

Name	FANUC Series 30*i*-MODEL A/B FANUC Series 31*i*-MODEL A/B FANUC Series 32*i*-MODEL A/B FANUC Series 35*i*-MODEL B FANUC Power Motion *i*-MODEL A FANUC Series 0*i*-MODEL F Industrial Ethernet CONNECTION MANUAL
Spec.No./Version	B-64013EN/03

2. Summary of change

Group	Name / Outline	New, Add, Correct, Delete	Applicable Date
Basic Function			
Optional Function	The DI/DO signals of EtherNet/IP function can be allocated to the DCS-PMC area.	Add	Immediately
Unit			
Maintenance parts			
Notice			
Correction			
Another			

Edit	Date	Design	Description

Date	13-Mar-2018	Design	Ikki	Apprv.	

Title	FS30i/31i/32i/35i-B, PMi-A, FS0i-F Support of allocation to DCS-PMC in EtherNet/IP function
Draw No.	**B-64013EN/03-7**
FANUC CORPORATION	Sheet 1/4

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APPLIED SOFTWARE

Following software is required to allocate DI/DO data to DCS-PMC in EtherNet/IP function.

Embedded Ethernet software

Model	Series	Edition
Series 30*i*/31*i*/32*i*/35*i*-MODEL B (STEP1 / STEP2) Power Motion *i*-MODEL A	658M	20 or later
Series 30*i*/31*i* -MODEL B (CPU card D)	658V	01 or later
Series 0*i*-MODEL F (STEP1 / STEP2)	658A	10 or later

The relation between this manual and Industrial Ethernet CONNECTION MANUAL (B-64013EN/03)

This manual	Industrial Ethernet CONNECTION MANUAL (B-64013EN/03)
Subsection 3.1.1, "Allocating PMC Areas"	Replace Subsection 3.1.1, "Allocating PMC Areas" in Part II, "COMMON" with this subsection.
Subsection 1.2.2, "Lists of Specifications"	Add the description of this subsection to Subsection 1.2.2, "Lists of Specifications" in Part III, "FUNCTION".
Subsection 1.3.6, "SIMPLE Setting Screen"	Add the description of this subsection to Subsection 1.3.6, "SIMPLE Setting Screen" in Part III, "FUNCTION".
Subsection 2.3.5, "BASIC Screen and ALLOCATION Screen"	Add the description of this subsection to Subsection 2.3.5, "BASIC Screen and ALLOCATION Screen" in Part III, "FUNCTION".

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3.1.1 Allocating PMC Areas

To allocate a PMC area in the setting screen of each communication function, specify it as follows:

```
Input format)
    <Path number>:<PMC address>
```

For example, for R0500 on the second path of the PMC, input "2:R500".
If DCS-PMC is allocated, input 'S' or '9' to <Path number>.
If <Path number> is omitted (R500), the first path is assumed (1:R0500).
If the <:> key is not available, it can be substituted with the </> key or the <EOB> key. ":" is optional.
To clear "<Path number>:<PMC address>" previously set, input " " (blank). ("---" will be displayed).
In this case, it is assumed that no PMC area is used.

⚠ CAUTION

1. In the PMC area, the R, X, and Y areas, and E area in volatile memory are all set to 0 immediately after power-on.
2. The D area in the PMC area is allocated to nonvolatile memory. In addition, the E area in the PMC area is normally allocated to volatile memory. However, it can also be used as nonvolatile memory by setting the option.
   When the area is used as nonvolatile memory, the contents of the area are retained even after the power is turned off. So, special attention should be paid not to cause an unpredictable operation when the power is turned on next time.

1.2.2 Lists of Specifications

Specification related to the EtherNet/IP Scanner function

Item	Description
PMC area that can be allocated	1st to 5th path PMC - DI: R, D, E, and X areas - DO: R, D, E, and Y areas - Status: R, D, and E areas DCS-PMC - DI: R, and X areas - DO: R, and Y areas

Specification related to the EtherNet/IP Adapter function

Item	Description
PMC area that can be allocated	1st to 5th path PMC - DI: R, D, E, and X areas - DO: R, D, E, and Y areas - Status: R, D, and E areas DCS-PMC - DI: R, and X areas - DO: R, and Y areas

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1.3.6 SIMPLE Setting Screen

Setting items

Item	Description
ADDRESS Default: ---	Specify the area for storing DI/DO data. When "TYPE" is "00:UNUSED", no value can be set. When "TYPE" IS "01:PMC", specify the following start address. 1st to 5th path PMC - DI: R, D, E, and X areas - DO: R, D, E, and Y areas - Status: R, D, and E areas DCS-PMC - DI: R, and X areas - DO: R, and Y areas The valid setting range depends on the actual range of the PMC R/E/D/X/Y area. While considering the "SIZE" setting, specify a value so that the area is within the PMC area range. To allocate the PMC X/Y area, also set parameters Nos. 11937 to 11939. For details of these parameters, see Section 4.3, "PARAMETERS RELATED TO PMC" in Part II, "COMMON".

2.3.5 BASIC Screen and ALLOCATION Screen

ALLOCATION screen

Setting items

Item	Description
ADDRESS Default: ---	Specify the address of the area for storing DI/DO data. When "TYPE" is 0, no value can be set. When "TYPE" is 1, specify the following start address. 1st to 5th path PMC - DI: R, D, E, and X areas - DO: R, D, E, and Y areas - Status: R, D, and E areas DCS-PMC - DI: R, and X areas - DO: R, and Y areas The valid setting range depends on the actual range of the PMC R/E/D/X/Y area. While considering the "SIZE" setting, specify a value so that the area is within the PMC area range. To allocate the PMC X/Y area, also set parameters Nos. 11937 to 11939. For details of these parameters, see Section 4.3, "PARAMETERS RELATED to PMC" in Part II, "COMMON".

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FANUC Series 30*i*/31*i*/32*i*/35*i*–MODEL B,
FANUC Power Motion *i*–MODEL A, FANUC Series 0*i*-MODEL F
Industrial Ethernet CONNECTION MANUAL

1. Type of applied technical documents

Name	FANUC Series 30*i*–MODEL B FANUC Series 31*i*–MODEL B FANUC Series 32*i*–MODEL B FANUC Series 35*i*–MODEL B FANUC Power Motion *i*–MODEL A FANUC Series 0*i*–MODEL F Industrial Ethernet CONNECTION MANUAL
Spec.No./Version	B-64013EN/03

2. Summary of change

Group	Name / Outline	New, Add, Correct, Delete	Applicable Date
Basic Function			
Optional Function	The mode not checking APDU status has been corrected.	Correct	Immediately
Unit			
Maintenance parts			
Notice			
Correction			
Another			

Edit	Date	Design	Description
Date	2019.01.07	Design R.Imada	Apprv. T.Hosaka

Title	FANUC Series 30*i*/31*i*/32*i*/35*i*-MODEL B, Power Motion *i*-MODEL A, FANUC Series 0*i*-MODEL F Industrial Ethernet CONNECTION MANUAL
Draw No.	B-64013EN/03-08
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PROFINET function software in the following table is updated.

SYSTEM	SERIES	EDITION
FS30*i*/31*i*/32*i*/35*i*-B Power Motion *i*-A	658R	07
FS0*i*-F	658U	07

These software have the following additional functions and improvements.

Number	Overview of new function
1	When using the mode that APDU status is not checked, the value of DI data may be kept even if the connection with IO device becomes error because of disconnection and so on. This problem has been corrected. Refer to attached material for detail.

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Attached material:
The relation between Industrial Ethernet CONNECTION MANUAL (B-64013EN/03) and this manual

This manual	Industrial Ethernet CONNECTION MANUAL (B-64013EN/03)
Subsection 4.3.3.2, " Status" in Chapter 4, "PROFINET IO CONTROLLER FUNCTION"	Replace this Subsection with Subsection 4.3.3.2, " Status " in Part III, "FUNCTION". - The description of “Status (+1 to +48)”Bit2 is changed. The checking status is changed according to bit 3 of "OPTION" on the setting screen of the PROFINET IO Controller function.

4 PROFINET IO CONTROLLER FUNCTION

4.3.2.3 Status

This subsection describes the allocation of the status to the PMC.

		Status							
		#7	#6	#5	#4	#3	#2	#1	#0
Address	+0	SW		–	–	–	–	BF	SF
	+1	–	–	–	–	–	IO00	RAP00	CON00
	...	...							
	+48	–	–	–	–	–	IO47	RAP47	CON47

Status (+0)

This is the status of the entire PROFINET IO Controller function.

Bit	Name	Description
#0	SF	System error 0: The PROFINET IO Controller function operates normally. 1: An unrecoverable fault occurs in the PROFINET IO Controller function.
#1	BF	Bus fault 0: Communication with all IO Devices has been established. 1: One or more IO Devices exist with which communication has not been established.
#2-6	–	Reserved (zero is notified)
#7	SW	System wake up 0: The system of the PROFINET IO Controller function has not started. 1: The system of the PROFINET IO Controller function has started. The other status bits become effective after SW is changed to 1.

Status (+1 to +48)

This is the status of each IO Device.
In the following description, "xx" (= 0 to 47) means an IO Device number.

Bit	Name	Description
#0	CONxx	Connection with the IO Device 0: The IO Device is not connected. 1: The IO Device is connected.

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Bit	Name	Description
#1	RAPxx	Application ready signal from the IO Device 0: The application ready signal is not notified from the IO Device. 1: The application ready signal is notified from the IO Device. This signal becomes 0 if the communication with the corresponding IO Device is disconnected.
#2	IOxx	DI/DO communication 0: The CNC is not communicating with the IO Device about DI/DO data. 1: The CNC is communicating with the IO Device about DI/DO data. If the following status bits in the PROFINET standard are 1, IOxx is set to 1. The condition depends on the OPTION Bit 3 setting and the DI/DO size.

- Bit 3 of "OPTION" on the setting screen of the PROFINET IO Controller function is “0”

DI/DO size conditions	Status bits to check
DI size > 0 and DO size > 0	• Bits 2, 4, and 5 of the APDU status • Bit 7 of the IOPS status • Bit 7 of the IOCS status
DI size > 0 and DO size = 0	• Bits 2, 4, and 5 of the APDU status • Bit 7 of the IOPS status
DI size = 0 and DO size > 0	• Bits 2, 4, and 5 of the APDU status • Bit 7 of the IOCS status

- Bit 3 of "OPTION" on the setting screen of the PROFINET IO Controller function is “1”

DI/DO size conditions	Status bits to check
DI size > 0 and DO size > 0	• Bit 2 of the APDU status • Bit 7 of the IOPS status • Bit 7 of the IOCS status
DI size > 0 and DO size = 0	• Bit 2 of the APDU status • Bit 7 of the IOPS status
DI size = 0 and DO size > 0	• Bit 2 of the APDU status • Bit 7 of the IOCS status

The meaning of each status bit is as follows.

Status	Description
Bit 2 of the APDU status	This bit indicates that the data of the input frame is effective.
Bit 4 of the APDU status	This bit indicates that the control application of the IO Device is in the "RUN" state.
Bit 5 of the APDU status	This bit indicates that the IO Device is in normal operation.
Bit 7 of the IOPS status	This bit indicates that the data of the input module is effective. If multiple input modules are connected, there is IOPS for each input module, and IOxx becomes 1 only if the data of all input modules is effective.
Bit 7 of the IOCS status	This bit indicates that the data of the output module was correctly processed on the IO Device. If multiple output modules are connected, there is IOCS for each output module, and IOxx becomes 1 only if the data of all output modules was correctly processed.

NOTE

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Bit	Name	Description
		When bit 3 of "OPTION" on the setting screen of the PROFINET IO Controller function is set to 1 and this bit "IOxx" is 1, DI data is reflected to the DI area of the PMC even if the APDU status is error. When the APDU status is error, the meaning of DI data depends on the specification of each IO Devices. For details of the specification of IO Devices, see the IO Device manual or ask for IO Device manufacturer. For details of the status in the PROFINET standard, see Subsection 4.6.2.3, "Status".
#3-7	–	Reserved (zero is notified)

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FANUC Series 30*i*/31*i*/32*i*/35*i*-MODEL B
FANUC Power Motion *i*-MODEL A
FANUC Series 0*i*-MODEL F
Support of Tag Communication in EtherNet/IP function

1. Type of applied technical documents

Name	FANUC Series 30*i*-MODEL A/B FANUC Series 31*i*-MODEL A/B FANUC Series 32*i*-MODEL A/B FANUC Series 35*i*-MODEL B FANUC Power Motion *i*-MODEL A FANUC Series 0*i*-MODEL F Industrial Ethernet CONNECTION MANUAL
Spec.No./Version	B-64013EN/03

2. Summary of change

Group	Name / Outline	New, Add, Correct, Delete	Applicable Date
Basic Function			
Optional Function	In EtherNet/IP, Tag Communication has been supported. In Adapter function, the maximum number of allocation setting has been expanded from 4 to 16. In Adapter and Scanner function, the maximum data size has been expanded from 256 bytes to 1444 bytes.	Add	Immediately
Unit			
Maintenance parts			
Notice			
Correction			
Another			

Edit	Date	Design	Description

Date	16-Jan-2019	Design	Uchiumi	Apprv.	Hosaka

Title	FS30i/31i/32i/35i-B, PMi-A, FS0i-F Support of Tag Communication in EtherNet/IP function
Draw No.	**B-64013EN/03-09**
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APPLIED SOFTWARE

Following software is required to use EtherNet/IP Tag Communication function.

Embedded Ethernet software

Model	Series	Edition
Series 30i/31i/32i/35i-MODEL B (STEP1 / STEP2) Power Motion i-MODEL A	658M	22 or later
Series 0i-MODEL F (STEP1 / STEP2)	658A	12 or later

Fast Ethernet software

Model	Series	Edition
Series 30i/31i/32i/35i-MODEL B (STEP1 / STEP2) Power Motion i-MODEL A	658K	24 or later
Series 0i-MODEL F (STEP1 / STEP2)	658B	09 or later

CNC system software

Model	Series	Edition
Series 30i-MODEL B (STEP2)	G303/G313/G323/G333/G353	19 or later
Series 30i-MODEL B (STEP1)	G30A/G31A/G32A/G33A/G35A	19 or later
Series 31i-MODEL B5 (STEP2)	G423/G433/G483/G4H3/G424	19 or later
Series 31i-MODEL B5 (STEP1)	G42A/G43A	19 or later
	G422/G481	38 or later
Series 31i-MODEL B (STEP2)	G403/G413/G453/G4G3/G404	19 or later
Series 31i-MODEL B (STEP1)	G40A/G41A	19 or later
	G402/G451	38 or later
Series 31*i*-MODEL B（Line）	G441	22 or later
Series 32i-MODEL B (STEP2)	G503/G513/G523	19 or later
Series 32i-MODEL B (STEP1)	G50A/G51A	19 or later
	G521	38 or later
Series 32*i*-MODEL B（Line）	G541	22 or later
Series 35i-MODEL B	G601/G611	32 or later (Plan)
Series 35*i*-MODEL B（Line）	G641	22 or later
Series 0*i*-MODEL TF Plus	D6G3	02 or later (Plan)
Series 0i-MODEL TF (STEP2)	D6G2	20 or later
Series 0i-MODEL TF (STEP1)	D6G1	55 or later
Series 0*i*-MODEL MF Plus	D4G3	02 or later (Plan)
Series 0i-MODEL MF (STEP2)	D4G2	20 or later
Series 0i-MODEL MF (STEP1)	D4G1	55 or later
Power Motion i-MODEL A	88H0	38 or later (Plan)

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The relation between this manual and Industrial Ethernet CONNECTION MANUAL (B-64013EN/03)

This manual	Industrial Ethernet CONNECTION MANUAL (B-64013EN/03)
EtherNet/IP Scanner function	
Subsection 1.1.2, “Terminology”	Add the description of this subsection to Subsection 1.1.2, “Terminology " in Part III, "FUNCTION".
Subsection 1.1.5, “About Tag Communication”	Add this subsection to Part III, "FUNCTION" as Subsection 1.1.5, “About Tag Communication"
Subsection 1.2.2, “Lists of Specifications”	Add the description of this subsection to Subsection 1.2.2, “Lists of Specifications” in Part III, "FUNCTION".
Subsection 1.3.4, “Configuration of the EtherNet/IP Scanner Setting Screens”	Replace Subsection1.3.4, “Configuration of the EtherNet/IP Scanner Setting Screens” in Part III, "FUNCTION" with this subsection.
Subsection 1.3.5, “BASIC Setting Screen and LIST Screen”	Add the description of this subsection to Subsection 1.3.5, “BASIC Setting Screen and LIST Screen” in Part III, "FUNCTION".
Subsection 1.3.6, “SIMPLE Setting Screen”	Add the description of this subsection to Subsection 1.3.6, “SIMPLE Setting Screen” in Part III, "FUNCTION".
Subsection 1.3.7, “DETAIL Setting Screen”	Add the description of this subsection to Subsection 1.3.7, “DETAIL Setting Screen” in Part III, "FUNCTION".
Subsection 1.3.11, “EtherNet/IP MESSAGING Setting Screen”	Add the description of this subsection to Subsection 1.3.11, “EtherNet/IP MESSAGING Setting Screen” in Part III, "FUNCTION".
Subsection 1.5.2, “Estimating the Communication Load”	Replace Subsection1.5.2, “Estimating the Communication Load” in Part III, "FUNCTION" with this subsection.
Subsection 1.6.2, “Supported Classes and Instances”	Replace Subsection1.6.2, “Supported Classes and Instances” in Part III, "FUNCTION" with this subsection.
Subsection 1.6.3, “EtherNet/IP Error Codes”	Add the description of this subsection to Subsection 1.6.3, “EtherNet/IP Error Codes” in Part III, "FUNCTION".
EtherNet/IP Adapter function	
Subsection 2.1.1, “Allocation Setting and Scanner Setting”	Replace Subsection 2.1.1, “Allocation Setting and Scanner Setting” in Part III, "FUNCTION" with this subsection.
Subsection 2.1.2, “EDS File”	Add the description of this subsection to Subsection 2.1.2, “EDS File” in Part III, "FUNCTION".
Subsection 2.3.1, “Procedure for Setting the Adapter”	Add the description of this subsection to Subsection 2.3.1, “Procedure for Setting the Adapter” in Part III, "FUNCTION".
Subsection 2.3.4., “Configuration of the EtherNet/IP Adapter Setting Screens”	Replace Subsection 2.3.4., “Configuration of the EtherNet/IP Adapter Setting Screens” in Part III, "FUNCTION" with this subsection.
Subsection 2.3.5, “BASIC Screen and ALLOCATION Screen”	Add the description of this subsection to Subsection 2.3.5, “BASIC Screen and ALLOCATION Screen” in Part III, "FUNCTION".
Subsection 2.4.2, “ADAPTER INFO and SCANNER LIST Screens”	Add the description of this subsection to Subsection 2.4.2, “ADAPTER INFO and SCANNER LIST Screens” in Part III, "FUNCTION".
EtherNet/IP EDA function	
Subsection D.2.1, “EtherNet/IP Adapter Function”	Add the description of this subsection to Subsection D.2.1, “EtherNet/IP Adapter Function” in Part III, "FUNCTION".

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1 EtherNet/IP SCANNER FUNCTION

1.1 OVERVIEW

1.1.2 Terminology

Allocation Setting

For the CNC Adapter function, data areas exchanged with a scanner are specified by a setting called an allocation setting. The PMC data area is used. Up to 16 allocation settings can be specified.

Tag Communication

In communication, when the Originator specifies the Target I/O data, it is a communication method specified by the tag name of the target instead of the instance number of the assembly object.
The EtherNet/IP Scanner function and EtherNet/IP Adapter function of CNC support tag communication in Input Only communication of Class 1.

1.1.5 Tag Communication

The EtherNet/IP Scanner function and EtherNet/IP Adapter function of CNC support tag communication in Input Only communication of Class 1. Exclusive Owner communication is not supported.
To exchange input data and output data like Exclusive Owner communication, please establish a connection by tag communication from both sides as shown below.

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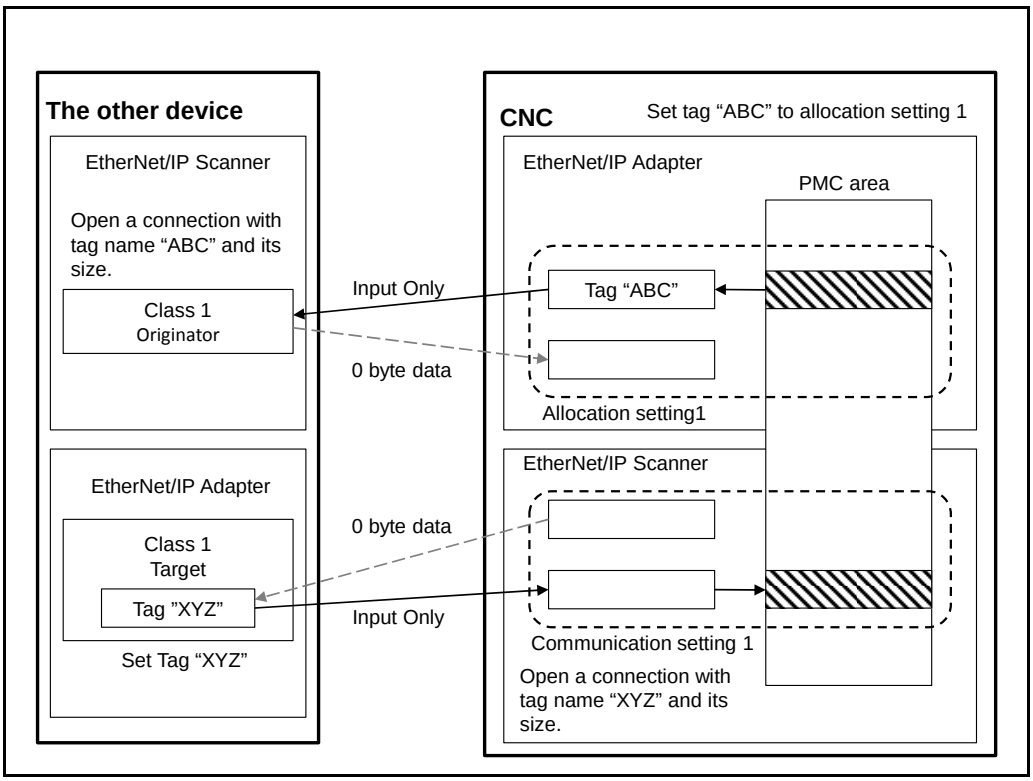

1.2 SPECIFICATION

1.2.2 Lists of Specifications

Specification related to the EtherNet/IP Scanner function

Item	Description
Maximum data size per communication setting	1444 bytes

Specification related to the EtherNet/IP Adapter function

Item	Description
Maximum number of allocation settings	16
Maximum data size per communication setting	1444 bytes

Message Communication Specification

Item	Description
Size of areas available to applications	1444 or less bytes

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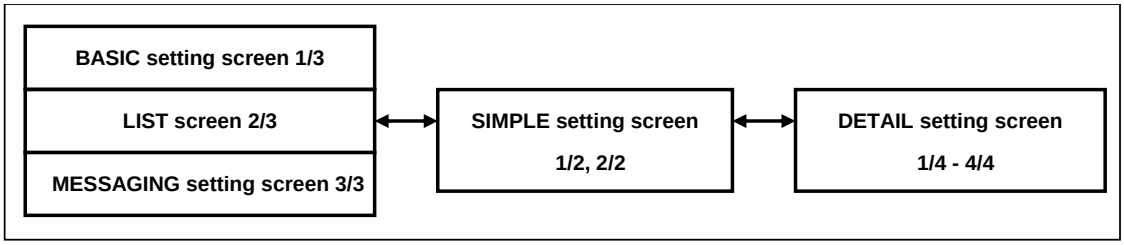
1.3 SETTING

1.3.4 Configuration of the EtherNet/IP Scanner Setting Screens

This subsection explains the setting screens for operating the EtherNet/IP Scanner function.
The figure below shows the configuration of the setting screens.



Configuration of the setting screens of the EtherNet/IP Scanner function

Set general items relating to the EtherNet/IP Scanner function on the BASIC setting screen.
The LIST screen lists communication settings. Selecting a communication setting to modify moves you to the SIMPLE setting screen.
On the SIMPLE setting screen, make setting necessary for I/O communication with an adapter device.
Selecting a setting on the SIMPLE setting screen moves you to the DETAIL setting screen.
On the DETAIL setting screen, make detailed settings for I/O communication, if necessary.
Make settings for the message communication function on the MESSAGING setting screen, if necessary.

The following subsections describe those screens in detail.

For each communication setting, you can select instance ID and tag name as the I/O data specification method.
Also, the displays of LIST screen and SIMPLE setting screen change according to the selection.

NOTE
1. Before changing a parameter on an EtherNet/IP Scanner setting screen, set the MDI mode or emergency stop state.
2. If the Change protection level of the Ethernet function is higher than the Operation level in the 8-level data protection function, no settings can be changed. This rule applies to both operation on a hardware option on which the Ethernet function runs and that on a hardware on which the function does not run.

1.3.5 BASIC Setting Screen and LIST Screen

LIST screen

The LIST screen is displayed on page 2. The screen shows an outline of the communication setting selected by the cursor.

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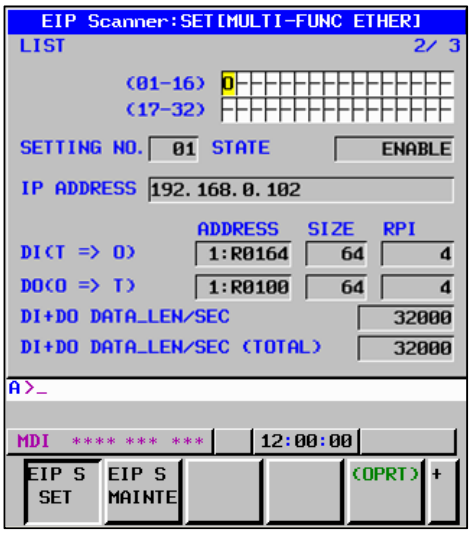
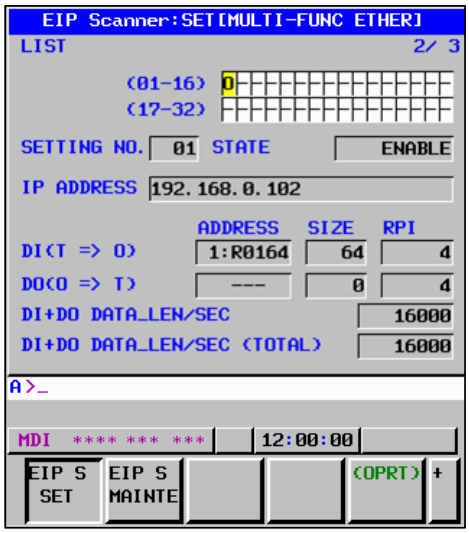
You can change the STATE value (ENABLE or DISABLE). You can also move to the SIMPLE setting screen.

Instance ID



EtherNet/IP Scanner setting screen (LIST - INSTANCE ID)

Tag Name



EtherNet/IP Scanner setting screen (LIST – TAG NAME)

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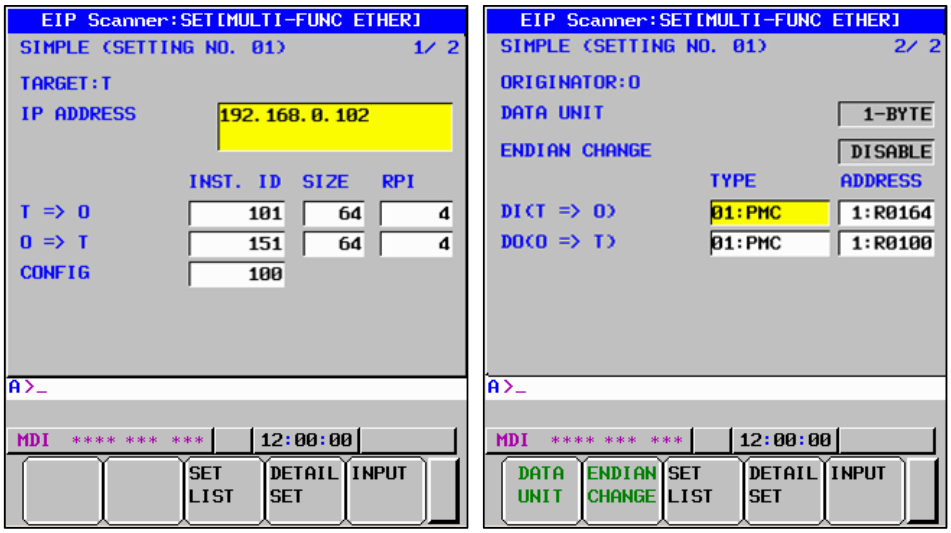
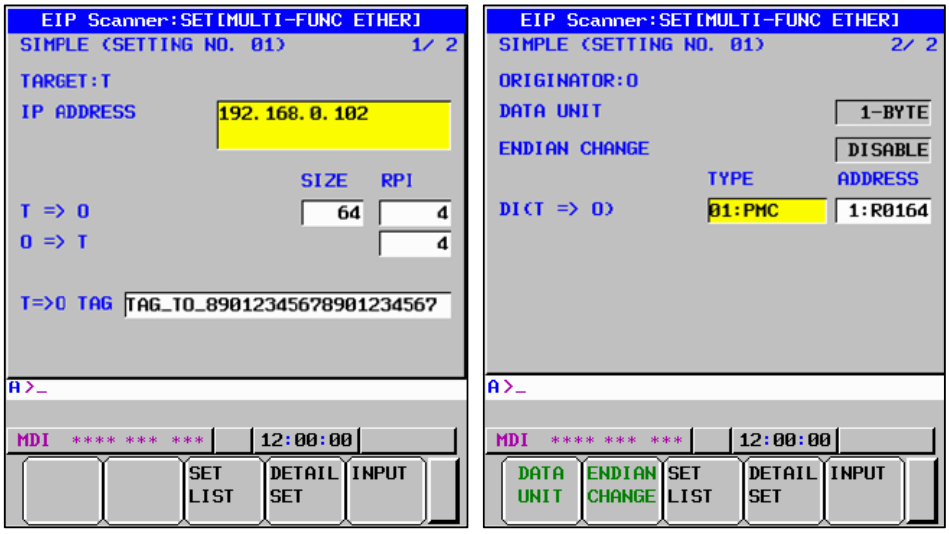
1.3.6 SIMPLE Setting Screen

Instance ID



EtherNet/IP Scanner setting screen (SIMPLE – INSTANCE ID 1/2, 2/2)

Tag Name



EtherNet/IP Scanner setting screen (SIMPLE – TAG NAME 1/2, 2/2)

Setting items

Item	Description
INST.ID Default : 0 Valid settings : 0 to 65535, and blank (SP)	Specify the input instance number, output instance number, and configuration instance number of the assembly class of the adapter device. When this item is not used, specify a blank (SP). In T ⇒ O and O ⇒ T, T means the target (adapter) and O means the originator (scanner).

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Item	Description
TAG Default : blank (SP)	Specify the tag name of the adapter device. The maximum number of character is 27 characters. The characters that can be used are half size alphanumeric characters and the following symbols. ! # $% () + -. = @ [] _ If you do not use tags, please enter " " (blank). In T ⇒ O and O ⇒ T, T means the target (adapter) and O means the originator (scanner).
SIZE Default: 0 Valid setting range: 0 to 1444	Specify the size (in bytes) of an area for storing input/output data.

Operations

Switching the specification method of I/O data

1 Press soft key [(OPRT)]. Soft key [SWITCH] appears.

2 Press soft key [SWITCH]. Soft keys [INST. ID] and [TAG NAME] appear.

3 By Pressing soft key [INST. ID] or [TAG NAME], it is possible to switching the specification method of I/O data.

1.3.7 DETAIL Setting Screen

Setting items

Item	Description
OPTION1 Default: 00000000	Bit 0: For specifying the I/O data when requesting connection to adapter device, 0: the instance ID is used. 1: the tag name is used. Setting can also be done using soft key. Press soft key [SWITCH] on the SIMPLE setting screen and select from soft key [INSTANCE ID] and [TAG NAME]. Bits 1-7: Reserved. (Must be 0.)

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1.3.11 EtherNet/IP MESSAGING Setting Screen

Setting items

Item	Description
TRANSMISSION Default: ---- / 0 bytes Valid setting range: 0, 18 to 1462 bytes	Specify the start address of the transmission area in the PMC area. R/E/D areas of the PMC can be used as the transmission area. Set SIZE to the size of the transmission area in byte. A valid value falls between 18 and 1462. This value can be calculated by adding 18 and the maximum request data size. When SIZE has the default, specifying ADDRESS sets SIZE to 18 automatically. When ADDRESS is not specified, SIZE cannot be set. To reset the value to default, set ADDRESS to space or set SIZE to zero (0).
RECEPTION Default: ---- / 0 bytes Valid setting range: 0, 6 to 1450 bytes	Specify the start address of the reception area in the PMC area. R/E areas of the PMC can be used as the reception area. Set SIZE to the size of the reception area in byte. A valid value falls between 6 and 1450. This value can be calculated by adding 6 and the maximum response data size from the destination. When SIZE has the default, specifying ADDRESS sets SIZE to 6 automatically. When ADDRESS is not specified, SIZE cannot be set. To reset the value to default, set ADDRESS to space or set SIZE to zero (0).

1.3.11.3 Transmission area

Request data size

Specify the size of the request data in byte.
Set this area to zero (0) if the request data are not used.
Valid setting range: 0 to 1444 bytes

1.3.11.4 Reception area

Response data size

This area stores the size of the response data stored in the reception area.
When this area has a value of zero (0), no response data are stored.
If the reception area whose size is specified on the EtherNet/IP Scanner setting screen (MESSAGING) is not big enough to store all the received data, the following message will appear on the EtherNet/IP LOG screen.

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Error No.	Log message	Meaning
E-1171	[D=nn, S=xxH, Storable=nnn, Received=nnn]	The reception area is not big enough to store all the received data. D = Destination number S = Service code Storable = the maximum size of the data to store Data range: 0 to 1444 bytes Received = the size of the received data Data range: 1 or more bytes (more than Storable)

1.5 COMMUNICATION CONDITIONS

1.5.2 Estimating the Communication Load

This subsection explains the method for estimating the load based on the communication settings. When running the EtherNet/IP function on two hardware options, check the communication load individually on these hardware options.
The communication load can be estimated based on the RPI and data size values specified for the connections. These connections include both connections created by the Adapter function and those created by the Scanner function.
For stable communication, set the RPI value so that the following conditional expression is satisfied.

For all connections created by the Adapter and Scanner functions

$$\text{Total of } \left(\frac{\text{DI size (bytes)} + 360}{\text{DI RPI (ms)}} + \frac{\text{DO size (bytes)} + 360}{\min(32,\ \text{DO RPI (ms)})} \right) <= 750$$

Where, min(32, DO RPI) is

$$\min(32,\ \text{DO RPI}) = \begin{cases} 32 & (\text{DO RPI} >= 32) \\ \text{DO RPI} & (\text{DO RPI} < 32) \end{cases}$$

When the size is 0, do not omit the relevant item, but add the value of 360/RPI.
Example) When only the Scanner function is used

- DI/DO = 8/8 bytes, RPI = 8 ms, 2 units
- DI/DO = 1444/1444 bytes, RPI = 128 ms, 4 units
- DI/DO = 32/0 bytes, RPI = 30 ms, 2 units

$$\left(\frac{8+360}{8} + \frac{8+360}{8} \right) \times 2 + \left(\frac{1444+360}{128} + \frac{1444+360}{32} \right) \times 4 + \left(\frac{32+360}{30} + \frac{0+360}{30} \right) \times 2 = 516.0$$

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NOTE

The communication load estimated according to the above conditional expression is just a standard value and does not guarantee performance.
When other Ethernet functions including the FOCAS2/Ethernet functions and CNC screen display function are used in addition to the EtherNet/IP function, give an enough margin for the setting to use these functions.

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1.6 APPENDIX

1.6.2 Supported Classes and Instances

The supported classes and instances are listed below. When item "A" is checked, the corresponding class is supported by the Adapter function; when item "S" is checked, the corresponding class is supported by the Scanner function.

Name	A	S	Class	Instance(s)
Identity	✓	✓	01h	01h
Message Router	✓	✓	02h	01h
Assembly	✓		04h	64h, 65h～74h, 97h～A6h, FEh, FFh
Connection Manager	✓	✓	06h	01h
Connection Configuration		✓	F3h	01h
Port	✓	✓	F4h	01h
TCP/IP	✓	✓	F5h	01h
Ethernet Link	✓	✓	F6h	01h

The relationships between allocation setting numbers and Assembly object instances for the Adapter function are shown below.

Allocation Setting number	Output Assembly (T→O)	Input Assembly (O→T)		
	Exclusive Owner, Input Only, Listen Only	Exclusive Owner	Input Only	Listen Only
	Size : 1 - 1444 bytes	Size : 1 - 1444 bytes	Size: 0 byte	Size: 0 byte
1	65h (101)	97h (151)	FEh (254)	FFh (255)
2	66h (102)	98h (152)		
3	67h (103)	99h (153)		
4	68h (104)	9Ah (154)		
5	69h (105)	9Bh (155)		
6	6Ah (106)	9Ch (156)		
7	6Bh (107)	9Dh (157)		
8	6Ch (108)	9Eh (158)		
9	6Dh (109)	9Fh (159)		
10	6Eh (110)	A0h (160)		
11	6Fh (111)	A1h (161)		
12	70h (112)	A2h (162)		
13	71h (113)	A3h (163)		
14	72h (114)	A4h (164)		
15	73h (115)	A5h (165)		
16	74h (116)	A6h (166)		

Allocation Setting number	Configuration Assembly
1 - 16	64h (100) Size: 0 bytes

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1.6.3 EtherNet/IP Error Codes

ERR GEN (Hex)	ERR EXT (Hex)	Detected by	Description
01	012E	Adapter	The specified tag name (T ⇒ O) is wrong.

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2 EtherNet/IP ADAPTER FUNCTIONE

2.1 OVERVIEW

2.1.1 Allocation Setting and Scanner Setting

In a CNC allocation setting, specify I/O areas to be used for exchanging data with a scanner. More specifically, specify the addresses and sizes of the PMC area. Up to 16 allocation settings can be specified for one hardware option.

An example of specification for using two allocation settings is shown below.

Allocation setting number		PMC address	Size
1	DI	1:R1008	8
	DO	1:R1000	8
2	DI	1:R2016	16
	DO	1:R2000	16
3 - 16	DI	＜Not used＞	＜Not used＞
	DO	＜Not used＞	＜Not used＞

This number includes 101, 151, 102, and 152 in the following figure. These internal data numbers are called Assembly object instances.
In the CNC, an allocation setting and corresponding Assembly object instances are fixed and this correspondence is contained in the relevant EDS file.
A scanner setting tool can acquire each allocation setting and its corresponding Assembly object instances in the CNC by reading the EDS file. The scanner setting tool specifies an allocation setting number as a connection used for communication. With this operation, the Assembly object instances are determined and a scanner device uses the number to communicate with the CNC.
For this reason, when a scanner device is set using an EDS file, the data areas in a destination CNC can be specified with an allocation setting number.

If you specify the data of the adapter in the scanner, you can specify the data area of CNC with the tag name instead of the instance number of the Assembly object.

A general setting procedure for EtherNet/IP communication is shown below:
<1> On the CNC screen, specify values for each allocation setting.
<2> Output an EDS file in the CNC.
<3> Use a scanner setting tool to read the EDS file created in step <2>.
<4> On the scanner setting tool, select a CNC allocation setting used for communication. Make settings for the scanner if necessary.
<5> Transfer the EtherNet/IP setting from the scanner setting tool to the scanner device. The scanner device is notified of the Assembly object instances corresponding to the specified CNC allocation setting.
<6> The scanner device uses the Assembly object instances to create a connection to the CNC and exchange DI/DO data.

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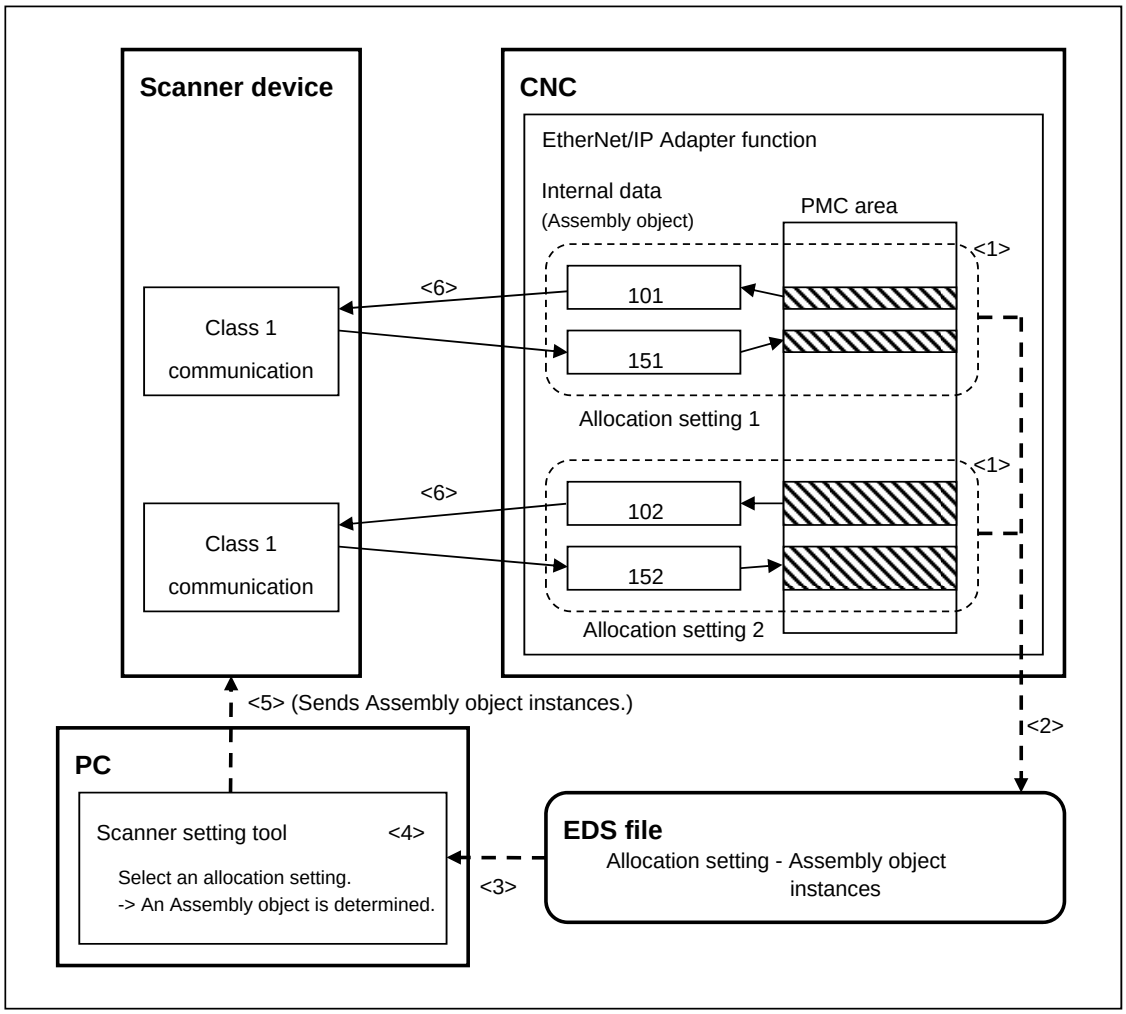

NOTE

1 This chapter covers steps <1> and <2> in the figure. For details of steps <3> to <5>, refer to the manual of the scanner device you want to use.

2 In either of the following cases, specify the Assembly object instances corresponding to each allocation setting on the scanner and scanner setting tool:
- To set the scanner without using an EDS file
- To execute Class 3 communication with the CNC

3 For details of Assembly object instances, see Subsection 1.6.2, "Supported

2.1.2 EDS File

Data for the Adapter function in an EDS file

Standard data and data corresponding to each allocation setting are the same except how connections are set.

The following explains how connections are set.

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Standard data

The following connection settings are saved regardless of allocation settings in the CNC.
[16 types of allocation settings, Nos. 01 to 16] × [4 types of communication, Exclusive Owner, Input Only, and Listen Only, Input Only (Tag)] = Total of 64 types
The EDS file does not contain DI/DO data sizes. On a scanner setting tool, specify these sizes according to the allocation settings in the CNC.

Data corresponding to each allocation setting

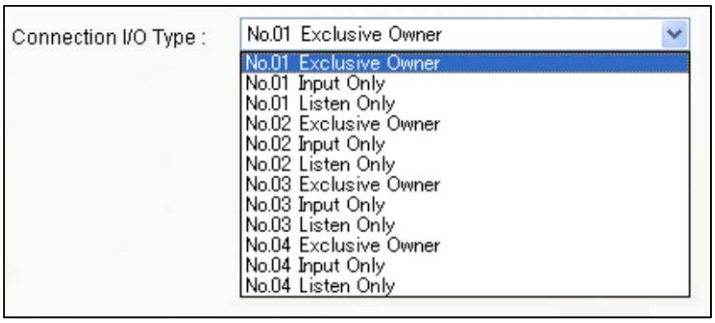
Data corresponds to each allocation setting in the CNC. The setting of the connection in each allocation setting for which STATE is ENABLE is saved.
Only when each type of communication is valid according to the DI/DO sizes set in each allocation setting in the CNC, it is saved.
If DO size is 1 or more and the tag name is set, the tag communication is saved as the communication type.

DI/DO sizes in an allocation setting	Exclusive Owner	Input Only	Listen Only
DI size: 1 or more DO size: 1 or more	✓	✓	✓
DI size: 0 DO size: 1 or more		✓	✓
DI size: 1 or more DO size: 0	✓		

The EDS file contains the DI/DO sizes specified in each allocation setting in the CNC. Therefore, it is not necessary to specify these sizes on a scanner setting tool.

Selecting a connection on a scanner setting tool

On a scanner setting tool, connection settings in an EDS file are displayed under items including "Connection I/O Type" and "Connection Name".



Sample screen on a scanner setting tool

A connection name displayed on a scanner setting tool is explained below.

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Select an allocation setting and type of communication that are to be used for communication with the target adapter.

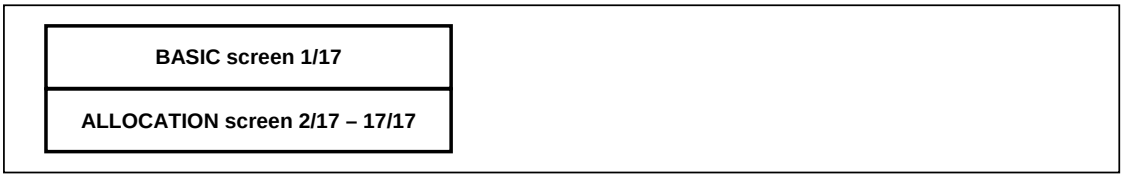
2.3 SETTING

2.3.1 Procedure for Setting the Adapter

	Operation	Description
3	Specify items on the ALLOCATION screen on pages 2 to 17.	Specify items required for allocation settings Nos. 1 to 16.

2.3.4 Configuration of the EtherNet/IP Adapter Setting Screens

This subsection explains the setting screens for operating the EtherNet/IP Adapter function. The configuration of the setting screens is shown below.



Configuration of the setting screens for the EtherNet/IP Adapter function

Use the BASIC screen to set general items related to the EtherNet/IP Adapter function.
One page of the ALLOCATION screen corresponds to one allocation. Up to 16 allocation settings can be specified.

2.3.5 BASIC Screen and ALLOCATION Screen

BASIC screen

The BASIC screen is displayed on page 1. Specify items common to the EtherNet/IP Adapter function.

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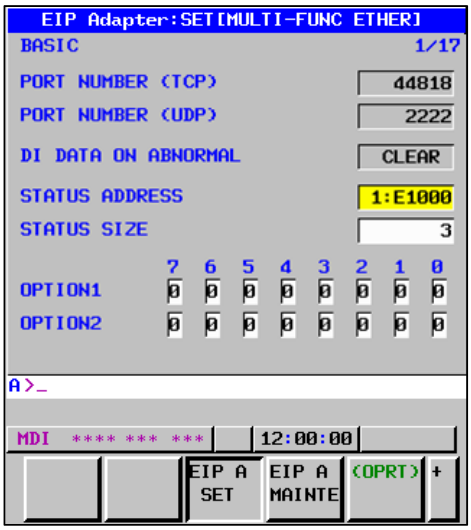

EtherNet/IP Adapter setting screen (BASIC)

Setting items

Item	Description
STATUS SIZE Default: 0 Valid settings: 0, 1, 3, and 5	Specify the size of the PMC area for storing the status. Data to be output to the PMC area can be determined according to the size. If you do not want to use the status, specify 0. "---" is displayed in "STATUS ADDRESS" and 0 is displayed in "STATUS SIZE".

Status

The status is detected by the EtherNet/IP Adapter function. When STATUS SIZE is 1, only the 1st byte is output to the PMC area; when it is 5, all information is output to the area.

		Status							
		#7	#6	#5	#4	#3	#2	#1	#0
Status address	+0	OPE	–	–	–	–	–	–	ERR
	+1	ENA8	ENA7	ENA6	ENA5	ENA4	ENA3	ENA2	ENA1
	+2	IN8	IN7	IN6	IN5	IN4	IN3	IN2	IN1
	+3	ENA16	ENA15	ENA14	ENA13	ENA12	ENA11	ENA10	ENA9
	+4	IN16	IN15	IN14	IN13	IN12	IN11	IN10	IN9

The number at the end of each signal name indicates the number of the corresponding allocation setting. This number is represented as x in the table below.

Signal	Description
ERR	An error occurs. (MS: RECOVERABLE FAULT or UNRECOVERABLE FAULT)
OPE	Communication is normally operating. (MS: DEVICE OPERATIONAL)
ENAx	Item "STATE" of allocation setting x is "ENABLE".
INx	An Exclusive Owner connection is being connected to allocation setting x.

⚠ CAUTION
When IN1 to IN16 in the status is 1, the value of the DI signal is not always valid. Check the actual signal value to see whether communication is being executed.

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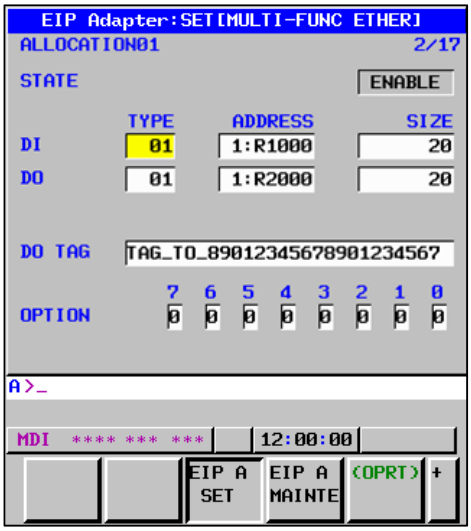
ALLOCATION screen

The ALLOCATION screen is displayed on pages 2 to 17. Pages 2 to 17 correspond to allocation setting 1 to 16, respectively.



EtherNet/IP Adapter setting screen (ALLOCATION)

Setting items

Item	Description
SIZE Default: 0 Valid setting range: 0 to 1444	Specify the size (in bytes) of the area for storing DI/DO data. When "TYPE" is 0, no value can be set. When "TYPE" is 1, specify the size of the PMC area for storing DI/DO data. While considering the "ADDRESS" setting, specify a value so that the area is within the PMC area range.
TAG Default: blank (SP)	Specify the tag name of DO data. The maximum number of character is 27 characters. The characters that can be used are half size alphanumeric characters and the following symbols. ! # $% () + -. = @ [] _ If you do not use tags, please enter " " (blank). Capital letters and lowercase letters are not distinguished. When setting the tag name, please give a tag name which does not overlap with other allocation settings.

2.4 MAINTENANCE

2.4.2 ADAPTER INFO and SCANNER LIST Screens

SCANNER LIST screen

The SCANNER LIST screen is displayed on pages 2 to 5. A list of scanners being connected is displayed.

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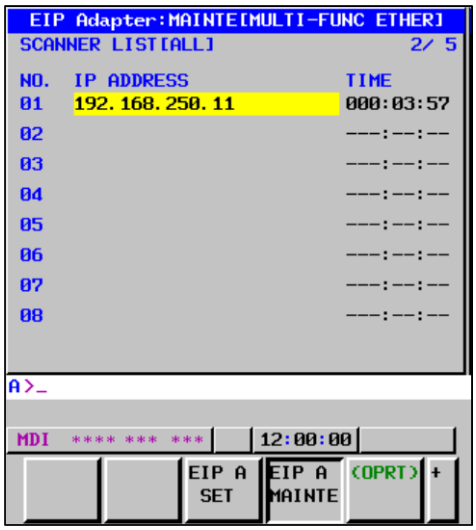

EtherNet/IP Adapter maintenance screen (SCANNER LIST)

Operations

Changing the scanners displayed in the list according to an allocation setting

1 Press soft key [(OPRT)]. Soft key [FILTER] appears.

2 Each time soft key [FILTER] is pressed, the end of the title changes as follow:
[ALL]→[ALLOCATION01]→[ALLOCATION02]→[ALLOCATION03]→[ALLOCATION04]→…
→[ALLOCATION16]→[ALL]→
Only the scanners connected to the allocation setting displayed in brackets are displayed in the list.
If you enter 1 to 16 in the key-in buffer and press the soft key [FILTER], the setting will switch to the specified allocation.
The connections for connected Explicit messaging (Class 3 server) are displayed when [ALL] is specified.

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D EtherNet/IP EDA FUNCTION

D.2 SETTING

D.2.1 EtherNet/IP Adapter Function

項目	説明
Option Default setting: 00000000	Bit 3: EDA function is: 0: Not used. 1: Used. This setting is valid only for the allocations 01 to 04. In addition, when using the EDA function, it is necessary to set the DI/DO size within 256 bytes.

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02	Mar., 2014	• Addition of warnings to "Safety Precautions" • Correction of errors
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