FANUC Robot series

R-30iA/R-30iB/R-30iB Mate/R-30iB Plus/R-30iB Mate Plus/ R-30iB Compact Plus/R-30iB Mini Plus CONTROLLER

PROFINET Function

OPERATOR'S MANUAL

B-82864EN/08

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┌──────────────────────────────────────────────────────────────┐
│                    ● Original Instructions                   │
└──────────────────────────────────────────────────────────────┘
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Thank you very much for purchasing FANUC Robot.

Before using the Robot, be sure to read the "FANUC Robot series SAFETY HANDBOOK (B-80687EN)" and understand the content.

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┌──────────────────────────────────────────────────────────────┐
│  In this manual, we endeavor to include all pertinent        │
│  matters. There are, however, a very large number of         │
│  operations that must not or cannot be performed, and if the │
│  manual contained them all, it would be enormous in volume.  │
│  It is, therefore, requested to assume that any operations   │
│  that are not explicitly described as being possible are     │
│  "not possible".                                            │
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SAFETY PRECAUTIONS

This chapter describes the precautions which must be followed to enable the safe use of the robot. Before using the robot, be sure to read this chapter thoroughly.

For detailed functions of the robot operation, read the relevant operator's manual to understand fully its specification.

For the safety of the operator and the system, follow all safety precautions when operating a robot and its peripheral equipment installed in a work cell.
For safe use of FANUC robots, you must read and follow the instructions in "FANUC Robot series SAFETY HANDBOOK (**B-80687EN)**".

1   PERSONNEL

Personnel can be classified as follows.

Operator:
- Turns the robot controller power ON/OFF
- Starts the robot program from operator panel

Programmer or Teaching operator:
- Operates the robot
- Teaches the robot inside the safeguarded space

Maintenance technician:
- Operates the robot
- Teaches the robot inside the safeguarded space
- Performs maintenance (repair, adjustment, replacement)

- The operator is not allowed to work in the safeguarded space.
- The programmer or teaching operator and maintenance technician are allowed to work in the safeguarded space. Works carried out in the safeguarded space include transportation, installation, teaching, adjustment, and maintenance.
- To work inside the safeguarded space, the person must be trained on proper robot operation.

Table 1 (a) lists the work outside the safeguarded space. In this table, the symbol "O" means the work allowed to be carried out by the specified personnel.

Table 1 (a) List of work outside the Safeguarded Space

	Operator	Programmer or Teaching operator	Maintenance technician
Turn power ON/OFF to Robot controller	O	O	O
Select operating mode (AUTO/T1/T2)		O	O
Select remote/local mode		O	O
Select robot program with teach pendant		O	O
Select robot program with external device		O	O
Start robot program with operator's panel	O	O	O
Start robot program with teach pendant		O	O
Reset alarm with operator's panel		O	O
Reset alarm with teach pendant		O	O
Set data on teach pendant		O	O
Teaching with teach pendant		O	O
Emergency stop with operator's panel	O	O	O
Emergency stop with teach pendant	O	O	O
Operator's panel maintenance			O
Teach pendant maintenance			O

During robot operation, programming and maintenance, the operator, programmer, teaching operator and maintenance technician take care of their safety using at least the following safety protectors.

- Use clothes, uniform, overall adequate for the work
- Safety shoes
- Helmet

2 DEFINITION OF SAFETY NOTATIONS

To ensure the safety of users and prevent damage to the machine, this manual indicates each precaution on safety with "**WARNING**" or "**CAUTION**" according to its severity. Supplementary information is indicated by "**NOTE**". Read the contents of each **"WARNING"**, "**CAUTION**" and "**NOTE**" before using the robot.

Symbol	Definitions
⚠**WARNING**	Used if hazard resulting in the death or serious injury of the user will be expected to occur if he or she fails to follow the approved procedure.
⚠**CAUTION**	Used if a hazard resulting in the minor or moderate injury of the user, or equipment damage may be expected to occur if he or she fails to follow the approved procedure.
NOTE	Used if a supplementary explanation not related to any of WARNING and CAUTION is to be indicated.

TABLE OF CONTENTS

APPENDIX

1   OVERVIEW

1.1   OVERVIEW OF PROFINET

PROFINET I/O is an open network for automation, based on industrial Ethernet. The robot controller can communicate with other PROFINET devices, such as PLC or peripheral devices by PROFINET real-time communication (RT is supported, IRT is not supported).

The following is an example of PROFINET I/O network. There are I/O Controllers that control network, and I/O Devices that are connected to I/O Controller. The robot controller works as an I/O Device to communicate with PLC. On the other hand, the robot controller works as an I/O Controller to communicate with peripheral devices.
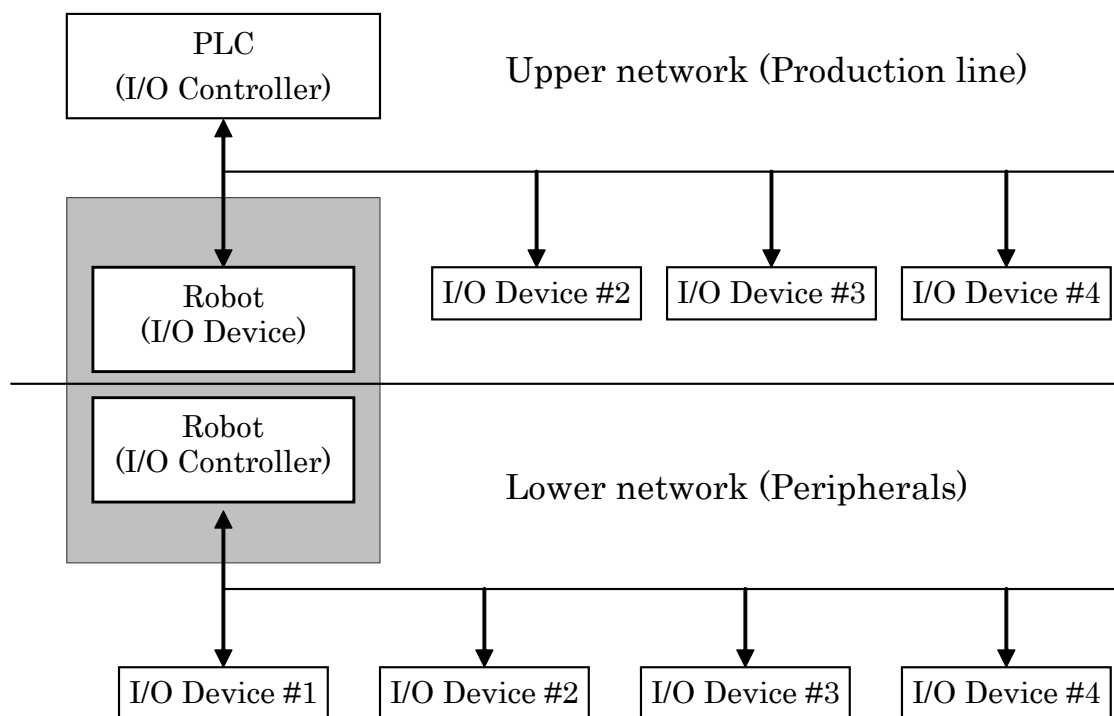
This documents aims to explain how to setup and use the robot controller as a PROFINET I/O Controller and I/O Device, and the screens and the error codes of PROFINET interface function.

1.2   OVERVIEW OF COMMUNICATION FUNCTION

This manual explains the following functions.

Option software	Description
PROFINET I/O	This option software is necessary for PROFINET communication. This function has been supported by R-30*i*A, R-30*i*B, R-30*i*B Mate (Open Air).
PROFINET I-device	PROFINET I-device is PROFINET V2.3 compliant and is based on PROFINET I/O. This function has been supported by R-30*i*B Plus. Please refer to Chapter 7 and 8 for details.
Dual Channel PROFINET	This option software is necessary for PROFINET communication using mini-slot size communication board. It is PROFINET V2.3 compliant on R-30iB Plus. This function has been supported by R-30*i*B, R-30*i*B Mate, R-30*i*B Plus, R-30*i*B Mate Plus, R-30*i*B Compact Plus. It has been not supported by R-30*i*B Mate (Open Air). Please refer to Appendix D for details.
PROFINET FANUC board	This option software is a necessary for PROFINET communication using a FANUC PROFINET board. This function has been supported by R-30*i*B Plus Please refer to Chapter 9 and 10 for details.

2   PROFINET I/O

2.1   SPECIFICATION

Name	Description
PROFINET	I/O Controller, I/O Device
Number of digital input	Up to 2048 points in total for I/O Controller and I/O Devices.
Number of digital output	Up to 2048 points in total for I/O Controller and I/O Devices.
Number of analog input	Up to 50 channel in total for I/O Controller and I/O Devices
Number of analog output	Up to 50 channel in total for I/O Controller and I/O Devices

2.2   ORDER INFORMATION

2.2.1   Software

Table 2.2.1 (a) Software ordering specification

Ordering specification	Option software	Description
A05B-2600-J930 (R-30*i*B) A05B-2500-J930 (R-30*i*A)	PROFINET I/O	This option software is necessary for using PROFINET I/O function. For R-30*i*A, please use 7DA7/30(V7.70P/30) or later for any new installation with PROFINET I/O function. PROFINET function has been changed since it was first released on 7DA3/17(V7.30P/17). There are some features that require newer software. R-30*i*B supports all features supported by "7DA7/22(V7.70P/22)" if not otherwise specified.
A05B-2600-J931 (R-30*i*B) A05B-2500-J931 (R-30*i*A)	PROFINET Safety	This option software is for safety communication on PROFINET. This option software requires PROFINET I/O option software. This function has been supported since 7DA7/22(V7.70P/22) in R-30*i*A.

Table 2.2.1 (b) Software ordering specification (R-30*i*B)

Ordering specification	Option software	Description
A05B-2600-J744	PROFINET Firmware	The firmware of the PROFINET board corresponding to the software version of the controller is written to the controller at shipment. The controller's FROM module size must be at least 64 MB. Please refer to Appendix A.4 for details.

NOTE
1   This function is changed in 7DC3(V8.30). There is a change in the setting method, and the compatibility of the configuration file PNIO.SV is lost, so the configuration file PNIO.SV of 7DC1(V8.10) and 7DC2(V8.20) cannot be read into 7DC3(V8.30). (7DC1(V8.10) and 7DC2(V8.20)) and 7DC3(V8.30) are recognized as different products in the network. Please refer to Appendix E for details.
2   For PROFINET safety function in R-30iB, PROFINET board (CP1604) must be used.

> **NOTE**
> 3 For PROFINET Safety function that exchanges safety signals on PROFINET I/O
>   Device, please read "R-30iA/R-30iA Mate CONTROLLER Dual Check Safety
>   Function (ISO 13849-1:2006 compliant) OPERATOR'S MANUAL (B-83104EN)"
>   or "R-30iB/R-30iB Mate/R-30iB Plus/R-30iB Mate Plus/R-30iB Compact Plus
>   CONTROLLER Dual Check Safety Function OPERATOR'S MANUAL
>   (B-83184EN)" in addition to this manual.
> 4 For 7DA3(V7.30), boot software must be 7DA3/17(V7.30P/17) or later. Install all
>   software to update boot software before installing PROFINET board.

2.2.2　Hardware

PROFINET I/O function needs two hardware, motherboard (FANUC hardware), and PROFINET board (Siemens hardware). There are PCI type PROFINET board (CP1616), and PC104+ type PROFINET board (CP1604). CP1616 and CP1604 are the products of Siemens. CP1604 is supported by 7DA7/22(V7.70P/22) or later and R-30iB. Please also refer to Subsection 2.2.3 for PROFINET board firmware.

> **NOTE**
> There are some requirements when the external power is supplied to PROFINET
> board. Please refer to 2.3 for more details.

PROFINET motherboard

There are motherboard for full slot, and wide-mini slot. The motherboard is selected by the type of PROFINET board. Please use the ordering specification A05B-2600-J073 to order a motherboard for the wide-mini slot and CP1604 together.

Table 2.2.2 (a) Hardware ordering specification for motherboard (R-30iB)

Ordering Specification	Description
A05B-2600-J075	PROFINET motherboard Wide-mini slot size. This board is used with CP1604.
A05B-2600-J073	PROFINET motherboard Wide-mini slot size. It is shipped with CP1604 installed.
A05B-2600-J060	PROFINET motherboard Full slot size. This board is used with CP1616.

Table 2.2.2 (b) Hardware ordering specification for motherboard (R-30iA)

Ordering Specification	Description
A05B-2500-J075	PROFINET motherboard Wide-mini slot size. This board is used with CP1604.
A05B-2500-J063	PROFINET motherboard Full slot size. This board is used with CP1616.

PROFINET BOARD(CP1604)

CP1604 can be installed to R-30iA/R-30iB with A-cabinet and B-cabinet and R-30iB Mate (Open Air). PROFINET motherboard Wide-mini slot size is needed to install CP1604 to the backplane of R-30iA/R-30iB (wide-mini slot). CP1604 is supported by 7DA7/22(V7.70P/22) or later and R-30iB.
The order number for direct purchase from Siemens is 6GK1-160-4AA01. It replaces the discontinued order number 6GK1-160-4AA00.

PROFINET BOARD(CP1616)

CP1616 can be installed to R-30iA/R-30iB with B-cabinet. CP1616 can't be installed to R-30iA/R-30iB with A-cabinet. PROFINET motherboard Full slot size is needed to install CP1616 to the backplane of R-30iA/R-30iB (full slot). In R-30iB, the motherboard can be installed only on the full slot next to the main board (slot 2).
The current order number is 6GK1 161-6AA02. It replaces the two former, discontinued order number, 6GK1 161-6AA00 and 6GK1 161-6AA01.

2.2.3 PROFINET Board Firmware

PROFINET board firmware needs to be the version corresponding to the robot software. If they are different, they need to be rewritten to a compatible version. Please refer to Appendix A.4 for details.

Table 2.2.3 (a) Firmware version (R-30iA)

Robot software version	Firmware version
7DA3/17-34(V7.30P/17-34) 7DA4/01-19(V7.40P/01-19) 7DA5/01-09(V7.50P/01-09)	V2.1.3, V2.1.4
7DA3/35(V7.30P/35) or later 7DA4/20(V7.40P/20) or later 7DA5/10(V7.50P/10) or later 7DA7/01-21(V7.70P/01-21)	V2.3.1, V2.4.1
7DA7/22(V7.70P/22) or later	V2.5.2.0

Table 2.2.3 (b) Firmware version (R-30iB/R-30iB Mate Open Air)

Robot software version	Firmware version
7DC1(V8.10) 7DC2(V8.20)	V2.5.2.2.1
7DC3(V8.30)	V2.6.0.3

> ⚠ **WARNING**
> PROFINET board firmware needs to be the version corresponding to the robot software.

> **NOTE**
> 1 If the robot software version is not listed in the table above, please contact FANUC.
> 2 The firmware version before V2.3.2 does not work with 6GK1 161-6AA02.
> 3 The firmware version before V2.2 does not work with 6GK1 161-6AA01.
> 4 For the robot software version 7DA3/35(V7.30P/35) or later, 7DA4/20(V7.40P/20) or later, 7DA5/10(V7.50P/10) or later, 7DA7/01-21(V7.70P/01-21), The CP1616 with order number, 6GK1 161-6AA02 canbe used for new hardware or replacement, however the firmware must be downgraded to V2.4.1 or later (V2.4.x; but not V2.5.x). The CP1616 with two former order number, 6GK1 161-6AA00 and 6GK1 161-6AA01 can be used but the firmware must be V2.3.1 or later (V2.3.x or V2.4.x).
> 5 Please follow the procedure below to downgrade the firmware from V2.5.2 if the order number is 6GK1 161-6AA01 or 6GK1 161-6AA02.
>   1) Download the V2.5.0 to the PROFINET board in SUSPEND mode.
>   2) Cycle power the robot controller.
>   3) Download the required firmware to the PROFINET board in SUSPEND mode.

2.2.4 GSDML File

GSDML file is used by configuration software. GSDML file provides the information of the device as a PROFINET I/O Device. In order to communicate with the robot controller, the GSDML file is read and used by the I/O Controller configuration software when configuring the I/O Controller. Select the GSDML file to be used according to the robot controller software version.

PROFINET XML-Viewer or PROFINET GSD Checker, which is available from Siemens, is useful to see the content of the GSDML file.

Notes on using GSDML file in STEP7

The GSDML file for robot by FANUC is a third-party GSDML file. Siemens configuration tool may need the update for "I/O device coupling with I/O devices of third-party vendor" (available from Siemens) to configure I/O coupling of the robot (as a third-party I/O Device), and PC-Station (as an I/O Controller).

Vendor ID and Device ID of GSDML file

In the GSDML file, identification information of I/O Device is defined by vendor ID and device ID. Vendor ID is a unique number for a device manufacturer. 0x01B7 = 439 corresponds to FANUC. 0x002A = 42 corresponds to Siemens. The robot software version 7DA7/22(V7.70P/22) or before uses Siemens GSDML file, so the vendor ID is that of Siemens. Device ID is a number assigned by the manufacturer for each product. The I/O Controller identifies the I/O Device by the vendor ID and device ID. Communication cannot be performed if they are incorrect.

Table 2.2.4 (a) GSDML file(R-30*i*A)

Robot software version	File name	Vendor ID	Device ID
7DA3(V7.30) 7DA4(V7.40) 7DA5(V7.50) 7DA7/01-21 (V7.70P/01-21)	GSDML-V2.2-Siemens-CP16xx-20100709-142000.xml	0x002A	0x0003
7DA5/14(V7.50P/14) or later (selection)	GSDML-V2.2-Fanuc-J930-20100831.xml	0x01B7	0x0001
7DA7/22(V7.70P/22) or later	GSDML-V2.25-Fanuc-J930-20120113.xml	0x01B7	0x0001

> **NOTE**
> For 7DA5/14(V7.50P/14) or later, GSDML file which use vendor ID and device ID of FANUC can be used. Please change $PNIO_CFG.$CUSTOM from 0 to 1, and cycle power the robot controller to use it. This is recommended when compatibility with 7DA5/13(V7.50P/13) or before is not required. This setting changes the vendor ID and the device ID parameters in the robot controller to match the GSDML file.

Table 2.2.4 (b) GSDML file (R-30*i*B/R-30*i*B Mate Open Air)

Robot software version	File name	Vendor ID	Device ID
7DC1(V8.10) 7DC2(V8.20)	GSDML-V2.25-Fanuc-A05B2600J930-20120627.xml	0x01B7	0x0002
7DC3(V8.30)	Refer to Table 2.2.4 (c)	0x01B7	0x0005 0x0006 0x0007 0x0008

There are four types of 7DC3(V8.30) GSDML files, which can be selected depending on the PROFINET board type and whether the I/O Controller is enabled. The device ID differs in each GSDML file, so I/O Controller recognizes R-30*i*B as a different device. Please refer to Appendix E.3 for details.

Table 2.2.4 (c) GSDML file of 7DC3(V8.30)

Conditions	File name	Vendor ID	Device ID
CP1616 I/O controller enabled	GSDML-V2.3-Fanuc-A05B2600J930V820M6-20131203.xml	0x01B7	0x0005
CP1616 I/O controller disabled	GSDML-V2.3-Fanuc-A05B2600J930V820D6-20131203.xml	0x01B7	0x0006
CP1604 I/O controller enabled	GSDML-V2.3-Fanuc-A05B2600J930V820M4-20131203.xml	0x01B7	0x0007
CP1604 I/O controller disabled	GSDML-V2.3-Fanuc-A05B2600J930V820D4-20131203.xml	0x01B7	0x0008

2.3   REQUIERMENTS

1   This function needs motherboard (available from FANUC), and PROFINET board (CP1604 or CP1616, available from Siemens).
2   To configure PROFINET board, PC that Siemens configuration tool is installed is needed. One of the following PC configuration tool is required to perform setup.
-    NCM PC : Configuration software bundled with CP1604/CP1616.
-    STEP7 :   Configuration software for Siemens PLC

> **NOTE**
>   Use NCM/STEP7 V5.5 or later as configuration software for V2.5.2 firmware.

3   The software version must be 7DA7/22(V7.70P/22) or later in R-30*i*A with A-cabinet to use CP1604 because CP1616 can't be installed to the robot controller with A-cabinet.
4   The software version must be 7DA7/22(V7.70P/22) or later to use PROFINET Safety (F-Device) in R-30*i*A. The software version must be 7DC1/06(V8.10P/06) or later to use PROFINET Safety (F-Device) in R-30*i*B. PROFINET board (CP1604) must be used for PROFINET Safety (F-Device) in R-30*i*B.
5   There are some requirements when the external power is supplied to PROFINET board.
   a   The watchdog function of CP1604/CP1616 must be disabled by setting the system variable, $PNIO_CFG.$WD_ENABLE from 1 to 0. Cycle power is required to activate the change.
   b   The software version must be 7DA7/27(V7.70P/27) or later in R-30*i*A.
   c   I/O Router function cannot be used in R-30*i*A.

2.4   RESTRICTIONS

1   This function cannot be used in R-30*i*A Mate.
2   PROFINET can coexist with TCP/IP, but TCP/IP via PROFINET board is not supported.
     Connect Ethernet cable to the Ethernet port of the main board of the robot controller to use TCP/IP.
3   Start up the robot controller in SUSPEND start up mode when firmware of PROFINET board CP1616 is to be loaded. If the software version is 7DA7/22(V7.70P/22) or later, the firmware can be downloaded at Controlled Start (Please refer to Appendix A.4).
4   PROFINET Safety function only supports F-Device. It doesn't support F-Host.

2.5   READ BEFORE ROBOT SOFTWARE UPDATE

This section is for R-30*i*A. PROFINET I/O function was changed greatly in 7DA7/22(V7.70P/22). If the robot software with PROFINET I/O function is to be updated from 7DA7/01-21(V7.70P/01-21) to 7DA7/22(V7.70P/22) or later, please read the following information, and refer to Appendix C before update.

NOTE
1   Please use 7DA7/25(V7.70P/25) or later if legacy vendor ID and device ID must be used, for example, to solve compatibility problem, because 7DA7/22-24(V7.70P/22-24) always use new vendor ID and device ID. Please refer to table 2.2.4 (a) for the values of vendor ID and device ID. Refer to Appendix C.2 and Appendix C.4.1 for more detail.
2   Vendor ID and device ID are changed in 7DA7/22(V7.70P/22) as written in table 2.2.4 (a). Therefore the robot as I/O Device is identified as another device if the robot software is updated from 7DA7/01-21(V7.70P/01-21) to 7DA7/22(V7.70P/22) or later.
3   Restoring PNIO.SV from 7DA7/01-21(V7.70P/01-21) to 7DA7/22(V7.70P/22) or later overwrites the internal database that contains the module ID of V2.5 data access point by old database. This can be recovered by changing some system variables. Refer to Appendix C for more detail.

2.6   I/O DATA ASSIGNMENT

The following rack and slot number are used for referring PROFINET I/O in the robot controller.

Table 2.6 Rack and Slot number of PROFINET I/O

Function	Rack	Slot
PROFINET I/O Controller	99	1
PROFINET I/O Device	100	1

The direction of data in PROFINET network is decided by the direction viewed from I/O Controller. For example, Input Data is input of I/O Controller, but it is output of I/O Device. On the other hand, Output Data is output of I/O Controller, but it is input of I/O Device. When the robot controller is I/O Device, DI/AI is mapped to Output Data of PROFINET, and DO/AO is mapped to Input Data of PROFINET.

2.7   ADVANCED FEATURES

Some features are added and usable since 7DA7/22(V7.70P/22). R-30*i*B supports all features supported by 7DA7/22(V7.70P/22). Please refer to Appendix A for more detail.

3   SETUP PROFINET I/O

3.1   INTRODUCTION

This section describes briefly the steps of setup PROFINET I/O. One of the following PC configuration tool is required to perform setup.

- NCM PC : Configuration software bundled with CP1604/CP1616.
- STEP7 : Configuration software for Siemens PLC

1   Plug an Ethernet cable to PROFINET board and configure IP address and device name by the configuration tool. This step is needed for new PROFINET board at least once.
2   Create a project by the configuration tool and make PROFINET network configuration. IP address and device name of the robot controller must be equal to those set in step 1. This project will be downloaded later to PROFINET board and/or PLC.
3   Setup PROFINET I/O function by PROFINET setup screens of the robot controller.
The following settings are made in this step.
- Enable/Disable of I/O Controller
- Enable/Disable of I/O Device
- Mapping of PROFINET data to I/O of the robot controller (when I/O Controller is enabled).
- The module configuration in module list/detail screen (when I/O Device is enabled).
4   When settings are made, change the start up mode to SUSPEND and cycle power the robot controller.
5   The robot controller starts up by SUSPEND mode. PROFINET board stops in this state to enable project download. If I/O Controller is enabled, download the project to PROFINET board. If I/O Device is enabled, download the project to PLC.
6   When download finishes, change the start up mode to READ IN. PROFINET function of the robot controller starts immediately. The robot controller as I/O Controller reads in current configuration. If any configuration of I/O Controller or I/O Device in the robot controller does not match the configuration in the project, error will occur.

> ⚠ **WARNING**
> Changing start up mode from SUSPEND immediately takes effect, that is, PROFINET function of the robot controller starts immediately. Please verify the safety is assured and make sure if it is safe to start PROFINET I/O data exchange before changing the start up mode from SUSPEND.

7   Cycle power the robot controller if the robot software version is 7DA5/01-22(V7.50P/01-22), 7DB6/01-08(V7.63P/01-08), 7DA7/01-29(V7.70P/01-29) or 7DC1/01-06(V8.10P/01-06). Refer to Section 6.2 for more detail.
8   If there is any error, check the setting and the project to solve the error. To download project again, change the start up mode to SUSPEND and cycle power the robot controller and go back to step 5.
9   If there is no error or all error is resolved, change the start up mode to OPERATION and cycle power the robot controller.
10   The robot controller starts up with the configuration read in at step 6 when the robot controller starts up in OPERATION mode.
11   If the robot controller starts up without error, setting of PROFINET is completed.

3.2 SETTING IP ADDRESS AND DEVICE NAME OF PROFINET BOARD

This section describes the operation of configuration tool (NCM PC or STEP 7).

3.2.1 Selection of Network Interface Board

1   Start "SIMATIC NCM PC Manager" from start menu, for example.
2   Click "Set PG/PC Interface" of "Option" tool bar.
3   Wait for a while, and the window like below appears.
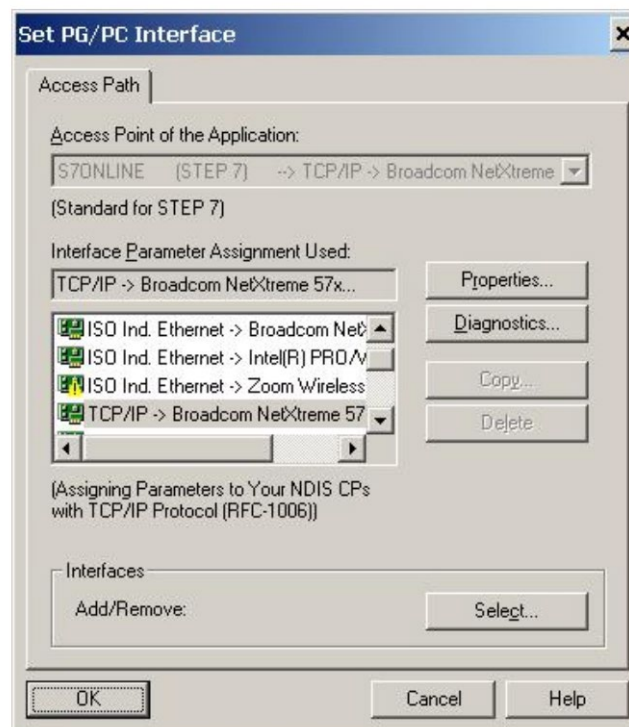
4   Select network interface board that is used for PROFINET connection among the items whose name
     start by TCP/IP or TCP/IP(Auto).

3.2.2   Setting IP Address and Device Name

1   Start "SIMATIC NCM PC Manager" from start menu, for example.
2   Click "Edit Ethernet Node" from "PLC" tool bar.
     The window like below appears after a while.
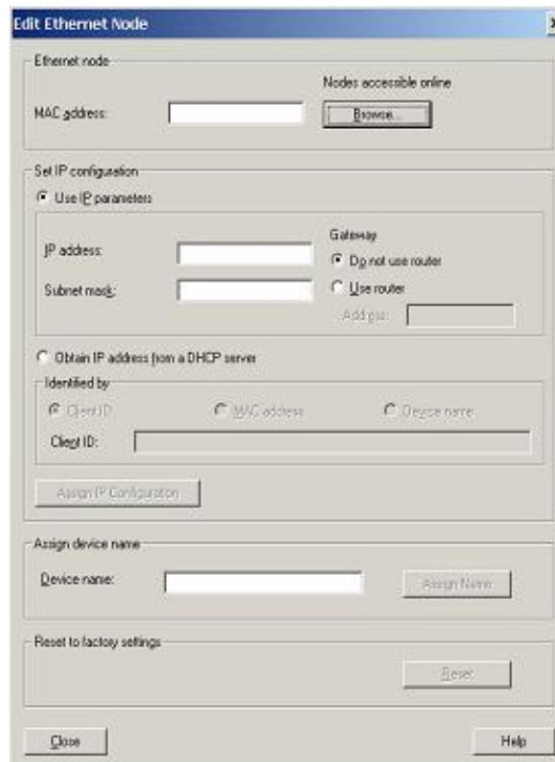
3   Press "Browse" button. The configuration tool will search all devices connected to the Ethernet. The window like below appears after a while.
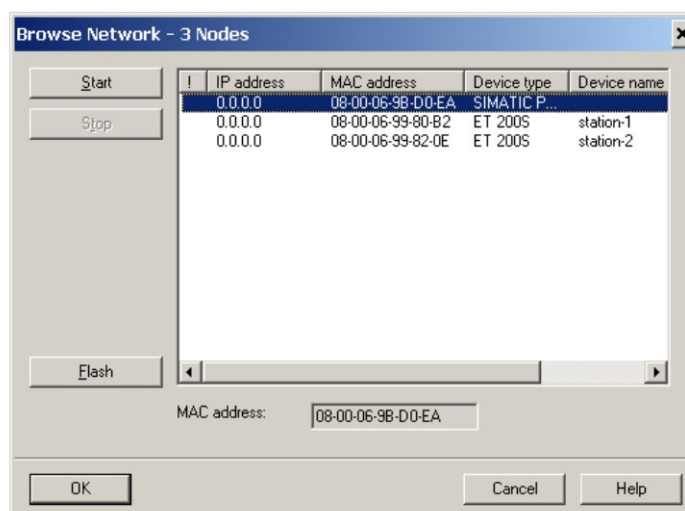
4   Find out PROFINET board and select it. Then press "OK".
5   The window like below appears. IP address and device name can be set from this window.
6   Enter IP address and subnet mask. Press "Assign IP Configuration".
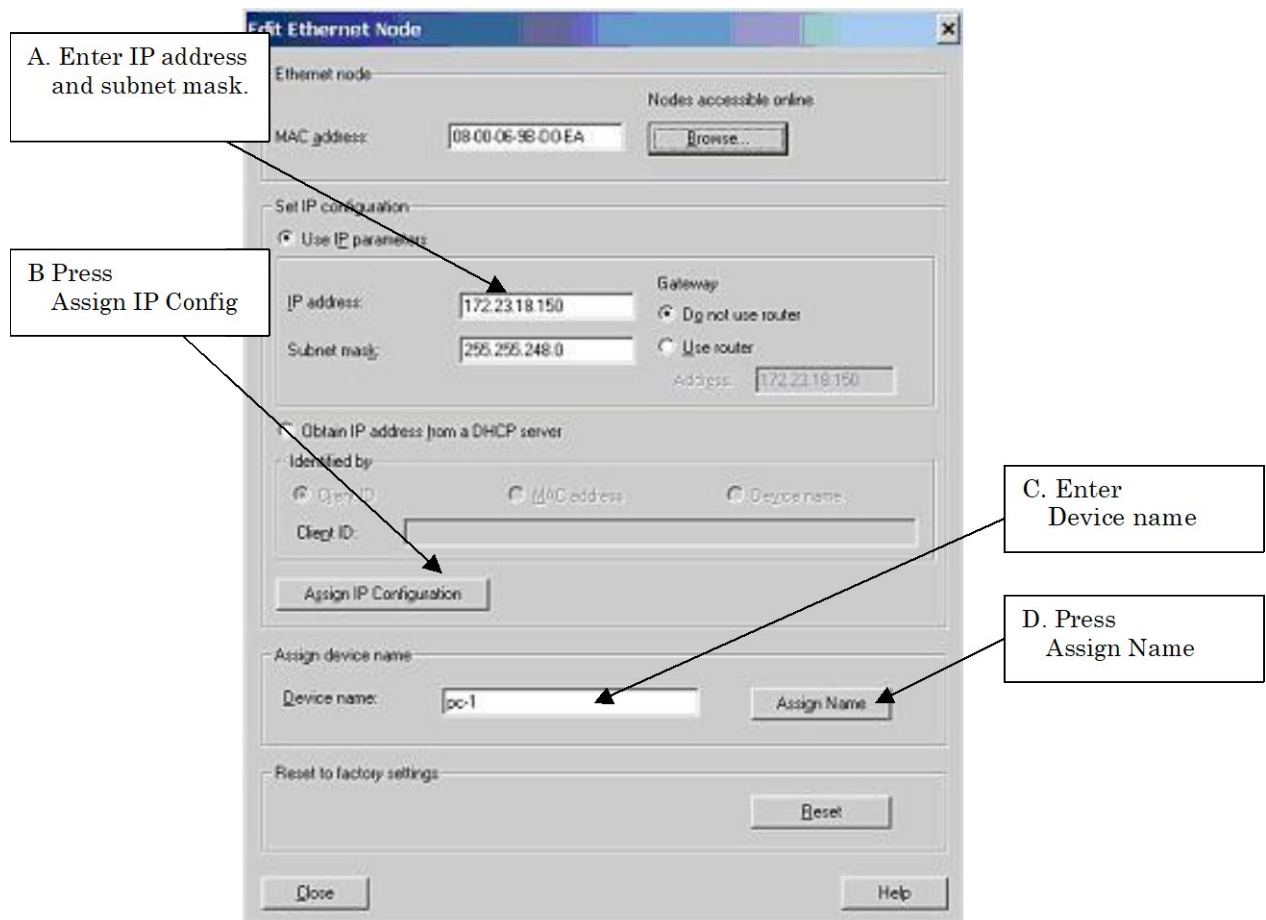
7   Enter device name and press "Assign Name" button.

NOTE
   Device name cannot be modified if PROFINET board has been configured as I/O
   Controller. In this case, press "Reset" button in the "Reset to factory setting" field
   to initialize PROFINET board.
---

8   This procedure is completed. Press "Close" button to close the window.

3.3   MAKING PROFINET PROJECT BY CONFIGURATION TOOL

This section describes the outline of how to set up PROFINET I/O Controller by using NCM PC
configuration tool. Please refer to the start up of the operation manual of NCM PC or STEP7 for the
details.

3.3.1   SIMATIC NCM PC Manager

First of all, start "SIMATIC NCM PC Manager" to create new project. After a project is created, the
window like below shows up. Right click the window and select "Insert New Object". Add "SIMATIC
PC Station" and "Industrial Ethernet".
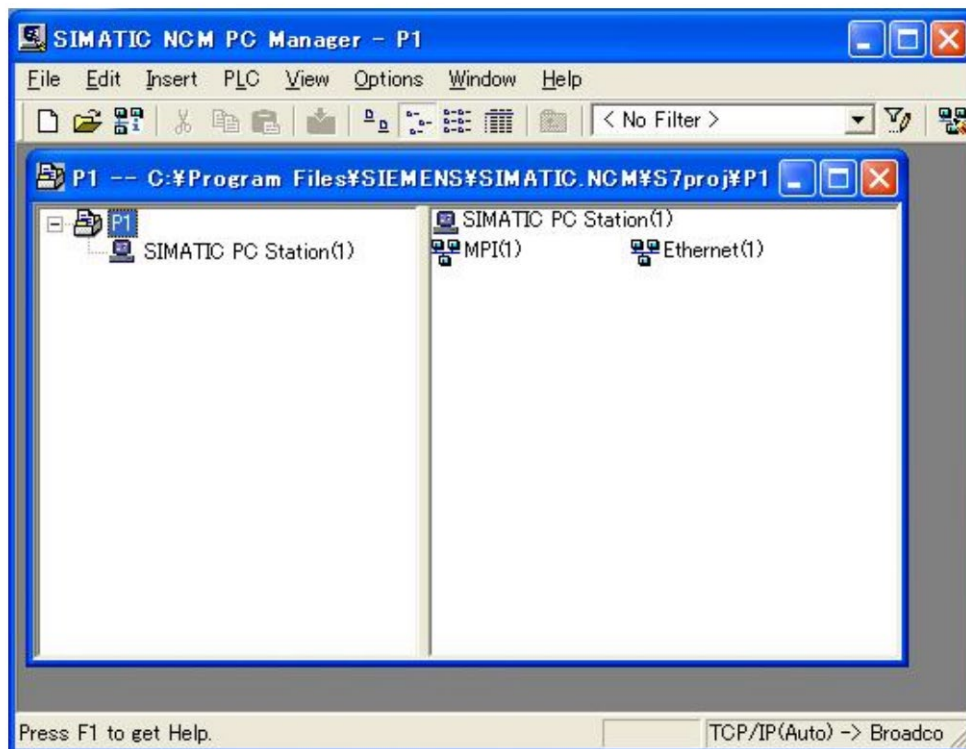
The left window displays the hierarchy of the project. "SIMATIC PC Station" has been added. The right window displays the components of the selected level of the hierarchy. Clicking a component will open other configuration software such as "NetPro" or "SIMATIC NCM PC Config" for detailed configuration of the component.

Example 1)
    Select the top level in the left window. Double click "Industrial Ethernet", and NetPro will open.

Example 2)
    Select "SIMATIC PC Station". Double click "Configuration", and "SIMATIC NCM PC Config" will open.

3.3.2   SIMATIC NCM PC Config

"SIMATIC NCM PC Config" is used for setting up the configuration of PROFINET module. PROFINET board must be added to "SIMATIC PC Station" by this software.
This section explains the procedure of setup by using CP1616 V2.0 as an example. However, the version should be chosen according to the firmware version of PROFINET board when actual configuration is to be made.

1   Starts "SIMATIC NCM PC Config" " or "HW Config" according to the example 2 of 3.3.1.
2   Select the top of empty row of PC.
3   Click "CP Industrial Ethernet" in the right window to show the lower level.
4   Select V2.0 under "CP1616", and the top row of PC becomes green, which means the selected component can be inserted here.
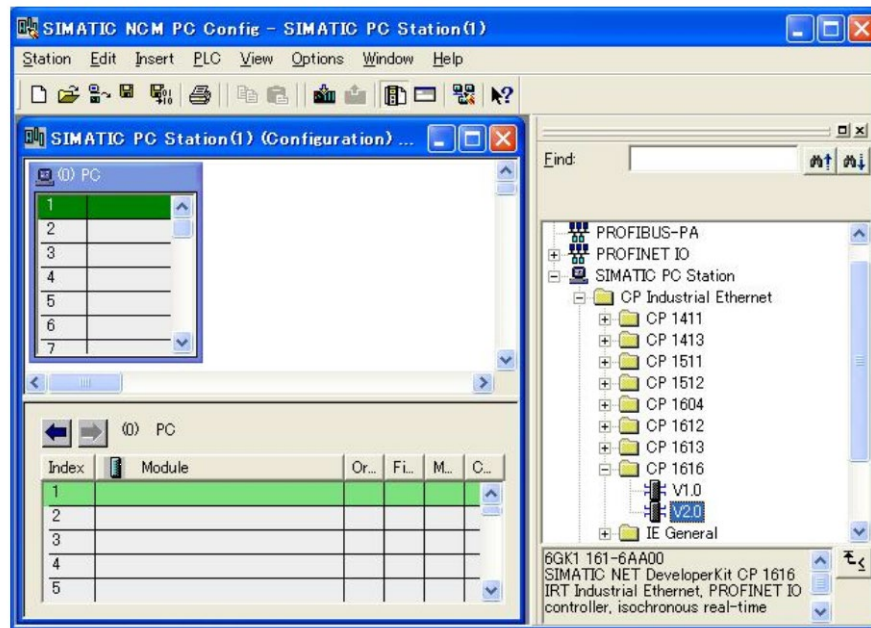
5   Double click V2.0, and the windows like below shows up.
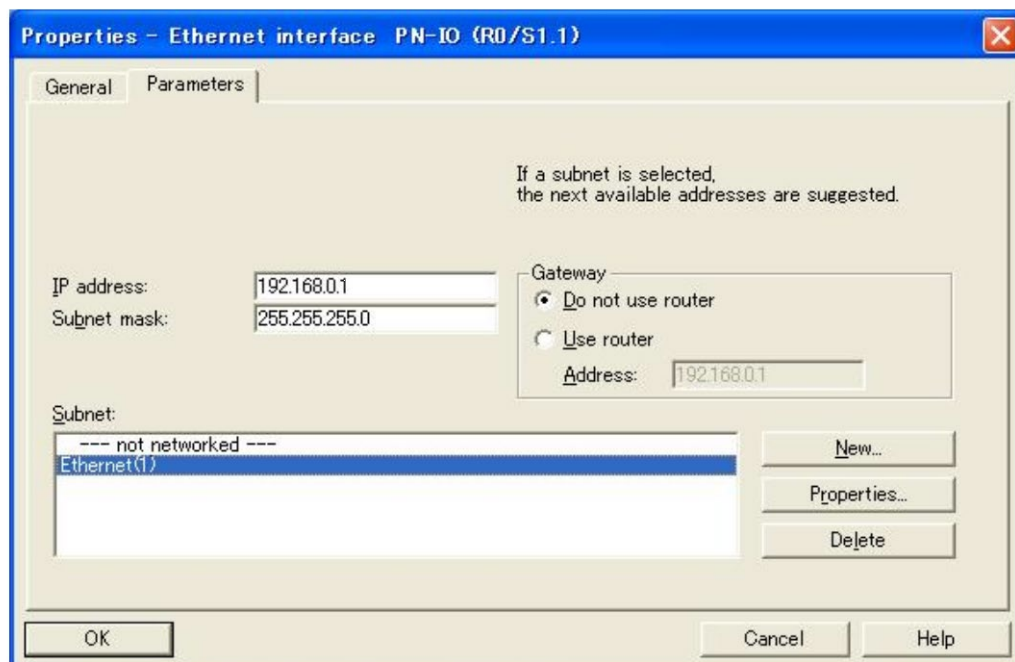
6   Check IP address and subnet mask are correct.
7   Select the network to connect CP1616in the "Subnet" field.
8   Press "OK" to close the window, and an Ethernet cable shows up inside the left window.
        CP1616 has been connected to the Ethernet.
9   After modification finishes, do "Save and Compile" to apply the changes.

By the similar procedure, it is possible to add the device here that communicates with CP1616. Click the Ethernet cable that shows up in step 8, and click "IM151-3 PN" under "PROFINET I/O->I/O->ET200S", for example. Then "IM151-3 PN" module is added like the figure below. Then add the input/output modules to the remaining rows of "IM151-3 PN".
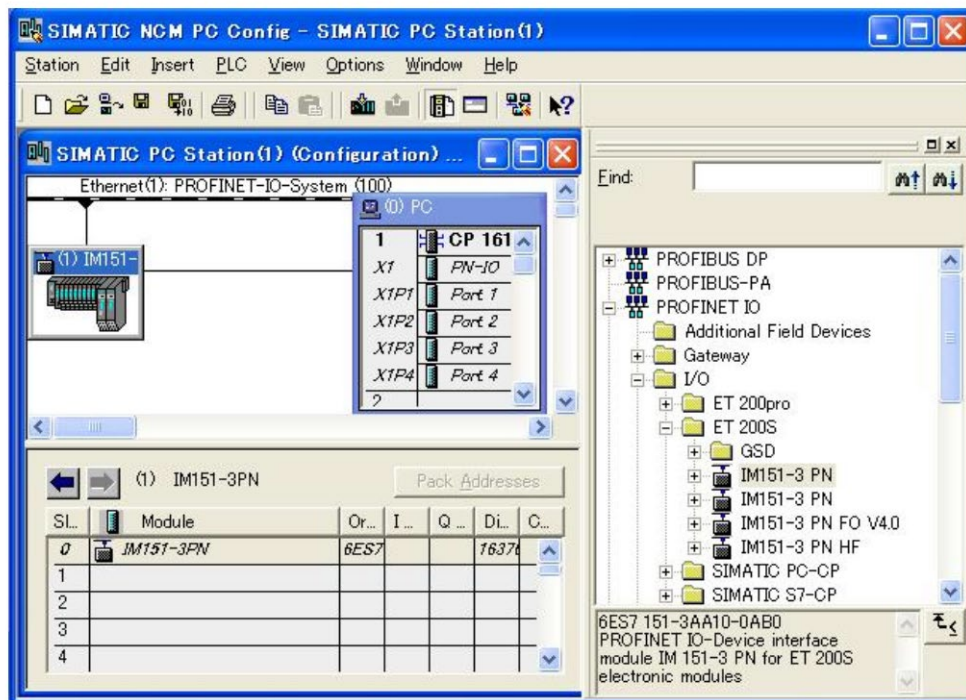
3.3.3 NetPro

NetPro can setup the configuration of PROFINET network. "NetPro" can be opened according to the example 1 of Subsection 3.3.1. The figure below shows the network after adding "IM151-3 PN module according to Subsection 3.3.2.
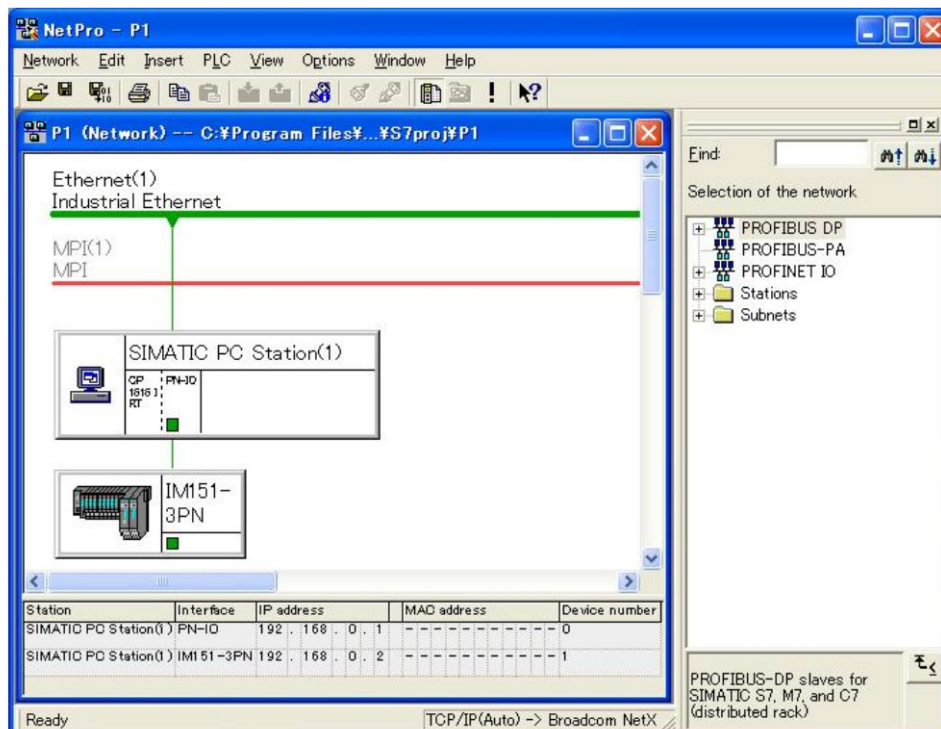
3.4   SETUP SCREENS

3.4.1   Setup General Screen

Use this screen to select start up mode, and to change Enable/Disable of I/O Controller and I/O Device. Press F3 key to show up the pop-up menu to open other screens. Press F10 key (press NEXT and then press F5) to clear I/O assignment.

```
┌──────────────────────────────────────────────┐
│ Setup PROFINET IO               JOINT   10 %  │
│ General                         1/4           │
│  1. MAX_DIG_PRT :               2048          │
│  2. Start up mode :             [SUSPEND]     │
│  3. I/O Controller              ENABLED       │
│  4. I/O Device                  ENABLED       │
│                                               │
│                                               │
│                                               │
│                                               │
│                                               │
│ [ TYPE ]         [Other]            >         │
├──────────────────────────────────────────────┤
│                                 CLR_ASG       │
└──────────────────────────────────────────────┘
```

Fig. 3.4.1 Setup general screen

⚠ **WARNING**
1 Changing start up mode from SUSPEND immediately takes effect, that is, PROFINET function of the robot controller starts immediately. Please verify the safety is assured and make sure if it is safe to start PROFINET I/O data exchange before changing the start up mode from SUSPEND.
2 Cycle power the robot controller after changing start up mode to READ IN if the robot software version is 7DA5/01-22(V7.50P/01-22), 7DB6/01-08(V7.63P/01-08), 7DA7/01-29(V7.70P/01-29) or 7DC1/01-06(V8.10P/01-06). Please refer to 6.2 for more detail.

NOTE
1 The comment of modules is erased when the network configuration is read in. To recover the comment, please write it down before changing start up mode to READ IN.
2 I/O Controller has initial setting of input/output size for DIO and AIO. If I/O Controller is not used, set 0 to "Number of digital input/output" for DIO and "Number of analog input/output" for AIO in setup I/O Controller screen (refer to 3.4.2). Find the assignment with rack 99, slot 1 in digital I/O config screen and analog I/O config screen under I/O menu and delete them. Cycle power the robot controller to apply the change.
3 I/O Device doesn't have any initial setting. I/O Device setting must be made by Module list/detail screens (refer to 3.4.3.1 and 3.4.3.2). The input/output size for DIO and AIO is calculated from the process data size of modules in I/O Device setting, and is displayed in setup I/O Device screen (refer to 3.4.3).

Table 3.4.1   Setup general screen items

#	Item	Adjustable values	Description
1	MAX_DIG_PRT	-	This item displays $MAX_DIG_PRT
2 (a)	Start up mode	SUSPEND READ IN OPERATION	SUSPEND: (setup stage) To start up with the PROFINET board stopped. The project can only be downloaded in this state. READ IN: (setup stage) PROFINET board starts automatically and network configuration of I/O Controller is read in from PROFINET board. OPERATION: (production stage) PROFINET board starts automatically and network configuration of I/O Controller is checked if it is matched to the stored one. If it does not match, error message shows up and communication does not start.
3 (a)	I/O Controller	ENABLE DISABLE	Enable/Disable of I/O Controller
4 (a)	I/O Device	ENABLE DISABLE	Enable/Disable of I/O Device

(a)   Need to cycle power to have the change applied.

Function key	Words	Description of function keys
F3	Other	Selection of setup screens
F10	CLR_ASG	Clear I/O assignments *Clear ALL I/O assignments?*

3.4.2   Setup I/O Controller Screen

The items 2-5 specify the size of digital I/O and analog I/O of PROFINET. Items 6-9 specify the start address of PROFINET data that are mapped to digital I/O or analog I/O. This address can be assigned to each I/O Device in the PC configuration tool. The areas specified by the size and the start addresses are mapped to digital I/O or analog I/O. The data for I/O Devices that you want to use for analog I/O is allocated from the address of analog I/O set here to the data size area of analog I/O points.

Press F3 key to show up the pop-up menu to open other screens. Press F4 key to open arc welding I/O screen. Press F5 key to open analog I/O list screen. Press F10 key to clear I/O assignment.

```
Setup PROFINET IO                    JOINT   10 %
I/O Controller                                   1/5
 1. Error one shot :                       DISABLED
 2. Number of digital input :                  1024
 3. Number of digital output :                 1024
 4. Number of analog input :                     25
 5. Number of analog output :                    25
 6. Digital input offset address:                 0
 7. Digital output offset address:                0
 8. Analog input offset address:                512
 9. Analog output offset address:               512


[ TYPE ]         [Other]   arc    analog              >
                                          CLR_ASG
```

Fig.3.4.2(a) Setup I/O controller screen

Table 3.4.2(a) Setup I/O controller screen items

#	Item	Adjustable values	Description
1	Error one shot	ENABLE DISABLE	If it is ENABLE, pressing reset button can erase network error of I/O Controller even if it is present.
2 (a)	Number of digital input	0-2048	Number of DI mapped as rack 99. The value must be multiple of 8.
3 (a)	Number of digital output	0-2048	Numbers of DO mapped as rack 99. The value must be multiple of 8.
4 (a)	Number of analog input	0-25	Number of AI mapped as rack 99.
5 (a)	Number of analog output	0-25	Number of AO mapped as rack 99.
6(a)	Digital input offset address	0-9998	The start address of PROFINET data mapped to DI (rack 99).
7(a)	Digital output offset address	0-9998	The start address of PROFINET data mapped to DO (rack 99).
8(a)	Analog input offset address	0-9998	The start address of PROFINET data mapped to AI (rack 99).
9(a)	Analog output offset address	0-9998	The start address of PROFINET data mapped to AO (rack 99).

(a)   Power OFF/ON is necessary to enable a change of settings.

Function key	Words	Description of function keys
F3	Other	Selection of setup screens
F4	arc	Arc welding signal screen
F5	analog	Analog list screen
F10	CLR_ASG	Clear I/O assignments *Clear ALL I/O assignments?*

NOTE
The data of a PROFINET I/O module can be allocated to only a single type of I/O (digital, analog, arc welding). It must be placed within the area specified by the start address and the size for a type of I/O and it must not be placed across the border of any areas, otherwise it is not allocated to any I/O. In such case, PRIO-630 appears at start up with PRIO-631 or PRIO-632 to inform which data is not allocated.

3.4.2.1   Arc welding signal screen

The setting of arc welding signals, such as WI/WO or WSTK, that are used by Arc tool can be modified in this screen. This screen can be used only when the application is Arc tool. Press PREV to go back to I/O Controller screen.

```
┌─────────────────────────────────────────────────────┐
│ Setup PROFINET IO                    JOINT   10 %     │
│ I/O Controller : Arc weld I/O     1/25                │
│                                                       │
│ 1. Enable arc weld I/O :          False               │
│ 2. WI offset :                                    0   │
│ 3. WI size :                                      0   │
│ 4. WO offset :                                    0   │
│ 5. WO size :                                      0   │
│ 6. WSTK(IN) offset :                              0   │
│ 7. WSTK(IN) size :                                0   │
│ 8. WSTK(OUT) offset :                             0   │
│ 9. WSTK(OUT) size :                               0   │
│                                                       │
│ [ TYPE ]           [Other]                            │
└─────────────────────────────────────────────────────┘
```

Fig. 3.4.2.1(a) Arc welding signal screen

Table 3.4.2.1(a) Arc welding signal screen items

#	Item	Adjustable values	Description
1 (a)	Enable arc weld I/O	False True	Specify if WI/WO and WSTK are available. It can be "True" only if arc tool is ordered.
2,4,6,8 (a)	WI/WO/WSTK offset	0-9998	Address where WI/WO/WSTK starts.
3,5,7,9 (a)	WI/WO/WSTK size	0-40	Number of WI/WO/WSTK mapped as rack 99. The value must be multiple of 8.

(a)   Power OFF/ON is necessary to enable a change of settings.

Function key	Words	Description of function keys
F3	Other	Selection of setup screens

NOTE
The data of a PROFINET I/O module can be allocated to only a single type of I/O (digital, analog, arc welding). It must be placed within the area specified by the start address and the size for a type of I/O and it must not be placed across the border of any areas, otherwise it is not allocated to any I/O. In such case, PRIO-630 appears at start up with PRIO-631 or PRIO-632 to inform which data is not allocated.

3.4.2.2   Analog list screen

There are analog list screens for AO and AI. These screens show the mapping of analog I/O of the robot controller and the address of PROFINET data. The comment of analog I/O is also displayed in this screen. Press PREV to go back to I/O Controller screen. Press F2 key to open analog detail screen. Press F5 key to switch AO and AI.

```
Setup PROFINET IO              JOINT   10 %
I/O Controller : List AO                    1/25
    NO   Addr Comment
AO[ 1]  512 [                      ]
AO[ 2]  514 [                      ]
AO[ 3]  516 [                      ]
AO[ 4]  518 [                      ]
AO[ 5]  520 [                      ]
AO[ 6]  522 [                      ]
AO[ 7]  524 [                      ]
AO[ 8]  526 [                      ]
AO[ 9]  528 [                      ]


[ TYPE ]      detail        [Other]        I/O
```

Fig. 3.4.2.2(a) Analog list screen(AO)

Table 3.4.2.2(a) Analog list screen items

#	Item	Adjustable values	Description
1	No	None	Analog output number
2	Addr	None	Address in bytes, where the PROFINET data for this AI/AO is located (Address must be equal to NCM or STEP7).
3	Comment	None String[24]	Comment of this analog output (the same as AI/AO screen). Display only.

Power OFF/ON is necessary to enable a change of settings.

Function key	Words	Description of function keys
F2	detail	Go to detail screen
F3	Other	Selection of setup screens
F5	I/O	Switch AO and AI.

3.4.2.3   Analog detail screen

There are analog detail screens for AO and AI. The setting of bit shift operation and valid bits can be modified in this screen. Use default setting if the value of analog signal is to be used as original value.

```
Setup PROFINET IO              JOINT   10 %
I/O Controller : Detail AO 1                 1/2


   Address :                           512
   Comment :
        [                     ]
1. AO left shift count :                   0
2. AO valid bits :                        16




[ TYPE ]      list      prev     next      I/O
```

Fig. 3.4.2.3(a) Analog detail screen(AO)

Table 3.4.2.3(a) Analog detail screen items

#	Item	Adjustable values	Description
	Address		Address in bytes, where the value for this AI/AO is located (Address must be equal to NCM or STEP7). Display only
	Comment	None String[24]	Comment of this analog output (the same as AI/AO screen). Display only.
1 (a)	AI right shift count AO left shift count	0 1-16	This is the setting for how many bits right or left shift the value.
2 (a)	AI/AO valid bits	16 1-16	Set the number of valid bits. Bits not included in the valid bits are treated as 0.

(a)   Power OFF/ON is necessary to enable a change of settings.

Function key	Words	Description of function keys
F2	list	Go to list screen
F3	prev	Go to previous analog port
F4	next	Go to next analog port
F5	I/O	Switch AO and AI.

3.4.3   Setup I/O Device Screen

This screen is a top screen for I/O Device setting. The robot controller as PROFINET I/O Device is a modular device, that is, it is composed of up to 17 modules. The configuration of modules is made in the module list/detail screens. To enter module list screen, move cursor to the second line, "Module", and press Enter. This screen shows the amount of digital and analog I/O used by the robot controller as PROFINET I/O Device.

```
 Setup PROFINET IO              JOINT   10 %
 I/O Device                                1/2
 1. Error one shot :               DISABLED
 2. Modules                         <Detail>
 3. Number of digital inputs :           128
 4. Number of digital outputs :          128
 5. Number of analog inputs :              0
 6. Number of analog outputs :             0




 [ TYPE ]            [Other]               >
                                    CLR_ASG
```

Fig. 3.4.3(a) Setup I/O Device screen

Table 3.4.3(a) Setup I/O Device items

#	Item	Adjustable values	Description
1	Error one shot	ENABLE DISABLE	If it is ENABLE, pressing reset button can erase network error of I/O Controller even if it is present. Use this only during setup.
2	Modules	None	Moves to "Module list" sub screen by pressing enter key with the cursor on this item.
3	Number of digital inputs	None	Displays sum of digital input number of modules, which are to be mapped to rack 100. Calculated according to setting. Not actual value.

#	Item	Adjustable values	Description
4	Number of digital outputs	None	Displays sum of digital output number of modules, which are to be mapped to rack 100. Calculated according to setting. Not actual value.
5	Number of analog inputs	None	Displays sum of analog input number of modules, which are to be mapped to rack 100. Calculated according to setting.
6	Number of analog outputs	None	Displays sum of analog output number of modules, which are to be mapped to rack 100. Calculated according to setting.

Power OFF/ON is necessary to enable a change of settings.

Function key	Words	Description of function keys
F3	Other	Selection of setup screens

NOTE
Appendix B provides an example of I/O Device setting and usage of Setup I/O Device screen and Module list/detail screens when I/O Controller is disabled.

3.4.3.1   Module list screen

The robot controller as PROFINET I/O Device is composed of up to 17 modules. There is no module defined by default, therefore modules location (slot, subslot) and module identifier (modId, subslotId) must be specified by module list/detail screens. There is a device access point (always slot 0 before 7DC3(V8.30), slot 1 in 7DC3(V8.30)), input modules, output modules, and input/output modules. Please refer to the GSDML file for the parameters of modules. Select a submodule and press F2 Detail to enter the parameters of the submodule. Press PREV to go back to setup I/O Device screen.

```
 Setup PROFINET IO              JOINT   10 %
 I/O Device : Modules                      1/17
 No Slot Sub Comment
 0    0   1  [CP1616 V2.5                    ]
 1    1   1  [                               ]
 2    2   1  [                               ]
 3    0   0  [                               ]
 4    0   0  [                               ]
 5    0   0  [                               ]
 6    0   0  [                               ]
 7    0   0  [                               ]
 8    0   0  [                               ]
 9    0   0  [                               ]
 [ TYPE ]      detail        [Other]         >
           DEL_ALL
```

Fig. 3.4.3.1(a) Module list screen

Table 3.4.3.1(a) Module list screen

#	Item	Adjustable values	Description
1	Slot	None 0-16	Displays slot number Slot number is up to 16.
2	Sub	None 0-1	Displays sub slot number
3	Comment	String[24]	Explanation of the module

Power OFF/ON is necessary to enable a change of settings.

Function key	Words	Description of function keys
F2	detail	Go to Module Detail screen of the selected submodule.
F3	Other	Selection of setup screens.
F7	DEL_ALL	Delete all module settings. *Delete ALL modules?*

> **NOTE**
> 1 Appendix B provides an example of I/O Device setting and usage of Setup I/O Device screen and Module list/detail screens when I/O Controller is disabled.
> 2 The first module must be device access point. Choose the device access point without "Migration" subcategory when only I/O Device is enabled in the robot controller. Choose the device access point with "Migration" subcategory when both of I/O Controller and I/O Device are enabled in the robot controller.

3.4.3.2   Module Detail Screen

Enter the parameters of the module that consists of the robot controller as PROFINET I/O Device in this screen. Slot and subslot specify the location of the module within 17 slots. ModId and subslotId specify the type of module. Please see the following properties in the GSDML file for ModId and SubslotId.

Item name	Property name in GSDML file (use PROFINET-XML viewer to open the file)
ModId	Module Ident Number
SubslotId	Submodule Ident Number

When module ID is entered, internal database is searched to find out the module. If there is a match, data size and module I/O type are automatically set. Enter slot, subslot and subslotId by manual. Choose data type from digital and analog.

The parameters of module (except for data type) must be equal to those of project made by configuration tool. Otherwise, error will occur and the communication will not establish.

```
 Setup PROFINET IO                    JOINT   10 %
I/O Device : Module 1                            1/6
1. Slot :                                          1
2. Subslot :                                       1
   Comment :
3.             [                        ]
4. ModId(hex) :                          0x00000027
5. SubslotId(hex) :                      0x00000001
    Module I/O type :                            DO
6. Data size :                          [16 Bytes]
7. Data type :                           [Digital]


   [ TYPE ]       list        prev       next
```

Fig. 3.4.3.2(a) Module detail screen

Table 3.4.3.2(a) Module detail screen

#	Item	Adjustable values	Description
1(a)	Slot	0-16	Slot number of the module Slot number is up to 16.
2(a)	Sub	0-1	Sub slot number of the module
3	Comment	String[24]	Explanation of the module

#	Item	Adjustable values	Description
4(a)	ModId	LONG	Module Id of the module Enter the value by decimal number.
5(a)	SubslotId	LONG	Subslot Id of the module Enter the value by decimal number.
	Module I/O type	DI, DO, AI, AO, NONE	The type of I/O of the module decided by the direction of data and the data type (item 7).
6(a)	Data size	0, 1, 4, 16 Bytes (b)	Choose from 0, 1, 4, and 16 Bytes (b)
7(a)	Data type	Digital Analog	Choose from digital and analog. It specifies if the process data is assigned to DI/DO or AI/AO. 1Byte module can't be assigned to analog. It doesn't have any effect on PROFINET I/O exchange.

(a)   Power OFF/ON is necessary to enable a change of settings.
(b)   For 7DA5/14(V7.50P/14) or later, 7DA7/22(V7.70P/22) or later, R-30*i*B, please see the GSDML file for robot by FANUC.

Function key	Words	Description of function keys
F2	list	Go to module list screen
F3	prev	Go to previous module
F4	next	Go to next module

NOTE
Appendix B provides an example of I/O Device setting and usage of Setup
I/O Device screen and Module list/detail screens when I/O Controller is disabled.

3.4.4   Setup Configuration List Screen

This screen displays the configuration of I/O Controller that has been read in when the start up mode is READ IN. After the configuration is read in, device can be activated or deactivated by changing the item of E/D when TP is enabled. The comment of device can be entered in this screen. If the comment is set to the first device of a station, the comment will be shown next to the TP switching instruction when the instruction is taught in a TP program. Some error message displays the comment as well as error location.

```
 Setup PROFINET IO                    JOINT   10 %
 I/O Controller : Config list                    1/256
   St Slot Sub Comment
E  1   2   1 [                         ]
E  1   5   1 [                         ]
E  1   6   1 [                         ]
E  1   8   1 [                         ]
E  2   2   1 [                         ]
E  2   3   1 [                         ]
E  2   4   1 [                         ]
E  2   6   1 [                         ]
D  0   0   0 [                         ]
D  0   0   0 [                         ]
 [ TYPE ]      detail        [Other]
```

Fig. 3.4.4(a) Setup Configuration list screen

Table 3.4.4(a) Setup Configuration list screen

#	Item	Adjustable values	Description
1	E/D	Enable Disable	Module can be activated/deactivated from here. Press F4 Enable to enable the module. Press F5 Disable to disable the module.
2	St	None 0-999	Displays station number
3	Slot	None 0-999	Displays slot number
4	Sub	None 0-999	Displays sub slot number
5	Comment	String[24]	Explanation of the module

Power OFF/ON is necessary to enable a change of settings.

Function key	Words	Description of function keys
F2	detail	Go to config detail screen
F3	Other	Selection of setup screens

NOTE

The comment of modules is erased when the network configuration is read in.
To recover the comment, please write it down before changing start up mode to
READ IN.

3.4.4.1   Configuration detail screen

This screen shows the detail of the module within the configuration of I/O Controller that has been read in when the start up mode is READ IN. After the configuration is read in, device can be activated or deactivated by changing the status to enable or disable when TP is enabled. The comment of device can be entered in this screen.

To show error message when the device is deactivated, set the second item to ON.

```
Setup PROFINET IO                    JOINT  10 %
I/O Controller : Module 1                      1/11
1. Status :                                 Enable
2. Show error when deactivated:On
3. Station :                                     1
4. Slot :                                        2
5. Subslot :                                     1
   Comment :
6.          [                          ]
7. Address :                                     0
8. Length :                                      1
9. IO data type :                               IN
10. Data type :                                  0
11. Com type :                                   0
[ TYPE ]   list    prev    next
```

Fig. 3.4.4.1(a) Configuration detail screen

Table 3.4.4.1(a) Configuration detail screen

#	Item	Adjustable values	Description
1	Status	Enable Disable	Module can be activated/deactivated from here. Press F4 Enable to enable the module. Press F5 Disable to disable the module.
2	Show error when deactivated	Off On	When the setting is On, error message will show up when the device is disconnected unless it is deactivated by configuration screen or TP instruction.
3	Station	LONG	Station number of the module
4	Slot	LONG	Slot number of the module
5	Sub	LONG	Sub slot number of the module
6	Comment	String[24]	Explanation of the module
7	Address	LONG	Process data address of the module specified by configuration tool (NCM or STEP7).
8	Length	LONG	Process data length of the module
9	I/O data type		Shows data type is input or output
10	Data type		
11	Com type		

Power OFF/ON is necessary to enable a change of settings.

Function key	Words	Description of function keys
F2	list	Go to config list screen
F3	prev	Go to previous module
F4	next	Go to next module

NOTE
The comment of modules is erased when the network configuration is read in.
To recover the comment, please write it down before changing start up mode to READ IN.

3.5   DOWNLOAD OF PROJECT IN SUSPEND MODE

It is required to download a project to PROFINET board by configuration tool. If there is any other PROFINET I/O Controller in the network, the project must be downloaded to the stations, too.
Change start up mode to "READ IN" when download is completed.

⚠ WARNING
Changing start up mode from SUSPEND immediately takes effect, that is, PROFINET function of the robot controller starts immediately. Please verify the safety is assured and make sure if it is safe to start PROFINET I/O data exchange before changing the start up mode from SUSPEND.

NOTE
1 When the robot controller starts up with start up mode other than SUSPEND, project cannot be downloaded to PROFINET board.
2 When the robot controller starts up with SUSPEND start up mode, PROFINET board is stopped. Start up mode must be SUSPEND when firmware of PROFINET board is updated.
3 Cycle power the robot controller after firmware update. If the external power supply of PROFINET board is connected, remove it before cycle power and connect it again after power up.

3.6   READ IN MODE

The robot controller tries to establish PROFINET communication when start up mode is changed from "SUSPEND" mode to "READ IN" mode or when it starts up with "READ IN" mode. If there is wrong setting or the configuration does not match to the downloaded project, error will occur.

If there is no error, current configuration will be read in to the robot controller and PROFINET communication will establish, but PRIO-623 with STOP severity will be posted to prohibit robot motion. To release PRIO-623, change start up mode to OPERATION and cycle power the robot controller.

The configuration read in will be stored and used when start up mode is OPERATION. On the other hand, if the robot controller starts up with "READ IN" mode, configuration will be read in and last configuration will be overwritten. The setting in Subsection 3.4.4 and 3.4.4.1 are initialized.

⚠ **WARNING**
1   Cycle power the robot controller after changing start up mode to READ IN if the robot software version is 7DA5/01-22(V7.50P/01-22), 7DB6/01-08(V7.63P/01-08), 7DA7/01-29(V7.70P/01-29) or 7DC1/01-06(V8.10P/01-06). Please refer to 6.2 for more detail.
2   Please confirm if the communication is OK and I/O data is exchanged correctly before changing start up mode to OPERATION.

NOTE
The comment of modules is erased when the network configuration is read in. To recover the comment, please write it down before changing start up mode to READ IN.

3.7   OPERATION MODE

The robot controller starts up with the stored configuration, and check if it matches to the current configuration. Therefore, use OPERATION mode after PROFINET setting is completed.

The setting of "Show error when deactivated" (see 3.4.4.1) will be used in OPERATION mode. If the device with the setting = ON is disconnected, error message will show up unless the device is deactivated by configuration screen or TP instruction. The device switching status is recovered at power failure recovery in OPERATION mode.

4 STATUS SCREEN

4.1 I/O CONTROLLER MODULE LIST SCREEN

This screen shows the list of modules of I/O Device that communicate with the robot controller. The list is based on current PROFINET configuration, and therefore it can be different with the list of setup configuration list screen when start up mode is OPERATION.

```
 Status    PROFINET  IO              JOINT  10 %
 I/O Controller : Module list                    1/256
     St    Slot Sub    Addr   Len   RS_I RS_O
 E   1     2    1       0      1    0000 0000
 E   1     5    1       2      1    0000 0000
 E   1     6    1       0      1    0000 0000
 E   1     8    1       2      1    0000 0000
 E   2     2    1       4      1    0000 0000
 E   2     3    1       6      1    0000 0000
 E   2     4    1       4      1    0000 0000
 E   2     6    1       6      1    0000 0000
 D   0     0    0       0      0    0000 0000
 D   0     0    0       0      0    0000 0000
 [ TYPE ]   detail
```

Fig. 4.1(a) Status module list screen

Table 4.1(a) Status module list screen

#	Item	Values	Description
1	E/D	ENABLE DISABLE	Shows if the module is activated or not.
2	Station	None 0-999	Displays station number
3	Slot	None 0-999	Displays slot number
4	Sub	None 0-999	Displays sub slot number
5	Address	None 0-99999	Displays process data address
6	Length	None 0-999	Displays process data length
7	RS_I		Remote status of Input data
8	RS_O		Remote status of Output data

Function key	Words	Description of function keys
F2	detail	Go to module detail screen

- 28 -

4.2   I/O CONTROLLER MODULE DETAIL SCREEN

```
 Status   PROFINET   IO              JOINT   10 %
 I/O Controller : Module 1                      1/11
 1. Status :                          Enable
 2. Station :                              1
 3. Slot :                                 2
 4. Subslot :                              1
 5. Address :                              0
 6. Length :                               0
 7. IO data type :                         0
 8. Data type :                            0
 9. Com type :                             0


 [ TYPE ]   list    prev    next
```

Fig. 4.2(a) Status module detail screen

Table 4.2(a) Status module detail screen

#	Item	Values	Description
1	Status	Enable Disable	Shows if the module is activated or not.
2	Station	LONG	Station number of the module
3	Slot	LONG	Slot number of the module
4	Sub	LONG	Sub slot number of the module
5	Address	LONG	Process data address of the module specified by configuration tool (NCM or STEP7).
6	Length	LONG	Process data length of the module
7	I/O data type		Shows data type is input or output
8	Data type		
9	Com type		

Function key	Words	Description of function keys
F2	list	Go to module list screen
F3	prev	Go to previous module
F4	next	Go to next module

5   DEVICE SWITCHING TP INSTRUCTION

Device switching TP instruction is used to activate or deactivate PROFINET I/O Device, such as a peripheral I/O module on detachable hand or tool. Specify the operation (attach or detach) and the station number in the instruction. The device switching status is recovered at power failure recovery in OPERATION mode.

```
┌─────────────────────────────────────────────────────┐
│  TEST              LINE 0        ABORTED             │
│ ▓TEST▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓JOINT   10 %▓▓▓▓▓▓▓ │
│  1 :   PNIO attach 3 "Module Comment"               │
│  2 :                                                │
│  3 :   PNIO detach 3 "Module Comment"               │
│                                                     │
│                                                     │
│                                                     │
│                                                     │
│                                                     │
│                                                     │
│                                                     │
│  [ INST ]                       [EDCMD]             │
└─────────────────────────────────────────────────────┘
```

Fig. 5(a) TP instruction to activate and deactivate module

Table 5(a) TP instruction to activate and deactivate module

Instruction	argument	Description
PNIO attach	station no.	Activate the specified module and wait until it is activated, or timeout occurs. Module comment of the first module of the station is brought from config list/detail screen and displayed after module no.
PNIO detach	station no.	Deactivate the specified module and wait until it is deactivated or timeout occurs. Module comment of the first module of the station is brought from config list/detail screen and displayed after module no.

6   TROUBLESHOOTING

6.1   ERROR CODES

Please refer to Appendix H.

6.2   INFORMATION ABOUT I/O CONTROLLER

When I/O Controller function is used, READ IN is done to read in the network configuration after downloading the project to PROFINET board firmware. Then the order of modules in network configuration read in by the first READ IN and those of the following READ IN may differ.

If the robot software version is 7DA5/01-22(V7.50P/01-22), 7DB6/01-08(V7.63P/01-08), 7DA7/01-29(V7.70P/01-29) or 7DC1/01-06(V8.10P/01-06), the robot software is affected by this, therefore it is required to cycle power the robot controller after the first READ IN to do the second READ IN at next power on.

If the start up mode is changed to OPERATION after the first READ IN (without the required cycle power), the following problem may occur.

1. The enable/disable status of device is not recovered correctly at power failure recovery.
   The station disabled before power off gets to enable, and another station gets to disable.

2. The comment of module where alarm indication comes from is not displayed correctly.
   The comment of other module may be displayed.

The same problem may occur when PROFINET board is changed, or PNIO.SV is restored.

To know if the condition of the problem occur is true or not, compare the order of modules in the setup configuration list screen (refer to 3.4.4) with that in the status module list screen (refer to 4.1). If they don't match, the problem may occur. As a workaround of the problem, please follow the procedure below to do READ IN again.

Procedure 6.2 : Retry of READ IN

1   Write down the comment of modules in the setup configuration list screen.

> **NOTE**
> The comment of modules is erased when the network configuration is read in.
> To recover the comment, please write it down before changing start up mode to READ IN.

2   Change the start up mode to READ IN in the setup general screen, and then cycle power the robot controller.
3   Change the start up mode to OPERATION in the setup general screen, and then cycle power the robot controller.
4   Verify that the order of modules in the setup configuration list screen and that in the status module list screen match.
5   Restore the comments that were written down.

7   PROFINET I-DEVICE

In R-30*i*B Plus, the firmware of Siemens PROFINET board has been switched to a version compatible with PROFINET V2.3. As there is no compatibility with the past, the software option name has been changed from PROFINET I/O to PROFINET I-device. Note that PROFINET board CP1616 is not supported by PROFINET I-device.

7.1   OVERVIEW

The maximum number of digital I/O of I/O controller and I/O Device is total 8192 points. To increase the number of points used, increase the number of digital I/O at the maximum number of control start. The analog I/O of the I/O controller and I/O device is up to 50 channels.

The actual usable data size is obtained by the calculation.

(Total input data of I/O controller and I/O device [byte]) +(Total output data of I/O controller and I/O device [byte]) + {8 * (The number of submodules of I/O controller and I/O device)} < 800 bytes

Table 7.1(a) The number of I/O points and submodules

Number of submodules	Number of input	Number of output
2	3192	3192
16	2688	2688
36	2048	2048

If the value on the left side exceeds 512 bytes, please use Mainboard C (Force Sensor, High-speed communication CPU, for IO-Link *i* slave).

> **NOTE**
> The controllers other than R-30iB Plus do not support the high-speed communication CPU. Therefore, the actual usable data size should not exceed 512 bytes.

7.2   SOFTWARE

Table 7.2(a) Option software of PROFINET I-device

Option software	Ordering specification	Description
PROFINET I-device	A05B-2600-J709	PROFINET consists of PROFINET motherboard wide-mini slot size and Siemens PROFINET board CP1604. This function cannot coexist with Dual Channel PROFINET function.
PROFINET Safety	A05B-2600-J931	This option software is for safety communication on PROFINET. For PROFINET Safety function, please read "R-30*i*B/R-30*i*B Mate/R-30*i*B Plus/R-30*i*B Mate Plus/R-30*i*B Compact Plus CONTROLLER Dual Check Safety Function OPERATOR'S MANUAL (B-83184EN) in addition to this manual. "

Option software	Ordering specification	Description
PROFINET CP16XX firmware	A05B-2600-J744	PROFINET board firmware is stored on the controller at shipment.

7.3   HARDWARE

Table 7.3 (a) Hardware of PROFINET I-device

Name	Ordering specification	Description
PROFINET motherboard (without CP1604, wide-mini slot)	A05B-2600-J075	The motherboard for Siemens PROFINET board CP1604. CP1604 is purchased by customer.
PROFINET motherboard (with CP1604, wide-mini slot)	A05B-2600-J073	The motherboard for Siemens PROFINET board CP1604. CP1604 is installed.

If the value on the left side in Section 7.1 exceeds 512 bytes, please use Mainboard C (Force Sensor, High-speed communication CPU, for IO-Link i slave).

Table 7.3 (b) R-30iB Plus Mainboard C

Name	Ordering specification	Description
R-30iB Plus Mainboard C (Force Sensor, High-speed communication CPU for IO Link i slave)	A05B-2670-H003	Since the high-speed communication CPU is installed, the performance of PROFINET is expected to be improved.

> **NOTE**
> The controllers other than R-30iB Plus do not support the high-speed communication CPU. Therefore, the actual usable data size in Section 7.1 should not exceed 512 bytes.

PROFINET board (CP1604)

CP1604 can be installed to R-30iB Plus A-cabinet and B-cabinet. PROFINET motherboard wide-mini slot size is needed to install CP1604 to the backplane of R-30iB Plus (wide-mini slot). The current ordering specification for direct purchase from Siemens is 6GK1 160-4AA01.

7.4   PROFINET BOARD FIRMWARE

The PROFINET board firmware version needs to be the version corresponding to the robot controller software. If it is not, please rewrite the firmware referring to Appendix A.4.

Table 7.4(a) Firmware version (R-30iB Plus)

Robot software version	Firmware version
7DF1(V9.10)	V2.7.2.0

7.5   CONFIGURATION SOFTWARE

To configure PROFINET board CP1604, PC that Siemens configuration tool TIA Portal (V14 SP1 or later) is installed is needed.
Configuration of CP1604 can be done in trial version.

TIA Portal is included on the CD-ROM supplied with the PROFINET board, so please check the version before use. Please contact your local FANUC representative if the version of TIA Portal is older than V14 SP1. Please contact FANUC if the CD-ROM is not included or the TIA Portal is not included in the CD-ROM. TIA Portal can be downloaded from the Siemens website.

When configuring CP1604 in TIA Portal, enter the followings in Catalog information:

Table 7.5(a) I/O Module type (R-30*i*B Plus, 7DF1 (V9.10))

Name	Value
PROFINET vendor ID	1B7
PROFINET Device ID	E
Article no	A05B-2600-J709
Product family	Robot Controller
Vendor name	FANUC
Product name	R-30*i*B Plus

Table 7.5(b) I/O Module type (R-30*i*B Mini Plus, 7DF5(V9.40))

Name	Value
PROFINET vendor ID	1B7
PROFINET Device ID	10
Article no	A05B-2600-J709
Product family	Robot Controller
Vendor name	FANUC
Product name	R-30*i*B Mini Plus

7.6 INPUT SIGNALS AT COMMUNICATION FAILURE

When I/O Device communication failed, "PRIO-621 PNIO(D) device is not running" shows up.
Input signals of I/O Device are cleared if IOPS = BAD, at power up and when the connection is lost.
When I/O Controller communication failed, "PRIO-622 PNIO(C) controller is not running" shows up.
Input signals of I/O Controller are cleared if IOPS = BAD, at power up and when the connection is lost.

7.7 SYSTEM VARIABLES

PROFINET I-device inherits the system variables from PROFINET I/O. The head of the inherited system variable's name changes. The system variable name starts with $PNIO in PROFINET I/O, but starts with $PNG2 in PROFINET I-device.

8   SETUP PROFINET I-DEVICE

8.1   OVERVIEW

PROFINET I-device function setup consists of the following steps.

1   PROFINET network configuration is made by a configuration tool, TIA Portal that is a products of Siemens, and downloaded to a PROFINET board. This step may include setting IP address and device name to PROFINET board. Please refer to Appendix I for more detail. Please change the start mode to "STOP" to stop the PROFINET board when you download the configuration to the PROFINET board.
2   Set Enable/Disable for I-Device and I/O Controller in the robot controller in Setup General screen.
3   Set the number of input/output in Setup I/O Controller screen and Setup I-Device screen.
4   Set "Protect Config." to FALSE in Setup General screen to permit PROFINET I-device function to read in the configuration made at step 1 from PROFINET board.
5   Cycle power of the robot controller.
6   Check I/O assignment of PROFINET input/output signals of robots. If it is not correct, change I/O assignment and turn off/on the robot controller.
7   Change the start mode from "STOP" to "RUN" in Setup General screen.

> ⚠ **WARNING**
> Changing start up mode to RUN immediately takes effect, that is, the PROFINET input/output signals of the robot controller activates immediately. Please verify I/O assignment of the robot controller is done and correct before changing the start up mode to RUN. Please verify the safety is assured and make sure if it is safe to start PROFINET I/O data exchange before changing the start up mode to RUN.

8   Then PROFINET I-device function reads in the configuration from the PROFINET board during an attempt to start PROFINET communication.
9   If there is any error, check the configuration made by the configuration tool to solve the error. To download configuration again, change the start up mode to STOP and.
10   If there is no error, check PROFINET I/O data exchange.
11   Do additional setting to the configuration read in from PROFINET board.
12   Then set "Protect Config." to TRUE so that PROFINET I-device function doesn't read in the configuration from the PROFINET board at next attempt to start PROFINET communication.
13   Turn off the robot controller.
14   The additional setting will be activated at next power up.

8.2 SETUP SCREENS

8.2.1 Setup General Screen

Use this screen to select start up mode, and to change Enable/Disable of I/O Controller and I/O Device. Press F3 key to show up the pop-up menu to open other screens. Press F10 key (press NEXT and then press F5) to clear I/O assignment.

```
┌──────────────────────────────────────────────────┐
│ Setup PROFINET IO              JOINT   10 %        │
│ General                        1/4                 │
│ 1. Max. digital port number :  2048                │
│ 2. Start up mode :             [SUSPEND]           │
│ 3. Protect config.              DISABLED           │
│ 4. I/O Controller              ENABLED             │
│ 5. I-Device                    ENABLED             │
│    Device ID                   0x000E              │
│    Vendor ID                   0x01B7              │
│ 6. Restart                     [1 SEC ]            │
│ 7. Reset Firmware              Execute             │
│                                                    │
│ [ TYPE ]    PEF      [Other]         >             │
│                                           CLR_ASG  │
└──────────────────────────────────────────────────┘
```

Fig.8.2.1(a) Setup general screen

┌──┐
│ ⚠ **WARNING**   │
│   Changing start up mode to RUN immediately takes effect, that is, the PROFINET │
│   input/output signals of the robot controller activates immediately. Please verify │
│   I/O assignment of the robot controller is done and correct before changing the │
│   start up mode to RUN. Please verify the safety is assured and make sure if it is │
│   safe to start PROFINET I/O data exchange before changing the start up mode to │
│   RUN.   │
└──┘

┌──┐
│ **NOTE**   │
│   The comment of modules is erased when the network configuration is read in. │
│   To recover the comment, please write it down before changing start up mode to │
│   STOP.   │
└──┘

Table 8.2.1(a) Setup general screen items

#	Item	Adjustable values	Description
1	Max. digital port number	-	This item displays $MAX_DIG_PRT
2	Start up mode	STOP RUN	STOP: PROFINET does not start automatically at power up. RUN : PROFINET starts automatically at power up. STOP -> RUN : PROFINET starts by changing start mode to RUN. Configuration is read in from PROFINET board if "Protect Config." is FALSE. RUN -> STOP : PROFINET stops by changing start mode to STOP.
3 (a)	Protect Config.	ENABLE DISABLE	DISABLE : (default) Configuration is read in from PROFINET board at an attempt of starting PROFINET. Existing configuration stored in system variabls are overwritten. ENABLE : Existing configuration is compared to the configuration stored in PROFINET board. They should match to start PROFINET. Otherwise alarm shows up.
4 (a)	I/O Controller	ENABLE DISABLE	Enable/Disable of I/O Controller
5 (a)	I-Device	ENABLE DISABLE	Enable/Disable of I-Device
	Device ID	-	Device ID stored to configuration in PROFINET board.
	Vendor ID	-	Vendor ID stored to configuration in PROFINET board.
6	Restart	1 SEC RESET NONE LEGACY	Behavior of restart attempt when PROFINET board is stopped from remote PC (e.g. configuration tool). 1 SEC : Restart is tried every 1 second. RESET : Restart is tried when reset button is pressed. NONE : Restart is never tried. LEGACY : Restart is done by the setting in system variables.
7	Reset firmware	-	By pressing "Execute", resetting firmware is attempted. PROFINET should start before this operation. This is used for recovery from error.

(a)   Need to cycle power to have the change applied.

Function key	Words	Description of function keys
F2	PEF	Open performance screen.
F3	Other	Selection of setup screens
F10	CLR_ASG	Clear I/O assignments *Clear ALL I/O assignments?*

8.2.1.1   Performance screen

Performance screen shows the indicator of the load of updating I/O signals of PROFINET.

```
 Setup PROFINET I/O                  JOINT   10 %
Performance
   Phase            Time
     1              1612
     2                 9
     3               128
     4                12




   [ TYPE ]                        Update

```

Fig. 8.2.1.1(a) Performance screen

Function key	Words	Description of function keys
F5	Update	Refresh the pane.

8.2.2   Setup I/O Controller Screen

Setup I/O Controller Screen is the same as that of PROFINET I/O function. Please refer to 3.4.2 for details.

8.2.3   Setup I-Device Screen

This screen is a top screen for I-Device setting. The robot controller as PROFINET I-Device is a modular device, whose configuration is made by TIA Portal. To enter module list screen, move cursor to the second line, "Module", and press Enter.

```
 Setup PROFINET IO                   JOINT   10 %
I-Device                                         1/2
1. Error one shot :                  DISABLED
2. Transfer areas                    <Detail>
3. Number of digital inputs :          1024
4. Number of digital outputs :         1024
5. Number of analog inputs :              0
6. Number of analog outputs :             0






   [ TYPE ]            [Other]               >
                                        CLR_ASG
```

Fig. 8.2.3(a) Setup I-Device screen

Table 8.2.3(a) Setup I-Device items

#	Item	Adjustable values	Description
1	Error one shot	ENABLE DISABLE	If it is ENABLE, pressing reset button can erase network error of I/O Controller even if it is present. Use this only during setup.
2	Transfer areas	-	Moves to "Module list" sub screen by pressing enter key with the cursor on this item.
3(a)	Number of digital inputs	0-8192	Number of DI mapped to rack 100. The value must be multiple of 8.
4(a)	Number of digital outputs	0-8192	Number of DO mapped to rack 100. The value must be multiple of 8.
5(a)	Number of analog inputs	0-25	Number of AI mapped to rack 100.
6(a)	Number of analog outputs	0-25	Number of AO mapped to rack 100.

(a)   Need to cycle power to have the change applied.

Function key	Words	Description of function keys
F3	Other	Selection of setup screens

8.2.3.1   Module list screen

The robot controller as PROFINET I-Device is composed of modules in PROFINET configuration made by TIA Portal. This screen displays the list of modules. Select a module and press F2 Detail to enter the parameters of the module. Press PREV to go back to setup I/O Device screen.

```
 Setup PROFINET IO                    JOINT   10 %
  I-Device : Modules                             1/17
 Slot Sub      Comment
   1   1000 SF [                                  ]
   1   1001    [                                  ]
   1   1002 TM [                                  ]
   1 32768     [                                  ]
   0 32769     [                                  ]
   0 32770     [                                  ]
   0 32771     [                                  ]
   0 32772     [                                  ]
   0     0     [                                  ]
   0     0     [                                  ]
 [ TYPE ]     detail          [Other]          >
```

Fig. 8.2.3.1(a) Module list screen

Table 8.2.3.1(a) Module list screen

#	Item	Adjustable values	Description
1	Slot	None	Displays slot number
2	Sub	None	Displays sub slot number
	Module Type	None	Abbreviation of module type is displayed for a safety module (SM) and a transfer module (TM).
3	Comment	String[24]	Explanation of the module

Need to cycle power to have the change applied.

Function key	Words	Description of function keys
F2	detail	Go to Module Detail screen of the selected submodule.
F3	Other	Selection of setup screens.

8.2.3.2   Module Detail Screen

The parameters of the module are displayed in this screen.

Table 8.2.3.2(a) Property name in GSDML file

Item name	Property name in GSDML file (use PROFINET-XML viewer to open the file)
ModId	Module Ident Number
SubslotId	Submodule Ident Number

```
Setup PROFINET IO                    JOINT   10 %
I/O Device : Module 1                          1/6
 1. Slot :                                        1
    Subslot :                                  1001
     Comment :
 2.                      [                        ]
    ModId(hex) :                       0x00000042
    SubslotId(hex) :                   0x00002e6f
    Input Length                              0
    Output Length                            16
    Module type :                           I/O
 3. Data type :                        [Digital]




      [ TYPE ]        list        prev      next
```

Fig. 8.2.3.2(a) Module detail screen

Table 8.2.3.2 (b) Module detail screen

#	Item	Adjustable values	Description
1	Slot	-	Slot number of the module
	Sub	-	Sub slot number of the module
2	Comment	String[24]	Explanation of the module
	ModId	-	Module Id of the module
	SubslotId	-	Subslot Id of the module
	Input Length	-	Input data length of the module in byte
	Output Length	-	Output data length of the module in byte
	Module type	-	Type of module (I/O, Safety, Transfer, None).
3 (a)	Data type	Digital Analog	Choose from digital and analog. It specifies if the process data is assigned to DI/DO or AI/AO. 1Byte module can't be assigned to analog. It doesn't have any effect on PROFINET I/O exchange.

(a)   Need to cycle power to have the change applied.

Function key	Words	Description of function keys
F2	list	Go to module list screen
F3	prev	Go to previous module
F4	next	Go to next module

> **NOTE**
> 1 Module parameters are set by TIA Portal.
>   Subslot ID 0x1001-0x1008 are reserved for PROFINET Safety module, therefore don't set subslot ID 0x1001-0x1008 on other modules.
> 2 PROFINET Safety option is required to use safety module. Only one safety module is possible. Subslot ID 0x1001-0x1008 are reserved for PROFINET Safety module, therefore don't set subslot ID 0x1001-0x1008 on other modules.

8.2.4   Setup Configuration List Screen

Setup Configuration List Screen is the same as that of PROFINET I/O function. Please refer to 3.4.4 for more detail.

8.3   STATUS SCREENS

Status screens are the same as those of PROFINET I/O function. Please refer to the chapter 4 for more detail.

8.4   DEVICE SWITCHING TP INSTRUCTIONS

Device switching TP instructions of PROFINET I-device function are the same as those of PROFINET I/O function. Please refer to the chapter 5 for more detail.

8.5   XDB BACKUP FUNCTION

Robot controller can take a backup of network configuration by reading out an XDB file from CP1604 PROFINET communication board.

The backup will be done automatically at the following events:
-    Before communication start at Hot Start or Cold Start
-    Before communication start when the start mode is changed from STOP to RUN on the PROFINET Setup General screen

This function is enabled when the bit 1(2) of system variable $PNG2_DL2.$K_BACKUP is ON.
e.g.) $PNG2_DL2.$K_BACKUP = 3(Enable), $PNG2_DL2.$K_BACKUP = 1(Disable)
Cycle power is needed for change to take effect. The backup destination is specified by $PNG2_DL2.$BACK_XDB.

First of all, the backup process checks the XDB file specified by $PNG2_DL2.$BACK_XDB.

If the XDB file exists, the file is compared to the XDB file in CP1604.
-    In case of match, the process ends and the backup is skipped. Any alarm isn't posted.
-    In case of mismatch, the process continues for taking a backup.
-    In case the comparison fails by internal error, following alarm is posted and the process ends.

    PRIO-668 WARN "PNIO(C): XDB backup check failed"

If the XDB file does not exist, the process continues for taking a backup. Next, the following alarms are posted when the process starts taking a backup.
    PRIO-662 STOP "PNIO: Backup is running"
    PRIO-655 WARN "PNIO: XDB backup started"

The following alarm is posted if the backup is successful.

PRIO-656 WARN "PNIO: XDB backup finished"

The following alarm is posted if the backup is failed, for example, when the file cannot be written to the specified backup destination etc.

PRIO-657 WARN "PNIO: XDB backup failed"

The timeout of the backup is specified by $PNG2_DL2.$COLD_TIMEO. The default is 300 seconds. The backup fails if it is not completed within this time.

The alarm severity of PRIO-655, PRIO-656, PRIO-657, PRIO-662, and PRIO-668 is set by the following system variables.

Table 8.5 (a) Relationship of Alarm and system variable

Alarm	System variable
PRIO-655	$PNG2_DL2.$BXDB_SEV1
PRIO-656	$PNG2_DL2.$BXDB_SEV1
PRIO-657	$PNG2_DL2.$BXDB_SEV2
PRIO-662	$PNG2_DL2.$BACKUP_SEV
PRIO-668	$PNG2_DL2.$XDBCHK_SEV

Table 8.5 (b) Alarm severity

Value	Severity
0	STOP
1	PAUSE
2	WARN
3	NOTE
5	SYSTEM

PROFINET communication is going to start after the backup process regardless of the backup succeeds or fails. To know the failure of backup, monitor PRIO-657 and PRIO-668. The state of XDB backup is set to $PNG2_DIAG2.$BACKUP_STAT.

Table 8.5 (c) $PNG2_DIAG2.$BACKUP_STAT

Value	Definition
0	XDB backup has not executed yet / boot up of controller (initial state)
1	XDB backup started (on going)
2	XDB check failed, (process ended with failure)
3	XDB exists, is same (process ended OK)
4	XDB exists but is different, backup processing started (on going)
5	XDB does not exists, backup processing started (on going)
6	XDB file writing failed, (process ended with failure)
7	Timeout, (process ended with failure)
8	Backup process successfully ended (process ended OK)

The value returns to 1 when backup process starts. $PNG2_DIAG2.$BACKUP_STAT changes as following figure.
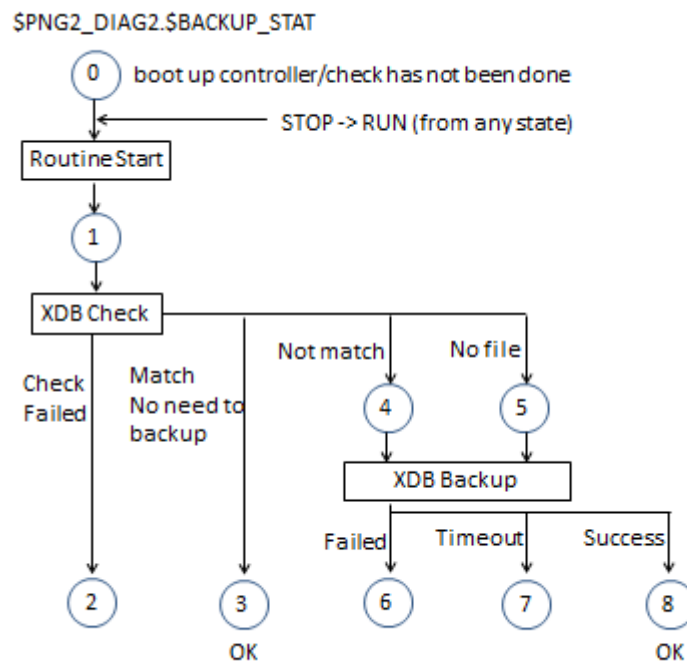
Fig. 8.5(a) $PNG2_DIAG2.$BACKUP_STAT

> **NOTE**
>   Cycle power is needed for change to take effect.

9 PROFINET FANUC board

This chapter describes the PROFINET function of the FANUC PROFINET board.

9.1 OVERVIEW

The maximum number of digital I/O of I/O controller and I/O Device is total 8192 points. To increase the number of points used, increase the number of digital I/O at the maximum number of control start. The analog I/O of the I/O controller and I/O device is not supported.

The actual usable data size is calculated as below.

(Total input data of I/O controller and I/O device [byte]) + (Total output data of I/O controller and I/O device [byte]) + {8 * (The number of submodules of I/O controller and I/O device)} < 800 bytes

Table 9.1(a) The number of I/O points and submodules

Number of submodules	Number of input	Number of output
2	3192	3192
16	2688	2688
36	2048	2048

If the value on the left side exceeds 512 bytes, please use Mainboard C (Force Sensor, High-speed communication CPU, for IO-Link *i* slave).

The I/O controller function has the following restrictions.
1   The enabled / disabled state of the device is not restored when the power is restored.
2   PRIO-621 does not occur even when there is no communication with the device.
    Check the connection status with the device on the Setting List Screen in Section 3.4.4. If necessary, make sure that the device is connected by the I/O value of the device. For example, if a device is connected, make sure that one point of the device's input signal is ON.
3   Appendix F HANDLING ALARM STORM is not supported.

> **NOTE**
> The models other than R-30iB Plus do not support the high-speed communication CPU. Therefore, the actual usable data size should not exceed 512 bytes.

9.2 SOFTWARE

Table 9.2(a) Option software of PROFINET FANUC board

Option software	Ordering specification	Description
PROFINET FANUC board	A05B-2600-S523	PROFINET consists of mini slot size PROFINET board made by FANUC. This function cannot coexist with PROFINET I-device function or Dual Channel PROFINET function. Software series 7DF4 or 7DF5 is required. Additionally, this function is supported on Single Channel only.

Option software	Ordering specification	Description
PROFINET FANUC board Single / Dual Channel	A05B-2600-S536	The PROFINET function is realized by inserting a PROFINET FANUC board into the mini-slot. In addition to the functions of the PROFINET FANUC board (A05B-2600-S523), this function allows subnetting of I/O communication. Cannot coexist with other PROFINET functions. Additionally, this function is supported on 7DF5 only. This function can be set with iPendant.
PROFINET Safety	A05B-2600-J931	This option software is for safety communication on PROFINET. For PROFINET Safety function, please refer to "Dual Check Safety Function OPERATOR'S MANUAL (B-83184EN)" in addition to this manual.

> **NOTE**
> Please check the overall version number of PROFINET FANUC board before setting the channel mode to Dual Channel. If it was PROFINET FANUC board before 02B, please contact your local FANUC representative.

9.3   HARDWARE

9.3.1   Ordering specification

Table 9.3.1(a) Hardware option of PROFINET FANUC board

Option hardware	Ordering specification	Description
PROFINET FANUC BOARD	A05B-2600-J084	Mini-slot size PROFINET board manufactured by FANUC

Table 9.3.1(b) R-30*i*B Plus Mainboard C

Option hardware	Ordering specification	Description
R-30*i*B Plus Mainboard C (Force Sensor, High-speed communication CPU for IO Link i slave)	A05B-2670-H003	With the high-speed communication CPU, the performance of PROFINET can be improved. If the actual usable data size in Section 9.1 exceeds 512 bytes, be sure to use mainboard C.

> **NOTE**
> The models other than R-30iB Plus do not support the high-speed communication CPU. Therefore, the actual usable data size in Section 9.1 should not exceed 512 bytes.

9.3.2 Details of HARDWARE

The PROFINET FANUC board has four Ethernet ports and an external power supply connector as shown in Fig. 9.3.2. The external power supply connector will be used for future supported functions. No wiring is currently required. Please refer to Table 9.3.2 for more information on the LEDs on the board.
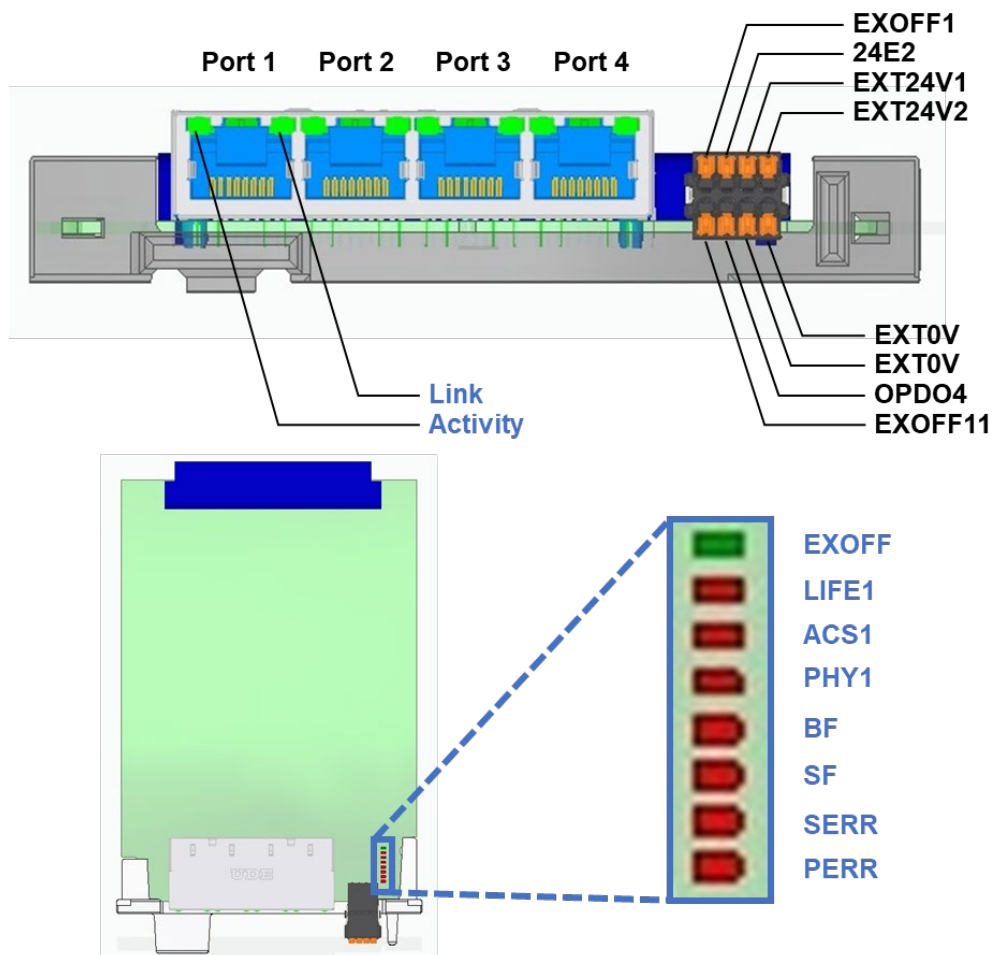
Fig. 9.3.2 PROFINET FANUC BOARD

Table 9.3.2 PROFINET FANUC BOARD LEDs

LED name	Color	Status	Description
Link	Orange	Lighting	Connection established
Activity	Green	Lighting	Sending and receiving data
BF	-	Off	Link established
	Red	Lighting	Link error occurred
SF	-	Off	Normal
	Red	Blinking	DCP LED flash
SERR	Red	Lighting	System error occurred
PERR	Red	Lighting	Parity error occurred
PHY1	Red	Lighting	Reserved
ACS1	Red	Lighting	Reserved
LIFE1	Red	Lighting	Reserved
EXOFF	Green	Off	Reserved

9.3.3   Details of Ethernet ports

The PROFINET FANUC board has four Ethernet ports as shown in Figs. 9.3.3(a), 9.3.3(b). Figs. 9.3.3(a), 9.3.3(b) show the details of Ethernet port assignment for Single and Dual Channels. If you chose the Dual Channel mode, port 1 and port 2 are I/O Device, port 3 and port 4 are I/O Controller, respectively.
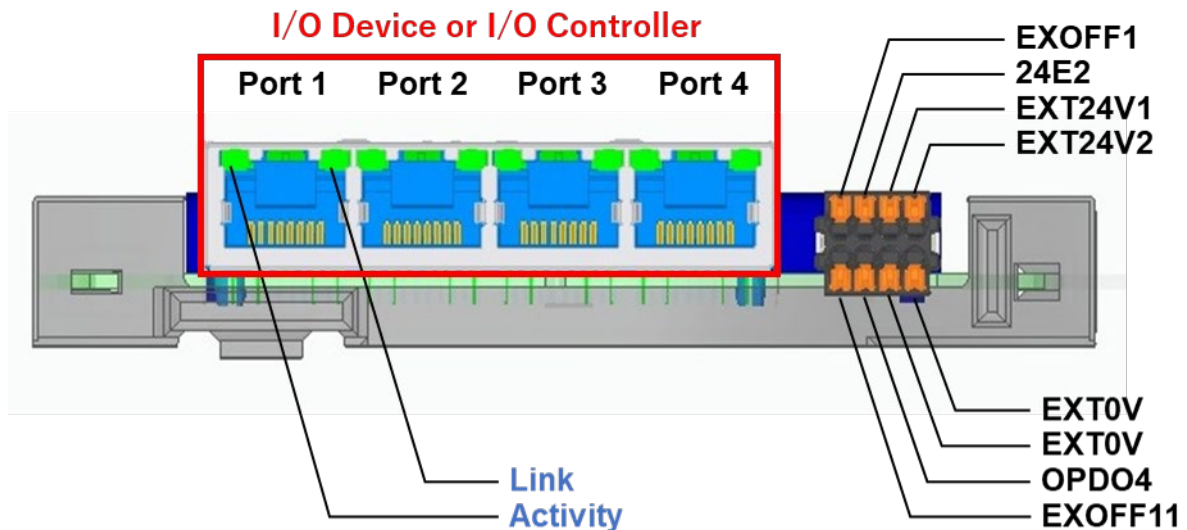
Fig. 9.3.3(a) PROFINET FANUC board (Single Channel)
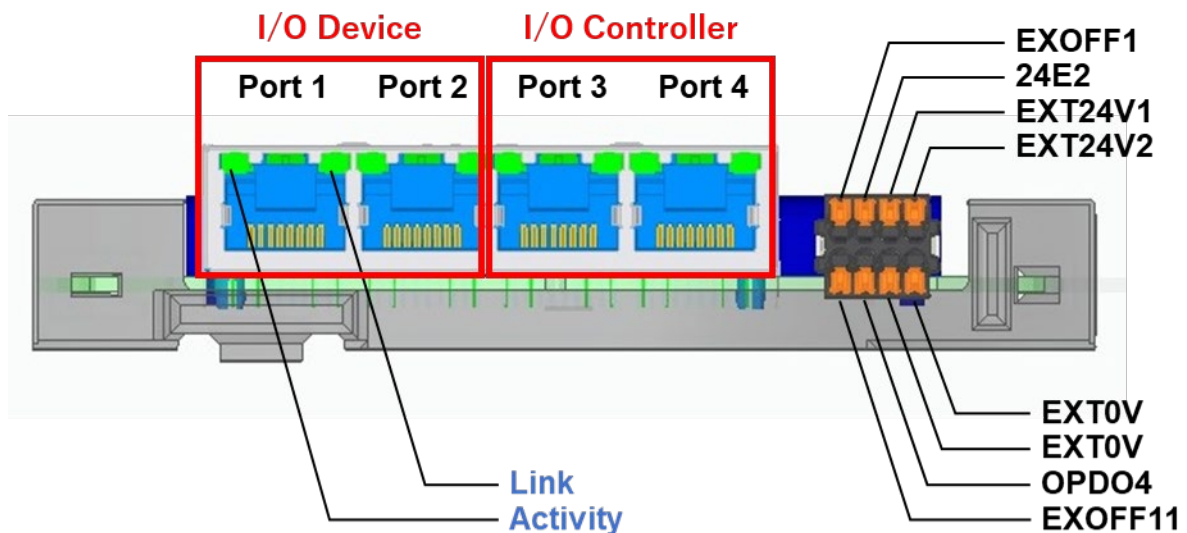
Fig. 9.3.3(b) PROFINET FANUC board (Dual Channel)

9.4   PROFINET FANUC board firmware

There are three types of PROFINET FANUC board firmware: Boot, OS, and App, all of which must be compatible with the robot controller software. For different versions, you need to update the firmware by following the steps below.

NOTE

Please use a PROFINET FANUC board with a comprehensive version number 03C or later in order to set the channel mode to Dual Channel with 7DF5/29 or later.

NOTE

If the firmware version does not match with the software of the robot controller, PRIO-649 is displayed. PRIO-649 is displayed when you also change the channel mode. Please update the firmware following procedure when this alarm displayed.

In addition, if you use the software of the robot controller before 7DF4/07 or 7DF5/19, the PRIO-649 will not be displayed. However, a firmware update must be performed. After executing the firmware update and rebooting, the version display on the BOOT screen may not be displayed correctly. It has no practical problem when in use.

The firmware is updated by a KAREL pnfbupdt.pc. Open the list screen with the SELECT key and execute pnfbupdt.pc. When you press the [MENU] key to open the user screen, the following screen is displayed. Press the key 1 to update, or press other key not to update. Please check the channel mode displayed on the Firmware Update screen before updating the firmware. If you press the key 1, it will be updated to the version displayed on the screen.
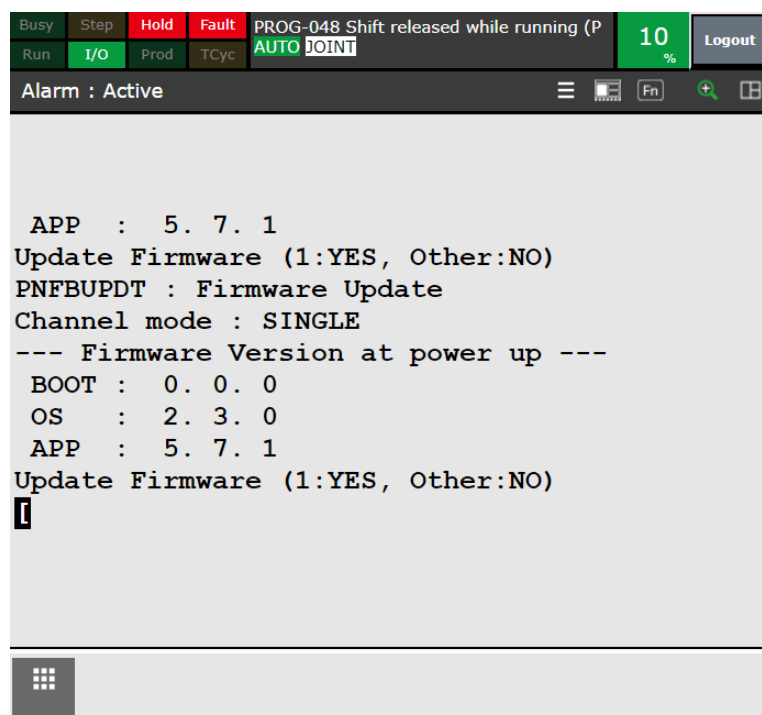
Fig. 9.4(a) Firmware Update screen (Single Channel)
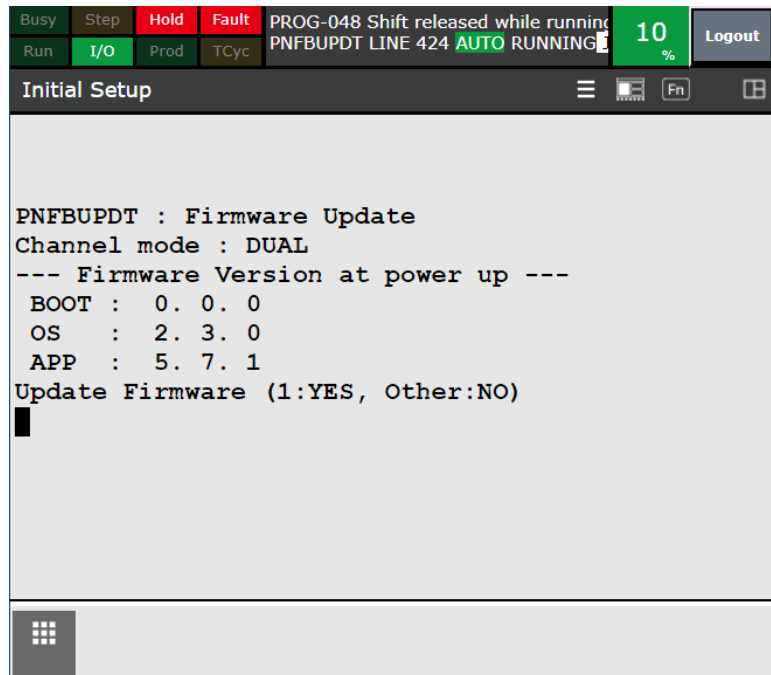
Fig. 9.4(b) Firmware Update screen (Dual Channel)

⚠ **WARNING**
Never turn off the power while updating the firmware. The firmware may be corrupted and the PROFINET FANUC board may stop working.

NOTE
Depending on the firmware version, the following message may be displayed after updating the App when run pnfbupdt.pc. Only if you see this message, turn off the power and then run pnfbupdt.pc again in the same way.

```
          *   SKIP BOOT UPDATE   *
     ***** Please RUN this program *****
     *****   again after cycle power  *****
     *****        to update BOOT      *****
```

9.5　GSDML

GSDML file is used by the configuration software. The GSDML file contains information about the device as a PROFINET device. When setting the I/O controller that communicates with the robot controller, read the GSDML file into the I/O controller setting software and use it. FANUC provides the GSDML file.

Table 9.5(a) GSDML file (Single Channel)

H/W Platform	Model	File name	Vendor ID	Device ID
7DF4 (V9.36P)	R-30iB Plus	GSDML-V2.42-Fanuc-A05B2600S523V9 36P4P-20220112.xml	0x01B7	0x20
7DF5 (V9.40P)	R-30iB Plus	GSDML-V2.41-Fanuc-A05B2600S523V9 40P4P-20210921.xml	0x01B7	0x20
	R-30iB Mini Plus	GSDML-V2.41-Fanuc-A05B2600S523V9 40X4P-20211018.xml	0x01B7	0x21
	R-30iB Mate Plus	GSDML-V2.41-Fanuc-A05B2600S523V9 40M4P-20211026.xml	0x01B7	0x22
	R-30iB Compact Plus	GSDML-V2.41-Fanuc-A05B2600S523V9 40C4P-20211027.xml	0x01B7	0x23

Table 9.5(b) GSDML file (Dual Channel)

H/W Platform	Model	File name	Vendor ID	Device ID
7DF5 (V9.40P)	R-30iB Plus	GSDML-V2.42-Fanuc-A05B2600S536V9 40P2P-20220518.xml	0x01B7	0x24
	R-30iB Mini Plus	GSDML-V2.42-Fanuc-A05B2600S536V9 40X2P-20220518.xml	0x01B7	0x25
	R-30iB Mate Plus	GSDML-V2.42-Fanuc-A05B2600S536V9 40M2P-20220518.xml	0x01B7	0x26
	R-30iB Compact Plus	GSDML-V2.42-Fanuc-A05B2600S536V9 40C2P-20220518.xml	0x01B7	0x27

> **NOTE**
> The GSDML file is different for Single and Dual Channels. Please check the channel mode and supported model before use.

9.6　INPUT SIGNALS AT COMMUNICATION FAILURE

If I/O Device communication failes, "PRIO-621 PNIO(D) device is not running" shows up.
Input signals of I/O Device are cleared if IOPS = BAD, at power up and when the connection is lost.
IF I/O Controller communication failes, "PRIO-622 PNIO(C) controller is not running" shows up.
Input signals of I/O Controller are cleared if IOPS = BAD, at power up and when the connection is lost.

10   SETUP PROFINET FANUC board

10.1   OVERVIEW

This section describes the procedure for setting the PROFINET FANUC board.

1   Create the configuration files required for PROFINET network settings and copy them to the FR:¥pnfb directory of the robot controller. Please refer to 10.5 for details. Set the IP address and device name of PROFINET. You can use a Siemens configuration tool (TIA Portal, PRONETA) to set the IP address and device name. Please refer to 10.6 for details. When performing this work, switch the start mode to STOP in order to stop the PROFINET board.
2   Set Enable/Disable of I-Device and I/O Controller on the Setup General Screen.
3   Set the number of I/O points on the Setup I-Device Screen and the Setup I/O Controller Screen.
4   Restart the robot controller.
5   Check I/O assignment of PROFINET. If it does not connect, change the I/O assignment and restart the robot controller.
6   Switch start mode STOP to RUN on the Setup General Screen.

> ⚠ **WARNING**
> Changing start mode to RUN, the PROFINET input/output signals of the robot controller activates. Please verify I/O assignment of the robot controller is done and correct before changing the start up mode to RUN. Please verify the safety is assured and make sure if it is safe to start PROFINET I/O data exchange before changing the start up mode to RUN.

7   Changing start mode to RUN, the configuration files are installed from the FR:¥pnfb of the robot controller to PROFINET board. If the configuration files are not found in the FR:¥pnfb directory, upload the configuration file currently loaded on the PROFINET board to the FR:¥pnfb directory.
8   If there are any errors, check the configuration created by the configuration tool to fix the error. To download configuration again, and change the start up mode to STOP.
9   If there is no error, check PROFINET I/O data exchange.
10   Do additional setting to the configuration read in from PROFINET board.
11   Turn off the robot controller.
12   The additional setting will be activated at next power up.

10.2   SETUP SCREENS

10.2.1   Setup General Screen

Use this screen to select start mode, and to change Enable/Disable of I/O Controller and I/O Device. Press the F3 key to show up the pop-up menu to open other screens. Press the F10 key (press NEXT and then press the F5) to clear I/O assignment.
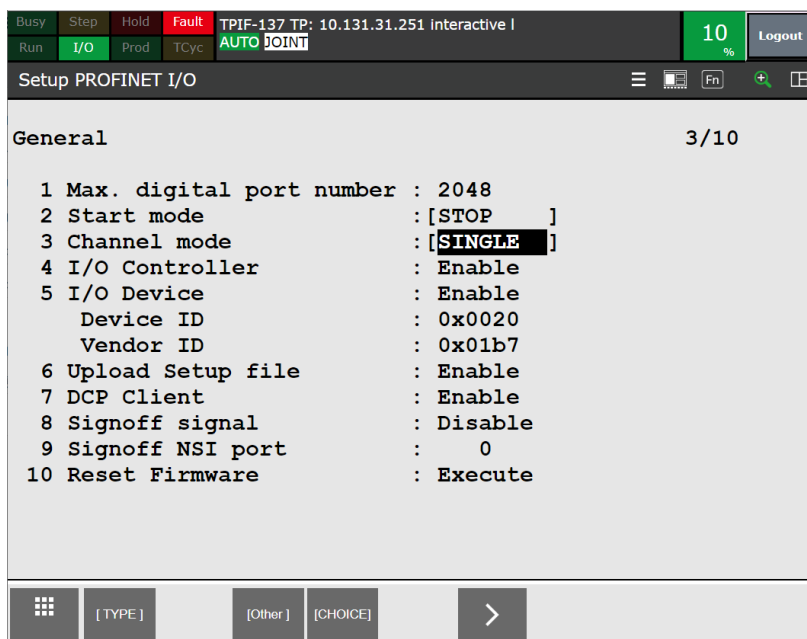
Fig. 10.2.1(a) Setup general screen (Single channel)
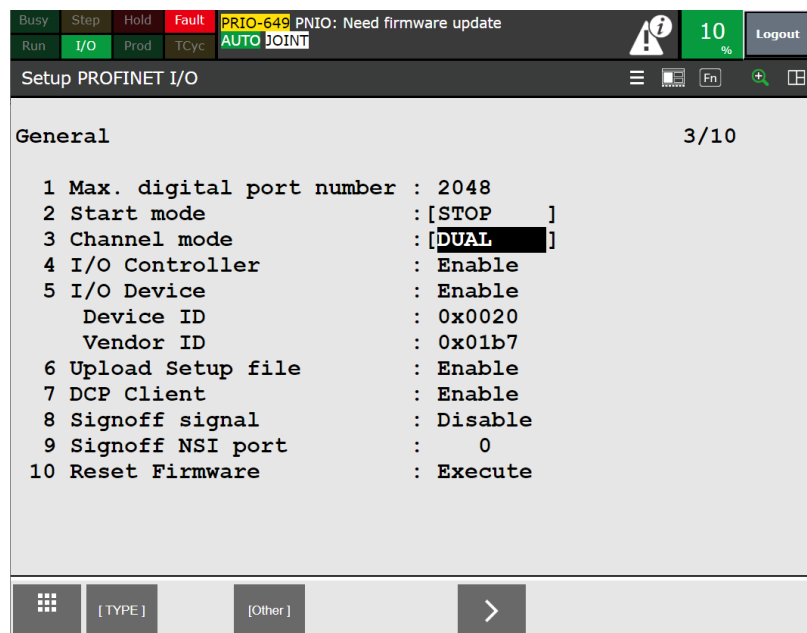
Fig. 10.2.1(b) Setup general screen (Dual channel)

Table 10.2.1(a) Setup general screen items

#	Item	Adjustable values	Description
1	Max. digital port number	-	Displays max digital port number
2	Start mode	STOP RUN	STOP : PROFINET does not start automatically at power up. RUN : PROFINET starts automatically at power up. STOP -> RUN : PROFINET starts by changing start mode to RUN. RUN -> STOP : PROFINET stops by changing start mode to STOP.
3(a)	Channel mode	SINGLE DUAL	SINGLE : Single channel I/O communication. DUAL : Dual channel I/O communication. Port 1 and port 2 are I/O Device, port 3 and port 4 are I/O Controller, respectively. (Requires A05B-2600-S536 to use this function) Initial value : SINGLE This item is always displayed if the software version is 7DF5/29 or later.
4(a)	I/O Controller	ENABLE DISABLE	Enable/Disable of I/O Controller Initial value : ENABLE
5(a)	I-Device	ENABLE DISABLE	Enable/Disable of I-Device Initial value : ENABLE
	Device ID	-	Device ID stored to configuration in PROFINET board.
	Vendor ID	-	Vendor ID stored to configuration in PROFINET board.
6	Upload Setup file	ENABLE DISABLE	Enable/Disable of upload setup file Initial value : ENABLE This item is always displayed if the software version is 7DF5/29 or later.
7		ENABLE DISABLE	Enable/Disable of DCP Client Initial value : ENABLE
8		ENABLE DISABLE	Enable/Disable of Sign off (Requires A05B-2600-J638 or A05B-2600-J639 to use this function) Initial value : DISABLE
9		0 ~	Number of using Sign off signal (Requires A05B-2600-J638 or A05B-2600-J639 to use this function) Initial value : 0
10	Reset firmware	-	By pressing "Execute", resetting firmware is attempted. Please switch the start mode to STOP before executing.

(a) Need to cycle power to have the change applied.

Function key	Words	Description
F2	PEF	Unused
F3	Other	Selection of setup screens
F10	CLR_ASG	Clear I/O assignments

> ⚠ **WARNING**
> Changing start mode to RUN, the PROFINET input/output signals of the robot
> controller activates. Please verify I/O assignment of the robot controller is done
> and correct before changing the start up mode to RUN. Please verify the safety
> is assured and make sure if it is safe to start PROFINET I/O data exchange
> before changing the start up mode to RUN.

> **NOTE**
> The comment of modules is erased when the network configuration is read in.
> To recover the comment, please write it down before changing start up mode to
> STOP.

> **NOTE**
> The configuration file has a limit to the number of times it can be written, we
> recommend setting it to "Upload Setup file : DISABLE" after the startup is
> complete.

10.2.2 Setup I/O Controller Screen

Setup I/O Controller Screen is the same as that of PROFINET I/O function. Please refer to 3.4.2.

10.2.3 Setup I-Device Screen

Setup I-Device Screen is the same as that of PROFINET I-device function. Please refer to 8.2.3.
Module List Screen and Module Detail Screen do not support the display of modules on the device.

10.2.4 Setup Configuration List Screen

Setup Configuration List Screen is the same as that of PROFINET I/O function. Please refer to 3.4.4.

10.2.5 Setup Ethernet Address Screen

Use this screen to setup Ethernet address of I/O Device and I/O Controller.

> **NOTE**
> Please enter the IP Address, Subnet Mask and Router Address without spaces.
> Them might not be set up correctly.

Fig. 10.2.5(a) Setup Ethernet address screen (Single Channel)

Table 10.2.5(a) Setup Ethernet address screen items (Single Channel)

#	Item	Adjustable values	Description
1	IP Address	[0.0.0.0]-[255.255.255.255]	IP address of I/O Device or I/O Controller
2	Subnet Mask	[0.0.0.0]-[255.255.255.255]	Subnet mask of I/O Device or I/O Controller
3	Router Address	[0.0.0.0]-[255.255.255.255]	Router address of I/O Device or I/O Controller
4	Device Name	0-32	Device name of I/O Device or I/O Controller Please set the device name in lowercase alphabetical or numeric characters.

Fig. 10.2.5(b) Setup Ethernet address screen (Dual Channel)

Table 10.2.5(b) Setup Ethernet address screen items (Dual Channel)

#	Item	Adjustable values	Description
1	IP Address	[0.0.0.0]-[255.255.255.255]	IP address of I/O Device
2	Subnet Mask	[0.0.0.0]-[255.255.255.255]	Subnet mask of I/O Device This item should be set to the values different from the subnet mask of the I/O Controller.
3	Router Address	[0.0.0.0]-[255.255.255.255]	Router address of I/O Device
4	Device Name	0-32	Device name of I/O Device Please set the device name in lowercase alphabetical or numeric characters.
5	IP Address	[0.0.0.0]-[255.255.255.255]	IP address of I/O Controller
6	Subnet Mask	[0.0.0.0]-[255.255.255.255]	Subnet mask of I/O Controller This item should be set to the values different from the subnet mask of the I/O Device.
7	Router Address	[0.0.0.0]-[255.255.255.255]	Router address of I/O Controller
8	Device Name	0-32	Device name of I/O Controller Please set the device name in lowercase alphabetical or numeric characters.

Function key	Words	Description
F1	TYPE	Selection of setup screens
F2	APPLY	Application of changes
F3	Other	Selection of setup screens
F10	CLR_ASG	Clear I/O assignments

10.3   I/O CONFIGURATION

I/O Configuration Screen is the same as that of PROFINET I/O function. Please refer to chapter 4.

10.4 DEVICE SWITCHING TP INSTRUCTIONS

Device switching TP instructions are the same as those of PROFINET FANUC board function. Please refer to the chapter 5.

10.5 CONFIGURATION FILE

10.5.1 Configuration File List

Create the configuration file required to communicate with the PROFINET FANUC board and copy it to the FR:¥pnfb¥ directory.The required configuration files are listed in Table 10.5.1 (a). Also, the file name must be the same as in Table 10.5.1 (a).

Table 10.5.1(a) Configuration file list

Name	Description
device1.zip	This is a configuration file for I/O Device communication. This file is load to the PROFINET FANUC BOARD from the FR:¥pnfb directory when communication starts. Please refer to 10.5.2 for details.
tic.zip	This is a configuration file for I/O Controller communication. This file is load to the PROFINET FANUC BOARD from the FR:¥pnfb directory when communication starts. Please refer to 10.5.3 for details.
dev_config.dt	This file contains device information (device name, station ID, etc.) for I/O controller communication. Please refer to 10.5.4 for details.
bas_cm_api.ini	This is a configuration file for PROFINET FANUC BOARD. This file will be uploaded from the PROFINET FANUC BOARD for backup at power on. This file does not need to be created.

10.5.2 Creating device1.zip

device1.zip is a configuration file required for I/O Device communication. Use any text editor to create device1.xml, ZIP-compress it with the name device1.zip, and copy it to the FR:¥pnfb directory. device1.zip in the FR:¥pnfb directory will be loaded into the PROFINET board at the start of communication.

The format of device1.xml of Single and Dual Channel are shown below. Please use it as it is without changing the following parts.

Single Channel

```
<?xml version="1.0" encoding="utf-8"?>
<Device>
  <Module Slot="0" ID="0x00000300">
    <Submodule API="0" Subslot="1" ID="0x00000001" Inputlen="0" Outputlen="0" IMCarrier="1" />
    <Submodule API="0" Subslot="0x8000" ID="0x00008000" Inputlen="0" Outputlen="0" />
    <Submodule API="0" Subslot="0x8001" ID="0x00008001" Inputlen="0" Outputlen="0" />
    <Submodule API="0" Subslot="0x8002" ID="0x00008002" Inputlen="0" Outputlen="0" />
    <Submodule API="0" Subslot="0x8003" ID="0x00008003" Inputlen="0" Outputlen="0" />
    <Submodule API="0" Subslot="0x8004" ID="0x00008004" Inputlen="0" Outputlen="0" />
  </Module>
</Device>
```

Dual Channel

```
<?xml version="1.0" encoding="utf-8"?>
<Device>
  <Module Slot="0" ID="0x00000300">
    <Submodule  API="0"  Subslot="1"  ID="0x00000001"  Inputlen="0"  Outputlen="0"
IMCarrier="1" />
    <Submodule API="0" Subslot="0x8000" ID="0x00008000" Inputlen="0" Outputlen="0" />
    <Submodule API="0" Subslot="0x8001" ID="0x00008001" Inputlen="0" Outputlen="0" />
    <Submodule API="0" Subslot="0x8002" ID="0x00008002" Inputlen="0" Outputlen="0" />
  </Module>
</Device>
```

Set the I/O Device by writing up to 8 modules of I/O module and safety I/O module after </ Module>. The number of input and output points of the I/O Device is the total of the modules. It is necessary to select the same module when setting the I/O Device with the PLC setting tool. The settings for each module consist of the following three lines. Table 10.5.2 (a) for module elements, Table 10.5.2 (b) for submodule elements, Table 10.5.2 (c) for I/O module elements, and safety I/O module elements refer Table 10.5.2 (d) for details.

```
<Module Slot="1" ID="8">
  <Submodule API="0" Subslot="01" ID="0x00000001" Inputlen="4" Outputlen="0" />
</Module>
```

Table 10.5.2(a) Elements of Module

Element	Value	Description
Slot	1	A number (1-8) that indicates the order of the modules. Numbers 1 to 8 are assigned in order from the front. (Cannot be duplicated)
ID	8	A number (1-8) that indicates the kind of the modules. Please refer to Table 10.5.2(c), (d) for details. Both decimal and hexadecimal numbers can be used as the ID value, but Table 10.5.2 (c) is displayed in decimal number and Table 10.5.2 (d) is displayed in hexadecimal number. The safe I / O modules in Table 10.5.2 (d) can only be set to Slot = 1.

Table 10.5.2(b) Elements of Submodule

Element	Value	Description
API	0	always 0
Subslot	01	always 01
ID	0x00000001	always 0x00000001
Inputlen	4	Specify a number of input points in byte (8 points) units. This values corresponding to the IDs in Table 10.5.2 (c) and (d)
Outputlen	0	Specify a number of output points in byte (8 points) units. This values corresponding to the IDs in Table 10.5.2 (c) and (d)

Table 10.5.2(c) I/O module list

ID (dec)	Inputlen	Outputlen	Description
1	1	1	Input 8 points. Output 8 points.
2	1	0	Input 8 points.
3	0	1	Output 8 points.
4	2	2	Input 16 points. Output 16 points.
5	2	0	Input 16 points.
6	0	2	Output 16 points.
7	4	4	Input 32 points. Output 32 points.
8	4	0	Input 32 points.

ID (dec)	Inputlen	Outputlen	Description
9	0	4	Output 32 points.
10	16	16	Input 128 points. Output 128 points.
11	16	0	Input 128 points.
12	0	16	Output 128 points.
13	32	32	Input 256 points. Output 256 points.
14	32	0	Input 256 points.
15	0	32	Output 256 points.
16	64	64	Input 512 points. Output 512 points.
17	64	0	Input 512 points.
18	0	64	Output 512 points.
19	128	128	Input 1024 points. Output 1024 points.
20	128	0	Input 1024 points.
21	0	128	Output 1024 points.

Table 10.5.2(d) Safe I/O module list

ID (hex)	Inputlen	Outputlen	Description
0x2001	6	6	Safety input 8 points. Safety output 8 points.
0x2002	7	7	Safety input 16 points. Safety output 16 points.
0x2003	8	8	Safety input 24 points. Safety output 24 points.
0x2004	9	9	Safety input 32 points. Safety output 32 points.
0x2005	10	10	Safety input 40 points. Safety output 40 points.
0x2006	11	11	Safety input 48 points. Safety output 48 points.
0x2007	12	12	Safety input 56 points. Safety output 56 points.
0x2008	13	13	Safety input 64 points. Safety output 64 points.

The setting example is described below.
Example 1)
Slot 1: input 1024 points. output 1024 points

```
<Module Slot="1" ID="19">
  <Submodule API="0" Subslot="01" ID="0x00000001" Inputlen="128" Outputlen="128" />
</Module>
```

Example 2)
Slot 1: Safety input 64 points. Safety output 64 points.
Slot 2: input 512 points. output 512 points.

```
<Module Slot="1" ID="0x2008">
  <Submodule API="0" Subslot="01" ID="0x00000001" Inputlen="13" Outputlen="13" />
</Module>
<Module Slot="1" ID="16">
  <Submodule API="0" Subslot="01" ID="0x00000001" Inputlen="64" Outputlen="64" />
</Module>
```

10.5.3   Creating tic.zip

tic.zip is a configuration file required for I/O Controller communication. Create it using PLCnext Engineer (*1), ZIP-compress the created file with the name tic.zip, and copy it to the FR:¥pnfb directory. The tic.zip in the FR:¥pnfb directory is loaded into the PROFINET FANUC board when communication starts. The procedure for creating tic.zip is explained below.

1   Start PLCnext Engineer, and select "Create a new project".
2   Read the .fdcml file with "File → Import → Import FDCML 3.0 device description …"
     The .fdcml file can be obtained from FANUC.

3   Read the .gsdml file of device I/O Controller communication with "File → Import → Import GSDML file …" (Obtain the .gsdml file from the device manufacturer).

4   Select SW IOC from "Network → local → Devices → PLC" in the "Component" window and drag and drop it into the "Plant" window to add the SW IOC.

5   Select modules from "Network → local → Devices → I/O → Interface modules" in the "Component" window and drag and drop it into the "Plant" window to add the modules.

6   Additional parameter settings may be required depending on the device used. The Siemens ET200SP requires the base module (light or dark) setting, so double-click the added module and set it from the Parameter tab.

7   When building with Project → REBUILD, in addition to links.xml and sw-ioc-1.tic, as many .tic as the number of added devices will be created (*2). ZIP-compress all of this with the name tic.zip.

(*1)   PLCnext Engineer can be downloaded free from the PHOENIX CONTACT website.

(*2)   Created in "C:¥Users¥Public¥PLCnext Engineer¥Binaries¥*@binary¥RES_* ¥Arp.Io.PnC" by default.

10.5.4   Creating dev_config.dt

dev_config.dt contains device information (device name, station ID, etc.) for I/O Controller communication. Create a dev_config.dt with any text editor, and change the extension to .dt.

By dev_config.dt copying to FR:¥pnfb¥ directory, read at power up and update the robot controller setting. The following explains how to create dev_config.dt.

The version number is written on the first line. The version is 1.1. Enter the device information on the second and subsequent lines. When entering device information, enter it in the format "slot [*slot number*]. *Element = x*". You can use slot numbers from 1 to 25. Use the elements in Table 10.5.4 (a) to specify the device name, station ID, etc.

```
ver : 1.1
slot[1].name = dev01
slot[1].station_id = 201
slot[1].di_byte = 2
slot[1].do_byte = 2
slot[1].alias = device_1
slot[2].name = dev02
slot[2].station_id = 202
slot[2].di_byte = 2
slot[2].do_byte = 2
slot[2].alias = device_2
```

Table 10.5.4(a) Elements used in the dev_config.dt

Element	Description
name	Specify the device name. Up to 59 characters. (Cannot be duplicated)
station_id	Specify the station ID. (Cannot be duplicated)
di_byte	Specify the number of DI points to be assigned to the device in bytes (8 points).
do_byte	Specify the number of DO points to be assigned to the device in bytes (8 points).
alias	Specify any character string to be displayed instead of the device name.

Check if the device name described in the .tic file is in dev_config.dt at the start of communication. If the .tic file matches the device name listed in dev_config.dt, the I/O data for that device is copied between the DI/DO in the slot of the station ID.

As an example above, if the device name dev01 in dev_config.dt matches that in the .tic file, copy the input / output data (2 bytes / 2 bytes) on device dev01 between the DI/DO in slot 201.

> **NOTE**
> When specifying the device name, station ID, etc., the data cannot be read correctly unless a space is entered before and after the =. In this case, the alarm PRIO-721 "PNIO: dev_config.dt read failure (line:%d)" indicating a syntax error is displayed. PRIO-721 will be displayed even if there is a blank line, so do not insert unnecessary line breaks.

10.6   DCP Client

DCP Client is supported as standard in PROFINET FANUC board. Switching between enable and disable is executed on the Setup General Screen. Please refer to 10.2.1 for detail.
By enabling the DCP Client, PRONETA Basic (*1) can recognize the PROFINET FANUC board even when PROFINET communication is stopped. The device name and IP address of PROFINET FANUC board can be set from PRONETA Basic with this DCP Client enabled.

(*1) PRONETA Basic can be downloaded free from the Siemens website.

10.6.1   Setup device name and IP address

1. Please confirm to stop the PROFINET communication on Setup General Screen. If the start mode is RUN, switch the start mode to STOP.
2. Connect the PROFINET FANUC board to the PC on which PRONETA Basic is installed.
3. Start PRONETA Basic. Then, the home screen will be displayed, so select "Network Analysis".
4. After a while, the screen will switch to the screen shown in Fig. 10.6.1(a), and the current network configuration will be displayed. In Fig. 10.6.1(a), the PLC, I / O module, PROFINET FANUC board and PC are connected via an Ethernet switch.
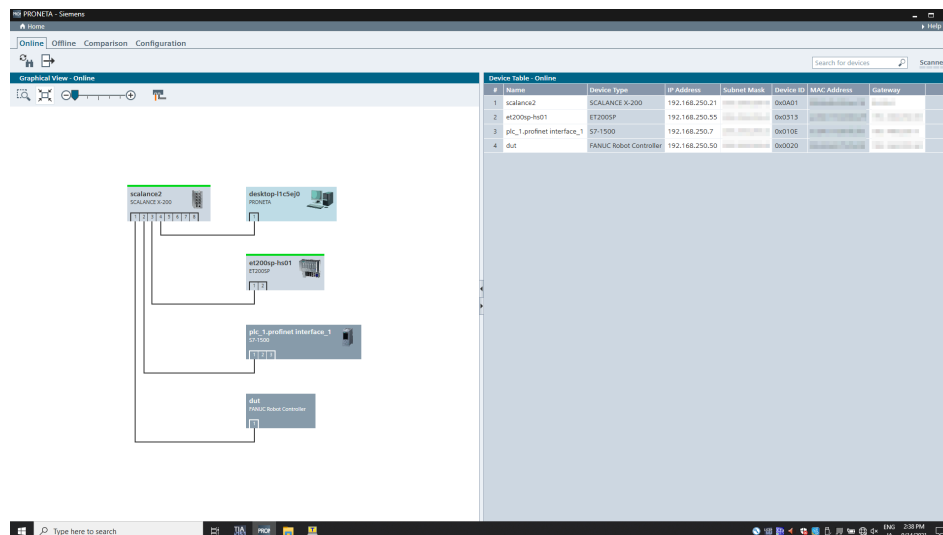
Fig. 10.6.1(a) PRONETA Online Screen

5. Place the cursor on the device you want to set and left-click in the Device Table - Online window. Then the item will be marked in blue, so right-click here. When the property menu is displayed as shown in Fig. 10.6.1 (b), select "Set Network Parameters".
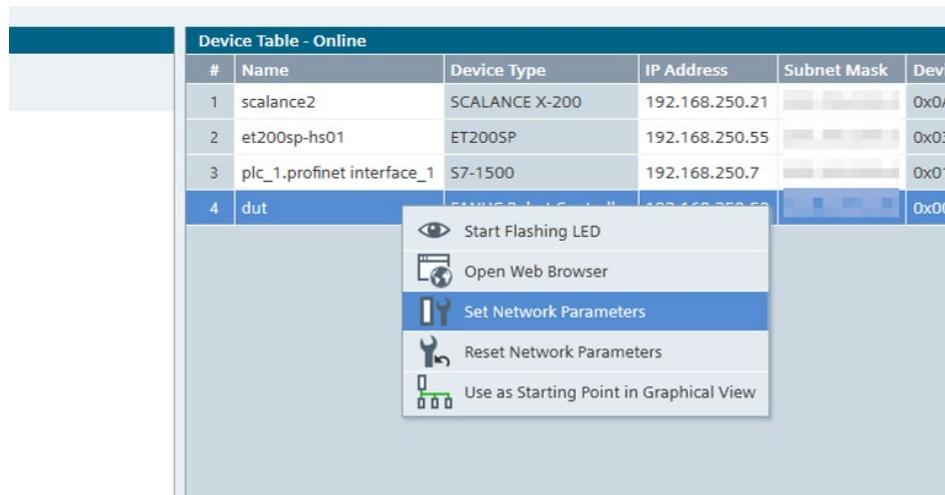
Fig. 10.6.1(b) PRONETA properties menu

6. The Set Network Parameters window is displayed as shown in Fig. 10.6.1 (c). If you want to change the device name, select "Assign Device Name". If you want to change the IP address, select "IP Configuration" and enter the value. Left-click "Set" to complete the settings.
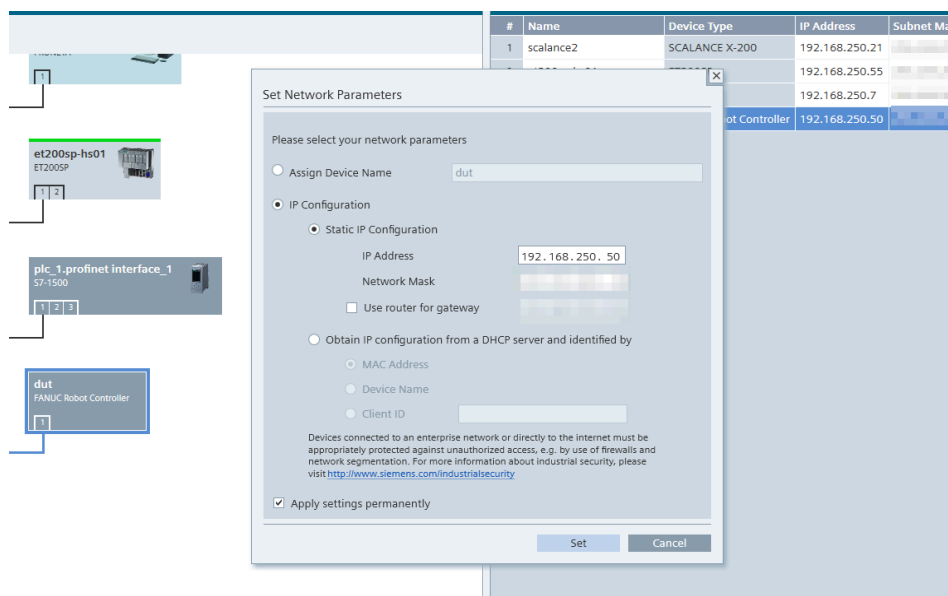
Fig. 10.6.1(c) PRONETA Set Network Parameters window

7. Click the "Refresh" at the top left of the screen and check if the setting changes are applied.

APPENDIX

A ADVANCED FEATURES

A.1 OVERVIEW

A.1.1 Important Notice

Important information about advanced features are listed here, please read them at first.
The contents of Appendix A apply only to the PROFINET I/O function and PROFINET I-device function.

> **NOTE**
> 1 Alarm indication interface (refer to Appendix A.3) function needs a KAREL program that reads out alarm indication. Customer must make the KAREL program by themselves. This function must be disabled if the KAREL program doesn't exist (refer to Appendix A.1.2). Otherwise, alarm indication uses memory while it is kept unread. PRIO-645 warns this status. This function is disabled by default in 7DA7/26(V7.70P/26) or later, and R-30*i*B.
> 2 A part of new alarms shows up just for event notification. If this is not desirable, suppress the alarms by system variables. Please refer to Appendix A.1.2 for more detail.

A.1.2 System Variables

There are system variables that control advanced features. Each bit corresponds to a function of an advanced feature. If the bit is set (1), the feature is enabled. If the bit is not set (0), the feature is disabled.

Example)
If the bit 0, 1, 4, 5 are ON, the value is 1+2+16+32 = 51.

$PNIO_CFG2.$USHORT4

Bit	Dec	Meaning	Refer to
0	1	IOPS monitoring enable (GOOD->BAD)	A.2.2
1	2	IOPS monitoring enable (BAD->GOOD) This bit is considered only when the bit 0 is ON.	A.2.2
2	4	Alarm indication interface for diagnostic alarm/disappear	A.3
3	8	Alarm indication interface for other alarm/disappear This bit is considered only when the bit 2 is ON.	A.3
4	16	IOCS monitoring for output device (GOOD->BAD)	A.2.2
5	32	IOCS monitoring for output device (BAD->GOOD) This bit is considered only when the bit 4 is ON.	A.2.2
6-15	-	Reserved (usually these bits should be OFF)	

$PNIO_CFG2.$USHORT5

Bit	Dec	Meaning	Refer to
0	1	Device return notification	A.2.3
1	2	Device return notification by switching function This bit is considered only when the bit 0 is ON.	A.2.3
2-15	-	Reserved (usually these bits should be OFF)	

A.2   IMPROVED ERROR MESSAGE

A.2.1   Detailed Alarm Indication

EXPLANATION

This function is for I/O Controller function. While I/O Controller function exchanges process data with I/O Devices in its configuration list, an alarm may occur in some of the I/O Devices. I/O Controller function receives alarm indication from the I/O Device via PROFINET board. I/O Controller displays the alarm type and the location by new alarm PRIO-642.

REQUIREMENTS

The software version is 7DA7/22(V7.70P/22) or later, and R-30*i*B.

FUNCTION

New alarm PRIO-642 shows the alarm type and the location of alarm indication from I/O Device. The figures in the message are alarm type, API number, station number, slot number, and subslot number.

PRIO-642 WARN   "Alarm %x:api %x,st %d, %d,%d"

If the alarm is belong to a subslot, the comment strings of the subslot is displayed together. If not, the comment strings of the station is displayed instead.

> **NOTE**
> For the coding of alarm type, please refer to table 387 in page 10463 of "Technical Specification for PROFINET Version2.3 – Date October 2010 OrderNo.: 2.722".

A.2.2   Monitoring IOCS/IOPS

EXPLANATION

This function is for I/O Controller function. I/O Controller function receives the I/O consumer/producer status of process data from I/O Device. New alarms, PRIO-640, PRIO-641, PRIO-646, and PRIO-647, show up when the status changes.

REQUIREMENTS

The software version is 7DA7/22(V7.70P/22) or later, and R-30*i*B.

FUNCTION

I/O Controller function monitors I/O producer status (IOPS) of DI module. When it changes from GOOD to BAD, PRIO-640 shows up. On the other hand, when it changes from BAD to GOOD, PRIO-641 shows up. The figures in the message are API number, station number, slot number, and subslot number. Each of these monitoring can be enabled or disabled by the system variable (refer to Appendix A.1.2).

PRIO-640 WARN   "IOPS=bad:api %x,st %d, %d,%d"
PRIO-641 WARN   "IOPS=good:api %x,st %d, %d,%d"

When the reset button is pressed, PRIO-640 is displayed again if IOPS is still BAD. PRIO-640 will be displayed if an input module with IOPS=BAD is attached. PRIO-641 doesn't appear again by pressing reset button. PRIO-641 doesn't show up if an input module with IOPS=GOOD is attached because IOPS=GOOD is expected.

I/O Controller function monitors I/O consumer status (IOCS) of DO module. When it changes from GOOD to BAD, PRIO-646 shows up. On the other hand, when it changes from BAD to GOOD, PRIO-647 shows up. The figures in the message are API number, station number, slot number, and subslot number. Each of these monitoring can be enabled or disabled by the system variable (refer to Appendix A.1.2).

PRIO-646 WARN   "IOCS=bad:api %x,st %d, %d,%d"
PRIO-647 WARN   "IOCS=good:api %x,st %d, %d,%d"

When the reset button is pressed, PRIO-646 is displayed again if IOCS is still BAD. PRIO-646 will be displayed if an output module with IOCS=BAD is attached. PRIO-647 doesn't appear again by pressing reset button. PRIO-647 doesn't show up if an output module with IOCS=GOOD is attached because IOCS=GOOD is expected.

A.2.3 Device Return Notification

EXPLANATION

This function is for I/O Controller function. I/O Controller function posts new PRIO-643 alarm when a station is activated. KAREL program, for example, can monitor PRIO-643 to know the station is activated.

REQUIREMENTS

The software version is 7DA7/22(V7.70P/22) or later, and R-30*i*B.

FUNCTION

I/O Controller function posts new PRIO-643 alarm when a station is activated. The figure in the error message is the station number. PRIO-643 doesn't show up at all when the bit 0 of $PNIO_CFG2.$USHORT5 is 0. PRIO-643 doesn't show up by execution of PNIO attach TP instruction when the bit 1 of $PNIO_CFG2.$USHORT5 is 0. Please refer to Appendix A.1.2.

PRIO-643 WARN   "PNIO(C) station %d activated"

A.3 ALARM INDICATION INTERFACE

EXPLANATION

This function is for I/O Controller function. In addition to PRIO-642 (refer to Appendix A.2.1), this function provides KAREL program with the interface for reading out alarm indication for diagnostic purpose in the data format specified by PROFINET specification. This function requires a user KAREL program that monitors alarm indication and reads out it by KAREL variable. If the user KAREL program is not made, this function should be disabled (refer to Appendix A.1.2).

REQUIREMENTS

The software version is 7DA7/22(V7.70P/22) or later, and R-30*i*B. This function needs a KAREL program that reads out alarm indication, which is created by customer.

FUNCTION

PRIO-642 shows up when I/O Controller function receives an alarm indication from an I/O Device. Then the diagnostic data in alarm indication is stored to the memory of the robot controller. It can be read via KAREL variable named PNIOALM.VR, which can be displayed in Data screen. The diagnostic data is queued (FIFO), and can be read one by one. The following KAREL variables are used as the interface to a user KAREL program.

Table A.3(a) The KAREL variable of PNIOALM.VR

Name	Meaning and function
$NUM_DIAG	The number of alarm indications that have not been read out.
$READ	This item makes the user KAREL program aware of alarm indication. 0: No alarm indication is made. 1: An alarm indication is made, and its data is copied to $DATA. 2: The user KAREL program sets $READ=2 after processing the alarm indication. The next alarm indication is read out from the queue if it is present.
$LENGTH	The data length of the alarm indication in $DATA.
$TYPE	The alarm type of the alarm indication. Please refer to table 387 in page 10463 of "Technical Specification for PROFINET Version2.3 – Date October 2010 OrderNo.: 2.722".
$API	The API of the module of the I/O Device.
$STATION	The station number of the module of the I/O Device.
$SLOT	The slot number of the module of the I/O Device.
$SUBSLOT	The subslot number of the module of the I/O Device.
$SPEC	This item is valid when $TYPE=1 (diagnosis). This is the value of the alarm specifier that indicates which type of diagnostic data is present. Please refer to table 388-392 in the page 10463-10466 of "Technical Specification for PROFINET Version2.3 – Date October 2010 OrderNo.: 2.722".
$USI	This item is valid when $TYPE=1 (diagnosis). This is the value of the user structure identifier that indicates which type of diagnostic structure follows. Please refer to table 512 in the page 10522 of "Technical Specification for PROFINET Version2.3 – Date October 2010 OrderNo.: 2.722".
$DATA	The diagnostic data in the alarm indication. The data format is defined by the PROFINET normative. Please refer to DiagnosisItem in Table 383 in the page 10442, and ChannelDiagnosisData, ExtChannelDiagnosisData, QualifiedChannelDiagnosisData, and MaintenanceItem in the page 10450 of "Technical Specification for PROFINET Version2.3 – Date October 2010 OrderNo.: 2.722". $DATA is erased when no alarm indication is made. The use of $DATA is up to a user KAREL program, for example, the KAREL program may decode $DATA to monitor if a specific error is present, or if Maintenance Required/Demanded bit is ON or OFF.

The user KAREL program checks $READ periodically. $READ is 0 as long as no alarm indication is made. $READ gets to 1 when an alarm indication is made. The content of the alarm indication has been copied to other variables of PNIOALM.VR.

The user KAREL program can read these variables. The user KAREL program is supposed to set $READ to 2 when it has finished reading these variables. As long as $READ is 1, these variables are not overwritten by next alarm indication. If next alarm indication comes when $READ is 1, it is stored in memory of the robot controller and $NUM_DIAG is incremented by 1.

When the user KAREL program changes $READ to 2, $READ gets to 0 if there is no next alarm indication at present. Otherwise, $READ gets to 1, $NUM_DIAG is decremented by 1, and the content of next of next alarm indication has been copied to the variables of PNIOALM.VR.

A.4   DOWNLOAD SCREEN AT CONTROLLED START

EXPLANATION

PROFINET download screen (only available at controlled start) provides the download function of XDB file and PROFINET board firmware from the device (such as MC:) instead of direct downloading from PC. XDB file is used for I/O controller function.

REQUIREMENTS

The software version is 7DA7/22(V7.70P/22) or later, and R-30*i*B.

Start up mode should be changed to READ IN after downloading XDB file to read in the network configuration of I/O Controller function.

FUNCTION

PROFINET download screen is available only at controlled start (MENU->Next page->Next page->1. PROFINET). The file to be downloaded must be transferred to the device before downloading. Please refer to the procedure A.4.1, A.4.2 and A.4.3.

```
┌─────────────────────────────────────────────────────┐
│ Setup PROFINET IO                    JOINT   10 %    │
│ Download                              1/4            │
│                                                      │
│  1. Download XDB file                                │
│       XDB file name                                  │
│  2.  [ MC:pcst_1.xdb                         ]       │
│  3. Download firmware                                │
│       Firmware file name                             │
│  4.  [ MC:fw16xx-2.5.0.0.19.fwl              ]       │
│                                                      │
│                                                      │
│  [ TYPE ]                                            │
│                                                      │
└─────────────────────────────────────────────────────┘
```

Fig. A.4(a) Download screen

Table A.4(a) Download screen items

#	Item	Adjustable values	Description
1	Download XDB file	None	Press Enter here to start XDB download.
2	XDB file name	String	The name of XDB file with device path.
3	Download firmware	None	Press Enter here to start firmware download.
4	Firmware file name	String	The name of firmware file with device path.

Procedure A.4.1 : Download of XDB file

To download XDB project file, please follow the procedure below.
1   Set the start up mode to SUSPEND or READ IN before controlled start.

> **NOTE**
> The comment of modules is erased when the network configuration is read in.
> To recover the comment, please write it down before changing start up mode to READ IN.

2   Open the setup PROFINET download screen. Check the XDB file name displayed in the screen. If the file name is not equal to the XDB file to be downloaded, change the file name. The file name must be specified with device path.
3   Move cursor to "Download XDB file", and press Enter.
4   Dialogue with a message like "This operation may take 2 minutes" shows up. Answer "Yes" to proceed.
5   Wait for the completion of download. Don't turn off the robot controller during the download.
6   The result of download shows up in the screen when download has finished or failed.
7   Change the start up mode to READ IN after cold start to read in the network configuration of I/O Controller function. Cycle power the robot controller after changing start up mode to READ IN if

the robot software version is 7DA5/01-22(V7.50P/01-22), 7DB6/01-08(V7.63P/01-08), 7DA7/01-29(V7.70P/01-29) or 7DC1/01-06(V8.10P/01-06). Refer to Section 6.2 for more detail.

Procedure A.4.2 : Download of firmware

To download firmware, please follow the procedure below.
1   Open the setup PROFINET download screen. Check the firmware file name displayed in the screen. If the file name is not equal to the firmware file to be download, change the file name. The file name must be specified with device path. However, if you have installed A05B-2600-J744, the firmware file name will be set automatically and you do not need to rename the file.
2   Move cursor to "Download firmware", and press Enter.
3   Dialogue with a message like "This operation may take 7 minutes" shows up. Answer "Yes" to proceed.
4   Wait for the completion of download. Never turn off the robot controller during the download, otherwise firmware in PROFINET board might be erased, and PROFINET board is no longer operational until firmware is not recovered.
5   The result of download shows up in the screen when download has finished or failed.
6   Cold start the robot controller.

> **NOTE**
> If the external power supply of PROFINET board is connected, remove it before cold start and connect it again after power up.

Procedure A.4.3 : Recovery in case the firmware of PROFINET board is erased

In case of the failure of firmware download by a corrupted firmware file, or the robot controller is turned off during firmware download, the firmware of PROFINET board might be erased. Then the PROFINET board is no longer operational until the firmware is recovered. To recover the firmware, prepare the firmware that can be downloaded successfully, and follow the procedure below. The firmware download can be tried again after firmware recovery.

1   Set $PNIO_DL.$NO_FIRM_ST to 1. Please note that the system variable will return to 0 at next start up of the robot controller.
2   Perform "Controlled Start" of the robot controller.
3   Open the setup PROFINET download screen (MENU->Next page->Next page->1. PROFINET), and follow the procedure A.4.2 to download the firmware. Please note that PROFINET board is not operational until firmware is downloaded, for example, downloading of XDB file would fail.

A.5   I/O ROUTER

EXPLANATION

This function can be used when both I/O Device and I/O Controller are enabled. The process data of I/O Controller function can be referred from I/O Device function. In short, PLC in upper network can read the process data of an I/O Device in the lower network. This is I/O Router function of PROFINET board. For the detailed information about I/O Router function, please refer to the chapter 4. "I/O Routing" of "CP1604/CP1616 Operating Instructions" 10/2011 (available from Siemens). Among the type of I/O routing, reading module-oriented and writing module-oriented are supported, but writing bit-oriented is not supported.

REQUIREMENTS

The software version is 7DA7/22(V7.70P/22) or later, and R-30*i*B.
The configuration software of Siemens must be STEP7 V5.5 or later, and the update for "I/O device coupling with I/O devices of third-party vendor" (available from Siemens) must be applied.

FUNCTION

This function is configured by STEP7 Siemens configuration software. Transfer modules (DI or DO) are used instead of standard I/O modules. Please see the Migration data access point section of the GSDML file for robot by FANUC about the supported transfer modules. The setup PROFINET module list/detail screen setting procedure is the same as standard I/O modules.

A.6   PROFINET SAFETY

EXPLANATION

This function is for I/O Device function. PROFINET Safety is another software option that provides the functionality of PROFINET Safety F-Device function of PROFIsafe V2. This manual only writes about the requirement and the title of document that should be referred to. The GSDML file for robot by FANUC defines the supported safety modules.

REQUIREMENTS

The software version is 7DA7/22(V7.70P/22) or later, and R-30*i*B.
PROFINET Safety option is ordered.
The firmware version of PROFINET board must be V2.5.2 or later in R-30*i*A, the firmware version must be V2.5.2.2(1) or later in R-30*i*B.
The configuration software of Siemens must be STEP7 V5.5 or later.
The GSDML file for robot by FANUC is used.
For R-30*i*B, PROFINET board (CP1604) must be used.

NOTE

For PROFINET Safety function that exchanges safety signals on PROFINET I/O Device, please read "R-30*i*A/R-30*i*A Mate CONTROLLER Dual Check Safety Function (ISO 13849-1:2006 compliant) OPERATOR'S MANUAL (B-83104EN)" or "R-30*i*B/R-30*i*B Mate/R-30*i*B Plus/R-30*i*B Mate Plus/R-30*i*B Compact Plus CONTROLLER Dual Check Safety Function OPERATOR'S MANUAL (B-83184EN)" in addition to this manual.

B   I/O DEVICE SETUP BY GSDML

B.1   OVERVIEW

This chapter provides an example of how to sett up I/O Device function of the robot controller by using the GSDML file for robot provided by FANUC. In this example, the robot controller is R-30iA, and the robot software version is 7DA7/22(V7.70P/22). I/O Device is enabled but I/O Controller is disabled. The I/O size is DI 128 (16Bytes) and DO 128 (16Bytes). The GSDML file name is GSDML-V2.25-Fanuc-J930-20120113.xml. The PROFINET board is CP1616. The configuration tool is STEP7 V5.5.

> **NOTE**
> The procedure written in this chapter is only an example. It focuses on the way of setting. The operator must read the manual of the configuration tool for actual operation.

B.2   SETUP PROCEDURE IN TP SCREENS

B.2.1   Removing I/O Controller I/O Assignment

By default, the input/output size of I/O Controller is defined, and DIO and AIO are assigned by these values (if $IO_AUTO_CFG is true). If I/O Controller is disabled, these DIO and AIO are not used at all. If necessary, remove these setting by the following operation.

1   Go to setup I/O Controller screen. Set 0 to "Number of digital input/output", and "Number of analog input/output". Please refer to Subsection 3.4.2.

```
 Setup PROFINET IO                    JOINT   10 %
 I/O Controller                                   1/5
 1. Error one shot :                         DISABLED
 2. Number of digital input :                        0
 3. Number of digital output :                       0
 4. Number of analog input :                         0
 5. Number of analog output :                        0
 6. Digital input offset address:                    0
 7. Digital output offset address:                   0
 8. Analog input offset address:                   512
 9. Analog output offset address:                  512


 [ TYPE ]         [Other]   arc     analog           >
                                            CLR_ASG
```

2   Go to digital/analog I/O screen, and press F2 CONFIG to display the assignment. Search the I/O assignment of PROFINET by the rack and slot number in the table below to delete the I/O signals for I/O Controller. Please cycle power the robot controller to enable changes.

Function	Rack	Slot
PROFINET I/O Controller	99	1

B.2.2   Setup I/O Device Modules Based on GSDML

As described in 3.4.3, the robot controller as PROFINET I/O Device is composed of up to 17 modules. The parameters of each module must be entered one by one in setup module list/detail screens. This example aims to show which information in the GSDML file is used, and how to enter the parameters in the screens.

Please open GSDML-V2.25-Fanuc-J930-20120113.xml by PROFINET XML-Viewer. Information of modules is written in the GSDML file. The following values are to be entered in module detail screen.

Item name	Property name in GSDML file (use PROFINET-XML viewer to open the file)
ModId	Module Ident Number
SubslotId	Submodule Ident Number

There are definitions of data access point modules in the GSDML file. First of all, it is necessary to decide which device access point is used. Select device access point by the firmware version, and whether it has migration subcategory. To use V2.5 firmware as only I/O Device in this example, use CP1616 V2.5 without migration subcategory.

Device Access Point ID=DAP 17: V2.5	
Module Ident Number	0x00000017
Category	CP1616PS
Software Version	V2.5
Submodule Ident Number	0x00010001

> **NOTE**
> The module in slot = 0 must be device access point. Choose the device access point without "Migration" subcategory when only I/O Device is enabled in the robot controller. Choose the device access point with "Migration" subcategory when both of I/O Controller and I/O Device are enabled in the robot controller.

Usable modules are listed in data access point section. There are links to the I/O module property. For example, 16 bytes modules are the following.

Module ID=ID_Mod_07: 16bytes	
Module Ident Number	0x00000026
Category	DI/DO
Submodule Ident Number	0x0001

Module ID=ID_Mod_08: 16bytes	
Module Ident Number	0x00000027
Category	DI
Submodule Ident Number	0x0001

Module ID=ID_Mod_09: 16bytes	
Module Ident Number	0x00000028
Category	DO
Submodule Ident Number	0x0001

In this example, there is one 16 bytes DI module and one 16 bytes DO module. The parameters of these modules are entered by the procedure like below.

1   Move cursor to No. 0 in Module list screen, and press F2 detail to enter detail screen.

```
 Setup PROFINET IO                    JOINT   10 %
 I/O Device : Modules                              1/17
 No Slot Sub Comment
 0   0   1  [CP1616 V2.5                          ]
 1   1   1  [                                     ]
 2   2   1  [                                     ]
 3   0   0  [                                     ]
 4   0   0  [                                     ]
 5   0   0  [                                     ]
 6   0   0  [                                     ]
 7   0   0  [                                     ]
 8   0   0  [                                     ]
 9   0   0  [                                     ]
 [ TYPE ]      detail          [Other]           >

            DEL_ALL
```

2   Enter the values as follows by decimal number for data access point module.
     Slot 0, Subslot 1, ModId 23 (=0x17), SubslotId 65537 (=0x00010001)

Device Access Point ID=DAP 17: V2.5	
Module Ident Number	0x00000017
Category	CP1616PS
Software Version	V2.5
Submodule Ident Number	0x00010001

Please note that ModId is displayed by hexadecimal number but the value must be specified by the decimal number (0x17 = 16 x 1 + 7 = 23) in setting the value. Please check the displayed value becomes 0x00000017 after pressing enter key.

```
 Setup PROFINET IO                    JOINT   10 %
 I/O Device : Module 1                             1/6
 1. Slot :                                           1
 2. Subslot :                                        1
    Comment :
 3.            [                      ]
 4. ModId(hex) :                         0x00000017
 5. SubslotId(hex) :                     0x00010001
    Module I/O type :                         NONE
 6. Data size :                          [        ]
 7. Data type :                          [        ]


    [ TYPE ]      list       prev       next
```

3   Press F4 next, to go to the detail screen of the next module.
4   Enter the values as follows for 16 bytes DI module.
     Slot 1, Subslot 1, ModId 39 (=0x27), SubslotId 1

Module ID=ID_Mod_08: 16bytes	
Module Ident Number	0x00000027
Category	DI
Submodule Ident Number	0x0001

When 39 set is to ModId, and the displayed value becomes 0x00000027.

5   Press F4 next, to go to the detail screen of the next module.
6   Enter the values as follows for 16 bytes DO module.
     Slot 2, Subslot 1, ModId 40 (=0x28), SubslotId 1

Module ID=ID_Mod_09: 16bytes	
Module Ident Number	0x00000028
Category	DO
Submodule Ident Number	0x0001

     When 40 set is to ModId, and the displayed value becomes 0x00000028.
7   Press "PREV" twice to return "Setup I/O Device screen". The total number of digital for I/O Device
     has been changed. Number of digital input/output will be 128.

```
┌──────────────────────────────────────────────────┐
│ Setup PROFINET IO                 JOINT   10 %     │
│ I/O Device                                   1/2   │
│ 1. Error one shot :                      DISABLED  │
│ 2. Modules                               <Detail>  │
│ 3. Number of digital inputs :                128   │
│ 4. Number of digital outputs :               128   │
│ 5. Number of analog inputs :                   0   │
│ 6. Number of analog outputs :                  0   │
│                                                    │
│                                                    │
│                                                    │
│                                                    │
│ [ TYPE ]              [Other]                 >    │
├──────────────────────────────────────────────────┤
│                                           CLR_ASG  │
└──────────────────────────────────────────────────┘
```

> **NOTE**
> By default, the first 18 digital inputs and 20 digital outputs of PROFINET I/O
> Device are assigned to UOP (UI/UO) if there are enough digital inputs/outputs
> and UOP auto assignment is enabled.

8   To enable changes, cycle power the robot controller.

B.3   SETUP PROCEDURE ON CONFIGURATION SOFTWARE

STEP7 project must be created to configure PLC to communicate with the robot controller (I/O Device).
The outline of how to create a project and download it to PLC is explained here. In this example, PLC is
SIMATIC S7-300 (PS-307 5A, CPU317F-2PN/DP V2.6 without any I/O modules), and default names are
used to refer objects.

Procedure B.3.3 (a) : Creating a project

1   Start "SIMATIC Manager" from start menu, for example.
2   Open "File" tool bar and select "New".
3   Enter Project Name. Press OK.
4   Right Click the project window.
5   Insert New Object->Industrial Ethernet. The default name is Ethernet(1).
6   Insert New Object->SIMATIC 300 Station. The default name is SIMATIC 300(1).

Procedure B.3.3 (b) : Enter PLC Configuration

1   Click "SIMATIC 300(1)" icon under the project icon in the project window (left pane).
2   Double click "Hardware" in the project window (right pane).
3   HW Config window will show up.
4   There is a list in the right pane of HW Config window. Move there and search
    SIMATIC 300->Rack-300->Rail and double click it, then small window with many slots appears.
5   Select slot1. Double click the following in the list in the right pane of HW Config window.
    SIMATIC 300->PS-300->PS 307 5A (for example).
    (You have to choose correct PS module you use in fact.)
6   Select slot2. Double click the following.
    SIMATIC 300->CPU317->CPU317F-2PN/DP->6ES7-2FK13-0AB0->V2.6 (for example)
    (You have to choose correct CPU module instead of that in the example.)
7   New window appears. Enter IP address and subnet mask of PLC. Select "Ethernet(1)" as subnet.
    Press OK. The window is closed.
8   In this example, all modules have been added. Open "Station" tool bar, and select "Save and
    Compile".
    Some questions may appear. Answer them properly.

Procedure B.3.3 (c) : Install GSDML file of FANUC robot

1   Open "Option" tool bar of HW Config, and select "Install GSD File".
2   Press "Browse" to select the folder where the GSDML file is stored.
3   Select "GSDML-V2.25-Fanuc-J930-20120113.xml", and press "Install".
4   Press "Yes" to proceed.
5   The message "Installation was completed successfully" shows up.
6   Finish STEP7 by closing all windows("SIMATIC Manager", "NetPro", "HW Config" etc).
7   Start STEP7 again, and open the project.

Procedure B.3.3 (d) : Connect the robot controller to PLC in the project

1   Open SIMATIC Manager
2   Click project in the left pane of SIMATIC Manager window.
3   Double click "Ethernet(1)".
4   NetPro window will show up.
5   Click "PN-IO" in "SIMATIC 300(1)" to select it.
    (If you forgot doing "Save and Compile", PN-IO does not show up.)
6   There is also a list in the right pane of NetPro window like HW Config window.
    Select the following in the list, and double click it.
    PROFINET I/O->Additional Field Device->I/O->FANUC Robot Controller->CP1616PS->6GK
    161-6AA00->V2.5
    (If you forgot selecting "PN-IO", error message will appear. Go back to step e and try again.)
7   Robot icon will appear.
8   Right click the robot and select "Object Properties".
9   Enter device name. Set the device name you set in CP1616 beforehand.
    Device name must match to that set to CP1616.
    (For your information, the name of GSDML file is displayed under device name.)
10 Select device number.
11 Remove the check in "Assign IP address via IO Controller".
12 Open "Network" tool bar, and select "Save and Compile".

Procedure B.3.3 (e) : Configure modules of robot controller

In this example, one 16 bytes DI module and one 16 bytes DO module are configured. The module
configuration must match that in setup module screen of the robot controller.
1   Double click robot icon in NetPro window.

2   Select slot 1 of CP1616 in the left-side down window.
3   Select the following in the list in the right pane of HW Config window, and double click it.
     PROFINET I/O->Additional Field Device->I/O->FANUC Robot Controller->CP1616PS->6GK
     161-6AA00->V2.5->DI->16 bytes
4   Select the following in the list in the right pane of HW Config window, and double click it.
     PROFINET I/O-> Additional Field Device->I/O->FANUC Robot Controller->CP1616PS->6GK
     161-6AA00->V2.5->DO->16 bytes
5   In this example, all modules has been added. Open "Station" tool bar, and select "Save and
     Compile".
     Some questions may appear. Answer them properly.

Procedure B.3.3 (f) : Download the project to PLC

Be sure to set the start up mode of the robot controller to SUSPEND mode before downloading.
1   Move to NetPro window.
2   Select "SIMATIC 300(1)"
3   Right click it, and select Download->Selected Stations.
4   Dialogue may show up. Choose station to download.
     You don't have to change PLC to Run mode at this time.

B.4   STARTING I/O DEVICE

The next step will start PROFINET I/O exchange if PROFINET board is configured properly by
downloading the project. Please read the warning below for the safety of person and equipment.

```
⚠ WARNING
   Changing start up mode from SUSPEND immediately takes effect, that is,
   PROFINET function of the robot controller starts immediately. Please
   verify the safety is assured and make sure if it is safe to start PROFINET I/O
   data exchange before changing the start up mode from SUSPEND.
```

Change start up mode from SUSPEND to READ IN. The robot controller tries to start I/O Device
communication.

```
⚠ WARNING
   Cycle power the robot controller after changing start up mode to READ IN if the
   robot software version is 7DA5/01-22(V7.50P/01-22),
   7DB6/01-08(V7.63P/01-08), 7DA7/01-29(V7.70P/01-29) or
   7DC1/01-06(V8.10P/01-06). Please refer to Subsection 6.2 for more detail.
```

If both of PLC and the robot controller are configured well, connection will be established when PLC is
changed to RUN mode. Please make sure if no error is present, and I/O exchange is OK. If any error
occurs, please check the parameters set in the robot controller and in STEP7 project match, or check
device name of PROFINET board matches.

Change the start up mode to OPERATION after I/O exchange is verified. Please cycle power the robot
controller after changing start up mode to OPERATION. The robot controller works as READ IN mode
until next power up.

B.5　MODULE INFORMATION FOR DATA ACCESS POINT

The information of modules written in the data access point section of the GSDML file is stored to the array of system variable $PNIO_DB. An element of the array corresponds to the module ID information for a PROFINET board (CP1604, CP1616) and with or without Migration subcategory. The initial value of $PNIO_DB from 7DA7/22(V7.70P/22) is written here.

NOTE
1　The device access point without "Migration" subcategory is used when only I/O Device is enabled. The device access point with "Migration" subcategory is used when both of I/O Controller and I/O Device are enabled.
2　The module ID of safety modules and transfer modules are not stored in any system variables.
3　The module ID of DI/DO, DI and DO modules with more than 16bytes exist but are not used in 7DA5/13(V7.50P/13) or before, and 7DA7/21(V7.70P/21) or before.

Data Access Point for CP1604 V2.5 without Migration

Table B.5 (a) Data Access Point for CP1604 V2.5 without Migration

Variable	Value	Description
$PNIO_DB[1].$BASE_MODID	24	Module ID of data access point
$PNIO_DB[1].$IO_MOD1	32	Module ID of DI/DO 1Byte
$PNIO_DB[1].$I_MOD1	33	Module ID of DO 1Byte
$PNIO_DB[1].$O_MOD1	34	Module ID of DI 1Byte
$PNIO_DB[1].$IO_MOD4	35	Module ID of DI/DO 4Bytes
$PNIO_DB[1].$I_MOD4	36	Module ID of DI 4Bytes
$PNIO_DB[1].$O_MOD4	37	Module ID of DO 4Bytes
$PNIO_DB[1].$IO_MOD16	38	Module ID of DI/DO 16Bytes
$PNIO_DB[1].$I_MOD16	39	Module ID of DI 16Bytes
$PNIO_DB[1].$O_MOD16	40	Module ID of DO 16Bytes
$PNIO_DB[1].$IO_MOD20	53	Module ID of DI/DO 32Bytes
$PNIO_DB[1].$I_MOD20	54	Module ID of DI 32Bytes
$PNIO_DB[1].$O_MOD20	55	Module ID of DO 32Bytes
$PNIO_DB[1].$IO_MOD64	41	Module ID of DI/DO 64Bytes
$PNIO_DB[1].$I_MOD64	48	Module ID of DI 64Bytes
$PNIO_DB[1].$O_MOD64	49	Module ID of DO 64Bytes
$PNIO_DB[1].$ULONG1	288	Module ID of DI/DO 128Bytes
$PNIO_DB[1].$ULONG2	289	Module ID of DI 128Bytes
$PNIO_DB[1].$ULONG3	290	Module ID of DO 128Bytes

Data Access Point for CP1604 V2.5 with Migration

Table B.5 (b) Data Access Point for CP1604 V2.5 with Migration

Variable	Value	Description
$PNIO_DB[2].$BASE_MODID	22	Module ID of data access point
$PNIO_DB[2].$IO_MOD1	32	Module ID of DI/DO 1Byte
$PNIO_DB[2].$I_MOD1	33	Module ID of DO 1Byte
$PNIO_DB[2].$O_MOD1	34	Module ID of DI 1Byte
$PNIO_DB[2].$IO_MOD4	35	Module ID of DI/DO 4Bytes
$PNIO_DB[2].$I_MOD4	36	Module ID of DI 4Bytes
$PNIO_DB[2].$O_MOD4	37	Module ID of DO 4Bytes
$PNIO_DB[2].$IO_MOD16	38	Module ID of DI/DO 16Bytes
$PNIO_DB[2].$I_MOD16	39	Module ID of DI 16Bytes
$PNIO_DB[2].$O_MOD16	40	Module ID of DO 16Bytes
$PNIO_DB[2].$IO_MOD20	53	Module ID of DI/DO 32Bytes
$PNIO_DB[2].$I_MOD20	54	Module ID of DI 32Bytes
$PNIO_DB[2].$O_MOD20	55	Module ID of DO 32Bytes
$PNIO_DB[2].$IO_MOD64	41	Module ID of DI/DO 64Bytes
$PNIO_DB[2].$I_MOD64	48	Module ID of DI 64Bytes
$PNIO_DB[2].$O_MOD64	49	Module ID of DO 64Bytes
$PNIO_DB[2].$ULONG1	288	Module ID of DI/DO 128Bytes
$PNIO_DB[2].$ULONG2	289	Module ID of DI 128Bytes
$PNIO_DB[2].$ULONG3	290	Module ID of DO 128Bytes

Data Access Point for CP1616 V2.5 without Migration

Table B.5 (c) Data Access Point for CP1616 V2.5 without Migration

Variable	Value	Description
$PNIO_DB[3].$BASE_MODID	23	Module ID of data access point
$PNIO_DB[3].$IO_MOD1	32	Module ID of DI/DO 1Byte
$PNIO_DB[3].$I_MOD1	33	Module ID of DO 1Byte
$PNIO_DB[3].$O_MOD1	34	Module ID of DI 1Byte
$PNIO_DB[3].$IO_MOD4	35	Module ID of DI/DO 4Bytes
$PNIO_DB[3].$I_MOD4	36	Module ID of DI 4Bytes
$PNIO_DB[3].$O_MOD4	37	Module ID of DO 4Bytes
$PNIO_DB[3].$IO_MOD16	38	Module ID of DI/DO 16Bytes
$PNIO_DB[3].$I_MOD16	39	Module ID of DI 16Bytes
$PNIO_DB[3].$O_MOD16	40	Module ID of DO 16Bytes
$PNIO_DB[3].$IO_MOD20	53	Module ID of DI/DO 32Bytes
$PNIO_DB[3].$I_MOD20	54	Module ID of DI 32Bytes
$PNIO_DB[3].$O_MOD20	55	Module ID of DO 32Bytes
$PNIO_DB[3].$IO_MOD64	41	Module ID of DI/DO 64Bytes
$PNIO_DB[3].$I_MOD64	48	Module ID of DI 64Bytes
$PNIO_DB[3].$O_MOD64	49	Module ID of DO 64Bytes
$PNIO_DB[3].$ULONG1	288	Module ID of DI/DO 128Bytes
$PNIO_DB[3].$ULONG2	289	Module ID of DI 128Bytes
$PNIO_DB[3].$ULONG3	290	Module ID of DO 128Bytes

Data Access Point for CP1616 V2.5 with Migration

Table B.5 (d) Data Access Point for CP1616 V2.5 with Migration

Variable	Value	Description
$PNIO_DB[4].$BASE_MODID	21	Module ID of data access point
$PNIO_DB[4].$IO_MOD1	32	Module ID of DI/DO 1Byte
$PNIO_DB[4].$I_MOD1	33	Module ID of DO 1Byte
$PNIO_DB[4].$O_MOD1	34	Module ID of DI 1Byte
$PNIO_DB[4].$IO_MOD4	35	Module ID of DI/DO 4Bytes
$PNIO_DB[4].$I_MOD4	36	Module ID of DI 4Bytes
$PNIO_DB[4].$O_MOD4	37	Module ID of DO 4Bytes
$PNIO_DB[4].$IO_MOD16	38	Module ID of DI/DO 16Bytes
$PNIO_DB[4].$I_MOD16	39	Module ID of DI 16Bytes
$PNIO_DB[4].$O_MOD16	40	Module ID of DO 16Bytes
$PNIO_DB[4].$IO_MOD20	53	Module ID of DI/DO 32Bytes
$PNIO_DB[4].$I_MOD20	54	Module ID of DI 32Bytes
$PNIO_DB[4].$O_MOD20	55	Module ID of DO 32Bytes
$PNIO_DB[4].$IO_MOD64	41	Module ID of DI/DO 64Bytes
$PNIO_DB[4].$I_MOD64	48	Module ID of DI 64Bytes
$PNIO_DB[4].$O_MOD64	49	Module ID of DO 64Bytes
$PNIO_DB[4].$ULONG1	288	Module ID of DI/DO 128Bytes
$PNIO_DB[4].$ULONG2	289	Module ID of DI 128Bytes
$PNIO_DB[4].$ULONG3	290	Module ID of DO 128Bytes

C ROBOT SOFTWARE UPDATE

C.1 OVERVIEW

This chapter is applicable for R-30*i*A. PROFINET I/O function was greatly changed for PROFINET conformance in 7DA7/22(V7.70P/22), and I/O Device identification, such as vendor ID and device ID, was also changed. This is an improvement but it might bring a problem when the robot software with PROFINET function is updated from 7DA7/01-21(V7.70P/01-21) to 7DA7/22(V7.70P/22) or later. For example,

- When I/O Device is enabled, PLC identifies the robot controller as different I/O Device and doesn't start PROFINET I/O exchange because of the change of vendor ID and device ID.
- Restoring PNIO.SV after robot software update will overwrite the setting for 7DA7/22(V7.70P/22) or later.

The user has two options. The one is using existing configuration as before and keeping the change by software update as small as possible. Please refer to Appendix C.2 for this option. Another option is doing configuration again for improved PROFINET function, and, if necessary, recovering the setting for 7DA7/22(V7.70P/22) or later. Please refer to Appendix C.3 for this option. In addition to Appendix C.2 and Appendix C.3, please refer to Appendix C.4 for the system variables related to this topic.

As for the network configuration of I/O Controller, it must be read in again. Please see the following.

NOTE
1 The network configuration of I/O Controller is stored in the robot controller when the start up mode is OPERATION. It can be restored by PNIO.SV, however it must be discarded if the robot software is updated to 7DA7/22(V7.70P/22) or later. Change the start up mode to READ IN and cycle power the robot controller. Then verify I/O Controller data exchange works before changing the start up mode to OPERATION.
2 The comment of modules is erased when the network configuration is read in. To recover the comment, please write it down before changing start up mode to READ IN.

C.2 USING EXISTING CONFIGURATION

The user may want to update the robot software, and expect that PROFINET function works as it is without any configuration change in PLC etc. Please use 7DA7/25(V7.70P/25) or later in this case. This is possible for I/O Device function by using the same vendor ID and device ID before software update, however new features, such as PROFINET Safety and I/O Router cannot be used at all because these function needs the GSDML file for robot provided by FANUC. Even if this option is taken, the network configuration must be read in again for I/O Controller function.

NOTE
Please use 7DA7/25(V7.70P/25) or later if legacy vendor ID and device ID must be used, for example, to solve compatibility problem, because 7DA7/22-24(V7.70P/22-24) always use new vendor ID and device ID. Please refer to 2.2.4 for the values of vendor ID and device ID.

Procedure C.2 : Using existing configuration

This procedure assumes that PROFINET function works before the software update, and start up mode is OPERATION. In addition, PNIO.SV before software update is supposed to be restored after software update.

1   Backup all files in File screen before update. Please write down the comment of modules in setup Config list screen to recover it because it is erased during this procedure.
2   Update the robot software.
3   After the software is updated, start up the robot controller by controlled start.
4   Restore PNIO.SV.
5   Change $PNIO_CFG.$CUSTOM from 0 to 1 to use legacy vendor ID and device ID.
6   Change $PNIO_CFG.$UBYTE18 from 0 to 1.
7   Change $PNIO_CFG.$UBYTE19 from 0 to 152.
8   Change $PNIO_CFG.$UBYTE20 from 0 to 3.
9   Cold start the robot controller.
10   If I/O Controller is installed, change the start up mode to READ IN, and cycle power the robot controller.
11   Verify PROFINET I/O data exchange.
12   Change the start up mode to OPERATION.

> ⚠ **WARNING**
> Cycle power the robot controller after changing start up mode to READ IN if the robot software version is 7DA5/01-22(V7.50P/01-22), 7DB6/01-08(V7.63P/01-08), 7DA7/01-29(V7.70P/01-29) or 7DC1/01-06(V8.10P/01-06). Please refer to 6.2 for more detail.

> **NOTE**
> Restoring PNIO.SV before software update will change the internal database, and the module information of recent access point, however the information of recent access point is not used in using existing configuration.

C.3   MAKING NEW CONFIGURATION

The user may want to update the robot software to 7DA7/22(V7.70P/22) or later, and use improved PROFINET function. In this case, the GSDML file for robot by FANUC must be used. Therefore, when I/O Device is enabled, existing PLC configuration must be modified and downloaded to PLC. In addition, the module ID of data access point (slot 0, subslot 1) must be changed in setup module detail screen. Please refer to Appendix B for detailed procedure for I/O Device. If I/O Controller is enabled, the configuration for I/O Controller must be done by using the PC station with the PROFINET board and the firmware version, and downloaded to PROFINET board again. The network configuration of I/O Controller must be read in again.

> **NOTE**
> 1   The firmware of PROFINET board must be updated to V2.5.2 or later.
> 2   Use NCM/STEP7 V5.5 or later as configuration software for V2.5.2 firmware.
> 3   The GSDML file for robot provided by FANUC is a third-party GSDML file. Siemens configuration tool may need the update for "I/O device coupling with I/O devices of third-party vendor" (available from Siemens) to configure I/O coupling of the robot (as a third-party I/O Device), and PC-Station (as an I/O Controller).

The user may want to restore PNIO.SV but this operation will override the information of recent data access point. Some system variables must be recovered by manual. Please see the procedure below.

Procedure C.3 : Recovery of system variable for 7DA7/22(V7.70P/22) or later

This procedure assumes that PNIO.SV before software update is supposed to be restored after software update. This procedure overrides the information of old data access point by V2.5 data access point.

1   Backup all files in File screen before update. Please write down the comment of modules in setup Config list screen to recover it because it is erased during this procedure.
2   Update the robot software.
3   After the software is updated, start up the robot controller by controlled start.
4   Restore PNIO.SV.
5   Change $PNIO_CFG.$UBYTE18 from 0 to 1.
6   Change $PNIO_CFG.$UBYTE19 from 0 to 152.
7   Change $PNIO_CFG.$UBYTE20 from 0 to 3.
8   If I/O Controller is enabled, refer to Appendix B.5 for the value of system variables for the data access point that must be recovered. Consider the type of PROFINET board etc. in selecting it.
9   Enter the values to $PNIO_DB[1] by manual. This will override old information.
10   Change $PNIO_CFG.$START_MODE to 0.
11   Cold start the robot controller.
12   Continue I/O Device and I/O Controller setting.

⚠ **WARNING**
Cycle power the robot controller after changing start up mode to READ IN if the robot software version is 7DA5/01-22(V7.50P/01-22), 7DB6/01-08(V7.63P/01-08), 7DA7/01-29(V7.70P/01-29) or 7DC1/01-06(V8.10P/01-06). Please refer to 6.2 for more detail.

C.4   SYSTEM VARIABLES AND SOFTWARE UPDATE

C.4.1   Compatibility Bit for Identification as I/O Device

$PNIO_CFG.$CUSTOM is a 32-bit system variable. The bit 0 (1) of $PNIO_CFG.$CUSTOM is used as a compatibility bit for vendor ID and device ID information in the software 7DA7/25(V7.70P/25) or later. If the bit is OFF, vendor ID and device ID for the GSDML file for robot by FANUC are always used regardless of system variable. If the bit is ON, vendor ID and device ID can be changed by the following system variables.

Table C.4.1(a) System variable for vendor ID and device ID

Variable	Description	7DA7/21(V7.70P/21) or before	7DA7/22(V7.70P/22) or later
$PNIO_CFG.$DEV_VID	Vendor ID	42	439
$PNIO_CFG.$DEV_DID	Device ID	3	1

NOTE
1 Vendor ID and device ID must be equal to those of the GSDML file.
2 PROFINET XML-viewer, which is available from Siemens, is useful to see the content of the GSDML file.
3 Please use 7DA7/25(V7.70P/25) or later if legacy vendor ID and device ID must be used, for example, to solve compatibility problem because 7DA7/22-24(V7.70P/22-24) always use new vendor ID and device ID.
   Please refer to Subsection 2.2.4 for the vendor ID and device ID.

C.4.2   I/O Device Module Database

$PNIO_DB is an array of system variable that stores module ID used by module list/detail screen. Each element stores the module ID of a data access point, and the module ID of DI/DO module of the data access point.

$PNIO_DB is saved to PNIO.SV. Restoring PNIO.SV after robot software update to 7DA7/22(V7.70P/22) or later will override the recent database. If necessary, for example, to use the GSDML file for robot provided by FANUC, the value must be recovered by manual. The information of unused data access point can be overridden. Please refer to Appendix B.5 for the module information of data access point for CP1604 V2.5 and CP1616 V2.5.

C.4.3   Other System Variables

Some system variables are internally used. The following system variables must be recovered by manual if PNIO.SV is restored after robot software update to 7DA7/22(V7.70P/22) or later.

Table C.4.3(a) Other system variables to be recovered by manual

Variable	Value
$PNIO_CFG.$UBYTE18	1
$PNIO_CFG.$UBYTE19	152
$PNIO_CFG.$UBYTE20	3

D   DUAL CHANNEL PROFINET FUNCTION

D.1   OVERVIEW

This chapter explains mini-slot dual channel PROFINET software/hardware.

D.1.1   Features / Functions

The PROFINET Interface includes the following features :
- Mini-slot dual channel hardware
    - o   Supports the I/O Controller function through a built-in switch with two RJ45 ports.
    - o   Supports the I/O Device and F-Device function through a built-in switch with two RJ45 ports. F-Device requires the PROFINET Safety (J931) option.
    - o   External 24vdc power connector to maintain switch function when the robot is turned off.
- I/O Device function supports up to 128 bytes of inputs and 128 bytes of outputs.
    - o   I/O Can be mapped as digital, group, and/or peripheral (UOP) I/O using Rack 102 Slot 1.
- I/O Controller function supports up to 128 bytes of inputs and 128 bytes of outputs.
    - o   I/O can be mapped as digital, group, and/or analog using Rack 101 and the slot configured (1-128).
    - o   Supports up to 128 connections to peripheral devices.
- F-Device function : See the PROFINET Safety chapter in the Dual Check Safety Function Operator Manual. Note that PROFINET Safety software option (J931) must be purchased/loaded for this additional functionality.
- The following configuration files are available on the robot through a normal backup process or individually through the memory device (MD:) :
    - o   PROFINET Configuration in the robot (including the template files, I/O Device configuration, and I/O Controller configuration) is saved in PMCFG.ZIP.
    - o   The associated system variables are saved in PMIO.SV.

D.1.2   Ordering Information

Software Options :
- R834 : Dual Channel PROFINET Interface (Mini-slot)
    - o   Requires the dual channel PROFINET mini-slot hardware.
    - o   This option can't be used with PROFINET I/O software option(J930).
- J931 : PROFINET Safety
    - o   Requires Dual Channel PROFINET Interface software option(R834).

NOTE
For PROFINET Safety function that exchanges safety signals on PROFINET I/O Device, please read "R-30iA/R-30iA Mate CONTROLLER Dual Check Safety Function (ISO 13849-1:2006 compliant) OPERATOR'S MANUAL (B-83104EN)" or "R-30iB/R-30iB Mate/R-30iB Plus/R-30iB Mate Plus/R-30iB Compact Plus CONTROLLER Dual Check Safety Function OPERATOR'S MANUAL (B-83184EN)" in addition to this manual.

Hardware Options :
- Dual channel PROFINET hardware consists of the followings :
    - o   PROFINET mother board (mini slot) : A05B-2600-J076

- • FANUC spare part # A20B-8101-0930
- o Molex PROFINET daughter board A05B-2600-J083
  - • FANUC spare part # A15L-0001-0150
  - • See Appendix D.5 for DIP switch settings.
  - • Firmware version is checked at power up. See Appendix D.6 to manually update firmware. For R-30iB (7DC3(V8.30) or later), the firmware version is V1.3.1.0. For R-30iB Plus (7DF1/05(V9.10P/05) or later), the firmware version is V1.3.3.2. For R-30iB Mate Plus and R-30iB Compact Plus (7DF1/10(V9.10P/10) or later), the firmware version is V1.3.3.3. Please see Appendix D.6 for the firmware version details.

NOTE
1 For R-30iB, 7DC3 (V8.30) or later is required.
2 Molex PROFINET daughter board is installed on the PROFINET mother board (mini slot) if it is purchased from FANUC.
3 You need to use a firmware version compatible with the robot controller. When you install the board to other controller, refer to Section D.6 and update the firmware to the version compatible with the controller to be installed.

D.1.3   System Overview

The dual channel PROFINET interface consists of the following components:
- • Robot Controller
  - o Dual Channel PROFINET mini-slot hardware(PROFINET mother board and daughter board)
  - o Teach Pendant with PROFINET user interface
  - o R834 Dual Channel PROFINET Software Option(mini-slot)
- • GSDML File
- • PROFINET Configuration Tool (PFN-CT)
  - o Used to create initial I/O Controller template library which is then downloaded to robot(s)
  - o Not required during production
- • Optional PC based Profinet user interface application (PFN-TP-CT)
  - o Available for remote access of the Robot Profinet user interface.
  - o Identical to Teach Pendant interface, instead allowing remote configuration through Robot IP address.
  - o The robot only supports one open interface at a time.
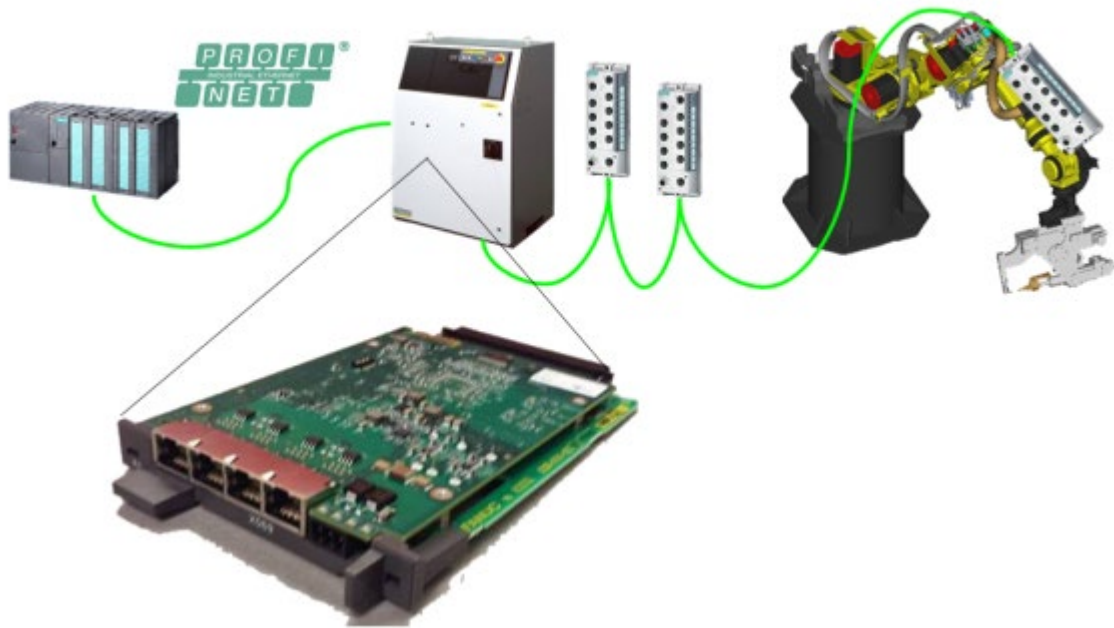
D.2   I/O DEVICE SETUP

Configuring the I/O Device involves :
- Setting up the I/O Device channel (Channel 2) in the robot
  - o Name and IP Address Settings
  - o Switch Settings
  - o IO Modules
- Adding the robot I/O Device configuration to the PLC configuration
  - o Import robot GSDML file to the PLC configuration software and add the specific configuration that is consistent with how robot is configured
  - o Download the new configuration to the PLC

The upper two RJ45 ports with the card installed are used for the I/O Device function.
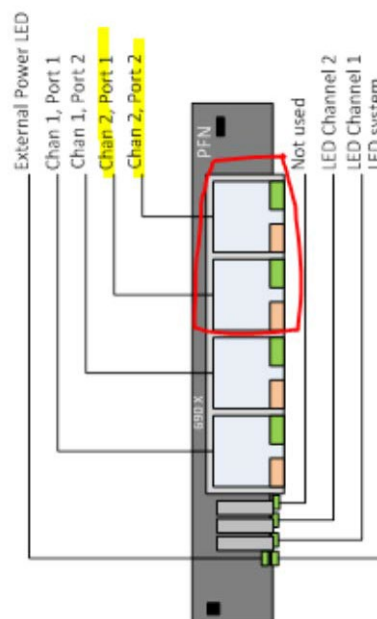
> **NOTE**
> In case 4 RJ45 ports are numbered regardless of channels, the lowest port is port 1. Then I/O Device uses port 3 and port 4.

D.2.1   Configuring the Robot

Please note that the following user interface screens can be directly accessed from the PC based PROFINET user interface application (PFN-TP-CT). Please see Appendix D.9 for details.

The robot I/O Device channel is configured through the following screen on the Teach Pendant (MENUS -> I/O -> F1 Type -> PROFINET(M), cursor to Channel 2) :
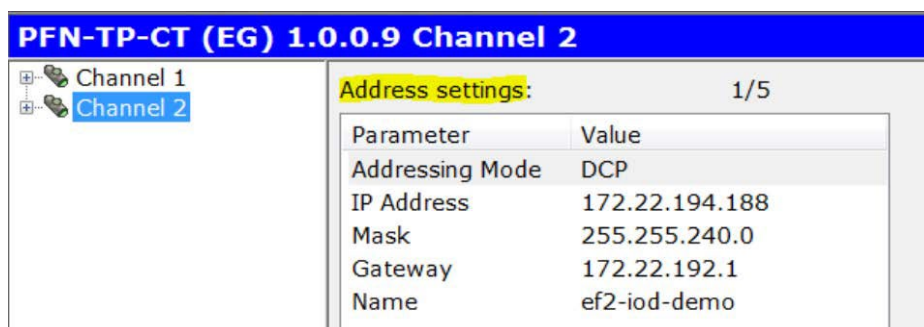
Please fill in the Address Settings as appropriate for the application. The DISP key on the Teach Pendant moves the focus between the right and left panes.
The switch settings can also be adjusted by moving cursor down to Channel 2 and pressing the right arrow to expand the tree view in the left pane. Then cursor to the Switch as follows:
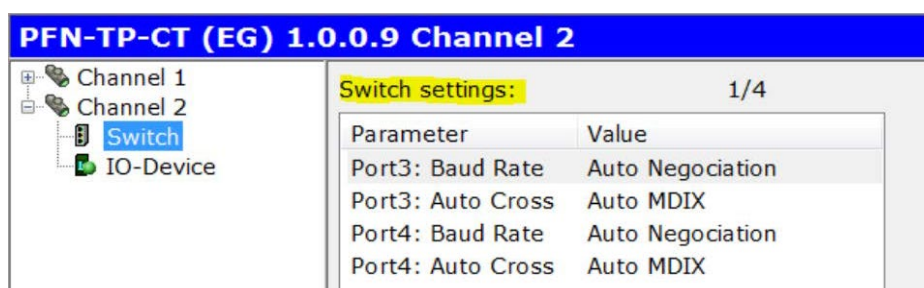
> **NOTE**
>   Port 3 is Channel 2 Port 1. Port 4 is Channel 2 Port2.

Next the actual IO modules to be allocated for the I/O Device should be chosen. Add DI/DO/AI/AO modules to each slot according to I/O to be exchanged by I/O Device.
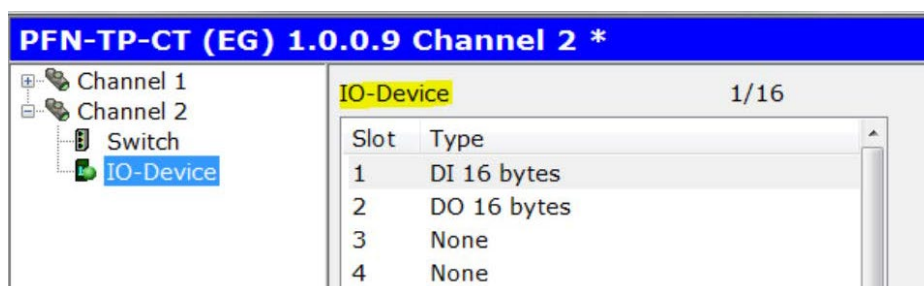
The EDIT key (F4) will expose the choices. Use the APPLY key after moving cursor to the desired selection.

Finally use the SAVE key to save the configuration to the robot. The configuration actually takes effect on the next power cycle of the robot. Note the Title Bar is normally BLUE. When changes are made to the existing configuration an asterisk appears at the end of the title bar text. After pressing SAVE the title bar turns RED indicating that a power cycle is required to update the configuration.
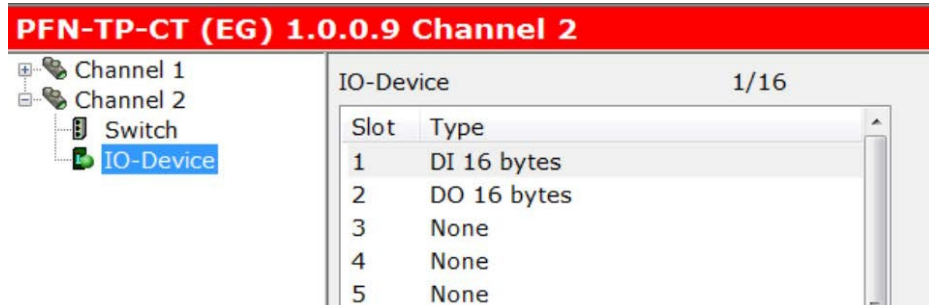
If PROFINET-Safety is needed in the configuration this module needs to be configured as the first module.

D.2.2   Configuring the PLC

Please consult the documentation for the specific PLC and PLC configuration tool. The general steps are :
*   Import the robot GSDML file.
    o   The robot GSDML file is available from FANUC.

H/W Platform	GSDML File	Device Icon
R30*i*B	GSDML-V2.3-Fanuc-A05B2600R834V830-20140601.xml	GSDML-01B7-0003-R30IB.bmp
R30*i*B Plus	GSDML-V2.33-Fanuc-A05B2600R834V910-20180517.xml	GSDML-01B7-0011-R30IBPlus.bmp
R30*i*B Mate Plus	GSDML-V2.33-Fanuc-A05B2600R834V910M-20180411.xml	GSDML-01B7-0013-R30IBMatePlus.bmp
R30*i*B Compact Plus	GSDML-V2.33-Fanuc-A05B2600R834V910C-20180502.xml	GSDML-01B7-0015-R30IBCompactPlus.bmp

*   Add the robot to the project
*   Choose the modules to be consistent with how the robot is configured.
    o   Note if the robot is configured with an output module first and then input module second then the PLC would be configured opposite (input module first and output module second).
*   Save the new configuration and download it to the PLC.

D.2.3   Status and Troubleshooting

Please note that the following user interface screens can be directly accessed from the PC based PROFINET user interface application (PFN-TP-CT). Please see Appendix D.9 for details.

The current status of I/O connections is shown graphically in the left pane of the PROFINET screen at all times. Each connection will show a circle of one of the following colors :
*   Green : Connection is running.
*   Red : Connection is faulted.
*   Grey : Connection is disabled.
The DIAGMSG function key (F2) will provide more detailed status (have the cursor on the specific device in the left pane).

PFN-TP-CT (EG) 1.0.0.9 Channel 2

- Channel 1
  - Switch
  - IO-Controller
- Channel 2
  - Switch
  - IO-Device

Name   ef2-iod-demo
IP/Subnet 172.22.194.188/255.255.240.0
Gateway   172.22.192.1

Connection state:

(9) Connection lost due to IO-Device event (DataValid = 0).

(129) Connection is down

PROFINET status:

Status	Description
NA	NA
NA	NA
NA	NA
NA	NA

| SAVE | SETTINGS | | | DISABLE |

The upper (Status In) connection state in the right pane may be one of the following values:

Value (*)	comment
254	Connection never establish, never tried.
0	No error connection is up
1	The apdu_status is in stop. Do not take care about Input values
2	The apdu_status is in Run. One of IOPS is bad.
3	The apdu_status is in Run. One of IOCS is bad.
9	Connection lost due to IO-Device event (DataValid = 0).

The lower (Status Out) connection state may be one of the following values:

Value (*)	comment
53	Connection is primary, Run and data valid
37	Connection is primary, STOP and data valid
129	Connection is down

For a properly operating connection the upper connection state should be 0 and lower state should be 53. If the upper number is 128, it means there is a minor configuration mismatch but I/O Device can still operate.

Checking connectivity is a good first step if the connection is not made. If PLC cannot ping the robot then there may be a cabling or network problem.

If no I/O Controller makes a connection, a "PRIO-379 PMIO Chnl 2Slot 1 Idle" alarm is posted. By default this is WARNING severity. It can be changed to STOP severity by setting $PM_CFG.$IOD_ERR_SEV from 1 to 0. The associated robot inputs (Rack 102, slot 1) are zeroed by default when the connection fails but this behavior can be changed to keep last state by setting $PM_CFG.$IOD_KEEP from 0 to 1.

D.3   I/O CONTROLLER SETUP

Configuring the I/O Controller involves :
- Setting up the I/O Controller channel (Channel 1) in the robot
  - o   Name and IP Address Settings
  - o   Switch Settings
- Generating the Template Library and downloading it to the robot(s)
  - o   This is generally an onetime procedure at the beginning of the project. The template library usually includes all the devices that might be used with the robot(s)
- Adding the I/O Devices to the Robot's Channel 1 device list
  - o   This is done on the Teach Pendant automatically using the DETECT function. A device can be added manually if it does not yet exist on the network.
- After DETECT any un-configured devices can be commissioned (IP/Name commissioning, factory reset, etc.)
  - o   Save the new configuration and cycle power to the robot

The lower two RJ45 connectors with the card installed are used for the I/O Controller function.
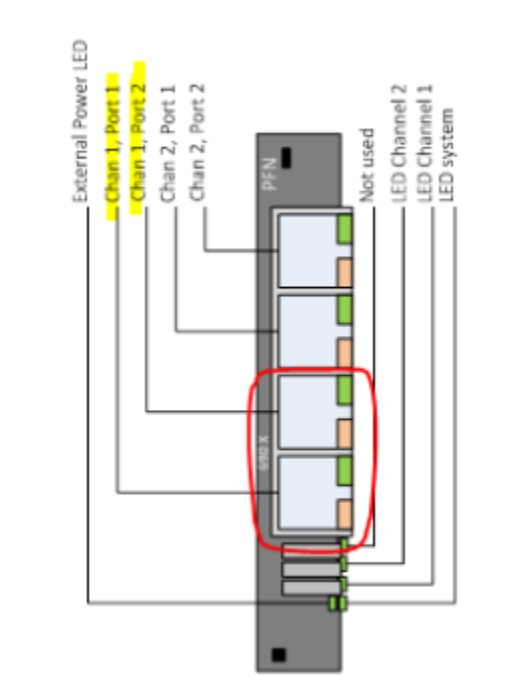
D.3.1   Setting up the I/O Controller Channel
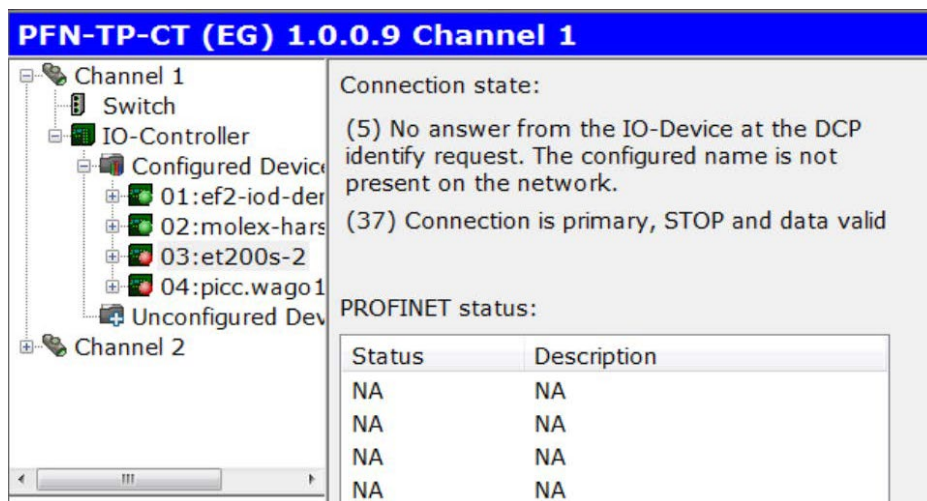
Please note that the following user interface screens can be directly accessed from the PC based PROFINET user interface application (PFN-TP-CT). Please see Appendix D.9 for details.

Set the address and switch settings for channel 1 through the following screens on the Teach Pendant (MENUS -> I/O -> F1 Type -> PROFINET(M), cursor to Channel 1)
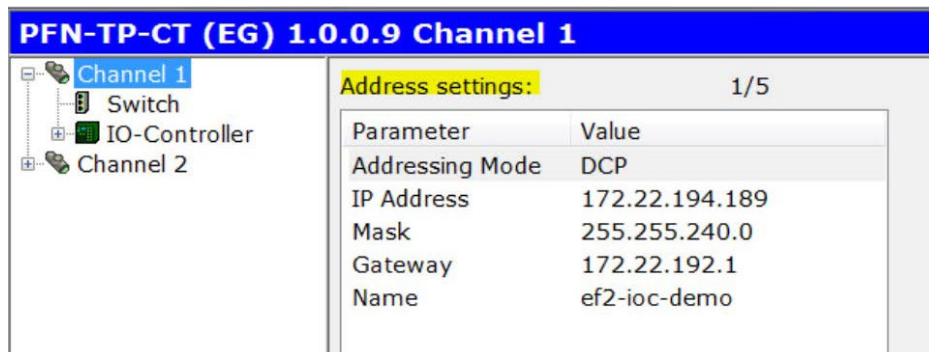
PFN-TP-CT (EG) 1.0.0.9 Channel 1

Channel 1
  Switch
  IO-Controller
Channel 2

Address settings:	1/5
Parameter	Value
Addressing Mode	DCP
IP Address	172.22.194.189
Mask	255.255.240.0
Gateway	172.22.192.1
Name	ef2-ioc-demo

Please fill in the Address Settings as appropriate for the application. The DISP key on the Teach Pendant moves the focus between the right and left panes.

The switch settings can also be adjusted by moving cursor to Channel 1 and pressing the right arrow to expand the tree view in the left pane. Then cursor to the Switch as follows:

PFN-TP-CT (EG) 1.0.0.9 Channel 1

Channel 1
  Switch
  IO-Controller
Channel 2

Switch settings:	1/4
Parameter	Value
Port1: Baud Rate	Auto Negociation
Port1: Auto Cross	Auto MDIX
Port2: Baud Rate	Auto Negociation
Port2: Auto Cross	Auto MDIX

Finally use the SAVE key to save the configuration to the robot (the configuration actually takes effect on the next power cycle of the robot. Note the Title Bar is normally BLUE. When changes are made to the existing configuration an asterisk appears at the end of the title bar text. After pressing SAVE the title bar turns RED indicating that a power cycle is required to update the configuration.

D.3.2   Creating a Template Library

A template library contains information on each of the possible devices that may be connected to the I/O Controller. Each device template can be configured for the specific application requirements (e.g. setting an analog channel to 4-20ms or configuring a discrete I/O point to operate as an output on a configurable block). The template library is created using a PROFINET Configuration Tool (PFN-CT). This Windows PC application (setuppct.exe) can be provided by FANUC. Please see Appendix D.8 for details and an example of template library creation and download.

Each device GSDML file is imported to the tool and then, by either automatically detecting devices on a physical network or manually adding devices, the template library is generated. The template library is then downloaded to the robot(s). This is simply done by choosing Download Configuration while online with the target robot :
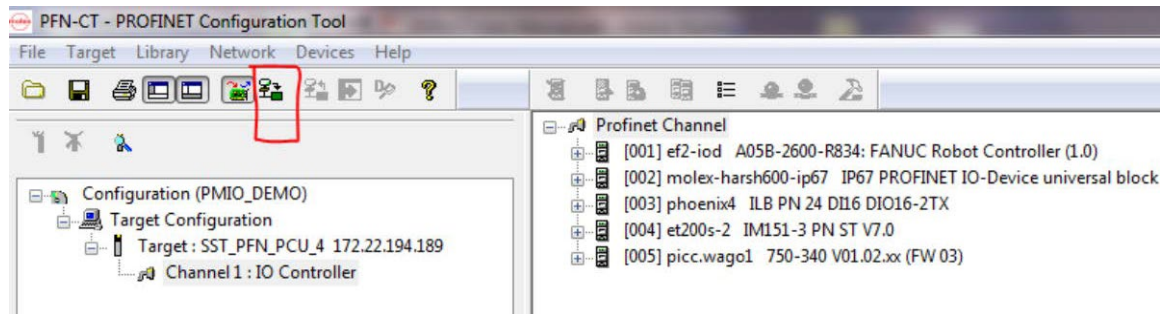
Note that the download takes place to the PROFINET card itself on the robot. Please be sure to go into the Teach Pendant PROFINET screen and choose Update and Save so the template library is permanently stored on the robot. This is detailed in Appendix D.3.3.

The template library is part of the robot backup and is included within pmcfg.zip. See Subsection D.4.2 for details on backup/restore. Copying pmcfg.zip is the quickest/easiest way to duplicate a configuration between robots.

D.3.3   Adding I/O Devices to the Robot's Device List

Peripheral I/O Devices are managed from the PROFINET Setup screen. They can be added/removed, enabled/disabled, and detailed status is shown. Please go to MENUS -> I/O -> F1 Type -> PROFINET(M) to see the following screen :
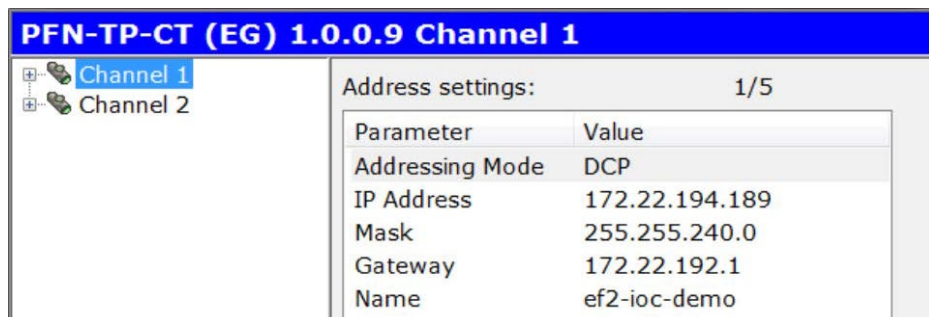
The I/O Controller channel (Channel 1) can be expanded in the left pane by using the right arrow with the cursor on Channel 1 (note that DISP can be used to move between right and left panes). Please cursor down to I/O Controller and the right pane will show details of the current template library.

If a new template library was downloaded to the robot please use the UPDATE (F5) key to load the new template library now.

I/O Devices can be added automatically or manually. If the physical devices are available on the I/O Controller network automatic detection is recommended and done by expanding I/O Controller in the right pane to expose the Configured and Not configured devices, and with cursor on Not configured devices
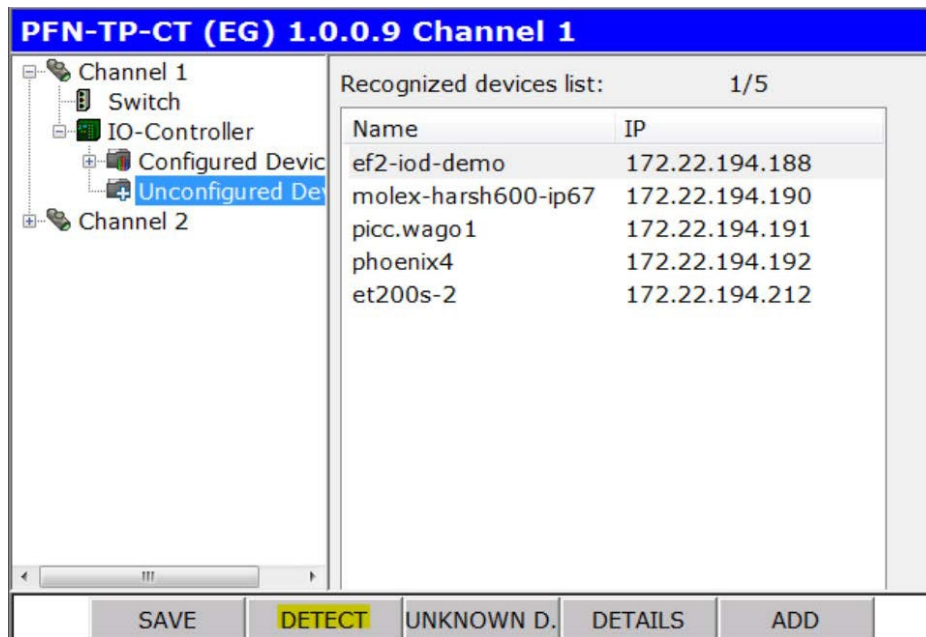
If the devices are recognized they will show in the Recognized (known) devices list. This means there is a match with an existing template and the ADD button (F5) will directly add the device to the I/O Controller. If all devices are Recognized please choose ADD (F5) with the cursor on each device. Then press SAVE (F1) and once save is complete cycle power to have changes take effect.
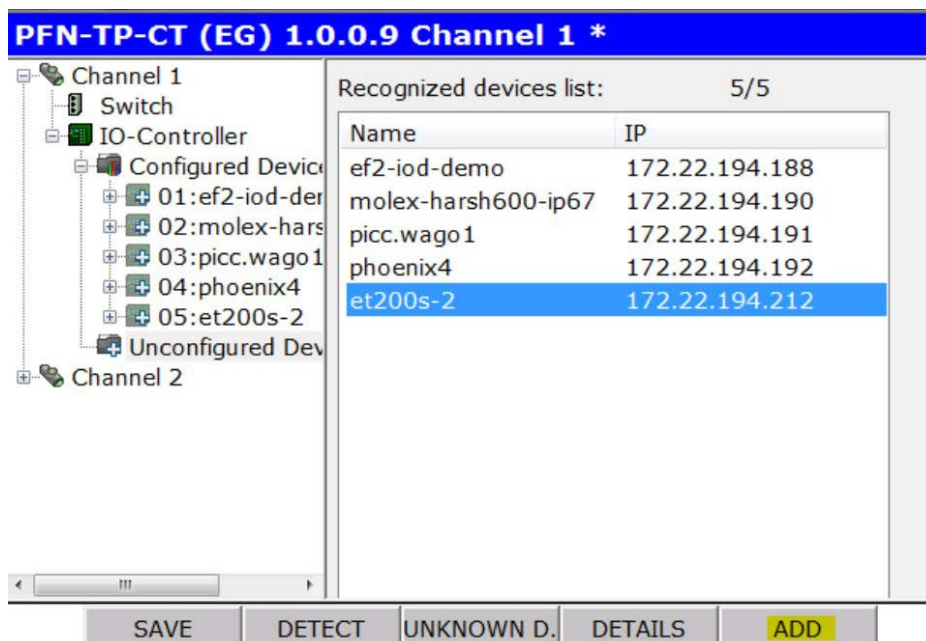
The DETAILS function key (4) will show addressing details of each device and includes the ability to set/change the IP address and Name of each device under the CHOICES function key (F3). This screen is available for both Known and Unknown devices. Specifically the Choices function key includes the following features :
•   IP Commissioning : IP address of the I/O Device can be set.
•   Name Commissioning : Name of the I/O Device can be set.

- 94 -

- Start Blinking : LED of I/O Device starts blinking for identification by sight.
- Factory Reset : IP address and name of I/O Device can be reset.
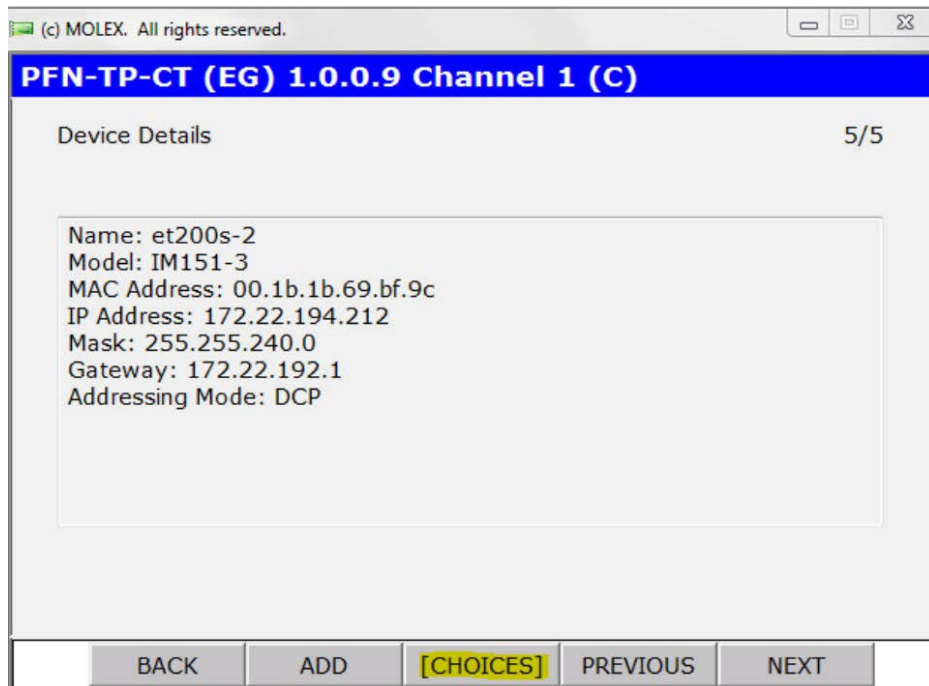
The UNKNOWN D. function key (F3) will display any unknown devices. These are devices that did not match any existing template or may need resolution of IP address and/or name (commissioning). If Name or IP commissioning is needed it can be done and DETECT run again so the device is available to be Added from the Known/Recognized Devices list.

Note that when PROFINET configuration is changed on the teach pendant that there is an asterisk on the right side of the string in the title bar. This means a SAVE is needed. Once a SAVE is done the title bar will be red indicating a power cycle is needed for the new configuration to take effect.
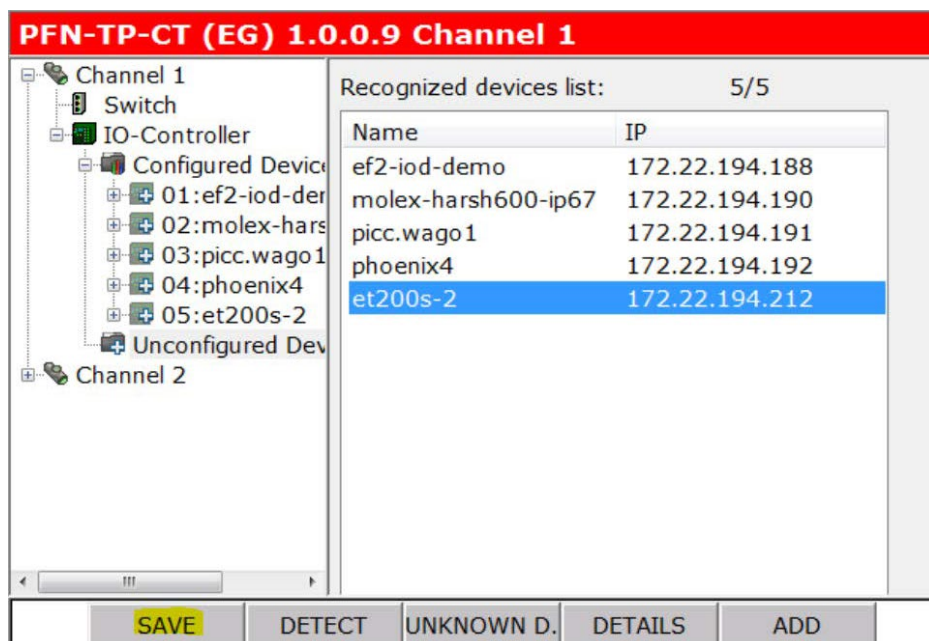
D.3.4   Status and Troubleshooting

Please note that the following user interface screens can be directly accessed from the PC based PROFINET user interface application (PFN-TP-CT). Please see Appendix D.9 for details.

The current status of IO connections is shown graphically in the left pane of the PROFINET screen at all times. Each connection will show a circle of one of the following colors :
*   Green : Connection is running.
*   Red : Connection is faulted.
*   Grey : Connection is disabled.
The DIAGMSG function key (F2) will provide more detailed status (have the cursor on the specific device in the left pane).

The upper (Status In) connection state in the right pane may be one of the following values :

Value (*)	comment
255	Not used, connection not configured
254	Connection never establish, never tried.
253	Connection failed without specific error (default case)
0	No error connection is up
1	The apdu_status is in stop. Do not take care about Input values
2	The apdu_status is in Run. One of IOPS is bad.
3	The apdu_status is in Run. One of IOCS is bad.
4	IO-Device Configuration does not match.
5	No answer from the IO-Device at the DCP identify request. The configured name is not present on the network.
6	Duplicate name for the IO-Device. The DCP identify request received several answers from different IO-Devices.
7	Duplicate IP address detected during DCP identify request.
8	Out of AR resource. The device is already connected and do not accept more connection.
9	Connection lost due to IO-Device event (DataValid = 0).

The lower (Status Out) connection state may be one of the following values :

Value (*)	comment
53	Connection is primary, RUN and data valid
37	Connection is primary, STOP and data valid
129	Connection is down

For a properly operating connection the upper connection state should be 0 and lower state should be 53. If the upper number is 128, it means there is a minor configuration mismatch but I/O Device can still operate.

If the connection has failed "PRIO-378 PMIO Chnl 1 Slot x Conn Err" alarm is posted (where slot x corresponds to the connection which failed). By default, this is STOP severity. This can be changed to WARN severity by setting $PM_CFG.$IOC_ERR_SEV from 0 to 1. The associated robot inputs (Rack 101) are zeroed by default when the connection fails, but this behavior can be changed to keep last state by setting $PM_CFG.$IOC_KEEP from 0 to 1. These two settings apply to all I/O Controller connections. See Appendix D.7 (Tool Change Macros) to programmatically enable/disable or mask faults on an individual connection.

D.4   MANAGING THE I/O CONFIGURATION

D.4.1   Mapping PROFINET I/O

Please note that the following user interface screens can be directly accessed from the PC based PROFINET user interface application (PFN-TP-CT). Please see Appendix D.9 for details.

As with other I/O systems in the robot, the PROFINET I/O is mapped using rack, slot, and starting point. The PROFINET I/O Controller (Channel 1) is always Rack 101. The Slot corresponds with the IO Slot setting in each device as shown below :
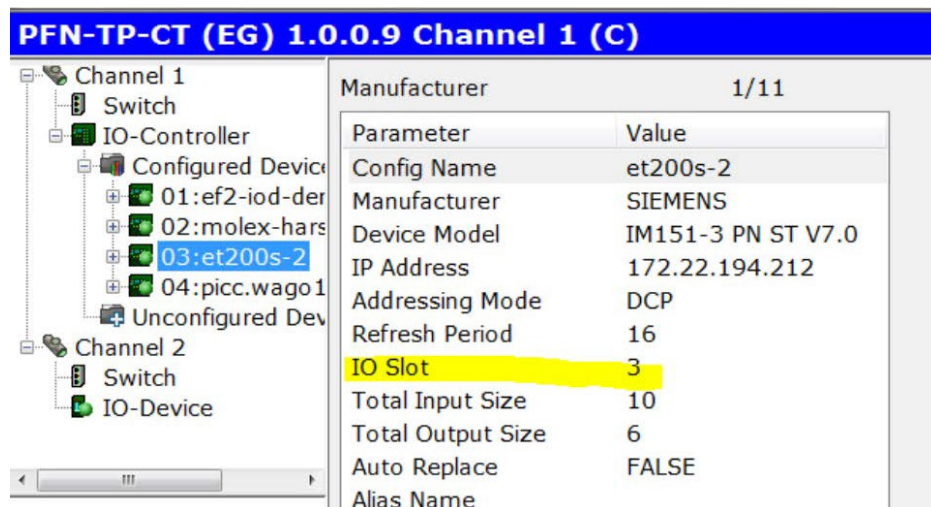
The PROFINET I/O Device (Channel 2) is always Rack 102. The Slot is always 1.

D.4.2   Backing up the PROFINET I/O Configuration

If the Dual Channel PROFINET Interface option is loaded a robot backup will include the following files :
*   PMCFG.ZIP : This includes the configuration for both channels along with template files. It should be backed up and restored as a single zip file.
*   PMIO.SV : This includes PROFINET specific system variables.
The following file is always part of a backup :
*   DIOCFGSV.IO : This includes the I/O mappings and comments.

D.5   HARDWARE DETAILS

D.5.1   PROFINET MOTHER BOARD (mini slot)

The Molex daughter board has LEDs as the following figure. The following table shows their functions.
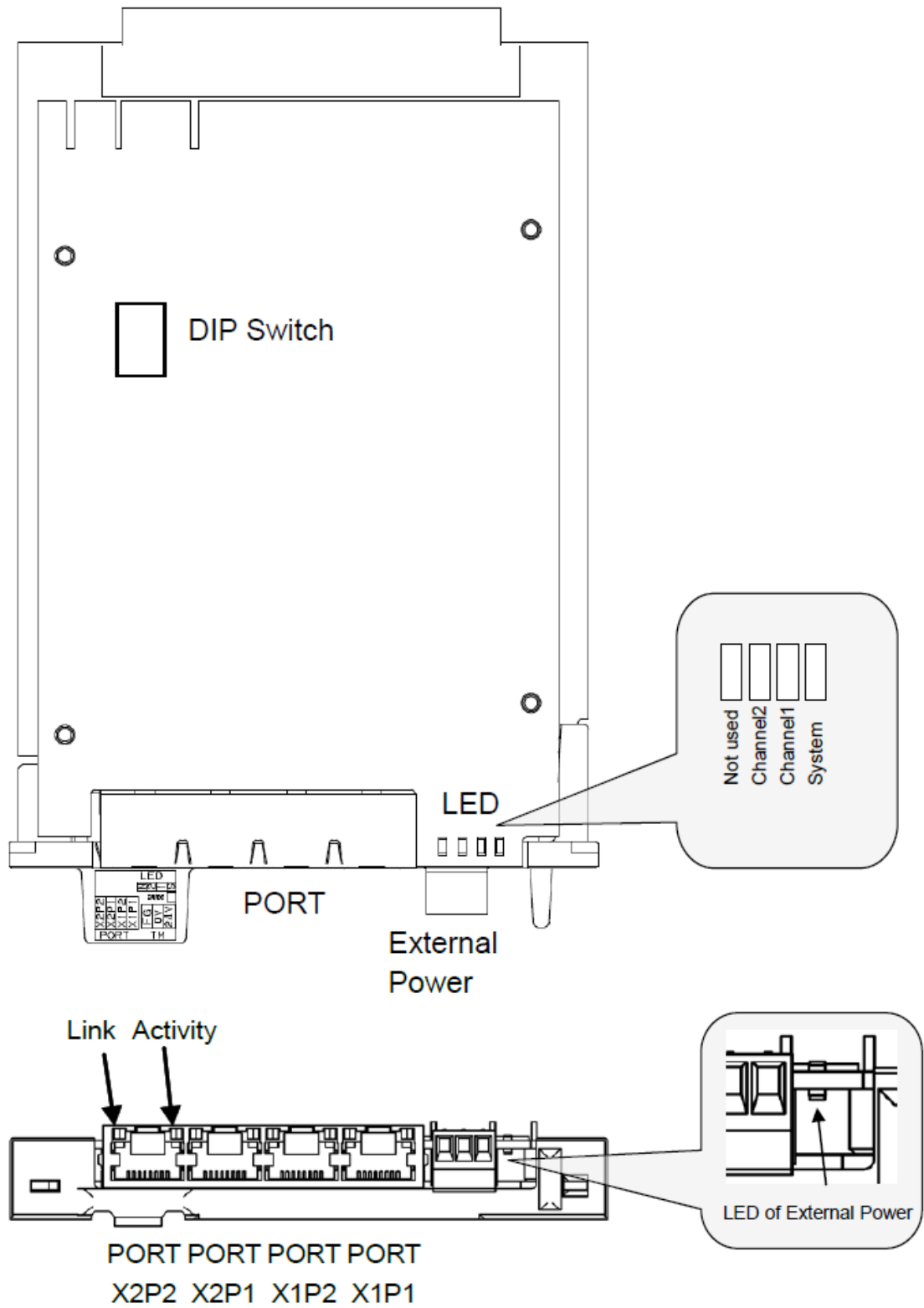
Name	PCB drawing number
PROFINET mother board (mini slot)	A20B-8101-0930

Name	Color	State	Description
Link	Green	On	A connection established.
Activity	Yellow	On	Sending and receiving
System		Off	Card not powered
	Green	On	System running
	Red		Hardware fault
	Red	Flash	System in Recovery mode
Channel1	Green	On	Channel 1 running
	Red		Channel 1 in fault
	Green	Flash	Channel 1 configured
	Red		Channel 1 degraded
Channel2	Green	On	Channel 2 running
	Red		Channel 2 in fault
	Green	Flash	Channel 2 configured
	Red		Channel 2 degraded
External Power	Green	On	External power is input

The Molex daughter board has DIP switch as the following figure. The DIP switch should be set like the figure below.
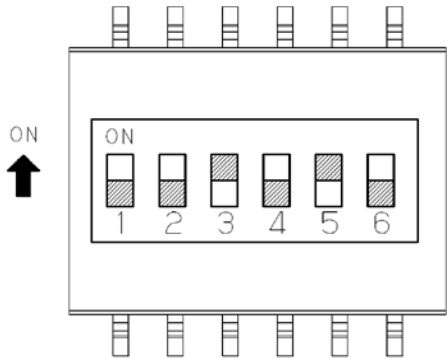
DIP switch setting

Switch1	Switch2	Switch3	Switch4	Switch5	Switch6
ON	ON	OFF	ON	OFF	ON

D.5.2   Installation

The following figures show how to install Molex daughter board.
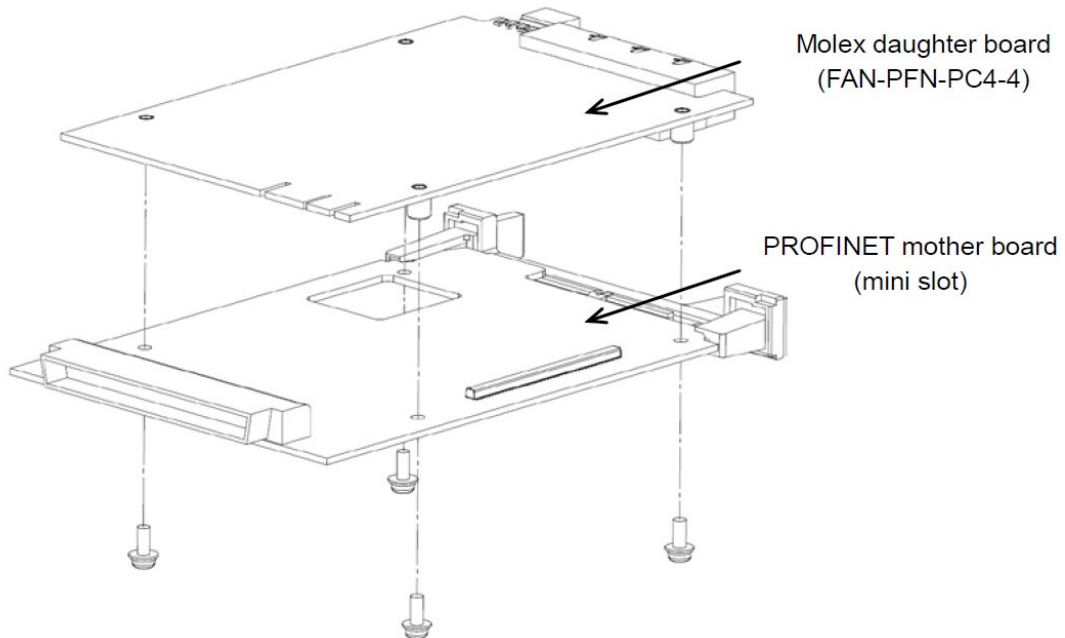
In the R-30*i*B controller, a PROFINET board can be installed to an option mini slot like the figure below.
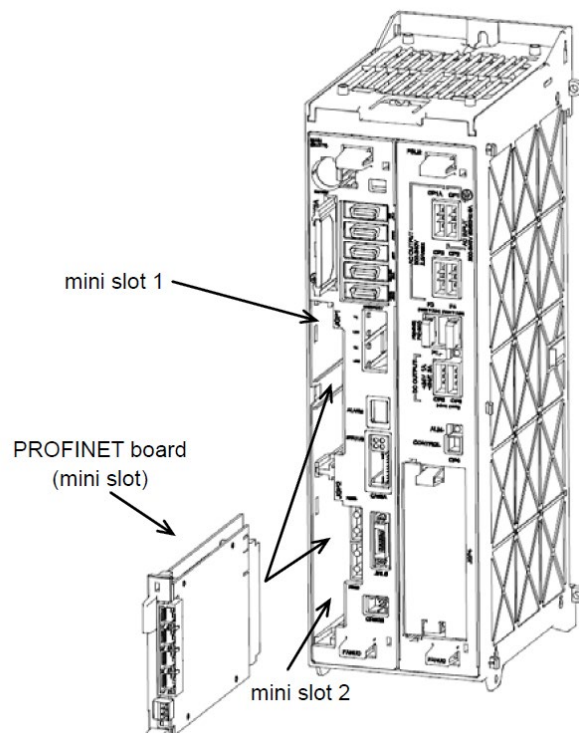
In the R-30*i*B Mate controller, a PROFINET board can be installed to a mini slot 2 like the figure below.

PROFINET board (mini slot)

mini slot 2   mini slot 1
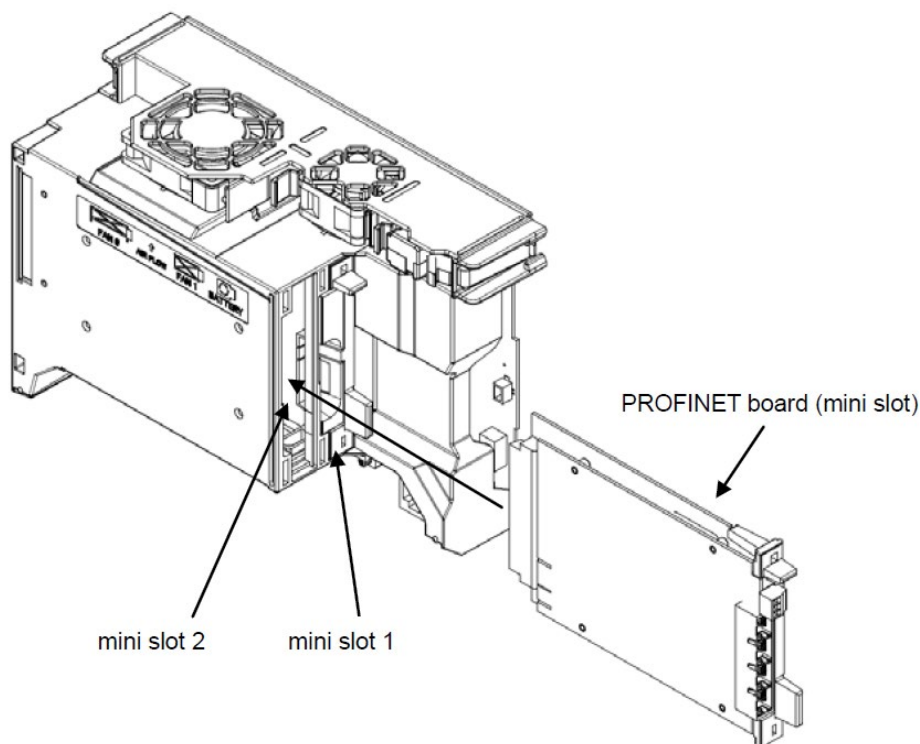
> **NOTE**
> In case of R-30*i*B Mate, PROFINET board (mini slot) cannot be installed in the mini slot 1.

D.5.3   External power supply of Molex PROFINET daughter board

The external power supply (+24V) allows the integrated switch (or switching hub) to function even when the robot controller is turned off.

> **NOTE**
> The switch function of Molex PROFINET daughter board is also available when the robot controller is turned off as long as it was turned on briefly at least once and the external power supply is connected.

Table D.5.3(a) Specification of external power supply of Molex PROFINET daughter board

Requirements	
Voltage range of the 24V supplies	18 to 34 V DC
Connection	
Molex connector	Manufacturer : Molex Manufacture specification : 39500-0503
Current consumption of the external 24V voltage	
At 18V DC supply	Max. 220mA
At 34V DC supply	Max. 175mA
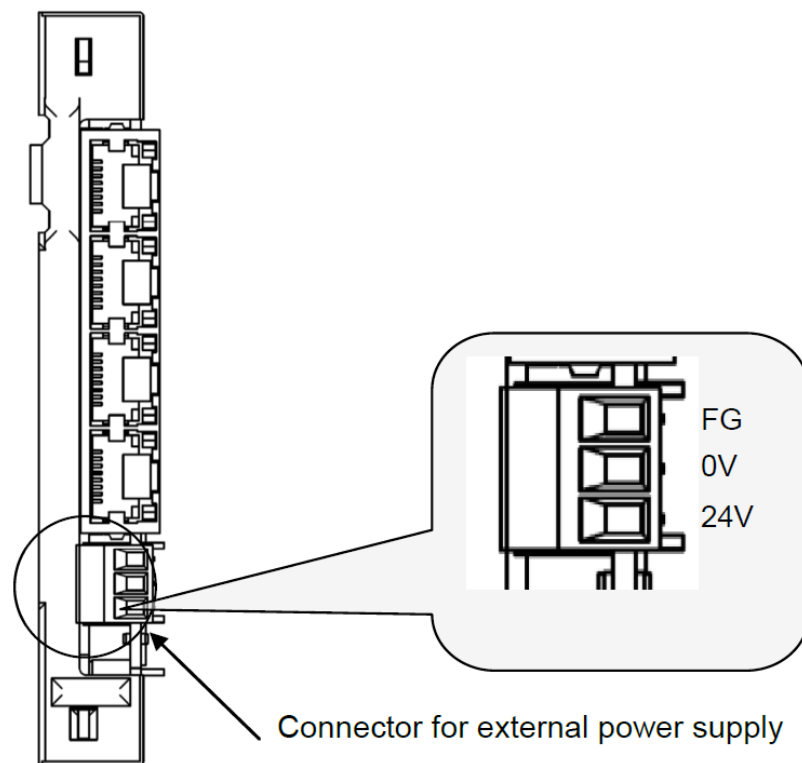
Fig. D.5.3(a) Connector for external power supply (PROFINET board (mini slot))

D.6   UPDATING FIRMWARE

If the PROFINET card firmware version is not equal to the version expected by the robot controller software, the robot will post "PRIO-397 Profinet Firmware Update Needed". The PROFINET Firmware can be updated with the robot at CTRL Start on R-30iB Plus, R-30iB Mate Plus and R-30iB Compact Plus controller. Please contact FANUC if firmware update is needed on R-30iB controller.

Note the current and expected firmware versions are held in the following system variables for reference. The current firmware version is updated each power up.
- $PM_STAT.$CUR_FW_VERS : The current firmware version
- $PM_STAT.$EXP_FW_VERS : The expected firmware version

The following procedure can be used to update firmware :
- Press PREV and NEXT while turning on the robot power. This brings the robot to the Configuration Start Menu.
- Select Control Start
- When at Control Start press MENUS -> Next -> Next -> PROFINET Setup(M)

D.6.1   Automatic Firmware Update

When the Dual Channel PROFINET Interface (R834) is installed on R-30iB Plus or R30iB Mate Plus or R30iB Compact Plus controller, V1.3.3.2 and V1.3.3.3 (for Mate and Compact) firmware are also installed. R834 updates the firmware of the Molex PROFINET board during cold start from controlled start. The firmware version is selected according to the type of the controller. It may take few minutes to complete. The controller will perform a COLD start as soon as the update is complete.

> **NOTE**
> Please do not turn off the power of the controller while firmware is being updated.
> In case that the power of the controller is turned off while firmware update is
> performed, a bad influence may occur on the PROFINET board.

The firmware versions are listed in Table D.6.1(a) as appropriate.

Table D.6.1(a) EF2 firmware version

Robot H/W Platform	EF2 FW Version	FW File Name
R-30*i*B	V1.3.1.0	ef2.bin
R-30*i*B Plus	V1.3.3.2	ef2.bin
R-30*i*B Mate Plus	V1.3.3.3	ef2m.bin
R-30*i*B Compact Plus	V1.3.3.3	ef2m.bin
R-30*i*B Mini Plus	V1.3.3.3	ef2m.bin

D.6.2   Manual Firmware Update

- When at Control Start press MENU -> Next (0) -> Next (0) -> PROFINET Setup (1)
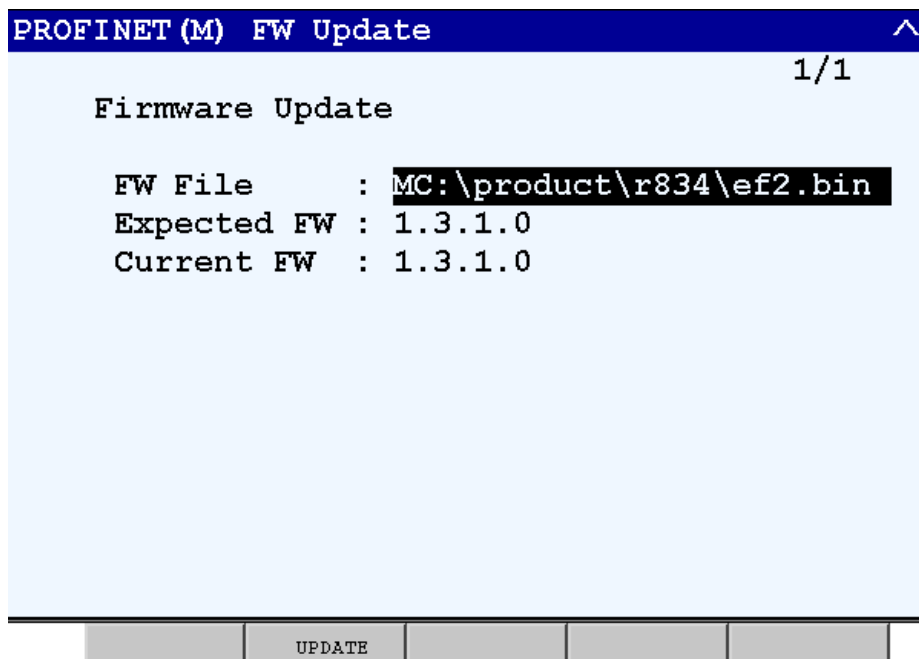
- Put the storage device with firmware to the robot. Modify the FW File setting above as required (e.g. if using a thumb drive on controller door it begins with UD1 instead of MC).
- Press UPDATE (F2) to initiate the firmware update. This will take about 5 minutes. When complete the prompt line will indicate successful completion and the robot will post "PRIO-399 PMIO Firmware Updated."

> **NOTE**
> Please do not turn off the power of the controller while firmware is being
> updated. In case that the power of the controller is turned off while firmware
> update is performed, a bad influence may occur on the PROFINET board.

- Press FCTN + COLD on the teach pendant to return the robot to the normal operating mode with the updated firmware.

D.7   TOOL CHANGE MACROS

D.7.1   Overview

The Dual Channel PROFINET (R834) option installs the following KAREL programs:
- PM_OFFLN - Allows a teach pendant program to disable PROFINET connection.
- PM_ONLN - Allows a teach pendant program to enable PROFINET connection.
- PM_MFOFF - Allows a teach pendant program to disable masking of faults for connection. Any faults on the connection are posted (not masked) by default.
- PM_MFON - Allows a teach pendant program to enable masking of faults for a connection (this allows the robot to continue when a device is disconnected as may occur in a tool change application).
- PM_STCHK - Allows a teach pendant program to check the status of PROFINET connection.

D.7.2   Karel Program Descriptions and Parameters

The following are the KAREL program descriptions and parameters.

PM_OFFLN (INTEGER channel, INTEGER slot_number)

This program allows a teach pendant program to disable a connection. This program takes the channel and slot numbers as arguments. The valid numbers for channel are 1 (I/O Controller) and 2 (I/O Device). The valid values for a slot number are 1 through 128. There is no difference between this call and disabling the connection from the teach pendant.

PM_ONLN (INTEGER channel, INTEGER slot_number, INTEGER <wait_time>)

This program allows a teach pendant program to enable a connection. This program takes the channel and slot numbers as arguments. The valid numbers for channel are 1 (I/O Controller) and 2 (I/O Device). The valid values for a slot number are 1 through 128. There is no difference between this call and disabling the connection from the teach pendant. The optional argument, wait_time, is used as follows:
- If wait_time is not used.
  If wait_time is not explicitly specified (it is an optional argument), its value   will be defaulted to 15 and PM_ONLN follows the: if wait_time is not 0 rule.
- If wait_time is not 0.
  The connection will be enabled. Auto-reconnect will also be enabled, causing the I/O controller to attempt to make a connection to the I/O device until successful. Note that PM_ONLN will block and will not return until a successful connection is made, or until the user aborts the teach pendant program. An alarm will be posted if wait_time seconds pass before a connection is established. After the alarm is posted and the robot faults, a reset/resume from either the PLC or teach pendant will restart/resume the program inside of the PM_ONLN call and the wait_time timer will be reset. Before EN_ONLN returns, auto-reconnect will set to its original state (its state before PM_ONLN was called).
- If wait_time is used and set to 0.
  Auto-reconnect will not be enabled, so the user must enable Auto-reconnect manually if needed. The connection will be enabled and the call will return immediately (will not block until a successful connection is made). The application or user programs can use PM_STCHK to check the status if it needs to confirm the status of the connection.

There is no difference between this call and enabling the connection from the teach pendant.

PM_MFOFF (INTEGER channel, INTEGER slot_number)

This program allows a teach pendant program to disable masking of faults for a PROFINET connection. Any faults on the connection are posted (not masked) by default. The valid numbers for channel are 1 (I/O Controller) and 2 (I/O Device). The valid values for a slot number are 1 through 128.

PM_MFON (INTEGER channel, (INTEGER slot_ number)

This program allows a teach pendant program to enable masking of faults for a connection (this allows the robot to continue when a device is disconnected as may occur in a tool change application). The valid numbers for channel are 1 (I/O Controller) and 2 (I/O Device). The valid values for a slot number are 1 through 128.

PM_STCHK (INTEGER channel, INTEGER slot_number, INTEGER register_number)

This program allows a teach pendant program to check the status of a PROFINET connection. The valid numbers for channel are 1 (I/O Controller) and 2 (I/O Device). The valid values for a slot number are 1 through 128. The possible status values returned in the register_number are:
- 0 Online (I/O is being exchanged)
- 1 Error
- 2 Pending (in the process of resetting)
- 3 Disabled

D.7.3   Using Karel Program in Teach Pendant Program

The following shows how to use the PM_STCHK KAREL program. The other programs listed in this section can be used in the same way.
1   Press the [SELECT] key.
2   Display the appropriate list of programs. If F1, [TYPE], is not displayed on the screen, press >,NEXT, until it is displayed.
   a   Press F1, [TYPE].
   b   Select the list you want:
3   Move the cursor to the name of the program you want to modify and press the [ENTER].
4   Turn the teach pendant ON/OFF switch to ON.
5   Select F1, [INST].
6   Select Call from the list of options that appear at the top of the screen.
7   Select Call Program and press the [ENTER] key.
8   Press F3, [COLLECT] and press the [ENTER] key to display the available KAREL programs at the top of the screen. (They are displayed when system variable $KAREL_ENB = 1. By default it is set to 0, so they are not displayed.)
9   Select PM_STCHK and press the [ENTER] key.
10   Place the cursor to the right of the word PM_STCHK.
11   Press F4, [CHOICE].
12   Select Constant from the list at the top of the screen and press the [ENTER] key.
13   Type the Channel Number and press the [ENTER] key.
14   Press F4, [CHOICE].
15   Select Constant from the list at the top of the screen and press the [ENTER] key.
16   Type the Slot Number and press the [ENTER] key.
17   Press F4, [CHOICE].
18   Select Constant from the list at the top of the screen and press the [ENTER] key.
19   Type the Register Number for the result of the device status check and press the [ENTER] key. The finished line in the teach pendant program should look like the following: CALL PM_STCHK (1, 2,50)

D.8   TEMPLATE LIBRARY CREATION AND DOWNLOAD

The PROFINET configuration tool (PFN-CT) provides a template library of I/O Devices that the robot may connect to. This template library is used to manually or through auto detection add devices to the I/O Controller scan list. Each device template can be configured as needed (e.g. specific device defaults can be modified before downloading the template library to the robot). This operation is generally done once for a project to create a common template library.

The PC needs to be on the same network as either the I/O Device and/or I/O Controller to communicate with the PROFINET daughter board.

Launch PFN-CT, then double click on Configuration to create a new configuration or open an existing one.
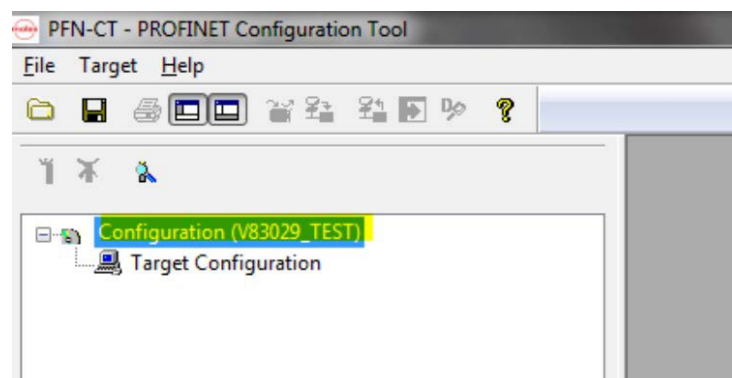
Double click on Target Configuration and click OK.
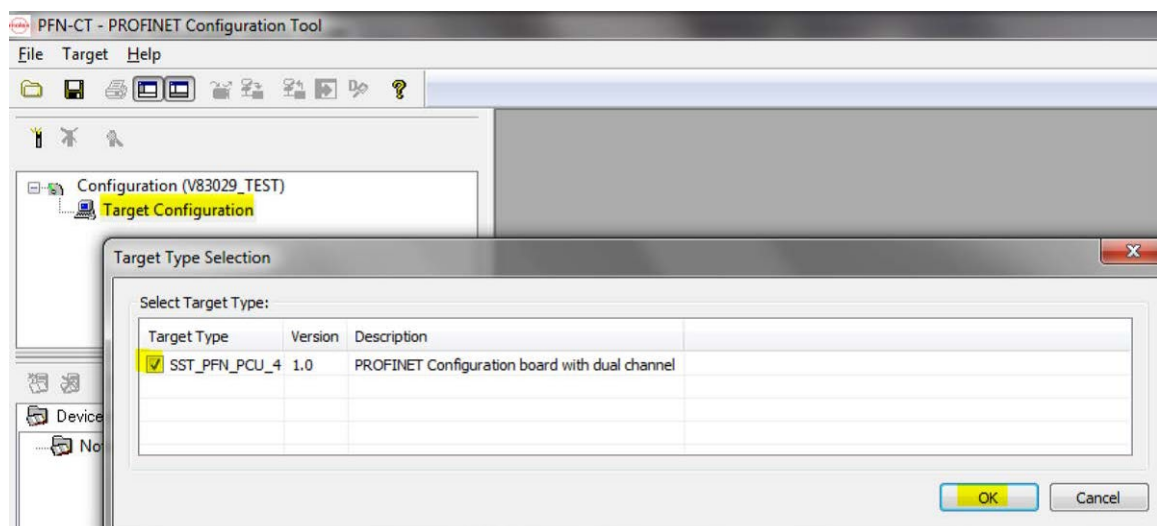
Enter the IP address configured for the I/O Controller if it is accessible from the PC. Otherwise enter the I/O Device IP address if it is accessible from the PC.
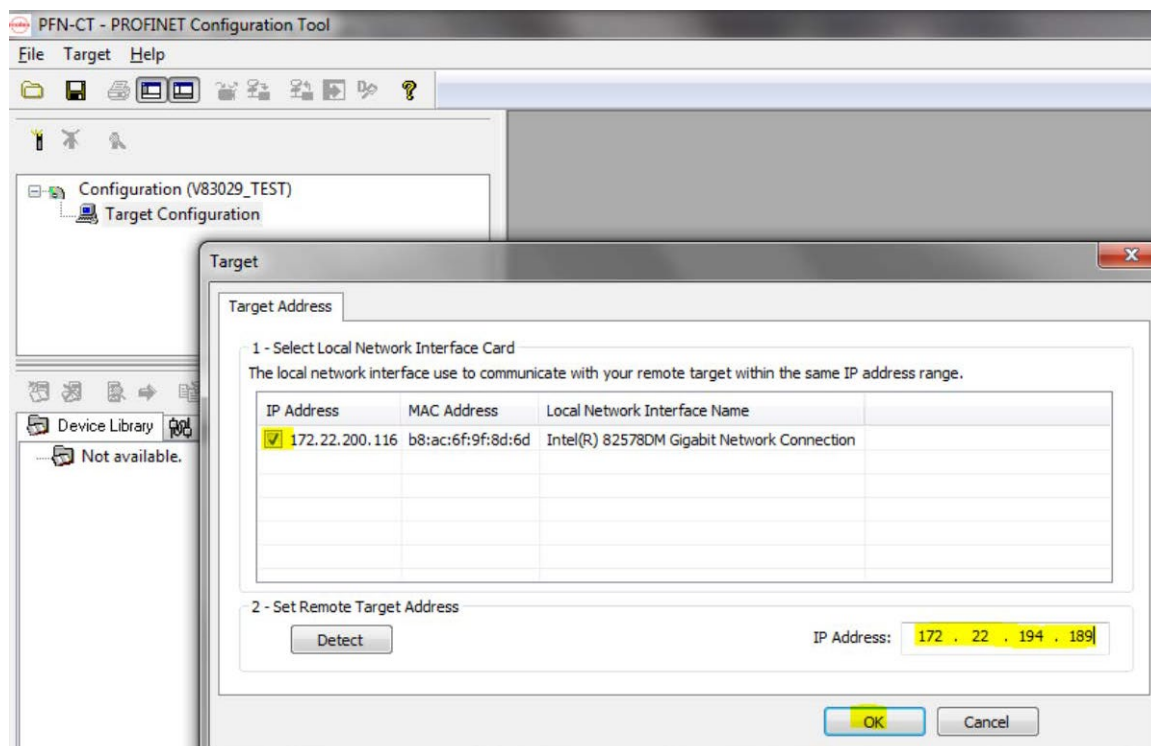
Note that the Detect button can go out and look for the channel. This function will also allow the channels IP address to be set remotely. However, the setting is temporary and still needs to be set from the teach pendant. Also the setting is only allowed if the channel is disabled. It is recommended to simply set the IP address on the teach pendant before using this tool.

If connection is done through the I/O Device channel the PC firewall may block communication. Please be sure that PN_Manager.exe and m2mDriverLauncher.exe programs are included (allowed/enabled) in the PC firewall.

Click on Channel 1 : I/O Controller to open the PROFINET configuration.
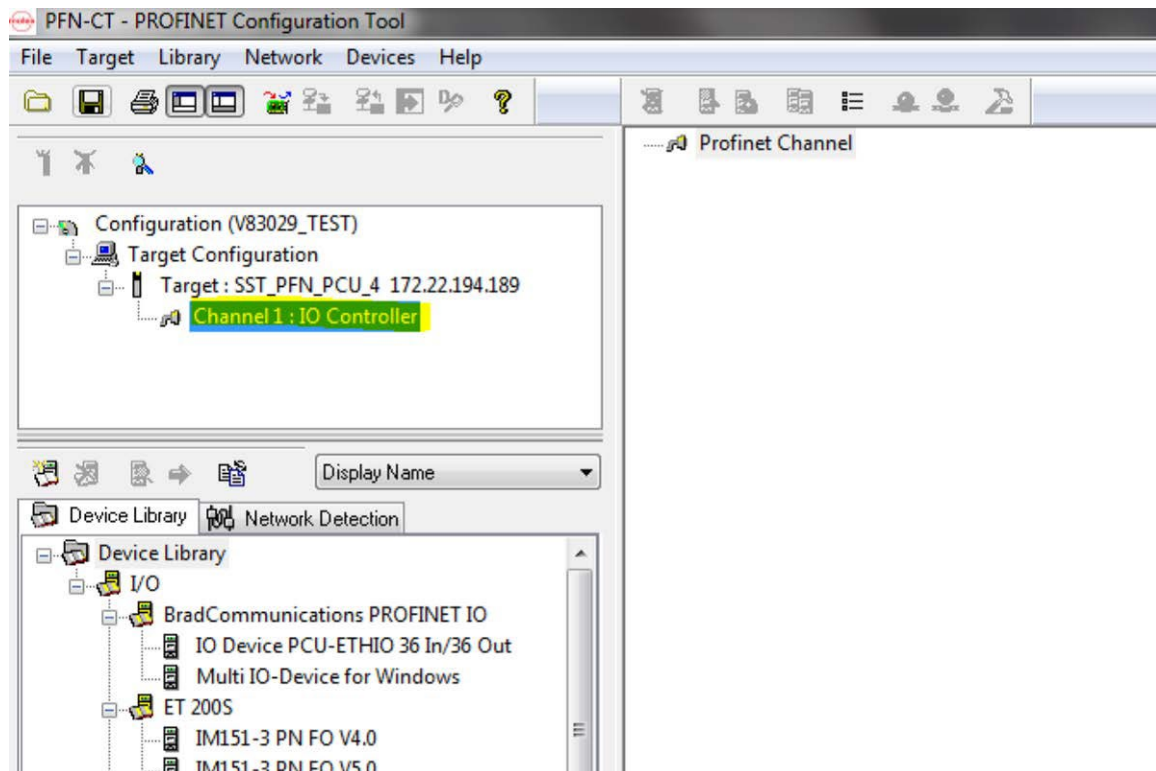
Use the buttons (just above the Device Library tab) to add/delete, or view the GSDML files. Please add GSDML files for any I/O Devices that this tool and the robot may communicate to.
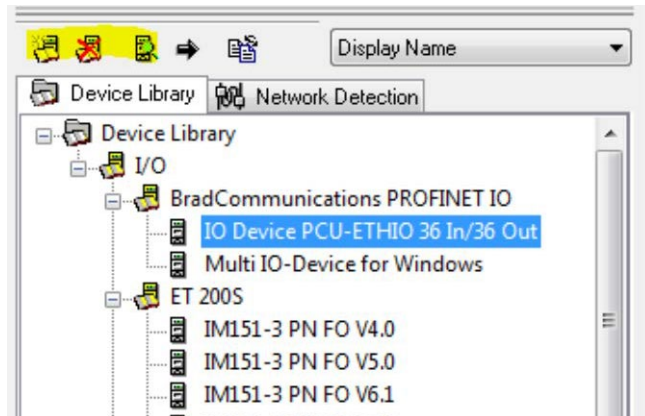
The configuration can be entered manually by inserting an I/O Device from the Device Library or can be detected automatically with the I/O Device detection feature. To manually add a device, double click on the device (under Device Library tab) or select the device and click on the Right Arrow (just above the Device Library tab).

Before launching the Automatic I/O Device detection:
• I/O Devices have to be present on the network.
• FANUC I/O Controller has to be present on the network.
• GSDML file of each I/O Device should be part of the Device Library.
• Each I/O Device has to be configured with an IP address in relation (same network range) to the I/O Controller IP address. The Online Action function described below can help with this if it is not done.

Click to go online then click the Network Detection Tab. If the connection fails, an error message is displayed in the Output Message View, at the bottom of PFN-CT.
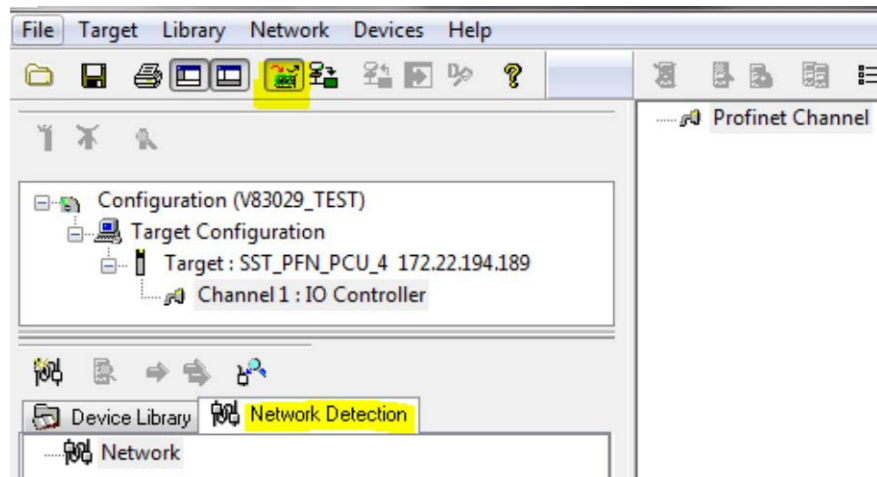
Use the [icon] Online Action button for the following functions if needed :
- Detect I/O Devices present on the network.
- Return an I/O Device to its factory settings.
- Name an I/O Device.
- Configure the IP address for an I/O Device.
- Identify an I/O Device on the network.

Click on the [icon] Read Network Configuration button to find I/O Devices on the network.
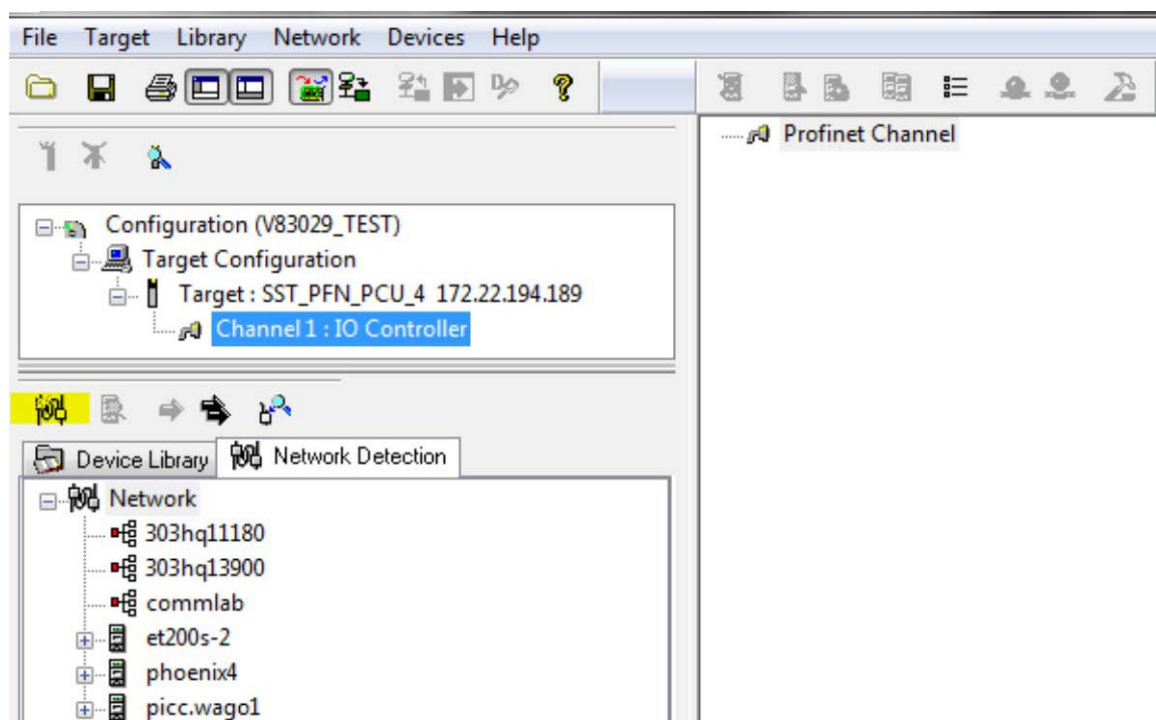
Two types of arrow buttons [icons] to push one or all detected I/O Device in the configuration area. At this point, a default configuration is completed. I/O Device parameters can be modified from default if needed. Fast Startup can be enabled here.
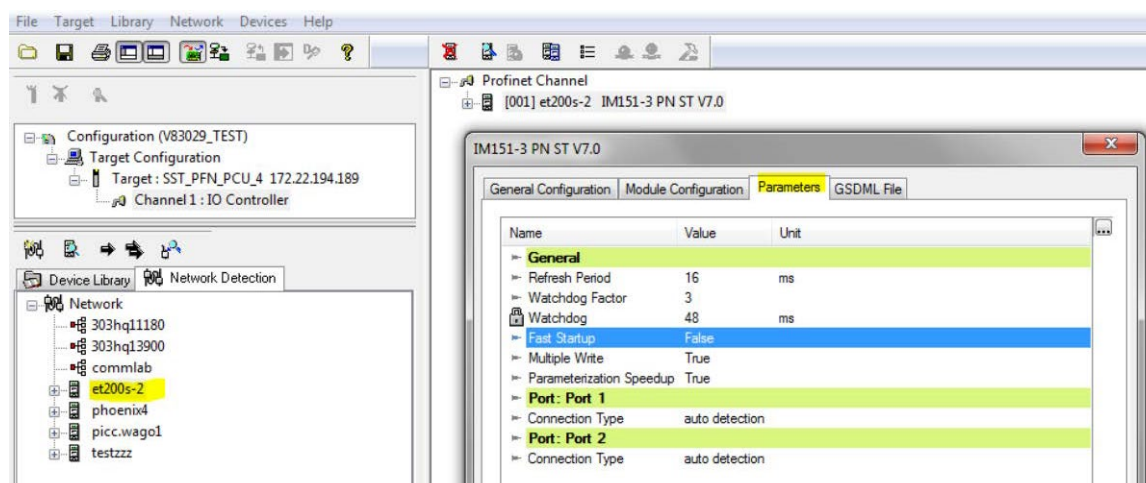
The Download Configuration button ![icon] is available to download the template configuration to the robot. Please select F5, [Update] and then F1, [Save] on the teach pendant to save it on the robot.
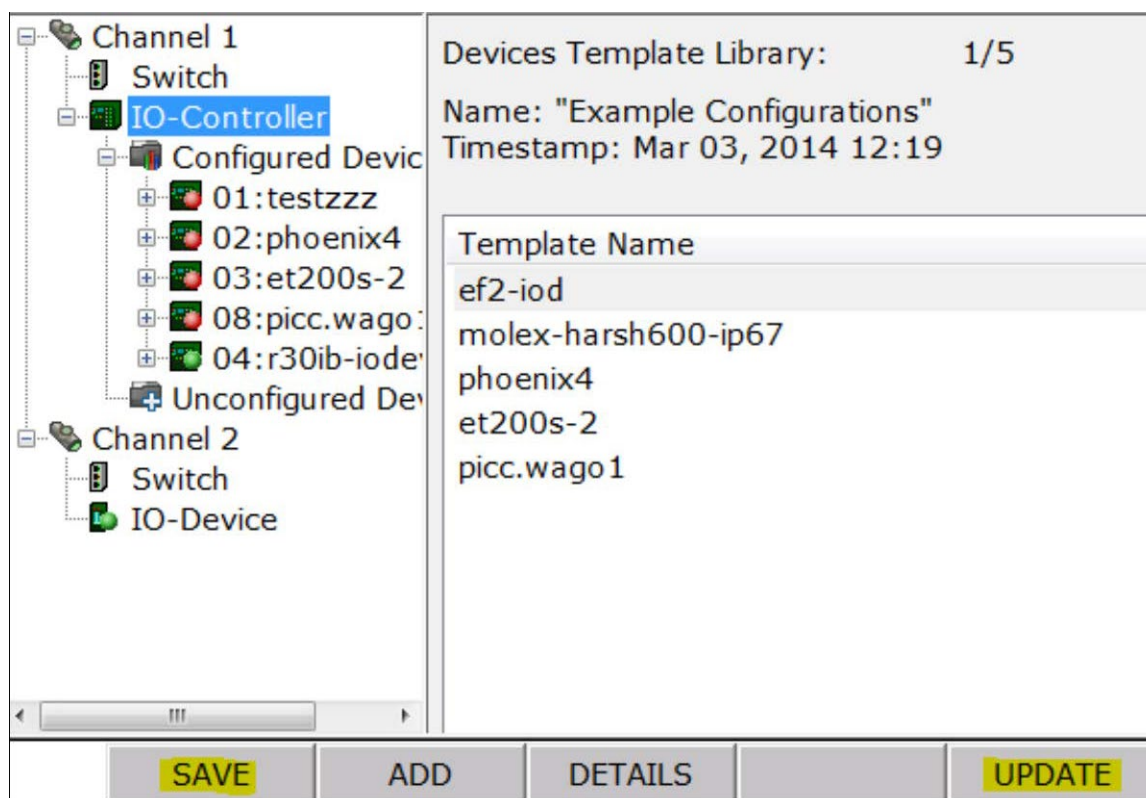
Please use the PROFINET IO configuration tool reference Guide for detailed documentation on this tool. It is provided from FANUC.

D.9   PC BASED USER INTERFACE APPLICATION (PFN-TP-CT)

The PC based PROFINET user interface application is an optional alternative to using the PROFINET user interface in the robot's teach pendant. The functionality of the PC application is identical to that of the teach pendant interface. This is useful in cases where access to the teach pendant does not exist, is limited, or if configuration from a PC is more convenient.

Please contact your FANUC representative for Information on obtaining the PC application.

In order to establish a connection with a target robot, the PC needs to be on the same network as one of the target robot's two standard Ethernet interfaces. Details on the robot Ethernet interfaces and TCP/IP configuration and diagnostics can be found in the "Ethernet Function OPERATOR'S MANUAL" (B-82974/EN).

Please note that the robot supports a maximum of one active user interface at a time. If the teach pendant user interface is opened, it will remain active in the background until the next power cycle. In the event the PC based application fails to connect, it may be due to an active teach pendant interface in the background. If that case is suspected, please cycle power.

Additional troubleshooting steps for the PC user interface application are listed for the issues described below:

"Application loading" screen fails to complete and is followed by the error notification "PFN-TP-CT: Can't connect, please verify network information"

This indicates the target robot address is not accessible by the PC.
Verify network connections.
- Make sure the PC running the user interface application can PING the target robot address.
- Double check PC and Robot network interface settings.
- Ensure the Ethernet status LEDs at the RJ45 connectors are active and valid.
- If there is a firewall between the Ethernet interfaces of the robot and PC, please ensure traffic to and from the PC is allowed for the robot TCP ports 60012 and 80 (the HTTP request port). Please also check the firewall and other security settings of your PC.

"Application loading" screen fails to complete and is followed by the error notification "PFN-TP-CT: Not a FANUC Robot"

This indicates the target robot it busy with another instance of the user interface, or the target address is not a supported robot software version.
- Please verify the network address and software version of the robot.
- Please ensure no other PC user interface application is connected with the target robot.
- The user interface on the teach pendant may be active in the background. You can either cycle power to clear it, or use the teach pendant user interface instead (MENUS -> I/O -> Type / F1 -> Profinet (M)).

"Application loading" screen completes and is followed by the error notification "PFN-TP-CT: No template files found… You will not be able to add devices to controller configuration."

This indicates that a connection to the robot of valid software version was successful. However, required startup files could not be accessed.
- Please verify there is no interference from a firewall on network traffic. See issue the above for details about traffic requirements.
- Please ensure template files have been configured and downloaded to the PROFINET card. Please see Appendix D.8 for details on configuring, and downloading template files.
- Please obtain a robot backup and provide this to your FANUC service representative. Please see Appendix D.4.2 for details on backup/restore of Dual Channel PROFINET files.

E   IMPORTANT NOTICE ABOUT 7DC3(V8.30)

E.1   OVERVIEW

Appendix E is applied to R-30*i*B PROFINET I/O function (A05B-2600-J930). This function is greatly changed in 7DC3(V8.30) to support V2.6.0.3 firmware of Siemens PROFINET board CP1604/CP1616. The way of configuring I/O Device have been changed, and the differences from the previous versions are explained here.

NOTE
1   Please use the PROFINET board firmware V2.6.0.3 for PROFINET I/O
     function(A05B-2600-J930) of 7DC3(V8.30). Especially PROFINET safety can't
     be used with other firmware version. The firmware can be updated from a robot
     controller. Please refer to A.4 for the details.
2   Don't restore PNIO.SV from 7DC1(V8.10) or 7DC2(V8.20) to use the PROFINET
     board firmware V2.6.0.3.
3   I/O Controller recognizes R-30*i*B as an I/O Device by device ID. Since the device
     ID of 7DC3(V8.30) has been changed from the 7DC1(V8.10) and7DC2(V8.20),
     I/O Controller recognizes R-30*i*B 7DC3(V8.30) as different device.
4   The firmware version is composed of 5 digits, but often only a part of the digits,
     usually the first 2 or 4 digits, should be taken care. This is why all digits are not
     always written in this document.
5   Appendix E is updated information for 7DC3(V8.30). As for 7DC3(V8.30), the
     description of Appendix E takes precedence when there is a contradiction in
     previous part of this manual.

Please use the PROFINET board firmware V2.6.0.3. The following alarm message shows up if the firmware version other than V2.6.0.3 is used.

PRIO-665 WARN "PNIO: unconfirmed FW. %d. %d. %d. %d. %d"

The firmware version must be V2.6.0.3 to use PROFINET safety. Otherwise, the following alarm shows up.

PRIO-673 WARN "PNIO; Safety disabled"

E.2   GSDML FILES FOR 7DC3(V8.30)

There are four GSDML files for 7DC3(V8.30). Please choose a GSDML file by the type of PROFINET board and if I/O Controller is enabled. Each GSDML file has different Device ID. I/O Controller recognizes R-30*i*B with different device ID as a different device.

Table E.2(a) GSDML files for 7DC3(V8.30)

Condition	File name	Vendor ID	Device ID
CP1616 I/O Controller enabled	GSDML-V2.3-Fanuc-A05B2600J930V820M6-20131203.xml	0x01B7	0x0005
CP1616 I/O Controller disabled	GSDML-V2.3-Fanuc-A05B2600J930V820D6-20131203.xml	0x01B7	0x0006
CP1604 I/O Controller enabled	GSDML-V2.3-Fanuc-A05B2600J930V820M4-20131203.xml	0x01B7	0x0007
CP1604 I/O Controller disabled	GSDML-V2.3-Fanuc-A05B2600J930V820D4-20131203.xml	0x01B7	0x0008

The following is an example of a procedure for installing one of the GSDML files to STEP7.

Procedure E.2 : Install a GSDML file of 7DC3(V8.30) to STEP7

1   Start HW Config of STEP7.
2   Open "Option" tool bar of HW Config, and select "Install GSD File".
3   Press "Browse" to select the folder where the GSDML file is stored.
4   Select one of the GSDML files from the table E.2, and press "Install".
5   Press "Yes" to proceed.
6   The message "Installation was completed successfully" shows up.
7   Finish STEP7 by closing all windows("SIMATIC Manager", "NetPro", "HW Config" etc.).
8   Start STEP7 again, and open the project.

E.3   CHANGE IN I/O DEVICE SETTING

This section is applied when I/O Device is enabled. With the firmware V2.6, the slot number of I/O Device starts from 1. This is written in the GSDML files. Please set slot number of each modules in the Setup Module List screen so that the slot number of the first module is 1. If there is a safety module, it must be placed in slot 2. In case the configuration with the slot number = 0 exists, the following alarm message shows up.

PRIO-664 STOP "PNIO(D) : Bad module setting"

```
Setup PROFINET IO            JOINT   10 %
I/O Device : Modules  1              1/17
No Slot Sub  Comment
0   1   1  [CP1616 V2.6          ]
1   2   1  [                     ]
2   3   1  [                     ]
3   0   0  [                     ]
4   0   0  [                     ]
5   0   0  [                     ]
6   0   0  [                     ]
7   0   0  [                     ]
8   0   0  [                     ]
9   0   0  [                     ]
[ TYPE ]   detail   [ CHOICE ]         >

         DEL_ALL
```

Fig. E.3 (a) An example of the Module List screen (the slot number starts form 1)

Then, move to the Setup Module Detail screen, set the ModId of the module in slot 1 according to the following table.

Table E.3(a) ModId of the module in slot 1

PROFINET board	I/O Controller	ModId(hexadecimal)	Input value(decimal)
CP1616	Enable	0x19	25
CP1616	Disable	0x1b	27
CP1604	Enable	0x1a	26
CP1604	Disable	0x1c	28

```
Setup PROFINET IO            JOINT   10 %
I/O Device : Module  1              1/6
1. Slot :                       1
2. Subslot :                    1
   Comment :
3.        [                  ]
4. ModId(hex) :          0x0000001a
5. SubslotId(hex) :      0x00000001
   Module I/O type  :          NONE
6. Data size  :          [ 0 Bytes]
7. Data type  :          [ Digital ]



[ TYPE ]   list    prev    next

```

Fig. E.3 (b) An example of the Module Detail screen

New line "Device ID" is added to the Setup General screen to show the current Device ID value stored in the robot controller. The Device ID is stored in the system variable, $PNIO_CFG.$DEV_DID.

```
 ┌─────────────────────────────────────────────┐
 │ Setup PROFINET IO          JOINT   10 %      │
 │ General                            1/4       │
 │ 1. MAX_DIG_PRT :               2048          │
 │ 2. Start up mode       :     [SUSPEND]       │
 │ 3. I/O Controller             ENABLED        │
 │ 4. I/O Device                 ENABLED        │
 │    Device ID                  0x0007         │
 │                                              │
 │                                              │
 │                                              │
 │ [ TYPE ]          [Other]              >     │
 ├─────────────────────────────────────────────┤
 │                              CLR_ASG         │
 └─────────────────────────────────────────────┘
```

Fig. E.3 (c) Setup general screen

Table E.3 (b) Device ID for 7DC3(V8.30)

PROFINET board	I/O Controller	Vendor ID	Device ID	Default
CP1616	I/O Controller enabled	0x01B7	0x0005	
CP1616	I/O Controller disabled	0x01B7	0x0006	
CP1604	I/O Controller enabled	0x01B7	0x0007	✓
CP1604	I/O Controller disabled	0x01B7	0x0008	

As described in Appendix E.2, there are four Device ID for 7DC3(V8.30) that must match to PROFINET board type and if I/O Controller is enabled. The default Device ID is 0x0007.

When I/O Controller is enabled/disabled in this screen, dialogue message, "Change Device ID for this setting?", shows up. If "YES" is selected. the value is changed according to if I/O Controller is enabled/disabled.

On the other hand, there is no user interface for specifying PROFINET board type. Please set Device ID to $PNIO_CFG.$DEV_DID manually if you are using CP1616, or when you change PROFINET board type later.

F HANDLING ALARM STORM

F.1 OVERVIEW

This section applies when I/O Controller is enabled. This section describes new I/O Controller function that handles alarm storm status. A PROFINET I/O Device is supposed to send alarm notification to an I/O Controller when an alarm event occurs, for example, appearance and disappearance of a fault. On the other hand, an I/O Device may be broken and send many alarm notifications within a short interval of time, which disturbs I/O Controller operation. This status is called "ALARM STORM" here. To avoid bad effects from alarm storm, the robot controller as an I/O Controller needs to decide if the device is in alarm storm status. The robot controller counts the number of alarm notifications from an I/O Device within a specific length of time, and detects alarm storm if the number exceeds a specific value. The robot controller counts the number for each stations. The robot controller generates the following alarm message when it detects alarm storm.

PRIO-653 WARN "PNIO(C) alarm storm, st %d"

The digit in alarm message is the station number of the device. If it is 0, the station number in the alarm notification is faulty and the sending device can't be located. In this case, it is handled as alarm storm status of a non-existing station.

Then the robot controller ignores further alarm notification from the I/O Device until an operator releases the alarm storm status from the Setup I/O Controller screen, the Setup Configuration Detail screen, or the system variable. Find out and fix the faulty device, and release the alarm storm status by the following descriptions in this section. In addition, alarm storm status of all stations are released at every power up.

The robot controller manages alarm storm status in each stations. PRIO-653 appears again until alarm storm status of the station is released when the reset button is pressed. The following alarm message shows up when all alarm storm status is released

.PRIO- 654 WARN "PNIO(C) alarm storm cleared"

F.2   CHANGE IN SETUP I/O CONTROLLER SCREEN

Alarm storm status of all stations can be released in this screen. Move cursor on "Clear Alarm Storm" and press the [Enter] key to clear alarm storm status of all stations. To release alarm storm status of only a specific station, please refer to Appendix F.4.

```
Setup PROFINET IO              JOINT   10 %
 I/O Controller                        1/5
 1. Error one shot:          DISABLED
 2. Number of digital input:      1024
 3. Number of digital output:     1024
 4. Number of analog input:         25
 5. Number of analog output:        25
 6. Digital input offset address:   0
 7. Digital output offset address:  0
 8. Analog input offset address:   512
 9. Analog output offset address: 512
10. Clear Alarm Storm:        Execute

[ TYPE ]        [ Other ]   arc   analog  >

                          CLR_ASG
```

Fig. F.2(a) I/O controller screen

F.3   CHANGE IN CONFIGURATION LIST SCREEN

Whether any device is in alarm storm status or not can be seen in this screen. "*" is displayed next to comment of the device if it is in alarm storm status. For example, the station 2 is in alarm storm status in the Fig. F.3(a). Press F2, detail, to open the Setup Configuration Detail screen, where the alarm storm status of the device can be released.

```
Setup PROFINET IO              JOINT   10 %
 I/O Controller : Config list          1/256
  St Slot Sub Comment
E  1   2   1 [                       ]
E  1   5   1 [                       ]
E  1   6   1 [                       ]
E  1   8   1 [                       ]
E  2   2   1*[                       ]
E  2   3   1*[                       ]
E  2   4   1*[                       ]
E  2   6   1*[                       ]
D  0   0   0 [                       ]
D  0   0   0 [                       ]
[ TYPE ]   detail   [ Other ]
```

Fig. F.3(a) Setup Configuration list screen

F.4   CHANGE IN CONFIGURATION DETAIL SCREEN

Whether the selected device is in alarm storm status can be seen in this screen, and alarm storm status of the selected device can be released. Move cursor on "Clear" next to "Alarm Storm" and press the [Enter] key to clear alarm storm status.

```
Setup PROFINET IO             JOINT   10 %
I/OController:Module  1                1/11
 1. Status:                         Enable
 2. Show error when deactivated:    On
 3. Station:                          1
 4. Slot:                             2
 5. Subslot:                          1
    Comment:
 6.          [                     ]
 7. Address:                          0
 8. Length:                           1
 9. IO data type:                    IN
10. Data type:                        0
11. Com type:                         0
12. Alarm Storm ( On   ):        Clear
[ TYPE ]   list    prev     next
```

Fig. F.4(a) Configuration detail screen

F.5   SYSTEM VARIABLES

The following system variables are used to control this function.

Name	Description
$PNIO_DL2.$STORM_ENB	Set 1 to enable this function (default). Set 0 to disable this function.
$PNIO_DL2.$STORM_TIME	The specified length of time in seconds to count the number of alarm notifications. Default value is 6 (seconds).
$PNIO_DL2.$STORM_COUNT	The robot controller decides the station is in alarm storm status if the number of alarm notifications exceeds this value. Default value is 40.

The following system variables indicate the alarm storm status. These system variables are initialized every power up.

Name	Description
$PNIO_STM[x] x = 1-256	This array shows if the device in each index in the Setup Configuration list screen is in alarm storm status. Bit 0 : 1 = In alarm storm status, 0 = Not in alarm storm status. Bit 1-31 : Reserved.
$PNIO_DIAG2.$STORM_UNKST	Bit 0 : 1 = Alarm storm status in non-existing station (the station number in received alarm notifications are faulty), 0 = No alarm storm status in non-existing station. Bit 1-31 : Reserved.
$PNIO_DIAG2.$STORM_EXIST	Bit 0 : 1 = At least one device is in alarm storm status, 0 = No device is in alarm storm status. Bit 1-31 : Reserved.

The following system variables can be used to release alarm storm status from KAREL etc.

Name	Description
$PNIO_DIAG2.$STORM_RESET	Set 1 to release the alarm storm status after setting $PNIO_DIAG2.$STORM_ST. The value gets back to 0 when the request is sent.
$PNIO_DIAG2.$STORM_ST	Set 0 to release all alarm storm status, or set the station number to release the alarm status of a specific station. Please set 0 to clear the alarm storm status of non-existing station.

G   HARDWARE AND INSTALLATION

This chapter shows the hardware of PROFINET I/O and PROFINET I-Device.

G.1   PROFINET BOARD CP1616

The figure below shows how to install Siemens CP1616. Install Siemens CP1616 to slot 1 of PCI motherboard.

PCI Slot
upper slot : slot 1
lower slot : slot 2

PCI daughter board
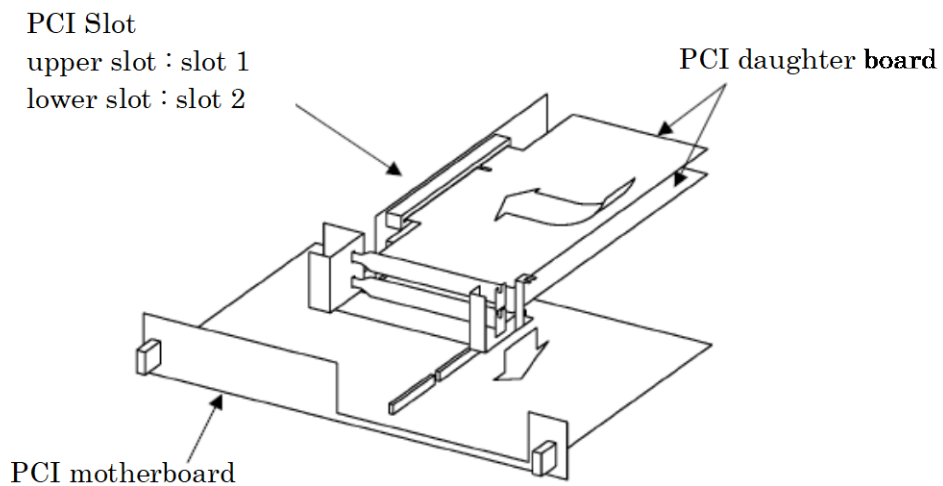
PCI motherboard

G.2   PROFINET BOARD CP1604

The following figures show how to install Siemens CP1604.

1   Fix (4) studs with (4) nuts on motherboard.
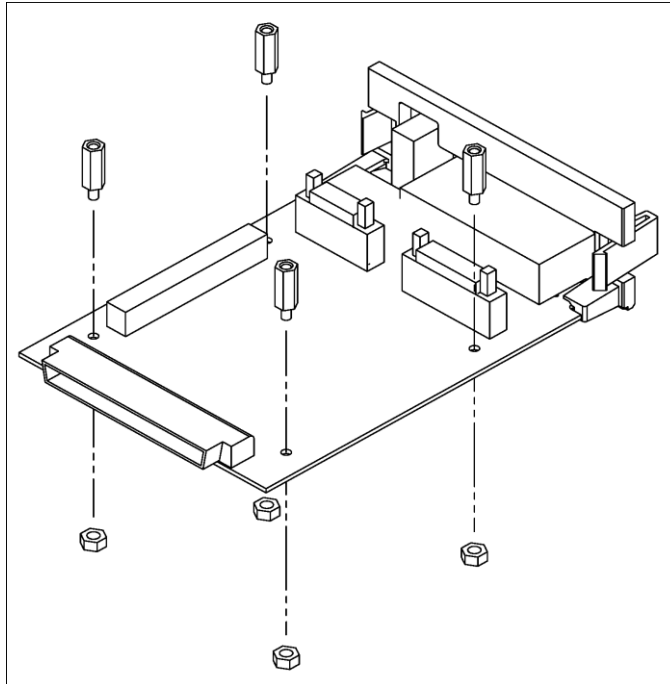
2   Install the CP1604 on motherboard.
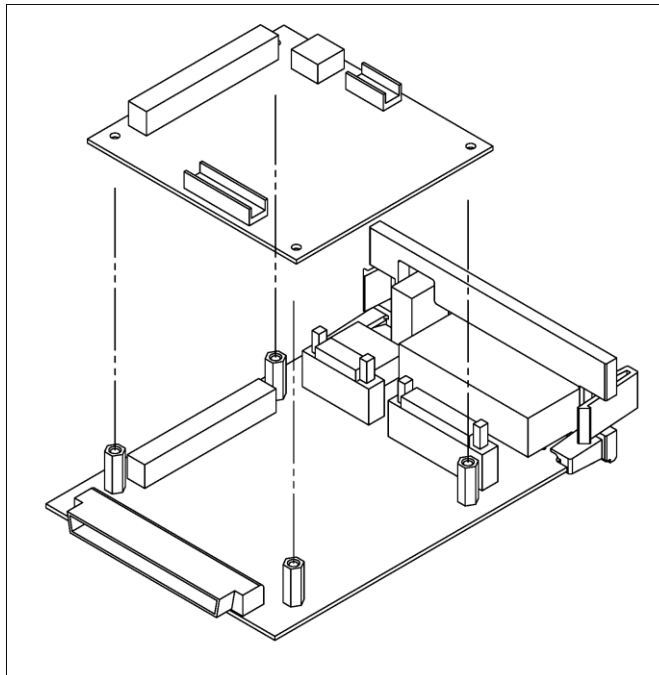
3   Connect (2) flat cables and fix the CP1604 with (2) screws.

Flat cable
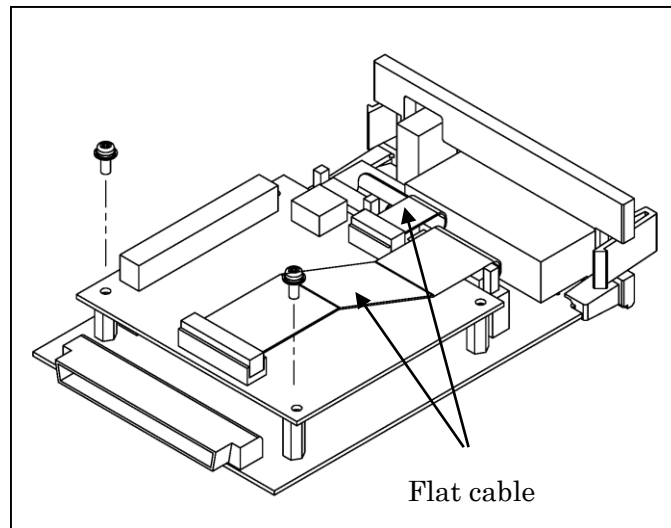
4   Fix a plate with (2) screws.
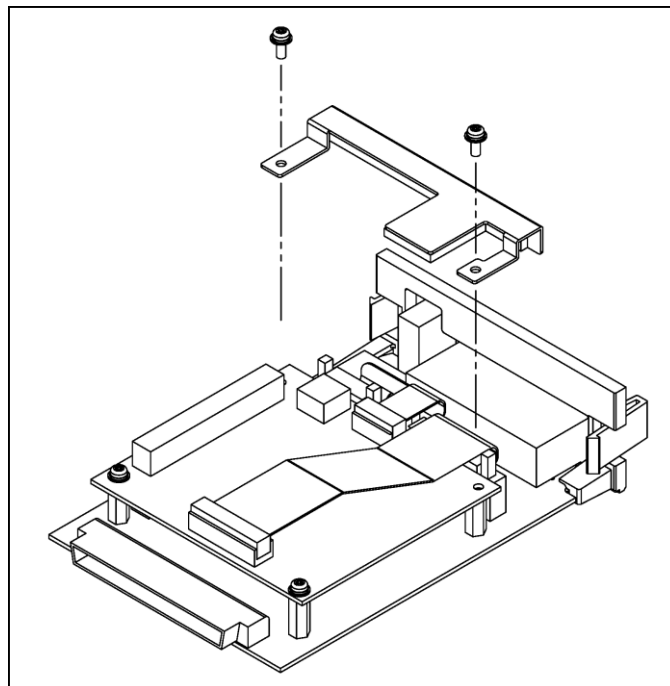
5   Complete assemblies.
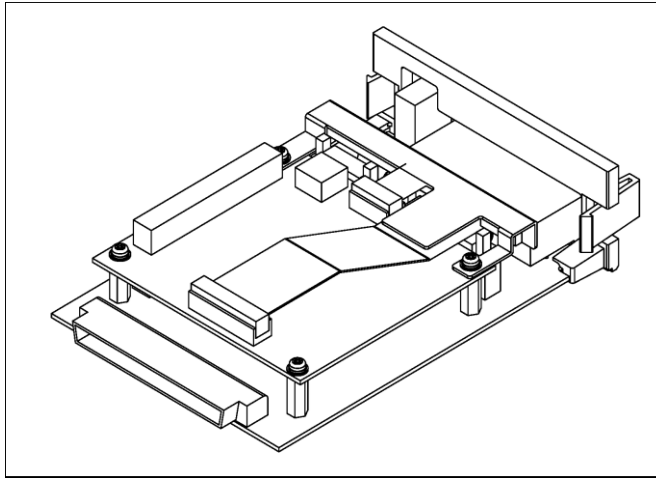
6   Install motherboard into wide-mini slot of backplane.

Wide-mini slot
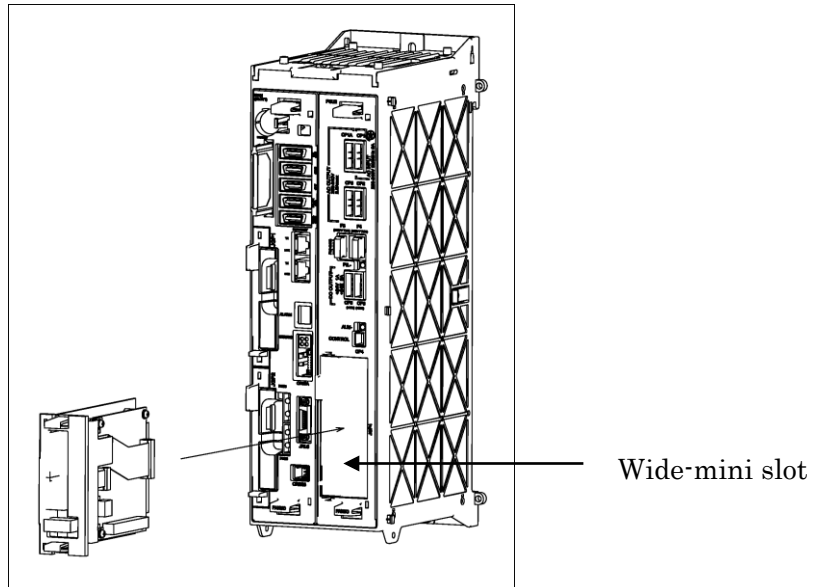
G.3 THE SWITCH FUNCTION OF CP1604 WITH EXTERNAL POWER SUPPLY

The external power supply (+24V) allows the integrated real-time switch to function even when the robot controller is turned off.

NOTE
1 The switch function of the CP1604 is available even when the robot controller is turned off as long as it was turned on briefly at least once and the external power supply is connected.
2 There are some requirements when the external power is supplied to PROFINET board. Please refer to Section 2.3 for more details.

Table G.3(a) Specification of external power supply

Requirements	
Voltage range of the 24V supplies	18 to 32 V DC
Connection	
WAGO connector	Manufacture specification : 734-102
	FANUC specification : A63L-0002-0154#102
Current consumption of the external 24V voltage	
At 18V DC supply	Max. 300mA
At 32V DC supply	Max. 200mA

The following figure shows the connector for external power supply.
The connector for external power supply allows two separate external 24V power supply to be fed in.
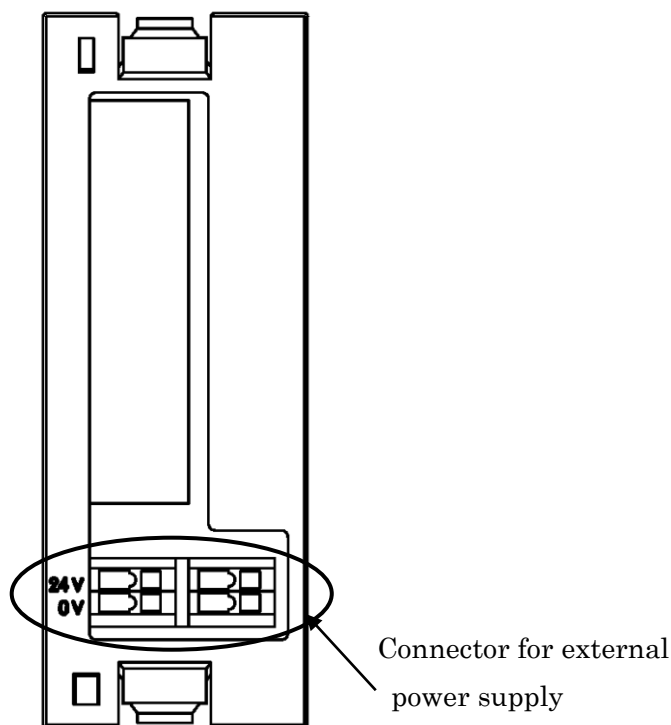
Fig. G.3(a) Connector for external power supply

H ERROR CODES

The error message starts with "PNIO(D)" is related to I/O Device. The error message starts with "PNIO(C)" is related to I/O Controller. Some error cannot be reset by reset button until the cause of the error is resolved. If the error has to be reset, for example, when robot has to move for setup, change "ERROR ONE SHOT" setting to enable temporarily. This error code list includes the message for advanced features, which only shows up in specific versions.

PRIO-600 WARN   "PNIO board not installed"
Cause   :PROFINET board is not installed.
Remedy :Check motherboard or PROFINET board are inserted firmly.

PRIO-601 SYST   "PNIO watchdog alarm"
Cause   :PROFINET software on the robot controller is not working.
Remedy :Cycle power the robot controller. Please contact FANUC if this error occurs repeatedly.

PRIO-602 WARN   "PNIO system error(ID=%x)(%d)"
Cause   :System error.
Remedy :Please contact FANUC. Report the value in the error message.

PRIO-603 WARN   "%s"
Cause   :System error.
Remedy :Please contact FANUC. Report the error message

PRIO-604 WARN   "PNIO SYSTEM error"
Cause   :System error.
Remedy :Open alarm history screen because this error may show up together with another error message. Please contact FANUC, and report the error message.

> **NOTE**
> When PROFINET Safety is used, PRIO-604 may show up with PRIO-603 "PROFIsafe hard fail", "CRC check error" or "status check error". Then, first of all, check whether the configuration of safety PLC and the setting of robot controller match. Check the size of safety input/output in DCS PROFINET Safety screen, configure the safety PLC again, and cycle power the robot controller. If the problem persists, the error is probably due to a hardware problem. Please contact FANUC.

PRIO-605 WARN   "PNIO(D) open error %04x"
Cause   :Failed to start PROFINET I/O Device function. This error message may show up during remote configuration by PC configuration tool. This error message may show up when the robot controller is used only as I/O Device and its IP address is supposed to be set by I/O Controller (such as PLC), but the I/O Controller has not started.
Remedy :The value in the error message is error code from PROFINET board. The value might be one of the followings. If the value is not in the list, or if the error is not resolved, write down the value in the error message and contact FANUC and report the value.

7DA3, 7DA4, 7DA5/01-13 and 7DA7/01-21

Error Code	Meaning	Remedy
0x030D	Config in update	Cycle power the robot controller. Check if IP address and device name of PROFINET board have been set correctly.
0x030E	No communication to PROFINET board	Cycle power the robot controller.

7DA5/14 or later, 7DB6, 7DA7/22 or later, R-30iB

Error Code	Meaning	Remedy
0x0309	Wrong calling sequence	Wait for a while, or press reset. Then the robot controller tries to start I/O Device again.
0x030D	Config in update PROFINET board might be stopped by PC configuration tool for remote configuration.	If the robot controller is used only as I/O Device, start the I/O Controller which is supposed to set the IP address. Finish remote configuration and start PROFINET board by PC configuration tool, and then press reset. Then the robot controller tries to start I/O Device again. Check if IP address and device name of PROFINET board have been set correctly.
0x030E	No communication to PROFINET board PROFINET board might be stopped by PC configuration tool for remote configuration.	Finish remote configuration and start PROFINET board by PC configuration tool, and then press reset. Then the robot controller tries to start I/O Device again.

PRIO-606 STOP   "PNIO(D) abort indication %x"
   Cause   :PROFINET I/O communication is aborted by I/O Controller.
   Remedy   :This is just notification.

PRIO-607 STOP   "PNIO(D) offline indication %x"
   Cause   :PROFINET I/O communication is stopped by I/O Controller.
   Remedy   :This is just notification.

PRIO-608 STOP   "PNIO(D) mismatch slot %d %d"
   Cause   :Reported module with slot number and subslot number does not match the configuration of project file downloaded to I/O Controller.
   Remedy   :Check the setting in setup module detail screen. Check the project file.

PRIO-609 STOP   "PNIO: Need reset for restart"
   Cause   :PROFINET board is stopped by PC configuration tool when I/O Controller is enabled.
   Remedy   :Start PROFINET board by PC configuration tool and then press reset.

PRIO-610 WARN   "PNIO(C) open error %04x"
   Cause   :Failed to start PROFINET I/O Controller function. This error message may show up when PROFINET board is stopped by PC configuration tool.
   Remedy   :The value in the error message is error code from PROFINET board. The value might be one of the followings. If the value is not in the list, or if the error is not resolved, write down the value in the error message and contact FANUC and report the value.

7DA3, 7DA4, 7DA5/01-13 and 7DA7/01-21

Error Code	Meaning	Remedy
0x0304	No configuration is available	Download configuration to PROFINET board in SUSPEND mode.
0x030D	Config in update	Cycle power the robot controller.

Error Code	Meaning	Remedy
0x030E	No communication to PROFINET board	Cycle power the robot controller.

7DA5/14 or later, 7DB6, 7DA7/22 or later, R-30_iB_

Error Code	Meaning	Remedy
0x0304	No configuration is available	Download XDB project file to PROFINET board in controlled start, or download configuration to PROFINET board in SUSPEND mode.
0x0309	Wrong calling sequence	Press reset. Then the robot controller tries to start I/O Controller again.
0x030D	Config in update PROFINET board might be stopped by PC configuration tool for remote configuration.	Finish remote configuration and start PROFINET board by PC configuration tool, and then press reset. Then the robot controller tries to start I/O Controller again.
0x030E	No communication to PROFINET board	Finish remote configuration and start PROFINET board by PC configuration tool, and then press reset. Then the robot controller tries to start I/O Controller again.

PRIO-611 WARN   "PNIO(C) alarm indication %x"
   Cause :Alarm is indicated by PROFINET board.
Remedy :This is just notification.

PRIO-612 WARN   "PNIO(C) offline indication"
   Cause :Operating mode is changed to offline.
Remedy :This is just notification.

PRIO-613 WARN   "PNIO(C) clear indication"
   Cause :Operating mode is changed to clear
Remedy :This is just notification.

PRIO-614 STOP   "PNIO watchdog start failed"
   Cause :System error.
Remedy :Please contact FANUC. Report the error message

PRIO-615 WARN   "PNIO can't find the station"
   Cause :Specified station number is not found when switching TP instruction is executed.
Remedy :Check the station number.

PRIO-616 STOP   "PNIO attach/detach Timeout"
   Cause :Switching TP instruction has been timeout.
Remedy :Check if the target station is connected well.

PRIO-617 STOP   "PNIO(D) mod plug failed %x %x"
   Cause :I/O Device function failed because the specified module is wrong.
Remedy :Check the module specified by two numbers, the former is slot number, the latter is subslot number.

PRIO-618 STOP   "PNIO(D) submod plug failed %x %x"
   Cause :I/O Device function failed because the specified submodule is wrong.
Remedy :Check the module specified by two numbers, the former is slot number, the latter is subslot number.

PRIO-619 STOP   "PNIO(C) mismatch st %d slot %d %d"
   Cause :The stored configuration of the module that is specified by station number, slot number and subslot number does not match to the current configuration when the start up mode is OPERATION.
Remedy :Check the parameters of the module that is specified by station number, slot number and subslot number.

PRIO-620 STOP   "PNIO(C) station %d deactivated"
  Cause   :The device whose "Show error when deactivated" setting is ON is deactivated.
  Remedy :Check the station specified the station number, and activate it.

PRIO-621 STOP   "PNIO(D) device is not running"
  Cause   :The start up of I/O Device has not completed or terminated by error.
  Remedy :Disable I/O Device if I/O Device function is not used in setup general screen. If I/O Device function is used, check if
          any error related to I/O Device is present. Check if I/O Controller that is supposed to communicate with the robot
          controller is running. This error can be released when the setting of I/O Device is correct and communication to the
          I/O Controller establishes.

PRIO-622 STOP   "PNIO(C) controller is not running"
  Cause   :The start up of I/O Controller has not completed or terminated by error.
  Remedy :Disable I/O Controller if I/O Controller function is not used. If I/O Controller function is used, check if any error
          related to I/O Controller is present. This error can be released when the setting of I/O Controller is correct and
          communication to the I/O Devices establishes.

PRIO-623 STOP   "PNIO(C) not in operation mode"
  Cause   :The start up of I/O Controller has completed but the start up mode is not OPERATION.
  Remedy :Change the start up mode to OPERATION, and cycle power the robot controller.

PRIO-624 STOP   "PNIO(C) mod number mismatch"
  Cause   :The stored configuration is different from the current configuration in the number of modules when the start up mode
          is OPERATION.
  Remedy :Check if the project downloaded to PROFINET board matches the current configuration, and if the configuration was
          read in by the robot controller in READ IN mode.

PRIO-625 WARN   "PNIO(C) read in complete"
  Cause   :PROFINET network configuration has been read in successfully when start up mode is READ IN.
  Remedy :This is just notification of completion of read in. Check PROFINET I/O Controller communication and I/O data
          exchange before changing start up mode to OPERATION.

PRIO-626 WARN   "PNIO: please power OFF/ON"
  Cause   :PROFINET setting was changed and it is required to turn off/on the power to enable the change.
  Remedy :Please power OFF/ON the robot controller.

PRIO-628 STOP   "PNIO(C) group is not recovered"
  Cause   :The device switching status cannot be recovered.
  Remedy :Restore each device by configuration screen or TP instruction.

PRIO-629 WARN   "Restore group manually"
  Cause   :The device switching status cannot be recovered.
  Remedy :Restore each device by configuration screen or TP instruction.

PRIO-630 WARN   "PNIO(C) mod data out of area"
  Cause   :The data of a PROFINET I/O module is not placed inside of the area specified by the start address and the size for any
          type of I/O, or it is placed across the border of some of the areas. In this case, the data is not allocated to any I/O.
  Remedy :If the data need to be allocated to I/O of the robot controller, change the configuration in the robot controller,
          NCM/PC or STEP7 according to the information with PRIO-631 or PRIO-632.

> **NOTE**
> The data of a PROFINET I/O module can be allocated to only a single type of I/O (digital, analog, arc welding). It must be placed within the area specified by the start address and the size for a type of I/O and it must not be placed across the border of any areas, otherwise it is not allocated to any I/O. In such case, PRIO-630 appears at start up with PRIO-631 or PRIO-632 to inform which data is not allocated.

PRIO-631 WARN   "IN: address (%d - %d)"
  Cause   :PRIO-631 appears with PRIO-630 to inform which data is not allocated.
 Remedy :The first number is the start address of the input data from a PROFINET I/O module to the robot. The second number is the last address of the data. Check the configuration in the robot controller.

PRIO-632 WARN   "OUT: address (%d - %d)"
  Cause   :PRIO-632 appears with PRIO-630 to inform which data is not allocated.
 Remedy :The first number is the start address of the output data from the robot to a PROFINET I/O module. The second number is the last address of the data. Check the configuration in the robot controller.

PRIO-633 STOP   "PNIO: Updating Firmware"
  Cause   :Firmware update of PROFINET board has started.
 Remedy :Wait until firmware update is completed. Never turn off the robot controller during the download, otherwise the firmware might be erased and PROFINET board is not operational until it is recovered. In such case, please refer to Appendix A.4 for the procedure of recovery.

PRIO-634 STOP   "PNIO: FW. updated"
  Cause   :Firmware update of PROFINET board has completed successfully.
 Remedy :Cold start the robot controller.

PRIO-635 STOP   "PNIO: FW. update failed"
  Cause   :Firmware update of PROFINET board has failed.
 Remedy :Download can be retried. In case the firmware is erased, please refer to Appendix A.4 for the procedure of recovery.

PRIO-636 STOP   "PNIO: XDB downloaded"
  Cause   :XDB project file is downloaded to PROFINET board.
 Remedy :This is just an information

PRIO-637 STOP   "PNIO: Can't open file"
  Cause   :The specified file can't be opened.
 Remedy :Make sure the file name with device path (such as MC:) is correct.

PRIO-638 STOP   "PNIO: Not enough memory"
  Cause   :There is not enough memory in COMM processor for this operation.
 Remedy :Please contact FANUC.

PRIO-639 WARN   "PNIO: Unsupported feature"
  Cause   :Configuration of unsupported feature is found.
 Remedy :Please see the cause code to know what is not supported. Change the configuration by remote configuration tool.

PRIO-640 WARN   "IOPS=bad:api %x,st %d, %d,%d"
  Cause   :I/O producer status of the specified module of PROFINET I/O has turned to BAD. The figures in the message are API number, station number, slot number, and subslot number.
 Remedy :Check the specified module.

PRIO-641 WARN   "IOPS=good:api %x,st %d, %d,%d"
  Cause   :I/O producer status of the specified module of PROFINET I/O has turned to GOOD. The figures in the message are API number, station number, slot number, and subslot number.
 Remedy :This is only notification of recovery.

PRIO-642 WARN   "Alarm %x:api %x,st %d, %d,%d"
 Cause   :An alarm indication of PROFINET I/O has come. The figures in the message are alarm type, API number, station number, slot number, and subslot number.
 Remedy :Check the alarm data of the specified module.

PRIO-643 WARN   "PNIO(C) station %d activated"
 Cause   :The device specified by the alarm message is activated.
 Remedy :This is just notification.

PRIO-644 WARN   "PNIO msg too long ch=%d(%d/%d)"
 Cause   :The length of a PROFINET message from PROFINET board exceeds the limit.
 Remedy :Check if the limit parameter is adequate. Locate the event that causes this alarm.

PRIO-645 WARN   "PNIO: many unread alarm ind."
 Cause   :The number of unread alarm indication gets too large. Alarm indication interface function is enabled but probably there is no KAREL program that reads it out. Alarm indication should be read out because it uses memory while it is kept unread.
 Remedy :Disable alarm indication interface function by setting bit2,3 of $PNIO_CFG2.$USHORT4 to 0. For example, if $PNIO_CFG2.$USHORT is 63 (0x3F), set 51 (0x33). Cycle power is needed to apply the change. Or create a KAREL program that reads out alarm indication. Please refer to Appendix A for more details.

PRIO-646 WARN   "IOCS=bad:api %x,st %d, %d,%d"
 Cause :I/O consumer status of the specified module of PROFINET I/O has turned to BAD. The figures in the message are API number, station number, slot number, and subslot number.
 Remedy :Check the specified module.

PRIO-647 WARN   "IOCS=good:api %x,st %d, %d,%d"
 Cause :I/O consumer status of the specified module of PROFINET I/O has turned to GOOD. The figures in the message are API number, station number, slot number, and subslot number.
 Remedy :This is only notification of recovery.

PRIO-648 STOP   "PNIO(C) Too many devices"
 Cause   :Too many devices exist in PROFINET project.
 Remedy :Decrease the number of stations, I/O modules and interface modules.

PRIO-653 WARN   "PNIO(C) alarm storm st %d"
 Cause   :Alarm storm is detected. A device has been faulty and keeps on sending many alarms   and diagnostics.
 Remedy   :Find out and fix the faulty device. Then release alarm storm status by TP screen or by system variable..

PRIO-654 WARN   "PNIO(C) alarm storm cleared"
 Cause   :Alarm storm status has been cleared.
 Remedy :This is just a notification.

PRIO-664 STOP   "PNIO(D): Bad module setting"
 Cause   :There is a bad setting in I/O Device module setting. For example, slot number = 0 can't be used with V2.6 firmware.
 Remedy :Check the cause code for what is bad setting. In the example case, open I/O Device module list/detail screen. Renumber the slot number of the modules from slot 1. Then cycle power the controller.

PRIO-665 WARN   "PNIO: unconfirmed FW. %d.%d.%d.%d.%d"
 Cause   :The version of the firmware currently installed on the PROFINET board is not equal to that of tested firmware.
 Remedy :This is an information of firmware version mismatch. It doesn't necessarily mean any problem is present. It is up to operator how to react this. For example, the operator may download the tested version. On the other hand, when there is a problem, this error message shows that firmware version mismatch might cause the problem.

PRIO-673 WARN   "PNIO: Safety disabled"
Cause   : PROFINET Safety is installed but can't be enabled for some reason. For example, the firmware version of PROFINET board doesn't meet the requirement. The slot number for safety module doesn't match that defined in GSD file.
Remedy   :Check the firmware version on PROFINET board by looking $PNIO_DIAG.$FW_VERSION. Refer to PROFINET I/O function operator's manual for the required firmware version and the GSD file for it. Download the required firmware to PROFINET board, and confirm the GSD is used in configuration tool. Check the slot number of safety module.

PRIO-675 WARN   "PNIO: Old backup is loaded"
Cause   :Backup file of PROFINET I/O function is loaded. Old identification information and configuration are found.
Remedy   :This is an information.

PRIO-676 WARN   "PNIO(D): DeviceID set to 0x%x"
Cause   :Identification number of PROFINET I/O Device is set to the specified number.
Remedy   :This is an information. The I/O Controller that connects to the robot I/O Device may need to be configured again by the GSD file with the device identification number.

PRIO-682 WARN   " PNIO(C) controller closed"
Cause   : I/O Controller has been closed.
Remedy   :This is an information.

PRIO-683 WARN   " PNIO(D) device closed"
Cause   : I/O Device has been closed.
Remedy   :This is an information.

PRIO-685 WARN   " PROFIsafe F_iPar_CRC Error %x"
Cause   :PROFIsafe is stopped due to F_iPar_CRC check.
Remedy   : If F_iPar_CRC check is enabled, F_iPar_CRC must be present in F-Parameter sent from Safety PLC, and it must be equal to that calculated by robot based on current DCS parameters, otherwise PROFIsafe is stopped. If F_iPar_CRC check is disabled, F_iPar_CRC must not be present in F-Parameter sent from Safety PLC, otherwise PROFIsafe is stopped. F_iPar_CRC check enable/disable should be used by default setting because robot GSDML file determines if F_iPar_CRC is present in F-Parameter sent from PLC.

PRIO-686 WARN   "PNIO(D): Too many submodules"
Cause   : The number of I-Device submodule exceeds the limit.
Remedy   : Decrease the transfer area of I-Device in configuration tool.

PRIO-687 WARN   " PNIO(D) mod data out of area"
Cause   : The number of I/O for I-Device is not enough for mapping the data of the submodule.
Remedy   : Increase the number of I/O for I-Device, or decrease the length of I-Device data.

PRIO-688 WARN   " More than 1 safe mod %d %d"
Cause   : More than 1 submodules have the subslot ID of safety submodule.
Remedy   : Only 1 safety submodule is permissible at the beginning of I-Device transfer area. Change the subslot ID of the specified submodule other than 0x1001 - 0x1008.

PRIO-689 WARN   "PNIO: to STOP mode (SUSPEND)"
Cause   : The mode of PROFINET has changed to STOP mode (former SUSPEND mode).
Remedy   :This is an information.

PRIO-690 WARN   "PNIO(%s): Close Start"
Cause   : PROFINET interface is closing. It might be because of configuration error.
Remedy   : Check alarm history to see if any error in I/O controller or I-Device.

PRIO-691 WARN   "PNIO(%s): Stop Request"
Cause   : Stop of PROFINET interface is requested, for example by manual operation.
Remedy   :This is an information.

PRIO-692 WARN   "PNIO(%s): Restart Request"
  Cause   : Restart of PROFINET interface is requested, for example by manual operation.
  Remedy :This is an information.

PRIO-693 WARN   "PNIO: FW. reset started"
  Cause   : Reset of the firmware on the PROFINET board started.
  Remedy :This is an information.

PRIO-694 WARN   "PNIO: FW. reset finished"
  Cause   : Reset of the firmware on the PROFINET board finished.
  Remedy :This is an information.

PRIO-695 WARN   "PNIO: STOP before operation"
  Cause   : Requested Operation requires PROFINET to be stopped.
  Remedy : Stop PROFINET before operation.

PRIO-720 STOP   "PNIO(D): input not updated"
  Cause   : Update of iput of PROFINET I/O Device is stopped.
  Remedy : Check PLC doesn't disable data exchange with I/O Device.

PRIO-721 WARN   "PNIO: %s load error (line:%d)"
  Cause   : Description of specified line is incorrect.
  Remedy : Check file and correct the description.

PRIO-722 STOP   "PNIO: Board is not responding"
  Cause   : Board is not responding to robot software request.
  Remedy : Make sure the board is inserted correctly.

I   SETUP CP1604 USING TIA PORTAL

I.1   OVERVIEW

When you use the PROFINET I-device (J709), please configure the Siemens CP1604 board with the Siemens configuration tool TIA Portal (V14 SP1 or later). This chapter shows an example of how to set it up. TIA Portal is available for download from the Siemens website. You need to purchase a TIA Portal license from Siemens if you set up PLC etc., but if you just set up the CP1604 board, you can use the trial version of TIA Portal regardless of the trial period.

> **NOTE**
> The procedure in this chapter are just examples. The instructions here are written with a focus on configuration. Before actually performing the operation, the user needs to read the manual of the configuration tool.

I.2   SETUP PROCEDURE IN CONFIGURATION TOOL

The following is the procedure for setting up CP1604 with the TIA Portal V14 SP1.
Instructions for creating a CP1604 configuration project are described in Procedure l.2 (a) and l.2 (b).
Settings of CP1604 including slave (I/O Device) settings are described in Procedure l.2 (c).
Master (I/O Controller) settings are described in Procedure l.2 (d). If you don't use it as a master, this procedure is unnecessary.
The way of downloading the settings to CP1604 is described in Procedure l.2 (e) and l.2 (f).
The way of outputting the CP1604 configuration file (GSD) from the project of the TIA Portal and loading it to PLC Configuration software is described in Procedure l.2 (g). This procedure is required when you set up a PLC.

Procedure I.2 (a) : Creating a project

1   Open the TIA Portal V14 SP1. Start screen is displayed.
2   Click "Create new project".
3   Enter the project name, then click "Create". A new project will be created successfully.
4   Click "Open the project view".

Procedure I.2 (b) : Adding CP1604 to the network

1   Click "Devices & networks" (left pane).
2   Open "Hardware catalog" tree (right pane).
3   Double click "PC Systems -> PC general -> PC station".
4   Double click "PC station" in the Network view.
5   Select the first line of Device overview.
6   Double click "Communication modules -> PROFINET/Ethernet -> CP1604 -> 6GK1 160-4AA01" on the Hardware catalog tree (right pane). CP1604 is added.

Procedure I.2 (c) : Configuration for CP1604

1   Click "Properties" tab (below the center pane)
2   Check "IO device" in Operating mode.
3   Check "Use manually assigned submodule IDs".

4   Scroll down to find "Transfer areas". The configuration for the I/O module on the I/O Device side of the CP1604 I-device is here. Double click "<Add new>", then you can change the name of the "Transfer area".

5   If you add a PROFINET Safety module, please follow the procedure below.
    a   Under the "Type", select the "F-PS", then Input and Output modules are added (the first and second line)
    b   Enter the size of Safety I/O under the "Length".
    c   Configure "Submodule ID" to 0x1000 + the size of Safety I/O.

6   If you add an I/O module, please follow the procedure below.
    a   Under the "Type", select the "CD".
    b   Use the arrows to switch between input and output.
    c   Enter the data size under the "Length".

7   There are added Transfer areas under "PROFINET interface(X1) -> Operating mode -> I-device communication" (lower left pane). Make advanced settings for them.
    -    If you use PROFIenergy, check "Enable PROFIenergy communication" on the first module.
    -    If you check "Bi-directional address mapping ", it becomes the module which has both input and output, but it is not recommended.

8   Click "General -> Catalog information" on the tree. (lower left pane)

9   Check "Enable customization", then set the information shown in Table 1.2.

Table I.2 (a) I/O module type (R-30iB Plus, 7DF1(V9.10))

Name	Value
PROFINET vendor ID	1B7
PROFINET Device ID	E
Article no	A05B-2600-J709
Product family	Robot Controller
Vendor name	FANUC
Product name	R-30iB Plus

10   Click "PROFINET interface(X1) -> Ethernet addresses" on the tree. (lower left pane)

11   Set up the item "Interface networked with". If you don't add the Ethernet, click "Add new subnet", then "PN/IE_1" is added to Subnet. This is the name of the Ethernet network.

12   Set up the item "IP protocol". Confirm that "Set IP address in the project" is checked. Set up "IP address" and "Subnet mask". If you use a router, check "Use router", then set up "Router address".

13   Set up the item "PROFINET". If you configure the device name manually, uncheck "Generate PROFINET device name automatically" and enter the device name.

14   Click "Save project" after the completion.

Procedure I.2 (d) : Settings to communicate with other I/O Device

1   Click "Devices & networks". (left pane)

2   Add I/O Device on "Hardware catalog" tree. (right pane)
    Example: station-5
    IM151-3 PN ST V5.0   6ES7 151-3AA22-0AB0
    PM-E DC24V   6ES7 138-4CA01-0AA0
    4DI DC24V ST   6ES7 131-4BD01-0AA0 I Address 6
    PM-E DC24V..48V   6ES7 138-4CA50-0AB0
    4DO DC24V/0.5A ST   6ES7 132-4BD02-0AA0 O Address 6

3   Double click "Distributed I/O -> ET200S -> Interface modules -> PROFINET -> IM 151-3 PN -> 6ES7 151-3AA22-0AB0".

4   Double click I/O Device added to "Network view", then open "Properties" of the I/O Device.

5   Set up the item "Interfaced networked with". Select PN/IE_1 on Subnet.

6   Set up the item "IP protocol". If you set an IP address from CP1604, set the "IP address".

7   Set up the item "PROFINET". If you configure the device name manually, uncheck "Generate PROFINET device name automatically" and enter the device name. "Device number" is assigned automatically, but you can change it.

8   Click "Save project" after the completion.

9   With the device overview open, set up the subsequent modules from the third line in the upper center pane. Double click each item below from Catalog in the right pane to add a module.
- PM -> PM-E 24VDC -> 6ES7 138-4CA01-0AA0
- DI -> 4DI 24VDC ST -> 6ES7 131-4BD01-0AA0
- PM -> PM-E 24 to 48VDC -> 6ES7 138-4CA50-0AB0
- DO -> 4DO 24VDC / 0.5A ST -> 6ES7 132-4BD02-0AA0

10   Connect the I/O Device with CP1604 under "Network view". Click "Not assigned" of I/O Device, select the controller from the pop-up. Confirm the display has changed from "Not assigned". This operation can also be done by dragging the green square on the icon. "I address" and "Q address" of the device overview are assigned as address areas, and can be changed as necessary.

11   Repeat Procedure l.2 (d) for all I/O Devices.

Procedure I.2 (e) : Compile the project

1   Right click "PC-Systems_1. (left pane)
2   Select "Compile -> Hardware and software (only changes)" from the menu.
3   Make sure that there are no compilation errors.

Procedure I.2 (f) : Download the project

1   Right click "PC-Systems_1. (left pane)
2   Select "Download to device -> Hardware configuration" from the menu.

Procedure I.2 (g) : Output the GSD file

You can output the GSD file after compilation.
1   Click CP1604 from the view.
2   Click "Export" in "Export generic station description file (GSD)" from "Operating mode" in "Properties".
3   Enter the destination for the path in "Export generic station description file (GSD)". Click "Export", then the GSD file is output.

INDEX

REVISION RECORD

Edition	Date	Contents
08	Sep., 2022	• PROFINET FANUC board Configurable Single / Dual Channel is supported on PROFINET FANUC board. • Updated chapter 9, 10. • Correction of errors.
07	Oct., 2021	• PROFINET FANUC board is supported on R-30iB Mini Plus. • Updated chapter 9, 10.
06	Feb., 2021	• Revised as the manual forR-30iA/R-30iB/R-30iB Mate/R-30iB Plus/R-30iB Mate Plus/R-30iB Compact Plus /R-30iB Mini Plus controller. • Addition of PROFINET FANUC board. • Addition of Appendix D.9.
05	July, 2019	• Revised as the manual forR-30iA/R-30iB/R-30iB Mate/R-30iB Plus/R-30iB Mate Plus/R-30iB Compact Plus controller. • Changed the manual title "PROFINET I/O" to "PROFINET Function". • Addition of PROFINET I-device. • Addition of Dual Channel PROFINET. • Addition of Appendix D, E, F, G, H and I.. • Move HARDWARE AND INSTALLATION to Appendix G. • Move ERROR CODES to Appendix H.
04	Oct., 2012	• Revised as the manual for R-30iA/R-30iB controller.
03	Mar., 2012	• Appendix A, B, C are added. • Order information is updated. • V2.5.2 firmware is supported.
02	Mar..,2010	• V2.3.1 firmware is supported. • The device switching status is recovered at HOT start.
01	Jan.,2008	

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