

Unified Controller

nv Series

PROFIBUS (PA912) Module

Instruction Manual

Notes

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Safety Precautions

On the product and this operation manual, important information for safe and correct use to prevent danger to the user and other people as well as property damage is described.

Understand the following information (signs and symbols) before reading the text, and follow the described items.

Description of signs







Sign	Description
 DANGER	Indicates that failure to avoid it will result in an immediate risk of death or serious injury ^(*1) .
 WARNING	Indicates that failure to avoid it will result in a risk of death or serious injury ^(*1) .
 CAUTION	Indicates that failure to avoid it will result in a risk of light or medium injury ^(*2) or only property damage ^(*3) .

*1: A serious injury indicates loss of sight, injury, burns (high/low temperature), electric shock, broken bones, or intoxication that will have aftereffects and require hospitalization or long-term hospital visits for healing.

*2: An injury indicates an injury, burn, or electric shock that does not need hospitalization or long-term hospital visits for healing.

*3: A property damage indicates consequential damage in terms of breakage of properties or materials.

Description of symbols

Symbol	Meaning
 Prohibited	Indicates “Prohibition” or “You must not do”. Specific details are indicated near the symbol  with pictures and text.
 Mandatory	Indicates “Mandatory Action” or “Do as indicated”. Specific details are indicated near the symbol  with pictures and text.
 Warning	Indicates Warning. Specific details are indicated near the symbol  with pictures and text.

(Note) Descriptions of Prohibition, Mandatory Action, and Warning vary depending on the display on the main unit.

1. Safety Precautions on Installation

WARNING



Ground

Ground the device.

Otherwise, it may cause an electric shock or fire.

CAUTION



Prohibited

Do not install, store, or use it in the following environments.

- A place with a lot of dust
- A place with corrosive gases (SO₂, H₂S) or flammable gases
- A place with vibrations and shocks exceeding the allowed values
- A place with condensations due to rapid temperature changes
- A place with low or high temperature outside of the installation condition
- A place with high humidity outside of the installation condition
- A place with direct sunlight
- A place near equipment generating strong radio waves or magnetic fields

It may cause accidents.



Prohibited

Do not block the ventilation hole or air inlet/outlet.

It may cause fire or failure due to overheat.



Mandatory

For installation and wiring of the system, observe the installation conditions and methods described in this document.

Otherwise, it may cause a fall, fire, failure, or malfunction.




Mandatory

Install the device in a place where maintenance and inspection can be done easily.

Otherwise, it may cause accidents.


2. Safety Precautions on Maintenance and Inspection

WARNING



Mandatory **When installing or removing the module after wiring, make sure that the external power supply is off.**

Otherwise, there will be live electric poles on the back of the external terminal block of the module, causing an electric shock.


CAUTION


Prohibited **Do not drop, crush, or apply strong shocks to the device or board.**


It may cause failure.


Mandatory **Place a board or module removed from the unit or base unit on a conductive mat or conductive bag (used for a backup board, etc.) on a grounded table.**


Otherwise, parts may be damaged due to static electricity.


Mandatory **Before touching the device or board, touch a grounded metal to discharge the static electricity of your body.**

Otherwise, it may cause malfunction or failure due to static electricity.


Prohibited **Do not use benzene or thinner to remove stain on device, module, or board.**

It may cause deformation or discoloration of the device panel, module, or board.



Mandatory **Wipe off stain on the device, module, or board with a soft cloth.**

For severe stain, use a wet cloth wrung tightly.

Leaving them stained may cause wrong decision or malfunction.

3. Safety Precautions on Replacement of Life Limited Parts


WARNING

 **Mandatory**
If the device has power fuses or alarm fuses, when replacing them, turn off the switch of the device.


Otherwise, it may cause an electric shock or fire.

4. Safety Precautions on Daily Use

WARNING


 **No touch**
Do not touch the terminals of the module and unit during energization.

It may cause an electric shock.


 **Prohibited**
Do not modify, repair, disassemble, or adjust the device, module, or board.

It may cause an electric shock, fire, injury, or failure.


Upon faulty operation or failure, contact Toshiba's branch office or service offices.

 **Mandatory**
Before using, check that the power capacity, frequency, voltage, and regulation comply with the device specifications.

If not, it may cause damage of the device, or fire due to overheat, as well as not obtaining the original performance of the device.

 **Mandatory**
When the ambient or internal temperature of the device rises abnormally or failure occurs in the device, stop using the device, turn off the power, and contact one of Toshiba's service representatives.

Using it as it is may cause fire due to overheat.

 **No touch**
Do not touch the terminals of the module and unit during energization.

It may cause an electric shock.

The power supply module is for the nv series only. Do not use it alone for any other purposes.

CAUTION



Prohibited

Do not touch anything other than the operation part (setting switches inside the module), such as the IC parts and terminals, connectors, and soldered surfaces inside the module.

Doing so may result in electrostatic breakdown of the ICs and LSIs, causing failure. Also, an injury may occur due to the ends of the part lead wires, or burns may occur due to hot parts.



Prohibited

Do not forcefully bend, pull, or twist the power cord and cables.

It may cause breaks or heating.



Prohibited

Do not insert any metal into the gaps of the device main body.

It may cause fire.



Prohibited

Do not disassemble or modify the device or module.

It may cause malfunction or failure as well as loss of safety of the device.

5. Safety Precautions on Transportation, Storage, and Disposal

CAUTION



Mandatory

Observe ordinances and rules.

When destroying the product, observe the ordinances and rules of the local government.



Prohibited

For transportation and storage of the product, use a conductive bag and packaging box.

Otherwise it will cause failure.

Restrictions on Application

- This product is not developed/manufactured for use in systems involving devices that directly affect human life (Note 1). Do not use them for such applications.
- To use this product for systems that involve devices that significantly affect human safety or maintenance of public functions (Note 2), special considerations (Note 3) are required in system operation, maintenance, and management. In this case, contact one of Toshiba's sales representatives.

(Note 1) Devices that directly affect human life include the following.

- Medical devices such as life supporting devices and devices for surgical units.

(Note 2) Systems that involve devices that significantly affect human safety or maintenance of public functions include the following.

- Main unit control systems of nuclear power plants, safety protection systems of nuclear facilities, and other systems that are critical for safety
- Operation control systems of mass transportation systems and air traffic control systems

(Note 3) Special considerations indicate sufficient discussions with Toshiba's engineers to construct a safe system (e.g. employing fool-proof design, fail-safe design, or redundant design).

Disclaimer

- Toshiba shall not be responsible for any damage caused by an earthquake, lightning and wind, flood damage, fire for which Toshiba is not responsible for, acts of a third party, other accidents, the client's willful acts or negligence, misuse, or use in abnormal conditions.
- Toshiba shall not be responsible for any incidental damage (loss of business profits, interruption of business, change or loss of stored memory) caused by use of or being unable to use this product.
- Toshiba shall not be responsible for any damage caused by failure to observe the information described in the operation manual.
- Toshiba shall not be responsible for any damage caused by malfunctions due to combination with any connected device.
- Toshiba shall not be responsible for any damage caused by malfunctions due to combination with any application program created by the customer.

Note

Use your cellular phone or PHS 1 meter or more away from the product main unit in operation, various transmission cables, and I/O bus cable. Otherwise, the system may malfunction.

Introduction

This manual is described about how to use the PA912 module.

The functions, how to install, set, and maintenance are written in this manual.

To use the module correctly, we recommend you to read “Safety Precautions” as the first step.

The manuals related to the PA912 module are as follows.

- Unified Controller nv series Controller Unit Instruction Manual (6F8C1220)
Describes the unit hardware of the nv series controller.
- Unified Controller nv series type 1 Function Manual (6F8C1221)
Describes the functions and basic use of the nv series type 1.
- Unified Controller nv series/Integrated Controller V series Programming Instructions (6F8C1226)
- Unified Controller nv series/Integrated Controller V series Engineering Tool 4 (Basic) Instruction Manual (6F8C1290)
Describes how to create, debug, print, and save programs using nV-Tool.
- Unified Controller nv series/Integrated Controller V series Engineering Tool 4 (Setup) Operation Manual (6F8C1291)
Describes how to set up nV-Tool.
- Unified Controller nv series TC-net 100 (TN8) Module Instruction Manual (6F8C1360)
Describes the TC-net 100 (TN8) module, which is common to type 1 and type 2 of the nv series.
- High-speed Serial I/O System TC-net I/O Instruction Manual (6F8C1240)
This describes the specification, handling method and maintenance on nv series I/O and TC-net I/O system.

● Notational conventions

The following are the notational conventions for better understanding of this document.

- ◆ **Important:** Describes what the user should be particularly aware of to handle the product correctly.
- ◆ **Note:** Describes what the user should observe to handle the product correctly.
- ◇ **Remark:** Describes a remark.

● Reading this document

This document consists of the following chapters.

- Chapter 1 Introducing the PA912 module
Describes the functions, characteristics, and names and functions of the parts.
- Chapter 2 Installation and wiring
Describes how to install it to the basic unit and how to connect cables.
- Chapter 3 Setting
Describes how to set the switches and parameters to use the module correctly.
- Chapter 4 Startup and Shutdown
Describes the operations such as checking before operation, startup, and shutdown.
- Chapter 5 Troubleshooting
Describes troubleshooting such as what to do when failure occurs.
- Chapter 6 Maintenance and inspection
Describes troubleshooting regarding daily inspection and periodical inspection and how to perform inspections.

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Introducing the PA912 Module

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1.1 Functions and Characteristics of the PA912 Module

The PA912 is the module to connect the Unified Controller "nv series" and the PROFIBUS slave device by PROFIBUS network.

The PROFIBUS was developed by Siemens AG, and has been regarded as a global standard network.

The PROFIBUS approved by the Deutsche Industrie Normen (DIN19245) and the European Norm (EN50170), followed by the international standard IEC-61158. At the practical application level, the PROFIBUS is widely used in Europe, North America and other regions with more than 1,100 companies participating in the users group as well as approximately 300 vendors providing about 2,000 types of products. The PROFIBUS has three protocols, "DP", "FMS", "PA". The PA912 supports the "DP" protocol, because "DP" protocol is most widely used and has a specification of most high speed performance, efficiency, and connected cost. The PA912 can configure transmission paths with twisted pair cables.

■ Characteristics of the PA912 module

- **PROFIBUS-DP DP-V0 protocol version compliance**

Connected to the PROFIBUS as the master module, the PA912 can control PROFIBUS slave I/O devices.

- **Relay to TC-net I/O loop**

The PA912 relays input/output data of PROFIBUS slave I/O devices to the TC-net I/O loop. It enables high speed cyclic data transmission.

- **Fast transfer**

Fast data transfer is possible because PROFIBUS bus I/O data are directly transferred with the dedicated transmission gate arrays.

- **High reliability**

PROFIBUS I/O data is subjected to data check and error correction based on ECC, thus providing a highly reliable data transfer.



CAUTION

To use PA912 module as a duplexed module is not available.



Mandatory



CAUTION

For the slave I/O setting of PA912 PROFIBUS, use the HMS PROFIBUS configurator tool, (Anybus NetTool-PB).



Mandatory



CAUTION

Confirm the version of nV-Tool before use the PA912 module. The target version of this module is Ver4.6.0 or later and refer to the Unified Controller nv series/Integrated Controller V series Engineering Tool 4 (Basic) Instruction Manual (6F8C1290) for how to confirm the nV-Tool version.



Mandatory

■ System configuration example

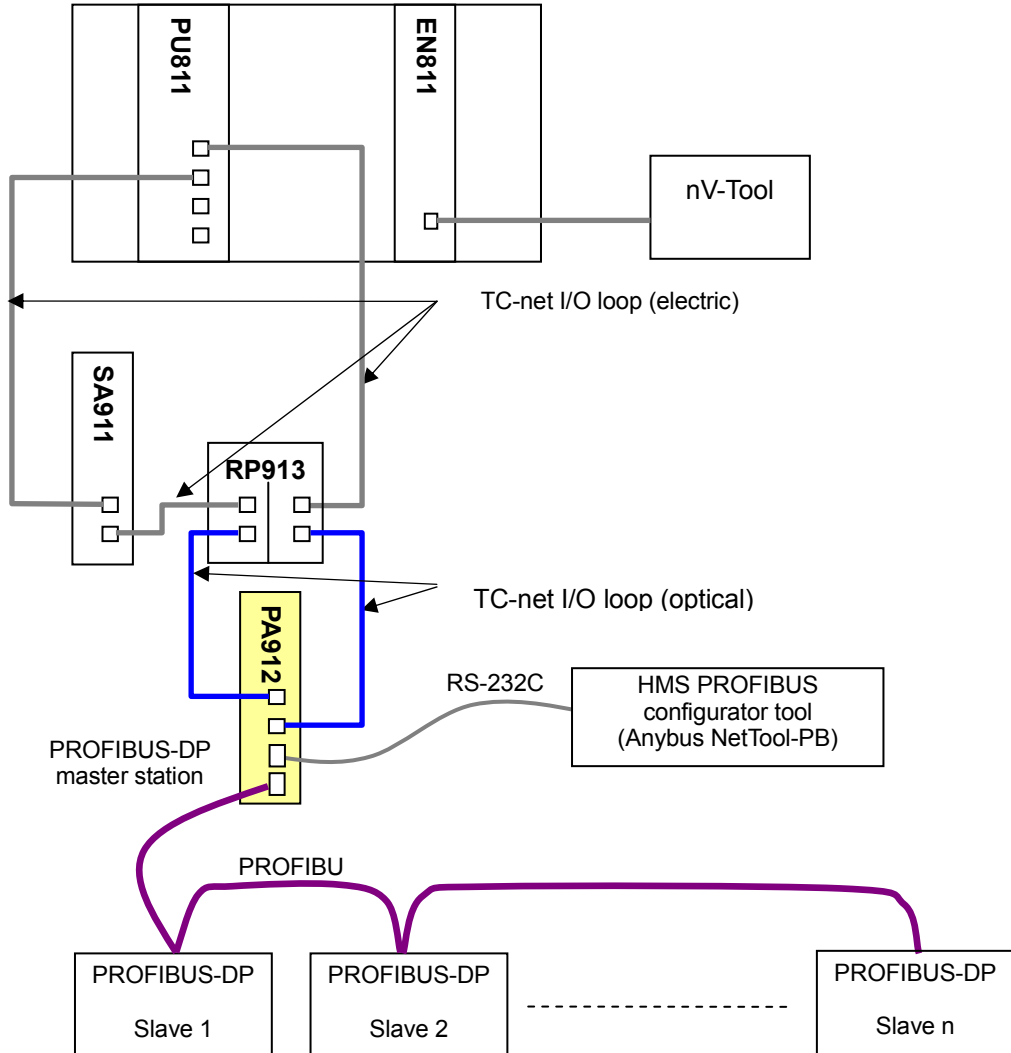


Figure 1-1 System configuration example



CAUTION

TC-net I/O loop with PA912 should be a single loop configuration. When using Unified Controller type1 with PA912, set the “I/O loop number” on the “module parameter”-“I/O loop” pane of the controller to “1”. Note that PA912 is not available for Unified Controller type2.



Mandatory

1.1.1 Cyclic transmission

As the PROFIBUS master module, the PA912 module controls slave I/O devices (input and output devices) connected via the PROFIBUS. The PA912 is controlled by the nv controller. The nv controller and the PA912 are connected via the TC-net I/O loop, and they have a virtually shared memory area called "common memory". When the output information is set in the common memory by the nv controller, the information is outputted to the PROFIBUS slave output devices via the TC-net I/O loop. Similarly, the input information to the slave input devices is inputted in the nv controller common memory via the PA912 and the TC-net I/O loop.

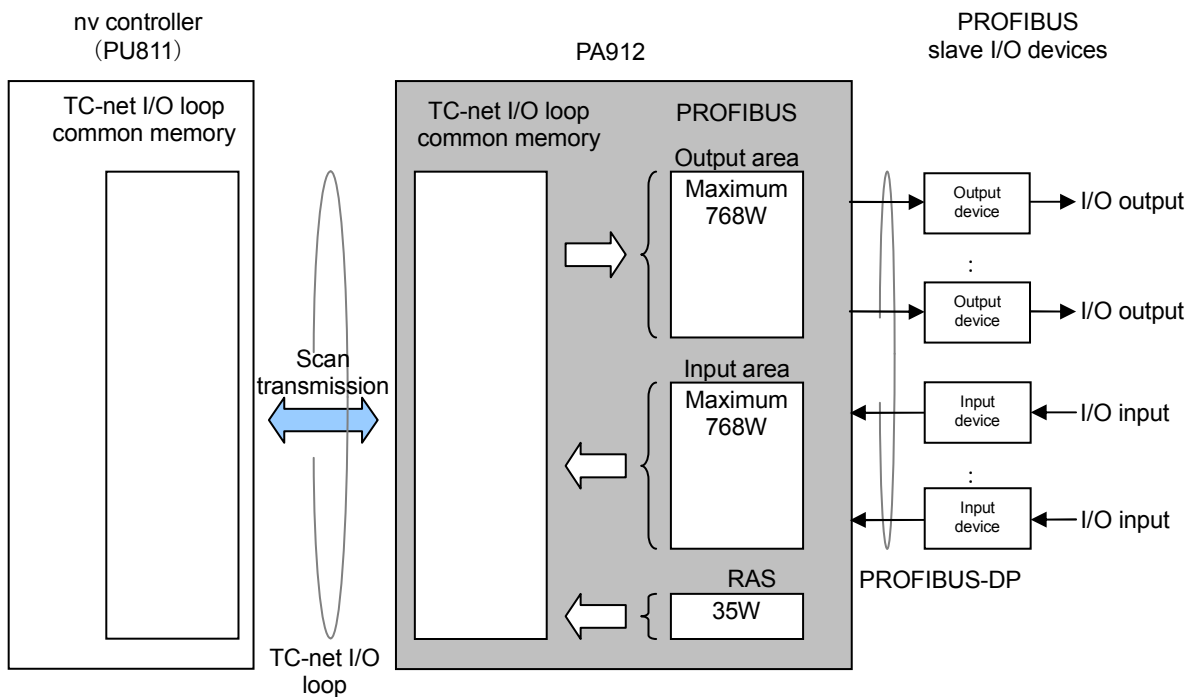


Figure 1-2 Cyclic transmission

1.1.2 Specifying medium/high speed TC-net I/O loop scan

"Medium speed" and "high speed" is available as the TC-net I/O loop scan transmission speed. When a short response time is required between the controller and the slave I/O devices, the response speed between the slave I/O devices and the nv controller can be enhanced by setting the slave I/O devices to "high speed".

Input and output areas of the slave I/O devices process data (cyclic data) are both divided into high speed area (first half) and medium speed area (latter half) by 128 byte sizes. The high speed area (first half) is allocated for high speed transmission of the TC-net I/O loop, and the medium speed area (latter half) is allocated for medium speed transmission. Thus, a relation is established by setting the input and output addresses of the slave I/O devices in the high speed area (first half) or the medium speed area (latter half).

The input and output areas for the slave I/O devices process data (cyclic data) can be specified as the high speed or medium speed area via the nV-Tool by using a module parameter "High-speed scan byte size (input/output)" of the PA912-M module. The setting method is described in "Chapter 3: Setting."

It should be noted that the RAS information is fixedly set to medium speed.

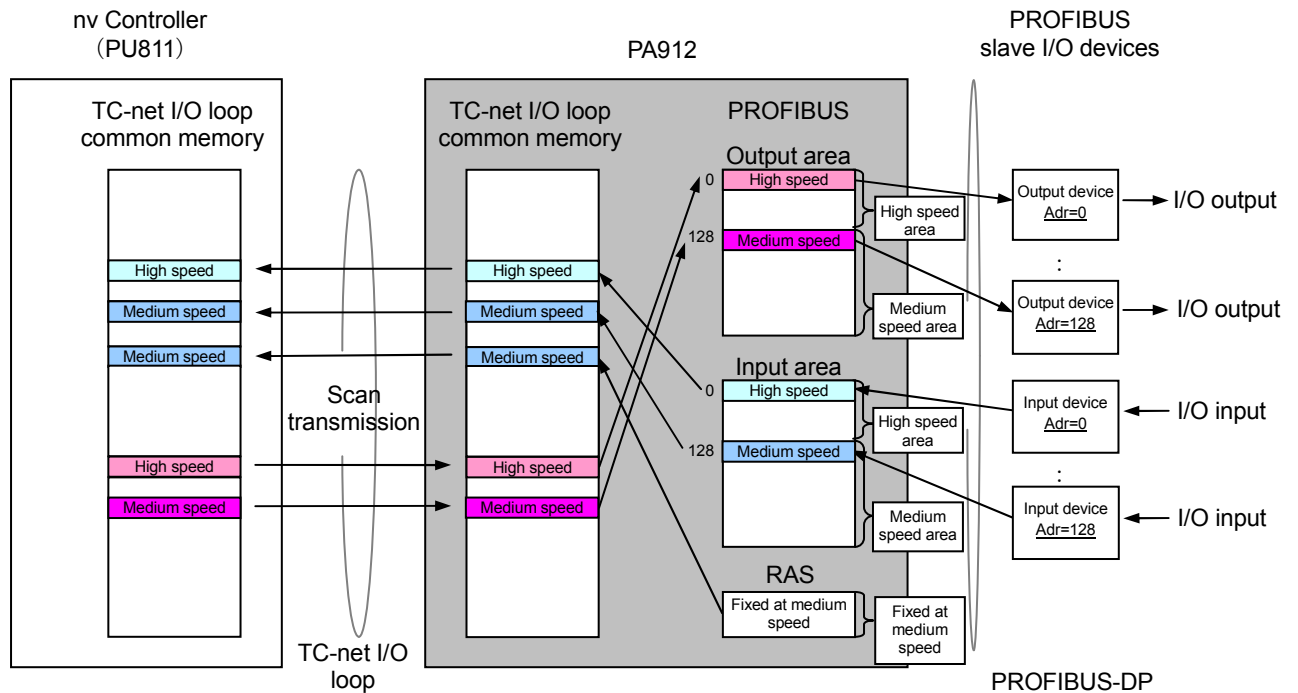


Figure 1-3 Specification of medium/high speed TC-net I/O loop scan

Table 1-1 Setting details of byte size used for high speed scan (input/output)

Setting item	Description
High-speed scan byte size (Output)	Up to 1536 bytes can be set in units of 128 bytes (0-1536). High-speed scan byte size < Output address of slave I/O device: Target slave I/O device is subjected to high speed scan transmission in the TC-net I/O loop. High-speed scan byte size \geq Output address of slave I/O device: Target slave I/O device is subjected to medium speed scan transmission in the TC-net I/O loop.
High-speed scan byte size (Input)	Up to 1536 bytes can be set in units of 128 bytes (0-1536). High-speed scan byte size < Input address of slave I/O device: Target slave I/O device is subjected to high speed scan transmission in the TC-net I/O loop. High-speed scan byte size \geq Input address of slave I/O device: Target slave I/O device is subjected to medium speed scan transmission in the TC-net I/O loop.

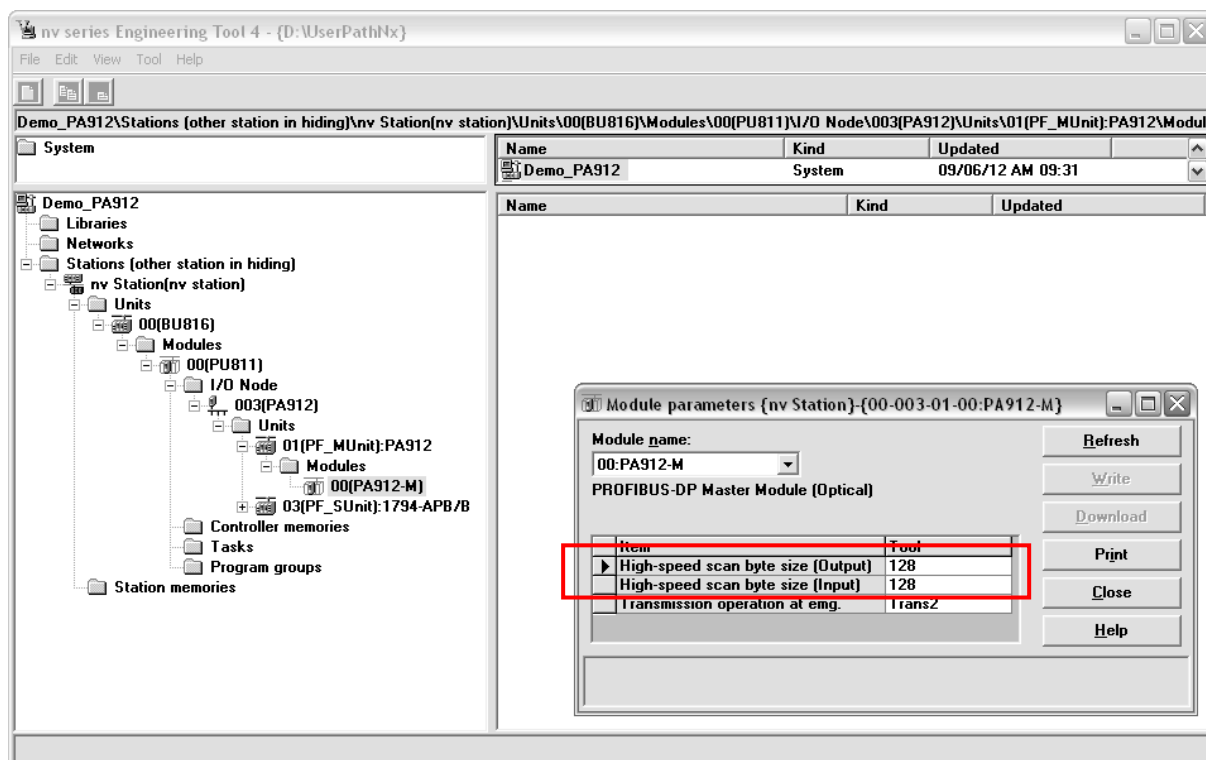


Figure 1-4 Setting screen of byte size used for high speed scan

1.1.3 Transmission operation upon error

When the controller is failed to operate properly or an error is detected on the TC-net I/O loop, one of the following three output modes can be specified as the output operation for the PROFIBUS slave I/O devices. The transmission operation upon error can be specified via the nV-Tool by using a module parameter "Transmission operation at emg." of the PA912-M module. The setting method is described in "Chapter 3: Setting."

Table 1-2 Transmission operation upon error

Mode	Transmission operation
Stop	Halts the transmission operation.
Trans 1	Continues the transmission operation by setting the transmission data to the value immediately before the error occurrence.
Trans 2	Continues the transmission operation by setting the transmission data to 0.

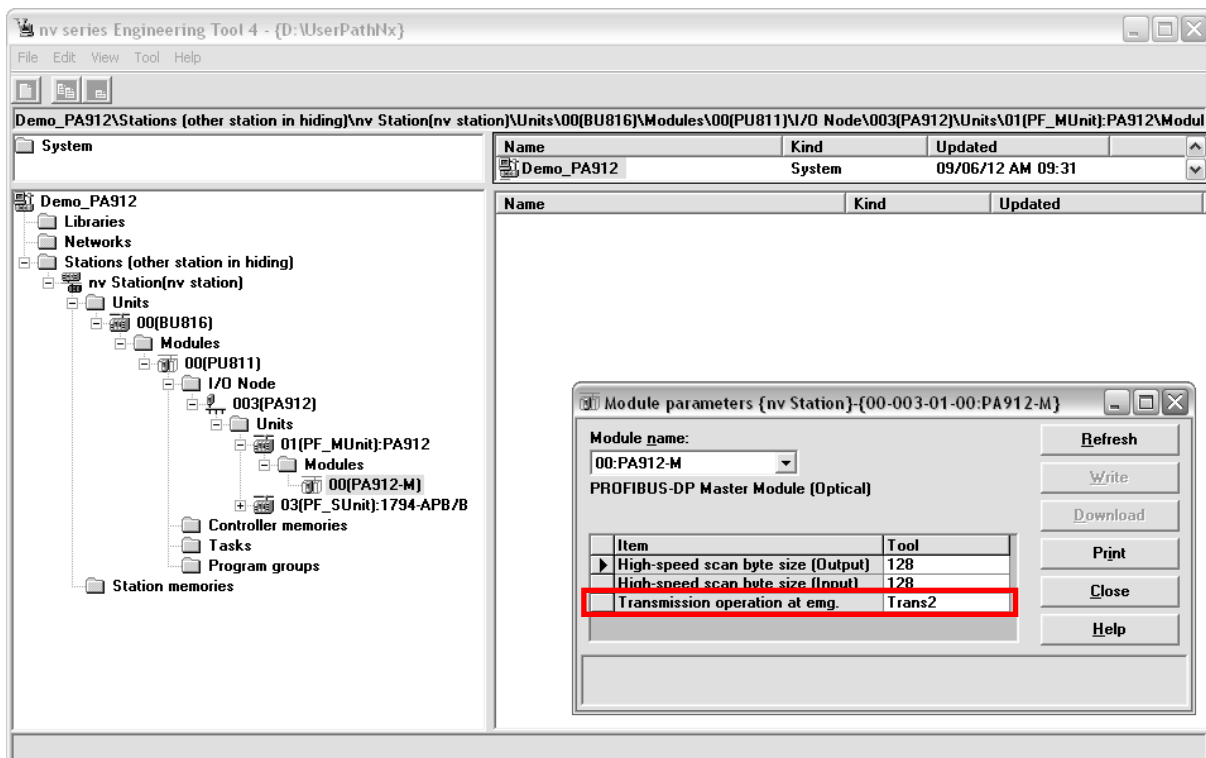




Figure 1-5 Setting screen of transmission operation upon error

 CAUTION	Pay due consideration to the system operation before specifying the operation mode of the PA912 upon error.	 Mandatory
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1.2 Names and Functions of the Parts

1.2.1 Names of the parts

Figure 1-6 shows the names of the parts of the PA912 module and I/O base unit BU90A.

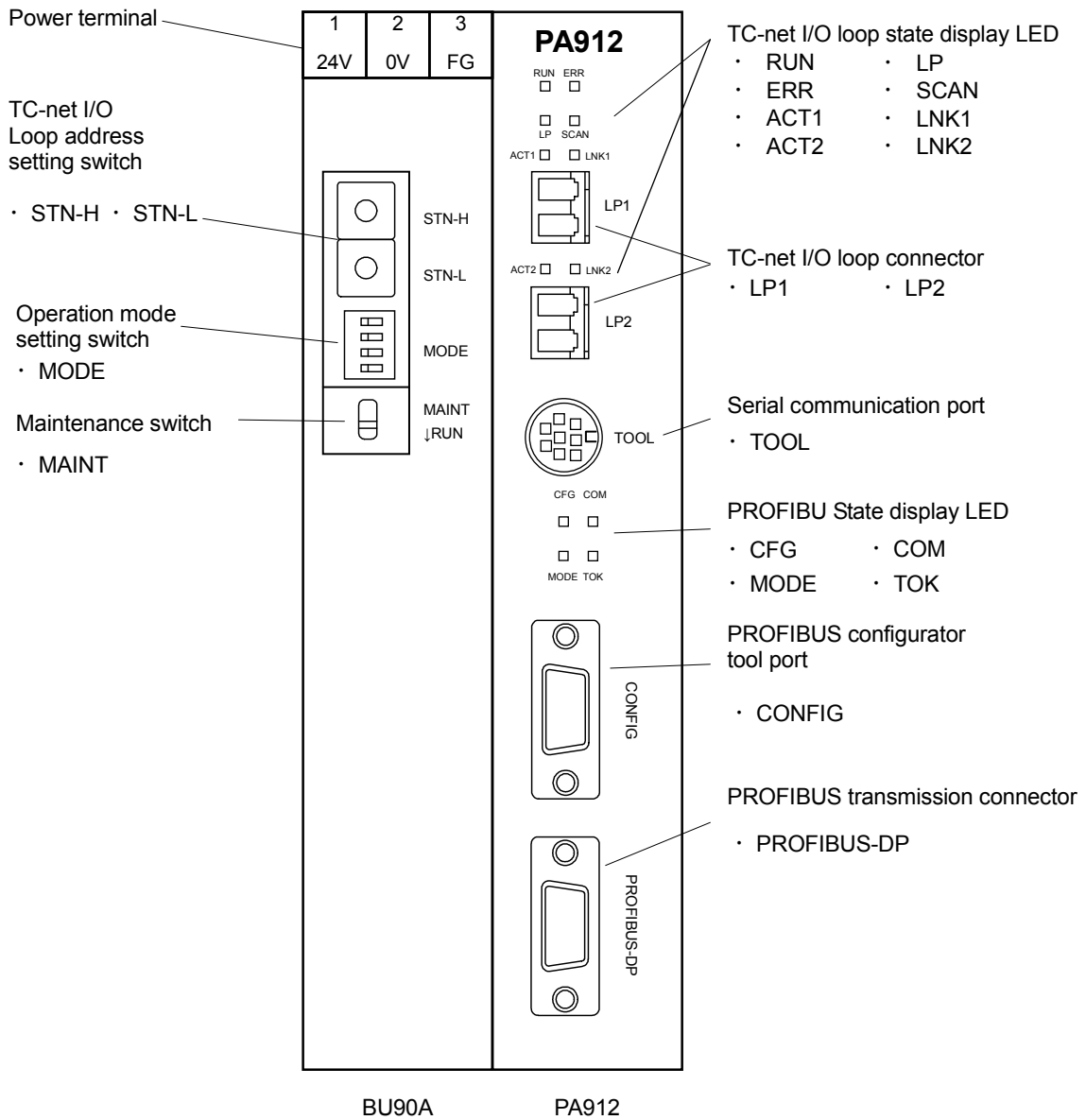


Figure 1-6 Names of the parts of the PA912 module and I/O base unit BU90A

1.2.2 Functions of the parts

The major functions of the parts are as shown below.

■ TC-net I/O loop state display LED

Table 1-3 Display details on the TC-net I/O loop state display LED

Name	Display
RUN(green)	ON: Module is normal or waiting for parameter download OFF: Module is abnormal
ERR(red)	ON: Module is abnormal OFF: Module is normal
LP(green)	ON: TC-net I/O loop is normal OFF: Disconnection of TC-net I/O loop exists
SCAN(green)	ON: TC-net I/O loop side scan transmission is running normally OFF: TC-net I/O loop side scan transmission is in suspension Blinking: TC-net I/O loop side scan block is overlapping
LNK1(green)	ON: LP1 Link established (normal) OFF: LP1 No link established (abnormal)
ACT1(green)	Blinking: LP1 Transmission is running (normal) OFF: LP1 No transmission is running (abnormal)
LNK2(green)	ON: LP2 Link established (normal) OFF: LP2 No link established (abnormal)
ACT2(green)	Blinking: LP2 Transmission is running (normal) OFF: LP2 No transmission is running (abnormal)

(Note) 1. Check the LED states from the front.

◆ Note

- When the maintenance switch is set to the maintenance state (MAINT), all LEDs go off.

■ TC-net I/O loop connector

LP1 and LP2 are the connectors for TC-net I/O loop optical cable. For the details, refer to "Chapter 2 Installation and Wiring."

■ TC-net I/O loop address setting switch



STN-H and STN-L are the switches to set the address on the TC-net I/O loop in hexadecimal. For the setting method, refer to "Chapter 3 Setting."

■ Mode setting switch

MODE is the switch to set the operation mode of the PA912. For the setting method, refer to "Chapter 3 Setting."



■ Maintenance switch

MAINT switch is used to insert or remove the TC-net I/O loop cable.
For details, refer to "Chapter 2 Installation and Wiring."

	CAUTION Maintenance switch is used only for inserting or removing the TC-net I/O loop cable. Do not use it when PA912 is operating.	 Mandatory
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■ Serial communication port

Tool port is an RS-232C port for Toshiba's maintenance. The connector is a 9-pin D-sub connector (socket).

	CAUTION Do not connect any cables to the serial communication port. Otherwise, PA912 may go wrong.	 Mandatory
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■ PROFIBUS state display LED

Table 1-4 Display details on the PROFIBUS state display LED

Name	Display
CFG (green/red)	ON (green): Configuration data OK Blinking (green): Configuration data download in progress ON (red): Configuration data invalid OFF: No Configuration data downloaded
COM (green/red)	ON (green): Data exchange with all configured slaves Blinking (green): Data exchange with at least one configured slave ON (red): Bus control error OFF: No data exchange with any of the configured slaves
MODE (green/red)	ON (green): Operate mode Blinking (green): Clear mode (Output data is zero) ON (red): Stop mode OFF: Offline
TOK (green)	ON: The module has the token OFF: The module does not have the token

(Note) 1. Check the LED states from the front.

◆ Note

- When the maintenance switch is set to the maintenance state (MAINT), all LEDs go off.

■ PROFIBUS configurator tool port

CONFIG port is to connect the HMS configurator tool and set the slave I/O of PROFIBUS.

For details, refer to "Chapter 3 3.2 Setting the Slave Device Configuration Information."

■ **PROFIBUS transmission connector**

PROFIBUS-DP is a connector for the PROFIBUS transmission cable.
For details, refer to "Chapter 2 Installation and Wiring."

■ **Power terminal**

This is a terminal for the DC24V system power supply.
For details, refer to "Chapter 2 Installation and Wiring."





Chapter 2



Installation and Wiring

This chapter describes installation and wiring methods of the PA912 module. Before installation and wiring, read this operation manual thoroughly.



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 **WARNING** Before installing or removing the module, make sure that the I/O base unit to which the PA912 module is installed is turned off.  **Mandatory**

Otherwise, it may cause an electric shock.



 **WARNING** Do not touch the interior of the product except the switches.  **Prohibited**

It may cause an electric shock.



 **CAUTION** Install it under an environment that satisfies the product specifications.  **Prohibited**

When installing it under an environment that does not satisfy the product operating temperature range, apply forced cooling with cooling equipment.



Operating temperature range: 0 to 55°C

 **CAUTION** Before installation or wiring, remove the static electricity from your body.  **Prohibited**



The static electricity accumulated in the human body may cause failure of the product.



 **CAUTION** Do not touch the cables carelessly.  **Prohibited**



Applying stress to the cables may cause malfunction or accidents.



 **CAUTION** Do not insert or remove any cables, and do not install, remove, or replace the PA912 module or the I/O base unit while the power is on.  **Prohibited**

It may cause an electric shock or malfunction. When installing the product to the I/O base unit, be careful not to snap or bend the TC-net I/O bus connector pins.

 **CAUTION** When installing the product to the I/O base unit, do not break or bend the pins of the TC-net I/O bus connector.  **Prohibited**

 **CAUTION** If it is difficult to insert the module to the I/O base unit, remove it once and try again rather than forcing it.  Prohibited

 **CAUTION** Use a screwdriver.
To prevent damage to the screws, use a screwdriver that is suitable for the screws.  Prohibited

 **CAUTION** Perform a notification check in the application level using the transmission protocol.  Mandatory

2.1 Types of I/O Base Units



2



The PA912 module is installed to the I/O base unit (hereinafter "base unit") (BU90A).

For the specifications of the I/O base unit, refer to "Appendix A.2 PA912 and BU90A Specifications."

2.2 Installing the Module

2.2.1 Vertical installation of the module

 CAUTION	<p>Do not insert or remove any cables, and do not install, remove, or replace the base unit while the power is on.</p> <p>It may cause an electric shock or malfunction.</p>	 Prohibited
--	--	---

 CAUTION	<p>In the case of the vertical installation, allow a space of 10cm or more from the top of the base unit BU90A to which the PA912 is installed for ventilation.</p> <p>If ventilation is insufficient, the internal temperature of the PA912 may increase, causing failure or malfunction.</p>	 Mandatory
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The installation procedure is as follows.

1 Install the base unit.

Use a 35mm-wide DIN rail in the vertical direction. Hook the DIN rail to the notch in the left side of the DIN rail installation slot on the back of the module, and turn the base unit clockwise to install it to the rail (press it fully until it clicks).

Install DIN rail stoppers at the upper and lower ends of the base unit so that the base unit will not move on the DIN rail.

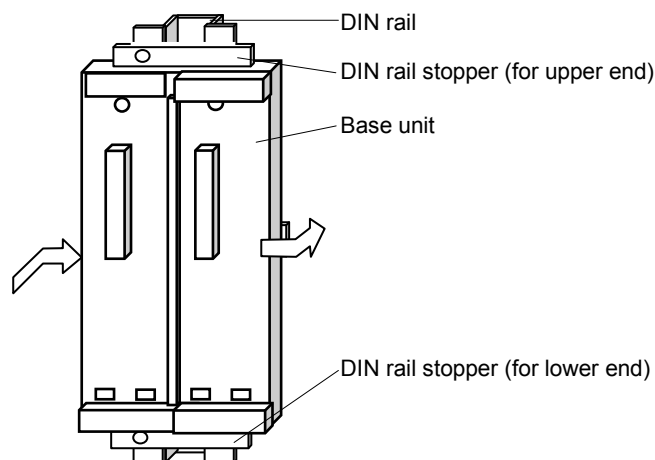


Figure 2-1 Installing the base unit to the DIN rail

**CAUTION**

When using it in an environment with extreme vibrations, insert a cushion rubber cap (ADP901) or other cushion material between the base unit and DIN rail stopper.

This will prevent damage and scratch of the case.



Mandatory

2 Connect the power terminal block of the base unit (BU90A) of the PA912.

Connect 24VDC, 0V, and FG (D-class grounding with ground resistance of 100 Ω or less dedicated ground) to the power terminal block of the base unit (BU90A) of the PA912. (the screw size for these wiring terminals is M3.5).

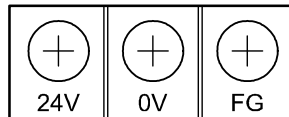


Figure 2-2 Power terminal block of the base unit BU90A

**CAUTION**

Do not share the 24VDC power supply for the BU90A with the power supply for other I/O.

If it is shared with the power supply for other I/O, it may cause malfunction or failure of the modules.



Prohibited

**CAUTION**

For DC24V power supply to the BU90A, refer to “Appendix A.4 DC24V system power supply specifications.”

If the I/O power supply other than the specification is used, it may cause malfunction or failure of the module.



Mandatory

3 Install the PA912 module to each of the base units.

- (1) Hook the module to the slot on the bottom of the module in the lower part of the base unit, and rotate it to fit the connector.
- (2) Secure it to the base unit with the fixing screw on the top of the module.

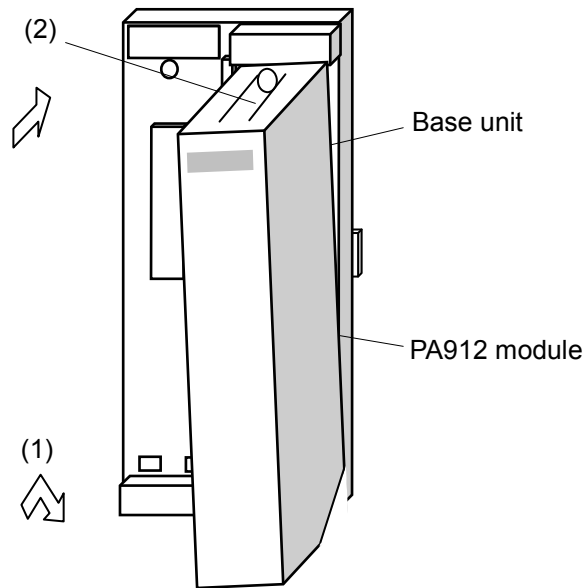



Figure 2-3 Installing the module


4 Check before the operation.

Before turning on the power to operate the product, check again that the switch setting, installation, and wiring are as described in this operation manual.

2.2.2 Horizontal installation of the module

CAUTION Do not insert or remove any cables, and do not install, remove, or replace the base unit while the power is on.  Prohibited

It may cause an electric shock or malfunction.

CAUTION In the case of the horizontal installation, allow a space of 50mm or more from the top and bottom of the base unit BU90A to which the PA912 is installed for ventilation.  Mandatory

If ventilation is insufficient, the internal temperature of the PA912 may increase, causing failure or malfunction.

PA912 can be installed in the horizontal direction. The installation procedure is as follows.

- 1 Place the base unit BU90A with its power terminal is on the left side, and its switches are on the down side.**
The horizontal installation of the other positioning is not available.

- 2 Allow a space of 50mm or more from the top and bottom of the base unit.**
The space of the top is for the heat dissipation and the space of the bottom is for the cables.

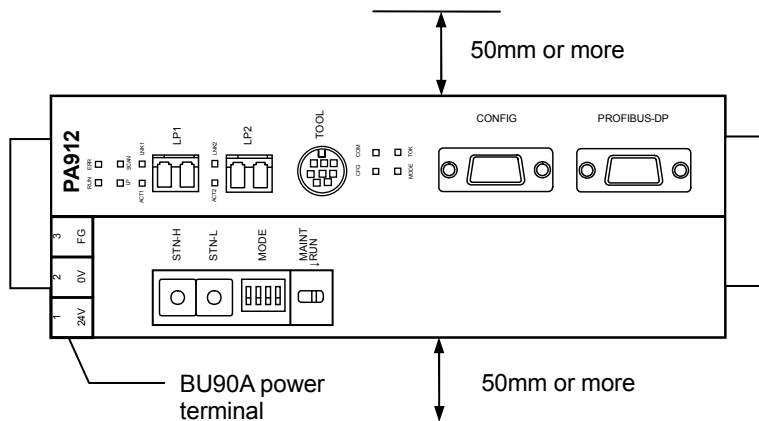


Figure 2-4 Horizontal installation

2.3 Connecting the TC-net I/O Loop Transmission Connector

Connect the TC-net I/O loop transmission cable.

Figure 2-5 and Figure 2-6 show the order of connection of the cables.

2

◆ Important

- Connect the cable correctly, otherwise I/O loop status may not be displayed "normal" on the system view screen of the nV-Tool.

◆ Note

- Use an optical transmission cable (double-LC connector, core diameter/cladding diameter: 50/125, 62.5/125) as a transmission cable connected to the TC-net I/O loop.

For the handling suggestions of optical transmission cable, refer to "Unified Controller nv series High-Speed Serial I/O System TC-net I/O Instruction Manual" (6F8C1240).

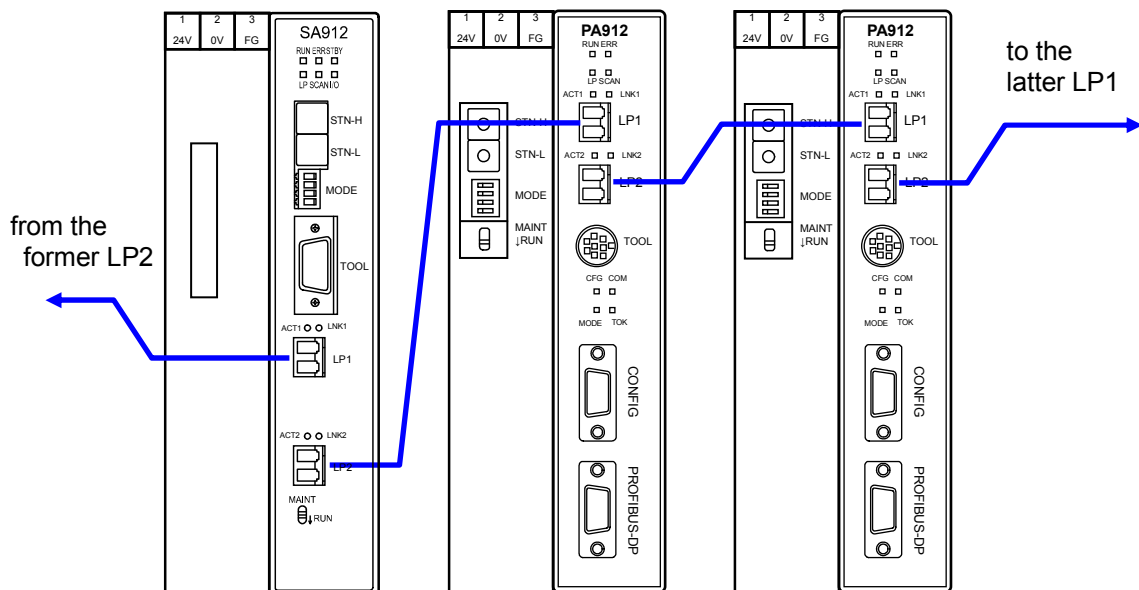


Figure 2-5 TC-net I/O loop transmission cable connection (optical cables only)

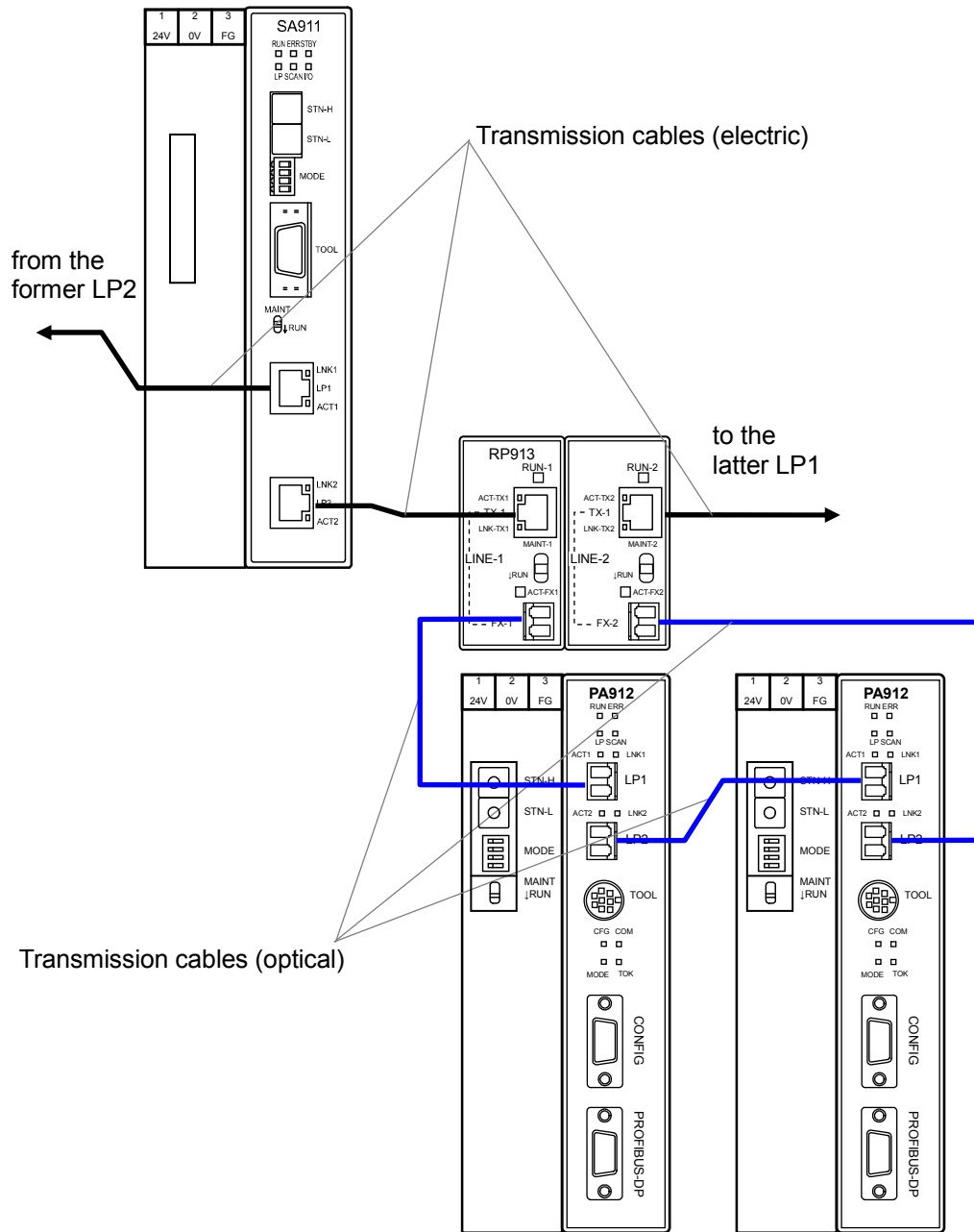


Figure 2-6 TC-net I/O loop transmission cable connection (mixed system of electric cables and optical cables)

2.4 Connecting the PROFIBUS Transmission Connectors

The PROFIBUS transmission cables are connected between the connectors in the order illustrated in Figure 2-7.

◆ Important

- At terminating stations, turn ON the termination resistor "TERM" built in the connectors.

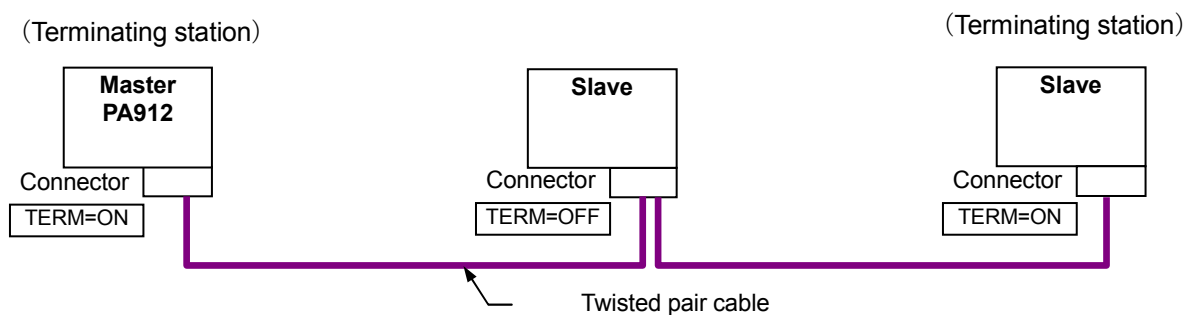


Figure 2-7 Connection of PROFIBUS transmission cables

◆ Note

For information on twisted pair cable and the connector for the PROFIBUS, refer to "Appendix C Related Products."

2.5 Replacing the Module

The PA912 module can be replaced while the system is not energized.

Turn off the DC24V power supply to the PA912 module.

Set the maintenance switch of the I/O base unit BU90A to the up (MAINT) position.

Remove the TC-net I/O loop optical transmission cables and PROFIBUS transmission cables (twisted pair cables) that are connected to PA912 from the module.

Loosen the fixing screw on the top of the module, and rotate the module downward to pull it off.

Remove the cables of the DC24V power supply that connected to the power terminal of the I/O base unit BU90A.

Upon replacement, note the following.

- Make sure that the replaced module is the same model.
- Confirm that the cable connection of the DC24V power supply is correct after the replacement.
- Set the hexadecimal rotary switch and 4-bit dip switch of the I/O base unit BU90A to the same setting as the I/O base unit before replacement.
- After installing the module and connecting the TC-net I/O loop optical transmission cable and PROFIBUS transmission cable, set the maintenance switch to the down (RUN) position.
- After completing the module replacement, switch settings and cable connection, turn the DC24V power on.



CAUTION

Before touching the module or inserting or removing the transmission cable, wear a wrist strap and white cotton gloves. Ground the wrist strap to remove static electricity.

Otherwise, it may cause damage or failure of the module.



Mandatory



CAUTION

When placing the module during replacement, use a conductive mat.

Ground the conductive mat.

Otherwise, it may cause damage or failure of the module.



Mandatory

**CAUTION**

Replace the PA912 module only when the system is not energized.

The DC24V power system to the PA912 module should be separated from the power system of the other modules or should be the independent configuration so that only PA912 can be powered off. (for example, system with the no- fuse breaker)

**Mandatory****CAUTION**

When replacing only the PA912 module during the nv controller is in operation, specify the fallback mode to avoid the system failure.

If the DC24V power system to the PA912 module is turned off, the communication of the module will stop and it will cause a serious failure. The controller will go down when the fallback mode is not specified.

**Mandatory**

2.6 Removing the Base Unit

2

When removing the base unit, perform the steps in "2.2 Installing the module" in the reverse order. Also turn off the power.

To remove the base unit from the DIN rail, remove all the cables, and slide the stopper (white plastic) on the back of the base unit outward by using a screwdriver.

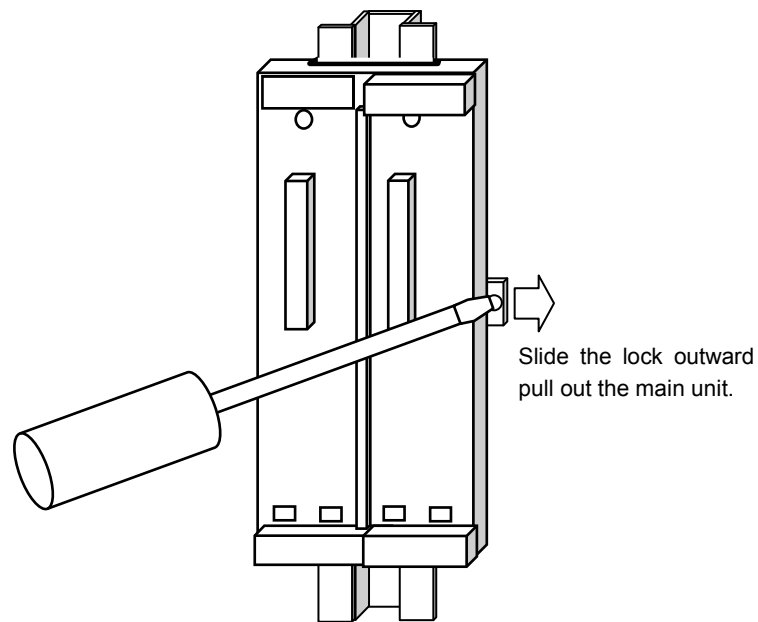


Figure 2-8 Removing the base unit

Chapter 3

Setting

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3.1 Switch Setting

The switches that determine the operation mode and TC-net I/O loop address of PA912 are on the BU90A unit.

The method to set the switches is shown below.

◆ Important

- Set the switches that determine the operation mode and station address of the PA912 module before turning the power on.

3.1.1 TC-net I/O loop address setting switch (STN-H, STN-L)

TC-net loop address setting switches are hexadecimal rotary switches that determine the loop address on the TC-net I/O loop.

Set the station address (3 to 34) that has been assigned upon system configuration in a HEX code (03 to 22 (h)). Assign an address with a different value to each of the nodes in the system.

Table 3-1 shows the setting of a TC-net I/O loop address.

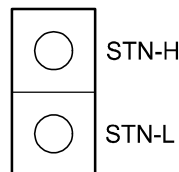


Figure 3-1 TC-net I/O loop switch setting configuration

Table 3-1 TC-net I/O loop address setting

Name	Description	Remark
STN-H	Setting range : 03 to 22(h) STN-H(upper digit address): 0 to F(h)	00h is set as a factory default
STN-L	STN-L(lower digit address): 0 to F(h)	

(Note) (h) indicates hexadecimal.

Set the station address in hexadecimal.

For example, if the address value is 28, it is '1C' (h) when converted to hexadecimal. Therefore, set as follows:

STN-H side: '1'

STN-L side: 'C'

For decimal-hexadecimal conversion, refer to "Appendix D Decimal-hexadecimal conversion table."

◆ Important

- TC-net I/O loop address can be set from 3 to 22(h). If the address is set as 0 to 2 or 23 to FF(h), this module becomes down.
- The remaining addresses are for Toshiba's maintenance. Do not use them.
- Set different values as the TC-net I/O loop addresses of the SA911/SA912/PA912 connected to the same I/O loop. If the setting values are the same, it does not function normally.

◆ Note

- The TC-net I/O loop transmission system does not have the TC-net I/O loop address overlap detection function. Therefore, if the same TC-net I/O loop address is set in multiple stations, the SA911/SA912/PA912 may apparently function normally. When construction the system, ensure that the TC-net I/O loop address does not overlap with other SA911/SA912/PA912.

3.1.2 Operation mode setting switch (MODE)

PA912 module has the 4-bit dip switches to determine the operation mode.

◆ **Remark**

- For setting, use a small slotted screwdriver.

When the switch lever of each bit of the dip switch is turned to right (to the ON side), it is set to ON; when it is turned to left, it is set to OFF.

Table 3-2 shows the descriptions of the switches.

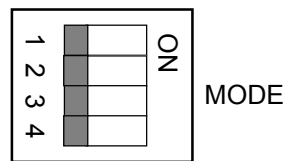


Figure 3-2 Operation mode setting switch configuration

Table 3-2 Operation mode setting table

Switch number	Settings	Remarks
1	For Toshiba's maintenance	Normally OFF is set as a default for all switches. OFF is set as a factory default for all switches. Byte-swap mode is needed to be the Switch number 3 ON and Use the nV-Tool V4.8.3 later.
2	For Toshiba's maintenance	
3	For Byte-swap mode	
4	Spare	

◆ **Note**

- The loop address setting switch and operation mode setting switch in the front of the module capture values when the power is turned on. When the switch setting is changed, turn on the power again.

◆ **Note**

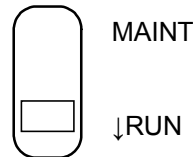
- To enable Byte-swap mode, it is necessary to set the Operation mode switch 3 ON. Confirm the PA912 Firmware version V2.2x or later and nV-Tool V4.8.3 later, before you enable the switch No.3 ON.(more information about how to use the byte-swap mode, refer 3.3.2)
- After you set the switch No.3 ON for enabling the Byte-swap mode, Do not forget the restart PA912 with the Maintenance switch.
- While Byte-swap mode ON, the performance of exchanging Input data and output data between TC-net I/O Loop and PROFIBUS Slave I/Os will get worsen about 20percent at worst case, compared Byte-swap mode OFF.
- If the Byte-swap mode OFF with switch No.3 OFF, factory default settings, PA912 ignore the Byte-swap command from nV-tool.
- Specification of Byte-swap mode is identified at Appendix A.6.

◆ **Important**

- Never operate the switches for maintenance and for spare.

3.1.3 Maintenance switch (MAINT)

Figure 3-3 shows the maintenance switch configuration.



3

Figure 3-3 Maintenance switch configuration

The switch is operated only to insert or remove the TC-net I/O transmission cable or PROFIBUS transmission cable.

Before inserting or removing cables, set the switch to up (MAINT) position to isolate the module from the system.

After inserting the cable, set the switch to down (RUN) position.

AS a factory default switch is set to be (MAINT) position.

◆ **Note**

- Do not insert or remove cables during the PA912 is in operation and the maintenance switch is set (RUN) position.

◆ **Important**

- The maintenance switch should be operated with a precision driver.

3.2 Setting the Slave Device Configuration Information

When using the PA912, transmission parameters need be set by using the HMS PROFIBUS configurator tool (Anybus NetTool-PB), besides making settings and registration in the nv controller.

For the PROFIBUS configurator tool, use the following product.

Table 3-3 HMS PROFIBUS configurator tool

Item	Details
Name	Anybus NetTool-PB
Manufacturer	HMS Industrial Networks (http://www.anybus.com/)
Applicable OS	Windows 98/ME/NT/2000/XP/Vista

The PA912 and a computer are connected via the RS-232C interface. Connect the RS-232C connector on the computer and the CONFIG connector (9-pin, male) on the PA912 by using the connection cable specified below.

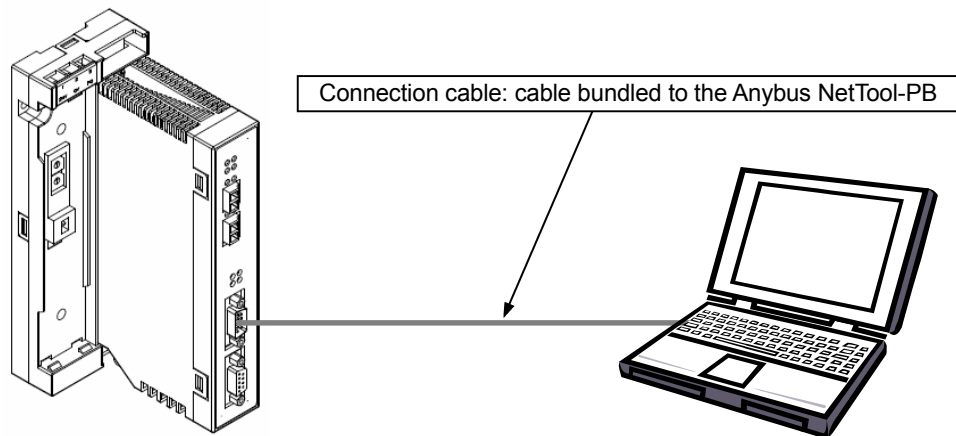


Figure 3-4 PROFIBUS configurator tool connection

◆ Important

- The PA912 uses the Anybus NetTool-PB as a HMS PROFIBUS configurator tool.
- Note that the HMS PROFIBUS configurator tool (name: Sycon), which is used for the parallel I/O module PF311, etc. of the Integrated Controller V series, is not applicable to the PA912.

◆ Note

- HMS PROFIBUS configurator tool (Anybus NetTool-PB) is not bundled to the PA912 module package. Purchase the tool separately.
- The Target versions of HMS PROFIBUS configurator tool (Anybus NetTool-PB) is Ver 1.6.1.1 or later versions.

Refer to the Anybus NetTool-PB Instruction Manual for the installation method and detailed usage instructions of the PROFIBUS configurator tool.

This chapter explains a simple operation method for registering the PROFIBUS slave I/O devices with the use of the Anybus NetTool-PB. The following description is based on the case where the Anybus NetTool-PB ver. V1.6.1.1 is used. When screens or setting methods have been changed due to the upgrade, etc. of the configurator software, refer to the instruction manual of the configurator tool.

Note that the explanations are given according to the following configuration.

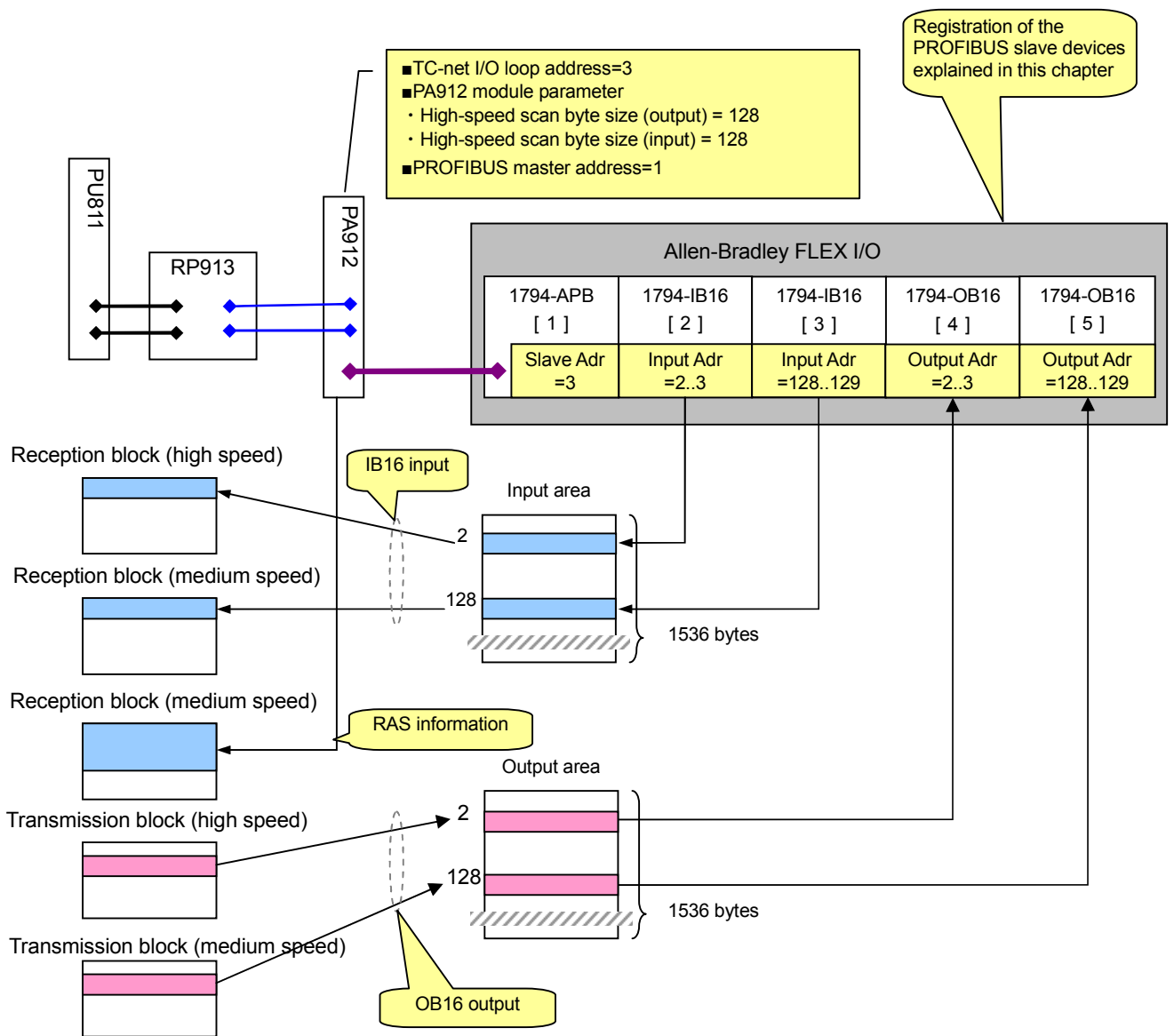


Figure 3-5 System configuration and setting example

3.2.1 Setting the master node (installation of the PA912 GSD file)

For using the PA912 as the master node, install Toshiba GSD file (TSB_0C32_V2.gsd) for the PA912 to Anybus NetTool-PB and the PA912 can be registered as the master node.

The following describes how to install Toshiba GSD file for the PA912.

1 Start up the Anybus NetTool-PB.

2 Select [Tools] - [Install new GS*-file].

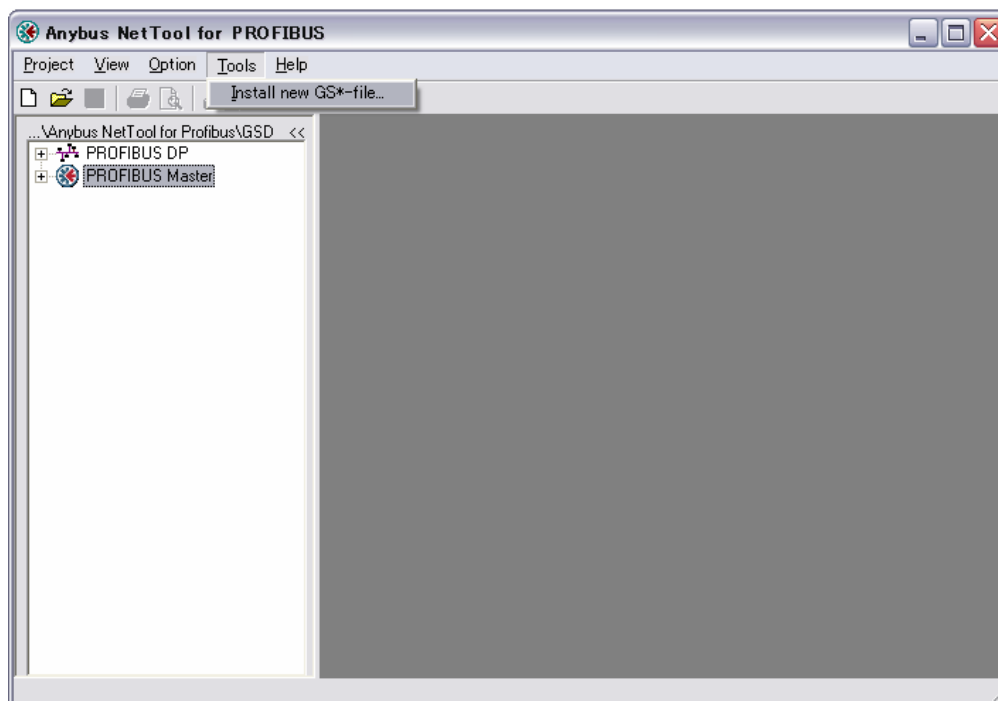


Figure 3-6 Installation screen of the GSD file

◆ **Note**

- HMS PROFIBUS configurator tool (Anybus NetTool-PB) is not bundled to the PA912 module package. Purchase the tool separately. (See the web site of configurator tool manufacturer, HMS <http://www.anybus.jp/>)
- The Target versions of HMS PROFIBUS configurator tool (Anybus NetTool- PB) is Ver 1.6.1.1 or later versions.

3 Select the GSD file, and click the [Open] button.

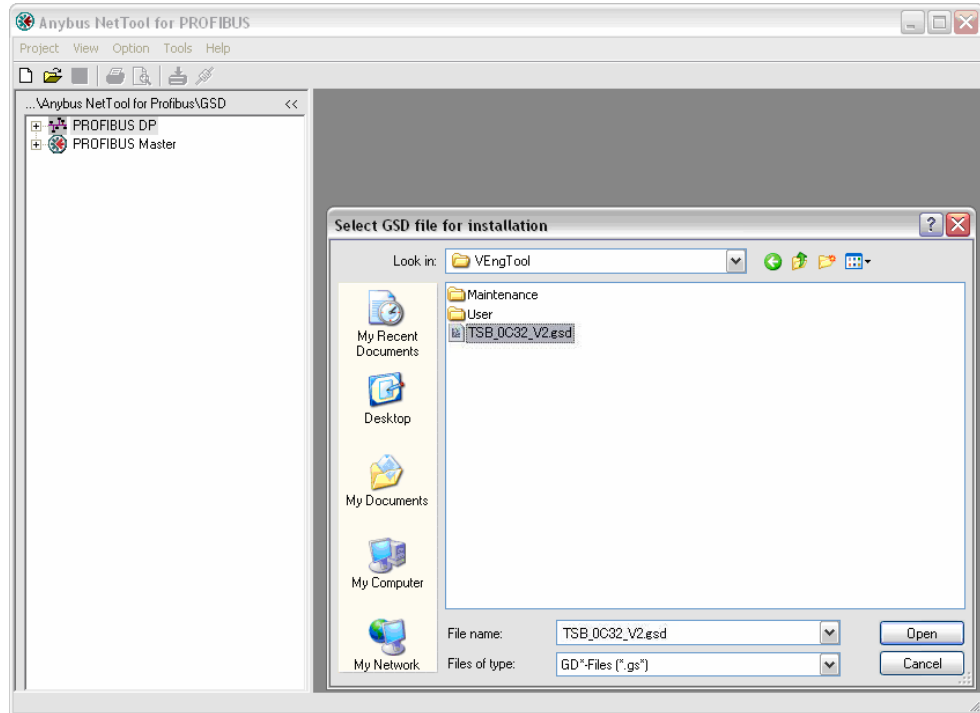


Figure 3-7 Selecting the GSD file

◆ Note

- If version 4.6.0 or later of the nV-Tool is installed, Toshiba GSD file (TSB_0C32_V2.gsd) for the PA912 is also installed in the same folder of the nV-Tool.

◆ Important

- The PA912 is restricted to use the combination of the versions between PA912 firmware and the GSD. (See the table below). If the correct combination of versions is not used, the input and output data is set to be incorrect.
- To avoid to use the incorrect combination of the versions PA912 firmware and Gsd. Confirm the versions of the PA912 firmware version with nV-Tool.

[Combination versions between PA912 firmware and GSD]

PA912 firmware version	PA912 GSD version	nV-Tool Version	Byte-swap mode
V1.00	TSB_0C32.gsd	4.5.1	Not Avail
V2.01	TSB_0C32_V2.gsd	4.6.0 or later	Not Avail
V2.10	TSB_0C32.gsd	4.6.0 or later	Not Avail
V2.20 or later	TSB_0C32_V2.gsd TSB_0C32.gsd	4.8.3 or later	Avail

- 4** "PA912_V2" is displayed under the PROFIBUS Master, and the import is complete.

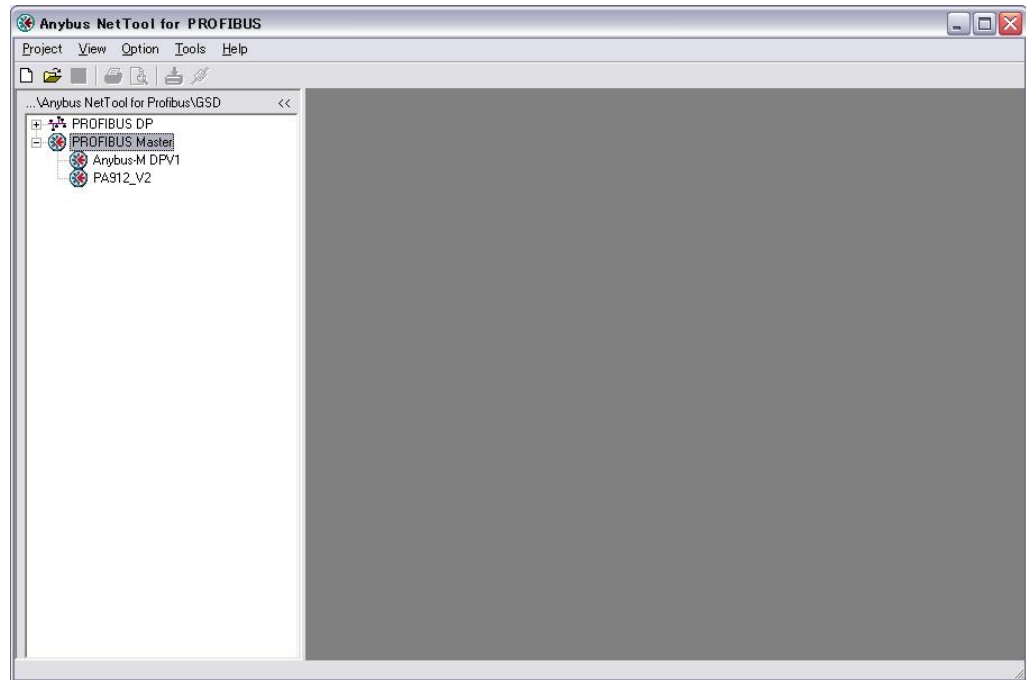


Figure 3-8 Screen after installing the master node

◆ **Note**

- To identify the versions of GSD. See the displayed the words of the Screen after installing the GSD files to HMS PROFIBUS configurator tool (Anybus NetTool-PB) .If you installed the elder version, TSB_0C32.gsd, "PA912" is displayed as PROFIBUS Master.
- If you installed the latest version, TSB_0C32_V2.gsd" to HMS PROFIBUS configurator tool (Anybus NetTool-PB). PA912_V2 is displayed as PROFIBUS Master

3.2.2 Creating a new project and setting the device configuration

The following describes how to create a new project.

1 Select the [Project] menu - [New].

After selecting [New], a new project is created.

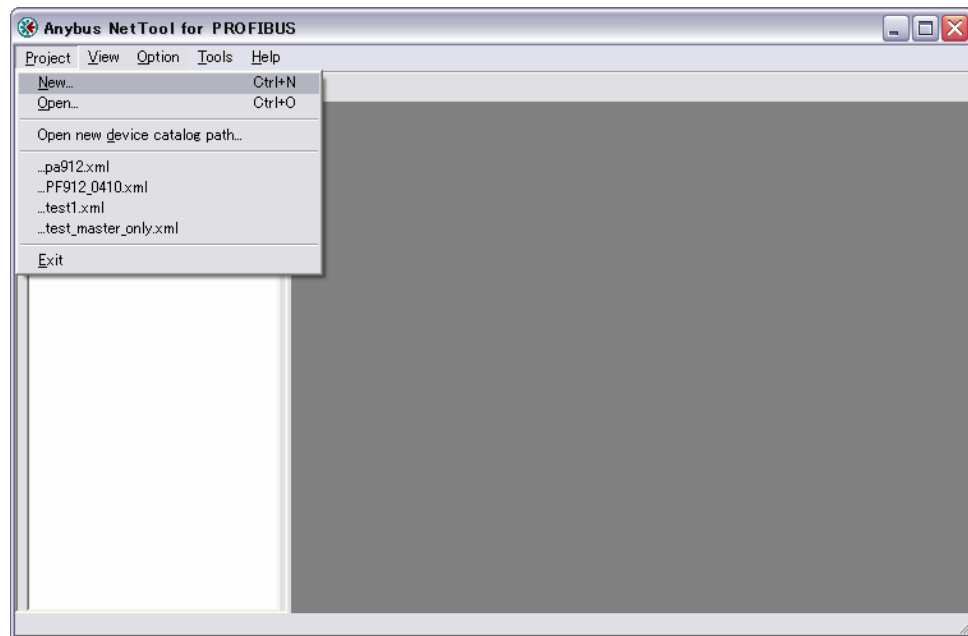


Figure 3-9 Creating a new project

2 Register the master node.

To register the master node, select the master node "PA912" in the left portion of the main screen, and drag and drop it to the upper portion of the [bus configuration 1] area.

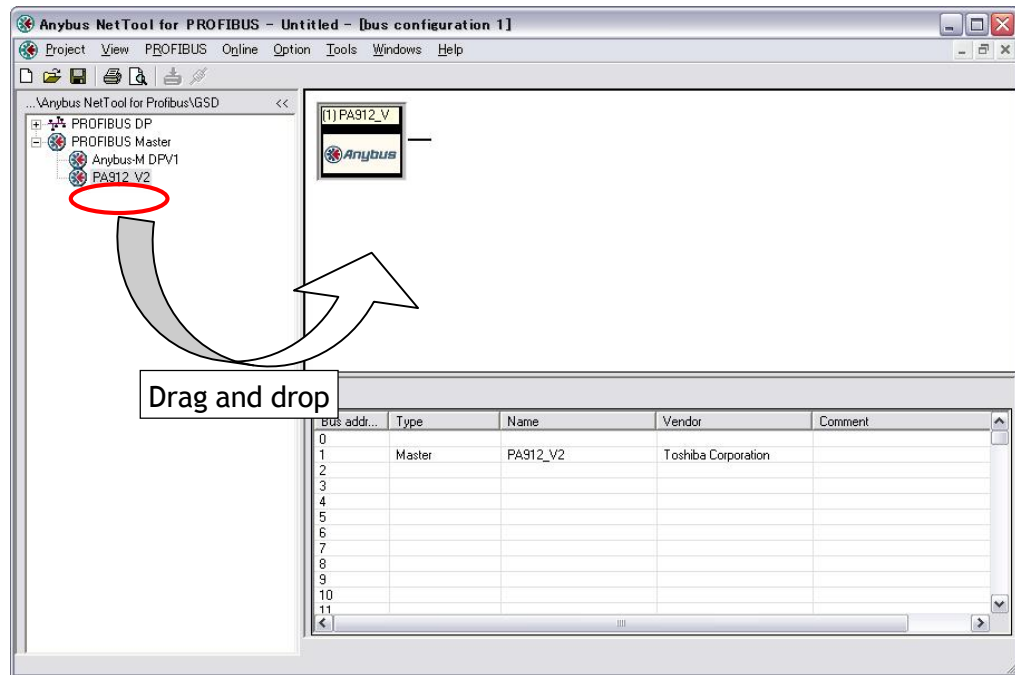


Figure 3-10 Master node registration

◆ Important

- Set "1" for the PROFIBUS address of the PA912 master node. If the value other than "1" is set, the configuration import to the nV-Tool described in "3.3 Setting with the Engineering Tool" will not be available.

3 Register a slave node.

To register for a slave node, select the slave node in the left portion of the main screen, and drag and drop it to the upper portion of the [bus configuration 1] area.

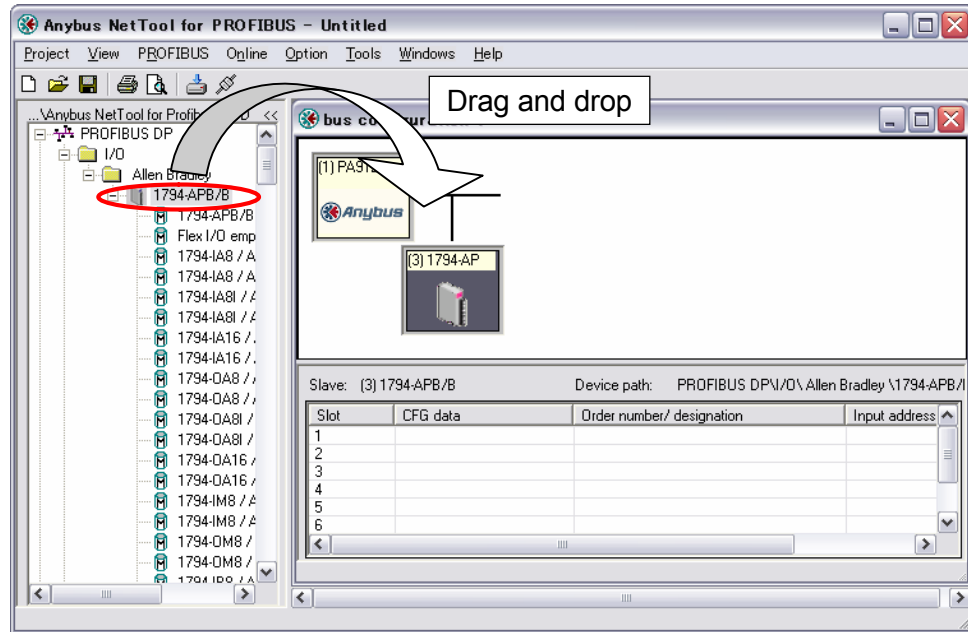


Figure 3-11 Slave node registration (1)

◆ Important

- Set within the range of 3 to 125 for the PROFIBUS address of the slave node. If the value out of the range is set, the configuration import to the nV-Tool described in “3.3 Setting with the Engineering Tool” will not be available.

4 Register an I/O device under the slave node.

To register a slave I/O device, select the slave I/O device in the left portion of the main screen, and drag and drop it to the lower portion of the [bus configuration 1] area.

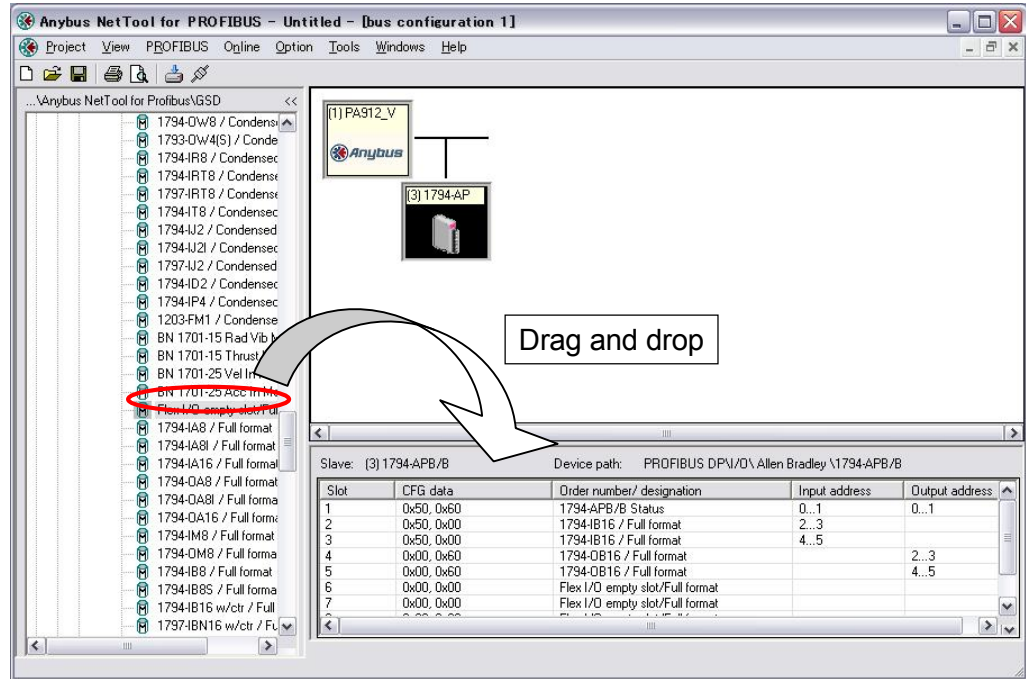


Figure 3-12 Slave node registration (2)

◆ Note

- To register the configurations or others of the I/O device to the slave node, refer to the instruction manual of the slave device.

5 Open the property setting screen of the slave I/O device.

To set the scan transmission speed of the TC-net I/O loop to middle/high speed, specify the input and output addresses of the slave I/O device. Right-click on the target slave I/O device, and select [Object properties] from the context menu.

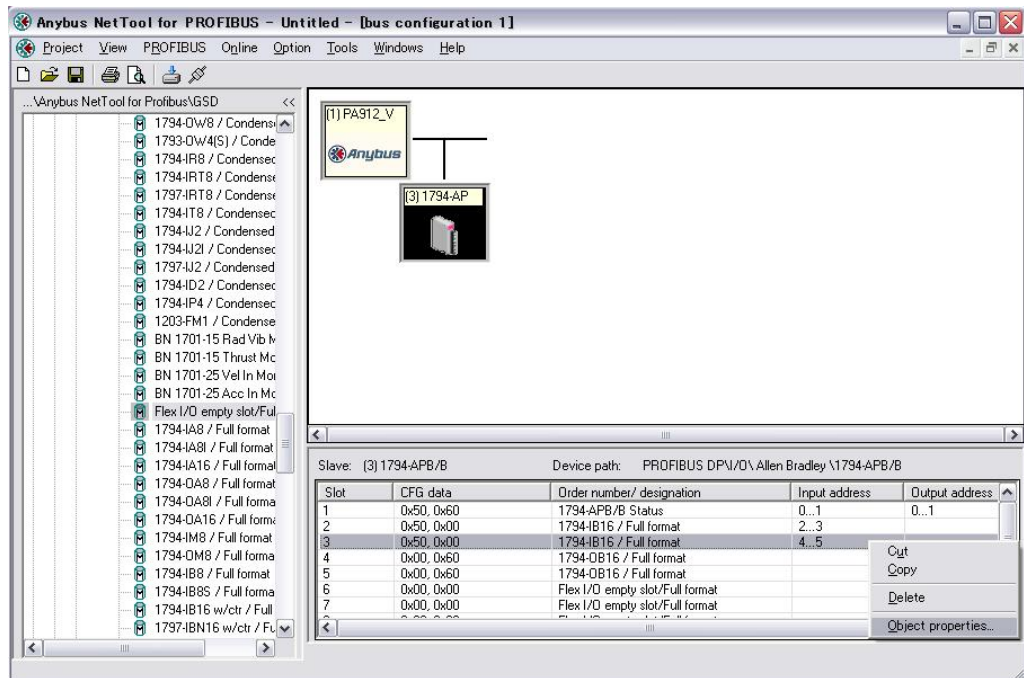


Figure 3-13 Selecting the slave I/O properties

6 Set properties of the slave I/O device.

Set the input and output addresses in the Module properties screen.

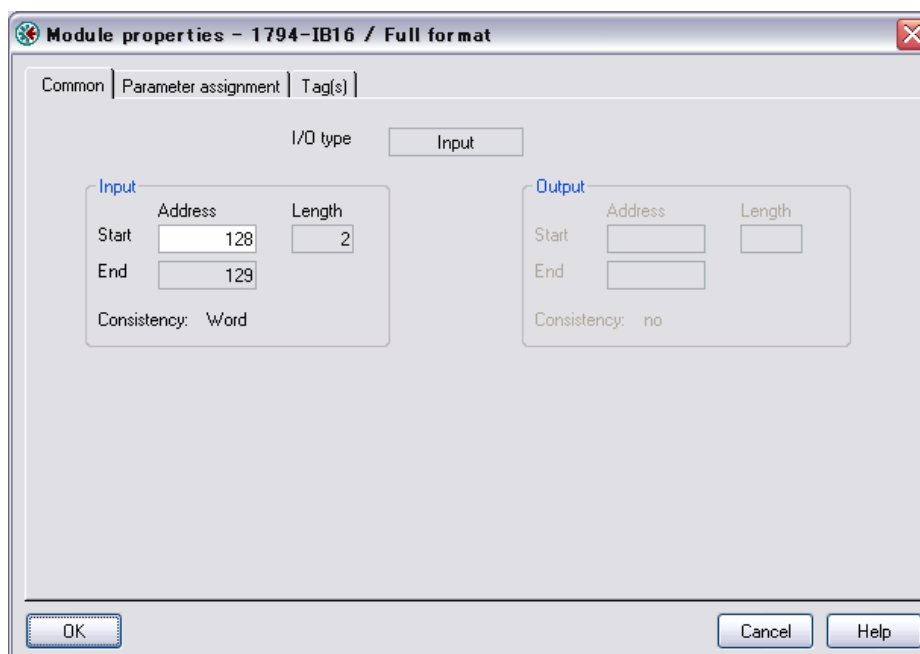


Figure 3-14 Slave I/O property setting

◆ Important

- The minimum data type of the I/O variable in the nV-Tool can be set in increments of 1 word. The Start Address of the slave I/O device must start with an even byte address. If an odd byte address is specified, the configuration cannot be imported to the nV-Tool.
- The Start Address of the slave I/O device must start with a multiple-of-4 byte address in the case of using 2W length data (DINT, REAL, DWORD, TIME, TOD, DATE) in the nV-Tool.

7 Check whether the setting is correct.

After making settings, check the input and output addresses of the slave devices.

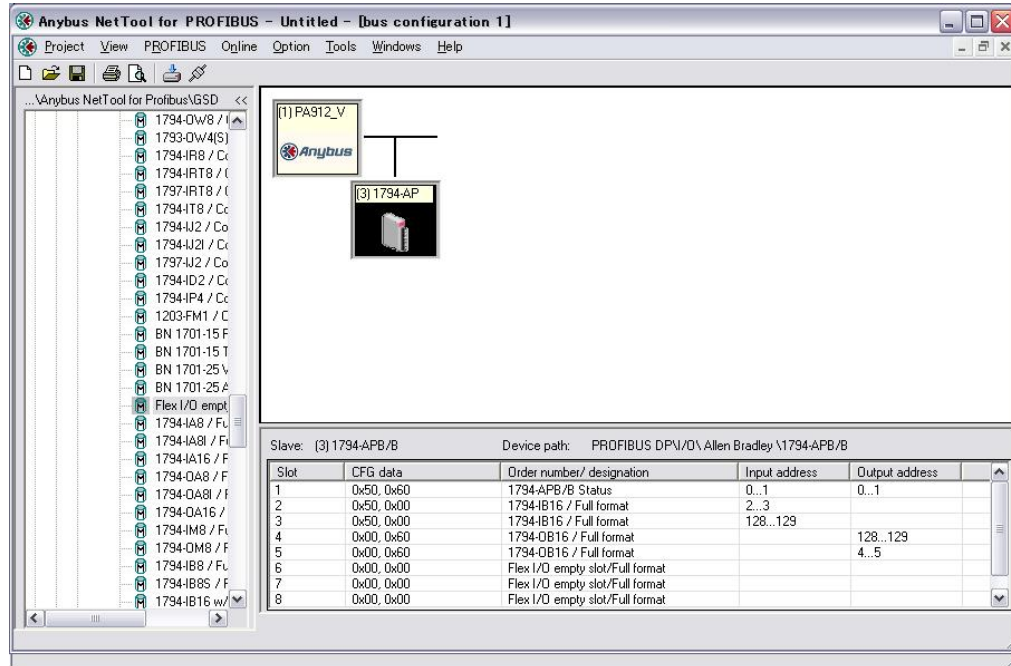


Figure 3-15 Screen after setting the slave I/O properties

8 Store the setting information of the slave device configuration.

Store the registration details. Save them under a new name by selecting the [Project] menu - [Save as].

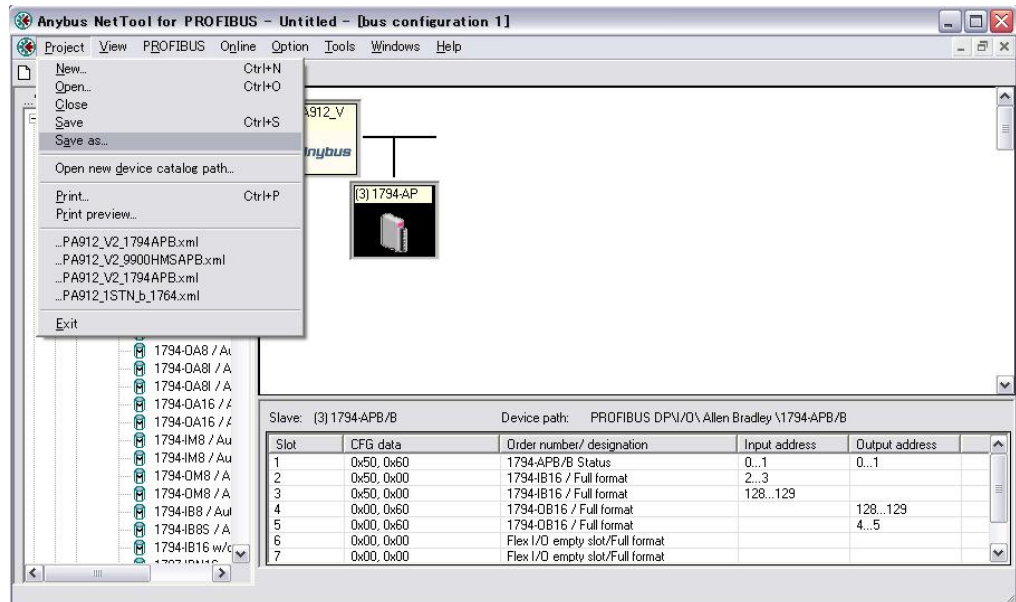


Figure 3-16 Saving the slave I/O device settings

9 Download the registration details to the PA912.

Download the registration details to the PA912. Before downloading, connect the computer to the PA912 CONFIG connector via a cable bundled to the Anybus NetTool-PB.

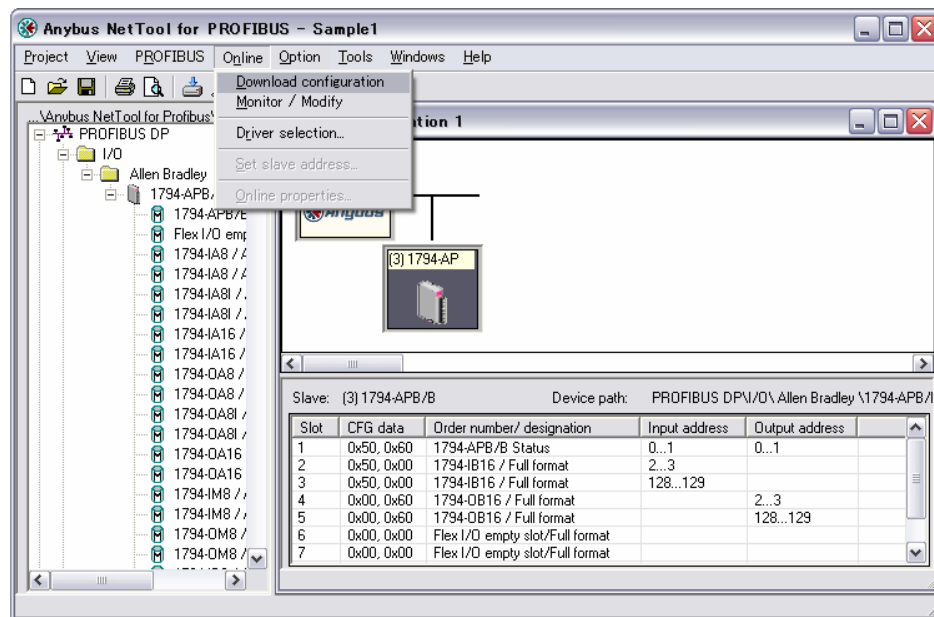


Figure 3-17 Downloading to the PA912

◆ Note

- If Transport Paths of the Anybus NetTool-PB has not been set, the Transport Paths window will open. Make settings for the serial port in the [Serial] tab. For details, refer to the Anybus NetTool-PB Instruction Manual.

◆ Important

- When downloading the registration details to the PA912, nv controller should be in HALT condition and PA912 should be in initial condition (the condition that the DC24V power supply to the PA912 module has turned off, and “COM”, “MODE” and “TOK” of the PROFIBUS status display LED are OFF status). Otherwise an error may occur during the download of the registration details.
- After downloading the registration details to the PA912, turn off the DC24V power supply to the PA912 module once, and turn it on again. Otherwise the settings downloaded will not be enabled.

3.3 Setting with the Engineering Tool

This section explains how to register and set the PA912 module in the nv controller. Make sure to use the nV-Tool V4.5.1 or a later version. For the operation method of the engineering tool, refer to "Unified Controller nv series/Integrated Controller V series nV-Tool (Basic) Instruction Manual"(6E8C4890).

The following illustrates the outline of how to set and register the PA912. For registering and setting the PA912, explanations are given with reference to a system in which the target system, stations and modules (controllers) have been registered.

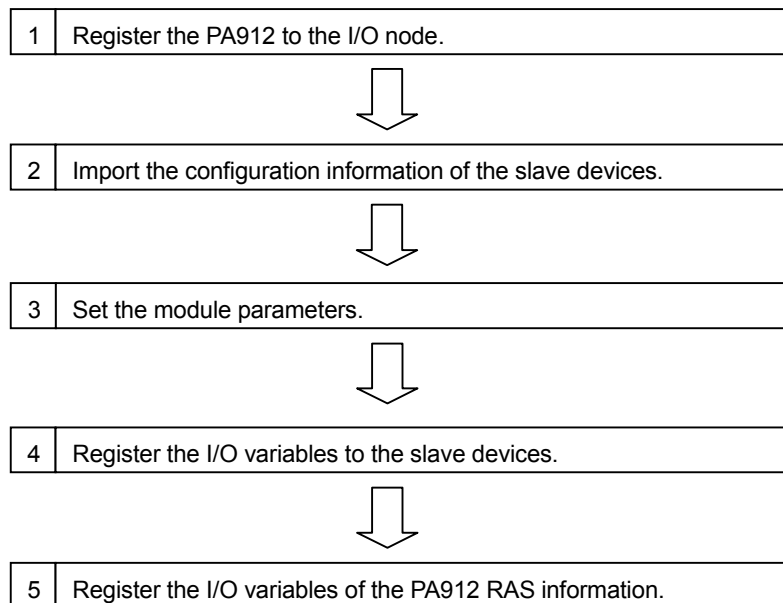


Figure 3-18 nV-Tool registration procedure

3.3.1 Importing the slave device configuration

In the following steps, import the slave device configuration created with the Anybus NetTool-PB.

1 Register the PA912 to the I/O node.

Select [I/O node], and select the [File] menu - [New].

Specify an arbitrary I/O node number and set "I/O node device name = PA912." Then, click the [OK] button.

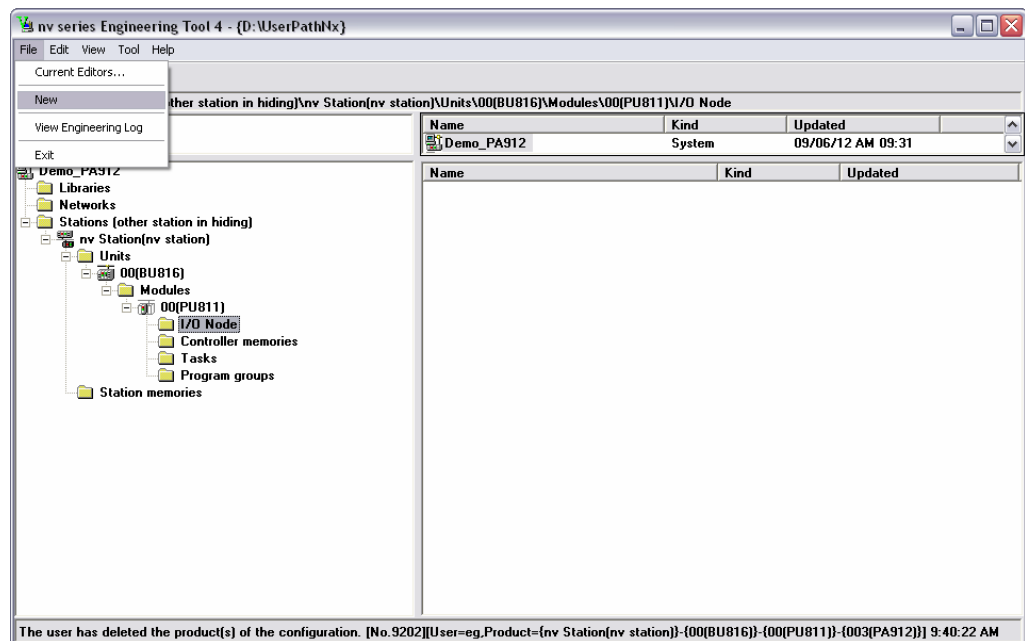


Figure 3-19 New I/O node creation screen

2 Start up Configuration Import.

Select "PA912" to which you wish to import the slave device configuration, and select the [File] menu - [Configuration Import].

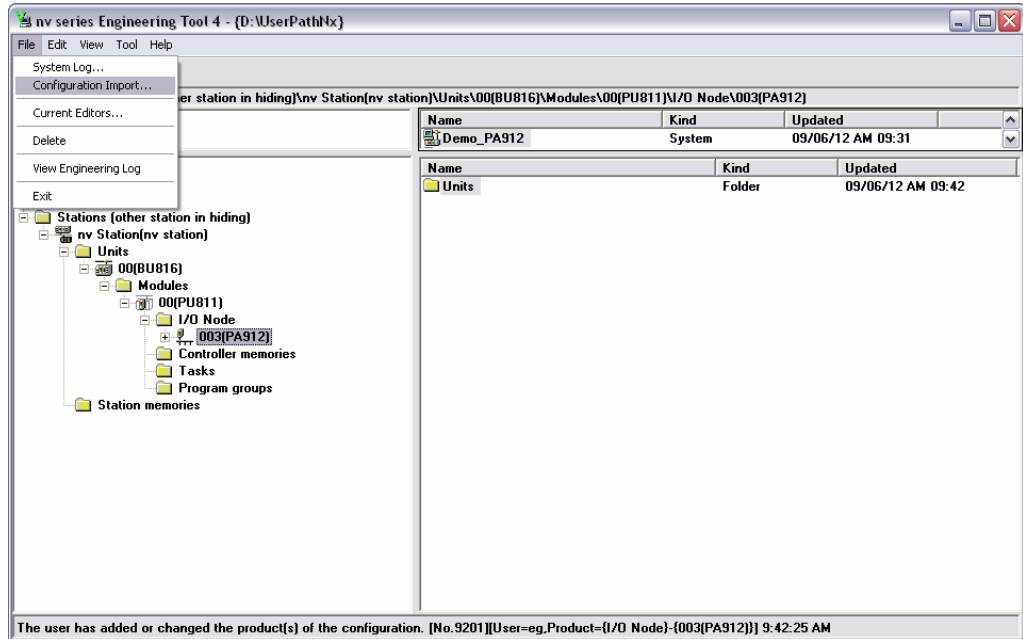


Figure 3-20 Configuration import start-up screen

3 Specify import files.

In the configuration import screen, select the configuration information (a file with an xml extension) saved by using the Anybus NetTool-PB, and click the [OK] button.

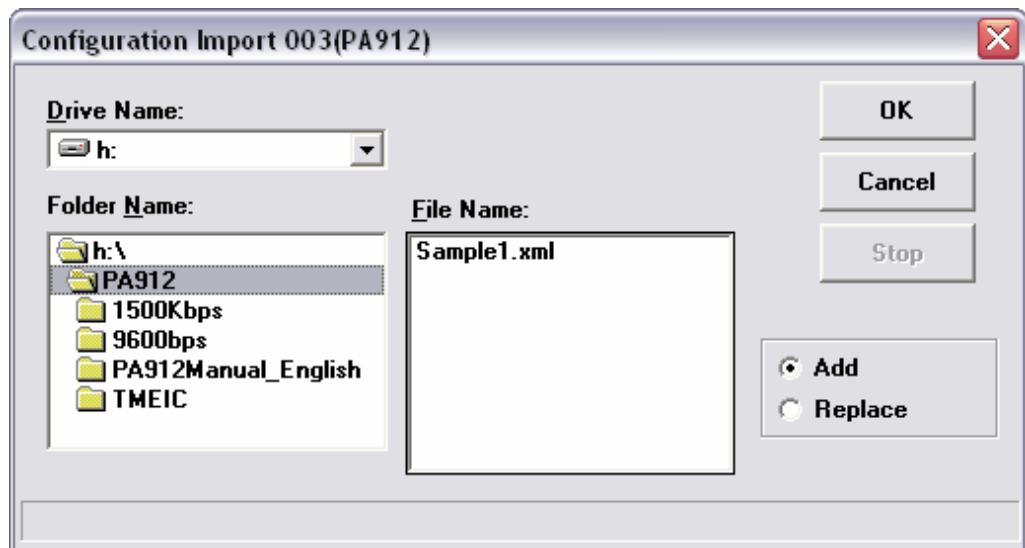


Figure 3-21 Configuration import file designation screen

◆ Note

- Clicking on the [Add] radio button will import the newly added slave devices only. Thus, the I/O variables for the registered slave devices remain available.
- Clicking on the [Change] radio button will delete all the registered slave devices and import new ones.

4 Check the registration details after import.

3

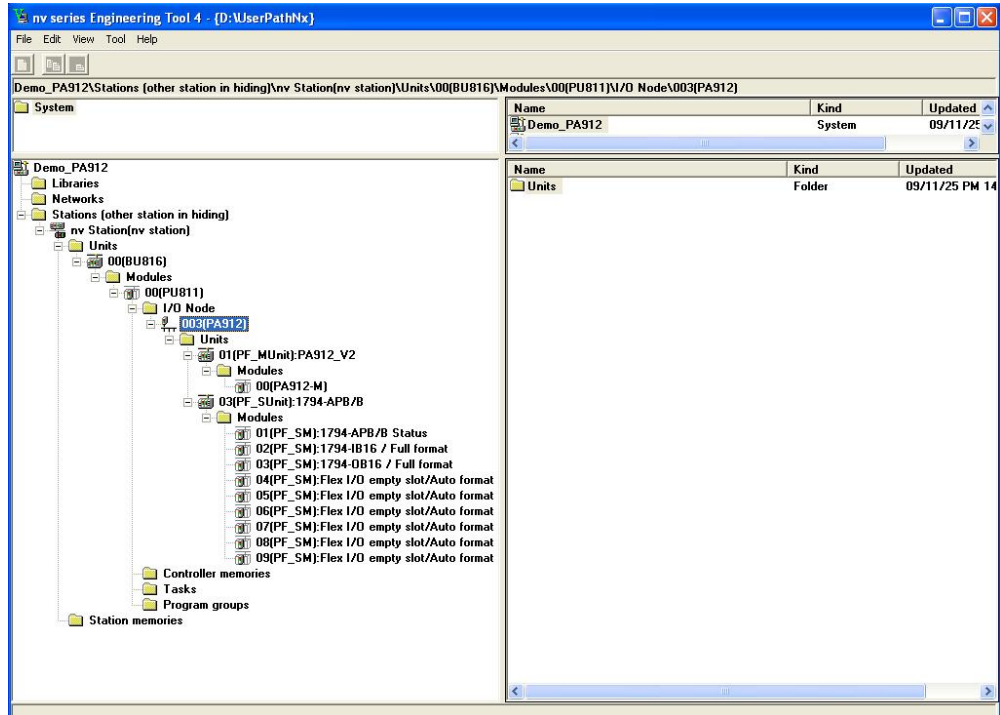


Figure 3-22 Screen after the completion of configuration import

3.3.2 Module parameter setting

Set the module parameters in the PA912-M in the following steps.

1 Open the Module Parameters setting screen.

Select "PA912-M," and select the [File] menu - [Module Parameters].

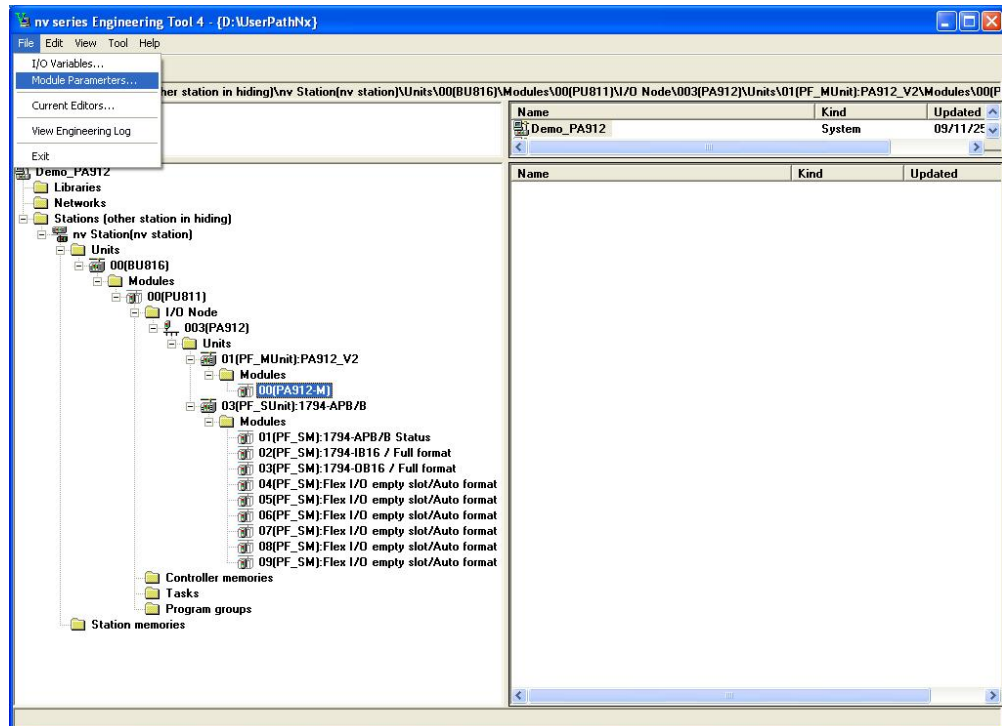


Figure 3-23 Opening the Module Parameters screen

2 Set the module parameters.

Set various kinds of parameters in the Module Parameters screen.

It sometimes occurred that the input data or output data of each pair of high and low byte-address from PROFIBUS slave I/Os set as incorrect order in word address block area. This is caused by the difference between PROFIBUS slave I/Os vendors specification and nv controller specification. To solve this problem, with nV-Tool it is necessary to download the Byte-swap command for the word address which is needed to be swapped.

Select the Slave I/O module parameter and chose the Tabs of Byte swap(IN) or Byte swap(Out). Then select the address of word which you want to swap the data order. After you select the data IN and Out, Turn the MODE switch 3 ON (Refer 3.1.2) and Restart the PA912 with maintenance switch.

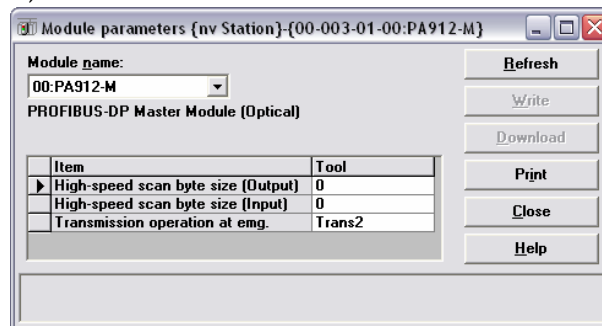


Figure 3-24 Module Parameters screen

◇ Remark

- Refer to "Chapter 1 Introducing the PA912 Module" for details on module parameters.

◆ Important

- After downloading the registration details to the PA912, turn off the DC24V power supply to the PA912 module once, and turn it on again. Otherwise the settings downloaded will not be enabled.

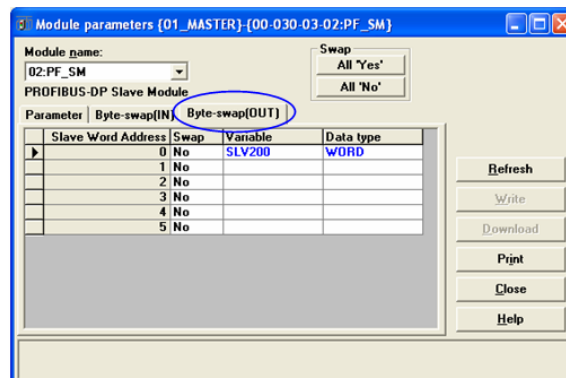


Figure 3-25 Slave Module Parameters screen

◆ Important

- Before setting of the slave word Address of I/Os with the Slave Module Parameters and downloading the registration of byte swap word address to the PA912, Confirm the MODE switch 3 ON. Otherwise the registration will be ignored and Restart the PA912 with Maintenance switch.
- Confirm the nV-Tool version V4.8.3 later.

3.3.3 Registering the I/O variables

1 Add I/O variables to a slave I/O devices.

Select a slave I/O device, and select the [File] menu - [I/O Variables].

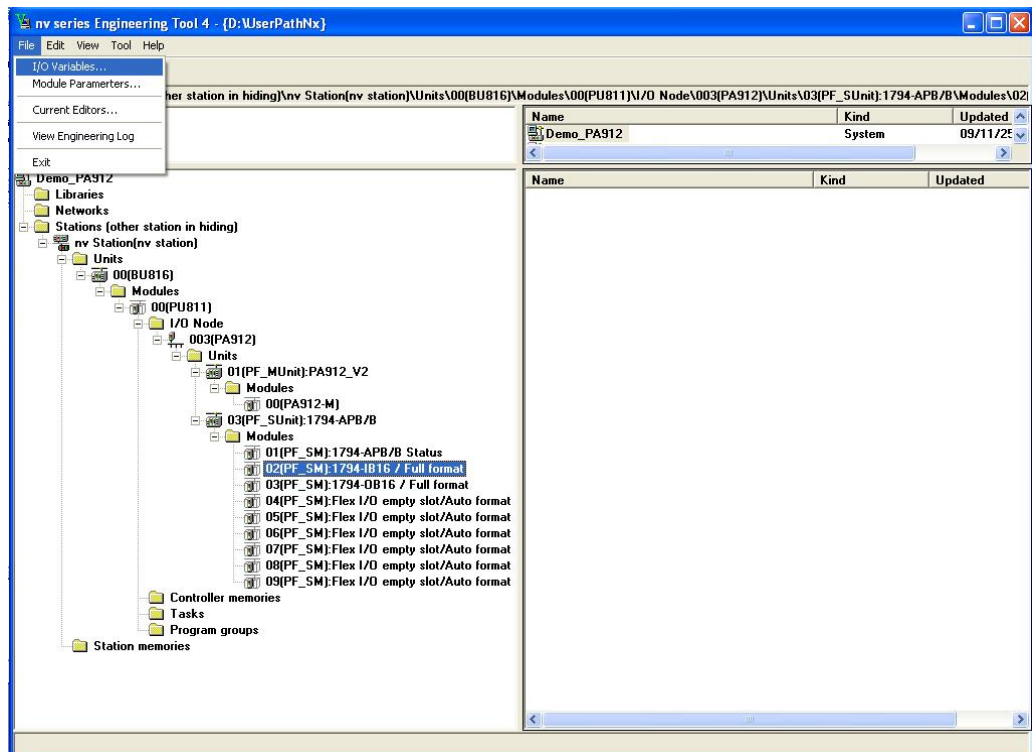


Figure 3-26 I/O variable registration start screen

2 Register I/O variables.

In the I/O Variables screen, make settings for I/O Word No., Bit No., Variable, Data type, Comment (optional), I/O Speed and Task.

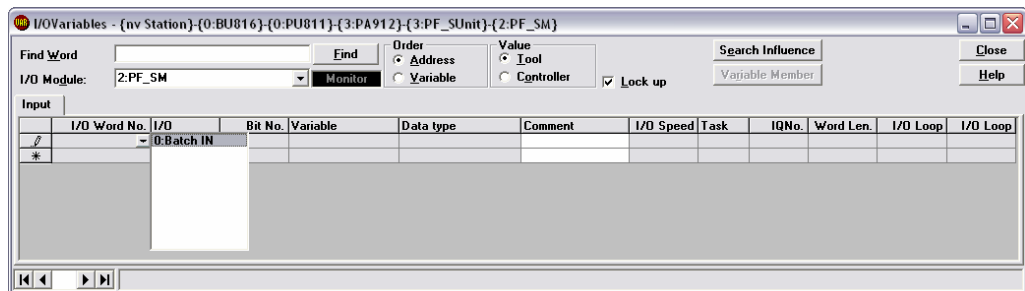


Figure 3-27 I/O variable registration screen

3 Check the details of I/O variable registration.

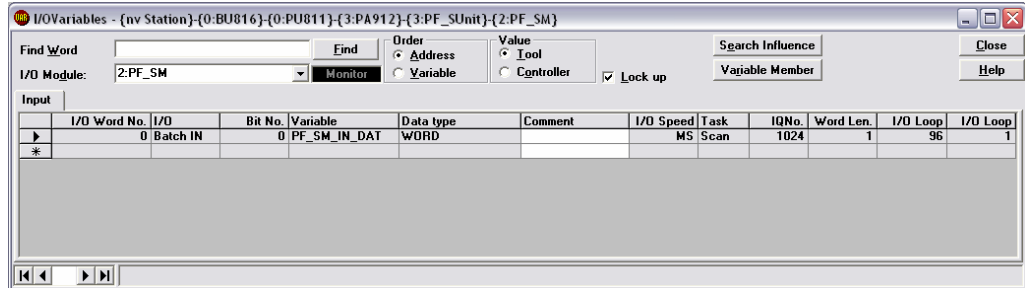


Figure 3-28 I/O Variables screen

4 Register all slave I/O devices.

Repeat the steps 1 - 3 until I/O variables of all slave I/O devices are registered.

3.3.4 Setting the PA912 RAS variables

RAS information such as the operation status of the PROFIBUS slave devices connected to the PA912 as well as the PA912 status information can be registered as the I/O variables and can be referenced by using the nV-Tool.

1 Add I/O variables to the PA912-M module.

Select the PA912-M, and select the [File] menu - [I/O Variables].

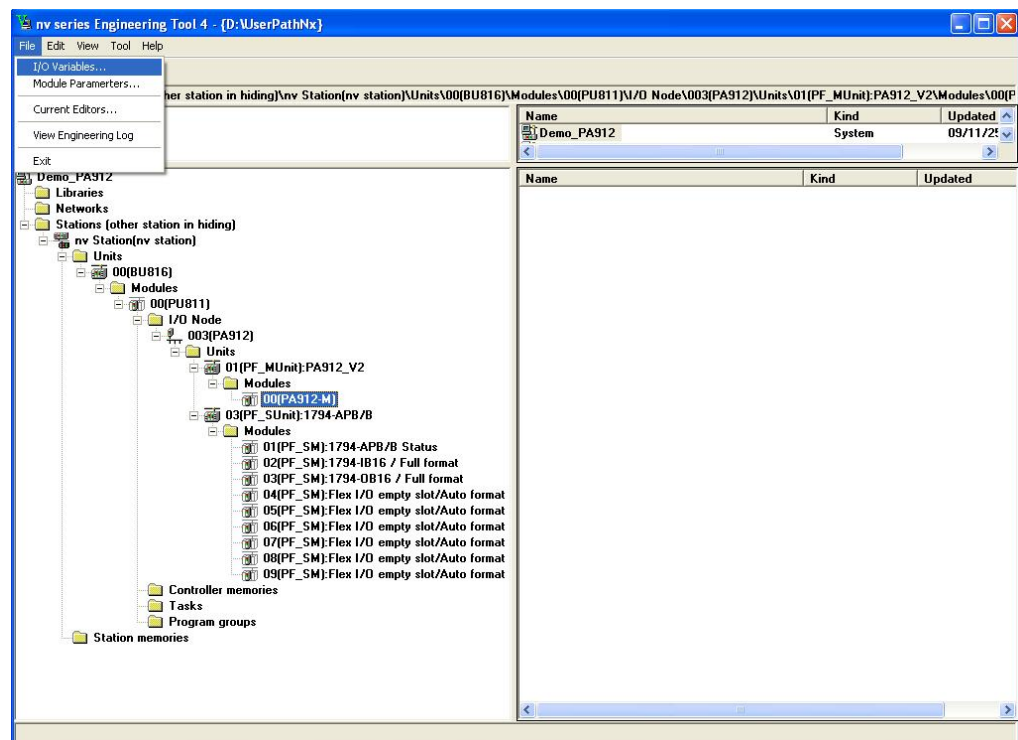


Figure 3-29 I/O variable selection screen

2 Register the I/O variables.

Click the [Default variable] button in the I/O Variables screen.

3

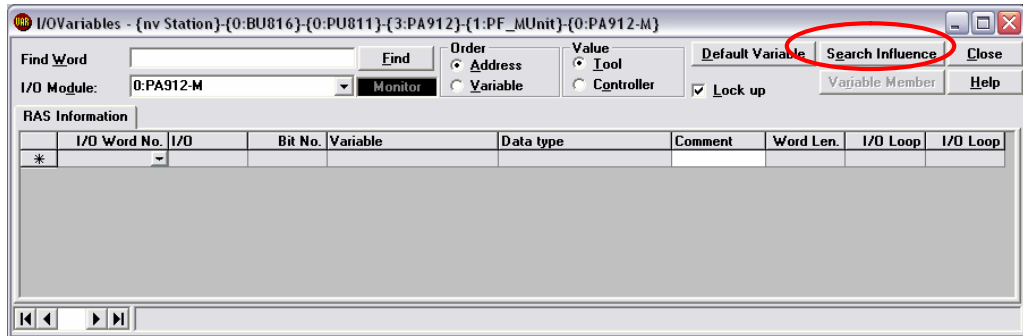


Figure 3-30 I/O variable selection screen

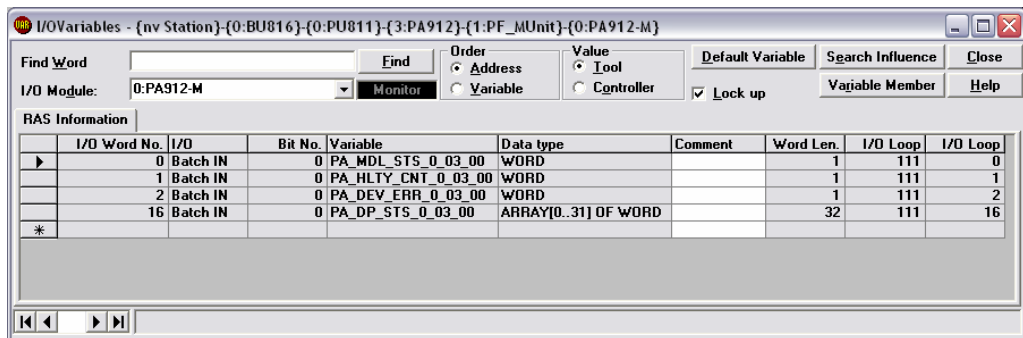


Figure 3-31 Screen after the I/O variable registration

● PF module status (PA_MDL_STS_**)

Indicates the PROFIBUS transmission status of the PA912.

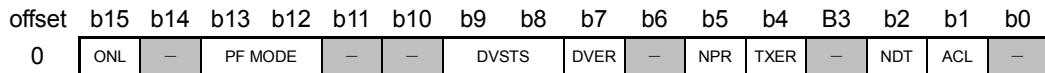


Figure 3-32 PF module status

Table 3-4 PF module status

Name	Description
ONL	1: PA912 in PROFIBUS transmission with one or more devices 0: PA912 not in PROFIBUS transmission with other devices
PF MODE	00: PA912 PROFIBUS transmission in ONLINE status 01: PA912 PROFIBUS transmission in STANDBY status 10: PA912 PROFIBUS transmission in NOT OPERATE status 11: PA912 PROFIBUS transmission in DOWN status
DVSTS	00: Transmission module (PROFIBUS-DP transmission I/F module) in OFFLINE status 01: Transmission module (PROFIBUS-DP transmission I/F module) in STOP status 10: Transmission module (PROFIBUS-DP transmission I/F module) in CLEAR status 11: Transmission module (PROFIBUS-DP transmission I/F module) in OPERATE status
DVER	1: Transmission module (PROFIBUS-DP transmission I/F module) in error status 0: Transmission module (PROFIBUS-DP transmission I/F module) in normal operation
NPR	1: Activation request exists 0: No activation request exists
TXER	1: Transmission error exists 0: In normal operation
NDT	1: Halted slave exists 0: In normal operation
ACL	1: Automatic clear mode is enabled 0: Automatic clear mode is not enabled

◇ Remark

- "ACL(Automatic clear mode)" bit of the Tabele 3-4 PF modeule status is setted as same status as you setted with HMS configurator tool.If the ACL is setted as 1(enable),The output data from PA912 to Profibus Slave I/Os via PROFIBUS network will be cleared(setted as "0") in the case some harmful problem is ocured on the PROFIBUS network and PA912 found the disconnected to Profibus Slave I/Os.

● Healthy counter (PA_HLTY_CNT_**)

Indicates the normal operation status of the PROFIBUS-DP transmission I/F module connected to the PA912.

It is a 16-bit counter updated in intervals of 100 ms, which indicates that the PROFIBUS-DP transmission I/F module is in normal operation. The counter returns to 0000h after FFFFh.

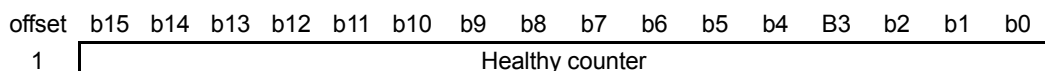


Figure 3-33 Healthy counter

● **Device error (PA_DEV_ERR_**)**

Indicates the error status of the PROFIBUS-DP transmission I/F module.

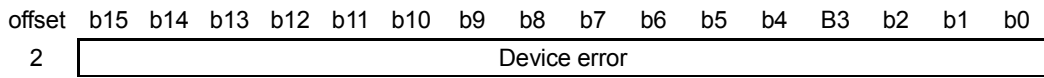


Figure 3-34 Device error

Table 3-5 Device error

Error code	Symbol	Description
0	—	No error
53	SRAM_TEST	SRAM BCC check error in PA912
100	FATAL_ERROR	Fatal error in PROFIBUS-DP interface module
201	Watchdog	Watchdog timer error

● **PROFIBUS-DP status (PA_DP_STS_**)**

Indicates the operation status of the PROFIBUS-DP transmission I/F module.

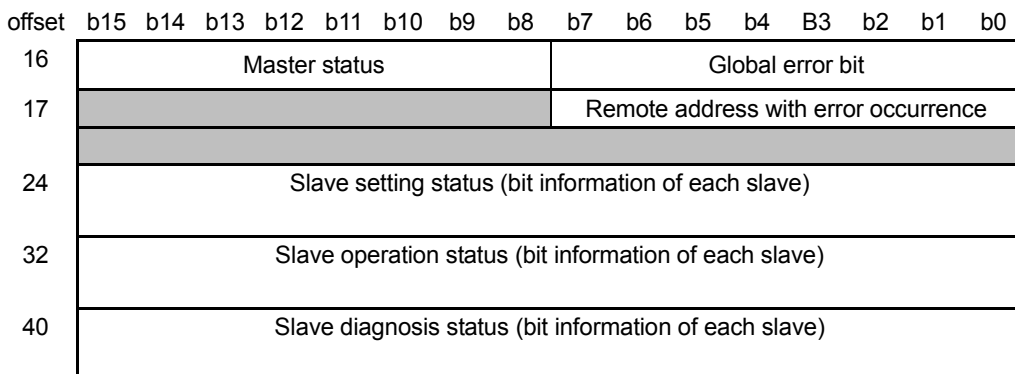


Figure 3-35 PROFIBUS-DP status

◇ Remark

- PA912 verifies the disconnection as minor error via PROFIBUS Slave I/Os within 500ms just after some traffic accident happens (such as cable disconnection).In nV-Tool, User are able to confirm disconnection as minor error at I/O status in System view.
- All PROFIBUS Slave I/Os are disconnected via PA912.PA912 registered the error logs as " PROFIBUS request Timeout". In this case , the below problem ,will be suspected to have been occured and confirmed the equipment and peripherals.
 - All Slave I/Os are not able to operate normally.
 - The PROFIBUS cable connected to PA912 is not disconnected.

◆ Note

- The value of I/O bus healthy settings in nV-Tool are not any meaning to PA912.the I/Os which are indicated in nV-Tool does not mean the PROFIBUS -bus I/Os belongs to PA912.

- **Global error bit**

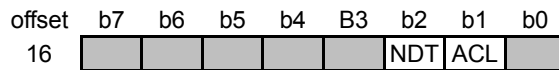


Figure 3-36 Global error bit

Table 3-6 Global error bit

Name	Description
NDT	1: Halted slave exists 0: In normal operation
ACL	1: Automatic clear mode is enabled 0: Automatic clear mode is not enabled

- **Master status**

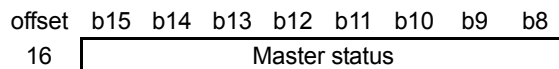


Figure 3-37 Master status

Table 3-7 Master status

Value	Name	Description
00h	OFFLINE	Offline status
40h	STOP	Master-slave data transmission halted
80h	CLEAR	Slave input information can be read out; output is cleared or retained.
C0h	OPERATE	Cyclically inputting/outputting data

- **Remote address with error occurrence**

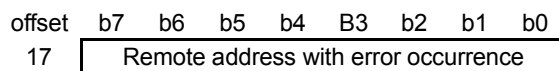


Figure 3-38 Remote address with error occurrence

Table 3-8 Remote address with error occurrence

Value	Description
00h	No error in master module
FFh	Error in master module

• slave setting status

offset	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	B3	b2	b1	b0
24	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
25	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
26	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
27	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
28	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
29	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
30	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
31	—	—	125	124	123	122	121	120	119	118	117	116	115	114	113	112

Figure 3-39 Slave setting status

Table 3-9 Slave setting status

Value	Description
1	Remote node is set
0	Remote node is not set

• Slave operation status

offset	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	B3	b2	b1	b0
32	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
33	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
34	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
35	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
36	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
37	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
38	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
39	—	—	125	124	123	122	121	120	119	118	117	116	115	114	113	112

Figure 3-40 Slave operation status

Table 3-10 Slave operation status

Value	Description
1	Remote node is in operation
0	No remote node or operation was halted

- **slave diagnosis status**

offset	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	B3	b2	b1	b0
40	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
41	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
42	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
43	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
44	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
45	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
46	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
47	—	—	125	124	123	122	121	120	119	118	117	116	115	114	113	112

Figure 3-41 Slave diagnosis status

Table 3-11 Slave diagnosis status

Value	Description
1	New diagnosis information exists
0	New diagnosis information does not exist

Chapter 4

Startup and Shutdown

This chapter describes the operations of the PA912 module, such as checking before operation, startup, and shutdown.

4.1	Checking the Switch before Startup	64
4.2	Startup	64
4.3	Shutdown	65

4.1 Checking the Switch before Startup

Check the switch and wiring before startup. For details, refer to "Chapter 2 Installation and wiring."

For startup and shutdown of the power supply, refer to "Unified Controller nv series Controller Unit Operation Manual (6F8C1220)."

4.2 Startup

4

To start up the unified controller, do the following.

1 Turn on the power of the controller unit.

The POWER LED of the power supply module illuminates in green.

2 Turn on the TC-net I/O base unit external power supply.

3 Turn on the PROFIBUS slave I/O external power supply and slave I/O load power supply.

Share the external power supply and load power supply whenever possible.

If this is not possible, construct the system so that the external power supply and load power supply are turned on simultaneously (or in the order of external power supply → load power supply).



CAUTION

Turn on the power in the following order:

Turn on the power of the nv series and then turn on the TC-net I/O base unit external power supply, and finally turn on the PROFIBUS slave I/O external power supply and slave I/O load power supply.

If this order is not followed, it may cause an accident or damage to the machine due to malfunction.



Mandatory

4 Change the operation mode switch of the controller module to "RUN."



CAUTION

It is rarely happened that Minor Error about I/O node is registered on the system log of PA912, and some seconds later the error is recovered, when the controller mode is turned to be as RUN-mode. This I/O flicking error is caused by the delay of starting up of PROFIBUS Slave I/Os, though PA912 and controller starts and found each others via TC-net I/O Loop more faster. The timing performance of Slave I/Os starting up is depends on the characteristics of the its manufacturer.



Mandatory

4.3 Shutdown

To shut down the unified controller, do the following.

- 1** Change the operation mode switch of the controller module to "HALT."
- 2** Turn off the PROFIBUS slave I/O external power supply and slave I/O load power supply.

If the external power supply and load power supply cannot be shared, construct the system so that they are turned off simultaneously (or in the order of load power supply → external power supply).

- 3** Turn off the TC-net I/O base unit external power supply.
- 4** Turn off the power of the controller unit.



CAUTION

For system safety, turn off the PROFIBUS slave I/O load power before the power of the nv series.



Mandatory

If this order is not followed, it may cause an accident or damage to the machine.

Share the external power supply for the PROFIBUS slave I/O device with the load power supply whenever possible. If this is not possible, construct the system so that the external power supply and load power supply are turned off simultaneously.

Chapter 5

Troubleshooting

This chapter describes troubleshooting for the PA912 module.



If the state display LED of the product displays anything different from the normal display as described in "Table 1-3 Display details on the TC-net I/O loop state display LED" on page 10, or if any error is detected in the human interface station, stop using it immediately and contact one of Toshiba's service representatives.

■ Fault diagnosis method for PA912 module

Check the LED status of the module on the front of PA912 module.

Perform diagnosis by referring to the following table.

Table 5-1 Diagnosis of the PA912 using LED (1)

State name	LED display		State	Remedy
	RUN	ERR		
Normal operation	ON	OFF	Normal	—
Abnormal operation	OFF	ON	Module error	Replace the module. Contact one of Toshiba's service representatives.

■ Fault diagnosis of the TC-net I/O loop

Check the LED status of the TC-net I/O loop on the front of PA912 module.

Perform diagnosis by referring to the following table.

Table 5-2 Diagnosis of the PA912 using LED (2)

State name	State display LED		Transmission loop connector LED				State	Remedy
	LP	SCAN	LNK1	ACT1	LNK2	ACT2		
Normal operation	ON	ON	ON	Blinking	ON	Blinking	Normal	—
Abnormal operation	OFF	OFF	OFF	Other than the above	OFF	Other than the above	I/O loop transmission error	Contact one of Toshiba's service representatives.

■ Fault diagnosis of the PROFIBUS transmission

Check the LED status of the PROFIBUS transmission on the front of PA912 module. Perform diagnosis by referring to the following table.

Table 5-3 Diagnosis of PROFIBUS using LED

State name	State display LED				State	Remedy
	CFG	COM	MODE	TOK		
Normal operation	On (green)	On (green)	On (green)	On (green)	Normal	—
Abnormal operation	Other than the above	Other than the above	Other than the above	Off	Error	Refer to the Table 1-4 (on page 11)

■ Reading the system log

System logs of the I/O node are collected for analyzing problems.

System logs of the I/O node can be collected with the Unified Controller nv series/Integrated Controller V series Engineering Tool nV-Tool.

The procedure to collect system logs is shown below. Also refer to the online help of the nV-Tool, and "Unified Controller nv series/Integrated Controller V series Engineering Tool 4 Basic Operation Manual (6F8C1290)."

1 Display the system view.

2 Display the state of the I/O node.

To display the state of the I/O node, select the controller and click the I/O node state button, or double-click the [I/O state] area. The typical alarm states of the I/O node and I/O module are displayed by I/O node.

3 Display the system logs.

To display the system logs of the I/O node, select the PA912 and select <View><System log> from the menu.

4 Save the displayed system logs to a file.

The system log information displayed on the screen can be saved to a file in the CSV format.

To save, select <File><Save file> from the menu.

5







Chapter 6



Maintenance and Inspection



This chapter describes maintenance and inspection such as daily inspection, periodical inspection, and cleaning of PA912 module.

6.1	Inspection	73
6.1.1	Daily inspection	73
6.1.2	Periodical inspection	74
6.2	Maintenance Parts	75

	WARNING For safety, avoid touching the interior of the product. It may cause an electric shock.	 Mandatory
---	---	--

	CAUTION When touching the product for cleaning, remove the static electricity from your body. The static electricity accumulated in the human body may cause failure of the product.	 Mandatory
---	--	--

	CAUTION When cleaning the product, do not change the switch setting. Do not exert any stress on the cables. Exerting stress on the cables by touching them may cause malfunction or accidents.	 Prohibited
---	---	---

	CAUTION Stop using immediately when an error occurs. When an error occurs such as unable to turn on the power, stop using and contact one of Toshiba's service representatives.	 Mandatory
--	---	---

6.1 Inspection

6.1.1 Daily inspection

For daily inspection, check the following.



CAUTION

When there is any smoke or strange odor, turn off the power.

Otherwise, it may cause a fire or electric shock.



Mandatory

◇ Remark

- To keep the system normal and avoid unnecessary troubles, perform daily inspections, periodical inspections, and cleaning.

■ Front panel

<LED>

Check if each of the LEDs is visible. If not, clean it with a soft cloth.

Be careful not to change the switch settings. Check the LED state from the front side.

<PROFIBUS connector>

Check the following:

- The cable is connected correctly.
- Cable connection is normal.
- Cable connection is not loose or has an abnormal appearance.

If any abnormality is found, follow the procedure in “chapter 5 Troubleshooting.”

■ Ventilation hole

Check the front panel and upper ventilation hole of the product for dust or stain. If the ventilation hole is blocked by dust or stain, remove the dust with a vacuum cleaner, and then wipe it with a soft cloth.

■ Indoor environment

Check if the temperature and humidity of the location where the product is located are within the product specification range (Table A-1 in Appendix A).

6.1.2 Periodical inspection

Check the following items regularly (about once every 6 months). Also, check them when the ambient condition or environment changes.



WARNING

Be extremely careful when measuring the power supply voltage at the power terminal part of the module during an inspection.

Otherwise, it may cause an electric shock.



Mandatory



WARNING

Do not modify, repair, disassemble, or adjust the device, module, or board.

It may cause an electric shock, fire, injury, or failure.

In case of an operation error or failure, contact one of Toshiba's sales representatives.



Prohibited

Table 6-1 Periodical inspection items

Item	Inspection details	Criteria
Installation state	Check if the I/O base unit is fixed firmly to DIN rail and if the module of the I/O base unit is secured.	No looseness or backlash
	Check for looseness of the cable connector and damage of the cable.	No looseness or damage
PA912 module	Measure voltage at the I/O base unit terminal block of BU90A.	Within specified values
	Check the state display LED.	Illuminates normally
PROFIBUS slave I/O	Check the input state display LED.	Illuminates normally
	Check the output state display LED.	Illuminates normally
	Check if the I/O terminal block is secured.	No looseness or backlash
	Check for looseness of the terminal screw.	No looseness
	Check for damage of the wiring cable.	No damage
Ambient environment	Check if the temperature, humidity, vibration, dust are within the specified values.	Within the general specifications

6.2 Maintenance Parts

For early recovery in case of failure, it is recommended preparing at least the following maintenance parts.

Table 6-2 Maintenance parts

Product name	Quantity	Remark
PA912 module	1	To limit system down to the minimum, at least one should be kept as a spare.
Optical cable	1	To limit system down to the minimum, at least one each should be kept as a spare.
PROFIBUS transmission cable	1	

◆ Important

- When storing spare items, avoid a place with high temperature or humidity.

6

Appendix A

Specifications

A.1	General Specifications	78
A.2	PA912 and BU90A Specifications	79
A.3	PA912 Transmission Specifications	80
A.4	DC 24V System Power Supply Specifications	81
A.5	Serial Communication Port (RS-232C) Transmission Specifications	82
A.6	Byte-swap mode Specifications	82

A.1 General Specifications

Table A-1 PA912 general specifications

Item	Specification
Operating temperature range (product ambient temperature)	0 to 55°C
Operating humidity range	10 to 95%RH (no condensation)
Storage temperature range	-40 to 70°C
Dust	0.3mg/m ³ or less (no conductive dust)
Vibration resistance	5≤f<9: half amplitude 3.1mm 9≤f<150: constant acceleration 9.8m/sec ²
Shock resistance	147m/S ² (3-axis directions)
Grounding	D-class grounding with ground resistance of 100 Ω or less (prescribed by the Japanese Ministerial Ordinance)
Atmosphere	No corrosive gas
Withstand voltage (between power terminal and FG)	500VAC, 1 minute

Keep the product at normal temperature and humidity when storing it for a long period of time.

Table A-2 Environment for long-time storage

Item	Environment
Temperature	0-40°C
Humidity	20-80% RH (no condensation)
Rate of temperature change	10°C/H or lower
Storage style	Keep the product in a packaging box before storage.

A.2 PA912 and BU90A Specifications

Table A-3 shows the specifications of PA912 and BU90A

Table A-3 PA912/BU90A specifications

Category	Item	Specification
Performance specification	Fault detection	Watchdog timer error Memory ECC error (common memory) Bus timeout error, etc.
TC-net I/O loop specification	System	Optical
	Topology	Loop
	Transmission speed	100Mbps
	Redundancy	Redundant loop
	Number of nodes connected	Up to 254 nodes
	Number of I/O adaptors connected	Up to 32 adaptors
	Transmission cable	Optical fiber (core diameter/clad 50/125, 62.5/125)
	Connection connector	Optical module
	Maximum cable length	2km
	Total extension	4km
	Communication service	Scan transmission/message transmission
	Scan cycle	High-speed scan: 100 μ s or more Middle-speed scan: 1ms or more
Scan transmission capacity	64kW/system (1024 blocks/system) Maximum transmission capacity 32kW/node	
Module specification	Cooling method	Natural air cooling
	Dimensions	PA912: 35 × 185 × 95mm BU90A: 72 × 200 × 30mm
	Weight	PA912 + BU90A: 500g or less
	Power voltage range	20.4 to 26.4VDC (24VDC+10% -15%) Supplied from the BU90A power supply terminal block
	Power terminal	M3.5 screw terminal block (BU90A)
	Current consumption (when rated power is fed)	0.5A or less (24VDC) for a PA912
	Communication interface	PROFIBUS-DP

◆ Important

- The PA912 is restricted to use the combination of the versions between PA912 firmware and the GSD.(See the table below).If the correct combination of versions is not used, the input and output data is set to be incorrect.
- To avoid to use the incorrect combination of the versions PA912 firmware and Gsd. Confirm the versions of the PA912 firmware version with nV-Tool.
- To enable byte-swapp mode,PA912 firmware version V2.2x or later and nV-tool version also 4.8.3 or later

[Combination versions between PA912 firmware and GSD]

PA912 firmware version	PA912 GSD version	nV-Tool Version	Byte-swap mode
V1.00	TSB_0C32.gsd	4.5.1	Not Avail
V2.01	TSB_0C32_V2.gsd	4.6.0 or later	Not Avail
V2.10	TSB_0C32.gsd	4.6.0 or later	Not Avail
V2.20 or later	TSB_0C32_V2.gsd	4.8.3 or later	Avail
	TSB_0C32.gsd		

A.3 PA912 Transmission Specifications

Table A-4 PA912 transmission specifications

Item	Specification
PROFIBUS standard	EN50170, IEC61158
PROFIBUS protocol version	DP-V0
Topology	Bus topology
Number of transmission stations (including the PA912)	Up to 32 stations/segments (no repeater) Up to 124 stations (up to 9 repeaters)
Data transmission speed	9.6 kbps-12 Mbps
Physical layer	RS-485 (with photocoupler isolation)
Transmission code	Manchester code
Modulation method	Baseband
Access method	Token passing
Transmission service	Cyclic transmission Input: 768 words + RAS information 35 words Output: 768 words

A.4 DC 24V System Power Supply Specifications

Table A-5 shows the requirements specifications of the DC 24V system power supply that supplies power to the BU90A.

Recommended power supply: TDK Lambda K.K. EWS-□□-24 (power capacity: □□)

Table A-5 System power supply specifications

	Specification	Remark
Power voltage range	20.4-26.4 V (24 V +10% -15%)	
Ripple voltage	24 V 5% or lower (p-p)	
Protection circuit	Overcurrent and overvoltage protection circuits required. The overvoltage protection circuit should detect the overvoltage from 27 to 33 V.	

A.5 Serial Communication Port (RS-232C) Transmission Specifications

Table A-6 Serial specifications

Item	Specifications
Data transmission speed	Max. 9600 bps
Synchronization method	Asynchronous
Transmission cable	Cross cable with 9-pin-9-pin D-sub connector
Cable length	Max. 15 m
Communication method	Half duplex
Communication setting	<ul style="list-style-type: none"> •Parity bit: none •Character length: 8 bits •Stop bit: 1 bit

A.6 Byte-swap mode Specifications

With Byte-swap mode, PA912 automatically rearrange data of the byte address order in TC-net I/O loop common area ,both Input and Output area, via PROFIBUS Slave I/Os by referring the Slave I/O's configuration information.

So, data in TC-net I/O loop common area is converted to little-endian ordinarily. Expectation is the case of which Slave I/O transfer its data to PROFIBUS as little-endian order with word-type. Data transferring type is depend on the Slave I/O's manufacturer's specification, and At that case User is needed to send byte-swap command by nv-tool (Detail is described at Chapter. 3)

Table A-7 PROFIBUS I/O's Transfer specifications

PROFIBUS Slave I/O Transfer Specification		Byte-swap mode	
Data Format type	Order	Valid	In-valid
Byte	—	○	×
Word	Big-endian	○	○
	Little-endian	□	×

- : Order in the TC-net common area is correct .and No need for additional setting.
- : Order in the TC-net common area is incorrect.(Byte-swap is occurs) and User is needs for additional setting by nv-tool.
- × : Order in the TC-net common area is incorrect.(Byte-swap is occurs). and User is needs to set PA912 as byte-swap mode.

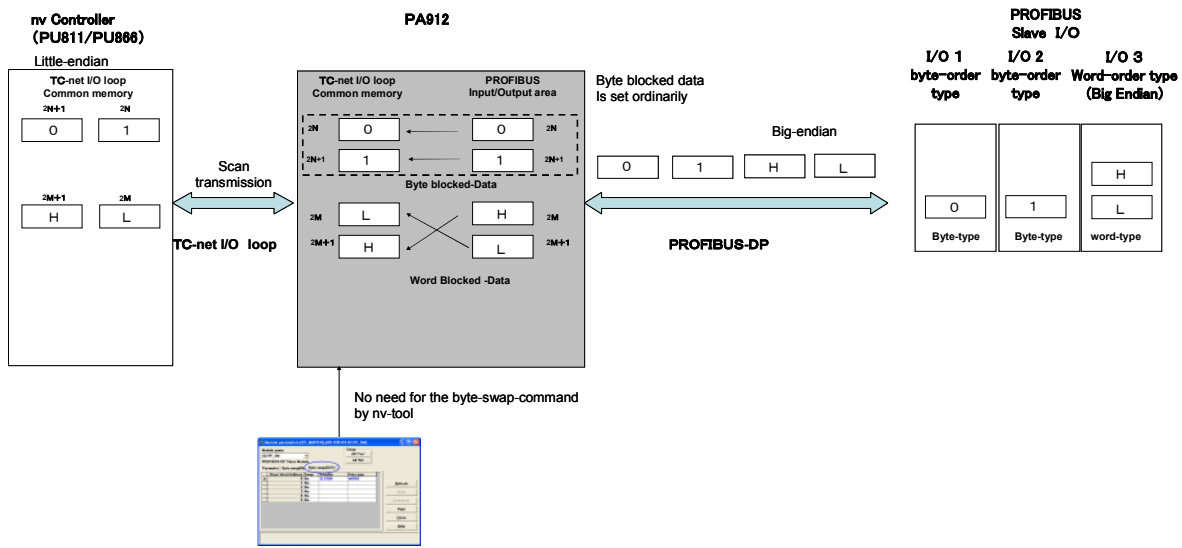


Figure A-1 Case: Unnecessary for additional setting by nV-Tool (Byte-swap mode)

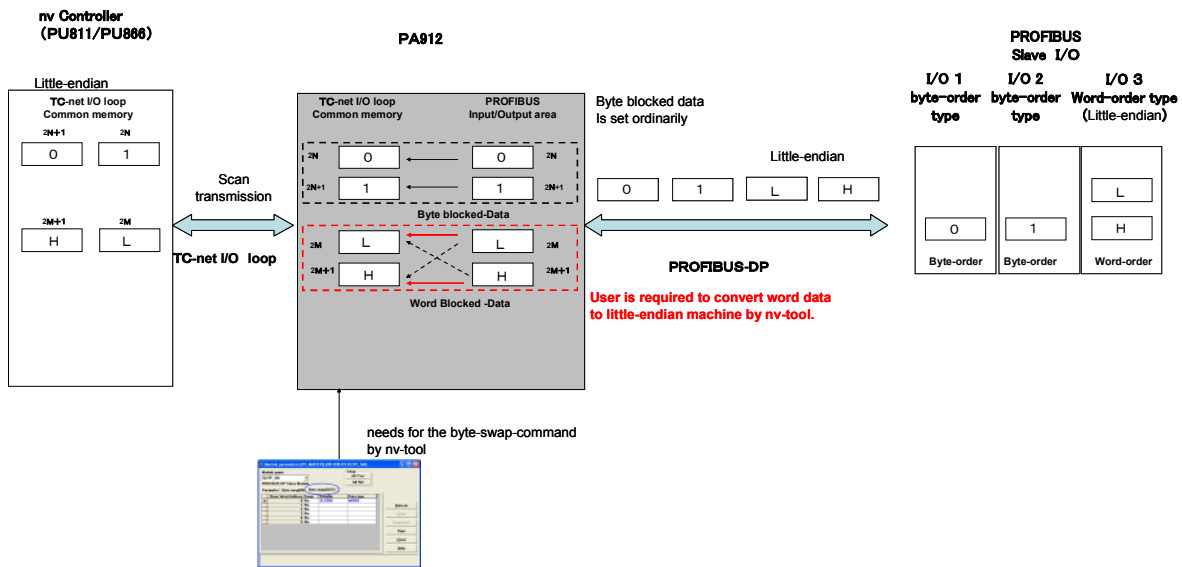


Figure A-2 Case: Necessary for additional setting by nV-Tool (Byte-swap mode)

◆ Note

- Scope of byte-swap mode is word-type.
- To enable Byte-swap mode, it is necessary to set the Operation mode switch 3 ON. Confirm the PA912 Firmware version V2.2x or later and nV-Tool V4.8.3 later, before you enable the switch No.3 ON.(more information about how to use the byte-swap mode, refer 3.3.2)
- After you set the switch No.3 ON for enabling the Byte-swap mode, Do not forget the restart PA912 with the Maintenance switch.
- While Byte-swap mode ON, the performance of exchanging Input data and output data between TC-net I/O Loop and PROFIBUS Slave I/Os will get worsen about 20percent at worst case, compared Byte-swap mode OFF.
- If the Byte-swap mode OFF with switch No.3 OFF, factory default settings, PA912 ignore the Byte-swap command from nV-tool.



Appendix B

Outside Dimensions

B

The following figure shows the outside dimensions of the combination of PA912 and BU90A.

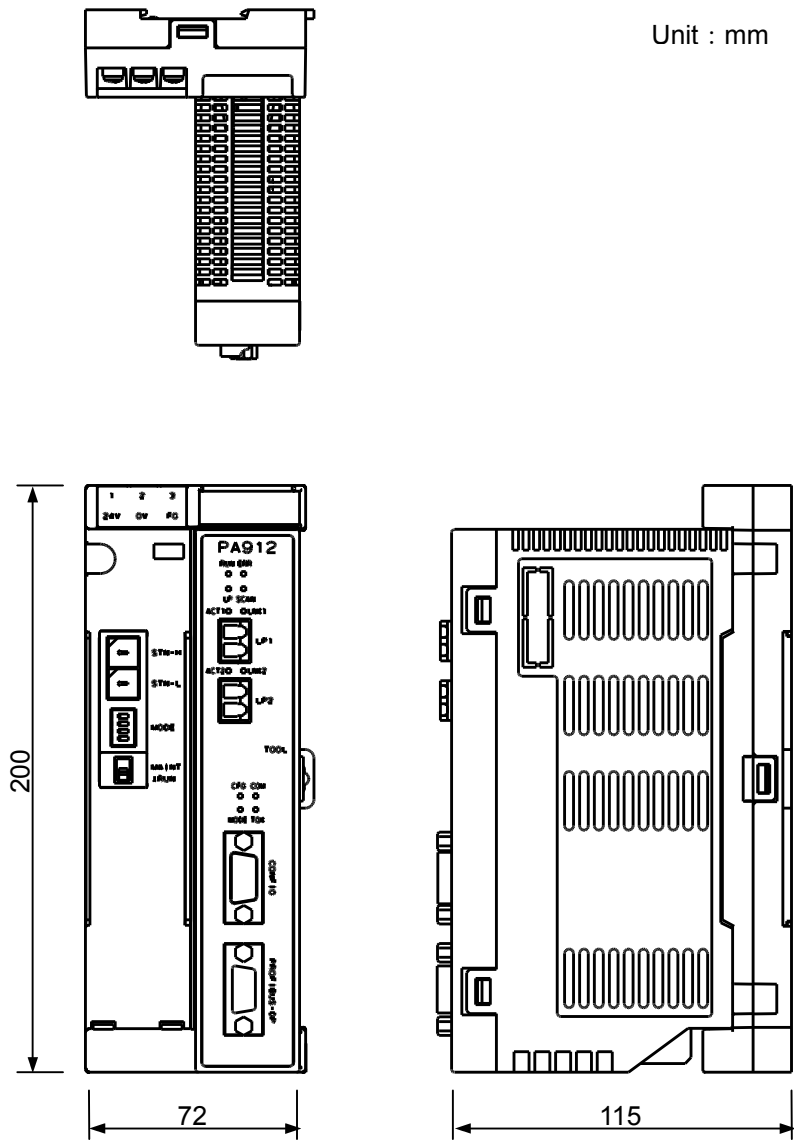


Figure B-1 Outside dimensions of the combination of PA912 and BU90A

Appendix C

Related Products



Table C-1 Related products (cable/connector)

Item	Specification	Remarks
PROFIBUS twisted pair cable	Type A cable for PROFIBUS-DP	For details, refer to the website of PROFIBUS International (http://www.profibus.com/)
PROFIBUS connector	D-SUB 9pin connector (IP20)	

Table C-2 Related products (PROFIBUS configurator tool)

Product name	Manufacturer	Applicable OS
Anybus NetTool-PB	HMS Industrial Networks	Windows 98/ME/NT/2000/XP/Vista

◆ Note

- HMS PROFIBUS configurator tool (Anybus NetTool-PB) is not bundled to the PA912 module package. Purchase the tool separately.(See the web site of configurator tool manufacturer HMS <http://www.anybus.jp/>)
- The Target versions of HMS PROFIBUS configurator tool (Anybus NetTool-PB) is Ver 1.6.1.1 or later versions.

Appendix D

Decimal-hexadecimal Conversion Table

Table D-1 Decimal-hexadecimal conversion table (1)

Decimal	Hexadecimal	Decimal	Hexadecimal	Decimal	Hexadecimal	Decimal	Hexadecimal
0	0	32	20	64	40	96	60
1	1	33	21	65	41	97	61
2	2	34	22	66	42	98	62
3	3	35	23	67	43	99	63
4	4	36	24	68	44	100	64
5	5	37	25	69	45	101	65
6	6	38	26	70	46	102	66
7	7	39	27	71	47	103	67
8	8	40	28	72	48	104	68
9	9	41	29	73	49	105	69
10	A	42	2A	74	4A	106	6A
11	B	43	2B	75	4B	107	6B
12	C	44	2C	76	4C	108	6C
13	D	45	2D	77	4D	109	6D
14	E	46	2E	78	4E	110	6E
15	F	47	2F	79	4F	111	6F
16	10	48	30	80	50	112	70
17	11	49	31	81	51	113	71
18	12	50	32	82	52	114	72
19	13	51	33	83	53	115	73
20	14	52	34	84	54	116	74
21	15	53	35	85	55	117	75
22	16	54	36	86	56	118	76
23	17	55	37	87	57	119	77
24	18	56	38	88	58	120	78
25	19	57	39	89	59	121	79
26	1A	58	3A	90	5A	122	7A
27	1B	59	3B	91	5B	123	7B
28	1C	60	3C	92	5C	124	7C
29	1D	61	3D	93	5D	125	7D
30	1E	62	3E	94	5E	126	7E
31	1F	63	3F	95	5F	127	7F

Table D-1 Decimal-hexadecimal conversion table (2)

Decimal	Hexadecimal	Decimal	Hexadecimal	Decimal	Hexadecimal	Decimal	Hexadecimal
128	80	160	A0	192	C0	224	E0
129	81	161	A1	193	C1	225	E1
130	82	162	A2	194	C2	226	E2
131	83	163	A3	195	C3	227	E3
132	84	164	A4	196	C4	228	E4
133	85	165	A5	197	C5	229	E5
134	86	166	A6	198	C6	230	E6
135	87	167	A7	199	C7	231	E7
136	88	168	A8	200	C8	232	E8
137	89	169	A9	201	C9	233	E9
138	8A	170	AA	202	CA	234	EA
139	8B	171	AB	203	CB	235	EB
140	8C	172	AC	204	CC	236	EC
141	8D	173	AD	205	CD	237	ED
142	8E	174	AE	206	CE	238	EE
143	8F	175	AF	207	CF	239	EF
144	90	176	B0	208	D0	240	F0
145	91	177	B1	209	D1	241	F1
146	92	178	B2	210	D2	242	F2
147	93	179	B3	211	D3	243	F3
148	94	180	B4	212	D4	244	F4
149	95	181	B5	213	D5	245	F5
150	96	182	B6	214	D6	246	F6
151	97	183	B7	215	D7	247	F7
152	98	184	B8	216	D8	248	F8
153	99	185	B9	217	D9	249	F9
154	9A	186	BA	218	DA	250	FA
155	9B	187	BB	219	DB	251	FB
156	9C	188	BC	220	DC	252	FC
157	9D	189	BD	221	DD	253	FD
158	9E	190	BE	222	DE	254	FE
159	9F	191	BF	223	DF	255	FF



D

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