RZ/T1 Group

PROFINET Transfer Procedure Startup Manual

(for Products with the R-IN Engine)

R01AN4280EJ0100
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Outline

This manual explains the procedure for connecting a CODESYS software programmable logic controller (PLC) with the Renesas Electronics RZ/T1 evaluation board to enable PROFINET transfer.

The RZ/T1 PROFINET stack sample program in this package (“sample program”) runs on the Arm® Cortex®-R4 core or Arm Cortex-M3 core. Its configuration is intended for those who wish to start developing PROFINET devices with products of the RZ/T1 Group that incorporate an R-IN Engine.

For details of the functions of the program, you can separately download the relevant documents from the Renesas Electronics website.

Target Devices

RZ/T1 Group

Sample Program

This sample program uses the evaluation version of PROFINET stack manufactured by our partner Sherpa Inc.

For purchase of the official version, contact our partner Sherpa Inc.

Sherpa Inc. : https://www.sherpa-tech.net/

Contents

1. Operating Environment

The sample program covered in this manual runs in the environment below.

Table 1.1 Operating Environment

Item	Description
Board used	RZ/T1 evaluation board RTK7910018C00000BE
MCU	RZ/T1 (version incorporating an R-IN engine) R7S910018
Operating frequency	CPU clock (CPUCLK): 450 MHz (Cortex-R4) System clock (ICLK): 150 MHz (Cortex-M3)
Operating voltage	3.3 V
Operating mode	SPI boot mode
Device used	Serial flash memory MX25L51245GMI-10G from Macronix International Co., Ltd.
Communications protocol	PROFINET
Integrated development environment	Embedded Workbench for Arm version 7.80 from IAR Systems
Emulator	I-jet from IAR Systems
Software PLC	CODESYS V3.5 SP11 from 3S-Systems GmbH

Note: This manual assumes that you have installed the IDE and software PLC.

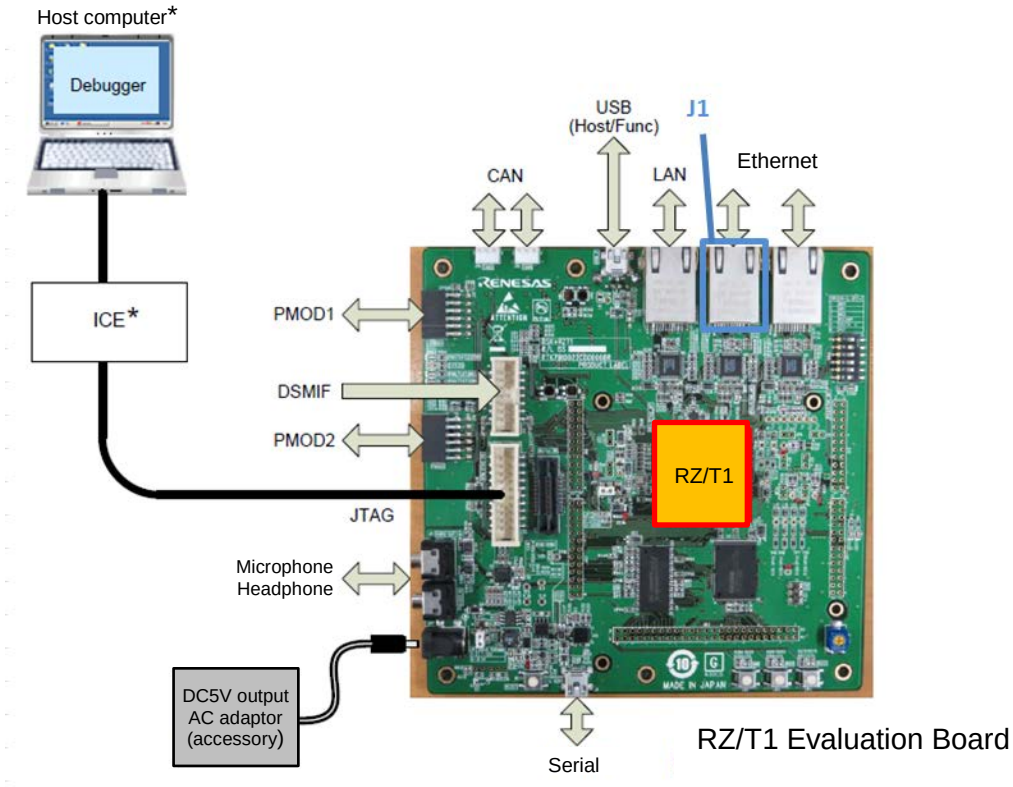
The software PLC is available from the Linx website (http://linx.jp/download/codesysv3).

2. Setting up and Connecting the RZ/T1 Evaluation Board

For detailed information on the board, refer to the *RZ/T1 Evaluation Board User's Manual.*

2.1 Setting up the RZ/T1 Evaluation Board

Before supplying power, set up the DIP switches and jumpers and connect the cables. The figure below shows the locations of the related parts.



The asterisks (*) indicate the devices that the user needs to prepare.

Figure 2.1 Parts to Set up and the Locations for Cable Connections

2.1.1 Selecting the Operating Mode

The levels on external pins (MD0, MD1, and MD2) of the RZ/T1 select the operating mode.

The table below shows the relationship between the levels on the mode-setting pins and the operating mode.

Table 2.1 Operating Mode Selection

Mode Setting Pin			Operating Mode
MD2	MD1	MD0	
Low	Low	Low	SPI boot mode (serial flash memory) The system is booted from the serial flash memory connected to the SPI multi-I/O bus space.
Low	High	Low	16-bit bus boot mode (NOR flash memory) The system is booted from the NOR flash memory (with a bus width of 16 bits) connected to the CS0 space.
Low	High	High	32-bit bus boot mode (NOR flash memory) The system is booted from the NOR flash memory (with a bus width of 32 bits) connected to the CS0 space (the setting is prohibited in the RZ/T1 evaluation board).
Other than the above			Reserved (setting prohibited)

As a mechanism to select these operating modes, the above MD0, MD1, and MD2 pins are connected to switches on a DIP-switch block (SW4-1, 4-2, and 4-3) on the RZ/T1 evaluation board and they are set up to suit the sample program you are using.

The table below lists the operating modes of the sample program and all corresponding settings on SW4.

Table 2.2 Settings on SW4

Sample Program	SW4-1	SW4-2	SW4-3	SW4-4	SW4-5	SW4-6
16-bit bus boot mode version	ON	OFF	ON	ON	ON	OFF
SPI boot mode version	ON	ON	ON	ON	ON	OFF
RAM execution version	Either of the above combinations					

The operating mode should be selected before power is supplied.

2.1.2 Selecting the Power Supply

The RZ/T1 evaluation board has jumper blocks for power-supply selection (JP2 and JP7).

The jumpers should be set according to the settings shaded in gray in the table below.

Table 2.3 JP2 and JP7 Settings

Jumper	Setting	Function
JP2 System power-supply selection	1-2	The system power-supply voltage is from 7 to 12 V.
	2-3	The system power-supply voltage is 5 V.
JP7 VCCQ33B supply source selection	1-2	Power for VCCQ33B is from the RZ/T1's digital 3.3-V power supply.
	2-3	Power for VCCQ33B is from the RZ/T1's digital 1.2-V power supply.

The jumpers for power-supply selection should be in place before power is supplied.

2.2 Connecting the RZ/T1 Evaluation Board

Connect the cables as described below.

(1) Connect the Ethernet cable (category 5 is recommended) to J1.

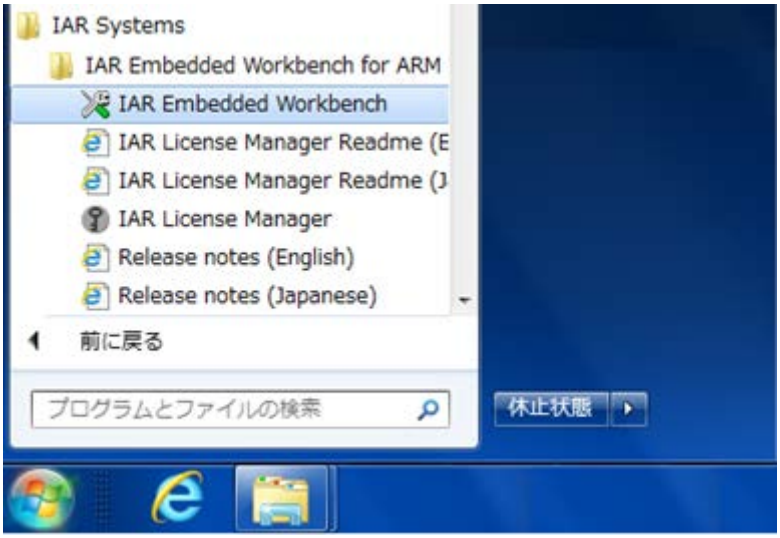
(2) Connect the JTAG connector for ICE (I-jet) to J10 (ARM JTAG20) to connect the host computer over the USB.

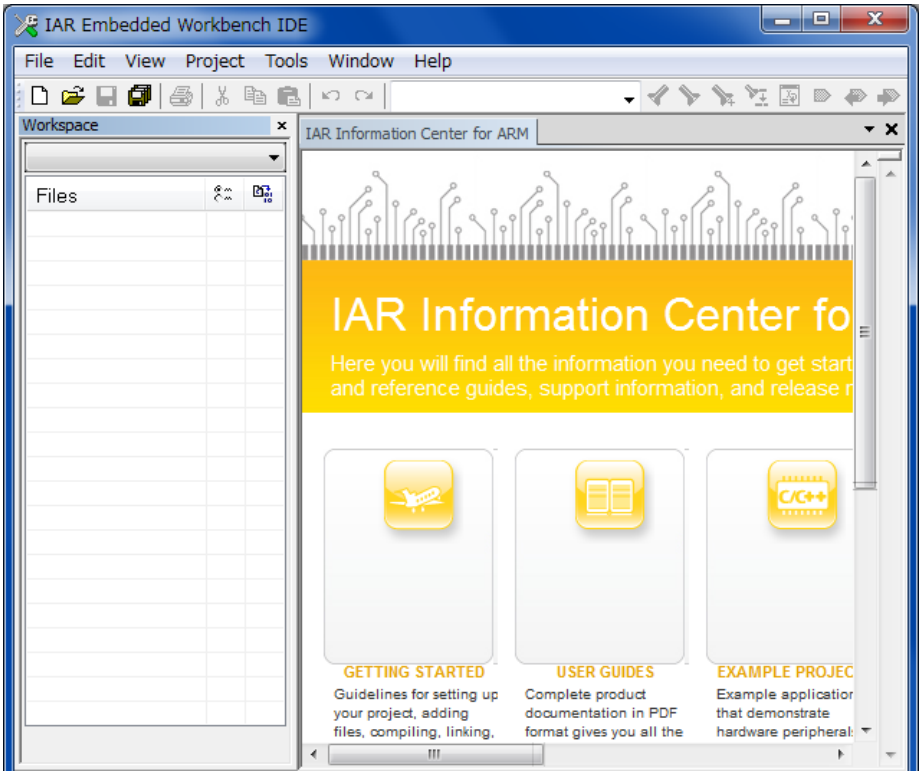
(3) Connect an AC adapter with DC 5 V output to J17 to supply power.

3. Starting the RZ/T1 PROFINET Stack Sample Program

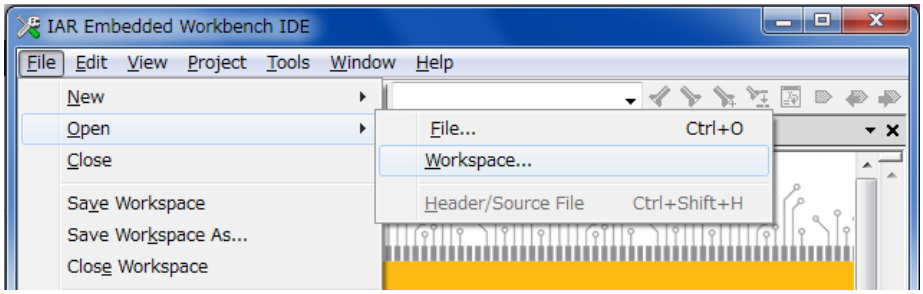
3.1 Starting and Building a Project

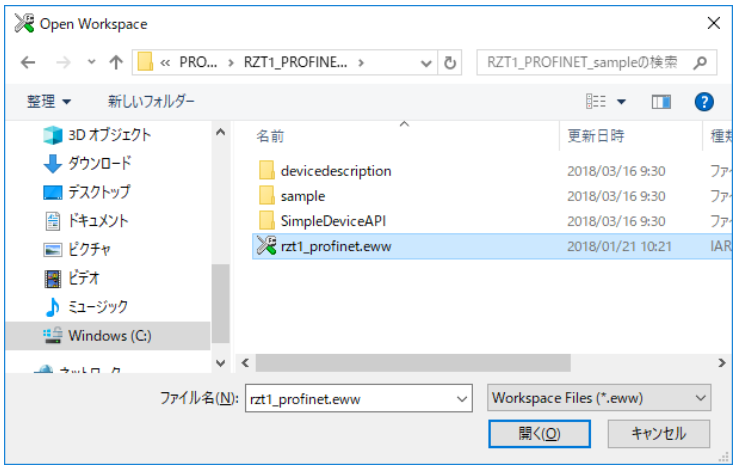
(1) From the Windows Start menu, click on [All Programs] → [IAR Systems] → [IAR Embedded Workbench for ARM x.xx] → [IAR Embedded Workbench] to start the IAR Embedded Workbench.



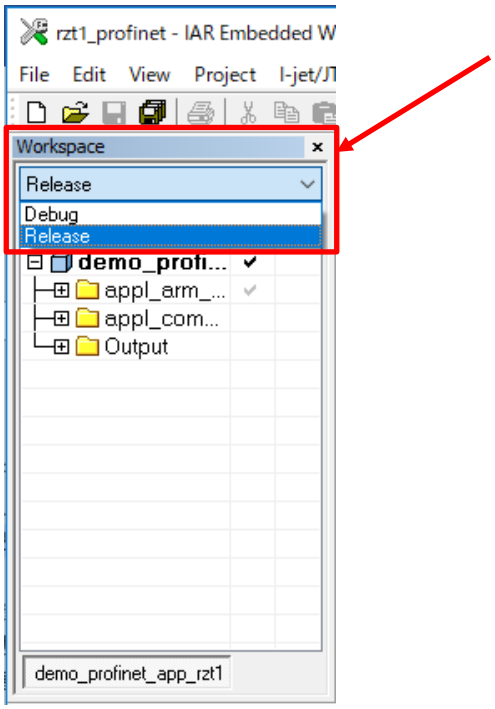


(2) Select [File] → [Open] → [Workspace] and double-click on the “rzt1_profinet.eww” filename in ¥an-r01an4280ej0100_rzt1_profinet¥RZT1_PROFINET_sample.

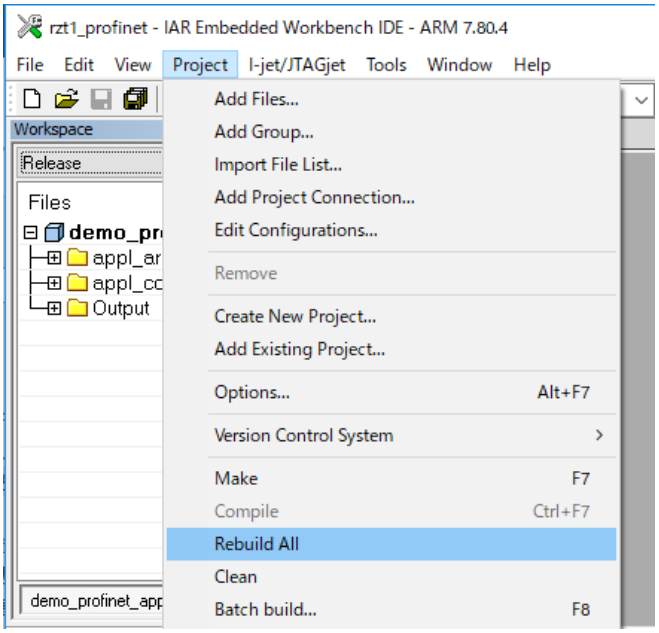




(3) Click on “Release” to select building.

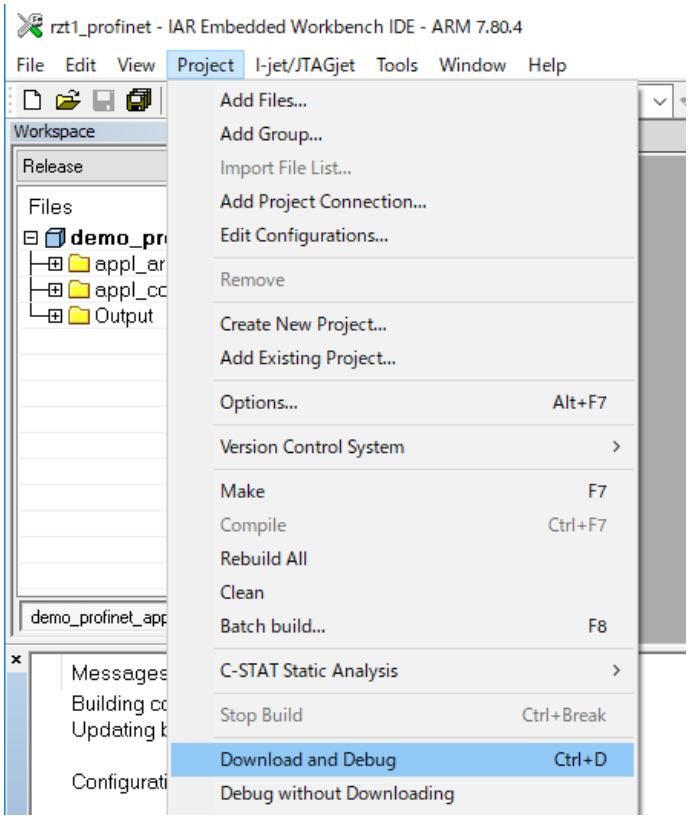


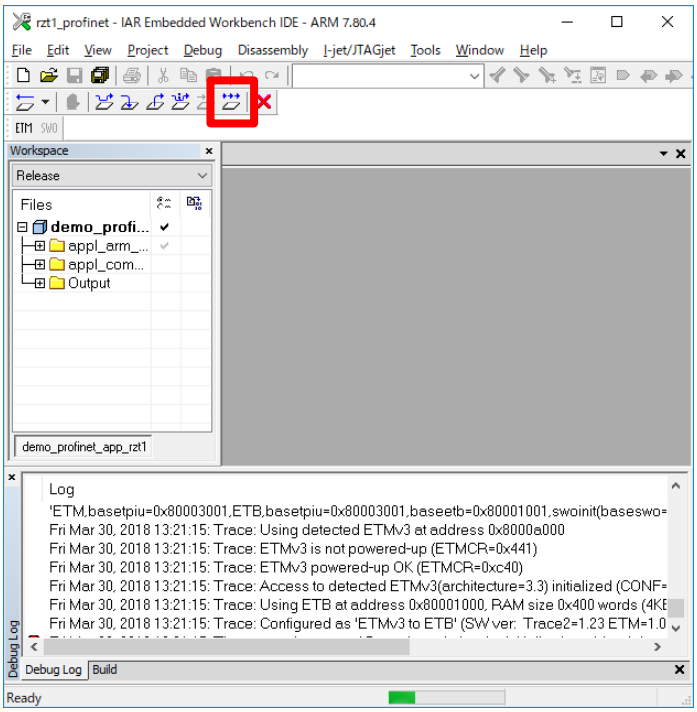
(4) Select [Project] → [Rebuild All] to run a build.



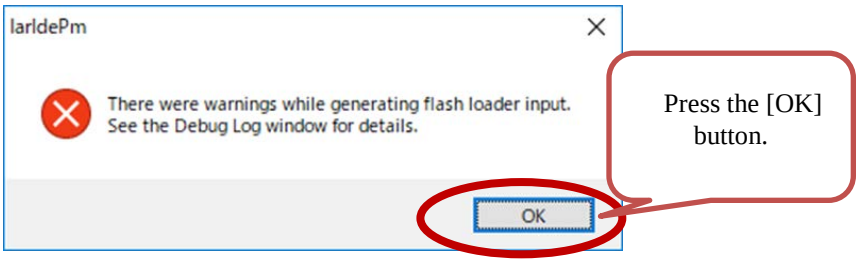
3.2 Starting the Program

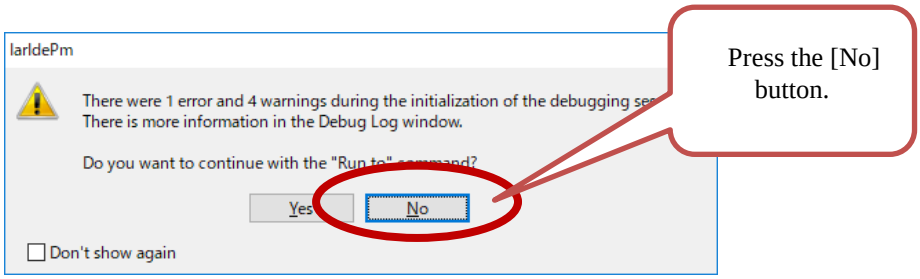
Select [Project] → [Download and Debug] to program the flash memory. Click on the [Go] button to start the program.





The following are the ways of responding when either of the below messages is output when writing the program.





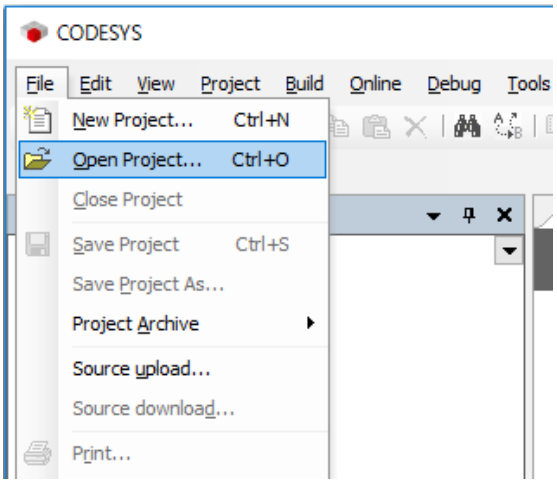
4. Confirming Transfer to and from CODESYS

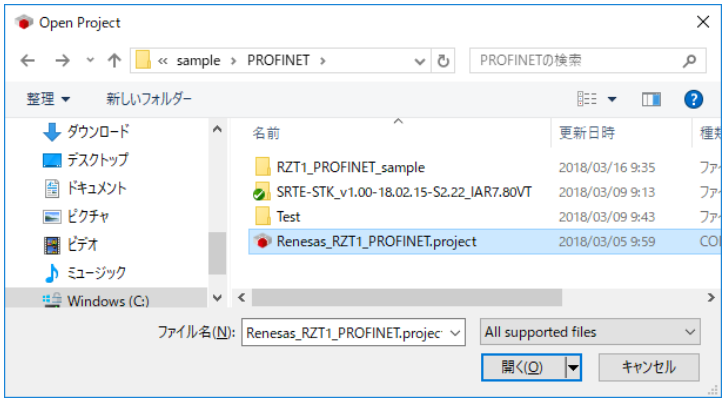
4.1 Starting CODESYS

(1) From the Windows Start menu, select [All Programs] > 3S CODESYS > CODESYS > CODESYS Vx.x (x.x represents the version number). You can also start the program by double-clicking on the CODESYS icon, which will be created after the installation of the program.

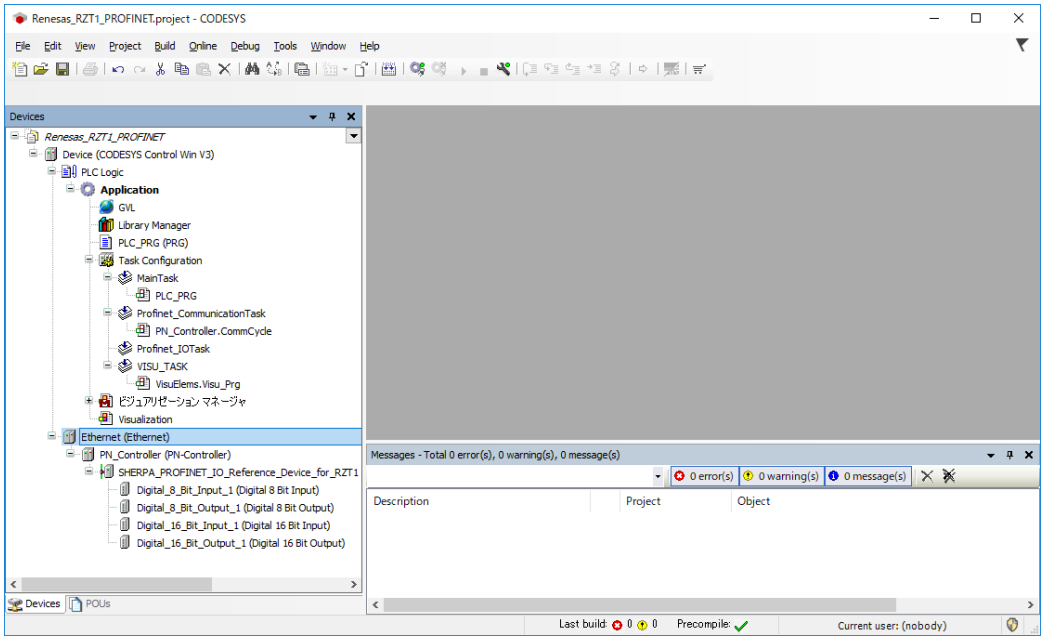
(2) Click on [File] → [Open Project …] and double-click on the “Renesas_RZT1_PROFINET.project” filename in ¥an-r01an4280ej0100_rzt1_profinet¥.

Regarding the procedures for building new CODESYS projects and for creating and simulating a user interface, refer to the *R-IN, RZ/T1, EC-1, TPS-1 Groups Software PLC Guide: Configuring Projects and Creating User Interfaces*.





(3) When the project is started, the “Devices” tree will be displayed.



4.2 Updating the Slave Device

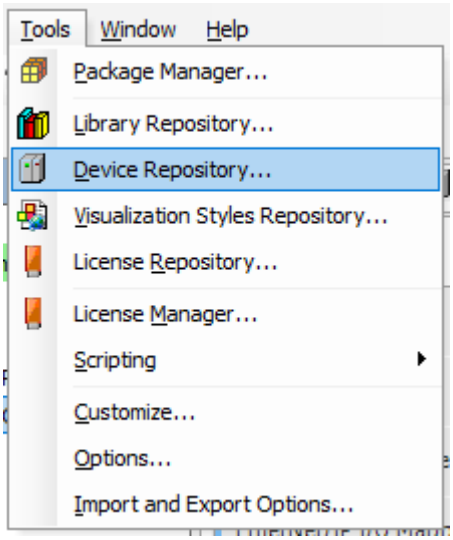
Only follow the procedure described in this section the first time you start “Renesas_RZT1_PROFINET.project” in ¥an-r01an4280ej0100_rzt1_profinet¥.

4.2.1 Installing Device Information

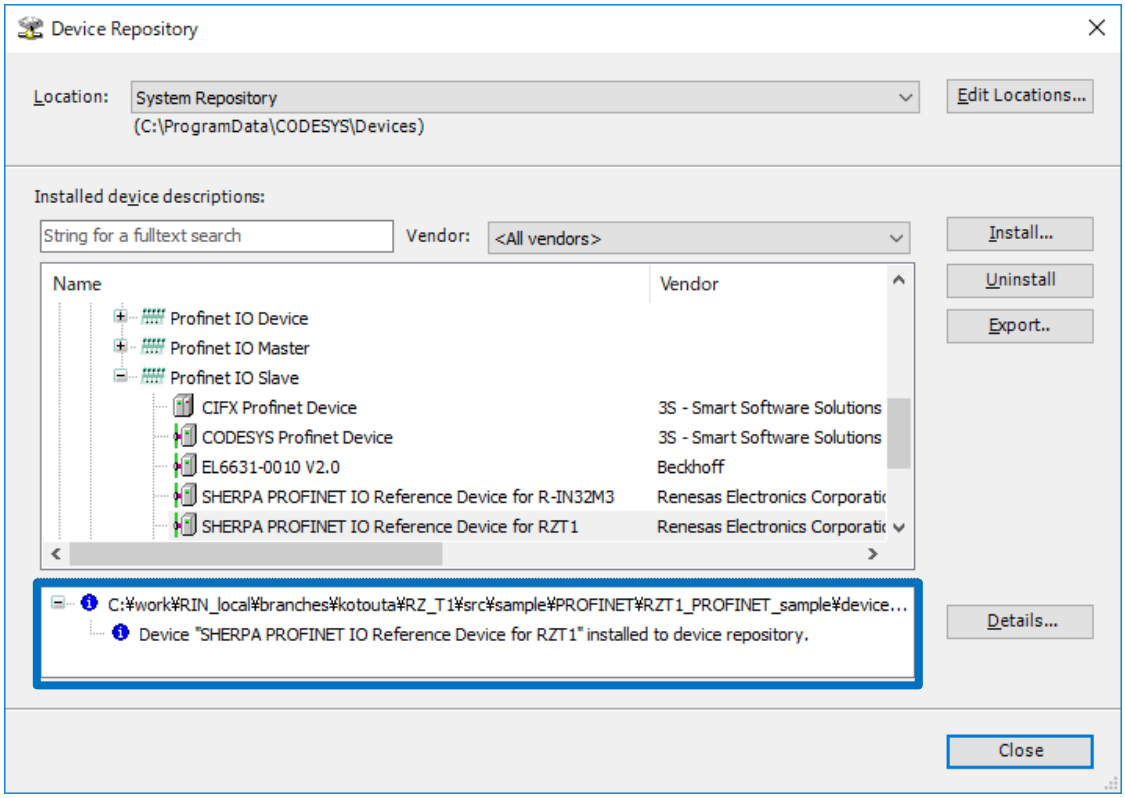
To use the PROFINET slave device, you need to install the General Station Description (GSD) file which contains information on the device.

Use the GSD file “GSDML-V2.34-SHERPA-RZT1-CCB-20180614.xml” in ¥an-r01an4280ej0100_rzt1_profinet¥RZT1_PROFINET_sample¥devicedescription¥profinet.

Select [Device Repository] from the [Tool] menu in CODESYS.



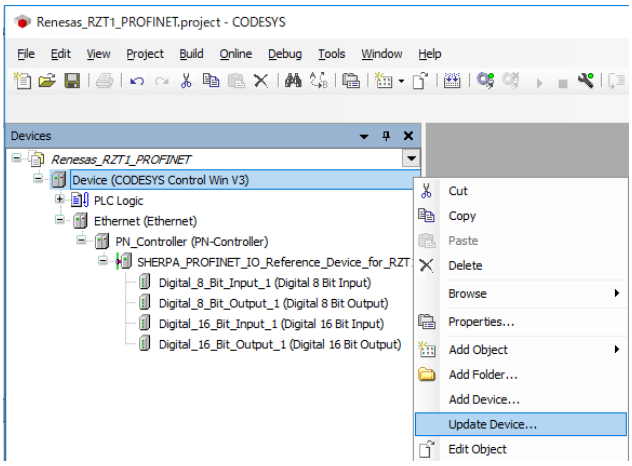
In the “Device Repository” dialog box, click on [Install]. A file dialog box will appear. Specify the GSD file “GSDML-V2.34-SHERPA-RZT1-CCB-20180614.xml” in ¥an-r01an4280ej0100_rzt1_profinet¥RZT1_PROFINET_sample¥devicedescription¥profinet. The result of installation will be indicated within the area in the blue frame in the figure below. The " " icon is displayed next to the result of a successful installation.



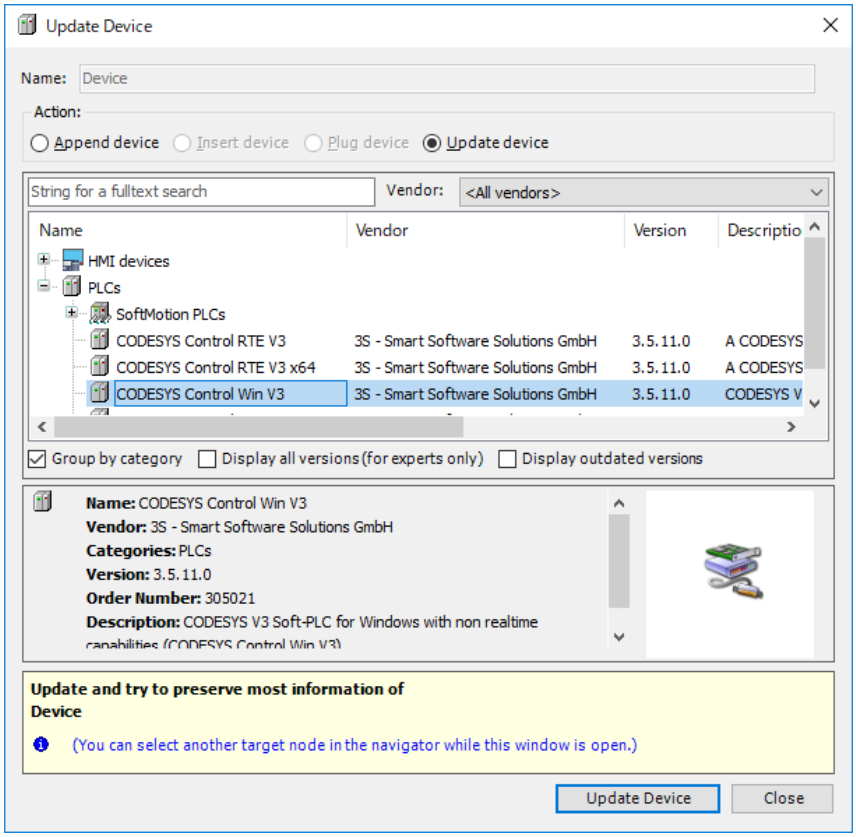
4.2.2 Updating the Devices

(1) Updating the Device

Right-click on “Device (CODESYS Control Win V3)” in the “Devices” tree, then select [Update Device…].

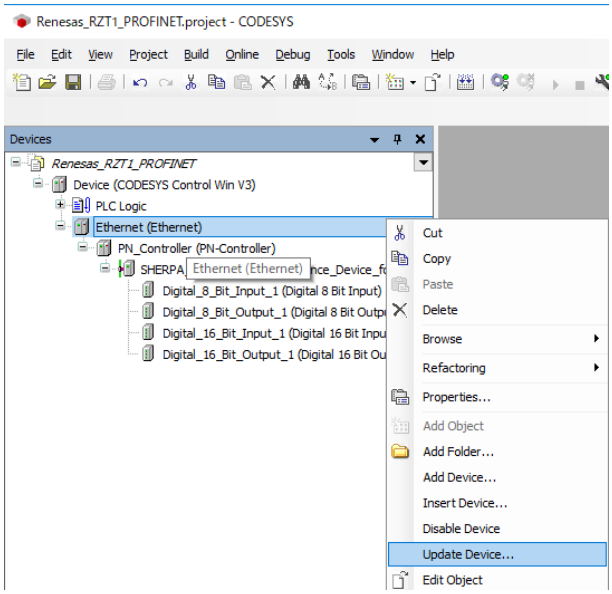


In the “Update Device” dialog box, select “CODESYS Control Win V3” under “PLCs”, “SoftMotion PLCs”, then click on the [Update Device] button.

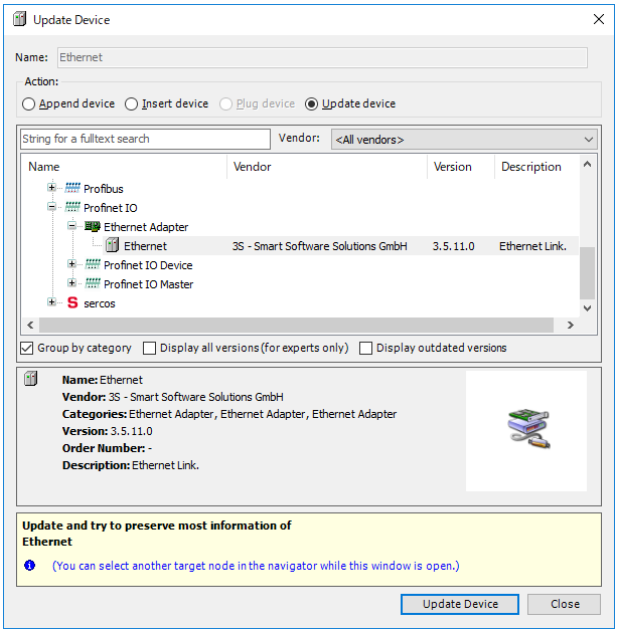


(2) Updating the Ethernet Settings

Right-click on “Ethernet (Ethernet)” in the “Devices” tree, then select [Update Device…].

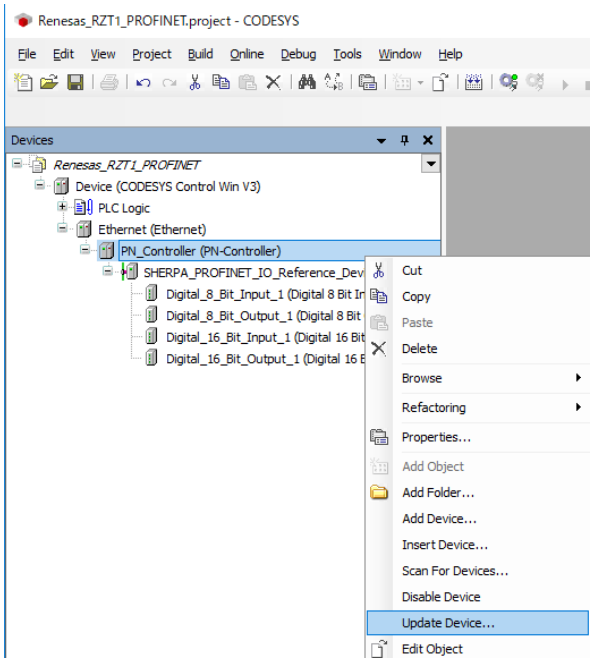


In the “Update Device” dialog box, select “Ethernet” under “Fieldbusses”, “Profinet IO”, “Ethernet Adapter”, then click on the [Update Device] button.

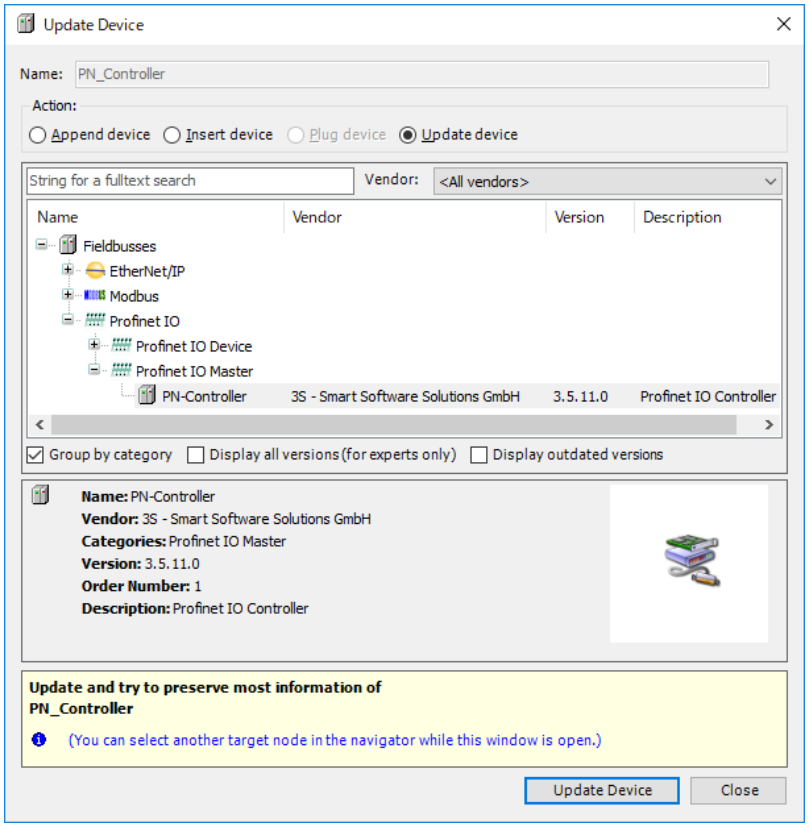


(3) Updating PN_Controller

Right-click on “PN_Controller (PN_Controller)” in the “Devices” tree, then select [Update Device…].

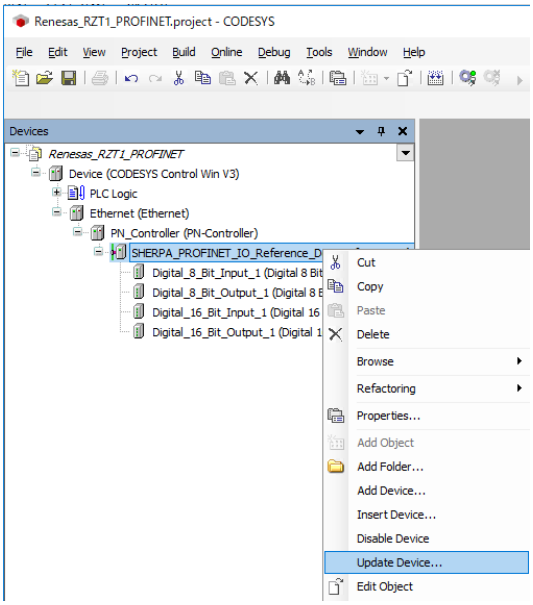


In the “Update Device” dialog box, select “PN_Controller” under “Fieldbusses”, “Profinet IO”, “Profinet IO Master”, then click on the [Update Device] button.

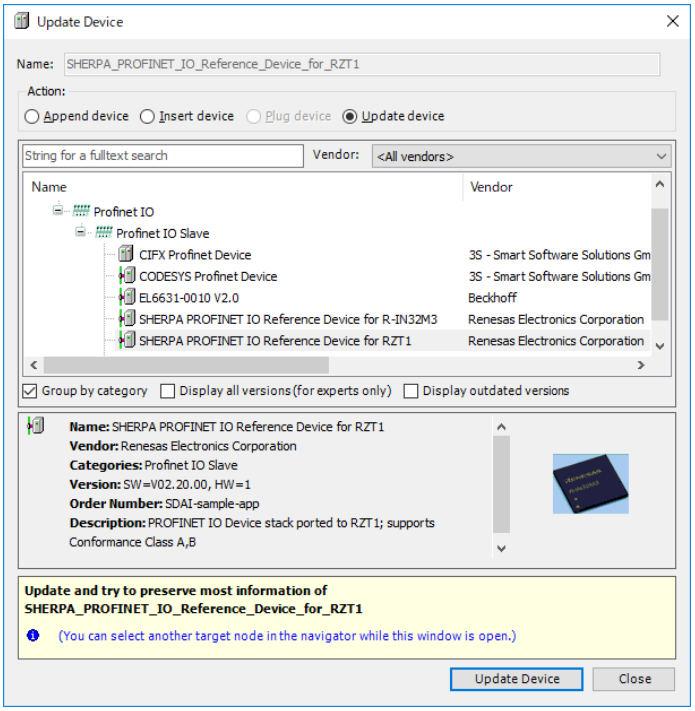


(4) Updating SHERPA_PROFINET_IO_Reference_Device_for_RZT1

Right-click on “SHERPA_PROFINET_IO_Reference_Device_for_RZT1 (SHERPA_PROFINET_IO_Reference_Device_for_RZT1)” in the “Devices” tree, then select [Update Device…].



In the “Update Device” dialog box, select “SHERPA_PROFINET_IO_Reference_Device_for_RZT1” under “Fieldbusses”, “Profinet IO”, “Profinet IO Slave”, then click on the [Update Device] button.

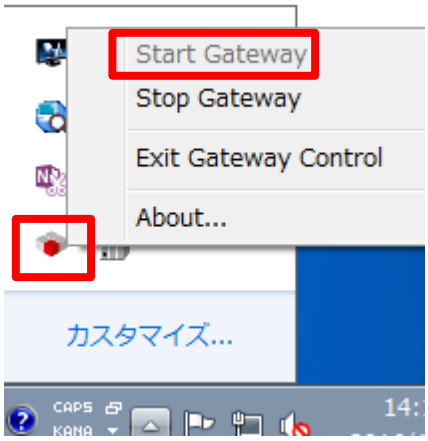


4.3 Connecting to the Software PLC

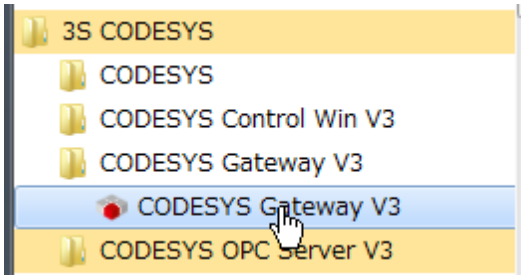
This section describes the procedure for connecting to the target software PLC from the development environment via a gateway.

4.3.1 Starting the Gateway Server

Check the operating state of the gateway server in the system tray. If the server is stopped, click on the "  " icon and select [Start Gateway] to start up the server. Usually, the server will be automatically started as a standard service when Windows is started. An icon in the system tray at the bottom-right corner of the desktop indicates the state of operation.

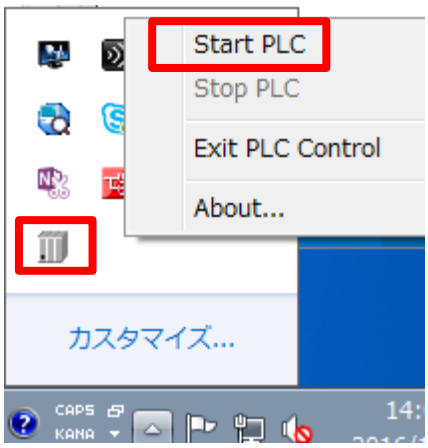


Note: If you cannot find the icon in the system tray, start up the gateway server by selecting All Programs > 3S CODESYS > CODESYS Gateway V3.
If the icon still does not appear in the system tray, try rebooting your computer.

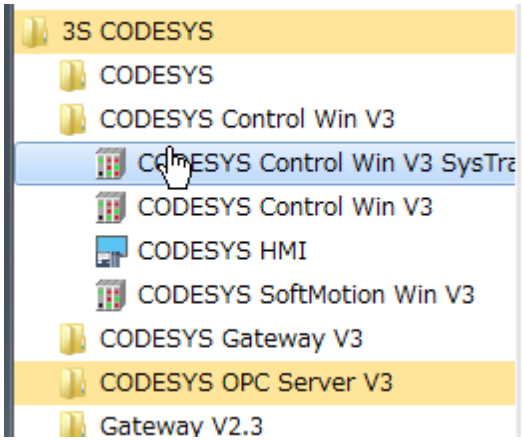


4.3.2 Starting the Software PLC

Check the operating state of the software PLC in the system tray. If the software PLC is stopped, click on the "  " icon and select [Start PLC] to start it. Usually, the software PLC will be automatically started as a standard service when Windows is started. An icon in the system tray at the bottom-right corner of the desktop indicates the state of operation.

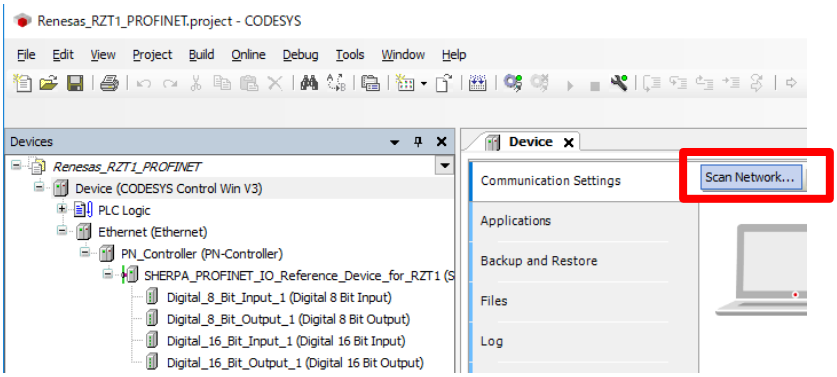


Note: If you cannot find the icon in the system tray, start up the gateway server by selecting All Programs > 3S CODESYS > CODESYS Gateway V3.
If the icon still does not appear in the system tray, try rebooting your computer.



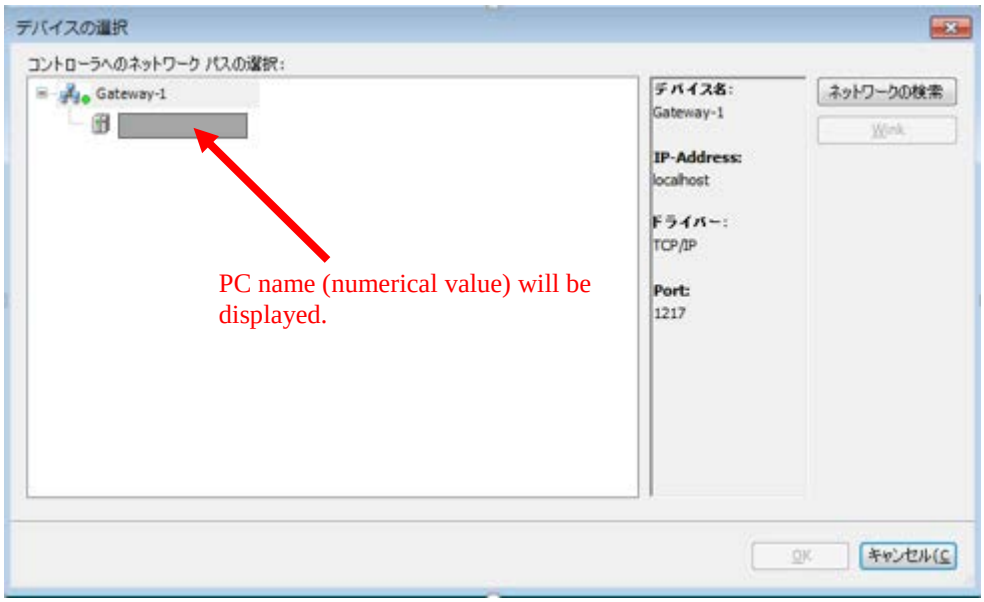
4.3.3 Setting up Connection with the Software PLC

Double-click on “Device (CODESYS Control Win V3)” in the “Devices” tree. The “Communication Settings” pane will open. In this pane, you can make communications settings for connecting the software PLC service from your development environment. Click on the [Scan Network…] button on the “Communication Settings” tabbed page.



The “Select Device” window appears and a search for available devices that can use the local network automatically starts. The search is successful if a software PLC service is found. Double-click on the PC name displayed.

If the PC name is not displayed, re-check the settings described in sections 4.3.1, Starting the Gateway Server and 4.3.2, Starting the Software PLC.

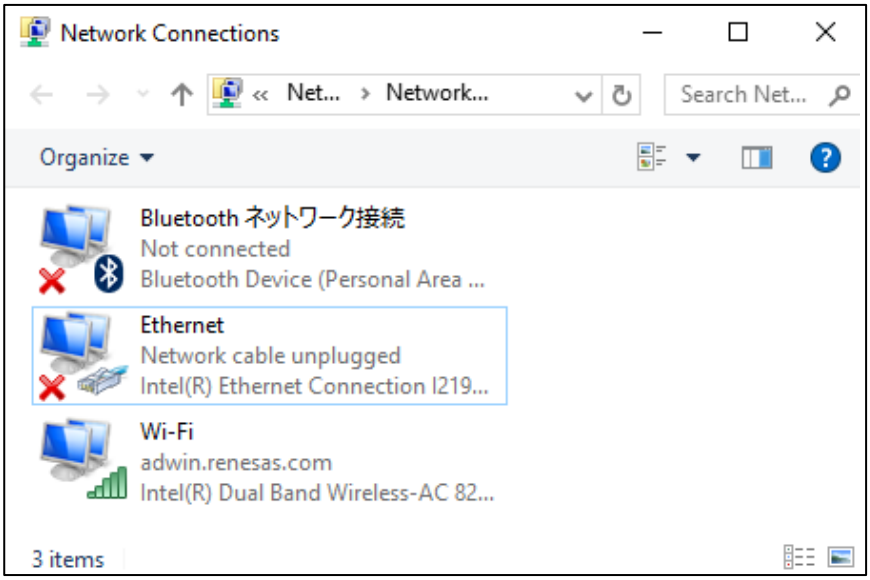


4.4 Network Settings for Devices

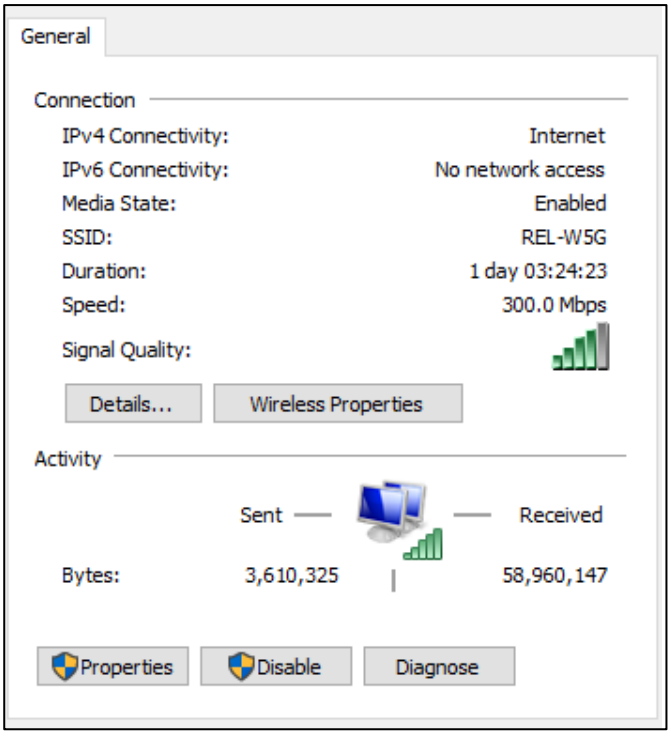
4.4.1 Configuring the Host IP Address

Before setting the devices, set the IP address of the host PC. Open “Network Settings”.

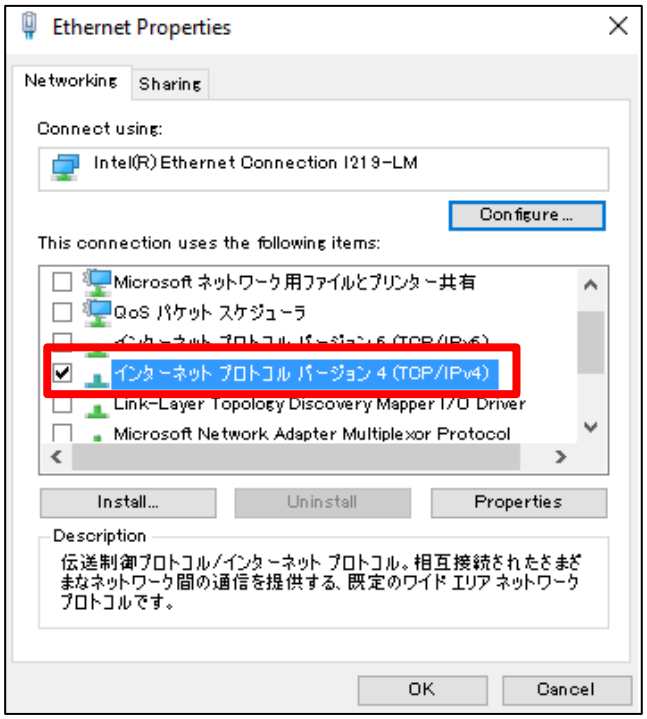
In Windows 7, go to Control Panel -> Network and Sharing Center -> Change Adapter Settings.



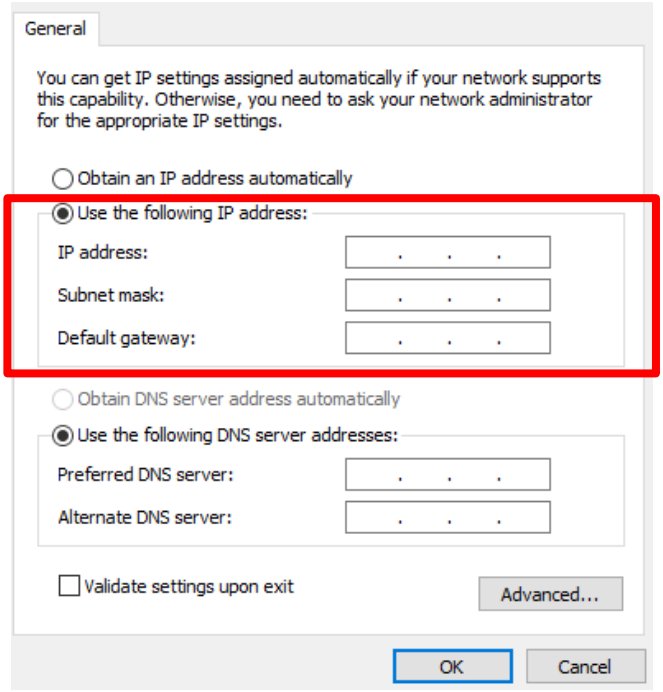
Double-click (or right-click) on Local Area Connection and select Properties.



Select “Internet Protocol Version 4 (TCP/IPv4)” and click on the [Properties] button.



Select the IP address and subnet mask in the area indicated by the red frame in the figure below.

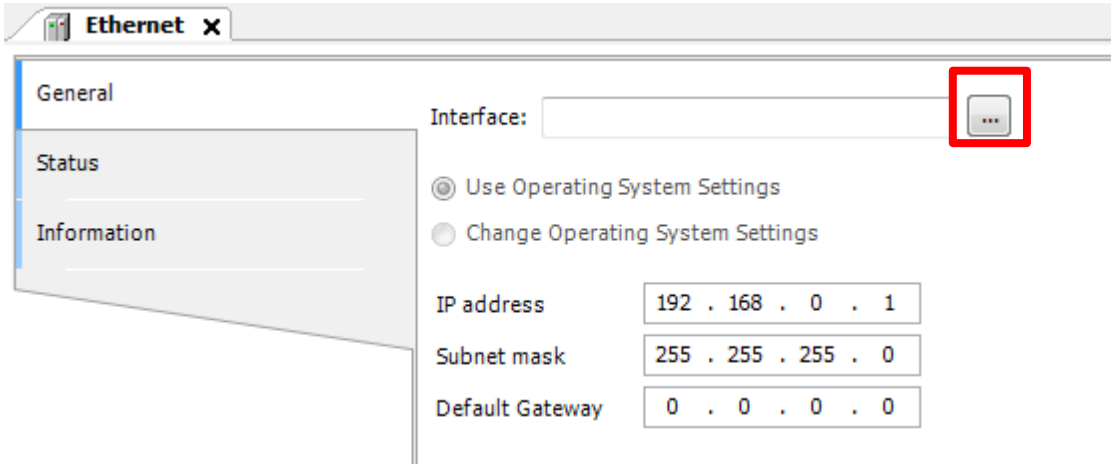


You have now completed the settings.

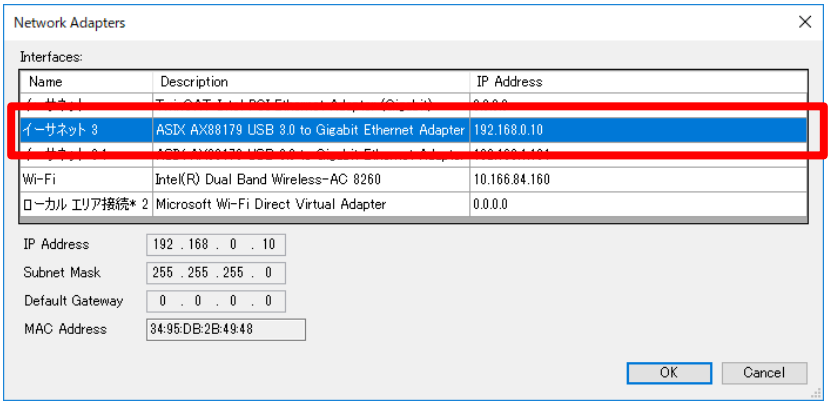
4.4.2 Configuring the Ethernet Link

Double-click on “Ethernet (Ethernet)” in the “Devices” tree to open the configuration window.

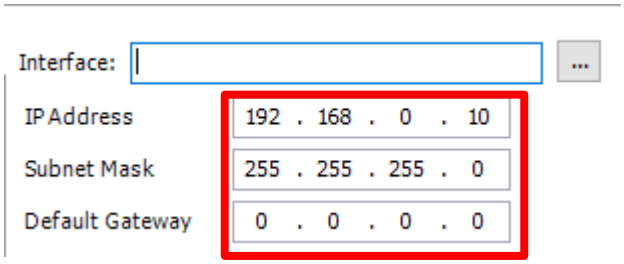
On the “General” tabbed page, click on the icon next to the text box for “Interface” selection indicated by the red frame below to display the “Network Adapters” window.



The names of connected ports will be displayed in the “Network Adapters” window. Select the port you will be using.



Check whether the IP address of the selected port has been correctly set.

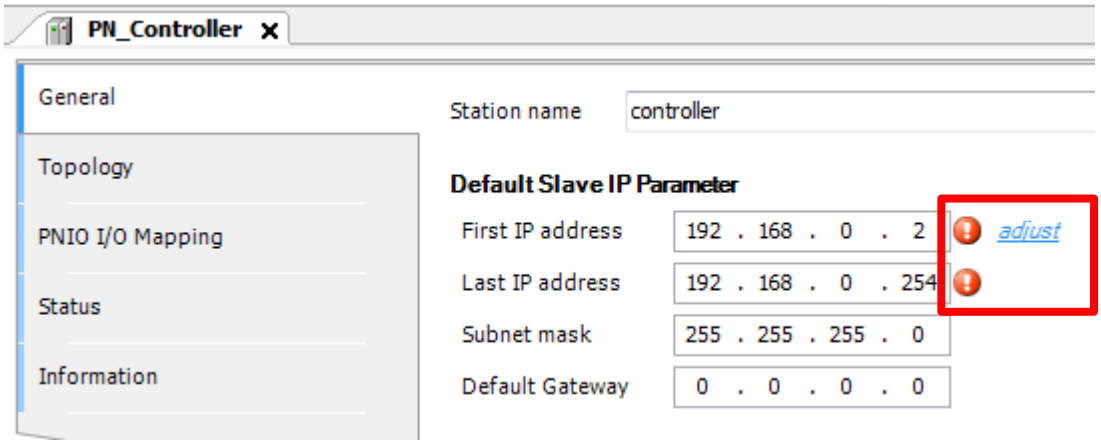


4.4.3 Configuring PN_Controller

Double-click on “PN-Controller (PN-Controller)” in the “Devices” tree to open the configuration window. In this window, make settings on the “General” tabbed page.

If you have set the IP address according to the procedure described in section 4.4.2, Configuring the Ethernet, “adjust” will be indicated next to the corresponding IP address field as shown below.

Clicking on “adjust” automatically sets a suitable IP address.

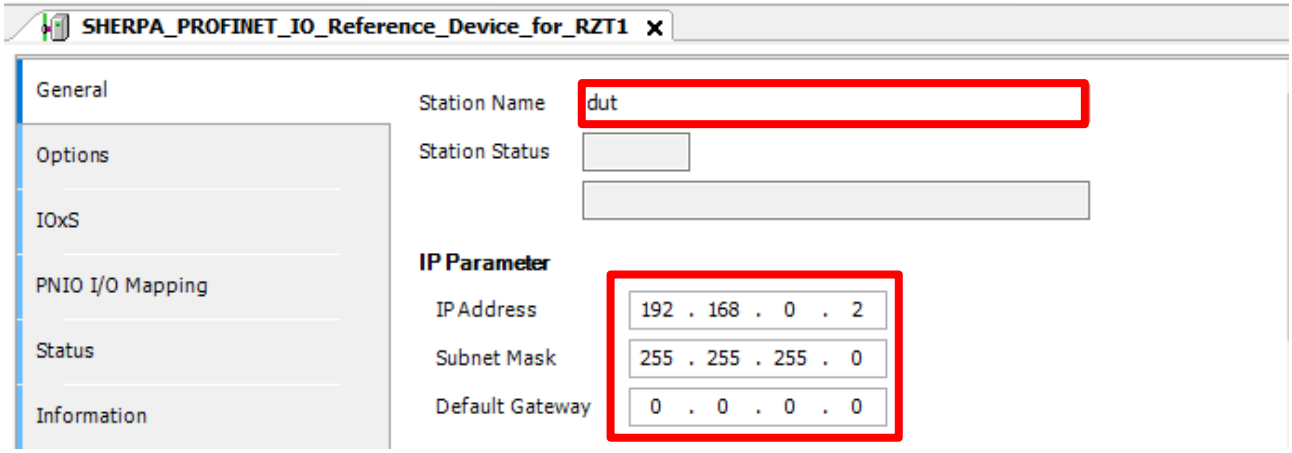


4.4.4 Configuring SHERPA_PROFINET_IO_Reference_Device_for_RZT 1

Double-click on “SHERPA_PROFINET_IO_Reference_Device_for_RZT1 (SHERPA_PROFINET_IO_Reference_Device_for_RZT 1)” in the “Devices” tree to open the configuration window. In this window, make settings on the “General” tabbed page.

As the IP settings, set the IP address within the range of values from "First IP address" to "Last IP address" which have been set in section 4.4.3, Configuring PN_Controller.

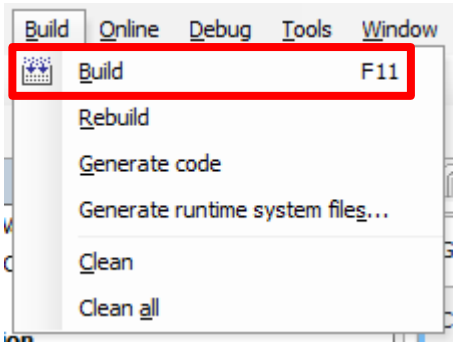
In PROFINET, a slave device is identified by its station name. Here, enter the station name which has been set for the device in the "Station Name" field.



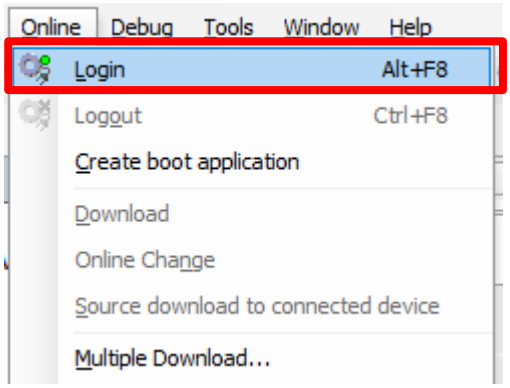
4.5 Confirming the Connection with the Device

This section describes the procedures for running a program in the CODESYS development environment and confirming connection of the device.

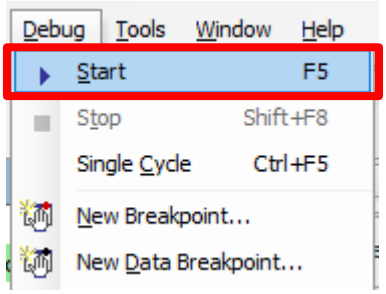
Select [Build] from the [Build] menu.



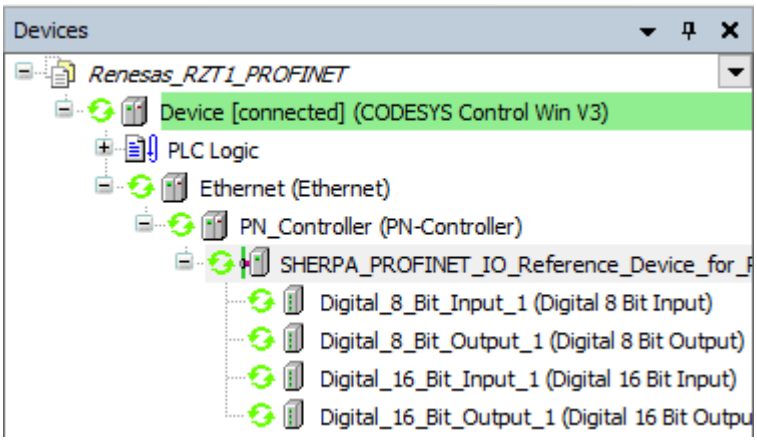
Select [Login] from the [Online] menu.



Select [Start] from the [Debug] menu. The project will automatically start on Windows.



The state of connection will be indicated next to each device name. Successful connection is indicated by the " " icon as shown in the tree view below.

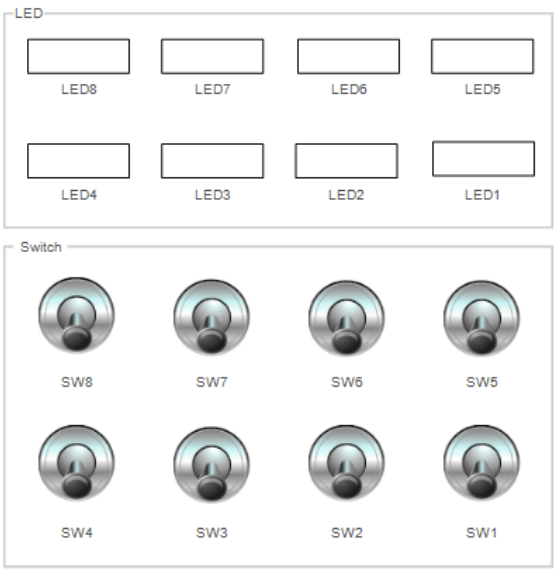


The icons indicating the state of each device are listed below.

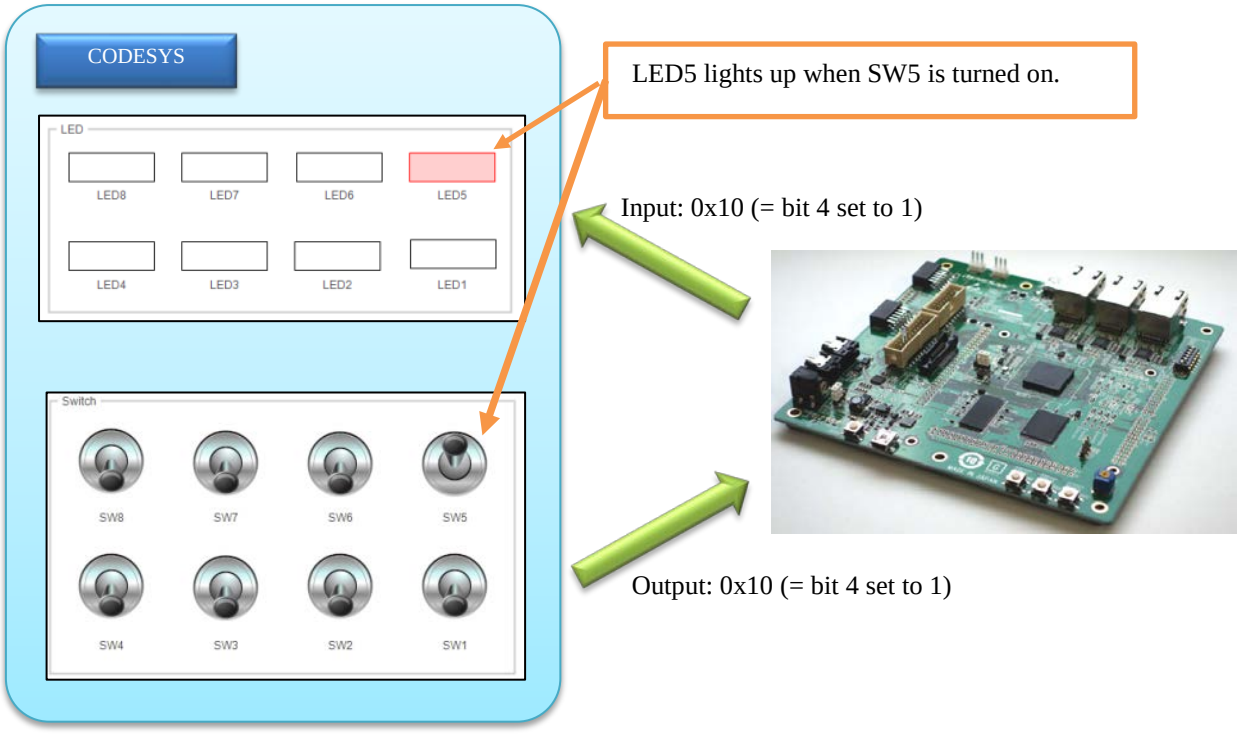
: The PLC is connected and the application is running.
: The PLC is connected and the application is stopped.
: Error. Check the details of the error and the settings of the device.
: The device information could not be found in the device repository. Recheck the device information file and reinstall the device.

4.6 Operations of CODESYS

When CODESYS starts running, the following display will appear. The evaluation board receives the states of the switches in the display and transmits the states of the switches as they are.



The following shows the image when SW5 is turned on.



5. Documents for Reference

- Documents, Application Notes, and Sample Code
  - RZ/T1 Group Initial Settings
  - RZ/T1 Group User's Manual: Hardware
  - RZ/T1 Evaluation Board RTK7910022C00000BR User's Manual
  - R-IN, RZ/T1, EC-1, TPS-1 Groups Software PLC Guide: Configuring Projects and Creating User Interfaces
  - R-IN, RZ/T1 Groups Software PLC Guide: PROFINET I/O

  Download the latest version from the Renesas Electronics website.

- Technical Updates and Technical News
  Download the latest version from the Renesas Electronics website.

- Development Environment
  Download the latest versions from the websites of the respective companies.

  The latest version for the IAR integrated development environment (IAR Embedded Workbench® for Arm) is available from the IAR Systems website.

  The latest version for the software PLC (CODESYS) is available from the Linx website.

Appendix A Changing the Configuration of the RZ/T1 Evaluation Board

By serially connecting the host PC and the RZ/T1 evaluation board, the following settings can be changed through terminal software running on the host PC.

Name	Default Value
Device Name	dut
IP Address	192.168.0.50
Netmask	255.255.255.0
Gateway	0.0.0.0
MAC Address	74:90:50:f0:09:2e
MAC Port1	74:90:50:f0:09:01
MAC Port2	74:90:50:f0:09:02

If the PROFINET stack program had already been written to the RZ/T1 evaluation board at the time the board was shipped so will run on the board, the above default values will have been written to the flash ROM. The initial values written to the flash ROM are given priority from the second startup.

A-1 System Configuration

The figure below shows the configuration of the system.

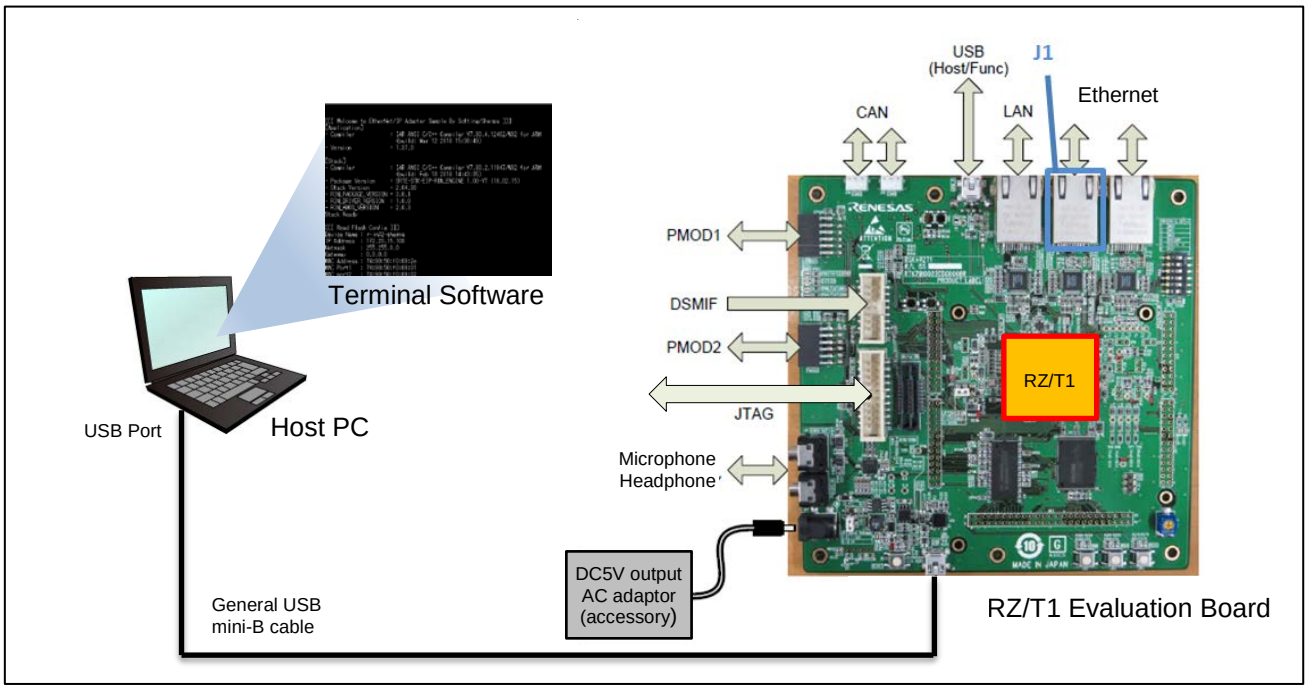


Figure A.1 System Configuration

A-2 Changing the Configuration

A-2-1 Connecting the RZ/T1 Evaluation Board

Follow the procedure below to connect the cables.

(1) Connect the mini-B end of the general USB mini-B cable to the J8 USB serial port connector to connect the host computer with the USB port on the evaluation board.

(2) Connect an AC adapter with 5-V DC output to J17 to supply power.

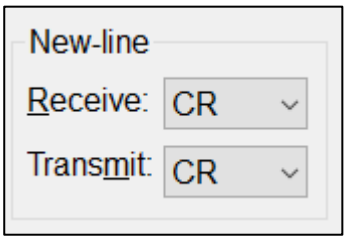
A-2-2 Changing the Configuration

(1) Starting the Terminal Software

Start the terminal software and make settings for serial communications. The table below lists the settings for serial communications.

Bit rate	115200 bps
Data	8 bits
Parity	None
Stop	1 bit
Flow control	None

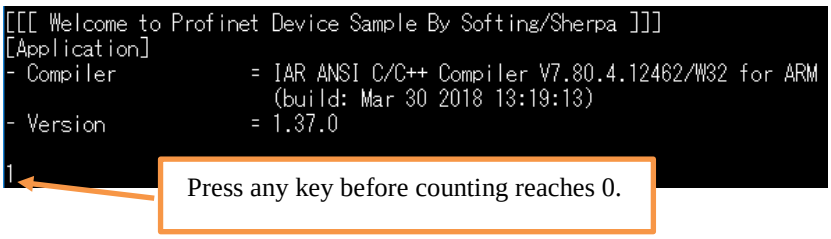
The following shows the settings for the line-feed codes of the terminal software.



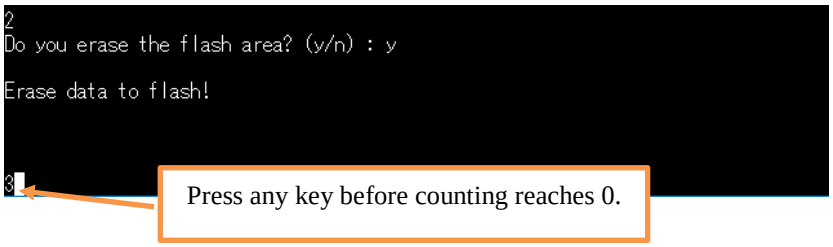
(2) Resetting and Starting the RZ/T1 Evaluation Board

Press the reset button. This produces the following display.

Before the count-down reaches 0, enter any number on the key board.

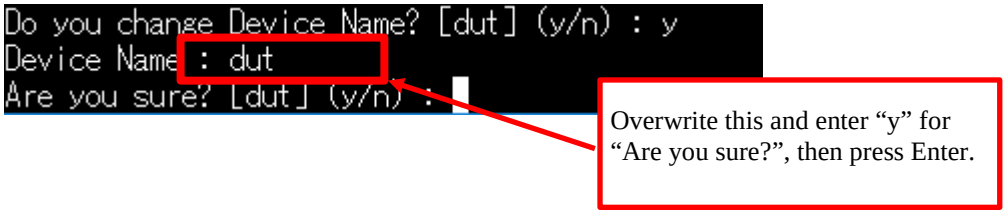


To delete the flash ROM area, enter “y” for “Do you erase the flash area? (y/n):” and press Enter. Before the count-down reaches 0 again, enter any number on the keyboard.



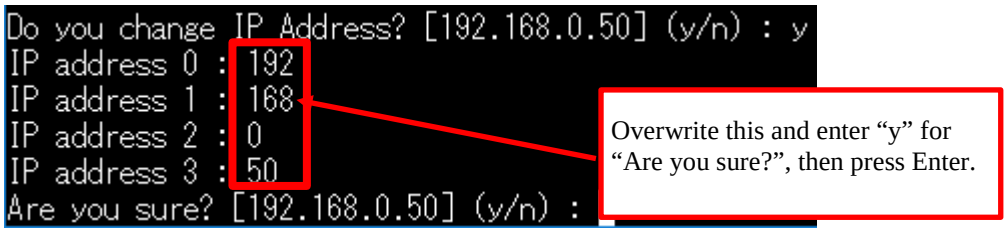
(3) Changing the Device Name

To change the device name “dut”, enter “y” and press Enter. Otherwise, enter “n” and press Enter.



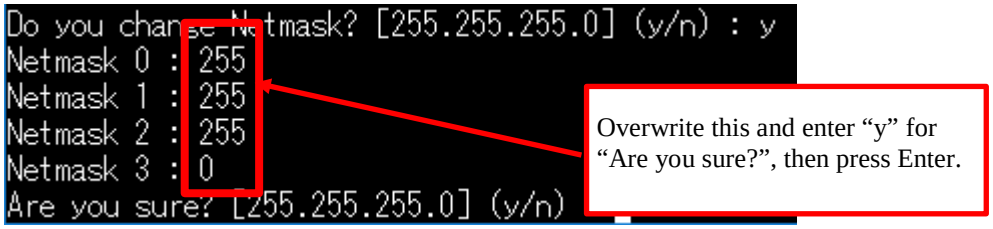
(4) Changing the IP Address

To change the IP address “192.168.0.50”, enter “y” and press Enter. Otherwise, enter “n” and press Enter.



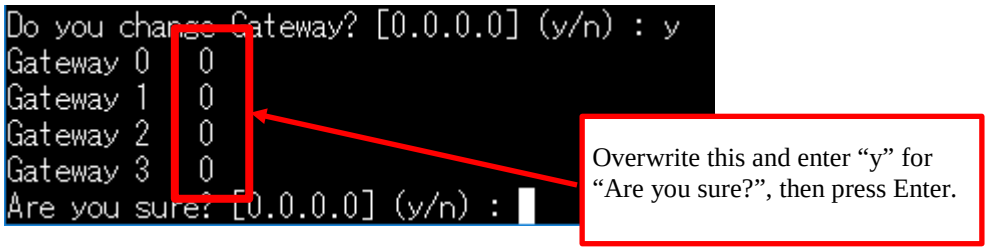
(5) Changing the Netmask

To change the netmask “255.255.255.0”, enter “y” and press Enter. Otherwise, enter “n” and press Enter.



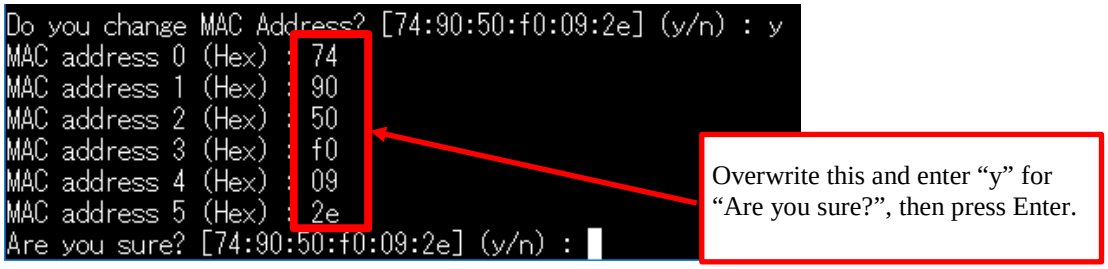
(6) Changing the Gateway

To change the gateway “0.0.0.0”, enter “y” and press Enter. Otherwise, enter “n” and press Enter.



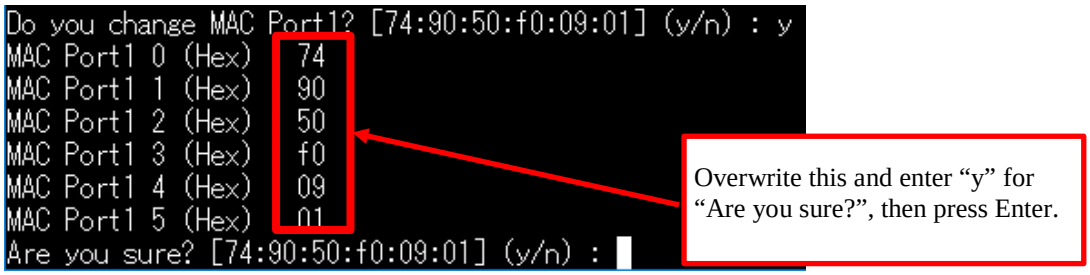
(7) Changing the MAC Address

To change the MAC address “74:90:50:f0:09:2e”, enter “y” and press Enter. Otherwise, enter “n” and press Enter.



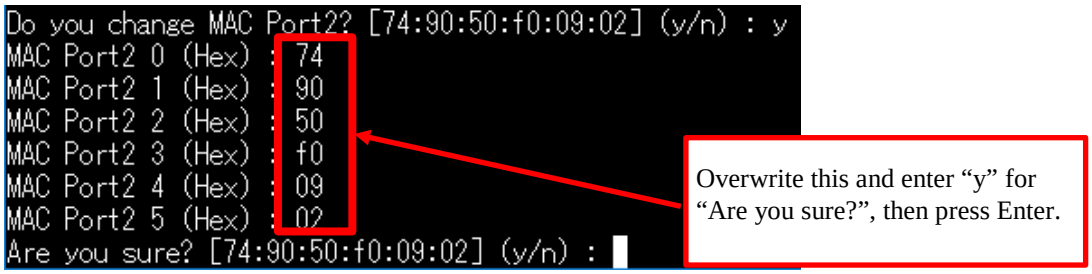
(8) Changing MAC Port 1

To change MAC port 1 “74:90:50:f0:09:01”, enter “y” and press Enter. Otherwise, enter “n” and press Enter.



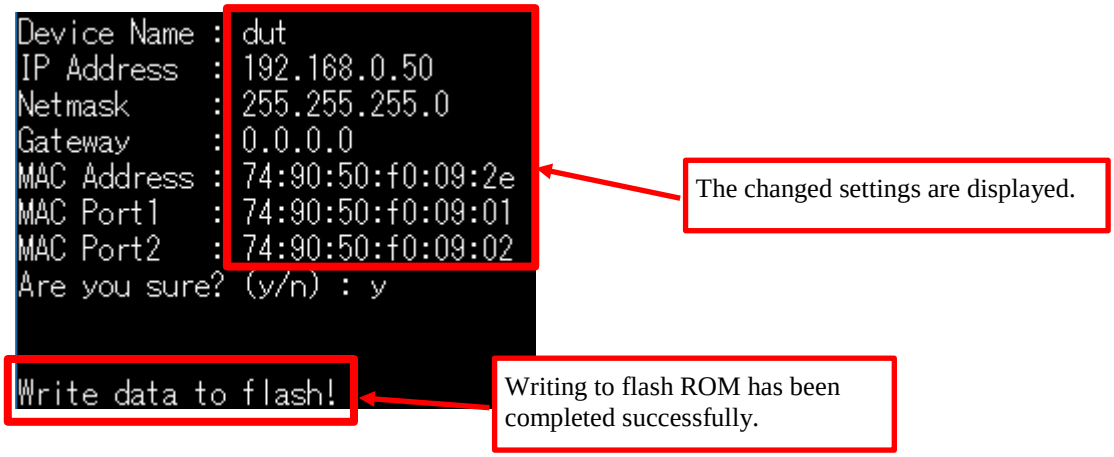
(9) Changing MAC Port 2

To change MAC port 2 “74:90:50:f0:09:02”, enter “y” and press Enter. Otherwise, enter “n” and press Enter.



(10) Writing to the Flash ROM

If you have no problem with the changed settings, enter “y” and press Enter. If “Write data to flash!” appears, writing to the flash ROM has been completed successfully. If you want to change the settings again, enter “n” and press Enter.



Appendix B Notes on the Sample Program

● Timeout

The sample program is for evaluation and therefore has functionality for timeout if communications continue for more than 24 hours. If you want to release the timeout functionality, contact our partner Sherpa Inc. (https://www.sherpa-tech.net/).

● Vendor ID

The sample program is for evaluation and therefore uses the vendor ID owned by Renesas Electronics. If you want to use your own vendor ID, contact our partner Sherpa Inc. (https://www.sherpa-tech.net/).

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Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Jul. 31, 2018	—	First edition issued

General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Handling of Unused Pins

   Handle unused pins in accordance with the directions given under Handling of Unused Pins in the manual.

   — The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible. Unused pins should be handled as described under Handling of Unused Pins in the manual.

2. Processing at Power-on

   The state of the product is undefined at the moment when power is supplied.

   — The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the moment when power is supplied.
   In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the moment when power is supplied until the reset process is completed.
   In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the moment when power is supplied until the power reaches the level at which resetting has been specified.

3. Prohibition of Access to Reserved Addresses

   Access to reserved addresses is prohibited.

   — The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.

4. Clock Signals

   After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has stabilized.

   — When the clock signal is generated with an external resonator (or from an external oscillator) during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Moreover, when switching to a clock signal produced with an external resonator (or by an external oscillator) while program execution is in progress, wait until the target clock signal is stable.

5. Differences between Products

   Before changing from one product to another, i.e. to a product with a different part number, confirm that the change will not lead to problems.

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