# R-IN32M3 Series

## EtherNet/IP Transfer Procedure Startup Manual

R01AN4281EJ0100
Rev.1.00
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### Outline

This manual explains the procedure for connecting a CODESYS software programmable logic controller (PLC) with the Renesas Electronics R-IN32M3-EC evaluation board to enable EtherNet/IP™ transfer.

The R-IN32M3 EtherNet/IP stack sample program in this package (“sample program”) runs on the Arm® Cortex®-M3 core. Its configuration is intended for those who wish to start developing EtherNet/IP devices with products of the R-IN32M3 series.

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

### Target Devices

R-IN32M3 Series

### Sample Program

This sample program uses the evaluation version of EtherNet/IP 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 | R-IN32M3-EC evaluation board<br>TS-R-IN32M3-EC |
| MCU | R-IN32M3 |
| Operating frequency | 100 MHz |
| Operating voltage | 3.3 V |
| Operating mode | • Boot from the instruction RAM.<br>• Boot from the external serial flash ROM. |
| Device used | Serial flash memory<br>S25FL032P0XNFI010 from Spansion |
| Communications protocol | EtherNet/IP |
| 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 R-IN32M3-EC Evaluation Board

For detailed information on the board, refer to the *TS-R-IN32M3-EC-E User's Manual*, which is available at the following link.

http://www.tessera.co.jp/eng/ts-r-in32m3-e.html

### 2.1 Setting up the R-IN32M3-EC 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.

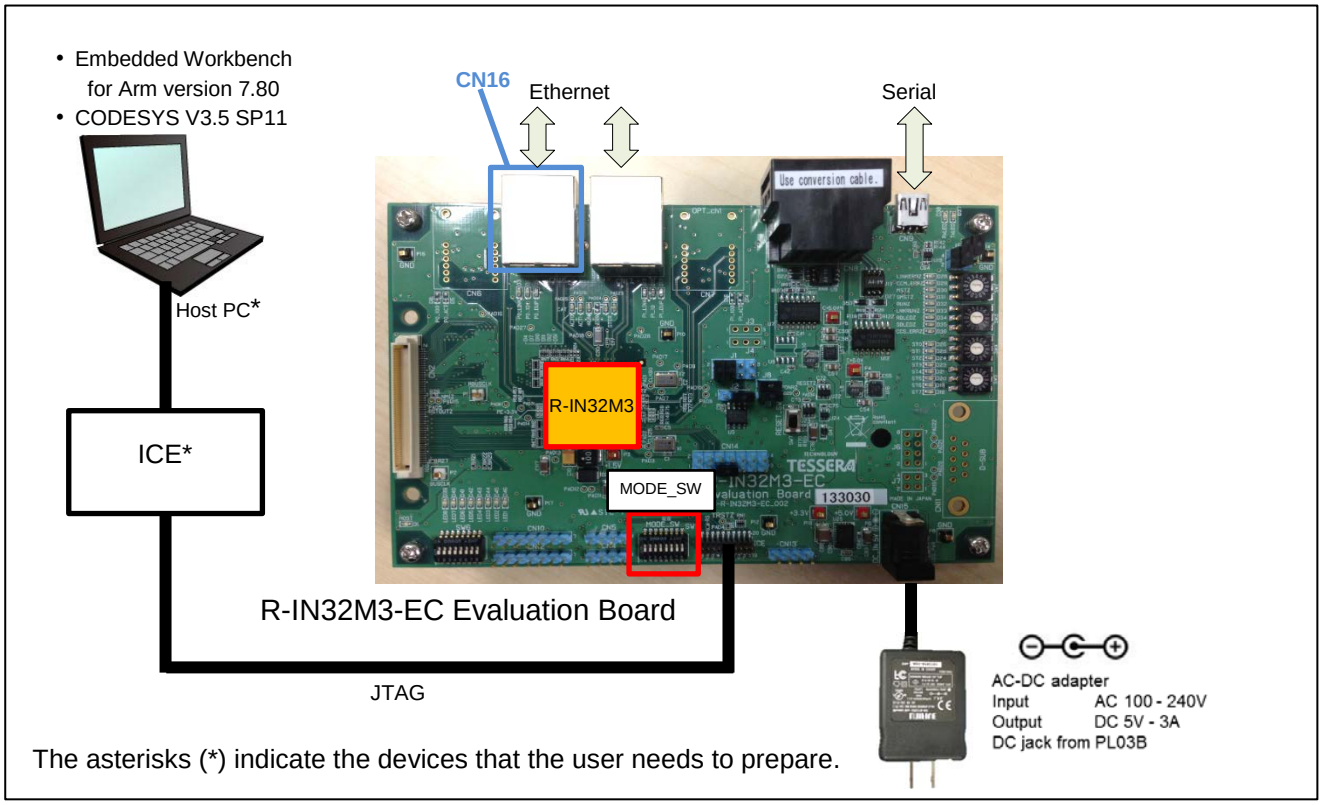



Figure 2.1 Parts to Set up and the Locations for Cable Connections

## 2.2 Settings to Start the R-IN32M3-EC Board

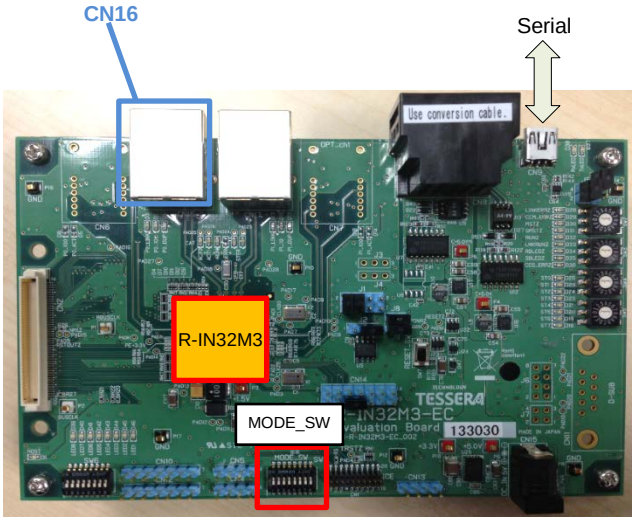
The levels on external pins (BOOT0 and BOOT1) of the R-IN32M3 series device select the source from which the board is to be booted up. The boot mode for the R-IN32M3-EC evaluation board is selected by the setting of MODE_SW (SW1).

The setting should be made before connecting an DC adapter to supply 5 V at up to 3 A.

Table 2.1 Operating Mode Selection

| MODE_SW (SW1) | | Boot Mode Selection |
|---|---|---|
| 1 | 2 | |
| ON (High) | ON (High) | Booting is from the instruction RAM (only usable for debugging). |
| OFF (Low) | ON (High) | Booting is from the external MCU. |
| ON (High) | OFF (Low) | Booting is from the external serial flash ROM. |
| OFF (Low) | OFF (Low) | Booting is from the external parallel flash ROM. |

R-IN32M3-EC Evaluation Board




■ Setting for booting from the instruction RAM (MODE_SW(SW1[1:8]))

TS-R-IN32M3-EC

ON ■■□□□□□□

OFF □□■■■■■■

■ Setting for booting from the external serial flash ROM (MODE_SW(SW1[1:8]))

TS-R-IN32M3-EC

ON ■□□□□□□□

OFF □■■■■■■■

## 2.3 Connecting the R-IN32M3-EC Evaluation Board

Connect the cables as described below.

(1) Connect the Ethernet cable (category 5 is recommended) to CN16.

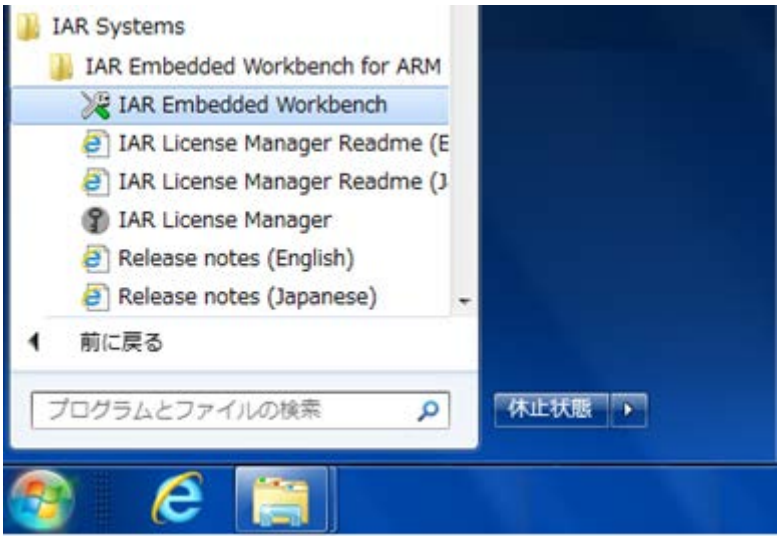
(2) Connect the JTAG connector for ICE (I-jet) to CN1 (ARM JTAG20) to connect the host computer over the USB.

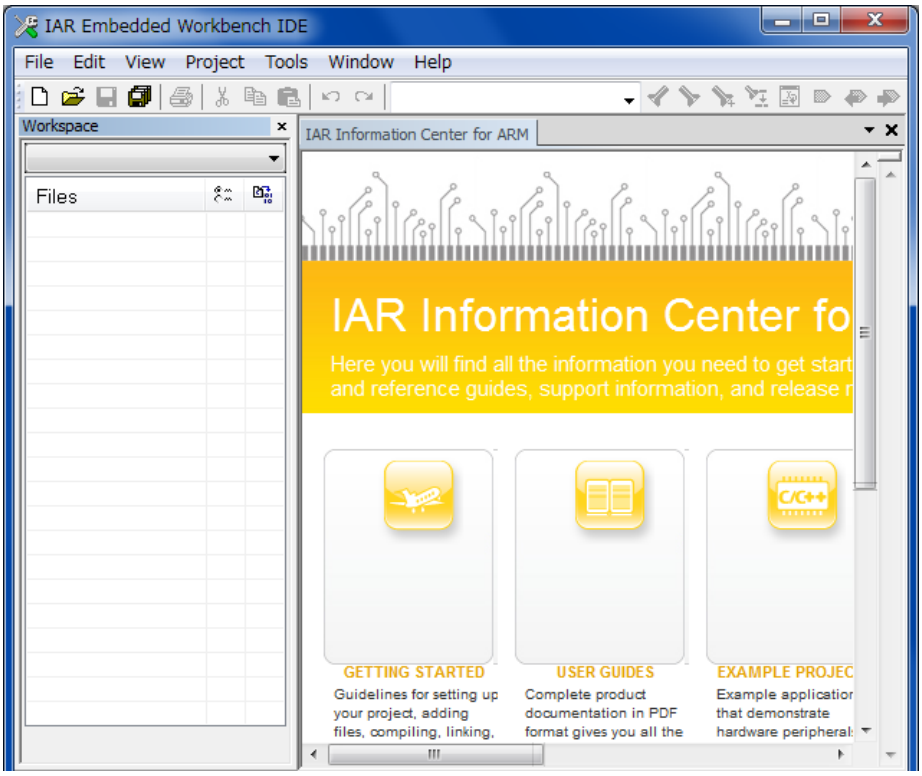
(3) Connect an AC adapter with DC 5 V output to CN15 to supply power.

# 3. Starting the R-IN32M3 EtherNet/IP Stack Sample Program

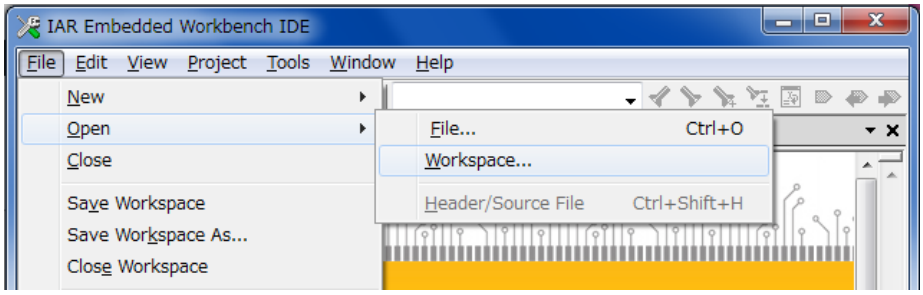
## 3.1 Starting and Building a Project

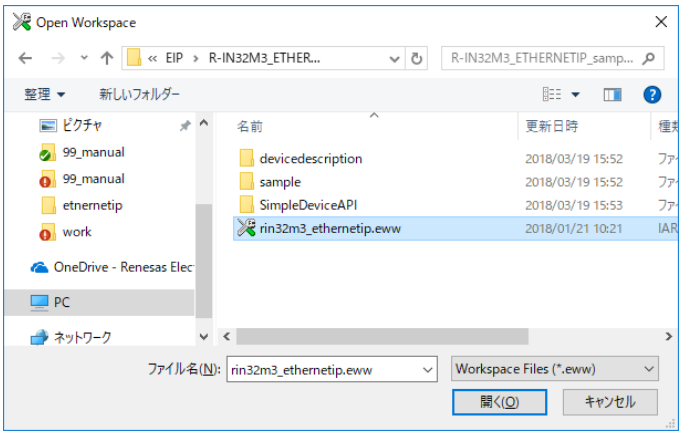
(1) From the Windows Start menu, click on [All Programs] → [IAR Systems] → [IAR Embedded Workbench for ARM x.xx] → [IAR Embedded Workbench] to start the IAR Embedded Workbench.



(2) Select [File] → [Open] → [Workspace] and double-click on the “rin32m3_ethernetip.eww” filename in ¥an-r01an4281ej0100_rin32m3_ethernetip¥R-IN32M3_ETHERNETIP_sample to open the workspace.



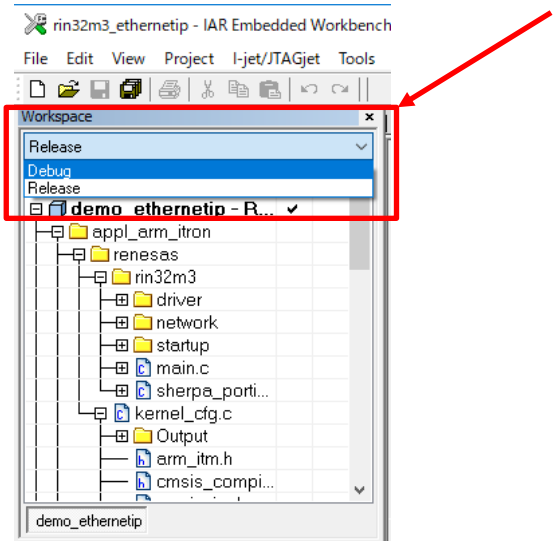




(3) Select the build setting from the following two types (“Debug” and “Release”).

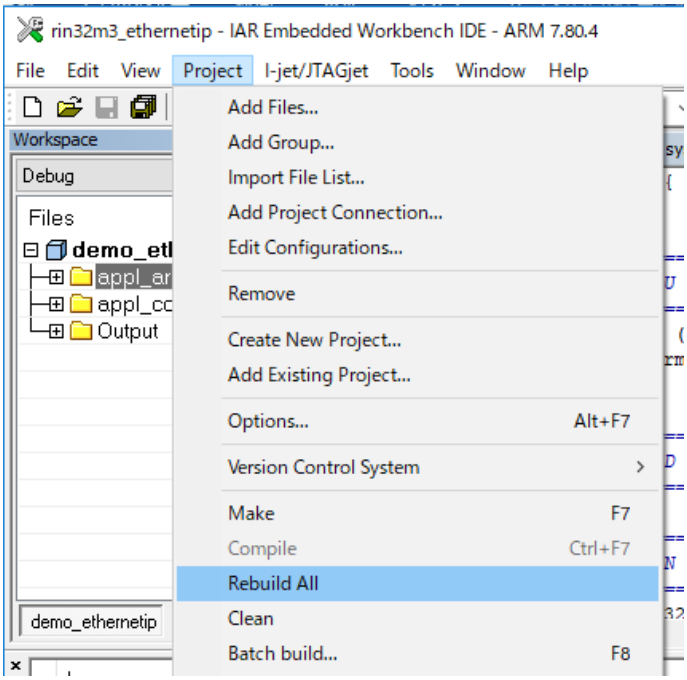
[For execution from the internal RAM (iRAM) of R-IN32M3 from the ICE]

If you selected booting from the instruction RAM in section 2.2, Settings to Start the R-IN32M3-EC Board, select “Debug”.

[For booting from the external serial flash ROM of R-IN32M3 from the ICE]
If you selected booting from the external serial flash ROM in section 2.2, Settings to Start the R-IN32M3-EC Board, select “Release”.

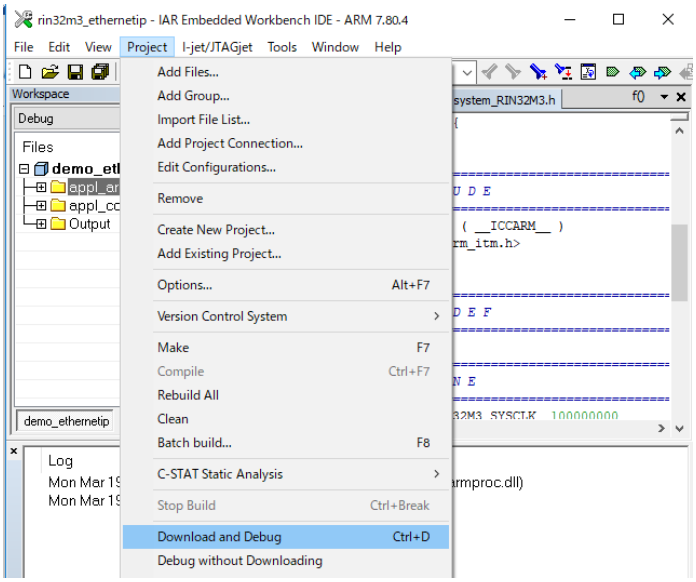


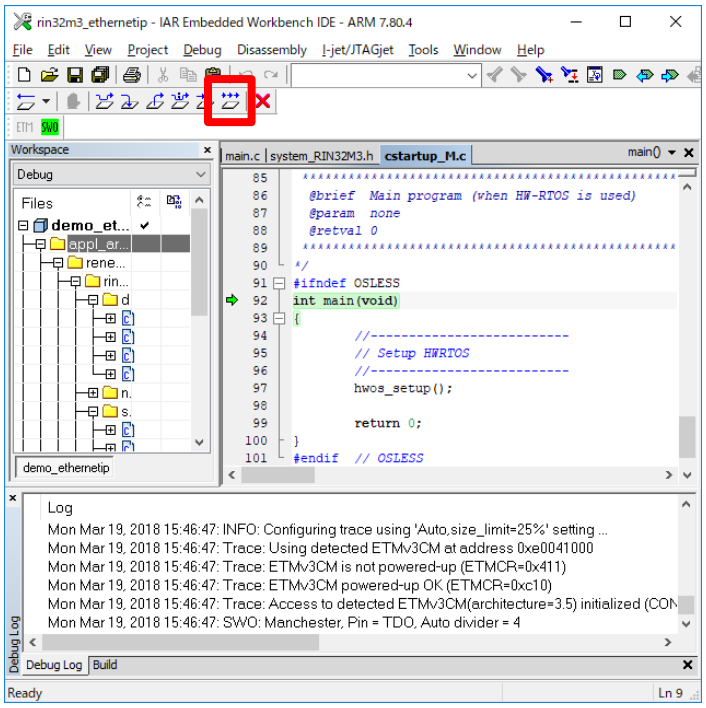
(4) Select [Project] → [Rebuild All] to run a build.



## 3.2 Starting the Program

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



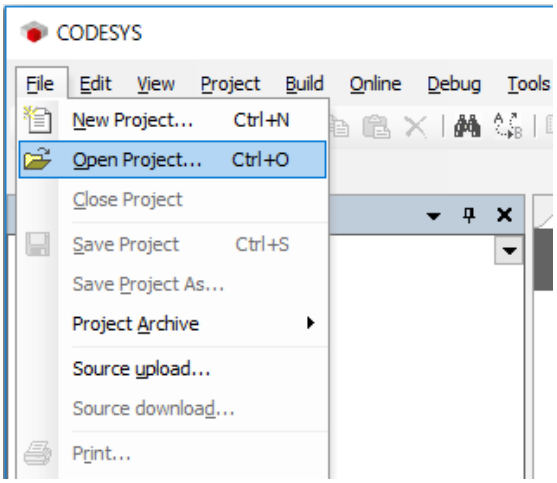
# 4. Confirming Transfer to and from CODESYS

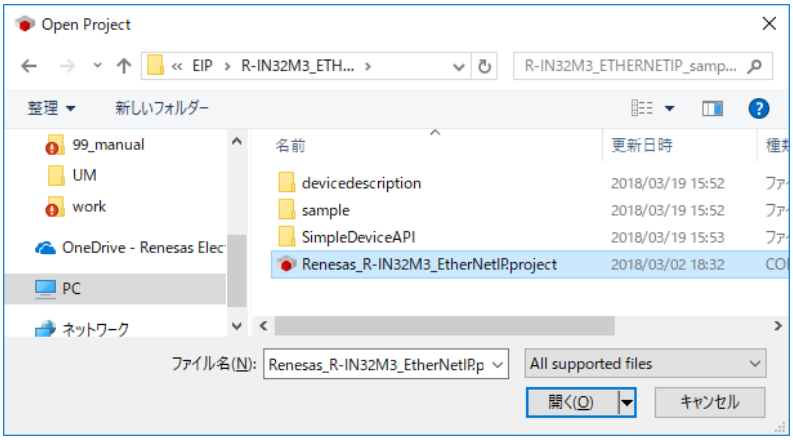
## 4.1 Starting CODESYS

(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.

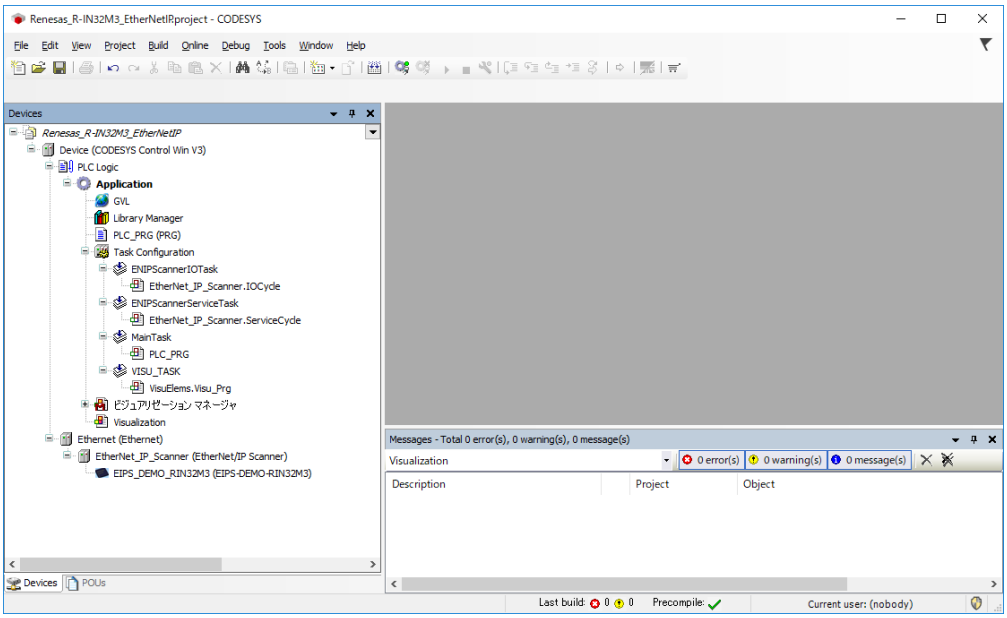
(2) Click on [File] → [Open Project …] and double-click on the “Renesas_R-IN32M3_EtherNetIP.project” filename in ¥an-r01an4281ej0100_rin32m3_ethernetip¥ to open the project.

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.



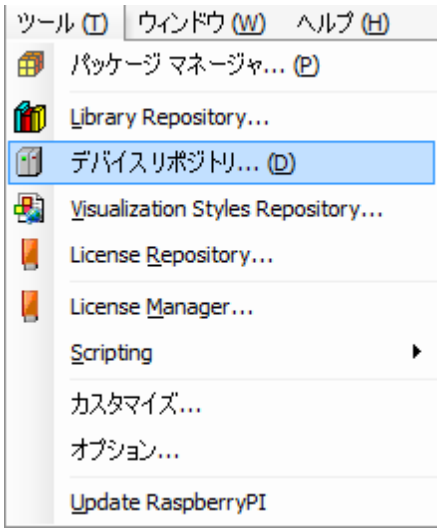

## 4.2 Updating the Slave Device

Only follow the procedure described in this section the first time you start “Renesas_R-IN32M3_EtherNetIP.project” in ¥an-r01an4281ej0100_rin32m3_ethernetip¥.

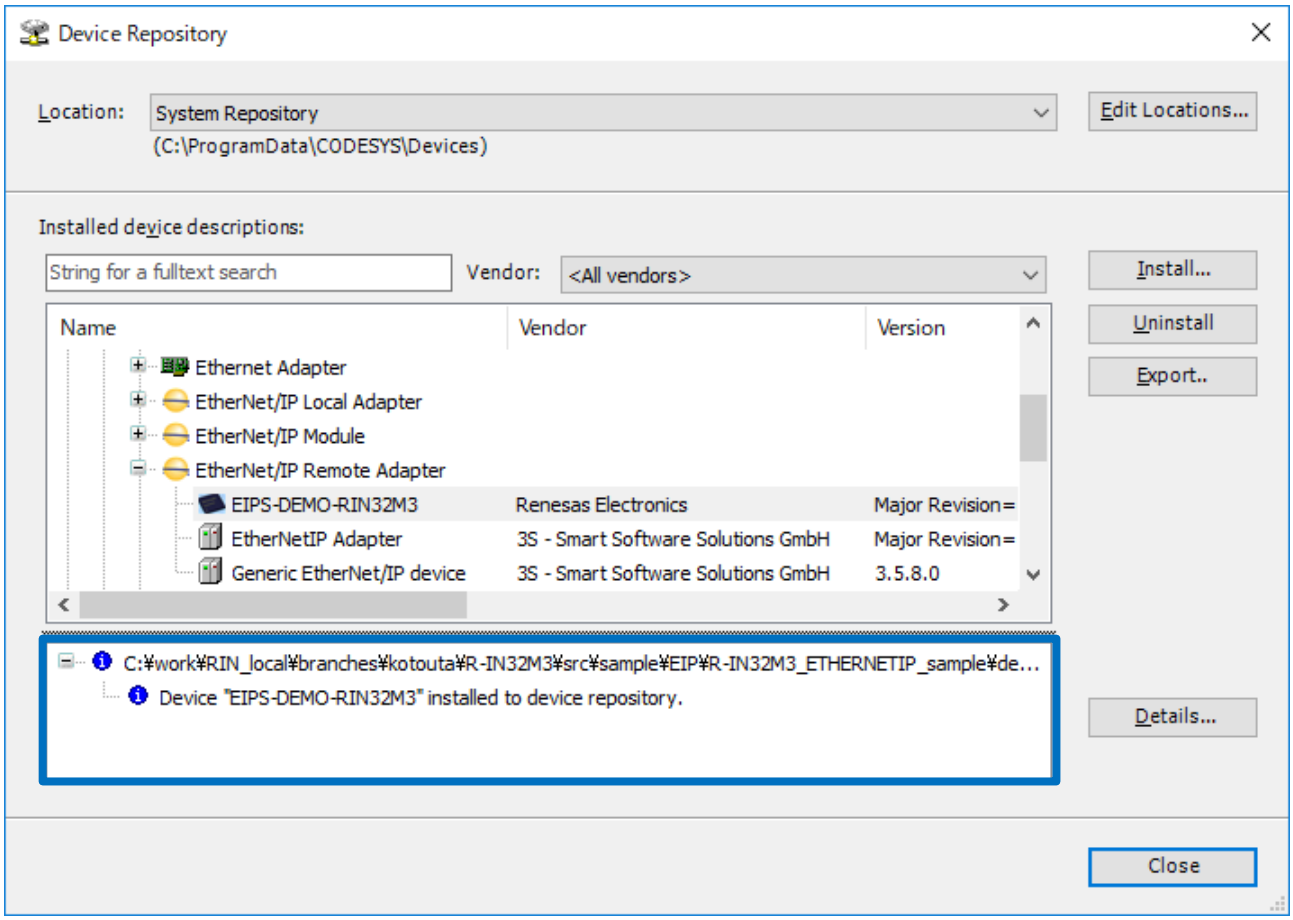
### 4.2.1 Installing Device Information

To use the EtherNet/IP slave device, you need to install the Electronic Data Sheet (EDS) file which contains information on the device. Use the file which is included in the stack.

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



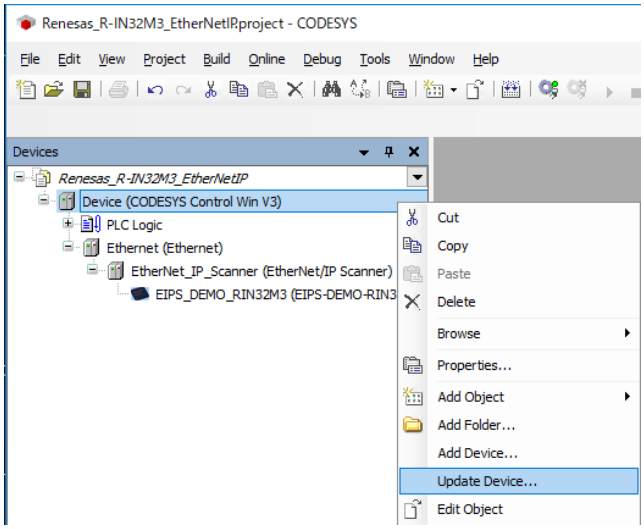
In the “Device Repository” dialog box, click on [Install]. A file dialog box will appear. Specify the EDS file “RIN32M3-EthernetIP-Adapter_R3.eds” in ¥an-r01an4281ej0100_rin32m3_ethernetip¥ R-IN32M3_ETHERNETIP_sample¥devicedescription¥etnernetip. The result of installation will be indicated within the area in the blue frame in the figure below. The “ ” icon is displayed next to the result of a successful installation.



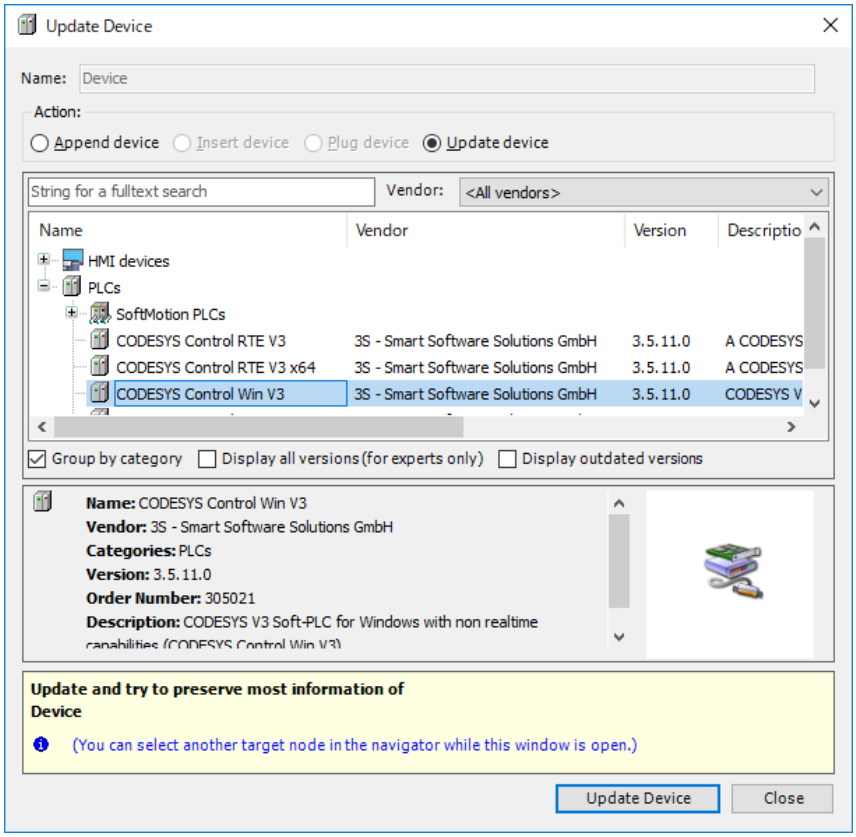
### 4.2.2 Updating the Devices

(1) Updating the Device

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

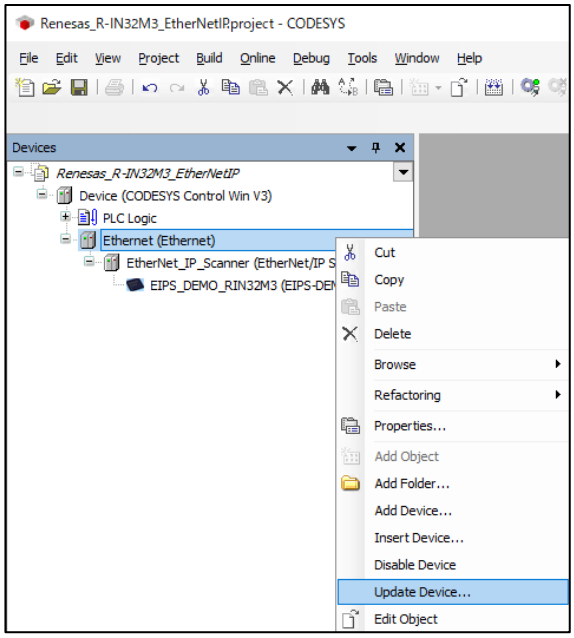



In the “Update Device” dialog box, select “CODESYS Control Win V3” under “PLCs”, “SoftMotion PLCs”, then click on the [Update Device] button.

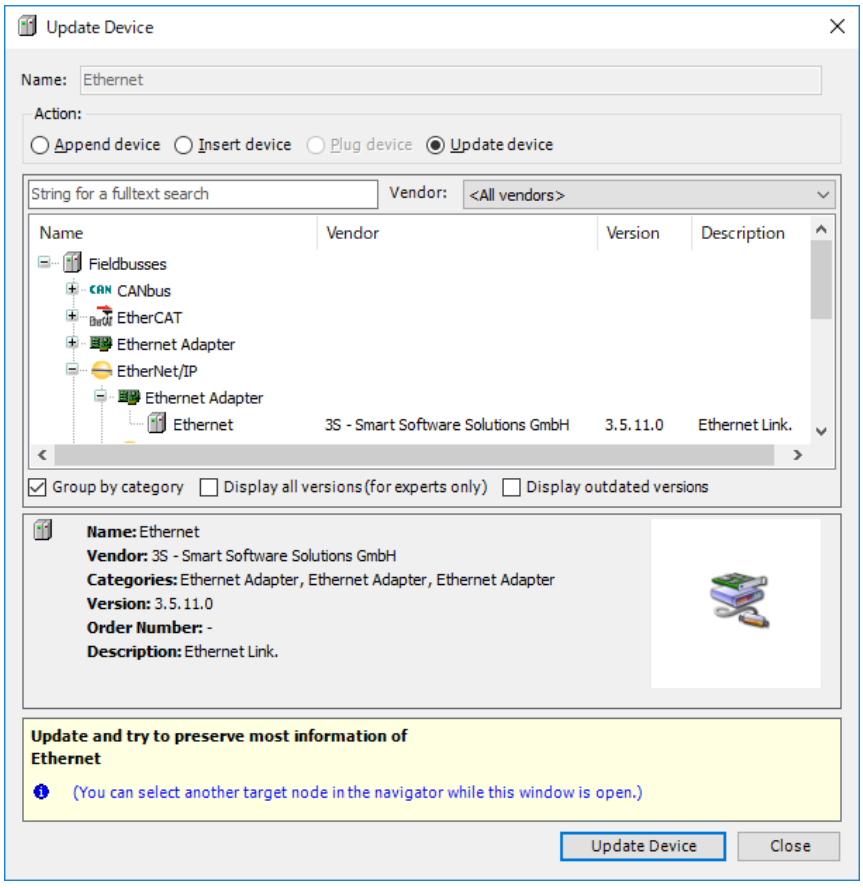


(2) Updating the Ethernet Settings

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

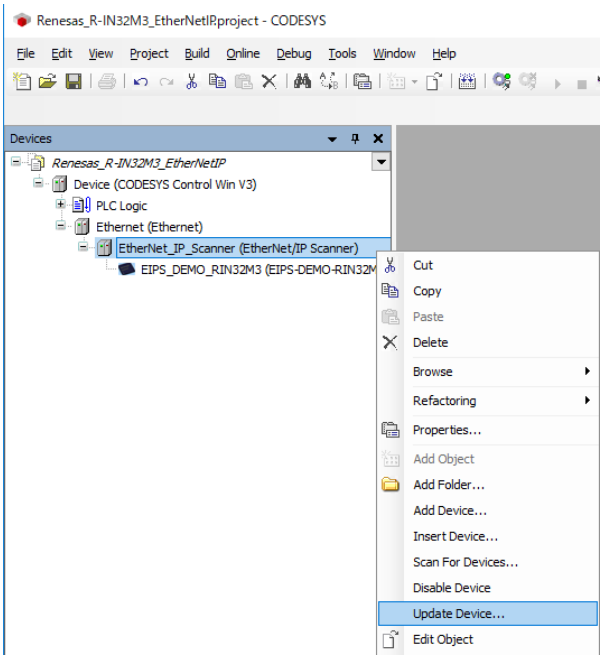



In the “Update Device” dialog box, select “Ethernet” under “Fieldbusses”, “EtherNet/IP”, “Ethernet Adapter”, then click on the [Update Device] button.

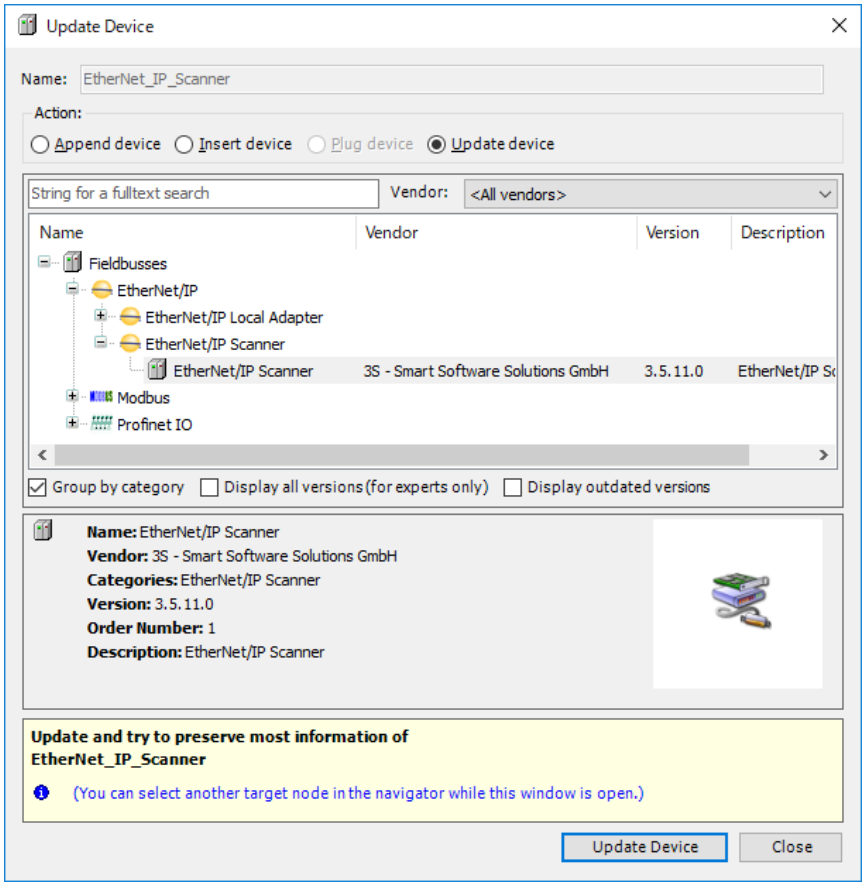


(3) Updating the EtherNet/IP Scanner

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

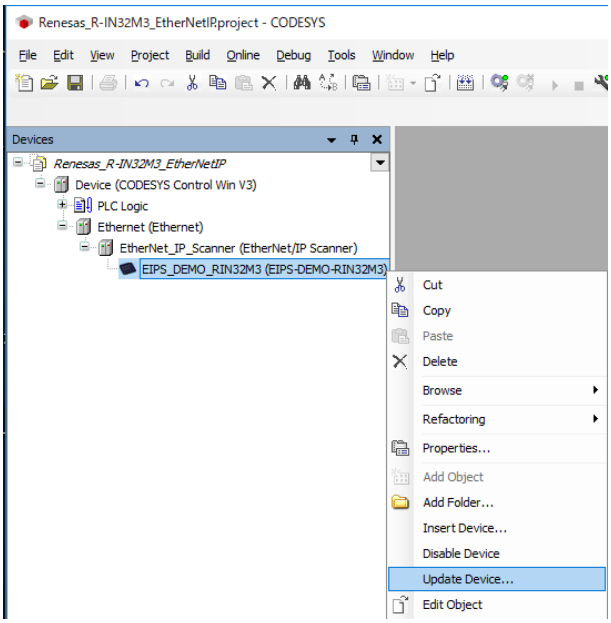



In the “Update Device” dialog box, select “EtherNet/IP Scanner” under “Fieldbusses”, “EtherNet/IP”, “EtherNet/IP Scanner”, then click on the [Update Device] button.

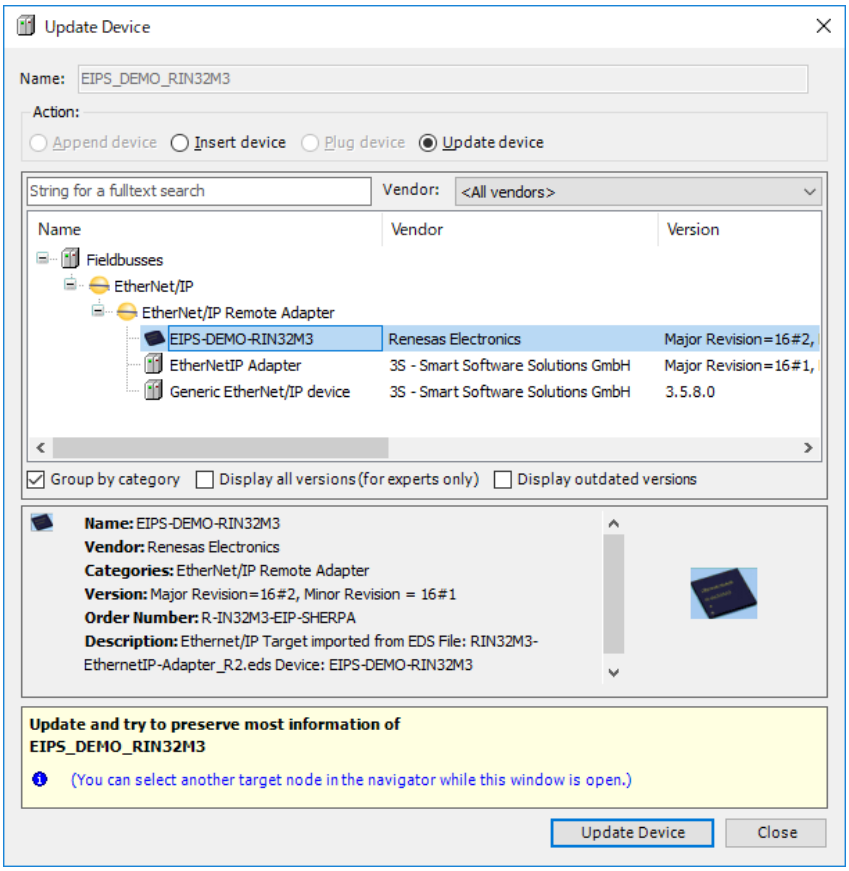


(4) Updating EIPS_DEMO_RIN32M3

Right-click on “EIPS_DEMO_RIN32M3 (EIPS_DEMO_RIN32M3)” in the “Devices” tree, then select [Update Device…].




In the “Update Device” dialog box, select “EIPS_DEMO_RIN32M3” under “Fieldbusses”, “EtherNet/IP”, “EtherNet/IP Remote Adapter”, then click on the [Update Device] button.

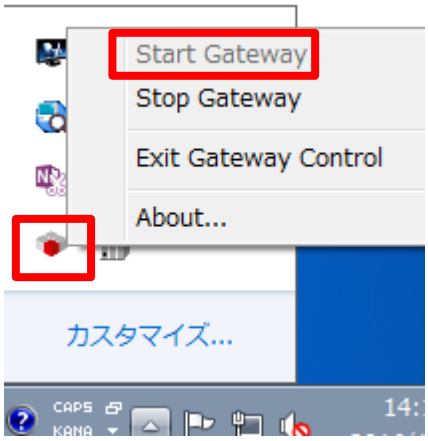


## 4.3 Connecting to the Software PLC

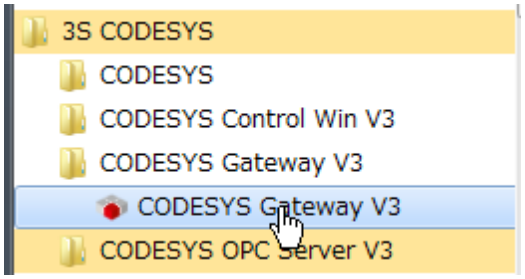
This section describes the procedure for connecting to the target software PLC from the development environment via a gateway.

### 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.

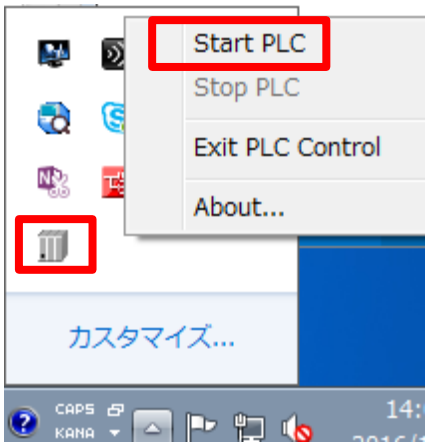



Note: If you cannot find the icon in the system tray, start up the gateway server by selecting All Programs > 3S CODESYS > CODESYS Gateway V3.
If the icon still does not appear in the system tray, try rebooting your computer.

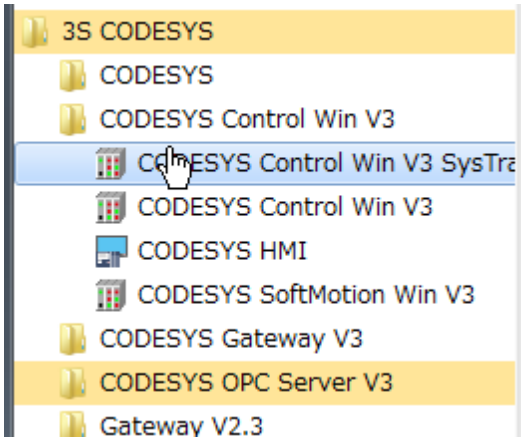


### 4.3.2 Starting the Software PLC

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.

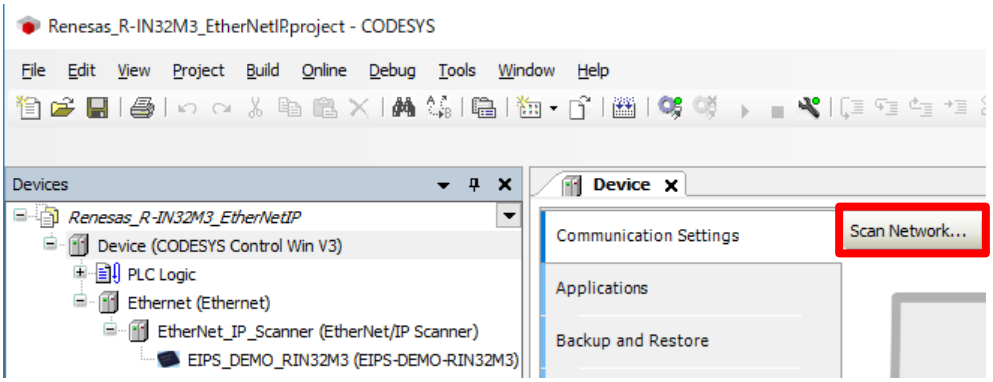



Note: If you cannot find the icon in the system tray, start up the gateway server by selecting All Programs > 3S CODESYS > CODESYS Gateway V3.
If the icon still does not appear in the system tray, try rebooting your computer.



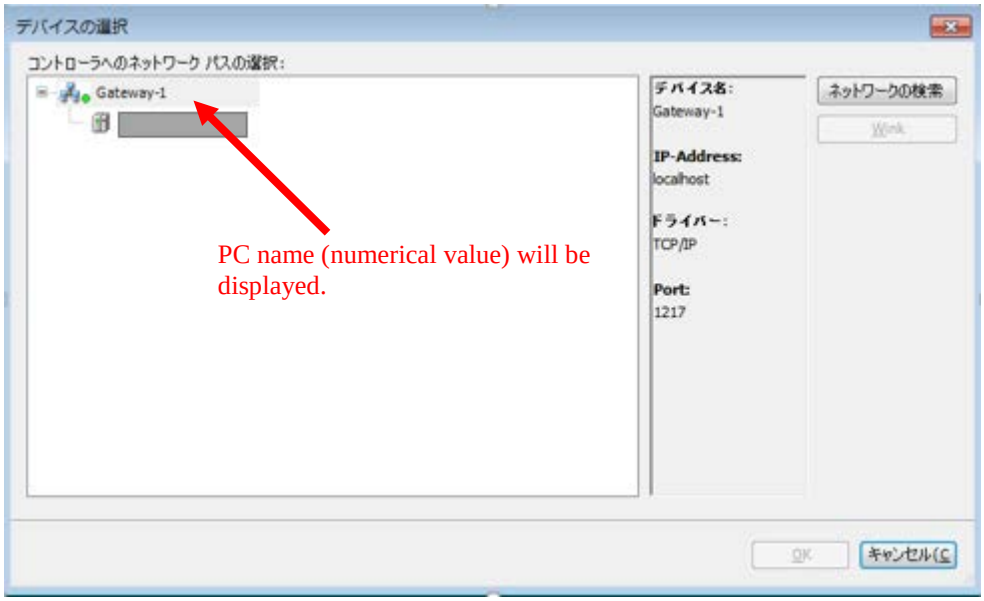
### 4.3.3 Setting up Connection with the Software PLC

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.

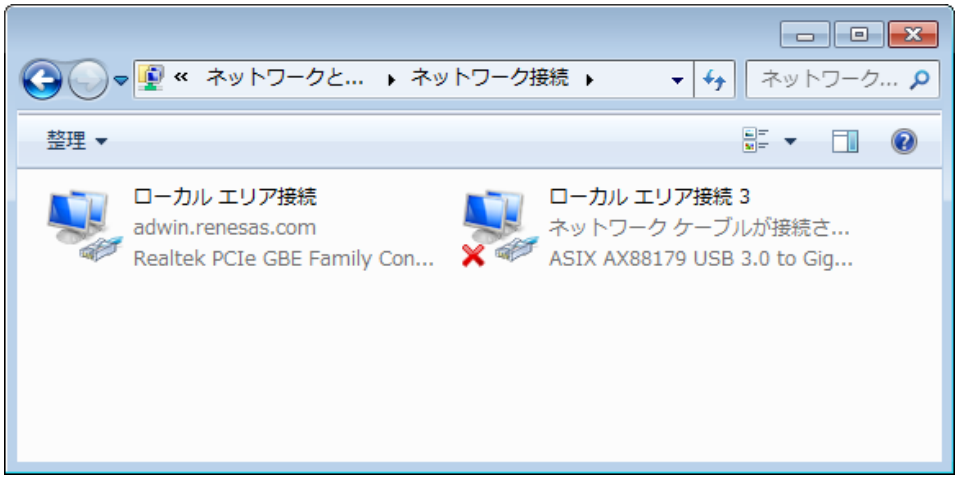


## 4.4 Network Settings for Devices

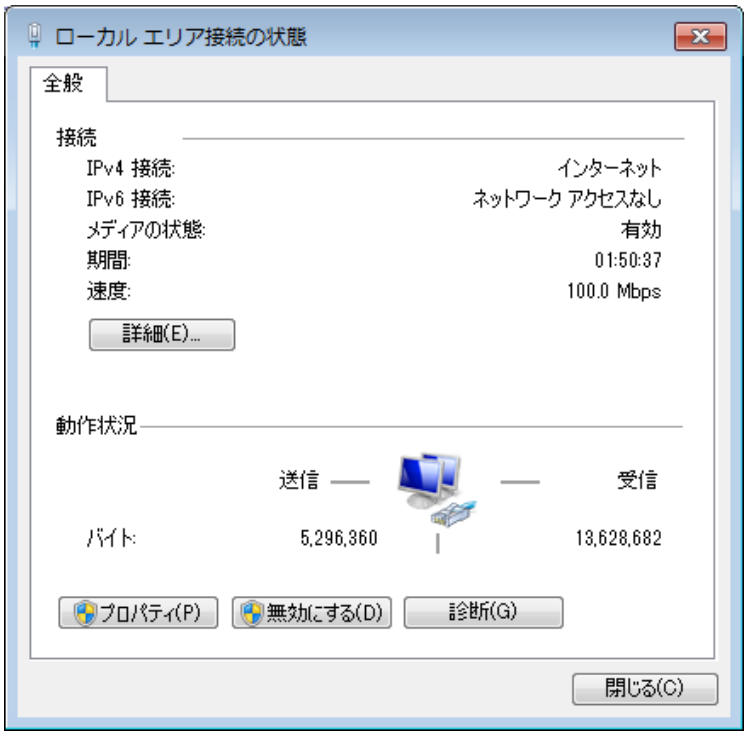
### 4.4.1 Configuring the Host IP Address

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

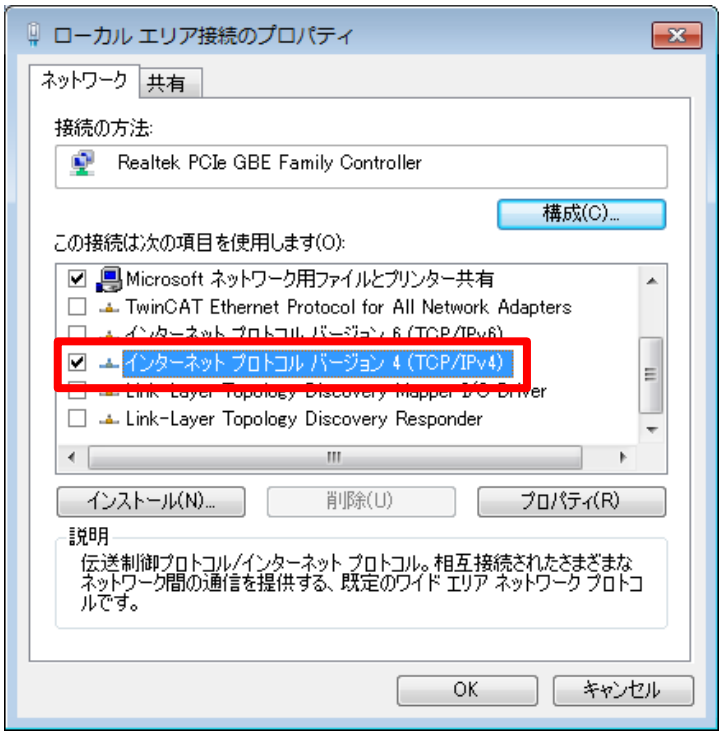
In Windows 7, go to Control Panel -> Network and Sharing Center -> Change Adapter Settings.



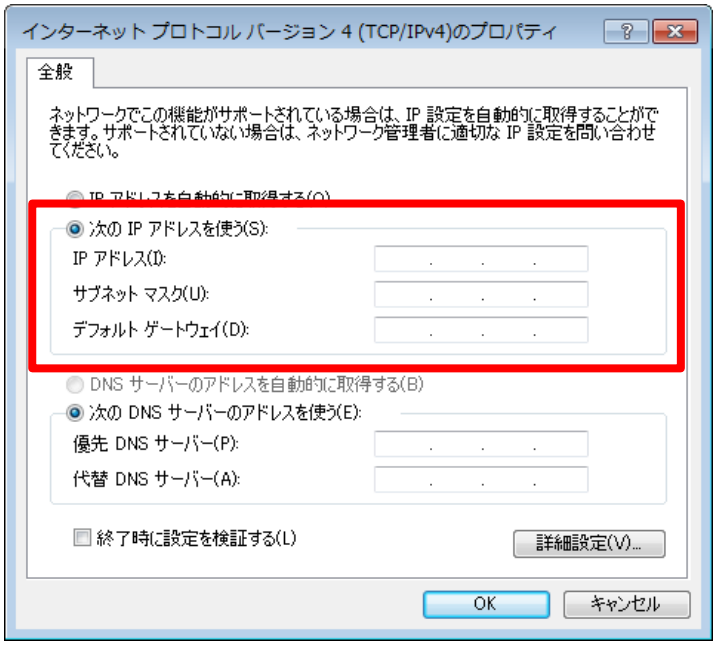

Double-click (or right-click) on Local Area Connection and select Properties.



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.

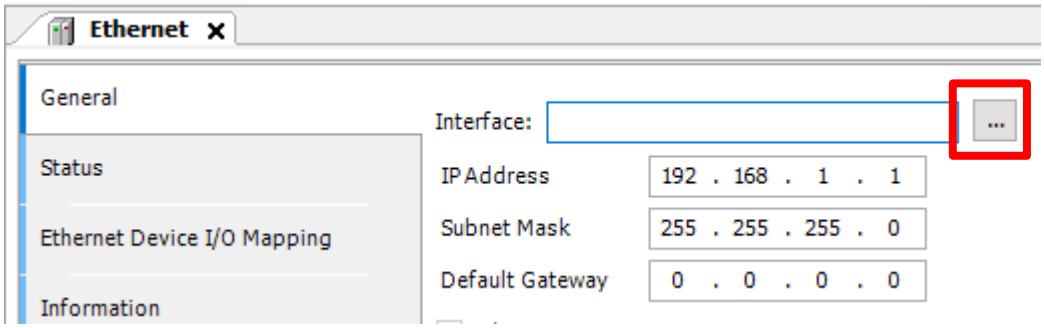



You have now completed the settings.

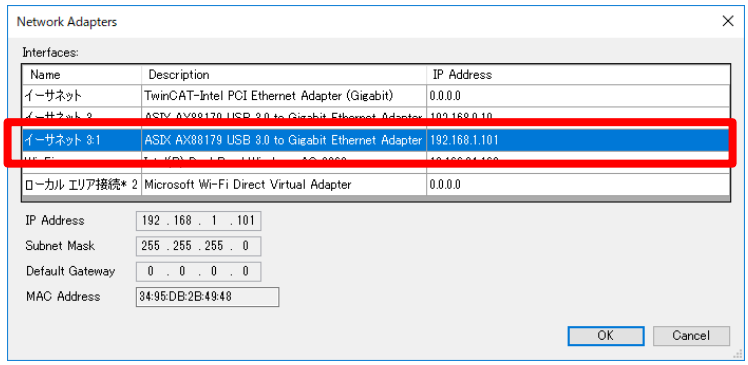
### 4.4.2 Configuring the Ethernet Link

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

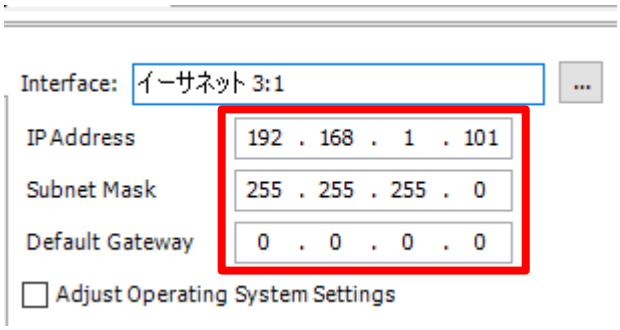
On the “General” tabbed page, click on the icon next to the text box for “Interface” selection indicated by the red frame below to display the “Network Adapters” window.




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.



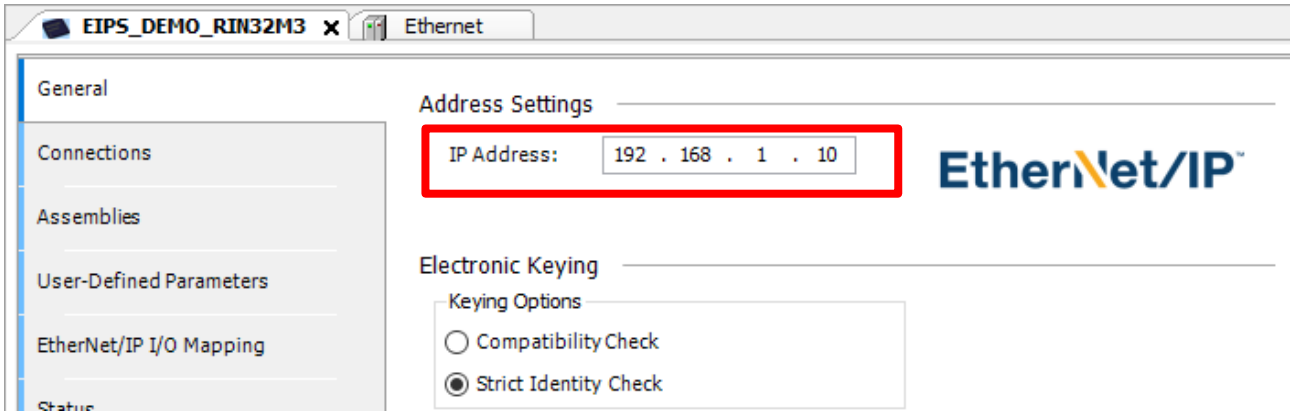
### 4.4.3 Configuring EtherNet_IP_Scanner

You do not need to make settings for this device.

### 4.4.4 Configuring EIPS_DEMO_RIN32M3

Double-click on “EIPS_DEMO_RIN32M3 (EIPS_DEMO_RIN32M3)" in the “Devices” tree to open the configuration window. In this window, make settings on the “General” tabbed page.

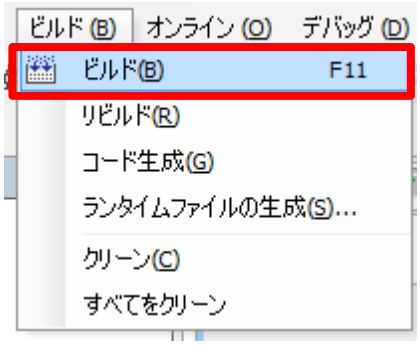
In EtherNet/IP, a slave device is identified by its IP address. Here, set the value of the IP address which has been set for the device.



## 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.

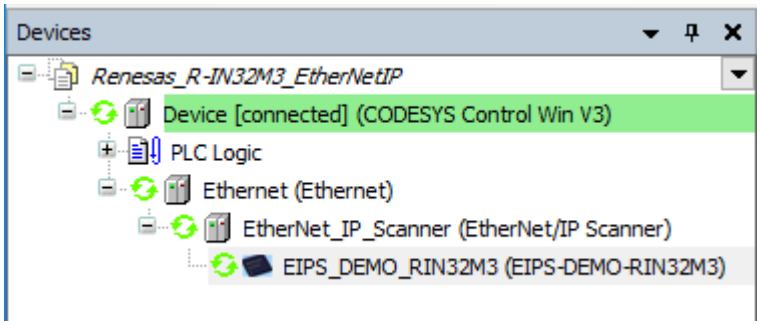
Select [Build] from the [Build] menu.




Select [Login] from the [Online] menu.


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

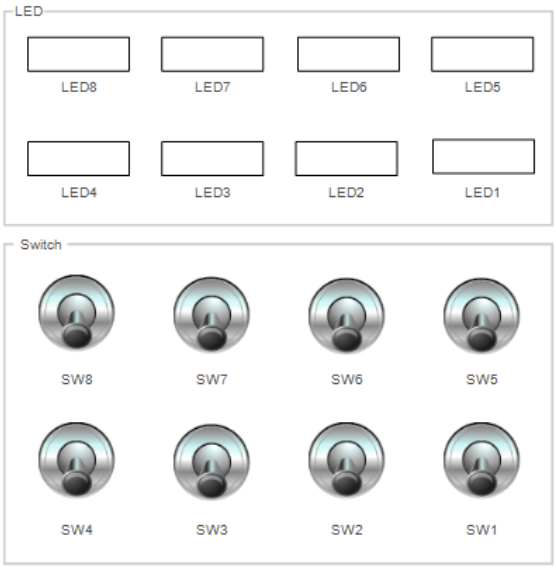
The state of connection will be indicated next to each device name. Successful connection is indicated by the " " icon as shown in the tree view below.



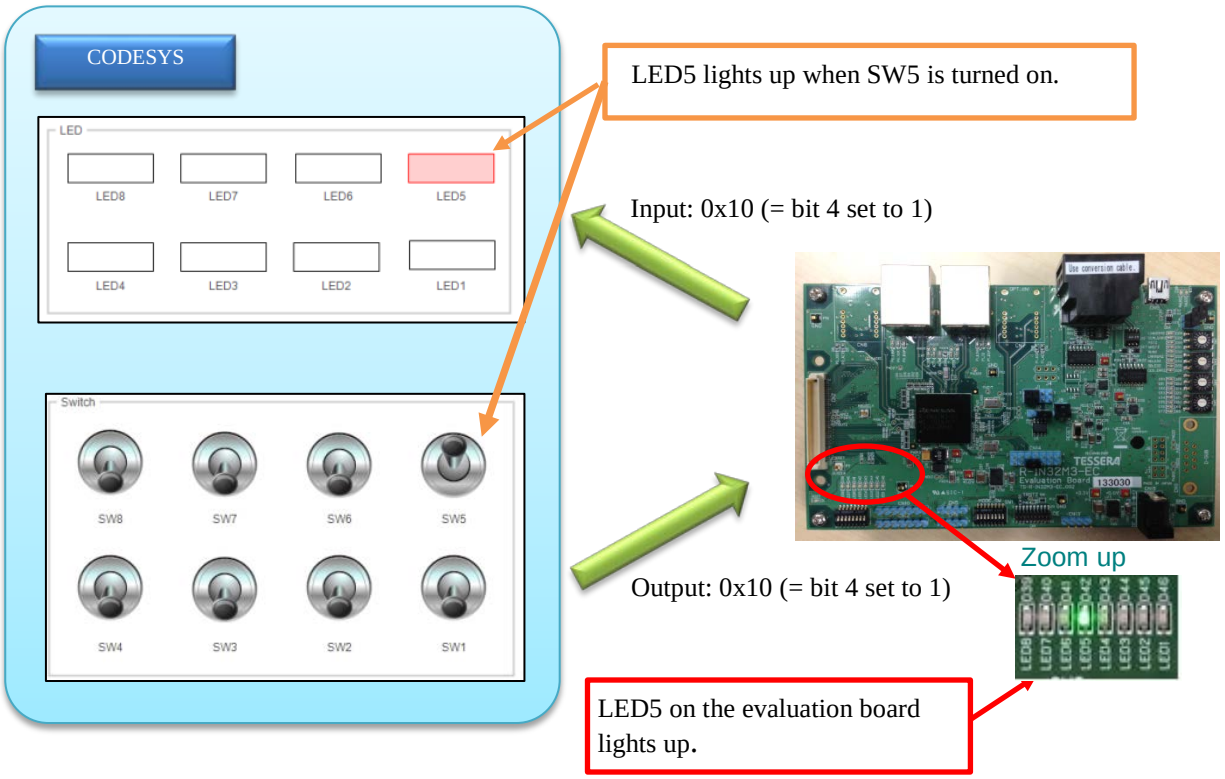

The icons indicating the state of each device are listed below.
: The PLC is connected and the application is running.
: The PLC is connected and the application is stopped.
: Error. Check the details of the error and the settings of the device.
: The device information could not be found in the device 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 following display and lights up the corresponding LEDs by transmitting 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
  - R-IN32M3 Series Datasheet
  - R-IN32M3 Series User's Manual: R-IN32M3-CL
  - R-IN32M3 Series User's Manual: R-IN32M3-EC
  - R-IN32M3 Series User's Manual: Peripheral Modules
  - 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: EtherNet/IP

  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 R-IN32M3-EC Evaluation Board

By serially connecting the host PC and the R-IN32M3-EC evaluation board, the following settings can be changed through terminal software running on the host PC.

| Name | Default Value |
|---|---|
| Device Name | dut |
| IP Address | 192.168.1.10 |
| 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 EtherNet/IP stack program had already been written to the R-IN32M3-EC 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.

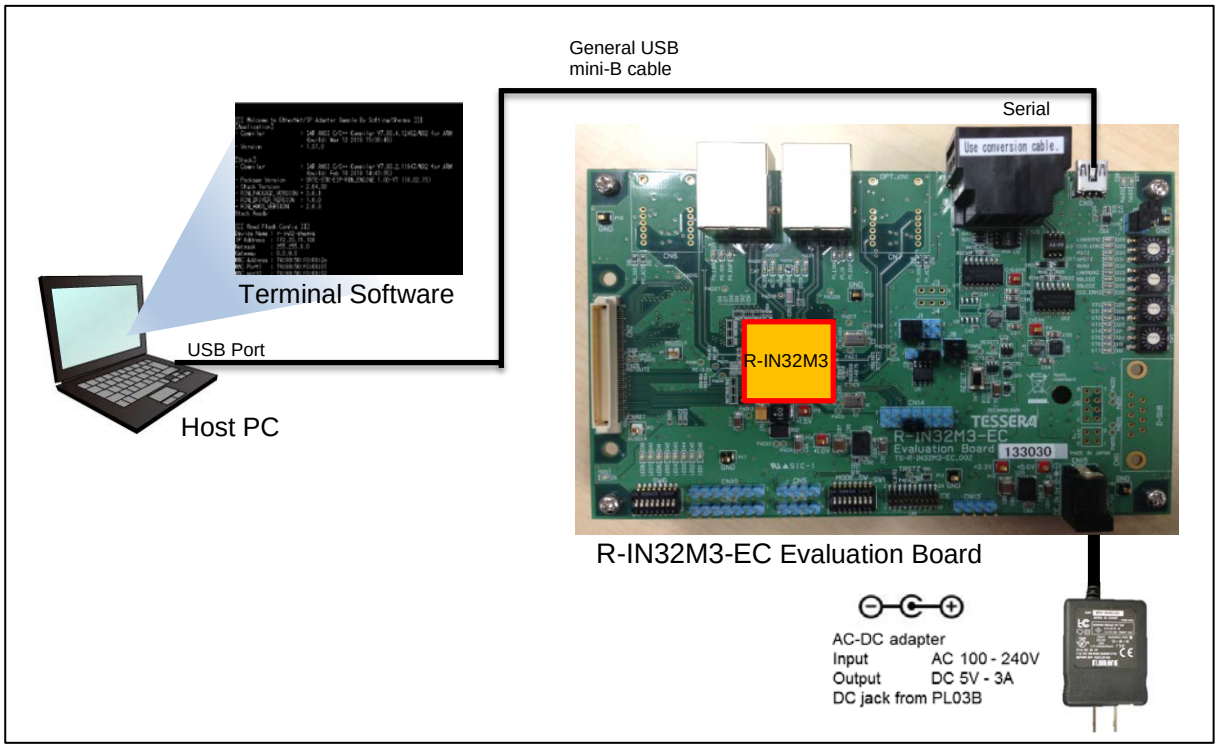



Figure A.1 System Configuration

## A-2 Changing the Configuration

### A-2-1 Connecting the R-IN32M3-EC 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 CN9 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 CN15 to supply power.

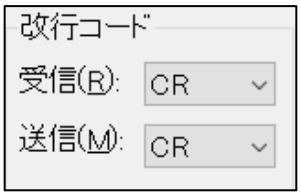
### A-2-2 Changing the Configuration

(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 |

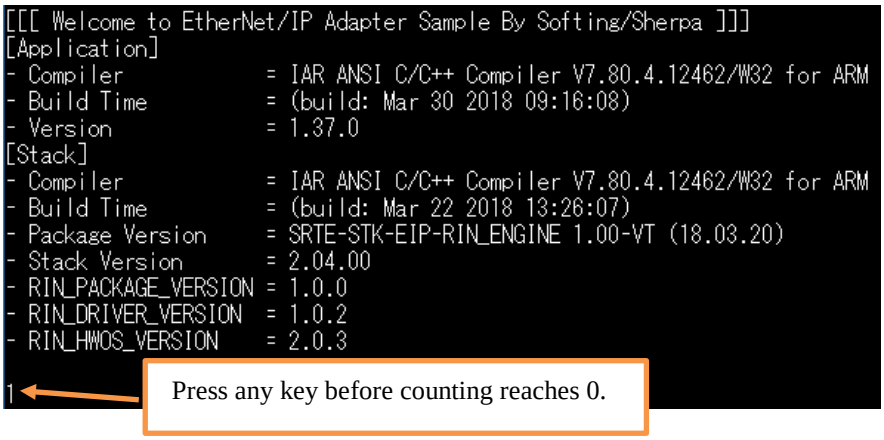
The following shows the settings for the line-feed codes of the terminal software.



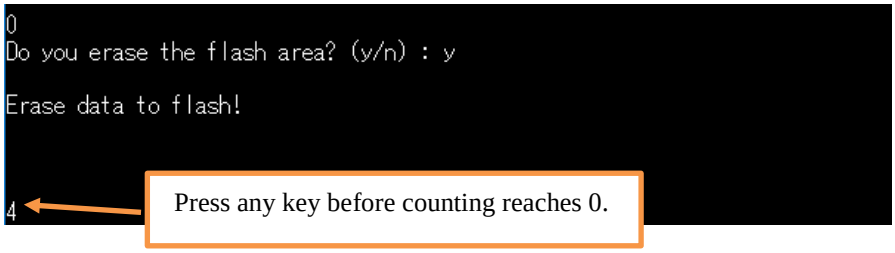
(2) Resetting and Starting the R-IN32M3-EC Evaluation Board

Press the reset button. This produces the following display.

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

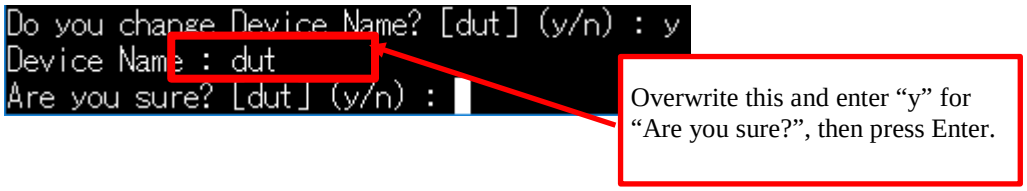



To delete the flash ROM area, enter “y” for “Do you erase the flash area? (y/n):” and press Enter. Before the count-down reaches 0 again, enter any number on the keyboard.



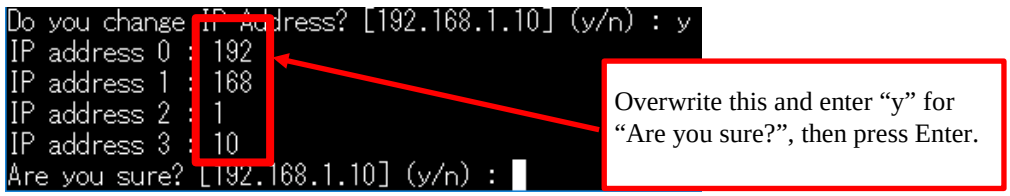

(3) Changing the Device Name

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



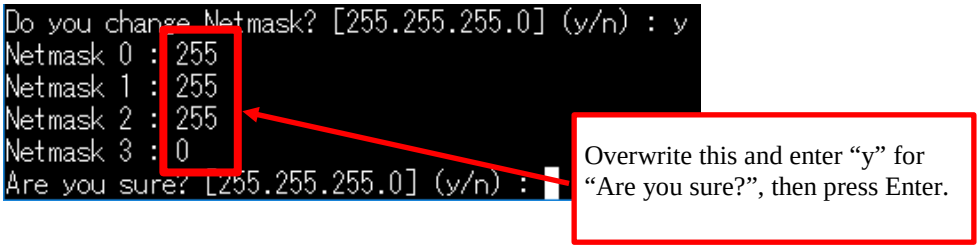

(4) Changing the IP Address

To change the IP address “192.168.1.10”, enter “y” and press Enter. Otherwise, enter “n” and press Enter.



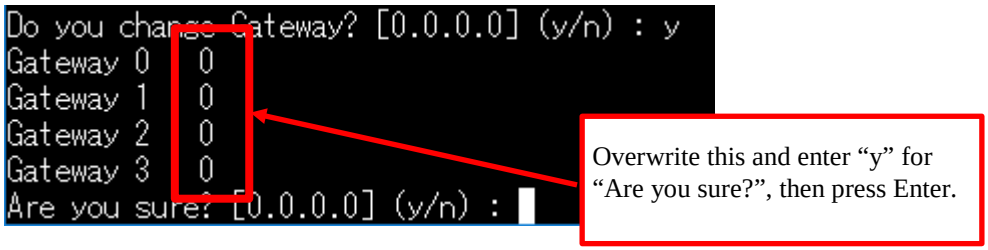
(5) Changing the Netmask

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



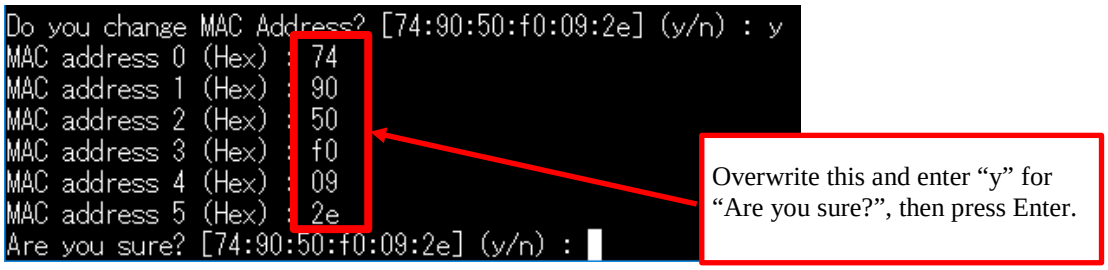

(6) Changing the Gateway

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



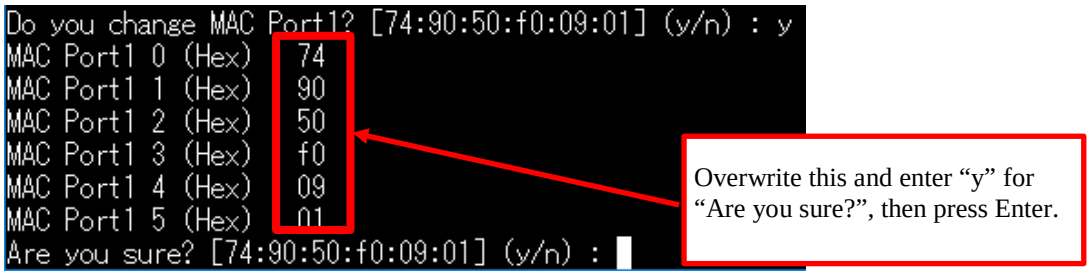

(7) Changing the MAC Address

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



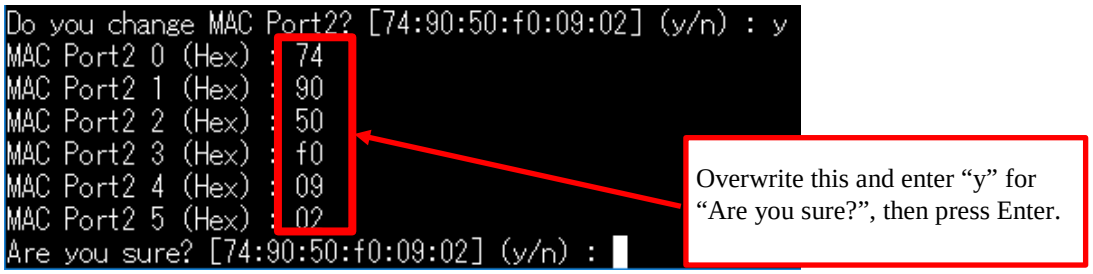
(8) Changing MAC Port 1

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



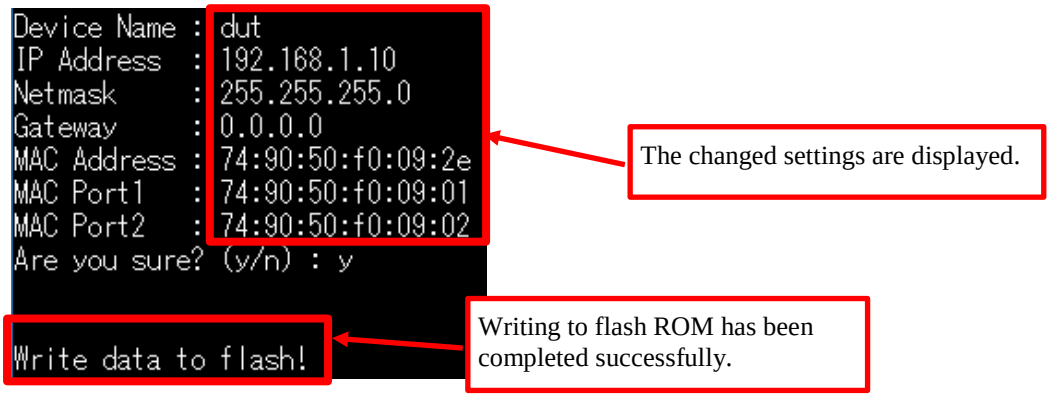

(9) Changing MAC Port 2

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 | May. 25, 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.

   — The characteristics of Microprocessing unit or Microcontroller unit products in the same group but having a different part number may differ in terms of the internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

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