R-IN32M3, RZ/T1, and TPS-1 Group

PROFINET PLC Connection Guide

R01AN3798EJ0101
Rev.1.01
Feb 1, 2021

Outline

This application note describes the procedure for connection between the evaluation board containing the R-IN32M3, RZ/T1, TPS1 group MCU to which the PROFINET software has been downloaded and the SIEMENS AG Hardware PLC using the PLC Engineering Tool "TIA Portal" provided by SIEMENS AG and the procedure for operating the PLC.

Applicable devices

R-IN32M3-EC

R-IN32M3-CL

R-IN32M3 Module

RZ/T1

TPS-1

Contents

1. Start

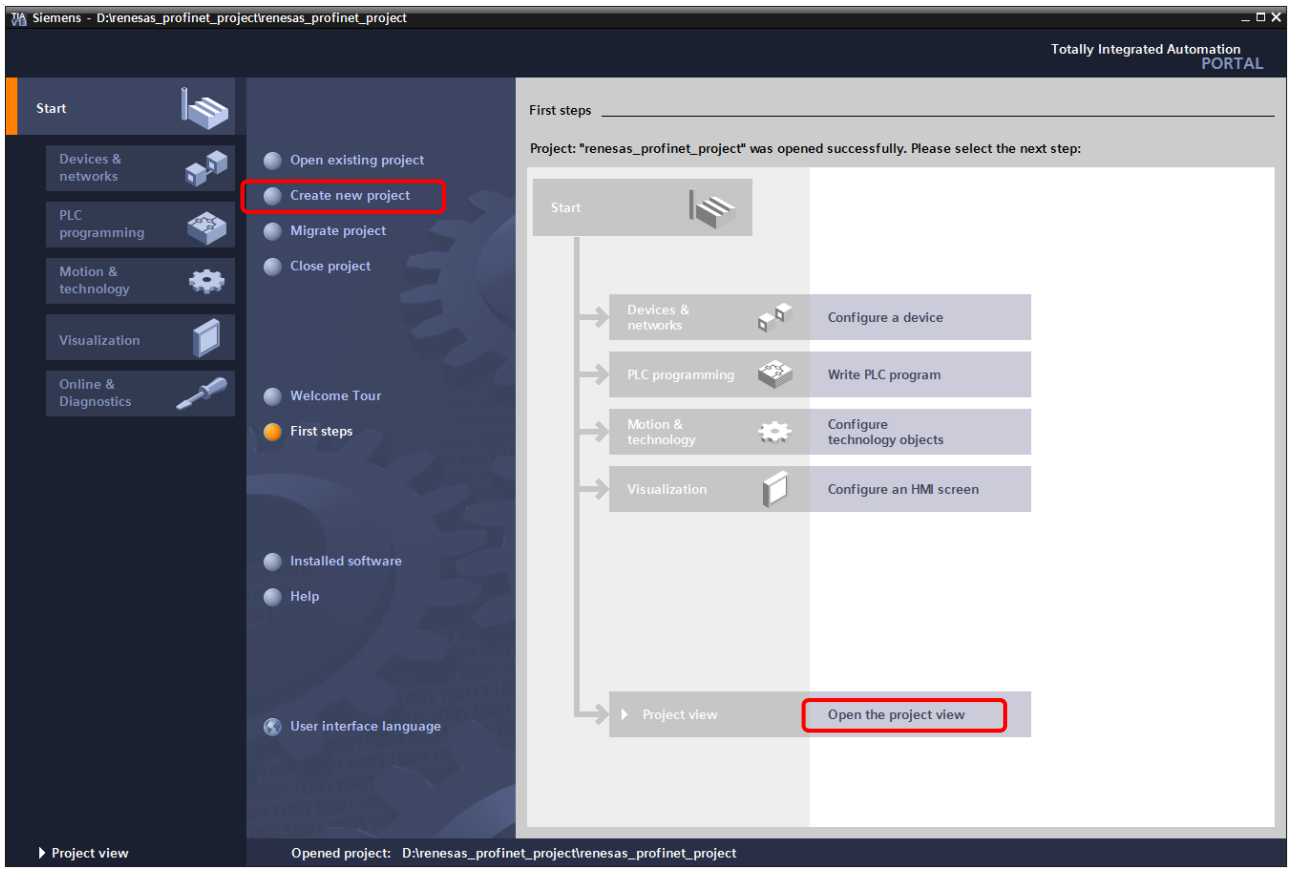
From the Windows Start menu, select All Programs > Siemens Automation> TIA portal v** to start the procedure.

You can also start the procedure by clicking the "TIA Portal" icon that appears on the desktop after installation.

2. Creating a New Project

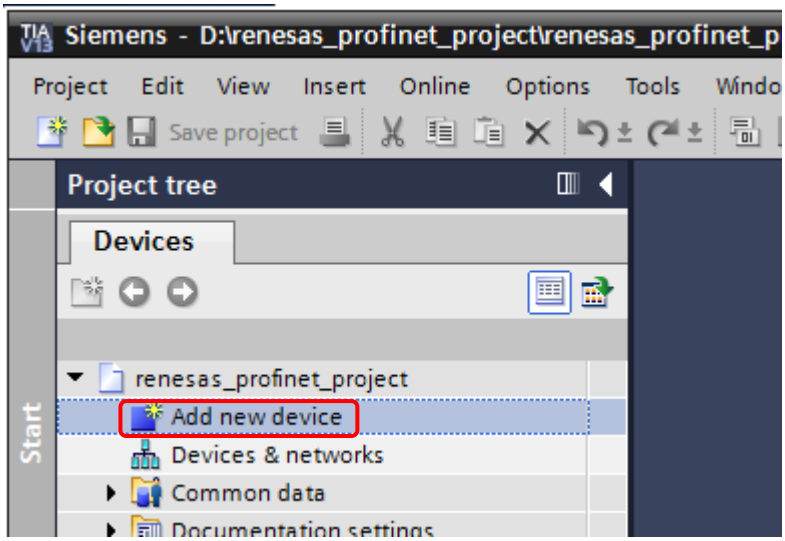
From the top menu, select "Create new project" and create a new project.

After a project has been created, click "Open the project view" to open the Project window.

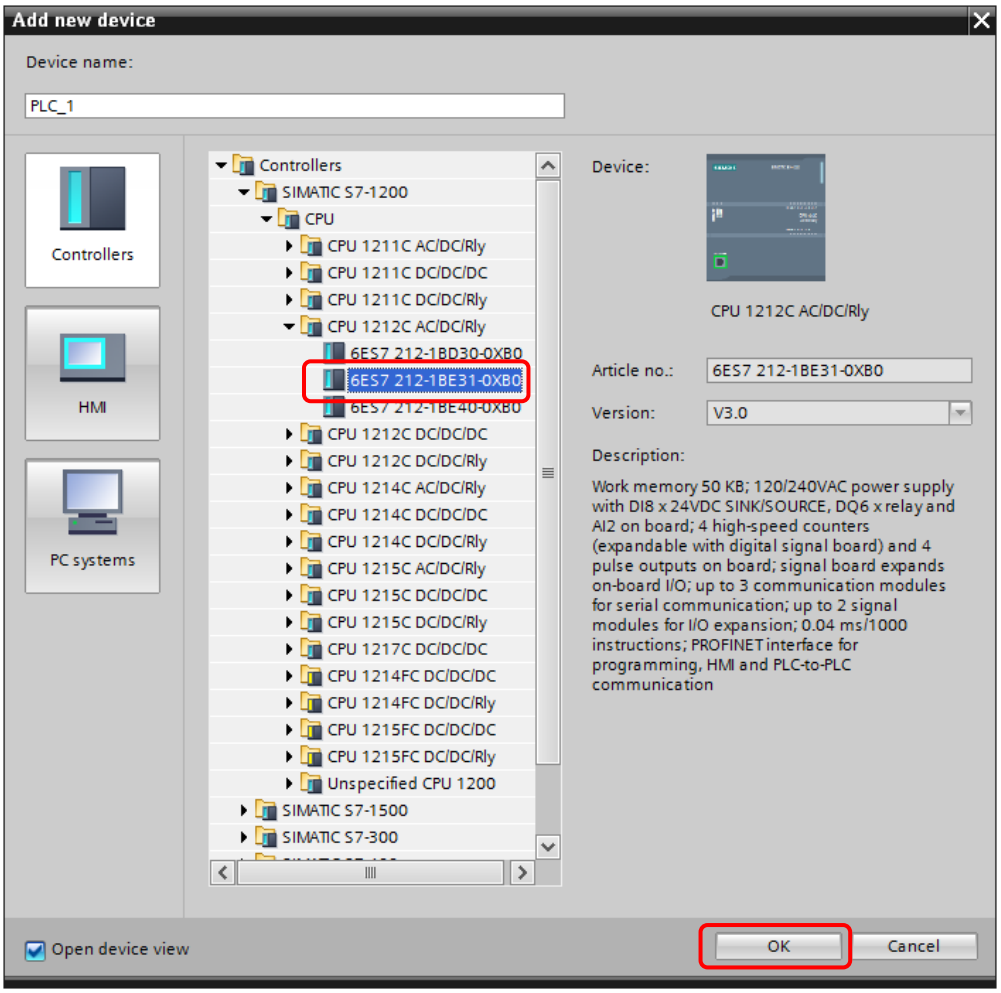


3. Registering PLC

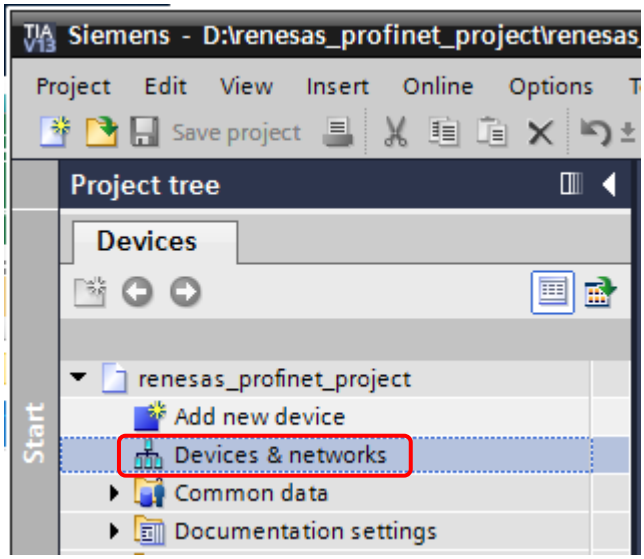
Set the PLC to be used for PROFINET communication.
On the Devices tab, double-click "Add new device".



From the tree, select the PLC to be used, and then click the [OK] button.
Confirm the model number provided on the PLC body.

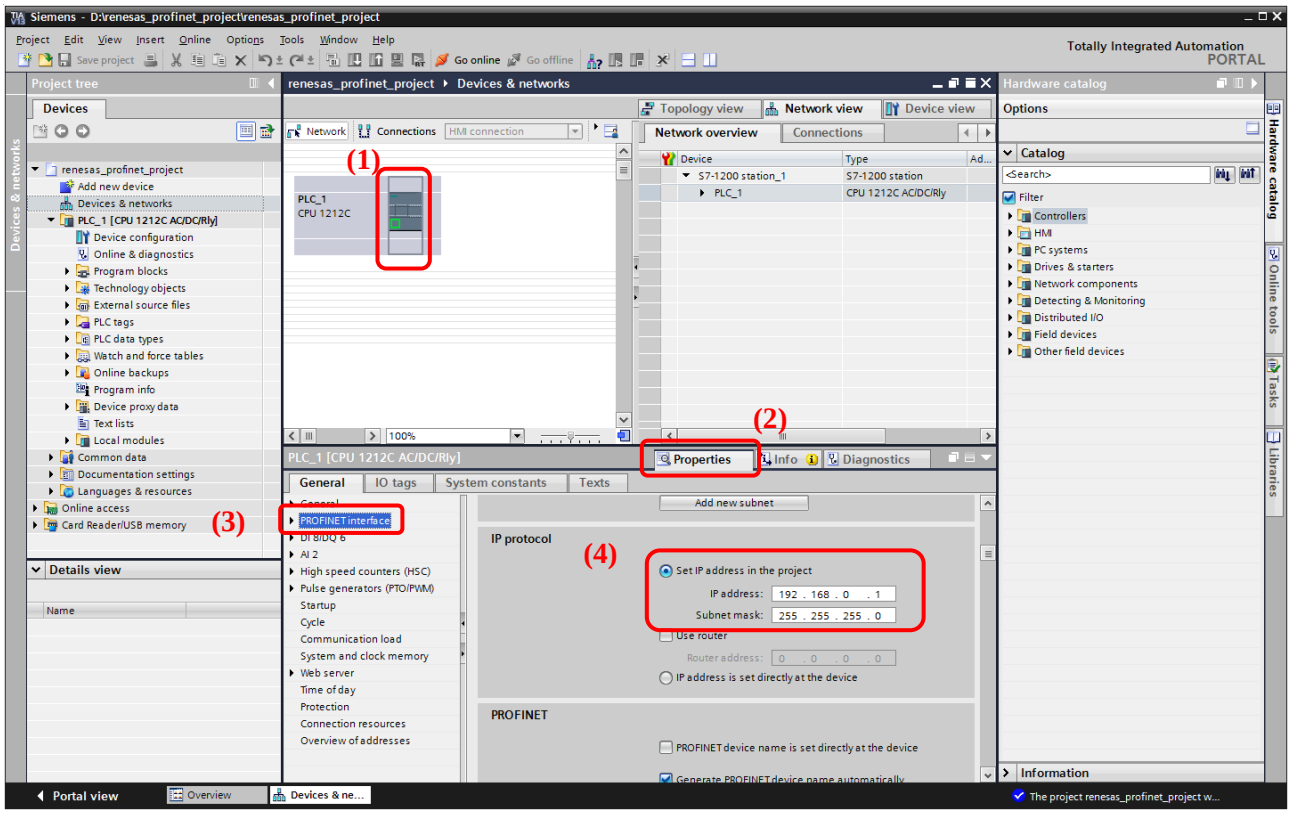


On the Devices tab, double-click "Devices & networks".



Perform the following procedure to set the PLC's IP address. (Set a unique IP address.)

(1) On the Network tab, select the PLC.
(2) Select the Properties tab.
(3) On the General tab, select the PROFINET interface.
(4) Set the IP address.

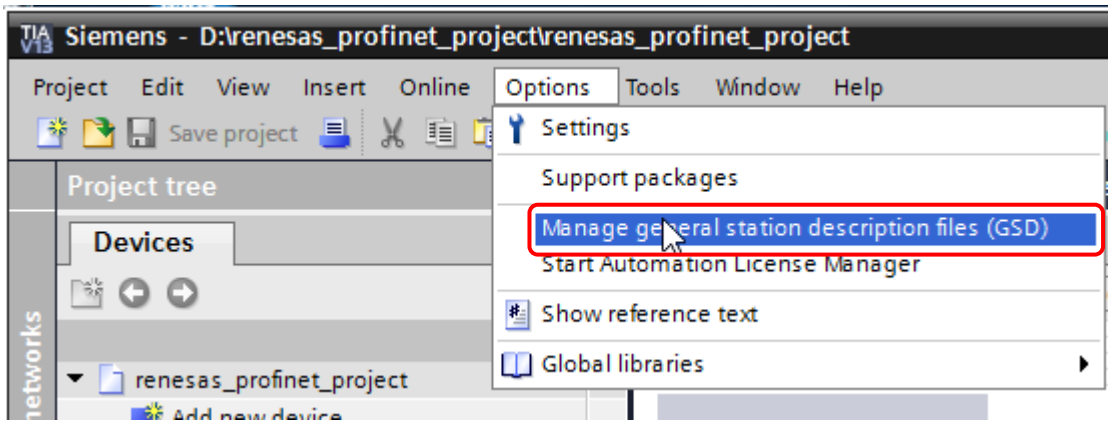


4. Registering the Device

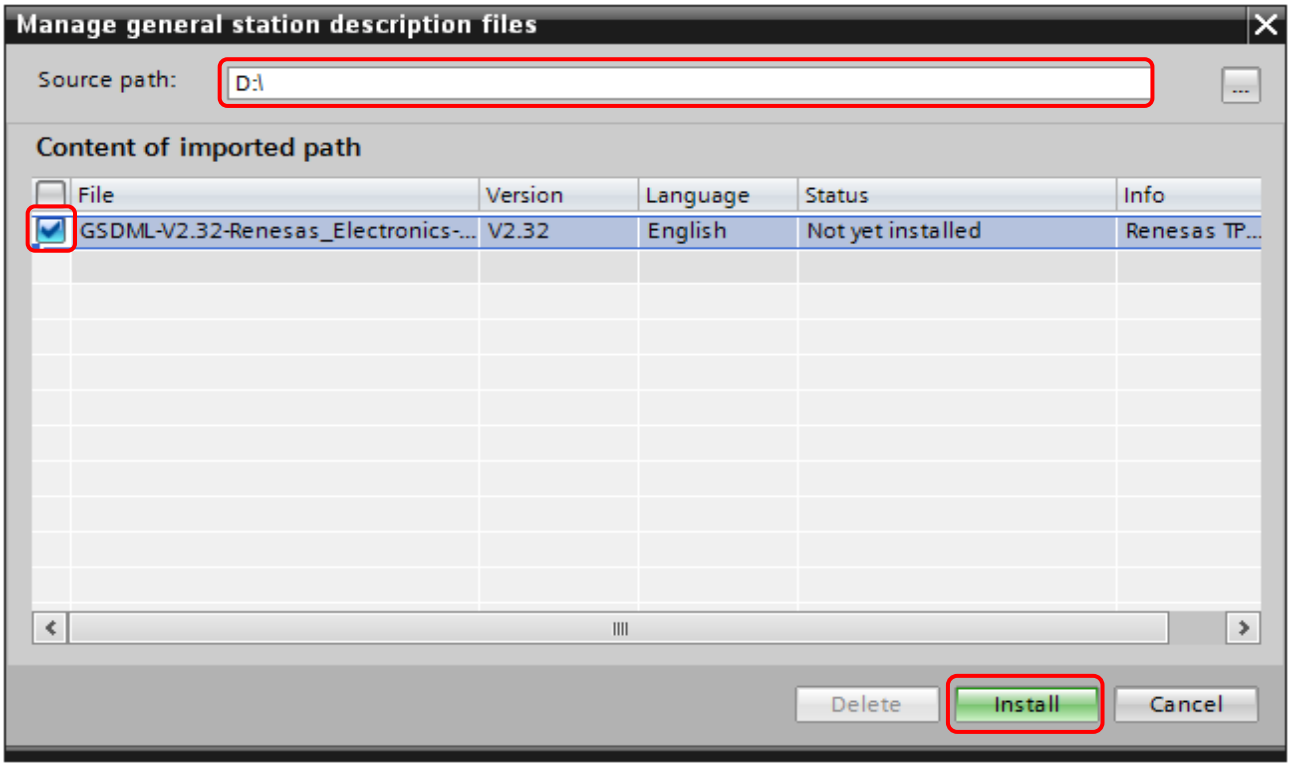
Set the device to be used for PROFINET communication.

To register a new device on the Network, install the GSDML file.

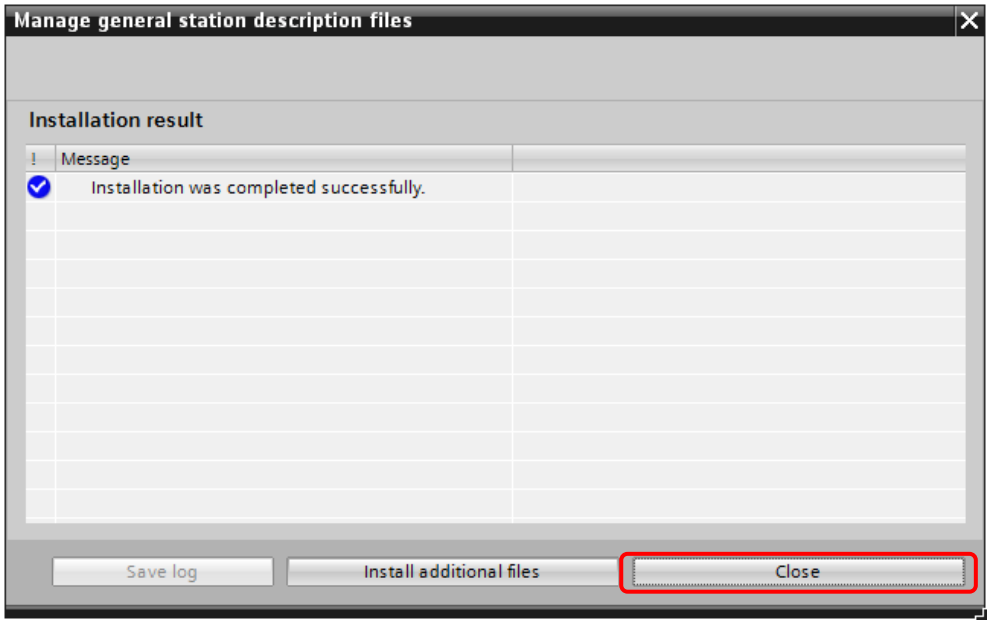
From the Options menu, select " Manage general station description files (GSD)".



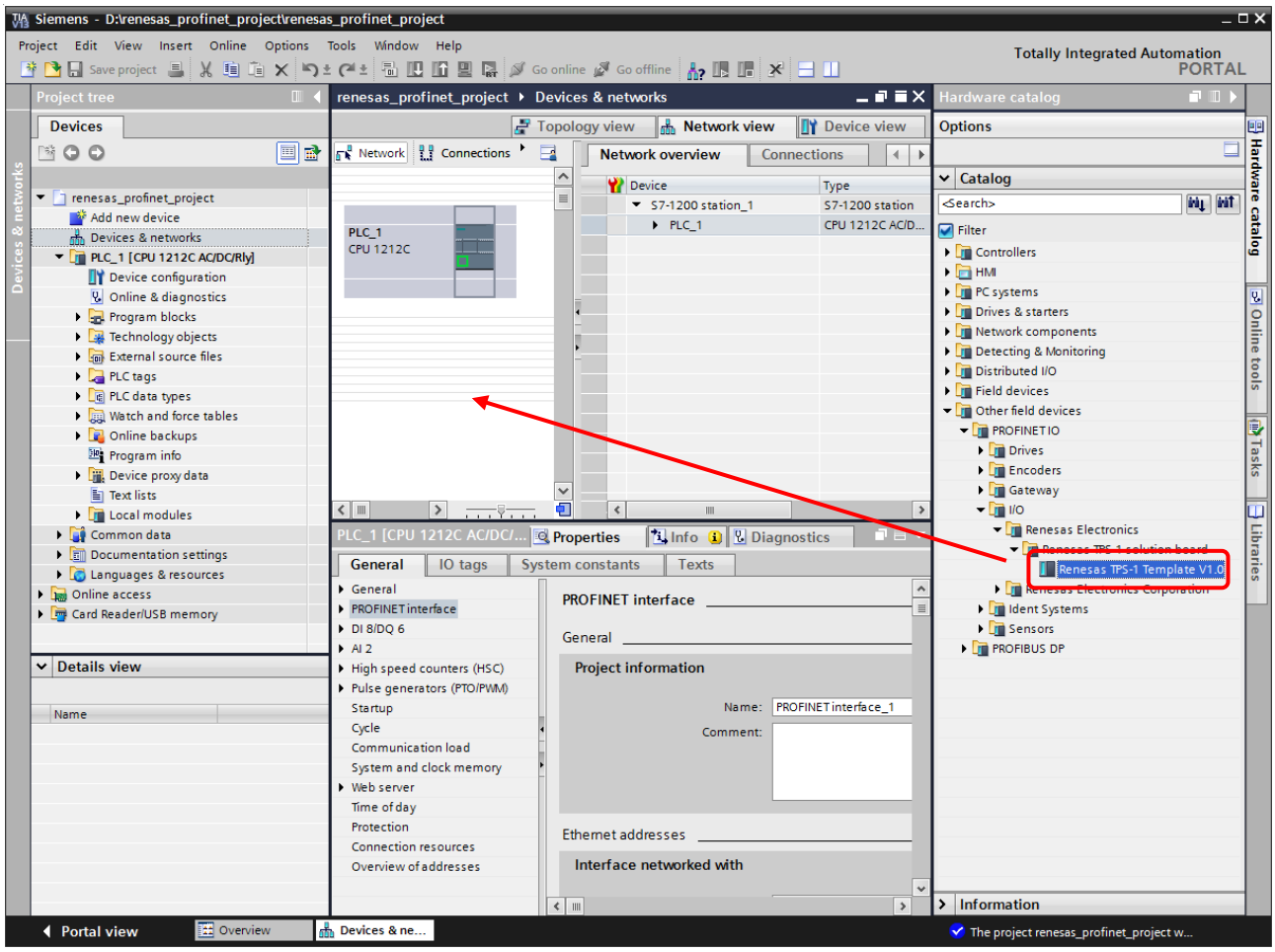
Specify the folder that contains the GSD file you want to register, select the checkbox of the file to be installed, and then click the [Install] button.



The installation result is displayed. Click the [Close] button to close the window.

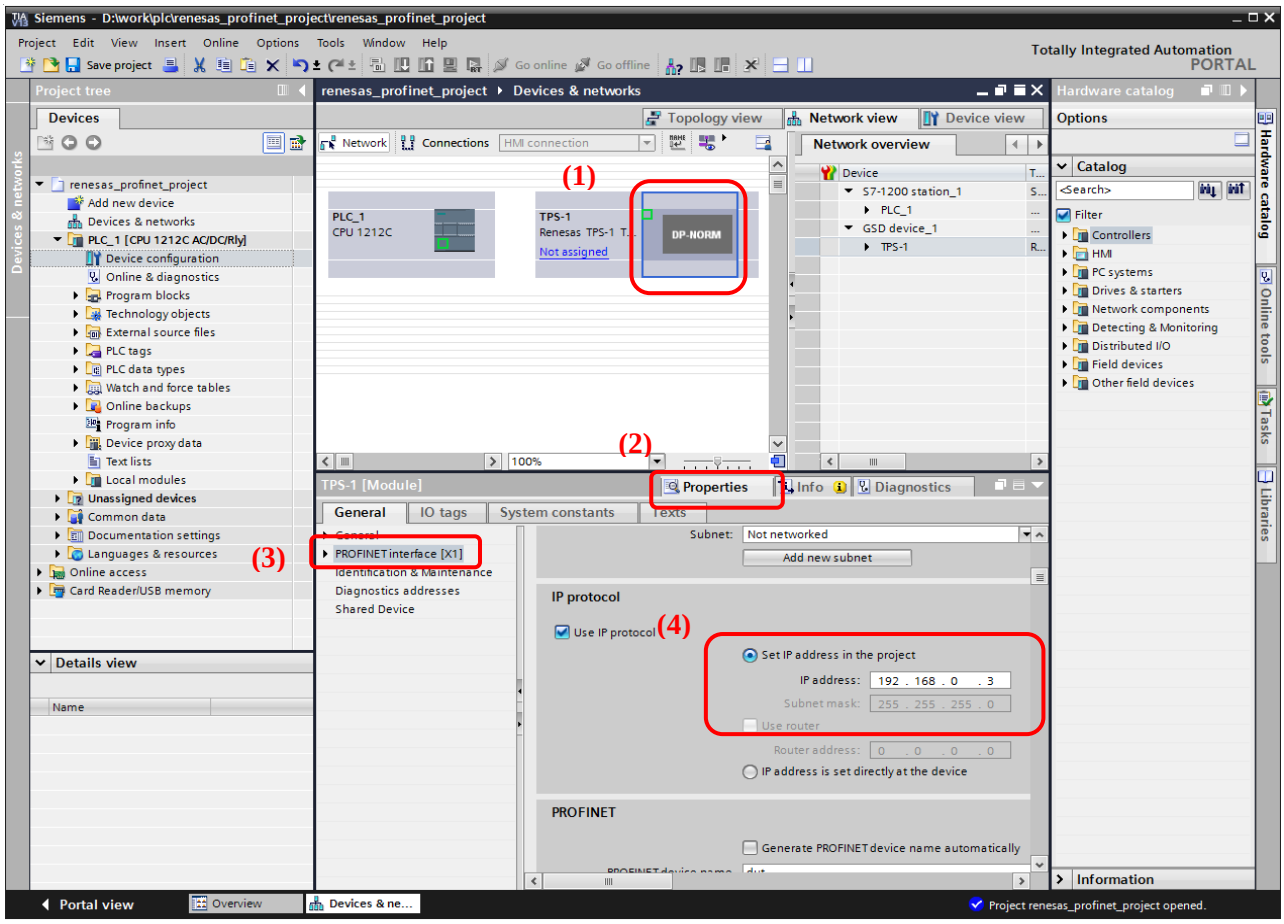


The catalog information is updated and the device is added to the Catalog window.
Select the device and drag and drop it on the Network view tab.

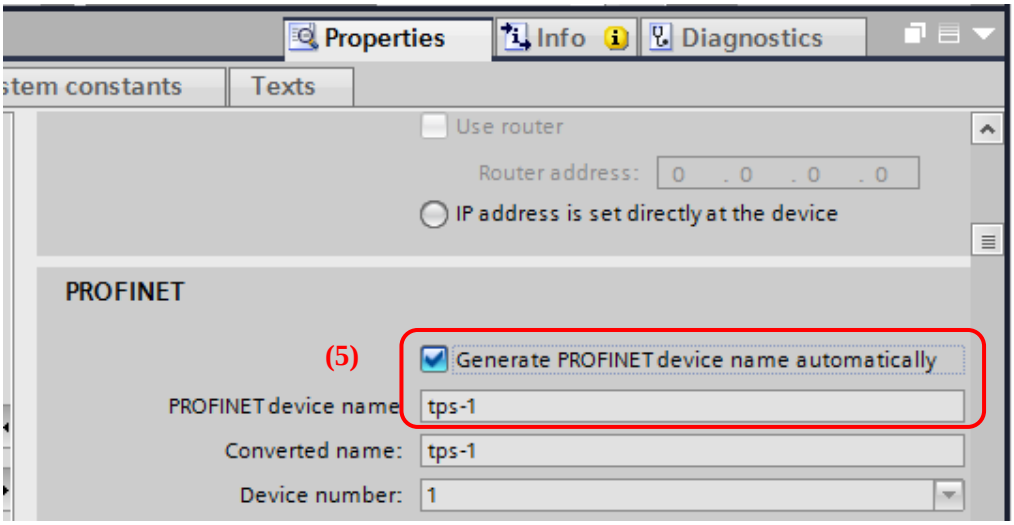


Perform the following procedure to set the device's IP address. (Set a unique IP address.)

(1) On the Network view tab, select a device.
(2) Select the Properties tab.
(3) On the General tab, select the PROFINET interface.
(4) Set the IP address of the device.



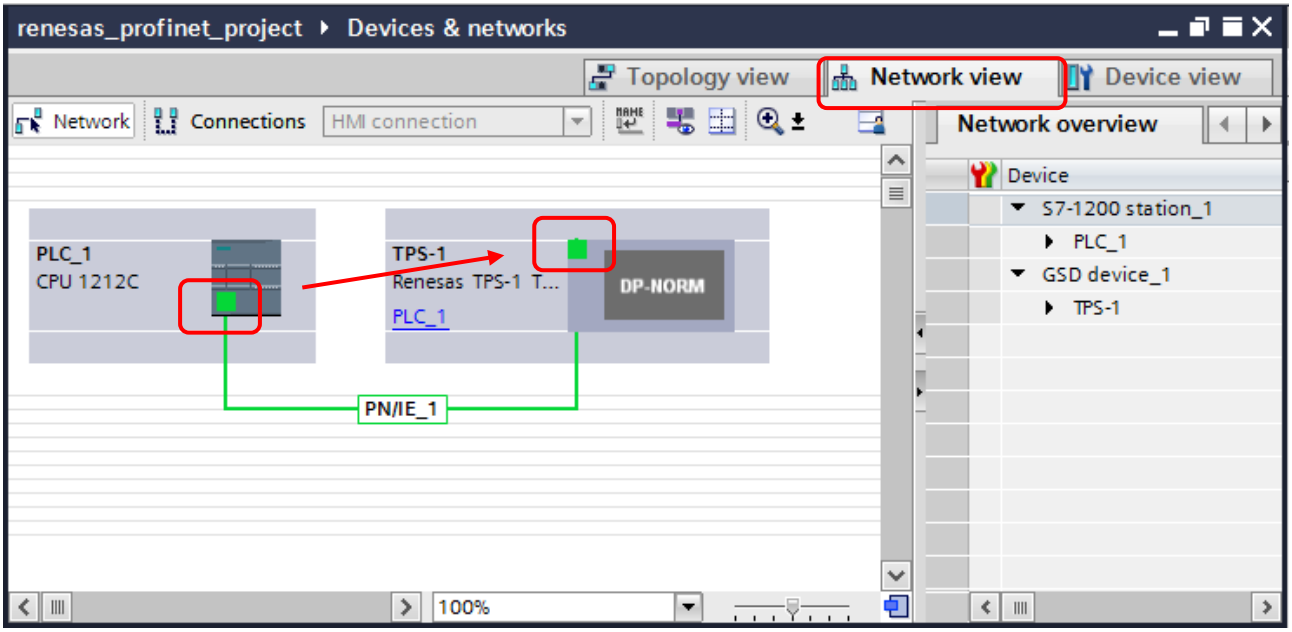
(5) The PROFINET identifies devices with the PROFINET device name. Set the device name that is set for the device to be used as a PROFINET device name by clearing the check in the box. The device name setting field is provided under the IP address setting field. (A device name is automatically set by default.)



5. Making a Connection between PLC and Device

Connect the PLC to a device.

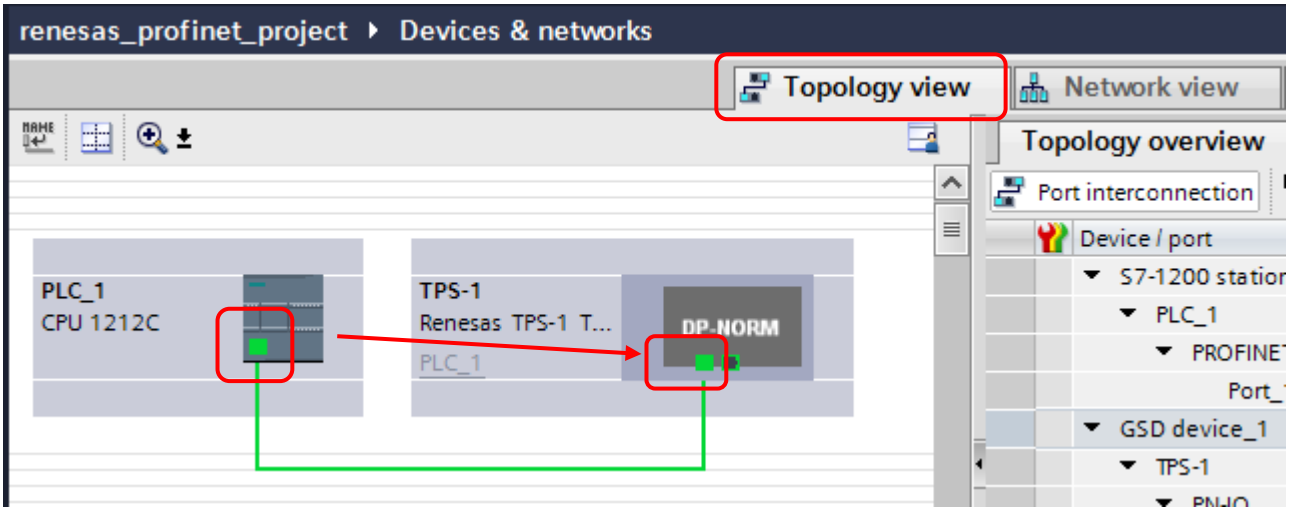
Select the Network view tab, select the PCL's Ethernet port and then drag and drop the selected port to the device's Ethernet port to make a connection between PLC and device.



Ports that allow connection can be restricted by the topology setting.

Select the Topology view tab, and then select connectable Ethernet ports of the PLC and the device.

The following example shows that the device has two ports and the PLC is connected to port 1 (Connection to port 2 is not allowed.)



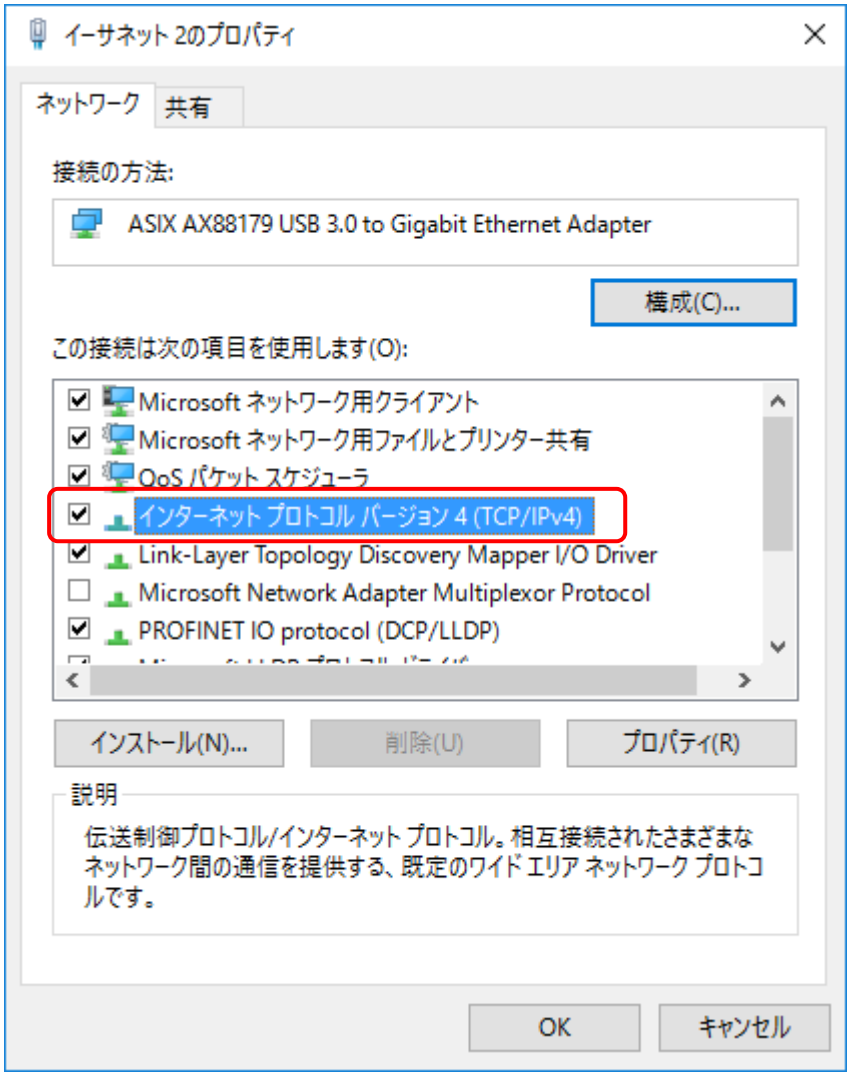
6. Downloading a Project

This section describes the procedure to download a project file to the PLC.
For creating a program, see section 7, PLC Programming.

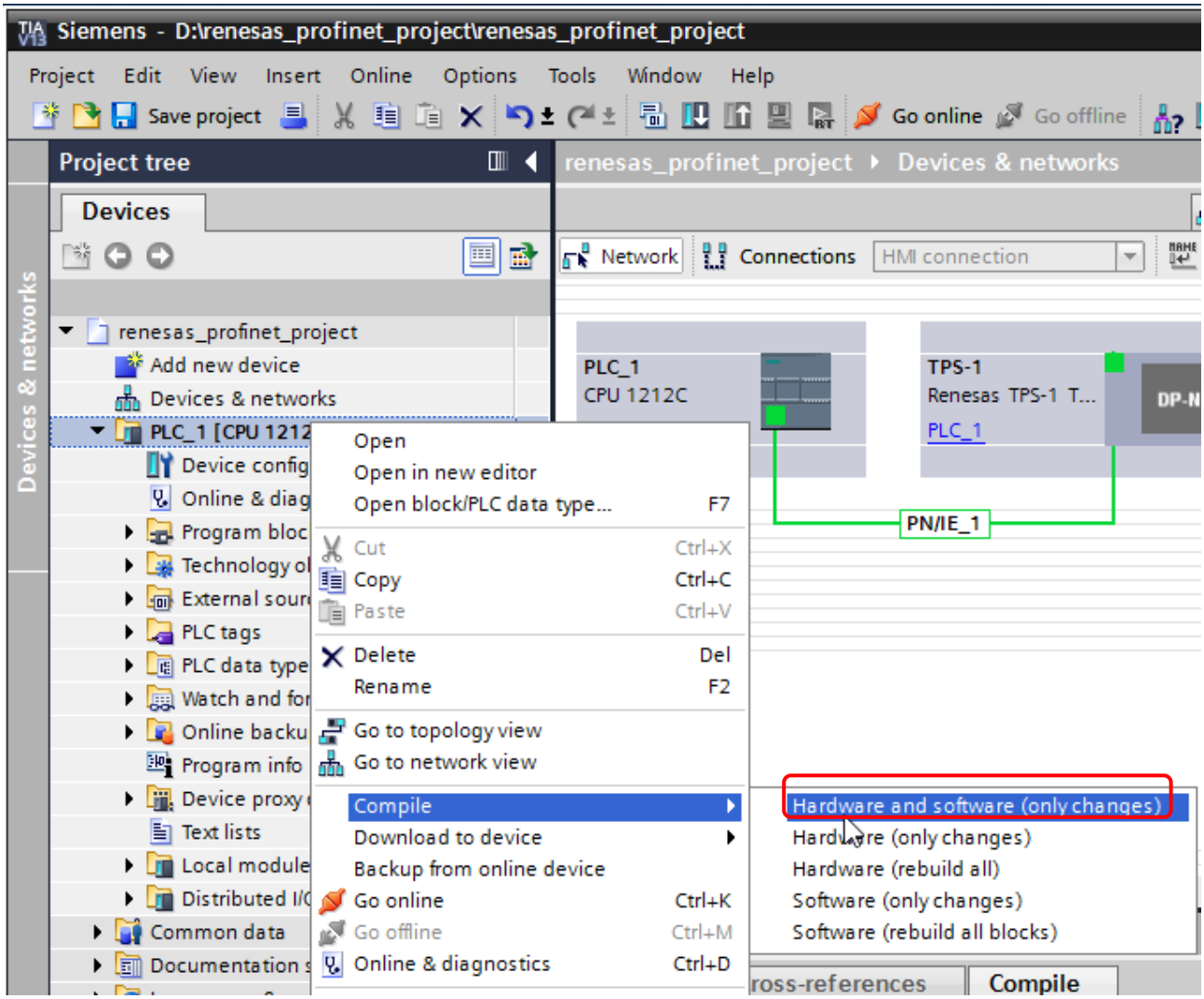
Connect the PLC to a PC through the Ethernet port.

Open the Ethernet port properties window of the PC and set the PC's IP address with TCP/IPv4.

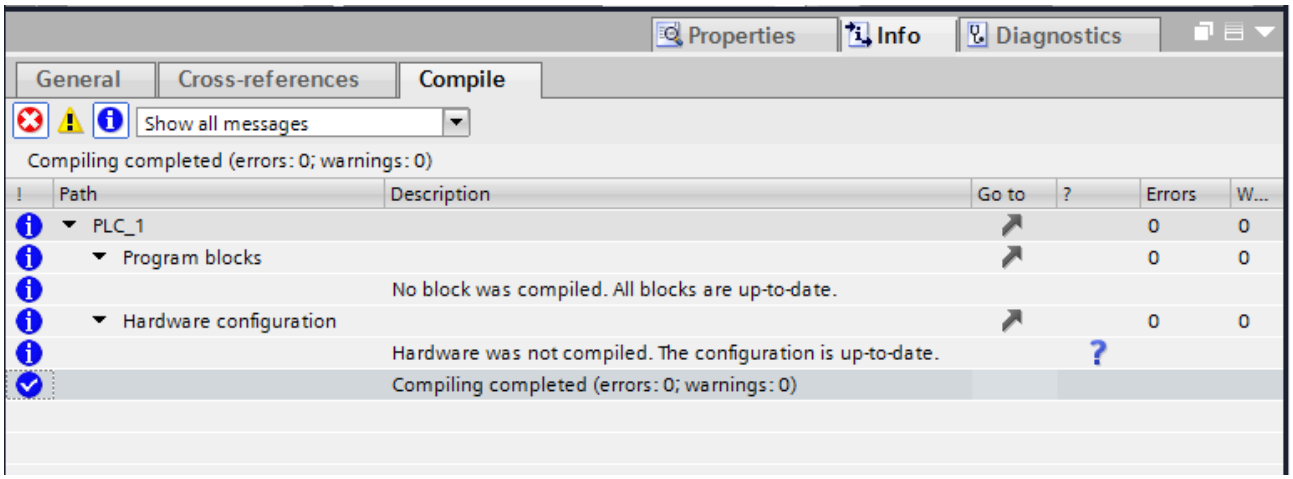
Set a network address equal to the IP address set in the PLC.



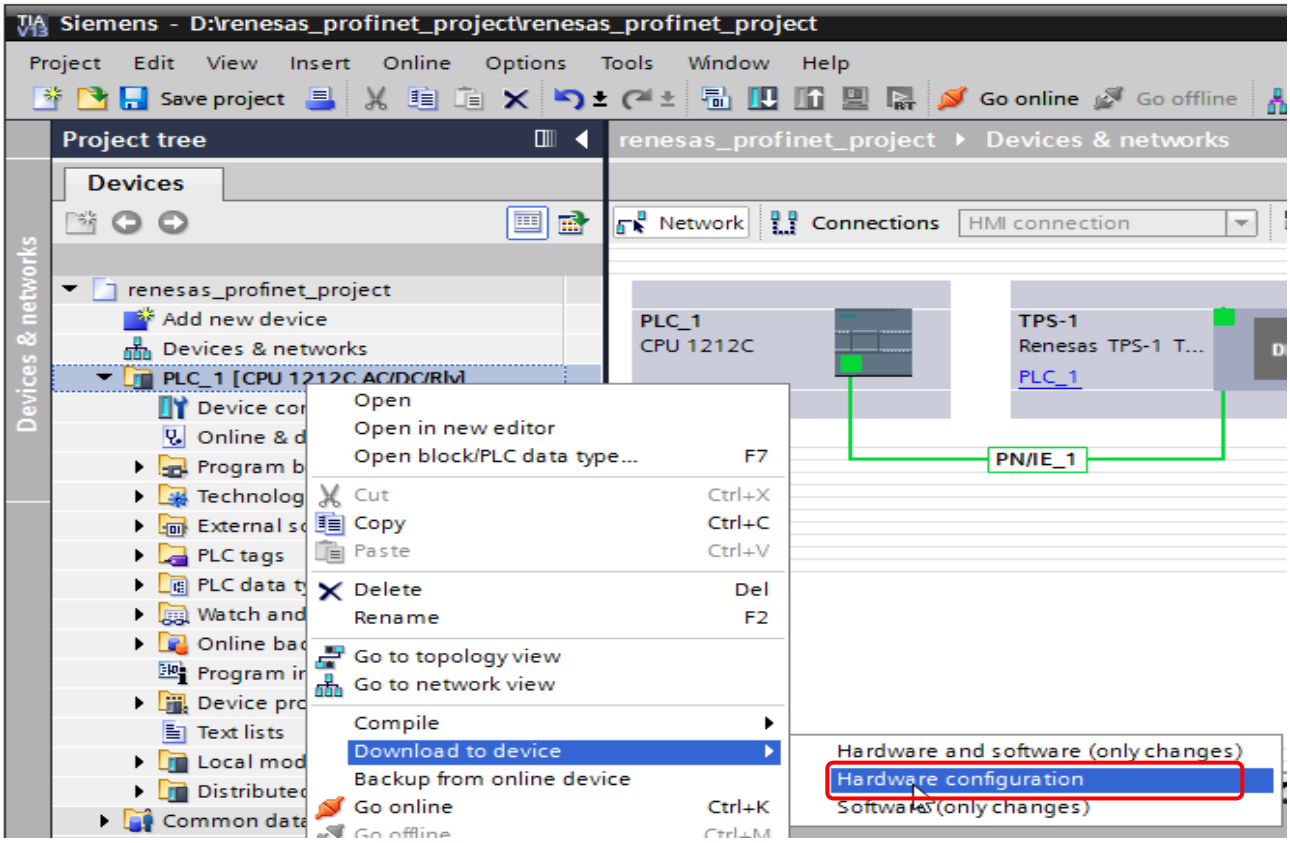
Compile the project. On the Devices tab, right-click PLC in the tree and select Compile > Hardware and software (only changes).



After the project has been compiled, the compilation result is displayed on the Compile tab at the lower part of the window. Make sure that the compilation has been successfully completed.

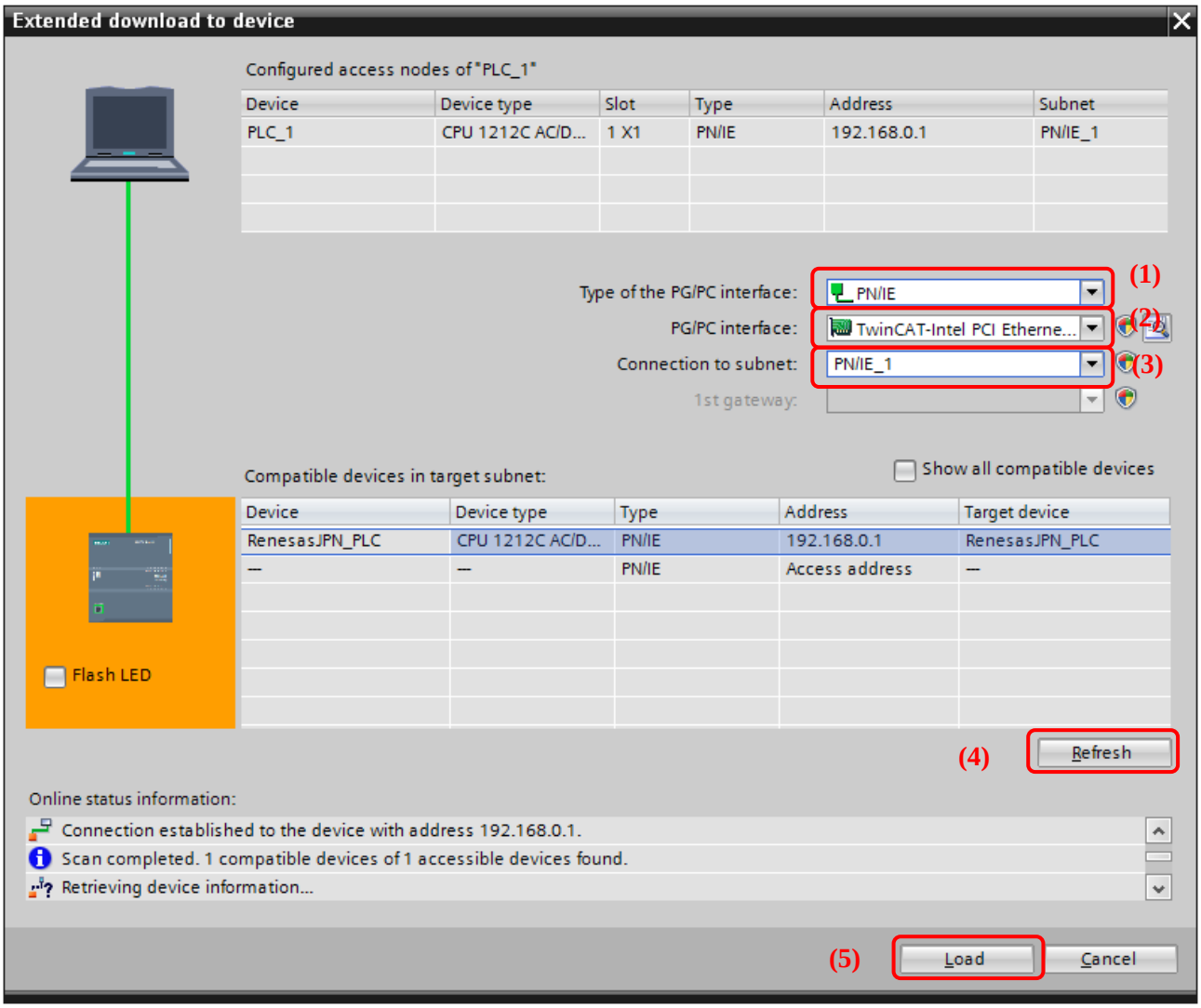


Download the project to the PLC. On the Device tab, right-click PLC in the tree and select Download to device > Hardware configuration.



Search the PLC to which the project is downloaded.

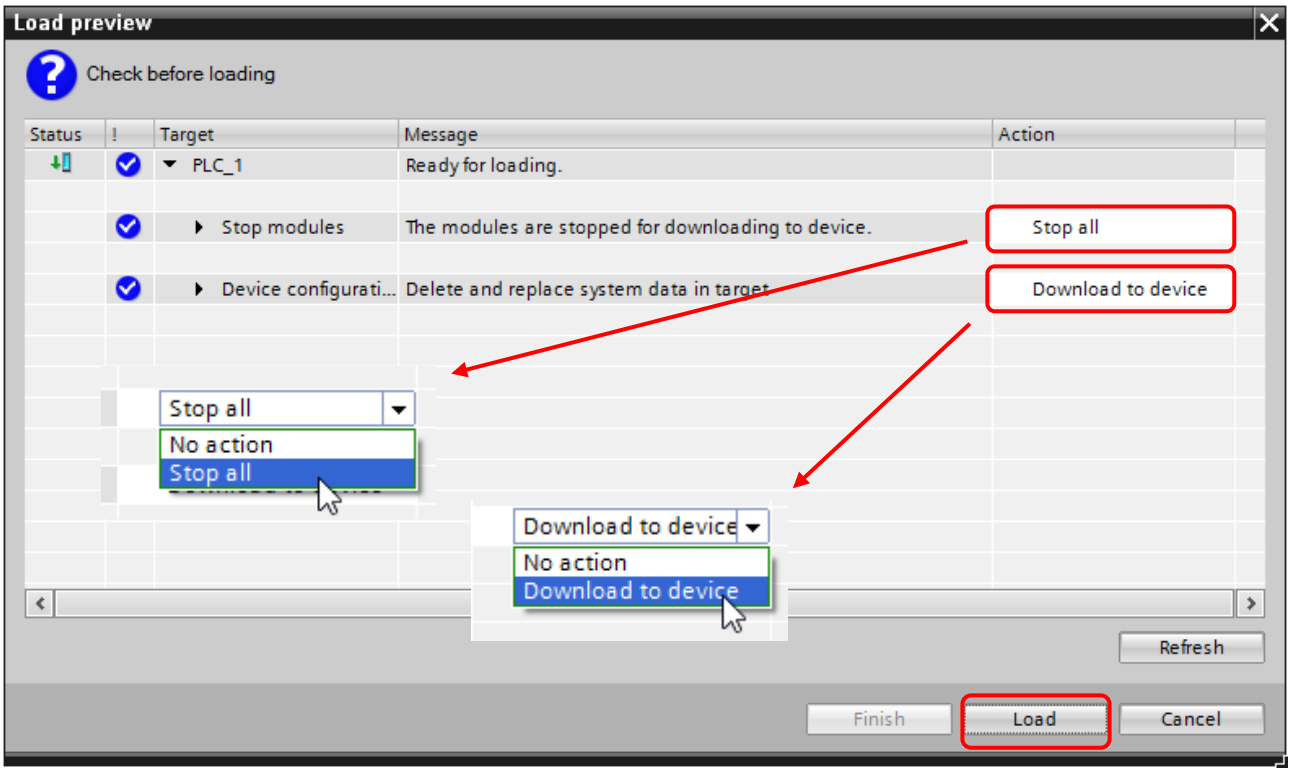
(1) In the "Type of the PG/PC interface" field, select "PN/IE".
(2) In the "PG/PC interface" field, select the network connected to the PLC.
(3) In the "Connection to subnet" field, select "PN/IE_1".
(4) Click the [Refresh] button to search PLCs and select the target PLC.
(5) Click the [Load] button.



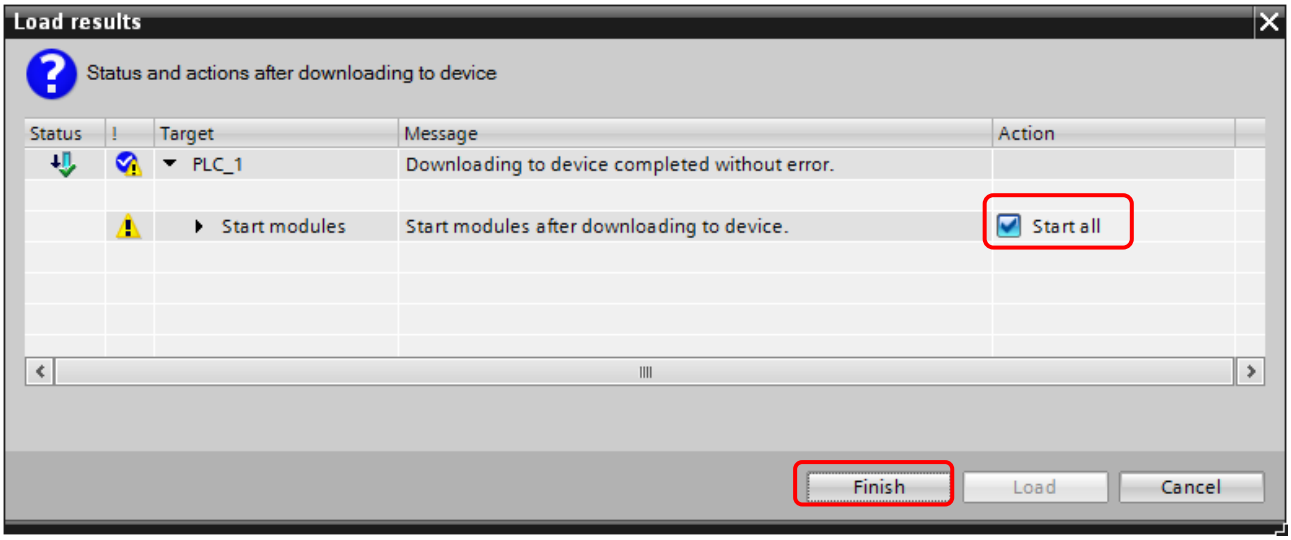
The Load Preview window opens.

If the action status of "Stop modules" and "Device configuration" indicates "No action", select "Stop all" for "Stop modules" and select "Download to device" for "Device configuration" from each drop-down list.

When no error is present, click the [Load] button.



Select the "Start all" checkbox of Start modules, and then click the [Finish] button.



Connect the real PLC to the real device in accordance with the topology configuration.

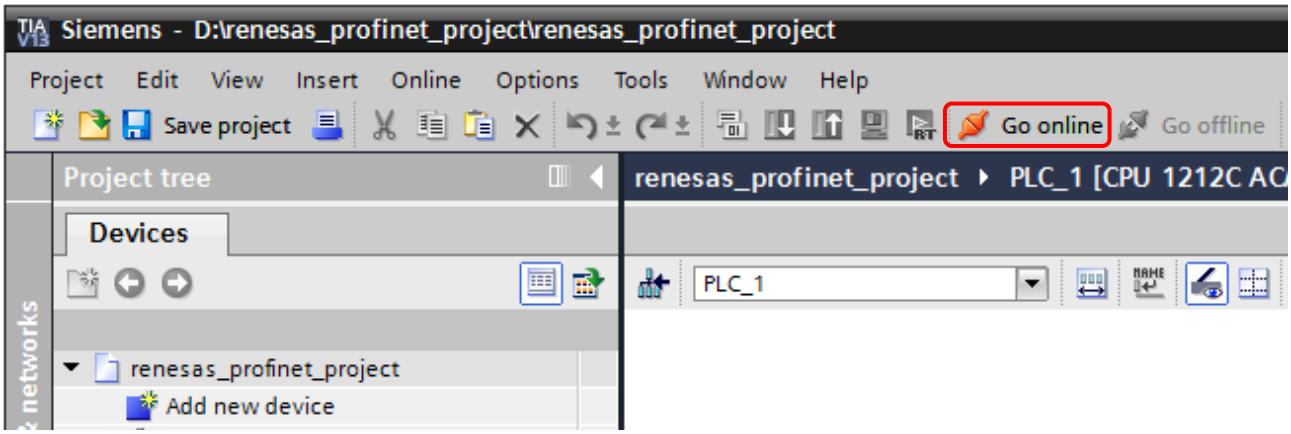
When the ERROR indicator on the real PLC does not light and the RUN/STOP indicator lights green, the PROFINET connection has been successfully established.

For checking online connection, see section 6.1, Checking Online Connection.

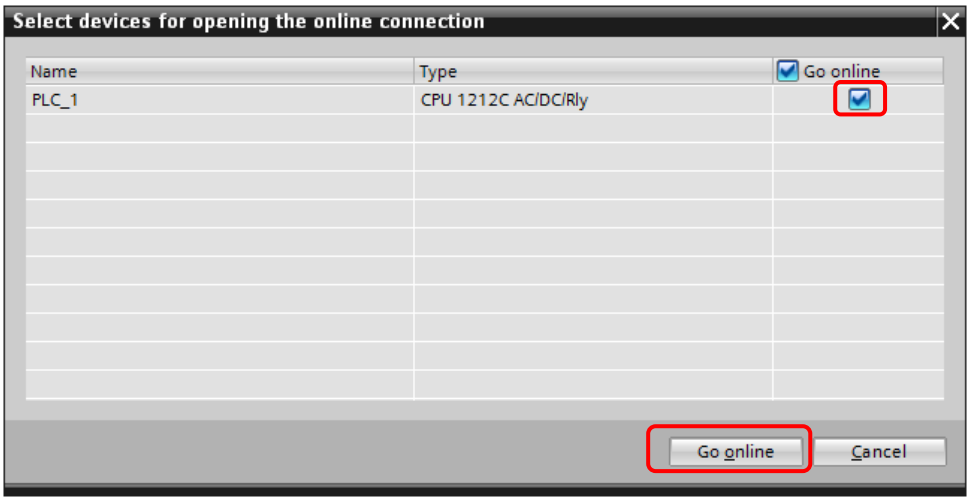
6.1 Checking Online Connection

The network connection status and the status of device's modules can be monitored on the TIA portal by connecting a PC to the same network using a switching hub.

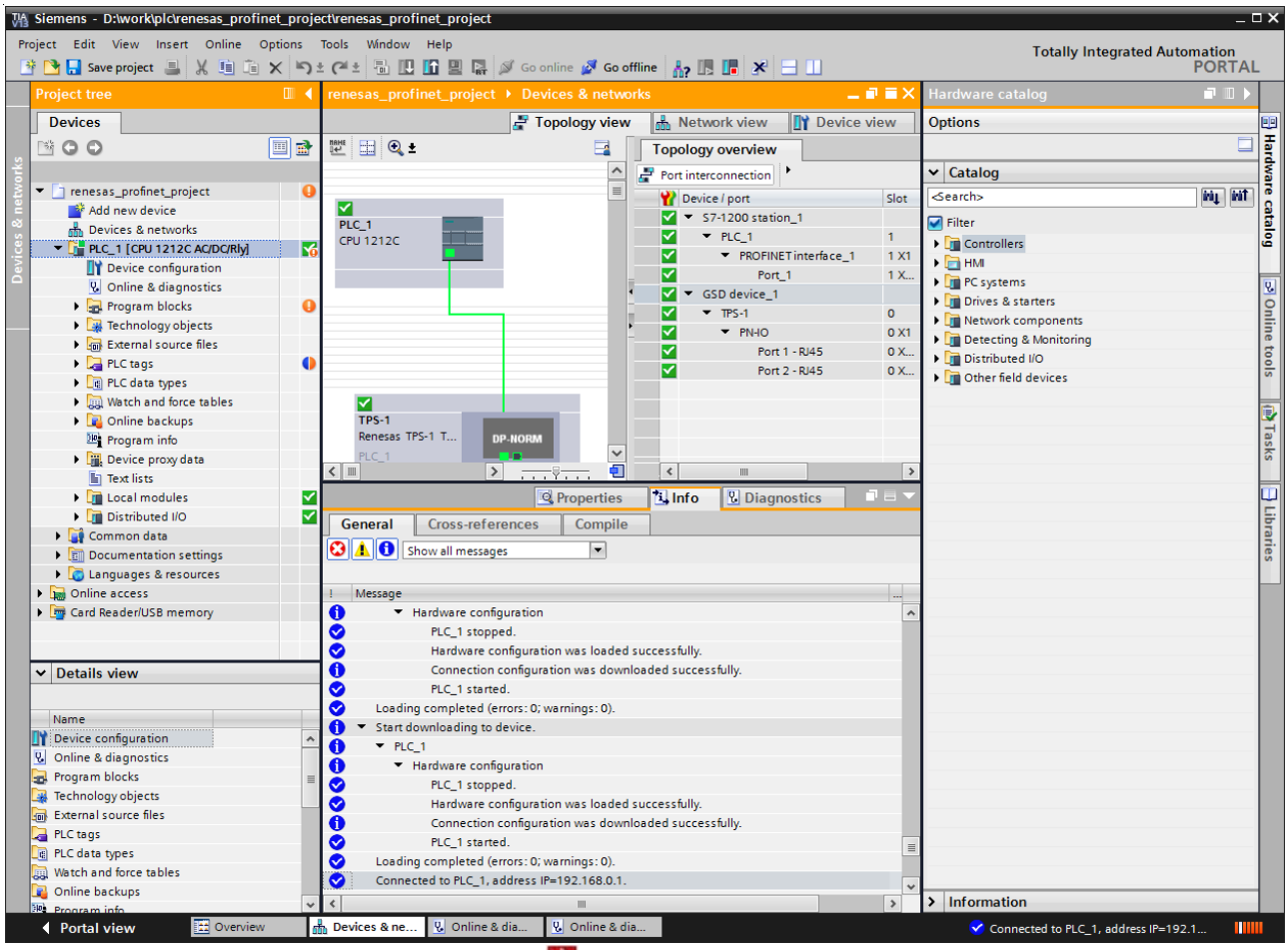
Select "Go online" from the menu.



Check the target PLC, and then click the [Go online] button.



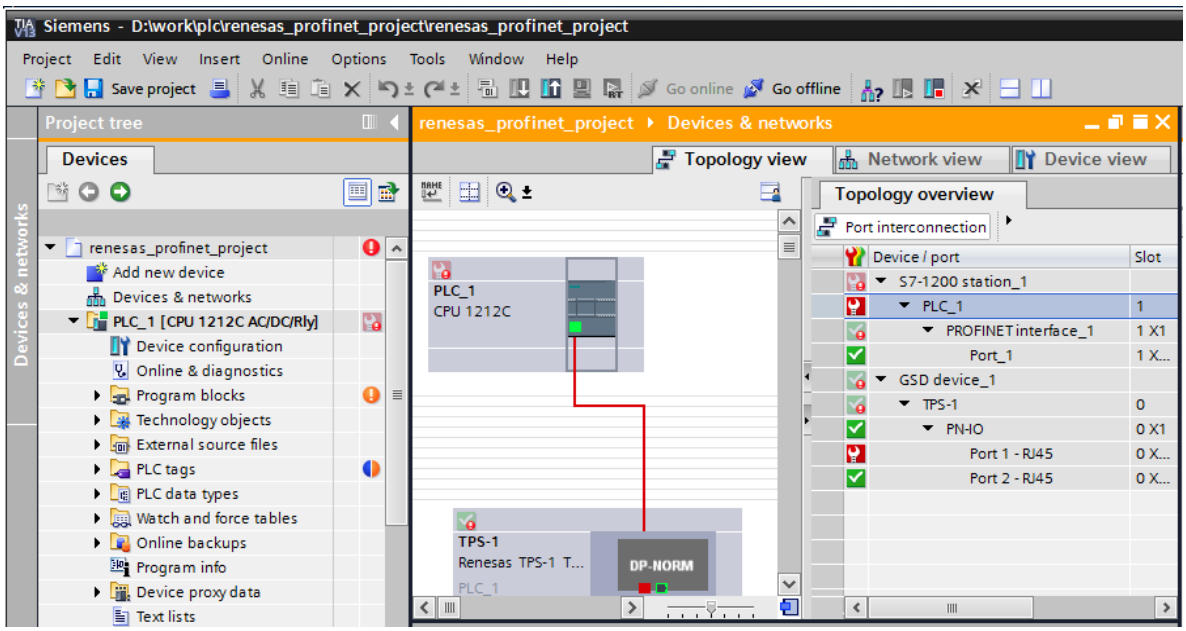
When the connection is successfully established, the icon is indicated as "".



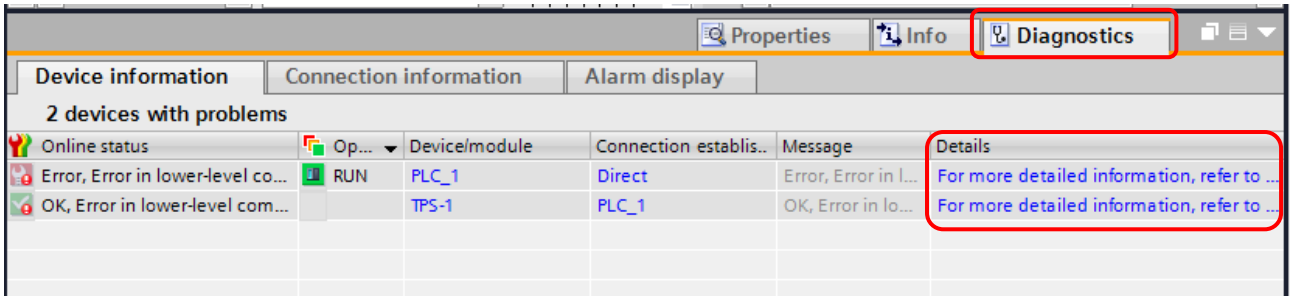
When an error is present, the icon is indicated as "".

The example below shows an error if a PC is connected to a port that is not set in the topology.

Check other icons from Help on the TIA portal.



Selecting the Diagnostics tab at the lower part of the window displays the device status.
You can check details of each error by selecting the link in the Details column.



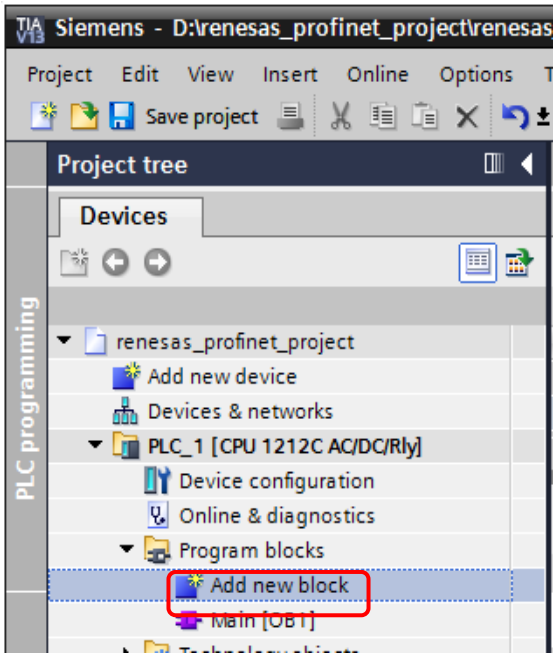
7. PLC Programming

This section describes PLC programming.

An example using the SCL language is provided in this section.

7.1 Creating a New Program

From the tree on the Devices tab, select PLC > Program blocks > Add new block.



From program types, select "Organization block".

The Organization block is automatically called in each type shown below.

・Program cycle: This type is processed at intervals specified in the PLC device setting. Other blocks can be called in this main processing.

・Startup: When the PLC starts (STOP to RUN), this item is processed.

・Time delay interrupt: This item is processed for the specified time period.

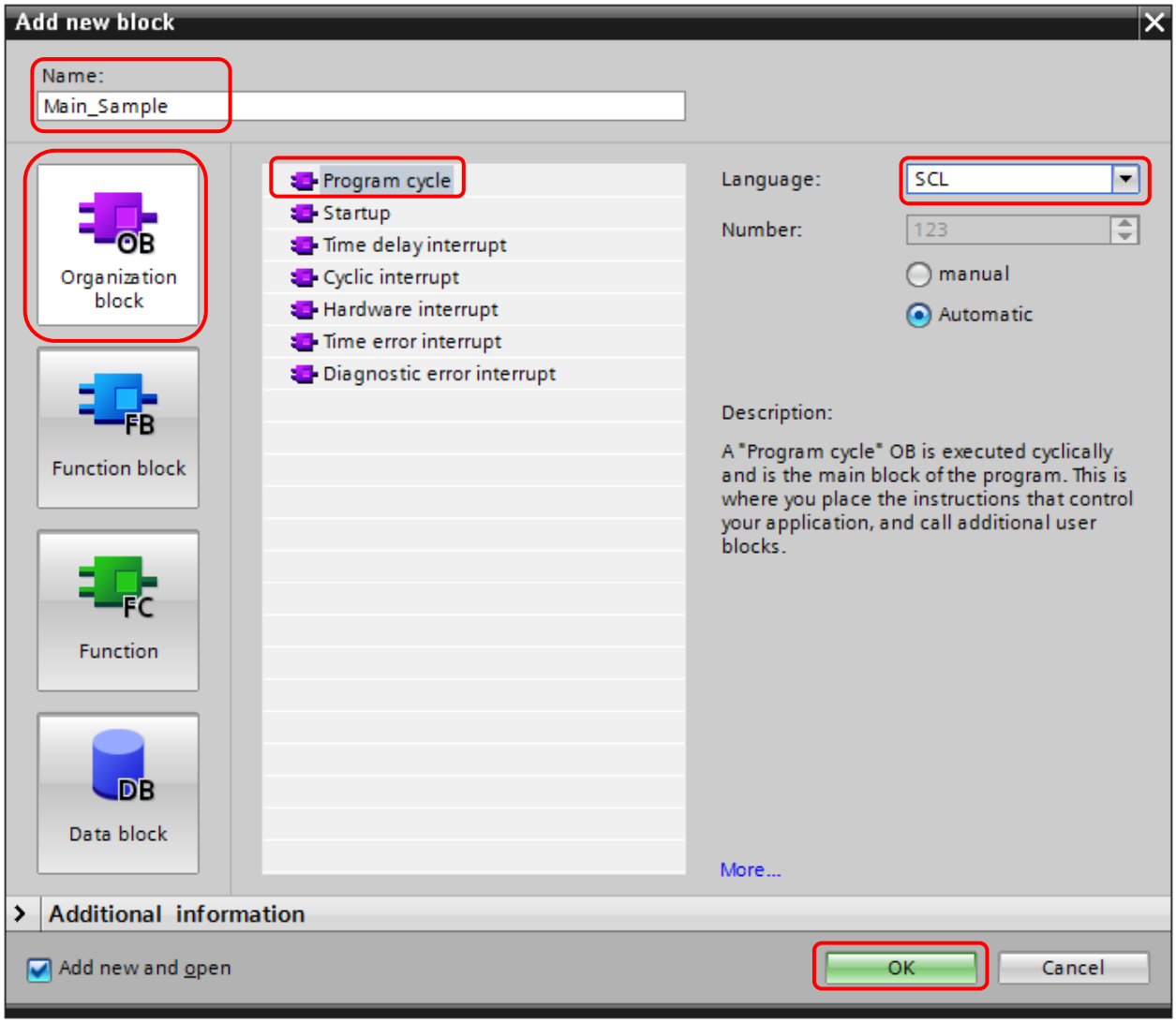
・Cyclic interrupt: When an interrupt occurs at specified intervals, this item is processed.

・Hardware interrupt: When a hardware event occurs, the main processing is interrupted and this item is processed.

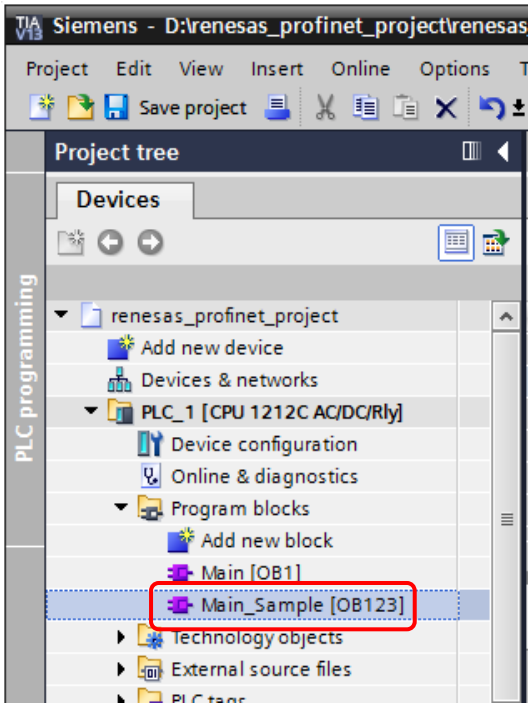
・Time error interrupt: When the specified maximum cycle time is exceeded, the main processing is interrupted and this item is processed.

・Diagnostic error interrupt: When an error interrupt is detected, the main processing is interrupted and this item is processed.

Set the name, select "Program cycle", select SCL from the Language drop-down list, and then click the [OK] button.



A new block is added in the tree.



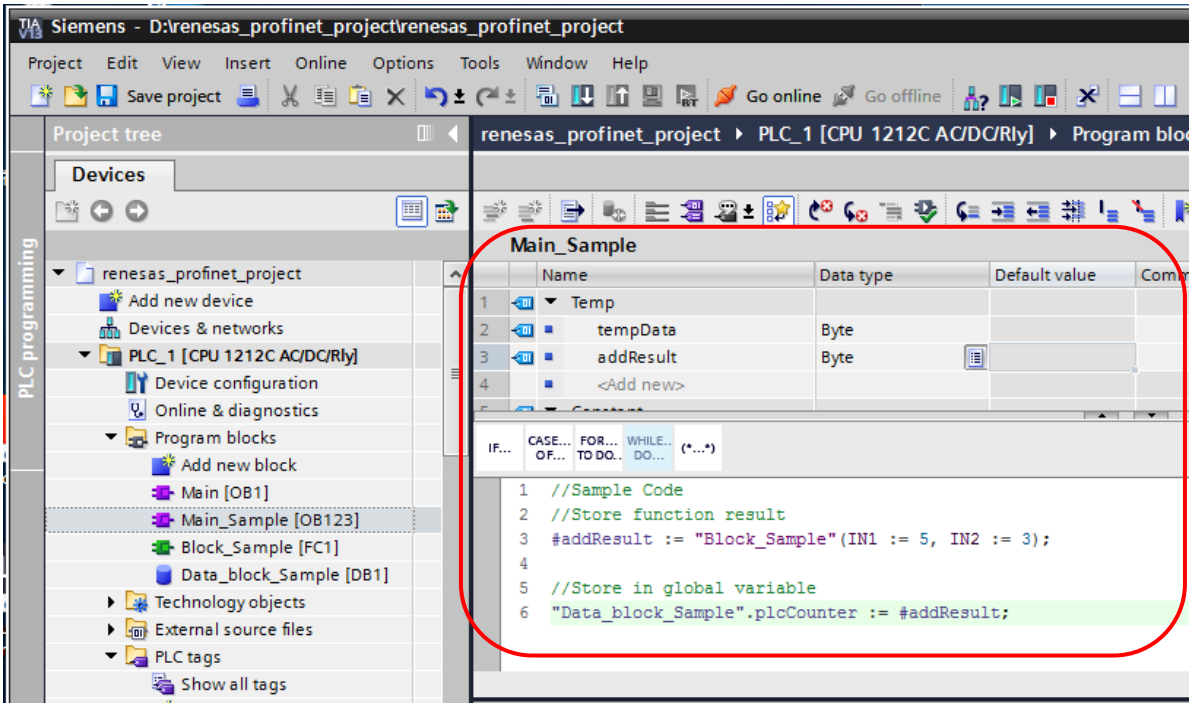
Double-clicking the block makes it possible to edit the code.

Declaration of local variables that are valid only in the code is defined below Temp in the Interface window shown below.

When using a local variable, attach "#" to the head of variable name.

When assigning to a value to a variable, describe ":=".

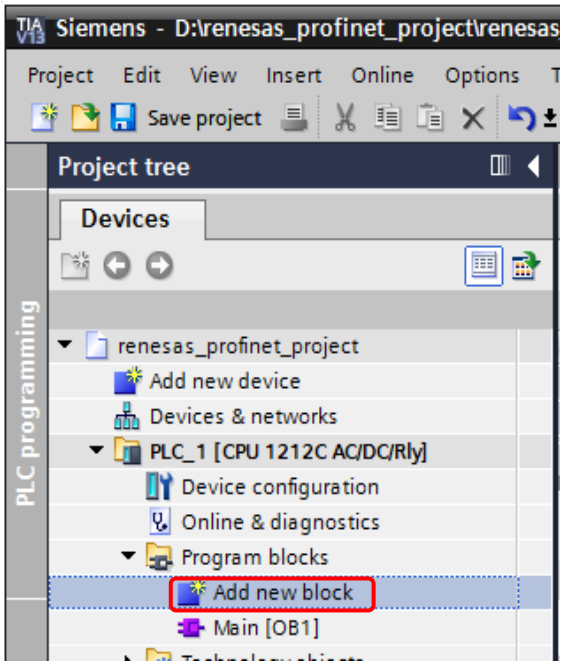
When entering a global variable or a function name, enter "”" to display a list and enter "”"" to close it automatically.



7.2 Creating a Function

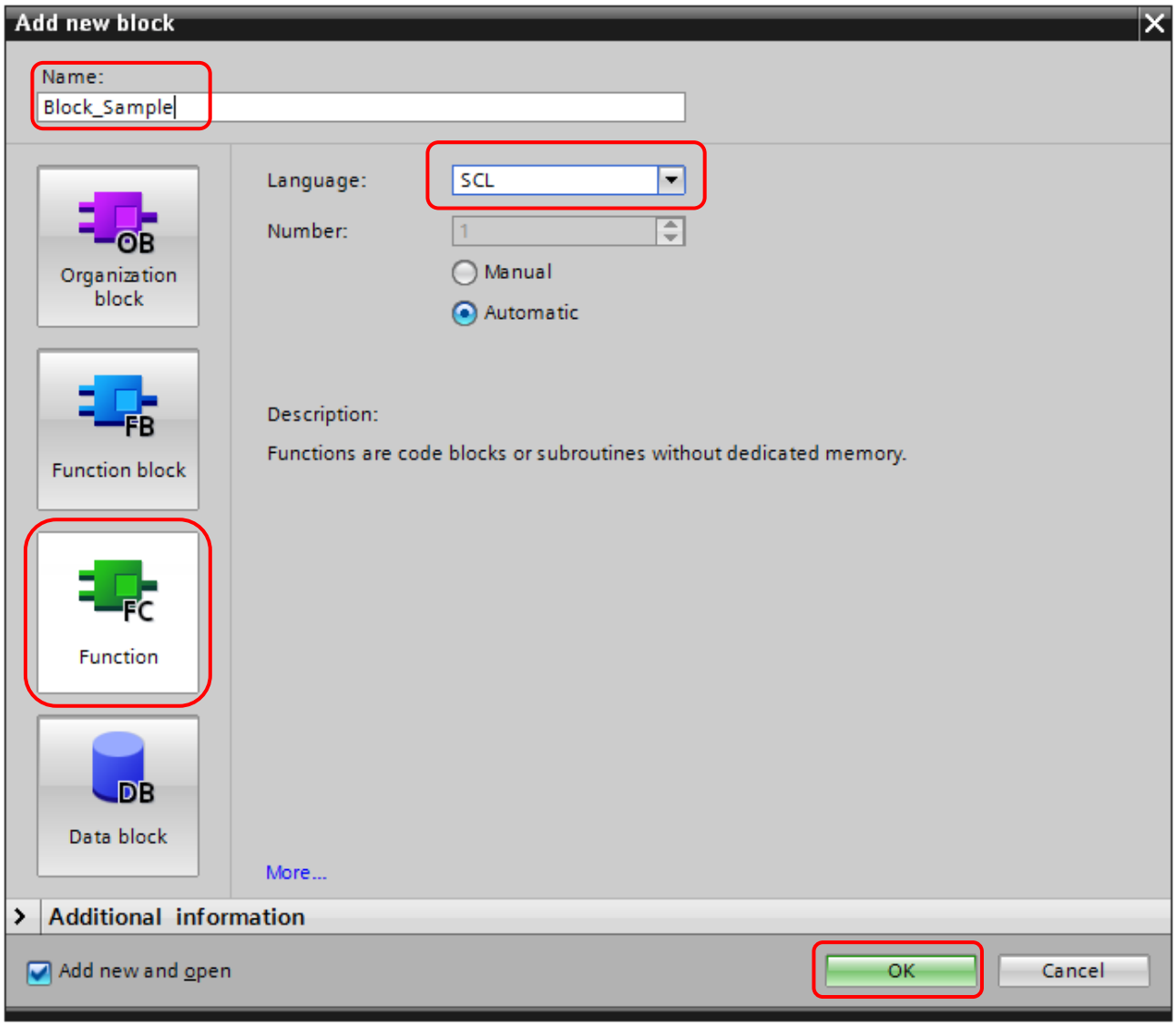
The following describes how to create a function that can be called in the main processing.

From the tree on the Devices tab, select PLC > Program blocks > Add new block.



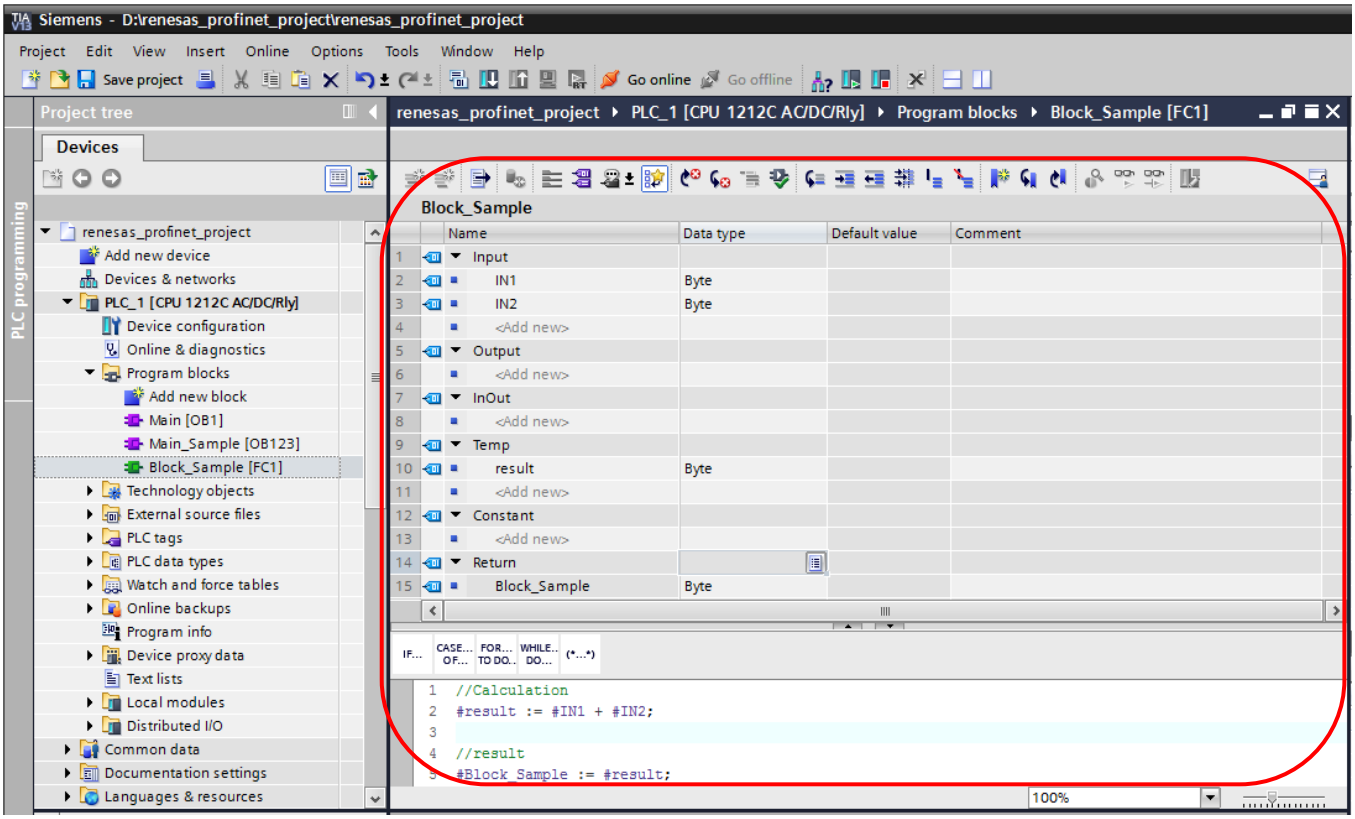
Select "Function" from program types.

Set the name, select SCL from the Language drop-down list, and then click the [OK] button.



"Input", "Output", and "In Out" are arguments of the function. "Temp" is a local variable.
"Return" is a return value. When a return value exists, assign it to the return value variable (same as function name).
Change the specification of type to an appropriate type from void.

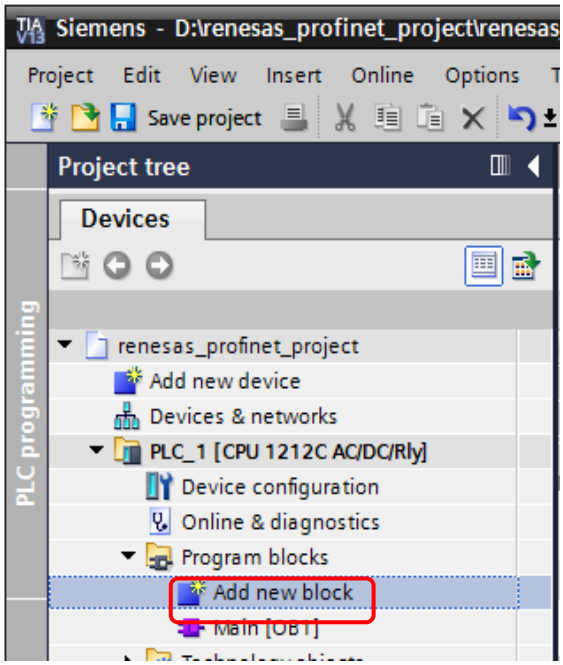
A usage example is shown below.
The following function returns the addition result of arguments IN1 and IN2.
#addResult := Block_Sample(IN1 := 5 , IN2 := 3);



7.3 Creating a Global Variable

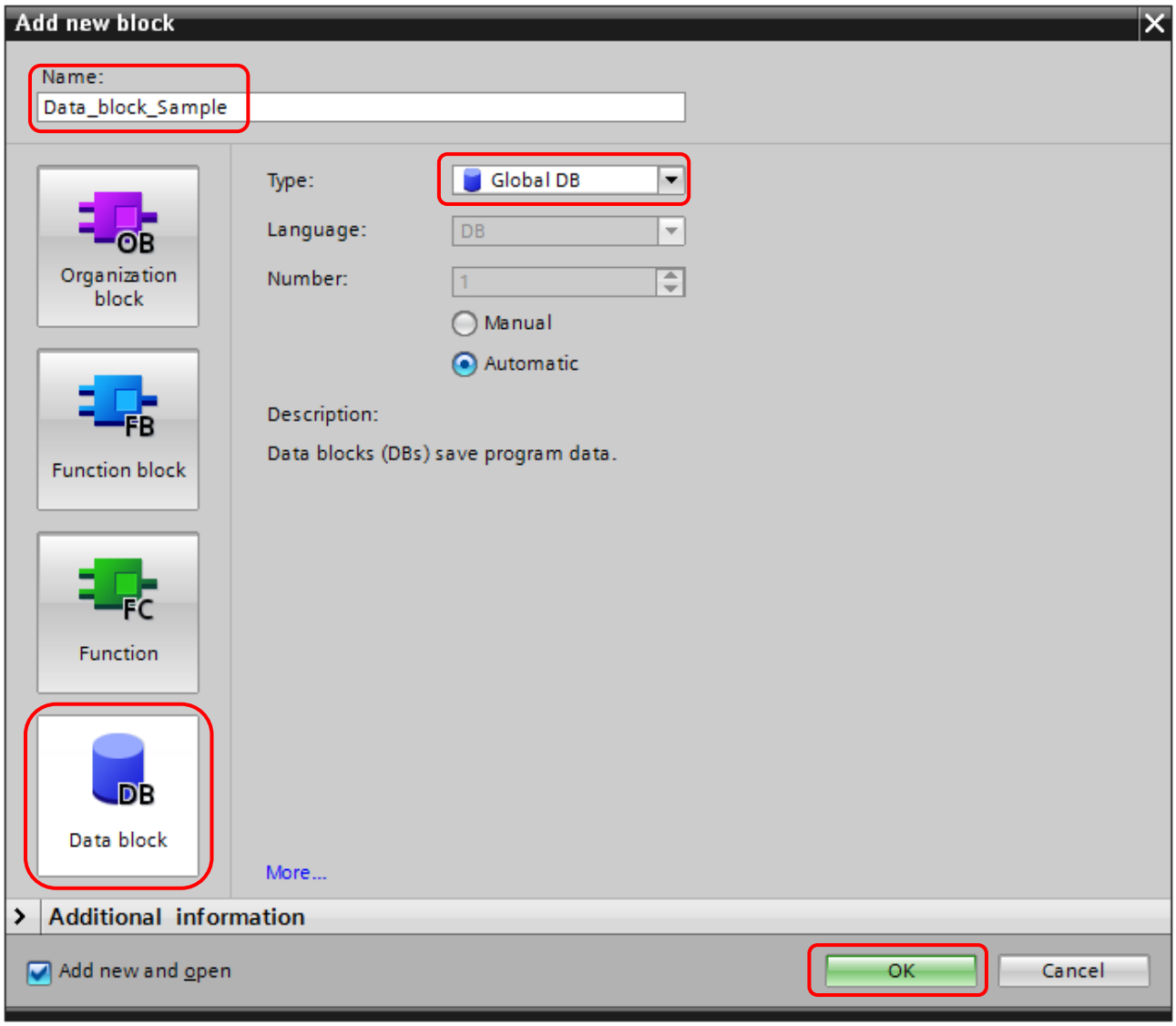
The following describes how to create a function that can be called in the main processing.

From the tree on the Devices tab, select PLC > Program blocks > Add new block.



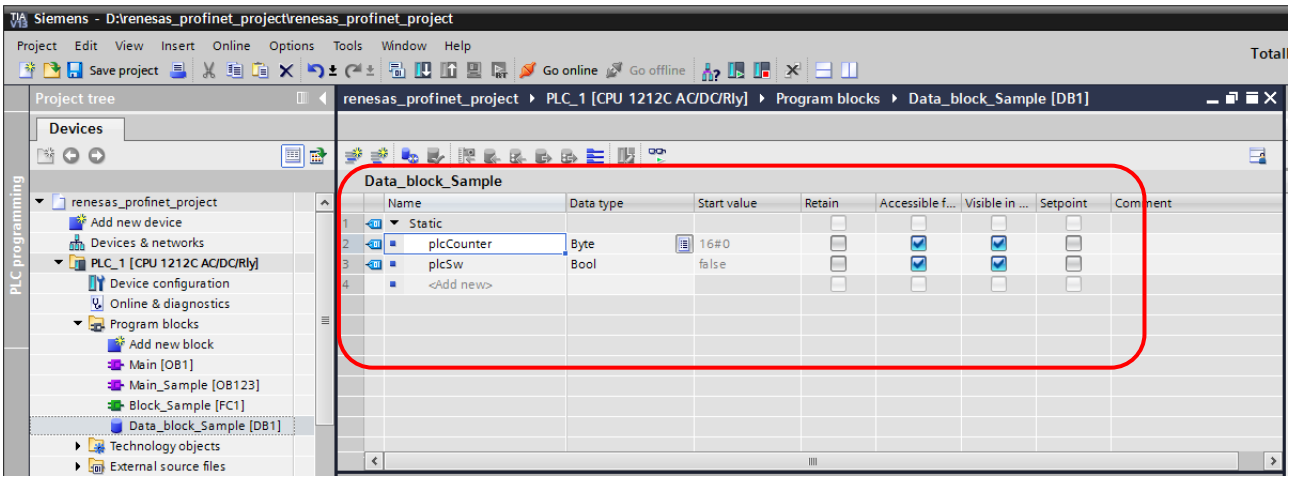
Select "Data block" from program types.

Set the name, select Global DB from the Type drop-down list, and then click the [OK] button.



In the Interface window, add the definition of variables.
You can also specify initial values.

A usage example is shown below.
GlobalDB name.variable name
Example)
Data_block_Sample.plcSW = True;
Data_block_Sample.plcCounter = 10;

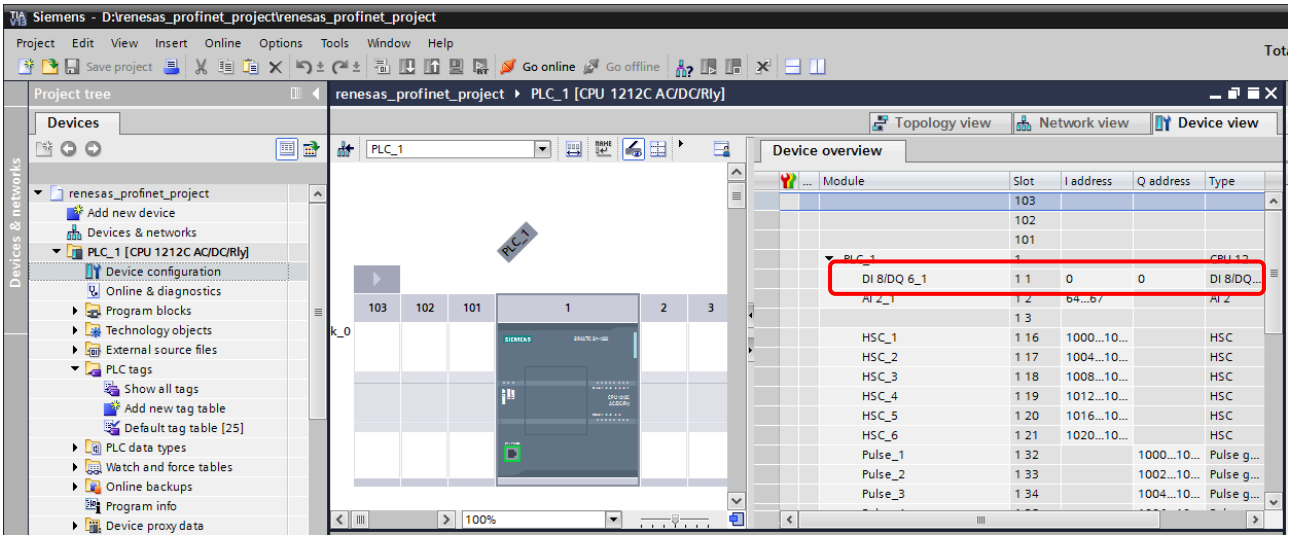


7.4 Defining I/O Data

The following describes how to set a tag to use I/Os that are set in the PLC and device on a program.

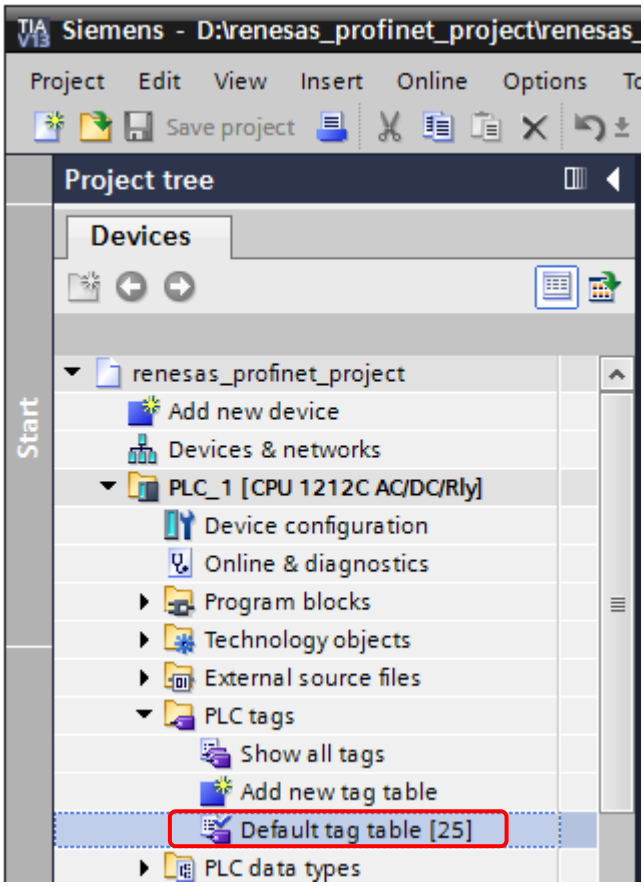
Assignment of I/Os of the device can be checked on the Device view tab.

When I/Os are assigned, addresses are automatically allocated.



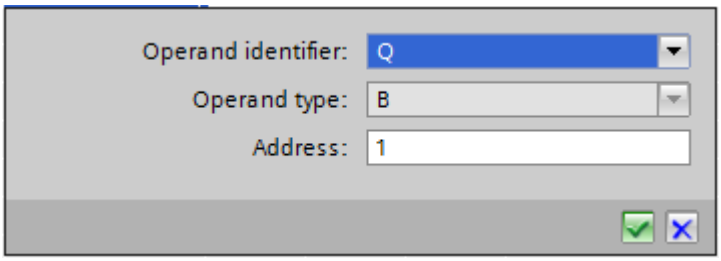
A tag must be defined to use I/Os.

From the tree on the Devices tab, select PLC > PLC tags > Default tag table.



Specify the tag name in "Name" and define the type in "Data type".
Set the I/O to be assigned in "Address".

Selecting the Address drop-down displays the following setting items.
Operand identifier: I = input, Q = output, M = in out
Operand type: The type specified in "Data type" is automatically set.
Address: Enter the address of the target I/O.

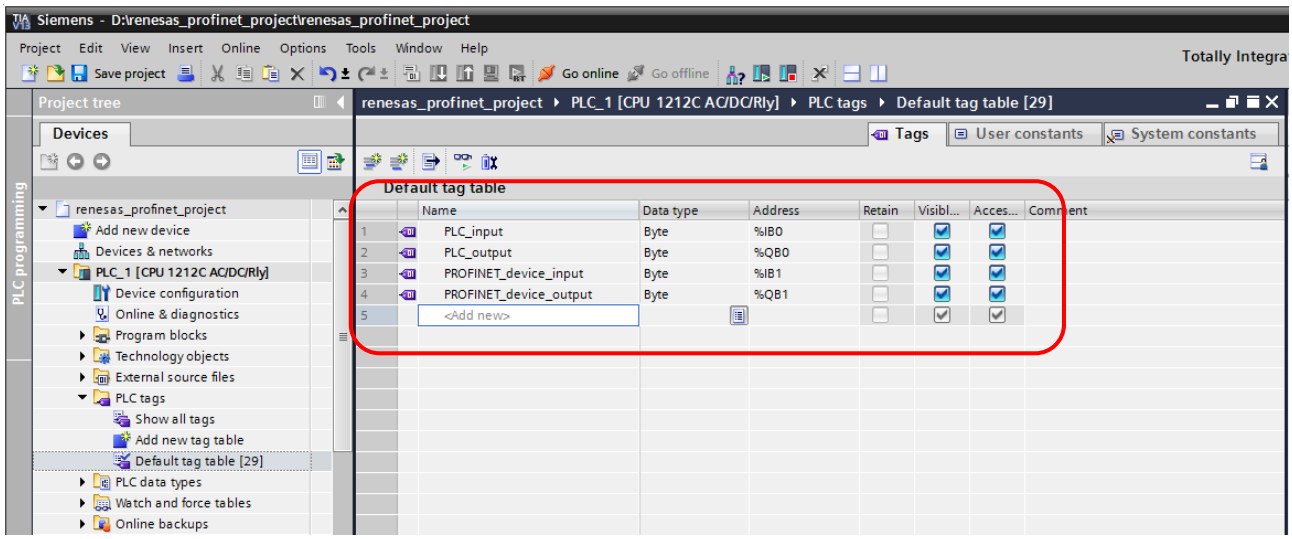


Assuming that there is a configuration where I/Os are assigned to the PLC and device shown below, an example of creating a sample program that sends and receives data is shown below.

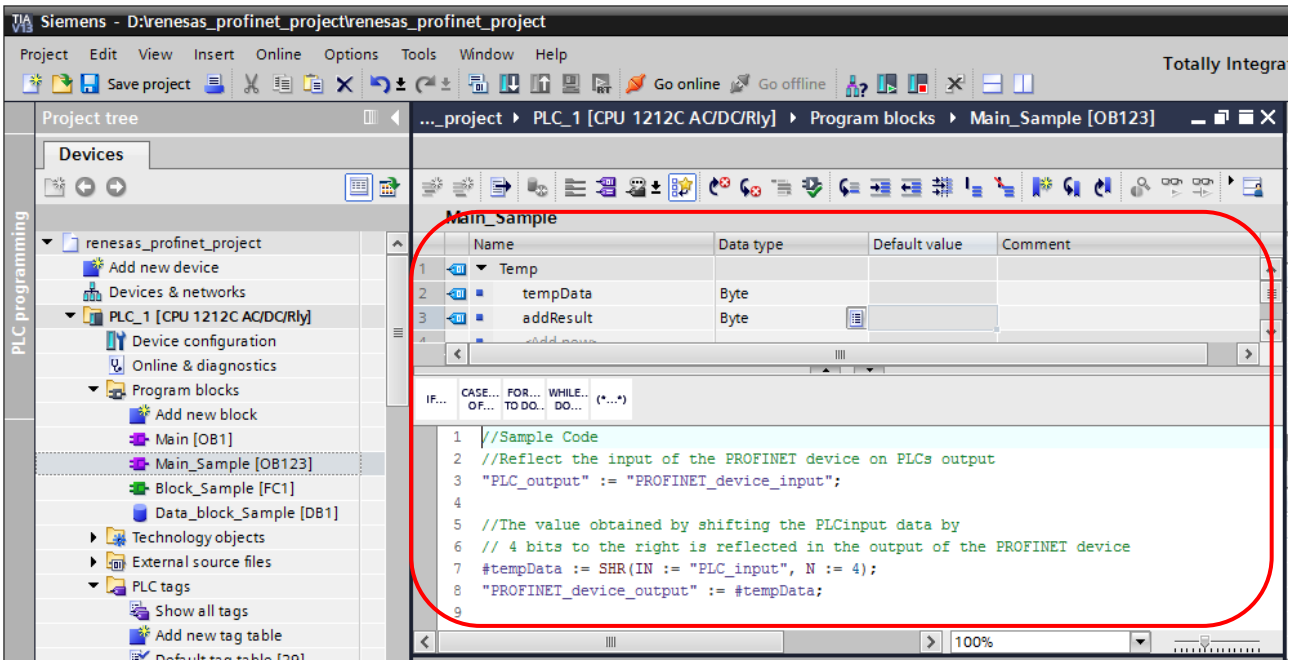
PLC: Input: 8 bits / Output: 6 bits, Address = 0

Device: Input: 2 bytes / Output: 2 bytes, Address = 1..2

Set tags for each I/O.



Using the tag set in the source program makes it possible to send and receive I/O data.
In the following sample program, input data of the device is assigned to the PLC output.
The value that is right-shifted by 4 bits from the PLC's input data is assigned to the device output.



8. Website and Support

Renesas Electronics Website
http://www.renesas.com/

Inquiries
http://www.renesas.com/contact/

Revision History

		Description	
Rev.	**Date**	**Page**	**Summary**
1.00	Jun. 20, 2017	-	First version
1.01	Feb. 1, 2021	P.1	Add R-IN32M3 module on Applicable device

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.

Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.
2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other disputes involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawing, chart, program, algorithm, application examples.
3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
4. You shall not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copy or otherwise misappropriation of Renesas Electronics products.
5. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The intended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.

   "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots etc.

   "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.

   Renesas Electronics products are neither intended nor authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems, surgical implantations etc.), or may cause serious property damages (space and undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for which the product is not intended by Renesas Electronics.
6. When using the Renesas Electronics products, refer to the latest product information (data sheets, user's manuals, application notes, "General Notes for Handling and Using Semiconductor Devices" in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat radiation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions or failure or accident arising out of the use of Renesas Electronics products beyond such specified ranges.
7. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please ensure to implement safety measures to guard them against the possibility of bodily injury, injury or damage caused by fire, and social damage in the event of failure or malfunction of Renesas Electronics products, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures by your own responsibility as warranty for your products/system. Because the evaluation of microcomputer software alone is very difficult and not practical, please evaluate the safety of the final products or systems manufactured by you.
8. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please investigate applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive carefully and sufficiently and use Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
9. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall not use Renesas Electronics products or technologies for (1) any purpose relating to the development, design, manufacture, use, stockpiling, etc., of weapons of mass destruction, such as nuclear weapons, chemical weapons, or biological weapons, or missiles (including unmanned aerial vehicles (UAVs)) for delivering such weapons, (2) any purpose relating to the development, design, manufacture, or use of conventional weapons, or (3) any other purpose of disturbing international peace and security, and you shall not sell, export, lease, transfer, or release Renesas Electronics products or technologies to any third party whether directly or indirectly with knowledge or reason to know that the third party or any other party will engage in the activities described above. When exporting, selling, transferring, etc., Renesas Electronics products or technologies, you shall comply with any applicable export control laws and regulations promulgated and administered by the governments of the countries asserting jurisdiction over the parties or transactions.
10. Please acknowledge and agree that you shall bear all the losses and damages which are incurred from the misuse or violation of the terms and conditions described in this document, including this notice, and hold Renesas Electronics harmless, if such misuse or violation results from your resale or making Renesas Electronics products available any third party.
11. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.

(Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

(Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

(Rev.3.0-1 November 2016)

RENESAS

SALES OFFICES Renesas Electronics Corporation http://www.renesas.com

Refer to "http://www.renesas.com/" for the latest and detailed information.

Renesas Electronics America Inc.
2801 Scott Boulevard Santa Clara, CA 95050-2549, U.S.A.
Tel: +1-408-588-6000, Fax: +1-408-588-6130

Renesas Electronics Canada Limited
9251 Yonge Street, Suite 8309 Richmond Hill, Ontario Canada L4C 9T3
Tel: +1-905-237-2004

Renesas Electronics Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-585-100, Fax: +44-1628-585-900

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-6503-0, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.
Room 1709, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100191, P.R.China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.
Unit 301, Tower A, Central Towers, 555 Langao Road, Putuo District, Shanghai, P. R. China 200333
Tel: +86-21-2226-0888, Fax: +86-21-2226-0999

Renesas Electronics Hong Kong Limited
Unit 1601-1611, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2265-6688, Fax: +852 2886-9022

Renesas Electronics Taiwan Co., Ltd.
13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

Renesas Electronics Singapore Pte. Ltd.
80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre, Singapore 339949
Tel: +65-6213-0200, Fax: +65-6213-0300

Renesas Electronics Malaysia Sdn.Bhd.
Unit 1207, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

Renesas Electronics India Pvt. Ltd.
No.777C, 100 Feet Road, HAL II Stage, Indiranagar, Bangalore, India
Tel: +91-80-67208700, Fax: +91-80-67208777

Renesas Electronics Korea Co., Ltd.
12F., 234 Teheran-ro, Gangnam-Gu, Seoul, 135-080, Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5141

Colophon 6.0