RIN32M3 Module (RY9012A0)

Software PLC Guide: CODESYS for PROFINET

R30AN0377ED0101
Rev.1.01
2020.6.25

Introduction

This application note explains the procedure for running evaluation the R-IN32M3module Solution Kit in connection with the CODESYS software programmable logic controller (PLC). In particular, this covers how to add and configure the protocol stack PROFINET supported by CODESYS.

Target Device

R-IN32M3 module

Related document

Document Type	Document Title	Document No.
Data Sheet	R-IN32M3 Module Datasheet	R19DS0109ED****
User's Manual	R-IN32M3 Module User's Manual: Hardware	R19UH0122ED****
User's Manual	R-IN32M3 Module User's Manual: Software	R17US0002ED****
Quick Start Guide	R-IN32M3 Module Application Note: Quick Start Guide	R12QS0042ED****
Application Note	R-IN32M3 Module (RY9012A0) User's Implementation Guide	R30AN0386EJ****
User's Manual	Adaptor Board with R-IN32M3 module YCONNECT-IT-I-RJ4501	R12UZ0094EJ****
Quick Start Guide	Evaluation Kit for RA6M3 Microcontroller Group EK-RA6M3 Quick Start Guide	R20QS0011EU***
Application Note	R-IN32M3 Module (RY9012A0) Application Note RA6M3/RA6M4	R30AN0388EJ****
Application Note	R-IN32M3 Module (RY9012A0) Application Note RX66T	R12AN0111EJ****
Application Note	Software PLC Connection Guide CODESYS for EtherNet/IP	R30AN0378ED****
Application Note	Software PLC Connection Guide CODESYS for EtherCAT	R30AN0379ED****
Application Note	Software PLC Connection Guide TwinCAT	R30AN0380ED****

Table of Contents

1. Overview

1.1 Abstract

This document describes how to setup R-IN32M3 module with CODESYS for PROFINET.

1.2 Operating environment

For details on the software environment and hardware environment, refer to the application note included in the sample package (r18an0052xx0 ***).

Table 1-1 Application Note

資料名	資料番号
R-IN32M3 Module Application Note RA6M3 / RA6M4	R30AN0388EJ****
R-IN32M3 Module Application Note RX66T	R12AN0111EJ****

The connection procedure described in this manual assumes that the following conditions are met. For the setup method of each evaluation board, refer to the application note corresponding to each sample software included in the sample package.

1.2.1 Software environment

Table 1-2 shows the software operating environment.
Sample software and various documents are included in the sample package.

Table 1-2 Software environment

Name	Link
R-IN32M3module sample package	r18an0052xx0***
CODESYS CODESYS Group	https://www.codesys.com/
Npcap NMAP.ORG	https://nmap.org/npcap/

1.2.2 Hardware environment

This document applies only to the following configurations:

1) R-IN32M3 module Adapter board with EK-RA6M3 / EK-RA6M4
2) R-IN32M3 module Adapter board with SK-S7G2
3) R-IN32M3 module CPU card

1) R-IN32M3 module + EK-RA6M4

2) R-IN32M3 module + SK-S7G2

3) R-IN32M3 module CPU card [SEMB1320]

Fig. 1.1 Evaluation environment

Table 1-3 Evaluation environment

Name	Type
R-IN32M3 Module Adapter board	YCONNECT-IT-I-RJ450
R-IN32M3 Module CPU card	SEMB1320
RA6M3 MCU Group Evaluation Board	EK-RA6M3
RA6M4 MCU Group Evaluation Board	EK-RA6M4
SK-S7G2 starter kit.	SK-S7G2

2. CODESYS Setup

2.1 Setup PROFINET project

2.1.1 Creating a project

Select “All Programs > CODESYS > CODESYS V*.* SP** Patch** ” from the Windows start menu.

Select "New Project" from the "File" menu to create a new project.

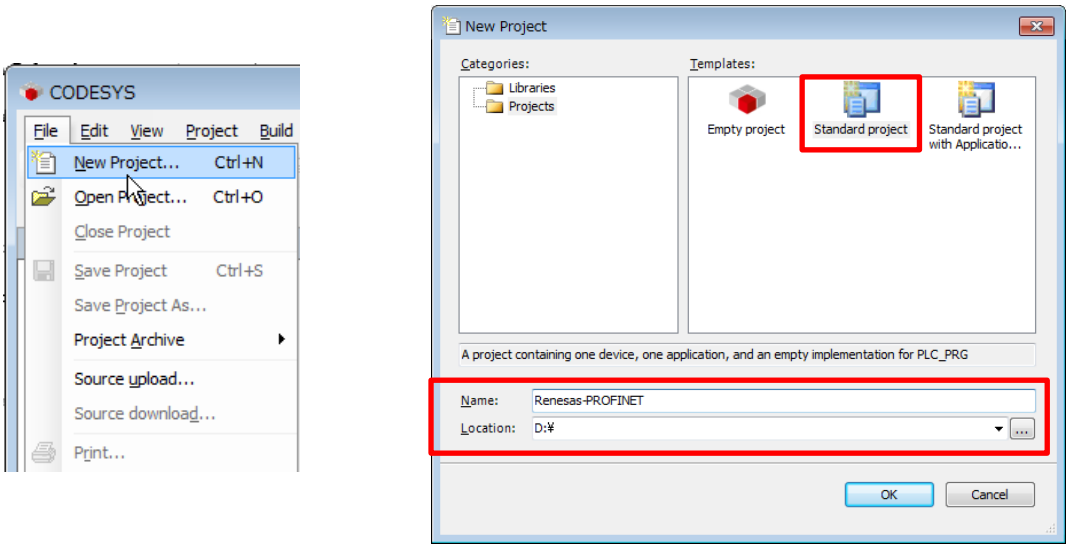


Figure 2.1 new project

In the "New Project" window, select "Projects" from the "Categories" section and "Standard project" from the "Templates" section. Then, specify the name of the project.

In the "Standard Project" window, select the controller and programming language you wish to use from the drop-down lists for "Device" and "PLC_PRG in". For this example, select "**CODESYS Control Win V3 x64**" and "Structured Text (ST)", respectively. After that, click on "OK" to open the new project.

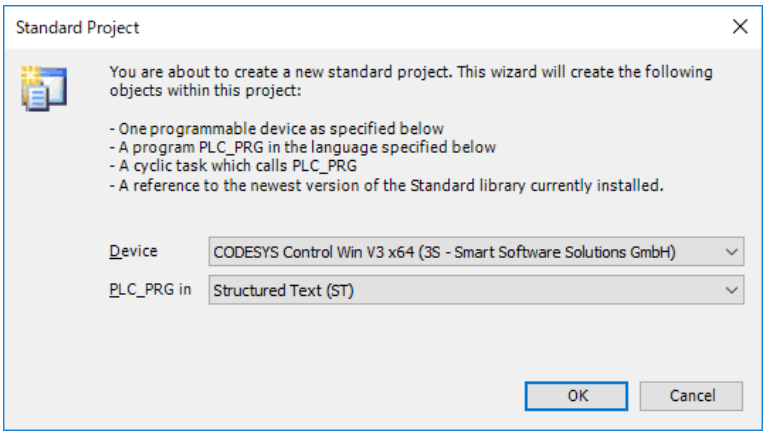


Figure 2.2 Select the Device and PLC programming

The "Device" tree for the newly created project will be displayed as shown below.

The components that belong to "Device (CODESYS Control Win V3 x64)" are managed in a tree structure.

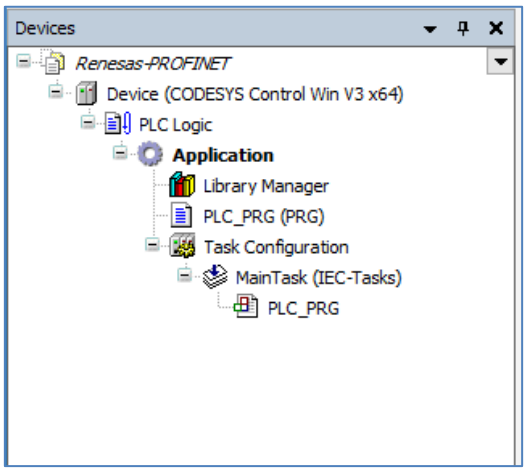


Figure 2.3 Project View

2.1.2 Install Device Information (GSD)

Install a GSD (General Station Description) file which contains a description of the PROFINET slave device. An XML file called GSDML for use with PROFINET is provided with the released stack. Select "Device Repository…" from the "Tools" menu of the CODESYS program.

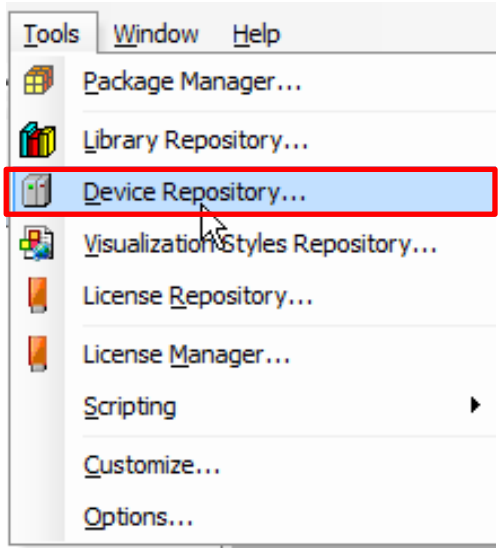


Figure 2.4 Open Device Repository

In the dialog box, click on the "Install" button to produce the dialog box where you are to enter the name of the provided GSDML file. The R-IN32M3 module sample package has GSDML file for each application (**Table 2-1 GSDML file**).
When the installation is complete, [R-IN32M3_Module] will be registered in “PROFINET IO Slave” tree.

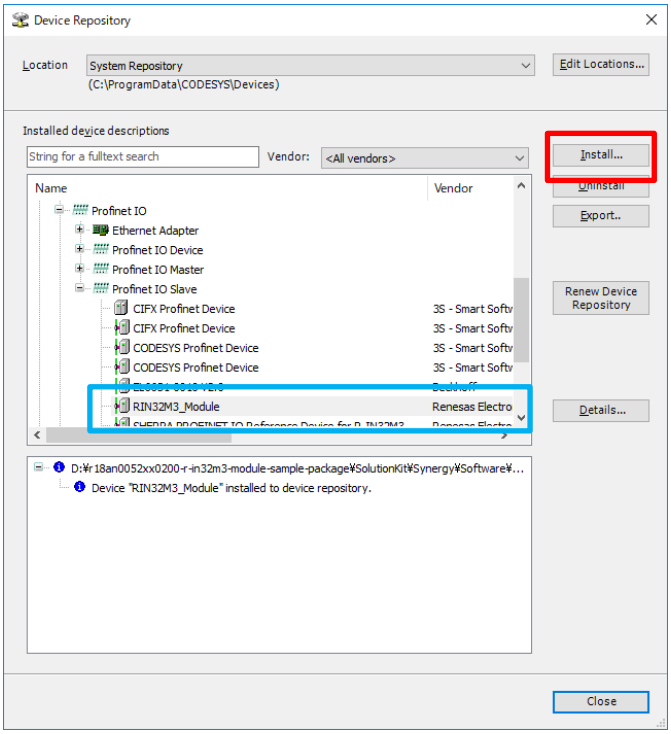


Figure 2.5 Install the GSDML File

Table 2-1 GSDML file

Sample project	application	directory
RA sample	Mirror	RA6_CCM_V***\appl\mirror_sample\ac\01_pnio_io_renesas\gsdml
	Remote-IO	RA6_CCM_V***\appl\remote_io_sample\ac\01_pnio_io_renesas\gsdml
	Sensor	RA6_CCM_V***\appl\sensor_sample\ac\01_pnio_io_renesas\gsdml
Synergy sample	Mirror	Synergy_CCM_V***\appl\2015013_irj45\ac\01_pnio_io_mirror\gsdml
RX66T sample	Mirror	RX66T_CCM_V***\appl\mirror_io_sample\01_pnio_io \gsdml
	Remote-IO	RX66T_CCM_V***\appl\remote_io_sample\01_pnio_io \gsdml
	Motor	RX66T_CCM_V***\appl\motor_sample\01_pnio_io \gsdml

2.1.3 Add Master and Slave Device

Add the Master device and "R-IN32M3 Module" Slave device to the project.

1.) Add the Ethernet Interface

Right-click on "Device (CODESYS Control Win V3 x64)" in the "Device" tree and select "Add Device…".

The "Add Device" dialog box opens. Select "Ethernet" under "Fieldbuses", then "Ethernet" and click on the "Add Device" button.

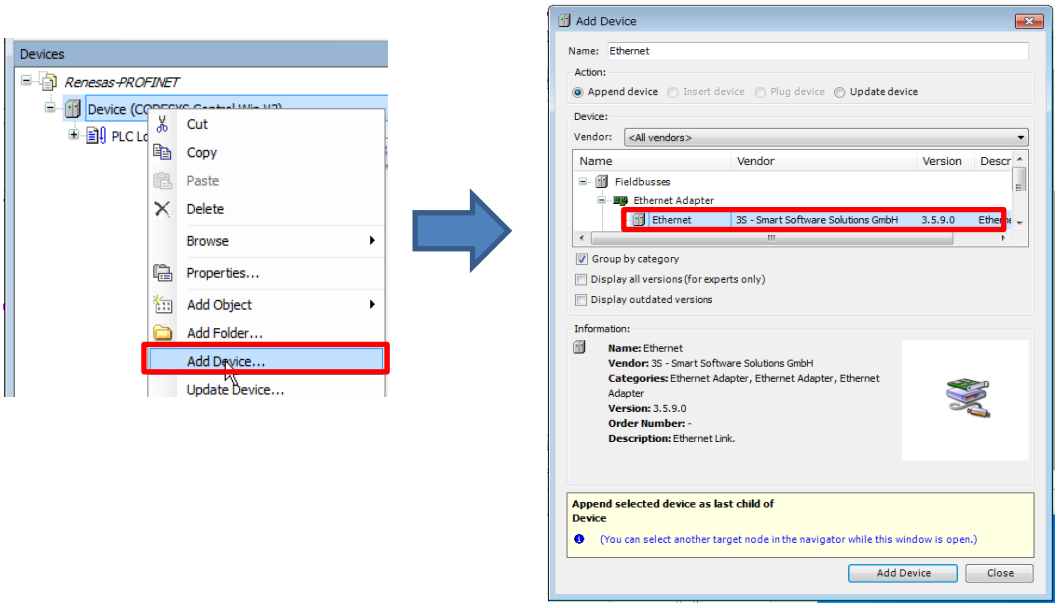


Figure 2.6 Add Device

You can see that "Ethernet" has been added under "Ethernet (Ethernet)" in the "Device" tree.

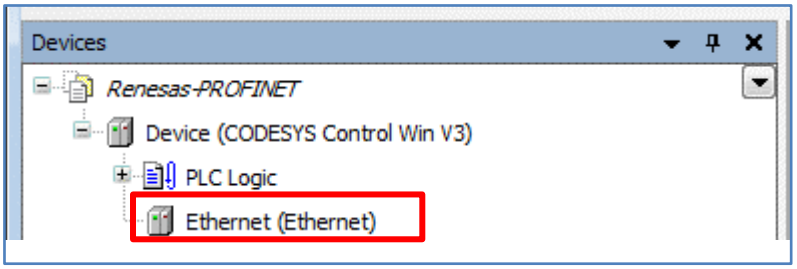


Figure 2.7 Ethernet Interface in Project Tree

2.) Add a Master PN Controller

Right-click on "Ethernet (Ethernet)" in the "Device" tree and select "Add Device".

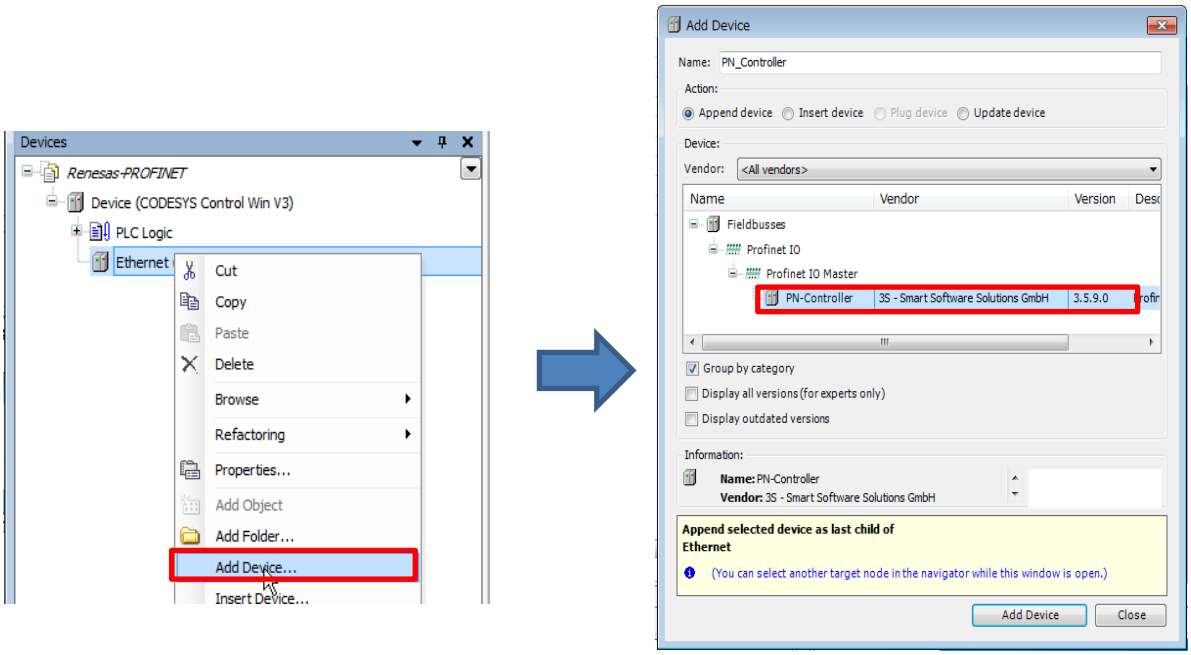


Figure 2.8 Add PROFINET Controller

The "Add Device" dialog box opens. Select "PN-Controller" under "Fieldbusses", "Profinet IO", then "Profinet IO Master" and click on the "Add Device" button.

You can see that "PN-Controller" has been added under "Ethernet" Interface in the Project tree.

3.) Add a R-IN32 Module Slave

Right-click on "PN-Controller" in the Project tree and select "Add Device".

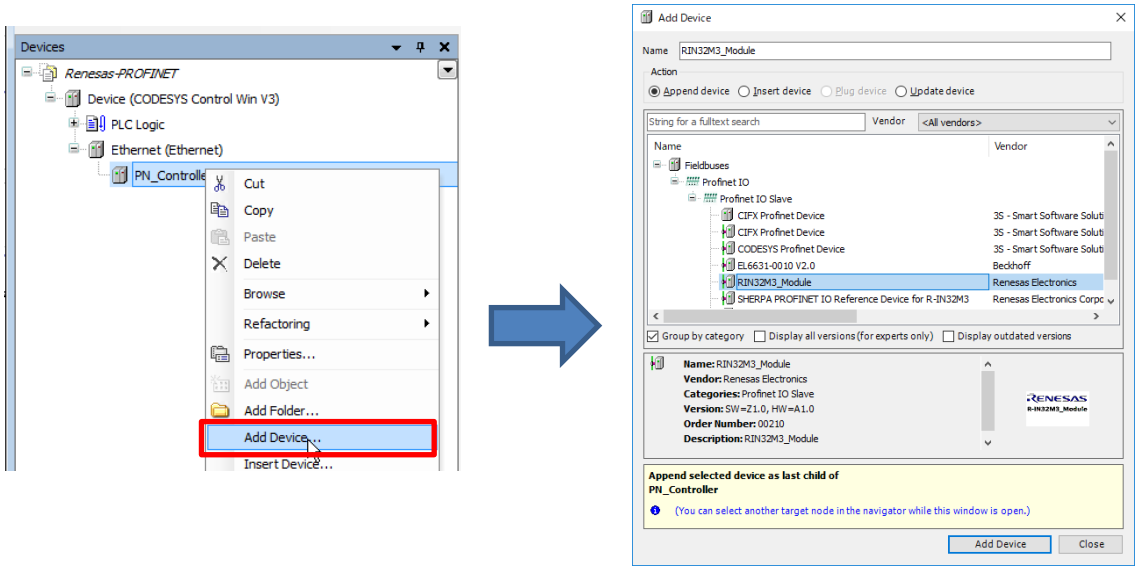


Figure 2.9 Add the R-IN32M3 Module

The "Add Device" dialog box opens. Select "RIN32M3_Module" under "Fieldbusses", "Profinet IO", then "Profinet IO Slave" and click on the "Add Device" button.

You can see that "R-IN32M3 Module" has been added under "PN-Controller" in the Project tree.

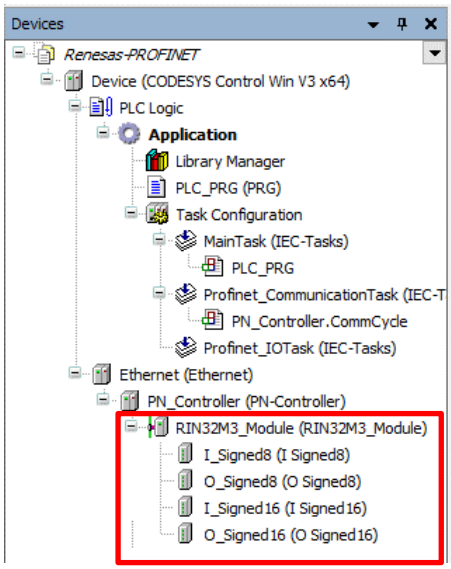


Figure 2.10 R-IN32M3 Module in Project

Figure 2.10 R-IN32M3 Module in Project shows the Synergy sample mirror app with the R-IN32M3 module added.

3. Configuring CODESYS Network

3.1 Connecting HOST PC IP address

IP address setup to the HOST PC.

Open "Network Connection". Double-click or right-click on the "Local Area Connection" icon.

In the "Local Area Connection Status" window, select "Properties".

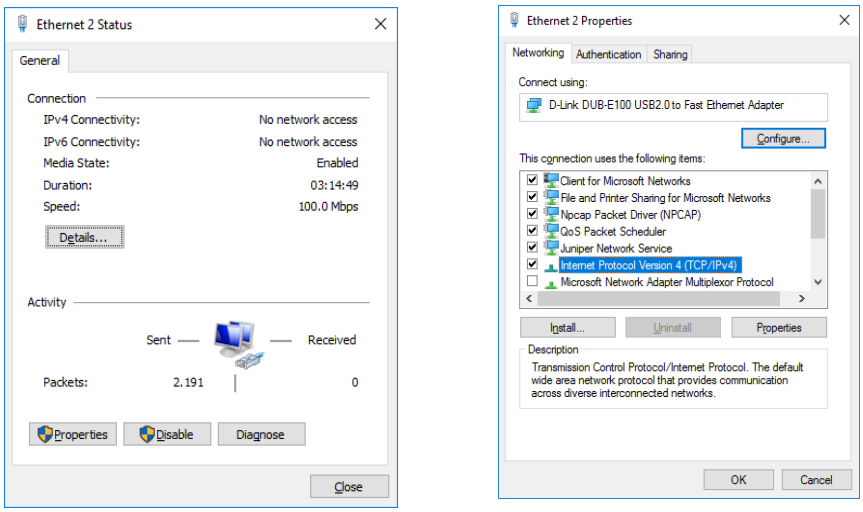


Figure 3.1 Network Status

In the "Local Area Connection Properties" window, highlight "Internet Protocol Version 4 (TCP/IPv4)" then click on the "Properties" button.

Select the radio button "Use the following IP Address" and set IP [192.168.0.1] and subnet mask [255.255.255.0].

Figure 3.2 IP address setting

Click on “OK” to finish the configuration.

3.2 Connecting to the Software PLC

This section gives the procedure for connection to the target software PLC from the CODESYS development environment via a gateway.

3.2.1 Starting the Gateway Server

Check the state of the gateway server on the system tray. If the server is down, click on the " " icon and select "Start Gateway" to start the server up. Usually, the server will automatically be started as a standard service on booting of Windows and its status is indicated in the system tray[Note] in the lower-right corner of the desktop.

Note: If you cannot find the icon in the system tray, start the server up by the following procedure:
Click on “All Programs” > CODESYS > CODESYS Gateway V3.

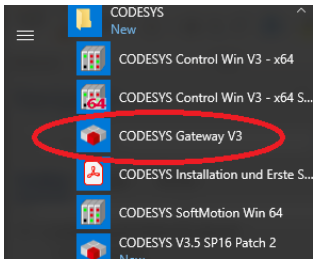


Figure 3.3 Start of Gateway Server

3.2.2 Starting the Software PLC

Check the state of the software PLC on the system tray. If the program is stopped, click on the " " icon and select "Start PLC" to start the program up.

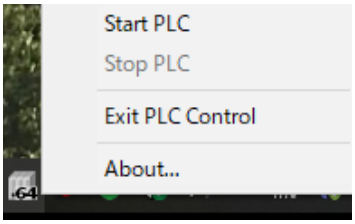


Figure 3.4 Start PLC Controller

Usually, the program will automatically be started as a standard service on booting of Windows and its status is indicated in the system tray[Note] in the lower-right corner of the desktop.

Note: If you cannot find the icon in the system tray, start the server up by the following procedure:
Click on “All Programs” > CODESYS > CODESYS Control Win V3 x64 SysTray.

Figure 3.5 Run PLC Controller

3.3 Configuring Network

3.3.1 Device registration

Make connection settings for connecting the software PLC service from your development environment. Double-click on the "Device (CODESYS Control Win V3 x64) in the "Device" tree. On the "Device" tabbed page, select "Connection settings" and click on the "Scan network…" button.

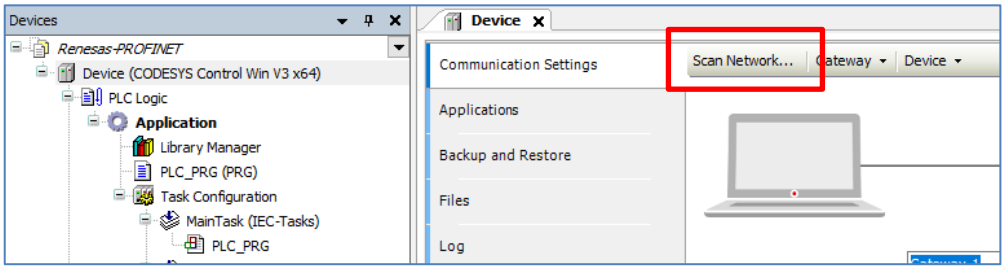


Figure 3.6 Device Scan

The "Select Device" window opens and a search for available devices that can use the local network automatically starts. Finding a software PLC service constitutes success and the name of the corresponding PC will be indicated. Double-click on the PC name to make a connection.

If the service will not be found, check the settings described in previous sections, **3.2 Connecting to the Software PLC**.

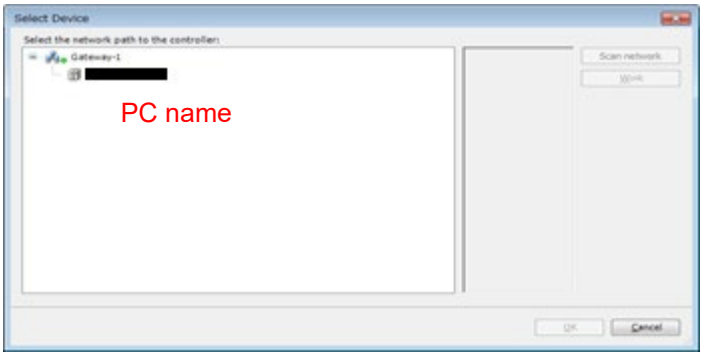


Figure 3.7 Select the PLC

When the available device is registered, the device is activated, and the green circle mark lights up.

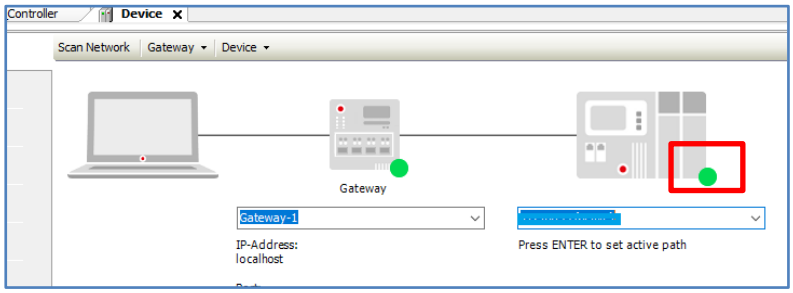


Figure 3.8 registered device

3.3.2 Configuring the Network adapter

Double-click on "Ethernet (Ethernet)" in the "Device" tree to open the configuration window. In the "General" tabbed page, click on the icon next to the text box for "Interface" section as shown in the red rectangle below.

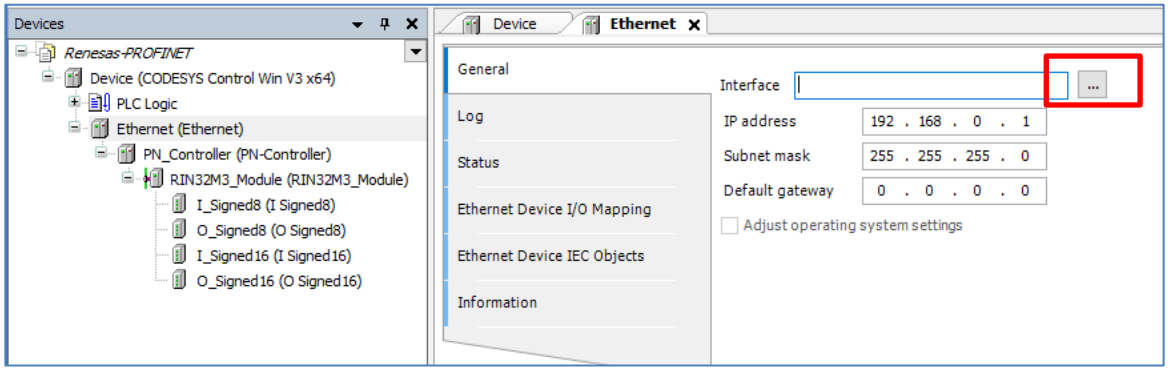


Figure 3.9 Configure the Network Adapter

In the "Network Adapters" window, select the interface set by **3.1 Connecting HOST PC IP address**.

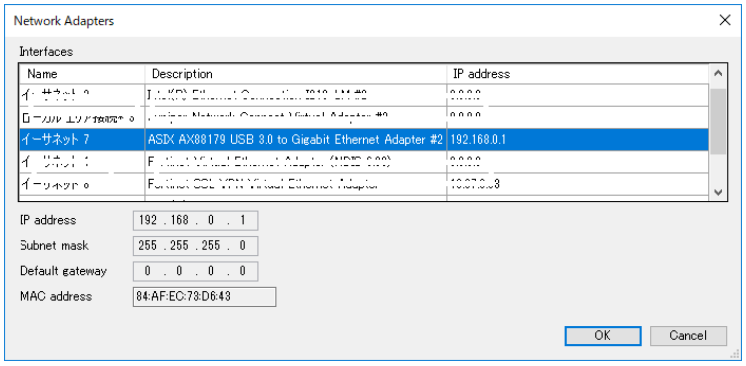


Figure 3.10 Select the Network Adapter

3.3.3 PN-Controller setting

Double-click on "PN-Controller (PN-Controller)" in the "Device" tree to open the configuration window. Select the "General" tab in the window.

Here, if you have configured an IP address as described in the previous section, **3.1.4 Configuring the Ethernet Network**, if there are any applicable IP addresses, "adjust" will be indicated next to the corresponding IP address range, as shown in the red rectangle below. Clicking on this indication leads to automatic setting of the applicable IP address.

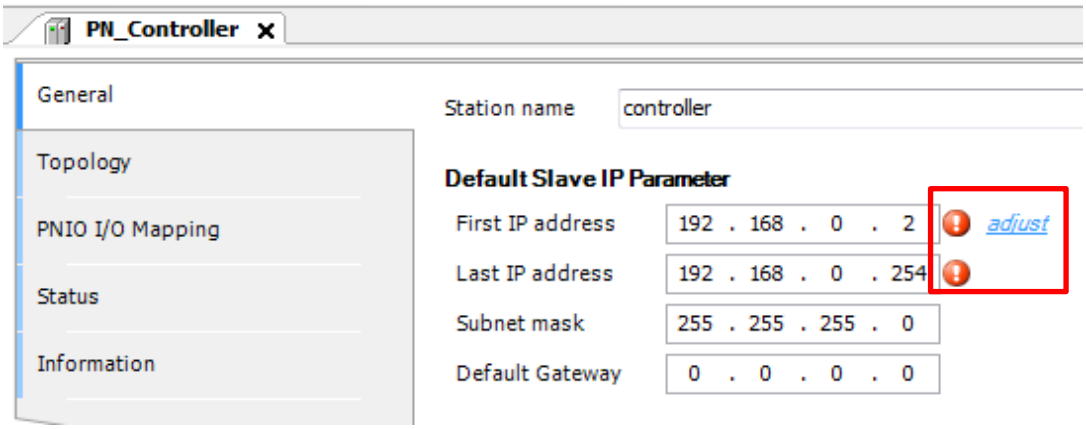


Figure 3.11 Configuration of Controller

3.3.4 R-In32M3 Module Configuration

Double-click on "RIN32M3_Module" in the "Device" tree to open the configuration window. Then, select the "General" tab.

As the IP Parameter, specify the address ranges from "First IP address" to "Last IP address" you have configured according to the description in the previous section, **3.3.3 PN-Controller**.

The PROFINET system recognizes slave devices by the names specified in the "Station name" section of this page. Enter the station name set within the slave device.

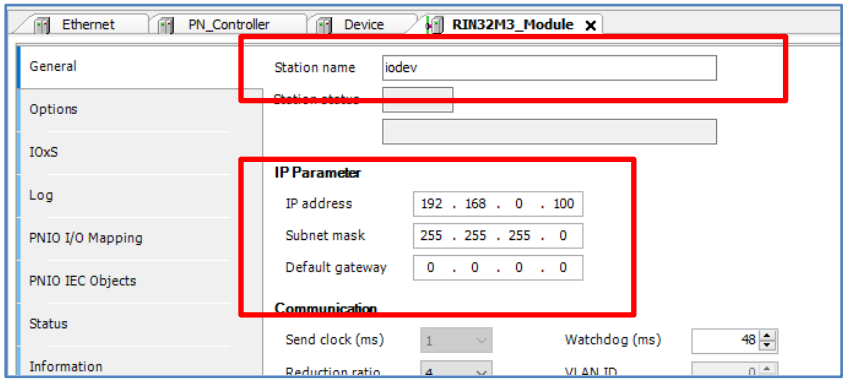


Figure 3.12 Stet Station Name and IP Address

4. CODESYS Network Connection

4.1 Download the Project

Now we have finished the offline configuration and can start the online mode.

Click on the button  to build and download the configuration.

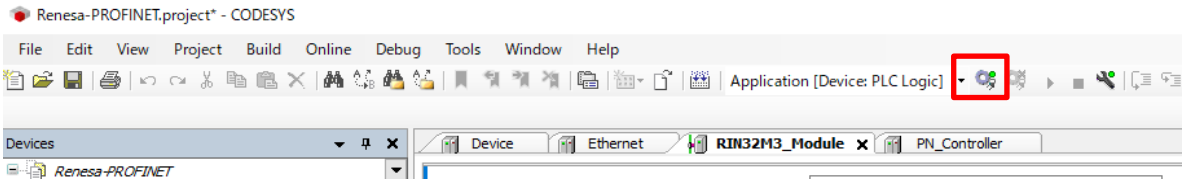


Figure 4.1 Login the project

When you have change something in the project then you will be asked to download it. Acknowledge it with “OK”

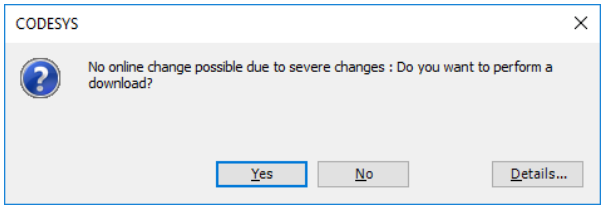


Figure 4.2 Download project

When the download is finished click “Start” to run the project.

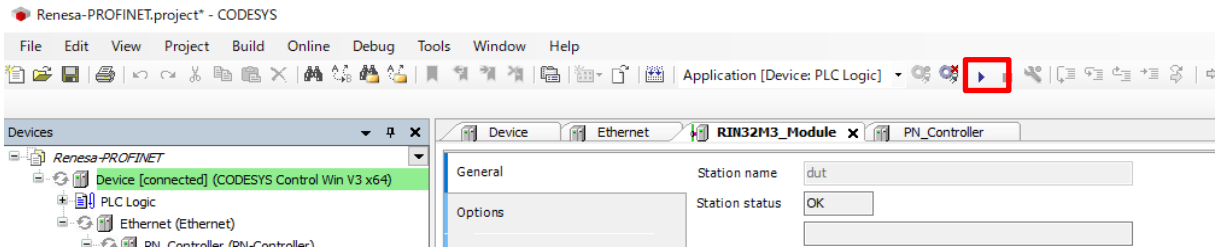


Figure 4.3 Start project

4.2 Run Project

Now, if all the icons in front of the device turn green, the PROFINET connection is successful.

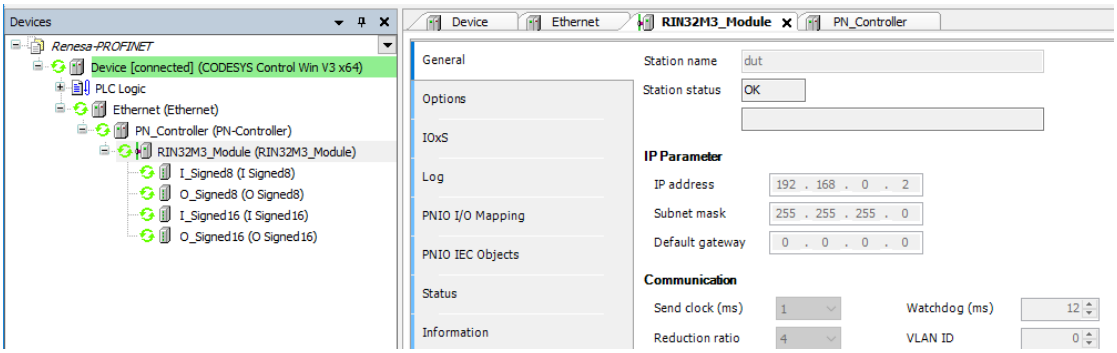


Figure 4.4 successful PROFINET Connection

The icons indicating status of each device is listed below.

: The application is connected to the PLC and is running.

: The application is connected to the PLC but is not running.

: Error. Check the error contents and the settings of the device.

: There is no device information in the device repository. Review the device information file and re-install it.

4.3 Creating and Simulating a User Interface

4.3.1 General

This section includes the following procedures:

- Displaying the development environment screen
- Implementation example
- Relating variables to components and to the I/O ports of devices

The CODESYS development environment allows the creation of user interfaces. You can access all internal variables used in the PLC program on the screen as well as monitoring and changing the parameters.

The PLC example it this case uses the “mirror” feature (Mirror sample application) of the R-IN32M3 module application. The INPUT value of the device (Module) will be increase by one and send back to the OUTPUT value of the PLC. The speed of this increase can be controlled by the value MAXI.

4.3.1.1 Adding Components

Components to be placed on a user-interface display need to be added to the "Device" tree before creating one. Right-click on "Application" in the tree and select "Add Object", then "Visualization…".

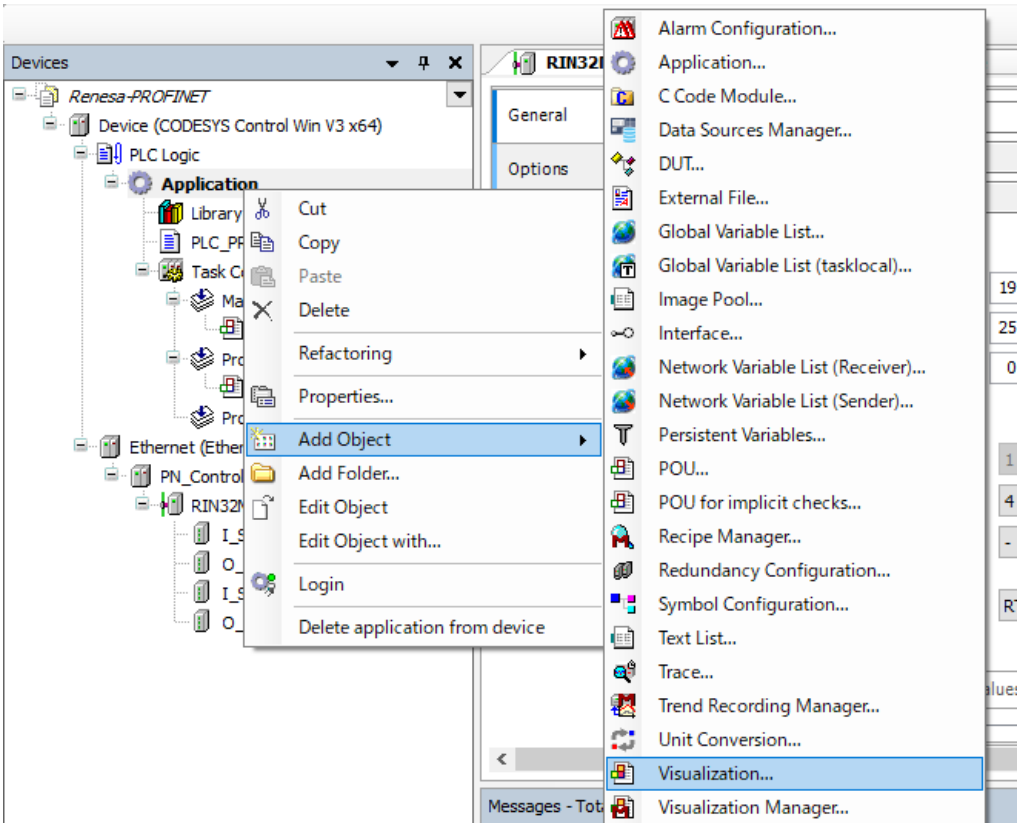


Figure 4.5 Add of Visualization object in Project tree

4.3.1.2 Development Pane

Double-clicking on "Visualization" in the tree displays the development pane.

Development pane
The main pane for structuring user-interface displays.
Place the components you will be using here.

Toolbox
The toolbox provides basic components for placements in the development pane. As well as such as graphs, tables, and labels, meters, switches, progress bars, and other items are available.
Users can select the desired components from this box and place them in the development pane.

Properties
Parameters for the components placed on the development pane are monitored and changed from here. The internal variables of the PLC program are also handled within this pane.

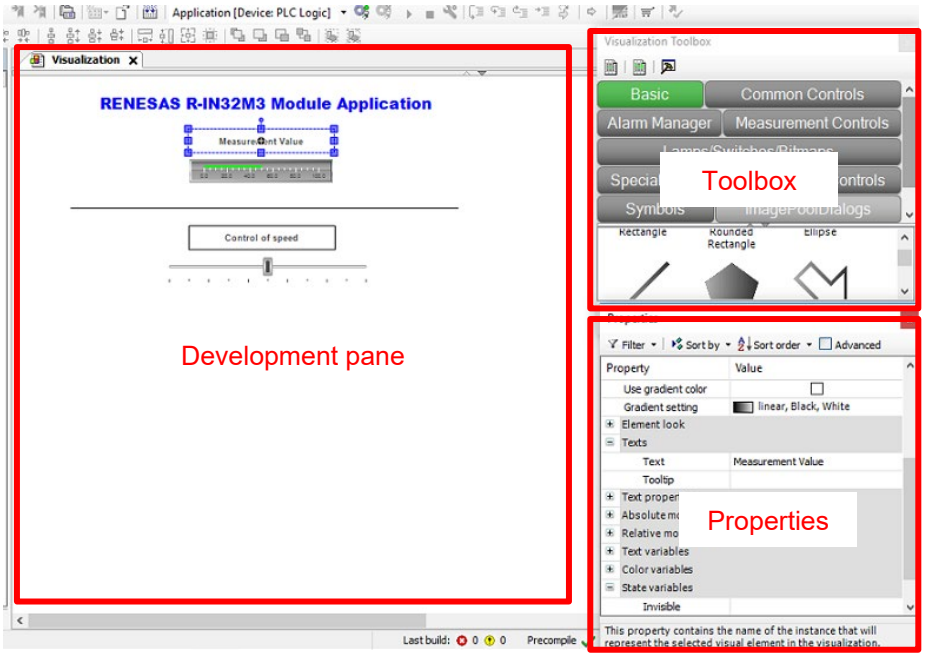


Figure 4.6 Development of visualisation example

To design an example just drag and drop the display and control item out of the “Toolbox” in the “Development pane”

4.3.1.3 Development of PLC program

For our PLC example we have to establish a small application program.

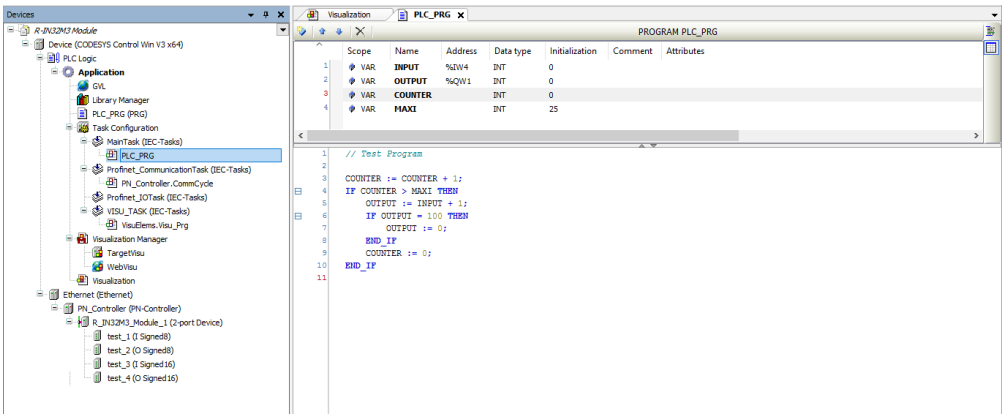


Figure 4.7 Development of visualisation example

Therefore, please double click of “PLC_PRG” in the project tree.

Input the necessary variables like “INPUT”, “OUTPUT”, “COUNTER” and “MAXI”.

The variables “INPUT” and “OUTPUT” are assigned to dedicated device address. These addresses can be found in the device configuration. Make a double click on the Input or/and Output module of the device and open the tab “PNIO Module I/O Mapping”.

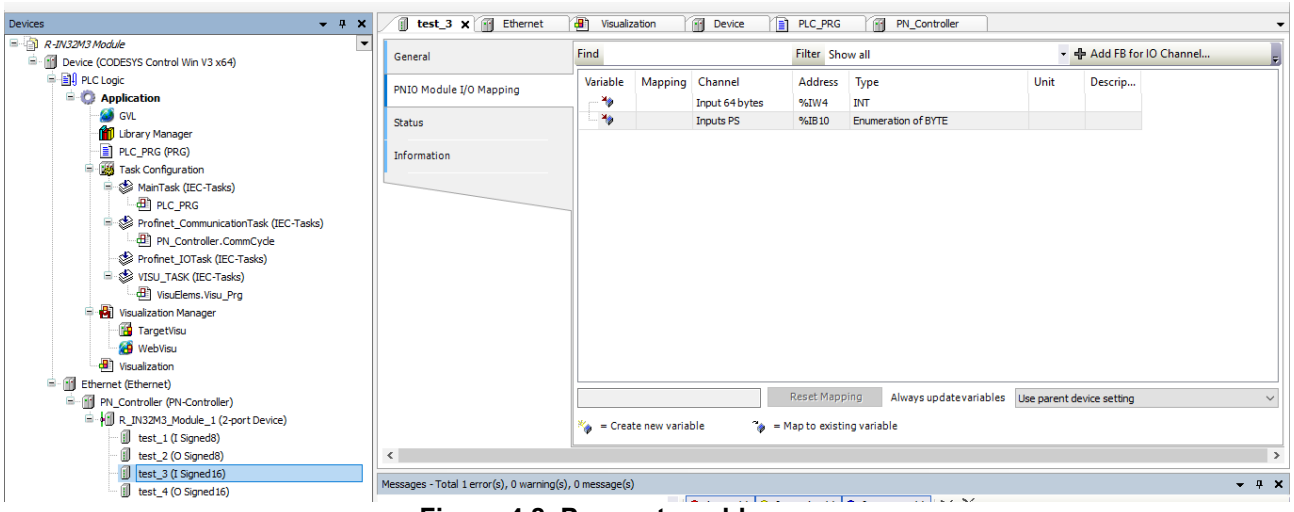


Figure 4.8 Parameter addresses

Here are the addresses of the module parameters. In our case the address %IW4 will be used for the INPUT variable.

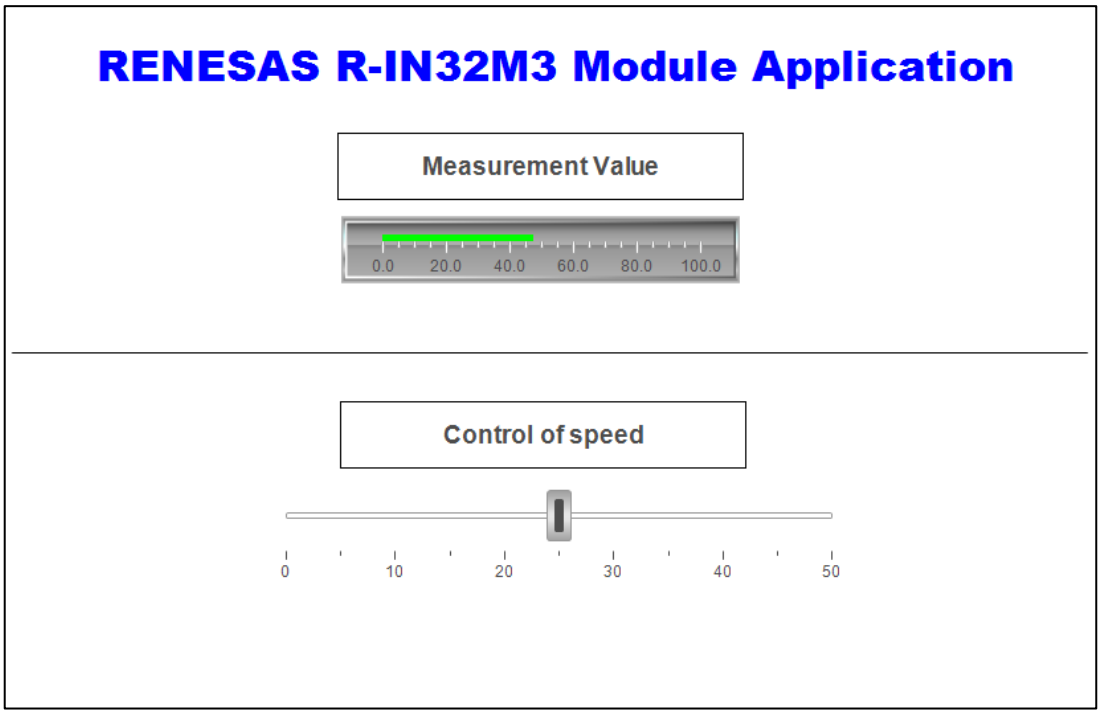
On the "PLC_PRG" tabbed page, write the source code in the code-writing section with defined variables.

```
1   // Test Program
2
3   COUNTER := COUNTER + 1;
4   IF COUNTER > MAXI THEN
5       OUTPUT := INPUT + 1;
6       IF OUTPUT = 100 THEN
7           OUTPUT := 0;
8       END_IF
9       COUNTER := 0;
10  END_IF
11
```

Figure 4.9 PLC program

4.3.1.4 Result of Running the Program

By starting the PLC, the following screen will come up:



The measurement value (green bar) will move from “0” to “100” and back to “0”.

The speed of the increase of the measurement value can be controlled by the slider. The default value is 25. The highest speed is a “0” and the slowest is a “50”.

Revision History

Rev.	Date	Description	
		Page	Summary
Rev.1.0	2020.12.15	-	First Edition
Rev.1.01	2020.6.25	3	Add Evaluation Environment part

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(Rev.4.0-1 November 2017)

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