

RIN32M3 Module (RY9012A0)

R30AN0379ED0100

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Software PLC Guide: CODESYS for EtherCAT

Introduction

This application note explains the procedure for running evaluation the R-IN32M3 Industrial Ethernet Module Solution Kit in connection with the CODESYS software programmable logic controller (PLC). In particular, this covers how to add and configure the protocol stack EtherCAT supported by CODESYS.

Target Device

R-IN32M3 module

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1. Configuring the Ethernet network

1.1 Introduction

Before the network configuration can be started please make sure that the points below are settled:

- 1.) The hardware of the R-IN32M3 Module Solution Kit has to be set up correctly. Please see the Quick Start Guide [R12QS0043xx].
- 2.) The application software "09_ecat_slave" is programmed. Please see the Quick Start Guide [R12QS0043xx].
- 3.) Connect one of the Ethernet port of the module with one of PC Ethernet port.

1.2 Setting the Host IP Address

This section describes device configuration, including the setting of an IP address for use in a network of devices.

Set the IP address before configuring the device.

Open "Network Connection".

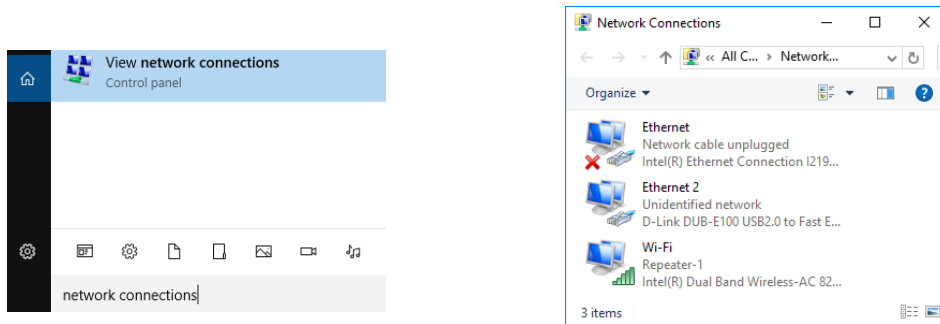


Figure 1.1 View network connections

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

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

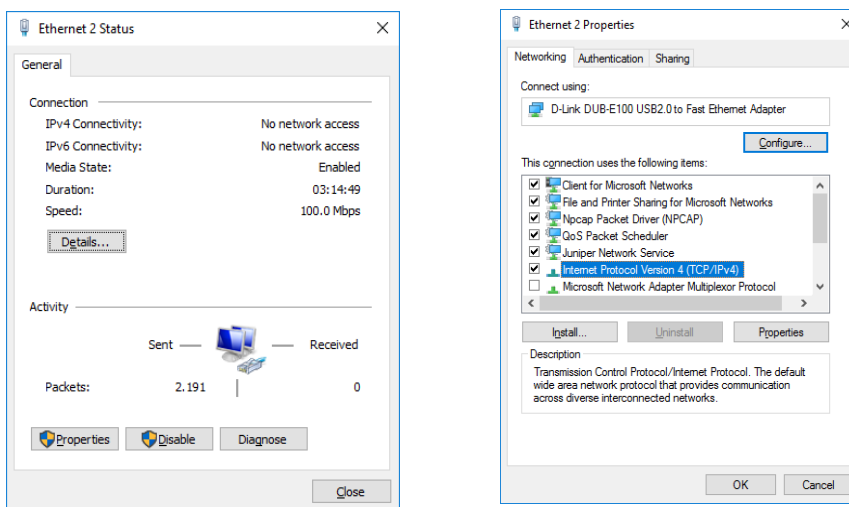


Figure 1.2 Network Status

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 and subnet mask



Figure 1.3 TCP/IP configuration

Click on "OK" to finish the configuration.

1.3 WinPCAP / Npcap

The WinPcap needs to be installed to use the Codesys.

WinPcap: <https://www.winpcap.org>

The Npcap also supports the Codesys, select "Winpcap API compatibility mode" when installing Npcap.

Npcap: <https://nmap.org/>

1.4 Wireshark

For a more detailed protocol analysis, it is recommended to install the Wireshark tools.

Wireshark: <https://www.wireshark.org>.

2. Configuring the Device

2.1 Setup EtherCAT project

2.1.1 Creating a project

Select "All Programs" > CODESYS > CODESYS Vx.x (x.x represents the version number) from the Windows start menu.

You can also startup the program by double-clicking on the "CODESYS" icon, which will be created on the desktop after the installation of the program.

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

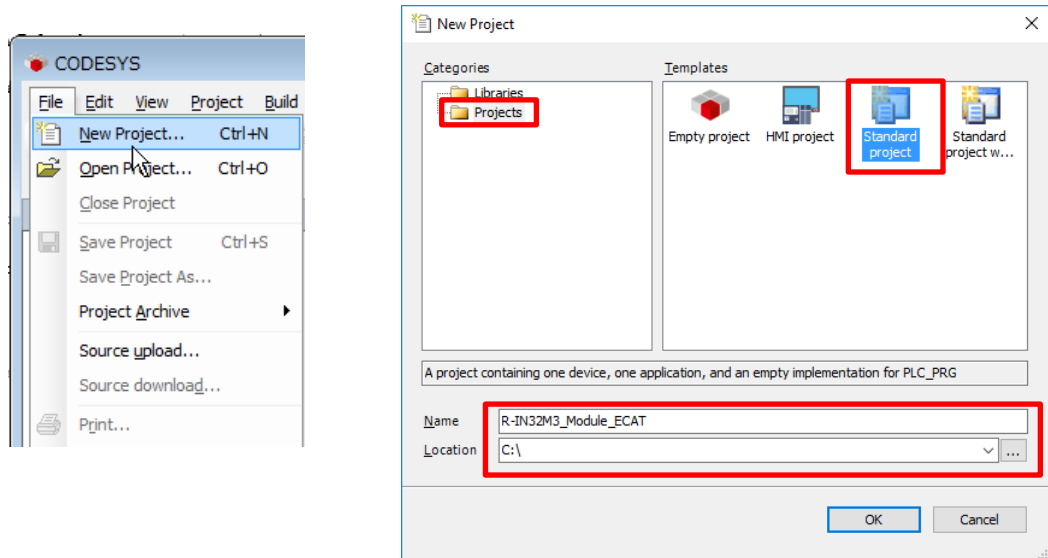


Figure 2.1 Open new project

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.

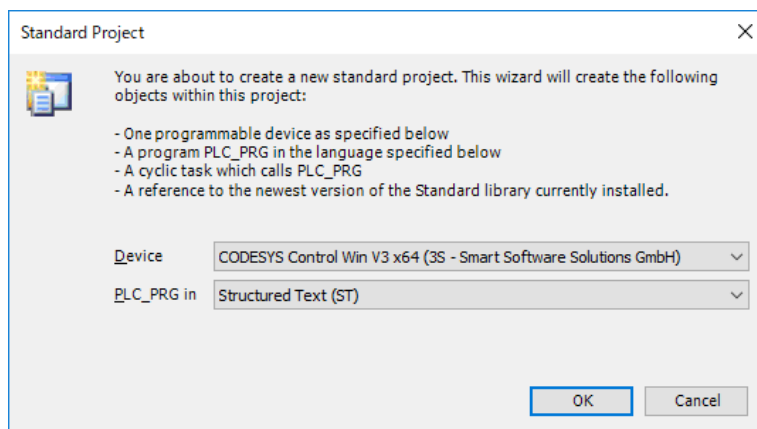


Figure 2.2 Select the Device and PLC programming

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.

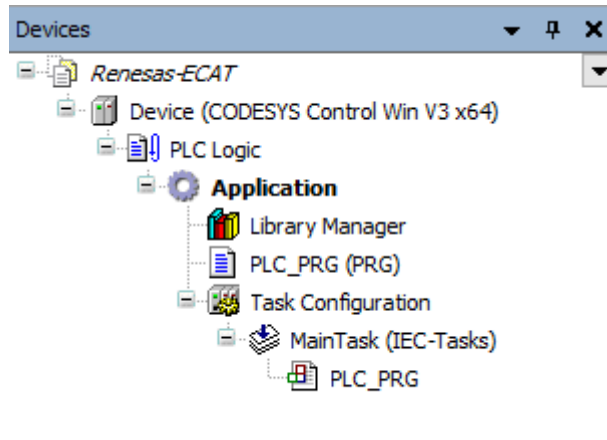


Figure 2.3 Project View

2.1.2 Install Slave Information (ESI)

Install an ESI (EtherCAT Slave Information) file which contains a description of the EtherCAT slave device.

Select "Device Repository..." from the "Tools" menu of the CODESYS program.

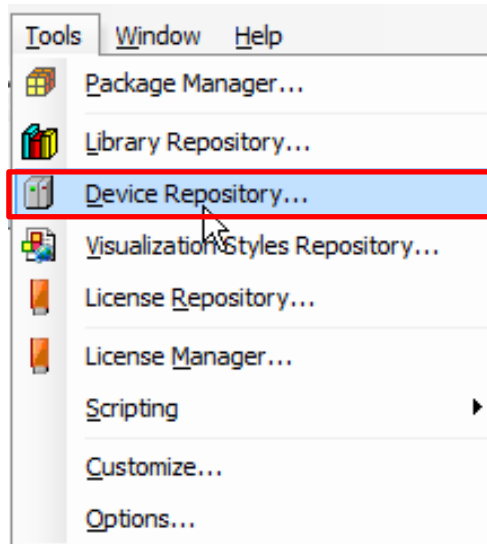


Figure 2.4 Open Device Repository

In the dialog box, click on the "Install" button to produce the dialog box where you are to enter the name of the provided ESI (XML) file ("09_ecat_slave_renesas.xml"). The result of installation will be indicated under the file name. An icon " i " appears in the case of normal installation, as is shown within the blue rectangle in the figure below.

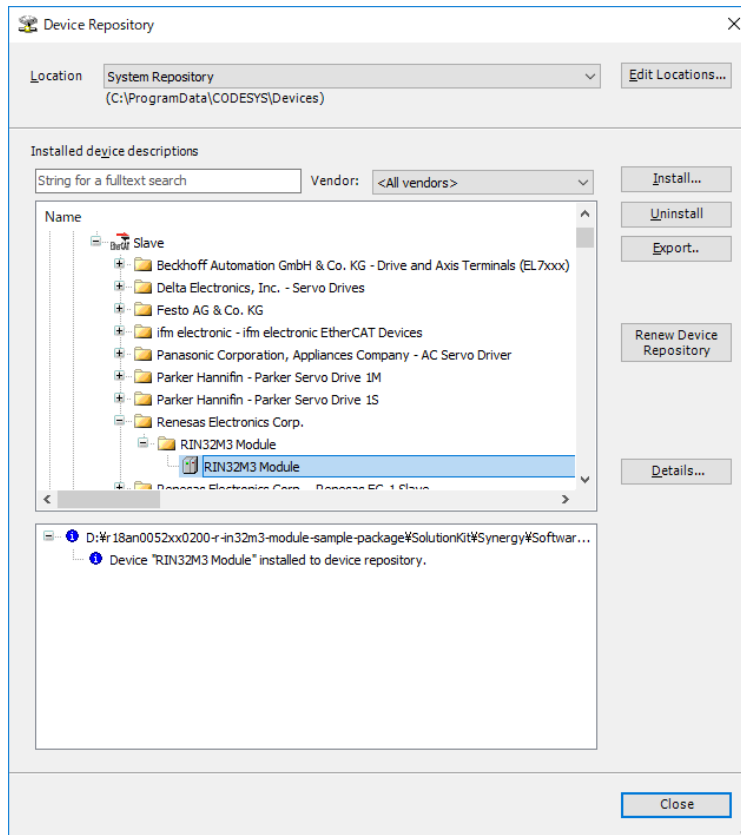


Figure 2.5 Install the ESI File

2.1.3 Adding Master and Slave Device

Add necessary devices to the "R-IN32M3 Module" to the project tree.

- 1.) Add the Ethernet Interface

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

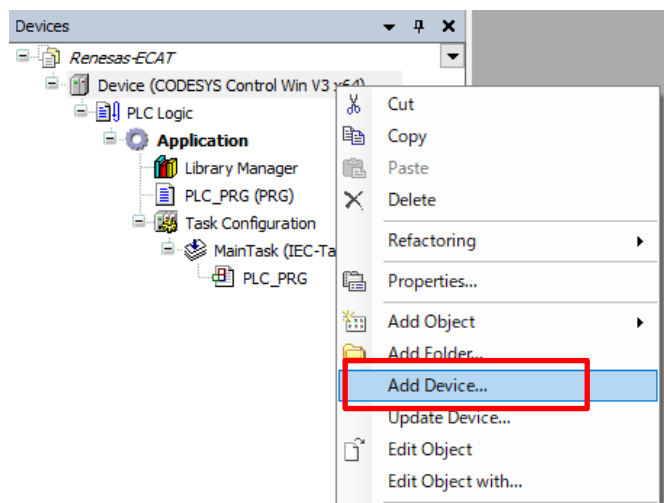


Figure 2.6 Add Device

2.) Add the EtherCAT Master

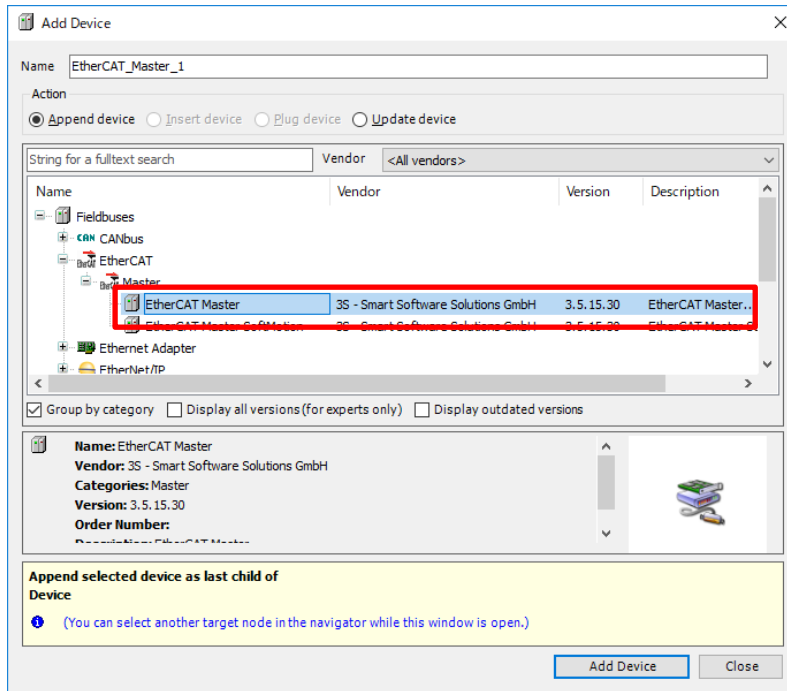


Figure 2.7 Add an EtherCAT Master

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

You can see that "EtherCAT Mater" has been added in the Project tree.

3.) Add the R-IN32 Module

Right-click on "EtherCAT Master" in the Project tree and select "Add Device".

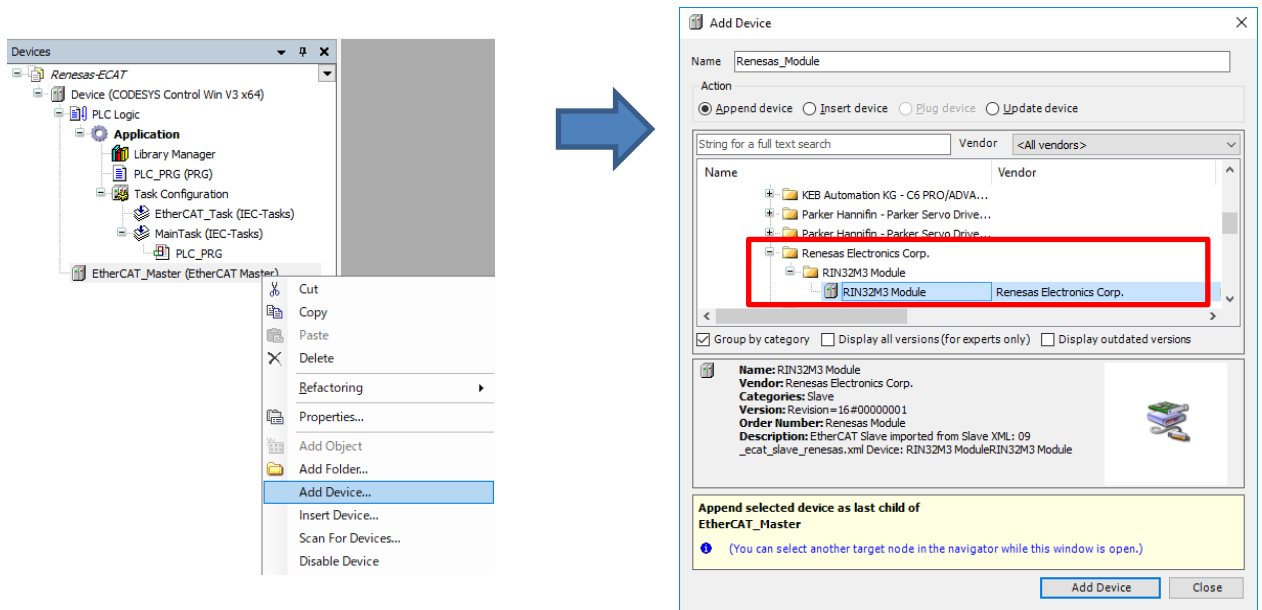


Figure 2.8 Add the R-IN32M3 Module

The "Add Device" dialog box opens. Select "RIN32M3 Module" under "Fieldbuses", "EtherCAT", then "Slave" and click on the "Add Device" button.

You can see that "Renesas_ModuleR-IN32M3 Module (RIN32M3 Mode)" has been added under "EtherCAT Master (EtherCAT Master)" in the Project tree.

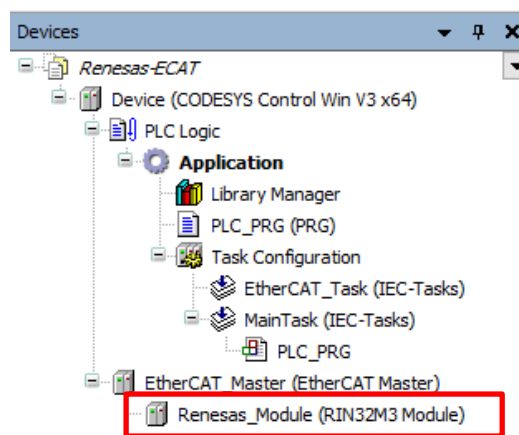


Figure 2.9 R-IN32M3 Module in Project Tree

3. Configuring Projects and Creating User Interfaces

3.1 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.

3.1.1 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.

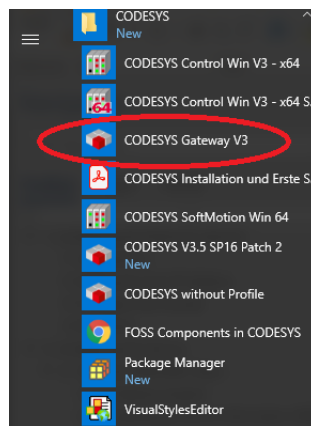


Figure 3.1 Start of Gateway Server

3.1.2 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. 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.

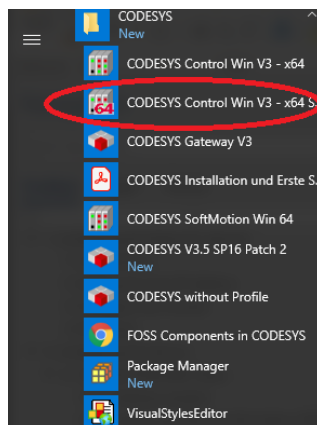


Figure 3.2 Start of PLC

3.1.3 Configuring Connection with the Software PLC

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

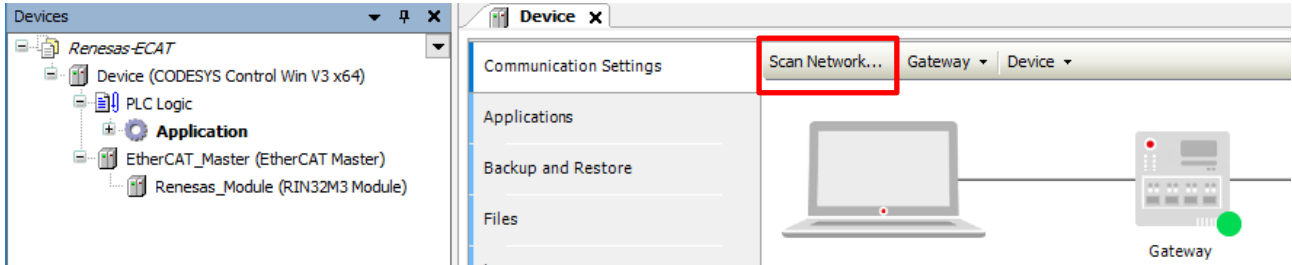


Figure 3.3 Start of PLC

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, 3.1.1 Starting the Gateway Server and 3.1.2 Starting the Software PLC

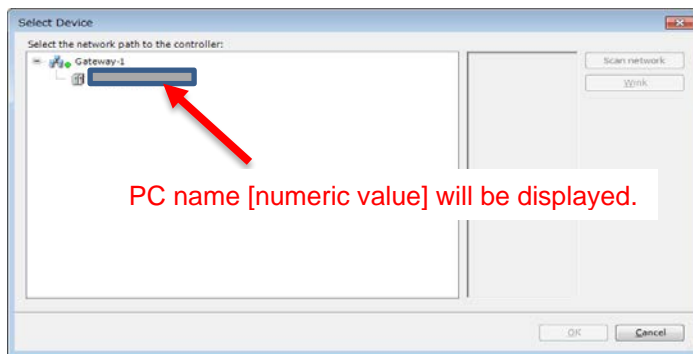


Figure 3.4 Select the PLC

3.1.4 Configuring the EtherCAT Master

Double-click on "EtherCAT Master" 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.

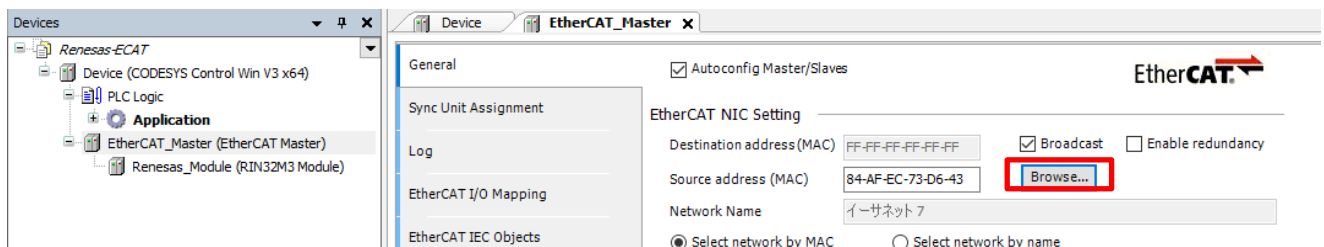


Figure 3.5 Configure the EtherCAT Master

In the "Select Network Adapters" window, select the interface you wish to use from among the interfaces offered for connection.

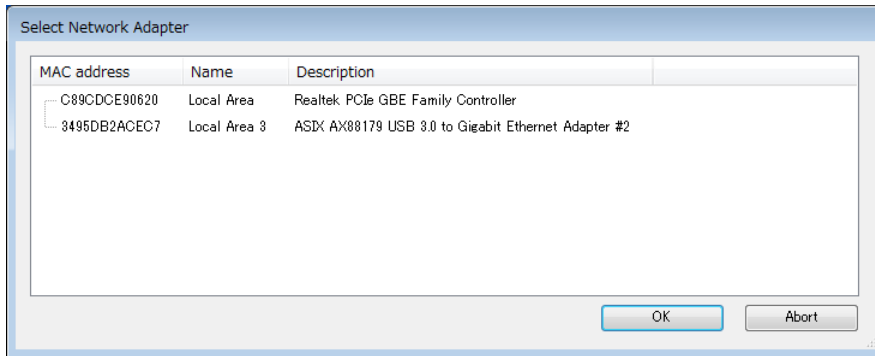


Figure 3.6 Select the Networking Card

Confirm that the correct MAC address is set for the interface you have selected.

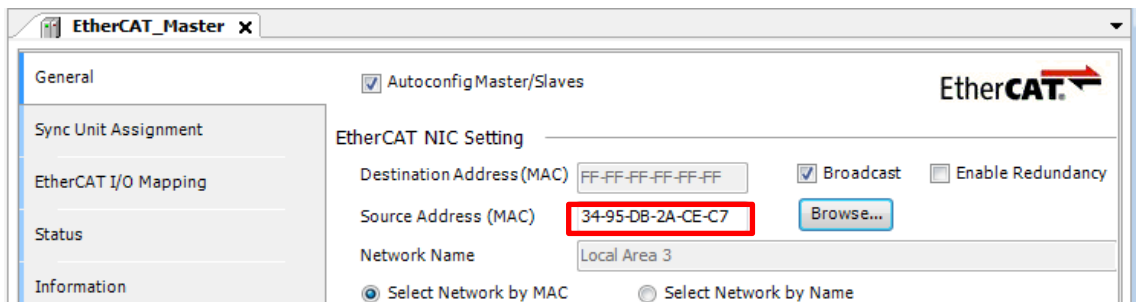



Figure 3.7 MAC address configured

3.1.5 Connect module

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

Click on the button  to build and download the configuration.

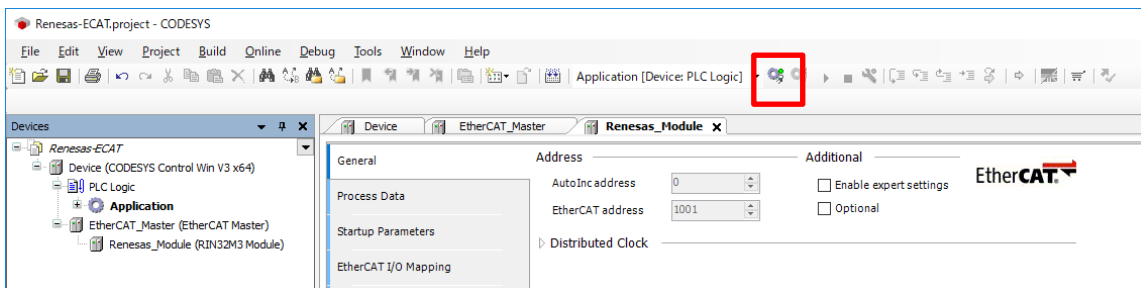


Figure 3.8 Login the project

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

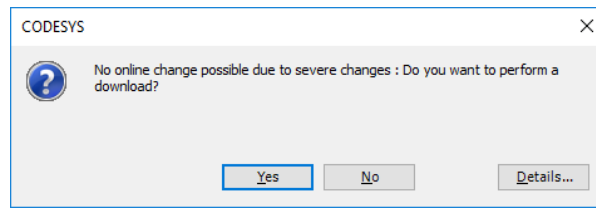


Figure 3.9 Download project

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

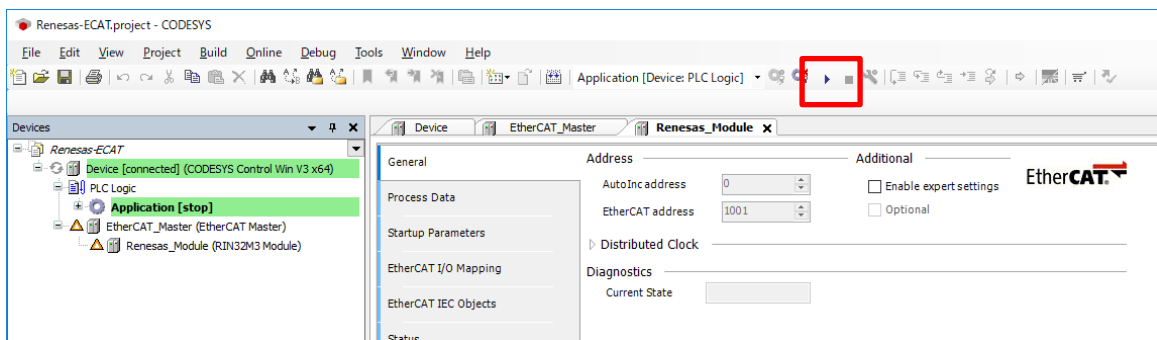


Figure 3.10 Start project

Now, all icons in front of the devices become green.

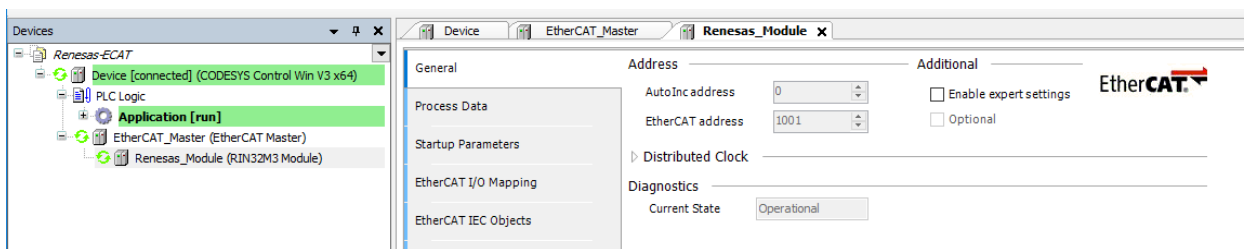






Figure 3.11 successful running project

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.

3.2 Creating and Simulating a User Interface

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

3.2.1.1 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...".

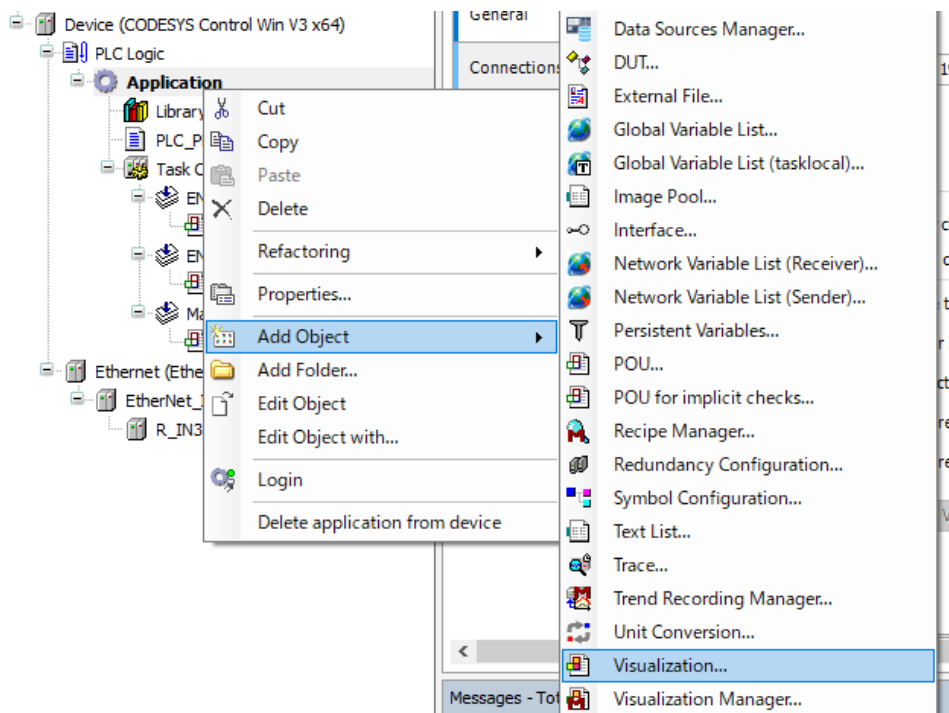


Figure 3.12 Add of Visualization object in Project tree

3.2.1.2 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.

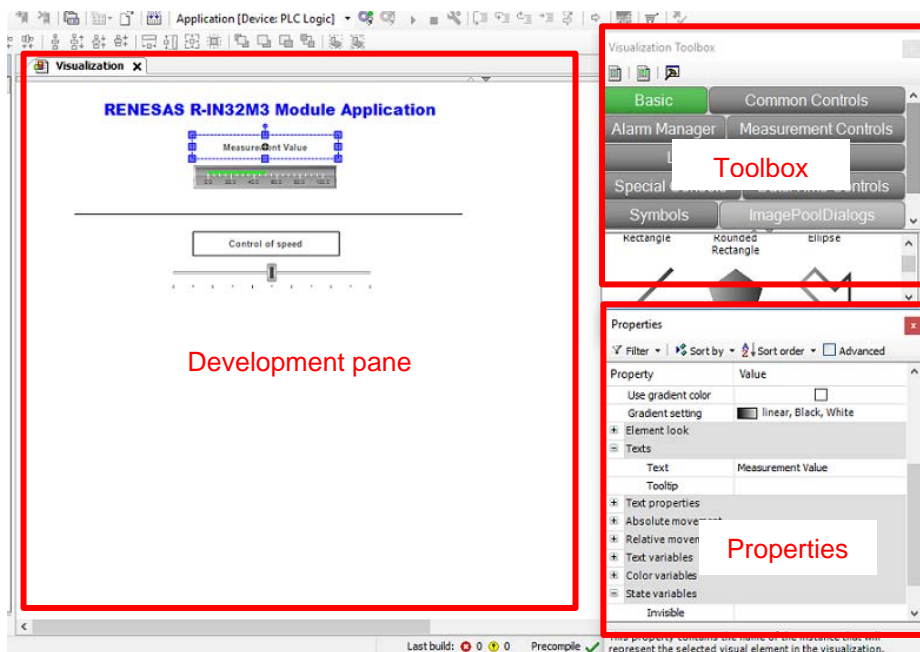


Figure 3.13 Development of visualisation example

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

3.2.1.3 Development of PLC program

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

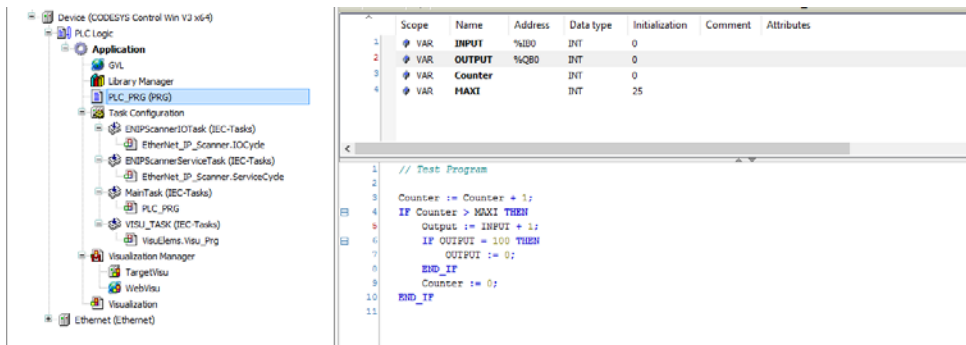


Figure 3.14 Development of visualisation example

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”.

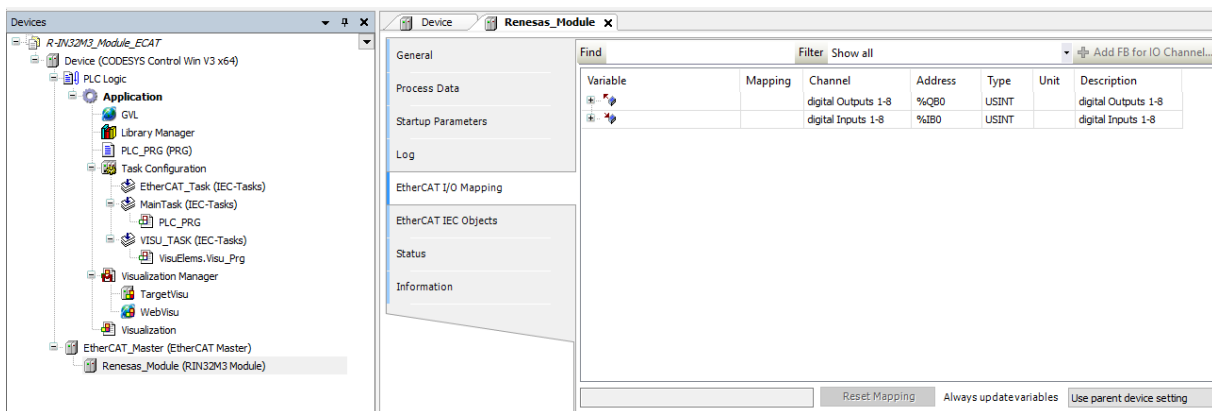


Figure 3.15 Parameter addresses

Here are the addresses of the module parameters. In our case the address %I0 will be used for the INPUT variable and %Q0 for OUTPUT.

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


```

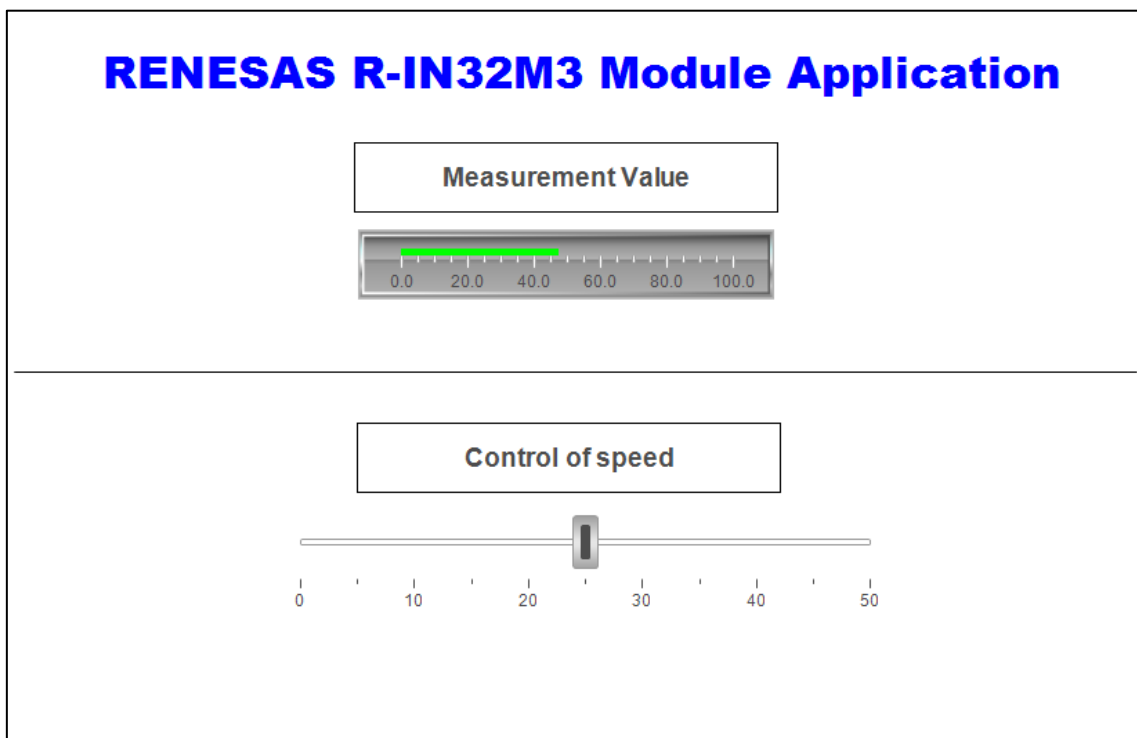
1 // Test Program
2
3 COUNTER := COUNTER + 1;
4 IF COUNTER > MAXI THEN
5     OUTPUT := INPUT + 1;
6     IF OUTPUT = 100 THEN
7         OUTPUT := 0;
8     END_IF
9     COUNTER := 0;
10 END_IF
11

```

Figure 3.16 PLC program

3.2.1.4 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”.

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5. Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Dec 15, 2020	-	First Edition

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