

# RIN32M3 Module (RY9012A0)

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## Software PLC Guide: TwinCAT

### Introduction

This document explains the procedures for EtherCAT<sup>®</sup> slave functionalities with R-IN32M3 module. It describes step by step the evaluation by using the TwinCAT<sup>®</sup> Master Configuration tool.

### Target Device

R-IN32M3 module

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## 1. Overview

### 1.1 Purpose

This document describes how to setup R-IN32M3 module with TwinCAT.

It describes the step how to evaluate the slave behaviour and stack features by using TwinCAT Master Configuration tool.

### 1.2 Scope

The document scope is testing of its behavior against TwinCAT master and Test Application.

### 1.3 Abbreviations/Definitions

Table 1. Abbreviations/Definitions

Index	Abbreviations /Definitions	Description
1	CoE	CAN application protocol over EtherCAT
2	EEPROM	Electrically Erasable Programmable Read-Only Memory
3	ESC	EtherCAT Slave Controller
4	ESI	EtherCAT Slave Information
5	FoE	File Access Over EtherCAT
6	I2C	Inter-Integrated Circuit
7	MB	Mail Box
8	PDO	Process Data Object
9	SSC	Slave Stack Code
10	EoE	Ethernet Over EtherCAT
11	SII	Slave Information Interface

## 1.4 Reference

Technical information' about EtherCAT is available via ETG member site, and information about R-IN32M3 module is available via Renesas.

**Table 2. Technical Inputs**

Index	Technical Inputs
1	ETG2200_V3i1i0_G_R_SlaveImplementationGuide.pdf
2	ETG2000_S_R_V1i0i12_EtherCATSlaveInformationSpecification.pdf

## 2. Features

- ESM (EtherCAT State Machine)
- mailbox protocols:
  - CoE (CAN application protocol over EtherCAT), EoE (Ethernet over EtherCAT), FoE (File Access over EtherCAT)
- synchronization Modes:
  - Free Run
  - Sync Manager Synchronization
  - DC Synchronization



EtherCAT is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

## 3. Project Setup

### 3.1 Requirements

**Table 3. Requirements**

Item	Description
Board	Renesas Electronics <ul style="list-style-type: none"> <li>• <a href="#">YCONNECT-IT-I-RJ4501 with YSSKS7G2E30</a></li> </ul> or Shimafuji Electric Incorporated <ul style="list-style-type: none"> <li>• <a href="#">SEMB1320</a></li> </ul>
Sample Software	<a href="#">r18an0052xx0***</a>
Software PLC	Beckhoff Automation <ul style="list-style-type: none"> <li>• <a href="#">TwinCAT3</a></li> </ul>

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

- 1.) EtherCAT support requires firmware version 2.0.0.0 or later for the R-IN32M3 module. For the firmware update method, refer to the R-IN32M3 Module (RY9012A0) Quick Start Guide (R12QS0042ED\*\*\*\*).
- 2.) The hardware of the R-IN32M3 Module Solution Kit has to be set up correctly.  
Please see the Quick Start Guide [R12QS0043xx] for Synergy sample or Application Note [R12AN0111xx] for RX66T sample.
- 3.) The application software “09\_ecat\_slave” is programmed.  
Please see the Quick Start Guide [R12QS0043xx] for Synergy sample or Application Note [R12AN0111xx] for RX66T sample.
- 4.) Connect one of the Ethernet port of the module with one of PC Ethernet port.

### 4. TwinCAT3 connection

#### 4.1 ESI File

Before starting TwinCAT, copy the ESI files that are included in the release folder to TwinCAT destination  
 “\TwinCAT\3.x\Config\IO\EtherCAT”

ESI file for current release available at,

##### Synergy solution Kit.

“\SolutionKit\Synergy\Software\ Synergy\_CCM\_V\*\*\*\appl\2015013\_irj45\ac\09\_ecat\_slave\esi”

##### RX solution Kit.

OS: “\SolutionKit\RX66T\ OS\Synergy\_CCM\_V\*\*\*\appl\\*\*\*\_sample\ac\03\_ecat\_slave\esi”

OS less: “\SolutionKit\RX66T\ OSless\Synergy\_CCM\_V\*\*\*\appl\\*\*\*\_sample\ac\03\_ecat\_slave\esi”

\* The RX66T Solution Kit has samples for mirror control, remote IO control, and motor control, but explain using mirror control as an example.

#### 4.2 Network Adapter

Need to set enable only “TwinCAT RT-Ethernet Filter Driver” and “TwinCAT Ethernet Protocol for All Network Adapters” on configuration of network connections. Depending on the type of network adapter, it may be available “TwinCAT Ethernet Protocol for All Network Adapters” only.

Recommend disable other drivers.

If TwinCAT RT-Ethernet Filter Driver is not indicated or the driver is not installed, install the driver according to [Appendix A](#).

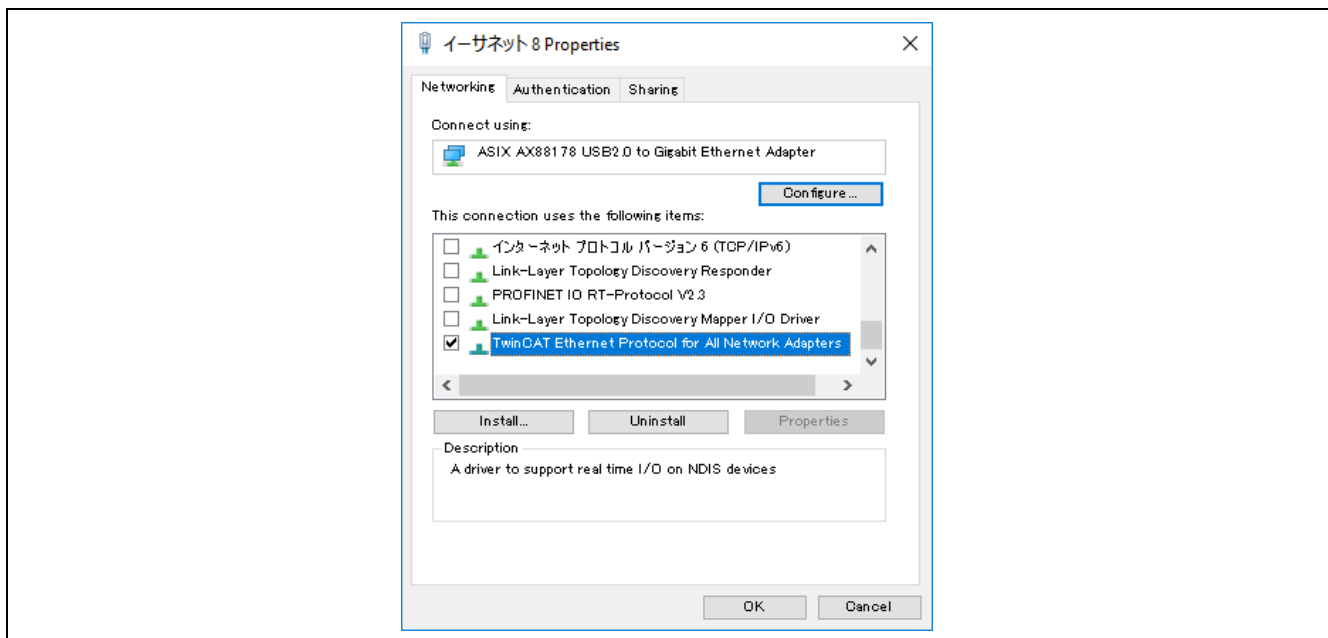


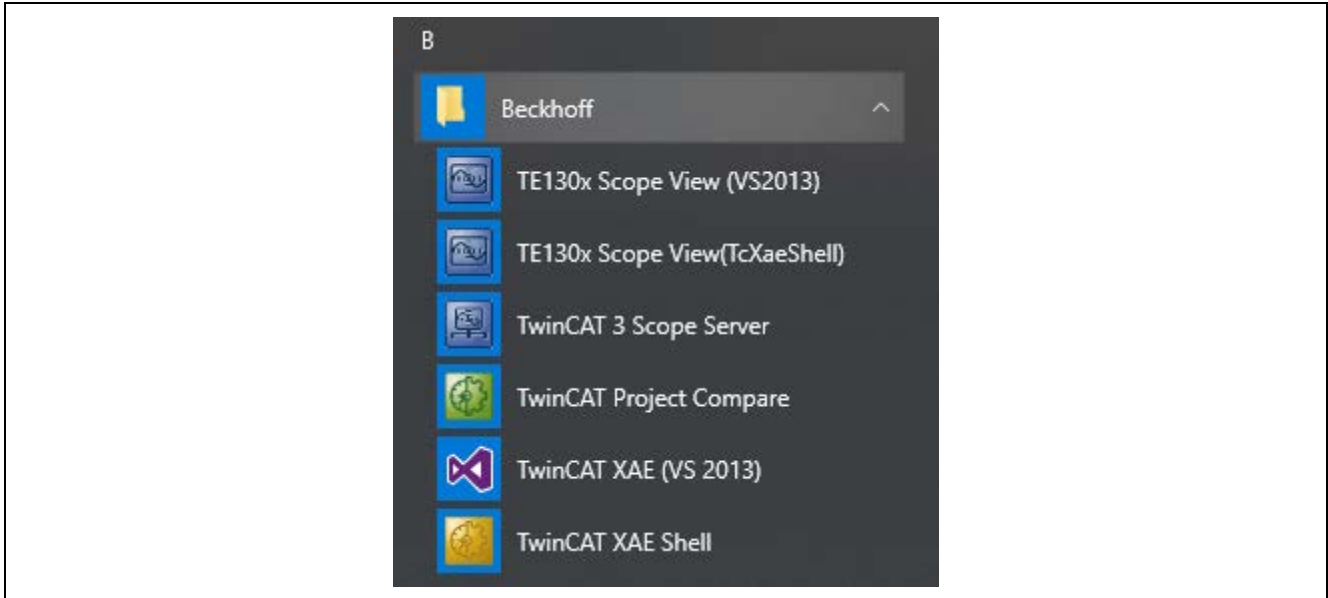
Figure 4.1: Network Adapter

### 4.3 Setup TwinCAT3

Start TwinCAT3 by using the procedure described below,

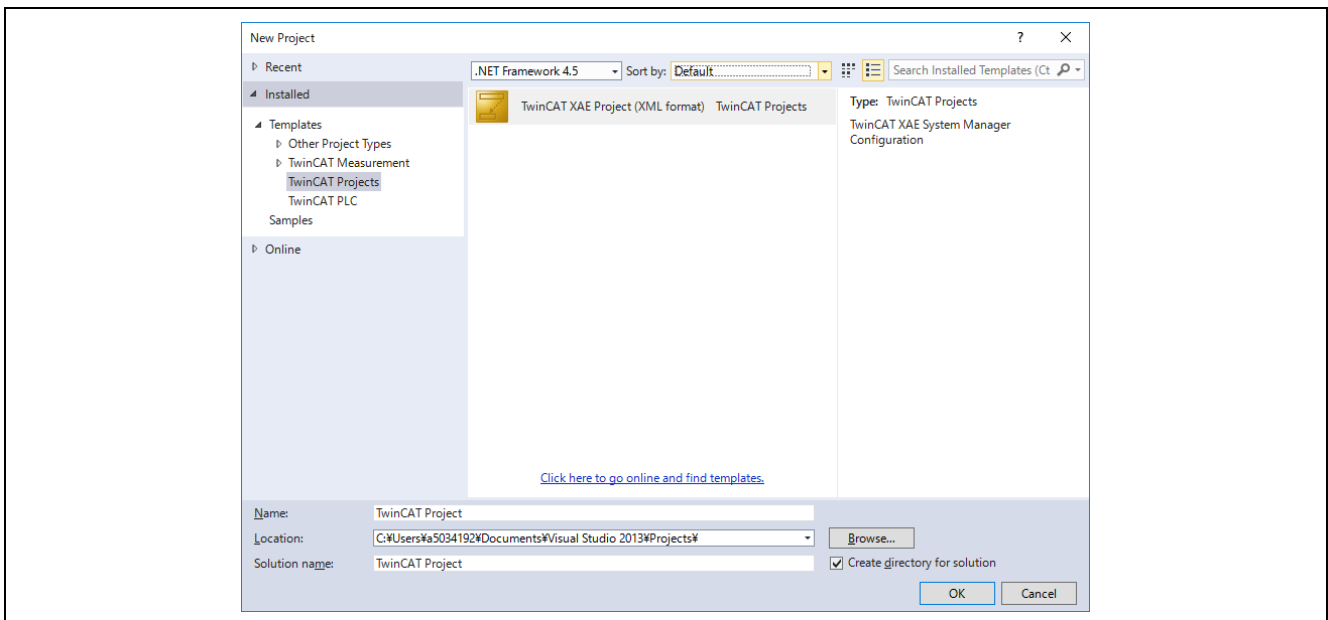
From the start menu, select [Beckhoff] → [TwinCAT3] → [TwinCAT XAE (\*\*\*\*)]

or [Beckhoff] → [TwinCAT3] → [TwinCAT XAE Shell].



**Figure 4.2: Start TwinCAT**

After the TwinCAT is started, selecting [File] → [New] → [Project], create a new project of the TwinCAT XAE Project type.



**Figure 4.3: Open Project**

### 4.4 Scan EtherCAT module

- (Scan for device): Under solution explorer -> I/O -> Devices, select 'Scan'

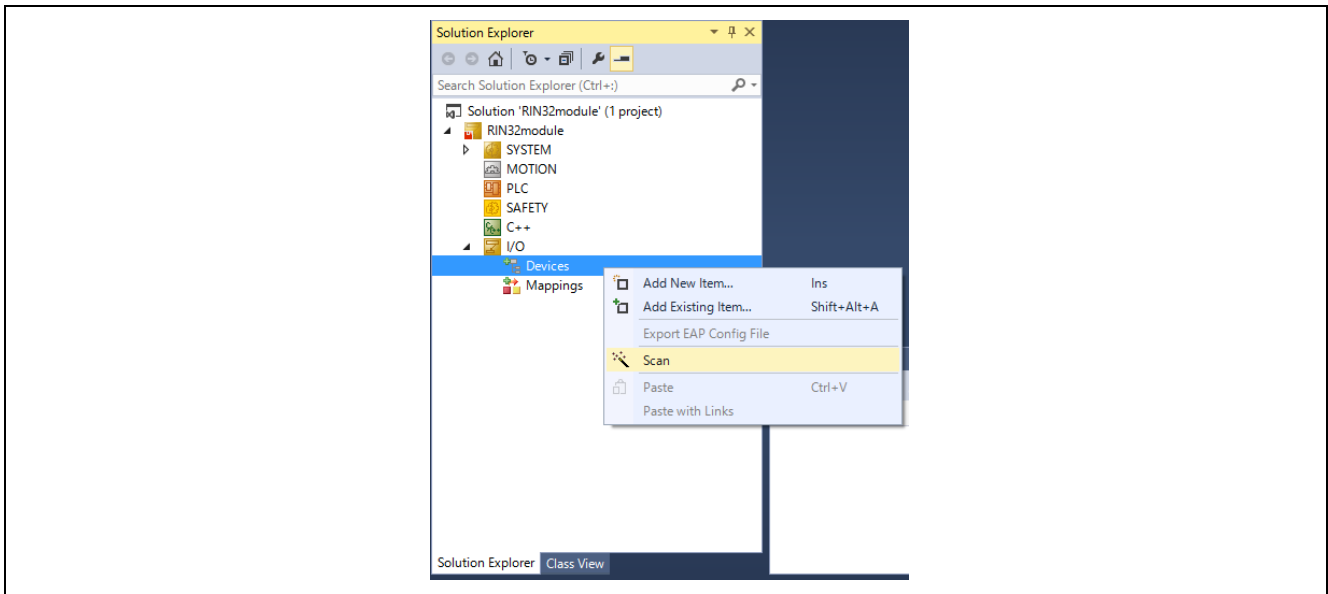


Figure 4.4: Scan Device

- (I/O driver set): The EtherCAT I/O driver with EtherCAT enabled is automatically selected.
- Then, select OK and run "Scan for box".

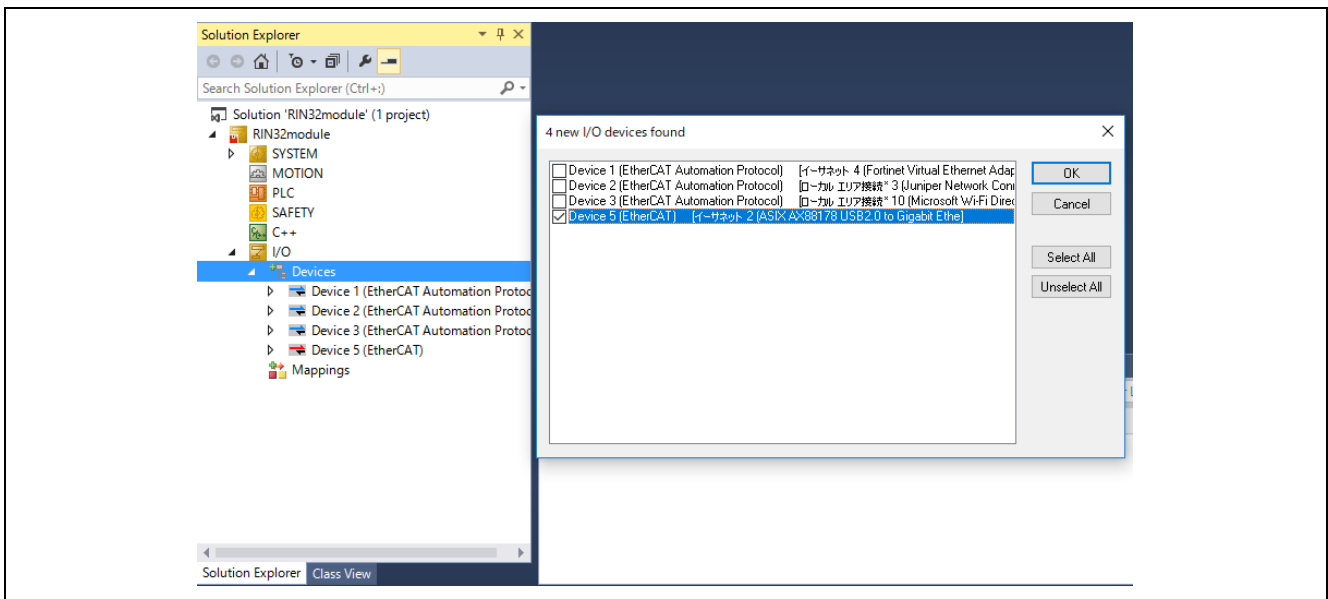
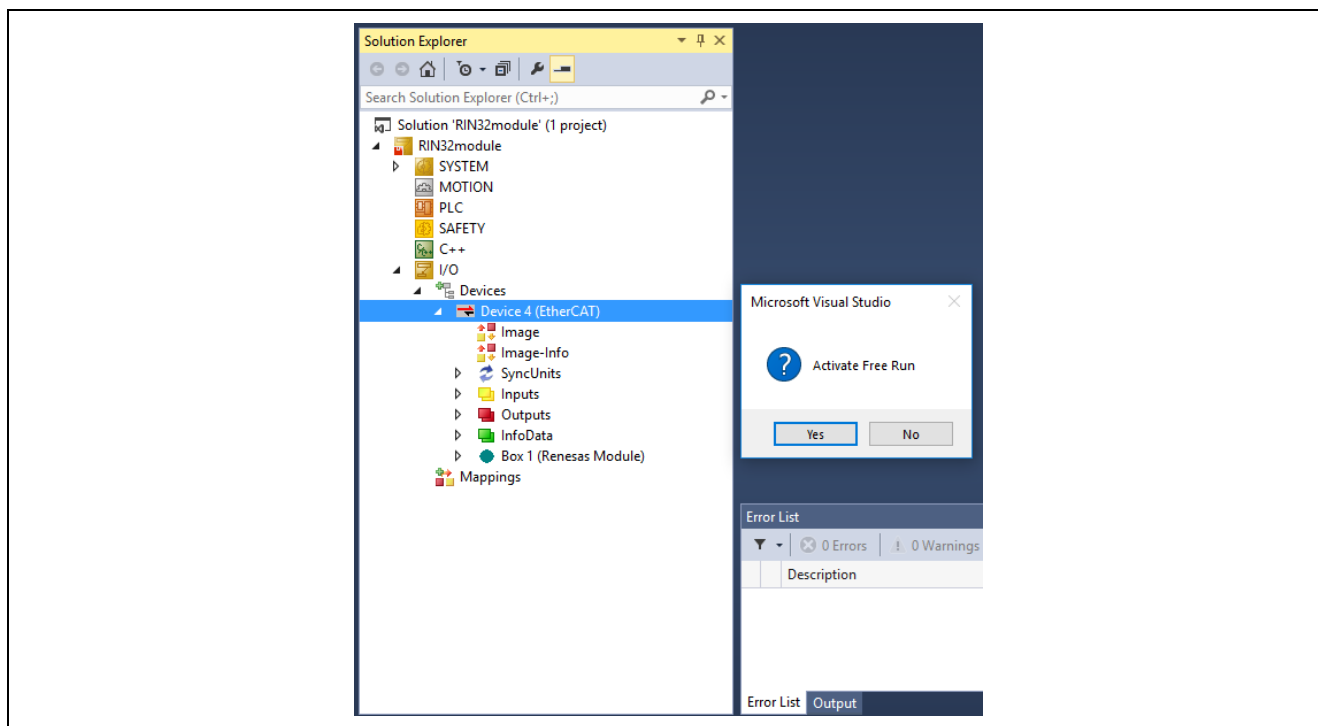


Figure 4.5: Select I/O device

- (Activate slave): R-IN32M3 module is listed in the boxes, in this reference case “Renesas Module” in box.
- And start “activate free-run”.



**Figure 4.6: Activate Slave**

Note1: If "Box 1 (PFFFFFFF RFFFFFFF)" appears, the Slave Information Interface (SII) may not have been programmed in the EEPROM on the RIN32M3 module. In this case, program the EEPROM according to [Appendix-B EEPROM Program](#).  
The EEPROM of RIN32M3 module is not programmed at the factory release.



### 4.5 Communication Status

(Check for slave state): Check the state of EtherCAT slave in 'Online' tab. If the connection is completed correctly, "Current State" show "OP".

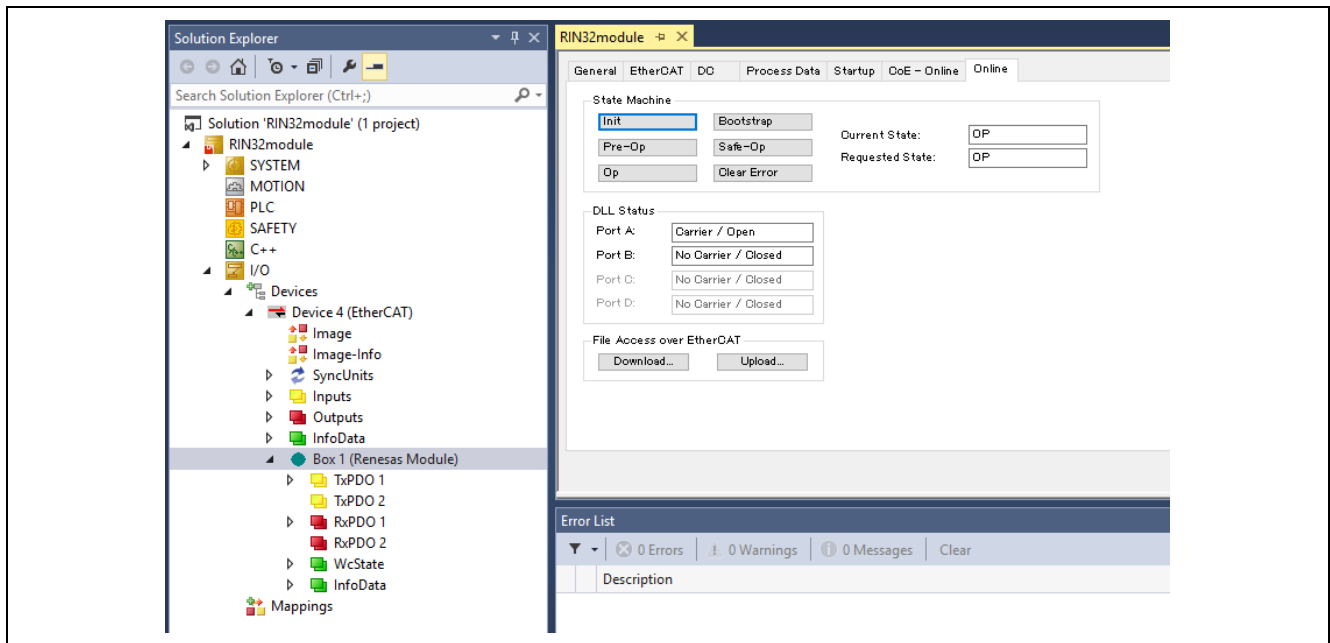


Figure 4.7: State Machine

## 5. Sample Program

This section describes the method of TxPDO/RxPDO communication between the TwinCAT master and R-IN32M3 module. The following sample application is provided in the sample software for the EtherCAT.

### 5.1 Sample application

RxPDO: Sends 1-byte Output value from the TwinCAT master to R-IN32M3 module.

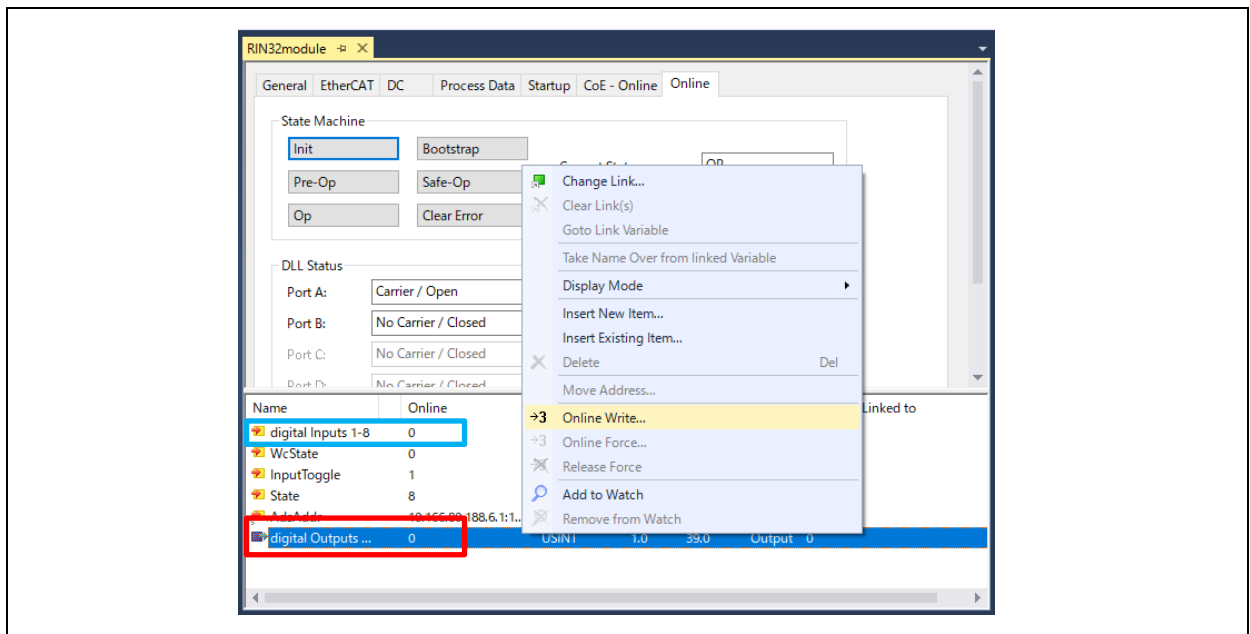
TxPDO: Receive the mirror 1-byte data Input value from R-IN32M3 module to the TwinCAT master.

\* The RX66T Solution Kit has samples for mirror control, remote IO control, and motor control, but explain using mirror control as an example.

1. Read the Input value and write the Output value.

RxPDO can send on OP state and TxPDO can receive on Safe-OP.

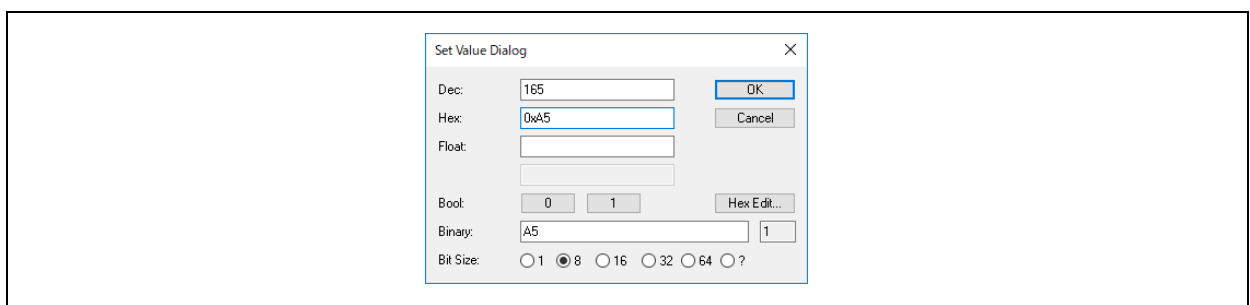
Right-click Outputs and select "Online Write".



**Figure 5.1: Select Output**

2. Write the Output value.

Set the 1-byte RxPDO value to be sent from the TwinCAT to RIN32M3 module, and then click the [OK].



**Figure 5.2: Write Output Value (RxPDO)**

### 3. Read the Input value.

The 1-byte mirror value received from the RIN32M3 module is show on the input.

Name	Online	Type	Size	>Addr...	In/Out	User ID	Linked to
digital Inputs 1-8	165	USINT	1.0	39.0	Input	0	
WcState	0	BIT	0.1	1522.1	Input	0	
InputToggle	1	BIT	0.1	1524.1	Input	0	
State	8	UINT	2.0	1548.0	Input	0	
AdsAddr	10.166.80.188.6.1:1...	AMSADDR	8.0	1550.0	Input	0	
digital Outputs ...	165	USINT	1.0	39.0	Output	0	

**Figure 5.3: Mirror of Output Value(RxPDO) to Input Value(TxPDO)**

## Appendix-A. EtherCAT Driver Install

The TwinCAT driver must be installed to use the TwinCAT. Perform the following installation procedure.

### 1. Ethernet adapter

Select TwinCAT > Show real Time Ethernet Compatible Devices.

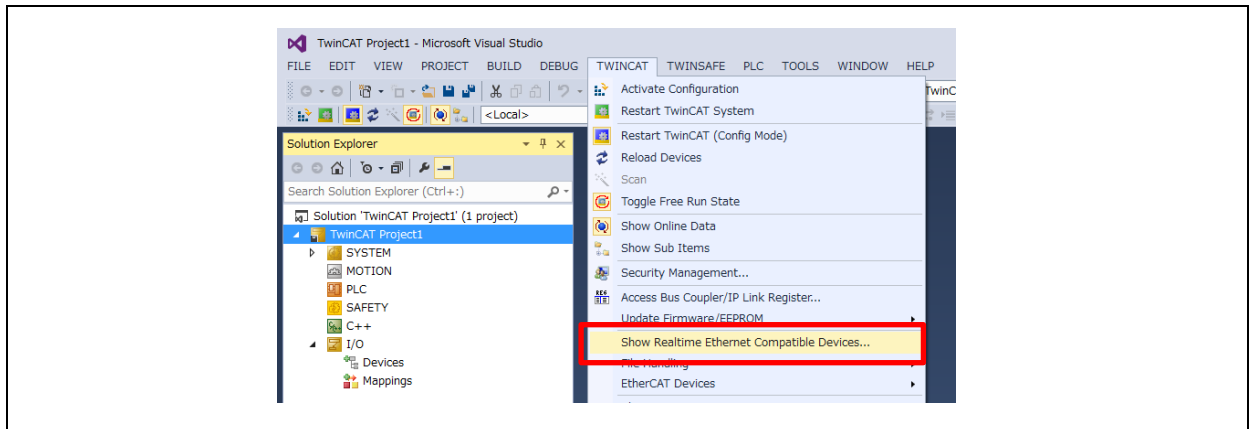


Figure A.1: Show Ethernet Adapter

### 2. Install TwinCAT driver.

Select the network adapter to be an installation destination and click the [Install].

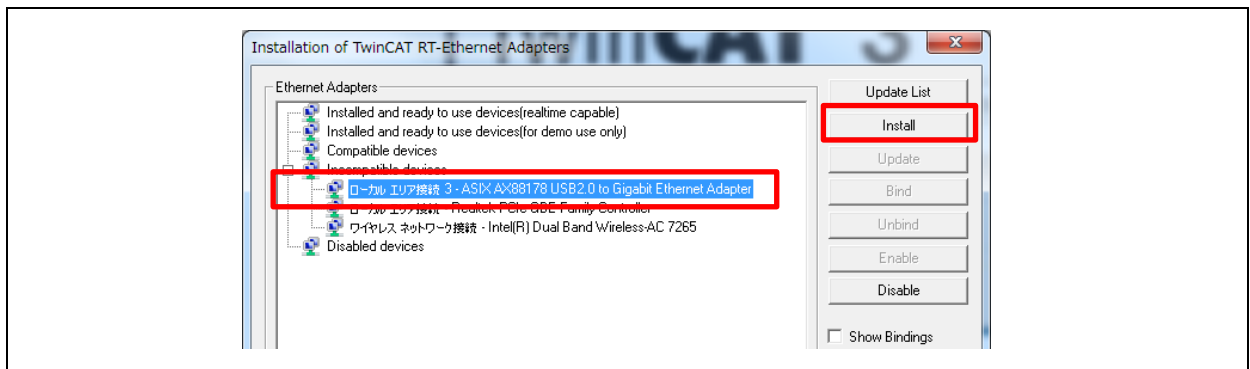
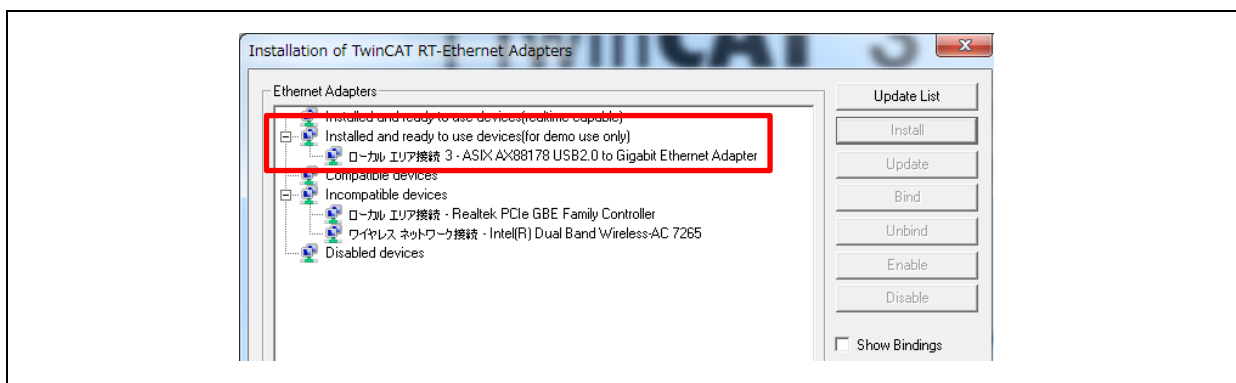


Figure A.2: Install

When the installed network adapter is displayed in "Installed and ready to use devices" at the end of installation, the installation has been successfully completed.



**Figure A.3: Installed**

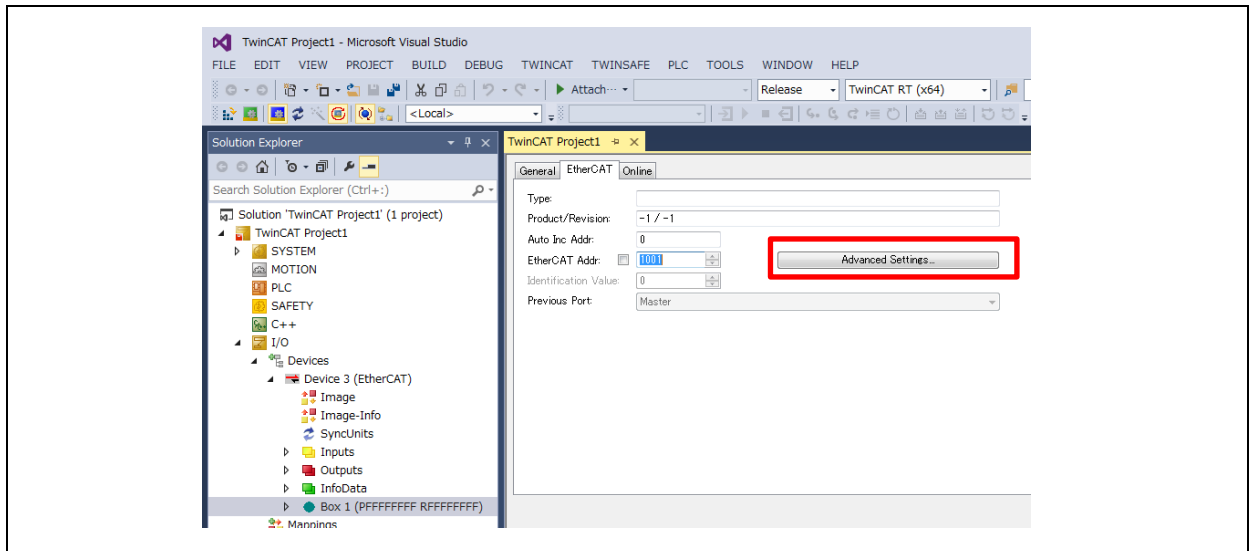
If the installation is unsuccessful, it means that the Ethernet adapter is not compatible with the driver.

### Appendix-B. EEPROM program

The Slave Information Interface (SII) must have been programmed in the EEPROM. The EEPROM is blank in the initial state of the board. Perform the following procedure to program the SII.

#### 1. Start Advanced Setting

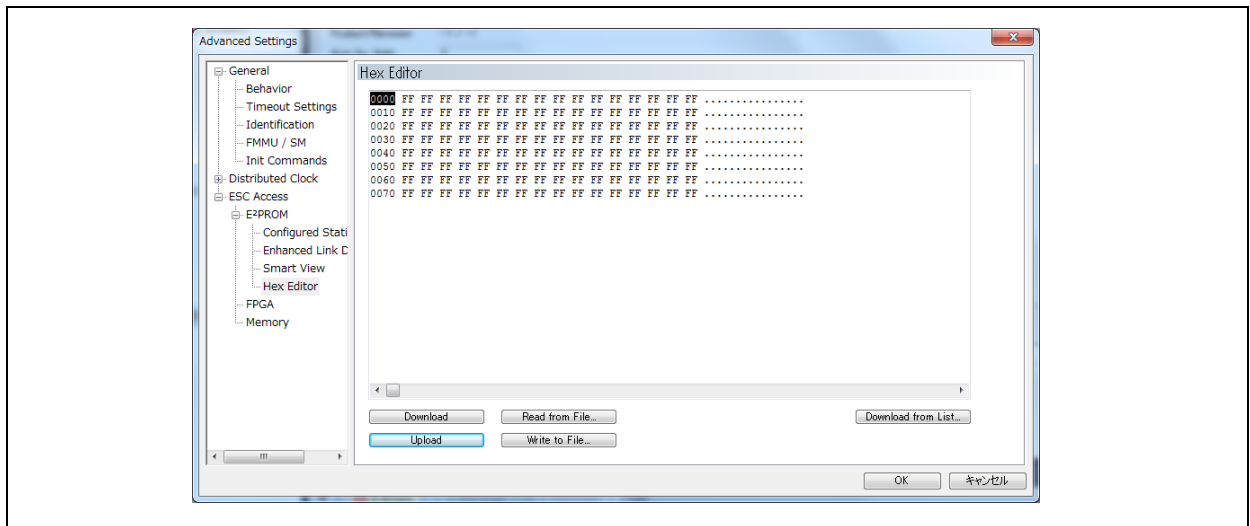
Double-click the box of the slave in which the SII is programmed, and then select the EtherCAT tab. Click “Advanced Setting”.



**Figure B.1: Select Advanced Setting**

#### 2. Hex Editor

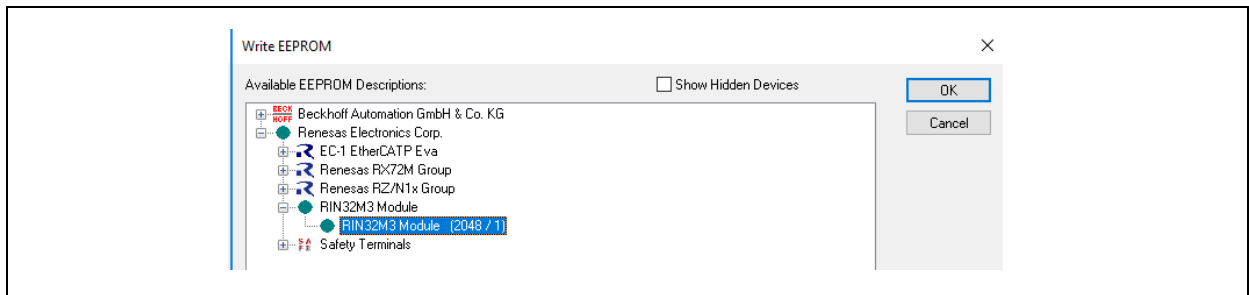
Select ESC Access > E2PROM > Hex Editor. Click the [Download from List] button.



**Figure B.2: EEPROM Editor**

### 3. Select the ESI file

Select the ESI file stored in section [4.1 ESI File](#), and then click [OK].

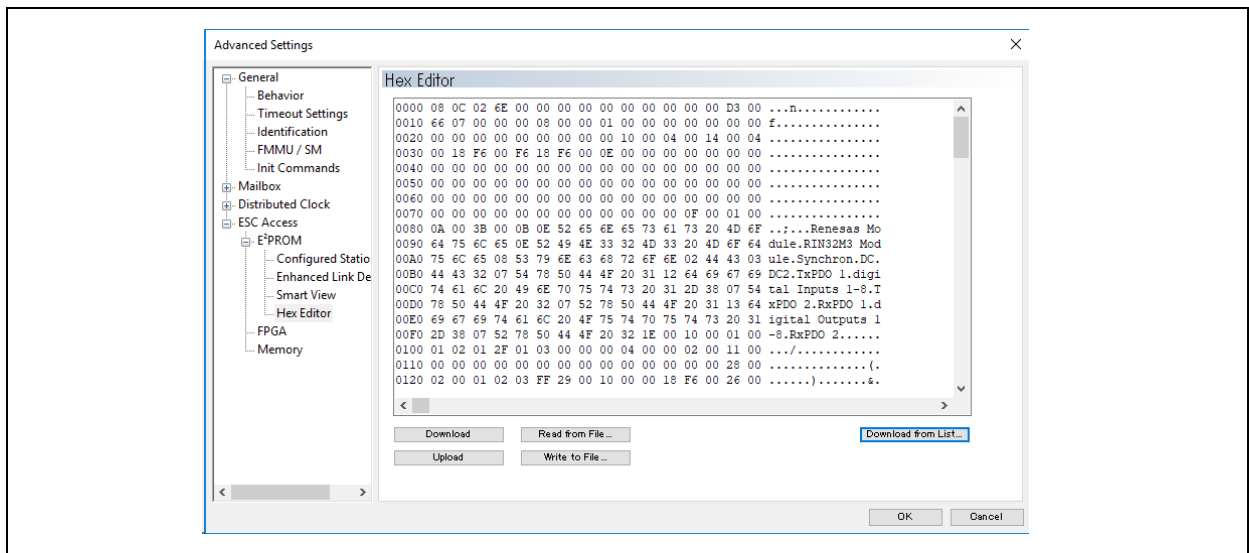


**Figure B.3: Select ESI File**

### 4. Download

When hexadecimal information is displayed as shown below, the programming has been completed.

After the EEPROM has been reprogrammed, turn off and on the board. and then click [OK].



**Figure B.4: Program EEPROM**

Restart TwinCAT and R-IN32M3 module and rerun [chapter 4.3](#).

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## Revision History

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1.00	Dec 15, 2020	—	First edition
1.01	Feb 1, 2021		Add a supplementary explanation
		P.3	- Chapter 3
		P.5, 8	- Chapter 4

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## Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,

Koto-ku, Tokyo 135-0061, Japan

[www.renesas.com](http://www.renesas.com)

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