

User Manual

Advantech CODESYS for RTE X86

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Chapter 1

1. Introduction

1.1. About This Manual

This document describes the use of the CODESYS programming environment and the RTE runtime system for the Advantech X86 series products.

Advantech provides add-on package for CODESYS which allows developers and end users to connected I/O modules; perform configurations, and simple testing of the I/O.

This manual supplies information about how to apply CODESYS to control Advantech X86 platforms, including software installation, writing a new program in CODESYS and how to use the fieldbus.

1.2. Organization of This Manual

This user manual is divided into the following sections:

- Introduction
- Installations
- Create and run a project
- Advantech I/O Modules
- Diagnosis and Troubleshooting

Introduction

This section gives the user a basic idea of this manual.

Installations

This section provides instructions on how to install CODESYS and Advantech Add-on Package

Create and run a project

This section gives the new user a walk-through in creating a simple program.

Advantech I/O Modules

This section introduces the detail configuration and mapping variables of Advantech APAX-5000 I/O modules and AMAX-5000 EtherCAT I/O Modules

Diagnosis and Troubleshooting

This section provides instructions on how to troubleshooting and diagnose operation mistakes or module errors.

Chapter 2

2. Installations

2.1. CODESYS Installation

Step1: Double click and execute the "**Setup_CODESYSV<Version>.exe**" to start the installation assistant and then click Next to continue.



Step2: You must accept License Agreement



Step 3: You will then be prompted for the installation location. By default, CODESYS will install to C:\Program Files\3S CODESYS, but you can specify the location or folder name of your choice. Click Next to proceed.

CODESYS V3.5 SP6 - InstallShield Wizard
Choose Destination Location Select folder where setup will install files.
Setup will install CODESYS V3.5 SP6 in the following folder.
To install to this folder, click Next. To install to a different folder, click Browse and select another folder.
Destination Folder
C:\Program Files (x86)\3S CODESYS\ Browse
InstallShield
< Back Next > Cancel

Step 3: Select all features and then click Next to proceed.

CODESYS V3.5 SP6 - InstallShield Wizard	X
Select Features Select the features setup will install.	
Select the features you want to install, and deselect the features of CODESYS V3	eatures you do not want to install. Description CODESYS V3 Next generation object oriented programming tool for IEC 61131-3 PLC programs.
1.49 GB of space required on the C drive 5.99 GB of space available on the C drive InstallShield ————————————————————————————————————	k Next > Cancel

Step4: You must the program folder "3S CODESYS". Please do not change and then click "Next" to proceed.

CODESYS V3.5 SP6 - InstallShield Wizard	×
Select Program Folder Please select a program folder.	
Setup will add program icons to the Program Folder listed below. Yo name, or select one from the existing folders list. Click Next to contin	u may type a new folder nue.
Program Folder:	
3S CODESYS	
Existing Folders: 3S CODESYS	
7-Zip Accessories	
Administrative Tools	
Advantech Automation Beyond Compare 2	
Business Explorer	
Citrix	-
InstallShield	
< Back	Next > Cancel

Step5: Start coping files and then click "Next" to proceed.

CODESYS V3.5 SP6 - InstallShield Wizard	×
Start Copying Files Review settings before copying files.	4
Setup has enough information to start copying the program files. If you want to review or change any settings, click Back. If you are satisfied with the settings, click Next to begin copying files.	
Current Settings:	
Selected Features: CODESYS V3 CODESYS Converter CODESYS Gateway CODESYS Control Win V3 CODESYS OPC Server 3 CODESYS Gateway V2.3 Destination Folder: C:\Program Files (x86)\3S CODESYS\	E
	T
· · · · · · · · · · · · · · · · · · ·	
InstallShield	
< Back Next > Canc	el



Step 6: Complete to install CODESYS and you'll see CODESYS icon which is available on the desktop. Click "Finish" to close the installation wizard.



2.2. Add-on Package Installation

Now you have installed CODESYS on your system successfully. To equip Advantech device information or use Advantech add-on functionalities, user needs to follow below steps to install Advantech add-on Package on the CODESYS.

2.2.1. Installation

Step 1: Install add-on package from CODESYS Package Manager. Activate the dialog window from the menu (Tools -> Package Manager)

Step 2: In the Package Manager, click Install and select the file. The file would be as below format.

"Advantech CODESYS ADD ON V<Version>.package".

Refresh			Sort by Name	•	Install
Name CODESYS Automation Server Connector CODESYS SoftMotion	Version 1.9.0.0 4.7.0.0	Installation date 8/26/2020 8/26/2020	Update info Free version 4.8.0.0 available	Licer No lic No lic	Uninstall Details
					Updates Search Updates Download CODESYS Store Rating CODESYS Store

Step 3: Select Typical setup and click next.

🗊 Installation - Choose Setup Type	×
Advantech CODESYS ADD ON [3.5.16.2] Please select the type of setup you would like to perform.	6
 Complete setup All package components will be installed. Typical setup The most commonly used package components will be installed. Customized setup Full control over which package components are installed. Recommended for advanced users. 	
Cancel < Back Next >	Finish

Step 4: After few dialog window, you will see the completion screen. Click "Finish" to close the installation wizard.

2.2.2. Updating the Package

It's highly recommended that you uninstall the previous version package before updating and installing new add-on package.

Start CODESYS and perform command **Package Manager** from the menu (**Tools -> Package Manager**). Select the package you want to uninstall and then click "Uninstall". Click "Close" to close the package manager.

After uninstalling the old package successfully, please refer to Chapter 2.2.1 Installation

Package Manager						X
Currently Installed Packages						
Refresh			Sort by Nan	ne	•	Install
Name	Version	Installation date	Update info		li	
Advantech CODESYS ADD ON	3.5.16.2	8/26/2020			Nc	Details
CODESYS Automation Server Connector	1.9.0.0	8/26/2020			Nc	
CODESYS SoftMotion	4.7.0.0	8/26/2020	Free version 4.8.	.0.0 available	Nc	Updates
🗇 Uninstallation				×		Search Updates
Advantech CODESYS ADD	ON [3.5.1	6.2]				Download
Uninstallation	011 [0.0.1		1			
				′		CODESVS Store
						Pating
The package will be removed fro	m your syste	m. Click Next to conti	iue.			Kating
						CODESYS Store
<					•	
Displa Canc	el <	Back Next :	• Finish			Close

Chapter 3

3. Create and run a project

3.1. Start CODESYS

Start CODESYS by double-clicking the CODESYS icon which is available on the desktop.

Alternatively, you can start the CODESYS programming system with

Start -> Programs -> 3S Software -> CODESYS -> CODESYS V<version>

When you start the programming system the first time after first installation on the system,

you will be asked to choose the default collection of settings and features. Choose the

"Professional" and then click Start to proceed.



Before creating a project, make sure that Advantech ADAM add-on package is installed

successfully. Choose Package Manger from the Tools menu:

If the Advantech ADAM add-on package didn't show in manager, please refer to <u>Chapter 2</u> and update your package.

Package Manager					<u> </u>
Currently installed packages:			Sort by:	Name 🔻	Install
Name	Version	Installation date	Update info	License info	Uninstall
Advantech ADAM CODESYS ADD ON CODESYS Package Designer	1.0.0.0 3.5.5.0	2014/12/5 2014/11/26		License info not availab No license required	Details Updates Search updates Download CODESYS Store Rating CODESYS Store
✓	background	III		•	Close

3.2. Create a Project

Step 1: To create a new project, choose command **New project** from the **File** menu:

In the New Project dialog select **Standard project** in the 'Templates' field and enter a Name and a Location path for the project file. Press OK to confirm.

🛅 New Proj	ect	×
Categories:	raries ojects	Image:
A project co	ontaining one device, one app	lication, and an empty implementation for PLC_PRG
<u>N</u> ame:	Advantech_Sample_Project	
Location:	C:\Documents and Settings	USER\My Documents
		OK Cancel

Step 2: You will then be prompted for choosing devices. Choose device **Advantech Control x86 RTE V3 (ADVANTECH)** and programming language **Structured Text (ST)** (depend on developer) for PLC_PRG. Press OK to open the new project.

Standard Pr	roject	
	You are about objects within	t to create a new standard project. This wizard will create the following this project:
	- One progran - A program P - A cyclic task - A reference f	nmable device as specified below LC_PRG in the language specified below which calls PLC_PRG to the newest version of the Standard library currently installed.
	Device:	Advantech Series x86 RTE V3 (ADVANTECH)
	PLC_PRG in:	Structured Text (ST)
		OK Cancel

Step 3: The project name now will appear in the title bar of the CODESYS user interface and the Devices window.



3.3. Write a Program

In the **Devices** window, double-chick **PLC_PRG(PRG)** and language editor window will open. The editor consists of a declaration part (upper) and a body part (lower), separated by a screen divider. The declaration part shows line numbers at the left border and the embracing keywords "VAR" and "END_VAR" for the variables declaration.

Devices 🗸 🗸 🗙	PLC_PRG X
🖃 🎒 Advantech_Sample_Project 🛛 💽	1 PROGRAM PLC_PRGDeclaration part
E IA Device (Advantech ADAM-5560 WinCE V3)	
Plc Logic	3 i base: INT;
= 😳 Application	4 i height: INT;
👘 Library Manager	5 i radius: INT;
PLC_PRG (PRG)	6 END VAR
🖻 🔣 Task Configuration	D 7 VAR CONSTANT
🗉 🐨 MainTask	8 const PI: REAL := 3.14;
PLC_PRG	9 END VAR
🖃 🔚 Backplane (Backplane)	
<pre> <empty> (<empty>)</empty></empty></pre>	11 d_area: REAL;
<pre><empty>(<empty>)</empty></empty></pre>	12 END VAR
<pre>Comparison <= Comparison <= Comparison</pre>	10
<pre>Comparison (</pre>	<
<pre> <empty> (<empty>)</empty></empty></pre>	1 // Calculate triangle area
<pre><pre><pre><pre><pre><pre><pre><pre></pre></pre></pre></pre></pre></pre></pre></pre>	² i_base := 5; Body part
····K <empty>(<empty>)</empty></empty>	<pre>3 i_height := 7;</pre>
	<pre>4 d_area := i_base * i_height * 0.5;</pre>
Device window	5 // Calculate circle area
	6 i_radius := 6;
1	7 d_area := i_radius * i_radius * const_PI;
L	

In the declaration part of the editor put the cursor behind VAR and press the Return-key. A new empty line will be displayed where you enter the declaration of variables.

Here, we write a simple program to calculate the area of triangle and circle, so declare **i_base**, **i_height**, **i_radius** which are of type INTEGER, **d_area** of type REAL:

```
PROGRAM PLC_PRG
VAR
    i_base: INT;
    i_height: INT;
    i_radius: INT;
END_VAR
VAR CONSTANT
    const_PI: REAL := 3.14;
END_VAR
VAR
    d_area: REAL;
END_VAR
```

In the body part of the PLC_PRG editor put the cursor in line 1 and enter the following lines:

```
// Calculate triangle area
i_base := 5;
i_height := 7;
d_area := i_base * i_height * 0.5;
// Calculate circle area
i_radius := 6;
d_area := i_radius * i_radius * const_PI;
```

We need to check the program for syntactic errors and perform command **Build** if from the menu (**Build -> Build**) or press **<F11>**:

Messages - Totally 0 error(s), 0 warning(s), 0 message(s)				
Build	🗕 🖸 0 em	or(s) 😗 0 warning(s)	🜖 O message(s)	$ \times$
Description				
Build started: Application: Device.Application				
typify code				
Compile complete 0 errors, 0 warnings				

Note!

No code will be generated in this case. Error messages will be displayed in the Messages window which is placed at the lower part of the user interface per default.

3.4. Connect to the Target Device

In this section, we want to discuss how to connect to Advantech X86 RTE platforms. We need to set the active application by using Device editor. It displays an icon of programming device, the current gateway and the target device with their connection status. The **Device editor** opens by double clicking the device name in the device tree.



Click the **Scan network** button to search for available devices in your local network. You will then be prompted for the device selection. Choose your target device and click OK to proceed.

Select Device	X
Select the network path to the controller:	
🖃 💏 🔓 Gateway-1	Device Name: Scan network
APAX-5580-32 [0069]	APAX-5580-32 Wink
APAX-5580CDS [0051]	Device Address:
	0069
	Target Version:
	3.5.6.20
	Target Vendor:
	ADVANTECH
	Europe b.v.
	Target ID:
	1635 0002
	Target Name:
	Advantech
	OK Cancel

In Device editor, it will show the connection status. Please check that the colored status points are all in green.

Note!

Meaning of the colored status point on the gateway and the device:

Red: Connection cannot be established

Green: Connection established

Black: Connection not defined

Communication Settings Applica	tions Files L	log PLC settings	PLC shell	Users and Groups	Access Rights	Task deployment	Status	Information
Scan network Gateway 🔻	Device 👻							
	Gateway-1	Gateway	Ţ	[0069] (active		-		
	IP-Address: localhost			Device Name APAX-5580-32	2			
	Port: 1217			Device Addre 0069	SS:			
				Target ID: 1635 0002				
				Target Type: 4096				
				Target Vendo ADVANTECH	r: Europeb.v.			
				Target Versio 3.5.6.20	n:			

3.5. Run the Application

We can download the application by performing command Login if from the menu (Online -> Login) or press <Alt+F8>. You will then be prompted for choosing login options. Here, we choose "Login with download" for the first time and click OK to proceed.

Note!

Meaning of login options:

"Login with online change": Only the modified objects will be loaded.

"Login with download": The complete application will be loaded and initialized

completely. "Login without any change": The latest modifications will not be loaded.

CODESY	s 🔀
0	Application changed since last download. What do you want to do? Login with online change. Login with download. Login without any change.
	OK Cancel Details

We run the program by performing command **Start** if from the menu (**Debug -> Start**) or press **<F5>**. The online view of PLC_PRG will be opened: In the upper part a table shows the watch variables in application. In the lower part you see the code lines as entered in offline mode, supplemented by the little inline monitoring windows behind each variable, showing the actual value.



Stop the program by performing command **Stop** from the menu (**Debug -> Stop**) or press **<Shift+F8>**.

If you want to change into the offline mode and disconnect the programming system from the target device, perform command **Logout** from the menu (**Online -> Logout**) or press **<Ctrl+F8>**.

Chapter 4

4. System Diagnosis

4.1. System Information

For diagnosis, we provide the related system information including CPU load, memory usage, CPU temperature, etc.

Click the **System Diagnosis**, the detail of the system information is shown.

Devices 💌 👎	×	🚺 Device 🛛 🗖 System	Diagnosis	X PLC_PRG				
manual Device (Advantech Series x86 RTE V3)		System Diagnosis I/O Mapping	Status 🧃	Information				
PLC Logic		Variable	Mapping	Channel	Address	Туре	Unit	Description
Library Manager		🖃 🎽		System Information	%ID0			System Informationg
		*Þ		Average CPU Load	%IW0	UINT		Average CPU Load
Task Configuration		*•		Codesys CPU Load	%IW1	UINT		Codesys CPULoad
🗎 🍰 MainTask		*•		Memory Usage	%IW2	UINT		Memory Usage
PLC PRG		*•		CPU Temperature	%ID2	REAL		CPU Temperature
System Diagnosis (System Diagnosis)		*** **		Board Temperature	%ID3	REAL		Board Temperature
		*		Voltage 1	%ID4	REAL		Voltage 1
	- 11	*		Voltage 2	%ID5	REAL		Voltage 2
		* •		Voltage 3	%ID6	REAL		Voltage 3
		* ø		Voltage 4	%ID7	REAL		Voltage 4

Average CPU Load: the average percentage of CPU load. For example, if there are dual core, it is the average percentage of dual core's load.

CODESYS CPU Load: the percentage of the load of CPU CODESYS is running without

Windows existed.

Memory Usage: the percentage of memory is in active use.

CPU Temperature: the temperature of the processor.

Board Temperature: the temperature of the main board.

4.2. Map Variables to System Information

In this section, we want to discuss how to map variable to system information for programming use. For more details on creating a new program please refer to <u>Chapter 3</u>. Here, we declare *uiLoad* and *bAlarm* in declaration part and *bAlarm* is set to true if *uiLoad* is more than 50 in body part.



Open **System Diagnosis** by double clicking in the device tree. Double-click on the variable column and choose mapping variable by clicking the button. In this example, we try to map the variable (*uiLoad*) to the average CPU load, so we double-click on the first row of variable column.

🗮 System Diagnosis I/O Mapping	Status (Information				
Channels						
Variable	Mapping	Channel	Address	Туре	Unit	Description
🖃 🍫		System Information	%ID0			System Informationg
		Average CPU Load	%IW0	UINT		Average CPU Load
🍫		Codesys CPU Load	%IW1	UINT		Codesys CPULoad
🍬		Memory Usage	%IW2	UINT		Memory Usage
🍬		CPU Temperature	%ID2	REAL		CPU Temperature
🍬		Board Temperature	%ID3	REAL		Board Temperature
🍬		Voltage 1	%ID4	REAL		Voltage 1
🍬		Voltage 2	%ID5	REAL		Voltage 2
🍬		Voltage 3	%ID6	REAL		Voltage 3
i		Voltage 4	%ID7	REAL		Voltage 4

It will open the **Input Assistant Dialog**, where you can choose one of available variables stored for the average CPU load.

Input Assistant	-	The second secon		X
Text search Categories				
Variables	▲ Name	Туре	Address	Origin
	- O Application	Application		
	PLC_PRG	PROGRAM		
	Ø bAlarm	BOOL		
	BPLog	Library		breakpoint logging fu
	🗄 🖉 Io Config_Globals	VAR_GLOBAL		
		\mathbf{A}		
		\backslash		
		\setminus		
		\backslash		
		$\langle \rangle$		
		$\langle \rangle$		
		\backslash		
Structured view			Fil	ter: None 🔻
			t with prouments	Insert with namesnace prefix
Documentation:			r with arguments	insercimentamespace prenx
uit oad: UINT:				*
(VAR)			$\langle \rangle$	
			$\langle \rangle$	
			\setminus	
				-
				OK Cancel

Now, we can download the application by performing command Login and then performing

command Start.



Chapter 5

5. Advantech I/O Modules

5.1. APAX-5000 IO Modules

5.1.1. Scan I/O Modules into CODESYS

We can scan and configure Advantech APAX-5000 I/O modules as objects in the device tree.

If there is no any project existed in APAX-5580, you must login first.



Choose the **Backplane** and click **Scan For Devices** in context menu.

If there is a project existed in the APAX-5580, you can directly click **Scan For Devices** in context menu.



And then you can get all the online APAX-5000 IO modules. Copy the specified IO module or all IO modules to the project by click **Copy to project** or **Copy all devices to project**.

Note!

(1) Make sure that the APAX-5580 is not in RUN mode before scanning IO.

Only when APAX-5580 is in STOP mode, scan IO is available.

(2) Through scanning IO modules, there is a limitation that cannot get current safety value of each channel from APAX-5028. Therefore, please re-configure the **safety value** of each channel of APAX-5028 after scanning IO modules.

Devicename	Devicetype	Slot ID	Digital Filter	Safety Function	Safety Value	Type of AI-0	Type of AI-1	Type of A
APAX_5040	APAX-5040	0	30					
APAX_5046	APAX-5046	1		FALSE	0			
- APAX_5017	APAX-5017	2				322	323	322
L. APAX_5028	APAX-5028	3		TRUE				
APAX_5028	APAX-5028	3		TRUE				

Devicename	Devicetype	Slot ID	Digital Filter	Safety Function	Safety Value	Type of AI-0	Type of AI-1	Type of
APAX_5040	APAX-5040	0	30					
APAX_5046	APAX-5046	1		FALSE	0			
APAX_5017	APAX-5017	2				322	323	322
L. APAX_5028	APAX-5028	3		TRUE				
L. APAX_5028	APAX-5028	3		TRUE				

All the devices or the specified device will be added into the Backplane.



Note!

You can remove the existing device by click **Delete** \times in context menu.

5.1.2. Insert I/O Modules into CODESYS

We can add and configure Advantech APAX-5000 I/O modules as objects in the device tree.

Choose the **Backplane** and click **Add Device** in context menu.


It will open the **Add Device dialog**, where you can choose one of available devices. Click **Add Device** to proceed and then press **Close** to close the device dialog.

Add	Device			×
Nerrow	ADAX 5040			
Name:	: APAX_5040			
Action	n:			
Ap	ppend device 🔘 Inser	t device 🔘 Plug	device 🔘 Update device	
Devic	ce:			
Vend	ior: <a>All vendors>			•
Nar	me	Vendor		
8-6	Miscellaneous			
	APAX-5013	ADVANTECH		
	APAX-5017	ADVANTECH		
	APAX-5017H	ADVANTECH		
	APAX-5017PE	ADVANTECH		
	APAX-5018	ADVANTECH		
	APAX-5028	ADVANTECH		
	APAX-5040	ADVANTECH		
	APAX-5040PE	ADVANTECH		
	APAX-5045	ADVANTECH		
	APAX-5046	ADVANTECH		
	APAX-504650	ADVANTECH		
	APAX-5060	ADVANTECH		
	APAX-5060PE	ADVANTECH		
V G	Group by category			
D	isplay outdated version	s		
Inton	mation:			
	Vendor: APAX-5040			
	Groups:			
	Version: 3.5.6.0			8 29
	Model Number: -			v
	Description: 24 Char	nnels Digital input M	odule	
Appe Back	end selected device as oplane	s last child of		
0	(You can select another	r target node in th	e navigator while this window is open.)	
			Add Devi	ce Close
			Add Dem	0.030

Then the specified IO module will be added into the Backplane.



Note!

If inserting IO modules is used, you must configure the right Slot ID of each inserted APAX-5000 IO modules. If scanning IO modules is used, you do not need to do the Slot ID configuration.

5.1.3. Map Variables to I/O Modules

In this section, we want to discuss how to map variable of program to Advantech I/O modules. For more details on creating a new program please refer to <u>Chapter 3</u>. Here, we declare *bValue* in declaration part and set true in body part.

PROGRAM PLC_PRG VAR bValue: BOOL; END VAR

bValue:= true;

Open **Module Editor** by double clicking the device name in the device tree. Double-click on the variable column and choose mapping variable by clicking the button. In this example, we try to map the variable (*bValue*) to channel 0, so we double-click on the first row of variable column.

🗮 Status I/O Mapping 🛛 Statu	s 🤹 Informal	ion				
Channels						
Variable	Mapping	Channel	Address	Туре	Unit	Description
📮 🍢		DO	%QW0	WORD		Digital output ch0 ~ ch15
- *)	DO-0	%QX0.0	BOOL		Digital output 0
* @		DO-1	%QX0.1	BOOL		Digital output 1
* @		DO-2	%QX0.2	BOOL		Digital output 2

Note!

If you want to control all channels, declare a WORD variable and map it.

🗮 Status I/O Mapping	Status 🤹 Inform	nation					
Channels							
Variable		Mapping	Channel	Address	Туре	Unit	Descri
📮 - 🍢			DO	%QW0	WORD		Digital o
[*] @			DO-0	%QX	BOOL		Digital o
- * ø			DO-1	%QX	BOOL		Digital o

It will open the **Input Assistant Dialog**, where you can choose one of available variables for the current digital output channel.

Input Assistant					X
Text search Categories					
Variables	Name Application PICPRG Valu Br (Config_Globa	Type Application PROGRAM BOOL Is VAR_GLOBAL	Address	Origin	
Structured view				Eilter: None	~
Show documentation			✓ Insert with arguments	Insert with <u>n</u>	amespace prefix
bValue: BOOL; (VAR)				ОК	Cancel

Now, we can download the application by performing command **Login** and then performing command **Start**. The channel-0 of I/O module will be lit up.

Channels								
Variable	Mapping	Channel	Address	Туре	Current Value	Prepar	Unit	Description
📮 🍢		DO	%QW0	WORD				Digital output ch0 ~ ch15
Application.PLC_PRG.byValue	~	DO-0	%QX	BOOL	TRUE			Digital output 0
[*] @		DO-1	%QX	BOOL	FALSE			Digital output 1
E CARACTER A								

Note!

If the Advantech modules are correctly configured, it will show a green circle icon $\stackrel{\circ}{\rightarrow}$ next to the device name in the device tree. If it shows a red triangle $^{\triangle}$, see <u>Chapter 8</u> for troubleshooting.



5.1.4. Support List

Advantech provides 13 types of APAX-5000 I/O modules for various applications so far. Following table is the I/O modules support list. In the following section, we will introduce I/O modules according to their types.

Module	Name	Specification	Reference
	APAX-5013	8-ch RTD Input	Isolated
	APAX-5017	12-ch Al	Isolated
Analog Input	APAX-5017H	12-ch High Speed Al	Isolated
	APAX-5017PE	12-ch Al	Isolated
	APAX-5018	12-ch TC Input	Isolated
Analog Output	APAX-5028	8-ch AO	Isolated
Digital Input	APAX-5040	24-ch DI w/LED	Isolated
	APAX-5040PE	24-ch DI w/LED	Isolated
Digital Output	APAX-5046	24-ch DO w/LED	Isolated
	APAX-5046SO	20-ch DO source w/LED	Isolated
Digital I/O	APAX-5045	24-ch DI/O w/LED	Isolated
Relay Output	APAX-5060	12-ch Relay Output w/LED	Isolated
	APAX-5060PE	12-ch Relay Output w/LED	Isolated

5.1.5. Digital Input Modules

In this section, we are going to introduce digital input modules.

The **Module editor** opens by double clicking the device name in the device tree. It consists of four tab pages, that is, **Status Configuration**, **Status I/O Mapping**, **Status and Information**.

Status Configuration: Provide the status page for setting device. Double-click on the value column of the particular setting.

Status Configuration	🗮 Status I/O Mappi	ing Status	Information		
Parameter	Туре	Value	Default Value	Unit	Description
🖗 🖗 Slot ID	UINT(031)	0	0		Slot ID
Digital Filter	UINT(30400)	30	30	0.1ms	Digital filter

Note!

If scan IO and then copy to the project is used, do not need to modify the Slot ID.

If manually insert IO into the project is used, need to configure the right Slot ID.

Status I/O Mapping: Show the I/O mapping status between variable to module channel. It consists of seven columns.

Mapping: The mapping status of each variable.

Note!

There are two categories of variables: Channel values and Error ID.

Channel values: The data type of each channel is in single bit. If the value is "true", it means that the channel is on; "false" for off. All channel values can represent as one word.

For detailed variable mapping information, see Chapter 4.2.

Error ID: This variable holds the status of I/O module and its data type is in Word (16 Bits). Get module error ID by mapping the last variable in table. For detailed error ID information, see <u>Chapter 5.3.</u>

Address: The starting physical address of the variables for this I/O group. The board shown below has 24 digital inputs. This will require either 24 Boolean addresses or 2 WORD (4 BYTE) addresses.

Note!

Meaning of address expression:

% = Directly Mapped variable

I = Physical Input

W = Word (16 bits)

X = Single bit

\$(N1). \$(N2) = The starting address. The first number means the starting byte; the second number means the starting bit.

Type: The data type of each variable.

Description: The description of each variable.

Status: The reserved page.

Information: Provide the brief information to current module.

nanneis						
/ariable	Mapping	Channel	Address	Туре	Unit	Description
- *		DI 0~15	%IW0	WORD		Digital input ch0 ~ ch15
🍫		DI-0	%IX0.0	BOOL		Digital input channel 0
		DI-1	%IX0.1	BOOL		Digital input channel 1
		DI-2	%IX0.2	BOOL		Digital input channel 2
🍫		DI-3	%IX0.3	BOOL		Digital input channel 3
🍫		DI-4	%IX0.4	BOOL		Digital input channel 4
🍫		DI-5	%IX0.5	BOOL		Digital input channel 5
🍫		DI-6	%IX0.6	BOOL		Digital input channel 6
* >		DI-7	%IX0.7	BOOL		Digital input channel 7
🍫		DI-8	%IX1.0	BOOL		Digital input channel 8
🍫		DI-9	%IX1.1	BOOL		Digital input channel 9
* >		DI-10	%IX1.2	BOOL		Digital input channel 10
🍬		DI-11	%IX1.3	BOOL		Digital input channel 11
🍫		DI-12	%IX1.4	BOOL		Digital input channel 12
		DI-13	%IX1.5	BOOL		Digital input channel 13
		DI-14	%IX1.6	BOOL		Digital input channel 14
- *		DI-15	%IX1.7	BOOL		Digital input channel 15
- X		DI 16~23	%IW1	WORD		Digital input ch16 ~ ch23
		DI-16	%IX2.0	BOOL		Digital input channel 16
* >		DI-17	%IX2.1	BOOL		Digital input channel 17
*		DI-18	%IX2.2	BOOL		Digital input channel 18
		DI-19	%IX2.3	BOOL		Digital input channel 19
🍬		DI-20	%IX2.4	BOOL		Digital input channel 20
*		DI-21	%IX2.5	BOOL		Digital input channel 21
		DI-22	%IX2.6	BOOL		Digital input channel 22
L 🍫		DI-23	%IX2.7	BOOL		Digital input channel 23

5.1.6. Digital Output Modules

In this section, we are going to introduce digital output modules.

The **Module editor** opens by double clicking the device name in the device tree. It consists of four tab pages, that is, **Status Configuration**, **Status I/O Mapping**, **Status and Information**.

Status Configuration: Provide the status page for setting device. Double-click on the value column of the particular setting.

	Status Configuration	🛱 Status I/O Mapping 🛛 Status 🛛 🄇	Information	n		
	Parameter	Туре	Value	Default Value	Unit	Description
l	🖗 🖗 Slot ID	UINT(031)	1	0		Slot ID
l	Safety Function	n BOOL	FALSE	FALSE		Safety function enable/disable
l	🔍 🖗 Safety Value	DWORD(16#016#FFFFF)	0	16#0		Safety value

Note!

If scan IO and then copy to the project is used, do not need to modify the Slot ID.

If manually insert IO into the project is used, need to configure the right Slot ID.

Status I/O Mapping: Show the I/O mapping status between variable to module channel. It consists of seven columns.

Mapping: The mapping status of each variable.

Note!

There are two categories of variables: Channel values and Error ID.

Channel values: The data type of each channel is in single bit. Set the value to "true" for switching on the channel; "false" for switching off. All channel values can represent as two WORDs.

For detailed variable mapping information, see Chapter 4.2.

Error ID: This variable holds the status of I/O module and its data type is in Word (16 Bits). Get module error ID by mapping the last variable in table. For detailed error ID information, see <u>Chapter 5.3.</u>

Address: The starting physical address of the variables for this I/O group. The board shown below has 24 digital outputs. This will require either 24 Boolean addresses or 2 WORD (4 Byte) addresses.

Note!

Meaning of address expression:

% = Directly Mapped variable

Q = Physical Output

W = Word (16 bits)

X = Single bit

\$(N1). \$(N2) = The starting address. The first number means the starting byte; the second number means the starting bit.

Type: The data type of each variable.

Description: The description of each variable.

Status: The reserved page.

Information: Provide the brief information to current module.

Status Configuration 🗮	Status I/O Mapping	Status 🚺 I	nformation			
Channels						
Variable	Mapping	Channel	Address	Туре	Unit	Description
📮 🍢		DO 0~15	%QW0	WORD		Digital output ch0 ~ ch15
**		DO-0	%QX0.0	BOOL		Digital output channel 0
**		D0-1	%QX0.1	BOOL		Digital output channel 1
**		D0-2	%QX0.2	BOOL		Digital output channel 2
**		DO-3	%QX0.3	BOOL		Digital output channel 3
**		D0-4	%QX0.4	BOOL		Digital output channel 4
**		D0-5	%QX0.5	BOOL		Digital output channel 5
**		DO-6	%QX0.6	BOOL		Digital output channel 6
* ø		D0-7	%QX0.7	BOOL		Digital output channel 7
* ø		DO-8	%QX1.0	BOOL		Digital output channel 8
* ø		DO-9	%QX1.1	BOOL		Digital output channel 9
* ø		DO-10	%QX1.2	BOOL		Digital output channel 10
* ø		D0-11	%QX1.3	BOOL		Digital output channel 11
* ø		DO-12	%QX1.4	BOOL		Digital output channel 12
* ø		DO-13	%QX1.5	BOOL		Digital output channel 13
* ø		D0-14	%QX1.6	BOOL		Digital output channel 14
		DO-15	%QX1.7	BOOL		Digital output channel 15
🚔 e 🍢		DO 16~23	%QW1	WORD		Digital output ch16 ~ ch23
* @		DO-16	%QX2.0	BOOL		Digital output channel 16
* @		D0-17	%QX2.1	BOOL		Digital output channel 17
- * @		DO-18	%QX2.2	BOOL		Digital output channel 18
- *		DO-19	%QX2.3	BOOL		Digital output channel 19
* @		DO-20	%QX2.4	BOOL		Digital output channel 20
* @		D0-21	%QX2.5	BOOL		Digital output channel 21
· · · · · · · · · · · · · · · · · ·		D0-22	%QX2.6	BOOL		Digital output channel 22
*		DO-23	%QX2.7	BOOL		Digital output channel 23
- L		ErrorID	%IW3	WORD		Error ID currently happened in the module

5.1.7. Analog Input Modules

In this section, we are going to introduce analog input modules.

The **Module editor** opens by double clicking the device name in the device tree. It consists of four tab pages, that is, **Status Configuration**, **Status I/O Mapping**, **Status and Information**.

Status Configuration: Provide the channel status page for setting channel ranges.

Double-click on the value column of the particular channel.

Note!

If scan IO and then copy to the project is used, do not need to modify the Slot ID.

If manually insert IO into the project is used, need to configure the right Slot ID.

Status Configuration 🗮 Status I/O Ma	apping Status 🕕 Informa	tion			
Parameter	Туре	Value	Default Value	Unit	Description
👘 🖗 Slot ID	UINT(031)	2	0		Slot ID
Type of AI-0	Enumeration of WORD	+/- 10 V 🔹	+/- 150 mV		
Type of AI-1	Enumeration of WORD	+/- 150 mV	+/- 150 mV		
Type of AI-2	Enumeration of WORD	+/- 500 mv +/- 1 V	+/- 150 mV		
Type of AI-3	Enumeration of WORD	+/- 5 V	+/- 150 mV		
Type of AI-4	Enumeration of WORD	4~20 mA	+/- 150 mV		
Type of AI-5	Enumeration of WORD	+/- 20 mA	+/- 150 mV		
🖤 🖗 Type of AI-6	Enumeration of WORD	0~20 mA	+/- 150 mV		
🖤 🖗 Type of AI-7	Enumeration of WORD	0~20 mA	+/- 150 mV		
🖤 🖗 Type of AI-8	Enumeration of WORD	+/- 10 V	+/- 150 mV		
🖤 < Type of AI-9	Enumeration of WORD	+/- 10 V	+/- 150 mV		
🖤 🕸 Type of AI-10	Enumeration of WORD	+/- 150 mV	+/- 150 mV		
🖤 🕸 Type of AI-11	Enumeration of WORD	+/- 150 mV	+/- 150 mV		
Burnout detect mode	Enumeration of DWORD	Down Scale	Up Scale		
 Sampling rate (Total channel) 	Enumeration of DWORD	120 Hz	12 Hz		
🧼 🖗 Channel mask	DWORD(16#116#FFF)	4095	16#FFF		

Status I/O Mapping: Show the I/O mapping status between variable to module channel.

Mapping: The mapping status of each variable.

Note!

There are two categories of variables: Channel values and Error ID.

Channel values: The data type of each channel is in REAL.

For detailed variable mapping information, see <u>Chapter 4.2</u>.

Error ID: This variable holds the status of I/O module and its data type is in Word (16 Bits). Get module error ID by mapping the last variable in table. For detailed error ID information, see <u>Chapter 5.3.</u>

Address: The starting physical address of the variables for this I/O group. The board shown below has 12 analog inputs. This will require 12 DWORD addresses.

Note!

Meaning of address expression:

% = Directly Mapped variable

I = Physical Input

D = Double word (32 Bits)

\$(N) = The starting address.

Type: The data type of each variable.

Description: The description of each variable.

Status Configuration 🗮	Status I/O Mapping	Status 🕕	Information			
Channels						
Variable	Mapping	Channel	Address	Туре	Unit	Description
		AI-0	%ID2	REAL		Analog input 0
		AI-1	%ID3	REAL		Analog input 1
🍫		AI-2	%ID4	REAL		Analog input 2
🍫		AI-3	%ID5	REAL		Analog input 3
		AI-4	%ID6	REAL		Analog input 4
		AI-5	%ID7	REAL		Analog input 5
		AI-6	%ID8	REAL		Analog input 6
		AI-7	%ID9	REAL		Analog input 7
		AI-8	%ID10	REAL		Analog input 8
		AI-9	%ID11	REAL		Analog input 9
		AI-10	%ID12	REAL		Analog input 10
		AI-11	%ID13	REAL		Analog input 11
		Status-0	%IB56	BYTE		Analog input ch-0 status
		Status-1	%IB57	BYTE		Analog input ch-1 status
		Status-2	%IB58	BYTE		Analog input ch-2 status
🍫		Status-3	%IB59	BYTE		Analog input ch-3 status
		Status-4	%IB60	BYTE		Analog input ch-4 status
* >		Status-5	%IB61	BYTE		Analog input ch-5 status
*		Status-6	%IB62	BYTE		Analog input ch-6 status
		Status-7	%IB63	BYTE		Analog input ch-7 status
		Status-8	%IB64	BYTE		Analog input ch-8 status
		Status-9	%IB65	BYTE		Analog input ch-9 status
		Status-10	%IB66	BYTE		Analog input ch-10 status
		Status-11	%IB67	BYTE		Analog input ch-11 status
L 🍫		ErrorID	%IW34	WORD		Error ID currently happened in the module

Status: The reserved page.

Information: Provide the brief information for current module.

5.1.8. Analog Output Modules

In this section, we are going to introduce analog output modules.

The Module editor opens by double clicking the device name in the device tree. It consists of

four tab pages, that is, Status Configuration, Status I/O Mapping, Status and Information.

Status Configuration: Provide the channel status page for setting channel ranges.

Double-click on the value column of the particular channel.

Status Configuration	Status I/O Mapping Statu	ıs 🕕 Information	1		
Parameter	Туре	Value	Default Value	Unit	Description
🖗 Slot ID	UINT(031)	3	0		Slot ID
Type of AO-0	Enumeration of WORI	D +/- 10 V 🔻	+/- 2.5 V		
🖤 🖗 Type of AO-1	Enumeration of WORI	D +/- 2.5 V	+/- 2.5 V		
🖤 🖗 Type of AO-2	Enumeration of WORI	D +/- 10 V	+/- 2.5 V		
🖤 🖗 Type of AO-3	Enumeration of WORI	D 0~2.5 V	+/- 2.5 V		
🖤 🖗 Type of AO-4	Enumeration of WORI	D 0~10 V	+/- 2.5 V		
🖤 🖗 Type of AO-5	Enumeration of WORI	D 4~20 mA	+/- 2.5 V		
🖤 🖗 Type of AO-6	Enumeration of WORI	D U~20 mA	+/- 2.5 V		
🖤 🖗 Type of AO-7	Enumeration of WORI	D 0~20 mA	+/- 2.5 V		
🔷 🖗 AO Safety Value	e 0 REAL	0	0		Analog output ch0 Safety Value
🔷 🖗 AO Safety Value	e 1 REAL	0	0		Analog output ch1 Safety Value
🔷 🖗 AO Safety Value	e 2 REAL	0	0		Analog output ch2 Safety Value
🔷 🖗 AO Safety Value	e 3 REAL	0	0		Analog output ch3 Safety Value
🔷 🖗 AO Safety Value	e 4 REAL	0	0		Analog output ch4 Safety Value
🖤 🖗 AO Safety Value	e 5 REAL	0	0		Analog output ch5 Safety Value
🔷 🖗 AO Safety Value	e 6 REAL	0	0		Analog output ch6 Safety Value
🔷 🖗 AO Safety Value	e 7 REAL	0	0		Analog output ch7 Safety Value
🔍 🖗 Safety Function	BOOL	TRUE	FALSE		Safety function enable/disable

Note!

If scan IO and then copy to the project is used, do not need to modify the Slot ID.

If manually insert IO into the project is used, need to configure the right Slot ID.

Status I/O Mapping: Show the I/O mapping status between local variable to module channel.

Mapping: The mapping status of each variable.

Note!

There are two categories of variables: Channel values and Error ID.

Channel values: The data type of each channel is in REAL.

For detailed variable mapping information, see <u>chapter 4.2</u>.

Error ID: This variable holds the status of I/O module and its data type is in Word (16 Bits). Get module error ID by mapping the last variable in table. For detailed error ID information, see <u>chapter 5.3.</u>

Address: The starting physical address of the variables for this I/O group. The board shown below has 8 analog outputs. This will require 8 DWORD addresses.

Note!

Meaning of address expression:

% = Directly Mapped variable

Q = Physical Output

D = Double word (32 Bits)

\$(N) = The starting address.

Type: The data type of each variable.

Description: The description of each variable.

Status Configuration 🗮 Stat	tus I/O Mapping	Status 🕕	Information			
Channels						
Variable	Mapping	Channel	Address	Туре	Unit	Description
*		AO-0	%QD1	REAL		Analog output 0
* @		A0-1	%QD2	REAL		Analog output 1
* @		A0-2	%QD3	REAL		Analog output 2
* @		A0-3	%QD4	REAL		Analog output 3
* *		A0-4	%QD5	REAL		Analog output 4
* @		AO-5	%QD6	REAL		Analog output 5
- *		AO-6	%QD7	REAL		Analog output 6
* @		A0-7	%QD8	REAL		Analog output 7
L 🍬		ErrorID	%IW35	WORD		Error ID currently happened in the module

Status: The reserved page.

Information: Provide the brief information for current module.

5.1.9. Relay Output Modules

In this section, we are going to introduce relay output modules.

The **Module editor** opens by double clicking the device name in the device tree. It consists of four tab pages, that is, **Status Configuration**, **Status I/O Mapping**, **Status and Information**.

Status Configuration: Provide the status page for setting device. Double-click on the value column of the particular setting.

	Status Configuration	芊 Status I/O Mapping Status	🕕 🕕 Informa	tion		
l	Parameter	Туре	Value	Default Value	Unit	Description
l	🖗 🖗 Slot ID	UINT(031)	4	0		Slot ID
l	Safety Function	on BOOL	FALSE	FALSE		Safety function enable/disable
l	🔍 🖗 Safety Value	DWORD(16#016#FFF)	16#0	16#0		Safety value

Note!

If scan IO and then copy to the project is used, do not need to modify the Slot ID.

If manually insert IO into the project is used, need to configure the right Slot ID.

Status I/O Mapping: Show the I/O mapping status between local variable to module channel. It consists of seven columns.

Mapping: The mapping status of each variable.

Note!

There are two categories of variables: Channel values and Error ID.

Channel values: The data type of each channel is in single bit. Set the value to "true" for switching on the channel; "false" for switching off. All channel values can represent as one word.

For detailed variable mapping information, see Chapter 4.2.

Error ID: This variable holds the status of I/O module and its data type is in Word (16 Bits). Get module error ID by mapping the last variable in table. For detailed error ID information, see <u>Chapter 5.3.</u>

Address: The starting physical address of the variables for this I/O group. The board shown below has 12 relay outputs. This will require either 12 Boolean addresses or 1 WORD address.

Note!

Meaning of address expression: % = Directly Mapped variable **Q** = Physical Output

W = Word (16 bits)

X = Single bit

\$(N1). \$(N2) = The starting address. The first number means the starting byte; the second number means the starting bit.

Type: The data type of each variable.

Description: The description of each variable.

Status: The reserved page.

Information: Provide the brief information to current module.

Channels						
Variable	Mapping	Channel	Address	Туре	Unit	Description
⊒ * ø		DO 0~11	%QW18	WORD		Relay output ch0 ~ ch11
*>		DO-0	%QX36.0	BOOL		Relay output channel 0
🍫		D0-1	%QX36.1	BOOL		Relay output channel 1
🍫		D0-2	%QX36.2	BOOL		Relay output channel 2
🍫		D0-3	%QX36.3	BOOL		Relay output channel 3
🍫		D0-4	%QX36.4	BOOL		Relay output channel 4
* ø		D0-5	%QX36.5	BOOL		Relay output channel 5
**		DO-6	%QX36.6	BOOL		Relay output channel 6
🍫		D0-7	%QX36.7	BOOL		Relay output channel 7
* ø		DO-8	%QX37.0	BOOL		Relay output channel 8
**		DO-9	%QX37.1	BOOL		Relay output channel 9
* ø		DO-10	%QX37.2	BOOL		Relay output channel 10
		D0-11	%QX37.3	BOOL		Relay output channel 11
L 妆		ErrorID	%IW36	WORD		Error ID currently happened in the modul

5.2. AMAX-5000 IO Modules

5.2.1. Scan AMAX I/O Modules into CODESYS

AMAX-5000 series EtherCAT Slice IO modules are standard EtherCAT IO modules, the standard process to equip EtherCAT fieldbus has described in Chapter 6.5.

Before connecting to slaves by using EtherCAT client, please install the related EtherCAT XML device description files (*.xml) first. Please get this file from Advantech support website. Or contact your window of technical support.

If user follows the Chapter 2.2 to install Advantech Add-on Package, the latest device description file would be well installed. Please check the version in the dialog window of **Device Repository (Tool \rightarrow Device Repository)**

🧝 Device Re	pository					X
Location	System Pepository				•	Edit Locations
	(c:\ProgramData\CODESYS\Devices)					
Installed E	Device Descriptions					
String for	a full text search Vendor <all td="" vendor<=""><td>\$></td><td></td><td></td><td>•</td><td>Install</td></all>	\$>			•	Install
Name		Vendor	Version	Description	*	Uninstall
	not Module					Emert
	= burg Slave					
	- 📴 Advantech Co., Ltd ADAM-5000/ECAT					
	🌸 📴 Advantech Co., LTD AMAX-4800 Series EtherCA	(T I/O Module			E	
	😑 📴 Advantech Co., Ltd AMAX-5000 Series EtherCA	T I/O Module				Renew Device
	- MAX-5001	Advantech Co., Ltd.	Revision=16#00000004	EtherCAT Slave imported from Slave XML: AMAX-5000	v2.3.xml Device: AMAX-5001	Repository
	AMAX-5015	Advantech Co., Ltd.	Revision=16#00001002	EtherCAT Slave imported from Slave XML: AMAX-5000	v2.3.xml Device: AMAX-5015	
	MAX-5017C	Advantech Co., Ltd.	Revision=16#00021002	EtherCAT Slave imported from Slave XML: AMAX-5000	v2.3.xml Device: AMAX-5017C	
	- MAX-5017V	Advantech Co., Ltd.	Revision=16#00031002	EtherCAT Slave imported from Slave XML: AMAX-5000	v2.3.xml Device: AMAX-5017V	
	- 🗊 AMAX-5018	Advantech Co., Ltd.	Revision=16#00001002	EtherCAT Slave imported from Slave XML: AMAX-5000	v2.3.xml Device: AMAX-5018	
	- MAX-5024	Advantech Co., Ltd.	Revision=16#00001002	EtherCAT Slave imported from Slave XML: AMAX-5000	v2.3.xml Device: AMAX-5024	Details
	- 🛗 AMAX-5051 8 DI Module.	Advantech Co., Ltd.	Revision=16#0000002	EtherCAT Slave imported from Slave XML: AMAX-5000	v2.3.xml Device: AMAX-5051 8 DI Module.	
	🛗 AMAX-5051T 8-ch DI with 2-ch Timestamp	Advantech Co., Ltd.	Revision=16#00001001	EtherCAT Slave imported from Slave XML: AMAX-5000	v2.3.xml Device: AMAX-5051T 8-ch DI with 2-ch Timestam	
	AMAX-5052 16 DI Module.	Advantech Co., Ltd.	Revision=16#00000001	EtherCAT Slave imported from Slave XML: AMAX-5000	v2.3.xml Device: AMAX-5052 16 DI Module.	
	- MAX-5056 8 DO Module.	Advantech Co., Ltd.	Revision=16#0000002	EtherCAT Slave imported from Slave XML: AMAX-5000	v2.3.xml Device: AMAX-5056 8 DO Module.	
	AMAX-5056SO 8 DO Module.	Advantech Co., Ltd.	Revision=16#00010002	EtherCAT Slave imported from Slave XML: AMAX-5000	v2.3.xml Device: AMAX-5056SO 8 DO Module.	
	AMAX-5056T 2-ch Do Timestamp	Advantech Co., Ltd.	Revision=16#00001001	EtherCAT Slave imported from Slave XML: AMAX-5000	v2.3.xml Device: AMAX-5056T 2-ch Do Timestamp	
	- III AMAX-5057 16 DO Module.	Advantech Co., Ltd.	Revision=16#00000002	EtherCAT Slave imported from Slave XML: AMAX-5000	v2.3.xml Device: AMAX-5057 16 DO Module.	
	- MAX-5057SO 16 DO Module.	Advantech Co., Ltd.	Revision=16#00010002	EtherCAT Slave imported from Slave XML: AMAX-5000	v2.3.xml Device: AMAX-5057SO 16 DO Module.	
	- III AMAX-5074	Advantech Co., Ltd.	Revision=16#00000004	EtherCAT Slave imported from Slave XML: AMAX-5000	v2.3.xml Device: AMAX-5074	
	AMAX-5080	Advantech Co., Ltd.	Revision=16#00000005	EtherCAT Slave imported from Slave XML: AMAX-5000	v2.3.xml Device: AMAX-5080	
	Advantech Co., Ltd WISE-5000 Series EtherCAT	FI/O Module				
	Beckhoff Automation GmbH & Co. KG - Drive and A	Axis Terminals				
	Delta Electronics, Inc.					
	Festo AG & Co. KG					
	Hitachi Industrial Equipment Systems Co.,Ltd.				-	
-	The Proof of the stand of the s	m			F.	
						Close

If user needs to install another version of description file, please click "Install" button and select the related file you want to install.

After installed successfully, the following information will be shown: "Device xxxx installed to device repository".

Before scan the device, user has to connect to specified Advantech X86 RTE platform. Please refer to Chapter 3.4 for detail.

To scan the EtherCAT device, user has to add EtherCAT Master first. In Device Window, Right-click on **Device** Add **Device**. You will then be prompted for the Add Device dialog.



Choose **EtherCAT Master** in the **EtherCAT/Master** option and click **Add Device** to proceed and then press Close to close the device dialog.

Add Device			×
Name: EtherCAT Master			
Action:			
Action:			
Append device Insert device	Plug device 🔘 Update device		
Device:			
Vendor: <a>All vendors>			•
Name	Vendor		
🖃 💮 Fieldbusses			
CANbus			
Bed Ethercat			
🖃 - Brader Master			
🔛 🚹 EtherCAT Master	35 - Smart Software Solutions Gm	юн	
🗈 - 🍱 Ethernet Adapter			
🗈 👄 EtherNet/IP			
🗄 🗰 🗰 Modbus			
🗈 🋲 Profibus			
🗈 🛲 Profinet IO			
🗄 S sercos			
Group by category			
Information:			
Name: EtherCAT Master	Kana Cabu	<u> </u>	
Groups: Master	aons GmbH		
Version: 3.5.5.0		=	
Model Number: ???			×.
Description: EtherCAT Master		-	
Append selected device as last child Device	of		
(You can select another target node	e in the navigator while this window	w is open.)	
		Add Device	Close

Now, you'll see EtherCAT Master icon to set configuration. Click **Browse** and then select proper Ethernet Adapter.

	✓ Autoconfigmaster/slaves	Ether CAT
nc Unit Assignment	EtherCAT NIC Settings	
g	Destination address (MAC) FF-FF-FF-FF-FF	Redundancy
herCAT I/O Mapping	Source address (MAC) 74-FE-48-3F-F5-87 Browse	
herCAT IEC Objects	Select network by MAC Select network by MAC	
atus	Distributed Clock Options	
formation	Cycle time 4000	ead of LWR/LRD rtask restart slaves
Select Network Adapter	Description	
74FE483FF587 Local Ar	rea Connection 3 CoDeSys EtherExpress GBit PCI Ethernet Adapter #3	
74FE4840D2A9 Local Ar	rea Connection 2 CoDeSys EtherExpress GBit PCI Ethernet Adapter #2	

Note!

- Different platform would have different result of Network Adapter, for AMAX-5580 LAN1 and LAN3 are recommended to set as EtherCAT Master Port. And the MAC address is listed on the side of AMAX-5580 as reference.
- (2) For APAX-5580, only LAN2 can be selected as EtherCAT Master Port
- (3) "Auto restart slaves" is suggested to be clicked.

Options
Use LRW instead of LWR/LRD
🔲 Enable messages pertask
V Auto restart slaves

At the first scan, at least **once a login (and running)** must have been done. Otherwise, the Advantech X86 RTE platform must be running before a scan.

beneed		▼
Advantech_Sample_Project		
🗄 🤣 🔼 Device [connected] (Advantech APAX-55	80 x8	6 RTE V3)
Plc Logic		
🖹 🔘 Application [run]		
Library Manager		
PLC_PRG (PRG)		
🖹 🔛 Task Configuration		
🖻 🕸 EtherCAT_Master		
EtherCAT_Master.Ether	CAT_	Task
🗏 🚷 MainTask		
PLC_PRG		
A Contraction of the second se		
EtherCAI_Master (EtherCAI Master)	Ж	Cut
		Сору
	æ	Paste
	\times	Delete
		Refactoring •
	Ŀ,	Properties
	12	Add Object
		Add Folder
		Add Device
		Insert Device
		Scan For Devices
		Disable Device
	D°	Edit Object
		Edit Object With
		Edit IO mapping
		Import mappings from CSV
		Export mappings to CSV
		Device Configuration

Choose the EtherCAT_Master and right click Scan For Devices in context menu.

A list of all devices and modules are found during the last scan. Select the specified one device and then copy to the project. Or copy all listed devices to the project.

Device name	Device type	Alias Address	
AMAX_5001	AMAX-5001	8	
AMAX_5051	AMAX-5051 8 DI Module.	1	
AMAX_5057SO	AMAX-5057SO 16 DO Module.	1304	
AMAX_5056	AMAX-5056 8 DO Module.	3	
AMAX_5015	AMAX-5015	19	
AMAX_5017V	AMAX-5017V	121	

Now, you'll see the devices copied to the project under the EtherCAT_Master.

EtherCAT_Master (EtherCAT Master)
 AMAX_5001 (AMAX-5001)
 AMAX_5051 (AMAX-5051 8 DI Module.)
 AMAX_5057SO (AMAX-5057SO 16 DO Module.)
 AMAX_5056 (AMAX-5056 8 DO Module.)
 AMAX_5015 (AMAX-5015)
 AMAX_5017V (AMAX-5017V)

After completely finish device configuration, it is necessary to login again.

EtherCAT_Master (EtherCAT Master)
 AMAX_5001 (AMAX-5001)
 AMAX_5051 (AMAX-5051 8 DI Module.)
 AMAX_5057SO (AMAX-5057SO 16 DO Module.)
 AMAX_5056 (AMAX-5056 8 DO Module.)
 AMAX_5015 (AMAX-5015)
 AMAX_5017V (AMAX-5017V)

Note!

You can remove the existing device by click **Delete** \bowtie in context menu.

5.2.2. Insert AMAX I/O Modules into CODESYS

If user do not have the I/O modules on line, user can add and configure Advantech AMAX-5000 I/O modules as objects in the device tree in off-line mode.

Choose the EtherCAT Master in the tree view and click Add Device in the context manual.

Devices		→ ₽ X
AMAX-5000 project		
🖹 🔼 Device (Advantech Control x86 RTE	V3 x6	4)
Application		
Library Manager		
PLC_PRG (PRG)		
Task Configuration		
EtherCAT_Task		
System Diagnosis (System Diag	nosis)	
EtherCAT Master (EtherCAT M	aster)	
_ (Ж	Cut
	Ē	Сору
	æ	Paste
	\times	Delete
		Refactoring +
	æ	Properties
	1	Add Object
	\bigcirc	Add Folder
		Add Device
		Insert Device
		Scan for Devices
		Disable Device
		Update Device
	ß	Edit Object
		Edit Object With
		Edit IO mapping
		Import mappings from CSV
		Export mappings to CSV
	_	

It will open the **Add Device dialog**, where you can choose one of available devices. Click **Add Device** to proceed and then press **Close** to close the device dialog.

Add Device	- IN Advention for the	1				×
Name AMAX_500)1					
Action						
Append device	e 🦱 Insert device 🦳 Plug devi	ice i 🖱 Undate device				
	01					
String for a full tex	kt search V	/endor <all vendors=""></all>				-
Name			Vendor	Version	Description	-
😑 📆 Fieldbuses	s					E
😑 🔐 🔐 Ether	CAT					
⊟ Brot S	lave					
⊕- <u>C</u>	Advantech Co., Ltd ADAM-500	00/ECAT				
₩- 6	Advantech Co., LTD AMAX-480	00 Series EtherCAT I/O Module	÷			
P-0	Advantech Co., Ltd AMAX-500	00 Series EtherCAT I/O Module				
	MAX-5001		Advantech Co., Ltd.	Revision=16#00000004	EtherCAT Slave imported from Slave XML: AMAX-5000_v2.3.xml Device: AMAX-5001	
	MAX-5015		Advantech Co., Ltd.	Revision=16#00001002	EtherCAT Slave imported from Slave XML: AMAX-5000_v2.3.xml Device: AMAX-5015	
	MAX-5017C		Advantech Co., Ltd.	Revision=16#00021002	EtherCAT Slave Imported from Slave XML: AMAX-5000_v2.3.xml Device: AMAX-5017C	
	MAX-5017V		Advantech Co., Ltd.	Revision=16#00031002	EtherCAT Slave imported from Slave XML: AMAX-5000_v2.3.xml Device: AMAX-5017V	
	MAX-5018		Advantech Co., Ltd.	Revision=16#00001002	EtherCAT Slave Imported from Slave XML: AMAX-5000_v2.3.xml Device: AMAX-5018	
	MAX-5024		Advantech Co., Ltd.	Revision=16#00001002	EtherCAT Slave imported from Slave XML: AMAX-5000_v2.3.xml Device: AMAX-5024	
	MANAX-SUST & DI MOULE.	di Timaatama	Advantech Co., Ltd.	Revision=16#00000002	EtherCAT Slave Imported from Slave XML: AMAX 5000_V2.5.Xml Device: AMAX-5051 8 D1 Module.	
	MAX-5052 16 DI Module	or ninestanp	Advantech Co., Ltd.	Revision=16#00001001	EtherCAT Slave imported from Slave XML: AMAX-5000_V2.3.xml Device: AMAX-50511 6-0101 With 2-011 Intestamp	
	MAX-5056 8 DO Module		Advantech Co., Ltd.	Revision=16#00000001	Ether CAT Slave imported from Slave XML: AMAX-5000_22.3.xml Device: AMAX-5052.10.01 Module.	
	MAX-505650 8 DO Module.		Advantech Co., Ltd.	Revision = 16#00010002	Ether CAT Slave imported from Slave XMI : AMAX-5000_22.3.xml Device: AMAX-5056S0 8 DO Module.	
	AMAX-5056T 2-ch Do Timesta	amp	Advantech Co., Ltd.	Revision=16#00001001	EtherCAT Slave imported from Slave XML: AMAX-5000 v2.3.xml Device: AMAX-5056T 2-ch Do Timestamp	
	AMAX-5057 16 DO Module.		Advantech Co., Ltd.	Revision=16#0000002	EtherCAT Slave imported from Slave XML: AMAX-5000 v2.3.xml Device: AMAX-5057 16 DO Module.	
	AMAX-5057SO 16 DO Module	e.	Advantech Co., Ltd.	Revision=16#00010002	EtherCAT Slave imported from Slave XML: AMAX-5000_v2.3.xml Device: AMAX-5057SO 16 DO Module.	
	MAX-5074		Advantech Co., Ltd.	Revision=16#00000004	EtherCAT Slave imported from Slave XML: AMAX-5000_v2.3.xml Device: AMAX-5074	
	MAX-5080		Advantech Co., Ltd.	Revision=16#00000005	EtherCAT Slave imported from Slave XML: AMAX-5000_v2.3.xml Device: AMAX-5080	
÷-0	Advantech Co., Ltd WISE-5000	0 Series EtherCAT I/O Module				
) 🕫 - 🕻	Delta Electronics, Inc.					
						F.
Group by cated	nory 🔲 Display all versions (for e	experts only) 🔲 Display or	tdated versions			_
Name: Al	MAX-5001 Advantach Co., Ltd					
Categori	ies: Slave					
Version: Order Nu	Revision=16#00000004					
Descript	ion: EtherCAT Slave imported from S	Slave XML: AMAX-5000_v2.3.>	ml Device: AMAX-5001			
Append selecte	d device as last child of					
EtherCAT_Mast	er					
(You can se	lect another target node in the nav	vigator while this window is o	open.)			
						_
					Add Device C	lose

Then the specified IO module will be added into the Backplane.

Devices	→ ₽ X	AMAX_5001	×			
AMAX-5000 project AMAX-5000 project Avantech Control x86 RTE V3 x64)	-	General	Address		Additional	Ethore
PLC Logic		FMMU/Sync	AutoInc address EtherCAT address	0	Expert settings Optional	Ether CAI .
Library Manager PLC_PRG (PRG)		Process Data	Distributed Clock			
		Startup Parameters				
MainTask		Log EtherCAT I/O Manning				
EtherCAT_Master (EtherCAT Master)		EtherCAT IEC Objects				
		Status				
		Information				

Note!

If user inserts I/O modules manually, user has to configure the AMAX-5000 I/O modules to map to the same sequence physically. And suggest user do scanning again and checking the box of **Show differences to project** to compare and adjust the I/O system.

canned Devices			Configu	red Devices		
Device name	Device type	Alias Address		Device name	Device type	
AMAX_5001	AMAX-5001	8		AMAX_5001	AMAX-5001	
	AMAX-5051 8 DI Module.	1				
AMAX_5057SO	AMAX-5057SO 16 DO Module.	1304	ļļ,			
	AMAX-5056 8 DO Module.	3				
- AMAX_5015	AMAX-5015	19				
	AMAX-5017V	121				
			×			
			×ŗ			

5.2.3. Map Variables to I/O Modules

In this section, we want to discuss how to map variable of program to Advantech I/O modules. For more details on creating a new program please refer to <u>Chapter 3</u>. Here, we declare *bValue* in declaration part and set true in body part.

PRO	RAM PLC_PRG
VAR	
	bValue: BOOL;
END	VAR

bValue:= true;

Note!

If the program will be used to access the EtherCAT IO, the program need to be under the **EtherCAT_Task**, this task will synchronize with the EtherCAT Master



Open **Device Editor** by double clicking the device name in the device tree. Double-click on the variable column and choose mapping variable by clicking the button. In this example, we try to map the variable (*bValue*) to channel 0, so we double-click on the first row of variable column.

General	Find		Filter Show	all			•
EMMLI/Sync	Variable	Mapping	Channel	Address	Туре	Unit	Description
, interprise	Top		DO0	%QX1.0	BIT		DO0
Process Data	* ø		DO1	%QX1.1	BIT		DO1
	*		DO2	%QX1.2	BIT		DO2
.og	* ø		DO3	%QX1.3	BIT		DO3
	· · · · · · · · · · · · · · · · ·		DO4	%QX1.4	BIT		DO4
EtherCAT I/O Mapping	* ø		DO5	%QX1.5	BIT		DO5
	* @		DO6	%QX1.6	BIT		DO6
therCAT IEC Objects	* @		DO7	%QX1.7	BIT		DO7
Statue	* @		DO8	%QX2.0	BIT		DO8
latus	[*] @		DO9	%QX2.1	BIT		DO9
information	* @		DO 10	%QX2.2	BIT		DO10
			DO11	%QX2.3	BIT		DO11
	* @		DO12	%QX2.4	BIT		DO12
			DO13	%QX2.5	BIT		DO13
	* @		DO14	%QX2.6	BIT		DO14
	· · · · · · · · · · · · · · · · ·		DO15	%QX2.7	BIT		DO15

It will open the **Input Assistant Dialog**, where you can choose one of available variables for the current digital output channel.

nput Assistant		and the second			×
Text Search Categories					
Variables	 Name 	Туре	Address	Origin	
	Application	Application PROGRAM			
	<pre></pre>	BOOL			
Structured view	 ● U DED ● Ø IoConfig_Globals 	Library VAR_GLOBAL	Filter	CAA Device Diagnosis	•
Documentation		√ Insert v	with arguments	Insert with namespace p	refix
bValue: BOOL(VAR)					*
				ОК Са	ncel

Now, we can download the application by performing command **Login** and then performing command **Start**. The channel-0 of I/O module will be lit up.

Variable	Mapping	Channel	Address	Туре		Current Value	Prepared Value	Unit	Description	
Application.PLC_PRG.bValue	~ >	DO0	%QX3.0	BIT	TRUE				DO0	
**		DO1	%QX3.1	BIT	FALSE				DO1	
* @		DO2	%QX3.2	BIT	FALSE				DO2	
* ø		DO3	%QX3.3	BIT	FALSE				DO3	
* ø		DO4	%QX3.4	BIT	FALSE				DO4	
* ø		DO5	%QX3.5	BIT	FALSE				DO5	
* ø		DO6	%QX3.6	BIT	FALSE				DO6	
* @		DO7	%QX3.7	BIT	FALSE				D07	

Note!

If the Advantech modules are correctly configured, it will show a green circle icon \Im next to the device name in the device tree. If it shows a red triangle \blacktriangle , see <u>Chapter 8</u> for troubleshooting.



5.2.4. Support List

Advantech provides 16 types of AMAX-5000 I/O modules for various applications so far. Following table is the I/O modules support list. In the following section, we will introduce I/O modules according to their types.

Module	Name	Specification	Reference
Power Input &	AMAX-5001	Power Input with 4-ch DI	Isolated
Coupler	AMAX-5074	Power Input & Coupler with ID	Isolated
	AMAX-5015	4-ch RTD Input	Isolated
	AMAX-5017C	6-ch AI /Current Type	Isolated
Analog Input	AMAX-5017V	6-ch AI /Voltage Type	Isolated
	AMAX-5018	6-ch Thermocouple Input	Isolated
Analog Output	AMAX-5024	4-ch AO	Isolated
Digital Input	AMAX-5051	8-ch DI w/LED	Isolated
	AMAX-5051T	2-ch DI w/Timestamp, 6-ch DI	Isolated
	AMAX-5052	16-ch DI w/LED	Isolated
Digital Output	AMAX-5056	8-ch DO (sink) w/LED	Isolated
	AMAX-5056SO	8-ch DO (source) w/LED	Isolated
	AMAX-5056T	2-ch DO (sink) w/Timestamp	Isolated
	AMAX-5057	16-ch DO (sink) w/LED	Isolated
	AMAX-5057SO	16-ch DO (source) w/LED	Isolated
Counter	AMAX-5080	2-ch Counter/Encoder 32-bit	Isolated

5.2.5. EtherCAT Slave Modules Configuration

Advantech AMAX-5000 IO modules follow the standard EtherCAT slave stack and can be identified as standard EtherCAT slave modules under CODESYS. This section is to introduce the general setting for EtherCAT slave modules. And user can also refer to the CODESYS on line help for more detail.

P Help	
🚱 Back 💿 🛃 🍓 Contents 🔂 Index 🔍 Search 🕼	
Contents 👻 🕂 🗙	EtherCAT Slave
🕀 🔶 CODESYS Development System	
🚊 🔟 Fieldbus Support	EtherCAT Configurator > EtherCAT Slave
Device Diagnostics	
CAN-Based Fieldbuses	EtherCAT Slave
EtherCAT Configurator	
Getting Started with Commissioning an EtherCAT Network	
Tab 'EtherCAT Master - General'	Tab 'EtherCAT Slave - General'
Tab 'EtherCAT Master - Sync Unit Assignment'	
Tab 'EtherCAT Master - Parameters'	 Tab 'EtherCAT Slave - FMMU/Sync'
EtherCAT Slave	 Tab 'EtherCAT Slave - Expert Mode Process Data'
Tab 'EtherCAT Slave - General'	Tab 'EtherCAT Slave - Process Data'
Tab EtherCAT Slave - Expert Mode Process Data	
🖬 Tab 'EtherCAT Slave - Process Data'	 Tab 'EtherCAT Slave - Startup Parameters'
Tab 'EtherCAT Slave - Startup Parameters'	 Tab 'EtherCAT Slave - Safety Diagnosis'
Tab 'EtherCAT Slave - Safety Diagnosis' Tab 'EtherCAT Slave - Diagnostics History'	 Tab 'EtherCAT Slave - Diagnostics History'
Tab 'EtherCAT Slave - Online'	Tab 'EtherCAT Slave - Online'
Tab 'EtherCAT Slave - CoE Online'	
Tab 'EtherCAT Slave - Parameters'	 Tab 'EtherCAT Slave - CoE Online'
EtherCAT Module	 Tab 'EtherCAT Slave - Parameters'
EtherCAT Gateways	Tab 'EtherCAT Slave - EoE Settings'
EtherCAT-Specific Variables	Ŭ
Bus Cycle Task - EtherCAT	
Command 'Scan for Devices'	
Ulagnostics and Error Correction	
EtherNet/IP Configurator	
Ethernet Adapter Configurator	
🗄 🚸 IO-Link Configurator	
🗄 🍢 Modbus Configurator	
PROFIBUS DP Configurator	
H-> PROFINET Configurator	
Puntime Systems, OPC IIA Server	
CODESYS Application Composer	
CODESYS Store	
EODESYS Visualization	
🗄 📎 Libraries	
Glossary	
Advantech	
Harris Aud-ons	

Double click the target EtherCAT slave object under the tree of EtherCAT Master, the device editor will be shown as below:

MAX_5017V X				
General	Address		Additional	
FMMU/Sync	AutoInc address EtherCAT address	-5	Expert settings Optional	Ether CAT
Process Data	Distributed Clock			
Startup Parameters				
Log				
EtherCAT I/O Mapping				
EtherCAT IEC Objects				
Status	_			
Information				

In this dialog window, user can easily identify the EtherCAT address has been assigned automatically. And all the information is from device description file. User can also unfold the **Distributed Clock** option to change the related setting. Usually user can directly go the **EtherCAT I/O Mapping** tab to map variables to the physical I/O.

eneral	Find		Filter Show	all			- ÷.	Add F
MMU/Sync	Variable	Mapping	Channel	Address	Туре	Unit	Description	
	🖽 🦄		AI0	%IW58	UINT		AIO	
rocess Data	🖷 - 🍫		AI1	%IW60	UINT		AI1	
			AI2	%IW62	UINT		AI2	
tartup Parameters	🖷 - 🏘		AI3	%IW64	UINT		AI3	
	- 		AI4	%IW66	UINT		AI4	
og	🗉 🍫		AI5	%IW68	UINT		AI5	
tatus								

If user needs additional setting for the startup checking and time monitoring, the Expert

Process Data option can be selected. However, for standard applications, auto-configuration is sufficient.

MAX_5017V X				
General	Address		- Additional	
FMMU/Sync	AutoInc address -5 EtherCAT address 1006	× v	Expert settings Optional	Etner CAT
Expert Process Data	Distributed Clock			
Process Data	> Startup Checking		Dimeouts	
Startup Parameters	DC Cyclic Unit Control: As Watchdog	sign to Local µC		
Log	Identification			
EtherCAT I/O Mapping	 Disabled 			
EtherCAT IEC Objects	Configured station alias (AE	00 0x0012)	Value	121
Status	Explicit device identification	(ADO 0x0134)		
Information	🔘 Data Word (2 Bytes)		ADO (hex)	16#0

Some AMAX-5000 modules support various working modes, and need user to specify the working parameters. For example, setting the range code or sample rate for analogue input modules. These parameters can only be set while the module is on-line. To achieve this, please click the **Login** and check the **Expert settings** option, and then check the **CoE Online** tab as show below. For each function of individual module, please refer to AMAX-5000 user's manual.

eneral	Read Objects	Auto update 💿 Offline from E	SI file 🔘	Online from devi	ice
Expert Process Data	Index:Subindex	Name	Flags	Туре	Value
	16#1000:16#00	Device type	RO	UDINT	
Process Data	16#1001:16#00	Error register	RO	USINT	
	16#1008:16#00	Device name	RO	STRING(10)	
Startup Parameters	16#1009:16#00	Hardware version	RO	STRING(2)	
Online	16#100A:16#00	Software version	RO	STRING(5)	
onine	16#1018:16#00	Identity			
CoF Online	■ 16#10F1:16#00	Error Settings			
	16#10F8:16#00	Timestamp Object	RW	ULINT	
Log	I6#1A00:16#00	Analog Input Channel 0 process data mapping			
	■ 16#1A01:16#00	Analog Input Channel 1 process data mapping			
EtherCAT I/O Mapping	I6#1A02:16#00	Analog Input Channel 2 process data mapping			
	■ 16#1A03:16#00	Analog Input Channel 3 process data mapping			
EtherCAT IEC Objects	. 16#1A04:16#00	Analog Input Channel 4 process data mapping			
	■ 16#1A05:16#00	Analog Input Channel 5 process data mapping			
Status	. 16#1C00:16#00	Sync manager type			
		SyncManager 2 assignment			
Information		SyncManager 3 assignment			
	■ 16#1C33:16#00	SM input parameter			
	i= 16#6000:16#00	Analog Input Channel 0			
	:16#11	AIO	RO	UINT	
	■ 16#6010:16#00	Analog Input Channel 1			
	■ 16#6020:16#00	Analog Input Channel 2			
	■ 16#6030:16#00	Analog Input Channel 3			
	■ 16#6040:16#00	Analog Input Channel 4			
	■ 16#6050:16#00	Analog Input Channel 5			
		Analog Input Channel 0 Config Reg.			
	:16#11	AI0 Range	RW	UINT	
	■ 16#8010:16#00	Analog Input Channel 1 Config Reg.			
	· 	Analog Input Channel 2 Config Reg.			
	■ 16#8030:16#00	Analog Input Channel 3 Config Reg.			
	· 	Analog Input Channel 4 Config Reg.			
		Analog Input Channel 5 Config Reg.			
	■ 16#F000:16#00	Modular Profile			
	■ 16#F600:16#00	Module Configuration			
	:16#01	LocateModule	RW	BOOL	
			DW	LINT	

In the **Online** tab, user can change the State Machine of modules and update the firmware. To update the firmware, user has to click the **Bootstrap** button to change the state machine to be **Bootstrap** mode. Then click the Download button and select the target file to download. To prevent the human error, user has the enter password to proceed the download. The default password (Hex) is **"55aa55aa".** After finishing the download, please click **Init** button to switch the State Machine to Initial mode, the firmware will be updated automatically in the device. Please wait for 5 seconds and reset the device by **Online** → **Reset Origin**. The device will come back to **operational** mode.

Device MAMAX_5017	/ x
General Expert Process Data Process Data	State Machine Bootstrap Current state Operational Pre-Op Safe-Op Requested State Operational
Startup Parameters	File access over EtherCAT
Online	Download Upload
CoE Online	E ² PROM Access Write E ² PROM Write E ² PROM XML
Log	
EtherCAT I/O Mapping	
EtherCAT IEC Objects	
Status	
Information	

After the firmware update, please go back to CoE Online to check if the correct version is updated.

🔼 Device 🛛 🔂 AMAX_	5017V X				
General	Read Object	s 📄 Auto update 💿 Offline from	ESI file \tag	Online from de	evice
Expert Process Data	Index:Subindex	Name	Flags	Туре	Value
	16#1001:16#00	Error register	RO	USINT	0
Process Data	16#1008:16#00	Device name	RO	STRING	'AMAX-5017V'
	16#1009:16#00	Hardware version	RO	STRING	'A1'
Startup Parameters	16#100A:16#00	Software version	RO	STRING	'V1.09'
Online		Identity	RO	USINT	4
Unline	I6#10F1:16#00	Error Settings	RO	USINT	2
CoE Online	16#10F8:16#00	Timestamp Object	RW	ULINT	92306619584962
	I6#1A00:16#00	Analog Input Channel 0 process data mapping	RO	USINT	3
Log	. 16#1A01:16#00	Analog Input Channel 1 process data mapping	RO	USINT	3
	I6#1A02:16#00	Analog Input Channel 2 process data mapping	RO	USINT	3
EtherCAT I/O Mapping	. ±- 16#1A03:16#00	Analog Input Channel 3 process data mapping	RO	USINT	3
	I6#1A04:16#00	Analog Input Channel 4 process data mapping	RO	USINT	3
EtherCAT IEC Objects	16#1A05:16#00	Analog Input Channel 5 process data mapping	RO	USINT	3
	I6#1C00:16#00	Sync manager type	RO	USINT	4
Status	16#1C12:16#00	SyncManager 2 assignment	RO	USINT	0
	■ 16#1C13:16#00	SyncManager 3 assignment	RO	USINT	6
Information	I6#1C33:16#00	SM input parameter	RO	USINT	32
	€ 16#6000:16#00	Analog Input Channel 0	RO	USINT	17
		Analog Input Channel 1	RO	USINT	17
	16#6020:16#00	Analog Input Channel 2	RO	USINT	17
	€ 16#6030:16#00	Analog Input Channel 3	RO	USINT	17
	16#6040:16#00	Analog Input Channel 4	RO	USINT	17
	± 16#6050:16#00	Analog Input Chappel 5	RO	LISINT	17

5.2.6. Digital Input Modules

In this section, we are going to introduce AMAX-5000 digital input modules, and take AMAX-5051 as example. The **device editor** dialog window can be opened by double clicking the device name in the device tree.

In the **General tab**, user can easily identify the EtherCAT address has been assigned automatically. And all the information is from device description file. User can also unfold the **Distributed Clock** option to change the related setting. Usually user can directly go the **EtherCAT I/O Mapping** tab to map variables to the physical I/O.

General	Address			- Additional		
Deserve Data	AutoInc address	-3	*	Expert s	ettings	Ether CAT.
Process Data	EtherCAT address	1004	*	Optional		
Log	▲ Distributed Clock					
EtherCAT I/O Mapping	Select DC	SM-Synch	ron		•	
EtherCAT IEC Objects	Enable	4000	Sync u	nit cycle (µs)		
Chathan	Sync0					
Status	Enable Sync 0					
Information	Sync unit cycle	x 1	~	4000	Cycle time (µs)	
	User-defined			0	Shift time (µs)	
	Sync1					
	Enable Sync 1					
	Sync unit cycle	x 1	-	4000	Cycle time (µs)	
	O User-defined			0	Shift time (µs)	

General	Find		Filter Show	all			- 🕂 Ad	d FB for IO Channel → Go to Instanc
Process Data	Variable	Mapping	Channel	Address	Туре	Unit	Description	
locess bata			DI0	%IX112.0	BIT		DIO	
og	🍬		DI1	%IX112.1	BIT		DI1	
-	* >		DI2	%IX112.2	BIT		DI2	
therCAT I/O Mapping	* >		DI3	%IX112.3	BIT		DI3	
	* >		DI4	%IX112.4	BIT		DI4	
therCAT IEC Objects	¥ø		DI5	%IX112.5	BIT		DI5	
			DI6	%IX112.6	BIT		DI6	
status	· · · · · · · · · · · · · · · · ·		DI7	%IX112.7	BIT		DI7	
Information								

Variable: Double click the column and select the proper variable for mapping.

Mapping: The mapping status of each variable.

Address: The starting physical address of the variables for this I/O group. The board shown below has 8 digital inputs. This will require either 8 Boolean addresses.

Note!

Meaning of address expression:

% = Directly Mapped variable

I = Physical Input

X = Single bit

\$(N1). \$(N2) = Starting address. The first number means the starting byte; the second number means the starting bit.

Type: The data type of each variable.

Unit: Reserved Column

Description: The description of each variable.

User can also Login to be on-line and check the status of modules.

Seneral	Address	Additional	
Process Data	AutoInc address -3	Expert settings	Ether CAT
	EtherCAT address 1004	Optional	
LOG	Distributed Clock		
EtherCAT I/O Mapping	Diagnostics		
EtherCAT IEC Objects	Current State Operational		
Status			
Information			

AMAX_505	51 X								
General	Find		Filter Sho	w all		- + A	dd FB for IO Chanr	iel →	Go to Instance
Process Data	Variable	Mapping	Channel	Address	Type	Current Value	Prepared Value	Unit	Description
	r ᡟ		DIO	%IX112.0	BIT	FALSE			DIO
Log	**		DI1	%IX112.1	BIT				DI1
	*		DI2	%IX112.2	BIT				DI2
EtherCAT I/O Mapping			DI3	%IX112.3	BIT				DI3
			DI4	%IX112.4	BIT				DI4
EtherCAT IEC Objects	* >		DI5	%IX112.5	BIT				DI5
	* >		DI6	%IX112.6	BIT				DI6
Status	*		DI7	%IX112.7	BIT				DI7
Information									

5.2.7. Digital Output Modules

In this section, we are going to introduce AMAX-5000 digital output modules, and take AMAX-5057SO as example. The **device editor** dialog window can be opened by double clicking the device name in the device tree.

In the **General tab**, user can easily identify the EtherCAT address has been assigned automatically. And all the information is from device description file. User can also unfold the **Distributed Clock** option to change the related setting. Usually user can directly go the **EtherCAT I/O Mapping** tab to map variables to the physical I/O.

AMAX_50	05750 X							
General	Address			Additional –				
Process Data	AutoInc address	-4	×	Expert se	ttings	EtherCAT.		
	EtherCAT address	1005	×	Optional				
Log	▲ Distributed Clock							
EtherCAT I/O Mapping	Select DC	SM-Synchr	on		•			
EtherCAT IEC Objects	Enable	4000	Sync u	nit cycle (µs)				
Status	Sync0							
	Enable Sync 0			1000				
Information	Sync unit cycle	× 1	Ŧ	4000	Cycle time (µs)			
	 User-defined 			0	Shift time (µs)			
	Sync1							
	Enable Sync 1							
	Sync unit cycle	x 1	-	4000	Cycle time (µs)			
	User-defined			0	Shift time (µs)			
General	Find	all	- ⊕ Add					
----------------------	------------	---------	---------	---------	------	------	-------------	--
Process Data	Variable	Mapping	Channel	Address	Туре	Unit	Description	
			DO0	%QX2.0	BIT		DO0	
Log	* ø		DO1	%QX2.1	BIT		DO1	
	· *>		DO2	%QX2.2	BIT		DO2	
EtherCAT I/O Mapping	···· **		DO3	%QX2.3	BIT		DO3	
	*		DO4	%QX2.4	BIT		D04	
EtherCAT IEC Objects	🍫		DO5	%QX2.5	BIT		DO5	
			DO6	%QX2.6	BIT		DO6	
Status	* ø		D07	%QX2.7	BIT		D07	
Tefermation	**		DO8	%QX3.0	BIT		DO8	
Information	* ø		DO9	%QX3.1	BIT		DO9	
	*		DO 10	%QX3.2	BIT		DO10	
	* @		DO11	%QX3.3	BIT		DO11	
	····· **		DO12	%QX3.4	BIT		DO12	
	* ø		DO13	%QX3.5	BIT		DO13	
	🍫		DO14	%QX3.6	BIT		DO14	
			DO15	%QX3.7	BIT		DO15	

Variable: Double click the column and select the proper variable for mapping.

Mapping: The mapping status of each variable.

Address: The starting physical address of the variables for this I/O group. The board shown below has 8 digital inputs. This will require either 8 Boolean addresses.

Note!

Meaning of address expression:

% = Directly Mapped variable

Q = Physical Output

X = Single bit

\$(N1). \$(N2) = Starting address. The first number means the starting byte; the second number means the starting bit.

Type: The data type of each variable.

Unit: Reserved Column

Description: The description of each variable.

User can also Login to be on-line and check the status of modules.

General	Address	Additional	
Nessee Data	AutoInc address -4	Expert settings	Ether CAT
TOLESS Data	EtherCAT address 1005	Optional	
.og	Distributed Clock		
therCAT I/O Mapping	Diagnostics		
therCAT IEC Objects	Current State Operational		
itatus			
nformation			

🔼 Device 🛛 🗃 AMAX_	505750 X								
General	Find		Filter Show	all		- ÷.	Add FB for IO Char	nnel	Go to Instand
Process Data	Variable	Mapping	Channel	Address	Туре	Current Value	Prepared Value	Unit	Description
Hotess Data	- *		DO0	%QX2.0	BIT	FALSE			DO0
Log	* ø		DO1	%QX2.1	BIT				DO1
	· · · · · · · · · · · · · · · · ·		DO2	%QX2.2	BIT				DO2
EtherCAT I/O Mapping	*>		DO3	%QX2.3	BIT				DO3
	* ø		DO4	%QX2.4	BIT				DO4
EtherCAT IEC Objects	*>		DO5	%QX2.5	BIT				DO5
	*		DO6	%QX2.6	BIT				DO6
Status	*>		DO7	%QX2.7	BIT				DO7
Tefermetica	* @		DO8	%QX3.0	BIT				DO8
Information	🍫		DO9	%QX3.1	BIT				DO9
	🍫		DO 10	%QX3.2	BIT				DO10
	* @		DO11	%QX3.3	BIT				DO11
	* @		DO12	%QX3.4	BIT				DO12
	* @		DO13	%QX3.5	BIT				DO13
	* ø		DO14	%QX3.6	BIT				DO14
			DO15	%QX3.7	BIT				DO15

5.2.8. Analog Input Modules

In this section, we are going to introduce AMAX-5000 Analog input modules, and take AMAX-5017V as example. The **device editor** dialog window can be opened by double clicking the device name in the device tree.

In the **General tab**, user can easily identify the EtherCAT address has been assigned automatically. And all the information is from device description file. User can also unfold the **Distributed Clock** option to change the related setting. Usually user can directly go the **EtherCAT I/O Mapping** tab to map variables to the physical I/O.

Seneral	Address		Additional	[though a]
Process Data	AutoInc address	-5	Expert settings	EtherCAT.
	EtherCAT address	1006	Optional	
Startup Parameters	Distributed Clock			
Log	Select DC	SM-Synchron	•	
EtherCAT I/O Mapping	Enable	4000 Sync	unit cycle (µs)	
EtherCAT IEC Objects	Sync0			
Status	Sync unit cycle	-	0 A Cycle tim	e (µs)
Information	User-defined		0 A Shift time	e (µs)
	Sync1			
	Enable Sync 1			
	Sync unit cycle	-	0 Cycle tim	e (µs)
	O User-defined		0 🔶 Shift time	e (µs)

General	Find		Filter Show	all			- 🕂 Add	FB fo
Process Data	Variable	Mapping	Channel	Address	Туре	Unit	Description	
110ccss bata	🖷 – 🦘		AI0	%IW58	UINT		AIO	
Startup Parameters	😟 🍫		AI1	%IW60	UINT		AI1	
	🕸		AI2	%IW62	UINT		AI2	
Log	😟 - 🍫		AI3	%IW64	UINT		AI3	
	😐 🐐		AI4	%IW66	UINT		AI4	
EtherCAT I/O Mapping	😐 🍫		AI5	%IW68	UINT		AI5	
Status								
Information								

Variable: Double click the column and select the proper variable for mapping.

Mapping: The mapping status of each variable.

Address: The starting physical address of the variables for this I/O group. The board shown below has 6 analog inputs. This will require 6 WORD addresses.

Note!

Meaning of address expression:

% = Directly Mapped variable

I = Physical Input

W = Word (16 Bits)

\$(N) = Starting address.

Type: The data type of each variable.

Unit: Reserved Column

Description: The description of each variable.

User can also Login to be on-line and check the status of modules.

AMAX_50	17V X		
General	Address	Additional	
Process Data	AutoInc address -5 EtherCAT address 1006	Expert settings	EtherCAT.
Startup Parameters	Distributed Clock		
Log	Diagnostics		
EtherCAT I/O Mapping	Current State Operational		
EtherCAT IEC Objects			
Status			
Information			

Device MAMAX_50	117V X										
General	Find		Filter Show	all		🔹 🕂 Add FB for IO Channel 🏓 Go to Instance					
Process Data	Variable	Mapping	Channel	Address	Туре	Current Value	Prepared Value	Unit	Description		
			AIO	%IW58	UINT	0			AIO		
Startup Parameters	🖷 - 🍫		AI1	%IW60	UINT	0			AI1		
	1 - N		AI2	%IW62	UINT	0			AI2		
Log	🕮 - 🏷		AI3	%IW64	UINT	0			AI3		
51 01710 H	₩ ₩		AI4	%IW66	UINT	0			AI4		
EtherCAT 1/O Mapping	· · · · *>		AI5	%IW68	UINT	0			AI5		
EtherCAT IEC Objects Status Information											

If user would like to change the working parameter of module, please select the **Expert** settings in the **General** tab, and click the **CoE Online** tab.

Seneral	Read Objects	Auto update 💿 Offline from I	ESI file 💿	Online from dev	ice
Expert Process Data	Index:Subindex	Name	Flags	Туре	Value
	16#1000:16#00	Device type	RO	UDINT	5001
Process Data	16#1001:16#00	Error register	RO	USINT	0
	16#1008:16#00	Device name	RO	STRING(10)	'AMAX-5017V'
Startup Parameters	16#1009:16#00	Hardware version	RO	STRING(2)	'A1'
D-li	16#100A:16#00	Software version	RO	STRING(5)	'V1.09'
Jnine	■ 16#1018:16#00	Identity			
CoE Online		Error Settings			
cor online	16#10F8:16#00	Timestamp Object	RW	ULINT	81096813555520
.00		Analog Input Channel 0 process data mapping			
-	■ 16#1A01:16#00	Analog Input Channel 1 process data mapping			
EtherCAT I/O Mapping	± 16#1A02:16#00	Analog Input Channel 2 process data mapping			
	■ 16#1A03:16#00	Analog Input Channel 3 process data mapping			
EtherCAT IEC Objects	± 16#1A04:16#00	Analog Input Channel 4 process data mapping			
	■ 16#1A05:16#00	Analog Input Channel 5 process data mapping			
Status	± 16#1C00:16#00	Sync manager type			
	16#1C12:16#00	SyncManager 2 assignment			
Information		SyncManager 3 assignment			
	■ 16#1C33:16#00	SM input parameter			
	= 16#6000:16#00	Analog Input Channel 0			
	:16#11	AIO	RO	UINT	48
	± 16#6010:16#00	Analog Input Channel 1			
	16#6020:16#00	Analog Input Channel 2			
	± 16#6030:16#00	Analog Input Channel 3			
	16#6040:16#00	Analog Input Channel 4			
	16#6050:16#00	Analog Input Channel 5			
	□ 16#8000:16#00	Analog Input Channel 0 Config Reg.			
	:16#11	AI0_Range	RW	UINT	0~10 V
	16#8010:16#00	Analog Input Channel 1 Config Reg.			+/-150 mV
	16#8020:16#00	Analog Input Channel 2 Config Reg.			+/-500 mV
	16#8030:16#00	Analog Input Channel 3 Config Reg.			0~150 mV
	16#8040:16#00	Analog Input Channel 4 Config Reg.			+/-1 V
	16#8050:16#00	Analog Input Channel 5 Config Reg.			+/-5 V +/-10 V
	H 16#F000;16#00	Modular Profile			0~1V

Select the target parameters from the table and double click the **Value** column. Select the target settings from the drop-down manual.

5.2.9. Analog Output Modules

In this section, we are going to introduce AMAX-5000 Analog output modules, and take AMAX-5024 as example. The **device editor** dialog window can be opened by double clicking the device name in the device tree.

In the **General tab**, user can easily identify the EtherCAT address has been assigned automatically. And all the information is from device description file. User can also unfold the **Distributed Clock** option to change the related setting. Usually user can directly go the **EtherCAT I/O Mapping** tab to map variables to the physical I/O.

Device MAX_S	5024 ×					
General	Address			Additional –		F 11 e e
Process Data	AutoInc address	-6	×	Expert se	ttings	Ether CAT
Process Data	EtherCAT address	1007	A.V.	Optional		
Startup Parameters	▲ Distributed Clock					
Log	Select DC	SM-Synchr	on		•	
EtherCAT I/O Mapping	Enable	4000	Sync u	nit cycle (µs)		
EtherCAT IEC Objects	Sync0 Enable Sync 0					
Status	Sync unit cycle		-	0	Cycle time (µs)	
Information	O User-defined			0	Shift time (µs)	
	Sync1					
	Enable Sync 1					
	Sync unit cycle		T	0	Cycle time (µs)	
	User-defined			0	Shift time (µs)	

General	Find		Filter Show all	- 🕂 Add FB fo			
Process Data	Variable	Mapping	Channel	Address	Туре	Unit	Description
Toccoo Data	🕀 🍢		AO0	%QW3	UINT		AOD
Startup Parameters	😐 - 🍫		AO1	%QW5	UINT		AO1
			AO2	%QW7	UINT		AO2
.og	🕀 - 🍫		AO3	%QW9	UINT		AO3
			AO0_BurnOut	%IX138.0	BIT		AO0_BurnOut
therCAT I/O Mapping	😟 🧤		AO0	%IW70	UINT		AO0
	* ø		AO1_BurnOut	%IX142.0	BIT		AO1_BurnOut
therCAT IEC Objects	😟 - 🦄		AO1	%IW72	UINT		AO1
			AO2_BurnOut	%IX146.0	BIT		AO2_BurnOut
atus	😟 - 🍫		AO2	%IW74	UINT		AO2
formation	* ø		AO3_BurnOut	%IX150.0	BIT		AO3_BurnOut
	😟 - 🍫		AO3	%IW76	UINT		AO3

Variable: Double click the column and select the proper variable for mapping.

Mapping: The mapping status of each variable.

Address: The starting physical address of the variables for this I/O group. The board shown below has 4 analog outputs. This will require 4 WORD addresses.

Note!

Meaning of address expression:

% = Direct Mapped variable

Q = Physical Output

W = Word (16 Bits)

\$(N) = Starting address.

Type: The data type of each variable.

Unit: Reserved Column

Description: The description of each variable.

Note!

AMAX-5024 support AO read back function; please use the %IWxx to watch the real output of the module. For example, if users setup a slow slew rate of AO, user can use this variable to check the current real output value in each cycle.

User can also Login to be on-line and check the status of modules.

Seneral	Address		— Additional —	
Process Data	AutoInc address EtherCAT address	-6 ×	Expert settings	EtherCAT.
Startup Parameters	Distributed Clock			
Log	Diagnostics			
EtherCAT I/O Mapping	Current State	Operational		
EtherCAT IEC Objects				
Status				
Information				

General	Find		Filter Show all			 Add FB for IO Channel Go to Instance 				
Process Data	Variable	Mapping	Channel	Address	Туре	Current Value	Prepared Value	Unit	Description	
FIOCESS Data	⊞- * ⊘		AO0	%QW3	UINT	0			AO0	
Startup Parameters	🖽 - 🍢		AO1	%QW5	UINT	0			AO1	
			AO2	%QW7	UINT	0			AO2	
_og	😟 🍢		AO3	%QW9	UINT	0			AO3	
	· *>		AO0_BurnOut	%IX138.0	BIT	FALSE			AO0_BurnOu	
EtherCAT I/O Mapping	🕮 ᡟ 🖗		AO0	%IW70	UINT	0			AO0	
	* >		AO1_BurnOut	%IX142.0	BIT	FALSE			AO1_BurnOu	
EtherCAT IEC Objects	🗎 - 🍫		AO1	%IW72	UINT	0			AO1	
Thatwa	¥ø		AO2_BurnOut	%IX146.0	BIT	FALSE			AO2_BurnOu	
Status	۰ ا		AO2	%IW74	UINT	0			AO2	
Information	*		AO3_BurnOut	%IX150.0	BIT	FALSE			AO3_BurnOu	
	😟 🍓		AO3	%IW76	UINT	0			AO3	

If user would like to change the working parameter of module, please select the **Expert settings** in the **General** tab, and click the **CoE Online** tab.

	read Objects	Auto update 💿 Offline from ESI file	Online	from device	
Expert Process Data	Index:Subindex	Name	Flags	Туре	Value
	16#1000:16#00	Device type	RO	UDINT	5001
Process Data	16#1001:16#00	Error register	RO	USINT	0
	16#1008:16#00	Device name	RO	STRING(9)	'AMAX-5024'
Startup Parameters	16#1009:16#00	Hardware version	RO	STRING(2)	'A1'
	16#100A:16#00	Software version	RO	STRING(5)	'V1.11'
Unline	16#1018:16#00	Identity			
CoE Online	■ 16#10F1:16#00	Error Settings			
JOE ONIME	16#10F8:16#00	Timestamp Object	RW	ULINT	8577884917237
00	± 16#1600:16#00	Analog Output Channel 0 process data mapping			
		Analog Output Channel 1 process data mapping			
therCAT I/O Mapping		Analog Output Channel 2 process data mapping			
		Analog Output Channel 3 process data mapping			
therCAT IEC Objects	■ 16#1A00:16#00	Read Analog Output Channel 0 process data mapping			
	■ 16#1A01:16#00	Read Analog Output Channel 1 process data mapping			
tatus	16#1A02:16#00	Read Analog Output Channel 2 process data mapping			
	■ 16#1A03:16#00	Read Analog Output Channel 3 process data mapping			
nformation		Sync manager type			
		SyncManager 2 assignment			
	■ 16#1C13:16#00	SyncManager 3 assignment			
		SM output parameter			
	■ 16#1C33:16#00	SM input parameter			
	16#6000:16#00	Read Analog Output Channel 0			
	16#6010:16#00	Read Analog Output Channel 1			
	16#6020:16#00	Read Analog Output Channel 2			
	16#6030:16#00	Read Analog Output Channel 3			
	16#7000:16#00	Analog Output Channel 0			
	16#7010:16#00	Analog Output Channel 1			
	16#7020:16#00	Analog Output Channel 2			
	16#7030:16#00	Analog Output Channel 3			
	= 16#8000:16#00	Analog Output Channel 0 Config Reg.			
	:16#02	AO0_EnSlewRate	RW	BOOL	False
	:16#11	AO0_Range	RW	UINT	0~10 V
	:16#15	AO0_SlewRate	RW	UINT	+/-5 V
	# 16#8010:16#00	Analog Output Channel 1 Config Reg.			+/-10 V
	16#8020:16#00	Analog Output Channel 2 Config Reg.			0~10 V
	€ 16#8030:16#00	Analog Output Channel 3 Config Reg.			4~20 mA
		Modular Profile			0~20 mA

Select the target parameters from the table and double click the **Value** column. Select the target settings from the drop-down manual.

5.2.10. Counter Modules

In this section, we are going to introduce AMAX-5000 Counter modules, and take AMAX-5080 as example. The **device editor** dialog window can be opened by double clicking the device name in the device tree.

In the **General tab**, user can easily identify the EtherCAT address has been assigned automatically. And all the information is from device description file. User can also unfold the **Distributed Clock** option to change the related setting. Usually user can directly go the **EtherCAT I/O Mapping** tab to map variables to the physical I/O.

General	Address			— Additional –		
	AutoInc address	-7	A.V.	Expert se	ttings	Ether CAT
Process Data	EtherCAT address	1008	*	Optional		
Startup Parameters	Distributed Clock					
Log	Select DC	SM-Synchron	1		•	
EtherCAT I/O Mapping	Enable	4000	Sync u	nit cycle (µs)		
EtherCAT IEC Objects	Sync0					
	Enable Sync 0					
Status	 Sync unit cycle 		-	0	Cycle time (µs)	
Information	O User-defined			0	Shift time (µs)	
	Sync1					
	Enable Sync 1					
	 Sync unit cycle 		-	0	Cycle time (µs)	
	User-defined			0	Shift time (µs)	

eneral	Find		Filter Show all		- 4	Add F	B for IO Channel → Go to
rocase Data	Variable	Mapping	Channel	Address	Туре	Unit	Description
ocess Data			CO0 Set Counter	%QX20.0	BIT		CO0 Set Counter
tup Parameters	* @		CO0 Enable Latch Z	%QX20.1	BIT		CO0 Enable Latch Z
			CO0_Enable_Latch_External	%QX20.2	BIT		CO0 Enable Latch External
g	*		Reserve 1	%QX20.3	BIT		Reserve1
			Reserve 1	%QX20.4	BIT		Reserve1
nerCAT I/O Mapping	*		Reserve 1	%QX20.5	BIT		Reserve1
	[*] @		Reserve 1	%QX20.6	BIT		Reserve1
herCAT IEC Objects	*		Reserve 1	%QX20.7	BIT		Reserve1
	* ø		Reserve2	%QX21.0	BIT		Reserve2
itus	* @		Reserve2	%QX21.1	BIT		Reserve2
ormation	* @		Reserve2	%QX21.2	BIT		Reserve2
ormation	*		Reserve2	%QX21.3	BIT		Reserve2
	* @		Reserve2	%QX21.4	BIT		Reserve2
	- *		Reserve2	%QX21.5	BIT		Reserve2
	🍫		Reserve2	%QX21.6	BIT		Reserve2
	*		Reserve2	%QX21.7	BIT		Reserve2
	÷		CO0_Set_Counter_Value	%QD6	UDINT		CO0_Set_Counter_Value
	🍫		CO1_Set_Counter	%QX28.0	BIT		CO1_Set_Counter
	*		CO1_Enable_Latch_Z	%QX28.1	BIT		CO1_Enable_Latch_Z
	* @		CO1_Enable_Latch_External	%QX28.2	BIT		CO1_Enable_Latch_External
	🍫		Reserve 1	%QX28.3	BIT		Reserve1
	*		Reserve 1	%QX28.4	BIT		Reserve 1
	* @		Reserve 1	%QX28.5	BIT		Reserve1
	*>		Reserve 1	%QX28.6	BIT		Reserve1
	*		Reserve 1	%QX28.7	BIT		Reserve1
	* ø		Reserve2	%QX29.0	BIT		Reserve2
	*>		Reserve2	%QX29.1	BIT		Reserve2
	· · · · · · · · · · · · · · · · · · ·		Reserve2	%QX29.2	BIT		Reserve2
	* @		Reserve2	%QX29.3	BIT		Reserve2
	*>		Reserve2	%QX29.4	BIT		Reserve2
	· · · · · · · · · · · · · · · · · · ·		Reserve2	%QX29.5	BIT		Reserve2
	* @		Reserve2	%QX29.6	BIT		Reserve2
	*>		Reserve2	%QX29.7	BIT		Reserve2
	😟 🍫		CO1_Set_Counter_Value	%QD8	UDINT		CO1_Set_Counter_Value
	*		CI0_Set_Counter_Done	%IX156.0	BIT		CI0_Set_Counter_Done
	🍫		CI0_Latch_Z_Valid	%IX156.1	BIT		CI0_Latch_Z_Valid
	· · · · · · · · · · · · · · · · · · ·		CI0_Latch_External_Valid	%IX156.2	BIT		CI0_Latch_External_Valid
	*>		CI0_Over_Flow	%IX156.3	BIT		CI0_Over_Flow
	×		CI0 Under Flow	%IX156.4	BIT		CI0 Under Flow

Variable: Double click the column and select the proper variable for mapping.

Mapping: The mapping status of each variable.

Address: The starting physical address of the variables for this I/O group. The board shown below has 4 analog outputs. This will require 4 WORD addresses.

Note!

- Meaning of address expression:
- % = Direct Mapped variable
- **Q** = Physical Output
- I = Physical Input
- X = Single bit
- W = Word (16 Bits)
- **\$(N)** = Starting address.

Type: The data type of each variable.

Unit: Reserved Column

Description: The description of each variable.

Note!

AMAX-5080 support many kinds of operation modes and parameter, please refer to the hardware user's manual for detail.

User can also **Login** to be on-line and check the status of modules.

Seneral	Address	Additional	
Process Data	AutoInc address -7	Expert settings Optional	Ether CAT
Startup Parameters	Distributed Clock		
_og	Diagnostics		
EtherCAT I/O Mapping	Current State Operational		
EtherCAT IEC Objects			
Status			
Information			

General	Find		Filter Show all					
o enteror	Variable	Manning	Channel	Addross	Tune	Current Value	Prepared Value Unit	Description
Process Data	K	wapping		Audress	type	Current value	Frepareu value Unit	
			COU_Set_Counter	%QX20.0	BIT	TAUSE		COU_Set_Counter
Startup Parameters			COU_Enable_Latch_2	%QX20.1	BII	PALSE		COU_Enable_Latch_2
			CO0_Enable_Latch_External	%QX20.2	BIT	FALSE		CO0_Enable_Latch_External
Log			Reserve 1	%QX20.3	BIT	FALSE		Reserve1
EtherCAT I/O Menning			Reserve 1	%QX20.4	BIT	FALSE		Reserve1
culercar yo mapping			Reserve1	%QX20.5	BIT	FALSE		Reserve1
EtherCAT IEC Objects	· · · · · · · · · · · · · · · · · · ·		Reserve1	%QX20.6	BIT	FALSE		Reserve1
calcrear ice objects			Reserve 1	%QX20.7	BIT	FALSE		Reserve1
Status	····· **		Reserve2	%QX21.0	BIT	FALSE		Reserve2
210100	*		Reserve2	%QX21.1	BIT	FALSE		Reserve2
Information	*		Reserve2	%QX21.2	BIT	FALSE		Reserve2
			Reserve2	%QX21.3	BIT	FALSE		Reserve2
	**		Reserve2	%QX21.4	BIT	FALSE		Reserve2
			Reserve2	%QX21.5	BIT	FALSE		Reserve2
	***		Reserve2	%QX21.6	BIT	FALSE		Reserve2
	* ø		Reserve2	%QX21.7	BIT	FALSE		Reserve2
	÷		CO0_Set_Counter_Value	%QD6	UDINT	0		CO0_Set_Counter_Value
	* @		CO1_Set_Counter	%QX28.0	BIT	FALSE		CO1_Set_Counter
	^K ø		CO1_Enable_Latch_Z	%QX28.1	BIT	FALSE		CO1_Enable_Latch_Z
	* ø		CO1_Enable_Latch_External	%QX28.2	BIT	FALSE		CO1_Enable_Latch_External
	* ø		Reserve 1	%QX28.3	BIT	FALSE		Reserve1
	* ø		Reserve 1	%QX28.4	BIT	FALSE		Reserve 1
	···· **		Reserve 1	%QX28.5	BIT	FALSE		Reserve 1
	- *		Reserve 1	%OX28.6	BIT	FALSE		Reserve1
			Reserve 1	%QX28.7	BIT	FALSE		Reserve 1
	- * ø		Reserve2	%OX29.0	BIT	FALSE		Reserve2
	- *		Reserve2	%OX29.1	BIT	FALSE		Reserve2
	- K		Reserve?	%OX29.2	BIT	FALSE		Reserve?
			Deserve2	200222	017	EAL SE		D

If user would like to change the working parameter of module, please select the **Expert settings** in the **General** tab, and click the **CoE Online** tab.

General	Read Objects	Auto update 💿 Offline from	ESI file 🔘	Online from de	vice
Expert Process Data	Index:Subindex	Name	Flags	Туре	Value
	16#1008:16#00	Device name	RO	STRING(9)	'AMAX-5080'
Process Data	16#1009:16#00	Hardware version	RO	STRING(2)	'A2'
	16#100A:16#00	Software version	RO	STRING(5)	'V1.14'
Startup Parameters	I6#1018:16#00	Identity			
Delies	. 16#10F1:16#00	Error Settings			
Juine	16#10F8:16#00	Timestamp Object	RW	ULINT	2767230489374
OF Online		ENC Output Channel 0 process data mapping			
Joe online		ENC Output Channel 1 process data mapping			
.og	. 16#1A00:16#00	ENC Input Channel 0 process data mapping			
-	■ 16#1A01:16#00	ENC Input Channel 1 process data mapping			
therCAT I/O Mapping	. 16#1C00:16#00	Sync manager type			
	■ 16#1C12:16#00	SyncManager 2 assignment			
therCAT IEC Objects	I6#1C13:16#00	SyncManager 3 assignment			
		SM output parameter			
tatus	± 16#1C33:16#00	SM input parameter			
- f	I6#6000:16#00	ENC Input Channel 0			
nformation	± 16#6010:16#00	ENC Input Channel 1			
	16#7000:16#00	ENC Output Channel 0			
		ENC Output Channel 1			
	= 16#8000:16#00	ENC Input Channel 0 Config Reg.			
	:16#01	C0_Mode_Select	RW	UINT	Encoder Mode
	:16#02	C0_Enable_Z_Pulse_Reset	RW	UINT	Encoder Mode
	:16#03	C0_Z_Pulse_Active_Polarity	RW	UINT	Bi-Direction Mode
	:16#04	C0_Enable_External_Reset	RW	UINT	Disable
	:16#05	C0_External_Latch_Active_Polarity	RW	UINT	Rising Edge
	:16#06	C0_Enable_Register_Reload	RW	UINT	Disable
	:16#07	C0_Reload_Counter_Values	RW	UDINT	4294967295
	:16#08	C0_Input_Filter_Time	RW	UINT	0.3us (1.32MHz)
	≝ 16#8010:16#00	ENC Input Channel 1 Config Reg.			
	■ 16#F000:16#00	Modular Device Profile			

Select the target parameters from the table and double click the **Value** column. Select the target settings from the drop-down manual.

5.2.11. Timestamp Modules

In this section, we'll introduce the CoDeSys function block and sample code for AMAX-5051T and AMAX-5056T timestamp modules.

(Note: Please refer to AMAX-5000 user's manual chapter7 for more detailed product features.)

5.2.11.1 EtherCAT Timestamp Templates

By the installation of the Advantech add-on package, you can find the "EtherCAT_Timestamp project" in the template area.

管 New Pro	oject		×
Categories		Templates	
Lib	oraries ojects	Empty project EtherCAT_Tim estamp project HMI project modbusTCP project project Standard project w	
A project co	ontaining one device, one ap	plication, EtherCAT master, and a timestamp module example for PLC_PRG	
Name	Advantech Sample Projec	t	
Location	D:\AMAX-5000 timestamp	project ~ .	
		OK Cancel	

The new project created by the template contains four function blocks and a sample program; this document will introduce the definition of the function blocks.

Tibrary Manager 🗙		
🗄 Add library 🗙 Delete library 🖙 Properties 📷 Details 🗐 Placeholders 🎁 Library re	pository 🕕 Icon le	egend
Name	Namespace	Effective version
🖩 🕑 3SLicense = 3SLicense, 3.5.16.0 (3S - Smart Software Solutions GmbH)	_3S_LICENSE	3.5.16.0
🖶 📙 Advantech EtherCAT Library, 3.5.16.0 (Advantech Co. Ltd.)	Advantech	3.5.16.0
BreakpointLogging = Breakpoint Logging Functions, 3.5.5.0 (3S - Smart Software Solutions GmbH)	BPLog	3.5.5.0
🕮 📒 CAA Device Diagnosis = CAA Device Diagnosis, 3.5.15.0 (CAA Technical Workgroup)	DED	3.5.15.0
🖩 🣒 IODrvEtherCAT = IODrvEtherCAT, 3.5.16.0 (3S - Smart Software Solutions GmbH)	IoDrvEthercatLib	3.5.16.0
🗊 📒 IoStandard = IoStandard, 3.5.16.0 (System)	IoStandard	3.5.16.0
Standard = Standard, 3.5.15.0 (System)	Standard	3.5.15.0
Advantech EtherCAT Library, 3.5.16.0 (Advantech Co. Ltd.) DI_LatchDiff DI_Timestamp_Configuration DO_Timestamp_Control InitialSystemTime		

5.2.11.2 AMAX-5051T Digital Input with Timestamp

In order to latch the input signal, the digital input module contains a set of parameters to record the precise timestamp for each rising-edge (th) and falling-edge (tl). One thing to be noticed, is that there is only one pair of timestamp (for th and tl) can be stored in the module, so the user should select the latching mode: Single Event or Continuous (default).

The Single Event mode only latches the first rising-edge and falling-edge timestamp and ignores any state change afterward. The Continuous mode will continuously update the latest timestamp of state changes.

Each rising-edge (th) and falling-edge (tl) can be set to Single Event mode or Continuous mode independently.



Single Event Mode

Function Block – DI_Timestamp_Configuration

This function block provides an easy way to configure the mode of active edge.



Input	Data Type	Definition
		87

xExecute	BOOL	Execute the function block
wSlvAddr	WORD	The target slave's address
wChannel	WORD	The target slave channel
xSetPositiveEdge	BOOL	Select mode for positive edge timestamping:
		True: Single Event Mode
		False: Continuous Mode
xSetNegativeEdge	BOOL	Select mode for negative edge timestamping: True:
		Single Event Mode
		False: Continuous Mode

Output	Data Type	Definition
xDone	BOOL	The function block's task is Done
xBusy	BOOL	The function block's task is Busy
xError	BOOL	The function block's task is Error
xGetPostiveEdge	BOOL	Positive edge timestamping mode
xGetNegativeEdge	BOOL	Negative edge timestamping mode

Function Block – DI_LatchDiff

The DI_LatchDiff function block provides two functions:

- 1. Translate the data time base, and divide into two parts. (seconds, and fractional seconds)
- 2. Calculate the time difference between two input signal edges.

The Time System Translation

The time system for EtherCAT distribute clocks is start from **2000-01-01**, **00:00**:00, 64-bits range with 1ns resolution. And the time system in DT format in CoDeSys is start from **1970-01-01**, **00:00:00**. So some translation must be done before the use.

Calculation of the time difference between two edges

Object detection is one of the most common digital input applications in automation industry, the precise time difference between two input signal edges can be critical for some applications. The DI_LatchDiff function block provides a method to calculate 4 different forms of the time difference like figure below:





Input	Data Type	Definition
ulLatchPostive	ULINT	Mapping with the variable of AMAX-5051T LatchPos0 or
		LatchPos1
ulLatchNegative	ULINT	Mapping with the variable of AMAX-5051T LatchNeg0 or
		LatchNeg1
byMode	BYTE	Mode Selection:
		0: Pos_Neg = The time difference between previous
		ulLatchPostive and current ulLatchNegative.
		1: Pos_Pos = The time difference between previous
		ulLatchPostive and current ulLatchPostive.
		2: Neg_Pos = The time difference between previous
		ulLatchNegative and current ulLatchPostive.
		3: Neg_Neg = The time difference between previous
		ulLatchNegative and current ulLatchNegative.

Output	Data Type	Definition
dtLatchPostive	DT	Transform the ulLatchPostive data format to date time (in the unit of sec) e.g.
		, , ,
dtLatchNegative	DT	Transform the ulLatchNegative data format to date time (in the unit of sec)
LTlatchPos_Fracti onalSeconds	LTIME	The fractional seconds of ulLatchPostive (in the unit of ns)
LTlatchNeg_Fract ionalSeconds	LTIME	The fractional seconds of ulLatchNegative (in the unit of ns)
LTDelta	LTIME	The time difference between edges (in the unit of ns)

5.2.11.3 AMAX-5056T Digital Output with Timestamp

By setting Start Time and Activation to the time-stamping digital output module, the preset logic level will be activated at any specific time of the cycle as figure below.



Function Block – DO_Timestamp_Control

This function block provides a way to set the trigger time for the DO0 and DO1. Please note that there is only one timestamp register in the module, which means two channels of DO are sharing one timestamp, so the triggering signal can only be sent one at a time.



Input	Data Type	Definition
xExecute	BOOL	Execute the function block
xSetOutput0	BOOL	Setting the logic level of DO0 at start time
xSetOutput1	BOOL	Setting the logic level of DO1 at start time
ulSetStartTime	ULINT	Setting the trigger time of both DO0 and DO1
ulSystemTime	ULINT	Current Time

Output	Data Type	Definition
xDone	BOOL	The function block's task is Done
xBusy	BOOL	The function block's task is Busy
xError	BOOL	The function block's task is Error
xOutput0	BOOL	The output level of DO0
xOutput1	BOOL	The output level of DO1
usActivate	USINT	The activation of the slave PDO
ulStartTime	ULINT	The output start time

5.2.11.4 EtherCAT Distributed Clocks Synchronization

Function Block – InitialSystemTime

There are two ways to synchronize EtherCAT distribution clock:

- 1. Synchronize with master system clock.
- 2. Synchronize with first slave module.

This InitialSystemTime function block provides a way to set the method of distribution clock Synchronization.



Input	Data Type	Definition
xDCSyncToMaster BOOL		TRUE: Synchronize all slaves time with the master's system time.
		FALUE: Synchronize all slaves time with the first slave's time.

Output	Data Type	Definition
xDone	BOOL	The function block's task is Done

Chapter 6

6. Advantech Fieldbus Modules

Advantech ADAM series distributed data acquisition and control systems are the ideal tools for creating multi-drop Fieldbus networks. The module design allows users to create application-specific configurations with ease. System communicates with their controlling host using either serial COM port or communication protocols.

6.1. Modbus

6.1.1. Modbus RTU Client

In Device Window, Right-click on **Device** And click **Add Device**. You will then be prompted for the Add Device dialog. Type the device name in Name container. Choose **Modbus COM** in the **Modbus** option and click **Add Device** to proceed and then press Close to close the device dialog.



Now, you'll see Modbus COM ^{••} Modbus_COM (Modbus COM) in the device tree. Double-click

the Modbus COM icon to set configuration.

Status 🧼 Information
1
9600
NONE
8
1

Note!

The location of COM ports is shown below. Follow the figure to set COM Port index.



Right click on Modbus COM ^{Modbus_COM} (Modbus COM) in the device tree and click Add **Device.** Type the device name in Name container. Choose **Modbus Master, COM Port** in the **Modbus** option. Click Add Device to proceed and then press **Close** to close the device dialog.

👔 Add Device				
Name: Modbus_Master_COM_Port_1				
Action:				
Append device Insert device Piug device Update device				
Device:				
Vendor: <all vendors=""></all>	~			
Name Vendor	Version			
🖃 🕤 Fieldbusses				
🖨 - Kutti Modbus				
Modbus Serial Device 35 - Smart Software Solutions GmbH	3.5.5.0			
🖻 - 📖 Modbus Serial Master				
Modbus Master, COM Port 35 - Smart Software Solutions GmbH	3.5.5.0			
Carlog by category				
Display all versions (for experts only)				
Display outdated versions				
Information:				
Mame: Modbus Master, COM Port				
Vendor: 35 - Smart Software Solutions GmbH				
Groups: Modbus Serial Master	<u> </u>			
Model Number: -	1			
Description: A device that works as a Modbus Master on a serial COM Port of a				
Windows PC.				
Append selected device as last shild of				
Modbus_COM_1				
• (You can select another target node in the navigator while this window is open.)				
bbA	Device Close			

🗄 💮 Modbus_COM (Modbus COM)

Now, you'll see Modbus master

Modbus_Master_COM_Port (Modbus Master, COM Port)

in

the device tree. Double-click Modbus Master COM Port icon to set master configuration. For

Modbus Master Configuration 🛛 🗮 M	odbusGenericSerialMaster I/O Mapping	Status 🤳 Information
Modbus-RTU/ASCII		
Transmission Mode	<u> <u> R</u>TU ○ <u>A</u>SCII </u>	WUDRO2
Response Timeout (ms)	1000	
Time between Frames (ms)	10	
auto-restart communication		
	-	

further convenience, recommend you to check **auto-restart communication**.

Right click on Modbus master in the device tree and click **Add Device** in context menu. It will open the **Add Device dialog**, where you choose one available device for the current connection. Type the device name in Name container. Click **Add Device** to proceed and then press **Close** to close the device dialog.

f Add Device	×
Name: ADAM 4015 4015T	
Action:	
Append device Insert device Plug device U	ndate device
Device:	
Vendor: <all vendors=""></all>	▼
Name	Vendor
□ I Fieldbusses	
i Modbus	
Modbus Serial Slave	7
ADAM-4015/4015T	ADVANTECH
ADAM-401/P/4018P/4019P/411//4118	
= ADAM-1021	ADVANTECH
ADAM-1051	ADVANTECH
ADAM-40565/405650	ADVANTECH
ADAM-4068/4069/4168	ADVANTECH
	ADVANTECH
🥽 ADAM-5000E	ADVANTECH
Modbus Slave, COM Port	35 - Smart Software Solutions GmbH
Crown by rategory	
V Group by category	
Display outdated versions	
Information:	
Name: ADAM-4015/4015T	
Vendor: ADVANTECH	
Groups: Modbus Serial Slave	
Model Number: -	(and)
Description: ADAM-4015/4015T Analog Input Module	_
Append selected device ac last shild of	
Modbus_Master_COM_Port	
(You can select another target node in the navigator where the target node in the navigator where target node in tar	nile this window is open.)
	Add Device Close

Now, you will see Advantech ADAM modules on device list.

Modbus_COM (Modbus COM)

Modbus_Master_COM_Port (Modbus Master, COM Port)
 ADAM_4015_4015T (ADAM-4015/4015T)
 ADAM_4024 (ADAM-4024)
 ADAM_4051 (ADAM-4051)

Open the **Modbus Device editor** by double-clicking on the device icon in the device tree. The editor is subdivided in the following tabs and the details will be described below:

Modbus Slave Configuration:

The following parameters deal with Modbus slave settings:

Slave Address: This number may range between 1 and 247; it serves to identify the address of a serial Modbus device.

Note!

For ADAM-4000 series, move hardware switch to Initial mode and use **Advantech Adam/Apax Utility** X to set slave address.

For ADAM-5000 series, use the 8-pin DIP switch to set slave address. Valid settings range from 0 to 127 where ON in any of the 8 DIP switch positions equates to a binary 1, and OFF equates to a binary 0. For initial setting, set address as 0 and baud rate setting will be fixed to 9600 bps. It is recommended to setting the range from 1 to 127.



Response Timeout: Time interval for the master to wait for the response from the slave. This is especially configured for this slave node and overwrites the general response timeout setting of the respective master.

ľ	1odbus Slave Configuration Mo	dbus Slave Channel 🛛 Modbu	ıs Slave Init 🛛 🗮 ModbusGenericSerialSlave I/O Mapping
	_Modbus-RTU/ASCII		
			MODBUS
	Slave Address [1247]	1	
	Response Timeout (ms)	1000	

Modbus Slave Channel

This page is used to set up slave channels.

You can revise the default value by double-clicking the table. The following parameters

deal with slave channel settings:

Modbus Slave Configu	uration Modbus Slave Channel Modbus Slave I	(nit 🗮 ModbusGene	ricSerialSlave I/O M	lapping Sta	tus 🚺 Informatio	n			
Name	Access Type	Trigger	READ Offset	Length	Error Handling	WRITE Offset	Length	Comment	Ī
DI_Channel Read Coils (Function Code 01)		CYCLIC, t#100ms	16#0000	4	Keep last Value				
A0_Channel Write Multiple Registers (Function Code 16)		CYCLIC, t#100ms				16#0000	4		

Column Name	Description			
Name	The channel name			
	Read Coil Status (Function Code 01)			
Access Type	Read Holding Register (Function Code 03)			
Access Type	Force Multiple Coils (Function Code 15)			
	Preset Multiple Registers (Function Code 16)			
Trigger	CYCLIC: The request occurs periodically.			
	RISING_EDGE: The request occurs as a reaction to a rising edge of the			
	Boolean trigger variables.			
Cycle Time	If set Trigger as CYCLIC, it represents poll interval (in milliseconds)			
	Note!			
	The poll interval should be the same as or a multiple of the cycle time of			
	the application			

READ Offset	Start address where reading should start (Range 0-65535)
WRITE Offset	Start address where writing should start (Range 0-65535)
Length	Number of registers to be read/written (for word access) or number of discrete inputs to be read/written (for bit access)

We have already introduced **Modbus Slave Configuration** and **Modbus Slave Channel.** In the following section, we will introduce **Modbus Slave I/O Mapping** for ADAM-4000 Series and ADAM-5000 Series according to their Modbus function code.

6.1.1.1. ADAM-4000 Series

The ADAM-4000 series is a set of intelligent sensor-to-computer interface modules containing built-in microprocessor. They are remotely controlled through a simple set of commands issued in ASCII format and transmitted in RS-485 protocol. The figure below shows the brief overview of the ADAM-4000 system architecture.



Advantech provides 15 types of ADAM-4000 modules for various applications so far. Following table is ADAM-4000 series support list.

Name	Specification
ADAM-4015	6-ch RTD Input Module

ADAM-4015T	6-ch Thermocouple Input Module
ADAM-4017+	8-ch Analog Input Module
ADAM-4018+	8-ch Analog Input Module
ADAM-4019+	8-ch Analog Input Module
ADAM-4117	8-ch Analog Input Module
ADAM-4118	8-ch Thermocouple Input Module
ADAM-4024	4-ch Analog Output Module
ADAM-4051	16-ch Digital Input Module
ADAM-4055	8-ch Digital Input and 8-ch Digital Output Module
ADAM-4150	8-ch Digital Input and 8-ch Digital Output Module
ADAM-4056S (SO)	12-ch Digital Output Module
ADAM-4068	8-ch Relay Output Module
ADAM-4069	8-ch Relay Output Module
ADAM-4168	8-ch Relay Output Module

6.1.1.1.1. Read Coil Status

The Modbus Function 01 is used to read coil status, or the ON/OFF status of digital input (DI) modules. Open the **Modbus Device editor** by double-clicking on the device icon in the device tree. In **ModbusGenericSerialSlave I/O Mapping**, it shows the I/O mapping status between variable to module channel. It consists of seven columns.

Variable: The variable that are mapped onto an input.

Mapping: The mapping status of each variable.

The data type of each channel is in single bit. If the value is "true", it means that the channel is on; "false" for off. For detailed variable mapping information, see <u>chapter</u> <u>4.2</u>.

Address: The starting physical address of the variables for this I/O group. The board shown below has 8 digital inputs. This will require either 8 Boolean addresses or 1 Byte addresse.

Note!

Meaning of address expression:

% = Directly Mapped variable

I = Physical Input

X = Single bit

\$(N1). \$(N2) = The starting address. The first number means the starting byte; the second number means the starting bit.

Type: The data type of each variable.

Description: The description of each variable.

Modbus Slave Configuration Mo	dbus Slave Channel	Modbus Slave Init	: 🇮 Moo	lbusGenericSerialSlave I/O Ma	ipping s	itatus 🤹 Information		
Channels								
Variable	Mapping C	hannel Add	lress	Туре	Unit	Description		
📮 ᡟ	DI	Channel 9	%IB38	ARRAY [00] OF BYTE		Digital input value		
🖹 🧤	DI	Channel[0]	%IB38	BYTE		Digital input value		
¥ø	Bitt) 9	%IX38.0	BOOL		Digital input value		
¥ø	Bit:	L 9	%IX38.1	BOOL		Digital input value		
¥ø	Bita	2 9	%IX38.2	BOOL		Digital input value		
¥ø	Bitt	3 9	%IX38.3	BOOL		Digital input value		
¥ø	Bite	1 o	%IX38.4	BOOL		Digital input value		
¥ø	Bits	5 9	%IX38.5	BOOL		Digital input value		
¥ø	Bite	5 9	%IX38.6	BOOL		Digital input value		
*	Bitt	7 9	%IX38.7	BOOL		Digital input value		

6.1.1.1.2. Read Holding Registers

The Modbus Function 03 is used to read holding registers, or the quantity of registers to read from the analog input (AI) modules. Open the **Modbus Device editor** by double-clicking on the device icon in the device tree. In **ModbusGenericSerialSlave I/O Mapping**, it shows the I/O mapping status between variable to module channel. It consists of seven columns.

Variable: The variable that are mapped onto an input.

Mapping: The mapping status of each variable.

The data type of each channel is in WORD.

For detailed variable mapping information, see <u>chapter 4.2</u>.

Address: The starting physical address of the variables for this I/O group. The board shown below has 8 analog inputs. This will require 8 WORD addresses.

Note!

Meaning of address expression:

% = Directly Mapped variable

I = Physical Input

W = Single word (16 Bits)

\$(N) = The starting address.

Type: The data type of each variable.

Description: The description of each variable.

Modbus Slave Configuration	Modbus Slave Chanr	nel Modbus Sla	ve Init 🗮 🗮	ModbusGenericSerialSlave I,	'O Mapping	Status	🌵 Information		
Channels									
Variable	Mapping	Channel	Address	Туре	Unit	Desc	ription		
🖃 🍬		AI_Channel	%IW19	ARRAY [07] OF WORD)	Analo	input value		
¥ø		AI_Channel[0]	%IW19	WORD		Analo	input value		
- * >		AI_Channel[1]	%IW20	WORD		Analo	input value		
¥ø		AI_Channel[2]	%IW21	WORD		Analo	input value		
- * >		AI_Channel[3]	%IW22	WORD		Analo	input value		
* >		AI_Channel[4]	%IW23	WORD		Analo	input value		
- *>		AI_Channel[5]	%IW24	WORD		Analo	input value		
* >		AI_Channel[6]	%IW25	WORD		Analo	input value		
i		AI_Channel[7]	%IW26	WORD		Analo	input value		

6.1.1.1.3. Force Multiple Coils

The Modbus Function 15 is used to force multiple coils or ON/OFF state to digital output (DO) modules. Open the **Modbus Device editor** by double-clicking on the device icon in the device tree. In **ModbusGenericSerialSlave I/O Mapping**, it shows the I/O mapping status between variable to module channel. It consists of seven columns.

Variable: The variable that are mapped onto an output.

Mapping: The mapping status of each variable.

The data type of each channel is in single bit. Set the value to "true" for switching on the channel; "false" for switching off. For detailed variable mapping information, see <u>chapter 4.2</u>.

Address: The starting physical address of the variables for this I/O group. The board shown below has 8 digital outputs. This will require either 8 Boolean addresses or 1 Byte address.

Note!

Meaning of address expression:

- % = Directly Mapped variable
- **Q** = Physical Output

X = Single bit

\$(N1). \$(N2) = The starting address. The first number means the starting byte; the second number means the starting bit.

Type: The data type of each variable.

Description: The description of each variable.

Modbus Slave Configuration	Modbus Slave Chan	nel Modbus Slav	re Init 🛛 🗮 Ma	odbusGenericSerialSlave I/O	Mapping	Status 🤹 Information		
Channels								
Variable	Mapping	Channel	Address	Туре	Unit	Description		
🖃 ^K ø		DO_Channel	%QB2	ARRAY [00] OF BYTE		Digital output value		
🚊 🍢		DO_Channel[0]	%QB2	BYTE		Digital output value		
^K ø		BitO	%QX2.0	BOOL		Digital output value		
* ø		Bit1	%QX2.1	BOOL		Digital output value		
- * *		Bit2	%QX2.2	BOOL		Digital output value		
* ø		Bit3	%QX2.3	BOOL		Digital output value		
- * *		Bit4	%QX2.4	BOOL		Digital output value		
* ø		Bit5	%QX2.5	BOOL		Digital output value		
^K ø		Bit6	%QX2.6	BOOL		Digital output value		
L		Bit7	%QX2.7	BOOL		Digital output value		
6.1.1.1.4. Preset Multiple Registers

The Modbus Function 16 is used to preset multiple register or write the contents to analog output (AO) modules. Open the **Modbus Device editor** by double-clicking on the device icon in the device tree. In **ModbusGenericSerialSlave I/O Mapping**, it shows the I/O mapping status between variable to module channel. It consists of seven columns.

Variable: The variable that are mapped onto an output.

Mapping: The mapping status of each variable.

The data type of each channel is in WORD.

For detailed variable mapping information, see <u>chapter 4.2</u>.

Address: The starting physical address of the variables for this I/O group. The board shown below has 4 analog outputs. This will require either 4 WORD addresses.

Note!

Meaning of address expression:

% = Directly Mapped variable

Q = Physical Output

W = Single word (16 Bits)

\$(N1). \$(N2) = The starting address. The first number means the starting byte; the second number means the starting bit.

Type: The data type of each variable.

Description: The description of each variable.

🖮 *	AO_Chanr	nel %QW19	ARRAY [03] OF W	VORD Analog output value	
🛱 e 🍢	AO_Chanr	nel[0] %QW19	WORD	Analog output value	
🛱 - 🍢	AO_Chanr	nel[1] %QW20	WORD	Analog output value	
🛱 🍢	AO_Chanr	nel[2] %QW21	WORD	Analog output value	
🗄 - K	AO_Chanr	nel[3] %QW22	2 WORD	Analog output value	

Note!

Please map the WORD variable onto an analog output channel. Do not use the BOOL variable onto a bit of an analog output channel.

6.1.1.2. ADAM-5000 Series

The ADAM-5000 series is a complete product line that provides a wide variety of features in a data acquisition and control application. It includes 4 I/O-slots **ADAM-5000/485** and 8 I/O-slots **ADAM-5000E**. They are remotely controlled by the host computer through a set of commands and transmitted in a RS-485 / RS-232 network.



The following diagram shows the system configurations possible with the ADAM-5000.

Please refer to <u>Chapter 5.1.1.</u> and add **ADAM-5000/485 (4-slot)** or **ADAM-5000E (8-slot)** to device list.



Open the **Modbus Device editor** by double-clicking on the device icon in the device tree. The editor is subdivided in the 6 tabs. For more detailed information about **Modbus Slave Configuration** and **Modbus Slave Channel**, please refer to <u>Chapter 5.1.1</u>.

Modbus Slave Config	uration Modbus Slave Channel Modbus Slave	Init 🗮 ModbusGen	ericSerialSlave I/O	Mapping St	atus 🚺 🤹 Informati	on		
Name	Ассез Туре	Trigger	READ Off∞t	Length	Error Handling	WRITE Off∞t	Length	Comment
- DI_Channel	Read Coils (Function Code 01)	CYCLIC, t#500ms	16#0000	128	Keep last Value			
- DO_Channel	Write Multiple Coils (Function Code 15)	CYCLIC, t#500ms				16#0000	128	
- AI_Channel	Read Holding Registers (Function Code 03)	CYCLIC, t#500ms	16#0000	64	Keep last Value			
AO_Channel	Write Multiple Registers (Function Code 16)	CYCLIC, t#500ms				16#0000	64	

For ADAM-5000 series, Modbus slave address has been automatically assigned. CODESYS create default channel setting for different type module. The Modbus address mapping tables are shown below.

For Digital Input / Output Module:

	Slot 0	Slot 1	Slot 2	Slot 3	Slot 4	Slot 5	Slot 6	Slot 7
Bit 0	00001	00017	00033	00049	00065	00081	00097	00113
Bit 1	00002	00018	00034	00050	00066	00082	00098	00114
Bit 2	00003	00019	00035	00051	00067	00083	00099	00115
Bit 3	00004	00020	00036	00052	00068	00084	00100	00116
Bit 4	00005	00021	00037	00053	00069	00085	00101	00117
Bit 5	00006	00022	00038	00054	00070	00086	00102	00118
Bit 6	00007	00023	00039	00055	00071	00087	00103	00119
Bit 7	00008	00024	00040	00056	00072	00088	00104	00120
Bit 8	00009	00025	00041	00057	00073	00089	00105	00121
Bit 9	00010	00026	00042	00058	00074	00090	00106	00122
Bit 10	00011	00027	00043	00059	00075	00091	00107	00123
Bit 11	00012	00028	00044	00060	00076	00092	00108	00124
Bit 12	00013	00029	00045	00061	00077	00093	00109	00125
Bit 13	00014	00030	00046	00062	00078	00094	00110	00126
Bit 14	00015	00031	00047	00063	00079	00095	00111	00127
Bit 15	00016	00032	00048	00064	00080	00096	00112	00128

For Analog Input / Output Module:

	Slot 0	Slot 1	Slot 2	Slot 3	Slot 4	Slot 5	Slot 6	Slot 7
Ch 0	40001	40009	40017	40025	40033	40041	40049	40057
Ch 1	40002	40010	40018	40026	40034	40042	40050	40058
Ch 2	40003	40011	40019	40027	40035	40043	40051	40059
Ch 3	40004	40012	40020	40028	40036	40044	40052	40060
Ch 4	40005	40013	40021	40029	40037	40045	40053	40061
Ch 5	40006	40014	40022	40030	40038	40046	40054	40062
Ch 6	40007	40015	40023	40031	40039	40047	40055	40063
Ch 7	40008	40016	40024	40032	40040	40048	40056	40064

You can use default channel setting or add a new channel to a Modbus slave. For example, you insert ADAM-5018 (Analog Input module) in the second slot (slot 1) of ADAM-5000E. According to the Modbus address mapping table, start address as 40009 and length as 8. Now, go to **Modbus Slave Channel** page and click **Add Channel.** Select **Access type** as **Read Holding Register** and fill in **Offset** and **Length.** This dialog may be closed by clicking **OK** for creating the channel.

ADAM_500	10_485 x									
lbus Slave Confi	guration Modbus Slave Channel Mod	lbus Slave Init 🛛 🗮 ModbusGer	ericSerialSlave I/O	Mapping St	atus 🗼 🤹 Informat	ion				
ame DI_Channel	Access Type Read Colls (Function Code 01)	Trigger CYCLIC, t#500ms	READ Offset	Length 64	Error Handling Keep last Value	WRITE Offset	Length	Comment		
AI_Channel	ModbusChannel									
	Chappel									
	Name	ADAM-5018								
	TVallic	ADAMSOTO								
	Access Type	Read Holding Regi	sters (Funct	ion Code	e 3)	~				
	Trigger	Cyclic	*	Cycle 1	lime (ms)	500				
	Comment									
	READ Register									
	Offset	0×0008				~				
	Length	8								
	Error Handling	Keep last Value	*							
							\neg			
	WRITE Register -									
	Offset	0×0000				~		\backslash		
	Length	1								
				(<u>o</u> k		:el			
									Add Channel	Delete

Correspondent to the set channels, the slave's process data can then be monitored under **ModbusGenericSerialSlave I/O Mapping** page.

Modbus Slave Configuration	Modbus Slave Chanr	nel Modbus Sla	ve Init 🗮 Mod	busGenericSerialSlave I/O Maj	pping Stal	tus 🤹 Information			
Channels									
Variable	Mapping	Channel	Address	Туре	Unit	Description			
🖃 🎽		ADAM-5018	%IW21	ARRAY [07] OF WORD		Read Holding Registers			
🗄 🖷 🦄		ADAM-5018[0]	%IW21	WORD		READ 16#0008 (=00008)			
🗄 - 🏘		ADAM-5018[1]	%IW22	WORD		READ 16#0009 (=00009)			
🚊 🦄		ADAM-5018[2]	%IW23	WORD		READ 16#000A (=00010)			
🗄 - 🏘		ADAM-5018[3]	%IW24	WORD		READ 16#000B (=00011)			
🗄 🧤		ADAM-5018[4]	%IW25	WORD		READ 16#000C (=00012)			
🗄 - 🏘		ADAM-5018[5]	%IW26	WORD		READ 16#000D (=00013)			
🗄 🦄		ADAM-5018[6]	%IW27	WORD		READ 16#000E (=00014)			
🗄 🎽		ADAM-5018[7]	%IW28	WORD		READ 16#000F (=00015)			

6.1.2. Modbus TCP Client

In Device Window, Right-click on **Device** And click **Add Device**. You will then be prompted for the Add Device dialog. Choose **Ethernet** in **Ethernet Adapter** and click **Add Device** to close the dialog.



Right click on Ethernet adapter if Ethernet (Ethernet) in the device tree and click Add Device. Type the device name in Name container. Choose Modbus TCP Master in the Modbus option. Click Add Device to proceed and then press Close to close the device dialog.



🖃 🔟 Ethernet (Ethernet)

in the

Now, you'll see Modbus TCP master

device tree. Double-click Modbus TCP master to set master configuration. For further

convenience, recommend you to check **auto-restart communication**.

Name:	ModbusTCP Master Configu	uration 🛛 💳	ModbusTCPMaster I/O Mapping	ModbusTCPMaster Configuration	Status	٤	Information
	-Modbus-TCP			MODRUS			
	Response Timeout (ms)	1000 😂		mabbada			
	Socket Timeout (ms)	10 🛟					
	🔽 auto - reconnect						

Right click on Modbus TCP master in the device tree and click **Add Device** in context menu. It will open the **Add Device dialog**, where you choose one available device for the current connection. Type the device name in Name container. Click **Add Device** to proceed and then press **Close** to close the device dialog.

🚺 Add Device			
Name: ADAM_5000_TCP			
- Action:			
• Append device • Insert device	Plug device 🔿 Updat	e device	
Device			
Vendor: <01 vendors>			
News	V	Vania	
Fieldbusses	VEHICOL	V 613011	
i⊒ Kill\$ Modbus			
🖻 - 📖 Modbus TCP Slave			
ADAM-5000/TCP	ADVANTECH	3.5.4.0	=
ADAM-5000L/TCP	ADVANTECH	3.5.4.0	
ADAM-6015/6217	ADVANTECH	3.5.4.0	
ADAM-6018	ADVANTECH	3.5.4.0	
	ADVANTECH	3.5.4.0	
ADAM-6050	ADVANTECH	3.5.4.0	
ADAM-6051	ADVANTECH	3.5.4.0	
	ADVANTECH	3.5.4.0	
	ADVANTECH	3.3.4.0	
Group by category	$\langle \rangle$		
Display all versions (for experts only)	$\langle \rangle$		
Display outdated versions	\backslash		
 Information: 			
Name: ADAM-5000/TCP		\mathbf{A}	
Vendor: ADVANTECH		\mathbf{A}	
Groups: Modbus TCP Slave			
Version: 3.5.4.0			
Model Number: -	a second states and states have	Contract of Filment	
Description: 8-Slot Distributed Da	ta Acquisition and Contro	o System for Ethernet	
		\mathbf{A}	
		\	
Append selected device as last child o	of		
Modbus_TCP_Master		\mathbf{A}	
(You can select another target node)	in the navigator while th	is window is open.) 🍾	
		Add Device	lose

Now, you will see Advantech ADAM modules on device list.

Ethernet (Ethernet)
 Modbus_TCP_Master (Modbus TCP Master)
 ADAM_5000_TCP (ADAM-5000/TCP)
 ADAM_6015_6217 (ADAM-6015/6217)
 ADAM_6018 (ADAM-6018)

Now, set the IP address and node ID at ADAM module. Double-click on the device icon in the device tree and open the respective editors. Enter the module IP address and node ID in the register-tab "Modbus TCP Slave" (in this example: address 192.168.1.112 and node ID 1) and keep port as 502.

Μ	odbusTCP Slave Modbus Slave Ch	annel 🛛 Modbus Slave Init 🗍 ModbusTCPSlave Configuration 🗍 🗮 ModbusTCPSlave I/O Mapping 🗍 Status 🗎 🍁 Information 🗎
	Modbus-TCP	MODRUS
	Slave IP Address:	192 . 168 . 1 . 112
	Unit-ID [1247]	1
	Response Timeout (ms)	1000
	Port	502

6.1.2.1. ADAM-6000 Series

ADAM-6000 Ethernet-based data acquisition and control modules provide I/O, data acquisitions, and networking in one module to build a cost-effective, distributed monitoring and control solution for a wide variety of applications. Through standard Ethernet networking, ADAM-6000 retrieves I/O values from sensors, and can publish them as a real-time I/O values to networking nodes via LAN, Intranet, or Internet. The figure below shows the brief overview of the ADAM-6000 system architecture.



Advantech provides 16 types of ADAM-6000 modules for various applications so far. Following table is ADAM-6000 series support list.

Name	Specification
ADAM-6015	7-ch RTD Input Module
ADAM-6217	8-ch Analog Input Module
ADAM-6017	8-ch Analog Input Module with 2-ch DO
ADAM-6018	8-ch Thermocouple Input Module with 8-ch DO
ADAM-6050	18-ch Digital I/O Module
ADAM-6051	14-ch Digital I/O Module with 2-ch Counter
ADAM-6052	16-ch Digital I/O Module
ADAM-6266	4-ch Relay Output Module with 4-ch DI
ADAM-6250	15-ch Digital I/O Module
ADAM-6060	6-ch Digital Input and 6-ch Relay Module
ADAM-6066	6-ch Digital Input and 6-ch Power Relay Module
ADAM-6024	12-ch Universal Input/Output Module
ADAM-6224	4-ch Analog Output Module
ADAM-6251	16-ch Digital Input Module
ADAM-6256	16-ch Digital Output Module
ADAM-6260	6-ch Relay Output Module

For more detailed information about how to control ADAM-6000 modules, please refer to Chapter 5.1.1.1.1 to Chapter 5.1.1.1.4.

6.1.2.2. ADAM-5000 Series

ADAM-5000/TCP Series works as a Modbus data server. It allows PCs or tasks to access its current data simultaneously from LAN, Intranet, or Internet. The ADAM-5000/TCP Series uses a convenient backplane system common to the <u>ADAM-5000 series</u>. Advantech's complete line of ADAM-5000 modules integrates with the ADAM-5000/TCP Series to support your applications.

The figure below shows the brief overview of the ADAM-5000/TCP system architecture.



For more detailed information about how to access ADAM-5000 current data via Modbus protocol, please refer to Chapter 5.1.1.2.

6.1.3. Modbus TCP Server

In Device Window, Right-click on **Device** And click **Add Device**. You will then be prompted for the Add Device dialog. Choose **Ethernet** in **Ethernet Adapter** and click **Add Device** to close the dialog.

6	Add Device
s • + X Untitled2 CAlvantech ADAM-5560 WinCE V3)	Name: Ethernet Action: Append device Insert device Plug device Undate device
Properties	
Add Object	Device:
Add Folder	Vendor: <all vendors=""></all>
Add Device	Name Vendor
Update Device	□- 👔 Fieldbusses
🖶 👔 🔂 Edit Object	E CAN CANbus
Edit Object With	Brow Brow Ethercat
Edit IO mapping	Ethernet Adapter
Import mappings from CSV	Ethernet 3S - Smart Software Solutions GmbH
Export mappings to CSV	
Backplan Online Config Mode	The modules
	Group by category
Simulation	Display outdated versions
Ce Device Configuration	
	Information: Name: Ethernet Vendor: 35 - Smart Software Solutions GmbH Groups: Ethernet Adapter Version: 3.4.2.0 Model Number: - Description: Ethernet Link.
	Append selected device as last child of Device • (You can select another target node in the navigator while this window is open) Add Device Close

Right click on Ethernet adapter if Ethernet (Ethernet) in the device tree and click Add Device. Type the device name in Name container. Choose Modbus TCP Slave in the Modbus option. Click Add Device to proceed and then press Close to close the device dialog.

🚺 Add Device		
Name: ModbusTCP_Slave_Device_1		
Action		
⊙ Append device ○ Insert device ○ Plug ○	device 🚫 Update device	
Device:		
Vendor: <all vendors=""></all>		~
Name	Vendor	Version
Fieldbusses		
🗟 - 🎞 Modbus TCP Master		
ModbusTCP Slave Device	35 - Smart Software Solutions GmbH	3.5.5.0
<u> </u>		
Group by category	\mathbf{A}	
Display all versions (for experts only)	\sim	
Display outdated versions		
- Information:		
Mame: ModbusTCP Slave Device		
Append selected device as last child of		
Ethernet_1		
• (You can select another target node in the	navigator while this window is open.	
L		
	Add	

🚔 🔟 Ethernet (Ethernet)

Now, you'll see Modbus TCP slave

the device tree. Double-click Modbus TCP slave and go to **Config-Page** to set configuration.

Timeout	Activation of the timing supervision function. The timeout interval is
	given in milliseconds. Values are adjustable in steps of 500 ms. If there
	is no write command received within this time, the outputs will be
	reset to 0.To keep the output value, we recommend you to uncheck
	Timeout.
Slave Port	Port number of the slave. Keep slave port as 502.
Unit-ID	(Optional) Unit ID of the slave.
Holding Register	Number of holding register: Possible values: 2-500.
(%IW)	
Input Register	Number of input register: Possible values: 2-500.
(%QW)	

Config-Page 🚘 Modbus To	IP Slave De	vice I/O Mapping	🔹 Information
Configured Parameters			
TimeOut:	2000	🔶 (ms)	
Slave Port:	502	\$	
Unit ID:	1		
Holding Registers (%IW):	10	-	
Input Registers (%QW):	10	-	
- Data Model			
-Data Model			
Start Addresses:			
Coils:	0	*	
Discrete Inputs:	0	*	
Holding Register:	0	*	
Input Register:	0	\$	
Holding- and Input-Regi	ster Data Ar	reas overlay	

Correspondent to the number of holding register and input register, the slave channel can then be mapped under **Modbus TCP Slave Device I/O Mapping** page. For more detailed information about how to map variable, please refer to <u>Chapter 4.3.</u>.

Thannels					
Variable	Mapping Chan	nel Address	Туре	Unit	Description
⊒ * ≱	Inputs	%IW137	ARRAY [09] OF WORD		Modbus Holding Registers
😟 🦄	Inputs	[0] %IW137	WORD		
🗄 ᡟ	Inputs	[1] %IW138	WORD		
🗄 ᡟ	Inputs	[2] %IW139	WORD		
😟 🍬	Inputs	[3] %IW140	WORD		
🗄 ᡟ	Inputs	[4] %IW141	WORD		
😟 🍫	Inputs	[5] %IW142	WORD		
🗄 🍫	Inputs	[6] %IW143	WORD		
😟 🦄	Inputs	[7] %IW144	WORD		
🗄 ᡟ	Inputs	[8] %IW145	WORD		
😟 🦄	Inputs	[9] %IW146	WORD		
in K ø	Outpu	ts %QW111	ARRAY [09] OF WORD		Modbus Input Registers
🕀 🍢	Outpu	ts[0] %QW111	WORD		
🗄 🍢	Outpu	ts[1] %QW112	WORD		
😟 🍢	Outpu	ts[2] %QW113	WORD		
😟 🍢	Outpu	ts[3] %QW114	WORD		
😟 🍢	Outpu	ts[4] %QW115	WORD		
😟 🍢	Outpu	ts[5] %QW116	WORD		
🗎 🍢	Outpu	ts[6] %QW117	WORD		
±	Outpu	ts[7] %QW118	WORD		
🗎 🍢	Outpu	ts[8] %QW119	WORD		
🚊 🍢	Outpu	ts[9] %OW120	WORD		

6.2. CANOpen

6.2.1. CANOpen Client

6.2.1.1. Configuration Files Installation

Before connecting to slaves by using CANOpen client, please install the related EDS files (*.eds) first.

Start CODESYS and perform command Device Repository	from the menu (Tools ->
Device Repository). Click "Install" and then select the relation	ted EDS file you want to install.

After installed successfully, the following information will be shown: "Device xxxx installed to device repository".

Location:		
Location:		
	System Repository	Edit Locations
	(C: (ProgramData(CODESYS(Devices)	
Installed de	ijce descriptions:	
Name	Vendor Version	Install
🗷 🖷 🖬 Mi	scellaneous	Uninstall
🗷 👚 🕤 Fie	ldbusses	
🖻 🕤 PL	Cs	
🗄 🔗 So	ftMotion drives	Install DT <u>M</u>
		Details
	ADAY 5500005	
	Nevice "750-338. V13" installed to device repository	
	APAX-5580CDS\canopen\750-338\750-338m08.eds	
L 👩	Device "750-338m_V08" installed to device repository.	
		Close

6.2.1.2. Scan for Slaves

First, connect to your specified Advantech X86 RTE platform. Please refer to Chapter 3.4.

In Device Window, Right-click on **Device** And click Add Device. You will then be prompted for the Add Device dialog.



Choose CANbus in the CANbus option (Fieldbusses -> CANbus) and click Add Device to

proceed and then press Close to close the device dialog.

Add Device		X
Name: CANbus		
Action:		
Action:	rica . O Dive davica . O Hadata davica	
Append device O Liser: de	Vice O Mug device O Opdate device	
Device:		
Vendor: <all vendors=""></all>		▼
Name	Vendor	
🖃 🗂 Miscellaneous		
Backplane	ADVANTECH	
Fieldbusses		
	25 - Smart Software Solutions CmbH	
NetX CANbus	35 - Smart Software Solutions GmbH	
EtherCAT		
🗈 🎬 Ethernet Adapter		
🗉 😝 EtherNet/IP		
🗈 🗰 Modbus		
🗈 🛲 Profibus		
🗉 🛲 Profinet IO		
Group by category		
Display outdated versions		
Information:		
Name: CANbus Vendor: 3S - Smart Softw. Categories: CANbus Version: 3.5.5.0 Order Number: ???? Description: Needed for e.g. CANopen or DeviceNet	are Solutions GmbH all fieldbusses which communicate over the CANBus, t.	No.
Append selected device as las Device (You can select another tar	t child of get node in the navigator while this window is open.)	evice Close
	Add Di	close

Now, you'll see CANbus CANbus (CANbus) in the device tree. Double-click the CANbus

icon to set configuration. Set up the network ID for the CAN port and the corresponding baud rate.

CANbus Status 🚺 In	formation	
Network: Baudrate (bit/s):	0 (m) 250000 ▼	CAN

Right click on CANbus

in the device tree and click Add Device.

Choose CANOpen_Manager in the CANOpenManager option (Fieldbussed -> CANOpen -> CANOpenManager). Click Add Device to proceed and then press Close to close the device dialog.



Now, you'll see CANOpen_Manager (CANopen_Manager)

in the device

tree. Double-click the CANOpen_Manager icon to set configuration.

CANopen Manager 🗮 CAN	lopen I/O Mapping Status	(i) Information				
General						
Node ID: 127 Check and fix configuration						
✓ Autostart CANopenManager ✓ Polling of optional slaves						
✓ Start Slaves NMT Error Behaviour: Restart Slave						
📝 NMT Start All (if po	ossible)					
Sync						
Enable Sync Producin	g					
COB-ID (Hex): 16#	80					
Cycle Period (µs):	1000					
Window Length (µs):	1200					
Enable Sync Consumi	ng					
Heartbeat		TIME				
📝 Enable Heartbeat Pro	ducing	Enable TIME Producing	Ig			
Node ID:	127	COB-ID (Hex): 16#	100			
Producer Time (ms):	200	Producer Time (ms):	1000			

At the first scan, at least **once a login (and running)** must have been done. Otherwise, the Advantech X86 RTE platform must be running before a scan.

Choose the **CANOpen_Manager** and right click **Scan For Devices** in context menu.

Devices		🗕 🕂 🗙 🗾 Ві
E anopen3		
😑 😏 🚺 Device [connected] (Advantech Series x86 RTE V3)		
PLC Logic		Offline
Application [run]		🕚 0 war
🎁 Library Manager		Severity
PLC_PRG (PRG)		0
🖻 🔛 Task Configuration		0
🖻 😻 MainTask		0
PLC_PRG		0
- 🧐 🚾 Backplane (System Diagnosis)		0
E 🥵 🔛 CANbus (CANbus)	_	0
CANopen_Manager (CANopen_Manager)	Ж	Cut
	8	Сору
	2	Paste
	\times	Delete
		Refactoring •
	Ę,	Properties
		Add Object
		Add Folder
		Add Device
		Scan For Devices
		Disable Device
	ß	Edit Object
		Edit Object With
		Edit IO mapping
		Import mappings from CSV
		Export mappings to CSV
		Device Configuration

A list of all devices and modules are found during the last scan. Select the specified one device and then copy to the project. Or copy all listed devices to the project.

Now, you'll see the devices copied to the project under the **CANOpen_Manager**.



After completely finish device configuration, it is necessary to login again.



6.3. EtherNet/IP

6.3.1. EtherNet/IP Client

6.3.1.2. Configuration Files Installation

Before connecting to slaves by using Profinet client, please install the related EDS files (*.eds) first.

Start CODESYS and perform command Device Repository	1	from the menu (Tools ->
---	---	------------------------------------

Device Repository). Click "Install" and then select the related EDS file you want to install.

After installed successfully, the following information will be shown: "Device xxxx installed to device repository".

2	Device Re	pository	×
	Location:	System Repository (C:\ProgramData\CODESYS\Devices)	Edit Locations
	Installed d	evice descriptions:	
	Name	Vendor Version	Uninstall
	i	oftMotiondrives	Install DTM
			Details
		:\APAX-5580CDS\adam6100EI\new\ADAM-6117EI_20130329.eds Device "Advantech - ADAM-6117EI" installed to device repository.	
			Close

6.3.1.3. Add Slaves

First, connect to your specified Advantech X86 RTE platform. Please refer to Chapter 3.4.

In Device Window, Right-click on **Device** And click Add Device. You will then be prompted for the Add Device dialog.

Devices			•	д	×
Advantech_Sample_Project					
Device (Advantech APAX-5580 x86 RTE V3)	X	Out			
Pic Logic Orginal Application Orginal Library Manager		Copy Paste			
PLC_PRG (PRG)	\times	Delete			
🖹 🌃 Task Configuration	Ę,	Properties			
= ⊗ MainTask	*:::	Add Object			
Backplane (Backplane)	\bigcirc	Add Folder			
em+		Add Device			
	ũ	Update Device Edit Object Edit Object With			
	4	Edit IO mapping Import mappings from CSV Export mappings to CSV Online Config Mode Reset origin device [Device] Simulation			
		Device Configuration			

Choose **Ethernet** in the **Ethernet Adapter** option and click **Add Device** to proceed and then press Close to close the device dialog.

Add Device	×
Name: Ethernet	
Action	
Annend device O Insert device O Plug device O Undate device	
Device:	
Vendor: <all vendors=""></all>	•
Name Vendor	
Fieldbusses	
H-CAN CANbus	
Filement 35 - Smart Software Solutions GmbH	
🖶 🏧 Modbus	
🗈 - 🎹 Profibus	
🕀 - 🛲 Profinet IO	
⊞- S sercos	
Group by category	
Display outdated versions	
Information:	
Name: Ethernet	
Vendor: 3S - Smart Software Solutions GmbH	
Version: 3.5.6.0	
Order Number: -	×.
Description: Ethernet Link.	
Append selected device as last child of Device	
Append selected device as last child of Device (You can select another target node in the navigator while this window is open.)	

Now, you'll see Ethernet 🗐 Ethernet (Ethernet) in the device tree. Double-click the Ethernet icon to set configuration. Click Interface and then select any one Ethernet Adapter.

Ethernet Configuration	n Status (i) Information						
Interface:		 Network Ad	apters				
(Device uses operat	ing system settings)	Interfaces:					
IP address	192 . 168 . 0 . 1	Name	Description			IP Address	
Cubert mark		lan1	Intel(R) Ethernet	Connection I218	-LM #2	172.18.3.131	
Subnet mask	255 . 255 . 255 . 0	lan2	CoDeSys EtherE	xpress GBit PCI I	themet Adapter	192.168.0.1	
Default Gateway	0.0.0.0						
		IP address	192 .	168 . 0 . 1]		
		Subnet mas	.k 255 .	255 . 255 . 0	1		
		Default Gai	eway 0.	0.0.0	1		
		MAC-Add		COBOORIAD			
		Mile Haa	00.20	C5.B0.5E.IID			
						Ok	Cancel

Note!

- (1) Both LAN#1 and LAN#2 can be used for EtherNet/IP.
- (2) The IP address should be setup completely by using "Change Adapter settings" in Advantech X86 RTE platform.
- (3) The Ethernet Adapter must not have a Unicode String Name. Please rename your adapter using ASCII characters only.

Right click on Ethernet If Ethernet (Ethernet) in the device tree and click Add Device. Choose EtherNet/IP Scanner in the EtherNet/IP Scanner option (EtherNet/IP -> EtherNet/IP Scanner). Click Add Device to proceed and then press Close to close the device dialog.

Add	d Device		
lame	EtherNet_IP_Scanner		
Actio	on:		
A (0)	ppend device 🔘 Insert device 🔘	Plug device 🔘 Update device	
Devi	ce:		
Ven	den (Allundere)		
veno	dor: <ali vendors=""></ali>		
Na	ime	Vendor	
.	iii Fieldbusses		
	EtherNet/IP		
	EtherNet/IP Scanner		
	EtherNet/IP Scanner	35 - Smart Software Solutions Gm	IDH
	Modbus		
	Profinet IO		
	Group by category		
	oroup by category		
	Display outdated versions		
	Display outdated versions		
Info	rmation:		
•	Name: EtherNet/IP Scanner		
	Vendor: 3S - Smart Software Soluti	ons GmbH	
	Categories: EtherNet/IP Scanner		1
	Version: 3.5.6.0		
	Description: EtherNet/TP Scapper		
	beschption. Earcheigh Stanner		
Арр	end selected device as last child o	f	
Ethe	ernet		
0	(You can select another target node	in the navigator while this window is	open.)
			Add Device Close

Now, you'll see EtherNet_IP_Scanner ^{(EtherNet_IP_Scanner} in the device tree. Double-click the EtherNet_IP_Scanner icon to set configuration.

Scanner settings 🛛 🗮 E	therNet/IP Scanner I/O Mapping	Status 🕕 Information
Address Settings		
Ose static IP-Addr	ess	
IP Address:	192 . 168 . 0 . 1	EtherNet/IP
Subnet Mask:		
Gateway Address:		
BOOTP DI	HCP	
Ethernet Settings		
Speed & Duplex:	· · · · · · · · · · · · · · · · · · ·	
Options		
🚺 Auto-reestablish d	connections	

Right click on EtherNet_IP_Scanner ^{for} EtherNet_IP_Scanner (EtherNet/IP Scanner) in the device tree and click Add Device. Choose the specified EtherNet/IP slave you want to add in the EtherNet/IP Remote Adapter option (EtherNet/IP -> EtherNet/IP Remote Adapter). Click Add Device to proceed and then press Close to close the device dialog.

× 🚹 Add Device Name: Advantech ADAM 6117EI Action: (a) Append device (b) Insert device (c) Plug device (c) Update device Device: Vendor: <a>All vendors> Name Vendor 🖃 👔 Fieldbusses 🛓 😝 EtherNet/IP EtherNet/IP Remote Adapter Advantech - ADAM-6117EI Advantech Generic EtherNet/IP device 35 - Smart Software Solutions GmbH Group by category Display outdated versions Information: 1 Name: Advantech - ADAM-6117EI Vendor: Advantech Categories: EtherNet/IP Remote Adapter Version: Major Revision=16#1, Minor Revision = 16#1 Order Number: Description: Ethernet/IP Target imported from EDS File: ADAM-6117EI_ 20130329.eds Device: Advantech - ADAM-6117EI Append selected device as last child of EtherNet_IP_Scanner 0 (You can select another target node in the navigator while this window is open.) Add Device Close

Take the following as an example adding ADAM-6117EI into.

Now, you'll see ADVANTECH_ADAM_6117EI Advantech_ADAM_6117EI (Advantech - ADAM-6117EI) in the device tree. Double-click the ADVANTECH_ADAM_6117EI icon to set configuration including IP address,..etc.

Target settings	Connections	Assemblies	User Parameter	🗮 EtherNet/IP I/O Mapping	Status () Information
Address Settin	gs				
IP Address:	192 . 1	68.0.	2	EtherNet/IP	
Electronic Keyi	ng				
Keying Optio	ins				
Compatil	bility Check				
Strict Ide	ntity Check				
Check D	evice Type	0			
Check Ve	endor Code	94			
Check Pr	oduct Code	6117			
Check M	ajor Revision	1			
Check M	inor Revision	1			
Restore de	fault values				

After completely finish device configuration, it is necessary to login again.



6.4. Profinet

6.4.1. Profinet Client

6.4.1.2. Configuration Files Installation

Before connecting to slaves by using Profinet client, please install the related Profinet IO configuration files (GSDML*.xml) first.

Start CODESYS and perform command Device Repository	from the menu (Tools ->
Device Repository). Click "Install" and then select the rela	ted GSD file you want to install.

After installed successfully, the following information will be shown: "Device xxxx installed to device repository".

😤 Device Re	epository		×
Location:	System Repository (C:\ProgramData\CODESYS\	▼ ⊃evices)	Edit Locations
Installed d	evice descriptions:		
Name	Vendor Miscellaneous	Version	Install Uninstall
₽ . <u>.</u> P	PLCs SoftMotiondrives		Install DTM
			Details
	D:\Siemens\GSDML-V2.31-Sien D Device "IM 155-6 PN ST V1.	ens-ET200SP-20150218.xml 0" installed to device repository.	
	 Device "IM 155-6 PN ST S V Device "IM 155-6 PN ST V1. 	1.0" installed to device repository. 1" installed to device repository.	
	Device "IM 155-6 PN ST V3.	1" installed to device repository.	
	Device "IM 155-6 PN HF V2 Device "IM 155-6 PN HF V2	0" installed to device repository. 1" installed to device repository.	
	Device "IM 155-6 PN HF V2	2" installed to device repository.	
	Device "IM 155-6 PN HF V3	0" installed to device repository.	
	Device "IM 155-6 PN HF V3 Device "IM 155-6 PN BA V3	1" installed to device repository. 2" installed to device repository.	
			Close

6.4.1.3. Scan for Slaves

First, connect to your specified Advantech X86 RTE platform. Please refer to Chapter 3.4.

In Device Window, Right-click on **Device** And click Add Device. You will then be prompted for the Add Device dialog.

Devices			•	- 4	×
Advantech_Sample_Project					•
Device (Advantech APAX-5580 x86 RTE V3)	X	Out			
Gradient Contraction Gradient Contraction		Copy			
PLC_PRG (PRG)	×	Delete			
Task Configuration	G.	Properties			
□ S MainTask	*::	Add Object 🕨			
Backplane (Backplane)		Add Folder			
		Add Device			
		Update Device			
	D°	Edit Object			
		Edit Object With			
		Edit IO mapping			
		Import mappings from CSV			
		Export mappings to CSV			
	×°	Online Config Mode			
		Reset origin device [Device]			
		Simulation			
		Device Configuration			

Choose Ethernet in the Ethernet Adapter option (Profinet IO -> Ethernet Adapter) and click

Add Device to proceed and then press Close to close the device dialog.

Name: Et	hernet			
Action:				
Annen	d device 🖉 Insert device	Plug device Indate device		
 Appen 				
Device:				
Vendor:	<all vendors=""></all>			•
Name		Vendor		
🖃 - 🛐 F	ieldbusses			
<u>اع</u> ا	AN CANbus			
🕀 ·· Be	a Ethercat			
🗄 ·· 📕	Ethernet Adapter			
🕀 · 🧲	🔒 EtherNet/IP			
🕀 ·· 🗰	Modbus			
	# Profibus			
H · #	Profinet IO			
-	Ethernet Adapter			
	Ethernet	35 - Smart Software Solutions GmbH		
	I Destination of the second se			
	Profinet IO Device			
	Frofinet IO Device Profinet IO Master serros			
€	Hill Profinet IO Device Hill Profinet IO Master sercos by category			
Group Group Displa Informatio Gr Ve Gr	"## Profinet IO Device ## Profinet IO Master sercos by category ay outdated versions in: imme: Ethernet endor: 35 - Smart Software S oups: Ethernet Adapter, Eth resion: 35 - 6	olutions GmbH ernet Adapter		<u></u>
Group Displa Informatio Gr Ve Ma	"## Profinet IO Device ## Profinet IO Master sercos by category ay outdated versions in: in: in: in: Ethernet coops: Ethernet Adapter, Eth rsion: 3.5.6.0 del Number	olutions GmbH ernet Adapter		
Group Group Displa Informatio Na Ve Gr Ve Mi	"## Profinet IO Device ## Profinet IO Master sercos by category ay outdated versions in:	olutions GmbH ernet Adapter		
Group Group Displa Informatio Na Ve Gr Ve Mi De	"## Profinet IO Device ## Profinet IO Master sercos sercos sercos voy outdated versions in: in: endor: 35 - Smart Software S oups: Ethernet t endor: 35 - Smart Software S odel Number: - escription: Ethernet Link.	olutions GmbH ernet Adapter		<u></u>
Group Group Displa Informatic Ma Ve Gr Ve Ma De Append s Device (You		olutions GmbH iernet Adapter ild of iode in the navigator while this window	ris open.)	
Group Displa Informatio Na Ve Gr Ve M Device		olutions GmbH lernet Adapter ild of iode in the navigator while this window	ris open.)	

Now, you'll see Ethernet Itethernet (Ethernet) in the device tree. Double-click the Ethernet icon to set configuration. Click Interface and then select CODESYS Ethernet Adapter (LAN#2).

Ethernet Configuration	Status 🕕 Information				
Interface:		 Network Adap	ters		- • ×
(Device uses operati	ing system settings)	 Interfaces:			
		 Name	Description	IP Address	
IP address	192 . 168 . 0 . 1	 connection1	CoDeSys EtherExpress GBit PCI Ethe	emet Adapter 192.168.0.1	
Subnet mask	255 . 255 . 255 . 0	 connection2	Intel(R) Ethernet Connection I218-L1	ví#2 172.18.3.127	
Default Gateway	0.0.0.0				
		 IP address	192 . 168 . 0 . 1		
		 Subnet mask	255 . 255 . 255 . 0		
		 Default Gatew	ay 0.0.0.0		
		 MAC-Addres	: 00:D0:C9:B0:9E:AD		
				Ok	Cancel

Note!

- (1) Only LAN#2 can be used for Profinet.
- (2) The IP address should be setup completely by using "Change Adapter settings" in Advantech X86 RTE platform.
- (3) The Ethernet Adapter must not have a Unicode String Name. Please rename your adapter using ASCII characters only.

Right click on Ethernet If thernet (Ethernet) in the device tree and click Add Device. Choose PN-Controller in the Profinet IO Master option (Profinet IO-> Profinet IO Master). Click Add Device to proceed and then press Close to close the device dialog.

Add Device			×
Name: PN_Controller			
Action:			
Append device	Plug device O Update device		
Device:			
Vendor: <a>All vendors>			•
Name	Vendor		
Fieldburgen	Vendor		
EtherNet/ID			
H. Modbus			
Profinet IO			
Profinet IO Master			
PN-Controller	35 - Smart Software Solutions GmbH	1	
Crown by category			
Display outdated versions			
Information:			
Name: PN-Controller			
Vendor: 3S - Smart Software So	olutions GmbH		
Groups: Profinet IO Master			
Version: 3.5.6.0			
Model Number: 1	allar		
Description: Profinet 10 Contro	טווכו		
Append selected device as last chi Ethernet	ld of		
(You can select another target no	ode in the navigator while this window	v is open.)	
		Add Devi	ce Close

Now, you'll see PN-Controller ^{PN_Controller (PN-Controller)} in the device tree. Double-click the PN-Controller icon to set configuration.

If default slave IP address parameter is invalid, please click "adjust" to automatically adjust to the right First and Last IP address. And make sure the subnet mask and gateway are all configured correctly.
PNIO Master parameters		=	Pľ	VIO I	/0	Мар	pin	g S	tatus	1	Information
Station name	contro	oller									
Default Slave IP Parameter											
First IP address		192	•	168		1		2	0	<u>adjus</u> t	1
Last IP address		192		168		1		254	0		
Subnet mask		255		255		255		0			
Default Gateway		0		0		0		0			

At the first scan, at least **once a login** must have been done. Otherwise, the Advantech X86 RTE platform must be running before a scan.

Choose the **PN-Controller** and right click **Scan For Devices** in context menu.

Devices		→ ∓ X
Advantech_Sample_Project		•
😑 🧐 🔼 Device [connected] (Advantech APAX-	5580 :	x86 RTE V3)
Plc Logic		
Application [run]		
Library Manager		
PLC_PRG (PRG)		
🖃 🎎 Task Configuration		
MainTask		
	bek	
	ask Cycle	
Profinet IOTask	cycic	
Backplane (Backplane)		
🖻 😏 🗊 Ethernet (Ethernet)		
PN_Controller (PN-Controller)	U	• ·
	ф Б	cut
		Сору
	E	Paste
	X	Delete
		Refactoring •
	e	Properties
	52 111	Add Object
	\bigcirc	Add Folder
		Add Device
		Insert Device
		Scan For Devices
		Disable Device
	ß	Edit Object
		Edit Object With
		Edit IO mapping
		Import mappings from CSV
		Export mappings to CSV
		Device Configuration

A list of all devices and modules are found during the last scan. Select the specified one device and then copy to the project. Or copy all listed devices to the project.

Devicename	Devicetype	Station Na	Ident-Nr.	MAC address	IP address	Subnet
, et200sp1	IM 155-6 PN ST V1.0	et200sp1	16#00004700	00:1B:1B:6E:D2:5D	192.168.0.2	255.255.2
et200sp1_0	DI 16x24VDC ST V1.0		16#00004D40			
et200sp1_1	DQ 16x24VDC/0.5A ST V1.0		16#00004D80			
et200sp1_2	Server module (IM 155-6 PN ST V1.0)		16#00004710			
٠		m				. ,

Now, you'll see the devices copied to the project under the PN-Controller.



After completely finish device configuration, it is necessary to login again.



6.5. EtherCAT

6.5.1. EtherCAT Client

6.5.1.2. Configuration Files Installation

Before connecting to slaves by using EtherCAT client, please install the related EtherCAT XML device description configuration files (*.xml) first.

Start CODESYS and perform command **Device Repository** from the menu (**Tools ->**

Device Repository). Click "Install" and then select the related XML file you want to install.

After installed successfully, the following information will be shown: "Device xxxx installed to device repository".

😤 Device Repository	In successive papers in the local division in some	×
Location: System Reposito (C:\ProgramDat	ry a\CODESYS\Devices)	Edit Locations
Installed device descriptions	2	
Name	Vendor Version	Install
The Miscellaneous		Uninstall
± 11 Fieldbusses		Uninstan
PLCs		
🗉 🔗 SoftMotiondrives		Install DTM
		Details
 D:\APAX-5580CDS\ Device "ADAM- Device "ADAM- Device "ADAM- D:\APAX-5580CDS\ D	ADAM-5000ECAT.xml 5000/ECAT" installed to device repository. 5000/ECAT" installed to device repository. ADAM-5000ECAT_Modules.xml E50515, 16 Ch. Input (24V, 3.0ms)" installed to device repository. E50535, 32 Ch. Input (24V, 3.0ms)" installed to device repository. E50535, 32 Ch. Input (24V, 3.0ms)" installed to device repository.	
Device "ADAM	E50565/SO, 16 Ch. Output (30V, 0.2 A)" installed to device repository.	
Device "ADAM	E50575, 32 Ch. Output (24V, 0.5 A)" installed to device repository.	
Device "ADAM Device "ADAM	E5069, 8 Ch. Output (24V, 0.5 A)" installed to device repository.	
Device ADAM	ESO17, 6 Ch. and. Input (-107/0107) Installed to device repository.	
Device "ADAM Device "ADAM	E5024. 4 Ch. ana. Output (010V)" installed to device repository.	
Device "ADAM	E5024H, 4 Ch. ana. Output (010V)" installed to device repository.	
	m 🕑	
		Close

6.5.1.3. Scan for Slaves

First, connect to your specified Advantech X86 RTE platform. Please refer to Chapter 3.4.

In Device Window, Right-click on **Device** And click Add Device. You will then be prompted for the Add Device dialog.



Choose EtherCAT Master in the EtherCAT/Master option and click Add Device to proceed

and then press Close to close the device dialog.

f Add Device			X				
Name: EtherCAT Master							
Antioner Lance CARL_Master							
Action:							
Append device Insert device) Plug device 🔘 Update device						
Device:							
Vendor: <a>All vendors>			_				
Name	Vendor						
🖃 🕤 Fieldbusses							
CANbus							
Brad Ethercat							
Brow Master							
🖬 EtherCAT Master	35 - Smart Software Solutions Gm	ьн					
🗈 🕮 Ethernet Adapter							
🗉 👄 EtherNet/IP							
🗄 🗰 Modbus							
🗈 🛲 Profibus	🗑 - 🛲 Profibus						
🗎 🛲 Profinet IO							
Group by category							
Display outdated versions							
Information:							
Name: EtherCAT Master							
Vendor: 3S - Smart Software Solu	tions GmbH						
Groups: Master		=					
Version: 3.5.5.0							
Model Number: ???			~				
Description: EtherCAT Master		Ŧ					
Append selected device as last child Device	of						
(You can select another target nod	e in the navigator while this window	v is open.)					
		Add Davies					
		Add Device	Close				

Now, you'll see EtherCAT Master $\textcircled{ EtherCAT_Master (EtherCAT Master) } in the device tree. Double-click the EtherCAT Master icon to set configuration. Click$ **Browse**and then select

CODESYS Ethernet Adapter (LAN#2).

Master	🗮 EtherCAT I/O Map	ping Status	(1) Information
	Autoconfig Master/Slave	es	EtherCAT
-Ether(CAT NIC Setting		
Des	tination Address (MAC)	FF-FF-FF-FF-	FF-FF Broadcast Enable Redundancy
Sou	rce Address (MAC)	00-00-00-00-	00-00 Browse
Net	work Name		
•	Select network by MAC	© Se	elect network by Name
Distrib	uted Clock		Options
Cycle	time 4000	÷ µs	Use LRW instead of LWA/LRD
Sync	Offset 20	÷ %	Enable messages per task
S	ync Window Monitoring		Auto restart slaves
Sync	window 1	× µs	
Selec	t Network Adapter		
M	IAC address	Name	Description
	00D0C9B09EAD c	onnection1	CODESYS EthAdapter: {2D54AEB9-BE8F-4035-87CD-C88E9B84DC9F} 00:d0:c9:b0:9e:ad
			\mathbf{N}
			\mathbf{h}
			OK Abort
			h.

Note!

- (4) Only LAN#2 can be used for EtherCAT.
- (5) "Auto restart slaves" is suggested to be clicked.

Options
Use LRW instead of LWR/LRD
🔲 Enable messages per task
V Auto restart slaves

At the first scan, at least **once a login (and running)** must have been done. Otherwise, the Advantech X86 RTE platform must be running before a scan.

Choose the EtherCAT_Master and right click Scan For Devices in context menu.



A list of all devices and modules are found during the last scan. Select the specified one device and then copy to the project. Or copy all listed devices to the project.

Devicename	Devicetype	Alias Address
Attention! The device was not found in the repository	Vendorcode: 0x13FE, Productcode: 0x0, Revision: 0x0	
- Attention! The device was not found in the repository	Vendorcode: 0x13FE, Productcode: 0x0, Revision: 0x0	
- Attention! The device was not found in the repository	Vendorcode: 0x13FE, Productcode: 0x0, Revision: 0x0	
- Attention! The device was not found in the repository	Vendorcode: 0x13FE, Productcode: 0x0, Revision: 0x0	
- Attention! The device was not found in the repository	Vendorcode: 0x13FE, Productcode: 0x0, Revision: 0x0	
Attention! The device was not found in the repository	Vendorcode: 0x13FE, Productcode: 0x0, Revision: 0x0	
ADAM_5000_ECAT	ADAM-5000/ECAT	530
Attention! The device was not found in the repository	Vendorcode: 0x13FE, Productcode: 0x0, Revision: 0x0	
- Attention! The device was not found in the repository	Vendorcode: 0x13FE, Productcode: 0x0, Revision: 0x0	
ADAM_E5056S_SO	Digital Output Terminals	
ADAM_E5056S_SO	Digital Output Terminals	
- Attention! The device was not found in the repository	Vendorcode: 0x13FE, Productcode: 0x0, Revision: 0x0	
- Attention! The device was not found in the repository	Vendorcode: 0x13FE, Productcode: 0x0, Revision: 0x0	
- Attention! The device was not found in the repository	Vendorcode: 0x13FE, Productcode: 0x0, Revision: 0x0	
Attention! The device was not found in the repository	Vendorcode: 0x13FE, Productcode: 0x0, Revision: 0x0	
Assign Address		show differences to projec

Now, you'll see the devices copied to the project under the EtherCAT_Master.

- EtherCAT_Master (EtherCAT Master)
 - ADAM_5000_ECAT (ADAM-5000/ECAT)

 - <c <> Control <</pre>
 - ADAM_E5056S_SO (Digital Output Terminals)
 - ADAM_E5056S_SO_1 (Digital Output Terminals)
 - <cmpty5> (<Empty>)
 - ~K <Empty6> (<Empty>)
 - ~K <Empty7> (<Empty>)
 - Contraction (<Empty8> (<Empty>)

After completely finish device configuration, it is necessary to login again.

🖮 😏 🛐 EtherCAT_Master (EtherCAT Master)

ADAM_5000_ECAT_1 (ADAM-5000/ECAT)

ADAM_5051S (Digital Input Terminals)

C ADAM_E5051S (Digital Input Terminals)

ADAM_E5056S_SO_2 (Digital Output Terminals)

ADAM_E5056S_SO_3 (Digital Output Terminals)

C ADAM_E

Chapter 7

7. Examples

7.1. Visualization

The CODESYS visualization is a graphical representation of the project variables which allows inputs to the program in online mode via mouse and keypad. The CODESYS visualization editor, which is part of the programming system, provides graphic elements which can be arranged as desired and can be connected with project variables. The following example project shows how to write a scrolling LED program in visualizations.

7.1.1. Create a new Visualization

Step 1: To create a new visualization, right-click on Application and use commandVisualization from the menu. You will then be prompted for New visualization dialog. Enter the name of the new visualization.



Step 2: Resize the width and height of the visualization object (number of pixels) by right-click on the visualization object.

😑 🛃 Visualiza	ation	Manager		
🔚 🎦 Tar	getVi	sualization		
🔤 🥵 We	💮 WebVisualization		Pro	operties - Visualization [Device: Plc Logic: Application]
Visualiz Backplane (Bacl	Ж	Cut		Common Build Visualization Access control
		Сору		Use Visualization as:
	æ	Paste		Misualization Dialog
	\times	Delete		Numpad/ Keypad/ dialog for inputconfiguration
		Refactoring 🕨		Use automatic detected visualization size
	æ	Properties		Use specified visualization size
		Add Object		Visualization size: Width: 1024 Height: 768
	\bigcirc	Add Folder		
	C°.	Edit Object		
		Edit Object With		OK Cancel Apply

Step 3: Now, double-click on the visualization object and you'll see **ToolBox** on the right side. You can insert various geometric forms, as well as bitmaps, metafiles, buttons into your visualization by pushing down selected element into editor window.



7.1.2. Visualize the Scrolling LED

Step 1: In this case, we need to insert Advantech images into the visualization, so we create an image pool. Again, right-click on **Application** and use command **Image Pool** from the menu. Enter string ID and the path of the image file



In order to visualize the scrolling LED, we insert lamps, rectangle, button and images.



Step 2: Create a PLC program in PLC_PRG(PRG). For more detailed information about how to write a program, please refer to <u>Chapter3.3</u>.

	📄 Р	LC_PRG ×
	1	PROGRAM PLC_PRG
	2	VAR
	з	n: WORD := 1;
	4	vLED: WORD := 1;
	5	switch: BOOL;
	6	<pre>SL0_5056_STATUS: BOOL;</pre>
	- 7	END_VAR
	8	-
<		
	1	
	2	TE switch THEN
-	3	
-	a	THED - THED * MODD#2.
	5	n:=n+1:
	6	ELSE
	- 7	n:=1:
	8	$\mathbf{v}_{\mathrm{LED}} := \mathrm{MORD} \# 1$:
	9	END TF:
	10	END IF:
	11	IF gSL0 5056.Err \diamond 0 THEN
	12	SLO 5056 STATUS := FALSE:
	13	ELSE
	14	SLO 5056 STATUS := TRUE;
	15	END IF
	16	-
	17	
	18	qSLO 5056.DO CH := vLED;
	19	

Step 3: Map variables to the lamp objects. For the first lamp, map to first bit of DO channel variable (**gSL0_5056.DO_CH**). For more detailed information about how to map variable, please refer to <u>Chapter4.3</u>.

16 DO	۲
ADAN	4-5056D
DO 00	
D0 01	۲
DO 02	۲
DO 03	۲
D0 04	۲
DO 05	۲
DO 06	۲
DO 07	۲
DO 08	۲
DO 09	۲
DO 10	۲
D0 11	۲
D0 12	۲
DO 13	۲
D0 14	۲
DO 15	۲

Properties 🛛 👻 🗖							
🍸 Filter 🔹 🖹 🗞 Sort by 🔹 🤶 Sort order 👻 🛃 Expert							
Property	Value						
Elementname	GenElemInst_118						
Type of ele	Lamp1						
Position							
X	906						
Y	246						
Width	17						
Height	19						
Variable	gSL0_5056.DO_CH.0						
🖃 Image settin							
Isotropi	Isotropic						
Horizont	Left						
Vertical	Тор						
Texts							
Tooltip							
😑 State variabl							
Invisible							
😑 Background							
Image	Green						

Step 4: You have to connect to target device and running the program. Click on the button and the result was shown below.



7.2. Remnant Variables

Remnant variables retain their value throughout the usual program run time. They are declared as "Retain Variables" or "Persistent Variables". For keeping variables values even after the controller had been terminated or after the application has been reloaded, CODESYS offers different types:

7.2.1. Retain Variables

As we discuss how to declare variable in <u>Chapter3.3</u>, we can declare retain variables by adding the keyword RETAIN" in the declaration part, behind the keyword for the base variable's type.

Here, we declare 1 retain variable "var3_retain" with initial value 1000 and 2 normal variables.

P	LC_PRG X
1	PROGRAM PLC_PRG
2	VAR
З	<pre>varl: int := 0;</pre>
4	<pre>var2_init: int := 1000;</pre>
5	END_VAR
6	VAR RETAIN
7	<pre>var3_retain: int := 1000;</pre>
8	END_VAR

7.2.2. Persistent Variables

To create a new persistent variable, right-click on Application and use command Persistent

Variables from the menu.



Double-click the object in the device tree. Here, we declare a global variable "var4_persist" with initial value 1000.



7.2.3. Variable Behavior

We want to investigate and compare the variable behavior between retain and persistent, so we keep adding their value in the body part of the PLC_PRG editor.

```
1 varl := varl +1;
2 var2_init := var2_init +1;
3 var3_retain := var3_retain +1;
4 
5 var4_persist := var4_persist +1;
```

The result was shown below after we run our program on the target device.

```
1 varl 37 := varl 37 +1;
2 var2_init 1037 := var2_init 1037 +1;
3 var3_retain 1037 := var3_retain 1037 +1;
4 5 var4_persist 1037 := var4_persist 1037 +1;RETURN
```

There three **Online Commands** for controlling the application program on a real or on the simulation target system after having logged in, including **Reset warm**, **Reset cold** and **Reset origin**.

The command **Reset warm** will reset (with exception of the retain and persistent variables) all variables of the currently active application to their initialization values. The situation is that which occurs in the event of a power outage or by turning the controller off, then on (warm restart) while the program is running.

The command **Reset cold** will reset (with exception of the persistent variables) all variables of the currently active application to their initialization values. The situation is that which occurs at the start of a program which has been downloaded just before to the target device.

The command **Reset origin** resets all variables of the currently active application, including the retain and persistent variables to their initialization values and erases the application on the target device.



The following is the overview on the behavior of remanent variables:

o = Value is maintained - = Value is initialized

After online command	VAR	VAR RETAIN	VAR PERSISTENT RETAIN
Reset warm <application></application>	-	0	0
Reset cold <application></application>	-	-	0
Reset origin <application></application>	-	-	-
Download <application></application>	-	-	0
Online Change <application></application>	0	0	0
Reboot the target device	-	0	0

7.3. Modbus TCP Client

We use the following Advantech ADAM-5000 devices to demonstrate Modbus TCP client.

- ADAM-5560
- ADAM-5000/TCP with:
 - Slot 0: ADAM-5051(16-ch Digital Input)
 - Slot 1: ADAM-5056(16-ch Digital Output)
 - Slot 2: ADAM-5017(8-ch Analog Input)
 - Slot 3: ADAM-5024(4-ch Analog Output)
 - ADAM-6051(14-ch Digital I/O with 2-ch Counter)



Step 1: Refer to <u>Chapter5.1.2</u> and add Modbus TCP master to the project. Remember to enter the device's IP address.



Step 2: Start to write our program. Define new structure to store ADAM-5000 and

ADAM-6000 channel data and declare them as global variables.



We write the program in PLC_PRG.

Devices -	д X) PLC	PLC_PRG X
ADAM_5560_MBTCPClient ADAM_5560 WinCE V3) Device (Advantech ADAM-5560 WinCE V3) Device (Logic	-		1 2 3	PROGRAM PLC_PRG VAR AO_CHOO: REAL := 0.0;
Application			4 5	AI_CHOO: REAL; END_VAR
- 🧭 GVL - 💼 ImagePool - 🎁 Library Manager				
PLC_PRG (PRG) Symbol configuration Task Configuration				
G S MainTask □ □ PLC_PRG		<		
ie SVISU_TASK └@ VisuElems.Visu_Prg			1 2	A5000.wA0_CH[1] :=REAL_TO_WORD (409.5*A0_CH00);
🕮 - 🛃 Visualization Manager			3	AI_CHUU := (20.0* WORD_TU_REAL(ASOU0.WAI_CH[I])/65535.0)-10.0;

Step 3: Map Modbus data to the variables that we declared in previous step.

ModbusTCP Slave Modbus Slave Channel Modbus Slave Init ModbusTCPSlave C	Configuration 🏾 🇮 ModbusTCPSlave I/O Mappin	9 Status 🤳 Information
Channels		
Variable Mapping Channel Address	Type Unit De	scription
🗐 🖓 Application.A6051.byDI_CH 🌍 DI_Channel %IB0	ARRAY [01] OF BYTE Digi	tal input value
🖻 🦘 Application.A6051.byDO_CH 🌱 DO_Channel %QB	ARRAY [00] OF BYTE Digi	tal output value

Modbus Slave	Init ModbusTCP	Slave Configurat	ion 🗧 ModbusTCPSlave I/C) Mapping	Status 🚺 🤹 Information
Mapping	Channel	Address	Туре	Unit	Description
?∳	DI_Channel	%IB2	ARRAY [01] OF BYTE		Read Coils
~~	DO_Channel	%QB2	ARRAY [01] OF BYTE		Write Multiple Coils
~~	AI_Channel	%IW2	ARRAY [07] OF WORD		Read Holding Registers
~~	AO_Channel	%Q₩2	ARRAY [07] OF WORD		Write Multiple Registers
	Modbus Slave Mapping	Modbus Slave Init ModbusTCP Mapping Channel DI_Channel OD_Channel AI_Channel	Modbus Slave Init ModbusTCPSlave Configurat Mapping Channel Address OL DL State OL Channel %H82 OL Channel %H82 All_Channel %H82 All_Channel %H82 AO_Channel %H82	Modbus Slave Init ModbusTCPSlave Configuration Image: ModbusTCPSlave I/0 Mapping Channel Address Type Modbus DL_Channel %HB2 ARRAY [01] OF BYTE Modbus DL_Channel %HB2 ARRAY [01] OF BYTE AL_Channel %HB2 ARRAY [01] OF BYTE AL_Channel %HW2 ARRAY [07] OF WORD AO_Channel %HW2 ARRAY [07] OF WORD	Modbus Slave Init ModbusTCPSlave Configuration ModbusTCPSlave I/O Mapping Mapping Channel Address Type Unit Mapping D1_Channel %HB2 ARRAY [01] OF BYTE Unit D0_Channel %HB2 ARRAY [01] OF BYTE Unit AI_Channel %HB2 ARRAY [01] OF BYTE Unit ALChannel %HW2 ARRAY [07] OF WORD Unit

Step 4: Map all variables to the textfield objects in visualization.

	Object		Mapping variable
SL0_ADAM-5051DI_CH00	1X0001	%d	Text variables Text variable A5000.byDI_CH[1].0 Tooltip variable
SL1_ADAM-5056DO_CH00	0×0017	%d	Text variables Text variable Tooltip variable Inputconfiguration OnDialogClosed Configure OnMouseClick Configure OnMouseDown Configure Toggle a V
SL2_ADAM-5017AI_CH00	3X0017	%1.3fV	Text variables Text variable PLC_PRG.AI_CH00 Tooltip variable

SL3_ADAM-5024AO_CH00	4X0025	%1.3rV	Text variables Text variable PLC_PRG.AO_CH00 Tooltip variable
			Inputconfiguration OnDialogClosed Configure OnMouseClick Configure OnMouseDown Configure Write a Var Variable : , InputTyp
ADAM-6051DI_CH00~07	1X0001~8	%d	Text variables Text variable A6051.byDI_CH[1] Tooltip variable
ADAM-6051DO_CH00~01	0X0017~18	%d	Text variables Text variable A6051.byDO_CH[1] Tooltip variable
			Inputconfiguration OnDialogClosed Configure OnMouseClick Configure Imputconfigure Configure OnMouseDown Configure Write a Var Youriable : , InputType

Step 5: Compile our project and connect to the target device. The result was shown below.

For DO/AO channel, you can set its value by clicking on the textfield object and enter value in the pop-up dialog.

SL0_ADAM-5051DI_CH00	1X0001	0						
SL0_ADAM-5051DI_CH01	1X0002	0						
SL0_ADAM-5051DI_CH02	1X0003	0						
SL0_ADAM-5051DI_CH03	1X0004	0						
SL1_ADAM-5056DO_CH00	0X0017	0						
SL1_ADAM-5056DO_CH01	0X0018	1						
SL1_ADAM-5056DO_CH02	0X0019	1						
SL1_ADAM-5056DO_CH03	0×0020	0						
SL2_ADAM-5017AI_CH00	3X0017	0.001 V	ļ					
SL3_ADAM-5024AO_CH00	4X0025	5.000 V						
			2	5.000				Ī
ADAM-6051DI_CH00~07	1X0001~8	255		Min: 0.0		Max: 10.0)	
ADAM-6051DI_CH08~11	1X0009~12	15		7	8	9	Back	
ADAM-6051DO_CH00~01	0X0017~18	0		4	5	6	Clear	Í
				1	2	3	ESC	ĺ

7.4. Modbus TCP Server

We use the following Advantech ADAM-5000 devices to demonstrate Modbus TCP server.

- ADAM-5560

-Slot 0: ADAM-5056(16-ch Digital Output)

- Slot 1: ADAM-5051(16-ch Digital Input)

- Slot 2: ADAM-5017UH (8-ch Analog Input)

- Slot 3: ADAM-5024(4-ch Analog Output)

- Slot 4: ADAM-5069(8-ch Power Relay Output)

Step 1: Refer to <u>Chapter5.1.3</u> and add the Modbus TCP slaves to the project. Rename them if necessary.

Ethernet (Ethernet)
ModbusTCP_Slave_Device (ModbusTCP Slave Device)

Step 2: Add the Advantech ADAM-5000 I/O modules to the project.

Step 3: Start to write our program. Define new structure to store DI/DO, AI/AO, Modbus channel data and declare them as global variables.

	TYPE AIO :	
	STRUCT	
	CHOO:REAL;	
	CH01:REAL;	
	CH02:REAL;	
	CH03:REAL;	
TYPE DIO :	CH04:REAL;	
STRUCT	CH05:REAL;	TYPE MB_S :
DI_CH:WORD;	CH06:REAL;	STRUCT
DO_CH: WORD ;	CH07:REAL;	MB3: ARRAY [1100] OF WORD;
Err:WORD;	Err:WORD;	MB4: ARRAY [1100] OF WORD;
END_STRUCT	END_STRUCT	END_STRUCT
END_TYPE	END_TYPE	END_TYPE



We write the program in PLC_PRG.

POU X	<pre>SL0_5056D.D0_CH:= MB_Server.MB4[1];//5056 D0 CH0~15</pre>
1 PROCEDAM ROLL	<pre>pREAL:= ADR(MB_Server.MB4[3]);</pre>
	SL3_5024.CH00 := pREAL^;//5024 AO CH0
	<pre>pREAL:= ADR(MB_Server.MB4[5]);</pre>
3 MB_Server: MB_S;	SL3_5024.CH01 := pREAL^;//5024 AO CH1
4 IN1: WORD;	<pre>pREAL:= ADR(MB_Server.MB4[7]);</pre>
5 OUT1: WORD;	SL3_5024.CH02 := pREAL^;//5024 AO CH2
<pre>6 test: DWORD;</pre>	<pre>pREAL:= ADR(MB_Server.MB4[9]);</pre>
7 pREAL: POINTER TO REAL;	SL3_5024.CH03 := pREAL^;//5024 AO CH3
8 END VAR	SL4_5069.D0_CH:= MB_Server.MB4[11];//5069 CH0~7
_	
	<pre>MB_Server.MB3[1]:= SL0_5056D.Err ;//5056 Status</pre>
	<pre>MB_Server.MB3[2]:= SL1_5051S.Err ;//5051 Status</pre>
	<pre>MB_Server.MB3[3]:= SL2_5017UH.Err;//5017UH Status</pre>
	<pre>MB_Server.MB3[4]:= SL3_5024.Err;//5024 Status</pre>
	<pre>MB_Server.MB3[5]:= SL4_5069.Err;//5069 Status</pre>
	<pre>MB_Server.MB3[11]:= SL1_5051S.DI_CH;//5051 CH0~15</pre>
	MB_Server.MB3[13]:= %IW18;//5017UH CH0
	<pre>MB_Server.MB3[14]:= %IW19;</pre>
	MB_Server.MB3[15]:= %IW20;//5017UH CH1
	<pre>MB_Server.MB3[16]:= %IW21;</pre>
	MB_Server.MB3[17]:= %IW22;//5017UH CH2
	<pre>MB_Server.MB3[18]:= %IW23;</pre>
	MB_Server.MB3[19]:= %IW24;//5017UH CH3
	<pre>MB_Server.MB3[20]:= %IW25;</pre>
	MB_Server.MB3[21]:= %IW26;//5017UH CH4
	<pre>MB_Server.MB3[22]:= %IW27;</pre>
	<pre>MB_Server.MB3[23]:= %IW28;//5017UH CH5</pre>
	<pre>MB_Server.MB3[24]:= %IW29;</pre>
	<pre>MB_Server.MB3[25]:= %IW30;//5017UH CH6</pre>
	<pre>MB_Server.MB3[25]:= %IW31;</pre>
	<pre>MB_Server.MB3[27]:= %IW32;//5017UH CH7</pre>
	MB_Server.MB3[28]:= %IW33;

Step 4: Set Modbus TCP server configuration and map Modbus data to the variables that we declared in previous step.

ModbusTCP_Slave_Device X							
Config-Page 🗮 Modbus TCP Slave Device I/O Mapping 🥠 Information							
Mapping	Channel	Address	Туре	Unit	Description		
~	Inputs	%I₩37	ARRAY [099] OF WORD		Modbus Holding Registers		
~	Outputs	%Q₩11	ARRAY [099] OF WORD		Modbus Input Registers		
	e I/O Mapping Mapping 🍞	e I/O Mapping i Inform Mapping Channel i Inputs i Outputs	e I/O Mapping i Information Mapping Channel Address i Inputs %IW37 i Outputs %QW11	e I/O Mapping i Information Mapping Channel Address Type i Inputs %IW37 ARRAY [099] OF WORD i Outputs %QW11 ARRAY [099] OF WORD	Mapping Channel Address Type Unit % Inputs %UW37 ARRAY [099] OF WORD % Outputs %QW11 ARRAY [099] OF WORD	Mapping Channel Address Type Unit Description Inputs %HW37 ARRAY [099] OF WORD Modbus Holding Registers Imputs %QW11 ARRAY [099] OF WORD Modbus Input Registers	

Step 5: Map all variables to the textfield objects in visualization.

	Object		Mapping variable
ADAM-5056 CH0~CH15	4X0001	%d	Text variables Text variable POU.MB_Server.MB4[1] Tooltip variable
ADAM-5024 CH0	4X0003	%1.3f mA	Text variables Text variable SL3_5024.CH00 Tooltip variable
ADAM-5069 CH0~CH7	4X0011	%d	Text variables Text variable POU.MB_Server.MB4[11] Tooltip variable
ADAM-5051 CH0~CH15	3X0011	%d	Text variables Text variable POU.MB_Server.MB3[11] Tooltip variable
ADAM-5017UH CH0	3X0013	%1.3f mA	Text variables Text variable 5L2_5017UH.CH00 Tooltip variable

Step 6: Compile our project and connect to the target device. The result was shown below.

AD\ANTECH				26.02.15 Thu 01:03:07
Enabling an Intelligent Planet	ι.			
	and any long to g	Module Channel	Address	Value
ADAM-5560		ADAM-5056 CH0~CH15	4X0001	0
		ADAM-5024 CH0	4X0003	0.000 mA
		ADAM-5024 CH1	4X0005	0.000 mA
		ADAM-5024 CH2	4X0007	0.000 mA
		ADAM-5024 CH3	4X0009	0.000 mA
		ADAM-5069 CH0~CH7	4X0011	0
		ADAM-5051 CH0~CH15	3X0011	0
		ADAM-5017UH CH0	3X0013	4.000 mA
		ADAM-5017UH CH1	3X0015	4.000 mA
Module Name Address	Status	ADAM-5017UH CH2	3X0017	4.000 mA
ADAM-5056 3X0001	0	ADAM-5017UH CH3	3X0019	4.000 mA
ADAM-5051 3X0002	0	ADAM-5017UH CH4	3X0021	4.000 mA
ADAM-5017UH 3X0003	0	ADAM-5017UH CH5	3X0023	4.000 mA
ADAM-5024 3X0004	0	ADAM-5017UH CH6	3X0025	4.000 mA
ADAM-5069 3X0005	0	ADAM-5017UH CH7	3X0027	4.000 mA

Chapter 8

8. Diagnosis and Troubleshooting

8.1. Error Notification

In chapter 4, we introduce how to write a program to control Advantech I/O modules. If the Advantech modules are correctly configured, it will show a green circle icon $^{\bigcirc}$ next to the device name in the device tree after performing command **Login** and **Start**. If it shows a red triangle $^{\triangle}$, it means that I/O module encountered several errors while running.



8.2. Log Information

We can get log information from **Advantech CODESYS** or **target machine**, i.e. ADAM-5560, Advantech X86 RTE platforms.

In Advantech CODESYS development environment, double click the device name in the device tree to open **Device editor**. Select the **Log** dialog and it will display the log of the Advantech I/O module. A log entry line contains the following information:

Severity: There are four categories: warnings, errors, exceptions, information. The display of the entries of each category can be switched on or off by using the corresponding button from the bar above the listing. Each button always contains the current number of loggings in the respective category.

Time Stamp: Date and Time.

Description: Description of the event, for example "Device not found or not matched."

Component: ID and name of the component

	Double	e click				
Devices	→ ₽ X	Device X				
Advantech Sample Project Advantech APAX-5580 x86 RTE V3)		Communication Settings	Applications Files Lo	9 PLC settings	PLC shell Users and Group	s Access Rights Task deployment Status () I
P Plc Logic		Utrine-Logging	UTCTIMe			
Application [run]		🕚 0 warning(s) 🕴 1 e	error(s) 📧 0 exception(s)	147 information	(s) 0 debug message(s)	<all components=""></all>
- ffft Ubrary Manager - B PLC_PRG (PRG) ■ ffft Task Configuration		Severity	Time Stamp		Description	
		0	15.01.2015 22:33:26.389		Application [Application] loaded via [Download]
		0	15.01.2015 22:33:26.389		<slot 1=""> Device not fou</slot>	nd or not matched
		0	15.01.2015 22:33:26.369		No valid license found fo	or OPC UA server. Running in demo mode.
		0	15.01.2015 22:21:14.325		*******	*****
 Sackplane (Backplane) 		0	15.01.2015 22:21:14.325		URL:opc.tcp://192.168.0	.1:4840
APAX_5040 (APAX-5040)		0	15.01.2015 22:21:14.325		OPC UA Server	
APAX_5046 (APAX-5046)		A			*****	**********************************

On target machine, we can also get error ID from CODESYS RTE runtime.

In the Advantech X86 RTE platform's environment, open runtime by right-clicking the

runtime icon 👻 which is available on the lower-right corner of the desktop. Click PLC

configuration and then it will show the system error in the diagnostic of system configuration.

s	ystem Configuration
Ĩ	Diagnostic Startup Component Manager Application Logger Scheduler File Target
	Target Address: 0101:(licensed) Target Version: 3.5.6.20
	Target Type: 0x1006 Target ID: 0x2
	Kemel State: Kemel State: LOADED
	Scheduler State: ACTIVE. 1 IEC tasks scheduled
	PLC Load: 1% 0% 100%
	Application
	1. Application (running)
	2.
Start PLC	3.
Stop PLC	4.
Exit PLC Control	5.
CODESYS Softmotion RTE (running) Address: 0101;(licensed)	Last System Error Timestamp: Oxee036075 Class == ERROR ErrorID: 0x8000 ComponentID: 0x16352000 Errortext: <slot 1=""> Device not found or not matched</slot>
Customize	OK Cancel

8.3. Error ID

Following table is the error ID for I/O modules.

Error ID	Description
0x8000	The module didn't exist or match the setting module.
	Make sure that the setting module matches for the device that is being
	plugged and check your module is plugged in target device appropriately.
0x8001	The system failed to open the module.
	Please close all programs and reboot. If the system cannot returns to normal
	condition or the error occurred, please contact Advantech for technical
	support.
0x8002	The system was unable to complete configuration.
	Please power-off the system and plug the module again. If the error occurred,
	please replace a new module and contact Advantech for technical support.
0x8003	The system failed to read value from the module.
	Please power-off the system and plug the module again. If the error occurred,
	please replace a new module and contact Advantech for technical support.
0x8004	The system failed to write value to the module.
	Please power-off the system and plug the module again. If the error occurred,
	please replace a new module and contact Advantech for technical support.
0x8005	For counter module, the system failed to start/stop counter.
	Please power-off the system and plug the module again. If the error occurred,
	please replace a new module and contact Advantech for technical support.

0x8006	For counter module, the system failed to clear counting value.
	Please power-off the system and plug the module again. If the error occurred, please replace a new module and contact Advantech for technical support.
0x8007	For counter module, the system failed to clear overflow flag.
	Please power-off the system and plug the module again. If the error occurred, please replace a new module and contact Advantech for technical support.
0x8008	For counter module, the system failed to clear alarm flag.
	Please power-off the system and plug the module again. If the error occurred, please replace a new module and contact Advantech for technical support.