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## Digitized Automation for a Changing World

# ASRTU-EC16AP EtherCAT Remote Communication Module Operation Manual

# ASRTU-EC16AP Operation Manual

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**Chapter 1 Preface**

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## Caution

- This manual provides an introduction to product functions, specifications, installation, basic operations and settings.
- This product is an OPEN TYPE device and therefore should be installed in an enclosure free of airborne dust, humidity, electric shock and vibration. The enclosure should prevent non-maintenance staff from operating the device (e.g. key or specific tools are required for operating the enclosure) in case that danger and damage on the device may occur.
- Be sure to read the manual carefully and follow the instructions so as to avoid injuries to personnel and damage to products.

## 1.1 Explanation of Symbols in This Manual

### ● Precautions before operation

Before operation, please read relevant safety instructions carefully so as to prevent an injury to personnel and damage to products.

 <b>Danger</b>	Indicates the highly potential hazards. Severe personal injury or even death <b>will</b> result if you do not follow the instructions.
 <b>Warning</b>	Indicates the potential hazards. Minor personal injury or even death <b>may</b> result if you do not follow the instructions.
 <b>Caution</b>	Indicates much attention should be paid. A bad accident can occur if you do not follow the instructions.

## 1.2 Revision History

Version	Revision	Release Date
1 <sup>st</sup>	The first version was published.	November 1, 2022
2 <sup>nd</sup>	The external output wiring figure was updated by changing the max. output current from 0.1A to 0.5A in Section 4.4.2.	November 7, 2022
3 <sup>rd</sup>	<ol style="list-style-type: none"> <li>1. The title name “ASRTU-EC16AP1TA EtherCAT Remote Communication Module Operation Manual” of this manual was changed to “ASRTU-EC16AP EtherCAT Remote Communication Module Operation Manual”.</li> <li>2. Model names ASRTU-EC16AP1TA mentioned in this manual except Chapter 7 were replaced with ASRTU-EC16AP.</li> <li>3. Added the model description in the preface of Chapter 2, and updated the electrical and environmental specifications in Section 2.2.</li> <li>4. Updated the detailed explanation of the values of Bit1~Bit0 of Control Word in Section 6.4.1.2.</li> <li>5. Added Section 6.4.8 Touch probe parameters.</li> </ol>	July 20, 2023

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**Chapter 2 Overview**

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1. Thank you for choosing Delta ASRTU-EC16AP. To ensure correct installation and operation of the unit, please read this manual carefully before use.
2. This manual only provides introductory information on ASRTU-EC16AP. For more detailed information on EtherCAT protocol, please refer to relevant references or literatures.
3. ASRTU-EC16AP is defined as an EtherCAT remote slave and AS series DI/DO modules and AI/AO modules can be connected on its right side. (Note: The communication module and positioning module are not allowed to connect on the right side of ASRTU-EC16AP.)
4. Refer to *AS Series Module Manual* for more details on how to use AS series extension modules.
5. ASRTU-EC16AP series includes the two models: ASRTU-EC16AP1TA and ASRTU-EC16AP1PA. ASRTU-EC16AP1TA's local output points are NPN transistor outputs and ASRTU-EC16AP1PA's local output points are PNP transistor outputs.

## 2.1 Characteristics

- Compliant with the EtherCAT protocol, supports PDO, SDO and other services in the CoE protocol as well as Hot Connection function.
- Supports Distributed Clock SYNC, SyncManagers and Free Run.
- 8 digital input points and 8 digital output points are built in ASRTU-EC16AP
- 2 channels for high-speed counting with counting modes of single pulse, "pulse+direction" and "phase A+phase B" and maximum input frequency of 200kHz
- 2 channels for high-speed pulse output with pulse output modes of "pulse+direction", "Phase A + phase B" and CW/CCW with a maximum of 200 kHz output frequency.  
(Note: the maximum output frequency is 100 kHz for the "phase A+phase B" output mode)
- Supports AS series extension modules including digital modules, analog modules, load cell modules and temperature measurement modules.
- Maximum 32 modules in total including digital modules and special modules can be connected to the right side of ASRTU-EC16AP, among which the maximum number of special modules like analog modules, temperature measurement modules and load cell modules is 16.
- Maximum 1024 points in total for digital input and output, which include the input and output points built in ASRTU-EC16AP
- Ability to realize the high-speed remote I/O control with the minimum cycle (DC time) of 500  $\mu$ s.
- The node address of ASRTU-EC16AP can be set by the rotary address switches.

## 2.2 Specifications

### ■ Electrical specification

Item	Specification
Power voltage	24 VDC (-15% ~ 20%)
Consumption power	1.8 W
Insulation impedance	> 5M $\Omega$ (500 VAC between all inputs/outputs and the ground)
Rush current	240 A (@24VDC, I2t = 4.5 A2S)
Fuse	2.5 A / 250 VAC
Power protection	The DC power input is equipped with reverse polarity protection.
Surge voltage withstand level	3,000 VAC (Primary-secondary), 3,000 VAC (Primary-FE), 500 VAC (Secondary-FE)

■ Electrical specification for built-in digital input points (24VDC)

Item		Specification
Number of digital input points		8 points (X0.0 ~ X0.7)
Connector type		Removable terminal block
Input type		Digital input
Input form		Direct current (sinking or sourcing)
Input voltage/ current		24 VDC, 5 mA
Action level	OFF→ON	>15 VDC
	ON→OFF	<5 VDC
Response time	OFF→ON	X0.0~X0.3: < 2.5 us X0.4~X0.7: < 20 us
	ON→OFF	X0.0~X0.3: < 2.5 us X0.4~X0.7: < 200 us
Maximum digital input frequency		X0.0~X0.3: 200 kHz X0.4~X0.7: 500 Hz
Input Isolation		500 VAC
Input display		When the optocoupler is driven, the input LED indicator is ON.

■ Electrical specification for built-in digital output points

Item		Specification
Number of digital output points		8 points (Y0.0 ~ Y0.7)
Connector type		Removable terminal block
Output form		Transistor - T (sinking) (NPN), Transistor - P (sinking) (PNP)
Voltage		5~30 VDC
Leakage current		< 10 uA
Maximum load	Resistance	0.5A/output, 2A/COM
	Inductance	Not applicable
	Bulb	Not applicable
Minimum load		1mA/5V
Maximum output frequency	Resistance	200 kHz (Y0.0 ~ Y0.3) /100 Hz (Y0.4 ~ Y0.7)
	Inductance	Not applicable
	Bulb	Not applicable
Maximum response time	OFF→ON	2.5 us (Y0.0 ~ Y0.3) /0.5 ms (Y0.4 ~ Y0.7)
	ON→OFF	

■ EtherCAT communication specification

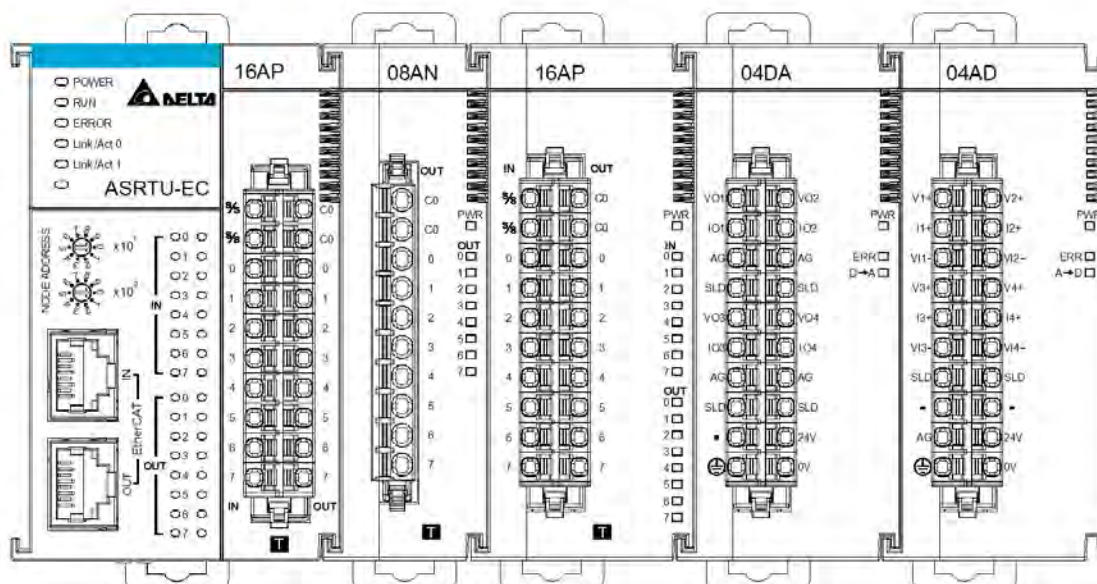
Item	Specification
Communication protocol	EtherCAT Protocol
Supported service	CoE (PDO, SDO)
Physical layer	100 BASE-TX
Baud rate	100 Mbps
Transmission medium	Cat 5 or above shielded cable
Transmission distance	100 m
Topology structure	Linear topology

■ Environmental Specification

Item	Specification
Noise Immunity	ESD (IEC 61131-2, IEC 61000-4-2) : 8KV Air Discharge, 6KV Contact Discharge EFT (IEC 61131-2, IEC 61000-4-4) : Power Line: 2KV, Digital I/O: 1KV Communication I/O: 2KV Damped-Oscillatory Wave: Power Line: 1KV, Digital I/O: 1KV RS (IEC 61131-2, IEC 61000-4-3) : 80M Hz ~ 1000M Hz, 10V/m; 1400M Hz ~ 6000M Hz, 3 V/m
Operating temperature	-20°C ~ 60°C
Storage temperature	-40°C ~ 80°C
Operating humidity	5 ~ 95% No condensation
Storage humidity	5 ~ 95% No condensation
Work environment	No corrosive gas exists.
Installation location	In a control box
Pollution degree	2
Ingress protection (IP ratings)	IP20
Ground	The diameter of the ground wire should not be less than the diameter of the wires at power supply terminals. (When using multiple PLCs, be sure to take the single-point ground method.)
Vibration/shock resistance	For vibration resistance Tested with: 5 Hz $\leq$ f $\leq$ 8.4 Hz, constant amplitude 3.5 mm, 8.4 Hz $\leq$ f $\leq$ 150 Hz, constant acceleration 1g Duration of oscillation: 10 sweep cycles per axis on each direction of the 3 mutually perpendicular axes Standard: IEC 61131-2 & IEC 60068-2-6 (TEST Fc)

Item	Specification
	For shock resistance Tested with: Half-sine wave: Strength of shock 15 g peak value, 11 ms duration, Shock direction: The shocks in each in direction per axis, on 3 mutually perpendicular axes (total of 18 shocks) Standard: IEC 61131-2 & IEC 60068-2-27 (TEST Ea)
Safety	Conforms to IEC 61131-2, UL508
Barometric pressure-altitude	Operating: 1080 ~ 795 hPa (-1000 ~ 2000 m) Storage: 1080 ~ 660 hPa (-1000 ~ 3500 m)
Flammability rating of plastic case	UL94V-0
Weight	84 g

## 2.3 Extension Modules Connectable



### ■ Digital input and output modules connectable to ASRTU-EC16AP and their specifications

DI/DO module (Model name)	Default I/O mapping data	
	(EtherCAT master → ASRTU-EC16AP)	(ASRTU-EC16AP → EtherCAT master)
AS08AM10N	N/A	8 bits
AS08AN01P	8 bits	N/A
AS08AN01R	8 bits	N/A
AS08AN01T	8 bits	N/A
AS16AM10N	N/A	16 bits
AS16AN01P	16 bits	N/A
AS16AN01R	16 bits	N/A
AS16AN01T	16 bits	N/A
AS16AP11P	8 bits	8 bits
AS16AP11R	8 bits	8 bits

DI/DO module (Model name)	Default I/O mapping data	
	(EtherCAT master → ASRTU-EC16AP)	(ASRTU-EC16AP → EtherCAT master)
AS16AP11T	8 bits	8 bits
AS32AM10N	N/A	32 bits
AS32AN02T	32 bits	N/A
AS64AM10N	N/A	64 bits
AS64AN02T	64 bits	N/A

■ Special modules connectable to ASRTU-EC16AP and their specifications

Special module (Model name)	Default I/O mapping data	
	(EtherCAT master → ASRTU-EC16AP)	(ASRTU-EC16AP → EtherCAT master)
AS04AD-A	-	10 words
AS08AD-B	-	18 words
AS08AD-C	-	18 words
AS04DA-A	8 words	2 words
AS06XA-A	4 words	10 words
AS04RTD-A	-	10 words
AS06RTD-A	-	14 words
AS04TC-A	-	10 words
AS08TC-A	-	18 words
AS02LC-A	1 word	7 words

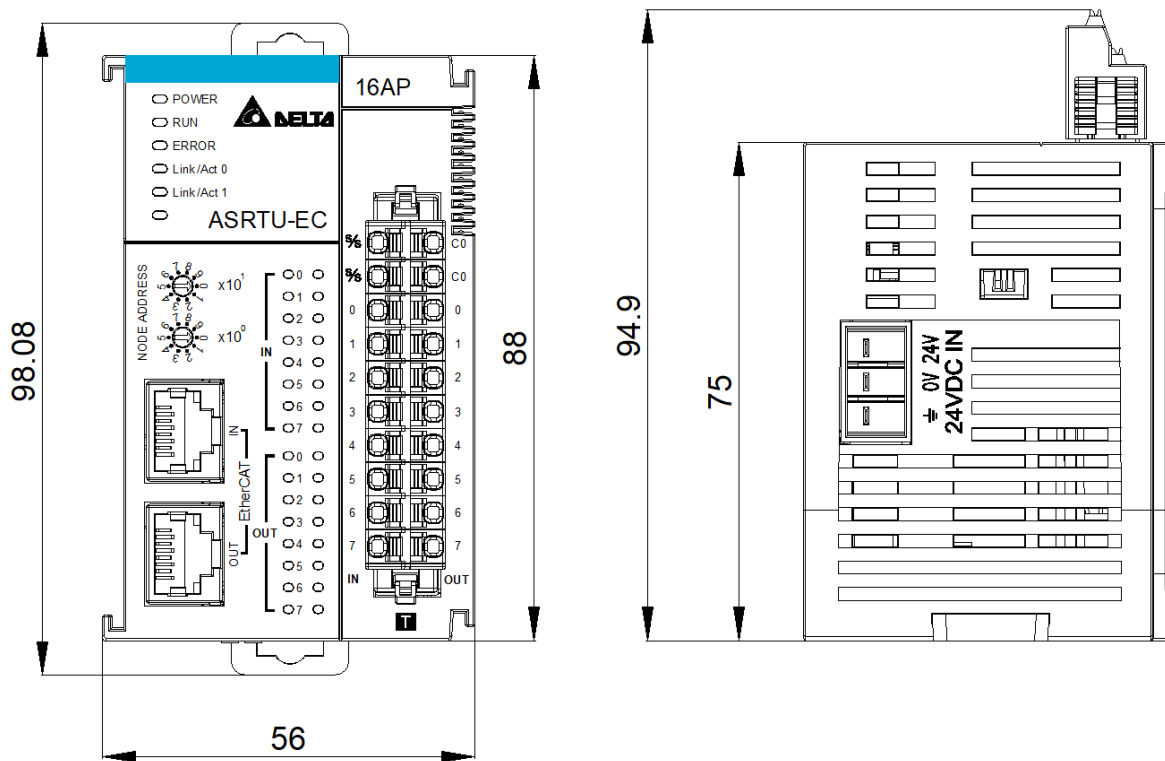
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**Chapter 3 Profile and Parts**

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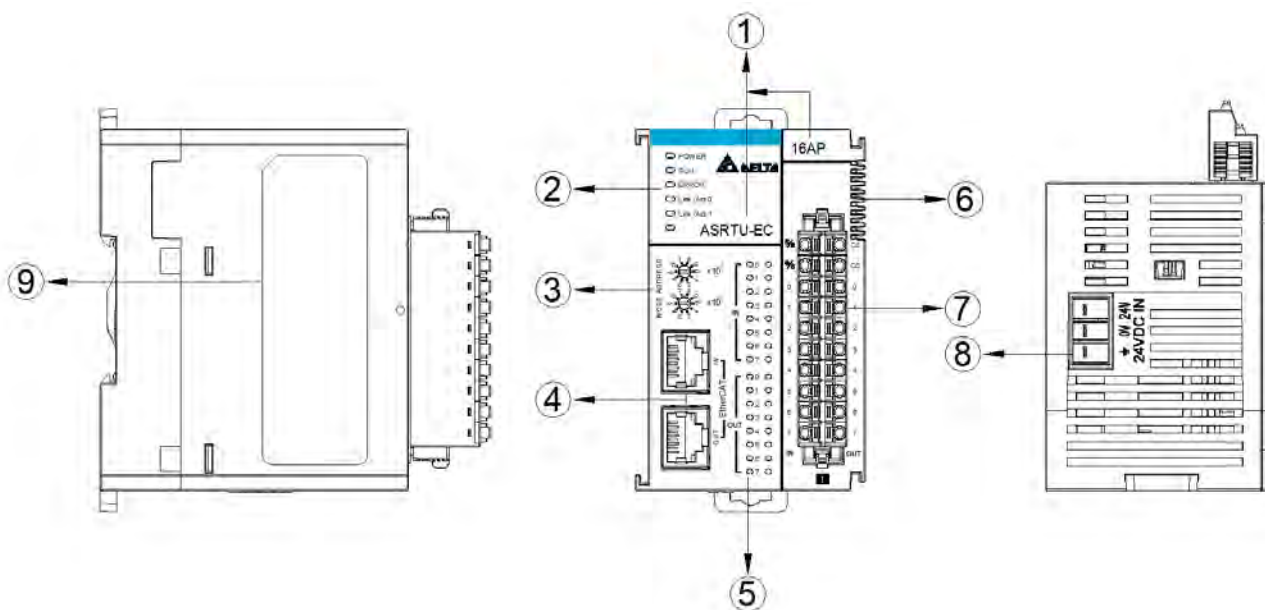
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### 3.1 Profile and Dimensions



Unit: mm

### 3.2 Parts



Number	Name	Description
1	Model Name	Model name of the module

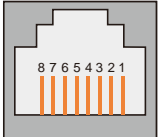
Number	Name	Description
2	POWER LED indicator (Blue)	Indicates the status of the power supply ON: The power is on. OFF: No power
	Run LED indicator (Green)	ON: The module is in EtherCAT Operational status. OFF: The module is in EtherCAT Initial status. Blinking: 1. The module is in EtherCAT Pre-Op status (blinks every 0.5 second). 2. The module is in EtherCAT Safe-Op status. (blinks every second).
	Error LED indicator (Red)	ON: The power voltage is too low (<17V). Blinking: An error occurs in the module. OFF: The module is normal.
	PORT1 LED indicator (Green)	ON: Normally connected at PORT1 and no data exchange Blinking: Normally connected at PORT1 and data exchange happening OFF: Not connected at PORT1
	PORT2 LED indicator (Green)	ON: Normally connected at PORT2 and no data exchange Blinking: Normally connected at PORT2 and data exchange happening OFF: Not connected at PORT2
3	Address switch	Sets the node address of the module
4	EtherCAT interface	Two ports, PORT1 for input and PORT2 for output
5	Input/output LED indicator (Red)	If there is an input signal, the input LED indicator is ON. If there is an output signal, the output LED indicator is ON.
6	Extension module port	Connects extension modules
7	Removable Terminal Block	Inputs are connected to transducers and switches. X0.0/X0.1 can be used as general input points as well as channel 1 for high-speed counting. X0.2/X0.3 can be used as general input points as well as channel 2 for high-speed counting. Outputs are connected to loads to be driven. Y0.0/Y0.1 can be used as general output points as well as channel 1 for high-speed pulse output. Y0.2/Y0.3 can be used as general output points as well as channel 2 for high-speed pulse output.
8	Power Input port	24V DC power input port
9	Label	Nameplate



### 3.3 Definition of EtherCAT Port Pins

There are two EtherCAT ports for the EtherCAT communication in ASRTU-EC16AP. See the following table for the definitions of EtherCAT port pins.

PIN	Signal	Description
1	Tx+	Positive pole for transmitting data
2	Tx-	Negative pole for transmitting data
3	Rx+	Positive pole for receiving data
4	Reserved	Reserved
5	Reserved	Reserved
6	Rx-	Negative pole for receiving data
7	Reserved	Reserved
8	Reserved	Reserved

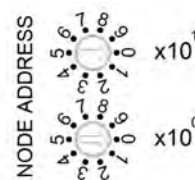


EtherCAT

### 3.4 Address Switches

The switches are used for setting up the node address of ASRTU-EC16AP in the EtherCAT network.

Switch setting	Description
0 ~ 99	EtherCAT node address



#### Example:

If you need to set the node address of ASRTU-EC16AP to 26, simply switch the corresponding switch of  $x10^1$  to 2 and the corresponding switch of  $x10^0$  to 6.

#### Notes:

- ✓ Please set up the node address when the power is switched off. After the setup is completed, re-power ASRTU-EC16AP.
- ✓ When ASRTU-EC16AP is operating, changing the setting of the node address is invalid.
- ✓ Use the slotted screwdriver to rotate the switch carefully in case the switch is scratched.
- ✓ To use the station alias function, please set the configured station alias to the same value as the address switch if the node address switch is set to a non-zero value. If the address switch is set to 0, set up the value for the configured station alias in the software.

### 3.5 Extension Module Port

The extension module port is used for connecting Delta AS series DI/DO extension modules and special modules.

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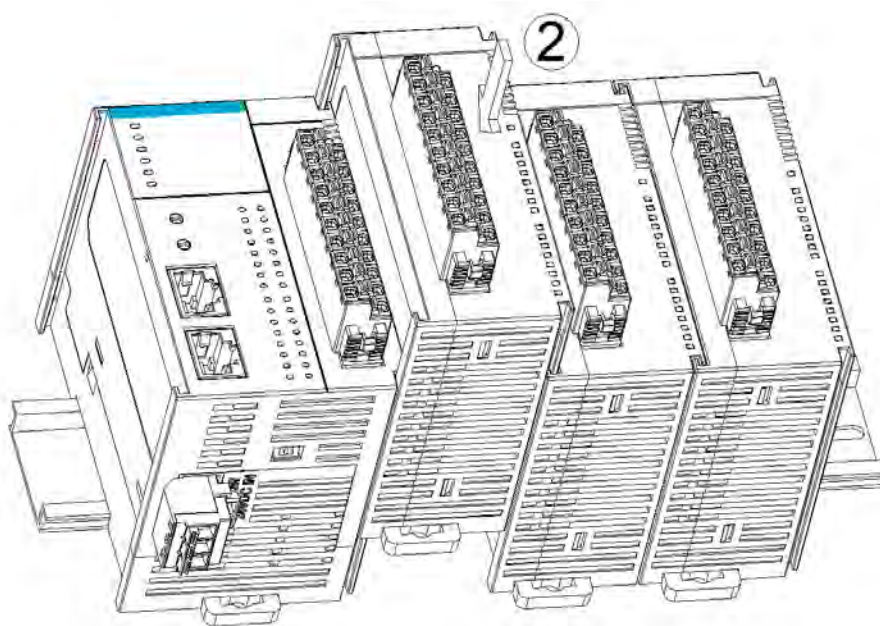
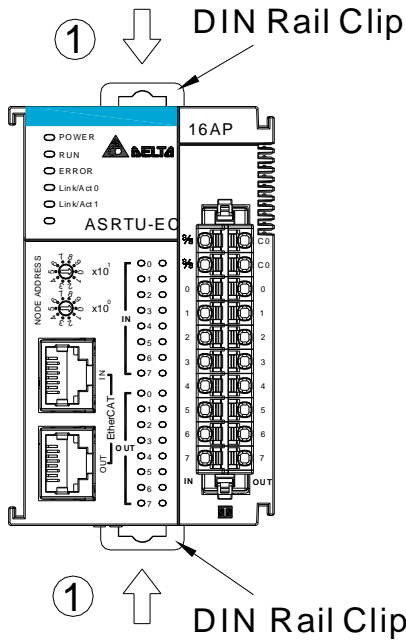
## Chapter 4 Installing and Wiring

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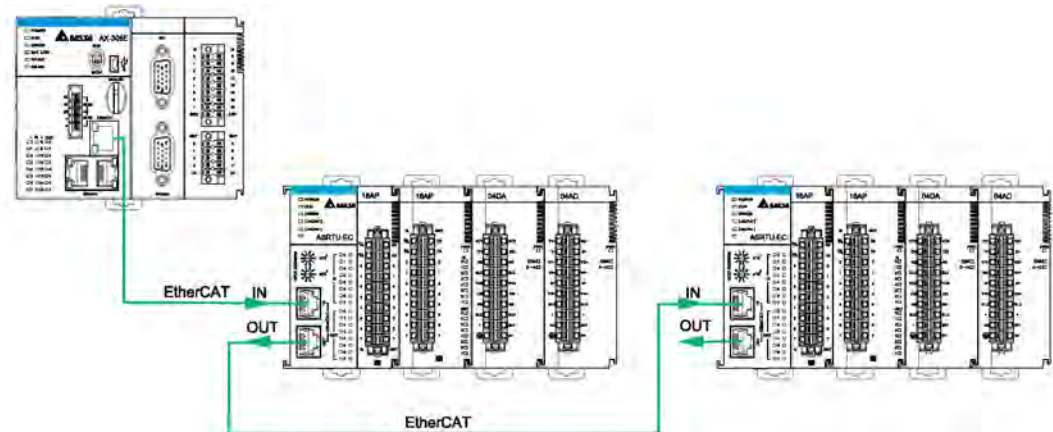
## 4.1 Installing ASRTU-EC16AP and AS Extension Modules to DIN Rail

- Please push the clips of ASRTU-EC16AP in the directions indicated by arrow ① until you hear a click. That means the DIN clips are interlocked each other. Then insert the module hooks at the bottom into the DIN rail mounting slot until you hear a click. That means ASRTU-EC16AP is well connected to the DIN rail.
- To install an extension module, push the clips of the AS extension module in the directions indicated by arrow ①. Then aim the left-side slot of the extension module at the right-side slot of ASRTU-EC16AP and push the extension module in the direction as illustrated by arrow ② until you hear a click, which means the module is secured to the DIN rail and well connected to ASRTU-EC16AP. In the same way, install more IO modules to the right side of ASRTU-EC16AP and secure them to DIN rail one by one.



## 4.2 Connecting EtherCAT Ports

- There is a strict network topology requirement for the EtherCAT network. The network must follow the rule that the input port of the next ASRTU-EC16AP must be connected to the output port of the current ASRTU-EC16AP.
- Using Delta cables for EtherCAT communication is recommended. For specifications of Delta cables, refer to Appendix A.



## 4.3 Wiring

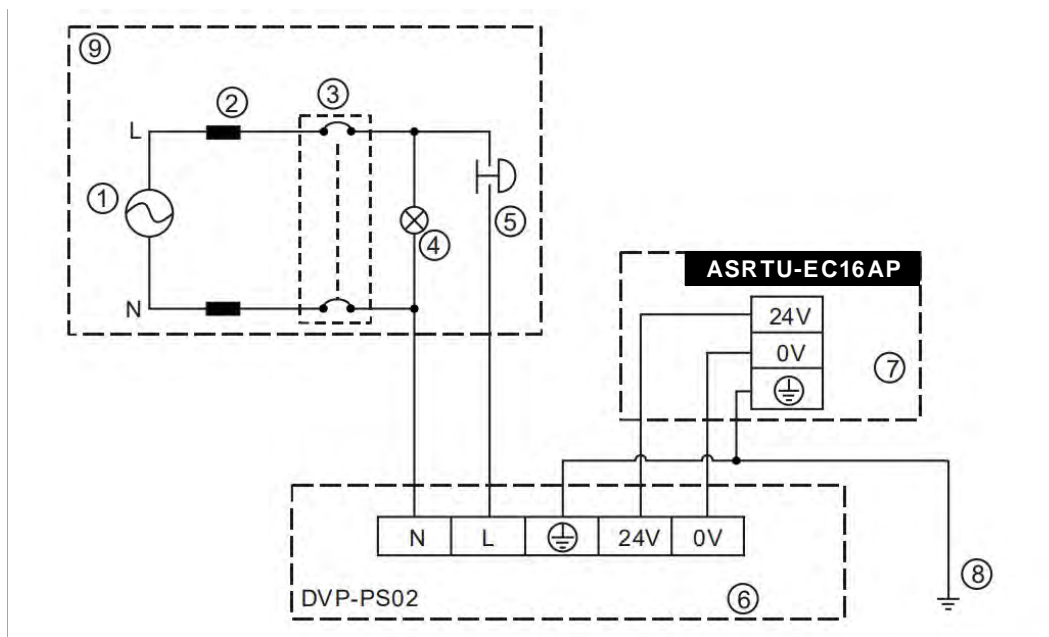
### 4.3.1 Power Input

The power input of ASRTU-EC16AP is 24V DC. Please notice the following points during use.

#### ⚠ Warning

- Connect the supply power to the two terminals, 24V and 0V and the grounding terminal to the earth. Be cautious that the ASRTU-EC16AP device may be damaged if the positive and negative polarities of the supply power are connected reversely.
- Please be sure to use certified power supply with SELV output or certified power supply providing double insulation evaluated by UL60950, or UL61010-1 and UL61010-2-201 standards
- The diameter of the power wire must be between 22 and 18 AWG and the rated temperature should be greater than 70°C. The power terminal block plug wiring torque is 4.5 in-lbs.
- The cables of the AC power 110V, 220V and DC power 24V must be twisted and connected to the module as short as possible in length.
- Do NOT combine the AC 110V, 220V, and DC 24V cables with the main circuit and I/O signal cables together and please keep them away from each other. If the space permits, it's recommended to separate these lines by more than 100mm.

### ASRTU-EC16AP Safety Circuit Wiring

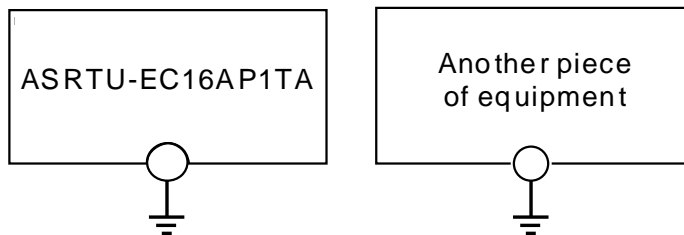


4

①	AC power supply: 100 ~ 240VAC; 50/60 Hz
②	Power supply circuit protection fuse
③	System circuit isolation device: The electromagnetic contactor, relay and other switch can be used as the isolation device to prevent the system from becoming unstable when the power supply is discontinuous.
④	Power indicator
⑤	Emergency stop button: The button cuts off the system power supply when an accidental situation takes place.
⑥	Delta power module DVP-PS02 or AS-PS02A (24VDC)
⑦	ASRTU-EC16AP device
⑧	Ground
⑨	Safety circuit

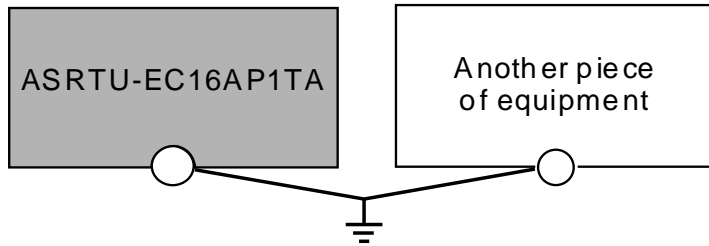
#### 4.3.2 Ground

- The diameter of the ground wire should not be less than the diameters of the wires connected to the terminals L and N.
- If using multiple pieces of equipment, do use a single-point ground.



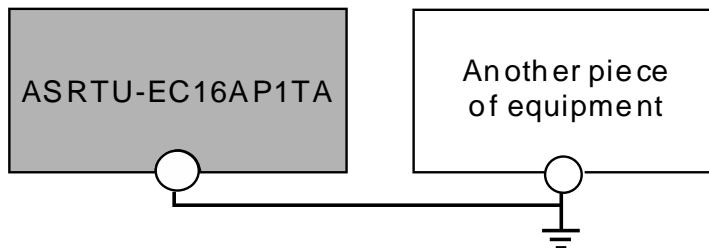
The single-point ground is better.

- If you cannot use a single-point ground, use a common-point ground.



The common-point ground is permitted.

- Do not connect equipment ground wires together as shown below.



The equipment can not be grounded in this way.

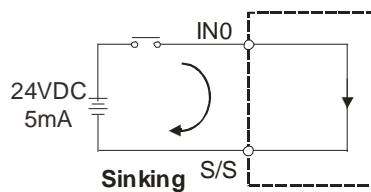
## 4.4 Input and Output Wiring

### 4.4.1 External Input Wiring

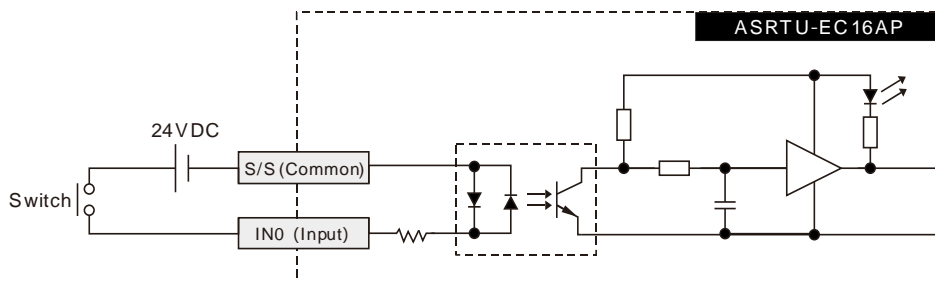
The input points X0.0~X0.7 of ASRTU-EC16AP are direct current inputs with two types of wiring: Sinking and Sourcing. See the two types of wiring below.

- **Sinking**

The simplified model is shown below.

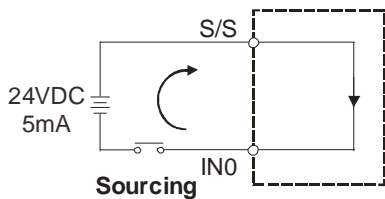


See the relevant wiring circuit in the following figure.

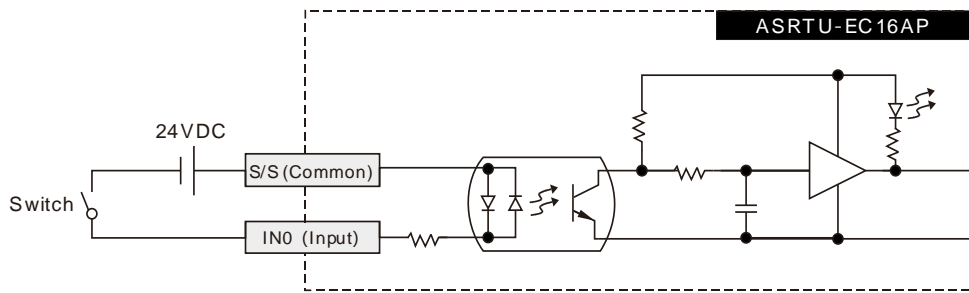


● **Sourcing**

The simplified model is illustrated below.



See the relevant wiring circuit in the following figure.

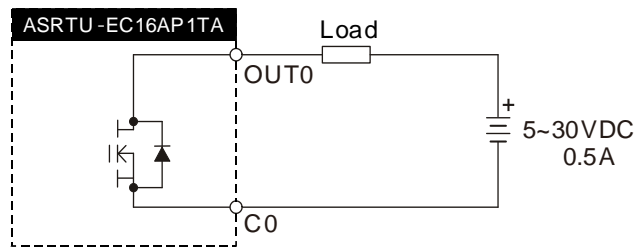


4

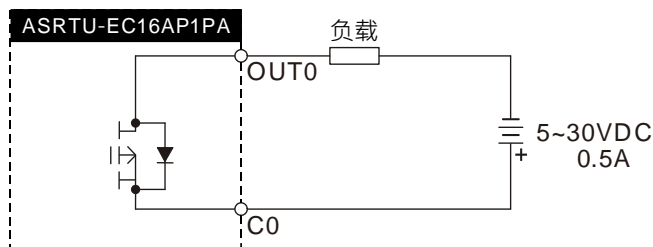
**4.4.2 External Output Wiring**

All local output points of ASRTU-EC16AP are transistor outputs with the following wiring circuits.

- For ASRTU-EC16AP1TA (NPN type)



- For ASRTU-EC16AP1PA (PNP type)



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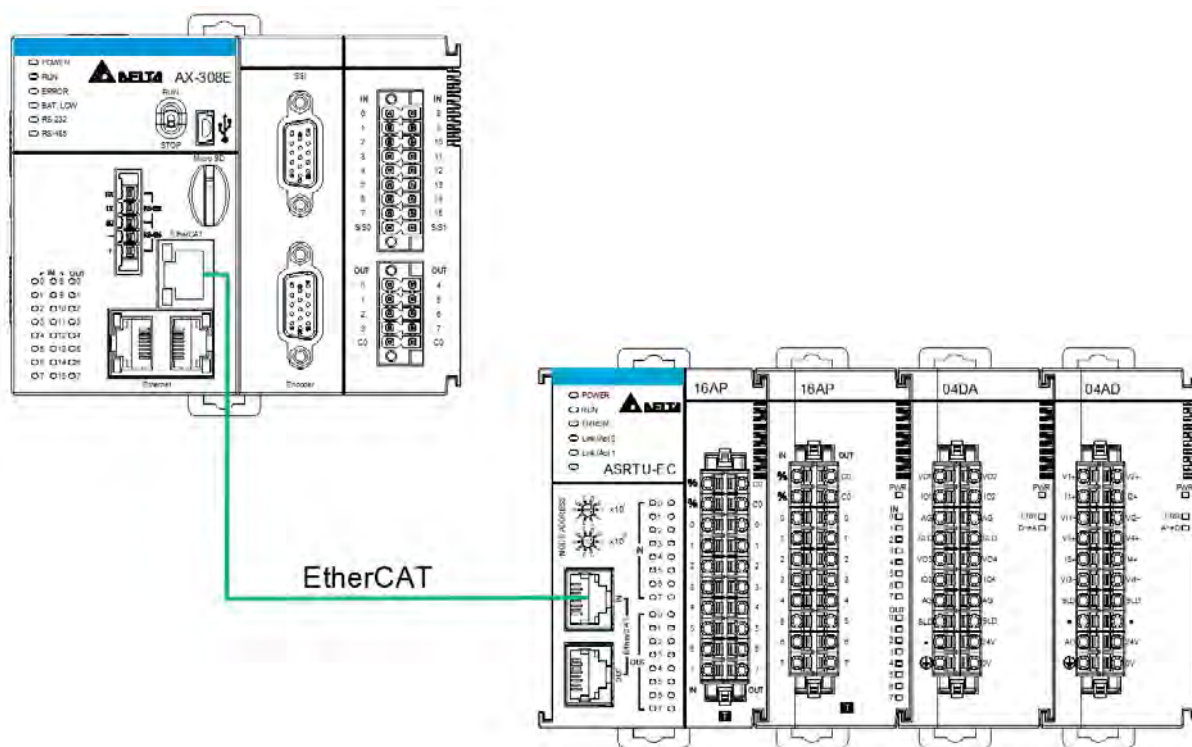
## Chapter 5 Configuring in DIADesigner-AX

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5.6 EtherCAT I/O Mapping .....	5-13



As EtherCAT slave, ASRTU-EC16AP realizes the data exchange between EtherCAT master and AS series extension modules. This chapter describes how to configure ASRTU-EC16AP by using AX-308E along with DIADesigner-AX software. See the hardware configuration as illustrated in the following figure.



5

## 5.1 Software Introduction

DIADesigner-AX, an IEC 61131-3 programming tool for Delta's new generation motion controller (AX series) adopts a large number of applied instructions, especially Motion library with a multilingual environment where users can switch the interface language according to need and a user-friendly interface providing users a convenient and efficient development environment.

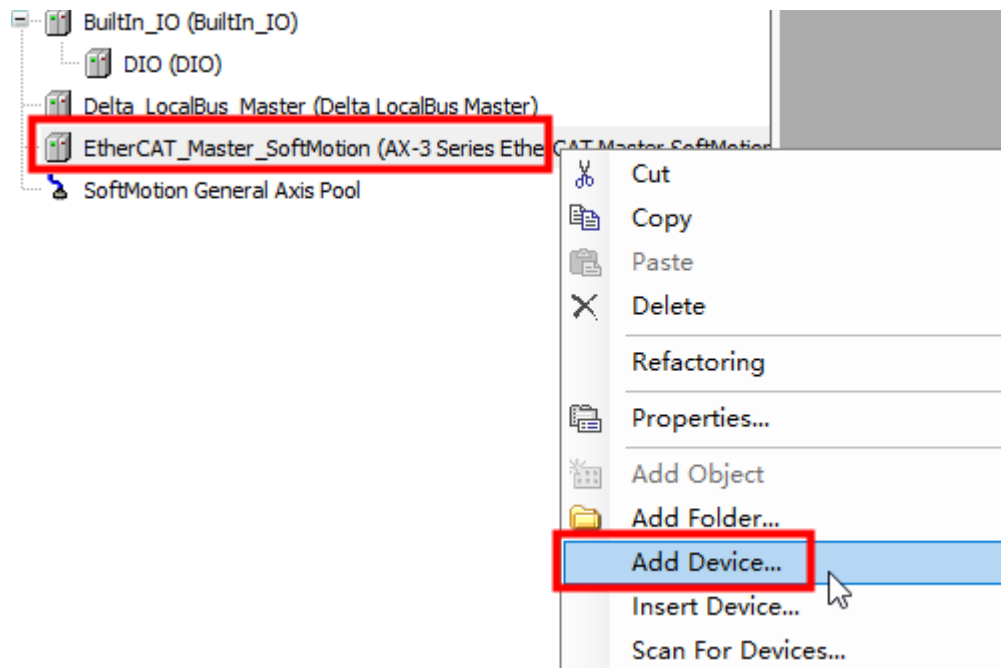
For details on operation, refer to DIADesigner-AX Software Manual.

## 5.2 Adding ASRTU-EC16AP and Right-Side Extension Modules

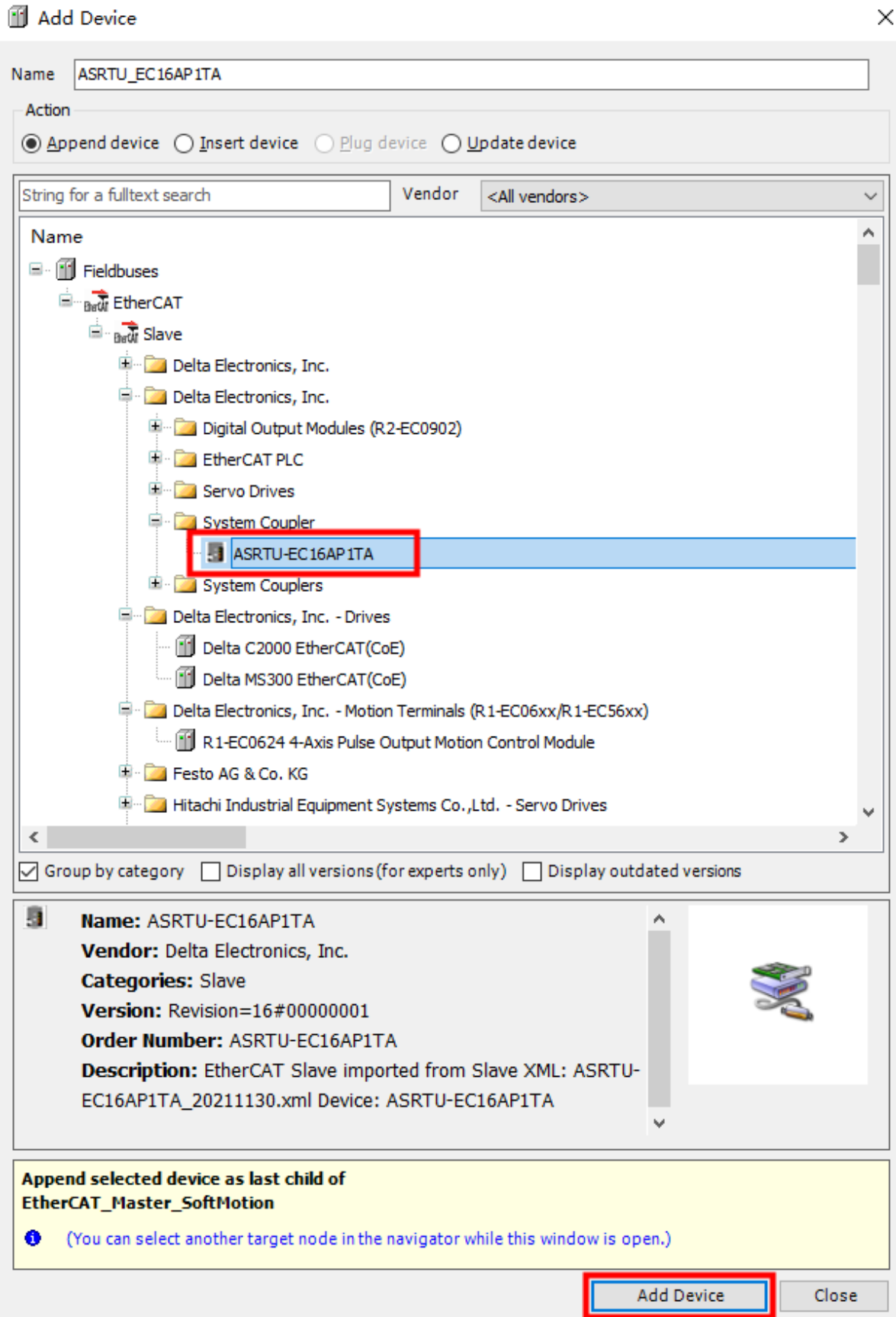
There are two methods of adding ASRTU-EC16AP and right-side extension modules to the EtherCAT master configuration. The first method is to manually add ASRTU-EC16AP first and then extension modules. The second method is to use the auto-scan function of the software to add ASRTU-EC16AP and its right-side extension modules.

### 5.2.1 Manually Adding ASRTU-EC16AP and Right-Side Extension Modules

1. Right-click "EtherCAT\_Master\_SoftMotion" on the left-side list of the DIADesigner-AX software and then click "Add Device..." from the drop-down menu that pops up.

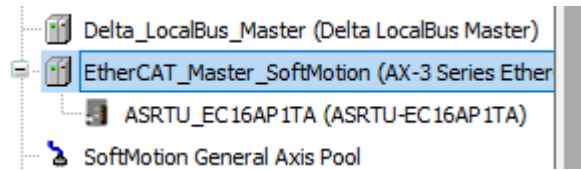


2. After the “Add Device” window is open, go to “Fieldbuses” → “EtherCAT” → “Slave” → “Delta Electronics, Inc” → “System Coupler”. Find out and select “ASRTU-EC16AP” (e.g. ASRTU-EC16AP1TA), and click on the “Add Device” button.



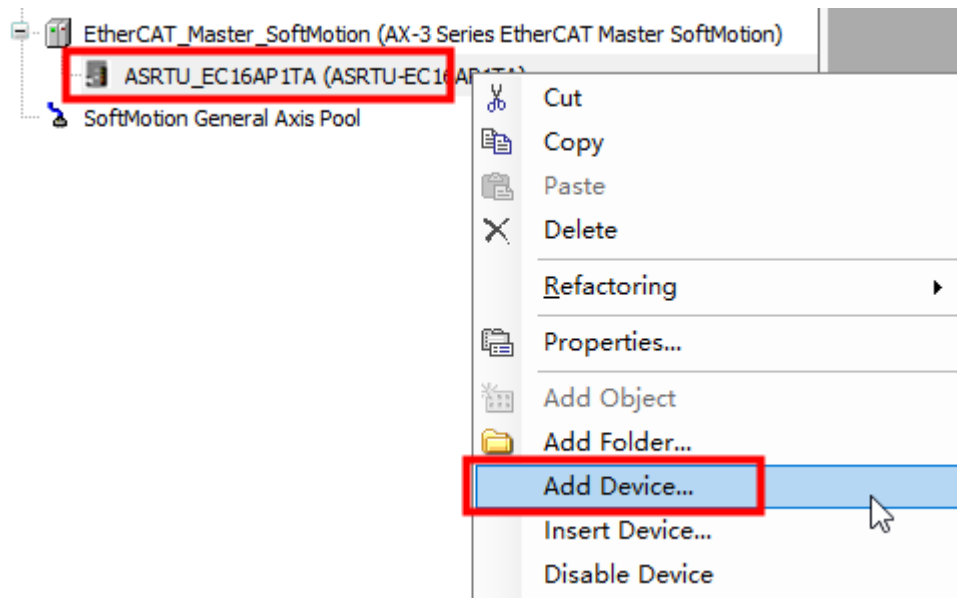
5

After that, ASRTU-EC16AP is visible in the EtherCAT configuration as the following figure shows.

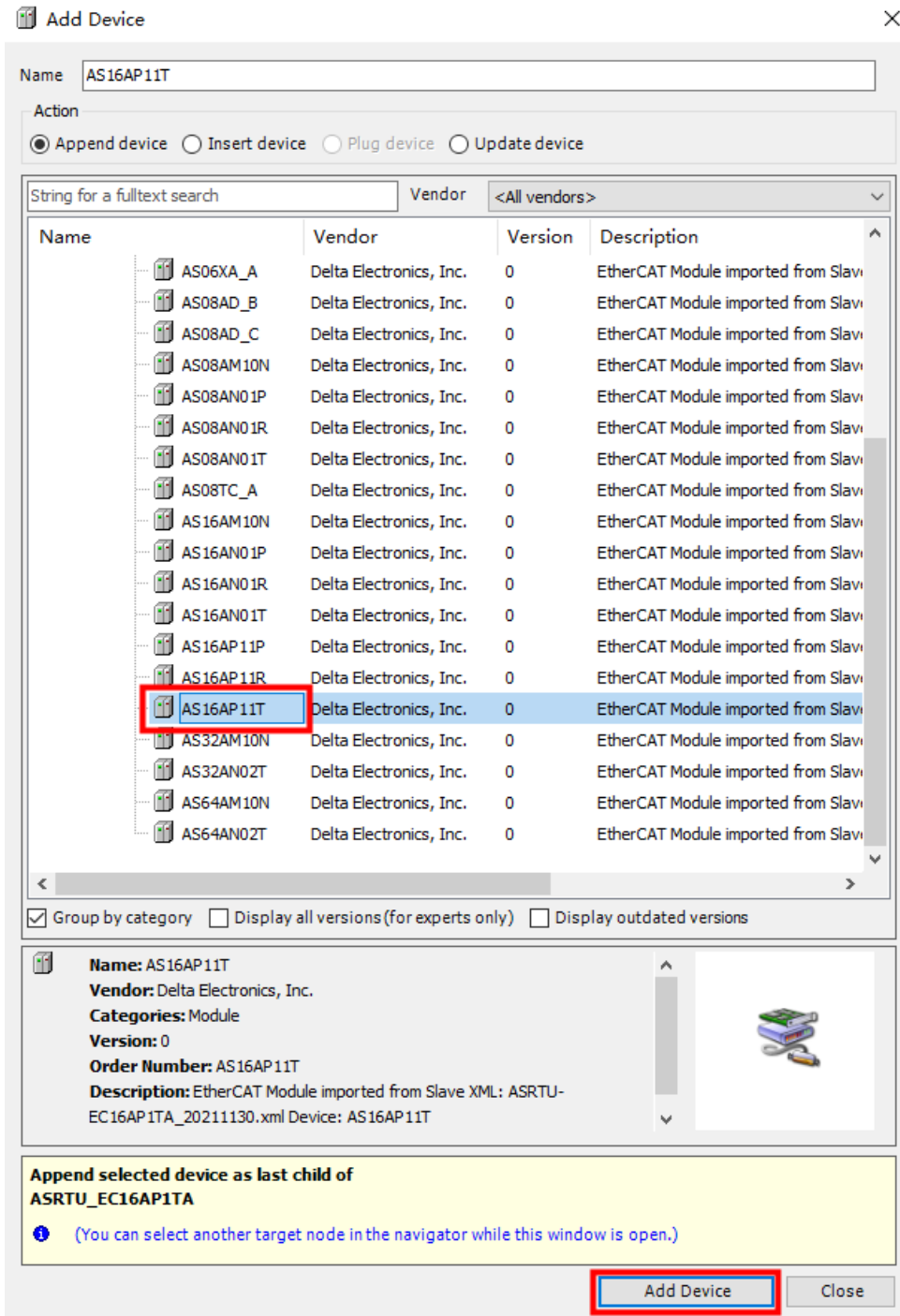


Close the window after adding the device is finished.

3. Right-click ASRTU-EC16AP and then click “Add Device...” from the context menu.



Then the “Add Device” window is open, where ASRTU-EC16AP’s right-side extension modules are added. Select corresponding modules one by one according to the actual connection order of the extension modules and click “Add Device” button to add them.

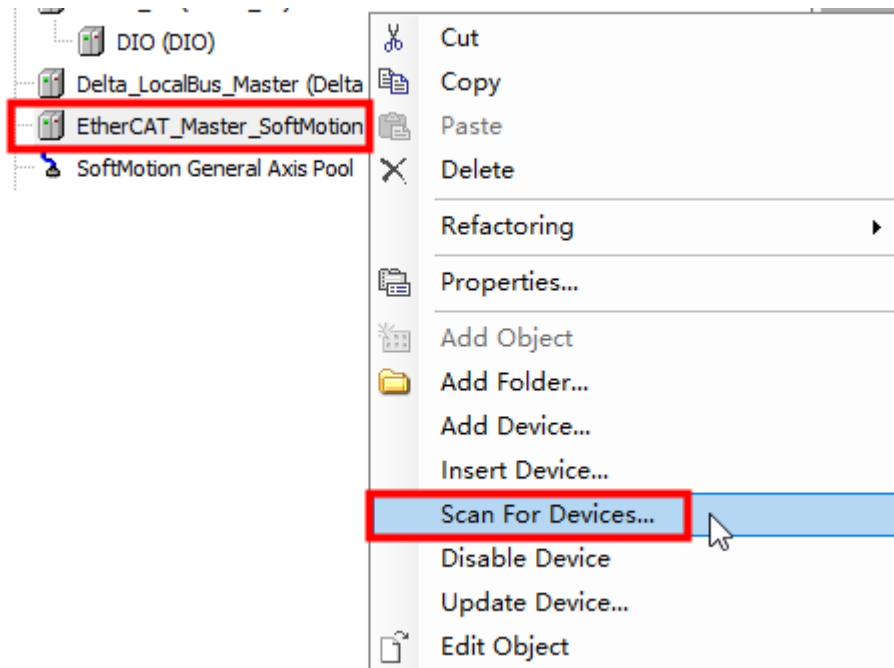


After adding right-side extension modules is complete, click “Close” to close the window.

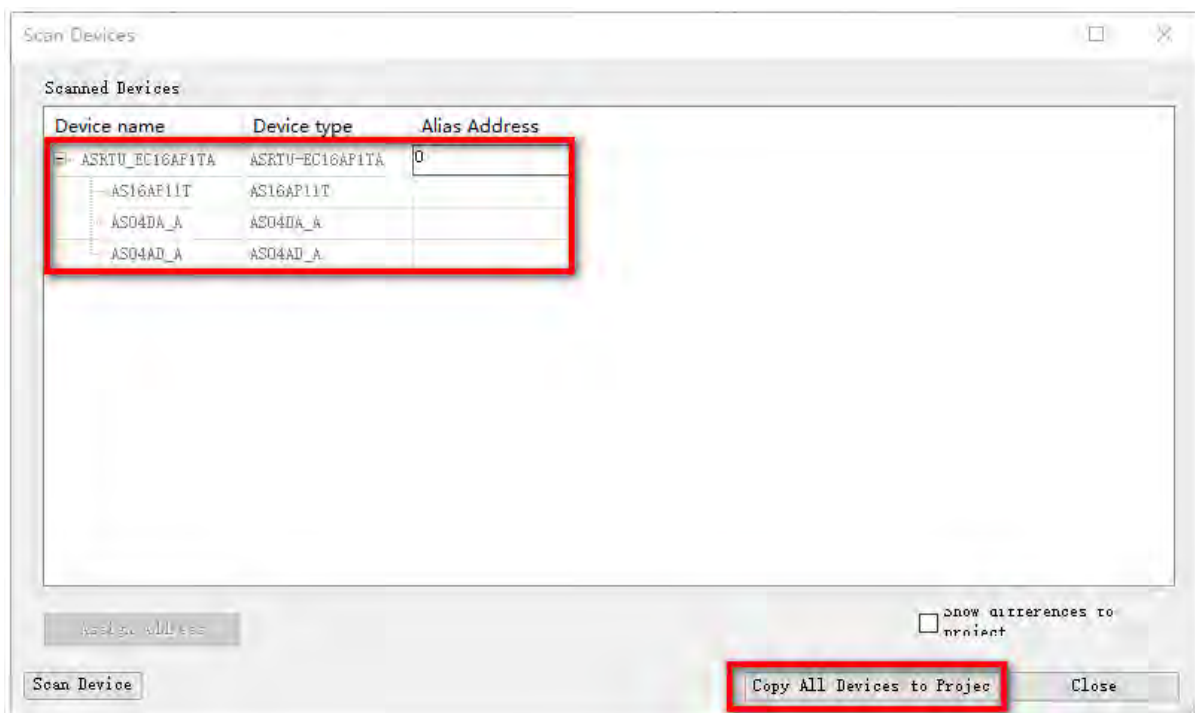
### 5.2.2 Using Auto Scan Function to Add ASRTU-EC16AP and Right-Side Modules

ASRTU-EC16AP supports the function of automatically scanning for ASRTU-EC16AP and right-side extension modules for easy configuration and operation. See the following steps for details.

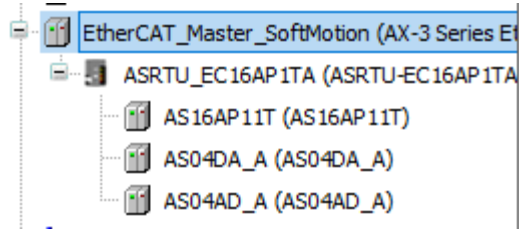
1. Right-click “EtherCAT\_Master\_SoftMotion” on the left-side list of the DIADesigner-AX software and then click the “Scan For Devices...” item from the context menu.



2. The “Scan Devices” window pops up and automatically displays ASRTU-EC16AP (e.g. ASRTU-EC16AP1TA) and its right-side extension modules which are scanned out.

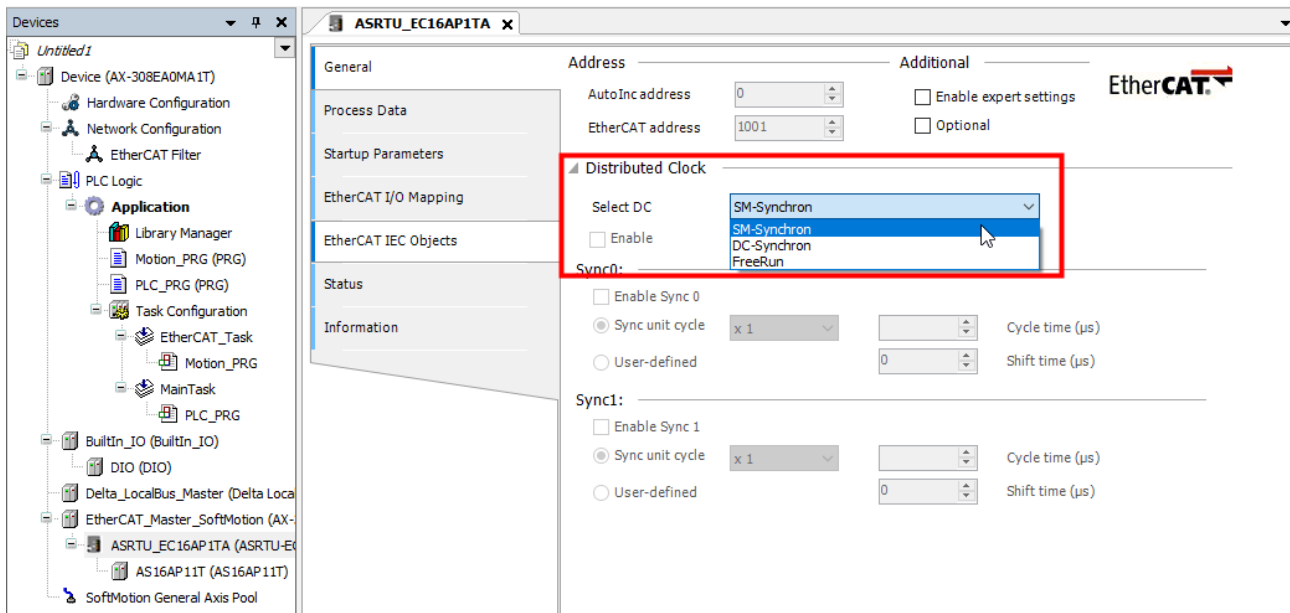


After the ASRTU-EC16AP slave and right-side extension modules are scanned out, click “Copy All Devices to Project” button to add ASRTU-EC16AP and its right-side extension modules to the EtherCAT master configuration.



### 5.3 Operation Mode Setup

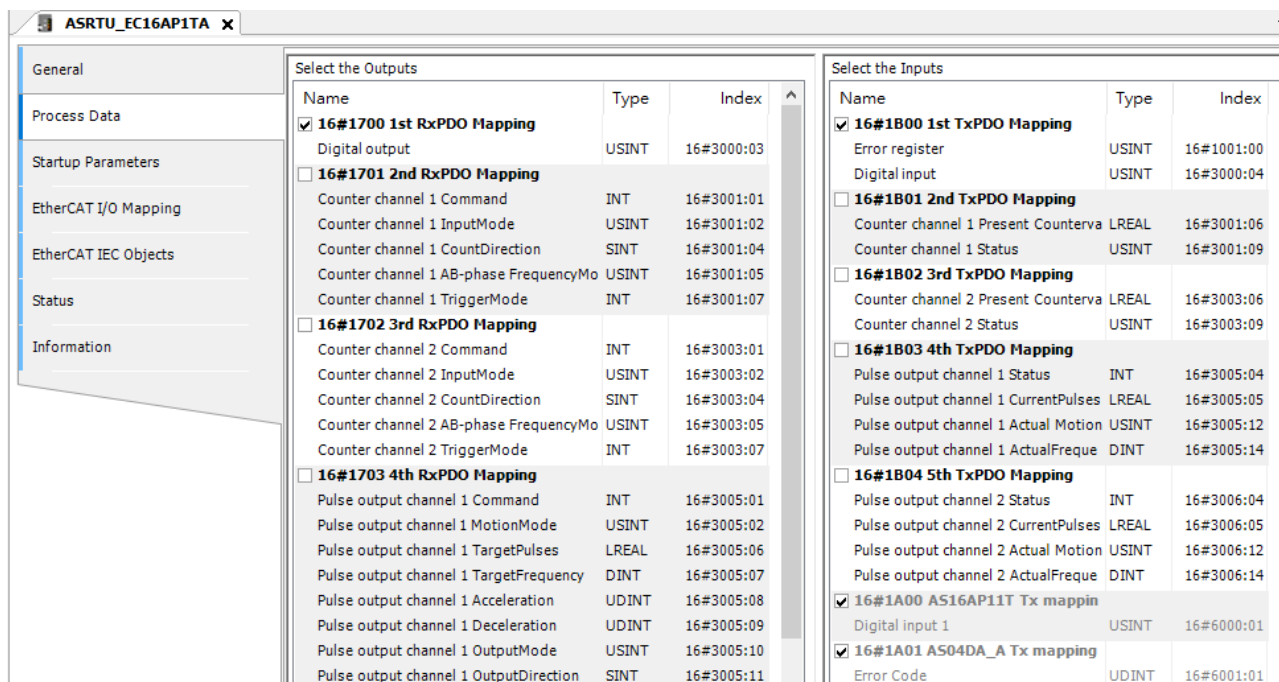
With a click on “General” tab in the configuration interface of ASRTU-EC16AP, users could set the mode of running ASRTU-EC16AP on the General page.



ASRTU-EC16AP supports three operation modes of SM-Synchron, DC-Synchron and FreeRun. Users could choose one mode from them in the drop-down box as shown above.

### 5.4 PDO Configuration

In the main configuration interface of ASRTU-EC16AP, with a click on “Process Data” tab, users could see PDO configuration page related to ASRTU-EC16AP and right-side extension modules.



ASRTU-EC16AP provides five TxPDO Mappings and five RxPDO Mappings for option. Users could choose desired ones on the page. Refer to Section 6.5 for details on parameters for each PDO mapping.

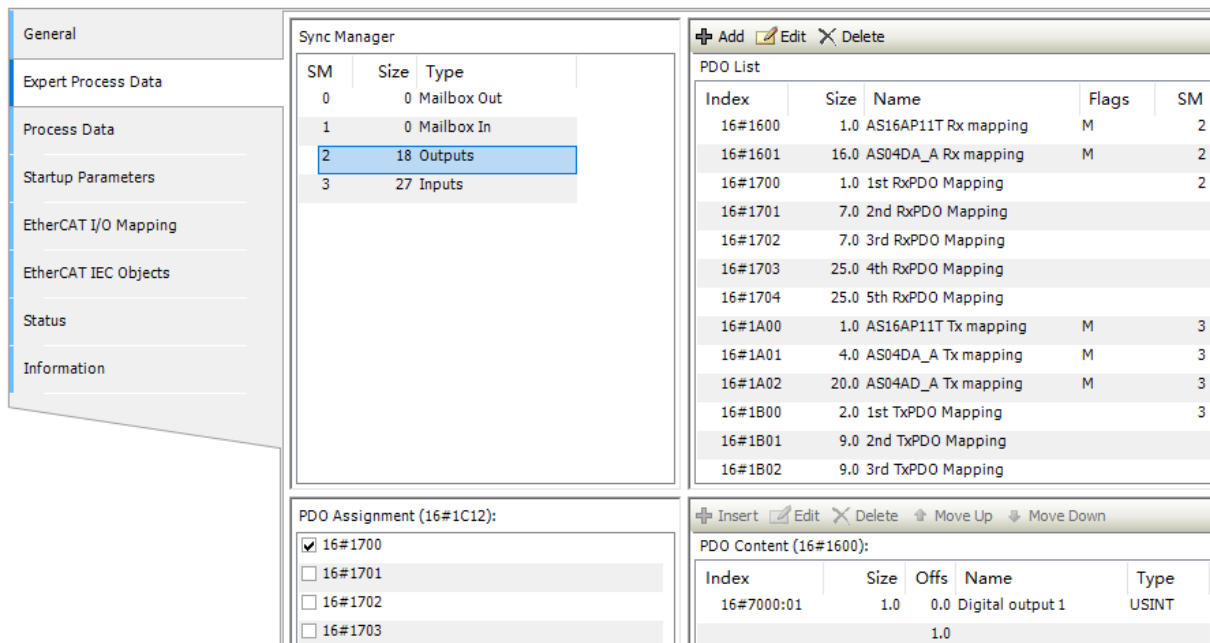
Apart from configuring 5 default TxPDO Mappings and 5 default RxPDO Mappings, users could also configure the parameters for each PDO Mapping in the following steps.

1. In the main configuration interface of ASRTU-EC16AP, click on “General” tab and tick the checkbox of “Enable expert settings”.



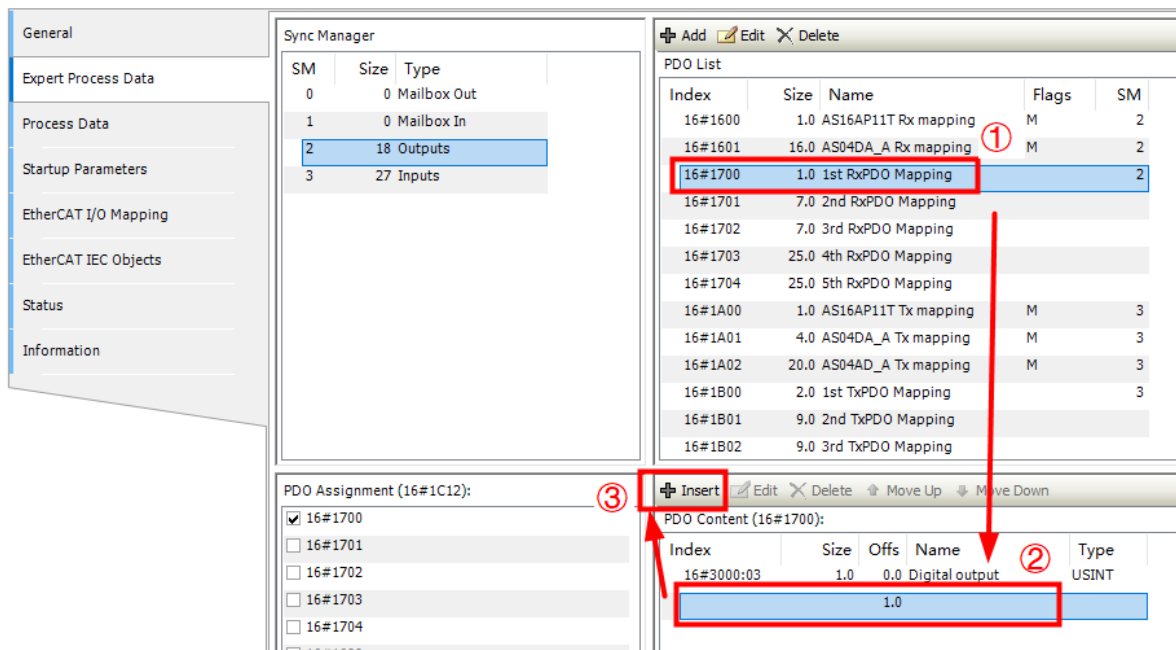
2. After ticking the checkbox of “Enable expert settings”, the “Expert Process Data” tag is added to the main configuration interface of ASRTU-EC16AP.



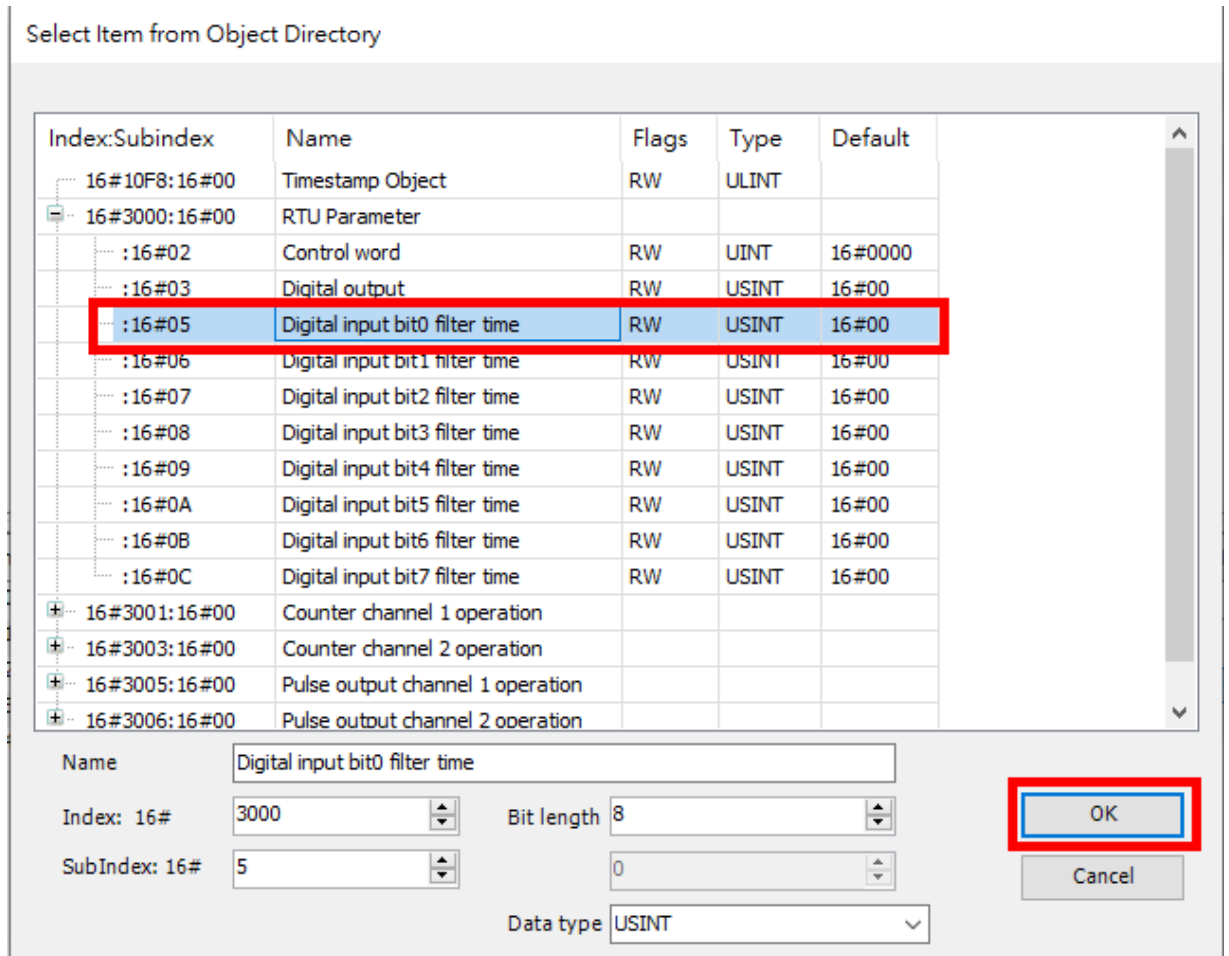


For example, to add the filter time parameter for input point X0.0 to the first RxPDO Mapping for ASRTU-EC16AP, click “1st RxPDO Mapping” first and then the blank row in the PDO Content area and finally click “+Insert” button.

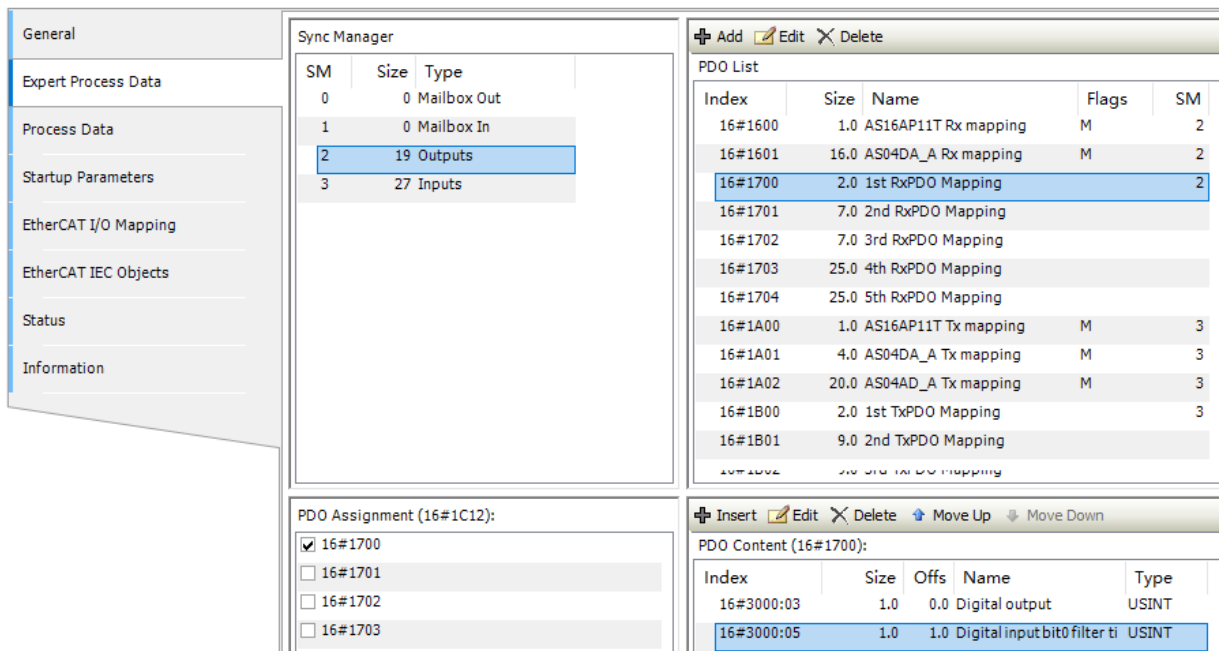
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After that, the “Select Item from Object Directory” window pops up, where you try to find “Digital input bit0 filter time” parameter as below.

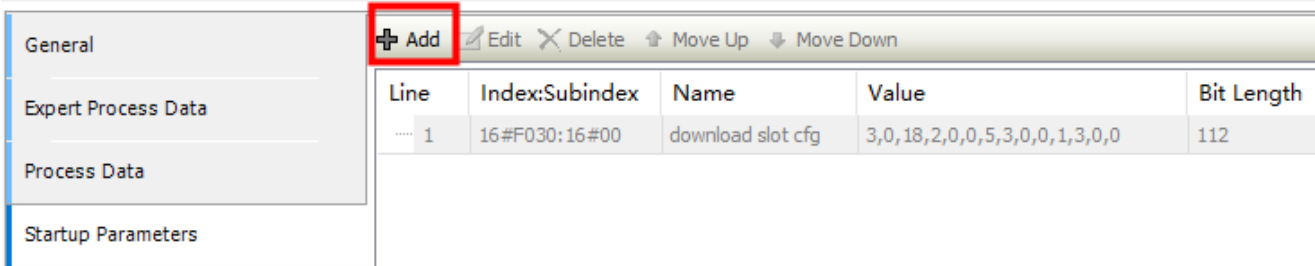


Select “Digital input bit0 filter time”. Then with a click on “OK”, the parameter “Digital input bit0 filter time” is added to the RxPDO Mapping.



## 5.5 Startup Parameters

The parameter values for ASRTU-EC16AP and extension modules could be preset on the page of the Startup Parameters tab. When the EtherCAT master and ASRTU-EC16AP make the connection successfully, the corresponding parameters will be written values into according to the data configured in the Startup Parameters tab.

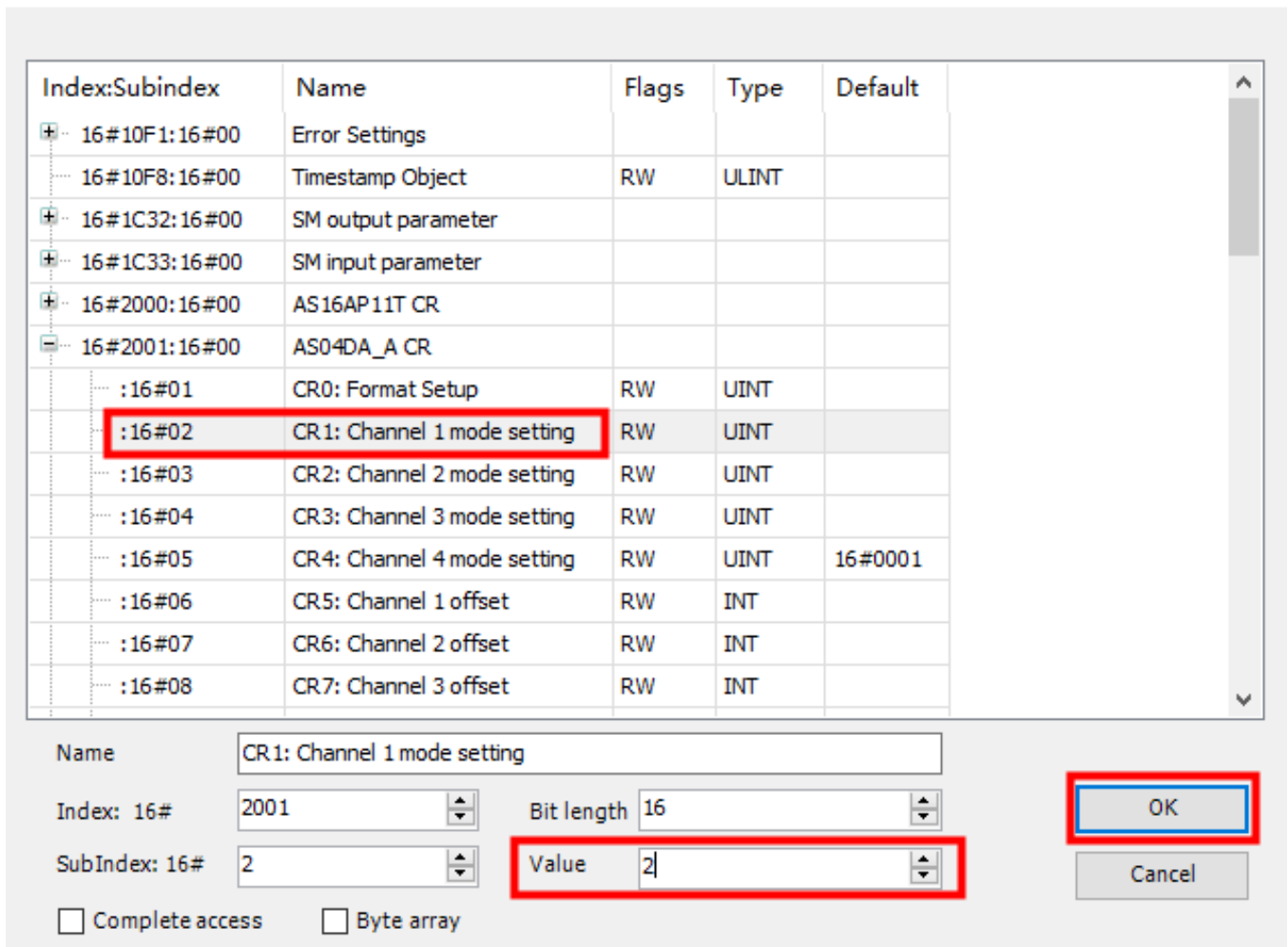


Click “+Add” button to add parameters for ASRTU-EC16AP and its right-side module here.

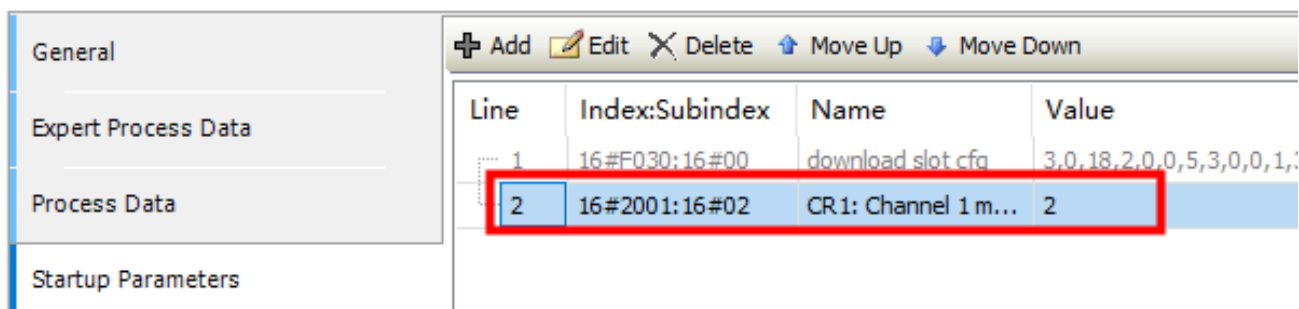
For example, to set channel 1 mode for ASRTU-EC16AP’s right-side module AS04DA\_A to 0~10V, firstly click the “Add” button in Startup Parameters tab; then select “CR1: Channel 1 mode setting” for AS04DA\_A from the “Select Item from Object Directory” window that pops up and set the parameter to 2 (0~10V). And finally click “OK.”

### Select Item from Object Directory

5



Afterward the “CR1: Channel 1 mode setting” parameter of AS04DA\_A is visible in the Startup Parameters tab as shown in the following image.



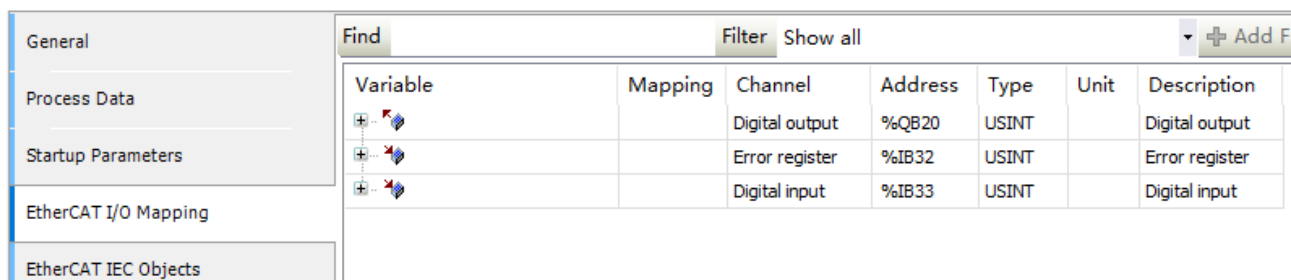
After you download the configuration data to the PLC, the channel 1 output mode of AS04DA\_A will be automatically set to 0~10V.

## 5.6 EtherCAT I/O Mapping

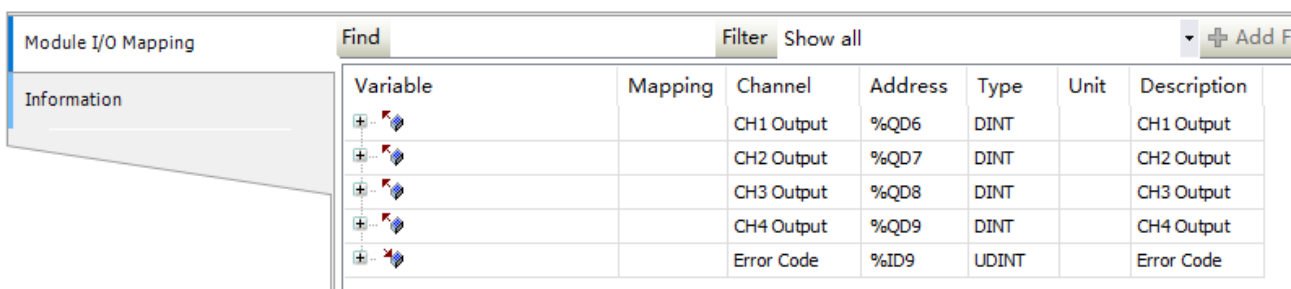
On the EtherCAT I/O mapping page, users could view the mapping relationship between PDO parameters and devices in PLC as well as define mapping variables or map user-defined variables to parameters.

Here are three types of commonly-used pages:

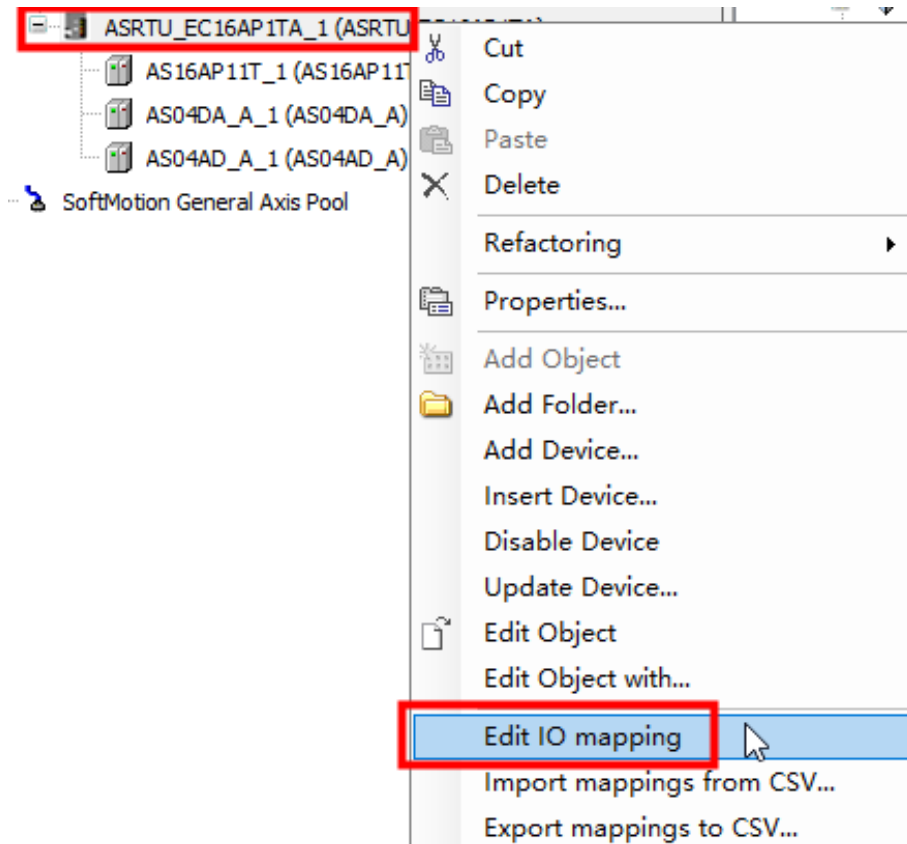
The first one is the EtherCAT I/O mapping page for ASRTU-EC16AP itself.



The second one is the EtherCAT I/O mapping page for the extension modules on the right side of ASRTU-EC 16AP1TA. For example, below is the EtherCAT I/O mapping page for the right-side extension module, AS04DA\_A.


















The third one is the Edit IO mapping page. Right-click on the slave ASRTU-EC16AP and then select “Edit IO mapping” item from the pop-up menu as shown below.



5

After that, the following page is open, where you can see corresponding PDO parameters for ASRTU-EC16A P1TA and right-side extension modules.

Edit IO mapping X				
Find		Filter	Show all	Add FB for IO Channel
Variable	Channel	Address	Type	Description
ASRTU_EC16AP1TA_1				
	Digital output	%QB20	USINT	Digital output
	Error register	%IB32	USINT	Error register
	Digital input	%IB33	USINT	Digital input
AS16AP11T_1				
	Digital output 1	%QB21	USINT	Digital output 1
	Digital input 1	%IB34	USINT	Digital input 1
AS04DA_A_1				
	CH1 Output	%QD6	DINT	CH1 Output
	CH2 Output	%QD7	DINT	CH2 Output
	CH3 Output	%QD8	DINT	CH3 Output
	CH4 Output	%QD9	DINT	CH4 Output
	Error Code	%ID9	UDINT	Error Code
AS04AD_A_1				
	Error Code	%ID10	UDINT	Error Code
	CH1 Input	%ID11	DINT	CH1 Input
	CH2 Input	%ID12	DINT	CH2 Input
	CH3 Input	%ID13	DINT	CH3 Input
	CH4 Input	%ID14	DINT	CH4 Input

**Note:**

After you have modified the PDO mappings for ASRTU-EC16AP, the PDO parameters for ASRTU-EC16AP and extension modules would show up simultaneously on the EtherCAT I/O mapping page and the mapping devices and variables for the right-side extension modules on the Module I/O mapping page would be invalid.

**MEMO**

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## Chapter 6 Introduction of Parameters

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## 6.1 Parameter List

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## 6.2 General Objects

### 6.2.1 Device Type (1000h)

The parameter is for describing the device type for ASRTU-EC16AP.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
1000h	0	Device type	UDINT	RO	NO	0x00001389

### 6.2.2 Error Register (1001h)

The parameter is the error register for ASRTU-EC16AP.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
1001h	0	Error register	USINT	RO	YES	0x00

When ASRTU-EC16AP produces an alarm, you can check the cause of the error and take a corrective action for ASRTU-EC16AP according to the value of the parameter.

See the detailed explanation of parameter values in the following table.

Value	Explanation	How to deal with
0	No error	-
1	The actual right-side extension modules and the configuration on the software do not match.	<ol style="list-style-type: none"> <li>1. Check if right-side extension modules are consistent with those configured on the software.</li> <li>2. Check if right-side extension modules are correctly installed and the connection between modules is normal.</li> </ol>

Value	Explanation	How to deal with
2	Right-side extension module error	Check the error information on the special modules on the right of ASRTU-EC16AP and find the error cause based on the error code value of the extension module. Refer to AS Series Module Manual for detailed information on error codes for the special modules
3	Right-side extension module alarm	<ol style="list-style-type: none"> <li>1. Check if the external power supply to the right-side modules is normal.</li> <li>2. Check the error information on the special modules on the right of ASRTU-EC16AP and find the error cause based the error code value of the extension module.</li> </ol> Refer to AS Series Module Manual for detailed information on error codes for the special modules
4	Timeout in communication between the ASRTU-EC16AP and extension modules	Check if ASRTU-EC16AP and right-side extension modules are disconnected or connected loosely.
5	Voltage abnormal	Check if the voltage of the power supply to ASRTU-EC16AP is normal.
6	Setting value of SYNC Cycle time is too small. (Note: After EtherCAT data refreshes are conducted 100 times, no refresh of right-side module data has been conducted yet.)	Please appropriately modify the bus SYNC Cycle time to a greater value according to Right IO Refresh Time (the cycle time for scanning for right-side modules).

### 6.2.3 Device Name (1008h)

The parameter is the device name for ASRTU-EC16AP.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
1008h	0	Device name	STRING	RO	NO	ASRTU-EC16AP1TA ASRTU-EC16AP1PA

### 6.2.4 Hardware Version (1009h)

The parameter is the hardware version for ASRTU-EC16AP.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
1009h	0	Hardware version	STRING	RO	NO	-

### 6.2.5 Software Version (100Ah)

The parameter is the firmware version for ASRTU-EC16AP.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
100Ah	0	Software version	STRING	RO	NO	-

### 6.2.6 Identity (1018h)

The object shows the basic information of ASRTU-EC16AP including vendor ID, product code, revision and serial number. See the following table for details.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
1018h	1	Vendor ID	UDINT	RO	NO	0x000001DD
	2	Product code	UDINT	RO	NO	0x10506102
	3	Revision	UDINT	RO	NO	0x00000001
	4	Serial number	UDINT	RO	NO	0x00000000

## 6.3 PDO Mapping Objects

The PDO mapping objects display all parameters for PDO mapping which are used in the CoE protocol (CAN Application Protocol over EtherCAT).

### 6.3.1 Receive PDO Mapping

The Receive PDO mapping consists of a set of output parameters for ASRTU-EC16AP and its right-side extension modules.

1600h~161Fh is the output parameter configuration set for right-side extension modules. 1600h is the output parameter set for the 1<sup>st</sup> extension module on the right of ASRTU-EC16AP, 1601h is the output parameter set for the 2<sup>nd</sup> extension module and so on. Thus, likewise 161Fh is the output parameter set for the 32<sup>nd</sup> extension module on the right of ASRTU-EC16AP.

1700h~1704h is the local output parameter configuration set for ASRTU-EC16AP.

### 6.3.2 Transmit PDO Mapping

The Transmit PDO mapping consists of a set of input parameters for ASRTU-EC16AP and its right-side extension modules.

1A00h~1A1Fh is the input parameter configuration set for right-side extension modules. 1A00h is the input parameter set for the 1<sup>st</sup> extension module on the right of ASRTU-EC16AP, 1A01h is the input parameter set for the 2<sup>nd</sup> extension module and so on. Thus, likewise 1A1Fh is the input parameter set for the 32<sup>nd</sup> extension module on the right of ASRTU-EC16AP.

1B00h is the local input parameter configuration set for ASRTU-EC16AP.

### 6.3.3 Parameters for Right-Side Extension Modules

The indexes for right-side extension module parameters range between 2000h and 201Fh. Index values depend on the location of each extension module on the right of ASRTU-EC16AP.

For example, when an extension module is located at the 1<sup>st</sup> place on the right of ASRTU-EC16AP, the index of the module parameters is 2000h; when an extension module is located at the 2<sup>nd</sup> place on the right of ASRTU-EC16AP, the index of the module parameters is 2001h and so on. Thus, likewise when an extension module is located at the 32<sup>nd</sup> place on the right of ASRTU-EC16AP, the index of the module parameters is 201Fh.

The subindexes for the extension modules correspond to CR parameters of the extension modules. When an extension module is located at the 1<sup>st</sup> place on the right of ASRTU-EC16AP, the index and subindex are 2000h and 01h respectively and correspond to CR0 of the extension module. When an extension module is located at the 2<sup>nd</sup> place on the right of ASRTU-EC16AP, the index and subindex are 2001h and 07h respectively and correspond to CR6 of the extension module.

The following table lists the indexes and subindexes for ASRTU-EC16AP's right-side extension module parameters.

Index	Subindex	Description
2000h	01h	The index and subindex that CR0 corresponds to when the extension module is the 1 <sup>st</sup> unit on the right side of ASRTU-EC16AP
	02h	The index and subindex that CR1 corresponds to when the extension module is the 1 <sup>st</sup> unit on the right side of ASRTU-EC16AP
	...	...
2001h	01h	The index and subindex that CR0 corresponds to when the extension module is the 2 <sup>nd</sup> unit on the right side of ASRTU-EC16AP
	02h	The index and subindex that CR1 corresponds to when the extension module is the 2 <sup>nd</sup> unit on the right side of ASRTU-EC16AP
	...	...
2002h	01h	The index and subindex that CR0 corresponds to when the extension module is the 3 <sup>rd</sup> unit on the right side of ASRTU-EC16AP
	02h	The index and subindex that CR1 corresponds to when the extension module is the 3 <sup>rd</sup> unit on the right side of ASRTU-EC16AP
	...	...
2003h	01h	The index and subindex that CR0 corresponds to when the extension module is the 4 <sup>th</sup> unit on the right side of ASRTU-EC16AP
	02h	The index and subindex that CR1 corresponds to when the extension module is the 4 <sup>th</sup> unit on the right side of ASRTU-EC16AP
	...	...
...	...	...
201Eh	01h	The index and subindex that CR0 corresponds to when the extension module is the 31 <sup>st</sup> unit on the right side of ASRTU-EC16AP
	02h	The index and subindex that CR1 corresponds to when the extension module is the 31 <sup>st</sup> unit on the right side of ASRTU-EC16AP
	...	...
201Fh	01h	The index and subindex that CR0 corresponds to when the extension module is the 32 <sup>nd</sup> unit on the right side of ASRTU-EC16AP
	02h	The index and subindex that CR1 corresponds to when the extension module is the 32 <sup>nd</sup> unit on the right side of ASRTU-EC16AP
	...	...

## 6.4 Local Parameter Objects

### 6.4.1 RTU Parameter (3000h)

The RTU Parameter set consists of general function parameters including switch ID, control word, digital input and digital output for ASRTU-EC16AP.

#### 6.4.1.1 Switch ID (3000:01h)

The Switch ID parameter reads the rotary switch value of the node address at the time when ASRTU-EC16AP is powered on.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3000h	1	Switch ID	UINT	RO	YES	0

### 6.4.1.2 Control Word (3000:02h)

The Control word parameter is the control word for ASRTU-EC16AP.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3000h	2	Control word	UINT	RW	YES	0

See explanation of the control word parameter values of ASRTU-EC16AP in the following table.

Bit	Value	Description
Bit0~Bit1	00	When ASRTU-EC16AP is disconnected from the master or exits from the OP state, users can set up the output values for local output points, the first 8 digital modules and the first 8 special modules with the parameters “COMlost_RTU_Output”, “COMlost_DOModule1_Outputs” to “COMlost_DOModule8_Outputs” and “COMlost_AOModule1_Outputs” to “COMlost_AOModule8_Outputs”. And the output for other modules will be cleared.
	01	When ASRTU-EC16AP is disconnected from the master or exits from the OP state, the output values after disconnection can be set up with the parameters CR124~CR132 of the right-side modules (ASRTU-EC16AP firmware V1.02.00 and later versions support this function.) <ol style="list-style-type: none"> <li>CR124 is used to set the output mode of a right-side module after disconnection. When CR124 is set to 0 and ASRTU-EC16AP disconnects from the master or exits from the OP state, the right-side module will output according to the values in CR125~CR132; When the value in CR124 is not 0 and ASRTU-EC16AP is disconnected from the master or exits from the OP state, the right-side module will maintain the current output.</li> <li>Each module on the right side of ASRTU-EC16AP has its own CR124~CR132. Users can set the output status of different modules with CR124~CR132 of each module when ASRTU-EC16AP is disconnected from the master or exits from the OP state.</li> <li>When ASRTU-EC16AP is disconnected from the master or exits from the OP state, local output points will still output the value of the parameter “COMloss_RTU_Output”.</li> <li>In this mode, the parameters “COMlost_DOModule1_Outputs” ~ “COMlost_DOModule8_Outputs” and “COMloss_AOModule1_Outputs” ~ “COMloss_AOModule8_Outputs” will be automatically cleared to 0.</li> </ol>
	10	When ASRTU-EC16AP is disconnected from the master or exits from the OP state, the output values of the local output points, the right-side special modules and digital modules are the same as they are before disconnection.
	11	
Bit2	0	When the actually connected right-side extension modules are inconsistent with those configured on the software, ASRTU-EC16AP will not enter the OP status.
	1	When the actually connected right-side extension modules are inconsistent with those configured on the software, ASRTU-EC16AP is allowed to enter the OP status.
Bit3	0	The Error LED indicator of ASRTU-EC16AP blinks when an alarm occurs to right-side modules.
	1	There is no change to the Error LED indicator of ASRTU-EC16AP when an alarm occurs to right-side modules.

Bit	Value	Description
Bit4	0	ASRTU-EC16AP stops the data exchange with right-side extension modules when a right-side extension module error occurs.
	1	ASRTU-EC16AP continues the data exchange with right-side extension modules when a right-side extension module error occurs.
Bit5	0	ASRTU-EC16AP stops the data exchange with right-side extension modules when an alarm occurs due to communication timeout between ASRTU-EC16AP and right-side modules.
	1	ASRTU-EC16AP continues the data exchange with right-side extension modules when an alarm occurs due to communication timeout between ASRTU-EC16AP and right-side modules.
Bit6	0/1	Reserved
Bit7	0/1	Reserved
Bit8	0/1	Reserved
Bit9	0/1	Reserved
Bit10	0/1	Reserved
Bit11	0/1	Reserved
Bit12	0/1	Reserved
Bit13	0/1	Reserved
Bit14	0/1	Reserved
Bit15	0/1	Reserved

**Note:** After modifying Bit0 and Bit1 of the "Control word" parameter, users need to reset the values of the relevant parameters for the output when communication disconnection occurs.

## 6

### 6.4.1.3 Digital Output (3000:03h)

The Digital output parameter controls the output of the local output points of ASRTU-EC16AP.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3000h	3	Digital output	USINT	RW	YES	0

Users can write a value into the parameter by configuring the parameter to a PDO or using a SDO so as to control ON/OFF of the local output points of ASRTU-EC16AP. Bit0 of the parameter corresponds to the local point Y0.0 of ASRTU-EC16AP, Bit1 of the parameter corresponds to Y0.1 and so on.

When the high-speed pulse output function of ASRTU-EC16AP is enabled, the "Digital output" parameter will not be able to control the output of the output points corresponding to output channels, but it can still control the output of the output points whose high-speed pulse output function is not enabled as well as the output of Y0.3 to Y0.7.

### 6.4.1.4 Digital Input (3000:04h)

The Digital input parameter reads the status of local input points of ASRTU-EC16AP.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3000h	4	Digital input	USINT	RO	YES	0

Users can read the value of the parameter by configuring the parameter to a PDO or using a SDO so as to get the status of the local input points of ASRTU-EC16AP. Bit0 of the parameter corresponds to local input point X0.0 of ASRTU-EC16AP, Bit1 of the parameter corresponds to local input point X0.1 and so on.

When the high-speed counting function of ASRTU-EC16AP is enabled, the “Digital input” parameter can display the status of the input points for high-speed counter channels.

#### 6.4.1.5 Digital Input Filter Time (3000:05h ~ 3000:0Ch)

The Digital input filter time parameter set specifies the input filter time for local input points X0.0~X0.7 of ASRTU-EC16AP within the range of 0 ~ 20ms.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3000h	5	Digital input bit0 filter time	USINT	RW	YES	0
	6	Digital input bit1 filter time	USINT	RW	YES	0
	7	Digital input bit2 filter time	USINT	RW	YES	0
	8	Digital input bit3 filter time	USINT	RW	YES	0
	9	Digital input bit4 filter time	USINT	RW	YES	0
	10	Digital input bit5 filter time	USINT	RW	YES	0
	11	Digital input bit6 filter time	USINT	RW	YES	0
	12	Digital input bit7 filter time	USINT	RW	YES	0

#### 6.4.1.6 Right IO Refresh Time (3000: 0Dh)

The Right IO refresh time parameter shows the cycle time for ASRTU-EC16AP’s right-side IO data refresh. (Unit: ms)

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3000h	13	Right IO refresh time	UINT	RO	YES	0

#### 6.4.1.7 COMlost\_RTU\_Output (3000:0Eh)

When ASRTU-EC16AP is disconnected from the master or exits from the OP state, and bit 1 of the control word parameter is 0, you can set the value of the local output points of ASRTU-EC16AP through the parameter.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3000h	14	COMlost_RTU_Output	USINT	RW	YES	0



### 6.4.2 Counter Channel 1 Operation (3001h)

The Counter channel 1 operation parameter set contains the relevant parameters for counter channel 1 and counter channel 1 corresponds to ASRTU-EC16AP's input points: X0.0 and X0.1.

Index	Subindex	Parameter name	Description
3001h	1	Counter channel 1 command	Command word for counter channel 1
	2	Counter channel 1 InputMode	Pulse input mode for counter channel 1
	3	Reserved	Reserved
	4	Counter channel 1 CountDirection	Direction of counting for counter channel 1 (Valid for single pulse mode only)
	5	Counter channel 1 AB-phase FrequencyMode	A/B phase input (multiplication x1/2/4) for counter channel 1
	6	Counter channel 1 Present Countervalue	Present counter value for counter channel 1
	7	Counter channel 1 TriggerMode	Trigger mode of pulse input counting for counter channel 1: rising edge or falling edge (Valid for single pulse and "pulse+direction" modes)
	8	Counter channel 1 ErrorCode	Error information for counter channel 1
	9	Counter channel 1 Status	Counting status for counter channel 1

#### 6.4.2.1 Counter Channel 1 Command (3001: 01h)

The parameter is the command word for counter channel 1 to enable or disable the high-speed counting function of ASRTU-EC16AP's input points: X0.0 and X0.1.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3001h	1	Counter channel 1 command	INT	RW	YES	0

See explanation of the parameter values in the following table.

Value	Description
0	The channel 1 high-speed counting function is disabled; ASRTU-EC16AP's counter channel 1 stops counting immediately and the current counter value remains unchanged.
1	The channel 1 high-speed counting function is enabled; ASRTU-EC16AP's counter channel 1 starts counting immediately and the counting continues from the last recorded counter value.
2	The function of clearing the counter value to 0 is enabled; the count value of ASRTU-EC16AP's counter channel 1 is cleared to 0 and meanwhile counter channel 1 stops counting immediately.

**Note:**

Please connect a resistor of 2.2K ohm between the input points and S/S common terminal when the input frequency exceeds 100 kHz.

### 6.4.2.2 Counter channel 1 InputMode (3001: 02h)

The parameter sets the input mode for counter channel 1. ASRTU-EC16AP supports three input modes: single pulse, “pulse + direction” and “phase A + phase B”.

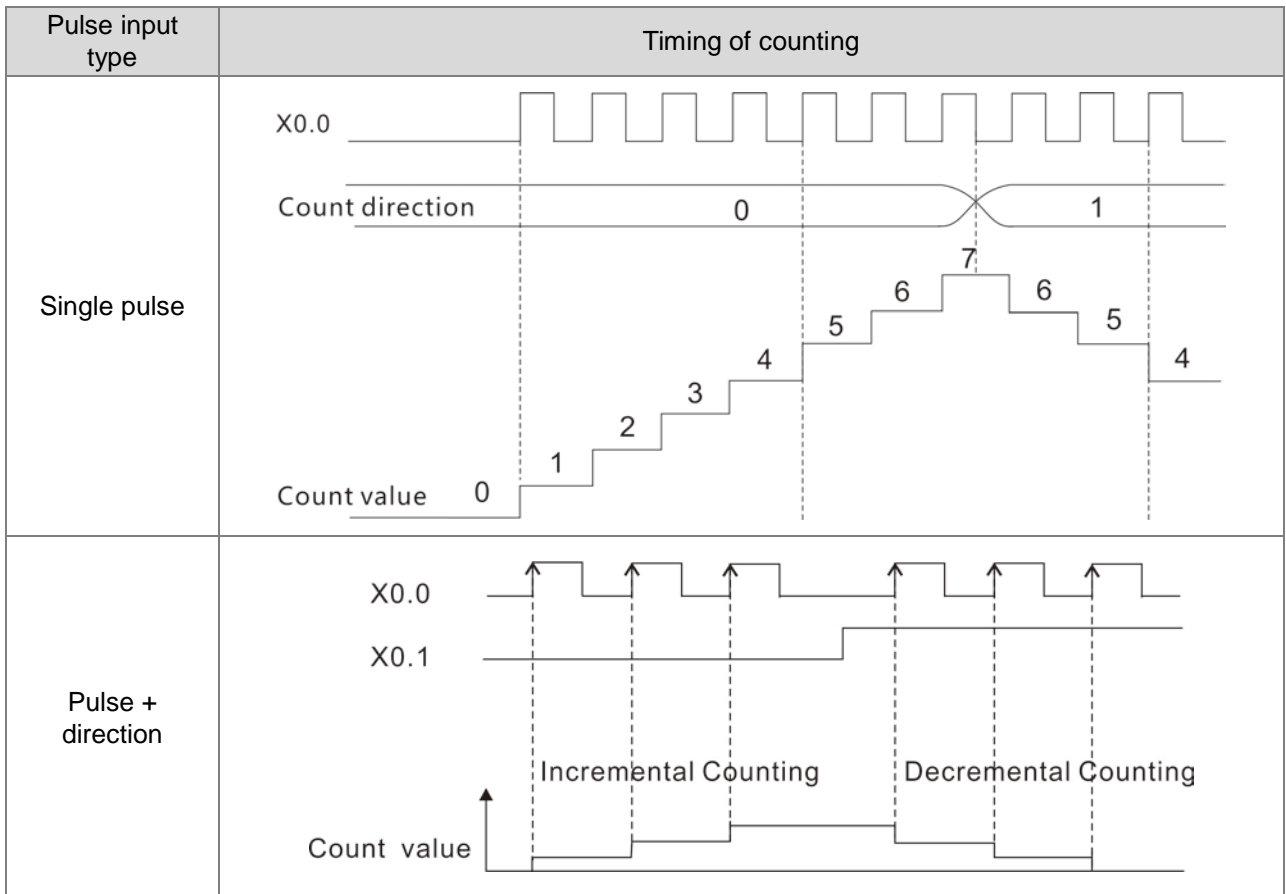
Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3001h	2	Counter channel 1 InputMode	USINT	RW	YES	0

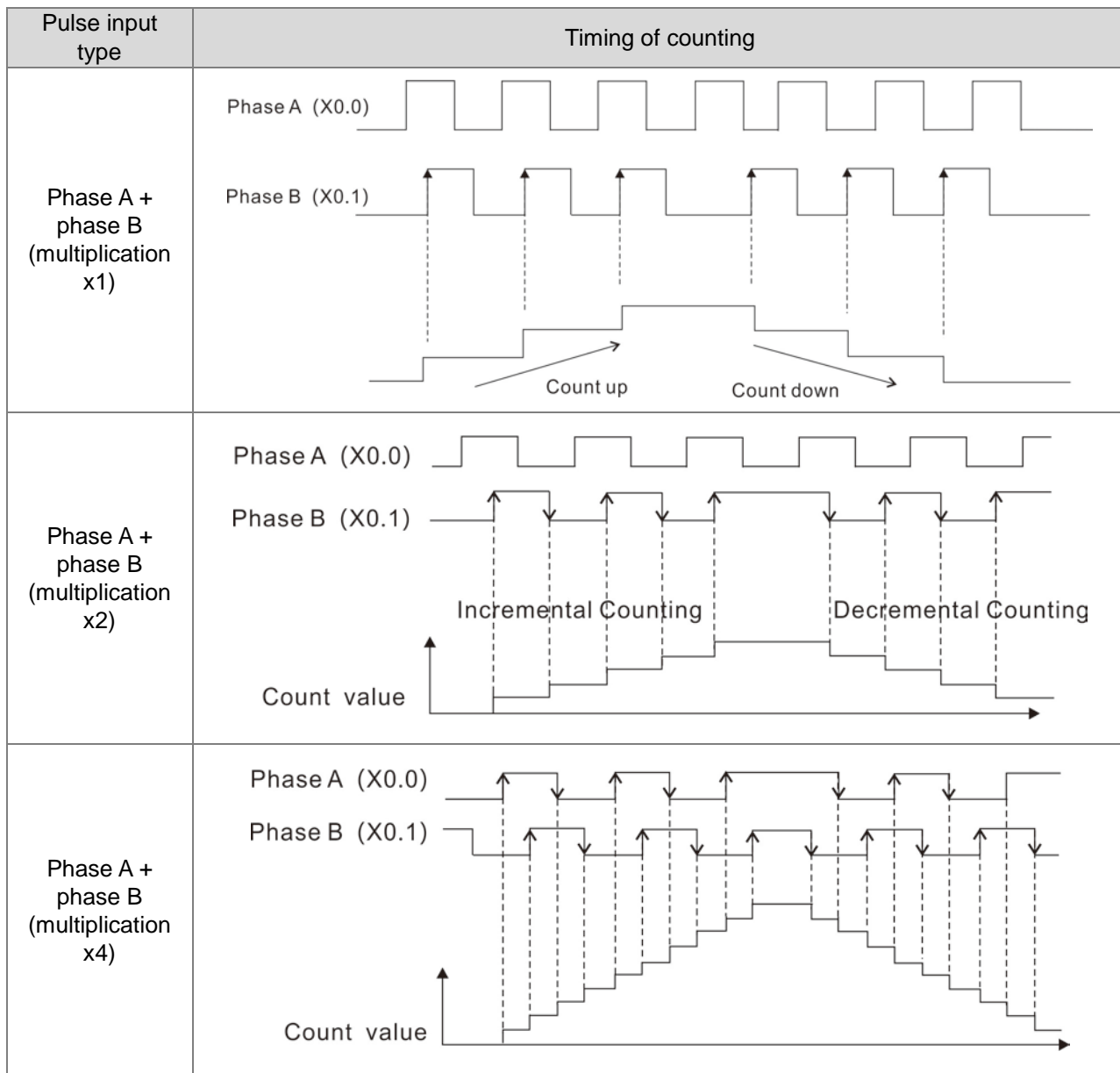
See explanation of the parameter values in the following table.

Value	Input mode
0	Single pulse
1	Pulse + direction
2	Phase A + phase B

The input mode for high-speed counting has to be set up before the high-speed counting function is enabled. You can select the corresponding mode according to the actual pulse input type.

The input modes for high-speed counting are illustrated in the following table.





### 6.4.2.3 Counter Channel 1 CountDirection (3001: 04h)

The parameter can be used for specifying the direction of counting when the “single pulse input” mode is set as the pulse input mode for counter channel 1.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3001h	4	Counter channel 1 CountDirection	SINT	RW	YES	0

The parameter value is 0 by default, which means counting up. If the parameter is set to 1 or other value, it means counting down.

If you modify the parameter value during counter channel 1 counting, the modification will not be effective right away until the Counter channel 1 command parameter changes from 0 to 1.

The function of the parameter is invalid if the set input mode is “pulse+ direction” or “phase A + phase B” for counter channel 1.

### 6.4.2.4 Counter Channel 1 AB-Phase FrequencyMode (3001: 05h)

The parameter is available to set the frequency multiplication when “phase A + phase B” is set as the pulse input mode for counter channel 1.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3001h	5	Counter channel 1 AB-phase FrequencyMode	USINT	RW	YES	4

See explanation of the parameter values in the following table.

Value	Description
1	Phase A + phase B: 1x
2	Phase A + phase B: 2x
4	Phase A + phase B: 4x

If the parameter is set to other value except 1, 2 and 4, it is 4x frequency multiplication by default.

### 6.4.2.5 Counter Channel 1 Present CounterValue (3001: 06h)

The parameter is the current counter value for counter channel 1.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3001h	6	Counter channel 1 Present CounterValue	LREAL	RW	YES	0

The parameter displays the current pulse number for counter channel 1 in real time. The range of counting is the valid range of the data type LREAL, i.e.  $-1.79769313486231e+308 \sim -2.22507385850721e-308 \cdot 0 \cdot +2.22507385850721e-308 \sim +1.79769313486231e+308$ .

#### 6.4.2.6 Counter Channel 1 TriggerMode (3001: 07h)

Through setting the value for the parameter, the counting can be triggered by the rising edge or falling edge of input pulses at X0.0 when “pulse + direction” is the pulse input mode for counter channel 1.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3001h	7	Counter channel 1 TriggerMode	INT	RW	YES	0

The parameter value is 0 by default, which means the counting is triggered by the rising edge. When it is 1, the counting is triggered by the falling edge. When the parameter is set to other value, the counting is triggered by the rising edge.

If you modify the parameter value during counter channel 1 counting, the modification will not be effective right away until the Counter channel 1 command parameter changes from 0 to 1.

The function of the parameter is invalid if the set input mode is “phase A + phase B” for counter channel 1.

#### 6.4.2.7 Counter Channel 1 ErrorCode (3001: 08h)

The parameter shows the current error information on counter channel 1.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3001h	8	Counter channel 1 ErrorCode	UINT	RO	YES	0

If the touch probe (position capture) function of ASRTU-EC16AP's input point X0.1 is enabled (the value of "Channel X1 TouchCommand" parameter is 1), high-speed counter channel 1 disables the counting function. At that time, if the value of "Counter channel 1 Command" parameter is set to 1, then the value of "Counter channel 1 ErrorCode" parameter will become 16 # 3000.

When the touch probe (position capture) function of ASRTU-EC16AP's input point X0.1 is disabled (the value of "Channel X1 TouchCommand" parameter is 0), the counting function of high speed counter channel 1 is enabled (the value of "Counter channel 1 Command" parameter changes from 0 to 1), high-speed counter channel 1 can count normally, and the value of "Counter channel 1 ErrorCode" parameter changes to 0.

#### 6.4.2.8 Counter Channel 1 Status (3001: 09h)

The parameter shows the current counting status for counter channel 1.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3001h	9	Counter channel 1 Status	USINT	RO	YES	0

See explanation of the parameter values in the following table.

Value	Description
0	No counting in counter channel 1
1	Counting is ongoing in counter channel 1

### 6.4.3 Counter Channel 2 Operation (3003h)

The Counter channel 2 operation parameter set contains the relevant parameters for counter channel 2 and counter channel 2 corresponds to ASRTU-EC16AP's input points: X0.2 and X0.3.

The explanations of the parameters for counter channel 2 operation are identical to those for Counter channel 1 operation. Please refer to corresponding parameters for Counter channel 1 operation in Section 6.4.2 for description of the parameters for Counter channel 2 operation.

Index	Subindex	Parameter name	Description
3003h	1	Counter channel 2 Command	Command word for counter channel 2
	2	Counter channel 2 InputMode	Pulse input mode for counter channel 2
	3	Reserved	Reserved
	4	Counter channel 2 CountDirection	Direction of counting for counter channel 2 (Valid for single pulse mode)
	5	Counter channel 2 AB-phase FrequencyMode	A/B phase input (multiplication x1/2/4) for counter channel 2
	6	Counter channel 2 Present Countervalue	Present counter value for counter channel 2
	7	Counter channel 2 TriggerMode	Trigger mode of pulse input counting for counter channel 2: rising edge or falling edge (Valid for single pulse and "pulse+direction" modes)
	8	Counter channel 2 ErrorCode	Error information for counter channel 2
	9	Counter channel 2 Status	Counting status for counter channel 2

### 6.4.4 Pulse Output Channel 1 Operation (3005h)

The Pulse output channel 1 operation parameter set contains the relevant parameters for pulse output channel 1 and pulse output channel 1 corresponds to ASRTU-EC16AP's output points: Y0.0 and Y0.1.

Index	Subindex	Parameter name	Description
3005h	1	Pulse output channel 1 Command	Command word for pulse output channel 1
	2	Pulse output channel 1 MotionMode	Motion mode for pulse output channel 1
	3	Reserved	Reserved
	4	Pulse output channel 1 Status	Output status for pulse output channel 1
	5	Pulse output channel 1 CurrentPulses	Current output pulse number for pulse output channel 1
	6	Pulse output channel 1 TargetPulses	Target pulse number for pulse output channel 1
	7	Pulse output channel 1 TargetFrequency	Target output frequency for pulse output channel 1
	8	Pulse output channel 1 Acceleration Time	Acceleration Time or PWM pulse width for pulse output channel 1
	9	Pulse output channel 1 Deceleration Time	Deceleration Time or cycle of PWM output for pulse output channel 1
	A	Pulse output channel 1 OutputMode	Output mode for pulse output channel 1
	B	Pulse output channel 1 OutputDirection	Output direction for pulse output channel 1 (Valid for "pulse+direction" mode only)

Index	Subindex	Parameter name	Description
	C	Pulse output channel 1 Actual MotionMode	Actual motion mode for pulse output channel 1
	D	Reserved	Reserved
	E	Pulse output channel 1 ActualFrequency	Actual frequency for pulse output channel 1

#### 6.4.4.1 Pulse Output Channel 1 Command (3005: 01h)

The parameter is the command word for pulse output channel 1 to enable or disable the high-speed pulse output function of ASRTU-EC16AP's output points: Y0.0 and Y0.1.

Please set up the parameter after all other pulse output parameters setting is complete.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3005h	1	Pulse output channel 1 Command	INT	RW	YES	0

See explanation of the parameter values in the following table.

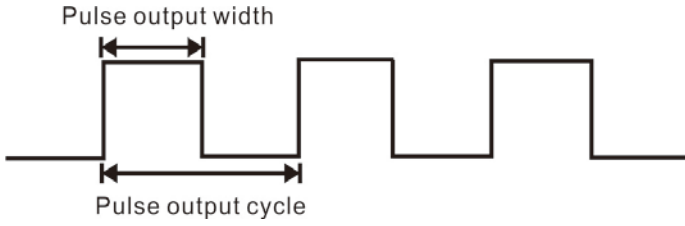
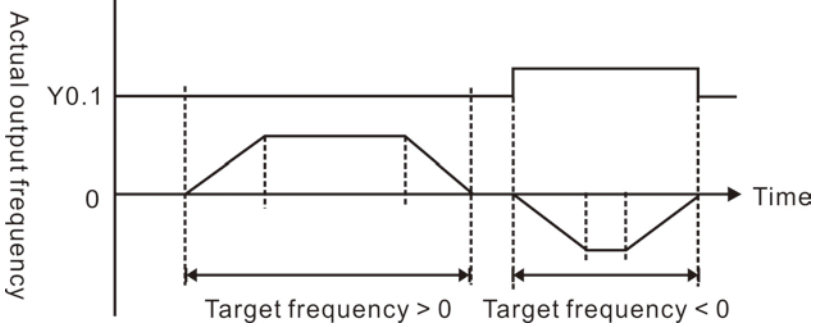
Value	Description
0	The output of pulses stops. If MotionMode is set to speed output or position output mode, and the parameter value is set to 0, pulse output channel 1 will stop the pulse output according to the set deceleration time. When MotionMode is set to PWM mode, pulse output channel 1 will stop the output.
1	The pulse output function is enabled and the settings of relevant parameters for the pulse output are effective. If MotionMode is set to speed output or position output mode, and the parameter value changes from 0 to 1, pulse output channel 1 will perform the output according to the set acceleration/deceleration time, target frequency and target pulse number. When MotionMode is set to PWM mode and the parameter value changes from 0 to 1, pulse output channel 1 will start the pulse output. <b>Note:</b> When the communication between ASRTU-EC16AP and the master is lost during the pulse output, pulse output channel 1 will stop immediately and the actual output pulse count will not be cleared to 0. After the connection between ASRTU-EC16AP and the master recovers, pulse output channel 1 will continue the output only when you set the "pulse output channel 1 command" parameter to 0 and then to 1.

### 6.4.4.2 Pulse Output Channel 1 MotionMode (3005: 02h)

The parameter is available to select the motion mode for pulse output channel 1. The motion modes include speed output, position output, PWM mode, home mode, and general output for option. The parameter setting is effective as the command word for pulse output channel 1 changes from 0 to 1.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3005h	2	Pulse output channel 1 MotionMode	USINT	RW	YES	0

See explanation of the values of the parameter in the following table.

Value	Description
0	General output mode, e.g. output points control the motion of cylinder.
2	<p>PWM mode: In this mode, the output point Y0.0 outputs pulse signals with the set pulse output cycle (Pulse output channel 1 Deceleration Time) and pulse output width (Pulse output channel 1 Acceleration Time).</p> 
3	<p>Speed output mode: In this mode, pulse output channel 1 continuously outputs pulse signals at the set target frequency (Pulse output channel 1 TargetFrequency).</p>  <p><b>Note:</b> If the acceleration time (Pulse output channel 1 Acceleration Time) and the deceleration time (Pulse output channel 1 Deceleration Time) are both not 0, the new target frequency after being modified during the pulse output will not take effect; if the acceleration time (Pulse output channel 1 Acceleration Time) or deceleration time (Pulse output channel 1 Deceleration Time) is 0, then the new target frequency after being modified during the pulse output can be effective.</p>



Value	Description
4	<p>Absolute position output mode:</p> <p>In this mode, the output point Y0.0 outputs a corresponding number of pulses according to the set target pulse number (Pulse output channel 1 TargetPulses), target frequency (Pulse output channel 1 TargetFrequency), acceleration time (Pulse output channel 1 Acceleration Time) and deceleration time (Pulse output channel 1 Deceleration Time) and etc.</p> <p>After the pulse output is complete, the actual pulse number (Pulse output channel 1 CurrentPulses) is equal to the target pulse number (Pulse output channel 1 TargetPulses).</p> <div style="display: flex; justify-content: space-around;"> <div data-bbox="336 607 759 972"> </div> <div data-bbox="868 618 1294 972"> </div> </div>
5	<p>Relative position output mode:</p> <p>In this mode, the output point Y0.0 outputs a corresponding number of pulses according to the set target pulse number (Pulse output channel 1 TargetPulses), target frequency (Pulse output channel 1 TargetFrequency), acceleration time (Pulse output channel 1 Acceleration Time) and deceleration time (Pulse output channel 1 Deceleration Time) and other parameters</p> <p>After the pulse output is complete, the actual pulse number (Pulse output channel 1 CurrentPulses) is the sum of the current pulse number (Pulse output channel 1 CurrentPulses) when the pulse output starts and the target pulse number (Pulse output channel 1 TargetPulses).</p> <div style="display: flex; justify-content: space-around;"> <div data-bbox="336 1373 810 1704"> </div> <div data-bbox="900 1373 1358 1704"> </div> </div>
10	<p>Home mode:</p> <p>In this mode, you can set the current pulse number (Pulse output channel 1 CurrentPulses) to the target pulse number (Pulse output channel 1 TargetPulses) after the command word (Pulse output channel 1 Command) is set to 1.</p>

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### 6.4.4.3 Pulse Output Channel 1 Status (3005:04h)

The parameter shows the status of pulse output channel 1.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3005h	4	Pulse output channel 1 Status	INT	RO	YES	0

See explanation of the values of the parameter in the following table.

Value	Description
0	No pulse outputs in pulse output channel 1
1	The output of pulses is ongoing in pulse output channel 1.
2	Under position output mode, the output of the target number of pulses is complete. Under speed output mode, the target frequency is reached.

### 6.4.4.4 Pulse Output Channel 1 CurrentPulses (3005: 05h)

The parameter shows the current output pulse count for pulse output channel 1.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3005h	5	Pulse output channel 1 CurrentPulses	DINT	RO	YES	0

The number of output pulses specified by this parameter is an absolute value. Every time the "Pulse output channel 1 Command" parameter changes from 0 to 1, in pulse output mode, the parameter value will vary on the basis of the current value, which will not be cleared to 0.

### 6.4.4.5 Pulse Output Channel 1 TargetPulse (3005: 06h)

The parameter specifies the target pulse number for pulse output channel 1.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3005h	6	Pulse output channel 1 TargetPulse	DINT	RW	YES	0

### 6.4.4.6 Pulse Output Channel 1 TargetFrequency (3005: 07h)

The parameter specifies the target output frequency for pulse output channel 1.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3005h	7	Pulse output channel 1 TargetFrequency	DINT	RW	YES	0

In speed output mode or position output mode, the pulse output channel 1 will not output pulses by setting the "Pulse output channel 1 TargetFrequency" parameter to 0 when the pulse output function of pulse output channel 1 is enabled.

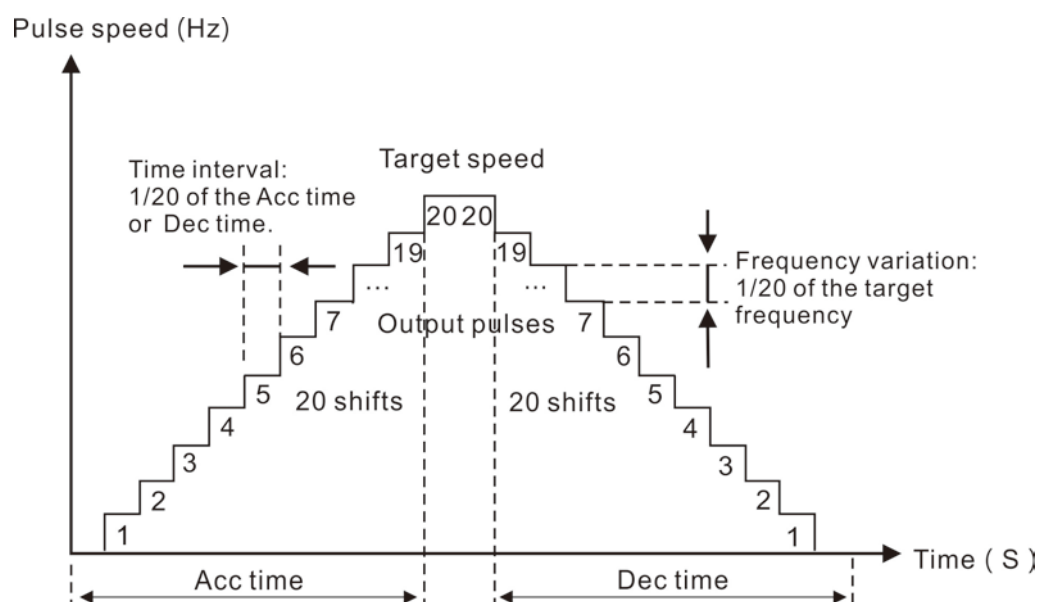
If the acceleration time (Pulse output channel 1 Acceleration Time) and the deceleration time (Pulse output channel 1 Deceleration Time) are both not 0 when the pulse output is enabled, the new target frequency will not take effect after the target frequency is modified during the pulse output. If the acceleration time (Pulse output channel 1 Acceleration Time) or deceleration time (Pulse output channel 1 Deceleration Time) is 0 when the pulse output is enabled, then the new target frequency can be effective after the target frequency is modified during the pulse output.

#### 6.4.4.7 Pulse Output Channel 1 Acceleration Time (3005: 08h)

The parameter is the acceleration time or pulse output width for pulse output channel 1. Modifying the parameter value is invalid after the pulse output is enabled except that the motion mode is set to PWM mode.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3005h	8	Pulse output channel 1 Acceleration Time	UDINT	RW	YES	0

In speed output mode or position output mode, this parameter refers to the acceleration time for reaching the target output frequency, with the unit: ms. When the pulse output is enabled, if the acceleration time or deceleration time is 0, the pulse output channel 1 will output pulses at the target frequency directly, and stop outputting pulses immediately once the target number of pulses is reached, with no any acceleration and deceleration process. If the acceleration time and deceleration time are both not 0, the pulse output channel 1 will accelerate the output of pulses from the static state until the target frequency is reached, and then decelerate the output of pulses while the target number of pulses is being approached and end up stopping outputting pulses once the target number of pulses is reached.



As shown in the figure above, when the acceleration time and deceleration time are both not 0, there are 20 steps respectively for the acceleration and deceleration of the pulse output. The output frequency increases or decreases by 1/20 of the target frequency every step, with the unit: Hz, and the time for each step is 1/20 of the acceleration time or deceleration time with the unit: ms.

In PWM mode, this parameter stands for the pulse output width, with the unit: us.

#### 6.4.4.8 Pulse Output Channel 1 Deceleration Time (3005: 09h)

The parameter is the deceleration time or pulse output cycle for pulse output channel 1. Modifying the parameter value is invalid after the pulse output is enabled except that the motion mode is set to PWM mode.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3005h	9	Pulse output channel 1 Deceleration Time	UDINT	RW	YES	0

In speed output mode or position output mode, the parameter means the deceleration time for reaching the target output frequency, with the unit: ms. In PWM mode, the parameter is the pulse output cycle with the unit: us.

#### 6.4.4.9 Pulse Output Channel 1 OutputMode (3005: 0Ah)

The parameter is available to set the output mode for pulse output channel 1. There are three output modes: “pulse + direction”, “phase A + phase B” and “CW/CCW” for option.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3005h	A	Pulse output channel 1 OutputMode	USINT	RW	YES	0

See explanation of the parameter values in the following table.

Value	Description
0	<p>Pulse + direction: Y0.0 outputs the pulse signal and Y0.1 outputs the direction signal.</p>
1	<p>A/B phase output: Y0.0 outputs phase A pulse, Y0.1 outputs phase B pulse. Note: When the mode of A/B phase output is selected, the maximum output frequency that ASRTU-EC16AP supports is 100 KHz.</p>
2	<p>CW/CCW: Clockwise mode and counterclockwise mode. In CW mode, Y0.0 outputs the pulse signal and Y0.1 is OFF. In CCW mode, Y0.0 is OFF and Y0.1 outputs the pulse signal.</p>

To switch the output mode during output process, please first set the parameters "Pulse output channel 1 command" and "Pulse output channel 1 MotionMode" to 0 after the pulse output stops, and then set "Pulse output channel 1 OutputMode" to 0, 1 or 2. After the pulse output mode is switched, set the parameter "Pulse output channel 1 MotionMode" to 3, 4 or 5 and then set "Pulse output channel 1 Command" to 1. After that, the high-speed pulse output channel 1 will output pulses in the new output mode.

#### 6.4.4.10 Pulse Output Channel 1 OutputDirection (3005: 0Bh)

The parameter can be used to set the action mode of direction output point Y0.1 when “pulse + direction” is set as the mode for pulse output.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3005h	B	Pulse output channel 1 OutputDirection	SINT	RW	YES	0

See explanation of the parameter values in the following table.

Value	Description
0	When pulses are output in the positive direction, Y0.1 is OFF. When pulses are output in the negative direction, Y0.1 is ON.
1	When pulses are output in the positive direction, Y0.1 is ON. When pulses are output in the negative direction, Y0.1 is OFF.

**Note:**

The parameter setting will not take effect until the setting is finished before the pulse output is started. The state of Y0.1 will not be cleared when the pulse output is complete or the output stops.

#### 6.4.4.11 Pulse Output Channel 1 Actual MotionMode (3005: 0Ch)

The parameter shows the current motion mode of pulses output for pulse output channel 1.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3005h	C	Pulse output channel 1 Actual MotionMode	SINT	RO	YES	0

The parameter is the same as the "Pulse output channel 1 MotionMode" parameter in the meaning of parameter values. Please refer to the description in Section 6.4.4.2 for the specific explanations of the parameter values.

#### 6.4.4.12 Pulse Output Channel 1 ActualFrequency (3005: 0Eh)

The parameter shows the actual frequency of pulse output for pulse output channel 1.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3005h	E	Pulse output channel 1 ActualFrequency	DINT	RO	YES	0

The parameter shows the actual output frequency value only when the motion mode of pulse output is set to the speed output or position output.

#### 6.4.5 Pulse Output Channel 2 Operation (3006h)

The Pulse output channel 2 operation parameter set contains the relevant parameters for pulse output channel 2 which corresponds to ASRTU-EC16AP's output point: Y0.2 and Y0.4.

The explanations of the parameters for pulse output channel 2 are identical to those for pulse output channel 1. Please refer to corresponding parameters for Pulse Output Channel 1 Operation in Section 6.4.4 for description of the parameters for pulse output channel 2.

Index	Subindex	Parameter name	Description
3006h	1	Pulse output channel 2 Command	Command word for pulse output channel 2
	2	Pulse output channel 2 MotionMode	Motion mode for pulse output channel 2
	3	Reserved	Reserved
	4	Pulse output channel 2 Status	Status for pulse output channel 2

Index	Subindex	Parameter name	Description
	5	Pulse output channel 2 CurrentPulses	Current output pulse number for pulse output channel 2
	6	Pulse output channel 2 TargetPulses	Target pulse number for pulse output channel 2
	7	Pulse output channel 2 TargetFrequency	Target output frequency for pulse output channel 2
	8	Pulse output channel 2 Acceleration Time	Acceleration time or PWM pulse width for pulse output channel 2
	9	Pulse output channel 2 Deceleration Time	Deceleration time or cycle of PWM output for pulse output channel 2
	A	Pulse output channel 2 OutputMode	Output mode for pulse output channel 2
	B	Pulse output channel 2 OutputDirection	Output direction for pulse output channel 2 (Valid for "pulse+direction" mode)
	C	Pulse output channel 2 Actual MotionMode	Actual motion mode for pulse output channel 2
	D	Reserved	Reserved
	E	Pulse output channel 2 ActualFrequency	Actual frequency for pulse output channel 2

#### 6.4.6 COMlost\_DOmodule\_Outputs (2100h~2107h)

When ASRTU-EC16AP is disconnected from the master or exits from the OP state, and bit 1 of the control word parameter is 0, ASRTU-EC16AP will control the right-side extension DO modules to output corresponding values according to the settings for the parameters below.

See details on this set of parameters in the following table.

Index	Subindex	Parameter name	Description
2100h	01	DOmodule1_output1	This parameter stands for the value of output points 0~15 of the 1 <sup>st</sup> DO extension module on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	02	DOmodule1_output2	This parameter stands for the value of output points 16~31 of the 1 <sup>st</sup> DO extension module on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	03	DOmodule1_output3	This parameter stands for the value of output points 32~47 of the 1 <sup>st</sup> DO extension module on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	04	DOmodule1_output4	This parameter stands for the value of output points 48~63 of the 1 <sup>st</sup> DO extension module on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
2101h	01	DOmodule2_output1	This parameter stands for the value of output points 0~15 of the 2 <sup>nd</sup> DO extension module on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	02	DOmodule2_output2	This parameter stands for the value of output points 16~31 of the 2 <sup>nd</sup> DO extension module on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.

Index	Subindex	Parameter name	Description
	03	DOmodule2_output3	This parameter stands for the value of output points 32~47 of the 2 <sup>nd</sup> DO extension module on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	04	DOmodule2_output4	This parameter stands for the value of output points 48~63 of the 2 <sup>nd</sup> DO extension module on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
2102h	01	DOmodule3_output1	This parameter stands for the value of output points 0~15 of the 3 <sup>rd</sup> DO extension module on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	02	DOmodule3_output2	This parameter stands for the value of output points 16~31 of the 3 <sup>rd</sup> DO extension module on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	03	DOmodule3_output3	This parameter stands for the value of output points 32~47 of the 3 <sup>rd</sup> DO extension module on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	04	DOmodule3_output4	This parameter stands for the value of output points 48~63 of the 3 <sup>rd</sup> DO extension module on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
...	...	...	...
2107h	01	DOmodule8_output1	This parameter stands for the value of output points 0~15 of the 8 <sup>th</sup> DO extension module on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	02	DOmodule8_output2	This parameter stands for the value of output points 16~31 of the 8 <sup>th</sup> DO extension module on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	03	DOmodule8_output3	This parameter stands for the value of output points 32~47 of the 8 <sup>th</sup> DO extension module on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	04	DOmodule8_output4	This parameter stands for the value of output points 48~63 of the 8 <sup>th</sup> DO extension module on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.

Before setting this set of parameters above, users need to know which one among all ASRTU-EC16AP's right-side DO extension modules is the DO module to be configured, instead of knowing which one among all extension modules on the right side of the ASRTU-EC16AP is the DO module to be configured.

For example, the extension modules AS16AP11T, AS16AM10N and AS16AN01T are arranged on the right side of ASRTU-EC16AP in order, among which AS16AP11T and AS16AN01T have output points. To make AS16AN01T output 16#5555 after ASRTU-EC16AP is disconnected from the master, set bit 1 of the control word parameter to 0 and the parameter "DOmodule2\_output1" to 16#5555 in advance.

### 6.4.7 COMlost\_AOmodule\_Outputs (2120h~2127h)

When ASRTU-EC16AP is disconnected from the master or exits from the OP state, and bit 1 of the control word parameter is 0, ASRTU-EC16AP will write data into TxPDO parameters of special modules according to the settings for this set of parameters below.

See details on this set of parameters in the following table.

Index	Subindex	Parameter name	Description
2120h	01	AOmodule1_output1	This parameter stands for the value in the 1 <sup>st</sup> Word of output data of the 1 <sup>st</sup> special module which has the RxPDO mapping, on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	02	AOmodule1_output2	This parameter stands for the value in the 2 <sup>nd</sup> Word of output data of the 1 <sup>st</sup> special module which has the RxPDO mapping, on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	03	AOmodule1_output3	This parameter stands for the value in the 3 <sup>rd</sup> Word of output data of the 1 <sup>st</sup> special module which has the RxPDO mapping, on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	04	AOmodule1_output4	This parameter stands for the value in the 4 <sup>th</sup> Word of output data of the 1 <sup>st</sup> special module which has the RxPDO mapping, on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	05	AOmodule1_output5	This parameter stands for the value in the 5 <sup>th</sup> Word of output data of the 1 <sup>st</sup> special module which has the RxPDO mapping, on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	06	AOmodule1_output6	This parameter stands for the value in the 6 <sup>th</sup> Word of output data of the 1 <sup>st</sup> special module which has the RxPDO mapping, on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	07	AOmodule1_output7	This parameter stands for the value in the 7 <sup>th</sup> Word of output data of the 1 <sup>st</sup> special module which has the RxPDO mapping, on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	08	AOmodule1_output8	This parameter stands for the value in the 8 <sup>th</sup> Word of output data of the 1 <sup>st</sup> special module which has the RxPDO mapping, on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
2121h	01	AOmodule2_output1	This parameter stands for the value in the 1 <sup>st</sup> Word of output data of the 2 <sup>nd</sup> special module which has the RxPDO mapping, on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.



Index	Subindex	Parameter name	Description
	02	AOmodule2_output2	This parameter stands for the value in the 2 <sup>nd</sup> Word of output data of the 2 <sup>nd</sup> special module which has the RxPDO mapping, on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	03	AOmodule2_output3	This parameter stands for the value in the 3 <sup>rd</sup> Word of output data of the 2 <sup>nd</sup> special module which has the RxPDO mapping, on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	04	AOmodule2_output4	This parameter stands for the value in the 4 <sup>th</sup> Word of output data of the 2 <sup>nd</sup> special module which has the RxPDO mapping, on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	05	AOmodule2_output5	This parameter stands for the value in the 5 <sup>th</sup> Word of output data of the 2 <sup>nd</sup> special module which has the RxPDO mapping, on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	06	AOmodule2_output6	This parameter stands for the value in the 6 <sup>th</sup> Word of output data of the 2 <sup>nd</sup> special module which has the RxPDO mapping, on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	07	AOmodule2_output7	This parameter stands for the value in the 7 <sup>th</sup> Word of output data of the 2 <sup>nd</sup> special module which has the RxPDO mapping, on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	08	AOmodule2_output8	This parameter stands for the value in the 8 <sup>th</sup> Word of output data of the 2 <sup>nd</sup> special module which has the RxPDO mapping, on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	...	...	...
2127h	01	AOmodule8_output1	This parameter stands for the value in the 1 <sup>st</sup> Word of output data of the 8 <sup>th</sup> special module which has the RxPDO mapping, on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	02	AOmodule8_output2	This parameter stands for the value in the 2 <sup>nd</sup> Word of output data of the 8 <sup>th</sup> special module which has the RxPDO mapping, on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	03	AOmodule8_output3	This parameter stands for the value in the 3 <sup>rd</sup> Word of output data of the 8 <sup>th</sup> special module which has the RxPDO mapping, on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.

Index	Subindex	Parameter name	Description
	04	AOmodule8_output4	This parameter stands for the value in the 4 <sup>th</sup> Word of output data of the 8 <sup>th</sup> special module which has the RxDPO mapping, on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	05	AOmodule8_output5	This parameter stands for the value in the 5 <sup>th</sup> Word of output data of the 8 <sup>th</sup> special module which has the RxDPO mapping, on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	06	AOmodule8_output6	This parameter stands for the value in the 6 <sup>th</sup> Word of output data of the 8 <sup>th</sup> special module which has the RxDPO mapping, on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	07	AOmodule8_output7	This parameter stands for the value in the 7 <sup>th</sup> Word of output data of the 8 <sup>th</sup> special module which has the RxDPO mapping, on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.
	08	AOmodule8_output8	This parameter stands for the value in the 8 <sup>th</sup> Word of output data of the 8 <sup>th</sup> special module which has the RxDPO mapping, on the right side of ASRTU-EC16AP when ASRTU-EC16AP is disconnected from the master or exits from the OP state.

Before setting this set of parameters above, users need to know which one among all ASRTU-EC16AP's right-side special modules which have RxDPO mappings is the special module to be configured, instead of knowing which one among all extension modules on the right side of the ASRTU-EC16AP is the special module to be configured.

For example, the extension modules AS06XA\_A, AS04AD\_A and AS04DA\_A are arranged on the right side of ASRTU-EC16AP in order. Among the modules, the output channel modes for AS06XA\_A and AS04DA\_A are set to 1 (for -10V~10V voltage output). If AS04DA\_A's channel 1 is to output 5V voltage, channel 2 is to output 10V voltage, channel 3 is to output -5V voltage, and channel 4 is to output -10V voltage after ASRTU-EC16AP is disconnected from the master, please set bit 1 of the control word parameter to 0 in advance, and then set the parameter AOmodule2\_output1 to 16000, AOmodule2\_output3 to 32000, AOmodule2\_output5 to -16000, and AOmodule2\_output7 to -32000.

### 6.4.8 Touch Probe Parameters

ASRTU-EC16AP's local input points X0.1, X0.2, X0.3, X0.6 and X0.7 support the high-speed touch probe function (which is supported by firmware version 1.1.0 or later version). The touch probe function of input point X0.1 and the counting function of high-speed counter channel 1 can't be used simultaneously, and the touch probe function of X0.2 and X0.3 and the counting function of the high-speed counter channel 2 can't either.

Related parameters for the touch probe function are as follows:

Index	Subindex	Parameter name	Description
3010h	01	Channel X1 TouchCommand	Touch probe command for high-speed touch probe point X0.1
	02	Channel X2 TouchCommand	Touch probe command for high-speed touch probe point X0.2
	03	Channel X3 TouchCommand	Touch probe command for high-speed touch probe point X0.3
	04	Channel X6 TouchCommand	Touch probe command for high-speed touch probe point X0.6
	05	Channel X7 TouchCommand	Touch probe command for high-speed touch probe point X0.7
3011h	01	Channel X1 TouchMode	Specify the touch probe mode for high-speed touch probe point X0.1
	02	Channel X2 TouchMode	Specify the touch probe mode for high-speed touch probe point X0.2
	03	Channel X3 TouchMode	Specify the touch probe mode for high-speed touch probe point X0.3
	04	Channel X6 TouchMode	Specify the touch probe mode for high-speed touch probe point X0.6
	05	Channel X7 TouchMode	Specify the touch probe mode for high-speed touch probe point X0.7
3012h	01	Channel X1 TouchStatus	Touch probe status of high-speed touch probe point X0.1
	02	Channel X2 TouchStatus	Touch probe status of high-speed touch probe point X0.2
	03	Channel X3 TouchStatus	Touch probe status of high-speed touch probe point X0.3
	04	Channel X6 TouchStatus	Touch probe status of high-speed touch probe point X0.6
	05	Channel X7 TouchStatus	Touch probe status of high-speed touch probe point X0.7
3013h	01	Channel X1 TouchErrorID	Error code of high-speed touch probe point X0.1
	02	Channel X2 TouchErrorID	Error code of high-speed touch probe point X0.2
	03	Channel X3 TouchErrorID	Error code of high-speed touch probe point X0.3
	04	Channel X6 TouchErrorID	Error code of high-speed touch probe point X0.6
	05	Channel X7 TouchErrorID	Error code of high-speed touch probe point X0.7

Index	Subindex	Parameter name	Description
3014h	01	Channel X1 TouchCounter1posval	Reserved
	02	Channel X2 TouchCounter1posval	Count value of high-speed counter channel 1 when high-speed touch probe point X0.2 is rising-edge triggered.
	03	Channel X3 TouchCounter1posval	Count value of high-speed counter channel 1 when high-speed touch probe point X0.3 is rising-edge triggered.
	04	Channel X6 TouchCounter1posval	Count value of high-speed counter channel 1 when high-speed touch probe point X0.6 is rising-edge triggered.
	05	Channel X7 TouchCounter1posval	Count value of high-speed counter channel 1 when high-speed touch probe point X0.7 is rising-edge triggered.
3015h	01	Channel X1 TouchCounter2posval	Count value of high-speed counter channel 2 when high-speed touch probe point X0.1 is rising-edge triggered.
	02	Channel X2 TouchCounter2posval	Reserved
	03	Channel X3 TouchCounter2posval	Reserved
	04	Channel X6 TouchCounter2posval	Count value of high-speed counter channel 2 when high-speed touch probe point X0.6 is rising-edge triggered.
	05	Channel X7 TouchCounter2posval	Count value of high-speed counter channel 2 when high-speed touch probe point X0.7 is rising-edge triggered.
3016h	01	Channel X1 TouchCounter1negval	Reserved
	02	Channel X2 TouchCounter1negval	Count value of high-speed counter channel 1 when high-speed touch probe point X0.2 is falling-edge triggered.
	03	Channel X3 TouchCounter1negval	Count value of high-speed counter channel 1 when high-speed touch probe point X0.3 is falling-edge triggered.
	04	Channel X6 TouchCounter1negval	Count value of high-speed counter channel 1 when high-speed touch probe point X0.6 is falling-edge triggered.
	05	Channel X7 TouchCounter1negval	Count value of high-speed counter channel 1 when high-speed touch probe point X0.7 is falling-edge triggered.
3017h	01	Channel X1 TouchCounter2negval	Count value of high-speed counter channel 2 when high-speed touch probe point X0.1 is falling-edge triggered.
	02	Channel X2 TouchCounter2negval	Reserved
	03	Channel X3 TouchCounter2negval	Reserved
	04	Channel X6 TouchCounter2negval	Count value of high-speed counter channel 2 when high-speed touch probe point X0.6 is falling-edge triggered.
	05	Channel X7 TouchCounter2negval	Count value of high-speed counter channel 2 when high-speed touch probe point X0.7 is falling-edge triggered.

### 6.4.8.1 Touch Probe Command (3010h)

This parameter set contains command words for ASRTU-EC16AP's touch probe points. Users can enable or disable the touch probe function of these points.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3010h	1	Channel X1 TouchCommand	UINT	RW	YES	0
	2	Channel X2 TouchCommand	UINT	RW	YES	0
	3	Channel X3 TouchCommand	UINT	RW	YES	0
	4	Channel X6 TouchCommand	UINT	RW	YES	0
	5	Channel X7 TouchCommand	UINT	RW	YES	0

Description of parameter setting values:

Value	Description
0	Disable the touch probe function of ASRTU-EC16AP's corresponding input point and then the point stops the function immediately.
1	Enable the touch probe function of ASRTU-EC16AP's corresponding input point and then the point starts the function.

While ASRTU-EC16AP's high-speed counter channel 1 is counting, the touch probe function of input point X0.1 is disabled, but the touch probe function of input points X0.2, X0.3, X0.6 and X0.7 can be used as normal. If users enable the touch probe function of input point X0.1 at this moment, the enabling of the touch probe function of input point X0.1 will fail and the value of "Channel X1 TouchErrorID" parameter will change to 16#3000.

While ASRTU-EC16AP's high-speed counter channel 2 is counting, the touch probe function of input points X0.2 and X0.3 is disabled, but the touch probe function of input points X0.1, X0.6 and X0.7 can be used as normal. If users enable the touch probe function of input points X0.2 and X0.3 at this moment, then the enabling of the touch probe function of input points X0.2 and X0.3 will fail and the values of both "Channel X2 TouchErrorID" and "Channel X3 TouchErrorID" will change to 16#3000.

When the touch probe function of ASRTU-EC16AP's input point X0.1 is enabled and the value of the parameter "Channel X1 TouchCommand" is 1, the counting function of high-speed counter channel 1 is disabled. If "Counter channel 1 Command" parameter is set to 1 at this moment, high-speed counter channel 1 will not count and the value of "Counter channel 1 ErrorCode" parameter will become 16 # 3000.

When the touch probe function of ASRTU-EC16AP's input point X0.2 or X0.3 is enabled and the value of the parameter "Channel X2 TouchCommand" or "Channel X3 TouchCommand" is 1, the counting function of high-speed counter channel 2 is disabled. If the parameter "Counter channel 2 Command" is set to 1 at that moment, the high-speed counter channel 2 will not count and the value of "Counter channel 2 ErrorCode" parameter will become 16 # 3000.

### 6.4.8.2 Touch Probe Mode (3011h)

The Touch Probe Mode parameter set is for configuring the touch probe mode of each touch probe point.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3011h	1	Channel X1 TouchMode	UINT	RW	YES	0
	2	Channel X2 TouchMode	UINT	RW	YES	0
	3	Channel X3 TouchMode	UINT	RW	YES	0
	4	Channel X6 TouchMode	UINT	RW	YES	0
	5	Channel X7 TouchMode	UINT	RW	YES	0

Description of parameter setting values:

Value	Description
0	Rising-edge single-cycle touch probe In this mode, after the command word for a touch probe point is set to 1, the relevant parameter will record the high-speed counter channel's current count value when the status of the corresponding input point changes from OFF to ON for the first time. After this touch probe is completed, no touch probe will be triggered again when the status of the input point changes from OFF to ON again.
1	Falling-edge single-cycle touch probe. In this mode, after the command word for a touch probe point is set to 1, the relevant parameter will record the high-speed counter channel's current count value when the status of the corresponding input point changes from ON to OFF for the first time,. After this touch probe is completed, no touch probe will be triggered again when the input point status changes from ON to OFF again.
2	Rising-edge and falling-edge single-cycle touch probe. In this mode, after the command word for a touch probe point is set to 1, the relevant parameter will record the high-speed counter channel's current count values when the status of the corresponding input point changes from ON to OFF for the first time and from OFF to ON for the first time. After both touch probes triggered by the rising edge and falling edge are completed, no touch probe will be triggered again when the input point status changes from ON to OFF again and from OFF to ON again.
3	Rising-edge cyclic touch probe. In this mode, after the command word for a touch probe point is set to 1, the relevant parameter will record the high-speed counter channel's current count values each time the status of the corresponding input point changes from OFF to ON. When the command word for the touch probe point changes from 1 to 0, the corresponding input point stops the touch probe.
4	Falling-edge cyclic touch probe. In this mode, after the command word for a touch probe point is set to 1, the relevant parameter will record the high-speed counter channel's current count values each time the corresponding input point status changes from ON to OFF. When the command word for the touch probe point changes from 1 to 0, the corresponding input point stops the touch probe.
5	Rising-edge and falling-edge cyclic touch probe. In this mode, after the command word for a touch probe point is set to 1, the relevant parameter will record the high-speed counter channel's current count values each time the corresponding input point status changes from OFF to ON and from ON to OFF. When the command word for the touch probe point changes from 1 to 0, the corresponding input point stops the touch probe.

### 6.4.8.3 Touch Probe Status (3012h)

The Touch Probe Status parameter set shows the touch probe status of each touch probe point.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3012h	1	Channel X1 Touchstatus	UINT	RO	YES	0
	2	Channel X2 Touchstatus	UINT	RO	YES	0
	3	Channel X3 Touchstatus	UINT	RO	YES	0
	4	Channel X6 Touchstatus	UINT	RO	YES	0
	5	Channel X7 Touchstatus	UINT	RO	YES	0

Description of values of bits:

Bit No.	Value	Description
Bit0	0	Touch probe function disabled.
	1	Touch probe function enabled.
Bit1	0	The rising edge-triggered touch probe of a touch probe point uncompleted.
	1	The rising edge-triggered touch probe of a touch probe point completed.
Bit2	0	The falling edge-triggered touch probe of a touch probe point uncompleted.
	1	The falling edge-triggered touch probe of a touch probe point completed.
Bit3~Bit15	0/1	Reserved

When the touch probe triggered by the rising edge or falling edge is completed, the value of Bit 1 or Bit 2 of the Touch Probe Status parameter will become 1, and Bit 1 or Bit 2 of the parameter will be showing 1 until the command word for the touch probe point changes from 0 to 1. After the command word for the touch probe point changes from 0 to 1, bit 1 or bit 2 of the touch probe status parameter will be 0 before the first touch probe of the touch probe point is completed.

#### 6.4.8.4 Touch Probe Error (3013h)

The Touch Probe Error parameter set shows error information of each touch probe point.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3013h	1	Channel X1 TouchErrorID	UINT	RO	YES	0
	2	Channel X2 TouchErrorID	UINT	RO	YES	0
	3	Channel X3 TouchErrorID	UINT	RO	YES	0
	4	Channel X6 TouchErrorID	UINT	RO	YES	0
	5	Channel X7 TouchErrorID	UINT	RO	YES	0

After the counting function of ASRTU-EC16AP's high-speed counter channel 1 is enabled, the touch probe function of the ASRTU-EC16AP's local input point X0.1 is disabled. If the touch probe function of input point X0.1 is enabled at that time, the value of "Channel X1 TouchErrorID" parameter will change to 16#3000.

After the counting function of ASRTU-EC16AP's high-speed counter channel 2 is enabled, the touch probe function of ASRTU-EC16AP's local input points X0.2 and X0.3 is disabled. If the touch probe function of input points X0.2 and X0.3 is enabled at that time, the value of the parameter "Channel X2 TouchErrorID" and "Channel X3 TouchErrorID" will become 16#3000.

When the command word for a touch probe point changes from 0 to 1 and the touch probe function of the input point is not disabled, the error code of the touch probe point will be cleared to 0.

#### 6.4.8.5 Touch Probe Counter1posval (3014h)

The Touch Probe Counter1posval parameter set is the current value of high-speed counter channel 1, which is captured by the rising edge at each touch probe point.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3014h	1	Channel X1 TouchCounter1posval	DINT	RO	YES	0
	2	Channel X2 TouchCounter1posval	DINT	RO	YES	0
	3	Channel X3 TouchCounter1posval	DINT	RO	YES	0
	4	Channel X6 TouchCounter1posval	DINT	RO	YES	0
	5	Channel X7 TouchCounter1posval	DINT	RO	YES	0

The parameter "Channel X1 TouchCounter1posval" is reserved since the touch probe function of ASRTU-EC16AP's input point X0.1 and the counting function of high-speed counter channel 1 cannot be used simultaneously.

#### 6.4.8.6 Touch probe Counter2posval (3015h)

The Touch Probe Counter2posval parameter set is the current value of high-speed counter channel 2, which is captured by the rising edge at each touch probe point.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3015h	1	Channel X1 TouchCounter2posval	DINT	RO	YES	0
	2	Channel X2 TouchCounter2posval	DINT	RO	YES	0
	3	Channel X3 TouchCounter2posval	DINT	RO	YES	0
	4	Channel X6 TouchCounter2posval	DINT	RO	YES	0
	5	Channel X7 TouchCounter2posval	DINT	RO	YES	0

The parameters "Channel X2 TouchCounter2posval" and "Channel X3 TouchCounter2posval" are reserved since the touch probe function of ASRTU-EC16AP's input points X0.2 and X0.3 and the counting function of high-speed counter channel 2 cannot be used simultaneously.

#### 6.4.8.7 Touch Probe Counter1negval (3016h)

The Touch Probe Counter1negval parameter set is the current value of high-speed counter channel 1, which is captured by falling edge at each touch probe point.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3016h	1	Channel X1 TouchCounter1negval	DINT	RO	YES	0
	2	Channel X2 TouchCounter1negval	DINT	RO	YES	0
	3	Channel X3 TouchCounter1negval	DINT	RO	YES	0
	4	Channel X6 TouchCounter1negval	DINT	RO	YES	0
	5	Channel X7 TouchCounter1negval	DINT	RO	YES	0

The parameter "Channel X1 TouchCounter1negval" is reserved since the touch probe function of ASRTU-EC16AP's input point X0.1 and the counting function of high-speed counter channel 1 cannot be used simultaneously.

#### 6.4.8.8 Touch Probe Counter2negval (3017h)

The Touch Probe Counter2negval parameter set is the current value of high-speed counter channel 2, which is captured by falling edge at each touch probe point.

Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
3017h	1	Channel X1 TouchCounter2negval	DINT	RO	YES	0
	2	Channel X2 TouchCounter2negval	DINT	RO	YES	0
	3	Channel X3 TouchCounter2negval	DINT	RO	YES	0



Index	Subindex	Name	Data type	Attribute	Supports PDO mapping or not?	Default
	4	Channel X6 TouchCounter2negval	DINT	RO	YES	0
	5	Channel X7 TouchCounter2negval	DINT	RO	YES	0

The parameters "Channel X2 TouchCounter2negval" and "Channel X3 TouchCounter2negval" are reserved since the touch probe function of ASRTU-EC16AP's input points X0.2 and X0.3 and the counting function of high-speed counter channel 2 cannot be used simultaneously.

## 6.5 Module Config Objects

### 6.5.1 Configured Module ID List (F030h)

The parameter set contains 32 parameters which are used to display the information on the user-configured extension modules.

See the detailed description in the following table.

Index	Subindex	Description
F030h	01h	The model code of the 1 <sup>st</sup> user-configured extension module on the right of ASRTU-EC16AP
	02h	The model code of the 2 <sup>nd</sup> user-configured extension module on the right of ASRTU-EC16AP
	03h	The model code of the 3 <sup>rd</sup> user-configured extension module on the right of ASRTU-EC16AP
	...	...
	1Eh	The model code of the 30 <sup>th</sup> user-configured extension module on the right of ASRTU-EC16AP
	1Fh	The model code of the 31 <sup>st</sup> user-configured extension module on the right of ASRTU-EC16AP
	20h	The model code of the 32 <sup>nd</sup> user-configured extension module on the right of ASRTU-EC16AP

### 6.5.2 Detected Module ID List (F050h)

The parameter set consists of 32 parameters which are used to display the model code of the extension modules which are actually connected to the right side of ASRTU-EC16AP.

See the details as follows.

Index	Subindex	Description
F050h	01h	The model code of the 1 <sup>st</sup> extension module actually connected to the right of ASRTU-EC16AP
	02h	The model code of the 2 <sup>nd</sup> extension module actually connected to the right of ASRTU-EC16AP
	03h	The model code of the 3 <sup>rd</sup> extension module actually connected to the right of ASRTU-EC16AP
	...	...
	1Eh	The model code of the 30 <sup>th</sup> extension module actually connected to the right of ASRTU-EC16AP
	1Fh	The model code of the 31 <sup>st</sup> extension module actually connected to the right of ASRTU-EC16AP
	20h	The model code of the 32 <sup>nd</sup> extension module actually connected to the right of ASRTU-EC16AP

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## **Chapter 7 Application Examples**

### **Table of Contents**

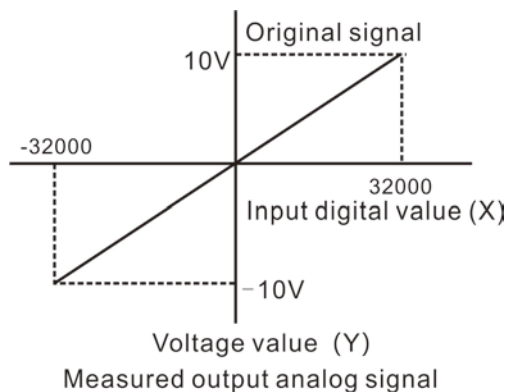
7.1 Using DELTA AX3 Series CPU with ASRTU-EC16AP1TA .....	7-4
7.2 Using ASRTU-EC16AP1TA's High-Speed Counting and Pulse Output .....	7-10

This chapter describes how to configure the parameters for the ASRTU-EC16AP1TA module by means of examples. In Sections 7.1 and 7.2 is the introduction of the configuration methods for ASRTU-EC16AP1TA used together with different EtherCAT masters.

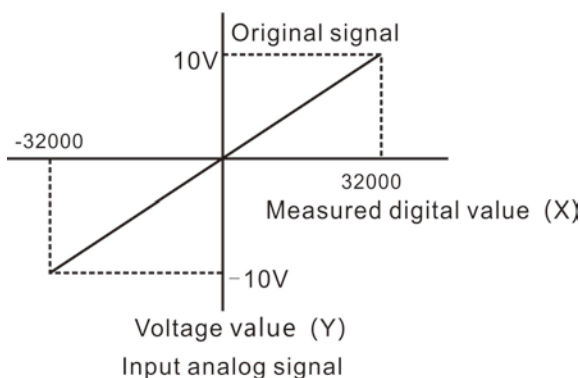
● **Control requirements**

1. Control local output points Y0.0~Y0.7 of the ASRTU-EC16AP1TA module to turn ON, and monitor the status of local input points X0.0~X0.7 of the ASRTU-EC16AP1TA module.
2. Control output points 0~7 of AS16AP11T to turn ON through ASRTU-EC16AP1TA, and monitor the input status of input points 0~7 of AS16AP11T.
3. Control channels 1~ 4 of AS04DA\_A to output 5 V voltage through ASRTU-EC16AP1TA.
4. Read the analog-to-digital conversion value from channels 1~4 of AS04AD\_A through ASRTU-EC16AP1TA.

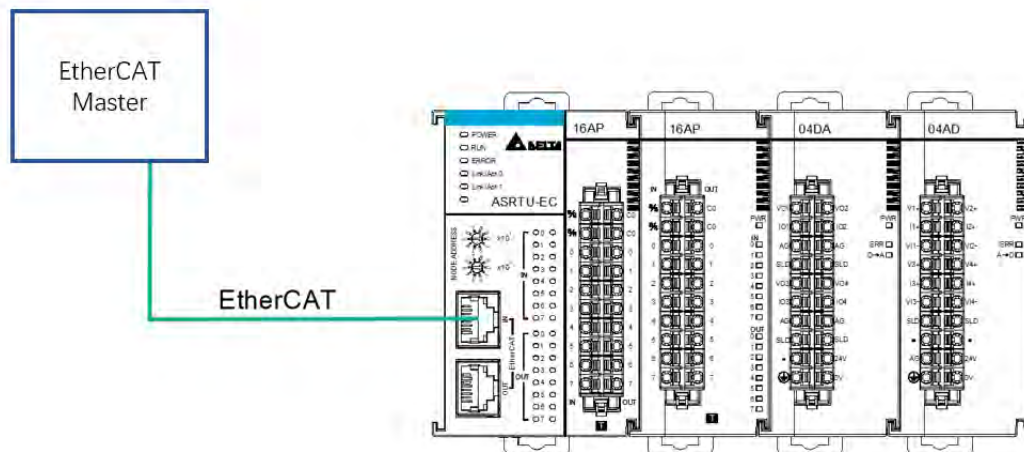
● **Corresponding relationship between digital values and analog values for AS04DA\_A**



● **Corresponding relationship between digital values and analog values for AS04AD\_A**



- Using ASRTU-EC16AP1TA to build an EtherCAT network



- List of devices used in the following examples

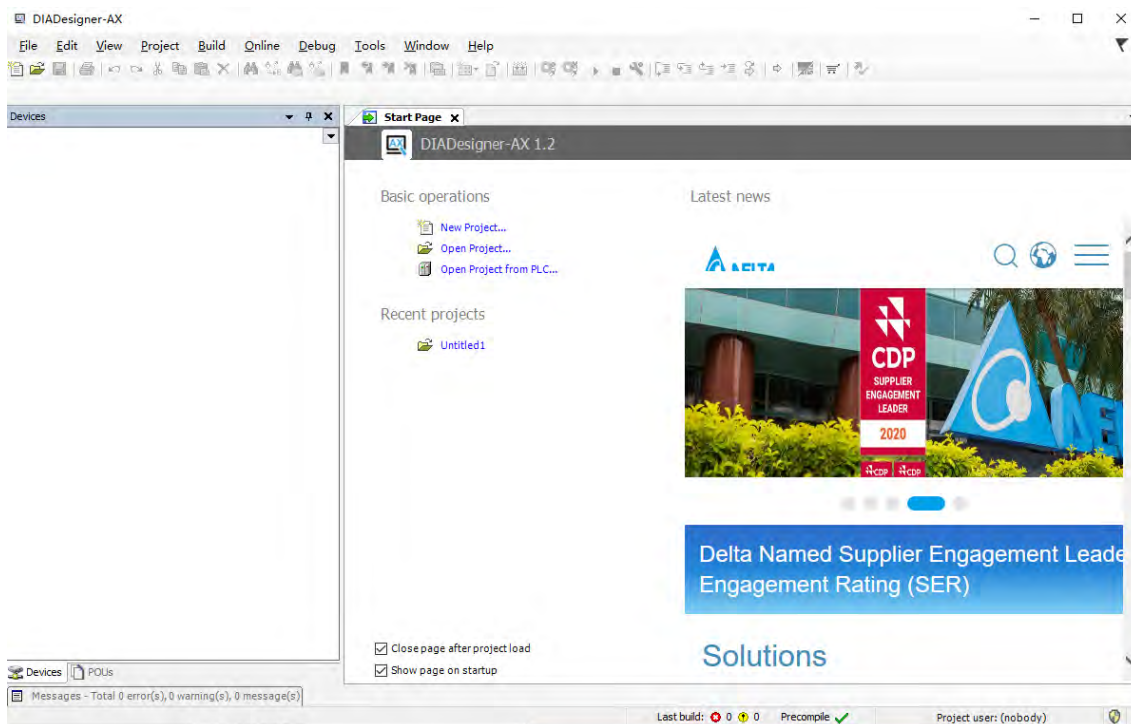
Device Name	Description
AX-308E CPU	Delta AX-3 series CPU type motion controller
DIADesigner-AX software	Delta EtherCAT configuration software
ASRTU-EC16AP1TA	Delta EtherCAT remote IO module
AS04DA_A	Delta analog-output module
AS04AD_A	Delta analog-input module
AS16AP11T	Delta digital input/output module with 8 points for output and 8 points for input

**Note:**

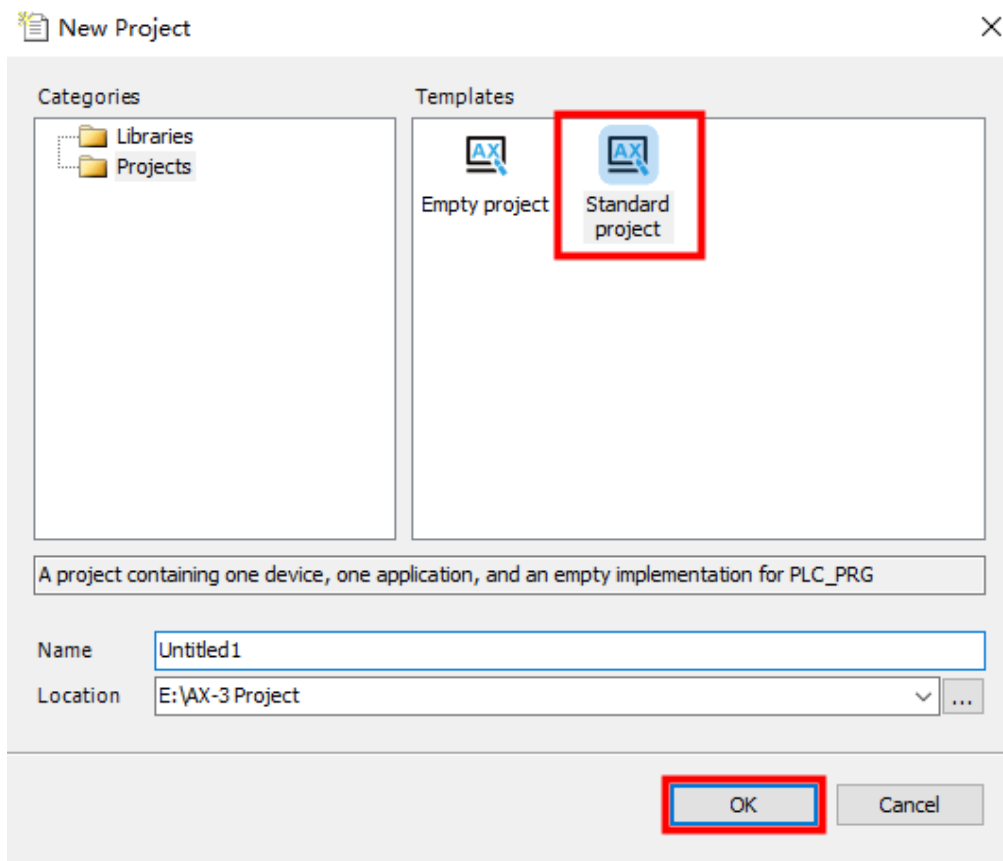
- Please check that the modules AS16AP11T, AS04DA\_A, AS04AD\_A and ASRTU-EC16AP1TA are working normally and the entire network wiring is proper.
- For more information on AS04DA\_A and AS04AD\_A, please refer to relevant descriptions in "AS Series Module Manual".

## 7.1 Using DELTA AX3 Series CPU with ASRTU-EC16AP1TA

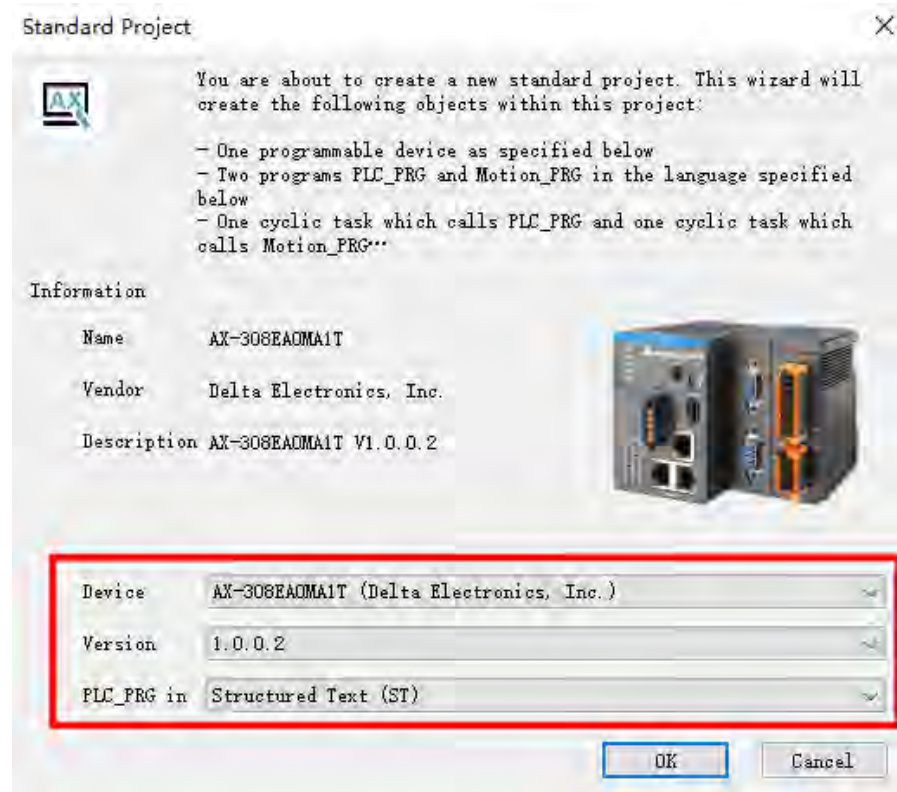
1. Download DIADesigner-AX software from Delta official website, install it and then start the software.



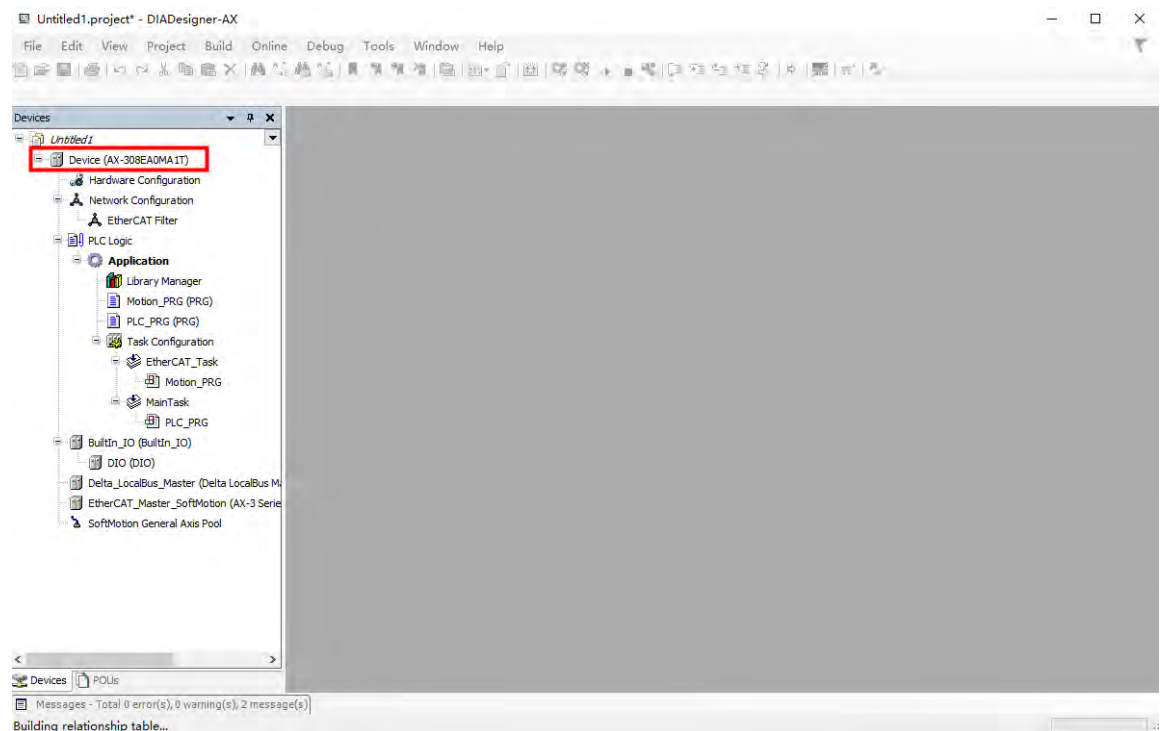
2. A new project is created by selecting the “Standard project” icon in the red box and then typing a project name and a storage location as below.



Click “OK” button to complete the setting. Afterward, select “AX-308EA0MA1T (Delta Electronics, Inc.)” in the “Device” field and one right version, and then click “OK” in the following window.



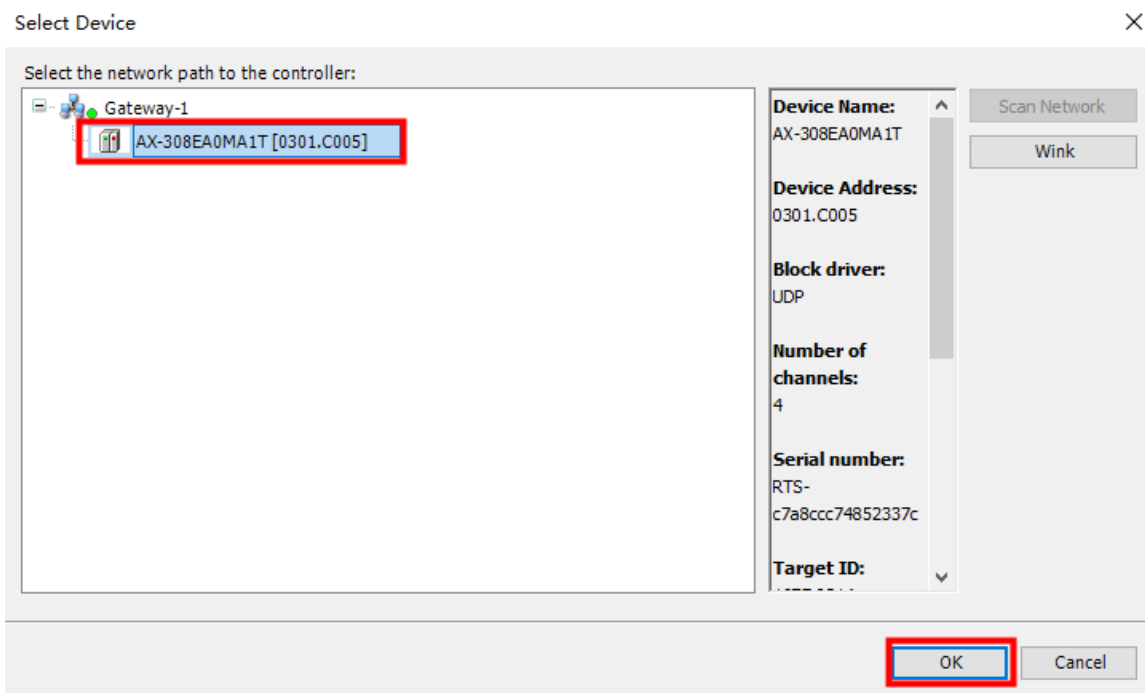
3. The created new project is shown as below.



Double-click on “Device” in the red box above and then click on “Scan Network...” in the red box in the following window.

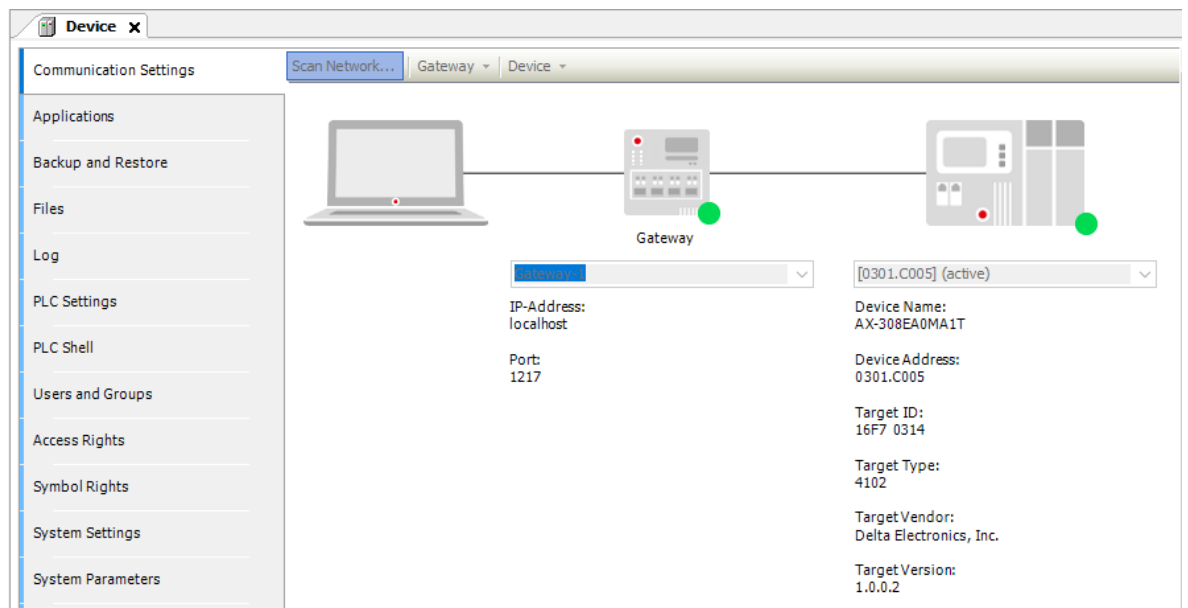


Then the following window appears, where AX-3 series controller will be searched for automatically. After the AX-3 controller shows up, select the controller and click “OK” button.

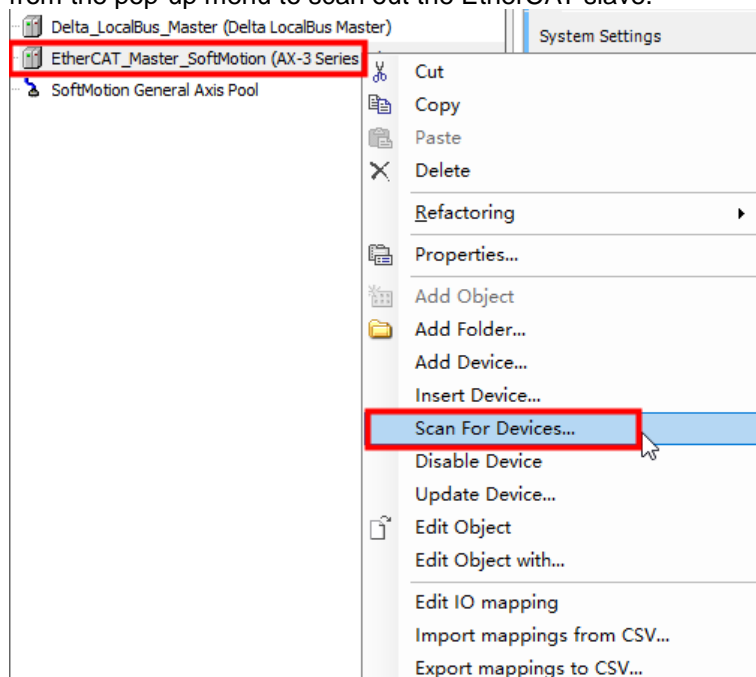


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After that, the connected CPU will automatically show up in the “Device” interface as below.

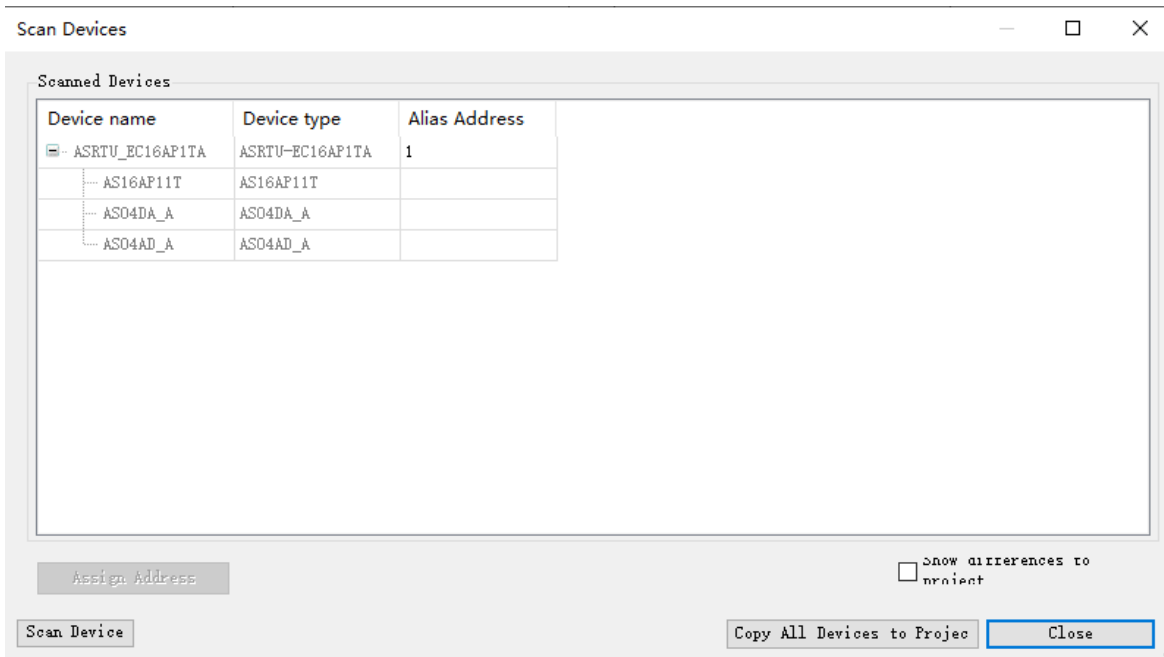


- Right-click on “EtherCAT\_Master\_Softmotion” in the red box below and select “Scan For Device” from the pop-up menu to scan out the EtherCAT slave.

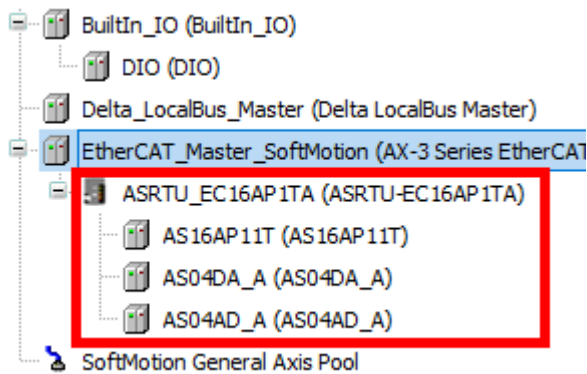


After the scan function is enabled, the software can scan out the ASRTU-EC16AP1TA module and its right-side extension modules.



































After the scan is complete, click “Copy All Devices to Project” to add all scanned devices to the software.



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5. After adding devices is complete, right-click on ASRTU-EC16AP1TA and select “Edit IO mapping” from the context menu to view the IO mapping for ASRTU-EC16AP1TA.

Edit IO mapping x				
Find		Filter	Show all	
Variable	Channel	Address	Type	Description
ASRTU_EC16AP1TA				
 + 	Digital output	%QB1	USINT	Digital output
 + 	Error register	%IB3	USINT	Error register
 + 	Digital input	%IB4	USINT	Digital input
AS16AP11T				
 + 	Digital output 1	%QB2	USINT	Digital output 1
 + 	Digital input 1	%IB5	USINT	Digital input 1
AS04DA_A				
 + 	CH1 Output	%QD1	DINT	CH1 Output
 + 	CH2 Output	%QD2	DINT	CH2 Output
 + 	CH3 Output	%QD3	DINT	CH3 Output
 + 	CH4 Output	%QD4	DINT	CH4 Output
 + 	Error Code	%ID2	UDINT	Error Code
AS04AD_A				
 + 	Error Code	%ID3	UDINT	Error Code
 + 	CH1 Input	%ID4	DINT	CH1 Input
 + 	CH2 Input	%ID5	DINT	CH2 Input
 + 	CH3 Input	%ID6	DINT	CH3 Input
 + 	CH4 Input	%ID7	DINT	CH4 Input

**Note:**

You can assign existing program variables or create IO variables for module channels in the “Variable” column as shown in the red box above.

When the module channels are not assigned any program variable, the I and Q devices in the “Address” column are valid, and you can directly operate the I and Q devices in the program to do the read or write operation to module channels.

After the module channels have been assigned program variables, the I and Q devices in the “Address” column are invalid, but you can do the read and write operation to each channel through the variables in the program.

For example, when no module channels are assigned any variables, write 255 into the %QB1 device to change all the local output points of ASRTU-EC16AP1TA to ON and then monitor the status of the local input points of ASRTU-EC16AP1TA through the %IB4 device.

To change output points 0~7 of AS16AP11T to ON, write 255 into the %QB2 device in the program. To make each of channel1 ~ channel4 of AS04DA-A output the 5V voltage, write a 16000 in each of %QD1~%QD4 devices in the program, and then read the channel1~channel4 analog conversion values of AS04AD-A through the %ID4~%ID7 devices.

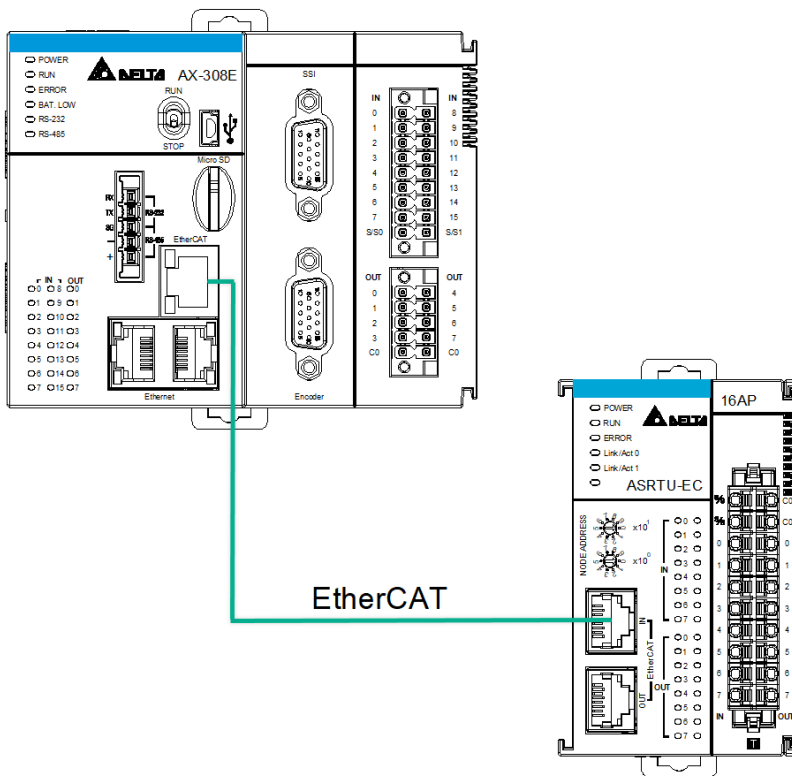
- If you need to modify the modes for AS04DA\_A's channel1 ~ channel4, please add corresponding CRs for the modes of channel1 to channel4 into the Startup Parameters of ASRTU-EC16AP1TA. For more information about startup parameters, please refer to Section 5.5.

## 7.2 Using ASRTU-EC16AP1TA's High-Speed Counting and Pulse Output

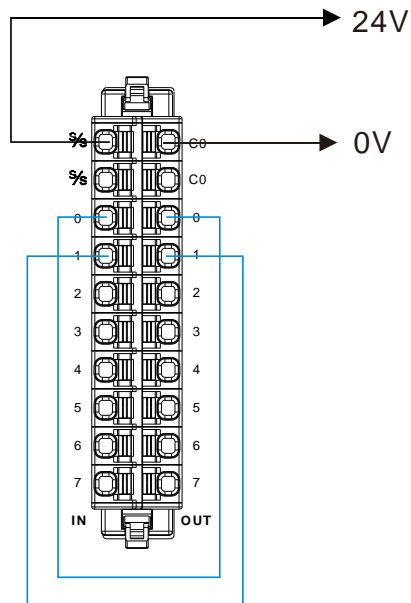
- **Control requirements**

1. Select the “pulse + direction” mode as the pulse output mode for pulse output channel 1 of ASRTU-EC16AP1TA, and set the target number of output pulses to 1,000,000, the target frequency to 100 kHz, and both acceleration time and deceleration time to 1000 milliseconds.
2. Select the “pulse + direction” mode as the pulse input mode for high-speed counter channel 1 of ASRTU-EC16AP1TA.
3. After the counting function of high-speed counter channel 1 of ASRTU-EC16AP1TA is enabled, pulse output channel 1 starts to output pulses. When the pulse output is complete, check whether the number of pulses counted by high-speed counter channel 1 is 1,000,000.

- **Configuring the EtherCAT network**

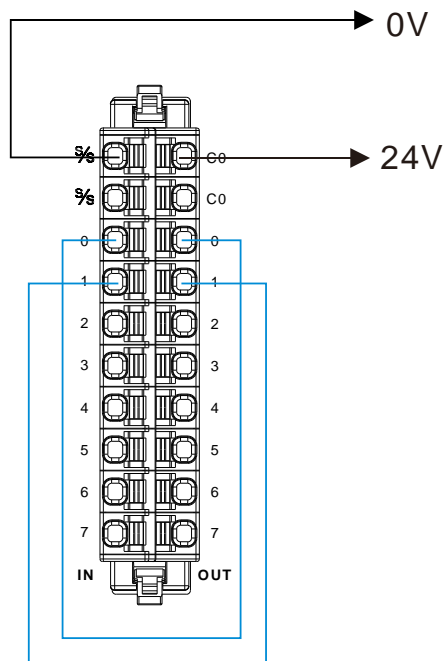


- **Wiring the inputs and outputs of ASRTU-EC16AP1TA (NPN Type)**



As the wiring in the above figure shows, please connect the common terminal S/S to 24V, C0 to 0V, input point X0.0 to output point Y0.0, and input point X0.1 to output point Y0.1.

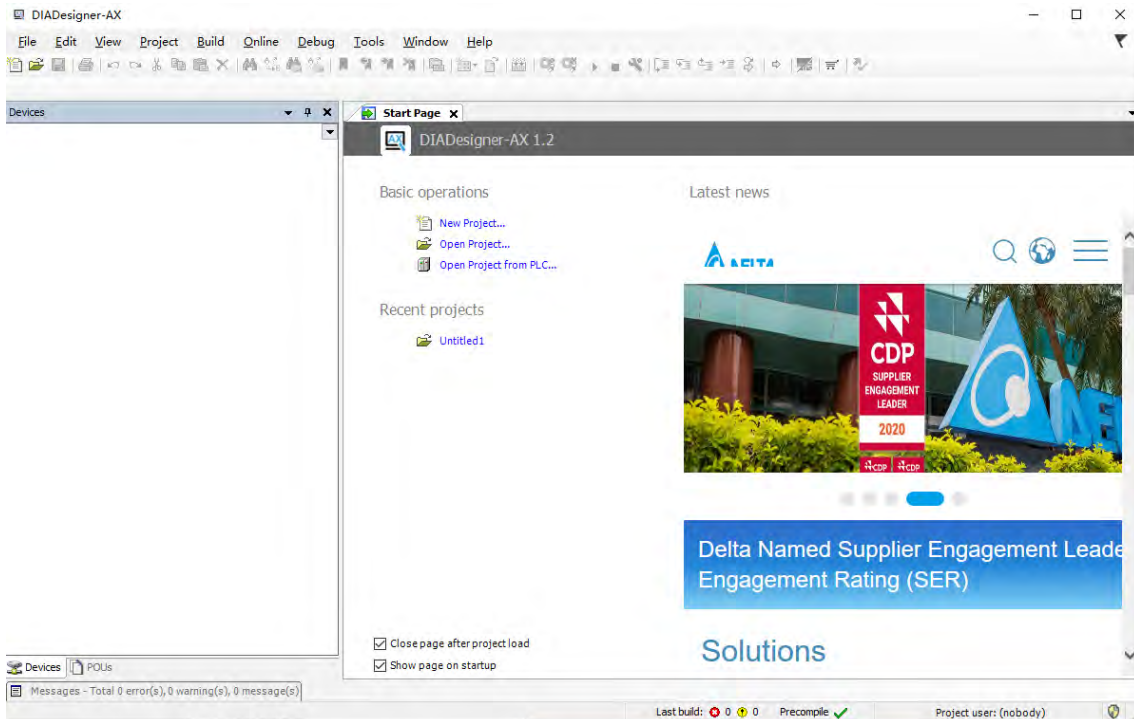
- **Wiring the inputs and outputs of ASRTU-EC16AP1PA (PNP Type)**



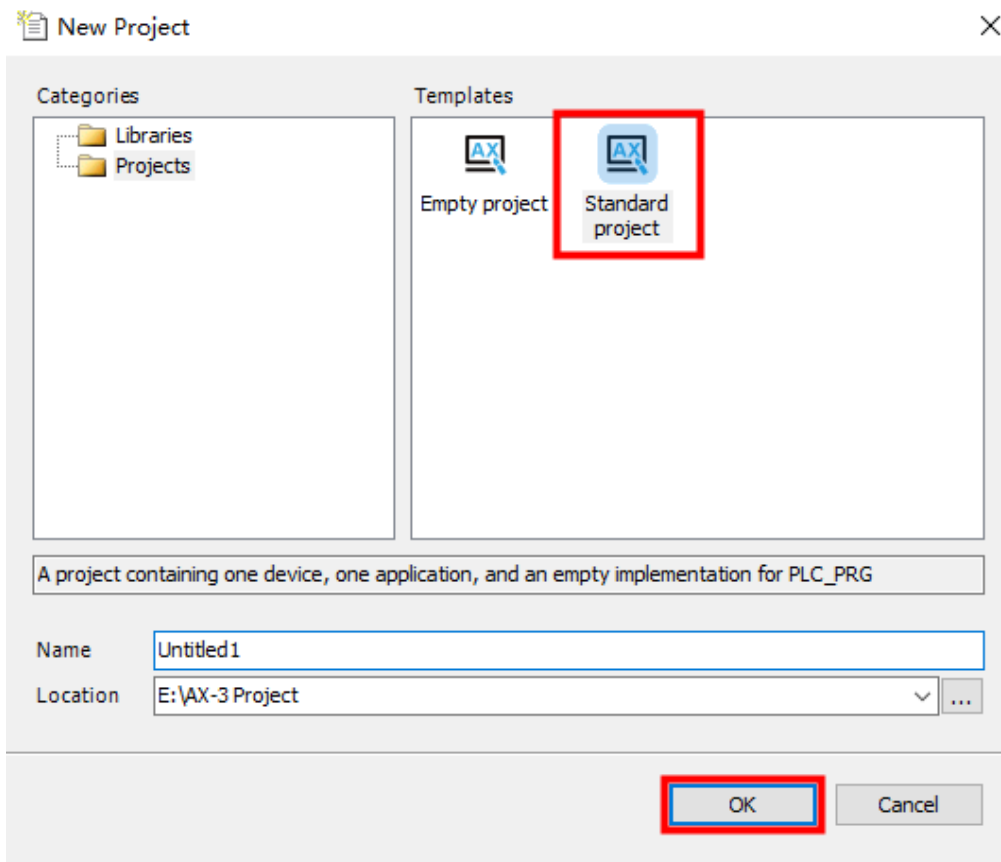
As the wiring in the above figure shows, please connect the common terminal S/S to 0V, C0 to 24V, input point X0.0 to output point Y0.0, and input point X0.1 to output point Y0.1.

- **Setting the network configuration**

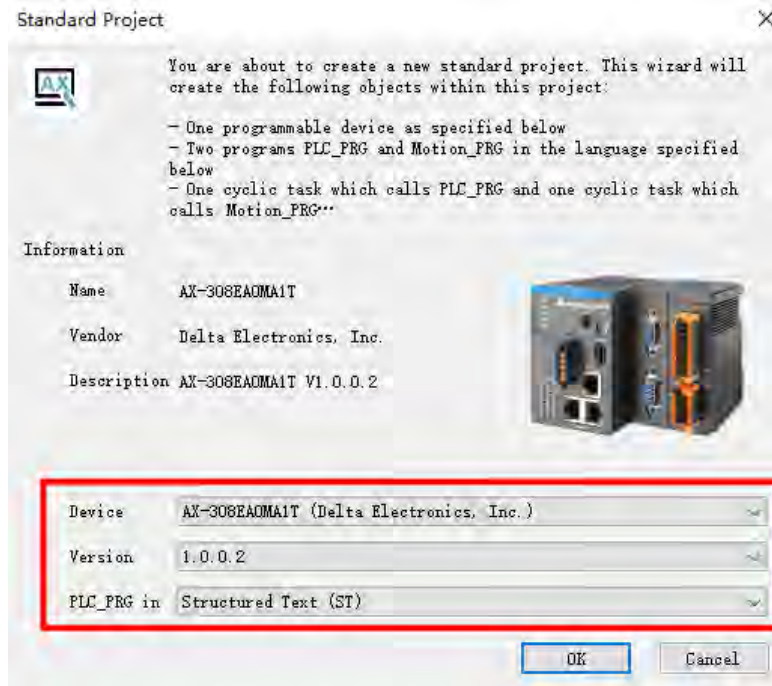
1. Download and DIADesigner-AX software from Delta official website, install it and then start the software.



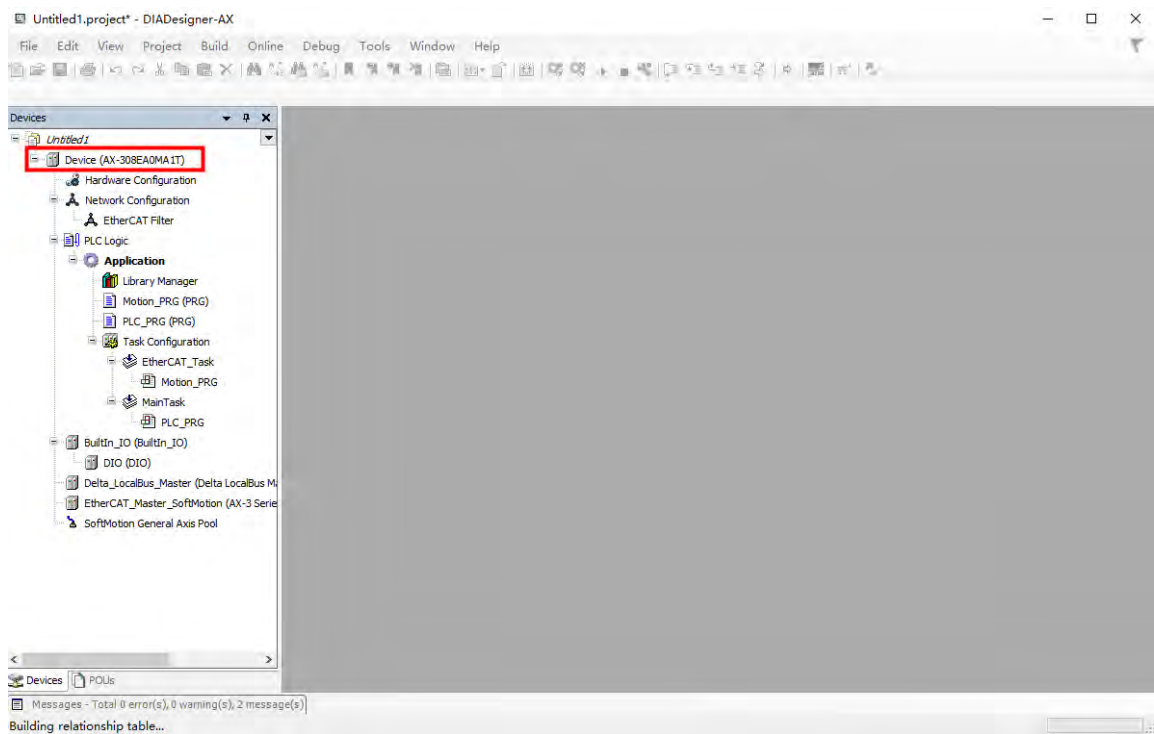
- After clicking “New Project...” in the open software interface, select the “Standard project” template and then type a project name and storage location in the “New Project” window as below.



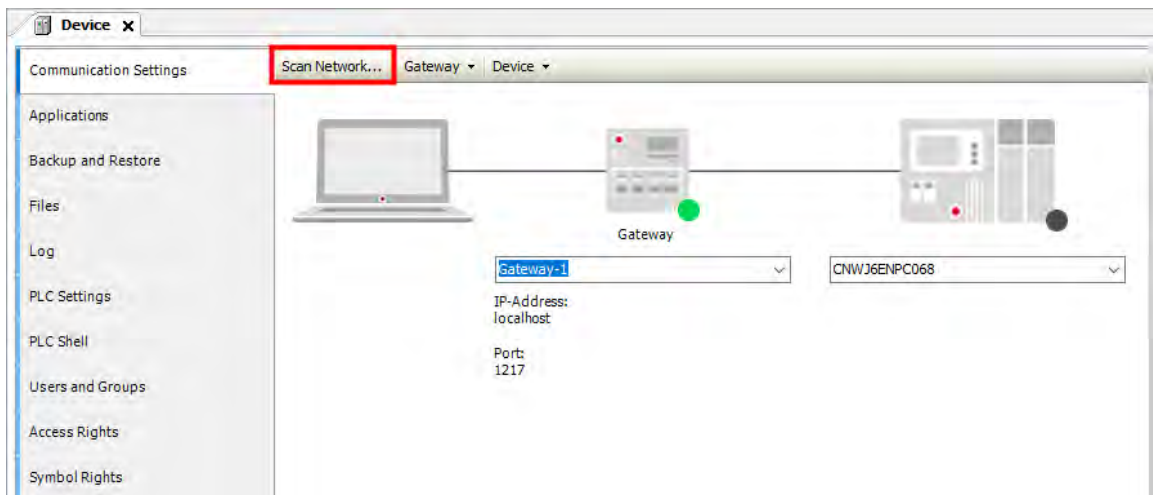
After the above setting is complete, click the "OK" button, then select "AX-308EA0MA1T" in the “Device” field and an appropriate version in the pop-up window, and click "OK" to finish the setting here.



3. The newly created project is viewed as below.

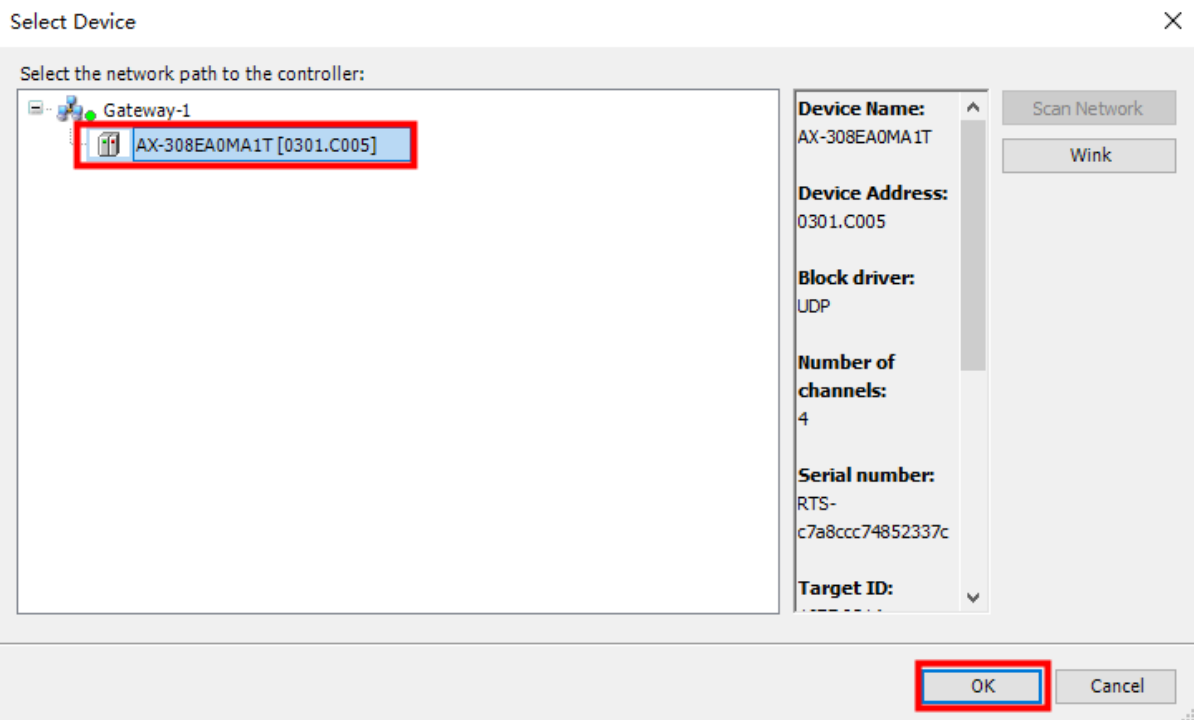


Double-click "Device" in the red box in the figure above, and then click the "Scan Network..." in the red box of the following figure.

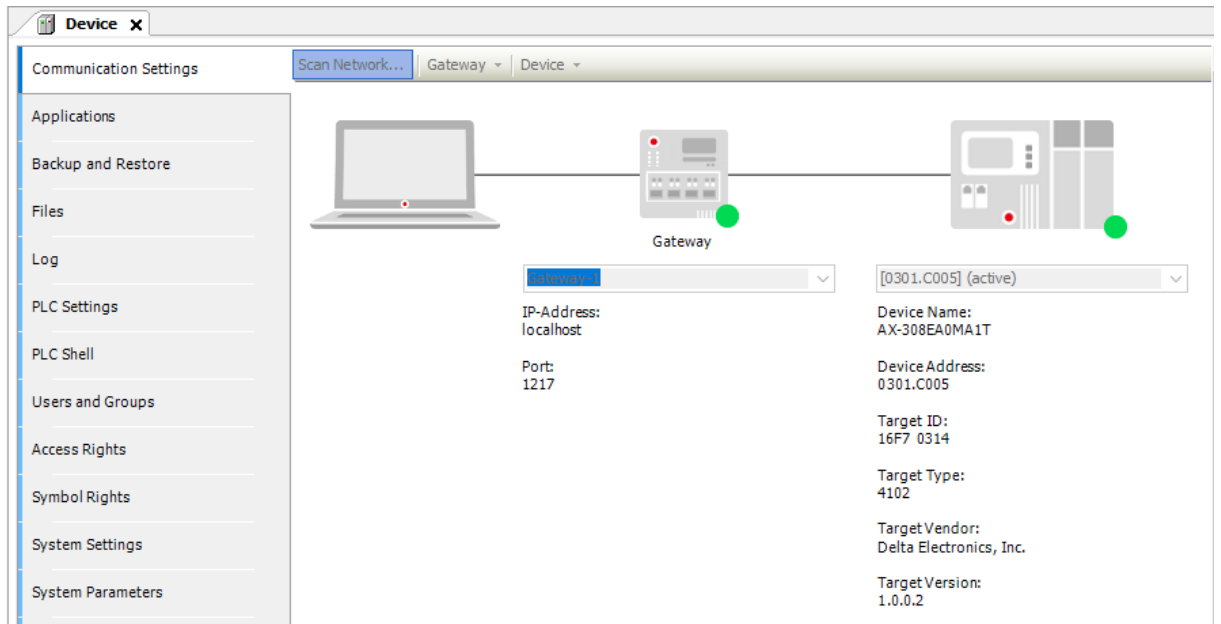


After clicking "Scan Network", a new window will pop up, where the software will automatically scan for AX-3 series controller.

After the software scans out the AX-3 controller, please select the controller, and then click "OK" button.

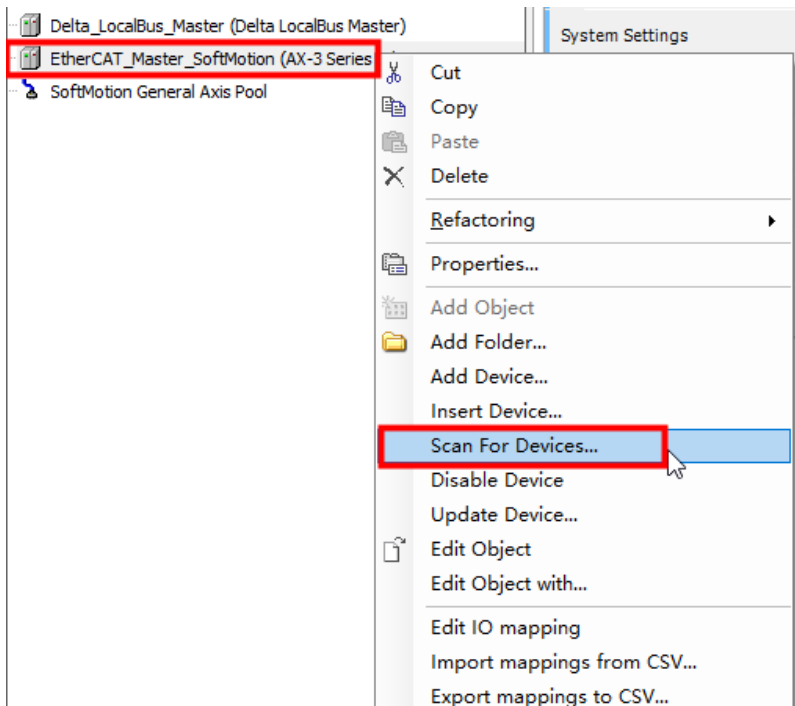


After clicking "OK", the "Device" page will automatically display the connected controller as shown in the following figure.

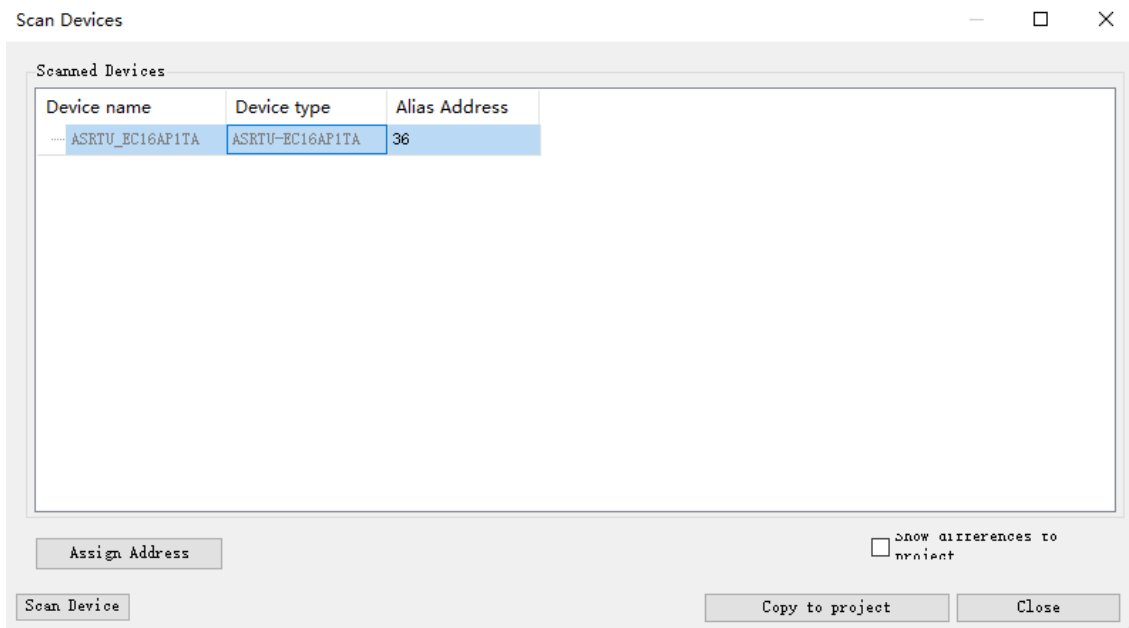




- Right-click on “EtherCAT\_Master\_Softmotion” and then select “Scan For Device” from the context menu to scan for the EtherCAT slave.

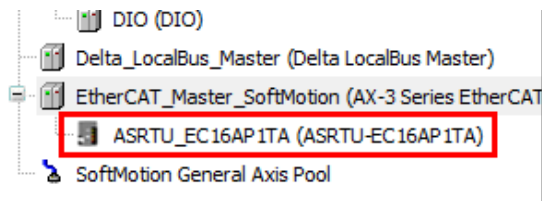


The “Scanned Devices” window pops up and the software automatically scans ASRTU-EC16AP1TA out after the scan function is enabled.



After the scan is complete, click “Copy All Devices to Project” to add all devices which are scanned out to the software.

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- Double-click ASRTU-EC16AP1TA to open the configuration window, where you click “Process Data” tag to open the page.

The screenshot shows the configuration window for ASRTU-EC16AP1TA. The 'Process Data' tab is selected. The 'Select the Outputs' section contains the following mappings:

Name	Type	Index
<input type="checkbox"/> 16#1700 1st RxPDO Mapping	Digital output	USINT 16#3000:03
<input checked="" type="checkbox"/> 16#1701 2nd RxPDO Mapping	Counter channel 1 Command	INT 16#3001:01
	Counter channel 1 InputMode	USINT 16#3001:02
	Counter channel 1 CountDirection	SINT 16#3001:04
	Counter channel 1 AB-phase FrequencyMode	USINT 16#3001:05
	Counter channel 1 TriggerMode	INT 16#3001:07
<input type="checkbox"/> 16#1702 3rd RxPDO Mapping	Counter channel 2 Command	INT 16#3003:01
	Counter channel 2 InputMode	USINT 16#3003:02
	Counter channel 2 CountDirection	SINT 16#3003:04
	Counter channel 2 AB-phase FrequencyMode	USINT 16#3003:05
	Counter channel 2 TriggerMode	INT 16#3003:07
<input checked="" type="checkbox"/> 16#1703 4th RxPDO Mapping	Pulse output channel 1 Command	INT 16#3005:01
	Pulse output channel 1 MotionMode	USINT 16#3005:02
	Pulse output channel 1 TargetPulses	LREAL 16#3005:06
	Pulse output channel 1 TargetFrequency	DINT 16#3005:07

The 'Select the Inputs' section contains the following mappings:

Name	Type	Index
<input type="checkbox"/> 16#1800 1st TxPDO Mapping	Error register	USINT 16#1001:00
	Digital Input	USINT 16#3000:04
<input checked="" type="checkbox"/> 16#1801 2nd TxPDO Mapping	Counter channel 1 Present Countervalue	LREAL 16#3001:06
	Counter channel 1 Status	USINT 16#3001:09
<input type="checkbox"/> 16#1802 3rd TxPDO Mapping	Counter channel 2 Present Countervalue	LREAL 16#3003:06
	Counter channel 2 Status	USINT 16#3003:09
<input checked="" type="checkbox"/> 16#1803 4th TxPDO Mapping	Pulse output channel 1 Status	INT 16#3005:04
	Pulse output channel 1 CurrentPulses	LREAL 16#3005:05
	Pulse output channel 1 Actual MotionMode	USINT 16#3005:12
	Pulse output channel 1 ActualFrequency	DINT 16#3005:14
<input type="checkbox"/> 16#1804 5th TxPDO Mapping	Pulse output channel 2 Status	INT 16#3006:04
	Pulse output channel 2 CurrentPulses	LREAL 16#3006:05
	Pulse output channel 2 Actual MotionMode	USINT 16#3006:12
	Pulse output channel 2 ActualFrequency	DINT 16#3006:14

On the Process Data page, select relevant PDO Mappings for pulse output channel 1 and counter channel 1 as the above figure shows.

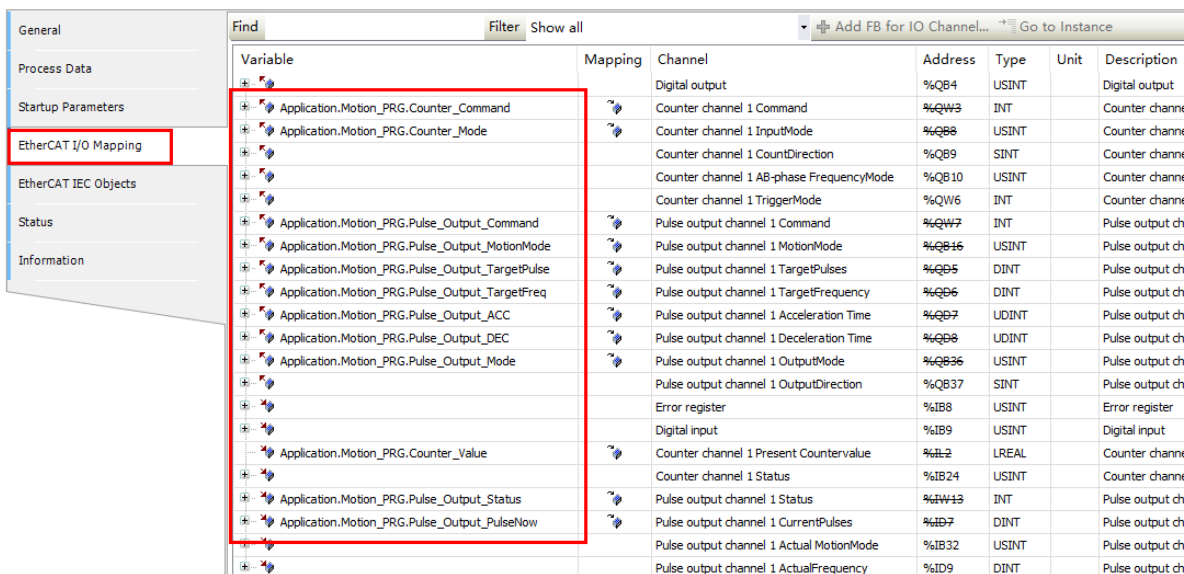
- Double-click "Motion\_PRG" to open the program, where you can define relevant variables in the variable table.

```

1  PROGRAM Motion_PRG
2  VAR
3      //COUNTER CHANNEL 1 VAR
4      Counter_Command: INT;
5      Counter_Mode: USINT;
6      Counter_Value: LREAL;
7
8      //PULSE OUTPUT CHANNEL 1 VAR
9      Pulse_Output_Command: INT;
10     Pulse_Output_MotionMode: USINT;
11     Pulse_Output_TargetPulse: DINT;
12     Pulse_Output_TargetFreq: DINT;
13     Pulse_Output_ACC: UDINT;
14     Pulse_Output_DEC: UDINT;
15     Pulse_Output_Mode: USINT;
16     Pulse_Output_Status: INT;
17     Pulse_Output_PulseNow: DINT;
18 END_VAR

```

- Double-click "ASRTU-EC16AP1TA ", and then click "EtherCAT I/O Mapping" tab. On the following "EtherCAT I/O Mapping" page, you can map the parameters to corresponding program variables as shown in the figure below.



Explanation of the variables in the figure above:

Variable name	Description
Counter_Command	Counter channel 1 command word for enabling the high-speed counting function
Counter_Mode	Input mode for counter channel 1; 1: Pulse + direction
Counter_Value	Counter value for counter channel 1
Pulse_Output_Command	Pulse output channel 1 command word for enabling the the pulse output function
Pulse_Output_MotionMode	Motion mode for pulse output channel 1; 4: Position output
Pulse_Output_TargetPulse	Target pulse number for pulse output channel 1
Pulse_Output_TargetFreq	Target frequency for pulse output channel 1
Pulse_Output_ACC	Acceleration time for pulse output channel 1; Unit: ms
Pulse_Output_DEC	Deceleration time for pulse output channel 1; Unit: ms
Pulse_Output_Mode	Output mode for pulse output channel 1; 0: Pulse + direction
Pulse_Output_Status	Current status for pulse output channel 1
Pulse_Output_PulseNow	Current output pulse number for pulse output channel 1

- Double-click "Motion\_PRG" to start programming. The program content is shown in the figure below. After editing the program is complete, click the "Login" item of "Online" menu on the menu bar to download the project to the AX-308E controller.

```

1 //set parameter
2 Counter_Mode := 1; //pulse + dir
3 Pulse_Output_MotionMode := 4; //pulse output mode
4 Pulse_Output_TargetFreq := 100000; //target frequency 100khz
5 Pulse_Output_ACC := 1000;
6 Pulse_Output_DEC := 1000;
7 Pulse_Output_Mode := 0; //pulse + dir
8
9 //pulse output && count
10 R_T(CLK:= Pulse_Out); //R_TRIG
11 IF R_T.Q THEN
12     Counter_Command := 1;
13     Pulse_Output_Command := 1;
14     Pulse_Output_TargetPulse := Pulse_Output_PulseNow + 1000000;
15 END_IF
16
17 IF Pulse_Output_Status = 2 THEN //pulse output complete
18     COUNT_VALUE := Counter_Value;
19 END_IF

```

**Description of lines in the program above:**

**Line 2:** The counting mode for counter channel 1 is set to “pulse + direction”.

**Line 3:** The motion mode for pulse output channel 1 is set to the “absolute position output” mode.

**Line 4:** The target frequency for pulse output channel 1 is set to 100 kHz.

**Line 5 & line 6:** The acceleration time and deceleration time for pulse output channel 1 are set to 1000 ms.

**Line 7:** The output mode for pulse output channel 1 is set to “pulse + direction” mode.

**Line 10:** The variable Pulse\_out in the program is set to TRUE.

**Lines 12 & line 13:** The values of command words for the high-speed counting and pulse output are set to 1 to start the functions of the pulse output and high-speed counting.

**Line 14:** 1,000,000 plus the value of Pulse\_Output\_PulseNow (current pulse number) are assigned to Pulse\_Output\_TargetPulse so as to output 1,000,000 pulses since Pulse\_Output\_TargetPulse (Target pulse number) for ASRTU-EC16AP1TA is an absolute value.

When the pulse output is completed, the value of the Pulse\_Output\_Status variable becomes 2. At the moment, you can check whether the number of pulses counted by ASRTU-EC16AP1TA's counter channel 1 is 1,000,000 or not.

After the pulse output is completed, please set the Pulse\_Output\_Command variable to 0 and then change the Pulse\_out variable from FALSE to TRUE so that you can output a second 1,000,000 pulses.

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## **Chapter 8 Error Diagnosis and Trouble-shooting**

ASRTU-EC16AP supports two diagnostic methods: LED indicator and status indication.

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8.1 LED Indicator Diagnosis .....	8-2
8.2 Status Indication Diagnosis .....	8-3

## 8.1 LED Indicator Diagnosis

### ● POWER LED

POWER LED indicates if the power supply to ASRTU-EC16AP is normal.

LED status	Indication	How to correct
Off	The power supply is abnormal.	Make sure that the power supply to ASRTU-EC16AP is normal
Green light on	The power supply is normal.	--

### ● Error LED

Error LED indicates if there is an error in ASRTU-EC16AP and right-side modules.

LED status	Indication	How to correct
Off	ASRTU-EC16AP works normally or lacks the work power.	--
Red light blinking	Possible causes: <ol style="list-style-type: none"> <li>1. The configuration data for ASRTU-EC16AP are invalid.</li> <li>2. The extension modules on the right of ASRTU-EC16AP are in error.</li> <li>3. The modules configured on the software are inconsistent with those actually connected on the right of ASRTU-EC16AP.</li> <li>4. The EtherCAT communication of ASRTU-EC16AP is broken.</li> <li>5. Firmware error and thus ASRTU-EC16AP's firmware online upgrade failure</li> </ol>	<ol style="list-style-type: none"> <li>1. Check if the actual modules on the right of ASRTU-EC16AP are consistent with those configured on the software.</li> <li>2. Check if the power supply and wiring of the modules on the right of ASRTU-EC16AP are fine.</li> <li>3. Check out the error information of the modules on the right of ASRTU-EC16AP and then deal with the errors by following the instructions in corresponding module manuals.</li> <li>4. Make sure that the connection of EtherCAT cable is normal.</li> <li>5. If the online upgrade of ASRTU-EC16AP's firmware fails, you can try to power it on again. If the problem cannot be solved after you repower it multiple times, contact local technicians.</li> </ol>
Red light on	ASRTU-EC16AP is under voltage	Check if the power supply for ASRTU-EC16AP works.

### ● RUN LED

RUN LED indicates the communication status of ASRTU-EC16AP in the EtherCAT network.

LED status	Indication	How to correct
Off	ASRTU-EC16AP is in <b>In</b> it status.	Check if the cable connection at the EtherCAT port of ASRTU-EC16AP is fine.
Green light blinking	ASRTU-EC16AP is not in <b>OP</b> status.	<ol style="list-style-type: none"> <li>1. Check if ASRTU-EC16AP produces an alarm (i.e. Error indicator ON or blinking) and ensure that no alarm occurs to right-side modules.</li> <li>2. Ensure that the cable connection at the EtherCAT port of ASRTU-EC16AP is normal.</li> </ol>
Green light on	ASRTU-EC16AP is communicating normally in the EtherCAT network.	--

- **Port1 LED**

Port1 LED indicates ASRTU-EC16AP's hardware connection state at the EtherCAT port and communication state.

LED status	Indication	How to correct
Off	The EtherCAT port of ASRTU-EC16AP has not been connected to the EtherCAT network yet.	Ensure that the hardware connection at the EtherCAT port is normal.
Green light on	The EtherCAT port of ASRTU-EC16AP has been connected to the EtherCAT network but no data exchange occurs.	Configure ASRTU-EC16AP and right-side extension modules into the master device
Green light blinking	The EtherCAT port of ASRTU-EC16AP has been connected to the EtherCAT network and data exchange is happening.	--

- **Port2 LED**

Port2 LED indicates ASRTU-EC16AP's hardware connection state at the EtherCAT port and communication state.

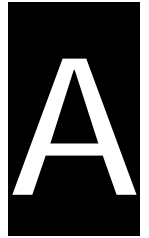
LED status	Indication	How to correct
Off	The EtherCAT port of ASRTU-EC16AP has not been connected to the EtherCAT network yet.	Ensure that the hardware connection at the EtherCAT port is normal.
Green light on	The EtherCAT port of ASRTU-EC16AP has been connected to the EtherCAT network but no data exchange occurs.	Configure ASRTU-EC16AP and right-side extension modules into the master device
Green light blinking	The EtherCAT port of ASRTU-EC16AP has been connected to the EtherCAT network and data exchange is happening.	--

## 8.2 Status Indication Diagnosis

The status indication parameter of ASRTU-EC16AP, "Error register" indicates current error information for ASRTU-EC16AP. See Section 6.2.2 for details on the explanation of the parameter values.



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## **Appendix A Accessories for EtherCAT Communication**

### **Table of Contents**

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## A.1 Accessories for EtherCAT Communication

- Cables

Figure	Model	Length	Diameter (AWG)
	UC-EMC003-02A	0.3M	4#22 PVC
	UC-EMC005-02A	0.5M	4#22 PVC
	UC-EMC010-02A	1.0M	4#22 PVC
	UC-EMC020-02A	2.0M	4#22 PVC
	UC-EMC050-02A	5.0M	4#22 PVC
	UC-EMC100-02A	10.0M	4#22 PVC
	UC-EMC200-02A	20.0M	4#22 PVC



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## **Appendix B Online Firmware Upgrade**

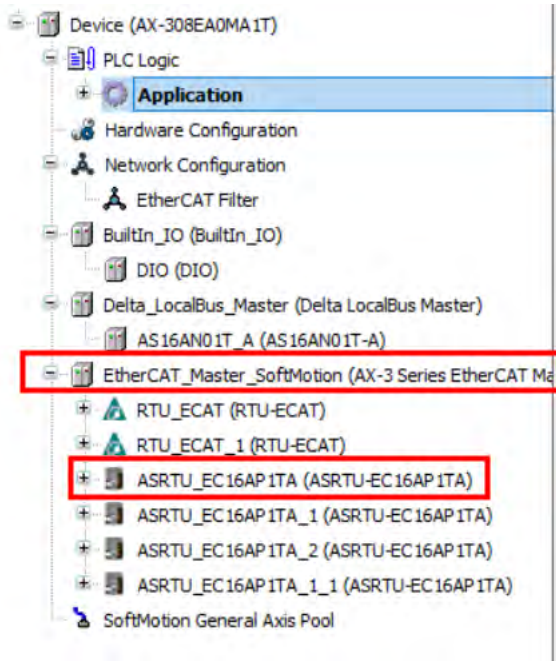
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## B.1 Online Firmware Upgrade

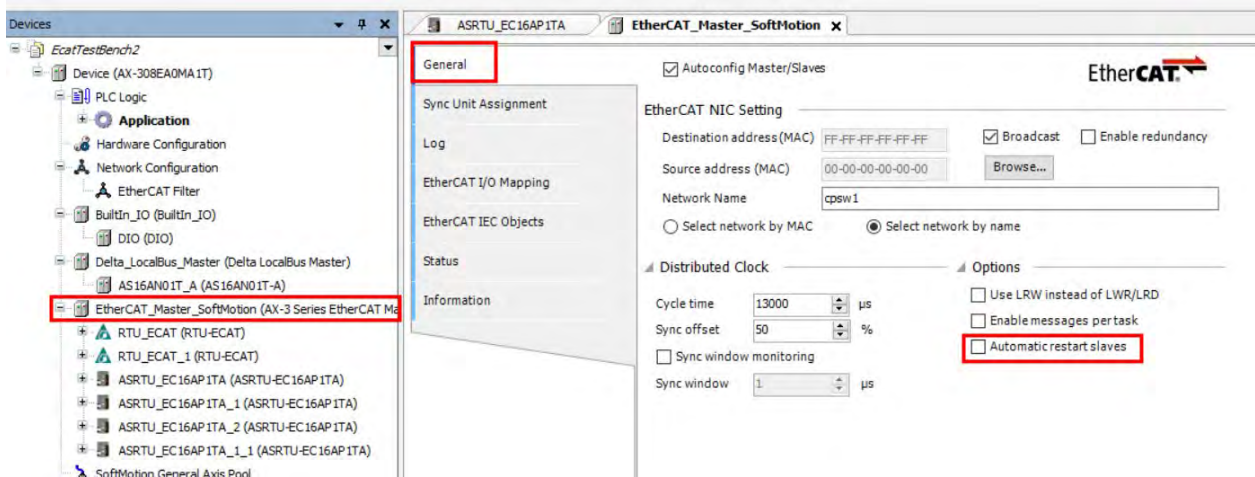
ASRTU-EC16AP's firmware V1.0 or later version supports the online upgrade. Relevant operation steps are as follows, using AX-308E together with ASRTU-EC16AP1TA for example.

1. Open the DIADesigner-AX software page, create a new project and then add ASRTU-EC16AP to the EtherCAT network, as shown in the following figure:



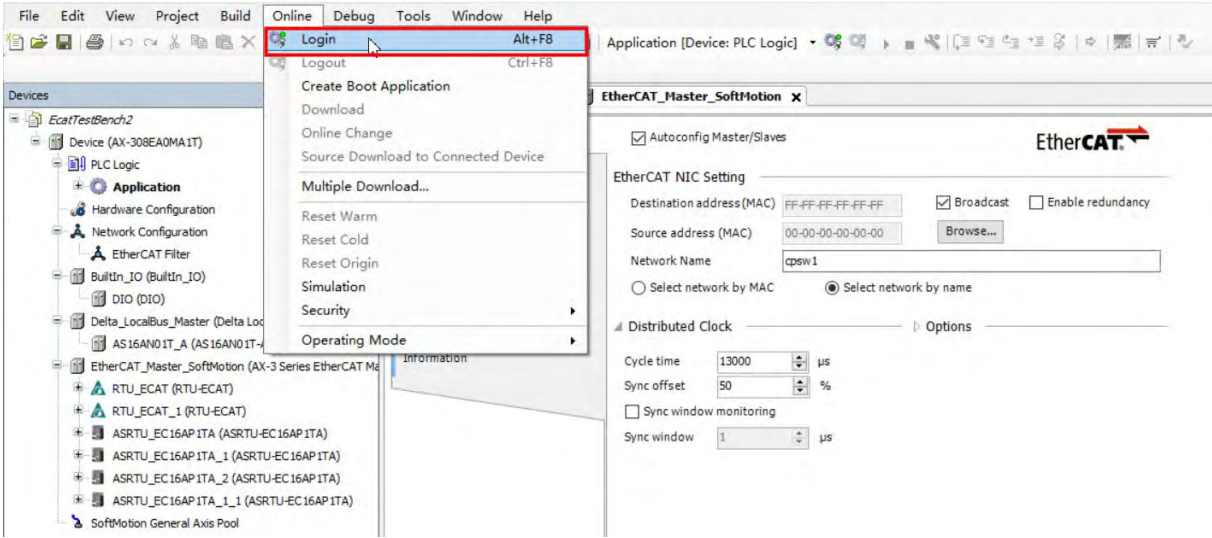
Note: Please refer to Section 5.2 for details on how to add ASRTU-EC16AP to the EtherCAT network.

2. With a double click on "EtherCAT\_Master\_SoftMotion", open the EtherCAT master configuration interface and then deselect "Automatic restart slaves" option in the "General" tab.

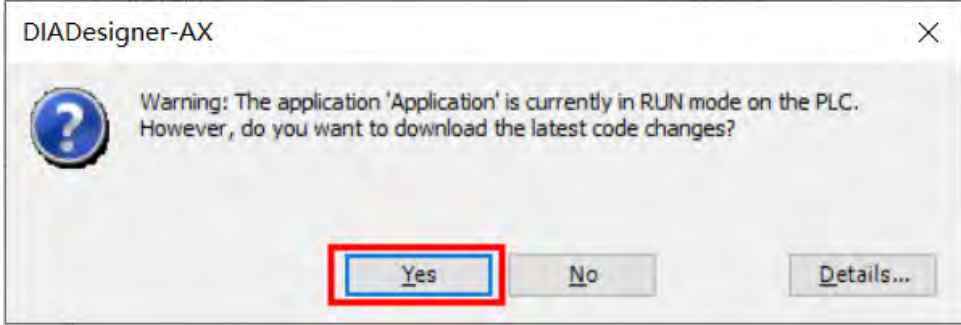


3. Click the "Login" option on the "Online" menu of the menu bar.

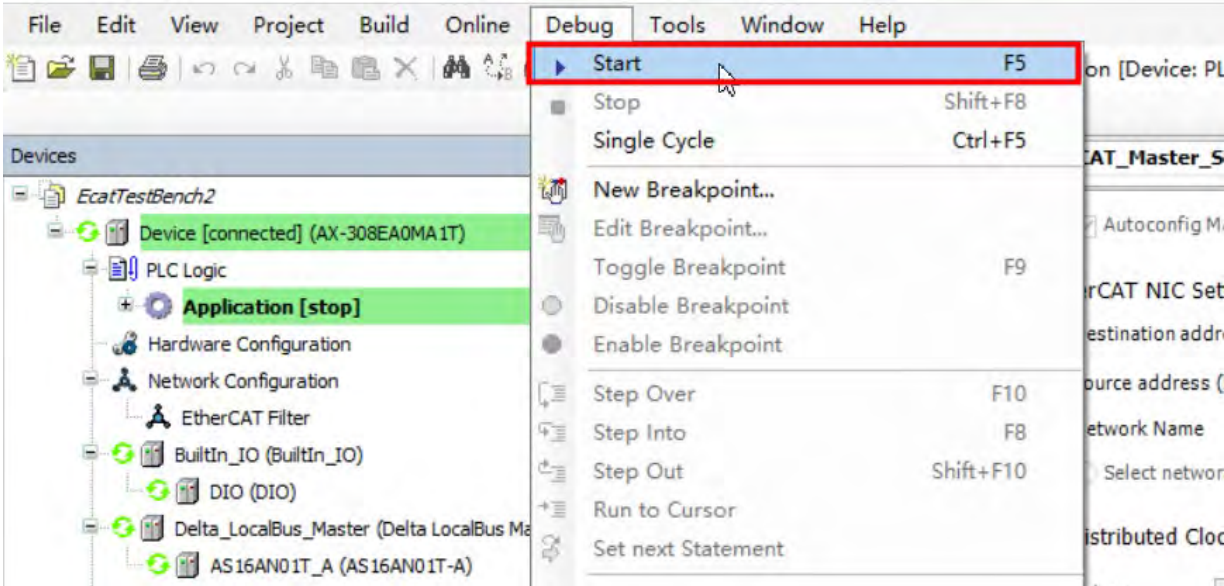
**B**



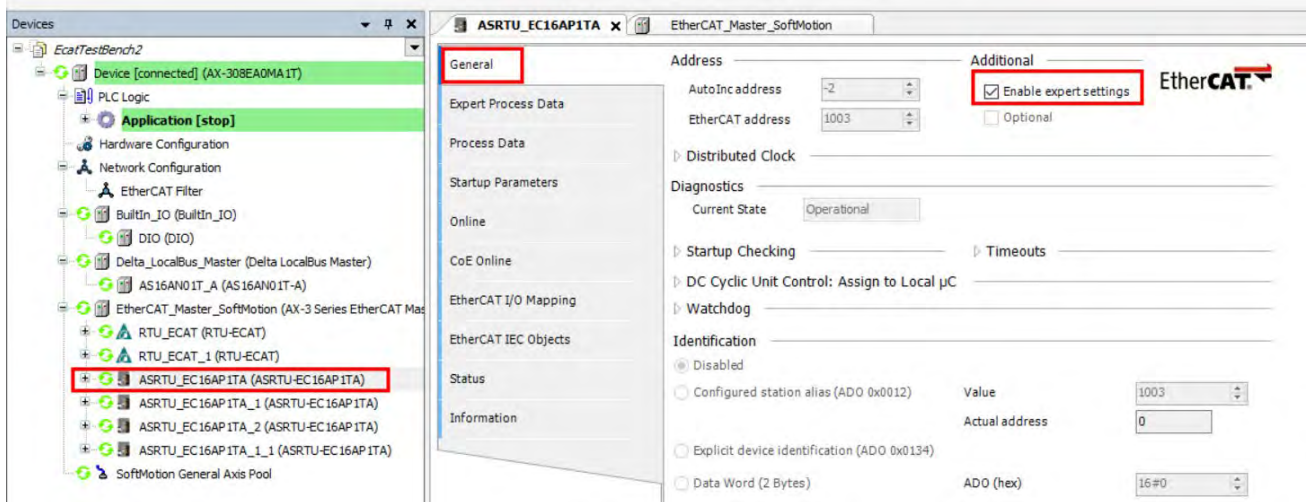
After clicking "Login", click the "Yes" button in the new pop-up window.



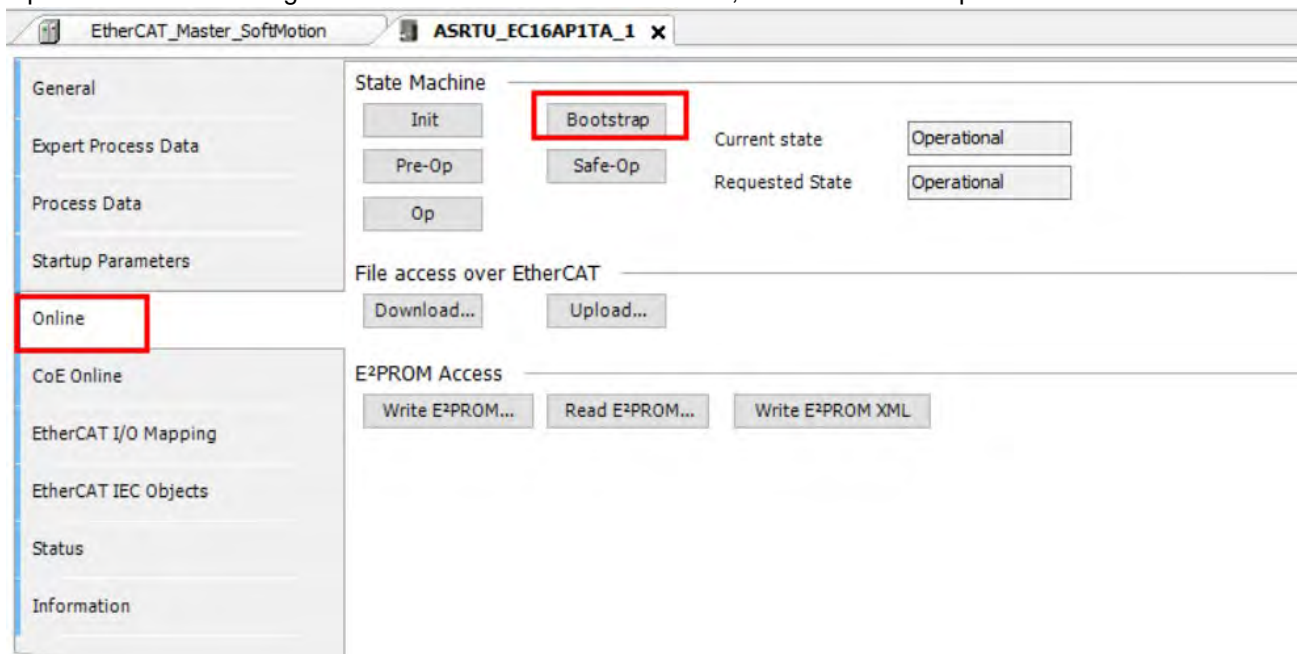
After successful login, click the "Start" option on the "Debug" menu of the menu bar.



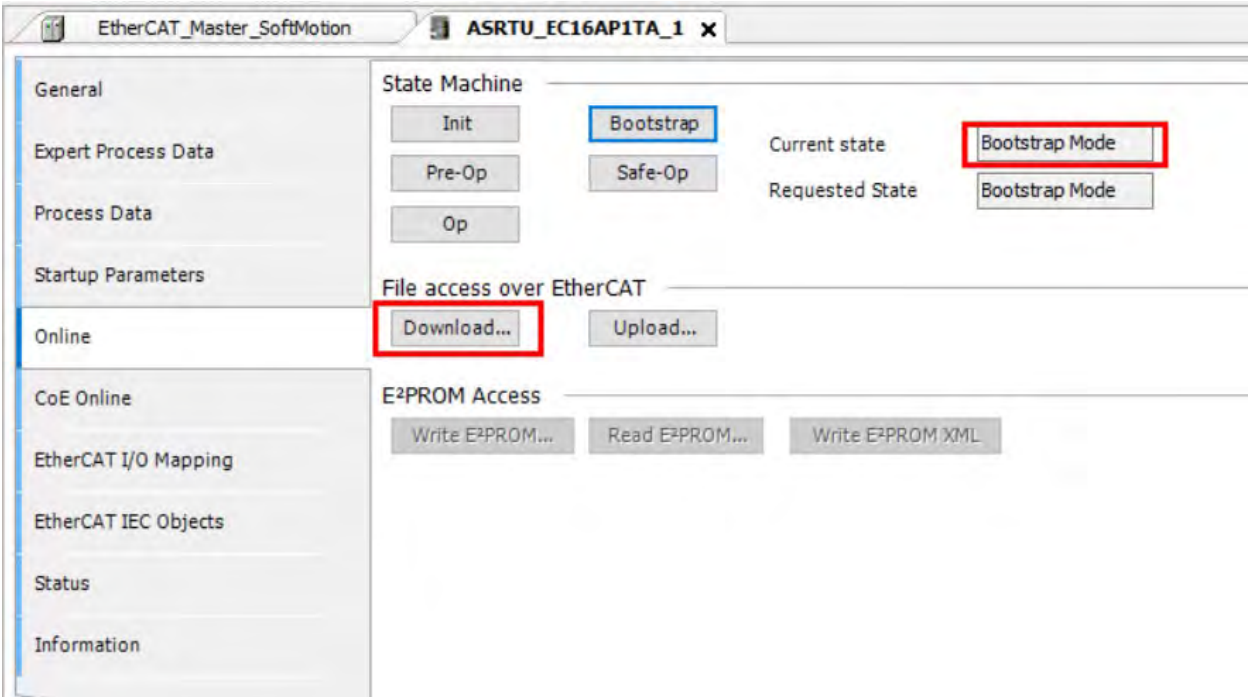
- 4. Open the configuration interface for ASRTU-EC16AP, and select "Enable expert settings" in the "General" tab.



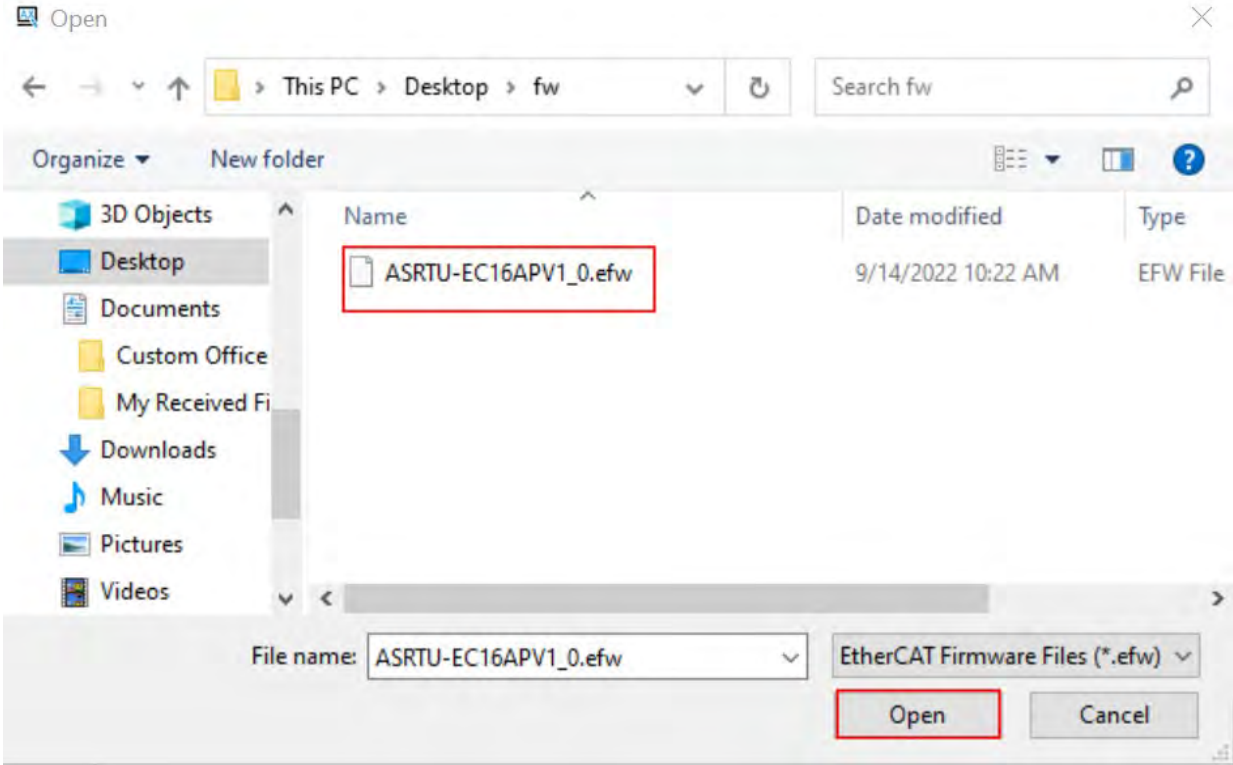
- Open the "Online" configuration interface for ASRTU-EC16AP, click the "Bootstrap" button.



After ASRTU-EC16AP enters the "Bootstrap Mode" state, click the "Download..." button under the "File access via EtherCAT" field.



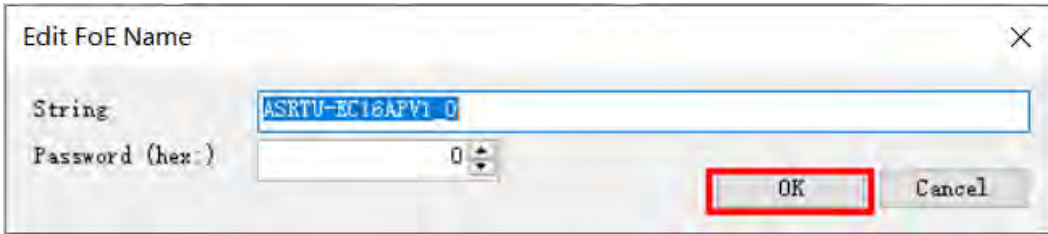
Select an online file for updating the firmware from the new interface, and then click the "Open" button.



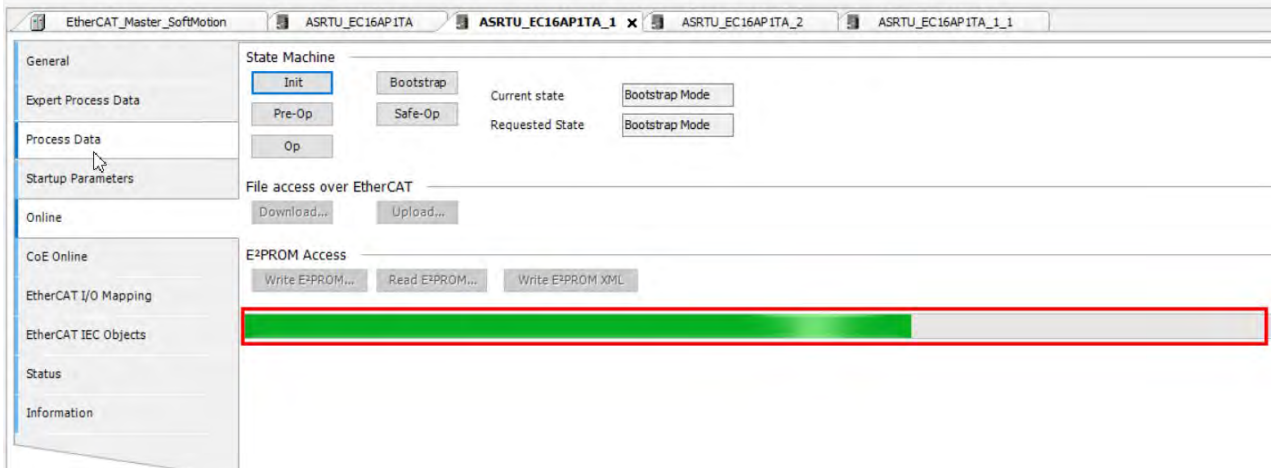
Click the "OK" button in the following pop-up window to start updating the firmware.

**B**

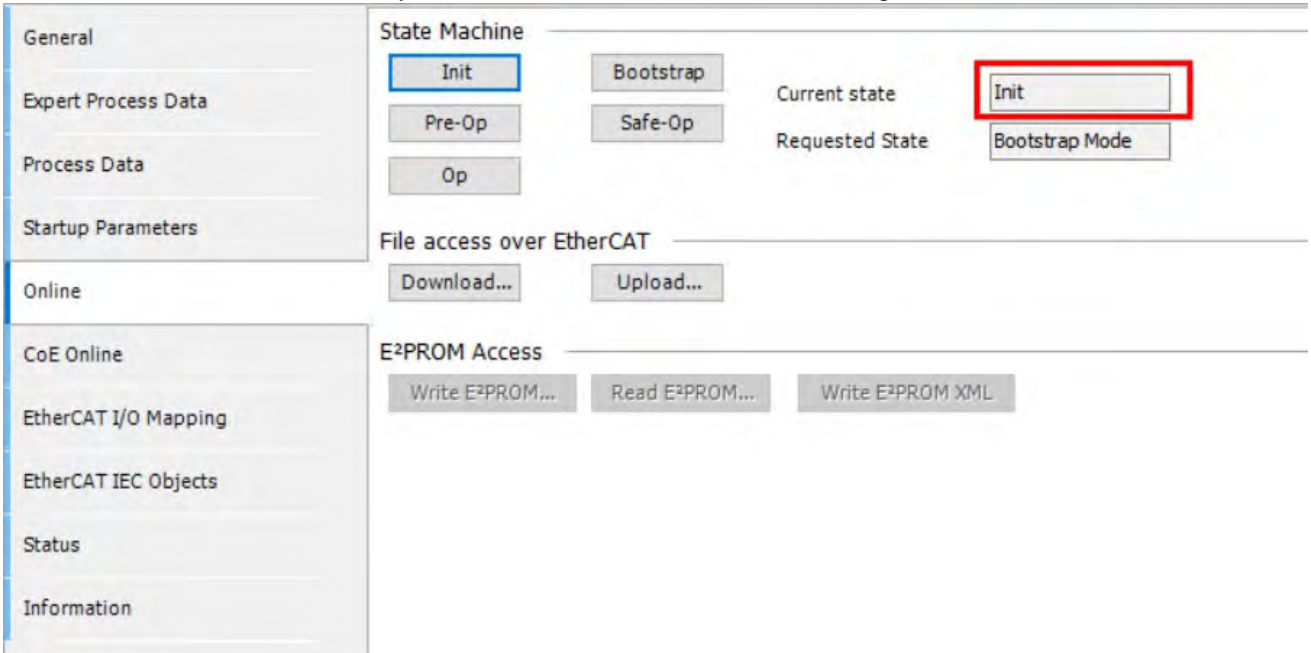




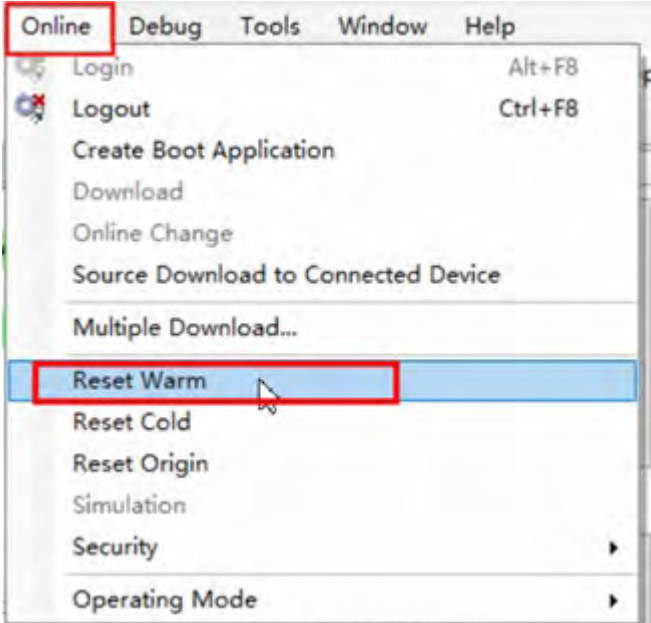
The following is the normal screen of the online firmware upgrade.



Once the online firmware upgrade is complete, the progress bar will disappear, and then the ASRTU-EC16AP will automatically restart, and the current status will change to "Init".



**B** Since the check box of "Automatic restart slaves" in the "EtherCAT\_Master\_SoftMotion" window has been deselected, you can reset the AX-308E by using the "Reset warm" option on the "Online" menu of the menu bar.



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