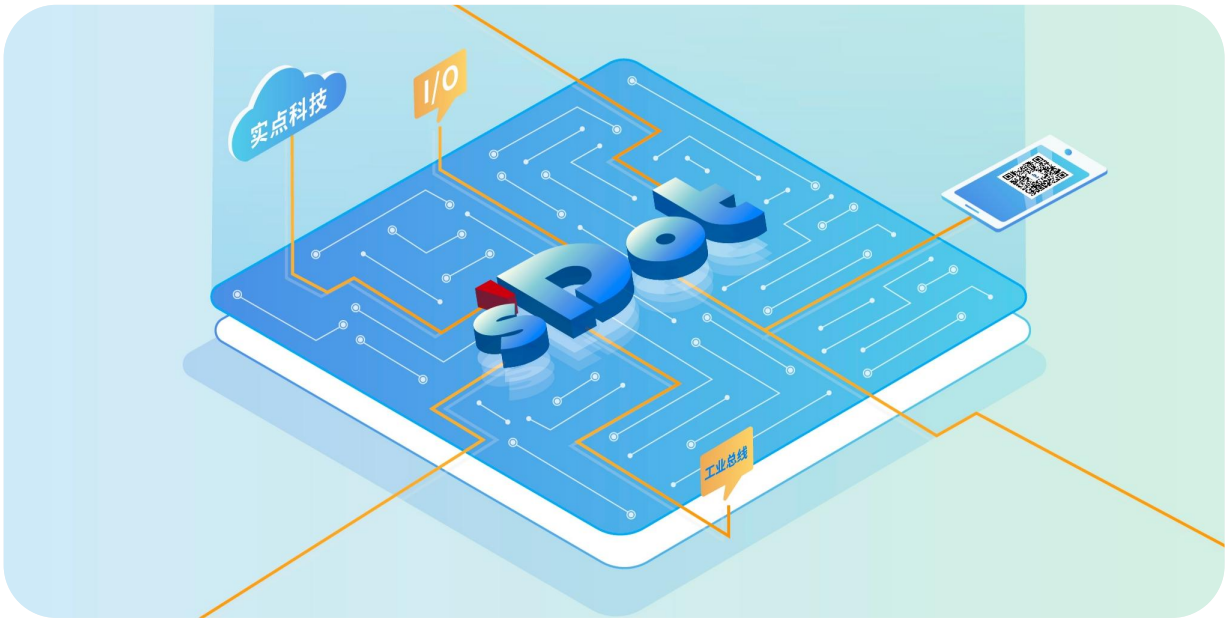

XB6S-PL20

Incremental Encoder Counter Module

User Manual

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CONTENTS

1 Product Introduction

1.1 Product Overview

XB6S-PL20 is a plug-in incremental encoder counter module, which adopts X-bus backplane and can be connected with two 24V single-ended incremental encoders. The module supports Z-phase clear, compare output, probe latch and other functions, and can be widely used in various industrial systems and equipment with our XB6S series couplers.

1.2 Product Characteristics

- Three Pulse Modes
  Supports AB orthogonal (ABZ), direction pulse (Pul+Dir), and double pulse (CW/CCW).
- Two Ring Count Ranges
  0~2^32-1 or 0~ ring count resolution x count ratio-1.
- Speed Report
  Supports reporting the real-time speed of two encoder channels.
- Z-Phase Clear
  Supports Z-phase clear function.
- Compare Output
  Supports the output of a time-adjustable pulse signal from the corresponding output channel when the count value reaches the set value.
- Probe Latch
  Supports latching the current count value when a voltage change occurs on the probe input pin.
- Magnification Count
  Supports 4x/2x/1x count.
- Power-Down Storage
  Supports power-down storage of count values.
- Small Volume
  Compact and small footprint.
- Easy Configuration

The configuration is simple and supports mainstream masters.

- Easy Installation
  DIN 35 mm standard rail installation
  Adopts shrapnel type terminals for easy and quick wiring.

2 Product Parameters

2.1 General parameter

Interface Parameter	
Product Model	XB6S-PL20
Bus Protocol	X-bus
Process Data Volume: Downstream	20 Bytes
Process Data Volume: Upstream	34 Bytes
Channel Type	Encoder input channels: 2 sets of channels (A-phase, B-phase and Z-phase), PNP/NPN
	Probe input channels: 4 channels (1 encoder with 2 probe functions), PNP/NPN
	General digital input channels: 4 channels (1 encoder with 2 common digital inputs), PNP/NPN
	compare output channels: 4 channels (1 encoder with 2 compare outputs), NPN
	General digital output channels: 4 channels (1 encoder with 2 common digital outputs), NPN
Refresh Rate	1ms

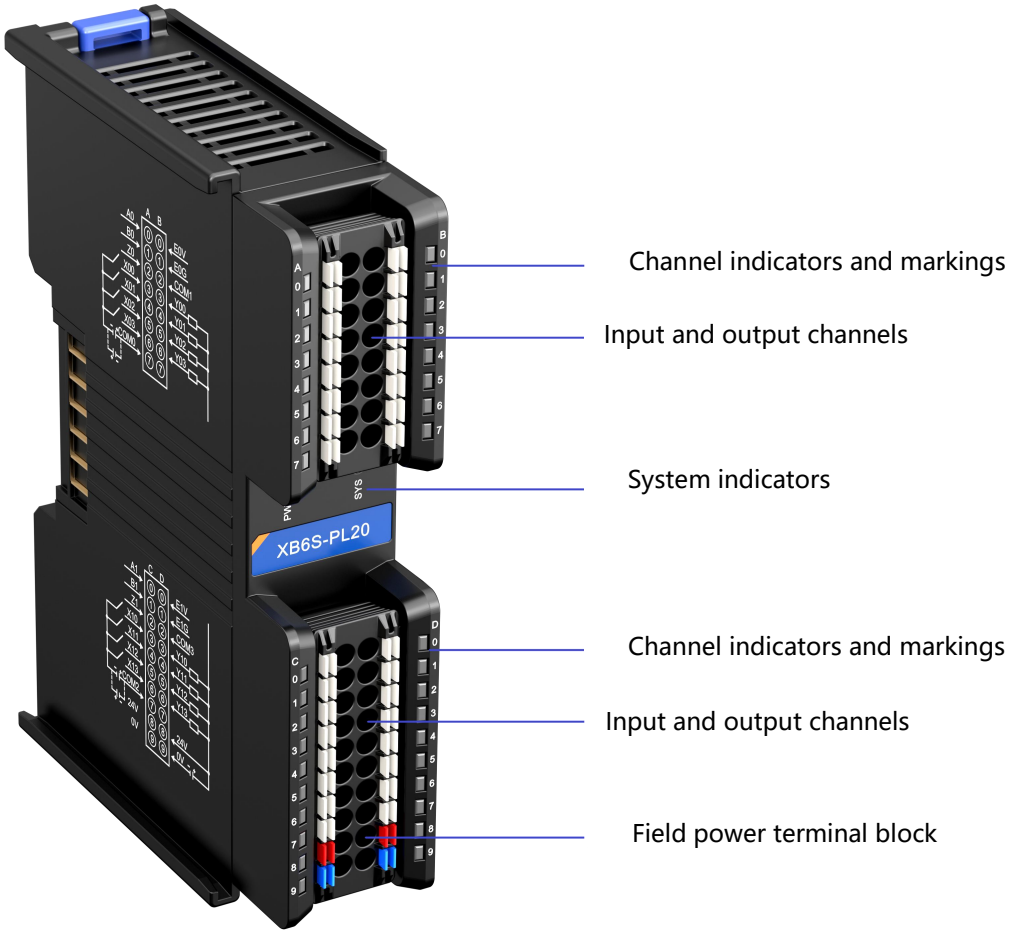
Technical Parameters	
System Input Power	5VDC (4.5V~5.5V)
Rated Current Consumption	160mA
Power Consumption	0.7W
Field-Side Power Rated Supply (Range)	24VDC (20.4V~28.8V)
Input Channel Rated Voltage (Range)	24VDC (20.4V~28.8V)
Encoder Pulse Input Mode	AB orthogonal (ABZ), directional pulse (Pul+Dir), double pulse (CW/CCW)
Encoder Pulse Input Frequency	1MHz
Real-Time Speed Of The Report Channel	Support
Z-Phase Clear	Support
Count Multiplier Setting	4x/2x/1x (default 1x)
Ring Count	Support
Count Range	0~2^32-1 or 0~Ring Count Resolution x Count Multiplier-1
Encoder Ring Count Resolution Setting[1]	Support (ring count resolution setting range 0~65535)
Count Initial Value Setting	Support (count initial value setting range 0 to 2^32-1)
Reverse Count	Support
Encoder Input Hardware Filter	Support (0 to 15 levels)
Probe Function (High Speed Hardware Latch)	Support
Probe Input Frequency	1MHz
Compare Output Function	Support
Compare Output Signal Response Speed	<10us
Input And Output Pin Function Selection	Support
Power-down Storage	Support
External Dimensions	106.4 x 25.7 x 72.3mm
Weight	110g
Wiring Method	Screwless Quick Plugs
Installation	35mm standard rail installation
Operating Temperature	-20℃~+60℃
Storage Temperature	-40℃~+80℃
Relative Humidity	95%, non-condensing
Protection Class	IP20

Note [1]: The ring count resolution here is only used to set the ring count range of the encoder and is different from the physical resolution of the encoder itself.

3 Panel

3.1 Panel Structure

Name of each part of the product



3.2 Indicator light function

Name	Markings	Color	Status	Description
Power indicator	PWR	GREEN	ON	Power supply normal
			OFF	The product is not powered up or the power supply is abnormal
System operation indicator	SYS	GREEN	ON	The system is functioning normally
			Flashing 1Hz	No business data interaction, waiting for business data interaction to be established
			Flashing 10Hz	Firmware Upgrade
			OFF	System not working
Encoder input AB phase indicator	0	GREEN	ON	Encoder enabled
	1		OFF	Encoder Disabled
Encoder input Z-phase indicator	2	GREEN	ON	Encoder Z-phase clear function enabled
			OFF	Encoder Z-phase zero function not enabled
Input Channel Indicator	3 to 6 (left side)	GREEN	ON	Channels have signal inputs
			OFF	No signal input for channel
Output Channel Indicator	3 to 6 (right side)	GREEN	ON	Channel has signal output
			OFF	No signal output from channel

4 Installation and uninstall

4.1 Installation Guide

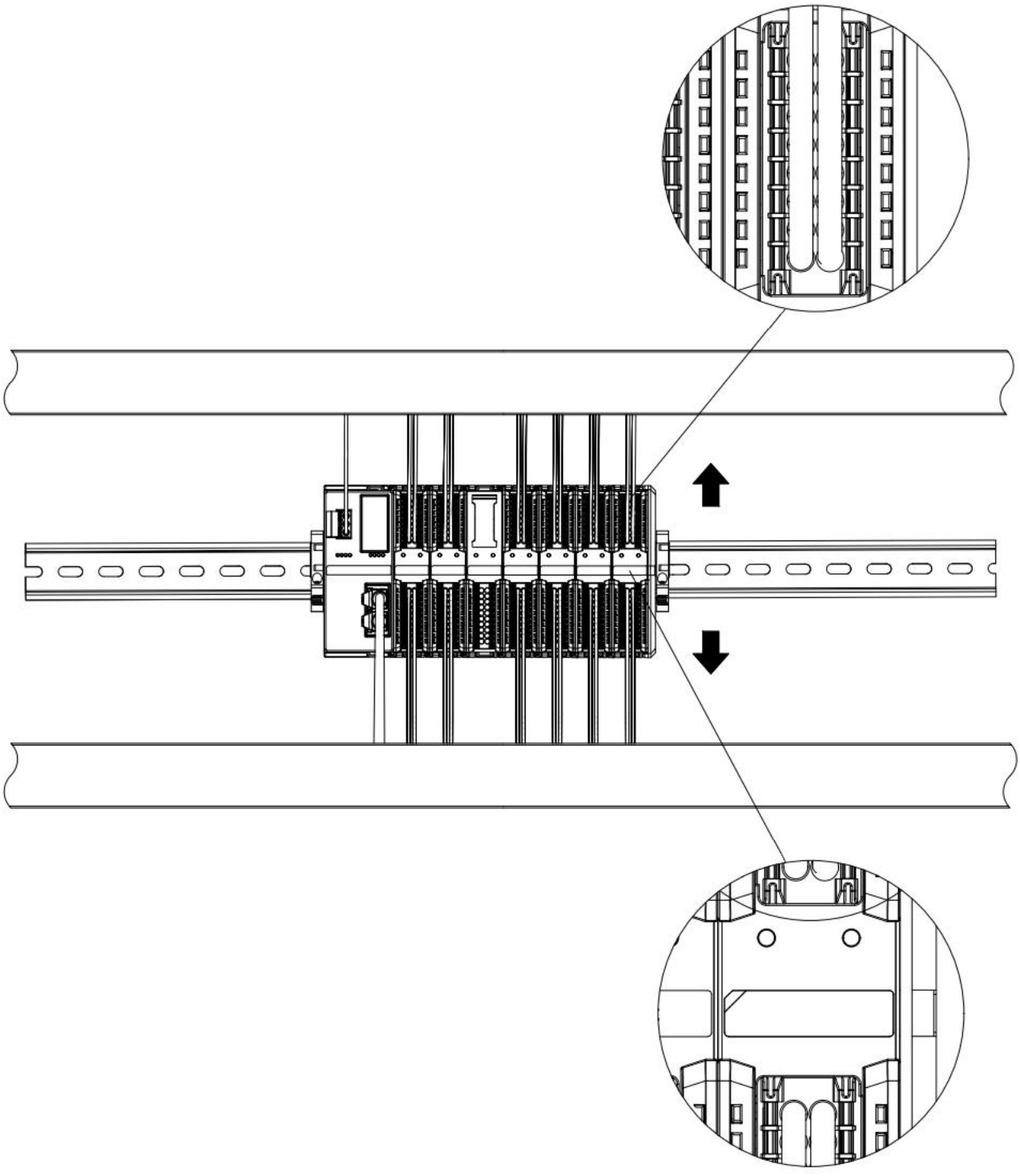
Precautions for installation\uninstall

- **The module protection class is IP20 and the module needs to be installed in the cabinet for indoor use.**
- **Ensure that the cabinet is well ventilated (e.g., the cabinet is fitted with an exhaust fan).**
- **Do not install this equipment next to or above equipment that may cause overheating.**
- **Be sure to mount the module vertically on the fixed rails and maintain air circulation around it (at least 50 mm air circulation space above and below the module).**
- **Once the module is installed, be sure to secure the module by installing rail mounts on both ends.**
- **Be sure to disconnect the power supply when installing/uninstalling.**
- **Once the module is installed, it is recommended that wiring and cabling be done in accordance with the top and bottom alignments.**

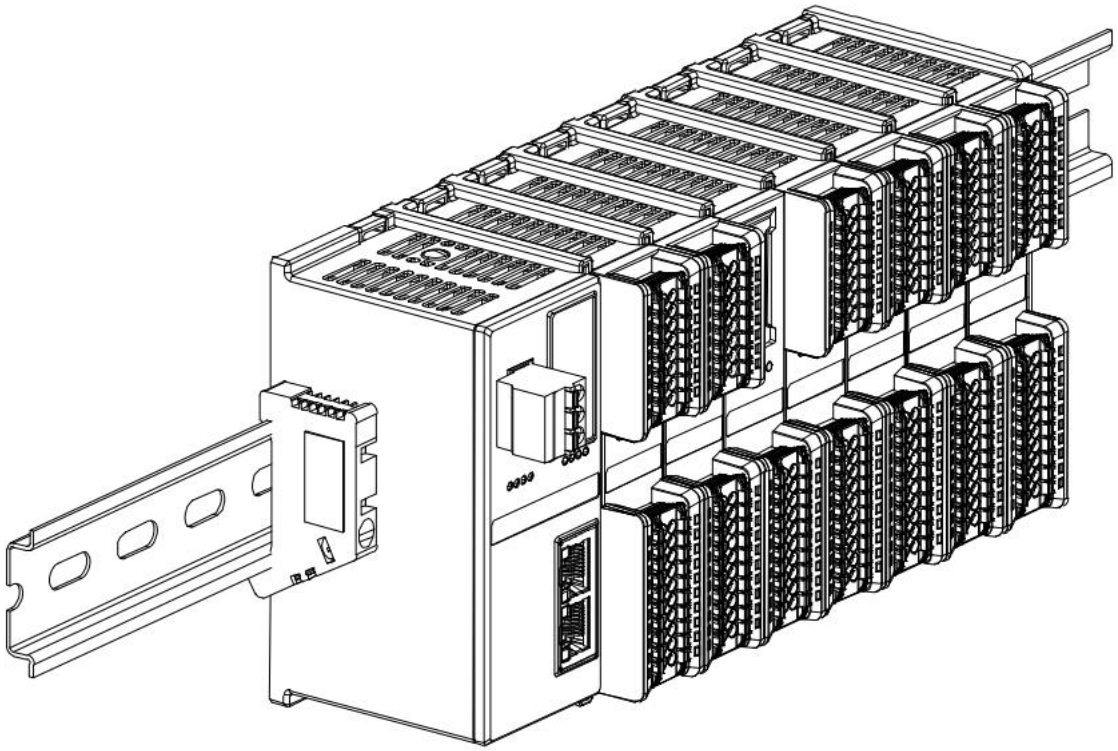
⚠ warnings

- The protection provided by the device may be jeopardized if it is not used in accordance with the product user manual.

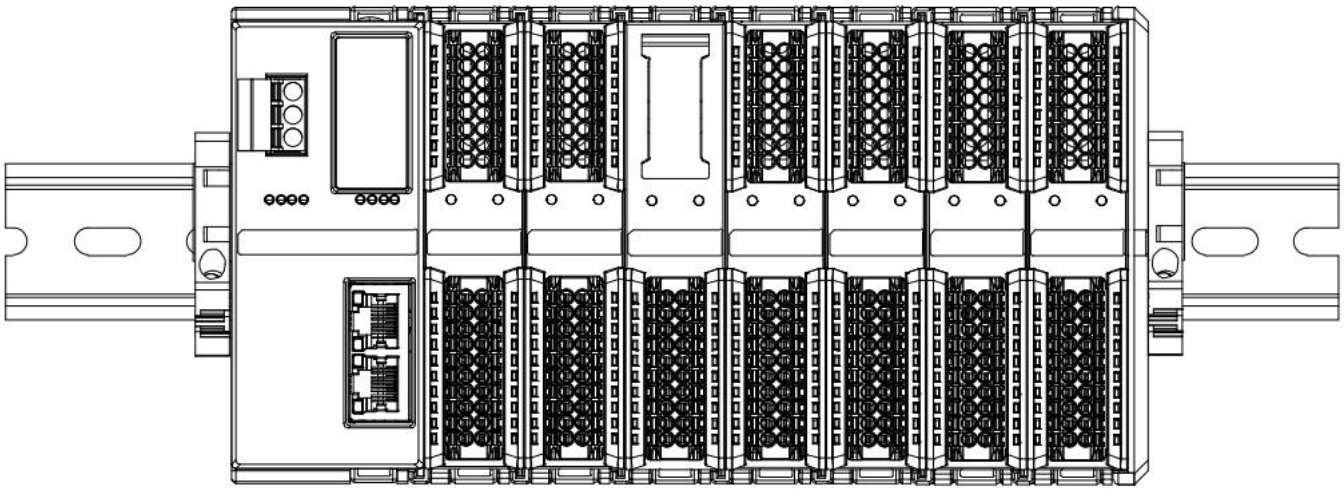
Module installation schematic, minimum clearance top and bottom (≥50mm)



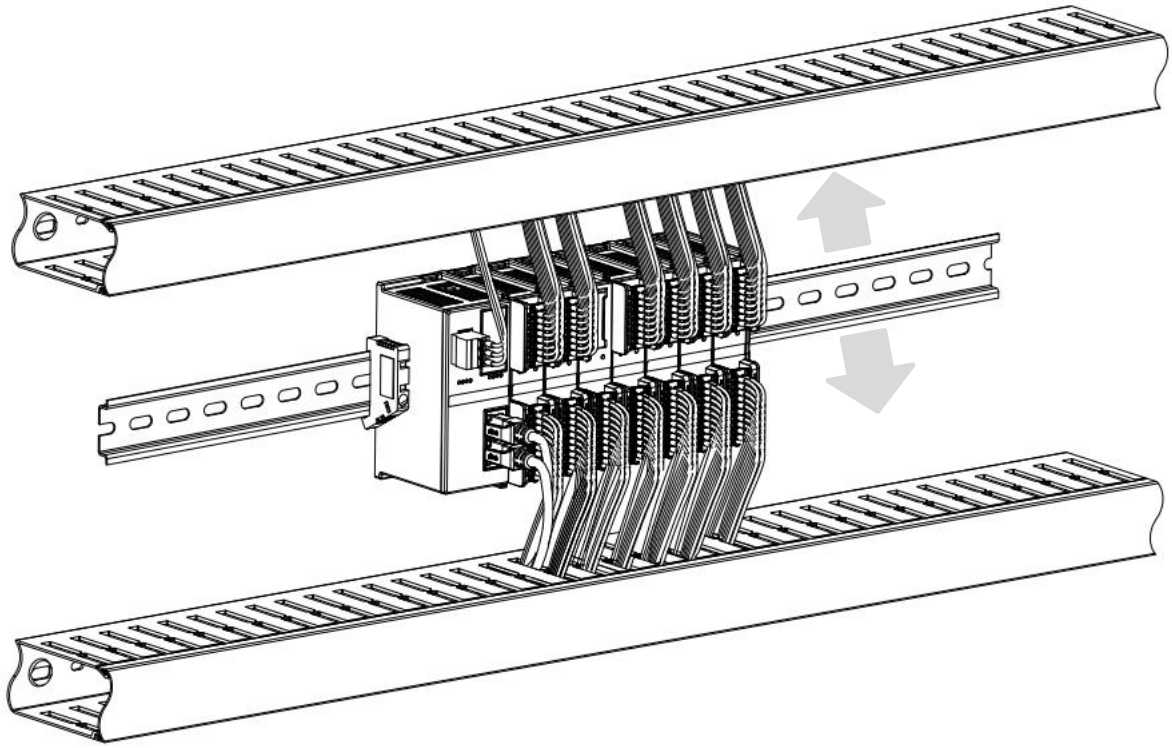
Ensure that the module is installed vertically on the fixed rail



Be sure to install the rail mounts



Schematic diagram of upper and lower wiring of the module



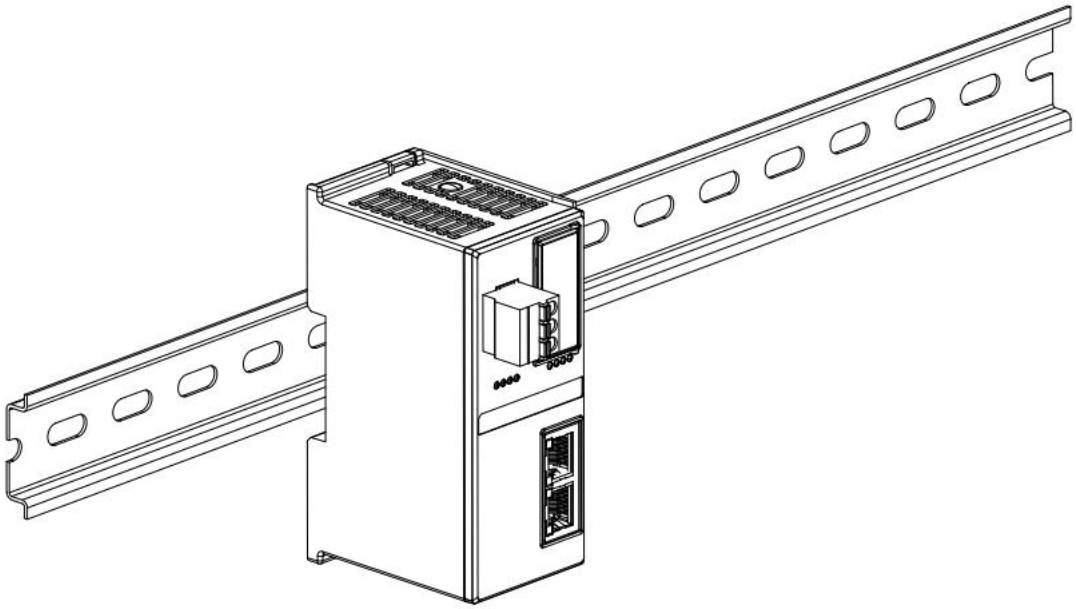
4.2 Installation and uninstall steps

Module installation and uninstall	
Module Installation Steps	1. Install the coupler module first on the rail that has been fixed.
	2. Install the required I/O modules or function modules in order to the right of the coupler module.
	3、After installing all the required modules, install the end cap to complete the installation of the module.
	4. Install the rail fixings at both ends of the coupler module and end cap to fix the module.
Module Uninstall Steps	1. Loosen the guide rail fixings at both ends of the module.
	2. Use a screwdriver to pry off the module snap.
	3. Pull out the uninstalled module.

4.3 Installation and uninstall diagram

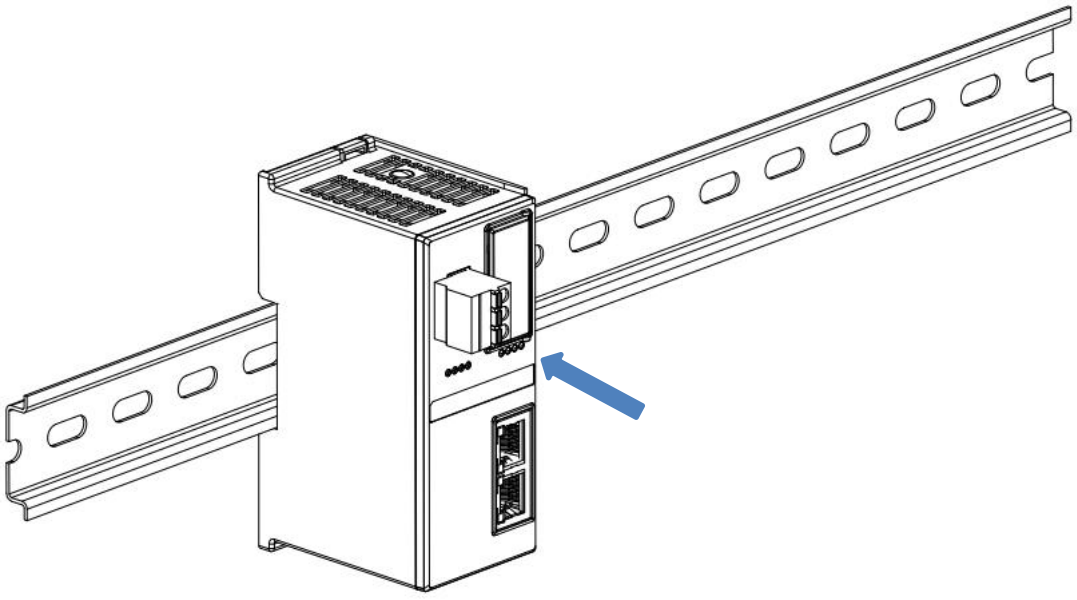
Coupler Module Installation

- Align the coupler module vertically in the rail slot as shown in Figure ① below.



①

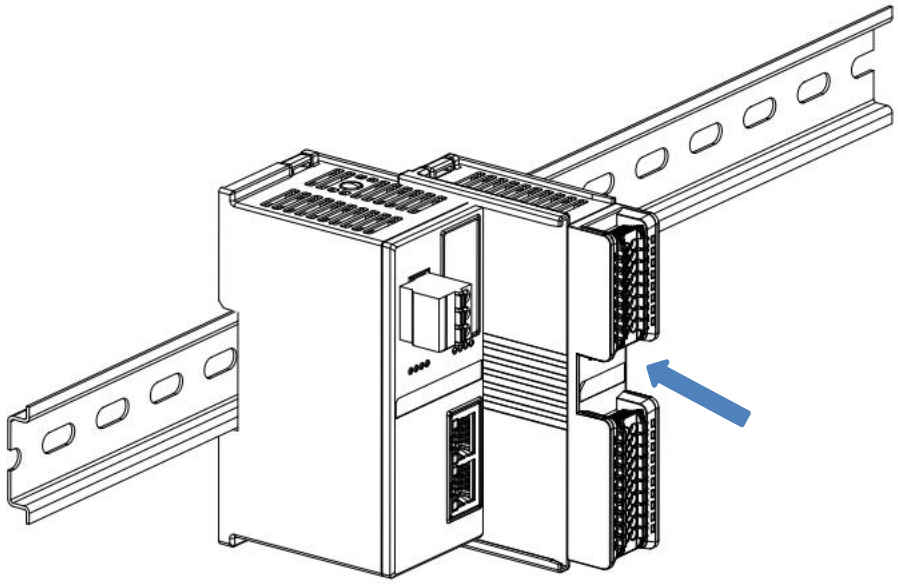
- Press the coupler module in the direction of the guide rail, and when you hear a "click" sound, the module is installed in place, as shown in Figure ② below.



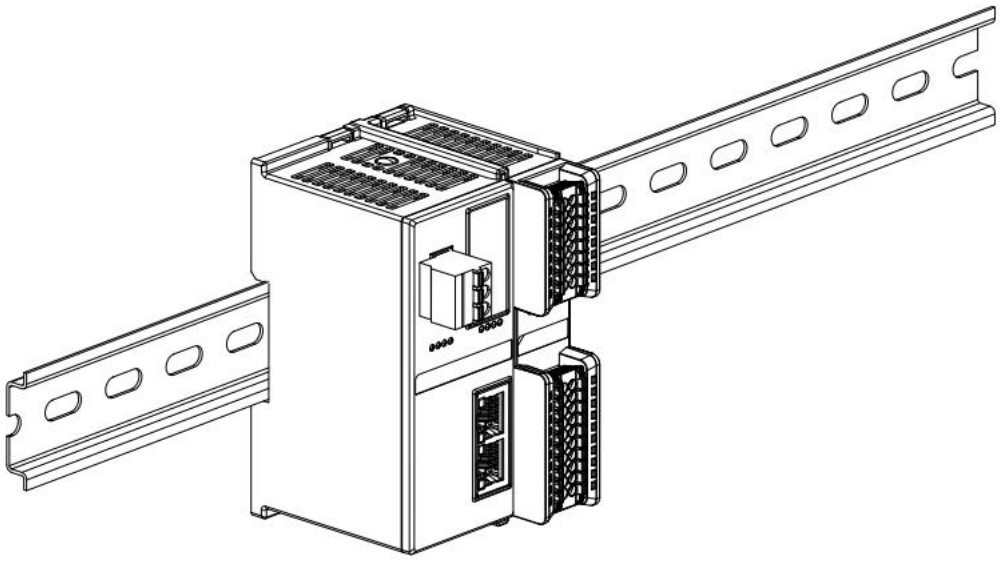
②

I/O Module Installation

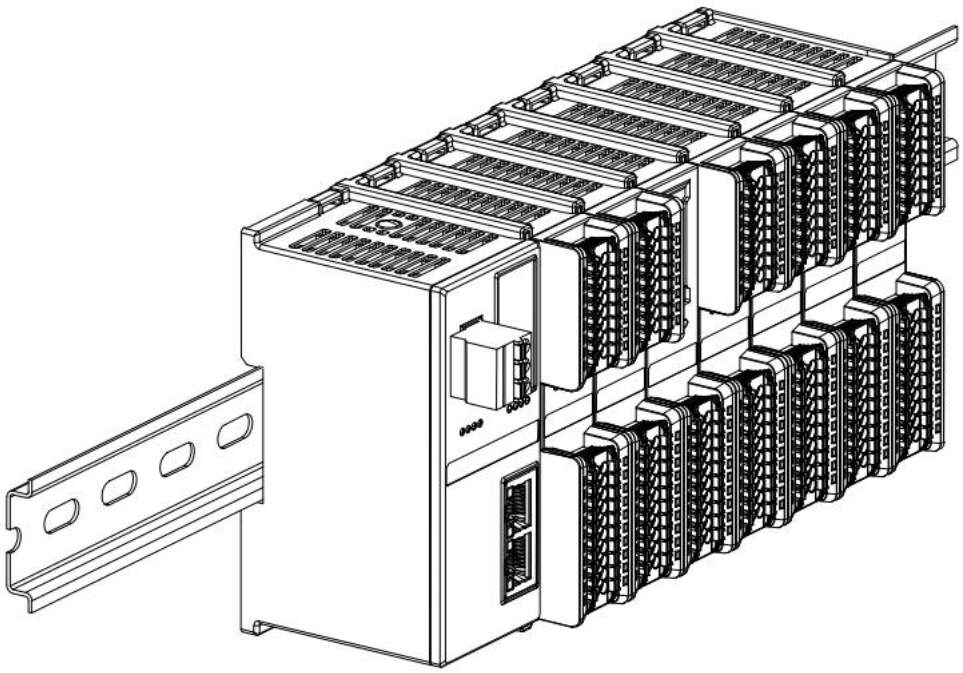
- Install the required I/O modules or function modules one by one according to the above steps of installing coupler modules as shown in Figures ③, ④ and ⑤ below, and push them in, and the modules will be installed in place when you hear the "click" sound.



③



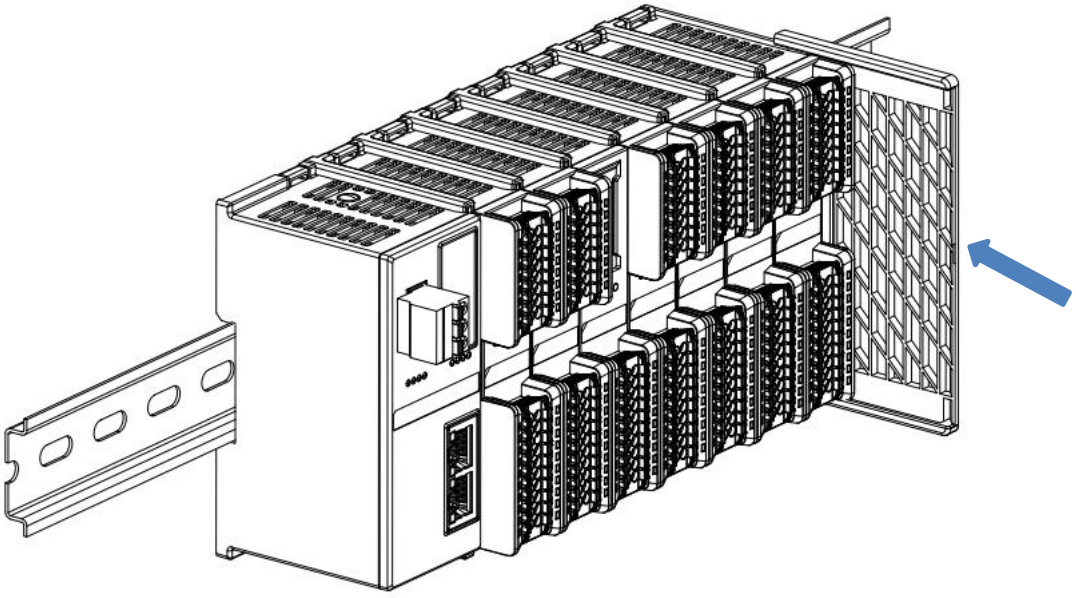
④



⑤

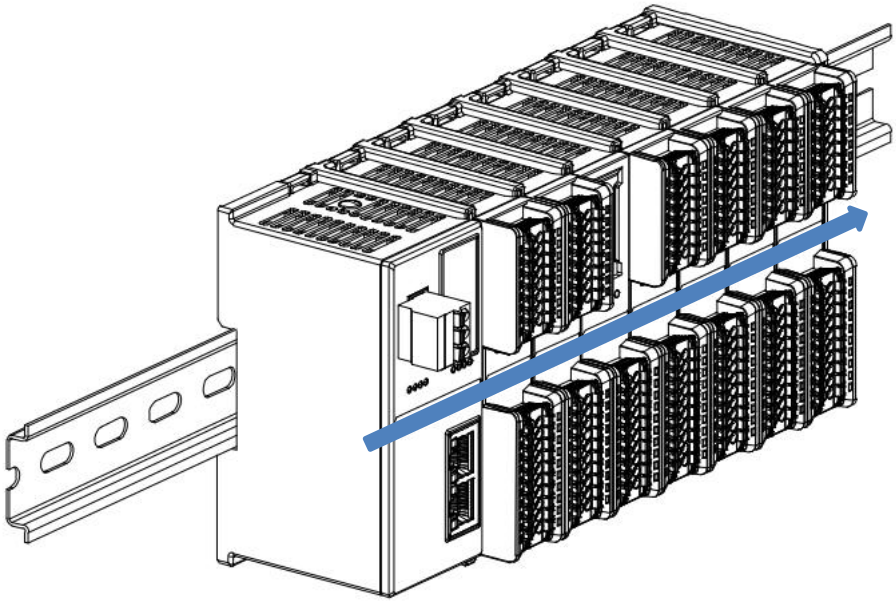
End cap installation

- Install the end cap on the right side of the last module, with the grooved side of the end cap aligned with the guide rail. Refer to the installation method of the I/O module for the installation method, and push the end cap inward into place, as shown in Figure ⑥ below.



⑥

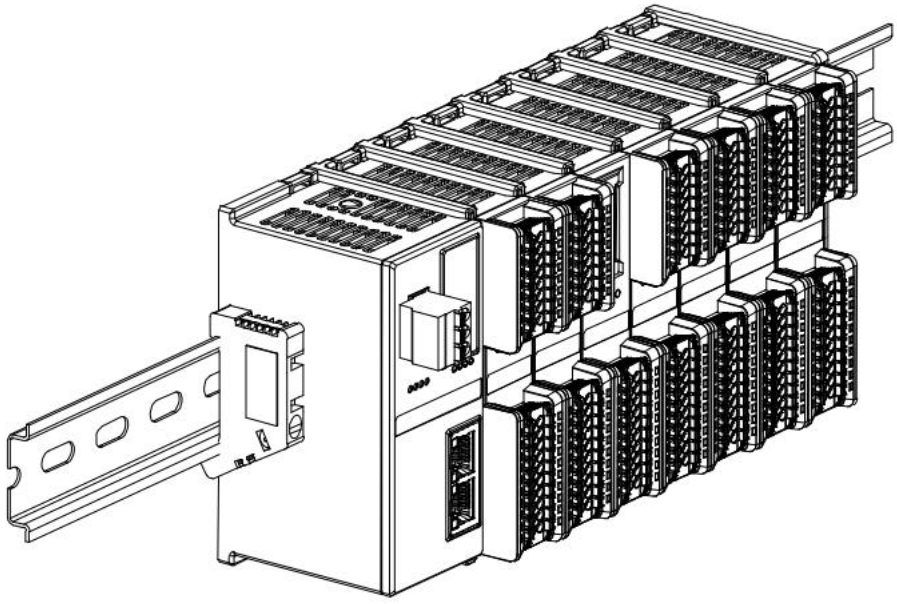
- After the end cap is installed, check whether the entire front of the module is flat to ensure that all modules and end caps are installed in place and the front is flush, as shown in Figure ⑦ below.



⑦

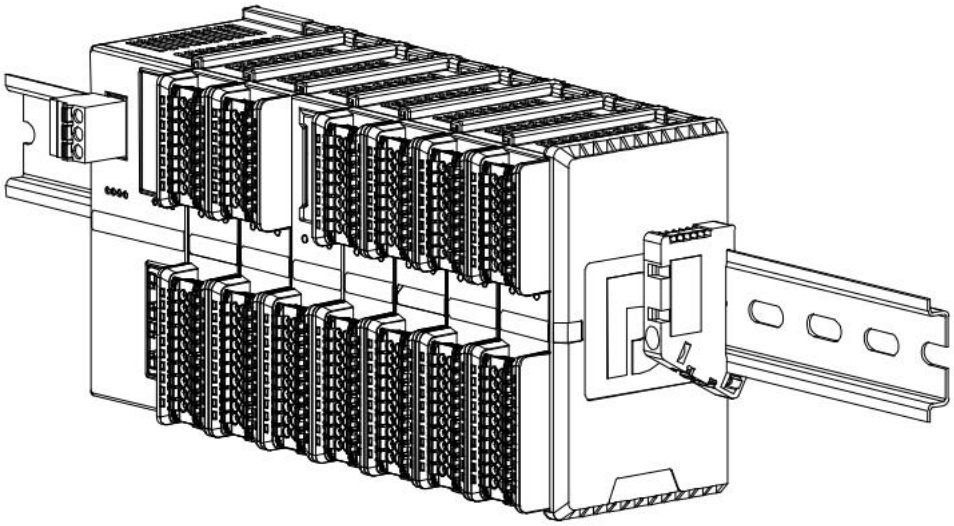
Installation of guide rail fixings

- Install and tighten the rail fixings firmly against the left side face of the coupler as shown in Figure ⑧ below.



⑧

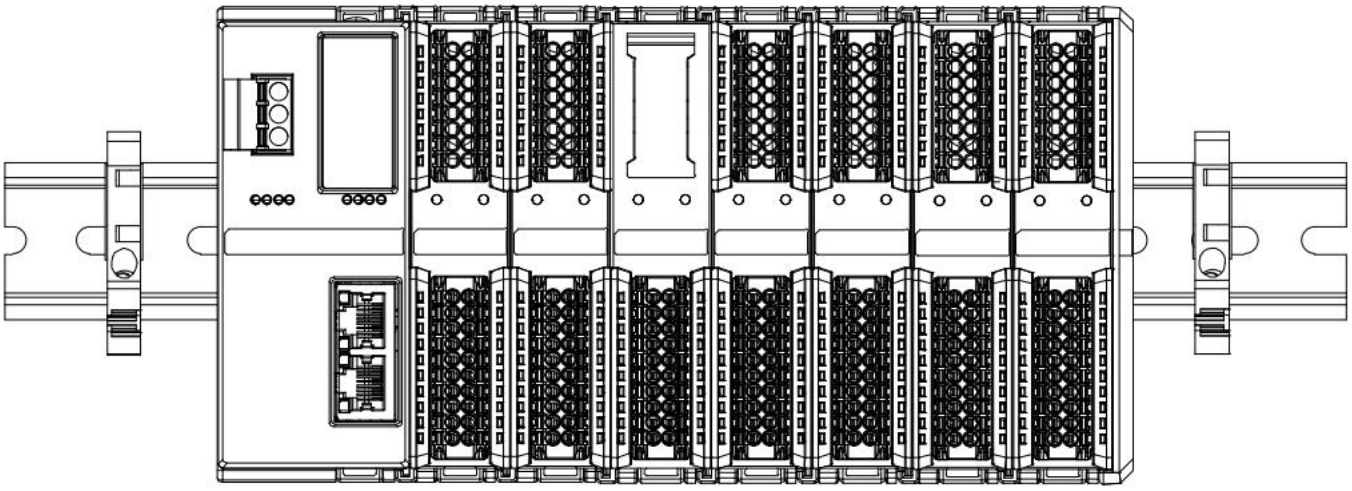
- Install the rail fixing on the right side of the end cap, first push the rail fixings firmly in the direction of the coupler to ensure that the module is installed tightly, and lock the rail fixings with a screwdriver, as shown in Figure ⑨ below.



⑨

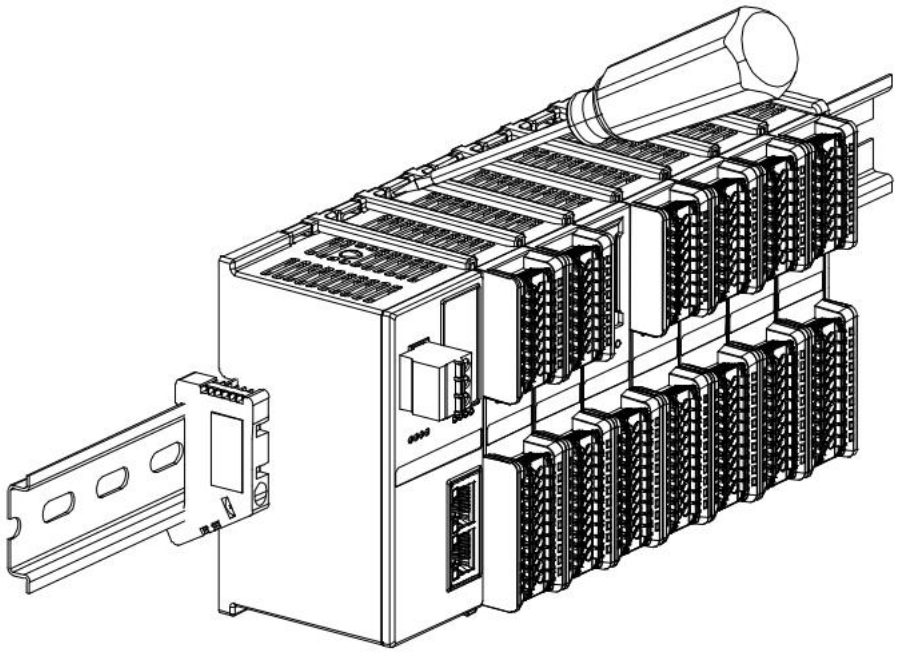
Uninstall

- Loosen the rail fixings at one end of the module with a screwdriver and move it to one side, making sure there is clearance between the module and the rail retainer, as shown in Figure ⑩ below.

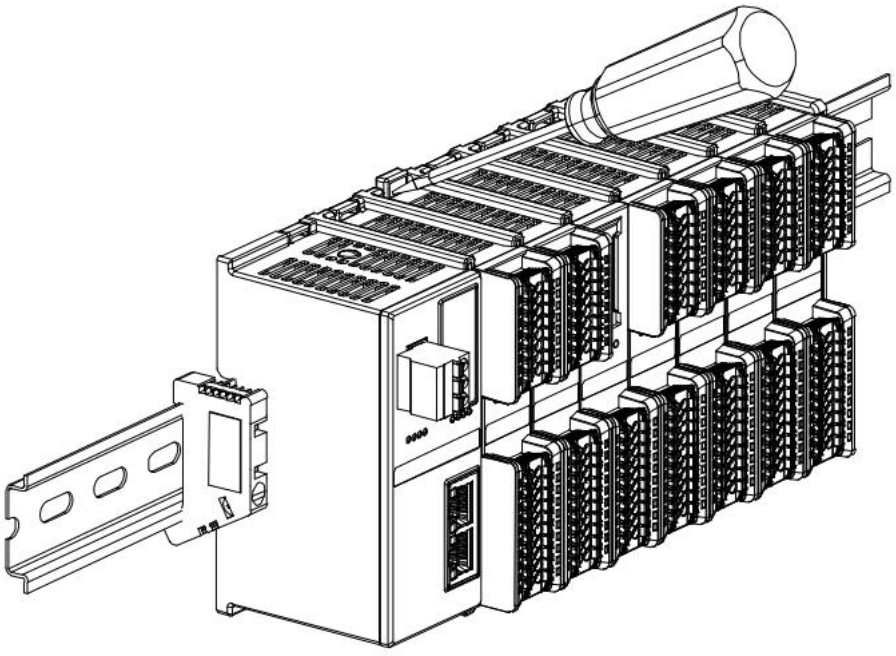


⑩

- Insert a screwdriver into the snap of the module to be installed, and apply pressure (hear the rattle) in the direction of the module sideways, as shown in the following figures ⑪ and ⑫. **Note: There is one snap on the top and bottom of each module, follow this method.**

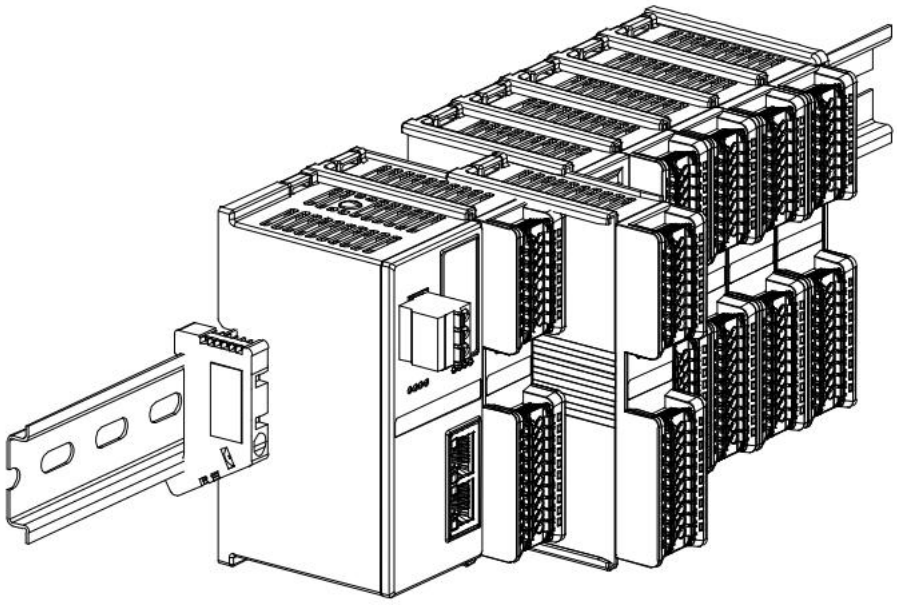


⑪



⑫

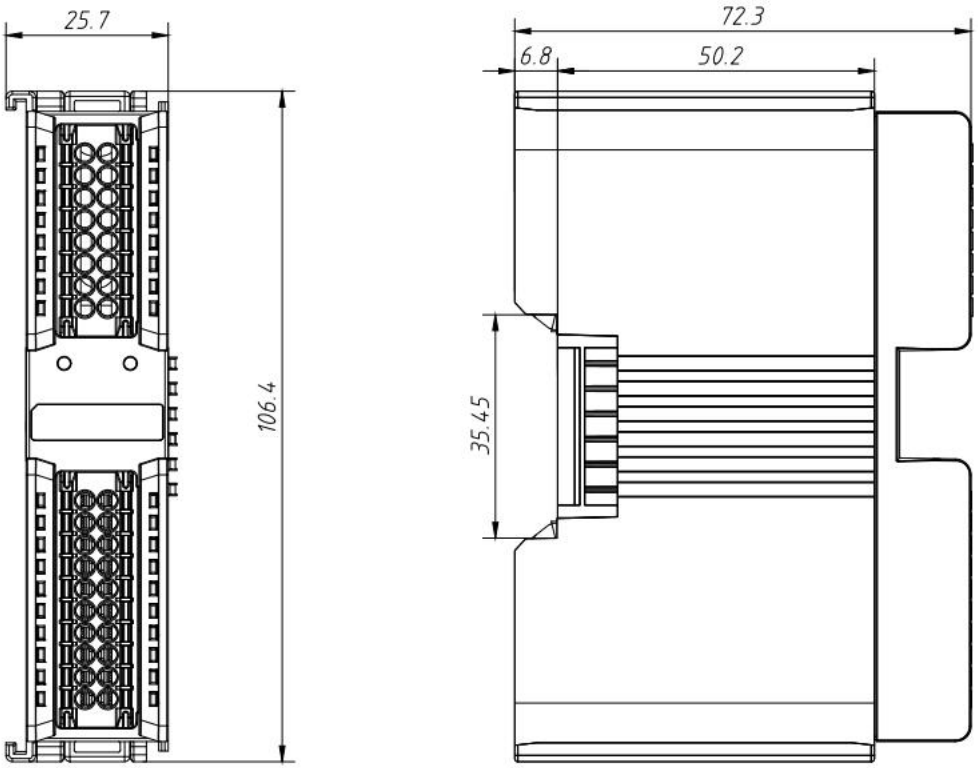
■ Uninstall the module as shown in figure ⑬ below, following the same steps as for installing the module.



⑬

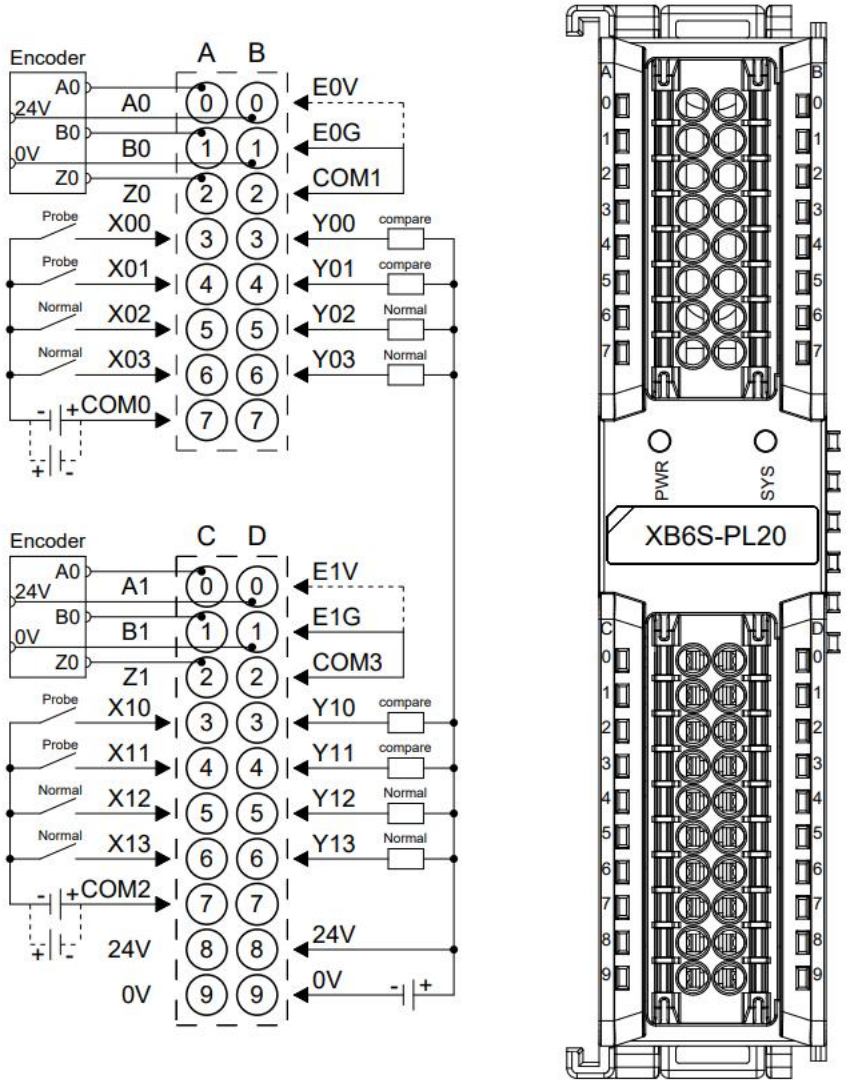
4.4 External dimensions

Form factor (unit mm)



5 Wiring

5.1 Wiring Diagram



- For personal and equipment safety, it is recommended that the power supply be disconnected during wiring operations.
- COM0 and COM2 are DI common, not internally interoperable and NPN/PNP compatible.
- COM1 and COM3 are encoder signal common, not internally interoperable and NPN/PNP compatible.
- 24V internal conduction, 0V internal conduction.

5.2 Terminal Block Definition

Encoder0					
A			B		
Terminal markings	Terminal Definition	Description	Terminal markings	Terminal Definition	Description
0	A0	ENC0_A	0	E0V	24V Encoder Power Supply
1	B0	ENC0_B	1	E0G	0V encoder power supply
2	Z0	ENC0_Z	2	COM1	ENC0 Encoder Common
3	X00	ENC0_Input0 (probe function)	3	Y00	ENC0_Output0 (compare output)
4	X01	ENC0_Input1 (probe function)	4	Y01	ENC0_Output1 (compare output)
5	X02	ENC0_Input2 Common DI	5	Y02	ENC0_Output2 common DO
6	X03	ENC0_Input3 Common DI	6	Y03	ENC0_Output3 Common DO
7	COM0	Input common COM0	7	NC	Empty terminal
Encoder1					
C			D		
Terminal markings	Terminal Definition	Description	Terminal markings	Terminal Definition	Description
0	A1	ENC1_A	0	E1V	24V Encoder Power Supply
1	B1	ENC1_B	1	E1G	0V encoder power supply
2	Z1	ENC1_Z	2	COM3	ENC1 Encoder Common
3	X10	ENC1_Input0 (probe function)	3	Y10	ENC1_Output0 (compare output)
4	X11	ENC1_Input1 (probe	4	Y11	ENC1_Output1 (compare

		function)			output)
5	X12	ENC1_Input2 Common DI	5	Y12	ENC1_Output2 Common DO
6	X13	ENC1_Input3 Common DI	6	Y13	ENC1_Output3 Common DO
7	COM2	Input common COM2	7	NC	Empty terminal
8	24V	Field side power supply 24V	8	24V	Field side power supply 24V
9	0V	Field side power supply 0V	9	0V	Field side power supply 0V

6 Operation

6.1 Process Data

6.1.1 Upstream Data

34 bytes of upstream data (17 bytes per encoder, encoder [n] takes values 0 to 1)				
Name	**Meaning**	**Range Of Values**	**Data Type**	**Lengths**
E[n] Input CH0 (Latch)	Encoder probe input signal channel 0	0: No signal input 1: With signal input	bool	1 bit
E[n] Input CH1 (Latch)	Encoder probe input signal channel 1	0: No signal input 1: With signal input	bool	1 bit
E[n] Input CH2	Encoder common input signal channel 2	0: No signal input 1: With signal input	bool	1 bit
E[n] Input CH3	Encoder common input signal channel 3	0: No signal input 1: With signal input	bool	1 bit
E[n] Latched Flag CH0	Encoder probe input channel 0 latch completion flag bit	0: 1->0 latch once, reverse once 1: 0->1 latch once, reverse once	bool	1 bit
E[n] Latched Flag CH1	Encoder probe input channel 1 latch completion flag bit	0: 1->0 latch once, reverse once 1: 0->1 latch once, reverse once	bool	1 bit
E[n] Count Value	Encoder count value	0~2^32-1	unsigned32	4 bytes

E[n] Latch Value CH0	Encoder probe input channel 0 latch value	0~2^32-1	unsigned32	4 bytes
E[n] Latch Value CH1	Encoder probe input channel 1 latch value	0~2^32-1	unsigned32	4 bytes
E[n] Speed	Encoder speed	-2^31~2^31-1	signed32	4 bytes

Upstream Data Notes:

- **Encoder Probe Input Signal Channel E[n] Input CH0/CH1 (Latch)**
  Each encoder is equipped with 2 probe input channels, indicating the presence or absence of the input signal of the corresponding probe input channel.
  When the probe input channel latch function is not turned on, it can be used as a common digital input channel.

- **Encoder Common Input Signal Channel E[n] Input CH2/CH3**
  Each encoder is equipped with 2 ordinary digital input channels, indicating the presence or absence of the corresponding DI channel input signal.

- **Encoder Probe Input Channel Latched Completion Flag Bit E[n] Latched Flag CH0/CH1**
  1 encoder with 2 probe input channels, after the probe input channel completes a latch, the flag bit will reverse 0->1 or 1->0.
  Example 1: The encoder 0 probe input channel 1 latch completion flag bit is 0. After completing one latch, the flag bit changes to 1, and after completing another latch, the flag bit changes to 0.

- **Encoder Count Value E[n] Count Value**
  The encoder count value is the current count size of the corresponding encoder, the value range is 0~2^32-1.

- **Encoder Probe Input Channel Latch Value E[n] Latch Value CH0/CH1**
  Each encoder is equipped with 2 probe input channels. By inputting a signal that meets the set conditions to the probe input channels, the current count value of the corresponding encoder can be quickly latched, so that the numerical range of the latched value is the same as that of the count value, and the numerical range is 0~2^32-1.

- **Encoder Speed E[n] Speed**
  The encoder speed is the magnitude of the pulse speed of the encoder input channel, and the value ranges from -2^31 to 2^31-1.

6.1.2 Downstream Data

Downstream command 20 bytes (10 bytes per encoder, encoder [n] takes values 0 to 1)				
Name	**Meaning**	**Range Of Values**	**Data Type**	**Lengths**
E[n] Enable	Encoder count enable	0: Disabled 1: Enabled	bool	1 bit bit0
E[n] Z Phase Clear Enable	Encoder z-phase clear enable	0: Disabled 1: Enabled	bool	1 bit bit1
E[n] Count Clear	Clear of encoder count value	0: Disabled 1: Enabled	bool	1 bit bit2
E[n] Compare Output CH0 Enable	Encoder compare output channel 0 enable	0: Disabled 1: Enabled	bool	1 bit bit3
E[n] Compare Output CH 1 Enable	Encoder compare output channel 1 enable	0: Disabled 1: Enabled	bool	1 bit bit4
E[n] Compare Output CH0 Direction	Encoder compare output channel 0 compare direction	0: Decreasing comparison 1: Incremental comparison	bool	1 bit bit5
E[n] Compare Output CH1 Direction	Encoder compare output channel 1 compare direction	0: Decreasing comparison 1: Incremental comparison	bool	1 bit bit6
E[n] Compare Output CH0 Mode	Encoder compare output channel 0 trigger mode	0: Single trigger 1: Repeat Trigger	bool	1 bit bit7
E[n] Compare Output CH1 Mode	Encoder compare output channel 1 trigger mode	0: Single trigger 1: Repeat Trigger	bool	1 bit bit0
E[n] Output CH0 (Compare)	Encoder output channel 0 (compare output)	0: Output high level 24V 1: Output low level 0V	bool	1 bit bit1
E[n] Output CH1 (Compare)	Encoder output channel 1 (compare output)	0: Output high level 24V 1: Output low level 0V	bool	1 bit bit2
E[n] Output CH2	Encoder output channel 2 (common output)	0: Output high level 24V 1: Output low level 0V	bool	1 bit bit3
E[n] Output CH3	Encoder output channel 3 (common output)	0: Output high level 24V 1: Output low level 0V	bool	1 bit bit4

E[n] Latch CH0 Enable	Encoder probe input channel 0 latch enable	0: Disabled 1: Enabled	bool	1 bit bit5
E[n] Latch CH1 Enable	Encoder probe input channel 1 latch enable	0: Disabled 1: Enabled	bool	1 bit bit6
E[n] Compare Value CH0	Encoder compare output channel 0 set value	0~2^32-1	unsigned32	4 bytes
E[n] Compare Value CH1	Encoder compare output channel 1 set value	0~2^32-1	unsigned32	4 bytes

Downside Data Notes:

- **Encoder count enable E[n] Enable**
  Encoder count enable is disabled if set to 0, and enabled if set to 1.

- **Encoder Z Phase Clear Enable E[n] Z Phase Clear Enable**
  Encoder Z-phase clear enable set to 0 is disabled, set to 1 is enabled.
  When Z-phase clear is enabled, the current count value is cleared by detecting the Z-phase signal of the encoder. For each rotation of the encoder, a Z-phase pulse is generated and the count value is cleared once.
  The physical resolution of the encoder is the number of pulses output by one rotation of the encoder, and the count ratio×physical resolution is the maximum value of single rotation count.
  z-phase clear function is on, and the count value is cleared once for each rotation of the encoder when the count value is incremented or decremented.

- **Encoder Count Clear E[n] Count Clear**
  Edge control, the corresponding encoder count value is cleared to zero when this bit is detected to be set from 0 to 1. If the initial value of the encoder count is set, the count value is also set to 0.

- **Encoder Compare Output - Channel Enable E[n] Compare Output CH0/CH1 Enable**
  The encoder compare output enable is disabled when set to 0, and enabled when set to 1.
  When the compare output channel function is not enabled, it can be used as a common digital output channel.
  Note: You must ensure that the compare output channel is not output before enabling the compare output, otherwise enabling the compare output in the output state will result in an output all the time.
  See 6.2.3 Compare Output Function for details.

- **Encoder Compare Output - Channel Compare Direction E[n] Compare Output CH0/CH1 Direction**
  The compare direction of the encoder compare output channel is set to 0 for decreasing comparison, i.e., the direction of count value from large to small; set to 1 for increasing comparison, i.e., the direction of count value from small to large.

- **Encoder Compare Output - Channel Trigger Mode E[n] Compare Output CH0/CH1 Mode**
  The encoder compare output channel trigger mode can be set to 0 (single trigger), 1 (repeat trigger).
  Single trigger, i.e., after the compare output function is enabled, the pulse output is triggered once when the count value meets the condition, after that, no more comparison is made, and the compare output is triggered again by re-enabling the compare output function.
  Repeat trigger, i.e., after the compare output function is enabled, a pulse output is triggered once when the count value meets the condition, and then the next comparison will start immediately, but the pulse output will not restart for a period of time again within the time of the compare output pulse. After a period of time is completed, the pulse output will be triggered again when the conditions of the compare output are met. For details, see 6.2.3 Compare Output Function.

- **Encoder output channel (Compare output) E[n] Output CH0/CH1 (Compare)**
  When the compare output channel function is not enabled, it can be used as a common digital output channel. Digital output (NPN type output): Setting "0" outputs high level 24V, setting "1" outputs low level 0V.
  When the compare output is established, the level of this pin will be reversed, so the invalid/valid level corresponding to the compare output can be set by setting this bit first and then enabling the compare output.

- **Encoder output channel (Common output) E[n] Output CH2/CH3**
  Digital channel output (NPN type output): Set "0" to output high level 24V, set "1" to output low level 0V.

- **Encoder Probe Input Channel Latch Enable E[n] Latch CH0/CH1 Enable**
  The latch function is enabled when the encoder input latch channel enable flag bit is set to 1, and disabled when it is set to 0.

- **Encoder Compare Output Channel Set Value E[n] Compare Output CH0/CH1 Set Value**
  The encoder compare output channel setting value is consistent with the encoder count range, which ranges from 0 to 2^32-1.
  When the compare output function is enabled, the module will compare the current count value with the set value to see if it is the same. When both the comparison direction and the comparison setting value are the same, the corresponding compare output channel will output a time-adjustable pulse. For details, see 6.2.3 compare output function.

6.2 Configuration Parameter Definitions

Module configuration has a total of 23 parameters, two encoders have 11 configuration parameters are the same and independently configured, there is one configuration parameter for the two encoders common (common parameters have been marked green in the following table), encoder 0 as an example of the introduction of configuration parameters, as shown in the table below. **Note: The configuration parameters will take effect when the encoder is enabled next time.**

Functionality	Parameter Name	Range Of Values	Default Value
Encoder 0 Pulse Mode	E0 Pulse Mode	0: ABZ (AB orthogonal)	0
		1: Pul+Dir (directional pulse)	
		2: CW/CCW (double pulse)	
Encoder 0 Filter	E0 Filter Level	0 to 15	7
Encoder 0 Count Ratio	E0 Count Ratio	MUL_1, 2, 4 (effective only in AB orthogonal mode)	MUL_1
Encoder 0 Count Range	E0 Count Range	0: 2^32 (0~2^32-1)	0
		1: Resolution x Multiple (0 ~ ring count resolution x count ratio -1, valid only in AB orthogonal mode)	
Encoder 0 Ring Count Resolution	E0 Count Resolution	0~65535	1
Encoder 0 Count Direction	E0 Count Direction	0: Forward	0
		1: Backward	
Encoder 0 Count Initial Value	E0 Initial Value	0~2^32-1	0
Encoder 0 Probe Mode	E0 Latch Mode	0: CH0 Single, CH1 Single Channel 0 Single, Channel 1 Single	0
		1: CH0 Repeat, CH1 Single Channel 0 Repeat, Channel 1 Single	
		2: CH0 Single, CH1 Repeat Channel 0 Single, Channel 1 Repeat	
		3: CH0 Repeat, CH1 Repeat Channel 0 Repeat, Channel 1 Repeat	
Encoder 0 probe trigger edge	E0 Latch Edge	0: CH0 Raising, CH1 Raising Channel 0 rising edge, Channel 1 rising edge	0
		1: CH0 Falling, CH1 Raising Channel 0 falling edge, Channel 1 rising edge	
		2: CH0 Raising, CH1 Falling Channel 0 rising edge, channel 1 falling	

		edge	
		3: CH1 Falling, CH1 Falling Channel 0 falling edge, Channel 1 falling edge	
Encoder 0 Compare Output Channel 0 Pulse Time	E0 Compare Output Time CH0	0~65535 (unit: ms)	10
Encoder 0 Compare Output Channel 1 Pulse Time	E0 Compare Output Time CH1	0~65535 (unit: ms)	10
Power-down storage enable	Power Off Storage	0: OFF	1
		1: ON	

6.2.1 Encoder count function

The encoder counting parameters include seven parameters: **encoder pulse mode**, **filter**, **count ratio**, **count range**, **ring count resolution**, **count direction** and **count initial value**.

Encoder Pulse Modes: The input pulse modes supported by the encoder counter are AB orthogonal mode, directional pulse mode and CW/CCW mode.

Encoder Filter: Encoder filter is valid in all three pulse modes, and there are 16 levels of filter (0~15), level 0 means no filter, and level 15 means the maximum degree of filter. The default encoder filter parameter is level 7, which can be configured as needed.

Encoder Count Ratio: The encoder count ratio is only valid in AB orthogonal pulse mode.

Encoder Count Range: The count range of the encoder can be set to 0~2^32-1 or 0~Ring count resolution x count ratio-1, the former is suitable for most cases, the latter is suitable for the case where the encoder does not have a Z-phase signal, but is still needed for single-turn count.

Encoder Ring Count Resolution: The ring count resolution is used to set the count range of the encoder, the setting range is 0~65535.

Note: The ring count resolution here is different from the physical resolution of the encoder itself. When the resolution is set to 0 and the count range is set to 1 i.e. 0~Ring Count Resolution x Count Multiplier -1, ring count does not take effect.

Encoder Count Direction: The default encoder counting direction is 0 for forward counting; when set to 1, the encoder will be counted in reverse direction after the encoder is re-enabled.

Encoder Count Initial Value: The count initial value of the encoder supports configuration and takes effect automatically after the encoder is re-enabled. The setting range of the count initial value is 0~2^32-1. Note: When the power-down storage function is enabled, the count initial value is invalid, and the encoder count initial values are all 0. When the count initial value is larger than the maximum value of the ring count, the ring count does not take effect.

Example 1: The encoder 0 pulse mode is set to AB orthogonal mode, the counting range of the encoder is selected from 0 to ring count resolution × count ratio -1, the ring count resolution is set to 50000, the count ratio is 4, the counting direction is forward, the initial count value is 0, then the count range is 0~200000. the module is connected to an encoder with a physical resolution of 1000, and the count starts from 0 and increases. The module is connected to an encoder with a physical resolution of 1000, after the

count starts, the count starts from 0 and increases, the encoder rotates one turn and the count value is 1000×4=4000, and after it reaches 200000, it returns to 0 and continues to count.

6.2.2 Probe Functions

The probe function parameters include two parameters: **probe mode** and **probe trigger edge**. Each encoder is equipped with two probe input channels. By inputting the corresponding signals to the probe input channels, the count value of the corresponding encoder can be latched.

Probe Mode: The Probe Mode parameter can be configured for single/continuous mode for each probe function channel of the encoder.

If the probe function channel is configured as single mode, the count value can be latched once when the channel inputs a signal that meets the set condition after the probe function is enabled; the subsequent input of a signal that meets the set condition again will no longer be latched unless the probe function channel is re-enabled.

If the probe function channel is configured as continuous mode, after the probe function is enabled, each time the channel inputs a signal that meets the set conditions, the count value can be latched once, which can be latched several times.

Probe Trigger Edge: The Probe Trigger Edge parameter allows to configure each probe function channel of the encoder to be triggered on the rising/falling edge. The latch trigger signals of the two probe channels of each encoder can be configured individually, and the latch values can be displayed separately.

The probe input channel is compatible with PNP/NPN signals through the COM terminal. When the COM terminal is connected to 0V, the input signal is PNP type, the input high level 24V signal is valid, the input low level 0V signal is invalid; when the COM terminal is connected to 24V, the input signal is NPN type, the input low level 0V signal is valid, the input high level 24V signal is invalid.

Raising edge triggering indicates that the probe input channel is triggered from an invalid signal to a valid signal, and falling edge triggering indicates that it is triggered from a valid signal to an invalid signal.

6.2.3 Compare Output Function

Compare output function is configured by the compare output channel enable, compare output set value, compare direction, single/repeat trigger mode and compare output channel pulse time. When the encoder count value reaches the set value and the compare direction is satisfied, the corresponding compare output channel will output a pulse with adjustable time, and the adjustable time is the compare output pulse time. The pulse response speed of the compare output function can reach 10us level.

Compare output function configuration parameters include **encoder compare output channel pulse time**, configurable time range is 0~65535ms.

Each encoder is equipped with 2 compare output channels. Compare output channel enable, compare output set value, compare direction and single/repeat trigger mode can be set in the downstream data. When the compare output channel function is not enabled, the compare output channels can be used as common digital outputs.

Example 1: When the compare output channel 1 of encoder 0 is used as a common digital output, the output value is set to 0 (NPN type output, at which time the output is 24V), and the channel indicator is off.

The set value of the compare output channel 1 of encoder 0 is set to 1000, the compare direction is set to incremental comparison, the compare output trigger mode is single trigger, the pulse time of the compare output channel 1 is configured as 5s, after the function of the compare output channel 1 is enabled, when the count value of the encoder 0 reaches 1000 from small to large (to satisfy the compare direction), the compare output channel 1 will be outputted as the compare output channel, the state is reversed, from the original high level output to low level output, the pulse output time is 5s, the channel indicator light will be on for 5s. 5 seconds later the high level output is restored, the channel indicator light is off. When the count value meets the set value of compare output and the compare direction again, the compare output channel does not react because the trigger mode of compare output is single trigger.

Example 2: When the compare output channel 1 of encoder 0 is used as a common digital output, the output value is set to 1 (NPN type output, at which time the output is 0V), and the channel indicator is on.

Encoder 0 compare output channel 1 set value is set to 1000, the compare direction is set to decreasing comparison, the compare output trigger mode is repeat trigger, the compare output channel 1 pulse time is configured to 5s, the compare output channel 1 function is enabled, when the count value of encoder 0 reaches 1000 from small to large (does not satisfy the compare direction), the compare output channel 1 has no reaction; when the count value of encoder 0 When the count value of encoder 0 reaches 1000 from large to small (to satisfy the comparison direction), the compare output channel will be output as a compare output channel, and the state will be reversed from the original low level output to high level output, the pulse output time is 5s, and the channel indicator will be off for 5s. 5 seconds later, the low level output will be restored, and the channel indicator is on.

compare output trigger mode is repeat trigger, pulse output time 5s within the count value again to meet the compare output set value and compare direction, the compare output channel will not change the pulse output state, still continue to complete the 5s pulse output. 5s to meet the conditions of the comparison again, the state will be reversed again, from the original high level output to a low level

output, the pulse output time of 5s, the channel indicator will be off for 5s. compare output is triggered repeatedly and so on.

6.2.4 Power-Down Storage Function

When the power-down storage enable parameter is turned on, the encoder count value can be stored in case of system power failure. The default value is 1 to enable the power-down storage function, and 0 to disable the power-down storage function.

When the power-down storage function is enabled, the initial value of the encoder count is invalid and the initial values of the encoder counts are all 0.

6.3 Application Cases

- **Encoder 0 Input AB orthogonal pulses, 40,000 pulses , Encoder 0 probe input channel 0 for latching**
  a. Configure the configuration parameters;
     a) The Encoder 0 Pulse Mode is set to AB Orthogonal Pulse Mode, i.e., E0 Pulse Mode is set to 0: ABZ;
     b) The Encoder 0 Count Ratio is set to 4x, i.e. E0 Count Ratio is set to MUL_4;
     c) The Encoder 0 Count Range is set to 0~Ring Count Resolution x Count Multiple-1, i.e., E0 Count Range is set to 1: Resolution x Multiple;
     d) Encoder 0 Ring Count Resolution is set to 20000, i.e. E0 Count Resolution is set to 20000;
     e) The Encoder 0 Count Direction is set to Forward Count, i.e. E0 Count Direction is set to 0: Forward;
     f) The Encoder 0 Count Initial Value is set to 0, i.e., E0 Initial Value is set to 0;
     g) Encoder 0 Probe Mode is set to Channel 0 Single, Channel 1 Single, i.e. E0 Latch Mode is set to 0: CH0 Single, CH1 Single;
     h) The Encoder 0 Probe Trigger Edge is set to Channel 0 Raising Edge, Channel 1 Raising Edge, i.e. E0 Latch Edge is set to 0: CH0 Raising, CH1 Raising;
  b. Set the encoder 0 count enable and the encoder 0 probe input channel 0 latch enabled;
     a) Downstream Data E0 Enable is set to 1;
     b) Downstream Data E0 Latch CH0 Enable is set to 1;
  c. Encoder 0 starts to input pulses and Encoder 0 probe input channel 0 inputs a valid signal.

- **Encoder 0 input directional pulses, number of pulses 40,000, encoder 0 compare output channel 0 for compare outputs**
  a. Configure the configuration parameters;
     a) The Encoder 0 Pulse Mode is set to Direction Pulse Mode, i.e. E0 Pulse Mode is set to 1: Pul+Dir;
     b) The Encoder 0 Count Range is set to 0~2^32-1, i.e., the E0 Count Range is set to 0:2^32;
     c) The Encoder 0 Count Direction is set to Forward Count, i.e. E0 Count Direction is set to 0: Forward;
     d) The Encoder 0 Count Initial Value is set to 0, i.e., E0 Initial Value is set to 0;
     e) The Encoder 0 Compare Output Channel 0 pulse time is set to 10s, i.e. E0 Compare Output Time CH0 is set to 10000;
  b. Set encoder 0 count enable, and encoder 0 compare output channel 0 sets and enables the compare set value, compare direction, and compare mode;
     a) Downstream Data E0 Enable is set to 1;
     b) Downstream Data E0 Compare Value CH0 is set to 1000;
     c) Downstream Data E0 Compare Output CH0 Direction set to 1 Incremental Compare;
     d) Downstream Data E0 Compare Output CH0 Mode is set to 1 Repeat Trigger;
     e) Downstream Data E0 Compare Output CH0 Enable is set to 1 to enable;
  c. Encoder 0 starts inputting pulses.

6.4 Module Configuration Description

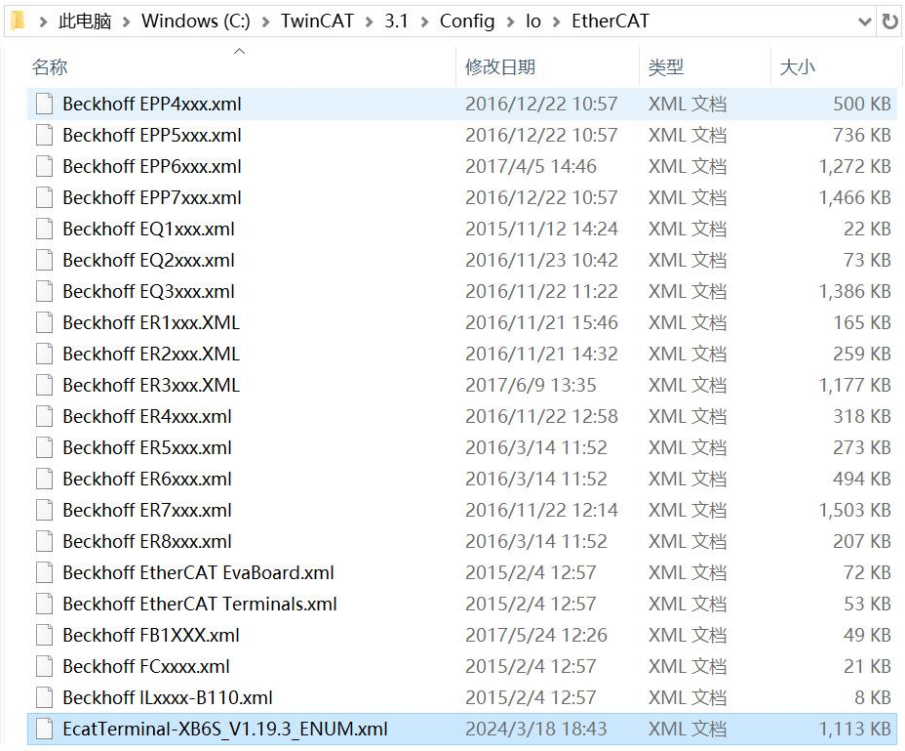
6.4.1 Application in TwinCAT3 software environment

1、Preliminary

- **Hardware Environment**
  - **Module Model XB6S-PL20**
  - **EtherCAT Coupler, End Cap**
    This description uses the XB6S-EC2002 coupler as an example
  - **A computer with pre-installed TwinCAT3 software**
  - **Shielded cables for EtherCAT**
  - **This description takes the connection of the XB6S-PT04A module as an example**
  - **Encoders and other devices**
  - **One switching power supply**
  - **Module installation rails and rail fixings**
  - **Device Configuration Files**
    Configuration file access: https://www.solidotech.com/documents/configfile
- **Hardware configuration and wiring**
  Follow "4 Installation and uninstall" and "5 Wiring".

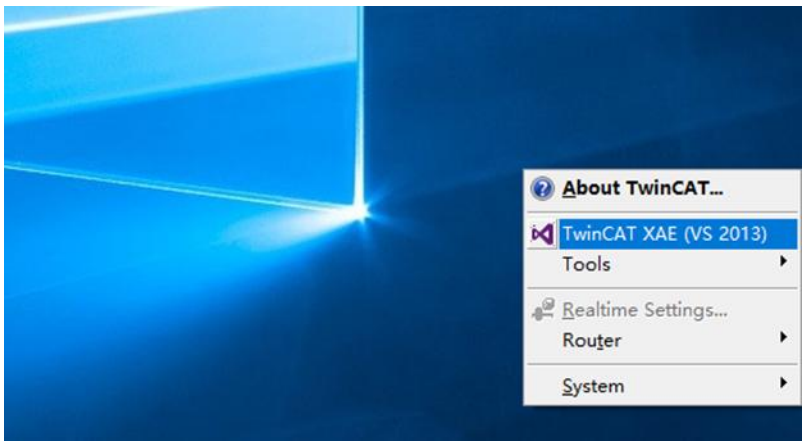
2、Preset Profiles

Place the ESI configuration file (EcatTerminal-XB6S_V1.19.3_ENUM.xml) in the TwinCAT installation directory under "C:\TwinCAT\3.1\Config\Io\EtherCAT" as shown below.

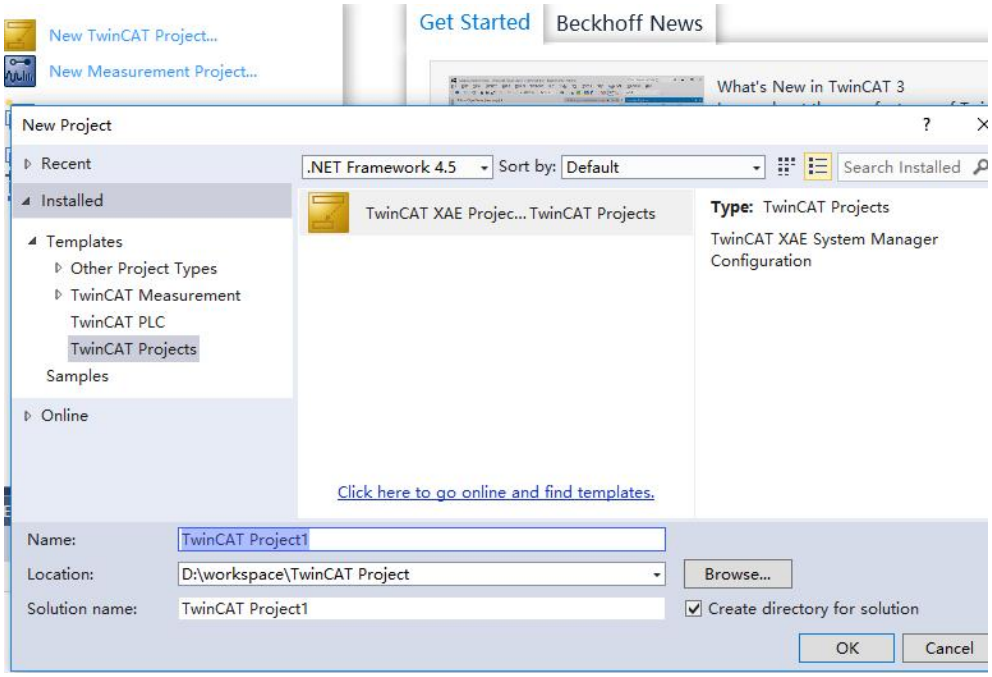


3、Create Project

a. Click the TwinCAT icon in the lower right corner of the desktop and select "TwinCAT XAE (VS xxxx)" to open the TwinCAT software as shown below.

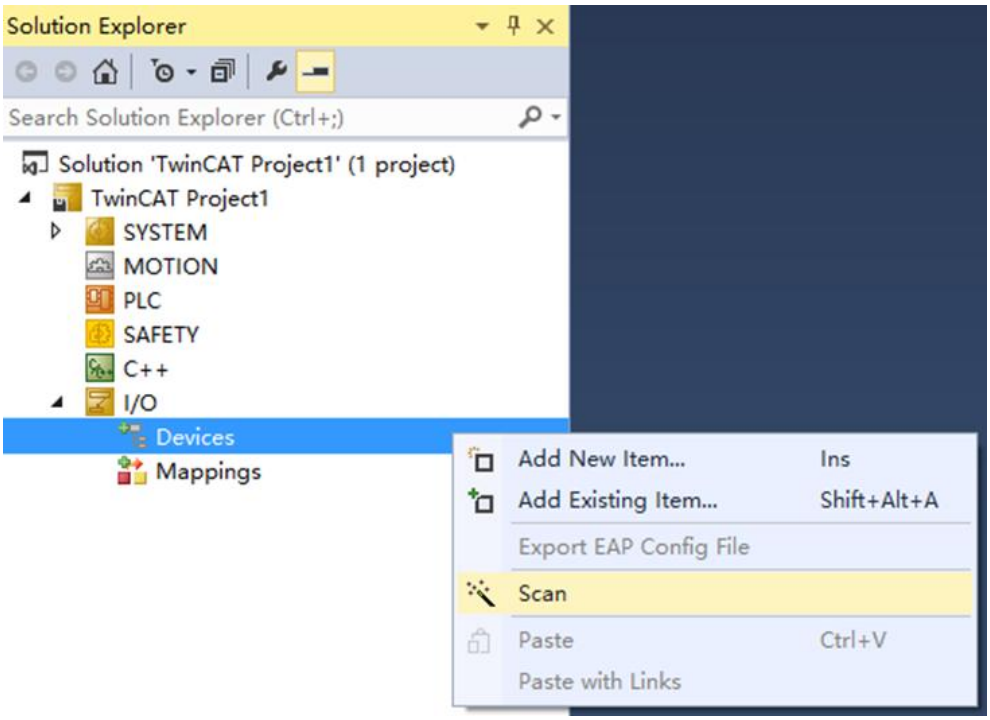


b. Click "New TwinCAT Project", in the pop-up window, "Name" and "Solution name" correspond to the project name and solution name, respectively, and "Location" corresponds to the project path, and these three items can be selected by default, then click "OK", the project is created successfully, as shown in the following figure.

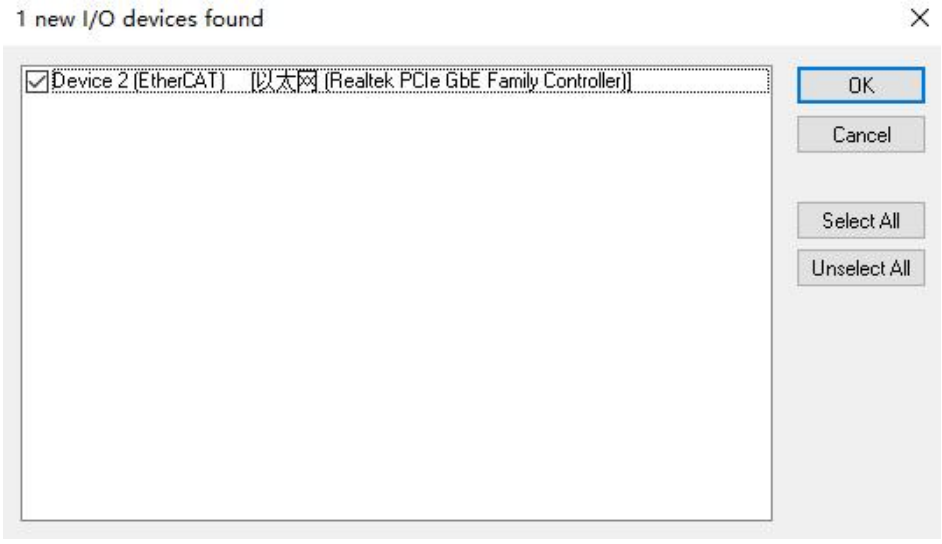


4、Scanning device

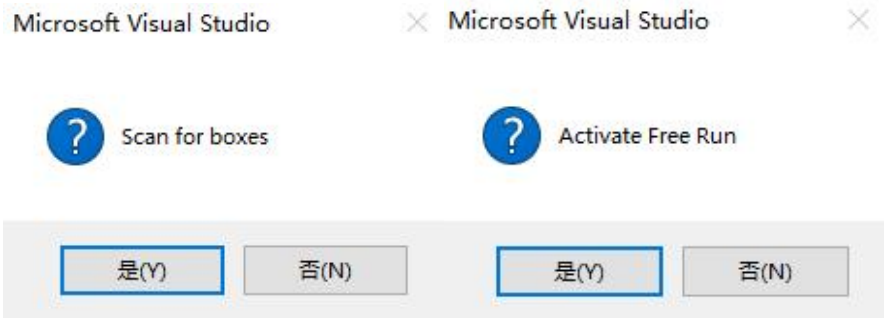
a. After creating the project, right-click on the "Scan" option under "I/O -> Devices" to perform a slave device scan, as shown in the following figure.



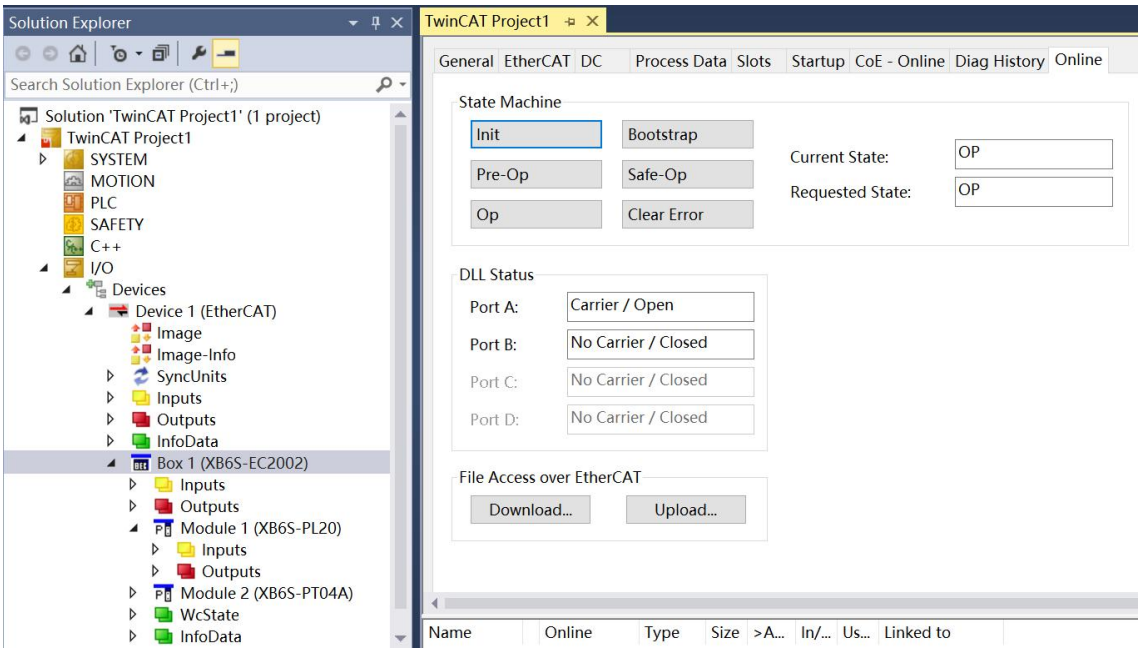
b. Check the "Local Connection" box, as shown in the following figure.



c. Click on the pop-up window "Scan for boxes" and select "Yes"; click on the pop-up window "Activate Free Run" and select "Yes". "Yes", as shown in the figure below.

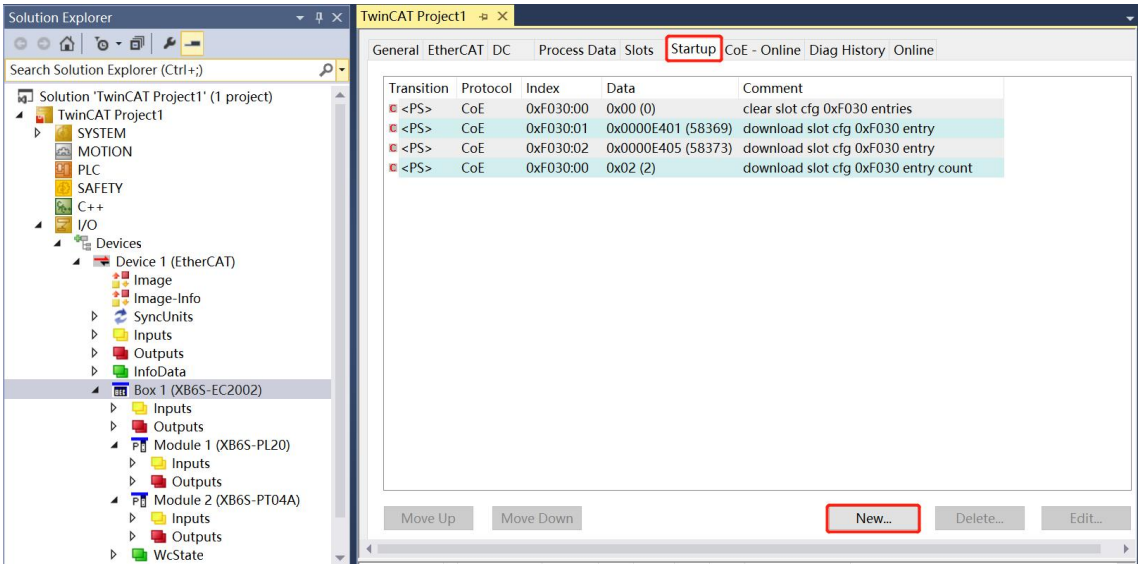


d. After scanning to the device, you can see Box1 (XB6S-EC2002) and Module 1 (XB6S-PL20) in the left navigation tree, and you can see that TwinCAT is in the "OP" state at "Online". You can observe that the RUN indicator of the slave device is always on, as shown in the figure below.

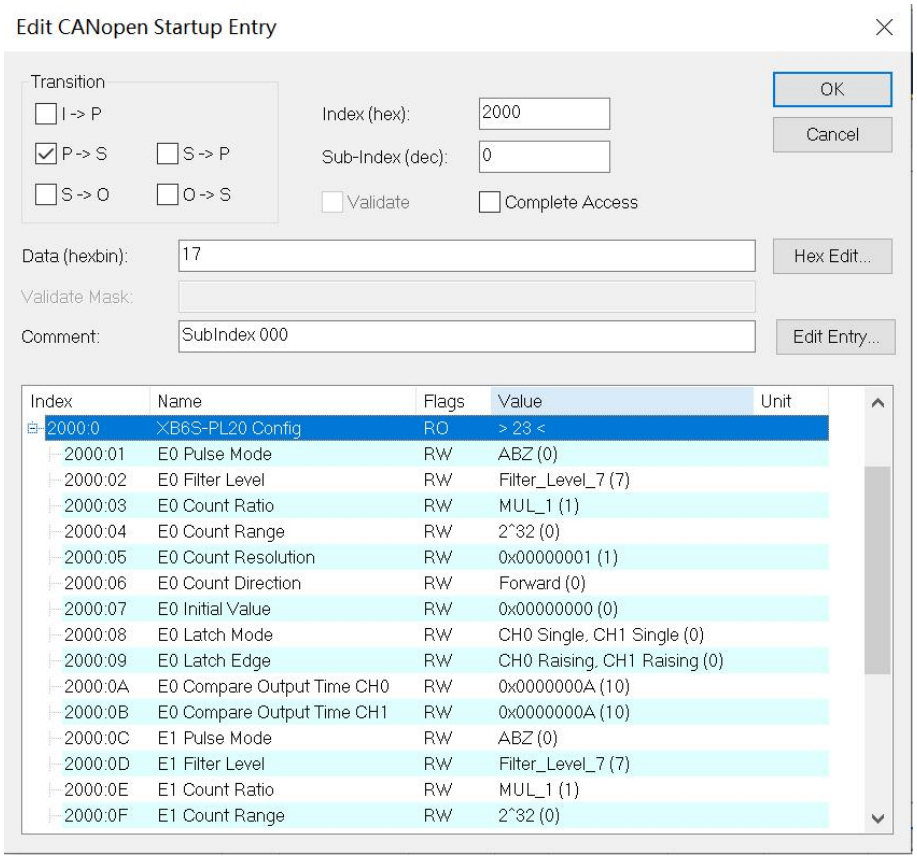


5、Validating Basic Functions

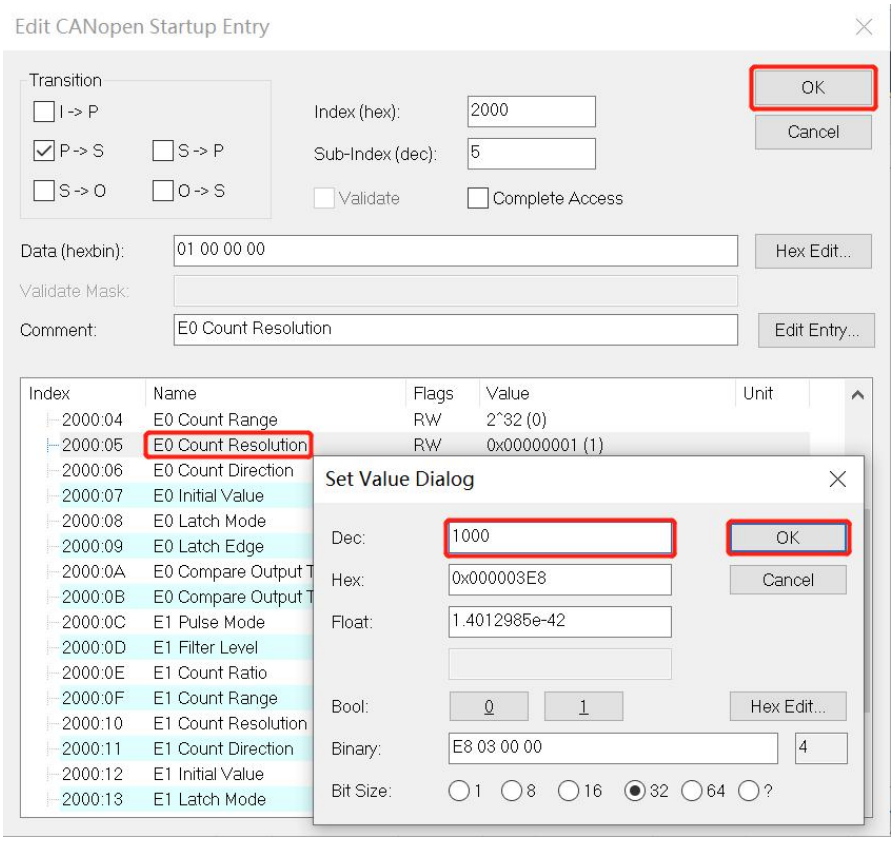
a. Click "Box1 -> Startup -> New" in the left navigation tree to enter the configuration parameter editing page, as shown in the following figure.



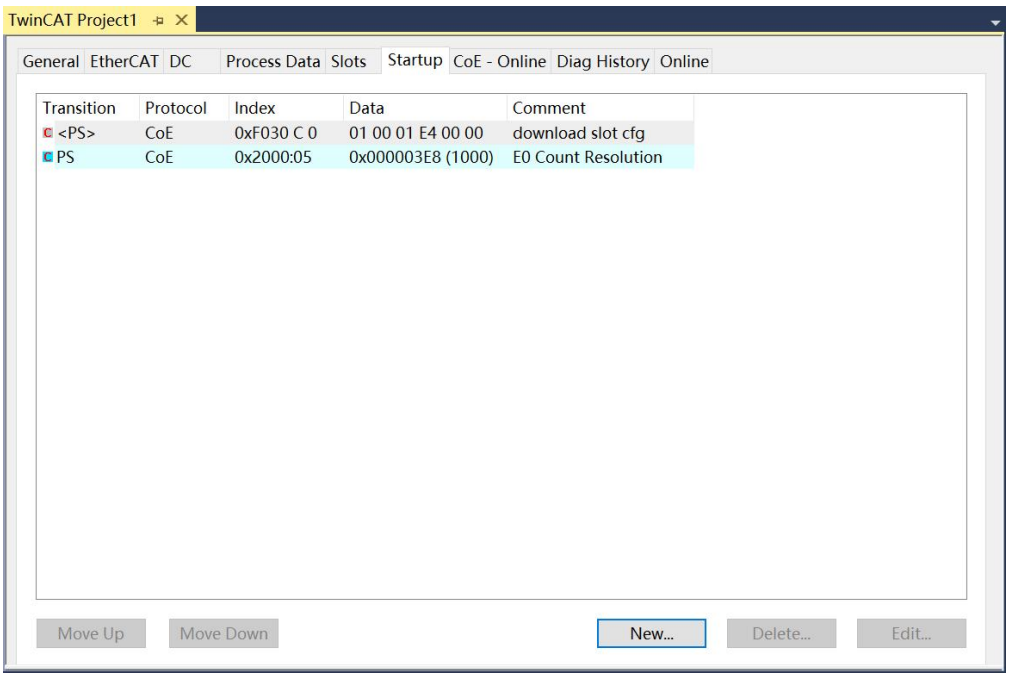
b. In the Edit CANopen Startup Entry pop-up window, click the "+" in front of Index 2000:0 to expand the configuration parameter menu, you can see 23 configuration parameters, click on any one of the parameters, you can set the relevant configuration, as shown in the following figure.



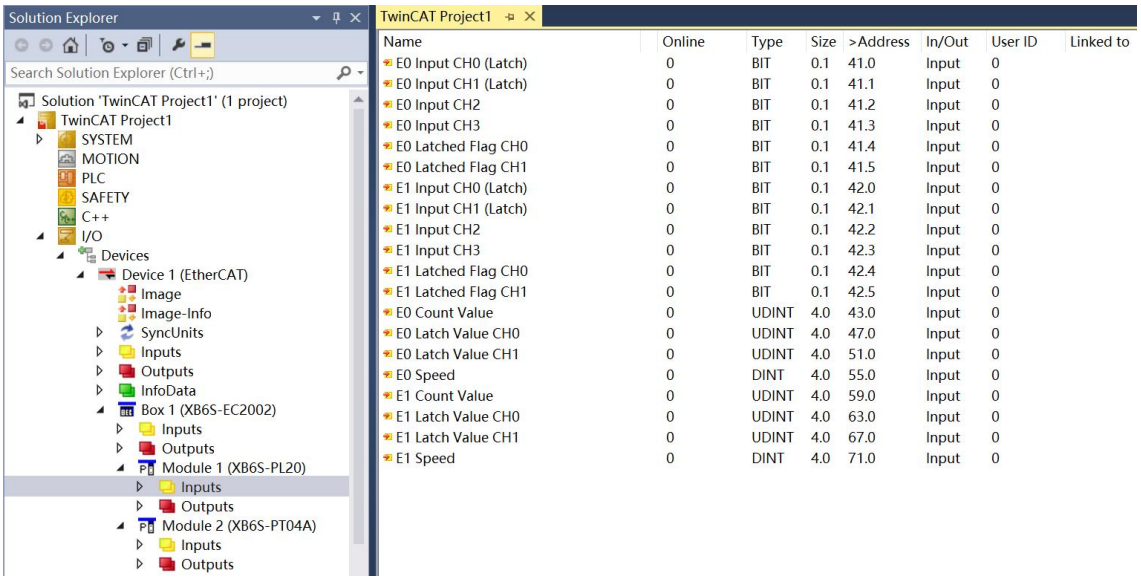
c. For example, to modify the encoder 0 ring count resolution parameter, you can double-click "E0 Count Resolution" to modify the parameter value, as shown in the following figure.



d. After the parameter modification is completed, you can see the modified parameter items and parameter values under Startup, as shown in the following figure. After the parameter setting is completed, it is necessary to carry out Reload operation and re-power up the module to realize that the master station automatically sends down the parameter setting.

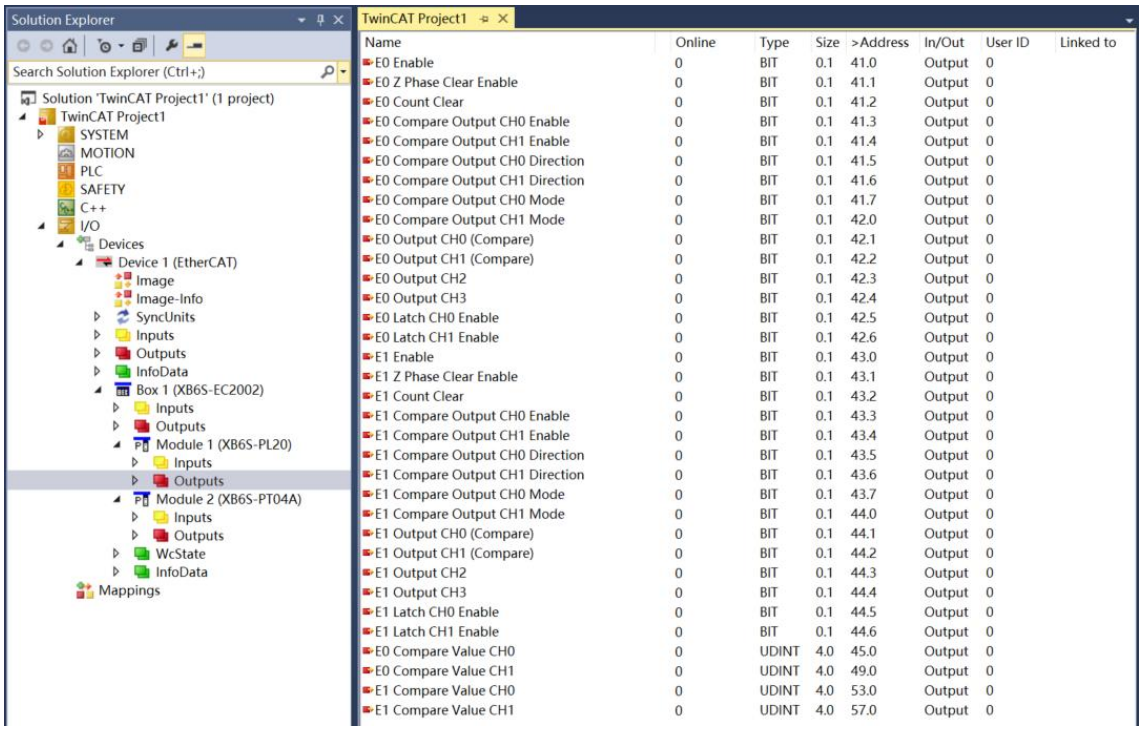


e. The left navigation tree "Module 1 -> Inputs" displays the module's upstream data, which is used to monitor the module's inputs, as shown in the following figure.



Name	Online	Type	Size	>Address	In/Out	User ID	Linked to
E0 Input CH0 (Latch)	0	BIT	0.1	41.0	Input	0	
E0 Input CH1 (Latch)	0	BIT	0.1	41.1	Input	0	
E0 Input CH2	0	BIT	0.1	41.2	Input	0	
E0 Input CH3	0	BIT	0.1	41.3	Input	0	
E0 Latched Flag CH0	0	BIT	0.1	41.4	Input	0	
E0 Latched Flag CH1	0	BIT	0.1	41.5	Input	0	
E1 Input CH0 (Latch)	0	BIT	0.1	42.0	Input	0	
E1 Input CH1 (Latch)	0	BIT	0.1	42.1	Input	0	
E1 Input CH2	0	BIT	0.1	42.2	Input	0	
E1 Input CH3	0	BIT	0.1	42.3	Input	0	
E1 Latched Flag CH0	0	BIT	0.1	42.4	Input	0	
E1 Latched Flag CH1	0	BIT	0.1	42.5	Input	0	
E0 Count Value	0	UDINT	4.0	43.0	Input	0	
E0 Latch Value CH0	0	UDINT	4.0	47.0	Input	0	
E0 Latch Value CH1	0	UDINT	4.0	51.0	Input	0	
E0 Speed	0	DINT	4.0	55.0	Input	0	
E1 Count Value	0	UDINT	4.0	59.0	Input	0	
E1 Latch Value CH0	0	UDINT	4.0	63.0	Input	0	
E1 Latch Value CH1	0	UDINT	4.0	67.0	Input	0	
E1 Speed	0	DINT	4.0	71.0	Input	0	

f. The left navigation tree "Module 1 -> Outputs" displays the downstream data of the module, which is used to control the outputs of the module, as shown in the following figure.



Name	Online	Type	Size	>Address	In/Out	User ID	Linked to
E0 Enable	0	BIT	0.1	41.0	Output	0	
E0 Z Phase Clear Enable	0	BIT	0.1	41.1	Output	0	
E0 Count Clear	0	BIT	0.1	41.2	Output	0	
E0 Compare Output CH0 Enable	0	BIT	0.1	41.3	Output	0	
E0 Compare Output CH1 Enable	0	BIT	0.1	41.4	Output	0	
E0 Compare Output CH0 Direction	0	BIT	0.1	41.5	Output	0	
E0 Compare Output CH1 Direction	0	BIT	0.1	41.6	Output	0	
E0 Compare Output CH0 Mode	0	BIT	0.1	41.7	Output	0	
E0 Compare Output CH1 Mode	0	BIT	0.1	42.0	Output	0	
E0 Output CH0 (Compare)	0	BIT	0.1	42.1	Output	0	
E0 Output CH1 (Compare)	0	BIT	0.1	42.2	Output	0	
E0 Output CH2	0	BIT	0.1	42.3	Output	0	
E0 Output CH3	0	BIT	0.1	42.4	Output	0	
E0 Latch CH0 Enable	0	BIT	0.1	42.5	Output	0	
E0 Latch CH1 Enable	0	BIT	0.1	42.6	Output	0	
E1 Enable	0	BIT	0.1	43.0	Output	0	
E1 Z Phase Clear Enable	0	BIT	0.1	43.1	Output	0	
E1 Count Clear	0	BIT	0.1	43.2	Output	0	
E1 Compare Output CH0 Enable	0	BIT	0.1	43.3	Output	0	
E1 Compare Output CH1 Enable	0	BIT	0.1	43.4	Output	0	
E1 Compare Output CH0 Direction	0	BIT	0.1	43.5	Output	0	
E1 Compare Output CH1 Direction	0	BIT	0.1	43.6	Output	0	
E1 Compare Output CH0 Mode	0	BIT	0.1	43.7	Output	0	
E1 Compare Output CH1 Mode	0	BIT	0.1	44.0	Output	0	
E1 Output CH0 (Compare)	0	BIT	0.1	44.1	Output	0	
E1 Output CH1 (Compare)	0	BIT	0.1	44.2	Output	0	
E1 Output CH2	0	BIT	0.1	44.3	Output	0	
E1 Output CH3	0	BIT	0.1	44.4	Output	0	
E1 Latch CH0 Enable	0	BIT	0.1	44.5	Output	0	
E1 Latch CH1 Enable	0	BIT	0.1	44.6	Output	0	
E0 Compare Value CH0	0	UDINT	4.0	45.0	Output	0	
E0 Compare Value CH1	0	UDINT	4.0	49.0	Output	0	
E1 Compare Value CH0	0	UDINT	4.0	53.0	Output	0	
E1 Compare Value CH1	0	UDINT	4.0	57.0	Output	0	

Examples of Module Functions

- **Encoder 0 input AB orthogonal pulses, 40,000 pulses, encoder 0 probe input channel 0 for latching**

a. Configure the configuration parameters as shown below.

a) The Encoder 0 Pulse Mode is set to AB orthogonal Pulse Mode, i.e., E0 Pulse Mode is set to 0: ABZ;

b) The Encoder 0 Count Ratio is set to 4x, i.e. E0 Count Ratio is set to MUL_4;

c) The Encoder 0 Count Range is set to 0 to Ring Count Resolution x Count Multiple - 1, i.e., E0 Count Range is set to 1: Resolution x Multiple;

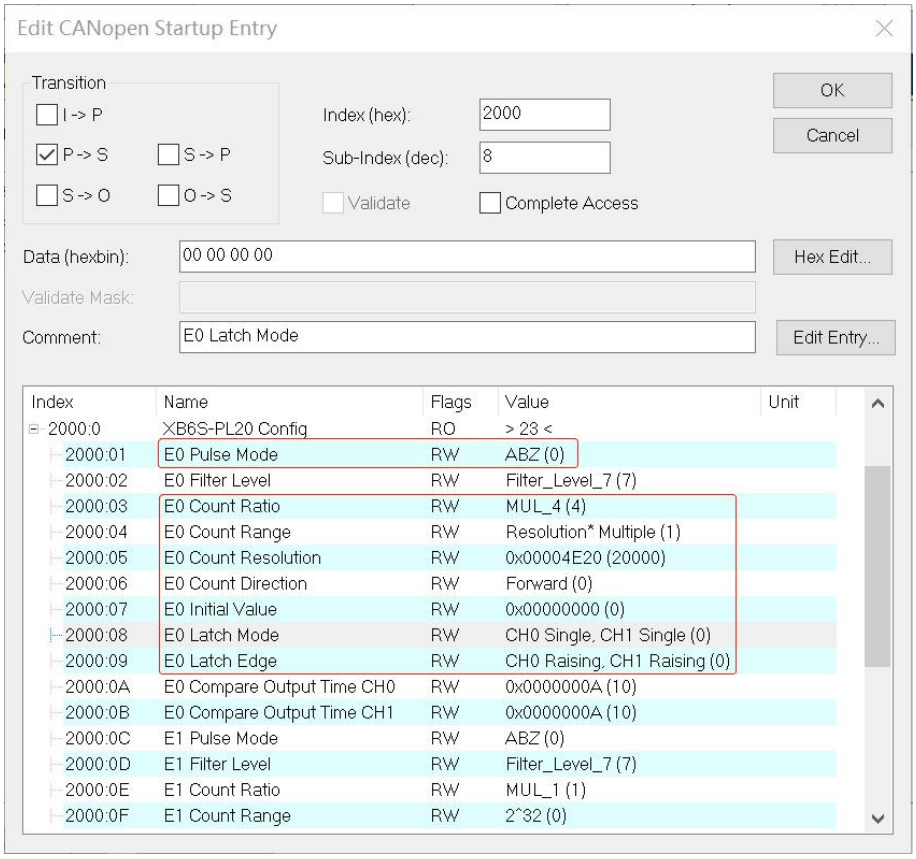
d) Encoder 0 Ring Count Resolution is set to 20000, i.e. E0 Count Resolution is set to 20000;

e) The Encoder 0 Count Direction is set to Forward Count, i.e. E0 Count Direction is set to 0: Forward;

f) The Encoder 0 Count Initial Value is set to 0, i.e., E0 Initial Value is set to 0;

g) Encoder 0 Probe Mode is set to Channel 0 Single, Channel 1 Single, i.e. E0 Latch Mode is set to 0: CH0 Single, CH1 Single;

h) The Encoder 0 Probe Trigger Edge is set to Channel 0 Raising Edge, Channel 1 Raising Edge, i.e. E0 Latch Edge is set to 0: CH0 Raising, CH1 Raising.

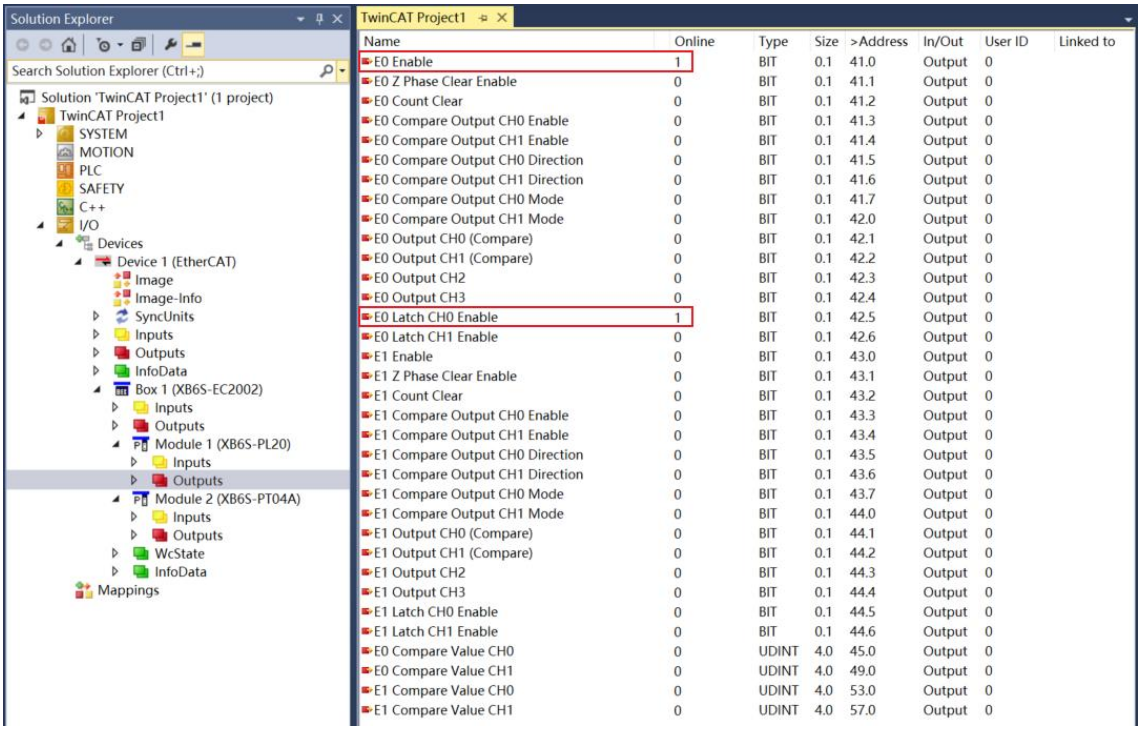


After the parameter setting is completed, Reload operation and module re-powering are required to realize the master station automatically sends down the parameter setting.

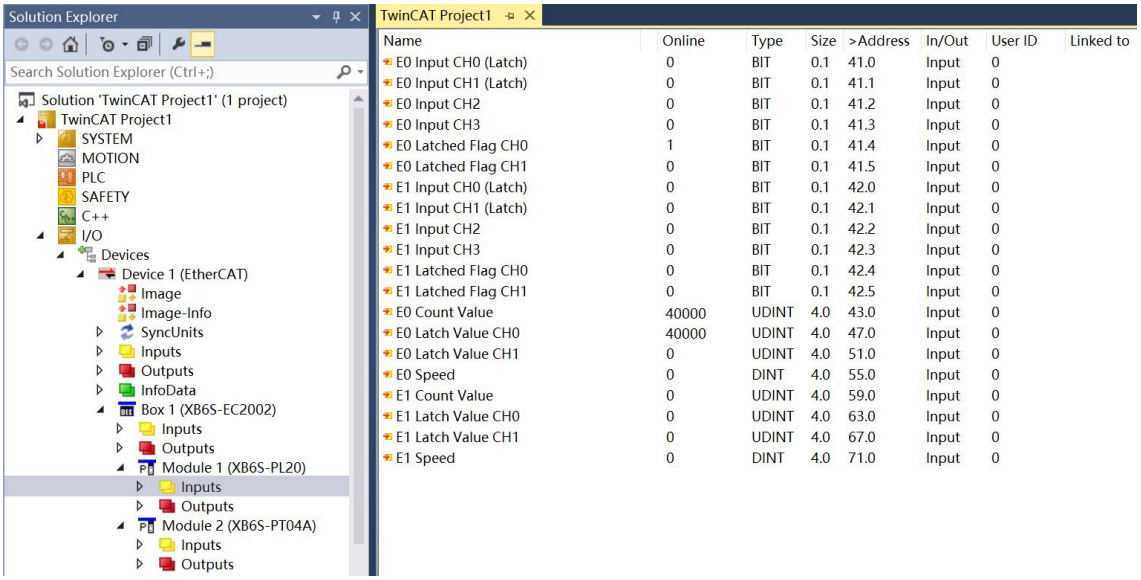
b. Set the encoder 0 count enable and the encoder 0 probe input channel 0 latch enable as shown below.

a) Downstream Data E0 Enable is set to 1;

b) Downstream Data E0 Latch CH0 Enable is set to 1.



c. Encoder 0 starts to input 40000 pulses, after the pulse counting is completed, encoder 0 probe input channel 0 inputs a valid signal, encoder 0 counts the value of 40000, probe input channel 0 latches the value of 40000, and the encoder probe input channel 0 latches the value of the completion flag bit value reversed once to 1, as shown in the following figure.



- **Encoder 0 input directional pulses, number of pulses 40,000, encoder 0 compare output channel 0 for compare outputs**

a. Configure the configuration parameters as shown below.

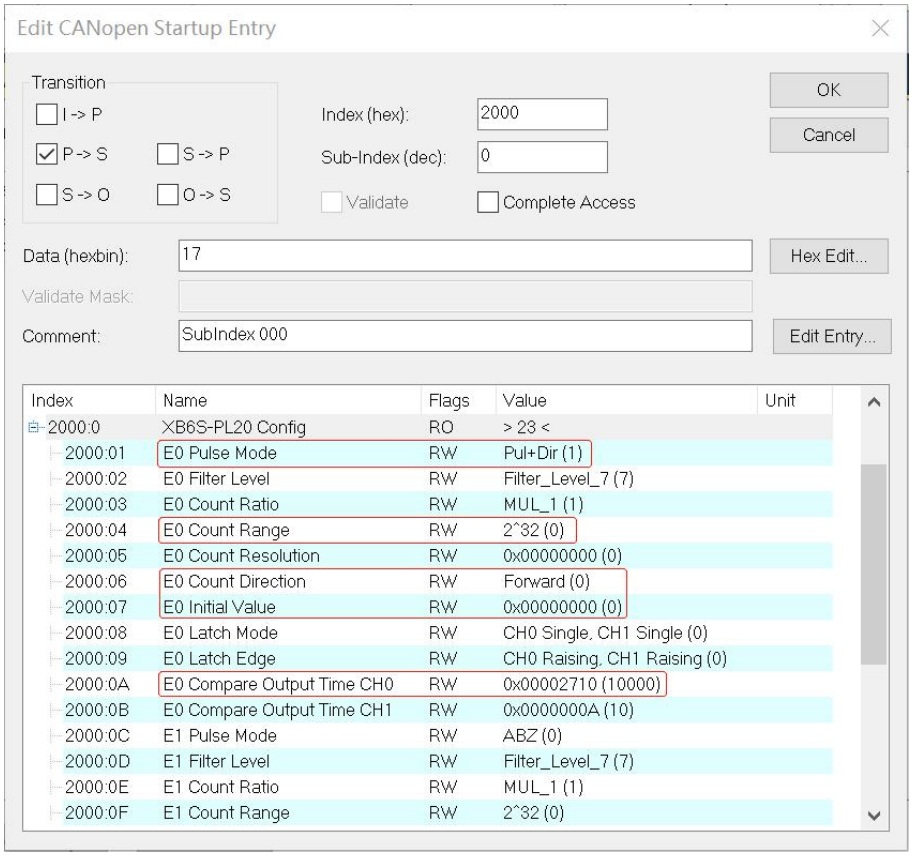
a) The Encoder 0 Pulse Mode is set to Direction Pulse Mode, i.e. E0 Pulse Mode is set to 1: Pul+Dir;

b) The Encoder 0 Count Range is set to 0~2^32-1, i.e., the E0 Count Range is set to 0:2^32;

c) The Encoder 0 Count Direction is set to Forward Count, i.e. E0 Count Direction is set to 0: Forward;

d) The Encoder 0 Count Initial Value is set to 0, i.e., E0 Initial Value is set to 0;

e) The Encoder 0 Compare Output Channel 0 pulse time is set to 10s, i.e. E0 Compare Output Time CH0 is set to 10000.



After the parameter setting is completed, Reload operation and module re-powering are required to realize the master station automatically sends down the parameter setting.

b. Set the encoder 0 count enable, and the encoder 0 compare output channel 0 sets the compare set value, compare direction, and compare mode and enables them as shown below.

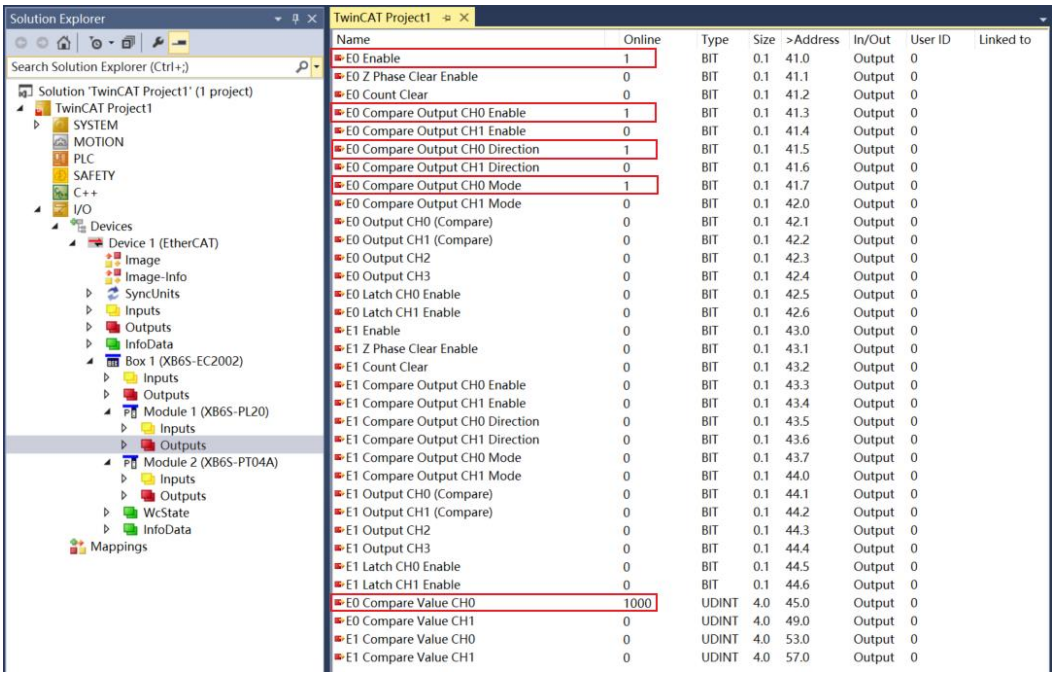
a) Downstream Data E0 Enable is set to 1;

b) Downstream Data E0 Compare Value CH0 is set to 1000;

c) Downstream Data E0 Compare Output CH0 Direction set to 1 Incremental Compare;

d) Downstream Data E0 Compare Output CH0 Mode is set to 1 Repeat Trigger;

e) Downstream Data E0 Compare Output CH0 Enable is set to 1 to enable.



c. Encoder 0 starts to input 40000 pulses, the count value is up from 0, when it reaches 1000 (to meet the compare set value and direction), the compare output channel 0 state is reversed, from the original low level output to high level output, the pulse output time is 10s, the channel indicator will be on for 10s. after the counting is completed, the count value of encoder 0 is 40000, as shown in the figure below.