FX20 User Manual for High-Speed Counting Module

FX20-CNT-BB00

Version 1.0, 2024-04-23

Tianjin Elco Automation Co.,Ltd

CONTENT

1. Product Introduction

The FX20 series high-speed counting module adopts a dual channel design, and each channel supports multiple counting modes of phase A, B, and Z, with forward and reverse counting functions. The maximum counting frequency is 500KHz, and it supports multiple types of high-speed pulse signals, including source, drain, and push-pull. At the same time, each channel is equipped with a pair of DI/DO signal points, which can easily set control logic such as overspeed alarm and counting reset.

Product features:

- High measurement accuracy
- Fast response speed
- Supports counting and frequency doubling
- Maintain the value of the power outage meter

The FX20 high-speed counting module is suitable for application scenarios such as motor speed measurement, servo control, and grating ruler measurement, providing a cost-effective IO comprehensive solution for industries such as metallurgy and machine tools.

2. Version change records

Revision date	Release version	Change content
2024-4	V1.0	First edition manual release

3. Regarding manual acquisition

This manual is not shipped with the product. If you need to obtain an electronic PDF file, you can obtain it through the following methods:

Log in to the official website of ELCO (www.elco holding. com. cn), search for keywords, and download.

Use WeChat to search and follow the official official account of " ELCO Automation" to obtain the product manual.

Contact the sales engineer of ELCO Automation in your region to obtain the latest manual materials.

4. Warranty Statement

Under normal use, if the product malfunctions or is damaged, ELCO Automation is responsible for an 18 months warranty (from the date of manufacture, the delivery date shall prevail, and any contractual agreements shall be executed in accordance with the agreement). If it exceeds 18 months, maintenance fees will be charged.

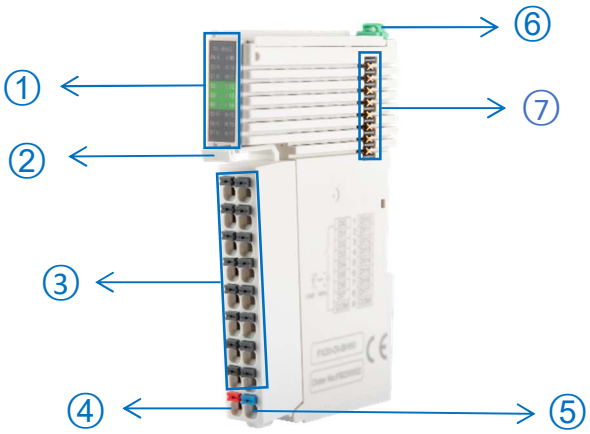
Within 18 months, repair fees will be charged for product damage caused by the following circumstances.

- Failure to operate this product according to the instructions in the manual, resulting in product damage.
- Damage to products caused by fires, floods, and abnormal voltage.
- Using this product for abnormal functions may cause product damage.
- Damage to the product caused by exceeding the specified usage range.
- Secondary damage to products caused by force majeure factors such as natural disasters, earthquakes, and lightning strikes.

The service fees shall be calculated according to the unified standards of ELCO. If there is a contract, the principle of contract priority shall be applied.

5. FX20 introduction to Dual Channel High Speed Counting Module

5.1. Introduction to Appearance and Function



No.	Items	Function	Status
1	**Running Indicators**		
	PW	Module power supply indicator light	Green: normal; Red: module power supply undervoltage, overvoltage; Off: No power supply to the module;
	MD	Module status indicator light	Green light: normal; Green flashing: Connected, not configured; Flashing red and green alternately: not connected; Red: Counter error
	EN1、EN2	Channel1 or 2 Enable	Green: enable; Off: Not enabled
	A1、B1、Z1 A2、B2、Z2	Channel1 or 2 Data receiving	Green: Data available; Off: No data
	UP1、UP2	Channel1 or 2 Forward Counting	Green: Counting Forward
	DN1、DN2	Channel1 or 2 Reverse counting	Green: Counting Reverse
	DI1、DI2	Channel1 or 2 Digital input	Green: DI ON

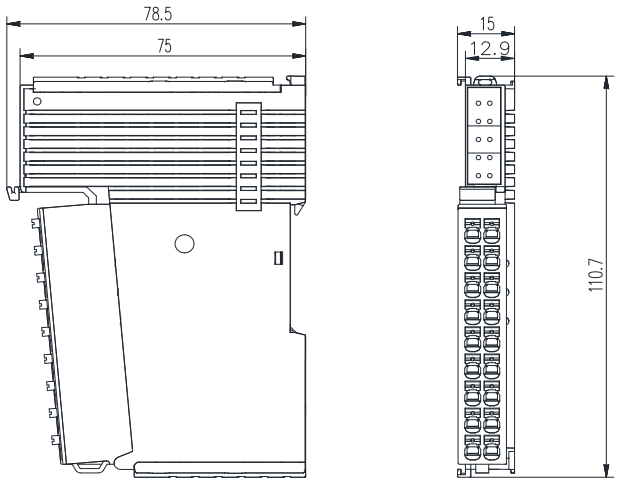
	DO1、DO2	Channel1 or 2 Digital output	Green: Do ON
2	**Terminal disassembly buckle**	Pressing the buckle can separate the wiring terminal block from the module	-
3	**Encoder wiring terminals**	Encoder signal wiring connection	-
00	A1	Channel1 A-phase signal input terminal	
01	B1	Channel1 B-phase signal input terminal	
02	Z1	Channel1 Z-phase signal input terminal	
03	24V	24V+，Power supply 24VDC	
04	GND	GND，Power supply 0V	
05	PE	Protective Earth	
06	DI1	Channel1 DI	
07	DO1	Channel1 DO	
20	A2	Channel2 A-phase signal input terminal	
22	B2	Channel2 B-phase signal input terminal	
22	Z2	Channel2 Z-phase signal input terminal	
23	24V	24V+，Power supply 24VDC	
24	GND	GND，Power supply 0V	
25	PE	Protective Earth	
26	DI2	Channel2 DI	
27	DO2	Channel2 DO	
4	24V in	24V+	-
5	24V in	0V	-
6	Module fixing buckle	Used to secure modules to standard DIN rails	Pulling up: installation position; Pressing down: locking position
7	Backplane bus expansion interface	Backboard communication between modules	-

5.2. Technical specifications

Ordering parameters	
Product model	FX20- CNT -BB00
Description	Dual channel high-speed counting module
Electrical parameters	
Input channel	2
Interface type	Terminal type
Power supply	2×24VDC
Encoder input	A/B/Z 3-phase，24V

Input signal type	Source, leakage, and push-pull type can be set
Counting type	B mode， B+A dir mode， A+B mode，A+B+Z mode
Counting frequency	Max.500kHz
Encoder frequency doubling	x1/x2/x4
Count data length	32bit
Counting range	-2147483648 ~ 2147483647
Count comparison function	support
Forward and reverse counting	support
Counting alarm function	support
Filtering function	0-10ms
I/O	Input：2 PNP/NPN，Output：2 PNP
General parameters	
Protective class	IP20
Installation	Standard 35mm DIN rails installation
Temperature	Operation：-5℃ to 60℃，storage：-25℃ to 70℃
Relative humidity	95%，non-condensing
Weight	70g
Size（H×W×D）	79mm×15mm×110mm

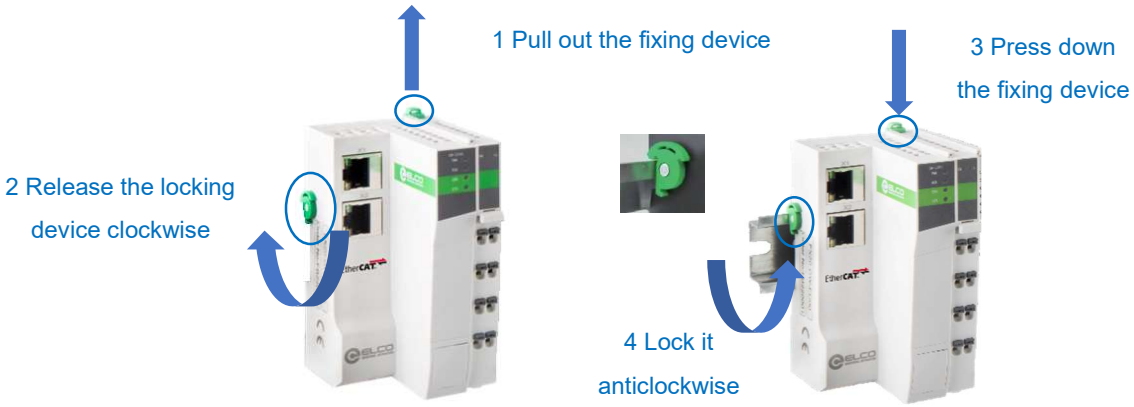
5.3. Dimension drawing



6. Mechanical installation and disassembly

6.1. FX20 coupler installation

The installation is carried out according to the following steps:

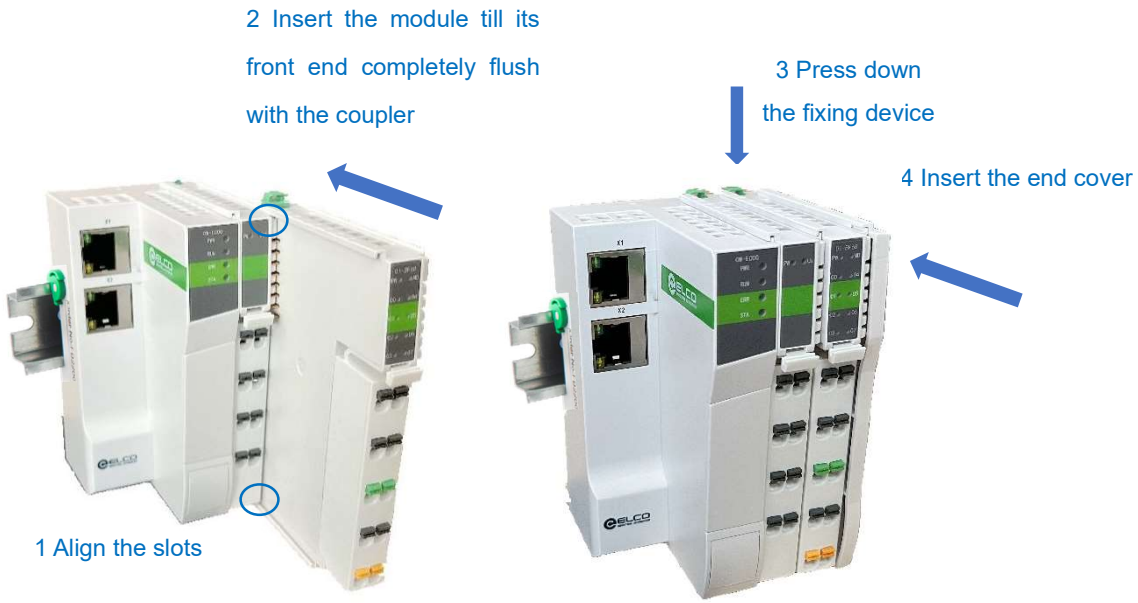


ATTENTION

During installation, align the module with the DIN rail and press the fixing device in the direction indicated by the arrow. After installation, there will be a noticeable clicking sound; change the position of the locking device slightly; after installing the module properly, make the locking device clamp the upper edge of the rail; to avoid damaging the product, do not apply excessive force.

6.2. I/O modules installation

After the installation of the coupler, the function modules can be sequentially inserted from the right side of the coupler. Before the insertion, ensure to pull out the fixing device and aligned with the two slots on the module.



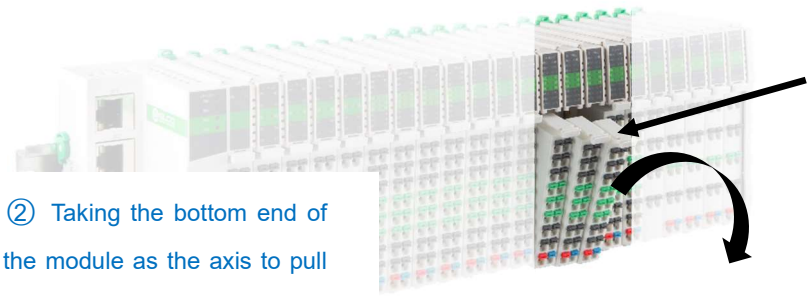
The end cover is only to protect the backplane bus interface of the end module, and it is packaged and shipped together with the coupler.

6.3. Module disassembly

Use a flat screwdriver or similar tool to pry up the locking device on the rail, and then pull the module away from the DIN rail.

°

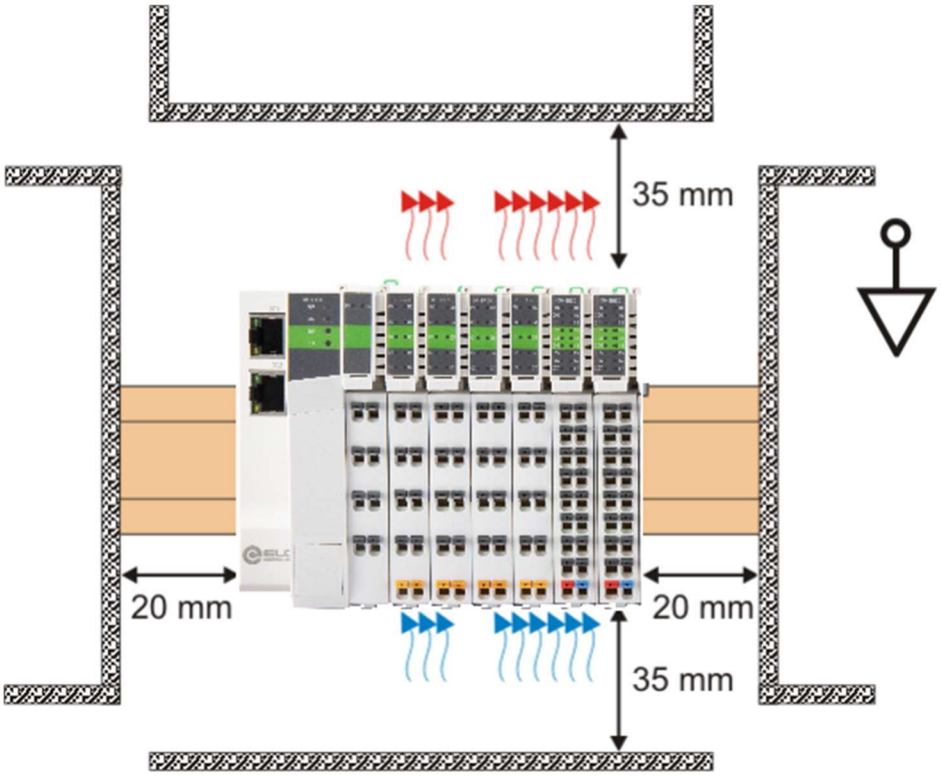
The wiring terminals of all modules can be removed separately to facilitate module replacement, as follows:



ATTENTION

The mechanical installation and disassembly of modules require qualified professional mechanical personnel to operate and pay attention to the correct wearing and use of labor protection equipment.

6.4. Installation position and minimum distances



Mount the mounting rail horizontally for the specified installation position. The connection surfaces of the coupler and the I/O modules must face forwards. This can be seen from the illustration.
The components are ventilated from bottom to top, which enables optimum cooling of the electronics by convection ventilation. The direction specification "down" corresponds to the direction of the positive acceleration due to gravity.

ATTENTION

Observe minimum distances
Maintain the distances to neighboring devices and control cabinet walls specified in the figure. This is the only way to ensure optimum convection cooling.
If sufficient convection cooling is not ensured, the devices may overheat and be damaged.

7. Electrical installation and wiring

7.1. Cable specification

7.1.1. Communication cable

Bus communication uses shielded network cables for data transmission, without short circuits, misalignment, and poor contact; The length of the cable between devices cannot exceed 100m, as exceeding this length will cause signal attenuation and affect normal communication. The following specifications of communication cables are recommended:

Item	Specification
Cable type	Elastic crossover cable, S-FTP, category 5
Standards met	EIA/TIA568A，EN50173，ISO/IEC11801 EIA/TIA bulletin TSB，EIA/TIA SB40-A&TSB36
Conductor section	AWG26
Wire type	Twisted pair
Wire pair	4

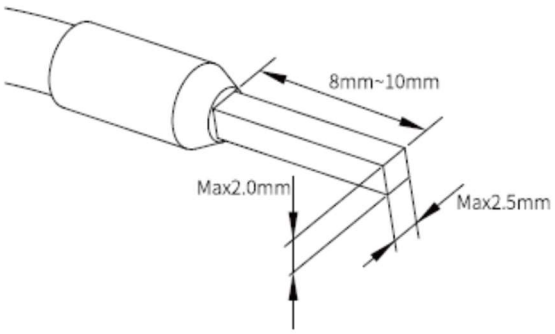
Pre-wired connectors are better for communication and construction. Elco pre-wired connectors can provide customized cable material and cable length in accordance with communication technology requirements. The following Elco Ethernet connectors are available:

Model	Description
E16DA4002M020	RJ45-M12 double-ended pre-wired Ethernet connector, male straight, D-CODE, 4-pin, Cat5e, PVC, 2 M, fixed installation
E66D04002M020	RJ45-RJ45 double-ended pre-wired Ethernet connector，male straight-male straight，4-pin，Cat5e，PVC，2 M, fixed installation
E16DA4004M020	RJ45-M12 double-ended pre-wired Ethernet connector, male straight, D-CODE，4-pin，Cat5e，PVC，2 M，suitable for drag chain
E66D04004M020	RJ45-RJ45 double-ended pre-wired Ethernet connector，male straight-male straight，4-pin，Cat5e，PUR，2 M，suitable for drag chain

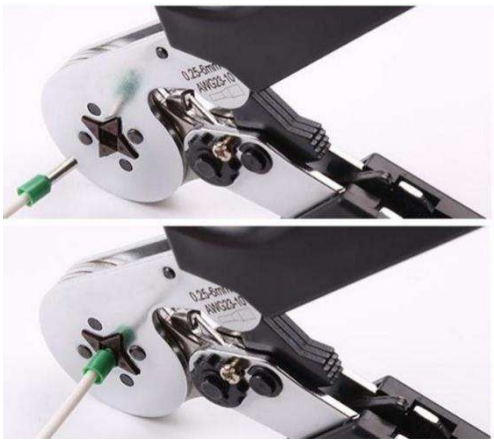
For more selection of Ethernet connectors, please refer to Elco's "Connectivity System Catalog".

7.1.2. Power and signal cables

The FX20 series adopts tool-free spring wiring terminals, and the wiring needs to be equipped with tube type cold pressing cable lugs. Please refer to the following figure for the stripping length and cable lug specifications:



Standard cable crimper can be used for pressing the wire ear, as shown in the following figure:



The wire connection does not need tools, and the wiring method is as follows:

1) Install the wire ear on the wire;
2) Insert the wire installed with the wire ear into the plug-in terminal to its most;
3) Pull the cable to ensure it's fixed securely.

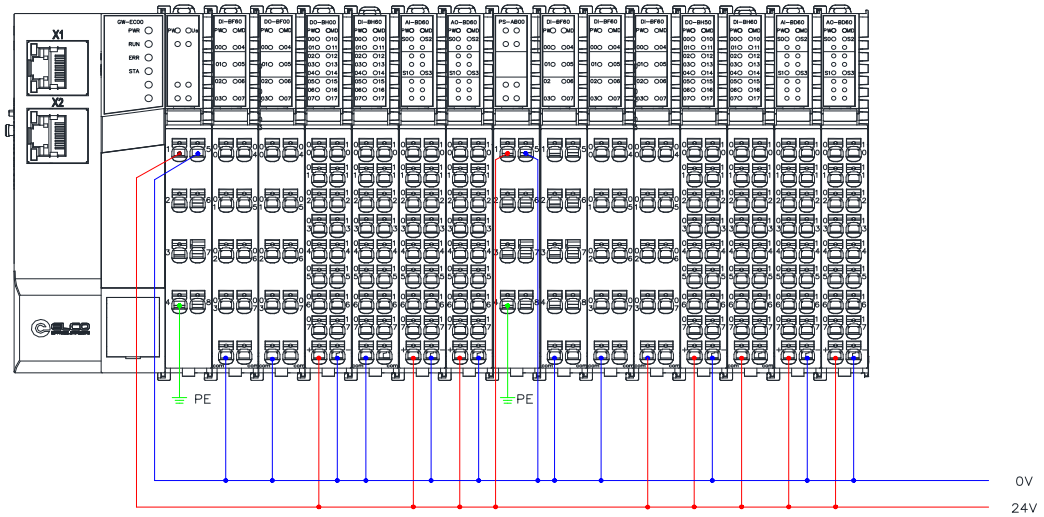
To release the wire:

1) Press the terminal spring button with your hand or a flat screwdriver
2) Pull out the wire and release the button.

7.2. FX20 wiring diagram

7.2.1. FX20 system power supply diagram

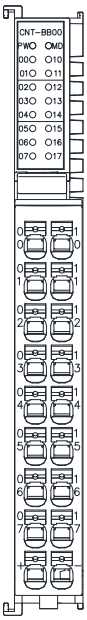
The FX20 series backplane 5VDC power supply is provided by the coupler, and IO power supply for function module needs to provide separately. Additionally, an auxiliary power supply module can provide a larger backplane power supply current. The power supply system diagram is as follows:

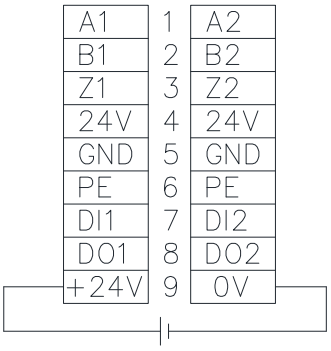


WARNING

- Be sure to disconnect all power connections before wiring!
- To ensure safety, must reliably connect the module grounding terminal to the ground!
- The wiring work must be operated by authorized electrical personnel to ensure safety!
- Using cables that do not meet the requirements will result in serious equipment damage or personal injury!
- Please refer to this manual or the wiring diagram printed on the side of the module for wiring. Incorrect wiring will cause module damage or personal injury!

7.2.2. Terminal Definition





8. Configuration and debugging

8.1. Debugging in Siemens PORTAL

This section introduces the usage of the FX20 high-speed counting module through a configuration practical operation process.

This example uses ELCO's FX20 distributed I/O as the Profinet slave station, and connects to Siemens PLC CPU1211C through the Profinet bus. By default, all power supply and bus connections have been completed, and the device name of the FX20 coupler module is set to "fx gateway".

The minimum firmware version for using the ELCO FX20 Profinet coupler in conjunction with the high-speed counting module is A692.

The list of selected products is as follows:

Model	Description	Quantity
FX20-GW-PN00	FX20 PROFINET coupler	1
FX20-CNT-BB00	Dual channel high-speed counting module	1

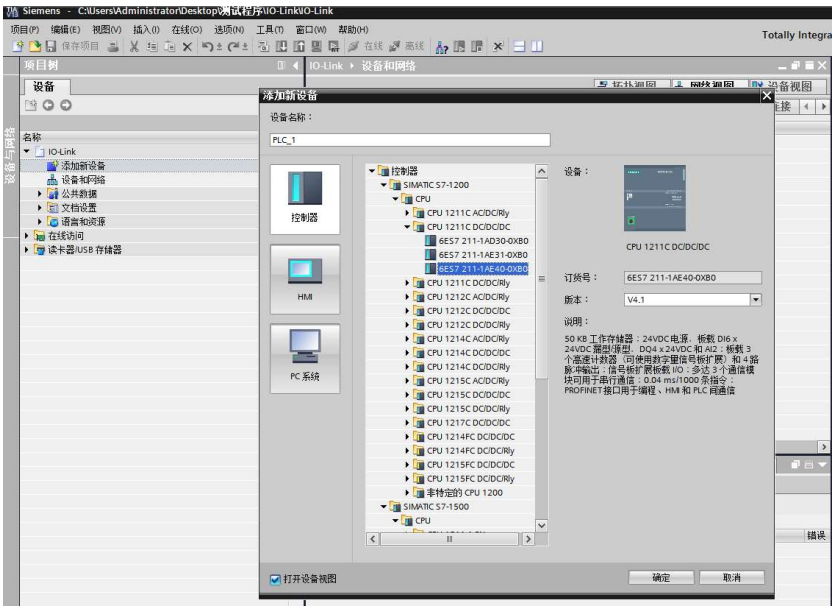
8.1.1. Configuration steps

8.1.1.1. Create a new Portal project

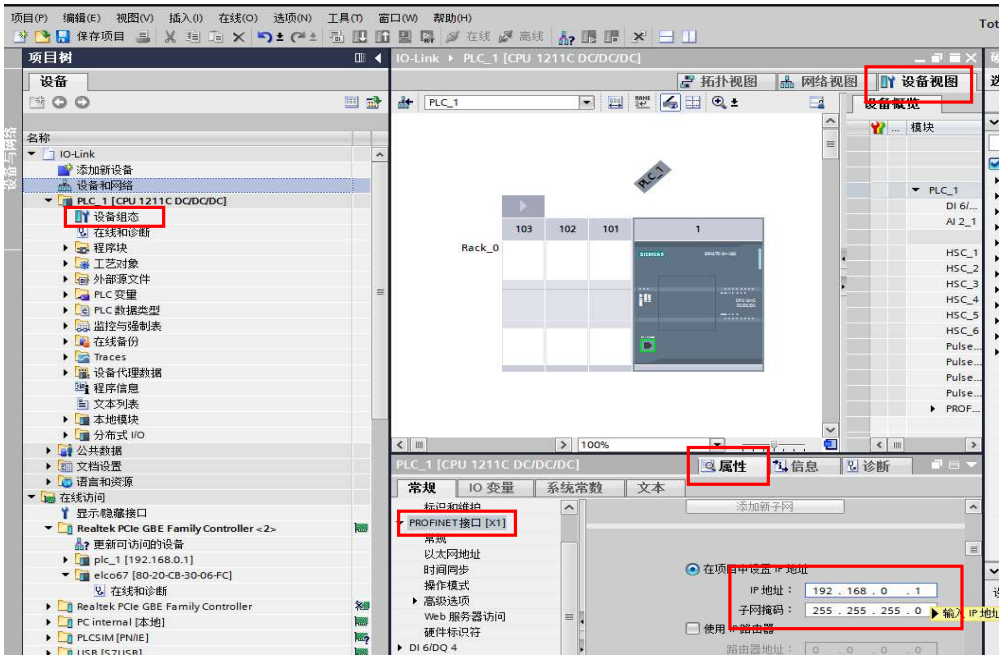
Open the TIA software, click "Create New Project", change the "Project Name" to FX20, select the save path, and click "Create".

8.1.1.2. Install the GSD file for FX20 products, refer to the relevant content in the FX20 Series Distributed IO PROFINET User Manual for specific methods.

8.1.1.3. Double click on "Add New Device" on the left and select the PLC model to use in the "Controller" window.

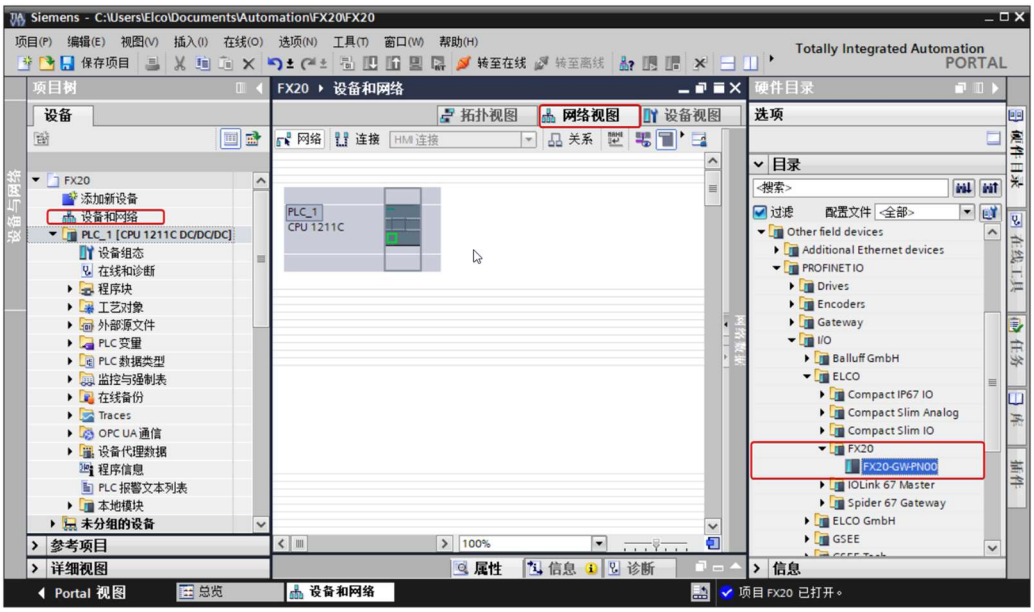


8.1.1.4. Double click on the "Device Configuration" window on the left, select "Properties" ->"PROFINET Interface [X2]" ->"Ethernet Address" in the "Device View" window, and set the IP address of the PLC.

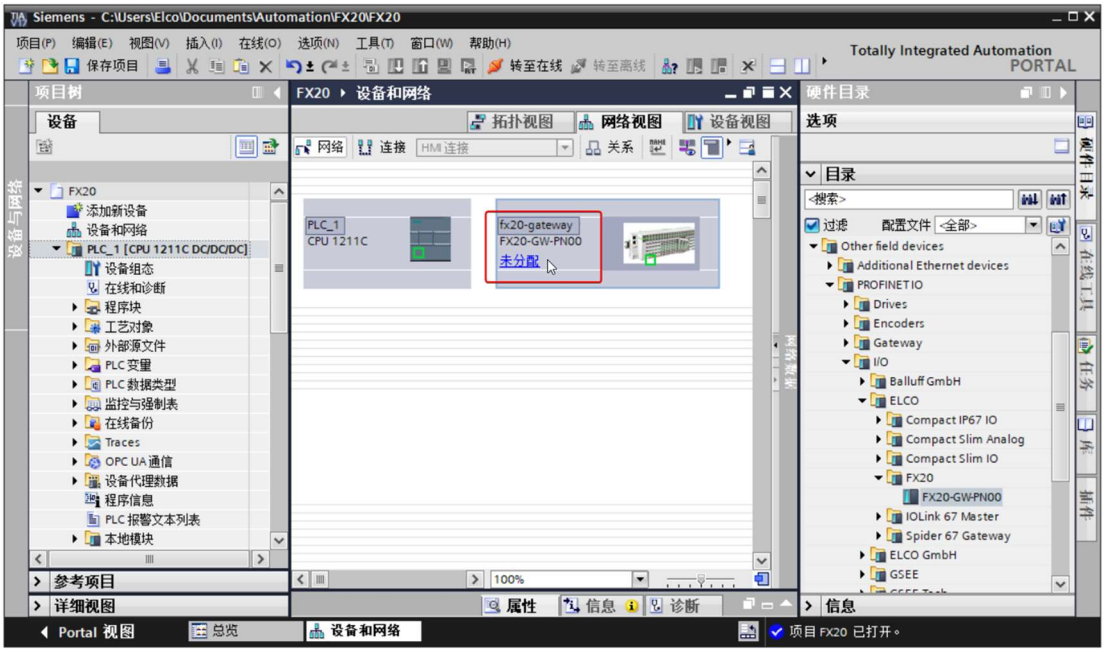


8.1.1.5. Add FX20 coupler module and communicate with PLC.

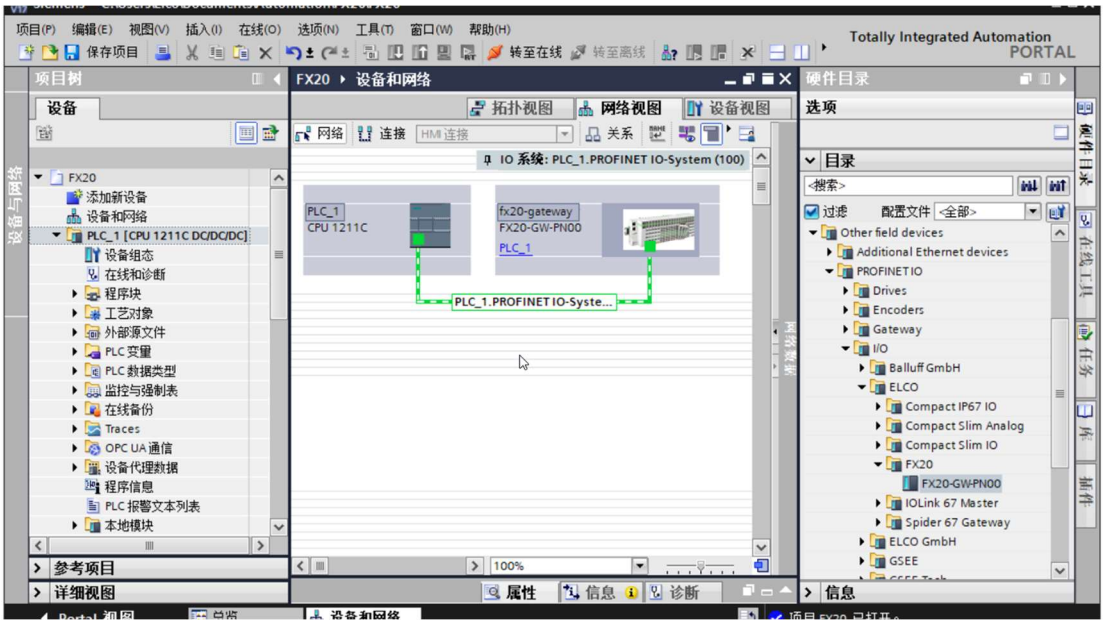
1) Double click on "Devices and Networks" on the left to enter the "Network View" interface. Select the FX20-GW-PN00 coupler for "Other Field Devices -->PROFINET IO -->I/O -->ELCO -->FX20" from the "Hardware Catalog", and double-click or drag to add it to the network.



2) Click "Unassigned" with the mouse and select "PLC_2.PROFINET interface_2".

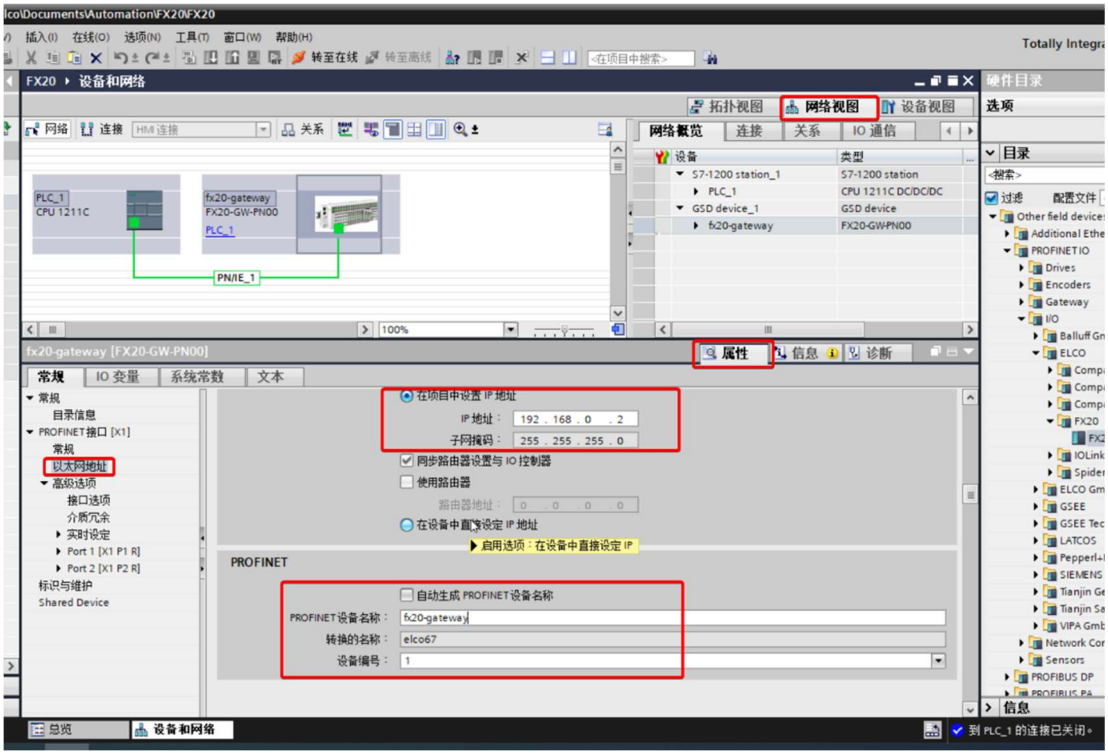


3) The FX20 coupler module is connected to the PLC for communication.

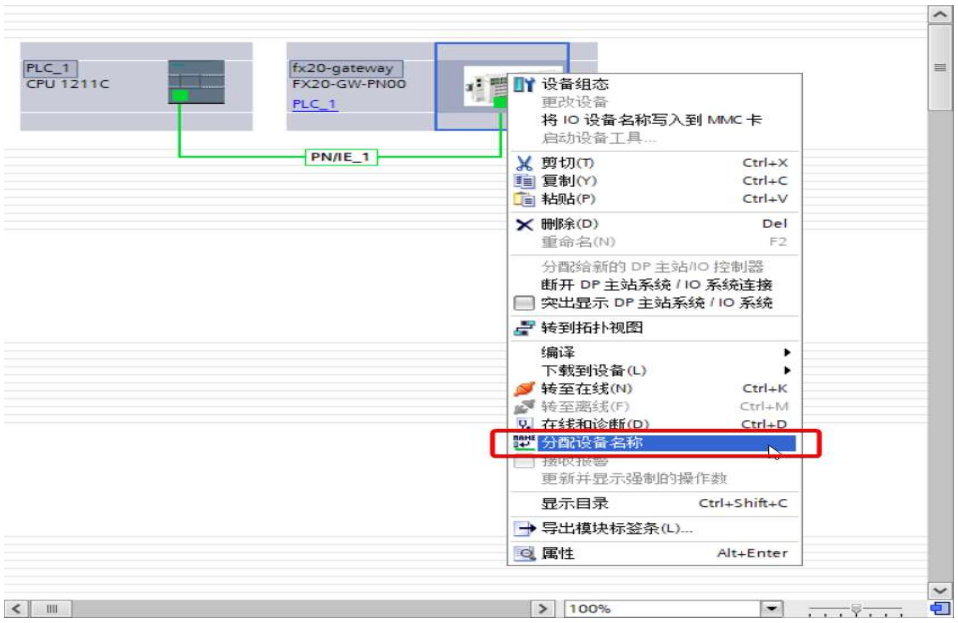


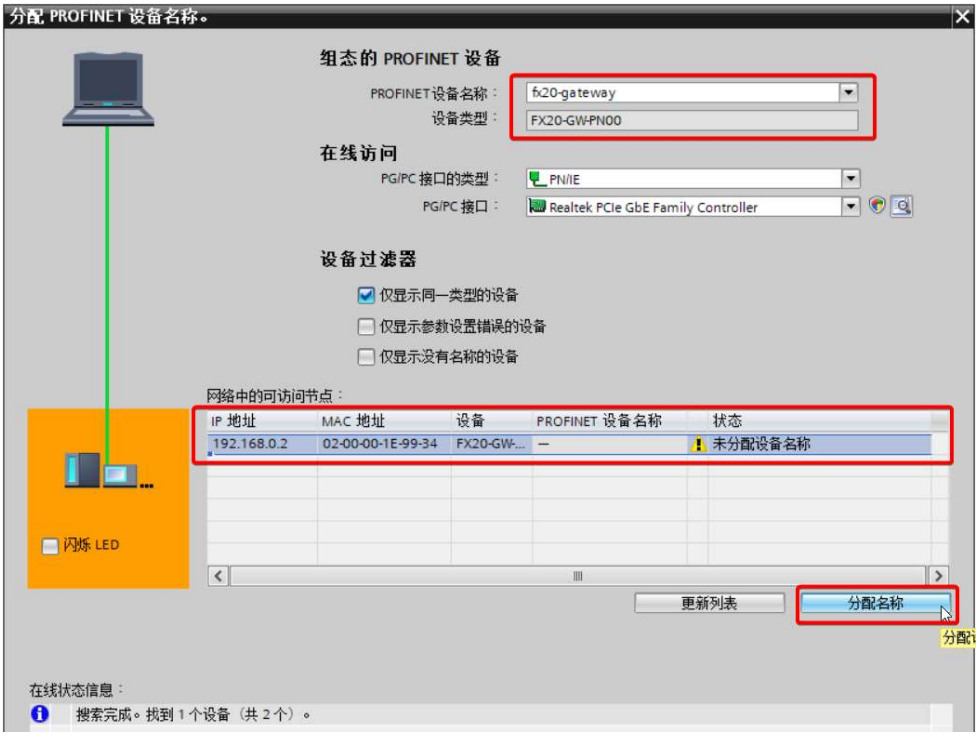
8.1.1.6. Modify the device name and IP address settings of the FX20 coupler module.

1) Click on the FX20 coupler module in the "Network View", select "Properties -->PROFINET Interface -->Ethernet Address", set the FX20 coupler module device name fx20 gateway in the window, and set the IP address. (Should be in the same network segment as the IP address of the PLC).



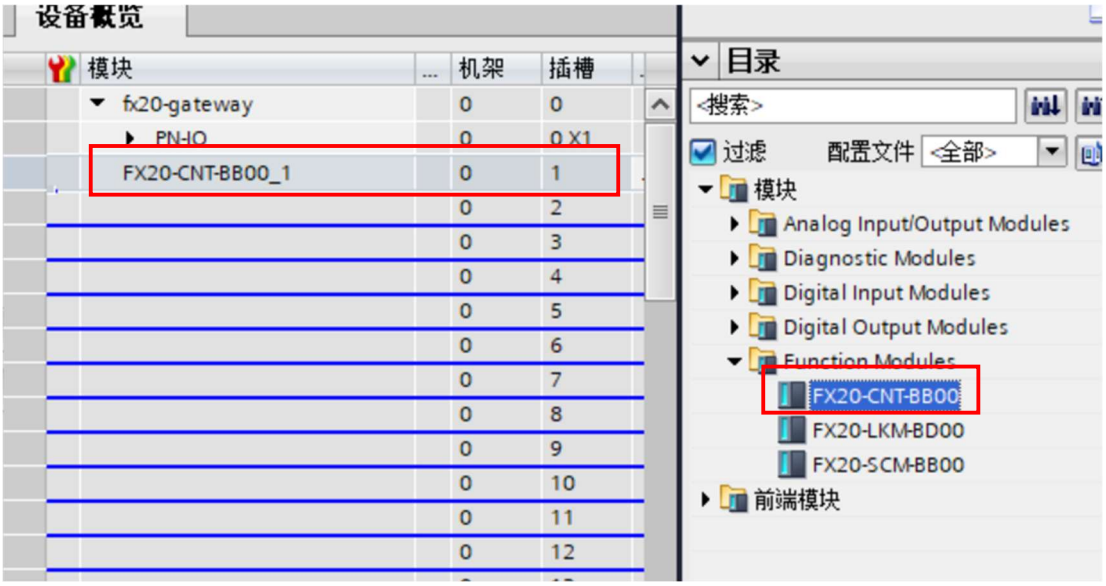
2) Select FX20-GW-PN00, right-click on the menu and select "Assign Device Name". In the interface for assigning Profinet device names, click "Update List". At this time, the name and MAC address of the FX20 coupler module connected will be scanned. Select the device whose MAC address matches and click "Assign Name".





8.1.1.7. Add the corresponding model of plug-in I/O module in the

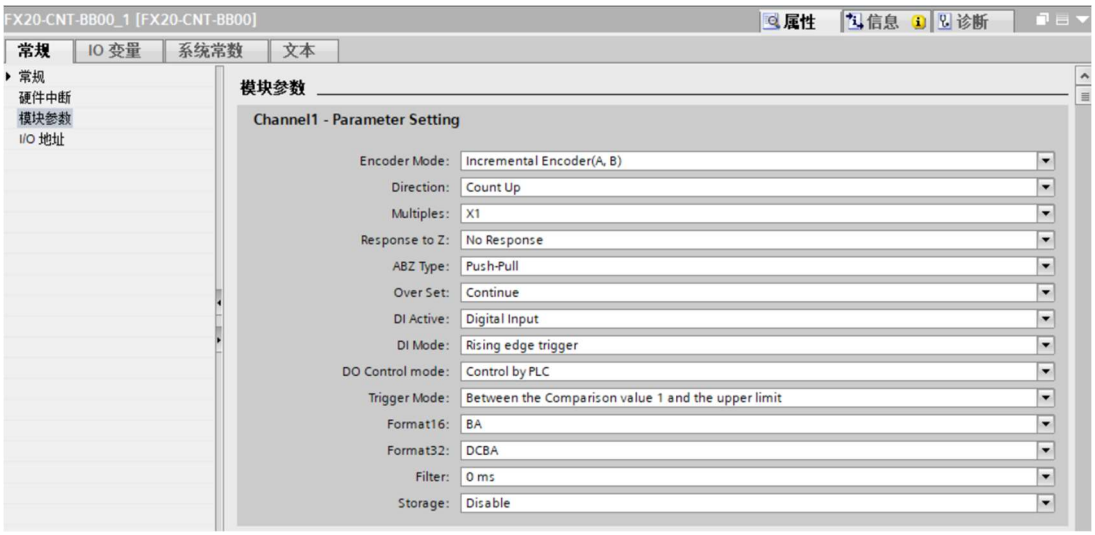
"Device Overview", select "Module -->Function Modules -->FX20-CNT-BB00" module in the "Hardware Catalog" window, and drag it to the corresponding slot.



Tip: In this example, the high-speed counter inputs addresses 1-28; Output addresses 1-20 (input/output addresses can be modified as needed).

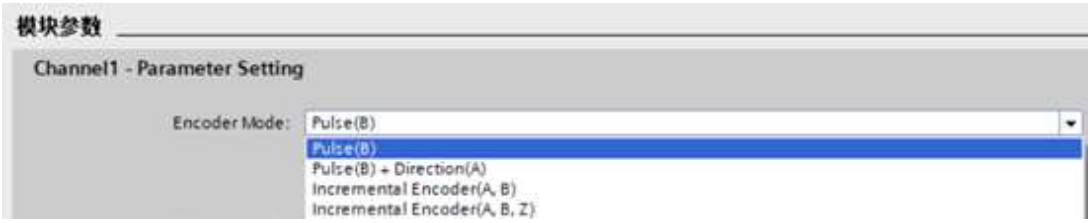
8.1.1.8. Select "FX20-CNT-BB00" ->"Properties" ->"Module Parameters" for parameter settings.

Taking channel 1 as an example, the setting method for channel 2 is consistent with this.



The meanings of each parameter are explained as follows:

1) Encoder Mode: Default incremental encoder (A,B)mode



a) Pulse B mode, only supports x1 frequency multiplication;
b) Pulse B, direction A, only supports x1 frequency multiplication;
c) AB incremental encoder mode, supporting x1/x2/x4 frequency multiplication;
d) ABZ incremental encoder mode, supporting x1/x2/x4 frequency multiplication.

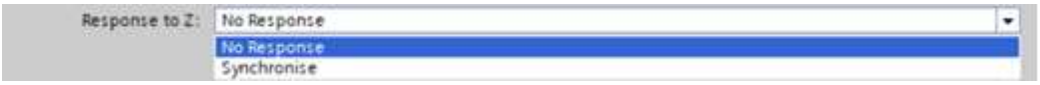
2) Direction: Counting direction,defaults to count up

a) Count Up;
b) Count Down。

3) Multiples:Frequency multiplication setting

a) X1：1 Multiplication;
b) X2：2 Multiplication;
c) X4：4 Multiplication;

4) Response to Z: Z-mode setting: default no response



a) No response;
b) Synchronise;

5) ABZ Type: ABZ signal input type

a) Push-pull type;
b) PNP type;
c) NPN type;

6) Over Set: Configure calculation mode

a) Continue
b) Stop

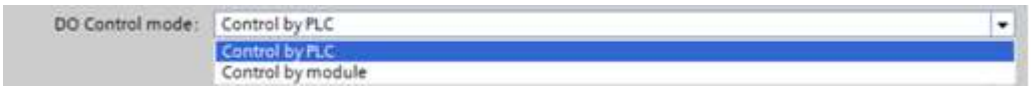
7) DI Active:Input detection function,default normal IO input

a) Digital Input;
b) Pulse Capture;

8) DI Mode: DI mode, default rising edge triggered

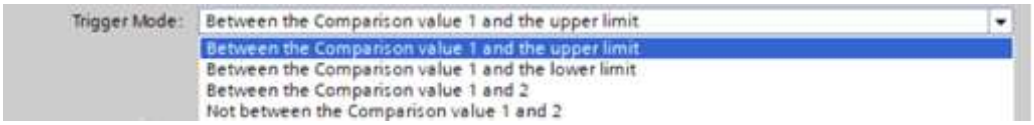
a) Rising edge trigger;
b) Failing edge trigger;
c) Rising/ Failing edge trigger;

9) DO Control Mode: DO control mode, default controlled by PLC



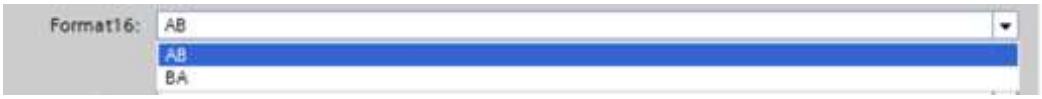
a) Control by PLC;
b) Control by Module;

10) Trigger Mode



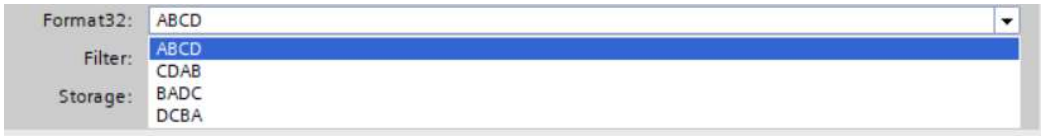
a) Between the Comparison value 1 and the upper limit;
b) Between the Comparison value 1 and the lower limit;
c) Between the Comparison value 1 and 2;
d) Not between the Comparison value 1 and 2;

11) Format16: Data format settings, default BA



a) AB;
b) BA;

12) Format32: Data format settings, default DCBA

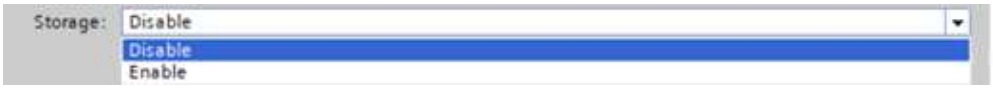


a) ABCD
b) CDAB
c) BADC

d) DCBA

13) Filter:Filter setting, default 0ms

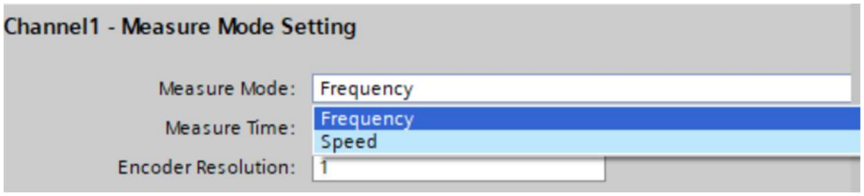
14) Storage Counter storage function, default disable



a) Disable;

b) Enable;

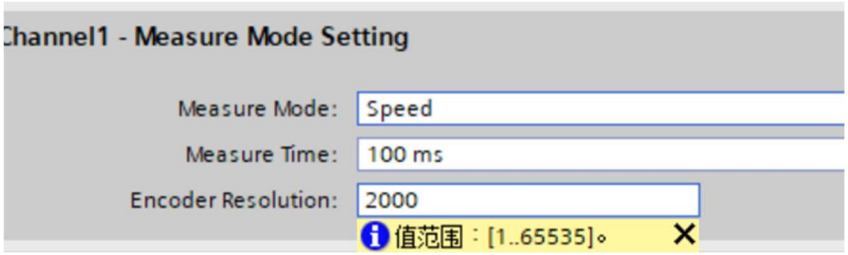
15) Measure Mode: Configure counter calculation mode, default to Frequency frequency measurement mode



If you need to modify it to "Speed", you need to modify the "Encoder Resolution" value based on the encoder's own resolution; For example, if the encoder resolution is 2000, modify the Encoder Resolution value to 2000.

16) Measure time: Calculation cycle, default to 1000ms

17) Encoder Resolution: Encoder resolution, default value is 1, range of values from 1 to 65535, to be filled in according to the encoder resolution value used



18) Upper limit value: Count upper limit value, default to 2147483647

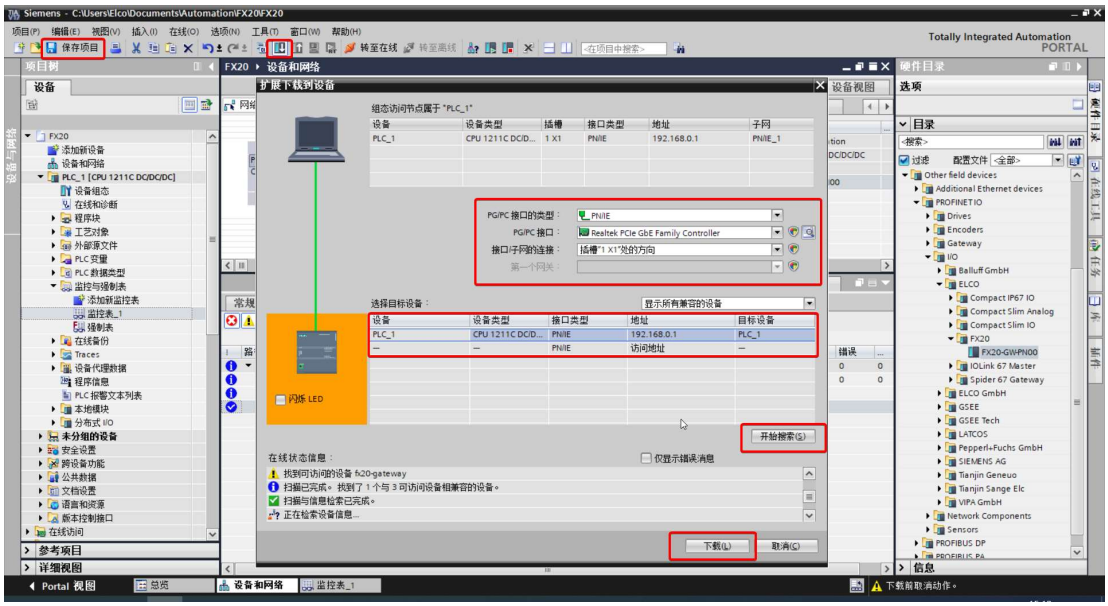
19) Initial value: Count initial value, default to 0, value range -2147483648 ~ 2147483647

20) Comparison_value1: Count comparison value 1, default to 0, value range -2147483648 ~ 2147483647

21) Comparison_value2: Count comparison value 1, default to 0, value range -2147483648 ~ 2147483647

The setting method for Channel2 is completely consistent with Channel1 and will not be repeated.

8.1.1.9. After completing the parameter settings and saving the compilation, download the configured configuration to the PLC to complete the configuration work.



8.1.1.10. If everything is configured correctly at this time, the indicator

lights of the FX20 coupler will be displayed in green, and the MD light of the serial communication module will be displayed in green and remain on.

9. Fault diagnosis

Item	Status	Meaning	Handling suggestions
High-speed counting module indicator lights			
PW	Green	Normal	None
	Off	Abnormal auxiliary power supply	1. Check if the high-speed counting module is connected to auxiliary power supply; 2. Check whether the polarity of the auxiliary power supply is correct; 3. The module is damaged and needs to be replaced.
	Red	Abnormal 24VDC power supply	1. Check whether the 24V auxiliary power supply of the module is overvoltage; 2. Check if the 24V auxiliary power supply of the module is under voltage; 3. The module is damaged and needs to be replaced.
MD	Green	Normal	None
	Green flashing	Connected, not configured	1. Check if the PLC configuration is complete; 2. Check if the module configuration is correct;
	Red/ green flashing	Not connected	1. Check if the gold finger connection between modules is reliable; 2. Check if the left and right modules of the module are connected properly;
	Red	Counter error	1. Check if the module count parameters are correct; 2. Check if there is a short circuit or overload in the module; 3. Module damaged, replace;
EN1、EN2	Green	Channel1 or 2 Enable	None
	Off	Disable	None
A1、B1、Z1	Green	With signal input	None
A2、B2、Z2	Off	No signal input	Check the encoder cable connection
UP	Green	Upward Count	-
	Off	-	-
DN	Green	Downward	-

		Count	
	Off	-	-
DI	Green	DI on	-
	Off	DI off	-
DO	Green	DO on	-
	Off	DO off	-

Appendix

Description of configuration data and process data

1. Configuration parameters

1.1. Configuration Data Description

No	Type	Description	Data length
1	Control register 1	Refer to 1.3	31bytes
2	Control register 2	Refer to 1.5	31bytes

1.2. Channel 1 configuration parameters

No.	index	subindex	Parameters	Description
1	0x3000	0x01	Encoder control register	Form 1.3 BYTE1-4
2		0x02	Encoder calculation control register	Form 1.3 BYTE5-7
3		0x03	Transmission ratio setting	Form 1.3 BYTE8-11
4		0x04	ch1_value_max	Form 1.3 BYTE12-15
5		0x05	ch1_value_reset	Form 1.3 BYTE16-19
6		0x06	ch1_value_min	Form 1.3 BYTE20-23
7		0x07	ch1_comparison_value1	Form 1.3 BYTE24-27
8		0x08	ch1_comparison_value2	Form 1.3 BYTE28-31

1.3. Channel 1 Control Register Description

No.	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
1	ch1_Z_set	ch1_multiples		ch1_dir		ch1_encoder_mode		
2	res	ch1_over_set	ch1_ABZ_type		ch1_di_enable	ch1_di_mode		
3	res	ch1_do_control	-		ch1_trigger_mode			
4	ch1_storage	ch1_format32		ch1_format16	ch1_filter			
5	res		ch1_measur_mode		ch1_measur_time			
6	ch1_encoder_resolution_h							
7	ch1_encoder_resolution_l							
8	ch1_measur_ratio_master_h							
9	ch1_measur_ratio_master_l							
10	ch1_measur_ratio_slave_h							
11	ch1_measur_ratio_slave_l							
12	ch1_value_max_4							
13	ch1_value_max_3							
14	ch1_value_max_2							
15	ch1_value_max_1							
16	ch1_value_reset_4							
17	ch1_value_reset_3							

18	ch1_value_reset_2
19	ch1_value_reset_1
20	ch1_value_min_4
21	ch1_value_min_3
22	ch1_value_min_2
23	ch1_value_min_1
24	ch1_comparison_value1_4
25	ch1_comparison_value1_3
26	ch1_comparison_value1_2
27	ch1_comparison_value1_1
28	ch1_comparison_value2_4
29	ch1_comparison_value2_3
30	ch1_comparison_value2_2
31	ch1_comparison_value2_1

1.4. Channel 2 configuration parameters

No.	index	subindex	Parameters	Description
1	0x3000	0x01	Encoder control register	Form 1.5 BYTE1-4
2		0x02	Encoder calculation control register	Form 1.5 BYTE5-7
3		0x03	Transmission ratio setting	Form 1.5 BYTE8-11
4		0x04	ch2_value_max	Form 1.5 BYTE12-15
5		0x05	ch2_value_reset	Form 1.5 BYTE16-19
6		0x06	ch2_value_min	Form 1.5 BYTE20-23
7		0x07	ch2_comparison_value1	Form 1.5 BYTE24-27
8		0x08	ch2_comparison_value2	Form 1.5 BYTE28-31

1.5. Channel 2 Control Register Description

No.	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
1	ch2_Z_set	ch2_multiples		ch2_dir		ch2_encoder_mode		
2	res	ch2_over_set	ch2_ABZ_type		ch2_di_enable	ch2_di_mode		
3	res	ch2_do_control	-		ch2_trigger_mode			
4	ch2_storage	ch2_format32		ch2_format16	ch2_filter			
5	res		ch2_measur_mode		ch2_measur_time			
6	ch2_encoder_resolution_h							
7	ch2_encoder_resolution_l							
8	ch2_measur_ratio_master_h							
9	ch2_measur_ratio_master_l							
10	ch2_measur_ratio_slave_h							
11	ch2_measur_ratio_slave_l							
12	ch2_value_max_4							

13	ch2_value_max_3
14	ch2_value_max_2
15	ch2_value_max_1
16	ch2_value_reset_4
17	ch2_value_reset_3
18	ch2_value_reset_2
19	ch2_value_reset_1
20	ch2_value_min_4
21	ch2_value_min_3
22	ch2_value_min_2
23	ch2_value_min_1
24	ch2_comparison_value1_4
25	ch2_comparison_value1_3
26	ch2_comparison_value1_2
27	ch2_comparison_value1_1
28	ch2_comparison_value2_4
29	ch2_comparison_value2_3
30	ch2_comparison_value2_2
31	ch2_comparison_value2_1

1.6. Configuration parameter description

- ch(1,2)_Z_set：Z mode set，default 0
  0- No response;
  1- Synchronization;
- ch(1,2)_multiples：Frequency multiplication setting, default value 0
  0- ×1
  1- ×2
  2- ×4
- ch(1,2)_dir：Counting direction，default 01
  01-Upward
  10-Downward
- ch(1,2)_encoder_mode：Encoder mode configuration, default value 011
  001- Pulse B mode，only x1 Frequency multiplication;
  010- Pulse B，direction A，only x1 Frequency multiplication;
  011- Incremental encoder AB mode，support x1/ x2/ x4 FM;
  100- Incremental encoder ABZ mode，support x1/ x2/ x4 FM.
- ch(1,2)_over_set：Configure calculation mode, default 0
  0- Continue counting;
  1- Stop counting;
- ch(1,2)_ABZ_type：ABZ input type settings

00-Push-pull
01-PNP
02-NPN

- ch(1,2)_DI_enable：Input detection function, default 0
  0- Normal IO input;
  1- Pulse capture function;
- ch(1,2)_di_mode：DI mode，default 000
  000- Rising edge trigger;
  001- Falling edge trigger;
  002- Edge trigger;
- ch(1,2)_do_control：DO control mode，default 0
  0- Controlled by PLC;
  1- Controlled by module;
- ch(1,2)_trigger_mode：Trigger mode configuration, default 0000
  0000- Between comparation_value1 and maximum value;
  0001- Between the minimum value and comparation_value1;
  0010- Between comparation value 1 and comparation value 2;
  0011- Not between comparation value 1 and comparation value 2;
- ch(1,2)_storage：Counting value storage function, default 0
  0- Not stored;
  1- Stored;
- ch(1,2)_format32：32-bit data format setting, default to 03
  00-ABCD
  01-CDAB
  02-BADC
  03-DCBA
- ch(1,2)_format16：16-bit data format setting, default to 1
  0- AB
  1- BA
- ch(1,2)_filter：Filter settings, default 0
  0- 0ms
  1- 10ms
  2- 5ms
  3- 2ms
  4- 1ms
  5- 500μs
  6- 200μs
  7- 100μs
  8- 50μs
  9- 20μs
  10-10μs
  11-5μs

- ch(1,2)_measur_mode：Configure calculation mode, default 01
  01-Frequency;
  02-Speed;
- ch(1,2)_measur_time：Calculation cycle, default 0110
  0000- 10ms;
  0001- 20ms;
  0010- 50ms;
  0011- 100ms;
  0100- 200ms;
  0101- 500ms;
  0110- 1000ms;
  0111- 2000ms;
- ch(1,2)_encoder_resolution_h、ch(1,2)_encoder_resolution_l：Sensor resolution, default value 1
  Input range：1 ~ 65535;
- ch(1,2)_measur_ratio_master_h、ch(1,2)_measur_ratio_master_l：Configure measure master conversion ratio, default value 1
  Input range：1 ~ 65535;
- ch(1,2)_measur_ratio_slave_h、ch(1,2)_measur_ratio_slave_l：Configure measure slave conversion ratio, default value 1;
  Input range：1 ~ 65535;
- ch(1,2)_value_max(4-1): Count upper limit value, default value 2147483647
  Input range：-2147483648 ~ 2147483647;
- ch(1,2)_value_reset(4-1): Initial value of count value, default value 0
  Input range：-2147483648 ~ 2147483647;
- ch(1,2)_value_min(4-1): Count lower limit value, default value -2147483648
  Input range：-2147483648 ~ 2147483647;
- ch(1,2)_comparison_value1(4-1): Count comparison value 1, default value 0
  Input range：-2147483648 ~ 2147483647;
- ch(1,2)_comparison_value2(4-1): Count comparison value 2, default value 0
  Input range：-2147483648 ~ 2147483647;

2. Process Data Description

2.1. Input Data

No.	Register Name	Register Description	Description	Data format	Data length
1	status	Status register	Refer to form 2.2	-	4bytes
2	ch1_count	Channel 1 Counting Value	Pulse count value for channel 1	int	4bytes
3	ch1_capture	Channel 1 capture value	When DI is triggered, the pulse count value	int	4bytes
4	ch1_measured	Channel 1 measurement value	Display conversion results based on configuration information	float	4bytes
5	ch2_count	Channel 2 Counting Value	Pulse count value for channel 2	int	4bytes
6	ch2_capture	Channel 2 capture value	When DI is triggered, the pulse count value	int	4bytes
7	ch2_measured	Channel 2 measurement value	Display conversion results based on configuration information	float	4bytes

2.2. Input Status Register Description

No.	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
1	ch1_sync	ch1_cap	ch1_cns	ch1_DI	ch1_up	ch1_down	ch1_over	ch1_under
2	ch2_sync	ch2_cap	ch2_cns	ch2_DI	ch2_up	ch2_down	ch2_over	ch2_under
3	suppower	res			res	res	res	ch1_ld_error
4	syspower	res			res	res	res	ch2_ld_error

- chx_sync：Indicates whether the current count loads the initial value through an external reference signal
  0- Not loaded;
  1- Loaded;
- chx_cap：Indicates whether the current count (capture) is updated
  0- Not Updated;
  1- Updated;
- chx_cns：Indicates the counting status of the current channel within 0.5 seconds
  0- No count;
  1- Counted;
- chx_DI：Indicates the current channel input signal status
  0- Low level;
  1- High level;
- chx_up：Display the current channel count up status
  1- Upward counting;

- chx_down：Display the current channel count down status
  1- Downward counting;
- chx_over：Determine whether the current count has caused an upward overflow;
  0- No overflow,
  1- Overflow;
- chx_under: Determine whether the current count has caused a downward overflow;
  0- No overflow;
  1- Overflow;
- suppower: External voltage overvoltage and undervoltage alarm;
- syspower: System voltage overvoltage or undervoltage alarm;
- chx_ld_error: Encoder error indication, not meeting the following conditions:
  Lower limit value≤counter value≤upper limit value;
  Lower limit value≤initial value≤upper limit value;
  Lower limit value≤Comparison value 1≤upper limit value;
  Lower limit value≤Comparison value 2≤upper limit value;
- Ch（1、2）_count：Current encoder count value;
- Ch（1、2）_di_count：Count value when DI is triggered;
- Ch（1、2）_measured：Converted value;

2.3. Output data

No.	Register	Description		Data format	Data length
1	control	Control register	See Form 2.4		4bytes
2	ch1_slot1	Channel 1 loading value 1	Channel 1 loading value 1	int	4bytes
3	ch1_slot2	Channel 1 loading value 2	Channel 1 loading value 2	int	4bytes
4	ch2_slot1	Channel 2 loading value 1	Channel 2 loading value 1	int	4bytes
5	ch2_slot2	Channel 2 loading value 2	Channel 2 loading value 2	int	4bytes

2.4. Output Status Control Register Description

No.	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
1	ch1_tv_set		ch1_DO		ch1_clear	ch1_DO_enable	ch1_DI_enable	ch1_enbale
2	ch2_tv_set		ch2_DO		ch2_clear	ch2_DO_enable	ch2_DI_enable	ch2_enbale
3	ch1_ld_slot2				ch1_ld_slot1			
4	ch2_ld_slot2				ch2_ld_slot1			

- ch(1,2)_tv_set：Trigger value setting, default 01
  01-comparison_value1 is upper limit value,comparison_value2 is Lower

limit value;
10- comparison_value2 is upper limit value,comparison_value1 is Lower limit value;

- ch(1,2)_DO：DO output, default 00
  00-Off;
  01-On;
- ch(1,2)_clear：Clear overflow flag
  0- Disable;
  1- Enable;
- ch(1,2)_DO_enable：DO enable setting，default 0
  0- Disable;
  1- Enable;
- ch(1,2)_DI_enable：DI input capture function setting, default 0
  0- Disable;
  1- Enable;
- ch(1,2)_enbale：Encoder enable configuration, default 0
  0- Stop;
  1- Start counting;
- ch(1,2)_ld_slot(1,2)：Set encoder trigger value
  0000- No response;
  0001- Load Count Values;
  0010- Reserved;
  0011- Load Initial Values;
  0100- Load Comparison Value 1;
  0101- Load Comparison Value 2;
  0110- Load Count Lower Limit;
  0111- Load Count Upper Limit;
  1000 ~ 1111-Reserved;
- ch(1,2)_slot(1,2)：Set encoder range value
  Input Range：-2147483648 ~ 2147483647.