



User Manual 用户手册



APG Serie bus gateway

CC-Link IE Field Basic Protocol transfer
MODBUS RTU master station
Model number: APG1505

CATALOGUE

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1.Preface

1.1 Document Usage Instructions

This document outlines the product's functional specifications, installation, operation, and settings, as well as information related to network protocols. This document is intended for use by well-trained electrical automation engineers only.

(1) Disclaimer

The author has conducted the necessary review of the document. However, as the product progresses and evolves, the document may contain errors in technical parameters or editing. We reserve the right to make adjustments and modifications without prior notification to the users.

(2) Trademark

The industrial Ethernet protocol (CC-Link IE Field Basic) was developed by CLPA and is strongly supported by Mitsubishi Automation.

(3) Patent Description

The designer of this product has obtained patent protection for both its appearance and the technical implementation method. Any attempt to copy, imitate or reverse engineer it could potentially violate the law.

(4) Copyright

Without the author's permission, it is strictly prohibited to copy, distribute or use this document.

1.2 Safety matters

This product is a professional equipment designed for industrial use and can only be operated by personnel with electrical operation experience. Before use, please carefully read this manual and follow the instructions to operate it properly to avoid causing personal injury or product damage.

This product is designed with an IP20 protection level. When using it, it needs to be installed in a distribution cabinet with dust-proof and moisture-proof functions.

1.3 Document history

Version	Date	Description
V1.1	2023.10	First release

1.4 Reference document

《IEC11631-22007 Programmable controllers –Part 2:Equipment requirements and tests》 ;

《IEC/TR 61158 Industrial Communication Network - Fieldbus Specification》 ;

《IEC61784-1Industrial Communication Network - Industry Standards Part 1: Fieldbus Standards》 ;



2.Specification parameters

2.1 APG1505 Specification Parameter Table

CC-Link IE Field Basic communication parameters		
Serial Number	Item	Specification
1	Agreement	CC-Link IE Field Basic
2	Transmission rate	10/100 Mbaud, Automatic transmission speed recognition
3	Bus interface	With dual RJ45 switches, it is an industrial Ethernet that complies with IEEE 802.xx standards, featuring auto-negotiation and auto-crossing functions.
4	Communication address	The only MAC address in the world
5	Transmission cable	CAT5e shielded cable
6	Port protection	Transformer isolation, 1500V DC (IEC61000-4-2)
Modbus communication format		
1	Transmission mode	Modbus_RTU
2	Physical interface	Open type connector with 5 pins (including terminal resistor interface)
3	Porter (kbps)	2400,4800,9600,19200,38400,57600,115200
4	Function code	01H、02H、03H、04H、05H、06H、0FH、10H
Other specifications		
1	Dimensions of the shape	(长) 114*(宽)30* (厚) 85mm
2	Installation method	35mm guide rail
3	Protection level	IP20
4	Environmental temperature	Transportation and storage: -40℃ to +70℃ Operating temperature: -20℃ to +55℃
5	Power supply voltage	24 VDC(±20%)
6	Rated current	110 mA (24 VDC)

Table 1 Parameter Specifications



3.Hardware description

3.1 Power interface

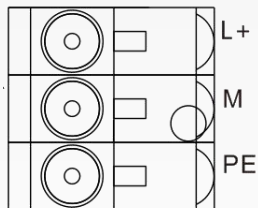


图 1 电源接口

Table 2 Power Indicator

Pin	Identifier	Description
1	L	24V, positive terminal of the DC power supply
2	M	negative terminal of the DC power supply
3	PE	ground connection

3.2 Communication interface

The module uses a physical interface with two RJ45 sockets for communication, and it has the function of a switch by itself. They are respectively identified as X1P1 and X1P2.

3.3 LED indication

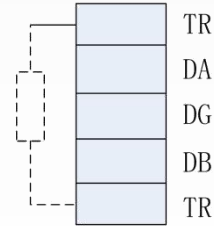
LED indications are divided into 3 types. These include power indication, Modbus status indication, and CC-Link IE Field Basic status indication. The definitions are as shown in Table 3.

Name	Colour	Explanation	
Power indicator			
PWR	green	Power indicator light	
Modbus Indicator light			
ALM	yellow	Modbus	Communication failure. Data timeout or incorrect data reception.
RX	green	Modbus	Data is being sent.
TX	green	Modbus	Data is being received.
CC-Link IE Field Basic Indicator light			
RY	Red light	The module enters the operating state and successfully establishes a connection with the main station.	
MT	green	Cycle data exchange	
SF	green	The LED indicates that there is a maintenance request for the module at present.	
ER	Red light	System failure - Hardware or software failure of the module is indicated.	

Table 3 LED Indicator Definitions

3.4 Modbus Communication interface

The module uses its own wiring socket as the physical interface for Modbus communication, where two TRs are terminal resistance selection terminals. An internal terminal resistance of 120R is integrated within the module. When TR1 is short-circuited to DA and TR2 is short-circuited to DB, the terminal resistances are effective. The interface definition is shown in Table 4.



TR
DA
DG
DB
TR

Figure 2 Modbus Interface

Pin	Signal	Description
1	TR1	Terminal resistor connection selection
2	DA	Receive/send data, line A (red)
3	DG	Data ground
4	DB	Receive/send data, line B (red)
5	TR2	Terminal resistor connection selection



4.Protocol conversion

4.1 Status register

"Status" refers to the status register of the gateway.

The definition is as follows:

Bit: 7	Bit: 6	Bit: 5	Bit: 1...4	Bit: 0
Retention	Received Error	Timeout	Error Code	Running Status

Regarding the error code 1...4 of Bit: Explanation

Bit: 4	Bit: 3	Bit: 2	Bit: 1	Decimal representation	Description
0	0	0	0	0	No errors.
0	0	0	1	1	Illegal registered address
0	0	1	0	2	Illegal parameters
0	0	1	1	3	Error in receiving data
0	1	0	0	4	Error in sending timeout
0	1	0	1	5	The host is currently busy
0	1	1	0	6	Error in executing function

4.2 Control Register

"Control" is the control register of the gateway.

It is defined as follows:

Bit: 3..7	Bit: 2	Bit: 1	Bit: 0
Keep	Reset Gateway	Error Clear	Start / Stop



5.Product Usage Instructions

5.1 LAEConfig software configuration module

The module configuration software is named "LAEConfig". LAEConfig is a software developed by our company with independent intellectual property rights. This software is developed by our company specifically for our controllers. This software can be used normally on systems prior to WIN10.

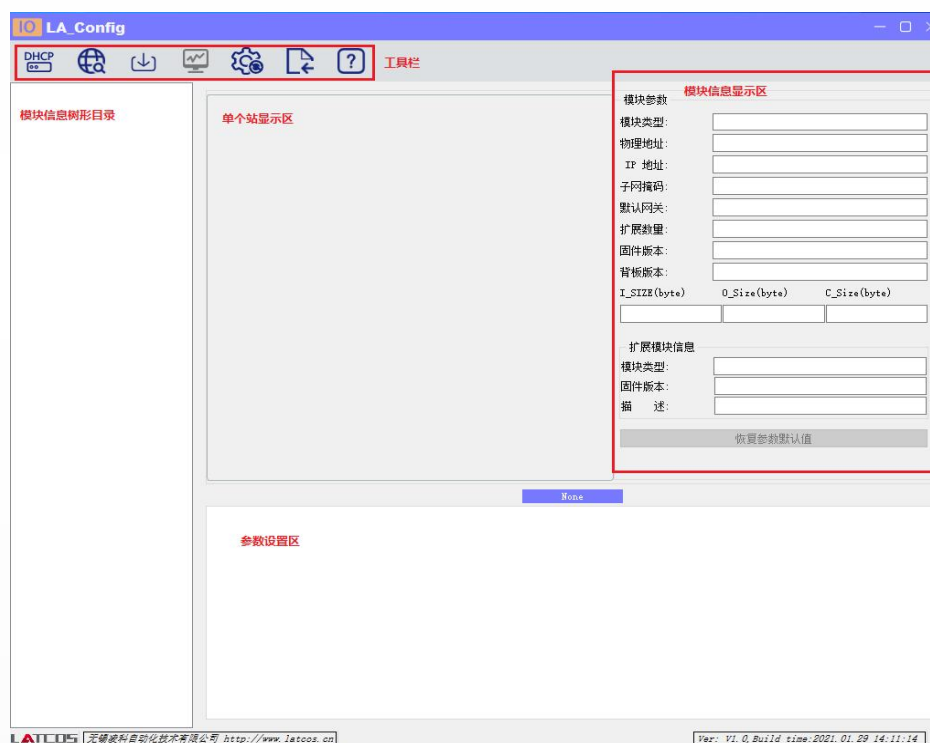


This is the installation file.

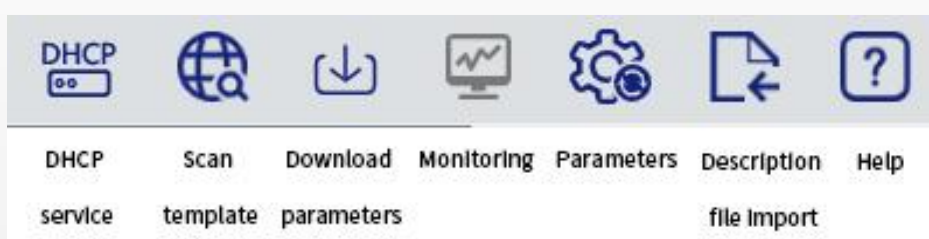


This is the desktop icon after the installation is completed.

5.2 Software Interface Introduction



The interface of this software includes: toolbar, module information tree directory, parameter setting area, module information display area, and so on.



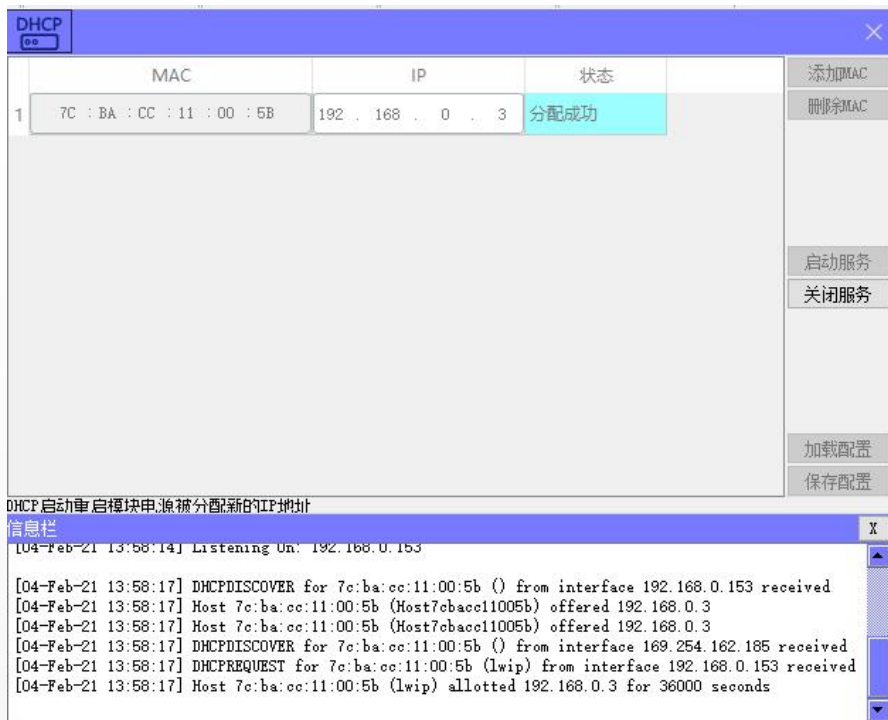
5.4 Modify the IP address of the module

5.4.1 Method 1 (This method is only applicable when "IP Address Allocation Method: Dynamic IP" is selected)



Click the button  in the toolbar to activate the DHCPService function. Click the "Add MAC" and "Delete MAC" buttons to add the MAC codes of the modules that need to be assigned, and fill in the corresponding IP addresses. After adding, click "Start Service" (as shown in the following figure).

Enter the process of allocating IP addresses. The success of the allocation can be displayed in the status column at the back (as shown in the following figure).



After all the assignments are completed successfully, click "Stop Service".

5.4.2 Method 2 (fully available)

Click the button  in the toolbar to display the interface shown in the following picture.



Click on the global scan option to scan all the modules within the entire local network.

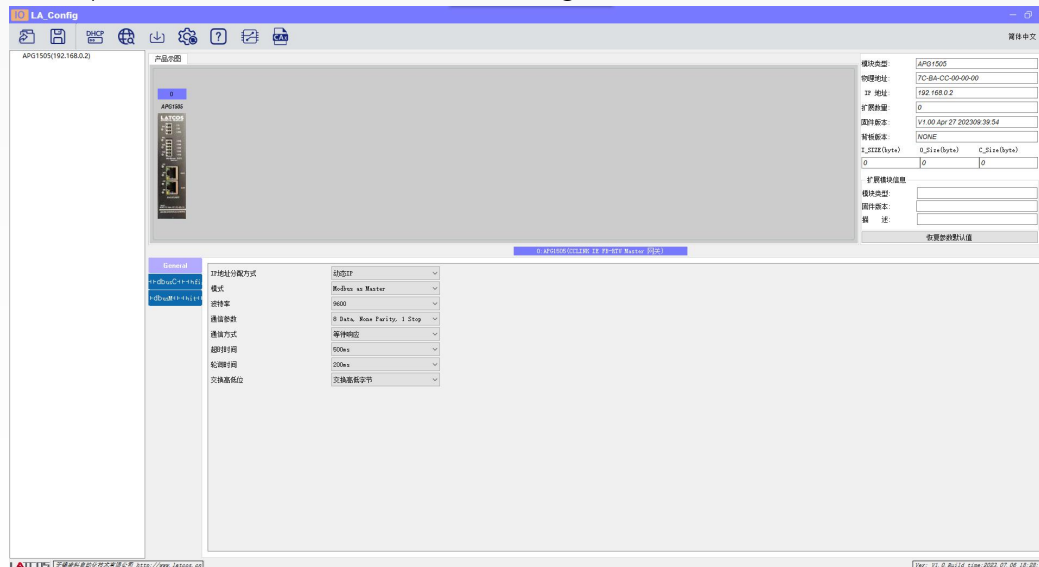


Modify the IP address in the table. After the modification is completed, click "Modify IP" to download the modified IP into the module. Check the status bar at the end to see if the allocation is successful.

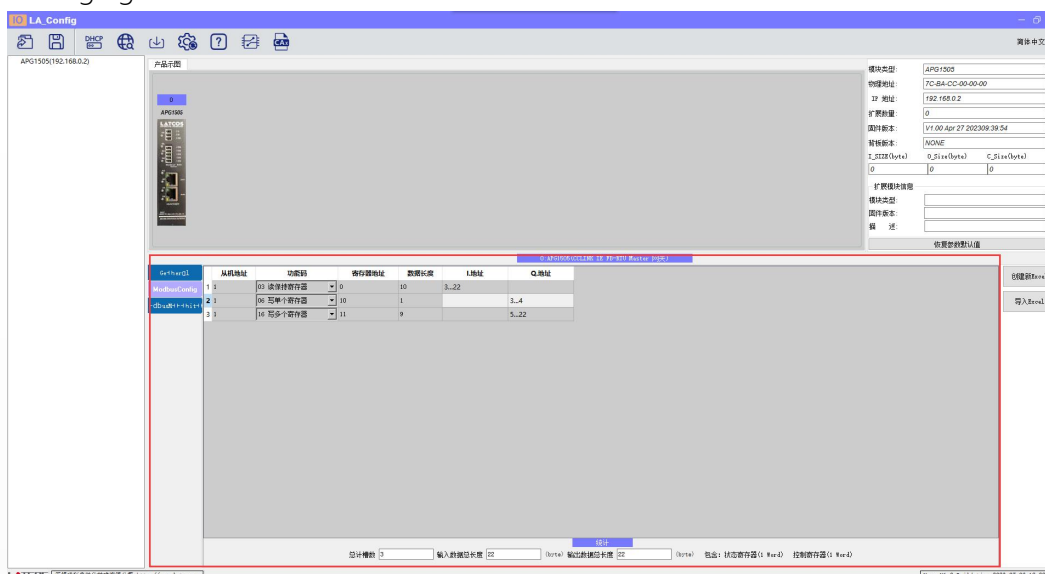
5.5 Modify the MODBUS parameters of the module

First, scan the module into the display area (as shown in the following figure)

1. Match the Modbus master communication parameters with the corresponding Modbus parameters of the communication target.



2. Set the communication message, click "Modbus Config", as shown in the following figure



3. Right-click on the red box, a menu will appear. Click on "Add" (to add Modbus messages), and then click on "Delete" (to delete Modbus messages).

For example:

In this configuration, three types of messages are configured, including reading 10 16-bit data and writing 10 16-bit data.

The input bytes correspond to RWr in the Mitsubishi software.

The output bytes correspond to RWW in the Mitsubishi software.

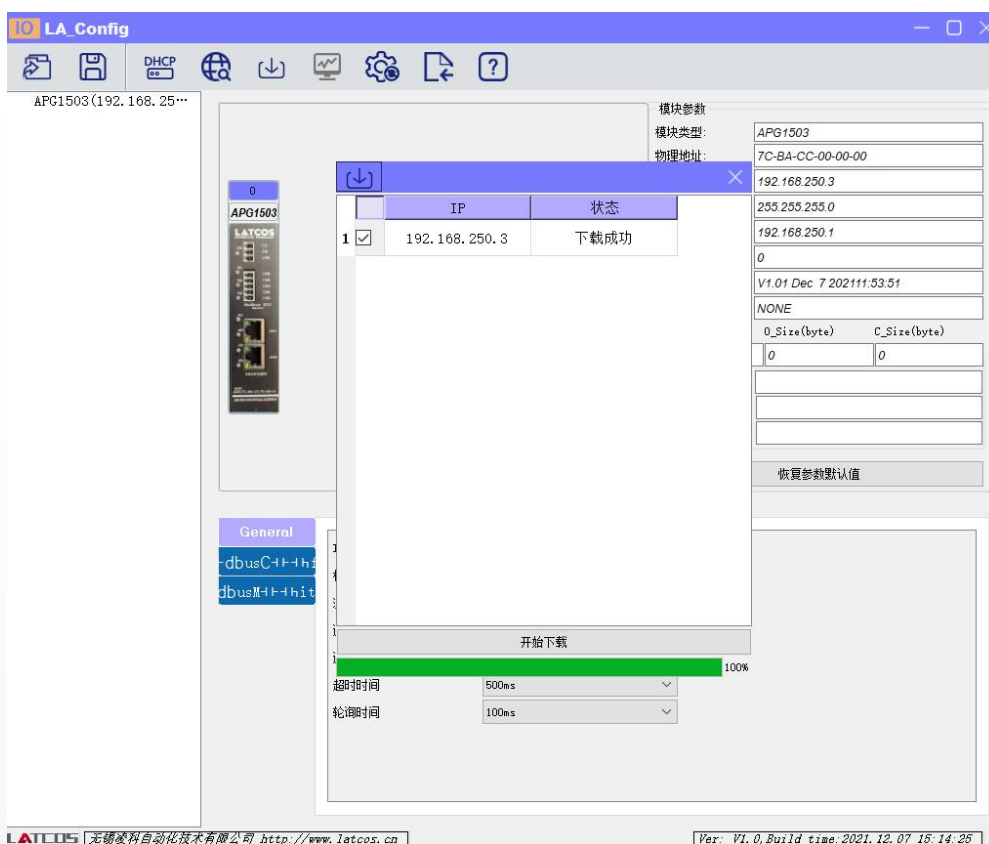
When the module parameters are set to maintain, Y100 is the high bit and Y101 is the low bit, which is a control word. X100 is the high bit and X101 is the low bit, which is a status word.

When the module parameters are set to swap the high and low bits, Y101 is the high bit and Y100 is the low bit, which is a control word. X101 is the high bit and X100 is the low bit, which is a status word. (The definition of status word control word can be found in the specification.)

Messages can be added or deleted as needed. The Modbus message contains the slave station address, function code, register address (starting address), data length and status information. These details need to be filled in according to the parameters of the actual communication object.

The data in the red box is calculated based on the filled-in message. The input data length and output data length are required when configuring the PLC communication.

4. After the configuration is completed, the parameters will be downloaded to the module.

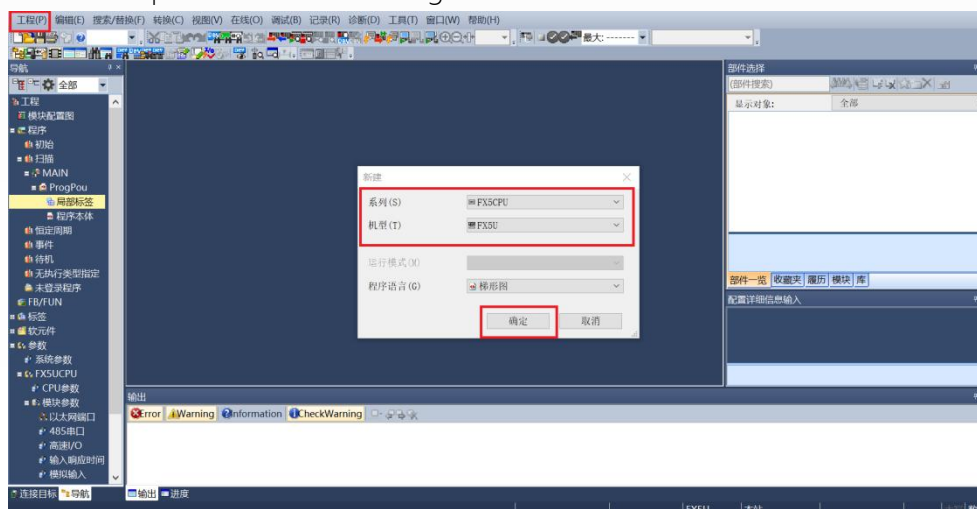


Click to download the parameters to the module. 

6.CC-Link IE Field Basic Connection Instructions

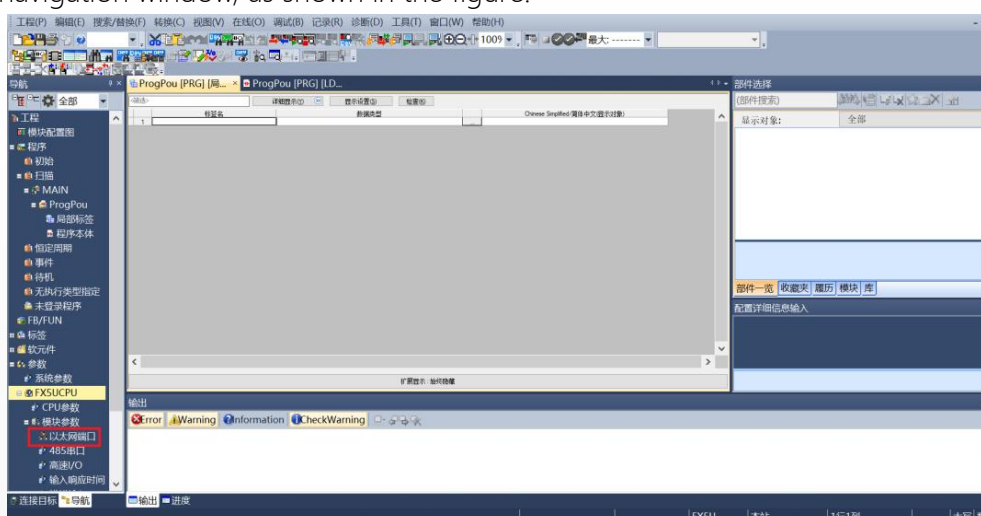
This manual is applicable to the APG1505 product and the Mitsubishi FX5U series PLC. It provides the configuration and usage methods through the CCLINK_IE_Field Basic communication connection.

Open the GX Works 3 software, select "Project" from the menu bar, then choose "New". Select the PLC series and the CPU model. For this example, let's take the 5U series CPU as an example. As shown in the figure.

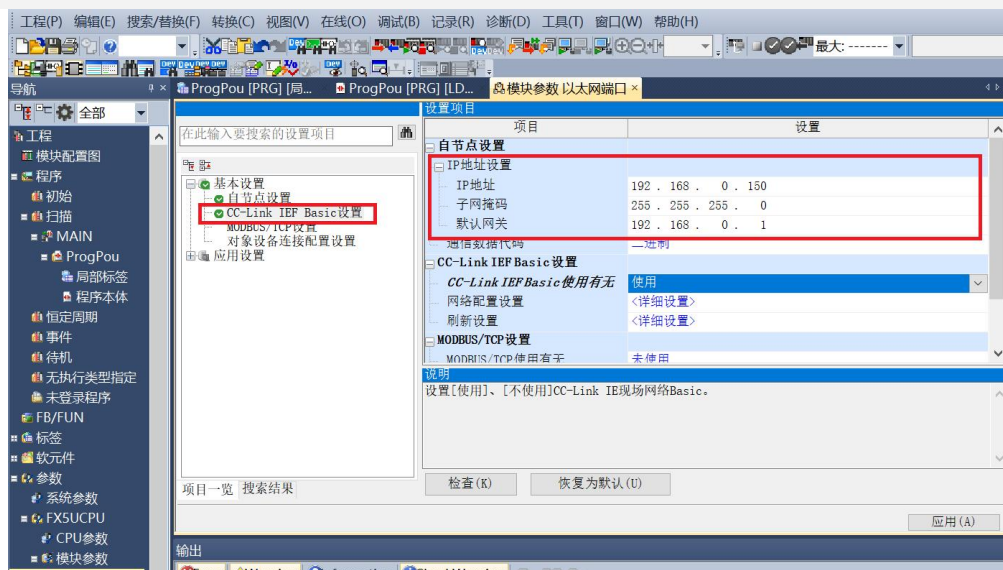


6.1 CC-Link IE Field Basic Parameter Settings

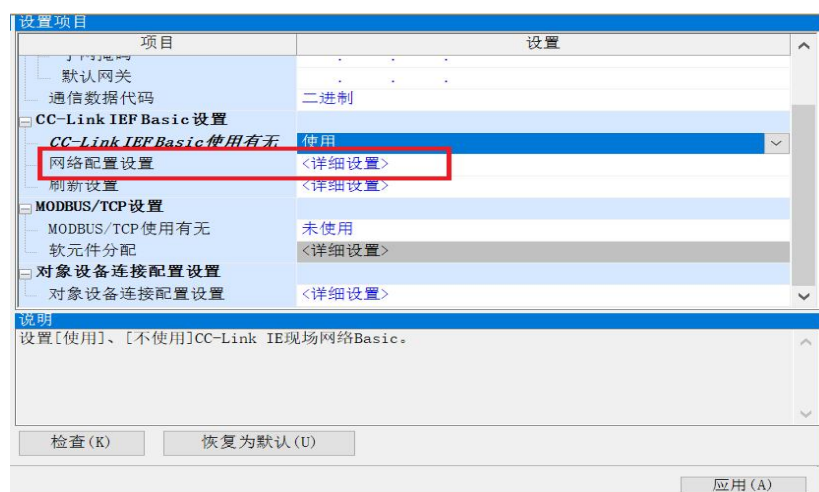
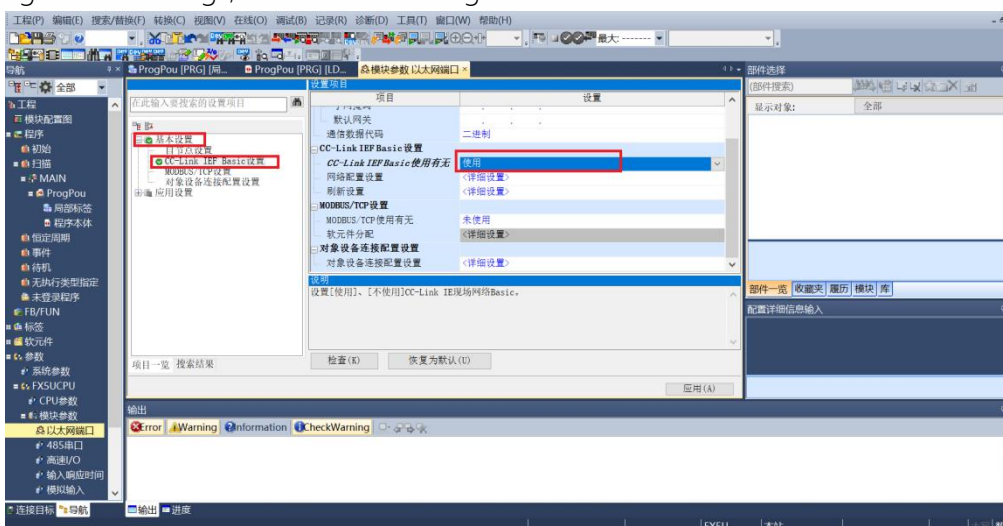
Select the "Parameters/FX5UCPU/Module Parameters/Ethernet Port" option in the left navigation window, as shown in the figure.



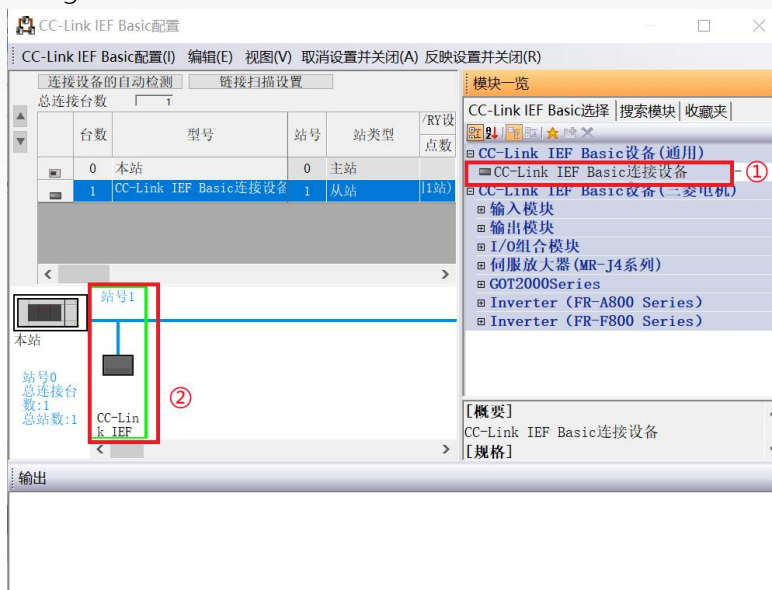
Set the IP address and subnet mask of the PLC master station as shown in the figure.



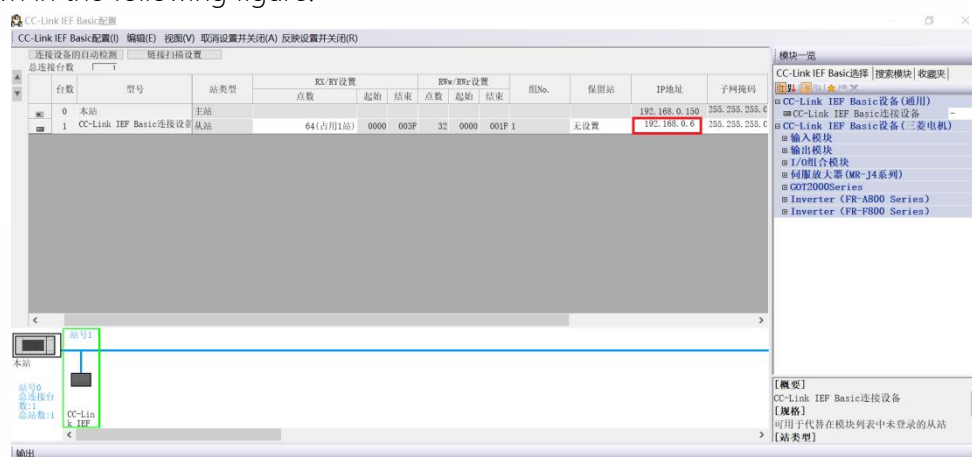
After setting the main station address and subnet mask, in the CC-Link IE Field Basic settings window, check the option to use CC-Link IE Field Basic and set the network configuration settings, as shown in the figure.



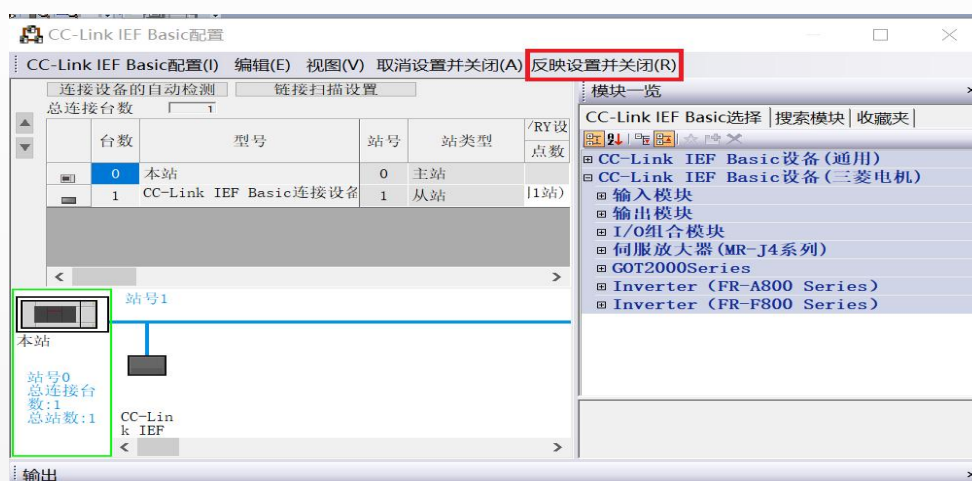
Manually add the module. In the CC-Link IE Field Basic configuration window, directly drag the IO module on the right side onto the CPU configuration at the bottom, as shown in the figure.



Change the IP address of CC-Link IE Field to be the same as the module address, as shown in the following figure.

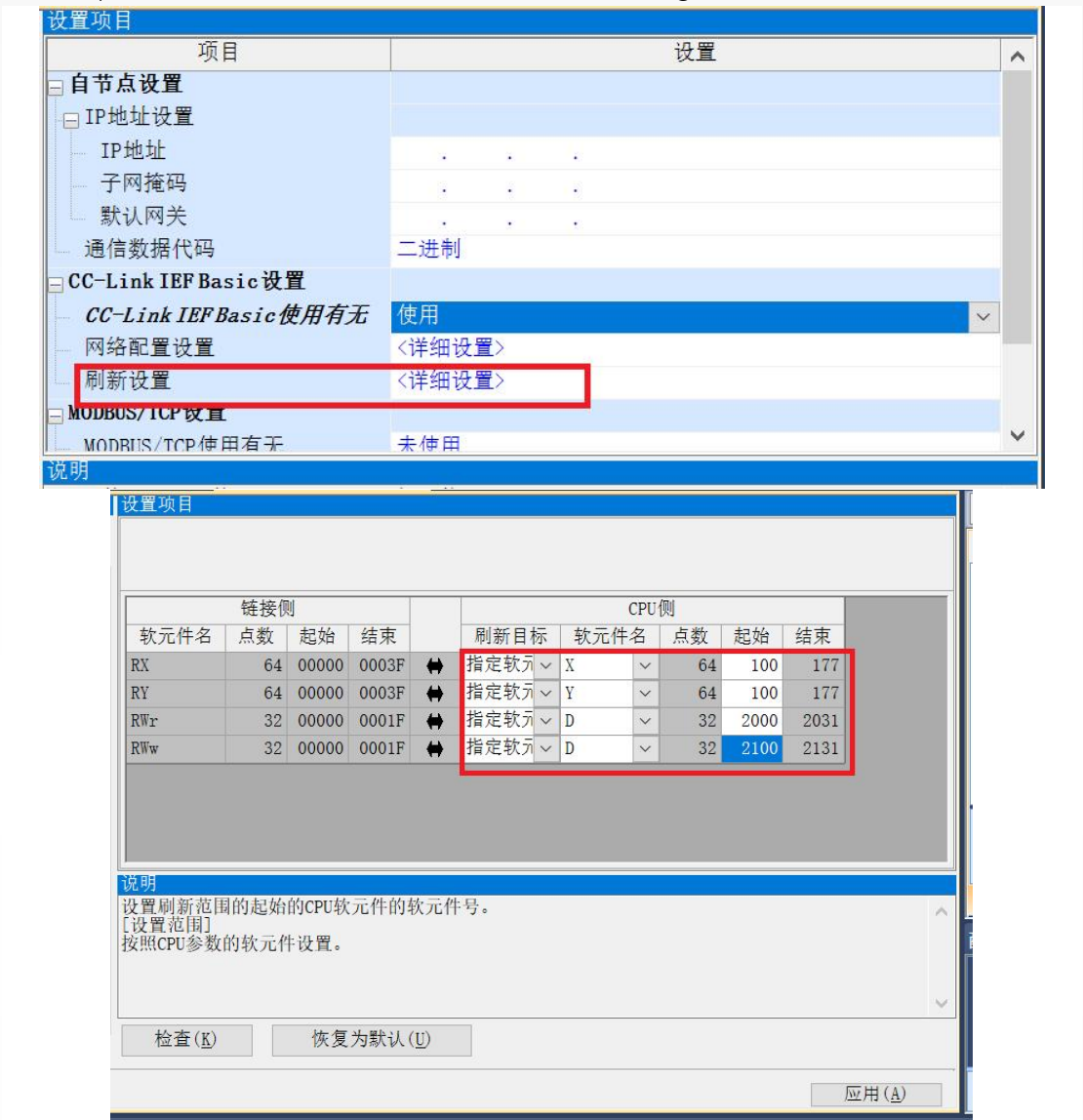


Then click "Set Feedback and Close" as shown in the figure.

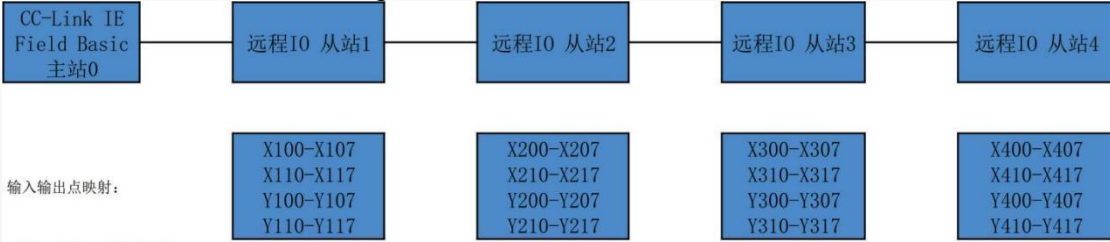


6.2 IO mapping configuration

In the CC-Link IE Field Basic configuration window, set the starting points of the input and output of the remote IO module as shown in the figure.



CC-Link IE Field Basic output point mapping method: Each slave station occupies 64 digital quantity points, namely 64DI and 64DO. The input and output points set here correspond to the starting points X100 and Y100. Each slave station occupies 32 analog quantity points, namely 32AI and 32AO. The input and output points set here correspond to the starting points D2000 and D2100. The mapping of the IO points of the slave station is shown in the figure.



*注: 120-170为空

Register types	Explanation	Comparison with PLC	Examples
(Coil Status)	Output port. It allows setting the output state of the port and also enables reading the output state of this bit. It can be divided into two different operating states, such as hold type or edge-triggered type.	DO (Digital Output)	Electromagnetic valve output, MOSFET output, LED display, etc.
(Input Status)	Input port. The input status can be changed through external settings, but it is read-only and not writable.	DI (Digital Input)	Dip switch, proximity switch, etc.
(Holding Register)	Output parameters or hold parameters, certain parameters set by the controller during operation, readable and writable	AO (Analog Output)	Set values for analog output, PID operating parameters, variable valve output size, sensor alarm upper and lower limits
(Input Register)	Input parameters. Parameters obtained by the controller from external devices during operation, which are readable but not writable.	AI (Analog Input)	Analog input

Modbus register address allocation

Register types	Register PLC address	Register Modbus protocol address	Symbolic name	Read/write status
(Coil Status)	00001~09999	0000H~FFFFH	0x	Readable and writable
(Input Status)	10001~19999	0000H~FFFFH	1x	Read-only
(Holding Register)	40001~49999	0000H~FFFFH	4x	Readable and writable
(Input Register)	30001~39999	0000H~FFFFH	3x	Read-only

64DI corresponds to Modbus Zone 1

64DO corresponds to Modbus Zone 0

32AI corresponds to Modbus Zone 3

32AO corresponds to Modbus Zone 4

After completing the parameter configuration, the project can be downloaded to the PLC. Then, the communication status can be detected through online diagnosis. In the menu bar, select "Diagnosis", and in the CC-Link IE Field Basic diagnosis window, you can view the status of the slave station IO module, as shown in the figure.



7. Unable to scan the module

- Use the ping module of the Windows command to ping the IP address. If it pings successfully, check the status of the indicator lights. If it fails to ping, check the network connection. If there is no abnormality in the network connection, scan the module again. If an unknown device can be detected, the reason is that the module's IP has not been allocated. Reallocate the IP and it will work. If the corresponding module still cannot be scanned, check the status of the indicator lights.

- If the RUN light is off and the ERR light is flashing, it indicates that there may be duplicate IP addresses in the network of the module. Check the devices with duplicate IP addresses and handle them. Restore the factory settings of the module and reset the IP address.

Official website



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