EdgeIO

BLIIOT®

MAKE IIOT EASIER

BL200 Series User Manual

Version：V1.1

Date：2023-07-27

Shenzhen Beilai Technology Co.,Ltd

Website：https://www.bliiot.com

Preface

Thanks for choosing BLIIoT Distributed I/O. These operating instructions contain all the information you need for operation of BL200 series products.

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Disclaimer

This document is designed for assisting user to better understand the device. As the described device is under continuous improvement, this manual may be updated or revised from time to time without prior notice. Please follow the instructions in the manual. Any damages caused by wrong operation will be beyond warranty.

Revision History

Update Date	Version	Description
2021-10-13	V1.0	First Edition
2022-07-01	V1.1	Add Profinet, EtherCAT protocol, add platform, logic control functions
2023-07-27	V1.1	Change Model name

Content

1 Product Introduction

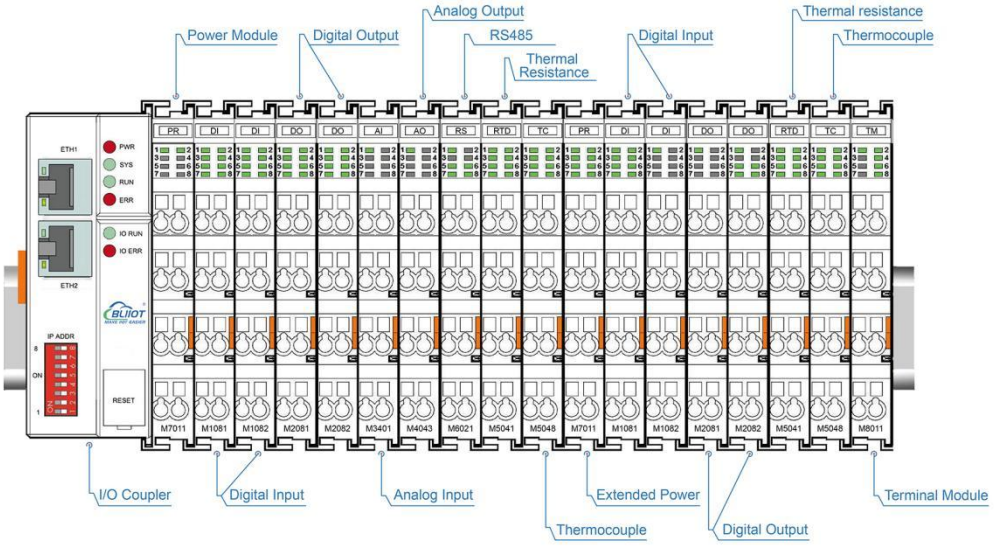
1.1 Overview

BL200 series product is distributed I/O system for data acquisition and industrial control.

The I/O controller is built around a powerful 32-bit microprocessor, it adopts Linux operating system, supports Modbus, MQTT, OPC UA, Profinet, EtherCAT, Ethernet/IP, BACnet/IP and other protocols, and can be connected to PLC, DCS, PAS, MES, Ignition, SCADA and ERP systems, as well as AWS, Thingsboard, Huawei Cloud, Alibaba Cloud and other cloud platforms.

The I/O system supports programmable logic control, edge computing, and customized applications, it is widely applicable to a variety of IIoT and industrial automation solutions.

The BL200 distributed I/O system consists of 3 parts: Controller, I/O modules and terminal modules.



The communication between the node and the field devices (eg PLC) takes place via the Ethernet interface of the fieldbus coupler, and the communication between the fieldbus coupler and the I/O modules takes place via the local bus. The two Ethernet interfaces are internally integrated with a switch function, which can establish a linear topology without the need for additional switches or hubs.

The system needs to use the power module to provide 24VDC system voltage and 24VDC field voltage. Since two independent power supplies are used, the field voltage input interface and system voltage input interface of BL200 series couplers are electrically isolated from each other.

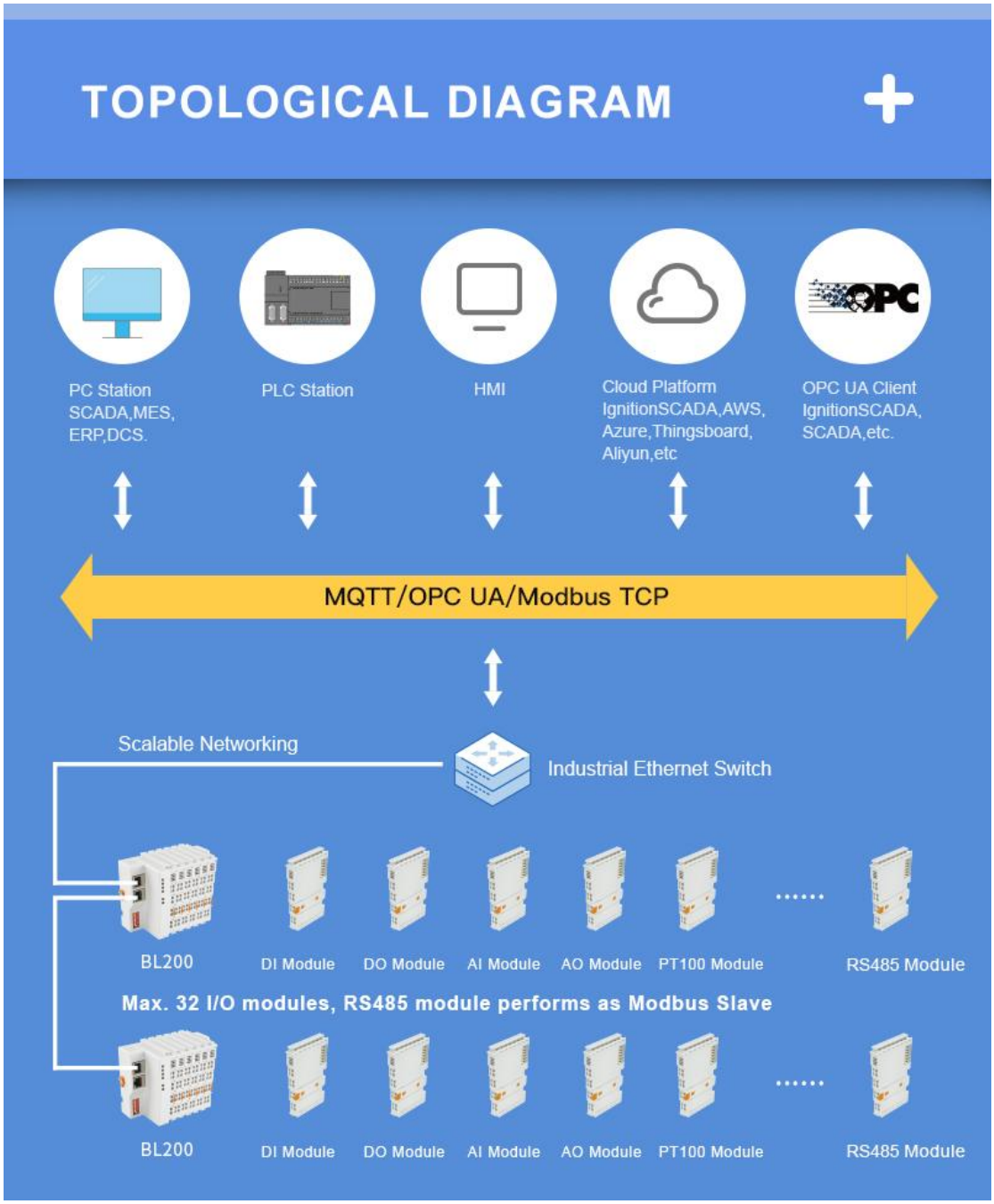
When assembling fieldbus node modules, each I/O module can be arranged in any combination, and it is not required to be grouped by module type.

A terminal module must be plugged into the end of a fieldbus node to ensure correct data transmission.

1.2 Typical Application

High reliability, easy expansion, easy setting, and convenient network wiring, these capabilities let users efficiently adapt the BL200 I/O system to a variety of complex industrial solutions.

The I/O system is widely applicable to a variety of industrial solutions, such as Internet of Things, smart factories, smart cities, smart medical care, smart homes, smart transportation, data center power environment monitoring, electric power, oil monitoring, automobiles, warehousing and logistics and other industries.



1.3 **Features**

- Each I/O system can have a maximum of I/O 32 modules.
- Support Modbus, MQTT, OPC UA, Profinet, EtherCAT, Ethernet/IP, BACnet/IP protocols.
- Support Alibaba Cloud, Huawei Cloud, AWS Cloud, Thingsboard, Ignition, etc.
- Support programmable logic control, edge computing, and customized

applications.

- The field side, the system side and the bus side are electrically isolated from each other.
- Support 2 X RJ45 interface, integrated switch function, can establish line topology, without the need for additional switches or hubs.
- Convenient wiring connection technology, screw-free installation.

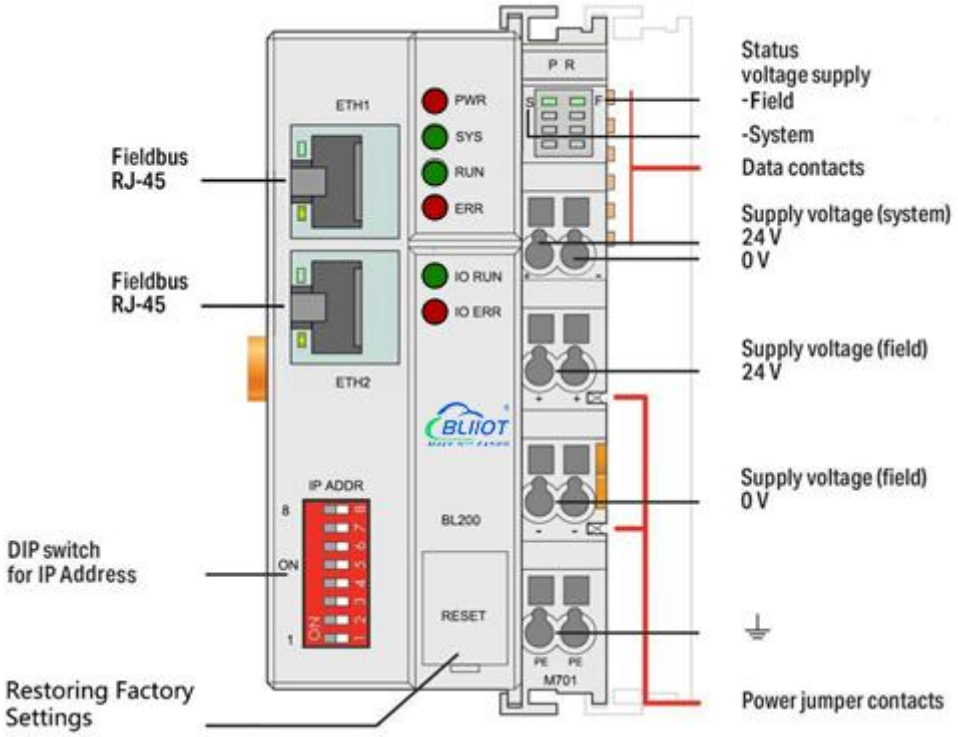
1.4 Model List

Description	Model	Channel	Type	
Modbus-TCP I/O Coupler	BL200	/	/	Finish
Profinet I/O Coupler	BL201	/	/	Finish
EtherCAT I/O Coupler	BL202	/	/	Finish
Ethernet/IP I/O Coupler	BL203	/	/	Finish
OPC UA EdgeIO Controller	BL205	/	/	Finish
MQTT EdgeIO Controller	BL206	/	/	Finish
MQTT+OPC UA+Modbus TCP	BL206Pro	/	/	Finish
BACnet/IP I/O Coupler	BL207	/	/	Ongoing
8CH DI, PNP	M1081	8	PNP	Finish
8CH DI, NPN	M1082	8	NPN	Finish
16CH DI, PNP	M1161	16	PNP	Finish
16CH DI, NPN	M1162	16	NPN	Finish
4CH DO, Relay	M2044	4	Relay	Finish
8CH DO, PNP	M2081	8	PNP	Finish
8CH DO, NPN	M2082	8	NPN	Finish
16CH DO, PNP	M2161	16	PNP	Finish
16CH DO, NPN	M2162	16	NPN	Finish
4CH AI 0/4-20mA Single-Ended	M3041	4	Current	Finish
4CH AI 0-5/10V Single-Ended	M3043	4	Voltage	Finish
4CH AI 0-5/10V Differential	M3044	4	Voltage	Finish
4CH AI ±5/±10V Differential	M3046	4	Voltage	Finish
4CH AO 0/4-20mA Single-Ended	M4041	4	Current	Finish
4CH AO 0-5/10V Single-Ended	M4043	4	Voltage	Finish
2CH 3Wire PT100	M5021	2	Resistor	Ongoing
2CH 3Wire PT1000	M5022	2	Resistor	Ongoing
2CH 4Wire PT100	M5023	2	Resistor	Ongoing
2CH 4Wire PT1000	M5024	2	Resistor	Ongoing

4CH TC	M5048	4	TC	Ongoing
2CH RS485	M6021	2	RS485	Finish
2CH RS232	M6022	2	RS232	Finish
1CH RS485, 1CH RS232	M6023	2	/	Finish
Power module	M7011	/	/	Finish
Terminal module	M8011	/	/	Finish
2CH SSI encoder	M9024	2	Encoder	Ongoing

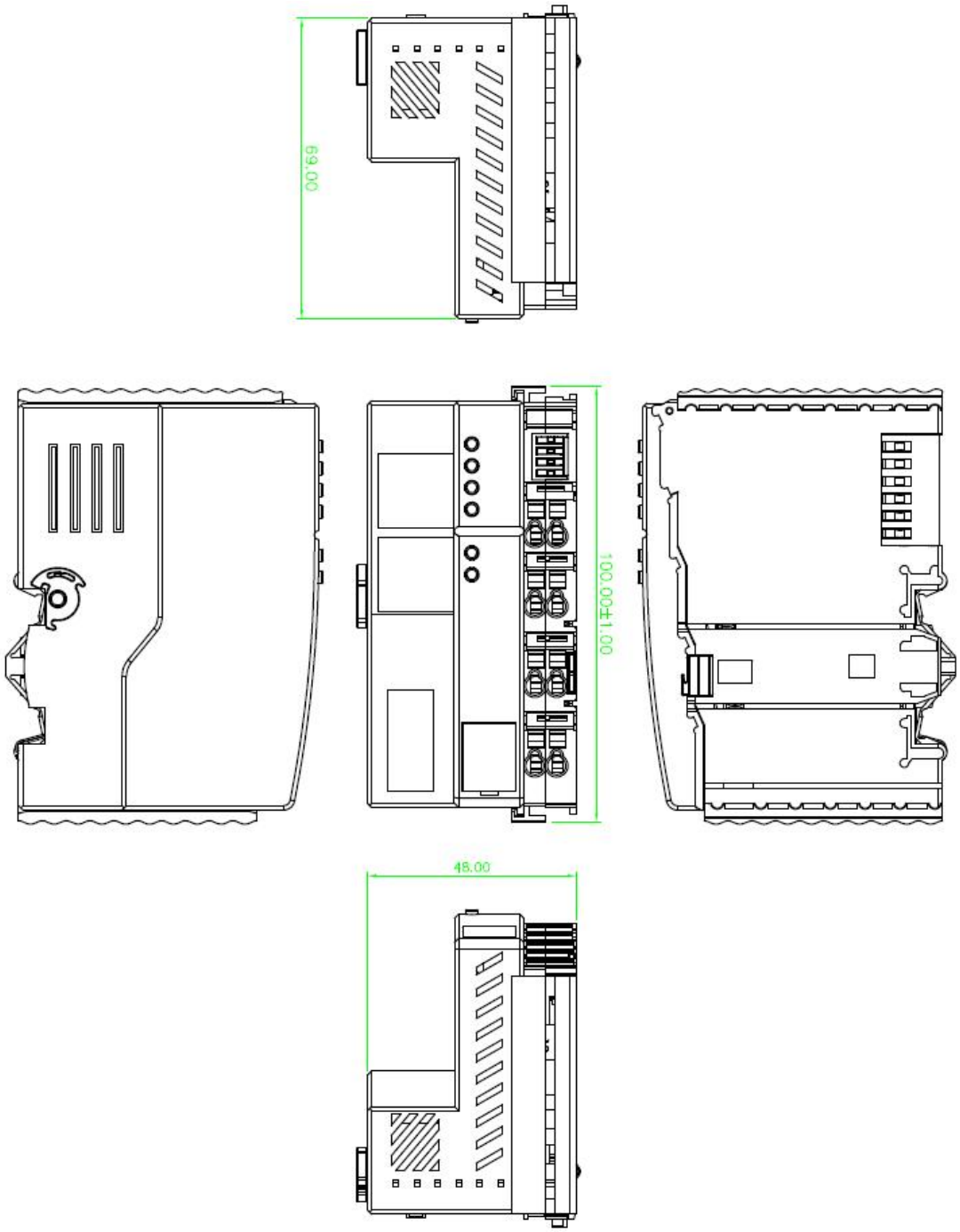
2 Hardware

2.1 I/O Controller



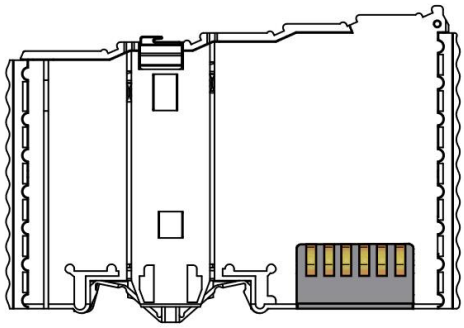
2.2 Dimension

Unit:mm



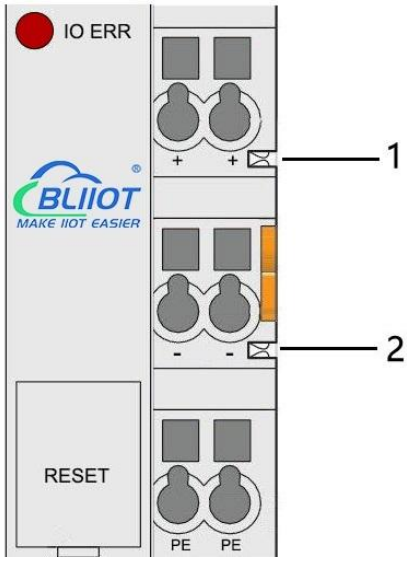
2.3 Data Contacts/Internal Bus

The communication between the fieldbus coupler/controller and the I/O modules, as well as the system power supply of the I/O modules are realized via the internal bus. The internal bus is made up of 6 data contacts, these gold-plated contacts are self-cleaning when connected.



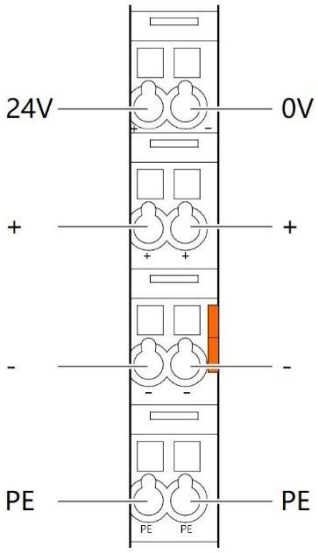
2.4 Power Jumper Contacts

The power module included with the coupler has two self-cleaning power jumper contacts for powering the field side. This power supply has a maximum current of 10A across the contacts, current exceeding the maximum will damage the contacts. When configuring the system, it must be ensured that the above-mentioned maximum current is not exceeded. If it exceeds, a power expansion module needs to be inserted.



No.	Type	Description
1	Spring contact	Supply 24V to the field side
2	Spring contact	Supply 0V to the field side

2.5 Terminal Point



Name	Description
24V	System Power 24VDC
0V	System Power 0VDC
+	Connections Field Supply 24 VDC
+	Connections Field Supply 24 VDC
-	Connections Field Supply 0 VDC
-	Connections Field Supply 0VDC
PE	Grounding
PE	Grounding

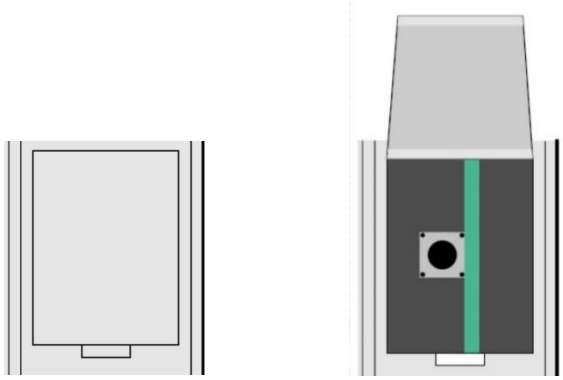
2.6 Factory Reset

This reset button is used to restore the device configuration parameters to the factory state.

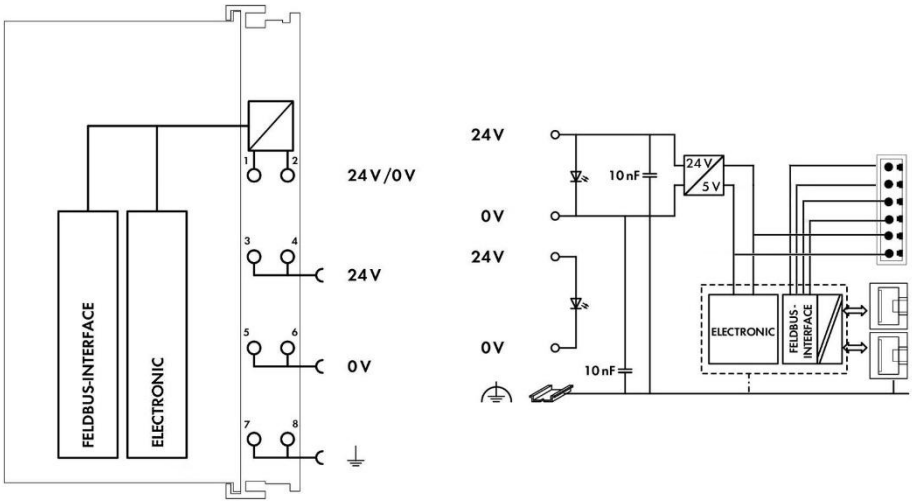
Operation steps:

1.When the device is running, open the flip cover;

2.Press and hold the button for more than 5 seconds, until all the LED lights go off, indicates reset successful, and then the device will automatically restart.



2.7 Electrical Schematic



3 Installation

3.1 Installation Sequence

All distributed couplers/controller and I/O modules from Beilai Technology must be mounted on a standard DIN 35 rail.

Starting from the coupler, the I/O modules are assembled from left to right, and the modules are installed next to each other. All I/O modules have grooves and power jumper contacts on the right side, to avoid assembly errors, I/O modules must be inserted from the right and top to avoid damage to the modules.

Utilizes a tongue and groove system to form a secure fit and connection. With the automatic locking function, the individual components are securely fixed on the rail

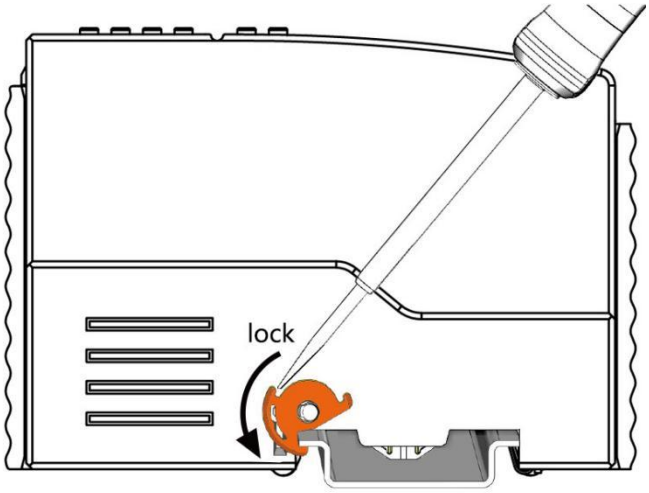
after installation.

Don't forget to install the terminal module! Always plug a terminal module (eg TERM) into the end of the I/O module to ensure correct data transmission.

3.2 Install Coupler

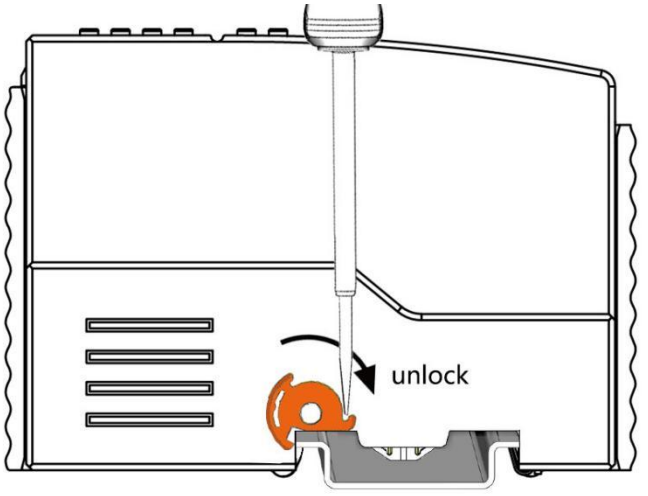
1.Snap the coupler onto the DIN rail first;

2.Use a tool such as a screwdriver to turn the locking cam until the locking cam engages the DIN rail.

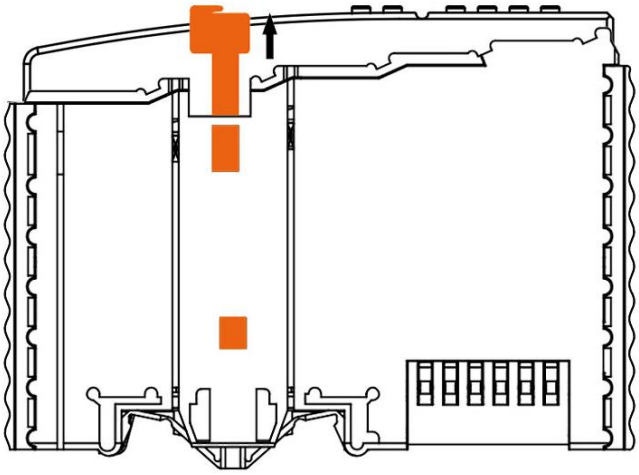


3.3 Remove Controller

1.Use a screwdriver to turn the locking disc cam until the locking cam no longer engages the rail.



2.Pull the release tab to remove the coupler from the assembly

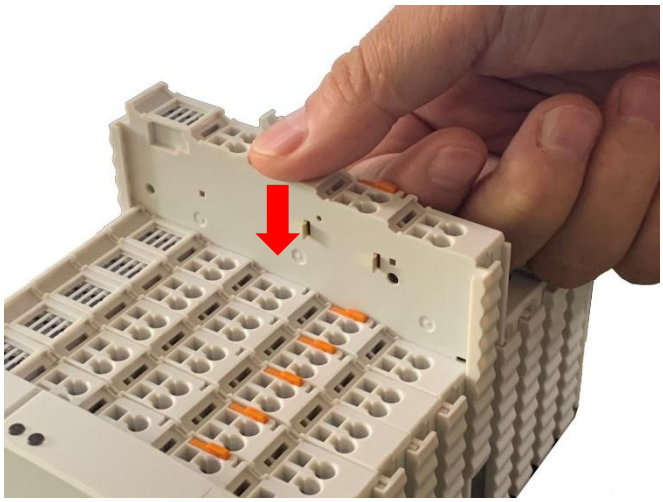


Data or power contacts are electrically disconnected from adjacent I/O modules when the coupler/controller is removed.

3.4 Insert I/O Modules

1.When inserting the module, make sure the tabs on the module line up with the grooves of the coupler or other I/O module to which it is attached.

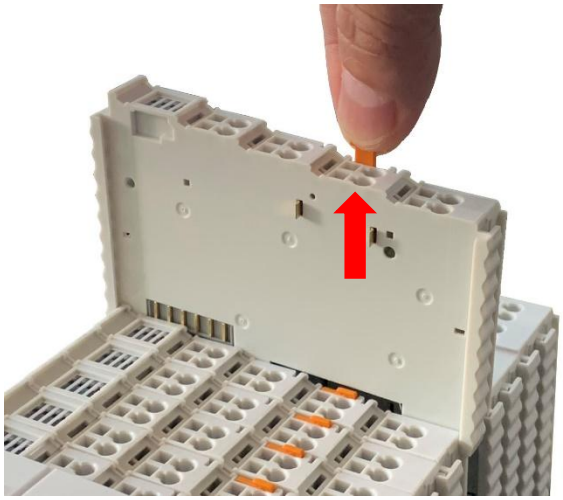
2.Press the I/O module into the assembly position until the I/O module snaps into the rail.



After the I/O module is installed, the electrical connection to the coupler (or the previous I/O module) and the following I/O module is established via the data contacts and the power jumper contacts.

3.5 Remove I/O Modules

Pull up on the latch to remove the I/O module from the assembly.



When the I/O module is removed, the electrical connection to the data or power jumper contacts is disconnection.

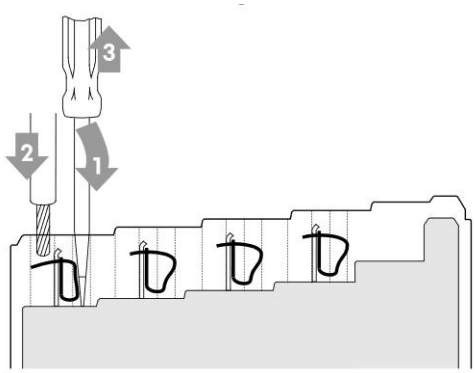
4 Device Connection

4.1 Wiring

CAGE CLAMP connection is suitable for solid, stranded and fine-stranded conductors. Only one wire can be connected to each CAGE CLAMP. If there is more than one wire,

it must be merged into a point before being connected.

1. Open the CAGE CLAMP by inserting the tool into the opening above the junction.
2. Insert the wire into the corresponding open connection terminal.
3. Once the tool is removed, the CAGE CLAMP closes and the wire is clamped firmly by the spring.



4.2 Power Supply

System and field voltages are supplied by power supply modules. The power supply module of the BL200 series coupler supplies power for the internal electronics of the coupler and the I/O modules. If necessary (there are many I/O modules and the current is relatively high), it can also be provided through an independent power supply module.

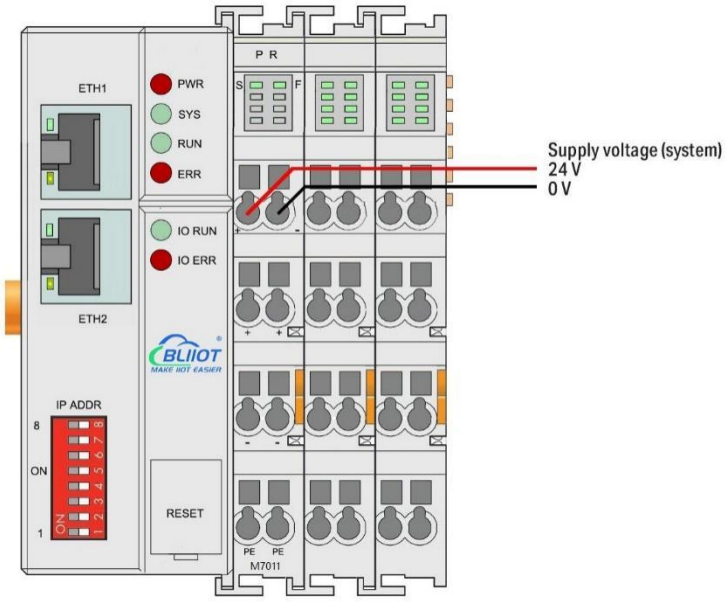
The fieldbus interface (Ethernet interface), system and field are galvanically isolated from each other.

4.2.1 System Power

BL200 series couplers require 24V DC system power, which is connected from the terminal of the power supply module. The 5V bus voltage required inside the system is converted from the 24V system voltage.

The power supply module only has proper fuse protection, please provide proper overcurrent protection externally.

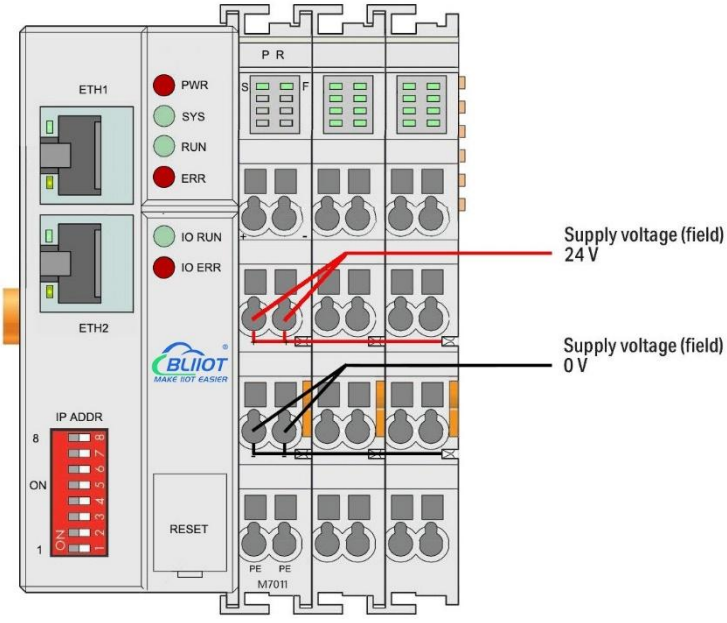
Please pay attention to matching the output power of the power supply module and the load power to avoid excessive load current.



4.2.2 On-site Power Supply

The power supply module supplies 24 VDC on the field side to power the sensors and actuators.

Field power supply only has proper fuse protection. Without overcurrent protection, electronic equipment can be damaged.



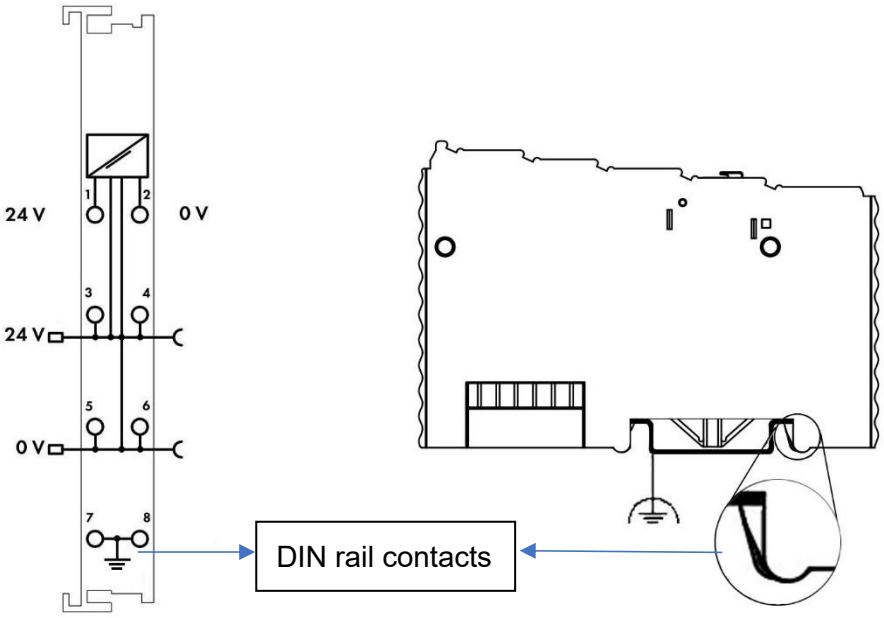
Field-side power is automatically output from the power jumper contact when the I/O module is connected. The continuous load current across the contacts of the power supply must not exceed 10 A.

The problem of excessive load power on the system side or on the field side can be

solved by plugging in additional power supply modules. After plugging in an additional power supply module, a new voltage potential may appear on the field side.
In the case where electrical isolation is not required, the field power supply and the system power supply can use the same power supply.

4.2.3 Grounding

When installing the enclosure cabinet, the cabinet must be grounded, and the rail is electrically connected to the cabinet through screws to ensure that the rail is properly grounded. Grounding can increase resistance to electromagnetic interference. Some components in the I/O system have rail contacts that dissipate EMI onto the rail.



5 BL200 Series Coupler/Controller

5.1 BL200 Modbus TCP Coupler

5.1.1 BL200 Coupler Overview

The Modbus TCP coupler supports standard Modbus TCP server communication, and the Ethernet supports the dual network port switch cascading function. The device

supports simultaneous access by 15 clients, supports function code 01/02/03/04/05/06/15/16, and supports 32 extended I/O modules.

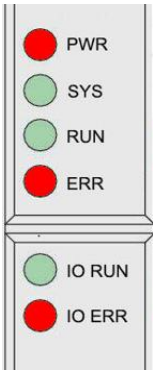
5.1.2 Technical Parameters

Name	Parameter	Description
Systen power	Input voltage(system)	24 VDC
	Input current(system)	MAX 500 mA@24VDC
	Power Efficiency	84%
	Internal bus voltage	5VDC
	Coupler consumption current	MAX 300mA@5VDC
	I/O consumption current	MAX 1700mA@5VDC
	Isolation protection	500 V system/supply
Field power	Input voltage (field)	24 VDC
	Power supply current across contacts (MAX)	10 ADC
Ethernet	Number	2 X RJ45
	Transmission medium	Twisted Pair STP 100 Ω Cat 5
	MAX cable length	100m
	Baud rate	10/100 Mbit/s
	Isolation protection	ESD contact: 8KV, Surge: 4KV(10/1000us)
System	Operating system	Linux
	CPU	300MHz
	RAM	64MB
	Flash	128MB
	I/O Modules	MAX 32
	Process mapping (Modbus) data points via serial port module	● Bool : 4096 ● 16 Bit : 2048 ● 32 Bit : 1024
	Protocol	Modbus TCP, HTTP, DHCP, DNS
	Maximum number of connections	15 Modbus TCP
Wiring method	Method	CAGE CLAMP
	Wire diameter	0.08 mm² ··· 2.5 mm², AWG 28 ··· 14
	Stripping length	8 mm ··· 9 mm / 0.33 in

Environment	Working temperature	0 ··· 55 ° C
	Storage temperature	-40 ··· 70 ° C
	Relative humidity	5 ··· 95% no condensation
	Working altitude	0 ··· 2000 m
	Protection type	IP20
Dimension	Width	48mm
	Length	100mm
	Height	69mm
Material	Color	Light gray
	Shell material	Polycarbonate, Nylon 6.6
	Fire load	1.239 MJ
	Weight	180g
Installation	Method	DIN-35 rail
Certificates	EMC	EN 55022: 2006/A1: 2007 (CE &RE) Class B
		IEC 61000-4-2 (ESD) Level 4
		IEC 61000-4-3 (RS) Level 4
		IEC 61000-4-4 (EFT) Level 4
		IEC 61000-4-5 (Surge)Level 3
		IEC 61000-4-6 (CS)Level 4
		IEC 61000-4-8 (M/S) Level 4

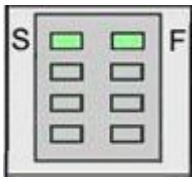
5.1.3 Hardware Interface

5.1.3.1 LED Indicators



LED	Description	Color	Status	Meaning
PWR	Power indicator	Red	ON	Power connection successful

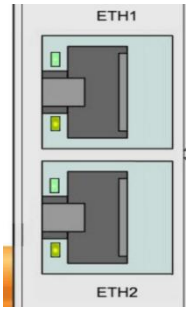
			OFF	No power
SYS	System indicator	Green	ON	System is abnormal
			OFF	System is running normally
RUN	Running indicator	Green	Flashing	System is running normally
			OFF	System is abnormal
ERR	Error indicator	Red	ON	Northbound protocol connection error
			OFF	No errors
I/O RUN	I/O Running indicator	Green	Flashing	I/O module is working normally
			OFF	Module not inserted
I/O ERR	I/O Error indicator	Red	ON	I/O module communication error
			OFF	No errors



LED	Description	Color	Status	Meaning
S	System 24V power indicator	Green	ON	Power is OK
			OFF	No power
F	Field 24V power indicator	Green	ON	Power is OK
			OFF	No power

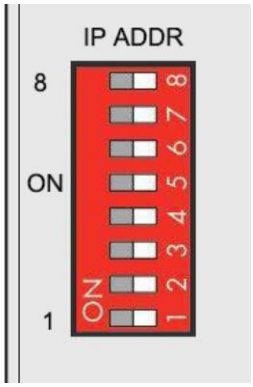
5.1.3.2 Ethernet Port

It is connected to the Ethernet-based fieldbus through the ETH2, and the EHT1 is used to connect other nodes that need to be connected to the Ethernet.



5.1.3.3 IP Address Selection Switch

The 8-bit DIP switch is used to set the IP address. The encoding of DIP switches is done bit by bit, starting from DIP switch 1 with the least significant bit (2^0) to DIP switch 8 with the most significant bit (2^7), corresponding to decimal values: 0-255.



When the value of the DIP switch is 1111 1111 (decimal 255), the IP address is set according to the web page. The web page setting can specify the IP or set the automatic acquisition. When the web page is not set, the IP address is: 192.168.1.10
When the value of the DIP switch is 0000 0000 – 1111 1110 (decimal 0-254), determine the 3rd byte of the IP address, and the 1st, 2nd and 4th bytes are fixed bytes, namely 192.168.xxx.253

5.1.4 Modbus Register Mapping

The internal register map of BL200 coupler node consists of 2 parts, one part is the data map of digital input and output and analog input and output module, the address range is 1000...9999; the other part is the serial port module, the address range is 10000... 49999
The state of digital and analog I/O modules can be determined or changed through the register map (Address 1000 ... 9999).

Modbus address		Data type	Access type	Function code	Description
decimal	hex				
1000…1999	0x03 E8…0x07 CF	1 Bit	read/write	0x01/05/0F	Digital output DO
2000…2999	0x07 D0…0x0B B7	1 Bit	read	0x02	Digital input DI
3000…3999	0x0B B8…0x0F 9F	32 Bit Float	read	0x04	Analog input AI
4000…4999	0x0F A0…0X13 87	32 Bit Float	read/write	0x03/06/10	Analog output

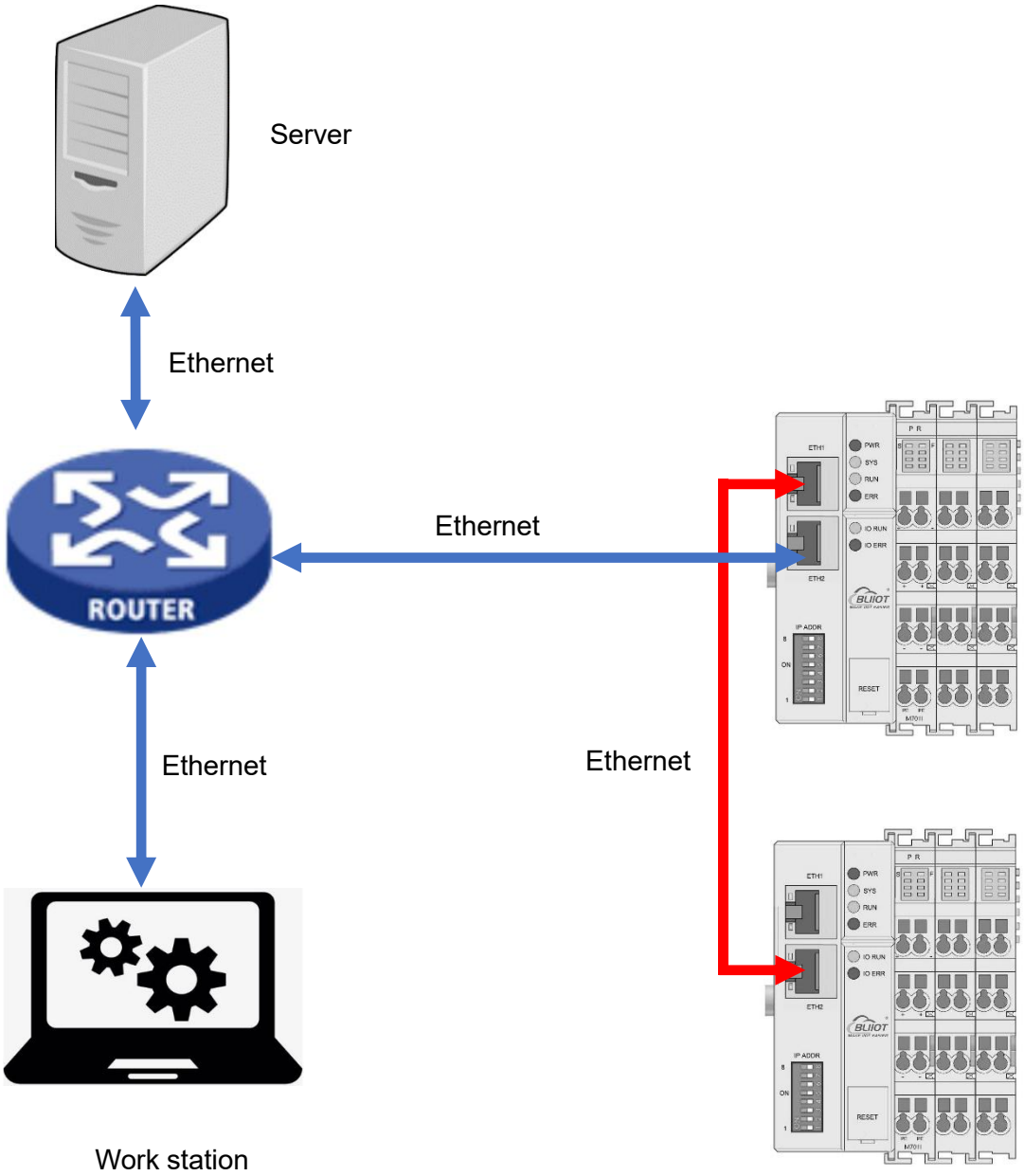
					AO
5000…8999	0x13 88…0x23 27	32 Bit Unint	read/write	0x03/04/10	DI count value
9000…9999	0x23 28…0x27 0F	1 Bit	read	0x02	Module power-on status

Determine or change the state of the data mapped from the serial I/O module through address 10000 ... 49999

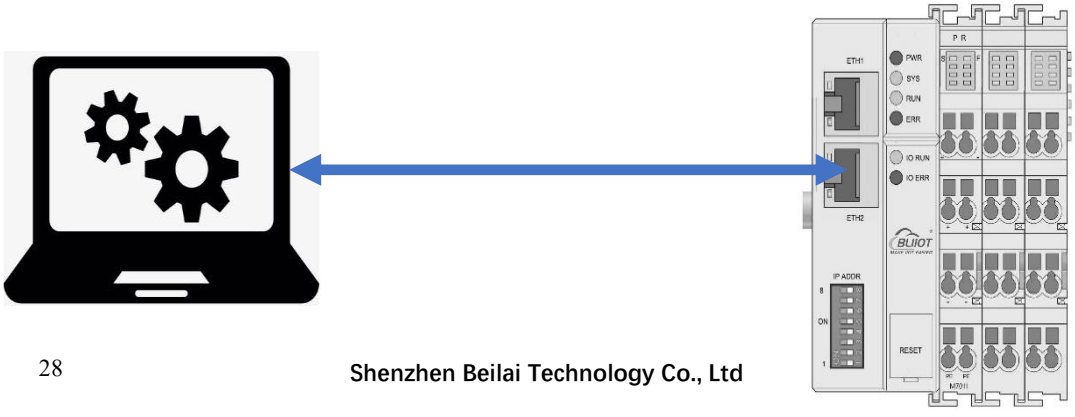
Modbus address		**Data type**	**Access type**	**Function code**	**Description**
decimal	**hex**				
10000…19999	0x27 10…0x4E 1F	1 Bit	read/write	0x01/05/0F	Digital output DO
20000…29999	0x4E 20…0x75 2F	1 Bit	read	0x02	Digital input DI
30000…39999	0x75 30…0x9C 3F	16 Bit	read	0x04	Analog input AI
40000…49999	0x9C 40…0XC3 4F	16 Bit	read/write	0x03/06/10	Analog output AO

5.1.5 Coupler Connection

The BL200 coupler comes with 2 x RJ45 Ethernet interfaces, integrated switch function inside, work in store-and-forward operation mode, each port supports 10/100 Mbit transmission speed and full-duplex and half-duplex transmission mode.
The BL200 coupler connect to the router Ethernet network via ETH2 only, while the EHT 1 is for connecting other BL200 field nodes.
The internal integrated switch supports bypass mode, which can automatically start the bypass mode when the controller system fails, and automatically maintain the link between ETH1 and EHT2.
The wiring of these Ethernet interfaces conforms to the 100BaseTX specification, which specifies the use of category 5 twisted pair cable as the connecting cable. Cable types S/UTP (Screened unshielded twisted pair) and STP (shielded twisted pair) can be used up to a length of 100m.



Directly connected to the computer through ETH 2.



5.1.6 Web Page Configuration

The BL200 coupler's built-in web server is a browser-based configuration utility. When the coupler is connected to your network, you can enter the server's IP address in a web browser to access the web console.

5.1.6.1 Preparation Before Configuration

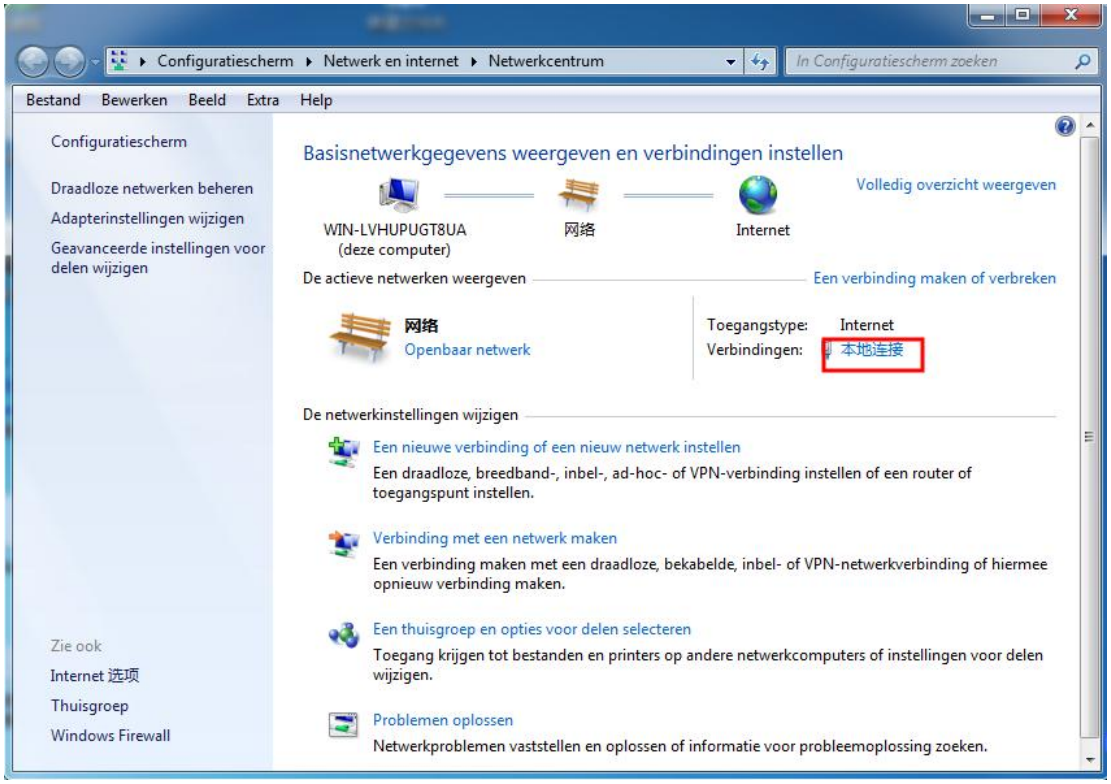
To successfully access the BL200 coupler, it must be properly installed and connected to the computer. In addition, configure them with correct IP addresses to keep them in the same network segment.

5.1.6.1.1 Connect Computer and Coupler

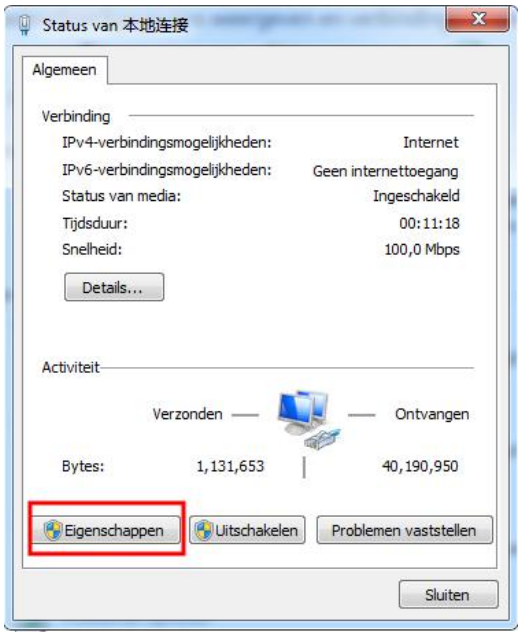
1.Mount the fieldbus node on a DIN35 rail. Follow the installation instructions in the "Installation" chapter.
2.Connect the 24 V power supply to the system power terminals.
3.The computer and the bus node can be connected in two ways, one is that the two are connected to the switch device of the local area network through the Ethernet interface; the other is that the two are directly connected point-to-point. For detailed steps, follow the instructions in the "Coupler Connection" chapter.
4.Turn on the power supply and start supplying power.
The coupler is initialized after power-up, creates process image according to the I/O modules configuration of the fieldbus node.

5.1.6.1.2 Configure Computer IP Address

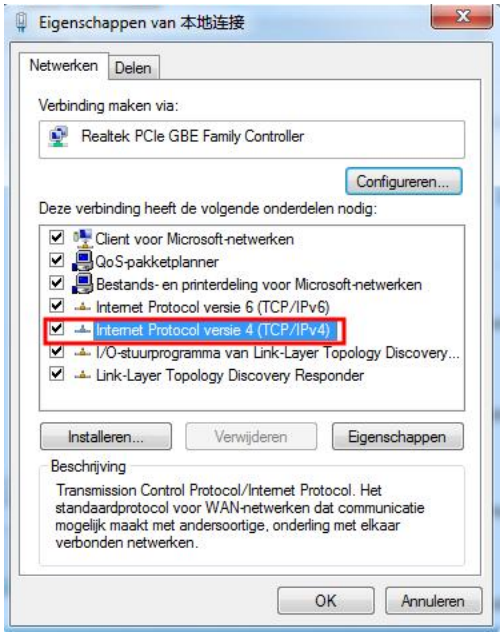
There are two ways to configure PC IP address. One is to turn on the automatic IP address option on the PC's local connection to dynamically assign DHCP in the network. The other is to configure a static IP address with the coupler node on the same network segment on the local connection of the PC.
Takes Windows 7 system as an example for configuration. Windows systems are all configured similarly.
1.Click Start > Control Panel > Network and Sharing Center, and click local connection in the window that opens.



2.In the local connection status window, click Properties.



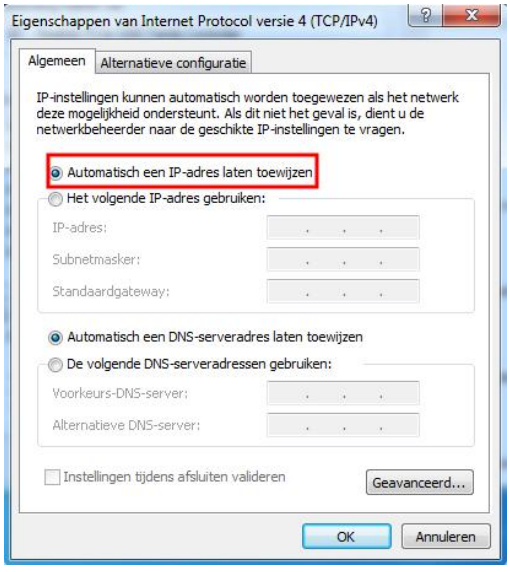
3.Double-click "Internet Protocol Version 4 (TCP/IPv4)" on the local connection properties page.



4.There are two ways to configure the IP address of the PC

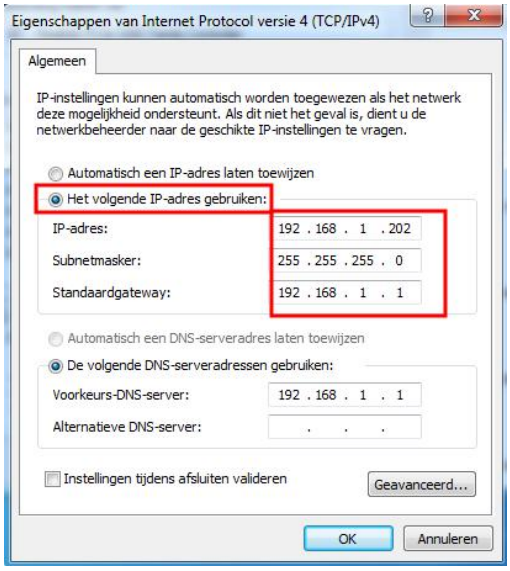
- Obtain IP address automatically (system default mode)

  To obtain an IP address automatically from a DHCP server, select "Obtain an IP address automatically";



- Set a static IP address

  Select "Use the following IP address" and set the correct values for the IP address, subnet mask and default gateway.



5.1.6.1.3 Configure Coupler IP address

There are 2 ways to assign an IP address

- Assignment via built-in web page (static IP or automatic IP assignment)
- Assign via DIP switch (static IP)

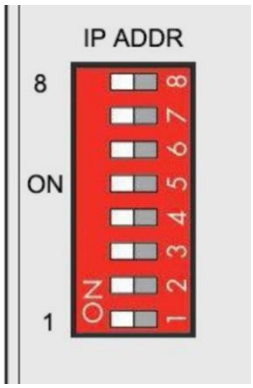
DIP address selector switch definition

Switch position (ON = 1)	**Value**	**Definition**
0000 0000 --- 1111 1110	0-254	Enable the DIP selector switch assignment function and determine the value of the 3rd byte. Example: 0010 0110 (22 decimal), the IP address is "192.168.22.253".
1111 1111	255	Enable the function of specifying IP on the web page, or select the function of DHCP automatic allocation. When the IP is not allocated through the web, the IP is 192.168.1.10.

5.1.6.1.3.1 Configuration via Web Page

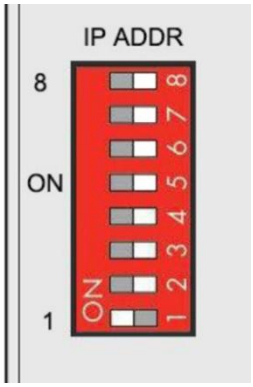
The fieldbus coupler can be set to an IP address via the "Settings > Local Settings"

page after entering the page, or it can be set to be assigned automatically. Select static address, if not set IP address, the IP is 192.168.1.10



5.1.6.1.3.2 Assign IP via DIP Switch

Set the value of the DIP address selector switch to 0000 0000 - 1111 1110 (decimal 0 - 254), and the IP address will be assigned by the DIP switch.
The IP address consists of fixed bytes and variable bytes. The 1st, 2nd and 4th bytes are fixed bytes, the DIP selector switch determines the 3rd byte, namely:
192.168.xxx.253
The fieldbus controller assigns an IP address via a DIP switch, and the IP address set in this way is static.



5.1.6.1.4 Factory Default Settings

Before logging into the web configuration page, it is necessary for you to understand the following default parameters,
Modbus TCP Server Port: 502, Modbus ID: 1
IP: Determined according to the DIP switch, if the DIP switch is 1111 1111, the default IP is 192.168.1.10

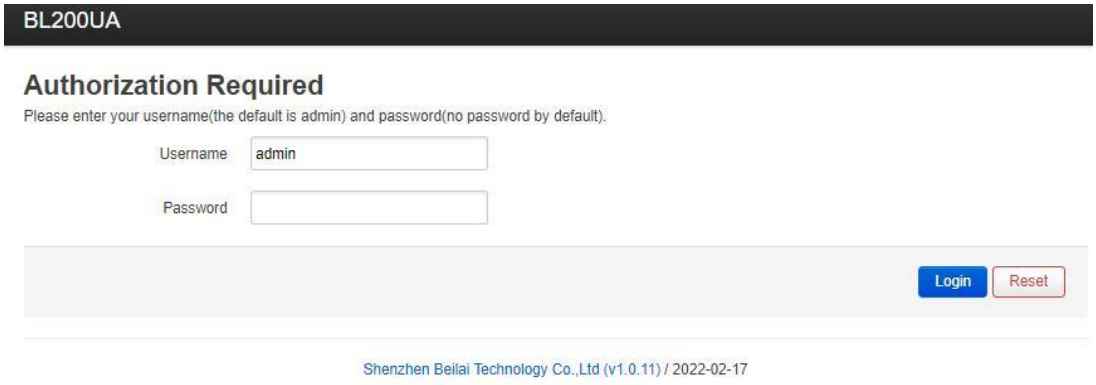
Item	Description
Username	admin
Password	Empty

5.1.6.2 Login Configuration Page

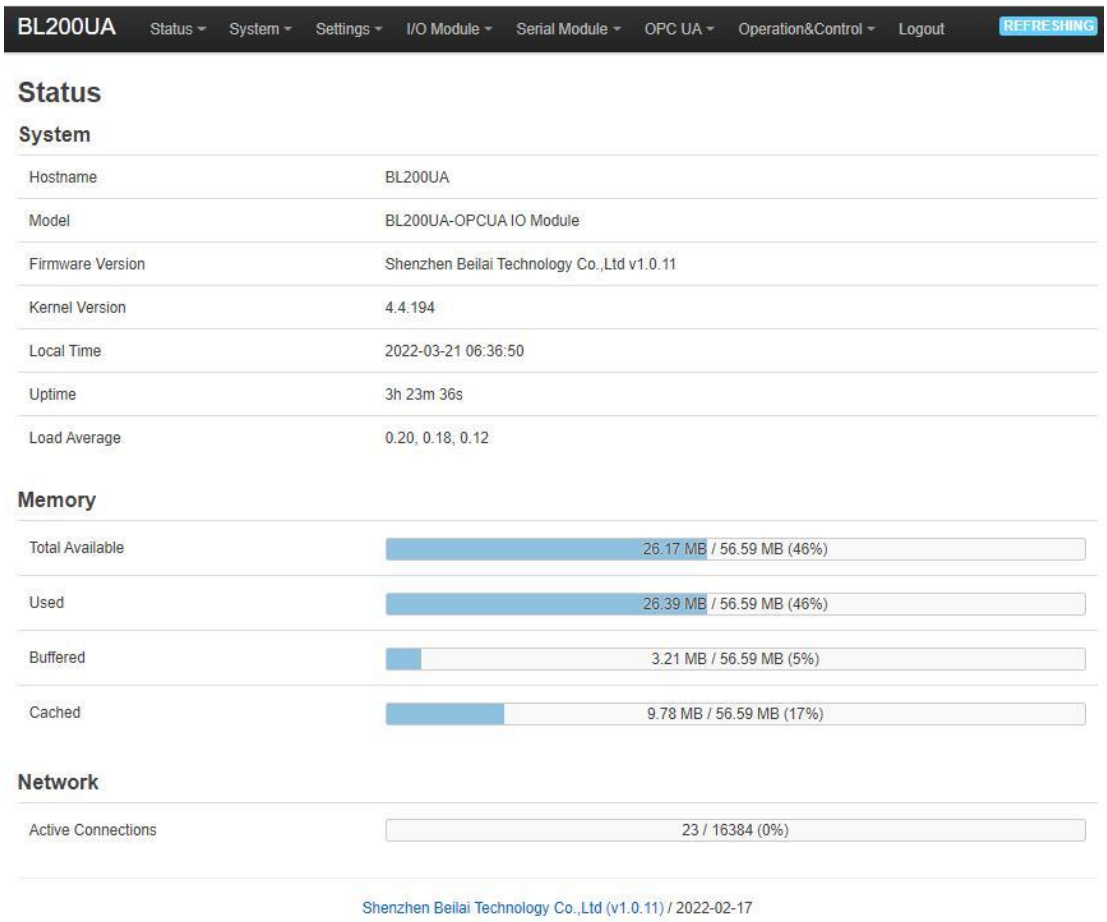
1.Open a browser on your computer, such as IE, Chrome, etc.

2.Enter the IP address of the coupler node (192.168.1.10) in the address bar of the browser to enter the user login interface.

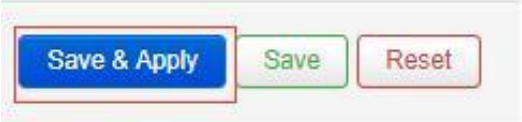
3.Enter "Username" and "Password" in the login interface, and then click Login.



4.After successfully logging in to the web interface, the display is as follows



5.After configuring the parameters, you need to click the "Save and Apply" button on the page to take effect.

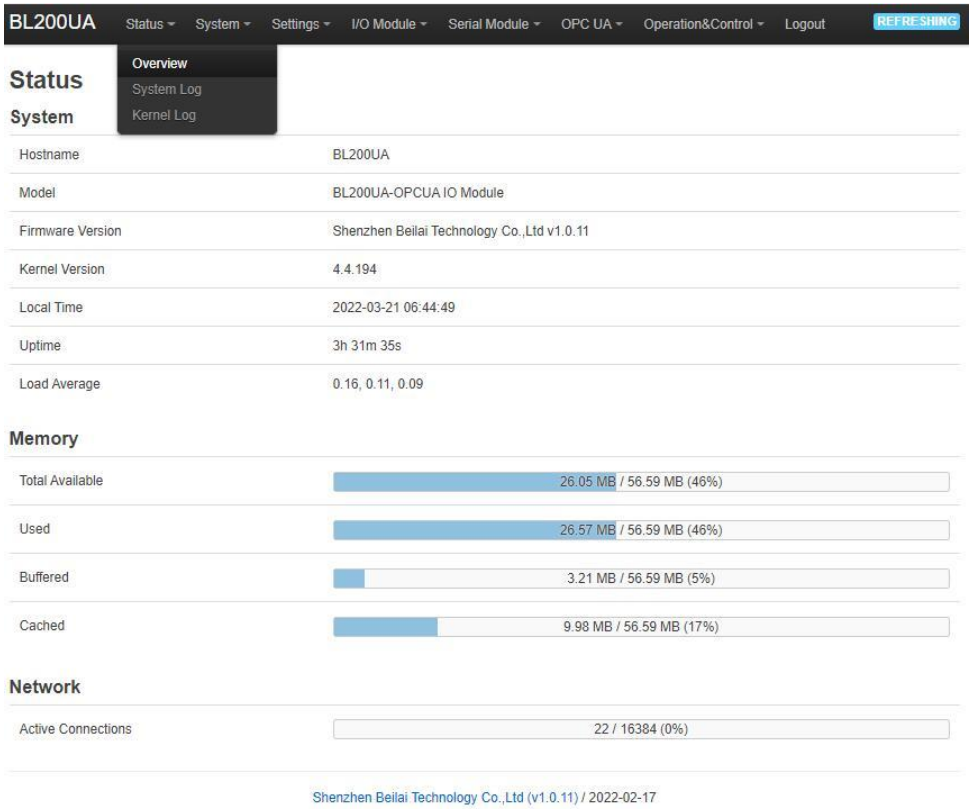


5.1.7 Web Configuration Page Description

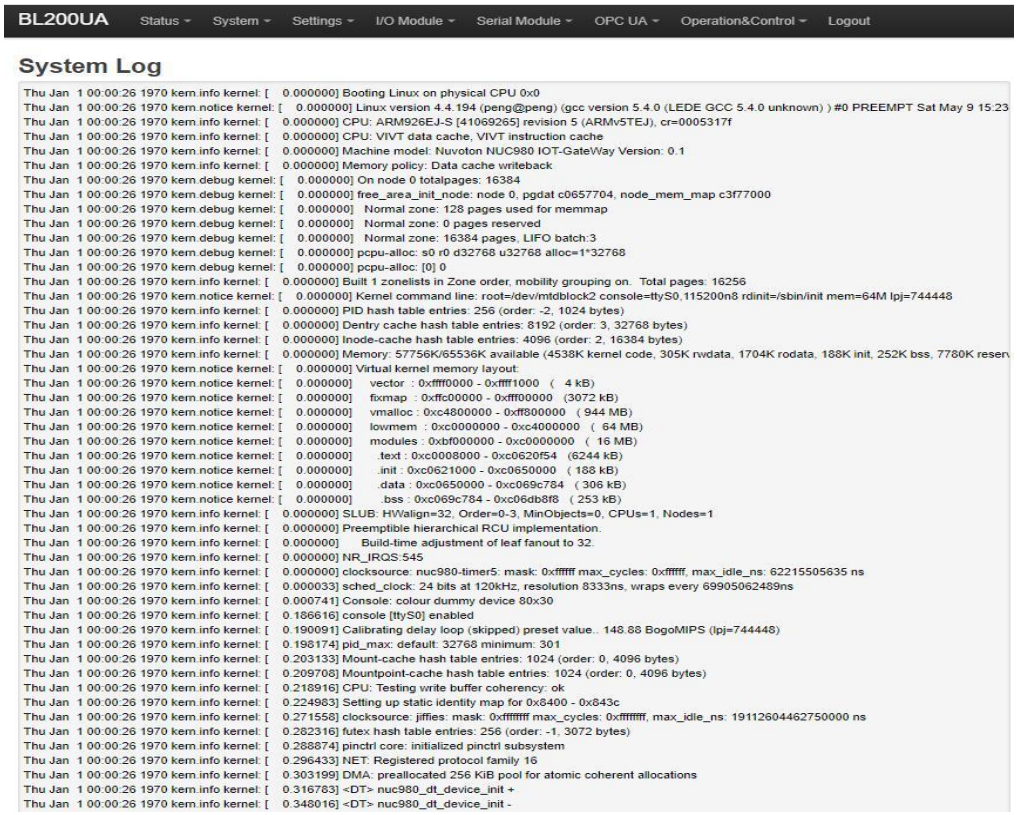
5.1.7.1 Status

Users can check overview, system log and kernel log, as well as device parameters and device operating status.

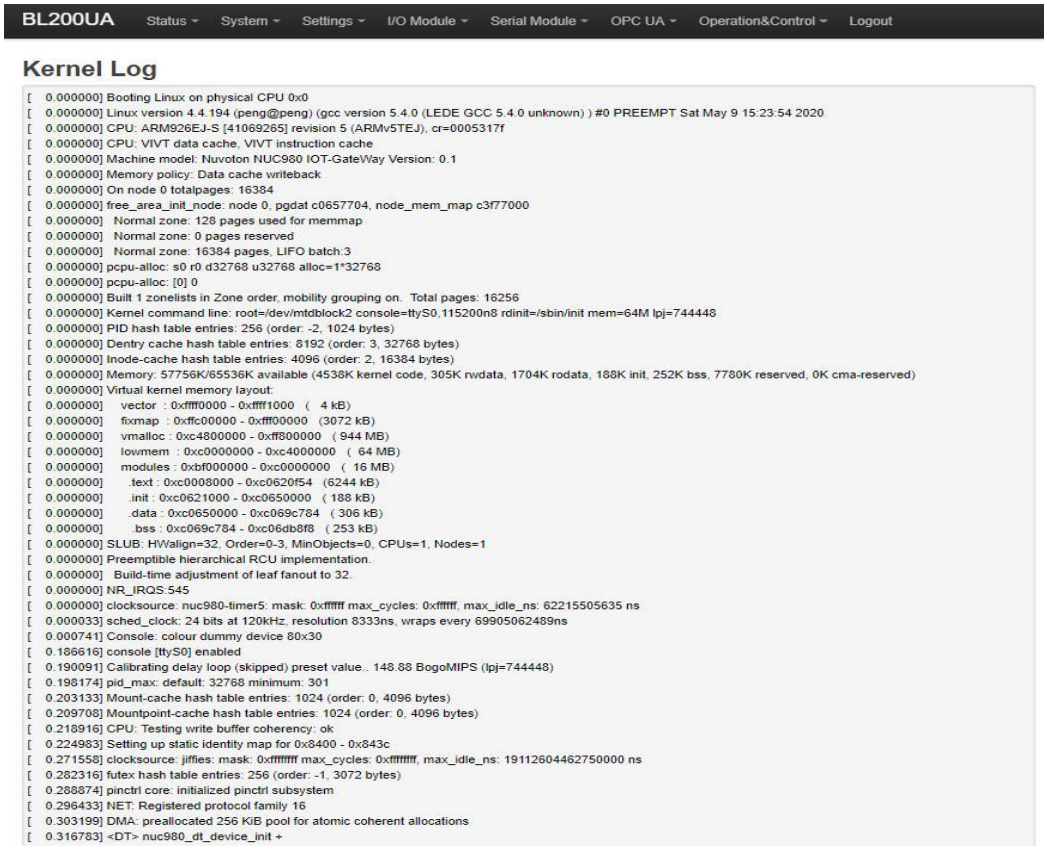
Status > Overview



Status > System Log



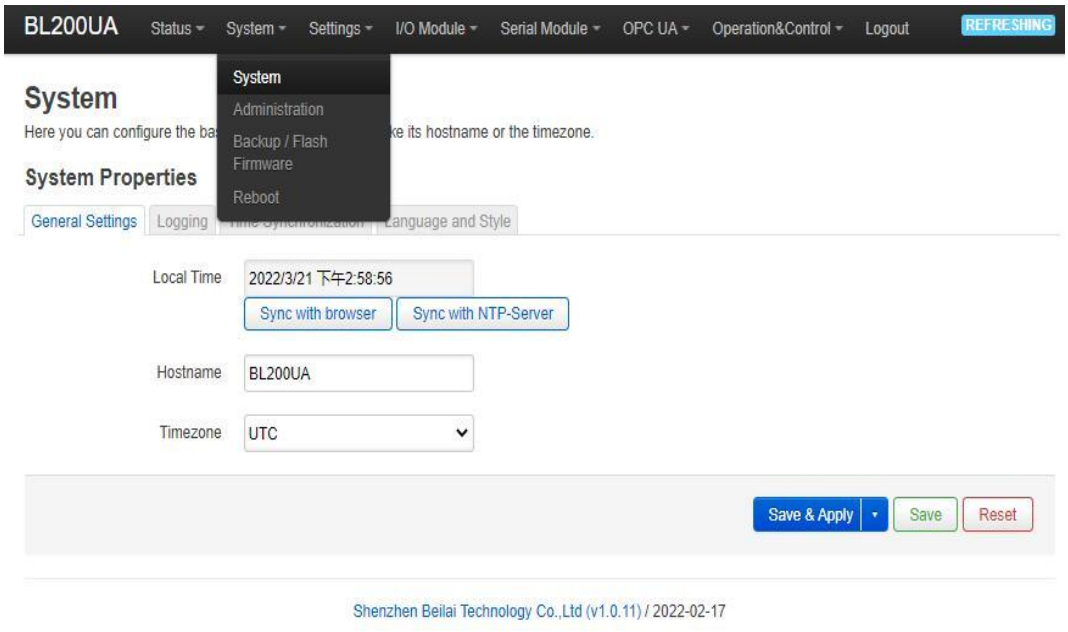
Status > Kernel Log



5.1.7.2 System

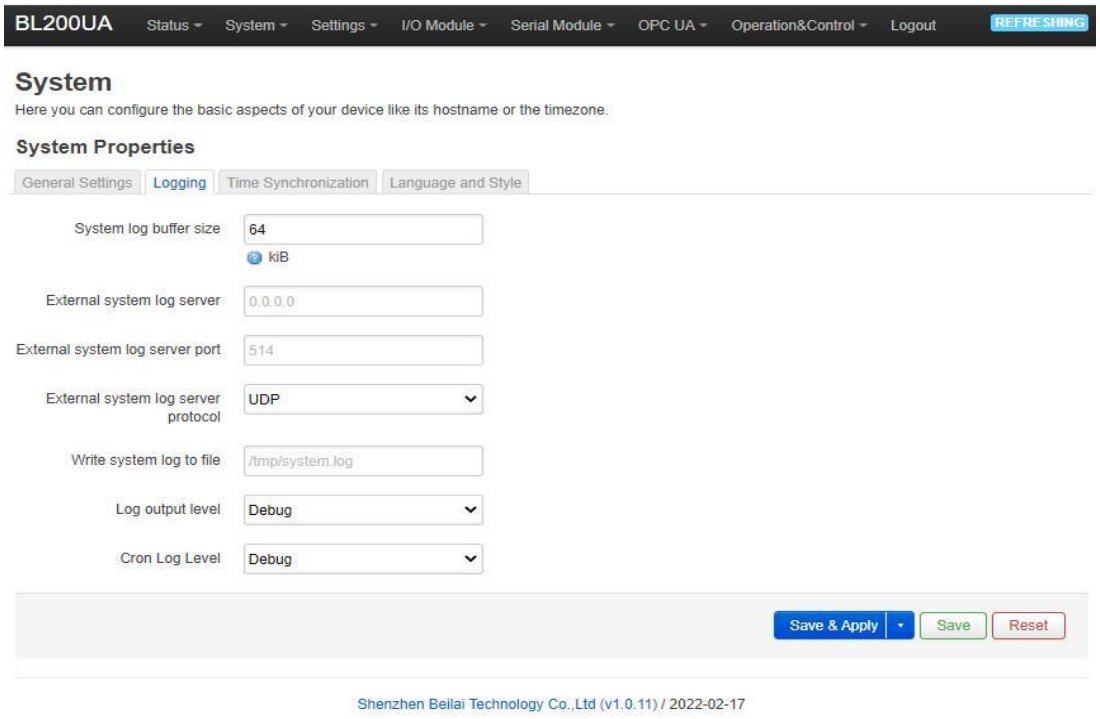
5.1.7.2.1 System

System Properties > General Settings



Item	Description	Default
Local time	Displays the current time of the device. You can click the "Sync browser time" or "Sync with NTP server" button to update the device time.	--
Hostname	The device name can be customized to easily distinguish between multiple devices.	BL200
Timezone	The time zone can be selected via the drop down menu	UTC

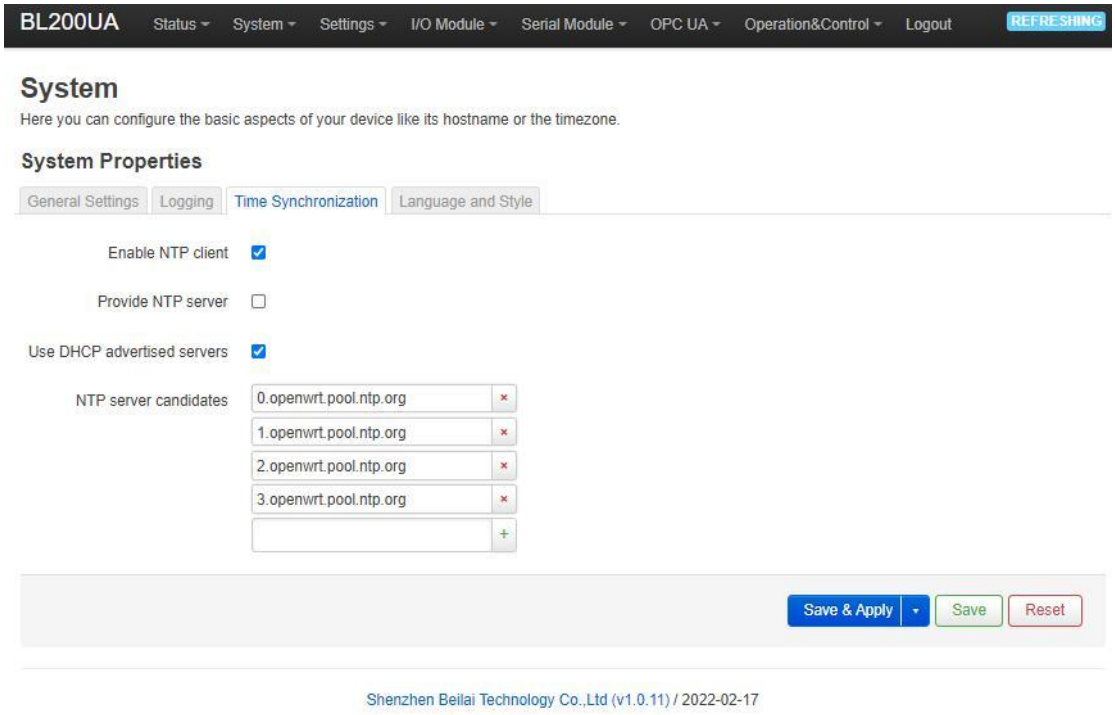
System Properties > Logging



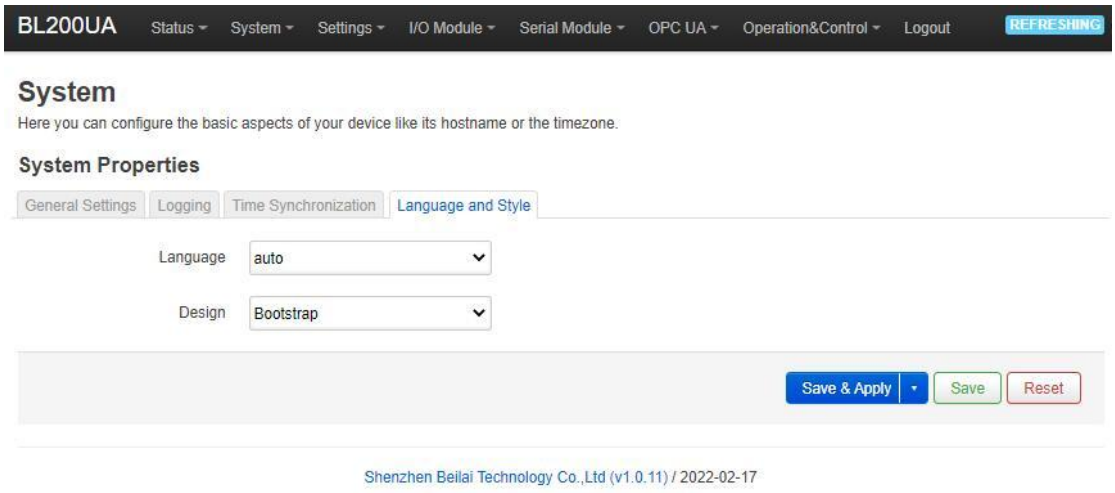
Item	Description	Default
System log buffer size		64
External system log server		
External system log server port		
External system log server protocol		
Write system log to file		
Log output level		
Cron log level		

System Properties > Time Synchronization

An NTP server can be set to synchronize time



System Properties > Language and Style

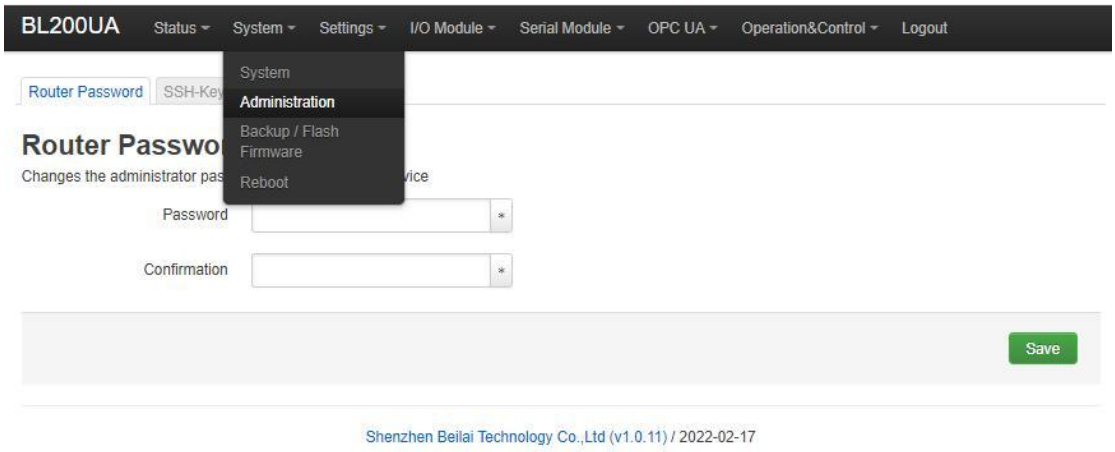


Item	Description	Default
Language	Available in auto, English, Chinese	auto
Design	Currently only Bootstrap is supported.	Bootstrap

5.1.7.2.2 Administration

Administration > Router Password

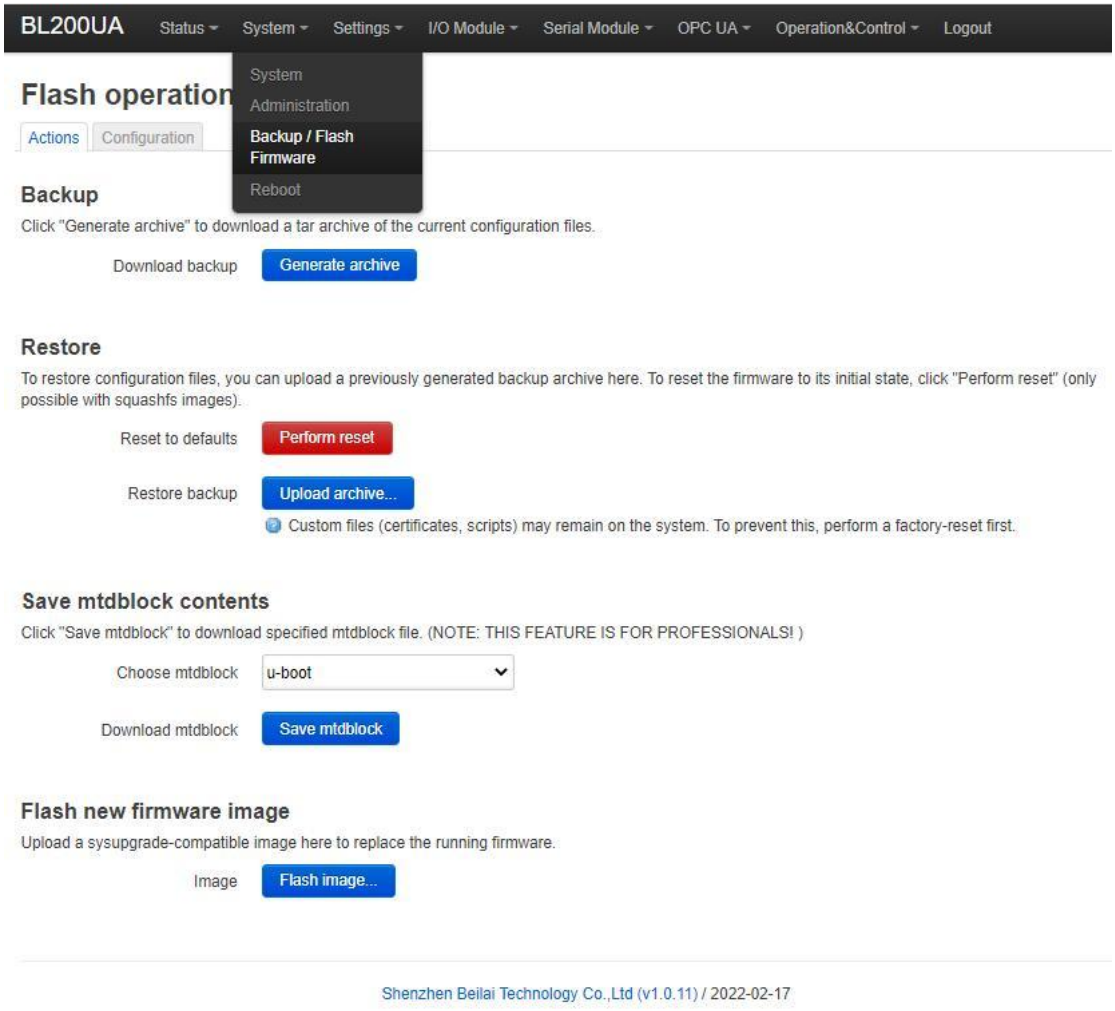
Change the administrator password for accessing the device.



Administration > SSH Keys

Public keys allow for the passwordless SSH logins with a higher security compared to the use of plain passwords. In order to upload a new key to the device, paste an OpenSSH compatible public key line or drag a .pub file into the input field.

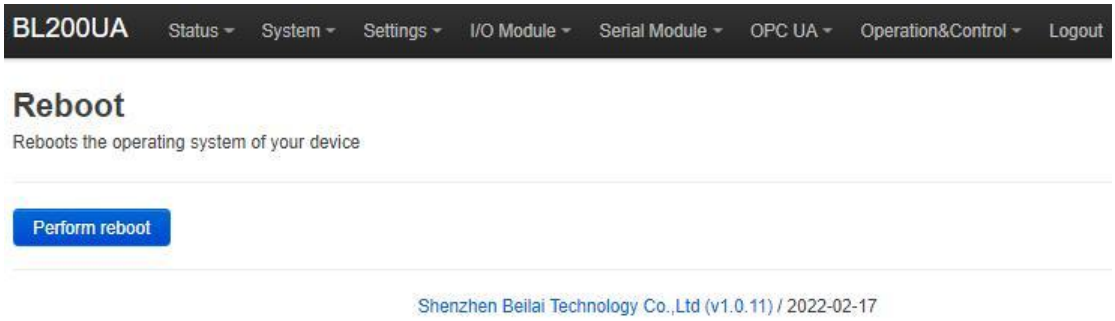
5.1.7.2.3 Backup/Flash Firmware



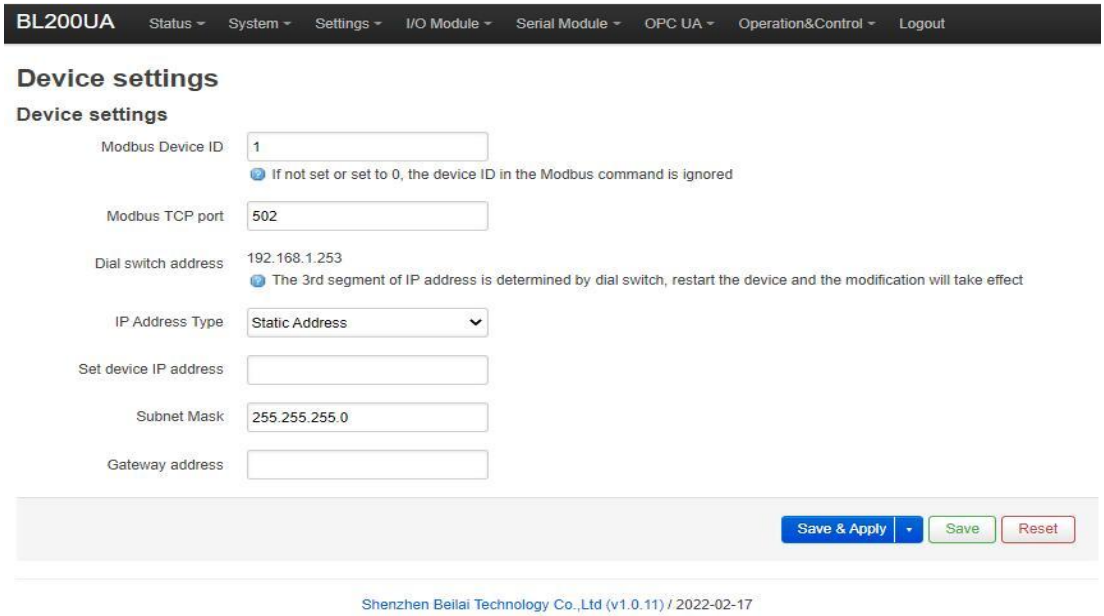
Item	Description	Default
Backup	Click "Generate archive" to download a tar archive of the current configuration files.	--
Restore	To restore configuration files, you can upload a previously generated backup archive here. To reset the firmware to its initial state, click "Perform reset" (only possible with squashfs images).	--
Save mtdblcok	Click "Save mtdblock" to download specified mtdblock file. (NOTE: THIS FEATURE IS FOR PROFESSIONALS)	--
Flash image	Upload a sysupgrade-compatible image here to replace the running firmware.	--

5.1.7.2.4 Reboot

Click "Perform reboot" will reboot your device



5.1.7.3 Settings

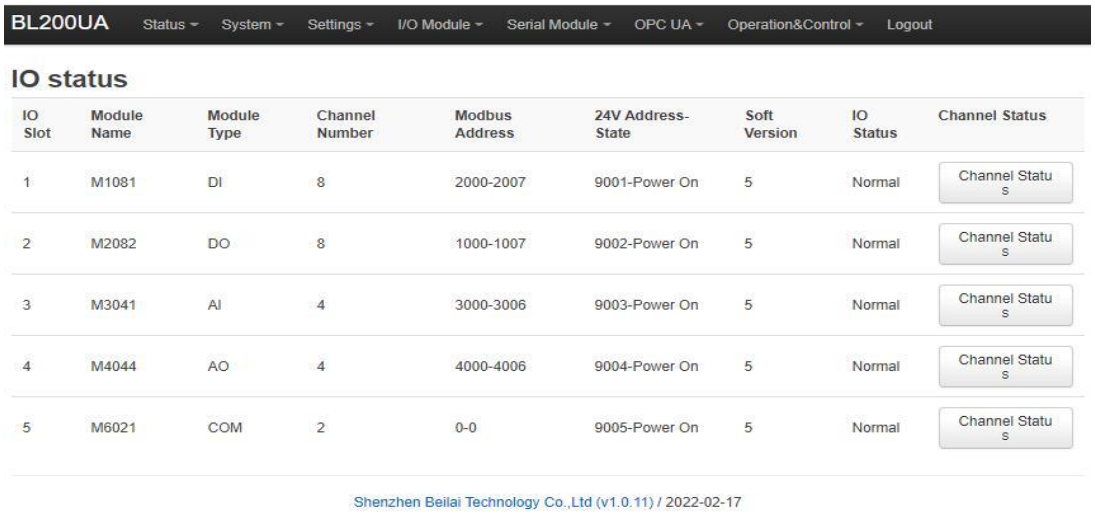


Item	Description	Default
Modbus Device ID	Modbus device ID range is 1~247.	1
Modbus TCP port	Modbus TCP protocol port number, which can be customized.	502
DIP switch address	Displays the IP address set by the DIP switch.	
IP address type	Select from "Static Address", "Dynamic Address(DHCP)".	
Set device IP address	The IP address of the device can be set by yourself, and it needs to be restarted to take effect after setting.	--

Subnet mask	Set IP subnet mask	
Gateway address	Set IP gateway address	

5.1.7.4 I/O Modules

After power on, the controller automatically recognizes all I/O modules connected to it and creates an internal local process image based on the module type, data width and the module's position in the node.
If I/O modules are added, changed or removed, a new process image is created and the process data addresses change. When adding an I/O module, the process data of all previous I/O modules must be considered.
The controller can connect up to 32 I/O modules, including digital input and output, analog input and output and special function modules.

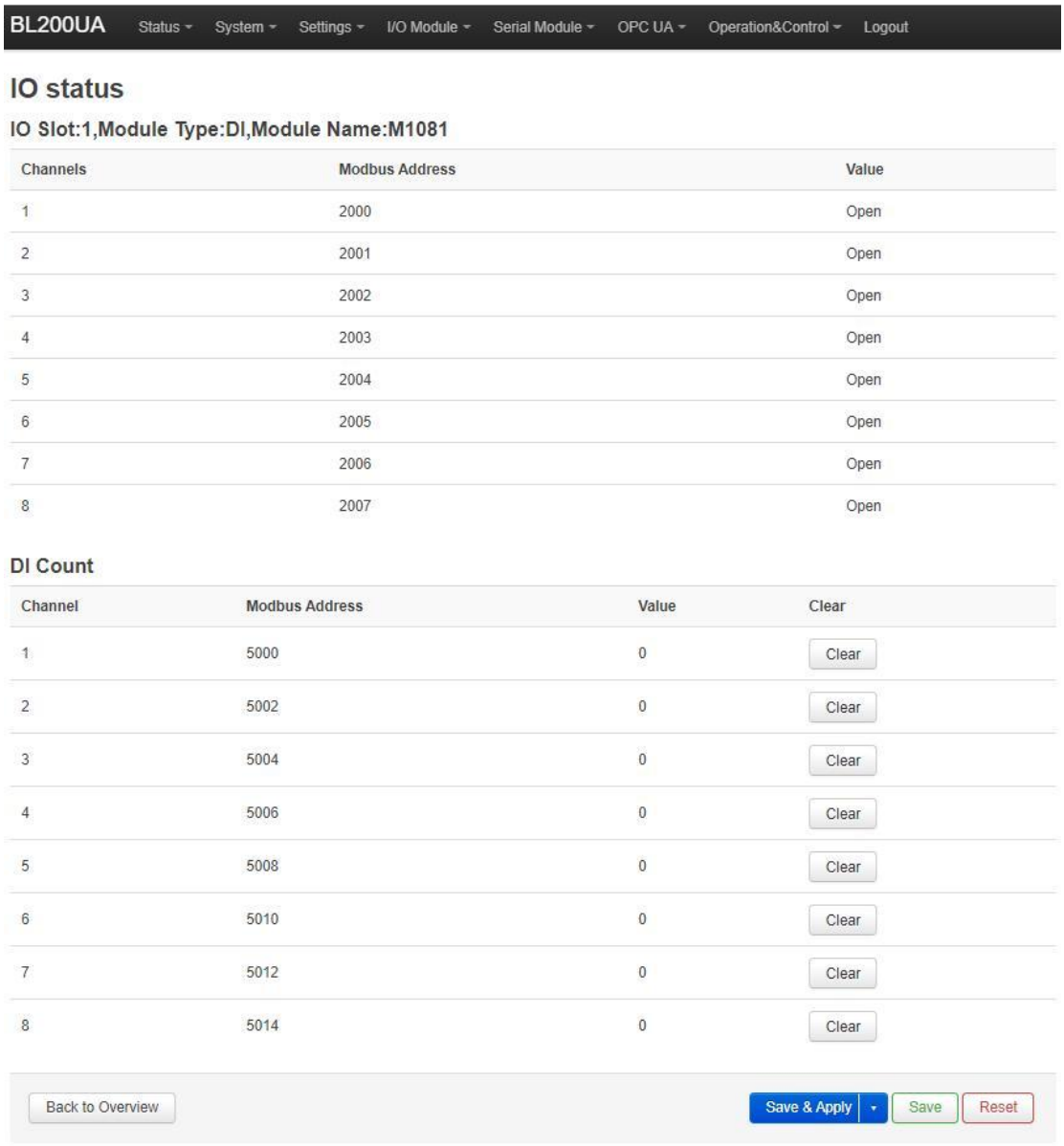


Item	Description
IO slot	The order of IO modules in the slot, the first module card position close to the controller is 1, and the following ones are 2 3 4...
Module name	I/O module model
Module type	I/O module function type
Channel Number	Data width of I/O module
Modbus Address	Process map address of the I/O module inside the controller
24V Address State	Power supply status on the field side of the IO module, digital, 1 bit
Software version	I/O module internal firmware version

IO status	I/O module and controller communication status
Channel status	Click to view and set the parameters of different types of I/O modules

5.1.7.4.1 Digital Input Module

The digital input module can provide two types of data, one is the current input state value, Boolean type; the other is the counter value, 32-bit numerical type, which supports the clear function.

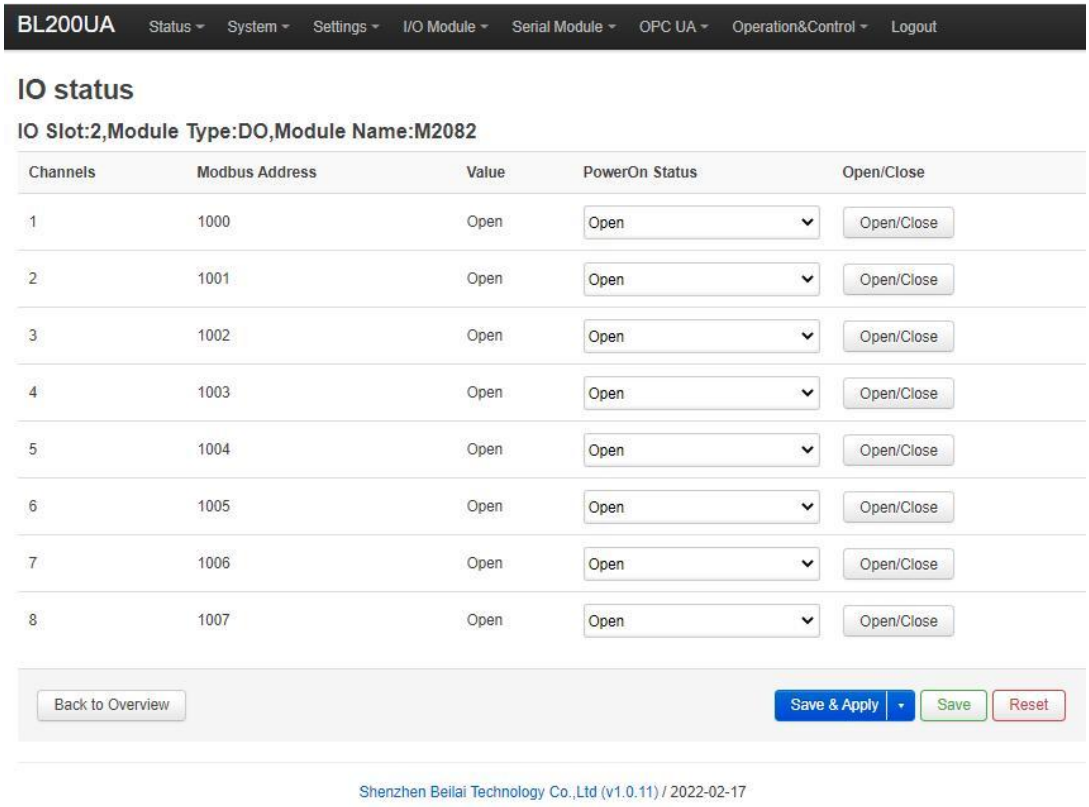


Item	Description
Channels	Channel number of the digital input module

Modbus Address	Process map address of Boolean status data inside the controller
Value	Display the current input state, open: logic 0, close: logic 1

Item	Description
Channels	Channel number of the digital input module
Modbus Address	Process map address of the count value inside the controller
Value	Display the current input count value, 32-bit unsigned integer
Clear	Can clear the current channel counter value

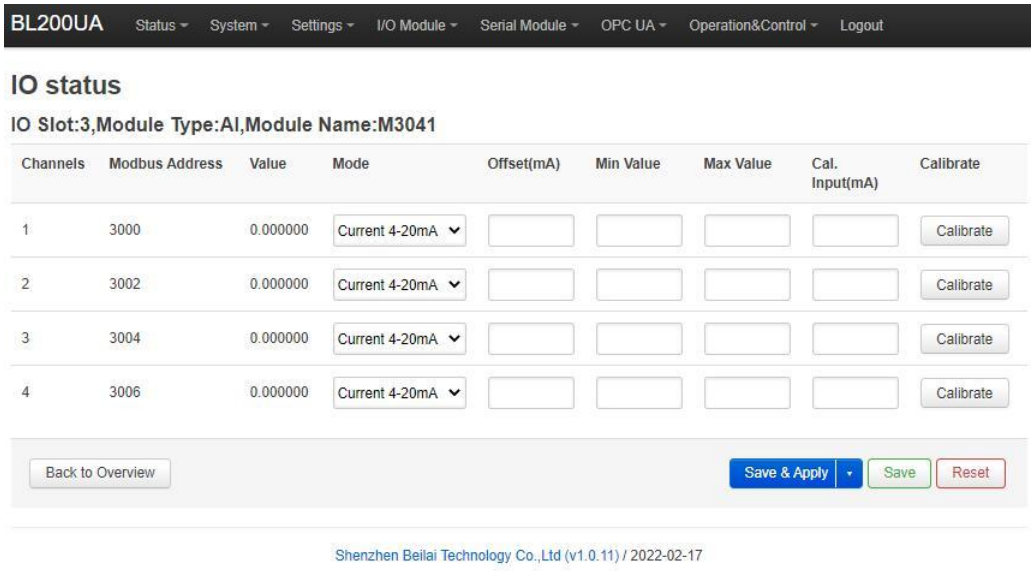
5.1.7.4.2 Digital Output Module



Item	Description
Channels	Channel number of the digital output module
Modbus Address	Process map address of the digital output boolean data inside the controller
Value	Display the current output state, open: 0, close: 1
Power-on status	Set the state of DO after power-on, select from "open", "close", "last"
Open/Close	Can control the current channel output state

5.1.7.4.3 Analog Input Module

The analog input (AI) type module supports setting parameters through the controller web page, so that the data conversion is automatically realized inside the module, and the actual engineering value corresponding to the sensor can be directly output.



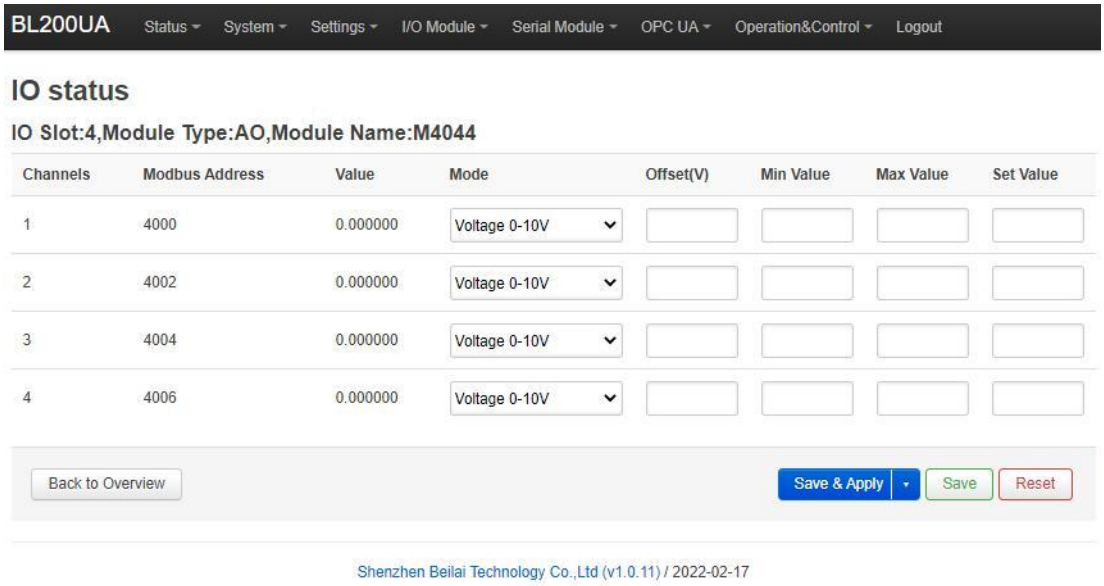
Item	Description
Channels	Channel number of the analog input module
Modbus Address	Process map address of the analog input module inside the controller
Value	Display the actual engineering value input by the current channel, 32-bit single-precision floating-point type
Mode	Different models of analog input modules have different options, please refer to the specific analog input I/O module manual for details.
Offset(mA)	The offset can be used to adjust the acquisition and actual error.
Min Value	Sensor range minimum
Max Value	Sensor range maximum
Calibrate Input(mA)	To calibrate the AI, enter the actual current of the AI.
Calibrate	Click "Calibrate" to confirm the calibration AI.

There is a linear relationship between the electrical signal value of the analog input module (usually a sensor) and the actual engineering value. Their formulas are as follows (take 4-20mA as an example):

Actual engineering value = (current value - 4) * ((maximum - minimum) / (20 - 4)) + minimum

Take the 4-20mA type water level sensor to measure the depth of the water tower as an example:
The known water level sensor range is 0-100m, the current data is 5.6mA, and the depth of the water tower is calculated:
Into the formula:
(5.6 - 4) * ((100 - 0) / (20 - 4)) + 0 = 10
The depth of the water tower is 10m

5.1.7.4.4 Analog Output Module



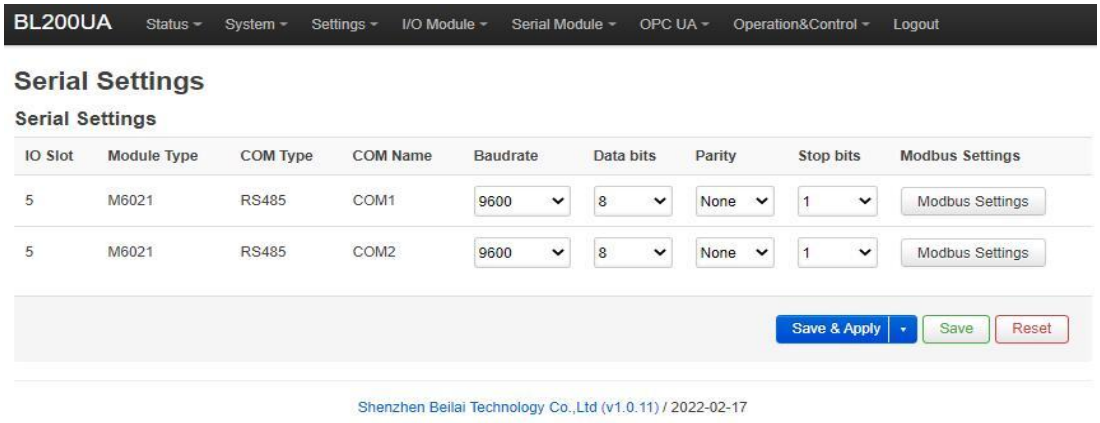
Item	Description
Channels	Channel number of the analog output module
Modbus Address	Process map address of the analog output module inside the controller
Value	Display the actual engineering value output by the current channel, 32-bit single-precision floating-point type
Mode	Different models of analog output modules have different options, please refer to the specific analog output I/O module manual for details.
Offset	Adjust the setting and the actual error
Min value	Actual engineering value minimum value

Max value	Actual engineering value maximum value
Set value	You can set the actual project value required for the output

5.1.7.5 Serial Port Module

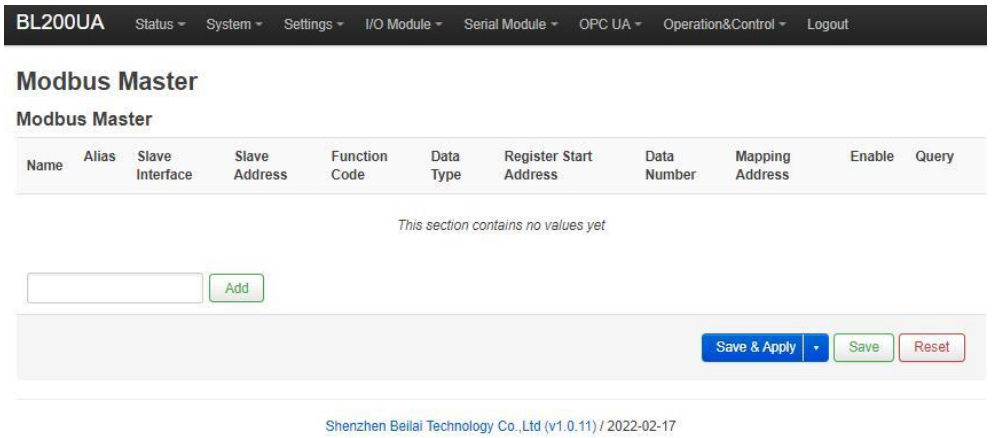
Various sensors, meters and other devices that support Modbus RTU protocol can be connected to the edge controller through the serial port module. It allows process mapping between external sensor data and the controller via the local bus.

5.1.7.5.1 Serial Port Settings

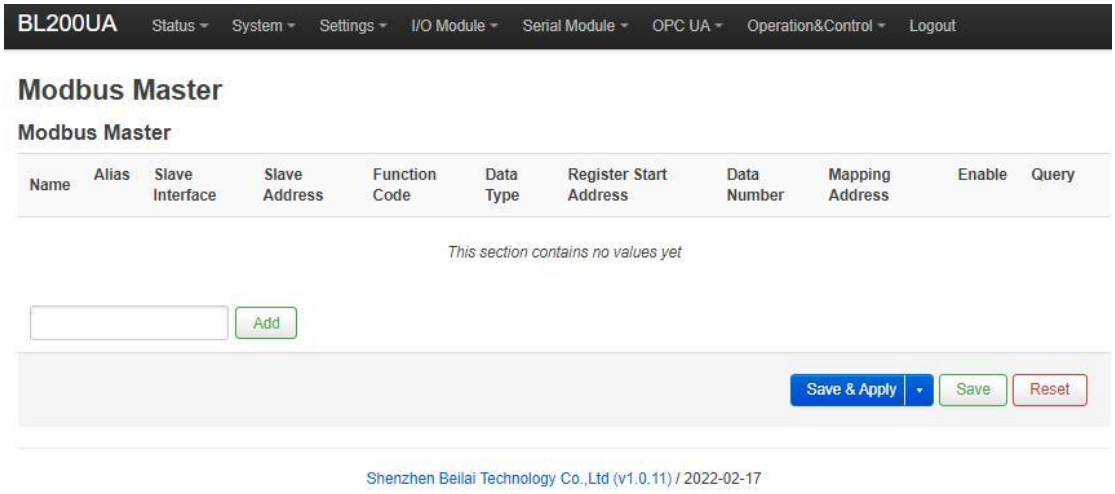


5.1.7.5.2 Modbus Settings

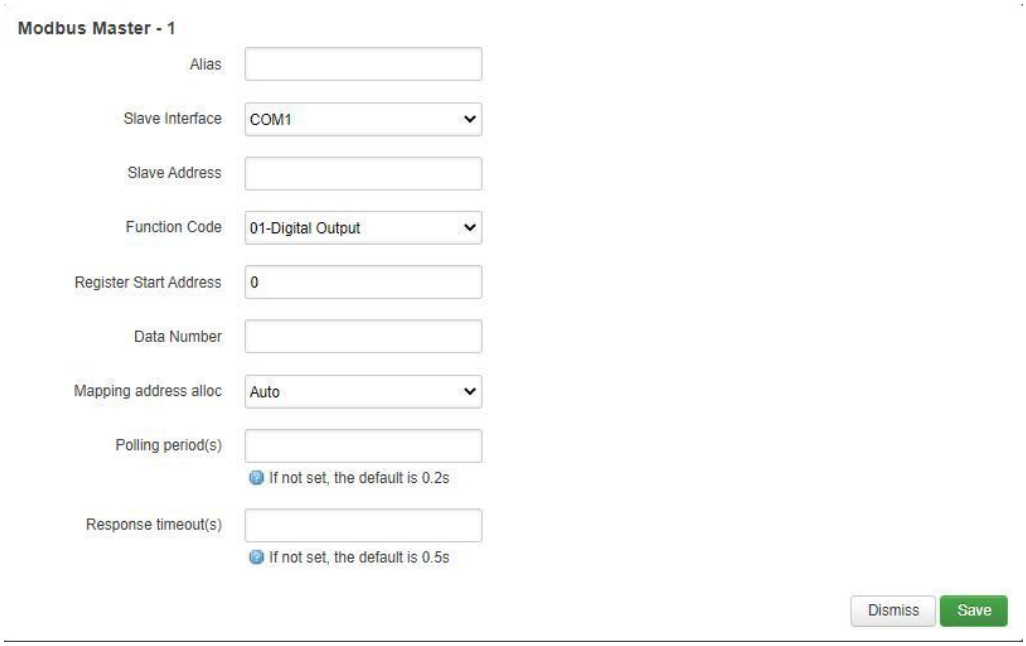
Modbus settings are used to add Modbus RTU devices to the serial communication I/O module.



Enter the custom data name in the input box and click Add



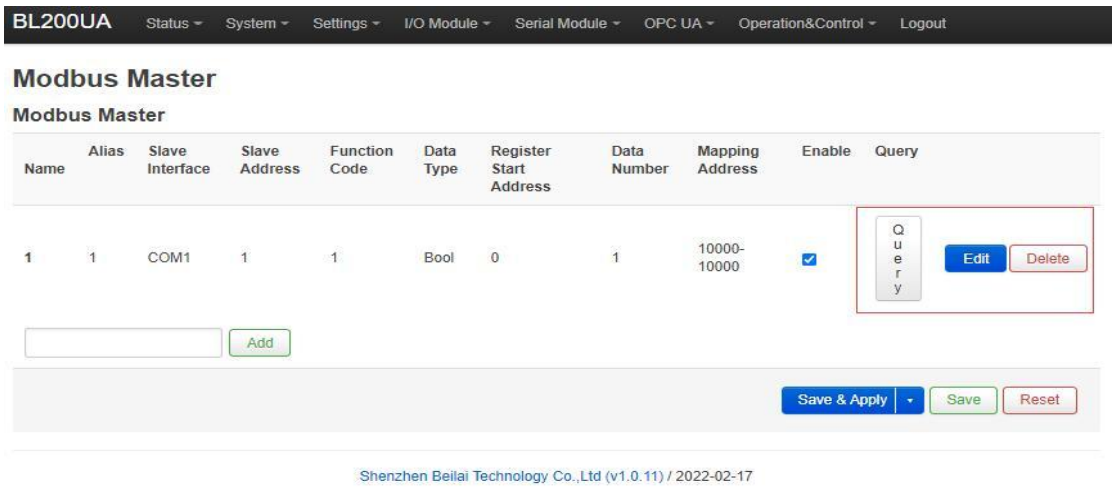
The configuration box pops



Item	Description
Alias	Device nickname can be used to distinguish data
Slave Interface	Select serial channel
Slave address	Slave device address, range 1-247
Function code	Select according to the slave data type, including: "01", "02", "03", "04"
Register start address	Register start address of slave data
Data number	Number of slave data
Mapping address	Support distribution method:

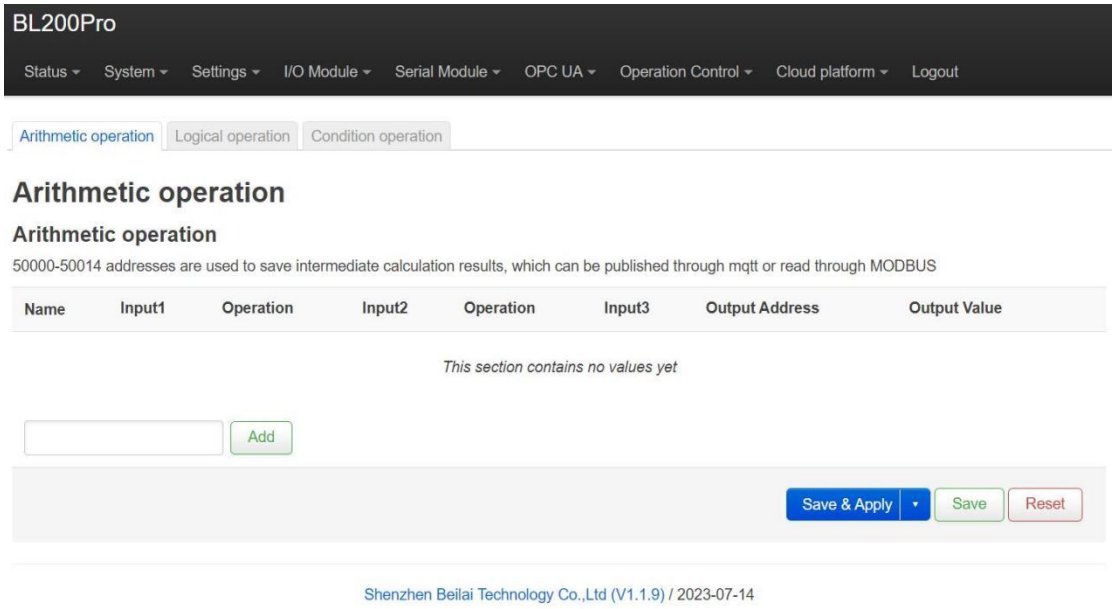
alloc	auto According to different data types, the system automatically allocates down the starting address of the mapping, and the addresses are continuous. manual Manual allocation allows mapping addresses to be allocated across segments
Polling period (s)	The interval between two adjacent polling commands
Response timeout (s)	After sending the command to the slave, wait for the maximum time for the slave to return data. If the time exceeds this time, the slave will be considered to have no response.

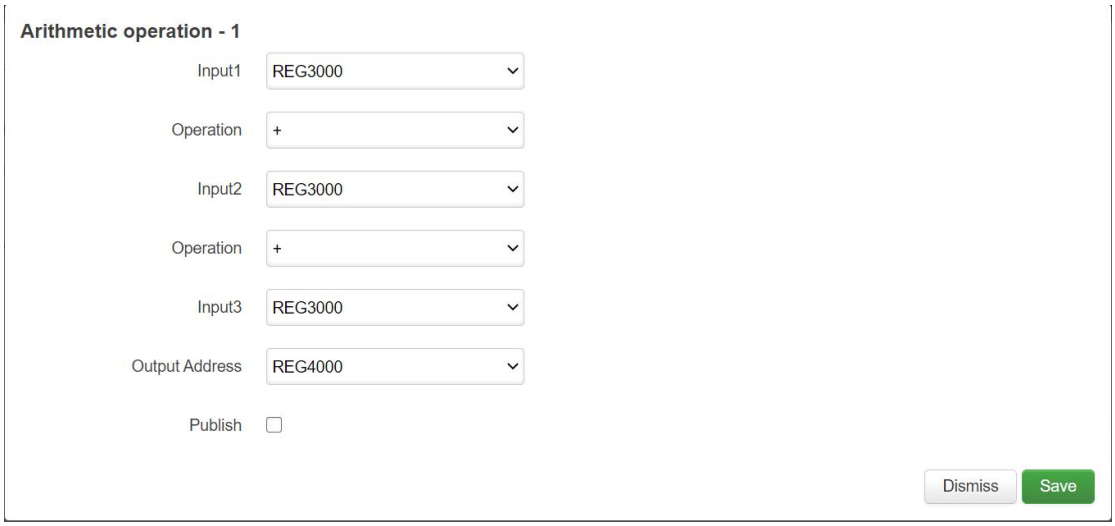
You can modify, delete, and view data of slave, or you can disable collection.



5.1.7.6 Operation and Control

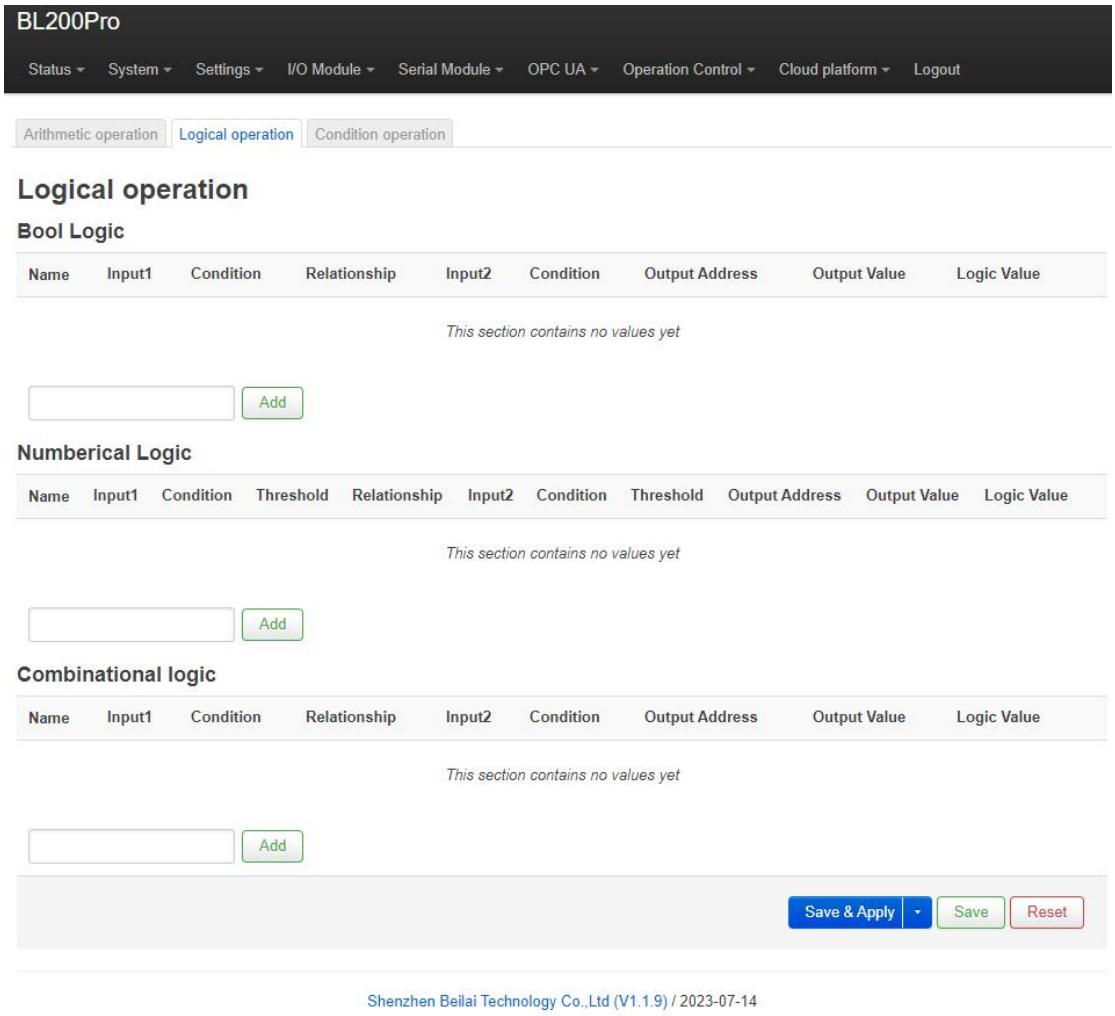
5.1.7.6.1 Arithmetic Operation



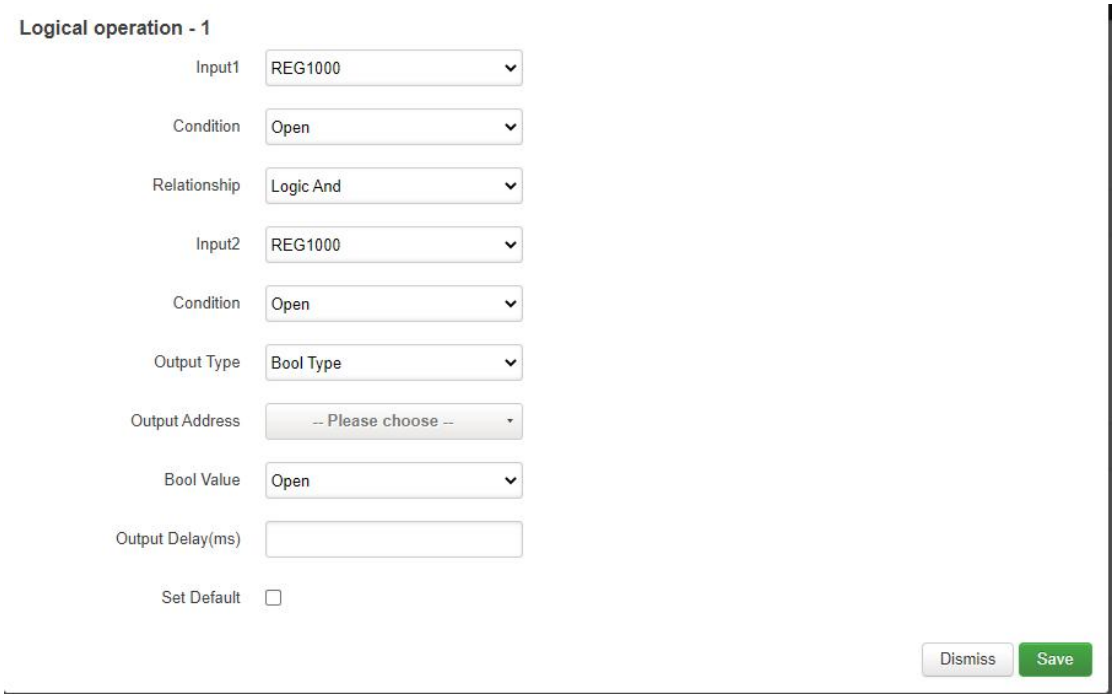


It supports "addition, subtraction, multiplication, and division" operations between AI, AO, or RS485 slave numerical data, and can also perform operations with "addition, subtraction, multiplication, and division" constants, and freely match 1 or 2 conditions to combine the output results. If a 16-bit register address is used as the output result, the output with a decimal is an integer.

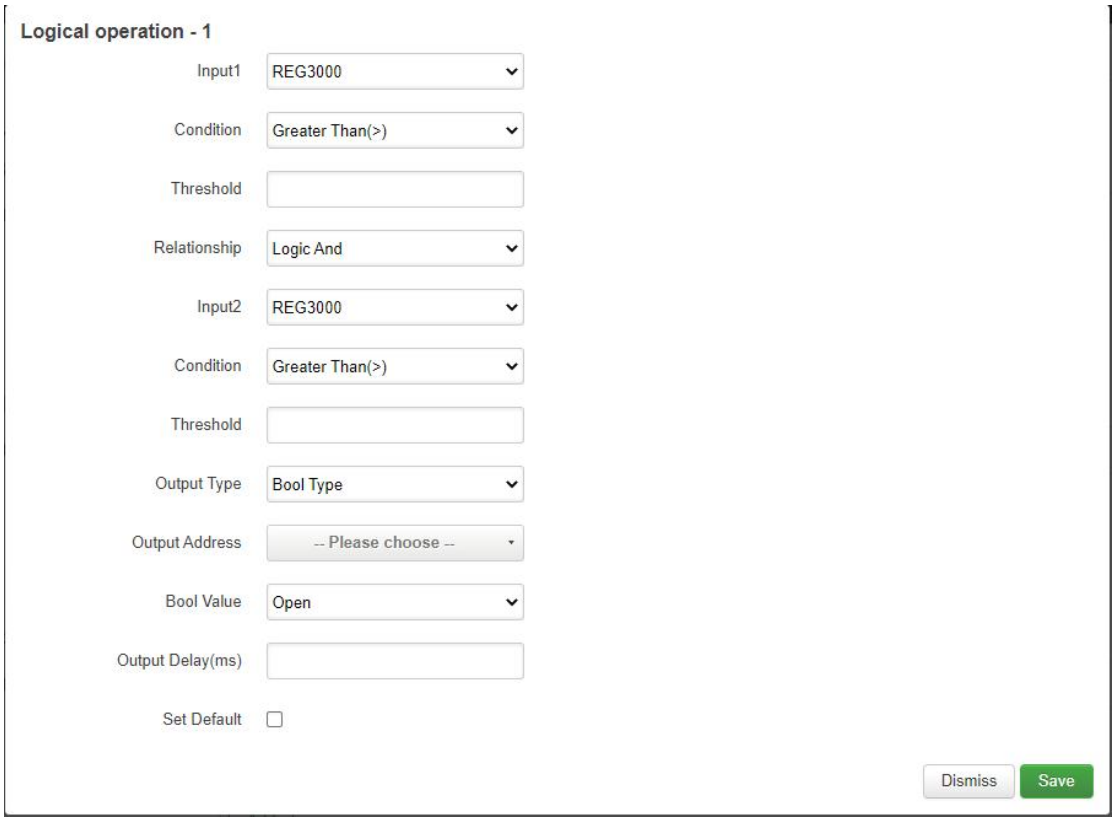
5.1.7.6.2 Logical Operation



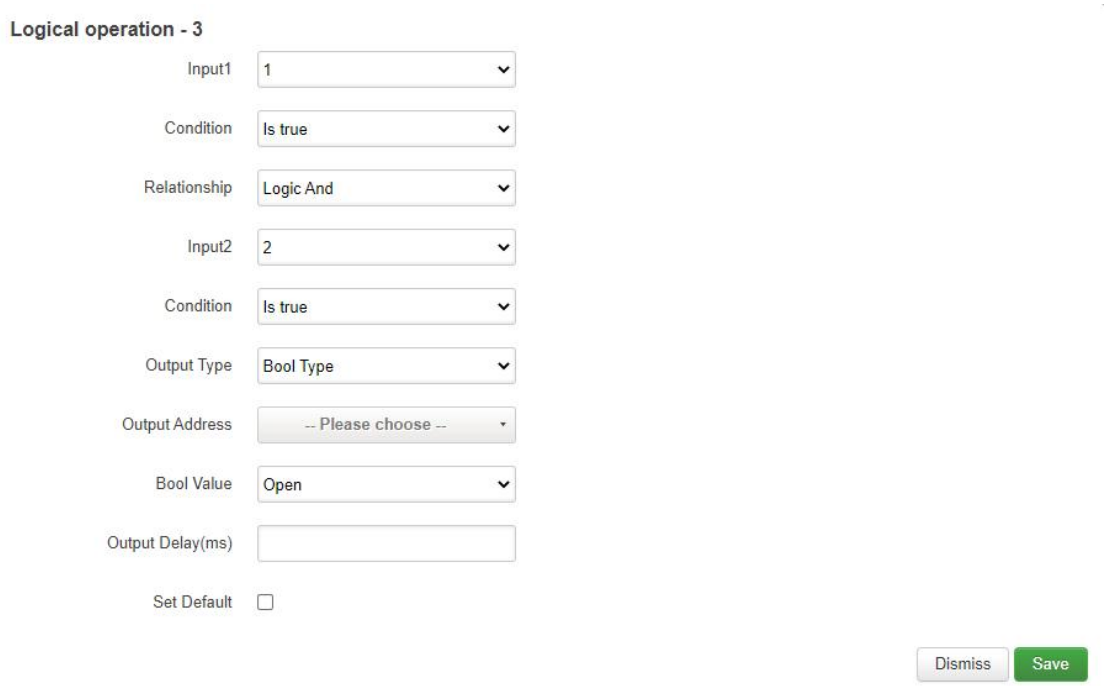
Bool logic configuration



Numerical Logic Configuration



Combinational logic configuration



Users can freely set various combination linkages between I/O (digital input and output, analog input and output) or serial port modules (Modbus slave data) according to needs. Whether the built logic is triggered can be judged according to the logic value item of the web page, "0" means not triggered, and "1" means triggered. Logical value items cannot be updated automatically, and the web page must be manually refreshed.

Example:

Logic 1 (And), input condition A and input condition B meet the trigger condition at the same time, output result Y.

Logic 2 (Or), any one of input condition C or input condition D satisfies the trigger condition, and the output result is Y.

Logic 3: Logic 1 + Logic 2 can be combined to form a logic 3 or more combinations.

5.1.7.6.3 Example

✧ Take a simple packing system as an example

Requirements:

(1) After pressing the start button, the conveyor belt B starts to run first, and drags the empty box forward to the designated position. After reaching the designated position, SQ2 sends a signal to stop the conveyor belt B from running.

(2) After the conveyor belt B stops, the conveyor belt A starts to run, and the products

fall into the boxes one by one. The SQ1 sensor detects the products and detects that the products fall into the box. Conveyor belt A stops running, conveyor belt B starts running, and it goes on and on, until the stop button is pressed, and conveyor belts A and B stop at the same time.

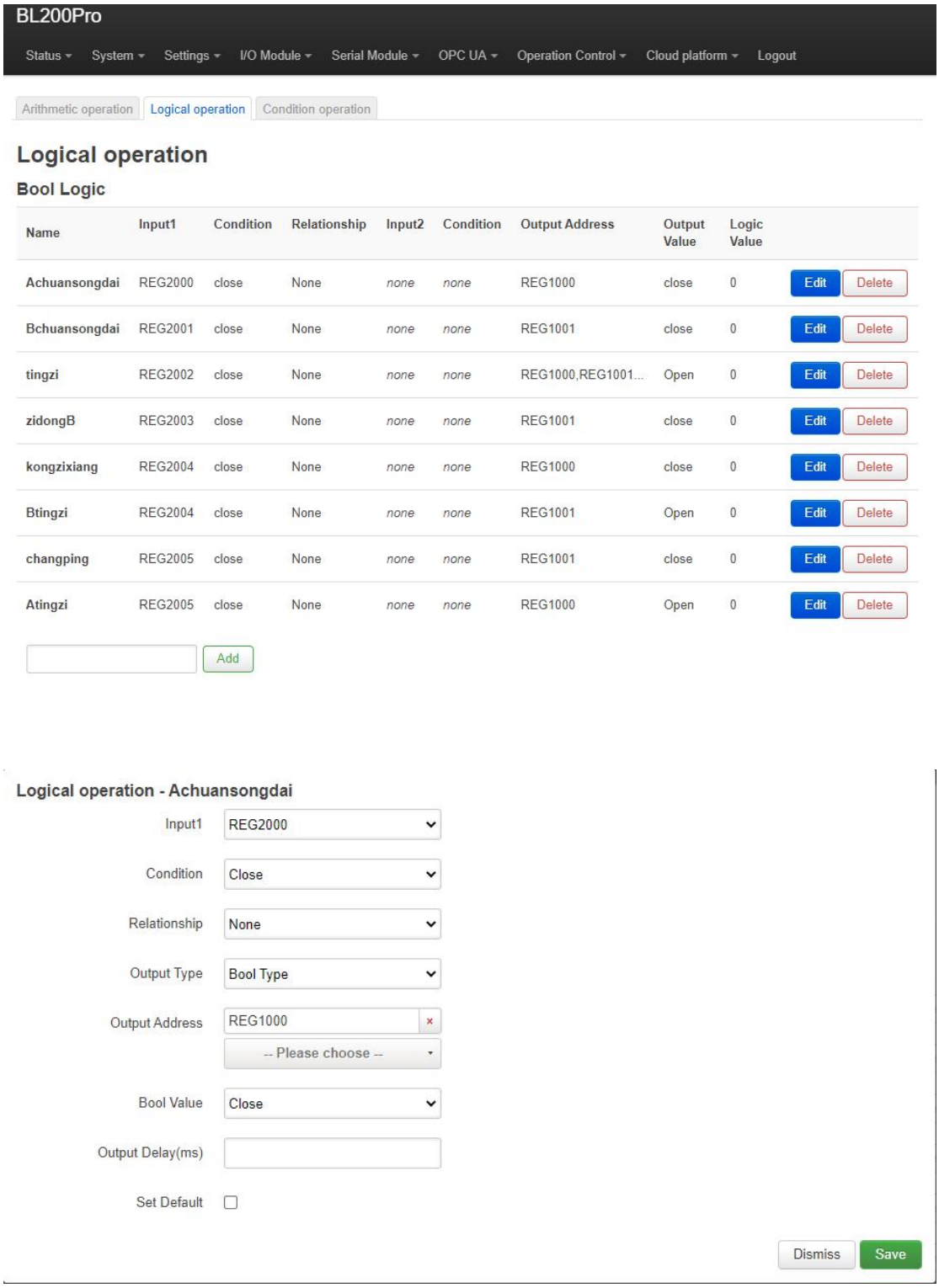
To realize such a function in S7-200SMART, the peripheral wiring needs to use DI and DQ as follows:

Input		Output	
I0.0	Automatic control button	Q0.1	Conveyor A output
I0.1	Stop button	Q0.2	Conveyor B output
I0.2	B conveyor belt moving		
I0.3	A conveyor belt moving		
I0.4	SQ2 input		
I0.5	SQ1 input		

Using BL200 calculation and control simulation to achieve such requirements, the DI and DO required for wiring are as follows:

Input		Output	
DI1	A conveyor belt moving	DO1	Conveyor A output
DI2	B conveyor belt moving	DO2	Conveyor B output
DI3	Stop button		
DI4	Automatic control button		
DI5	Detect empty box sensor, SQ2 input		
DI6	Detect product SQ1 input		

5.1.7.6.3.1 Bool Logic Configuration Instructions



Steps:

(1) Enter Achuansongdai, click Add, and the configuration box will pop up.

(2) Enter 1: Select DI1 register REG2000.

(3) Condition: Select Close.

(4) Relationship: Select "None", because DI1 directly controls the operation of A conveyor belt, so select "None" because there are no other conditions.

(5) Output type: Select Bool type, because DO1 control is Bool.

(6) Output address: REG1000, DI1 only controls one DO1, so only select the DO1 register address, if DI controls multiple registers, you can select multiple registers. As in the third logic "tingzi", press the stop button, both conveyor belts A and B stop.

(7) Bool value: Off, DI1 controls DO1 to close, so choose to close.

(8) Output delay (milliseconds): Since it is a timely response and no delay is required, leave it blank.

(9) Set default: When the selection logic is not established, whether DO1 restores the default state, select according to the requirements.

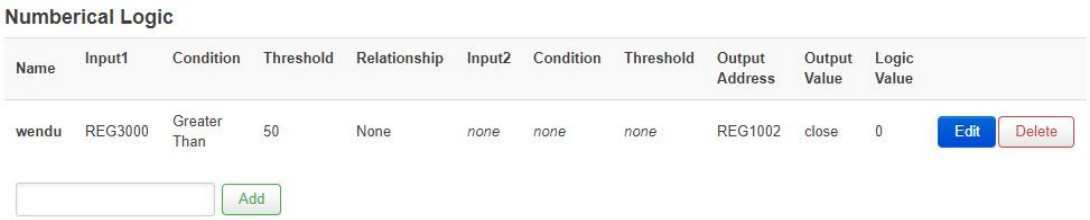
(10) Click "Save".

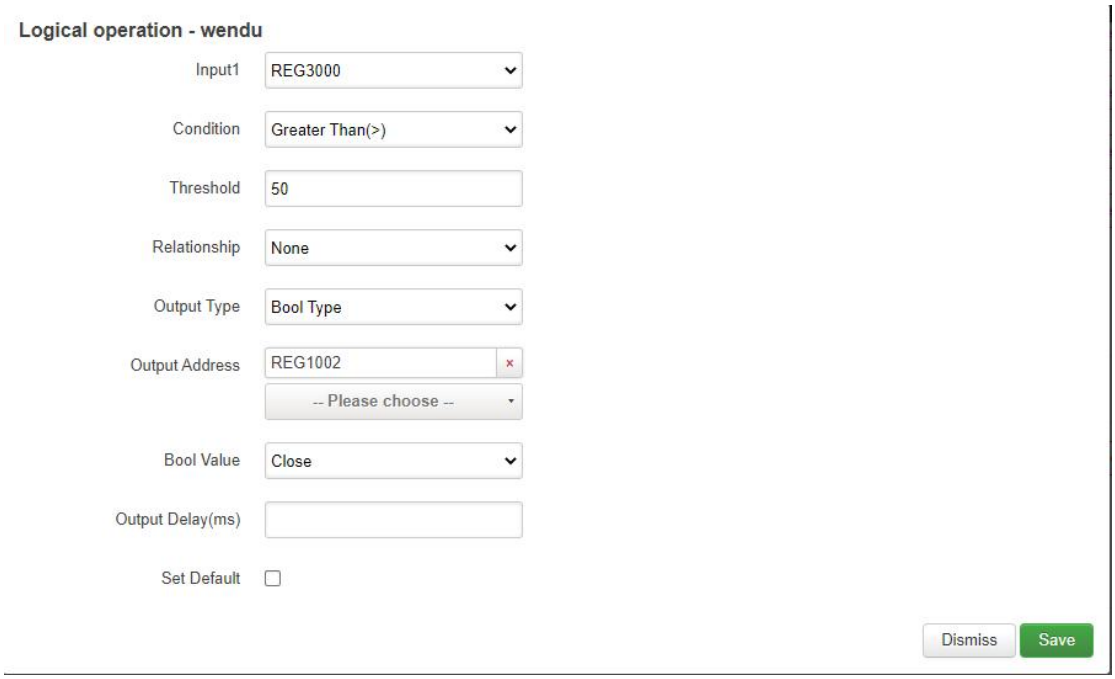
(11) Follow the same steps to build other logic.

(12) Click "Save and Apply" to write into the BL200 coupler.

5.1.7.6.3.2 Numerical Logic Configuration Example

The AI1 register REG3000 is connected to the temperature sensor to monitor the temperature of the motor. When the collected temperature is greater than 50, the fan is turned on, and the fan is controlled by the DO3 register REG1002.

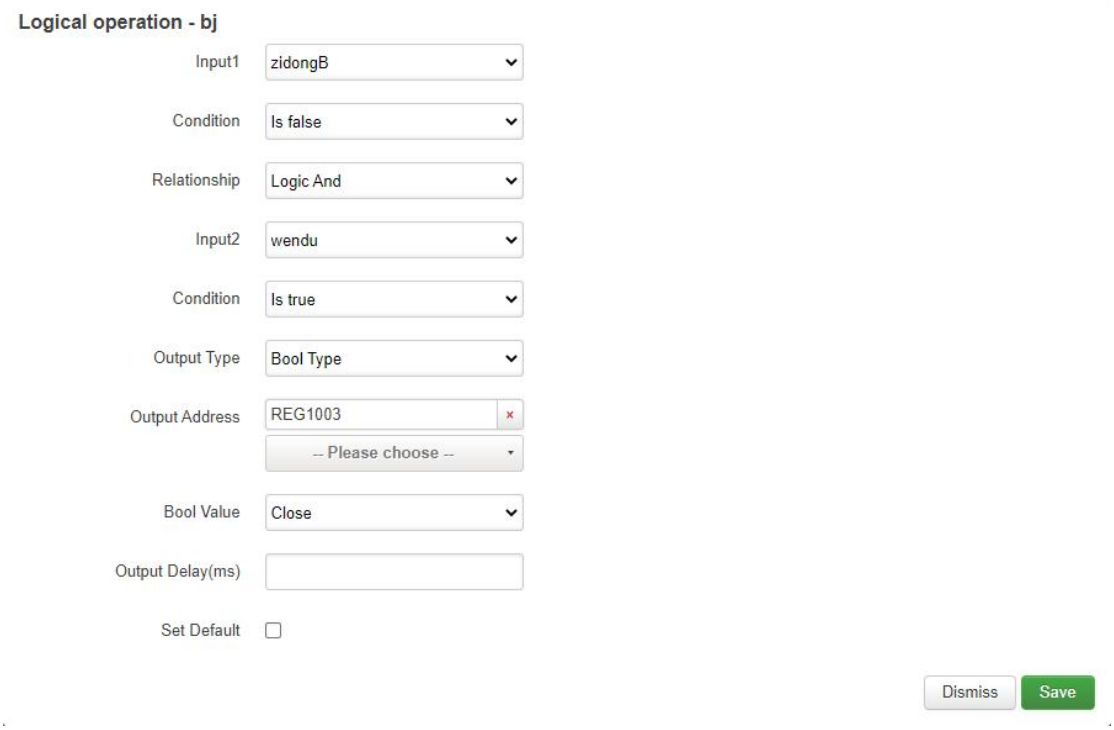




Similarly, numerical logic and Bool logic have the same logic principle. Numerical logic only judges that the condition is "greater than", "less than" or "equal to" a certain value as a linkage condition.

5.1.7.6.3.3 Combinational Logic Description

The conveyor belt is not running, the temperature of the motor exceeds 50 degrees, the fan is turned on, and the alarm DO4 register REG1003 is triggered.



Steps:

(1) In the Combinational Logic item, input the name "bj", click Add, and the configuration box will pop up.

(2) Input 1: Select the logic name "zidongB" built in Bool logic before, you can choose Bool logic or numerical logic according to your demand.

(3) Condition: Select "Is false", according to your demand, whether the logic selected by input 1 is triggered or not as a condition.

(4) Relationship: Select "Logic And" to choose, according to your demand, the logical relationship between condition 1 and condition 2, you can also select "no" condition 2.

(5) Input 2: Select the logic name "wendu", choose Bool logic or numerical logic according to your demand.

(6) Condition: Select "Is true", according to your demand, whether the logic selected by input 2 is triggered or not as a condition.

(7) Output Type: Select "Bool Type", select Bool or numeric data according to "Output Address".

(8) Output address: Select the register address to be operated. DO4 register REG1003.

(9) Bool value: Close, DO4 closed to control the alarm

(10) Output delay (milliseconds): It is a timely response, there is no need for a delay, so do not fill in.

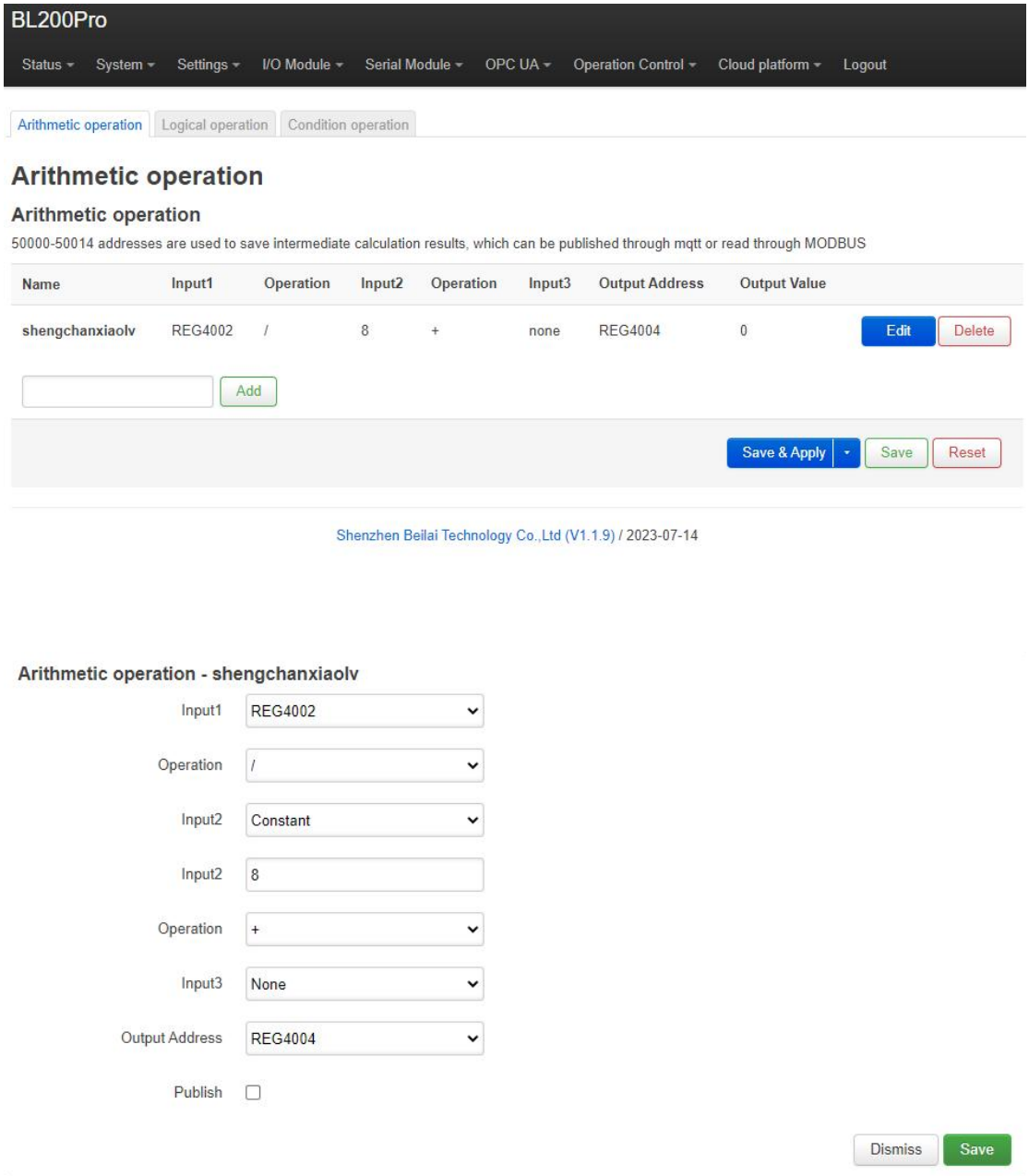
(11) Set default: Choose whether to restore the default state of DO4 when the logic is not valid, according to your demand.

(12) Click "Save".

(13) Click "Save and Apply" to write into BL200 coupler.

5.1.7.6.3.4 Arithmetic Operation Configurations

The sensor collects the quantity produced in a day and stores it in register REG40002, and through the arithmetic function it calculates the quantity produced in each hour of an 8-hour day and stores it in register REG40004, and the data in register REG40004 can be sent to your platform or server through MQTT, OPC UA or Modbus.



Steps

(1) Enter the name "shengchanxiaolv", click Add, and a configuration box will pop up.

(2) Input 1: Select the yield register REG40002.
(3) Operation: Select "/", you can select "add, subtract, multiply and divide" here according to your demand.
(4) Input 2: Select Constant, you can select other register address according to your demand.
(5) Input 2: Fill in the constant because constant is selected, when select a register, there is no such item.
(6) Operation: According to whether there is also a condition 3 selection, if not, then it doesn't matter.
(7) Input 3: Select "none", because there is no need for this condition option, you can also choose registers, constants, none.
(8) Output Address: Select the register address to store the result of the operation.
(9) Click "Save".
(10) Click "Save and Apply" to write into the BL200 coupler.

5.2 BL205 OPC UA EdgeIO Controller

5.2.1 BL205 Overview

The BL205 controller supports the OPC UA Server function and provides data as a server. Conforms to the IEC 62541 industrial automation unified architecture communication standard, and the data can be transmitted by encryption (X.509 certificate) and identity verification. The security policy supports basic128rsa15, basic256, basic256sha256, aes128sha256rsaoaep, can choose signature or signature and encryption. Supports the custom information model, and can fill in up to 5 reference models.

5.2.2 Technical Parameters

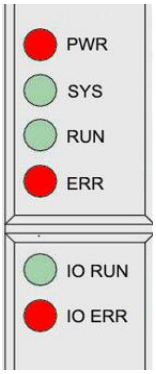
Name	Parameters	Description
System power	Input voltage(system)	24 VDC
	Input current(system)	MAX 500 mA@24VDC
	Power Efficiency	84%
	Internal bus voltage	5VDC
	Controller consumption current	MAX 300mA@5VDC
	I/O consumption current	MAX 1700mA@5VDC

	Isolation protection	500 V system/supply
Field power	Input voltage (field)	24 VDC
	Power supply current across contacts (MAX)	10 ADC
Ethernet	Number	2 X RJ45
	Transmission medium	Twisted Pair STP 100 Ω Cat 5
	MAX cable length	100m
	Baud rate	10/100 Mbit/s
	Isolation protection	ESD contact 8KV, Surge 4KV(10/1000us)
System	Operating system	Linux
	CPU	300MHz
	RAM	64MB
	Flash	128MB
	Number of I/O modules	MAX 32
	Protocols	OPC UA , HTTP, DHCP , DNS
Wiring	Method	CAGE CLAMP
	Wire diameter	0.08 mm² ··· 2.5 mm², AWG 28 ··· 14
	Strip length	8 mm ··· 9 mm / 0.33 in
Environment	Working temperature	0 ··· 55 °C
	Storage temperature	-40 ··· 70 °C
	Relative humidity	5 ··· 95% no condensation
	Working altitude	0 ··· 2000 m
	Protection	IP20
Dimension	Width	48mm
	Length	100mm
	Height	69mm
Material	Color	Light gray
	Shell material	Polycarbonate, Nylon 6.6
	Fire load	1.239 MJ
	Weight	180 g
Installation	Method	DIN-35 rial
Certificates	EMC	EN 55022: 2006/A1: 2007 (CE &RE) Class B
		IEC 61000-4-2 (ESD) Level 4
		IEC 61000-4-3 (RS) Level 4
		IEC 61000-4-4 (EFT) Level 4

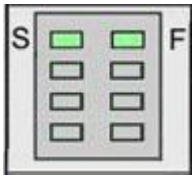
		IEC 61000-4-5 (Surge)Level 3
		IEC 61000-4-6 (CS)Level 4
		IEC 61000-4-8 (M/S) Level 4

5.2.3 Hardware Interface

5.2.3.1 LED Indicators



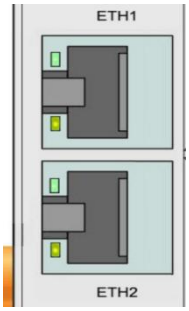
LED	Description	Color	Status	Meaning
PWR	Power indicator	Red	ON	Power connection successful
			OFF	No power
SYS	System indicator	Green	ON	System is abnormal
			OFF	System is running normally
RUN	Running indicator	Green	Flashing	System is running normally
			OFF	System is abnormal
ERR	Error indicator	Red	ON	Northbound protocol connection error
			OFF	No errors
I/O RUN	I/O Running indicator	Green	Flashing	I/O module is working normally
			OFF	Module not inserted
I/O ERR	I/O Error indicator	Red	ON	I/O module communication error
			OFF	No errors



LED	Description	Color	Status	Meaning
S	System 24V power indicator	Green	ON	Power is OK
			OFF	No power
F	Field 24V power indicator	Green	ON	Power is OK
			OFF	No power

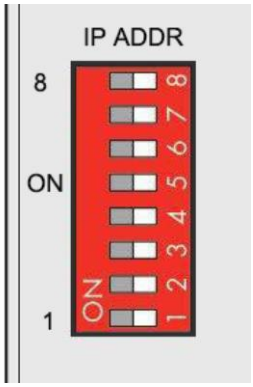
5.2.3.2 Ethernet Port

It is connected to the Ethernet-based fieldbus through the ETH2, and the EHT1 is used to connect other nodes that need to be connected to the Ethernet.



5.2.3.3 IP Address Selection Switch

The 8-bit DIP switch is used to set the IP address. The encoding of DIP switches is done bit by bit, starting from DIP switch 1 with the least significant bit (2^0) to DIP switch 8 with the most significant bit (2^7), corresponding to decimal values: 0-255.



When the value of the DIP switch is 1111 1111 (decimal 255), the IP address is set according to the web page. The web page setting can specify the IP or set the

automatic acquisition. When the web page is not set, the IP address is: 192.168.1.10 When the value of the DIP switch is 0000 0000 – 1111 1110 (decimal 0-254), determine the 3rd byte of the IP address, and the 1st, 2nd and 4th bytes are fixed bytes, namely 192.168.xxx.253

5.2.4 OPC UA Data Point Node Id

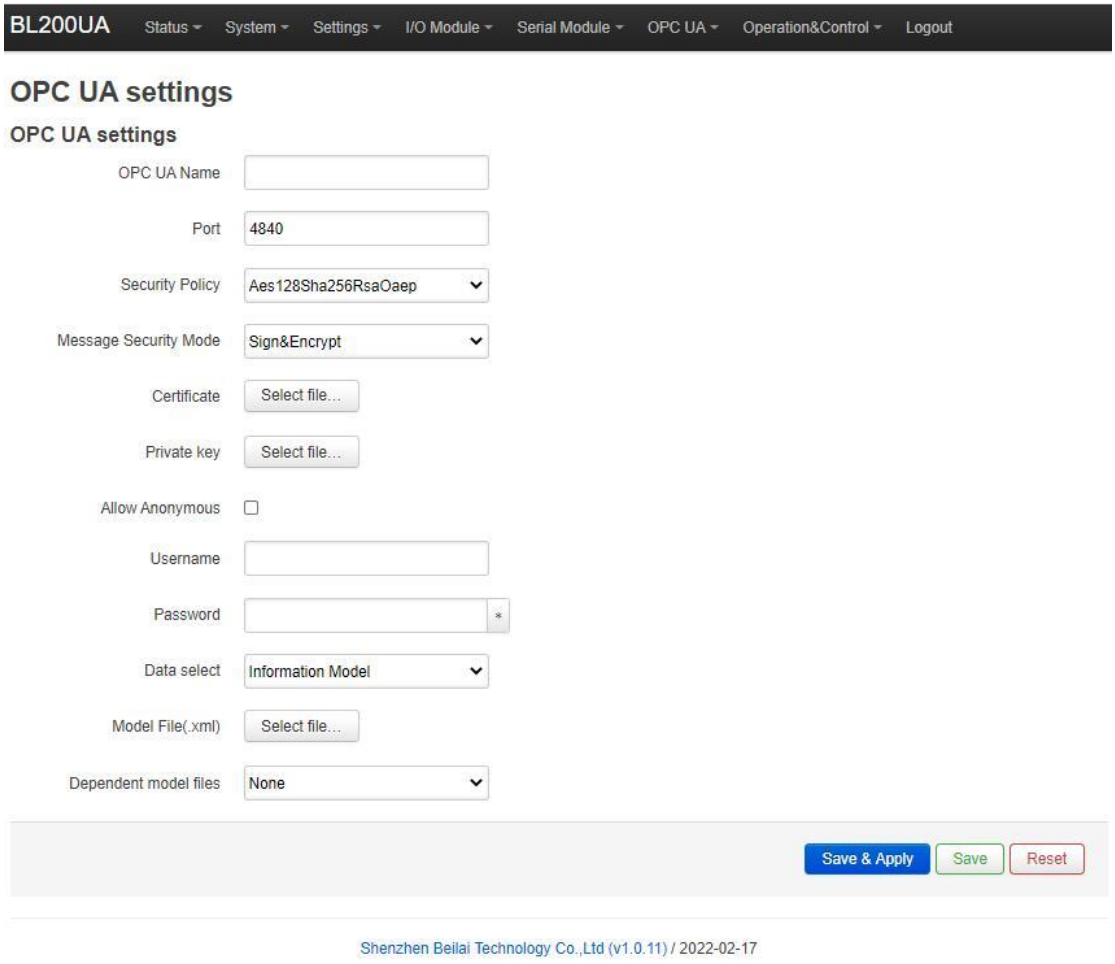
The Node Id of OPC UA defaults to NS=1; S=Modbus mapping address of the I/O data point (for example, the first DO module of the first DO module: NS=1; S=1000), custom OPC UA model Node Id can be customized.

5.2.5 Controller Connection

Refer to chapter 5.1.5

5.2.6 Web Page Configuration

Login web page configuration interface refer to chapter 5.1.6. The BL205 controller adds the OPC UA protocol on the basis of the BL200 coupler, so we only introduce the OPC UA configuration interface here, and the functions of other interfaces refer to chapter 5.1.7.



Item	Description	Default
OPC UA name	OPC UA server name	
Port	OPC UA server port number	4840
Security policy	None basic128rsa15 basic256 basic256sha256 aes128sha256rsaoaep All security policies	None
Message security mode	Sign Sign and encrypt	
Certificate	OPC UA certificate, click the uploaded certificate to load the configuration page.	
Private key	OPC UA private key, click on the uploaded certificate to load it into the configuration page.	

Allow anonymous	Whether to enable user name and password login	
Username	Fill in the username	
Password	Fill in password	
Data select	All data Select data point Information model	All data
Select data point	You can select the data points you want to read. "Data selection" option to select "select data point" to have this option	
Model file (.xml)	Upload the information model (.xml) file, select "Information Model" in the "Data Selection" item to have this option	
Dependent model files	Select the number of information models to reference, up to 5 can be selected.	
Dependent Models 1-5	Upload the information model (.xml) file to be referenced	

Note: For a customized information model, the data point description item must be in the format of REG + Modbus address during modeling. For example, DO1 point description item fills in REG1000, and other items are customized.

5.3 BL206 MQTT EdgeIO Controller

5.3.1 BL206 Overview

The BL206 controller supports MQTT protocol, and data can be uploaded to Alibaba Cloud, Huawei Cloud, AWS Cloud, Thingsboard, Ignition, and other platforms.

5.3.2 Technical Parameters

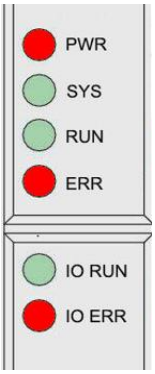
Name	Parameters	Description
System power	Input voltage(system)	24 VDC
	Input current(system)	MAX 500 mA@24VDC
	Power Efficiency	84%
	Internal bus voltage	5VDC
	Controller consumption current	MAX 300mA@5VDC

	I/O consumption current	MAX 1700mA@5VDC
	Isolation protection	500 V system/supply
Field power	Input voltage (field)	24 VDC
	Power supply current across contacts (MAX)	10 ADC
Ethernet	Number	2 X RJ45
	Transmission medium	Twisted Pair STP 100 Ω Cat 5
	MAX cable length	100m
	Baud rate	10/100 Mbit/s
	Isolation protection	ESD contact 8KV, Surge 4KV(10/1000us)
System	Operating system	Linux
	CPU	300MHz
	RAM	64MB
	Flash	128MB
	Number of I/O modules	MAX 32
	Protocols	MQTT, HTTP,, DHCP, DNS
Wiring	Method	CAGE CLAMP
	Wire diameter	0.08 mm² ··· 2.5 mm², AWG 28 ··· 14
	Strip length	8 mm ··· 9 mm / 0.33 in
Environment	Working temperature	0 ··· 55 ° C
	Storage temperature	-40 ··· 70 ° C
	Relative humidity	5 ··· 95% no condensation
	Working altitude	0 ··· 2000 m
	Protection	IP20
Dimension	Width	48mm
	Length	100mm
	Height	69mm
Material	Color	Light gray
	Shell material	Polycarbonate, Nylon 6.6
	Fire load	1.239 MJ
	Weight	180 g
Installation	Method	DIN-35 rail
Certificated	EMC	EN 55022: 2006/A1: 2007 (CE &RE) Class B
		IEC 61000-4-2 (ESD) Level 4
		IEC 61000-4-3 (RS) Level 4

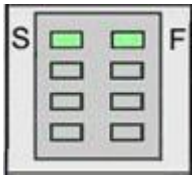
		IEC 61000-4-4 (EFT) Level 4
		IEC 61000-4-5 (Surge)Level 3
		IEC 61000-4-6 (CS)Level 4
		IEC 61000-4-8 (M/S) Level 4

5.3.3 Hardware Interface

5.3.3.1 LED Indicators



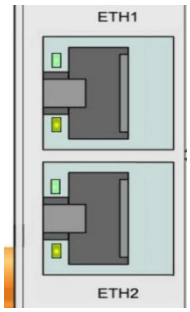
LED	Description	Color	Status	Meaning
PWR	Power indicator	Red	ON	Power connection successful
			OFF	No power
SYS	System indicator	Green	ON	System is abnormal
			OFF	System is running normally
RUN	Running indicator	Green	Flashing	System is running normally
			OFF	System is abnormal
ERR	Error indicator	Red	ON	Northbound protocol connection error
			OFF	No errors
I/O RUN	I/O Running indicator	Green	Flashing	I/O module is working normally
			OFF	Module not inserted
I/O ERR	I/O Error indicator	Red	ON	I/O module communication error
			OFF	No errors



LED	Description	Color	Status	Meaning
S	System 24V power indicator	Green	ON	Power is OK
			OFF	No power
F	Field 24V power indicator	Green	ON	Power is OK
			OFF	No power

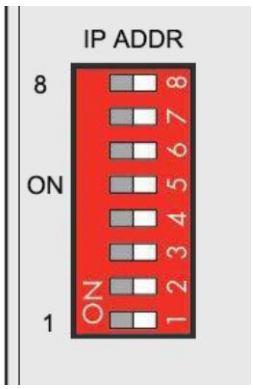
5.3.3.2 Ethernet Port

It is connected to the Ethernet-based fieldbus through the ETH2, and the EHT1 is used to connect other nodes that need to be connected to the Ethernet.



5.3.3.3 IP Address Selection Switch

The 8-bit DIP switch is used to set the IP address. The encoding of DIP switches is done bit by bit, starting from DIP switch 1 with the least significant bit (2^0) to DIP switch 8 with the most significant bit (2^7), corresponding to decimal values: 0-255.



When the value of the DIP switch is 1111 1111 (decimal 255), the IP address is set according to the web page. The web page setting can specify the IP or set the

automatic acquisition. When the web page is not set, the IP address is: 192.168.1.10 When the value of the DIP switch is 0000 0000 – 1111 1110 (decimal 0-254), determine the 3rd byte of the IP address, and the 1st, 2nd and 4th bytes are fixed bytes, namely 192.168.xxx.253

5.3.4 MQTT Identifiers

The MQTT identifier is REG+Modbus mapping address (such as the first DO module first DO: REG1000)

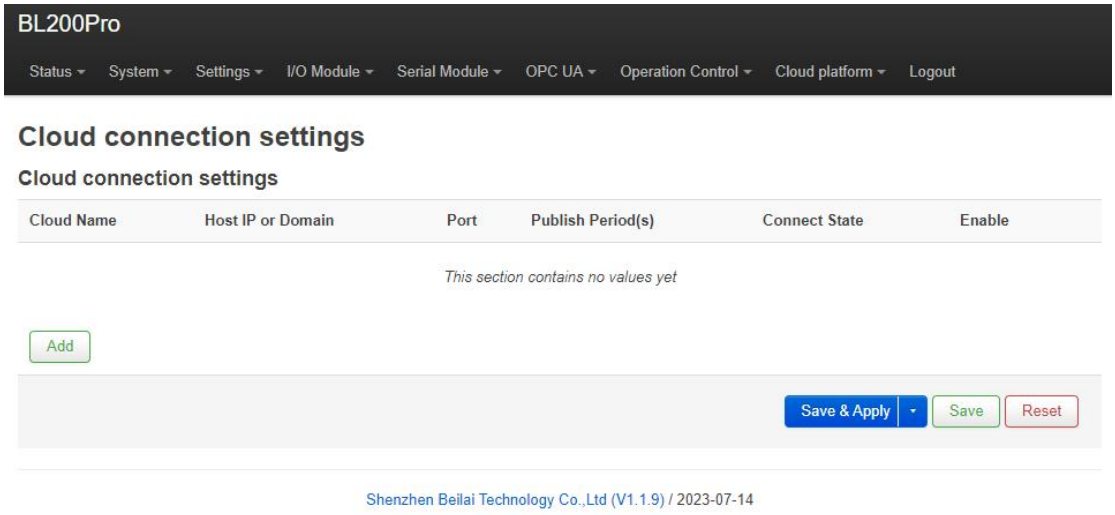
5.3.5 Controller Connection

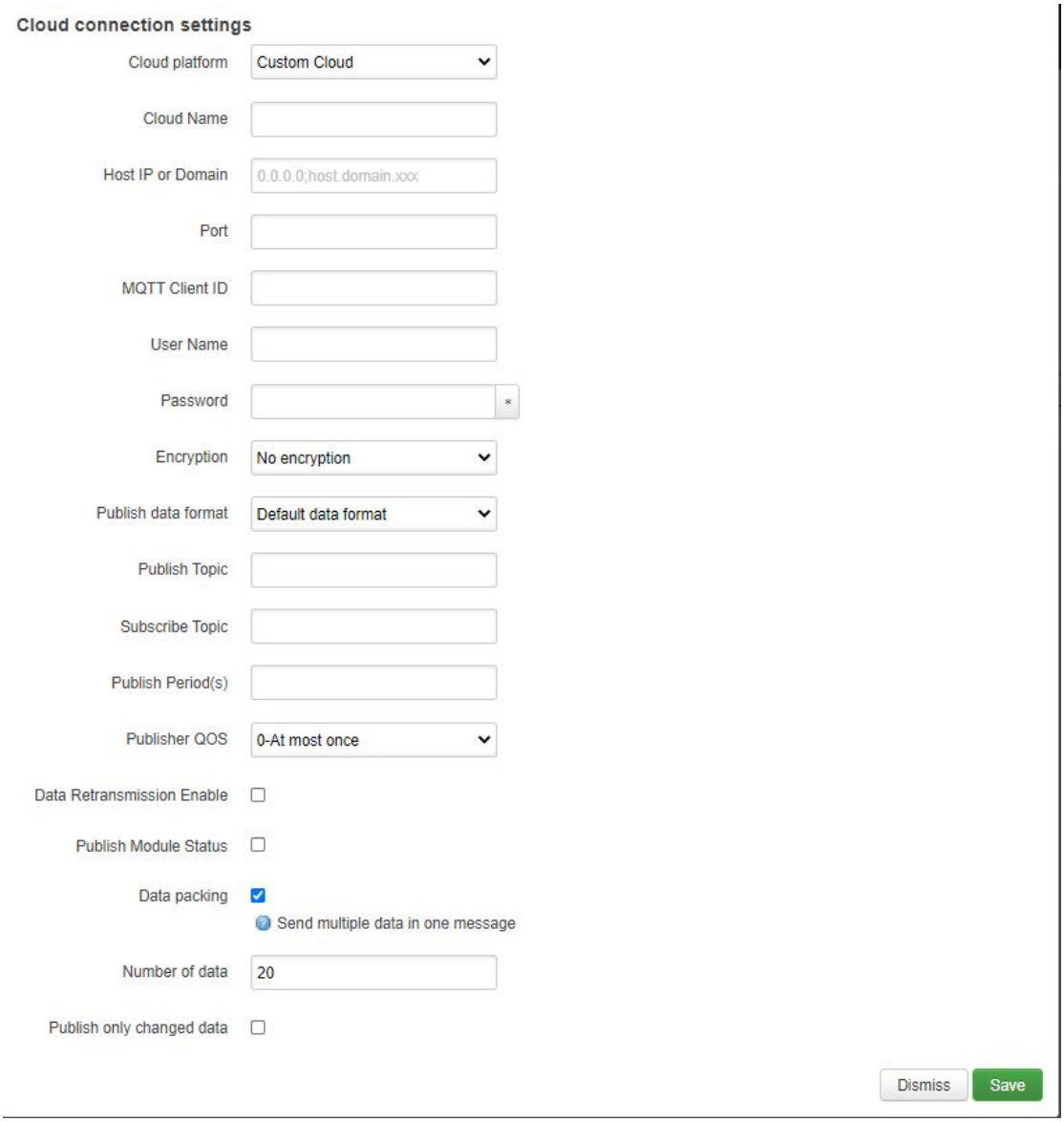
The BL206 controller is based on the BL200 coupler and adds the function of the cloud platform, mainly the MQTT protocol. Connection steps refers to chapter 5.1.5.

5.3.6 Web Page Configuration

Login web page configuration interface refer to chapter 5.1.6. The BL206 controller adds the cloud platform function on the basis of the BL200 coupler. For the functions of other interfaces, refer to chapter 5.1.7.

5.3.6.1 Cloud Connection Settings



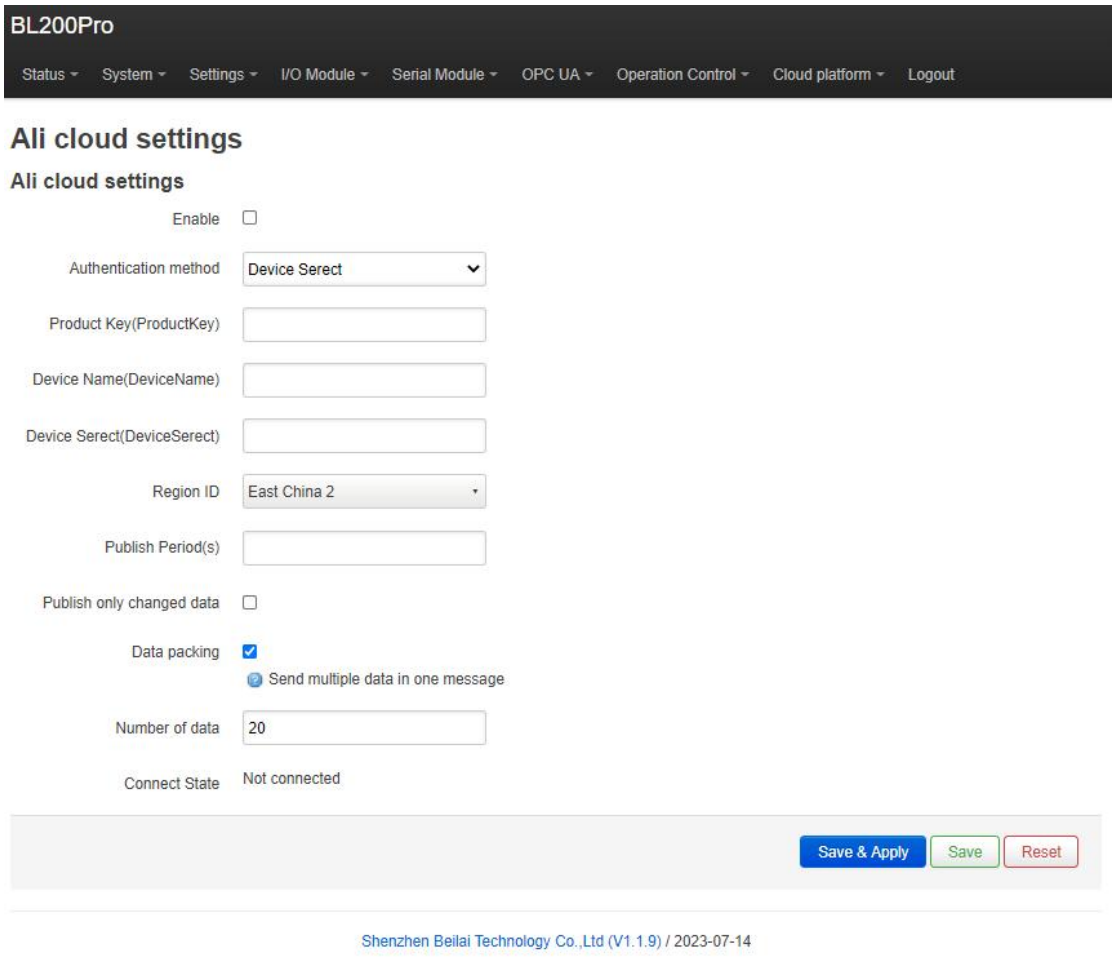


Cloud Connection Settings	
Item	Description
Enable	Check to enable

Cloud Name		BLIIoT V2.0, BLIIoT V3.0
Host Domain and Port		2.0 Modbus RTU: modbus.dtuip.com, Port 6651; 2. 0 Modbus TCP: mbtcp.dtuip.com, Port 6655; 2.0 MQTT: mqtt.dtuip.com, Port 1883 3.0 Modbus RTU: modbusrtu.kpiiot.com Port 4000
Link Protocol		Modbus RTU, Modbus TCP, MQTT
Modbus Protocol Parameters	Modbus Device ID	Default 1, Modbus device ID is set in the serial port settings
	Register packet	Contact sales if you need to connect BLIIoT cloud
	Heartbeat packet	Heartbeat packet to maintain connection
	Heartbeat response packet	The server responds with a heartbeat packet
	Heartbeat period(s)	Heartbeat packet sending cycle
	Host Silence time(s)	Silent time for the server to send no data, timeout will be reconnected
MQTT Protocol Parameters	MQTT Client ID	The client identifier used in the MQTT connection message. If you want to use BLIIoT MQTT, you need to contact the sales to get client ID.
	Publish period (s)	MQTT data timing publishing interval
	Data Retransmission Enable	Check to enable data retransmission
Custom Cloud Parameters	Cloud name	User defined (optional)
	Host IP or domain name	User defined

	Port	User defined
	Link protocol	Modbus RTU, Modbus TCP, MQTT
	Modbusdevice ID	Default 1, device Modbus device ID is set in the serial port settings
	Register packet	User defined
	Heartbeat packet, heartbeat response packet, heartbeat cycle, host silent time (as defined above)	

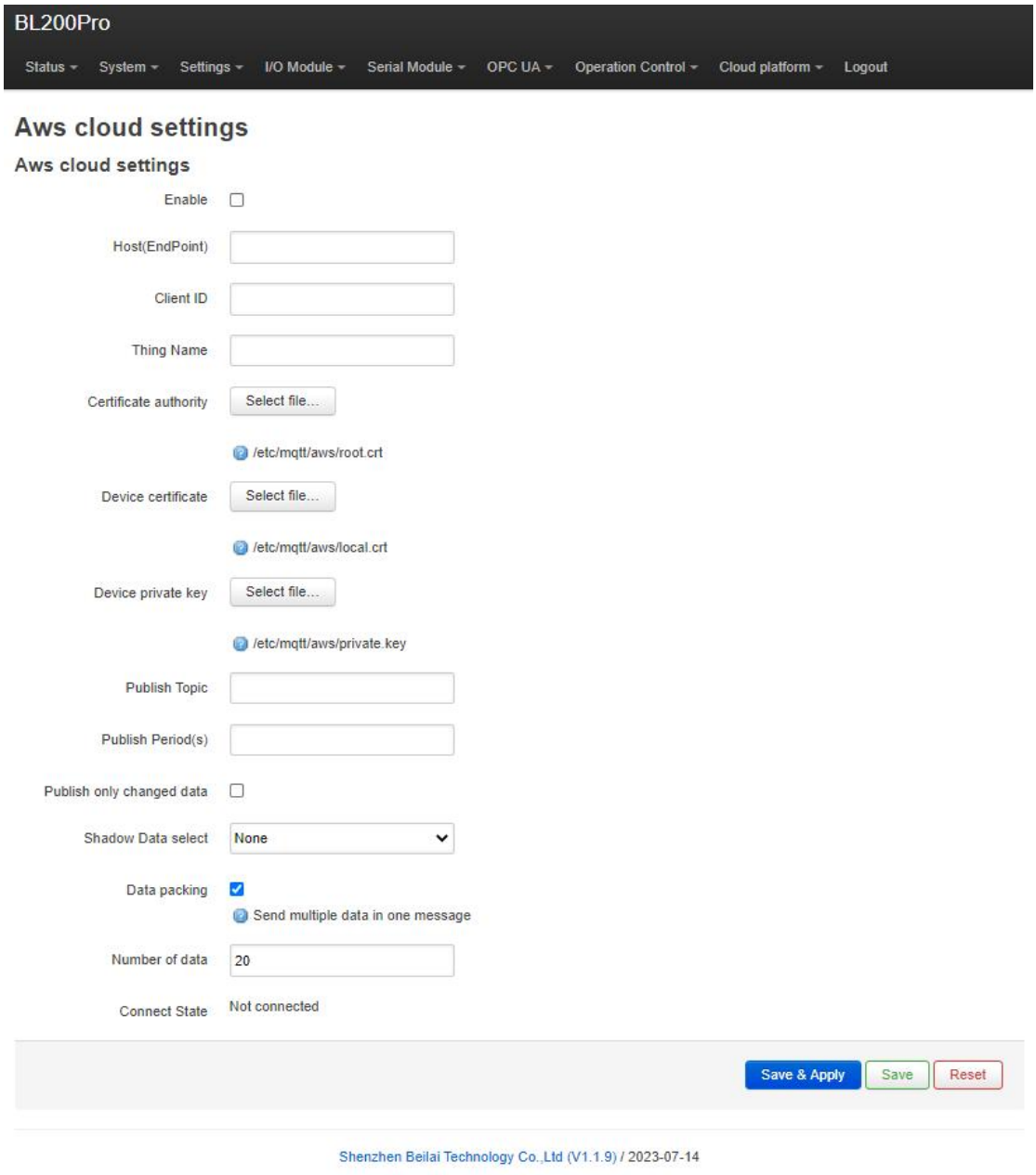
5.3.6.2 Ali Cloud



Ali Cloud Connection	
Item	Description
Enable	Check to enable
Authentication	"Device Secret" and "X.509"

Method	
Product Key	ProductKey on Ali Cloud
Device Name	DeviceName on Ali Cloud
Device Serect	DeviceSecret on Ali Cloud
Region ID	Ali cloud region
Publish Period(s)	More than 60s
Certification Authority (root certificate)	Select File Upload
Device Certificate	Select File Upload
Device Private Key	Select File Upload
Publish only changed data	Check to enable this function

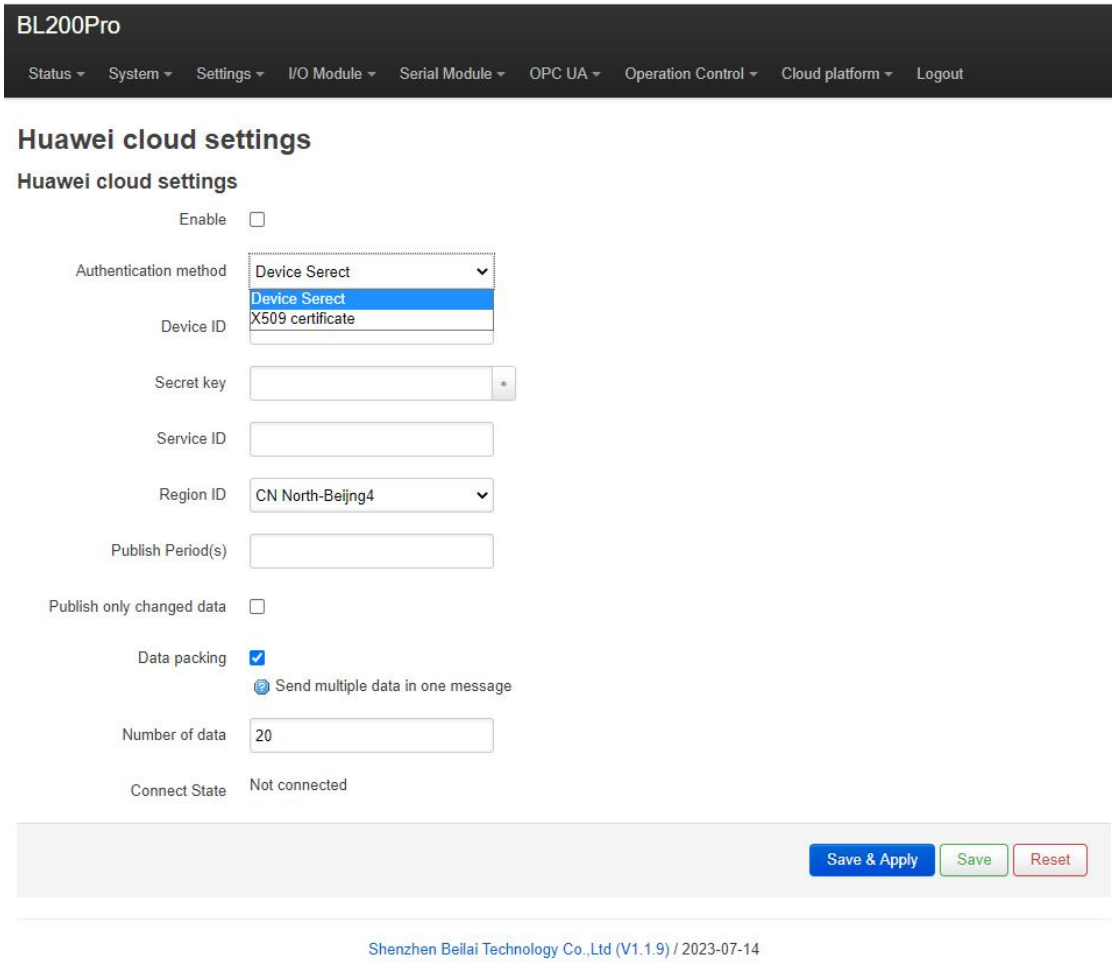
5.3.6.3 AWS



AWS Connection	
Item	Description
Enable	Check to enable
Host(EndPoint)	Set the endpoint
Client ID	The client identifier used in the MQTT connection message, the server uses the client identifier to identify the client, and each client connected to the server has a unique client identifier.
Thing Name	Set thing name

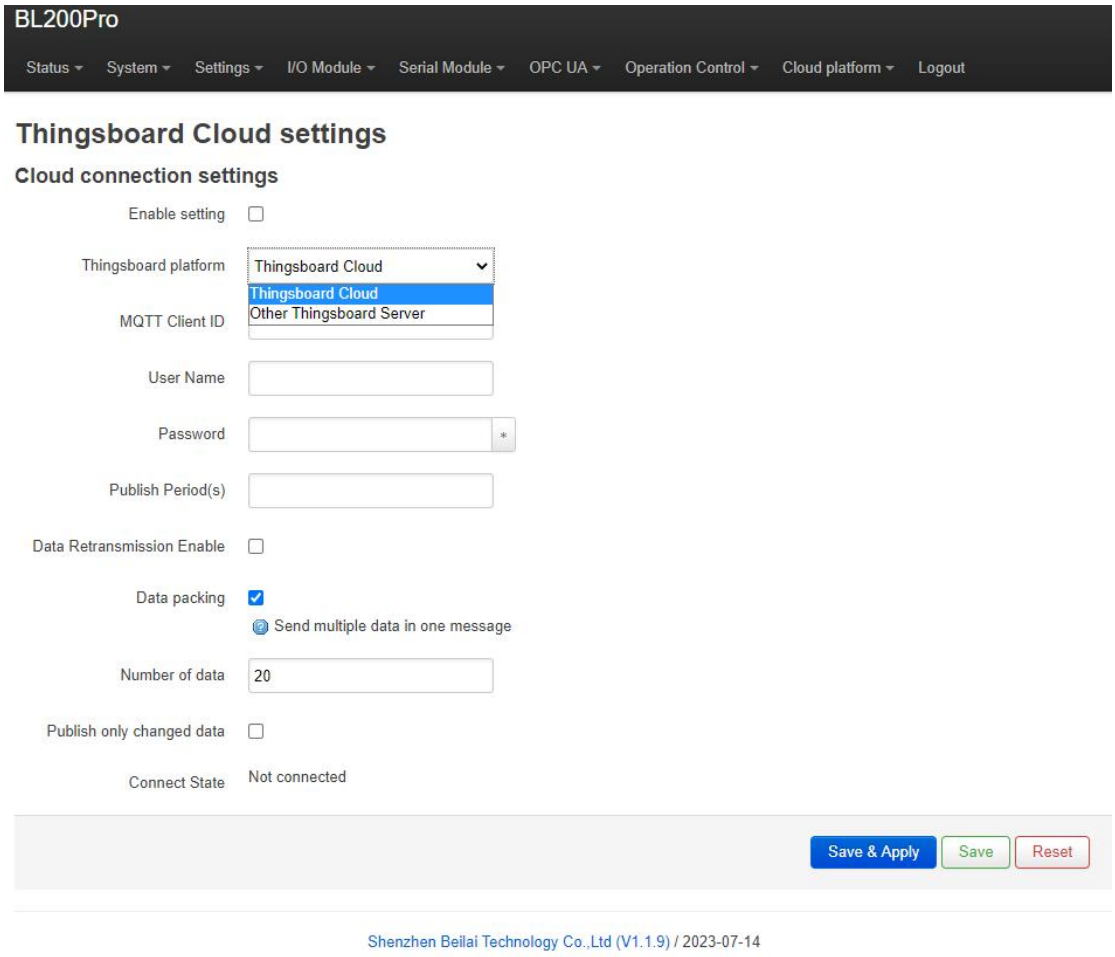
Publish Topic	The subject name used by MQTT to publish messages. The subject name is used to identify which information channel the payload data should be published to. The subject name in the published message cannot contain wildcards.
Publish Period(s)	More than 60s
Certification Authority (root certificate)	Select File Upload
Device Certificate	Select File Upload
Device Private Key	Select File Upload
Publish only changed data	Check to enable this function

5.3.6.4 HUAWEI Cloud



HUAWEI Cloud Connection	
Item	Description
Enable	Check to enable
Authentication Method	"Device Secret" and "X.509"
Device ID	Huawei Cloud Device ID
Service ID	Products need to create services to report data
Region ID	Device region
Publish Period(s)	More than 60s
Secret key	Password entered when creating the device certificate, you can refer to the HUAWEI CLOUD help document to create a test certificate
Certification authority (root certificate)	Root certificate provided by Huawei cloud
Device certificate	Device certificate deviceCert.pem, upload to /etc/conf directory and select the file
Device key	Device key/deviceCert.key, upload to/etc/conf directory and select the file
Only publish changed data	Check to enable this function

5.3.6.5 ThingsBoard



Thingsboard Connection	
Item	Description
Enable	Check to enable
Client ID	The client identifier used in the MQTT connection message, the server uses the client identifier to identify the client, and each client connected to the server has a unique client identifier.
User Name	The username used for MQTT connection messages, which the server can use for authentication and authorization.
Password	The password used for MQTT connection messages, which the server can use for authentication and authorization.
Publish Period(s)	More than 60s

Data Retransmission Enable	Check to enable data retransmission
Only publish changed data	Check to enable this function

5.4 BL206Pro EdgeIO Controller

5.4.1 BL206Pro Overview

BL206Pro includes the functions of BL200, BL205, and BL206

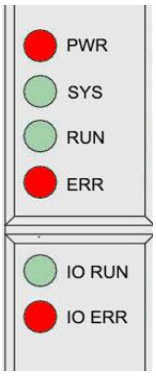
5.4.2 Technical Parameters

Name	Parameter	Description
Systen power	Input voltage(system)	24 VDC
	Input current(system)	MAX 500 mA@24VDC
	Power Efficiency	84%
	Internal bus voltage	5VDC
	Coupler consumption current	MAX 300mA@5VDC
	I/O consumption current	MAX 1700mA@5VDC
	Isolation protection	500 V system/supply
Field power	Input voltage (field)	24 VDC
	Power supply current across contacts (MAX)	10 ADC
Ethernet	Number	2 X RJ45
	Transmission medium	Twisted Pair STP 100 Ω Cat 5
	MAX cable length	100m
	Baud rate	10/100 Mbit/s
	Isolation protection	ESD contact: 8KV, Surge: 4KV(10/1000us)
System	Operating system	Linux
	CPU	300MHz
	RAM	64MB
	Flash	128MB
	I/O Modules	MAX 32
	Process mapping (Modbus)	● Bool : 4096

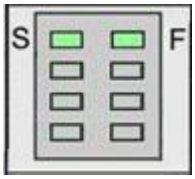
	data points via serial port module	● 16 Bit : 2048 ● 32 Bit : 1024
	Protocol	Modbus TCP, MQTT, OPC UA, HTTP, DHCP, DNS
	Maximum number of connections	15 Modbus TCP
Wiring method	Method	CAGE CLAMP
	Wire diameter	0.08 mm² ··· 2.5 mm², AWG 28 ··· 14
	Stripping length	8 mm ··· 9 mm / 0.33 in
Environment	Working temperature	0 ··· 55 ° C
	Storage temperature	-40 ··· 70 ° C
	Relative humidity	5 ··· 95% no condensation
	Working altitude	0 ··· 2000 m
	Protection type	IP20
Dimension	Width	48mm
	Length	100mm
	Height	69mm
Material	Color	Light gray
	Shell material	Polycarbonate, Nylon 6.6
	Fire load	1.239 MJ
	Weight	180g
Installation	Method	DIN-35 rail
Certificates	EMC	EN 55022: 2006/A1: 2007 (CE &RE) Class B
		IEC 61000-4-2 (ESD) Level 4
		IEC 61000-4-3 (RS) Level 4
		IEC 61000-4-4 (EFT) Level 4
		IEC 61000-4-5 (Surge)Level 3
		IEC 61000-4-6 (CS)Level 4
		IEC 61000-4-8 (M/S) Level 4

5.4.3 Hardware Interface

5.4.3.1 LED Indicators



LED	Description	Color	Status	Meaning
PWR	Power indicator	Red	ON	Power connection successful
			OFF	No power
SYS	System indicator	Green	ON	System is abnormal
			OFF	System is running normally
RUN	Running indicator	Green	Flashing	System is running normally
			OFF	System is abnormal
ERR	Error indicator	Red	ON	Northbound protocol connection error
			OFF	No errors
I/O RUN	I/O Running indicator	Green	Flashing	I/O module is working normally
			OFF	Module not inserted
I/O ERR	I/O Error indicator	Red	ON	I/O module communication error
			OFF	No errors

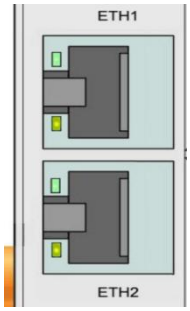


LED	Description	Color	Status	Meaning
S	System 24V power	Green	ON	Power is OK

	indicator		OFF	No power
F	Field 24V power indicator	Green	ON	Power is OK
			OFF	No power

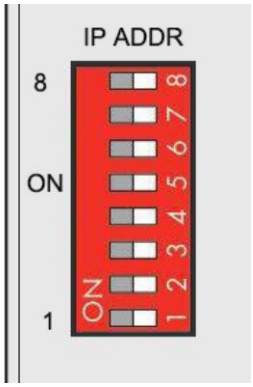
5.4.3.2 Ethernet Port

It is connected to the Ethernet-based fieldbus through the ETH2, and the EHT1 is used to connect other nodes that need to be connected to the Ethernet.



5.4.3.3 IP Address Selection Switch

The 8-bit DIP switch is used to set the IP address. The encoding of DIP switches is done bit by bit, starting from DIP switch 1 with the least significant bit (2^0) to DIP switch 8 with the most significant bit (2^7), corresponding to decimal values: 0-255.



When the value of the DIP switch is 1111 1111 (decimal 255), the IP address is set according to the web page. The web page setting can specify the IP or set the automatic acquisition. When the web page is not set, the IP address is: 192.168.1.10
When the value of the DIP switch is 0000 0000 – 1111 1110 (decimal 0-254), determine the 3rd byte of the IP address, and the 1st, 2nd and 4th bytes are fixed bytes, namely 192.168.xxx.253

5.4.4 Process Data Definition

The BL206Pro includes the functions of BL200, BL205, and BL206, so the Modbus mapping address, OPC UA data point Node Id, and MQTT identifier are all applicable to BL206Pro.

5.4.5 Controller Connection

Refer to chapter 5.1.5

5.4.6 Web Page Configuration

Login web page configuration interface refer to chapter 5.1.6, BL206Pro coupler includes the functions of BL200, BL205, and BL206, so for the function description of the configuration page, refer to the description chapter of the web page configuration page of BL200, BL205, and BL206.

5.5 BL201 Profinet Coupler

5.5.1 BL201 Coupler Overview

BL201 coupler supports standard Profinet I/O Device communication. Support RT real-time communication, the minimum period of RT real-time communication is 1ms. The coupler supports a maximum input of 1440 bytes, a maximum output of 1440 bytes, and supports 32 extended I/O modules.

5.5.2 Technical Parameters

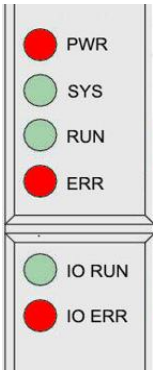
Name	Parameter	Description
Systen power	Input voltage(system)	24 VDC
	Input current(system)	MAX 500 mA@24VDC
	Power Efficiency	84%
	Internal bus voltage	5VDC
	Coupler consumption current	MAX 300mA@5VDC
	I/O consumption current	MAX 1700mA@5VDC
	Isolation protection	500 V system/supply

Field power	Input voltage (field)	24 VDC
	Power supply current across contacts (MAX)	10 ADC
Ethernet	Number	2 X RJ45
	Transmission medium	Twisted Pair STP 100 Ω Cat 5
	MAX cable length	100m
	Baud rate	10/100 Mbit/s
	Isolation protection	ESD contact: 8KV, Surge: 4KV(10/1000us)
System	Operating system	Linux
	CPU	300MHz
	RAM	64MB
	Flash	128MB
	I/O Modules	MAX 32
	Protocol	Profinet
	Process data area	Input up to 1440 bytes, output up to 1440 bytes
	RT	Support, minimum cycle 1ms
Wiring method	Method	CAGE CLAMP
	Wire diameter	0.08 mm² ··· 2.5 mm², AWG 28 ··· 14
	Stripping length	8 mm ··· 9 mm / 0.33 in
Environment	Working temperature	0 ··· 55 ° C
	Storage temperature	-40 ··· 70 ° C
	Relative humidity	5 ··· 95% no condensation
	Working altitude	0 ··· 2000 m
	Protection type	IP20
Dimension	Width	48mm
	Length	100mm
	Height	69mm
Material	Color	Light gray
	Shell material	Polycarbonate, Nylon 6.6
	Fire load	1.239 MJ
	Weight	180g
Installation	Method	DIN-35 rail
Certificates	EMC	EN 55022: 2006/A1: 2007 (CE &RE) Class B

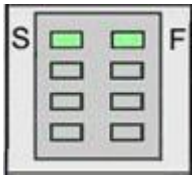
		IEC 61000-4-2 (ESD) Level 4
		IEC 61000-4-3 (RS) Level 4
		IEC 61000-4-4 (EFT) Level 4
		IEC 61000-4-5 (Surge)Level 3
		IEC 61000-4-6 (CS)Level 4
		IEC 61000-4-8 (M/S) Level 4

5.5.3 Hardware Interface

5.5.3.1 LED Indicators



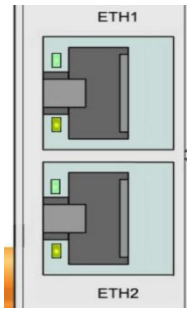
LED	Description	Color	Status	Meaning
PWR	Power indicator	Red	ON	Power connection successful
			OFF	No power
SYS	System indicator	Green	ON	System is abnormal
			OFF	System is running normally
RUN	Running indicator	Green	Flashing	System is running normally
			OFF	System is abnormal
ERR	Error indicator	Red	ON	Profinet protocol connection error
			OFF	No errors
I/O RUN	I/O Running indicator	Green	Flashing	I/O module is working normally
			OFF	Module not inserted
I/O ERR	I/O Error indicator	Red	ON	I/O module communication error
			OFF	No errors



LED	Description	Color	Status	Meaning
S	System 24V power indicator	Green	ON	Power is OK
			OFF	No power
F	Field 24V power indicator	Green	ON	Power is OK
			OFF	No power

5.5.3.2 Ethernet Port

ETH1 and ETH2 are Profinet communication ports, support switch function, 10M/100M self-adaptive.



5.5.3.3 IP Address Selection Switch

It's not working on BL201 couplers.

5.5.4 Process Data Definition

BL201 does not support the data collected by the serial port module temporarily, the data point address of the I/O module is determined by the Profinet master, and the data of AI and AO are mapped to 0-65535.

AO 0-5V/0-10V output data value

Voltage(0-5V)	Voltage(0-10V)	Decimal	Hexadecimal
5	10	65535	0xFFFF
.	.	.	.

.	.	.	.
2.5	5	32767	0x7FFF
.	.	.	.
.	.	.	.
0	0	0	0x0000

For example: Requires analog output 3V, the issued value is: When the range is 0-5V, 3*65535/5=39321. When the range is 0-10V, 3*65535/10=19660.5, since AO is an integer, 19660 will be issued.

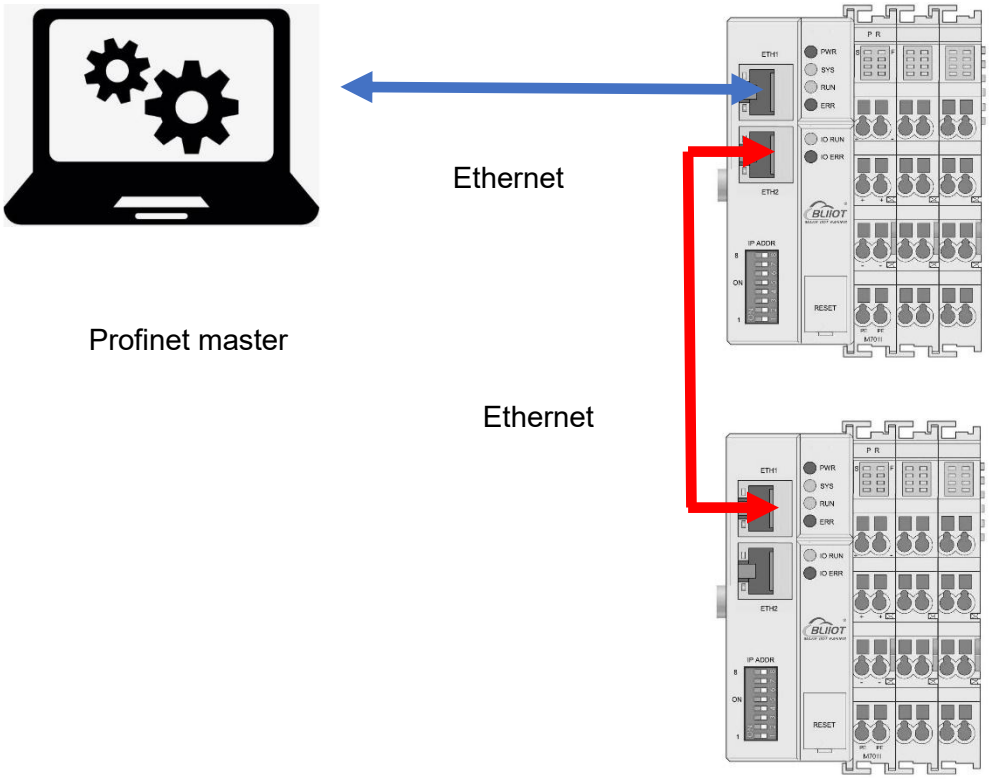
AI 0-20mA/4-20mA input Data value

Current(0-20mA)	Current(4-20mA)	Decimal	Hexadecimal
20	20	65535	0xFFFF
.	.	.	.
.	.	.	.
10	12	32767	0x7FFF
.	.	.	.
.	.	.	.
0	4	0	0x0000

For example: The AI value in the master is 56789, then when the range is 0-20mA, the theoretical value of AI is: 56789/65535/20=17.33089mA. When the range is 4-20mA, the theoretical value of AI is: 56789/65535*16+4=17.86471mA.

5.5.5 Coupler Connection

The BL201 coupler is used as a Profinet slave, and both ETH1 and ETH2 network ports can be directly connected to the Profinet master, or connected to the Profinet master through a switch. BL201 coupler does not have a separate web configuration interface.



5.6 BL203 Ethernet/IP Coupler

5.6.1 BL203 Coupler Overview

The BL203 coupler supports standard Ethernet/IP protocol access. The coupler supports a maximum input of 504 bytes and a maximum output of 504 bytes. The number of extended IO modules supported is 32.

5.6.2 Technical Parameters

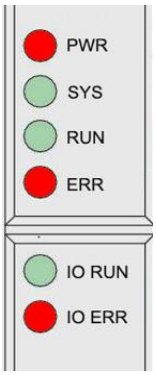
Name	Parameter	Description
Systen power	Input voltage(system)	24 VDC
	Input current(system)	MAX 500 mA@24VDC
	Power Efficiency	84%
	Internal bus voltage	5VDC
	Coupler consumption current	MAX 300mA@5VDC
	I/O consumption current	MAX 1700mA@5VDC
	Isolation protection	500 V system/supply
Field power	Input voltage (field)	24 VDC

	Power supply current across contacts (MAX)	10 ADC
Ethernet	Number	2 X RJ45
	Transmission medium	Twisted Pair STP 100 Ω Cat 5
	MAX cable length	100m
	Baud rate	10/100 Mbit/s
	Isolation protection	ESD contact: 8KV, Surge: 4KV(10/1000us)
System	Operating system	Linux
	CPU	300MHz
	RAM	64MB
	Flash	128MB
	I/O Modules	MAX 32
	Protocol	Ethernet/IP, HTTP, DHCP, DNS
	Process data area	The maximum input length is 504 bytes, and the maximum output length is 504 bytes
	Maximum number of explicit message connections	10
	Maximum number of implicit message connections	5
	Maximum number of CIP connections	10
Wiring method	Method	CAGE CLAMP
	Wire diameter	0.08 mm² … 2.5 mm², AWG 28 … 14
	Stripping length	8 mm … 9 mm / 0.33 in
Environment	Working temperature	0 … 55 ° C
	Storage temperature	-40 … 70 ° C
	Relative humidity	5 … 95% no condensation
	Working altitude	0 … 2000 m
	Protection type	IP20
Dimension	Width	48mm
	Length	100mm
	Height	69mm
Material	Color	Light gray
	Shell material	Polycarbonate, Nylon 6.6

	Fire load	1.239 MJ
	Weight	180g
Installation	Method	DIN-35 rail
Certificates	EMC	EN 55022: 2006/A1: 2007 (CE &RE) Class B
		IEC 61000-4-2 (ESD) Level 4
		IEC 61000-4-3 (RS) Level 4
		IEC 61000-4-4 (EFT) Level 4
		IEC 61000-4-5 (Surge)Level 3
		IEC 61000-4-6 (CS)Level 4
		IEC 61000-4-8 (M/S) Level 4

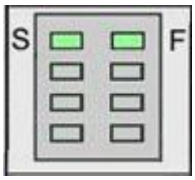
5.6.3 Hardware Interface

5.6.3.1 LED Indicators



LED	Description	Color	Status	Meaning
PWR	Power indicator	Red	ON	Power connection successful
			OFF	No power
SYS	System indicator	Green	ON	System is abnormal
			OFF	System is running normally
RUN	Running indicator	Green	Flashing	System is running normally
			OFF	System is abnormal
ERR	Error indicator	Red	ON	Ethernet/IP protocol connection error
			OFF	No errors
I/O RUN	I/O Running indicator	Green	Flashing	I/O module is working normally

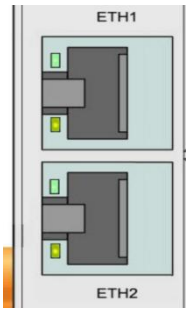
			OFF	Module not inserted
I/O ERR	I/O Error indicator	Red	ON	I/O module communication error
			OFF	No errors



LED	Description	Color	Status	Meaning
S	System 24V power indicator	Green	ON	Power is OK
			OFF	No power
F	Field 24V power indicator	Green	ON	Power is OK
			OFF	No power

5.6.3.2 Ethernet Port

It is connected to the Ethernet-based field bus through the ETH 1 interface, and ETH2 is used to connect other nodes that need to access the Ethernet.



5.6.3.3 IP Address Selection Switch

It's not working on BL203 couplers.

5.6.4 Process Data Definition

BL203 does not support the data collected by the serial port module temporarily, the data point address of the I/O module is determined by the Ethernet/IP master, and the data of AI and AO are mapped to 0-65535.

AO 0-5V/0-10V output data value

Voltage(0-5V)	Voltage(0-10V)	Decimal	Hexadecimal
5	10	65535	0xFFFF
.	.	.	.
.	.	.	.
2.5	5	32767	0x7FFF
.	.	.	.
.	.	.	.
0	0	0	0x0000

For example: Requires analog output 3V, the issued value is: When the range is 0-5V, 3*65535/5=39321. When the range is 0-10V, 3*65535/10=19660.5, since AO is an integer, 19660 will be issued.

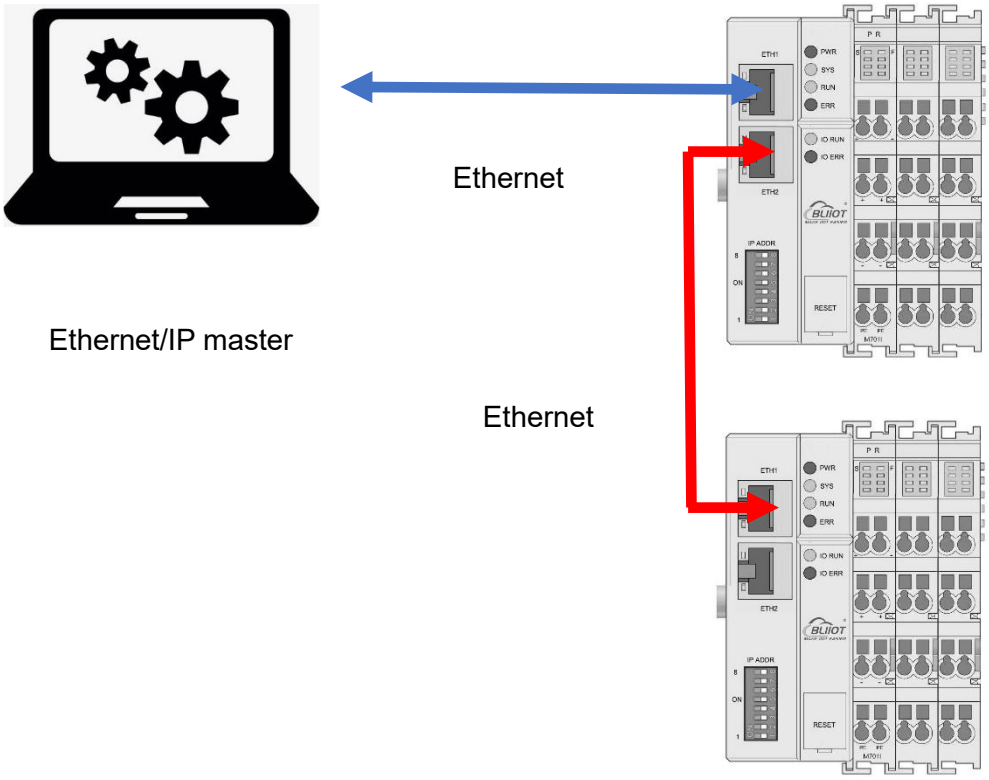
AI 0-20mA/4-20mA input data value

Current(0-20mA)	Current(4-20mA)	Decimal	Hexadecimal
20	20	65535	0xFFFF
.	.	.	.
.	.	.	.
10	12	32767	0x7FFF
.	.	.	.
.	.	.	.
0	4	0	0x0000

For example: The AI value in the master is 56789, then when the range is 0-20mA, the theoretical value of AI is: 56789/65535/20=17.33089mA. When the range is 4-20mA, the theoretical value of AI is: 56789/65535*16+4=17.86471mA.

5.6.5 Coupler Connection

The BL203 coupler is used as a Ethernet/IP slave, and both ETH1 and ETH2 network ports can be directly connected to the Ethernet/IP master, or connected to the Ethernet/IP master through a switch. BL203 coupler does not have a separate web configuration interface.



5.7 BL202 EtherCAT Coupler

5.7.1 BL202 Coupler Overview

The BL202 coupler supports standard EtherCAT protocol access. The coupler supports a maximum input of 1024 bytes, a maximum output of 1024 bytes, and supports 32 extended IO modules.

5.7.2 Technical Parameters

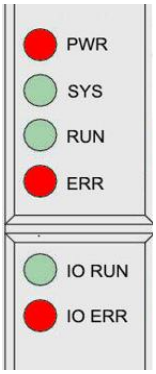
Name	Parameter	Description
Systen power	Input voltage(system)	24 VDC
	Input current(system)	MAX 500 mA@24VDC
	Power Efficiency	84%
	Internal bus voltage	5VDC
	Coupler consumption current	MAX 300mA@5VDC
	I/O consumption current	MAX 1700mA@5VDC
	Isolation protection	500 V system/supply
Field power	Input voltage (field)	24 VDC

	Power supply current across contacts (MAX)	10 ADC
Ethernet	Number	2 X RJ45
	Transmission medium	Shielded twisted pair S/FTP, F/FTP or SF/FTP; 100 Ω, Cat 6
	MAX cable length	100m
	Baud rate	10/100 Mbit/s
	Isolation protection	ESD contact: 8KV, Surge: 4KV(10/1000us)
System	Operating system	Linux
	CPU	300MHz
	RAM	64MB
	Flash	128MB
	I/O Modules	MAX 32
	Protocol	EtherCAT
	Process data area	Input up to 1024 bytes, output up to 1024 bytes
Wiring method	Method	CAGE CLAMP
	Wire diameter	0.08 mm² … 2.5 mm², AWG 28 … 14
	Stripping length	8 mm … 9 mm / 0.33 in
Environment	Working temperature	0 … 55 ° C
	Storage temperature	-40 … 70 ° C
	Relative humidity	5 … 95% no condensation
	Working altitude	0 … 2000 m
	Protection type	IP20
Dimension	Width	48mm
	Length	100mm
	Height	69mm
Material	Color	Light gray
	Shell material	Polycarbonate, Nylon 6.6
	Fire load	1.239 MJ
	Weight	180g
Installation	Method	DIN-35 rail
Certificates	EMC	EN 55022: 2006/A1: 2007 (CE &RE) Class B
		IEC 61000-4-2 (ESD) Level 4

		IEC 61000-4-3 (RS) Level 4
		IEC 61000-4-4 (EFT) Level 4
		IEC 61000-4-5 (Surge)Level 3
		IEC 61000-4-6 (CS)Level 4
		IEC 61000-4-8 (M/S) Level 4

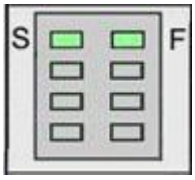
5.7.3 Hardware Interface

5.7.3.1 LED Indicators



LED	Description	Color	Status	Meaning
PWR	Power indicator	Red	ON	Power connection successful
			OFF	No power
SYS	System indicator	Green	ON	EtherCAT OP Status
			Fast Flash	EtherCAT Bootstrap Status
			Slow flash	EtherCAT Pre-OP Status
			On and off alternately	EtherCAT Safe-OP Status
			OFF	EtherCAT Init Status
RUN	Running indicator	Green	Flashing	System is running normally
			OFF	System is abnormal
ERR	Error indicator	Red	ON	The coupler is abnormal
			OFF	No errors
I/O RUN	I/O Running indicator	Green	Flashing	I/O module is working normally
			OFF	Module not inserted

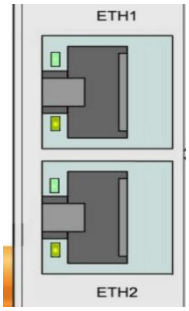
I/O ERR	I/O Error indicator	Red	ON	I/O module communication error
			OFF	No errors



LED	Description	Color	Status	Meaning
S	System 24V power indicator	Green	ON	Power is OK
			OFF	No power
F	Field 24V power indicator	Green	ON	Power is OK
			OFF	No power

5.7.3.2 Ethernet Port

It is connected to the Ethernet-based field bus through the ETH 1 interface, and ETH2 is used to connect other nodes that need to access the Ethernet.



5.7.3.3 IP Address Selection Switch

It's not working on BL202 couplers.

5.7.4 Process Data Definition

BL202 does not support the data collected by the serial port module temporarily. The data point address of the I/O module is determined by the EtherCAT master, and the data of AI and AO are mapped to 0-65535.

AO 0-5V/0-10V output data value

Voltage(0-5V)	Voltage(0-10V)	Decimal	Hexadecimal
5	10	65535	0xFFFF
.	.	.	.
.	.	.	.
2.5	5	32767	0x7FFF
.	.	.	.
.	.	.	.
0	0	0	0x0000

For example: Requires analog output 3V, the issued value is: When the range is 0-5V, 3*65535/5=39321. When the range is 0-10V, 3*65535/10=19660.5, since AO is an integer, 19660 will be issued.

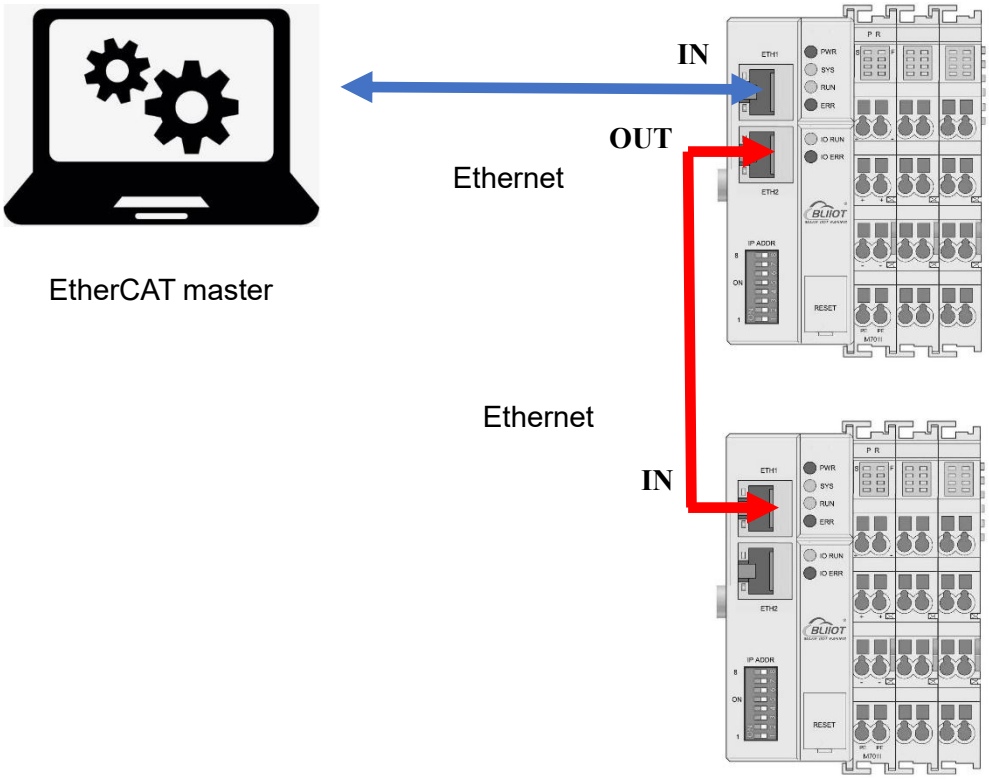
AI 0-20mA/4-20mA input data value

Current(0-20mA)	Current(4-20mA)	Decimal	Hexadecimal
20	20	65535	0xFFFF
.	.	.	.
.	.	.	.
10	12	32767	0x7FFF
.	.	.	.
.	.	.	.
0	4	0	0x0000

For example: The AI value in the master is 56789, then when the range is 0-20mA, the theoretical value of AI is: 56789/65535/20=17.33089mA. When the range is 4-20mA, the theoretical value of AI is: 56789/65535*16+4=17.86471mA.

5.7.5 Coupler Connection

The BL202 coupler is used as an EtherCAT slave, and is connected to the Ethernet-based fieldbus EtherCAT master through the ETH 1 interface. ETH 1 can also be connected to the EtherCAT master through a switch, and ETH2 is used to connect other nodes that need to access Ethernet . The BL202 coupler does not have a separate web configuration interface.



5.8 BL207 BACnet Coupler

6 Fieldbus Communication Example

6.1 BL200 Communication Example

6.1.1 Overview

Modbus is an open, manufacturer-independent fieldbus standard protocol for a variety of applications in manufacturing and process automation.

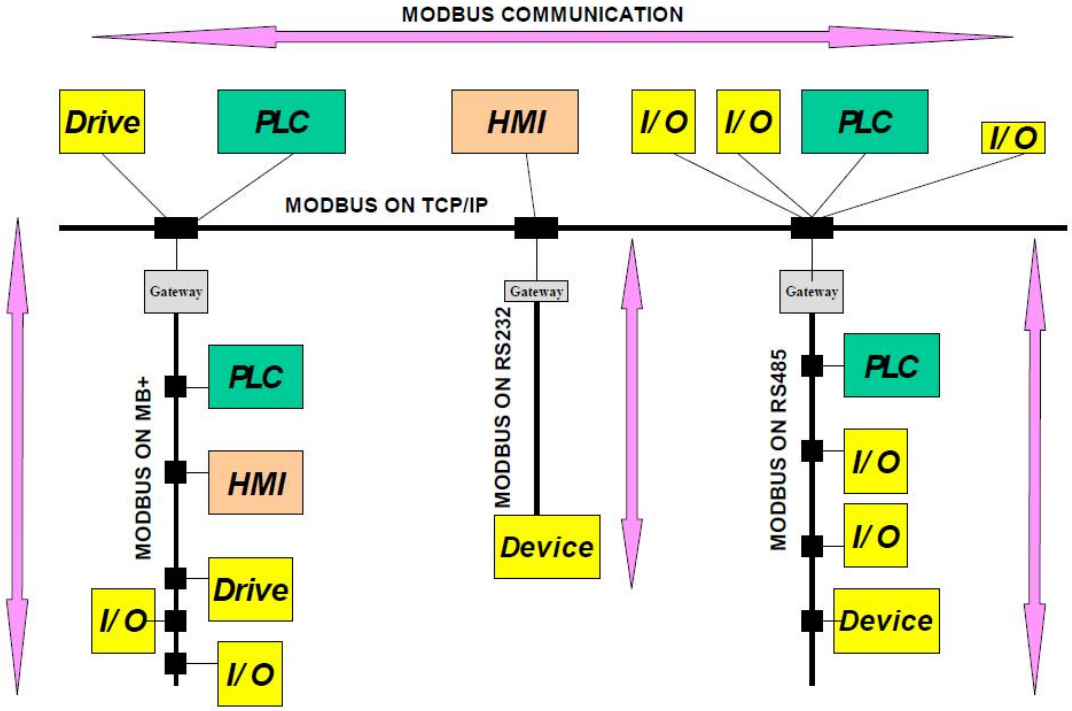
MODBUS is an application layer messaging protocol at layer 7 of the OSI model that enables client/server communication between devices connected on different types of buses or networks.

Several commonly used networks are as follows:

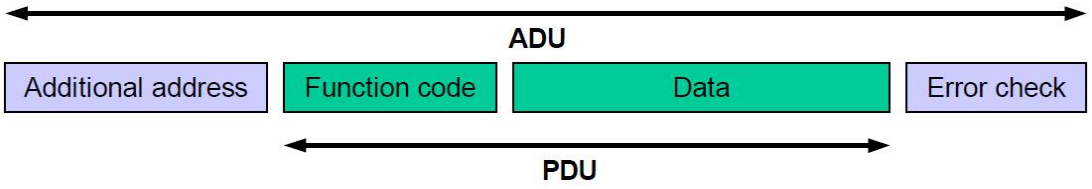
- TCP/IP over Ethernet
- Asynchronous serial transmission of multiple media (wired: EIA/TIA-232-E, EIA-422, EIA/TIA-485-A; optical fiber, radio, etc.).
- MODBUS PLUS, high-speed token.

MODBUS is a request/response protocol that provides services specified by function codes.

The MODBUS protocol allows easy communication within all types of network architectures.



MODBUS protocol defines a simple protocol data unit (PDU) independent of the underlying communication layer. The mapping of the MODBUS protocol on a specific bus or network can introduce some additional fields on the Application Data Unit (ADU).



6.1.1.1 Modbus TCP

The Modbus TCP protocol is a variant of the Modbus protocol that is optimized for communication over a TCP/IP connection. The protocol is designed for data exchange at the field level (ie for I/O data exchange in the process image). On the server side, all packets are sent over a TCP connection with port number 502.

The general Modbus TCP message is as follows:

byte	0	1	2	3	4	5	6	7	8 - n

Definition	Transaction identifier	Protocol identifier(Always 00)	Field length	Slave address	Modbus function code	Data

6.1.1.2 Modbus Data Encoding

Modbus uses "big endian" representation for address and data items. This means that when transferring numbers larger than a single byte, the most significant byte is sent first.

6.1.1.3 Modbus Data Type

The modbus protocol is based on the following basic data types:

Data type	Object type	Access type	Description
Digital input	1 bit	read	Digital input
Coil	1 bit	read/write	Digital output
Input register	16 bit (word)	read	Analog input
Holding register	16 bit (word)	read/write	Analog output

For each basic data type, one or more function codes are defined. These function codes allow digital or analog input and output data, as well as internal variables to be set or read directly from the fieldbus node.

6.1.2 Modbus Function Code

The function codes supported by the BL200 fieldbus node are shown in the table below. To perform the required functions, please specify the respective function codes and the address of the selected input or output channel or register.

Modbus function code	Function	Access type	Description
0x02	read digital input	read	Access by 1 bit
0x01	read coil	read/write	
0x05	write a single coil	read/write	
0x0F	write multiple coils	read/write	
0x04	read input register	read	Access by 16 Bit
0x03	read multiple registers	read/write	

0x06	write a single register	read/write	
0x10	write multiple registers	read/write	

The MODBUS function is performed as follows:

1. The MODBUS TCP master (such as PC) sends a request to the BL200 fieldbus node using a specific function code;
2. The BL200 fieldbus node receives the data message, and then responds to the master with correct data according to the master's request.

If a fieldbus node receives an incorrect request, it sends an error data telegram (exception) to the master.
The meaning of the exception code contained in the exception is as follows:

Exception code	Description
0x01	illegal function
0x02	illegal data address
0x03	illegal data value
0x04	slave device failure

6.1.2.1 Function Code 0x02

This function code is used to read the continuous state of single or multiple digital inputs.

1. Request

The request specifies the starting address and the quantity to be read.

Field Name	Number of bytes	Example	Description
Transaction identifier	2 Byte	0x00 01	Identification of Modbus request/response transactions
Protocol identifier	2 Byte	0x00 00	0x00 00: Modbus protocol
Message length	2 Byte	0x00 06	The number of bytes of the following data
Device address	1 Byte	0x01	Slave address identification
Function code	1 Byte	0x02	Read digital input, use function code 0x02
Start address	2 Byte	0x07 D0	The address is detailed in the

			"Modbus Register Mapping" chapter
Enter quantity	2 Byte	0x08	Read 8 digital inputs

2. Response

The data field indicates the value of the input state. A binary 1 corresponds to the on state and a 0 corresponds to the off state. The least significant bit (LSB) of the first data byte contains the first bit of the request, the others are in ascending order. If the response data is not a multiple of 8, the remaining bits of the last data byte will be padded with zeros (towards the upper bits of the byte).

Field Name	Number of bytes	Example	Description
Transaction identifier	2 Byte	0x00 01	Identification of Modbus request/response transactions
Protocol identifier	2 Byte	0x00 00	0x00 00: Modbus protocol
Message length	2 Byte	0x00 04	The number of bytes of the following data
Device address	1 Byte	0x01	Slave address identification
Function code	1 Byte	0x02	Read digital input, use function code 0x02
Data bytes	1 Byte	0x01	Number of bytes of data
Data	1 Byte	0x89	Response data

3. Abnormal

Field Name	Number of bytes	Example	Description
…			
Function code	1 Byte	0x82	Modbus function code + 0x80
Abnormal code	1 Byte	0x01	0x01 or 0x02

4. Example

Read the value of 8 digital inputs from address 2000 to 2007.

request

0x00 01 00 00 00 06 01 02 07 D0 00 08

Byte	1	2	3	4	5	6	7	8	9	10	11	12

Data	00 01	00 00	00 06	01	01	07 D0	00 08
illustrate	Transaction identifier	Protocol identifier	Message length	Device address	Function code	Start address	Number of coils

response

0x00 01 00 00 00 04 01 02 01 89

Byte	1	2	3	4	5	6	7	8	9	10
Data	00 01		00 00		00 04		01	01	01	89
illustrate	Transaction identifier		Protocol identifier		Message length		Device address	Function code	Data bytes	Data

Status from 2007 to 2000 is displayed as byte value 0x89 or binary 1000 1001. Address 2007 is the most significant bit MSB of the byte, 2000 is the least significant bit LSB, the distribution from high to low is as follows:

Bit	7	6	5	4	3	2	1	0
Address	2007	2006	2005	2004	2003	2002	2001	2000
Status	1	0	0	0	1	0	0	1
illustrate	close	open	open	open	close	open	open	close

6.1.2.2 Function Code 0x01

This function code is used to read the continuous status of single or multiple coils in the remote device.

1. Request

The request specifies the starting address, which specifies the address of the first coil, and the number of coils.

Field Name	Number of bytes	Example	illustrate
Transaction identifier	2 Byte	0x00 01	Identification of Modbus request/response transactions
Protocol identifier	2 Byte	0x00 00	0x00 00: Modbus protocol
Message length	2 Byte	0x00 06	The number of bytes of the following data
Device address	1 Byte	0x01	Slave address identification

Function code	1 Byte	0x01	Read coil, use function code 0x01
Start address	2 Byte	0x03 E8	The address is detailed in the "Modbus Register Mapping" chapter
Number of coils	2 Byte	0x00 08	Read 8 coil states

2. Response

The data field indicates the value of the input state. A binary 1 corresponds to the on state and a 0 corresponds to the off state. The least significant bit (LSB) of the first data byte contains the first bit of the request, the others are in ascending order. If the response data is not a multiple of 8, the remaining bits of the last data byte will be padded with zeros (towards the upper bits of the byte).

Field Name	**Number of bytes**	**Example**	**illustrate**
Transaction identifier	2 Byte	0x00 01	Identification of Modbus request/response transactions
Protocol identifier	2 Byte	0x00 00	0x00 00: Modbus protocol
Message length	2 Byte	0x00 04	The number of bytes of the following data
Device address	1 Byte	0x01	Slave address identification
Function code	1 Byte	0x01	Read coil, use function code 0x01
Data bytes	1 Byte	0x01	Number of bytes of data
Data	1 Byte	0x89	Response data

3. Abnormal

Field Name	**Number of bytes**	**Example**	**illustrate**
…			
Function code	1 Byte	0x81	Modbus function code + 0x80
Abnormal code	1 Byte	0x01	0x01 or 0x02

4. Example

Read the status values of 8 coils from addresses 1000 to 1007.

request

0x00 01 00 00 00 06 01 01 03 E8 00 08

Byte	1	2	3	4	5	6	7	8	9	10	11	12
Data	00 01		00 00		00 06		01	01	03 E8		00 08	
illustrate	Transaction identifier		Protocol identifier		Message length		Device address	Function code	Initial address		Number of coils	

response

0x00 01 00 00 00 04 01 01 01 89

Byte	1	2	3	4	5	6	7	8	9	10
Data	00 01		00 00		00 04		01	01	01	89
illustrate	Transaction identifier		Protocol identifier		Message length		Device address	Function code	Data bytes	Data

Status from 1007 to 1000 is displayed as byte value 0x89 or binary 1000 1001. Address 1007 is the most significant bit MSB of the byte, 1000 is the least significant bit LSB, the distribution from high to low is as follows:

Bit	7	6	5	4	3	2	1	0
Address	1007	1006	1005	1004	1003	1002	1001	1000
Status	1	0	0	0	1	0	0	1
illustrate	close	open	open	open	close	open	open	close

6.1.2.3 Function Code 0x05

This function will write a single coil status to the slave device.

1. Request

Field Name	**Number of bytes**	**Example**	**illustrate**
Transaction identifier	2 Byte	0x00 01	Identification of Modbus request/response transactions
Protocol identifier	2 Byte	0x00 00	0x00 00: Modbus protocol
Message length	2 Byte	0x00 06	The number of bytes of the following data
Device address	1 Byte	0x01	Slave address identification

Function code	1 Byte	0x05	To write a single coil, use function code 0x05
Register address	2 Byte	0x03 E8	The address is detailed in the "Modbus Register Mapping" chapter
Data input	2 Byte	0xFF 00	This value is: 0xFF 00 or 0x00 00. 0xFF 00 means write 1, 0x00 00 means write 0.

2. Response

Field Name	Number of bytes	Example	illustrate
Transaction identifier	2 Byte	0x00 01	Identification of Modbus request/response transactions
Protocol identifier	2 Byte	0x00 00	0x00 00: Modbus protocol
Message length	2 Byte	0x00 06	The number of bytes of the following data
Device address	1 Byte	0x01	Slave address identification
Function code	1 Byte	0x05	To write a single coil, use function code 0x05
Data bytes	2 Byte	0x03 E8	Write the register address of the coil
Data input	2 Byte	0xFF 00	This value is: 0xFF 00 or 0x00 00. 0xFF 00 means write 1, 0x00 00 means write 0.

3. Abnormal

Field Name	Number of bytes	Example	illustrate
…			
Function code	1 Byte	0x85	Modbus function code + 0x80
Abnormal code	1 Byte	0x81	0x01 or 0x02

4. Example

Write the state value of the coil at address 1000 as 1, that is, the closed state.

request

0x00 01 00 00 00 06 01 05 03 E8 FF 00

Byte	1	2	3	4	5	6	7	8	9	10	11	12

Data	00 01	00 00	00 06	01	05	03 E8	FF 00
illustrate	Transaction identifier	Protocol identifier	Message length	Device address	Function code	Coil address	Write "1"

response

0x00 01 00 00 00 06 01 05 03 E8 FF 00

Byte	1	2	3	4	5	6	7	8	9	10	11	12
Data	00 01		00 00		00 06		01	05	03 E8		FF 00	
illustrate	Transaction identifier		Protocol identifier		Message length		Device address	Function code	Coil address		Write "1"	

6.1.2.4 Function Code 0x0F

This function code is used to set multiple consecutive coils to open or close. The on/off state of the request is specified by the content of the request data field. A logical "1" requests the corresponding output to close, and a logical "0" requests it to open. The normal response returns the function code, the starting address and the number of coils executed.

1. Request

Field Name	**number of bytes**	**Example**	**illustrate**
Transaction identifier	2 Byte	0x00 01	Identification of Modbus request/response transactions
Protocol identifier	2 Byte	0x00 00	0x00 00: Modbus protocol
Message length	2 Byte	0x00 08	The number of bytes of the following data
Device address	1 Byte	0x01	Slave address identification
Function code	1 Byte	0x0F	Write multiple coils, use function code 0x0F
Start address	2 Byte	0x03 E8	The address is detailed in the "Modbus Register Mapping" chapter
Number of coils	2 Byte	0x00 08	

Data bytes	1 Byte	0x01	
Data	1 Byte	0xFF	

2. Response

Field Name	number of bytes	Example	illustrate
Transaction identifier	2 Byte	0x00 00	Identification of Modbus request/response transactions
Protocol identifier	2 Byte	0x00 00	0x00 00: Modbus protocol
Message length	2 Byte	0x00 06	The number of bytes of the following data
Device address	1 Byte	0x01	Slave address identification
Function code	1 Byte	0x0F	Write multiple coils, use function code 0x0F
Start address	2 Byte	0x03 E8	
Number of coils	2 Byte	0x00 08	

3. Abnormal

Field Name	number of bytes	Example	illustrate
…			
Function code	1 Byte	0x8F	Modbus function code + 0x80
Abnormal code	1 Byte		0x01 or 0x02

4. Example

Starting from address 1000, close all 8 coils, that is, write the value of 8 coils as 0xFF.

request

0x00 01 00 00 00 08 01 0F 03 E8 00 08 01 FF

Byte	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Data	00 01		00 00		00 08		01	0F	03 E8		00 08		01	FF
illustrate	Transaction identifier		Protocol identifier		Message length		Device address	Function code	Start address		Number of coils		Data bytes	Data

response

0x00 01 00 00 00 06 01 0F 03 E8 00 08

Byte	1	2	3	4	5	6	7	8	9	10	11	12
Data	00 01		00 00		00 06		01	0F	03 E8		00 08	
illustrate	Transactio n identifier		Protocol identifier		Message length		Device address	Function code	Start address		Number of coils	

6.1.2.5 Function Code 0x04

This function code is used to read consecutive input registers in multiple remote devices. The request PDU specifies the address of the starting register and the number of registers. The register data in the response message is packed into two bytes per register, and the binary content within each byte is right-aligned.

1. Request

Field Name	Number of bytes	Example	illustrate
Transaction identifier	2 Byte	0x00 01	Identification of Modbus request/response transactions
Protocol identifier	2 Byte	0x00 00	0x00 00: Modbus protocol
Message length	2 Byte	0x00 06	The number of bytes of the following data
Device address	1 Byte	0x01	Slave address identification
Function code	1 Byte	0x04	Read input register, use function code 0x04
Start address	2 Byte	0x0B B8	The address is detailed in the "Modbus Register Mapping" chapter
Number of registers	2 Byte	0x00 08	

2. Response

Field Name	Number of bytes	Example	illustrate
Transaction identifier	2 Byte	0x00 00	Identification of Modbus request/response transactions
Protocol identifier	2 Byte	0x00 00	0x00 00: Modbus protocol
Message	2 Byte	0x00 13	The number of bytes of the following

length			data
Device address	1 Byte	0x01	Slave address identification
Function code	1 Byte	0x04	Read input register, use function code 0x04
Data bytes	1 Byte	0x10	
Data	16 Byte	0x 3F 8E 38 86 40 0E 38 86 40 55 54 CA 40 8E 35 3F	

3. Abnormal

Field Name	**Number of bytes**	**Example**	**illustrate**
…			
Function code	1 Byte	0x84	Modbus function code + 0x80
Abnormal code	1 Byte	0x01	0x01 or 0x02

4. Example

Starting at address 3000, read the values of the 4 analog inputs. Since the BL200 controller node register map data type is 32Bit Float, that is, 1 analog input data = 2 registers = 4 bytes, 8 input registers need to be read.

request

0x00 01 00 00 00 06 01 04 0B B8 00 08

Byte	1	2	3	4	5	6	7	8	9	10	11	12
Data	00 01		00 00		00 06		01	04	0B B8		00 08	
illustrate	Transaction identifier		Protocol identifier		Message length		Device address	Function code	Start address		Number of registers	

response

0x00 01 00 00 00 13 01 04 10 3F 9D 70 A4 40 15 C2 8F 40 5C CC CD 40 91 EB 85

Byte	1	2	3	4	5	6	7	8	9	10…25
Data	00 01		00 00		00 13		01	04	10	xxx
illustr	Transactio		Protocol		Message		Device	Function	Data bytes	Data

ate	n identifier	identifier	length	address	code		

The data part has a total of 16 bytes, which are converted into decimal as follows

Byte	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Data	3F 9D 70 A4				40 15 C2 8F				40 5C CC CD				40 91 EB 85			
Decimal	1.23				2.34				3.45				4.56			
illustrate	First data				Second data				Third data				Fourth data			

6.1.2.6 Function Code 0x03

This function code is used to read continuous holding registers in multiple remote devices. The request PDU specifies the address of the starting register and the number of registers. The register data in the response message is packed into two bytes per register, and the binary content within each byte is right-aligned.

1. Request

Field Name	**number of bytes**	**Example**	**illustrate**
Transaction identifier	2 Byte	0x00 01	Identification of Modbus request/response transactions
Protocol identifier	2 Byte	0x00 00	0x00 00: Modbus protocol
Message length	2 Byte	0x00 06	The number of bytes of the following data
Device address	1 Byte	0x01	Slave address identification
Function code	1 Byte	0x03	Read holding register, use function code 0x03
Start address	2 Byte	0x0F A0	The address is detailed in the "Modbus Register Mapping" chapter
Number of registers	2 Byte	0x00 08	Number of holding registers to read

2. Response

Field Name	**Number of bytes**	**Example**	**illustrate**
Transaction identifier	2 Byte	0x00 00	Identification of Modbus request/response transactions

Protocol identifier	2 Byte	0x00 00	0x00 00: Modbus protocol
Message length	2 Byte	0x00 13	The number of bytes of the following data
Device address	1 Byte	0x01	Slave address identification
Function code	1 Byte	0x03	Read holding register, use function code 0x03
Data bytes	1 Byte	0x10	Data bytes
Data	16 Byte	0x 3F 9D 70 A4 40 15 C2 8F 40 5C CC CD 40 91 EB 85	Response data

3. Abnormal

Field Name	**Number of bytes**	**Example**	**illustrate**
…			
Function code	1 Byte	0x83	Modbus function code + 0x80
Abnormal code	1 Byte	0x01	0x01 or 0x02

4. Example

Starting at address 4000, read the values of the 4 analog outputs (belonging to the holding registers). Since the analog output I/O module register map data type is 32Bit Float, that is, 1 analog output data = 2 registers = 4 bytes, it is necessary to read 8 holding registers.

request

0x00 01 00 00 00 06 01 03 0F A0 00 08

Byte	1	2	3	4	5	6	7	8	9	10	11	12
Data	00 01		00 00		00 06		01	03	0F A0		00 08	
illustrate	Transaction identifier		Protocol identifier		Message length		Device address	Function code	Start address		Number of registers	

response

0x00 01 00 00 00 13 01 03 10 3F 9D 70 A4 40 15 C2 8F 40 5C CC CD 40 91 EB 85

Byte	1	2	3	4	5	6	7	8	9	10…25
Data	00 01		00 00		00 13		01	03	10	xxx
illustrate	Transaction identifier		Protocol identifier		Message length		Device address	Function code	Data bytes	Data

The data part has a total of 16 bytes, and the conversion to decimal is as follows:

Byte	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Data	3F 9D 70 A4				40 15 C2 8F				40 5C CC CD				40 91 EB 85			
Decimal	1.23				2.34				3.45				4.56			
illustrate	First data				Second data				Third data				Fourth data			

6.1.2.7 Function Code 0x06

This function code is used to write to holding registers in a single remote device. The request PDU specifies the address of the starting register and the number of registers. The register data in the response message is packed into two bytes per register, and the binary content within each byte is right-aligned.

This function code is only suitable for reading the serial port I/O module register mapping data, the address range: 40000 ... 49999. The data type of the analog input/output I/O module is 32Bit Float format, the complete data cannot be read, and this function cannot be used.

1. Request

Field Name	**Number of bytes**	**Example**	**illustrate**
Transaction identifier	2 Byte	0x00 01	Identification of Modbus request/response transactions
Protocol identifier	2 Byte	0x00 00	0x00 00: Modbus protocol
Message length	2 Byte	0x00 06	The number of bytes of the following data
Device address	1 Byte	0x01	Slave address identification
Function code	1 Byte	0x06	Write a single holding register, use function code 0x06
Register address	2 Byte	0x9C 40	The address is detailed in the "Modbus Register Mapping" chapter

Data	2 Byte	0x04 D2	

2. Response

Field Name	Number of bytes	Example	illustrate
Transaction identifier	2 Byte	0x00 00	Identification of Modbus request/response transactions
Protocol identifier	2 Byte	0x00 00	0x00 00: Modbus protocol
Message length	2 Byte	0x00 06	The number of bytes of the following data
Device address	1 Byte	0x01	Slave address identification
Function code	1 Byte	0x06	Write a single holding register, use function code 0x06
Register address	2 Byte	0x75 30	
Data	2 Byte	0x04 D2	

3. Abnormal

Field Name	Number of bytes	Example	illustrate
…			
Function code	1 Byte	0x86	Modbus function code + 0x80
Abnormal code	1 Byte	0x01	0x01 or 0x02

4. Example

Write the value of register address 40000 to 1234 (0x04 D2).

request

0x00 01 00 00 00 06 01 06 9C 40 04 D2

Byte	1	2	3	4	5	6	7	8	9	10	11	12
Data	00 01		00 00		00 06		01	06	9C 40		04 D2	
illustrate	Transaction identifier		Protocol identifier		Message length		Device address	Function code	Register address		Data	

response

0x00 01 00 00 00 06 01 06 9C 40 04 D2

Byte	1	2	3	4	5	6	7	8	9	10	11	12
Data	00 01		00 00		00 06		01	0F	9C 40		04 D2	
illustrate	Transaction identifier		Protocol identifier		Message length		Device address	Function code	Register address		Data	

6.1.2.8 Function Code 0x10

This function code is used to write to consecutive holding registers in multiple remote devices. The request PDU specifies the address of the starting register and the number of registers. The register data in the response message is packed into two bytes per register, and the binary content within each byte is right-aligned.

1. Request

Field Name	Number of bytes	Example	illustrate
Transaction identifier	2 Byte	0x00 01	Identification of Modbus request/response transactions
Protocol identifier	2 Byte	0x00 00	0x00 00: Modbus protocol
Message length	2 Byte	0x00 17	The number of bytes of the following data
Device address	1 Byte	0x01	Slave address identification
Function code	1 Byte	0x10	Write multiple holding registers, use function code 0x10
Start address	2 Byte	0x0F A0	The address is detailed in the "Modbus Register Mapping" chapter
Number of registers	2 Byte	0x00 08	
Data bytes	1 Byte	0x10	
Data	16 Byte	0x 3F 9D 70 A4 40 15 C2 8F 40 5C CC CD 40 91 EB 85	

2. Response

Field Name	Number of bytes	Example	illustrate
Transaction identifier	2 Byte	0x00 00	Identification of Modbus request/response transactions
Protocol identifier	2 Byte	0x00 00	0x00 00: Modbus protocol
Message length	2 Byte	0x00 13	The number of bytes of the following data
Device address	1 Byte	0x01	Slave address identification
Function code	1 Byte	0x10	Write multiple holding registers, use function code 0x10
Start address	2 Byte	0x0F A0	
Number of registers	2 Byte	0x00 08	

3. Abnormal

Field Name	number of bytes	Example	illustrate
…			
Function code	1 Byte	0x90	Modbus function code + 0x80
Abnormal code	1 Byte	0x01	0x01 or 0x02

4. Example

Starting at address 4000, write the values of the 4 analog outputs. Since the BL200 controller node register map data type is 32Bit Float, that is, 1 analog output data = 2 holding registers = 4 bytes, 8 holding registers need to be written.

request

0x00 01 00 00 00 17 01 10 0F A0 00 08 10 3F 9D 70 A4 40 15 C2 8F 40 5C CC CD 40 91 EB 85

Byte	1	2	3	4	5	6	7	8	9	10	11	12	13	14…23
Data	00 01		00 00		00 17	01		10	0F A0		00 08		10	xxx
illustrate	Transaction identifier		Protocol identifier		Message length	Device address		Function code	Start address		Number of registers		Data bytes	Data

The data part has a total of 16 bytes, and the conversion to decimal is as follows:

Byte	14															
Data	3F 9D 70 A4				40 15 C2 8F				40 5C CC CD				40 91 EB 85			
Decimal	1.23				2.34				3.45				4.56			
illustrate	First data				Second data				Third data				Fourth data			

response

0x00 01 00 00 00 06 01 10 0F A0 00 08

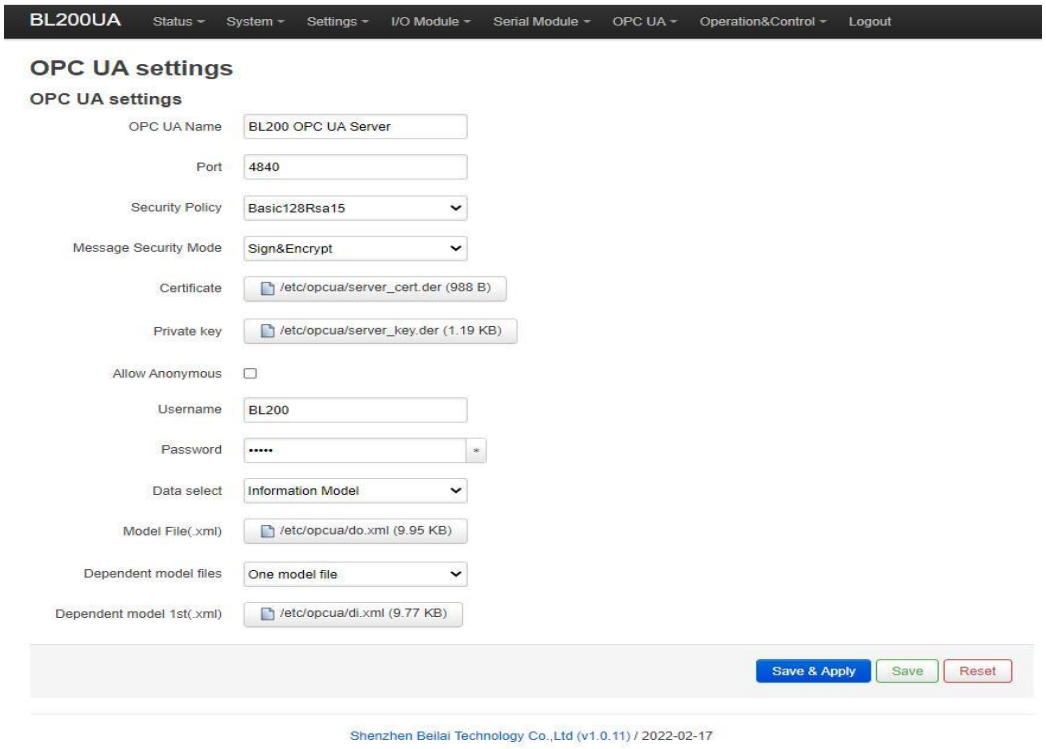
Byte	1	2	3	4	5	6	7	8	9	10	11	12
Data	00 01		00 00		00 06		01	10	0F A0		00 08	
illustrate	Transaction identifier		Protocol identifier		Message length		Device address	Function code	Start address		Number of registers	

6.2 BL205 Communication Example

6.2.1 Communication Between UaExpert and BL205

The BL205 collects DI, DO, and AI modules, selects basic128rsa15 as a security policy, and selects a signature and encryption method. The data format is based on a custom information model. Take an information model as an example. The data can also be uploaded directly according to the format of our company. For the definition of each configuration, please refer to chapter 5.2.6 web page configuration.

6.2.2.1 OPC UA Web Page Configuration



Steps:

(1) Fill in the OPC UA name, which can be customized to facilitate the OPC UA client to search and distinguish different OPC UA servers. For example: fill in "BL200 OPC UA Server".

(2) The port number of the OPC UA server, default: 4840.

(3) Security policy selection. For example, choose basic128rsa15.

(4) Message security mode selection. For example, choose Signing and Encryption.

(5) Upload the certificate and key, click "Select File" > click "Upload File" > select your certificate or key file, click Open > After it is displayed in the file name box, click Upload file > After uploading the file successfully The file you uploaded will be displayed in the box, click the certificate or key file you uploaded > then your certificate or key file will be displayed in the certificate or key item.

(6) Whether to allow anonymity, because of the use of signature and encryption methods, allow anonymity is not checked.

(7) Fill in the username and password. The client needs to fill in the username and password when connecting.

(8) Select the data, because the user-defined information model is used, so choose the "information model".

(9) Upload the information model file. The upload method is the same as uploading the certificate or key file. The uploaded file is an xml file.

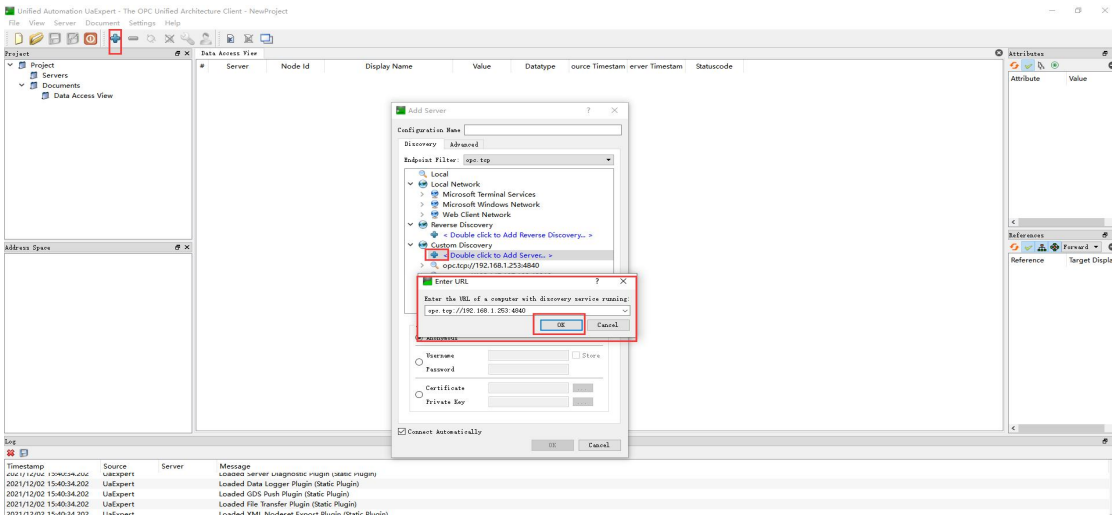
(10) Depends on the model file, whether there is a reference model, and how many references are there.

(11) Dependent model: Upload the model you refer to. The upload method is the same as uploading the certificate or key file. The upload is an xml file.

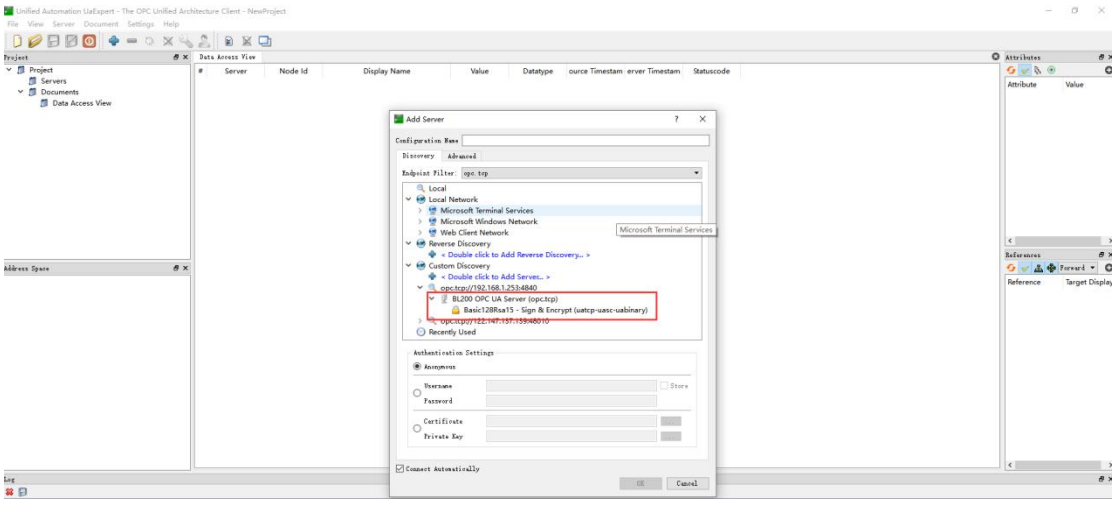
(12) Click "Save and Apply".

6.2.2.2 Send and Receive Data Using UaExpert Client

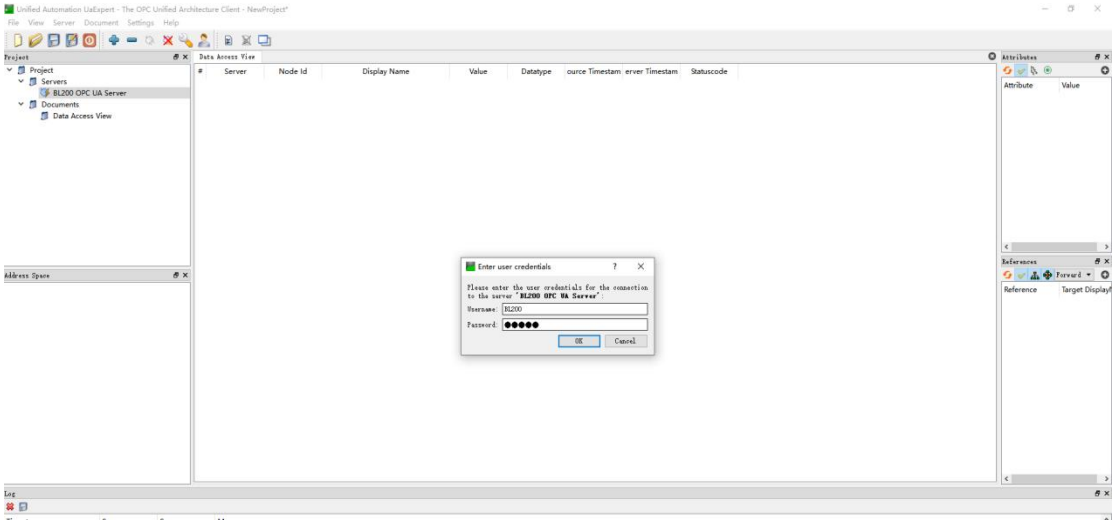
Open UaExpert (OPC UA client) and enter the OPC UA server IP and port.



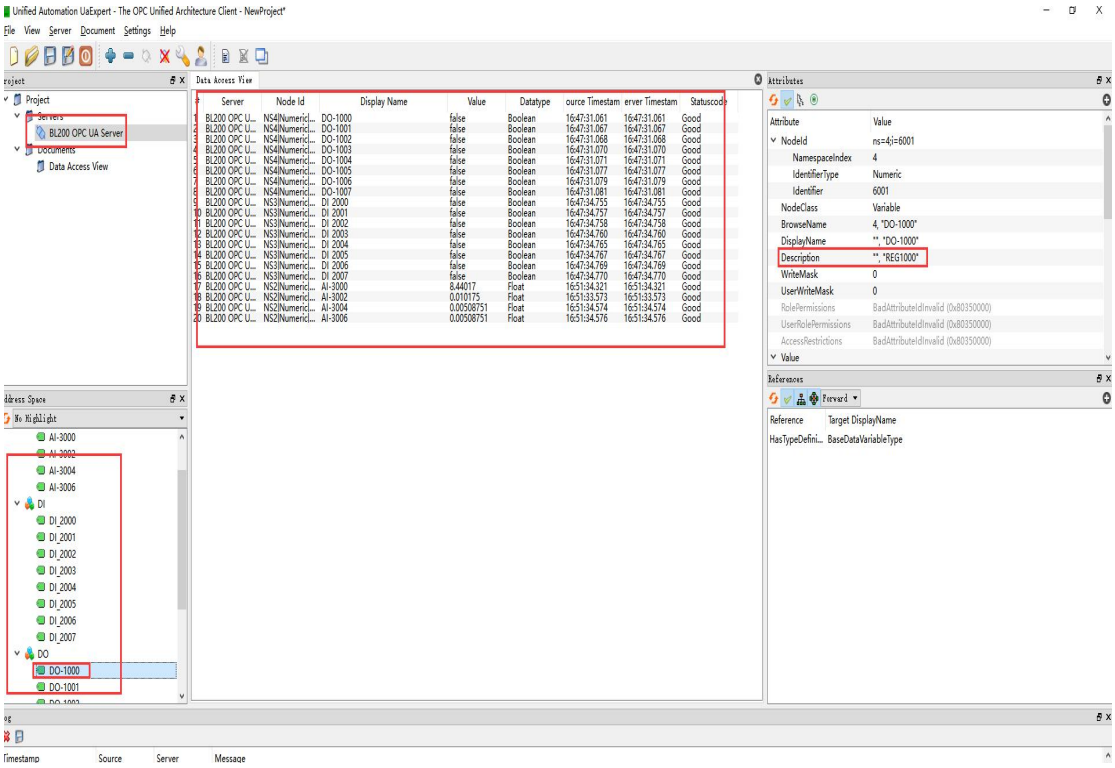
Click Search, click the searched OPC UA server, and click basic128rsa15 for Signature and Encryption.



Enter the set username and password



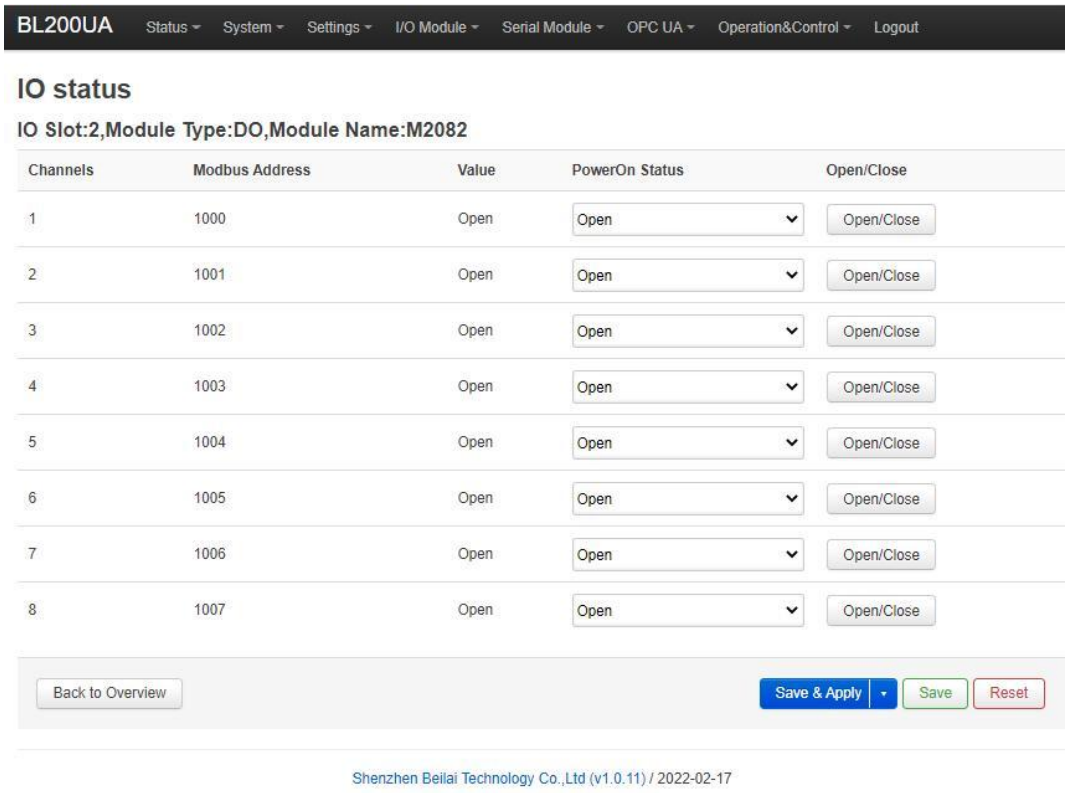
The collected data is as follows:



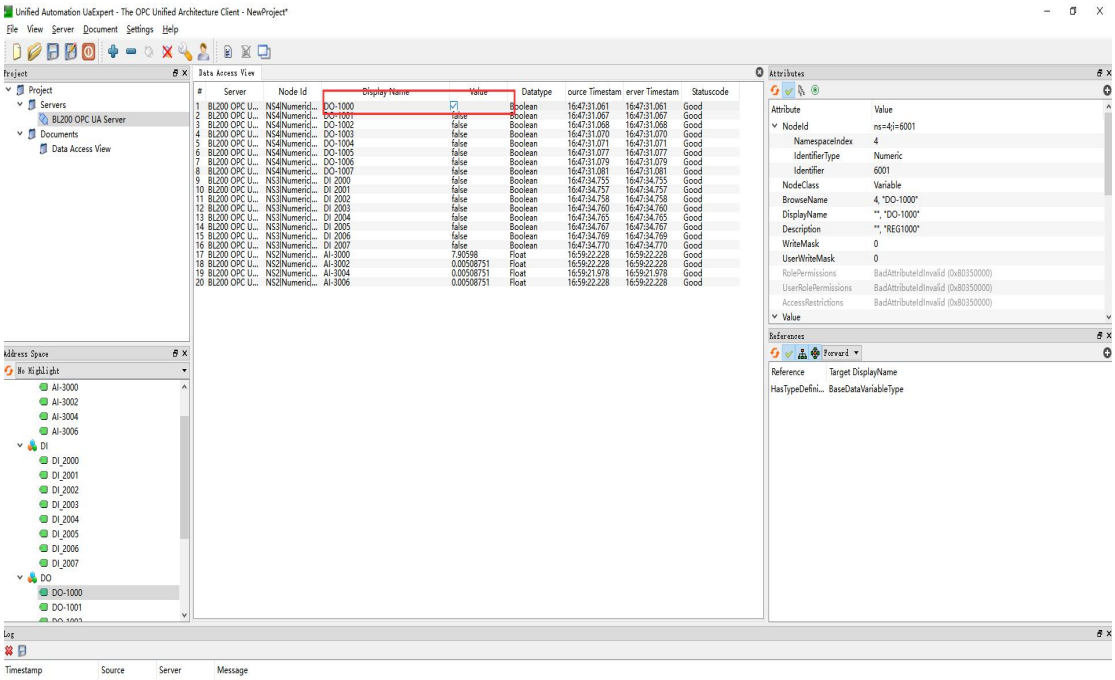
The description item of the custom information model data point must be REG+Modbus address, as shown in the description of the DO-1000 point in the figure above.

OPC UA client data delivery

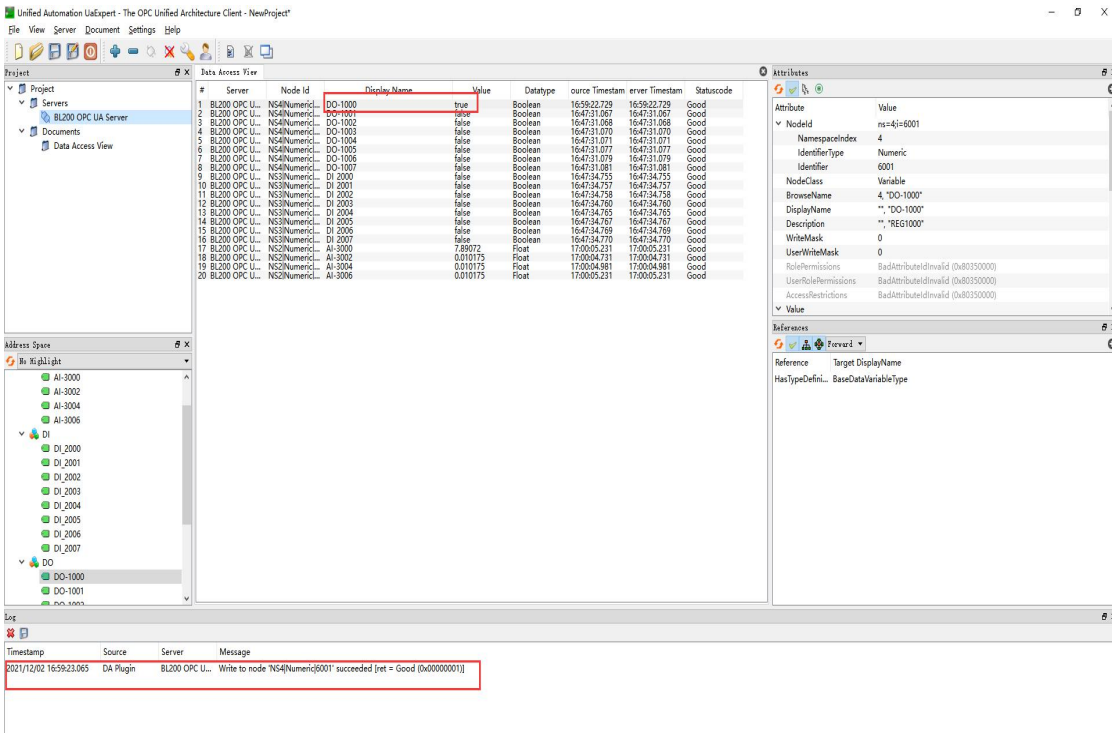
Take the following data point DO-1000 as an example



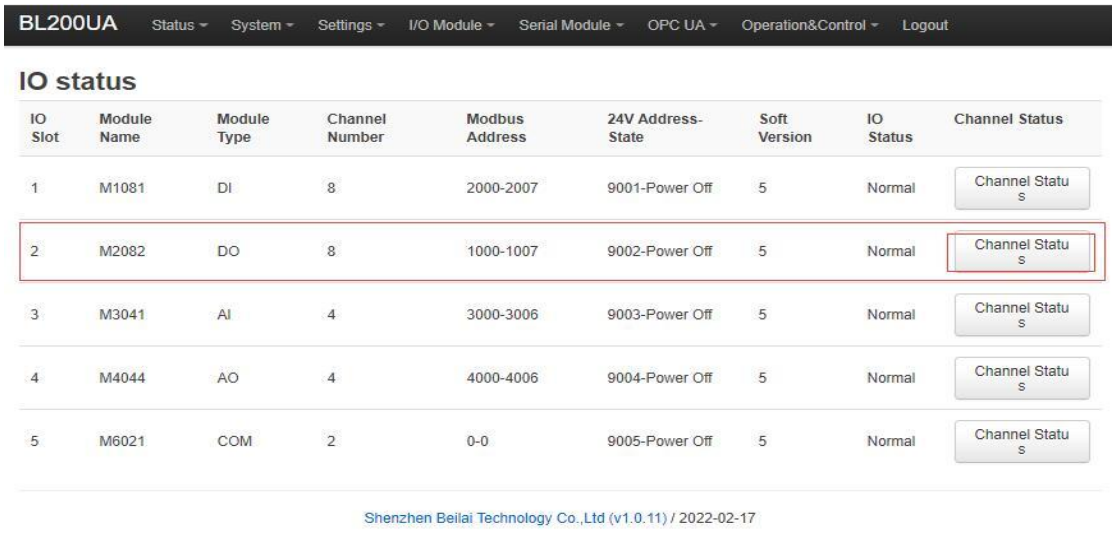
Click the value of the DO-1000 data point, it turned out to be false, there is no √ in the square, click once to put √, click the left mouse button in the blank space or press the [Enter] key on the keyboard.

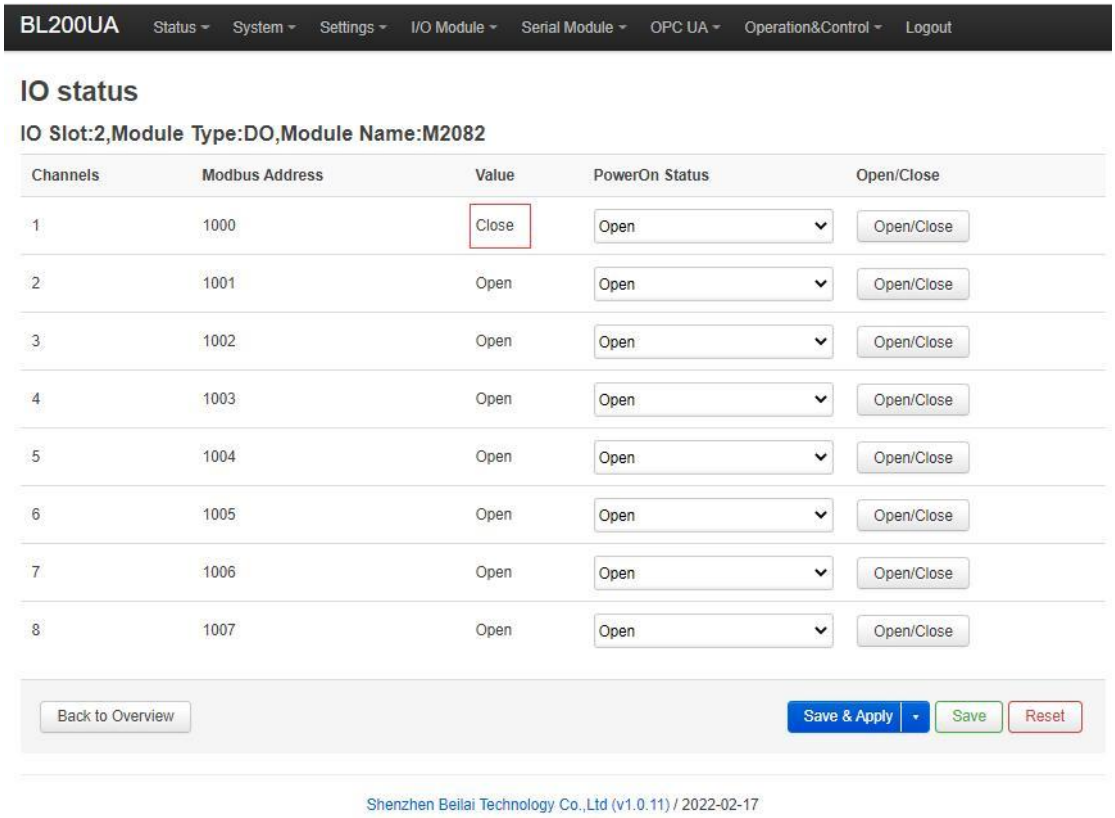


The OPC UA client will send a message successfully. Because the server responds quickly, you can see that the value has changed to "true".



Check the DO status in the web configuration of BL200. DO1 is also changed from the original open to close.





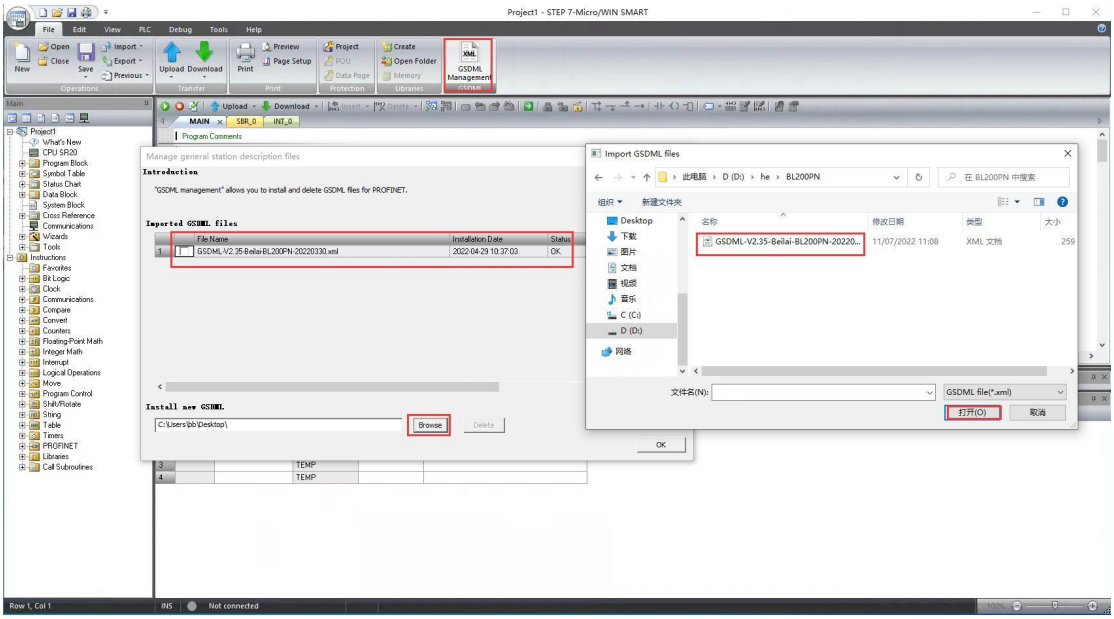
6.3 BL206 Communication Example

6.4 BL206Pro Communication Example

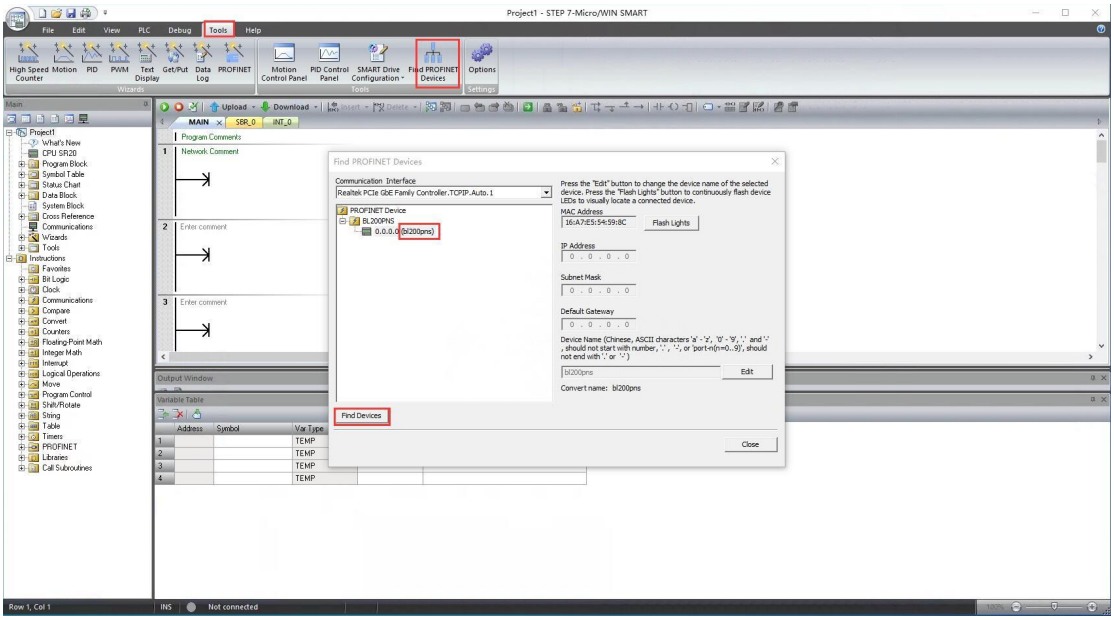
6.5 BL201 Communication Example

6.5.1 Siemens S7-200SMART and BL201

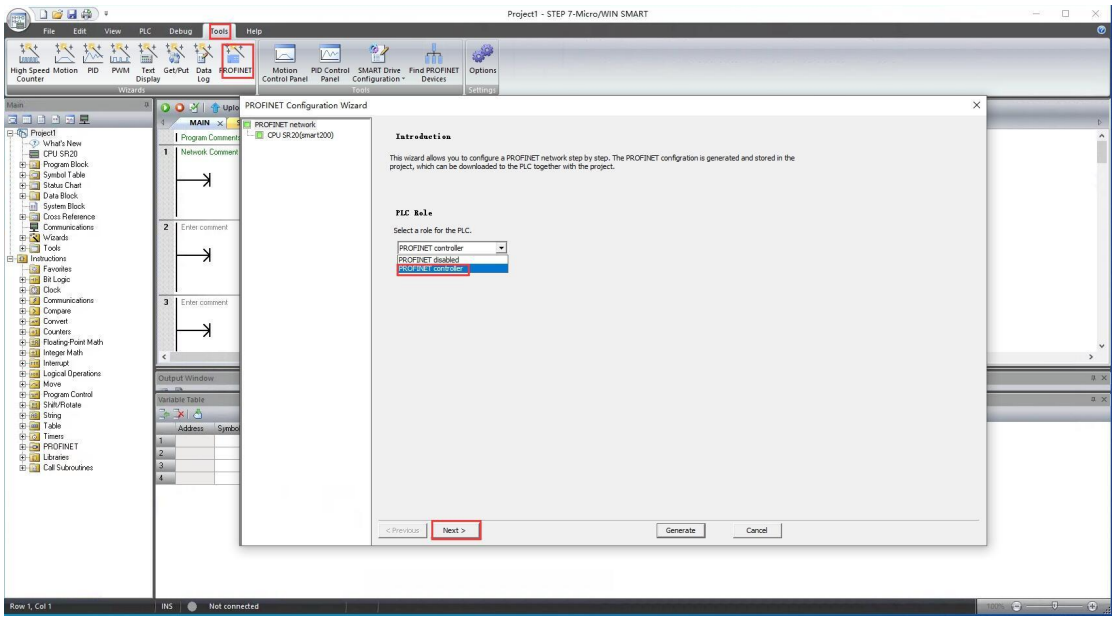
1. Prepare IO modules: Coupler BL201, digital output module M2082, digital input M1081, analog input module M3401, analog output M4043. Module assembly and wiring refer to 3 Installation, 4 Device connection.
2. BL201, S7-200SMART, and PC need the same LAN. Power on BL201 and S7-200SMART, and open Siemens STEP 7-MicroWIN SMART software. Click GSDML management, in the pop-up window, click Browse to find the GSD file of BL201 and click Open, click Open to complete the installation of the GSD file.



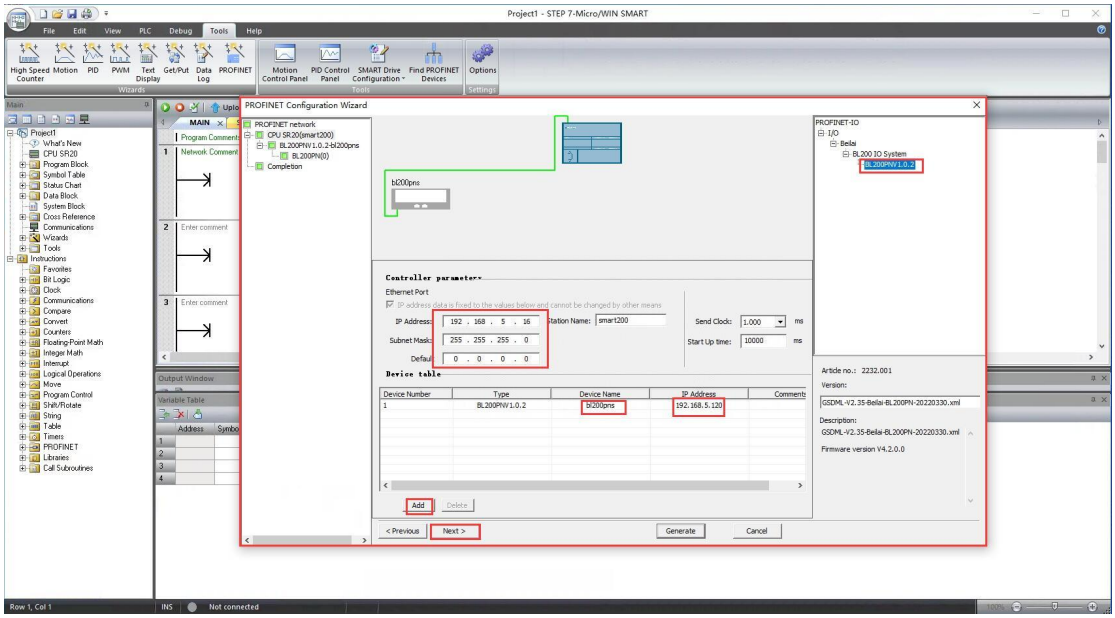
3. Click Tools, click Find PROFINET Devices, click Find Devices, find BL201, and the name of the BL201 coupler is bl200pns. (The found coupler name must be consistent with this name during configuration.)



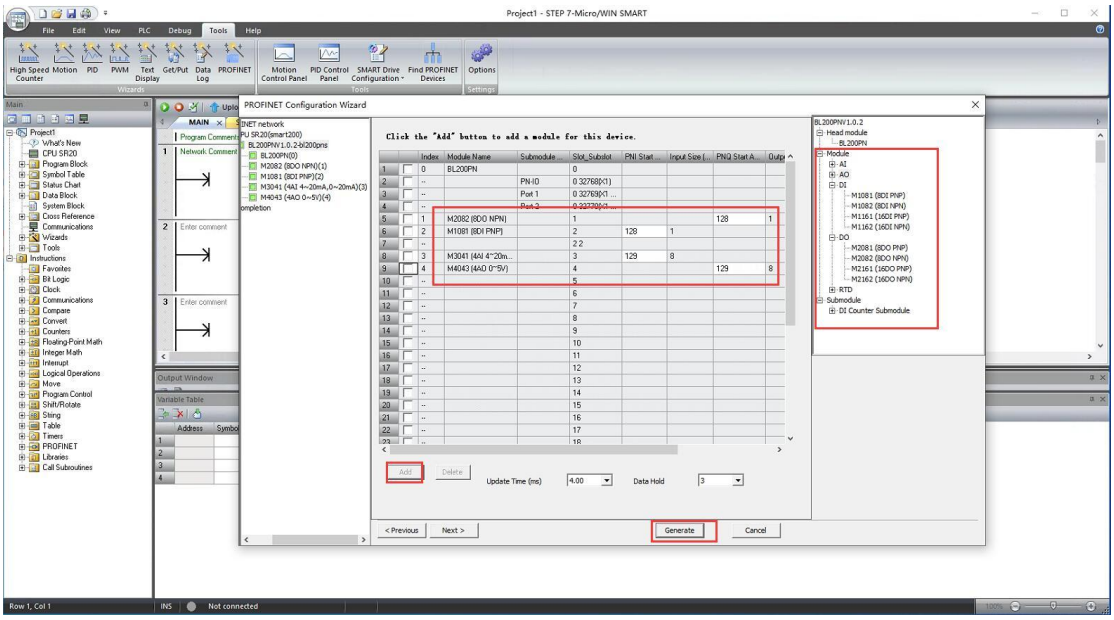
4. Click Tools, click PROFINET. Select the controller and click Next.



5. Find BL201 in the hardware catalog, click Add, add it to the device list, modify the name of the coupler to bl200pns (communication key parameters), and assign the IP address of 192.168.5.10 to the coupler. The IP address assigned to the coupler must be in the same LAN as the IP address of the PLC. You can also modify the IP address of the PLC on this interface. After the modification is complete, click Next.

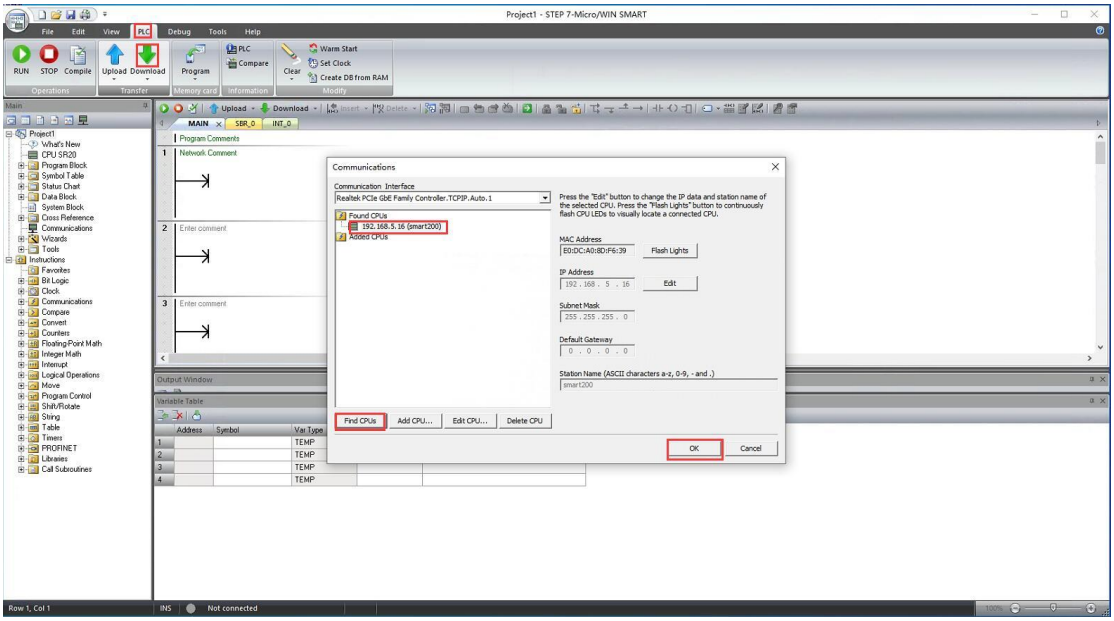


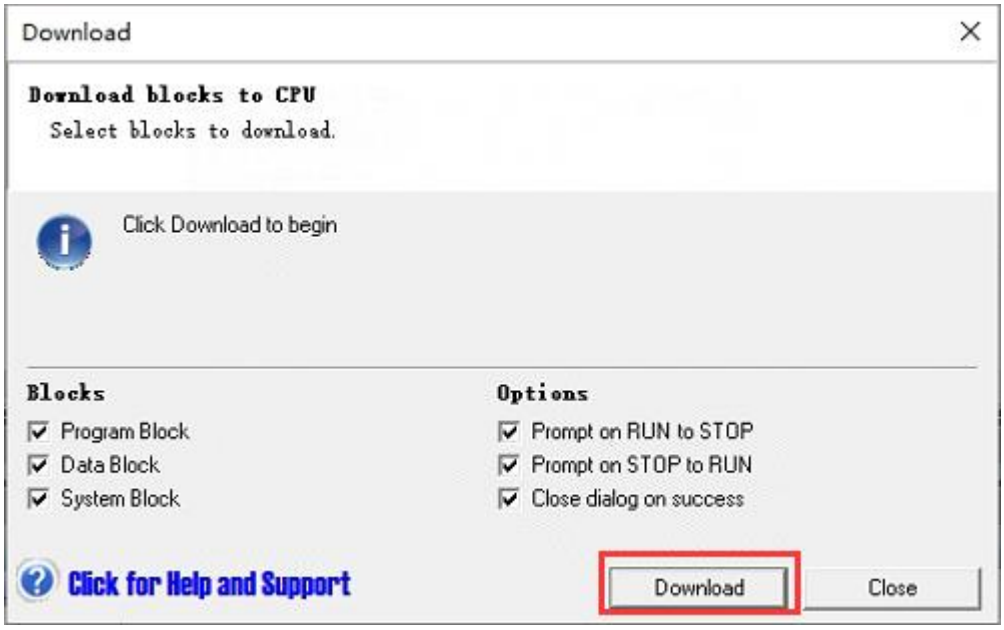
6. Configure the IO module connected with the BL201. Click Generate. Add modules in the order of the IO modules hung behind the BL201. Power supply modules, extended power supply modules, and terminal modules do not need to be configured and do not participate in the sorting.



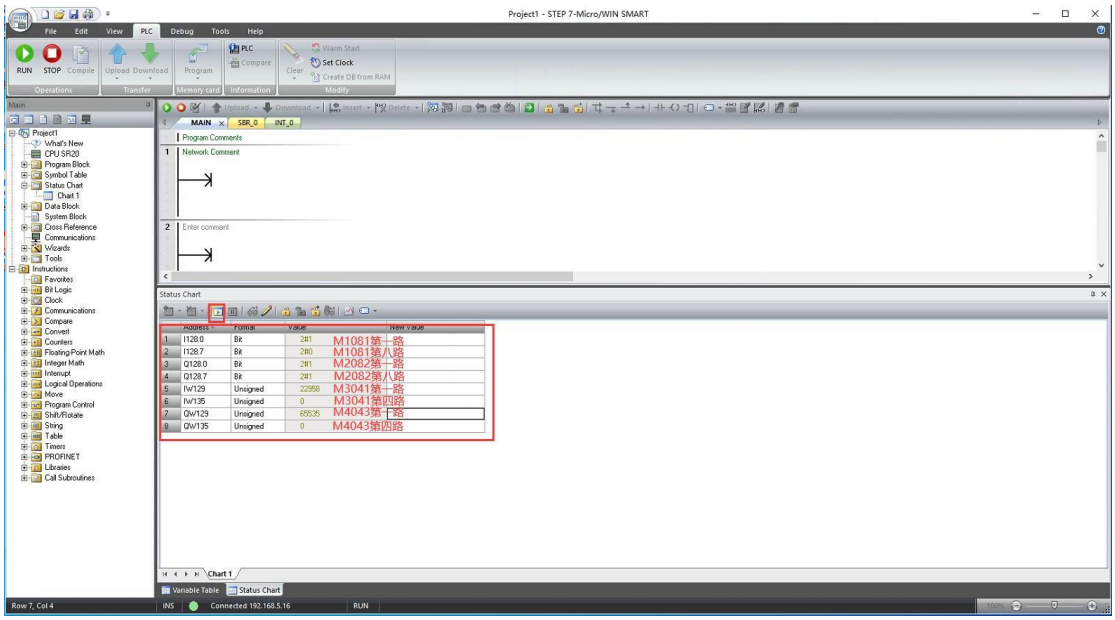
M2082 corresponds to address QW128, M1081 corresponds to address IW128, M3401 corresponds to address IW129-IW136, and M4043 corresponds to address QW129-QW136.

7. Click PLC, click Download, search for PLC in the pop-up window, and click OK. click to download.





After the download is successful, open the status chart and monitor the channel value of the IO module.

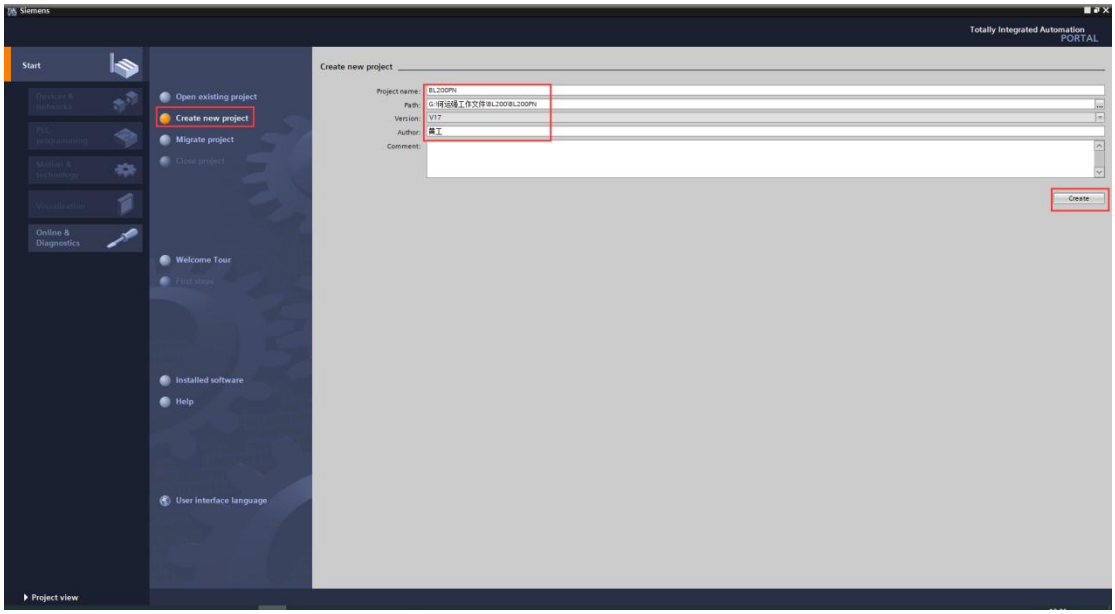


Refer to 5.5.4 Process Data Definition. When the range is 4-20mA, the theoretical value input of AI first channel IW129 is: 22958/65535*16+4=9.60507 mA. When the range is 0-5V, the output of the first AO QW129 is: 65535/65535*5=5V.

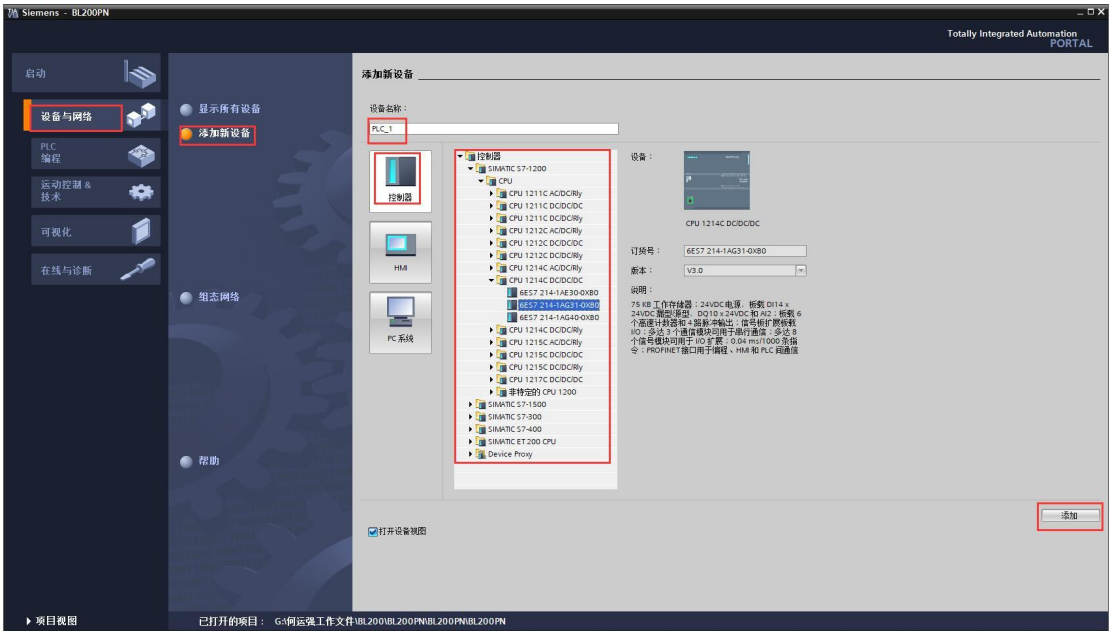
6.5.2 Siemens S7-1200 and BL201

1. Prepare IO modules: Coupler BL201, digital output module M2082, digital input M1081, analog input module M3401, analog output M4043. Module assembly and wiring refer to 3 Installation, 4 Device connection.

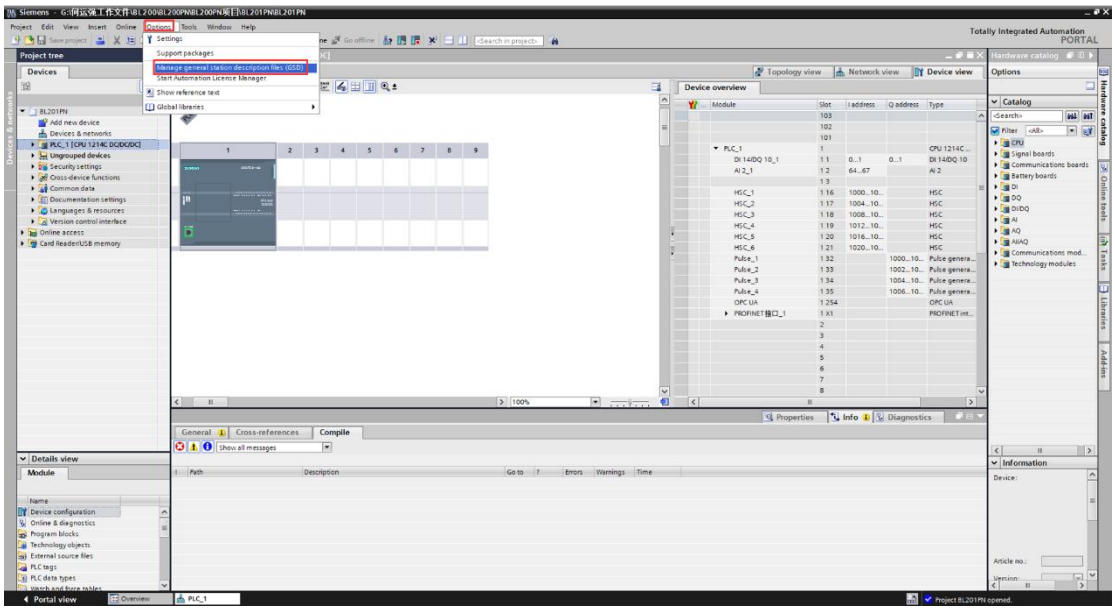
2. BL201, S7-1200, and PC need to be in the same LAN. Power on BL201 and S7-1200, open Siemens TIA V17 software, and create a new project "BL200PN".

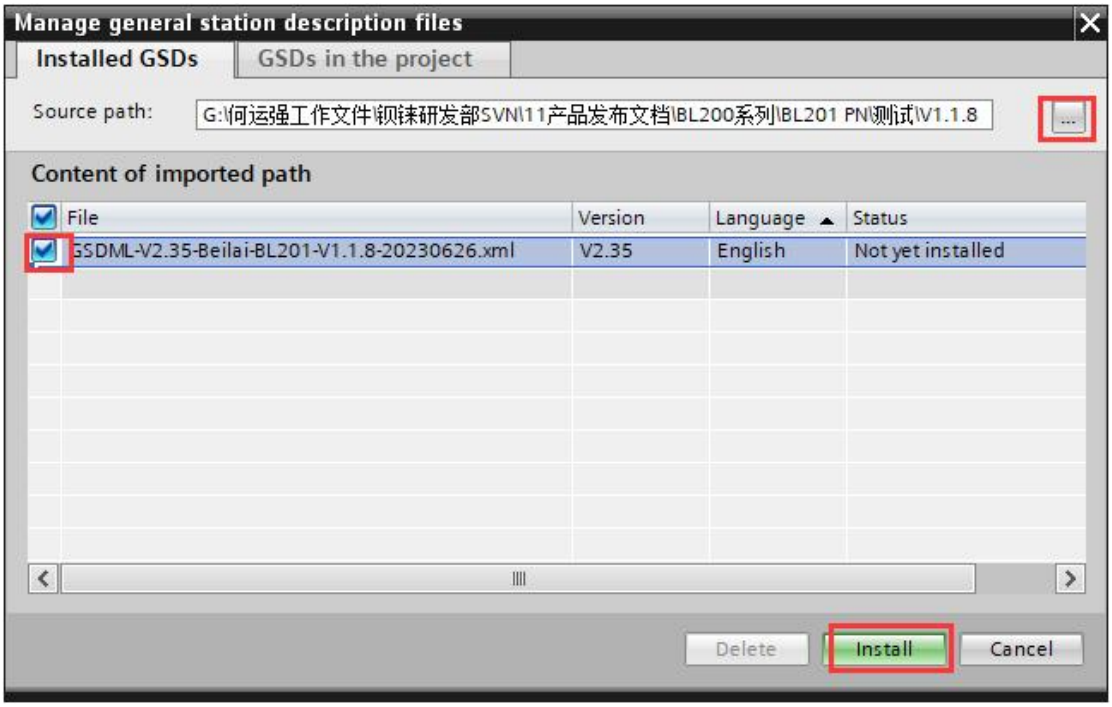


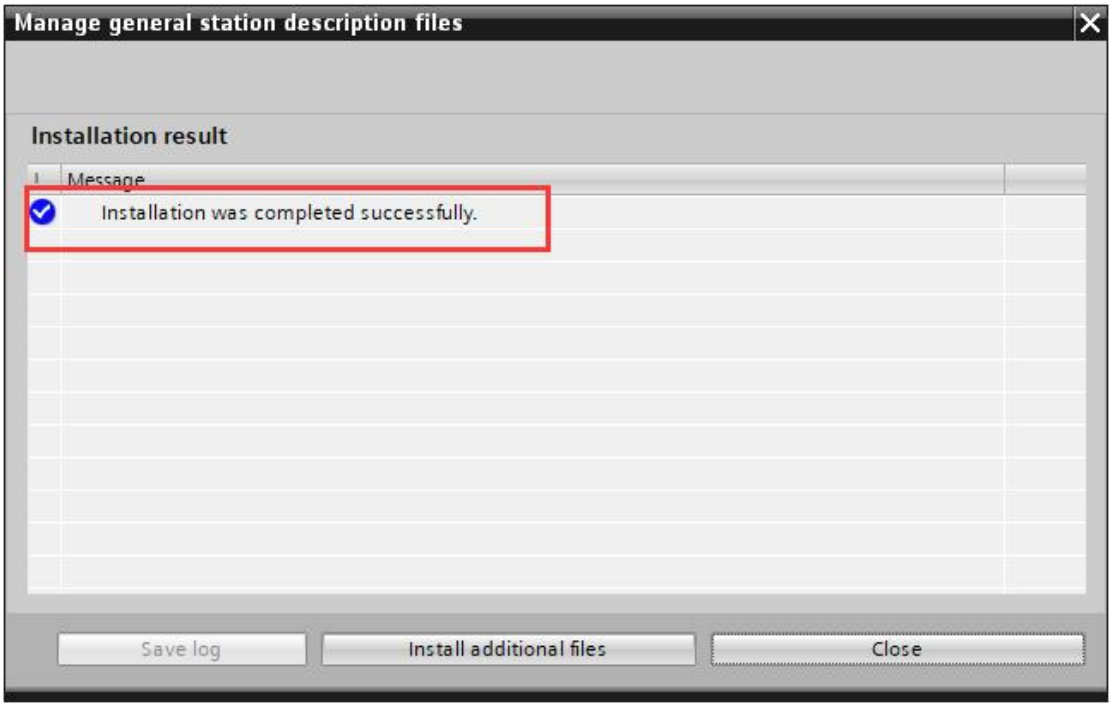
3. Click Devices and Network, click Add New Device, select the controller, select the corresponding CPU of S7-1200, and click Add.



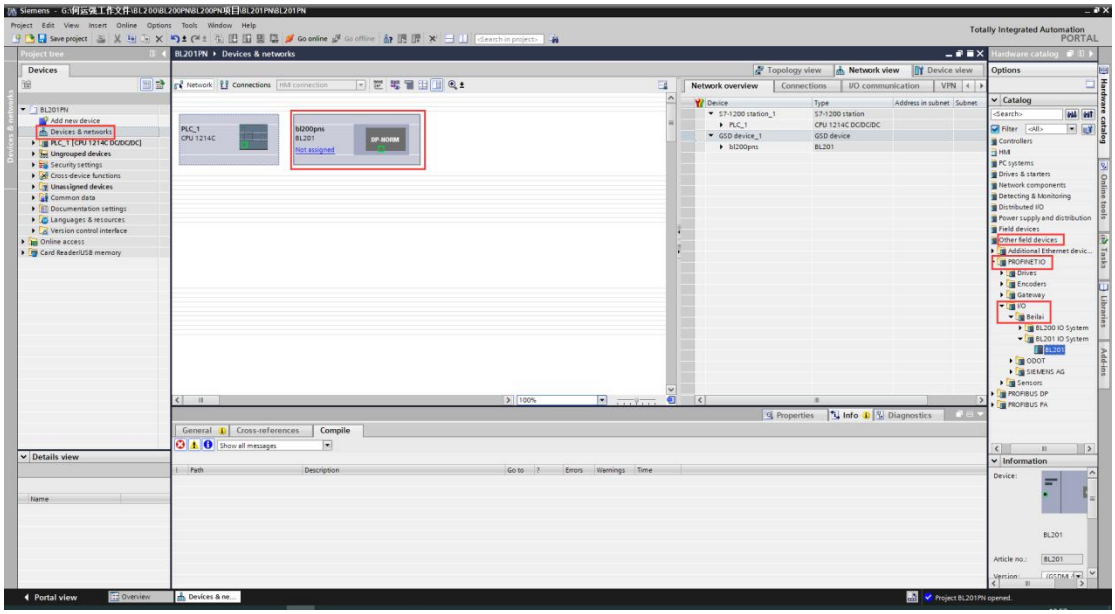
4. Click "Options" - "Manage General Station Description File GSD", in the pop-up interface, click "Source Path", search for the target folder where the GSD file is stored in the source path, select the file, click "OK", and select the GSD file , click Install, after the installation is complete, the hardware catalog will be updated automatically.


Siemens
Project tree
Devices
Options
Settings
Support packages
Manage general station description files (GSD)
Start Automation License Manager
Show reference text
Global libraries
Totally Integrated Automation
PORTAL
Topology view
Network view
Device view
Device overview
Hardware catalog
Catalog
Properties
Info
Diagnostics
General
Cross-references
Compile
Details view
Module
Information
Portal view
Overview
PLC_1

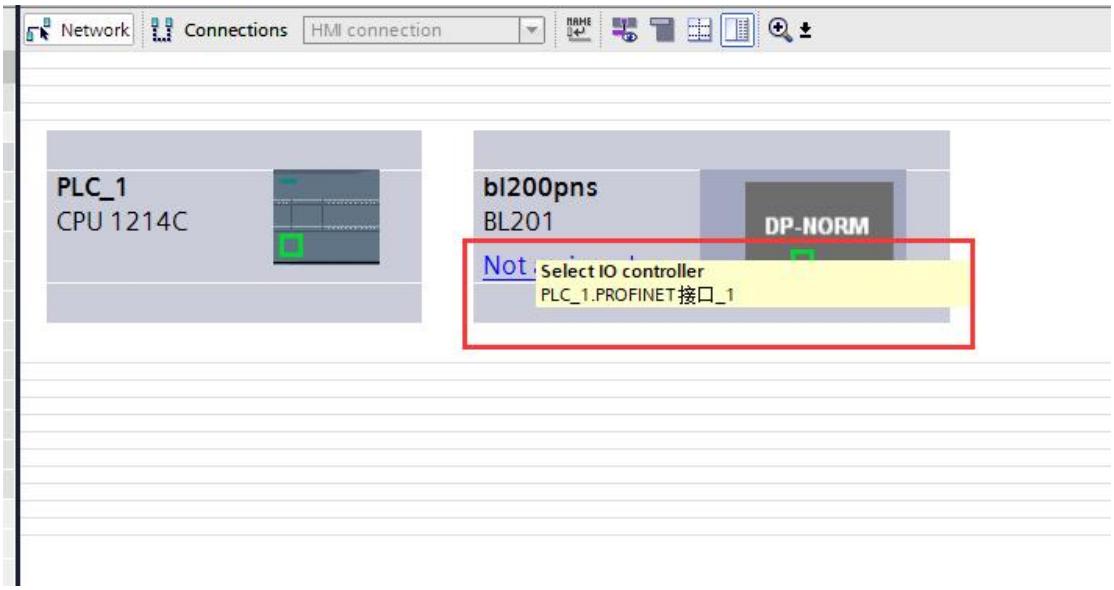

Manage general station description files
Installed GSDs
GSDs in the project
Source path:
G:\何运强工作文件\钡铼研发部SVN\11产品发布文档\BL200系列\BL201 PN\测试\V1.1.8
...
Content of imported path
File
Version
Language
Status
GSDML-V2.35-Beilai-BL201-V1.1.8-20230626.xml
V2.35
English
Not yet installed
Delete
Install
Cancel

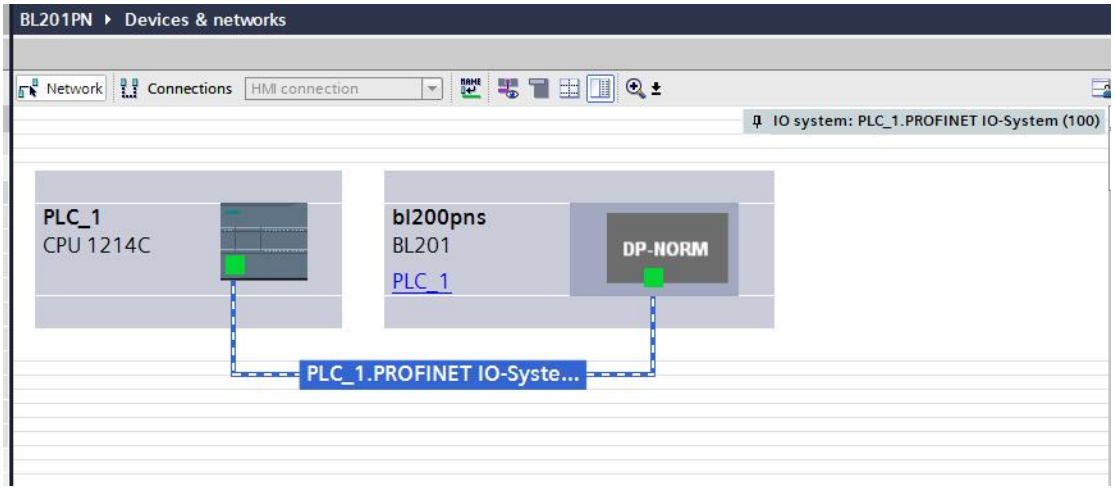


5. Double-click "Device and Network", in the right directory of the network view, find the product model of the GSD file installed above, the path is as shown in the figure (Other field devices->PROFINETIO->I/O->Beilai- >BL200 IO System->BL200PN), drag or double-click BL200PN to "Network View".

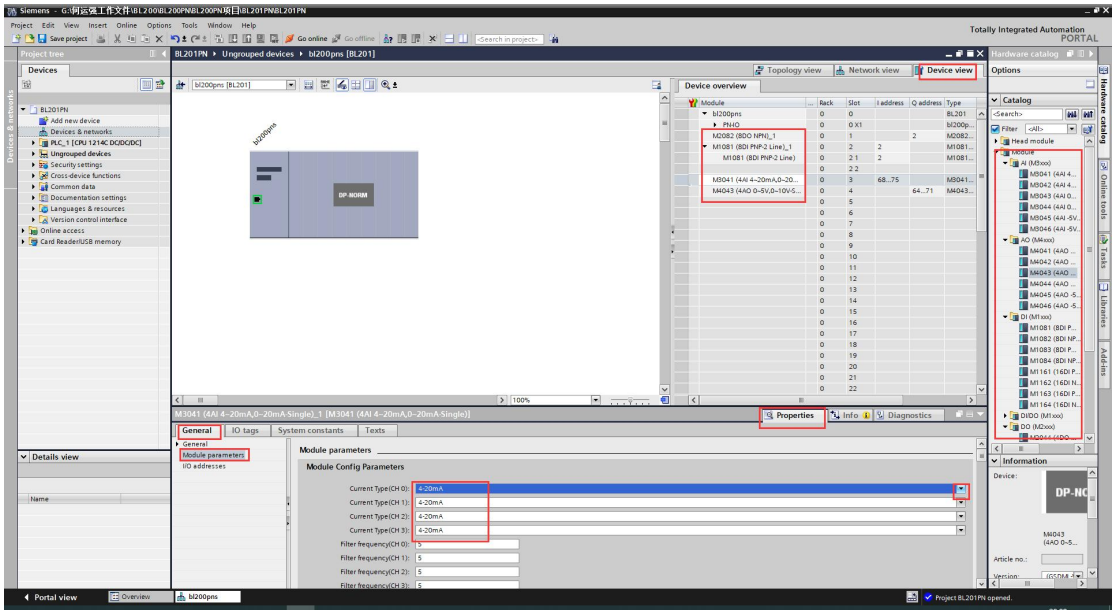


6. In "Network View", click "Unassigned (blue font)" on the BL200PN coupler and select "PLC_1.PROFINET interface_1".



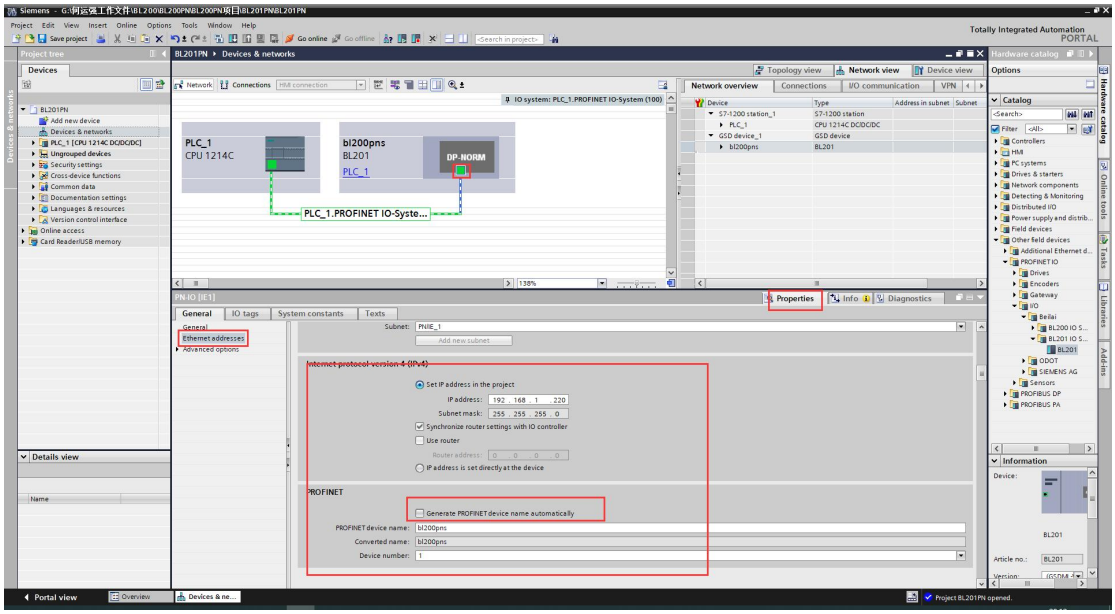


7. Double-click the coupler icon to enter the "Device View", add an extended IO module in the "Device Overview", find the corresponding IO module under the right directory - module, double-click the icon, the order of the modules should be in accordance with the order of the IO modules hung behind the BL200PN, the power module , extended power supply module, and terminal module do not need to be configured, and do not participate in the sorting.

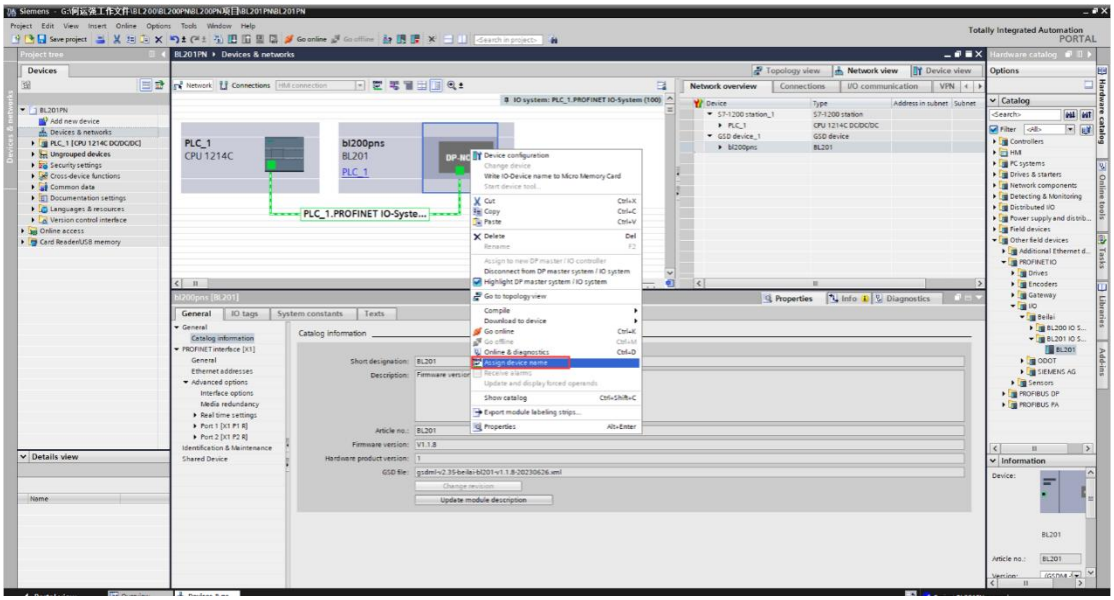


8. Click the network port of the coupler, click Properties, select the Ethernet address, and modify the Ethernet parameters of the coupler. The IP address must be in the same network segment as the S7-1200, and the PROFINET device name of the coupler is "bl200pns".

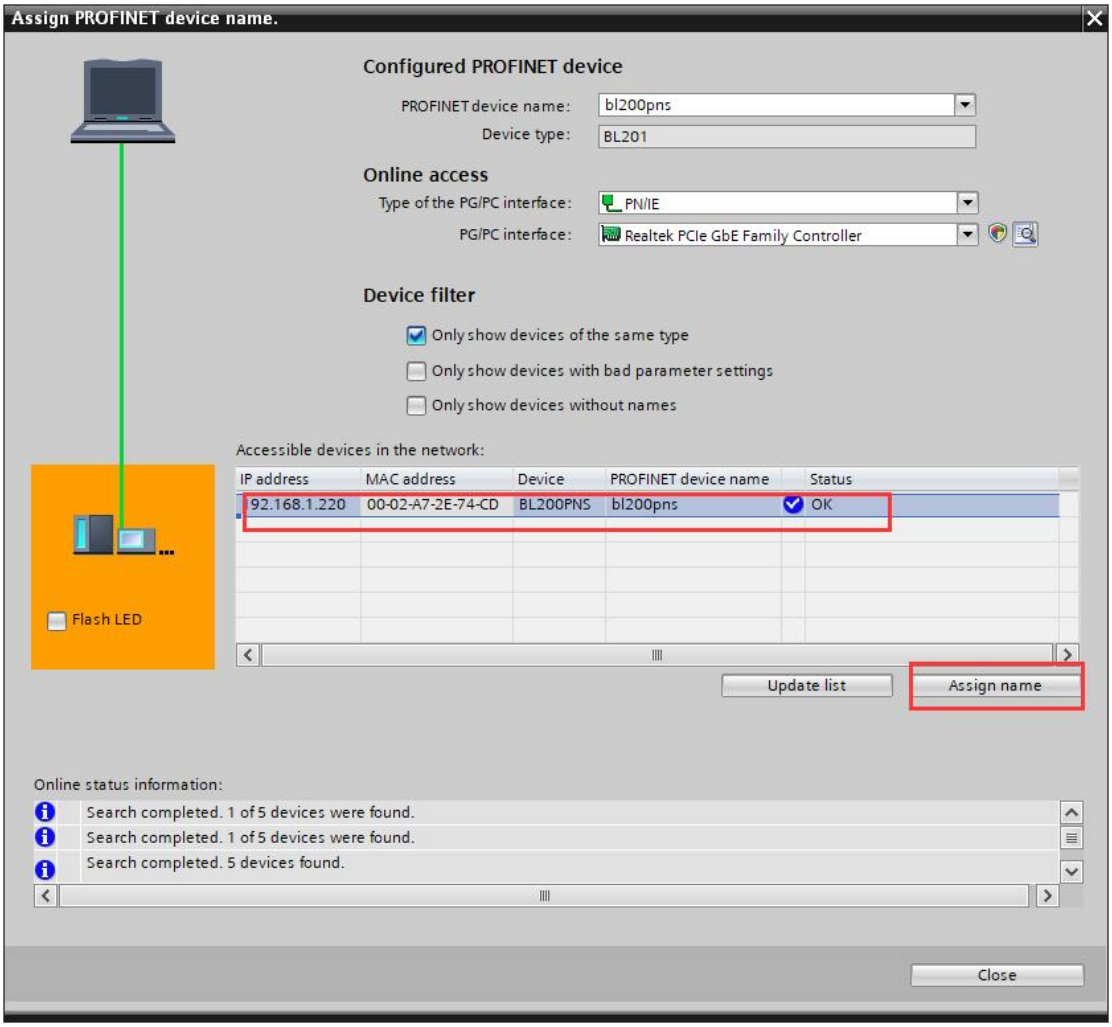
Note: Remove the "√" in front of "Generate PROFINET device name automatically ".



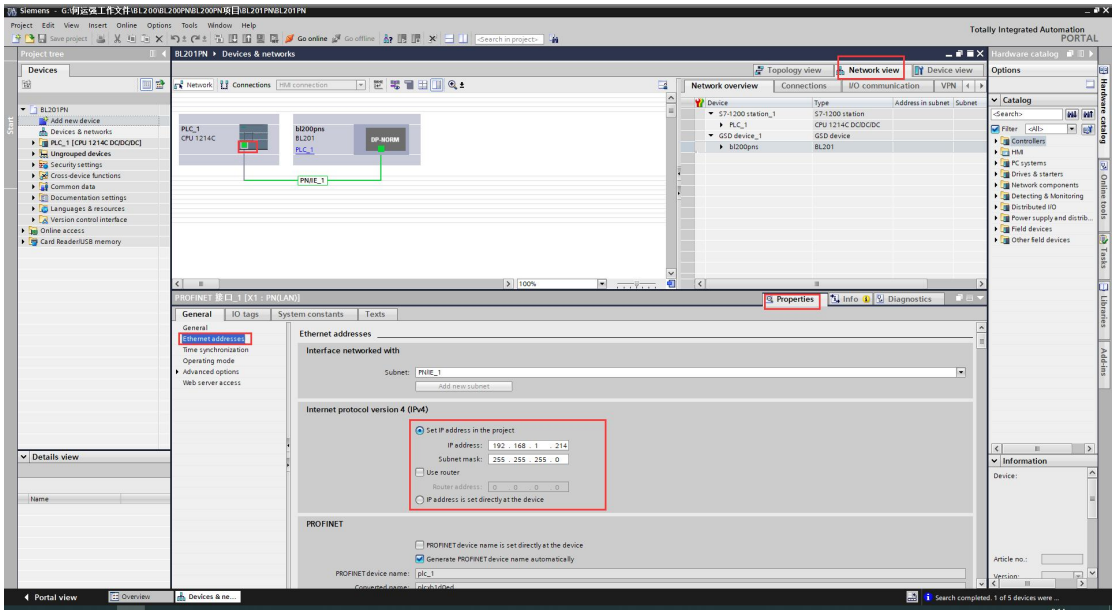
The default name of the BL200PN coupler is "bl200pns". If it is not filled with this name, click on the coupler and right-click to select the assigned name.



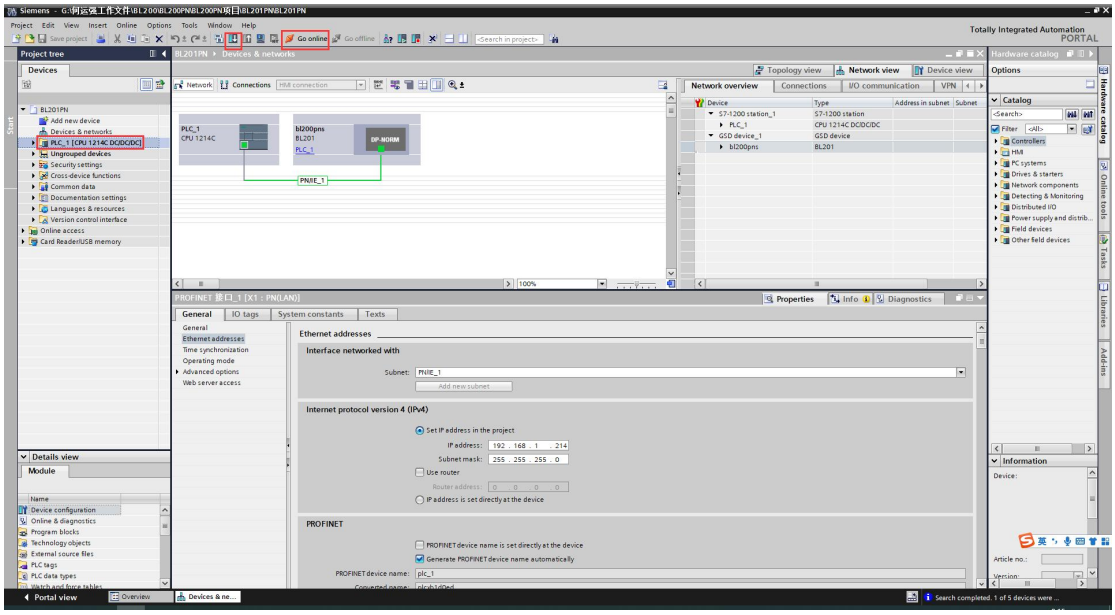
Click the drop-down menu behind "PROFINET device name", select the name of the device that has been allocated before, select "PN/IE" for "PG/PC interface type"; select your own network device for "PG/PC interface"; click " Update the list" and wait for the prompt "Search is complete. Select BL200PN coupler, click "Assign Device Name" below to complete the assignment of the coupler name, and click "Close" to close the page.

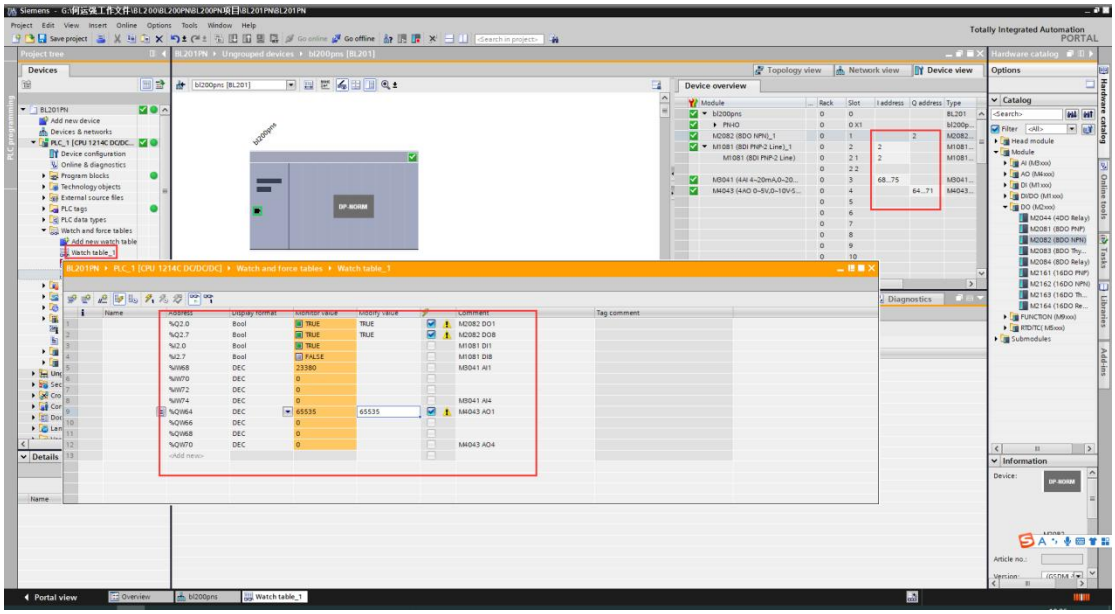


9. In the network view, select the S7-1200 PLC network port, click Properties, select the Ethernet address, and set the network port parameters.



10. The hardware configuration is completed, save, compile, and download. Click "Go Online". At the same time, a new monitoring table can be added, and the on-site IO value can be monitored online on the monitoring table.





Refer to 5.5.4 Process Data Definition. When the range is 4-20mA, the theoretical value input of AI fourth channel IW74 is: 23333/65535*16+4=9.69662 mA. When the range is 0-5V, the first QW64 output of AO is: 65535/65535*5=5V.

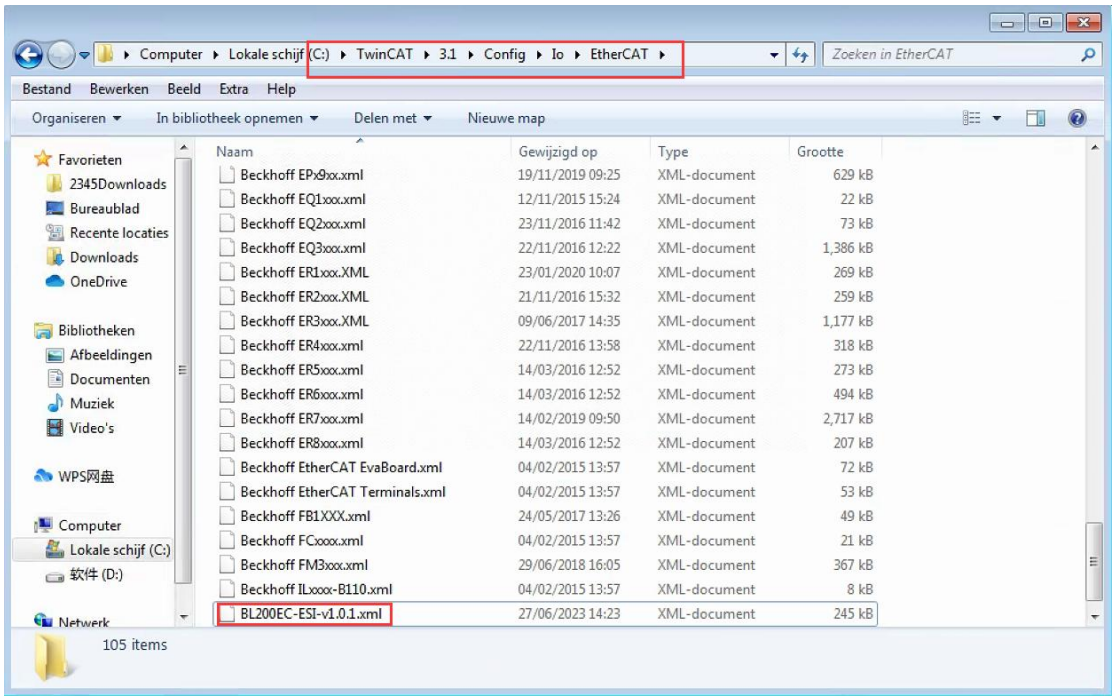
6.6 BL203 Communication Example

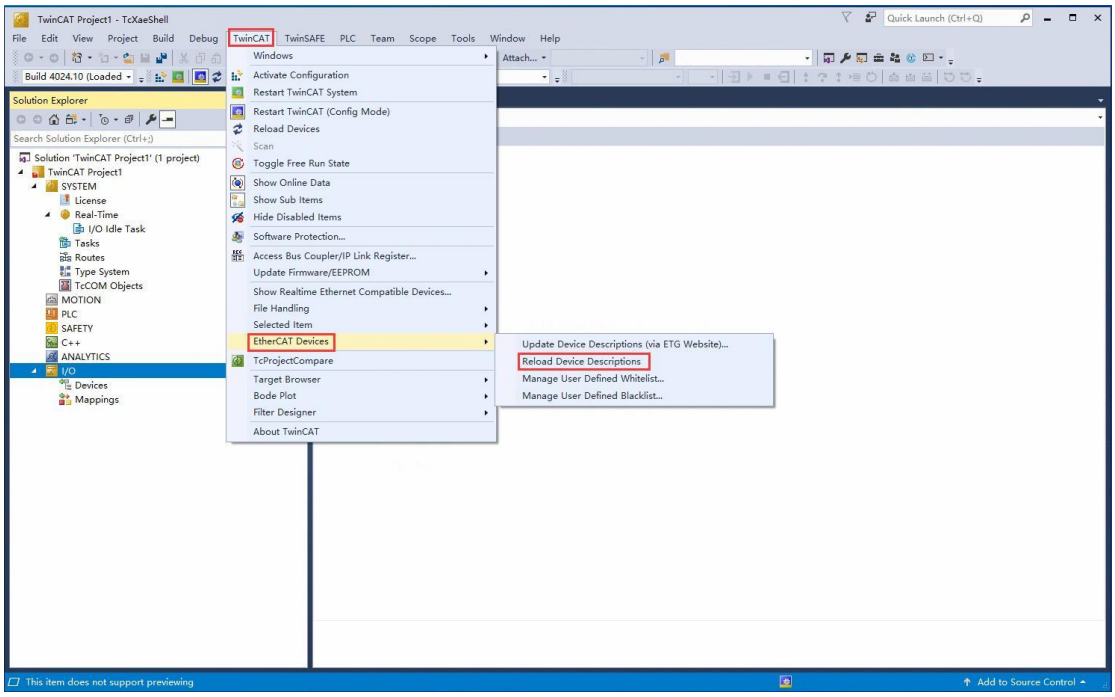
6.7 BL202 Communication Example

6.7.1 TwinCAT 3 and BL202

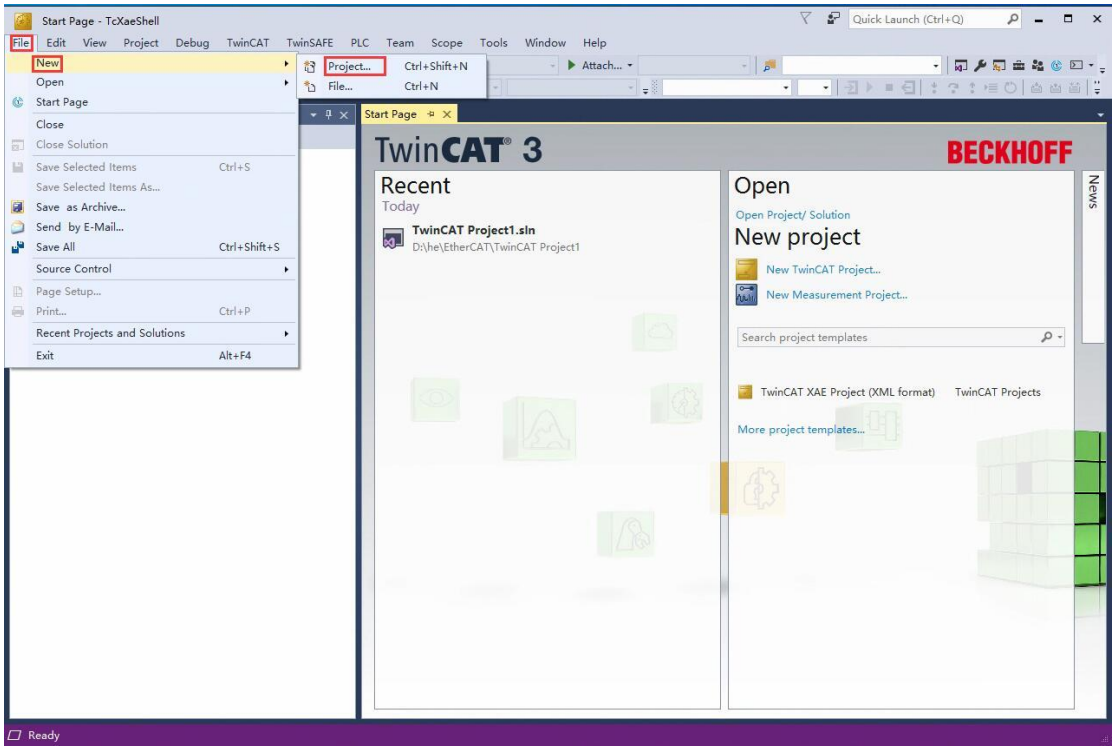
1. Prepare IO modules: Coupler BL202, digital output module M2082, digital input M1081, analog input module M3401, analog output M4043. Module assembly and wiring refer to 3 Installation, 4 Device connection.
2. Connect the network port ETH1 of the BL202 to the network port of the PC. Do not connect the network port of the BL202 wrongly, and power on the BL202 coupler.
3. Import the XML file

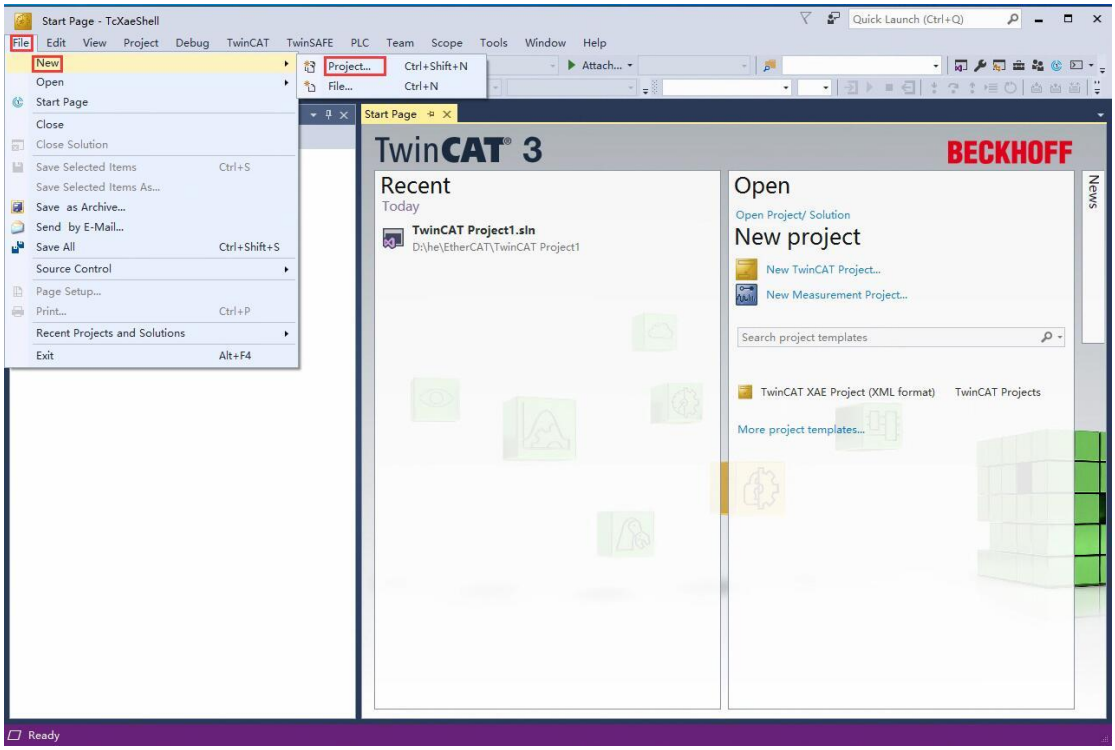
Copy the XML file (BL200EC-v1.01.xml) to: ...:\TwinCAT\3.1\Config\Io\EtherCAT, and load the XML to TwinCAT as shown in the figure below. Note: When the XML file in this folder is updated, you must re-click to download the device description file.





4. Open the TwinCAT XAE software, click [FILE] -> [New] -> [Project] in turn, and the interface as shown in the figure below will pop up.

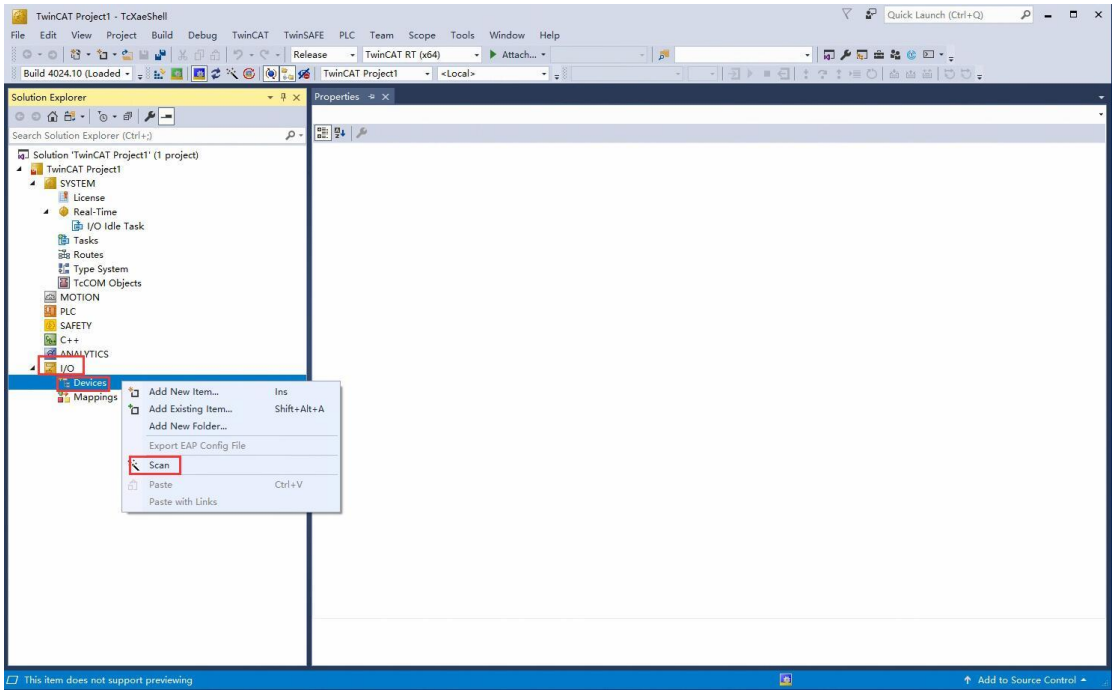


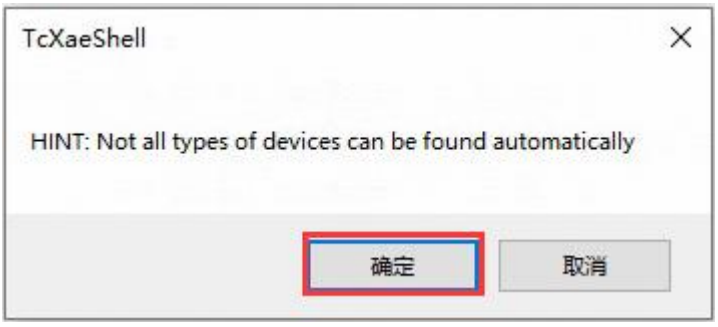


Select [TwinCAT Projects] as shown in the interface and select [TwinCAT XAE Project] in the middle of the interface, and keep the default (name, location, solution name can be modified according to needs), and click the [OK] button.

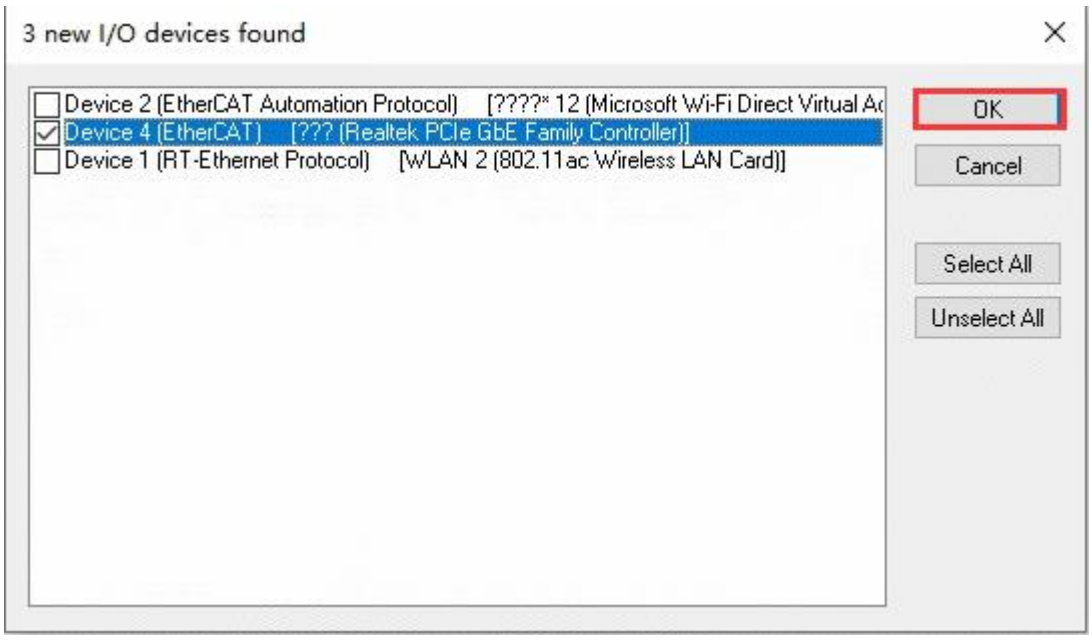
5. Scanning device

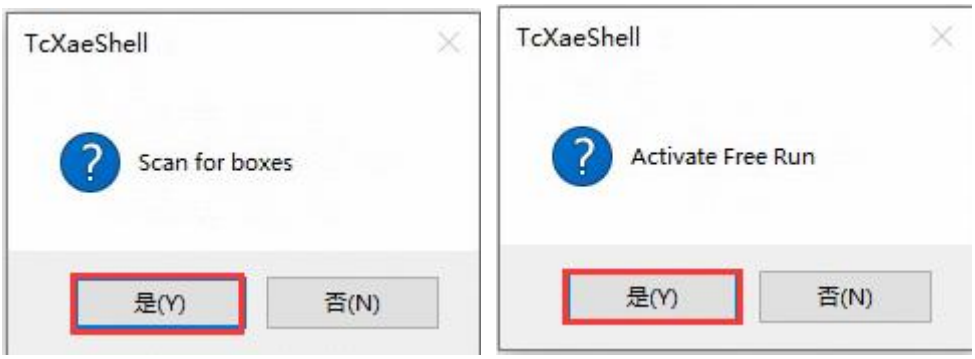
Click [I/O]->[Device]->[Scan], and click on the pop-up interface: OK—OK—Yes—Yes.



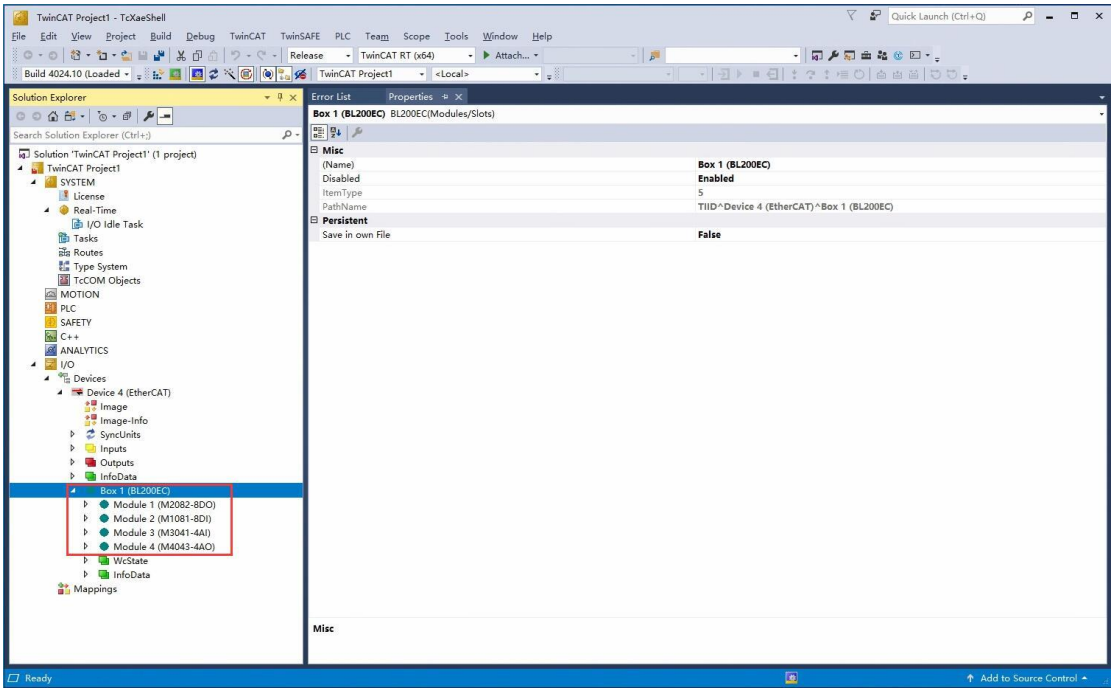


Check the "Local Area Connection" network card



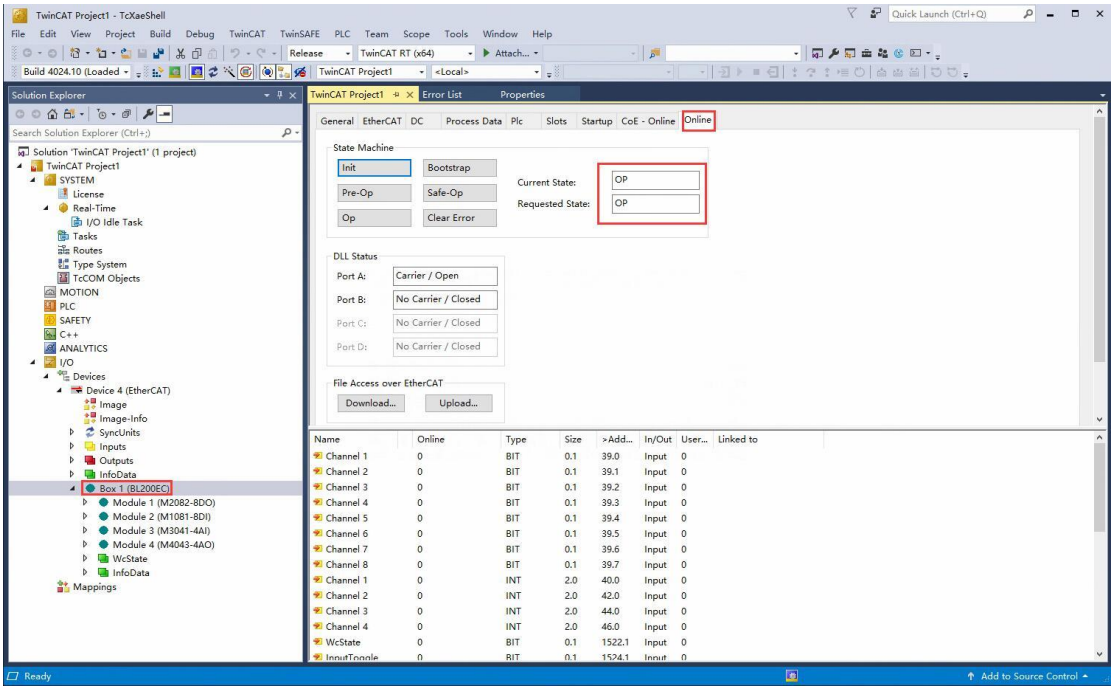


Scan to the Box1 (BL202) coupler, and the module information connected to the coupler is below Box1.



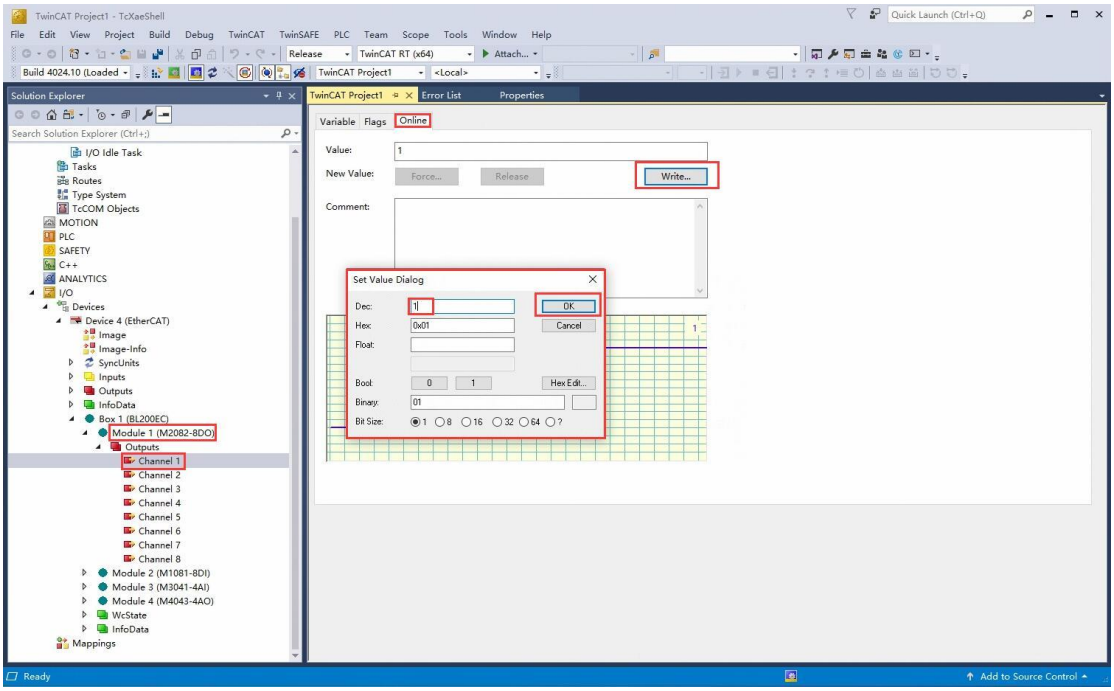
6. Data interaction

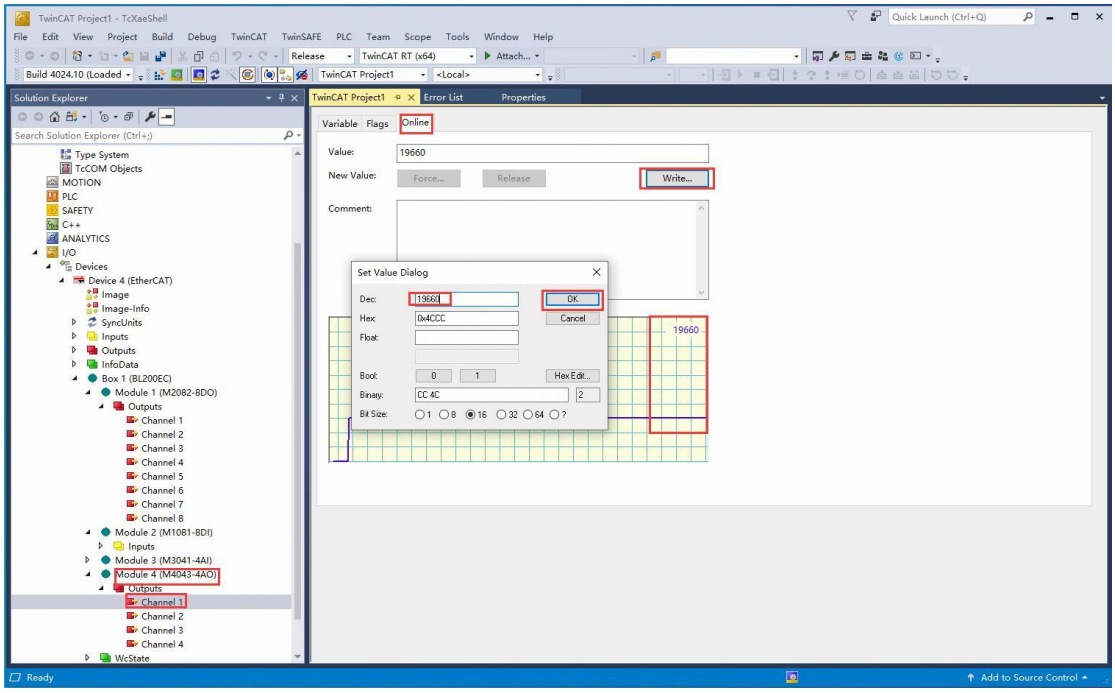
Check whether the BL202 coupler is in the OP state



Digital output and analog output

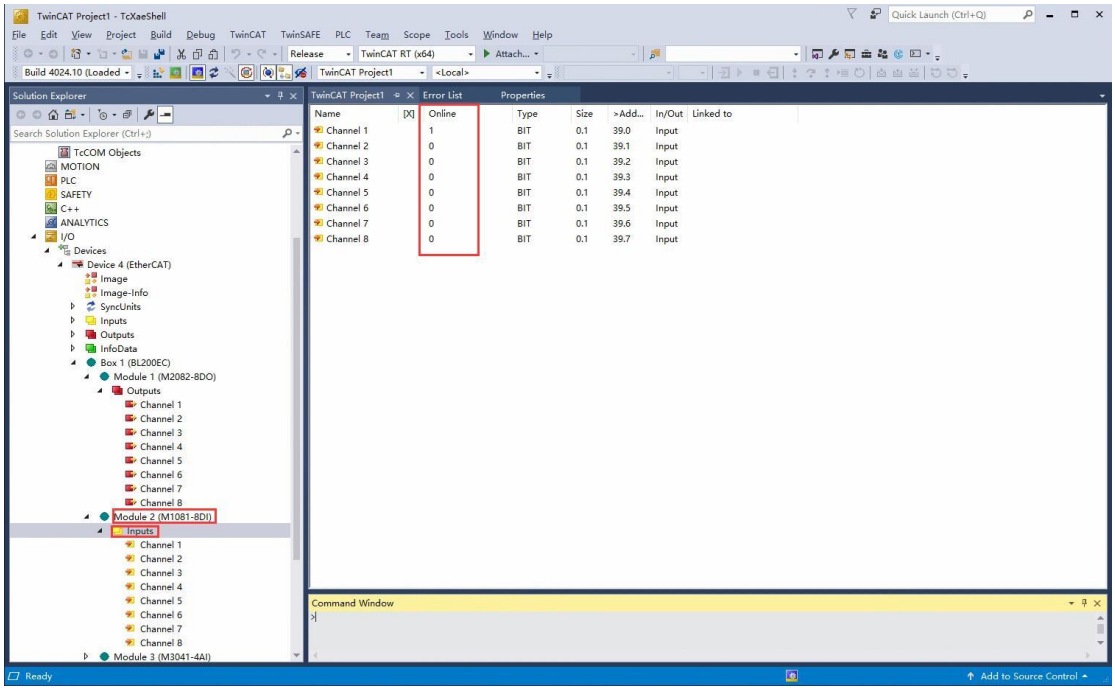
Take M2082 as an example: To make channel 1 of the module output, click "Write" in the "Online" window corresponding to the module "Output[1]", and enter the value "1" in the "Dec" column of the dialog box And click "OK", you can see that the channel indicator light corresponding to the module is on, and the software interface can display the written value at the same time. Similarly, the operation method of the analog AO output M4043 module is the same,

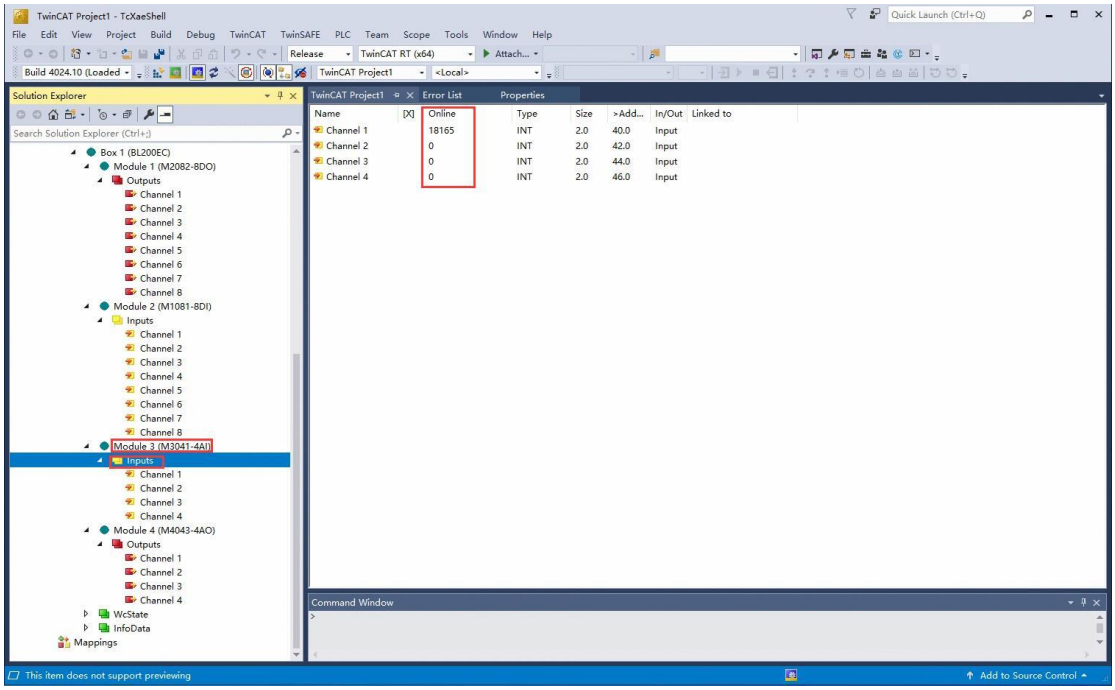




Digital and analog inputs

Take the M1081 module as an example: If the module has a signal input, it can be monitored in the "Inputs" of the module. Similarly, the viewing method of the analog AI input M3041 module is the same, as shown in the figure below:

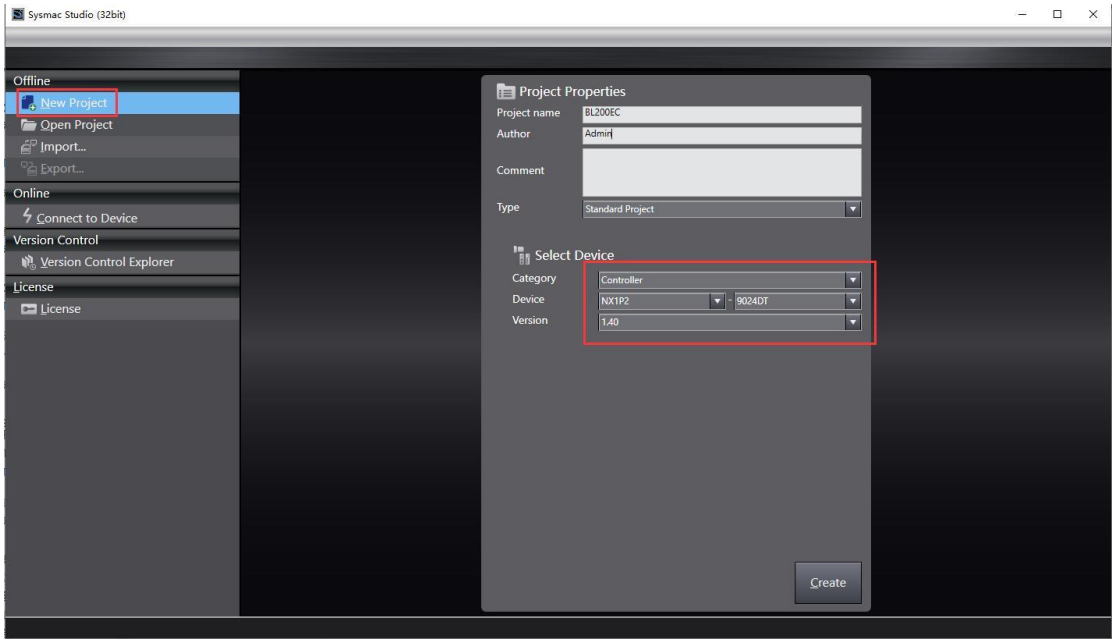




6.7.2 Omron NX1P2 and BL202

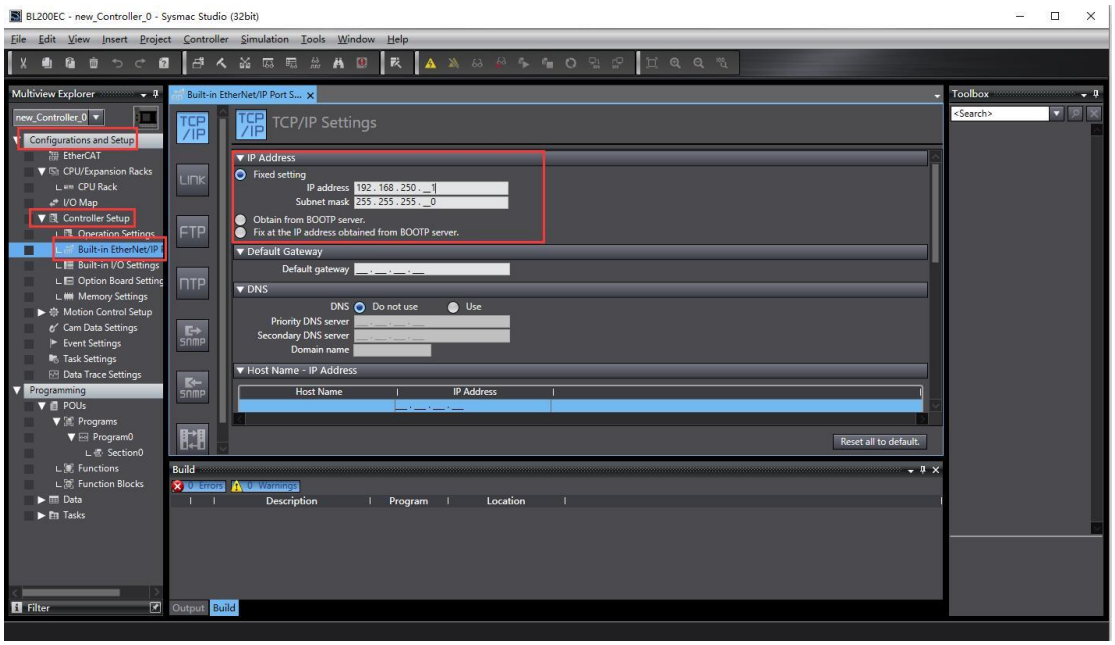
1. Port1 of Omron NX1P2 is connected to the network port of the computer, and Port2 is connected to the ETH1 network port of BL202. Omron NX1P2 and BL202 powered up.

2. Open the Sysmac Studio software, create a new project, select NX1P2-9024DT, and click Create.

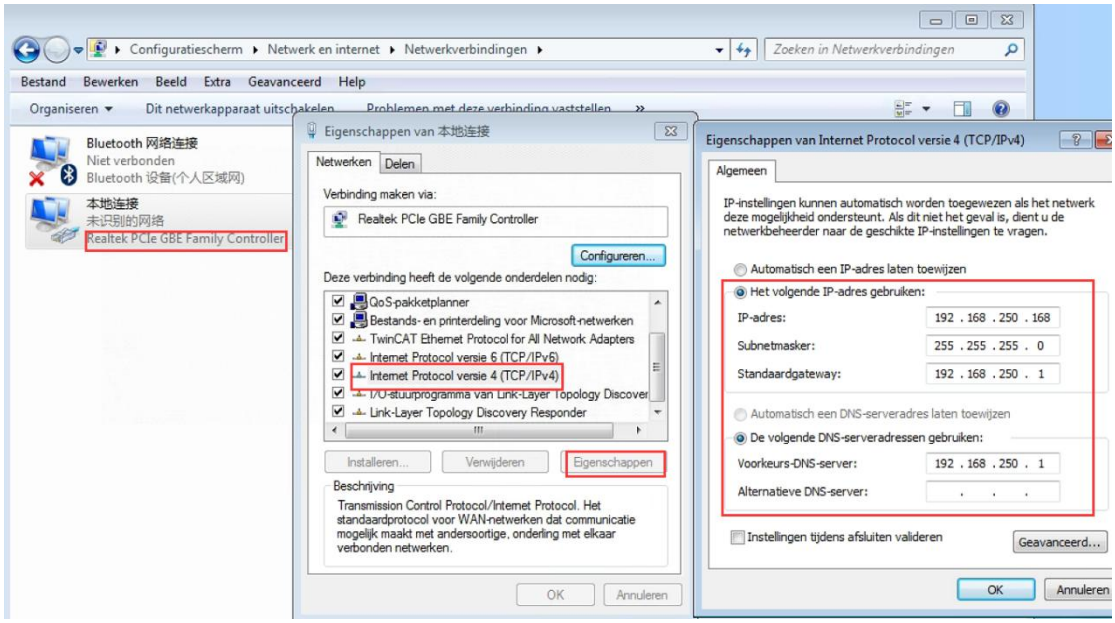


3. Click Configuration and Setup - Controller Setup - Built-in EtherNet/IP Port Setup to

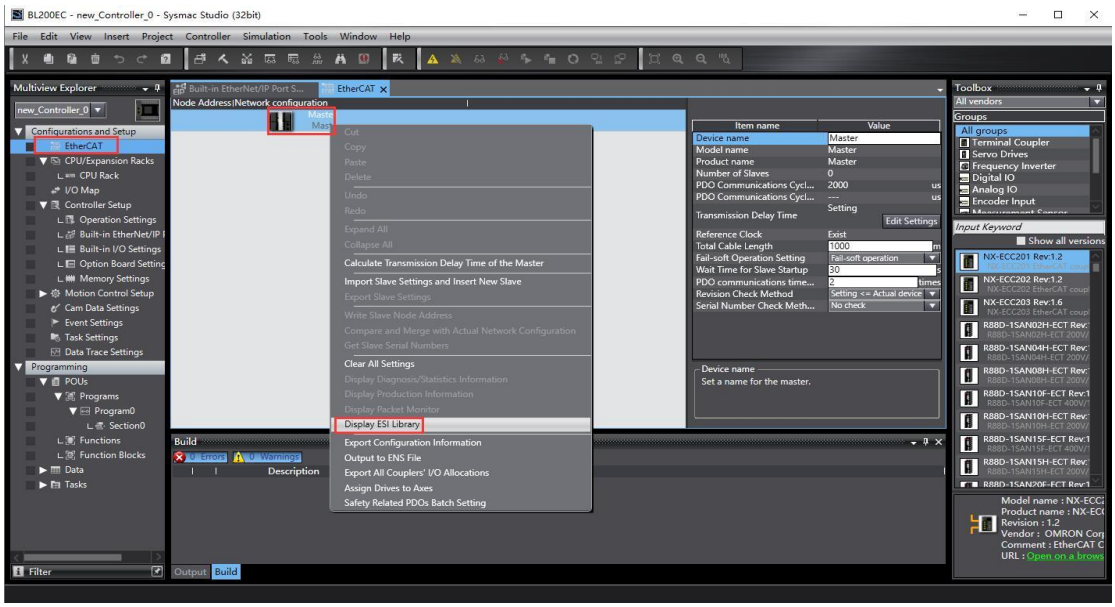
view the fixed IP address.

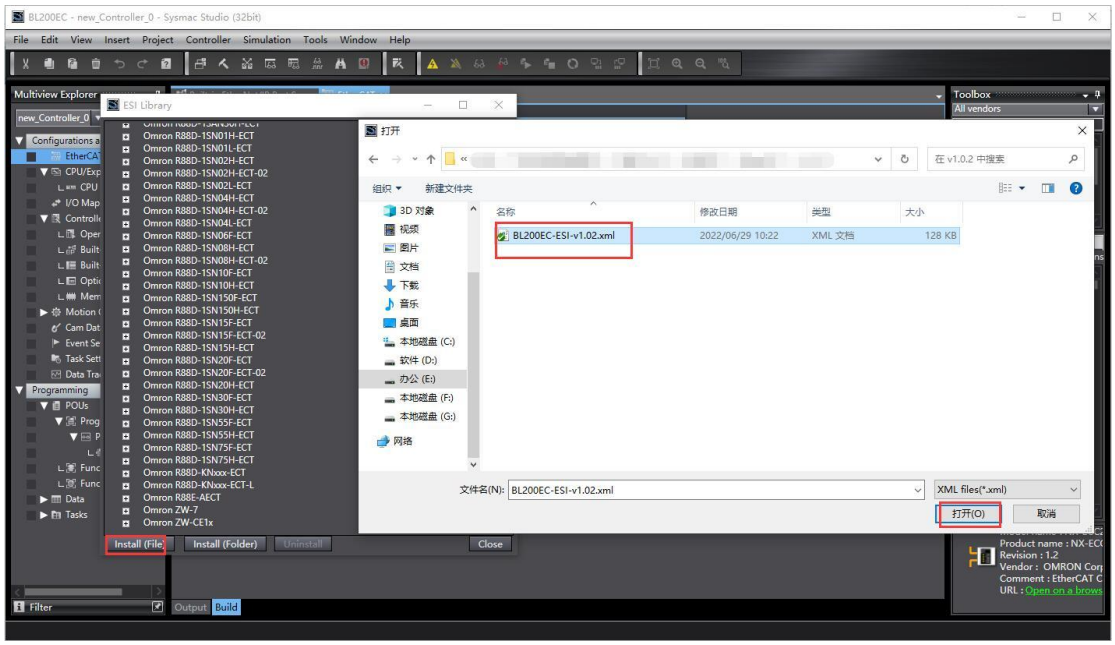


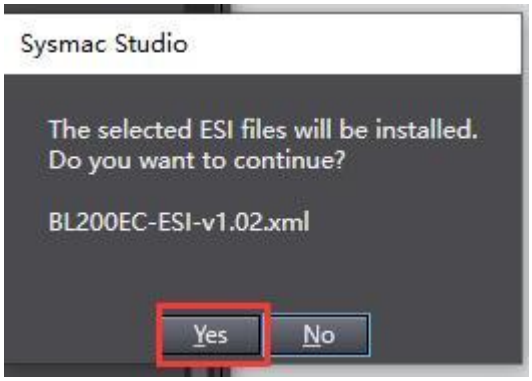
4. Set the computer IP and PLC in the same network segment.

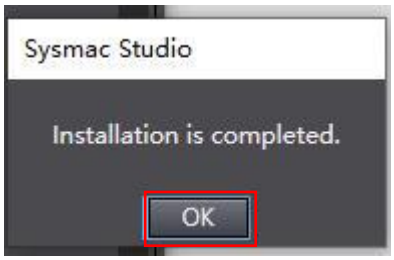


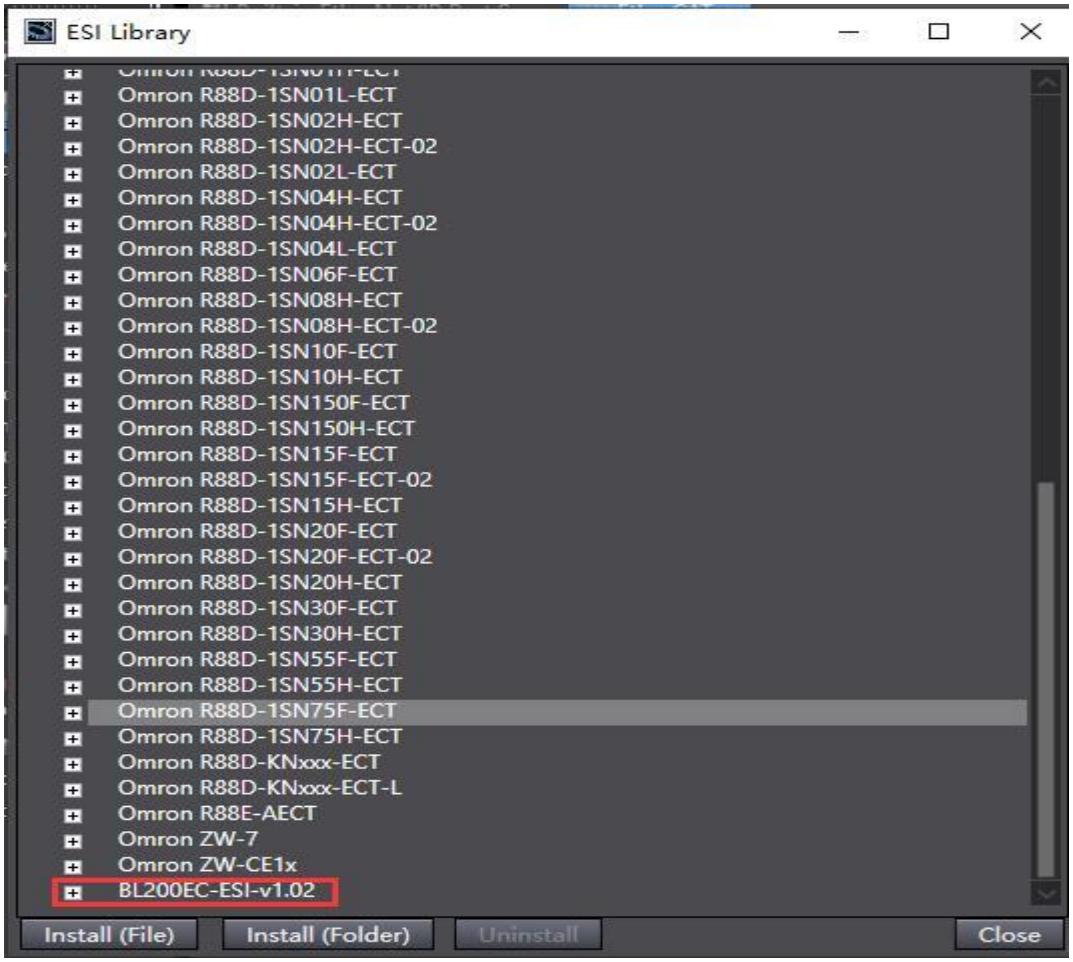
5. Double-click EtherCAT, right-click on the main device on the right side to display the ESI library, click the installation file in the pop-up window, find the BL200EC-ESI XML file, click Open, click Continue to install the XML file, and the installation is complete. You can see the newly installed BL202 at the bottom of the ESI library.


BL200EC - new_Controller_0 - Sysmac Studio (32bit)
File Edit View Insert Project Controller Simulation Tools Window Help
Multiview Explorer
Built-in EtherNet/IP Port S...
EtherCAT
Node Address|Network configuration
Cut
Copy
Paste
Delete
Undo
Redo
Expand All
Collapse All
Calculate Transmission Delay Time of the Master
Import Slave Settings and Insert New Slave
Export Slave Settings
Write Slave Node Address
Compare and Merge with Actual Network Configuration
Get Slave Serial Numbers
Clear All Settings
Display Diagnosis/Statistics Information
Display Production Information
Display Packet Monitor
Display ESI Library
Export Configuration Information
Output to ENS File
Export All Couplers' I/O Allocations
Assign Drives to Axes
Safety Related PDOs Batch Setting
Item name
Value
Device name
Model name
Product name
Number of Slaves
PDO Communications Cycl...
PDO Communications Cycl...
Transmission Delay Time
Edit Settings
Reference Clock
Total Cable Length
Fail-soft Operation Setting
Wait Time for Slave Startup
PDO communications time...
Revision Check Method
Serial Number Check Meth...
Device name
Set a name for the master.
Toolbox
All vendors
Groups
All groups
Terminal Coupler
Servo Drives
Frequency Inverter
Digital IO
Analog IO
Encoder Input
Input Keyword
Show all versions
Build
Description
Output
Build
Filter

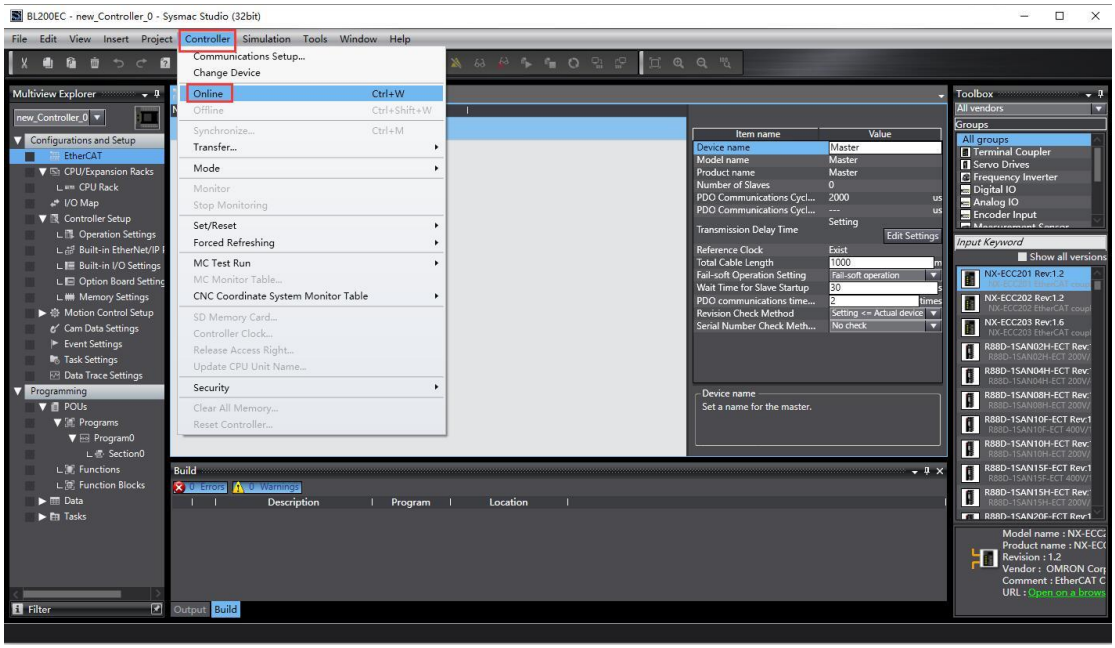

BL200EC - new_Controller_0 - Sysmac Studio (32bit)
File Edit View Insert Project Controller Simulation Tools Window Help
ESI Library
Omron R88D-1SN01H-ECT
Omron R88D-1SN01L-ECT
Omron R88D-1SN02H-ECT
Omron R88D-1SN02H-ECT-02
Omron R88D-1SN02L-ECT
Omron R88D-1SN04H-ECT
Omron R88D-1SN04H-ECT-02
Omron R88D-1SN04L-ECT
Omron R88D-1SN06F-ECT
Omron R88D-1SN08H-ECT
Omron R88D-1SN08H-ECT-02
Omron R88D-1SN10F-ECT
Omron R88D-1SN10H-ECT
Omron R88D-1SN150F-ECT
Omron R88D-1SN150H-ECT
Omron R88D-1SN15F-ECT
Omron R88D-1SN15F-ECT-02
Omron R88D-1SN15H-ECT
Omron R88D-1SN20F-ECT
Omron R88D-1SN20F-ECT-02
Omron R88D-1SN20H-ECT
Omron R88D-1SN30F-ECT
Omron R88D-1SN30H-ECT
Omron R88D-1SN55F-ECT
Omron R88D-1SN55H-ECT
Omron R88D-1SN75F-ECT
Omron R88D-1SN75H-ECT
Omron R88D-KNxxx-ECT
Omron R88D-KNxxx-ECT-L
Omron R88E-AECT
Omron ZW-7
Omron ZW-CE1x
Install (File)
Install (Folder)
Uninstall
Close
打开
组织
新建文件夹
名称
修改日期
类型
大小
BL200EC-ESI-v1.02.xml
2022/06/29 10:22
XML 文档
128 KB
文件名(N): BL200EC-ESI-v1.02.xml
XML files(*.xml)
打开(O)
取消
Toolbox
All vendors
Filter
Output
Build


Sysmac Studio
The selected ESI files will be installed.
Do you want to continue?
BL200EC-ESI-v1.02.xml
Yes
No

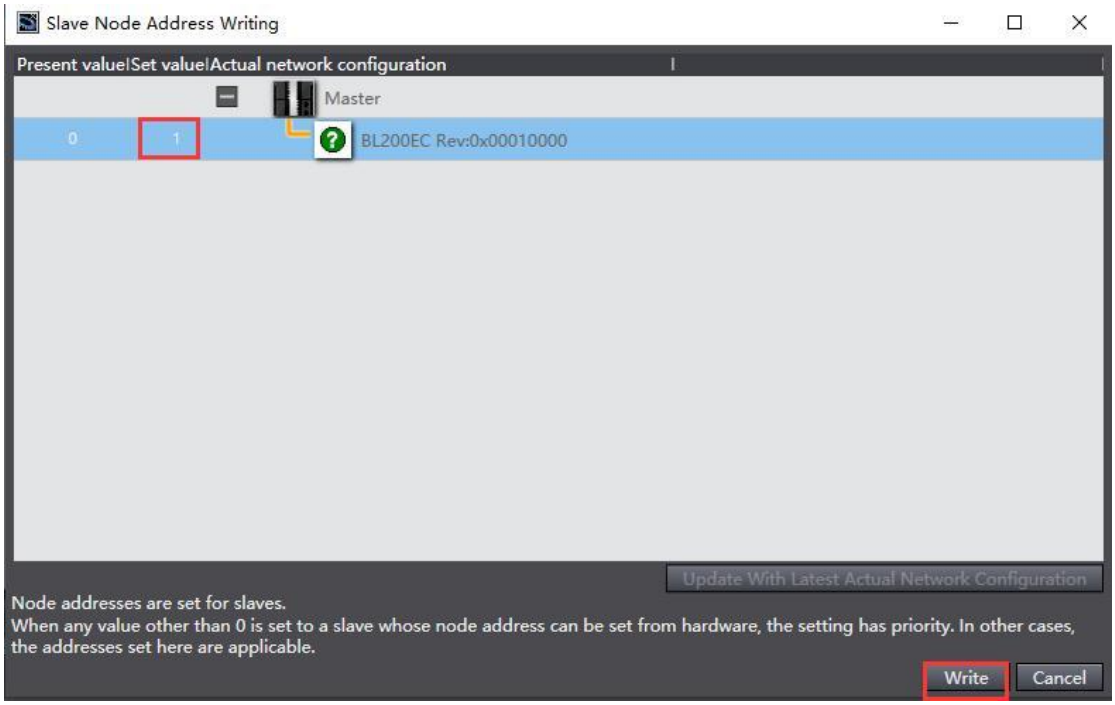

Sysmac Studio
Installation is completed.
OK



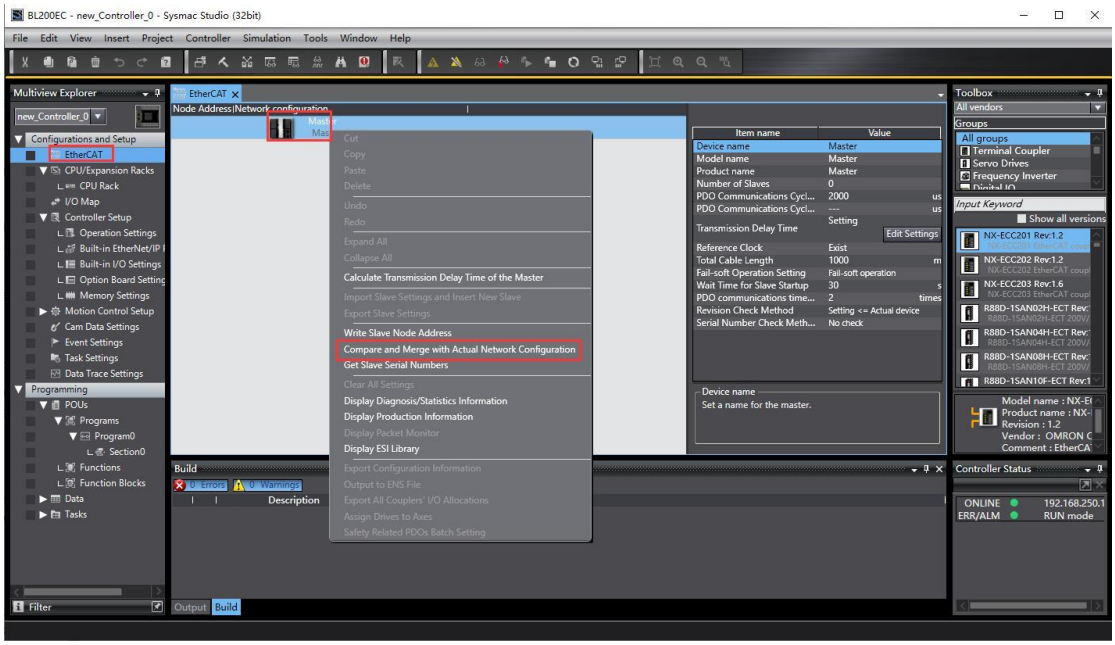
6. Click Controller—Online, or click the shortcut icon 



7. Write BL202 node address. After writing successfully, BL202 needs to be powered off and restarted.



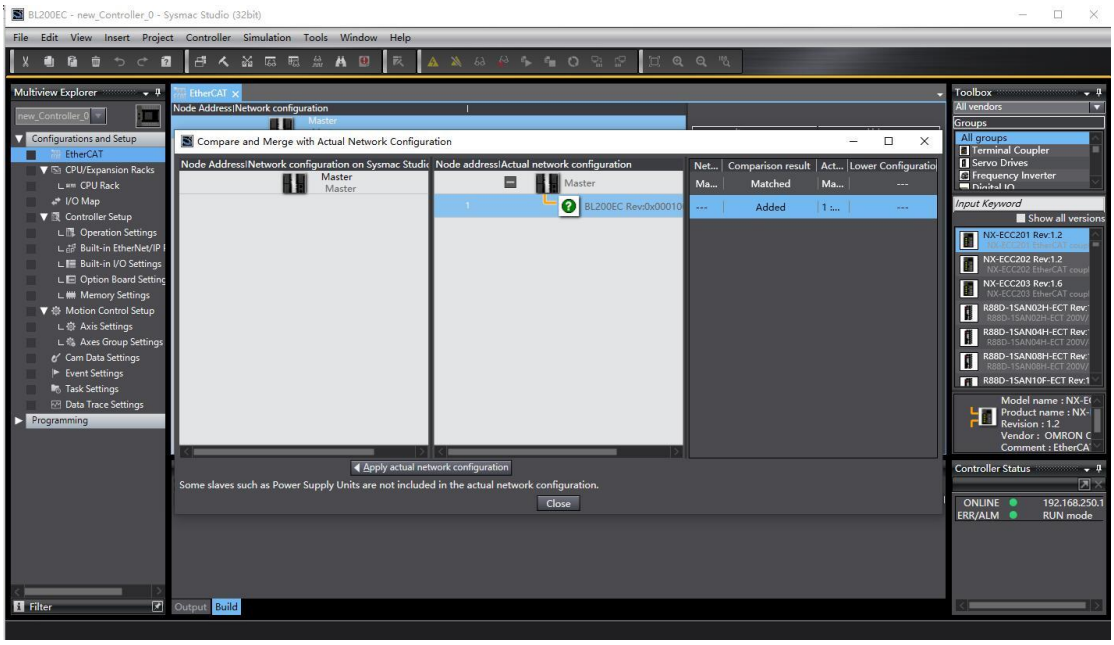
8. Double-click EtherCAT, right-click the master device, and click Compare and Merge with Physical Network Configuration.

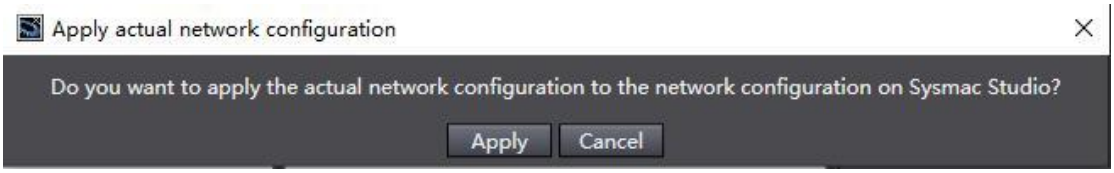


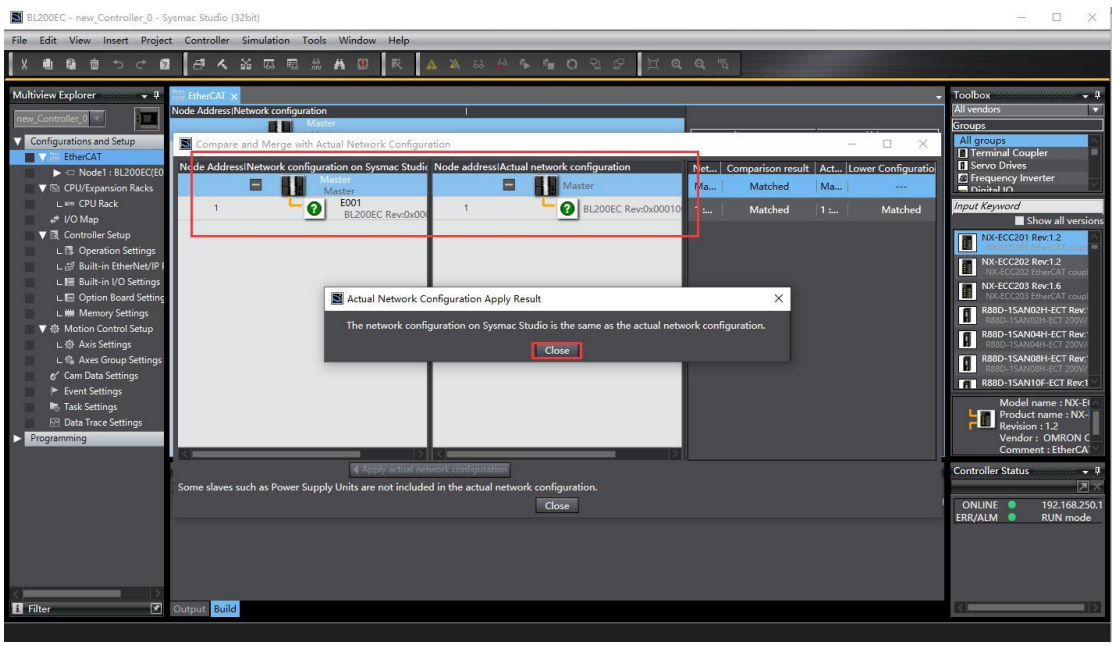
9. In the pop-up window for comparing and merging the same physical network configuration, you can see that a BL202 coupler with a node address of "1" is hung under the master device in the node address physical network configuration column, and in the network setting column on the node address Sysmac Studio, under the master device There is no hanging device. Click Apply Physical Network Configuration, click Apply in the pop-up window, and click Close in the pop-up window,

you can see that the network configuration on Sysmac Studio is the same as the actual network configuration.

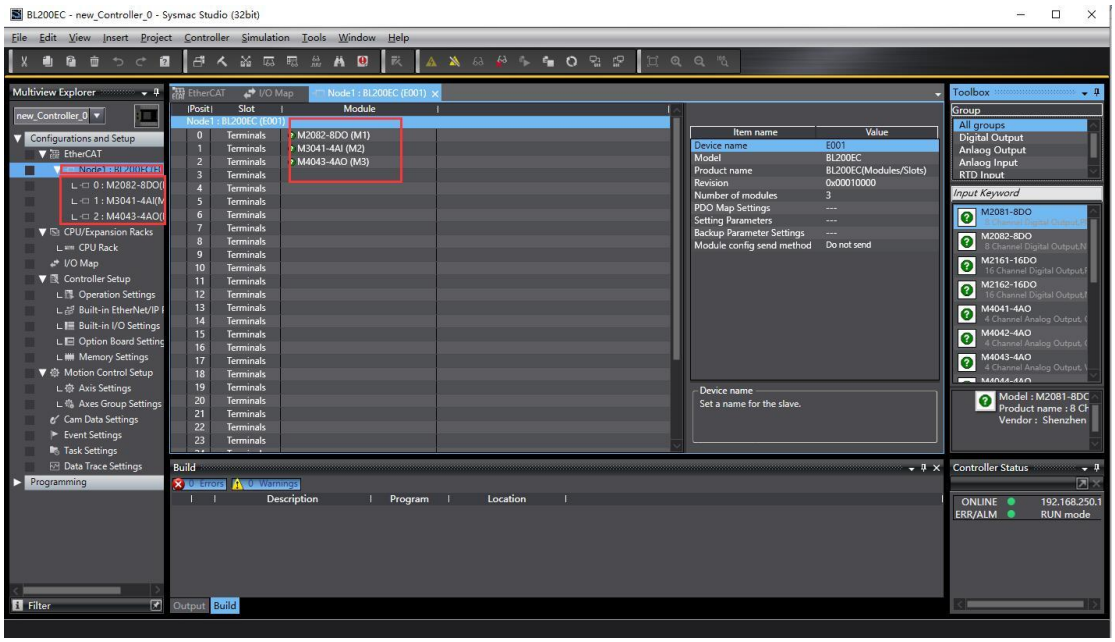
Note: Before writing the BL202 node address, you must power off and restart, otherwise it will prompt that the node address is invalid, you need to rewrite the node address, and then power off and restart. The BL202 does not have an address, and the window for comparing and merging configurations of the same physical network does not pop up.



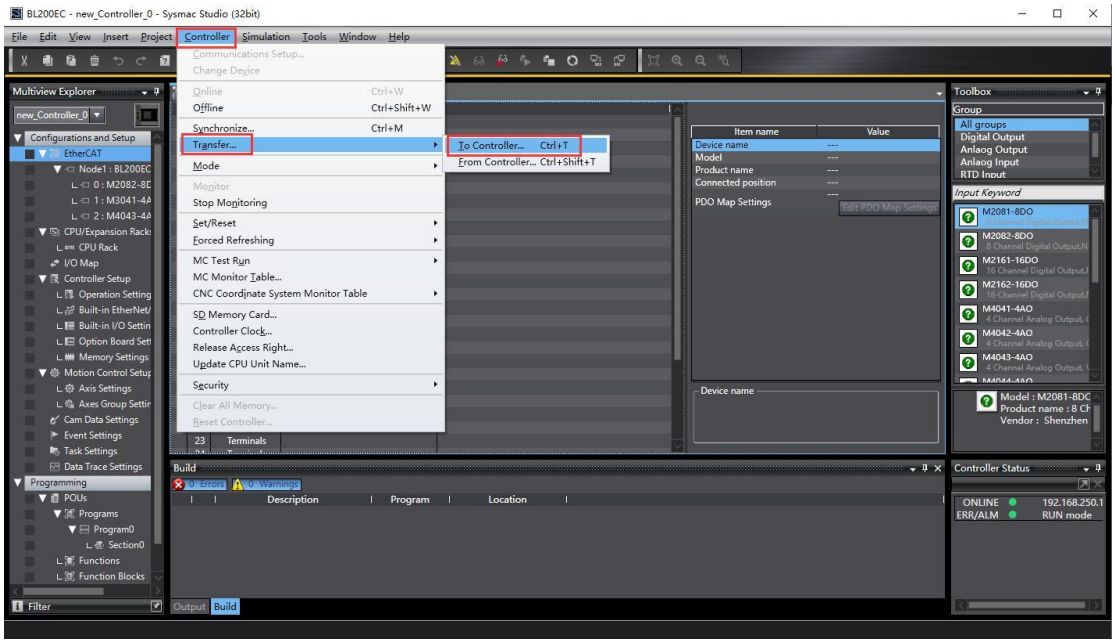


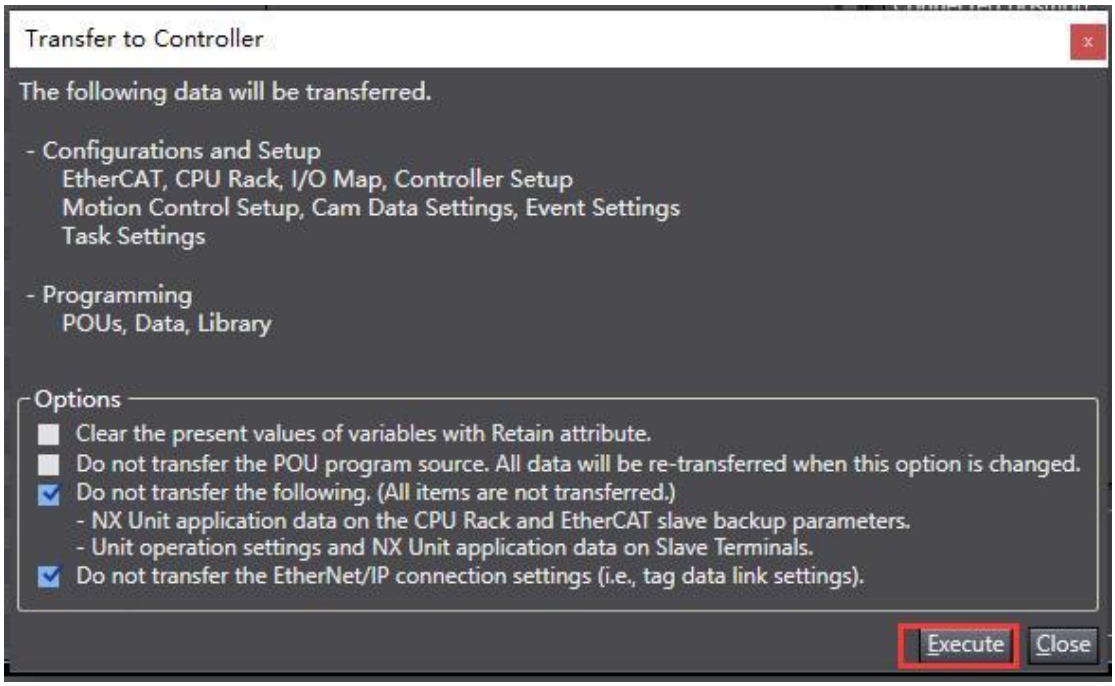


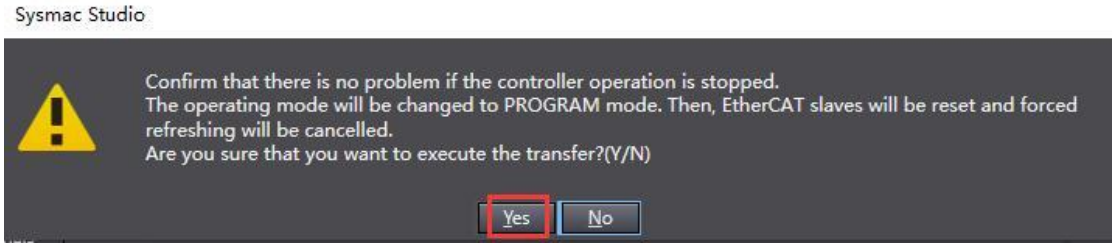
10. Double-click BL200EC, you can see the IO module behind BL202. You can also add IO modules manually, and manually add the PLC when it is offline.

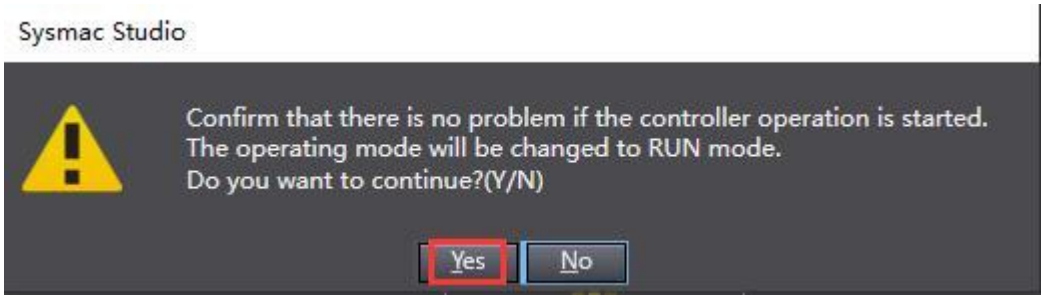


11. Click on the menu bar controller - transfer - transfer to the controller. Click Execute in the pop-up window to download the configuration, settings, and program to the PLC. In the pop-up window, click Yes-Yes-OK.

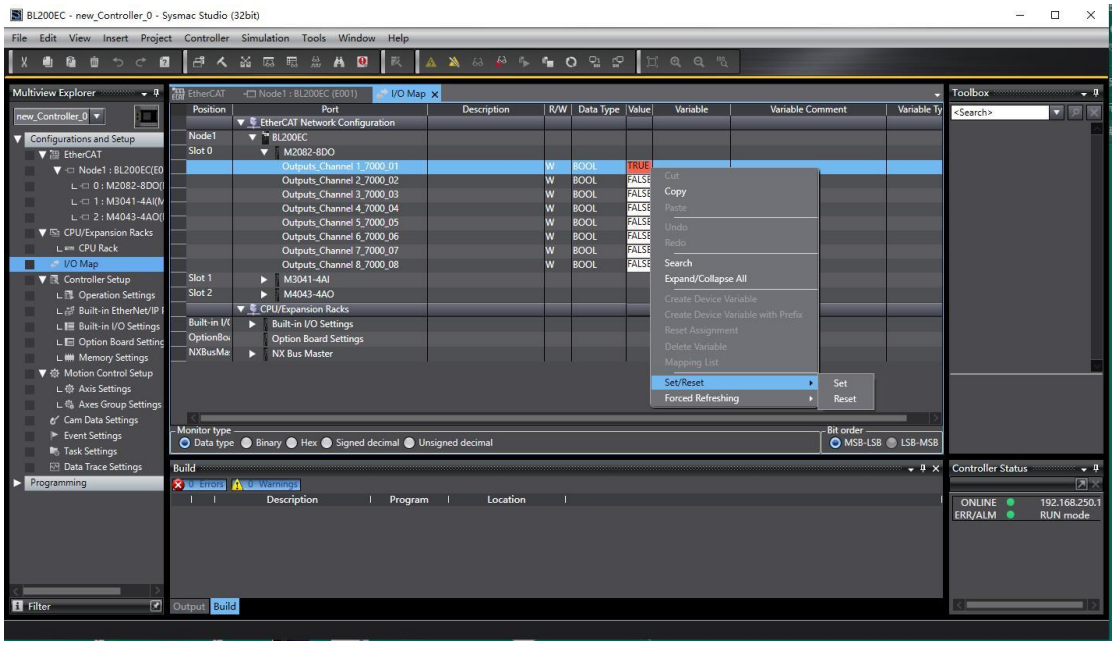

BL200EC - new_Controller_0 - Sysmac Studio (32bit)
File Edit View Insert Project Controller Simulation Tools Window Help
Communications Setup...
Change Device
Online Ctrl+W
Offline Ctrl+Shift+W
Synchronize... Ctrl+M
Transfer...
Mode
Monitor
Stop Monitoring
Set/Reset
Forced Refreshing
MC Test Run
MC Monitor Table...
CNC Coordinate System Monitor Table
SD Memory Card...
Controller Clock...
Release Access Right...
Update CPU Unit Name...
Security
Clear All Memory...
Reset Controller...
To Controller... Ctrl+T
From Controller... Ctrl+Shift+T
Multiview Explorer
Toolbox
Item name
Value
Device name
Model
Product name
Connected position
PDO Map Settings
Build
Description
Program
Location
Controller Status
ONLINE
ERR/ALM
RUN mode


Transfer to Controller
The following data will be transferred.
- Configurations and Setup
EtherCAT, CPU Rack, I/O Map, Controller Setup
Motion Control Setup, Cam Data Settings, Event Settings
Task Settings
- Programming
POUs, Data, Library
Options
Clear the present values of variables with Retain attribute.
Do not transfer the POU program source. All data will be re-transferred when this option is changed.
Do not transfer the following. (All items are not transferred.)
- NX Unit application data on the CPU Rack and EtherCAT slave backup parameters.
- Unit operation settings and NX Unit application data on Slave Terminals.
Do not transfer the EtherNet/IP connection settings (i.e., tag data link settings).
Execute
Close

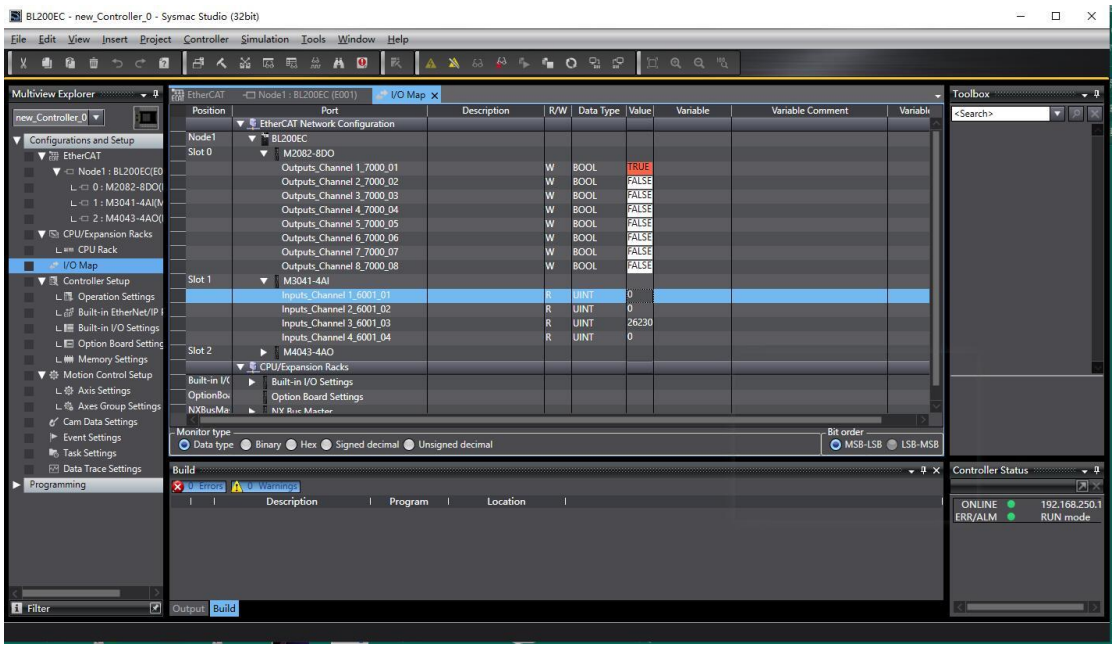

Sysmac Studio
Confirm that there is no problem if the controller operation is stopped.
The operating mode will be changed to PROGRAM mode. Then, EtherCAT slaves will be reset and forced refreshing will be cancelled.
Are you sure that you want to execute the transfer?(Y/N)
Yes
No



12. Double-click the I/O map, find the DO module M2082, select the channel and right-click Settings/Reset—Setting to set the corresponding channel to 1. Channel 1_7000_01 is set to 1 as shown in the screenshot. Analog output operation is the same as digital output operation.



13. View the data of the analog input. Refer to 5.7.4 Process Data Definition for specific values corresponding to AI.



6.8 BL207 Communication Example

7 MQTT Protocol

7.1 Device Communication Settings

1) Connection platform: You can choose BLIIoT Cloud V2.0, or choose other cloud platforms to enter the corresponding IP and port

2) Connection protocol: Select MQTT protocol

3) MQTT client ID: The unique identification of the device, which can be the serial number, device ID, or IMEI code. BLIIoT Cloud V2.0 is the serial number of the cloud platform. Please contact the sales representative for the serial number.

4) Username: The account that the device requests to connect to the proxy server. It is MQTT for BLIIoT Cloud V2.0

5) Password: The account password for the device to request to connect to the proxy server. It is MQTTPW for BLIIoT Cloud V2.0

6) Publish topic: Refers to the topic that the device publishes uplink data to the platform. It is cloud platform serial number for BLIIoT Cloud V2.0

7) Subscription topic: Refers to the topic subscribed when the device receives downlink data. It is cloud platform serial number /+ for BLIIoT Cloud V2.0

8) Publish cycle (seconds): MQTT data release interval cycle, unit second, BLIIoT

Cloud V2.0 cycle needs to be set to 10 seconds or more, if it is less than 10 seconds, the platform will disable the device

9) Publisher QOS: The quality of service level guarantee for application message distribution, 0-at most once, 1-at least once, 2-only once, can be selected according to needs

10) Encryption: You can use encryption to connect to the server as needed, and choose not to encrypt when connecting to BLIIoT Cloud V2.0

11) Enable data retransmission: Check Enable, after enabling it, when reconnecting to the cloud platform, the data during the disconnection period will be retransmitted

12) Data packaging: After check, multiple data will be sent in one message. When not check, one message corresponds to one I/O data point

After the configuration is complete, the client will initiate a connection to the server:

CONNECT: The client sends a CONNECT connection message request to the server;

CONNACK: The server responds with a CONNACK to confirm the connection message, indicating that the connection is successful;

After the client establishes a connection, it is a long connection, and the client can publish or subscribe to the message on the server;

Take the device and the customer's mobile phone as the client as an example:

After the device publishes the topic on the proxy server, the client can view the data by subscribing. That is, the device is the publisher, and the client mobile phone is the subscriber.

Similarly, users can also publish topics through the MQTT server to control devices. That is, users are publishers and devices are subscribers.

7.2 Data Publish Format

If data packaging is checked during configuration, multiple I/O data points will be sent in one message (multiple messages will be sent separately when there are many data points, and each message contains multiple data points), if not checked, the message only corresponds to one I/O data point, and there are some differences between the two publishing formats.

1) The payload data format in the device release message

Publish subject: Serial number (corresponding to the configured publish subject setting item)

```
{
        "sensorDatas":
        [
            {
                //switch type
                "switcher":"1",          //data type and value
                "flag":" REG 1000"              //Read and write identification
            },
             {
                //Slave switch type
                "switcher":"0",          //data type and value
                "flag":"REG10000"          //Read and write identification
            },

            {
                //numeric type
                "value":"10.00",
                "flag":" REG 4000"
            },
            {
                //Slave Numeric type
                "value":"217.5",
                "flag":"REG40001"
            },

        ],
        "time":"1602324850",
        //Time stamp, data publish timestamp UTC format

        "state":"alarm",
        //Alarm and recovery identification (This identification is only available for alarm
    or recovery data, but not for regularly reported data)

        "retransmit":"enable"
       //Retransmission flag, indicating historical data (This flag is only available for
retransmission historical data, but not for real-time data)
    }
```

Note:

//Data type and value: According to the type, it is divided into:

1. Switch type data: The character is "switcher", followed by "0" or "1" (0 means open, 1 means closed)

2. Numerical data: The character is "value", followed by "specific value"

//Read-write flag: The character is "flag", followed by "read-write flag representing the I/O data point", as follows:

1. Device I/O data point read and write identification:

Data name	Read and write identification	Data type	Description
DO	REG1000~1999	Switcher	0 is open, 1 is close
DI	REG2000~2999	Switcher	0 is open, 1 is close
AI	REG3000~3999	Value	true value = original value
AO	REG4000~4999	Value	true value = original value

2. Serial port module slave I/O data point read and write identification:

Data name	Read and write identification	Data type	Description
Coil state	REG10000~19999	Switcher	According to slave data definition
Input coil	REG20000~29999	Switcher	According to slave data definition
Holding register	REG40000~49999	Value	According to slave data definition
input register	REG30000~39999	Value	According to slave data definition

//Time stamp: The character is "time", followed by "specific reporting time stamp"

//Alarm and recovery identification: The character is "state", followed by "alarm" or "recovery" (alarm represents alarm data, recovery represents recovery data)

//Retransmission: The character is "retransmit", followed by "enable"

The data collected during network disconnection will be temporarily stored in the device, and will be republished when the network is restored. It will be marked with the "retransmit" field to indicate historical data. (You need to check Enable data retransmission on the configuration interface)

2) The payload data format in the device publish message (data is not packaged)

Publish subject: Serial number (corresponding to the configured publish subject setting item)
{ "switcher": "0", "flag": " REG2000", "time": "1602324850" }

When the data is not packed, except for a little difference in the format, everything else is exactly the same. This is an example of DI1. For other data types, please refer to the above description.

7.3 Subscription Data Format

Payload data format in device subscription message

Subscription topic: serial number/+ (corresponding to the configured subscription topic setting item) (The topic used by BLIIoT V2.0 for downlink publishing messages is named "Serial Number/Sensor ID", so the device subscription topic needs to add a wildcard "/+", so that the data sent by the platform can be received for control)
{ "sensorDatas": [{ "sensorsId": 211267, //Platform Sensor ID "switcher":1, //data type and value "flag":" REG1000" //Read and write identification }], "down":"down" //Platform downlink packet identifier }

Note:

//Platform sensor ID: The character is "sensorsID", followed by the ID number (the ID is automatically generated by the platform), and the self-built platform does not need to care about this item.

//Data type and value: According to the type, it is divided into:

1. Switch type data: The character is "switcher", followed by "0" or "1" (0 means open, 1 means closed)

2. Numerical data:The character is "value", followed by "specific value"

//Read-write flag: the character is "flag", followed by "read-write flag representing the IO data point"

8 Warranty

1) This equipment will be repaired free of charge for any material or quality problems within one year from the date of purchase.
2) This one-year warranty does not cover any product failure caused by man-made damage, improper operation, etc.

9 Technical Support

Shenzhen Beilai Technology Co., Ltd.
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