Modbus TCP

MT4 Series Integrated I/O

User Manual

Nanjing Solidot Electronic Technology

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1 Product Features

MT4 series integrated I/O modules are equipped with Modbus TCP protocol, built-in switches and dual industrial network ports. They provide users with a range of options for achieving high-speed data collection, optimal system configuration, simple on-site wiring, and improved system reliability.

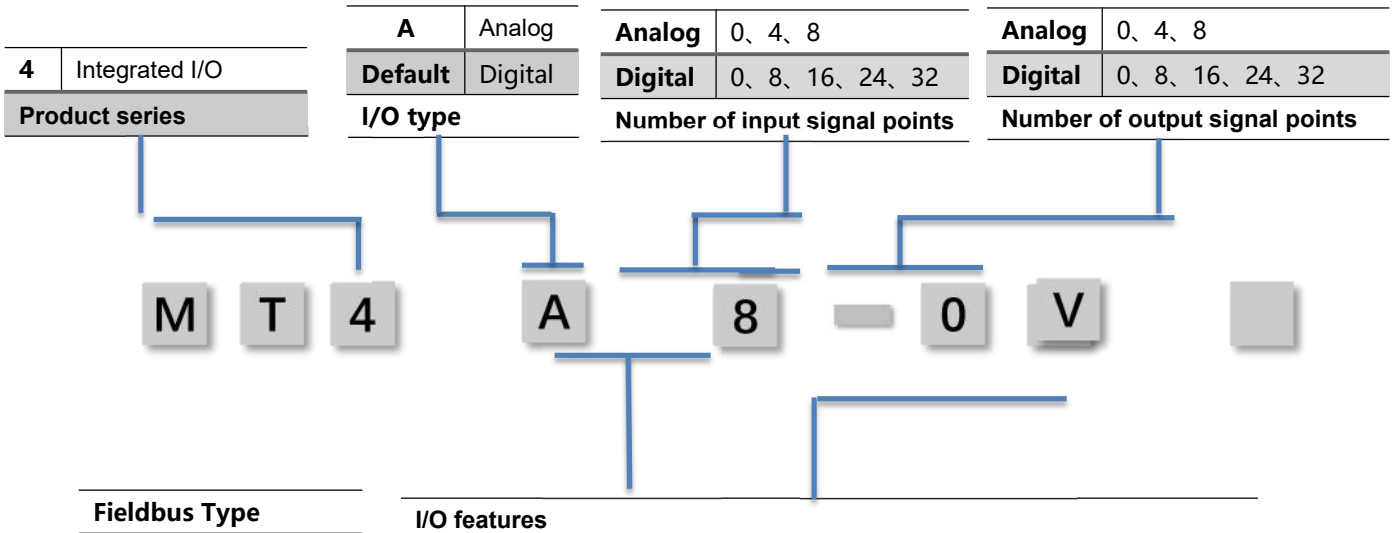
- Dual industrial network ports
  -Built-in switches
- High speed
  -100 GB industrial Ethernet port
- Diversified product lines
  -A rich variety of I/O modules including digital, analog, temperature, and other modules that can be integrated to meet demand of different application scenarios.
- Small footprint
  -Compact structure and small footprint, only measuring 102 mm × 72 mm × 25 mm
- Easy diagnosis
  -An innovative channel indicator design is adopted. As the indicators are placed close to the channels,channel status is displayed intuitively and clearly, facilitating detection and maintenance.
- Easy configuration
  -The modules are easy to configure, and support all mainstream Modbus TCP master stations.
- Easy installation
  -Installation on standard DIN 35 mm rails
  -Elastic terminal blocks are used for convenient and fast wiring.

2 Designation Rules

2.1 List of common products

Module	Product Description	
MT4-3200A	32-channel digital input module, NPN type	
MT4-3200B	32-channel digital input module, PNP type	
MT4-1616A	16-channel digital input, 16-channel digital output module, NPN type	
MT4-1616B	16-channel digital input, 16-channel digital output module, PNP type	
MT4-1616BW		
MT4-0032A	32-channel digital output module, NPN type	
MT4-0032B	32-channel digital output module, PNP type	
MT4-0032BW		
MT4-1600A	16-channel digital input module, NPN type	
MT4-1600B	16-channel digital input module, PNP type	
MT4-0016A	16-channel digital output module, NPN type	
MT4-0016B	16-channel digital output module, PNP type	
MT4-0016BW		
MT4-0808A	8-channel digital input, 8-channel digital output module, NPN type	
MT4-0808B	8-channel digital input, 8-channel digital output module, PNP type	
MT4-0808BW		
MT4-2408A	24-channel digital input, 8-channel digital output module, NPN type	
MT4-A80V	8-channel analog input module	Optional ranges: 0：-10~+10 V 、1：0~+10 V 2：-10~+10 V 、3：-5~+5 V 4：1~+5 V 、5：2~+10 V
MT4-A40V	4-channel analog input module	
MT4-A08V	8-channel analog output module	
MT4-A04V	4-channel analog output module	
MT4-A80I	8-channel analog input module	Optional ranges: 0：4~20 mA 、1：0~20 mA 2：4~20 mA、3：0~20 mA
MT4-A40I	4-channel analog input module	
MT4-A08I	8-channel analog output module	
MT4-A04I	4-channel analog output module	
MT4-1612J	16-channel digital input, 12-channel relay output module, NPN/PNP type	
XX4 C10_4	Common terminal extended module	

2.2 Designation rules



Fieldbus Type

MT	Modbus TCP

I/O features

Digital			Analog	
Code	**Input**	**Output**	**Code**	
A	NPN、3 ms	NPN、0.25 A	**V**	-10~+10 V Note①
B	PNP、3 ms	PNP、0.5 A	**I**	0~20 mA Note②
BW	PNP、3ms	PNP、0.25 A		
J	NPN/PNP、3 ms	Relay		

Note①: Multiple I/O range selections, support -10~+10 V、0~+10 V、-5~+5 V、1~+5 V、2~10 V

Note②: Multiple I/O range selections, support 0~20 mA、4~20 mA

3 Product Parameters

3.1 General parameters

Interface parameters	
Bus protocol	Modbus TCP
Number of I/O stations	127
Data transmission medium	CAT5 Ethernet cable
Transmission distance	⩽100 m (distance between stations)
Transmission rate	100 Mbps
Bus interface	2 × RJ45
Technical parameters	
Configuration method	Via mast station
Power supply	18~36 VDC
Weight	About 130g
Dimensions	102 mm × 72 mm × 25 mm
Working temperature	0~+55℃
Storage temperature	-20~75℃
Relative humidity	95%, non-condensing
Protection degree	IP20

3.2 Digital parameters

信号类型		
Input	Nominal voltage	24 VDC(±25%)
	Number of Inputs	8、16、24、32
	Transistor Polarity	NPN/ PNP
	“0” signal voltage (PNP)	-3~+3 V
	“1” signal voltage (PNP)	15~30 V
	“0” signal voltage (NPN)	15~30 V
	“1” signal voltage (NPN)	-3~+3 V
	Input filter	3 ms
	Input current	4 mA
	Isolation method	Optically-coupled isolation
	Electrical isolation	500 V
	Channel indicator	Green LED
Transistor output	Nominal voltage	24 VDC(±25%)
	Number of outputs	8、16、24、32
	Transistor Polarity	NPN/PNP
	Load type	Ohmic load, inductive load
	Output current per channel	NPN type Max：250 mA PNP type Max：500 mA BW type Max：250mA
	Port protection	Overvoltage and overcurrent protection
	Isolation method	Optically-coupled isolation
	Electrical isolation	500 V
	Channel indicator	Green LED
Relay output	Nominal voltage	24 VDC(±25%)
	Number of outputs	12
	Isolation method	Optically-coupled, relay
	Rated load	Single port: 4 A Common port: 8 A Whole module: 16 A
	Common terminal wiring method	4 points/1 common terminal
	Channel indicator	Green LED

3.3 Analog parameters

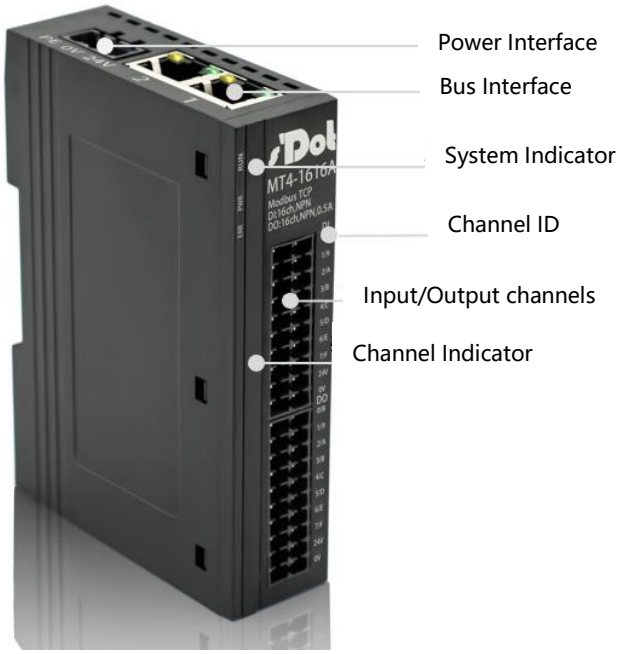
Type		
Input	Number of inputs	4、8
	Input signal (voltage type)	0：-10~+10 V (-32768~32767) 1： 0~+10 V (0~65535) 2：-10~+10 V (-27648~27648) 3 -5~+5 V (-27648~27648) 4: 1~+5 V (0~27648) 5: 2~+10 V (0~27648)
	Input signal (current type)	0: 4~20 mA (0~65535) 1: 0~20 mA (0~65535) 2: 4~20 mA (0~27648) 3: 0~20 mA (0~27648)
	Resolution	16 bit
	Sampling rate	⩽1 ksps
	Measurement error	±0.1%
	Internal Resistance (voltage type)	⩾2 kΩ
	Internal Resistance (current type)	100 Ω
	Electrical isolation	500 V
	Channel indicator	Green LED
Output	Number of outputs	4、8
	Output signal (voltage type)	0：-10~+10 V (-32768~32767) 1： 0~+10 V (0~65535) 2：-10~+10 V (-27648~27648) 3 -5~+5 V (-27648~27648) 4: 1~+5 V (0~27648) 5: 2~+10 V (0~27648)
	Output signal (current type)	0: 4~20 mA (0~65535) 1: 0~20 mA (0~65535) 2: 4~20 mA (0~27648) 3: 0~20 mA (0~27648)
	Resolution	16 bit
	Measurement error	±0.1%
	Load impedance (voltage type)	⩾2 kΩ
	Load impedance (current type)	⩽200 Ω
	Electrical isolation	500 V
	Channel indicator	Green LED

3.4Common terminal expansion module parameters

Common terminal	
Rated voltage	125 VDC/AC 250V
Rated current	8 A
Number of common terminals	4 sets (10 P/set)

4 Panel

Table 4- 1 Name of different module parts and functional description



LED Indicator Description			
PWR	Green	ON	Normal status of working power supply
		OFF	Unpowered or abnormal power supply
RUN	Green	ON	Normal status of system operation
		OFF	Abnormal status of system operation
ERR	Green	OFF	Normal status of Modules Operation
		ON	Abnormal status of Modules Operation
Network Port 1	Green	ON	Network connection established

		OFF	Absent or abnormal network connection
	Yellow	Flashing	Connection established with data interaction
		OFF	Absent or abnormal network connection
Network Port 2	Green	ON	Network connection established
		OFF	Absent or abnormal network connection
	Yellow	Flashing	Connection established with data interaction
		OFF	Absent or abnormal network connection
Input Indication	Green	ON	Presence of signal input in module channel
		OFF	Absence of signal input in module channel or abnormal signal input
Output Indication	Green	ON	Presence of signal output in module channel
		OFF	Absence of signal output in module channel or abnormal signal output

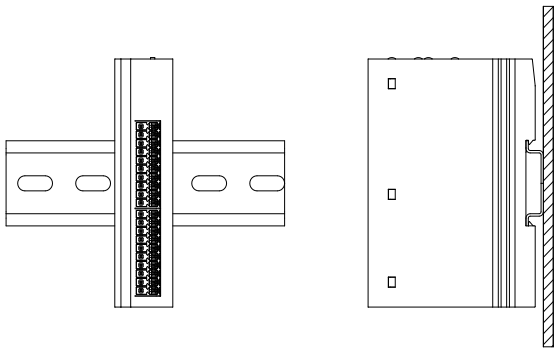
5 Installation and Disassembly

Installation\disassembly precautions

- **Ensure that the cabinet is well ventilated (e.g., equipped with a fan).**
- **Do not install this equipment near or above any equipment that may cause overheating.**
- **Make sure to install modules vertically and maintain adequate clearance between the modules and nearby devices.**

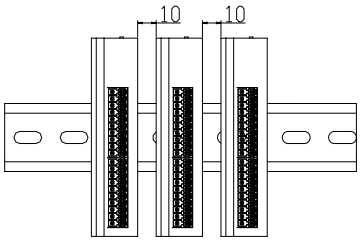
Installation direction

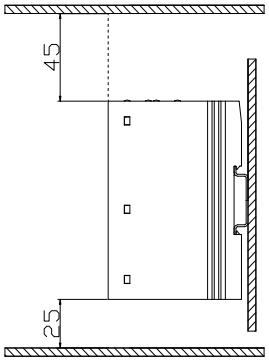
- **In order to maintain normal heat dissipation of the modules, make sure to install them vertically to ensure smooth airflow inside them.**



Minimum clearance

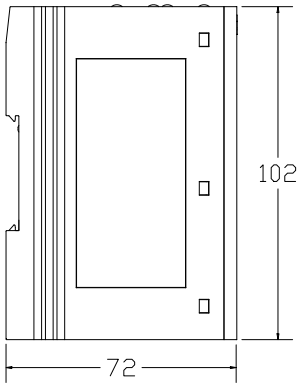
- **The protection degree of the modules is IP20, and they need to be installed inside boxes or cabinets. During installation, please follow the minimum distances (unit: mm) shown in the following figures between modules and those between modules and heating devices, other devices, or wiring slots.**

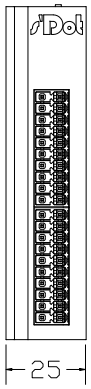




5.1 Dimensions

Dimensions	Installation method



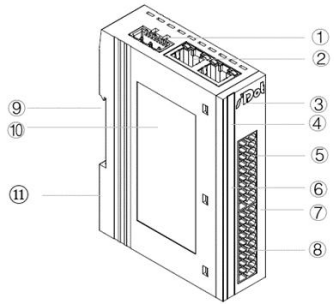


Snap-fitting installation on a standard DIN 35 mm guide

Note: Standard DIN guide rails are 35*7.5*1.0 and 35*15*1.0 in size

5.2 Module Structure Description

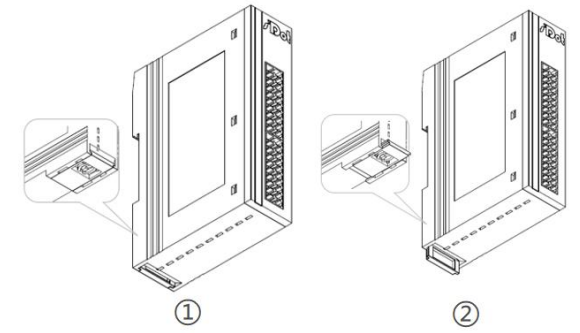
Module Structure Description



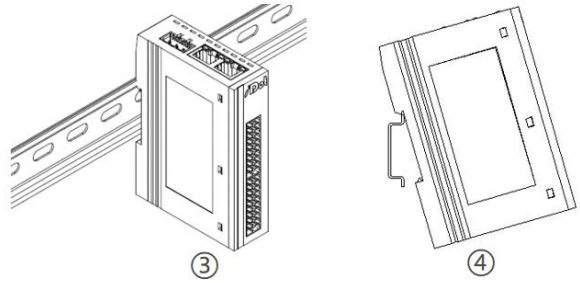
① Power supply interface
② Network Interface
③ ID panel
④ System light and ID
⑤ I/O interface
⑥ I/O signal Indicator
⑦ I/O channel ID
⑧ Bus interface
⑨ Guide rail mount
⑩ Module label
⑪ Snap
⑫ Reset button

5.3 Installation and Disassembly

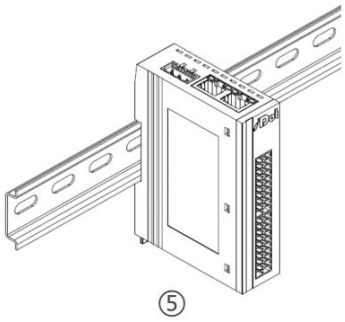
安装



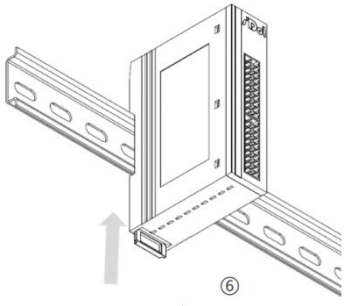
Push the fastener at the bottom of the module outward as shown in Figure① until it reaches the position shown in Figure② and a sound is heard.



Align the upper edge of the module fastener with the upper edge of the guide rail, and place the module into the guide rail, as shown in Figures③④.

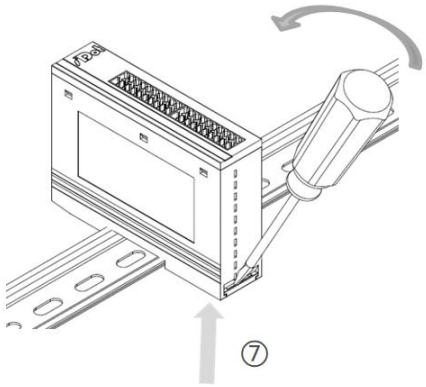


The module is placed as shown in Figure⑤.



Push the fastener towards the guide rail until a sound is heard. The module installation is now completed, as shown in Figure⑥.

Disassembly



Insert the flat head screwdriver into the fastener and apply force towards the module (until a sound is heard) as shown in Figure⑦.
Disassemble the module in the reverse order of installation steps.

6 Wiring

6.1 Wiring terminal

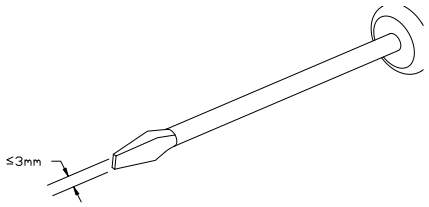
Wiring terminal		
Signal wire terminal	Number of poles	20 P
	Wire gauge	26 ~16 AWG　0.3~1.0 mm²
Power terminal	Number of poles	3 P
	Wire gauge	26~12 AWG　0.5~1.5 mm²
Bus interface	2 × RJ45	CAT5e: UTP or STP（STP recommended）

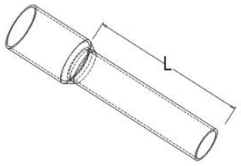
6.2 Wiring instructions and requirements

Power wiring precautions

- **The power supply on the module system side and that on the field side should be wired separately. Mixing should be avoided**
- **PE should be grounded reliably**

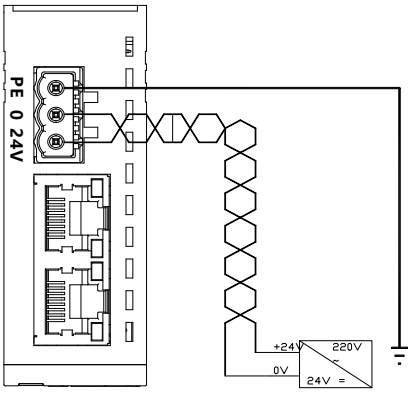
Table 6- 1: Tool and wiring requirements

Wiring tool requirement	
As the terminals are based on a screw-free design, cable installation and removal can be realized with a slotted screwdriver (size: ≤ 3 mm).	
Stripping length requirement	
Recommended stripping length: 10 mm	 
Wiring method	
For a single-strand hard wire, after stripping a required length, press the button while inserting the wire into the terminal.	
For a multi-strand flexible wire, after stripping a required length, use a compatible cold-pressed terminal (tubular insulated terminal, as shown in the table below). Press the button whiling inserting the wire.	

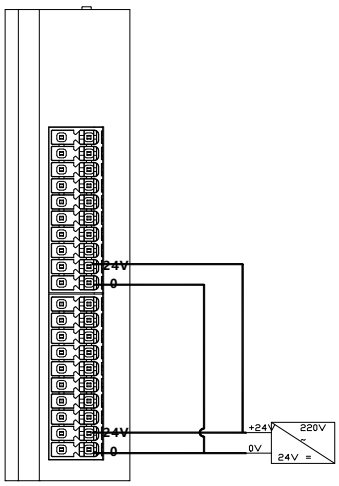
Specification of tubular insulated terminal		
Specification	**Model**	**Cable section area (mm²)**
 Length of tubular insulated terminal L ≥10 mm	E0510	0.5
	E0310	0.3
	E7510	0.75
	E7512	
	E1010	1.0
	E1012	
	E1510	1.5

3P terminal of power module

Twisted pair cable is recommended for power supply



20P terminal on the field side

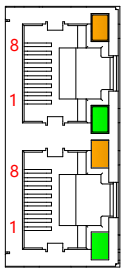


Signal terminal wiring requirement

Press the signal cable into the wiring terminal by referring to the I/O module wiring diagram and wiring method.

Bus wiring requirement

Standard RJ45 network interface and standard RJ45 connector are adopted.



Pin	Signal
1	TD+
2	TD-
3	RD+
4	—
5	—
6	RD-
7	—
8	—

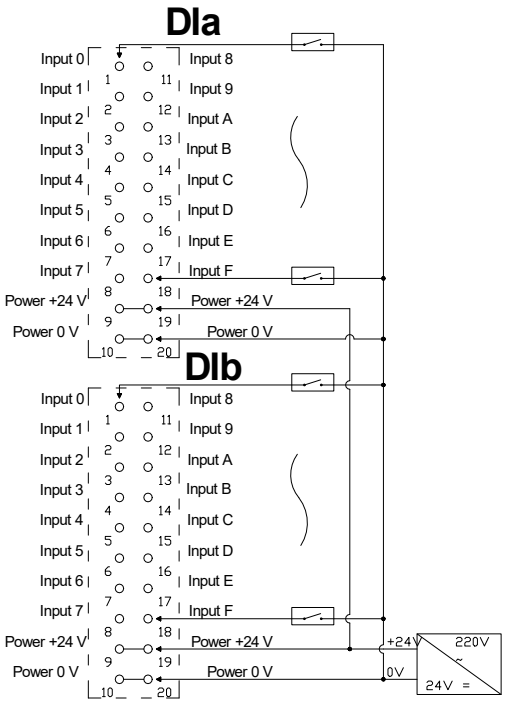
Category 5 or higher-level double-shielded (braided wire + aluminum foil) STP cable is recommended as communication cable.

The cable between any two devices should not exceed 100 m.

6.3 Wiring diagrams

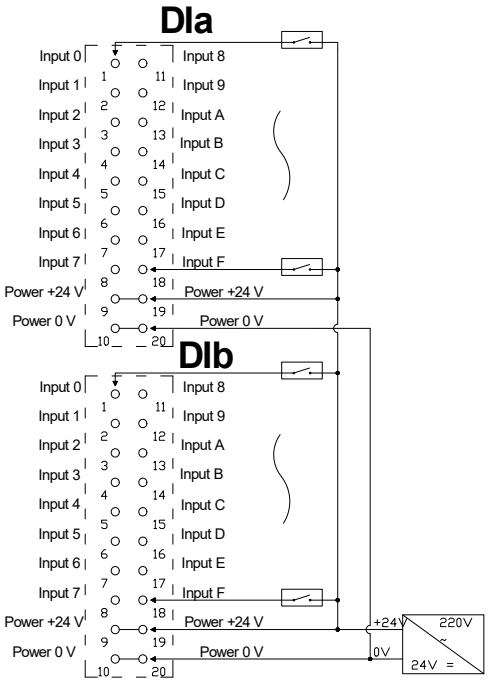
6.3.1 MT4-3200A

MT4-3200A	



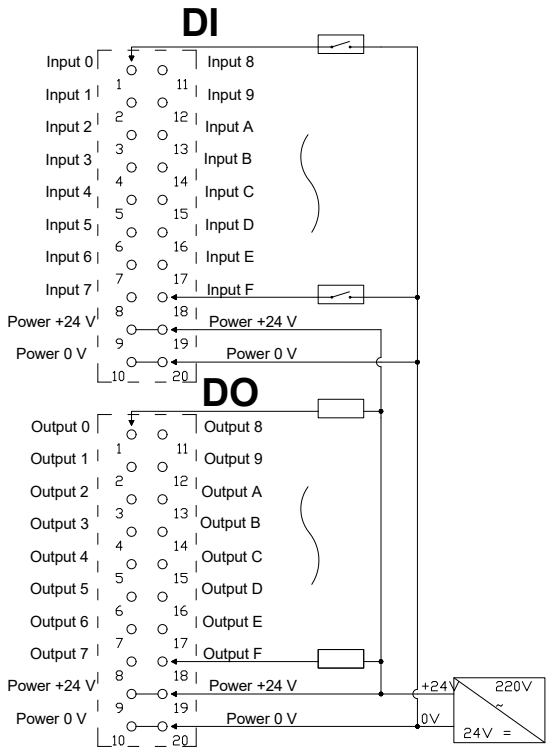
6.3.2 MT4-3200B

MT4-3200B	



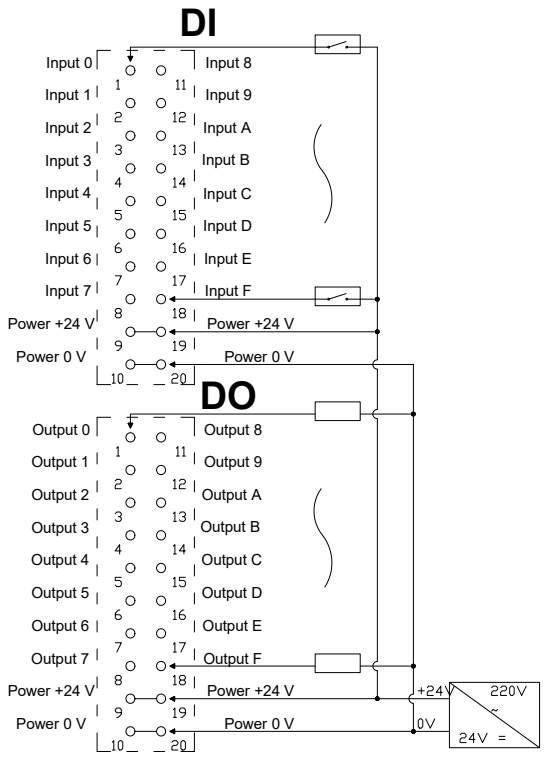
6.3.3 MT4-1616A

MT4-1616A



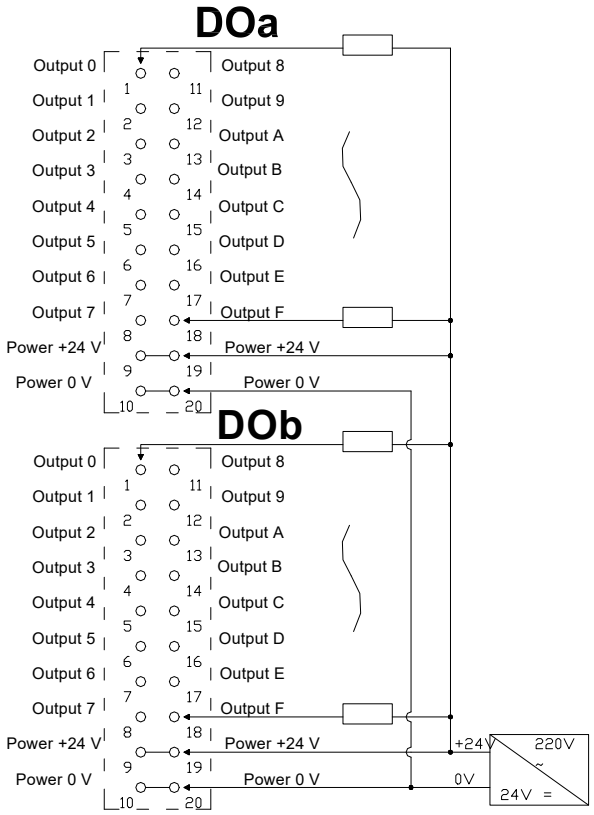
6.3.4MT4-1616B/ MT4-1616BW

MT4-1616B/ MT4-1616BW



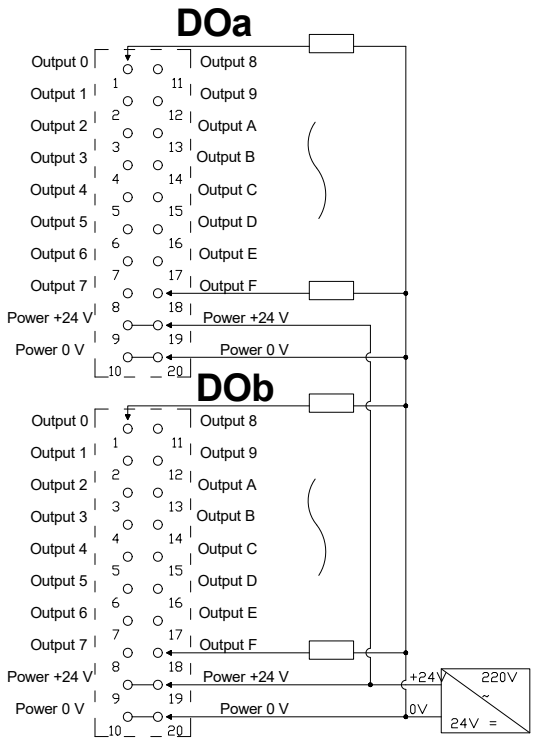
6.3.5 MT4-0032A

MT4-0032A



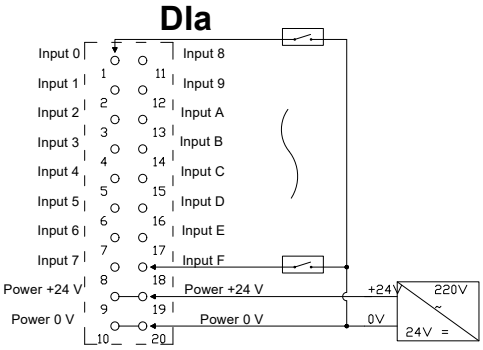
6.3.6 MT4-0032B/ MT4-0032BW

MT4-0032B/ MT4-0032BW	



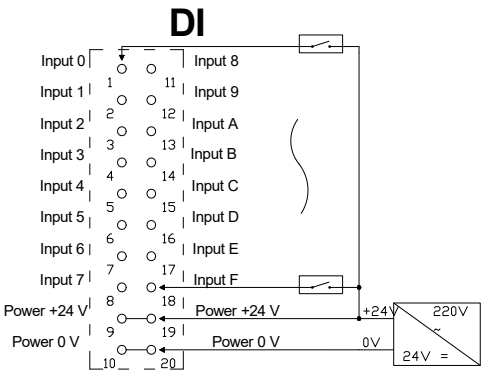
6.3.7 MT4-1600A

MT4-1600A	



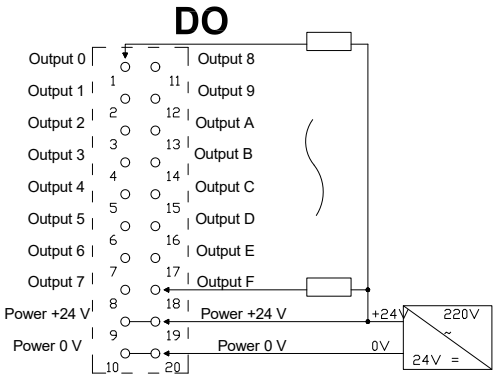
6.3.8 MT4-1600B

MT4-1600B	



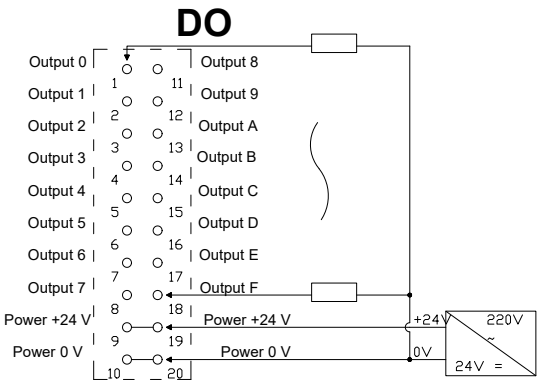
6.3.9 MT4-0016A

MT4-0016A	



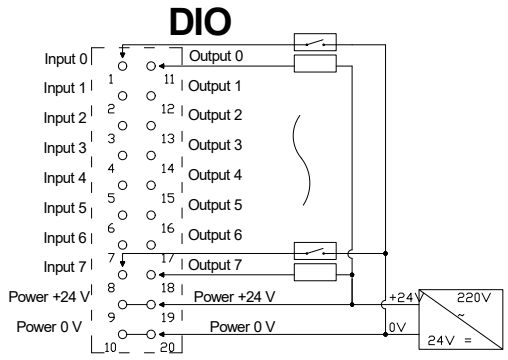
6.3.10 MT4-0016B/ MT4-0016BW

MT4-0016B/ MT4-0016BW



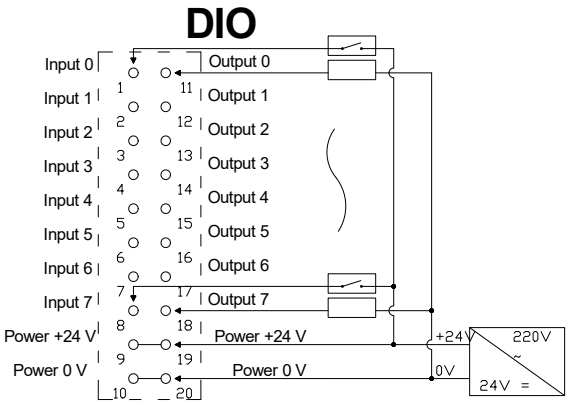
6.3.11 MT4-0808A

MT4-0808A	



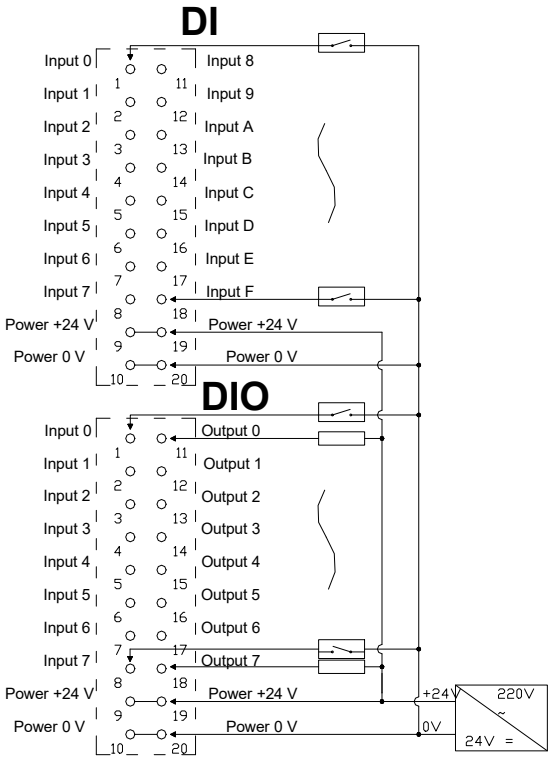
6.3.12 MT4-0808B/ MT4-0808BW

MT4-0808B/ MT4-0808BW



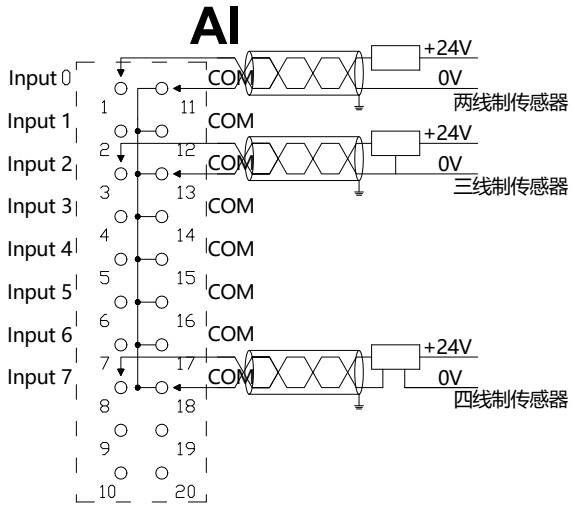
6.3.13 MT4-2408A

MT4-2408A



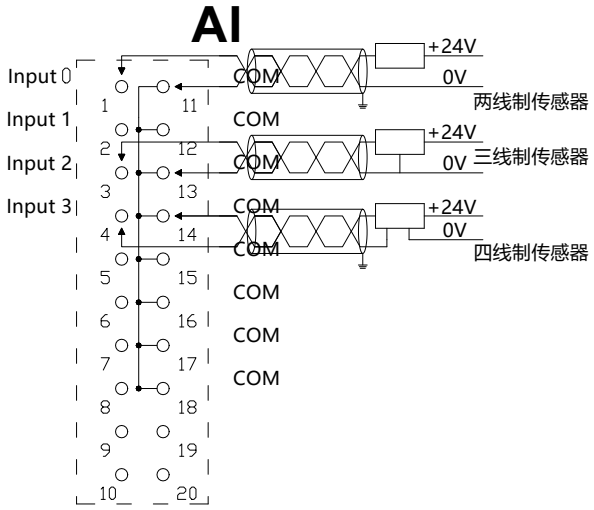
6.3.14 MT4-A80V/MT4-A80I

MT4-A80V/MT4-A80I



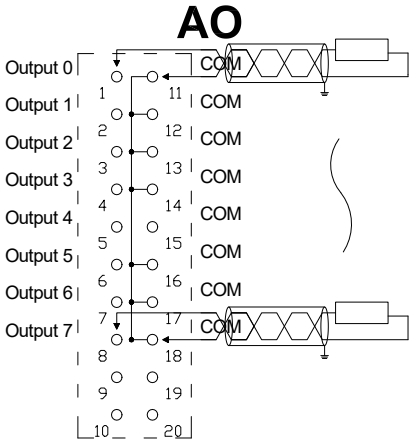
6.3.15 MT4-A40V/MT4-A40I

MT4-A40V/MT4-A40I



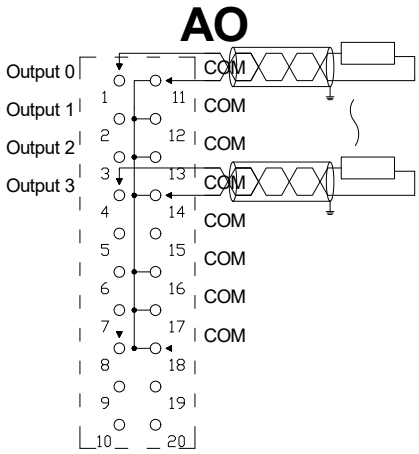
6.3.16 MT4-A08V

MT4-A08V



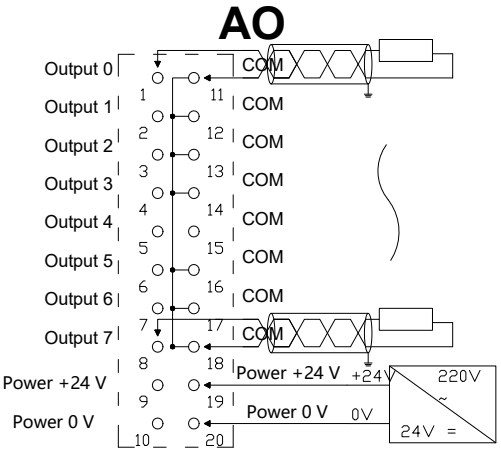
6.3.17 MT4-A04V

MT4-A04V



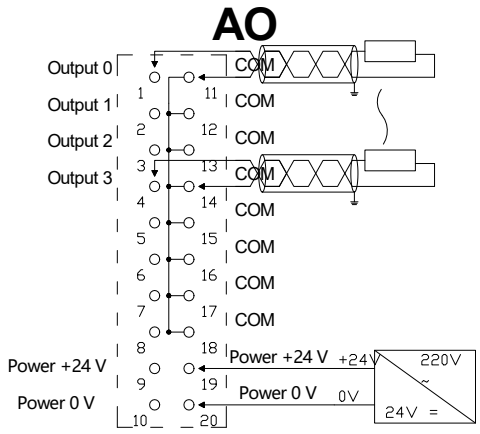
6.3.18 MT4-A08I

MT4-A08I



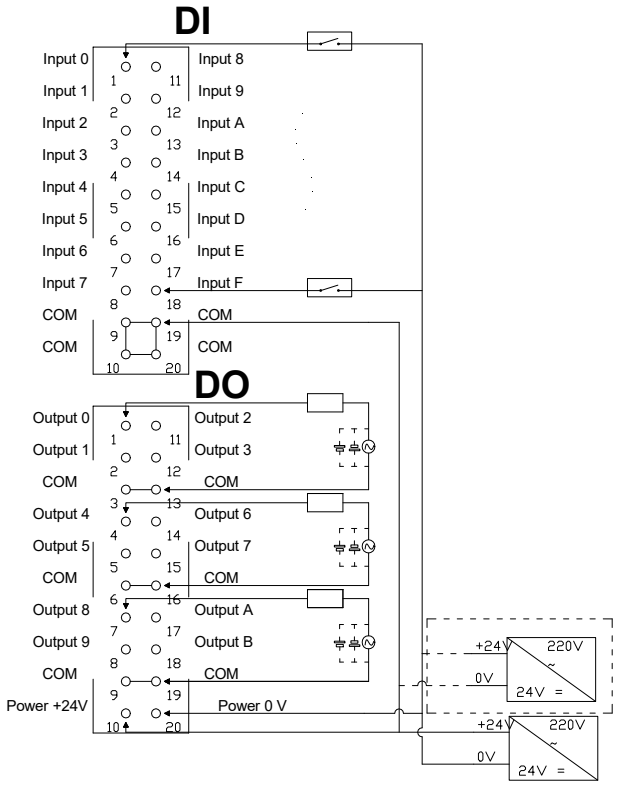
6.3.19 MT4-A04I

MT4-A04I	



6.3.20 MT4-1612J

MT4-1612J



Notes:

1. The input port supports two types of inputs: NPN and PNP, and COM is a common port.

2. Outputs 0~3 correspond to the common port com1.

Outputs 4~7 correspond to the common port com2.

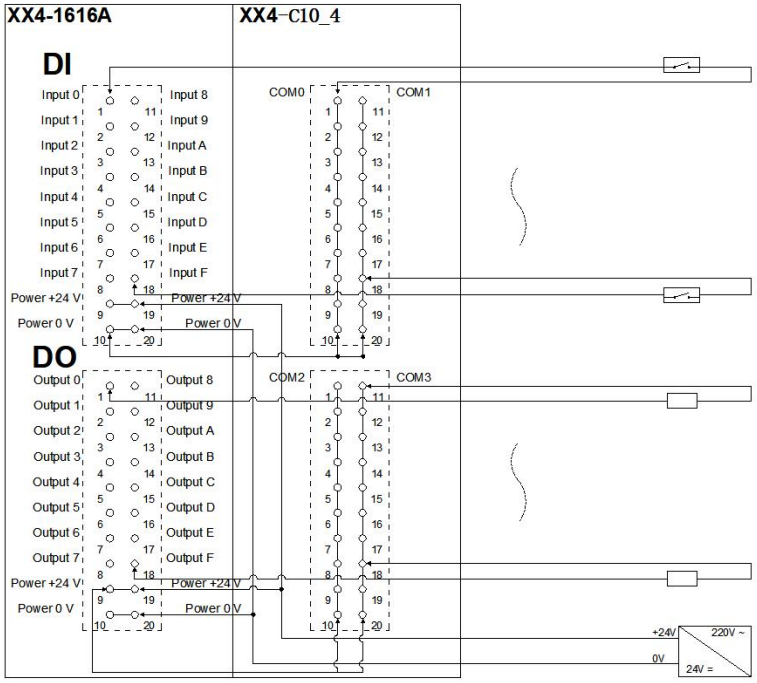
Outputs 8~B correspond to the common port com3.

6.4 Common terminal expansion module wiring diagrams

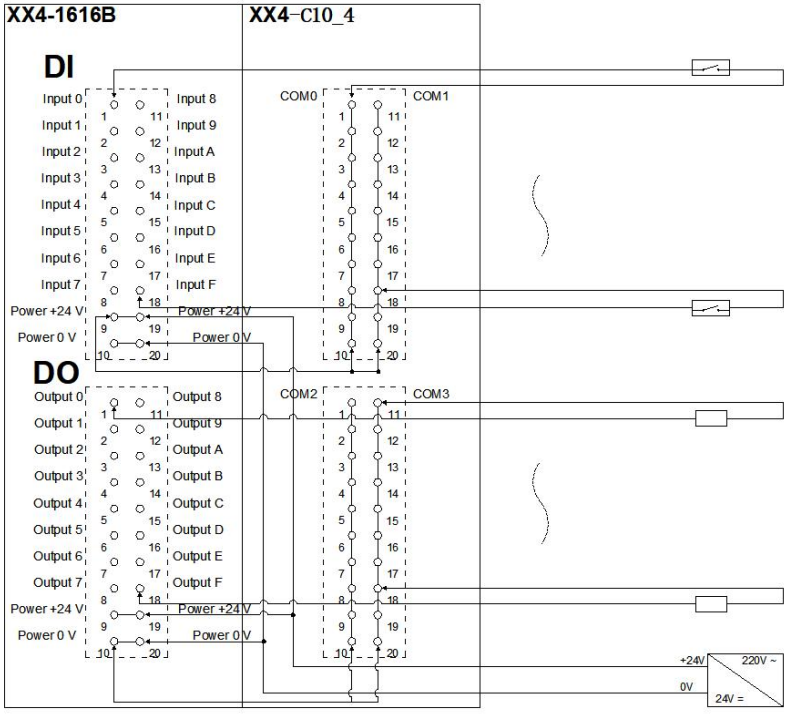
For our XX4 series IO modules, the power supply and common terminals on the field side of the modules can be expanded to facilitate sensor wiring and realize simpler wiring.

The wiring method of two-wire and three-wire sensors is described in this section, taking the two modules of XX4-1616A and XX4-1616B as examples.

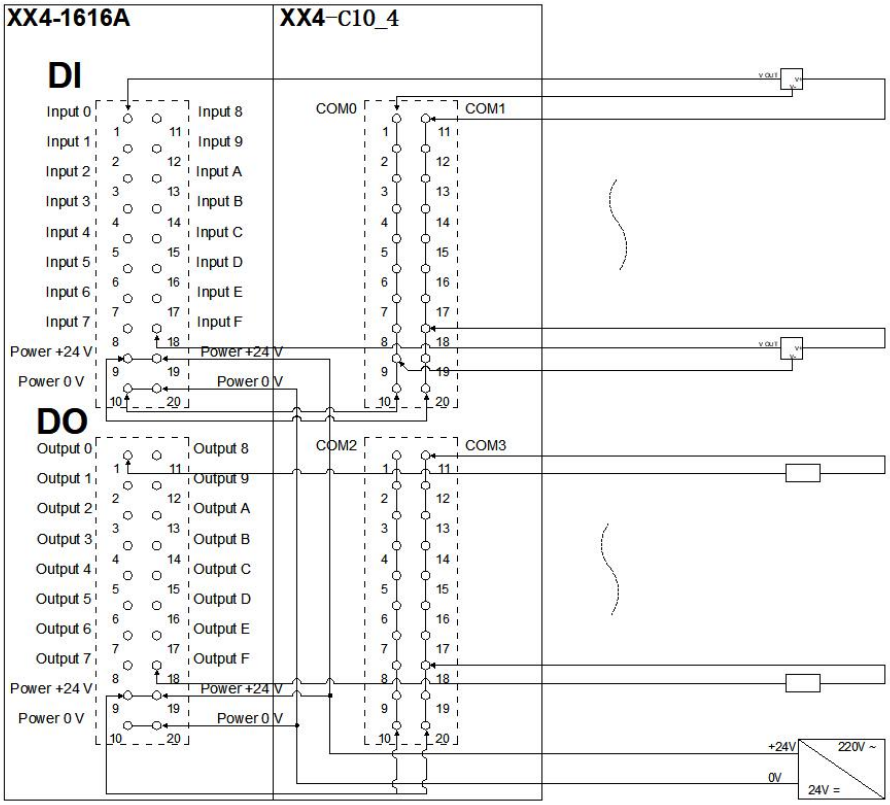
Wiring method of two-wire sensor (NPN type)



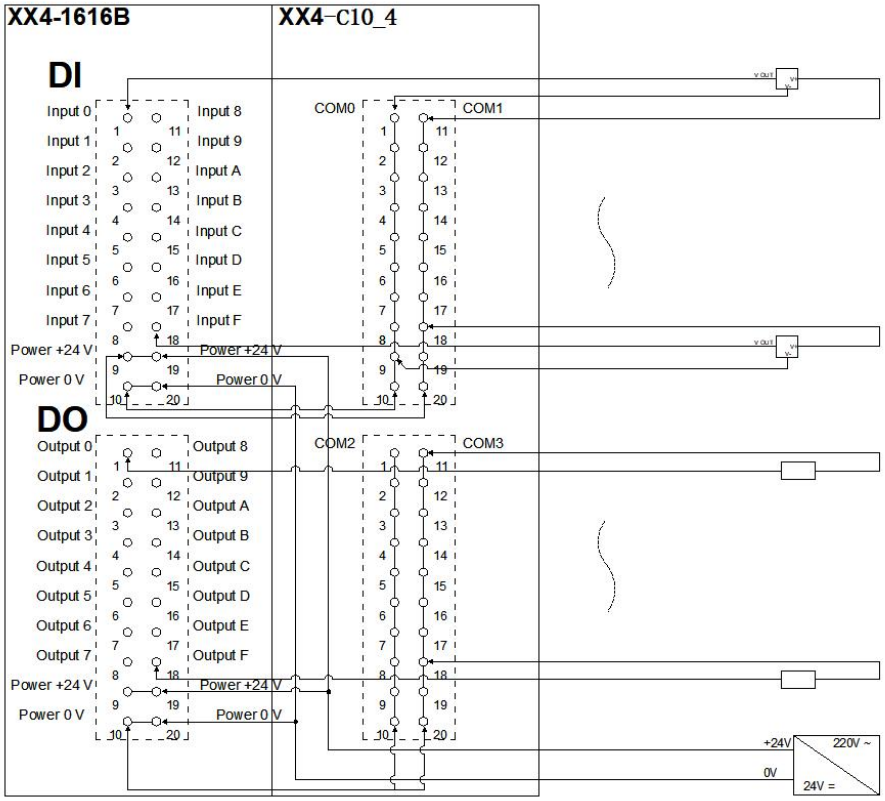
Wiring method of two-wire sensor (PNP type)



Wiring method of three-wire sensor (NPN type)



Wiring method of three-wire sensor (NPN type)



7 Operation

7.1 Parameters and functional configuration

1. Change IP Address

Each slave module has a default IP address, the default IP address is shown as follows:

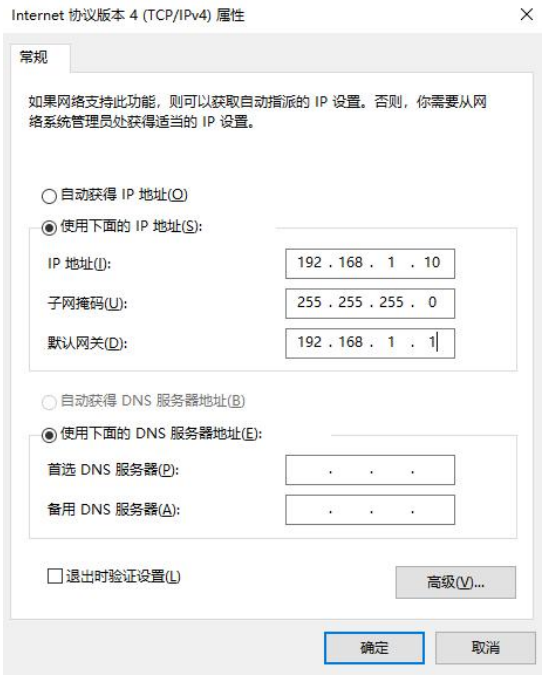
IP address: 192.168.1.120

Subnet mask: 255.255.255.0

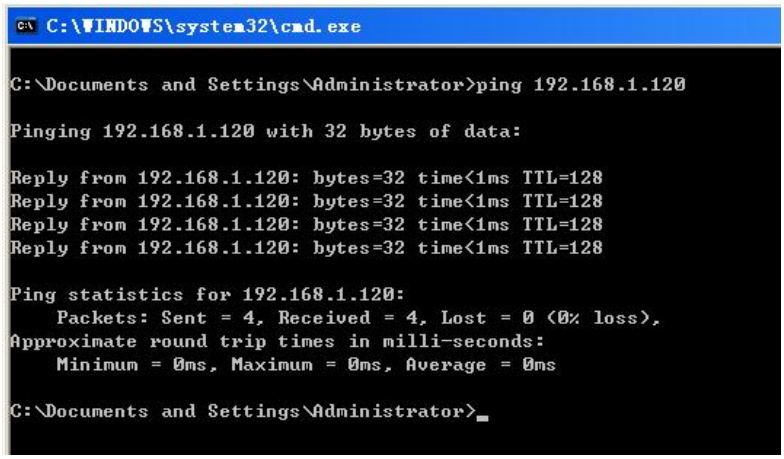
Gateway: 192.168.1.1

A. Check the communication network

1) connect the module and PC with a network cable, and set the IP address of PC and module in the same network segment, such as below figure



2) Run the CMD command for Windows



3) At the command prompt, enter: ping 192.168.1.120. Observe the network connection, no packet loss is normal. If there is any abnormality, please check the IP address setting and network connection.

B. Change IP address of I/O modules

Modify the IP address of the module via the web page. Type the IP address of the module (in this case 192.168.1.120) in the address bar of your browser as shown below:

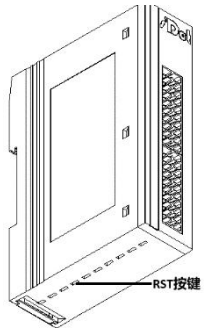
In the IP address field you can write the desired IP address, subnet mask and gateway. When you have finished modifying, click Save and restart the module.

2. IP address reset

If the IP address is forgotten, lost or other abnormalities occur during use, the module can be reset through the IP address reset function to restore the factory IP address default settings, the default IP address is as follows:

IP address: 192.168.1.120
Subnet mask: 255.255.255.0
Gateway: 192.168.1.1

IP address reset precautions



- **When the module is powered on, press and hold the reset button for 1s, the run/err light will flash, then stop the press, the run/err light will be on. After reset, you need to restart the module.**
- **Please use insulated tool with diameter or thickness less than 1.2mm for reset tool.**

3. Module function code correspondence table

The module supports a total of 4 function codes, read coil 0x01(1), write multiple coils 0x0f(15), read holding register 0x03(3), and write multiple registers 0x10(16).

Digital input and output address correspondence table

read coil 0x01(1)

Channel	Channel 0	Channel 1	…	Channel 127
Starting Address	0	1	…	127
Max length	128	127	…	1

write multiple coils 0x0f(15)

Channel	Channel 64	Channel 65	…	Channel 127
Starting Address	64	65	…	127
Max length	64	63	…	1

read holding register 0x03(3)

Channel	Channel 0~15	Channel 16~31	…	Channel 112~127
Starting Address	0	1	…	7
Max address	8	7	…	1

write multiple registers 0x10(16)

Channel	Channel 64~79	Channel 80~95	Channel 80~111	Channel 112~127
Starting Address	4	5	6	7
Max address	4	3	2	1

Analog input and output address correspondence table

read holding register 0x03(3)

Channel	Channel 0	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7
Starting Address	8	9	10	11	12	13	14	15
Max address	8	7	6	5	4	3	2	1

写多个寄存器 0x10(16)

Channel	Channel 0	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7
Starting Address	16	17	18	19	20	21	22	23
Max address	8	7	6	5	4	3	2	1

Analog range selection address correspondence table

write multiple registers0x10(16)

8 Channel analog range selection address correspondence table								
Channel	Channel 0	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7
Starting Address	32	33	34	35	36	37	38	39
Max address	8	7	6	5	4	3	2	1
4 Channel analog range selection address correspondence table								
Channel	Channel 0	Channel 1	Channel 2	Channel 3				
Starting Address	32	33	34	35				
Max address	4	3	2	1				

4. Output clearing/holding function

Keep output: keep output all the time

Clear output: clear output within the configured time, configurable from 1 to 30s

Power on the module, connect the computer through the network cable, change the IP address of the computer to the same network segment as the IP address of the module, and enter the IP address of the module in the IE browser;

Clear/hold:

The system default value is 0, when the disconnect time is set, the output is cleared after the configured time is over,

When hold is set to 1, the output remains in the pre-disconnect state

Disconnection time:

The setting value is 1~30, the unit is "second".

The system default value is 0, this function is invalid

5. Analog range selection function

Voltage Input/Output（Default 0 ）		
Range	Measurement range	Value range
0	-10~+10 V	-32768~32767
1	0~+10 V	0~65535
2	-10~+10 V	-27648~27648
3	-5~+5 V	-27648~27648
4	1~+5 V	0~27648
5	2~+10 V	0~27648
Current Input/Output（Default 0)		
0	4~20 mA	0~65535
1	0~20 mA	0~65535
2	4~20 mA	0~27648
3	0~20 mA	0~27648

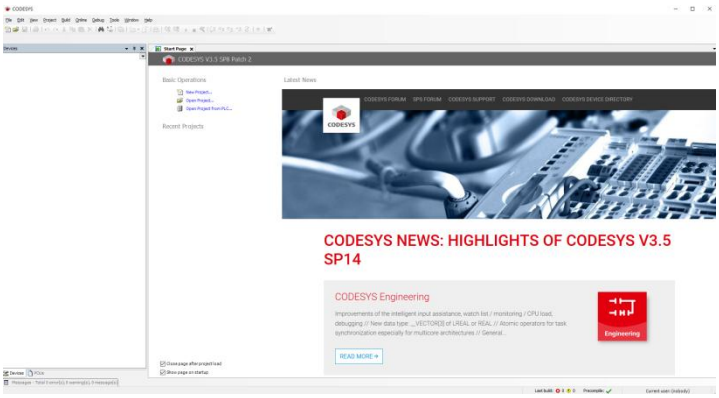
7.2 Configuration instructions with CODESYS

Description: The MT4 series integrated I/O modules are used in the same way. The instruction will take the MT4-1616A product as an example and introduces in details of the operation procedure of the MT4 series product on the CODESYS V3.5 (SP8 Patch 2) software.

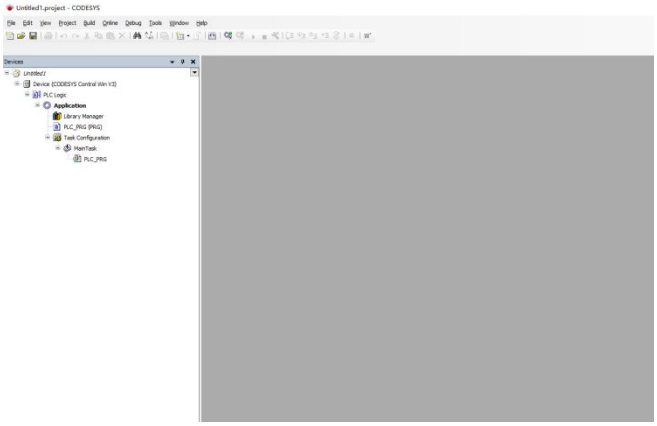
1、Set up

Please refer to the instructions in the module wiring section to connect the module to the system correctly.

2、Project Creation

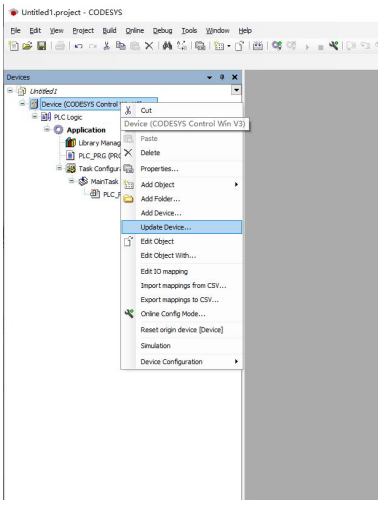


Click"New Project…." to create a new project

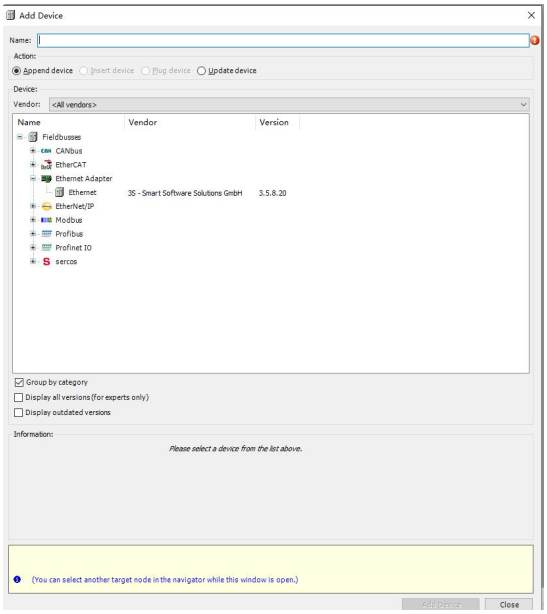


3、Add Ethernet

Click *"Device"* and then *"Add Device"*



Click *“Ethernet Adapter”*

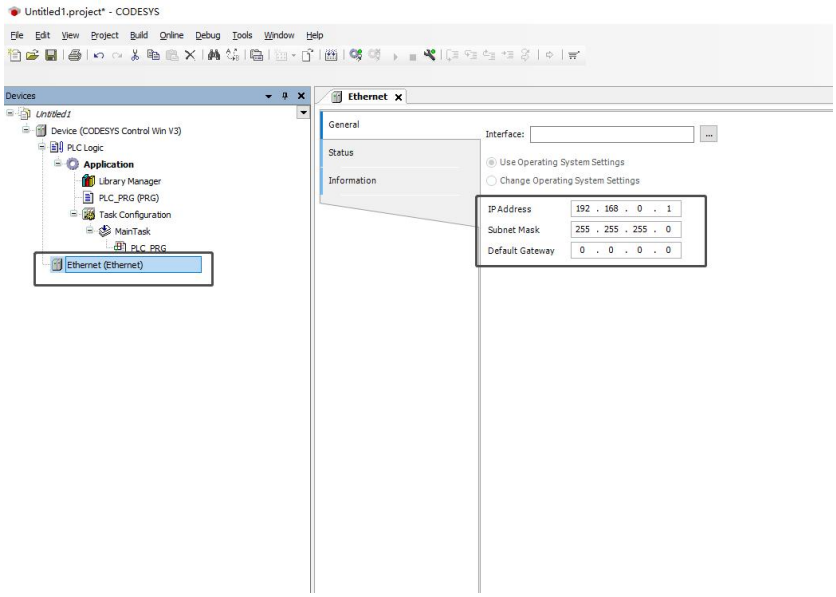


Add *“Ethernet”*

“PAC ” Configuration

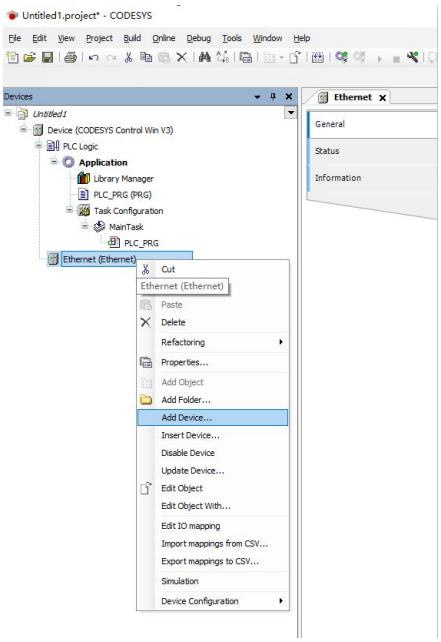
Choose “Ethernet” device and configure network parameters。

Note: The CODESYS master IP needs to be in the same network as the IP of the MT slave module.

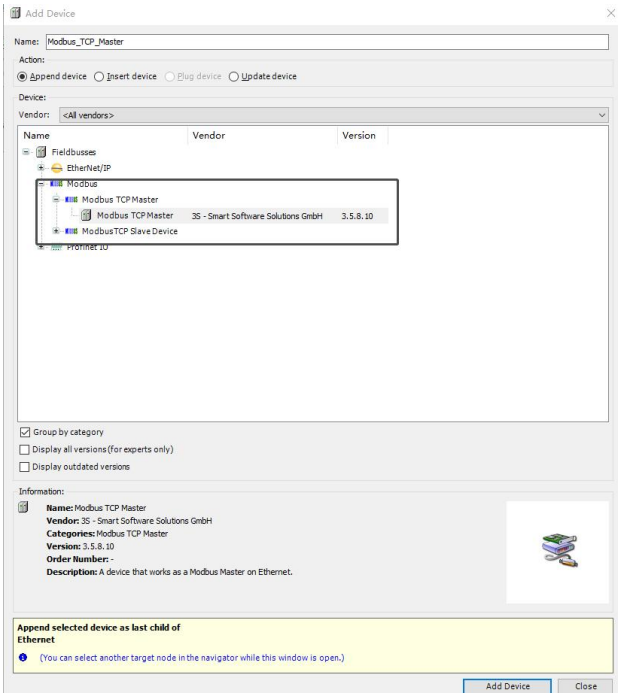


4、Add "Modbus TCP Master"

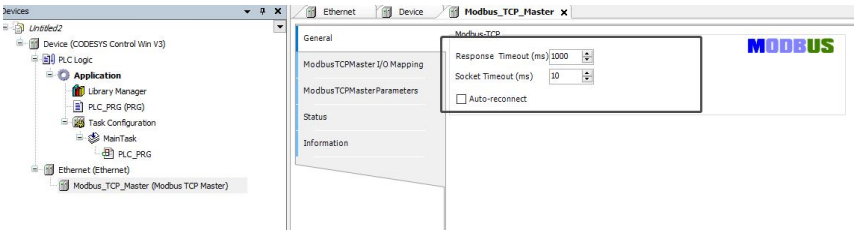
Choose *"Ethernet"* and then choose *"Add Device"*



On *"Add Device"* interface，click *"Modbus TCP Master"* under *"Modbus"*

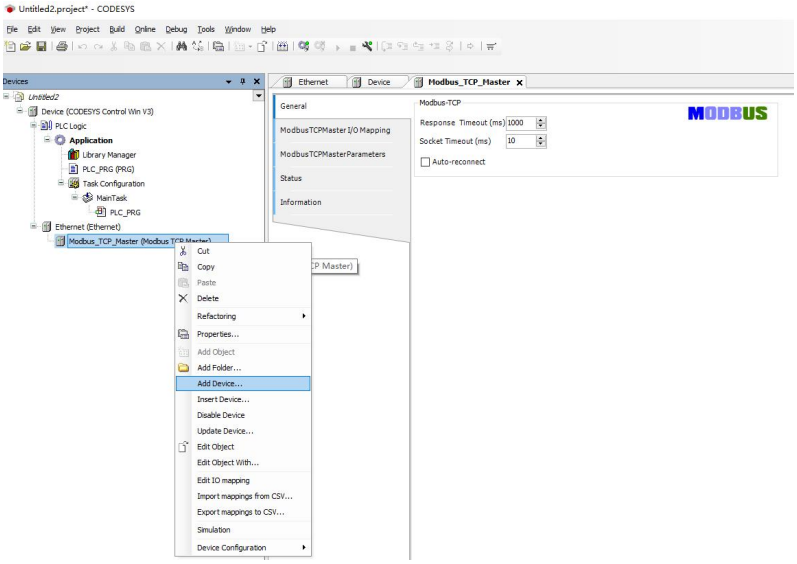


Configure "Modbus TCP Master"

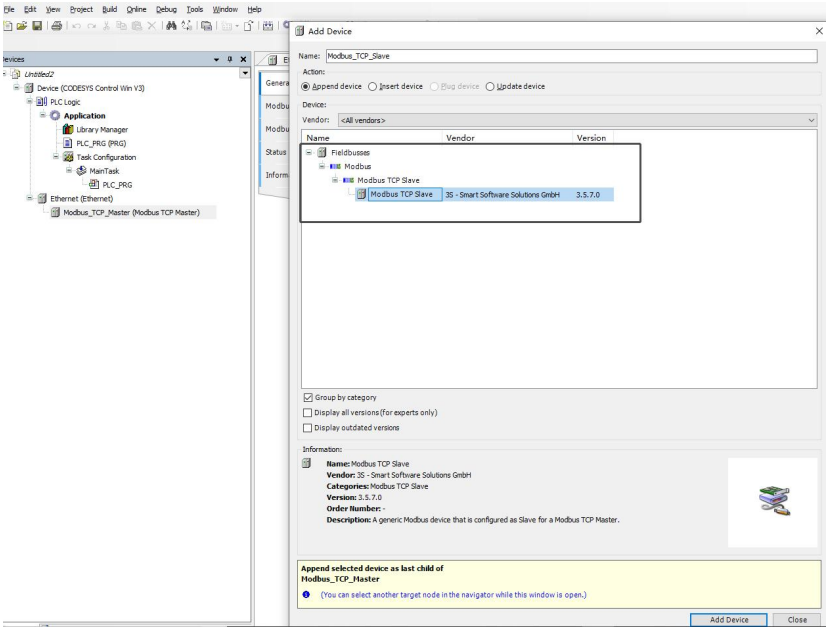


5、Add Device

Click *"Modbus TCP Master"* device and then*"Add Device"*

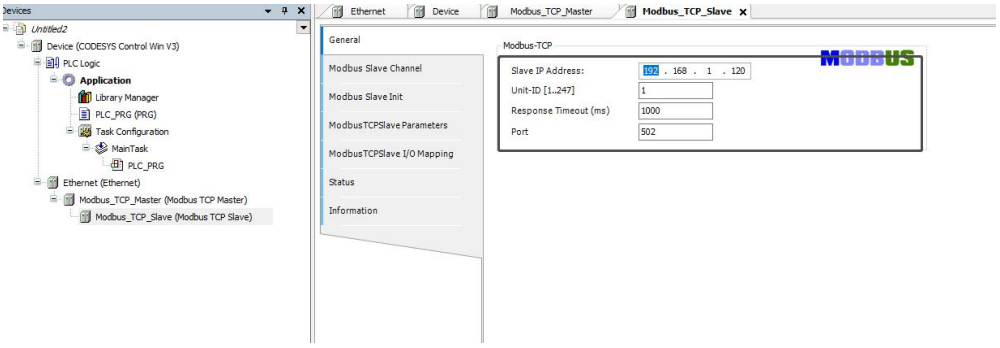


On Add Device interface, click *"Modbus TCP Slave"* under *"Modbus TCP"*



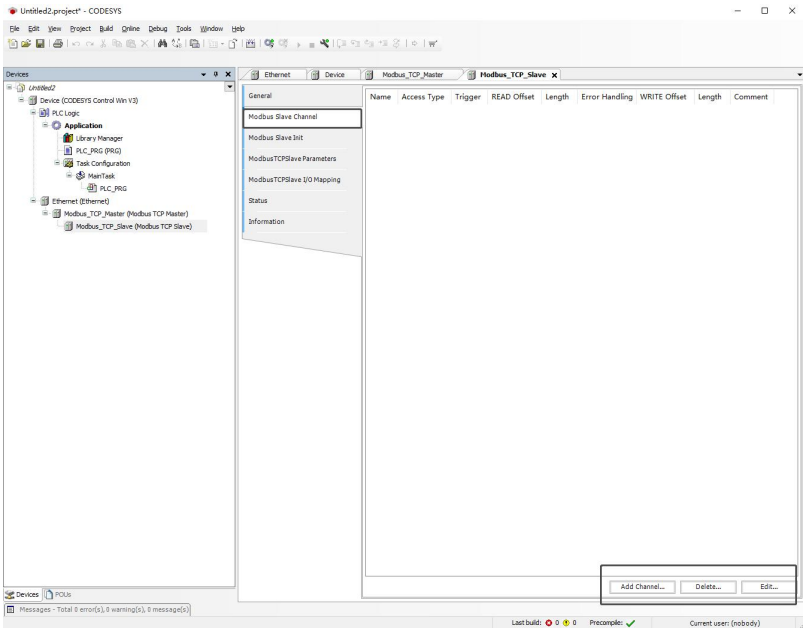
Configure "Modbus TCP Slave"

The IP address of the slave station is "192.168.1.120", ID is set as 1 , response time is "1000", and port number is "502"



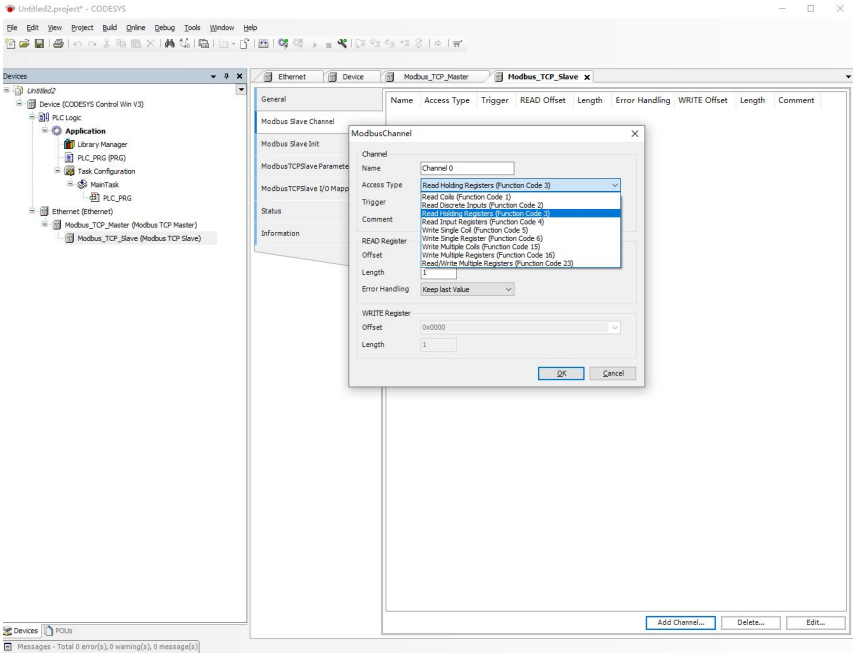
6、Configure IO channel of slave stiation

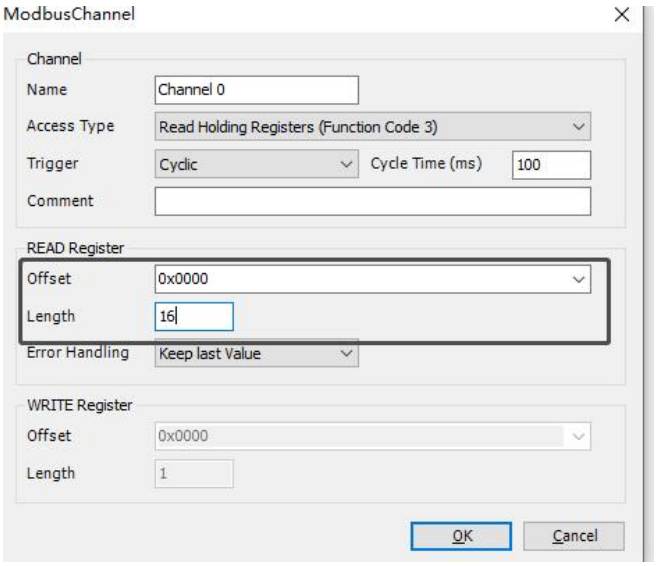
On “Modbus Slave Channel” interface，click *“ADD Channel…”*



Configure input channel：

This configuration used the slave station of “MT4-1616A”，the function code of reading coil is “3”，Offset is “0”，Length is “16”.





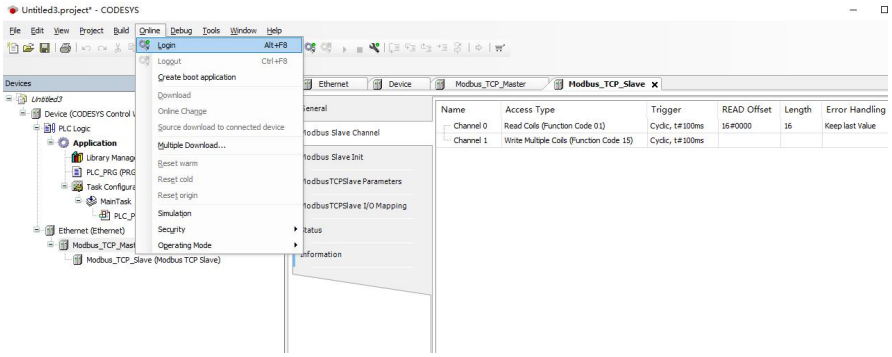
Configure output channel：

The function code for reading MT4-1616A's coil is 15, Offset is "64"，Length is "16".

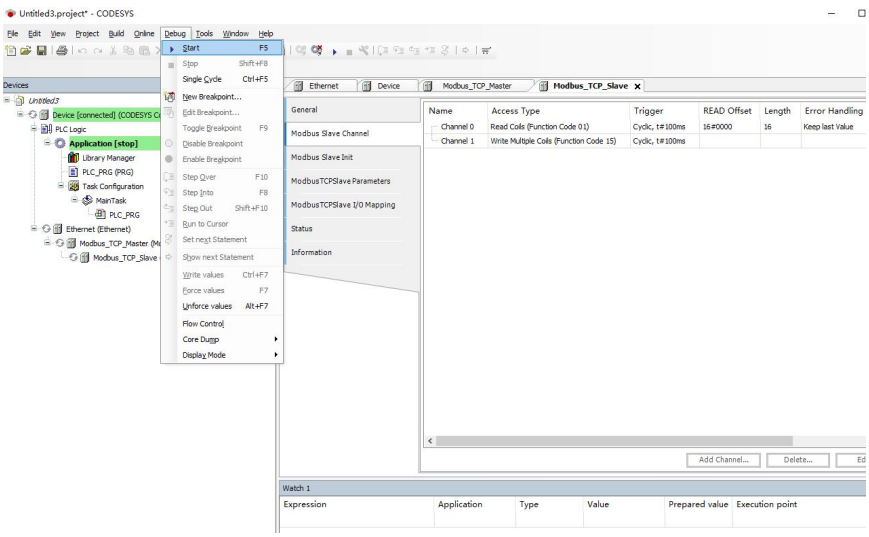
7、Run the master station program

Login PLC

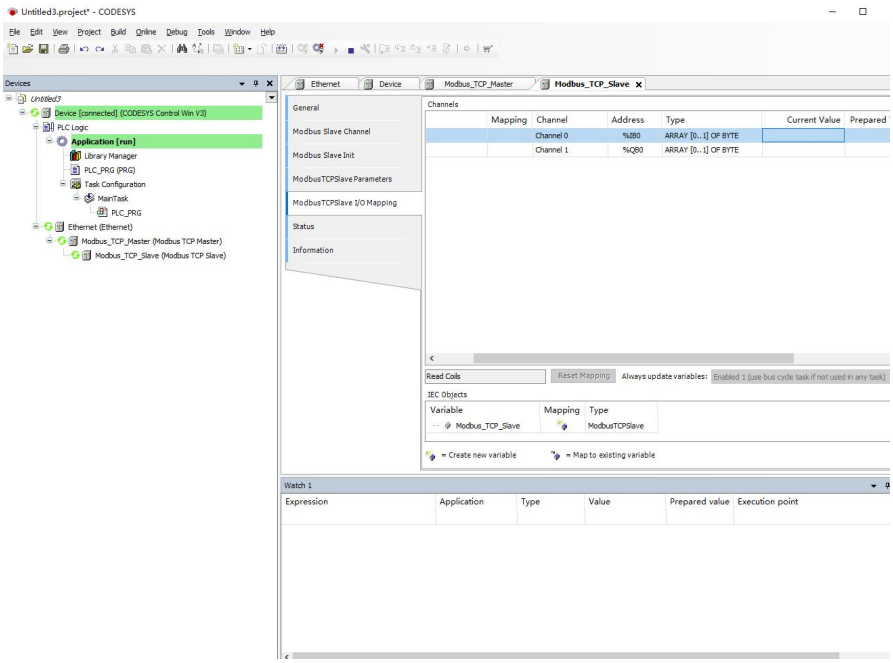
On "Online" menu，click*"Login"*



On "Debug" menu, click *"start"*



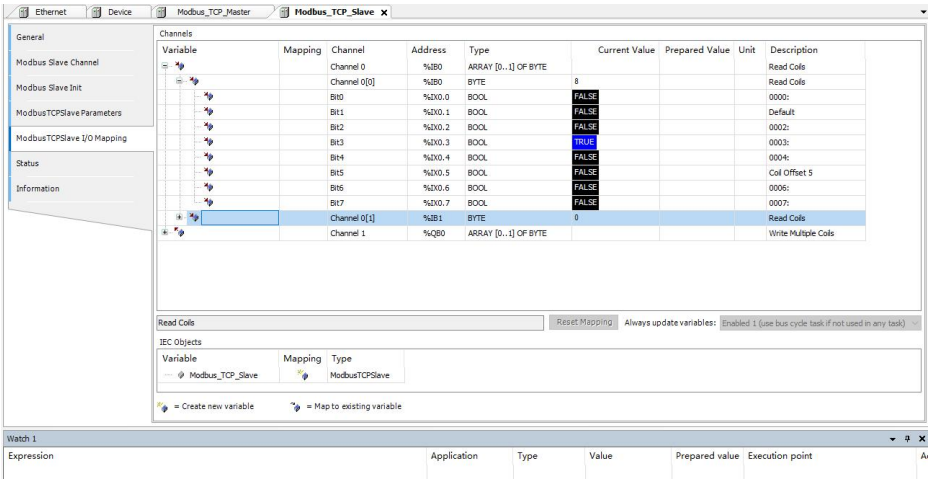
After running, the device directory tree is shown in the following figure:



7.3 Module Testing

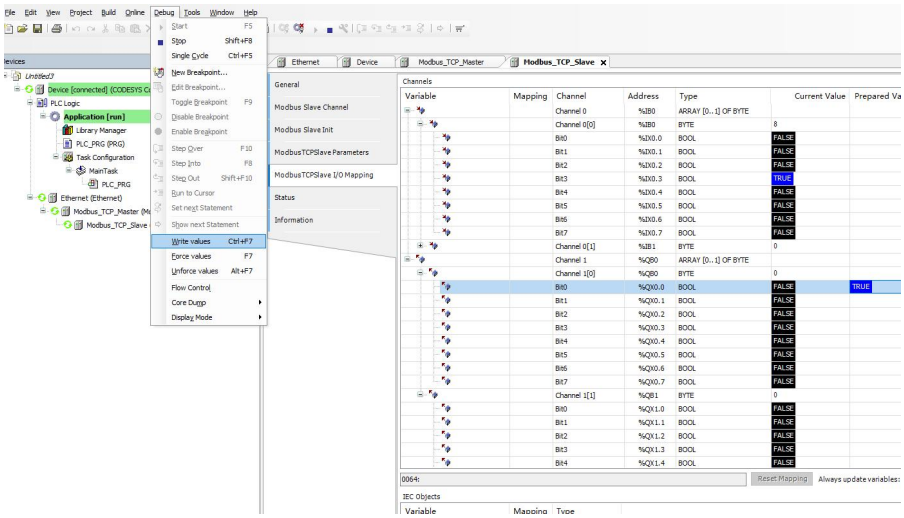
1、 Digital Input Module

On Modbus TCP Slave I/O Mapping, the change of the input value can be observed.



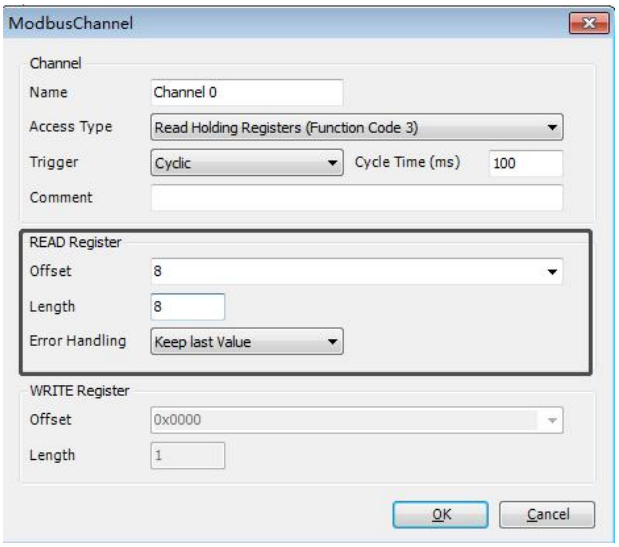
2、 Digital Output Module

On output channel ***"Prepared Value"***, input value "TRUE\FALSE"。On Debug, click ***"Write values"***, the channel will conduct the corresponding output.



3、 Analog Input Module

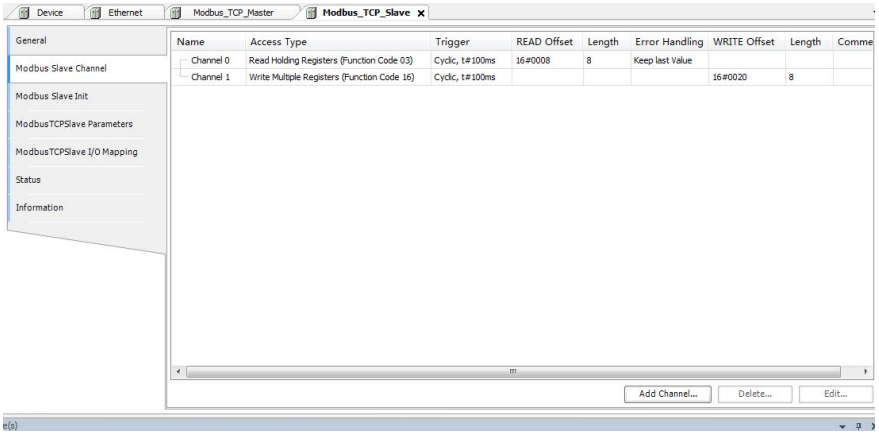
Add channel，the function code of reading registers on analog I/O is 3 ，the starting address of the channel is 8，channel number is 8.



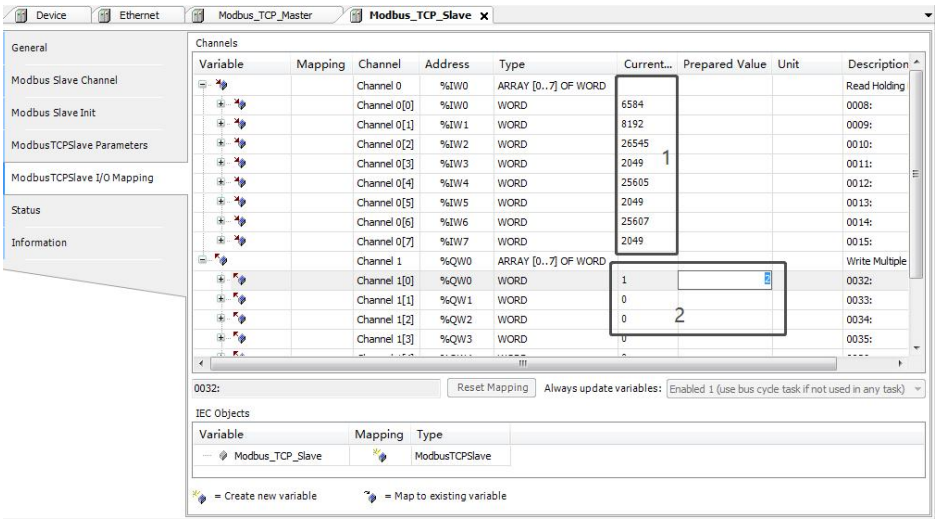
Channel parameter configuration

Add parameters to configure channel，the function code of reading registers on analog I/O is 16，the starting address of the channel is 32，channel number is 8.

Channel configuration completed



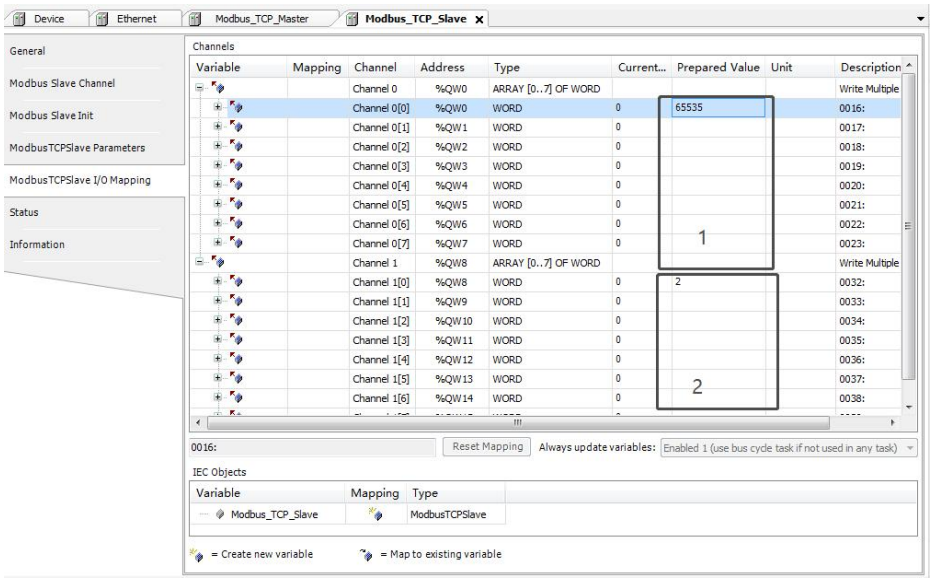
Module Testing



1 Monitor the input value **2 Modify the analog input range**

3 Analog output modules

Refer to the above analog input case, add analog output and parameter configuration channel.



Input value in 1 and measurement range selection in 2