

Modbus RTU/ASCII to Modbus TCP Protocol Converter

ODOT-S2E2

User Manual

V1.9

2021.09.08

ODOT-S2E2



Odor Automation System Co., Ltd.

2014-09

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Version information:

The following changes have been made to the document:

Date	Version number	Modification	Author
2014-09-15	V1.00	Release version	GJ
2014-12-05	V1.10	Modified version	GJ
2015-04-10	V1.20	Modified version	GJ
2016-07-14	V1.30	Modified version	LJP
2017-06-06	V1.5.0	Modified version	LJP
2018-06-01	V1.6.0	Hardware modification	CCL
2019-11-08	V1.7.0	WINCC application IP address modification	CCL
2020-08-10	V1.8.0	Hardware modification	CCL
2020-10-21	V1.8.1	Add firmware upgrade	CCL
2021-09-08	V1.9.0	Modify the diagnosis area	CCL

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Firmware information

1. V1.4 and above firmware versions support IAP upgrade function, and users can upgrade higher versions of firmware by themselves. Firmware can be provided by consulting Odor technician.
2. The firmware version supported by MGCC ConfigV1.7 is V1.9 or above.

Software downloads

Please log in to the www.odor.cn and click Download on the corresponding product page.

Disclaimer of Warranties

Product Usage

NOTE
• WHEN INSTALLING, OPERATING, AND MAINTAINING THE EQUIPMENT, DO NOT EXCEED ANY OF THE RATINGS SPECIFIED IN THE ELECTRICAL CHARACTERISTICS; • WHEN INSTALLING, OPERATING, AND MAINTAINING THE EQUIPMENT, DO NOT EXCEED ANY OF THE RATINGS SPECIFIED IN THE ENVIRONMENTAL CHARACTERISTICS. DO NOT USE THE PRODUCT IN THE FOLLOWING PLACES: PLACES WITH DUST, OIL FUMES, CONDUCTIVE DUST, CORROSIVE GASES, AND FLAMMABLE GASES; DO NOT EXPOSE TO HIGH TEMPERATURES, CONDENSATION, WIND AND RAIN; VIBRATION AND SHOCK WILL ALSO CAUSE DAMAGE TO THE PRODUCT; FAILURE TO FOLLOW THE INSTRUCTIONS MAY RENDER THE PROTECTION PROVIDED BY THE DEVICE NULL AND MAY RESULT IN MINOR BODILY INJURY OR DAMAGE TO THE DEVICE.

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The Company shall not be liable for any damage or malfunction of the equipment caused by:

1. Transportation damage: equipment damage caused by improper transportation or packaging;

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3. Improper use: damage caused by overload, non-standard operation, unauthorized modification or use of unqualified accessories;
4. Unauthorized maintenance: equipment failure caused by unauthorized maintenance or alteration;
5. Other non-product reasons: damage caused by other reasons that have nothing to do with the equipment itself.

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1. For the damage caused by the above reasons, the company will charge the repair fee according to the actual situation.
2. Outside the warranty period, the company provides paid maintenance services, and the cost is charged according to the maintenance situation.

Assumption of Risk

The company shall not be liable for casualties, property damage or other related losses caused by the use of the equipment. All risks are borne by the user.

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1. Product Overview

1.1 Product Functions

This product is a Modbus RTU/ASCII to Modbus TCP protocol converter developed by Sichuan ODOT Automation System Co., Ltd based on market demand and years of experience.

All slave devices that have RS485 interfaces and support Modbus RTU/ASCII can connect to the Modbus TCP network through this gateway and communicate with TCP clients. So as to realize the connection of low-speed serial devices to the high-speed Ethernet to realize high-speed data transmission. The gateway has two different working modes, "Transmission transparent" and "Mapping mode", which can achieve maximum system compatibility.

1.2 Functional Characteristics

- ◆ 19.2-28.8VDC voltage input, anti-reverse connection protection. DC-DC isolated power supply, 3000V isolation voltage.
- ◆ 2KV network port isolation protection, 10M/100Mbps rate adaptive, automatic MDI/MDIX flip.
- ◆ Small size, only 30mm thickness, saving installation space.
- ◆ Support address mapping mode to realize fast response to TCP client request.
- ◆ Support up to 10 TCP client accesses.
- ◆ The mapping mode supports function codes: 0x01, 0x02, 0x03, 0x04, 0x05, 0x06, 0x0F, 0x10.
- ◆ The transparent transmission mode supports all public function codes and custom function codes.
- ◆ 6KB large data buffer area, larger data transfer volume.
- ◆ RS485 dual serial port refreshes in real time, with short scanning period and strong load capacity.
- ◆ The master and slave modes of RTU and ASCII are optional, which is highly adaptable.
- ◆ The watchdog can be enabled and the watchdog time can be set.
- ◆ Support IAP download, it supports for updating the firmware program in the product through the network port.
- ◆ RS485 with surge protection, built-in bias circuit, strong stability. An external terminal resistor is required.
- ◆ The device comes with a powerful diagnostic function to monitor the communication status in real time.
- ◆ Support one-key reset function to restore factory settings.
- ◆ 35mm standard rail mounting.
- ◆ EMC complies with EN 55022:2010 & EN55024:2010 international standards.

1.3 Technical Parameters

The relevant technical parameters of this product are shown in the table below, please use this product within the parameters of this product in order to obtain better performance.

Environmental parameters	
Operating temperature	-40~85℃
Storage temperature	-55~125℃
Operating humidity	5%~95% (No condensation)
Power parameters	
Number of power ports	1
Voltage range	19.2~28.8VDC, 3KV isolation voltage
Power consumption	Max.100mA@24V
Ethernet parameters	
Working mode	Transparent transmission and mapping mode optional, Modbus TCP protocol
Number of Ethernet	2*RJ45, 2KV surge protection, 10M, 100M adaptive rate
Network protocol	ETHERNET, ARP, IP, TCP, ICMP
Number of TCP connections	Max 10
Serial port parameters	
Number of serial port	2*RS485
Serial communication mode	RTU mode and ASCII mode are optional.
Serial terminal resistance	120 Ω external resistance
Baud rate	1200~115200 bps
Validation mode	No check, odd check, even check
Number of slave stations	Maximum 62 (without repeater)
The function code of mapping mode	0x01, 0x02, 0x03, 0x04, 0x05, 0x06, 0x0F, 0x10
Modbus storage area	0xxxx area (coil): 8192 Bit 1xxxx area (discrete input): 8192 Bit 3xxxx area (input register): 2048 Word 4xxxx area (holding register): 2048 Word 3xxxx area (system diagnosis area): 263 Word

2. Hardware description

2.1 Product appearance



2.2 Indicator Description

The equipment has 6 indicators, the symbol and description are show in the table.

Symbol	Definition	State	Description
PWR	Power indicator	ON	The power supply is normal
		OFF	The power supply is abnormal
ETH	Gateway status indicator	ON	The gateway communication is abnormal
		OFF	The gateway communication is normal
TX1	Transmit indicator of serial port1	Flash	Serial port 1 is transmitting data
		OFF	Serial port 1 is not transmitting data
RX1	Receive indicator of serial port1	Flash	Serial port 1 is receiving data
		OFF	Serial port 1 is not receiving data
TX2	Transmit indicator of serial port2	Flash	Serial port 2 is transmitting data
		OFF	Serial port 2 is not transmitting data
RX2	Receive indicator of serial port1	Flash	Serial port 2 is receiving data
		OFF	Serial port 2 is not receiving data

2.3 Terminal definition

The wiring of the device adopts 3Pin and 16Pin 3.81mm pitch pluggable terminal blocks, and the terminals of the RS485 are defined as shown in the following table.

Power terminal definition

No.	Symbol	Definition
1	PE	Protecting Earth
2	V-	24VDC-
3	V+	24VDC+

RS485 terminal definition

No.	Symbol	Definition
1	1B-	Serial port1 RS485-
2	1A+	Serial port1 RS485+
3	SGND	Signal ground
4	PE	Protecting Earth
5	2B-	Serial port2 RS485-
6	2A+	Serial port2 RS485+
7	SGND	Signal ground
8	PE	Protecting Earth
9-16	NC	No connection

2.4 Reset Button



It can use a paper clip to click the reset button, and all indicators flash once to indicate that the reset is successful. The gateway is reset successfully, and the technical parameters of the gateway are as follows:

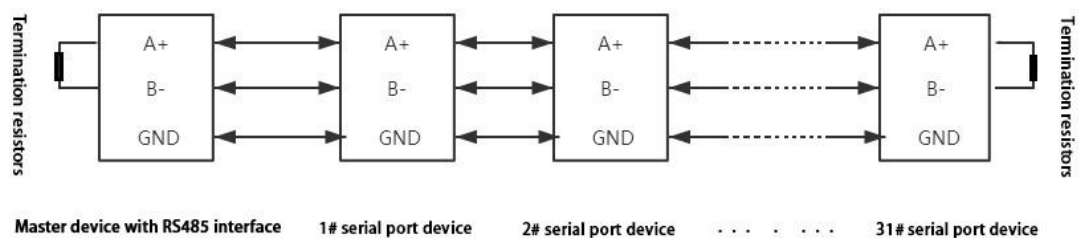
Parameter		Default value
Ethernet	IP address	192.168.1.254
	Subnet mask	255.255.255.0
	Gateway	192.168.1.1
	Modbus TCP port	502
	Download port	1024
	Modbus-TCP watchdog time	30S
	Modbus-TCP watchdog enabled	Enabled
	Gateway working mode	Transmission transparent
	Gateway address	247
Serials	Serial port working mode	Master mode
	Communication protocol	Modbus RTU
	Baud rate	9600bps
	Check	None
	Data bits	8
	Stop bits	1
	Receive delay	3.5t
	Send delay	0
	Timeout processing	Holding
	Slave response timeout	500ms

2.5 External Termination Resistor

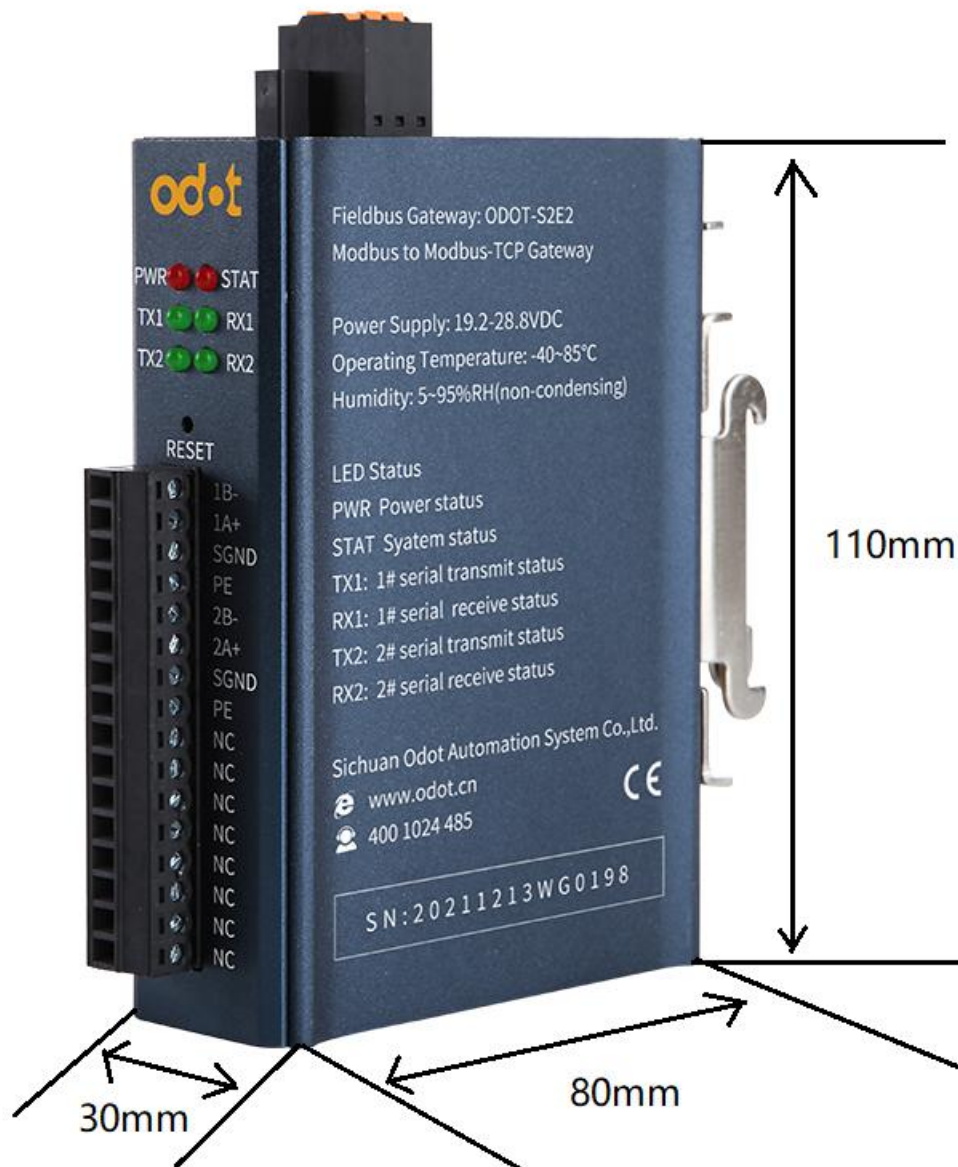
According to the actual situation on site, the serial port of the gateway needs to be connected with an external 120Ω terminal resistor. RS485 supports up to 32 nodes without relay, and the connection mode of "**daisy chain**" is adopted between nodes, and terminal resistance needs to be added at both ends of the communication cable, and its resistance value is required to be approximately equal to the characteristic impedance of the transmission cable. There is no need for a termination resistance for short-distance transmission, that is, generally below 300 meters. The termination resistors are connected at both ends of the transmission cable.

When the gateway is used in the field, if the distance of the RS485 bus in the field is far away, and the field interference is large, it is necessary to add 120Ω termination resistors at both ends of the RS485 bus to prevent the reflection of serial signals.

Note: The 120Ω resistor is attached to the box, please pay attention to check.



2.6 Installation Dimension



3. How to use the gateway

3.1 Introduction to how to use Gateway

3.1.1 Serial port working mode

Each serial port of the gateway has two modes of operation: **master mode and slave mode**.

When the serial port works in master mode, the serial port can connect up to 31 Modbus RTU/ASCII slave devices without trunk. This mode is mainly used for data communication between the Modbus TCP master and the Modbus RTU/ASCII slave.

When the serial port works in slave mode, the serial port can be connected to one Modbus RTU/ASCII master device; This mode can be used in the following applications:

- (1) Realize the data communication between the Modbus TCP client and the Modbus RTU/ASCII master;
- (2) Realize data communication between Modbus RTU/ASCII masters;
- (3) realize that the Modbus TCP client and the Modbus RTU/ASCII master station communicate with a Modbus RTU/ASCII slave station at the same time;

3.1.2 Gateway working mode

The gateway has two working modes of "transparent transmission" and "mapping", and the "transparent transmission" mode is set as default. In the "transparent transmission" mode, there is no data cache, no need to edit the slave address mapping table, the gateway directly delivers the command to the Modbus RTU/ASCII slave device after receiving the instructions of the Modbus TCP client, and waits for the response of the slave device, and then directly returns the data to the TCP client after the slave device responds. In the "mapping" mode, the slave address mapping table needs to be edited, and the gateway polls each slave after powering on, and stores the

data in the data buffer, and the gateway directly reads the data from the data buffer after receiving the instructions of the Modbus TCP client, and then returns it to the TCP client. This greatly reduces the wait time for the client to access the slave and increases the refresh rate.

3.1.3 Gateway data storage area

The data storage is divided into five parts, the first part is the "coil" (DO) storage area with a total of 8192 points. The second part is the "discrete input" (DI) storage area with 8192 points in total. The third part is the "input register" (AI) storage area, with a total of 2048 words. The fourth part is the "holding register" (AO) storage area with a total of 2048 words, and the fifth part is the "system diagnosis" storage area, which stores the working status of the slave device, with a total of 263 words. Visit the "system diagnostic area" to obtain slave station information, which can be used to set slave station disconnection alarms and other functions. The data storage area allocation and address coding range are shown in the table.

No.	Storage category	Description	Storage capacity	Address range
1	0xxxx	coil	8192 Bits	0x0000~0x1FFF
2	1xxxx	Discrete input	8192 Bits	0x0000~0x1FFF
3	3xxxx	Input register	2048 Words	0x0000~0x07FF
4	4xxxx	Holding register	2048 Words	0x0000~0x07FF
5	3xxxx	System diagnosis	263 Words	0x2000~0x2106

3.1.4 System diagnosis area

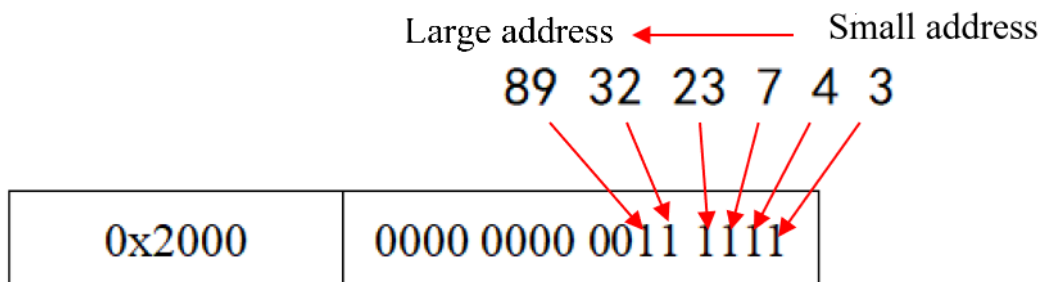
The system diagnosis is divided into two parts: the first part: address 0x2000-0x2003 consists of 4 words, which are "slave error indication area", and 0x2000-0x2001 are the 31 slave error indication areas under the COM1 interface.

0x2002-0x2003 are the 31 slave error indication areas under the COM2 interface.

When there is an error in slave communication, the corresponding slave bits are set to 1 according to the address size of the slave device configured in the configuration software. When the slave returns to normal, the corresponding error indicator will be automatically cleared. The data encoding format is shown in table.

Serial port	Modbus address	Data (binary display)	Remark
COM1	0x2000	0000 0000 0000 0000	The diagnostic display is sorted from smallest to largest according to the size of the configured slave device address. (Not sorted by station address)
	0x2001	0000 0000 0000 0000	
COM2	0x2002	0000 0000 0000 0000	
	0x2003	0000 0000 0000 0000	

For example, if the COM1 interface is configured with six slaves 32, 3, 4, 7, 23, and 89, which are valid at the lower 6 bits of the 0x2000 address, if all 6 stations report an error, the corresponding diagnostic area values are:



Part 2: Address 0x200F-0x208A a total of 124 Words, which is the "Slave Status Indication" area, 0x200F-0x204C (62 words) is the slave address and error code display of the COM1, 0x204D-0x208A (62 words) is the slave address and error code display of the COM2.

Reading this area can obtain the station address and the current working state of the corresponding serial port of the slave, and its data encoding format is shown in the

table.

Modbus address (hexadecimal)	Modbus address (decimal)	High bytes	Low bytes	Remark
0x200F	8207	Byte1	Byte0	The 01 is COM1, it can display the slave ID and error code of COM1
		01	Slave ID	
0x2010	8208	Byte1	Byte0	
		Function code	Error code	
...	...	...	...	
0x204B	8267	Byte1	Byte0	
		01	Slave ID	
0x204C	8268	Byte1	Byte0	
		Function code	Error code	
0x204D	8269	Byte1	Byte0	The 02 is COM2, it can display the slave ID and error code of COM2
		02	Slave ID	
0x204E	8270	Byte1	Byte0	
		Function code	Error code	
...	...	...	...	
0x2089	8329	Byte1	Byte0	
		02	Slave ID	
0x208A	8330	Byte1	Byte0	
		Function code	Error code	

Each slave diagnostic area has 2 Word addresses displayed, which are divided into two bytes, high and low.

In the first word, Byte1 is a high byte, indicating the serial number mounted. Byte0 is a low byte and indicates the address of the slave.

In the latter word, Byte1 is a high byte that indicates the function code mapped to the slave that is currently executed. Byte0 is a low byte that indicates the error code of the current slave communication. The specific meaning of the slave error code is shown in the table.

Error codes	Fault description	Troubleshooting methods
0x00	works normally	None
0x01	Illegal function code	The device does not support the current function code, please refer to the slave station manual to select the corresponding function code module
0x02	Illegal data address	The device data exceeds its address range, refer to the slave station manual to modify the data start address or data length
0x03	Illegal data value	Data length error, the data length exceeds the maximum allowable value of 125 (Word) or 2000 (Bit), modify the length
0x04	Data processing error	Check whether the data value range meets the requirements of the slave
0x05	The length of the application layer does not match	Increase the receiving character interval and check the communication parameter settings
0x06	Protocol ID error	Check the sender message
0x07	Cache address error	Device internal error
0x08	Bit offset error	Device internal error
0x09	Slave station ID number does not match	Increase the timeout time, check the hardware connection status, and check the communication parameter settings
0x0A	CRC error	CRC error, check the communication line
0x0B	LRC error	LRC error, check the communication line
0x0C	Response function code does not match	Check hardware connection status
0x0D	Response address does not match	Check hardware connection status
0x0E	Response data length does not match	Check hardware connection status
0x0F	Communication timeout	Increase the timeout time, check the hardware connection status, and check the communication parameter settings
0x10	ASCII mode start character error	‘.’ colon start character error
0x11	ASCII mode terminator error	CR/LF carriage return and line feed terminator error
0x12	Non-character data in ASCII mode	The data contains non-hexadecimal ASCII codes

0x13	The number of characters in ASCII mode is wrong	The response length of the slave is wrong
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3.2 Default parameters

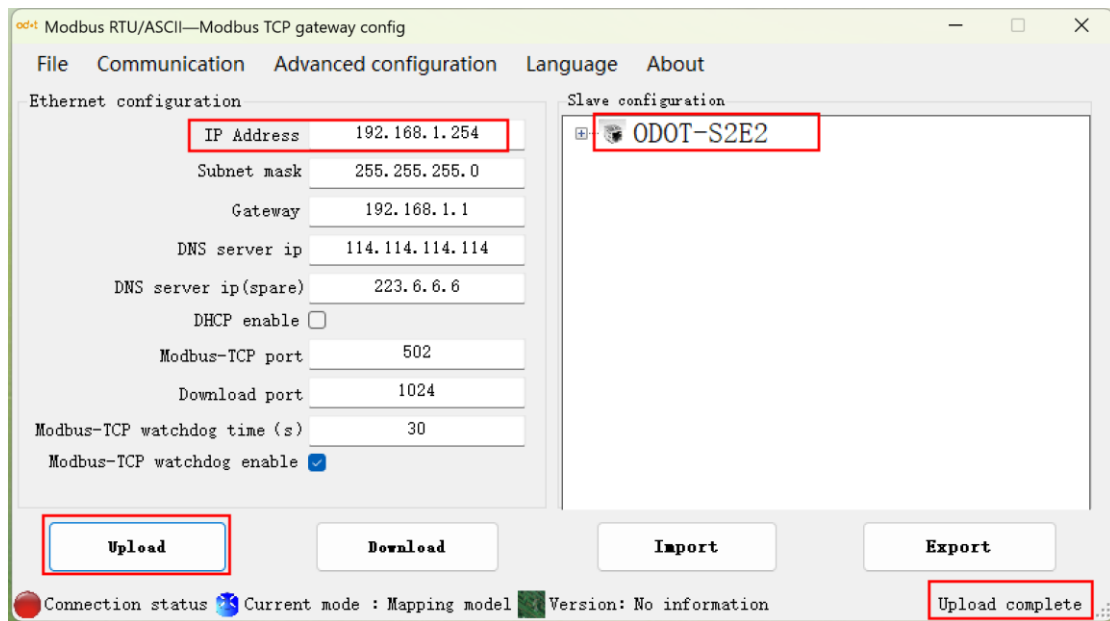
The default configuration of the gateway is as follows:

Parameters		Default value
Ethernet	IP address	192.168.1.254
	Subnet mask	255.255.255.0
	Gateway	192.168.1.1
	Modbus TCP port	502
	Download port	1024
	Modbus TCP watchdog time	30S
	Modbus TCP watchdog enabled	Enabled
	Gateway working mode	Transmission transparent
	Gateway address	247
Serial port	Serial port working mode	Master mode
	Communication protocol	Modbus RTU
	Baud rate	9600bps
	Check	None
	Data bits	8位
	Stop bits	1位
	Receive delay	3.5t
	Send delay	0
	Timeout mode	Holding
	Slave response timeout	500ms

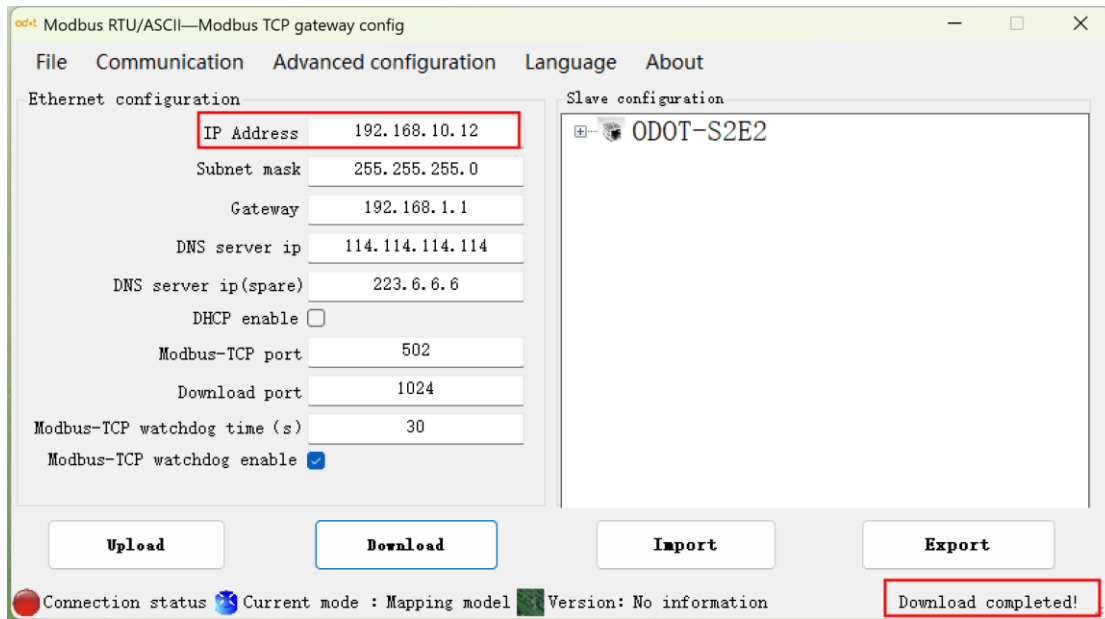
Note: The gateway is set to work in transparent transmission mode, which can be used without configuration, and all request data of the TCP client is sent to serial port 1. To configure the parameters of the gateway, please use the software "MGCC Config" to configure, the software installation package is located in the included CD, or call Odor Automation System Co., Ltd. hotline: 400-10024-485.

3.3 Modify the IP address

First supply 24VDC to the gateway, connect the gateway and the computer with a network cable, change the IP address of the computer's local network card to 192.168.1.* network segment, and then open the configuration software MGCC Config, click to upload the gateway configuration, and ensure normal communication with the gateway (the gateway configuration can be uploaded and downloaded normally).



Modify the gateway IP address of the configuration software interface to: 192.168.10.12 (cross-network segment), and change the LAN gateway IP to: 192.168.10.1, after the modification is completed, click to download the gateway configuration, a warning box will pop up to determine whether to modify the IP address, click OK, and it can see that the download is successful in the lower right corner.



After the IP address is successfully modified, it needs to change the IP address of the local computer to 192.168.10.*.

On the MGCC Config page, click Upload. After the upload is successful, it can see that the upload is successful in the lower right corner.

Modbus RTU/ASCII—Modbus TCP gateway config

File Communication Advanced configuration Language About

Ethernet configuration

IP Address	192.168.10.12
Subnet mask	255.255.255.0
Gateway	192.168.1.1
DNS server ip	114.114.114.114
DNS server ip(spare)	223.6.6.6
DHCP enable	☐
Modbus-TCP port	502
Download port	1024
Modbus-TCP watchdog time (s)	30
Modbus-TCP watchdog enable	☒

Slave configuration

ODOT-S2E2

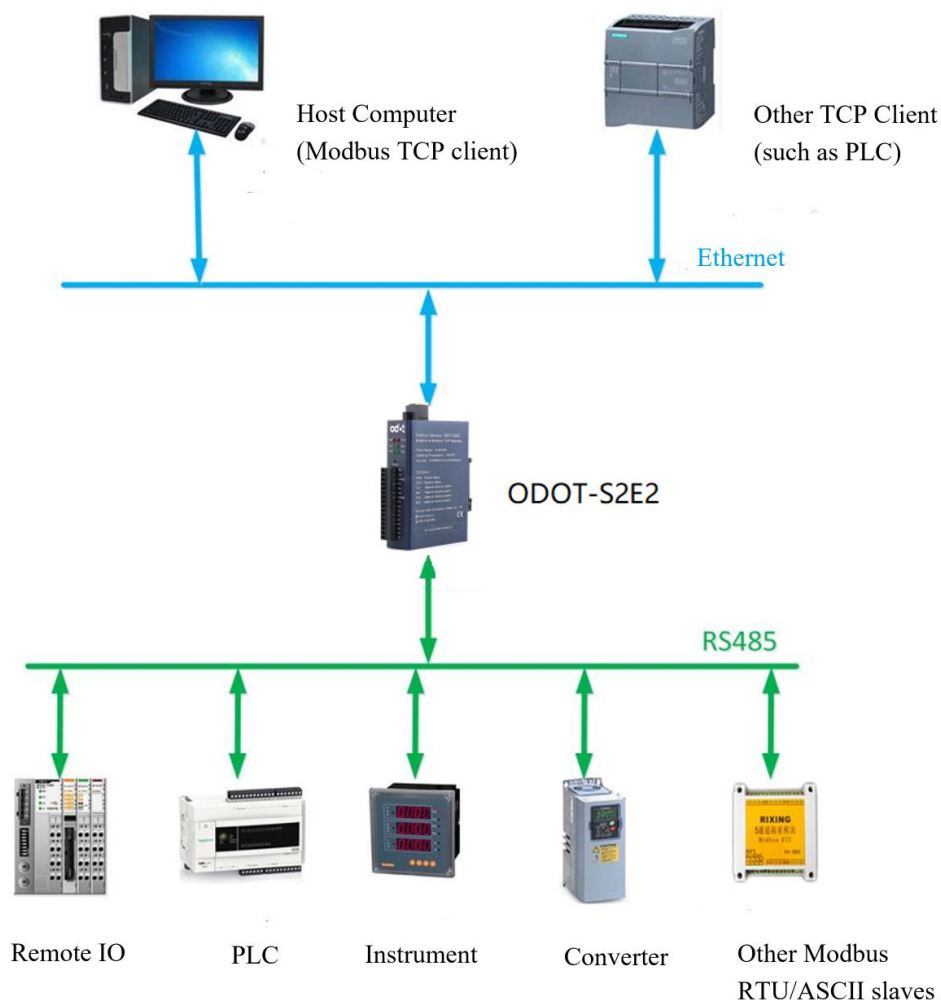
Upload Download Import Export

Connection status Current mode : Mapping model Version: No information Upload complete

3.4 Description of Typical Applications

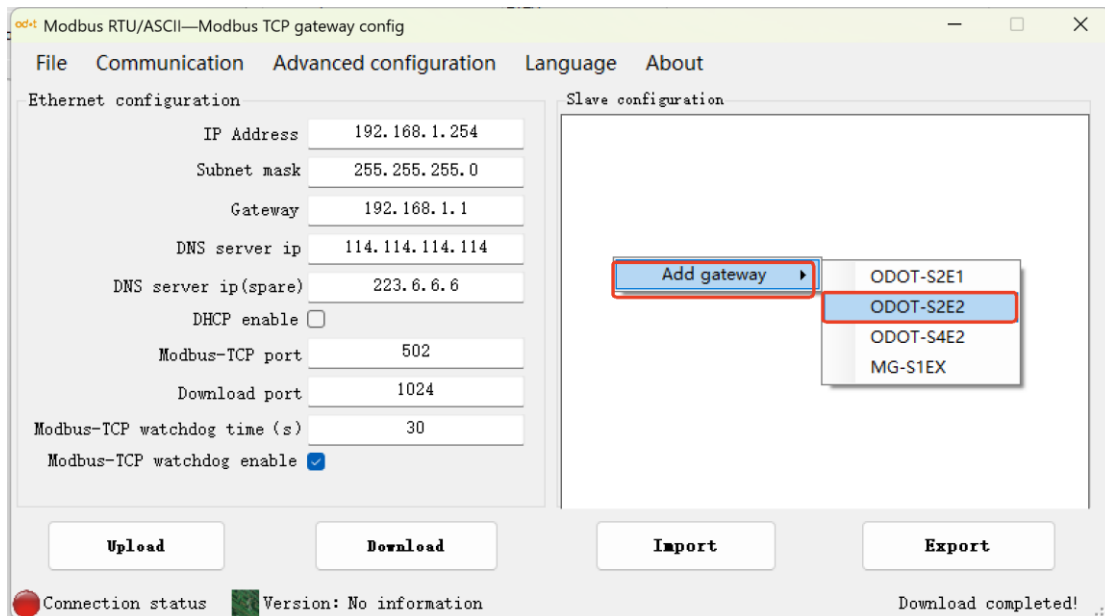
3.4.1 Communicate between Modbus TCP client and Modbus RTU/ASCII slave

Application topology

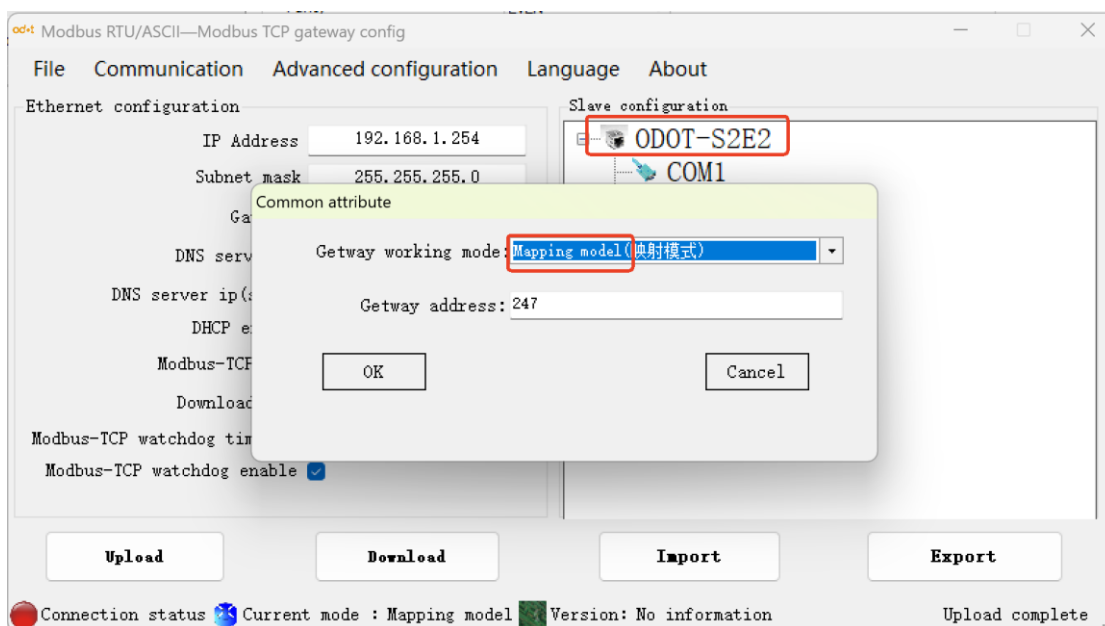


Transmission transparent

First open the configuration software “MGCC Config”, right-click on the slave configuration page, select Add gateway, and add ODOT-S2E2.



Double click the “ODOT-S2E2”, or right click “ODOT-S2E2”, select the “Common attribute”, in the pop-up interface, set the gateway working mode to mapping mode.



Double click the “COM1” or “COM2”, or right click the “COM1” and “COM2”, in the COM configuration interface, set the communication parameters, then click the

OK to save and exit.

The meaning of each parameter is as follows:

Working Mode:

It is used to set whether the gateway is used as a master or slave in the network connected to the serial port, and the default is the master mode, which is set to the master mode.

Communication protocol:

Used to set the type of protocol used by the gateway to communicate with other devices in the network connected to the serial port, Modbus RTU/ASCII is optional, please set this parameter to be consistent with the device connected to the serial port.

Baud rate:

The baud rate of the serial port is 1200~115200bps, the default is 9600bps, please set this parameter to be consistent with the device connected to the serial port.

Check:

It can choose none, odd, even, none by default, please set this parameter to be consistent with the device connected to the serial port.

Stop bits:

1-bit and 2-bit stop bits, and the default 1-bit stop bit. Please set this parameter to be consistent with the device connected to the serial port.

Receive delay:

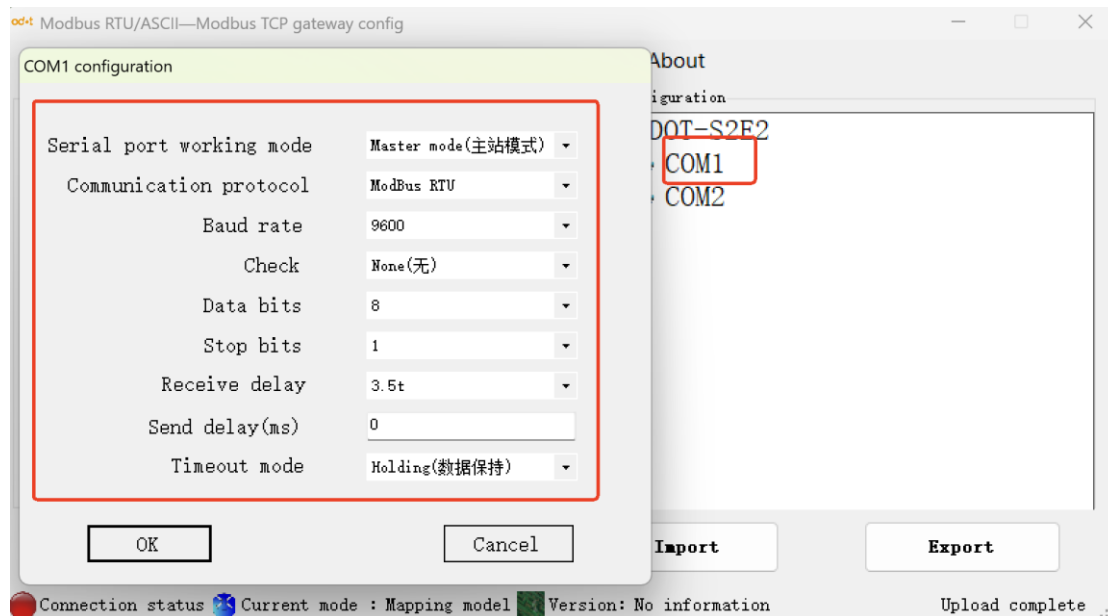
The frame interval detection time when receiving packets is 1.5t~200t, and the default is 3.5t(t is the time for a single character to be transmitted, which is related to the baud rate).

Send delay:

The interval between receiving the slave response packet and sending the next command can be set from 0ms to 65535ms, the default is 0ms, and it is recommended to set 100ms to prevent the connected device from responding too slowly and causing communication failures.

Timeout mode:

If the slave response times out, it can select Clearing or Holding if the slave response times out. The default " Holding " mode, this parameter is only valid for Modbus read commands, please set this value according to actual needs.



Select the “COM1” or “COM2”, right click to add slave, set the slave address and slave response timeout time, click OK to return. The slave ID should not be same, the slave ID can be set 1-247, and the slave name can not be same. The response timeout time needs to be obtained from the manual of device, it is recommended to set it to 500ms or more, click OK.

Slave address mapping table of "COM1_1#"

Slave name: Slave address(1-247):

	Function code	Slave register start address	Number of data	Gateway register start address	Slave response timeout time (ms)	When data changes the command is valid
▶	03 (4x) Read Hold...	0	10	0	500	☒
*					500	☐

Save Close

Configure the parameters in the Ethernet configuration, the meaning of the parameter is as follows:

IP address: the IP address of the device;

Subnet mask: the subnet mask of the device;

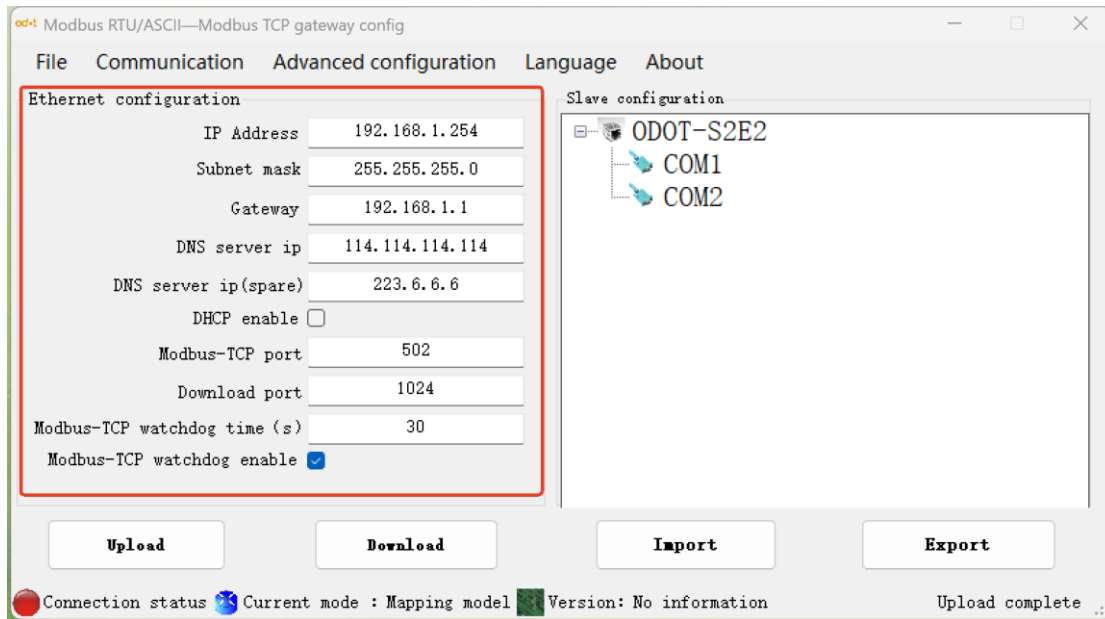
Gateway: the gateway IP address of the network where the device;

Modbus TCP port: generally 502;

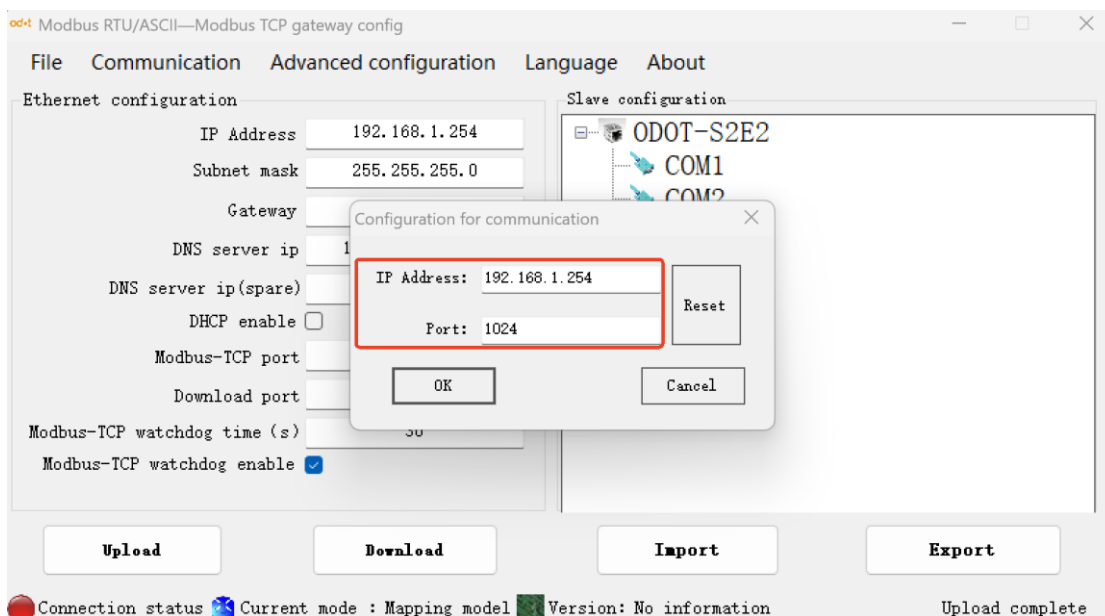
Download port: the configuration software downloads the configuration to the device through the port of the device;

Modbus TCP watchdog time: the time interval between the time the gateway receives the last Modbus TCP packet and the time when the gateway performs an automatic restart. Note: The gateway automatically restarts to release connection resources that have not been used for a long time in a timely manner.

Modbus TCP watchdog enable: whether to enable the watchdog function.

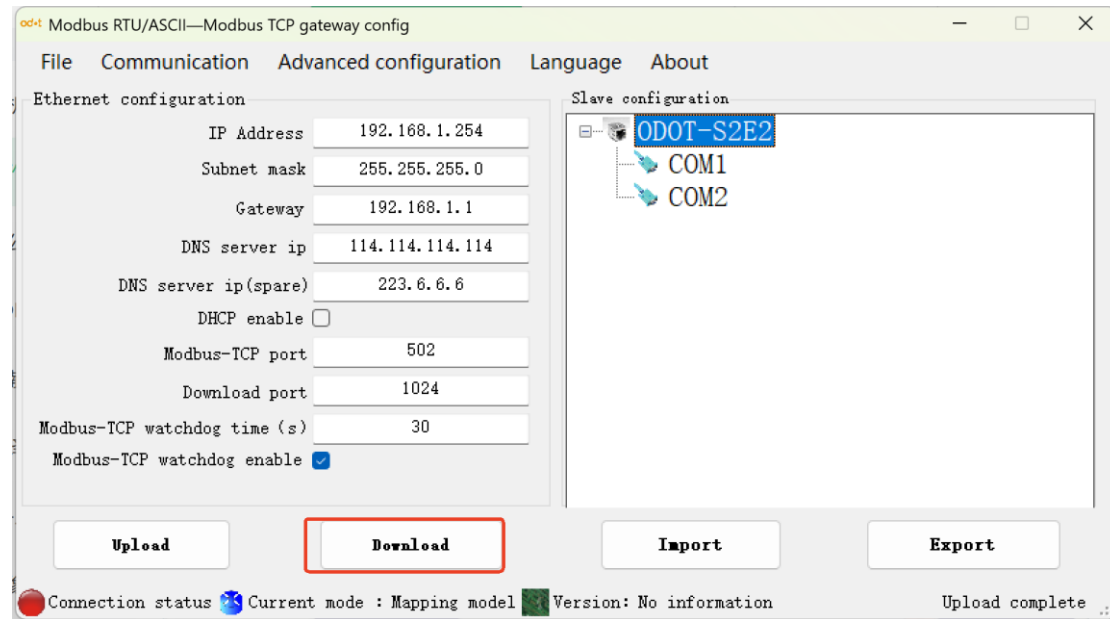


Click the communication—configure communication channel, set the IP address and port, the default IP address is 192.168.1.254 and the default port number is 1024.



Click the "Download" button to download the configuration parameters to the gateway. After the download is successful, the "download successful" prompt is displayed in the lower right corner of the status bar. After the download is successful, the gateway automatically restarts and enters the running state. If the download fails, please check whether the computer IP address and the gateway IP address are in the same network segment, and whether the gateway IP address is set correctly, if forget

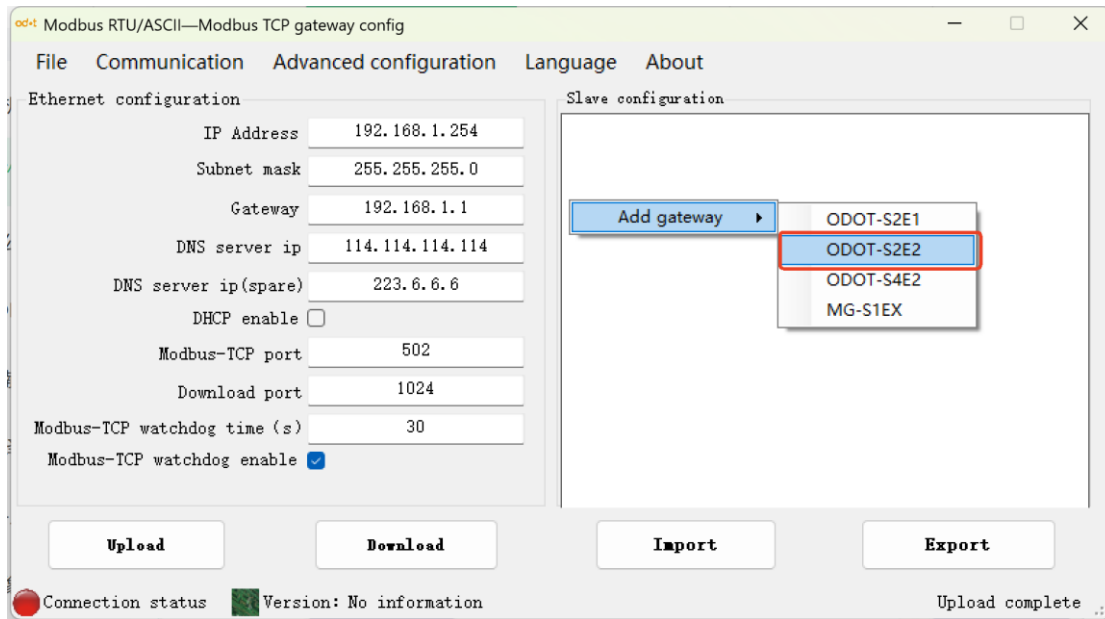
the gateway IP address, it can reset the gateway through the reset button, and the gateway IP address after reset It is the default IP address. Click "Import a Configuration File" and "Export the Configuration File" to import and save configuration files to the local disk. Click "Upload" to upload the current configuration of the gateway to the software. **Note: When downloading and uploading, ensure that the computer and the gateway are in the same network segment.**



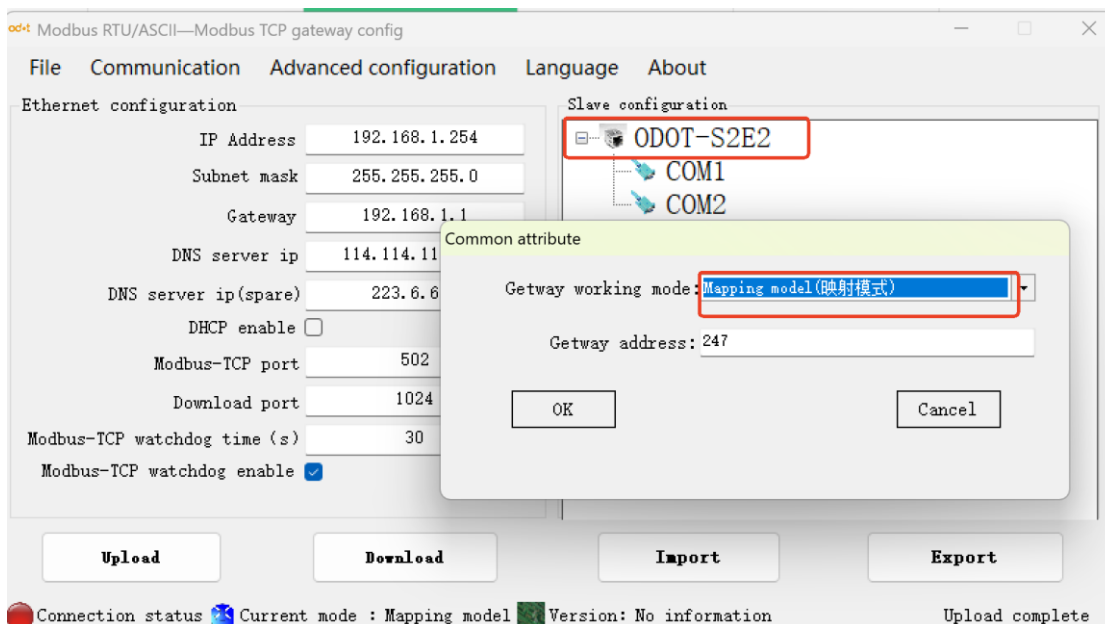
After completing the above settings, the Modbus TCP client can use the Modbus TCP protocol to access the slave device 16DI which the station number is 1 though the gateway IP address 192.168.1.254, the Modbus data communication port 502 and the slave station number 1.

The configuration of mapping mode

Open the configuration software " MGCC Config". Right-click on the configuration page of slave station and select "Add Device", then add "ODOT-S2E2".



Double-click "ODOT-S2E2", or right-click "ODOT-S2E2". Select "Common attribute". Set the gateway working mode to "Mapping Mode" in the popup setting page.



Double-click "COM1" or "COM2" or right-click "COM1" or "COM2" and click "Configure Port". The "COM1 configuration" window will pop up. After setting the communication parameters, click the "OK" button to save and return.

The meaning of each parameter is as follows:

Working Mode:

It is used to set whether the gateway is used as a master or slave in the network connected to the serial port, and the default is the master mode, which is set to the master mode.

Communication protocol:

Used to set the type of protocol used by the gateway to communicate with other devices in the network connected to the serial port, Modbus RTU/ASCII is optional, please set this parameter to be consistent with the device connected to the serial port.

Baud rate:

The baud rate of the serial port is 1200~115200bps, the default is 9600bps, please set this parameter to be consistent with the device connected to the serial port.

Check:

It can choose none, odd, even, none by default, please set this parameter to be consistent with the device connected to the serial port.

Stop bits:

1-bit and 2-bit stop bits, and the default 1-bit stop bit. Please set this parameter to be consistent with the device connected to the serial port.

Receive delay:

The frame interval detection time when receiving packets is $1.5t \sim 200t$, and the default is $3.5t$ (t is the time for a single character to be transmitted, which is related to the baud rate).

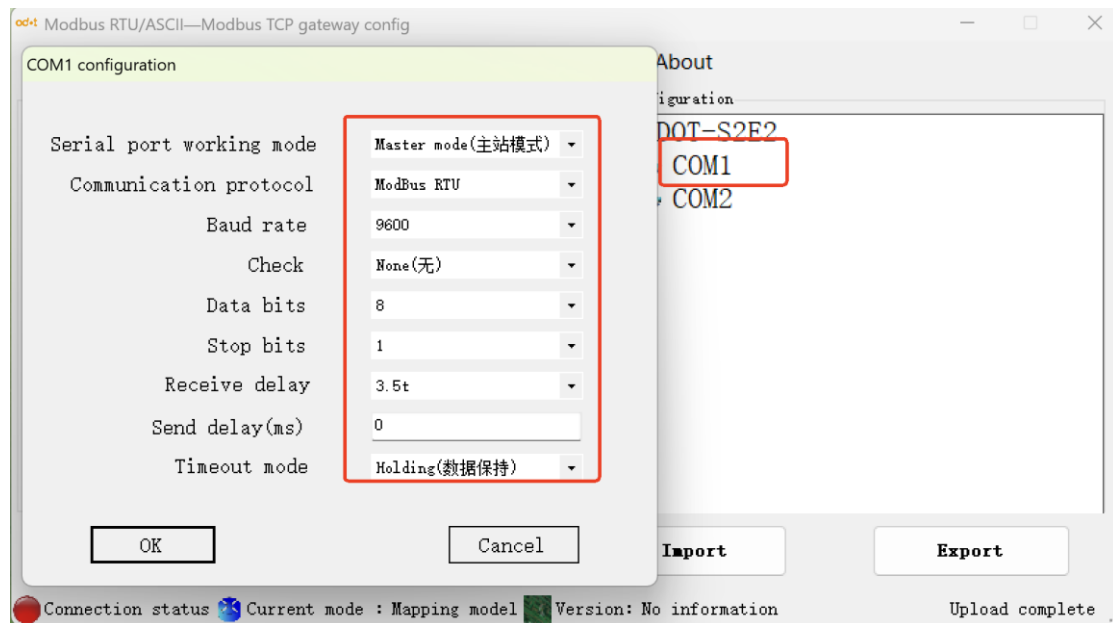
Send delay:

The interval between receiving the slave response packet and sending the next command can be set from 0ms to 65535ms, the default is 0ms, and it is recommended to set 100ms to prevent the connected device from responding too slowly and causing communication failures.

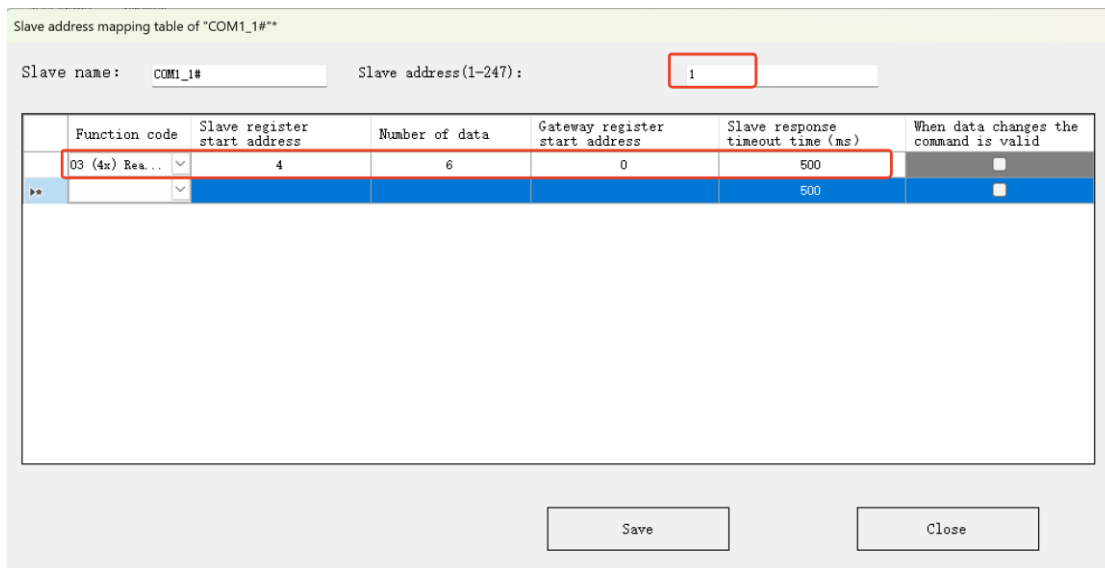
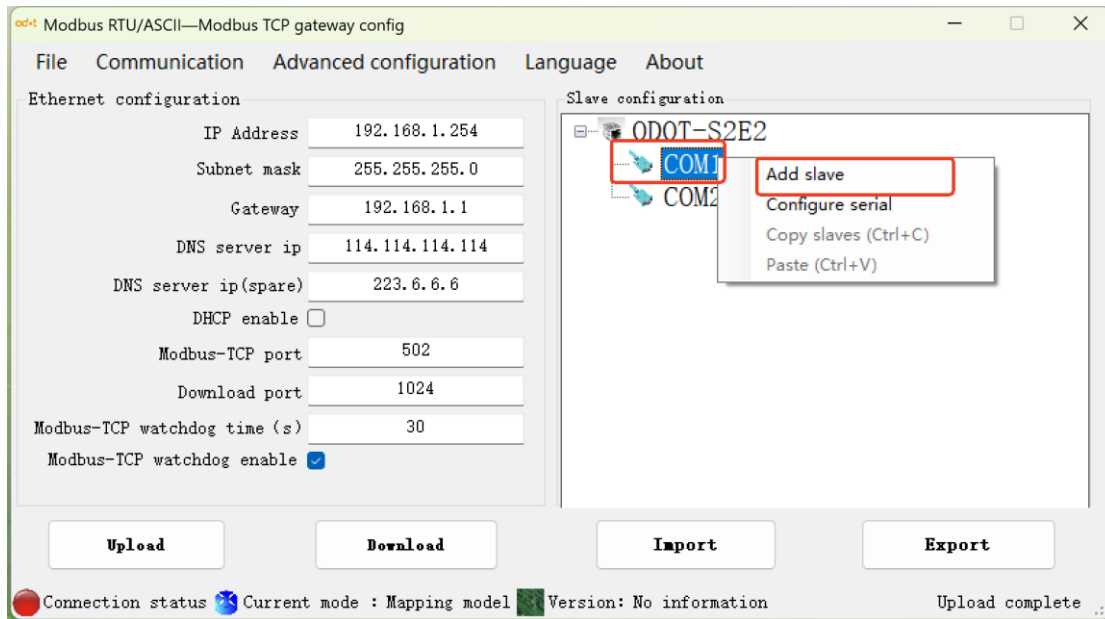
Timeout mode:

If the slave response times out, it can select Clearing or Holding if the slave response times out. The default " Holding " mode, this parameter is only valid for Modbus read

commands, please set this value according to actual needs.



Select "COM1" or "COM2", right-click to select Add Slave, enter "Slave Name", fill in "Slave Station Number", configure Modbus function code and slave data according to the communication manual of the slave device The starting address, the number of data, the starting address of the gateway mapping area, the response timeout time, and whether the number changes will be sent. The station number of the slave station under the same serial port cannot be the same or the same as the station number of the device, and the slave station address range is between 1-247. The slave station name under the same serial port cannot be the same. When a change occurs, the gateway executes this command once, and this parameter is only valid for write commands. After completing the settings, click "Save the current mapping table editing".



Configure the parameters in the Ethernet configuration, the meaning of the parameter is as follows:

IP address: the IP address of the device;

Subnet mask: the subnet mask of the device;

Gateway: the gateway IP address of the network where the device;

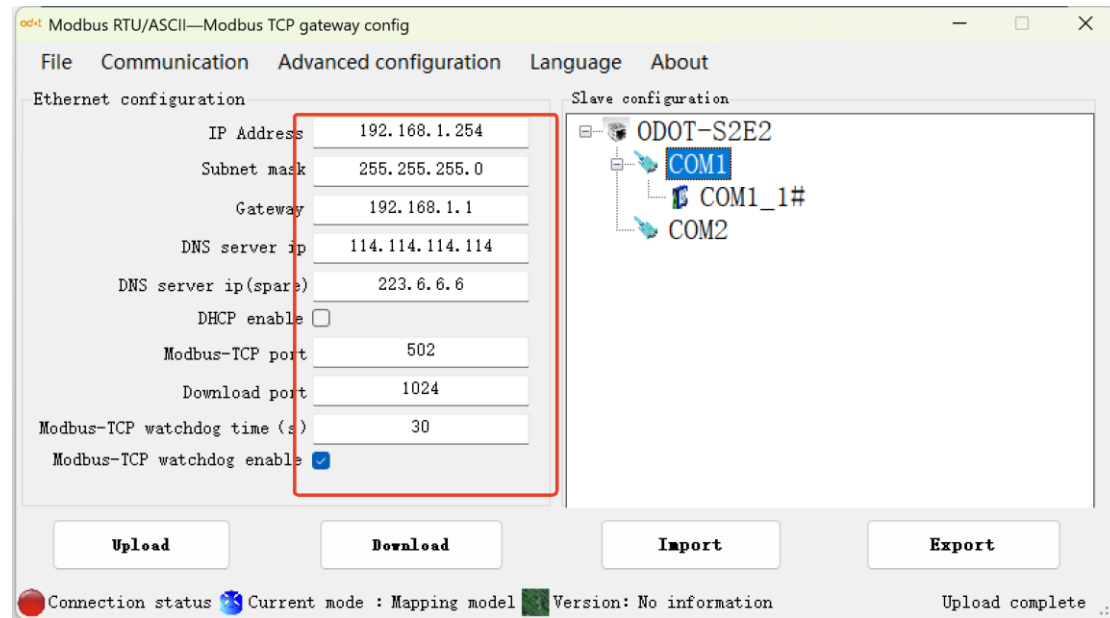
Modbus TCP port: generally 502;

Download port: the configuration software downloads the configuration to the device through the port of the device;

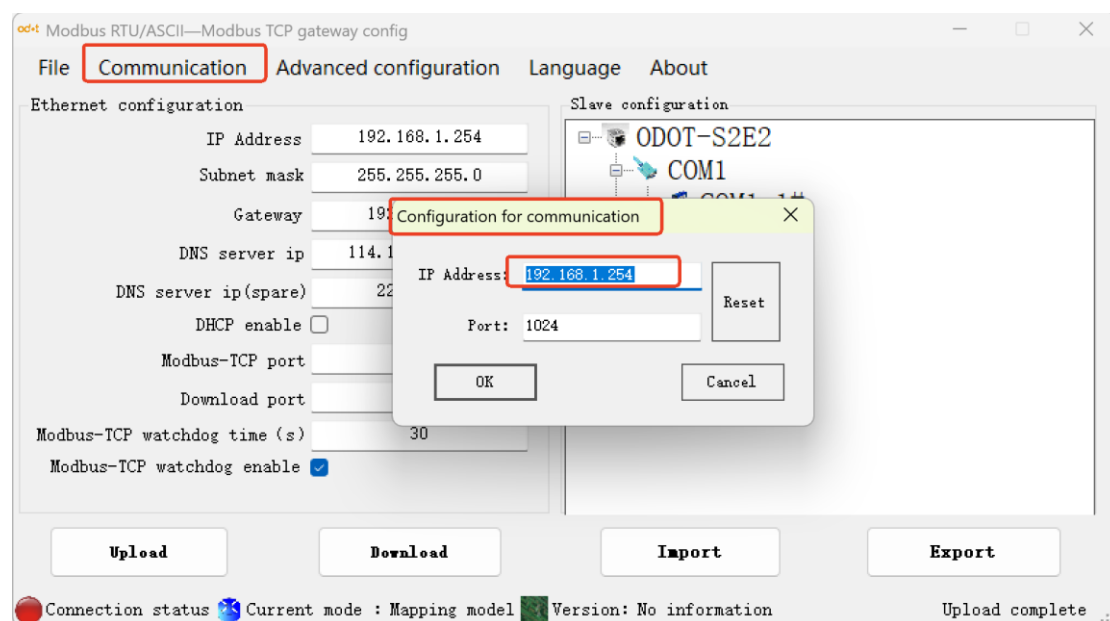
Modbus TCP watchdog time: the time interval between the time the gateway

receives the last Modbus TCP packet and the time when the gateway performs an automatic restart. Note: The gateway automatically restarts to release connection resources that have not been used for a long time in a timely manner.

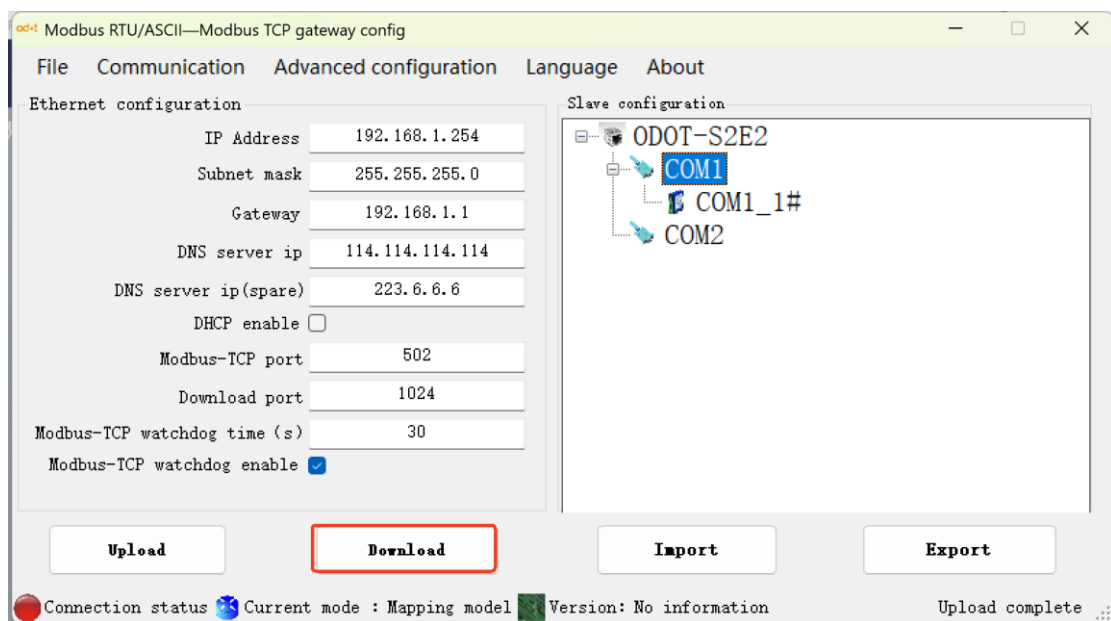
Modbus TCP watchdog enable: whether to enable the watchdog function.



Set the destination gateway address that want to download and download communication port number through “Communication” — “Communication Configuration”. The factory default of the gateway is IP 192.168.1.254 and port number 1024.



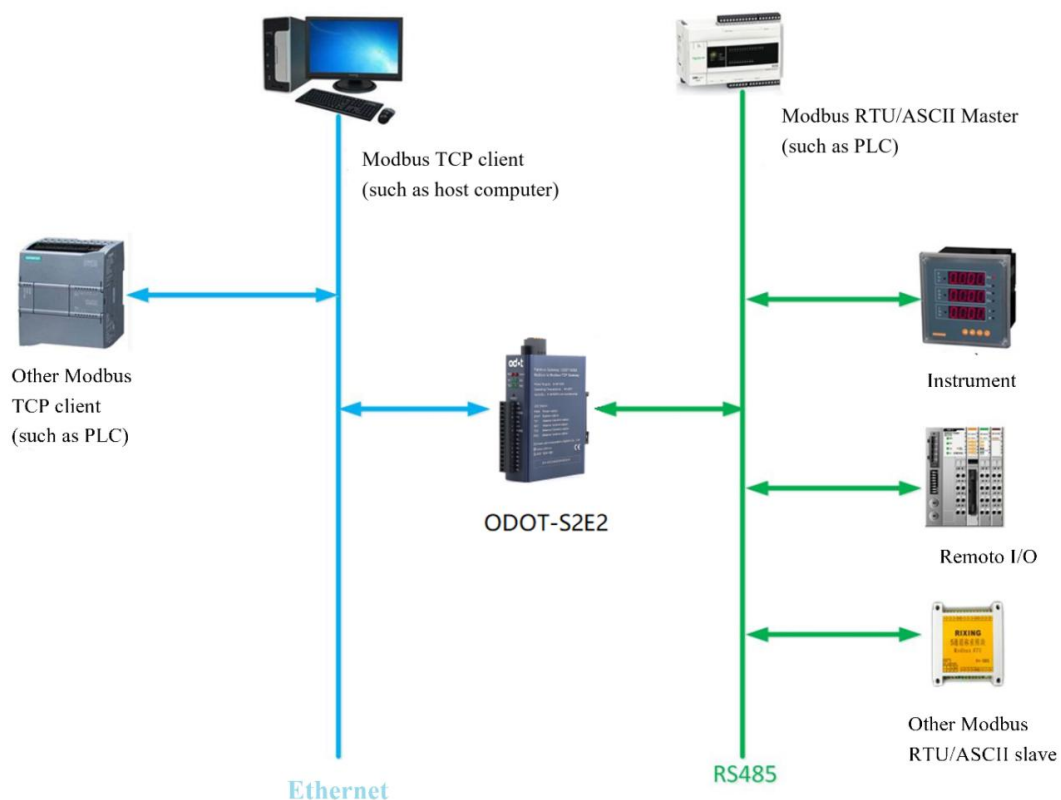
Click the "Download" button to download the configuration parameters to the gateway. After the download is successful, the "download successful" prompt is displayed in the lower right corner of the status bar. After the download is successful, the gateway automatically restarts and enters the running state. If the download fails, please check whether the computer IP address and the gateway IP address are in the same network segment, and whether the gateway IP address is set correctly, if forget the gateway IP address, it can reset the gateway through the reset button, and the gateway IP address after reset It is the default IP address. Click "Import a Configuration File" and "Export the Configuration File" to import and save configuration files to the local disk. Click "Upload" to upload the current configuration of the gateway to the software. **Note: When downloading and uploading, ensure that the computer and the gateway are in the same network segment.**



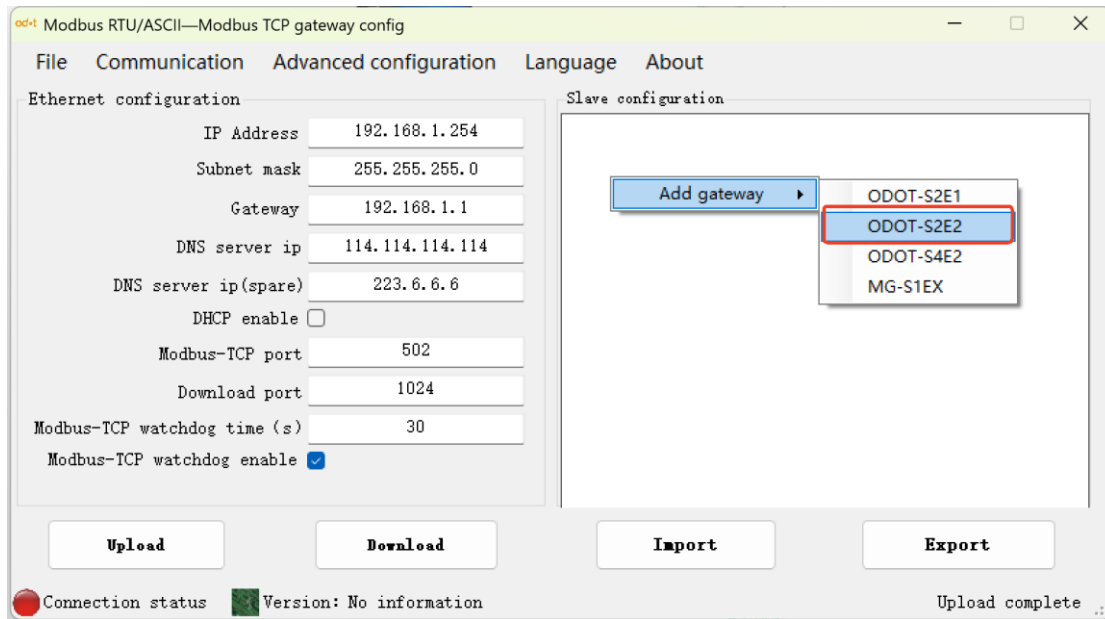
After completing the above settings, the Modbus TCP client can use the Modbus TCP protocol to access the slave device 16DI which the station number is 1 though the gateway IP address 192.168.1.254, the Modbus data communication port 502 and the slave station number 1.

3.4.2 Communicate between Modbus TCP client and Modbus RTU/ASCII master

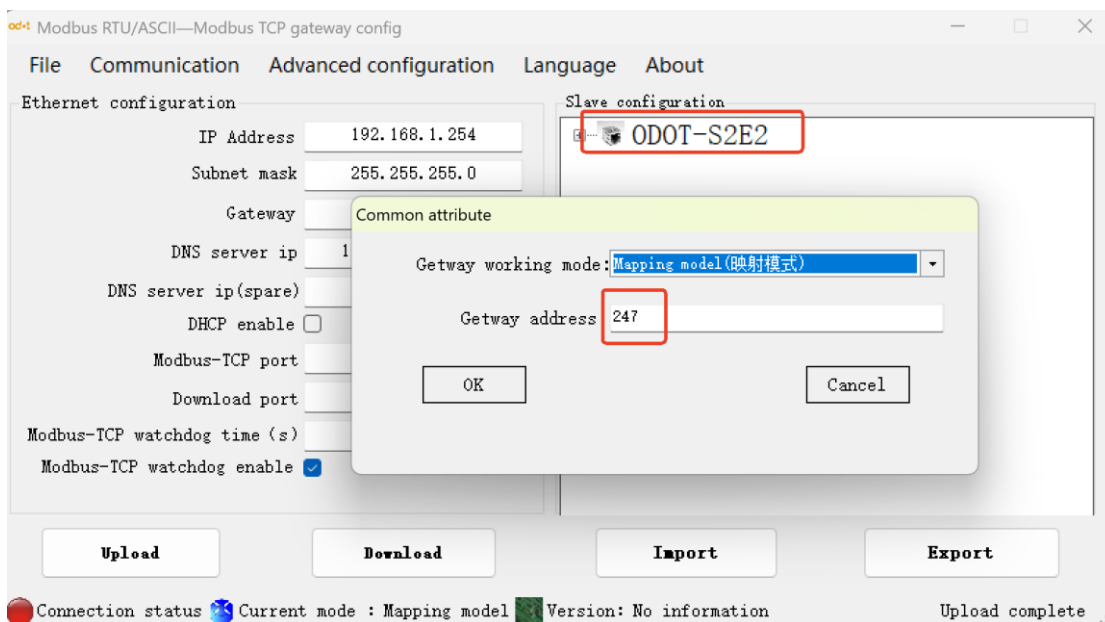
Application topology



Open the configuration software " MGCC Config". Right-click on the configuration page of slave station and select "Add Device", then add "ODOT-S2E2".



Double click "ODOT-S2E2" or right-click "ODOT-S2E2", select “common attributes”, set the gateway as the station number of the Modbus RTU/ASCII slave on the popup setup page.



Double-click "COM1" or "COM2" or right-click "COM1" or "COM2" and click "Configure Port". The "COM1 configuration" window will pop up. After setting the communication parameters, click the "OK" button to save and return.

The meaning of each parameter is as follows:

Working Mode:

It is used to set whether the gateway is used as a master or slave in the network connected to the serial port, and the default is the master mode, which is set to the master mode.

Communication protocol:

Used to set the type of protocol used by the gateway to communicate with other devices in the network connected to the serial port, Modbus RTU/ASCII is optional, please set this parameter to be consistent with the device connected to the serial port.

Baud rate:

The baud rate of the serial port is 1200~115200bps, the default is 9600bps, please set this parameter to be consistent with the device connected to the serial port.

Check:

It can choose none, odd, even, none by default, please set this parameter to be consistent with the device connected to the serial port.

Stop bits:

1-bit and 2-bit stop bits, and the default 1-bit stop bit. Please set this parameter to be consistent with the device connected to the serial port.

Receive delay:

The frame interval detection time when receiving packets is $1.5t \sim 200t$, and the default is $3.5t$ (t is the time for a single character to be transmitted, which is related to the baud rate).

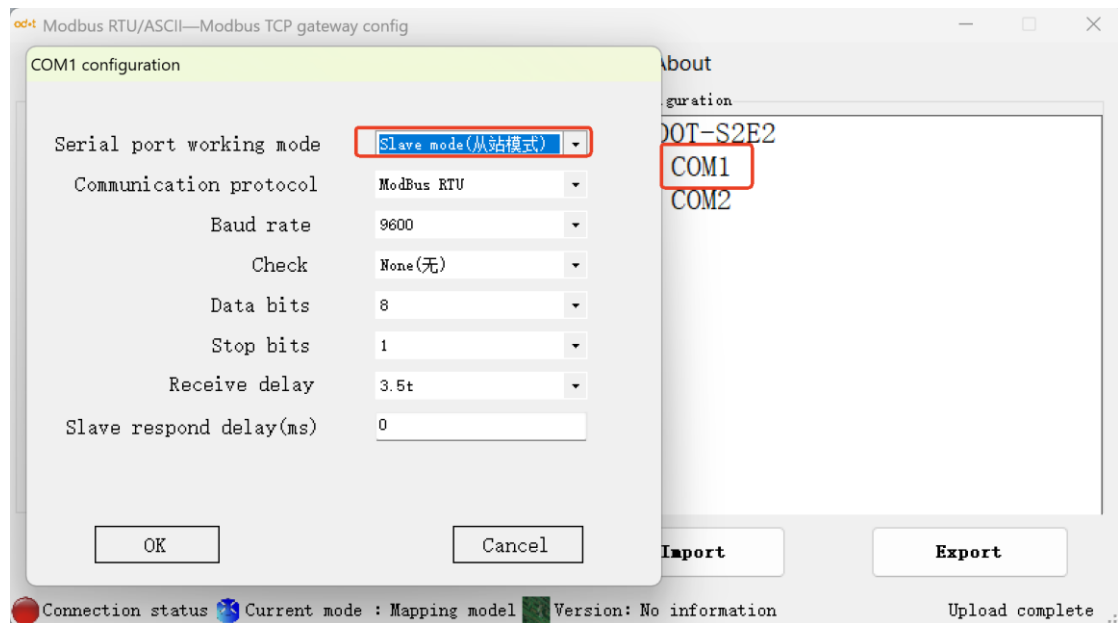
Send delay:

The interval between receiving the slave response packet and sending the next command can be set from 0ms to 65535ms, the default is 0ms, and it is recommended to set 100ms to prevent the connected device from responding too slowly and causing communication failures.

Timeout mode:

If the slave response times out, it can select Clearing or Holding if the slave response times out. The default " Holding " mode, this parameter is only valid for Modbus read

commands, please set this value according to actual needs.



Configure the parameters in the Ethernet configuration, the meaning of the parameter is as follows:

IP address: the IP address of the device;

Subnet mask: the subnet mask of the device;

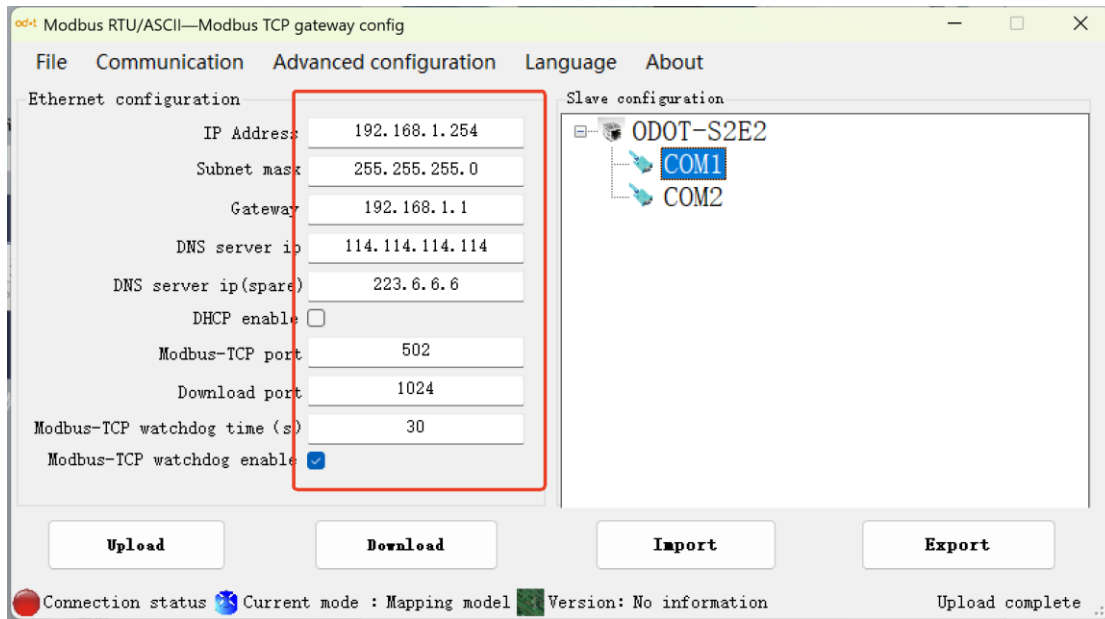
Gateway: the gateway IP address of the network where the device;

Modbus TCP port: generally 502;

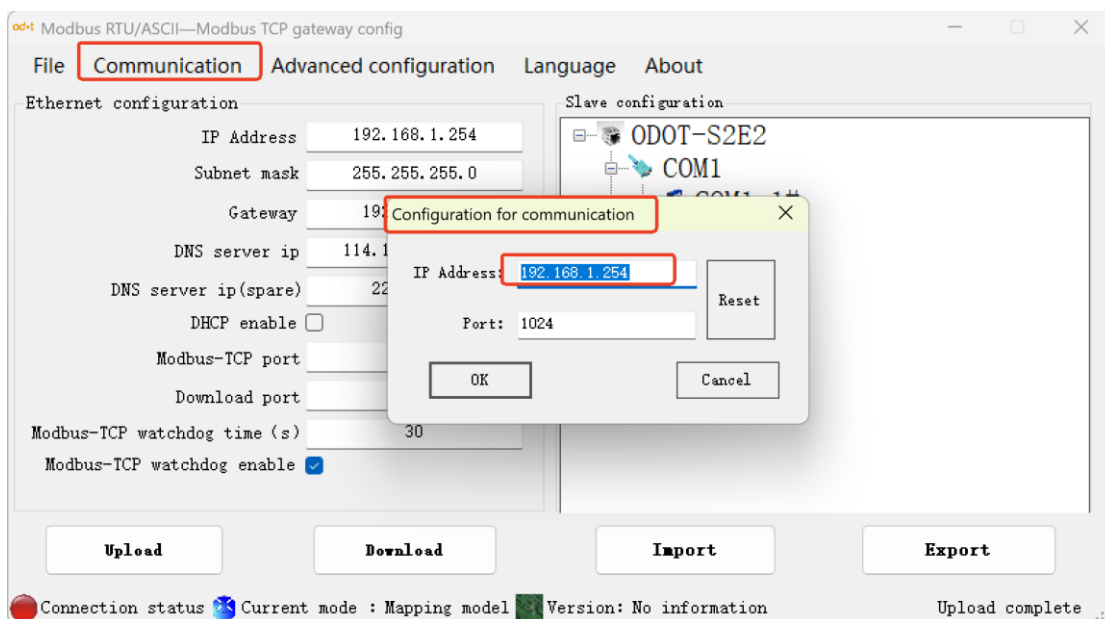
Download port: the configuration software downloads the configuration to the device through the port of the device;

Modbus TCP watchdog time: the time interval between the time the gateway receives the last Modbus TCP packet and the time when the gateway performs an automatic restart. Note: The gateway automatically restarts to release connection resources that have not been used for a long time in a timely manner.

Modbus TCP watchdog enable: whether to enable the watchdog function.

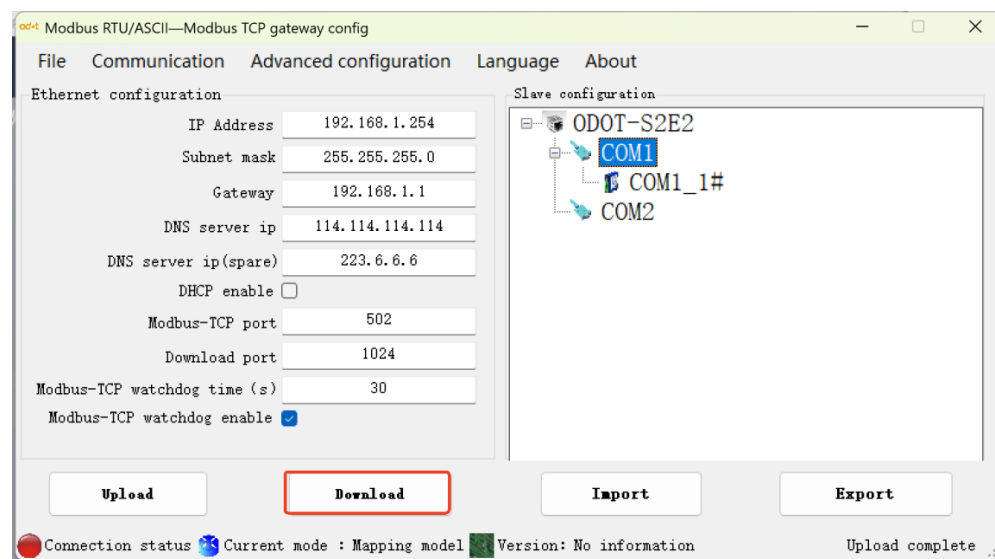


Set the destination gateway address that you want to download and download communication port number through “Communication” — “Communication Configuration”. The factory default of the gateway is IP 192.168.1.254 and port number 1024.



Click the "Download" button to download the configuration parameters to the gateway. After the download is successful, the "download successful" prompt is displayed in the lower right corner of the status bar. After the download is successful, the gateway automatically restarts and enters the running state. If the download fails,

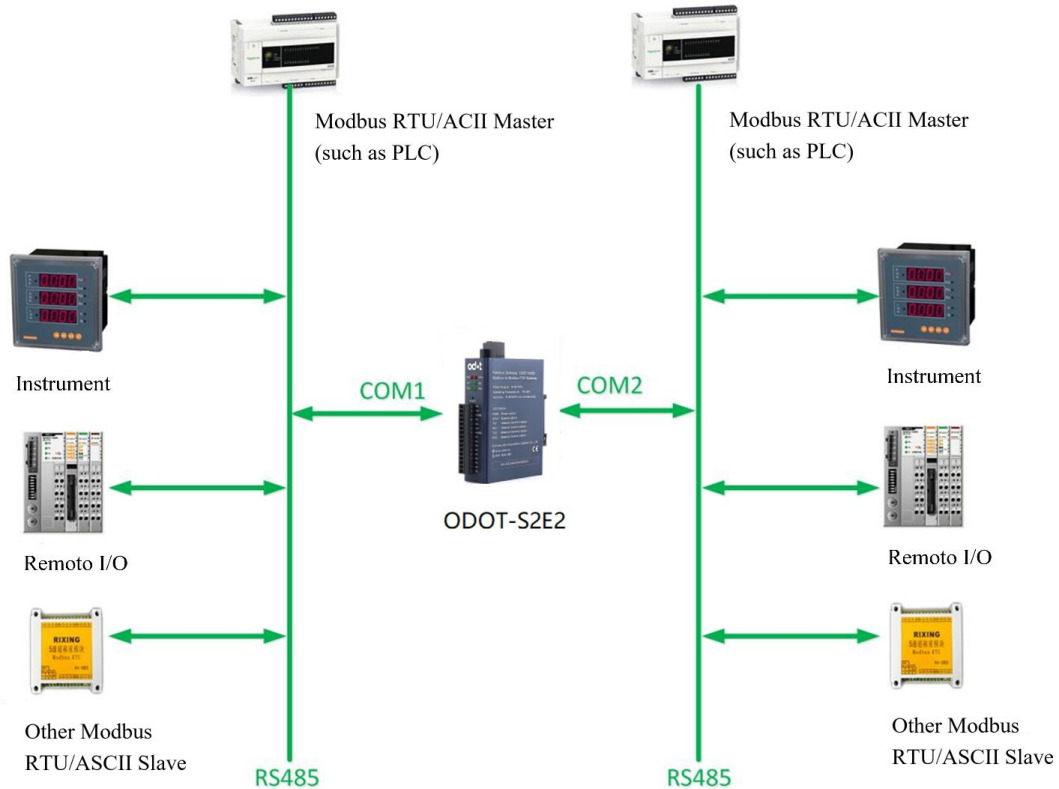
please check whether the computer IP address and the gateway IP address are in the same network segment, and whether the gateway IP address is set correctly, if forget the gateway IP address, it can reset the gateway through the reset button, and the gateway IP address after reset It is the default IP address. Click "Import a Configuration File" and "Export the Configuration File" to import and save configuration files to the local disk. Click "Upload" to upload the current configuration of the gateway to the software. **Note: When downloading and uploading, ensure that the computer and the gateway are in the same network segment.**



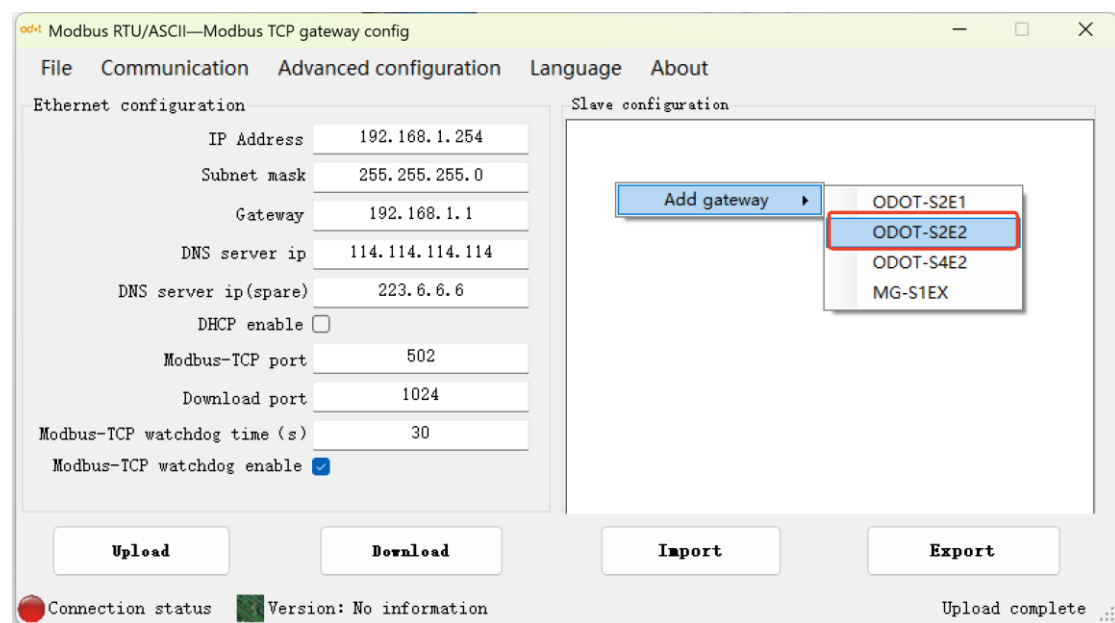
After the setting is completed, connect the gateway to the Modbus TCP network through Ethernet, and connect to the Modbus RTU/ASCII network through the corresponding serial port (the routine is configured as COM2). The gateway acts as a Modbus TCP server in the Modbus TCP network. As a slave station in the network, the Modbus TCP client can read and write the gateway data storage area inside the gateway through the Modbus TCP protocol, and the Modbus RTU/ASCII master station can also read and write the gateway data storage area inside the gateway through the Modbus RTU/ASCII protocol. The gateway acts as The function of a data relay realizes the communication between Modbus TCP client and Modbus RTU/ASCII master station.

3.4.3 Communication between Modbus RTU/ASCII masters

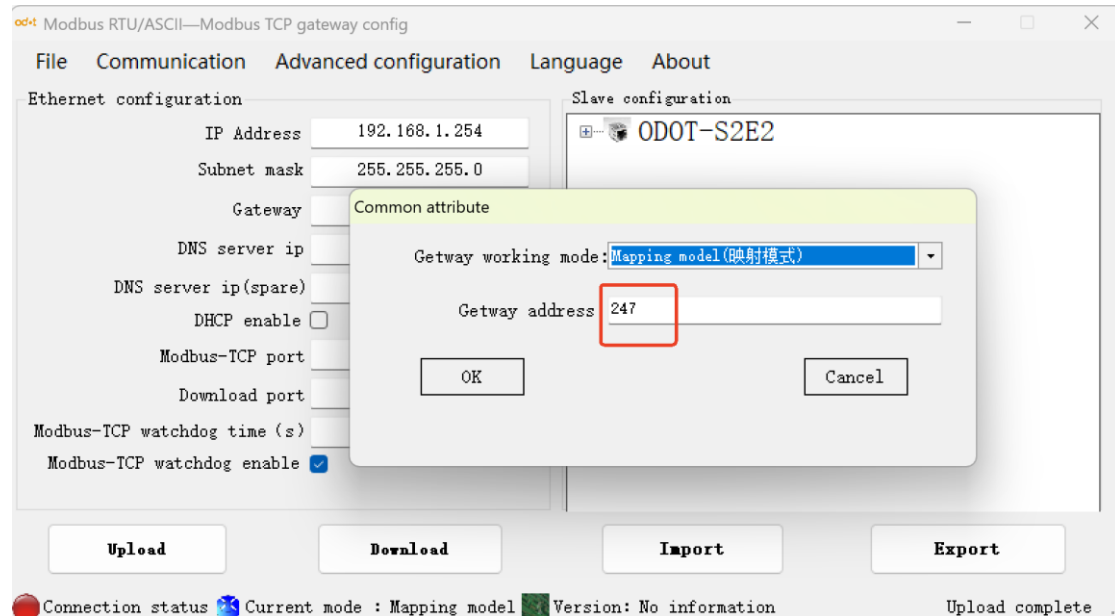
Application topology



Open the configuration software " MGCC Config". Right-click on the configuration page of slave station and select "Add Device", then add "ODOT-S2E2".



Double click "ODOT-S2E2" or right-click "ODOT-S2E2", Select “common attributes”, set the gateway as the station number of the Modbus RTU/ASCII slave on the popup setup page.



Double-click "COM1" or "COM2" or right-click "COM1" or "COM2" and click "Configure Port". The "COM1 configuration" window will pop up. After setting the communication parameters, click the "OK" button to save and return.

The meaning of each parameter is as follows:

Working Mode:

It is used to set whether the gateway is used as a master or slave in the network connected to the serial port, and the default is the master mode, which is set to the master mode.

Communication protocol:

Used to set the type of protocol used by the gateway to communicate with other devices in the network connected to the serial port, Modbus RTU/ASCII is optional, please set this parameter to be consistent with the device connected to the serial port.

Baud rate:

The baud rate of the serial port is 1200~115200bps, the default is 9600bps, please set this parameter to be consistent with the device connected to the serial port.

Check:

It can choose none, odd, even, none by default, please set this parameter to be consistent with the device connected to the serial port.

Stop bits:

1-bit and 2-bit stop bits, and the default 1-bit stop bit. Please set this parameter to be consistent with the device connected to the serial port.

Receive delay:

The frame interval detection time when receiving packets is 1.5t~200t, and the default is 3.5t(t is the time for a single character to be transmitted, which is related to the baud rate).

Send delay:

The interval between receiving the slave response packet and sending the next command can be set from 0ms to 65535ms, the default is 0ms, and it is recommended to set 100ms to prevent the connected device from responding too slowly and causing communication failures.

Timeout mode:

If the slave response times out, it can select Clearing or Holding if the slave response times out. The default " Holding " mode, this parameter is only valid for Modbus read commands, please set this value according to actual needs.

COM1 configuration

Serial port working mode	Slave mode(从站模式)
Communication protocol	ModBus RTU
Baud rate	9600
Check	None(无)
Data bits	8
Stop bits	1
Receive delay	3.5t
Slave respond delay(ms)	0

OK Cancel

Configure the parameters in the Ethernet configuration, the meaning of the parameter is as follows:

IP address: the IP address of the device;

Subnet mask: the subnet mask of the device;

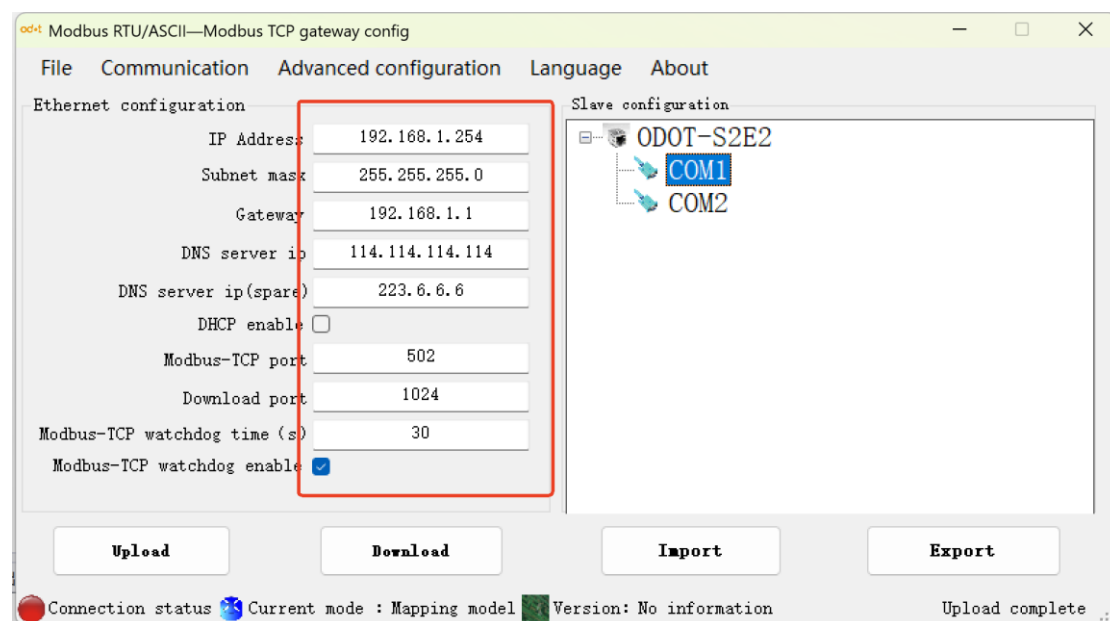
Gateway: the gateway IP address of the network where the device;

Modbus TCP port: generally 502;

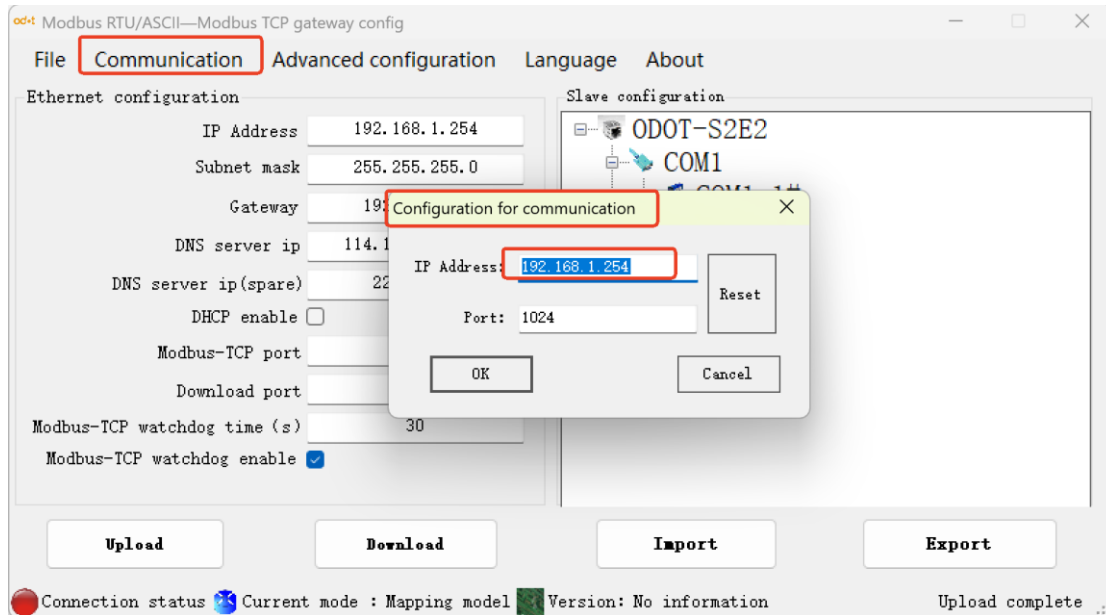
Download port: the configuration software downloads the configuration to the device through the port of the device;

Modbus TCP watchdog time: the time interval between the time the gateway receives the last Modbus TCP packet and the time when the gateway performs an automatic restart. Note: The gateway automatically restarts to release connection resources that have not been used for a long time in a timely manner.

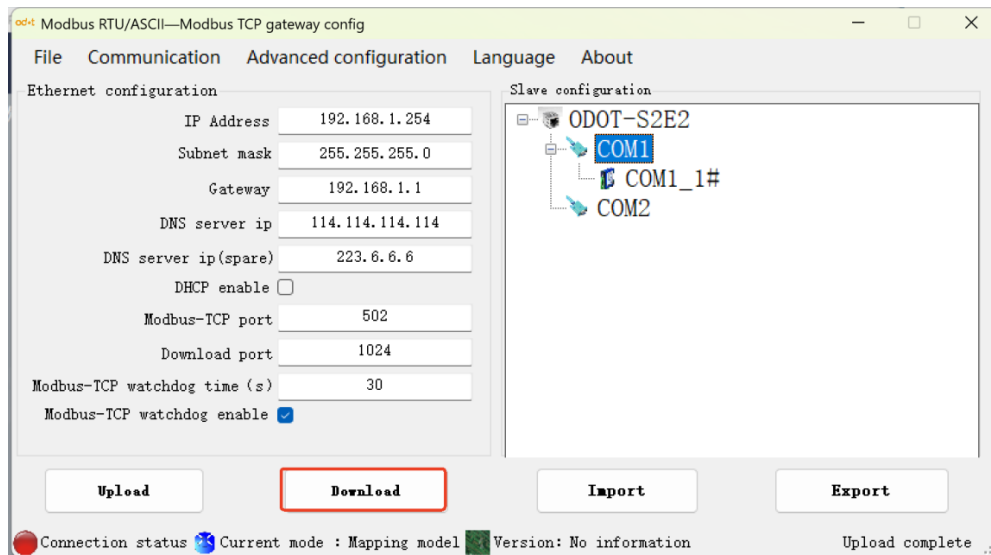
Modbus TCP watchdog enable: whether to enable the watchdog function.



Set the destination gateway address that you want to download and download communication port number through “Communication” — “Communication Configuration”. The factory default of the gateway is IP 192.168.1.254 and port number 1024.



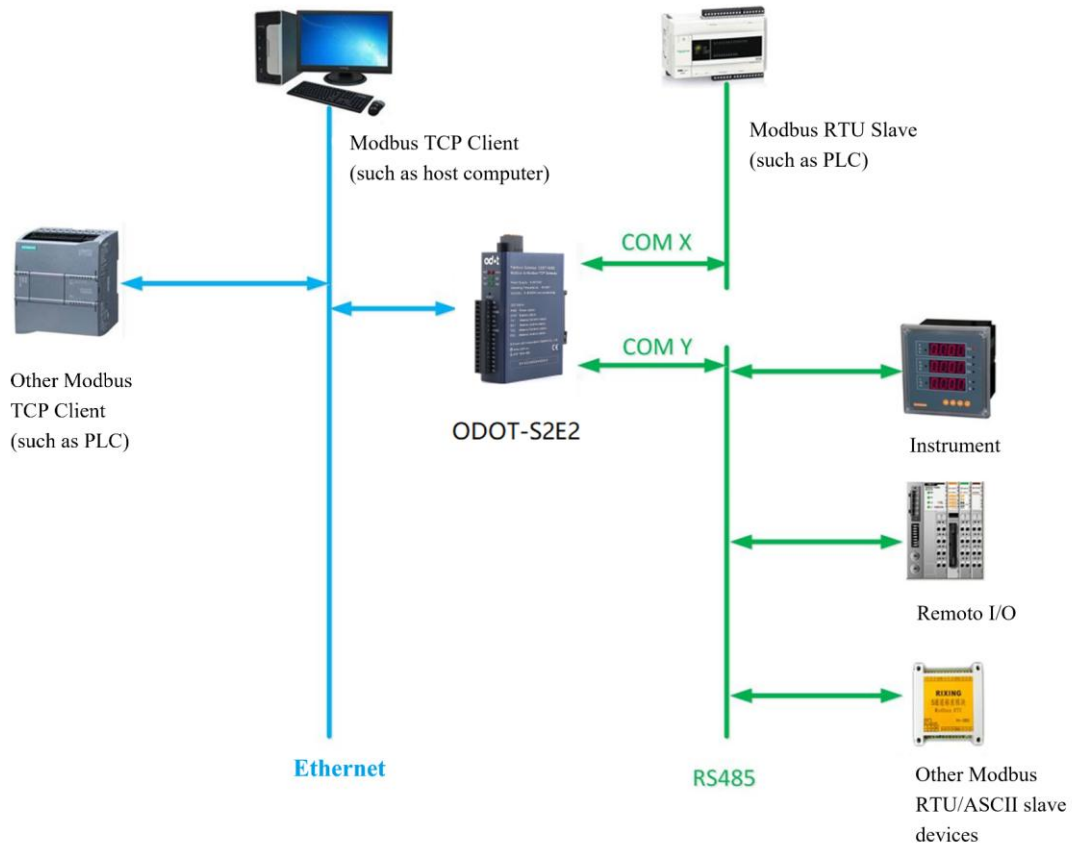
Click the "Download" button to download the configuration parameters to the gateway. After the download is successful, the "download successful" prompt is displayed in the lower right corner of the status bar. After the download is successful, the gateway automatically restarts and enters the running state. If the download fails, please check whether the computer IP address and the gateway IP address are in the same network segment, and whether the gateway IP address is set correctly, if forget the gateway IP address, it can reset the gateway through the reset button, and the gateway IP address after reset It is the default IP address. Click "Import a Configuration File" and "Export the Configuration File" to import and save configuration files to the local disk. Click "Upload" to upload the current configuration of the gateway to the software. **Note: When downloading and uploading, ensure that the computer and the gateway are in the same network segment.**



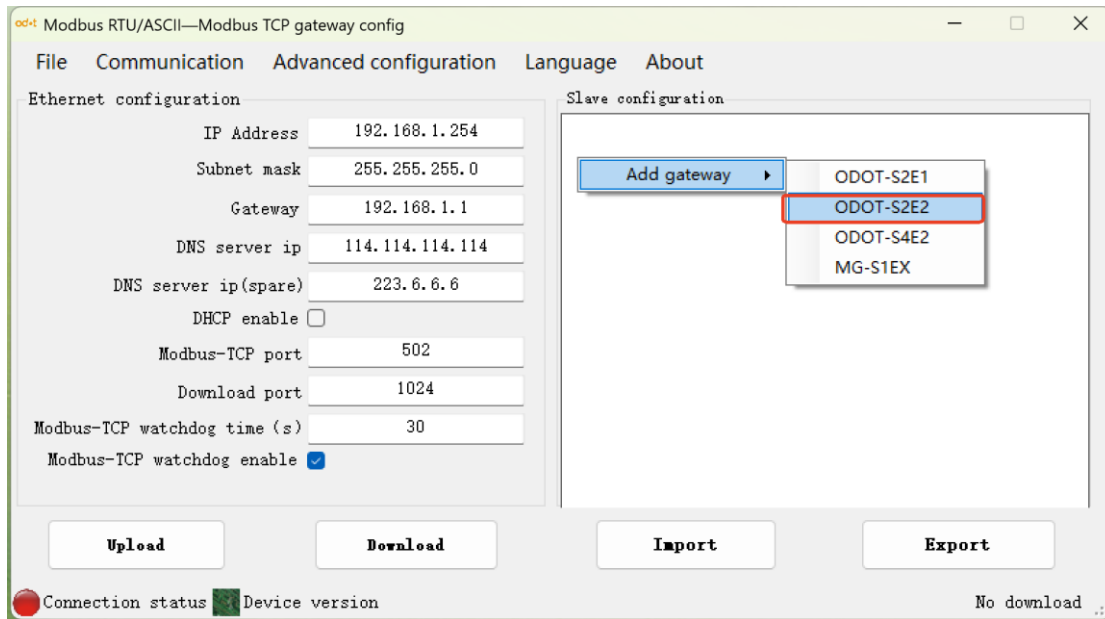
After setting up, two different Modbus RTU/ASCII networks are accessed through the corresponding serial ports. The gateway acts as slave station in both Modbus RTU/ASCII networks. The Modbus RTU/ASCII master stations in both networks can both read and write the gateway's" internal gateway data storage area" the Modbus RTU/ASCII protocol. The gateway realize communication between the Modbus TCP client and the Modbus RTU/ASCII master by taking the role of a data relay.

3.4.4 Communication Modbus TCP client between Modbus RTU/ASCII master and Modbus RTU/ASCII slave

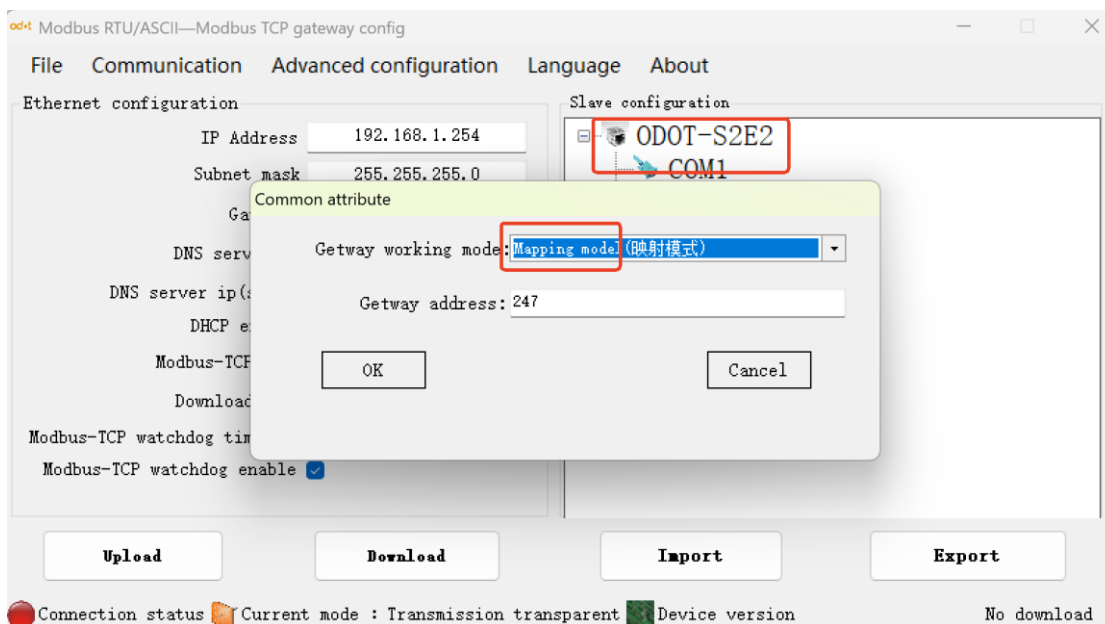
Application topology



Open the configuration software "MGCC Config", right-click on the slave configuration page, select "Add Device", and add "ODOT-S2E2".



Double-click ODOT-S2E2 or right-click ODOT-S2E2, select common attribute, and set the gateway working mode to Mapping Mode on the pop-up settings page.



Double-click "COM1" or "COM2" or right-click "COM1" or "COM2" and click "Configure Port". The "COM1 configuration" window will pop up. After setting the communication parameters, click the "OK" button to save and return.

The meaning of each parameter is as follows:

Working Mode:

It is used to set whether the gateway is used as a master or slave in the network

connected to the serial port, and the default is the master mode, which is set to the master mode.

Communication protocol:

Used to set the type of protocol used by the gateway to communicate with other devices in the network connected to the serial port, Modbus RTU/ASCII is optional, please set this parameter to be consistent with the device connected to the serial port.

Baud rate:

The baud rate of the serial port is 1200~115200bps, the default is 9600bps, please set this parameter to be consistent with the device connected to the serial port.

Check:

It can choose none, odd, even, none by default, please set this parameter to be consistent with the device connected to the serial port.

Stop bits:

1-bit and 2-bit stop bits, and the default 1-bit stop bit. Please set this parameter to be consistent with the device connected to the serial port.

Receive delay:

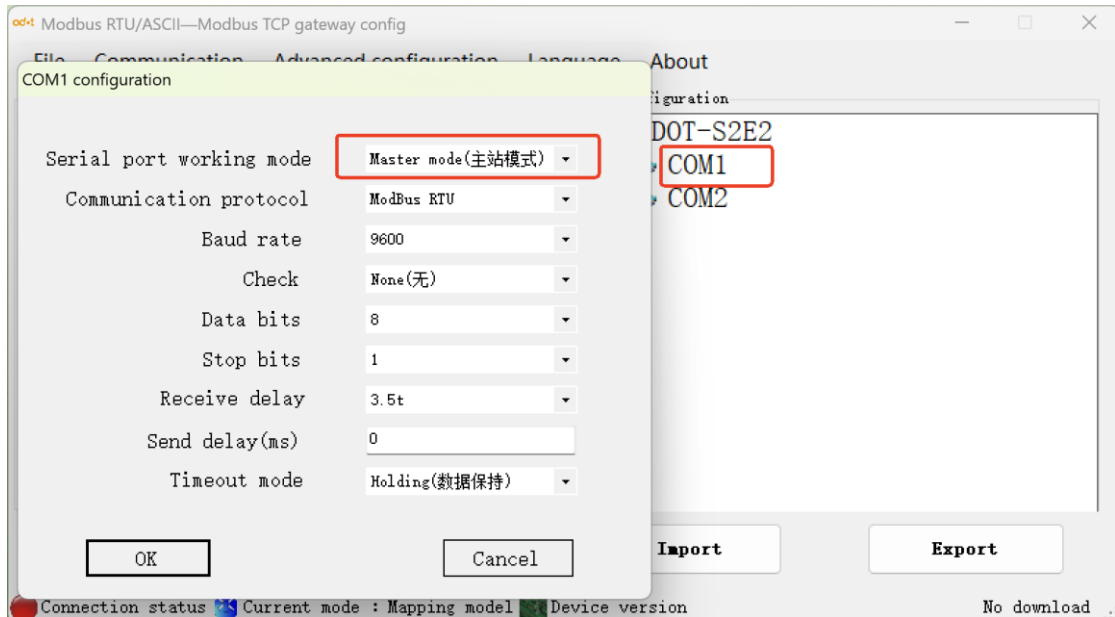
The frame interval detection time when receiving packets is $1.5t \sim 200t$, and the default is $3.5t$ (t is the time for a single character to be transmitted, which is related to the baud rate).

Send delay:

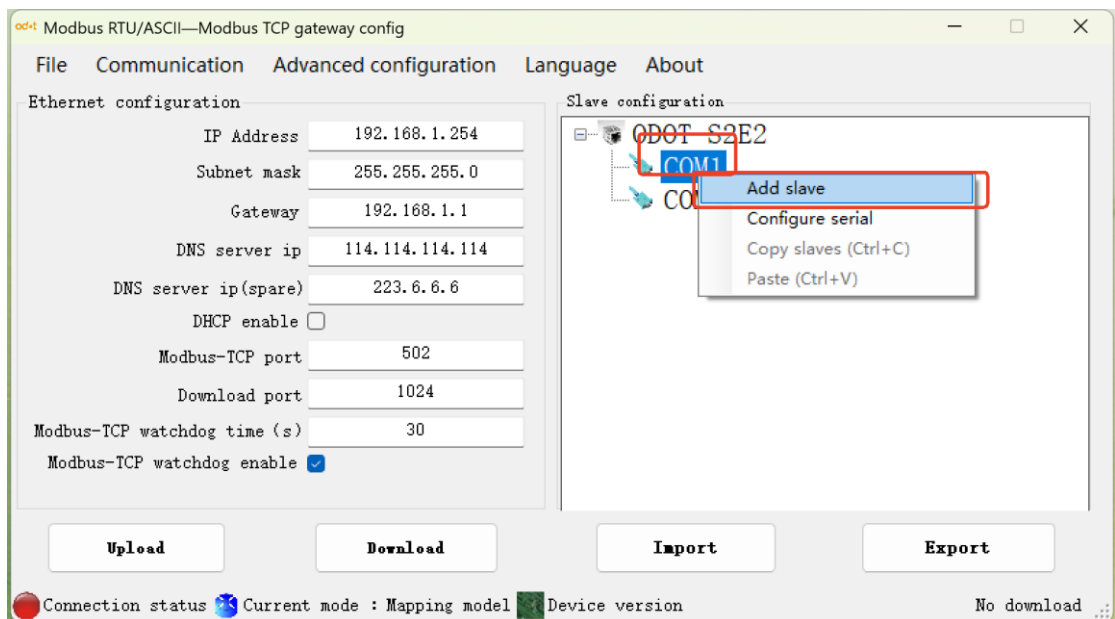
The interval between receiving the slave response packet and sending the next command can be set from 0ms to 65535ms, the default is 0ms, and it is recommended to set 100ms to prevent the connected device from responding too slowly and causing communication failures.

Timeout mode:

If the slave response times out, it can select Clearing or Holding if the slave response times out. The default " Holding " mode, this parameter is only valid for Modbus read commands, please set this value according to actual needs.



Select "COM1" or "COM2" (in this case, COM1), right-click to add slave, enter "slave name", and fill in "slave address". Configure the Modbus function code, the slave register start address, the number of data, the gateway register start address, the slave response timeout, and when data changes the command is valid. The slave address under the same serial port cannot be the same, and the slave address range is between 1 and 247, and slave name under the same serial port cannot be the same. When done with the settings, click "Save".



Slave address mapping table of "COM1_1#"**

Slave name: COM1_1# Slave address(1-247): 1

Function code	Slave register start address	Number of data	Gateway register start address	Slave response timeout time (ms)	When data changes the command is valid
03 (4x) Read Hold...	2	55	0	500	☐
...				500	☐

Save Close

Double-click "COM1" or "COM2" or right-click "COM1" or "COM2" and click "Configure Port". The "COM2 configuration" window will pop up. After setting the communication parameters, click the "OK" button to save and return.

The meaning of each parameter is as follows:

Working Mode:

It is used to set whether the gateway is used as a master or slave in the network connected to the serial port, and the default is the master mode, which is set to the master mode.

Communication protocol:

Used to set the type of protocol used by the gateway to communicate with other devices in the network connected to the serial port, Modbus RTU/ASCII is optional, please set this parameter to be consistent with the device connected to the serial port.

Baud rate:

The baud rate of the serial port is 1200~115200bps, the default is 9600bps, please set this parameter to be consistent with the device connected to the serial port.

Check:

It can choose none, odd, even, none by default, please set this parameter to be consistent with the device connected to the serial port.

Stop bits:

1-bit and 2-bit stop bits, and the default 1-bit stop bit. Please set this parameter to be consistent with the device connected to the serial port.

Receive delay:

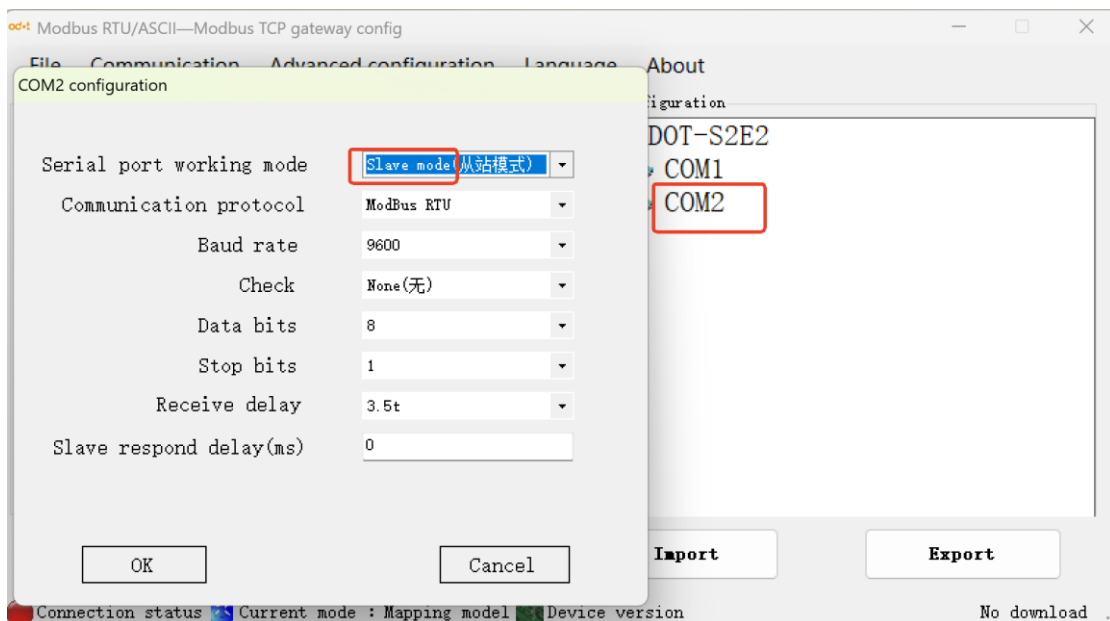
The frame interval detection time when receiving packets is 1.5t~200t, and the default is 3.5t(t is the time for a single character to be transmitted, which is related to the baud rate).

Send delay:

The interval between receiving the slave response packet and sending the next command can be set from 0ms to 65535ms, the default is 0ms, and it is recommended to set 100ms to prevent the connected device from responding too slowly and causing communication failures.

Timeout mode:

If the slave response times out, it can select Clearing or Holding if the slave response times out. The default " Holding " mode, this parameter is only valid for Modbus read commands, please set this value according to actual needs.



Configure the parameters in the Ethernet configuration, the meaning of the parameter is as follows:

IP address: the IP address of the device;

Subnet mask: the subnet mask of the device;

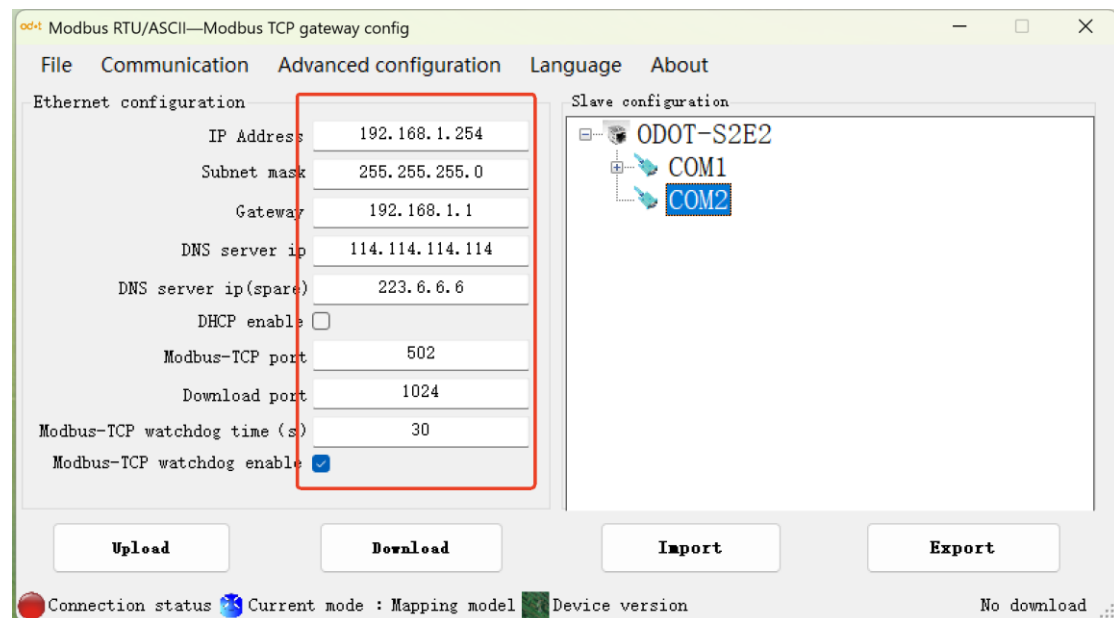
Gateway: the gateway IP address of the network where the device;

Modbus TCP port: generally 502;

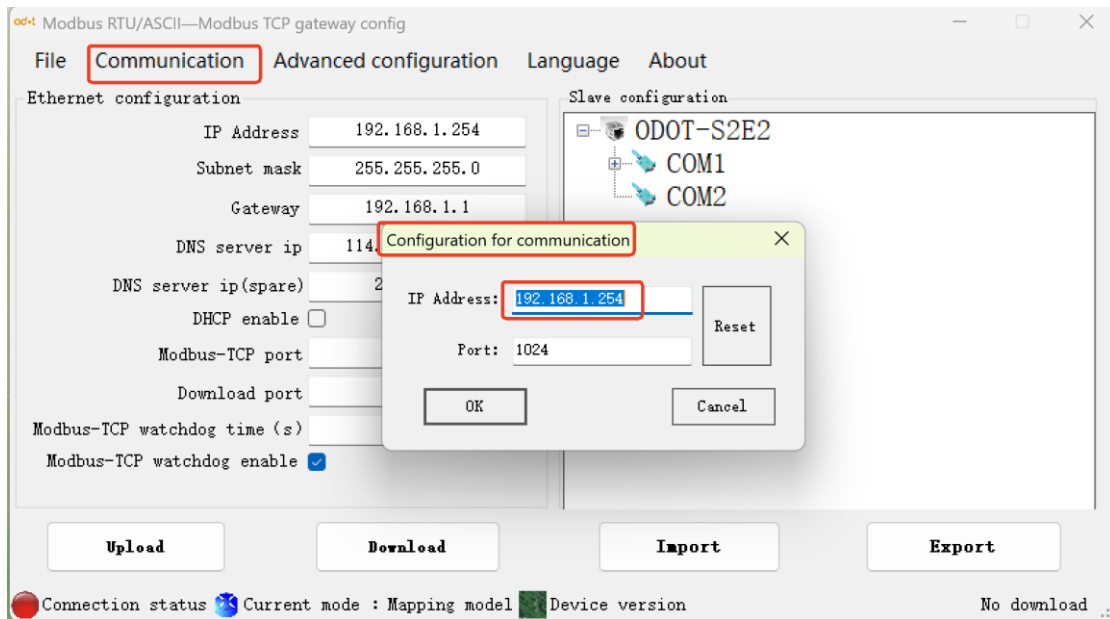
Download port: the configuration software downloads the configuration to the device through the port of the device;

Modbus TCP watchdog time: the time interval between the time the gateway receives the last Modbus TCP packet and the time when the gateway performs an automatic restart. Note: The gateway automatically restarts to release connection resources that have not been used for a long time in a timely manner.

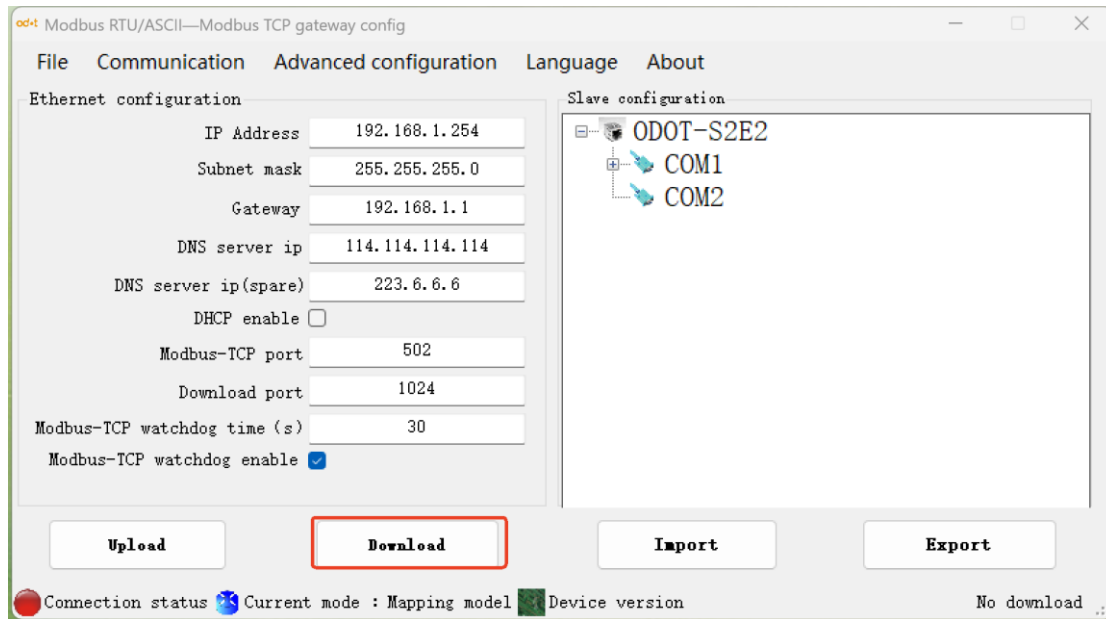
Modbus TCP watchdog enable: whether to enable the watchdog function.



Click the communication—configure communication channel to set the IP address of gateway and port number, the default IP address is 192.168.1.254, and the default port number is 1024.



Click the "Download" button to download the configuration parameters to the gateway. After the download is successful, the "download successful" prompt is displayed in the lower right corner of the status bar. After the download is successful, the gateway automatically restarts and enters the running state. If the download fails, please check whether the computer IP address and the gateway IP address are in the same network segment, and whether the gateway IP address is set correctly, if forget the gateway IP address, it can reset the gateway through the reset button, and the gateway IP address after reset It is the default IP address. Click "Import a Configuration File" and "Export the Configuration File" to import and save configuration files to the local disk. Click "Upload" to upload the current configuration of the gateway to the software. **Note: When downloading and uploading, ensure that the computer and the gateway are in the same network segment.**

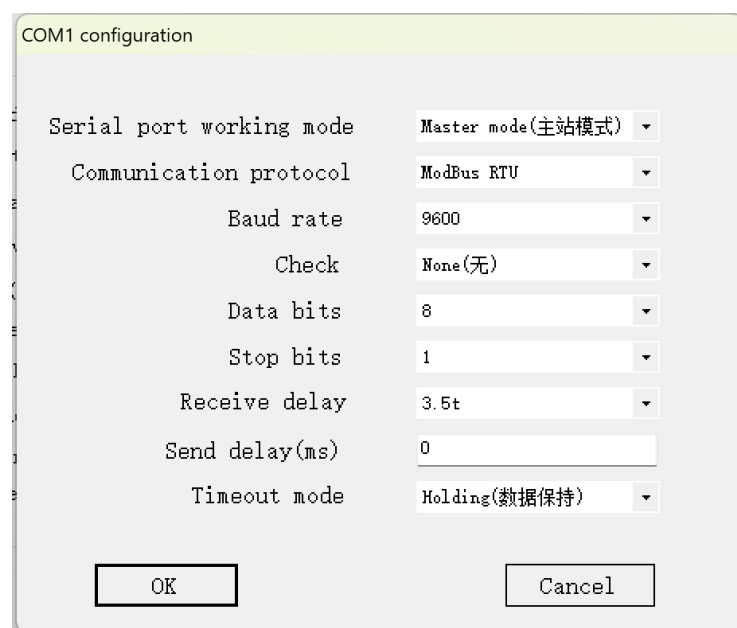
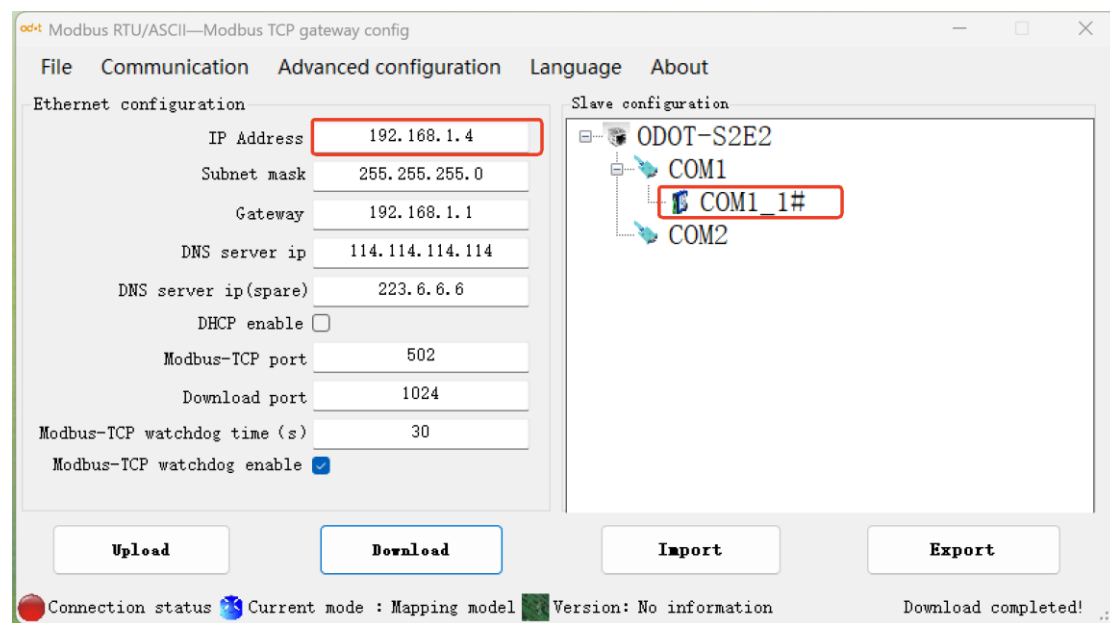


In this example, after completing the above settings, connect the Modbus RTU/ASCII slave to COM1, the Modbus RTU/ASCII master to COM2, and connect the Modbus TCP client to the gateway via Ethernet, and the gateway will automatically refresh the underlying Modbus RTU/ASCII slave data from COM1, and the Modbus RTU/ASCII master and Modbus The TCP client indirectly accesses the Modbus RTU/ASCII slave by accessing the gateway data store inside the gateway.

4. Application in Siemens TIA V19

4.1 Configure the ODOT-S2E2

The working mode of the gateway is mapping mode, the IP address is set to: 192.168.1.4, the parameters of the COM1: Modbus RTU protocol, 9600, N, 8, 1, slave ID=1, and the 03 function code is used to read 6 data in 4xxxx, and the starting address is 23. During the test, the Modbus slave was used to simulate the RS485 device in the field.



Slave address mapping table of "COM1_1#"

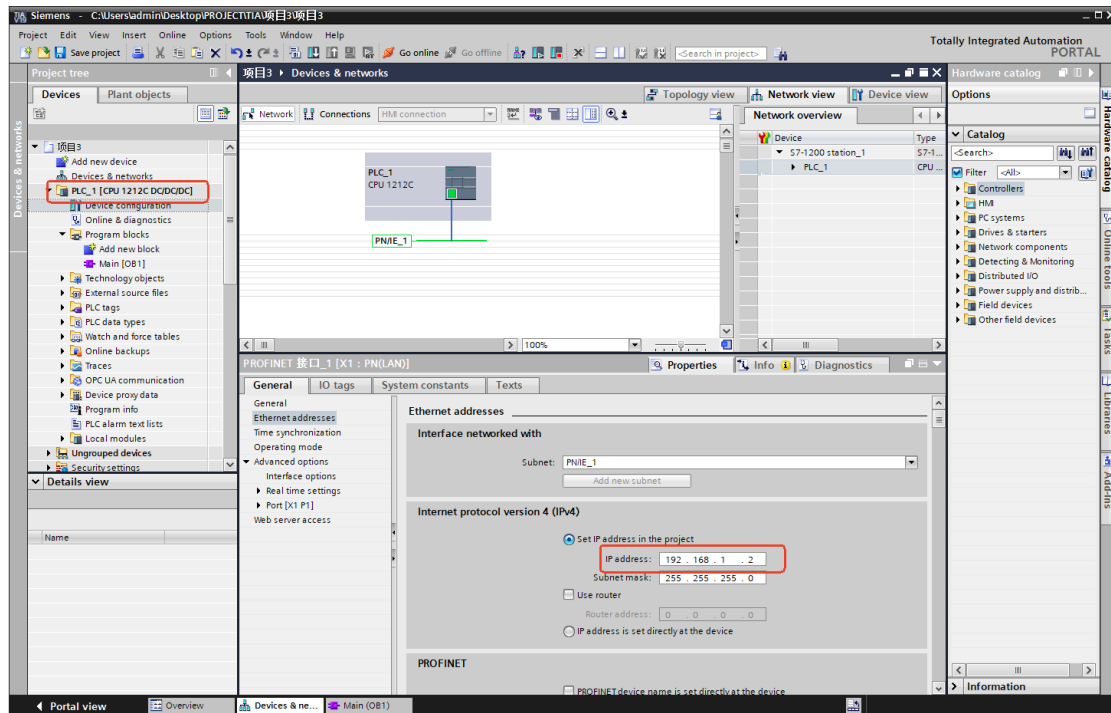
Slave name: COM1_1# Slave address(1-247): 1

	Function code	Slave register start address	Number of data	Gateway register start address	Slave response timeout time (ms)	When data changes the command is valid
▶	03 (4x) Read Holding...	0023	6	0000	500	☒
*						☐

Save Close

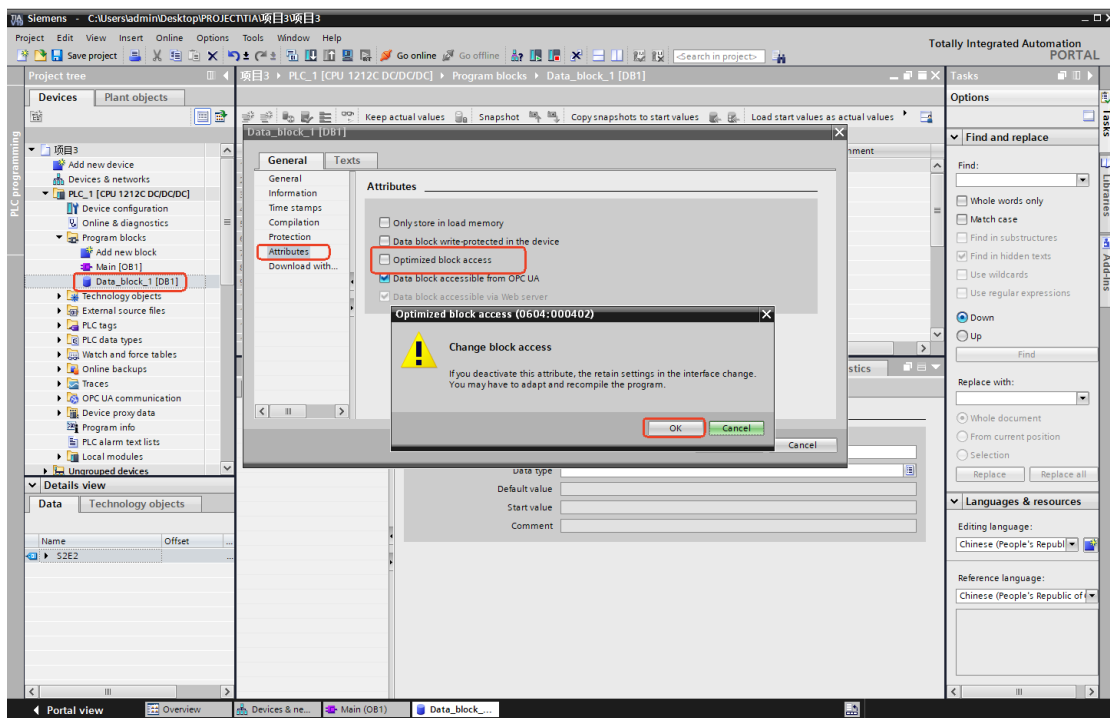
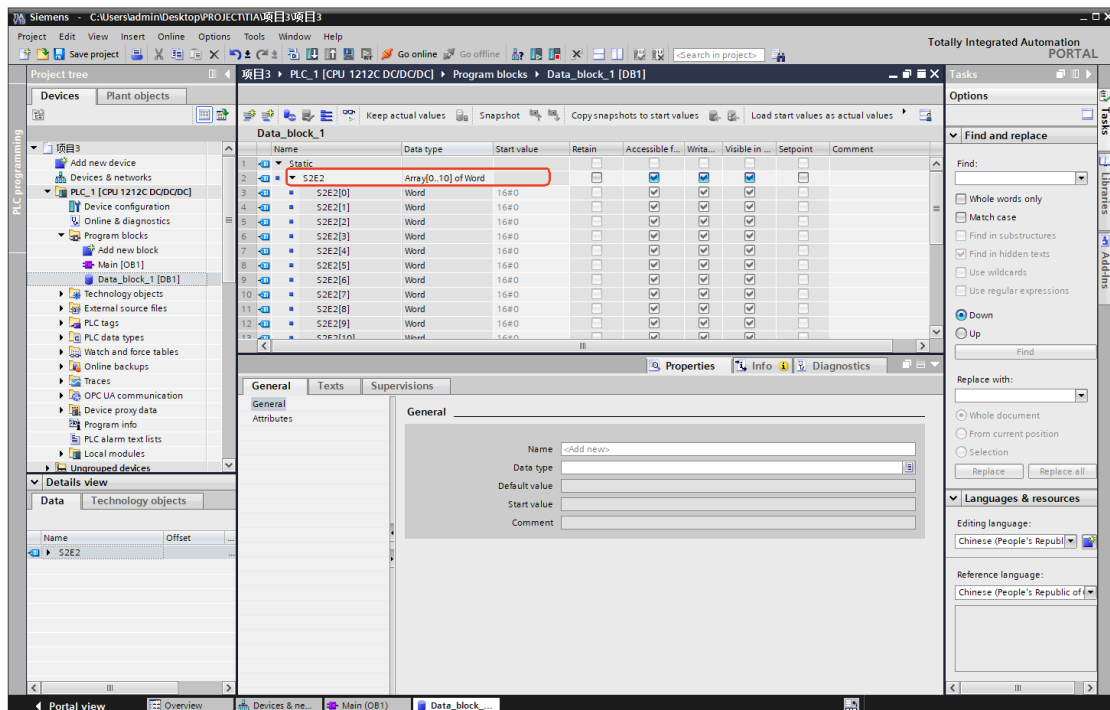
4.2 Configuration in TIA V19 Software

This test uses the S7-1200PLC as the main controller. Open the TIA software, create a new project, and add a new device S7-1212C DC/DC/DC. Set the IP address to 192.168.0.1.

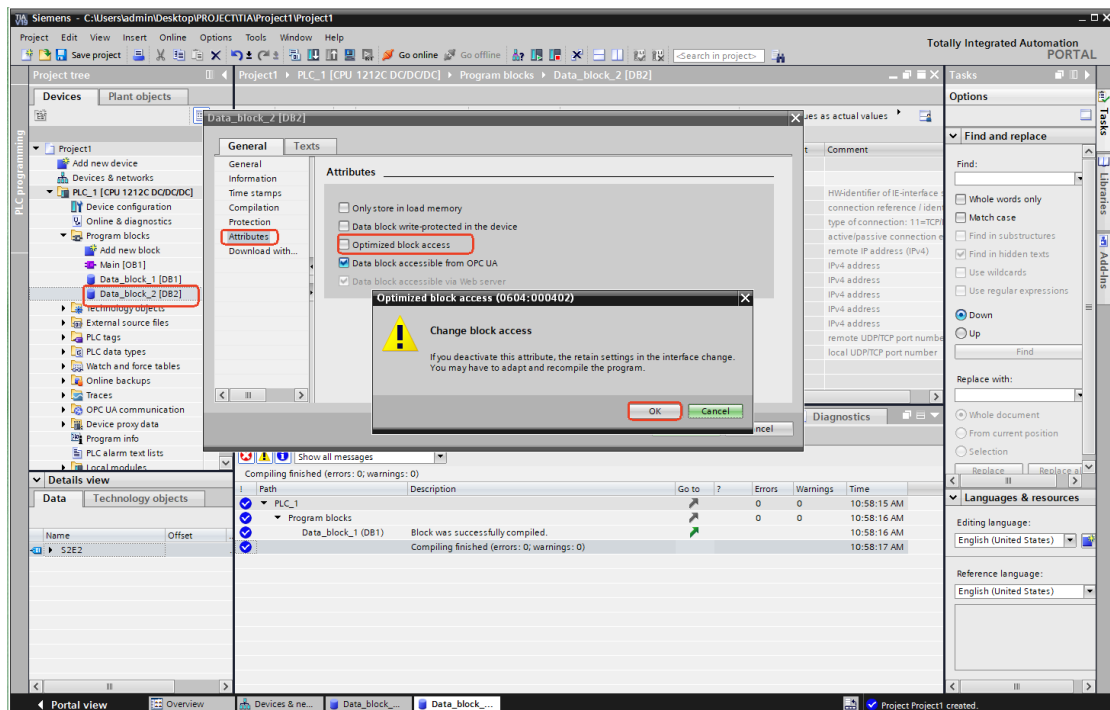
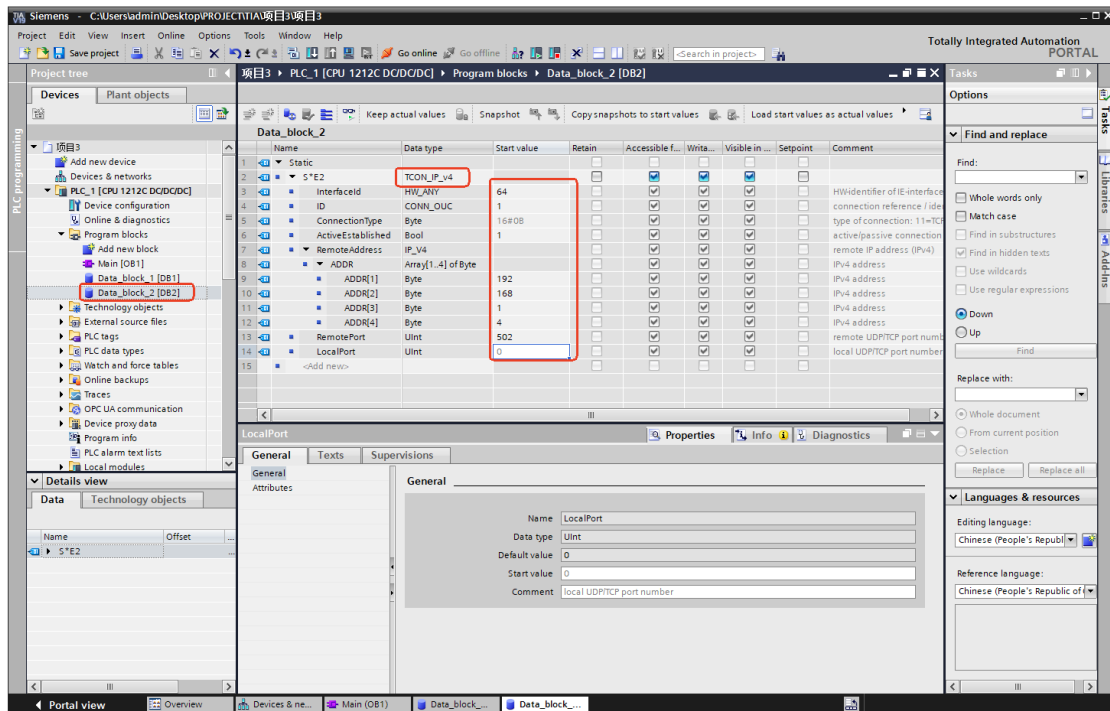


Click on the block, add a new block, and create data blocks DB2 and DB3.

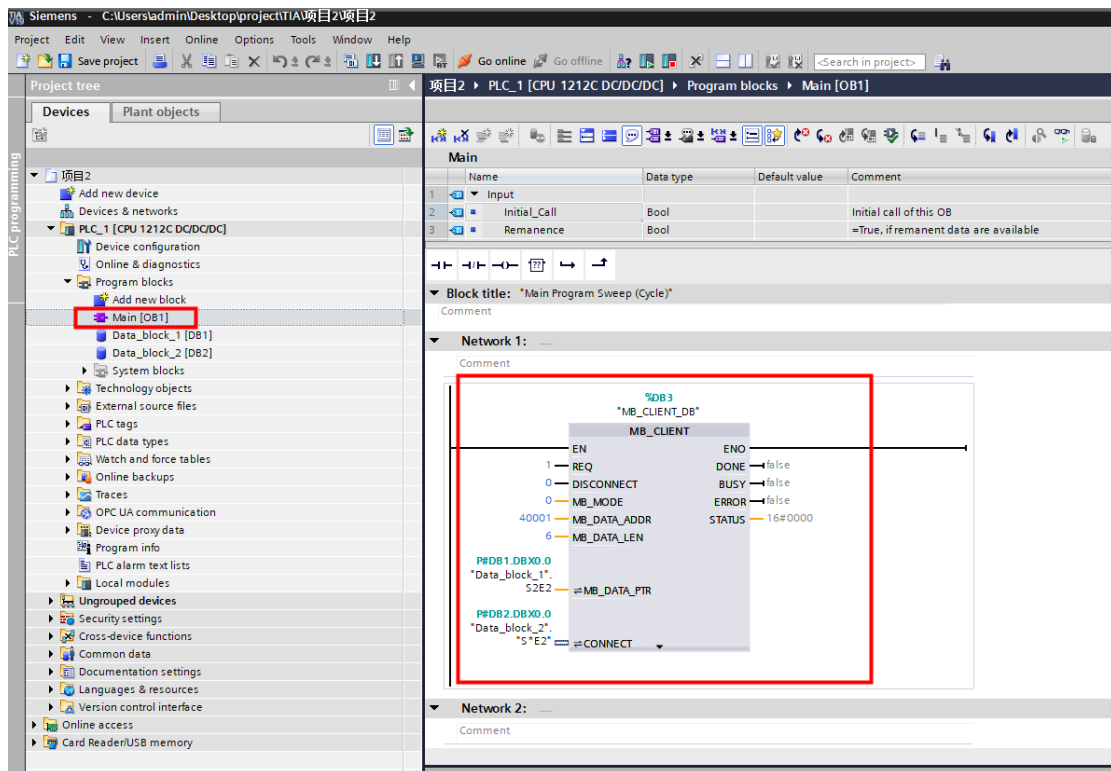
Create a data block for the Modbus server to receive data in DB2, and modify the DB2 properties to remove the $\sqrt{}$ in front of the optimized block access. Select DB2 and save the compilation.



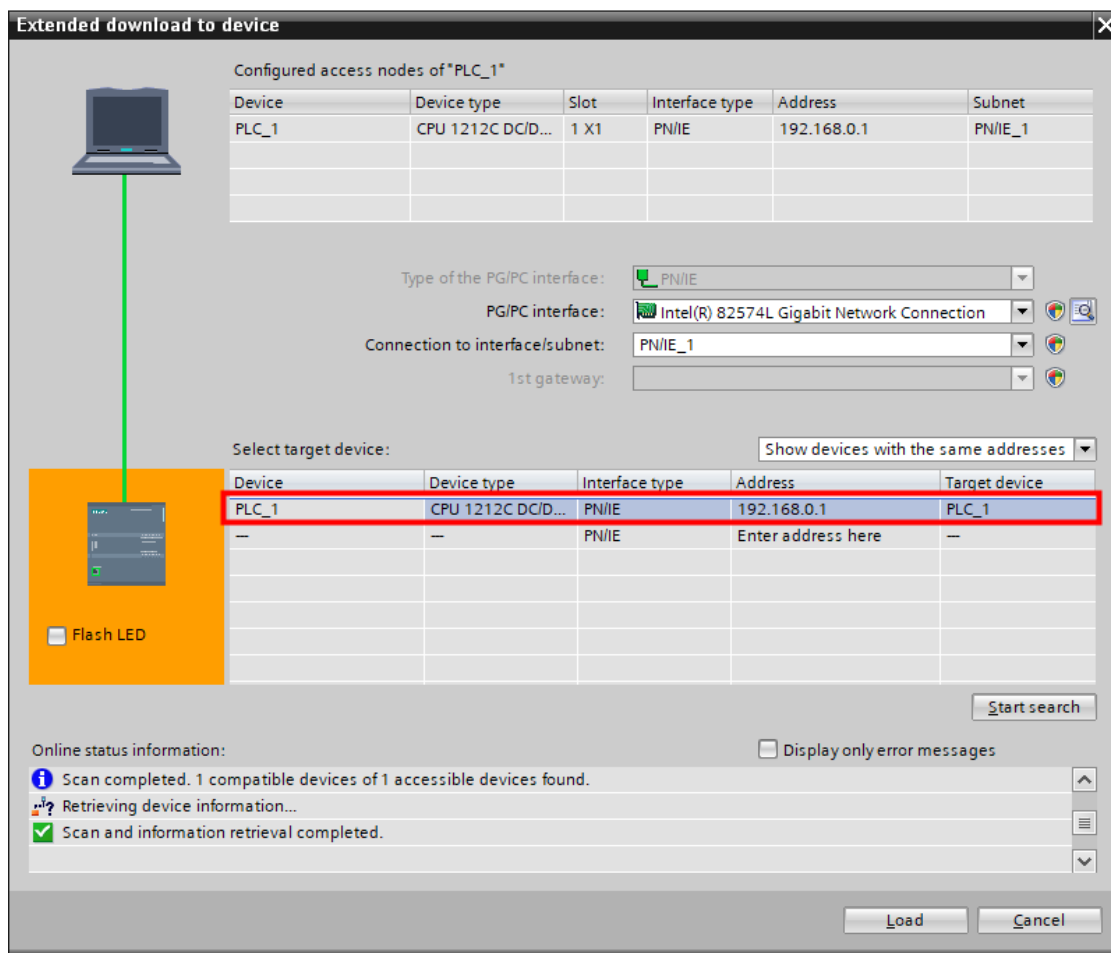
Establish all the address parameters required for the specified connection in DB3. Set the IP address of the gateway. Modify the DB3 properties to remove the $\sqrt{\quad}$ in front of the optimized block access. Select DB3 and save the compilation.



Double-click the main program block Main [OB1] and programmatically call the function block MB-CLIENT on the pop-up interface.

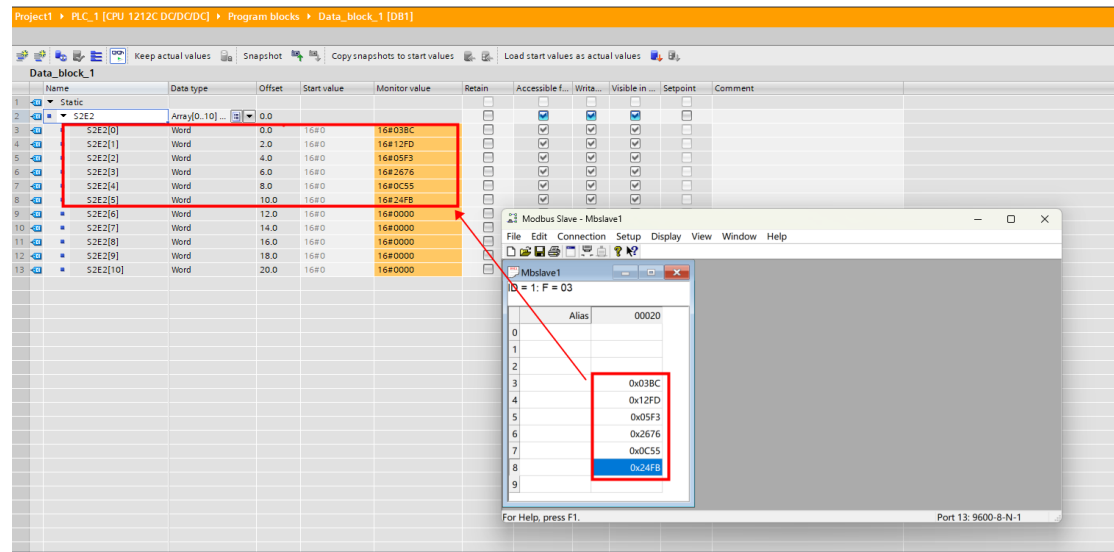


Save, compile, and download programs.



Open the Modbus Slave software to simulate the RS485 device in the field, open the

monitoring table, and monitor whether the data in DB2 is consistent with the data of the Modbus Slave.



5 Appendix

5.1 Modbus-RTU protocol introduction

Only need to understand that Modbus has 8 important function codes corresponding to 4 areas: 4 for reading, 2 for writing a single bit or register, and 2 for writing multiple bits or multiple registers. (Address description uses PLC address)

Modbus storage area

The storage area of the controller (or Modbus device) involved in Modbus is identified by 0XXXX, 1XXXX, 3XXXX, 4XXXX.

Store ID	Name	type of data	Read/write	Storage unit address
0XXXX	Output coil	Bit	Read/write	00001~0XXXX, XXXX: Related to equipment
1XXXX	Discrete input	Bit	Read only	10001~1XXXX, XXXX: Related to equipment
3XXXX	Input register	word	Read only	30001~3XXXX, XXXX: Related to equipment
4XXXX	Output/holding register	word	Read/write	40001~4XXXX, XXXX: Related to equipment

Modbus function code

The Modbus message is relatively fixed, so you only need to understand it a little bit. After reading a few messages, you will know its structure, and you can inquire about it when you need it.

(1) Read output coil status

Function code: 01H

Master query message format:

Address	Function Code	Start Address High	Start Address Low	High Number of Coils	Low Number of Coils	CRC
0x11	0x01	0x00	0x13	0x00	0x25	xxxx

Function: Read the 0XXXX status of the slave output coil.

Note: The start address of the coil of some equipment is 00000, which corresponds to the address 00001 in the equipment, which is sequentially extended.

This example: read the output coil of slave station 0x11, the register start address is 0x13=19, the number of coils is 0x0025H=37; therefore, the function of this query message is: read 0x11(17) slave station output coil 00019—00055, A total of 37 coil states.

Slave response format:

Address	Function Code	Byte count	Coil state 19-26	Coil state 27-34	Coil state 35-42	Coil state 43-50	Coil state 51-55	CRC
0x11	0x01	0x05	0xCD	0x6B	0xB2	0x0E	0x1B	xxxx

Function: Slave machine returns to output coil 0XXXX state

(2) Read discrete input state

Function code: 02H

Master inquiry message format:

address	function code	Start address	Start address low	High number of	Low number of coils	CRC
0x11	0x02	0x00	0xC4	0x00	0x16	xxxx

Function: Read the status of the slave input coil 1XXXX.

Note: The start address of some equipment coils is 10000, which corresponds to the address 10001 in the equipment, which will be extended sequentially.

This example: read the input coil of slave station 0x11, the starting address is 0x00C4=196, and the number of coils is 0x0016=22.

Therefore, the function of this inquiry message is: read 0x11 (17) slave station input

coil 10196-10217, a total of 22 discrete input states.

Slave response format:

address	function code	Byte count	DI 10196-10203	DI 10204-10211	DI 10212-10217	CRC
0x11	0x02	0x03	0xAC	0xDB	0x35	xxxx

Function: Slave machine returns to input coil 1 XXXX state

(3) Read output/holding register

Function code: 03H

Master inquiry message format:

address	function code	Register start address high	Register start address low	High register number	Low register number	CRC
0x11	0x03	0x00	0x6B	0x00	0x03	xxxx

Function: Read the value of the slave holding register 4XXXX.

Note: Some device registers start address 40000 corresponds to 40001 address in the device, and it is postponed sequentially.

This example: read the value of the holding register of the slave station 0x11, the starting address is 0x006BH=107, and the number of registers is 0x0003; therefore, the function of this query message is: reading the 3 holding registers 40107-40109 of the slave No. 0x11 (17H) value.

address	function code	byte count	register 40107 high	register 40107 low	register 40108 high	register 40108 low	register 40109 high	register 40109 low	CRC
0x11	0x03	0x06	0x02	0x2B	0x01	0x06	0x2A	0x64	xxxx

Function: The slave returns the value of the holding register: (40107) =0x022B,

(40108) =0x0106, (40109) =0x2A64

(4) Read the input register

Function code: 04H

Master inquiry message format:

address	function code	Register start address high	Register start address low	High register number	Low register number	CRC
0x11	0x04	0x00	0x08	0x00	0x01	xxxx

Function: Read the value of slave station input register 3XXXX.

Note: In some devices, the register start address 30000 corresponds to the address 30001 in the device, and it is extended sequentially.

This example: Reading the value of the input register of slave station 0x11, starting at 0x0008H Note: In some devices, the starting address of the register 30000 corresponds to the address 30001 in the device, and it is extended sequentially.

This example: read the input register value of slave station 0x11, the starting place is 0x0008H, and the register number is 0x0001;

Therefore, the function of this query message: read the value of 1 input register 30008 of slave station 0x11 (17); the number of registers is 0x0001;

Therefore, the function of this query message: read the value of 1 input register 30008 of slave station 0x11 (17);

Slave response format:

address	function code	Byte count	Input register 30008 high	Input register 30008 low	CRC
0x11	0x04	0x02	0x01	0x01	xxxx

Function: Slave station returns the value of input register 30008; (30008) = 0x0101

(5) Force a single coil

Function code: 05H

Master inquiry message format:

address	function code	coil address high	coil address low	Disconnect mark	Disconne ct mark	CRC
0x11	0x05	0x00	0xAC	0xFF	0x00	xxxx

Function: Force the value of 0x01(17) slave coil 0XXXX. In some devices, the coil start address 00000 corresponds to the address 00001 in the device, which is sequentially extended.

Disconnect mark=FF00, Set coil ON。

Disconnect mark=0000, Set coil OFF。

Example: The starting address is 0x00AC=172. Force the No. 17 slave coil 0172 to ON.

Response format: original text return

Function: Force No. 17 slave coil 0172 ON to return the original text

address	function code	Coil address high	Coil address low	Disconnec t mark	Disconnect mark	CRC
0x11	0x05	0x00	0xAC	0xFF	0x00	xxxx

(6) Preset single holding register

Function code: 06H

Master inquiry message format:

address	function code	coil address high	Register start address low	register number high	register number low	CRC
0x11	0x06	0x00	0x87	0x03	0x9E	xxxx

Function: Preset order to hold the value of register 4XXXX. In some devices, the coil start address of 40000 corresponds to the address of 40001 in the device, which is sequentially extended.

Example: preset the single holding register 40135 of No. 17 slave to 0x039E;

Response format: original text return

address	function code	coil address high	register start address low	register number high	register number low	CRC
0x11	0x06	0x00	0x87	0x03	0x9E	xxxx

Function: Preset No. 17 slave single holding register 40135 as 0x039E and return to the original text.

(7) Forced multiple coils

Function code: 0FH

Master inquiry message format:

address	function code	coil start address high	coil start address low	number of coils high	number of coils low	Byte count	Coil state 20-27	Coil state 28-29	CRC
0x11	0x0F	0x00	0x13	0x00	0x0A	0x02	0xCD	0x00	xxxx

Function: Force multiple continuous coils 0XXXX to ON/OFF state.

Note: In some devices, the coil start address 00000 corresponds to the address 00001 in the device, which is sequentially extended.

In this example: force multiple continuous coils from the slave station of No. 0x11, the start address of the coil is 0x0013=19, and the number of coils is 0x000A=10

Therefore, the function of this query message is: force the value of 0x11(17) slave station 10 coils 00019-00028; CDH→00019-00026; 00H→00027-00028;

Slave response format:

address	function code	High bit of coil start address	Low bit of coil start address	High number of coils	Low number of coils	CRC
0x11	0x0F	0x00	0x13	0x00	0x0A	xxxx

(8) Preset multiple registers

Function code: 10H

Master inquiry message format:

add res s	func tion code	Start regist er addres s high	Start regist er addres s low	regist er numb er high	regist er num ber low	Byte coun t	Data high	Low -leve l data	Data high	Data low	CRC
0x 11	0x10	0x00	0x87	0x00	0x02	0x04	0x01	0x05	0x0 A	0x10	xxxx

Function: preset multiple holding register values 4XXXX of the slave.

Note: In some devices, the starting address of the holding register 40000 corresponds to the address 40001 in the device, which is extended in turn.

This example: preset multiple holding register values of slave station 0x11, the starting address of the register is 0x0087=135, and the number of coils is 0x0002=2.

Therefore, the function of this query message is: preset the values of 2 holding registers of the slave station of No. 0x11 (17); 0105H→40135; 0A10H→40136.

Response format:

address	functi on code	Start register address high	Start register address Low	register number high	register number Low	CRC
0x11	0x10	0x00	0x87	0x00	0x02	xxxx

5.2 Brief introduction of serial network topology

RS232

RS232 is one of the serial communication interfaces of industrial control, and it is widely used to connect computer serial interfaces and peripherals. RS232 uses a signal line and a signal return line to form a common ground transmission form. The three-wire connection method can realize full-duplex communication. The transmission signal is a single-ended signal. This common ground transmission is prone to common mode interference. Therefore, the anti-noise interference is weak and the transmission distance is limited. The RS232 interface standard stipulates that the maximum transmission distance standard value is 50 feet (approximately 15 meters) when the symbol distortion is less than 4%. (Long-distance communication above 15m needs to be adopted Modem), the maximum transmission distance is also related to the communication baud rate. In actual use, if the transmission distance is far, please lower the baud rate. In order to reduce the external electromagnetic interference during signal transmission, please use shielded cables as communication cables.

The RS232 interface standard stipulates on TXD and RXD:

RS232 uses negative logic to transmit signals, and takes $-(3\sim15)$ V signal as logic "1"; takes $+(3\sim15)$ V signal as logic "0"; voltage between $-3\sim+3$ V It is meaningless, and a voltage lower than -15V or higher than +15V is also meaningless.

RS232 interface classification:

DB9 male connector

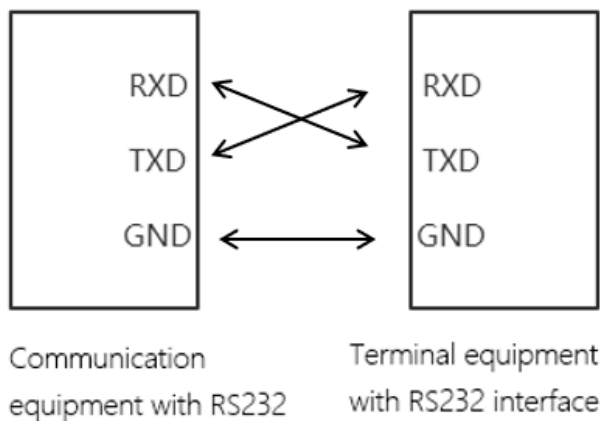


The upper left corner is 1, the lower right corner is 9

9-pin RS232 serial port (DB9)		
PIN	Name	Effect
1	CD	Carrier detect
2	RXD	Receive data
3	TXD	Receive data
4	DTR	Data terminal is ready
5	GND	Signal ground
6	DSR	Data ready
7	RTS	Request to send
8	CTS	Clear to send
9	RI	Ring alert

Because the RS232 interface has the above-mentioned electrical characteristics, it could only realize point-to-point communication.

The RS232 communication wiring diagram is shown in the figure:



RS422

The full name of RS422 interface standard is "Electrical Characteristics of Balanced Voltage Digital Interface Circuit", which defines the characteristics of the interface circuit. RS422 adopts four-wire plus ground wire (T+, T-, R+, R-, GND), full-duplex, differential transmission, multi-point communication data transmission protocol. It adopts balanced transmission and adopts unidirectional/non-reversible transmission line with or without enabling end. Because the receiver adopts high input impedance and the transmission driver has stronger driving ability than RS232, it is allowed to connect multiple receiving nodes on the same transmission line, up to 10 nodes can be

connected. That is, a master device (Master), and the rest are slave devices (Slave).

The slave devices cannot communicate, so RS-422 supports point-to-many two-way communications.

The maximum transmission distance of RS-422 is 4000 feet (about 1219 meters), and the maximum transmission rate is 10Mb/s. The length of the balanced twisted pair is inversely proportional to the transmission rate, and the maximum transmission distance is only possible when the rate is below 100kb/s. Only in a short distance can the highest transmission rate be obtained. Generally, the maximum transmission rate that can be obtained on a 100-meter-long twisted pair cable is only 1Mb/s.

RS-422 needs to be connected to a terminal resistor, and its resistance is required to be approximately equal to the characteristic impedance of the transmission cable. In short-distance transmission, no terminating resistor is needed, that is, no terminating resistor is generally required below 300 meters. The terminating resistor is connected to the far end of the transmission cable.

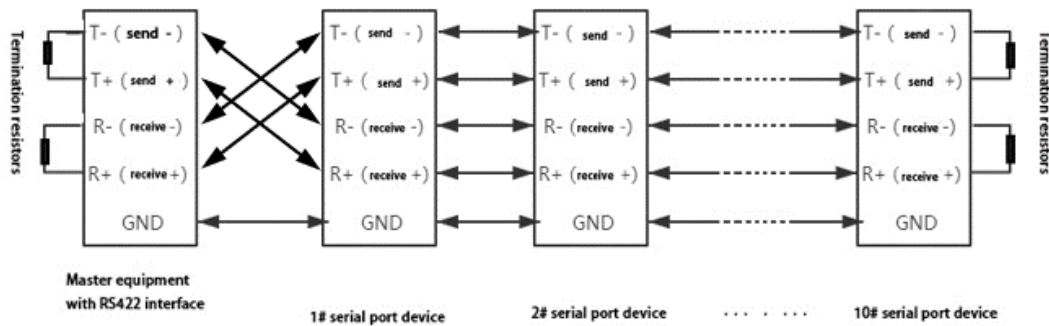
In the one-master-multi-slave network connection, the sending ends of all slave stations are connected to the receiving end of the last connected to the master station through a daisy chain; the receiving ends of all slaves are connected to the last connected to the master station through a daisy chain. Sender.

RS422 (9Pin)		effect	Remarks
3	R-	Receiving negative	Must connect
2	T-	Send negative	Must connect
7	R+	Receiving positive	Must connect
8	T+	Send positive	Must connect



The upper left corner is 1, the lower right corner is 9

The RS422 communication wiring diagram is shown in the figure:



RS485

Since RS-485 is developed on the basis of RS-422, many electrical regulations of RS-485 are similar to RS-422. For example, balanced transmission methods are adopted, and terminating resistors are required to be connected to the transmission line. RS-485 can adopt two-wire and four-wire methods, and the two-wire system can realize true multi-point two-way communication.

RS485 is a standard that defines the electrical characteristics of drivers and receivers in a balanced digital multipoint system. It uses a combination of balanced drivers and differential receivers to enhance the ability to resist common mode interference, that is, to resist noise interference. Since the half-duplex network composed of RS485 interface generally adopts two-wire connection mode, and uses differential signals to transmit data, the voltage difference between the two wires is $-(2\sim6)$ V, which means logic "0", the voltage difference between the two wires $+(2\sim6)$ V means logic "1".

The RS485 signal transmission distance is related to the communication baud rate. The higher the baud rate, the shorter the transmission distance. When the baud rate is not higher than 100KbpS, the theoretical maximum communication distance is about 1200 meters. In actual use, due to Factors such as electromagnetic interference often fail to reach the maximum communication distance. If you are communicating over a longer distance, please lower the baud rate. To reduce the signal's electromagnetic interference during transmission, please use twisted-pair shielded cables as communication cables.

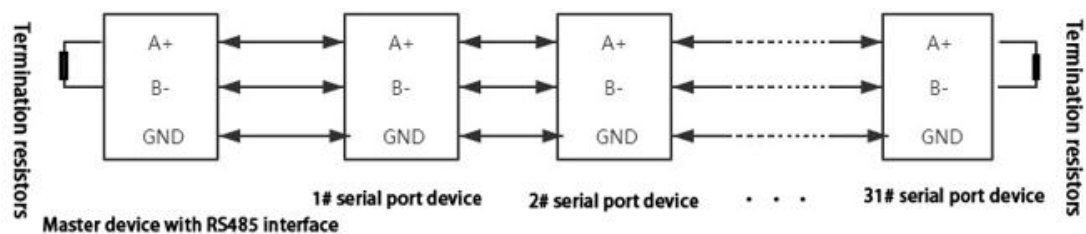
The RS485 bus supports a maximum of 32 nodes without relays. The nodes are connected by a "daisy chain" connection. Terminal resistors are required at both ends of the communication cable, and the resistance is required to be approximately equal to the characteristics of the transmission cable. impedance. In short-distance transmission, no terminating resistor is needed, that is, no terminating resistor is generally required below 300 meters. The terminating resistor is connected to the two ends of the transmission cable.

RS485 9-pin pin definition:

Pin	Name	Effect	Note
1	Data-/B-/485-	Send positive	Must connect
2	Data+/A+/485+	Receiving positive	Must connect
5	GND	Ground wire	



The RS485 communication wiring diagram is shown in the figure:



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