Protocol Converter

ODOT-S2E2

User Manual

V1.00

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ODOT Series ODOT-S2E2

ODOT Automation System Co., Ltd.

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Version information

The following changes have been made to the document:

Date	Version number	Revise content	Author
2014-09-15	V1.00	Release version	GJ
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Software download

Please log on the official website: www.odotautomation.com and click on the corresponding product page to download.

Catalogue

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/RS422 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, "transparent" and "mapping", which can achieve maximum system compatibility.

1.2 Functional Characteristics

◆ 9-36V wide 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 5 TCP client access.

◆ 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 data packet sending interval can be adjusted freely, making it more flexible to use.

◆ 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 installation.

◆ EMC complies with EN 55022:2010 & EN55024:2010 international standards.

1.3 Technical parameters

The technical parameters of this product are shown in Table 3.1. Please use this product within the parameters of this product to obtain better performance.

Table 3.1 Technical parameters

	ODOT-S1E1	ODOT-S2E1
Environmental parameters		
Working temperature	-40~85℃	
Storage temperature	-55~125℃	
Operating humidity	5%~95% (No condensation)	
The power supply parameters		
Number of power ports	1 road	
Input voltage	9-36V（DC） 3KV isolation voltage	
Power consumption	Max.100mA@24V	
Ethernet parameters		
Working mode	Transparent transmission mode, address mapping mode optional, Modbus TCP protocol	
Number of Ethernet ports	2 RJ45, 2KV surge protection, 10M, 100M adaptive rate 1	
Network protocol	ETHERNET、ARP、IP、TCP、ICMP	
Number of TCP connections	Max 5	
Serial port parameters		
Quantity of serial port	Dual RS485	

Serial communication mode	RTU mode and ASCII mode are optional.
Serial terminal resistance	120 Ω external resistance
Supported Baud rate	1200~115200 bps
Supported validation mode	No check, odd check, even check
Number of slave stations supported	Maximum 62 (without repeater)
Mapping mode protocol function code	0x01、0x02、0x03、0x04、0x05、0x06、0x0F、0x10
Modbus data 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 light description

The equipment has five LED status indicator lights, whose symbol definition and status description are shown in "Table 2.1".

Table 2.1 Description of indicator light

Symbol	Definition	State	Instruction
PWR	Power Light on/off	ON	Power on
		OFF	Power off
ETH	Gateway status indication	ON	TCP gateway communication error
		OFF	TCP gateway communication normal
TX1	Serial port no.1 send indicator light	ON	Serial port no.1 data is being sent.
		OFF	Serial port no.1 sends no data.
RX1	Serial port no.1 receiving indicator light	ON	Serial port no.1 data is being received.
		OFF	Serial port no.1 receives no data.
TX2	Serial port no.2 sending indicator light	ON	Serial port no.2 has data being sent.
		OFF	Serial port no.2 no data sent.
RX2	Serial port no.2 receiving indicator light	ON	Serial port no.2 has data being received.
		OFF	Serial port no.2 receives no data.

Caution：*——During normal communication, the status of the ODOT-S2E2 gateway indicator

2.3 Terminal definition

The equipment connection adopts 3 Pin and 16Pin 3.81mm distance unplugging terminal. The RS485 interface terminal is defined as follows.

RS485 terminal definition

serial	Terminal	Definition

number		
1	1B-	Serial port no.1 RS485-
2	1A+	Serial port no.1 RS485+
3	SGND	Signal ground
4	PE	Shield Earthing
5	2B-	Serial port no.2 RS485-
6	2A+	Serial port no.2 RS485+
7	SGND	Signal ground
8	PE	Shield Earthing
9-16	NC	

Power terminal definition

serial number	Terminal	Definition
1	PE	Shield Earthing
2	V-	24Vdc-
3	V+	24Vdc+

2.4 Reset switch

The paper clip can be used to click the reset button, and all the indicators blink once to indicate a successful reset. Gateway reset successfully, the technical parameters of the gateway are as follows:

| Parameter Name		Defaults
Ethernet side	Protocol converter IP	192.168.1.254
	Subnet mask	255.255.255.0
	LAN gateway IP	192.168.1.1
	Modbus TCP data port	502
	Configure the por	1024
	Modbus-TCP watchdog time	30S
	The enabling of Modbus-TCP watch dog	enable
	Gateway work mode	Transmission Mode
	Gateway station Number	247
Serial side	Serial port mode	Master station mode
	Protocol type of Modbus	Modbus RTU
	Serial port baud rate	9600bps
	Check digit	No check
	Data bits	8bit
	Stop bit	1bit
	Receive character interval	3.5t
	Message sent	0
	Timeout processing	Data retention
	Slave response timeout	500ms

2.5 External terminal resistance

According to the site situation, the serial port side of gateway needs external 120 Ω terminal resistance. The RS485 bus supports a maximum of 32 nodes without relay, A "daisy chain" connection is used between nodes, and terminal resistors are required at both ends of the communication cable, and their resistance is required to be approximately equal to the characteristic impedance of the transmission cable. In short-distance transmission, no terminating resistor is required, that is, no terminating resistor is generally required below 300 meters.

The terminating resistor is connected to the two ends of the transmission cable. When

the gateway is used in the field, if the field RS485 bus is far away and the field interference is large, it is necessary to add 120Ω terminal resistance at both ends of the RS485 bus to prevent the reflection of the serial signal.

Note: 120 Ω resistance attached to the package, please check it.
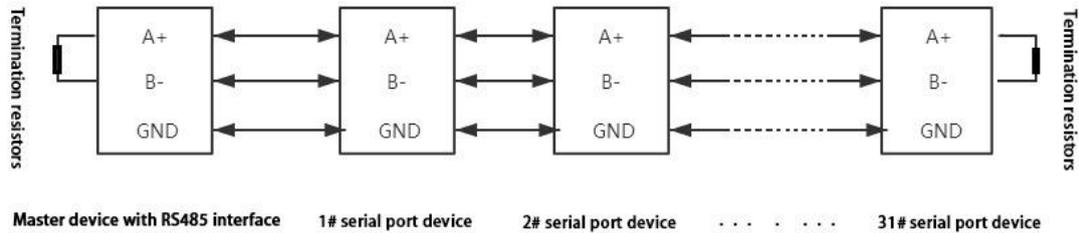
2.6 Installation dimension

3. How to use the gateway

3.1 Introduction to how to use Gateway

3.1.1 Serial port working mode

There are two types of working modes: **Master mode and slave mode**.

When the serial port works in the master station mode, the serial port can connect up

to 31 Modbus RTU/ASCII slave devices without relay; this mode is mainly used for the communication between the Modbus TCP master station and the Modbus RTU/ASCII slave station.

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

(1) Realize data communication between Modbus TCP client and Modbus RTU/ASCII master station;

(2) Realize data communication between Modbus RTU/ASCII master stations;

(3) Realize Modbus TCP client and a Modbus RTU/ASCII master to communicate with a Modbus RTU/ASCII slave at the same time.

3.1.2 Gateway working mode

The gateway has two working modes, "transparent" and "mapping", and it is in "transparent" mode under factory settings. There is no data buffer in the "transparent transmission" mode, and there is no need to edit the slave address mapping table. After receiving the command from the Modbus TCP client, the gateway directly sends the command to the Modbus RTU/ASCII slave device and waits for the slave device to respond After the slave device responds, it directly returns the data to the TCP client. The "mapping" mode adopts the data buffer mode, and the slave station address mapping table needs to be edited. After the gateway is powered on, the slave stations are polled and the data is stored in the data buffer area. After the gateway receives the command from the Modbus TCP client, it reads the data from the data buffer area and returns the data to the TCP client. This method can greatly reduce the waiting time when the client accesses the slave station and increase 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 "Table 3.1".

Table 3.1 Data storage area address table

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

3.1.4 System diagnosis area

The system diagnosis is divided into two parts. The first part: Address 0x2000-0x200F has 16 words i.e. 256 bits, which is the "slave station error indication area". The bits numbered 1-247 correspond to the slave stations with address 1-247. , The bits numbered 248-256 are reserved. When an error occurs in the slave communication, the bit corresponding to the slave address is set to 1. The corresponding error indication bit will be automatically cleared after the slave station returns to normal. The data encoding format is shown in "Table 3.2".

Table 3.2 Coding format of slave error indication area

	BIT	Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
Address 0x2000	Bit number	16	15	14	13	12	11	10	9
	BIT	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
	Bit number	8	7	6	5	4	3	2	1
Address 0x2001	BIT	Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
	Bit number	32	31	30	29	28	27	26	25
	BIT	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
	Bit number	24	23	22	21	20	19	18	17

	BIT	**Bit15**	**Bit14**	**Bit13**	**Bit12**	**Bit11**	**Bit10**	**Bit9**	**Bit8**
.									
.									
.									
Address 0x200F	BIT	**Bit15**	**Bit14**	**Bit13**	**Bit12**	**Bit11**	**Bit10**	**Bit9**	**Bit8**
	Bit number	x	x	x	x	x	x	x	x
	BIT	**Bit7**	**Bit6**	**Bit5**	**Bit4**	**Bit3**	**Bit2**	**Bit1**	**Bit0**
	Bit number	x	247	246	245	244	243	242	241

The second part: The address 0x2010-0x2106 has a total of 247 words, which is the "slave station status indication" area. Reading this area can get the current working status of the slave station. The data encoding format is shown in "Table 3.3".

Table 3.3 Coding format of slave status indication area

Address 0x2010	Slave station 1	**Byte1**	**Byte0**
		Function code	Error code
Address 0x2011	Slave station 2	**Byte1**	**Byte0**
		Function code	Error code
.			
.			
.			
Address 0x2106	Slave station 247	**Byte1**	**Byte0**
		Function code	Error code

Each Word is divided into high and low bytes. Byte1 is the high byte, indicating the function code currently executed and mapped to the slave. Byte0 is the low byte, indicating the error code of the current slave communication. The specific meaning of the slave error codes is shown in "Table 3.4".

Table 3.4 Description of Slave Error Code

Error code	Fault description	Troubleshooting method
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

3.2 Default parameters

The default factory configuration of the gateway is as follows:

Table 3.5 Factory default configuration of gateway

Parameter name		Default value
Ethernet side	Ethernet side protocol converter IP	192.168.1.254
	Subnet mask	255.255.255.0
	LAN gateway IP	192.168.1.1
	Modbus TCP data port	502
	Configure port	1024
	Modbus-TCP watchdog time	30S
	Whether Modbus-TCP watchdog is enabled	Enable
	Gateway working mode	Transparent transmission mode
	Gateway station number	247
Serial side	Serial working mode	Master mode
	Modbus protocol type	Modbus RTU
	Serial port baud rate	9600bps
	Check digit	No check
	Data bits	8 bits
	Stop bit	1 bit
	Receiving character interval	3.5t
	Message sent Ange	0
	Timeout processing method	Data retention
	Slave response timeout time	500ms

Note: The gateway factory-set work under transparent transmission mode can be used without configuration. At this time, all request data of the TCP client is sent to the serial port

1. If you want to configure the parameters of the gateway, please use the software "ODOT MGCC Config" for configuration. The software installation package is in the CD-ROM, or you can call the Sichuan Odot Automation System Co., Ltd. hotline: +86-816-2538289.

3.3 Gateway IP address modification

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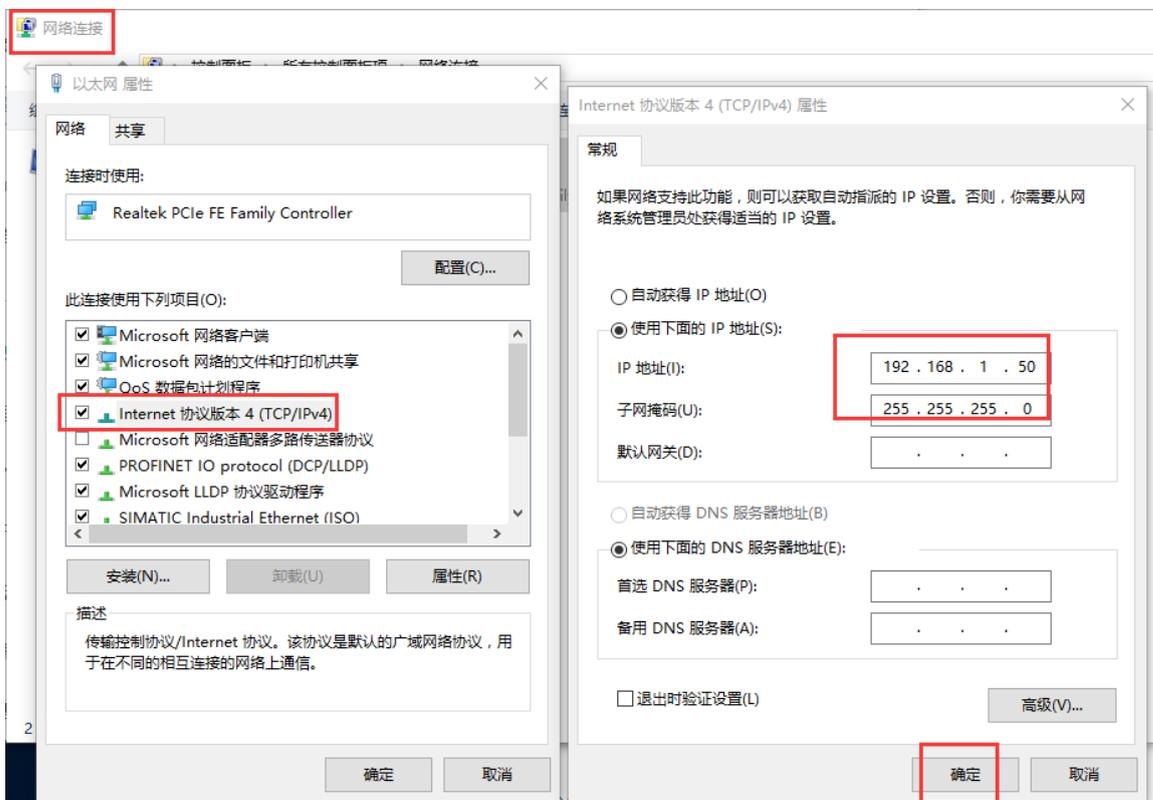
Modify the gateway IP address of the configuration software interface to:

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 directly,

and a warning box will pop up to confirm whether to modify the IP address. Click OK, you

can see the download is successful in the lower right corner.

After the IP address is successfully modified, you need to change the computer's IP address to: 192.168.10.* network segment.
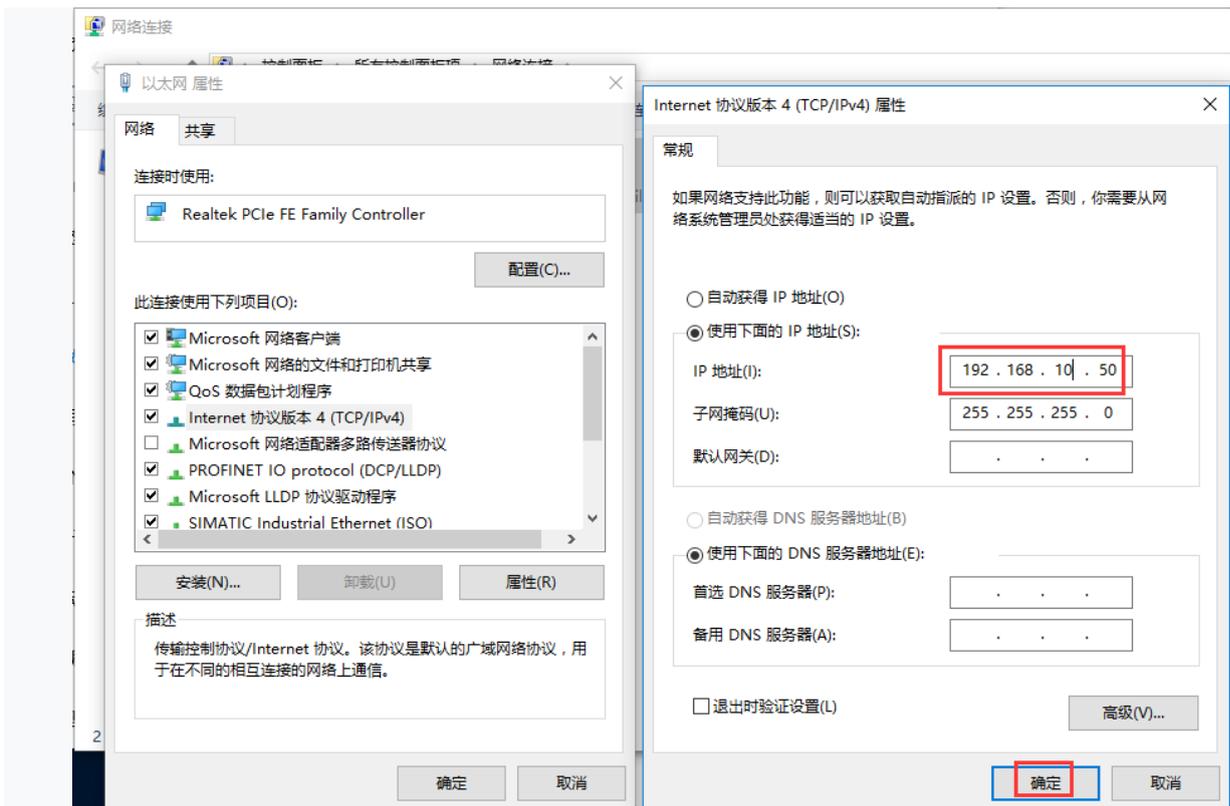
Click Upload Gateway Configuration on the configuration software MGCC Config interface. After the upload is successful, you can see the upload success in the lower right corner.

3.4 Description of typical applications

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

3.4.1.1 Application topology

上位机
（TCP客户端）

其他TCP客户
端（如PLC）

以太网

ODOT-S2E1

RS485

远程I/O   PLC   仪表   变频器   其他Modbus
RTU/ASCII从站设备

3.4.1.2 Transparent transmission mode configuration

1.Open configuration software "odot MGCC Config", Right click the slave configuration page and select "Add Device",Add "ODOT-S2 E2".
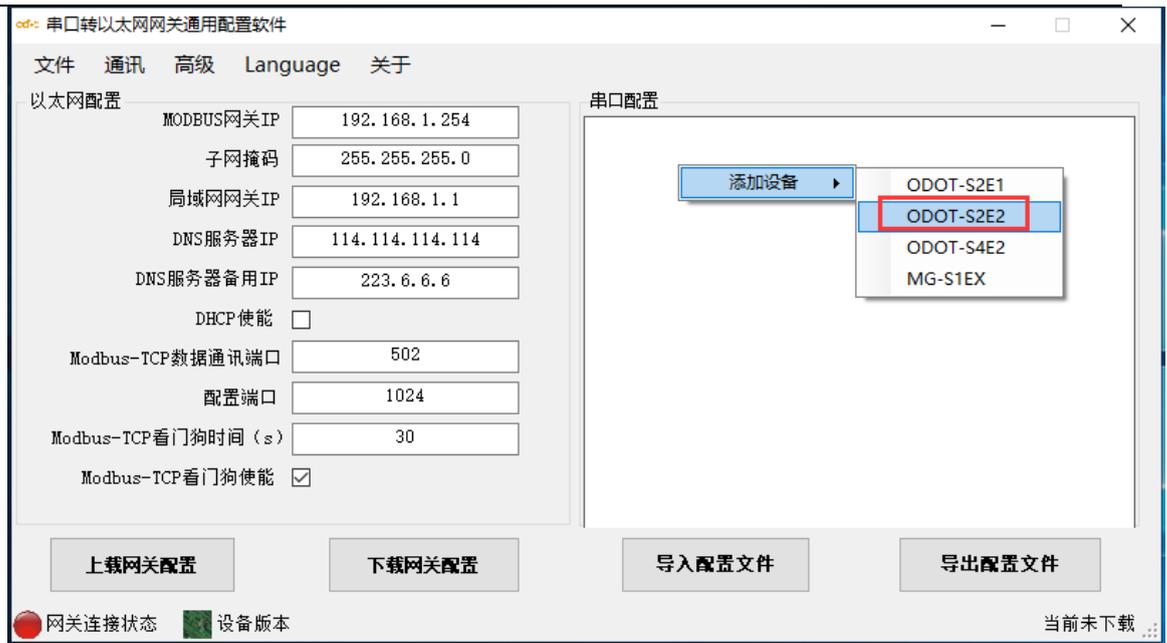
Figure 3.2 Add device

2. Double-click "ODOT-S2E2" or right-click "ODOT-S4E2", Select "common device attributes", Set the gateway working mode to Transparent in the popup page.

Double-click "COM1" or "COM2" or right-click "COM1" or "COM2" and click "Serial Port Properties". The "Serial Port Settings" 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：

Operating mode：
It is used to set up gateway as master station or slave station in the network.

Default is master mode.

Modbus protocol type：

It is used to set up the gateway's protocol type of the network between the communication of the serial port and other connected devices. You can choose Modbus RTU or Modbus ASCII. Please keep this parameter in accord with the device that is connected to the serial port.

Baud rate：

Serial port baud rate: optional range is 1200~115200bps and default is 9600bps, Please keep this parameter in accord with the device that is connected to the serial port.

Check Digit:

no parity, odd parity, even parity, no default can be chose. Please keep this parameter in accord with the device that is connected to the serial port.

Stop bit：
You can choose stop bit 1 or stop bits 2. Default is stop bit 1. Please keep this parameter in accord with the device that is connected to the serial port.

Receive character interval：
when receiving packets Frame interval detection time can be chose from 1.5t to 200t. Default is 3.5t. In general, you don't have to change this parameter.

Packet transmission interval：
Interval time for sending Modbus commands (Delayed time from receiving the slave response message to sending the next command) can be set from 0ms-65535ms. Default is 0ms. It is recommended to set 100ms.It can Prevent connected devices from communication failure due to slow response.

Timeout processing：

Read data from slave station. Data processing mode can choose "data clear" or "data retention"if slave station response timeout. Default is "Data Hold mode".This parameter is only valid for Modbus read command. Please set this value according to actual needs.
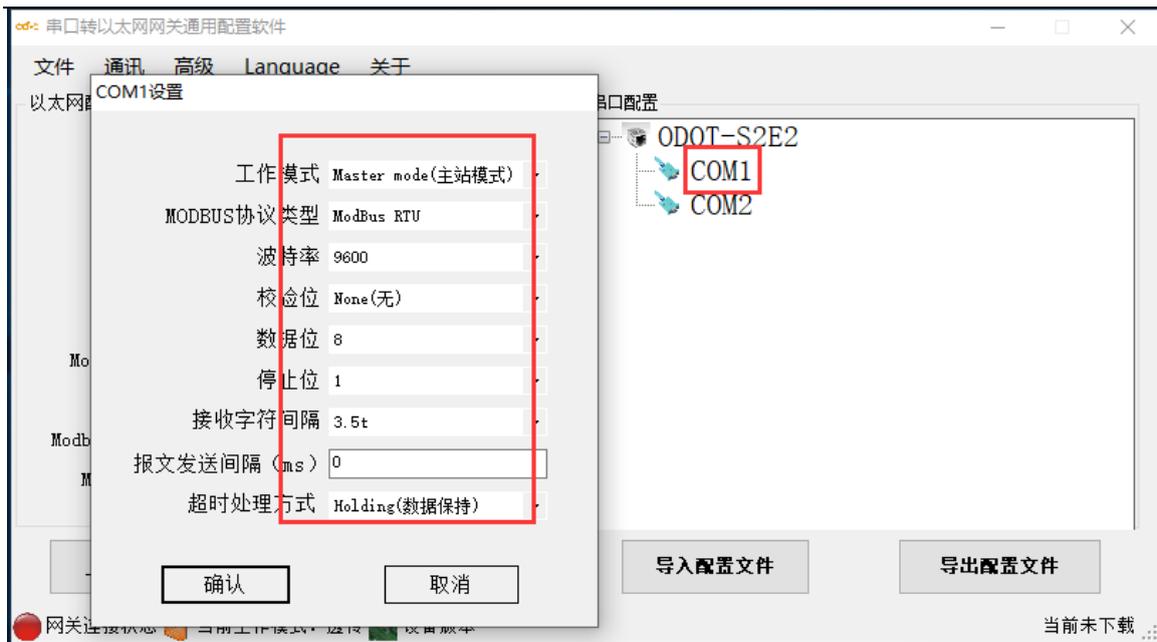
Figure 3.4 Set serial port properties

4.Select "COM1" or "COM2", right-click and select Add Slave, enter "Slave Name", fill in "Slave Station Number" and Slave "Response Timeout" time, and click "OK" to return. The station number of each slave station on the device cannot be the same, it cannot be the same as the station number of the device, and the slave station address range is between 1-247, and the slave station names under the same serial port cannot be the same. The "Response timeout" time needs to be obtained from the manual of the device. It is recommended to set it above 500ms, and click "OK".
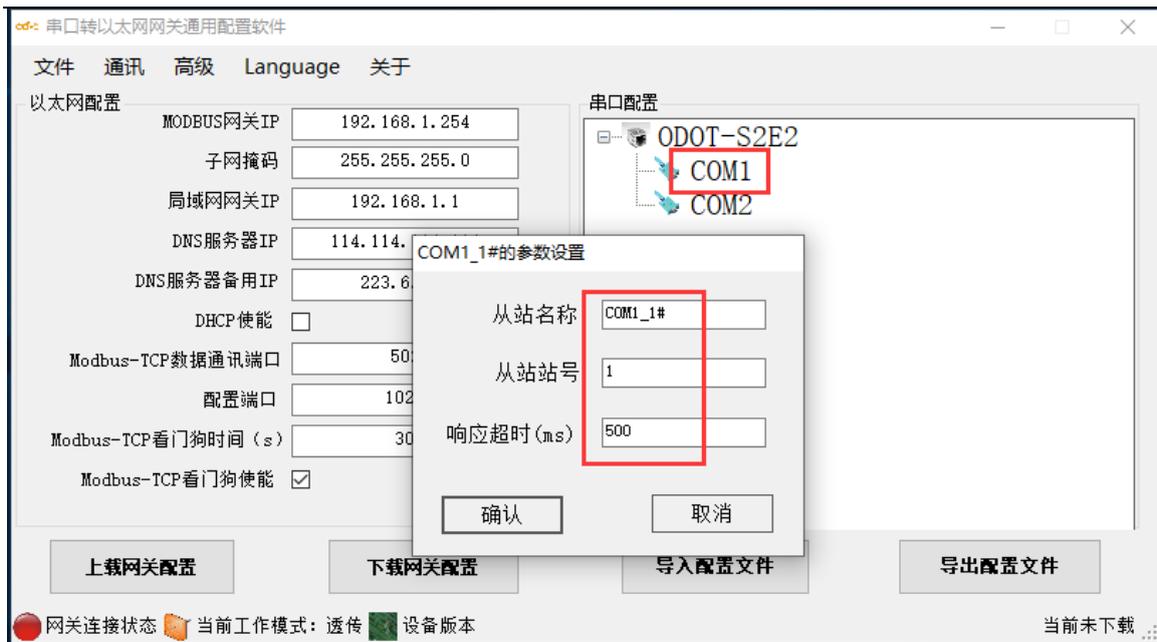
Figure 3.5 Add Slave

5.Configure the Ethernet parameters of the gateway through the "Ethernet Configuration" in the left half of the configuration software.

The meanings of some parameters are as follows:

Modbus gateway IP: the IP address of the device itself;

Subnet mask: the subnet mask of the device;

LAN gateway IP: the gateway IP address of the network where the device is located;

Modbus-TCP data communication port: generally 502;

Configuration port: The configuration software downloads the configuration to the device through this port of the device;

Modbus-TCP watchdog time: the time interval from the time the gateway receives the last Modbus TCP message to the automatic restart; Note: the automatic restart of the gateway can timely release the connection resources that have not been used for a long time;

Modbus-TCP watchdog enable: whether to enable the watchdog function.
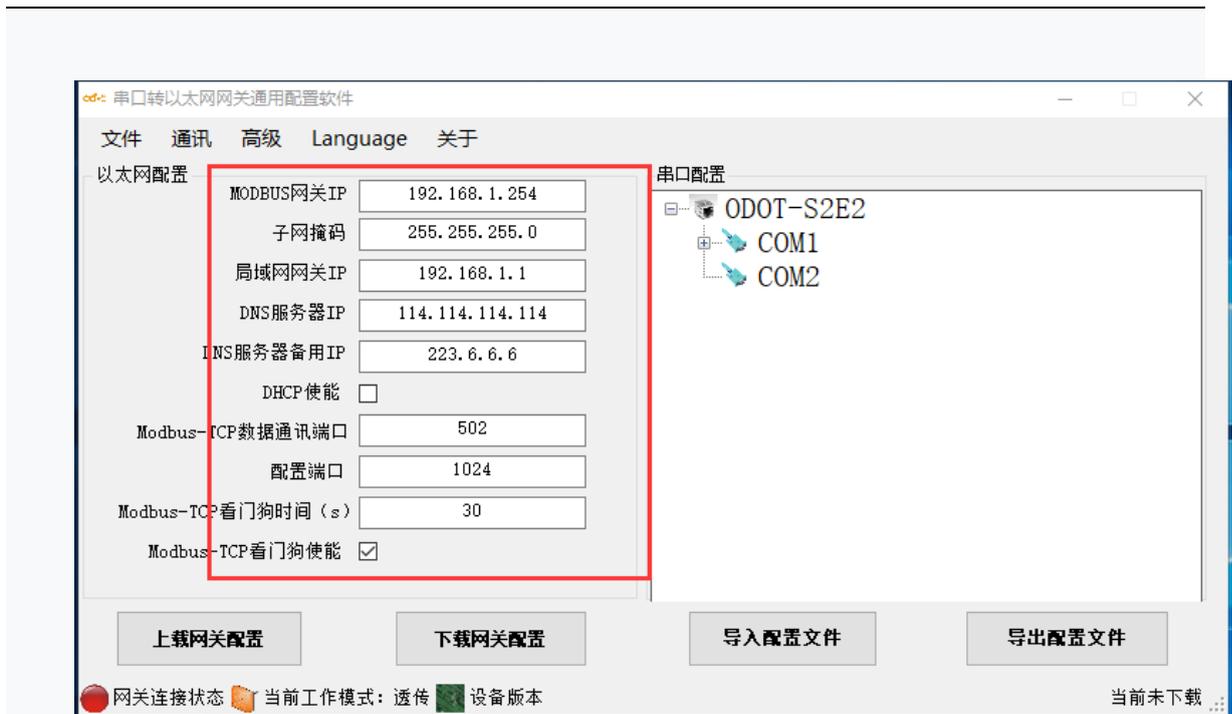
Figure 3.6 Set device Ethernet properties

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

Figure 3.7 Communication configuration between software and gateway

7．Click the "Download Gateway Configuration" 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 you forget the gateway IP address, you can reset the gateway through the reset button, and the gateway IP address after reset It is the factory default IP address. Click "Import Configuration File" and "Export Configuration File" to import and save configuration files to the local disk. Click "Upload Gateway Configuration" 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.

Figure 3.8 Download gateway configuration

8. 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.

3.4.1.3 Mapping mode configuration

Open the configuration software "odot MGCC Config".Right-click on the configuration page of slave station and select "Add Device" ,then add "ODOT-S2E2".
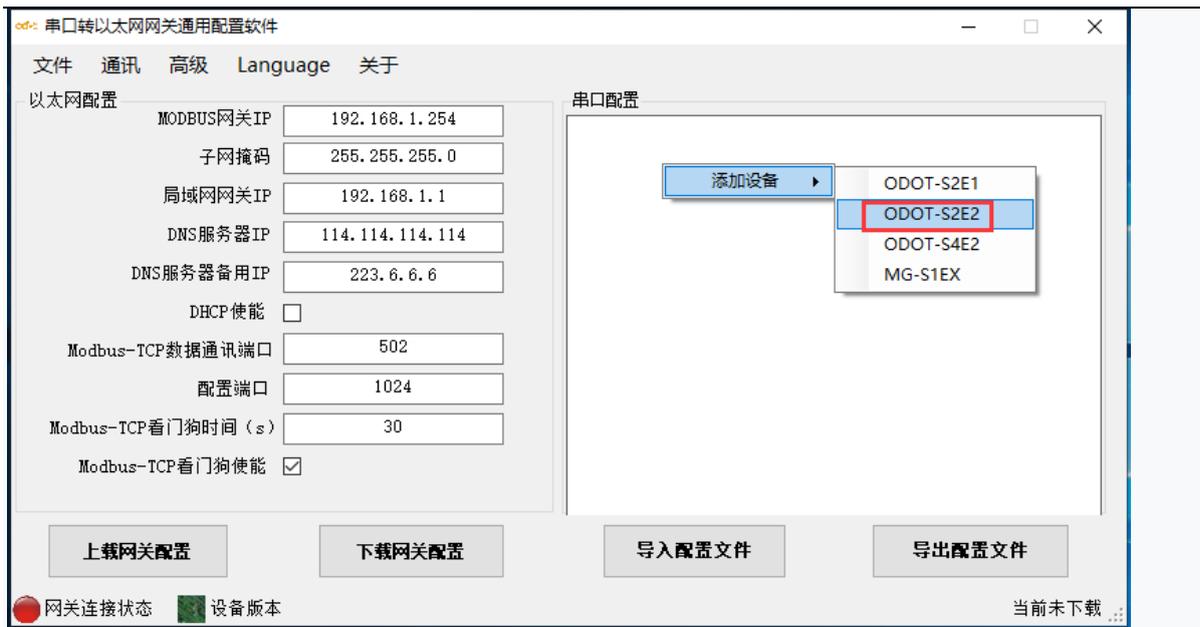
Figure 3.9 Add device

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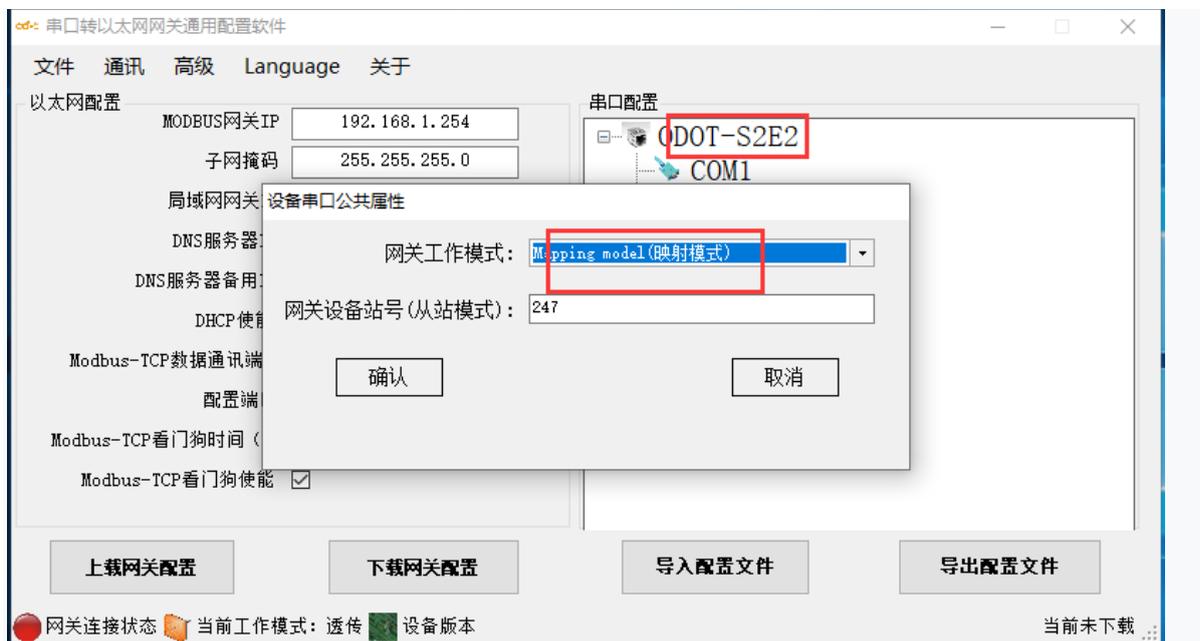

Figure 3.10 Set gateway working mode

Double-click "COM1" or "COM2" or right-click "COM1" or "COM2" and click "Serial Port Properties". The "Serial Port Settings" 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：

Operating mode：

It is used to set up gateway as master station or slave station in the network. Default is master mode.

Modbus protocol type：

It's used to set up the gateway's protocol type of the network between the communication of the serial port and other connected devices. You can choose Modbus RTU or Modbus ASCII. Please keep this parameter in accord with the device that is connected to the serial port.

Baud rate：

Serial port baud rate: optional range is 1200~115200bps and default is 9600bps, Please keep this parameter in accord with the device that is connected to the serial port.

Check Digit：

No parity, odd parity, even parity, no default can be chose. Please keep this parameter in accord with the device that is connected to the serial port.

Stop bit：

You can choose 1 stop bit or 2 stop bits. Default is 1 stop bit. Please keep this parameter in accord with the device that is connected to the serial port.

Receiving character interval:

when receiving packets Frame interval detection time can be chose from 1.5t to 200t. Default is 3.5t. In general, you don't have to change this parameter.

Packet transmission interval：

Interval time for sending Modbus commands (Delayed time from receiving the slave response message to sending the next command) can be set from 0ms-65535ms. Default is 0ms. It is recommended to set 100ms.It can Prevent connected devices from communication failure due to slow response.

Timeout processing：

Read data from slave station. Data processing mode can choose "data clear" or "data retention" if slave station response timeout. Default is "Data Hold mode". This parameter is only valid for Modbus read command. Please set this value according to actual needs.
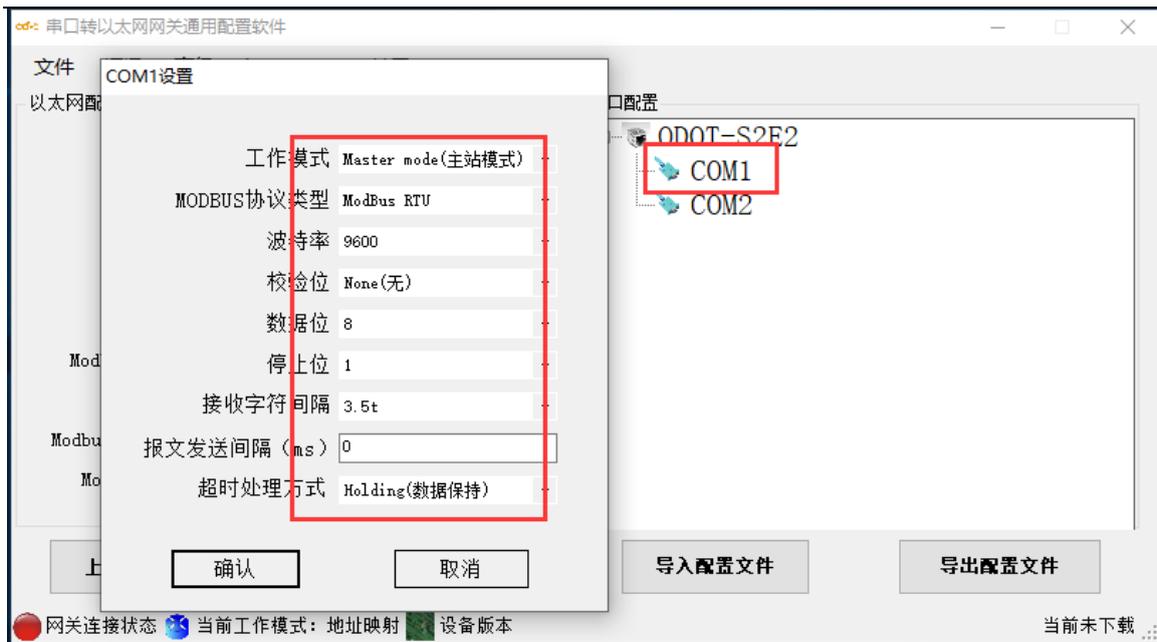
Figure 3.11 Set serial port parameters

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".
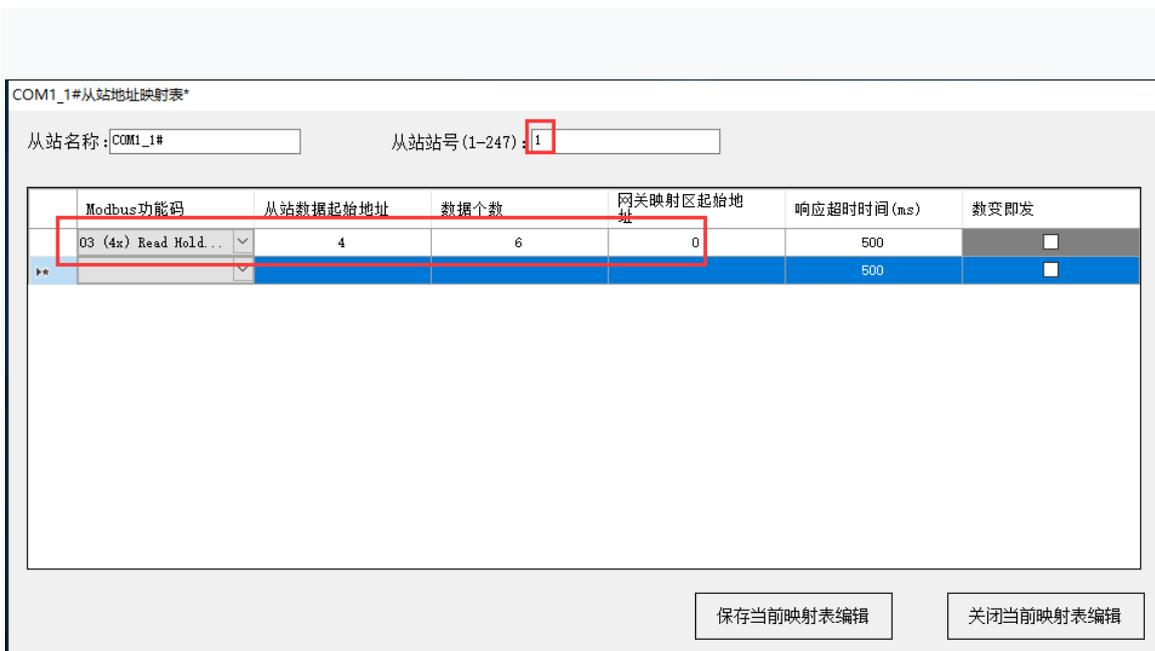
Figure 3.12 Add slave

Figure 3.13 Configure slave address mapping table

5．Configuring the Ethernet parameters of the gateway by the "Ethernet Configuration" on the left of the software.

Some of the parameters are as follows：

Modbus gateway IP：The device's own IP address;

Subnet mask：Subnet mask of the device;

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

Modbus-TCP data communication port：Generally 502；

Configure the port：The configuration software downloads the configuration to the device through this port of the device；

Modbus-TCP watchdog time：The time interval from when the gateway receives the last Modbus TCP packet to the automatic restart;

Modbus-TCP watchdog enable：Whether the watchdog function is enabled.

Figure 3.14 Configure gateway Ethernet parameters

6. 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.

Figure 3.15 Software and gateway communication configuration

7．Click the button "Download Gateway Configuration ".Download configuration parameters to the gateway. After the download is successful, the "Download successful" prompt appears in the Status Bar at the lower right. After the download is successful, the gateway restarts automatically then the gateway goes into running state.

If the download fails, please check out whether the computer's IP address and gateway IP address are in the same network segment. Then check whether the gateway IP address is set correctly. If you forget the gateway IP address, you can reset the gateway through the reset button. After reset, the gateway IP address is the factory default IP address.

Note: When downloading and uploading, you need to ensure that the computer and the gateway are in the same network segment.

Figure 3.15 Download gateway configurations

8．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 X(0<X<248 and X cannot be the device station number for the gateway) though the gateway IP address 192.168.1.254, the Modbus data communication port 502 and the slave station number 1.

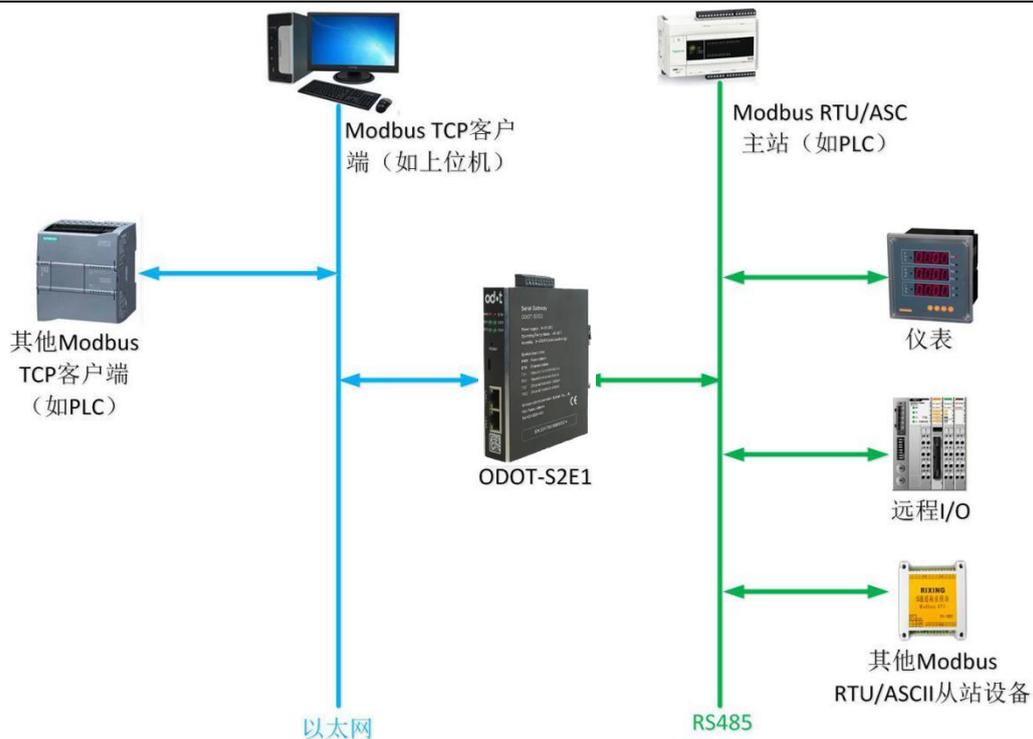## 3.4.2 Realize Modbus TCP Client and Modbus RTU/ASCII Master Station Communication

3.4.2.1 Application topology diagram

Figure 3.16 System topology diagram

3.4.2.2 Simple configuration

1.Open the configuration software "odot MGCC Config".Right-click on the configuration page of slave station and select "Add Device" ,then add "ODOT-S2E2".
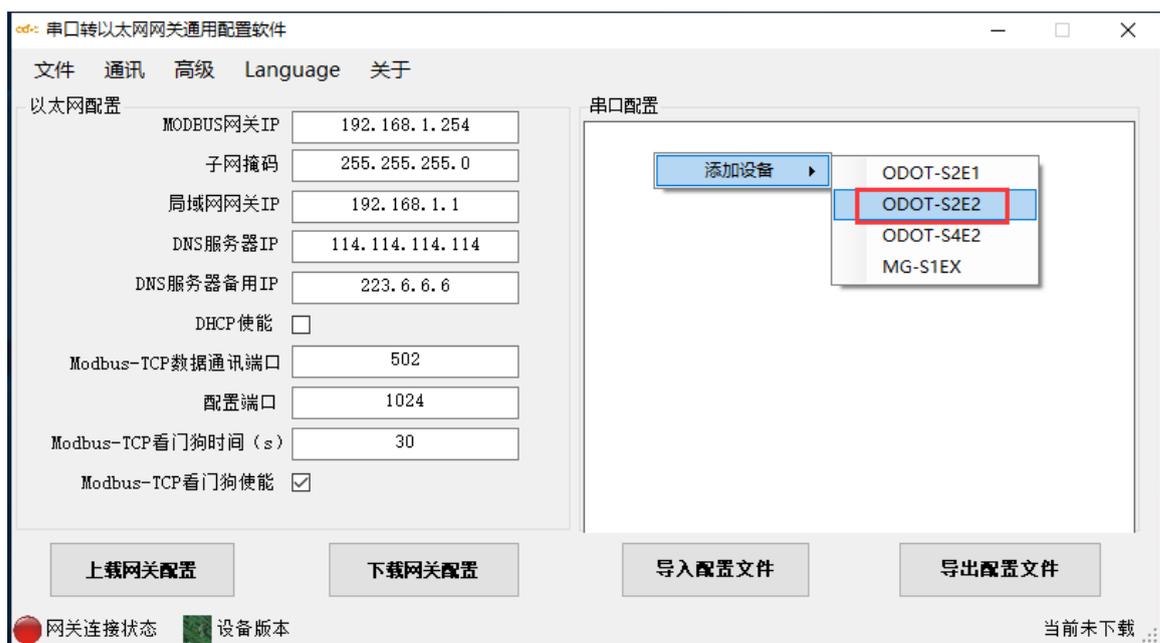
Figure 3.17 Add device

2.Double-click "ODOT-S4E2" or right-click "ODOT-S4E2", Select "common device attributes", set the gateway as the station number of the Modbus RTU/ASCII slave on the popup setup page.

Figure 3.18 Set gateway working mode

3.Double-click "COM1" or "COM2" or right-click "COM1" or "COM2" and click "Serial Port Properties", the "Serial Port Settings" window will pop up, set the communication parameters, set the serial port working mode to slave mode, click "Confirm" button to save and return.

The meaning of each parameter is as follows：

Operating mode：

It is used to set up gateway as master station or slave station in the network. Default is master mode. Here is set up slave mode.

Modbus protocol type：

It's used to set up the gateway's protocol type of the network between the communication of the serial port and other connected devices. You can choose Modbus RTU or Modbus ASCII. Please keep this parameter in accord with the device that is connected to the serial port.

Baud rate：

Serial port baud rate, its optional range is 1200~115200bps and default is 9600bps, Please keep this parameter in accord with the device that is connected to the serial port.

Check Digit：

No parity, odd parity, even parity, no default can be chose. Please keep this parameter

in accord with the device that is connected to the serial port.

Stop bit：

You can choose stop bit 1 or stop bits 2. Default is stop bit 1. Please keep this parameter in accord with the device that is connected to the serial port.

Receive character interval：

When receiving packets Frame interval detection time can be chose from 1.5t to 200t. Default is 3.5t. In general, you don't have to change this parameter.

Slave response delay：

The gateway acts as a Modbus RTU/ASCII slave, from the time it receives a message from the master to when it sends a reply. This parameter relates to the performance of the master.
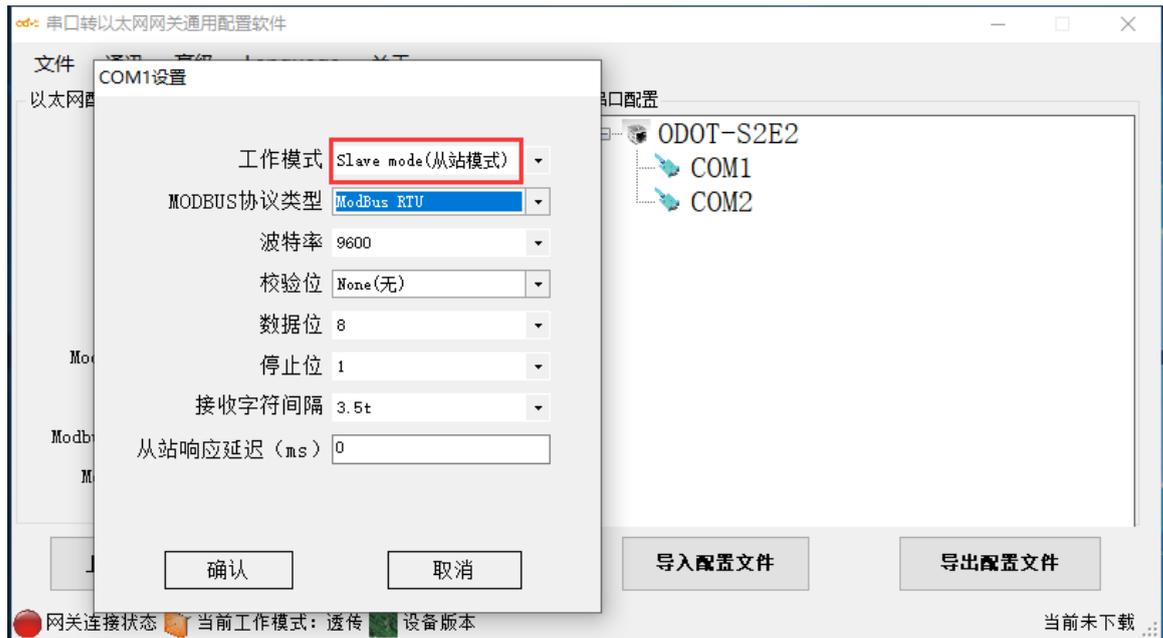

Figure 3.19 Set the corresponding serial port to slave mode

4.Configure the Ethernet parameters of the gateway by the "Ethernet Configuration" on the left of the software.

Some of the parameters are as follows：

Modbus gateway IP： The device's own IP address;

Subnet mask： Subnet mask of the device;

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

Modbus-TCP data communication port： Generally 502；

Configure the port: The configuration software downloads the configuration to the

device through this port of the device；

Modbus-TCP watchdog time: The time interval from when the gateway receives the last Modbus TCP packet to the automatic restart;

Note: Automatic restart of the gateway can release connection resources that have not been used for a long time in time;

Modbus-TCP watchdog enable： Whether the watchdog function is enabled.

Figure 3.20 Configure gateway Ethernet parameters

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

Figure 3.21 Software and gateway communication configuration

6. Click the button "Download Gateway Configuration ".Download configuration parameters to the gateway. After the download is successful, the "Download successful" prompt appears in the Status Bar at the lower right.After the download is successful, the gateway restarts automatically then the gateway go into running state.

If the download fails, please check out whether the computer's IP address and gateway IP address are in the same network segment. Then check whether the gateway IP address is set correctly. If you forget the gateway IP address, you can reset the gateway through the reset button, and after reset the gateway IP address is the factory default IP address.

Click "Import Profile" and "Export Profile" to import and save the configuration file to the local disk. Click "Upload Gateway Configuration" to upload the current gateway configuration to the software.

Note: When downloading and uploading, you need to ensure that the computer and the gateway are in the same network segment.

Figure 3.22 Download the gateway configuration.

7. 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 Realize the communication between Modbus RTU / ASCII master stations
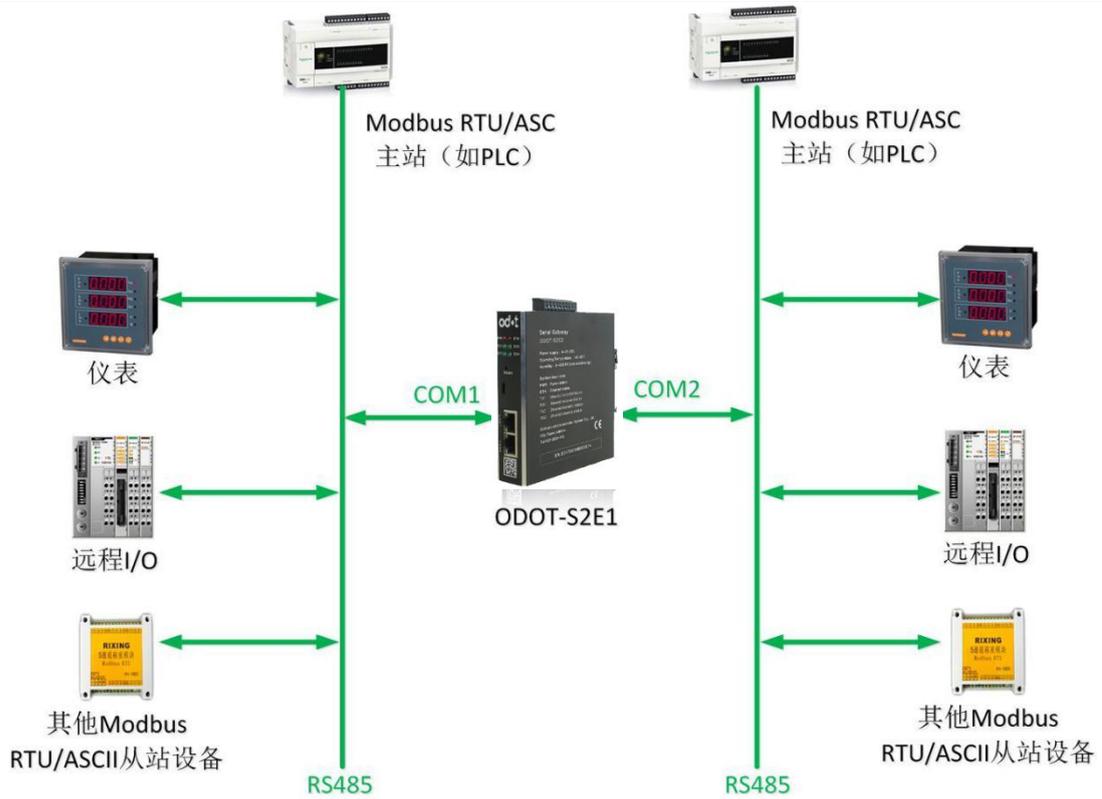
3.4.3.1Application topology diagram

Figure 3.23 System topology diagram

3.4.3.2 Simple configuration

1.Open the configuration software "odot MGCC Config".Right-click on the configuration page of slave station and select "Add Device" ,then add "ODOT-S4E2".
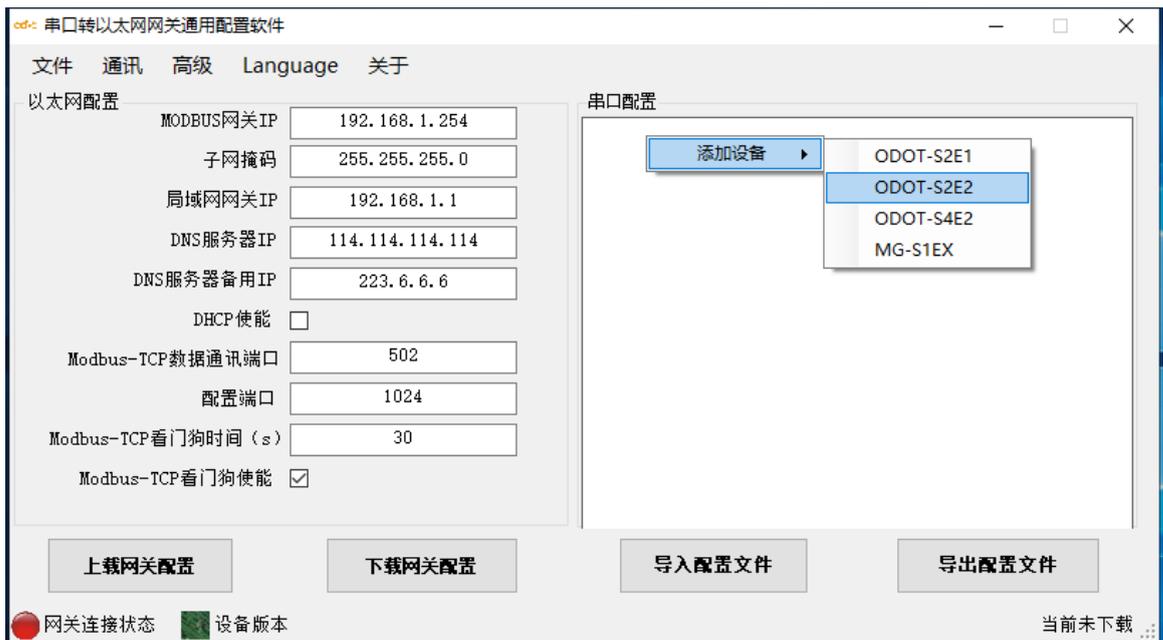
Figure 3.24 Add device

2. Double-click "ODOT-S4E2" or right-click "ODOT-S4E2", Select "common device attributes", set the gateway as the station number of the Modbus RTU/ASCII slave on the popup setup page.
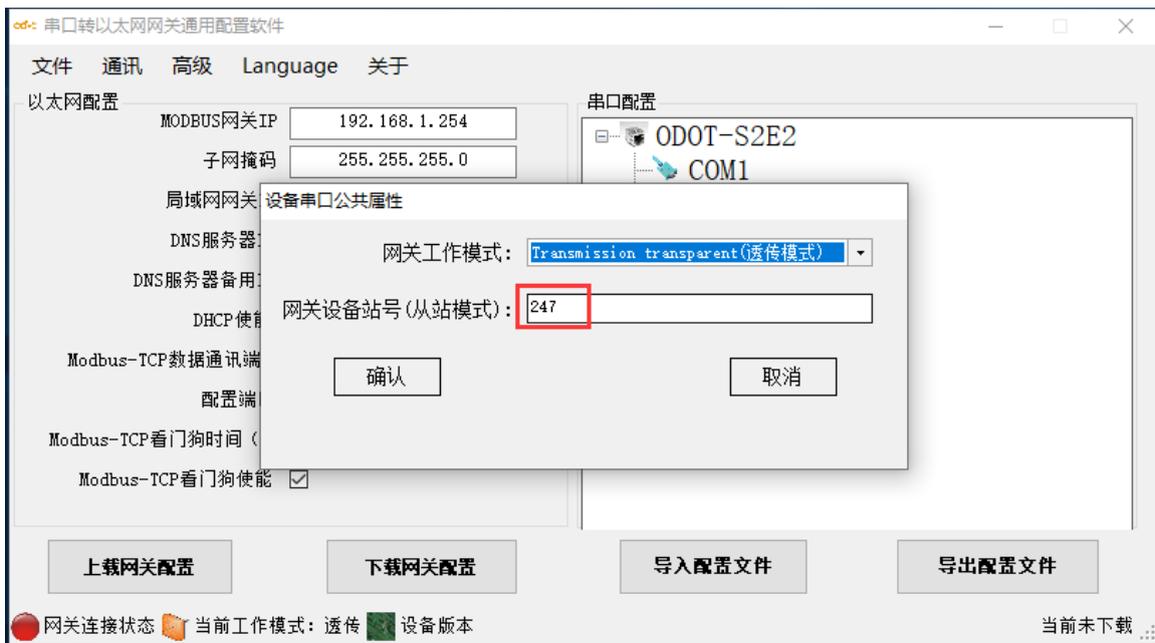

Figure 3.25 Set gateway working mode

3. Double-click "COM1", "COM2" or right-click "COM1", "COM2" and click "Serial Port Properties", the "Serial Port Settings" window will pop up, set the communication parameters, and set the working modes of both serial ports to slave Station mode, click the "OK" button to save and return.

The meaning of each parameter is as follows：

Operating mode：
It is used to set up gateway as master station or slave station in the network.
Default is master mode. Here is set up slave mode.

Modbus protocol type：
It is used to set up the gateway's protocol type of the network between the communication of the serial port and other connected devices.You can choose Modbus RTU or Modbus ASCII. Please keep this parameter in accord with the device that is connected to the serial port.

Baud rate：

Serial port baud rate: optional range is 1200~115200bps and default is 9600bps, Please keep this parameter in accord with the device that is connected to the serial port.

Check Digit：

No parity, odd parity, even parity, no default can be chose. Please keep this parameter in accord with the device that is connected to the serial port.

Stop bit：

You can choose stop bit 1 or stop bits 2. Default is stop bit 1. Please keep this parameter in accord with the device that is connected to the serial port.

Receive character interval：

When receiving packets Frame interval detection time can be chose from 1.5t to 200t. Default is 3.5t. In general, you don't have to change this parameter.

Slave response delay：

The gateway acts as a Modbus RTU/ASCII slave, from the time it receives a message from the master to when it sends a reply. This parameter relates to the performance of the master.
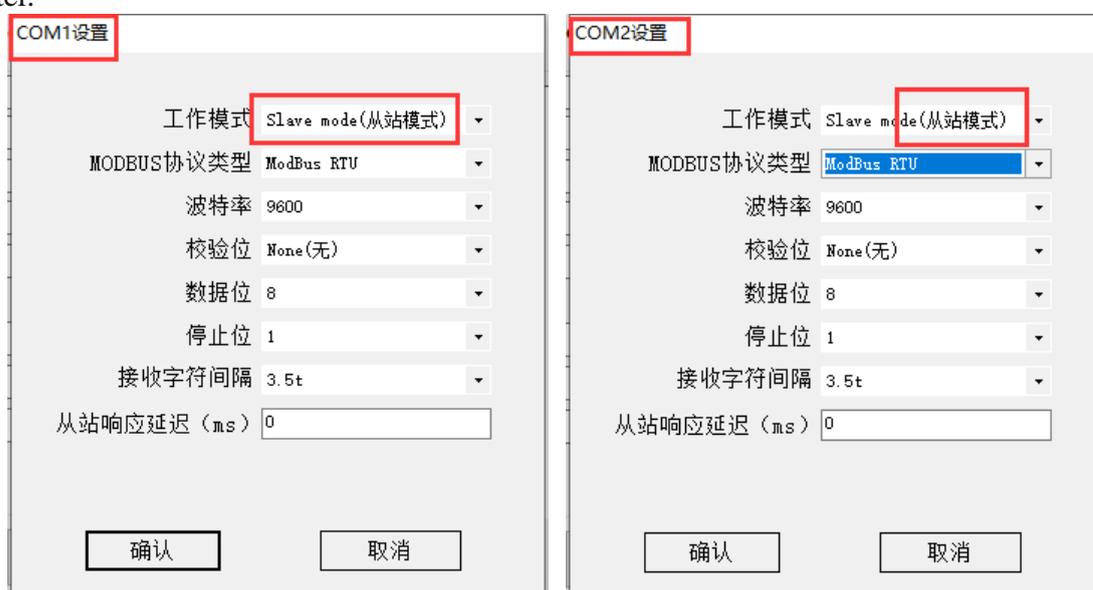

Figure 3.26 Set the corresponding serial port to slave mode

4.Configure the Ethernet parameters of the gateway by the "Ethernet Configuration" on the left of the software.

Some of the parameters are as follows：

Modbus gateway IP： The device's own IP address;

Subnet mask： Subnet mask of the device;

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

Modbus-TCP data communication port：Generally 502；

Configure the port：The configuration software downloads the configuration to the device through this port of the device；

Modbus-TCP watchdog time：The time interval from when the gateway receives the last Modbus TCP packet to the automatic restart;

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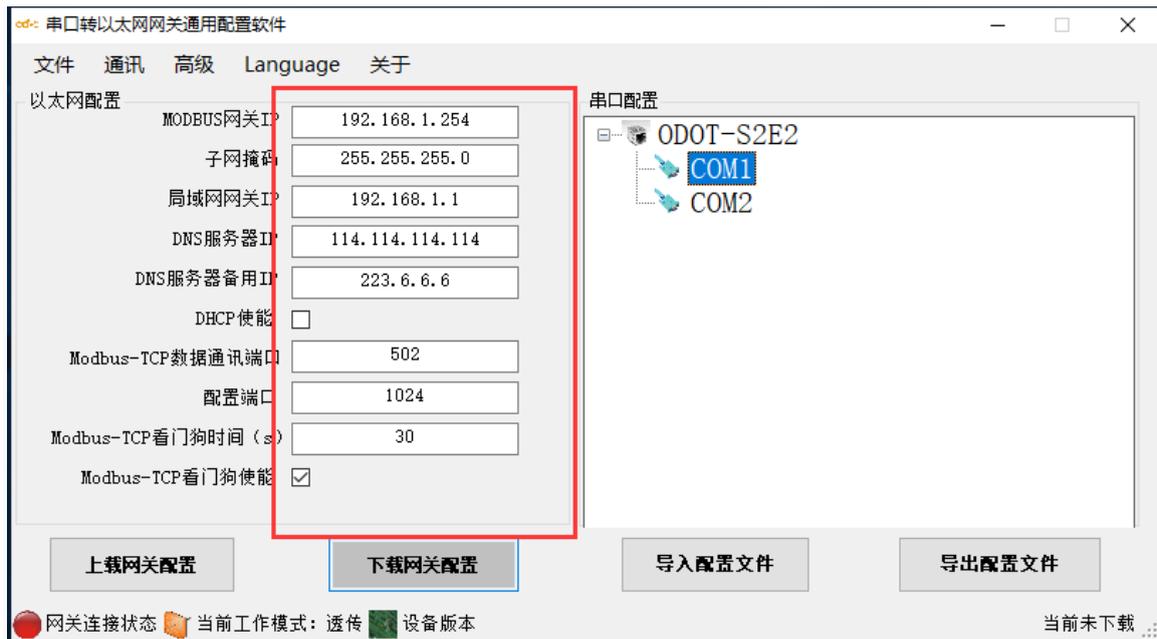

Figure 3.27 Configure gateway Ethernet parameters

5. Set the target gateway address you want to download and the communication port number used for download through "Communication"-"Communication Configuration". The default is the gateway factory default IP 192.168.1.254 and port number 1024.

Figure 3.28 Software and gateway communication configuration

6.Click the button "Download Gateway Configuration ".Download configuration parameters to the gateway. After the download is successful, the "Download successful" prompt appears in the Status Bar at the lower right. After the download is successful, the gateway restarts automatically and then the gateway go into running state. If the download fails, please check out whether the computer's IP address and gateway IP address are in the same network segment. Then check whether the gateway IP address is set correctly.If you forget the gateway IP address, you can reset the gateway through the reset button，After reset, the gateway IP address is the factory default IP address.

Click "Import Profile" and "Export Profile" to import and save the configuration file to the local disk.Click "Upload Gateway Configuration" to upload the current gateway configuration to the software.

Note: When downloading and uploading, you need to ensure that the computer and the gateway are in the same network segment.

Figure 3.29 Download gateway configuration

7. 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　Implementing Modbus TCP Client and Modbus RTU/ASCII Master Simultaneously Accessing One Modbus RTU/ASCII Slave Station

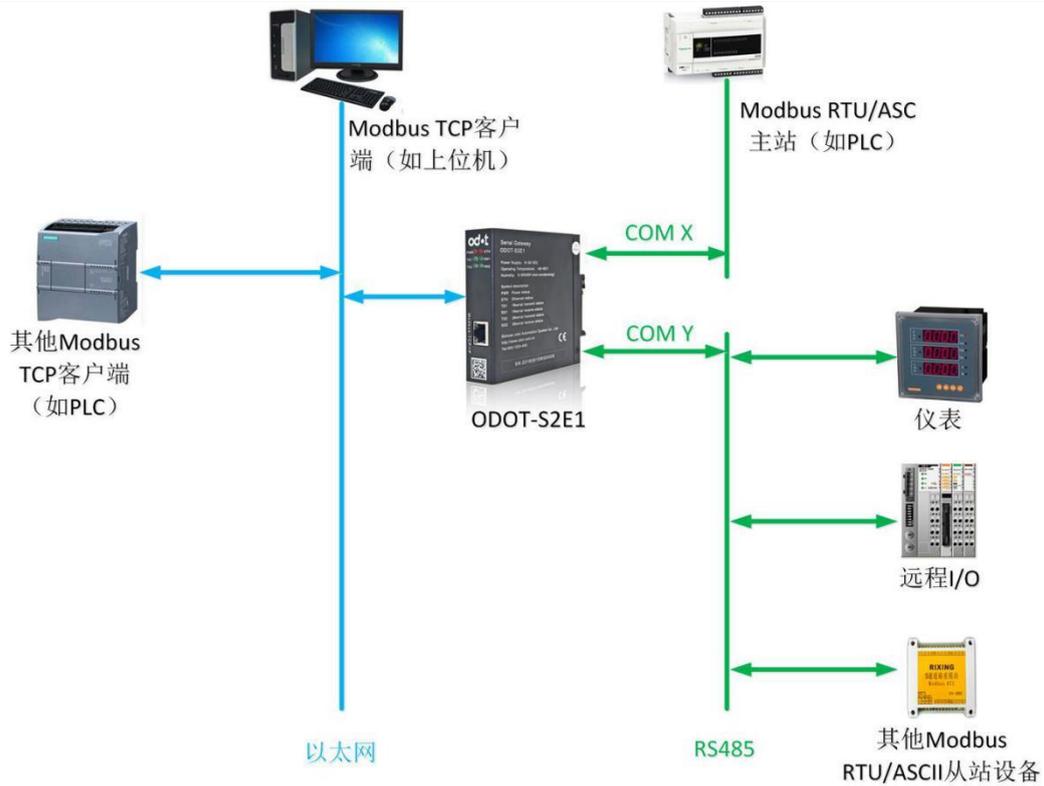### 3.4.4.1 Application topology diagram

Figure 3.30 System topology diagram

3.4.4.2 Simple configuration

1.Open the configuration software "odot MGCC Config".Right-click on the configuration page of slave station and select "Add Device" ,then add "ODOT-S4E2".
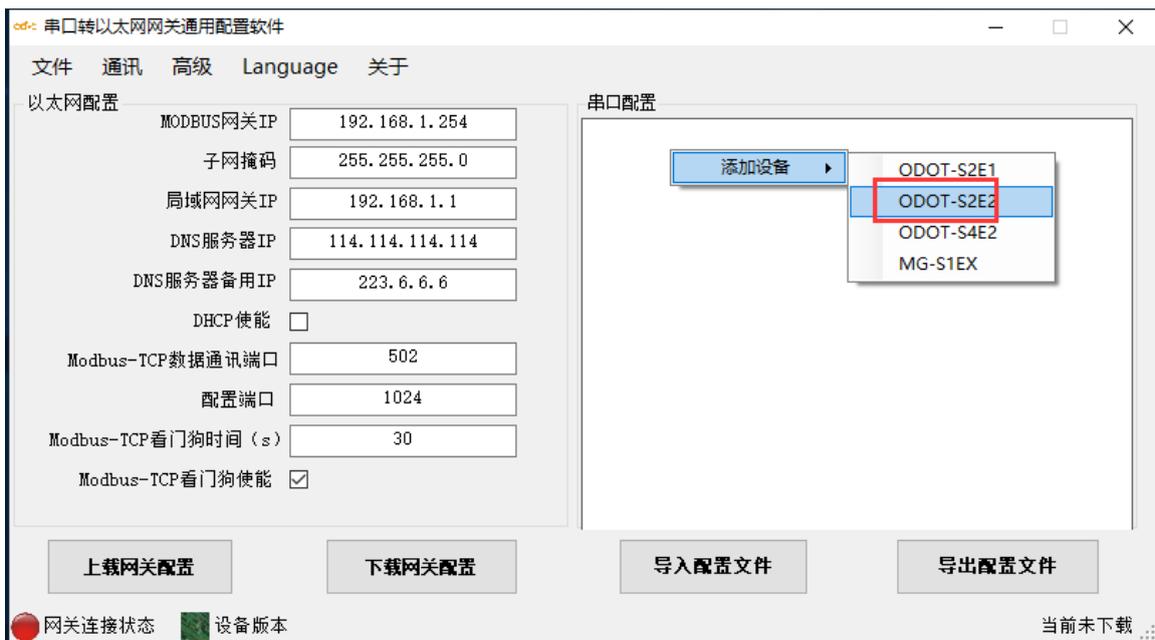

Figure 3.31 Add device

2. Double-click "ODOT-S2E2", or right-click "ODOT-S2E2", select "Common Properties of Device Serial Port", and set the gateway working mode to "Mapping Mode" on the pop-up setting page.

3. Double-click "COM1" or "COM2" or right-click "COM1" or "COM2" and click "Serial Port Properties". The "Serial Port Settings" window will pop up. After setting the communication parameters, click the "OK" button to save and return (this example Select COM1).

The meaning of each parameter is as follows：

Operating mode：

It is used to set up gateway as master station or slave station in the network.Default is master mode. Here is set up slave mode.

Modbus protocol type：

It is 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：

Serial port baud rate: optional range is 1200~115200bps and defaultis 9600bps, Please keep this parameter in accord with the device that is connected to the serial port.

Check Digit：

No parity, odd parity, even parity, no default can be chose. Please keep this parameter in accord with the device that is connected to the serial port.

Stop bit：

You can choose stop bit 1 or stop bit 2. Default is stop bit 1. Please keep this parameter in accord with the device that is connected to the serial port.

Receive character interval：

when receiving packets Frame interval detection time can be chose from 1.5t to 200t. Default is 3.5t. In general, you don't have to change this parameter.

Message sending interval:

Modbus command sending interval (the delay between receiving the response message from the slave station and sending the next command), 0ms-65535ms can be set, the default is 0ms, it is recommended to set 100ms to prevent the connected device from

responding too slowly and causing communication failures.

Overtime handling

Read the data from the slave station, if the slave station responds to the data processing mode of timeout, you can choose "data clear" or "data hold". The default "data hold" mode, this parameter is only valid for Modbus read commands, please set this value according to actual needs.

Figure 3.33 Set serial port parameters as Modbus RTU/ACII master station

4. Select "COM1" or "COM2" (COM1 in this example), right-click to select Add Slave, enter "Slave Name", fill in "Slave Station Number", and configure Modbus function code, the starting address of the slave station data, the number of data, the starting address of the gateway mapping area, the response timeout time, and whether the number changes will be sent   according to the communication manual of the slave device.. 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 edit".
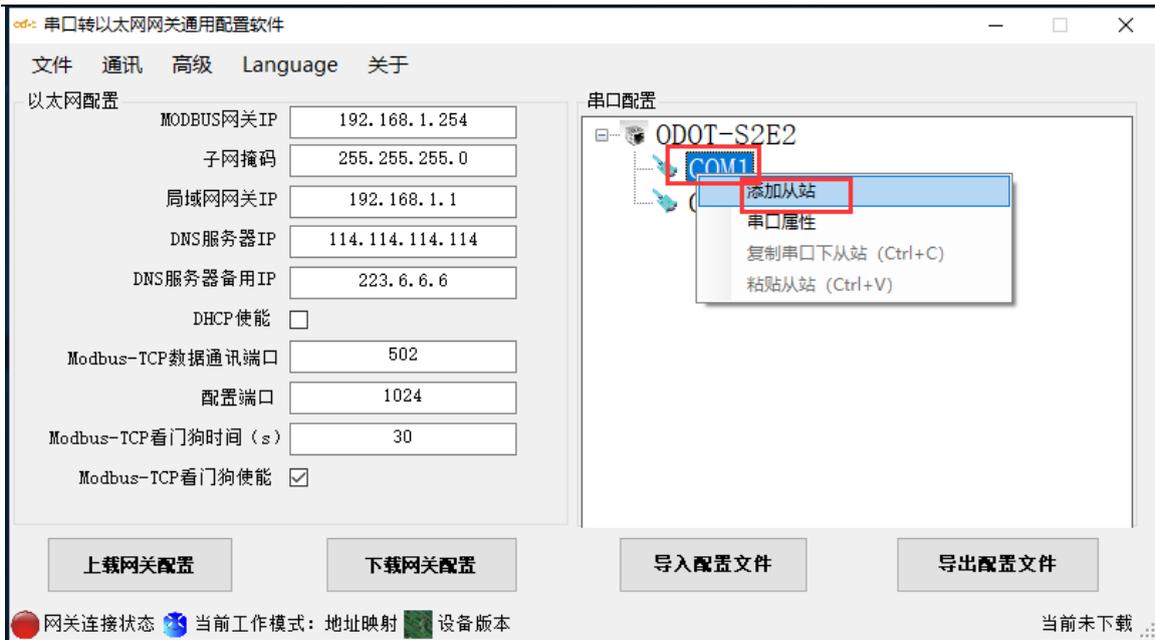
Figure 3.34 Adding slave

Figure 3.35 Configure slave address mapping table

5. Double-click "COM1" or "COM2" or right-click "COM1" or "COM2" and click "Serial Port Properties", the "Serial Port Settings" window will pop up, set the communication parameters, set the serial port working mode to slave mode, click "Confirm" button to save and return (select COM2 for this example).

The meaning of each parameter is as follows：

Operating mode：

It is used to set up gateway as master station or slave station in the network.Default is master mode. Here is set up slave mode.

Modbus protocol type：

It's used to set up the gateway's protocol type of the network between the ommunication of the serial port and other connected devices.You can choose Modbus RTU

or Modbus ASCII. Please keep this parameter in accord with the device that is connected to the serial port.

Baud rate：

Serial port baud rate: optional range is 1200~115200bps and default is 9600bps, Please keep this parameter in accord with the device that is connected to the serial port.

Check Digit：

No parity, odd parity, even parity, no default can be chose. Please keep this parameter in accord with the device that is connected to the serial port.

Stop bit：

You can choose stop bit 1 or stop bit 2. Default is stop bit 1. Please keep this parameter in accord with the device that is connected to the serial port.

Receive character interval：

when receiving packets Frame interval detection time can be chose from 1.5t to 200t. Default is 3.5t. In general, you don't have to change this parameter.

Slave response delay：

The gateway acts as a Modbus RTU/ASCII slave, from the time it receives a message from the master to when it sends a reply. This parameter relates to the performance of the master.
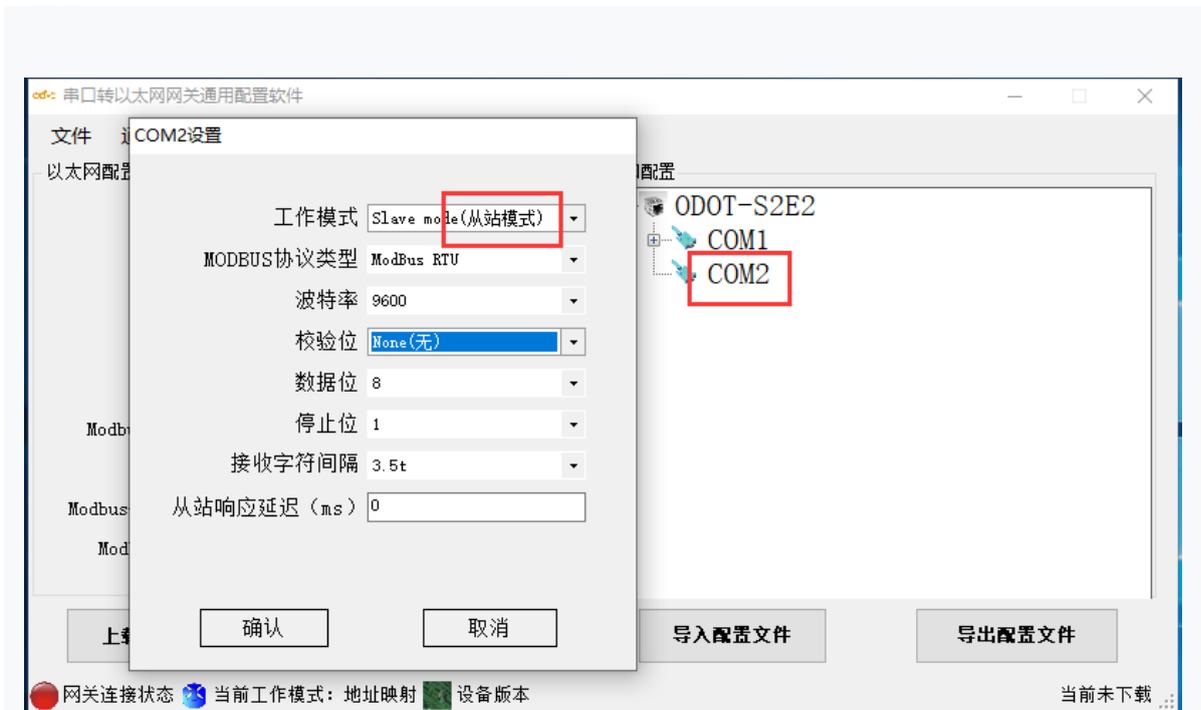

Figure 3.36 Set serial port parameters as Modbus RTU slave

6.Configure the Ethernet parameters of the gateway by configuring the

Ethernet Configuration" on the left half of the software.

Some of the parameters are as follows：

Modbus gateway IP： The device's own IP address;

Subnet mask： Subnet mask of the device;

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

Modbus-TCP data communication port：Generally 502；

Configure the port: The configuration software downloads the configuration to the device through this port of the device；

Modbus-TCP watchdog time: The time interval from when the gateway receives the last Modbus TCP packet to the automatic restart.

Note: Automatic restart of the gateway can release connection resources that have not been used for a long time in time;

Modbus-TCP watchdog enable：Whether the watchdog function is enabled

Figure 3.37 Configure gateway Ethernet parameters

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

Figure 3.38 Software and gateway communication configuration

8．Click the button "Download Gateway Configuration ".Download configuration parameters to the gateway. After the download is successful, the "Download successful" prompt appears in the Status Bar at the lower right. After

the download is successful, the gateway restarts automatically and then the gateway go into running state.

If the download fails, please check out whether the computer's IP address and gateway IP address are in the same network segment. Then check whether the gateway IP address is set correctly. If you forget the gateway IP address, you can reset the gateway through the reset button and after reset the gateway IP address is the factory default IP address.

Click "Import Profile" and "Export Profile" to import and save the configuration file to the local disk. Click "Upload Gateway Configuration" to upload the current gateway configuration to the software.

Note: When downloading and uploading, you need to ensure that the computer and the gateway are in the same network segment.

Figure 3.39 Download gateway configuration

9．After completing the above settings, connect a Modbus RTU/ASCII slave to COM1 and a Modbus RTU/ASCII master to COM2，Connect Modbus TCP Client to Gateway via Ethernet，Gateway will automatically refresh the underlying

Modbus RTU/ASCII slave data from COM1，The Modbus RTU/ASCII master and Modbus TCP clients indirectly access the Modbus RTU/ASCII slaves by accessing the gateway's internal gateway data store.

4. Supplement

Brief introduction of serial port network topology

1. RS232

RS232 is one of serial communication interfaces controlled by industry. It is widely used to connect computer serial interface with peripherals. RS232 using a signal and a signal transmission form, return lines were in the land of the three wire connection mode, can realize full-duplex communications, the transmission signals for single ended, the total transmission of easy to generate common-mode interference, so the noise resistance is weak, the transmission distance is limited, RS232 interface standards stipulated in the code element distortion maximum transmission distance is less than 4% under the condition of standard values of 50 feet (15 meters) (more than 15 m long distance communication, need to adopt modem), the maximum transmission distance is also associated with communication baud rate, in the process of practical application, if the transmission distance is far, Please reduce the baud rate.In order to reduce the electromagnetic interference from the outside during the signal transmission, please use the shielded cable as the communication cable.

RS232 interface standard specifies that TXD and RXD:

RS232 USES negative logic to transmit signals and takes the signal of -(3~15)V as logic "1".Take the signal of +(3~15)V as logical "0";Voltages between -3 and +3V are meaningless, as are voltages lower than -15V or higher than +15V.

RS232 Interface Classification:

DB9 header interface

The top left corner is 1, the bottom right corner is 9

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

As the RS232 interface has the above electrical characteristics, it can only realize point-to-point communication.

RS232 communication wiring diagram is shown in the figure below:

RXD
TXD
GND

RXD
TXD
GND

Communication equipment with RS232 interface　　**Terminal device with RS232 interface**
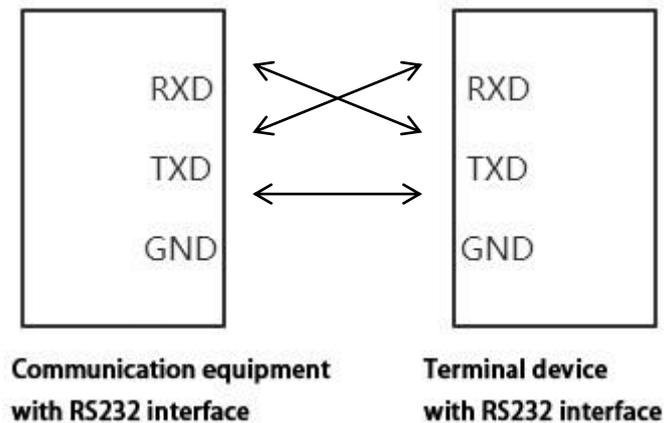
2. RS422

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 USES a balanced transmission line that is unidirectional/non-reversible, with or without an enabling end. Because the receiver USES a high input impedance and the sending driver is stronger than RS232, it is allowed to connect multiple receiving nodes on the same transmission line, up to 10 nodes. That is, one Master device (Master), the rest are slave devices (Salve), and the slave devices cannot communicate with each other, so RS-422 supports point-to-many two-way communication.

The RS-422 has a maximum transmission range of 4,000 feet and a maximum transmission rate of 10Mb/s. The length of the balanced twisted pair is inversely proportional to the transmission rate, and the maximum transmission distance can be reached only if the rate is below 100KB /s. The highest rate of transmission can be obtained only over very short distances. Generally, the maximum transmission rate obtained on 100 meters long twisted pair is only 1Mb/s.

The RS-422 requires a terminal resistance that is approximately equal to the characteristic impedance of the transmission cable. In short distance transmission, no final resistance is required, that is, no final resistance is generally required below 300 meters. The final resistance is connected to the farthest end of the transmission cable.

In a master multi-slave network connection, all the sending terminals of the slave connect to the receiving terminals of the master station by daisy-chain. All the receiving ends of the slave stations are connected by daisy-chain to the sending end which is finally connected to the master station.
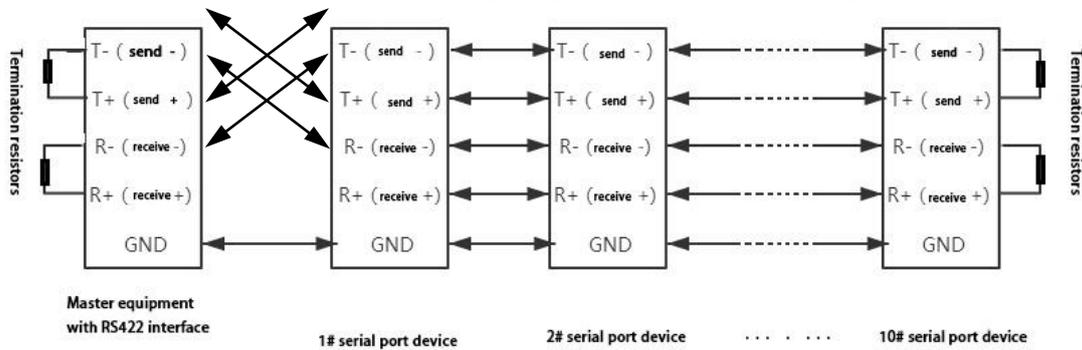
The RS422 pin definition:

RS422（9 Pin）		Function	Remark
3	R-	Receive 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:

3. RS485

Since the RS-485 is developed from the RS-422, many electrical provisions of the RS-485 are similar to those of the RS-422.If they all adopt the balanced transmission mode, they all need to connect the final resistance on the transmission line, etc. The RS-485 can adopt two - wire and four - wire mode, and the two - wire system can realize real multi - point two - way communication.

RS485 is a standard for defining the electrical characteristics of drivers and receivers in a balanced digital multipoint system, using a combination of balanced drivers and differential receivers for enhanced common-mode dry resistance, i.e., good noise interference resistance. Because the semi-duplex network composed of RS485 interface generally adopts the wiring mode of two-wire system and adopts differential signal to transmit data, the voltage difference between the two lines is -(2-6)V to represent logic "0 ", and the voltage difference between the two lines is +(2-6)V to represent logic "1".

RS485 signal transmission distance is related to communication baud rate, the higher the baud rate, the shorter the transmission distance, under the condition of the baud rate is not higher than 100 KBPS, theory of the maximum communication distance is about 1200 meters, in the process of practical application, Due to electromagnetic interference and other factors, often cannot meet the maximum

communication distance, if in a long-distance communication, please reduce the baud rate, to reduce the signal during transmission by external electromagnetic interference, please use twisted-pair shielded cable as a communication cable.

RS485 bus in the case of no trunk to support a maximum of 32 nodes, node and node between the "Daisy chain" connection mode, in the communication cable at both ends need to add terminal resistance, the resistance value is required to be approximately equal to the transmission cable characteristic impedance. In short distance transmission, no final resistance is required, that is, no final resistance is generally required below 300 meters. The final resistance is connected at the ends of the transmission cable.

RS485 9 pin definition:

Pin	Name	Function	Remark
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:
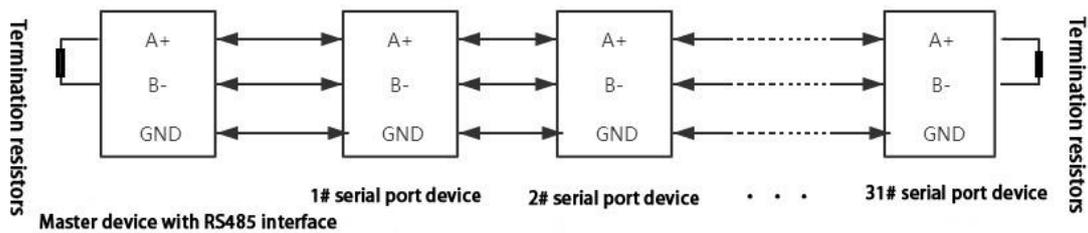
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