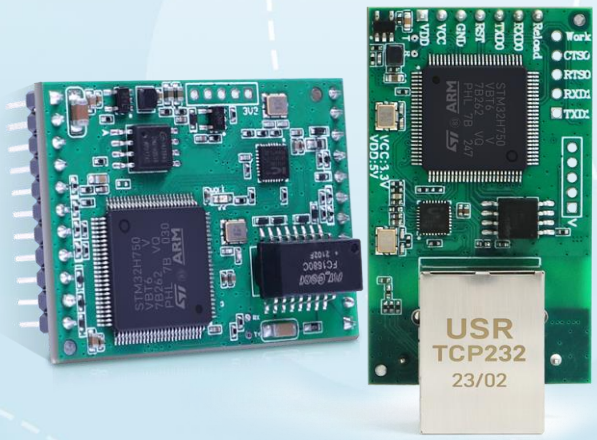
USR IOT
Be honest,Do best

Embedded UART to Ethernet Module

User Manual V1.0.0

USR-TCP232-E2， USR-TCP232-ED2



Build a Smarter IoT world, Your Trustworthy Partner

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1. Introduction

1.1. Overview

The embedded UART to ethernet module are versatile serial-to-Ethernet module that enables data transparent transmission between RJ45 Ethernet port and TTL interface. USR-TCP232-E2 supports two TTL serial ports and USR-TCP232-ED2 supports three TTL serial ports. E2 and ED2 modules are both based on the Cortex-M7 solution, with a high clock frequency of up to 400MHz, fast speed, low power consumption, and high stability.

The module integrates a 10/100M adaptive Ethernet interface and supports a maximum baud rate of 1024Kbps for serial communication. It offers various operation modes such as TCP Server, TCP Client, UDP, Httpd Client, and WEB to Serial (WebSocket) and can be easily configured through a web page or software. Additionally, it has an integrated TCP/IP protocol stack, which allows users to easily implement serial-to-Ethernet functionality for embedded devices, saving labor costs and development time and enabling faster product launch and enhanced competitiveness.

This product series has been rigorously tested and successfully applied in complex network environments such as banks, highways, large corporate networks, busy networks with cameras, and networks built through fiber-optic-to-Ethernet conversion.

1.2. Features

The USR-TCP232-E2 and USR-TCP232-E2 share the same software platform on different available hardware components. It provides:

- High-performance CPU processing ability, using 32-bit Arm Cortex-M7 core CPU, up to 400MHz frequency
- Provides remote serial access over the Internet for embedded UART to ethernet module
- 10/100Mbps Ethernet port and support Auto MDI/MDIX
- Supports a wide industrial operating temperature,-40℃~85℃
- Baud rate: 0.6~921.6 Kbps(maximum 230.4Kbps for N520-6 model), and any baud rate setting, support None, Odd, Even, Mark, Space Parity bit(firmware V2.0.0 or later)
- Supports Hardware and Software flow control
- Flexible serial port data framing setting, which can satisfy user’ s various demands for data packets segmentation
- Versatile operation modes: TCP Server, TCP Client, UDP, HTTP client, WebSocket server
- Support virtual COM ,COM Port Redirector USR-VCOM(windows)
- Modbus Ethernet-to-Serial support (Modbus/TCP, Modbus/RTU) for seamless integration of serial Modbus devices
- Provides rich configuration access, including: Windows configuration tool, and Web Browser
- Firmware upgrading via Web Browser and Windows configuration tool
- Easy-to-use Windows configuration tool for auto discovery, multiple device setting and monitoring
- High security via certificate verification SSL/TLS encryption for serial data transmission, HTTPS,TCPS,MQTTS(firmware V2.0.0 or later)
- Support custom webpage functionality, users can design or modify the layout of the webpage and images etc. according to their needs.
- Support Modbus gateway, MQTT gateway(firmware V2.0.0 or later)
- Support SNMP V1/V2

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2. Get started

Since the embedded modules are connected through a TCP/IP network, you may need to know some basic facts about networking in order to connect the server correctly.

The function of E2 and ED2 module are the same. The main difference between these two modules is that E2 has 2 serial ports(TTL) while the ED2 has 3 serial ports(TTL). The definition of the module pins will be described in the following text.

As is well known, by using a level conversion circuit, the TTL level can be converted to RS485/RS232/RS422. So in the following section, the manual may mentioned that the E2 and ED2 module can connect to the RS232/485/422 device.

2.1. Dimension

Unit: mm

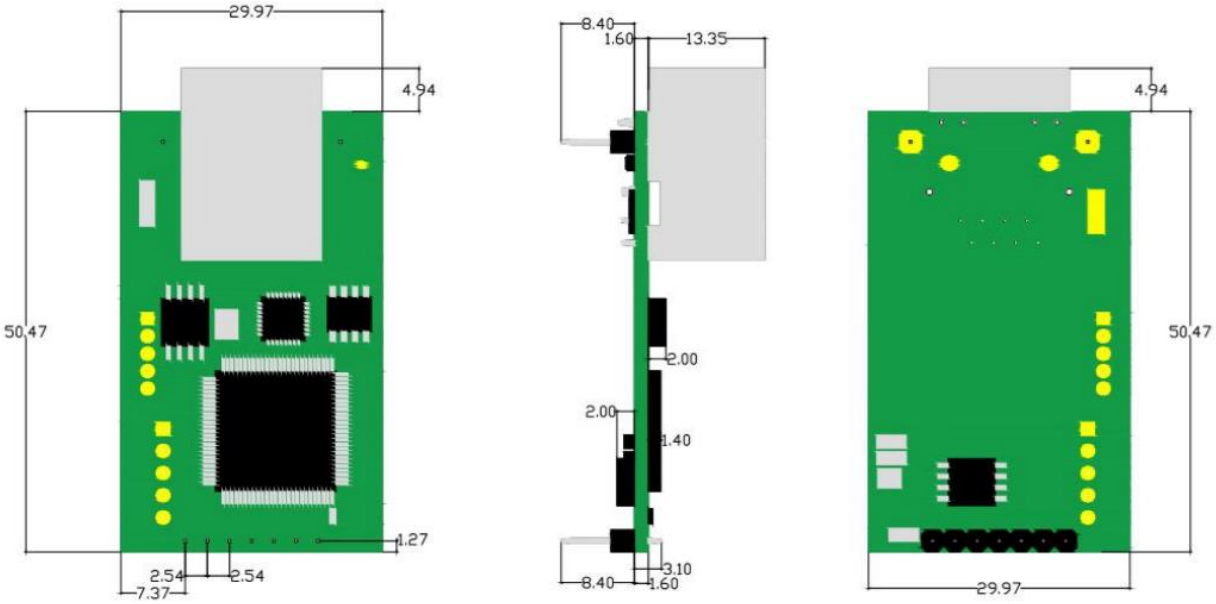


Fig. 1 Dimension of E2 module

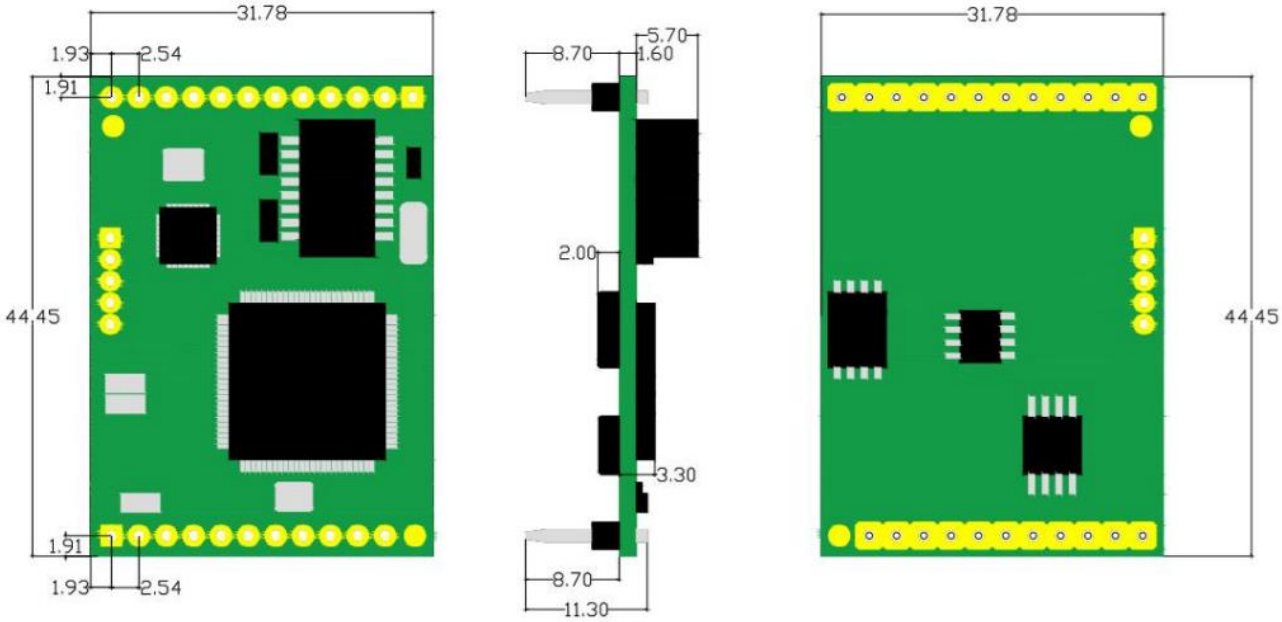


Fig. 2 Dimension of ED2 module

2.2. Pin description

2.2.1. Pin description of E2 module

Table 1

Pin	Name	I/O	Description
1	5V	power	Power supply： 5V@ 145mA
2	3.3V	Power	Power supply： 3.3V@ 200mA
3	GND	Power	Power ground
4	RST	I	Resetting the module and taking effect in low level. Inputting low level for 200ms will reset the module. User can connect RST pin to MCU I/O to reset the module through MCU controlling when exceptions occur.
5	TXD	O	Tx pin of serial 0，TTL level，can connect to MCU with 3.3V directly。It needs conversation circuit if connected to MCU with 5.0V. The module defaults to 10K pull-up internally.
6	RXD	I	Rx pin of serial 0，TTL level，can connect to MCU with 3.3V directly。It needs conversation circuit if connected to MCU with 5.0V. The module defaults to 10K pull-up internally.
7	Reload	I	Pulling down the pin for 5 seconds and then pulling it up can reset the module to factory default settings. The pin should be floating or pull-up to ensure the module can work well.
8	LED_WORK	O	Connected to LED or input pin of MCU, the level status of the pin indicates if the module working well. Reverse every 1s: the module is working well, Reverse every 200ms: the module isn't working properly.
9	CTS0	I	Pin of Hardware Flow Control (Clear to send)
10	RTS（485_EN）	O	UART 0 1. Enable pin of external RS485 chipset 2. Pin of Hardware Flow Control (Request to send)
11	RXD1	I	Rx pin of serial 1，TTL level, can connect to MCU with 3.3V directly。It needs conversation circuit if connected to MCU with 5.0V.
12	TXD1	O	Tx pin of serial 1，TTL level, can connect to MCU with 3.3V directly。It needs conversation circuit if connected to MCU with 5.0V.
13、14	Fixed pin		Used to support the E2 module

2.2.2. Pin description of ED2 module

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Table 2

Pin	Name	I/O	Description

1	ETH_TX+	O	Ethernet port: Send dada+
2	ETH_TX-	O	Ethernet port: Send dada-
3	ETH_RX+	I	Ethernet port: Receive data+
4	ETH_RX-	I	Ethernet port: Receive data+
5	LED_DATA	O	Indicator of transmitting/receiving data
6	TXD0	O	Tx pin of serial 0，TTL level，can connect to MCU with 3.3V directly。It needs conversation circuit if connected to MCU with 5.0V. The module defaults to 10K pull-up internally.
7	RXD0	I	Rx pin of serial 0，TTL level，can connect to MCU with 3.3V directly。It needs conversation circuit if connected to MCU with 5.0V. The module defaults to 10K pull-up internally.
8	485_EN(RTS0)	O	UART 0 1. Pin of Hardware Flow Control(Request to send) 2. Enable pin of external RS485 chipset
9	Reload	I	Pulling down the pin for 5 seconds and then pulling it up can reset the module to factory default settings. The pin should be floating or pull-up to ensure the module can work well.
10	RST	I	Resetting the module and taking effect in low level. Inputting low level for 200ms will reset the module. Leave it floating if not used. User can connect RST pin to MCU I/O to reset the module through MCU controlling when exceptions occur.
11	GND	Power	Power ground
12	GND	Power	Power ground
13	+5V	power	Power supply: 5V@ 175mA（HB Version：161mA@5.0V）
14	+5V	Power	Power supply: 5V @ 175mA（HB Version：161mA@5.0V）
15	LED_LINK	O	High level: No device is linked to the ethernet port, Low level: Device is linked to the ethernet port.
16	+3.3V	Power	Power supply: 3.3V@ 210mA（HB Version：227mA@3.3V）
17	RXD1	I	Rx pin of serial 1，TTL level，can connect to MCU with 3.3V directly。It needs conversation circuit if connected to MCU with 5.0V. The module defaults to 10K pull-up internally.
18	TXD1	O	Tx pin of serial 1，TTL level，can connect to MCU with 3.3V directly。It needs conversation circuit if connected to MCU with 5.0V. The module defaults to 10K pull-up internally.
19	RXD2	I	Rx pin of serial 2，TTL level，can connect to MCU with 3.3V directly。It needs conversation circuit if connected to MCU with 5.0V. The module defaults to 10K pull-up internally.
20	TXD2	O	Tx pin of serial 2，TTL level，can connect to MCU with 3.3V directly。It

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			needs conversation circuit if connected to MCU with 5.0V. The module defaults to 10K pull-up internally.
21	CTS0	I	UART 0 Pin of Hardware Flow Control (Clear to send)
22	RTS1	O	UART 1 1. Pin of Hardware Flow Control (Request to send) 2. Enable pin of external RS485 chipset
23	CTS1	I	UART 1 Pin of Hardware Flow Control (Clear to send)

2.3. Development kit

USR IOT provides development kit for users to explore the functionality of the E2 module. The model is USR-TCP232-EVK. The dimension of the kit is 100*76 mm.

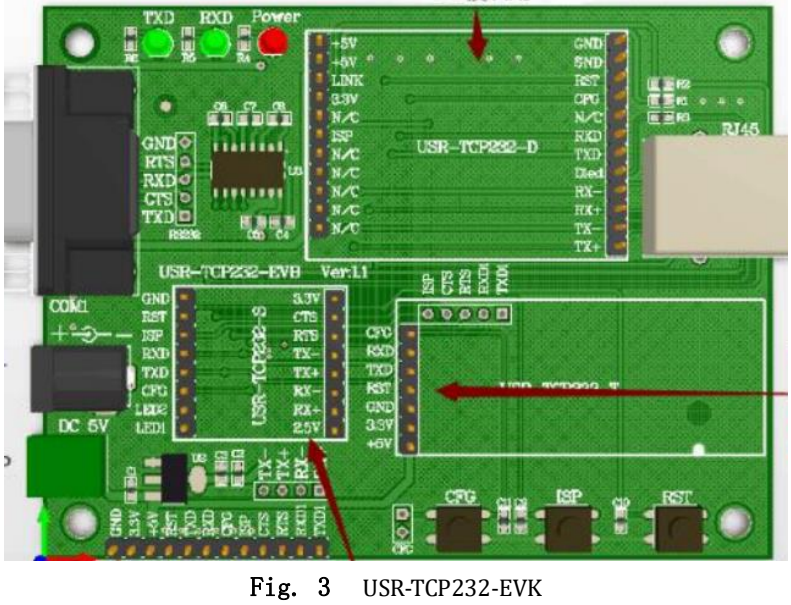


Fig. 3 USR-TCP232-EVK

2.4. Factory default settings

The E2/ED2 module comes with the following default settings.

Table 3 Default parameters

Parameter	Default Values
User Name	admin
Password	admin
Device IP	192.168.0.7
Subnet Mask	255.255.255.0
Gateway IP	192.168.0.1
COM port	115200,None,8,1
COM operation mode	TCP server,23
MQTT	Disable

2.5. Quick test

E2 module has a built-in Web server, which provides a convenient way to access and configure the module. Users can use Edge , Firefox or

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Google browser to access it. This chapter is a quick introduction to the E2 module. It is recommended that users read this chapter and follow the instructions once for the system, and you will have a basic understanding of the product. For specific function details and instructions, please refer to the subsequent chapters.

2.5.1. Download the software

Download the setting software from PUSR’s website:

https://www.pusr.com/support/downloads/H7-version-set-up-software.html

https://www.pusr.com/support/downloads/usr-tcp232-test-V13.html

You may find it in the download section under your product page. Run the software when the installation has been completed as shown in Fig.4 and Fig.5.

It is strongly recommended for the users to set the Network Parameters through configuration tool first. Other device-specific configurations can later be carried out via user-friendly Web-Interface.

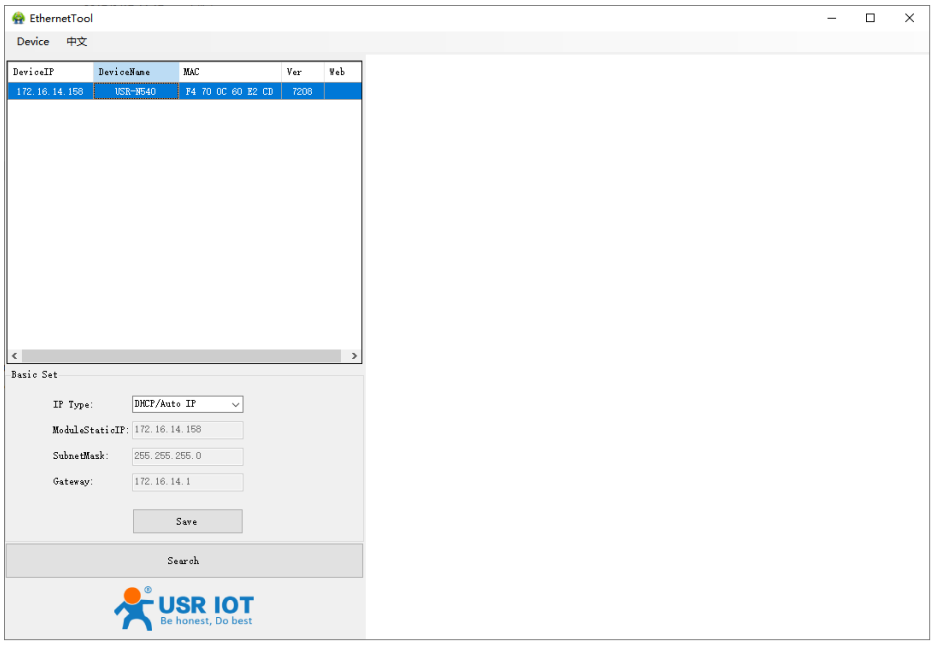


Fig. 4 **Windows configuration tool**

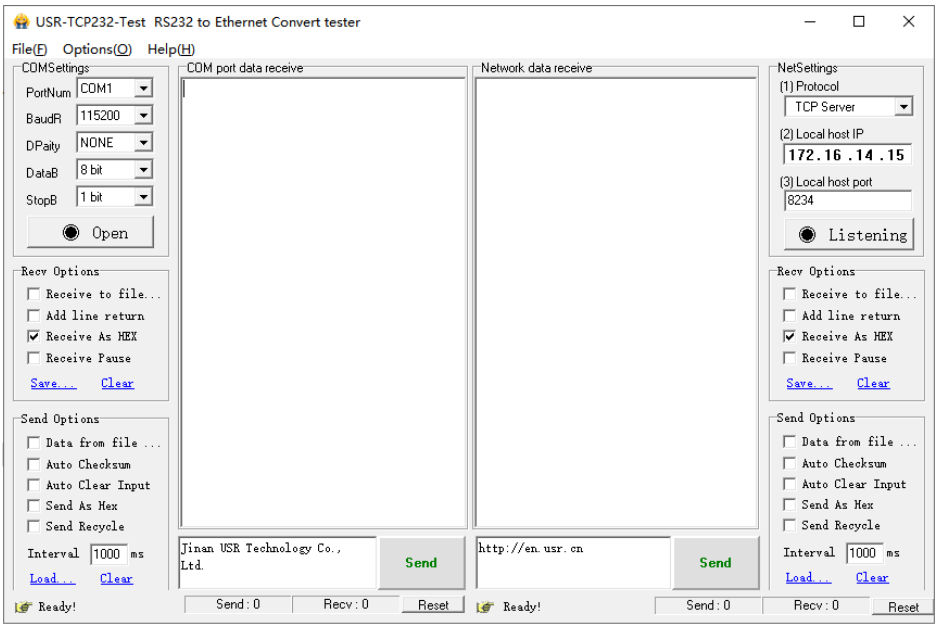


Fig. 5 **Test assistant**

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2.5.2. Hardware connection

For fast networking of E2 module, you need to prepare a PC, a router, a E2 module, a development kit, a network cable, a serial cable, and a DC5V/1A power supply. The hardware connection is shown in Fig. 13. To establish a TCP / IP network all devices must be connected to the same network either locally or via gateway connections.

- ✧ Connect the power line with development kit power input. If the power is properly supplied, the "PWR" LED will show a solid red color.
- ✧ Connect one end of the Ethernet cable to the E2's 10/100M Ethernet port and the other end of the cable to the same Ethernet network(same router or switch).
- ✧ Connect a serial data cable(USB to RS232 or RS485) between the E2 and PC.

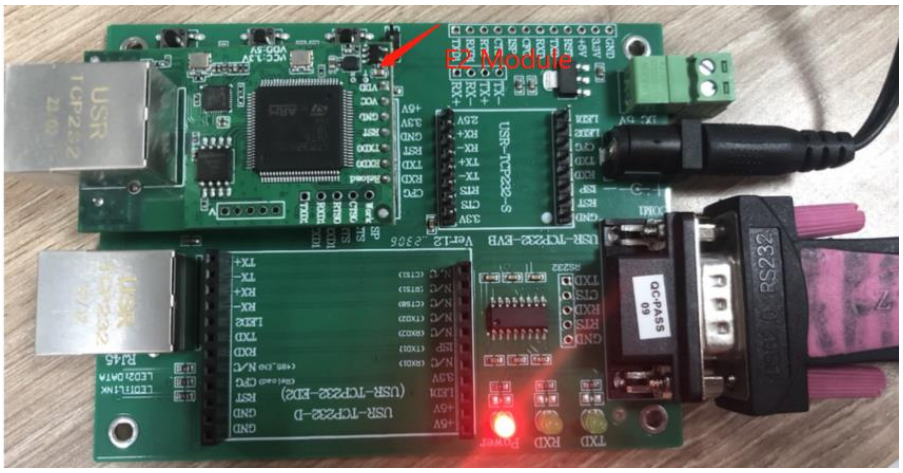


Fig. 6 **Hardware connection**

2.5.3. Network configuration （

The Broadcast Search function is used to locate all E2 modules that are connected to the same LAN as your computer. Since the Broadcast Search function searches by MAC address and not IP address, all E2 connected to the LAN will be located, regardless of whether or not they are part of the same subnet as the host.

In EthernetTool, click Search to search your LAN for E2 module. When your unit appears in the search results, you can click device to select it and change the IP type to DHCH, save your change. Wait for 5s and search it again.

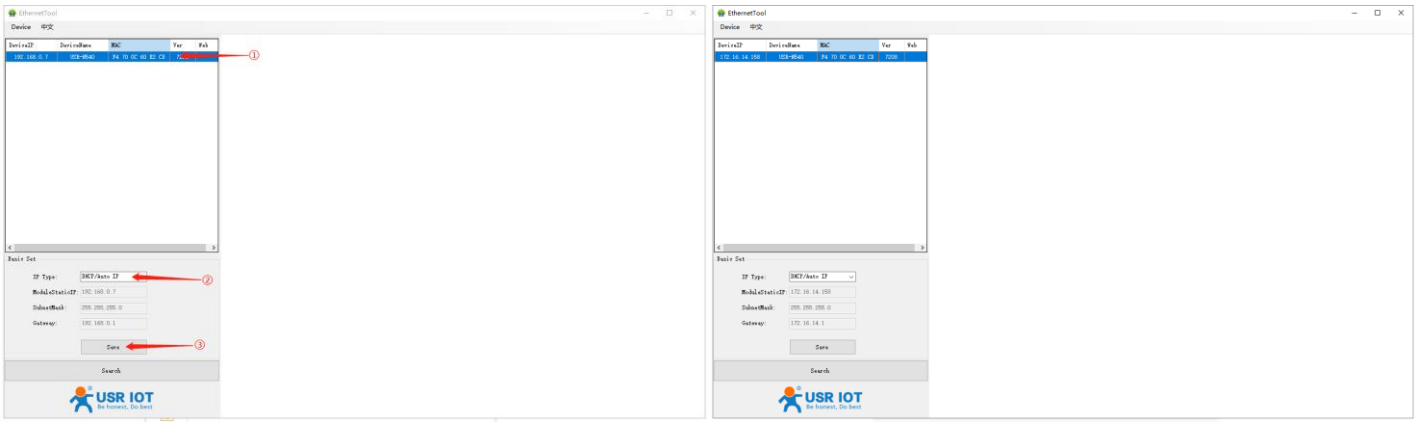


Fig. 7 **IP network setting**

When accessing the E2 module through the Web, the IP address of the module and the PC must be in the same network segment. After changing the IP address of the E2, you can access the Web page of the E2 module through browser and perform related configuration operations on it. The user name and initial password are both "admin". After entering the user name and password, click "OK" and the

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server will authenticate. After success, you will enter the main page of the Web server, as shown in Fig.15. The following uses firmware V2 version as an example. For details about the V1 version web page, see Section 3.1.

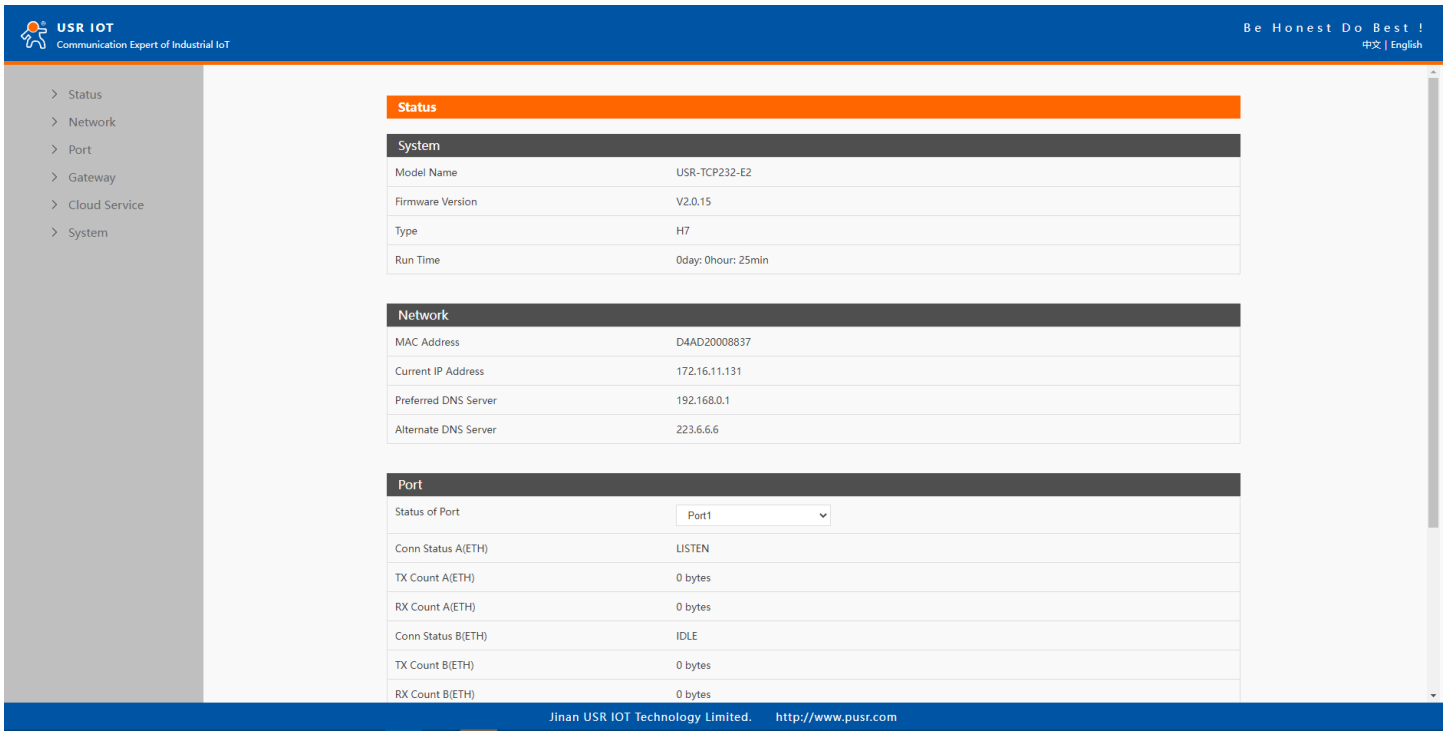


Fig. 8 **The main interface of the Web server**

The IP address of the PC must be modified to ensure that it is in the same local area network as the IP of the E2 module if you want to connect E2 to PC directly via a net cable. The default IP address of module is: 192.168.0.7. Set the PC's IP address as: 192.168.0.X (X is any valid value from 2 to 253 except 7). The specific Windows system operation page is shown in Fig.16. you can access the Web page of the E2 through browser as mentioned above.

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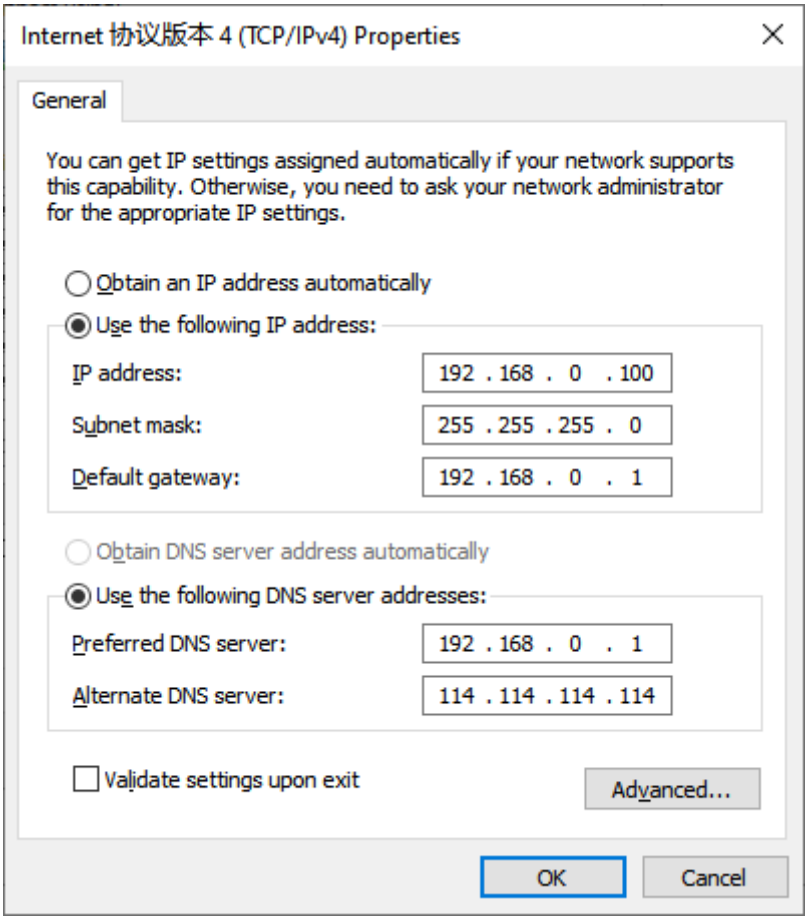


Fig. 9 **IP setting of PC**

2.5.4. Data transmission test（Step2 and 3）

You can select an operation mode in socket setting page, but for now we use default parameters to test, i.e TCP server. Now USR-TCP232-Test works as TCP client, you need configure the server IP and port, that is 172.16.14.158:23 of E2 module, the IP address of PC is 172.16.14.15.

In the serial port setting module, you can configure communication parameters for the serial ports, as shown in the figure below. When configuring a serial network you need to set the following within each device-Baud rate,Parity,Stop bits,Data bits and keep serial port parameters consistent in the same network. We now configure the COM Settings to operate as required for the E2 module. Go to the Port1 Settings tab for confirming values of parameters.

Fig.17 shows an example of parameters setting to test transparent transmission.

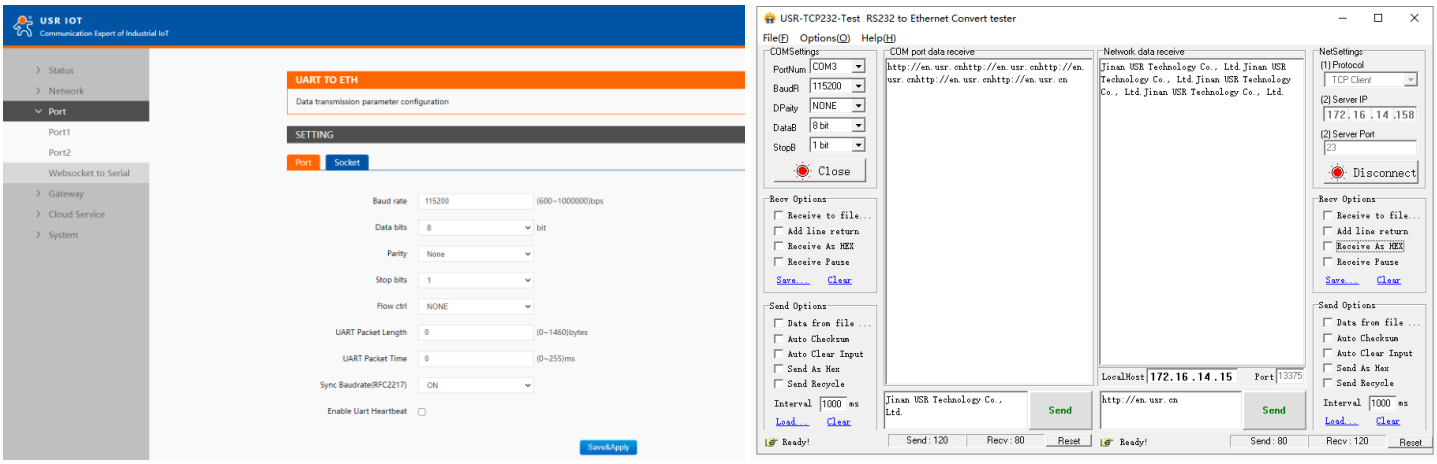


Fig. 10 **Transparent transmission test**

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2.6. Technical support and assistance

Please visit the USR IoT website: https://www.pusr.com where you can find the latest information about the product.

Contact your distributor, sales representative, or PUSR's support center:

http://h.usriot.com/index.php?c=frontTicket&m=sign for technical support if you need additional assistance. Please have the following information ready before you submit a ticket:

- Product model
- Description of your peripheral attachments
- Description of your software (firmware version, application,function description,etc.)
- A complete description of the issue and steps to reproduce

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3. Configuration and parameter details

3.1. Web interface(V1 version)

Every E2 module is equipped with a built-in web server in the firmware. Therefore, the device can be accessed by using a web browser for configuring by entering the device's IP address in the URL field of your web browser. An authentication will be required and you will have to enter the username (Default value is "admin") and password (Default value is "admin") for accessing the web interface as shown in Fig. 18. This approach (web interface) for configuring your device is the most user-friendly. It is the most recommended and the most common method used for E2 Serial Device Server Series. Please go to its corresponding section for a detailed explanation.



Fig. 11 **Authentication Required for Accessing Web Interface**

3.1.1. Status

After entering the correct user name and password and the authentication is successful, you will enter the main page of the Web, as shown in Fig.19. The main page can be roughly divided into three areas. The upper area displays the logo, the lower left area is the function menu area, the middle area is the main function display area, and the lower right area is the help document area. Fig.19 illustrates the status page of the web interface.

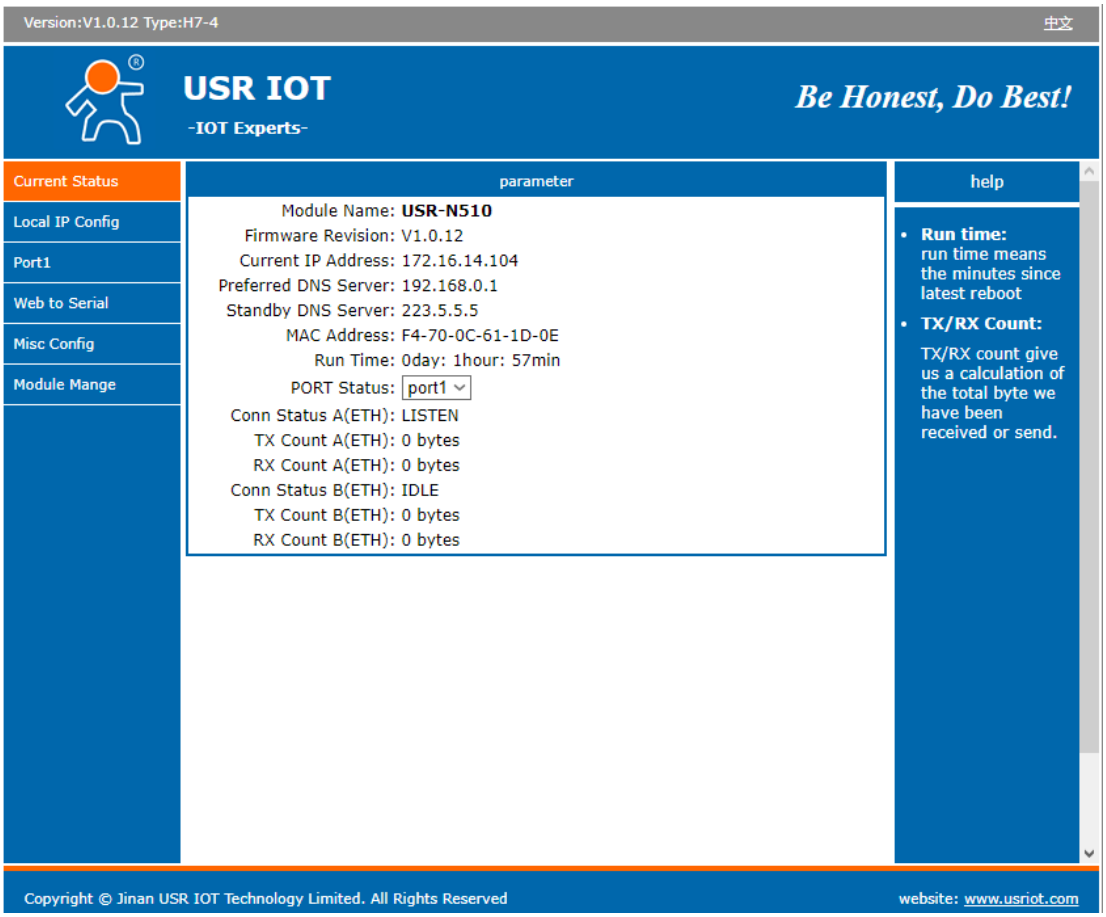


Fig. 12 **The main interface of the Web server**

The function of the device status part is to display some specific information of the current device, including module name, firmware version, IP address, DNS, MAC address, running time and serial port status.

Table 4 Status list

Parameter Item	Description
Module name	The name of the module, which can be customized by the user on the "Miscellaneous settings" page.
Firmware version	The current software version of the module.
IP address	The IP address of the module.
MAC address	The MAC address of the module.
Running time	Total time after the device start work. It will starts from 0 after reboot.
Port status	The working status of checked serial port. Select the serial port currently to be displayed ① Conn Status A(ETH): connection status of socket A. ✓ IDLE：Initialization status ✓ LISTEN：When the module works as TCP Server, it is listening for connection access ✓ CONNECTING：Works as TCP client, the module is establishing a connection to the TCP Server ✓ CONNECTED：Works as TCP server, the TCP connection to TCP server of the module has been established ✓ CONNECTED（n）：Number of TCP clients connected to the module ✓ ERROR：The module is abnormally disconnected ② Tx Count A(ETH): To count how many bytes be send to internet. ③ Rx Count A(ETH): To count how many bytes received from internet.

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3.1.2. IP settings

You must assign a valid IP address to the USR-E2 before it will work in your network environment. The IP address must be unique within the network. If the device is connected to the Internet and should connect to other servers over the Internet to get some services such as Network Time Protocol (NTP) server, you will need to configure the DNS server in order to be able to resolve the host name of the NTP server. The detailed description of the configuration parameters on this interface is shown in table 7.

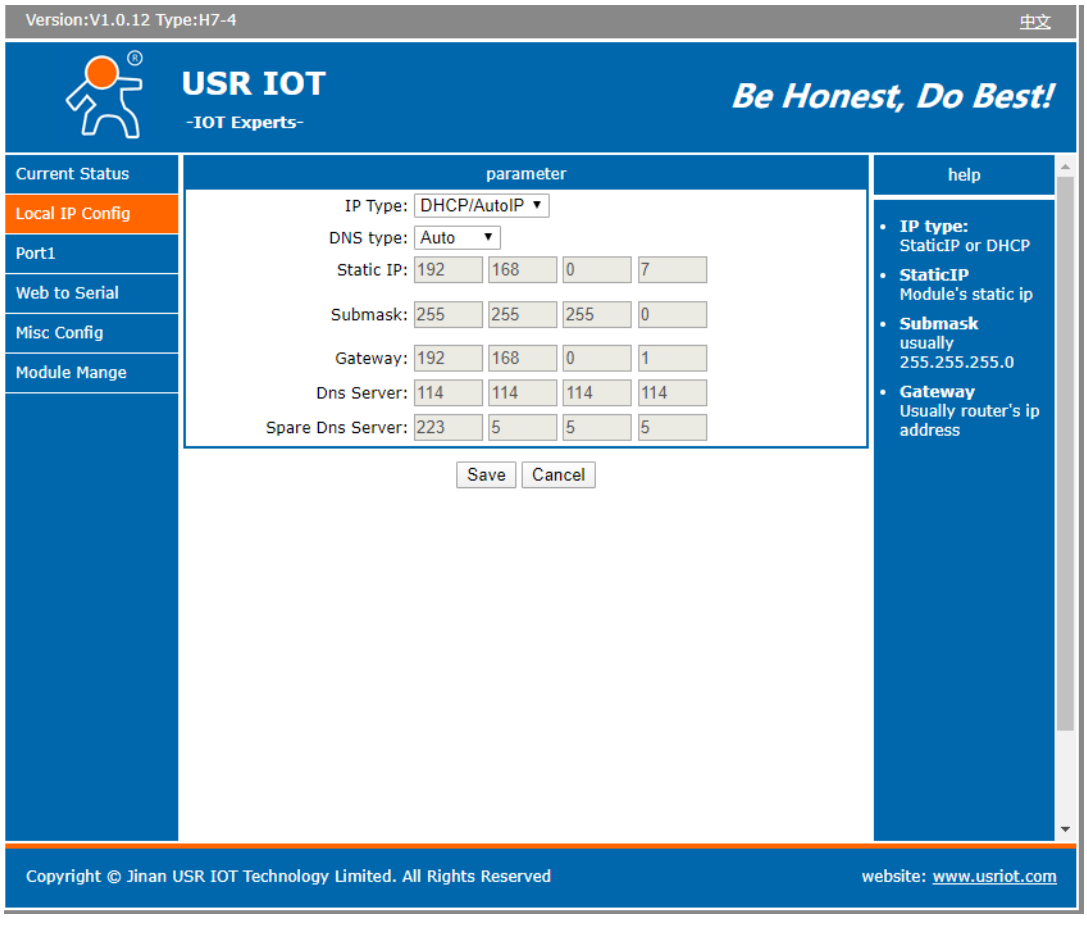


Fig. 13 **Network Settings Web Page**

Table 5 Network settings list

Parameter Item	Description
Network protocol	Click the drop-down menu to select the IP Address Setting mode: Static or DHCP. If you choose DHCP, the rest of the options will be greyed out or disabled.
DNS type	Click the drop-down menu to select the DNS mode: auto or manual. If you choose auto, the DNS options will be greyed out or disabled.
IP address	IP address is a 32-bit address assigned to devices connected to the Internet. The IP address consists of two fields: the network number field (Net-id) and host number field (host-id). In order to facilitate the management of IP addresses,IP addresses are divided into five categories: Class A, B, and C addresses are unicast addresses, Class D addresses are multicast addresses, Class E addresses are reserved addresses for future special purposes. The IP addresses currently in large numbers belong to three types of addresses: A, B, and C.
Subnet mask	The mask is a 32-bit number corresponding to an IP address. Some of these numbers are 1, and the others are 0. The mask can divide the IP address into two parts: the subnet address and the host address. The part

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	of the IP address corresponding to the 1 bit in the mask is the subnet address, and the other bits are the host address. The mask for class A addresses is 255.0.0.0, the mask for class B addresses is 255.255.0.0, the mask for class C addresses is 255.255.255.0.
Default gateway	The default gateway in the host is usually called the default route. The default route (Default route) is the route chosen by the router when no other route exists for the destination address in the IP packet. All packets whose destination is not in the router's routing table will use the default route.
DNS	The IP address of the DNS server. DNS Server part is where you can specify the IP Address of your Preferred DNS (Domain Name Server) and Alternate DNS. When the device uses a static IP address, the user is required to fill in this item, 8.8.8.8(Google) will be a good choice. If a specific DNS server is not used, the default gateway IP address is generally sufficient.

After finishing the network settings configuration, please click the Save button to save all changes that have been made. Finally, the web browser will be redirected to the Reboot page as shown in Fig.21. All modified parameters take effect after device restart.

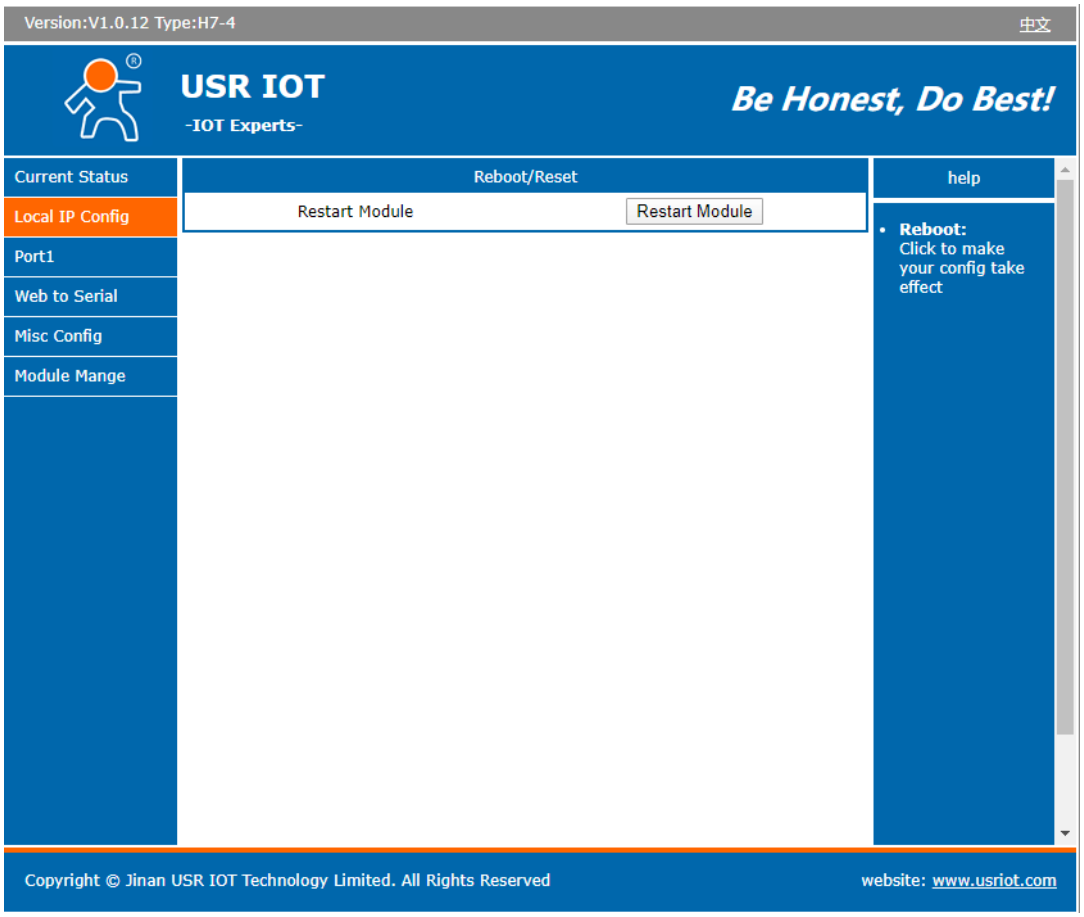


Fig. 14 **Reboot web page**

3.1.3. Serial port settings

The serial port module includes: serial port parameter configuration, network parameter configuration. The main function of the serial device server is to carry out two-way transparent transmission of standard serial bus data (RS-232, RS-485, RS-422) and standard Ethernet data supporting TCP/IP protocol to solve common serial equipment Networking problems on the Internet. The Port configuration page can configure the parameters of the serial port and socket, as shown in Fig.22.

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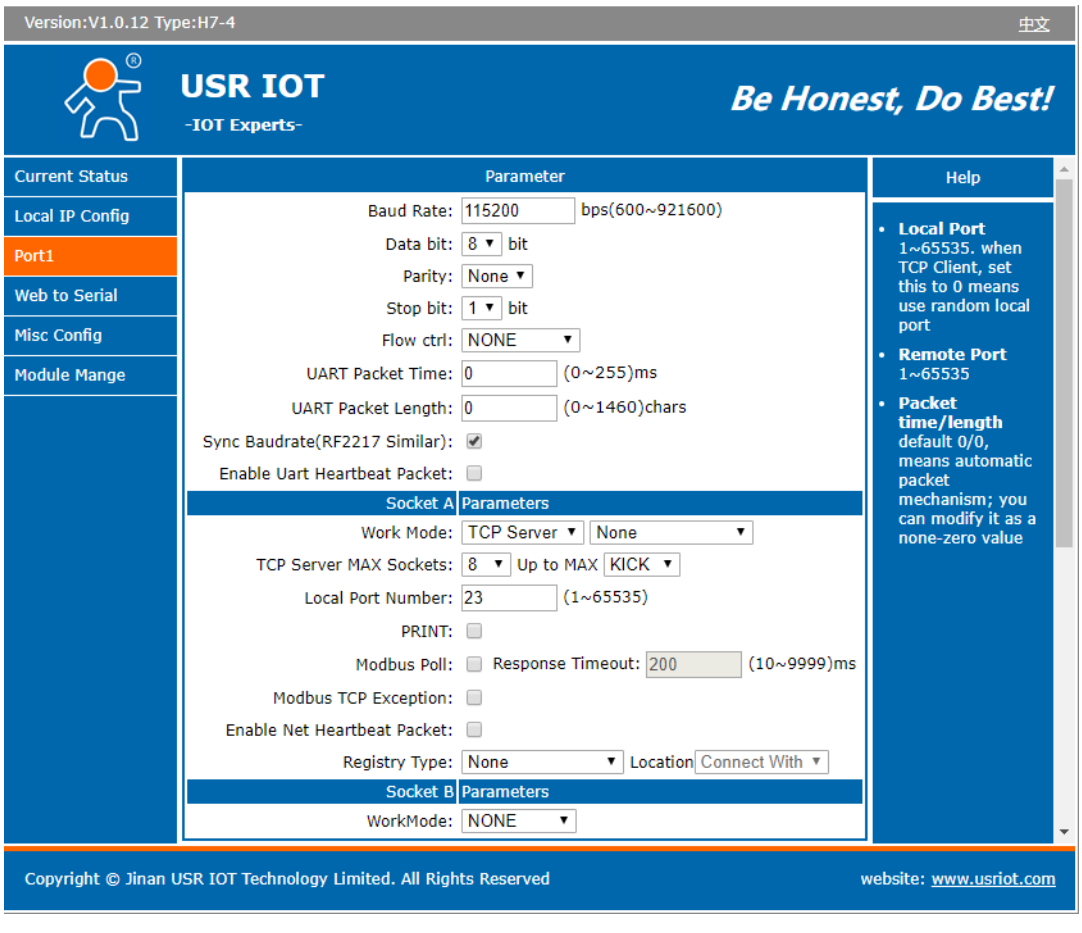


Fig. 15 **Serial port configuration page**

Details on work mode connectivity protocols and its settings of E2 series are given in Chapter 4 Operation modes, this section will only focus on the part of parameter description. The description of the configuration parameters on this interface is shown in table 8 and table 9.

Table 6 Serial settings

Parameter Item	Description
Baud rate	This sets the port’s data transfer speed. Choices are from 600—921600. Set this to match the baud rate setting of the connected device. Default is 115200.
Data bits	This sets the number of bits used to transmit one character of data. Choices are: 7 and 8. Set this to match the data bit setting of the connected device. Default is 8 (which is the default for the majority of serial devices).
Parity bits	This bit checks the integrity of the transmitted data. Choices are: None, Odd, Even. Set this to match the parity setting of the connected device. Default is None (which is the default for the majority of serial devices).
Stop bits	This indicates that a character has been transmitted. Set this to match the stop bit setting of the connected device. Choices are: 1 and 2. Default is 1 (which is the default for the majority of serial devices).
Flow control	This allows you to choose how the data flow will be controlled. Choices are: (No Flow Control), RTS/CTS (Hardware Flow Control), or Xon/Xoff (Software Flow Control). Set this to match the flow control setting of the connected device. Default is None. If Xon/Xoff is selected, the Xon and Xoff characters are 0x11 for Xon and 0x13 for Xoff. Note that these are hexadecimal numbers of ASCII characters (i.e., 0x11 = ‘1’ and 0x13 = ‘3’).
Serial mode(E2 models)	Click the drop-down menu to select the type of serial interface for the port. Choices are RS-232,RS-422, RS-485 (2 Wire).

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Packing time	Click the option to sent pack immediately by interval.
Packing length	Click the option to sent pack immediately by size.

Table 7 Operating modes settings

Parameter Item	Description
Work mode	USR-E2 series supports 5 different operation Modes which are TCP Server, TCP Client, and UDP,HTTP client and websocket. The operation Mode describes the role of the device and the connection between the device and other remote devices in the network which would like to communicate with serial device on E2’s COM port.
Maximum socket no.(TCP server only)	This option specifies the maximum number of remote devices/clients (with maximum of 16 clients, except N580 with 8) that can be connected to the serial device on this COM port.
Local port	This option specifies the port number that the TCP/UDP server should listen to. It is also used by the remote TCP/UDP client to connect to the TCP/UDP server. The default local port is 23. You can enter different port numbers in this option.
Remoter server addr.	Please specify the IP address of the TCP/UDP server program on the remote host in this field. This should match the IP settings of the TCP/UDP server program.
Remote port	Please specify the port number of the TCP/UDP server program on the remote host in this field. Once again, this should match the IP setting of the TCP/UDP server program.
Timeout reconnection(TCP/UDP client)	The default is disable. If you want to keep connection continually, you can disable it. Data idle Time is the time period for which the device waits for data. If the USR-E2 Series does not receive data during established idle time(timeout), the USR-E2 Series will disconnect temporarily. When the data comes in, it will reconnect automatically. Users do not need to reconnect.
Modbus polling	This option is selected when multiple modbus maters from Ethernet are polling the same serial port. Each serial port supports up to 16 simultaneous TCP connections allowing hosts to simultaneously transmit/receive data to/from the same serial port,USR-E2 Series processes the data in the order arrived. The serial device server determines the end of the serial acknowledgement through a response timeout.
Modbus exception	This option is used to enable modbus exception checking. If selected, error messages (TCP exception codes) are generated if a problem (such as a message timeout) should occur during Modbus operations.
Socket B	Socket B supports 2 different operation Modes which are TCP Client, and UDP client, this socket is closed by default.

The configuration will save to flash memory after clicking Save button. All configurations take effect after a system reboot.

3.1.4. Websocket server

This function is that the module acts as a WebSocket server, and transparently transmits the data received by the serial to the webpage in hexadecimal or ascii format. The WebSocket server can also send data to the serial device at any time.

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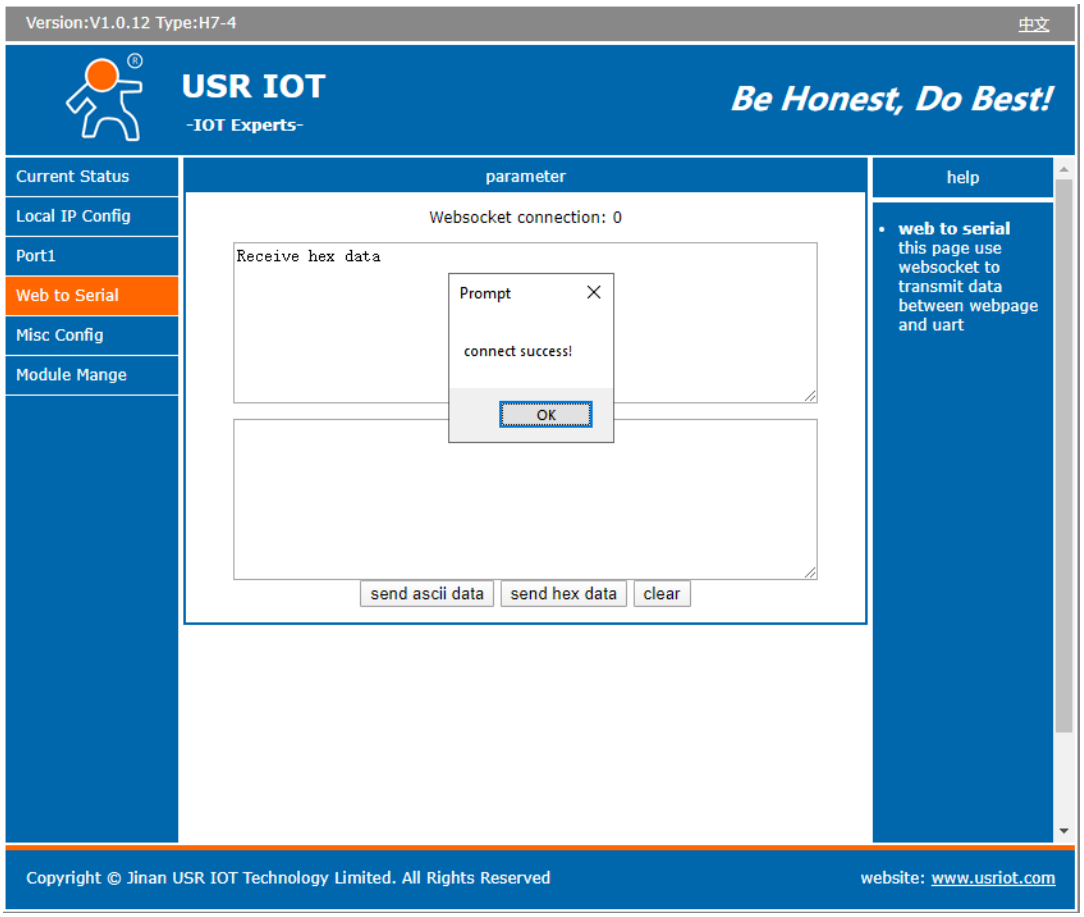


Fig. 16 **Websocket server**

3.1.5. Miscellaneous settings

This configuration tab includes several system level settings, such as device name, websocket, system log, user name and password. Most of these settings are optional.

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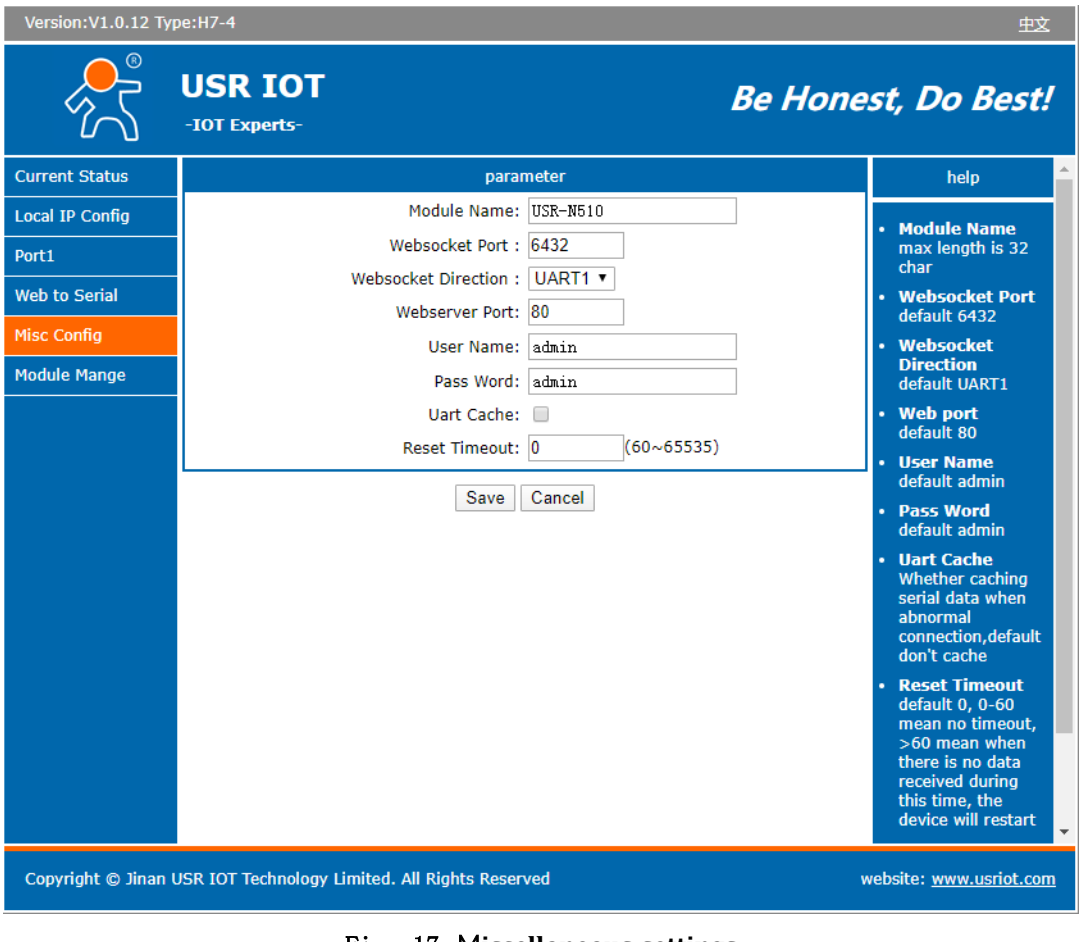


Fig. 17 Miscellaneous settings

Table 8 Miscellaneous settings

Parameter Item	Description
Module name	The name of the device, up to 32 characters,can’t be null
Websocket port	Websocket server listen port NO. Range 1-65535
Websocket direction	Click the drop-down menu to select websocket mapping direction: UART or Log.
Webserver port	Web server listen port NO. Range 1-65535
User name	The user name of web console and can be modified. up to 16 characters,can’t be NULL
Password	The password of web console and can be modified. up to 16 characters,can’t be NULL
UART cache	Click the option to enable serial buffer. By default, E2 will empty its serial buffer when a new TCP connection is established. This means that the TCP application will not receive buffered serial data during a TCP link breakage. To keep the serial data when there is no TCP connection and send out the buffered serial data immediately after a TCP connection is established, you can disable this option.
Reset timeout	This function is used for the serial device server without any data transmission or reception for a long time, and the module automatically restarts. If the restart time is set between 0 and 59 seconds, this function does not take effect. Only when the time is set to be greater than or equal to 60 seconds, the restart function of the device without data will take effect.

The configuration will save to flash memory after clicking Save button. All configurations take effect after a system reboot.

3.1.6. Management

This page can perform some system operations on the E2 series module, including restarting, restoring factory configuration, and

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upgrading. It is recommended that users use it with caution. Improper operation may damage the module.



Fig. 18 Module management

- Reboot

This function is used to restart the USR-E2 series module by software. Before the module is completely restarted, the device does not work and cannot forward any data packets. This restart is different from the hardware reset of power-on restart, but the module system software is reset, just like the "warm restart" of the windows operating system. Once a new setting is changed, you can use the Save function to accept the changes. You will need to reset the device to save the settings to flash memory. Click on "restart module" Button, the page pops up a prompt box, click "yes".

- Restore factory defaults

This function is used to restore the USR E2 module to the factory settings and automatically restart the module at the same time. Before the module restarts successfully, the module does not work and cannot forward any data packets. This function is to restore the factory default configuration value once the user sets the wrong parameter and causes the serial port server to work abnormally. Click the "Restore factory" button, and a prompt box will pop up on the page. Click "yes".

- Firmware upgrade

USR IoT continually upgrades its firmware to add new features and optimize performance. Please contact the sales to obtain the latest version of the firmware. Before upgrading the firmware, please make sure that the device has a reliable power source that will not be powered off or restarted during the firmware upgrading process(please be patient as this whole process might take up to 1 -2 minutes). Copy the new firmware file to your local computer. Note that the firmware file is a binary file with “.bin” extension. Before updating the firmware, make sure that your host’s Network domain is as same as the serial device server.

Next, click “Select the file” button as shown in Figure to find and choose the new firmware file. Then, click "Flashing the firmware" button to start the firmware upgrade process. The program will show the upload status. Please wait until the uploading process is finished (the

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amount of time varies depending on the equipment used).

Finally, the device will then proceed to restart itself. In most cases, you might require to re-configure your device.

Please refer to "USR-E2 firmware upgrade from V1 to V2 version user guide" for detail if you want to use V2 firmware function.

3.2. Web interface(V2 version)

Every E2 module is equipped with a built-in web server in the firmware. Therefore, the device can be accessed by using a web browser for configuring by entering the device's IP address in the URL field of your web browser. An authentication will be required and you will have to enter the username (Default value is "admin") and password (Default value is "admin") for accessing the web interface as shown in Fig. 26. This approach (web interface) for configuring your device is the most user-friendly. It is the most recommended and the most common method used for E2 module. Please go to its corresponding section for a detailed explanation.

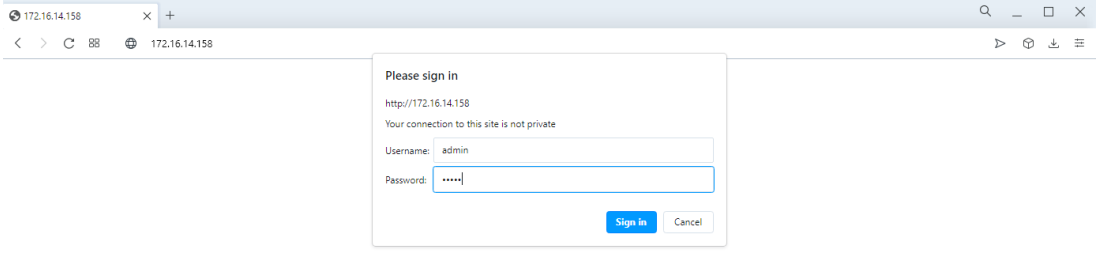


Fig. 19 **Authentication Required for Accessing Web Interface**

3.2.1. Status

After entering the correct user name and password and the authentication is successful, you will enter the main page of the Web, as shown in Fig.27.

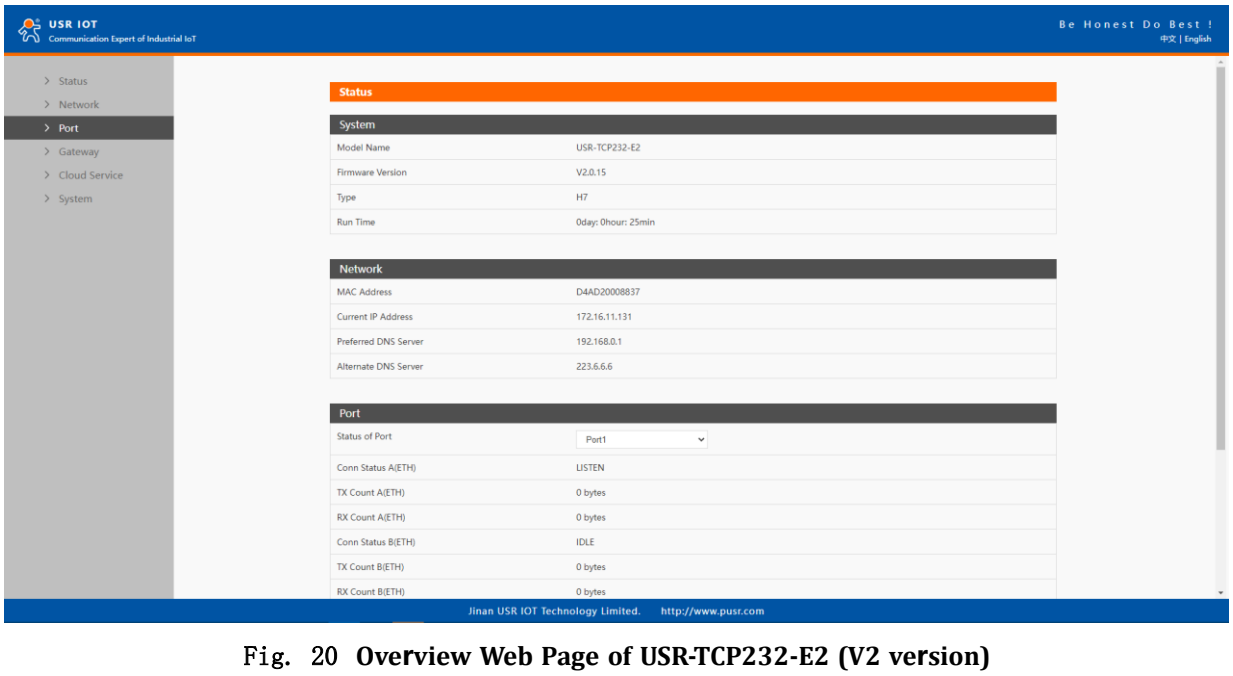


Fig. 20 **Overview Web Page of USR-TCP232-E2 (V2 version)**

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The function of the device status part is to display some specific information of the current device, including system, network, serial port, mqtt gateway.

Table 9 Overview status list

Parameter Item	Description
Model name	The name of the embedded module, which can be customized by the user on the "System setting" page.
Firmware version	The current software version of the module.
Type	The current hardware version of the module.
Run time	Total time after the device start work. It will starts from 0 after reboot.
MAC address	The MAC address of the module.
Current IP address	The IP address of the module.
Port status	The working status of checked serial port. Select the serial port currently to be displayed Conn Status A(ETH): connection status of socket A. IDLE：Initialization status LISTEN：When the module works as TCP Server, it is listening for connection access CONNECTING：Works as TCP client, the module is establishing a connection to the TCP Server CONNECTED：Works as TCP server, the TCP connection to TCP server of the module has been established CONNECTED（n）：Number of TCP clients connected to the module ERROR：The module is abnormally disconnected Tx Count A(ETH): To count how many bytes be send to internet. Rx Count A(ETH): To count how many bytes received from internet.
MQTT	Whether MQTT is enable
Connection status	Connection status of MQTT. CONNECTING：the module is establishing a MQTT connection to the MQTT broker CONNECTED：the MQTT connection to MQTT broker has been established ERROR：The module is abnormally disconnected

3.2.2. IP settings

You must assign a valid IP address to the USE-TCP232-E2 before it will work in your network environment. The IP address must be unique within the network. If the device is connected to the Internet and should connect to other servers over the Internet to get some services such as Network Time Protocol (NTP) server, you will need to configure the DNS server in order to be able to resolve the host name of the NTP server. The detailed description of the configuration parameters on this interface is shown in table 12.

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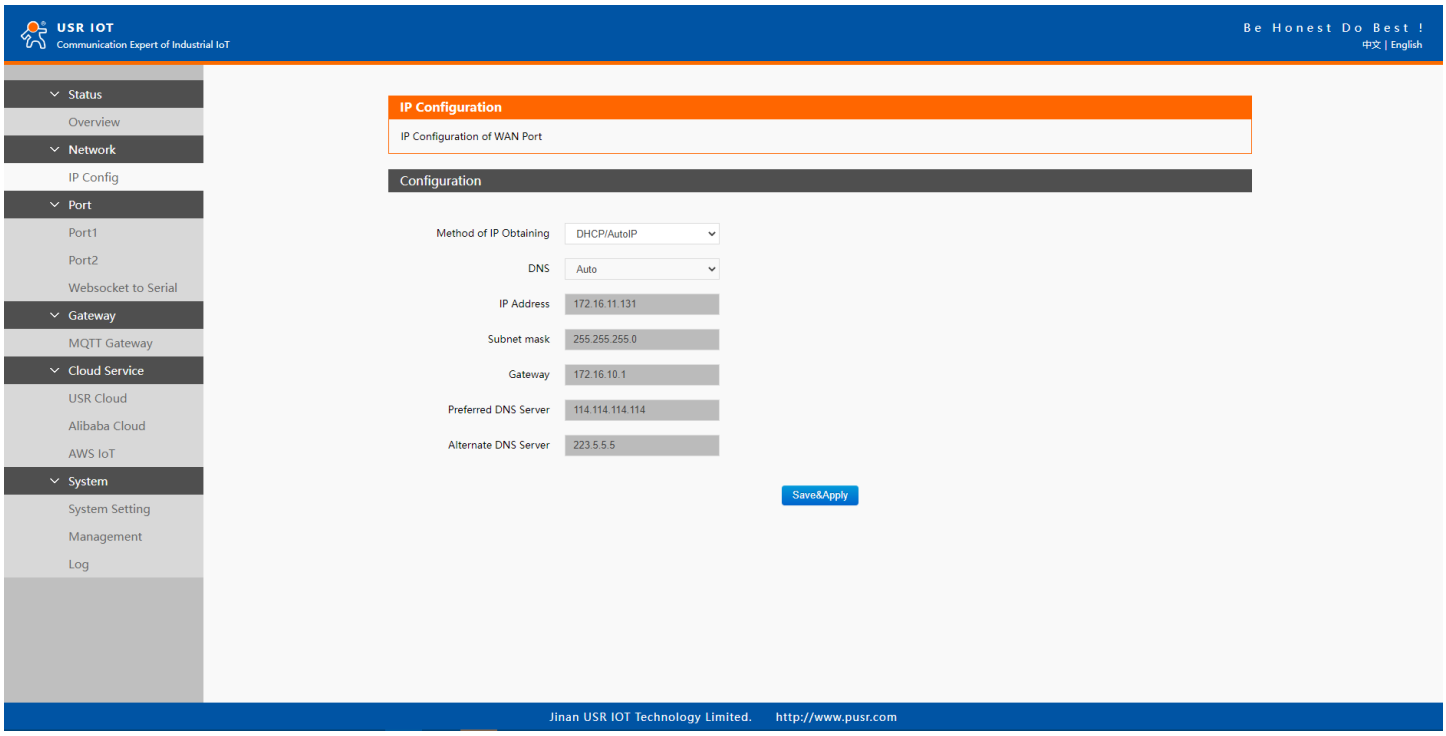


Fig. 21 **Network web page**

Table 10 Network configuration list

Parameter Item	Description
Network protocol	Click the drop-down menu to select the IP Address Setting mode: Static or DHCP. If you choose DHCP, the rest of the options will be greyed out or disabled.
DNS type	Click the drop-down menu to select the DNS mode: auto or manual. If you choose auto, the DNS options will be greyed out or disabled.
IP address	IP address is a 32-bit address assigned to devices connected to the Internet. The IP address consists of two fields: the network number field (Net-id) and host number field (host-id). In order to facilitate the management of IP addresses,IP addresses are divided into five categories: Class A, B, and C addresses are unicast addresses, Class D addresses are multicast addresses, Class E addresses are reserved addresses for future special purposes. The IP addresses currently in large numbers belong to three types of addresses: A, B, and C.
Subnet mask	The mask is a 32-bit number corresponding to an IP address. Some of these numbers are 1, and the others are 0. The mask can divide the IP address into two parts: the subnet address and the host address. The part of the IP address corresponding to the 1 bit in the mask is the subnet address, and the other bits are the host address. The mask for class A addresses is 255.0.0.0, the mask for class B addresses is 255.255.0.0, the mask for class C addresses is 255.255.255.0.
Gateway	The default gateway in the host is usually called the default route. The default route (Default route) is the route chosen by the router when no other route exists for the destination address in the IP packet. All packets whose destination is not in the router's routing table will use the default route.
DNS	The IP address of the DNS server. DNS Server part is where you can specify the IP Address of your Preferred DNS (Domain Name Server) and Alternate DNS. When the device uses a static IP address, the user is required to fill in this item, 8.8.8.8(Google) will be a good choice. If a specific DNS server is not used, the default

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	gateway IP address is generally sufficient.

The configuration will save to flash memory after clicking Save button. All configurations take effect after a system reboot.

3.2.3. Serial port settings

The serial port module includes: serial port parameter configuration, network parameter configuration. The main function of the module is to carry out two-way transparent transmission of TTL and standard Ethernet data supporting TCP/IP protocol to solve common serial equipment Networking problems on the Internet. The Port configuration page can configure the parameters of the serial port and socket, as shown in Fig.29. Details on work mode connectivity protocols and its settings of E2 module are given in Chapter 4 Operation modes, this section will only focus on the part of parameter description. The description of the configuration parameters on this interface is shown in table 13 and table 14.

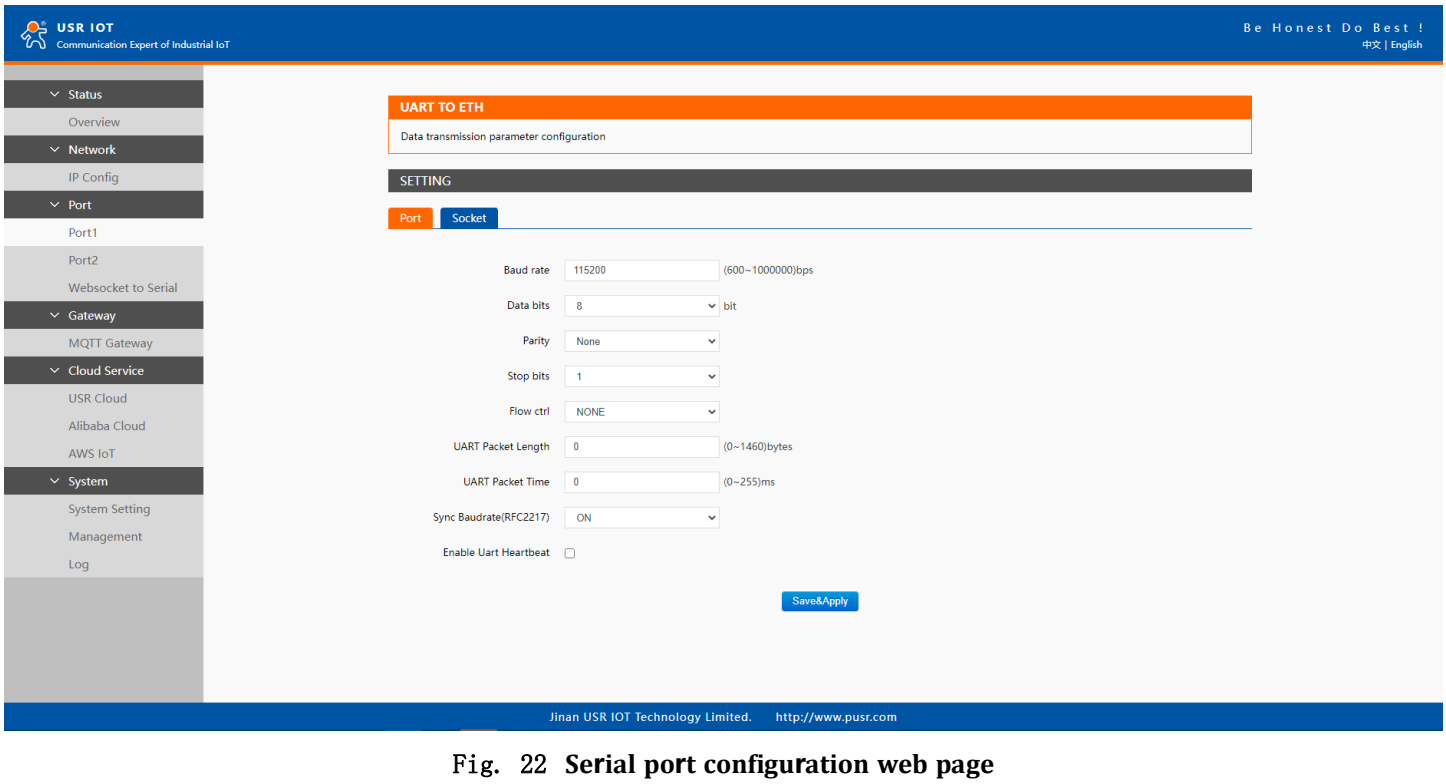


Fig. 22 Serial port configuration web page

Table 11 Serial settings list

Parameter Item	Description
Baud rate	This sets the port's data transfer speed. Choices are from 600—921600. Set this to match the baud rate setting of the connected device. Default is 115200.
Data bits	This sets the number of bits used to transmit one character of data. Choices are: 7 and 8. Set this to match the data bit setting of the connected device. Default is 8 (which is the default for the majority of serial devices).
Parity bits	This bit checks the integrity of the transmitted data. Choices are: None, Odd, Even, Space, Mark. Set this to match the parity setting of the connected device. Default is None (which is the default for the majority of serial devices).
Stop bits	This indicates that a character has been transmitted. Set this to match the stop bit setting of the connected device. Choices are: 1 and 2. Default is 1 (which is the default for the majority of serial devices).
Flow control	This allows you to choose how the data flow will be controlled. Choices are: (No Flow Control), RTS/CTS (Hardware Flow Control), or Xon/Xoff (Software Flow Control). Set this to match the flow control setting of

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	the connected device. Default is None. If Xon/Xoff is selected, the Xon and Xoff characters are 0x11 for Xon and 0x13 for Xoff. Note that these are hexadecimal numbers of ASCII characters (i.e., 0x11 = '1' and 0x13 = '3').
Serial mode(E2 models)	Click the drop-down menu to select the type of serial interface for the port. Choices are RS-232,RS-422, RS-485 (2 Wire).
Packing time	Click the option to sent pack immediately by interval.
Packing length	Click the option to sent pack immediately by size.

The configuration will save to flash memory after clicking Save button. All configurations take effect after a system reboot.

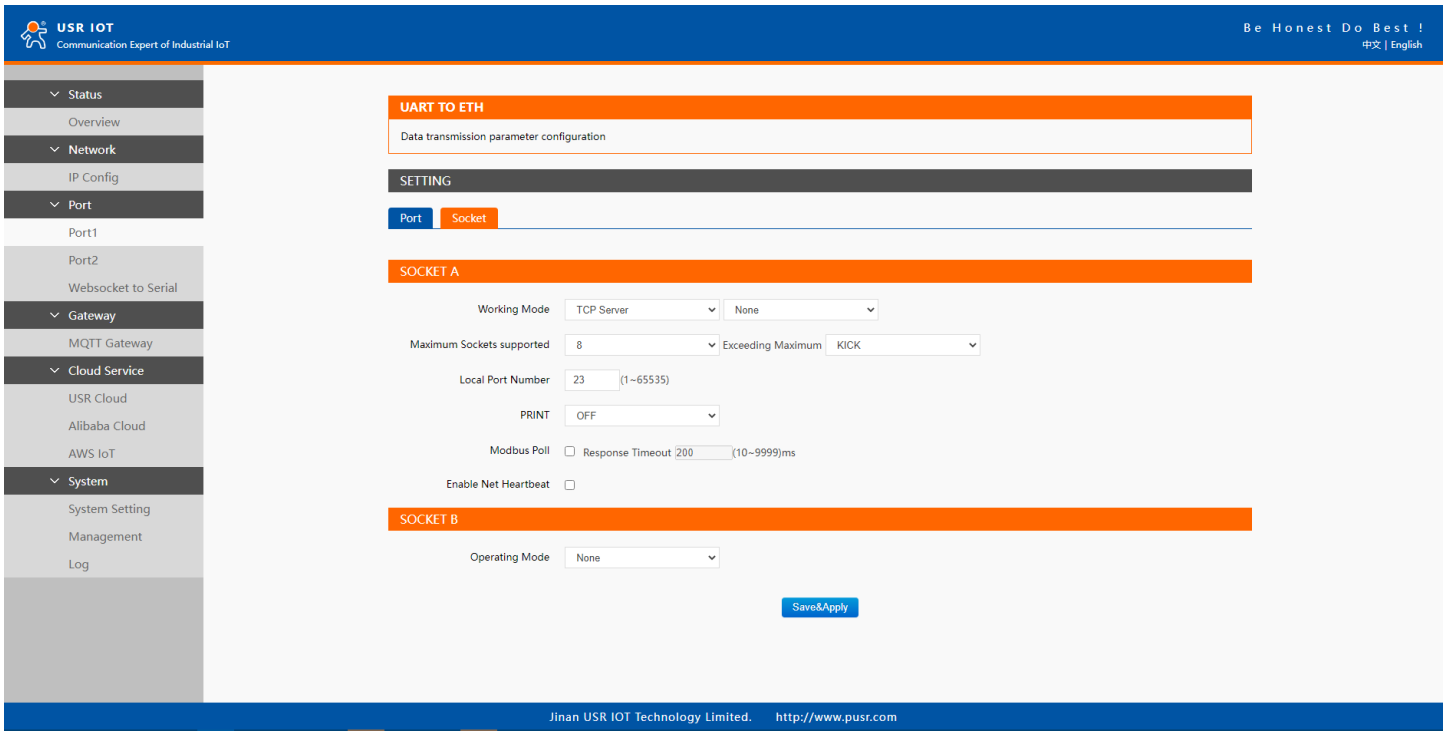


Fig. 23 **Socket configuration web page**

Table 12 Operation modes settings list

Parameter Item	Description
Work mode	USR-TCP232-E2 supports 5 different operation Modes which are TCP Server, TCP Client, and UDP,HTTP client and websocket. The operation Mode describes the role of the device and the connection between the device and other remote devices in the network which would like to communicate with serial device on E2's COM port.
Maximum socket no.(TCP server only)	This option specifies the maximum number of remote devices/clients (with maximum of 16 clients) that can be connected to the serial device on this COM port.
Local port	This option specifies the port number that the TCP/UDP server should listen to. It is also used by the remote TCP/UDP client to connect to the TCP/UDP server. The default local port is 23. You can enter different port numbers in this option.
Remoter server addr.	Please specify the IP address of the TCP/UDP server program on the remote host in this field. This should match the IP settings of the TCP/UDP server program.
Remote port	Please specify the port number of the TCP/UDP server program on the remote host in this field. Once again, this should match the IP setting of the TCP/UDP server program.

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Timeout reconnection(TCP/UDP client)	The default is disable. If you want to keep connection continually, you can disable it. Data idle Time is the time period for which the device waits for data. If the USR-E2 Series does not receive data during established idle time(timeout), the USR-E2 Series will disconnect temporarily. When the data comes in, it will reconnect automatically. Users do not need to reconnect.
Modbus polling	This option is selected when multiple modbus maters from Ethernet are polling the same serial port. Each serial port supports up to 16 simultaneous TCP connections allowing hosts to simultaneously transmit/receive data to/from the same serial port,USR-E2 Series processes the data in the order arrived. The serial device server determines the end of the serial acknowledgement through a response timeout.
Response timeout	If the Modbus device does not receive a response within the time specified here, the communication times out. Valid settings are from 10 – 9999ms.
Modbus exception	This option is used to enable modbus exception checking. If selected, error messages (TCP exception codes) are generated if a problem (such as a message timeout) should occur during Modbus operations.
SSL protocol	Choose TLS/SSL data encryption protocol version
Socket B	Socket B supports 2 different operation Modes which are TCP Client, and UDP client, this socket is closed by default.

The configuration will save to flash memory after clicking Save button. All configurations take effect after a system reboot.

3.2.4. Websocket server

This function is that the module acts as a WebSocket server, and transparently transmits the data received by the serial to the webpage in hexadecimal or ascii format. The WebSocket server can also send data to the serial device at any time.

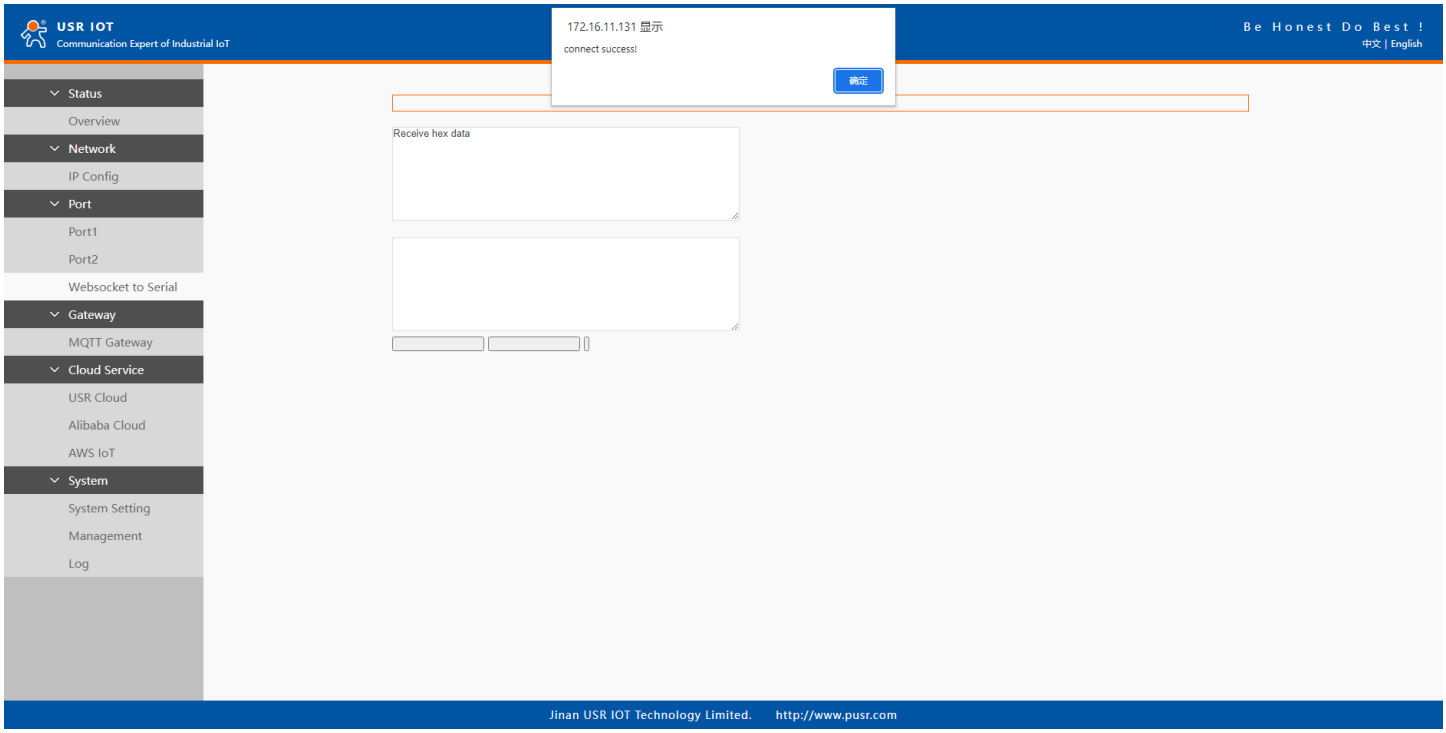


Fig. 24 **Websocket server**

3.2.5. MQTT gateway

If you enable MQTT Broker as your northbound connection, the E2 will be configured as MQTT Client. In Client mode, you can setup MQTT broker basic settings, general topic settings, TLS secure transmission, last will message, and advanced settings.

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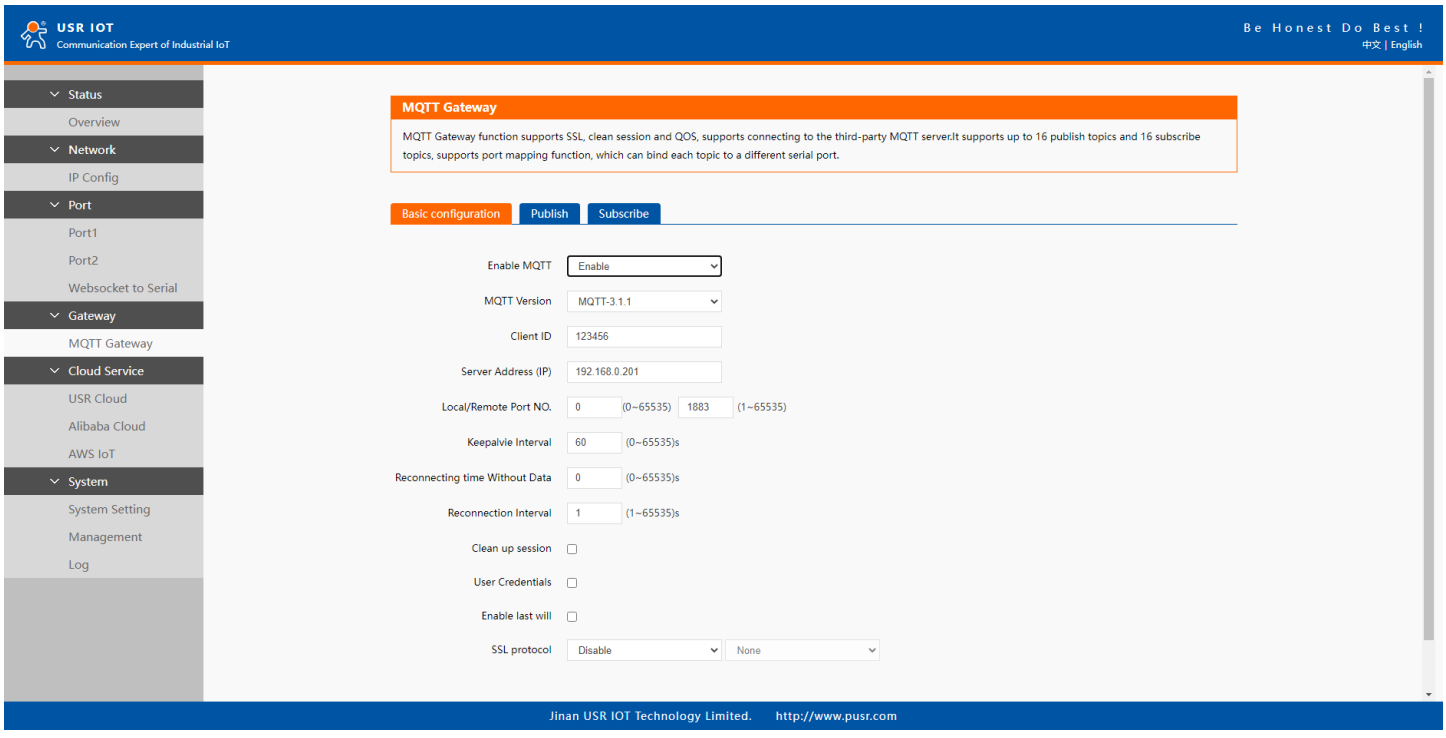


Fig. 25 MQTT connection profiles

Table 13 MQTT basic setting

Parameter Item	Description
Enable	Turns MQTT gateway on or off.
Version	Select the mqtt protocol version. V3.1 and V3.1.1 are supported.
Client ID	The client ID defined the identifier of the E2 Gateway. The IDs of the various MQTT clients have to be unique for the respective MQTT Broker. If two MQTT clients are using an identical ID, the connections of theses clients to the MQTT Broker are disconnected. For an individual client, there is no way to find out whether a specific client ID is already used by another client or not.
Server address	IP address or hostname of an MQTT broker.
Remote Port	Port number of the MQTT broker.
Keep alive interval	The Keep Alive is a time interval measured in seconds. It is the maximum time interval that the broker permits between when a client finishes sending one MQTT packet and starts to send the next.
Re-connection time	Automatic reconnection when there are not data flow in the MQTT session in the setting time. If the time is set 0, this function does not take effect.
Interval	Automatic reconnection interval after a fail network connection.
Clean session	Valid only for Qos1 and Qos2. When the clean session is checked, the client does not want a persistent session. If the client disconnects for any reason, all information and messages that are queued from a previous persistent session are lost. When the clean session is unchecked, the broker creates a persistent session for the client. All information and messages are preserved until the next time that the client requests a clean session.
User name	Username for authentication to the MQTT broker.
Password	Password for authentication to the MQTT broker.

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Last will	The last will message is part of the Last Will and Testament (LWT) feature of MQTT. The will message notifies other clients when a client disconnects ungracefully.
SSL/TLS	If you use a TLS connection, click the SSL/TLS tab, select Enable SSL/TLS, and then set the Protocol parameter to TLSv1.2

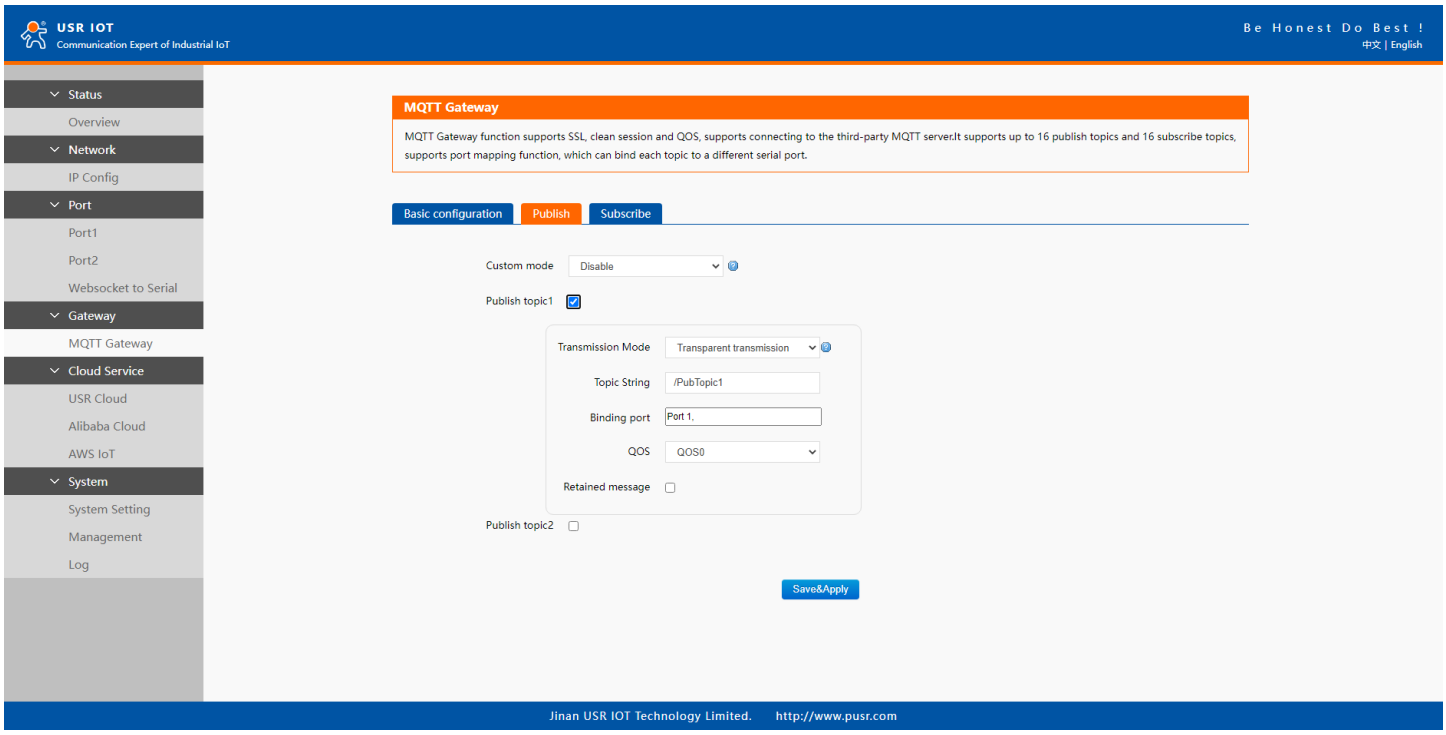


Fig. 26 Topic to publish

Table 14 Publish message setting

Parameter Item	Description
Transmission mode	Transparent transmission, just as its name implies,the gateway does not process any data, forward the data directly. Topic distribution,in this mode users should define a topic name when configuring the topic. After receiving serial port data, the device pushes it to the associated topics based on the topic name. Topic name and payload are separated by comma. For example, topic name, {"message": "Hello from USR-N510 gateway"} as serial data. Different topics are allowed to have the same topic name. In this way, data is pushed to all topics with the same topic name. Custom mode, add topic, Qos(0,1,2), retain(ON,OFF) message before payload. After receiving the serial data, N510 publishes the payload of the corresponding topic to cloud according to rules. This method can be used to publish any topic at any time. For example, awsiot/test,0,ON,{"message": "Hello from USR-N510 gateway"} as serial data.
TOPIC string	An MQTT topic is a UTF-8 string that the broker uses to filter messages for each connected client. To receive messages, the client must subscribe to the topic. A topic can have one or more topic levels. Each topic level is separated by a slash (Topic Level Separator).
Binding Port	The MQTT topic is bound to the serial port number of the device. Any data from the COM Port1 of the gateway will send to all the TOPIC it bindings to.
Qos	QoS 0: at most once. In this case, the client publishes a message to the broker only once.

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	QoS 1: at least once. In this case, when a client publishes a message to the broker, the client expects the broker to acknowledge whether or not a client has received the message. If the publisher does not receive acknowledgement from the broker within a preset time interval, it will republish the message again and again until acknowledgment is received. QoS 2: exactly once. The MQTT protocol uses the confirmation of confirmations to ensure that a message is delivered exactly once.
Retained message	By setting the Retain flag the MQTT Broker is instructed to save the most recent data value for the topic. Data values without Retain flag are only transferred from the MQTT Broker to those MQTT Subscribers that are registered at the broker and have subscribed to the appropriate topic in the moment when sending the data to the broker.

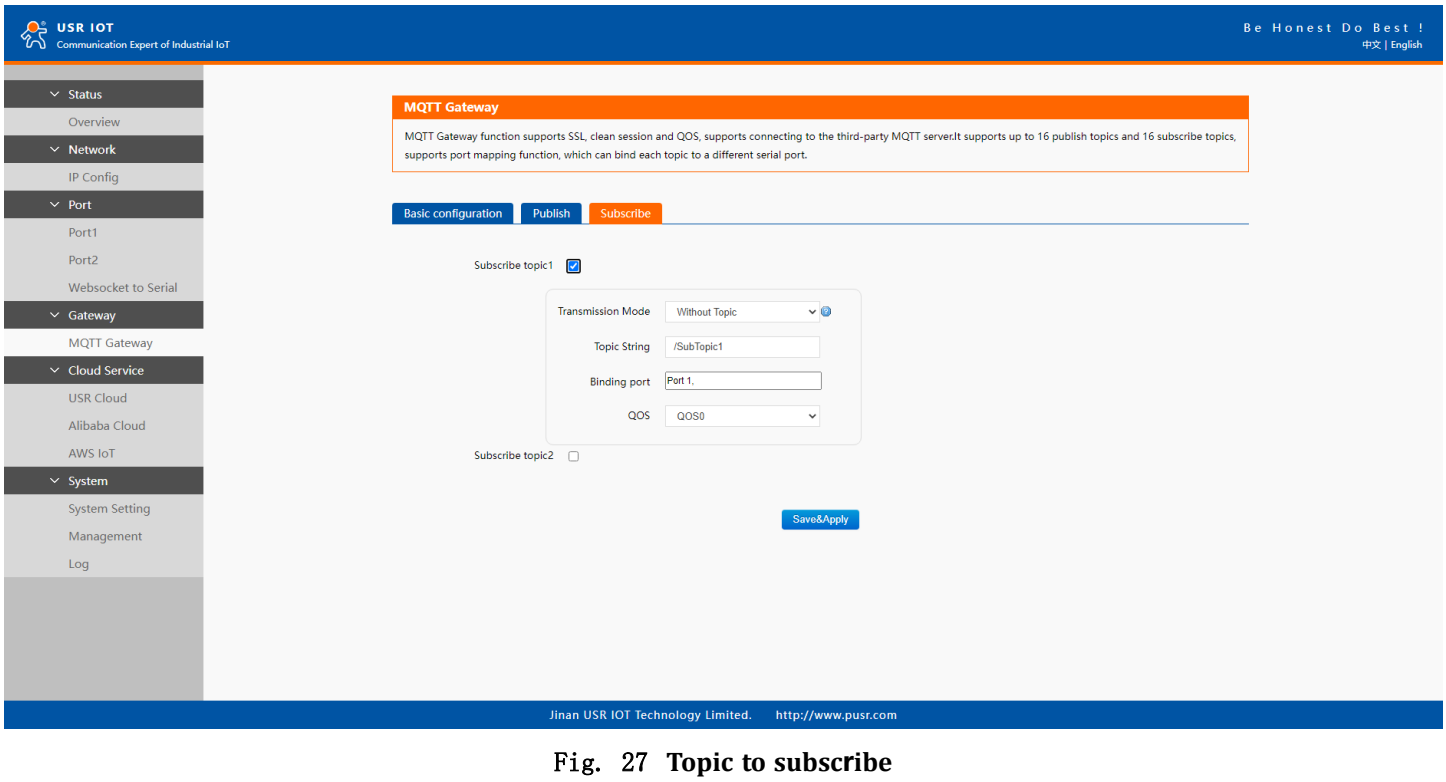


Fig. 27 Topic to subscribe

Table 15 Subscribe message setting

Parameter Item	Description
Transmission mode	The data printed to the serial port can be set whether to carry the Topic
Topic string	Same to Table 16
Binding port	Same to Table 16
QoS	Same to Table 16

3.2.6. Cloud service

Please refer to “USR-TCP232-E2 Quick Start Guide with AWS IoT” for detail.

Please refer to “USR-TCP232-E2 Quick Start Guide with PUSR cloud” for detail.

3.2.7. System setup

This system setting tab includes several system level settings, such as device name, websocket, system log, user name and password. Most

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of these settings are optional.

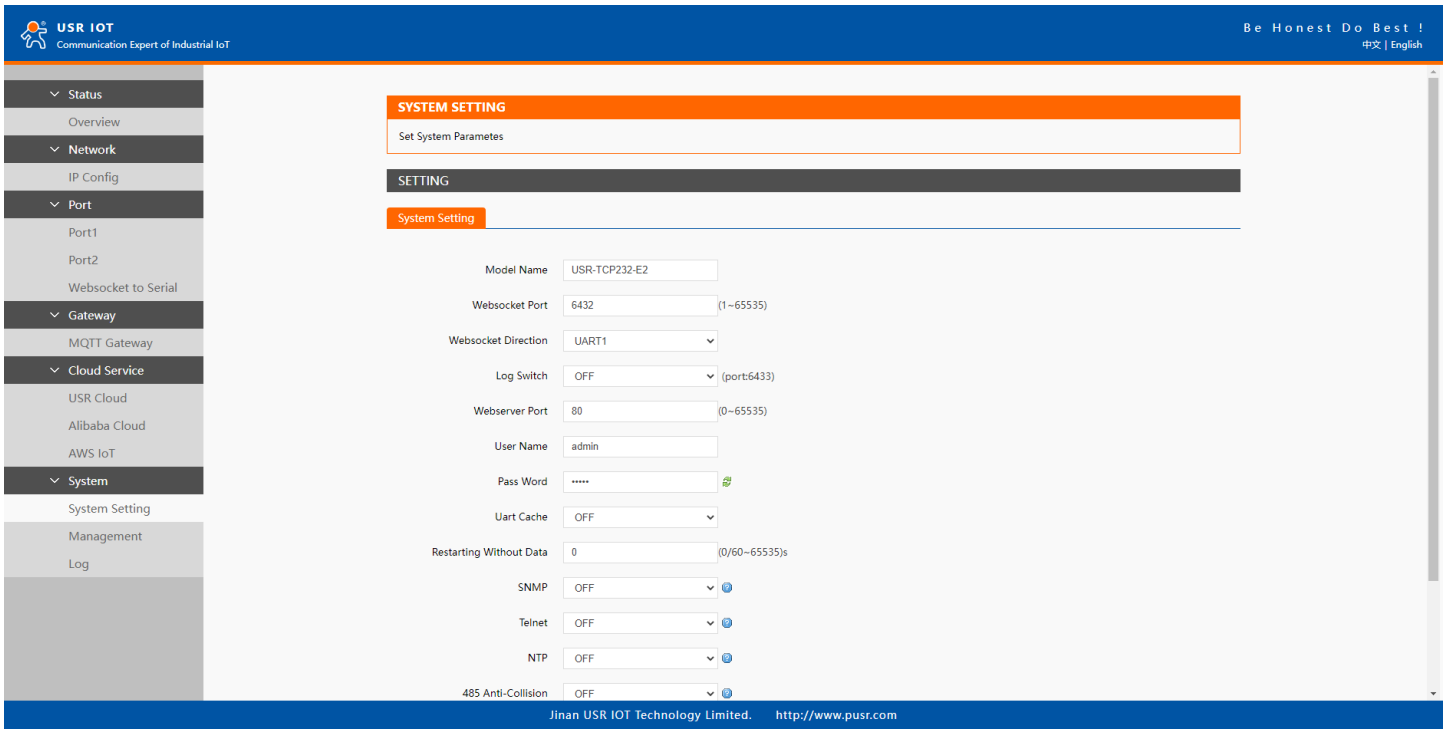


Fig. 28 System settings

Table 16 System settings list

Parameter Item	Description
Module name	The name of the device, up to 32 characters,can’t be null
Websocket port	Websocket server listen port NO. Range 1-65535
Websocket direction	Click the drop-down menu to select websocket mapping direction: UART or Log.
Webserver port	Web server listen port NO. Range 1-65535
User name	The user name of web console and can be modified. up to 16 characters,can’t be NULL
Password	The password of web console and can be modified. up to 16 characters,can’t be NULL
UART cache	Click the option to enable serial buffer. By default, E2 will empty its serial buffer when a new TCP connection is established. This means that the TCP application will not receive buffered serial data during a TCP link breakage. To keep the serial data when there is no TCP connection and send out the buffered serial data immediately after a TCP connection is established, you can disable this option.
Restarting without data	This function is used for the serial device server without any data transmission or reception for a long time, and the module automatically restarts. If the restart time is set between 0 and 59 seconds, this function does not take effect. Only when the time is set to be greater than or equal to 60 seconds, the restart function of the device without data will take effect.

The configuration will save to flash memory after clicking Save button. All configurations take effect after a system reboot.

In management page users can perform some system operations on the E2 series module, including restarting, restoring factory configuration, and upgrading. It is recommended that users use it with caution. Improper operation may damage the module.

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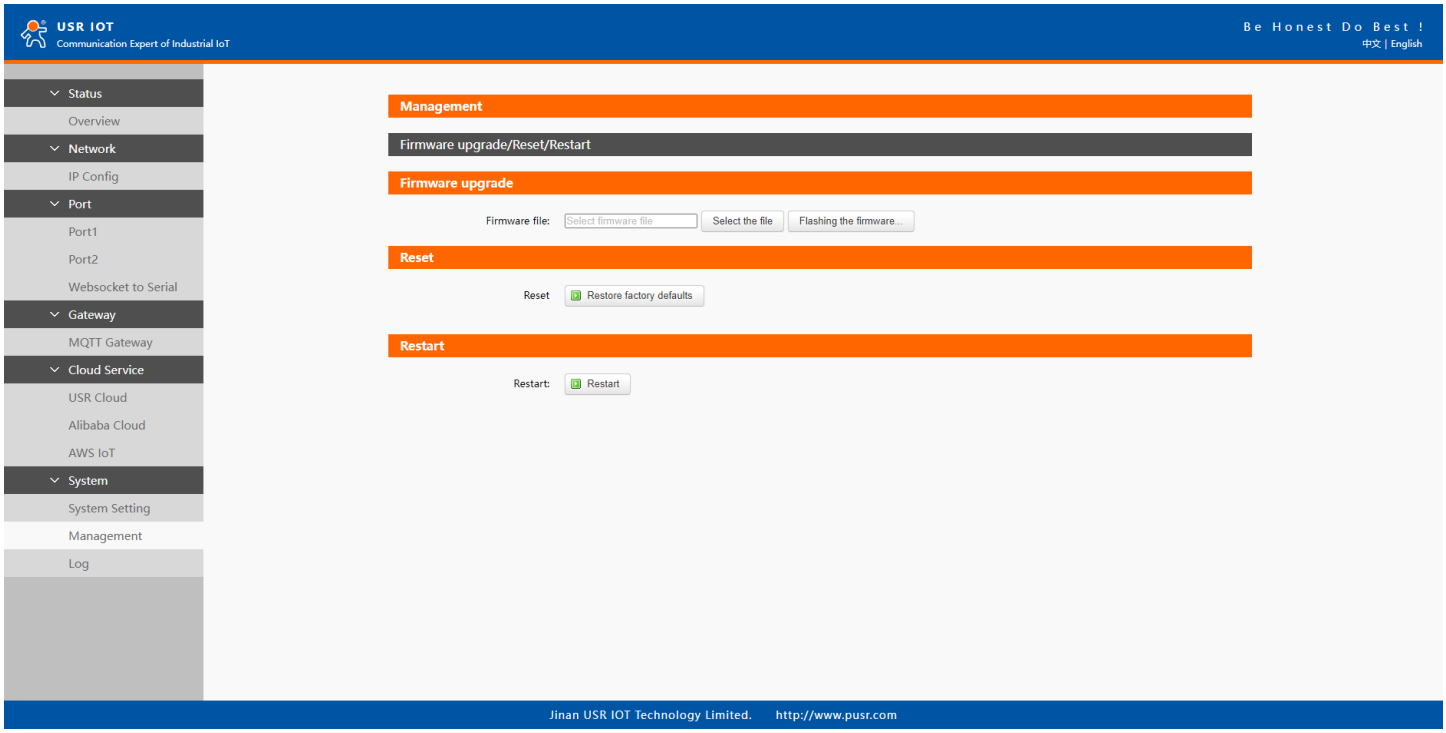


Fig. 29 Module management

- Restart

This function is used to restart the USR-TCP232-E2 module by software. Before the module is completely restarted, the device does not work and cannot forward any data packets. This restart is different from the hardware reset of power-on restart, but the module system software is reset, just like the "warm restart" of the windows operating system. Once a new setting is changed, you can use the Save function to accept the changes. You will need to reset the device to save the settings to flash memory. Click on "restart" Button, the page pops up a prompt box, click "OK".

- Restore factory defaults

This function is used to restore the USR E2 module to the factory settings and automatically restart the module at the same time. Before the module restarts successfully, the module does not work and cannot forward any data packets. This function is to restore the factory default configuration value once the user sets the wrong parameter and causes the serial port server to work abnormally. Click the "Restore factory defaults" button, and a prompt box will pop up on the page. Click "OK".

- Firmware upgrade

USR IoT continually upgrades its firmware to add new features and optimize performance. Please contact the sales to obtain the latest version of the firmware. Before upgrading the firmware, please make sure that the device has a reliable power source that will not be powered off or restarted during the firmware upgrading process(please be patient as this whole process might take up to 1 -2 minutes). Copy the new firmware file to your local computer. Note that the firmware file is a binary file with “.bin” extension. Before updating the firmware, make sure that your host’s Network domain is as same as the serial device server.

Next, click “Select the file” button as shown in Figure to find and choose the new firmware file. Then, click "Flashing the firmware" button to start the firmware upgrade process. After the progress bar in the page is read, the module software upgrade is completed. Please wait until the uploading process is finished (the amount of time varies depending on the equipment used).

Finally, the device will then proceed to restart itself. In most cases, you might require to re-configure your device.

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3.3. Configuration software

3.3.1. Discovering your device server

After you start EthernetTool software, if the USR-TCP232- is already connected to the same gateway as your PC, the device can be accessed via broadcast packets. Users can search all the USR-TCP232-E2 modules on the network and show them on the Serial Device Server List Area of the utility. Please select the right Ethernet adapter if you did not see any serial device server.

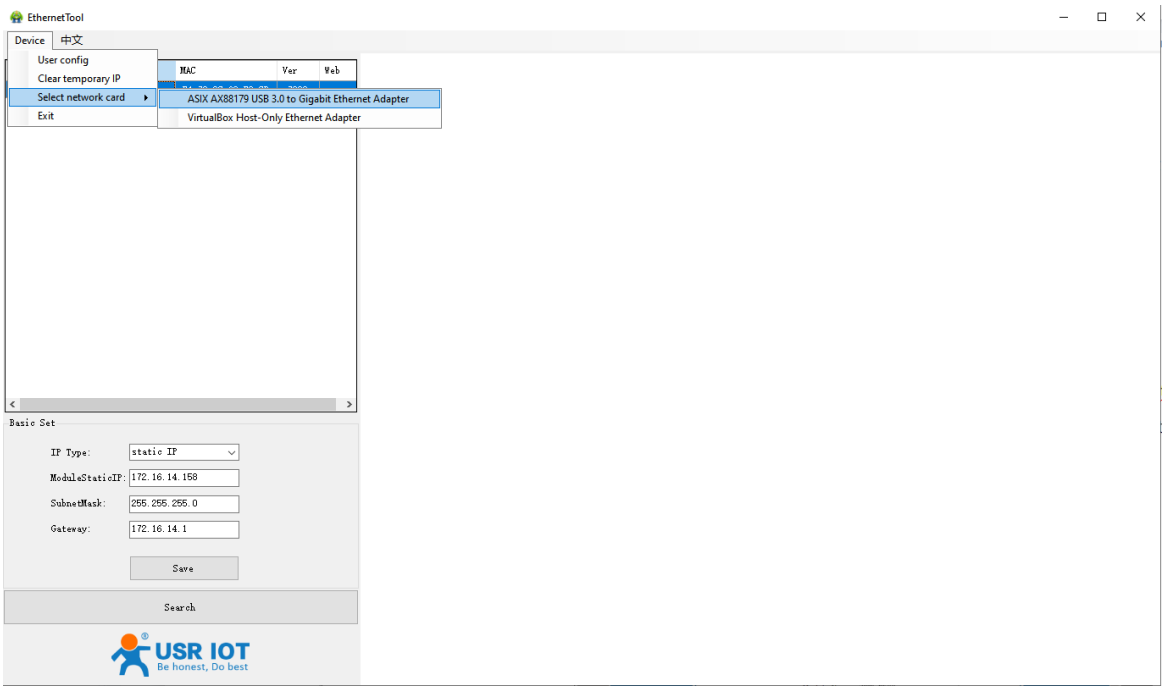


Fig. 30 Searching serial device server

3.3.2. Network setting

Sometime the E2 module might not be in the same subnet as your PC, therefore, you will have to use this utility to locate it in your environment. To configure each device, first click to select the desired device (default IP:192.168.0.7) in the list of configuration utility, and then change the IP address to avoid any IP address conflict with other hosts on your LAN, save your change.

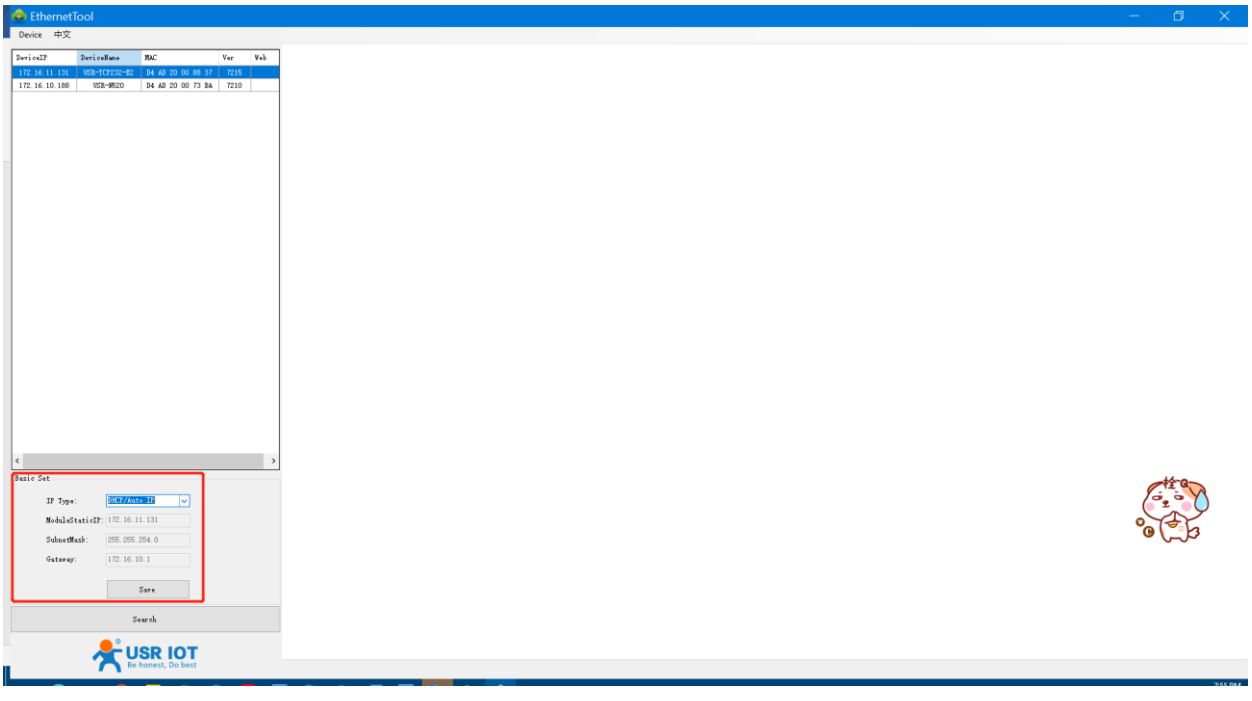


Fig. 31 Changing network settings

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3.3.3. Reboot the device

This function is available to allow you to reset the serial device server. The function disconnects both the ethernet and serial connections. The function also allows the serial device server to save new configuration settings to flash memory. To reset the device:

1. Right-click a desired device to display the settings menu.
2. Select Reboot.

Press the Reboot button and the system will give a reset response.

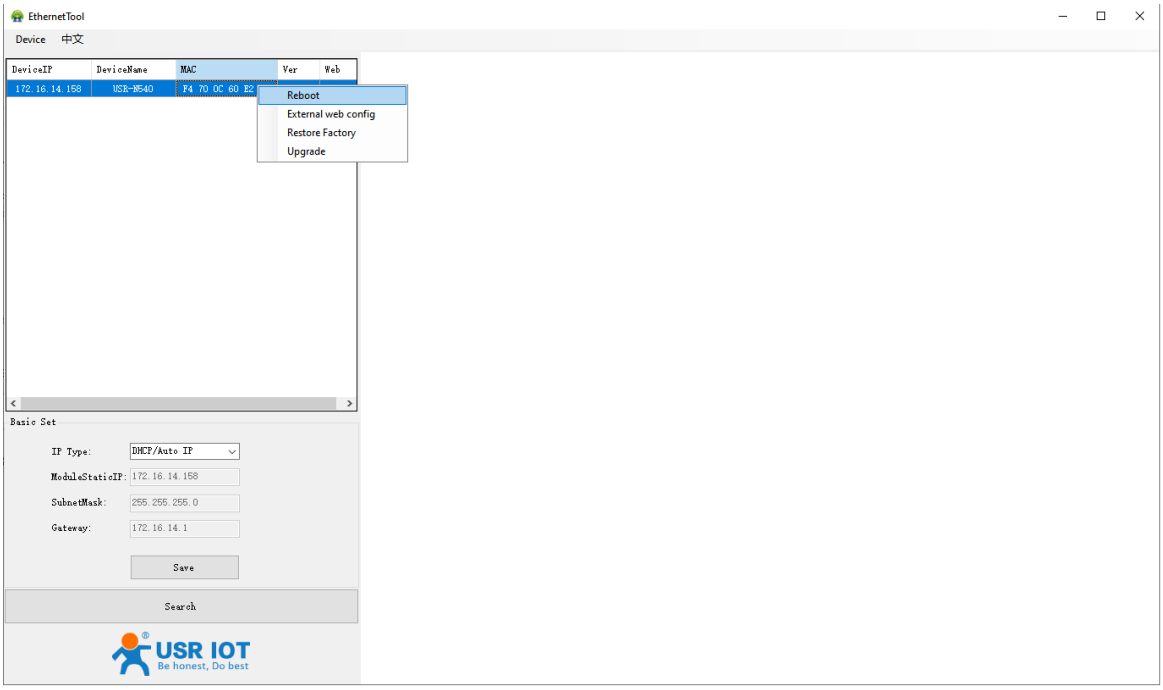


Fig. 32 **Reboot the device**

3.3.4. Restore to factory default settings

The configuration utility provides the function to restore the serial device server to factory default settings. If you really want to restore the serial device sever to factory default settings, please click restore factory button to continue.

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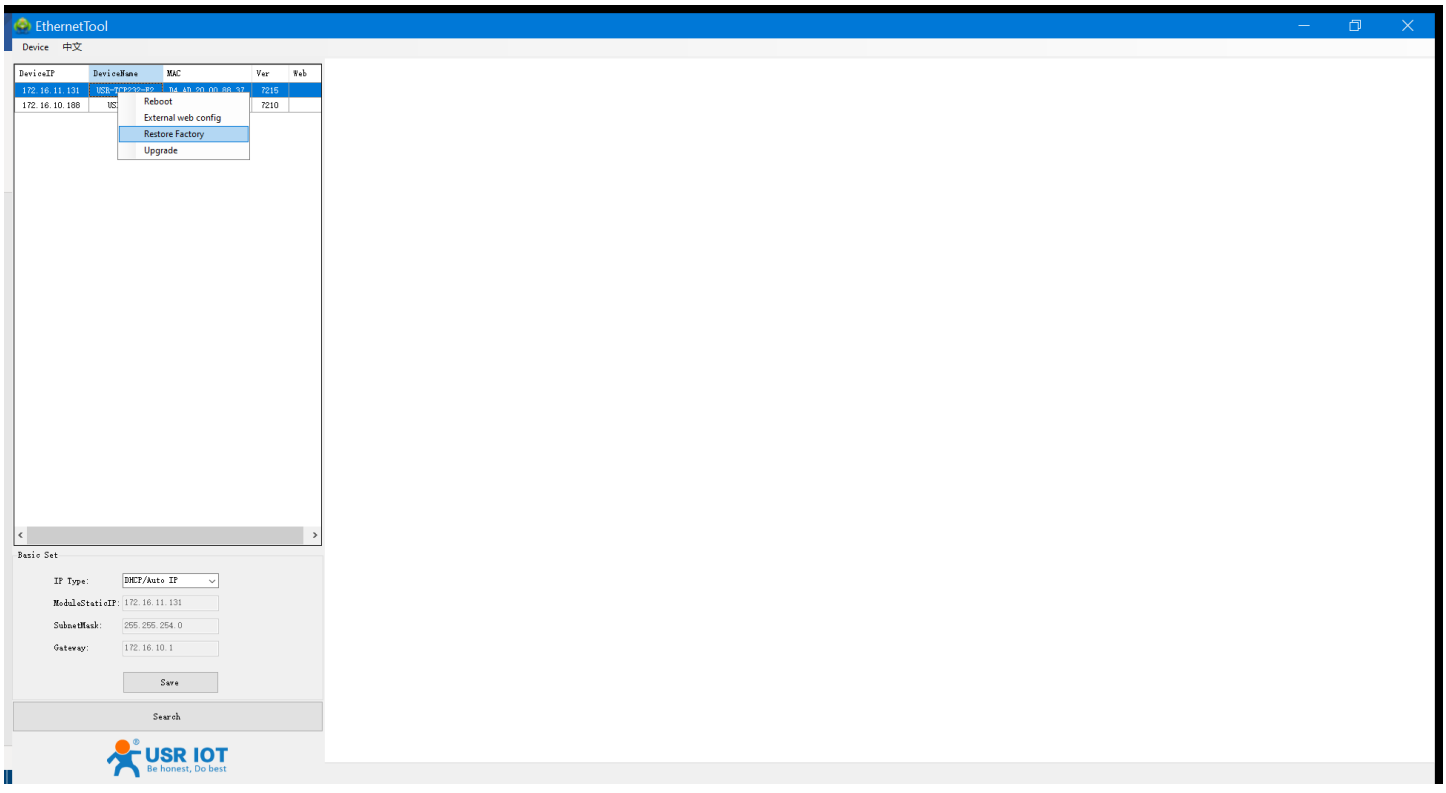


Fig. 33 **Restore factory defaults**

3.3.5. Open web server

Users can visit the web server of serial device server conveniently with configuration tool. Select the device you want to visit and right click,then click External web config ,you will open the web server with default browser such as Google Chrome.

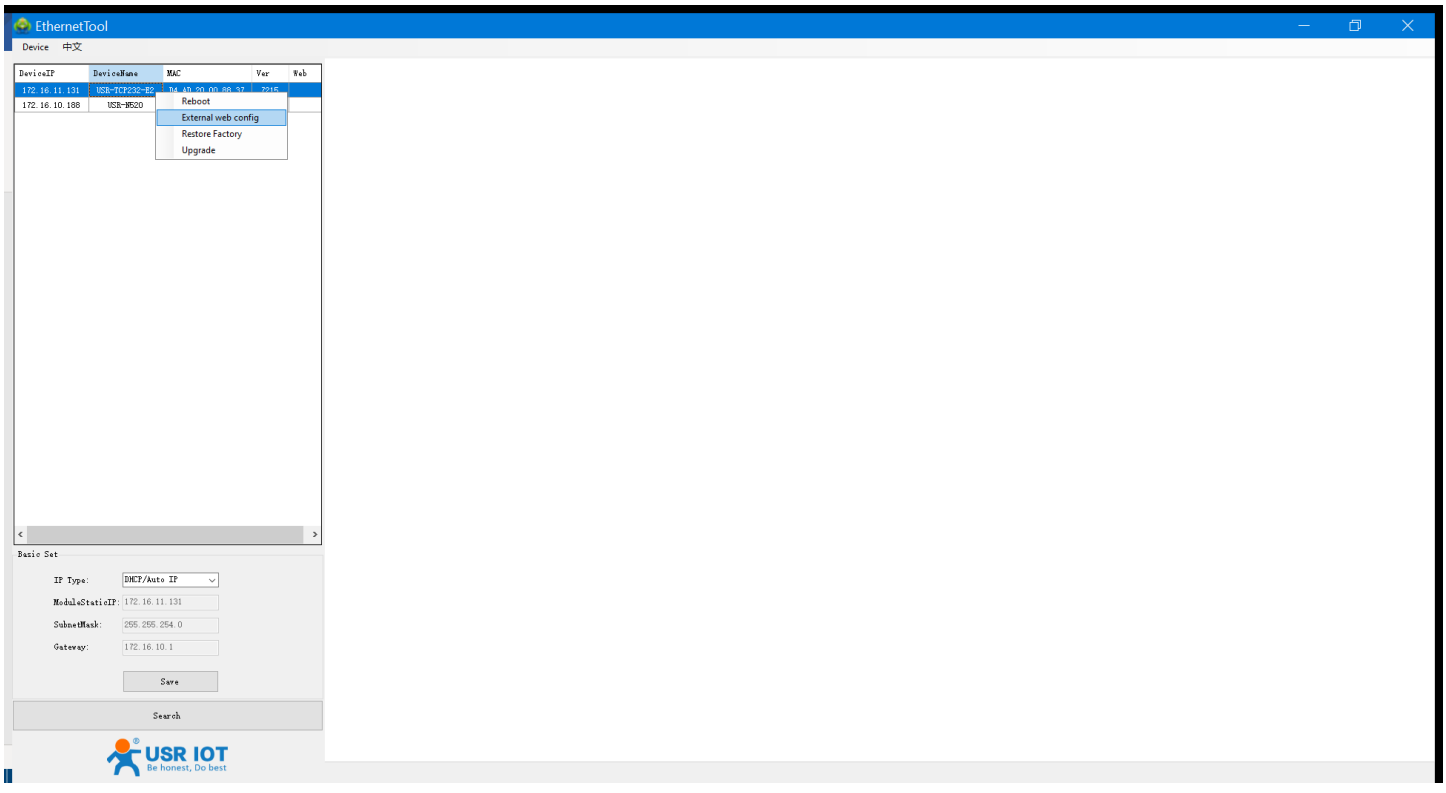


Fig. 34 **Open webpage in browser**

3.4. AT command

In order to reduce the length of this document, we have organized this section into a special document. Please refer to "USR Cortex M7

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series serial to Ethernet device server AT command manual" for detail.

4. Operation modes

The USR-TCP-E2 provides various operations: TCP Server/ Client mode, UDP mode, HTTP mode and Websocket mode. The main difference between the TCP and UDP protocols is that TCP guarantees delivery of data by requiring the recipient to send an acknowledgement to the sender. UDP does not require this type of verification, making it possible to offer speedier delivery. UDP also allows unicast or multicast of data to only one IP or groups of IP addresses. Detailed descriptions of each operation are provided in following sections. After choosing the proper operation mode in this chapter, refer to Chapter 3 for detailed configuration parameter definitions. Because the V2 firmware contains all the function of V1 firmware, we describe the configuration in V2 firmware as illustration in this chapter, users of V1 version can refer to it for reference.

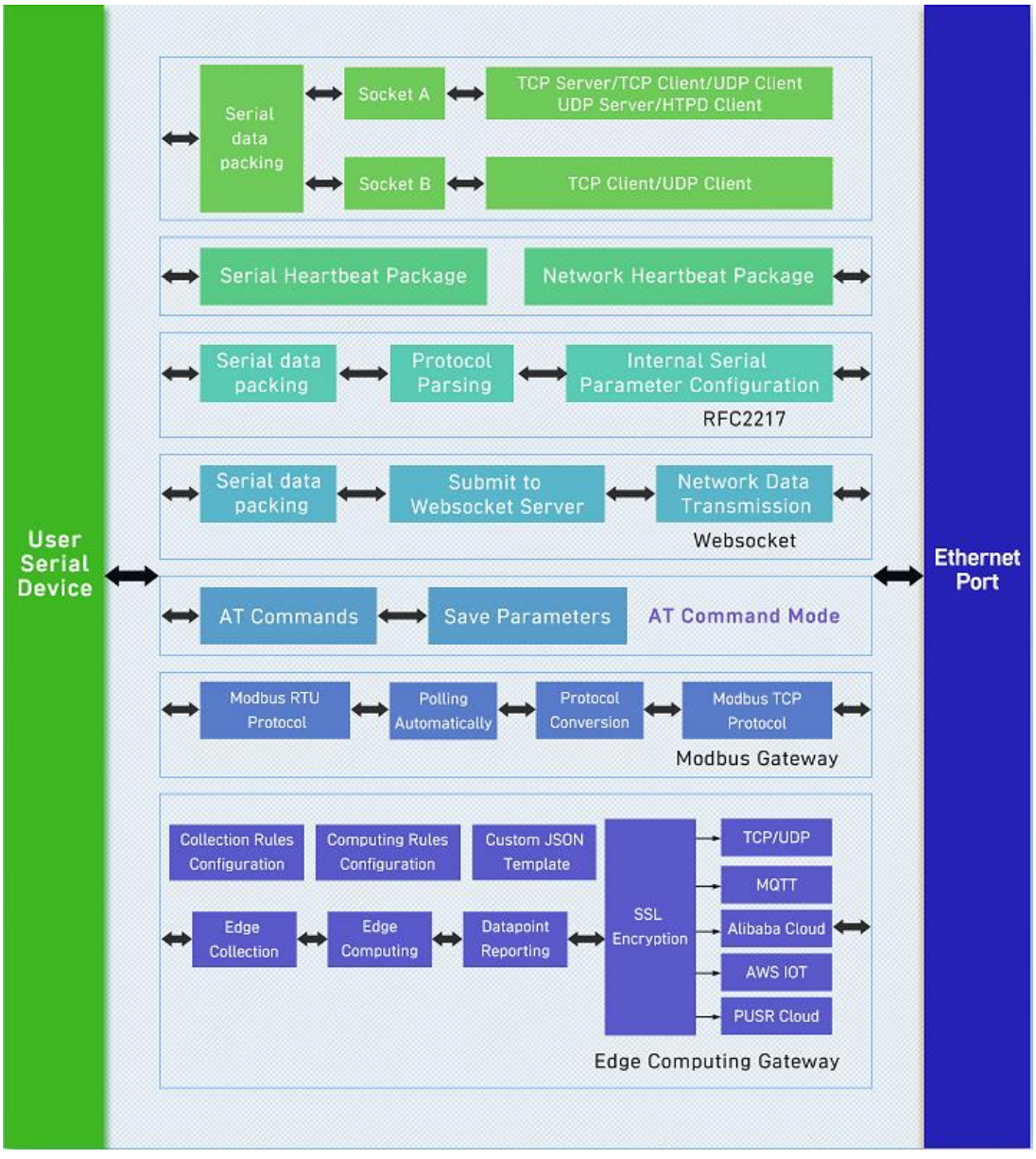


Fig. 35 **Block diagram**

4.1. TCP Server

4.1.1. Properties

In TCP server mode, the TCP connection is initiated from the host to the USR-TCP232-E2 module. This operation mode supports a maximum of 16 simultaneous connections for each serial port on an device server from a single or multiple hosts. After the connection is established between the serial module and the remote host computer (remote TCP client) , data can be transmitted in both directions. The

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COM port on the device will forward requests from all remote connected hosts(Ethernet) to the serial device immediately and reply to all remote connected hosts once it receives data from the serial device.

The default operation mode of USR-TCP232-E2 is the TCP Server mode. Fig.46 shows an example of configuration setting for TCP Server working mode under the Port1 socket tab. You can configure other serial ports in the same way. There are additional connection settings that can be configured as shown in Fig.46.

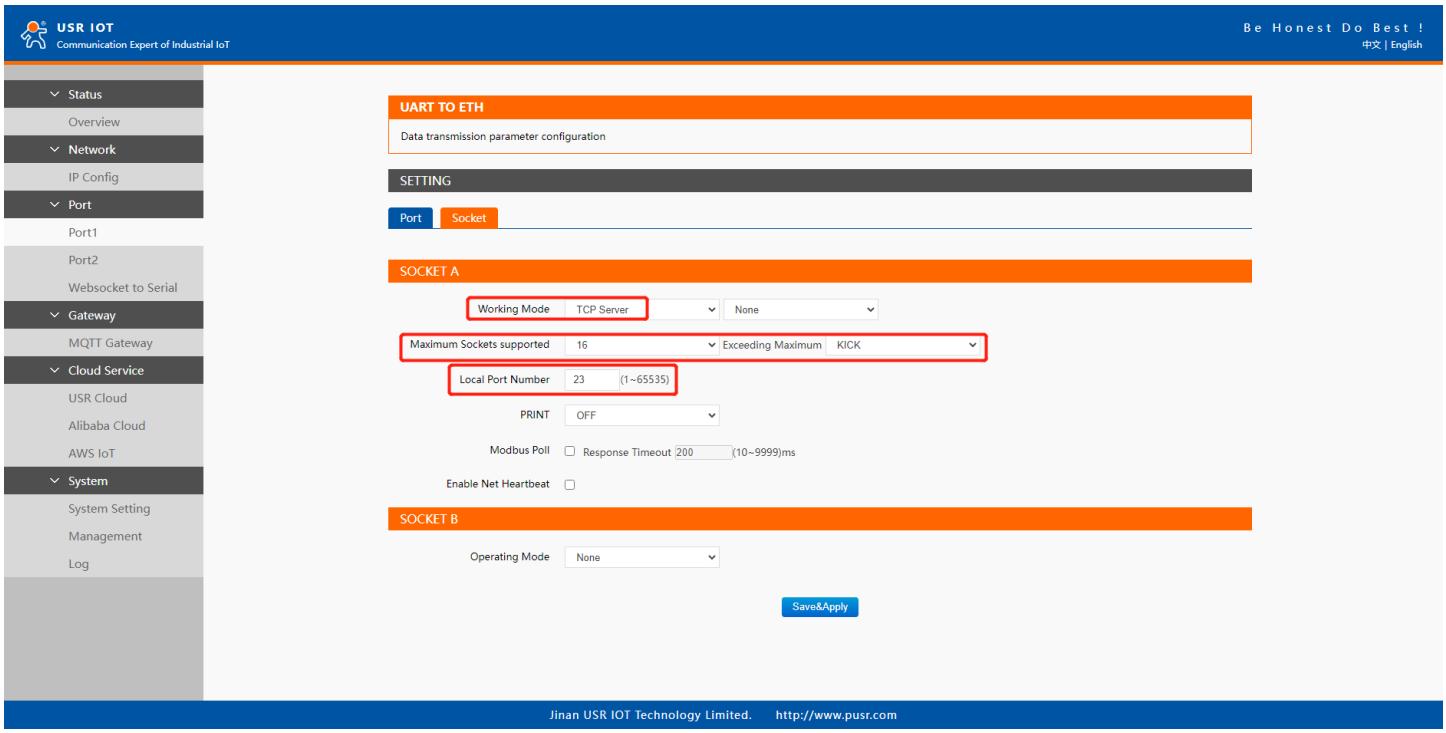


Fig. 36 **TCP server work mode**

Please follow the following steps to configure connection settings of the work mode for PORT1 port.

1. Click on the "Port1" tab on the menu frame on the left side of Web UI to go to Port1 page as shown in Fig.46.
2. For Serial Settings on the Port configuration page, please go to Section 3.2.3.
3. Click on the Socket tab in this page, select TCP Server in the working mode options. The local ports of different serial ports must be different. After receiving network data, the device determines which serial port the data is sent to based on the local port. For example, the default port number of the first serial port (Port1) is 23, the default port number of the second serial port (PORT2) is 26, and so on.
4. After finishing configuring the working Mode, please scroll down to the bottom of the page and click on "Save & Apply" button to save all the changes that you have made. All configurations take effect after a system reboot.

Fig.47 shows an example of test in this mode. By selecting the TCP Server work mode, a TCP client program on a remote host computer should be prepared to connect to USR-TCP232-E2. Server IP is IP address of USR-TCP232-E2, server port is local port of USR-TCP232-E2. In this case, IP address of USR-TCP232-E2 is 172.16.12.131.

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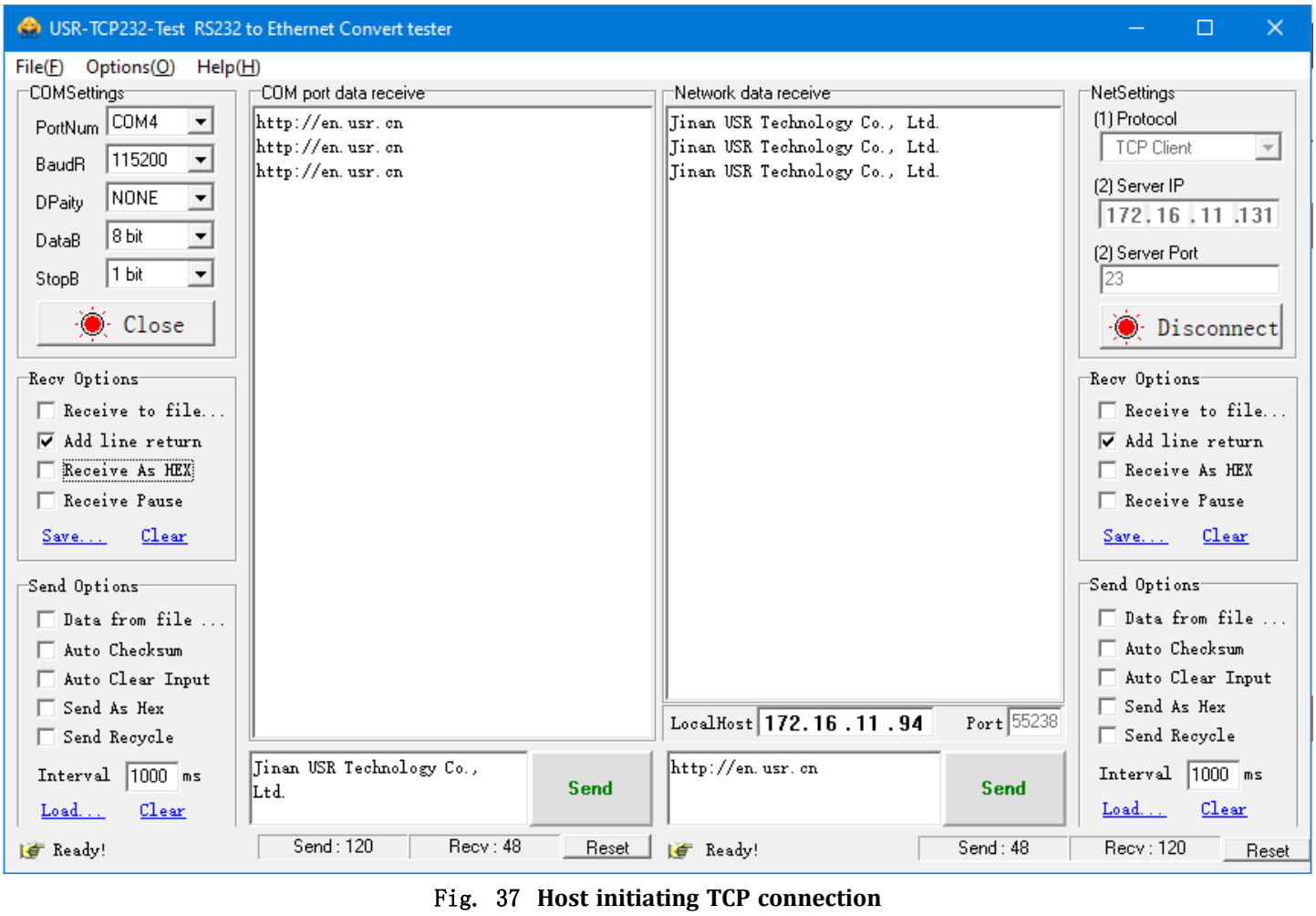


Fig. 37 **Host initiating TCP connection**

4.1.2. Multihost setting

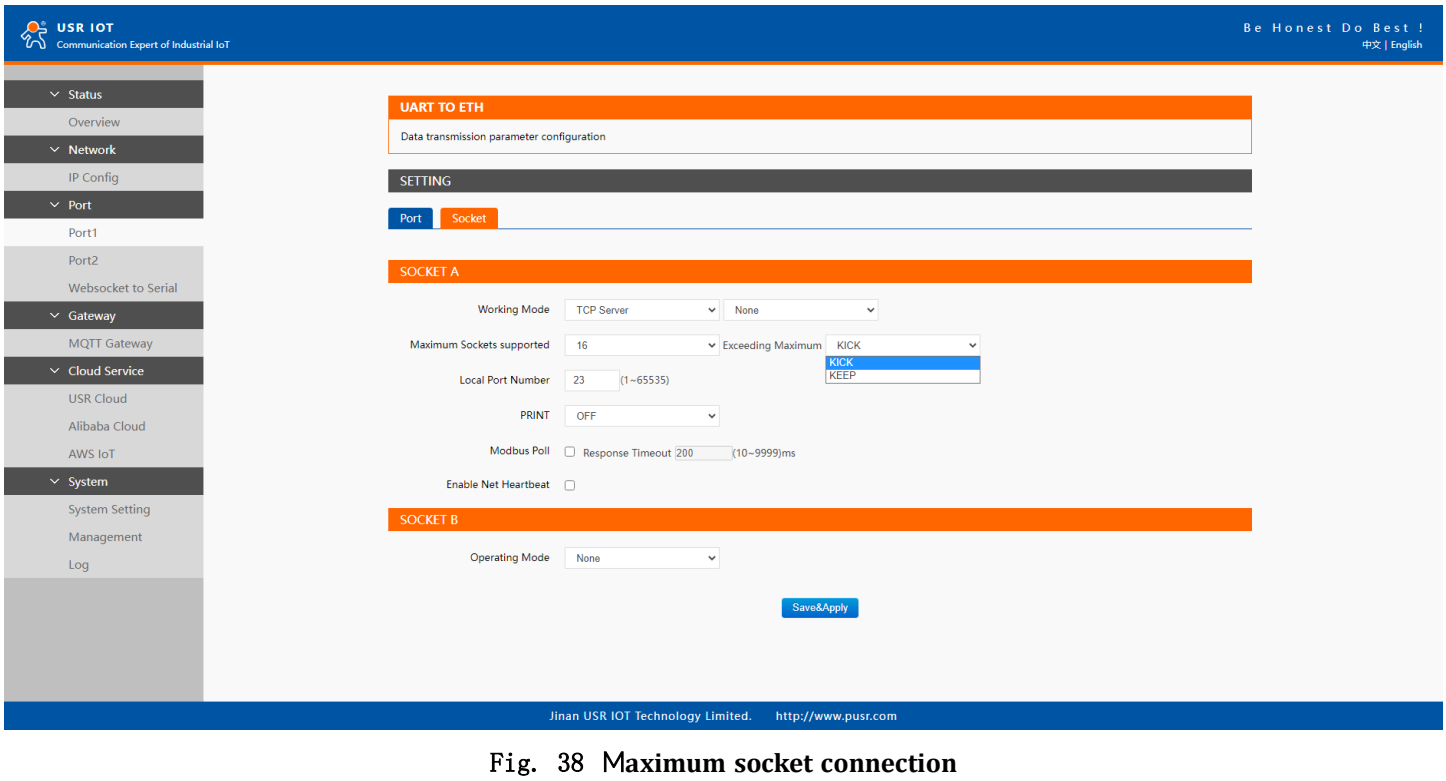


Fig. 38 **Maximum socket connection**

Maximum connection is usually used when the user needs to receive data from different hosts simultaneously. The factory default allows 8 connections at a time. This option specifies the maximum number of remote devices/clients (with maximum of 16 clients) that can be

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connected to the serial device on this COM port. And users can define the behavior when the connection established exceed the maximum.

Kick: when the connection exceeds the maximum number, actively kick out the oldest connection(first in first kick out).

Keep: when the connection exceeds the maximum number, keep the old connection and reject new connections.

4.2. TCP Client

4.2.1. Properties

When the working mode of this device is TCP Client, the remote device must work in TCP Server mode, and its IP address and port number must be configured, which can be configured in the corresponding options of the network connection. The local port number can be ignored and no configuration is required. USR-TCP232-E2 supports SSL (TLS v1.0 or v1.2) data encryption in this operating mode.

Fig.49 shows an example of configuration setting for TCP Client working mode under the Port1 socket page. You can configure other serial ports in the same way. There are additional connection settings that can be configured as shown in Fig.49.

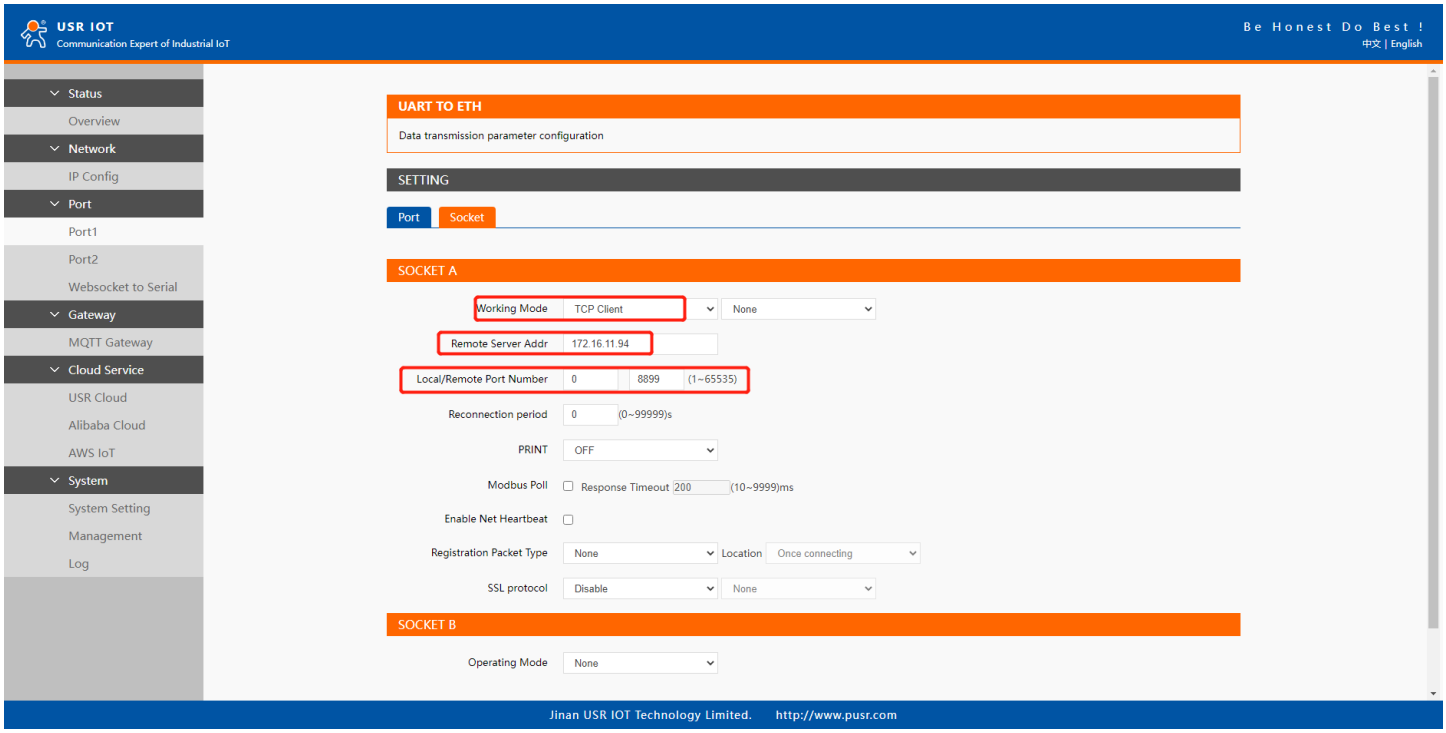


Fig. 39 TCP client work mode

Please follow the following steps to configure connection settings of the work mode for PORT1 port.

1. Click on the “Port1” tab on the menu frame on the left side of Web UI to go to Port1 page as shown in Fig.49.
2. For Serial Settings on the Port configuration page, please go to Section 3.2.3.
3. Click on the Socket tab in this page, select TCP Client in the working mode options. Please specify the Destination IP address and port number of the TCP server program on the remote host. This should match the IP settings of the TCP server program. The default local port number is 0, E2 will assign a random TCP Port.
4. After finishing configuring the working Mode, please scroll down to the bottom of the page and click on "Save & Apply" button to save all the changes that you have made. All configurations take effect after a system reboot.

Fig.50 shows an example of test in this mode. By selecting the TCP Client operation mode, a TCP server program on a remote host computer should be prepared to accept a connection request from the device. In this case,Host IP address is 172.16.14.15.

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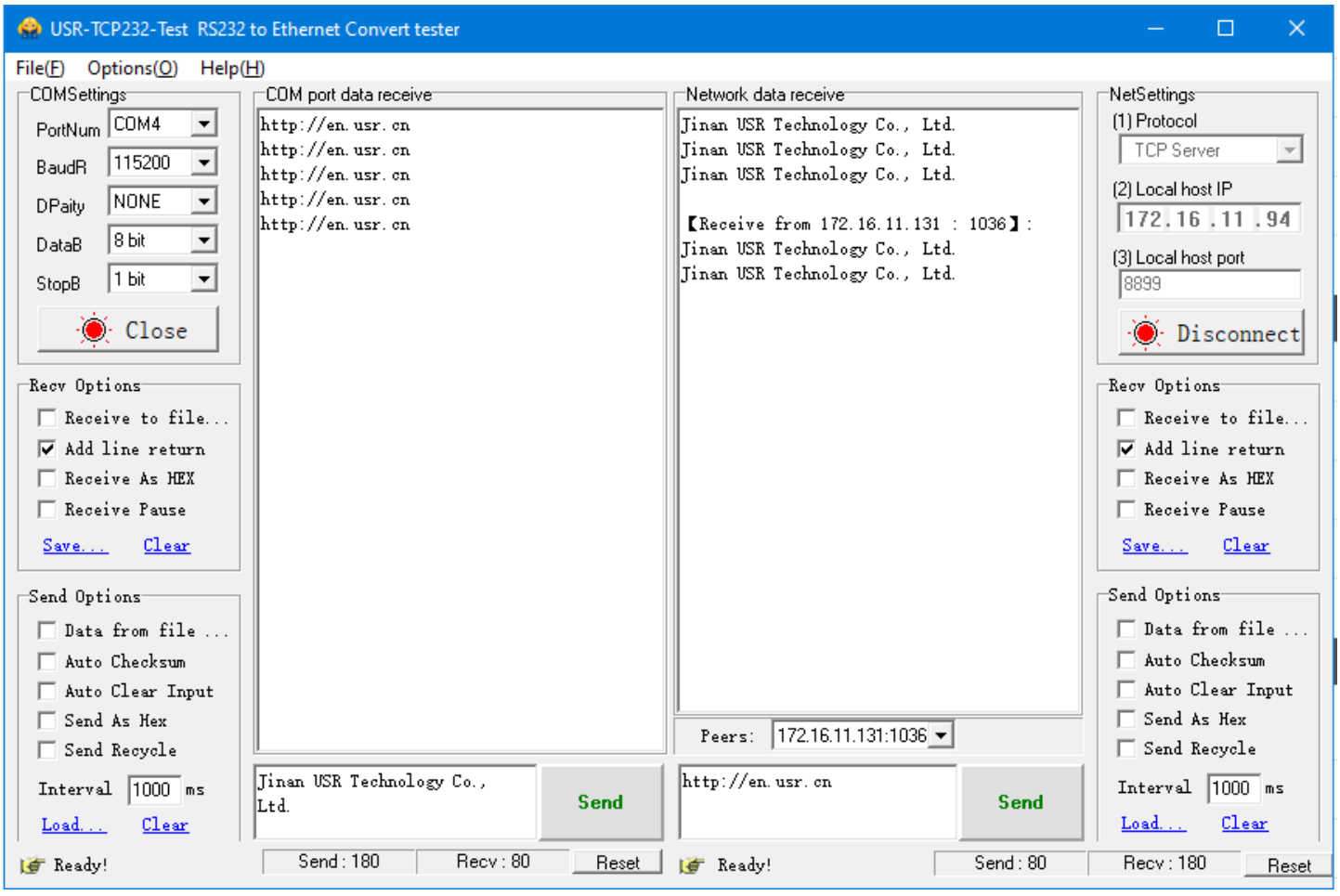


Fig. 40 E2 initiating TCP connection

4.2.2. SSL/TLS

If SSL certificate authentication is enabled on the remote server, user need to configure SSL encryption parameters on E2. User can select TLS1.0 or TLS1.2 version protocol. User can select None certificate Authentication, server certificate authentication and bidirectional certificate authentication.

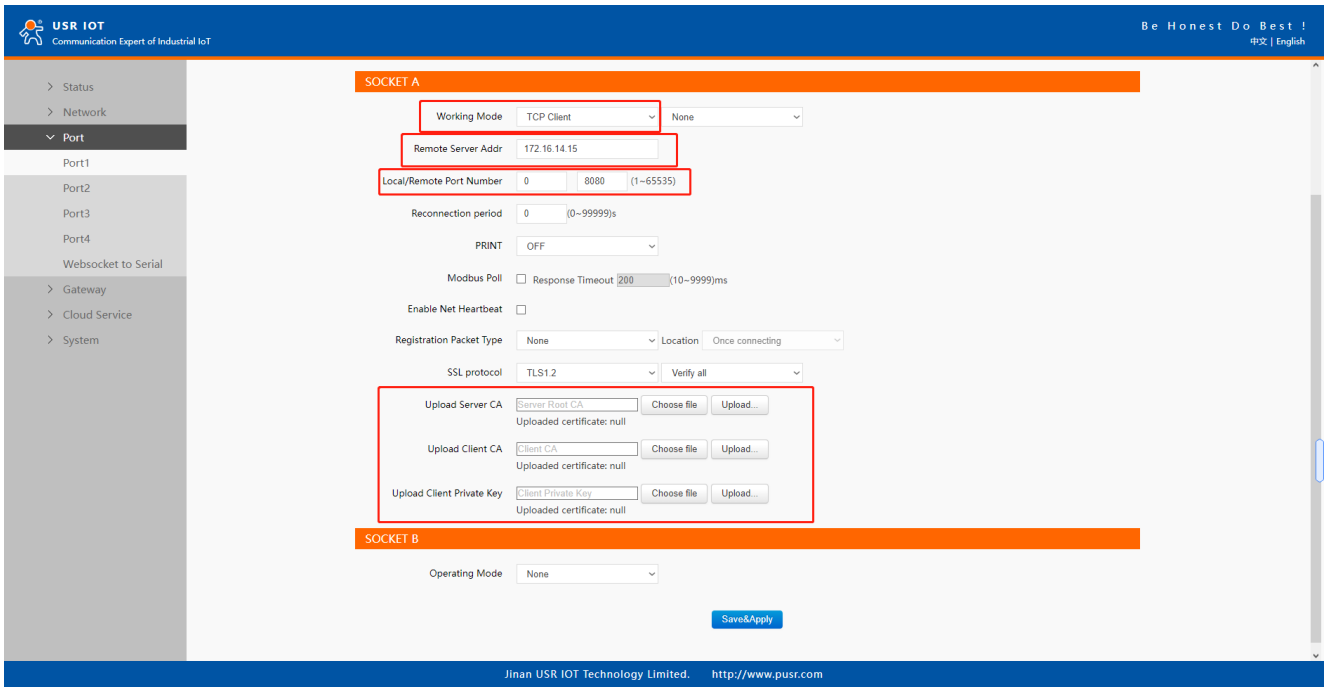


Fig. 41 SSL/TLS encryption

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4.2.3. Transient connection

This connection, called transitory due to its short-lived nature. If the serial port or network port receives none data within the setting time, the connection will be automatically disconnected. The E2 module used to send serial device data back to a control room or a cloud application need to open a remote connection before they can transfer the serial data. If a large number of serial devices are connected to the same network, the connection will require many resources in the control room or cloud application. To handle these large numbers of remote connections properly, serial device servers should support flexible connection control. The best way to do this is to open a connection only when serial data is received from a device. When the transmission is completed, the serial device server should immediately close the connection. Without support for flexible connection control, you would need to spend extra time handling connections at the central site or cloud application.

TCP transient connection is used primarily to save server resources. Fig.52 shows an example of configuration setting for transient connection in TCP Client working mode under the socket page.

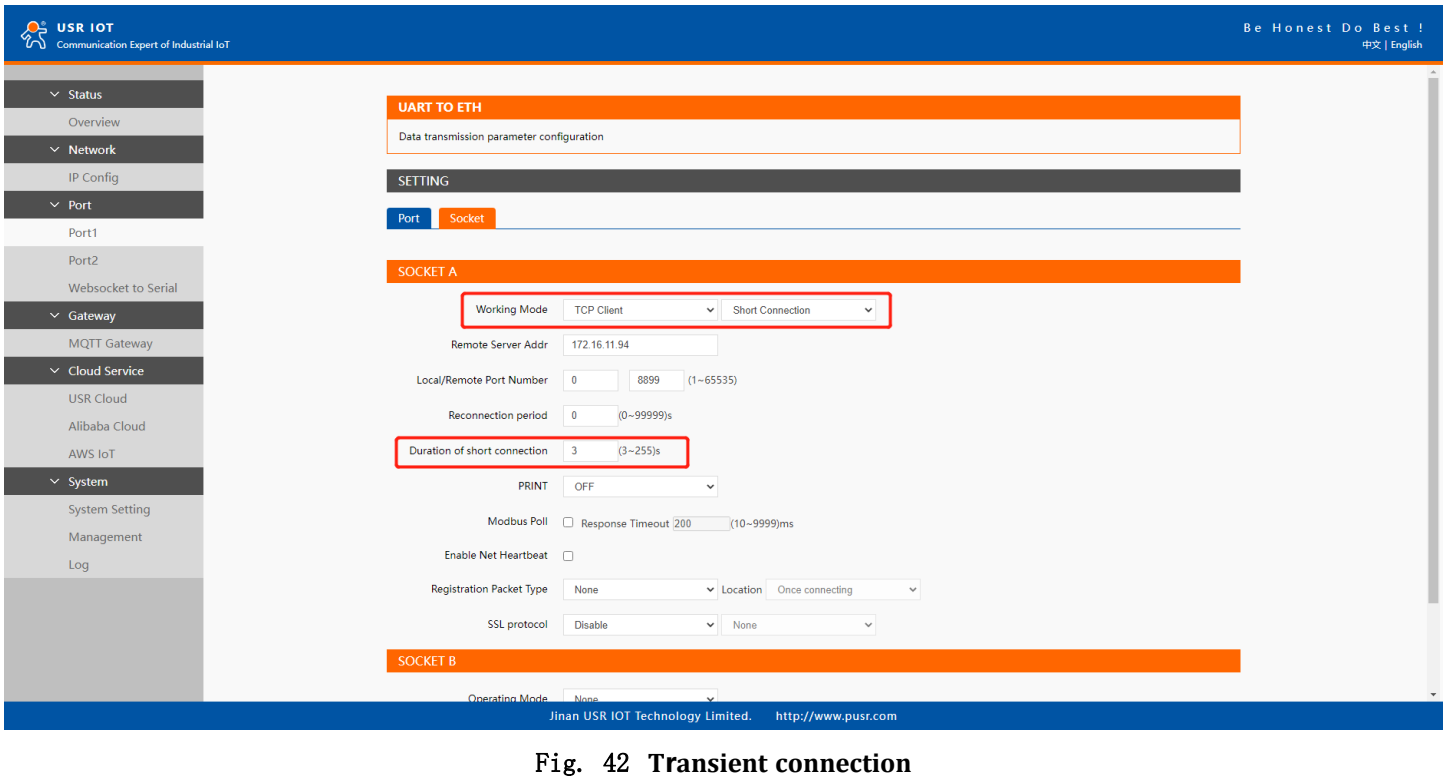


Fig. 42 **Transient connection**

4.3. UDP Server

4.3.1. Properties

User Datagram Protocol (UDP) is a faster and more efficient transport protocol than TCP but it is a connectionless transport protocol, it does not guarantee the delivery of network datagram. In UDP mode, you can unicast or multicast data from the serial device to one or multiple host computers, and the serial device can also receive data from one or multiple host computers. Please beware that even though UDP provides better efficiency in terms of response time and resource usage, it does not guarantee data delivery. It is recommended to utilize UDP only with cyclic polling protocols where each request is repeated and independent, such as Modbus Protocol.

When the working mode of the device is UDP server, the remote device must also work in UDP mode. You only need to specify the Local Port that USR-TCP232-E2 should listen to. In UDP server mode, serial port data is always sent to the last peer UDP device(IP and port) that communicates with the USR-TCP232-E2, and the USR-TCP232-E2 can record the IP and port number only after the peer UDP device sends data to the USR-TCP232-E2 first.

Fig.53 shows an example of configuration setting for UDP Server mode under the Port1 socket page. You can configure other serial ports in

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the same way.

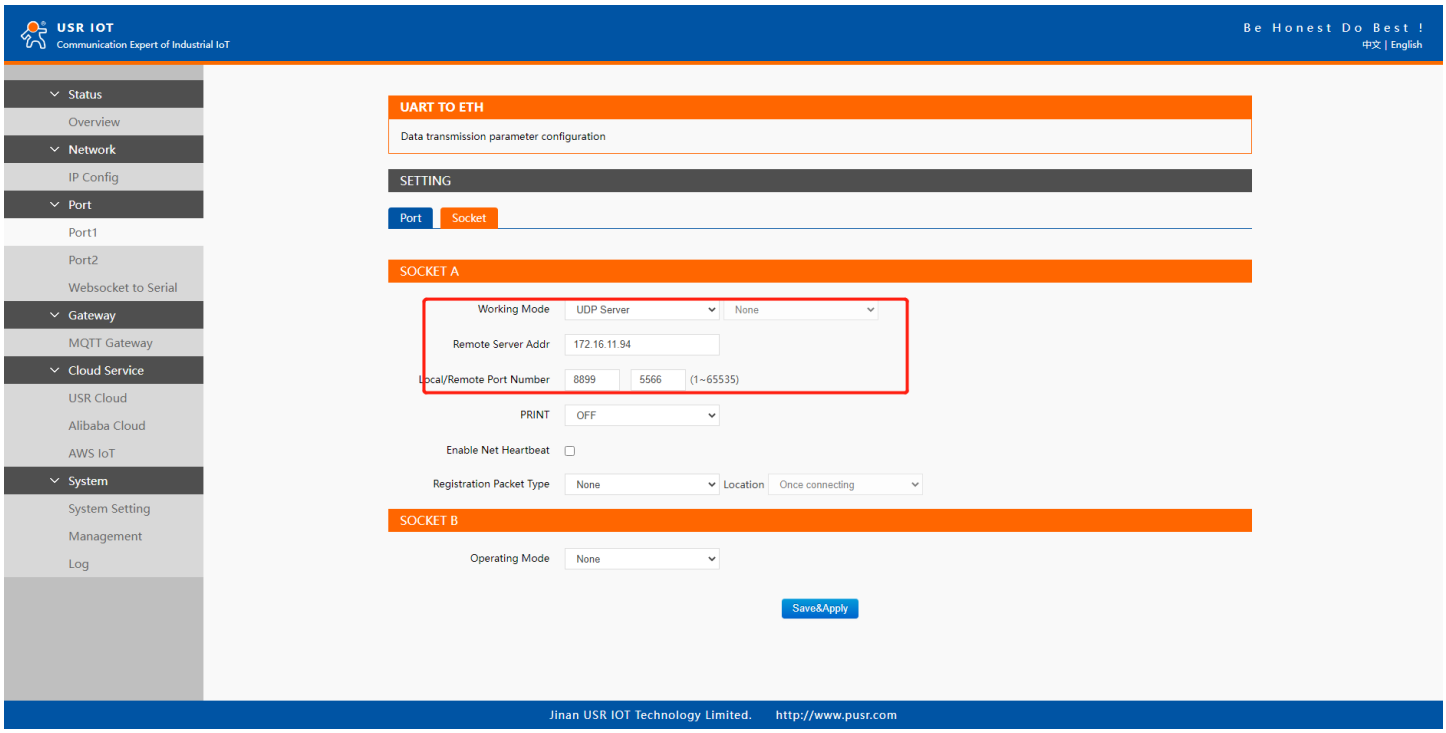


Fig. 43 **UDP server work mode**

Please follow the following steps to configure connection settings of the operation mode for PORT1 port.

1. Click on the “Port1” tab on the menu frame on the left side of Web UI to go to Port1 page as shown in Fig.53.
2. For Serial Settings on the Port configuration page, please go to Section 3.2.3.
3. Click on the Socket tab in this page, select UDP Server in the working mode options.
4. Local Port specifies the local port number for UDP server mode on E2 which it will be listening to and it can be any number between 1 and 65535. The local ports of different serial ports must be different. After receiving network data, the device determines which serial port the data is sent to based on the local port.
5. After finishing configuring the working Mode, please scroll down to the bottom of the page and click on "Save & Apply" button to save all the changes that you have made. All configurations take effect after a system reboot.

Serial port data is firstly sent to the preset destination IP/domain name and Destination port. After receiving a UDP packet, the system updates the destination IP address and port number, and sends the data back to the latest IP address and port number. In this case, IP address of USR-TCP232-E2 is 172.16.11.131, host IP address is 172.16.11.94.

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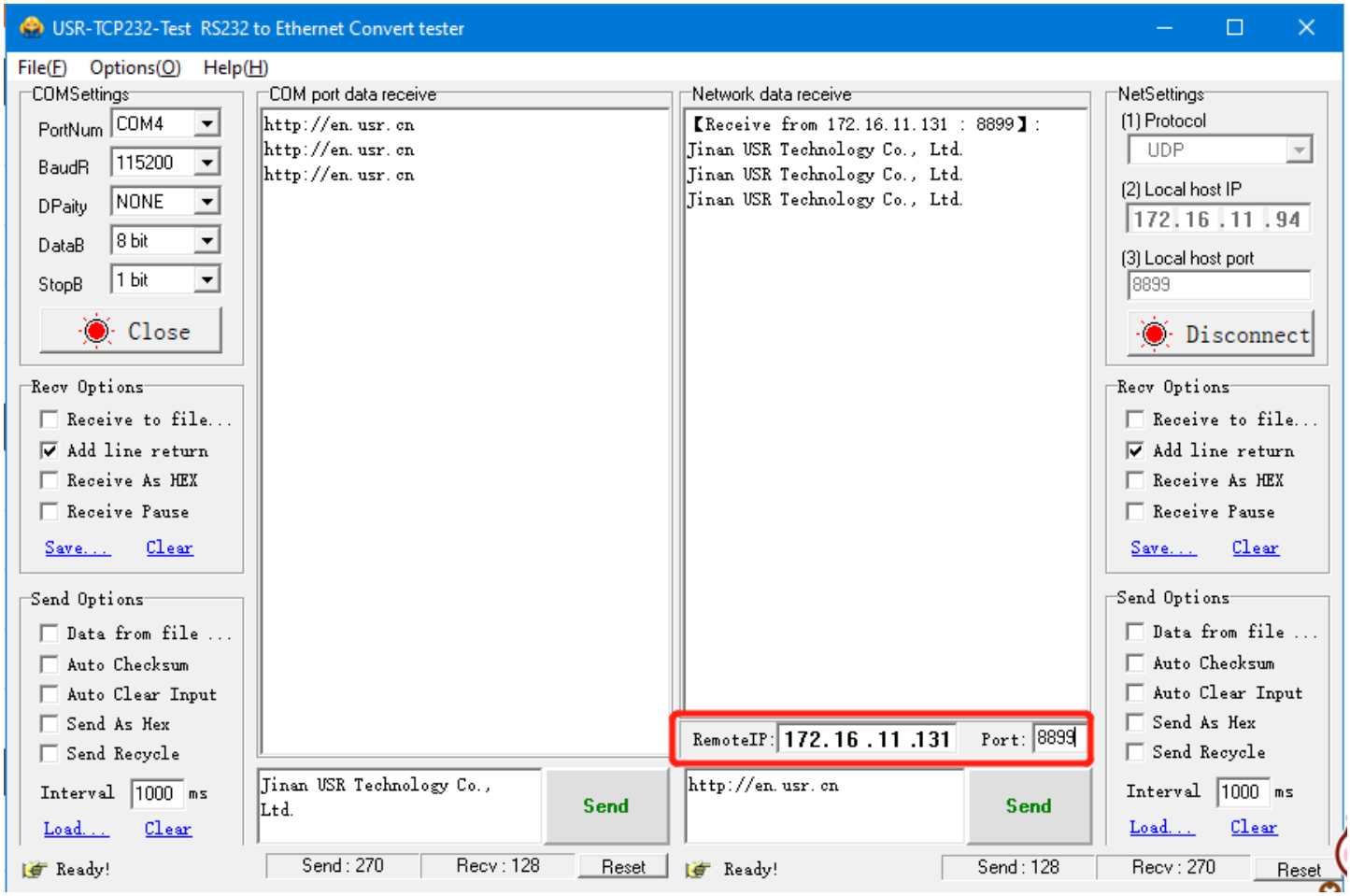


Fig. 44 **UDP transmission test**

4.4. UDP Client

4.4.1. Properties

When the working mode of the device is UDP client, the remote device must also work in UDP mode. E2 supports remote IP address and port verification. After verification is enabled(OFF), the E2 only communicates with the destination port of the destination IP address. If the data is not from this channel, the E2 will discard the data. If verification is disabled(ON), E2 does not filter the data of the destination IP address and destination port. Fig.55 shows an example of configuration setting for UDP Client mode under the Port1 socket page. You can configure other serial ports in the same way.

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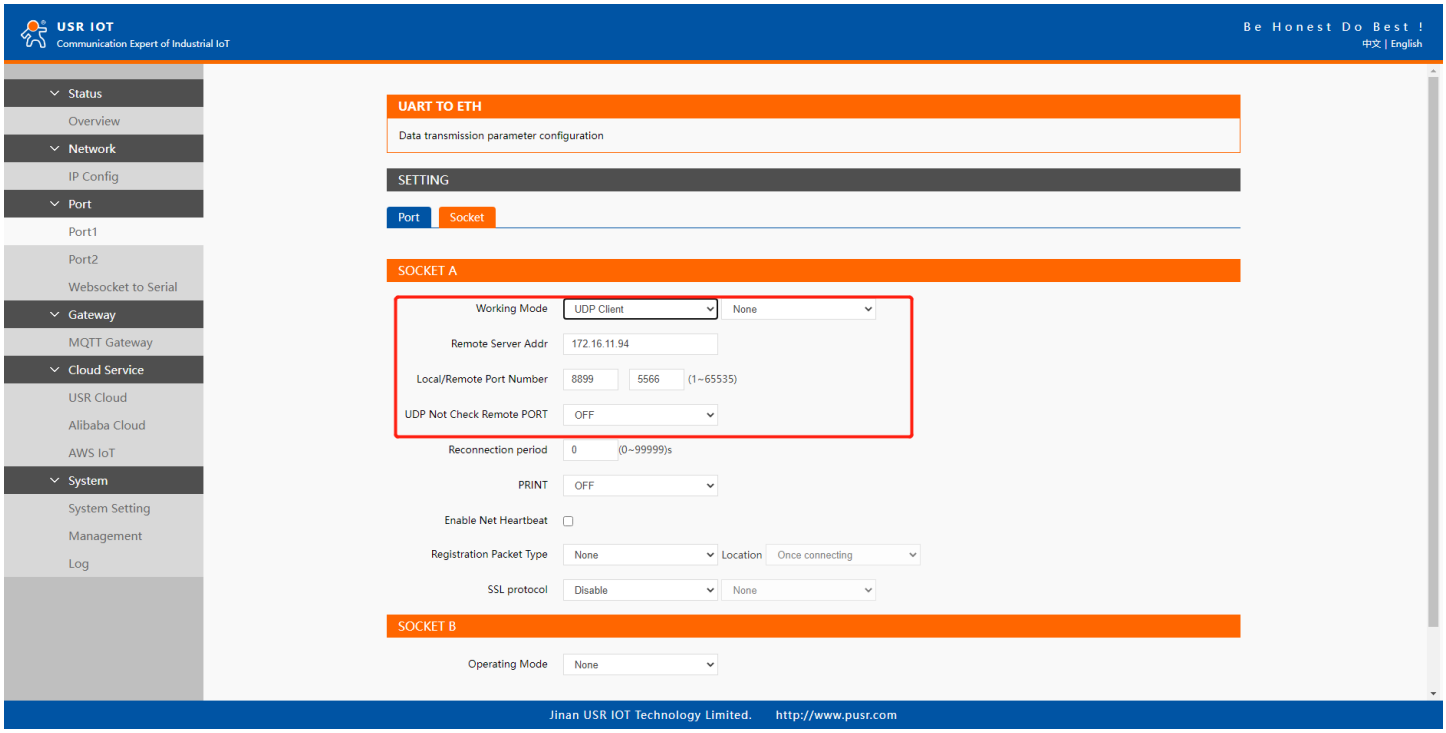


Fig. 45 UDP client work mode

Please follow the following steps to configure connection settings of the UDP client mode for PORT1 port.

1. Click on the "Port1" tab on the menu frame on the left side of Web UI to go to Port1 page as shown in Fig.55.
2. For Serial Settings on the Port configuration page, please go to Section 3.2.3.
3. Click on the Socket tab in this page, select UDP Client in the working mode options.
4. Please specify the Destination IP address and port number of the UDP program on the remote host. Local Port specifies the local port number which socket A will be listening to and it can be any number between 1 and 65535. The local ports of different serial ports must be different. After receiving network data, the device determines which serial port the data is sent to based on the local port. Note that typically the port number that is larger than 1024 is recommended to avoid conflicting with the well-known port numbers. You should match this setting with the remote UDP program. Note that this number is usually called destination port in the remote UDP program.
5. After finishing configuring the working Mode, please scroll down to the bottom of the page and click on "Save & Apply" button to save all the changes that you have made. All configurations take effect after a system reboot.

Fig.56 shows an example of test in this mode. In this case, IP address of USR-TCP232-E2 is 172.16.11.131, host IP address is 172.16.11.94.

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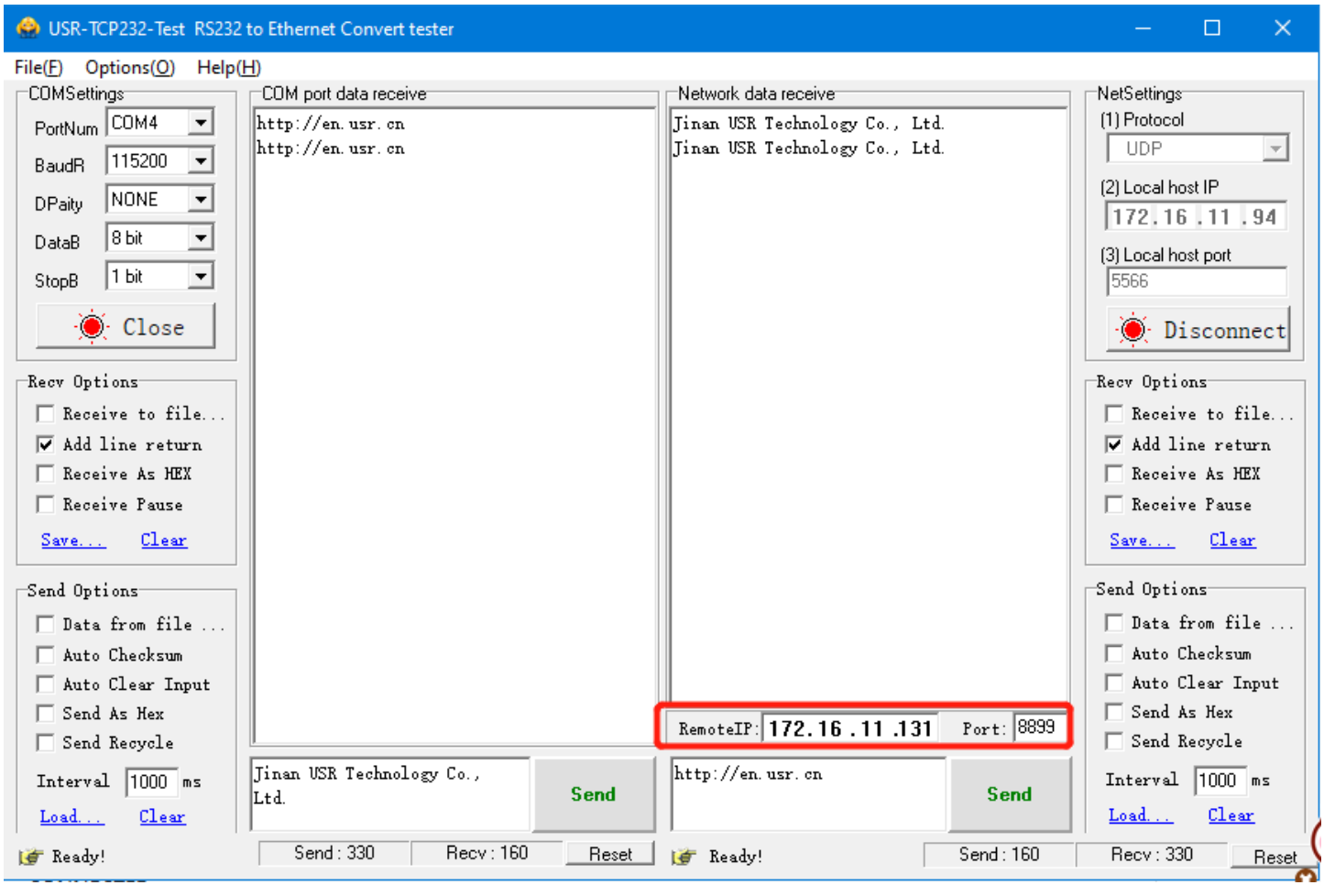
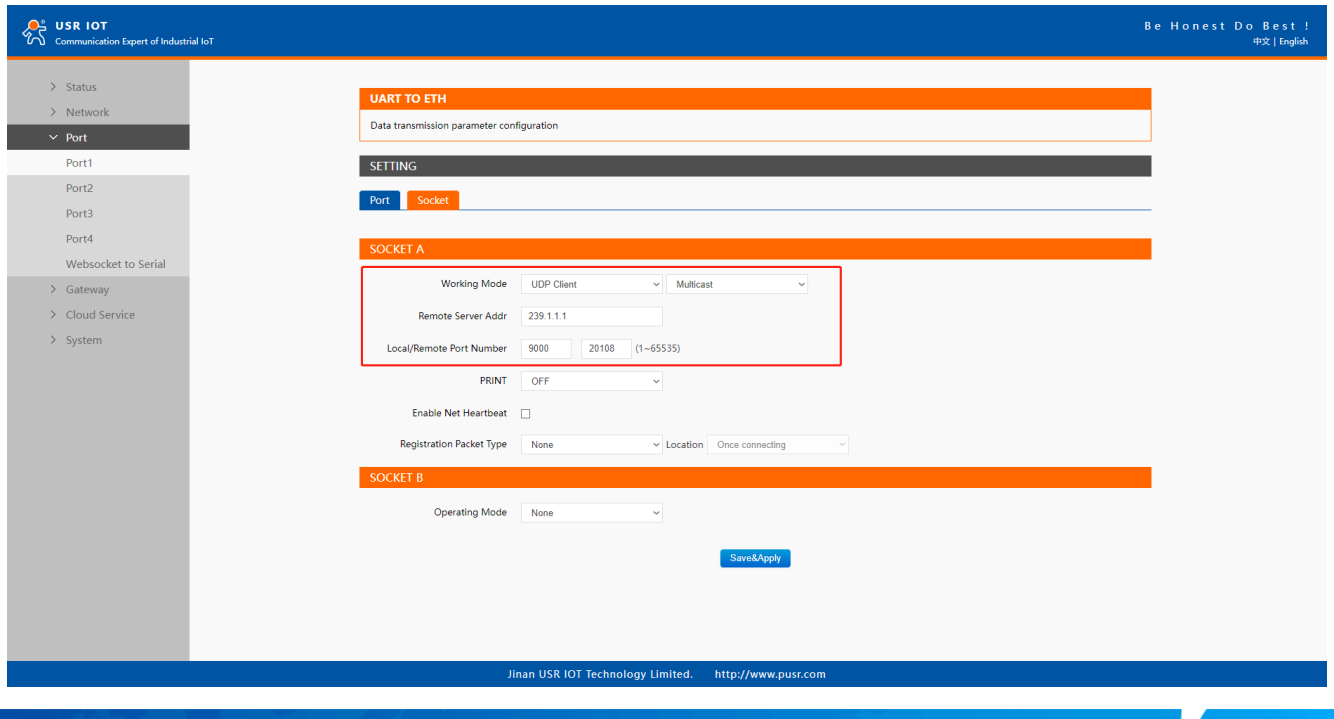


Fig. 46 **UDP client test**

4.4.2. UDP multicast

UDP also allows multicasting of data to groups of IP addresses. A multicast is a packet sent by one host to multiple hosts. In multicast mode, each host that belongs to a specific multicast group will receive multicast packets for that group. For a host to be configured as a multicast receiver over the Internet, the must inform the routers on its LAN. The Internet Group Management Protocol (IGMP) is used to communicate group membership information between hosts and routers on a LAN. The USR-E2 Series supports IGMP version 2.



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Fig. 47 USR-TCP232-E2 #1 UDP multicast setting

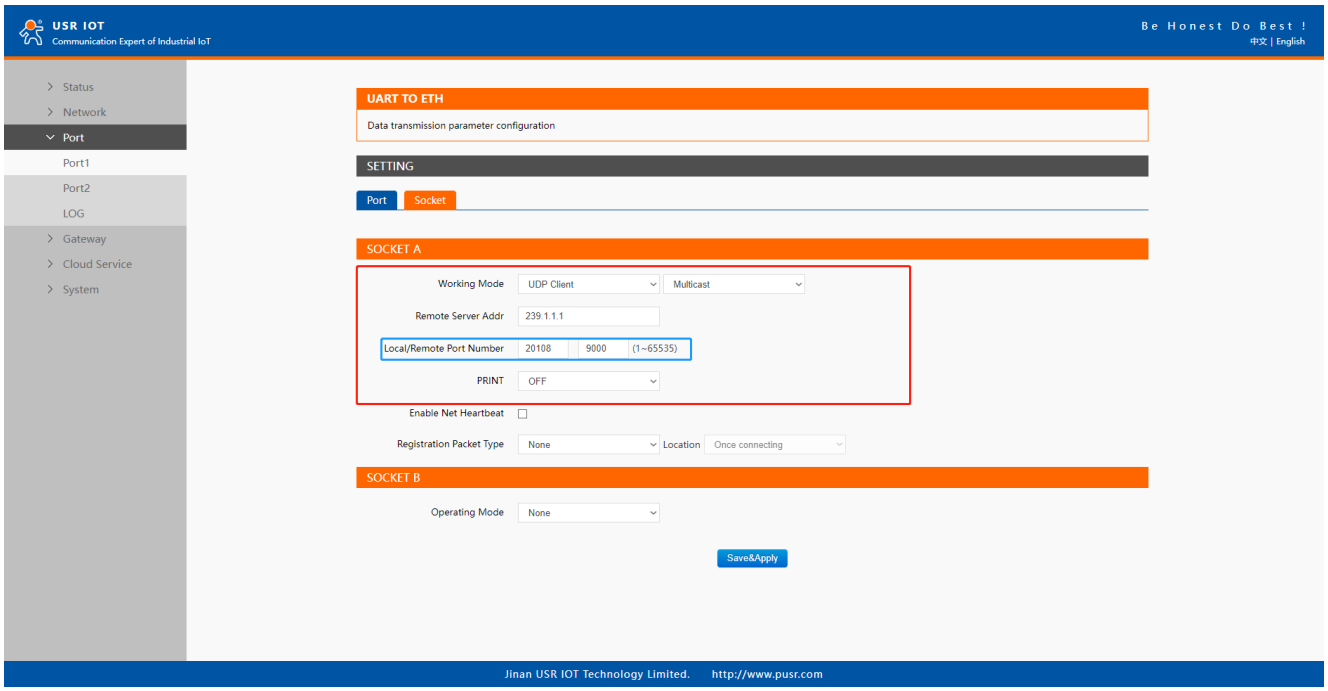


Fig. 48 USR-TCP232-E2 #2 UDP multicast setting

Fig.59 shows an example of test in this mode with two E2s.

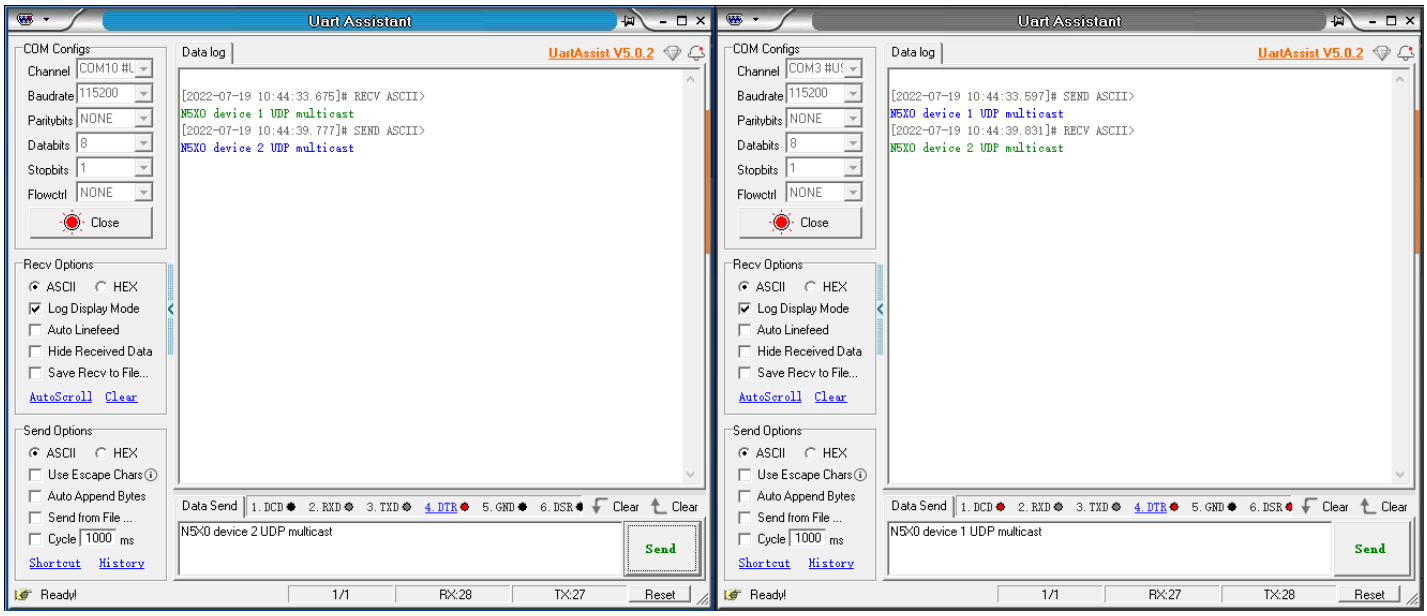


Fig. 49 UDP multicast transmission test

4.5. HTTP Client

4.5.1. Properties

When the operation mode of this device is Httpd Client, users need to specify the remote httpd server's address, port, method and other parameters. The device will submit the serially received data to the httpd server in the form of GET or POST. At the same time, the data sent by the httpd server can be transparently transmitted to the serial port.

Fig.60 shows an example of configuration setting for HTTP Client working mode under the Port1 socket page. You can configure other serial ports in the same way.

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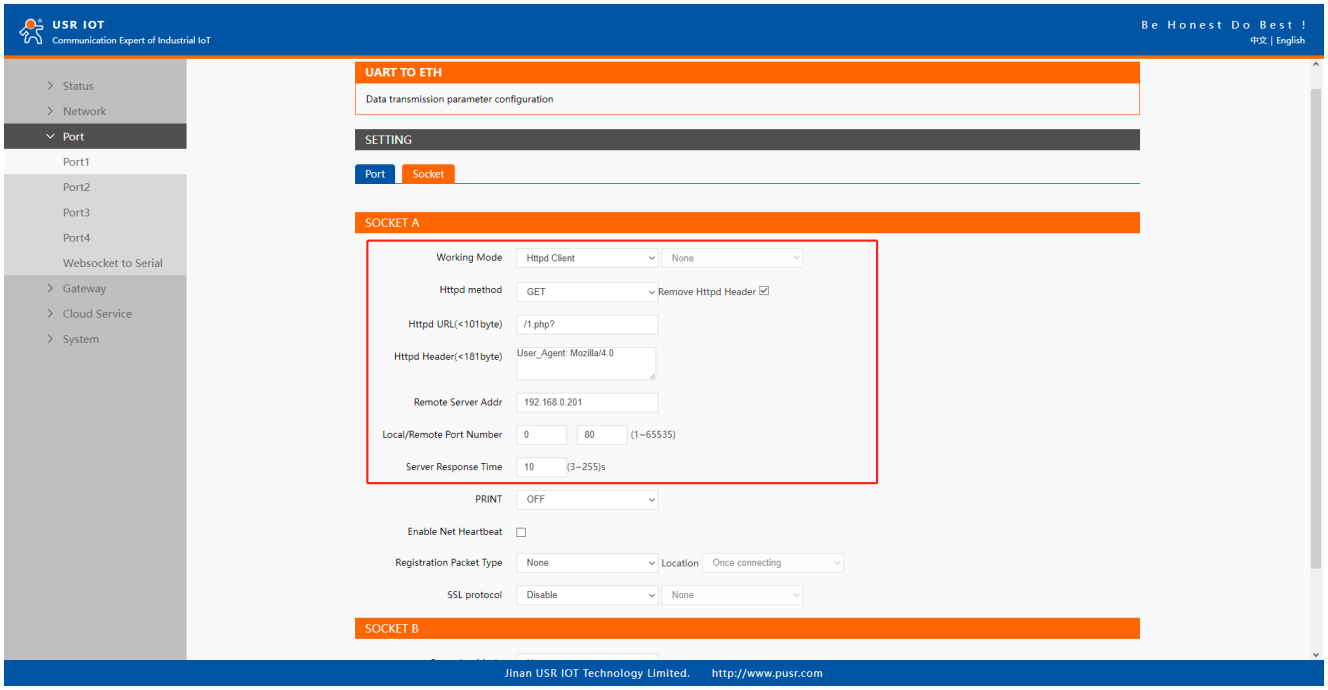


Fig. 50 **HTTP client mode**

Please follow the following steps to configure connection settings of the work mode for PORT1 port.

1. Click on the "Port1" tab on the menu frame on the left side of Web UI to go to Port1 page as shown in Fig.60.
2. For Serial Settings on the Port configuration page, please go to Section 3.2.3.
3. Click on the Socket tab in this page, select Httpd Client in the working mode options.
4. The HTTPD method needs to fill in the correct URL path, and select the GET or POST method as needed.
5. Fill in the HTTPD request header as needed.
6. Fill in the HTTPD address, that is, the address of the HTTP server, which can be an IP address or a domain name (the ability to connect to foreign countries is required).
7. Fill in the HTTPD port number. The default local port number is 0, E2 will assign a random TCP Port.
8. After finishing configuring the working Mode, please scroll down to the bottom of the page and click on "Save & Apply" button to save all the changes that you have made. All configurations take effect after a system reboot.

4.5.2. HTTPS

If SSL certificate authentication is enabled on the remote server, user need to configure SSL encryption parameters on E2. User can select TLS1.0 or TLS1.2 version protocol. User can select None certificate Authentication, server certificate authentication and bidirectional certificate authentication.

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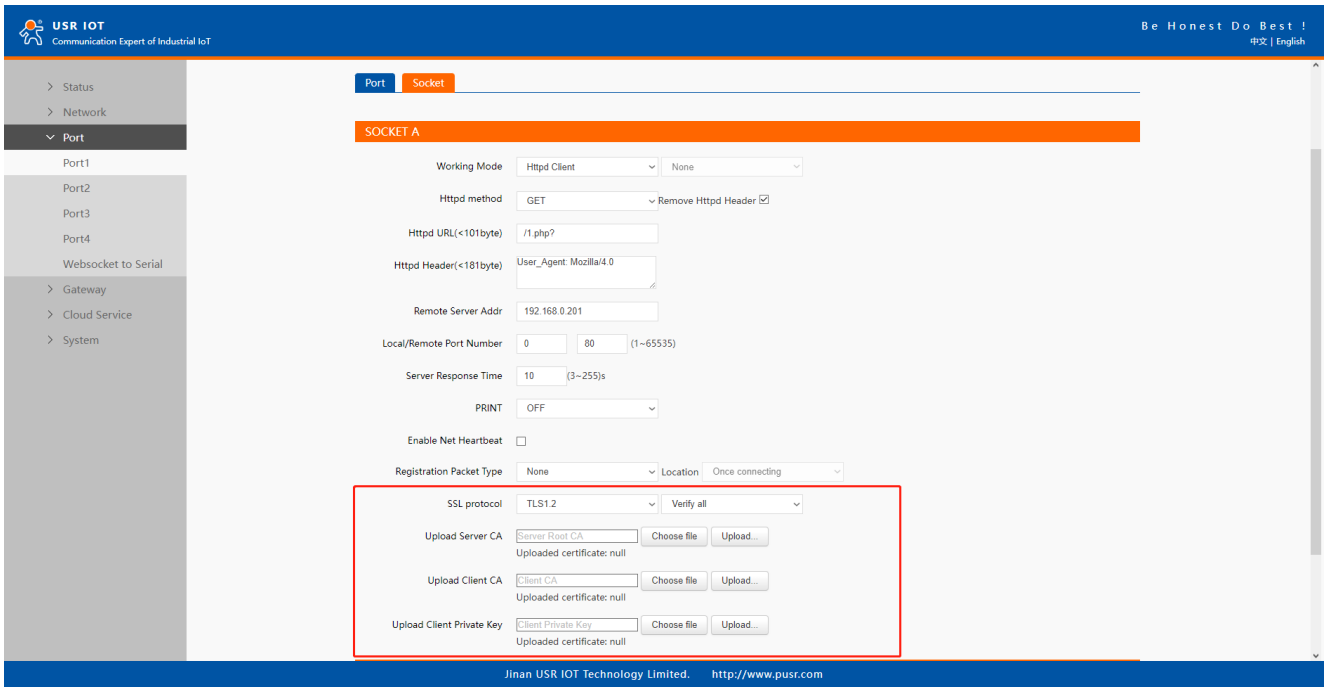


Fig. 51 **SSL/TLS encryption**

4.6. Websocket server

When the operation mode of this device is WebSocket server, the user needs to specify the main parameters such as listening port, forwarding direction. This function is that the module acts as a WebSocket server, and transparently transmits the data received by the serial to the WebSocket client in hexadecimal format. The WebSocket server can also forward data to the serial device at any time.

1. Click on the "system setting" tab on the menu frame on the left side of Web UI to go to system setting page as shown in Fig.62.
2. Fill in the WebSocket server listening port number,default 6432.
3. Select UART1 in websocket direction.
4. For Serial Settings on the Port configuration page, please go to Section 3.2.3.

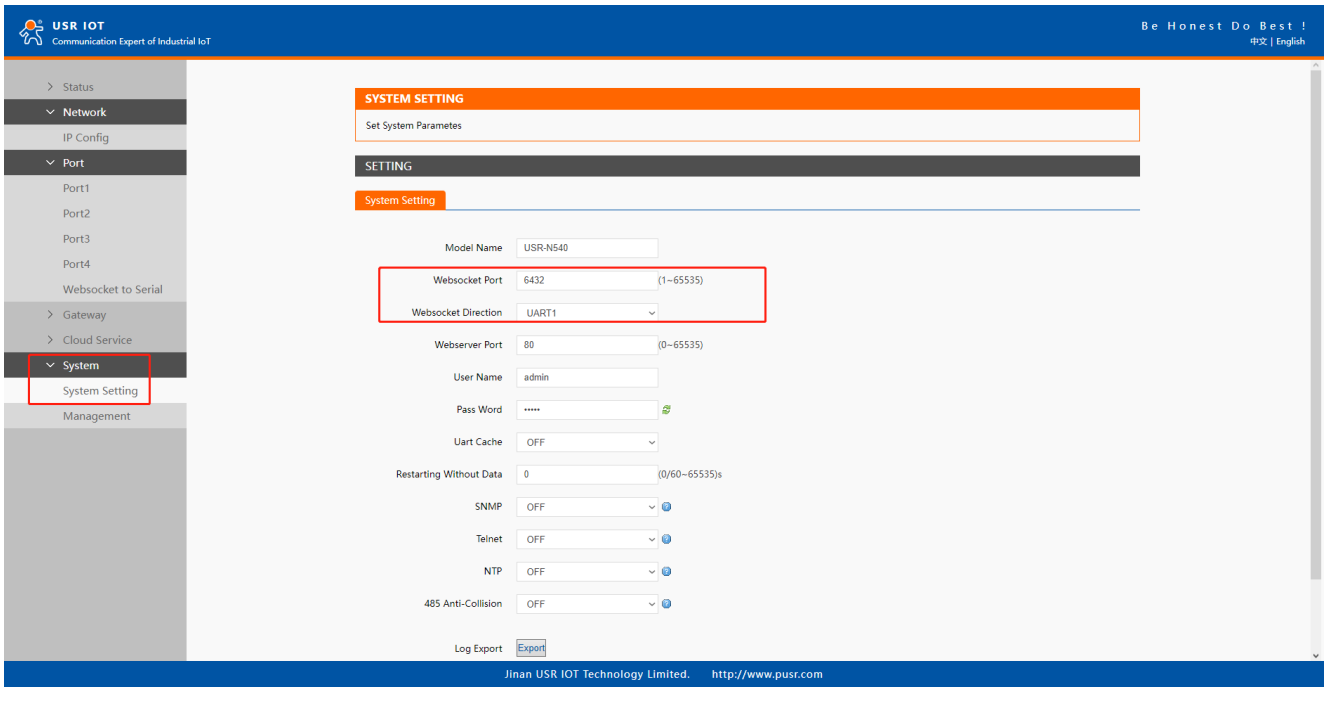


Fig. 52 **Websocket server setting**

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5. Click on the websocket to serial tab,browser will connect to the websocket server of E2 automatically.

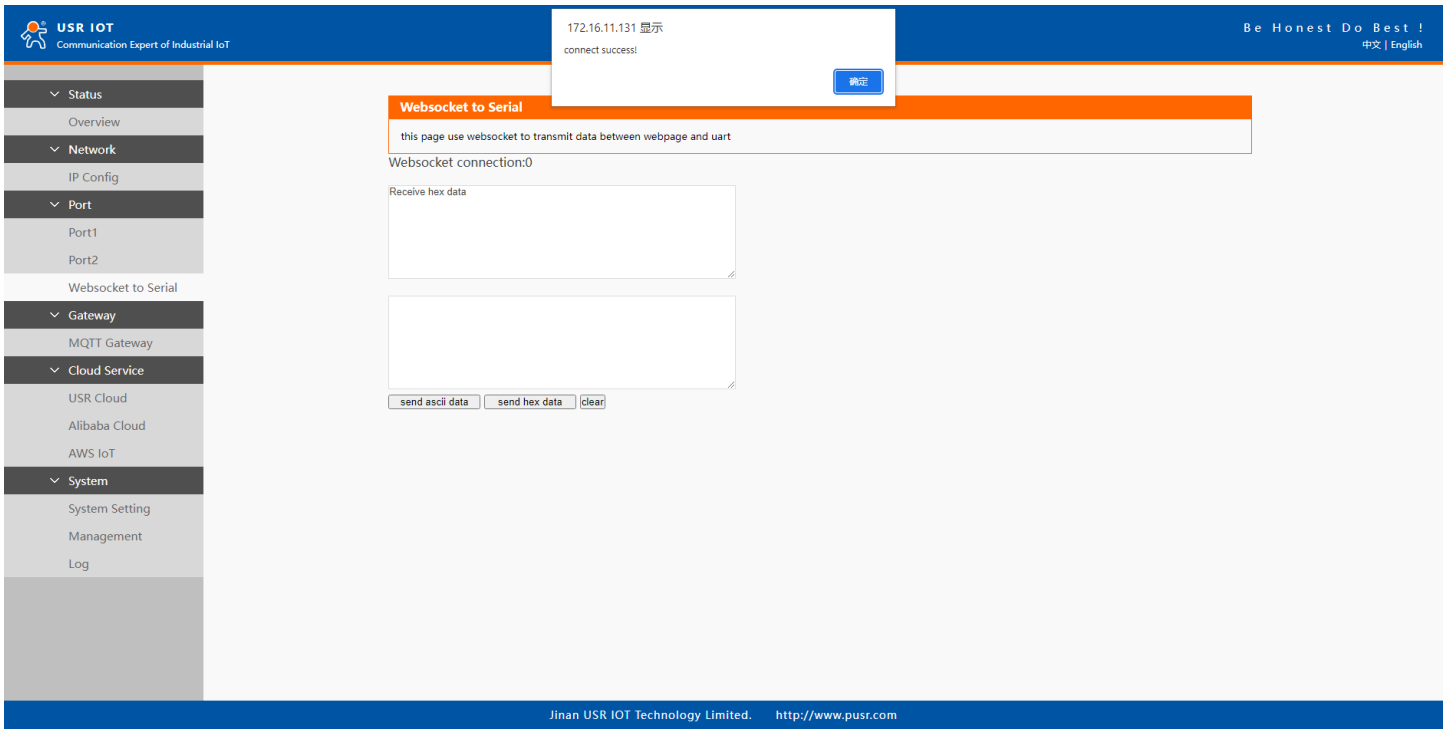


Fig. 53 **Browser as websocket client to connect E2**

Fig.64 shows an example of test in this mode.

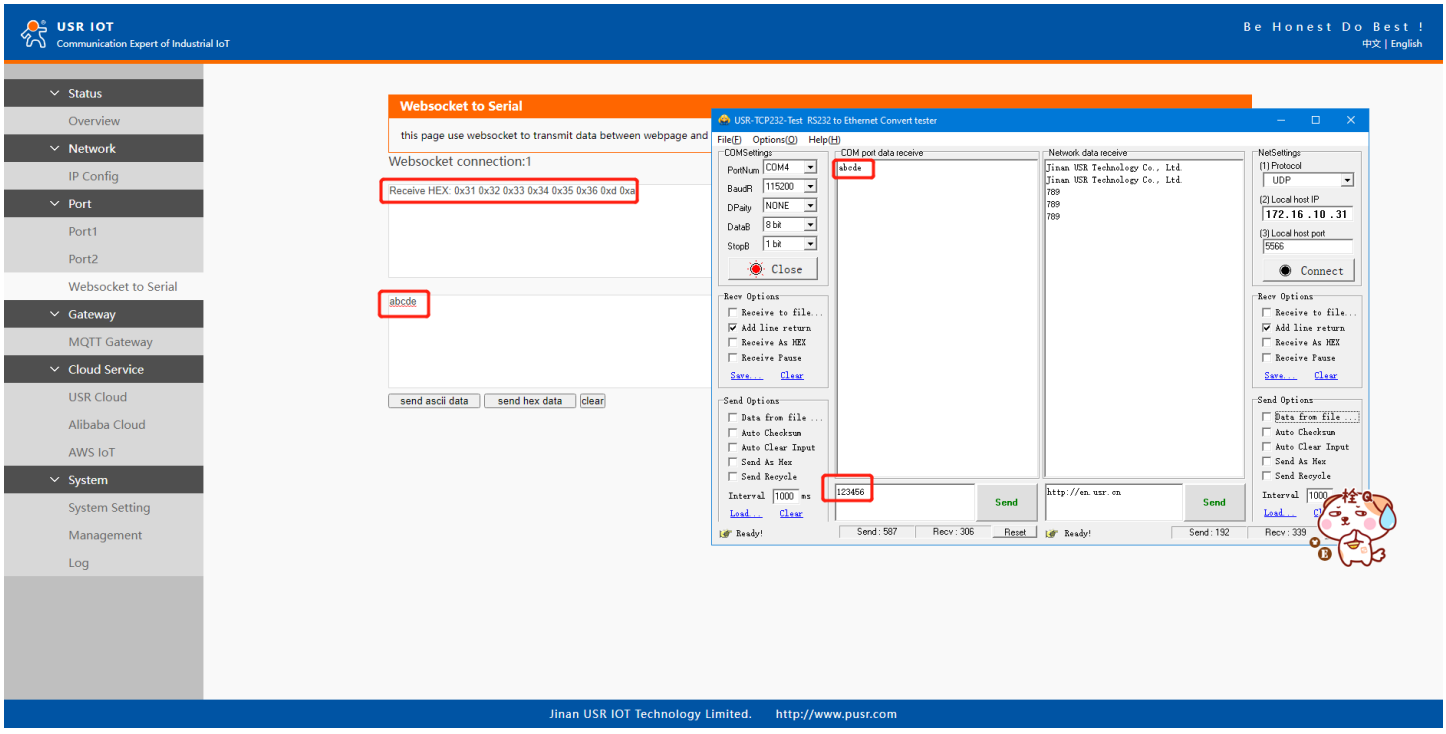


Fig. 54 **Data transmission test**

5. Virtual COM port

Traditional SCADA and data collection systems rely on serial ports (RS-232/422/485) to collect data from various kinds of instruments. Virtual COM ports on host computer allows remote access of serial devices over TCP/IP network that works like local native COM ports. Since USR-TCP232-E2 module enable network operation of instruments equipped with an RS-232/422/485 communication port, your SCADA and data collection system will be able to access all instruments connected to a standard TCP/IP network, regardless of whether the instruments are used locally or at a remote site.

To enable Virtual COM on host computer, you will require a VCOM software to emulate the COM port. For Windows operating system, a software utility called VCOM is supported by PUSR to be used for this purpose.

This function is useful with devices such POS terminals, Bar Code Readers, Serial printers, etc. since it allows you to use software that was written for pure serial communication applications.

Download the software from PUSR’s website:

https://www.pusr.com/support/downloads/VCOM_Setup_exe.html

Execute the VCOM program, click quick-install to install program files in the default directory, or select an alternative location. The Installing window reports the progress of the installation.

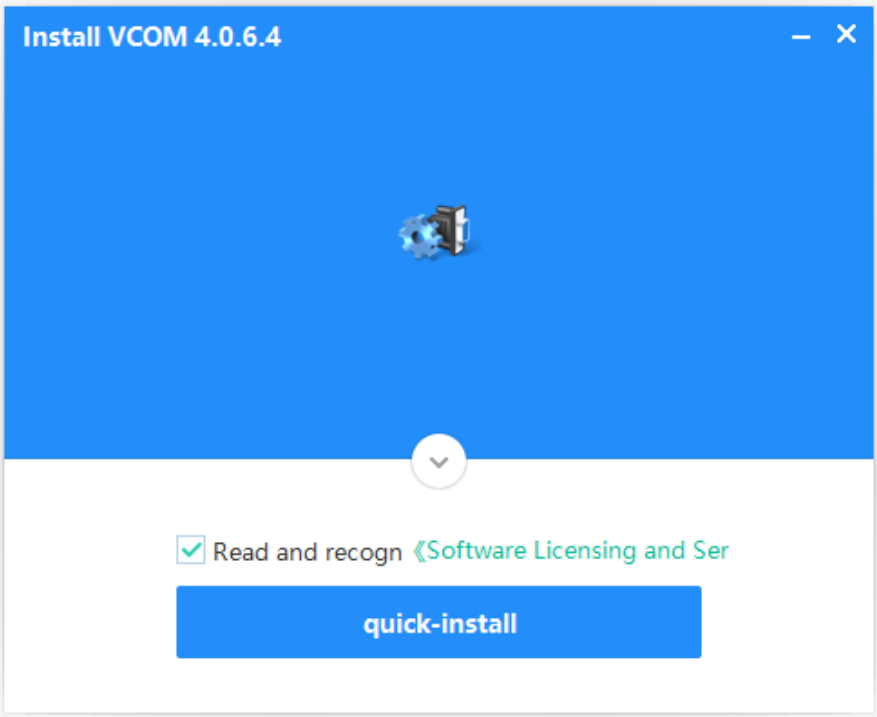


Fig. 55 **Install wizard 1**

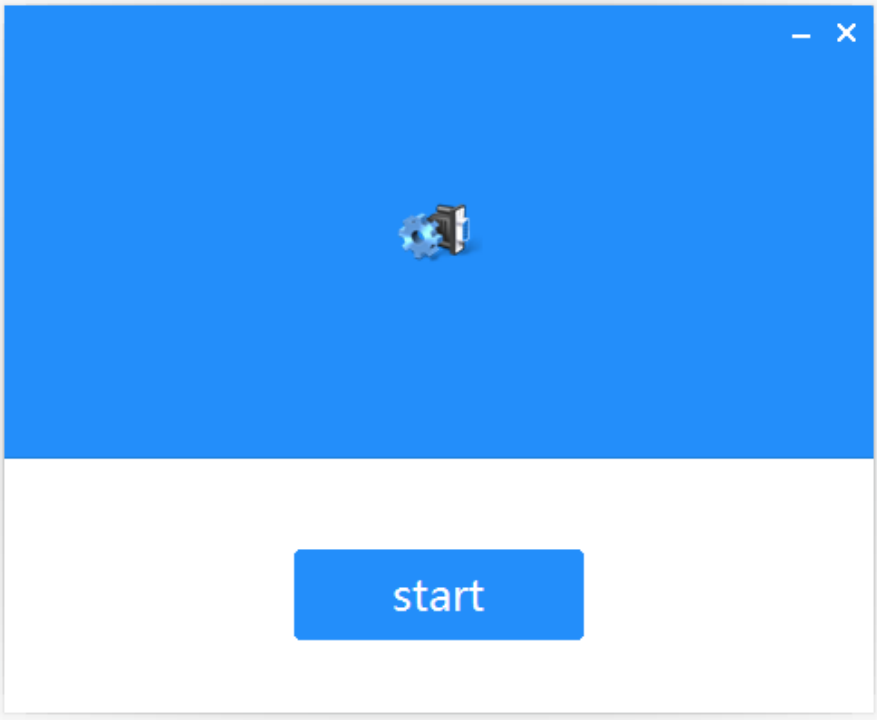


Fig. 56 **Install wizard 2**

Once the installation of the package is finished a start screen displays. Click start to conclude the process and launch the VCOM software.

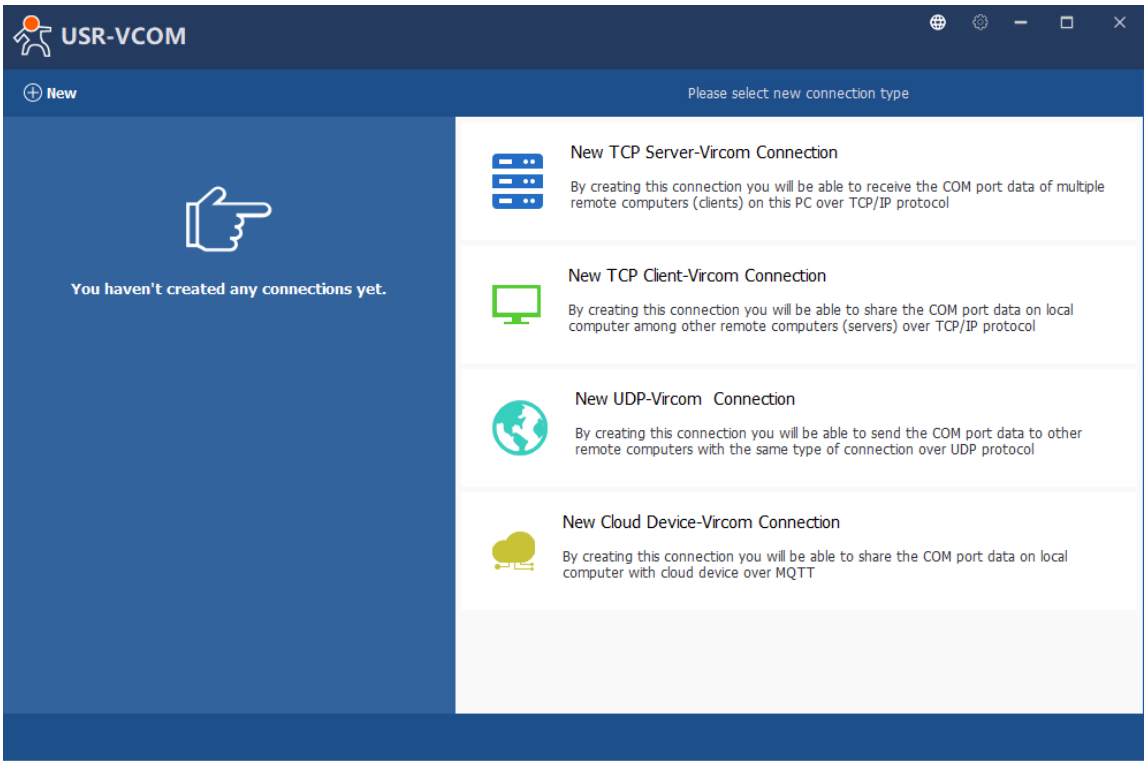


Fig. 57 **VCOM overview**

5.1. TCP Server Application with Virtual COM

Virtual COM on host computer allows remote access of serial devices over TCP/IP networks through Serial/IP Virtual COM ports that work like local native COM ports. Fig.68 is an example of Virtual COM application diagram. There are traditionally only two Physical COM ports (COM 1 and COM 2) on the personal computer (PC) while there can be several Virtual COM ports such as COM 11, 12, 13, and so on. This section will provide the procedure to enable Virtual COM (VCOM) on Windows based PC. Please follow the steps

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described here to configure your Virtual COM application.

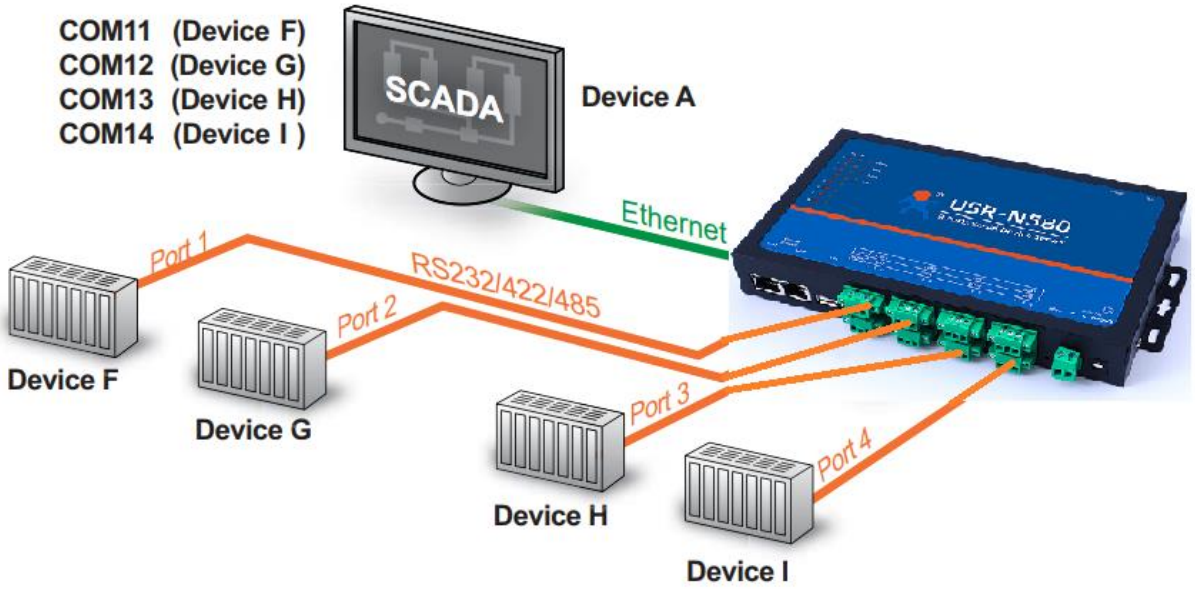


Fig. 58 **Diagram of Virtual COM Application over TCP/IP Network**

1. If the serial device server is running in TCP Server Mode (recommended), the VCOM utility on the host computer should be configured as the TCP client connecting to the serial device server. The characteristic of this mode is that the IP address of the host can be changed (usually automatically assigned by the router), and the IP address of the module must be fixed.

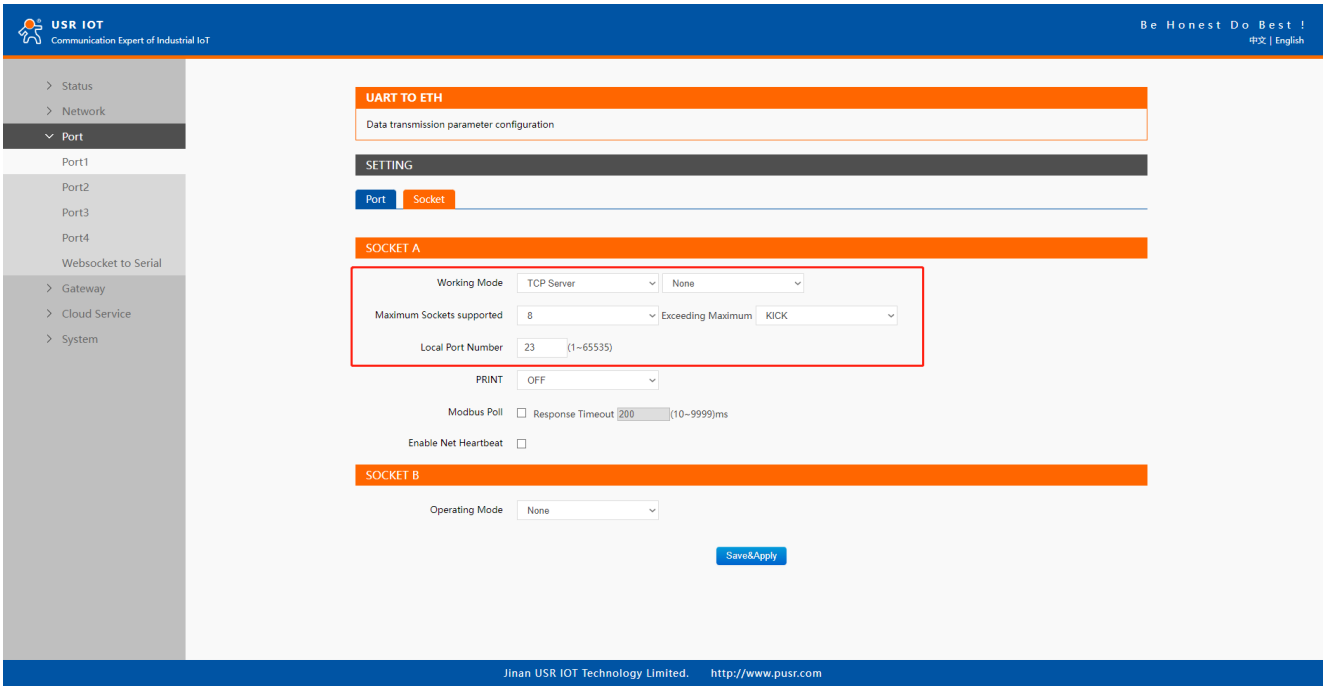


Fig. 59 **TCP server mode in USR-E2**

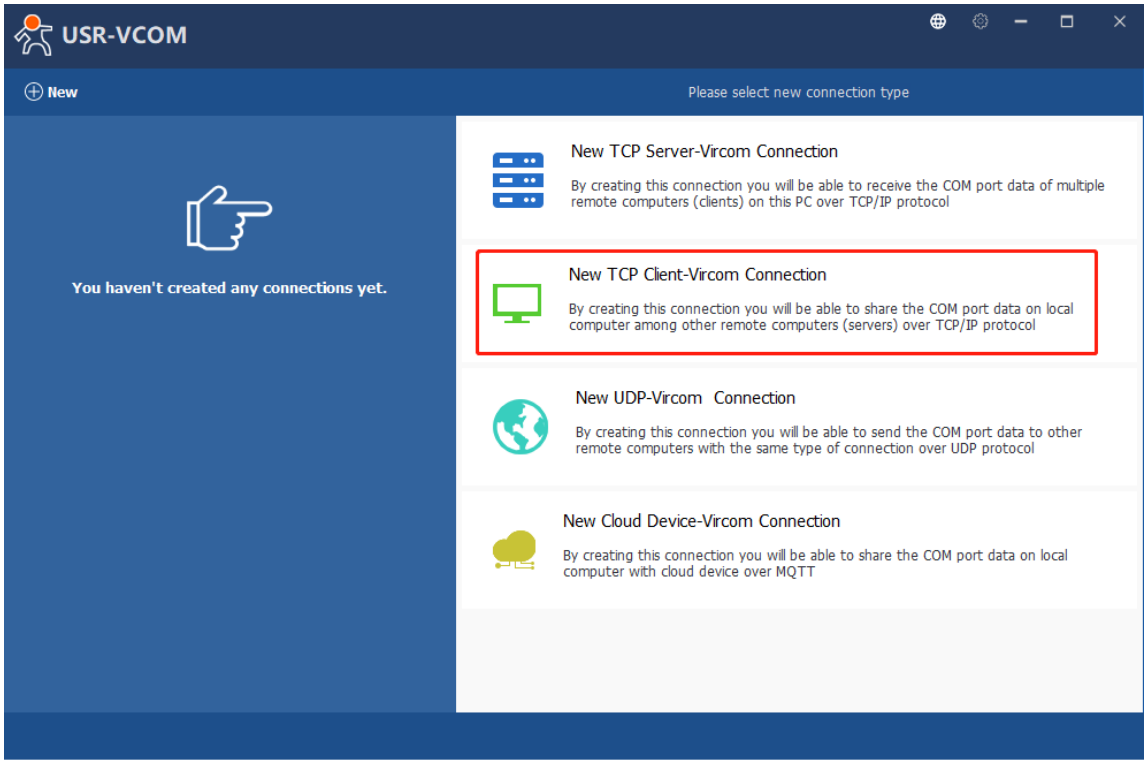


Fig. 60 **New Virtual COM connection**

2. Select one COM port as the Virtual COM port before proceeding as shown in Fig.71. Note that if a COM port number is used by other application or your operating system, you can not select it.

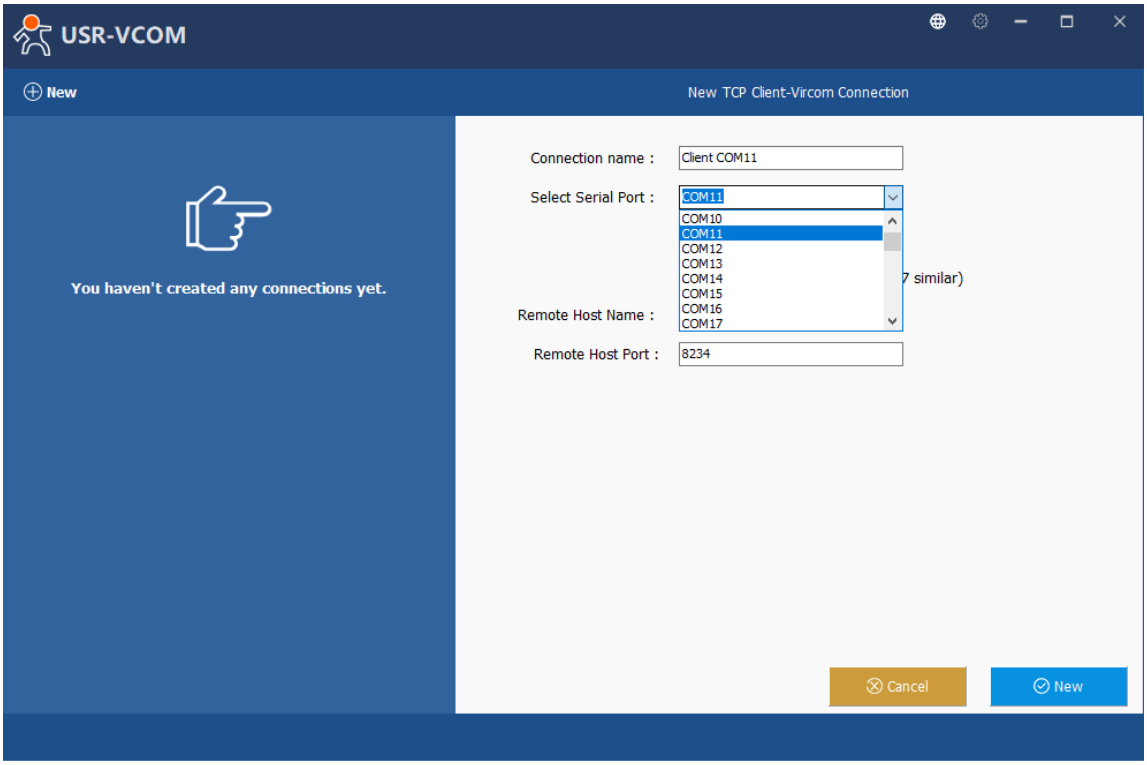


Fig. 61 **Select one COM port**

3. After selecting the virtual COM ports, please enter the IP Address of the serial device server with the specified Port Number. The Port Number here is the Local Listening Port for the serial device server which is specified in the Local Port field of Fig.72.

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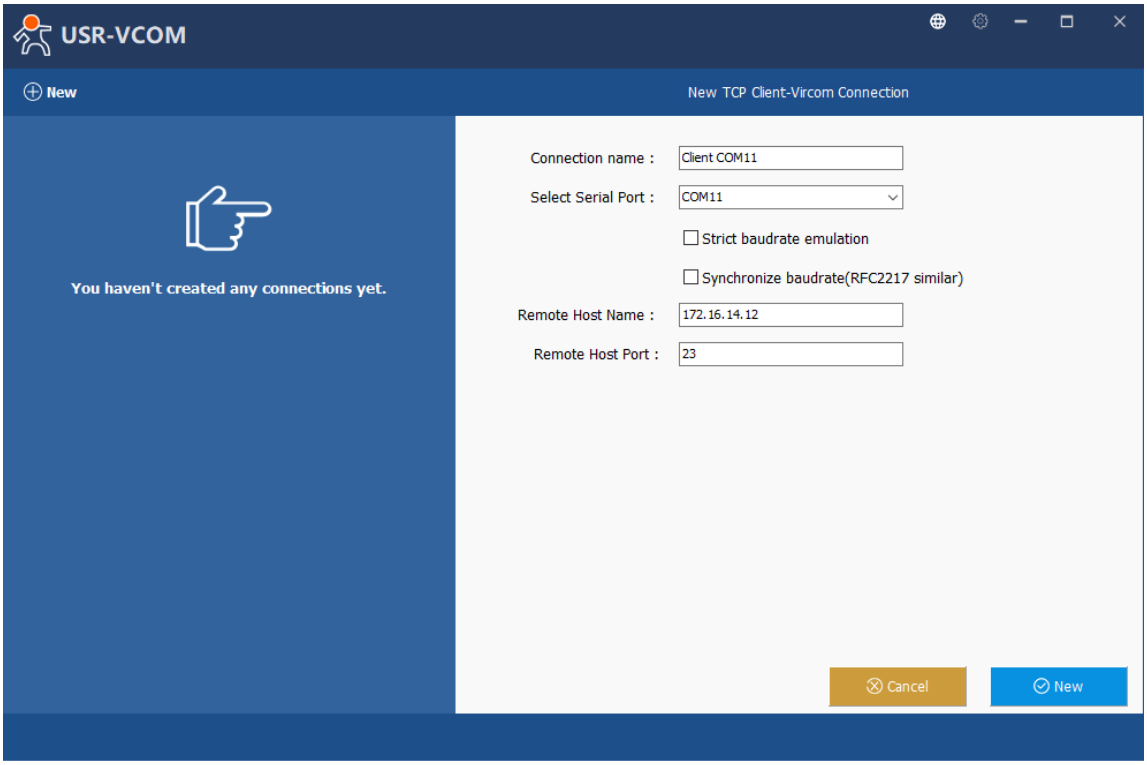


Fig. 62 **Virtual COM port mapping**

4. Click new to add the Virtual COM11. Click client COM11 on the left side of VCOM panel to check the status. If status become connected, the process is completed.

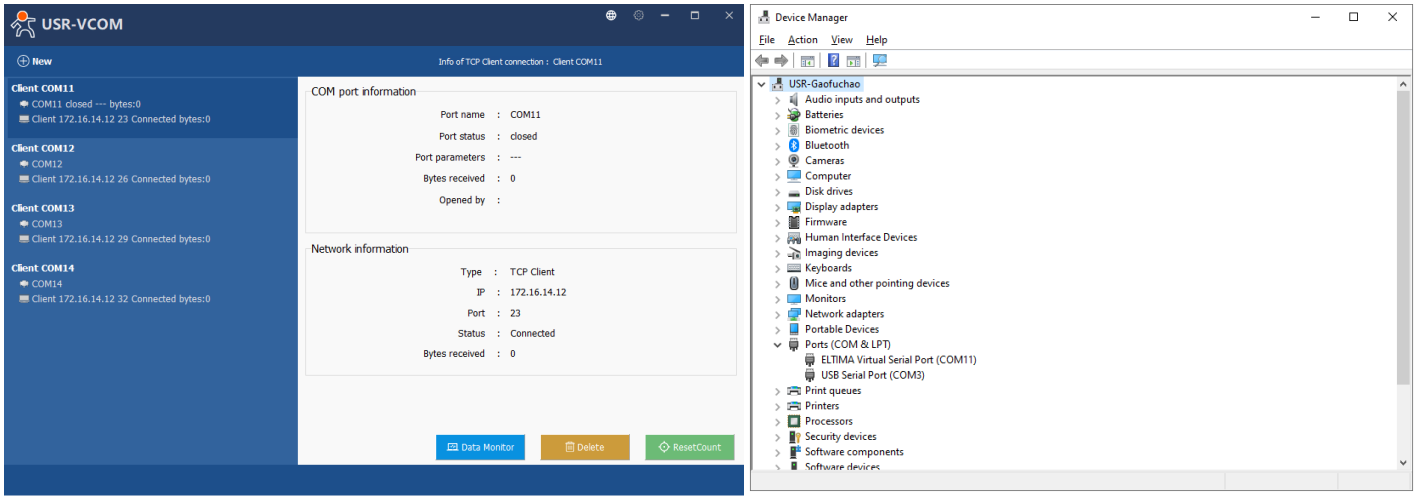


Fig. 63 **Virtual COM11 status**

5.2. TCP Client Application with Virtual COM

1. If the serial device server is running in TCP Client Mode, the VCOM utility on the host computer should be configured as the TCP server waiting for a serial device server to connect to the host computer. The feature of this mode is that the IP address of the computer cannot be changed, but the IP address of the serial device server can be changed (which can be automatically assigned by the router).

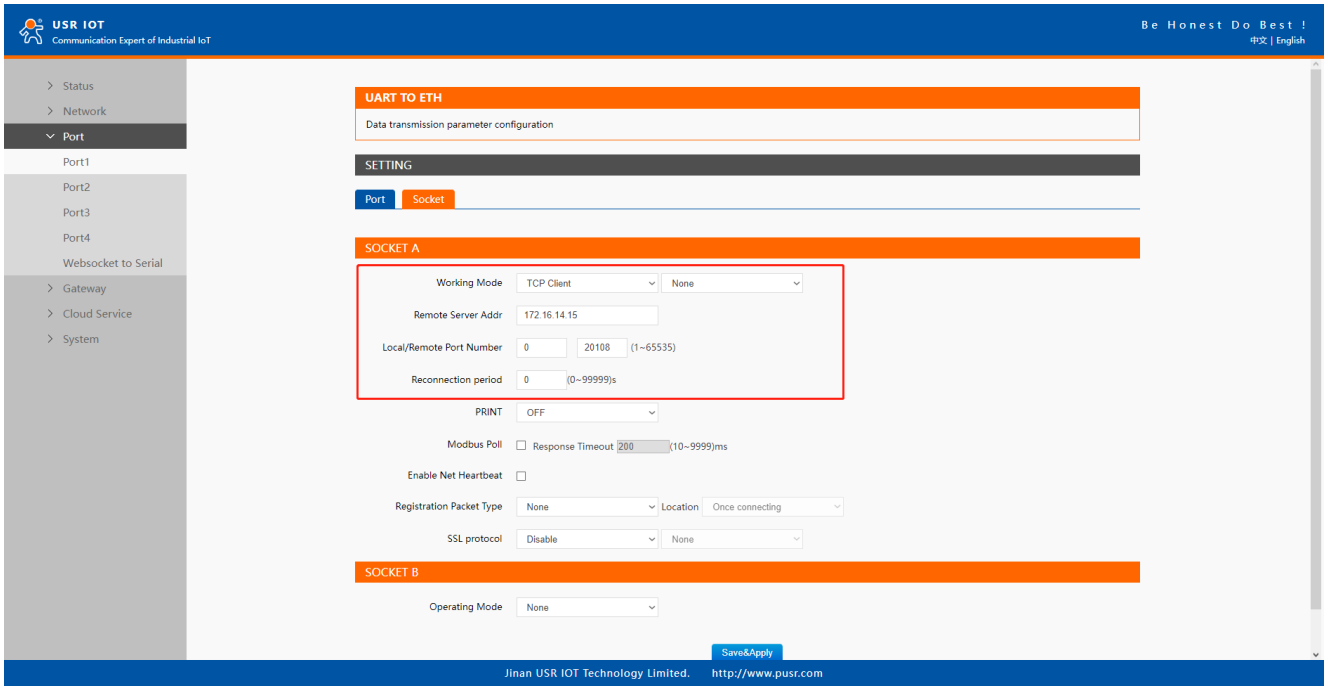


Fig. 64 **TCP client mode in USR-E2**

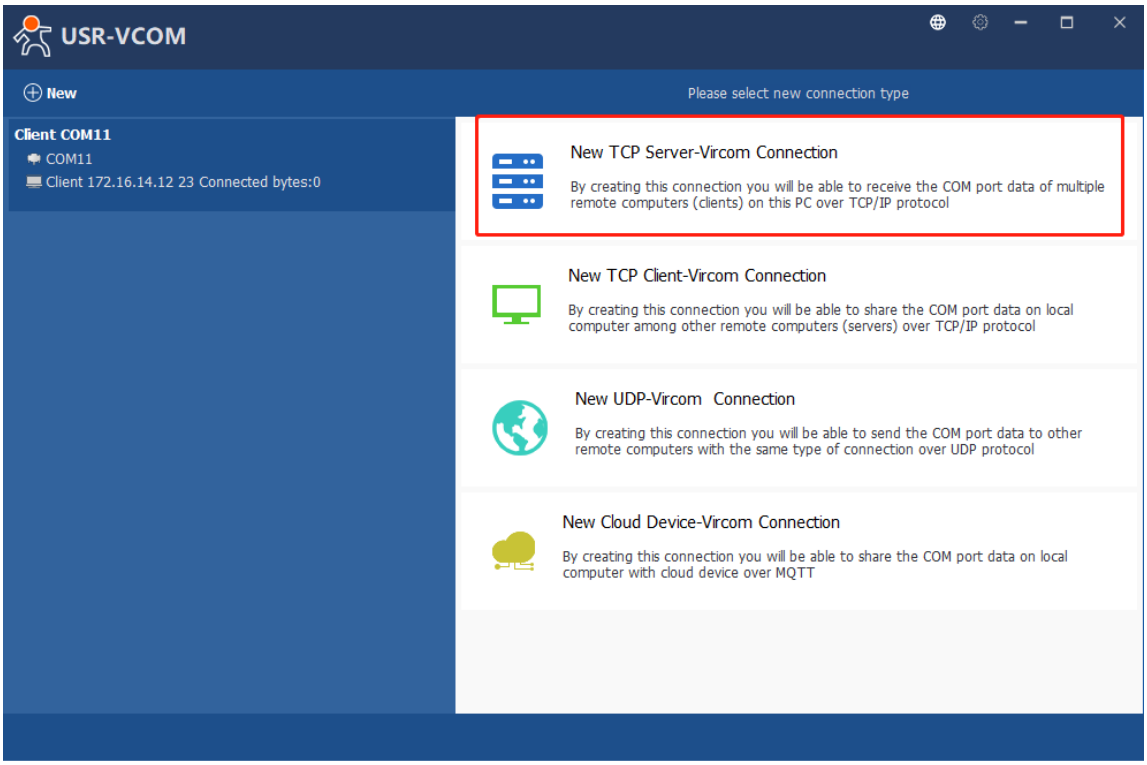


Fig. 65 **New Virtual COM connection**

2. Select one COM port as the Virtual COM port before proceeding as shown in Fig.76. Note that if a COM port number is used by other application or your operating system, you can not select it.

3. After selecting the virtual COM ports, please enter the specified Port Number. This Port Number is the Destination Port of the serial device server.

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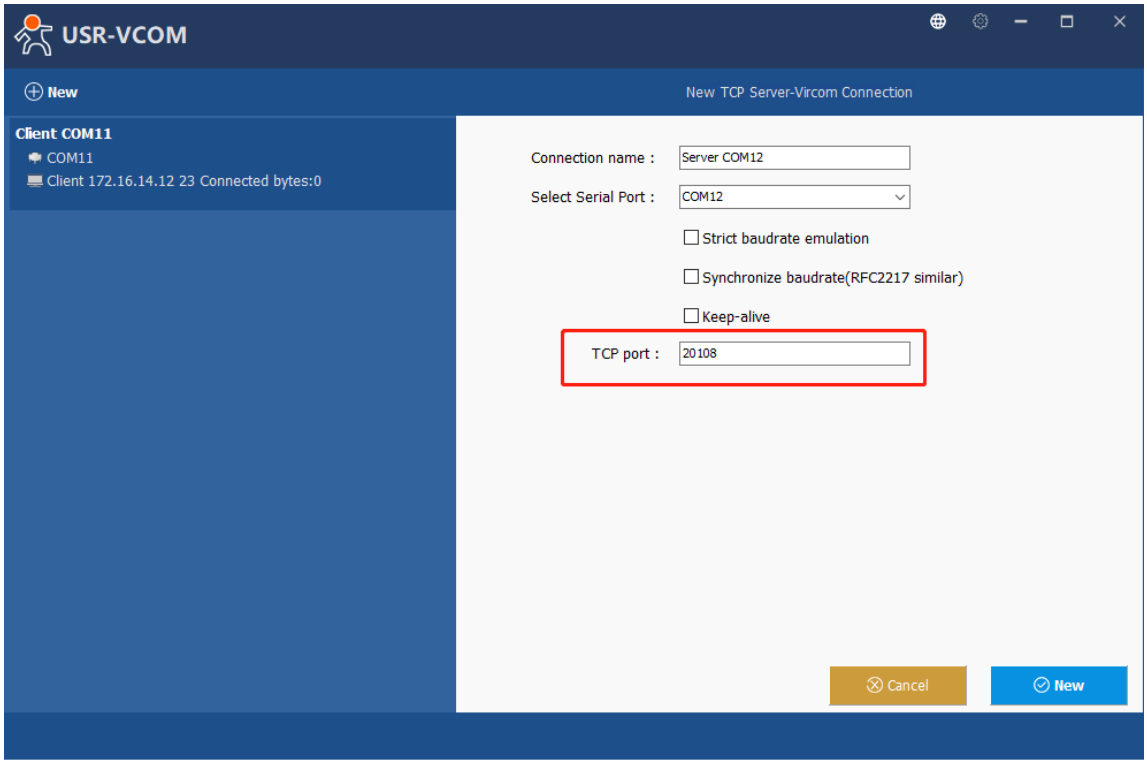


Fig. 66 **Virtual COM port mapping**

4. Click new to add the Virtual COM12. Click client COM12 on the left side of VCOM panel to check the status. If status become connected, the process is completed.

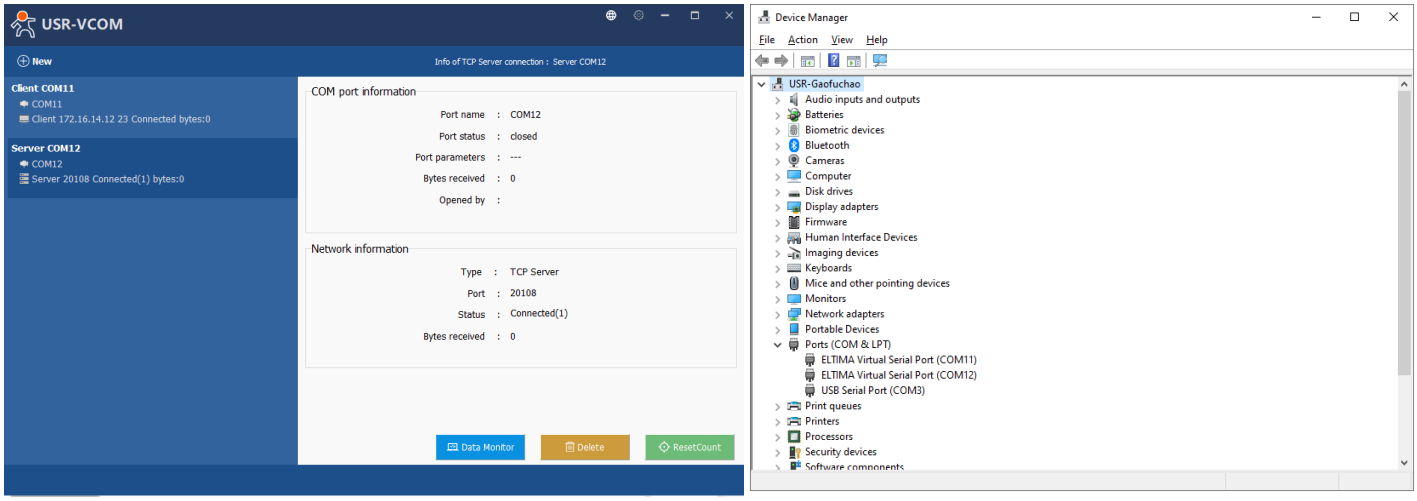


Fig. 67 **Virtual COM12 status**

5.3. Enable RFC2217 through Virtual COM

Enabling this function allows users to use customized RFC2217 commands on the network to dynamically modify the serial port's baud rate, data bits, stop bits, and parity bits. This function is only allowed when the working mode is TCP Server and TCP Client. Note that this protocol is used to change the serial port parameters of USR-E2.

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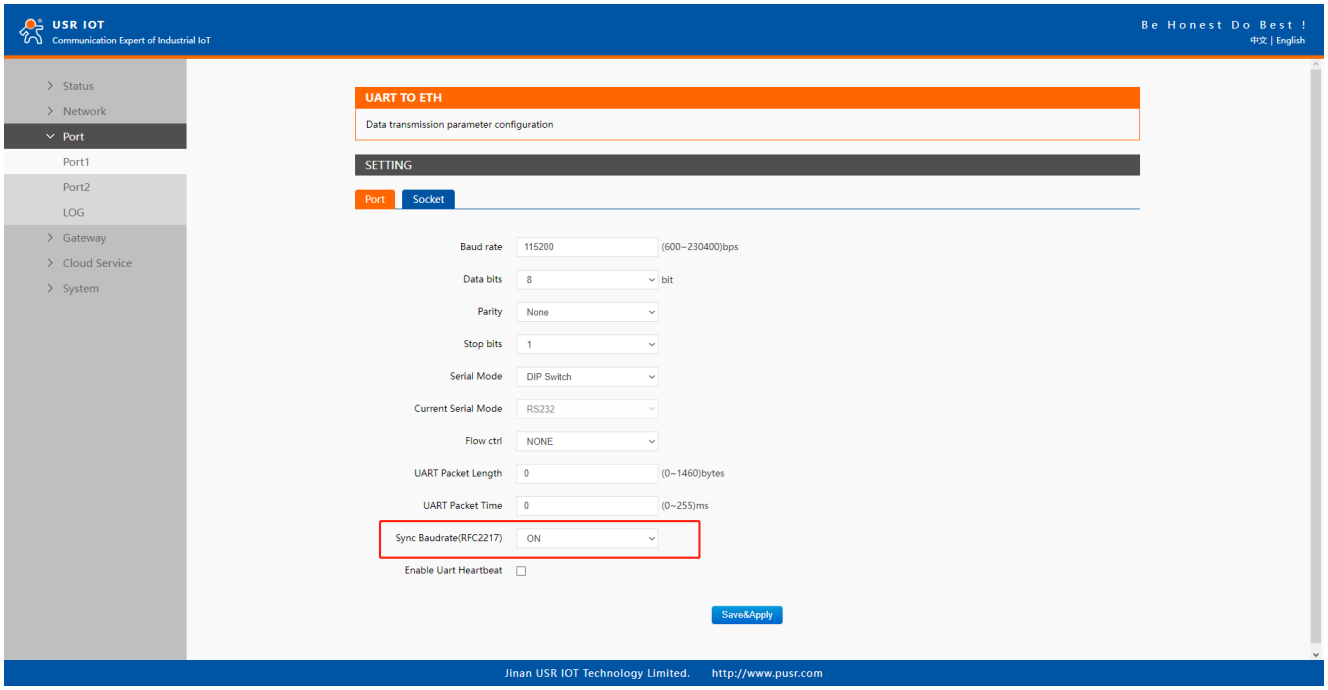


Fig. 68 **RFC2217 enabled**

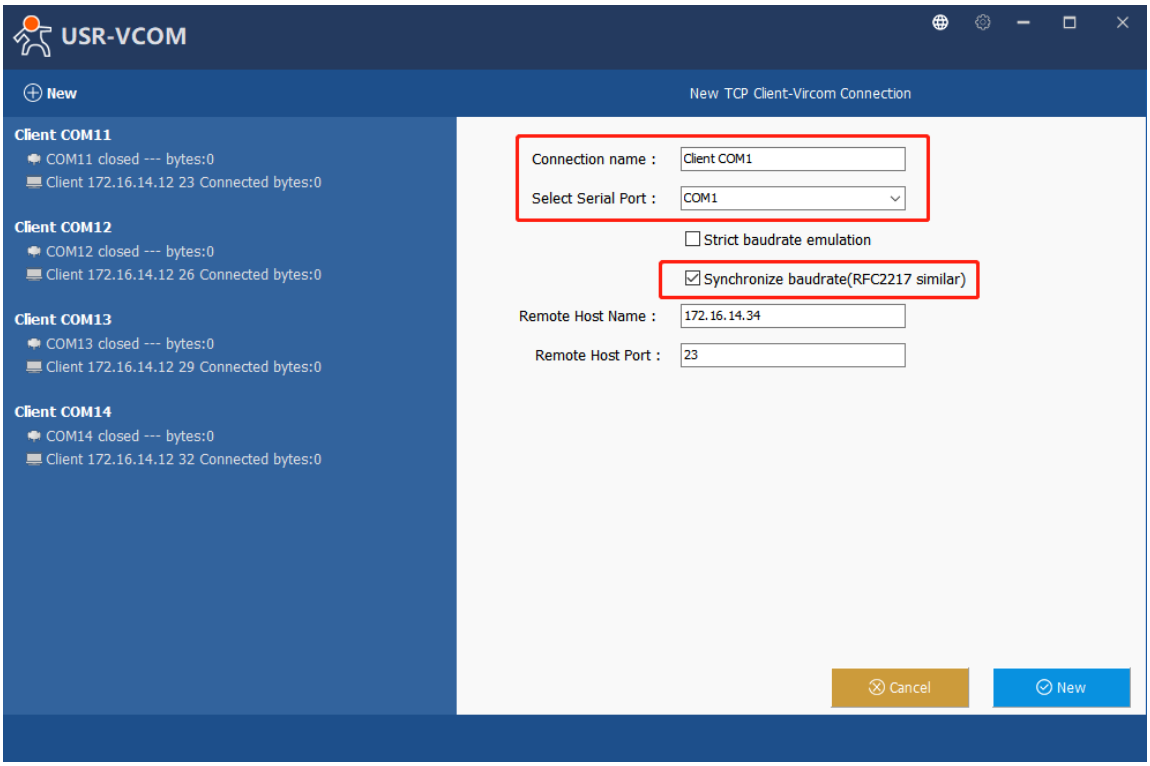


Fig. 69 **enable RFC2217 in VCOM**

When we change serial parameters in Virtual COM port 1, we can see these parameters have took effect in serial port of USR-E2.

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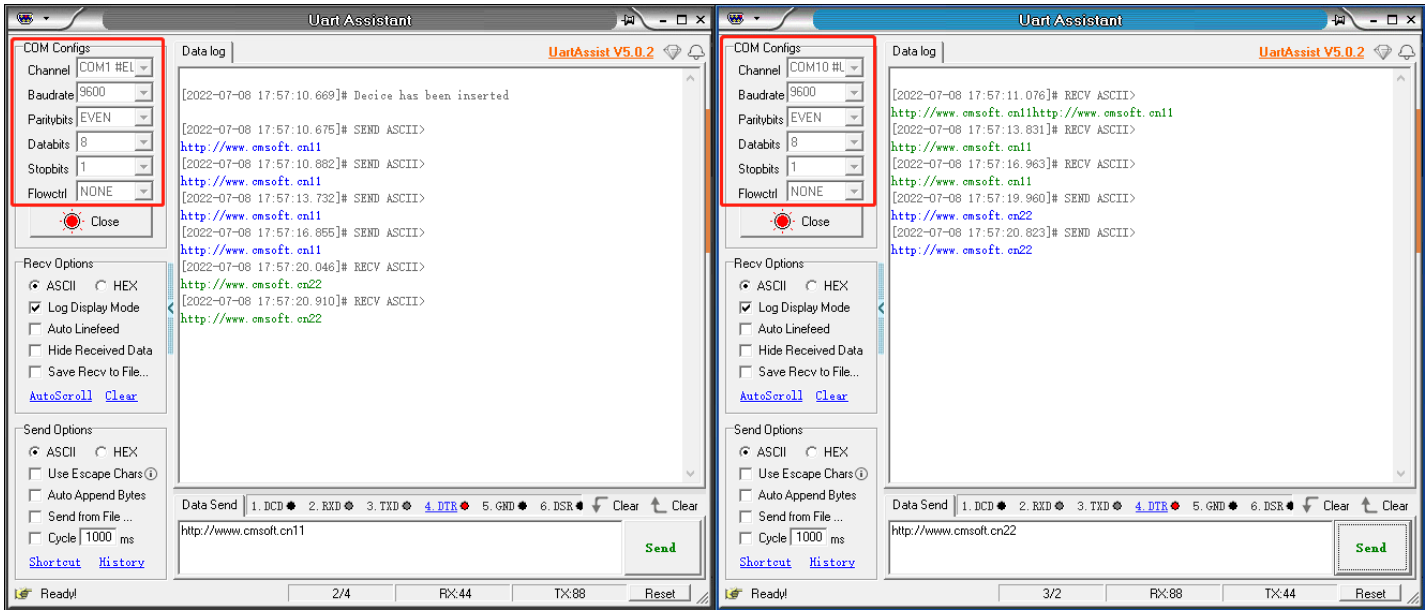


Fig. 70 **Synchronizing serial port parameters**

5.3.1. PUSR customized RFC2217 protocol

Table 17 Com Port Control commands

Name	Header	Baud rate	Serial parameter definition	Sum check
Length(bytes)	3	3	1	1
Description	Fixed	Big endian, e.g. 600（00 02 58）	Data bits/stop bits/parity bits setting. AS shown in the table 23 below	Check sum of 4 bytes of baud rate and serial parameter definition, retain the least significant byte
115200,N,8,1	55 AA 55	01 C2 00	03	C6
9600, N,8,1	55 AA 55	00 25 80	03	A8

Table 18 Serial parameter definition

Bit Position	Function	Value	Description
1:0	Data bits	10	7 Data bits
		11	8 Data bits
2	Stop bits	0	1 Stop bits
		1	2 Stop bits
3	Parity bit enable	0	disable the parity bit
		1	Enable the parity bit
5:4	Parity bit type	00	ODD
		01	EVEN
		10	Mark
		11	Space
7:6	undefinition	00	Please write 0

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6. Modbus TCP/RTU gateway

Modbus is one of the most popular automation protocols in the world. Many industrial devices, such as PLCs, DCSs, HMIs, instruments,

and meters, use Modbus as their communication standard. In industrial applications, the most common protocol conversion is Modbus RTU to Modbus TCP conversion, and it is usually required when legacy devices such as meters, mostly using Modbus RTU, need to be integrated with SCADA systems, mostly using Modbus TCP.

Most modern PLCs and host computers support Modbus TCP over Ethernet. In order to access discrete Modbus RTU devices for data collection and control, they can rely on Modbus gateway function of E2 or ED2 module.

6.1. Ethernet masters with serial slaves

When the host computer or PLC is Modbus TCP Master, the Modbus TCP function must be enabled, the remote device must work in Modbus RTU Slave mode. The E2 module(TCP Server mode) supports Modbus TCP with up to 16 simultaneous connections. When connected with more than one RS485 devices, please refer to section 7.5 for bus collision detection.

The device supports multiple hosts to query data from the slave in Q&A mode. Please select modbus polling function as shown in Fig.82. When E2 module does not receive a response from the serial port after a response timeout, the device replies with an acknowledgement and then processes the next host request.

When you need to use long frame data frequently or have high data transmission requirements, please adjust the baud rate and lengthen the sending interval appropriately to prevent the slow serial port from causing messy codes or packet loss.

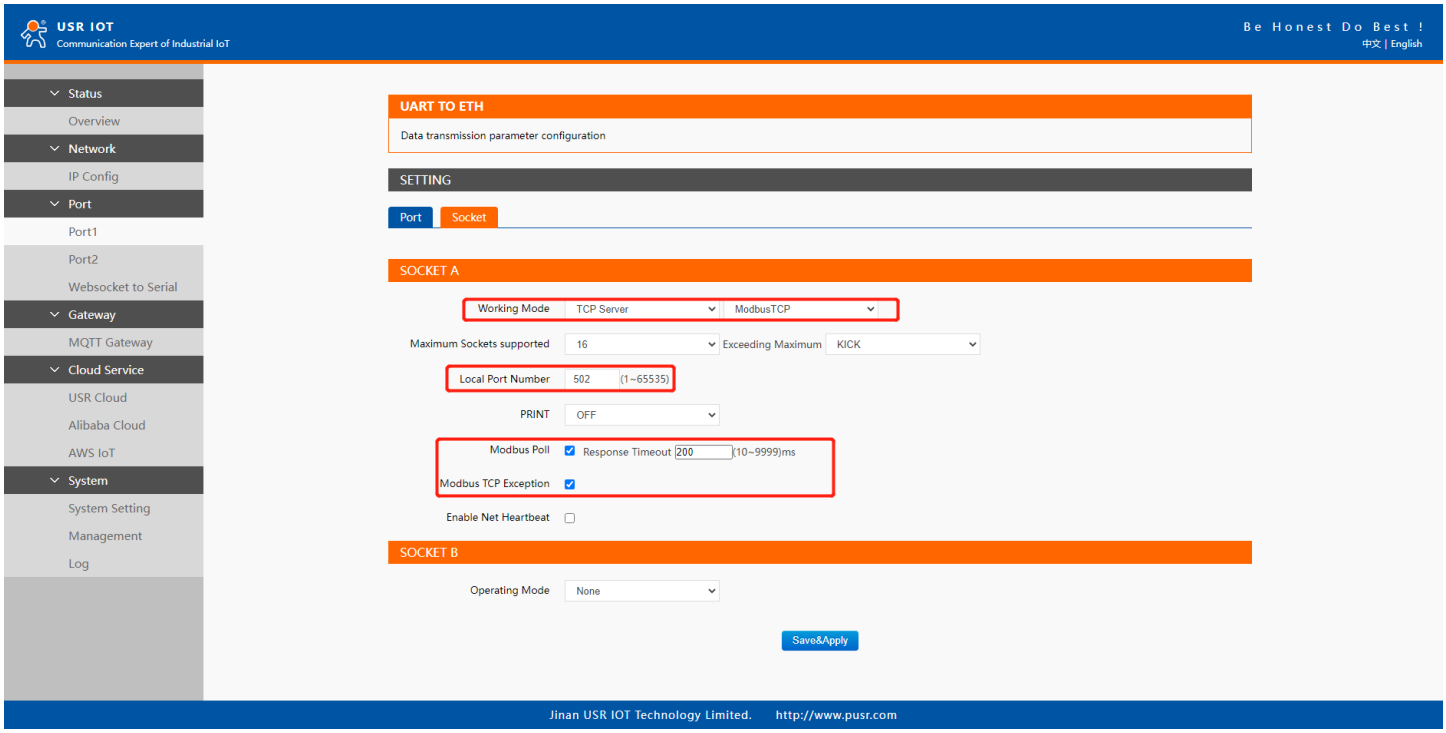


Fig. 71 Modbus TCP master settings

Open the Modbus Poll and Modbus Slave software, go to "Connect" -> "Connect", and the connection parameters are configured as follows, in this case, IP address of E2 module is 172.16.11.131.

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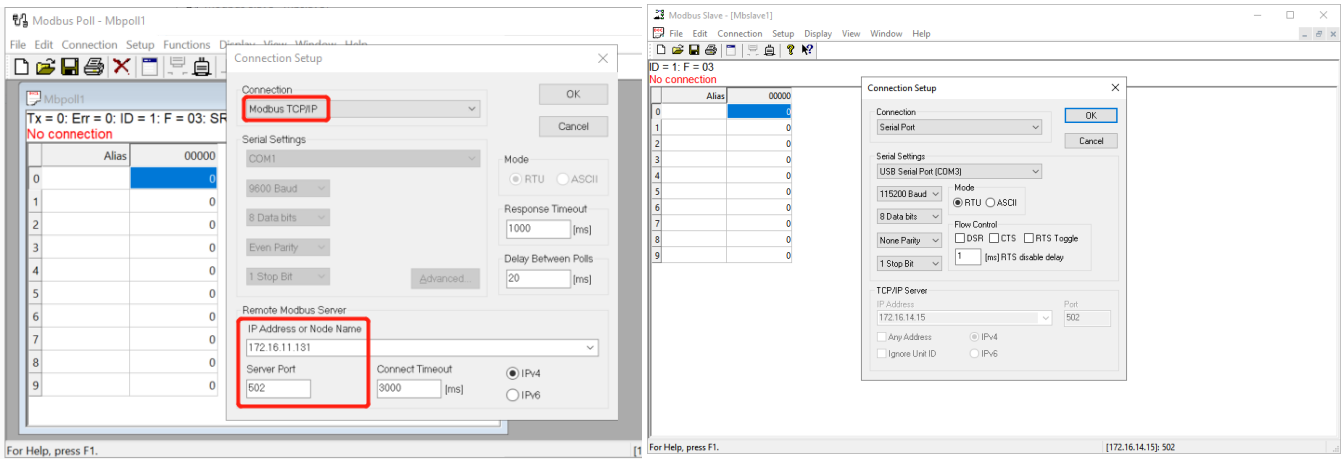


Fig. 72 Modbus emulator settings(Ethernet master and serial slave)

6.2. Serial master with Ethernet slave

Many HMI (Human Machine Interface) systems use a serial interface to connect to a discrete DCS (Data Control System). However, many DCSs are now Ethernet-based and operate as a Modbus TCP server device. The Modbus gateway can link a serial-based HMI to distributed DCSs over an Ethernet network.

When the host computer or HMI is Modbus RTU Master, if the remote device work in Modbus TCP Slave mode, the Modbus TCP function must be enabled. The E2(TCP Client mode) support only one Modbus TCP slave.

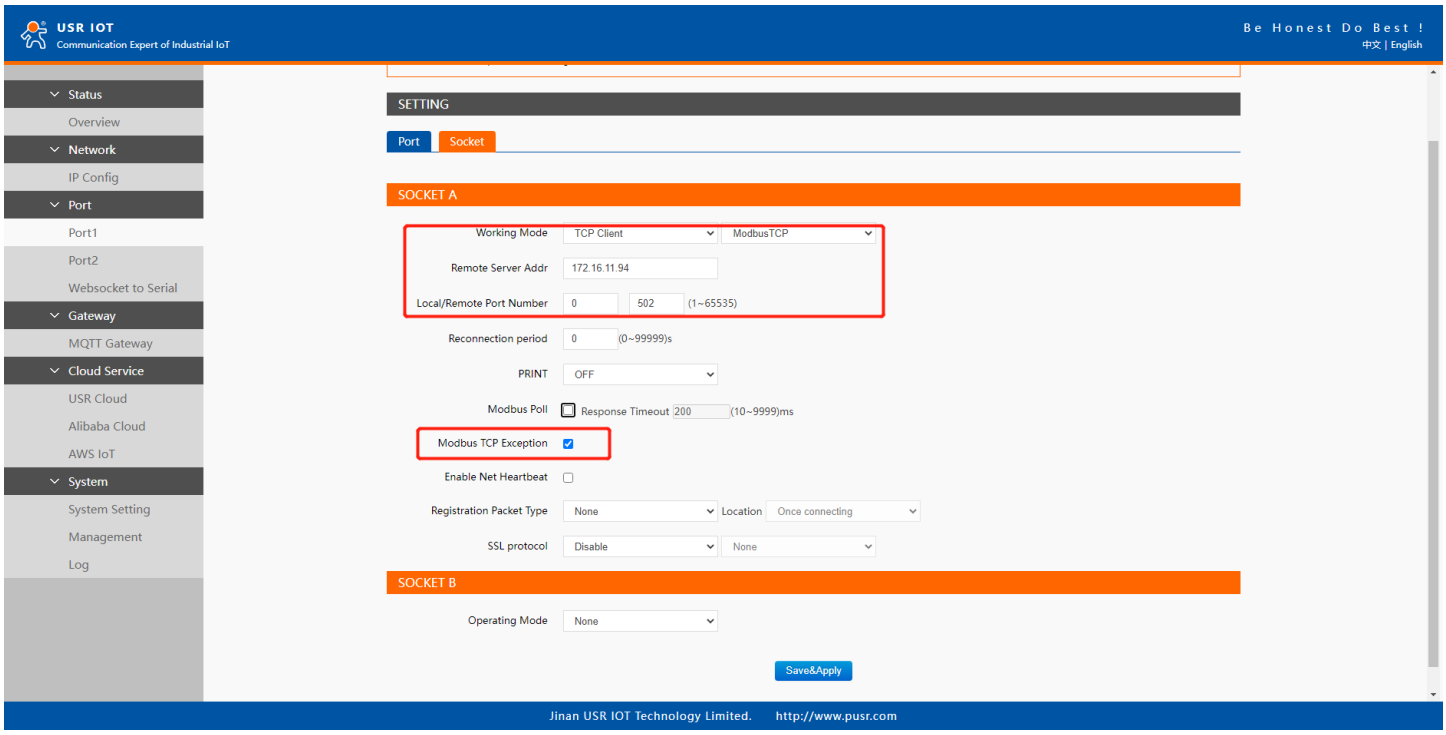


Fig. 73 Modbus TCP slave settings

Open the Modbus Poll and Modbus Slave software, go to "Connect" -> "Connect", and the connection parameters are configured as follows, in this case, IP address of E2 module is 172.16.11.131, host IP address is 172.16.11.94.

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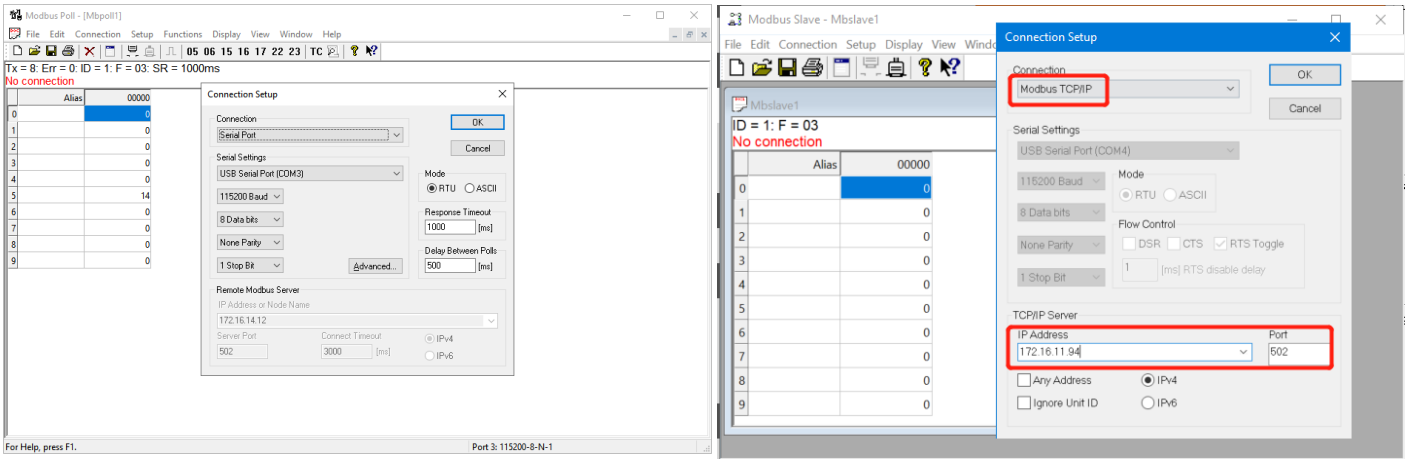


Fig. 74 Modbus emulator settings(serial master and Ethernet slave)

6.3. Serial master with serial slaves

When the HMI is Modbus RTU Master, all E2 modules must enable or disable ModbusTCP function at the same time, the remote device must work in Modbus RTU Slave mode. The E2 support up to 16 simultaneous TCP connections.

If there are more than one serial masters in RS485 network, users should select modbus poll function and configure response timeout in Fig.88. please refer to section 7.5 for bus collision detection.

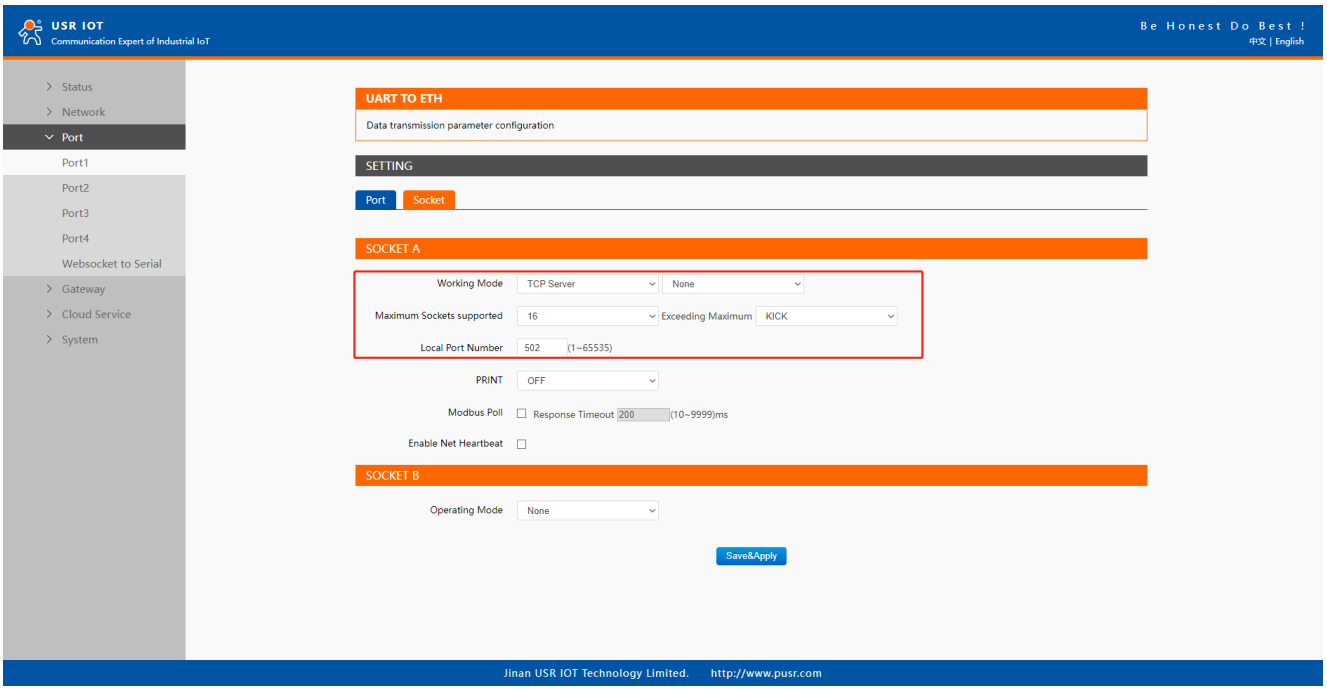


Fig. 75 Modbus RTU master settings(USR-TCP232-E2 1)

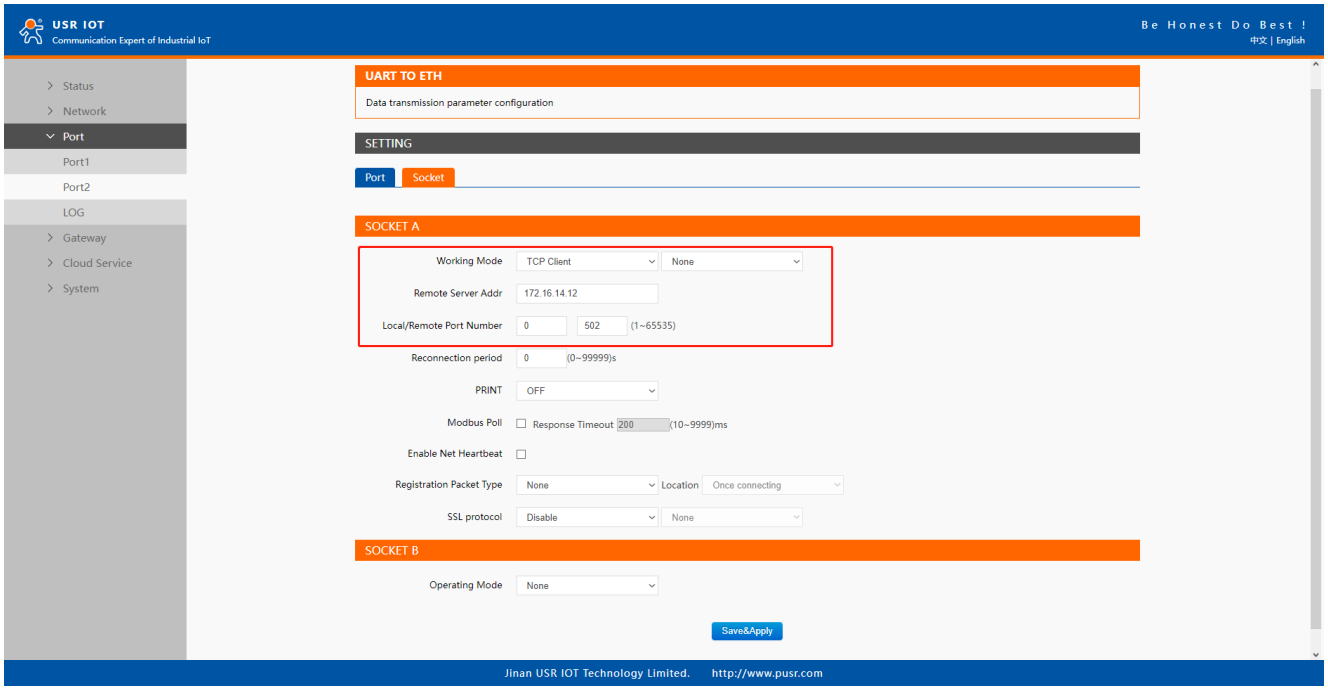


Fig. 76 Modbus RTU slave settings(USR-E2 2,3,4...)

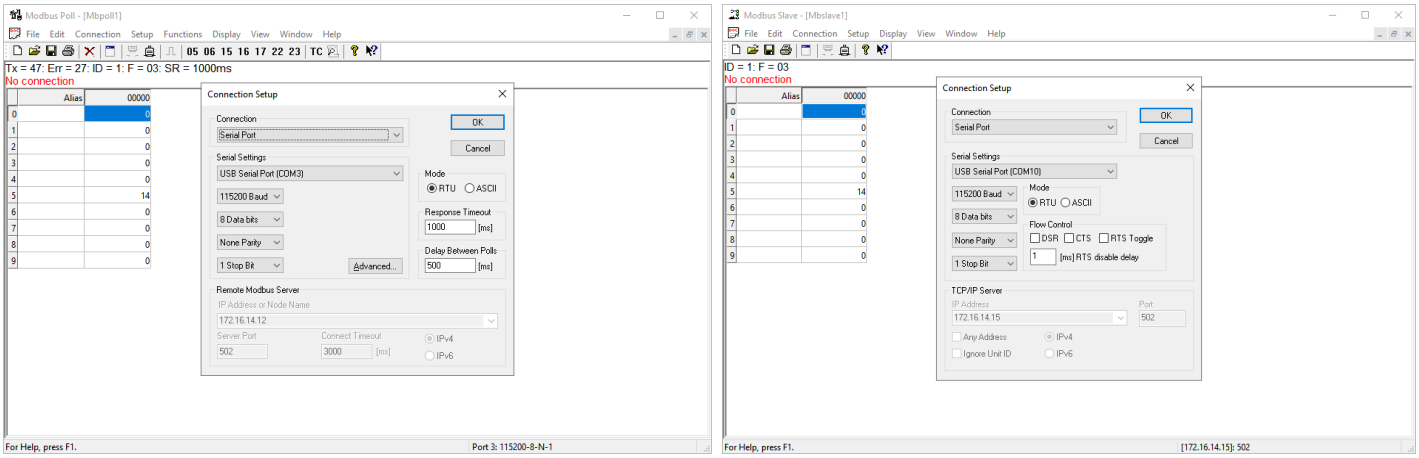


Fig. 77 Modbus emulator settings(serial master and serial slave)

6.4. Serial master via virtual COM with serial slaves

When the host computer is Modbus RTU master, if we use VCOM, the Modbus TCP function must be disabled, the remote device must work in Modbus RTU Slave mode.

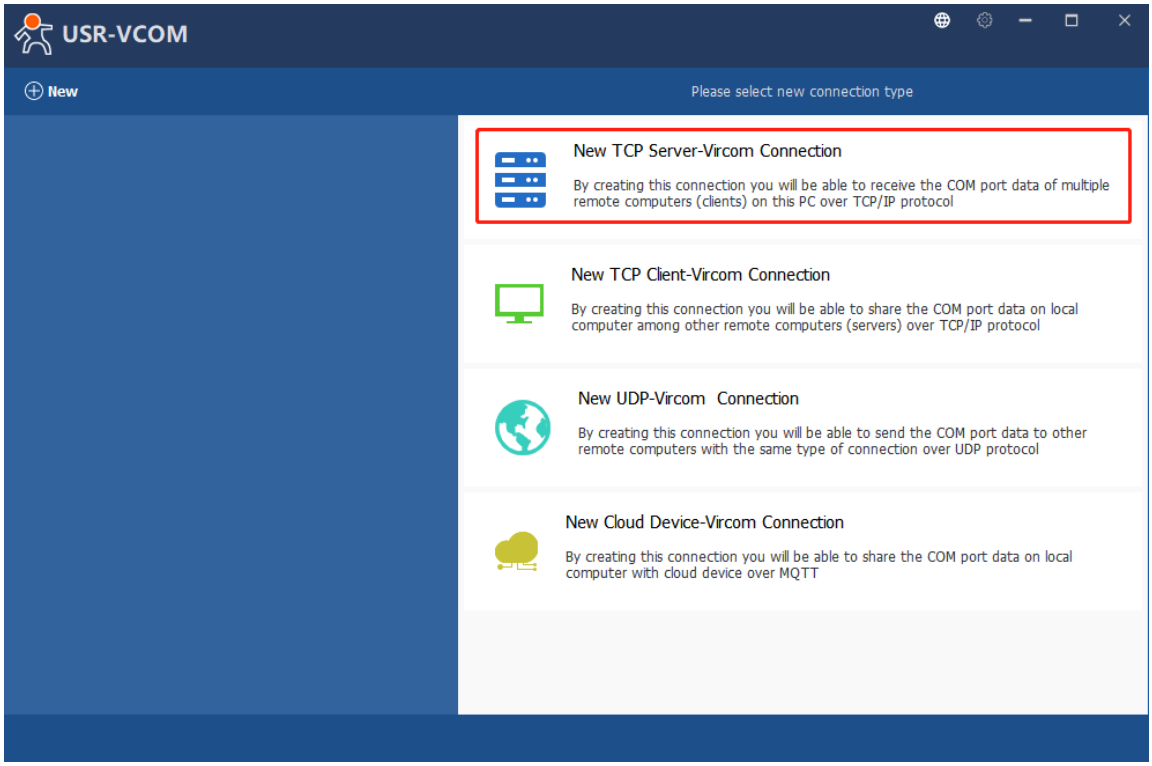


Fig. 78 New virtual COM port mapping

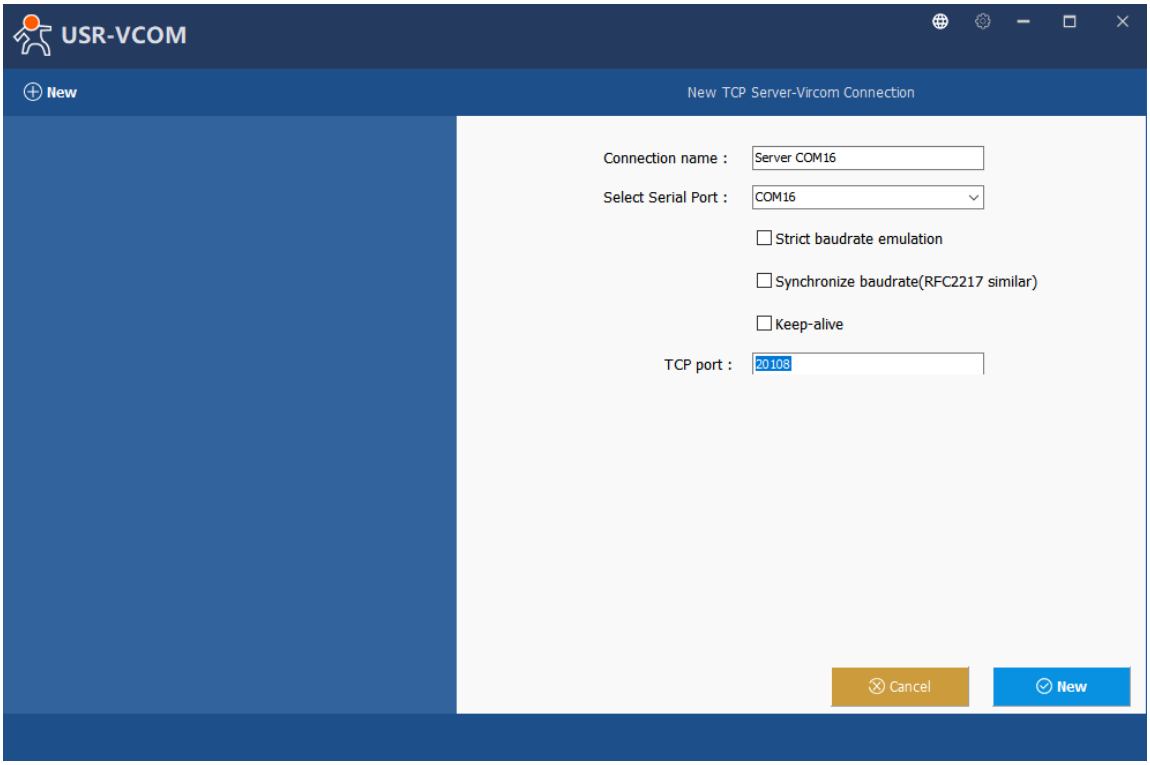


Fig. 79 Mapping a virtual COM port

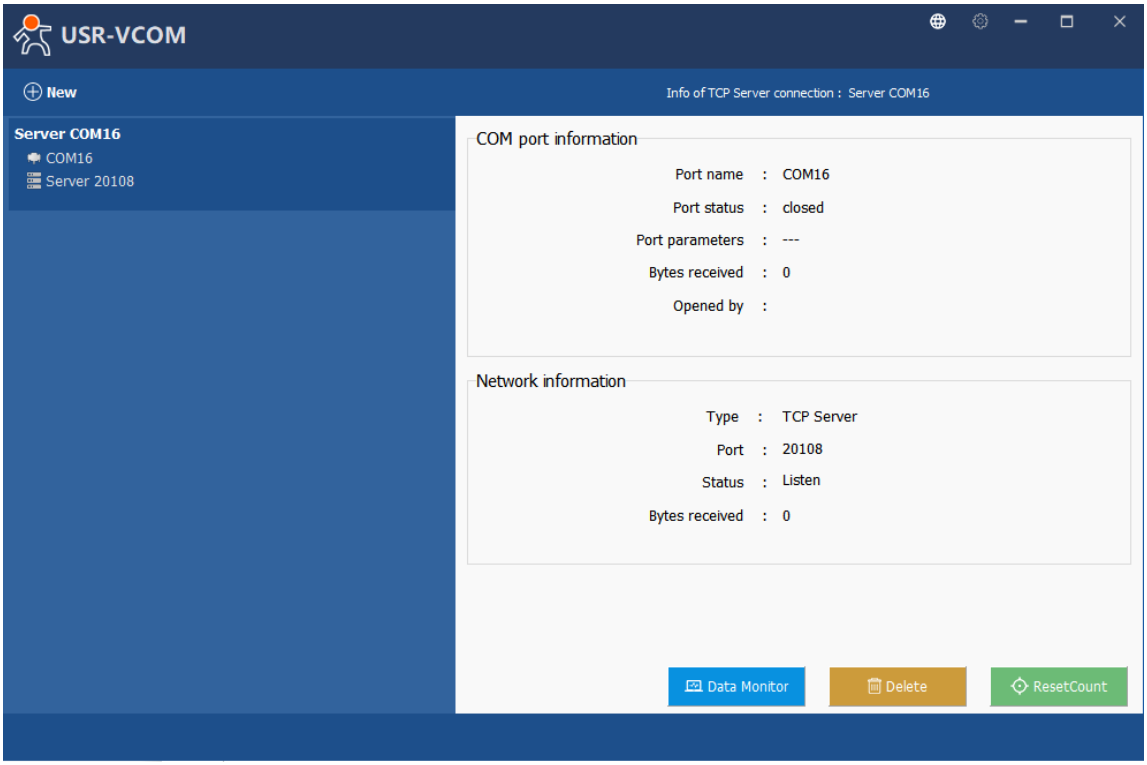


Fig. 80 **Virtual COM port mapping details**

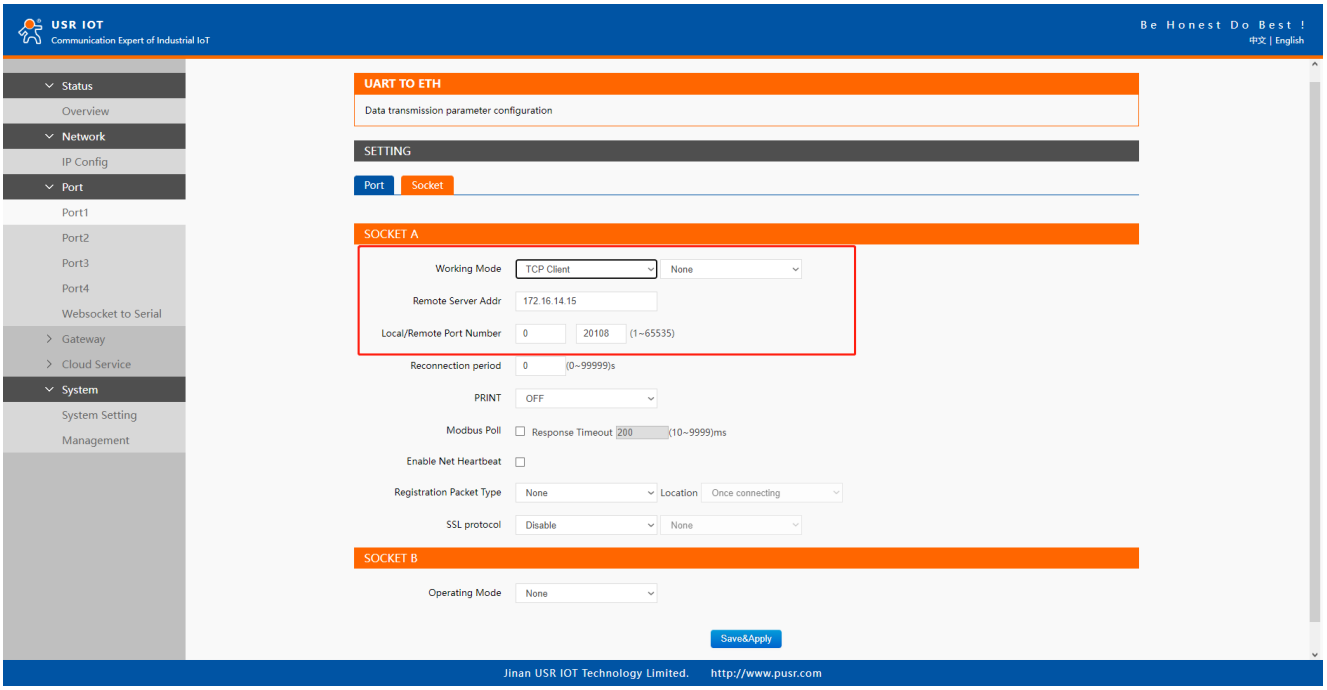


Fig. 81 **Serial device settings**

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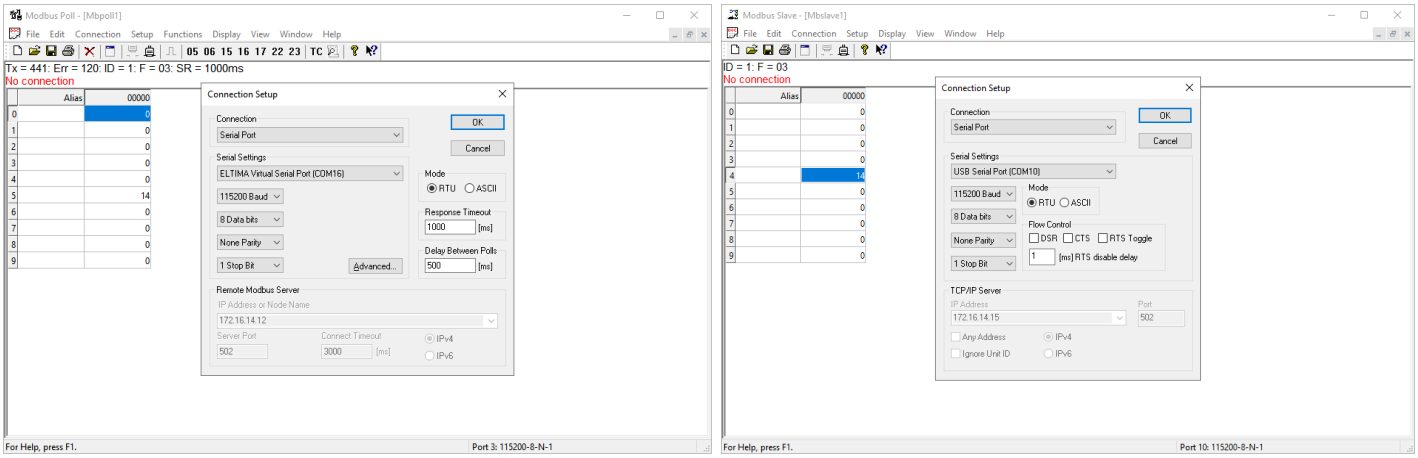


Fig. 82 Modbus emulator settings(serial master and serial slave)

6.5. Modbus poll with serial heartbeat packet

When the E2 is Modbus RTU Master, the serial device work in Modbus RTU Slave mode, the ModbusTCP function must be disabled. E2 works in TCP server mode, it supports up to 16 TCP connections.

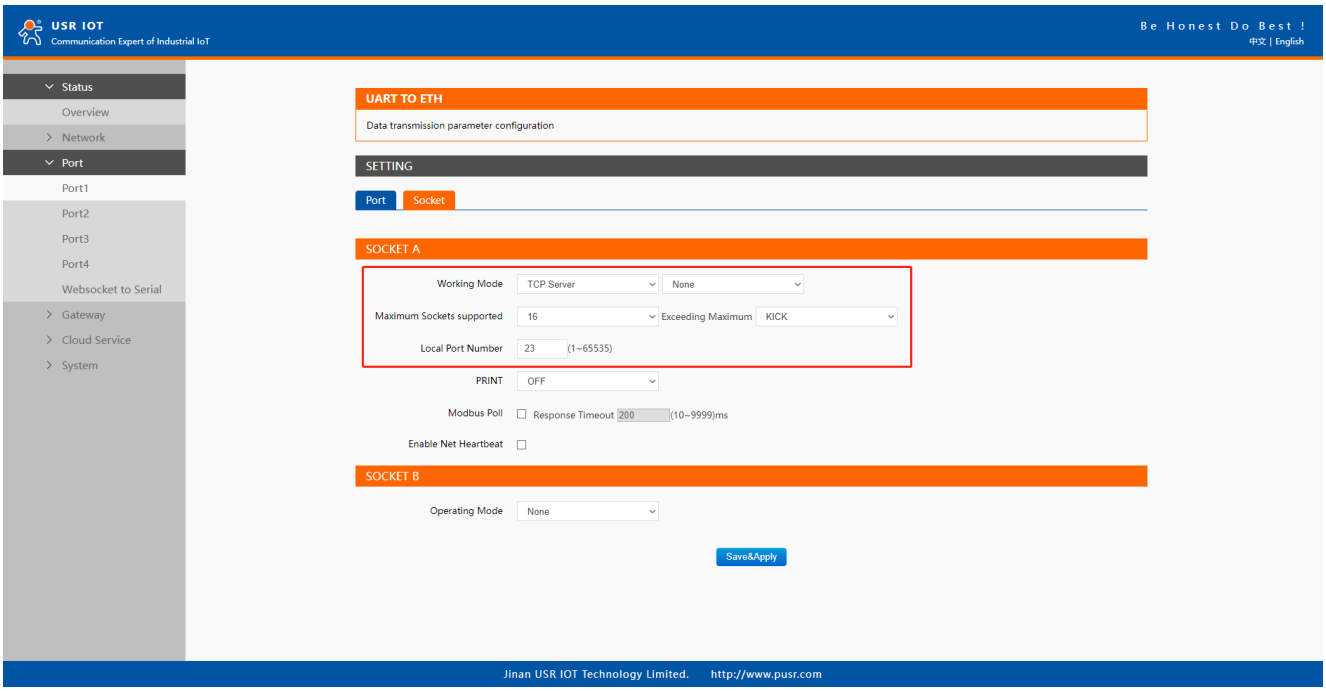


Fig. 83 Modbus RTU master Settings

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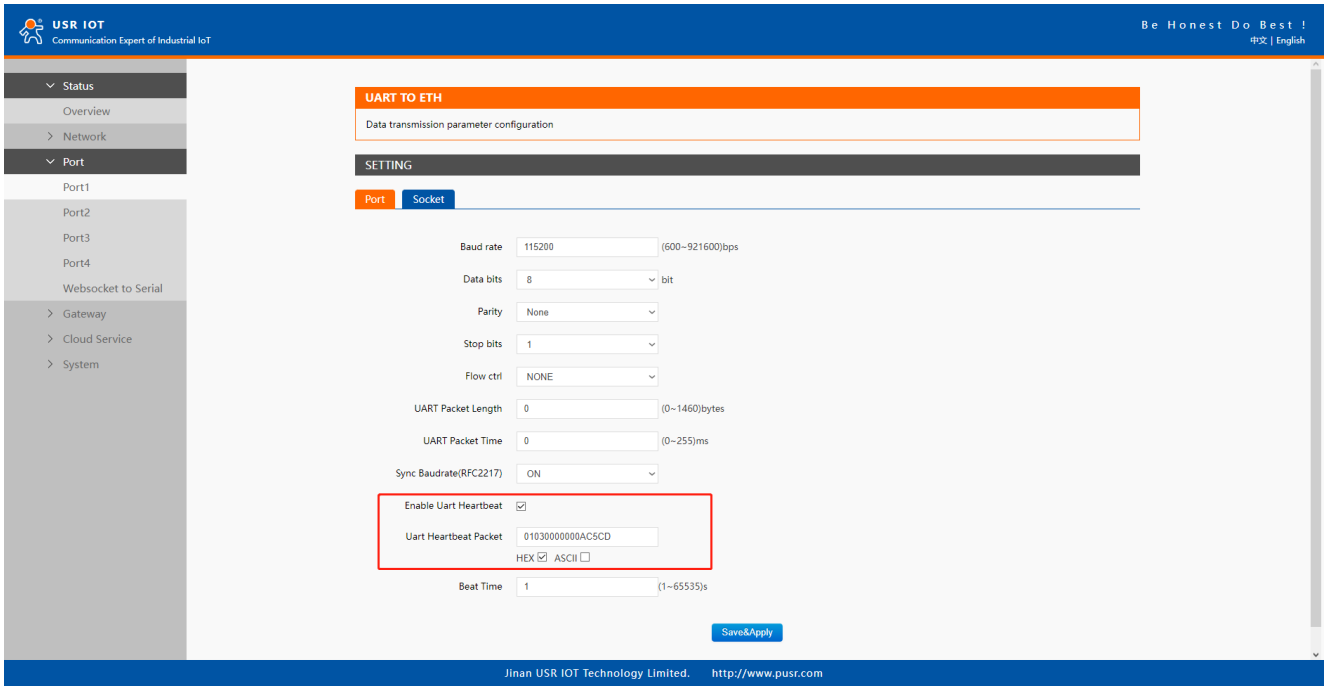


Fig. 84 **Serial heartbeat packet as modbus command**

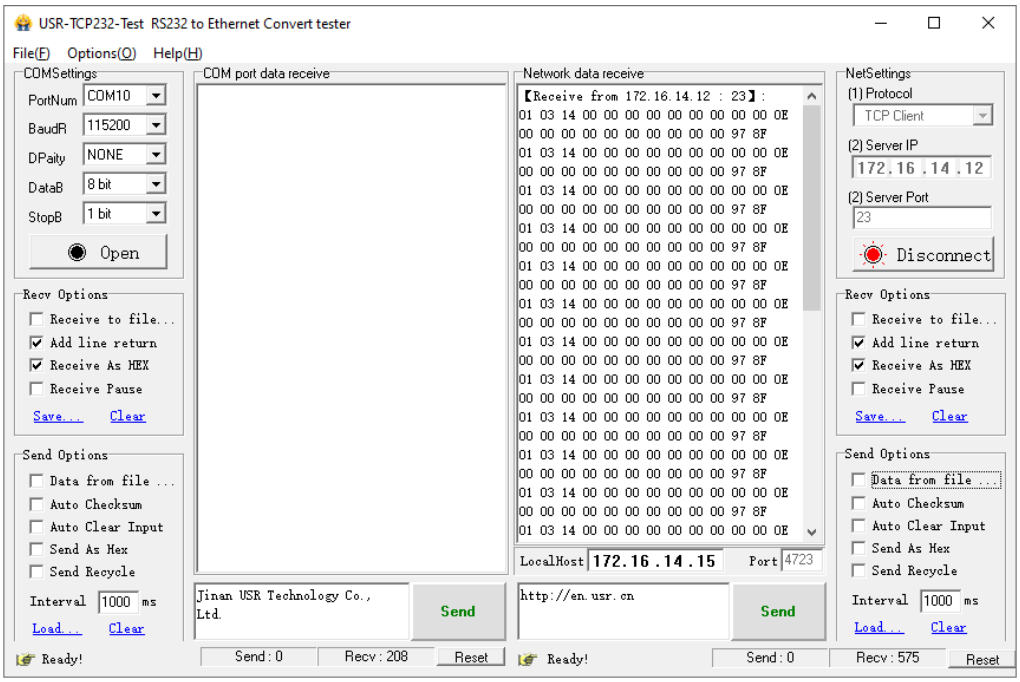


Fig. 85 **Modbus response transparently transmission**

7. Advanced features

7.1. Packing mechanism

Serial to Network Packet Delimiter: Packet delimiter is a way of packing data in the serial communication. It is designed to keep packets intact. USR-TCP232-E2 provides two types of delimiter: Time Delimiter, Maximum Bytes Delimiter. Note that the following delimiters (time, length) when they are selected are programmed in the OR logic. Meaning that if any of the two conditions were met, the device would transmit the serial data in its buffer over the network.

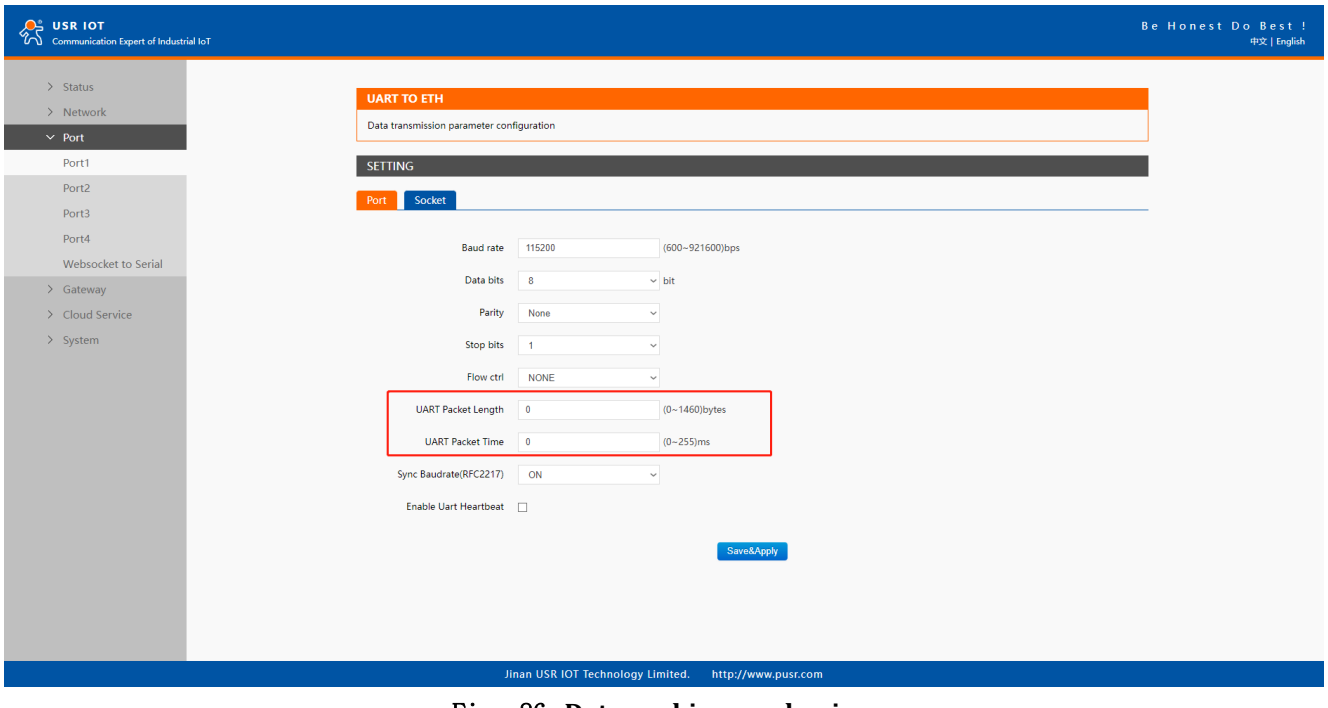


Fig. 86 Data packing mechanism

Packet time: USR-TCP232-E2 will transmit the serial data in its buffer when the specified time interval has reached and no more serial data comes in. The default value is calculated automatically based on the baud rate. If the automatic value results in chopped data, the timeout could be increased manually by specifying a larger value in the text box above. Note that the maximum interval is 255 milliseconds. This option is disabled by default.

The optimal "Interval timeout" depends on the application, but it must be at least larger than one-character interval within the specified baud rate. For example, assuming that the serial port is set to 1200 bps, 8 data bits, 1 stop bit, and no parity. In this case, the total number of bits needed to send a character is 10 bits (included 1 start bit), and the time required to transfer one character is (10 (bits)/1200 (bits/s))*1000 (ms/s) = 8.3 ms. Therefore, you should set the "Interval timeout" to be larger than 8.3 ms. Rounding 8.3 ms to the next integer would give you 9 ms. Which can be set as your interval timeout.

Packet length: USR-TCP232-E2 will transmit the serial data in its buffer when the specified length in the unit of bytes has reached. If you would like USR-TCP232-E2 to queue the data until it reaches a specific length,the data length can be configured for 1 to 1460 bytes. If the data length (in bytes) matches the configured value, the data will be forced out. Set to 0 if you do not need to limit the length.

7.2. Heartbeat packet

Network heartbeat packet: The serial device server sends a heartbeat packet regularly to notify the server that it is active and maintains a normal network connection with the server. This function is only allowed when the working mode is UDP and TCP Client.

Serial heartbeat packet: The serial device server notifies the serial device it is active via packet, and this packet can also be used to actively capture sensor data.

Heartbeat packet only works in no data traffic in the setting direction. There are no data coming from serial port or internet in heartbeat

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interval.

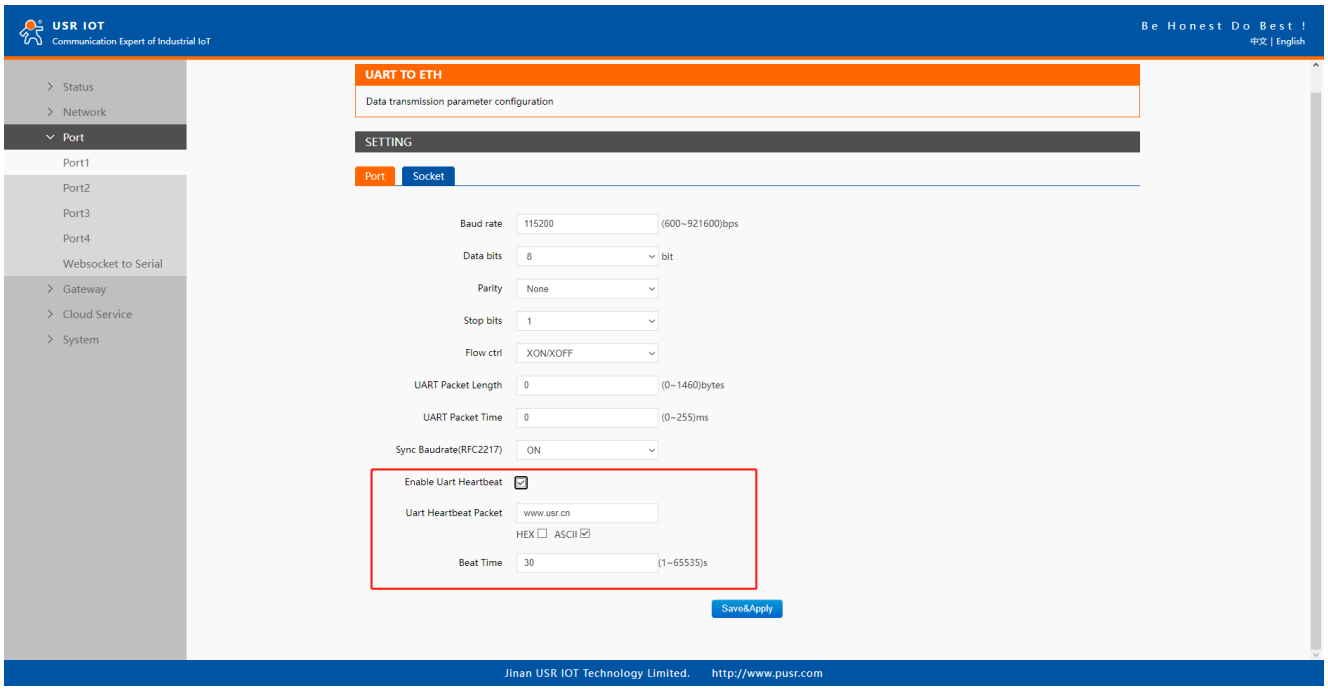


Fig. 87 **Serial heartbeat packets**

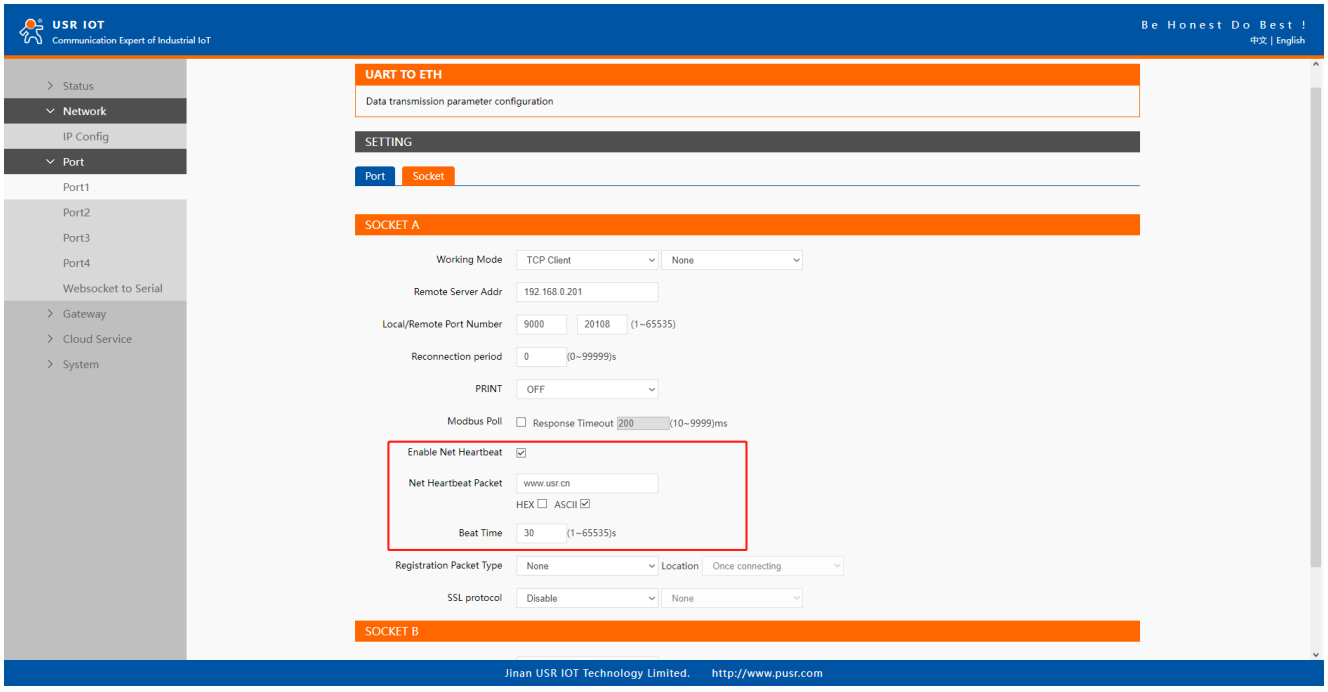


Fig. 88 **Network heartbeat packets**

7.3. Registration packet

This function is only allowed when the working mode is UDP and TCP Client. The content of the registration packet can be up to 40 bytes long. Users can choose to display this content in hexadecimal format or ASCII format.

Once connected: The registration packet is only sent once when the network connection is established;

Prefix of DATA: The registration packet is filled in front of the serial port data every time the serial port sends data to the network;

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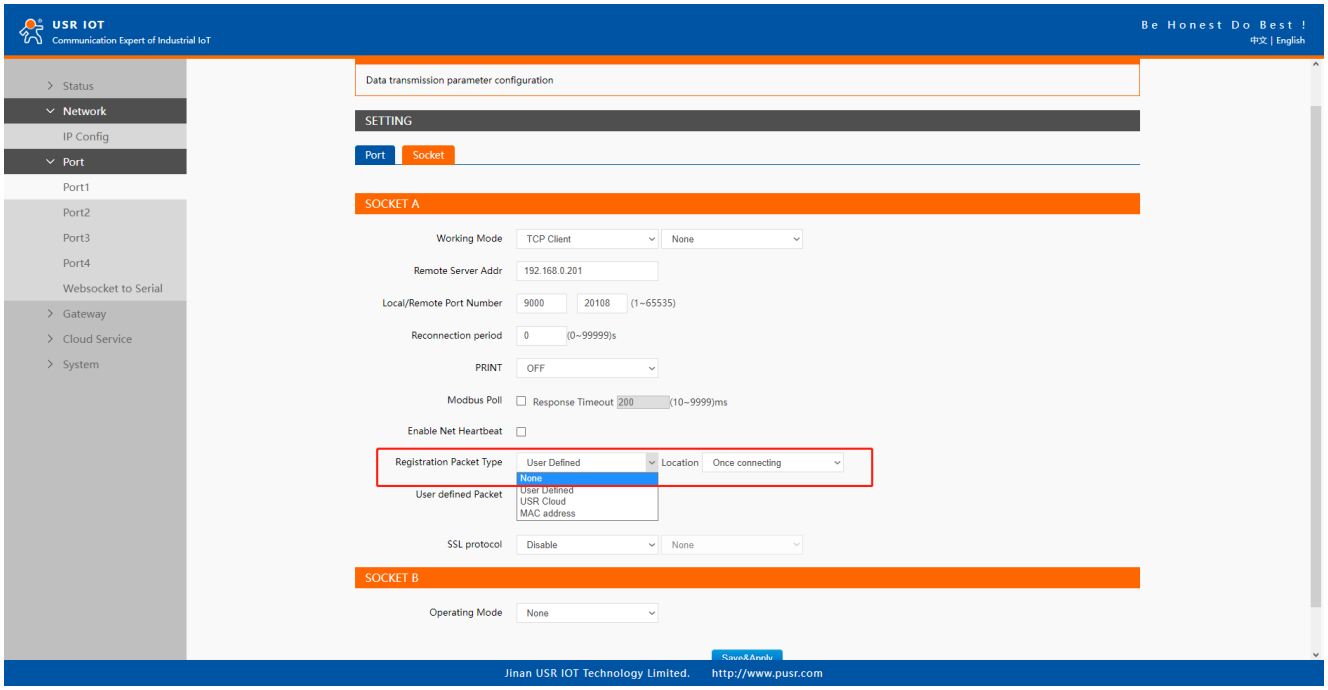


Fig. 89 **Registration packet type**

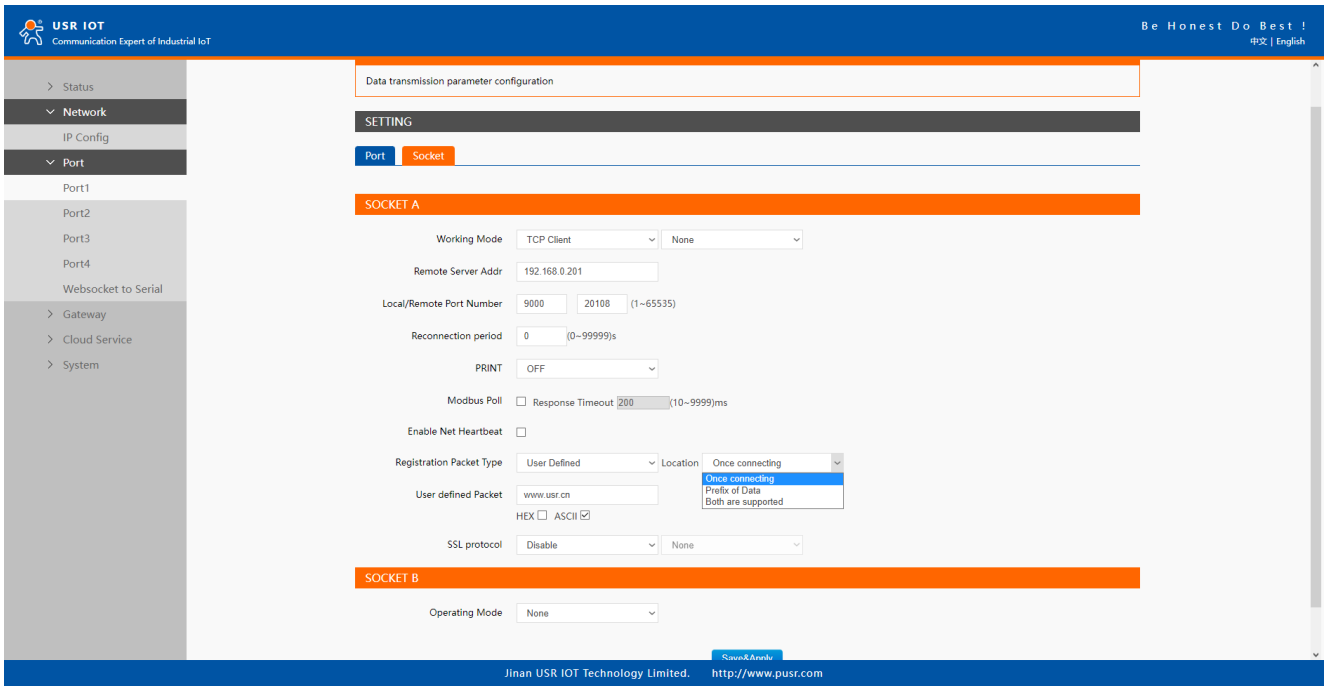


Fig. 90 **Registration packet method**

7.4. Socket B

Socket B supports TCP Client and UDP Client. Socket B and Socket A share the registration packet and heartbeat packet. When Socket B initiates a connection, it uses a random local port number to connect to the target server.

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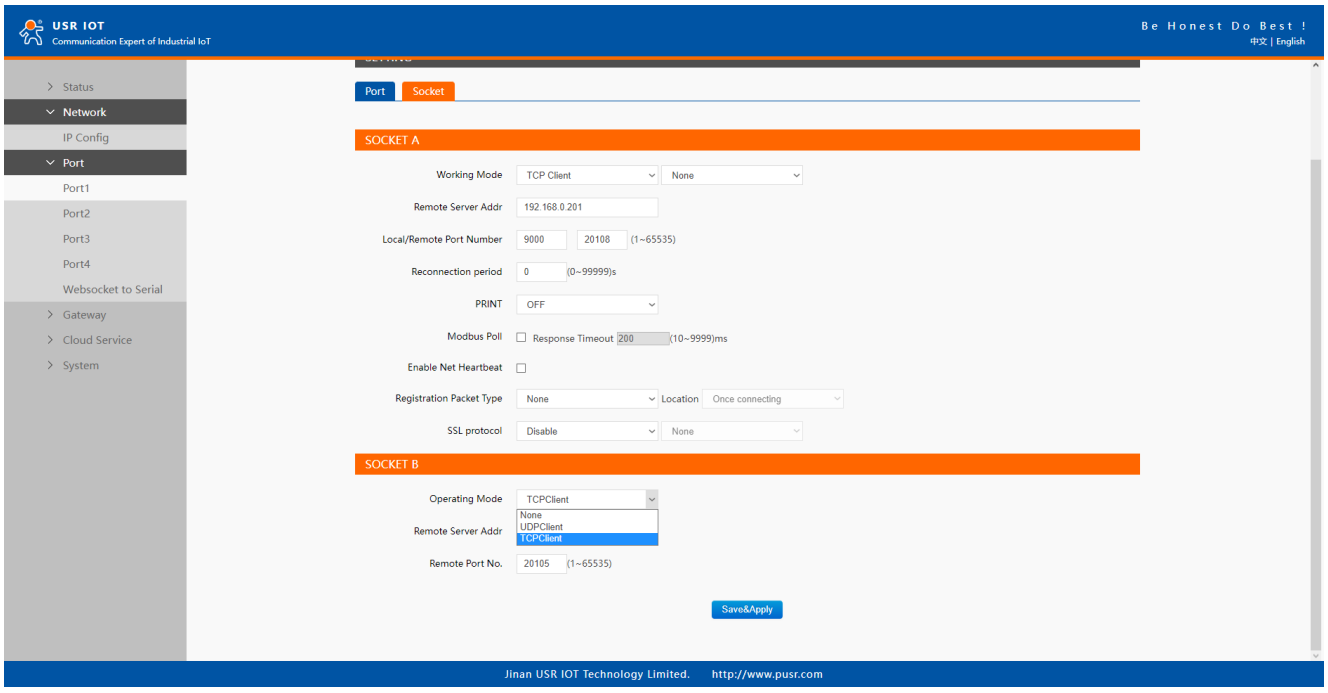


Fig. 91 **Socket B operating mode**

7.5. Rs485 bus detection

If RS485 bus is in the receiving state, E2 can not output data to serial port to achieve the 485 bus anti-conflict function.

Idle time: the interval time when E2 is allowed to send data to RS485 bus after the receiver is idle. The value ranges from 0 to 65535 (ms). Default value: 10. This parameter is mandatory.

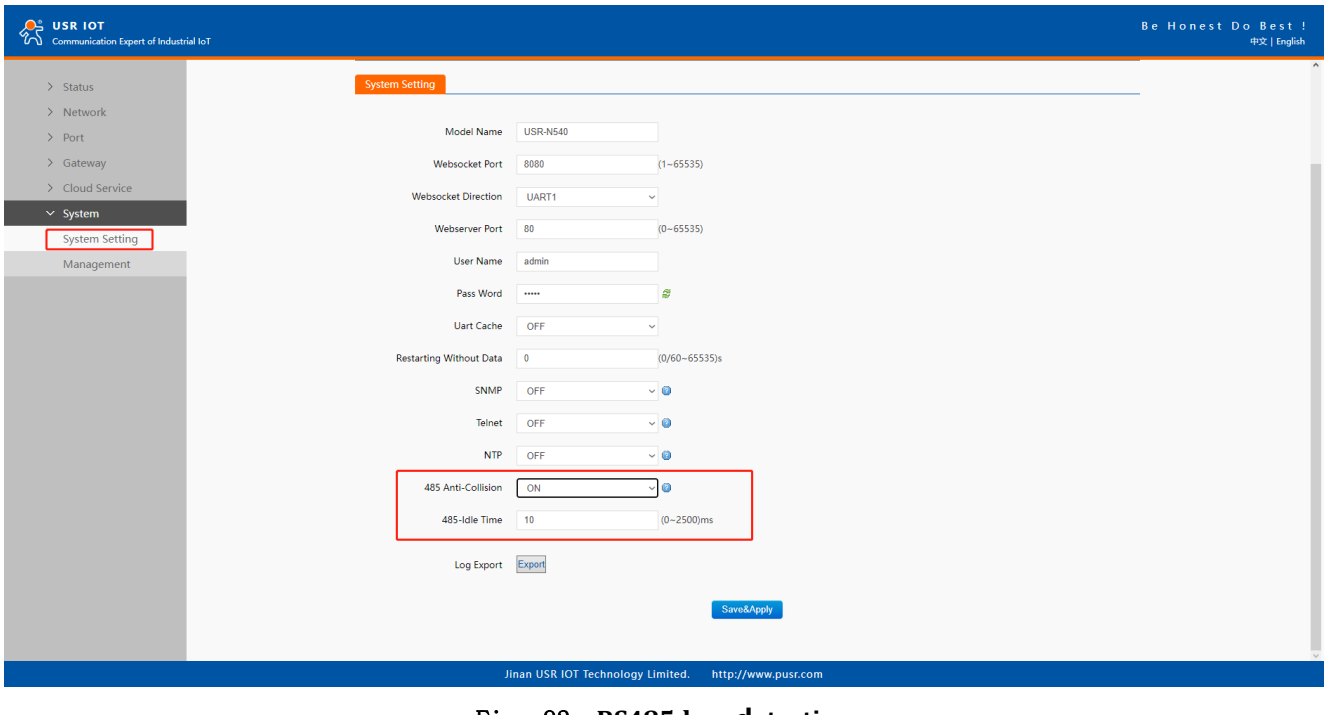


Fig. 92 **RS485 bus detection**

7.6. Serial Printer setting

Serial device servers transform any serial device into an Ethernet-capable device that can be used in a network. These servers allow serial devices such as a printer, control mechanisms or control systems to be used in a network without relying on the serial port of a computer for connectivity. This way, any serial device can be connected to the network and the internet and accessed from anywhere. Sharing a printer among coworkers in the same physical office can be implemented with a simple module that does not need to offer security or

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authorization capabilities.

The E2module features a Serial Printer option which functions in similar fashion to the Serial Printer option in the (COM) Ports dialog box. This option allows the associated TCP port to be identified as a serial printer connection. The connection does not consume a user license, is restricted to output only, and filters out the end-of-document marker correctly. In this case, IP address of USR-TCP232-E2 is 172.16.11.131.

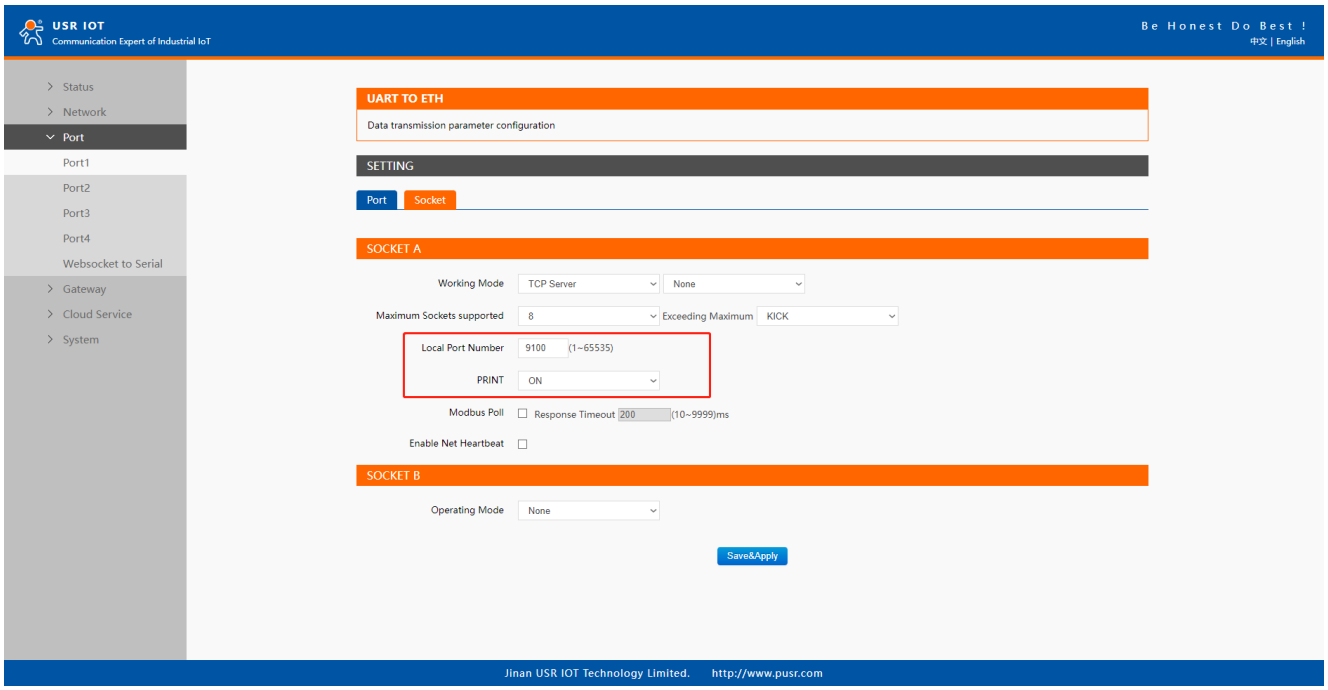


Fig. 93 **Serial printer option**

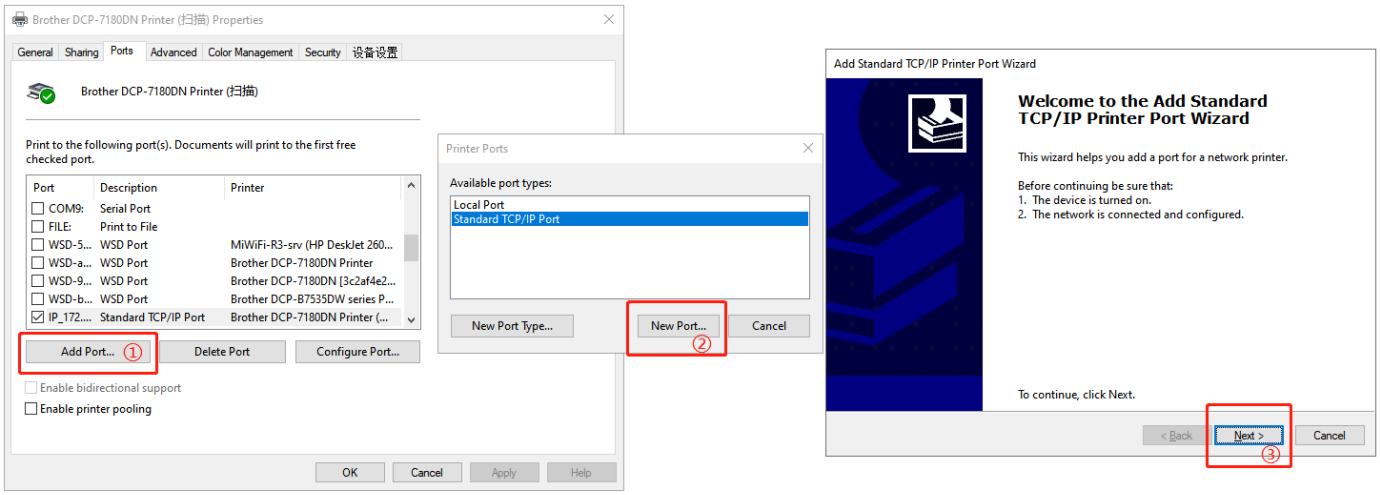


Fig. 94 **Serial printer setting wizard 1**

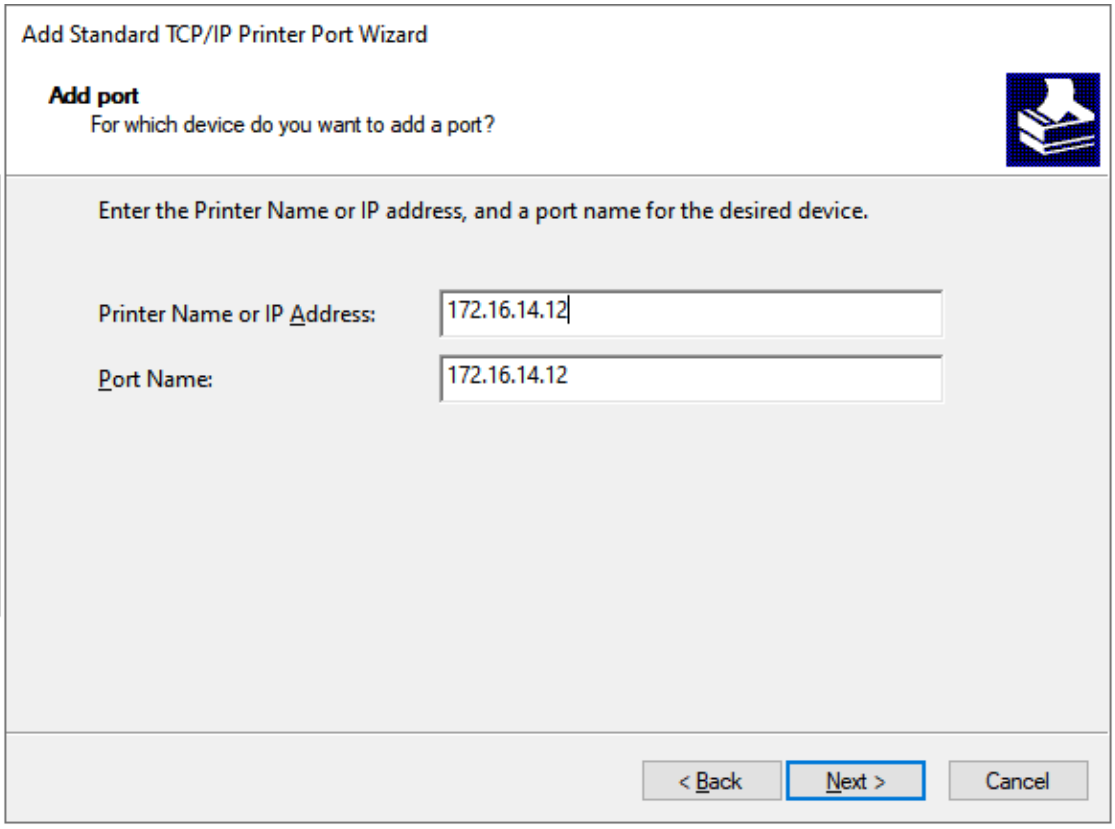


Fig. 95 **Serial printer setting wizard 1**

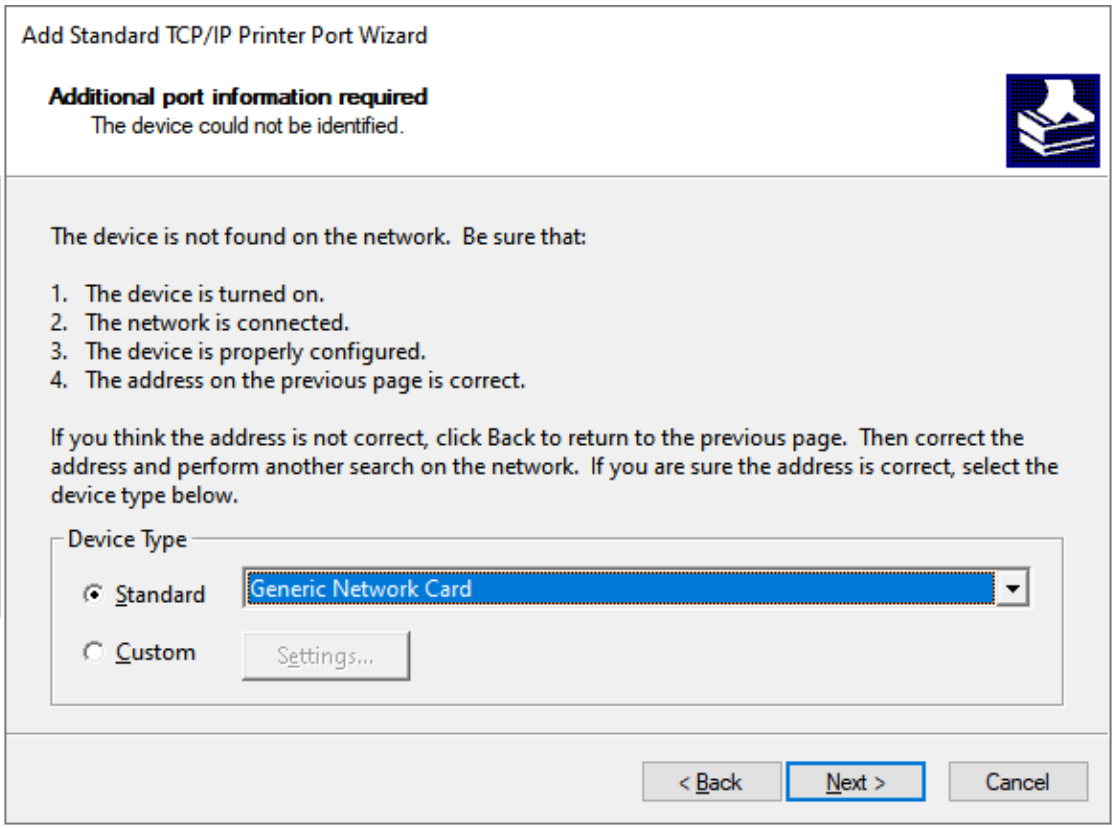


Fig. 96 **Serial printer setting wizard 1**

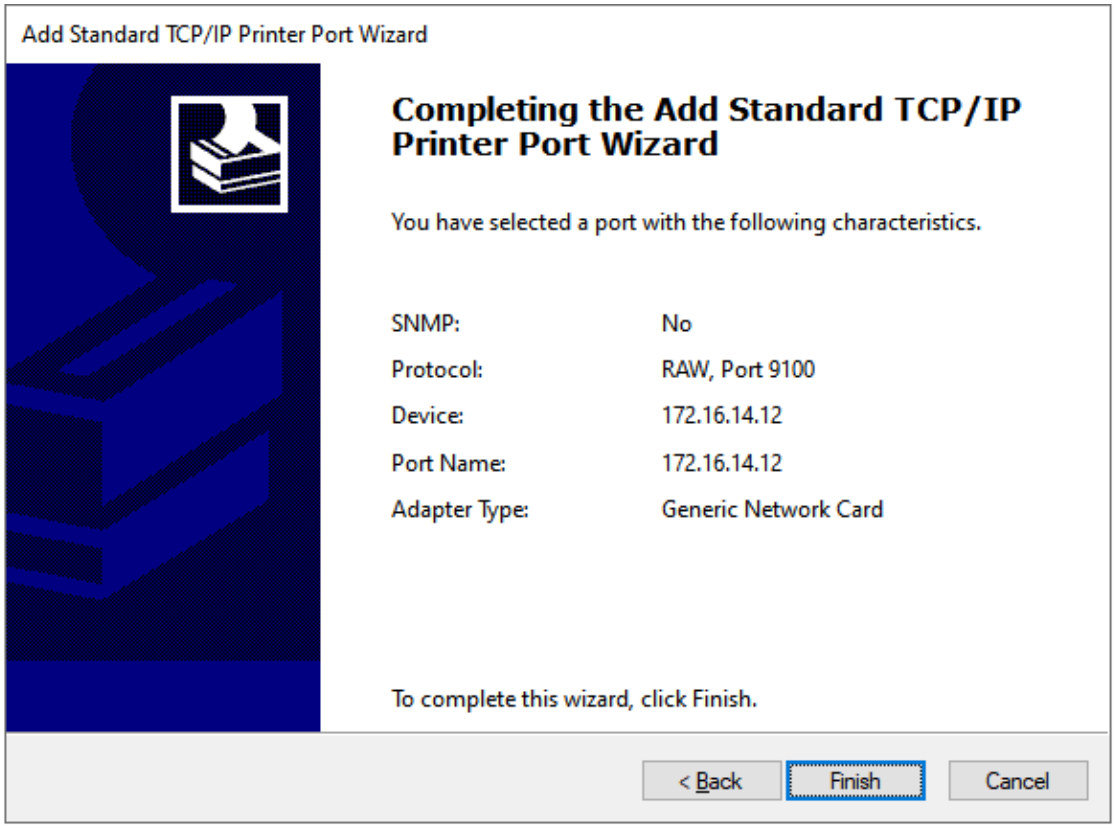


Fig. 97 **Serial printer setting wizard 1**

7.7. NTP

If device is connected to the internet or to a local NTP server, the Date/time can be set automatically by enable NTP function. If this option is chosen, the default value "cn.ntp.org.cn" should be shown in the NTP server field. User can select a proper Time Zone from the dropdown box. If the E2 device is connected to the Internet and should connect to other servers over the Internet to get NTP server, you will need to configure the DNS server to be able to resolve the host name of the NTP server.

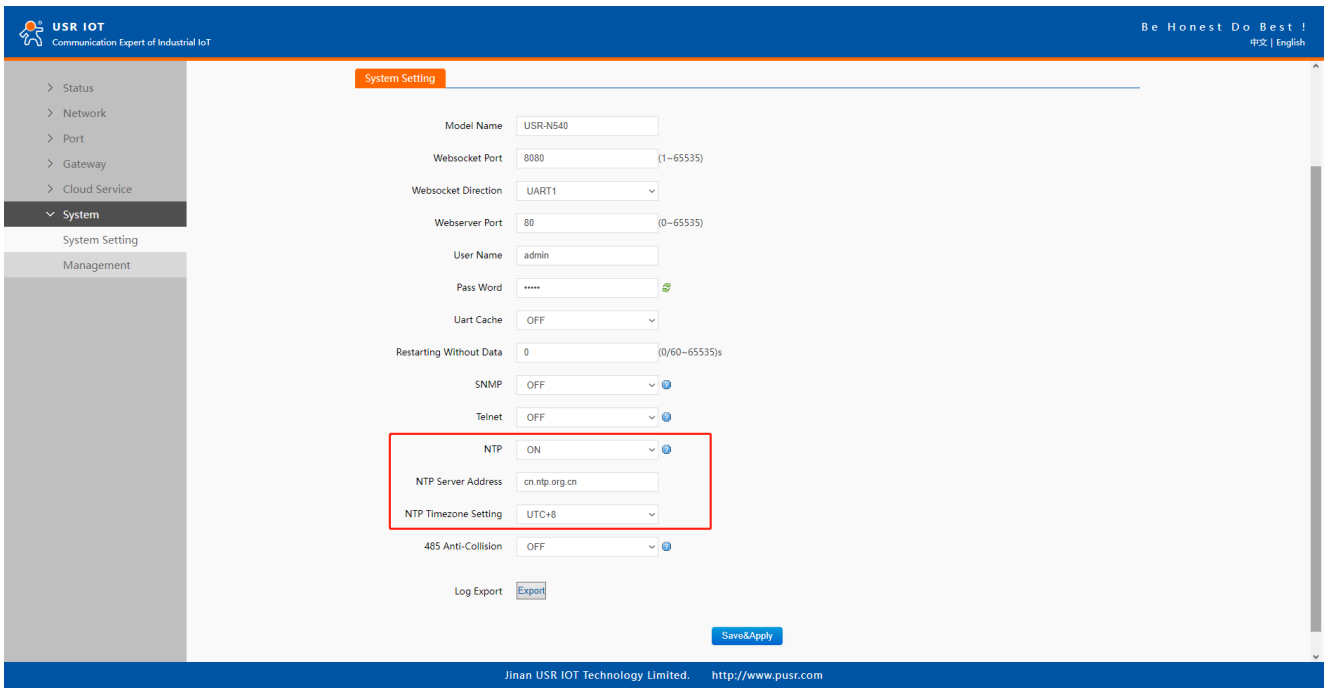


Fig. 98 **NTP settings**

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7.8. SNMP

The Simple Network Management Protocol (SNMP) is used by network management software to monitor devices in a network, to retrieve network status information of the devices, and to configure network parameters of the devices.

To make the device’s information available for public viewing/editing, you can enable the SNMP function by checking the Enable box. The supported SNMP Version:v1/v2c.The default SNMP Community Strings (or passphrases) is “admin”.

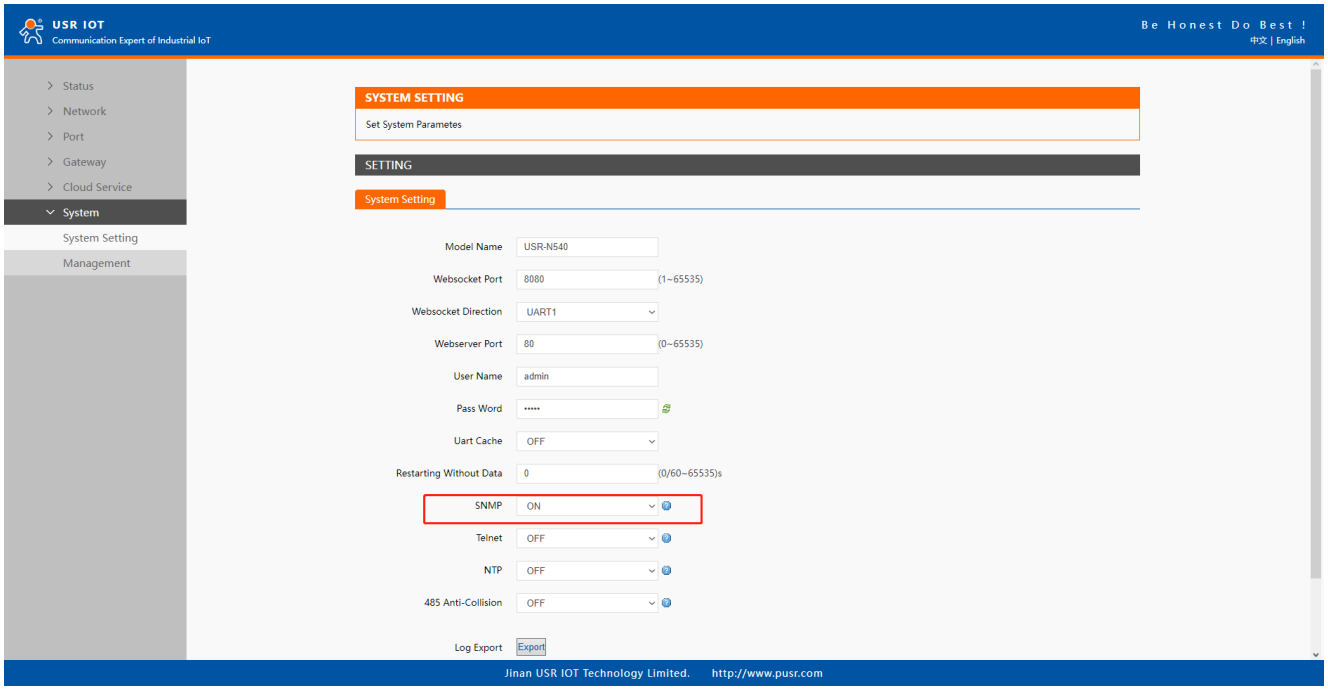


Fig. 99 Enable SNMP agent

Table 19 PUSR OID list

Item	OID
IP address	.1.3.6.1.2.1.4.20.1.1.172.16.11.131
Subnet mask	.1.3.6.1.2.1.4.20.1.3.172.16.11.131
Preferred DNS	.1.3.6.1.2.1.12.5.0
Alternate DNS	.1.3.6.1.2.1.12.6.0
Gateway	.1.3.6.1.2.1.4.21.1.1.172.16.11.131
Running time	.1.3.6.1.2.1.1.3.0
Port1	.1.3.6.1.2.1.13.1.0
Port2	.1.3.6.1.2.1.13.2.0
...	...
Port8	.1.3.6.1.2.1.13.8.0
Firmware version	.1.3.6.1.2.1.12.1.0
Hardware version	.1.3.6.1.2.1.12.2.0

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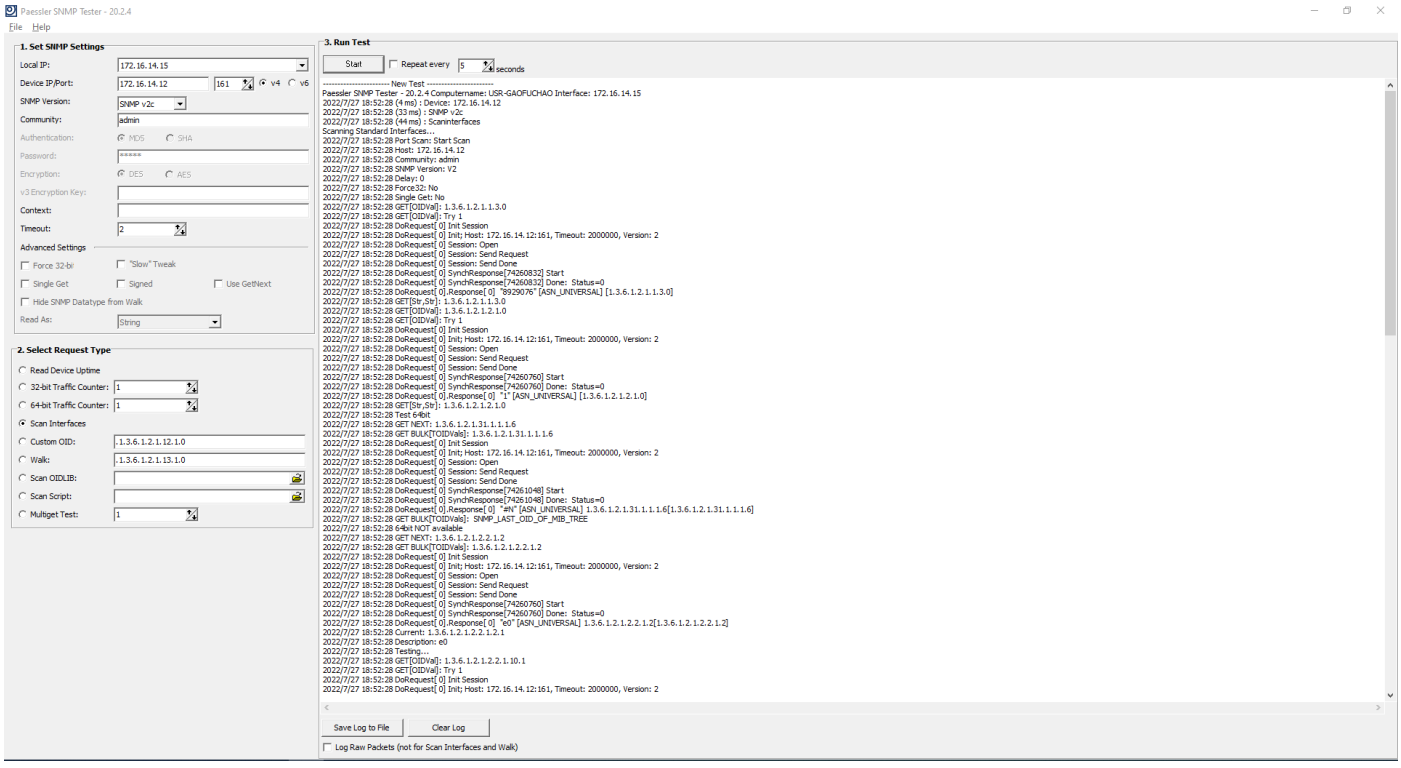


Fig. 100 SNMP test

7.9. User-defined webpage

PUSR opens the source code of the built-in webpage to users. Users can modify it according to their own needs, which helps customers fully develop the products.

7.9.1. Edit webpage file

Users can download the built-in webpage package first:The file in usr_web folder can be edited as user needed.

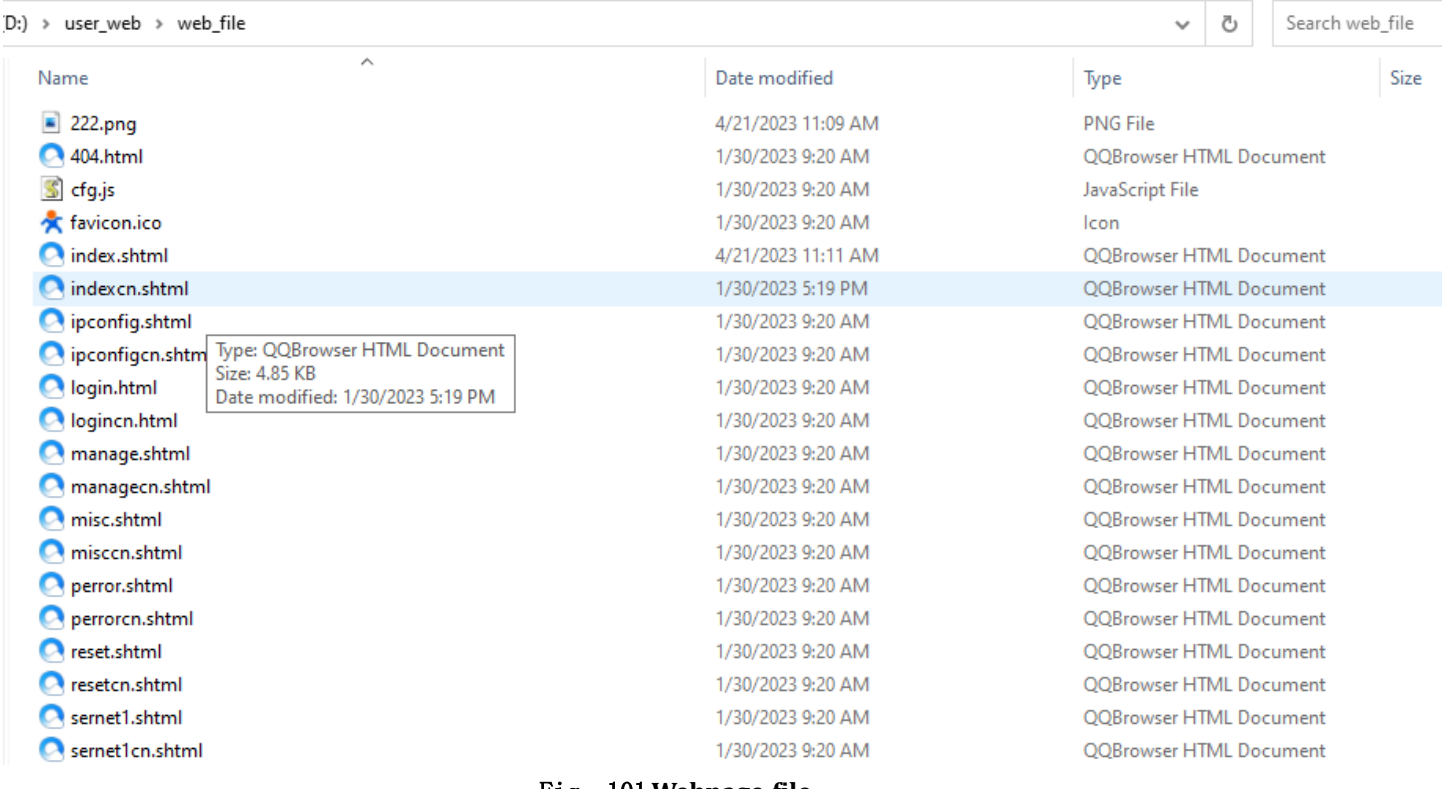


Fig. 101 Webpage file

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7.9.2. Upgrade the webpage

1>Search the device with the EthnetTool, Right-click a desired device to display the settings menu, select Web Upgrade.

2>In the following webpage, Please make sure the E2 and the PC in the same network,

3>Click upgrade, After the device restarted, users can access the webpage to check.

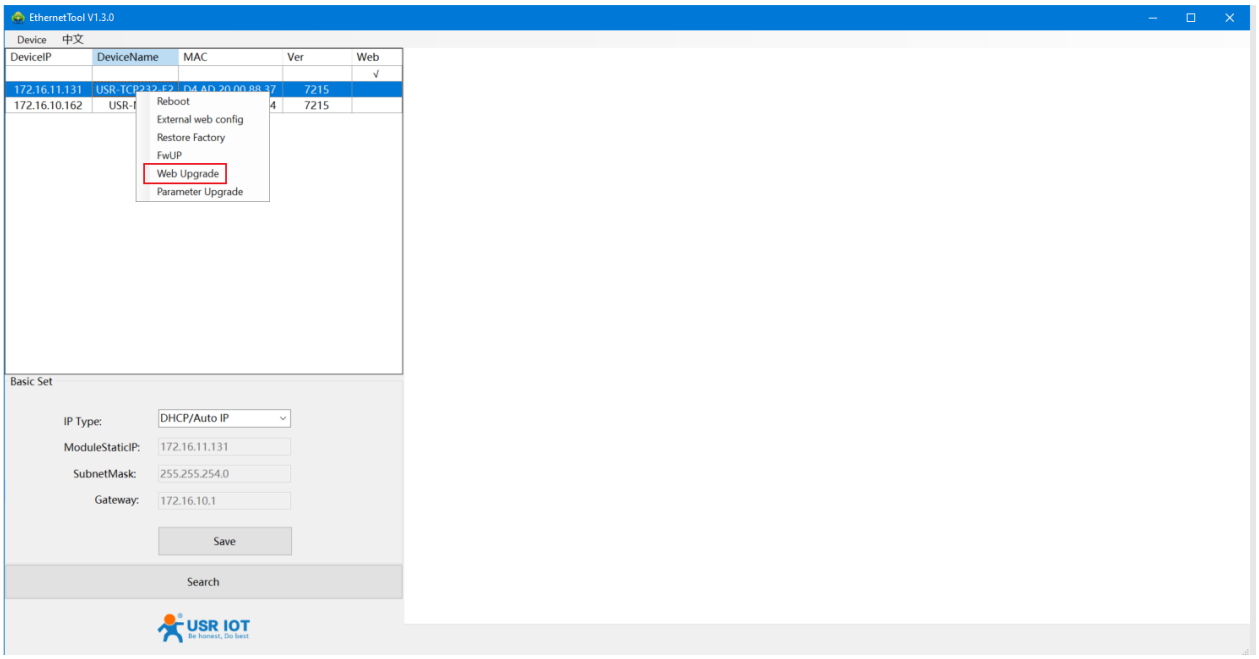


Fig. 102 **Web Upgrade**

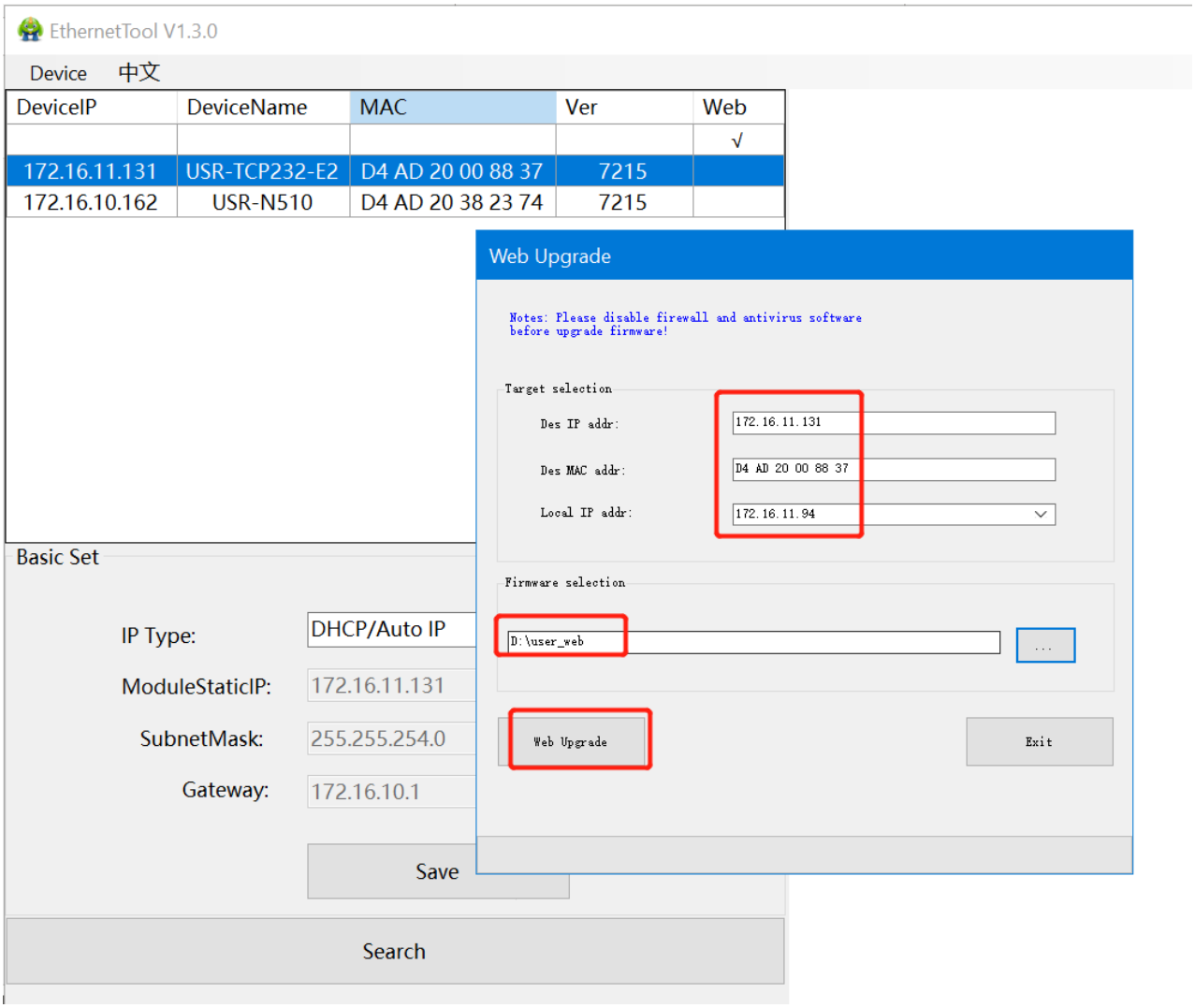


Fig. 103 **Web upgrade parameters**

7.10. Log information

The function is reserved for PUSR's technician. Users may not pay attention to this feature as it is not commonly used.

7.11. HTTPS

Through chapter 3.2 ， users know that the device can be accessed by using a web browser with HTTP protocol. The device provides another accessing protocol: HTTPS which can protect data during transmission while accessing web pages. Unlike HTTP, HTTPS uses SSL/TLS encryption technology to encrypt and protect data transmission, thereby preventing data from being eavesdropped or tempered with.

This function is OFF in default and can be enabled in the following figure. Users can upload their own Server CA and server key. If users don't have one, the system will use the built-in certificate and private key.

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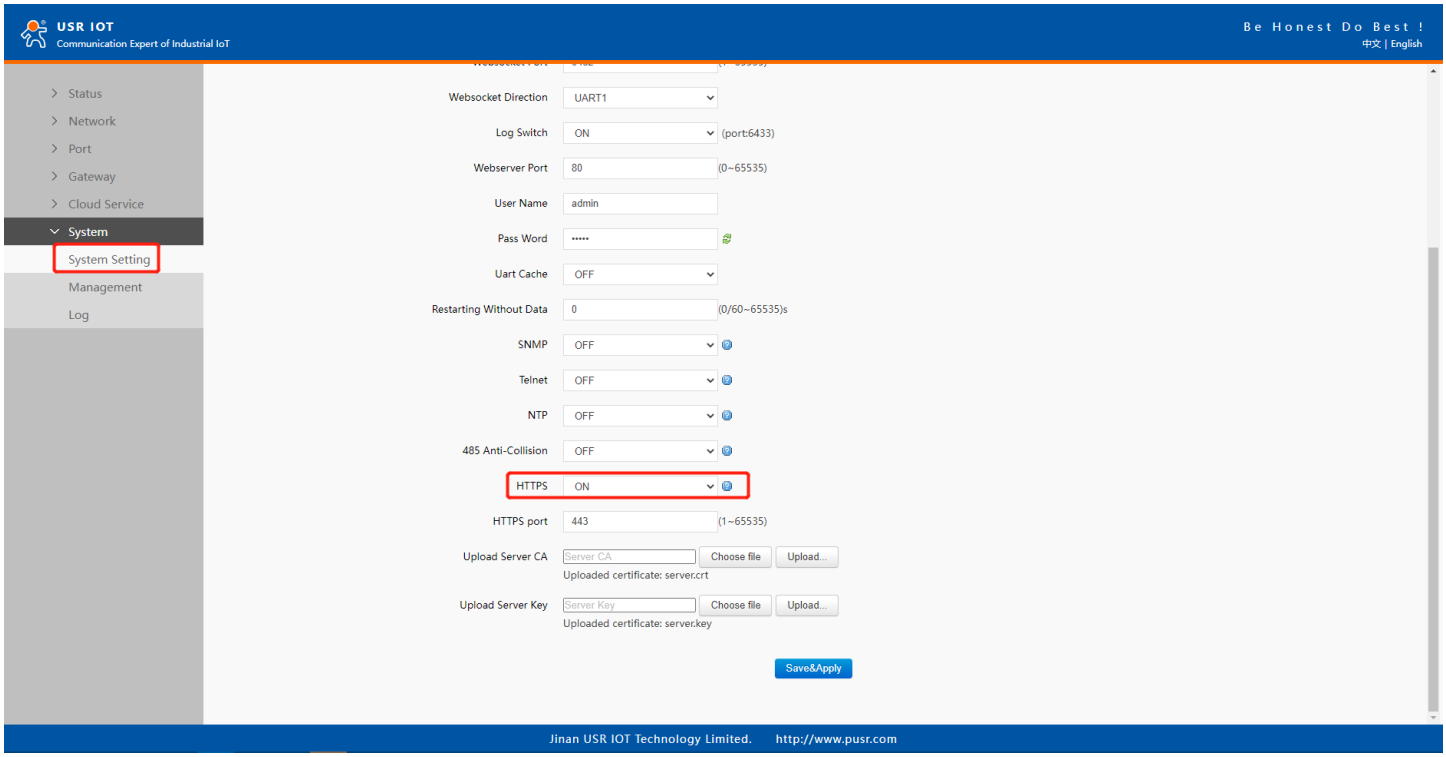


Fig. 104 HTPPS

8. MQTT gateway

Although the MQTT protocol has been around for nearly three decades, the design of the protocol makes it ideal for IIoT (Industrial Internet of Things) applications, the latest trend in automation engineering. This is particularly true for applications that stress "active notification," in which devices provide data only when needed, as opposed to "passive notification," in which devices are polled at regular intervals. MQTT's broker/client design eliminates the need for all devices in the system to be online at the same time. The clients (i.e., "devices" or "things") communicate directly with the broker, which plays the role of middleman to pass messages back and forth between clients.

8.1. Basic settings

When configuring the Broker information,Client ID, Host, and Port are already filled in by default. You can also modify it by yourself based on the actual Broker information. We will use Free Public MQTT Server provided by EMQX Cloud as the MQTT server address for quick testing.

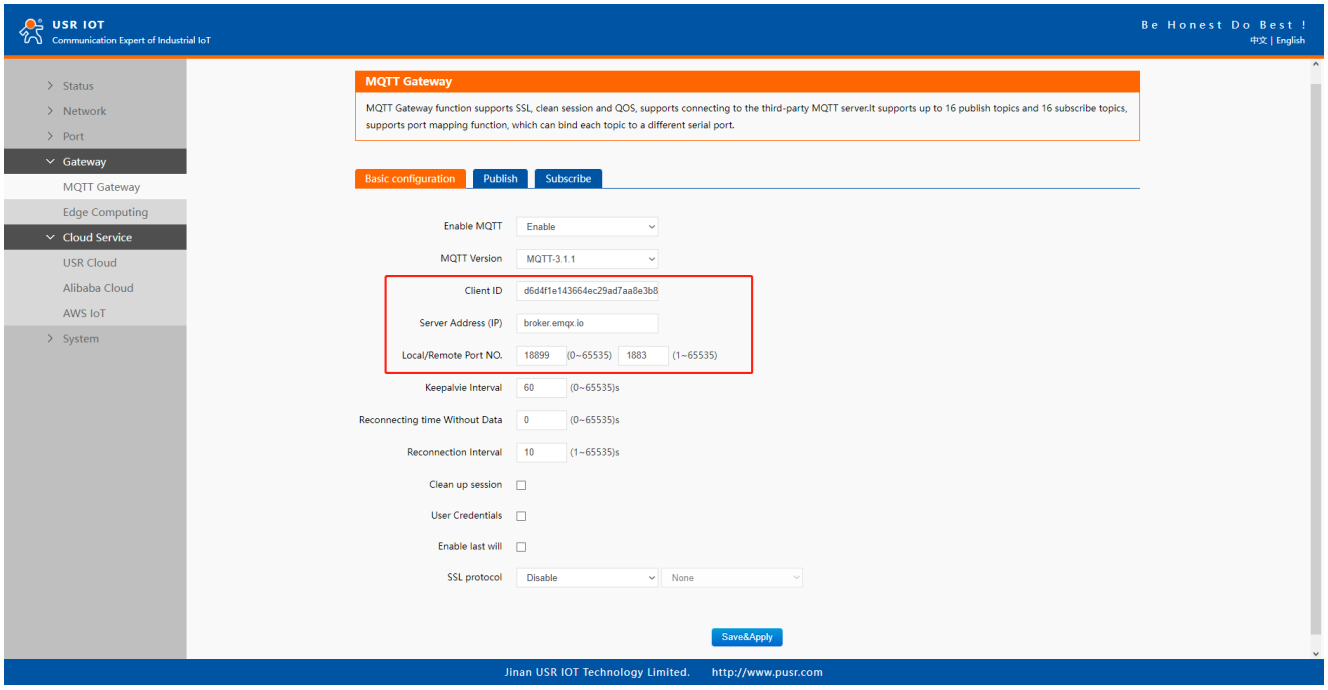


Fig. 105 MQTT broker setting

If your broker has enabled user authentication, you can fill in the information of Username and Password in the configuration item.

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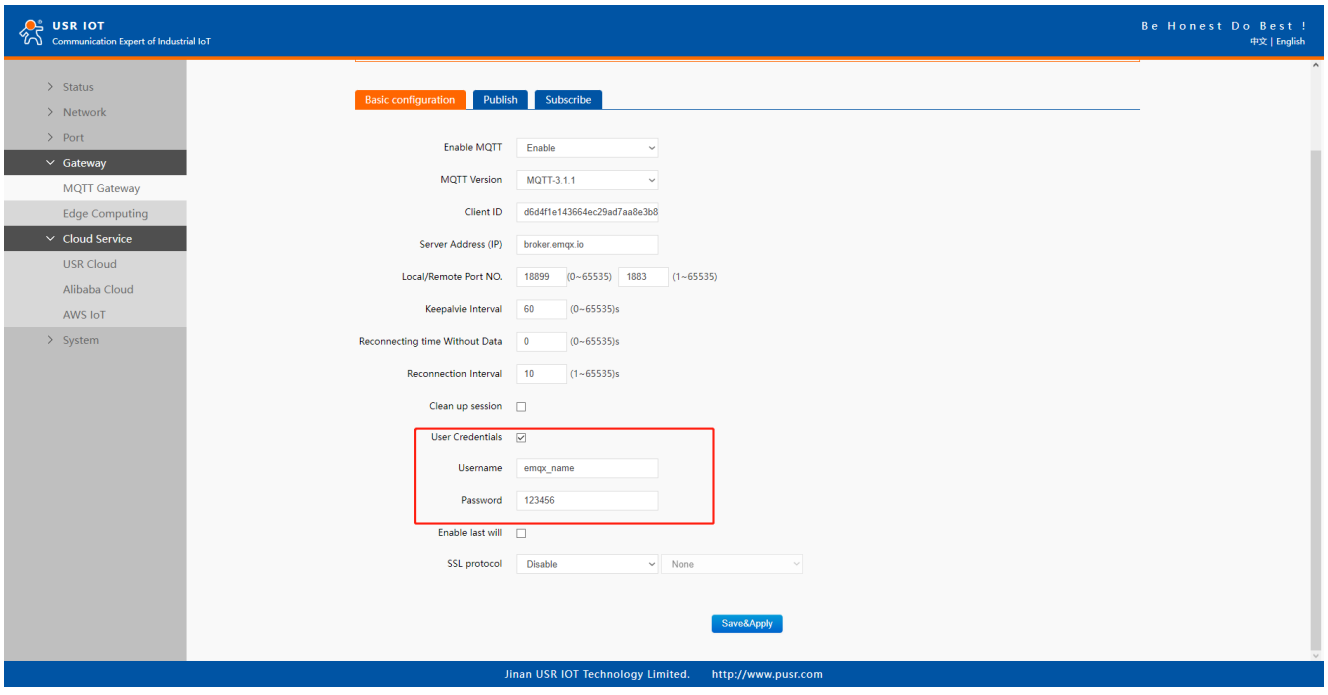


Fig. 106 **User credential**

When you need to enable SSL/TLS authentication, you need to set the SSL/TLS configuration item. The two versions,TLS 1.0 and TLS 1.2 are provided. If SSL/TLS is selected, certificate configuration can be performed. If it is a one-way connection, you only need to select your CA File. If it is a two-way authentication, you also need to select to configure Client Certificate File and Client key file. Click the choose file button on the far right to select the certificates you have generated.

- ✧ Uploads a Certificate Authority (CA) file. A Certificate Authority (CA) is an entity that issues digital certificates. A digital certificate certifies the ownership of a public key by the named subject of the certificate.
- ✧ Uploads a client certificate (cert) file. A certificate file is a type of digital certificate that is used by client systems to make authenticated requests to a remote server.
- ✧ Uploads a private key file.

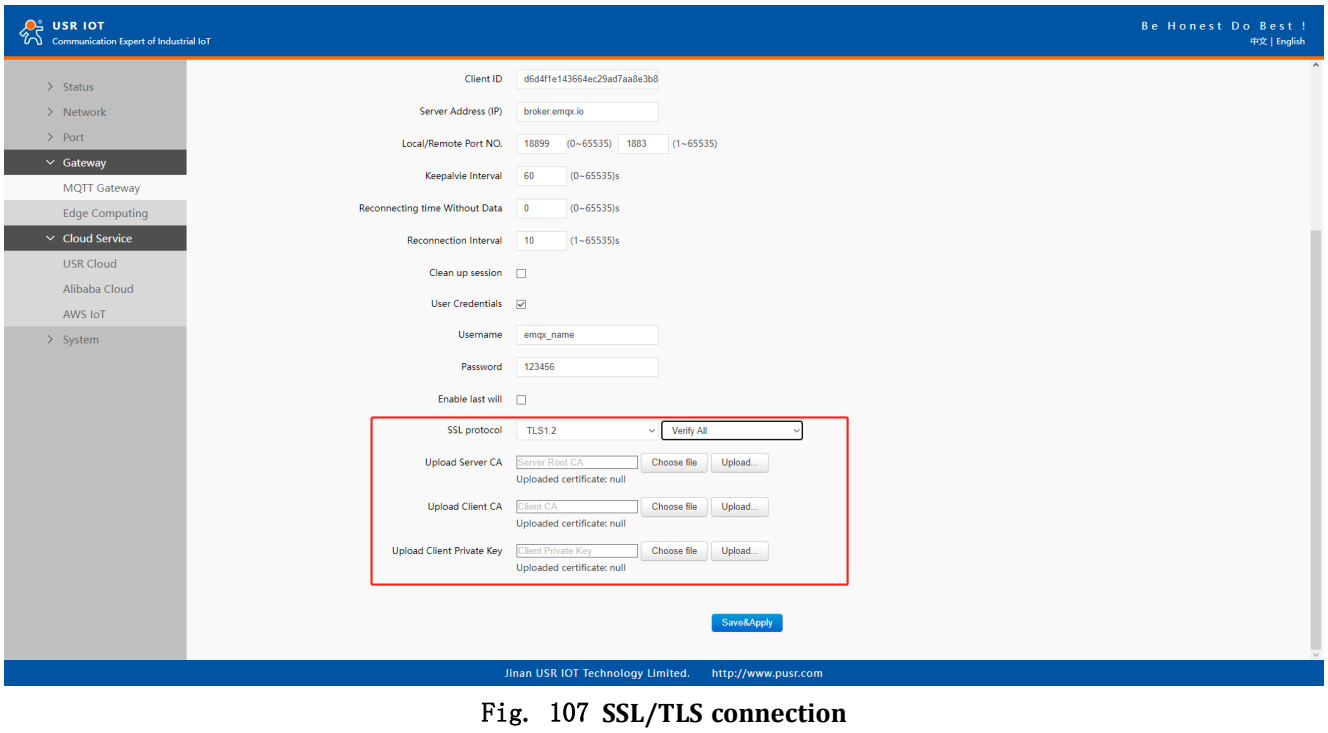


Fig. 107 **SSL/TLS connection**

you can configure KeepAlive, Clean Session, Auto Reconnect, MQTT Version, etc.

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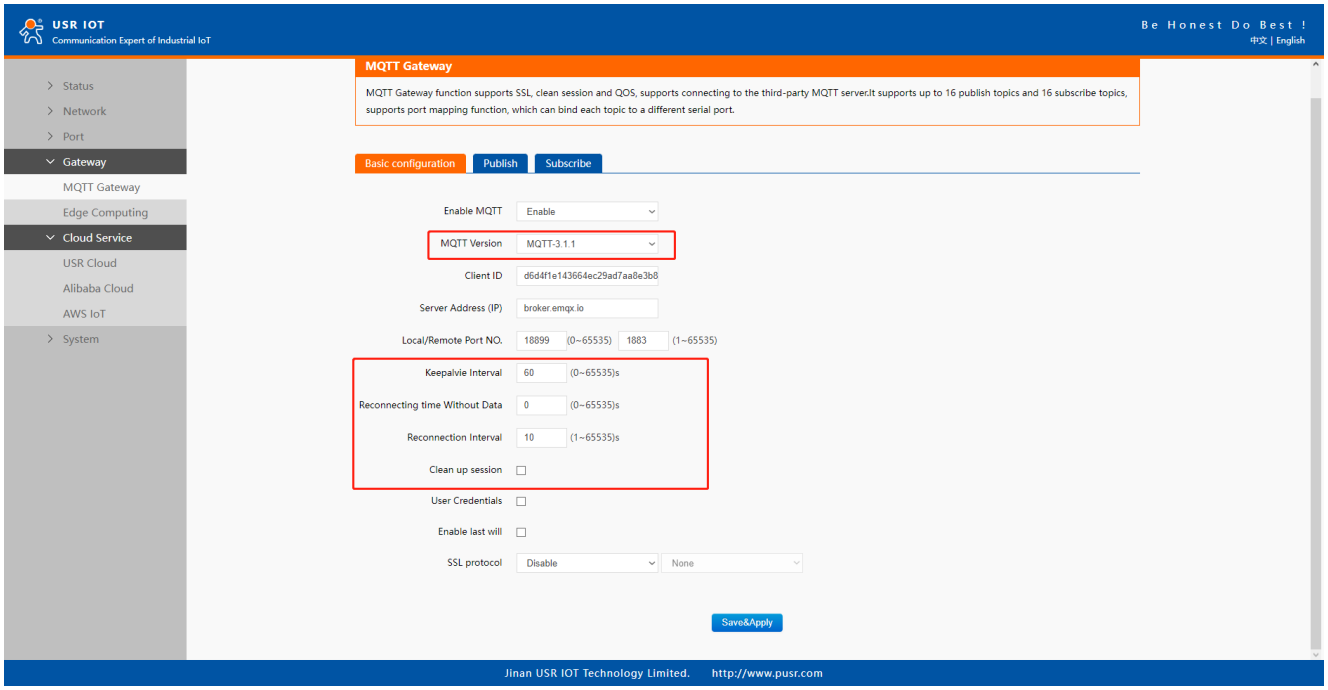


Fig. 108 **Advanced configuration**

You can configure the Will Message. The values of Last-Will-QoS and Last-Will-Retain are filled with 0 and False by default. When you enter the values of Last-Will-Topic and Last-Will-Payload, you can complete the configuration of Will Message.

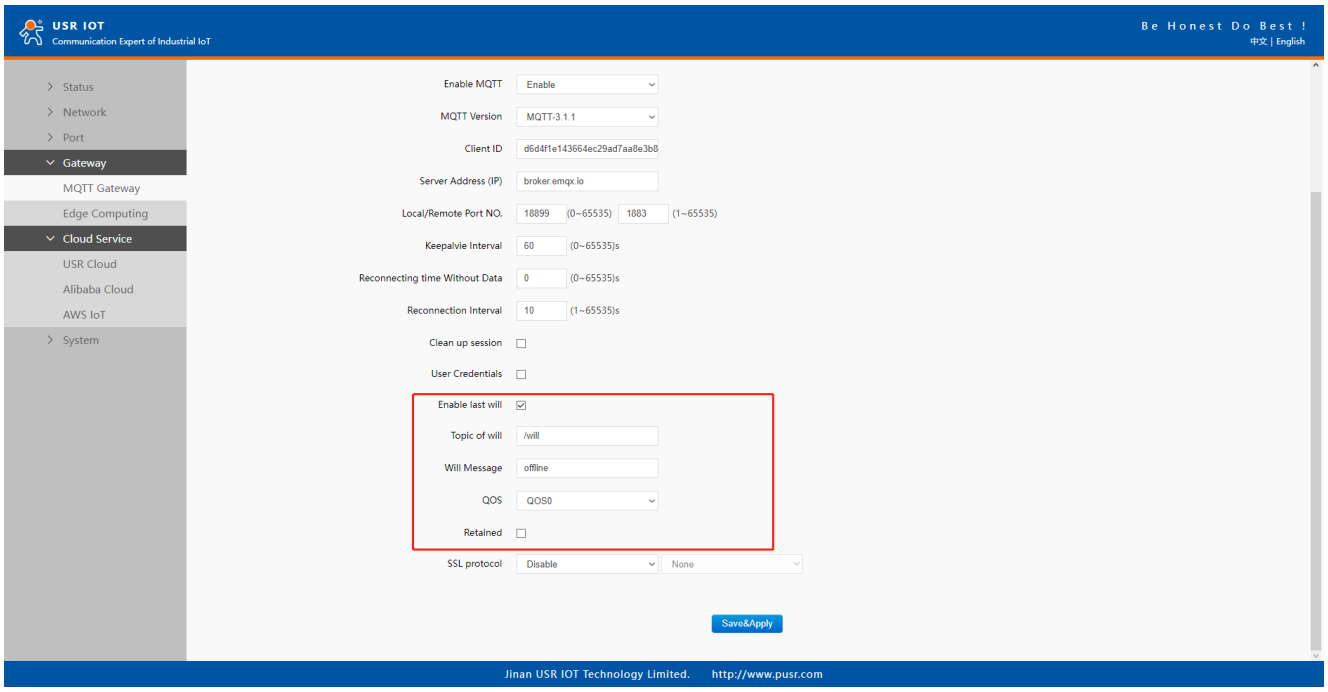


Fig. 109 **Last will message**

After finishing configuring the basic settings, please scroll down to the bottom of the page and click on "Save & Apply" button to save all the changes that you have made. All configurations take effect after a system reboot. In this case we only finish the follow parameters setting.

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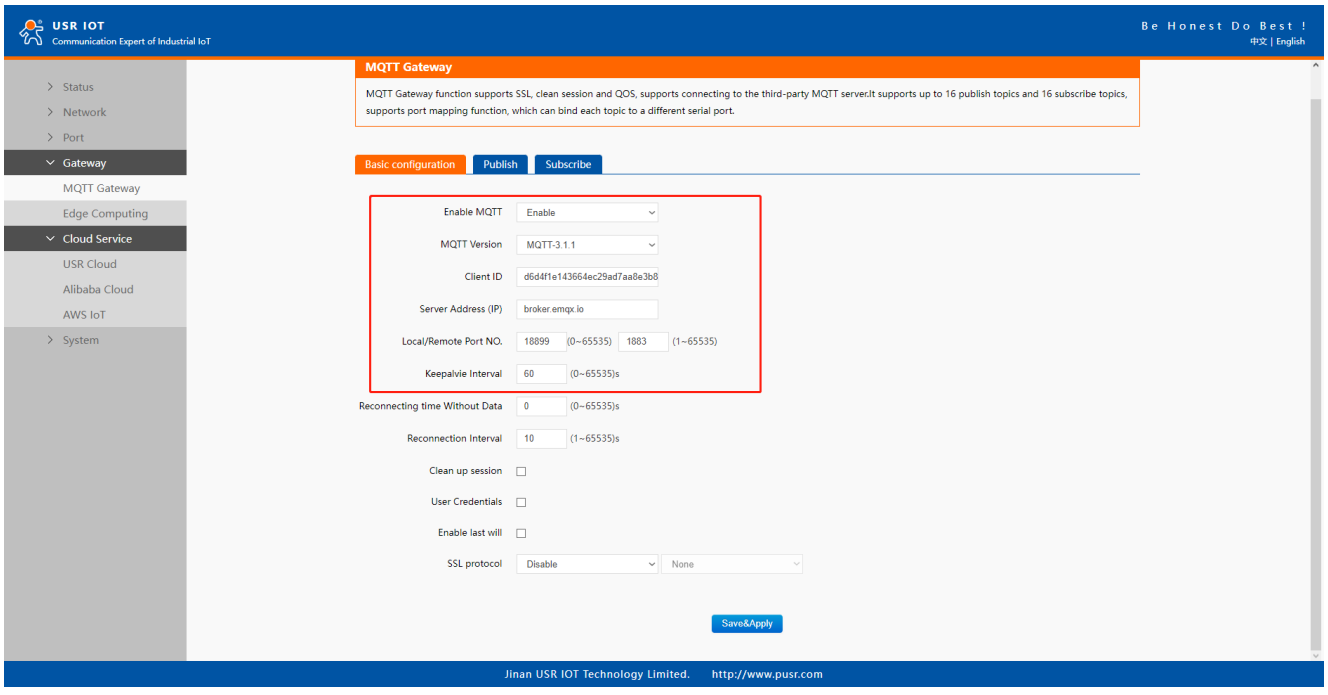


Fig. 110 **EMQX broker connection**

To view the status of the device, choose Status>Overview, the device is in the CONNECTED state, the connection to IoT Hub is successful, and publishing and subscribing operations can be performed.

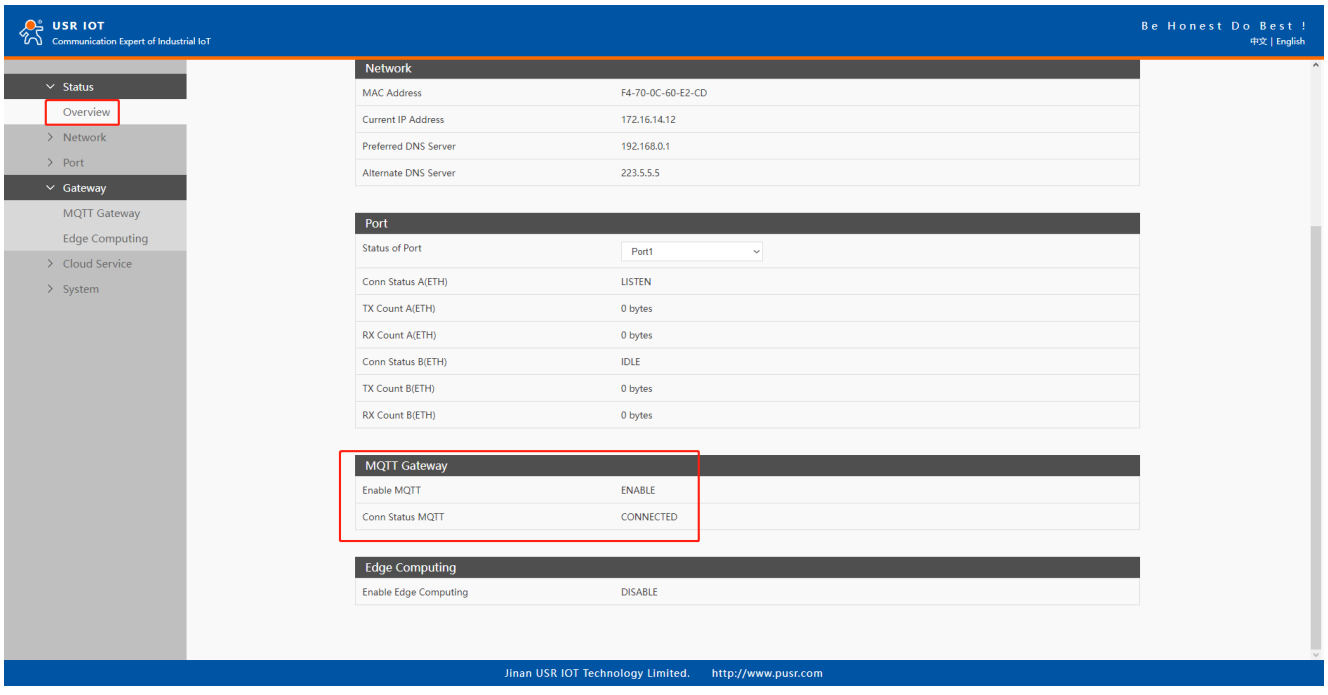


Fig. 111 **MQTT connection status**

8.2. Publishing a message

8.2.1. MQTT.fx tool introduction

MQTT.fx is a mainstream MQTT desktop client. Compatible with Windows, macOS, and Linux, it can quickly verify whether it is possible to connect to IoT Hub and publish or subscribe to messages. MQTT.fx in this article refers to version 1.7.1 without special instructions.

The main page is shown in the figure below. The top part is the MQTT Broker connection address bar and its connection configuration. The following function Tabs include Publish column, Subscribe column, Scripts column, Broker Status column, Log column for log information control.

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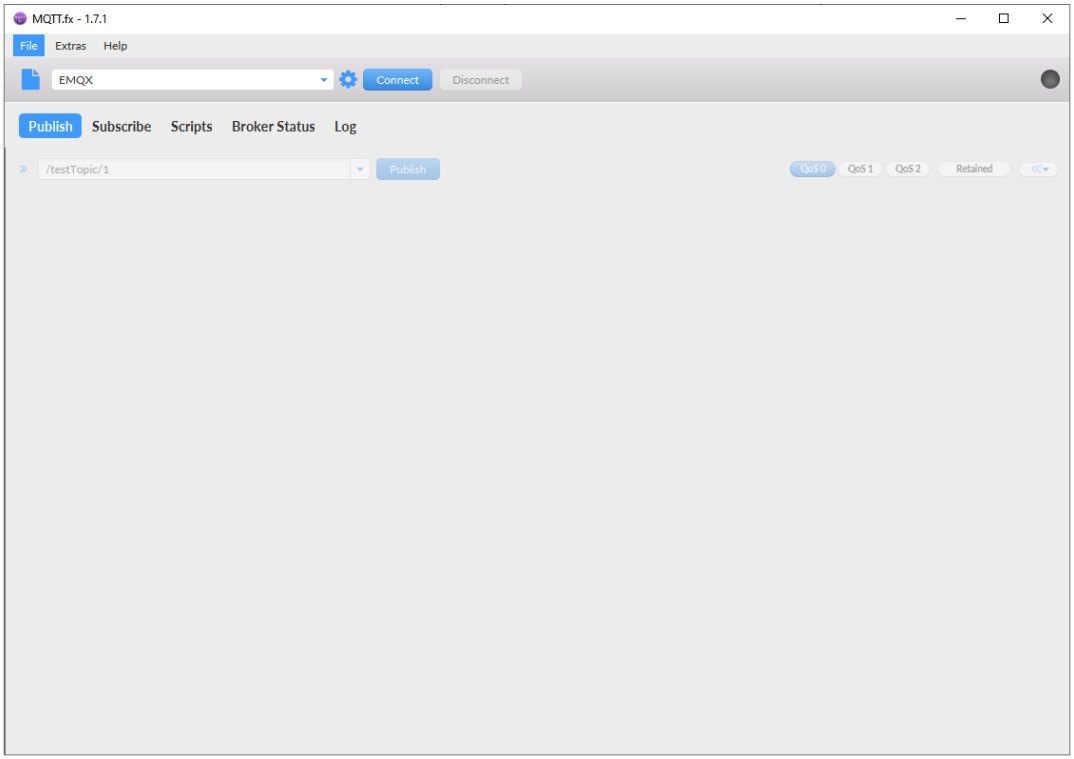


Fig. 112 MQTT.fx main page

First, the MQTT client and Broker need to establish a connection to communicate. Click the configuration icon on the right side of the input box in the connection address bar to enter the specific connection configuration. Select the Profile Type as MQTT Broker. Fill in broker.emqx.io for Broker Address and 1883 for Broker Port, as shown in the figure below:

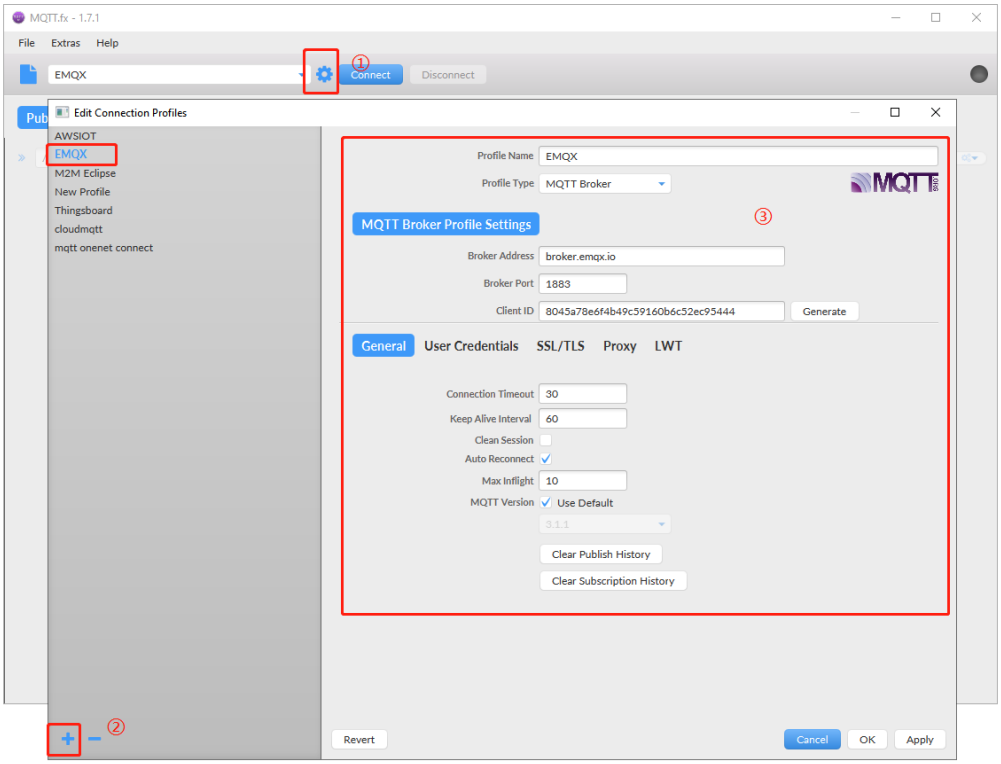


Fig. 113 Connection Profiles

Click OK to confirm the configuration, return to the main interface, and click Connect. It can be seen that the indicator on the right side turns to green, indicating that the current connection is successful, as shown in the following figure:

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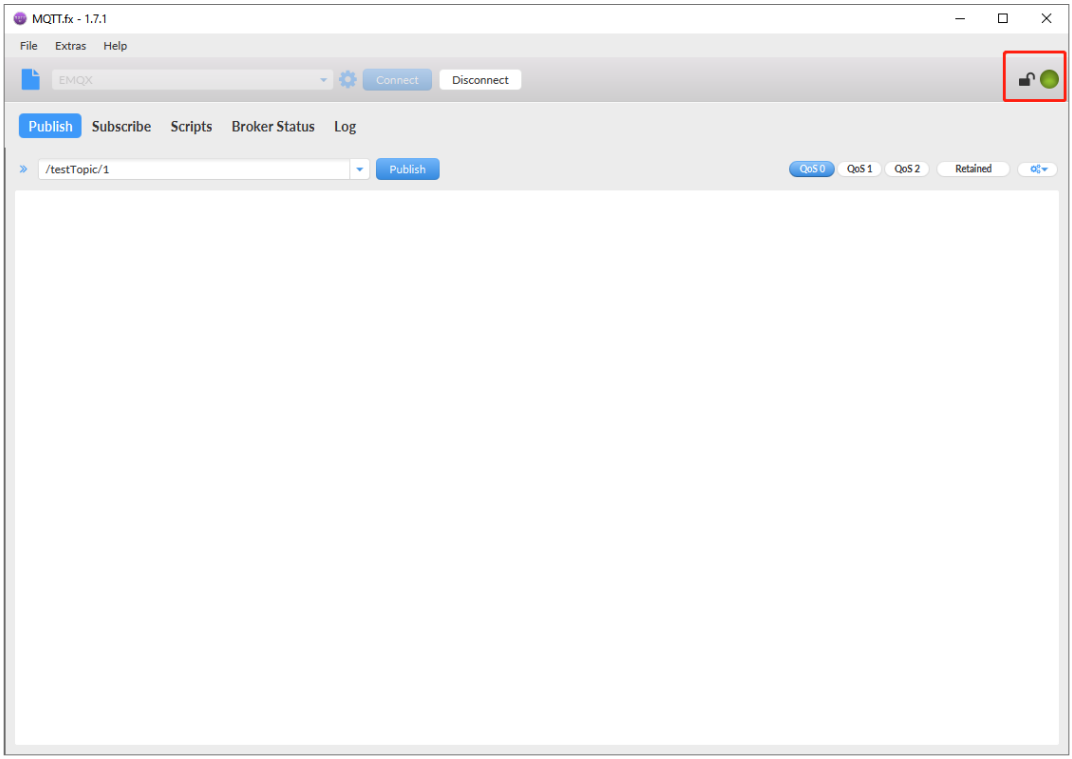


Fig. 114 **Successful connection**

8.2.2. Transparent transmission

In the Publish field, select Publish topic1, enter the topic, bind to the Port1, select Qos 0, uncheck retained message. We use the /PubTopic1 as an example to describe the process. After finishing configuring the Publish topic1, please scroll down to the bottom of the page and click on "Save & Apply" button to save all the changes that you have made. All configurations take effect after a system reboot.

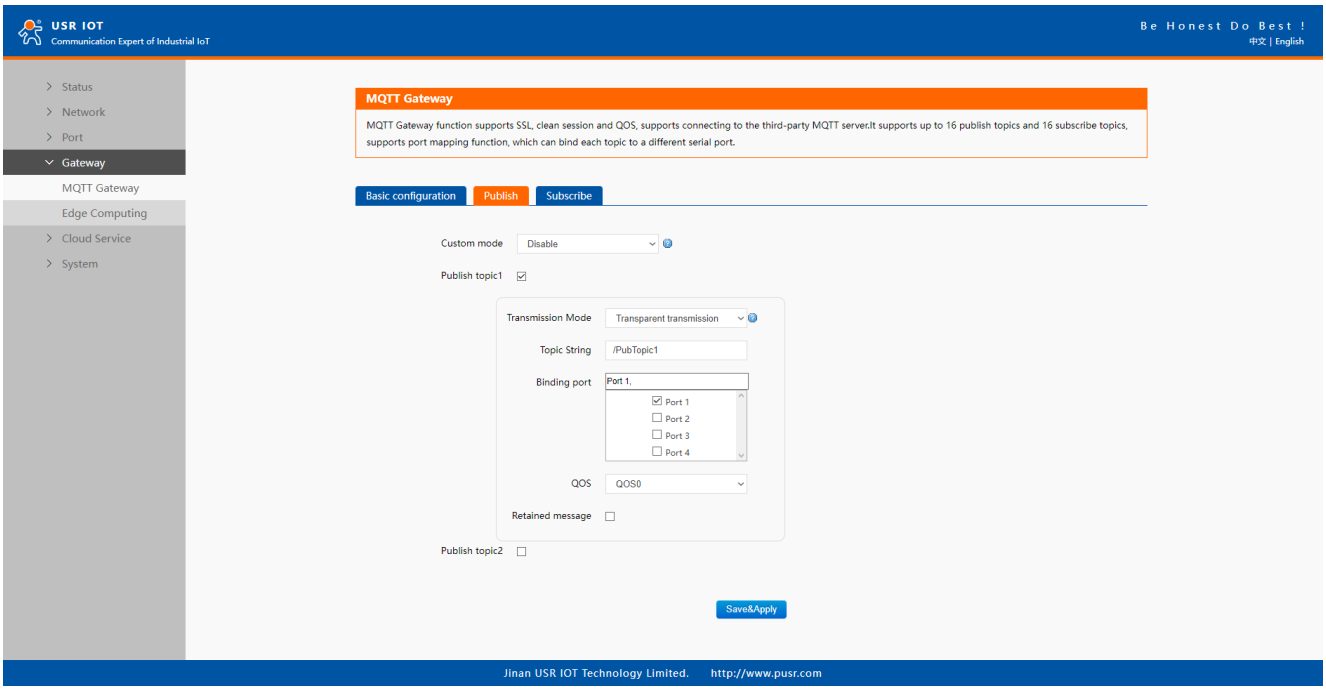


Fig. 115 **Add Publish topic**

Click to enter the Subscribe Tab to enter /PubTopic1 in the topic box. Then, select a QoS level, click the Subscribe button, and the list of subscribed topics will appear on the left. The current number of subscribed topics is 0, as shown in the following figure:

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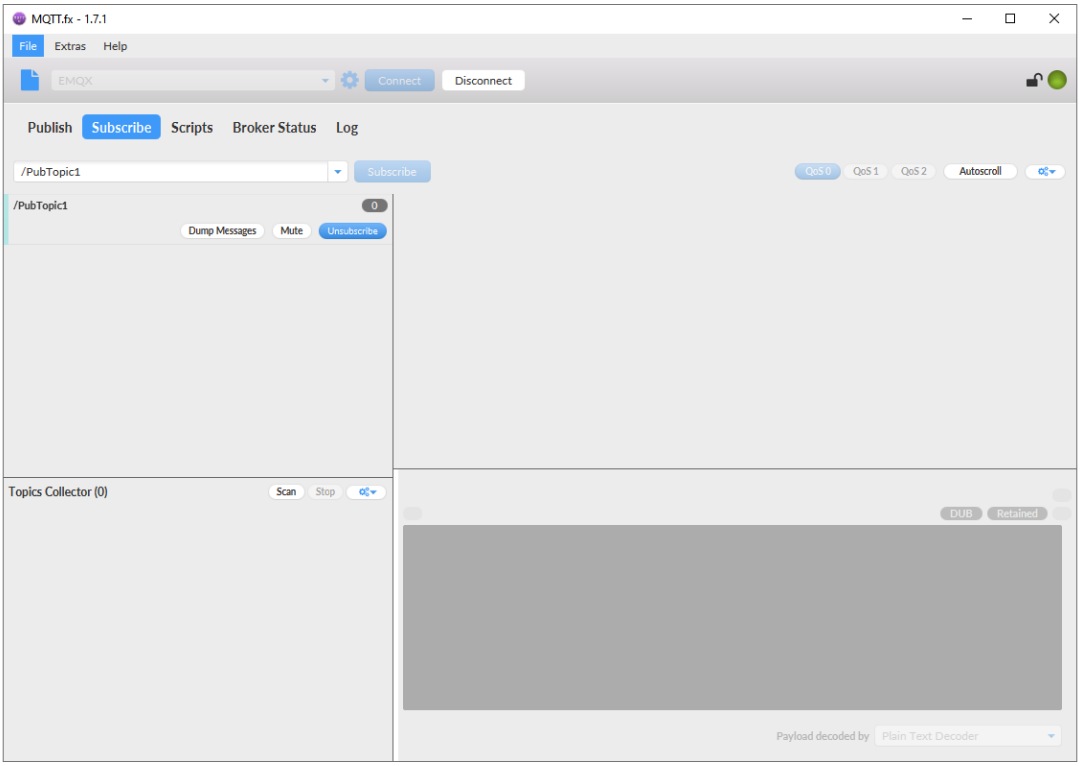


Fig. 116 **Subscribe to the E2 topic**

Launch serial debug assistant on PC, and open COM Port with the E2's serial default settings as below:

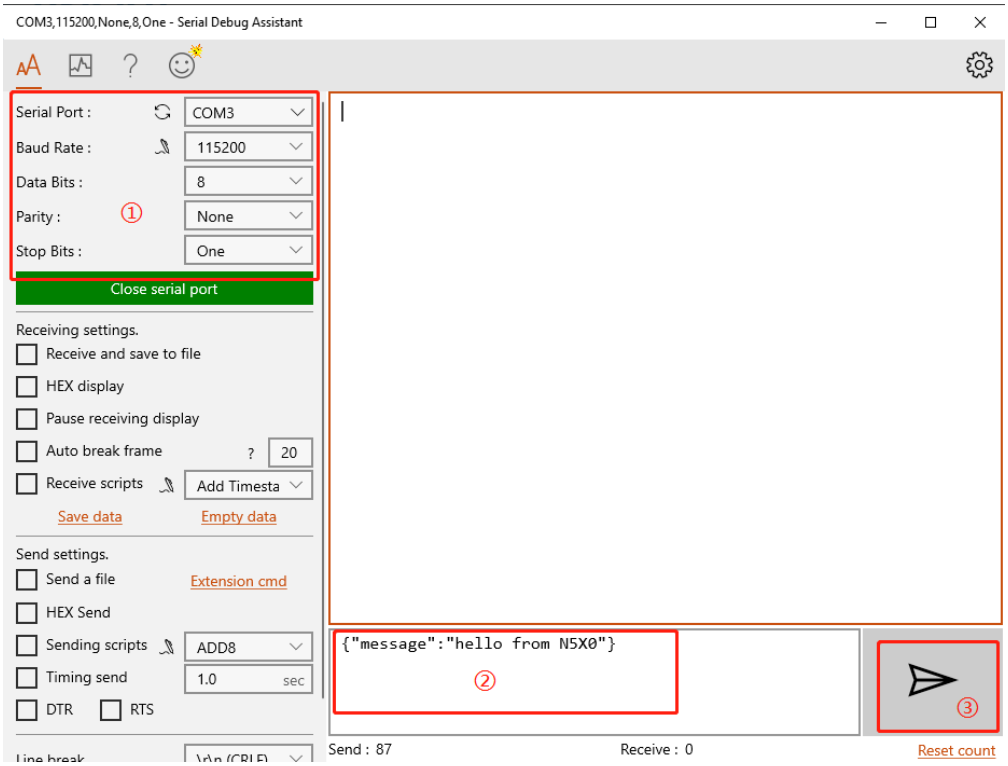


Fig. 117 **Serial debug assistant setting**

Click send button. On the MQTT.fx page, you will receive a message from the cloud that was sent from the E2. For Payload decoded by select "JSON Pretty Format Decoder" to show the message.

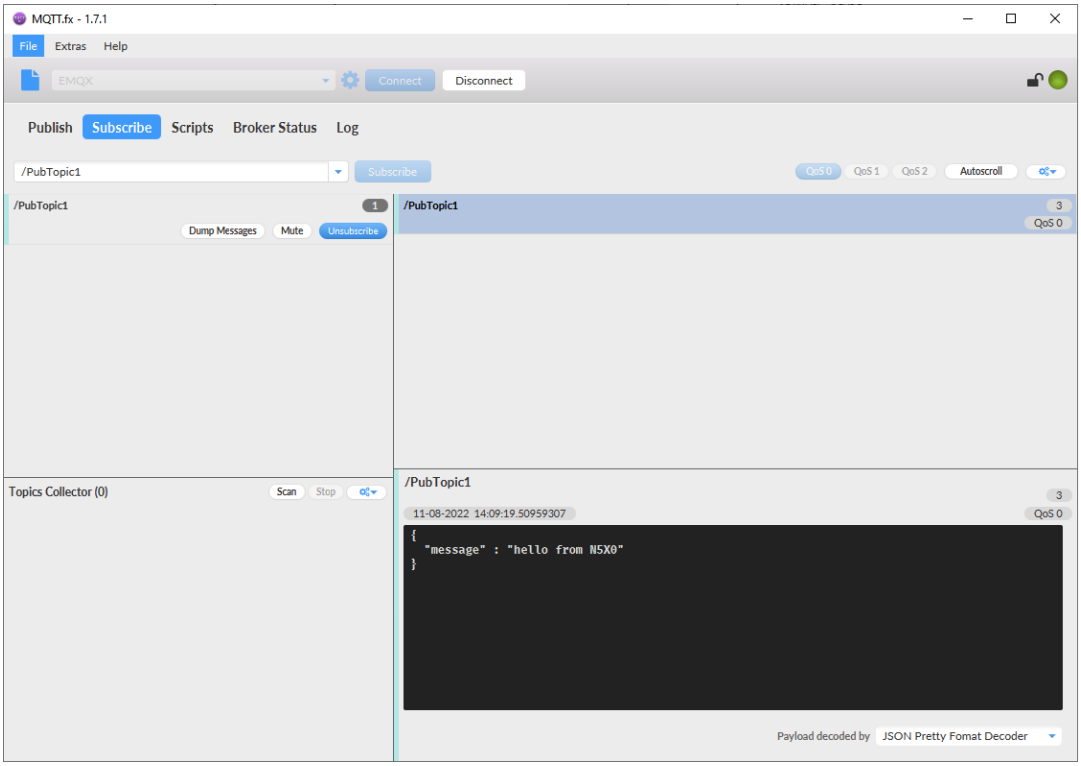


Fig. 118 **Receive message from E2**

8.2.3. Topic distribution

In the Publish field, select Publish topic2, enter the topic, topic name, bind to the Port1, select Qos 0, uncheck retained message. We use the /PubTopic2 as an example to describe the process. After finishing configuring the Publish topic2, please scroll down to the bottom of the page and click on "Save & Apply" button to save all the changes that you have made. All configurations take effect after a system reboot.

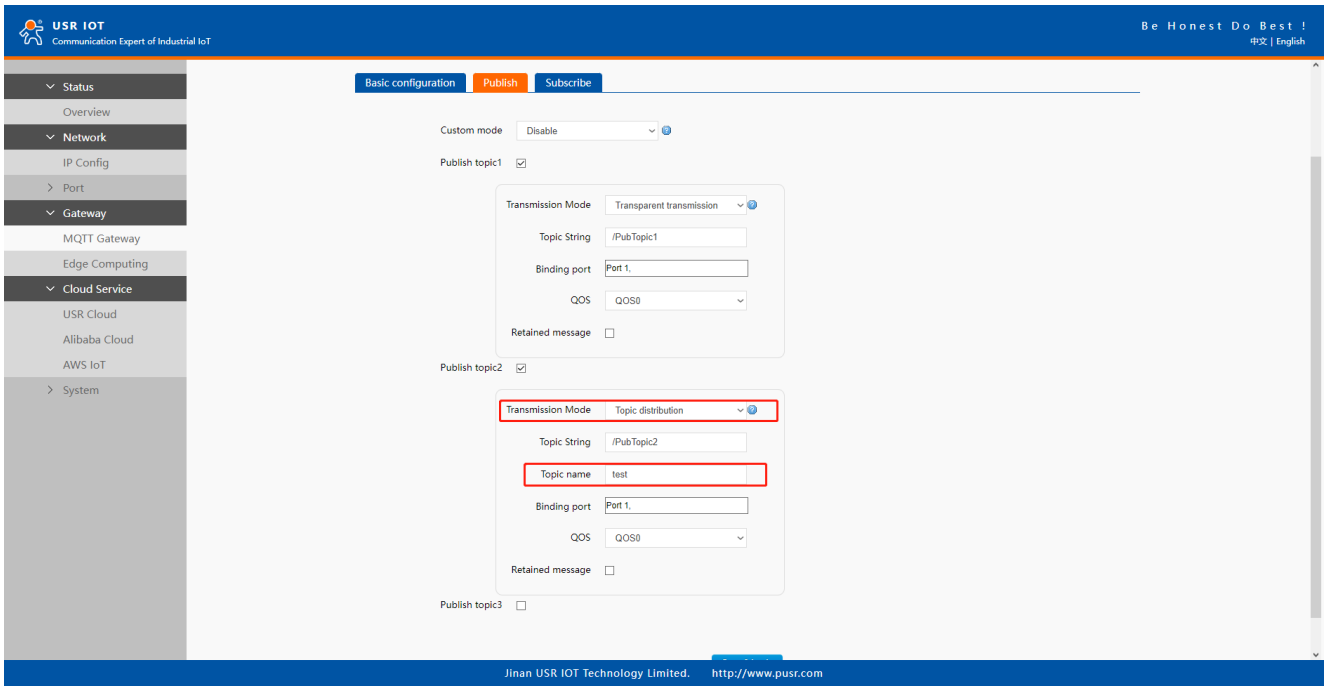


Fig. 119 **Topic distribution mode**

Click to enter the Subscribe Tab to enter /PubTopic2 in the topic box. Then, select a QoS level, click the Subscribe button, and the list of subscribed topics will appear on the left. The current number of subscribed topics is 0, as shown in the following figure:

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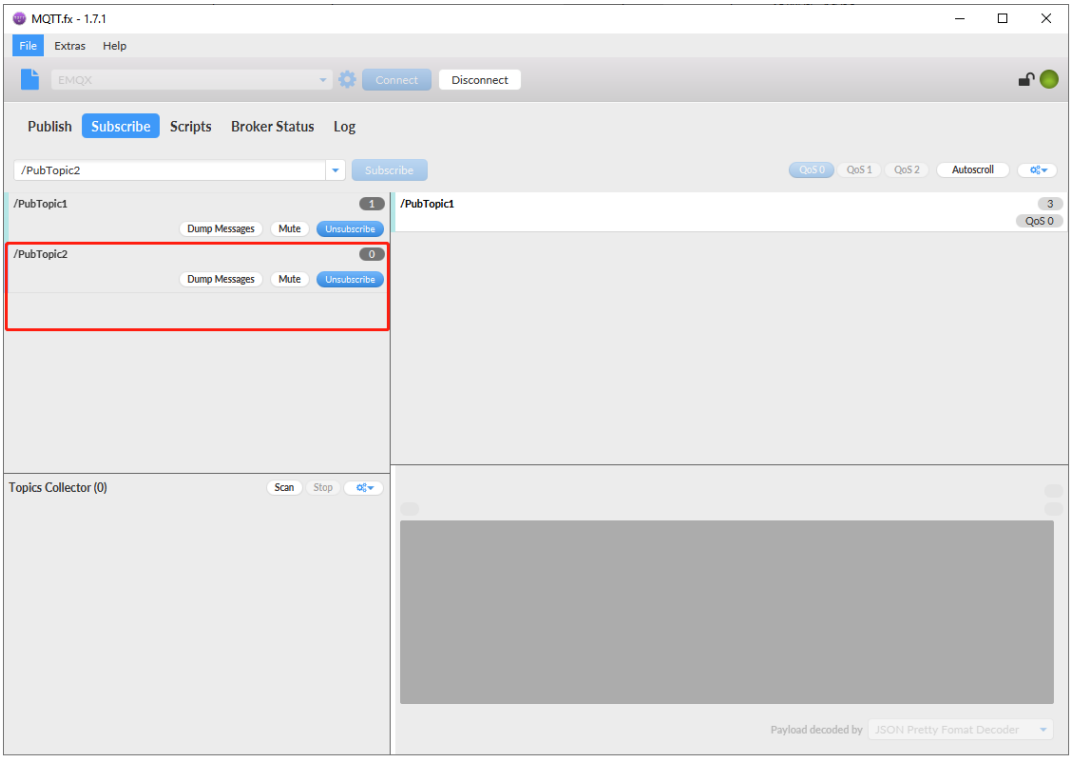


Fig. 120 **Subscribe to the E2 topic**

Launch serial debug assistant on PC, and open COM Port with the E2's serial default settings as below:

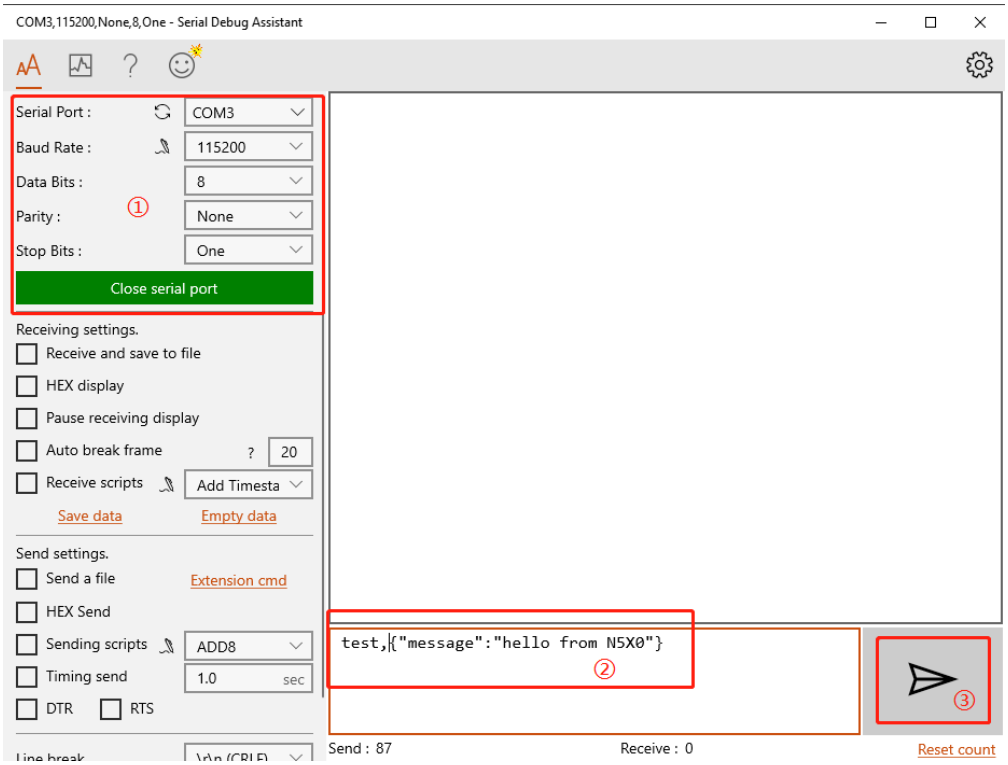


Fig. 121 **Serial debug assistant setting**

Enter the correct serial data format test,{"message":"hello from E2"}, Click send button. On the MQTT.fx page, you will receive a message from the cloud that was sent from the E2.

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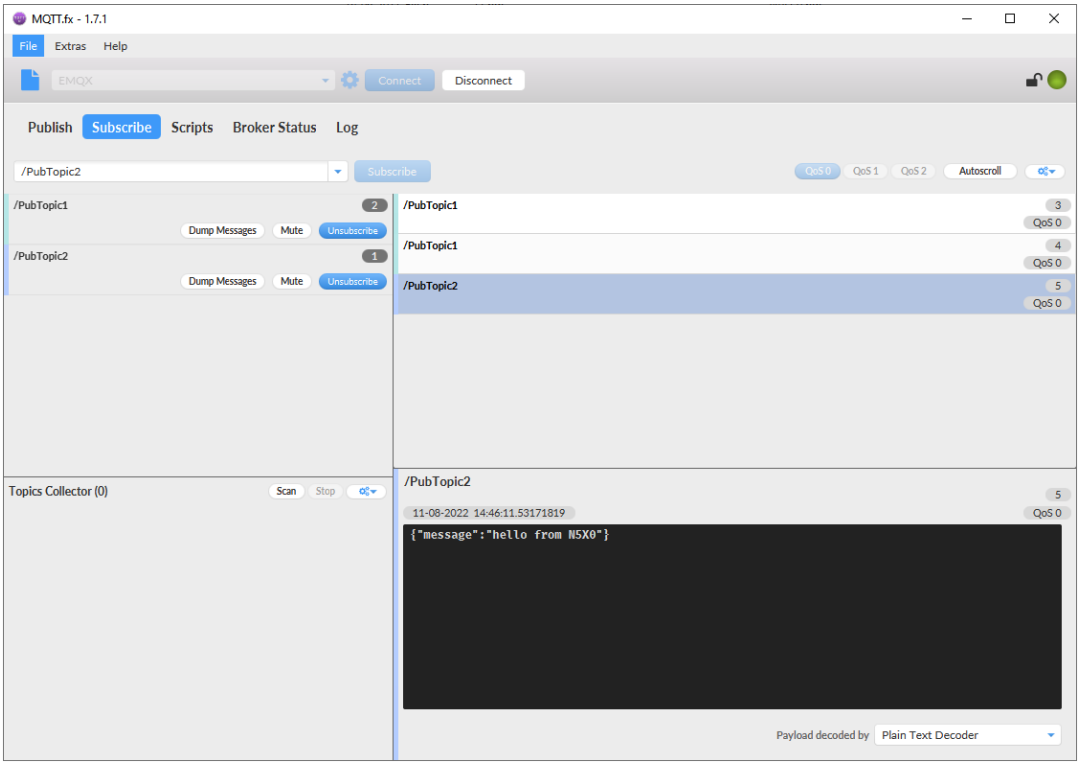


Fig. 122 **Receive message from E2**

8.2.4. Custom mode

In the Publish field, select Custom mode, bind to the Port1. Click on "Save & Apply" button to save all the changes that you have made. All configurations take effect after a system reboot.

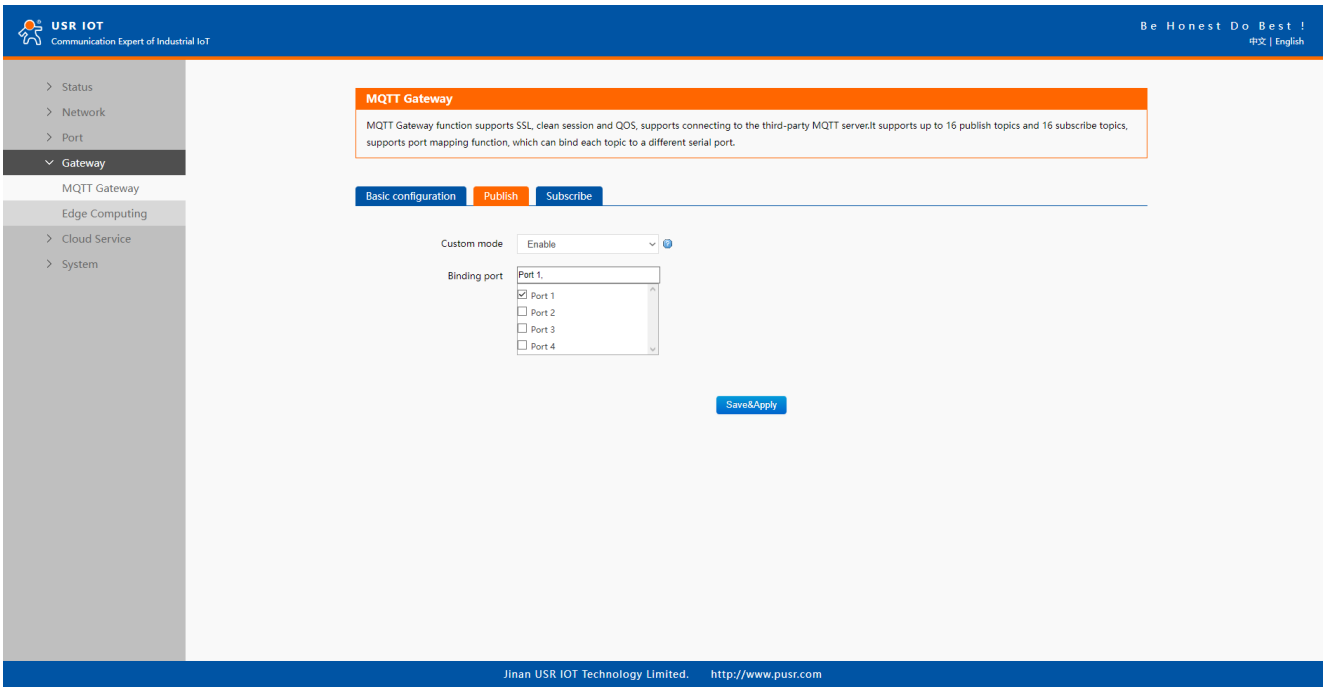


Fig. 123 **Custom mode**

Click to enter the Subscribe Tab to enter /PubTopic3 in the topic box. Then, select a QoS level, click the Subscribe button, and the list of subscribed topics will appear on the left. The current number of subscribed topics is 0, as shown in the following figure:

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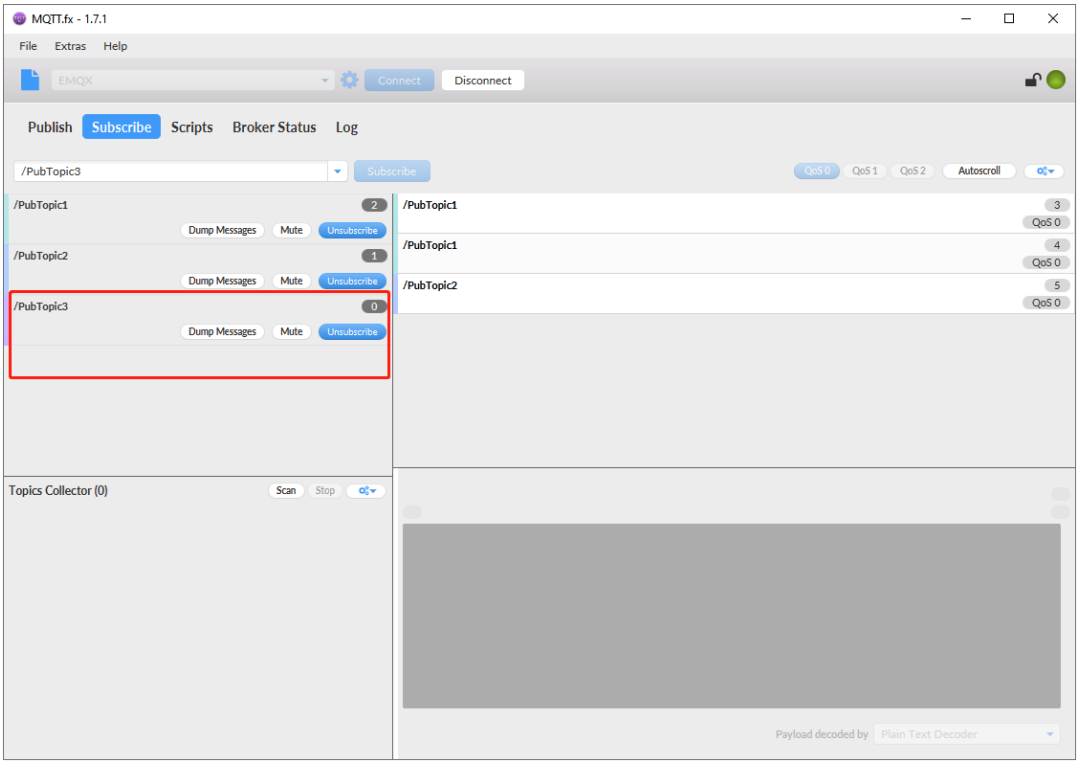


Fig. 124 **Subscribe to the E2 topic**

Launch serial debug assistant on PC, and open COM Port with the E2's serial default settings as below:

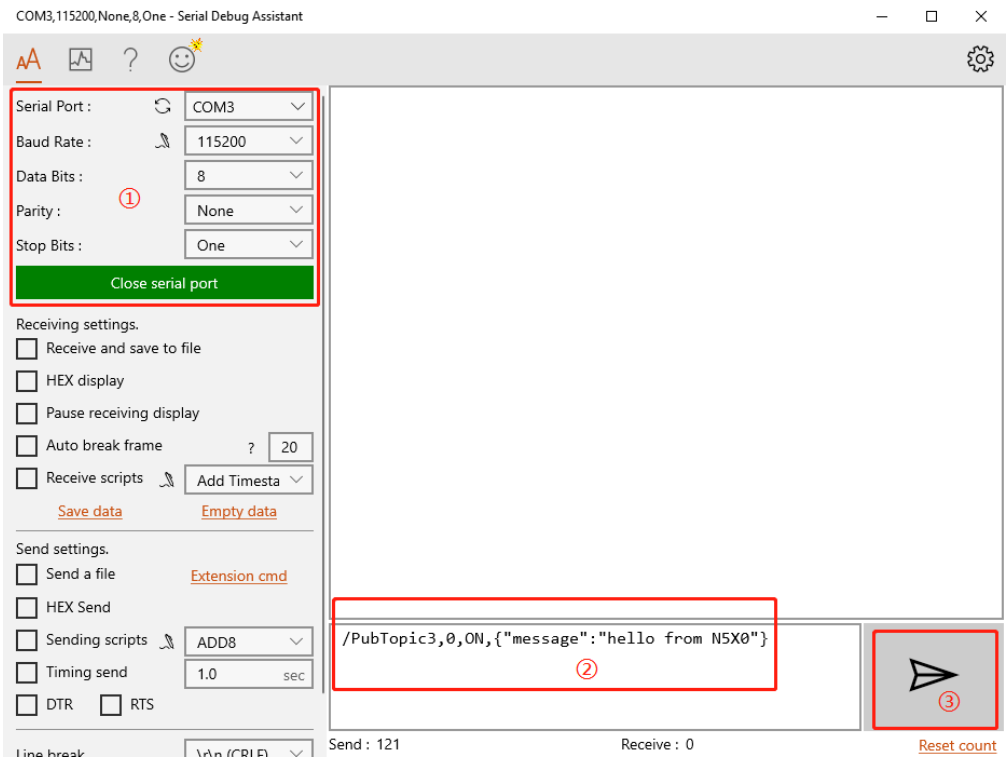


Fig. 125 **Serial debug assistant setting**

Enter the correct serial data format /PubTopic3,0,ON,{"message":"hello from E2"}, Click send button. On the MQTT.fx page, you will receive a message from the cloud that was sent from the E2.

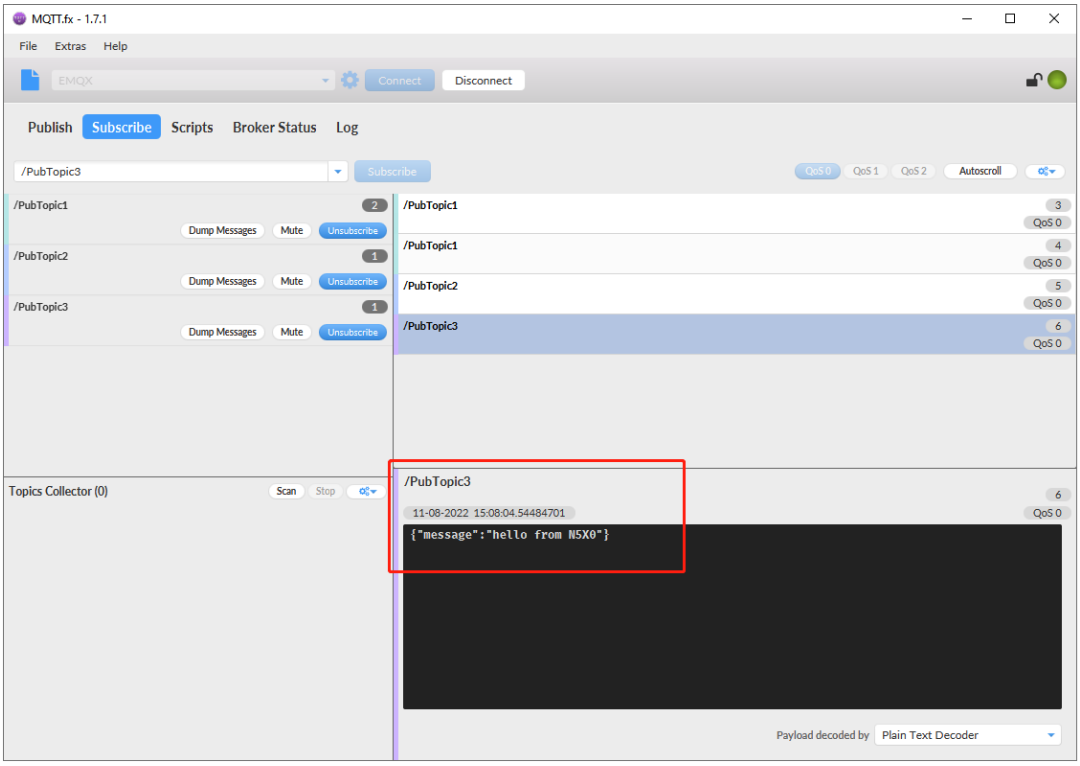


Fig. 126 **Receive message from E2**

8.3. Subscribe to a topic

In the Subscribe field, select Subscribe topic1, enter the topic, bind to the Port1, select Qos 0. We use the /SubTopic1 as an example to describe the process. After finishing configuring the Subscribe topic1, please scroll down to the bottom of the page and click on "Save & Apply" button to save all the changes that you have made. All configurations take effect after a system reboot.

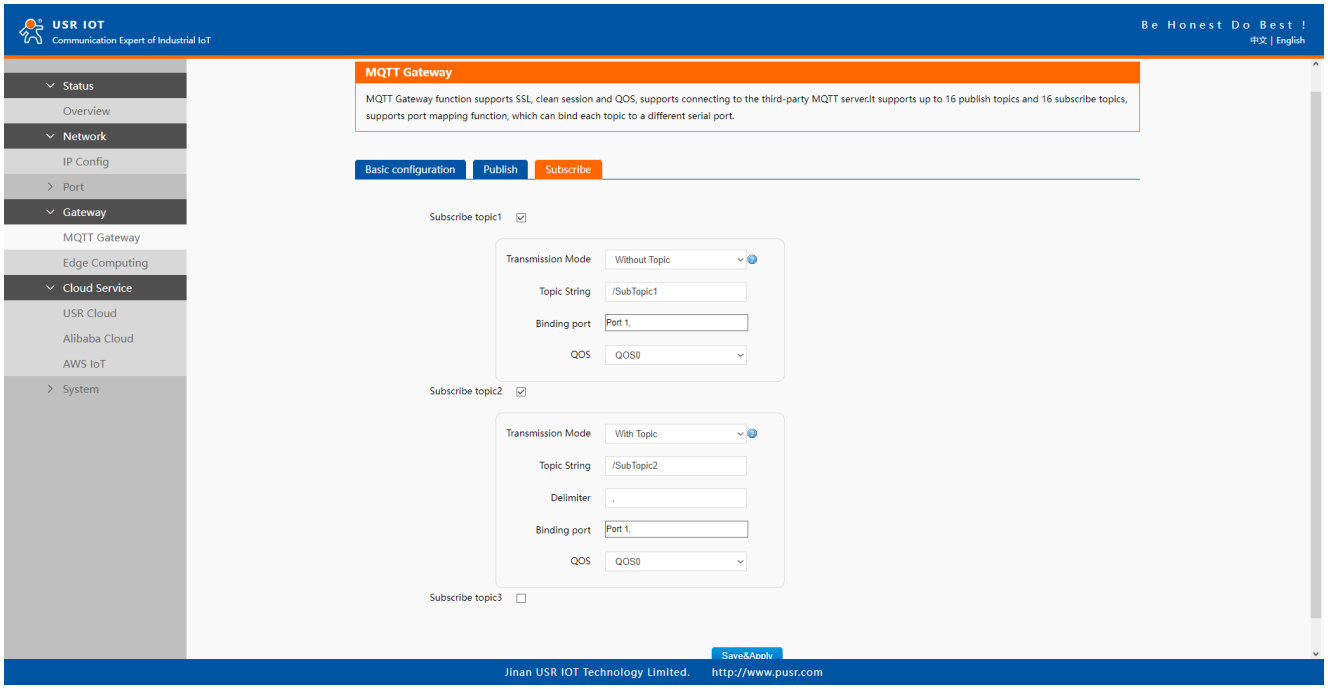


Fig. 127 **Add subscribe topic**

Click to enter the Publish Tab to enter /SubTopic1 in the topic box, and enter the message of "hello world" in the message input box, select a QoS level, and click Publish to publish the message, as shown in the following figure:

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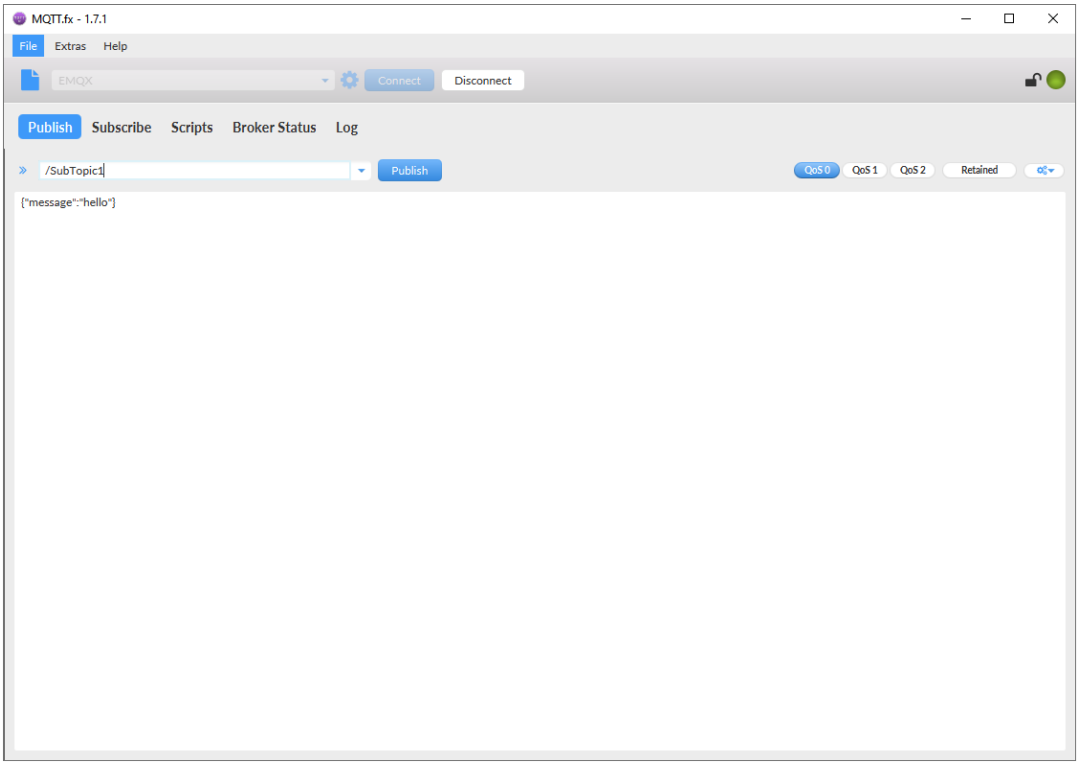


Fig. 128 **Publish message to E2**

Click Publish to send the messages and return to the serial debug assistant. We can find that the serial port has received the message, as shown in the following figure:

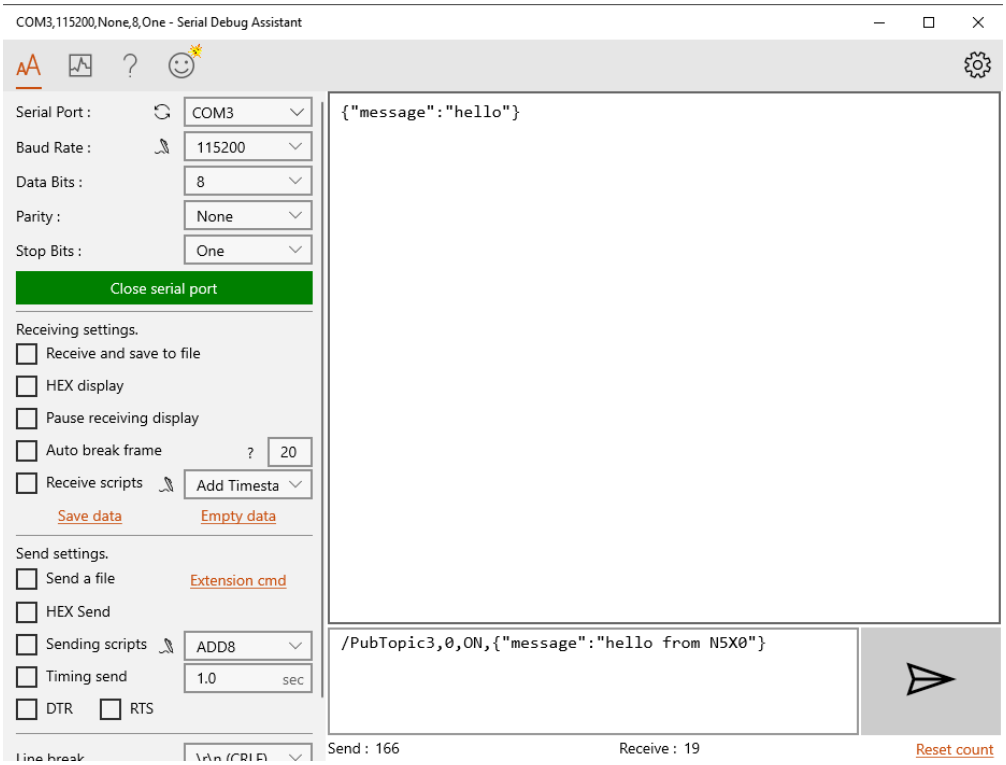


Fig. 129 **Receive message from cloud**

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9. AWS IoT service

In order to reduce the length of this document, we have organized this section into a special document. Please refer to "USR-E2 Quick Start Guide with AWS IoT" for detail.

10. PUSR cloud service

In order to reduce the length of this document, we have organized this section into a special document. Please refer to "USR-E2 Quick Start Guide with PUSR cloud" for detail.

11. Warranty

12. Contact Us

Jinan USR IOT Technology Limited

Address : Floor 12 and 13, CEIBS Alumni Industrial Building, No. 3 Road of Maolingshan, Lixia District, Jinan, Shandong, China

Official website:https://www.pusr.com

Official shop:https://shop.usriot.com

Technical support: http://h.usriot.com/

Email : sales@usriot.com

Tel : +86-531-88826739

Fax : +86-531-88826739-808

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14. Revision History

Version	Date	Author	Description
1.0.0	2022.7.30	Dean,Gao	Initial

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