Chengdu Ebyte Electronic Technology Co.,Ltd

Wireless Modem

User Manual

E90-DTU(xxxSLxx-ETH)_V2.0
Ethernet Gateway User Manual

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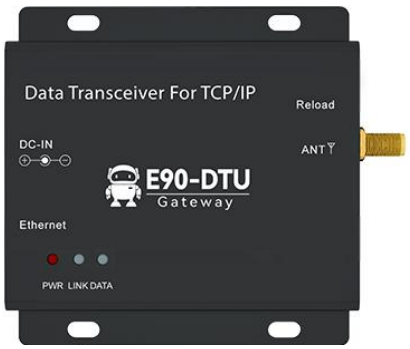
1 Introduction



E90-DTU(xxxSLxx-ETH)_V2.0 supports adaptive network rate (up to 100M full duplex), providing six working modes of TCP Server, TCP Client, UDP Server, UDP Client, HTTP Client, MQTT Client, while in TCP Server mode supporting six client connections;

Supporting a variety of Modbus gateways, which can perform simple interchange of Modbus TCP data and Modbus RTU data, as well as record and send the read instructions, and also actively upload the server through pre-stored instructions;

Wireless communication adopts LoRa direct sequence spread spectrum technology, which will bring longer communication distance and has the advantages of concentrated power density and strong anti-interference ability. With software FEC forward error correction algorithm, which has high coding efficiency and strong error correction capability, it can actively correct the interfered packets in the case of sudden interference, which greatly improves the reliability and transmission distance, and can help users to complete long-distance data transparent transmission efficiently. Users can make relevant configurations via WEB pages;

E90-DTU(xxxSLxx-ETH)_V2.0 includes the following 6 models:

E90-DTU(230SL22-ETH)_V2.0, E90-DTU(230SL30-ETH)_V2.0, E90-DTU(400SL22-ETH)_V2.0

E90-DTU(400SL30-ETH)_V2.0, E90-DTU(900SL22-ETH)_V2.0, E90-DTU(900SL30-ETH)_V2.0

Features

- Adopting the latest LoRa technology, which has a longer distance and more powerful performance than traditional LoRa digital radio;
- Adopting military grade LoRa modulation technology with data encryption and settable sub-packet length;
- Support LBT function, the radio waits to send according to the current environment noise intensity. Improving the radio's communication success rate in harsh environments;
- Support for wireless sending of command packets, remote configuration and communication encryption;
- Can realize multi-level relay network to effectively extend the communication distance and realize ultra-long distance communication;
- Industrial-grade design can work in -40℃～+85℃ environment, wide voltage input (DC 8～28V);
- Full aluminum alloy housing, compact size, easy installation and good heat dissipation;
- perfect shielding design, good electromagnetic compatibility and strong anti-interference capability;
- RJ45 adaptive 10 Ethernet interface;
- Support for multiple operating modes (TCPS, TCPC, UDPS, UDPC, HTTPC, MQTTC);
- Support for three configuration modes: configuration tool, web page and AT command;
- Support for up to six socket connections in server mode;
- Support for DHCP functionality;
- Support for DNS (domain name resolution), with custom domain name resolution servers;
- Support for multiple Modbus gateways (simple protocol conversion, multi-host mode, storage gateway, configurable gateway, etc.)
- Support for fast access to Ali cloud, Baidu cloud, OneNET, Huawei cloud, version 3.1 standard MQTT

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servers;

- Support for HTTP protocols (GET/POST requests);
- Support for time-out restart function with customizable time;
- Support short connection function, short connection interval time customization;
- Support for heartbeat packet and registration packet functions;
- Support for serial port cache cleaning function;
- Support for accessing external network, LAN, and virtual serial port tools;
- Support hardware restore factory settings and online upgrade

2 Quick start

2.1 Hardware preparation

E90-SL-ETH has three bands in total (E90-DTU(230SLxx-ETH)_V2.0, E90-DTU(400SLxx-ETH)_V2.0, E90-DTU(900SLxx-ETH)_V2.0), the use of different bands is the same, here the E90-DTU(xxxSLxx-ETH)_V2.0 with E90-DTU(xxxSLxx) for transparent transmission as an example.

In order to test the E90-DTU (xxxSLxx-ETH)_V2.0, the following hardware is required:

- A PC with a network port;
- One E90-DTU(xxxSLxx-ETH)_V2.0 (or other frequency band of the same series), hereinafter referred to as "gateway radio";
- One E90-DTU(xxxSLxx) digital radio, hereinafter referred to as "serial radio" (used as an example or purchased separately if needed);
- Two TX433-JKD-20P antennas (female thread, female pin);
- Two DC12V-1A power adapters;
- One network cable;
- One USB to RS-485 serial cable;

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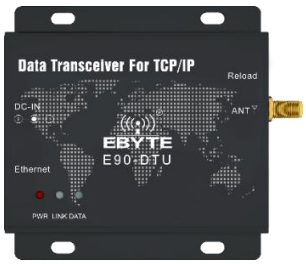
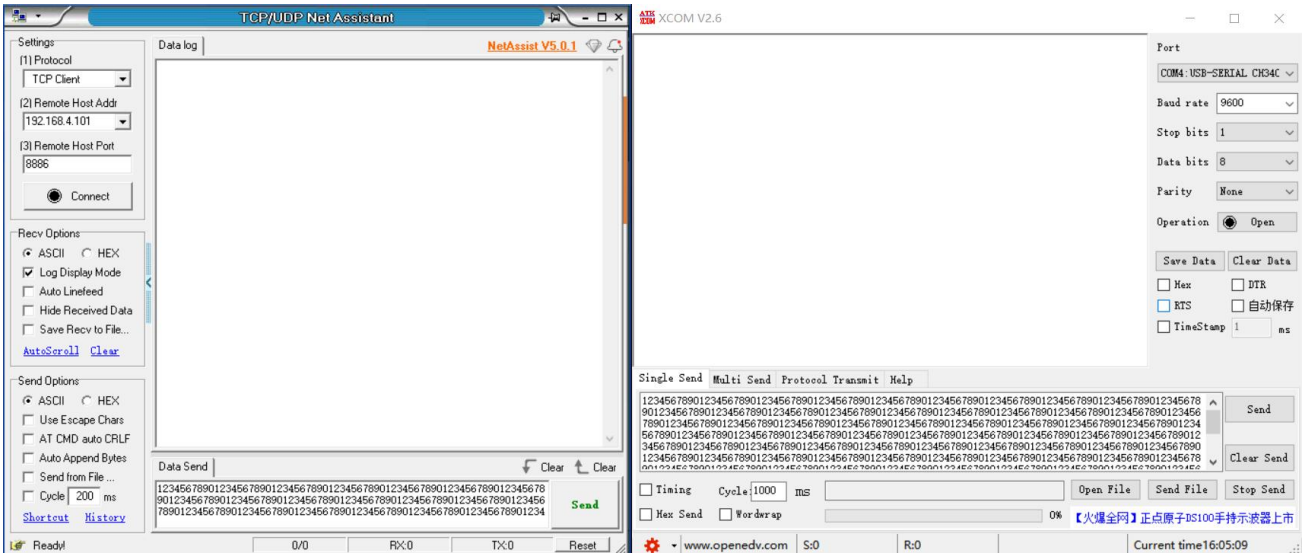
			
PC	E90-DTU(xxxSLxx-ETH)_V2.0	E90-DTU(xxxSLxx)	
RJ45 cable	DC12V-1A Power supply*2	Serial cable	TX433-JKD-20P*2

2.2 Software Preparation

Download the network debugging assistant "NetAssist" and serial port assistant "XCOM" from the product details on Ebyte website, as shown below. Official website address: https://www.cdebyte.com.



Download the configuration tool for the corresponding product details, use "Ebyte Config Tool" for "Gateway Radio E90-DTU(xxxSLxx-ETH)_V2.0" and use corresponding configuration software (e.g. "RF_Setting(E90-DTU SL)") for "Serial Radio E9x-DTU(xxxSLxx)".

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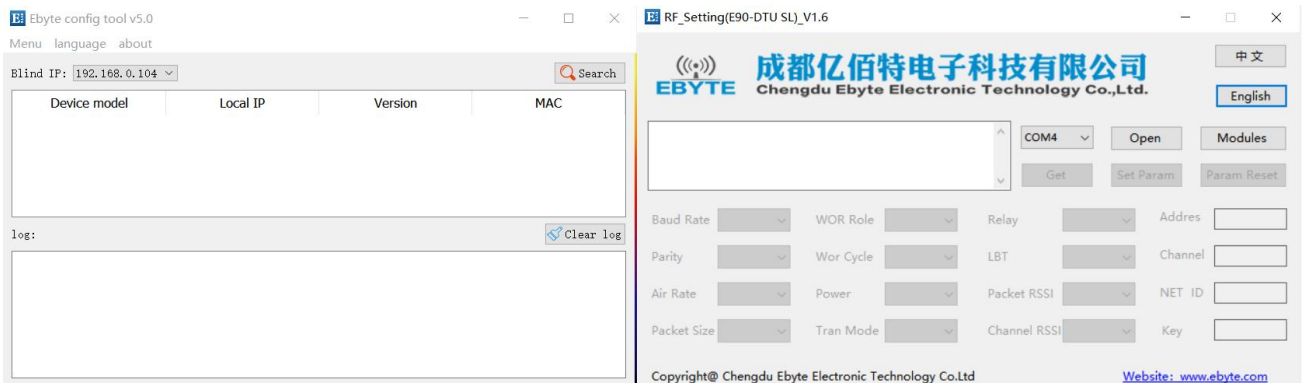
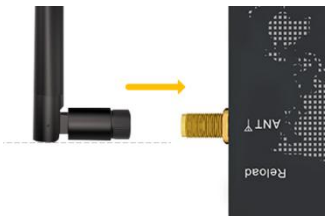
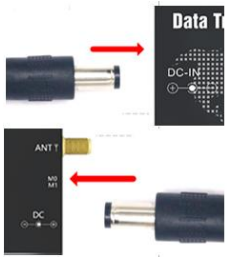
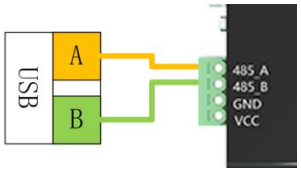


2.3 Hardware connection

Connecting the antenna to the E90 radio with power on (DC: 8 to 28V， DC12V/24V, 1A is recommended), RS485 connection, network cable connection:

			
Antenna connection	Up: "Gateway radio" is connected Down: "Serial Radio" connection	RS-485 connection for Serial Radio	RJ45 cable connection for Gateway radio

2.4 RF setting

2.4.1 Configuring "Serial Radio E9x-DTU(xxxSLxx)"

Step 1: Power on and connect the USB to RS-485 serial cable (serial cable A to radio 485_A and serial cable B to radio 485_B);

Step 2: check if the radio is working in configuration mode, if not in configuration mode, please enter configuration mode according to the configuration dip switch in the figure below;

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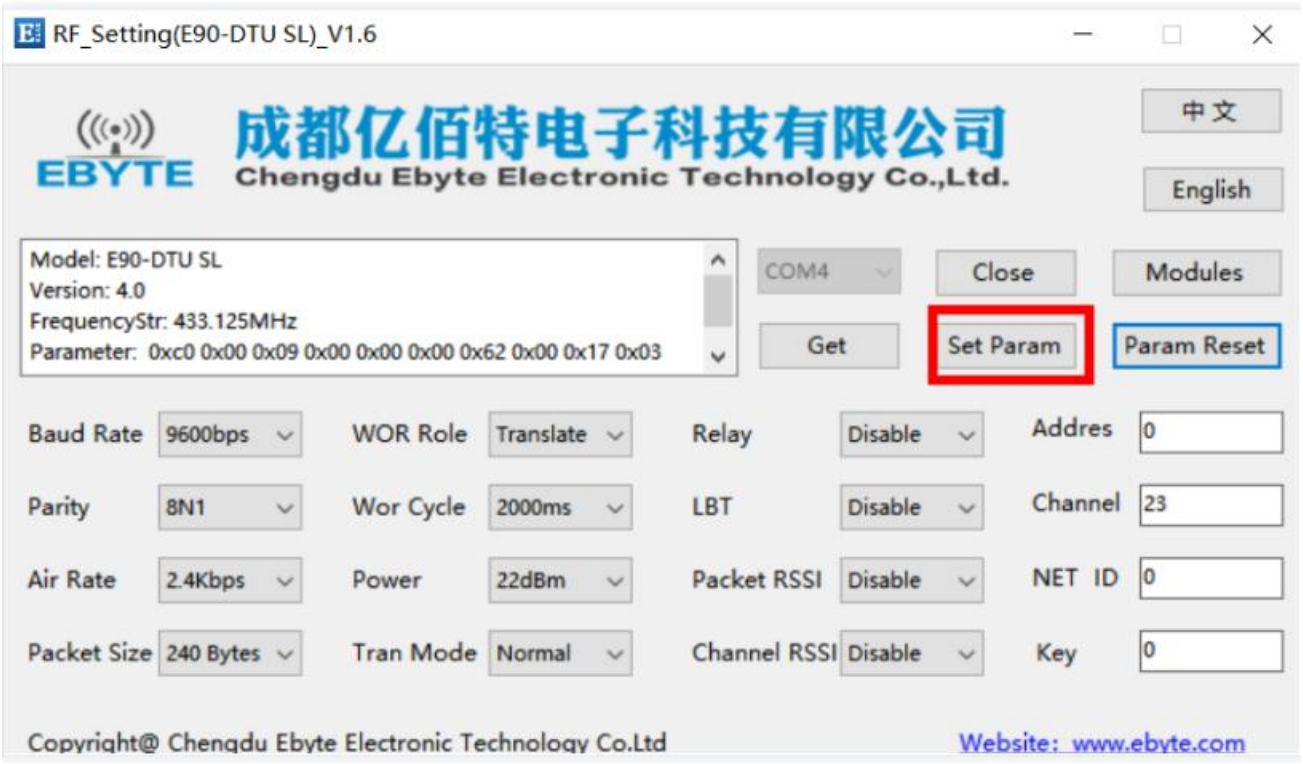
Transmission Mode

Configuration Mode

Step 3: Open the configuration software for "E9x-DTU(xxxSLxx)" and select the corresponding serial port;

Step 4: "Open serial port" and click "Get" to read parameters, then click "Param Reset" to restore factory settings;

Step 5: Configure the baud rate to 9600, parity to 8N1, null speed to 2.4Kbps, packet length to 240Bytes, etc., as shown in the figure below, click "Set Param";



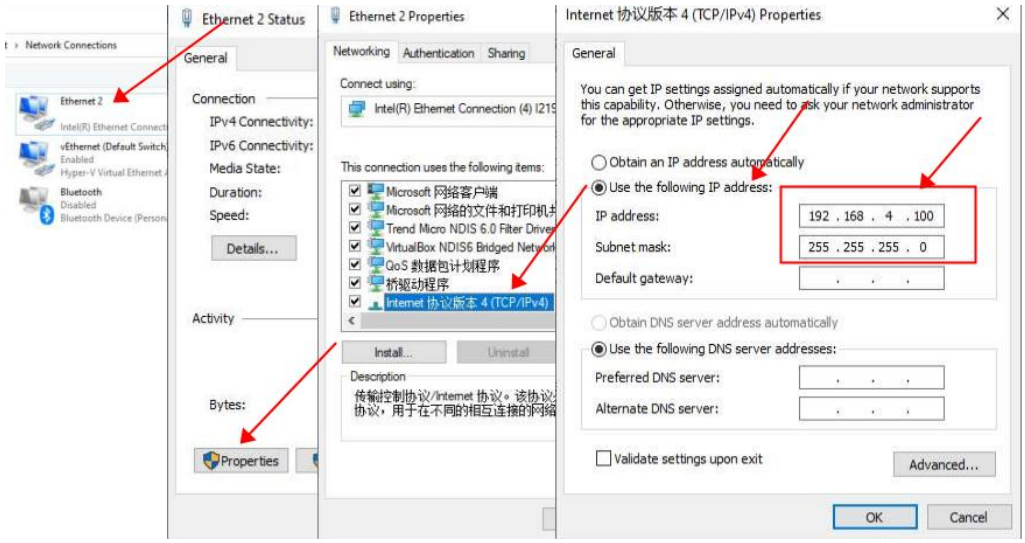
Step 6: Exit "Configuration Mode" and enter "Transmission Mode" by changing the dip switch;

2.4.2 Configuring "Gateway Radio E90-DTU(xxxSLxx-ETH)_V2.0"

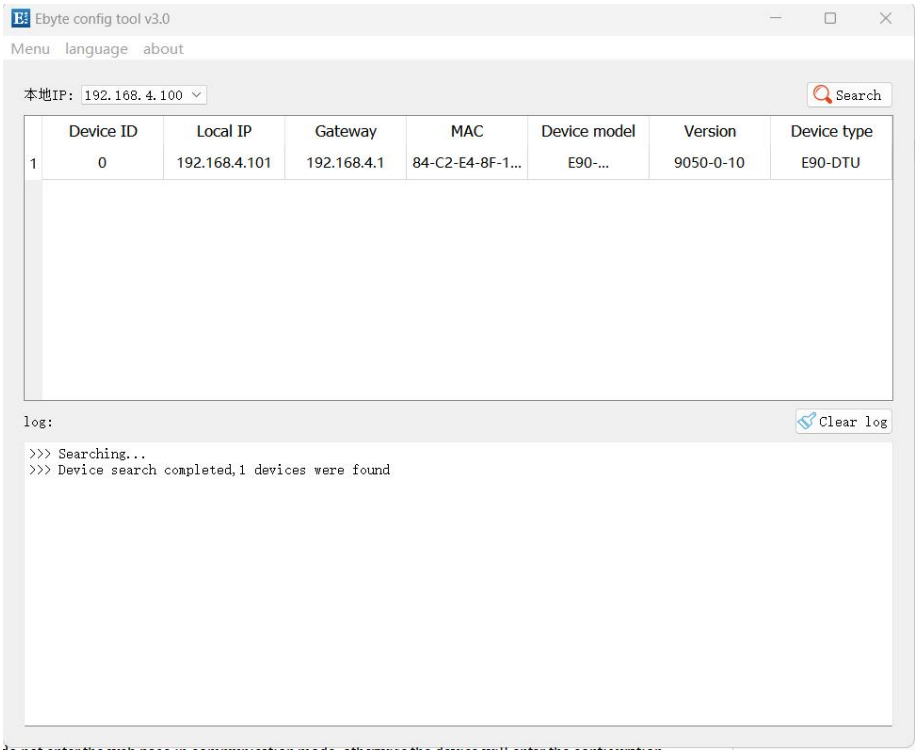
Step 1: Turn on the power and connect the PC to the "gateway radio" using a network cable;

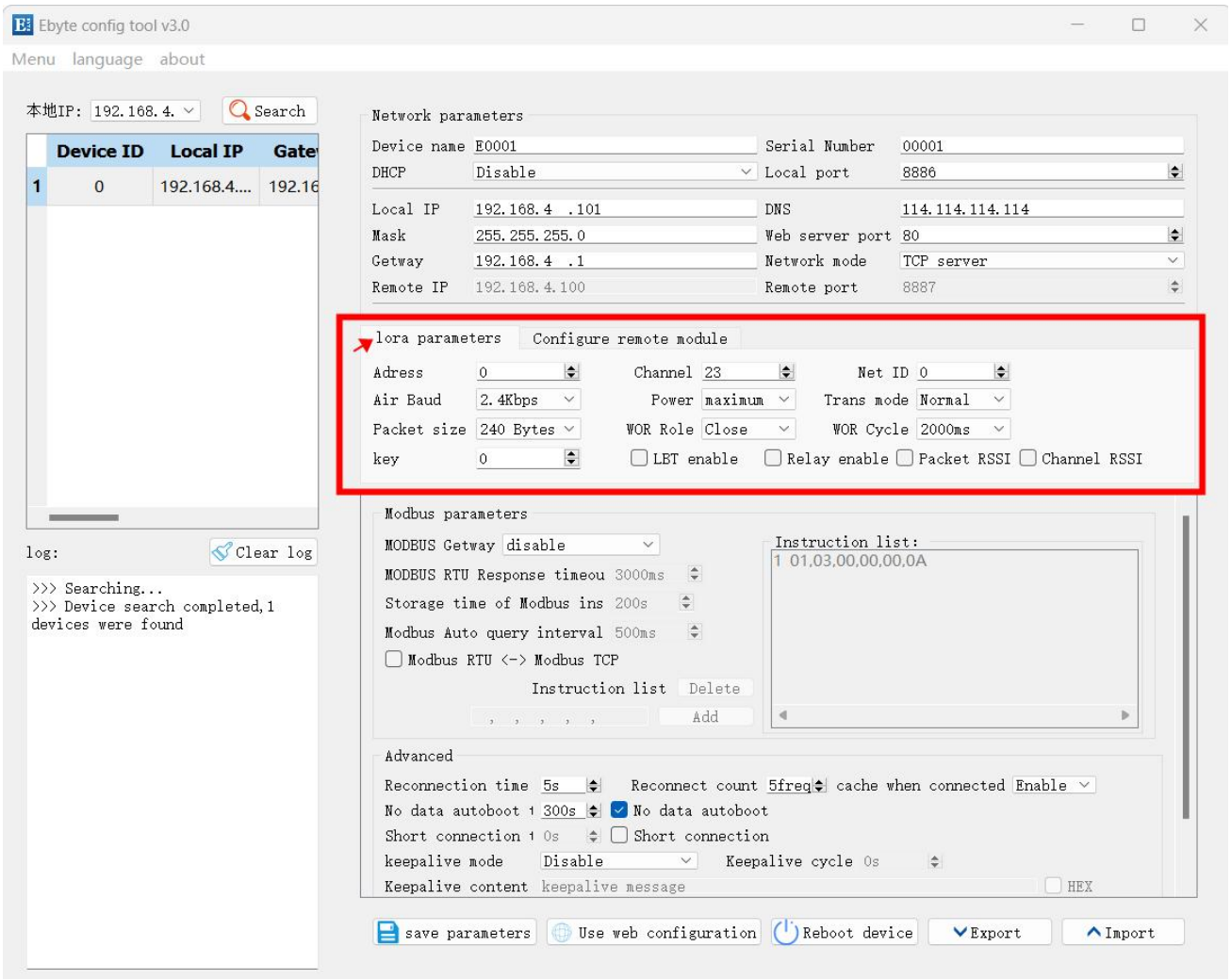
Step 2: Factory configure the gateway radio by pressing and holding the Reload button until all the indicators are fully on;

Step 3: Modify the IPv4 configuration of the PC, use a static IP, and ensure that the "gateway radio" and the PC are in the same network segment, the factory default IP for "gateway radio" is 192.168.4.101, so configure the PC's static IP 192.168.4.xxx, here we use 192.168.4.100 as an example, shown in the figure below:



Step 3: Use "Ebyte Config Tool" or Web Configuration to configure the RF parameters;





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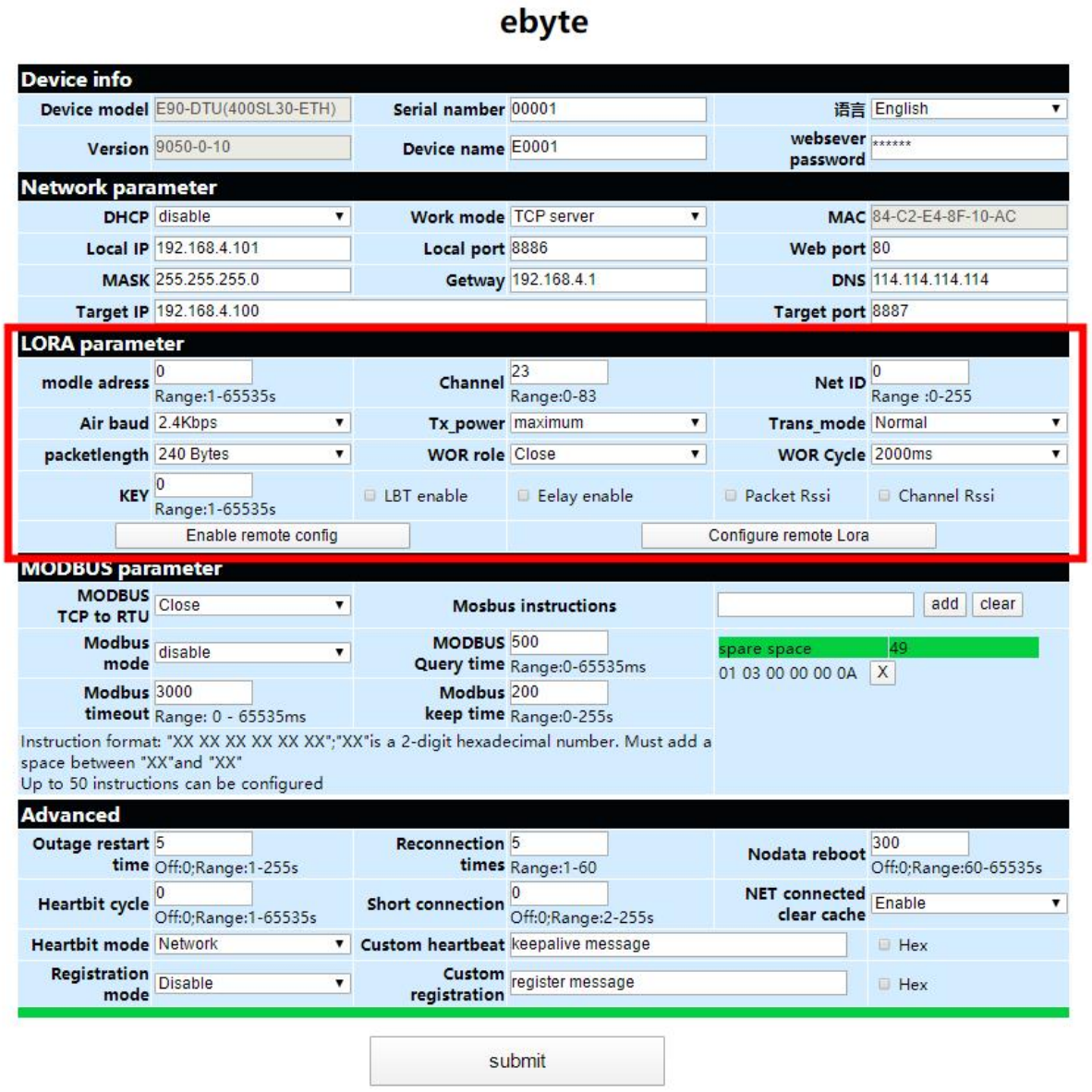

Step 4: Configure the wireless parameters as shown above;

If using "Ebyte Config Tool", please click "save parameters" and then click "Reboot device";

If using web configuration, please click “submit” and enter the password: 123456, waiting for the configuration to complete;

【Notes】

- Browsers with IE kernel are not supported, you can use Firefox, GOOGLE, the latest Edge etc.
- If the host computer failed to search the device, firstly check whether the network cable is connected well, then check whether the host computer has been turned on multiple times in the LAN, if it still failed to search the device, please close the firewall and restart the host computer;
- Please do not enter the web page in transmission mode, otherwise the device will enter the configuration mode. In this case, you can only exit the configuration mode by submitting data or restarting the device.

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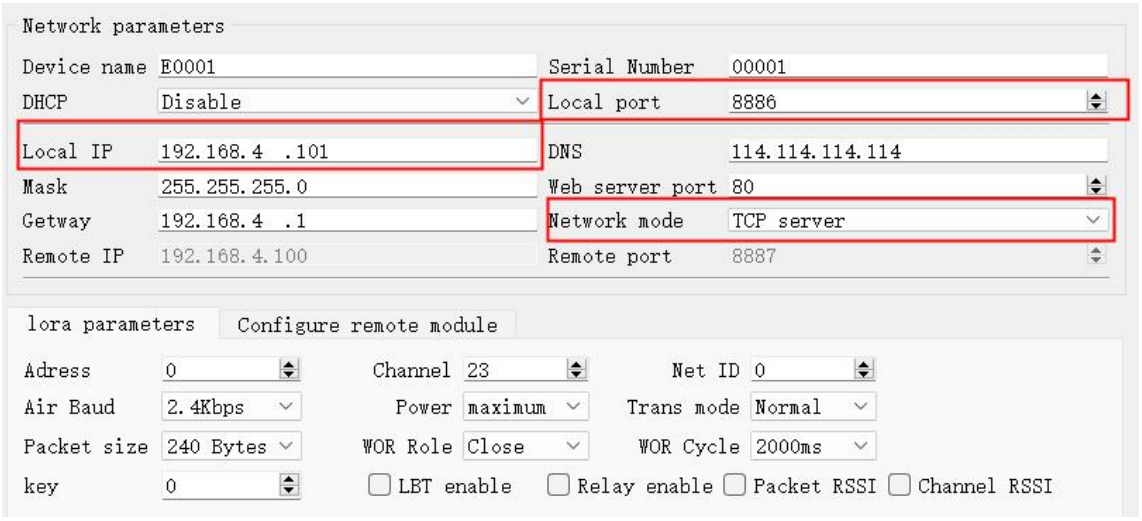
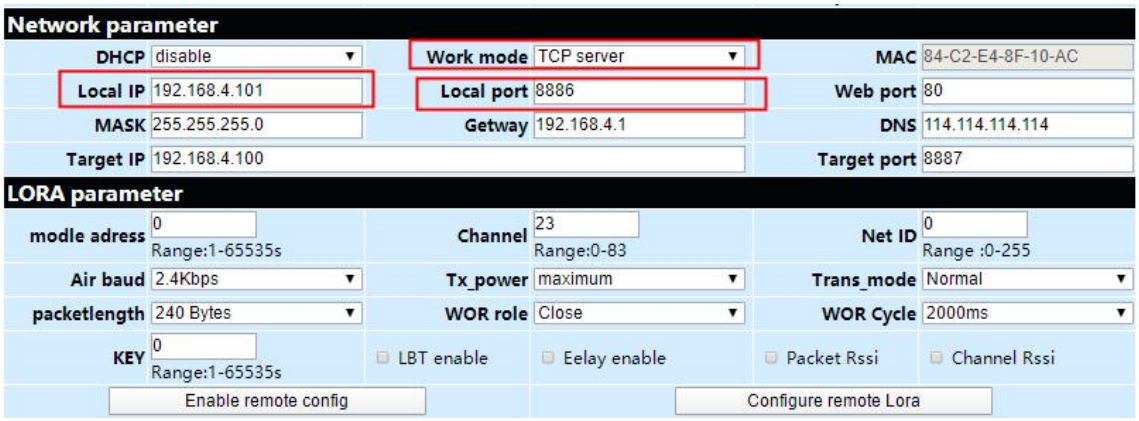
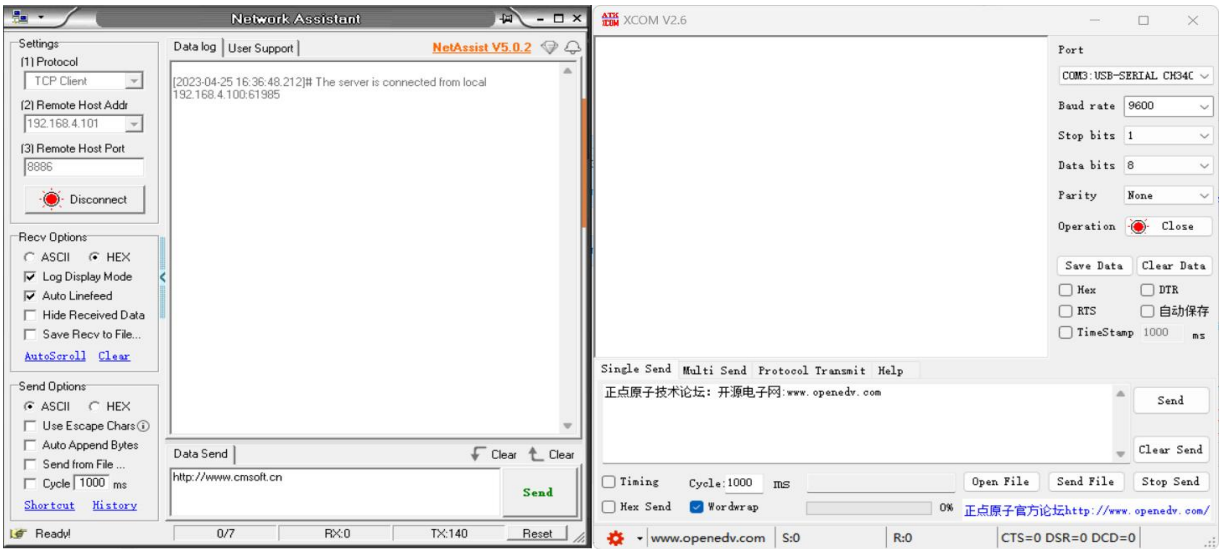
2.5 TCP servers instructions

Configure the Ethernet parameters of the "Gateway Radio", using the host computer and the web configuration as follows:





NetAssist connects to the "Gateway Radio" as shown below (the device LINK indicator is always on after successful connection, if it is connected but the indicator is not on, the device is in configuration mode and can be lifted by rebooting the device (power off, and then power on the device)), XCOM connects to the "Serial Radio":



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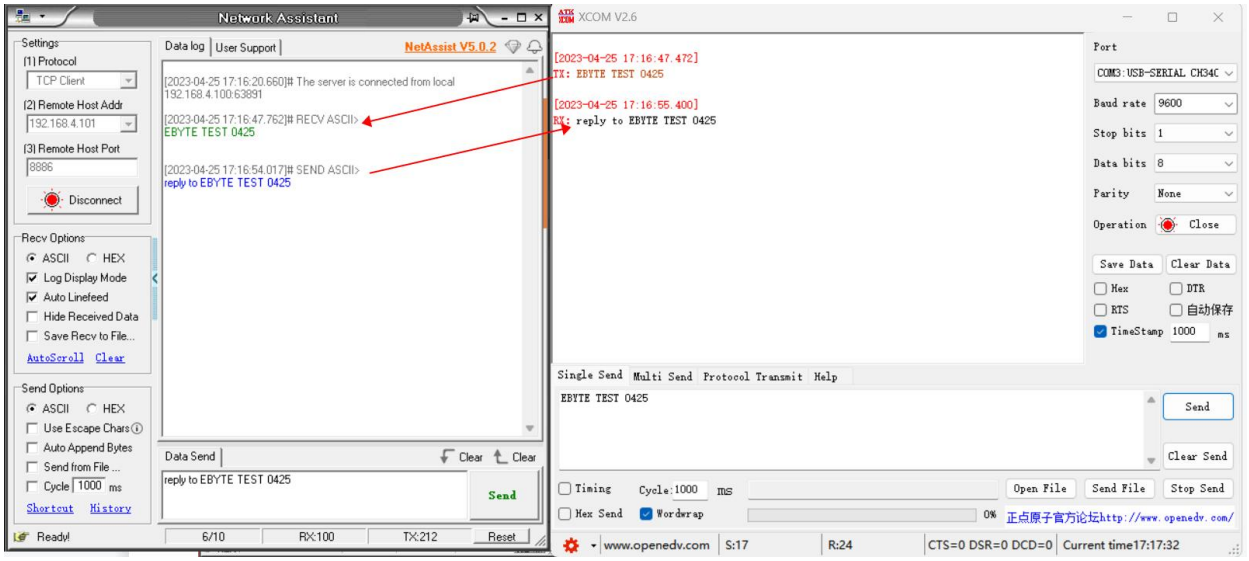
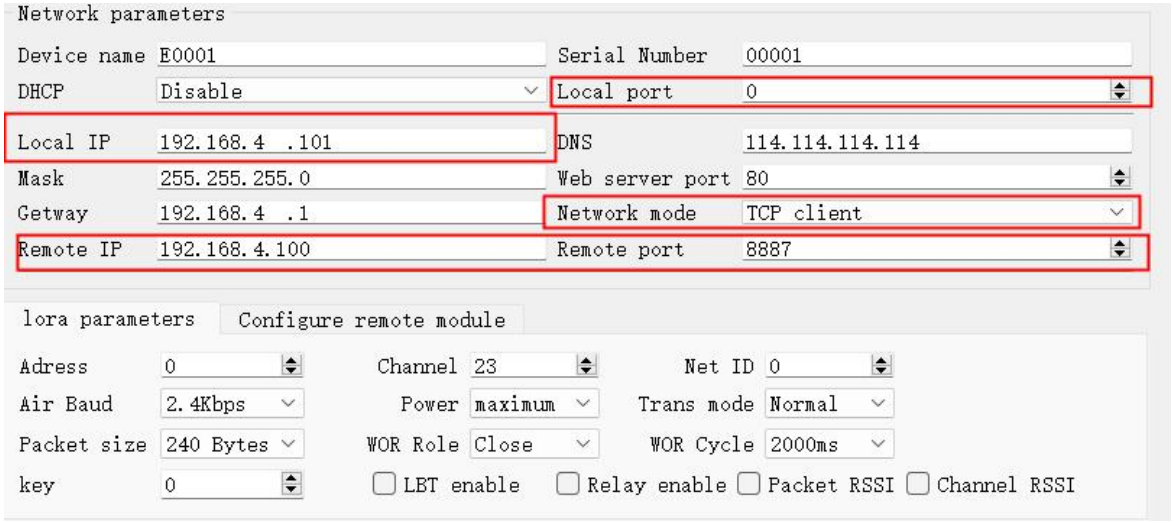
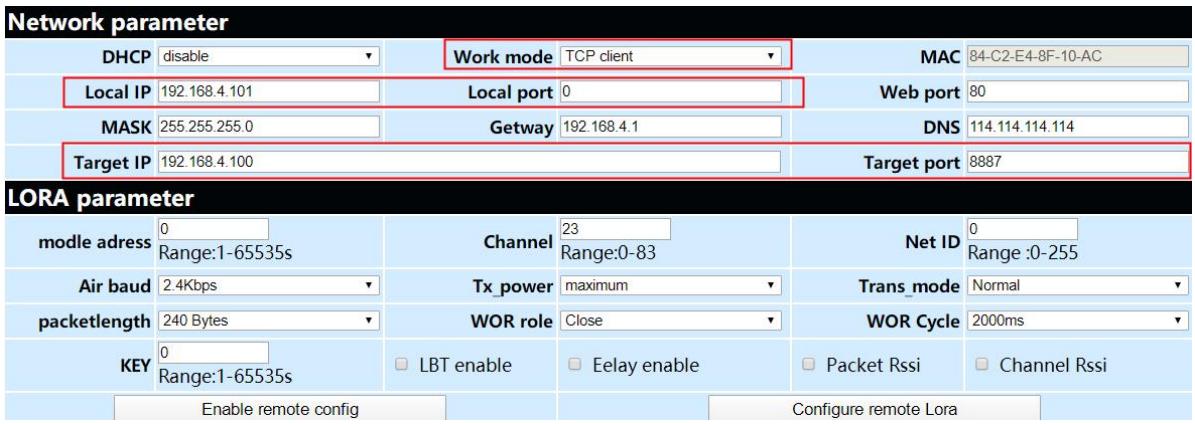
Data sending and receiving tests:



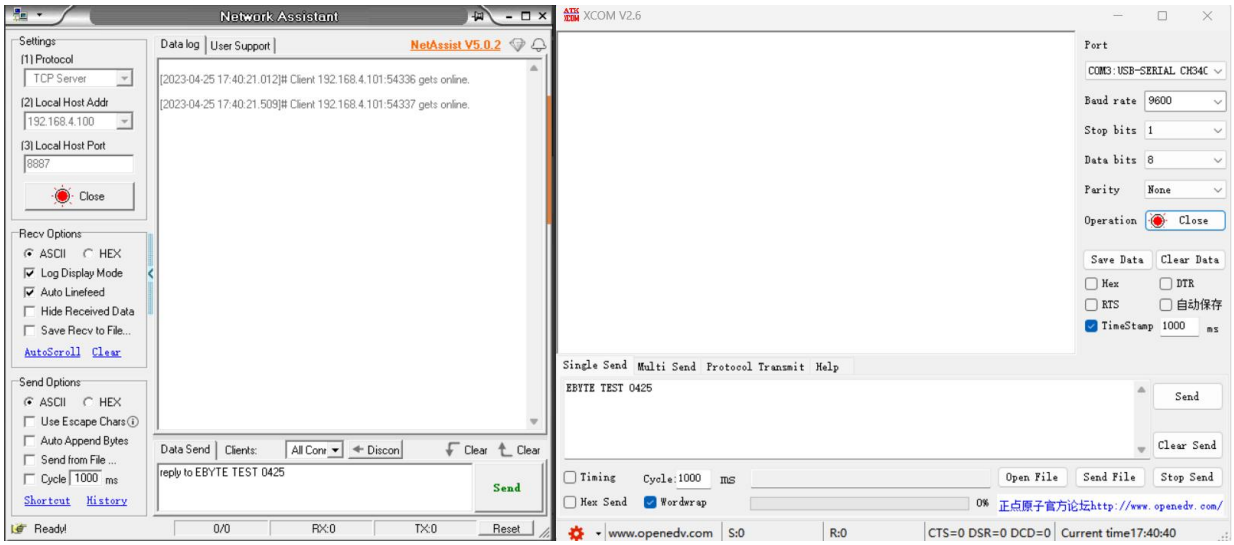
2.6 TCP client instructions

Configure the Ethernet parameters of the "Gateway Radio", using the host computer and the web configuration as follows:

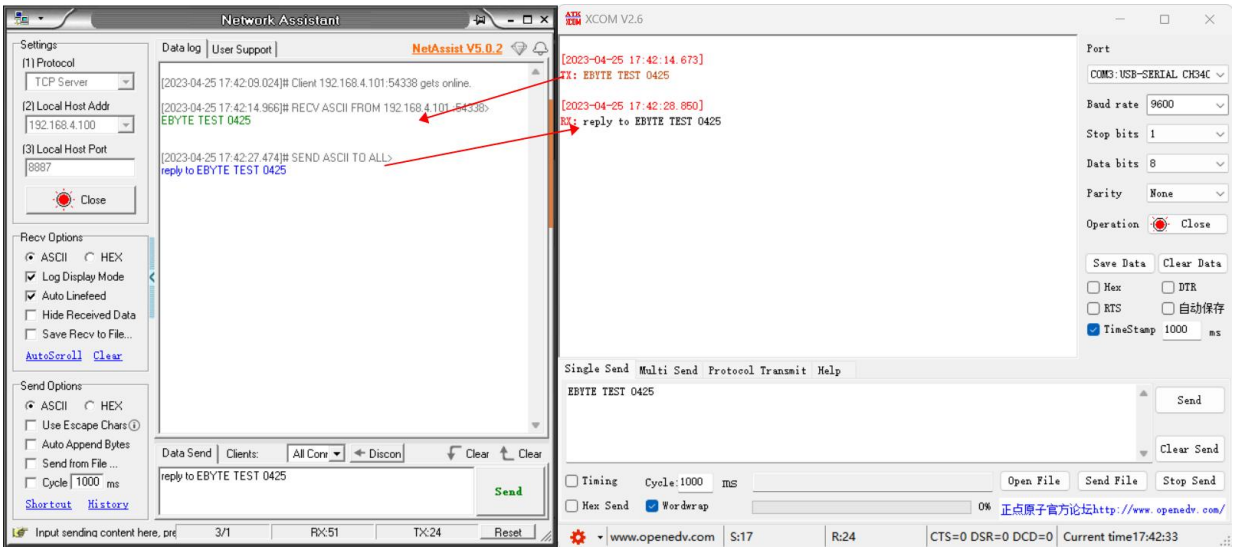




NetAssist connects to the "Gateway Radio" as shown below (the device LINK indicator is always on after successful connection), and XCOM connects to the "Serial Radio":

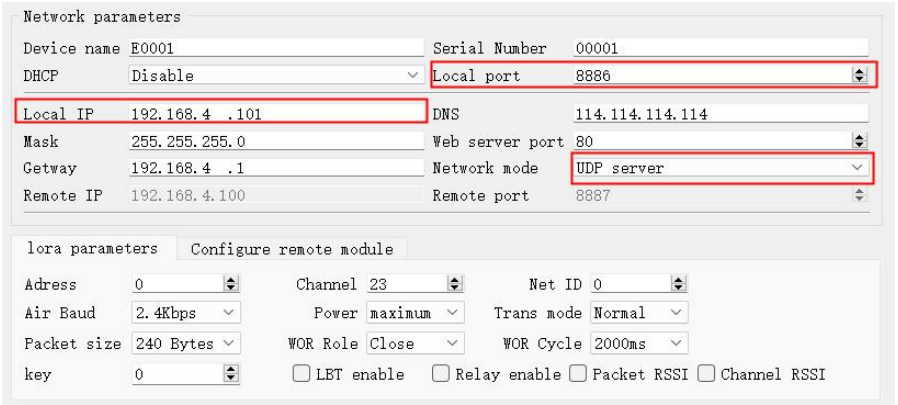


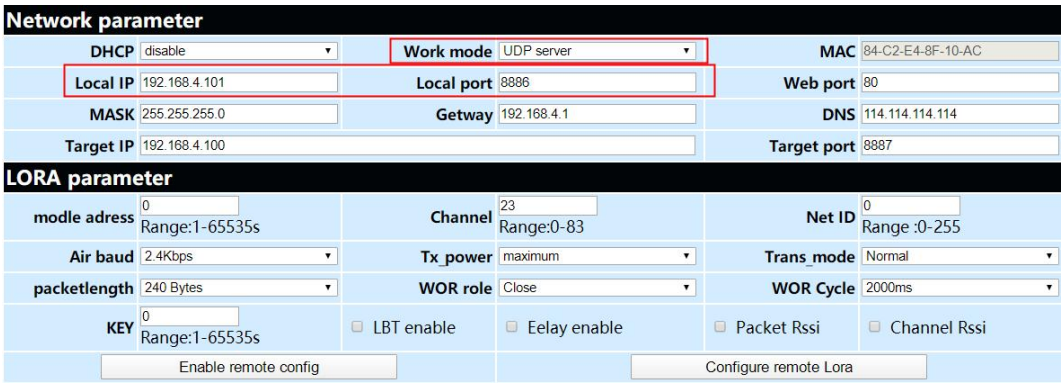
Data sending and receiving tests:



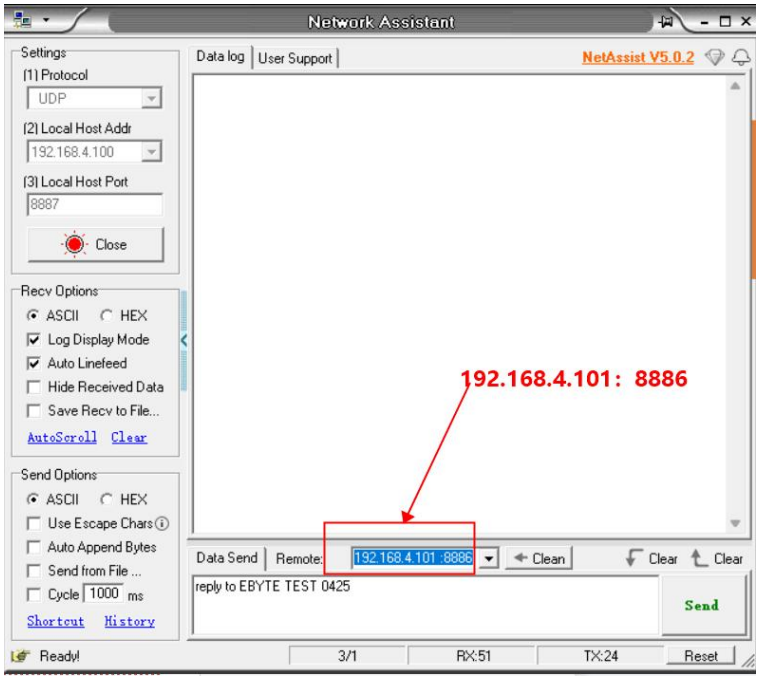
2.7 UDP server instructions

Configure the Ethernet parameters of the "Gateway Radio", the host computer and the web page as follows:

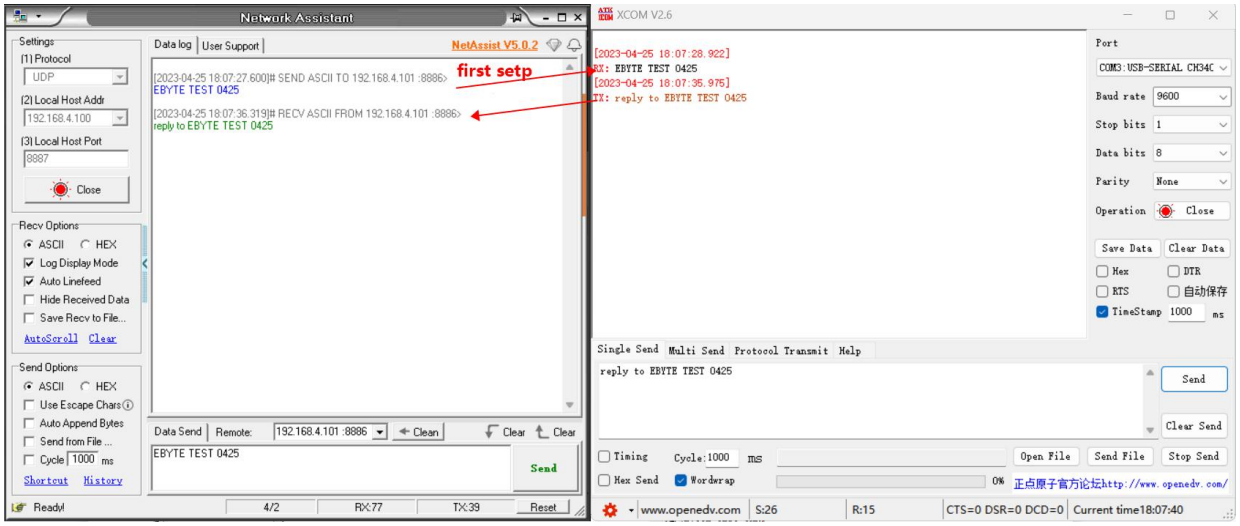




After the configuration is complete, the device's LINK indicator is always on and the NetAssist connection to the "Gateway Radio" is as shown below:

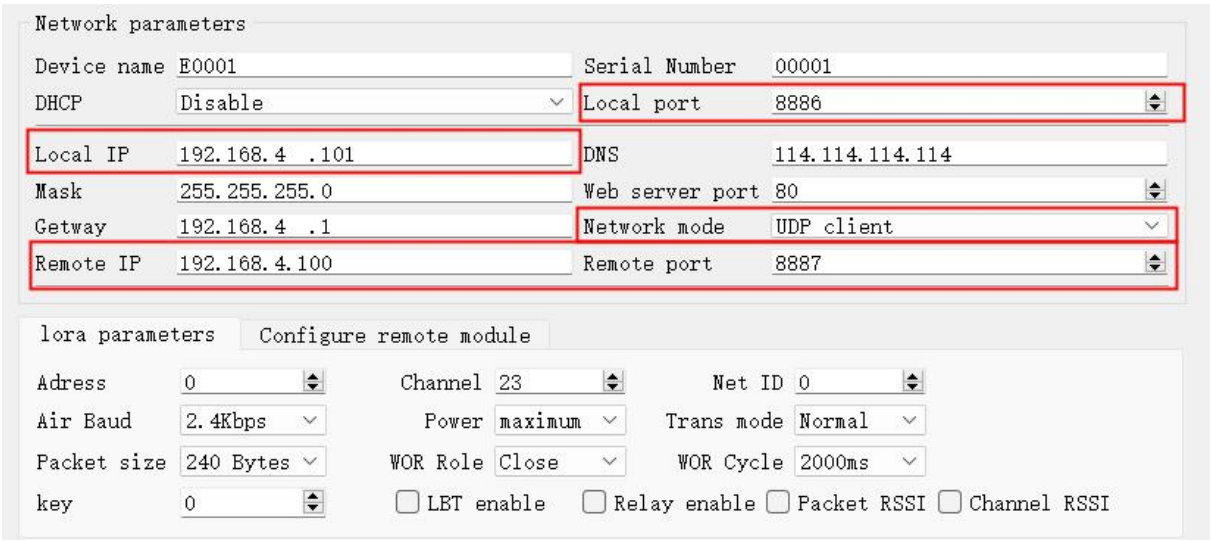


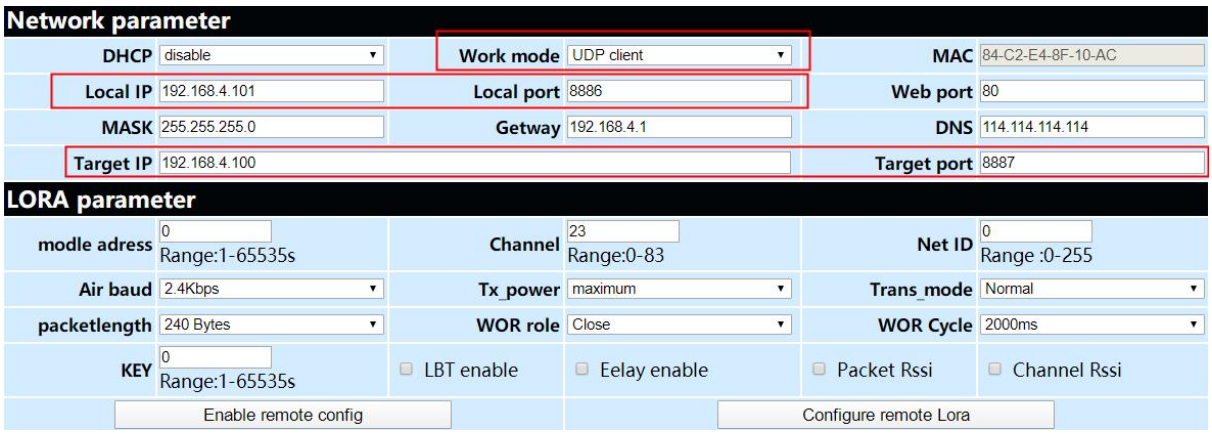
Data sending and receiving test (in UDP server mode, data must be sent by the PC first, UDP can dynamically adjust the destination address then, the data sent by serial port can only be received by the last communication UDP):



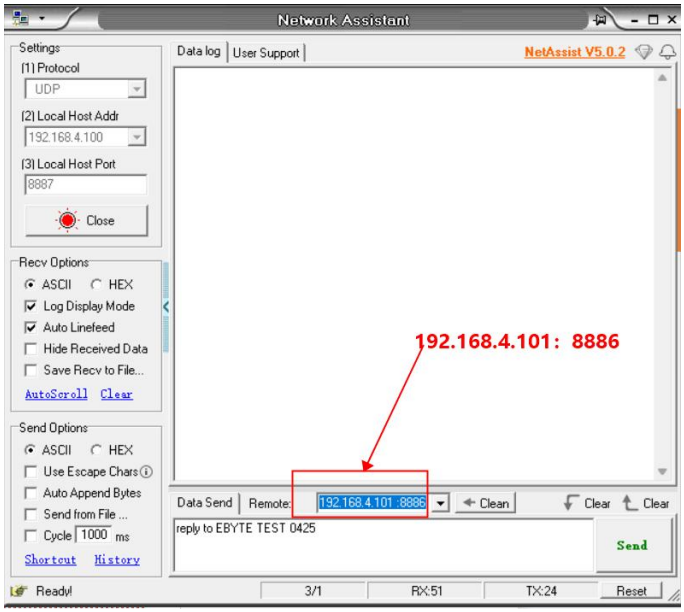
2.8 UDP client instruction

Configure the Ethernet parameters of the "Gateway Radio", the host computer and the web page as follows:

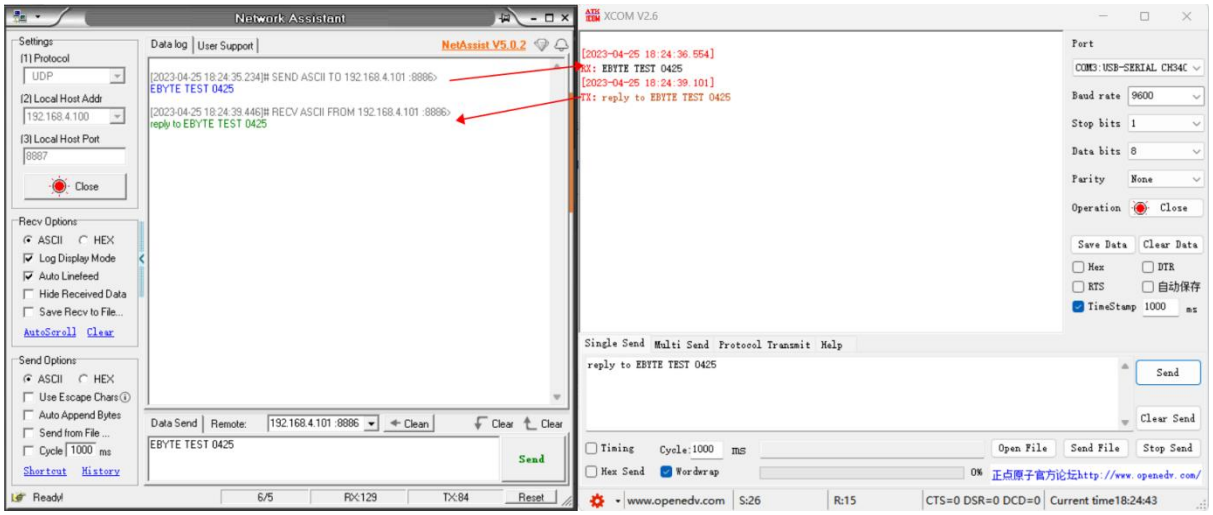




After the configuration is complete, the device's LINK indicator is always on and the NetAssist connection to the "Gateway Radio" is as shown below:



Data sending and receiving test: serial port data will only be received by UDP (192.168.4.100:8887):



3 Specification and parameter

3.1 General specifications

No.	Item	Specification
1	Power supply voltage	8V~28VDC, 12V or 24V power supply recommended
2	Network port specification	Standard RJ45, support 10/100Mbps
3	Network Protocol	IP, TCP/UDP, ARP, ICMP, IPv4, MQTT, HTTP
4	Socket Mode	TCP Server, TCP Client,
5	TCP Server Connection	UDP Server, UDP Client, HTTP Client, MQTT Client,
6	IP Acquisition Method	HTTP Client, MQTT Client
7	Domain Name Resolution	Support up to 6 TCP connections
8	Domain Name Server	Static IP, DHCP
9	User Configuration	Support
10	Antenna Interface	Customizable, default 114.114.114.114
11	Operating temperature	Web configuration, uplink, AT command
12	Operating Humidity	SMA (external screw, internal hole)
13	Size	-40 ~ +85℃, industrial grade
14	Average weight	10% ~ 90%, relative humidity, non-condensing
15	Storage Temperature	84mm*82mm*25mm

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3.2 Frequency and number of channels

Model	Default frequency	Frequency band	Channel spacing	Number of channels
	MHz	MHz	Hz	
E90-DTU (230SL-22/30-ETH)_V2.0	230.125	220.125～236.125	250K	0～64（Default 40） Half Duplex
E90-DTU (400SL-22/30-ETH)_V2.0	433.125	410.125～493.125	1M	0～83（Default 23） Half Duplex
E90-DTU (900SL-22/30-ETH)_V2.0	868.125	850.125～930.125	1M	0～80（Default 18） Half Duplex

【Note】：

In the same area using multiple groups of digital radios to communicate one-to-one at the same time, it is recommended that each group of digital radios set the channel interval above 3MHz.

3.3 Transmit power level

	E90-DTU (230/400/900SL22-ETH)_V2.0	E90-DTU (230/400/900SL30-ETH)_V2.0
High	22（dBm）（Default）	30（dBm）（Default）
Medium	17（dBm）	27（dBm）
Low	13（dBm）	24（dBm）
Very low	10（dBm）	21（dBm）

【Note】

1, the lower the transmitting power, the closer the transmission distance, but the working current does not decrease in proportion, it is recommended to use the maximum transmitting power;

2, software to adjust the power can not be accurately adjusted there are errors;

3.4 Air speed

Model	Airspeed range	Default parameters
E90-DTU(230SL-22/30-ETH)_V2.0	2.4、4.8、9.6、15.6Kbps	2.4Kbps
E90-DTU(400SL-22/30-ETH)_V2.0	2.4、4.8、9.6、19.2、38.4、62.5Kbps	2.4Kbps
E90-DTU(900SL-22/30-ETH)_V2.0	2.4、4.8、9.6、19.2、38.4、62.5 Kbps	2.4Kbps

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3.5 Subcontract length and method

Model	Subcontracted bytes	Default parameters
E90-DTU(230SL-22/30-ETH) _V2.0	32、64、128、240Bytes	240 Bytes
E90-DTU(400SL-22/30-ETH) _V2.0	32、64、128、240Bytes	240 Bytes
E90-DTU(900SL-22/30-ETH) _V2.0	32、64、128、240Bytes	240 Bytes

【Note】

It is recommended to use the default parameter 240Bytes for subpackaging;

3.6 Communication distance

Model	Distance	Remarks
E90-DTU(230SL-22-ETH) _V2.0	5KM	Clear and open environment, antenna gain 5dBi, antenna height 2.5m, air rate 2.4Kbps
E90-DTU(230SL-30-ETH) _V2.0	10KM	Clear and open environment, antenna gain 5dBi, antenna height 2.5m, air rate 2.4Kbps
E90-DTU(400SL-22-ETH) _V2.0	5KM	Clear and open environment, antenna gain 5dBi, antenna height 2.5m, air rate 2.4Kbps
E90-DTU(400SL-30-ETH) _V2.0	10KM	Clear and open environment, antenna gain 5dBi, antenna height 2.5m, air rate 2.4Kbps
E90-DTU(900SL-22-ETH) _V2.0	5KM	Clear and open environment, antenna gain 5dBi, antenna height 2.5m, air rate 2.4Kbps
E90-DTU(900SL-30-ETH) _V2.0	10KM	Clear and open environment, antenna gain 5dBi, antenna height 2.5m, air rate 2.4Kbps

3.7 Power consumption

Model	TX Current mA		Holding current mA	
	12V	24V	12V	24V
E90-DTU(230SL-22-ETH) _V2.0	72.9	35.9	10.2	7.8
E90-DTU(230SL-30-ETH) _V2.0	163.6	92.4	16.7	7.1
E90-DTU(400SL-22-ETH) _V2.0	63.8	29.7	10.4	6.2
E90-DTU(400SL-30-ETH) _V2.0	405.1	218.1	14.2	7.7
E90-DTU(900SL-22-ETH) _V2.0	84.1	42.9	10.3	6.0
E90-DTU(900SL-30-ETH) _V2.0	332.0	146.1	14.2	7.4

【Note】

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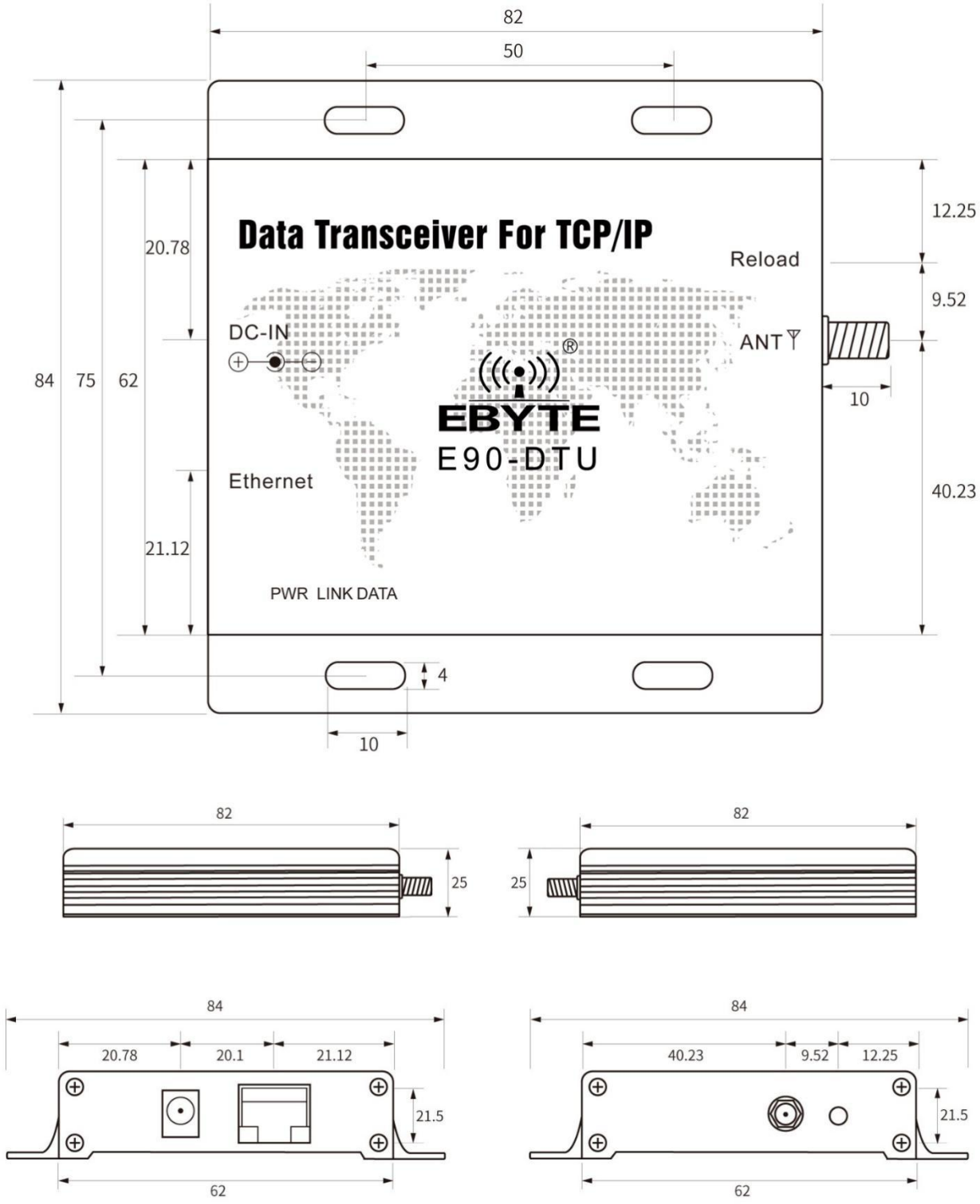
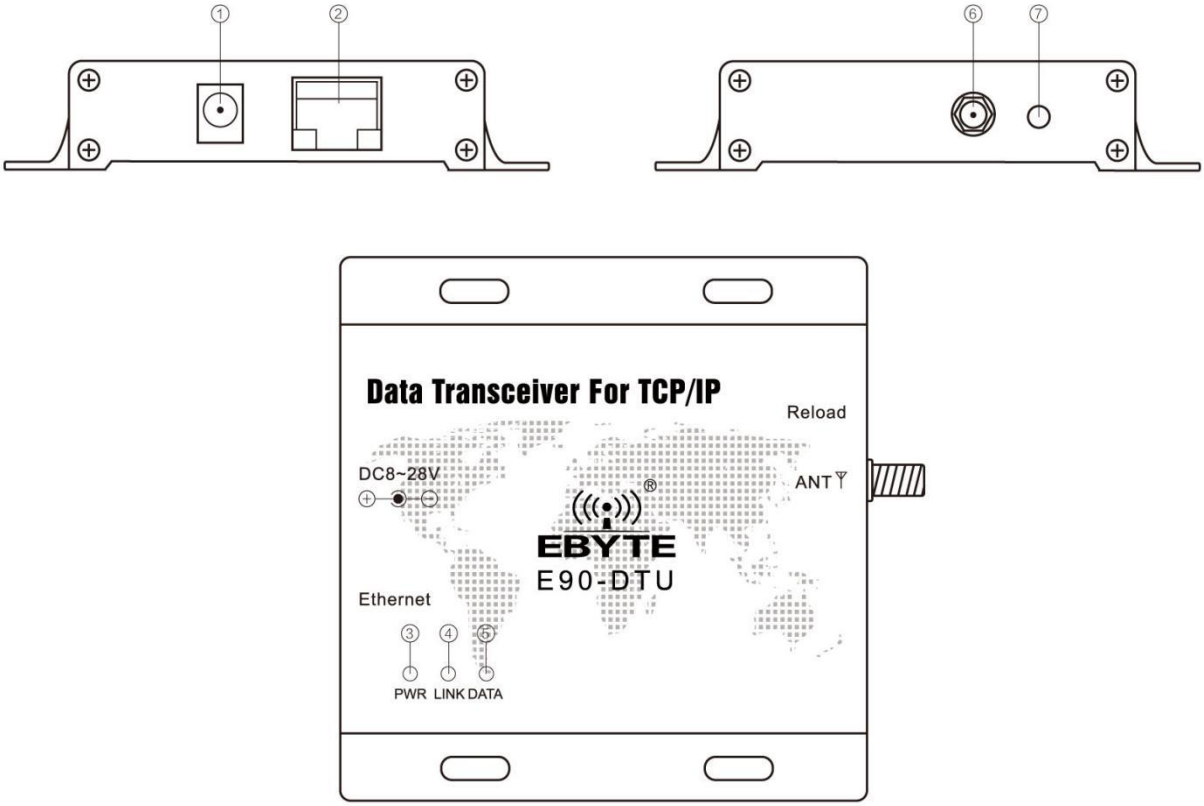
The test data here is the instantaneous peak. It is recommended to retain more than 50% current margin when selecting power supply, which is beneficial to the long-term stable operation of the radio.

3.8 Size



3.9 Pin definition



No	Name	Description
1	DC_IN	Power connector, 8 to 28V DC female connector (inner pin diameter 2.0mm, hole diameter 6.4mm)
2	ETHERNET	Ethernet interface, standard RJ45 interface
3	PWR	Power indicator
4	LINK	Connection establishment indicator
5	DATA	Serial port send/receive indicator
6	ANT	SMA antenna connector (external screw, internal hole)
7	Reload	Restore to factory settings button

4 Basic function

4.1 Default parameter

Category	Item	Parameter
LORA	Module Address	0
	Channel	40(230SL), 23(400SL), 18(900SL)

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	Network ID	0
	Air Rate	2.4Kbps
	Transmission method	Transparent transmission
	Packet Length	240 Bytes
	WOR Role	Close
	WOR period	2000ms
	Communication key	0
	LBT enable	Disable
	Relay Enable	Disable
	Data RSSI	Disable
	Channel RSSI	Disable
Networking	IP acquisition method	Static
	Local Port	8886
	Local IP	192.168.4.101
	Subnet Mask	255.255.255.0
	Gateway	192.168.4.1
	DNS server	114.114.114.114
	Web Access Port	80
	Network operating mode	TCP Server

4.2 LORA parameter

4.2.1 Basic wireless parameters

Channel: The equipment that needs to communicate should work on the same channel, and the current operating band can be calculated based on the channel value;

Operating frequency = minimum frequency band + channel value * channel interval

Module address: Transparent transmission should ensure that the devices that need to communicate have the same address, in fixed mode to distinguish between different devices on the same channel, relay mode is used to configure the relay address of the data, the configuration range 0 to 65535;

Network ID: Transparent transmission should ensure that the network IDs of the devices that need to communicate are the same, and in relay mode is used to distinguish the destination of the data, with a configuration range of 0 to 255;

Airspeed: ensure that the devices that need to communicate have the same airspeed;

Sub-packet length: to ensure that the devices that need to communicate have the same sub-packet;

4.2.2 Broadcast and monitoring

Set the DTU wireless address to 0xFFFF: it can listen to the data transmission of all modules on the same channel; the sent data can be received by modules with any address on the same channel, thus playing the role of

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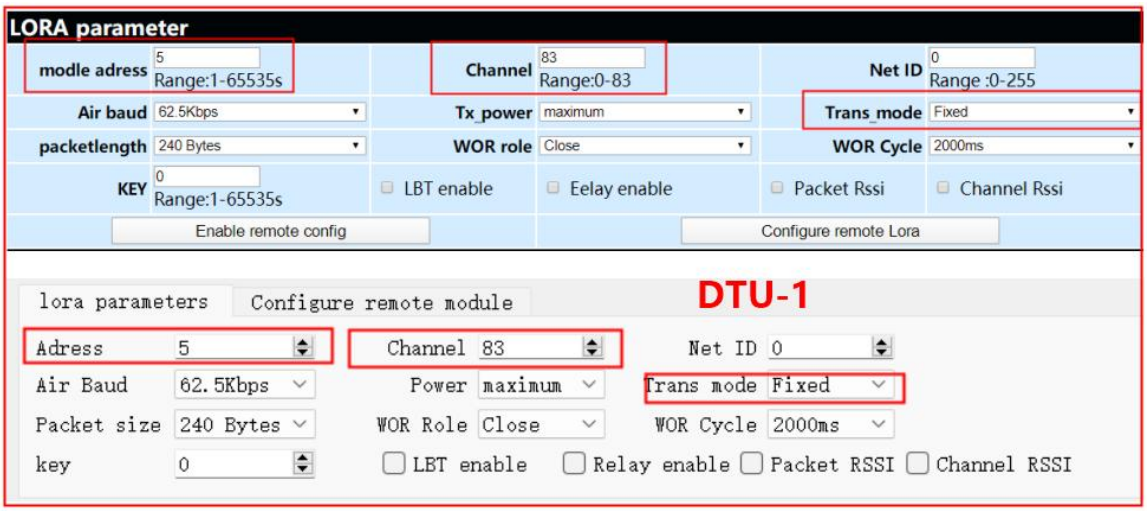
broadcasting and listening.

4.2.3 Fixed point transmission

Support address function, the host can transmit data to any address, any channel module, to achieve networking, relay and other applications: for example: module A needs to transmit data AA BB CC (HEX:41 41 20 42 42 20 43 43) to module B (address 0x0005, channel 0x05), its communication format is: 00 05 05 41 41 20 42 42 42 20 43 43, where 00 05 is module B address, 05 is module B channel, then module B can receive AA BB CC (other radio does not receive data). 43 43, where 00 05 is the module B address and 05 is the module B channel, then module B can receive AA BB CC (other stations do not receive data).

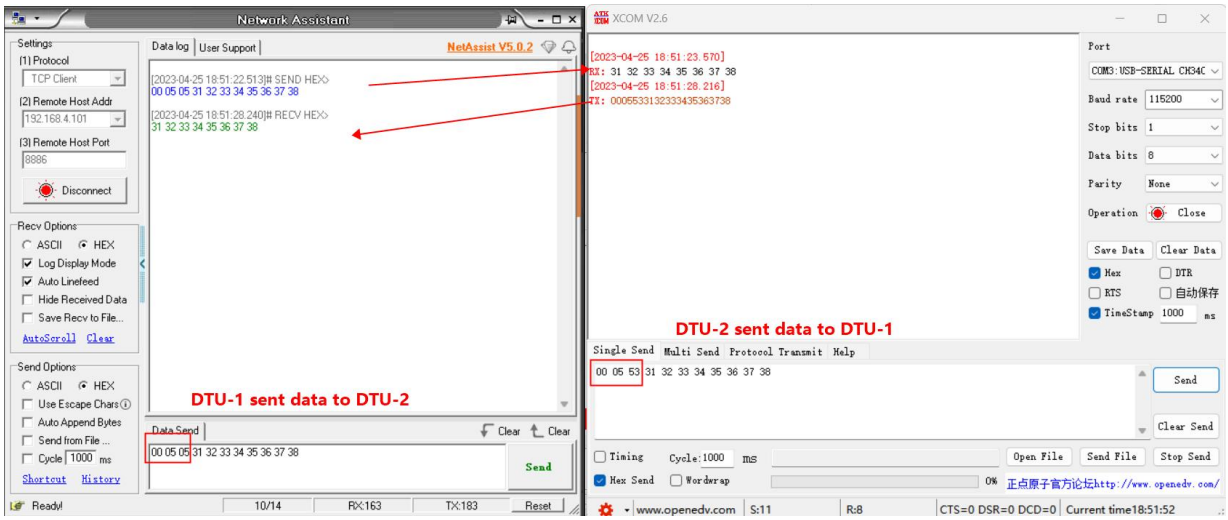
For example, configure this Gateway Radio (DTU_1) with the parameters in the diagram, PC connection "Gateway Radio" refers to "Quick Start", (DTU_2) is a Serial Radio with the same frequency band (need to buy separately), also been configured as the corresponding parameters in the figure.



Fixed-point sending demo:

DTU_1 to DTU_2 requires 00 05 05 (HEX) before the data;

DTU_2 to DTU_1 needs to add 00 05 53 (HEX) before the data;



4.2.4 Relay mode

No	Relay mode description
1	After setting the trunking mode by the configuration mode, the trunking starts to work when switching to the general mode.
2	In trunk mode, the "Module Address" is no longer in effect as an address parameter, but is forwarded to the pair as a Network ID (NETID), and if one of the networks is received, it is forwarded to the other network. The repeater's own network ID (NETID) is not valid.
3	In trunk mode, the repeater module cannot send and receive data and cannot perform low-power operation.

Relay networking rules description:

1、Forwarding rules, relay can forward data between two network IDs (NETID) in both directions.

2. In trunking mode, the "module address" is no longer in effect as an address parameter but as a network ID (NETID) forwarding pair.

As shown in the figure:

①One level relay

"Node 1" NETID is 08 (0x08).

"Node 2" NETID is 33 (0x21).

The module address of Relay 1 is 2081 (0x0821,ADDH:0x08,ADDL:0x21).

So the signal sent by node 1 (0x08) can be forwarded to node 2 (0x21)

Also node 1 and node 2 have the same address, so the data sent by node 1 can be received by node 2.

②Secondary Relay

The address of relay 2 is 8453 (0x2105,ADDH:0x21,ADDL:0x05).

So Relay 2 can forward data from Relay 1 to Network NETID: 05 (0x05).

Thereby node 3 and node 4 can receive node 1 data. Node 3 outputs data normally, and Node 4 has a different address from Node 1, so it does not output data.

③Two-way relay

As configured in the figure: the data sent by node 1 can be received by nodes 2 and 3, and the data sent by nodes 2 and 3 can be received by node 1.

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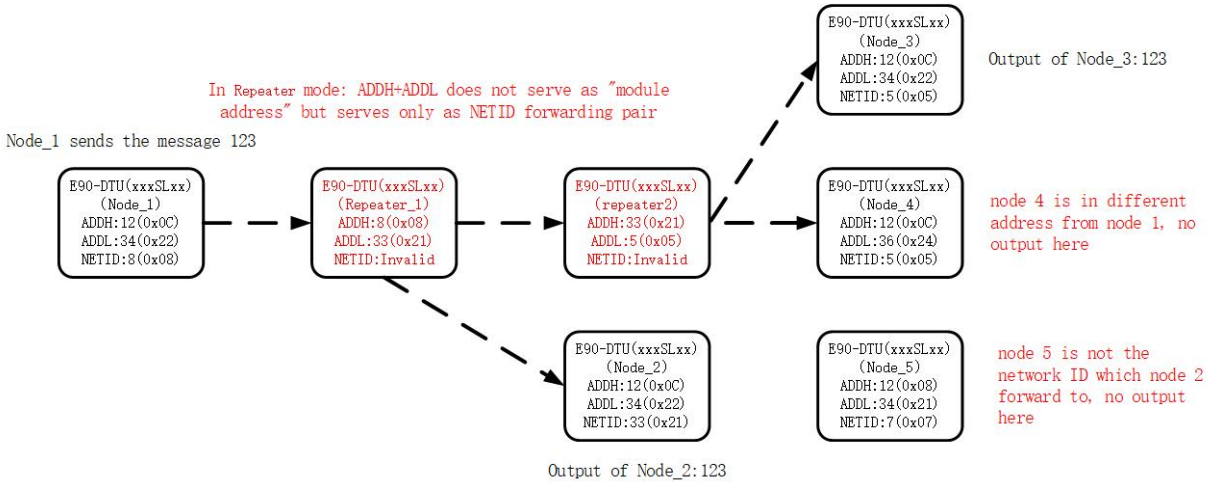

4.2.5 Communication key

The web configuration always shows 0 (configuration range 0 to 65535), the communication key is used for user encryption to avoid interception of over-the-air wireless data by similar modules. the DTU will internally use these two bytes as a calculation factor to transform the encryption process for the over-the-air wireless signal.

Web page configuration needs to configure the key every time, otherwise the device will encrypt the communication data with 0.

AT command and the upper computer can query the communication key of the current device, web configuration cannot query the communication key fixed return 0.

4.2.6 LBT

DTU has Listen before talk (LBT) function, when this function is turned on, the wireless data will actively listen to the channel environment noise before transmitting, the noise exceeds the threshold value will delay the transmission, this function can greatly improve the communication success rate of DTU in harsh environment, can be used for network transmission, anti-collision processing, but may bring data delay, LBT maximum dwell time 2 seconds.

4.2.7 WOR role

WOR off. the DTU works in transmission mode, the user input data through Ethernet, the DTU will start wireless transmitting out. Wireless receive function is on, and wireless data is received and output through Ethernet.

WOR transmitting side. DTU transmitting and receiving is on, and a certain time wake-up code is added when transmitting data.

WOR receiver. the DTU can not transmit data, working in WOR listening mode, the longer the WOR listening interval cycle time, the lower the average power consumption, but the greater the data delay, the receiving and transmitting sides must be consistent (very important).

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4.2.8 RSSI

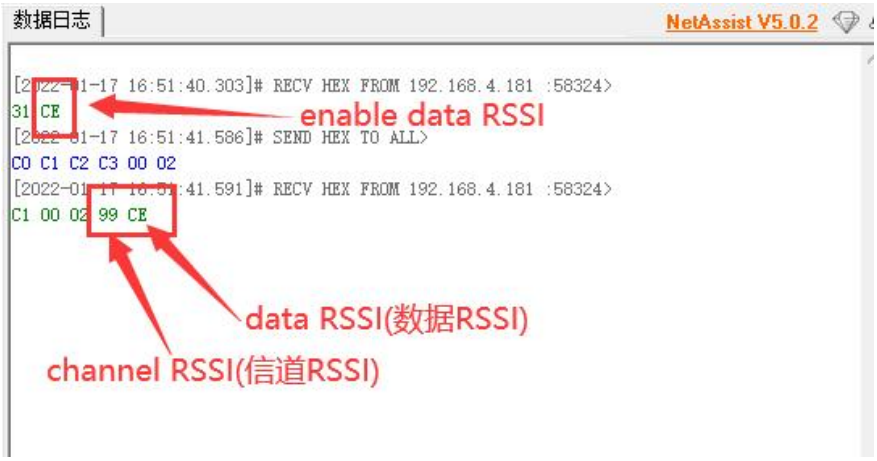
That is, the signal strength indication function. When enabled, data received wirelessly by the DTU will be followed by an RSSI strength byte (in hex) after the user data. It can be used to evaluate the signal quality, improve the communication network, range measurement, and can be used to implement the LBT function manually.

4.2.9 Channel RSSI enable

When enabled, the command C0 C1 C2 C3 can be sent in transmit mode or WOR send mode Read register.

- Register 0x00 : Current ambient noise RSSI;
- Register 0x01 : RSSI at the last received data. (Current channel noise is: dBm = -RSSI/2);
- Command format: C0 C1 C2 C3 + start address + read length;
- Return: C1 + address + read length + read valid value; for example: send C0 C1 C2 C3 00 01
- Return C1 00 01 RSSI

Demonstration note, open data RSSI and channel RSSI, first send 0x31 with the remote device, the gateway receives data (0x30) + RSSI (0xCE), and then query the channel RSSI and data RSSI results through the instruction C0 C1 C2 C3 00 02 (HEX) as shown in the following figure:



4.3 Ethernet

4.3.1 IP Acquisition

Dynamic acquisition（DHCP）：

The dynamic acquisition device will automatically obtain the IP address and subnet mask from the router while synchronizing the router's gateway and DNS server, so only the working mode and target parameters of the device can be configured in the dynamic acquisition mode.

Static configuration（STATIC）：

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You need to manually configure the IP (factory default: 192.168.3.7), subnet mask (factory default: 255.255.255.0), gateway (factory default: 192.168.3.1), DNS server (factory default: 114.114.114.114) and other parameters of the device, the configuration should ensure that the communication device is located in the same network segment and ensure to avoid IP conflict, otherwise the device can not be normal passage and web configuration.

4.3.2 Device port

Random ports:

TCP clients, UDP clients, HTTP clients, and MQTT clients can configure the native port to 0 (using a random native port), and server mode cannot use a random port, otherwise the client cannot establish a connection correctly (the device is not listening on the port correctly).

Using a random port connection can quickly re-establish the connection when the device accidentally disconnects from the server, preventing the server from rejecting the connection due to four incomplete waves, and it is recommended to use a random port in client mode.

The device will automatically configure random ports when configuring TCP client, HTTP client, and MQTT client modes on the web page, and can be customized to cancel.

Static port:

Device fixed port (factory default use: 8886), TCP server mode device listens to the configured port, accepts the client's connection request and establishes a connection for data communication, TCP client mode device fixed port to initiate a connection request.

4.3.3 Subnet mask & gateway configuration

The subnet mask is mainly used to determine the network number and host number of the IP address, indicating the number of subnets and a flag to determine whether the module is in the subnet.

The subnet mask must be set, we commonly use the class C subnet mask: 255.255.255.0, the network number is the first 24 bits, the host number is the last 8 bits, the number of subnets is 255, the module IP in the range of 255, the module IP is considered to be in this subnet.

The gateway is the network number of the network where the module's current IP address is located. If you connect to an external network with a router or other device, the gateway is the route.

4.3.4 Domain name resolution (DNS)

Domain name resolution converts domain names into network-identified IP addresses through domain name resolution (DNS) servers. The domain name resolution (DNS) server address of this product supports user-defined, which can achieve domain name resolution by customizing the domain name resolution server in case of domain name server abnormality, and the device will report the resolution request to the custom domain name resolution (DNS) server when the domain name resolution is done, and return the device connection parameters (usually IP address) after the resolution is completed.

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In DHCP mode, the domain name resolution (DNS) server address is automatically obtained (synchronized with the router domain name resolution address) and cannot be customized.

In static IP mode, the default address of the domain name resolution (DNS) server is 114.114.114.114, which can be customized by the user.

Destination IP/domain name 4.3.5

Target IP parameter can automatically identify whether the configuration parameter is IP address or domain name input, domain name input supports up to 128 characters configuration.

4.6 SOCKET function

4.6.1 TCP Server

TCP Server is the TCP server. In TCP Server mode, the device listens to the local port, accepts connection requests from clients and establishes connections for data communication. When the Modbus gateway function is disabled, the device sends the data received from the serial port to all client devices connected to the device, and supports connecting up to 6 clients.

It is usually used for communication with TCP clients in LAN.

Connection requests are no longer accepted after 6 clients are exceeded, and the web configuration is not available when 6 clients remain connected.

4.6.2 TCP Client

TCP Client is the TCP client. When the device works, it will initiate a connection request to the server and establish a connection, which is used to realize the interaction between serial port data and server data.

To use the client, you need to configure the IP address/domain name and target port of the exact configuration target.

4.6.3 UDP server

UDP Server means that the device does not verify the IP address of the data source when communicating using the UDP protocol. After each UDP packet is received, the source IP address and the source port of the packet are saved and set as the destination IP and port, so the data sent by the device only sends packets to the source IP address and port of the last time the device received data.

This mode is usually used in scenarios where multiple network devices communicate with this device with high frequency and the TCP Server cannot meet the conditions.

Using UDP Server requires the remote UDP device to send data first, otherwise it cannot send data properly.

【Note】 In UDP mode, the data sent down from the network to the device should be less than 512Bit per packet, otherwise it will cause data loss.

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4.6.4 UDP Client

UDP Client is a connectionless transport protocol that provides a simple transaction-oriented unreliable messaging service with no connection establishment and disconnection, only the destination IP and destination port need to be configured to send data to each other. It is typically used in data transfer scenarios where there is no requirement for packet loss, where packets are small and sent quickly, and where the data is destined for a specified IP.

In UDP Client mode, the device will only communicate with the configured (destination IP and destination port) remote UDP device.

In this mode, the destination address is set to 255.255.255.255 and the sent data will be broadcasted in the whole network segment, but the sending and receiving devices need to ensure that the ports are the same, and the device can also receive broadcasted data.

4.6.5 HTTP Client

This mode can achieve HTTP automatic packet function, providing two modes GET and POST, customers can configure URL, Header and other parameters by the device to send packets, to achieve fast communication between the digital radio and HTTP server, using HTTP client mode is recommended to use random ports and open a short connection to save HTTP server resources, the request single packet size is affected by LORA packet, when LORA configured for 240 bytes packet, the single packet data can not be larger than 240.

(1), GET usage demonstration

Use OneNET multi-protocol access HTTP mode to test the device HTTP-GET request.

Through OneNET-HTTP access instructions query (does not provide support for the use of OneNET, the user needs to query the use of the method, only to provide the parameters to fill in the instructions).

{

URL:/devices/863876867/datapoints?

Header:api-key:xxxxxxxxx (only demo instructions, users need to register their own accounts to use)
Host:api.heclouds.com

HTTP Server: api.heclouds.com

HTTP Port:80

Get send: datastream_id=char

}

The device needs to access the Internet, it is recommended to use dynamic IP acquisition to prevent the device from accessing the network normally due to unreasonable parameter configuration, it is recommended to enable short links to save server resources and open random ports (local port: 0), take the above configuration as an example.

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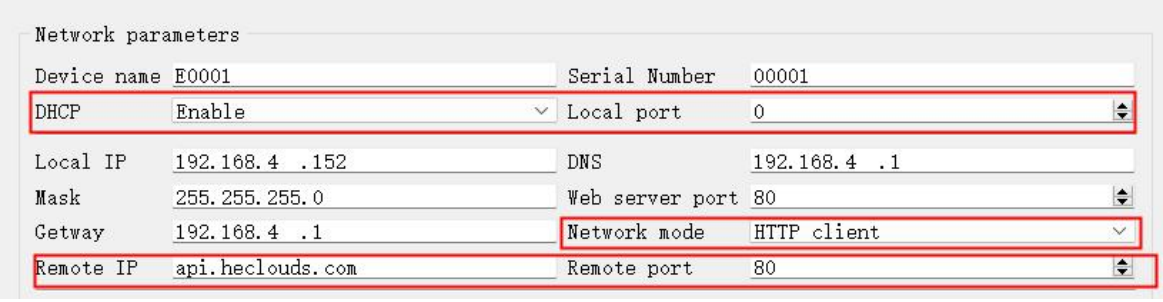

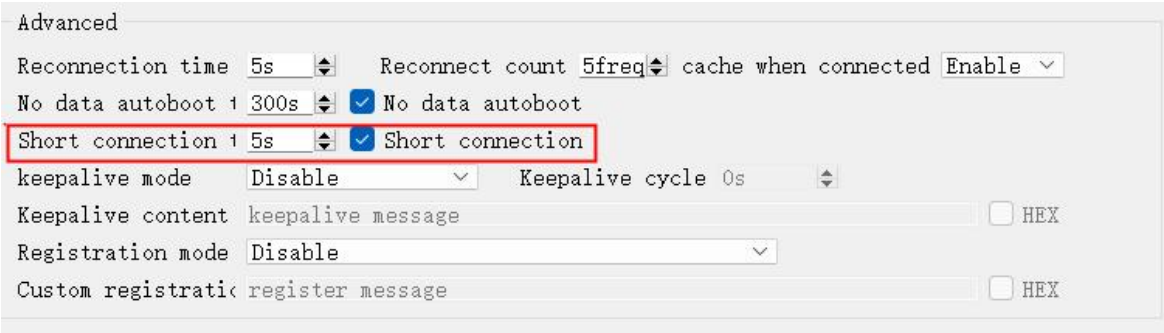

Return data configuration without packet headers (HTTP packet header input box can be entered with newlines):

"Serial Radio" (additional purchase required), wireless connection refer to "Quick Start", no further explanation here, request data demonstration:

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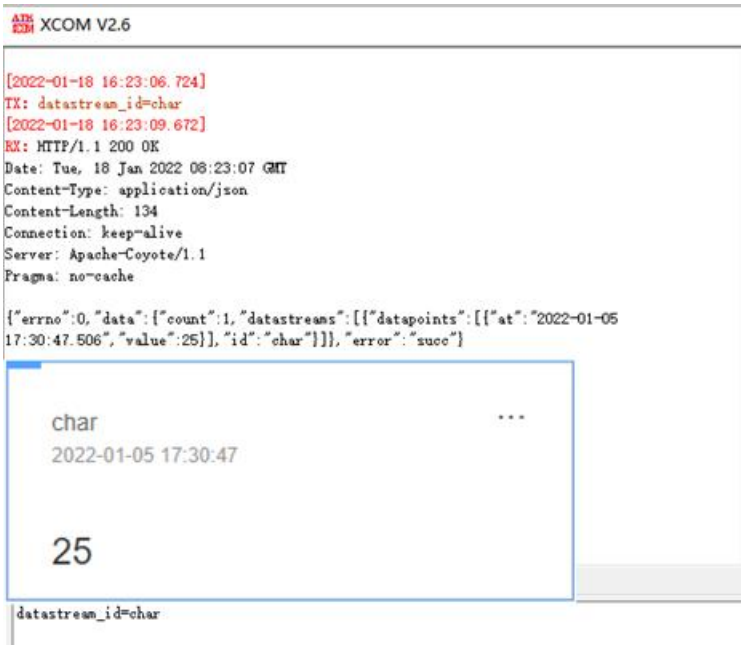
Return data configuration with packet header:

Request Data Presentation:



(2), POST

HTTP mode using OneNET multi-protocol access to test the device HTTP-POST requests.

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Through OneNET-HTTP access instructions query (does not provide support for the use of OneNET, users need to check the use of their own, only to provide instructions for filling in the parameters).

{

URL:/devices/863876867/datapoints

Header:api-key:xxxxxxxxx (only demo instructions, users need to register their own accounts to use)
Host:api.heclouds.com

HTTP Server: api.heclouds.com

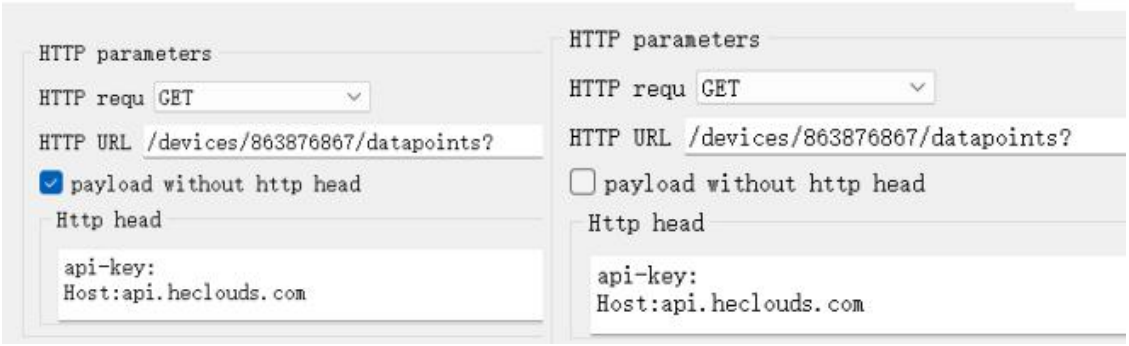
HTTP Port:80

Post send: {"datastreams":[{"id": "char", "datapoints":[{"value":28}]}]}

}

The device needs to access the Internet, it is recommended to use dynamic IP to prevent the device from accessing the network normally due to unreasonable parameter configuration, it is recommended to enable short links to save server resources and open random ports (local port: 0), refer to GET configuration.

Without packet header return data configuration (HTTP packet header input box can be entered newline character):



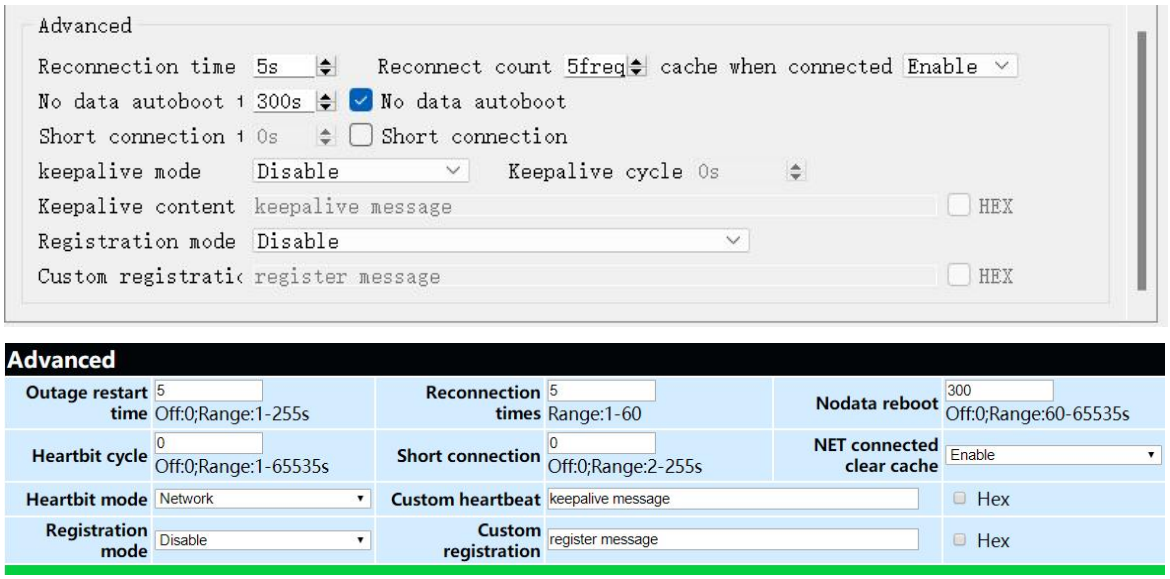
"Serial Radio" (additional purchase required), wireless connection refer to "Quick Start", no further explanation here, request data demonstration:

4.6.6 MQTT Client

Supports fast access to standard MQTT3.1.1 protocol servers (OneNET, Baidu Cloud, Huawei Cloud,

user-built and other server types) and Aliyun servers, supports quality of service level configuration (Qos 0, Qos 1), supports extra-long text configuration, facilitates better access to network service operators (server address, three elements, subscription and publishing addresses support up to 128 characters) configuration).

Advanced settings such as short links should be turned off using the MQTT feature as shown in the following diagram (upper diagram for the upper computer, lower diagram for the web configuration):



(1), Standard MQTT3.1.1

Standard MQTT3.1.1 cloud parameters configuration (left figure is the upper computer, right figure is the web configuration):

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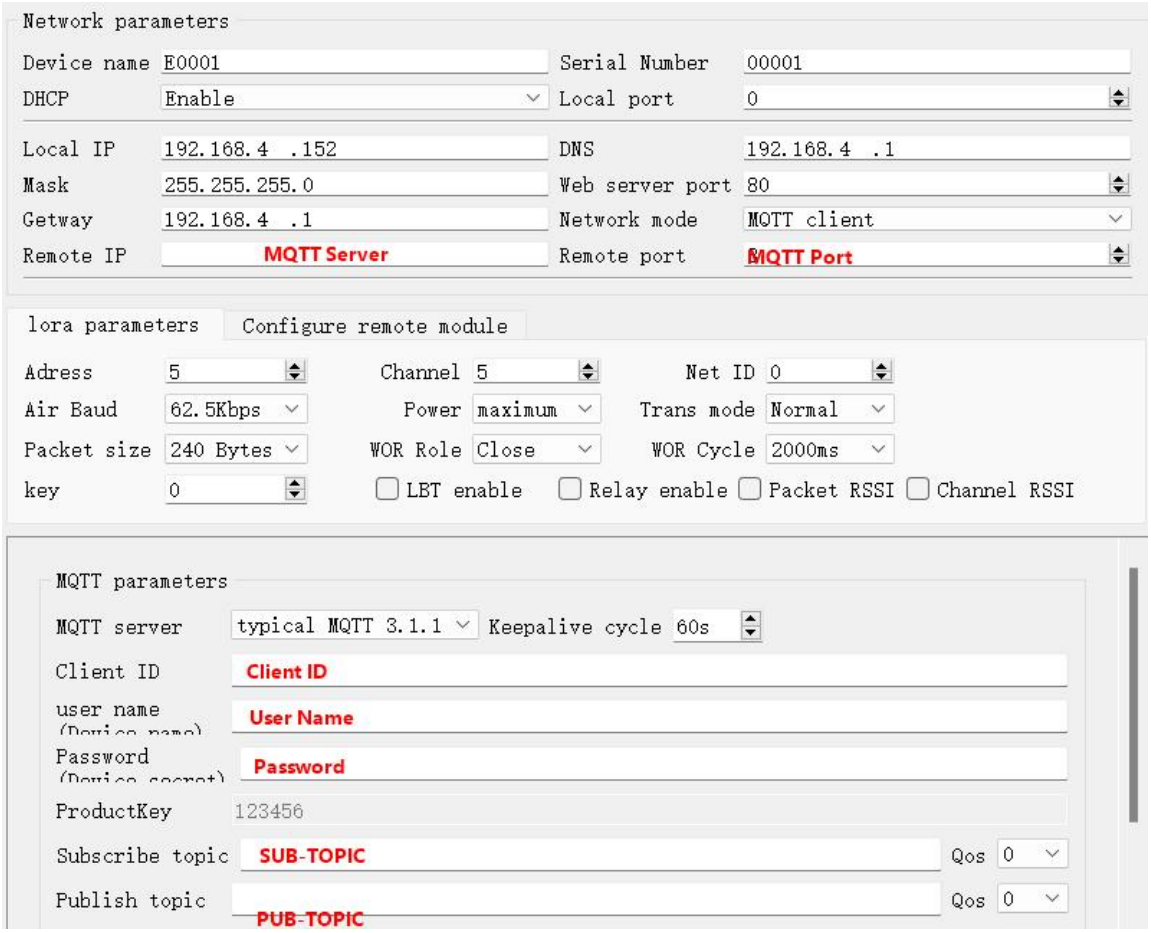

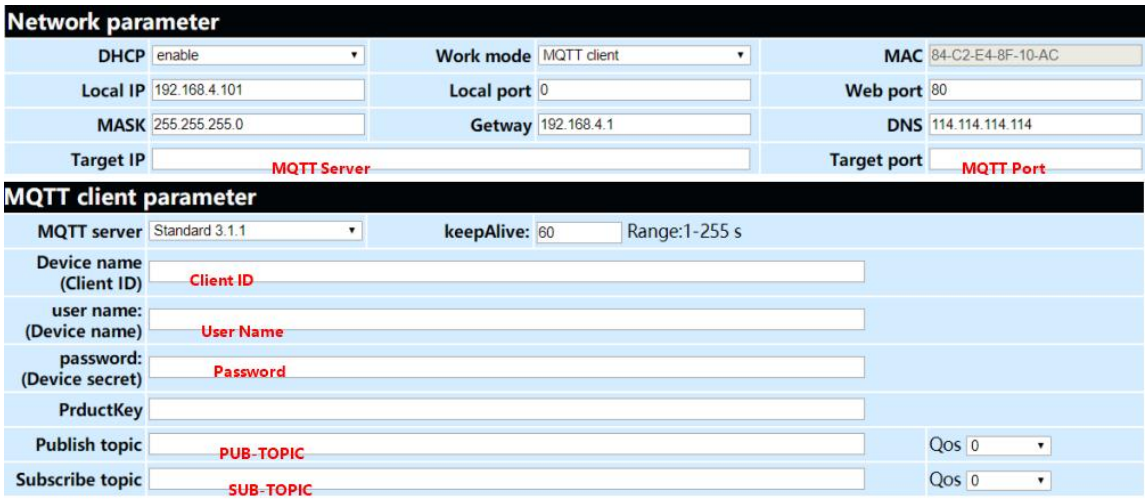

Demonstration of connecting to standard MQTT3.1.1 through the Tencent standard MQTT3.1.1 platform to achieve communication:

4.7 Web configuration

The device has a built-in web server, which is convenient for users to set and query parameters through the web.

Web server port is customizable (2-65535), default: 80

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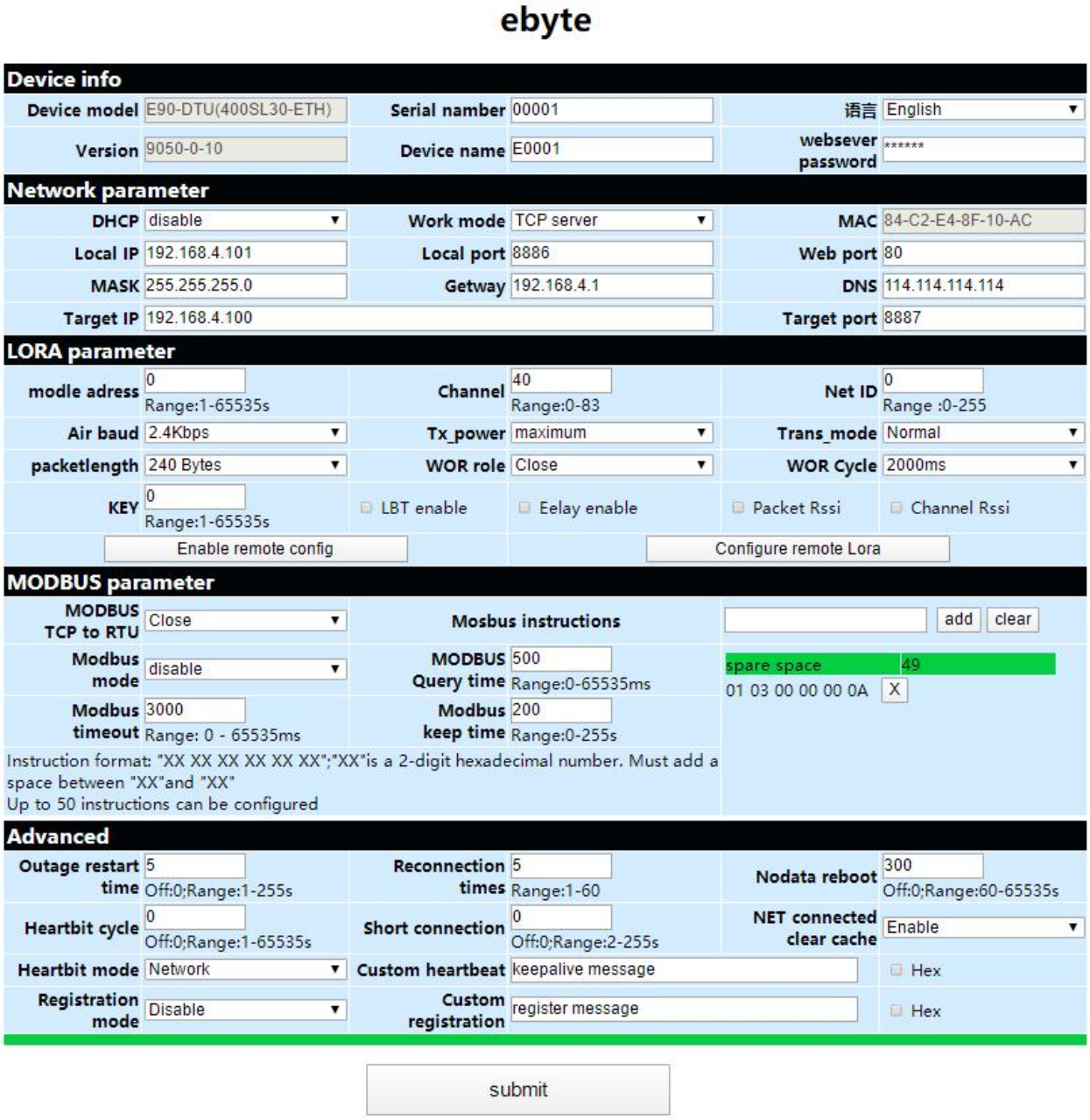
Operation method (Microsoft Edge version 94.0.992.50 for example, IE kernel browser is not supported)

(1) , open the browser, the address bar, enter the IP address of the device, such as 192.168.4.101 (IP address and computer need to maintain the same network segment, if you can not use the firewall to close try again), forget the local IP can be queried through AT commands and configuration software;



(2), the web page pops up the main interface, you can query and set the relevant parameters;

(3), click submit after entering the correct key can save the configuration parameters, the factory default key is: 123456;

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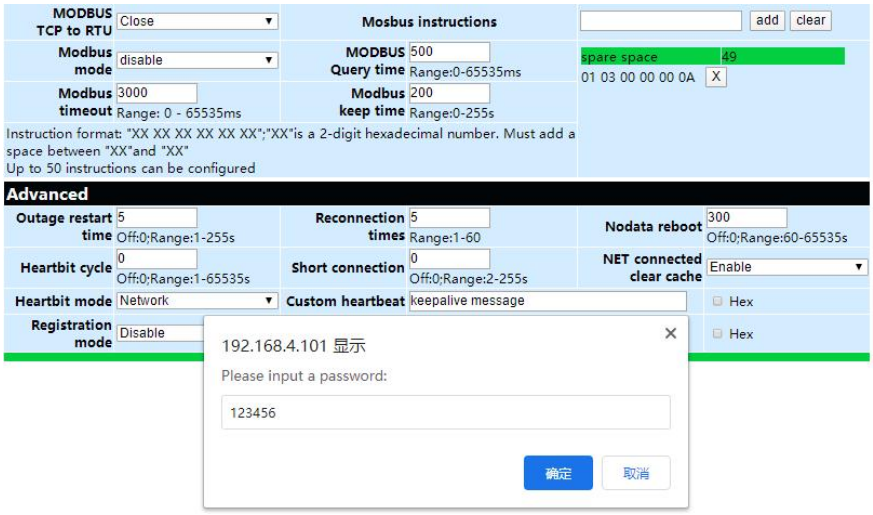
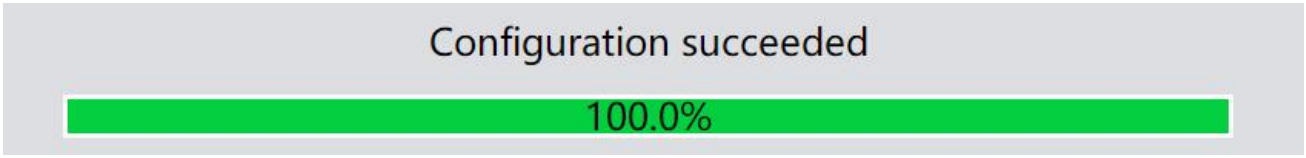
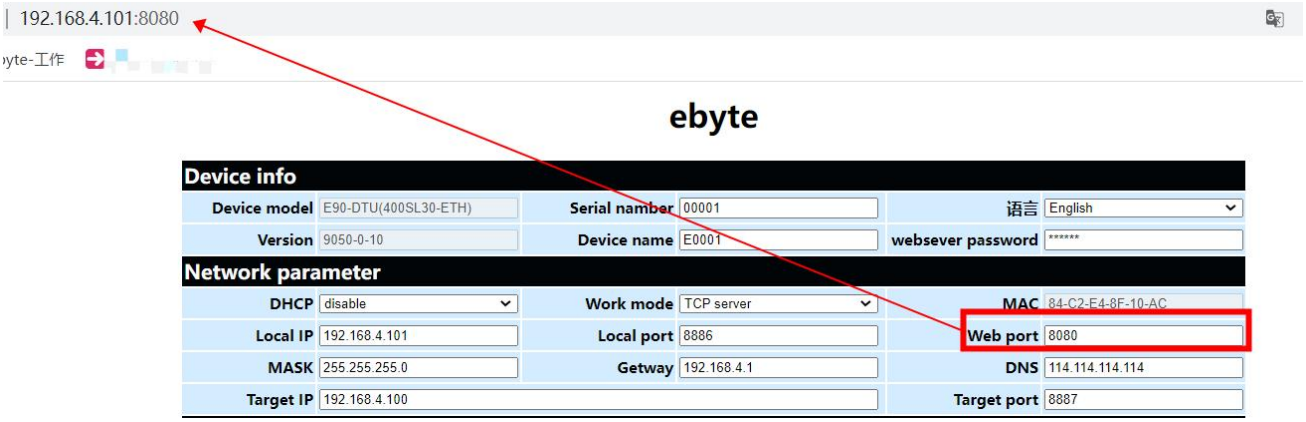


(4) , the progress bar prompts the configuration progress, please do not refresh the web page again after the configuration is complete (refresh the web page to enter the configuration mode again, you can reboot the device or submit again to enter the communication mode).



It can also be opened through the Open Web Configuration button of the configuration software.

【Note】 If the port number is modified, the port number should be added to the address input field, for example, if you modify the web access port to 8080, you need to enter 192.168.4.101:8080 in the address field to connect to the web configuration.



4.8 Hardware recovery factory

Pressing the key to restore the factory requires a valid connection to the network cable and power supply. Press the Reload pin of the device continuously until the LED is fully lit to release the key.

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5 Advanced Features

5.1 Heartbeat Pack

In client mode, users can choose to send heartbeat packets and customize the heartbeat packet time. The heartbeat packet can be sent in two modes: network heartbeat packet and serial heartbeat packet, which supports hexadecimal and ASCII code. It is recommended that you do not configure the KeepAlive time to be less than 60s, for example, 120s is recommended in the AliCloud manual.

Heartbeat packet sending mode:

(1) The default is to turn off the heartbeat packet mode.

(2), Serial mode -> The device sends heartbeat content to the serial bus according to the set heartbeat interval.

(3), Network port mode -> the device sends heartbeat content to the network bus at the set heartbeat interval.

Customize the heartbeat packet content (maximum support 40 bytes (ASCII) data, 20 bytes (HEX) data)

Custom heartbeat packet sending interval, set to 0 to turn off the heartbeat packet function, set value greater than zero to turn on the heartbeat packet function, settable range when turned on: (1-65536) seconds, default value is 0.

5.2 Registration package

In client mode, users can choose to send registration packets and customize the registration packet time settings.

The registration packet supports the following modes:

(1), MAC address sent when the network establishes a connection with the device (OLMAC)

(2), the network and the device to establish a connection to send a custom registration packet of data (OLCSTM)

(3), the network and the device to establish a connection, the device to the network to send each packet of data in front of the MAC address (EMBMAC)

(4), after the network and the device establish a connection, each packet of data sent by the device to the network is preceded by custom registration packet data (EMBCSTM)

Custom registration packet content (maximum support 40 bytes (ASCII) data, 20 bytes (HEX) data)

【Note】 Please do not use special characters (such as "," "\" "/" etc.) when configuring the registration packet on the web page, the host computer can configure special characters, but it may cause the web page configuration can not access.

5.3 Short connection

In client mode, it supports network short connection (the function is disabled by default). TCP short connection is mainly used to save server resource overhead and is generally applied to multi-point (multiple clients) to one-point (server) scenarios.

The TCP short connection function is used in TCP Client mode. When the short connection function is enabled, the device will only request to connect with the server when sending information, and after the connection is

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successful, the device will automatically disconnect if no data is received from the serial port or no data is sent or received from the network port within the set time.

The short link hold time is set to 0 to turn off the short connection function. When the setting range is (2-255) seconds, the short connection function is turned on, and the default hold time is 0 seconds (short link is turned off).

5.4 Disconnect and reconnect

In client mode, the device tries to actively connect to the server at the specified time after the network is disconnected. If the request times out and reaches the set number of reconnections and is not successfully reconnected, the device will perform a reboot to prevent the network from being reconnected after the device is disconnected.

Disconnection reconnection time: the time interval between each attempt of the device to re-establish the network.

Reconnect times: The number of times the device tries to re-establish the network. If the cumulative number of requests reaches the preset value, the device will automatically reboot if the connection is not yet successful.

The actual reboot time is the disconnection period multiplied by the number of reconnection times, and it is recommended to use the factory default parameters without special requirements.

5.5 Timeout restart

Support timeout restart function (default: 300 seconds), this function is mainly used to ensure the long-term stable operation of the device. If no data is sent or received within the set timeout restart time, the device will be restarted to avoid the abnormal situation to affect the communication.

Timeout restart time parameter range (60-65535) seconds, configured as 0 means turn off timeout restart. The default is 300 seconds.

5.6 Cache cleaning

The device is in client mode, when the TCP connection is not established, the data received by the serial port will be put in the cache area, the serial port receive cache is 1024 bytes, greater than 1024 bytes will overwrite the earliest received data, after the network connection is successful, you can choose to clear the serial port cache or send the cache through the network by configuration.

Enable: The device does not save the data received by the serial port before the connection is established.

Disable: The network will receive the data cached on the serial port after the connection is established.

5.7 Remote configuration

The remote configuration function of the upper computer and web page can be used to configure the remote digital radio. This series of products (E90-DTU(xxxSLxx-ETH)_V2.0) does not support being remotely configured, and remote configuration requires the remote device and the configuration device to communicate normally, otherwise the configuration command cannot reach the remote device.

After sending the remote configuration command, the indicator DATA double blinks and receives the remote

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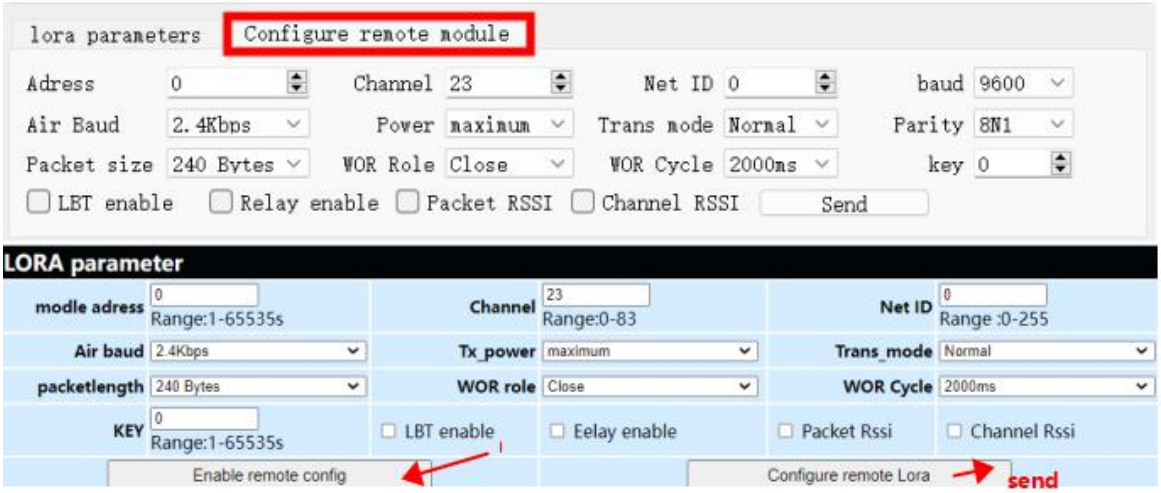
device return success, the indicator DATA blinks three times the configuration is sent but does not receive the configuration success return.

Remote configuration use instructions are shown in the following figure (the upper figure is the upper remote configuration, the lower figure is the web remote configuration):



【Note】 It is recommended that the remote configuration be used in transparent transmission mode and with air speed ≥ 2.4Kbps, and the web remote configuration needs to click "Start Remote Configuration" first.

5.8 Remote upgrades

In order to facilitate later maintenance and upgrade functions and replace different firmware, this product supports online firmware upgrade, through the upgrade firmware provided by our company users can upgrade or replace the current firmware through the host computer.

Network upgrade firmware operation steps:

Step 1: Open the host computer, open the device upgrade assistant in the menu bar, select the firmware needed (download firmware provided by the official website);

Step 2: click to search for the device and click to stop the search when the device is found;

Step 3: Select the device corresponding to the need to upgrade;

Step 4: Click Start to upgrade, the device indicator flashes and wait for the upgrade to complete.

【Note】When the device is just powered on, click "Search Device" of the upgrade assistant, the device will

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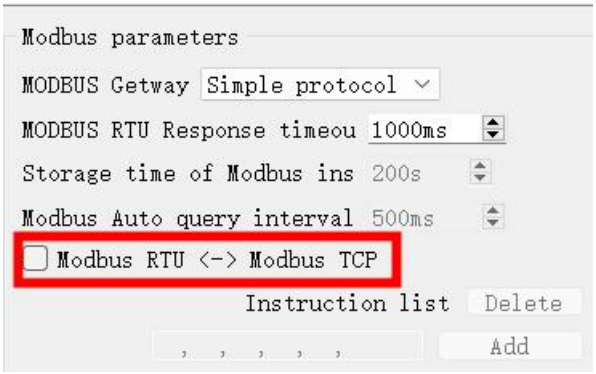
enter the firmware burning state, and resume normal mode after power off and reboot.

5.9 Modbus gateways

5.9.1 Protocol conversion



Enable: Checksumming of Modbus data Non-Modbus data (RTU/TCP) discards are not transmitted, interchanging Modbus RTU protocol with Modbus TCP protocol.

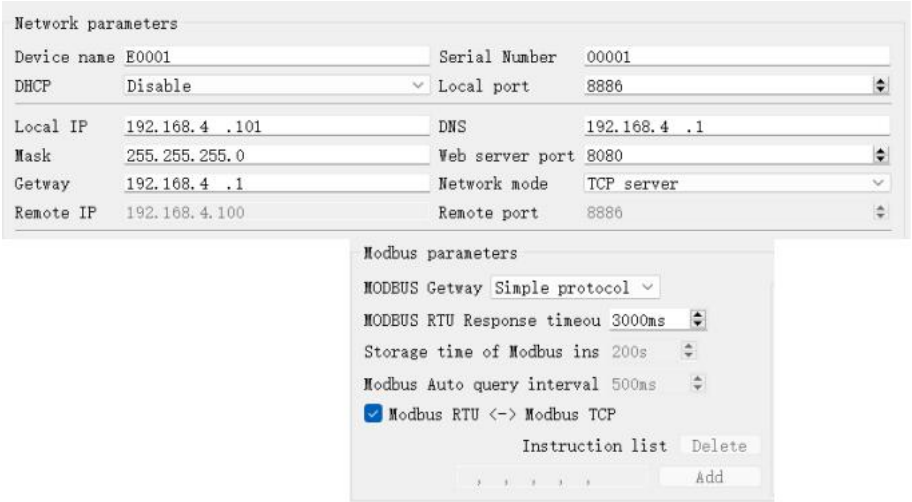
Disable: No protocol conversion but checksumming of Modbus data, non-Modbus data (RTU/TCP) discards are not transmitted.

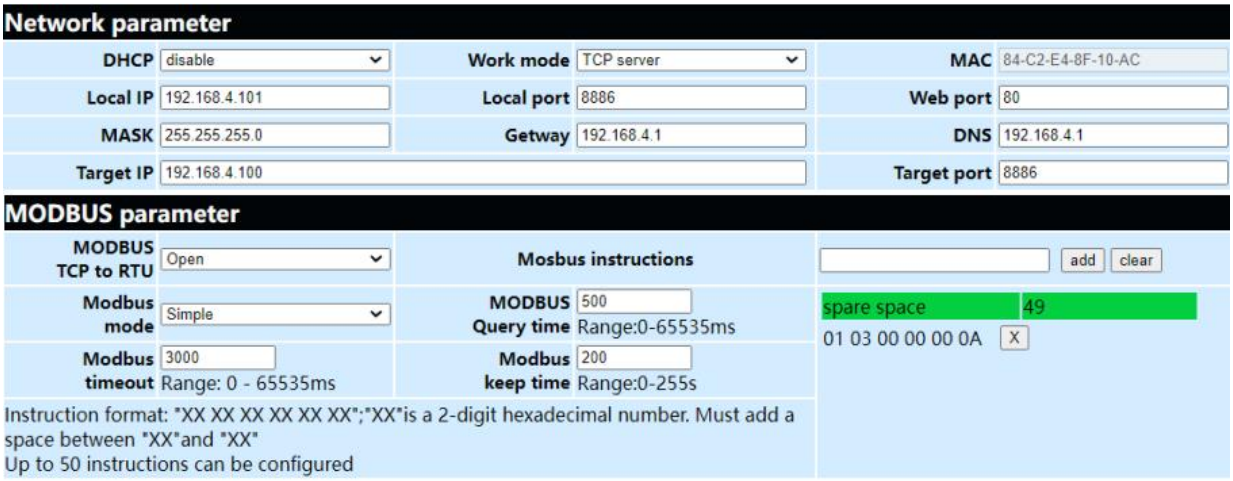
【Note】 Since there is a packetization mechanism for LORA wireless modulation, the maximum single packet is 240 bytes, so a maximum of 117 registers (03 and 04 function codes) or 1872 discrete quantities (01 and 02 function codes) can be read continuously in Modbus at one time.

5.9.2 Simple protocol conversions

Converts Modbus RTU data to Modbus TCP data or Modbus TCP data to Modbus RTU data, realizing the interconversion of Ethernet Modbus data and serial Modbus data.

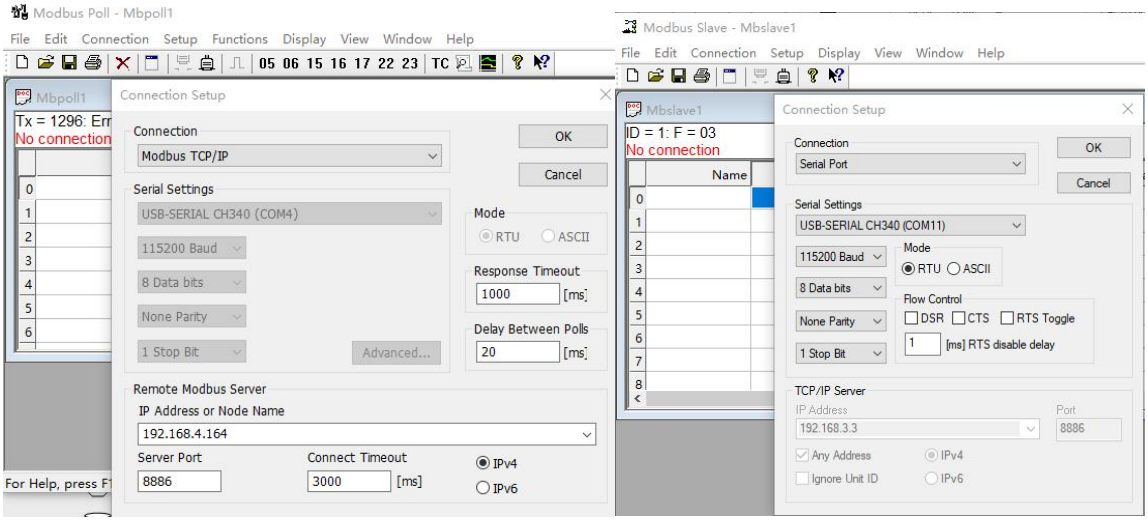
Simple protocol conversion can work in any mode (TCP client, TCP server, UDP client, UDP server, MQTT client), and only one Modbus master can exist no matter what mode it works in. Simple protocol conversion configuration (server mode as an example, left image is the upper computer, right image is the web page):





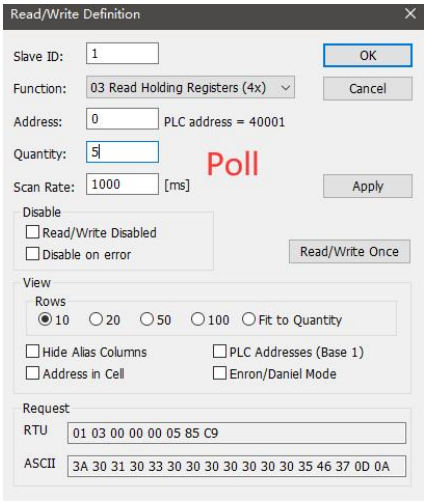
Modbus Poll and Modbus Slave software commissioning:

Software connection settings:

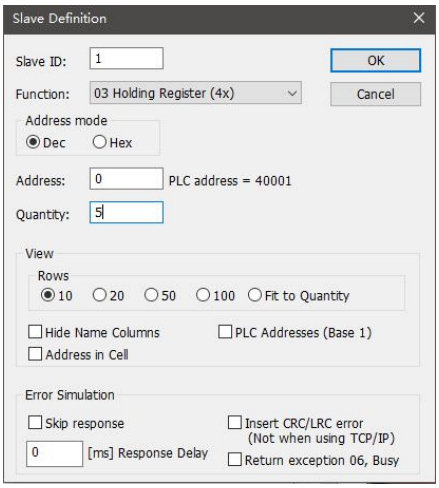


Software register reading and emulation configuration:

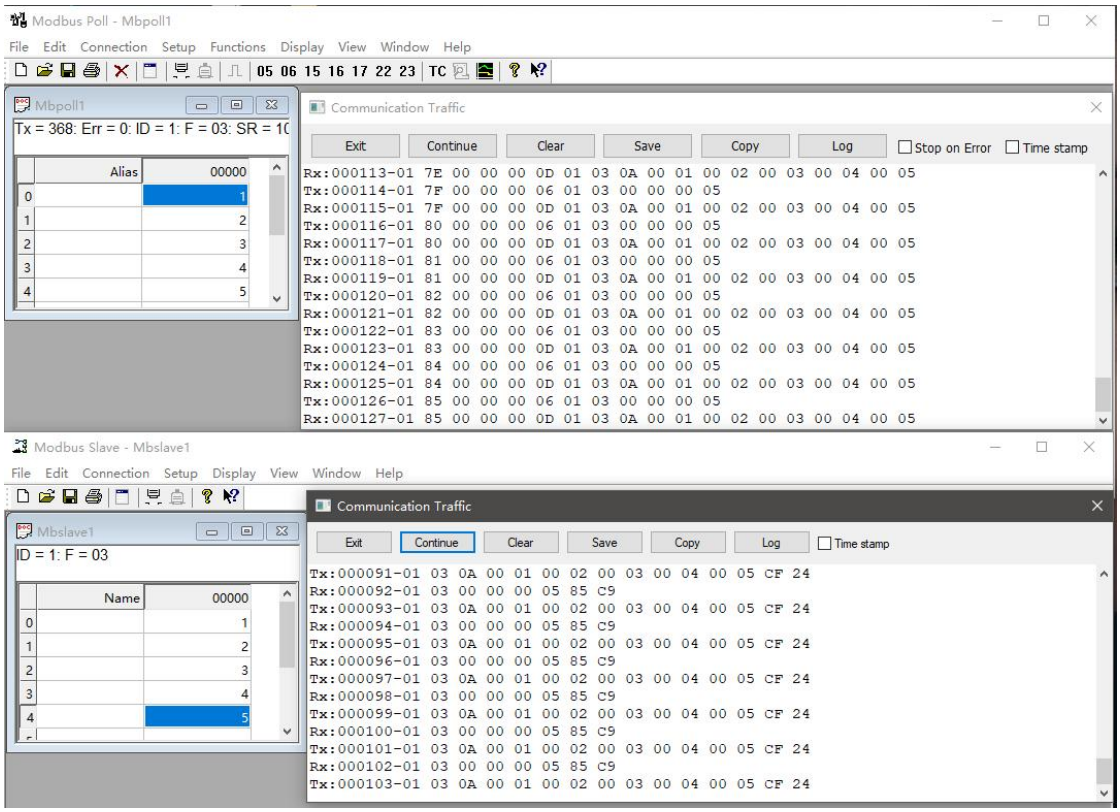
Poll menu select SetupRead/Write Definition



Slave menu select SetupSlave Definition



Communication demonstration:



5.9.3 Multi-host mode

Relatively simple protocol conversion can only exist one Modbus master, while multi-master mode can handle up to 4 Modbus TCP hosts, when multiple Modbus hosts access at the same time Modbus gateway will perform bus occupancy scheduling (RS-485 bus can only handle one request at a time, while multi-master mode will sort and process TCP requests according to the order of Other links will wait), thus solving the bus conflict problem (currently only 4 hosts are supported), and only supports working in TCP server mode, slaves can only be on the serial port, otherwise they cannot work properly.

As the number of hosts increases, the Modbus timeout time should be increased accordingly, and the request interval should be increased. If multiple hosts need to request continuously at high speed, it is recommended to use

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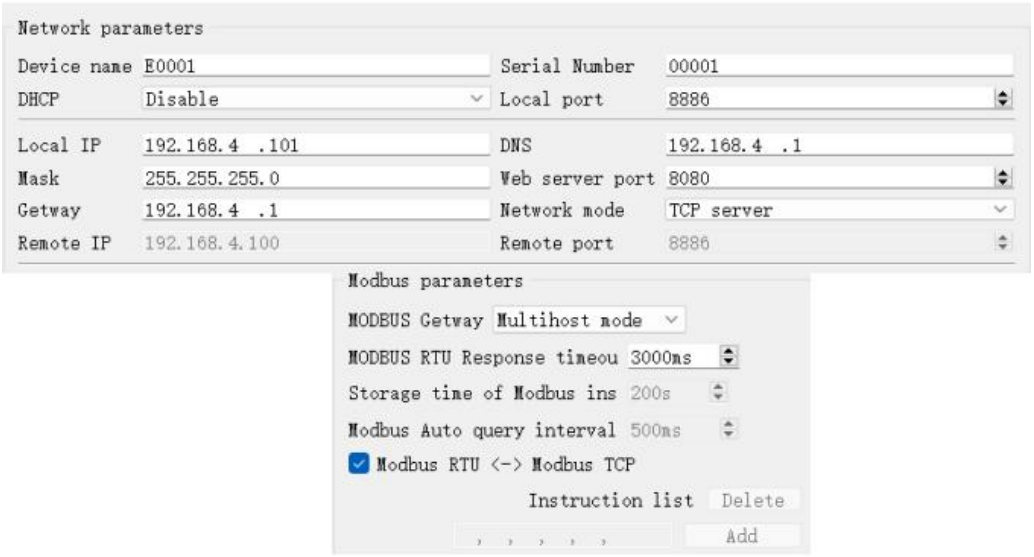
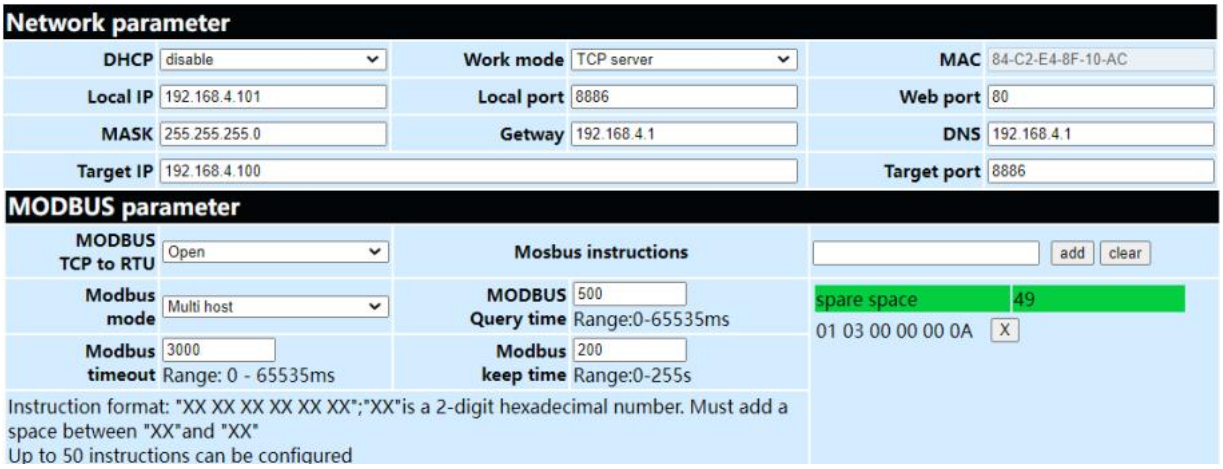
a "storage gateway".

It is recommended to configure it as "simple protocol conversion" when no multiple hosts are used.

Multi-host mode configuration (left image is the upper computer, right image is the web page):





Modbus Poll and Modbus Slave software debugging:

Refer to "Simple Protocol Conversion" for software configuration and register configuration, and open multiple Modbus Poll software at the same time (3 channels for example, up to 4 channels can be supported).

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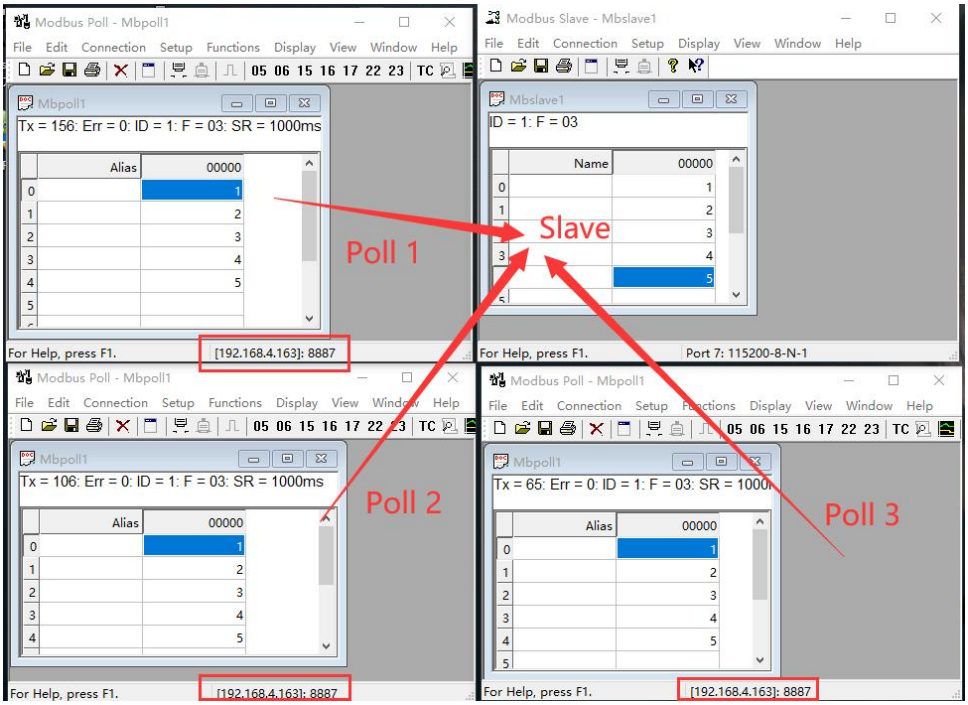


5.9.4 Storage gateway

The storage gateway not only arbitrates bus data but also stores repeated read commands. When different hosts request the same data, the gateway does not need to ask the RTU device register status several times, but directly returns the cached data in the storage area, which greatly improves the gateway's multi-host request processing capability and shortens the time consumed by the whole request process. Users can customize the command polling interval and command storage time in the storage area according to their needs.

The storage type gateway, as an optimization of the performance of multi-host requests, also works only in TCP server mode, improving the response speed on the network side.

Features:

(1) The gateway has a 3K cache for storage of instructions and return results (read 10 holding registers for example, roughly 100 instructions and return results can be stored);

(2) RTU response timeout automatically empties the cache to ensure real-time data and authenticity;

(3) Polling interval can be customized, 0-65535ms (default: 500ms);

(4) the gateway will be used to configure the instruction storage time polling RTU equipment, MODBUS host in the storage time is not again query the instruction, the gateway automatically delete the stored instructions to release the cache;

(5) the first instruction and control instructions (05, 06, 0F, 10 function codes) will directly access the RTU device;

(6) only support 01, 02, 03, 04 Modbus function code query result storage;

Storage type gateway configuration (left picture is the upper computer, right picture is the web page):

5.9.5 Configurable gateway

The gateway automatically polls the RTU device registers according to the pre-configured MODBUS commands

(only the configuration of MODBUS read commands is supported), and commands not stored in the table will operate the RTU device directly. It is possible to store frequently read commands in advance in the gateway, which can shorten the response time (querying for configured commands). Due to the above features, only Modbus slaves can be connected to the serial side of the configurable gateway.

5.9.6 Automatic upload

In client mode (TCP client, UDP client, MQTT client, HTTP client) the gateway will automatically poll the command table to store the commands and upload them to the server, and the feedback format (Modbus RTU format or Modbus TCP format) and the command polling interval (0-65535ms) can be selected according to requirements.

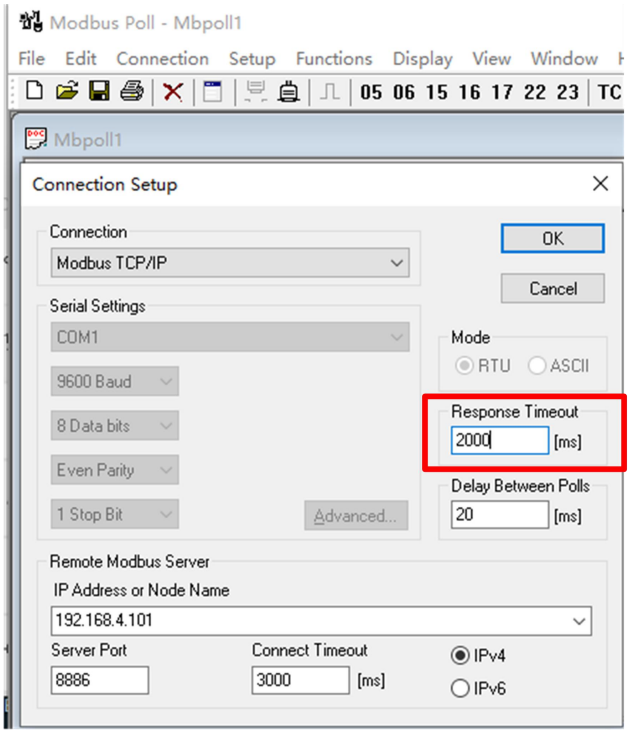
Refer to "Configurable Gateway - Instruction Storage Instructions" for instruction pre-storage and automatic upload to the host computer/web page for configuration:

5.9.7 Simple protocol conversion demo case

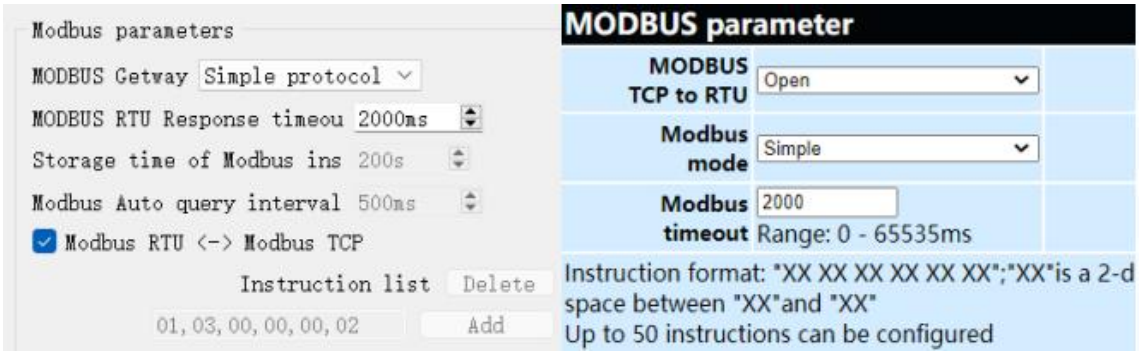
Step 1: adjust the Modbus timeout time of the gateway according to the actual application distance test data delay;

Use transparent transmission mode through XCOM with the network debugging assistant log roughly calculate the acceptance of the demonstration, as follows:

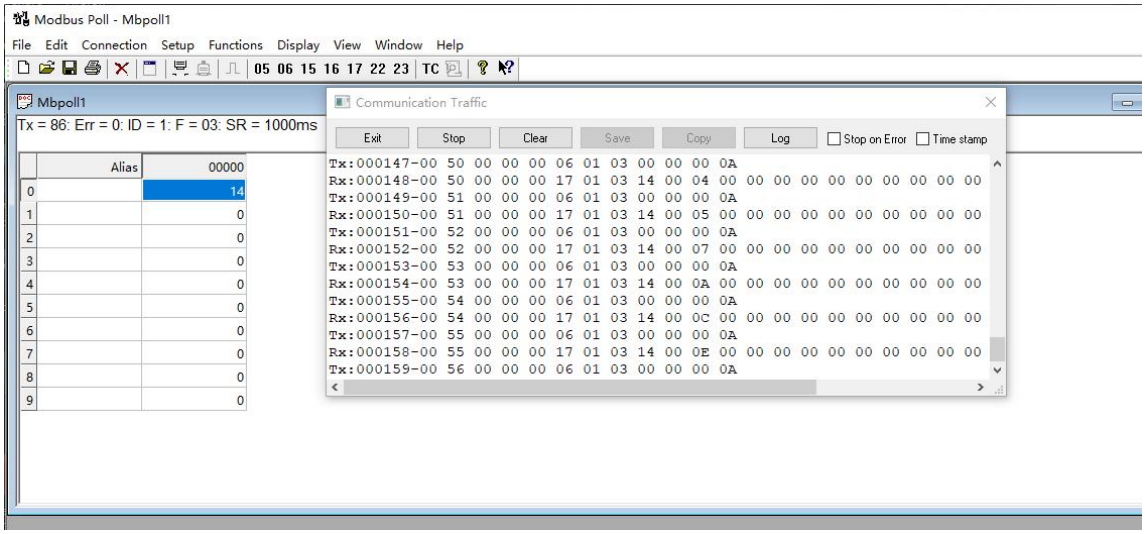
The Modbus timeout for the E90 gateway should be greater than the calculated time (it is recommended to use the maximum value for multiple transmissions). 2000ms timeout can be configured here (leave some margin, do not use 1400ms directly), and the timeout for the end device (e.g. Modbus Poll software) should be greater than or equal to the gateway timeout.



Step 2: Enabling Modbus gateway functionality (simple protocol conversion);



Step 3: Use Modbus Poll and Modbus Slave software to test the configuration as described in "Simple Protocol Conversion";



6 Configuration method

6.1 Web Configuration

You can customize the relevant parameters through Web setting method. Open the browser, enter the device IP (default: 192.168.4.101) in the address bar, enter the page, you can query and set parameters, and finally click "Submit" menu and wait for the web page to return to the success prompt to take effect.

Note: Please do not enter the web page configuration in normal use, it may lead to data loss, if you enter the web page configuration, you need to reboot to enter the communication mode.

Web configuration initialization password: 123456, customizable configuration, only supports 6 upper and lower case letters and numeric configuration.

Web configuration requires the use of newer kernel browsers to work properly, such as Microsoft Edge (96.0.1054.62), Google chrome (96.0.4664.110), Firefox (95.0.2), etc.

Note] IE, 360 compatibility mode, QQ browser compatibility mode and other browsers that use IE kernel are not supported to use the web configuration.

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6.2 Software configuration

Open the configuration tool software, search for the device, double-click the identified device, and pop up the parameter query configuration interface. You can customize the relevant parameters according to your needs, then save the configuration and restart the device to complete the parameter modification.

【Note】:

Please do not use more than one host computer in the same LAN environment, multi-network card industrial control machine need to temporarily disable not to use the network card, otherwise the host computer will not be able to search for the device normally (the same device is displayed multiple times, can not search for the device and other abnormal occurrences)

The host computer blocks the wireless network card, so it must be connected to the network cable to use the host computer, the wireless network card can be configured through the web page.

6.3 AT command configuration

The relevant parameters of the device can be configured by AT commands. For specific AT commands, please refer to "E90-DTU(xxxSLxx-ETH)_V2.0-AT Command Set".

The final interpretation right belongs to Chengdu Ebyte Electronic Technology Co., Ltd.

Revision History

Version	Date	Description	Maintainers
1.0	2023-4-26	Initial version	LYL

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