ZLAN7104M/

7104MI Rail-type

WIFI/Ethernet to RS485

Serial Server

ZL DUI 20230620.1.0

Version information

The following modifications have been made to the document:

Change log

Date	Version number	Document number	Modify content.
2023-06-20	Rev.1	ZLDUI 20230620.1.0	Release version

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1. Overview

The ZLAN7104M is a rail-type WIFI/Ethernet to serial server designed by Shanghai Zhuo Lan for industrial environments, featuring a heat-resistant and flame-retardant housing. It is a high-performance WIFI serial server that allows simultaneous use of Ethernet and WIFI, with easy configuration. The 7104M is positioned for high stability and rich functionality, suitable for industrial fields requiring high real-time and stability, equipped with one RS485 interface and one Ethernet interface. It adopts a rail-type installation method, with a compact size and convenient installation. It uses a terminal block power input with a wide voltage range of 9 to 24V. The ZLAN7104MI model features optical isolation on the 485 interface, effectively isolating the impact of strong interference environments on the device. The hardware interfaces and software functions of the 7104M and 7104MI are the same; this article mainly introduces the usage of the 7104M.

Figure 1 ZLAN7104M

The high-quality power supply design with a wide voltage range of 9~24V offers better adaptability to industrial environments; the rail clip at the back is suitable for rail mounting.

ZLAN7104M not only features RS485 to WIFI TCP/IP conversion but also integrates Modbus TCP gateway functionality, facilitating the conversion of Modbus RTU protocol to Modbus TCP protocol.

This serial port server conveniently allows serial devices to connect to WIFI networks, enabling wireless network upgrades for serial devices. The WIFI supports STA mode for connection to wireless routers, or operates in AP mode to allow devices like smartphones to connect.

For users employing virtual serial ports, the ZLVircom software by Zhuo Lan can be used to achieve virtual serial ports, and existing serial PC software does not need to be modified. Alternatively, Modbus TCP protocol in configuration software can be directly connected to RTU devices, achieving WIFI network communication.

7104M can be applied to:：

- PLC remote wireless monitoring;
- Power electronics, intelligent instruments;
- Banking/medical automation systems;
- Securities trading systems;
- Industrial automation systems;

The typical application connection is shown in Figure 2. The existing serial port device is connected to the ZLAN7104M, and then the ZLAN7104M is connected to the wireless network via WIFI. Any data sent by the serial port device will be transparently transmitted to the PC machine specified by the ZLAN7104M, and the data sent by the PC machine through the network to the ZLAN7104M will also be transparently transmitted to the serial port device.

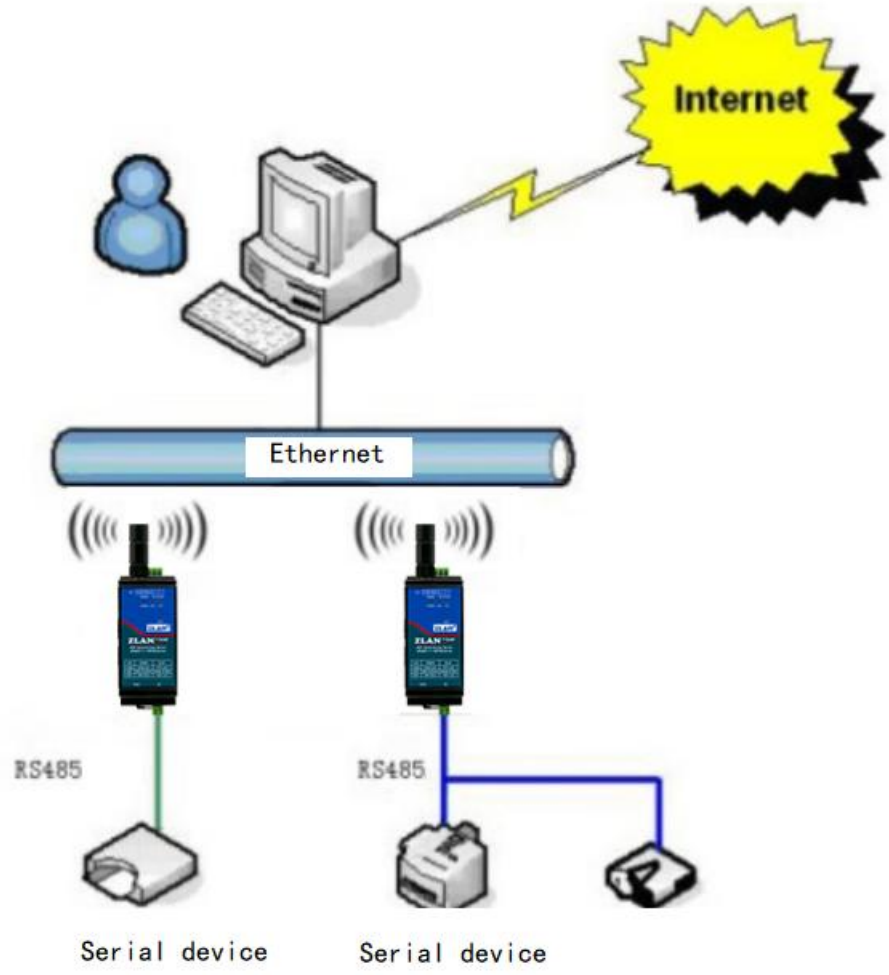


Figure 2 ZLAN7104M Network Structure

2. Function Features

1.1 General software functions

The main features and characteristics of 7104M:

1 Supports both Ethernet and Wifi access.

2 Wide voltage power supply: 9～24V power supply range. Power input is via industrial terminal block power supply method.

3 Terminal RS485 interface, supports up to 32 slave devices, baud rate support from 1200 to 115200bps.

4 Optimized packet 粘合, serial port framing with strong real-time performance. ZLAN7104M is suitable for industrial applications with strong serial port real-time requirements, preventing the merging of two serial port data frames. The serial packet segmentation interval for ordinary WIFI serial port servers is over 100ms, while ZLAN7104M can be set to 1ms～100ms, greatly improving resolution accuracy.

5 Supports system firmware upgrades via network port.

6 Supports wifi peer-to-peer connection between modules.

7 Provides 4 types of LINK indicator interfaces: LINK blue indicates TCP connection established, LINK green indicates Ethernet cable connected, WIFI blue indicates wifi connection established as AP or STA, WIFI green indicates normal operation of wifi function. A rich set of indicator lights can intuitively display the device status.

8 One-click search configuration.

8.1 WIFI Search: After establishing a link between the wifi and the PC or router, use the ZLVircom software to search and configure device parameters with one click. The device IP and PC do not need to be in the same network segment.

8.2 Ethernet Port Search: When you forget the SSID or password and cannot find the module via wifi, simply plug in the Ethernet cable. Even if not in the same network segment, you can immediately find the module and configure wifi, network, and serial port parameters using the ZLVircom tool by Zolane.

9 Supports DNS resolution, can act as a DHCP Client, and also as a DHCP Server when in AP mode.

10 Supports TCPServer, TCP Client, UDP, and UDP multicast. As a Server, it can handle up to 100 concurrent TCP connections communicating with the networking module; as a Client, it can connect to 7 destination IPs.

11 Supports the function of sending MAC address upon device connection, facilitating cloud management of devices.

12 Supports remote viewing of device TCP connection status, serial data transmission, and reception status through software. Virtual serial port supports data monitoring function.

13 Enclosure is flame retardant:High-temperature resistant shell, does not melt at 110 degrees Celsius.

14 7104MI serial port optocoupler isolation, with an isolation voltage of 1500V. Suitable for

strong interference environments where ordinary serial port servers cannot function properly.

1.2 Advanced software features

ZLAN7104M supports advanced software features, including:

1 Supports Modbus gateway functionality, enabling Modbus RTU to Modbus TCP conversion. It can support storage-type Modbus, automatically collect device data and store it; it also supports Modbus gateways in non-storage mode.

2 Supports multi-host functionality: under a request-response query method, it allows multiple computers to access the same serial device via the network port simultaneously.

3 Supports custom heartbeat and registration packet functionality: facilitating communication and device identification with the cloud.

4 Supports the feature of requiring password verification for TCP connection establishment, ensuring connection security.

5 Supports the "translation" function, which enables the translation work for specific device protocols, allowing different devices to interface with a unified software platform.

6 Supports data submission and distribution via HTTP, enabling the cloud to directly interact with the device's serial data using HTTP GET commands.

3. Technical specifications

Appearance			
Interface：	485：Terminal block		
Power supply：	Two-wire terminal method		
Size：	L x W x H =37.6mm×83.6mm×89.2mm		
Communication interface			
WIFI：	802.11b/g		
Serial port：	RS485:485A,485B		
Serial port parameters			
Baud rate：	1200~115200bps	Check digit：	None, Odd Parity, Even Parity, Mark, Space

Data bits：	5～9	Flow control：	NONE
Wireless			
Wireless Standards:	802.11 b/g		
Frequency range:	2.412GHz-2.484GHz		
Transmit power:	802.11b: +20dBm(Max.); 802.11g: +18dBm(Max.);		
Receive sensitivity:	802.11b: -89dBm; 802.11g: -81dBm;		
Antenna selection:	External: External antenna;		
Hardware			
以太网：	10M/100M。		
电源：	9~24V 小于 1W		
工作温度：	-40~85℃		
储存温度：	-45~125℃		
Software parameters			
Wireless working mode	STA/AP		
Security mechanisms：	WEP/WPA-PSK/WPA2-PSK		
Encryption types：	WEP64/WEP128/TKIP/AES		
Network protocols：	TCP/UDP/ARP/ICMP/DHCP/DNS/HTTP		
Communication methods：	Socket、Virtual Serial Port		

User Configuration：	Web Server、Windows Configuration toolzlvircom
Environmental requirements	
Operating temperature：	-40~85℃
Storage temperature：	-45~100℃
Humidity range:：	5~95%Relative humidity

4. Hardware instructions

The front view of the ZLAN7104M WIFI serial server is shown in Figure 3. The ZLAN7104M is made of high-temperature resistant and flame-retardant materials. It is compact in size and has a rail mounting clip on the back for easy installation.

Size：

Length × Width × Height=37.6mm×83.6mm×89.2mm

Figure 3 7104M front view

Panel light：

1. ACT: When the ACT light is yellow, it indicates that data is being normally transmitted between WIFI/Ethernet and RS485. A yellow flashing ACT light (with a hint of blue) means that data is being returned from RS485 to WIFI/Ethernet. If the data is short, the blue flashing duration is brief, so it's important to pay attention.
2. LINK: A green LINK light indicates that the RJ45 network cable is properly connected. A blue LINK light means that a TCP connection has been established or it is in UDP mode.
3. POWER: Indicates that the serial server has been powered on.
4. WIFI: A blue WIFI light means that WIFI has established a connection with the router as a STA or as an AP, or that a WIFI connection has been established with it. A green WIFI light: blinks once every 2 seconds, indicating that it is in AP mode and no WIFI connection has been established; blinks rapidly every 5 seconds, indicating that the device is in STA mode and is in the process of connecting to the router.

Figure 4 Bottom interface of 7104M

The bottom interface of the serial server is as shown in Figure 4, from left to right, they are:

1. Network port: Standard RJ45 interface
2. NC terminal: Empty

The top panel of the serial server is as shown in Figure 5, from left to right, respectively:

Figure 5 Top interface of 7104M

1. WIFI antenna: Default stick antenna. An extendable wire antenna can be chosen for easy installation on the outside of metal cabinets.
2. DEF button: Pressing the button once will reset the wifi mode to AP mode, the SSID will change to ZLAN, the password will be empty, and the IP will be set to 192.168.1.254.
3. RS485: GND, 485B (connected to the 485B/T- of the meter), 485A (connected to the 485A/T+ of the meter)
4. DC9-24V: V- is the negative power supply, V+ is the positive power supply.

5. WIFI Function

Assuming the user has already installed the ZLAN7104M device onto the rail and attached the WiFi antenna.

5.1. AP Pattern

First, do not plug in the network cable, and power on the 7104M baseboard. After a while, when you see the WIFI light start to blink, it indicates that the WIFI function is working properly. By default, the 7104M is in AP mode when it leaves the factory, and the SSID is "ZLAN". You should see "ZLAN" in the wifi list of your laptop and connect to it.

Figure 6 Search for ZLAN hotspots

After connecting, the laptop can automatically obtain an IP address from ZLAN7104M. Click the "Device Management" button in the ZLVircom software, and you can see a line in the device list, detecting the ZLAN7104M device.

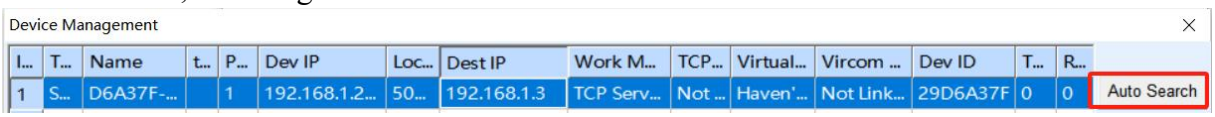


Figure 7 Search for 7104M device

Double-click this line to open the device parameter editing dialog box.

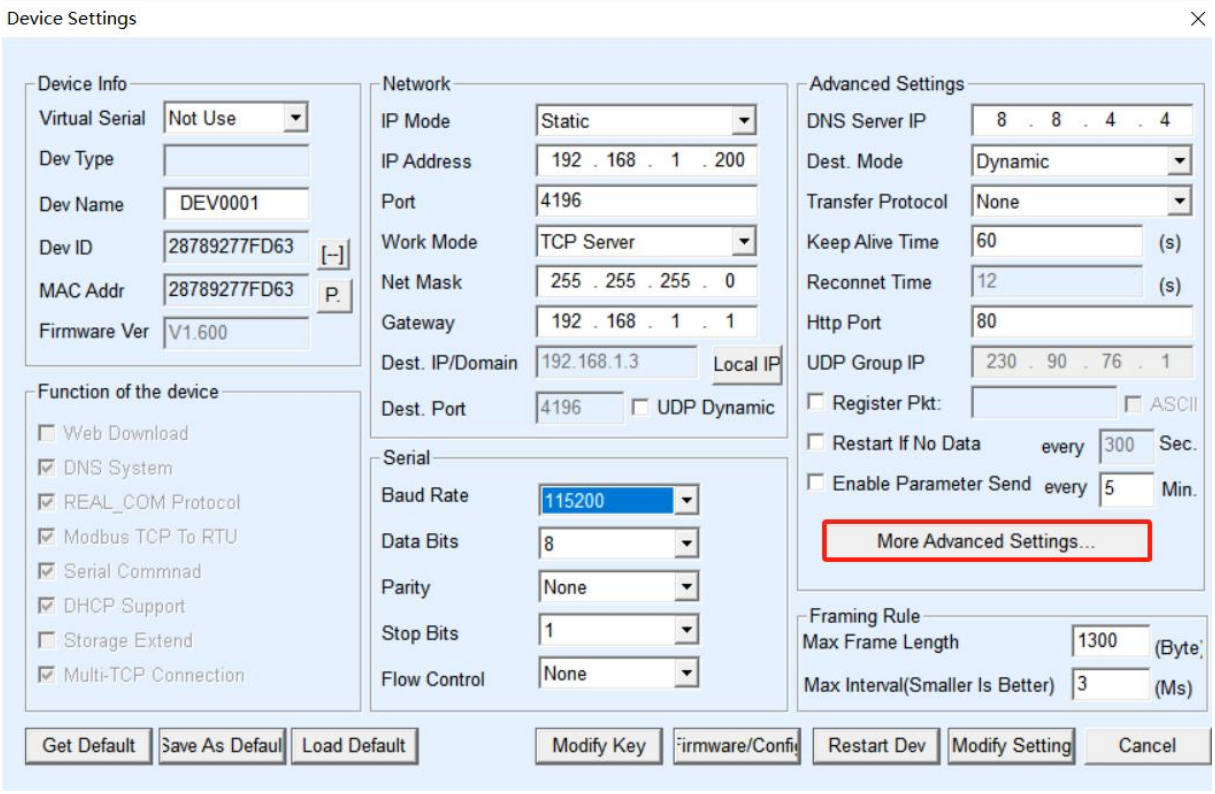


Figure 8 Device Parameter Settings Dialog Box

Here you can see a device model such as ZLSN7044, ZLSN7044N, or one of the others. You can also configure the IP address and baud rate here; the meaning of these parameters will be introduced later. Please click on "More Advanced Options," and in the dialog box that opens, you can configure the WiFi parameters for the 7104M.

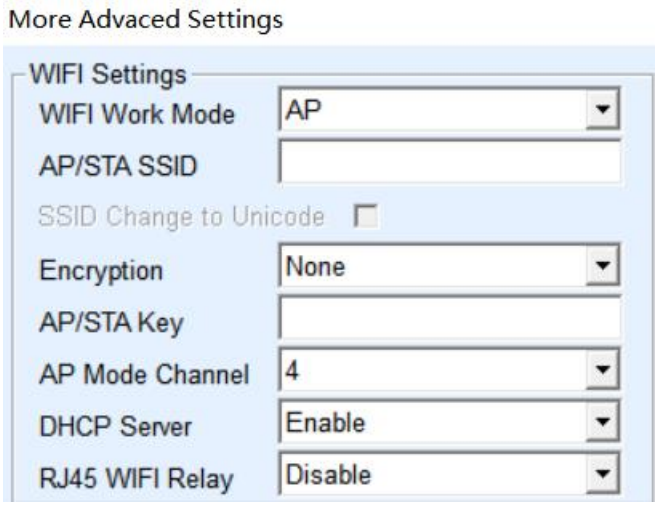


Figure 9: WiFi Parameter Configuration

WIFIThe meaning of the parameters is as follows:

Name	Optional values	Explanation
WIFI Work mode	➢ Wireless AP: The 7104M acts as a hotspot, allowing laptops, phones, and other devices to connect, mainly used for configuration during the first use. ➢ Wireless Station: In STA mode, the 7104M will actively connect to a hotspot (such as a router).。	
AP or STA SSID	String less than or equal to 32 bytes	When operating as an AP, this SSID is the hotspot name. When in STA mode, it is the SSID of the hotspot you are pre-connected to. Please note to change the SSID when switching from STA to AP mode, or else it may conflict with existing SSIDs on the network.
Encryption types	➢ Unencrypted: No password mode ➢ WEP64: Password length must be 5 characters. ➢ WEP128: Password length must be 13 characters. ➢ TKIP: TKIP encryption, password 1 to 32 bytes. ➢ AES: AES encryption, password 1 to 32 bytes. ➢ Automatic: Usually, routers use either TKIP or AES encryption. When the user is not sure	

	which one is being used, the automatic mode can be selected.	
AP or STA password	The password length varies depending on the encryption type.	When it is in AP mode, this password is the one for computers and phones to connect to 7104M. When it is in STA mode, this password is for the pre-connected AP.
APP attern channel selection	1～11	This parameter is only valid when in AP mode; it is invalid in STA mode.
DHCP Server	Enable/Disable	When using as an AP mode, the phone can obtain an IP by connecting to this hotspot. If only using the Ethernet port, it is recommended to turn off the DHCP server to avoid DHCP server allocation conflicts with the router.
Network port and WiFi interoperability	Enable/Disable	Allow the data from the WiFi to reach the network port, and vice versa, meaning it can be used as a router, not just as a serial server.

If 7104M is used in AP mode, it can be divided into password-protected and non-password-protected methods. The non-password-protected method simply involves selecting the "No Encryption" type; for the password-protected method, it is recommended to use WEP128 encryption, at which point the password length is 13 bytes.

5.2. STA

When operating in STA mode, please input the SSID, encryption mode, and password of the pre-connected router in Figure 9. If the encryption mode of the router is unknown, you can choose the "Auto" mode.

When in STA mode, the 7104M will automatically connect to the AP hotspot after being powered on. At this point, you will see the WIFI_WORK light flashing rapidly, indicating that it is in the process of connecting. Once the connection is established, the WIFI_LINK light will illuminate.

STA mode supports automatic reconnection. For example, after the AP hotspot restarts, the 7104M can automatically reconnect. If it fails to connect to the AP hotspot, please verify that the encryption method, password, and SSID are correct, that the antenna is installed, and that you are within the signal range.

5.3. Ethernet search

One advantage of the 7104M is that it has both WiFi and Ethernet capabilities. Whenever you are uncertain about the WiFi parameters of the 7104M and cannot connect to it, you can plug in an Ethernet cable and use the ZLVircom one-click search module to configure the desired WiFi parameters.

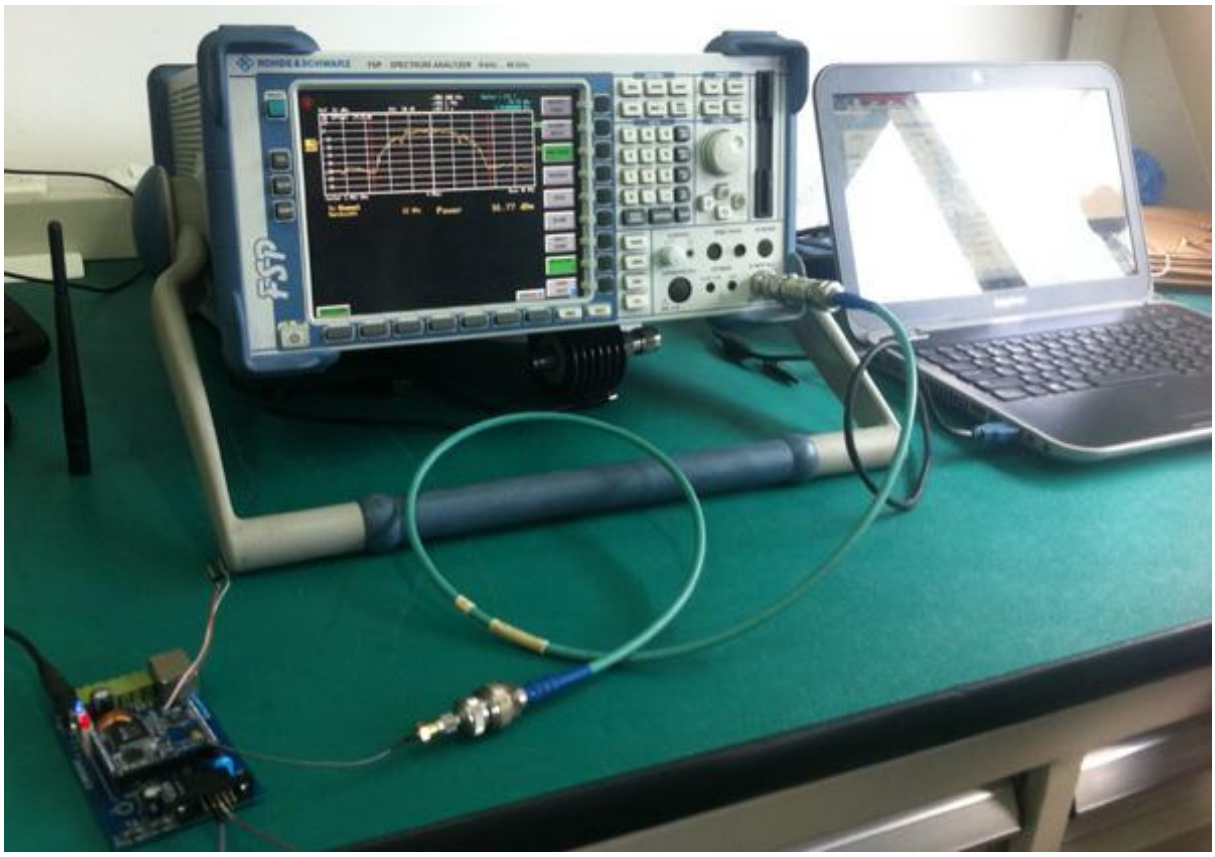
5.4. Wifi Pairing up

The 7104M supports the interconnection of 2 modules via WiFi. The configuration parameters during interconnection are as follows:

Parameter name	**As an AP module**	**As a module of STA**
WIFI Work mode	AP	Station
APor STA SSID	Both are the same.	Both are the same.
Encryption type	Suggest "No Encryption" or WEP128	Suggest "No Encryption" or WEP128
AP or STA password	Both are the same.	Both are the same.

When two 7104M devices establish a connection via Wi-Fi, the WIFI_LINK light will illuminate.

5.5. WIFI Signal testing



5.6.

Figure 10 7104M Signal Test Site

The test instrument used by 7104M is the 9kHz to 40GHz spectrum analyzer from ROHDE&SCHWARZ.

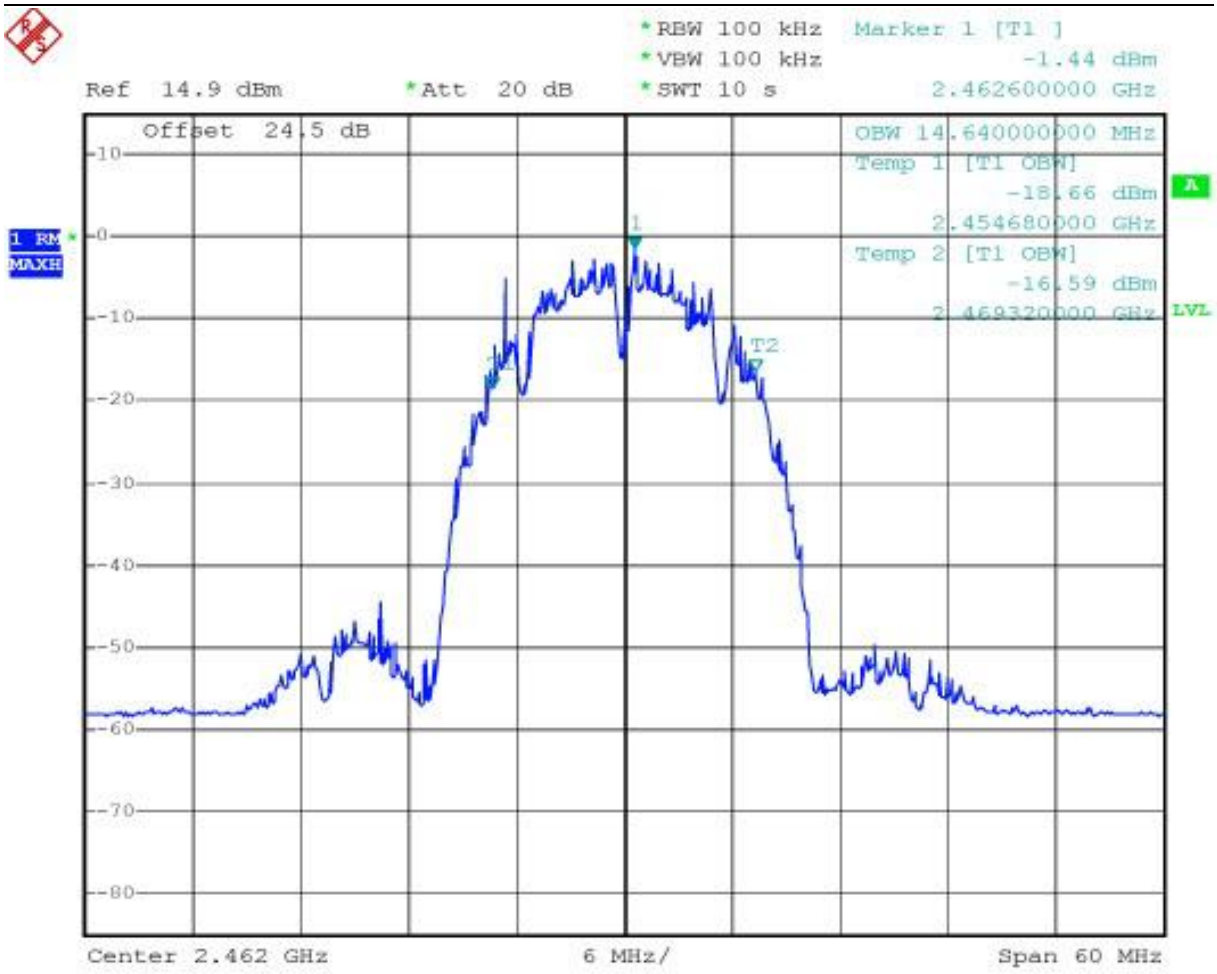


Figure 11 7104M bandwidth test curve

From the bandwidth test curve, it can be seen that the bandwidth of 7104M within the 20M range will not interfere with the adjacent channel signals.

Figure 12 7104M Power Test Curve

The transmission power within the range of two test points is observed to be 17.34 dBm from the power test curve, which meets the requirements for transmission power of standard WiFi signals.

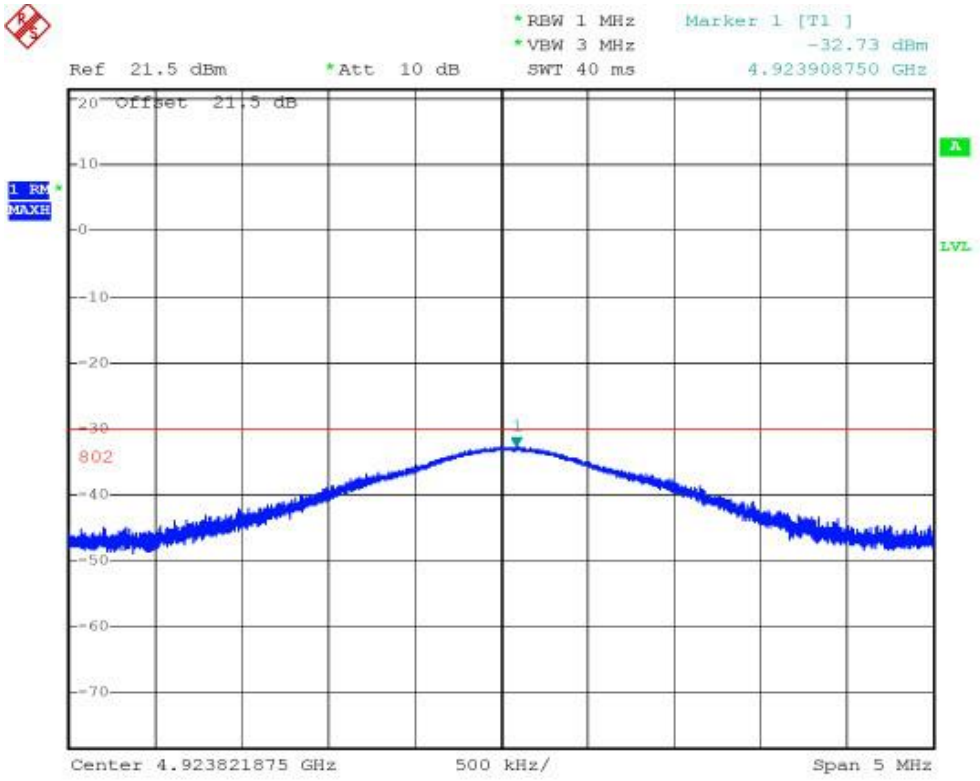


Figure 13 7104M Spurious Test Curve

From the spurious test of 7104M, the spurious emissions near the double frequency of 5GHz are less than -30dB, which meets the requirements for radio frequency spurious radiation.

5.7. Antenna Selection

If the module uses an internal antenna, no external antenna is required. If an external antenna is needed, it must meet the following characteristics. Zhuolan can provide an external antenna.

Impedance	50 Ohm
Return loss	-10dB(Max)
Connector types	I-PEX
Frequency range	2.4～2.5GHz
VSWR	2 (Max)

6. Using steps

6.1. Using overview

Please configure the 7104M using ZLVircom. Once the 7104M is connected to the network via Ethernet or Wi-Fi, computers within the same local area network can search for and configure the device using the installed zlvircom tool.

6.2. Software installation

ZLVircom can be used for the configuration of device IP and other parameters, as well as for creating virtual serial ports. If the virtual serial port function is not required, you can download the non-installation version. Download link：http://www.zlmcu.com/download.htm

Table 1 ZLVircom Version

Software Name	Explanation
ZLVircomDevice Management Tool (Non-installable Version)	The non-installation version does not include the virtual serial port function.
ZLVircom-Device Management Tool (Installer)	Installation version, includes ZLVircom_x64.msi and ZLVircom_x86.msi. Install the x64 version on 64-bit

	operating systems and the x86 version on 32-bit operating systems.

Install by following the default prompts. After installation, zlvircom will start with each computer boot to create virtual serial ports upon startup.

6.3. Parameter configuration

After the ZLVircom installation is complete and the hardware connection of the device is also completed, run the ZLvircom software as shown in Figure 14, then click on "Device Management" as shown in Figure 15. Using ZLVircom, you can search for and configure device parameters within different network segments, which is very convenient, as long as the device and the computer running ZLVircom are under the same switch.

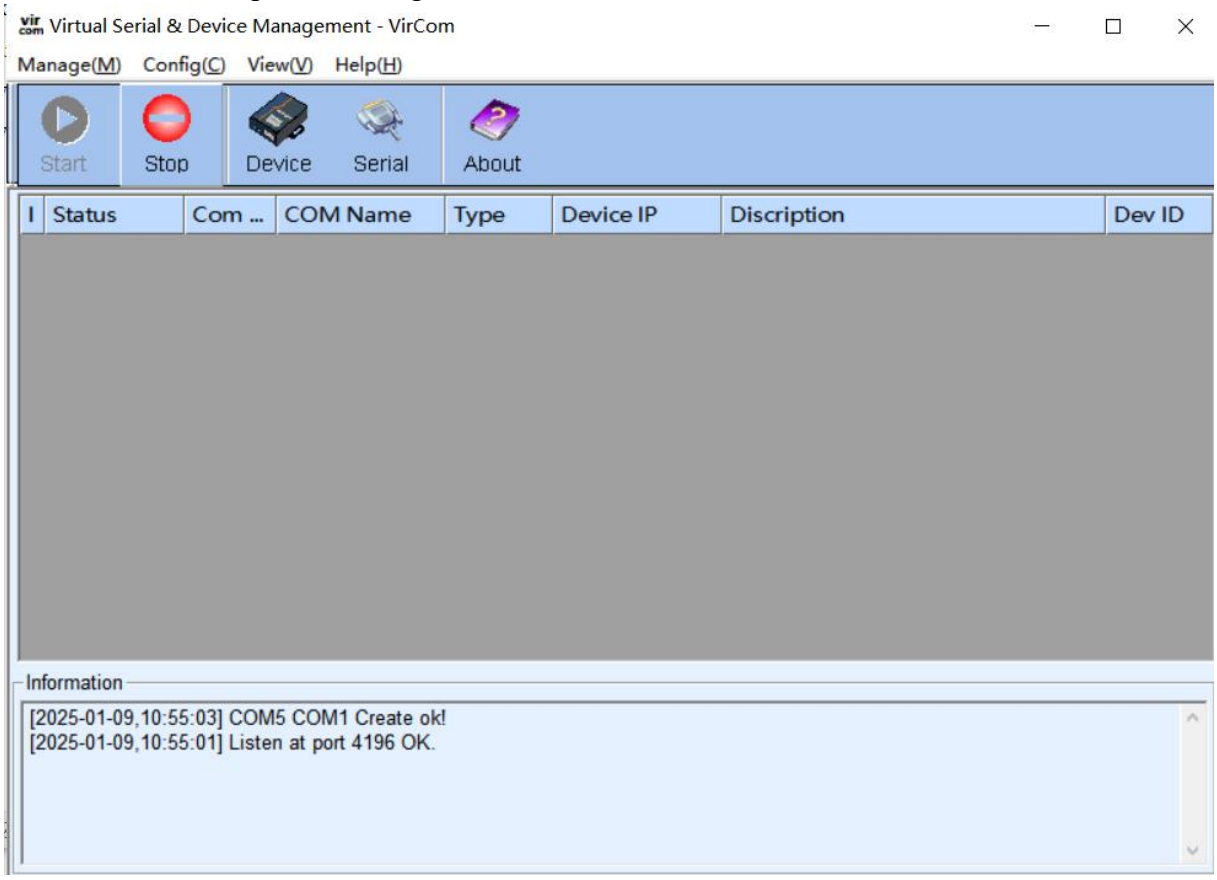


Figure 14 ZLVircom Main Interface

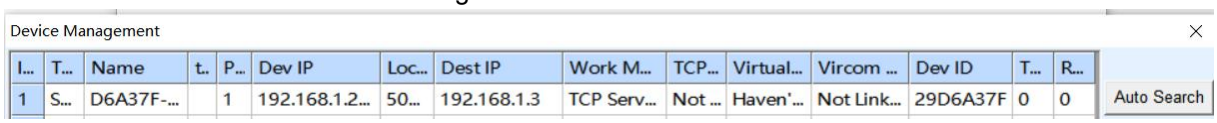


Figure 15 Device List

View all currently online devices from the device list. Click "Edit Device" to configure the parameters.

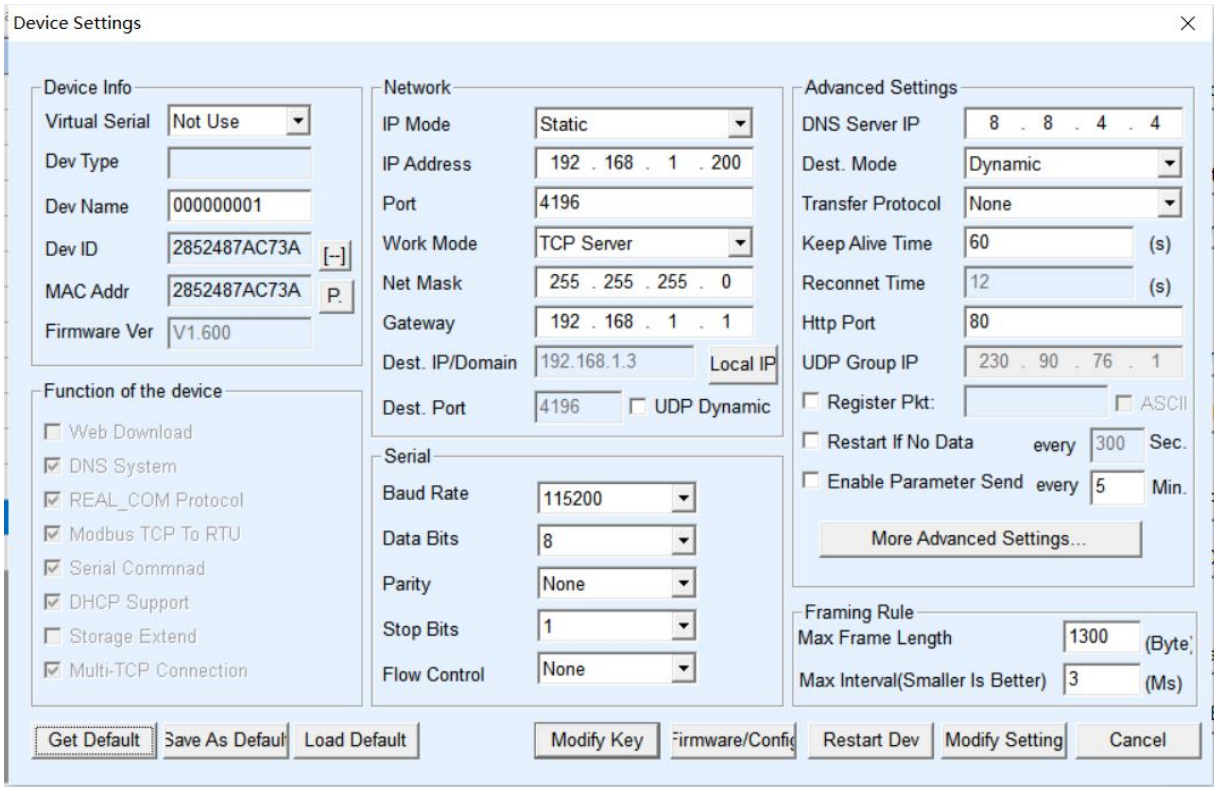


Figure 16 Equipment Parameters

In this interface, users can set the parameters of the device. After clicking "Modify Settings," the parameters are saved to the device's flash memory, ensuring they are not lost during a power outage. At the same time, the device will automatically restart.

The main parameters configured here include: baud rate, data bits, and parity bits in the serial port settings; IP address, subnet mask, and gateway in the network settings. Sometimes, depending on the computer software, the working mode of the serial port server also needs to be configured.

The detailed meanings of other parameters are as follows:

Table 2 Parameter Meanings

Parameter name	Range of values	Meaning
Virtual Serial Port	Do not use, create virtual serial port	You can bind the current device to a virtual serial port that has been created. Please add a COM port

		first in the "Serial Port Management" on the main interface.
Device model number		Display only the model number of the core module.
Device Name	Any	You can name the device with a readable name, up to 9 bytes long, supporting Chinese names.
Device ID		Unique factory ID, non-modifiable.
Firmware version		Firmware version of the core module
The functions supported by the device.		Refer to Table 3 for supported device features.
IP Pattern	Static、DHCP	The user can choose between static or DHCP (Dynamic Host Configuration Protocol).
IP Address		Serial port server's IP address
Port	0～65535	When the serial port server is in TCP Server or UDP mode, it listens on a specific port. As a client, it is best to specify the port as 0, which can improve connection speed. When using port 0, the system will randomly assign a local port. The difference between this and a non-zero port is: (1) When the local port is 0, upon module restart, a new TCP connection is established with the PC, and the old TCP connection may not be closed, potentially resulting in multiple false connections with the device. Generally, the upper computer wishes to close the old connection upon module restart; specifying a non-zero port will close the old connection. (2) When the local port is 0, the time to re-establish a TCP connection is faster. When the serial port server is in TCP client mode,

		it also listens for connections on a port as a TCP server. The local port number used by the TCP client to connect to the server is "port + 1".
Work mode	TCP server mode, TCP client mode, UDP mode, UDP multicast	When set as a TCP server, the serial port server waits for the computer to connect; when set as a TCP client, the serial port server initiates a connection to the network server specified by the destination IP.
Subnet mask	例如：255.255.255.0	Must be the same as the subnet mask of the local LAN.
Gateway	比如：192.168.1.1	Must be the same as the local LAN gateway.
Destination IP or domain name		In TCP client or UDP mode, data will be sent to the computer indicated by the destination IP or domain name.
Destination port		In TCP client or UDP mode, data will be sent to the destination IP's destination port.
Baud rate	1200、2400、4800、7200、9600、14400、19200、28800、38400、57600、76800、115200	Serial Port Baud Rate
Data bit	5、6、7、8、9	
Check digit	None, Even, Odd, Mark, Space	
Stop bit	1、2	
DNS Server		When the destination IP is described by a domain name, the IP of this DNS server needs to be filled in. When the IP mode is DHCP, there is no need to specify the DNS server, as it will automatically obtain it from the DHCP server.
Purpose mode	Static, dynamic	In TCP client mode: After using the static

		destination mode, the device will automatically restart if it fails to connect to the server 5 consecutive times.
Conversion protocol	NONE 、 Modbus TCP<->RTU、Real_COM	NONE indicates that data forwarding from serial port to network is transparent; Modbus TCP<->RTU will directly convert Modbus TCP protocol into RTU protocol, facilitating compatibility with Modbus TCP protocol; RealCOM is designed to be compatible with the older version of the REAL_COM protocol and is a type of protocol for virtual serial port, but when using a virtual serial port, it is not necessarily required to choose the RealCom protocol.
Keepalive timeout duration	0～255	Heartbeat interval. (1) When selected as 1 to 255, if the device is in TCP client mode, it will automatically send TCP heartbeats every "keep-alive time" to ensure the validity of the TCP link. Set to 0, there will be no TCP heartbeat. (2) When set to 0 to 254, if the conversion protocol is selected as REAL_COM protocol, the device will send a data packet with a length of 1 and content of 0 every keep-alive time, realizing the heartbeat mechanism in Realcom protocol. Set to 255, there will be no realcom heartbeat. (3) When set to 0 to 254, if the device is working in TCP client mode, it will send device parameters to the destination computer every keep-alive time. Set to 255, there will be no parameter sending function, which can realize remote device management.
Reconnect time after	0～255	When in TCP client mode, if the connection is not successful, it will attempt to reconnect to the

disconnection		computer every "reconnect time" interval. It can be set from 0 to 254 seconds; if set to 255, it means never to reconnect. Note that the first TCP connection (such as after hardware power-up, restarting the device via zlvircom software, or when the data light is off) is usually attempted immediately, and only after the first connection fails will it wait for the "reconnect time" before trying again. Therefore, the "reconnect time" does not affect the connection establishment time under normal network and server conditions.
Web access port	1～65535	The default is 80.
Multicast address of the group		Used in multicast. UDP
Enable the registration package.		When the TCP connection is established, send the registration packet to the computer. After enabling the registration packet, the realcom protocol must be selected. Supports TCP server and TCP client modes.
Packet length	1～1400	One of the serial port framing rules. After the serial port server receives data of this length, it sends the received data as one frame to the network.
Packet spacing	0～255	Serial port framing rule two. When the serial server receives data with pauses, and the pause time is greater than this time, the data received will be the collected data is sent as a frame onto the network.

The supported features of the device are explained as follows:

Table 3: Features Supported by the Device

Name	Explanation

Web download	Supports controlling serial port output commands through the web, only products with suffix W have this function.
Domain Name System	The destination IP can be a domain name (such as a www server address).
REAL_COM Protocol	A non-inherited serial server protocol suitable for multi-serial servers to bind virtual serial ports over the Internet. Because the protocol contains the device's MAC address, it helps the host computer to identify the device. Generally, it can be left unused.
Modbus TCPTurn RTU	It can achieve Modbus TCP to RTU conversion. It also supports multi-host functionality.
Serial port parameter modification	Supports serial AT commands for device parameter configuration and reading.
Automatically obtain IP	Supports DHCP client protocol
Storage Expansion EX Functionality	Subsequent expansion
Multiple TCP connections	Supports more than one TCP connection when acting as a TCP server.
UDP Multicast	UDP Multicast
Multi-purpose IP	As a TCP client, it supports simultaneous connections to 7 destination IPs.
Proxy server	Supports proxy server functionality (requires specific model).

6.4. TCP Communication test

After configuring the device parameters, you can use serial port tools and TCP debugging tools to perform TCP connection communication tests.

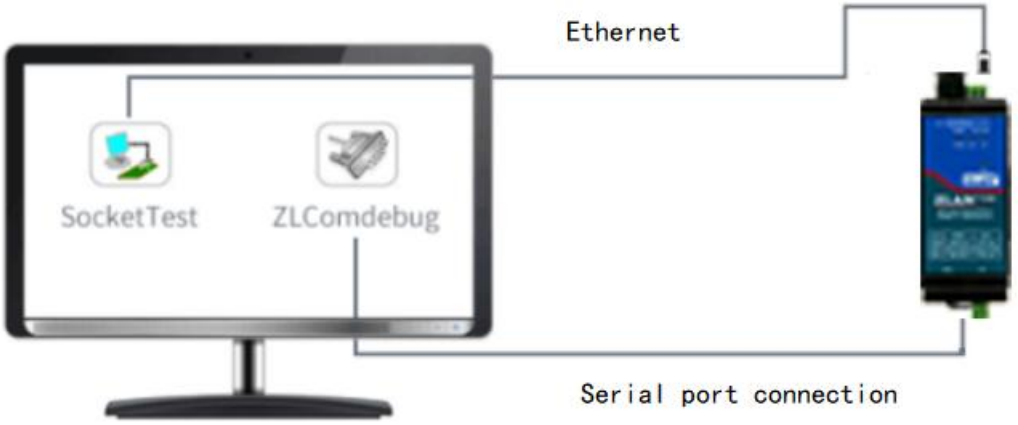


Figure 17 TCP Communication Diagram

Assume that the PC's COM port (USB to RS485 cable) is connected to the serial port server. Open the serial port debugging assistant ZLComDebug (http://www.zlmcu.com/download/Comdebug.rar) and open the corresponding COM port as shown in Figure 18; open the TCP&UDP debugging assistant SocketTest (http://www.zlmcu.com/download/SocketTest.rar), and use it as a TCP client, fill in the destination IP as the IP of the serial port server (currently 192.168.1.200), the destination port as 4196, then click the "Open" button as shown in Figure 19. In SocketTest, input "socket send" and click send, the data will be transferred from the network port of the serial port server to the RS485 interface, then sent to ZLComDebug, and then displayed in ZLComDebug; conversely, input "Comdebug send" in ZLComDebug, click send, and it can also be sent to SocketTest and displayed.

This feature demonstrates the transparent data forwarding function of the serial port server, converting serial port to network port and vice versa.

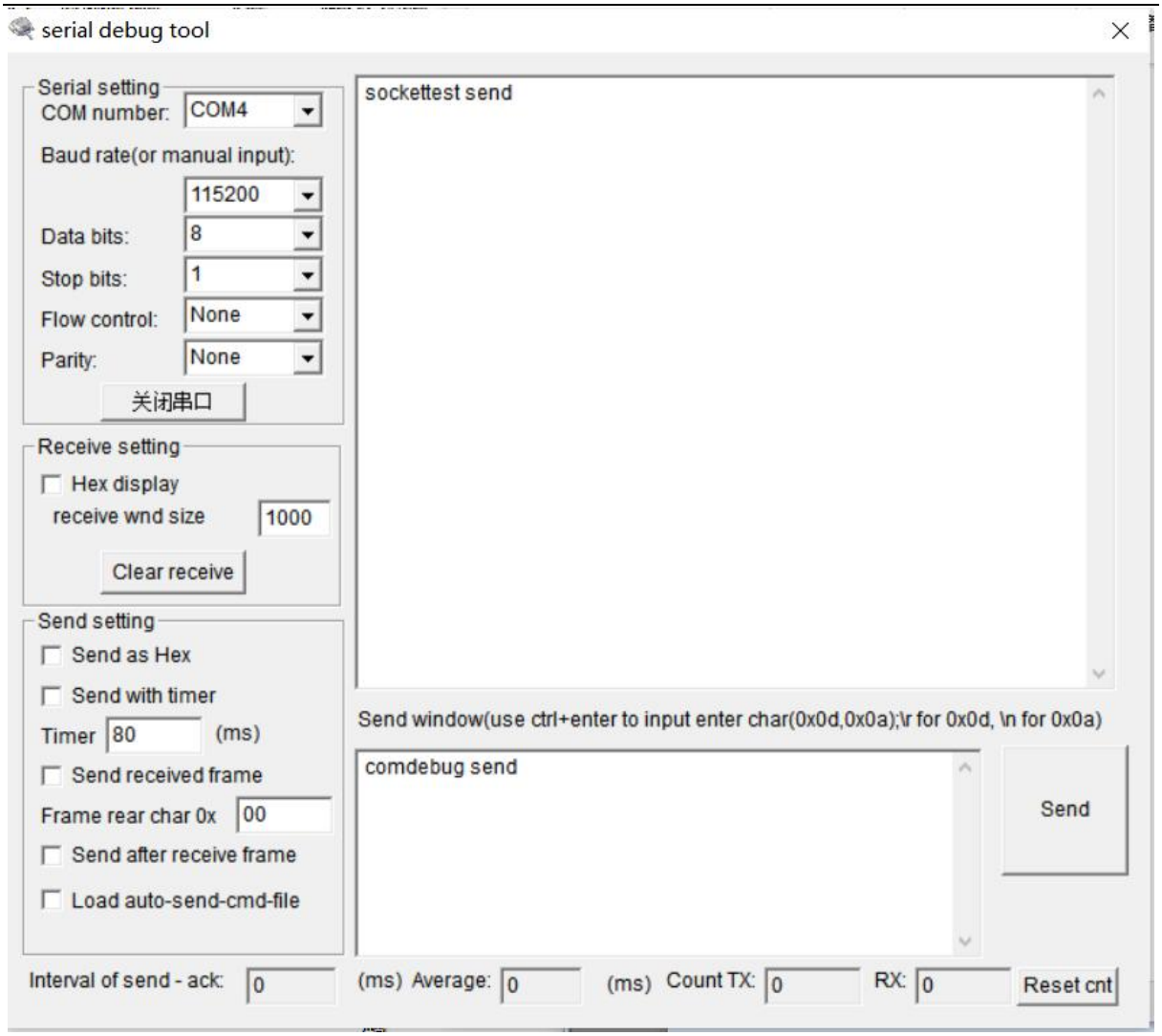


Figure 18 comdebug transmit and receive interface

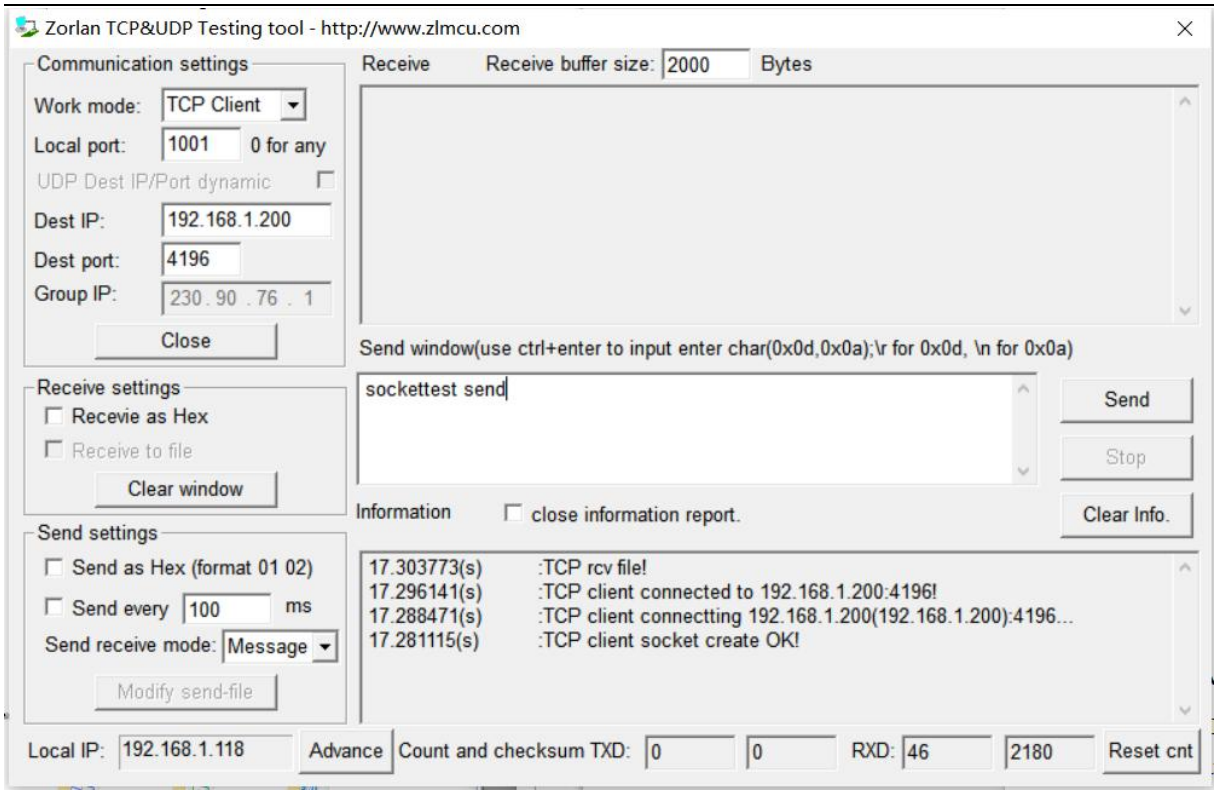


Figure 19 sockettest send and receive interface

6.5. Virtual Serial Port Test

In Figure 17, SocketTest communicates directly with the TCP and serial port server. To allow users to communicate with the serial port server using their existing serial port software, it is necessary to add a virtual serial port between the user program and the serial port server. As shown in Figure 20, ZLVircom and the user program run on the same computer. ZLVircom creates a virtual COM port, which corresponds to the serial port server. When the user program opens COM communication, it can communicate with the serial port server through ZLVircom. The following demonstrates the steps of this operation:

Figure 20 The role of virtual serial ports

Click on "Serial Port Management" on the main interface of ZLVircom, then click "Add", choose to add COM5, where COM5 is a COM port that does not originally exist on the computer.

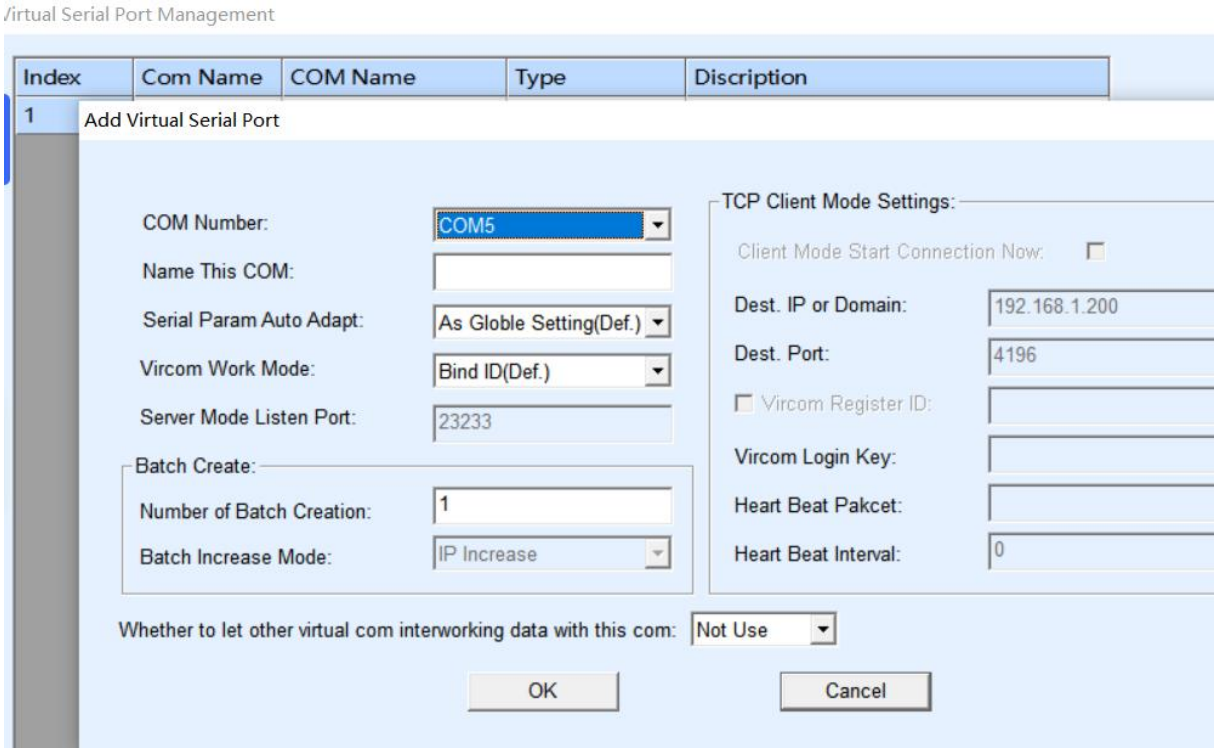


Figure 21 Add virtual serial port

Then enter the device manager and double-click the device that needs to be bound with COM5. As shown in Figure 16, select COM5 from the "Virtual Serial Port" list at the top left. Then click "Modify Settings". Return to the main interface of ZLVircom. You can see that

COM5 has been connected to the device with the IP address 192.168.1.200. At this point, COM5 can be used to communicate instead of SocketTest.

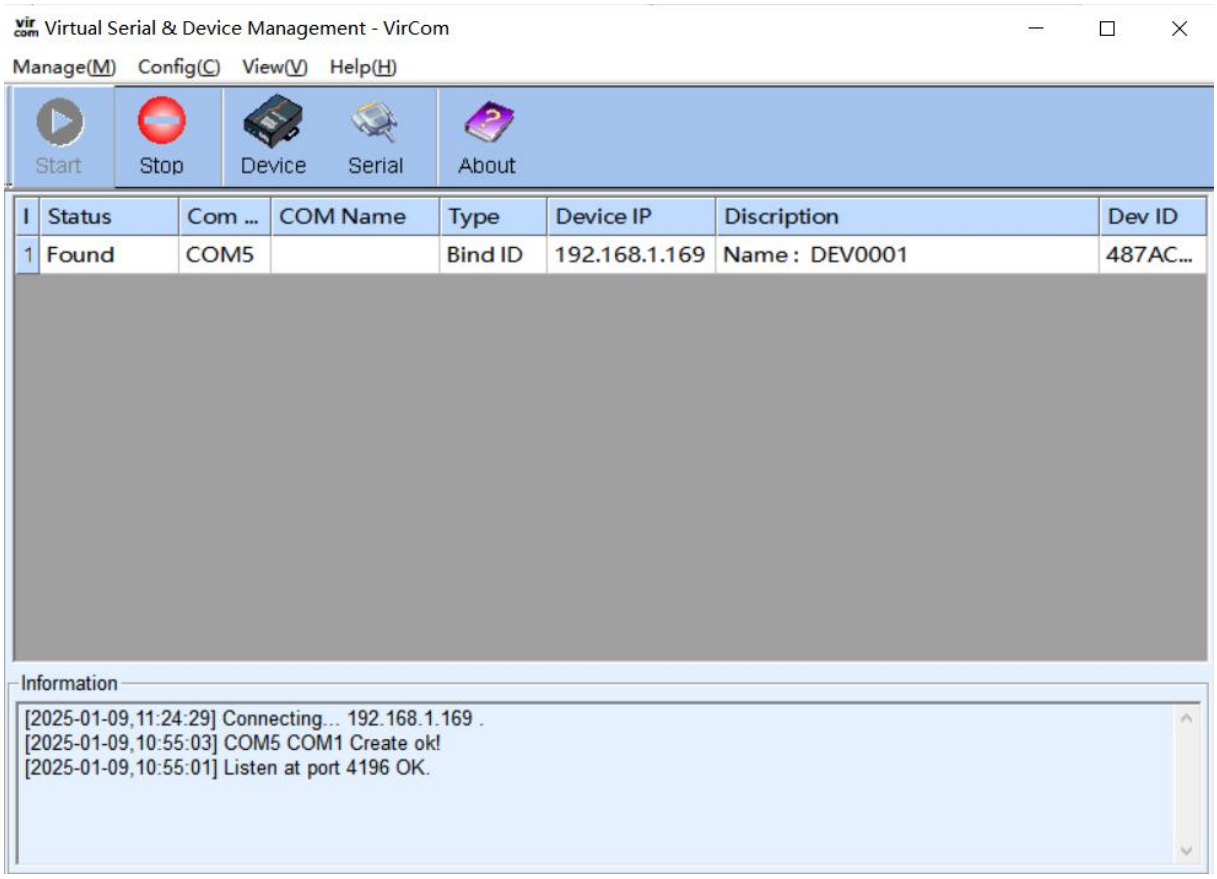


Figure 22 Virtual serial port has been connected

Open ZLComdebug to simulate the user's serial port program, open COM5 (the virtual serial port above), and open another ZLComdebug to simulate a serial port device, open COM4 (the hardware serial port). At this point, the data transmission link from COM5 is as follows: COM5 (ZLVircom (serial server network port (serial server serial port (COM4). Conversely, data can also be transmitted from COM4 to COM5: COM4 (serial server serial port (serial server network port (ZLVircom (COM5. As shown in Figure 23, both sides send and receive data conditions.

If COM4 is replaced with a user serial port device, COM5 can achieve communication with the user device.

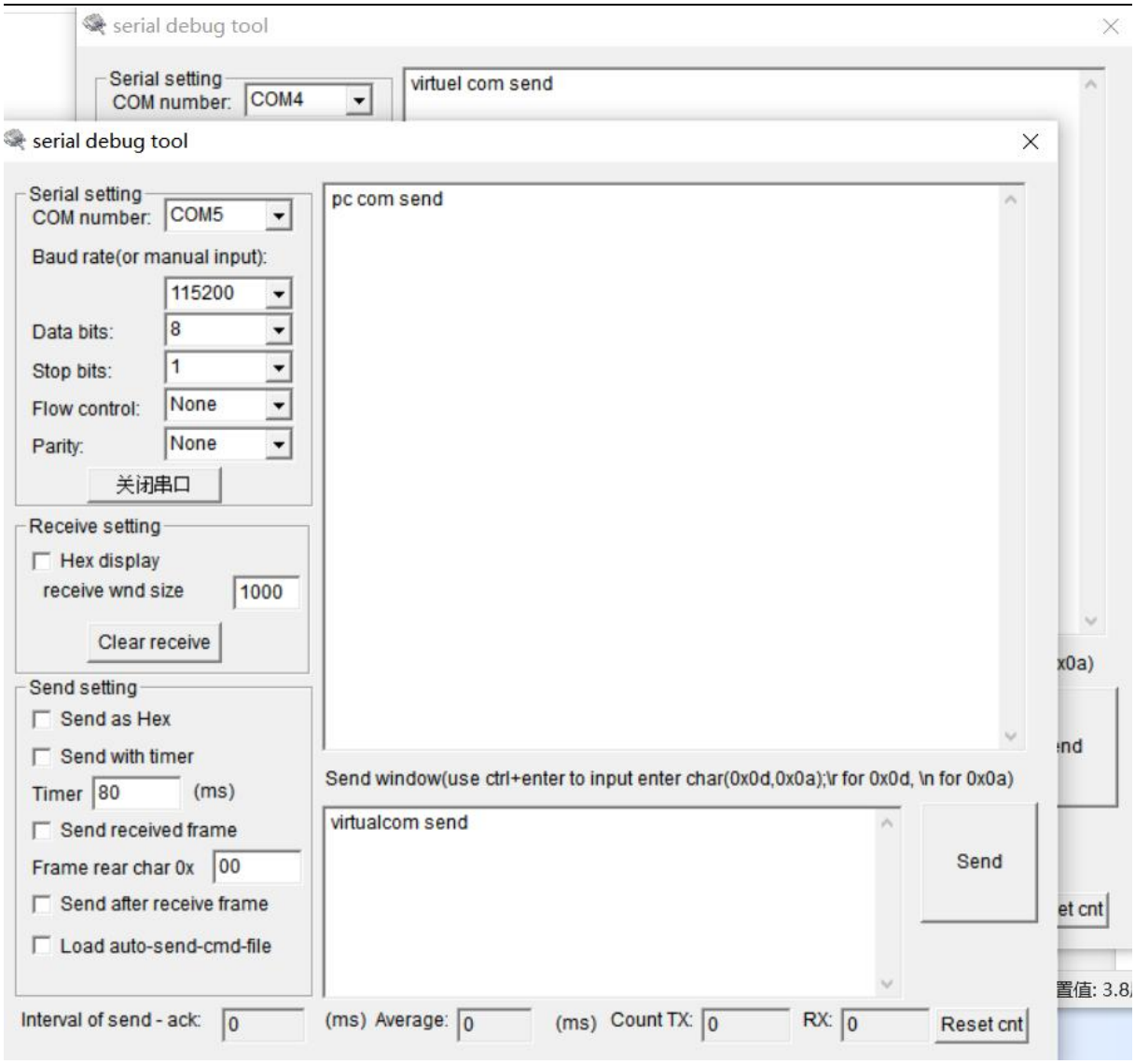


Figure 23 through virtual serial port communication

6.6. Modbus TCP Test

By default, serial and network data are transparently transmitted. If you need to implement Modbus TCP to RTU conversion, you must select the conversion protocol as "Modbus TCP((RTU)" in the device settings dialog box, as shown in Figure 24. At this point, the device port automatically changes to 502. Now, when the user's Modbus TCP tool connects to the IP of the serial server on port 502, the Modbus TCP commands sent will be converted into RTU commands and output from the serial port. For example, if the serial server network port receives the Modbus TCP command 00 00 00 00 00 06 01 03 00 00 0a,

the serial port will output the command 01 03 00 00 00 0a c5 cd. Note: The serial port may send multiple 01 03 00 00 00 0a c5 cd commands, because the default Modbus uses a stored query method, which automatically polls the query commands. We will explain how to switch to a non-stored query method later.

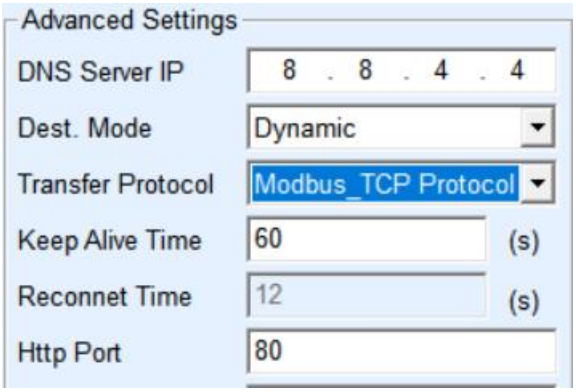


Figure 24 Enable Modbus TCP Functionality

If the user's Modbus TCP software is operating as a slave, then in addition to selecting the conversion protocol, the working mode needs to be changed to client, the destination IP set to the IP of the computer where the Modbus TCP software is located, and the destination port set to 502, as shown in Figure 25.

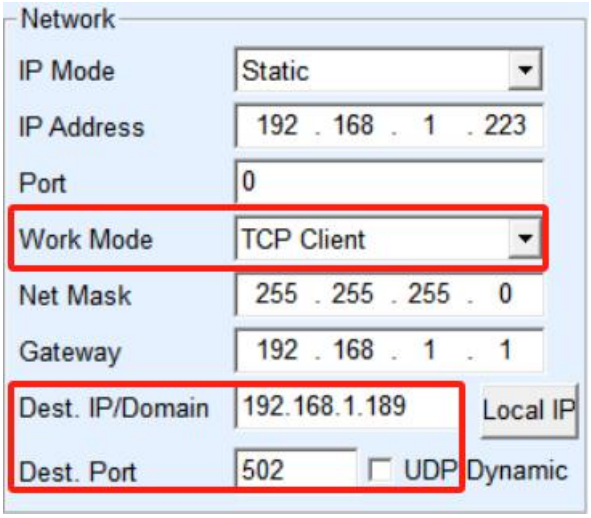


Figure 25 Modbus TCP as a client.

6.7. Web Method configuration

Using ZLVircom, you can search for and configure device parameters across different network segments. Web-based configuration requires that the computer and the serial port

server be in the same IP segment initially, and you must already know the IP address of the serial port server. However, Web configuration can be performed on any computer that does not have ZLVircom.

1. Enter the IP address of the serial server in the browser, for example http://192.168.1.200, to open the following webpage.

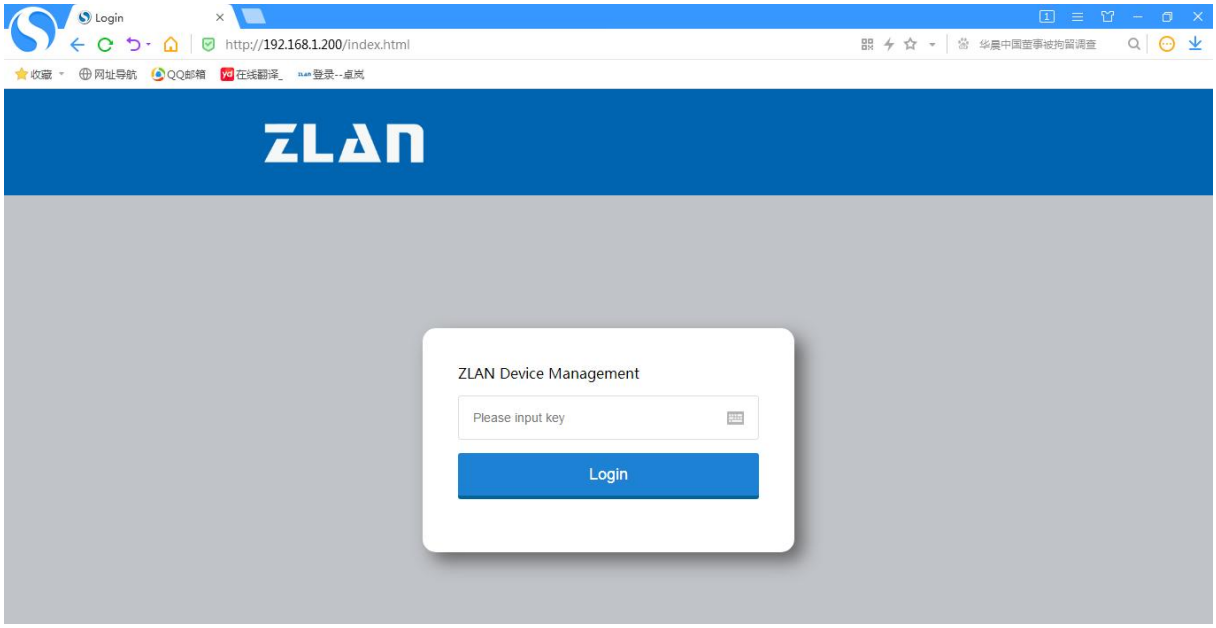


图 26

2. Enter the password in Password: The default is 123456. Click the login button to log in.

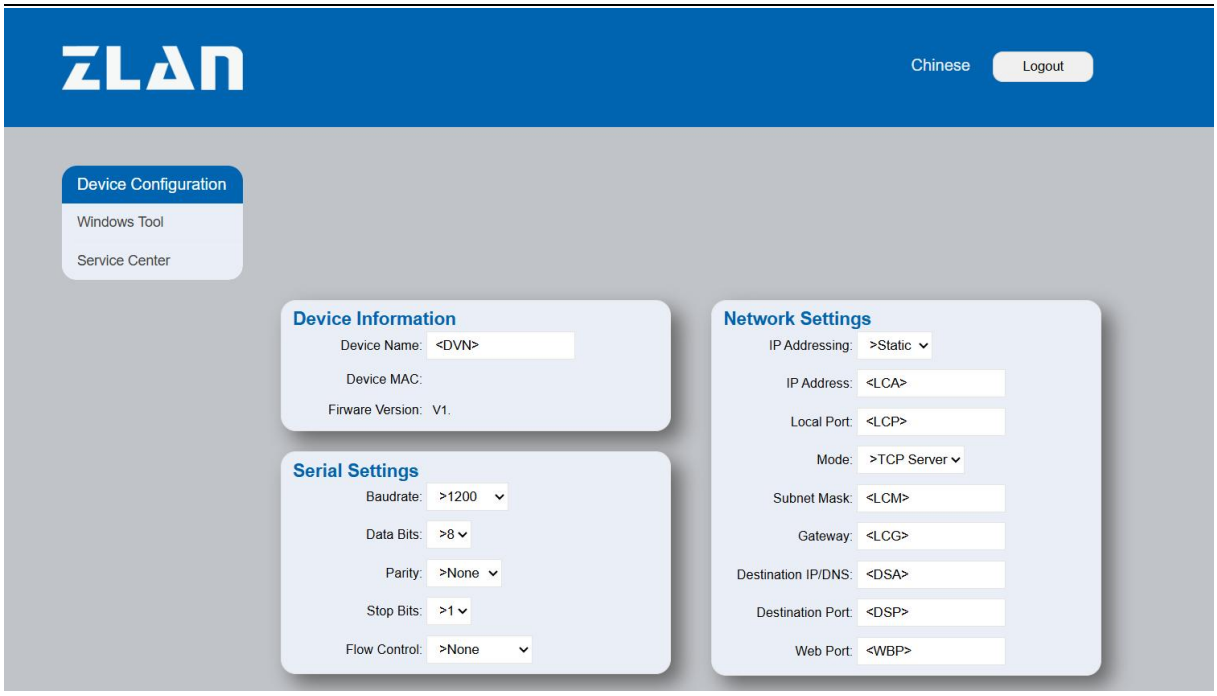


Figure 27 Web Configuration Interface

3. On the web page that appears, you can modify the serial server parameters. The related parameters can be referenced from Table 2, which explains their meanings.
4. Click the "Submit Changes" button after modifying the parameters.

7. Work mode and conversion protocol

In different application scenarios, various serial port server working modes and conversion protocols can be selected to ensure more stable and reliable use. The following details the use of serial port servers.

The use of serial port servers is basically divided into two types: with virtual serial ports and without virtual serial ports, as shown in Figure 17 TCP communication schematic and Figure 20 the role of virtual serial ports. The method with virtual serial ports requires that the user software to be interfaced is a serial port interface (COM port), meaning both the user software and user devices are serial ports; the method without virtual serial ports is when the user software communicates directly via TCP/IP, but the user device is still a serial port.

In the non-virtual serial port method, the "conversion protocol section" is further divided into three modes: transparent transmission, Modbus TCP to RTU, and Realcom protocol. If the user software uses a fixed protocol, Modbus TCP, and the lower-level machine uses

Modbus RTU, then the Modbus TCP to RTU mode should be selected; the Realcom protocol is currently only used when a multi-serial port server acts as a TCP client connecting to a server, and the server uses a virtual serial port.

The summary of usage is as follows:

Table 4 Network Configuration Modes

Number	Virtual Serial Port Usage	Device operating mode	Conversion protocol	Explanation
1	Using	TCPServer	None	Suitable for scenarios where user software actively collects data by opening a COM port.
2	Using	TCPClient	None	Suitable for occasions where devices actively upload data, if TCP server is chosen, there may be an issue where devices cannot reconnect after a disconnection.
3	Do not use	TCPServer	Modbus TCPTurn RTU	Applicable to user software isModbus TCP， The user device isModbus RTU。Modbus TCPIn the case of the main site.
4	Do not use	TCPClient	Modbus TCPTurn RTU	Applicable to user software isModbus TCP， The user device isModbus RTU。Modbus **RTU**In the case of the main site.
5	Using	TCPClient	RealcomProtocol	A multi-port server acting as a TCP client, and when using virtual serial ports, it is best to use the Realcom protocol.
6	Do not use	TCPClient	None	Suitable for a large number of devices, connected to a cloud in one way. And generally, the cloud is a

				server with a public IP on the Internet.
7	Do not use	TCPServer	None	Suitable for devices and computers that are all on the same local network, monitoring can be done locally without the need for communication across the Internet.

7.1. Virtual Serial Port Mode

If the user software communicates using a COM port, then it is necessary to use a virtual serial port mode. This includes some PLC software, configuration software, instrument software, etc.

Next, check if the monitoring computer and devices are all on the local network:

a) If the computer is a server with a public IP address rented on the Internet, then the device must use the TCP client method to connect to the server. At this point, you can choose option ② and ⑤ from Table 4, and if it is a multi-serial port server, option ⑤ must be selected.

b) If both are on the local network (able to ping each other), then it depends on whether the upper computer actively queries or the device actively sends data. If the device actively sends data, it must use the device as a TCP client in method ②, otherwise, method ① can be chosen.。

7.2. Direct TCP/IP communication mode

If there is no need for Modbus TCP protocol conversion and no need for virtual serial ports, the user software may communicate directly with the network port of the serial server via TCP/IP. The serial server converts TCP/IP data into serial data and sends it to the serial device. Generally, users develop their own upper-computer network communication software, integrating the parsing of the device's serial communication protocol. This method is more flexible and efficient than using virtual serial ports. Corresponding to items ⑥ and ⑦ in Table 4.

The section "6.6.4 TCP Communication Test" mainly describes how communication is carried out when the serial server acts as a TCP server. Here we will discuss how TCP clients, UDP mode, and multiple TCP connections communicate with computer software. The computer software is exemplified by SocketTest (a software that mimics user TCP/IP communication).

The Zoran serial server complies with the standard TCP/IP protocol, so any network terminal that adheres to this protocol can communicate with the serial server. Zoran Technology provides a network debugging tool (SocketDlgTest program) to simulate network terminals for communication with the serial server.

For two network terminals (here, the network debugging tool and the serial server) to communicate, their parameter configurations must be matched.

7.2.1. TCP Client mode

Under TCP mode, there are two working modes: TCP server and TCP client. Regardless of which mode is used, one side must be the server and the other the client. Only then can the client access the server; communication cannot be achieved if both sides are either clients or servers.

When the serial port server acts as a client, there must be three corresponding relationships, as shown in Figure 28. (1) Work mode correspondence: The work mode of the serial port server is set to client mode corresponding to the server mode of the network tool, (2) IP address correspondence: The destination IP of the serial port server must be the IP address of the computer where the network tool is located, (3) Port correspondence: The destination port of the serial port server must be the local port of the network tool. After such settings, the serial port server can automatically connect to the network tool, and once the connection is established, data can be transmitted and received.

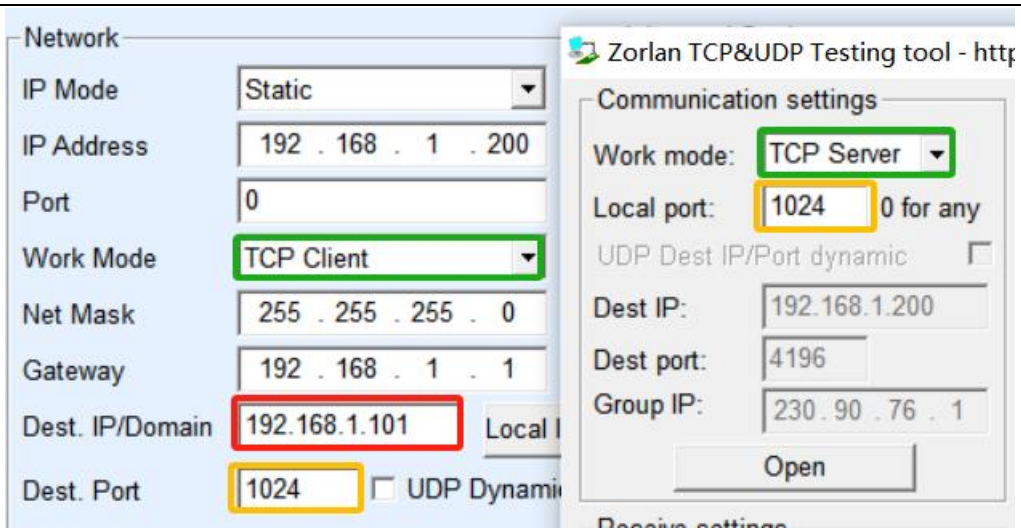


Figure 28 Serial Server as a Client

7.2.2. Client connects to multiple servers.

When the Zhuolan serial port server acts as a TCP client, it can connect to 7 destination IP addresses simultaneously, and the data sent from the serial port will be sent to all 7 destination IPs at the same time. If there aren't enough servers, the remaining destination IPs will be left blank. The usage method is as follows:

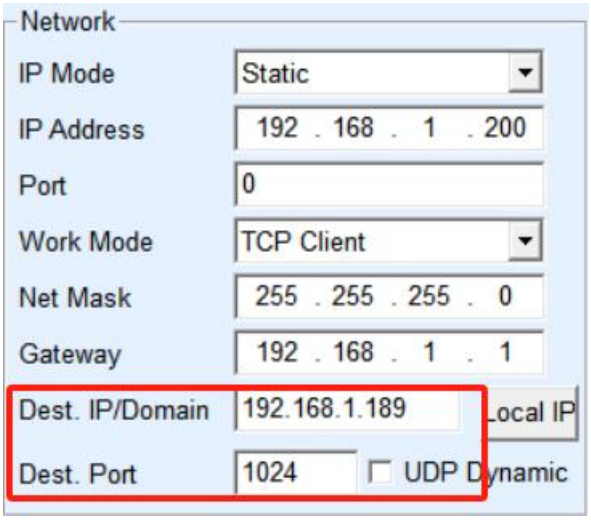


Figure 29 First destination IP and port

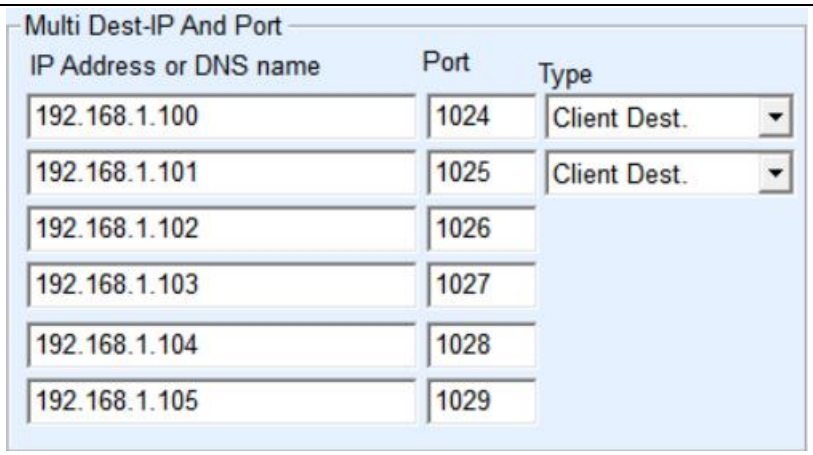


Figure 30: 2 to 7 remaining IP addresses and ports

The first IP is set in the device configuration interface as shown in Figure 29, where the first IP can be a domain name. The remaining 2 to 7 destination IPs are set by clicking the "More Advanced Options" button in the device configuration interface, opening more advanced options for setting.

After all 7 destination IPs are set, the connection can be made automatically. If the connection fails, it will repeatedly reconnect after waiting for the "reconnect after disconnection" time.

7.2.3. TCP Server mode

When the serial port server acts as a server, there are also three corresponding relationships, as shown in Figure 31, which will not be explained one by one here. After such settings, clicking the open button in the network tool can establish a TCP connection with the serial port server, and after the connection is established, data can be transmitted and received.

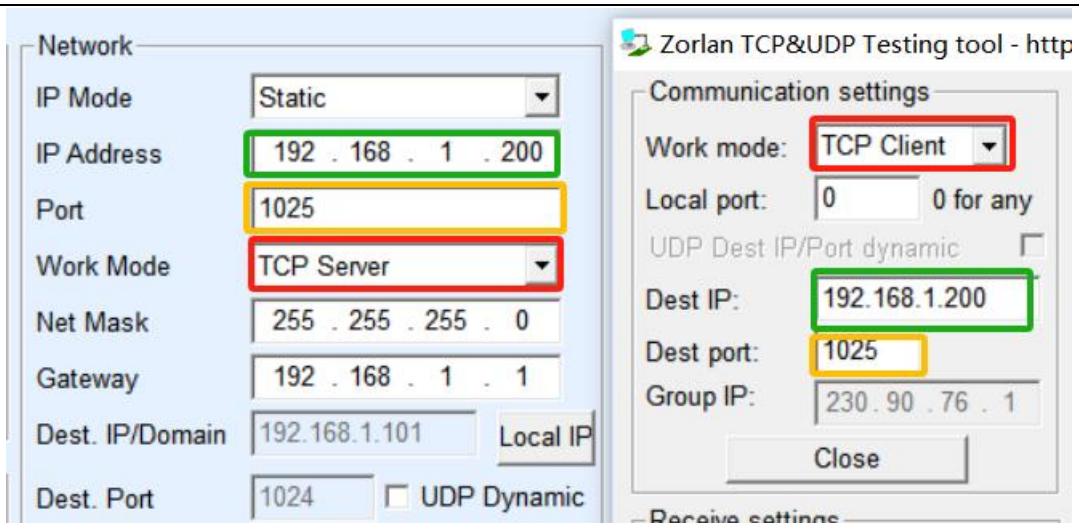


Figure 31 Serial Server as Server Side

When the serial port server acts as a server, it can accept up to 30 TCP connections simultaneously. Data received by the serial port will be forwarded to all established TCP connections. If you need to ensure that data is only sent to the TCP connection that has most recently received a network packet, you need to enable the multi-host feature. Please refer to section 4.9.4 for more details on the multi-host feature.

7.2.4. Serves as both a client and a server.

Zlan serial port server supports accepting TCP connections even when the device is in TCP client mode, meaning it also has TCP server functionality.

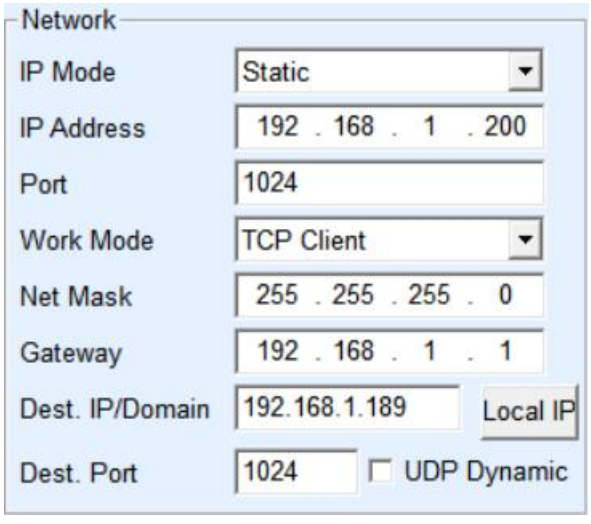


Figure 32 acts as both a client and a server.

By default, when configuring with ZLVircom, if the working mode is changed to "TCP

client" mode, the port (i.e., the local port) will automatically become 0 (0 indicates that a random free port will be selected). To support the TCP server mode, the computer software must know the local port of the device, so a specific value needs to be assigned, as shown in Figure 32. Now the computer software can connect to port 1024 of 192.168.1.200 for communication, while the device will also connect as a client to port 1024 of 192.168.1.189. It is important to note that since the local port 1024 is occupied by the server, when operating as a client, the local port uses "port + 1", which means the software on 192.168.1.189 sees the incoming port of the device as 1024 + 1 = 1025.

7.2.5. UDP Pattern

In UDP mode, the parameter configuration is as shown in Figure 33, with the left side being the configuration of the serial server in ZLVircom, and the right side being the settings of the network debugging tool SocketDlgTest. First, both must be in UDP mode. Additionally, as indicated by the red arrows, the destination IP and destination port of the network tool must point to the local IP and local port of the serial server. As indicated by the blue arrows, the destination IP of the serial server must be the IP address of the computer where the network tool is located, and the destination port of the serial server must be the local port of the network debugging tool. Only after these network parameters are configured can bidirectional UDP data communication be ensured.

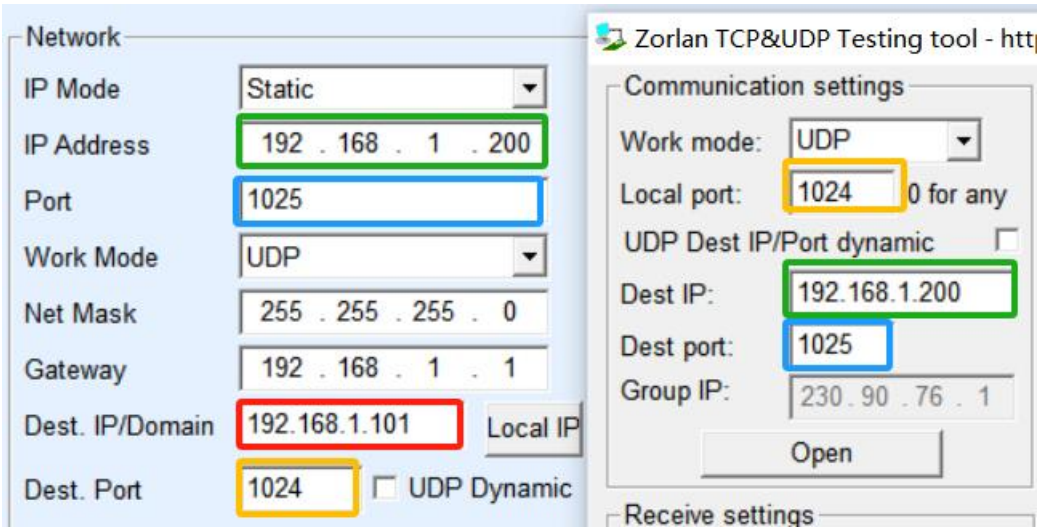


Figure 33 UDP Mode Parameter Configuration

7.3. Device pairing method

If the upper computer is neither a Socket program (SocketDlgTest) nor a virtual serial port, but rather two devices connected to each other through a network port, the configuration method is similar. First, the user needs to connect the two devices and the computer to the same local area network. The computer runs ZLVircom, and the connection to the computer is only for configuration purposes; after the configuration is complete, the computer does not need to be connected. Click on the device management of ZLVircom, find these two devices, as shown in Figure 35. Then click "Device Edit" to configure the devices. Device pairing can be divided into TCP pairing and UDP pairing. If it is a TCP pairing method, the parameters of the two devices are as shown in Figure 34. The parameters indicated by the arrows must correspond, just like the corresponding method when connected to a PC. After the TCP connection is successful, you can return to the "Device Management" dialog box to check the connection status, as shown in Figure 35. If the status of both devices is "Connected," it means that the TCP link between the two devices has been established.

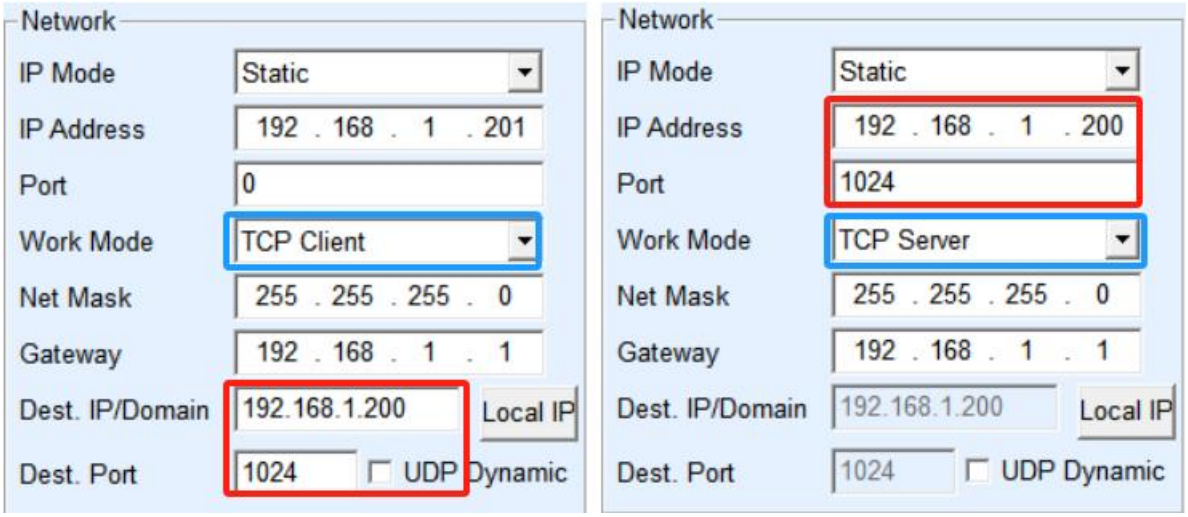


Figure 34 TCP Device Pairing Parameter Configuration

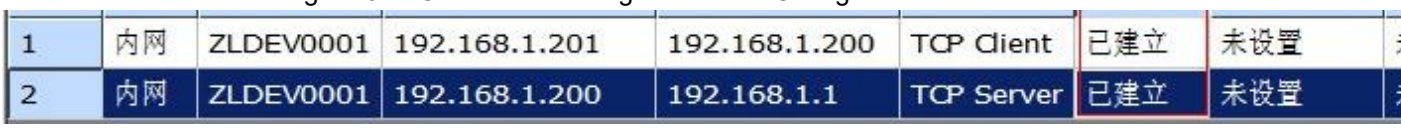


Figure 35 TCP device connection successful check

If it is connected via UDP, the configuration parameters are as shown in Figure 36, and the parameters corresponding to the arrows must be one-to-one. As long as the parameters are correctly configured for UDP pairing, there is no need to check the connection status; the data

sent will automatically be sent to the specified device.

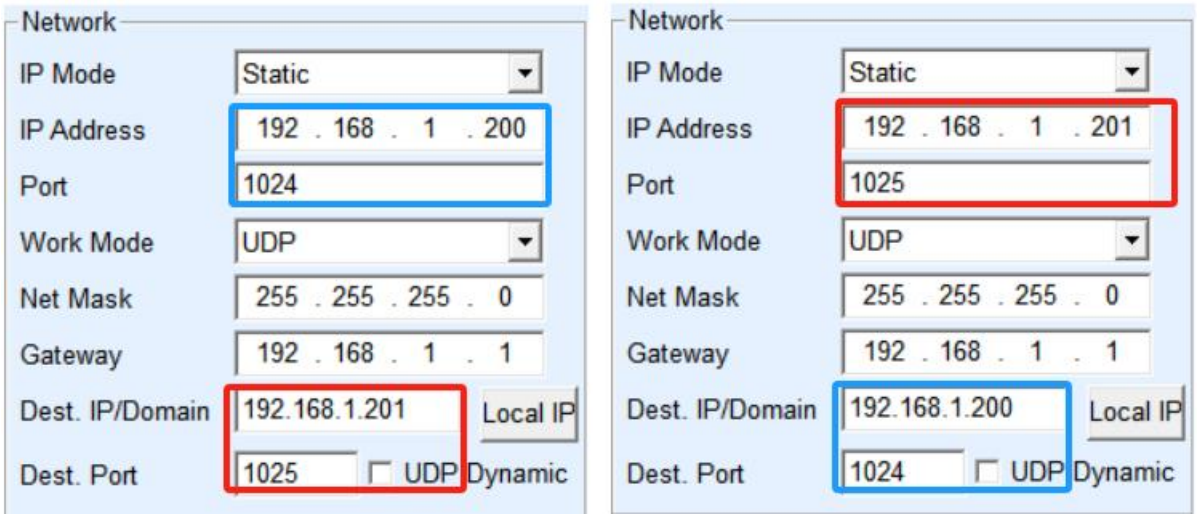


Figure 36 UDP Device Pairing Parameter Configuration

Finally, it's important to note that for device-to-device connections, in addition to setting the network parameters as mentioned above, the correct serial port parameters must also be configured. This includes ensuring that the baud rate of the serial port server matches that of the user's device. Once these settings are in place, user devices can send data to each other through the serial ports of the two serial port servers.

8. Equipment debugging

8.1. Network physical connection

A serial port server can be connected to a 10M/100M switch using a crossover cable or a straight-through cable, or it can be directly connected to a computer network port.

After the connection is established, the first step is to check if the Link light is green; if not, please check if the network cable is properly connected.

8.2. Network TCP Connection

When the device is set to dynamically obtain an IP address, it cannot directly connect to the computer network port. This is because there is no DHCP server available (usually the DHCP server is the router within the local area network). Therefore, when connecting directly, please specify an IP address. At the same time, the computer also needs to be assigned a fixed IP address.

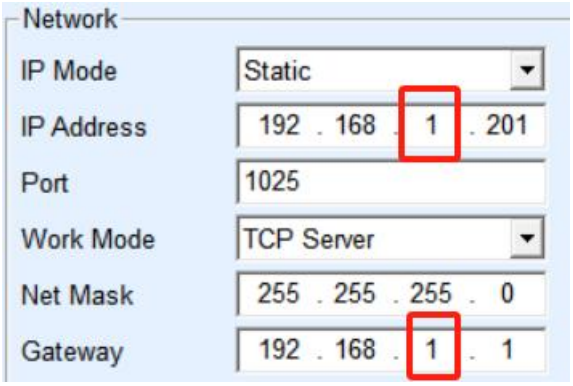


Figure 37 configured in the same network segment

Whether directly connected or through a switch, when configured with a static IP, devices and computers need to be on the same network segment (unless it is cross-gateway communication), as shown in Figure 37.

Since ZLVircom supports cross-segment search and configuration, the inability to communicate but the ability to search is usually due to the IP address not being configured correctly. At this point, ZLVircom can be used to configure the device on the same network segment.

After configuration, using the steps for the 6.6.4 TCP communication test or the 6.6.5 virtual serial port test, you can see that the Link light turns blue when a TCP connection is established. The blue Link light can also be seen through ZLVircom, such as in the device management list, if the TCP connection column reads "established," it indicates that the Link light is blue, as shown in Figure 38, which facilitates remote diagnosis.

Figure 38 Connection Status and Data Transmission and Reception Status

8.3. Data transmission and reception

Once the Link light turns blue, the software and serial port server can start transmitting and receiving data. At this point, if the software sends data, the Active light will turn green, typically staying that way for at least 1 second. The data will also be output from the serial port server's serial port, but whether the output data is correct depends on whether the correct serial port parameters (baud rate, data bits, stop bits, parity bits) have been configured.

For a correct command, serial devices usually respond. When there is a response (serial

port sending data to the network port), the Active light will turn blue. If not, please check the serial port parameters or whether there is a problem with the serial port connection.

To facilitate remote debugging, ZLVircom also supports viewing the transmission and reception data remotely, as shown in Figure 38. TXD represents the amount of data sent by the serial port server. When refreshing the device list, if this number changes, it indicates that there is data being sent down, and the Active light will be green; if the RXD number is changing, it indicates that the serial device is returning data, and the Active light will be blue.

8.4. ZLVircom Remote monitoring data

When using a virtual serial port, ZLVircom supports real-time capturing of data transmitted and received through the virtual serial port. This facilitates user debugging of the system, and the usage method is as follows:

Assuming that a virtual serial port communication has already been established following the method described in 6.6.5 Virtual Serial Port Test. Now, to monitor the data passing through the virtual serial port, open the ZLVircom menu / Configuration / Software Configuration / and open the vircom configuration dialog box.

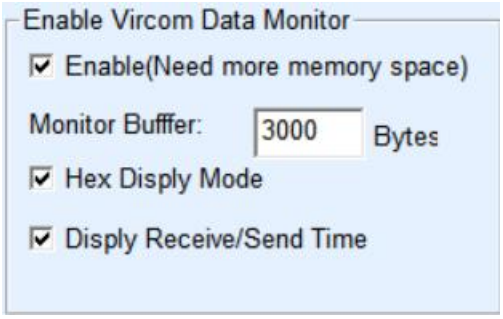


Figure 39 Enable ZLVirom monitoring

Check the boxes in front of the three options: monitor, hexadecimal monitor mode, and display data transmission time, as shown in Figure 39. Then click OK. Assuming data transmission and reception have been conducted previously, now select a virtual serial port to monitor on the main interface, and then choose Menu / View / Monitor, as shown in Figure 40.

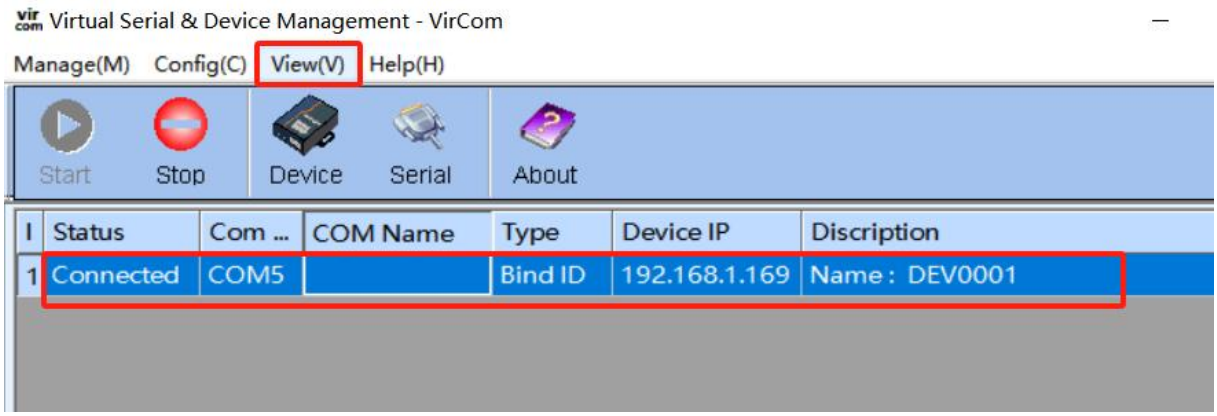


Figure 40 Open ZL Virocm monitoring

From the opened dialog box, you can see the instructions sent by the upper computer and the responses from the device, as shown in Figure 41. This function facilitates on-site communication debugging.

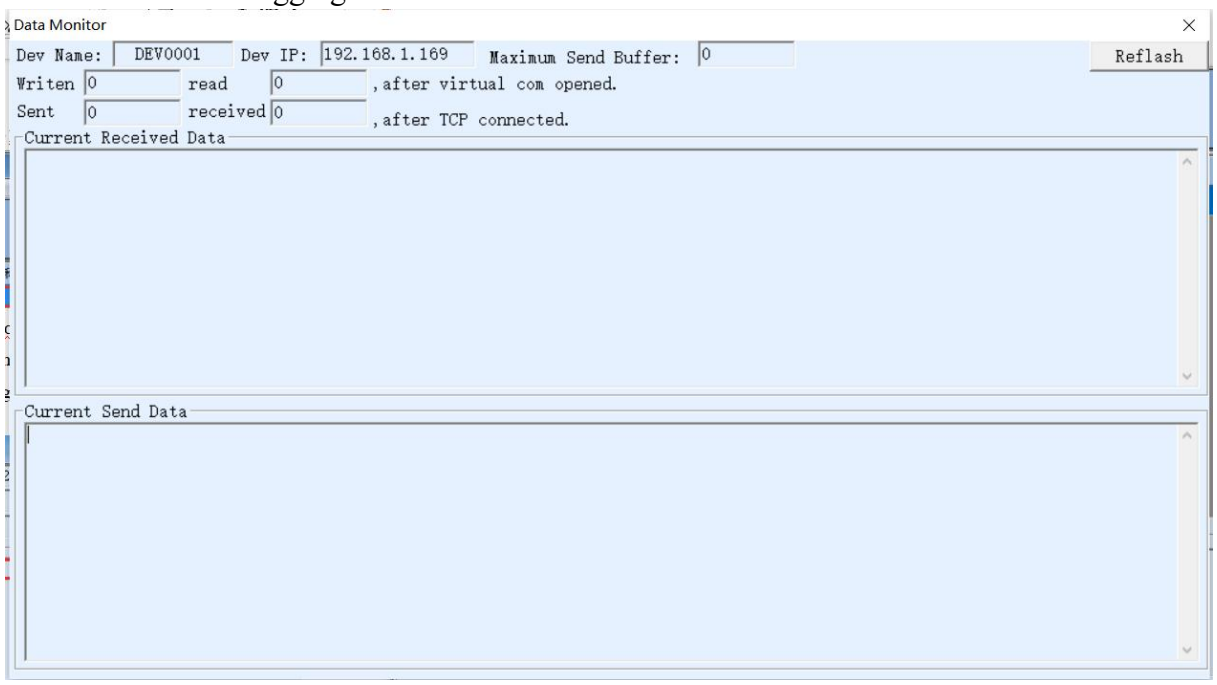


Figure 41 Monitor data transmission and reception

9. Modbus Advanced features

A serial server with Modbus gateway functionality does not have its own station address and registers; it serves as a bridge for communication. It generates Modbus RTU commands

based on the Slave ID, function code, register number, and register count included in the Modbus TCP instructions sent by the user software to the Modbus gateway, and outputs them through the serial port. It can be considered a "translator" for protocols.

9.1. Enable Modbus Gateway

Firstly, the serial server should support the Modbus gateway function, which means the "Modbus TCP to RTU" option in Table 3 of the device settings dialog should be checked.

By default, the serial server operates in transparent pass-through mode. If you need to switch to Modbus gateway mode, please select the "Modbus TCP to RTU" option under "Protocol Conversion." After this, the device will automatically change the "Port" parameter to 502 (the port for the Modbus server). In this way, the Modbus gateway is enabled.

If the serial RTU device is operating as a slave, the upper computer Modbus TCP software should connect to the Modbus gateway's 502 port. At this point, the Modbus gateway needs to operate in TCP server mode; if the serial RTU device is acting as a master, the Modbus gateway operates in TCP client mode, with the destination IP filled in as the IP address of the computer where the Modbus TCP software is located, and the destination port is typically 502.

9.2. Storage-type Modbus Gateway

The new generation ZLAN5143 (with a 3 at the end are all storage types) is a register-saving Modbus gateway. Compared to the ordinary ZLAN5142 (with a 2 or 0 at the end are all non-storage types), ZLAN5143 can save the content of the registers read in the gateway internally. This greatly improves the speed of Modbus TCP queries, and the performance is even more superior when supporting multiple master accesses.

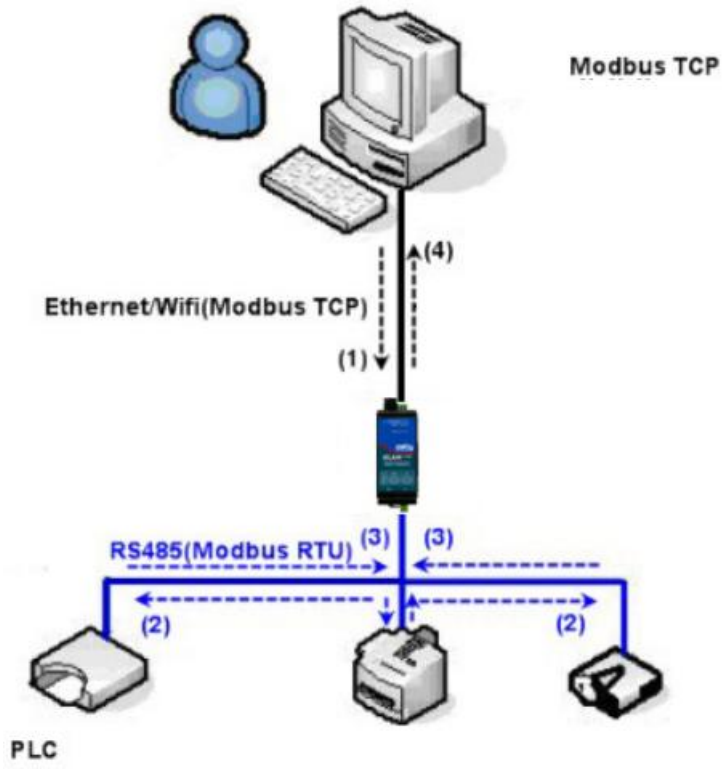


Figure 42 Storage-type Modbus Gateway Operation Mode

As shown in Figure 42: The direction of the normal Modbus TCP data flow is (1) ((2) ((3) ((4). That is, first convert the Modbus TCP command into the corresponding Modbus RTU command, then the device responds to the Modbus RTU command to the Modbus gateway, then the Modbus gateway converts it back into Modbus TCP and sends it to the monitoring upper computer.

We know that Modbus TCP is network communication, with a fast transmission speed, usually able to respond within 3ms, while Modbus RTU is RS485, with a speed of only 9600bps, and generally sending and receiving a command takes at least 30ms. Thus, the query response time of the ordinary non-storage type Modbus gateway is relatively long. In addition, if many upper computers are querying data at the same time, the serial port will become congested. If the network is compared to a highway, and the serial port to a single-lane bridge, then the original method is to pass the traffic of the highway on the single-lane bridge.

The register-saving Modbus gateway (ZLAN7104M) solves the above problems. It can temporarily save the register data obtained from queries in the Modbus gateway internally, so when the Modbus TCP query comes, the Modbus gateway can immediately return the

command, truly bringing out the fast characteristics of Modbus TCP. On the other hand, ZLAN7104M can actively send commands from the serial port to automatically update the content of the currently saved register data, keeping the latest register values.

In addition, ZLAN7104M is a fully automatic, plug-and-play Modbus gateway, users do not need to configure the required register addresses, function codes, slave addresses, etc. ZLAN7104M will automatically identify and dynamically add these registers based on the Modbus TCP commands coming from the network port.

When monitoring with multiple computers, ZLAN7104M can show good response speed, regardless of the baud rate of the serial port, it can generally respond with data to the upper computer within 3ms. And it shows good real-time update speed for serial port data.

The register-saving Modbus gateway is truly a Modbus TCP to Modbus RTU in the true sense, it truly leverages the advantages of fast speed and the ability to query from multiple hosts simultaneously of Modbus TCP.

Note that when the serial server acts as a TCP client, it does not have the storage function and will automatically switch to the non-storage type.

The following lists the features of the storage-type Modbus:

1. The first Modbus TCP query command is non-storage type. Because it is necessary to wait for the slow return of data from the RTU device before replying to the network port with register contents.
2. If a specific command is not queried by the upper computer on the network within 5 seconds, this command will be automatically deleted and will not be sent from the serial port to the RTU device.
3. Currently, 10K of Modbus cache can be stored, which can approximately store 500 commands for single register queries at the same time.
4. When multiple commands are being queried simultaneously, they are sent in the order they were received, with the first command being sent (the first command is acknowledged (waiting for the 485 anti-collision time (refer to the multi-master section) (the second command is sent……. After the last command is acknowledged, it returns to the first command.

9.3. Disable storage functions

Although the storage-type Modbus has a faster response speed, some users do not want RTU devices to receive a large number of query commands, which could affect the internal processing speed of the instrument. At this point, the storage feature can be disabled.

The method to disable storage is to click on the "More Advanced Options" button in the "Parameter Configuration" dialog box, select the Modbus gateway type as non-storage Modbus gateway as shown in Figure 43. Then return to the device settings and click on Modify Settings.

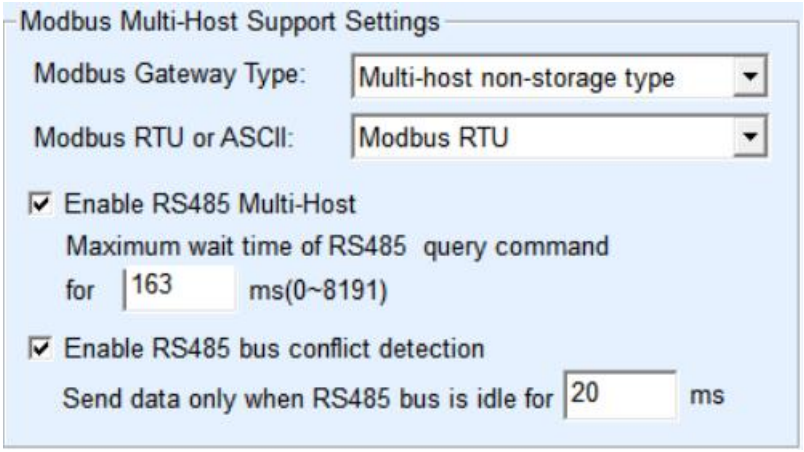


Figure 43 Disable storage functions

9.4. Multi-host functionality

As shown in Figure 43, the "RS458 multi-host support" and "RS485 bus collision detection function" are the multi-host features of Zhuolan. They are generally enabled and disabled simultaneously. Once enabled, devices with the conversion protocol set to Modbus TCP have the storage-type Modbus gateway function; otherwise, they are non-storage-type Modbus gateways. If the conversion protocol is set to none, it usually allows users to define their own RS485 protocols to have the function of serial devices that can be accessed by multiple hosts simultaneously. This is not achievable in a pure RS485 network, as simultaneous transmissions from multiple masters would cause collisions on the RS485 bus. Zhuolan's serial server can "coordinate" the RS485 bus to achieve the goal of multi-host access.

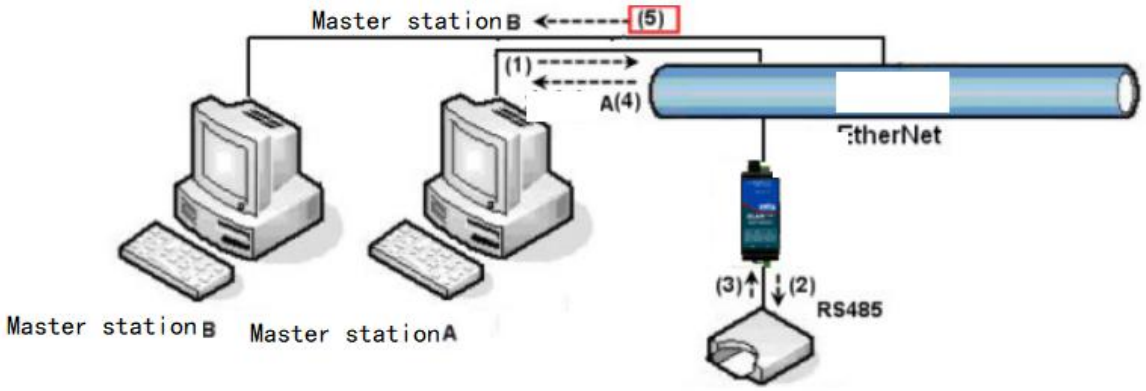


Figure 44 Multi-host Function Demonstration

As shown in Figure 44, in the normal mode, when two hosts: Host A and Host B are both connected to the serial server, at this time Host A sends instruction (1), the RS485 device receives instruction (2), and the RS485 device returns instruction (3). However, the serial server will simultaneously send instruction (4) to Host A and instruction (5) to Host B through its network port. Since Host B did not send a query, but it also receives the response instruction (5), Host B may experience a communication error. In multi-host mode, only instruction (4) will be sent, not instruction (5), because the serial server will automatically remember which host needs to return the response, only sending the instruction back to the host that recently communicated, Host A's query is only replied to A, Host B's query is replied to Host B.

Another function is that, in normal mode, if Host A and Host B both send data at the same time, it will cause the merging of instructions on the RS485 bus, making it impossible to recognize normally; in multi-host mode, the serial server can schedule the order of A and B's use of the bus, effectively preventing the conflict issue of multiple devices accessing simultaneously.

When the conversion protocol is set to "None", by default, the multi-host function is not activated. To enable the multi-host function, please click on "More Advanced Options" in the device configuration dialog box, and then check the box for "RS485 Multi-Host Support".

9.5. Multi-host parameters

"RS458 Multi-host Support" and "RS485 Bus Collision Detection Function" are introduced as follows.

Figure 45 RS485 Multi-Master Support

The RS485 command response timeout is the maximum time interval from when the serial server starts sending the command to when it receives a response. The time entered should be greater than the actual maximum time interval. This is because if a timeout is determined, the next command will be sent.

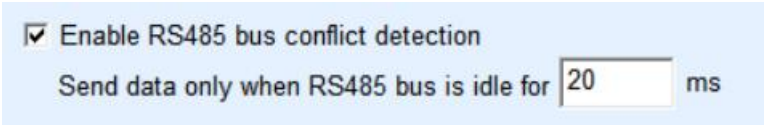


Figure 46 RS485 Anti-collision Idle Time

RS485 bus collision time: This indicates how many milliseconds the serial server waits after receiving the response to the first command before sending the second command. This parameter effectively defines the speed of command polling. It is recommended that this value be set to 20ms or above. The parameter "Maximum wait time 3 seconds" generally does not need to be modified.

When a user selects the conversion protocol as "Modbus TCP to RTU" using ZLVircom, the above two enable boxes will be automatically checked (unless the user manually enters advanced options to remove them), and the two times will also be automatically configured according to the baud rate. However, if the Modbus commands are relatively long or if the conversion protocol is set to "None", then these two parameters need to be manually configured.

The following are recommended settings for these parameters:

1. Figure 46 shows the "RS485 Bus Anti-Collision Time," which can generally be set to twice the "Packet Interval" at the bottom right corner of the parameter configuration interface, but it cannot be less than 20 at the minimum.
2. Figure 45 shows the "RS485 Command Response Timeout," which is generally determined by the length of the command to be responded to. If the sent command is N bytes and the response is M bytes, then the recommended value to set is: "Packet Interval" × (N+M+5) + 100.

9.6. Modbus under Multi-Purpose IP

As shown in Figure 44, if the serial port device (RTU device) acts as the master station, and the network port device (Modbus TCP device) acts as the slave station, with multiple network port slave devices existing simultaneously, then the serial port server can act as a client to connect to these multiple network port devices simultaneously, following the method introduced in section 7.7.2.7.2.2 for a client connecting to multiple servers.

The functionality that needs to be implemented is: when the serial port RTU sends an instruction, it can be sent to multiple network port devices. Network port devices identify whether the instruction is meant for them through the Slave ID field, and only the corresponding network port device with the matching Slave ID responds. The network port response is sent to the serial port server, which then converts it into an RTU instruction and outputs it from the serial port to the RTU device.

It is important to note that the two checkboxes for "RS485 Bus Anti-Collision Time" shown in Figure 46 and "RS485 Instruction Response Timeout Time" shown in Figure 45 need to be unchecked. Otherwise, the aforementioned forwarding function cannot be realized.

Another application method is: although the serial port server connects to multiple network port devices as a Client, the RTU device does not act as the master station. Instead, the network port device initiates the communication first, and the RTU device responds (acting as a slave). In this case, the checkboxes for "RS485 Bus Anti-Collision Time" and "RS485 Instruction Response Timeout Time" still need to be checked. This allows the functionality where multiple masters can access a single RTU device simultaneously.

10. Registration packets and heartbeat packets

Registration packets and heartbeat packets are a feature suitable for communication between devices and cloud software.

10.1. Registration package

The definition of a registration packet is that when a computer software establishes a TCP connection with a serial port server module (hereinafter referred to as the module), the module will first send a string of encoded data to the software. This allows the software to recognize which module is communicating with it. This string of encoded data is the registration packet.

Registration packets are particularly suitable for monitoring in the Internet of Things because cloud software typically runs on public servers on the Internet, while the modules are distributed across various collection and monitoring points. It is very important to enable the cloud software to identify the modules, which is essential for achieving IoT communication.

Shanghai Zolann's serial port servers provide the following multiple registration packet methods.

10.1.1. Connect and send the MAC address.

Connect and send the MAC address: This method is not only supported by model 4 (such as 5143), but also by ordinary models. The method is that when the module connects to the cloud, it sends its own MAC address to the cloud. Since the MAC address is unique, it can uniquely identify the device. This method is simple and does not require the writing of registration packets for each device, so it is simple and effective. The usage is: click on "More Advanced Options" in the device settings dialog, find "Send MAC address when TCP is established" in the upper middle part, check the box, then go back to the settings interface, and click "Modify Settings".

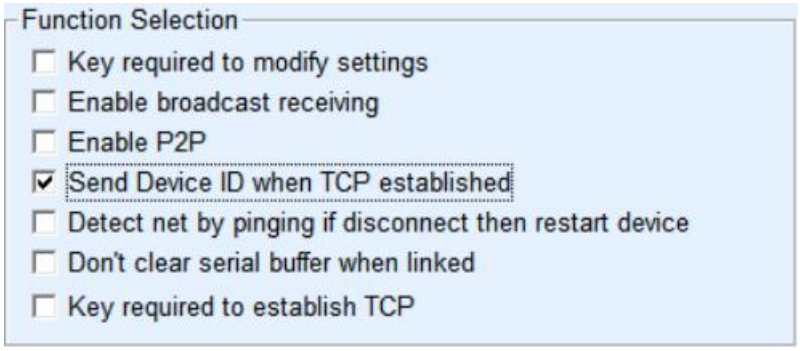


Figure 47 Connect to send the MAC address

10.1.2. Realcom Agreement

The Realcom protocol is a mature protocol that includes registration packets and heartbeat packets, allowing users to implement registration packet and heartbeat packet functionalities. To enable the Realcom protocol, go to the "Device Settings" dialog box and select "REAL_COM protocol" as the "Conversion Protocol." Note that the part for enabling registration packets should be left blank and not ticked.

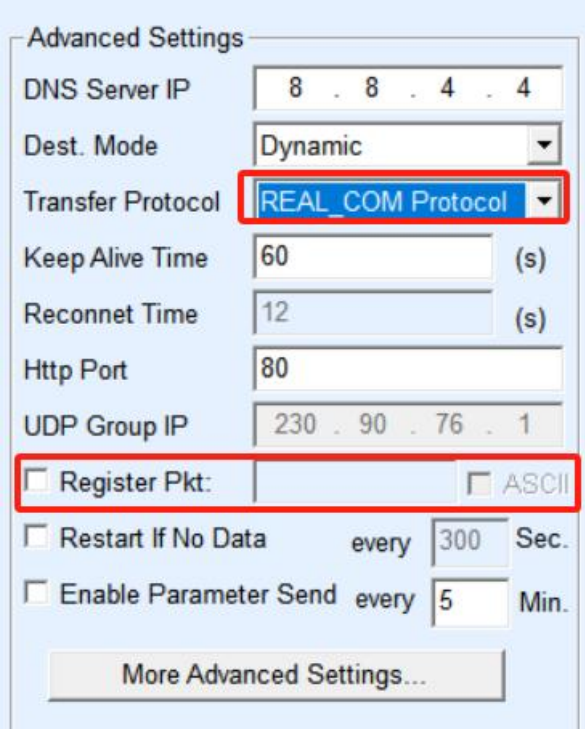


Figure 48 Enable realcom protocol

After enabling the Realcom protocol, it will not be transparent transmission communication; it has the following characteristics:

1. After the device establishes a TCP connection with the cloud, it automatically sends a hexadecimal registration packet FA 07 13 02 FA 02 MAC[5] MAC[4] MAC[3] MAC[2] MAC[1] MAC[0] FA FF. MAC[5] to MAC[0] in the packet are the device's MAC address.
2. When the device sends data to the network, it automatically adds a 3-byte header prefix FA 01 01.
3. Every keep-alive timing period, the device sends a 1-byte heartbeat packet containing 00 to the software.

The REAL_COM protocol can be used as the device's registration packet because it contains the MAC address. However, due to its fixed format, it is up to the cloud software to design the REALCOM protocol to be compatible with this approach.

10.1.3. Custom registration package

Custom registration package method allows users to fill in any registration package format. The method is: in the device settings interface, configure as follows:

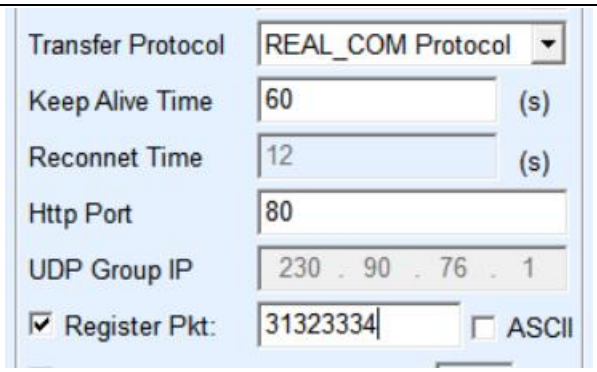


Figure 49 Set the registration package

The difference with the REAL_COM protocol is that here, the registration packet is enabled and filled with registration information such as 31 32 33 34. Note that this is hexadecimal, so the actual data sent is the string 1234. If you need the string to be displayed, click the "ASCII" option next to it.After the device connects to the cloud software, it can automatically send hexadecimal registration packets of 31 32 33 34. This method of registration packets is quite flexible, allowing the device to adapt to the existing cloud registration packet format; however, the registration packets do not contain wildcards like MAC, requiring separate configuration of different registration packets for each device, which is quite cumbersome. The configuration for each device is the same for the methods of sending MAC addresses and REALCOM, but due to different MACs, the registration packets are naturally different.

The maximum length of the registration packet is 33 bytes. This method supports registration packets and heartbeat packets in UDP mode.

10.2. Heartbeat packet

Heartbeat packets are mainly used to detect whether the communication link has been disconnected. The method is that the device sends a heartbeat packet data to the server software at regular intervals, which, once received, is discarded by the server and not treated as valid communication data.

Heartbeat packets have two main functions: firstly, they let the upper-level software know that the device is active; secondly, if the device fails to send a heartbeat, the device acting as a TCP client will automatically re-establish the TCP connection. Therefore, it serves as a means to restore network communication.

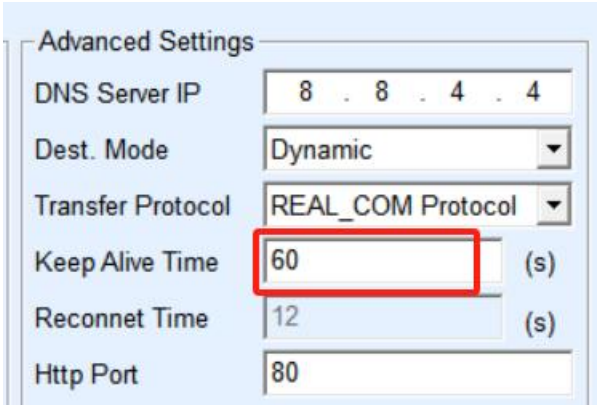


Figure 50 Keepalive Timeout Time

As shown in Figure 50, the sending time of heartbeat packets is set by the "keep-alive timeout".

10.2.1. Implied heartbeat

Even without setting any heartbeat packets, Zhuolan devices will enable the implicit heartbeat function when operating as a TCP client. Therefore, the implicit heartbeat function refers to the device sending data, but the server actually not receiving the heartbeat data. Thus, it cannot fulfill the first function of heartbeat packets, which is for the server to detect whether the device is active or not; however, since the device is actually sending data, it can fulfill the second function of heartbeat packets, which is to detect whether the TCP connection is normal. Once a disconnection is detected, it can automatically re-establish the TCP connection.

10.2.2. Custom heartbeat packets

First, fill out the registration package according to the method described in 10.1.3 for custom registration packages. Then, to add a heartbeat packet, click the "More Advanced Options" button in the device settings, enter the hexadecimal heartbeat packet on the second line for the multi-purpose IP and port, and change the option on the right to "Parameter Packet Destination."

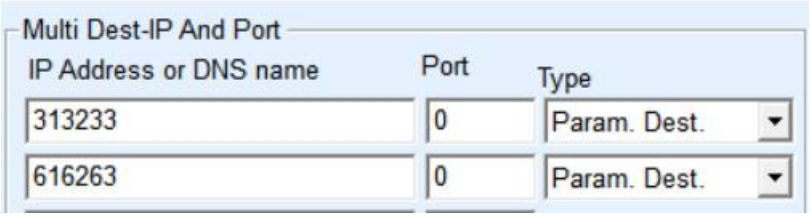


Figure 51 Custom Registration Package

Note that the sum of the registration packet and the heartbeat packet must be less than 33 bytes. The first line is actually the registration packet.

11. Httpd Client communication functionality

This feature is designed to directly send the data uploaded from the serial port server to the web-based server program, which simplifies the workload of cloud software development.

When Internet of Things (IoT) collection terminals interact with web servers (httpd programs), if the data can be submitted to the web server in accordance with the 规范格式 of HTTP GET and POST instructions, then the web server can process and store the data using existing php/asp languages. This eliminates the need for users to develop web application interfaces.

To support this feature, it is necessary to download a configuration file named httpd.txt within the Zlan serial port server. The download can be achieved using the firmware upgrade function of zlvircom.

1. The device supports converting serial port data into HTTP format directly via GET/POST methods, which can be recognized by the server.
2. Web server sending: The Web server can also send data required to the serial port server via GET/POST instructions, where the effective data content can be output from the serial port of the serial port server. When the serial port server receives the data, it can also give a specific response to the Web server, indicating that the data has been received.
3. It supports arbitrary conversion between input and output data in hexadecimal and string formats, making it convenient for the Web server to send data in character form, while the serial port outputs data in hexadecimal format to control the serial port device.

12. Network port modification parameters

Modifying parameters through the network port is to achieve the functionality of searching for devices and changing device parameters, similar to the zlvircom software. This is done by managing devices and changing parameters through the network port of the serial server. It is suitable for users who want to integrate the search and configuration functions into their own software.

Modifying parameters through the network port is implemented via the "UDP Management Port Protocol", for example:

1. The computer software sends UDP broadcast packets with the destination port set to 1092 over the network. When a device receives this packet, it sends back its information to the computer software, achieving the purpose of searching for devices.
2. The computer software sends UDP commands to modify parameters to the device's port 1092, achieving the purpose of modifying the device's parameters.

A detailed introduction to modifying network port parameters can be found in the document "Zhuo Lan Networking Product UDP Management Port Protocol". Alternatively, the device management functions in the Device Management Function Library version 14 can be used to achieve this.

13. Device Management Library

This feature is suitable for users who need to integrate device management functions into their own software.

The "UDP Management Port Protocol" has been integrated into the device management function library ZLDevManage. This is a DLL development library for the Windows platform, which can be called by various development tools such as VC, VB, Delphi, etc.

Detailed API interface introduction documents and VC calling Demo cases are provided. It can realize device search, parameter modification, P2P function calling, etc.

The development library can be obtained from the Zhuo Lan official website: find "Device Management Function Library" on the http://zlmcu.com/download.htm page.

14. Serial port parameter modification

Users can read and set parameters by sending commands to the serial port server's serial port. This is suitable for users who need to control and configure products at the chip or module level through serial port control. The parameters that can be set include: IP address, baud rate, device name, working mode, etc. After the new parameters are set, the serial port server can be restarted through serial port commands.

ZLan serial port commands have the following characteristics:

1. Serial port commands use a 10-byte data preamble, so there is no need to distinguish between communication data and commands through the pull-up or pull-down of additional configuration pins, nor is there a need to switch between command mode and communication mode, making usage more flexible and convenient.
2. The command set includes various command formats such as saving parameters, not saving parameters, and restarting the device.
3. It can achieve various applications, such as reading the MAC address of the serial port server, or modifying the operating mode of the serial port server. For example, when switching from TCP server to TCP client mode, it can actively connect to the server; when switching from TCP client to TCP server mode, it can disconnect from the server connection.

15. Remote Device Management

Remote device management refers to the ability to maintain and manage devices through ZLVircom software, including restarting devices, modifying parameters, and updating firmware. This feature is suitable for users who manage devices through ZLVircom.

For ZLVircom software, remote management can be performed as long as the device can be found in the device list. Remote management of devices can be divided into the following situations:

1. Automatic search: Under the same switch, regardless of whether they are on the same network segment, the way ZLVircom searches for devices on a computer is: ZLVircom sends a broadcast query (all devices receive the query and reply with their parameters to the ZLVircom tool. This method searches for all devices at once.)

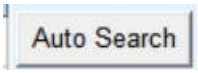


Figure 54 Automatic Search

2. Manually add: There are two situations:

Figure 55 manual addition

a) Large routers divide the network: In some large networks, broadcast packets are

divided by routers, so broadcast packets cannot reach the device end, but pinging the device IP is always through. At this point, manual addition is generally needed to solve the problem. The method of manual addition is to click "Manual Addition" in the "Device Management" dialog box to add the first and last IP, so that you can query each device one by one.

b) Public network server queries internal network devices: Serial servers are in the internal network and operate in TCP server mode, zlvircom is on the server with the public network IP. At this point, a UDP port mapping of 1092 needs to be done on the router of the network where the device is located, mapping to the IP where the device is located, and then manually adding this device through zlvircom, with the IP being the public IP of the device end.

3. TCP client: When the device acts as a TCP client, it will initiate a TCP connection to the destination IP (116.15.2.3) on port 4196. Once the connection is established, it will automatically send its parameter system to the destination UDP port (note, not the TCP port) every keep-alive timing interval, allowing zlvircom to detect the device on this computer (116.15.2.3). If the destination port is not 4196, the default parameter receiving port of zlvircom needs to be modified. This can be done by changing the default listening port in the menu / configuration / software configuration / default listening port, and then starting zlvircom. If a TCP port conflict message pops up, it can be ignored and the process continued.

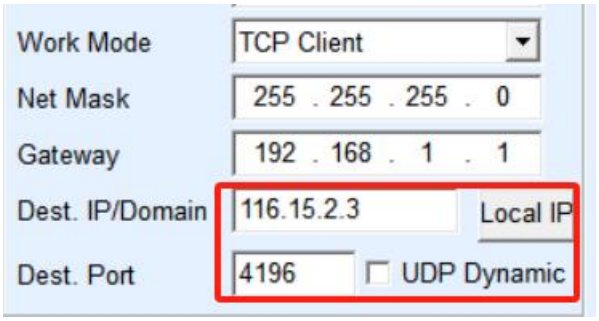


Figure 56 Client

4. Scheduled transmission parameters: Even when in TCP server mode, the serial server can select the "Scheduled Transmission Parameters" feature to send parameters every 5 minutes to the destination IP (here, 116.15.2.3) on the destination port. The zlvircom that receives the parameters on this port of the server can manage these devices.

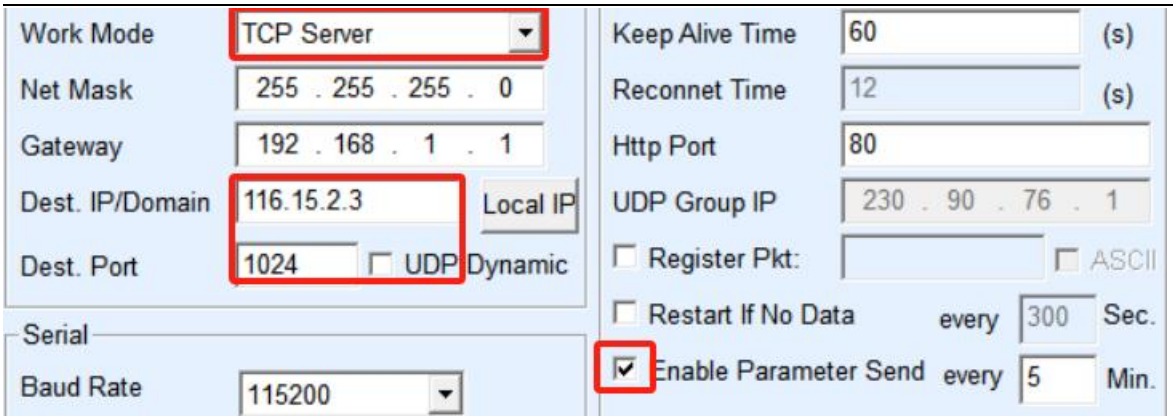


Figure 57 Timing Send Parameters

To facilitate the identification of devices, if remote management is needed, please name the device something easy to remember.

16. Firmware upgrade method

ZLAN7104M can upgrade their own programs, but they cannot upgrade each other's programs. Whether found in the device list through automatic search or manual addition, devices can be upgraded using this method.

1 Obtain the firmware file ZLSN7104 from Zhuolan, such as 1.507(2007).BIN.

2 In the ZLVircom tool, first search for the device that needs to be upgraded, then enter the device parameter editing dialog box. Click "Restart Device" once.

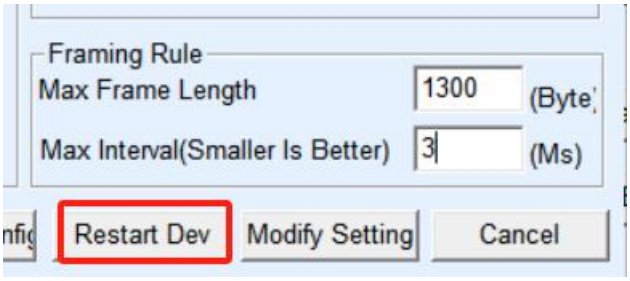


Figure 58 Upgrade Button

After the device restarts, use the same method to search for this device again, and re-enter this dialog box. Click the "Firmware and Configuration" button at the bottom right corner of the dialog box.

Figure 59 Firmware and Configuration Buttons

3 As shown in Figure 61, select the "Program File Download" radio button. In the program file, choose the firmware file. The IP address part for the serial server has been automatically filled in and does not need to be written again, the module type/model has been automatically selected. Then click on Download.

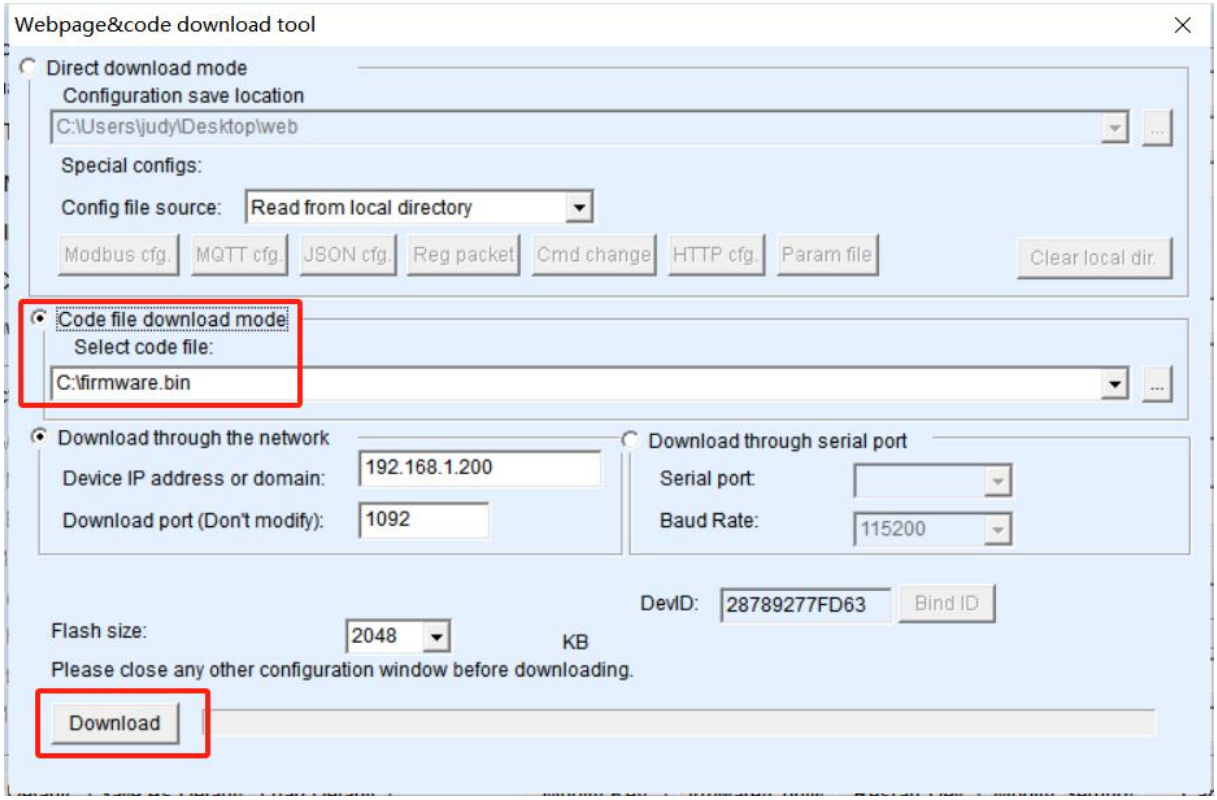


Figure 60 ZLAN7104M Firmware Upgrade Method

4 At this point, the download progress bar begins to move, and the download time is approximately 30 seconds. During the download process, you will see the ACT light on the device flashing. At the end of the download, you will see the LINK light flashing a few times. Then, a pop-up message will appear saying "Transfer complete, do not power off the device while the LINK light is flashing." Note: This only indicates that the

transfer is complete, and the writing to flash process takes about 3 seconds. During this time, the LINK light will flash, and you should not power off the device.

5 After the download is complete, the program will usually restart automatically, and generally, there is no need to power off. If the running indicator light is flashing and the program does not automatically restart, wait for the LINK light to stop flashing for more than 30 seconds before powering on again.

6 Web Configuration Interface Update: After the firmware upgrade, the internal configuration webpage of the module also needs to be updated, otherwise, it will not be possible to configure through Web, but communication will not be affected. If web configuration is not needed, the webpage does not need to be downloaded either. The method for downloading the Web is: as shown in Figure 61, change the "Program File" download mode to "Web Directory Download." And select the root directory of the local webpage as the directory where the webpage files to be downloaded are located (this directory can be obtained from Zhuolan), click download, and download all files from the local webpage directory to the device's internal file system.

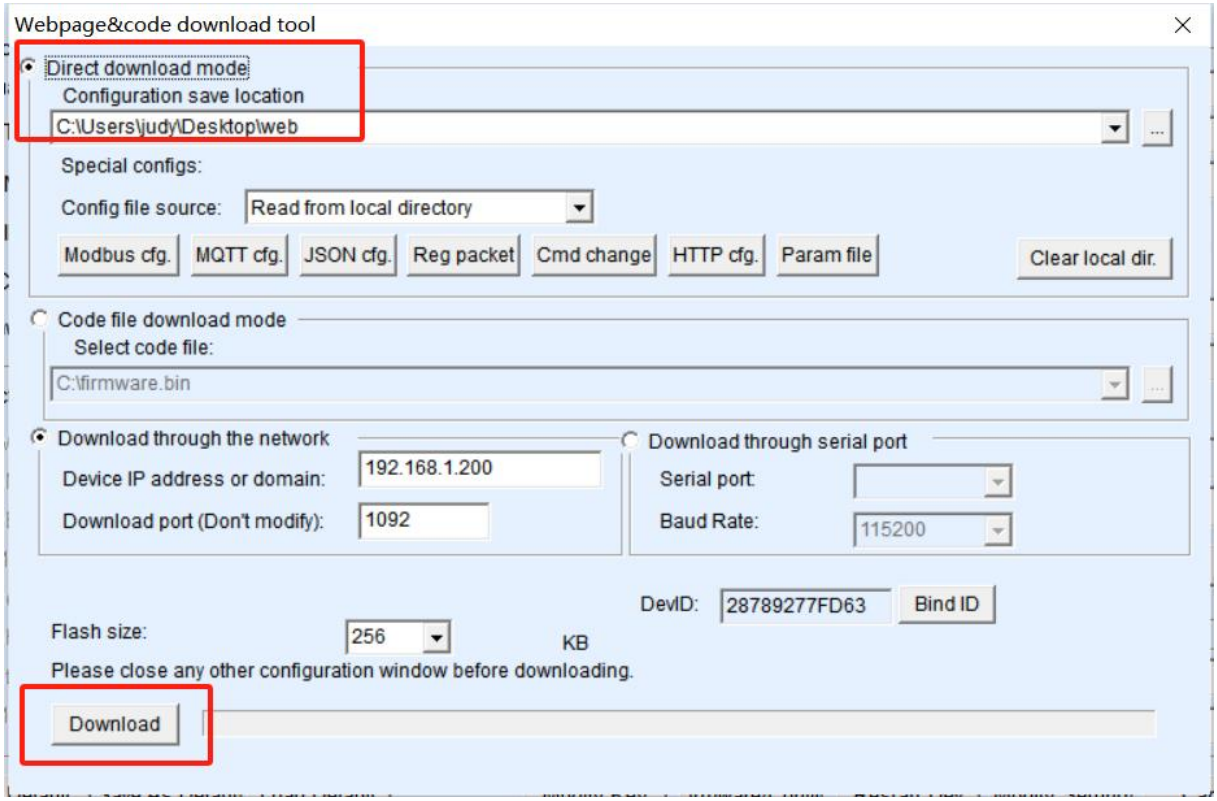
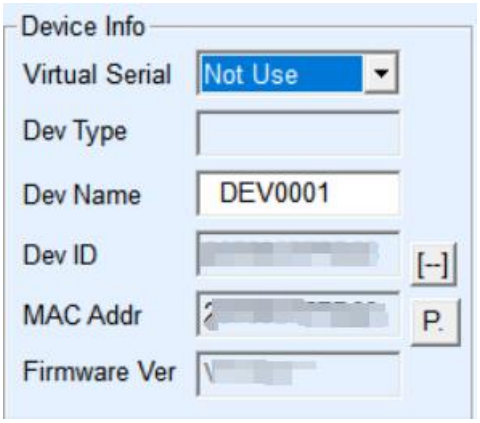


Figure 61 ZLAN7104M web upgrade method

7 Note：

7.1 If the download fails, it will not damage the device, please restart the download. Also, when the LINK light is flashing at the end of the download, do not cut off the power, otherwise the device will be damaged.

7.2 You can check the firmware version number through ZLVircom to determine if the new firmware has been successfully downloaded.



After completing level 62, check the firmware version.

17. Multi-Wi-Fi parameter configuration

17.1. Usage scenarios

The multi-Wi-Fi parameter configuration feature allows the ZLSN7104M to have multiple Wi-Fi parameters, such as three, which can be applied to scenarios like restoring to AP in STA mode and backup for multiple routers.

1.1.1. STA mode restored to AP

When the STA mode parameters are incorrectly configured, it is possible to switch to AP mode, allowing the laptop to reconnect to the module via WiFi and reconfigure it. In default mode, if the module is set as STA mode with incorrect SSID or password, it will not be able to connect to the router. In such cases, it is necessary to reset to AP mode using the reset switch or to search through the module's Ethernet port and then use the ZLVircom tool to reconfigure the WiFi parameters. In some situations, due to the inconvenience of switching the reset switch and connecting to the Ethernet port, it is desirable to cycle the WiFi parameters between STA and AP modes. When the WiFi parameters are in AP mode, users can connect to

the module to reconfigure it. Once any WiFi connection is established, the parameter switching will stop. During the switching process, the duration of staying in STA and AP modes can be set.

1.1.2. Multi-router backup

Choose to switch between multiple routers such as STA1 (STA2 (STA3… (STA1(… in sequence. For example, if STA1 is connected to the first router but cannot establish a connection, then switch to STA2 mode to connect to the second router. This allows for multiple router backup, so if one of the routers fails and cannot establish a WIFI connection, you can switch to the second router.

This method allows for two routers to be placed on-site, and if the first router cannot establish a WIFI connection, you can immediately switch to the second router, achieving hot standby.

17.2. wifi.txt File format

wifi.txt is a configuration file, an example of its content is as follows:

```
DEFAULT_WIFI_TIME=10
WIFI_CONFIG_COUNT=2

WIFI_MODE1=STA
WIFI_SSID1=TP-LINK_2312
WIFI_CRYPT1=AUTO
WIFI_KEY1=12345678
WIFI_BRIDGE1=0
WIFI_DHCP1=0
WIFI_TIME1=10

WIFI_MODE2=AP
WIFI_SSID2=TEMP_AP
```

WIFI_CRYPT2=NONE

WIFI_IP2=192.168.1.200

WIFI_TIME2=10

We assume that the WIFI parameters configured with ZLVircom are set to the DEFAULT_WIFI parameter, and this wifi.txt configuration file contains WIFI1 parameter, WIFI2 parameter, ..., WIFIN parameter, etc. Downloading this wifi.txt to ZLSN7104M will cause it to cycle between DEFAULT_WIFI, WIFI1, WIFI2, ..., WIFIN, and back to DEFAULT_WIFI.

DEFAULT_WIFI_TIME=10 indicates the time to stay on DEFAULT_WIFI, in seconds, which is 10 seconds here. WIFI_CONFIG_COUNT=2 indicates the total number of WIFI parameters in wifi.txt (not including DEFAULT_WIFI).

WIFI_MODE1=STA specifies the operating mode of WIFI1, with values being STA or AP.

WIFI_SSID1=TP-LINK_2312 indicates the SSID of the router to connect to, or if in AP mode, it would be your own SSID name.

WIFI_CRYPT1=AUTO indicates the encryption method, with NONE for no password and AUTO for other password methods. Other options include WEP64, WEP128, AES, TKIP, which are generally not commonly used.

WIFI_KEY1=12345678 represents the wifi password for the router.

WIFI_BRIDGE1=0 indicates whether the network port and wifi are interconnected, with 0 meaning they are not interconnected. If this is not a concern, this line can also be omitted, as the default is not interconnected.

WIFI_DHCP1=0 indicates whether the DHCP server function is turned on, with 0 meaning it is not turned on. By default, if this line is not written, the DHCP server in AP mode is turned on, while the DHCP server in STA mode is turned off.

The line WIFI_TIME1=10 cannot be omitted; it specifies how long to wait if a WIFI connection cannot be established in WIFI1 mode, which is 10 seconds in this case.

WIFI_IP2=192.168.1.200 means to force set to static IP mode with the IP address of 192.168.1.200. This is because if in STA mode the device is set to dynamically obtain an IP, when switching to AP mode, since there is no connection to a router, it may not be able to

obtain an IP, so it must exist with a static IP.

17.3. Download method

The steps to download the wifi.txt to ZLSN7104M are to create a new document named wifi.txt under the web page directory. If the user does not have a web directory, they can create a new webs directory and then create a separate wifi.txt file.

Figure 63 web directory

Now click the "Upgrade Firmware" button in "Device Configuration", and a webpage for web and firmware download will pop up:

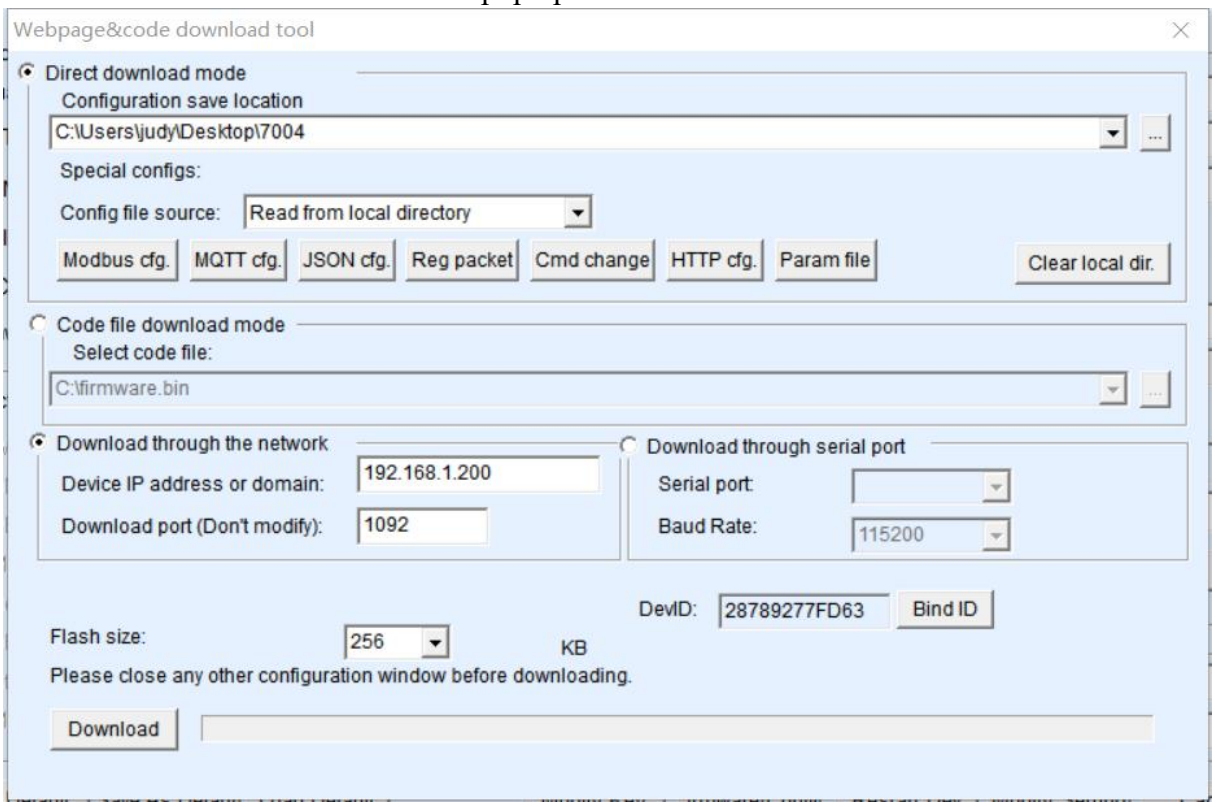


Figure 64 Download of wifi.txt in

As shown in the picture above, select the web directory download option, then choose the newly created web directory, and click the "Download" button to download the wifi.txt file to the internal storage of the device. The IP, model, space size, and port in the picture will be automatically filled in and do not require configuration. Note: The device needs to be rebooted whenever the wifi.txt file is updated.

17.4. wifi.txt Example

1.1.3. APSTA mode restored to AP

```
DEFAULT_WIFI_TIME=120
WIFI_CONFIG_COUNT=1

WIFI_MODE1=AP
WIFI_SSID1=TEMP_AP
WIFI_IP1=192.168.1.200
WIFI_TIME1=300
```

When the zlvircom is configured with WiFi parameters in STA mode, if it fails to connect for 2 minutes, it will switch to AP mode. The hotspot name is TEMP_AP, and it will stay in this mode for 5 minutes. If no laptop connects, it will attempt to connect again using the STA mode.

1.1.4. Multi-router backup

```
DEFAULT_WIFI_TIME=60
WIFI_CONFIG_COUNT=1

WIFI_MODE1=STA
```

WIFI_SSID1=TP-LINK_2312

WIFI_CRYPT1=AUTO

WIFI_KEY1=12345678

WIFI_TIME1=60

When the WiFi parameters configured by ZLVircom cannot connect within 1 minute, try to connect to the TP-LINK_2312 router. If that fails, try connecting to the parameters configured by ZLVircom again. Repeat this process until a WiFi connection is established.

17.5. Precautions

1. If the wifi.txt file does not exist, only the wifi parameters configured by ZLVircom are present, which is the same as if there were no wifi.txt. If the content of wifi.txt is empty, it is the same as if it did not exist.
2. When the reset switch DEF is in the open position, wifi.txt will not be loaded. If during debugging, an abnormal wifi.txt format causes the module to malfunction, you can switch DEF to the reset position and then reload wifi.txt.
3. If a wifi connection is established but a tcp connection cannot be established, a second wifi parameter switch will not be performed.
4. Note that after downloading wifi.txt, the module needs to be restarted for it to take effect.
5. After upgrading the firmware, wifi.txt will be lost and needs to be re-downloaded.
6. Failed to download firmware：
   a) When there is a wifi.txt file present, there will be a WiFi switch. At this time, if a firmware upgrade is needed, a WiFi connection must be established first. Otherwise, the module will keep resetting, making firmware upgrade impossible.
   b) When switching between different WiFi parameters, the device's IP address may switch between the IP set on the main interface of the device and WIFI_IP1. Therefore, if the download fails, it may be because the IP address in the download interface is no longer correct. In this case, you need to return to the device search interface, search for the device again to obtain the current real IP address before you can download.。

7. If the STA mode is set to automatically obtain an IP (IP mode is DHCP), then it is necessary to appropriately reduce the DEFAULT_WIFI_TIME. The reason is that the wifi cannot obtain an IP if it is not connected, but it will continuously attempt to do so for about 1 minute before starting the timing. Therefore, DEFAULT_WIFI_TIME should be 60 less than the normal value, but it cannot be set to 0.
8. In the usage of restoring to AP via STA mode, when ZLSN7104M switches from the default DEFAULT_WIFI STA parameters to the AP parameters of WIFI1, the wifi parameters seen on the web interface at this point are WIFI1 (even though what is seen from zlvircom is the DEFAULT_WIFI parameters). At this time, if you need to modify the wifi parameters via the web, you need to change all the wifi parameters, including STA/AP, SSID, password, and encryption method.

18. After-sales service

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