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Swarm Wireless Client

USR-FQ610

User Manual

V2.0

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Content

1. Introduction

Swarm ad hoc network is a network of autonomous mobile devices that communicate and cooperate with each other to form a dynamic, self-organizing network without a central controller. It has the characteristics of self-organization, self-repair, high flexibility, distribution, etc.; it supports 16-level relay in the physical layer, 1S fast networking, and 1024 equipment communication; it can perform the conversion between serial port/network port and swarm wireless network, and can support the function of wireless switch. USR-FQ610 adopts this kind of wireless network.

The product adopts industrial standard, wide temperature and wide voltage, high hardware protection; with 1*RS232/1*RS485/1* Ethernet, supporting TCP, UDP and other transmission protocols; built-in software and hardware dual watchdog, fault recovery and other mechanisms.

This product adopts wall mounting installation, which is widely used in scenarios requiring wireless centralized large connection and low delay requirements, such as swarm unmanned aerial vehicles, unmanned systems, data links, individual equipment, fire Internet of Things, power meter reading, urban pipe gallery, intelligent military camp, intelligent transportation and other fields.

1.1. Features

Stable and reliable

- ◆Fully industrial design, metal house, protection grade IP30;
- ◆Supports desktop placement, wall-mounting installation;
- ◆Wide voltage DC 9-24V input, with power reverse protection;
- ◆Industrial grade design, wide temperature -25℃~+75℃ ;
- ◆Built-in hardware watchdog, fault self-detection, self-repair, and firmware backup and restoration functions to ensure system stability and not crash;
- ◆ Relaying based on physical layer, any node leaving or joining does not affect the entire network communication;

Flexible networking

- ◆Support physical layer relay networking, reduce application burden, and any node leaving or joining will not affect the communication of the whole network;
- ◆High-speed synchronization and signal processing, Ad hoc network nodes can move quickly and in any way in the network;
- ◆The network topology between terminals can be changed arbitrarily, and can be deformed, folded and reconstructed freely.

◆Support stereo networking, realize signal continuity through automatic relay and multi-hop forwarding of equipment, and realize ground and underground intercommunication;

◆No need to give time, boot network construction, support 16-hop centerless ad hoc network, expand communication distance by 16 times, can carry 1024 devices;

◆The single-hop communication distance is 1-3 km, and the maximum rate is 740kbps. The more nodes, the better the signal coverage.

Powerful

◆Support RS232\RS485\Network port and swarm wireless network conversion;

◆Support serial broadcast mode, network broadcast mode, wireless serial service mode, wireless switch mode;

◆Support TCPC\TCPS\UDPC\UDPS network communication, DHCP, STATIC;

◆Support custom key, user total control, device ID, group definition;

◆Support network hop number can be set, relay, FM control, transmit power adjustable;

1.2. Technical Parameters

USR-FQ610 Wireless client parameters are as follows:

Items	Description
Power Supply	DC: 9~24V, 2-pin terminal block connector, 5.08mm-2P, reverse polarity protection, 5.5*2.1 DC jack connector
Working Current	Average: 300mA@12V, max: 600mA @12V
Serial port	
No.	1 x RS485, 2-pin terminal block connector, 3.81mm-2P 1 x RS232, DB9 female
Baud rates	RS232: 600/1200/2400/4800/9600/14400/19200/28800/38400/43000/57600/76800/115200/128000/230400 RS485: 600/1200/2400/4800/9600/14400/19200/28800/38400/43000/57600/76800/115200/128000/230400
Data bits	7, 8
Stop bits	1, 2
Parity	NONE, ODD, EVEN, Mark, Space
Flow Control	None
Ethernet Ports	
No.	1 x Ethernet ports

Interface	RJ45, 10/100 Mbps, compliance with IEEE 802.3, supports auto MDI/MDIX, 1.5KV network isolation transformer protection
Wireless	
Frequency	902~928MHz,
Bandwidth	125/200/500KHz/1MHz
Data speed	Up to 740kbps
Jump	16
Capacity	1024
Covering distance	1-3 kilometers/jump For 16 jumps, up to (1-3)*16 kilometers
Tx power	10-27dBm
Antenna Connector	1 x SMA-female
Time required for networking	1s
Physical Property	
Casing material	Metal shell, IP30 protection
Dimensions	86*82.5*25mm(L*W*H,antenna pedestal,terminal block are not included)
Installation	Wall munting, desktop placement
EMC	Surge protection: level 2, IEC61000 ESD protection: level 2, IEC61000 EFT protection: level 2, IEC61000
Operating temperature	-25℃～+75℃
Storage temperature	-40℃～+125℃
Operating humidity	5% ~ 95% RH, non-condensing
Storage humidity	1% ~ 95% RH, non-condensing
Software Function	
Network protocols	TCP, UDP
IP	DHCP/StaticIP
Socket mode	TCP server, TCP client, UDP server, UDP client
Work mode	4 work modes: Wireless switch mode, network broadcast mode, serial broadcast mode, wireless serial device server mode
Relay function	√
Data encryption	√
User Configuring	Configure tool, AT command
Others	
Reload	Pinhole reset button, press and hold for 3~15 to reset to factory settings

Indicators	1 x Power, 1 x Work, 1x Mesh, 1 x TXD, 1 x RXD
APPROVALS	
Regulatory	CE/RED*, RoHS*, WEEE*, FCC*

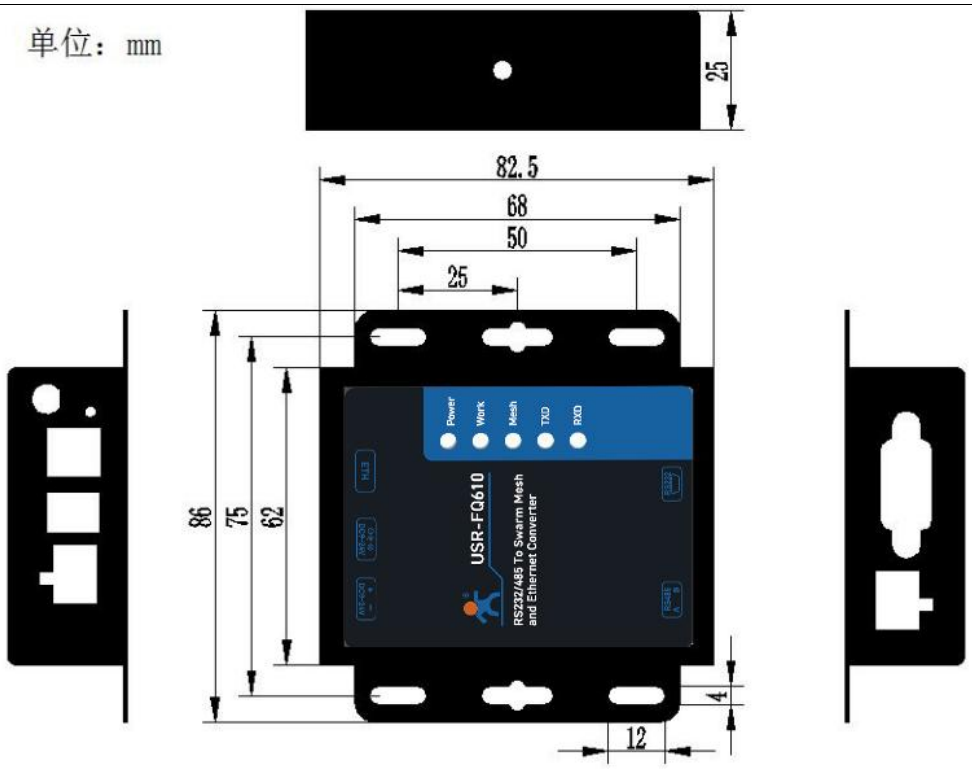
1.3. Indicator status description

Table 1. Indicator Status

Name	Description
PWR	Long light after power-on
WORK	Network port broadcast mode: 300ms frequency flash (300ms on, 300ms off) Serial broadcast mode: 1000ms interval slow flash (1000ms on, 1000ms off) Wireless serial service mode: 1300ms off, 200ms on Wireless switch mode: 1300ms on, 200ms off
Mesh	Flashes when there is data communication
TXD	Flashes when there is data communication
RXD	Flashes when there is data communication

1.4. Dimensions

Unit: mm



2. Function description

USR-FQ610 takes swarm module as its core function, and realizes communication functions from serial port to swarm module and network port to swarm module respectively. USR-FQ610 supports 4 working modes in total: serial broadcast mode, network port broadcast mode, wireless serial service mode and wireless switch mode.

Note: Under the swarm network, the user ID of each USR-FQ610 must not be duplicate, the key frequency and the total number of users must be consistent, and the group ID must be consistent or set to 0. If the group ID is 0, it means that the broadcast domain can be received.

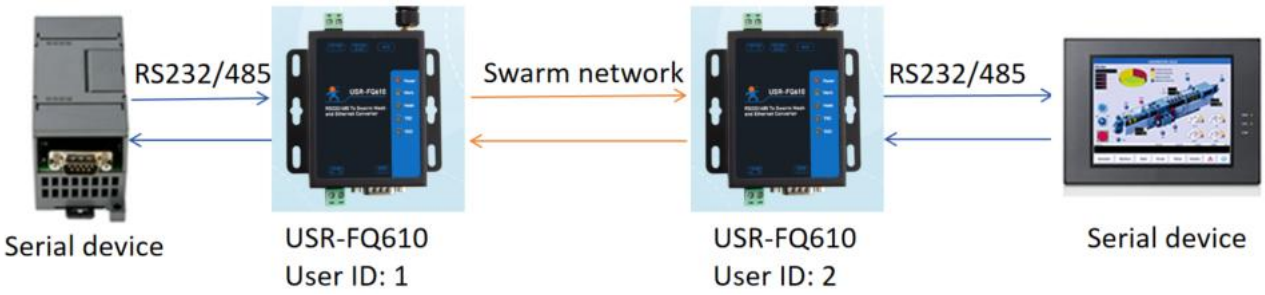
2.1. Serial broadcasting mode

2.1.1. Function introduction

When USR-FQ610 works in serial broadcast mode, the main function is that the data received by RS232/RS485 port is sent to the swarm network through the swarm module. Then other modules in the swarm network receive the data, the data is sent out from RS232/RS485 port.

In the serial broadcast mode, the data sent and received by the serial port is purely transparent and does not do any changing.

As shown below:



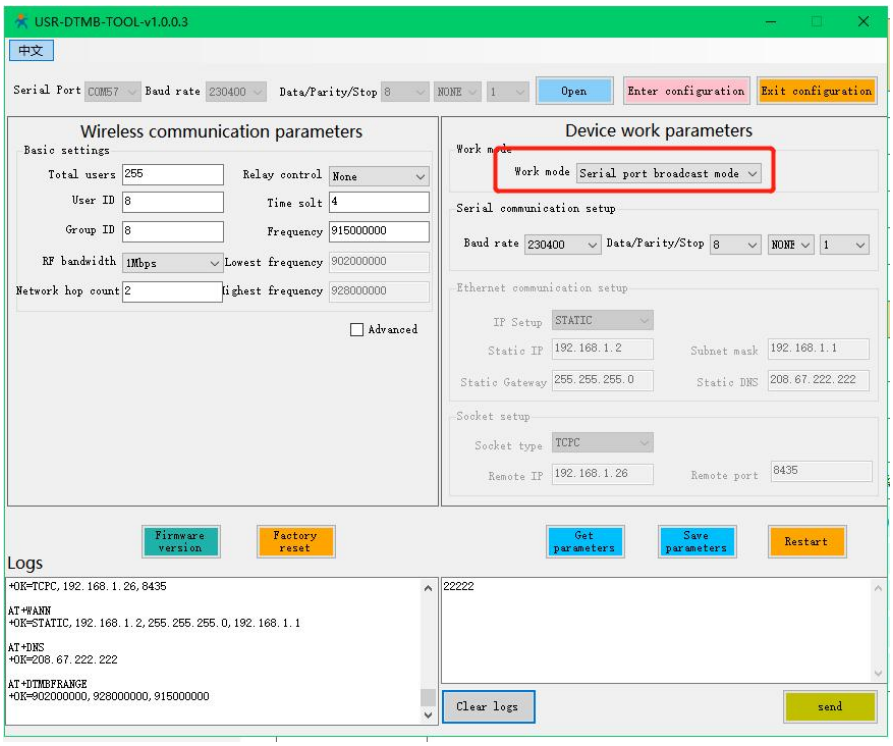
2.1.2. Operating steps

The function configuration process is as follows:

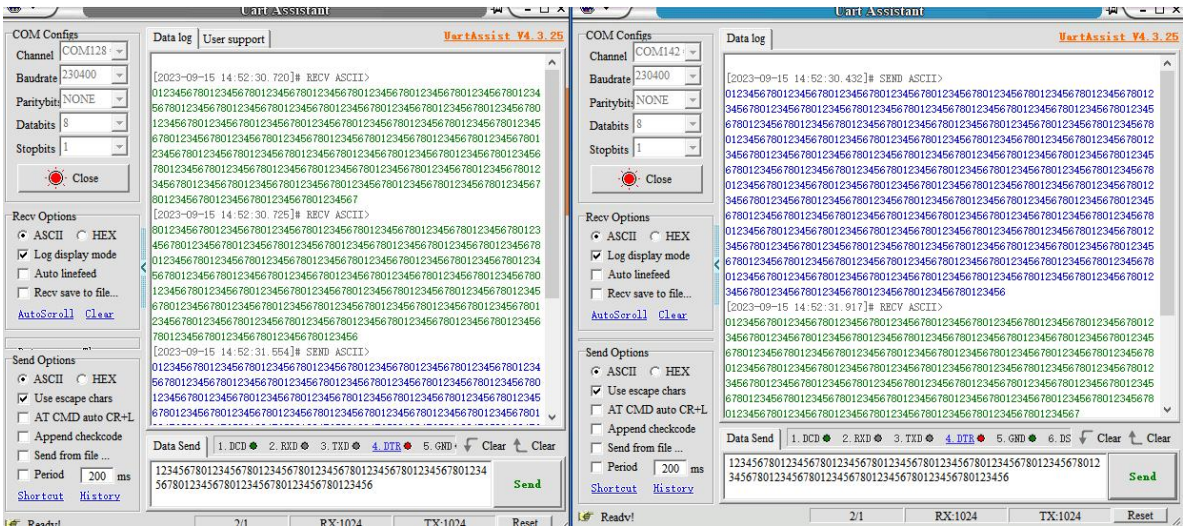
(1)Configure USR-FQ610 to work in transparent mode

(2)Configure another USR-FQ610 in the same way, taking care that the user ID is not the same.

(3)After saving the parameters, restart the device to take effect, and access the device to view the effect.



2.1.3. The communication tests



2.2. Network broadcast mode

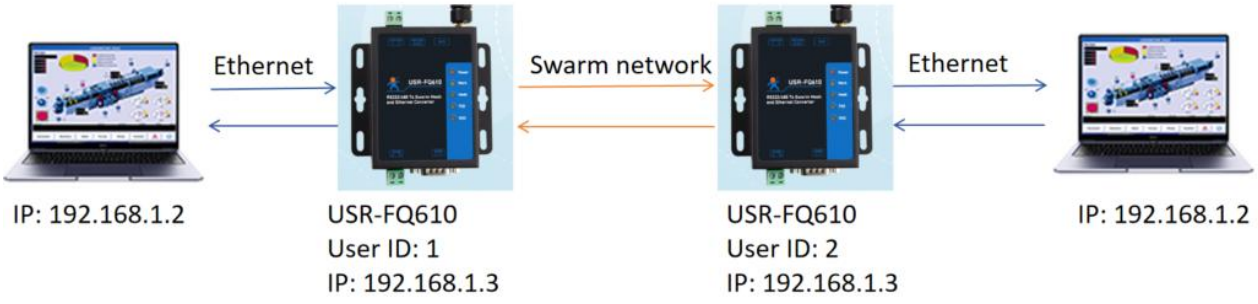
2.2.1. Function introduction

When USR-FQ610 works in the network broadcast mode, the main function is to transmit and receive data from the network port to the swarm module. The terminal device communicates with the USR-FQ610 through the socket. After receiving the data, the USR-FQ610 socket sends it to the swarm network through the swarm module. After receiving the data, the USR-FQ610 in the swarm network sends it to the terminal device at the other end through the socket.

In the network broadcast mode, the data sent and received by the socket and the data transmitted in the swarm are transparent.

Note: For UDP protocol, the maximum length of a packet is 1024 bytes. For TCP protocol, data transmission needs to be less than 100 bytes/500ms transmission.

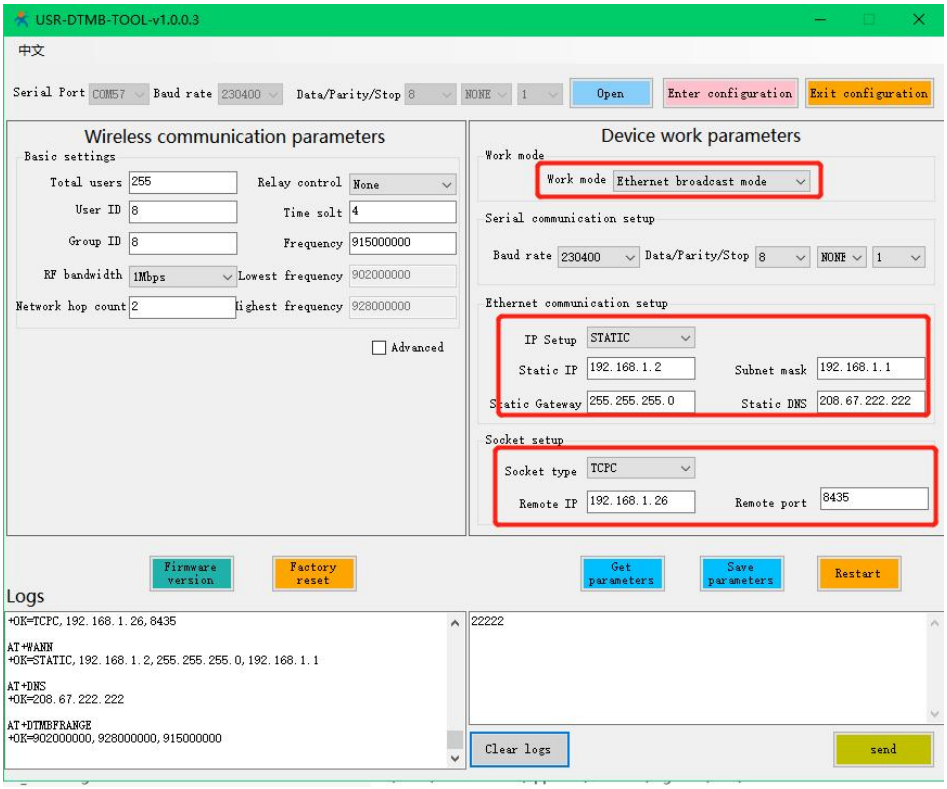
As shown below:

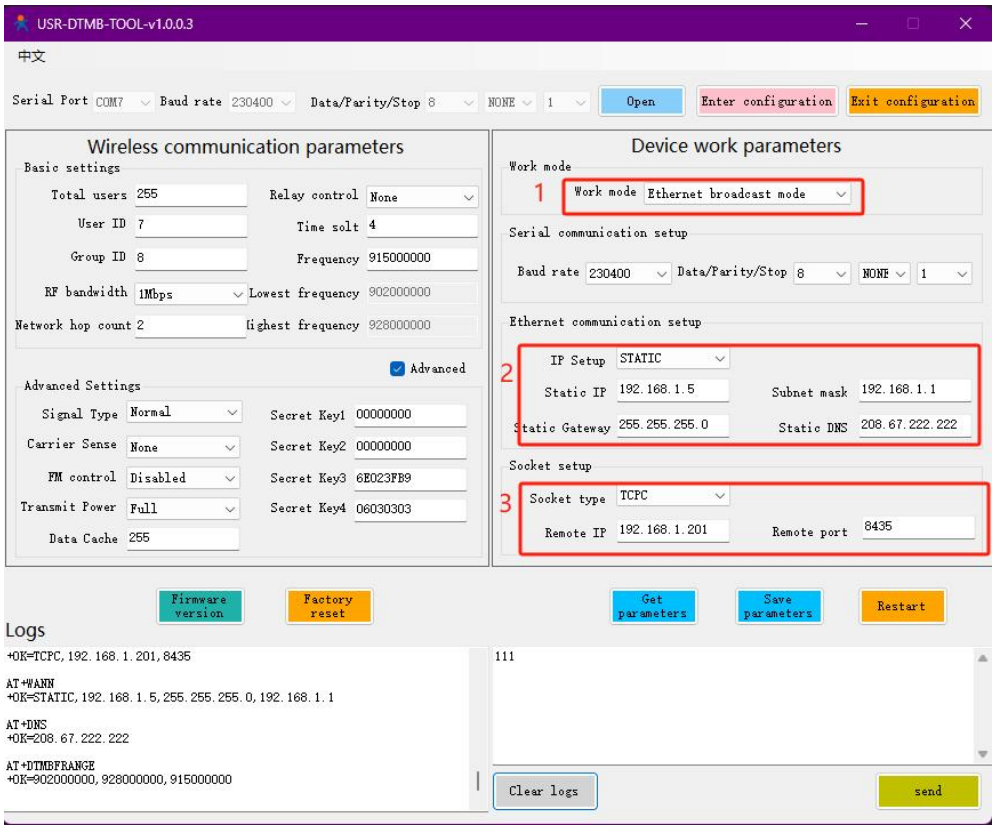


2.2.2. Operating steps

The function configuration steps is as follows:

(1)Configure USR-FQ610 to work in network broadcast mode. Socket mode: UDPS, remote address and port can be ignored. Set the local static IP address. Another USR-FQ610 was set up in the same way.

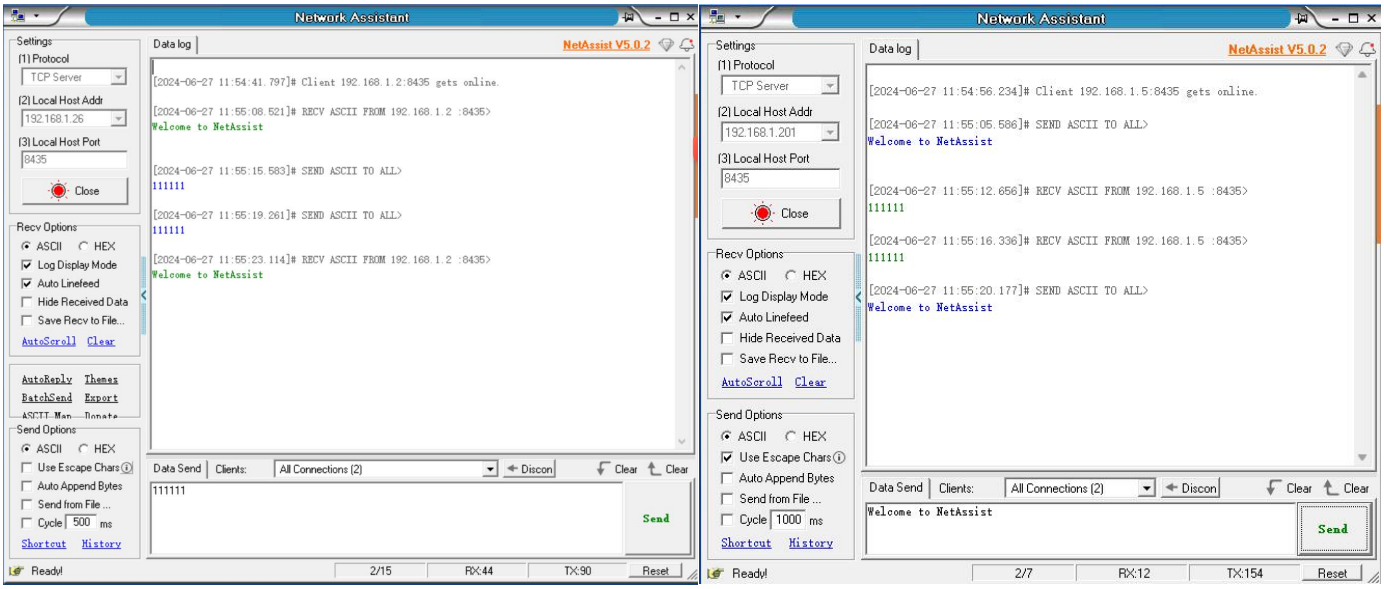




(2)Set the static IP address of the computer, as shown below.

(3)After the configuration is completed, power on again, and use the test software to test the effect as follows.

2.2.3. The communication tests



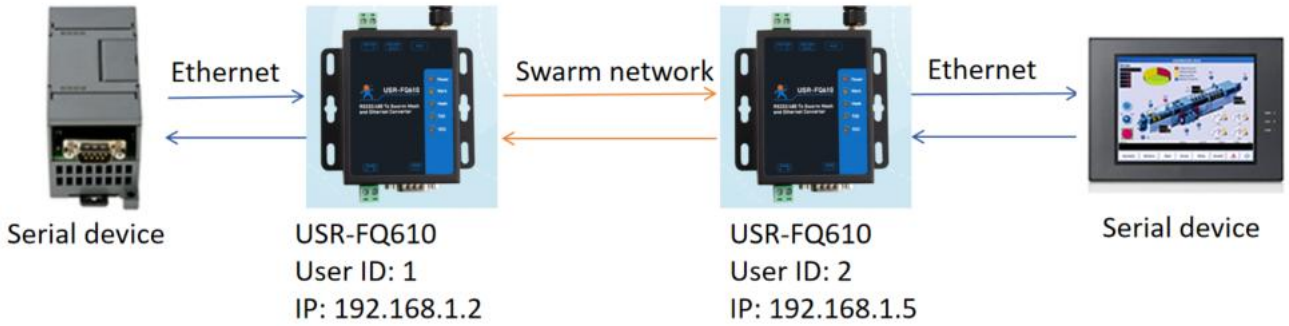
2.3. Wireless serial sever mode

2.3.1. Function introduction

When USR-FQ610 works in wireless serial service mode, the main function is to receive serial data and encapsulate it through TCP/IP protocol, and then send the data to the bee colony network through the bee colony module.After receiving the data, USR-FQ610 at the other end hands it over to TCP/IP protocol for unpacking, and then sends it out through serial port, or cooperates with wireless switch mode to send socket data to the corresponding socket of the computer.

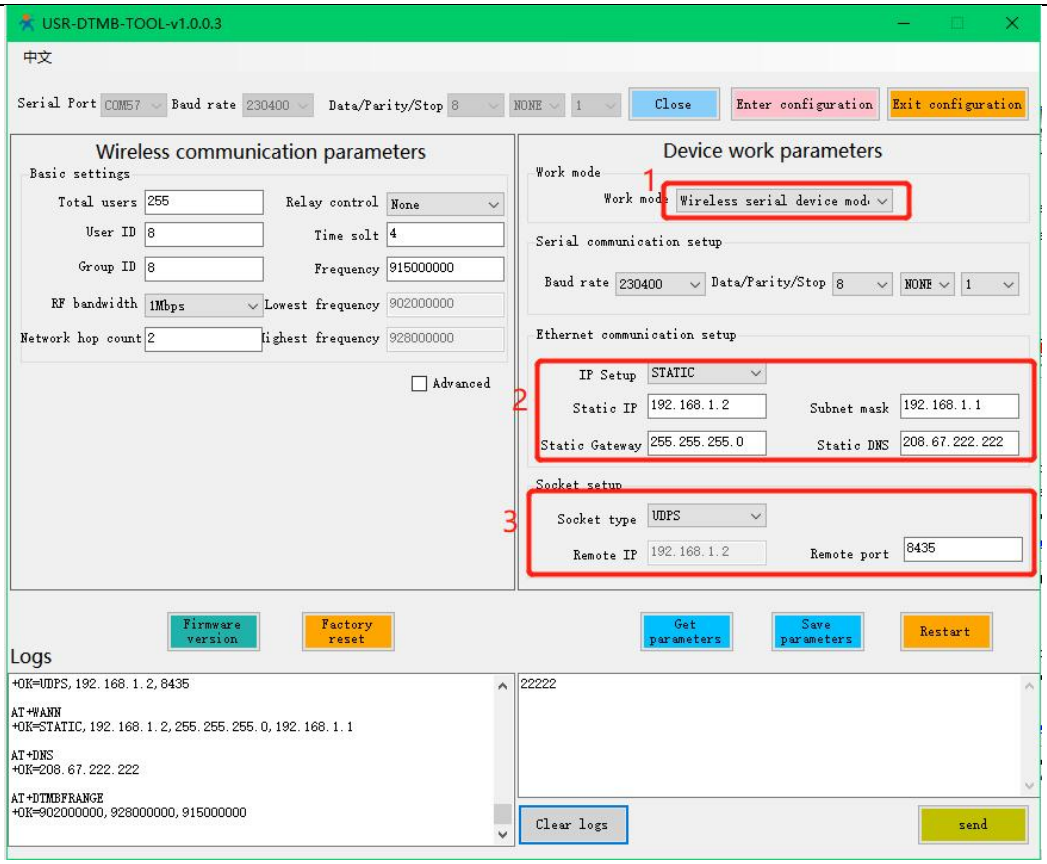
In wireless serial service mode, the data transmitted in the swarm is encapsulated by TCP/IP protocol, and socket parameters need to be configured when using it.

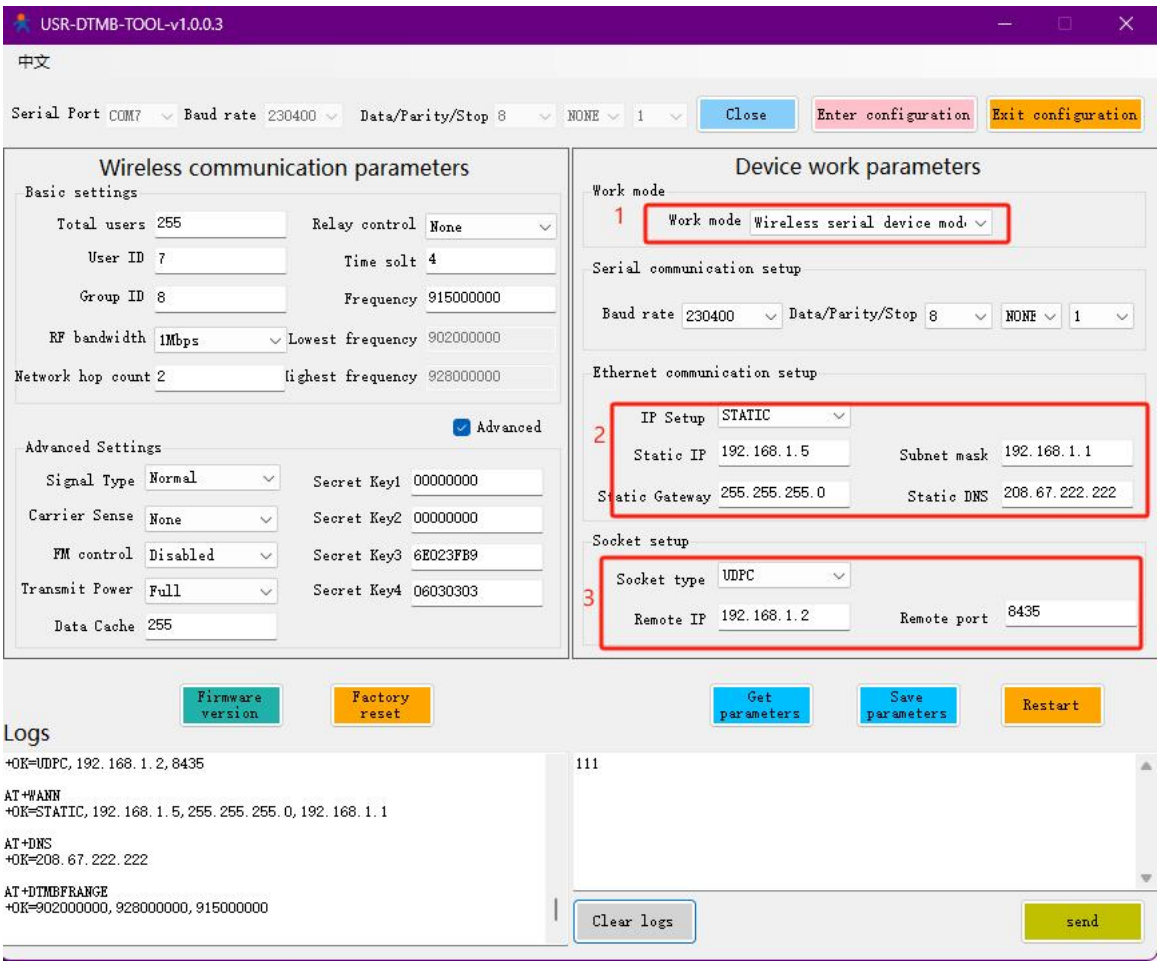
As shown below:



2.3.2. Operating steps

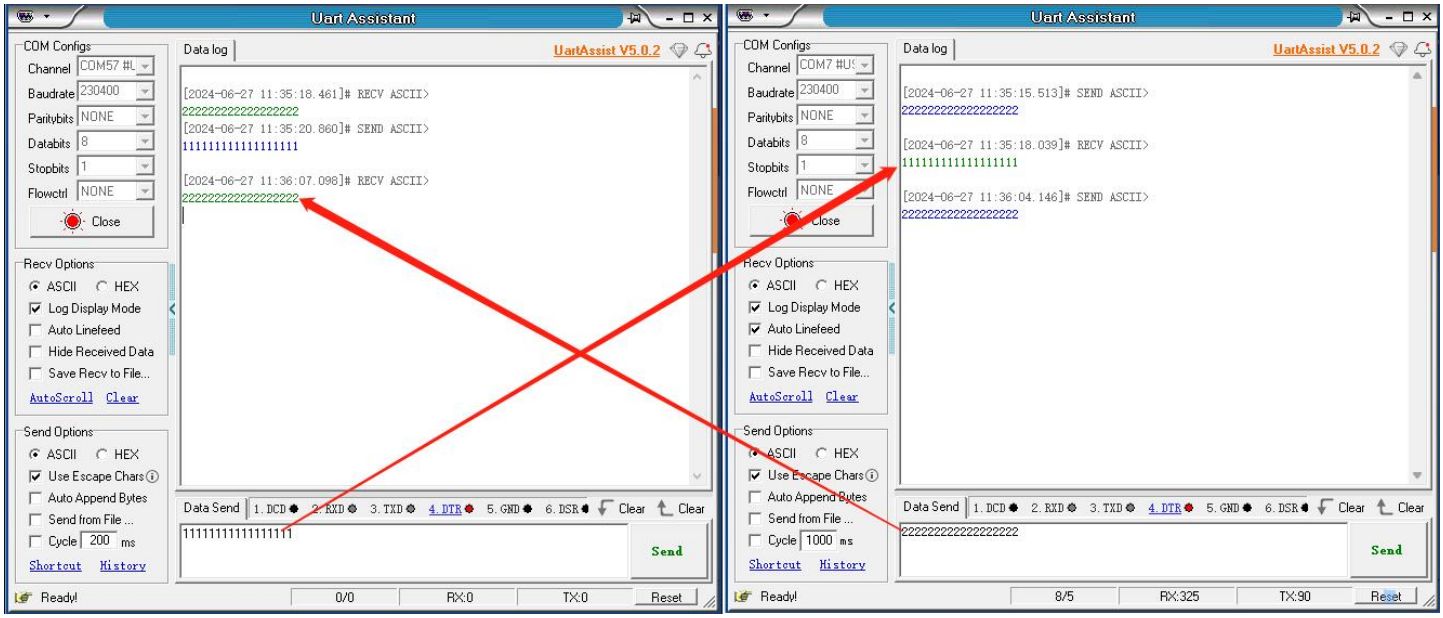
(1)Configure the USR-FQ610 to work in wireless serial server mode. Set IP to 192.168.1.23 and 192.168.1.10 respectively, and set socket to UDPS and UDPC respectively, as shown below:





(2)Restart after setting and send data to serial port respectively

2.3.3. The communication tests



2.4. Wireless Switch Mode

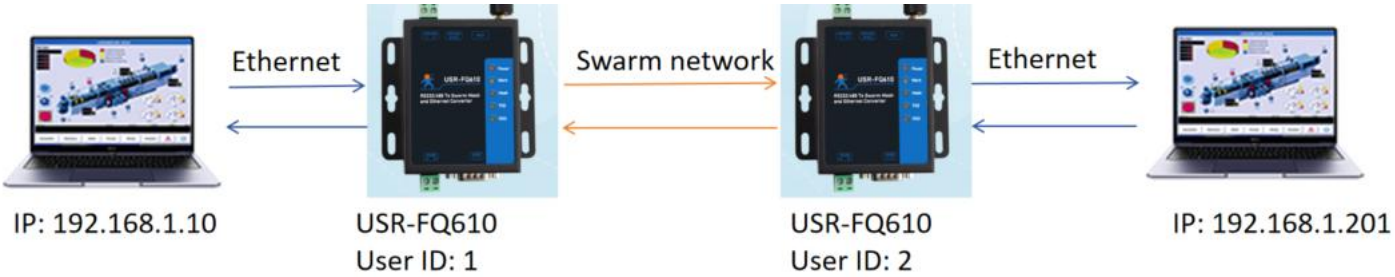
2.4.1. Function introduction

When USR-FQ610 works in wireless switch mode, the main function is to send data received by Ethernet interface to swarm network through swarm module, and send data from Ethernet interface after other modules in swarm network receive data.

In wireless switch mode, USR-FQ610 realizes transparent transmission of Ethernet port data, and the network data transmitted in the swarm is TCP/IP protocol.

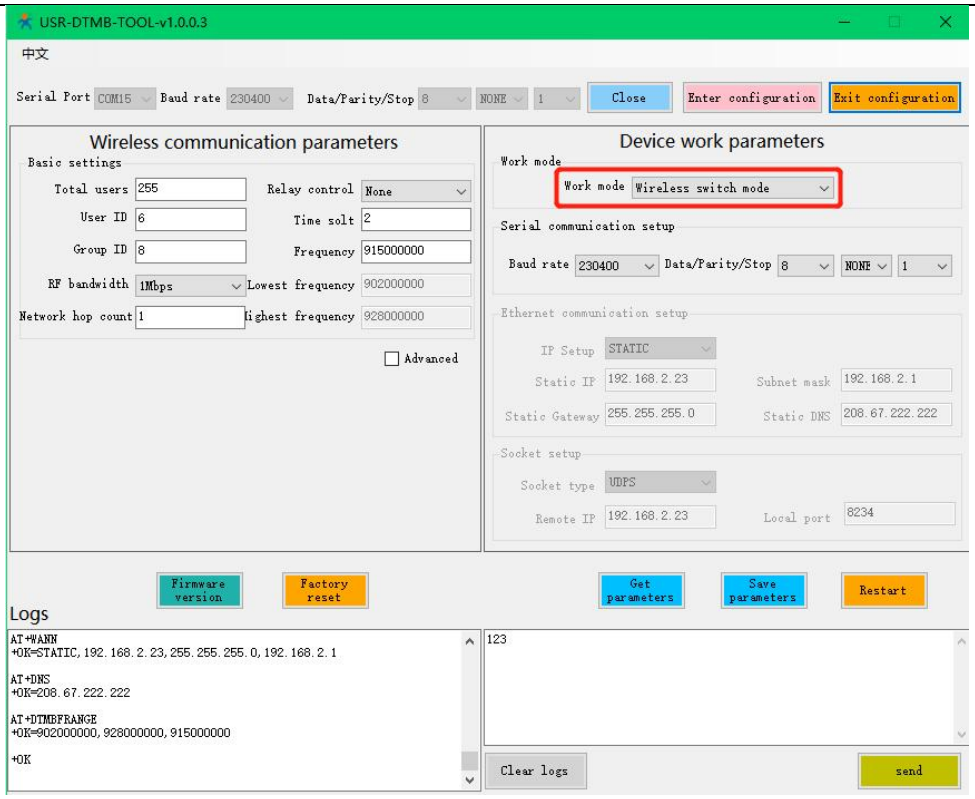
Note: UDP protocol a packet maximum of 1024 bytes, TCP protocol, data transmission needs to be less than 100 bytes/500ms transmission; time slot minimum set to 4, each more relay forwarding FQ610 hop point, time slot on the basis of 4 + 2.

As shown below:



2.4.2. Operating steps

(1)Configure the USR-FQ610 to work in wireless switch mode, the user ID should be different with each other device.

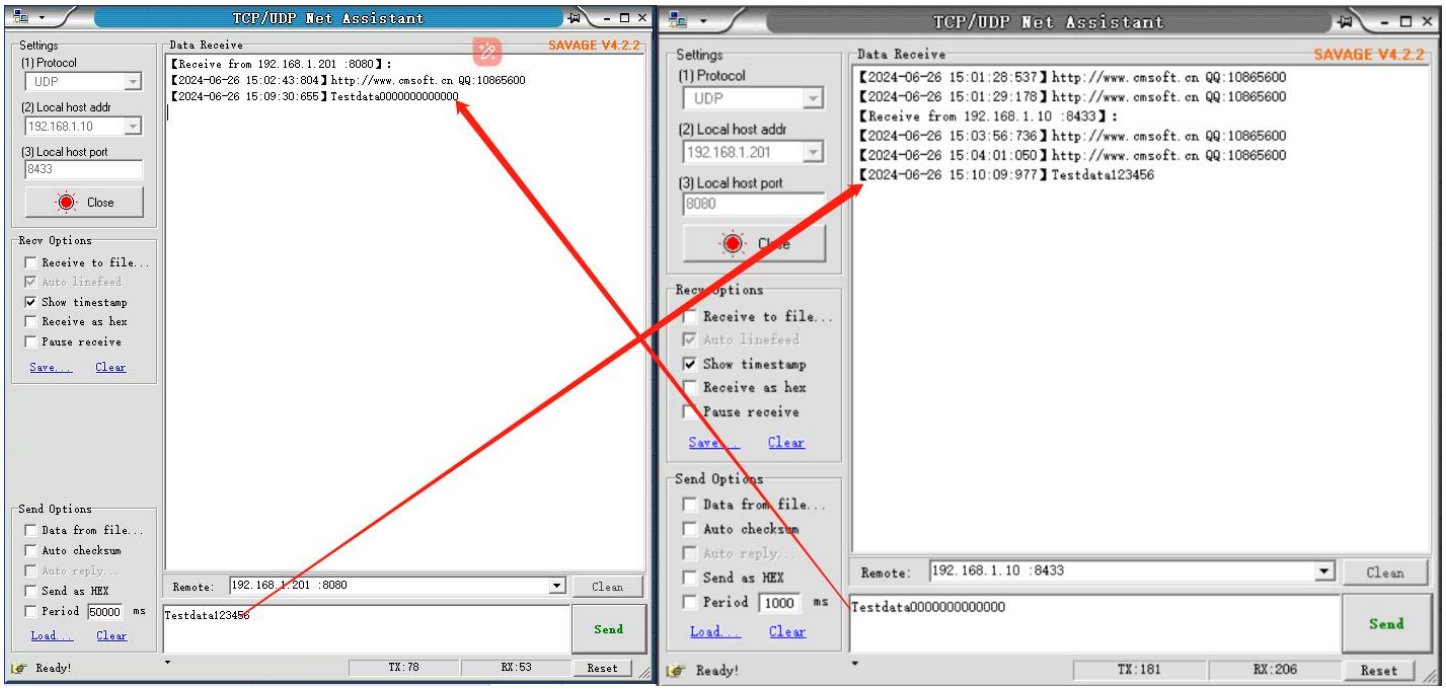


(2)Configure PC IP to 192.168.1.10 and 192.168.1.201 respectively.

(3)After configuration is completed, power on again and access the equipment to check the effect.

(4)Set up socket through test software, and send data

2.4.3. The communication tests

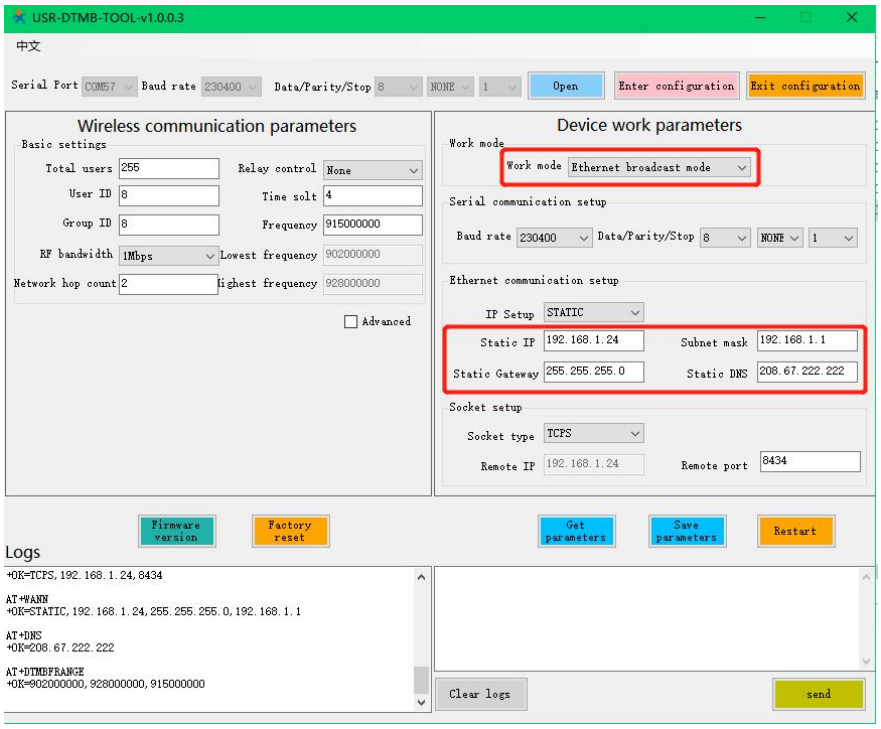


3. Firmware upgrade

Before firmware upgrade, the device need be set in network broadcast mode. Please download **the upgrade tool**: **https://www.pusr.com/support/download/Setup-Software-USR-M0-V2-2-6-1-exe.html**

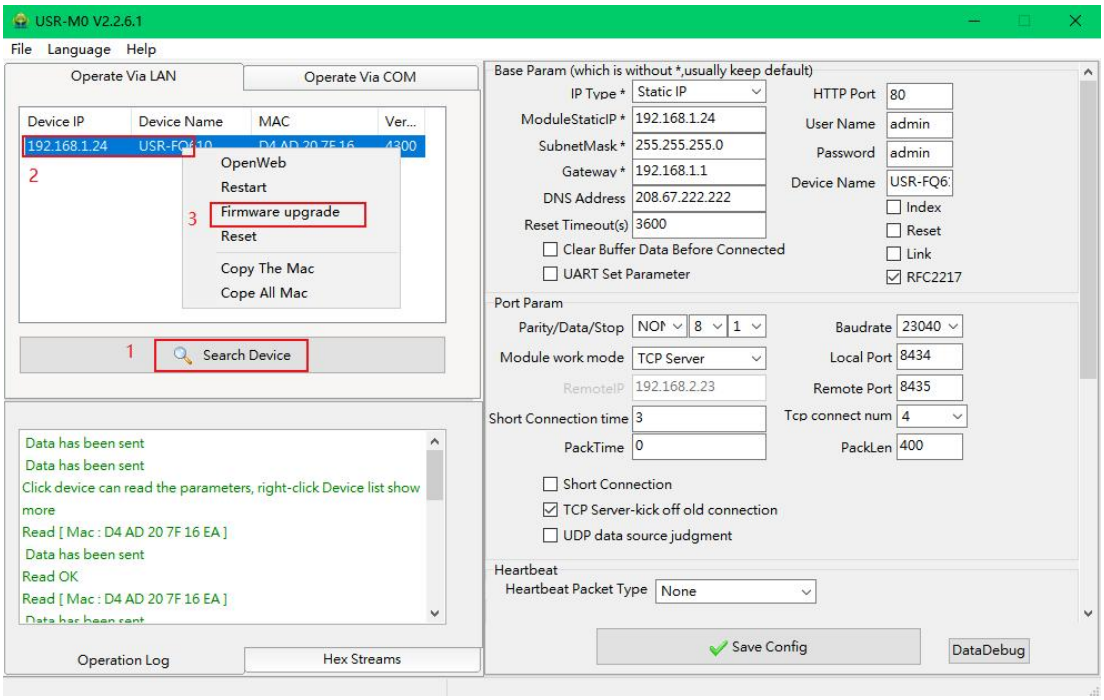
Steps of upgrading firmware:

(1)Connect the PC to FQ610 via RS232 cable, open the PC software to read parameters, and ensure that it is in network broadcast mode.

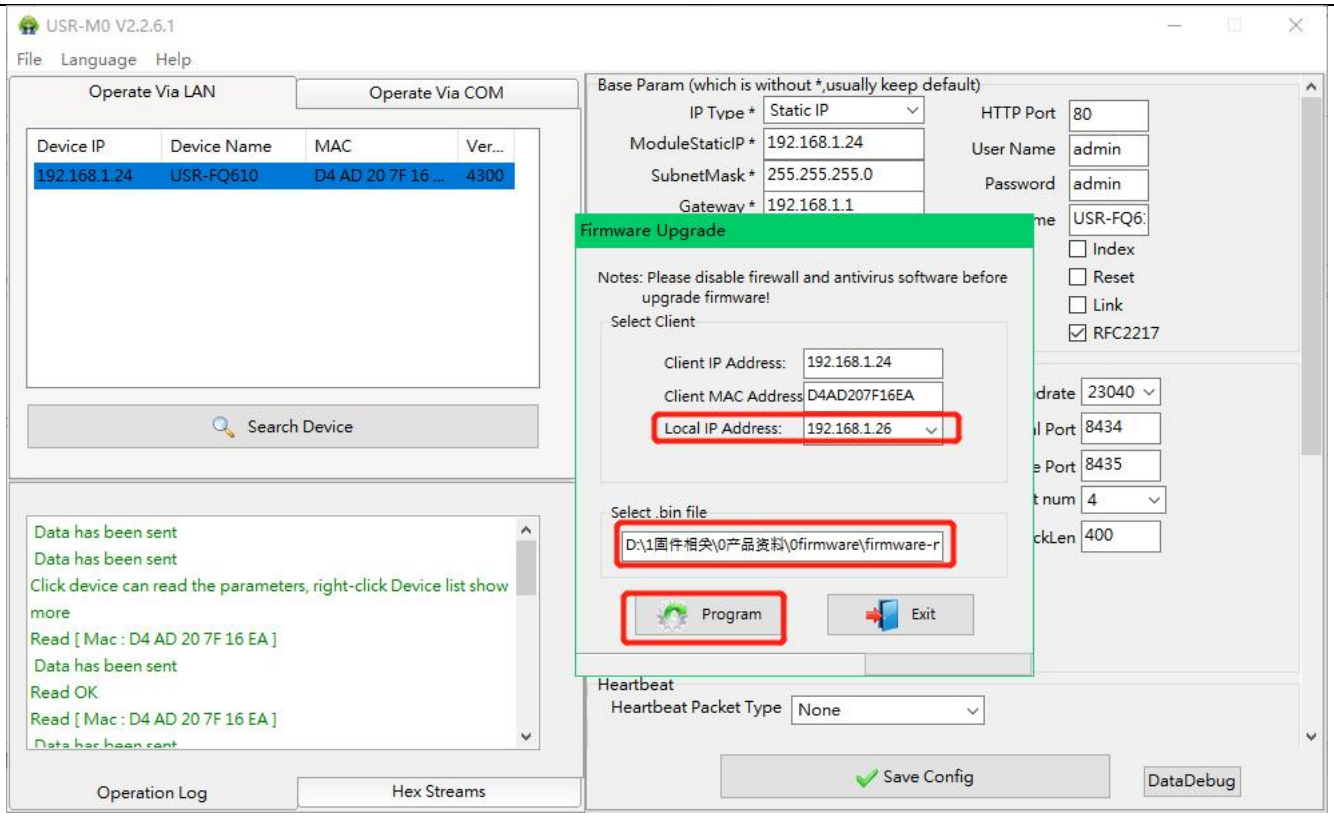


(2)Connect the PC to FQ610 via Ethernet cable, and set the IP of PC to the same network segment as FQ610.

(3)Open the upgrade software, search for the device, then right-click the device and select firmware upgrade



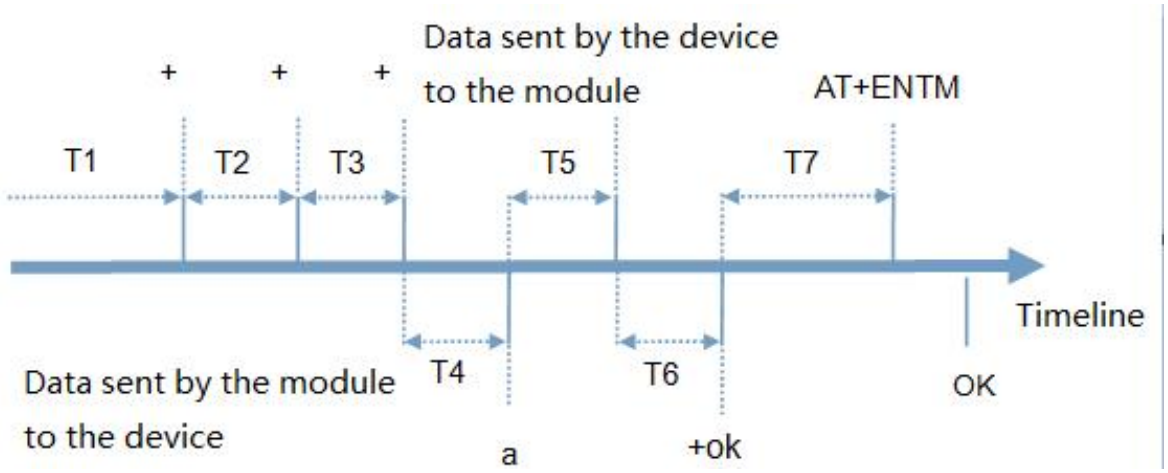
(4)Select local IP address (PC IP), select firmware, click Upgrade, wait for upgrade to complete successfully.



4. AT command

4.1. AT command mode

You can switch the device to Command Mode by sending data at a specific timing to the device's serial port. After completing operation in "command mode", return the device to the previous operating mode by sending specific commands.



Toggles the timing of command mode:

In the figure above, the horizontal axis is time, data above the time axis is sent by the serial device to FQ610, data below the time axis is sent by FQ610 to the serial port.

Time requirement:

T1 > current serial port packaging interval

T2 < current serial port packaging interval time

T3 < current serial port packaging interval time

T4 = current serial port packaging interval time

T5 < 3 s

T6 = current serial port packaging interval time

The time sequence of switching from transparent mode/HTTP mode to "AT Command mode":

1.Serial device continuously sends "+++" to the device. After receiving "+++", the device will send an "a" to the serial device. No data can be sent during a packaging cycle before sending "+++".

2.When the serial device receives "a", a "a" must be sent to the device within 3 seconds.

3.After receiving 'a', the device returns "+ok" and enter "temporary command mode".

4.After receiving "+ok", the device has enter "temporary command mode" and now can send AT command to it.

Time sequence of switching from AT command mode to transparent mode.HTTP mode:

1.Serial device sends "AT+ENTM" to FQ610.

2.After receiving the command, sends "OK" to the serial device and returns to the previous working mode.

3.After the serial device receives "OK", it knows that the device has returned to its previous working mode.

4.2. Introduction to instruction

AT command is a question-and-answer command, which is divided into two parts: "question" and "answer". "Ask" means to send AT command to T0 through serial port,"answer" means T0 replies information to device through serial port.

Table 2. Symbol description

Symbol name	Description
<>	Included content is required
[]	Included content is not required
{}	Included are strings with special meanings in this document
~	Parameter range, example A~B, parameter range is from A to B
CMD	indication instruction code
CR	Represents "carriage return" in ASCII code, hexadecimal number is represented as 0x0D
LF	Represents "newline" in ASCII code, hexadecimal number is 0x0A

4.2.1. Command content

AT command format:

Table 3. Command format

Type	Command format	Explain
0	<AT+><CMD><CR>	Execute the action of the instruction or query the current parameter value
1	<AT+><CMD><CR>	Execute the action of the instruction or query the current parameter value
2	<AT+><CMD>=[para-1,para-2,para-3,para-4...]<CR>	Set parameter values for this command

<Note>: If the user does not turn off the echo function (AT+E), the command entered by the user will be sent back by the module, and the terminator CR> will not be returned.

4.3. AT error description

Table 4. Error code list

Error code	Explain
ERR1	Invalid command format
ERR2	invalid command
ERR3	invalid operator
ERR4	invalid parameter

4.4. AT command set

4.4.1. Instruction specification

serial number	name	function
1	AT	Test AT command available
2	AT+E	Enable AT command echo
3	AT+Z	Restart the device
4	AT+ENTM	Exit configuration state and enter transparent transmission
5	AT+CLEAR	Factory data reset

6	AT+VER	Query Equipment Version No.
7	AT+MAC	Query current device MAC
9	AT+WKMODE	Set DTMB operating mode
10	AT+DTMBID	Set DTMB ID information
11	AT+DTMBBASE	Setting DTMB Basic Information
12	AT+DTMBRELAY	Set DTMB relay information
13	AT+DTMBRF	Set DTMB RF message
14	AT+DTMBCACHE	Set DTMB cache information
15	AT+DTMBSLOT	Set DTMB time slot information
16	AT+DTMBFREQ	Set DTMB frequency
17	AT+DTMBPSW	Set DTMB plus password
18	AT+WANN	Set/query WAN port parameters
19	AT+DNS	Set/Query DNS Server Address
20	UART	Set/query serial port parameters
21	SOCK	Set/Query SOCK Parameters
22	SOCKLK	Set/query TCP connection status
23	SOCKPORT	Set/query local port
24	PDTIME	Query production time

4.4.1.1. AT

Name	AT
Function	Test AT command
Inquire	AT<CR> <CR><LF>+OK<CR><LF>
Set	/
Parameter	Return: OK
Explain	The command takes effect immediately, and returning OK means that the AT command is OK.

4.4.1.2. AT+E

Name	AT+E
Function	Set/query device at command echo settings

Inquire	AT+E<CR> <CR><LF>+OK=<status><CR><LF>
Set	AT+E=< ON/OFF><CR> <CR><LF>+OK<CR><LF>
Parameter	ON: Turn on echo, echo commands entered under AT command, OFF: In AT command mode, input commands are not echoed.
Explain	This command must be in capital letters and take effect after restarting DTU

4.4.1.3. AT+Z

Name	AT+Z
Function	restart the device
Inquire	not have
Set	AT+Z<CR> <CR><LF>+OK<CR><LF>
Parameter	/
Explain	The command is executed correctly, OK is replied and the device restarts

4.4.1.4. AT+ENTM

Name	AT+ENTM
Function	Exit AT command mode and enter transparent transmission mode
Inquire	/
Set	AT+ENTM<CR> <CR><LF>+OK<CR><LF>
Parameter	Not have
Explain	Exit AT command mode and enter transparent transmission mode

4.4.1.5. AT+CLEAR

Name	AT+CLEAR
Function	Factory data reset
Inquire	/
Set	AT+CLEAR<CR> <CR><LF>+OK<CR><LF>
Parameter	Not have
Explain	This command is executed correctly to restore the factory restart equipment.

4.4.1.6. AT+VER

Name	AT+VER
Function	Query device software version number
Inquire	AT+VER<CR> <CR><LF>+OK=<ver><CR><LF>
Set	/
Parameter	ver: Current software version number
Explain	This command executes correctly and returns the current software version number.

4.4.1.7. AT+MAC

Name	AT+MAC
Function	Query WAN port MAC
Inquire	AT+MAC<CR> <CR><LF>+OK=<nac><CR><LF>
Set	/
Parameter	mac:WAN port MAC
Explain	

4.4.1.8. AT+WKMODE

Name	AT+WKMODE
Function	Set DTMB operating mode
Inquire	AT+WKMODE<CR> <CR><LF>+OK=<mode><CR><LF>

Set	AT+WKMODE=<mode><CR> <CR><LF>+OK<CR><LF>
Parameter	mode: working mode 0: Serial broadcast mode 1: Network port broadcast mode 2: Wireless serial service mode 3: Wireless switch mode

4.4.1.9. AT+DTMBID

Name	AT+DTMBID
Function	Set DTMB ID information
Inquire	AT+DTMBID<CR> <CR><LF>+OK=<all>,<userid>,<group><CR><LF>
Set	AT+DTMBID=<all>,<userid>,<group><CR> <CR><LF>+OK<CR><LF>
Parameter	all: Total number of users, range 1-1024 userid: User ID, range 1-1024 group: group number, range 0-15, 0 is broadcast group

4.4.1.10. AT+DTMBBASE

Name	AT+DTMBBASE
Function	Setting DTMB Basic Information
Inquire	AT+DTMBBASE<CR> <CR><LF>+OK=<baudrate>,<signaltype>,<enableheader>,<bandrate><CR><LF>
Set	AT+DTMBBASE=<baudrate>,<signaltype>,<enableheader>,<bandrate><CR> <CR><LF>+OK<CR><LF>
Parameter	Baud rate: 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600 Signal type: signal type, 0 normal, 1 test, 2 single

	frequency Enable header: enable header Band rate: RF bandwidth, 0, 1M 1, 500K 2, 250K 3, 125K

4.4.1.11. AT+DTMBRELAY

Name	AT+DTMBRELAY
Function	Set DTMB relay information
Inquire	AT+DTMBRELAY<CR> <CR> LF>+OK=Parameter 1>, Parameter 2>, Parameter 3><CR> LF>
Set	AT+DTMBRELAY= Parameter 1>, Parameter 2>, Parameter 3>,<CR> <CR><LF>+OK<CR><LF>
Parameter	Parameter 1: carrier sense, 0 no sense, 1 short sense, 2 medium sense, 3 long sense Parameter 2: Networking hops, 0-16 Parameter 3: Relay control, 0 No relay, 1 Intelligent relay, 2 Forced relay

4.4.1.12. AT+DTMBRF

Name	AT+DTMBRF
Function	Set DTMB RF message
Inquire	AT+DTMBRF<CR> <CR><LF>+OK=<skip>,<power>,<noise>,<rf><CR><LF>
Set	AT+DTMBRF=<skip>,<power>,<noise>,<rf>,<CR> <CR><LF>+OK<CR><LF>
Parameter	skip: Frequency hopping control, 0 off, 1 enabled power: transmit power, 0, low 1, medium 2, medium 3, full noise: low noise switch, 0, off, 1, enable rf: amplifier switch, 0, off, 1, enable

4.4.1.13. AT+DTMBCACHE

Name	AT+DTMBCACKE
Function	Set DTMB cache information
Inquire	AT+DTMBCACKE<CR> <CR><LF>+OK=<cache><CR><LF>
Set	AT+DTMBCACKE=<cache><CR> <CR><LF>+OK<CR><LF>
Parameter	cache: data cache size, values 1-256, actual cache is cache*32, maximum 8192(256*32) bytes

4.4.1.14. AT+DTMBSLOT

Name	AT+DTMBSLOT
Function	Set DTMB time slot information
Inquire	AT+DTMBSLOT<CR> <CR><LF>+OK=<slot><CR><LF>
Set	AT+DTMBSLOT=<slot><CR> <CR><LF>+OK<CR><LF>
Parameter	slot: transmit slot, values 1-16

4.4.1.15. AT+DTMBFREQ

Name	AT+DTMBFREQ
Function	Set DTMB frequency information
Inquire	AT+DTMBFREQ<CR> <CR><LF>+OK=<freq><CR><LF>
Set	AT+DTMBFREQ=<freq><CR> <CR><LF>+OK<CR><LF>
Parameter	freq: Operating frequency
Example	AT+DTMBFREQ +OK=915000000

4.4.1.16. AT+DTMBPSW

Name	AT+DTMBPSW
Function	Set DTMB plus password

Inquire	AT+DTMBPSW<CR> <CR><LF>+OK=<password><CR><LF>
Set	AT+DTMBPSW=<password><CR> <CR><LF>+OK<CR><LF>
Parameter	password: A 32-byte string in hexadecimal notation, such as 000000000006 E023FB906030304

4.4.1.17. AT+WANN

Name	AT+WANN
Function	Set/query WAN port parameters
Inquire	AT+WANN<CR> <CR><LF>+OK=<mode,address,mask,gateway><CR> <LF>
Set	AT+WANN=<mode,address,mask,gateway><CR> <CR><LF>+OK<CR><LF>
Parameter	mode: network IP mode,STATIC: static IP,DHCP: dynamic IP; default: STATIC Address:IP address; default: 192.168.1.23 Mask: subnet mask; default: 255.255.255.0 Gateway: Gateway address; default: 192.168.1.1

4.4.1.18. AT+DNS

Name	AT+DNS
Function	Query/set moduleDNS server address
Inquire	AT+DNS<CR> <CR><LF>+OK=< address ><CR><LF>
Set	AT+DNS=< address ><CR> <CR><LF>+OK<CR><LF>
Parameter	address:DNS server address, default: 208.67.222.222

4.4.1.19. AT+UART

Name	AT+UART
Function	Set/query serial port parameters

Inquire	AT+UART<CR> <CR><LF>+OK=<baudrate,data_bits,stop_bit,parity,flowctrl ><CR><LF>
Set	AT+UARTN=<baudrate,data_bits,stop_bit,parity,flowctrl ><CR> <CR><LF>+OK<CR><LF>
Parameter	baudrate: Baud rate: 600-230400 Default: 230400 data_bits: 7, 8; default: 8 stop_bits: 1, 2; default: 1 parity: NONE EVEN ODD MARK SPACE Default:NONE Flowctrl: Flow control, NFC: no flow control FCR: with software flow control, default: NFC

4.4.1.20. AT+SOCK

Name	AT+SOCK
Function	Query/set socket parameters of port
Inquire	AT+SOCK<CR> <CR><LF>+OK=<work_mode,ip_addr,port ><CR><LF>
Set	AT+SOCKMN=< work_mode,ip_addr,port ><CR> <CR><LF>+OK<CR><LF>
Parameter	work_mode: Protocol type: TCPS: TCP Server TCPC: TCP Client UDPS: UDP Server UDPC: UDP Client,default: UDPS

	ip_addr: Local IP/Destination IP or Domain Name (64 characters) According to C/S mode differentiation, when the module is set to "Client", IP address is remote server IP; when it is "Server", it islocal server; default: 192.168.1.23 Port:protocol port, decimal number, 0~65535 When port=0 is a random port number. Default 8234

4.4.1.21. AT+SOCKPORT

Name	AT+SOCKPORT
Function	Query/setSOCK local port number of port
Inquire	AT+SOCKPORT<CR> <CR><LF>+OK=<server>,<local><CR><LF>
Set	AT+SOCKPORTAN=<server>,<local><CR> <CR><LF>+OK<CR><LF>
Parameter	server: The server port number to which you need to connect as a client local: Local port number as client (0 = port =65535) Random port number 0 when port=0; default, 8234

4.4.1.22. AT+PDTIME

Name	AT+PDTIME
Function	Query production time
Inquire	AT+PDTIME<CR> <CR><LF>+OK=<time><CR><LF>
Set	/
Parameter	Date of birth: year-month-date hour:minute:second Example:202 3-07-23 11:37:13

5. Contact Us

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