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Serial to Dual Band WiFi Converter

USR-DR164, USR-DR162

User Manual



V2.0

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1. Introduction

USR-DR164/162 is an ultra-small size dual band WiFi serial server device with one serial port. It can realize transparent transmission between RS485/RS232 and WiFi device.

It supports 2.4G & 5.8G WiFi, compatible with IEEE 802.11 a/b/g/n standard. With 2.4 G WiFi, it has longer range signal while with 5.8G WiFi, it has fast speed and better resistance to signal interference.

In software, it supports multiple networking methods AP/STA/AP+STA mode, which is convenient for users to conduct wireless networking. And supports multiple communication protocols like TCP/UDP/HTTP/MQTT, and supports Modbus TCP/RTU conversion, so this device can establish a data communication bridge between the serial device and the server of different protocols, which is convenient for users to monitor the device remotely.

1.1. Features

- Dual band WiFi 2.4G & 5.8G, support IEEE 802.11 a/b/g/n.
- Ultra small size, save your space.
- Wide Operating Temp -40℃ ~ 85℃, industrial grade design, stable operation in harsh environments.
- V0 flame retardant rating,
- Wide power input designed DC 5-36V, EMC level 2.
- RS232/RS485 is optional.
- Hardware and software watchdog to ensure stable operation.
- DIN rail mounting, easy for installation.
- Support AP/STA/AP+STA mode.
- Rich communication protocol MQTT/TCP/UDP/HTTP.
- Support Modbus TCP/RTU conversion, heartbeat packet and registration packet.
- Support SmartAPLink app to set up network parameter.
- Multiple configuration methods AT command, browser, serial AT command, network AT command.
- Rich indicators Power, Work, COM, Link.
- Long transmission distance up to 200 meters(2.4G WiFi, open environment).

1.2. Ordering Guide

Model	USR-DR164	USR-DR162
Serial Port	RS485	RS232

1.3. Technical Parameters

USR-DR164/162 parameters are as follows:

Items	Description
Power Supply	DC: 5-36V, 2-pin push-type connector
Working Current	**170-350mA@5V**
Serial port	
No.	USR-DR164:1 x RS485, USR-DR162:1 x RS232, 3-pin push-type connector.
Baud rates	1200-460800 bps
Data bits	5, 6, 7, 8
Stop bits	1, 2
Parity	NONE, ODD, EVEN, Mark, Space
Packaging Interval	Range: 10 ~ 1000ms, default: 20ms
Packaging Length	Range: 32 ~ 1400 bytes, default: 1400 bytes
Pull-up Resistor	2.2 KΩ(Only USR-DR164)
Protection	ESD, EFT, over-voltage protection
Wi-Fi	
Standards & Frequency	IEEE 802.11a/b/g/n 2.4G: 2.412GHz-2.484GHz 5.8G: 5.17GHz-5.25GHz, 5.725GHz-5.835GHz
Working Mode	AP/STA/AP+STA
Tx power	2.4G: 802.11b: +17±1.5dBm(@11Mbps) 802.11g: +14±1.5dBm(@54Mbps) 802.11n: +14±1.5dBm(@HT20， MCS7) 5.8G: 15±1.5dBm (OFDM 6Mbps) 13±1.5dBm (OFDM 54Mbps) 12±1.5dBm (HT20 MCS7) 12±1.5dBm (HT40 MCS7)
Receive sensitivity	2.4G: 802.11b:-95 dBm (@1Mbps ,CCK) 802.11b:-85 dBm (@11Mbps ,CCK) 802.11g:-72 dBm (@54Mbps, OFDM) 802.11n:-70dBm (@HT20, MCS7) 802.11n:-67dBm (@HT40, MCS7) 5.8G: -90dBm (@6Mbps ,OFDM) -73dBm (@54Mbps ,OFDM) -70 dBm (HT20,MCS7) -67 dBm (HT40,MCS7)

Antenna	SMA female connector
Physical Property	
Casing material	ABS, V0 rating
Dimensions	92 * 24 *22mm(including terminal block connector)
Installation	DIN rail mounting
Operating temperature	-40℃ ~ +85℃
Storage temperature	-40℃ ~ +125℃
Operating humidity	5% ~ 95% RH, non-condensing
Storage humidity	1% ~ 95% RH, non-condensing
Software Function	
Work mode	TCP Client, TCP server, UDP client, UDP server, HTTP client, MQTT client, IGMP
Modbus Gateway	Modbus RTU/TCP protocol conversion
IP	DHCP/StaticIP
Registration packet	√
Heartbeat packet	√
WiFi Encryption	WEP/WPA-PSK/WPA2-PSK
Encryption Methods	WEP64/WEP128/TKIP/AES
IOT PLATFORMS	PUSR cloud
User Configuring	Web console(HTTP), AT command, SmartAPLink
Others	
Reset	Reset button 1>Press and hold for 4~15 to reset to factory settings 2>Quickly double-tap to enter SmartAPLink for networking
Indicators	Power, Work, COM, LINK
APPROVALS	
Regulatory	CE/RED*, RoHS*, WEEE*, FCC*

1.4. Indicator status description

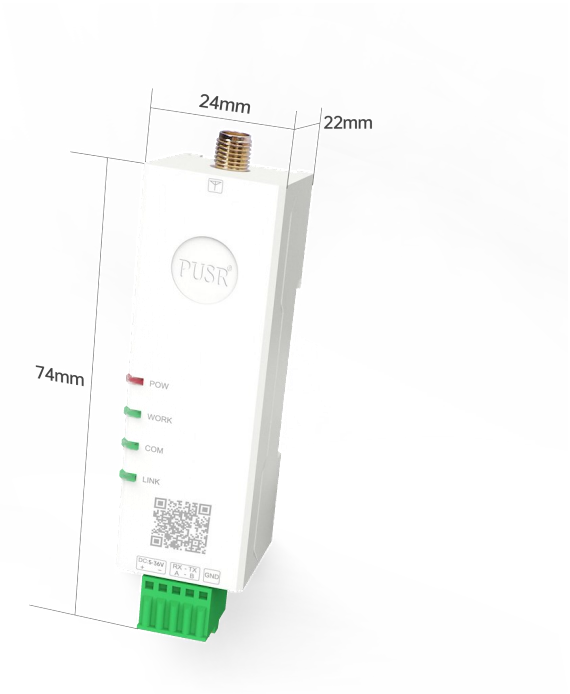
Table 1. Indicator Status

Name	Description
PWR	Red, on: power on Off: power off
WORK	Green,

	System on: 2Hz flashing frequency after the system boot up; Firmware upgrading: fast flashing.
COM	Flashing when there is data sending or receiving on serial port. Blue: sending data from serial port to network; Off: receiving data from network to serial port.
LINK	*In AP mode,* This indicator is off. *In STA mode,* The blue is on: RSSI≥-60, connected to AP device. The blue is flashing: RSSI≥-60, connected to AP device and have data communicating. The blue is off: RSSI≥-60, not connected to AP device The red is on: RSSI<-60, connected to AP device. The red is flashing:RSSI<-60, connected to AP device and have data communicating. The red is off: RSSI<-60, not connected to AP device

1.5. Dimensions

Unit: mm



1.6. Wiring connector

USR-DR164/162 series adopts push-type terminal connector, which can realize wiring conveniently and quickly. Terminal wiring definitions are shown below.





Table 2. Pin description

No.	Pin	Type	Description
1	DC 5-36V +	P	Positive input of the power supply
2	DC 5-36V -	P	Negative input of the power supply
3	RX/A	I/O	Serial signal
4	TX/B	I/O	Serial signal
5	GND	P	The digital ground

2. Get started

2.1. Preparations

2.1.1. Hardware

USB to RS485 converter*1

PC*1

USR-DR164*1

WiFi antenna*1

Power Supply*1

2.1.2. Log in device

Power on the USR-DR164 device，connect PC to USR-DR164 via Wi-Fi, users can login router via Chrome or the other browser. The default network parameters are shown in the following table:

Table 3. Default network parameters

Parameter	Default value

SSID	USR-DR164-xxxx
LAN IP	10.10.100.254
Username	admin
Password	admin
Wi-Fi password	None

Open the browser, enter 10.10.100.254 in the URL blank, and press Enter, it will navigate to the following web page. After entering the login password, clicking login, the web page will show configuration page of USR-DR164.



3. Serial port

3.1. Basic Parameters

Serial parameters of USR-DR164 must be consistent with the parameters of the serial device. Serial port parameters include basic parameters and framing parameters.

Item	Parameter
Baud rate	1200~460800bps
Data bit	5,6,7,8
Stop bit	1,2
Check bit	NONE, EVEN, ODD, Space, Mark

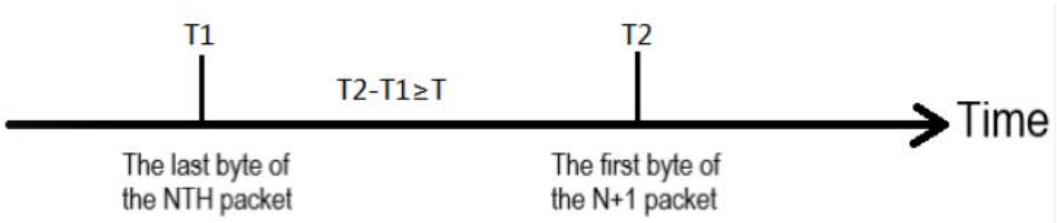


3.2. Frame Forming Mechanism

3.2.1. Time Trigger

When DR164 receives data from the UART, it continuously checks the interval of two adjacent bytes. If the interval time is greater or equal to a certain "time threshold", then a frame is considered finished, otherwise the data is received until greater or equal to the packet length byte set. This frame is sent to the network as a TCP or UDP packet. The "time threshold" here is the time between packages. The range of settable is 10ms~1000ms. Factory default: 20ms.

This parameter can be set by AT command, AT+UARTTM=<time>.



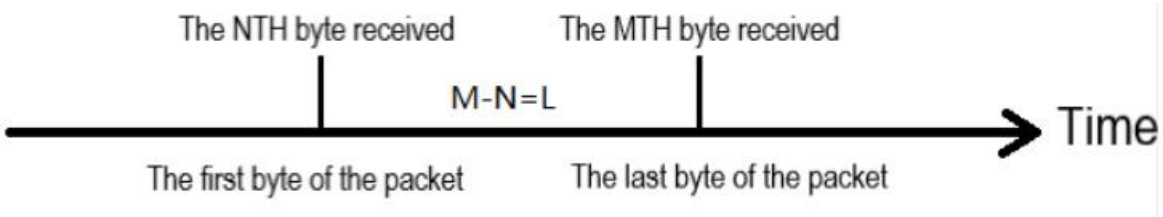


Note: T is the packing interval time.

3.2.2. Length trigger

When DR164 receives data from the UART, it constantly checks the number of bytes received. If the number of bytes received is equal to a certain "length threshold", a frame is considered to have ended, otherwise the packaging time is waiting for the end. This frame is sent to the network as a TCP or UDP packet. The "length threshold" here is the package length. The settable range is 32~1400. Factory defaults is 1400.

This parameter can be set by AT command, AT+UARTBUF=<length>.

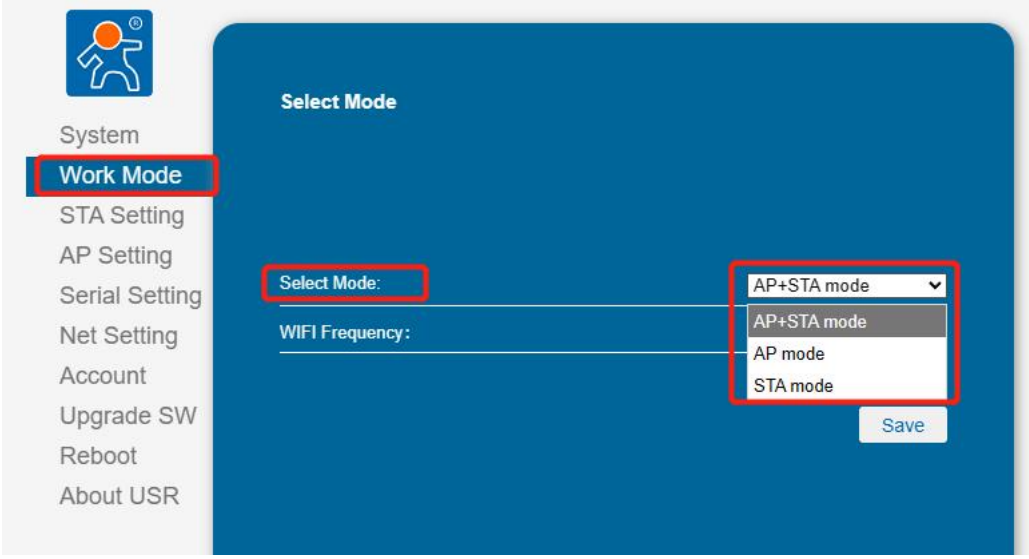




Note: L is the packaging length.

4. Networking application

USR-DR164 supports wireless WIFI communication modes, flexible networking and network topology.



4.1. AP mode

When USR-DR164/162 work as AP, other serial port device and PC can connect to it via WiFi as a STA, also it can connected to user device via RS485, as fellows:



Users can set parameters using the following AT commands:

(1) Set the WIFI server to AP mode

AT+WMODE=AP

(2) The parameters of the WIFI serial server in AP mode can be set according to needs or use the default parameters. For example:

AT+WAP=11BGN,USR-DR164-TEST,Auto(Optional)

AT+WAKEY=WPA2PSK,AES,12345678(Optional)

AT+LANN=10.10.100.254,255.0.0.0(Optional)

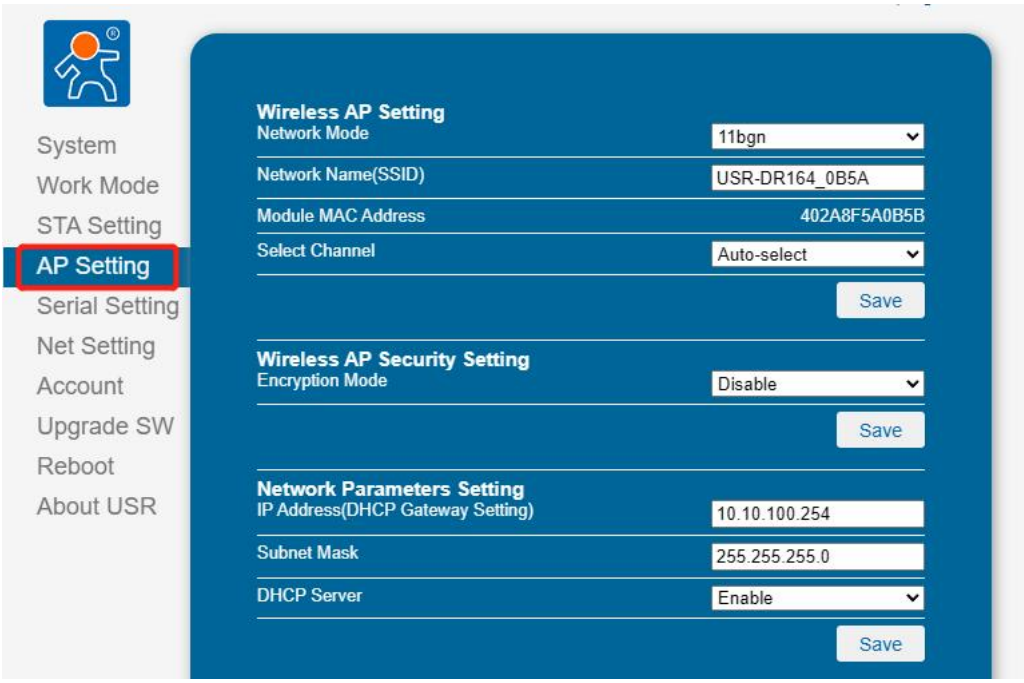
(3) Restart the WiFi serial device

AT+Z

Note: This device is a software AP(no routing function), so STA devices connected to the AP cannot

communicate with each other.

Settings on web page:



4.2. STA mode

When USR-DR164/162 work as STA, it connect to other AP via WiFi, all STA take the AP as wireless networking centre, mutual communication between STAs is completed through AP forwarding, as below:



WIFI serial server parameter settings are as follows:

(1)Set the working mode of WIFI serial server:

AT+WMODE=STA

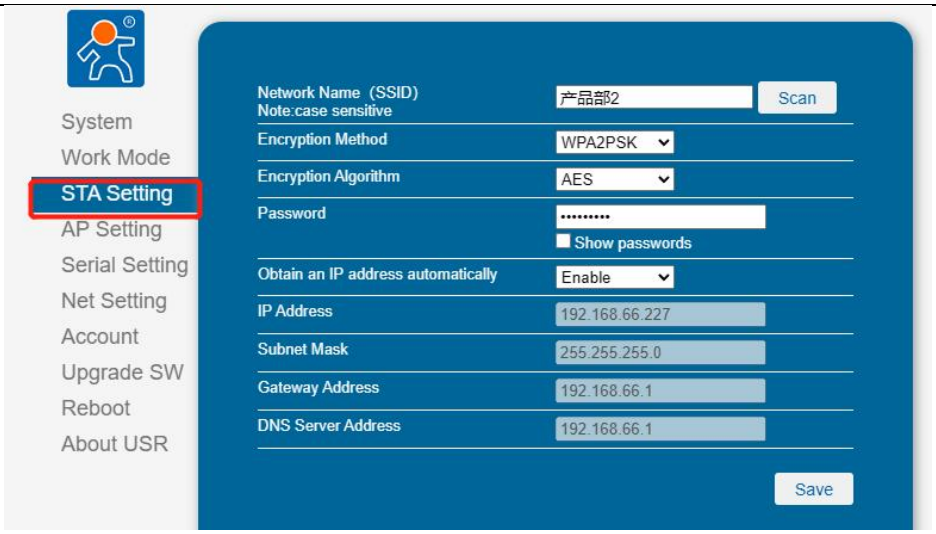
(2)Set the SSID, encryption mode, and password of the router to be connected (for example, the SSID of the route is: USR-WIFI-TEST, the encryption mode is WPA2PSK, AES, and the password is www.usr.cn). As follows:

AT+WSSSID=USR-WIFI-TEST

AT+WSKEY=WPA2PSK,AES,www.usr.cn

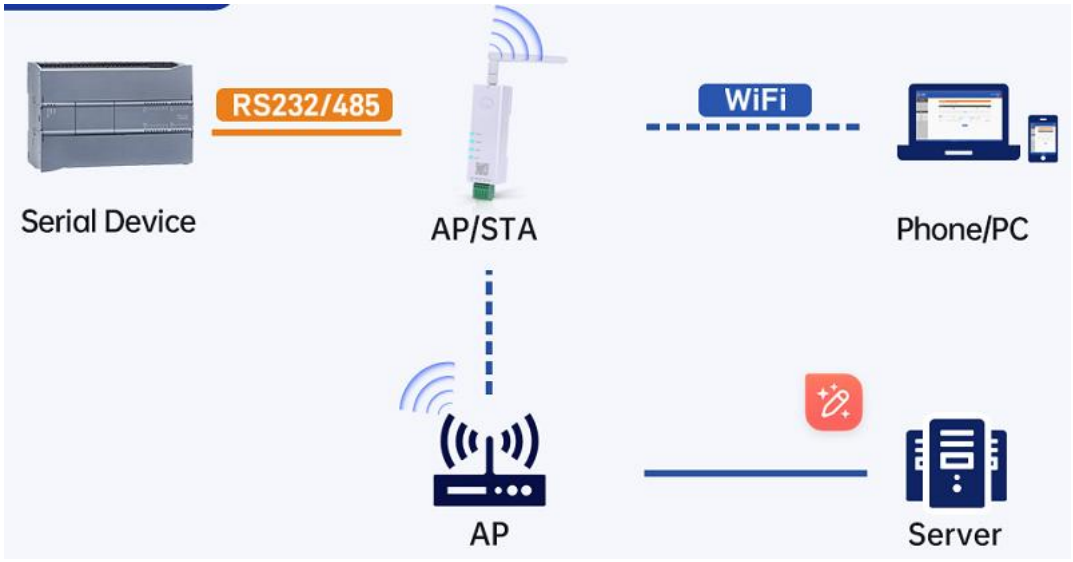
(4) Restart AT+Z

Settings on web page:



4.3. AP+STA mode

USR-DR164 can support AP+STA mode. Enable the AP+STA function, STA and AP interface can be used meanwhile, STA interface connected to the router, and then connected to the server in the internet via TCPB; AP interface can be connected by the phone/ pad (TCPA). So the TCP server, phone /pad can control the device connected to the DR164 and configure the parameters for the DR164. As below:



WIFI serial server parameter settings are as follows:

(1)Enable AP + STA function of WIFI serial server

AT+FAPSTA=on

(2)Parameters take effect after resetting the module

AT+RELD

(3)Set the WIFI serial server to STA mode, the WIFI serial server AP interface is still valid

AT+WMODE=STA

(4)Set the SSID, encryption mode, and password of the route to be connected (for example, the SSID of the route is: USR-WIFI-TEST, the encryption mode id WPA2PSK, AES, and the password is www.usr.cn). As follows:

AT+WSSSID=USR-WIFI-TEST

AT+WSKEY=WPA2PSK,AES,www.usr.cn

(4)Set socket A, socket B

Socket A setting example:

AT+NETP=TCP,Server,8899,10.10.100.100

Set the IP and port of the server to be connected.

Socket B setting example:

AT+TCPADDB=192.168.1.100

AT+TCPPTB=18899

(6)Restart

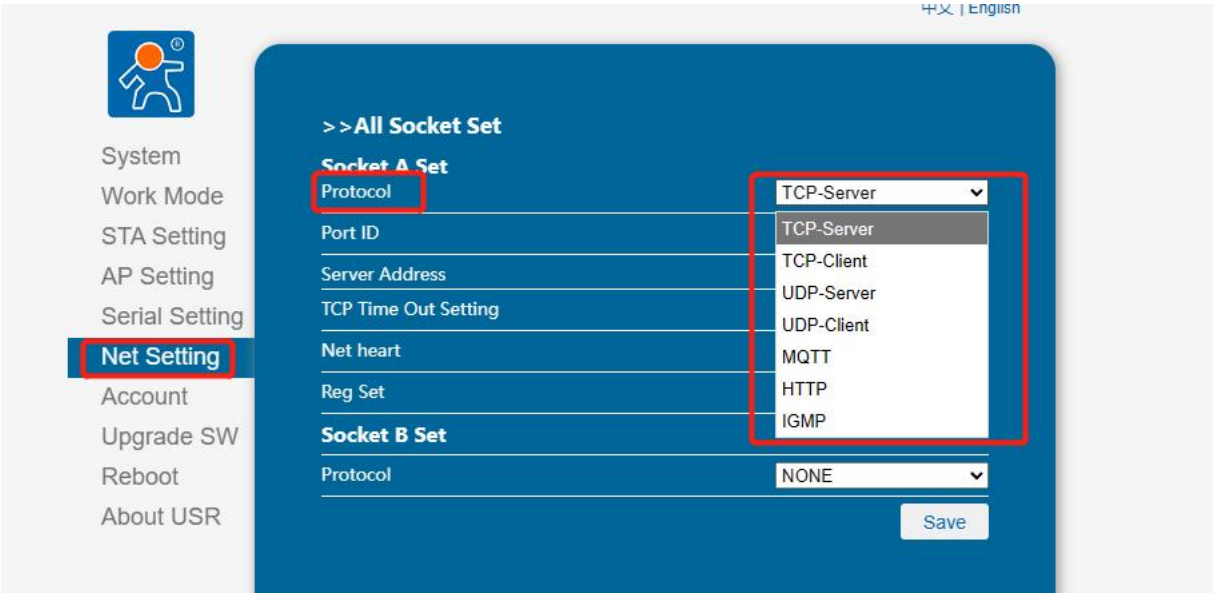
AT+Z

Note: In AP+STA mode, you are advised to use AP only for configuration. Because it is a soft AP (no routing function), STA devices connected to the AP cannot communicate with each other.

5. Product function

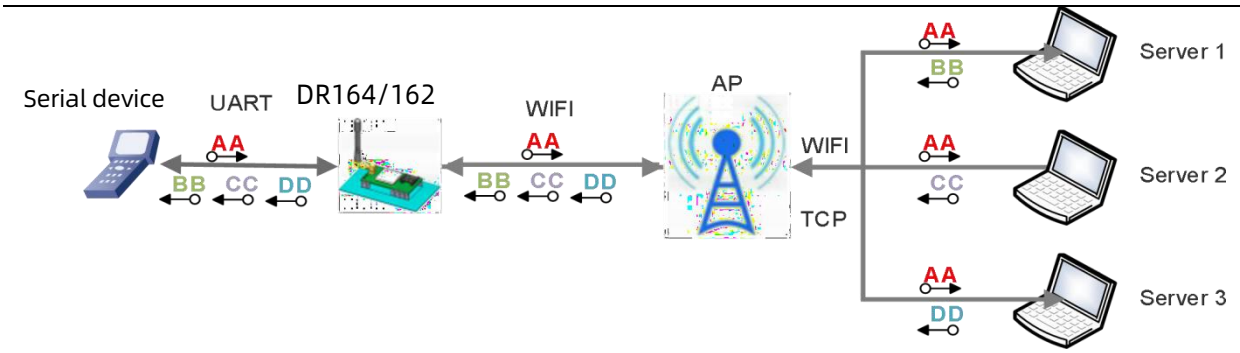
5.1. Work mode

USR-DR164 has 5 communication protocol: TCP, UDP, MQTT, HTTP,IGMP.



5.1.1. SOCKET function

When socket A in TCP server , at most supports 5 TCP client to connect. In multi-TCP link connection mode, data transmitted from TCP will be forwarded to the serial port one by one. The data coming from the serial port will be copied into multiple copies, and one copy will be forwarded on each TCP link. The specific data flow chart shows:



Socket A settings:

	Item	Description
1	AT+NETP	Setting / Query TCPA's network protocol parameters
2	AT+NETPIDEN	Set/query whether to display which communication channel the data comes from
3	AT+TCPLK	Query whether the TCP link is established
4	AT+TCPTO	Setting/query TCP timeout
5	AT+TCPDIS	Connect / Disconnect TCP (only valid when TCP Client)
6	AT+NETPID	Set or query the value of the channel ID tag
7	AT+MAXSK	Set/query the number of TCP Client connections when module SOCKA works in the TCP Server
8	AT+SEND	Send data to SOCKA in command mode
9	AT+RECV	Receive SOCKA data in command mode

Socket B settings:

	Item	Description
1	AT+SOCKB	Set or query SOCKB network protocol parameters
2	AT+TCPDISB	Establish or disconnect the SOCKB TCP Client mode
3	AT+TCPTOB	Set or query the TCP timeout period of SOCKB
4	AT+TCPLKB	Check whether the SOCKB link has been established
5	AT+SNDB	Send data to SOCKB in command mode
6	AT+RCVB	Receive data from SOCKB in command mode
7	AT+UDPLCPT	Set/query SOCKA, SOCKB used as UDP traffic The local port of the call

5.1.2. IGMP

IGMP is based on UDP. In IGMP mode, allows multicasting of data to groups of IP addresses. A multicast is a packet sent by one host to multiple hosts. In multicast mode, each host that belongs to a specific multicast group will receive multicast packets for that group. For a host to be configured as a multicast receiver over the Internet, the must inform the routers on its LAN. The Internet Group Management Protocol (IGMP) is used to communicate group membership information between hosts and routers on a LAN. The valid IP range for multicast group 224.0.0.2-239.255.255.255.

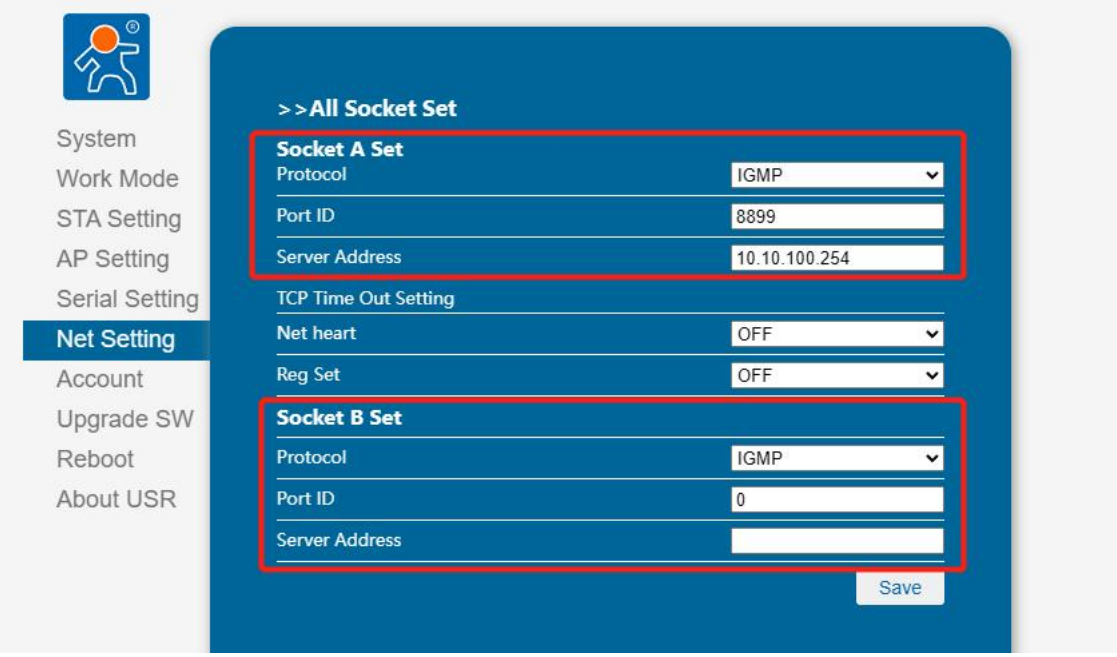
The relevant AT command:

AT+NETP=IGMP,CLIENT,8899,239.255.0.1 // Setting socket A work at IGMP mode, 8899 is the destination port and 239.255.0.1 is the destination multicast IP address. If the IP address is not a multicast address, an error is reported.

AT+SOCKB=IGMP,9999,239.255.0.2 //Setting socket B work at IGMP mode

AT+UDPLCPT=XXXX,XXXXX // Set the UDP local receive port, also applicable to multicast packets.

Setting on web page:



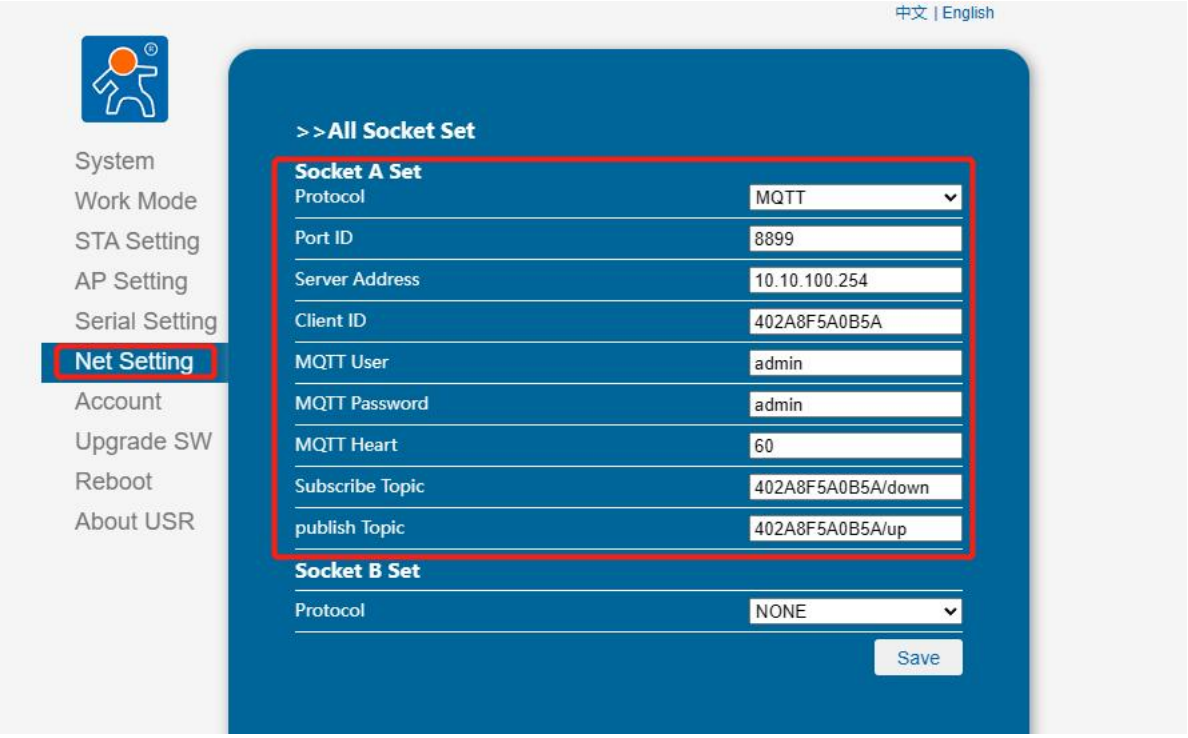
5.1.3. MQTT mode

MQTT's broker/client design eliminates the need for all devices in the system to be online at the same time. The clients (i.e., "devices" or "things") communicate directly with the broker, which plays the role of middleman to pass messages back and forth between clients.

The relevant AT command is as follows:

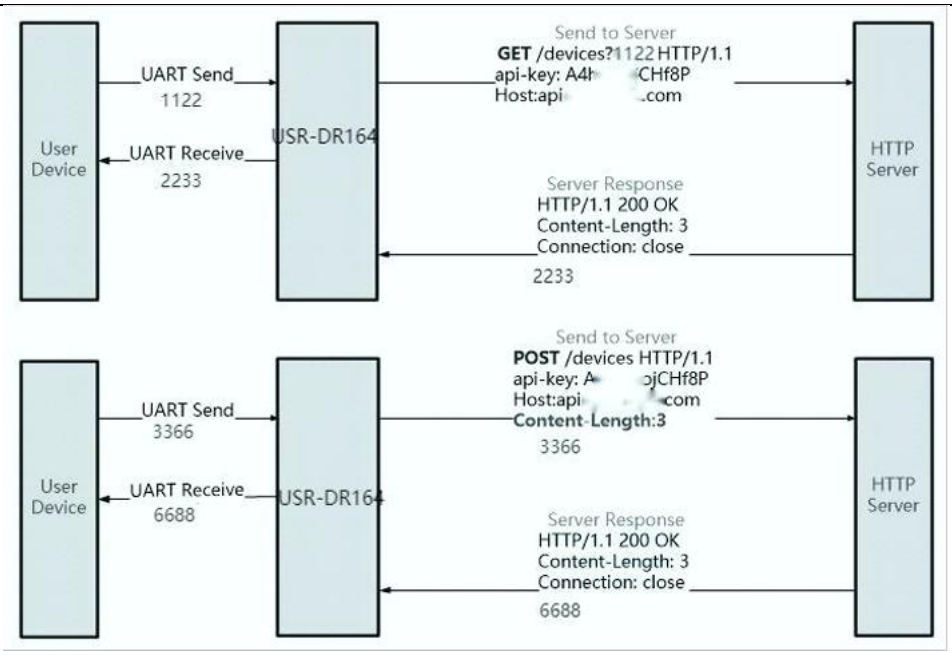
	Item	Description
1	AT+NETP	Setting / Query TCPA's network protocol parameters
2	AT+MQLOGIN	Set/query user name and password for MQTT. The setting takes effect after the reset
3	AT+MQID	Set/query MQTT Client ID. The setting takes effect after the reset
4	AT+MQTOPIC	Set/query MQTT topic. The setting takes effect after the reset
5	AT+MQPARA	Set/query MQTT parameters. The Settings take effect after the reset

Setting on web page:



5.1.4. HTTP mode

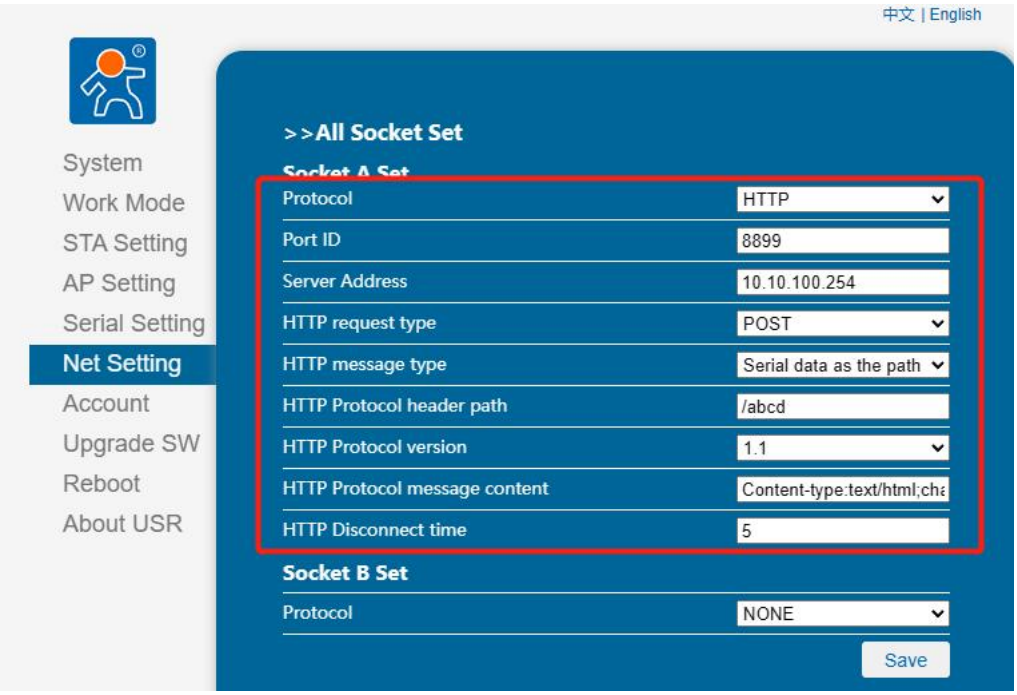
In HTTP mode(HTTP client), users need to specify the remote httpd server's address, port, method and other parameters. The device will submit the serially received data to the httpd server in the form of GET or POST. At the same time, the data sent by the http server can be transparently transmitted to the serial port.



Relevant AT command:

	Item	Description
1	AT+NETP	Setting / Query TCPA's network protocol parameters
2	AT+HTPTP	Set/query the HTTP request methods.
3	AT+HTPURL	Set or query the HTTP header path and version.
4	AT+HTPHEAD	Set or query the contents of HTTP packets of the new version.
5	AT+HTPPARA	Set/query a new version of the HTTP connection disconnection time.

Setting on web page:



5.2. Modbus function

USR-DR164/162 supports Modbus TCP/RTU conversion and Modbus polling(up to 10). This function is only valid for socket A.

Modbus TCP/RTU conversion:

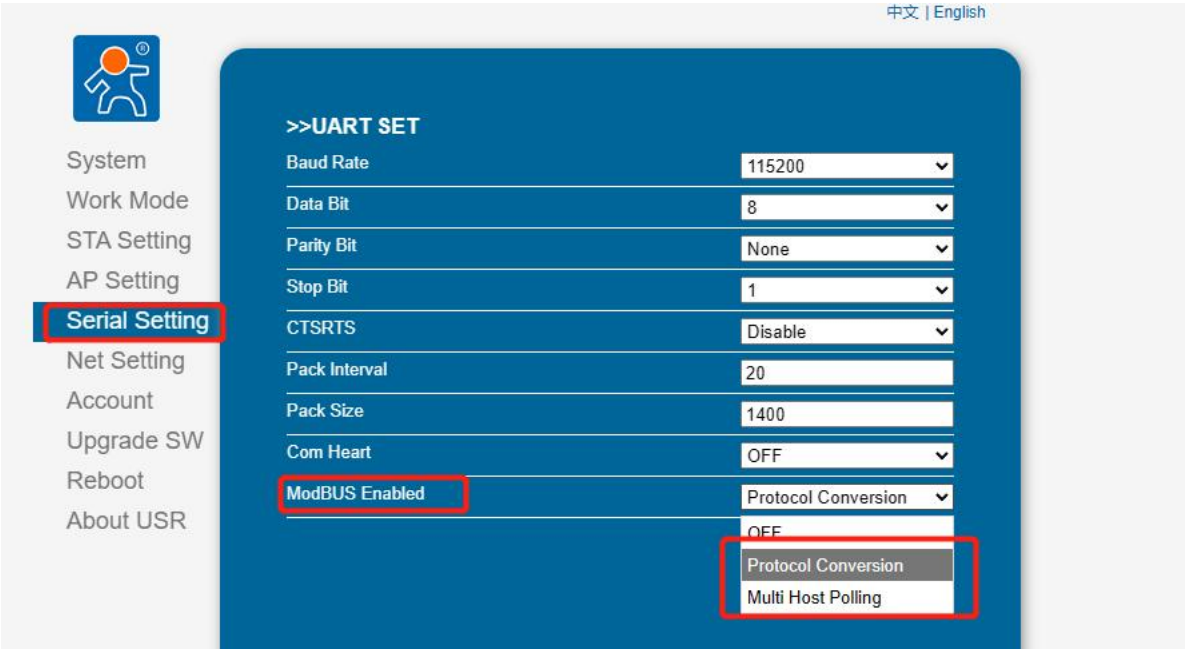


Modbus polling: USR-DR164 support multiple host polling to check parameter.

Relevant AT command:

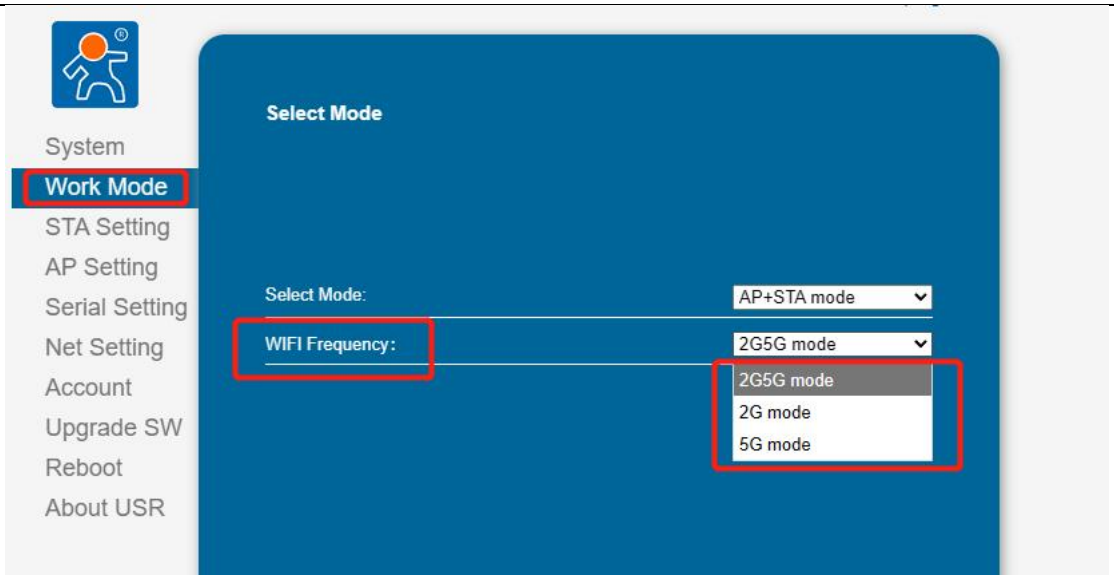
	Item	Description
1	AT+Modbus	Setting / Query Modbus parameters

Setting on web page:



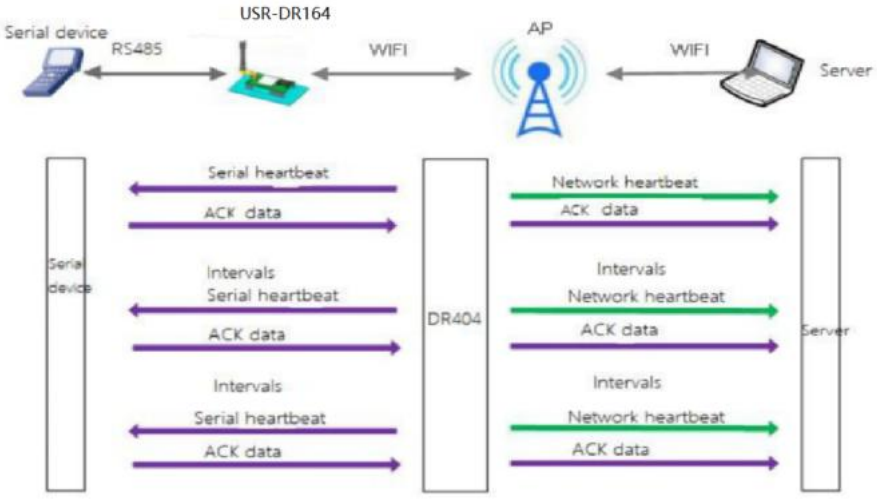
5.3. WiFi band settings

USR-DR164 supports 2.4G & 5.8G dual band WiFi, users can set it using AT+WFREQ command. In 2.4G & 5.8G dual-band, when connecting as a STA to a router with the same SSID, USR-DR164 connects to the router with better signal strength with priority. In 5G only frequency, USR-DR164 has better better anti-interference, so it can work in complex environment.



5.4. Heartbeat Packet

In the network transparent transmission mode, the user can choose to enable the custom heartbeat packet function. The heartbeat packet can be sent to the network or serial device:



The main purpose of sending to the network is to maintain a connection with the server, and at the same time let the server that is idle for a long time (do not send data to the server for a long time) to detect whether the current connection status is valid.

In applications where the server sends fixed query commands to the device, in order to reduce frequent interactions, users can choose to send heartbeat packets (query commands) to the serial device instead of sending query commands from the server.

Enable the custom heartbeat packet function. AT command settings are as follows:

(1)Enable heartbeat packet function AT+HEARTEN=on

(2)Set the sending direction (NET or COM) of the heartbeat packet, for example, set the heartbeat packet to

be sent to the network.

AT+HEARTTP=NET

(3)Set the heartbeat packet data (maximum 40 bytes). For example, to set the data to the string www.usr.cn, you need to first convert the string to hex 7777772E7573722E636E.

AT+HEARTDT=7777772E7573722E636E

(4)Set the interval for sending heartbeat packets. The setting range is 1-65535s, and the default is 30s. For example, set the sending interval to 30 seconds.

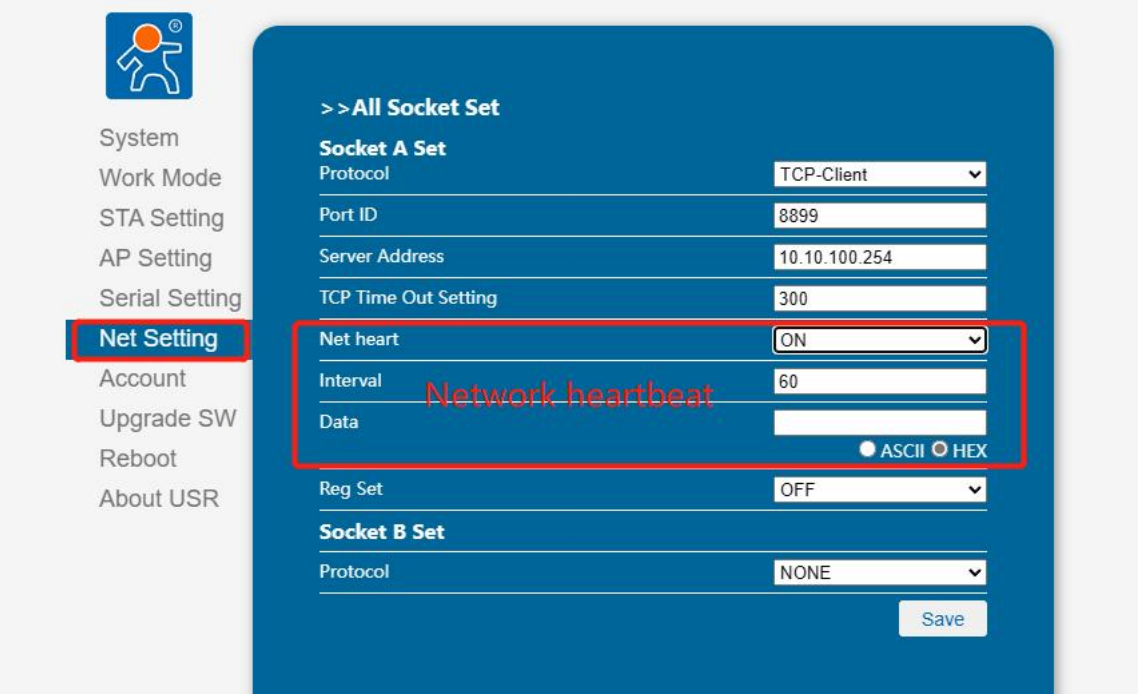
AT+HEARTTM=30

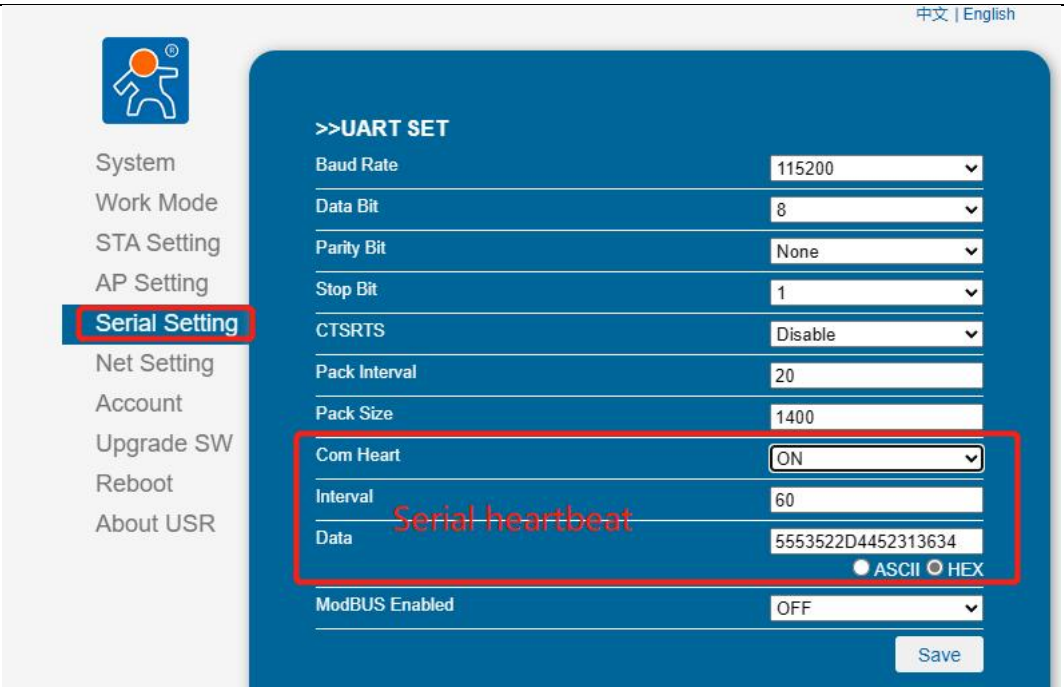
Then need to set up network connections such as socket A and socket B, please refer to section 2.4. After completing the settings, restart the serial server. After socket A or socket B is connected to the server, if there is no data transmission within 30 seconds, the serial server will send the string www.usr.cn to the server.

AT commands:

	Item	Description
1	HEARTEN	Query / Se whether to enable the heartbeat packet function
2	HEARTTP	Query / Set heartbeat packet sending mode
3	HEARTDT	Query / Set heartbeat packet data
4	HEARTTM	Query/ Set heartbeat packet sending interval

Setting on web page:





5.5. Registration packet

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

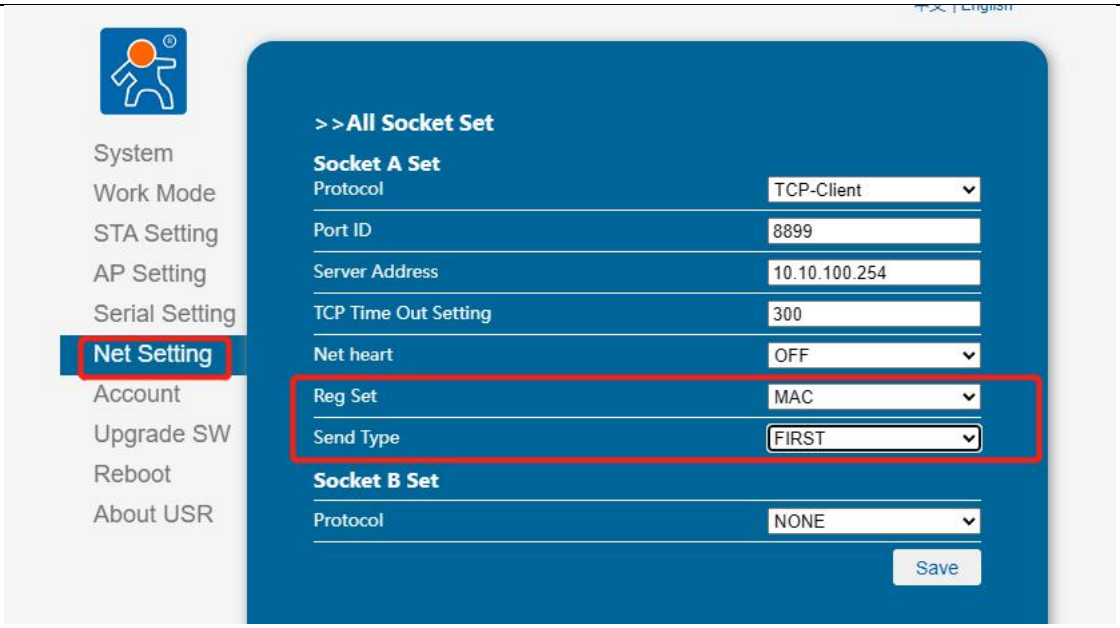
FIRST:The registration packet is only sent once when the network connection is established.

EVERY:The registration packet is filled in front of the serial port data every time the serial port sends data to the network.

AT commands:

	Item	Description
1	AT+REGEN	Set the registration package type
2	AT+REGSND	Set the registration package mode
3	AT+REGCLOUD	Set/query PUSR cloud account and password
4	AT+REGUSR	Set or query the content of the user-defined registration package

Settings on web page:

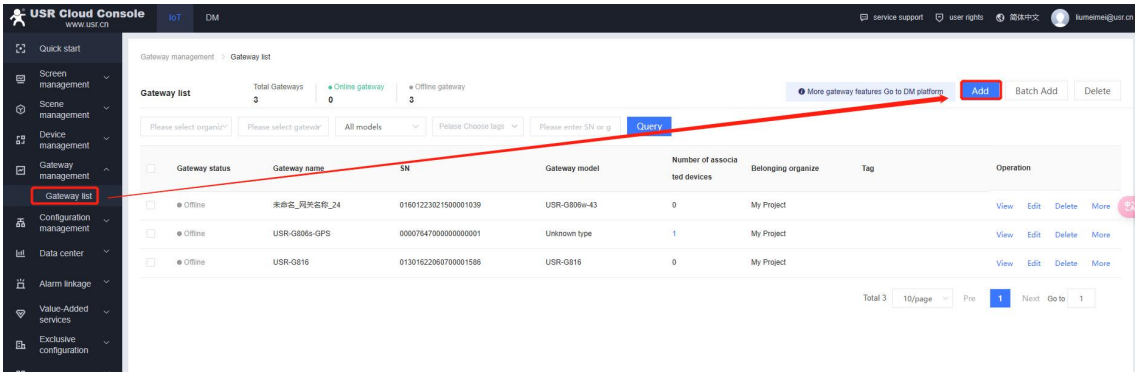


5.6. PUSR cloud

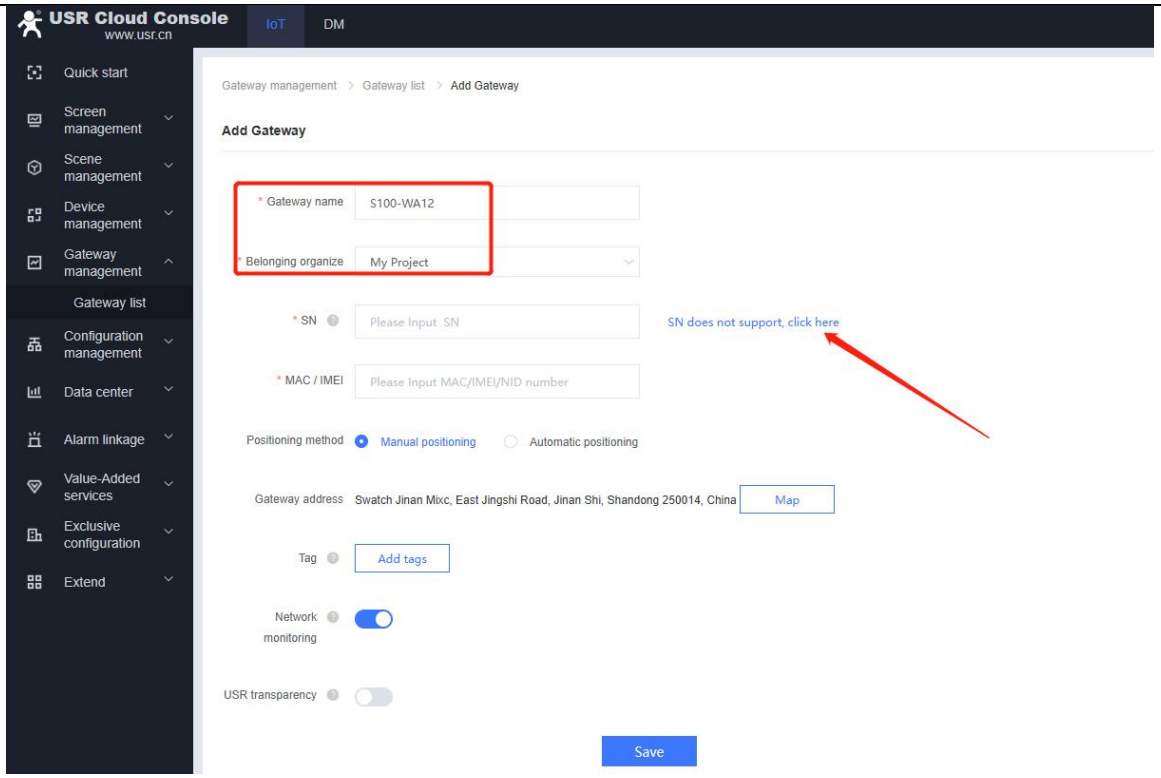
USR-DR164/162 supports sending data to PUSR cloud. It requires the device to connect to the WIFI network that can normally access the external network. Use the access address, port number,device SN and communication password generated by the manned cloud platform to fill in the device TCP Client and registration package content settings.

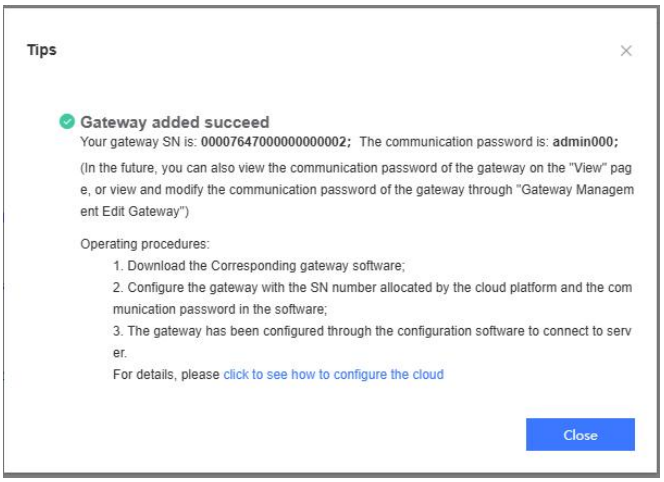
PUSR cloud address: **https://account.usriot.com/**

1> Add device



2> Edit device information, click “SN does not support, click here”

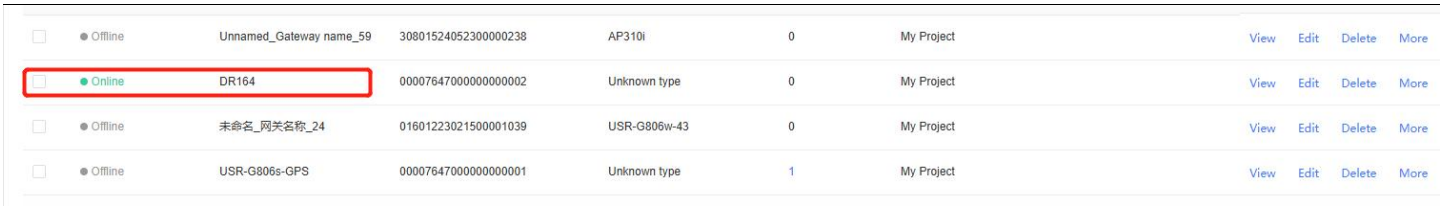




3> DR164/162 parameters setting, the server address is tcp.mp.usriot.com, and the port is 15000. The device number and password is the ones on the last picture.



4> Save and restart the device, we can see the S100-WA12 is online status on the cloud.



5.7. SmartAPLink

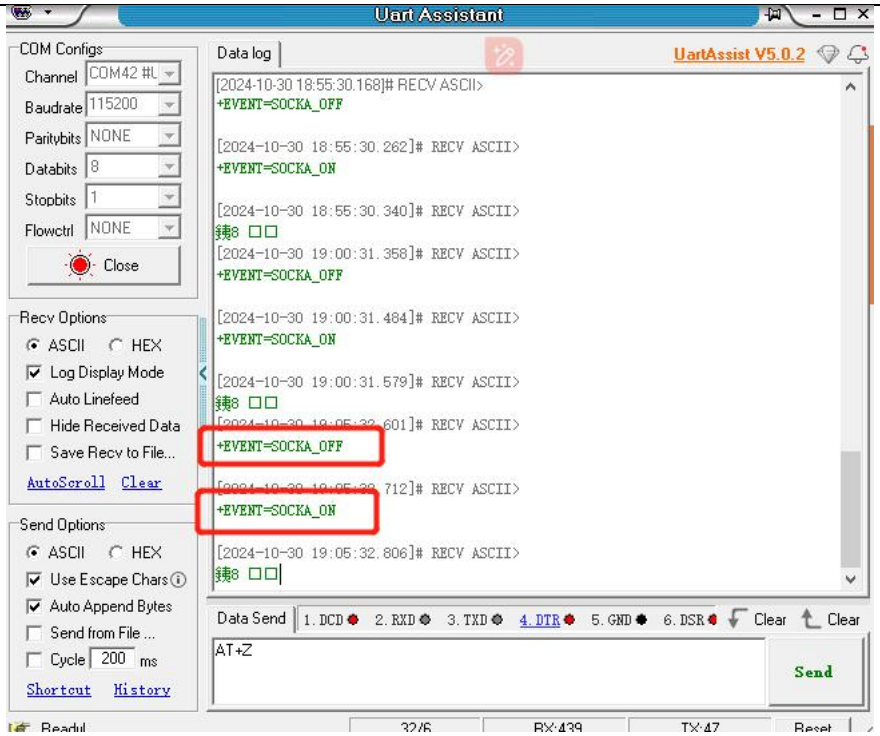
USR-DR164 supports SmartAPLink to get quick internet access.Press the Reload button twice to access the SmartAPLink configuration mode. Users can also use AT+SMARTAPSTART command to enter SmartAPLink configuration mode. After entering SmartAPLink mode, the Work indicator of the DR164 blinks rapidly.



5.8. Event

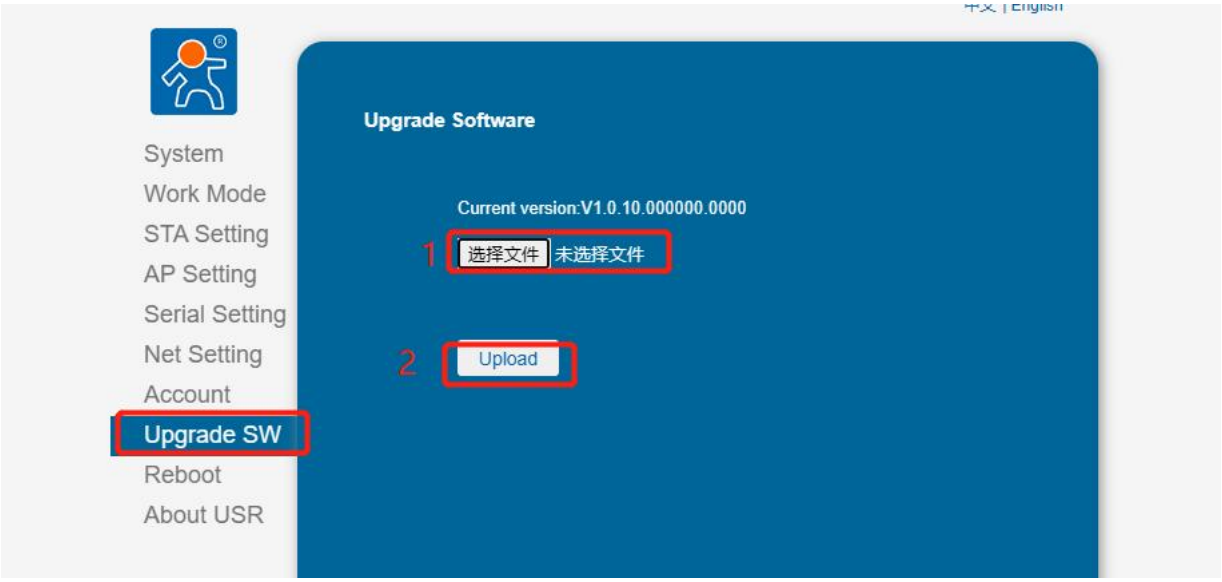
Using AT+EVENT=on to turn on this function, then users can receive the event from serial port.

	Item	Description
1	+EVENT=SOCKA_ON	When the SOCKA connection is established (TCPClient/Server only, MQTT,HTTP)
2	+EVENT=SOCKA_OFF	When SOCKA connection disconnected (TCPClient/Server only, MQTT, HTTP)
3	+EVENT=SOCKB_ON	When the SOCKB connection is established (TCP Client only)
4	+EVENT=SOCKB_OFF	When the SOCKB connection disconnected (only TCP Client)
5	+EVENT=CON_ON	When DR164 connect to router as STA
6	+EVENT=CON_OFF	When DR164 disconnect with router as STA
7	+EVENT=DHCP_OK	When DR164 get IP address with DHCP



5.9. Firmware upgrade

For DR164, the function firmware and the web firmware is separate. On the following page, user can upgrade function firmware.

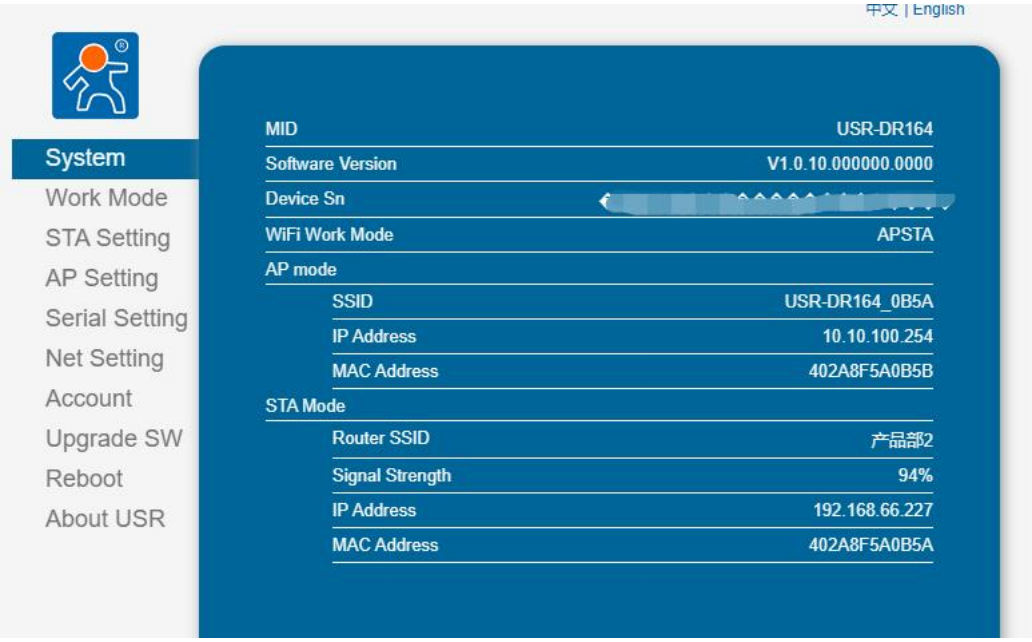


Users can upgrade the web firmware in this URL:**http://10.10.100.254/iweb.html**



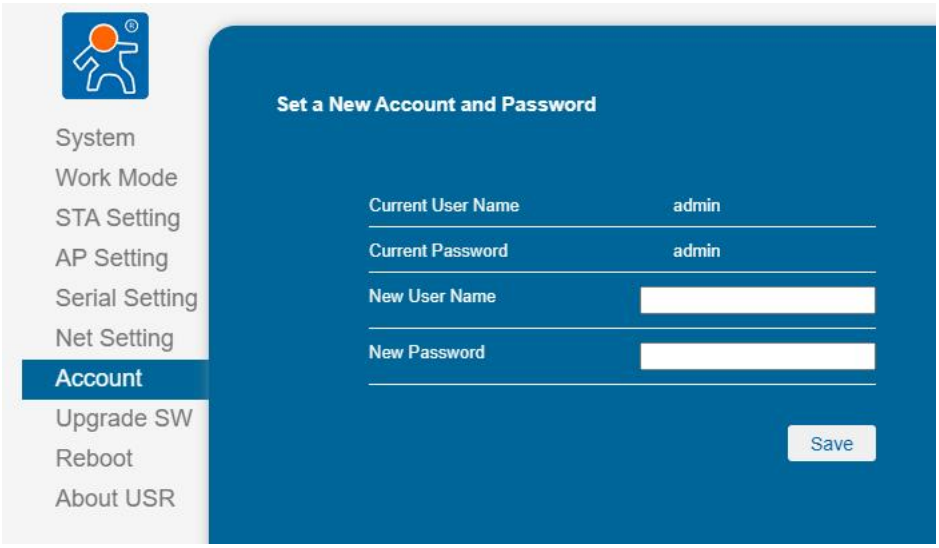
5.10. System information

On this page, users can check some system information like firmware version and others.



5.11. Account

Users can modify the user name and password of the login page.



6. AT Commands

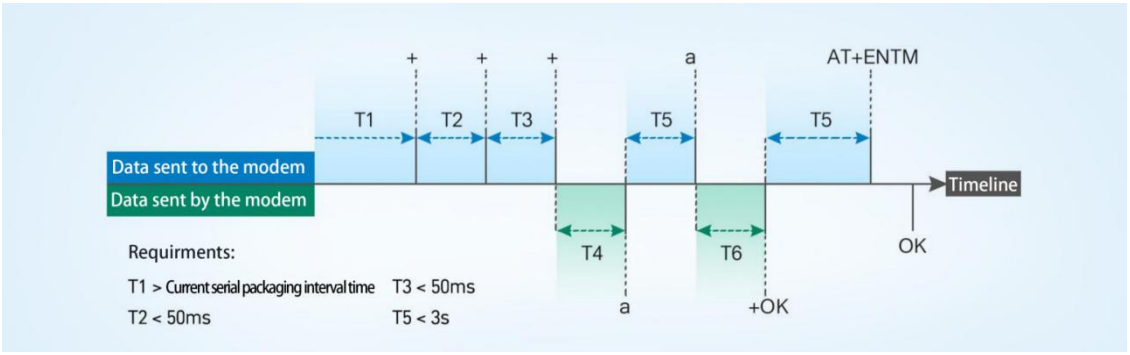
AT command is used for controlling modem, for USR devices in transparent mode normally, you must enter AT command mode at first, then you can send AT commands to configure or query the parameter settings. After setting all parameters, restart the modem to make the settings take effect. Every time the modem restart will work in work mode rather AT command mode.

Every AT command must add character carriage return <CR> and line feed <LF>. In Hex, <CR> is 0x0D

<LF> is 0x0A.

For detailed AT commands, please check the AT commands set.

6.1. AT Command Settings



➢Enter AT command mode:

1.Send “+++” from the serial port, it will be a “a” returned.

2.Do not send any data within a serial port packaging interval before sending "+++".

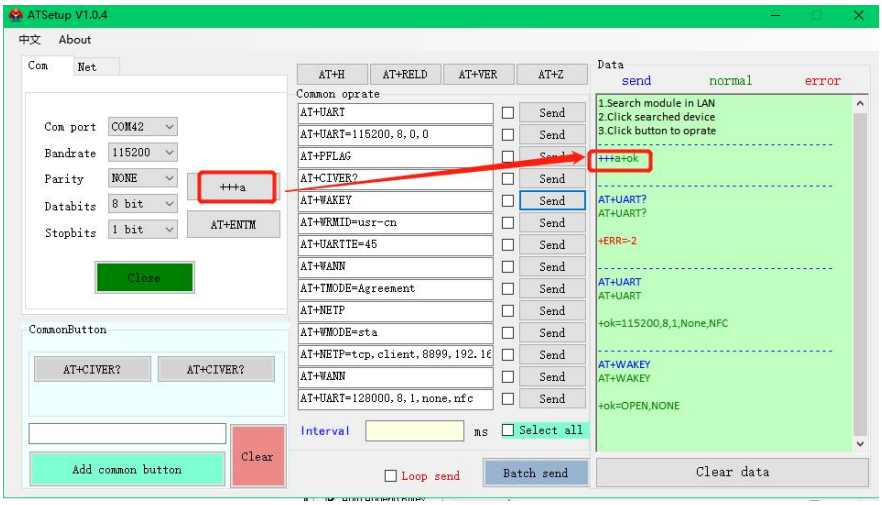
3.After receiving “a”, send another “a” within 3s.

4.Receiving “+ok” means the device has changed to AT command mode.

5.Then can send AT commands to the device.

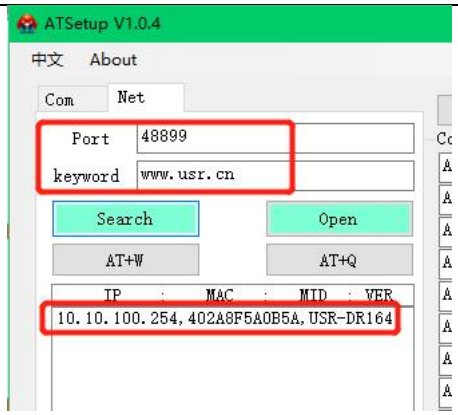
➢Exit AT command mode:

1. Send “AT+ENTM” from the serial port.
2. Receiving “+ok” means the device has exited AT command mode.

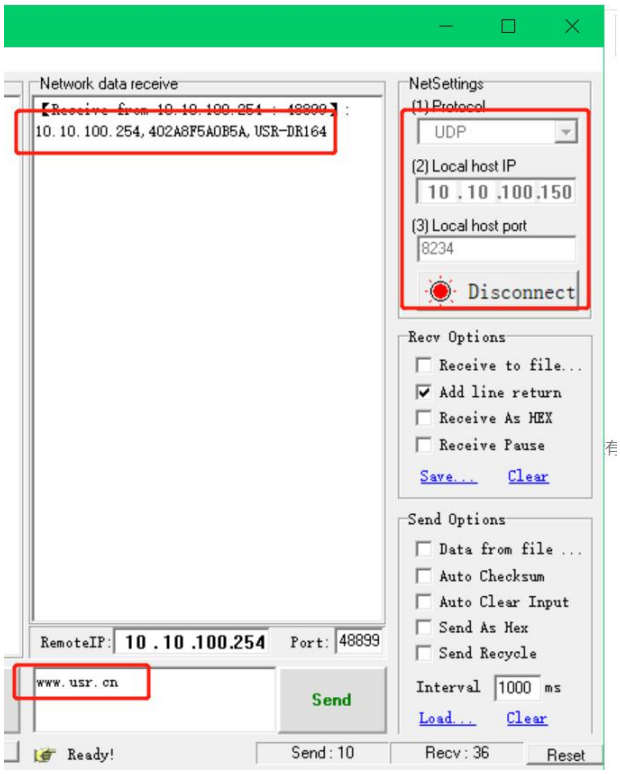


6.2. Network AT Commands

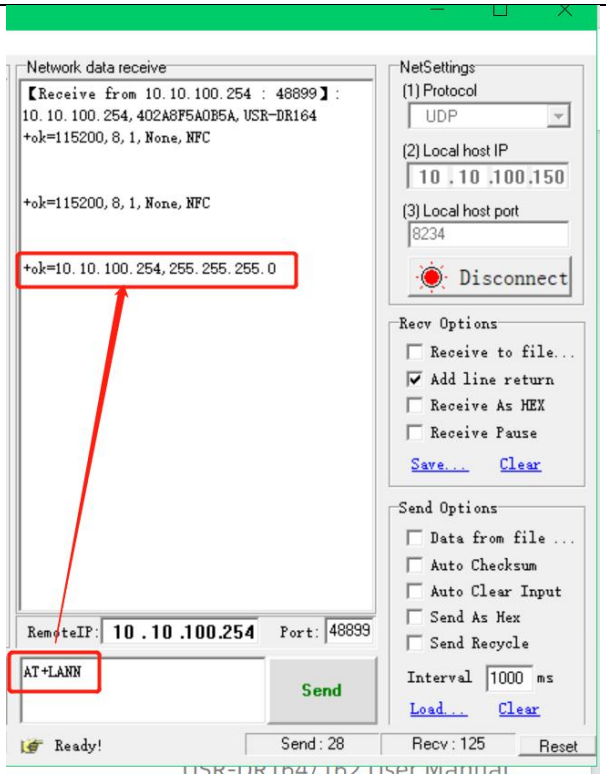
In transparent mode, you can also send AT command from the network side to query or change the modem’s parameter settings. The port is 48899, and the keyword is **www.usr.cn**



Users can using the network AT command on other software, the search protocol is based on UDP.



Example: query parameters of UART or the LAN port, there is a carriage return and line feed after the AT command.



7. Contact Us

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