USR-N540 User Manual

File Version: V1.1.2



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1. Quick Start

Four serial port server USR-N540 is used to realize data transparent transmission between TCP/UDP data package and RS232/RS485/RS422 interface. Three in one serial port communicating code, support common RS232/RS485/RS422 serial interfaces.

Any question during testing, please submit it on our technical support center: http://h.usriot.com

1.1. Hardware Testing Environment



Hardware Connection

USR-N540 connects to PC by serial port and RJ45 Port. Then power on USR-N540 with our AC adapter.The below picture will show you the connection.

Notes:

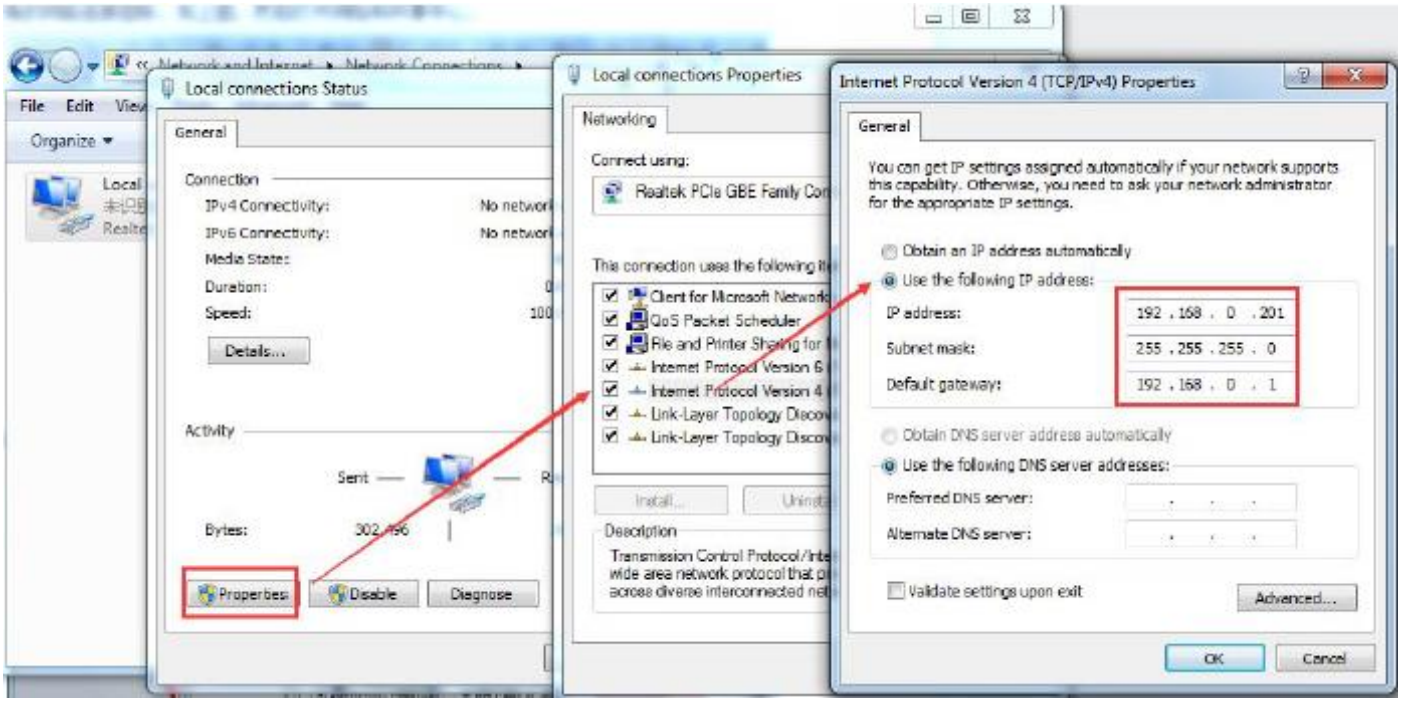
- AC adapter (12V) and connection cable are provided by USR IOT.
- RS232 is involved, no connection for RS485.
- PCs in above picture is the same one.

1.2. Network Test Environment

Please check PC setting after hardware connection.

1) Disable PC Firewall and anti-virus software.
2) Disable the network card nothing to do with testing and just leave one local connection.
3) As for USR-N540 connect with PC directly, should set static IP for PC, which in the same network segment with USR-N540, like 192.168.0.201.

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PC Local Connection Configuration

1.3. Default Parameter

Default parameter is as below:

User name	admin
Password	admin
IP address	192.168.0.7
Subnet mask	255.255.255.0
Default gateway	192.168.0.1
Default work mode of port 1	TCP Server
Default local port of port 1	23
Default work mode of port 2	TCP Server
Default local port of port 2	26
Default work mode of port 3	TCP Server
Default local port of port 3	29
Default work mode of port4	TCP Server
Default local port of port 4	32
Baud Rate	115200
Parity bit/Data bit/Stop bit	None/8/1

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1.4. Data Transmission Test

Data transmission test is based on the default parameters, please refer to the following steps:

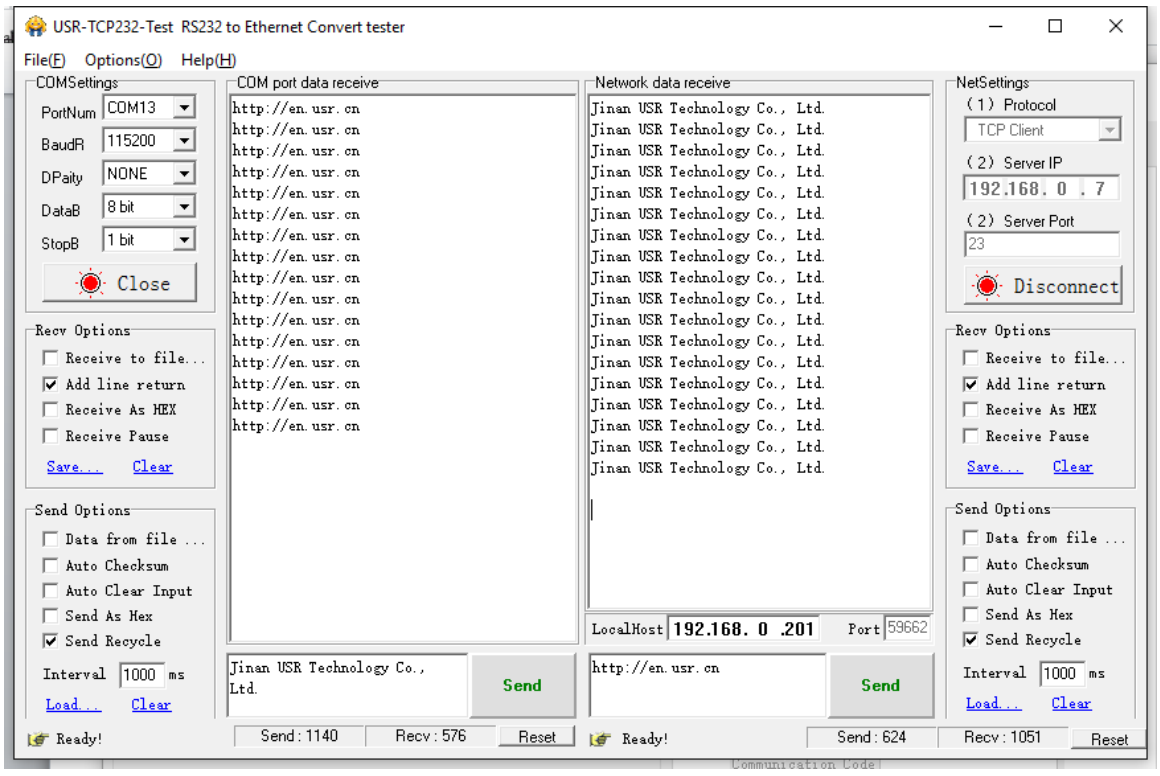
1) Open test software “USR-TCP232-Test.exe”, and do hardware connection according to Chapter 1.1 Hardware Testing Environment.
2) The right side is Network Settings: TCP Client, IP address: 192.168.0.7, port number: 23, click “Connect” to build TCP connection.
   The left side is Serial Settings: Baud Rate: 115200, Parity/Data bit/Stop bit: None/8/1,
   Click “Open” to enable the COM.

Then we can test data transmission between COM and network.

Data from serial to network is: PC’ COM->USR-N540’ COM->USR-N540 Ethernet port->PC Network;

Data from network to serial is: PC Network->N540’ Ethernet port->N540 COM-> PC’s COM.

The below picture is for your reference:



Default Parameter Test

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2. Overview

2.1. Brief Introduction

USR-N540 is used to transmit data transparently between TCP/UDP data packet and RS232/RS485/RS422 interface. It carries ARM processor, low power, fast speed, high stability and four serial port can work as RS232 or RS485 or RS422 serial interface which comfort to industrial standard.

2.2. Features

1. ARM base on Cortex-M4 kernel, and reliable TCP/IP protocol stack
2. Industrial working temperature range from -40C ~85C
3. Auto-MDI/MDIX,RJ45 port with 10/100Mbps
4. Support TCP server, TCP client, UDP, UDP server and HTTPD client work modes
5. One port corresponding to two socket
6. Support network printing via IP address
7. Function of Modbus gateway, modbus RTU to modbus TCP, modbus multi-host Polling
8. Four serial port, each port can work as RS232 or RS485 or RS422 and work individually
9. Distinguish which serial port connect to device via port number
10. Support virtual serial port and provide corresponding software USR-VCOM
11. Serial baud rate from 600bps to 230.4K bps; Check bit of None,Odd,Even,Mark and Space
12. Support static IP, DHCP/DNS and search devices within network through UDP broadcast.
13. Provide serial and network setting protocol, TCP/IP socket example code such as VB, C++ Delphi,Android,IOS
14. Built-in web page; Customized web page is acceptable
15. Reload button, one key to restore default settings
16. RJ45 with Link/Data indicator light, built-in isolation transformer and 2 KV electromagnetic isolation
17. The global unique MAC address bought from IEEE, also user can define MAC address
18. Upgrade firmware via network
19. Support web port revise (80 by default)
20. Keepalive, detect dead links and reconnect rapidly
21. Support account and password, used to page log in and network settings safely
22. Support one channel Web socket, realize bidirectional transparent transmission between web page and serial side
23. Power supply in two mode, DC adapter or 5.08-2 terminal pin
24. Communication indicator light of four serial port: RX/TX

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25. UPD broadcast function, can receive/send data to all IP in the same network
26. Support DDNS
27. Four serial port (can choose RS232/RS485/RS422 freely) default is DB9, provide the RS485/422 conversion
28. Provide upper TCP/IP socket example.

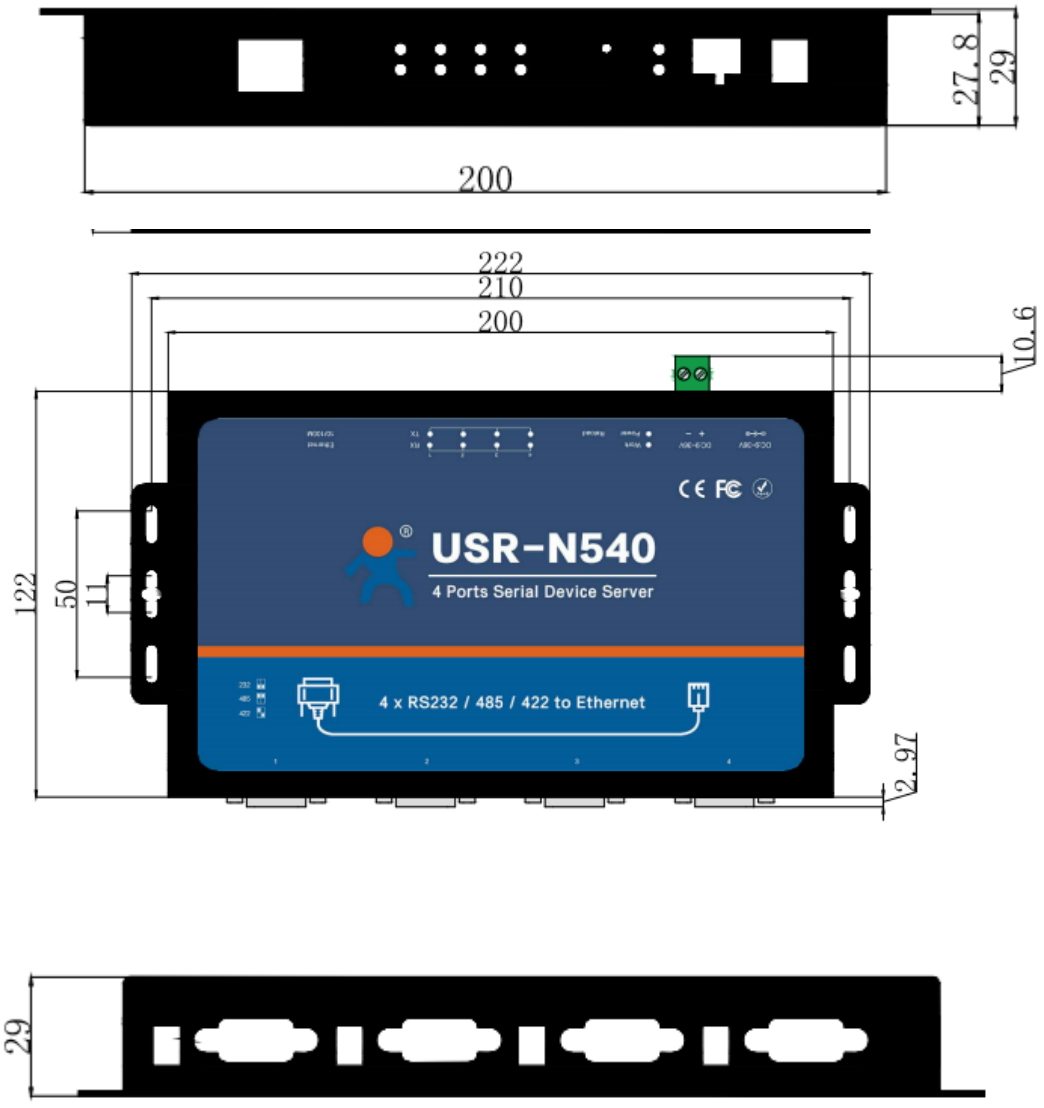
2.3. Basic Parameter

Parameter	Value
Input Voltage	DC5～36V
Working Current	95mA@5V
Power	<1W
Storage Temp.	-45～105°C, 5～95%RH
Net port	Rj45, 10/100mMbps
Serial port	600~230.4K(bps)
Software parameters	
Network protocol	IPV4, TCP/ IP, UDP, HTTP, DHCP, DNS, ARP, ICMP, Web socket
Access way to IP	Static IP, DHCP
DDNS	Support
User parameters	Software setting, webpage setting
Single transparent transmission	TCP Server/TCP client/UDP Server/UDP Client
Modbus	Modbus gateway
Webpage to serial port	Support the webpage to serial port in websocket communication
customize	Support
Synchronous baud rate	Support
Httpd client	support
TCP Server connection	At max connected 8
Net buffer	Send:16Kbyte; receive:16Kbyte
Serial port buffer	Send: 2Kbyte; receive: 2Kbyte
Average transport delay	<10ms
Set software	USR-VCOM, USR-Cloud, parameters setting software
others	
Certification	CE,FCC, ROHS

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Stable class	2KV ESD
SIZE	33.0x19.0x19.2 mm(L*W*H)
Operating Temp.	-40～+85°C
Storage temp	-45～+105°C
operating humidity	5%～95% RH
Storage humidity	5%～95% RH
Setting with delivery	none
Package	Electrostatic bubble

2.4. Dimension



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2.5. Indicators and Dial switch

2.5.1. Indicator light

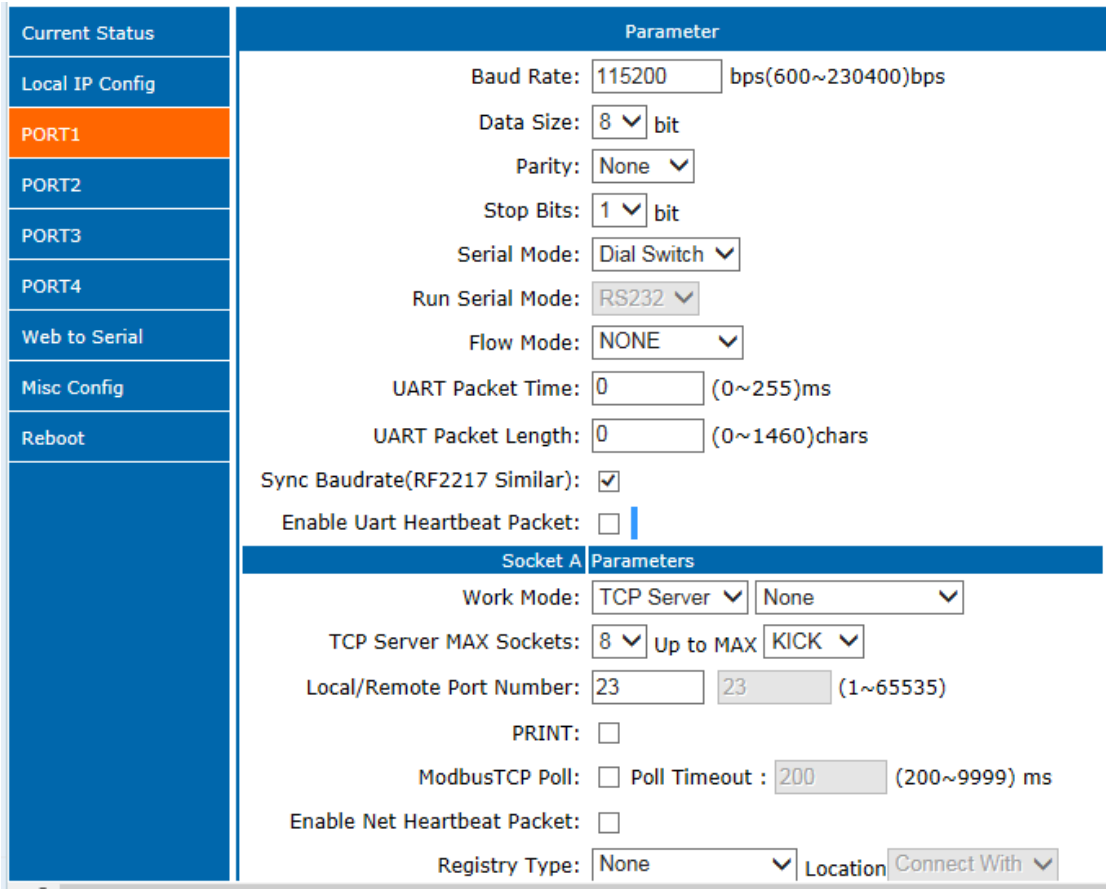


Indicator	Description
①Power	Indicate power. It is on when power is supplied
②Work	Indicate working status. It twinkles when N540 works well. If it is on or off for a period, N540 works improperly, you should cut the power and restart.
③TX1	It twinkles when port 1 sends data
④RX1	It twinkles when port 1 receive data
⑤TX2	It twinkles when port 2 sends data
⑥RX2	It twinkles when port 2 receive data
⑦TX3	It twinkles when port 3sends data
⑧RX3	It twinkles when port 3 receive data
⑨TX4	It twinkles when port 4 sends data
⑩RX4	It twinkles when port 4 receive data

2.5.2. Dial Switch

N540 setting serial port can using webpage or dial switch. When choosing the dial switch mode in webpage, the dial switch is on work; when setting serial port into customize mode, webpage is on work, the webpage is more priority than the dial switch.

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✧ For RS232 port, dial switch are down, such as the below picture.



✧ For RS485 port, dial switch are up, such as the below picture.

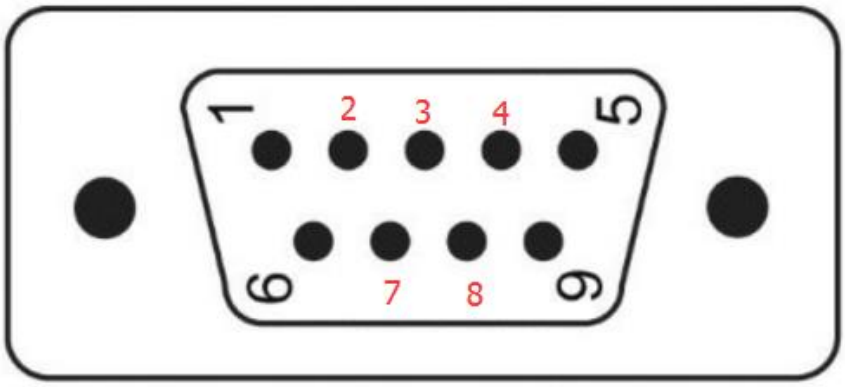


✧ For RS422 port, dial switch on the left are up, dial switch on the light are down,



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2.6. DB9 Pin Definition



✧ For RS232 port, pin definition is as below

Pin	Definition
2	RXD, pin of receives data
3	TXD
5	GND
7	RTS
8	CTS

✧ For RS485 port, pin 3 works as “B(-)”, Pin 7 works as “A+”

✧ For RS422 port

Pin	Definition
2	RX+, pin of receives data
3	TX-
5	GND
7	TX+
8	RX-

2.7. DB9 Pin-board

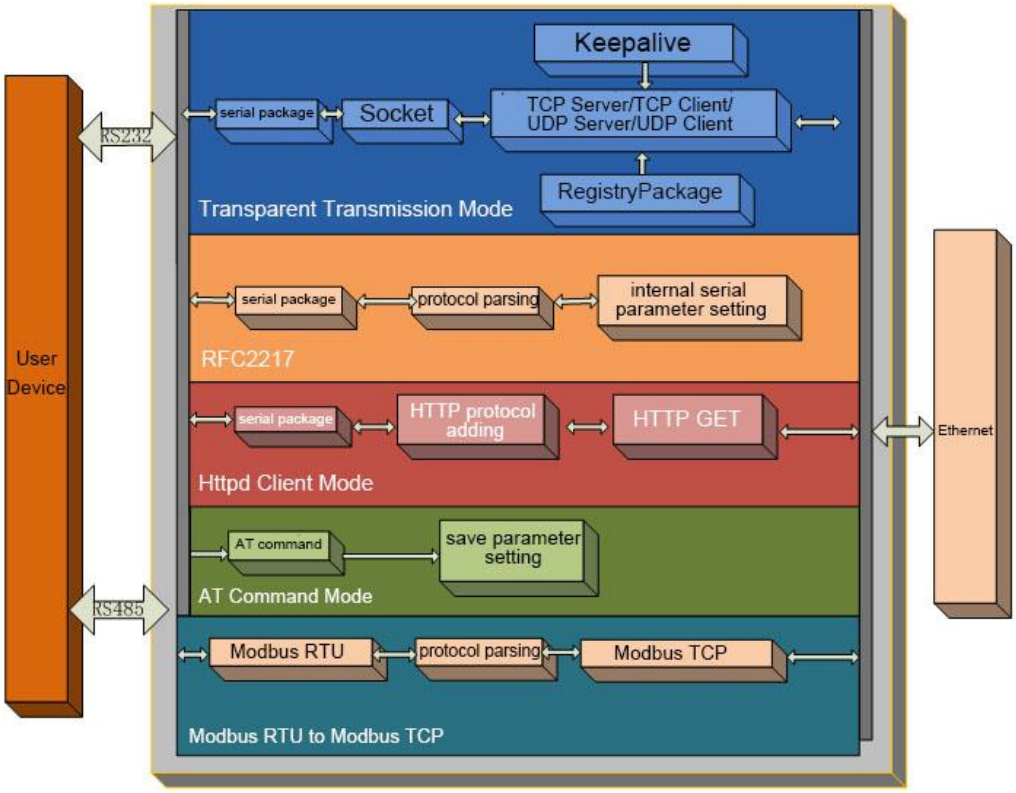
We provide DB9 pin-board for user to use terminal connection.

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Type	1	2	3	4	5
RS232		TX	RX		GND
RS485	A+	B-			GND
RS422	T+	T-	R+	R-	GND

3. Product Function



USR-N540 Function Diagram

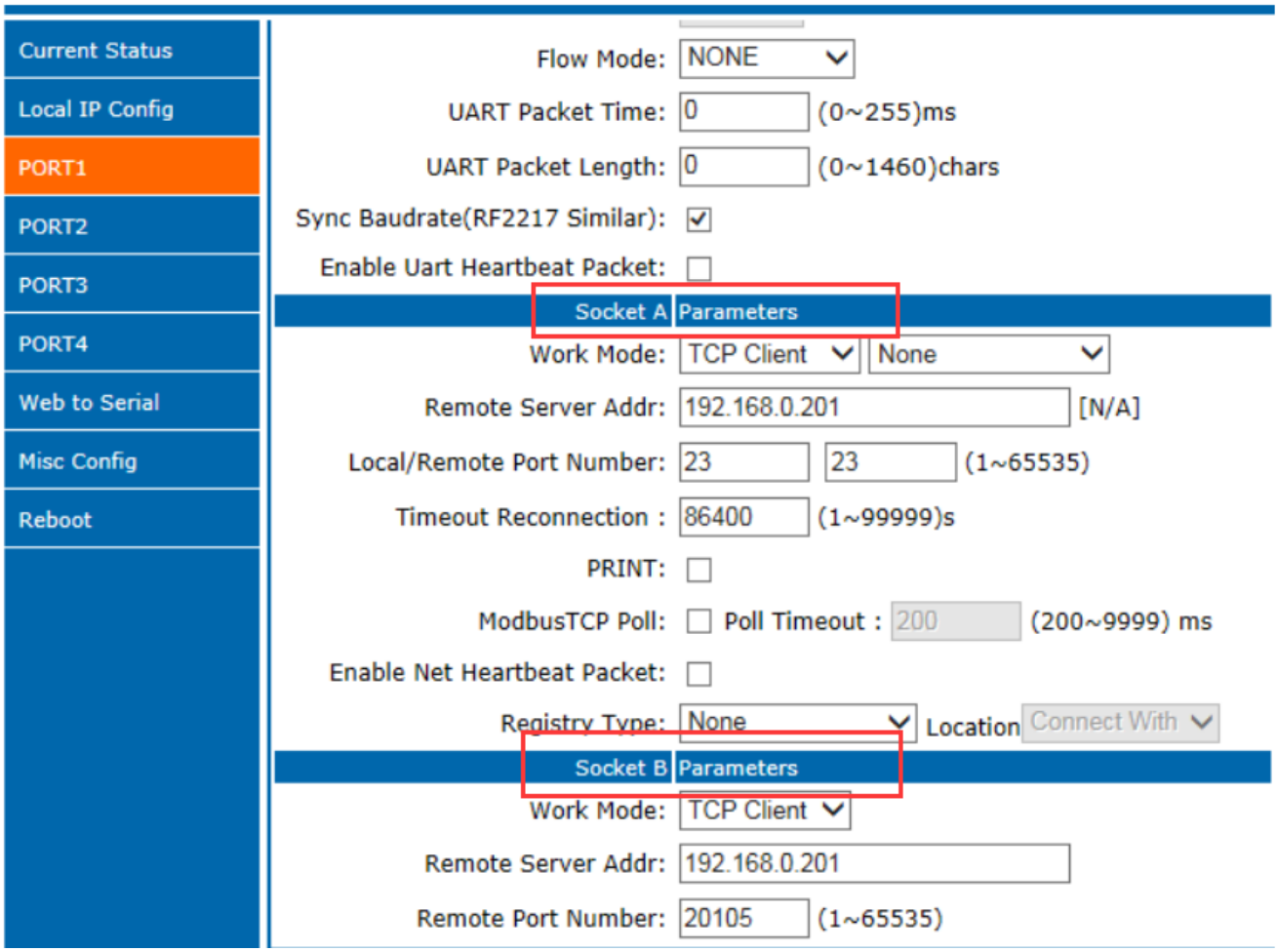
Each serial port corresponds to two socket: socket A and socket B. Socket B can be opened or closed.

Notes: USR-N540 supports double sockets. It means one serial port corresponds to two sockets.

Socket A: Supports TCP client, TCP server, UDP client, UDP server, Httpd client

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Socket B: Only support work mode of TCP client, UDP client.



3.1. Socket A Communication

3.1.1. TCP Client Mode

1) Different from UDP mode, in this mode, connection has status of disconnection and remaining. Connection is still remained although USR-N540 does not send data.
2) Identify disconnects. After connection built, it sends keepalive searching packet every 15 seconds. Once there is an interrupt, it can be detected rapidly then make USR-N540 disconnect from former connection and reconnect.
3) It will connect to same source port when USR-N540 try to connect server and local port is not “0”.
4) It supports USR Synchronous baud rate (Similar RCF2217), which can revise USR-N540’s serial parameter as baud rate accordingly. This function should be combined with USR-VCOM.
5) Under the same LAN, USR-N540 must be in the same network segment then can communicate. If not, USR-N540 must be set with right one.

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6) Support USR Cloud (http://console.usriot.com)
7) Support Modbus TCP function.
8) USR-N540 work as TCP Client, it connects to TCP server, Destination IP and port should be cared. The IP can be device with same LAN, also can be different LAN or cross public network. If it connects to server cross public network, the server should have public IP.
9) USR-N540 work under TCP Client, It connects to the target IP/Port automatically, will not accept other connection request.
10) As TCP Client, need to set USR-N540's local port number to be "0 then it can visit server with randomized port number, so that it can solve unsuccessful re-connection in case server judge connection status abnormally and shield USR-N540 re-connection request.
11) Test Example

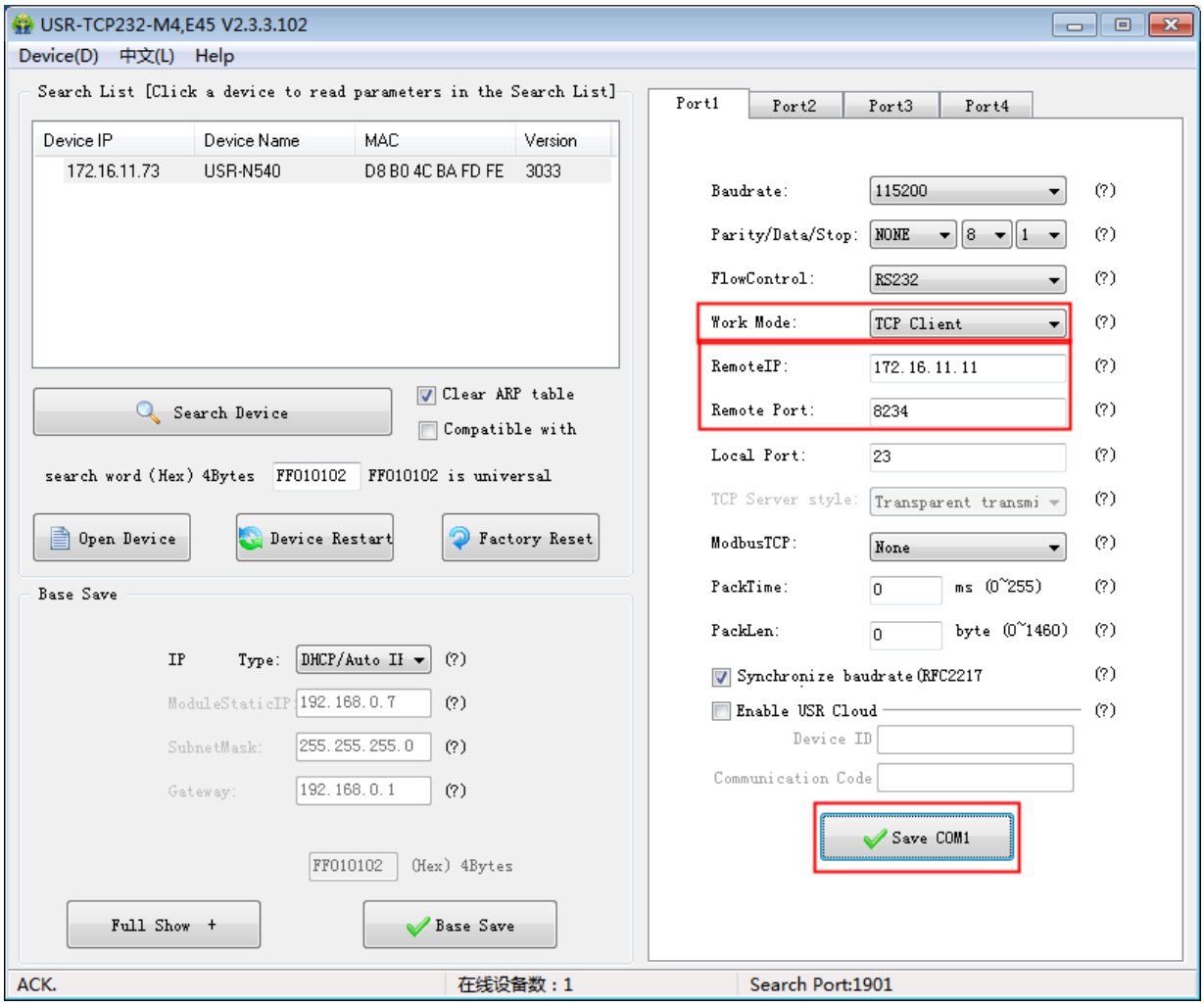
① Open "USR-TCP232-M4_E45 setup" software.

Set USR-N540 as TCP Client, Remote IP: 172.16.11.11 Remote port: 8234

Notes: Default IP address and type is static IP at 192.168.0.7. But in order to keep the device and PC in the same network segment to make the communication correct so we change IP type as DHCP. Just likes the following picture.

Click "Save COM1", and search USR-N540.

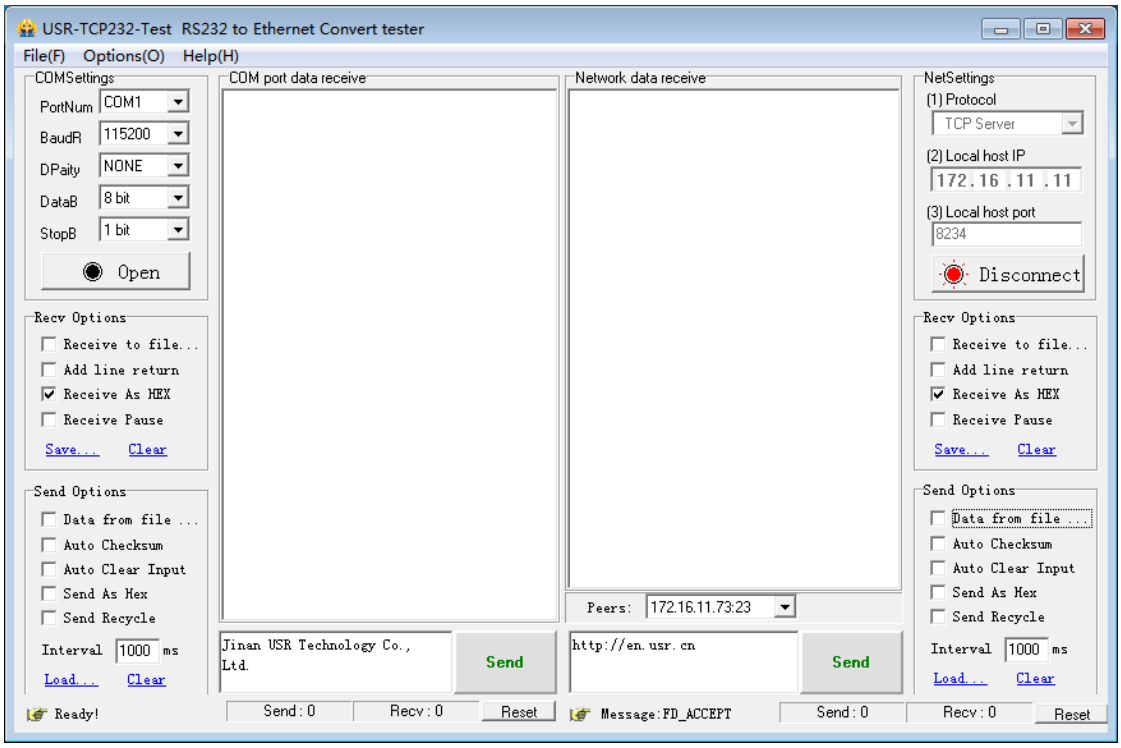
Then check if the parameters are correct when USR-N540 is found.



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② Open “USR-TCP232-TEST” software:

Need to connect to PC’s TCP Server, its IP: 172.16.11.11, Port number: 8234, Click “Listening”

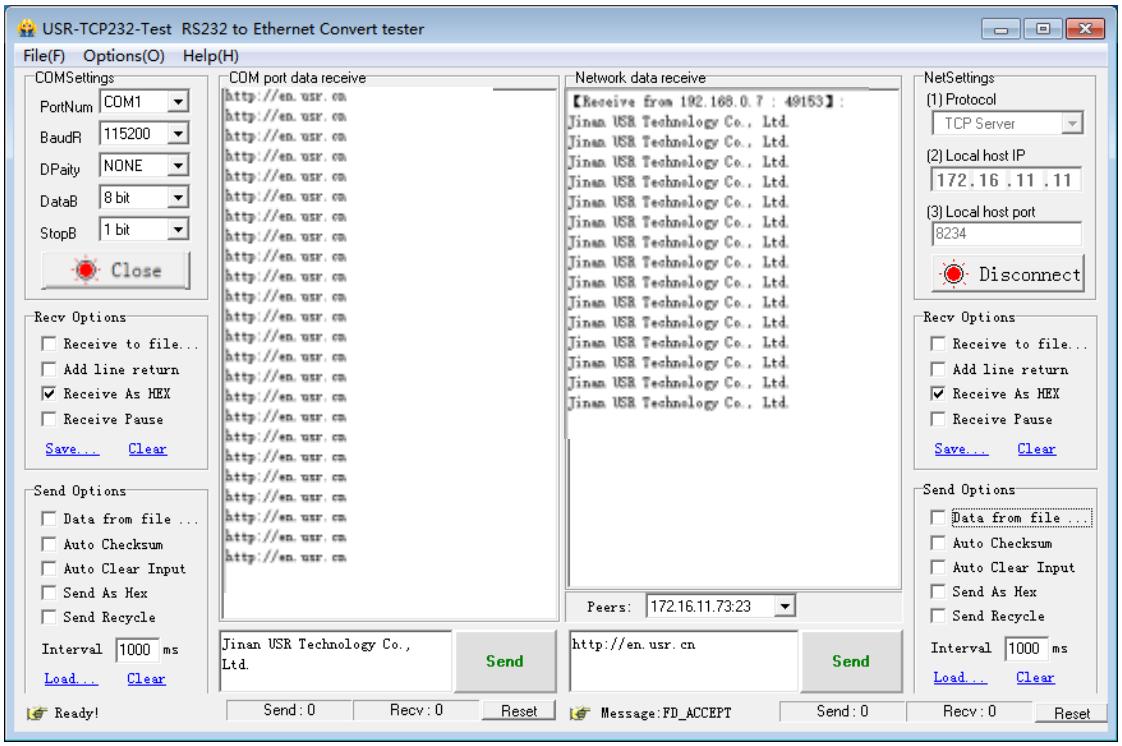


TCP Client Test Screen shot

③ USR-TCP232-TEST software:

Configure serial parameter. Click to open the port. Test software network part shows connection message:192.168.0.7:49153(port# assigned randomly). Click “send”, you can gain data from each side.

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TCP Client Software Configuration

3.1.2. TCP Server Mode

1) Different from UDP, in this mode, connection has status of disconnection and remaining. Connection is still remained although USR-N540 does not send data.
2) USR-N540 listens to local port set firstly, respond and build connection when there is a connection request. Serial port will send data to all client which connected with USR-N540 at the same time once serial port received data.
3) It supports USR Synchronous baud rate (Similar RCF2217), which can revise USR-N540 serial parameter as baud rate accordingly. This function should be combined with USR-VCOM.
4) Support Modbus TCP function.
5) It support 8 clients connections at max.
6) Under TCP Server mode, USR-N540 listens to local port actively and will not monitor connected IP and port. When the 9th client is connected, the oldest one will be ticked.
7) Test Example

① Set USR-N540 as TCP Server Mode, local port 23, same as default.

② Open ”USR-TCP232-TEST” Software, on the side of Net Settings:

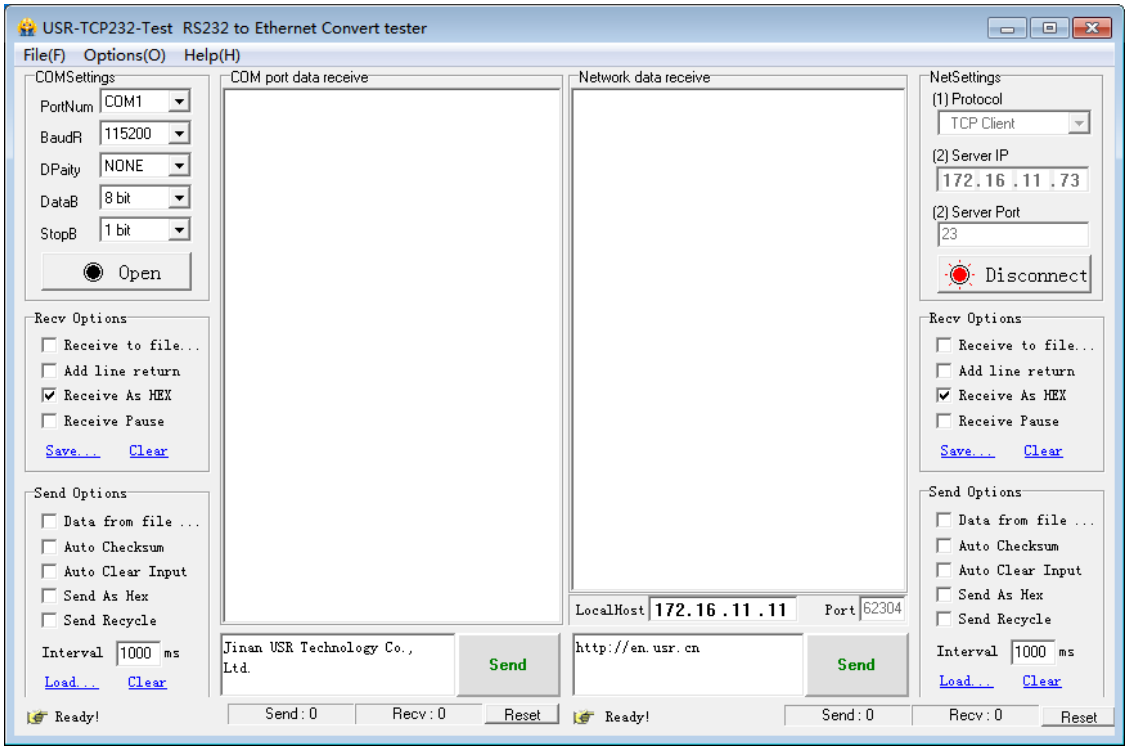
Protocol: TCP Client

Server IP/Port: the same value as the device IP N540

Default IP address and type is static IP at 192.168.0.7 You can find it in the “USR-TCP232-M4_E45 setup” software you are using.

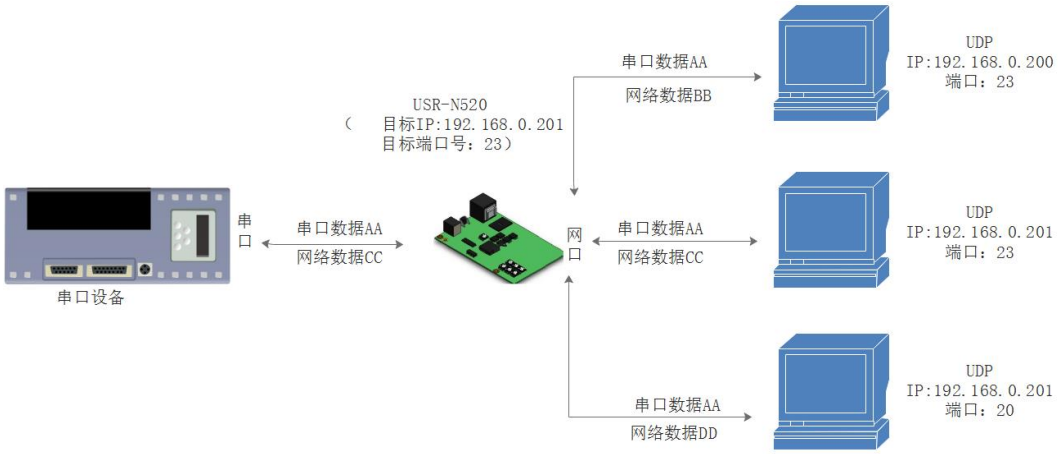
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③ Click ”Connect” to test data transmission.



TCP Server Test Screenshot

3.1.3. UDP Client Mode



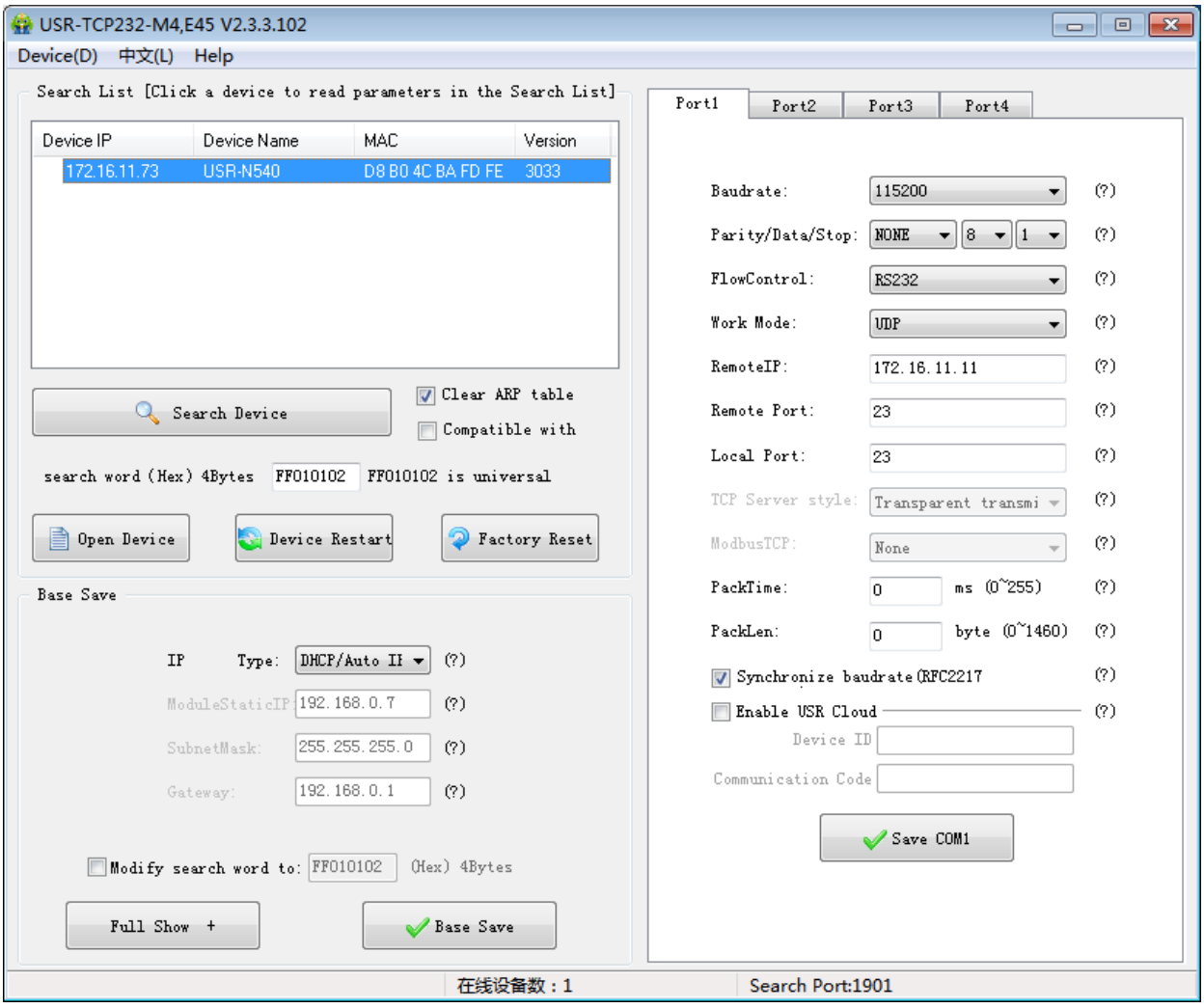
1) It subjects to UDP protocol, no connection, just only sending data.
2) USR-N540 only communicate with destination port of IP. Otherwise, the data cannot be received.
3) Under this mode, destination Address is 255.255.255.255, then it can make UDP broadcast and receive broadcast data. Broadcast within segment as 192.168.0.255, it can be sent but cannot be received currently.
4) Under UDP Client/ UDP Server mode.
5) Test Example：
   ① Open USR-TCP232-M4, E45 Setup Software: build a UDP firstly. PC’s IP is 192.168.0.95. Port to be listened

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is 20108.

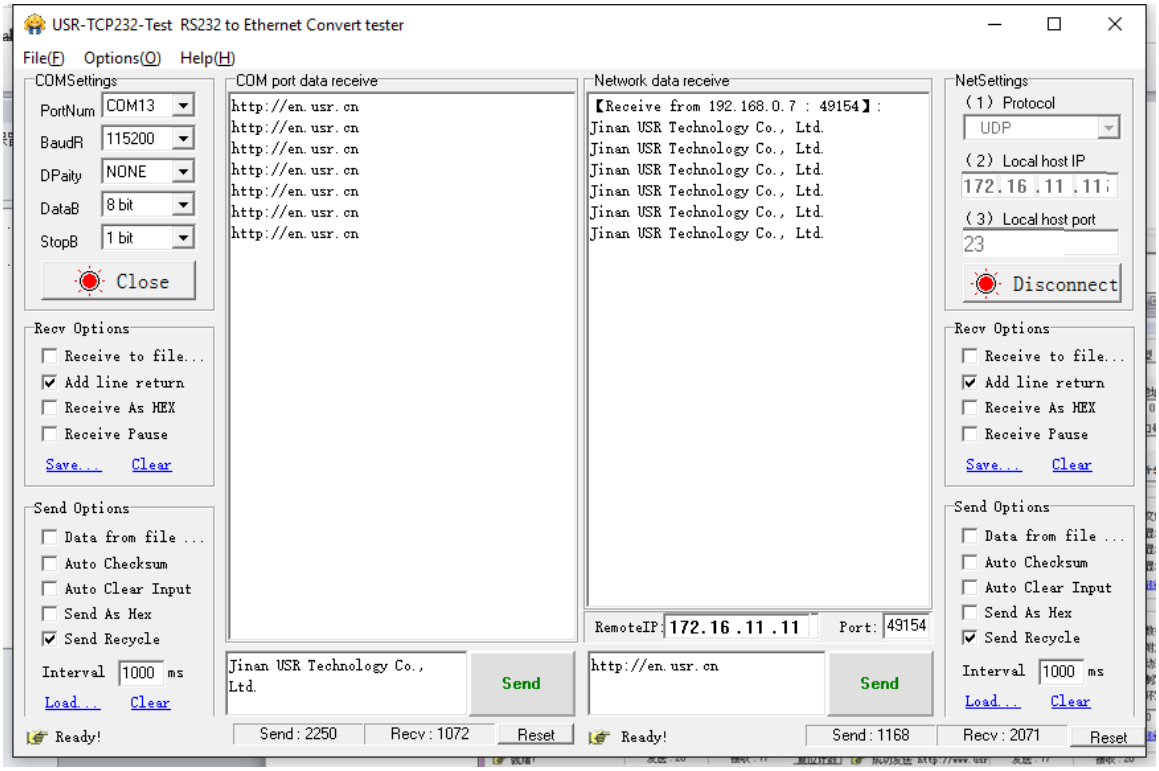
② Open USR-TCP232-TEST Software: set USR-N540 as UDP Client, destination port: 20108.

③ Click “Send” at serial side. Remote IP and port becomes USR-N540’s after receiving the data. Then click “Send” in network part and send data to COM.



UDP Client Software Configuration

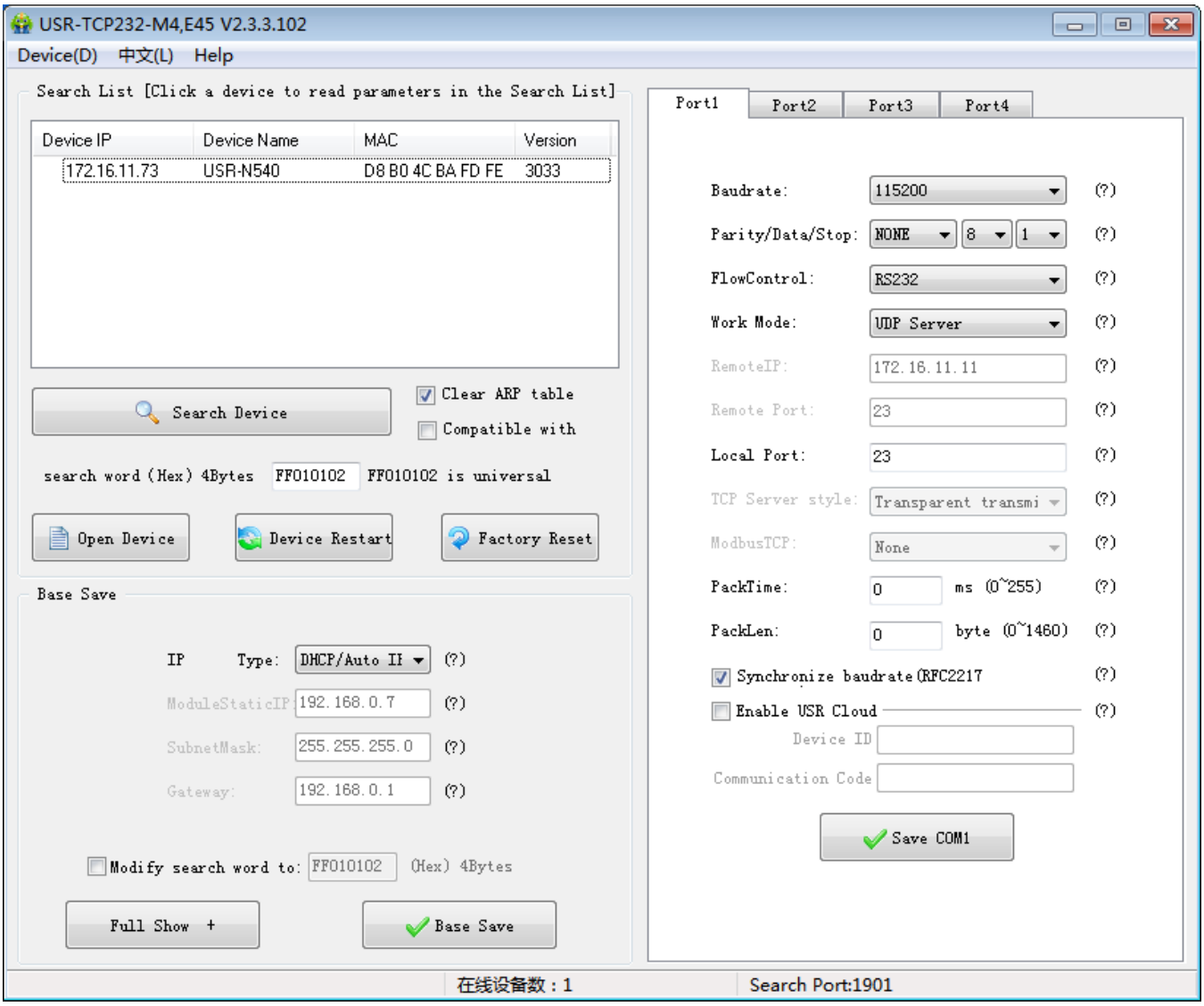
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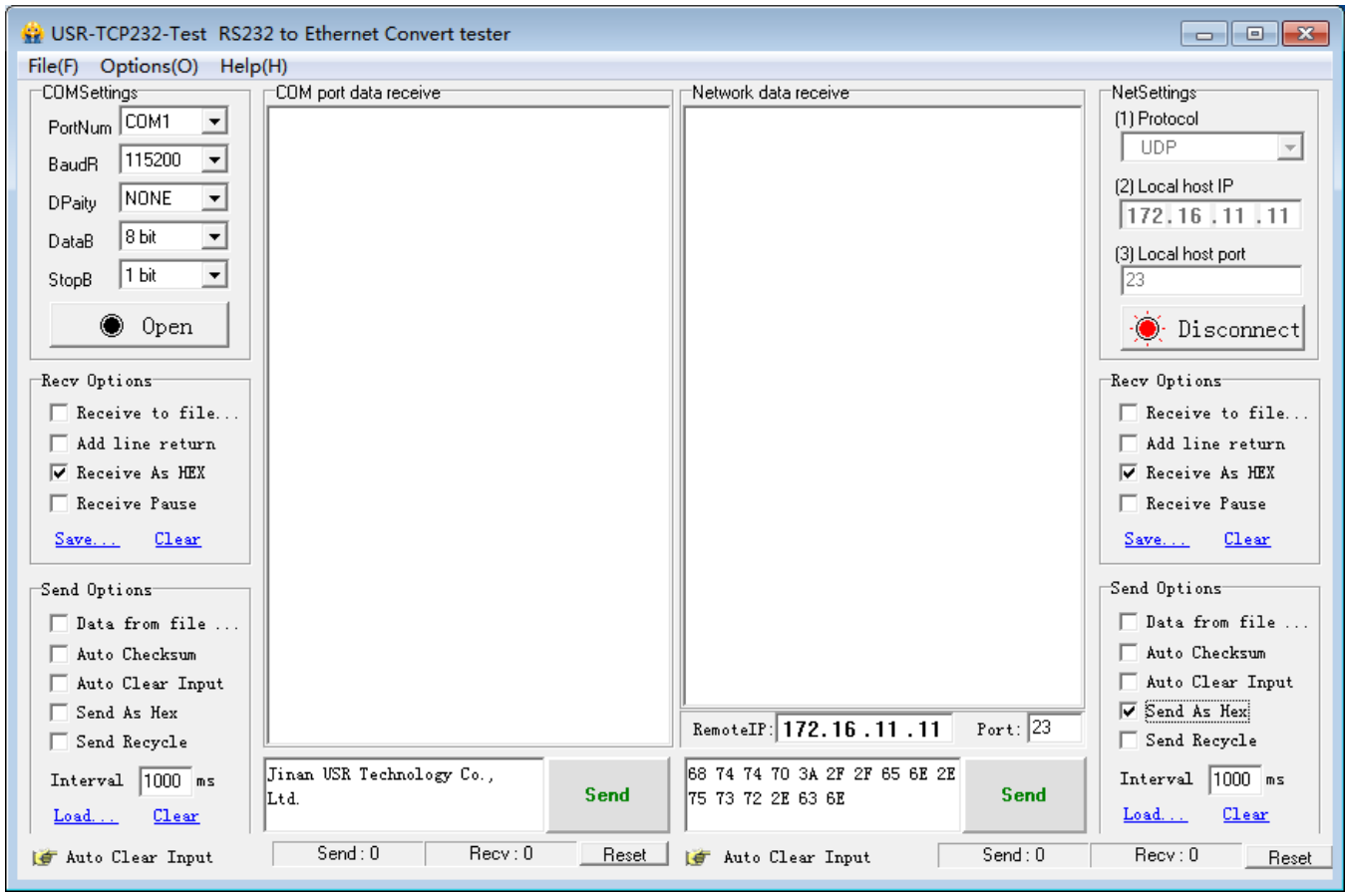
UDP Client Testing Screenshot

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3.1.4. UDP Server Mode



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1) Base on normal UDP, it doesn't verify source IP address. Every time USR-N540 receive one UDP data packet, it changes destination IP to where data comes and it sends the data to the IP and port which communicate latest.

2) Test Example：

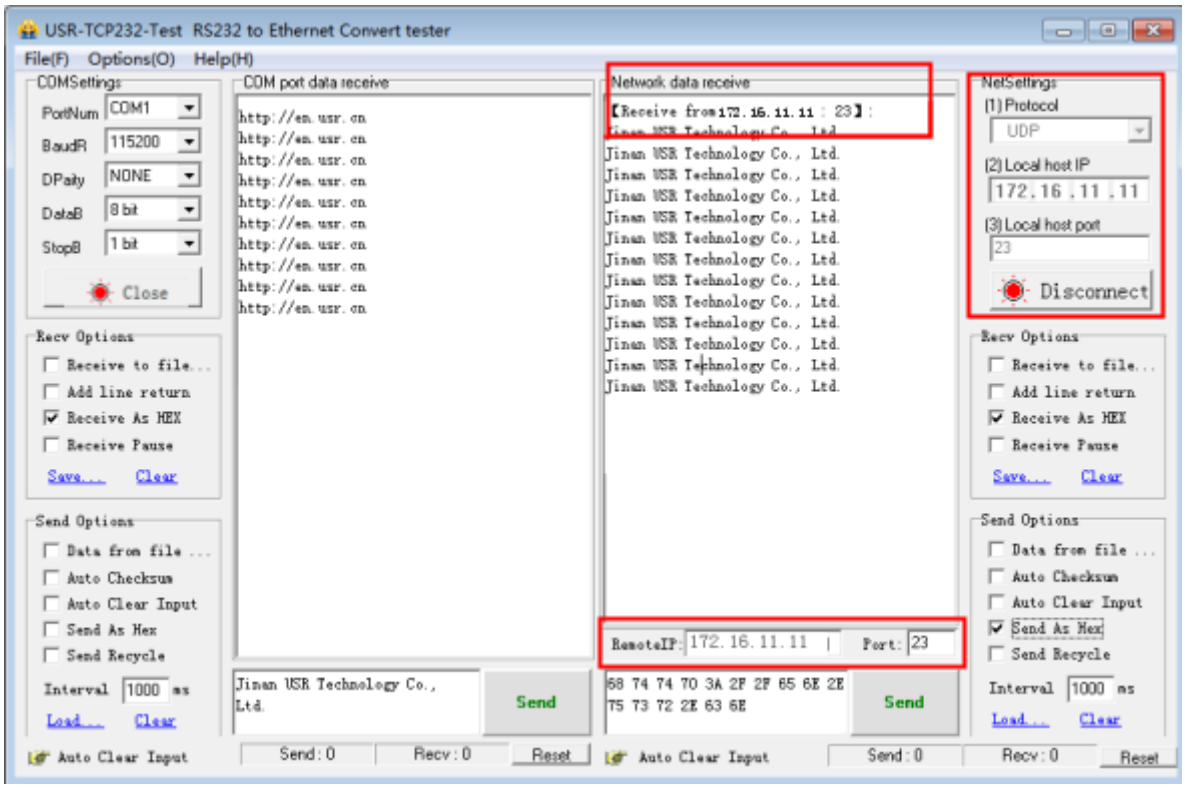
① Open “USR-TCP232-M4_ E45 Setup” Software: Set USR-N540 as UDP Server, local port: 23.

② Open “USR-TCP232-TEST” Software twice. Set work mode as UDP, remote IP and port same with USR-N540’.

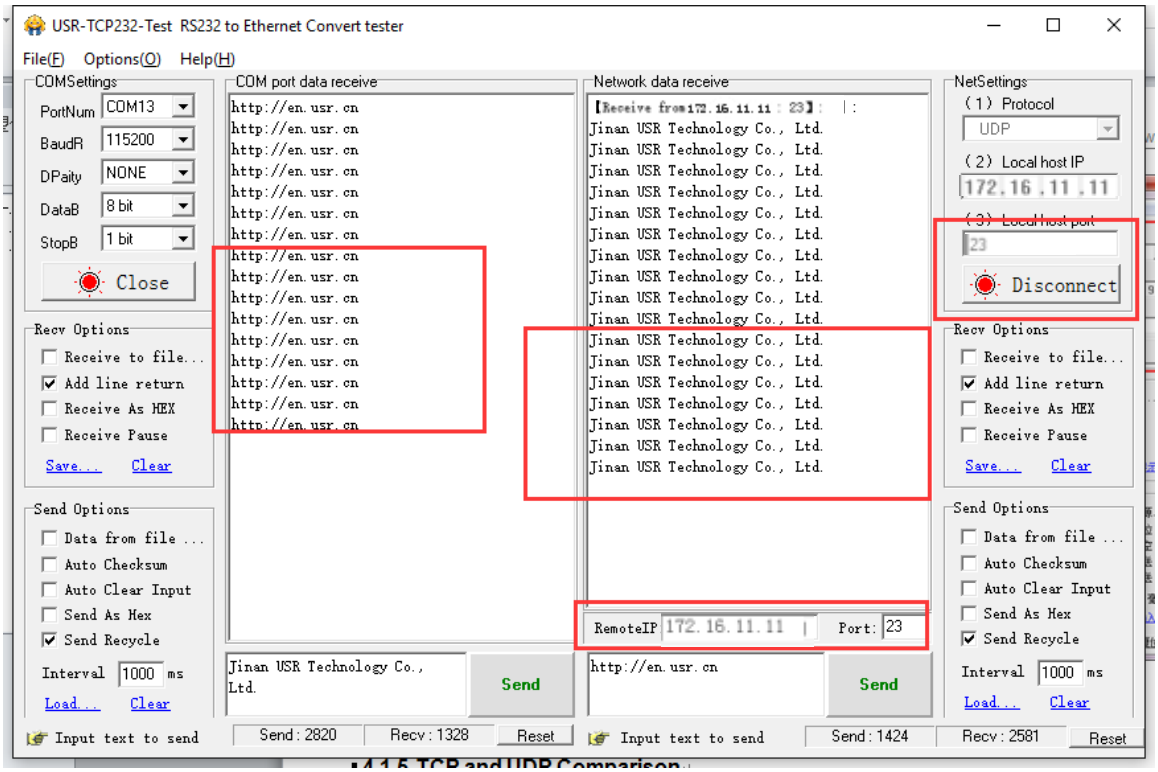
Click “Send” then the COM receive data.

Click “Send” at serial side, only the software communicate latest can receive the data.

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UDP Server Test Screenshot



UDP Server Test Screenshot

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3.1.5. TCP and UDP Comparison

	TCP	UDP
Advantages	Stable, no loss Reliable connection mechanism Resend after data sending fails	No Connection mechanism, simple, flexible Suit for small packet and high frequency Accurate data sending interval
Disadvantages	Long packet starting Jam for small packet and high frequency Inaccurate interval resulted from check and resend mechanism	More less under bad network environment

3.1.6. HTTPD Client

It is used to transmit data from USR-N540 to HTTP server or gain data from HTTP server.

USR-N540 can handle complex HTTP protocol so user just do programming for serial, and not need to worry about HTTP.

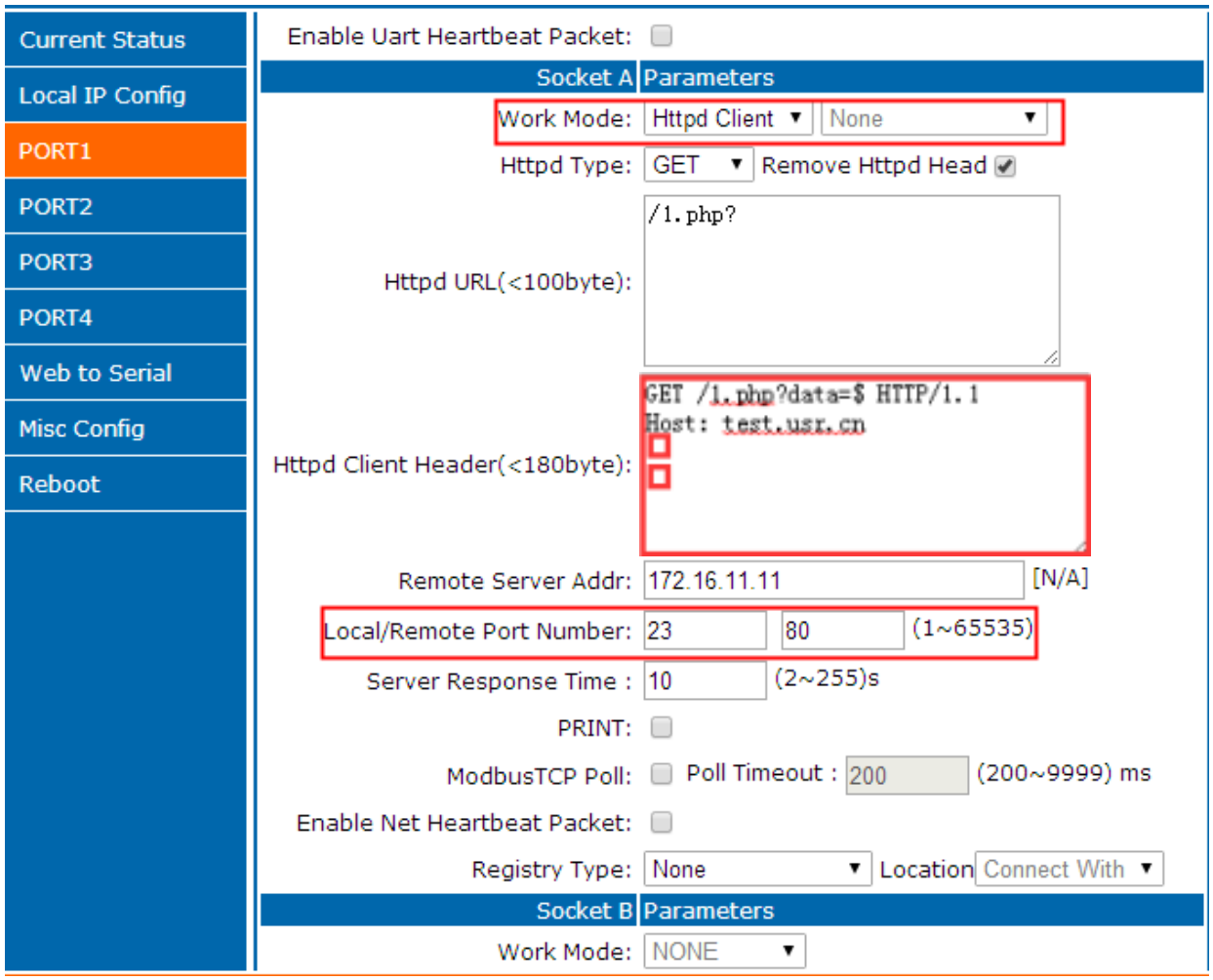
When USR-N540 sends data to HTTP server via serial port, it only needs to send the header of requested data; All the returned data will be transmitted by USR-N540, user need to analyze the packets.

Test Example：

1) Entry http://192.168.0.7 (N540's IP) to open its web page

1. Set USR-N540 as HTTPD Client.
2. Set HTTPD packet Header.

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HTTPD Client Web page Configuration Screen shot

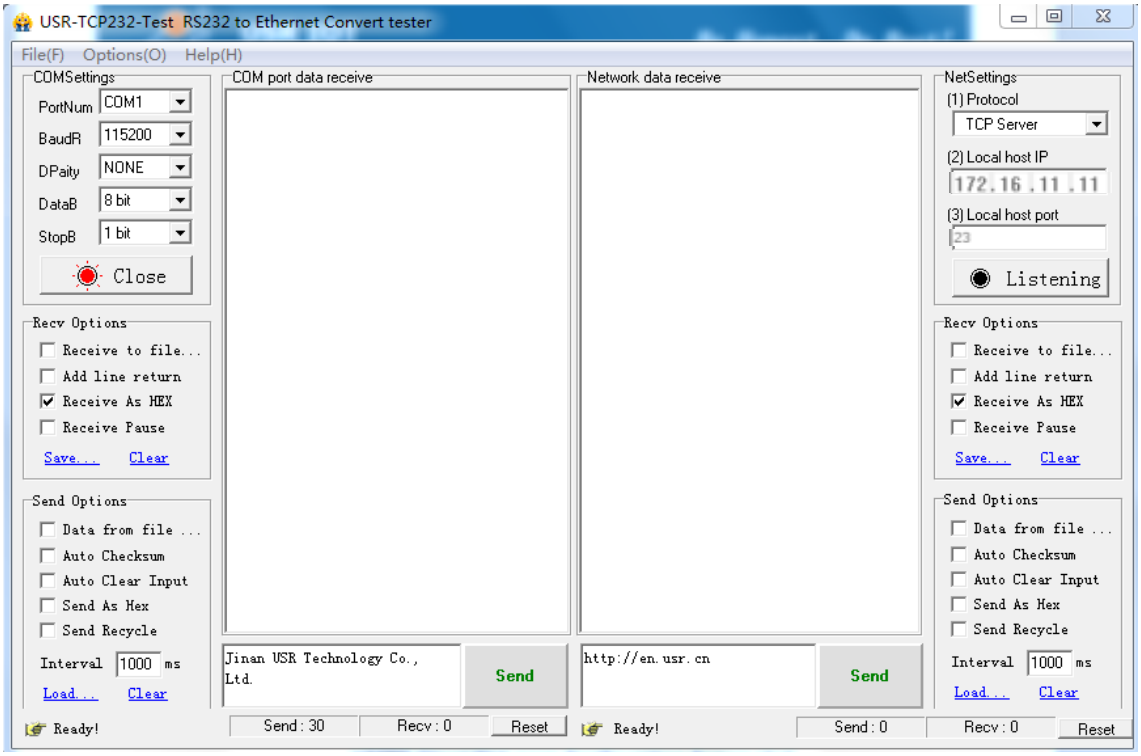
<Note>:

- HTTPD Client only support GET to request HTTPD Server. POST will be available in the following.
- GET/ is fixed packet header.
- 1.php?data= is the visited/submitted the page
- $ stands for data sent by serial (Serial port does not need to send "$")
- HTTP/1.1 is requested protocol.
- Host is means requested IP address/ domain.
- Enter twice

2) Save the parameters and restart USR-N540.

3) Open serial port to send data, then the data can be submitted onto our webpage server.

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HTTPD Client Test Screenshot

3.2. Socket B Communication

USR-N540 support double socket communication mode, socket A and socket B. One serial port corresponding to two socket communication mode can be realized through setting the parameter of socket B.

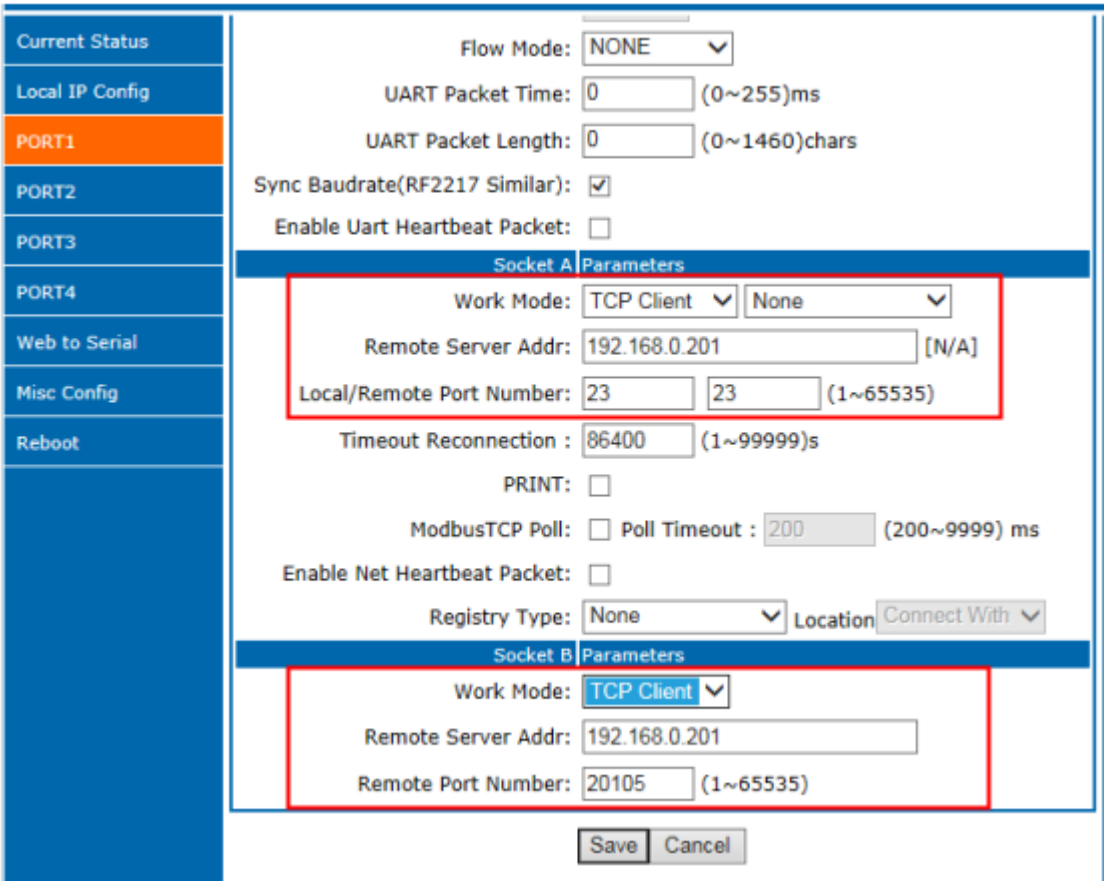
Notes: socket B is only used for transparent transmission and only worked as TCP client or UDP client.

Set USR-N540 as double socket communication mode, the data of serial port will be transparently transmitted to socket A and socket B at one time. When data comes from socket A and socket B simultaneously, USR-N540 will transmit the data of socket A to serial port firstly, and then transmit the data of socket B once the data of socket A finished.

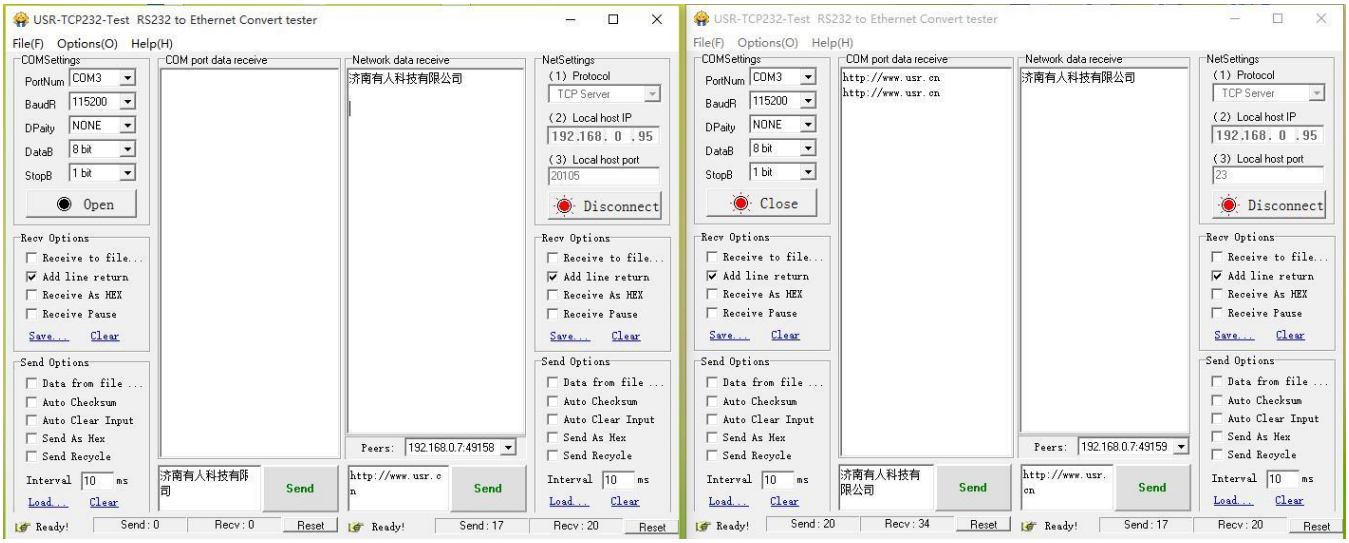
Communication example:

1. Set the parameter of socket A and socket B by web page

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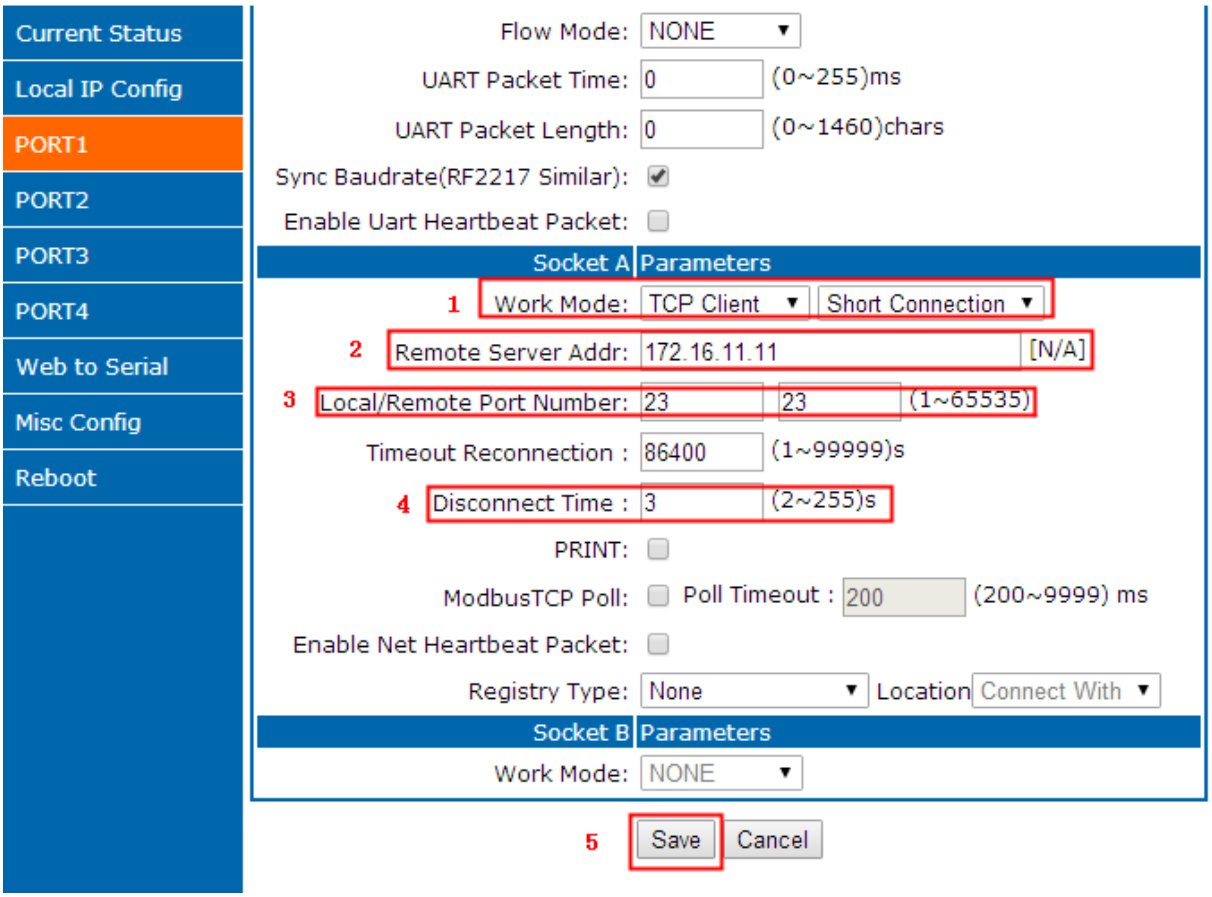
2. Set up socket A and socket B by “USR-TCP232-Test.exe”, and open serial port which connects to server.
3. Click “Send” on the software, data will be transmitted from socket A and socket B to serial port.



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3.3. Short Link

Short link means that the server is not connected at the beginning. It will connect to the server after the serial ports receives the data and then sends the data. If there is not data transmission in the serial port after sending the data, device will disconnect with the server. Short link can save server resources to avoid maintaining too many useless connections.



- Only for the mode of TCP client
- Disconnect time: Only for TCP client. If the network failure causes the link to break, the device will actively connect to the server within fixed time

3.4. USR-VCOM Application

It solve the transmission problem of traditional device PC software working as COM. USR-VCOM （Virtual com software) support receiving data from set COM and send serial data out as network.

How to connect USR-N540 with Virtual COM:

1. Set USR-N540 as TCP server
2. Open USR-VCOM software, click “Add COM’ and select COM2 (Avoid existed COM).

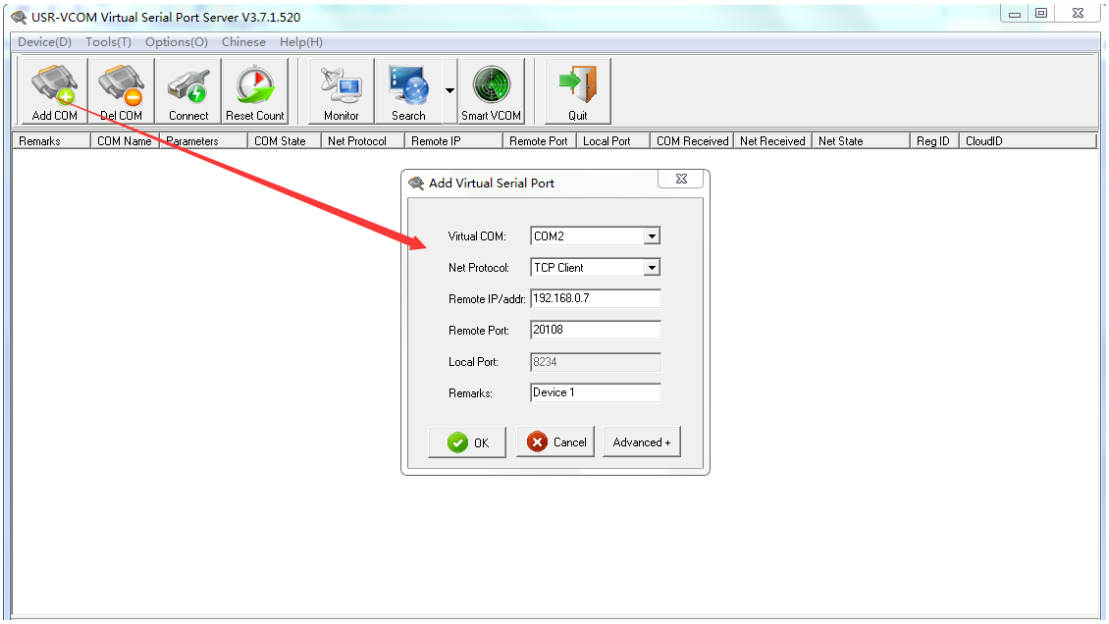
Net Protocol: TCP Client

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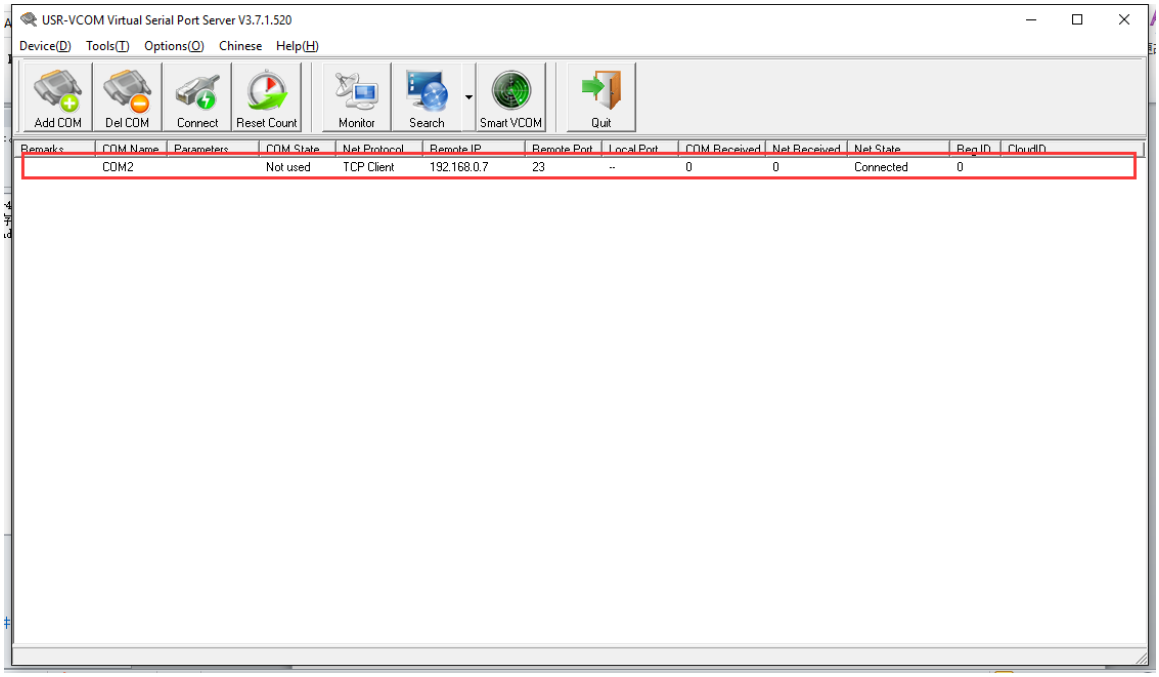
Remote IP and port is the same one with USR-N540

Remarks: Can write the name of device

3. Click “OK’ to check whether connection is built. “Connected” sow ready for data transmission.



USR-VCOM Add a COM



USR-VCOM Build Connection

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3.5. Modbus Gateway

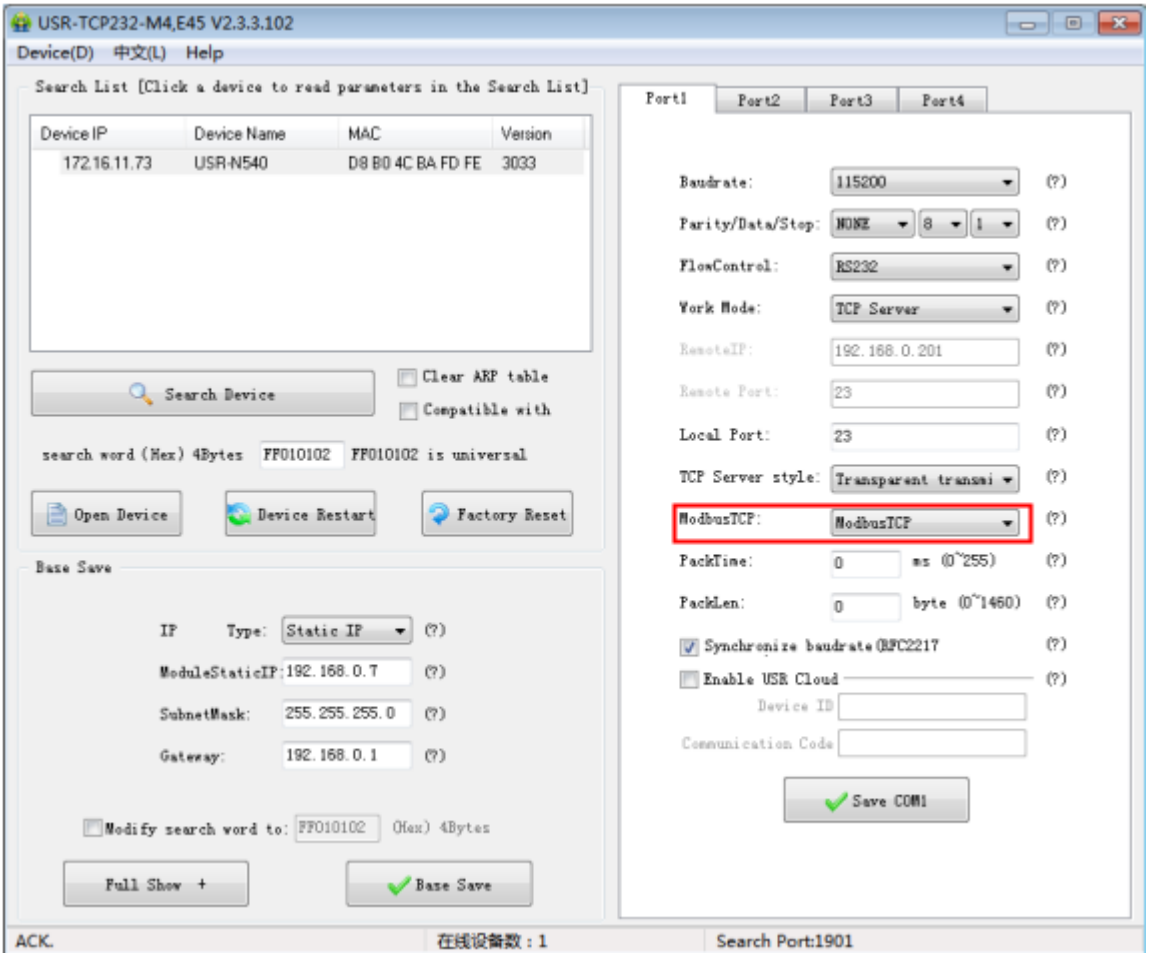
3.5.1. Transmit Modbus Protocol in Transparent Mode

USR-N540 supports the transmission of modbus protocol in transparent mode

3.5.2. Modbus RTU to Modbus TCP

USR-N540 support Modbus RTU to Modbus TCP, setting method as below:

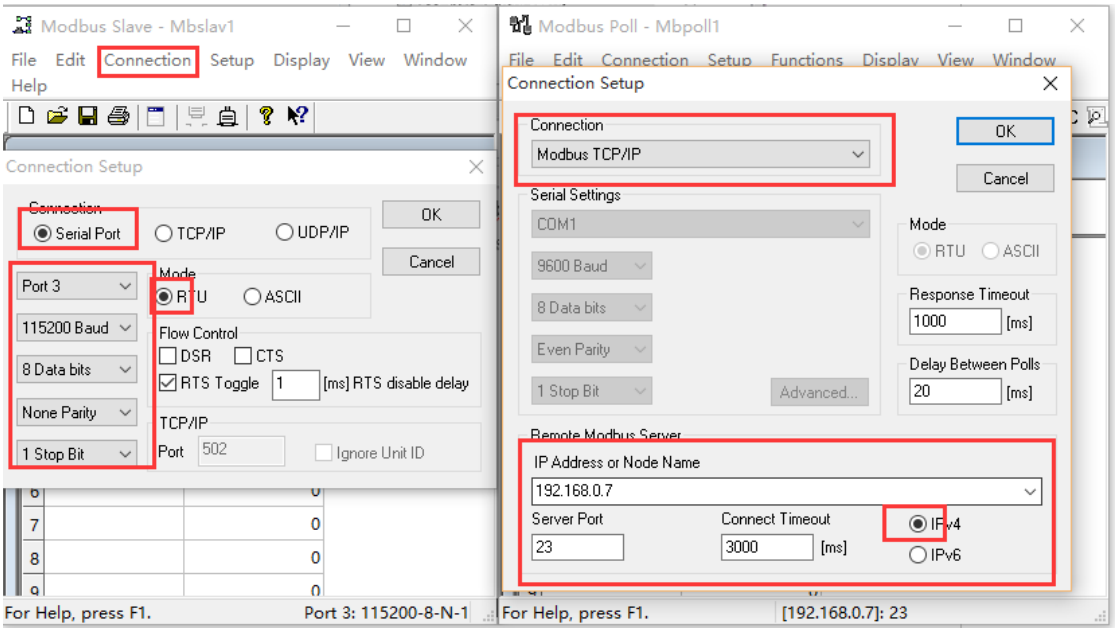
1. Open USR-TCP232-M4,E45 Setup Software, set USR-N540 as TCP server or TCP client.
2. Select “ModbusTCP” on the red color
3. Click to save the parameter



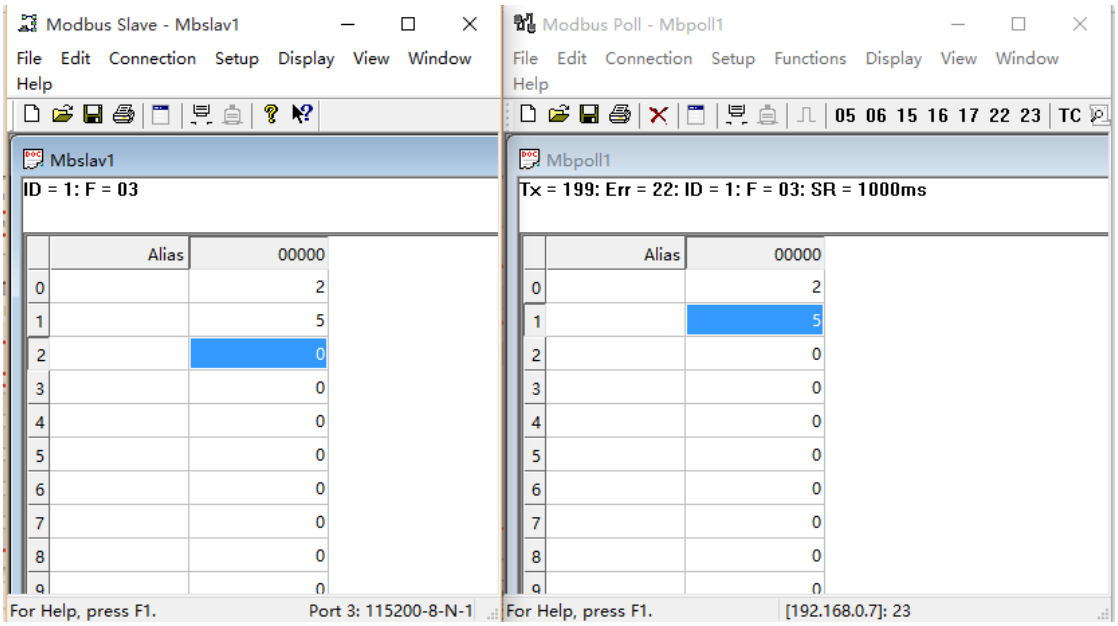
Modbus TCP Configuration

4. Check and verify Modbus RTU to Modbus TCP through modbus Poll and Modbus Slave
5. Setting modbus software is as below:

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6. Click OK once configuration finished, update the data of modbus slave and modbus data will also be updated.

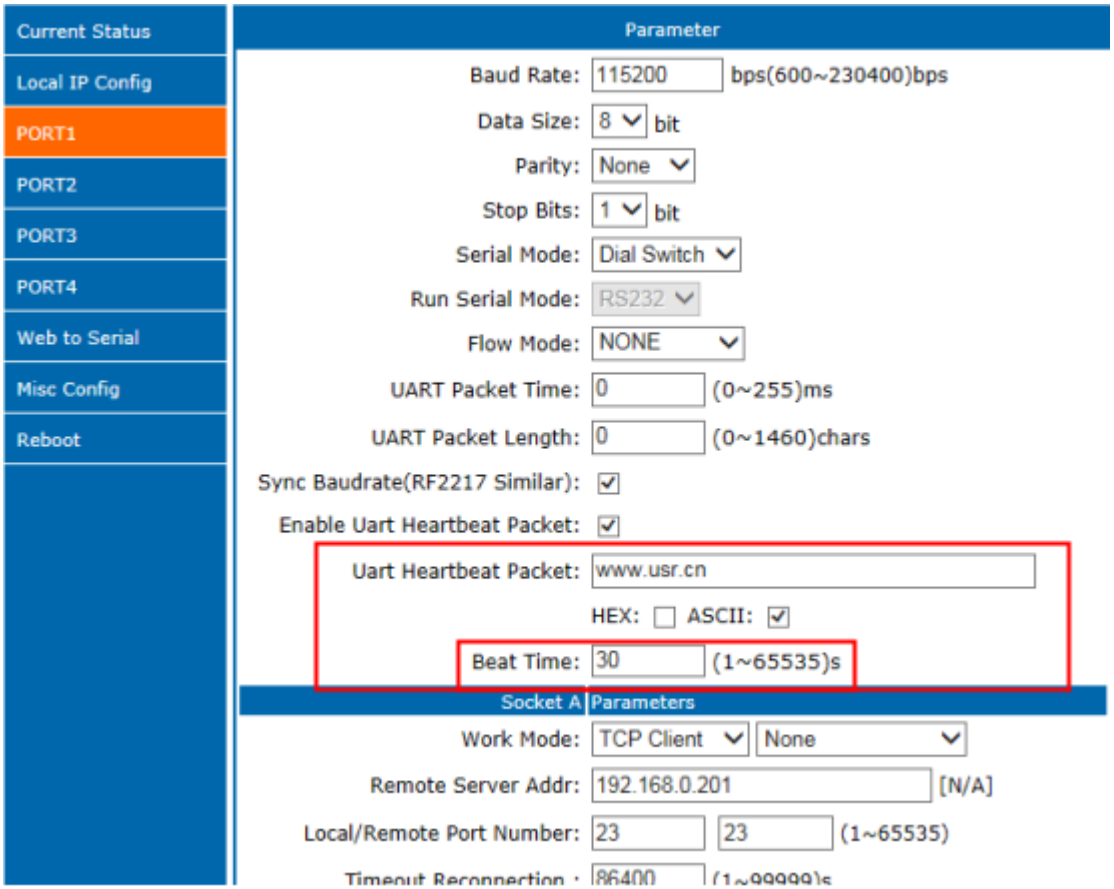


3.5.3. Modbus Active Query Function

Modbus active query function can be realized through the serial heartbeat packet function of USR-N540.

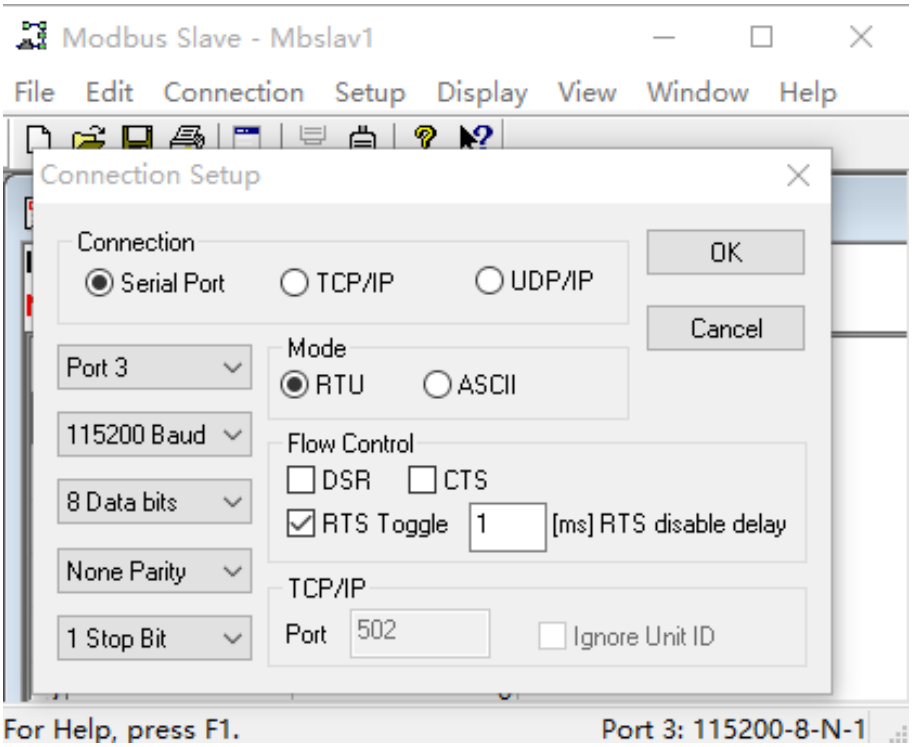
1. Open serial heartbeat packet function via web page, query command is heartbeat packet data, example:

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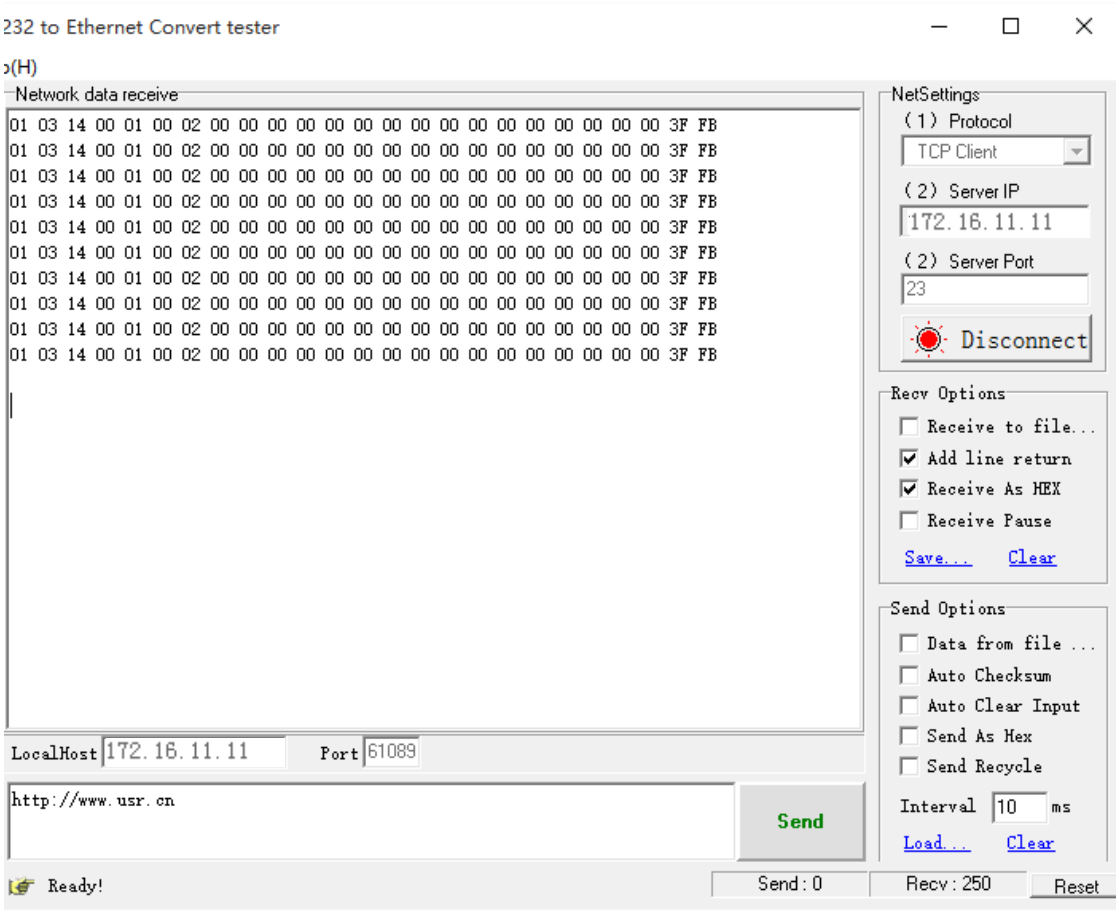
2. Set modbus slave software, refer to the following:

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3. Return result for query command is as drawing:

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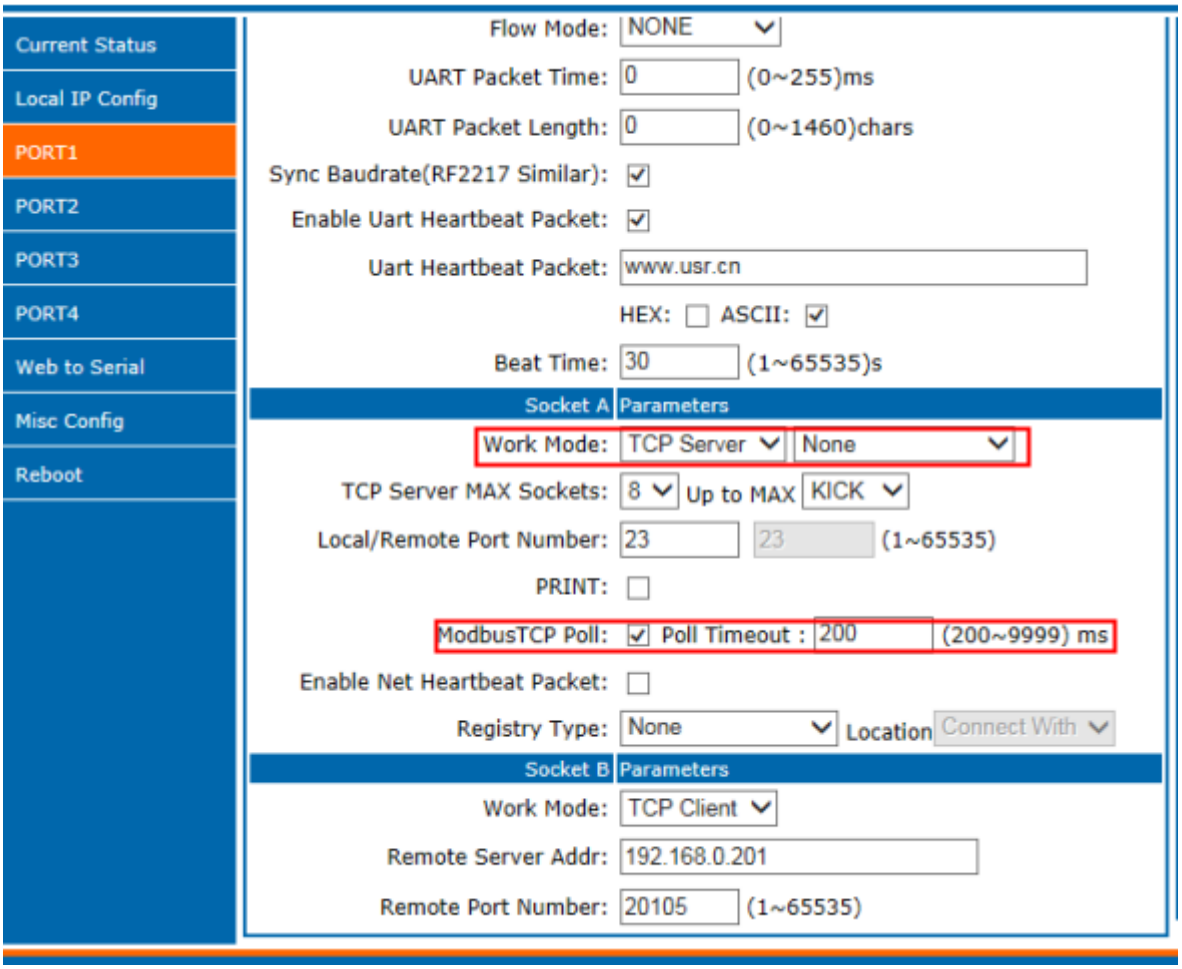
3.5.4. Modbus Polling

USR-N540 support modbus polling function under TCP server mode. Set USR-N540 as Modbus Poll, support multiple host polling to check parameter.

1. Multiple host polling is realized through virtual com.

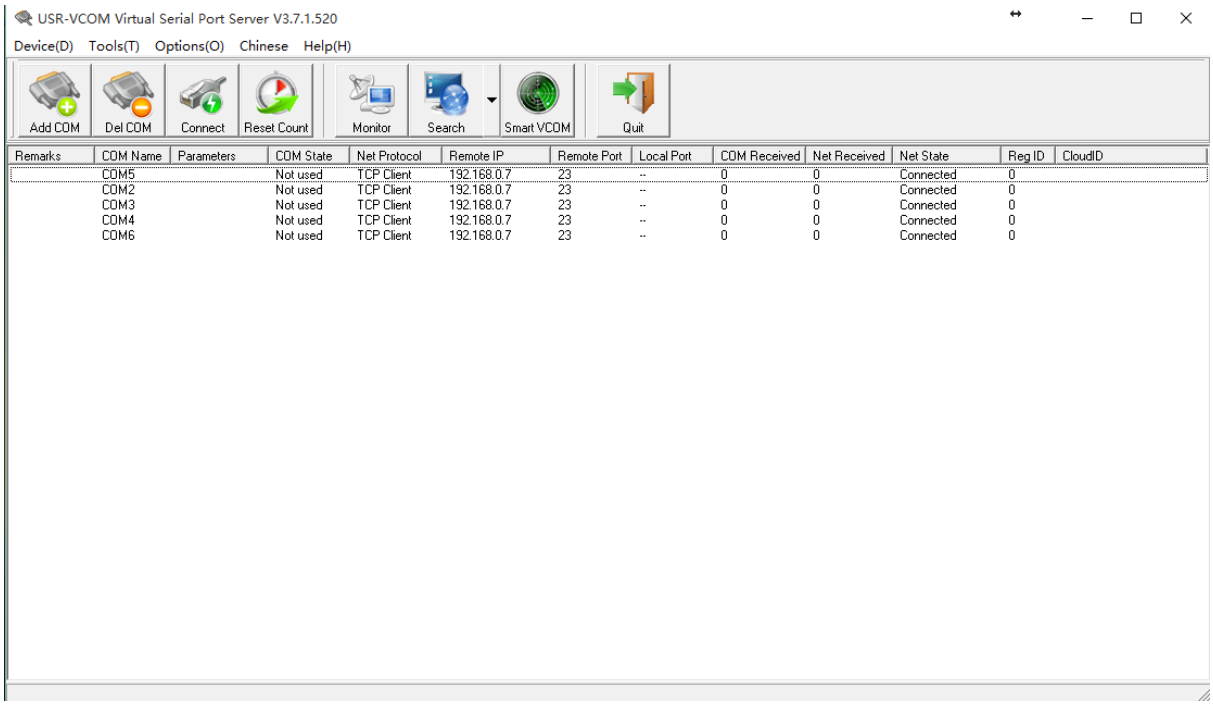
① Set parameter of USR-N540 via web page, make sure to select Modbus TCP Poll and set time

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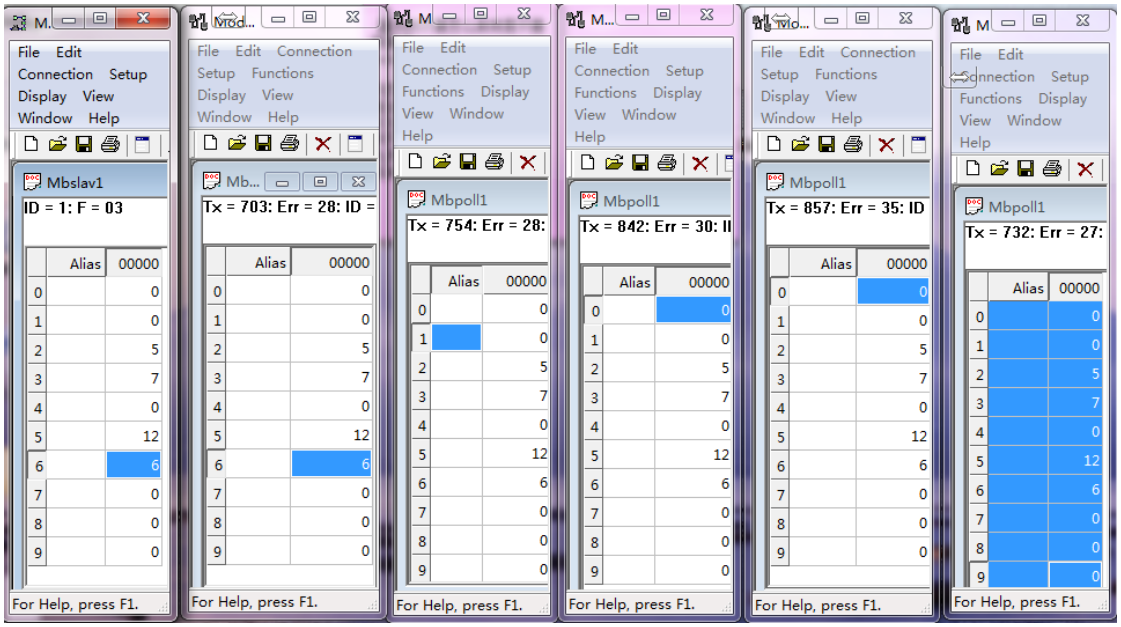
② Open virtual com software to setup serial ports and connects to USR-N540

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③ Open modbus slave software, choose the serial port which connected with USR-N540. Run modbus Poll software and make port-forwarding with this serial port.

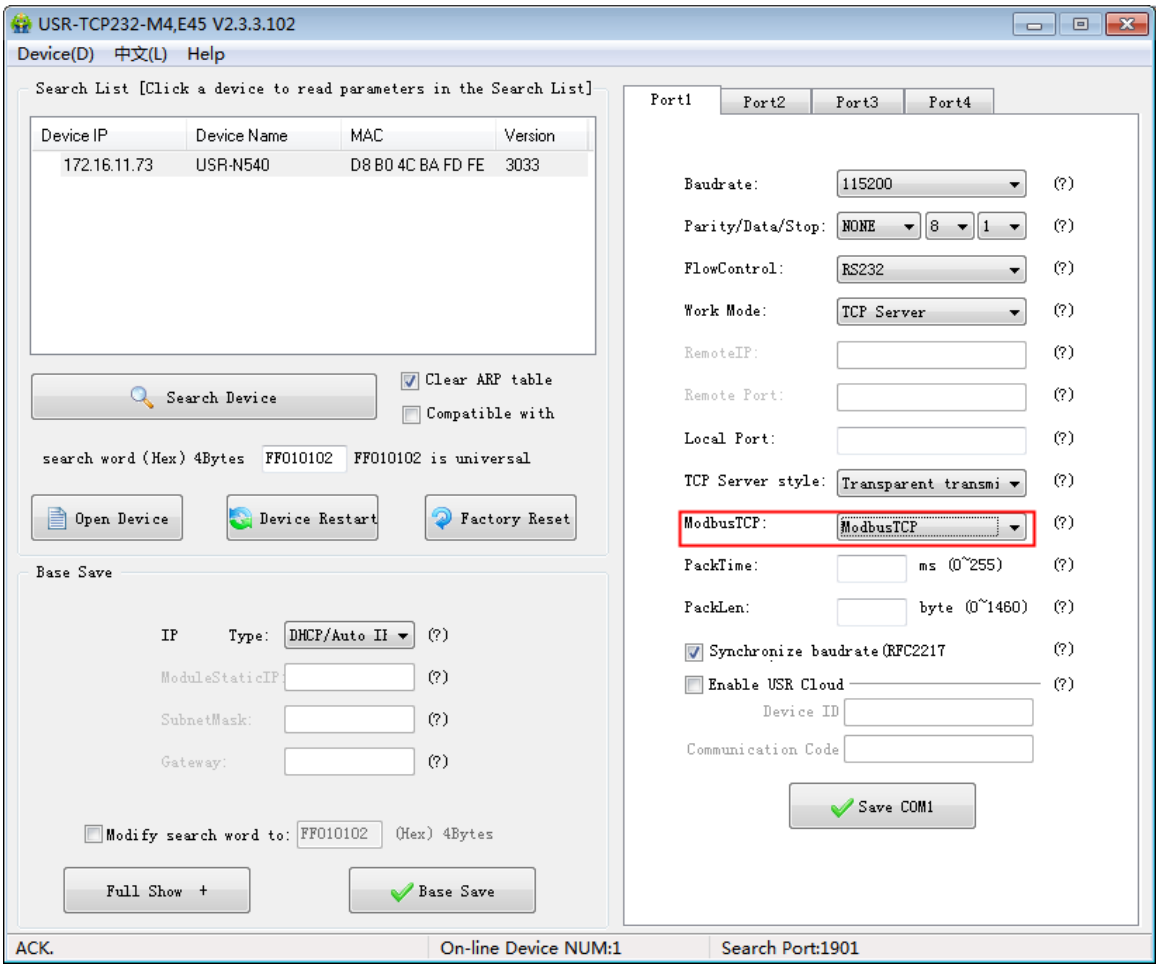
④ The value of modbus poll will also be changed when you revise the value of modbus slave.



2. Conduct Modbus Polling through Modbus TCP to Modbus RTU

① Set USR-N540 via software, select Modbus TCP

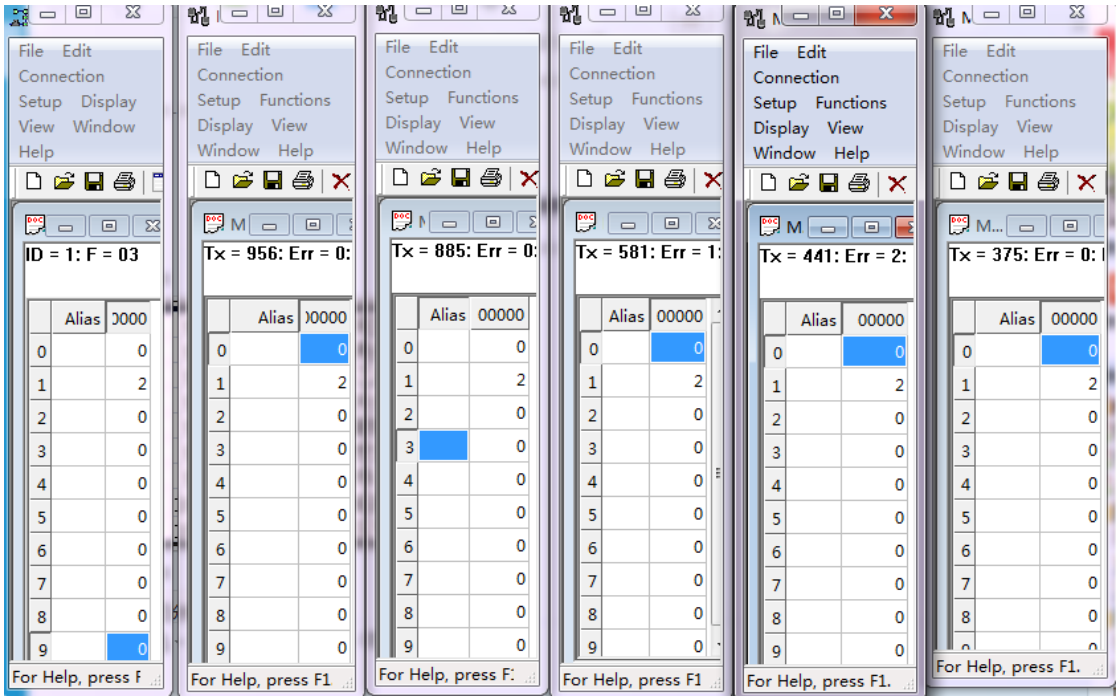
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② Open modbus slave software, choose the serial port which connected with USR-N540. Run modbus polling software to select network mode and connect with USR-N540.

③ The value of modbus poll will also be changed when you revise the value of modbus slave.

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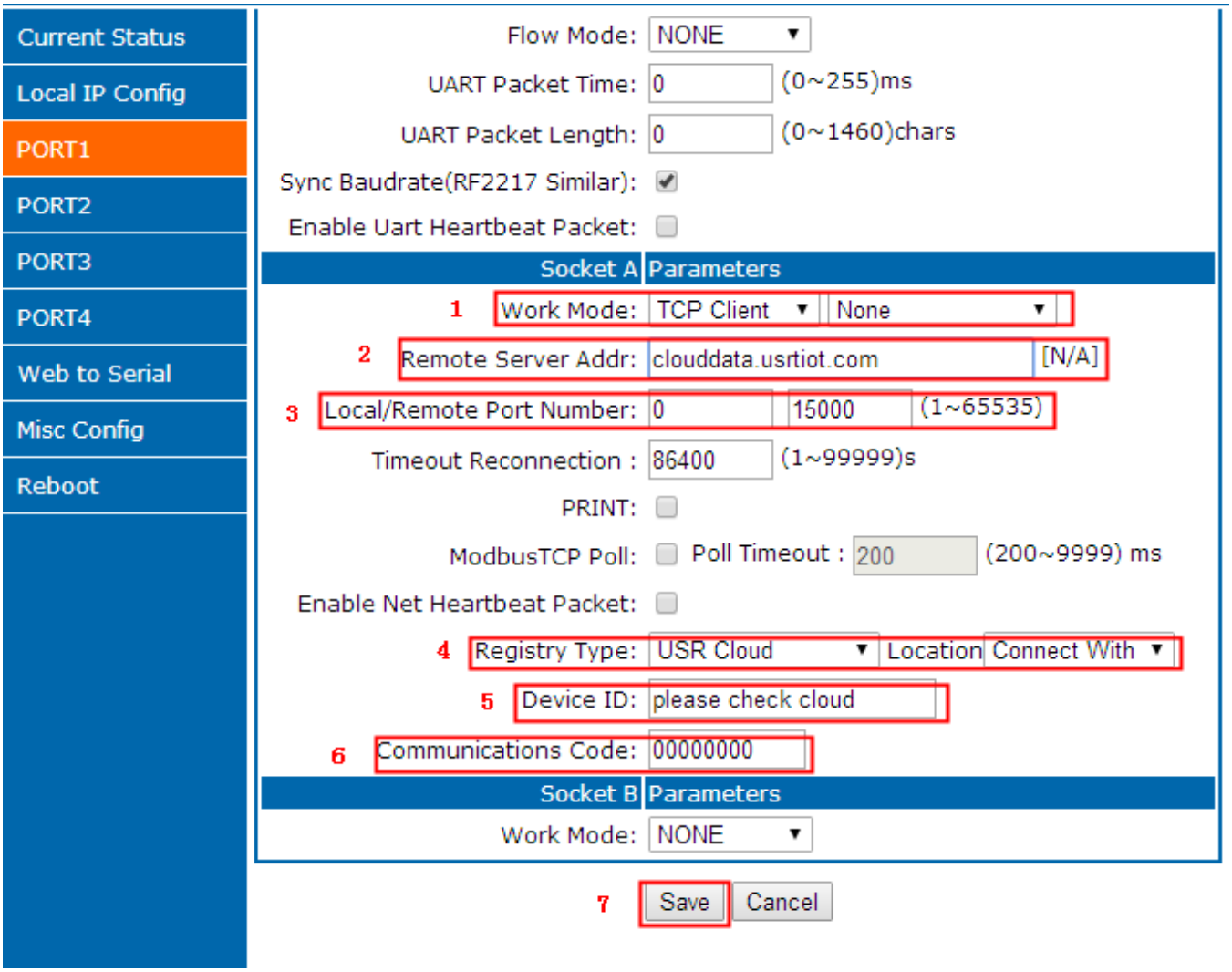


3. Modbus Polling supports 8 host query for the most, more in the near future. Need set polling time properly when using modbus polling function. If polling interval is too shot and baud rate is too low for the process of polling command which might lead to conflict between command circle and polling time.

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3.6. USR-Cloud Function

3.6.1.



USR-Cloud software is a platform for communication between devices and PC software. The cloud software is mainly used for data transmission or monitoring remotely. This function only works in TCP client mode and supports the devices with firmware 3009 and later versions.

- Login link of USRIOT Cloud: http://console.usriot.com
- Remote server address: clouddata.usriot.com
- Local port: The port of device, Remote port: Cloud software's port
- Device ID: It is assigned to device by cloud software
- Communications Code: Pass word generated after adding the device to cloud software

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3.7. Value-added Functions

3.7.1. DHCP

DHCP is obtaining IP address automatically. USR-N540 IP obtaining have 2 types: DHCP and static IP. It is static IP192.168.0.7 by default.

DHCP is effective after change to DHCP and restart. When USR-N540 connects to router or device assigning IP, it require IP address from host within network, which takes about 5-15 seconds.Then you can search N540's IP address. It is convenient for setting different IP address in different environment.

<Notes> Don't set DHCP when USR-N540 connected to PC directly because generally PC don't have the ability of assigning IP. Otherwise, USR-N540 cannot transmit data normally, but wait for IP.

3.7.2. DNS

USR-N540 access the domain name or dynamic domain name when work under Client mode. The length of domain name must be less than 30 bytes .USR-N540 will analysis the domain name constantly if cannot connect to destination server.

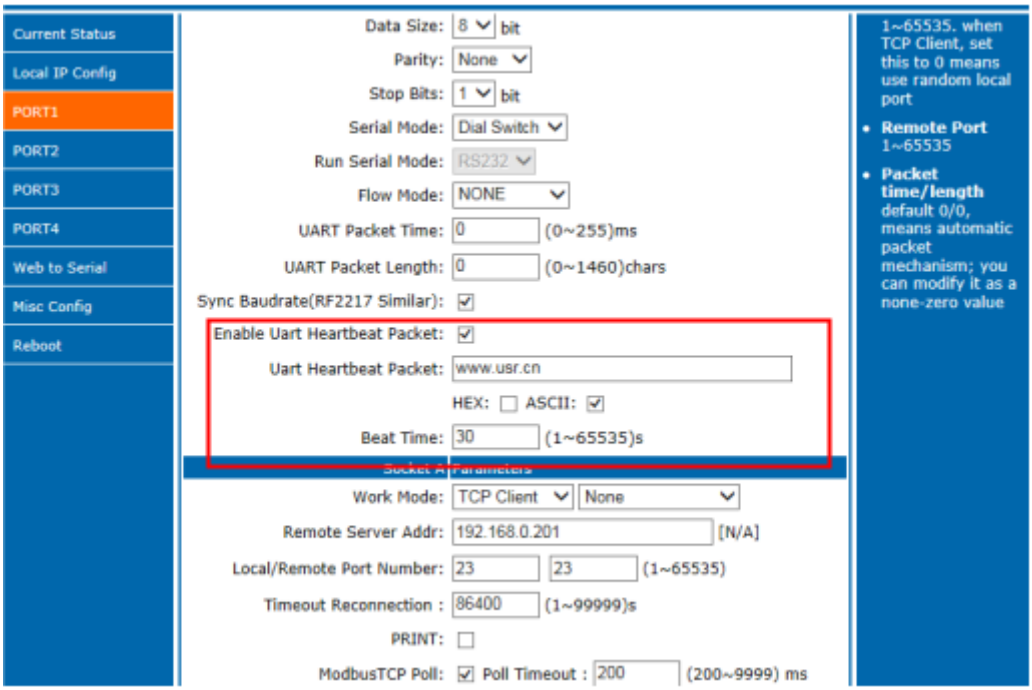
When server's IP address is dynamics, DNS make USR-N540 ' parameter no changes if according IP doesn't change no matter how server IP address changes.

3.7.3. Heartbeat Package Function

Heartbeat packet is divided into network heartbeat and serial port heartbeat. It can send heartbeat packet to serial port or to network.

Serial heartbeat packet: It can be sent to the serial port as a fixed query command

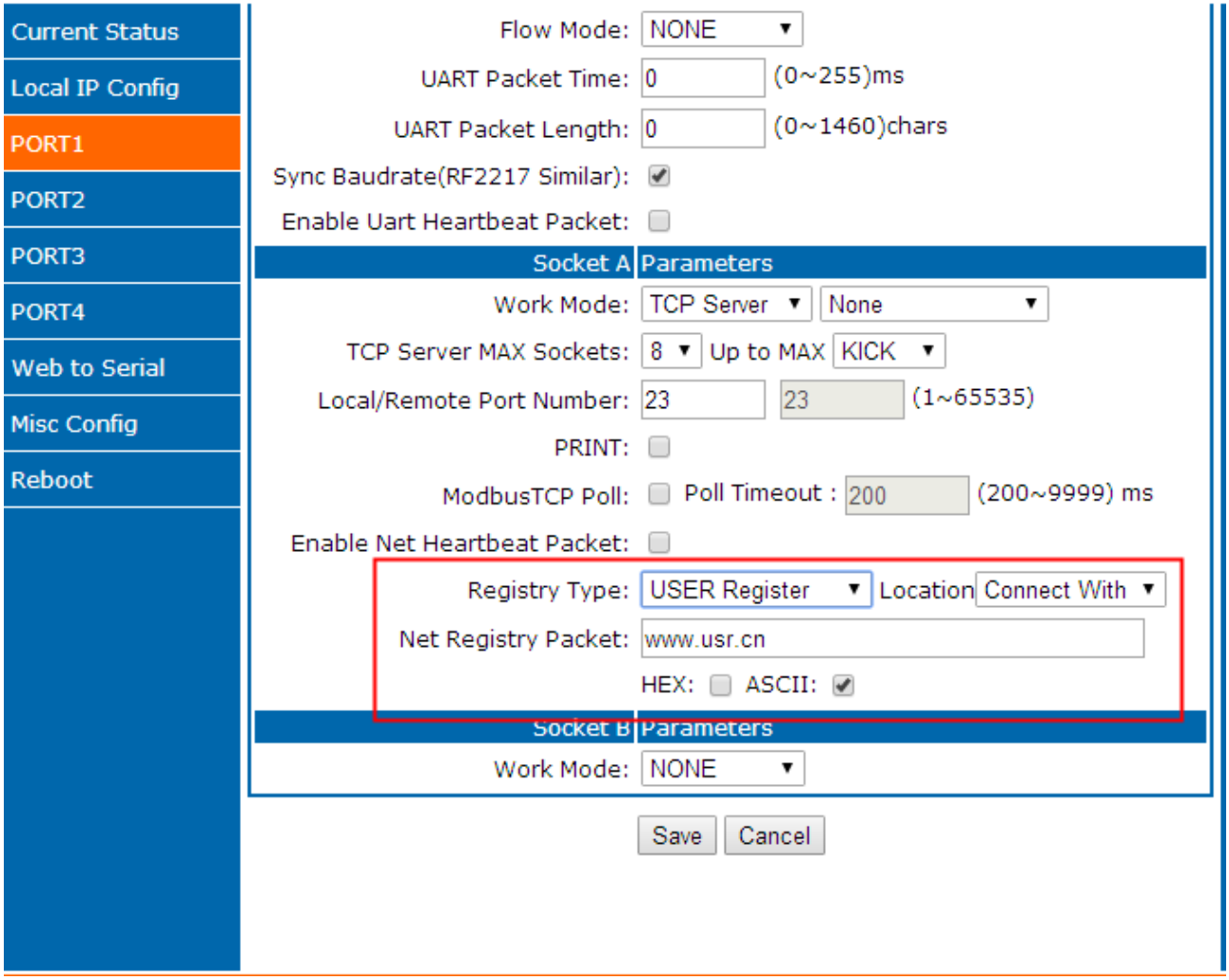
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Network heartbeat packet: It used for maintaining connection. Only valid at the mode of TCP client and UDP client.

- Beat time: Set the heartbeat packet time

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3.7.4. Registration Package Packet Function

USR-N540 supports self-defined registration package function and also supports to send self-defined registration package after connection establishment, meanwhile, it supports to send registration package when sending data.

Network registration packet includes: Establish a connection to send the registry packet, data carrying or both.

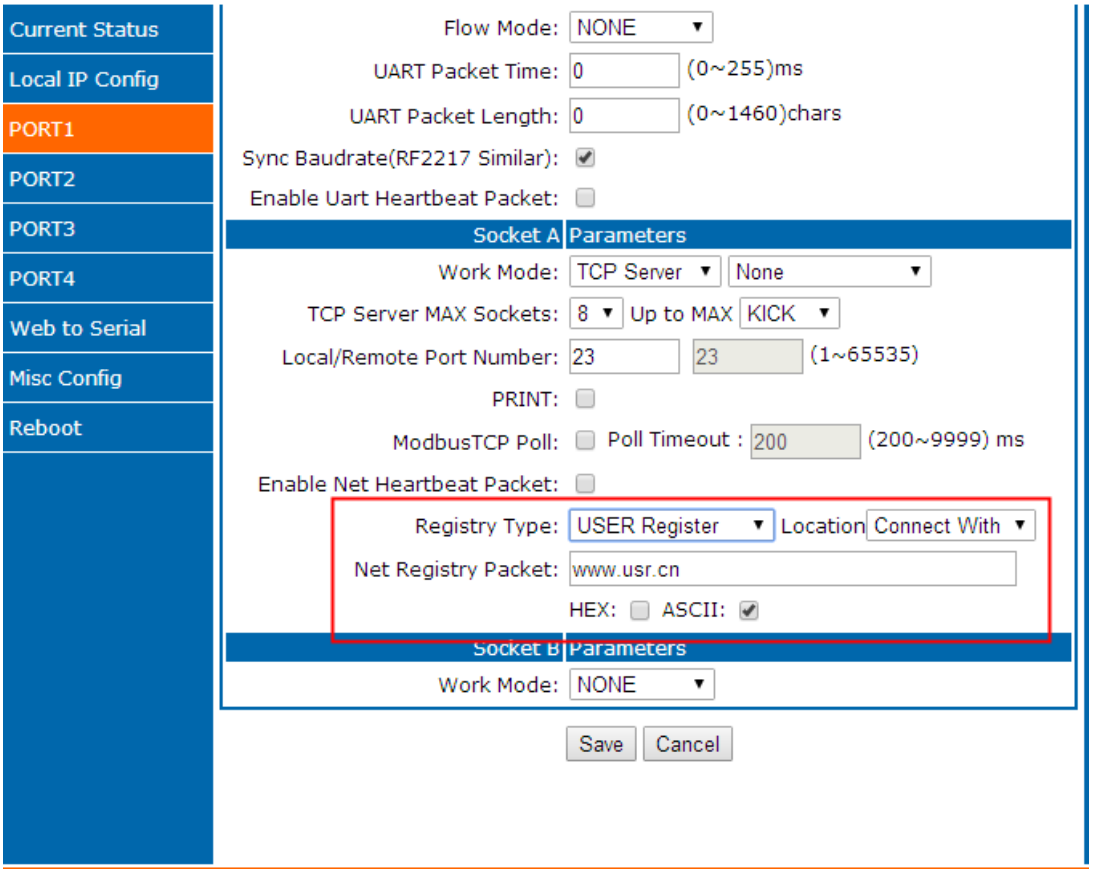
Establish a connection to send the registry packet: Send the registration packet immediately after the connection is established. The length of registration packet is 40 bytes.

Data carrying: The packet header is carried uniformly when sending data. It used for protocol transmission

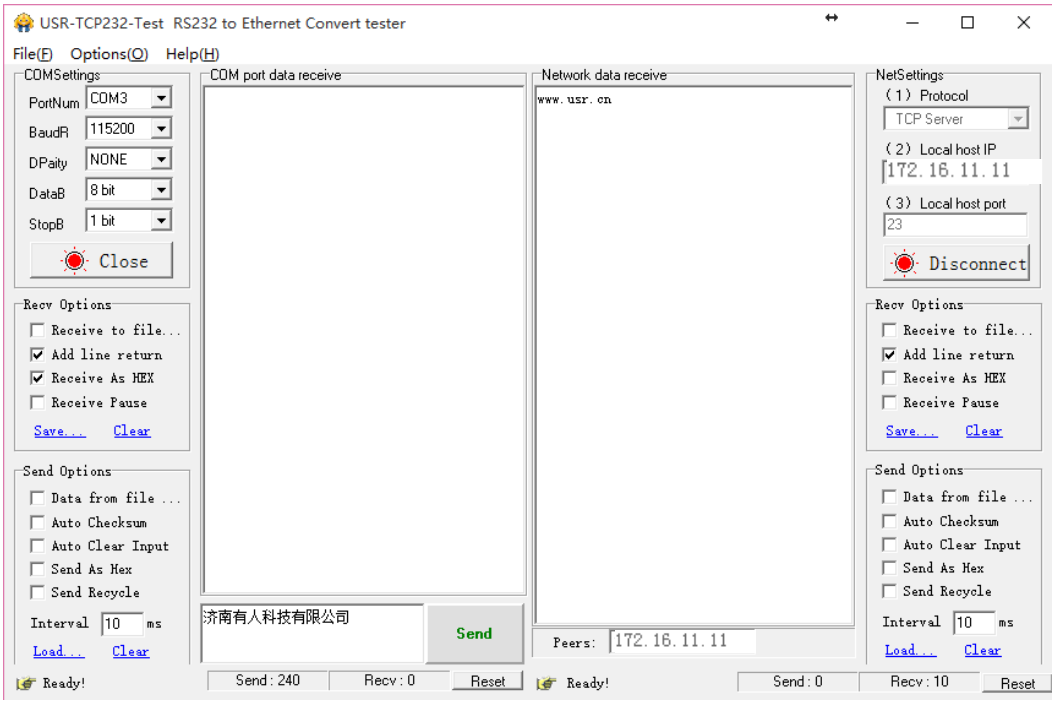
One example as blow:

① Configure the relevant parameters via web page

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② Testing result:

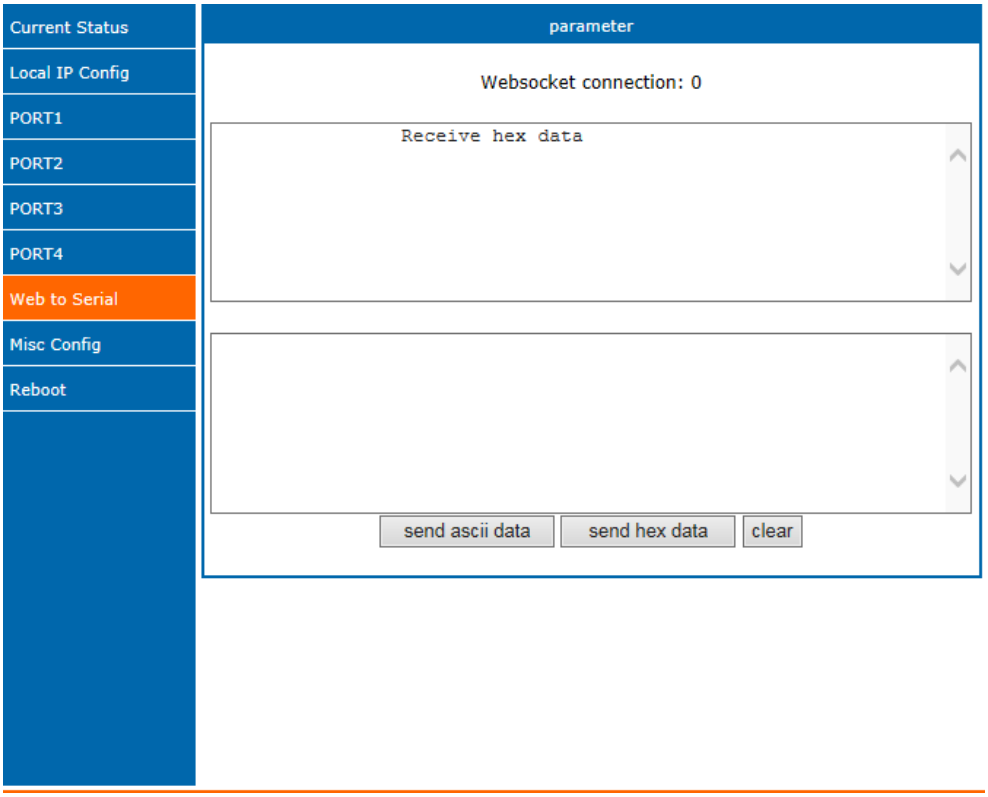


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3.7.5. Web to serial

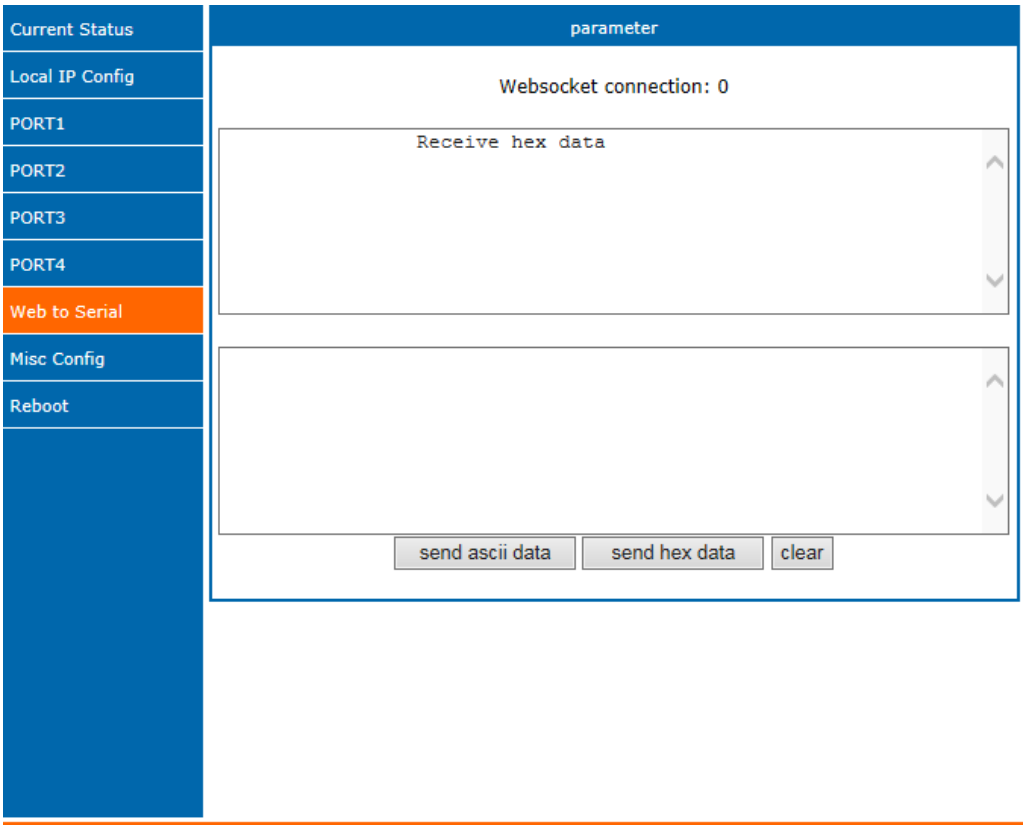
Web to serial function can make interaction between webpage and serial.

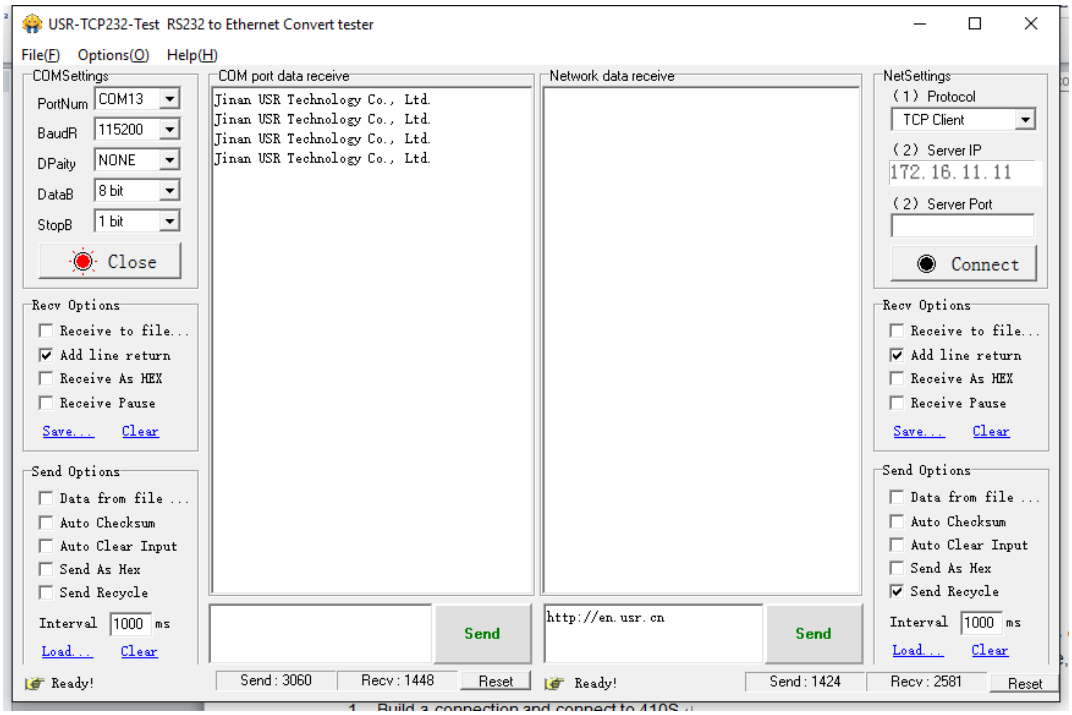
1. Set port 6432 as default.
2. Open webpage and click “web to serial”. It pops up “connect success” then can send/receive data. Open USR-TCP232-TEST Software, configure serial parameter and click “Open”.
3. Click “send ASCII data”, COM can receive data. Click “Send” in TEST Software, webpage can receive data.



Web to Serial Webpage

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Web to serial test

Web to serial needs user's webpage programming ability. Design webpage, request own device's data and process data then reveal the results on webpage. According to chapter4.1.17 Customized Webpage, can download revised

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webpage into USR-N540 .

1. Build a connection and connect to USR-N540

```
function connectx(){
try{
socket=new WebSocket('ws://'+window.location.host+':6432');
socket.binaryType = "arraybuffer";
}catch(e){
alert('error');
return;
}
socket.onopen = sOpen;
socket.onerror=sError;
socket.onmessage=sMessage;
socket.onclose=sClose
}
```

2. Receive Data Function

```
function sMessage(msg)
```

3. Send data function

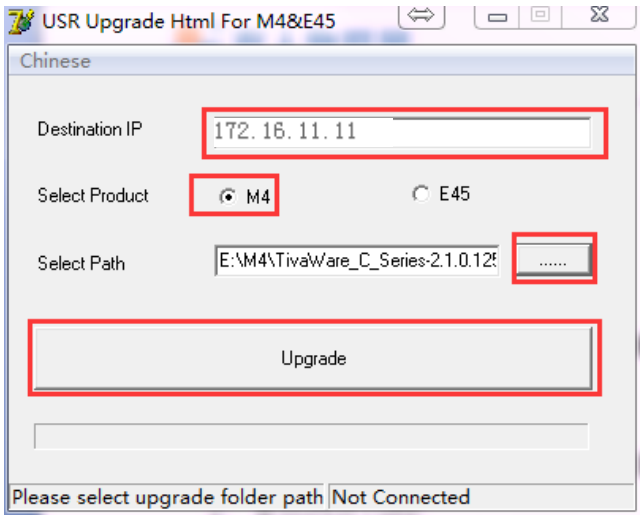
```
function send()
```

3.7.6. Customized Webpage

User can make revision as LOGO/NAME on the basis of USR-N540's webpage to realize the personalized applications.

1. Download Upgrade
2. http://www.usriot.com/e45-m4-seriesk3-self-defined-webpage/ (Different firmware version with different tool, please contact sales@usriot.com)
3. Revise webpage code
4. Open "UpgradeHtml.exe", set USR_N540' IP, Select product M4 and upload revised webpage file.

Then upgrade.



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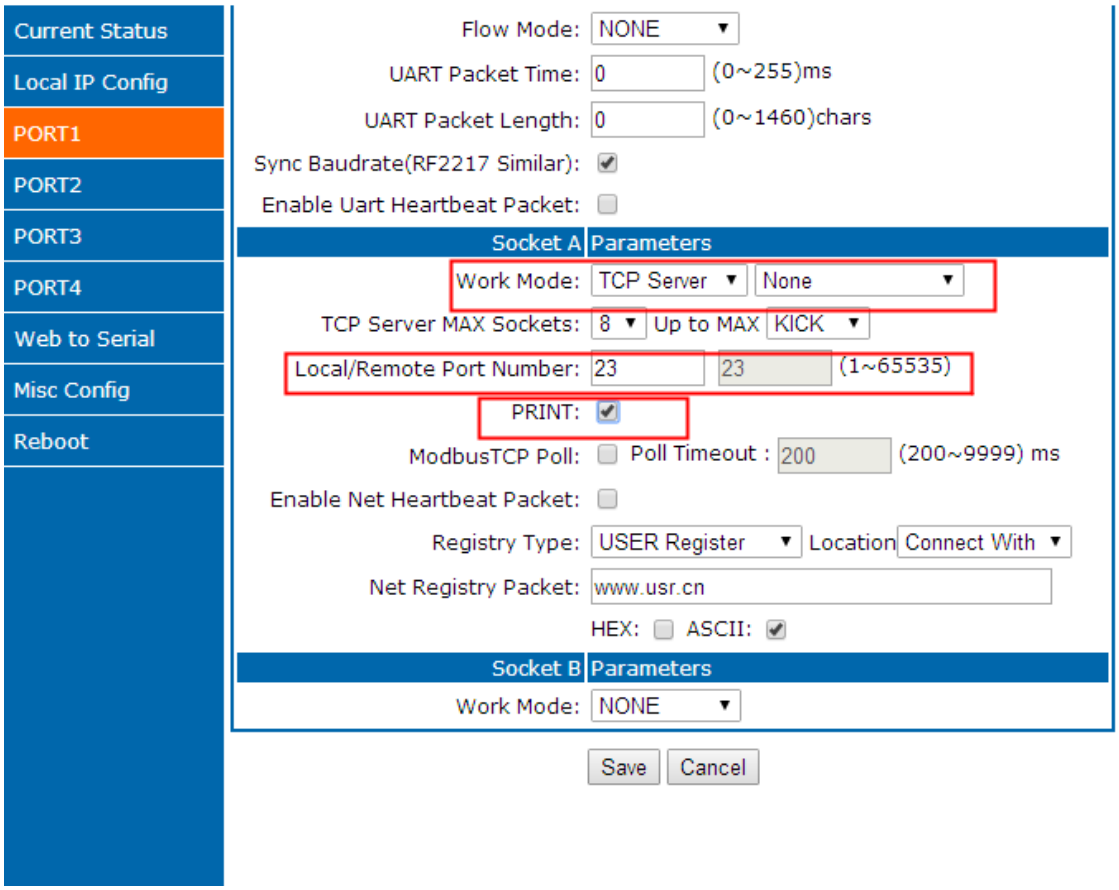
Customized Webpage Upgrade

3.7.7. Network Printing Function

Network printing function is similar to printer server, it can be realized by the previous serial printer through the existed printing driver.

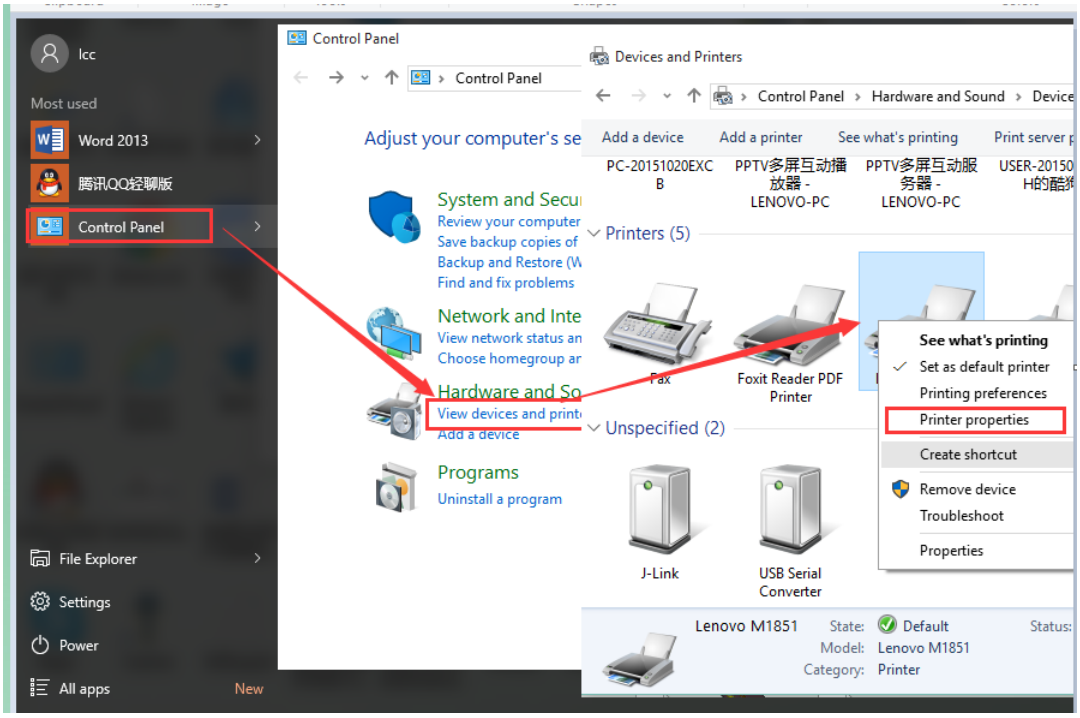
Testing Method:

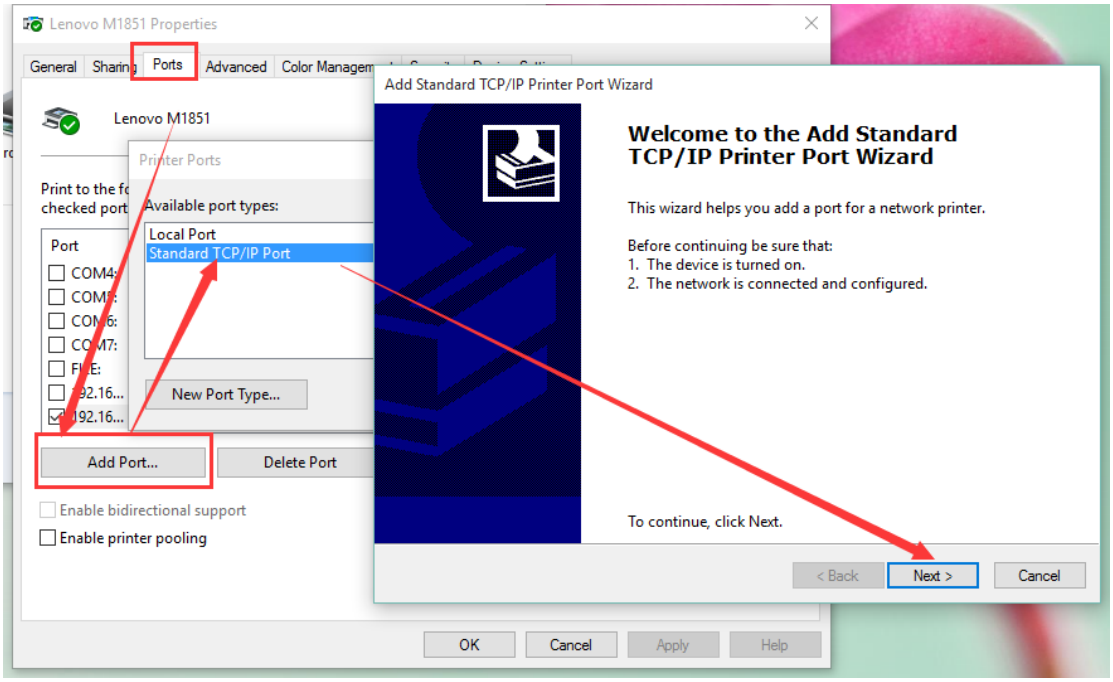
① Configure the parameter, set work mode as “TCP Server”, local port number “9100”, and have to choose “Net Buffer” and “PRINT”. Others do not need to be chosen.



② Set Printer Driver

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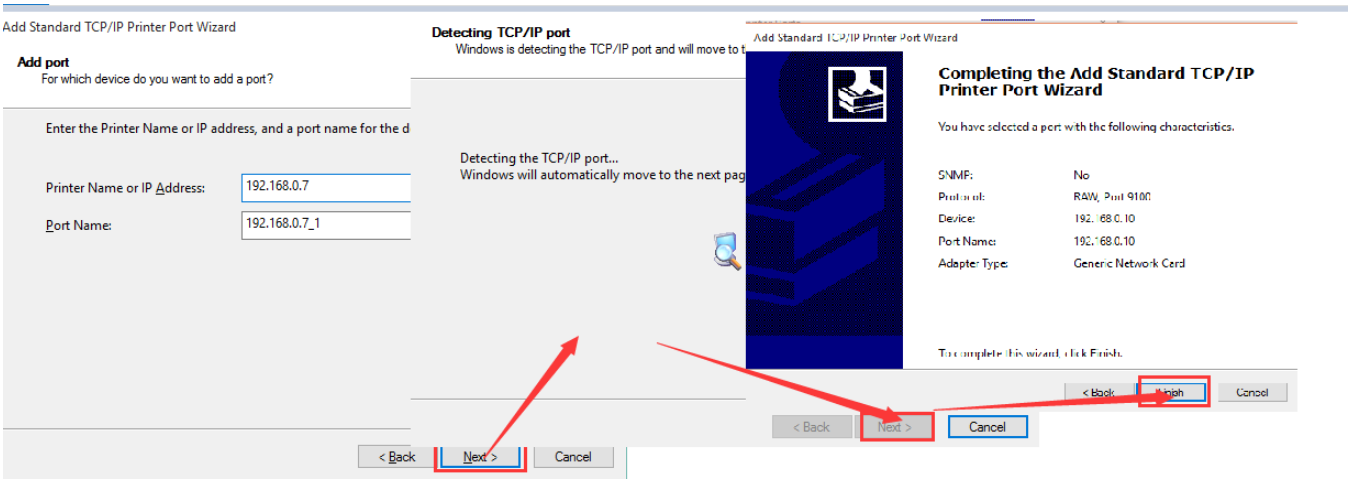




Click next and input the USR-N540'IP address,then keep clicking next til finished

③ Serial port connects to the printer, open a word file to print

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3.7.8. Serial Port Packaging Mechanism

USR-N540 can configure serial port packaging time and serial port packaging length. USR-N540 will make packaging for the data of serial port according to the packaging length and packaging time in the transparent transmission mode.

Example for judgment of packaging time and packaging length:

① Set packaging time as 10ms, packaging length as 512 bytes

When serial port received data, USR-N540 will package and send it to network if the interval time of receiving data is over than 10ms or data length is more than 512。

② If the value of packaging time or packaging length is 0, the packaging rule is effective for non-zero one.

③ Set packaging time and length as 0. USR-N540 will conduct default packaging time when packaging time is set as 0ms. Namely, when serial port receiving data, USR-N540 will package and send the data to network if interval time more than packaging time of sending 4 bytes. For example, baud rate 115200, packaging time for 4 bytes is T=0.4ms, when the calculated value is smaller than 0.1ms, packaging time can be calculated as 0.1ms.

T= 1/baud rate*10*4

3.7.9. Flow Calculation

When USR-N540 receives data from network and then send to serial port, as the limit of serial port speed, user have to control the flow, if not the problem of data overflow on serial port side will occur. So data flow is required to calculated when sending data from network to serial port.

Example:

Network sends data in m bytes every n seconds. Method of checking if there is overflow: (Supposed network condition is good and network data transmission time is negligible)

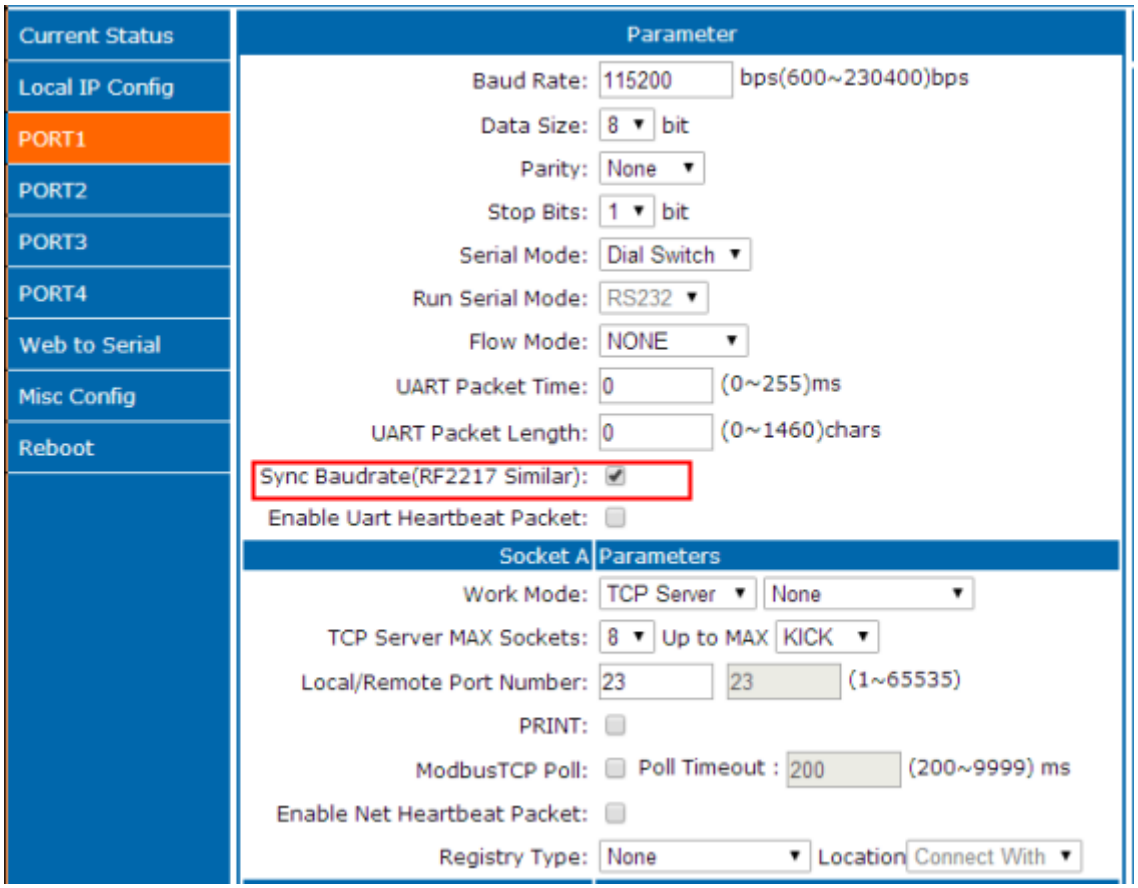
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① If there is no overflow, m bytes data must be transmitted within n seconds, then the transmitting time of M bytes data:

$$T = \frac{1}{\text{Baud Rate}} * 10 * \text{m}$$

If n >2T, then data will not overflow, USR-N540 can work normally. Just need keep n>T under baud rate 9600.

3.7.10. Synchronous baud rate (RFC2217)



For encryption during data transmission, devices change data bytes, baud rate, parity and so on. USR-N540 supports revise serial parameter accordingly.

Synchronous baud rate is named RFC2217. USR Similar RFC2217 make adjustments on the basis of RFC2217 protocol to improve accuracy of transmission.

Protocol length is 8 bytes. And values taken for example is in HEX:

Name	Packet Header	Baud Rate	Bytes parameter	Parity
Bytes	3	3	1	1

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Explanation	reduce misjudgment	High is in front, smallest is 600(00 02 58)	data bytes, baud rate, parity	Remove 4 bits of header and ignore the high bit
(115200, N,8,1)	55 AA 55	01 C2 00	03	46
(9600, N,8,1)	55 AA 55	00 25 80	03	28

Serial parameter bit:

Bit #	Explanation	Value	Description
1:0	Data bit selection	00	5 bits
		01	6 bits
		10	7 bits
		11	8bits
2	Stop Bit	00	1 bit
		01	2bits
3	Parity Enable	00	Disable Parity
		01	Enable Parity
5:4	Parity Type	00	ODD
		01	EVEN
		10	Mark
		11	Clear
8:6	NC	000	0

Using methods:

1. USR-TCP232-M4,E45 Setup software, click “Synchronous baud rate (RFC2217)”.
2. When serial parameter changes is needed, it send RFC 2217 packet. USR-N540 receive the command from network and revise serial parameter accordingly, do not transmit the RFC2217 command transparently.

3.7.11. Keep-Alive

When USR-N540’s network is abnormal, it can judge the status in time and disconnect. And connect to server once network recovers.

3.7.12. Device ID

The function have 2 types: send ID once connection and send ID once sending data. It is used to condition that need register packet or need packet header/tail for normal transmission.

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3.7.13. Webpage Port

USR-N540 has built-in webpage server and the port is 80. Also the port can be revised and visit the web via revised port.

3.7.14. Revise MAC

User can check software's MAC address. USR-N540 MAC is Globally Unique. Also it support customized MAC.

3.7.15. Firmware Upgrade

Firmware upgrade is fulfilled via network. For details, please refer to Chapter 5.1 configure parameter with configuration software.

3.7.16. Flow Control RTS/CTS & XON/XoFF

Flow control: the way for serial port to flow control, can choose enable 485 mode to control 485 transceiver or not. It is default to enable 458 control mode in the 3031 and the later version, enable 485 mode if you do not choose the hardware control.

None: default serial port mode. In this mode enable the control for 485 in 3031 and the later mode.

RTS/CTS: Hardware flow control function. It is disabled by default. Don't enable it if device doesn't support Hardware flow control . Notes: It is only run under RS232 port.

XoN/XoFF: Software flow control function. It is disabled by default. In this mode, the command character of serial port sends data is 0x11. 0X13 is not allowed.

By the flow control , user can deal with the data that serial port received or sent. If the buffer more than the threshold value, inform the remote serial port stopping. After the serial port buff, inform remote serial port to deal the data.

Generally, receiving on the serial port and dealing need some time.

3.7.17. Reload

Cut off power firstly.

Press "reload" and supply power. Then keep pressing reload for 5 seconds.

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Reload

4. Setting Protocol

USR-N540 includes two protocol: network setting protocol and serial port setting protocol.

4.1. Network Setting Protocol

4.1.1. Set Parameter Process

1. Build SOCKET:
   Build UDP SOCKET, destination IP: 55.255.255.255, destination port: 1901. Low is in front.
2. Setting command process:
   ① The network send searching command
   ② USR-N540 returns IP address and MAC
   ③ The network read USR-N540's parameter
   ④ Organize setting command according to MAC, known user name/password and parameter to be configured.
   ⑤ Send setting command
   ⑥ USR-N540 returns "correct setting"
   ⑦ Host PC send "save setting" command
   ⑧ USR-N540 returns "correct"
   ⑨ Restart command
   ⑩ USE-N540 returns "correct setting"

4.1.2. Setting Command Content

Command Look-up List:

Function	Header	Length	command	MAC (6 bytes)	User name /password (12bytes)	Parameter	Parity (sum)
search	FF	01	01	-	-	-	02
reset	FF	xx	02	[MAC]	[usrname] [password]	-	xx

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read settings	FF	xx	03	[MAC]	[usrname] [password]	-	xx
Save settings	FF	xx	04	[MAC]	[usrname] [password]	-	xx
Basic settings	FF	xx	05	[MAC]	[usrname] [password]	Basic parameter	xx
Com 0 settings	FF	xx	06	[MAC]	[usrname] [password]	COM parameter	xx
Com 1 settings	FF	xx	07	[MAC]	[usrname] [password]	COM parameter	xx
Com 2 settings	FF	xx	08	[MAC]	[usrname] [password]	COM parameter	xx
USR Cloud			0x10	[MAC]	[usrname] [password]		

Notice: Check bit is sum check, starts from length byte (including length) to adding before checking (not including checking), result is check value, only low byte is remained.

1. Command examples

① Search command example

Search command is set to:

FF 01 01 02

Sum check: 02 = 01 + 01

② Reset command example

FF 13 02 d8 b0 4c 00 04 c9 61 64 6d 69 6e 00 61 64 6d 69 6e 00 c8

Sum check:

C8 = 13 + 02 + ... + 6E + 00

User name and password both are 5 bytes+00 bits 0 for the lack.

③ Read settings command example

Send (16 bytes)：FF 13 03 AC CF 23 66 66 67 61 64 6D 69 6E 00 61 64 6D 69 6E 00 F9

④ Save reading settings command example

Send (16 bytes)：FF 13 04 AC CF 23 66 66 67 61 64 6D 69 6E 00 61 64 6D 69 6E 00 FA

2. Some commands detailed annotation

① Basic setting parameter command

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Basic Parameter:

Name	Byte	Example	Explanation
ucSequenceNum	1	xx	Write the read values
ucCRC	1	xx	Write the read values
ucVersion	1	xx	Write the read values
ucFlags	1	80	IP address type: 0 in 8th bit: DHCP;1 in 8th bit: Static IP
usLocationURLPort	2	20 19	Write the read values
usHTTPServerPort	2	50 00	HTTP server port
ucUserFlag	1		Write the read values
ulStaticIP	4	38 00 A8 C0	Static IP
ulGatewayIP	4	01 00 A8 C0	Gateway
ulSubnetMask	4	00 FF FF FF	Subnet Mask
ucModName	16	55 53 52 2D 54 43 50 32 33 32 2D 45 00 00 00 00	USR-N540 name
username	6	61 64 6D 69 6E 00	username
password	6	61 64 6D 69 6E 00	password
ucNetSendTime	1		Write the read values
uiId	2	01 00	Device ID
ucIdType	1	0	Device ID type (0~3) 0:no use 1:send id when connect 2:send id when send data 3:both
ucUserMAC	6	FF FF FF FF FF FF	MAC
ucReserved	8		Unused

Example:

FF 56 05 AC CF 23 66 66 67 61 64 6D 69 6E 00 61 64 6D 69 6E 00 61 66 03 80 20 19 50 00 02 07 00 A8 C0 01 00 A8 C0 00 FF FF FF 55 53 52 2D 54 43 50 32 33 32 2D 45 34 35 00 00 61 64 6D 69 6E 00 61 64 6D 69 6E 00 02 01 00 00 AC CF 23 66 66 67 00 48 54 54 50 2F 31 2E 1C

② Port settings parameter command

Port parameter:

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Name	bytes	example	Explanation
ulBaudRate	4	00 C2 01 00	Baud Rate
ucDataSize	1	08	COM data bits (0X05/0x06/0x07/0x08)
ucParity	1	01	COM parity 1: no, 2: odd, 3: even, 4: mark, 5: space
ucStopBits	1	01	COM stop bit (0x01/0x02)
ucFlowControl	1	01	COM flow control (0x01; no, 0x03:HW)
ulTelnetTimeout	4	00 00 00 00	Network reconnection time
usTelnetLocalPort	2	17 00	Local Port
usTelnetRemotePort	2	17 00	Remote Port
uiTelnetURL	30	31 39 32 2E 31 36 38 2E 30 2E 31 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	IP address send in ASCII. Example: 192.168.0.1
ulTelnetIPAddr	4	00 00 00 00	Not adopted
ucFlags	1	02	Enable MODBUSTCP：0x010(bit2) Enable 2217: 0x08(bit3) Enable USR cloud: 0x010(bit4)
ucWorkMode	1	03	Working mode: 0: UDP, 1: TCP Client, 2: UDP Server, 3: TCP Server, 4: HTTPD Client
uiPackLen	4	C8 00 00 00	COM pack length
ucPackTime	1	0A	COM pack time
ucTimeCount	1	91	Write the read values
TCP server type	1	1	Write the read values
ucReserved	4	Casual value	saved

Example:

FF 52 06 AC CF 23 66 66 67 61 64 6D 69 6E 00 61 64 6D 69 6E 00 00 C2 01 00 08 01 01 01 00 00 00 00 17 00 17 00 31 39 32 2E 31 36 38 2E 30 2E 32 30 31 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 08 03 C8 00 00 00 0A 95 11 00 00 00 00 42

4.1.3. Commands' Return Content

1. Return results of search command

Return command:

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Bytes	Name	Example	Explanation
0	TAG_STATUS	FF	
1	Packet_length	24	
2	CMD_DISCOVER_TARGET	01	
3	Board_type	00	
4	Board_ID	00	
5~8	Client_IP_address	C0 A8 00 07	Device IP(High in front)
9~14	MAC_address	AC CF 23 20 FE 3D	Device MAC(High in front)
15~18	Firemware_version	D0 07 12 34	D0 07: device version# (low in front) 12 34: encrypted version
19~34	Application_title	55 53 52 2D 54 43 50 32 33 32 2D 35 30 30 00 00	Device name
35	checksum	F0	checksum

Example:

Return results of search command(36 bytes)

FF 24 01 00 4B C0 A8 00 4D D8 B0 4C 00 04 C9 DD 07 01 00 55 53 52 2D 54 43 50 32 33 32 2D 34 30 31 00 00 EF

The method of the check is as follow:

0xEF = 00 - FF - 24 - 01 - 00 - 4B - ... - 31 - 00 - 00

2. Return results of reset command

   Response(4 bytes): FF 01 02 4B, if user name and password are right, 4B = 'K'

   FF 01 02 45, if user name and password are wrong, 45 = 'E'

3. Return results of read command

   Description：

   Return all parameter of USR-N540 network. 193 bytes in total, no parity, no protocol, return parameter directly.

   Returned content: 193 (basic parameter+serial parameter+serial parameter)

4. Return results of save settings command

   If settings are correct, it returns:

   FF 01 04 4B

5. Return results of basic settings command

   FF 01 05 4B

6. Others return results

   Sum check fault returns 'E' + right parity

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Correct execution: FF 01 CMD 'K'

User name/password fault returns: FF 01 CMD 'P'

Others faults return: FF 01 CMD 'E'

4.2. Serial Setting Protocol

4.2.1. Error Code

List of Error Code

Error	State
ERR1	Invalid command format
ERR2	Invalid command
ERR3	Invalid Operator
ERR4	Invalid Parameters
ERR5	Operation not allowed
ERR6	No operation permission

4.2.2. AT Command

Details of AT command refer to: https://www.usriot.com/download/M4/USR-N50-AT-Command-Set_V1.0.0.pdf

AT Command List:

Command	Instruction
E	Open/close display function
Z	Reboot device
VER	Query version number
ENTM	Enter to transparent transmission mode
MAC	Query MAC
USERMAC	Set customize MAC
RELD	Restore to factory setting
WANN	Query/set parameters of WAN port
DNS	Query/set DNS
WEBU	Query/set username and password of webpage
WEBPORT	Query/set port of webpage

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SEARCH	Query/set search key words
PLANG	Query/set webpage language
RSTIM	Query/set timeout reboot function
UARTCLBUF	Query/set net cache function
UARTn	Query/set parameters of UARTn
UARTTLn	Query/set package parameters of UARTn
RFCENn	Query/set enable/disable RFC2217
SOCKAn	Query/set socketA parameters of UARTn
SOCKBn	Query/set socketB parameters of UARTn
SOCKLKAn	Query/set connection status of UARTn
SOCKSLn	Query/set short-connection function of UARTn
SHORTOn	Query/set short-connection time of UARTn
SOCKTONn	Query/set timeout re-connection time of UARTn
MODTCPn	Query/set Mudbus TCP function of UARTn
MODPOLLn	Query/set Modbus poll function of the UARTn
MODBTO	Query/set Modbus poll time function of the UARTn
NETPRn	Query/set network printing function of UARTn
WEBSOCKPORTn	Query/set websocket port of UARTn
REGENn	Query/set registration package of UARTn
REGTCPn	Query/set the type of send registration package of UARTn
REGUSRn	Query/set customize registration package
REGCLOUDn	Query/set USR-Cloud parameters
HTPTPn	Query/set the work mode of the Httpd client UARTn
HTPURLn	Query/set URL of the Httpd client UARTn
HTPHEADn	Query/set head information of the Httpd client UARTn
HTPCHDn	Query/set delete head of UARTn
HEARTENn	Query/set enable/disable heartbeat package
HEARTTPn	Query/set type of heartbeat package
HEARTDTn	Query/set content of heartbeat package

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HEARTTMn	Query/set heartbeat package sending time

4.2.3. Enter AT Command Mode

① Send +++ to USR-N540 through serial port by test program
② USR-N540 return 'a'
③ Need reply "a" within 3s once received previous 'a'
④ Return+ok to enter AT command mode

5. Parameter Configuration

It is setup software configuration, webpage configuration and serial configuration.

How to configure:

Revise user name/password→set IP access method→serial parameter→USR-N540 work mode→work mode related parameter

5.1. Software Configuration

To make sure setup software normal running, please check the below firstly:

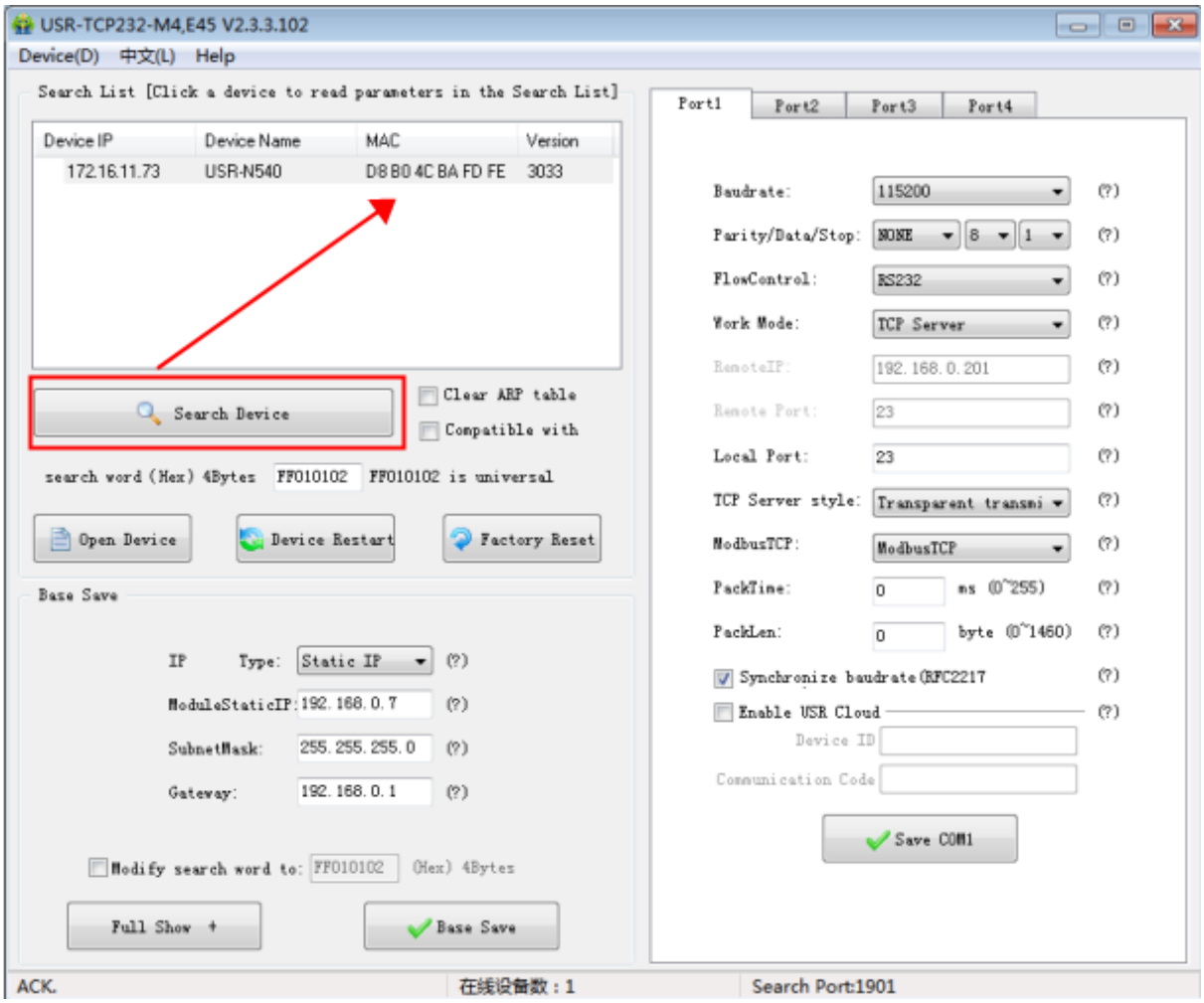
1. USR-N540 and setup software PC are within same LAN.
2. Disable the anti-virus software and firewall on PC.
3. Disable network card nothing to do with this testing.

Download [USR-TCP232-M4&E45] Setup software here:

https://www.usriot.com/support/downloads/usr-vcom-virtual-serial-software.html

Search device and all USR-N540 device within LAN can be found. It includes IP, name, MAC and version.

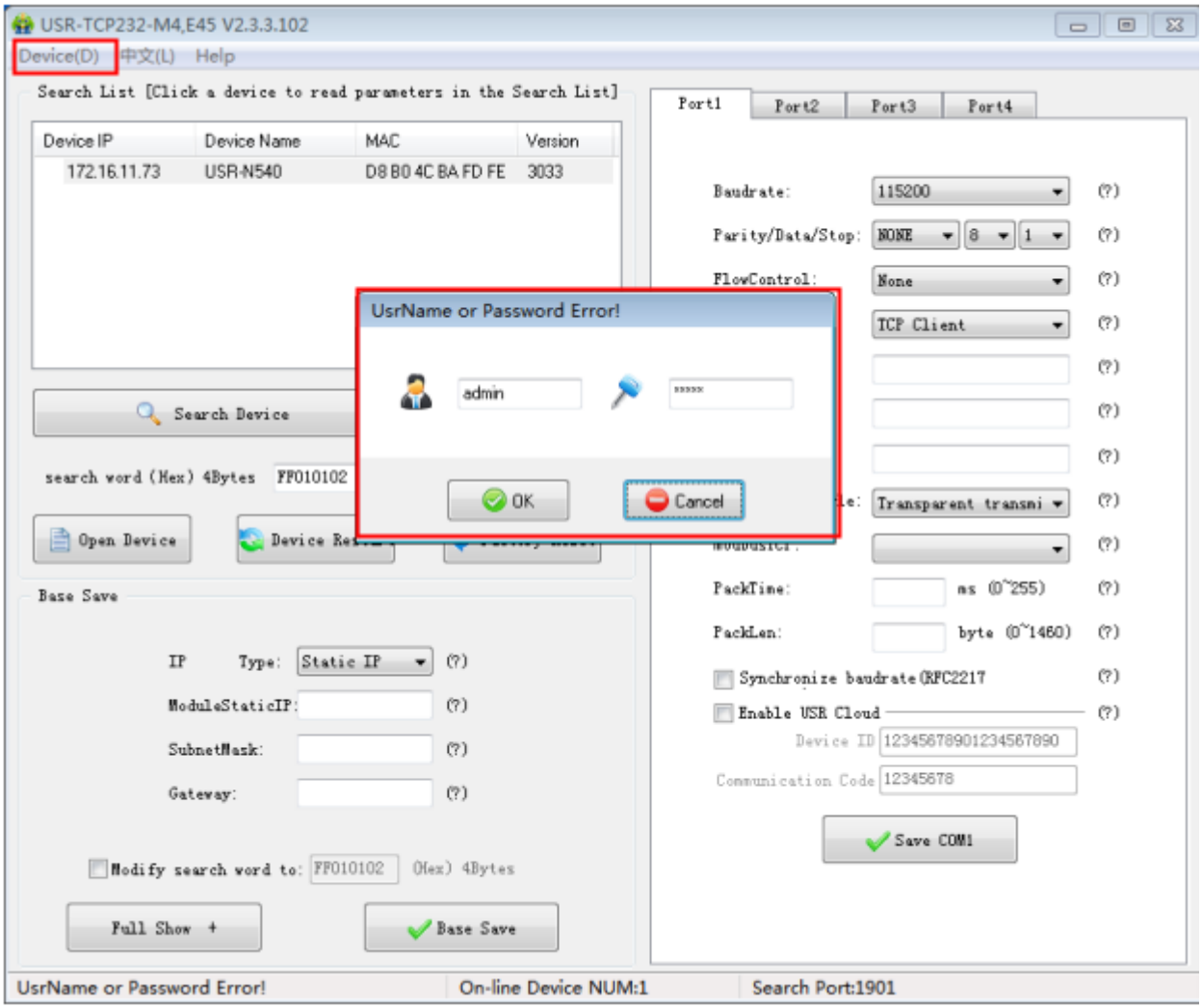
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Software Configuration—Search

1. Click ‘Device’ on the top of the program and then check user name/password via ‘User config’. If it is correct, it reveals USR-N540 information. If not, it pops up retype window, click “Confirm”.
   User name and password is admin by default.

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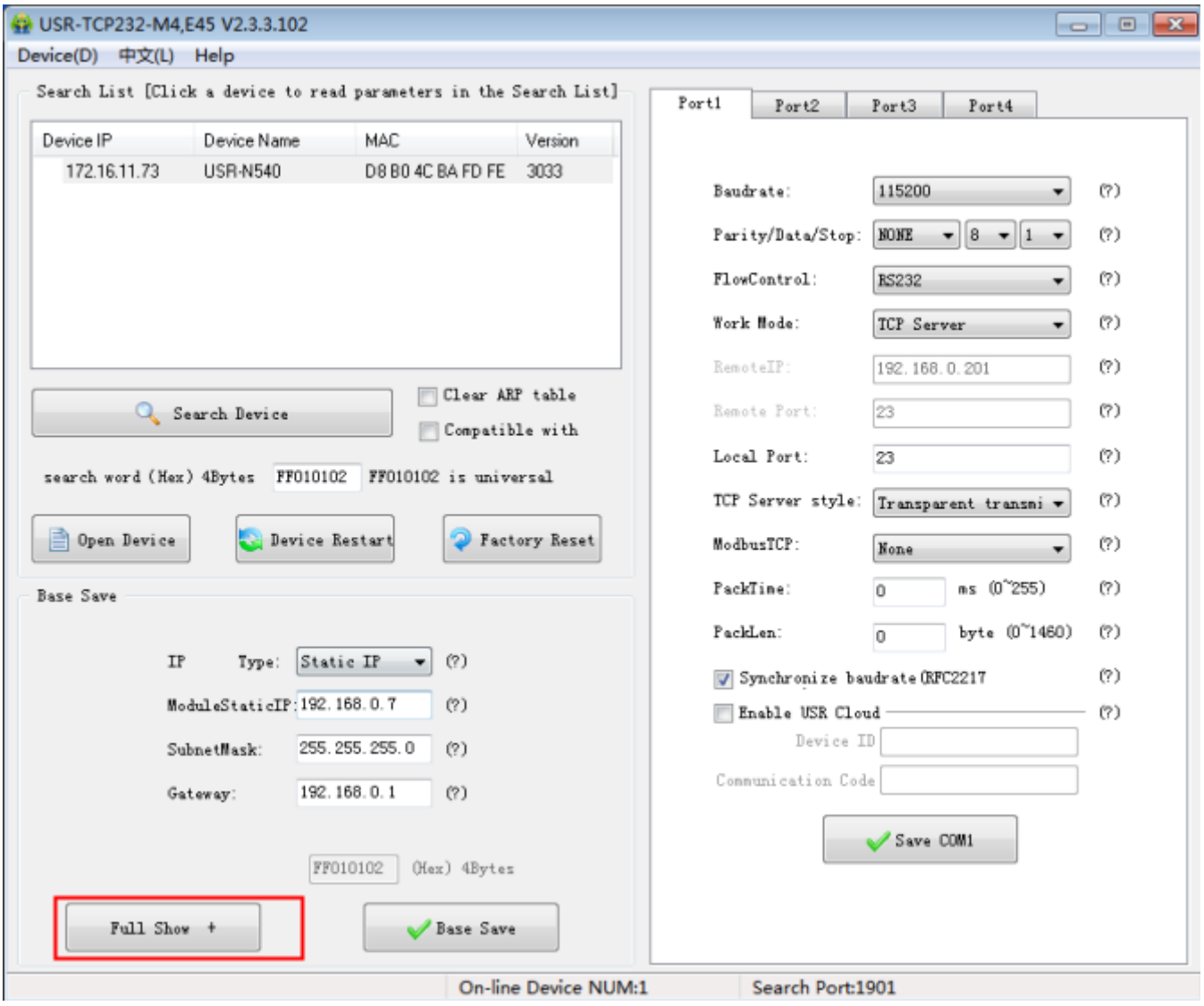
Software Configuration-Password

2. Basic parameter configuration

   Click “Full Show” and all basic parameter is revealed.

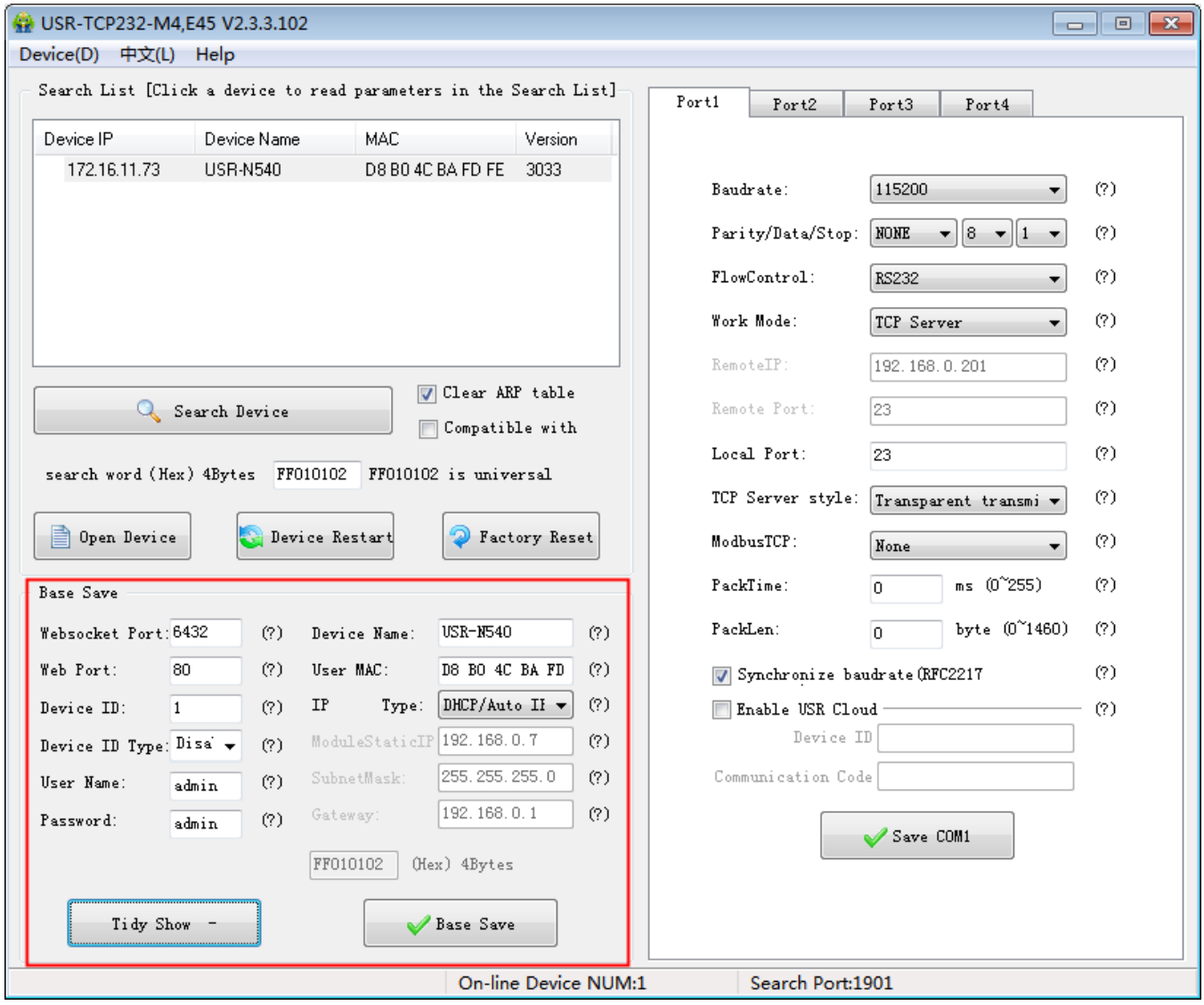
   Set the parameter as needs and click “Base Save” then can set successfully.

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Software Configuration --Full Show

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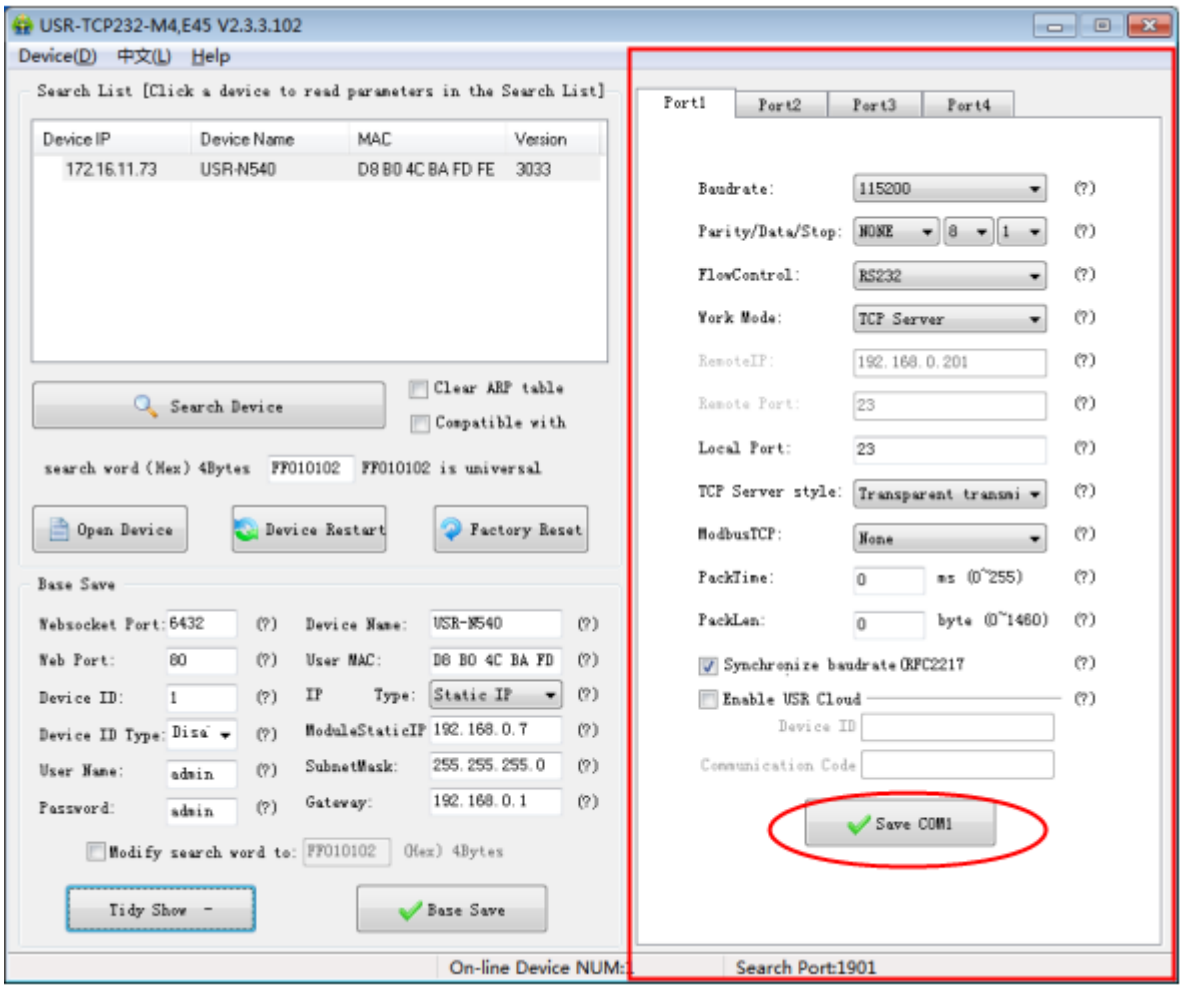
Software Configuration-Base Save

- Websocket port: refer to Chapter 4.1.8.3 Webpage to serial
- Webpage port: it is 80 by default when visit webpage.
- Device ID: refer to Chapter 4.1.8.6 Device ID
- Device ID type: sending ID type
- User name: Authentication Code for revising parameter to avoid other users within same LAN revising it.
- Password: same as user name.
- Device Name: USR-N540 ’s name an be revised.
- MAC address: USR-N540 ’ MAC
- IP address type: Static and DHCP
- USR-N540 static IP: same segment with router.
- Subnet Mask: 255.255.255.0 by default.
- Gateway: it is router IP generally, can transmit cross network segment and DNS if set correctly.

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3. Port configuration (Port1 / Port2 configuration)

Click the COM to set, revise parameter then click “Save COM1”.



Software Configuration-COM 1 Configuration

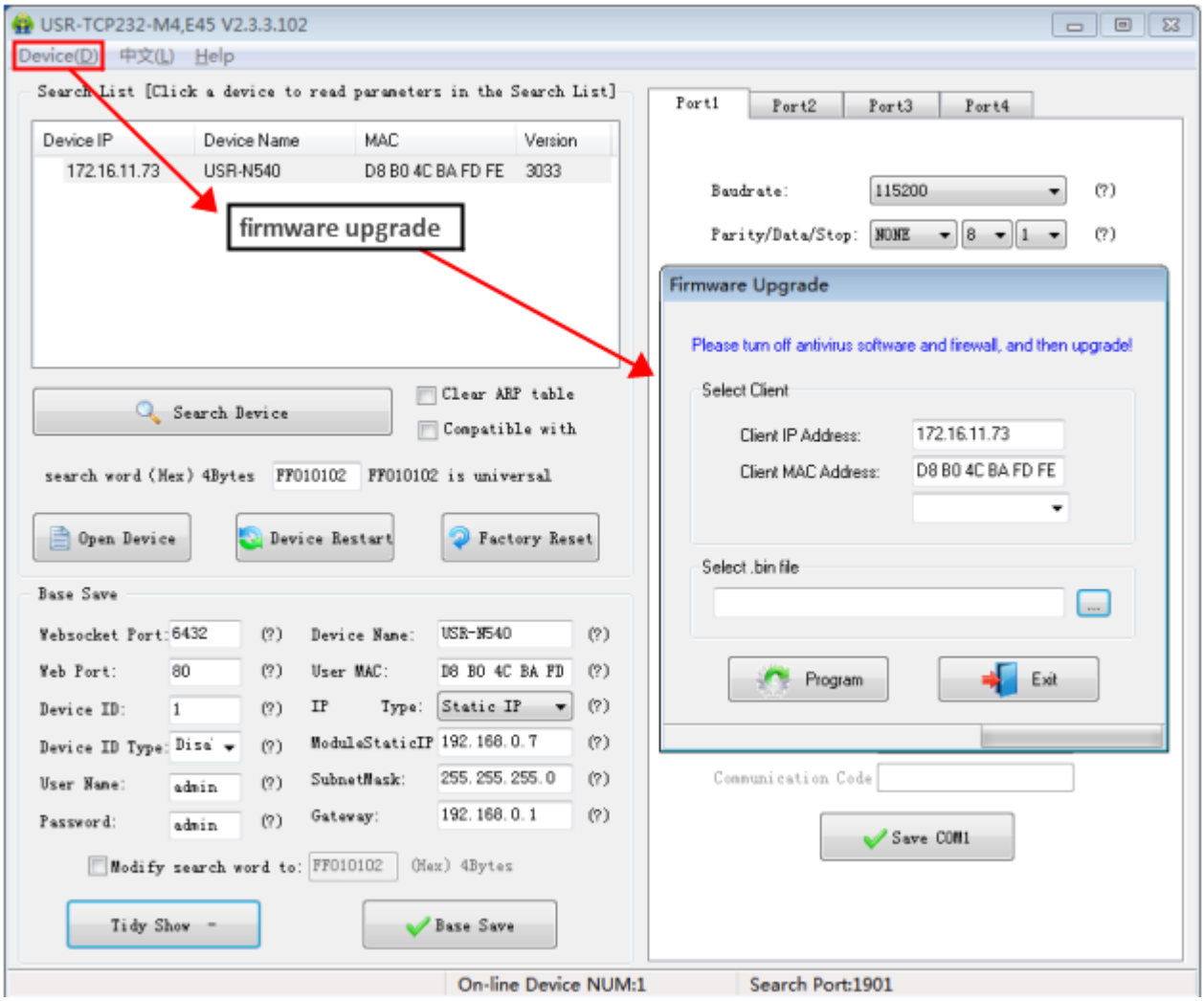
- Serial Baud rate: it can be standard or customized.
- Parity/Data/Stop: serial parameter.
- Serial Flow control: None/Hardware/XON XOFF, None for no flow control, Hardware for hardware flow control, XON/XOFF for software hardware flow.
- Work Mode: TCP Server /TCP Client/HTTPD Client/UDP Client/UDP Server
- Destination IP/Port: IP connected when USR-N540 works as client (TCP Client/HTTPD Client/UDP Client)
- Local Port: port USR-N540 to connect. Advice to set it to “0’’ when USR-N540 works under TCP Client for connection with Random port.
- TCP Server Type: No.
- Modbus TCP: set this when Modbus TCP to Modbus RTU is needed.
- Serial pack time: relate to serial unpacking mechanism.
- Serial pack length: relate to serial unpacking mechanism.
- Similar RFC2217: Please refer to Chapter 3.5.10 Similar RFC2217

4. Firmware Upgrade

If USR-N540 need to upgrade with new firmware, please contact USR sales.

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During firmware upgrade, USR-N540 connects to PC directly. PC Upgrade via Wi-Fi is prohibited.

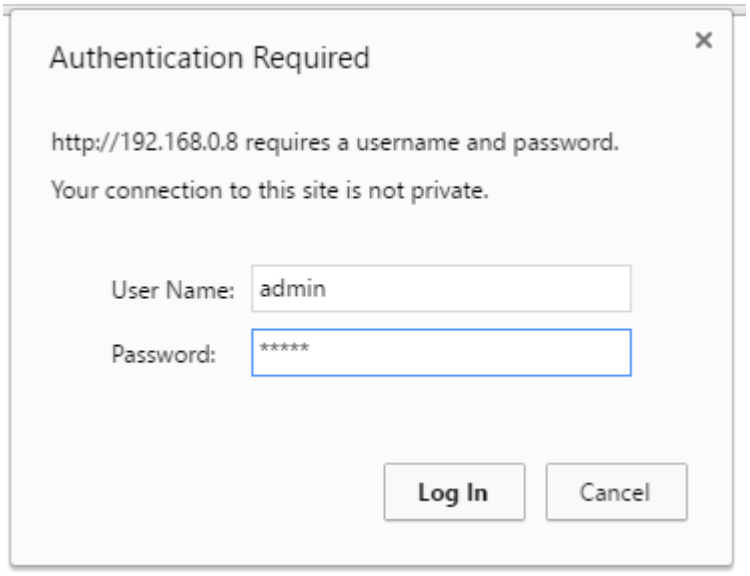


Firmware Upgrade

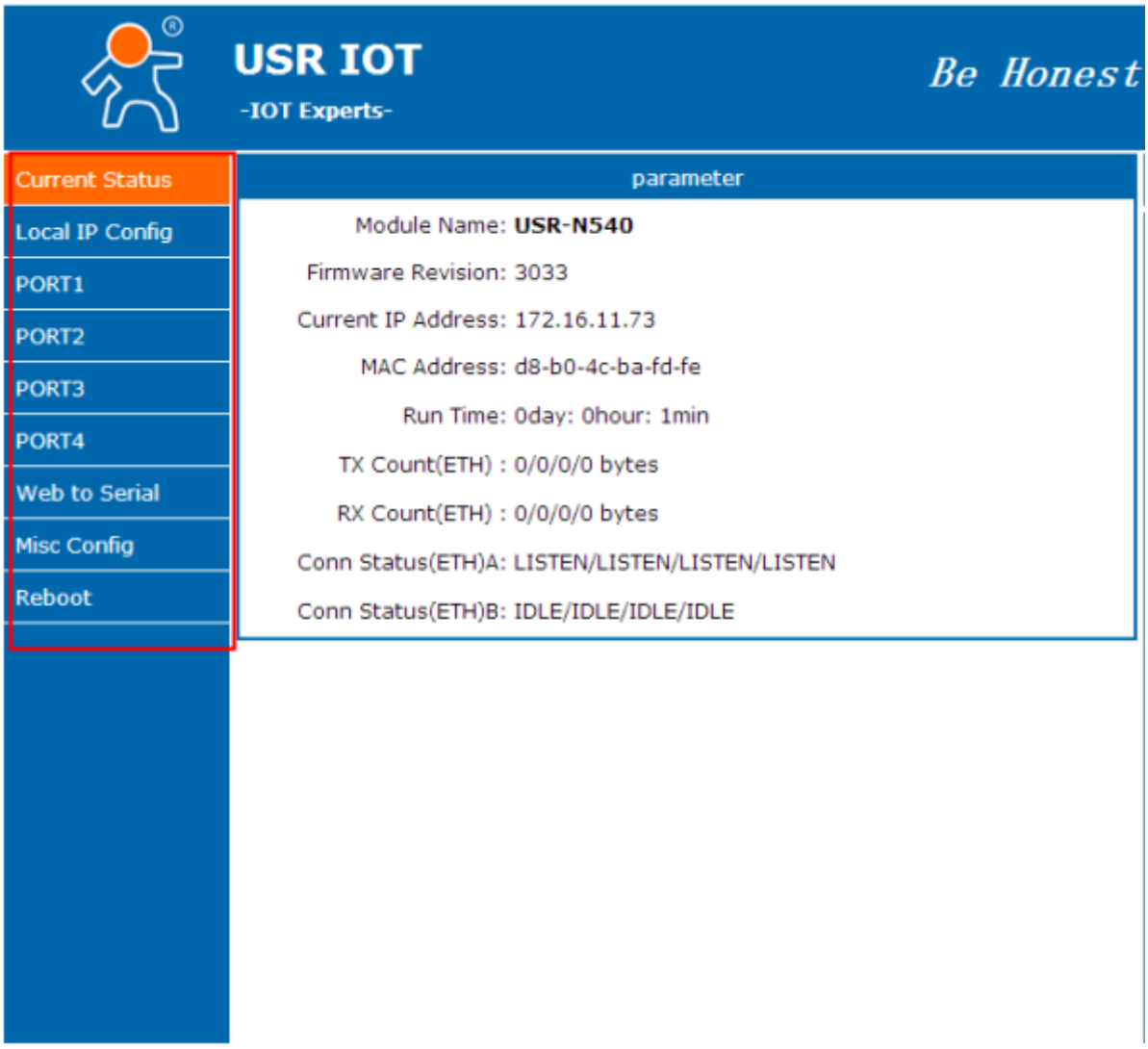
5.2. Webpage Configuration

User can login web-page by N540's IP address.
Example: Open browser and type in USR-N540 ' IP (192.168.0.7 by default).
Then user name: admin and password: admin.

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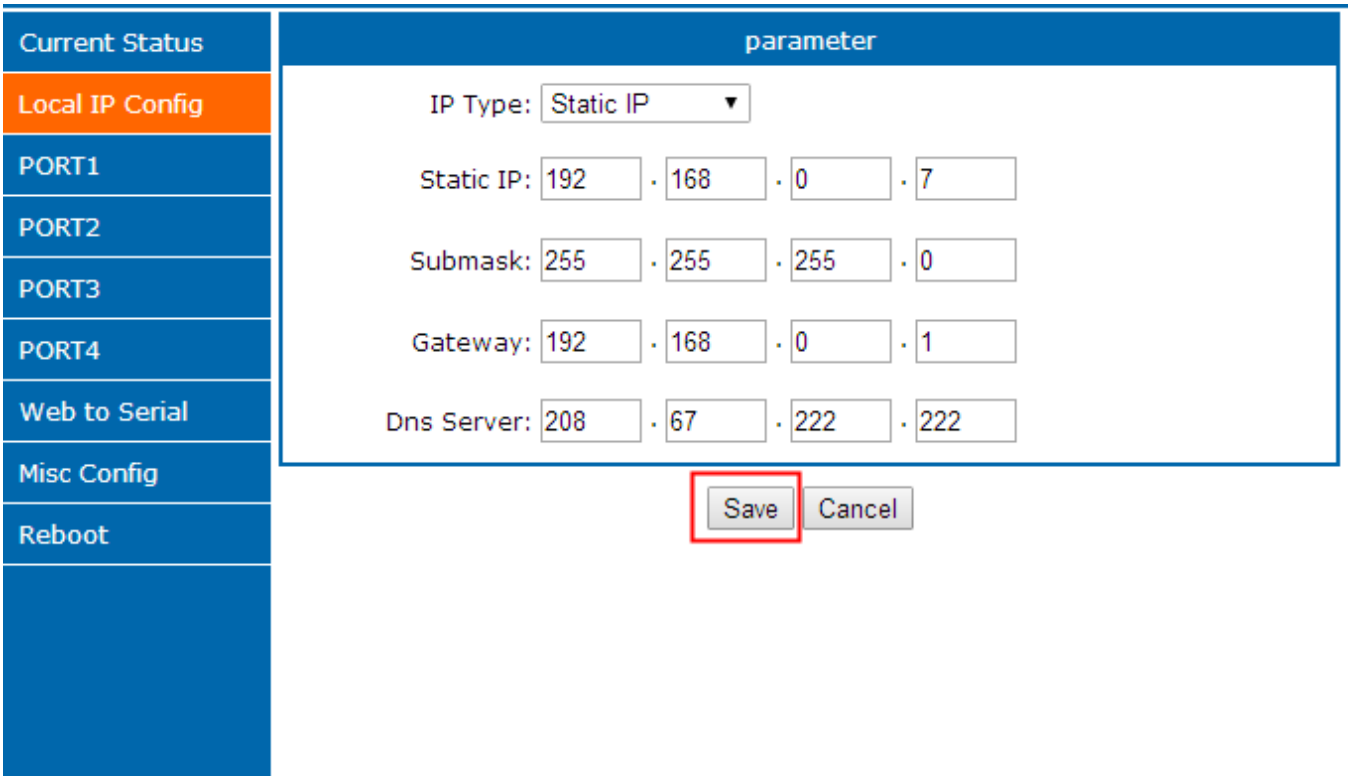
Webpage Log In



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1. Current Status - reveals basic information:
   - N540 name
   - Version
   - Current IP
   - MAC address
   - Total running time: from be powered
   - Count of data sending: how many data sent from powered
   - Count of data receiving: how many data received from powered
   - USR-N540 connection status: check whether connection is built.
2. Local IP Config

   Save configuration after revising the parameters. Then restart.



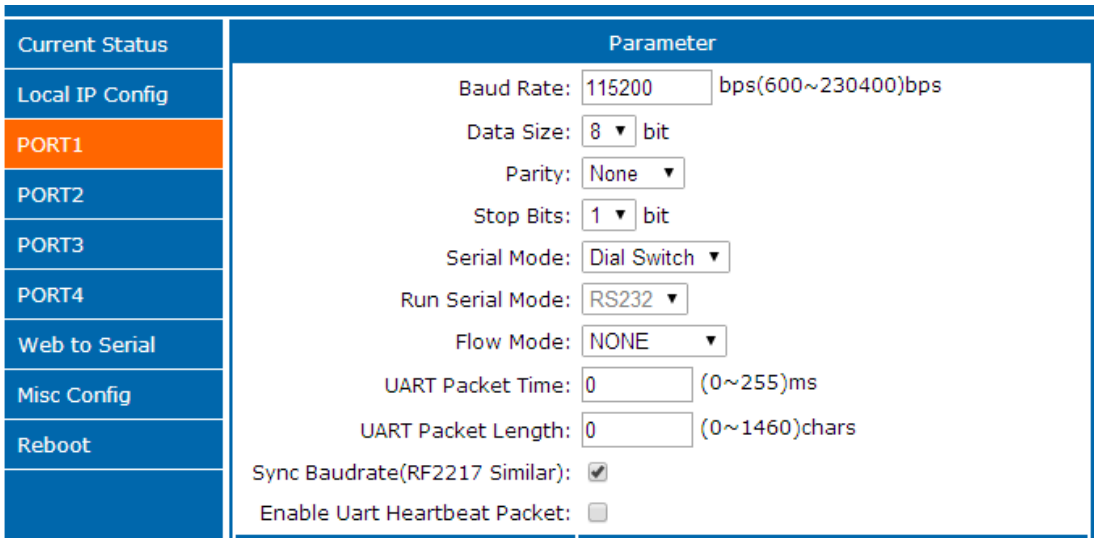
Webpage Configuration-Local IP Configuration

IP setting

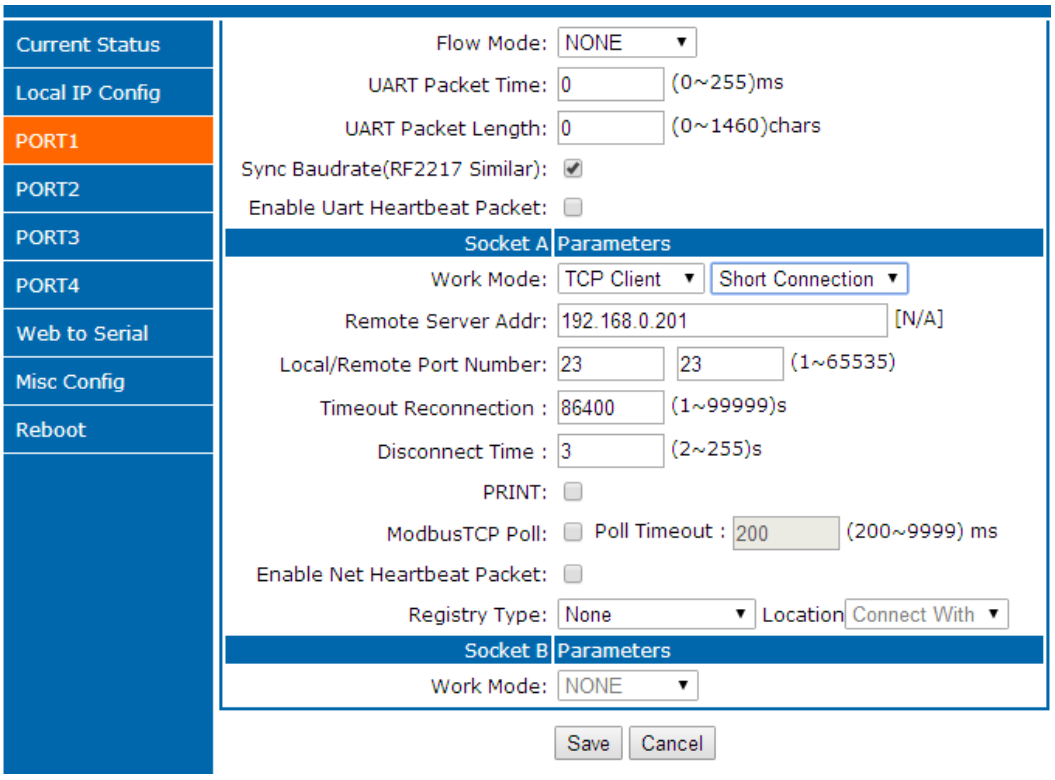
3. PORT1

   ① Basic Parameter, as below

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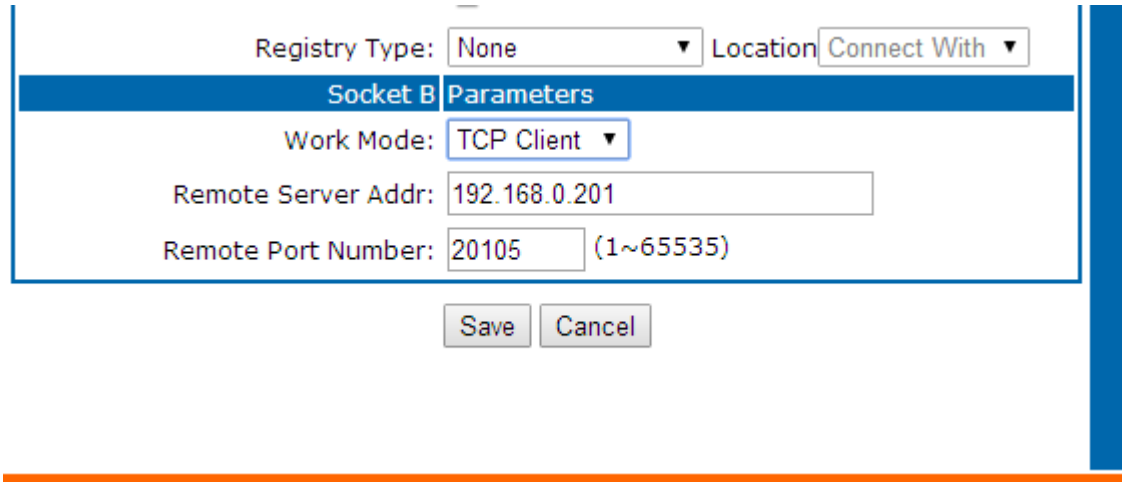
② Socket A Parameters Configuration



- Work Mode: TCP Client, TCP Server, UDP Client, UDP Server
- Timeout re-connection: When the ethernet port of device fails to receive the data or no data transmission within the specified time, the device will re-connect server to avoid the abnormal situation affecting the communication
- Disconnect time: Only for TCP client. If the network failure causes the link to break, the device will actively connect to the server within fixed time
- Print: Function for network printing
- ModbusTCP Poll: Function for Modbus Polling

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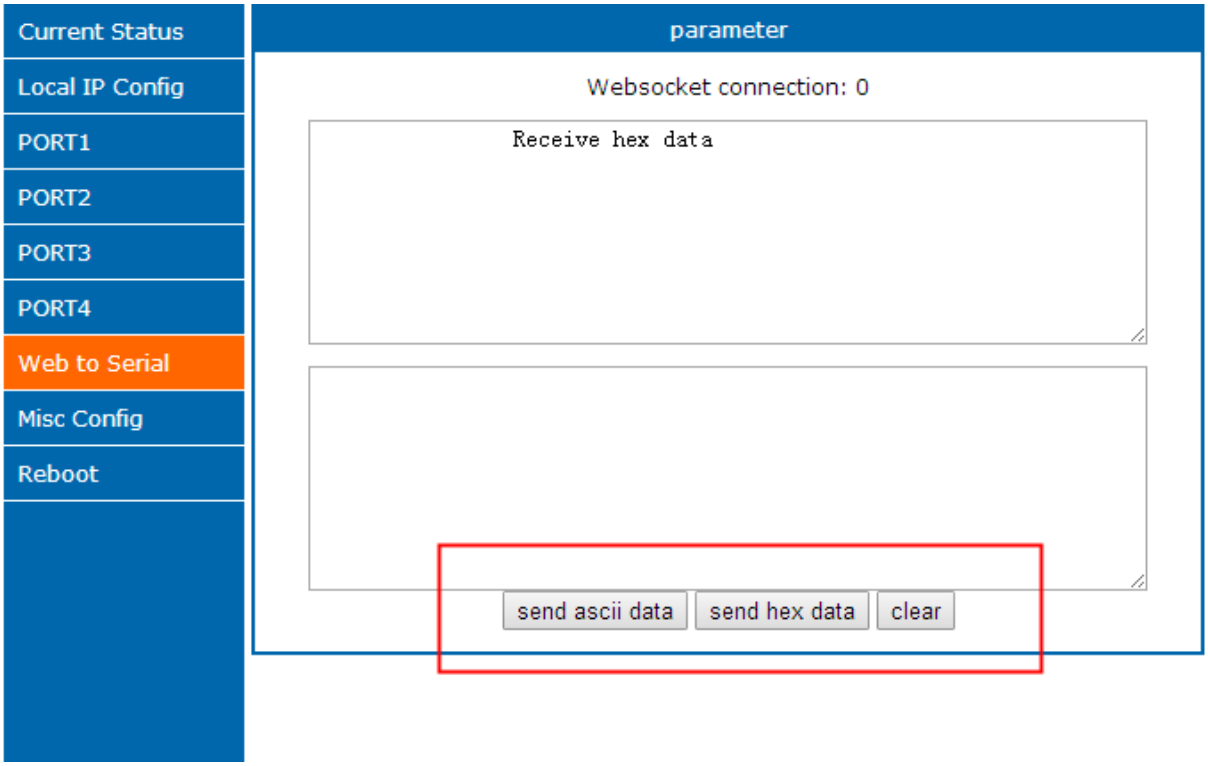
③ Socket B Parameters Configuration



- Work Mode: Only supports TCP Client/UDP Client

4. Web to serial

Click “web to serial ” and “connect success” pops up. Confirm then send data.



Web to Serial

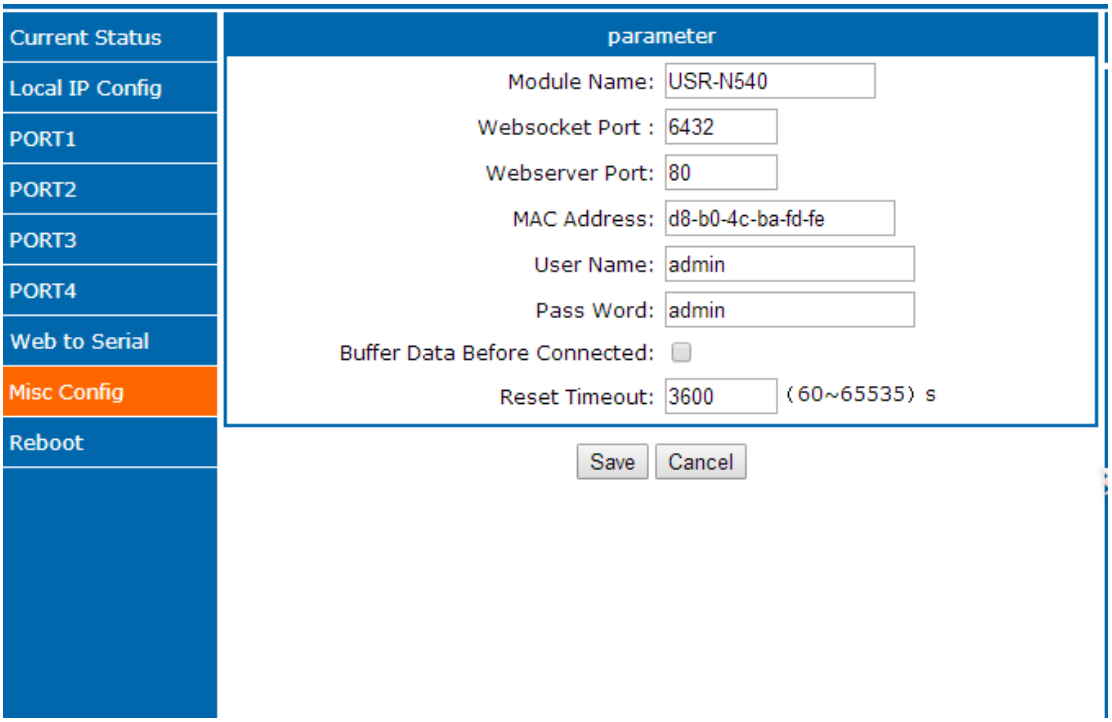
5. Misc Config

This part refers to the parameters of the device itself. User can modify them according to the application.

- Module Name: USR-N540 (User can modify it)
- Websocket port
- Webserver port：80

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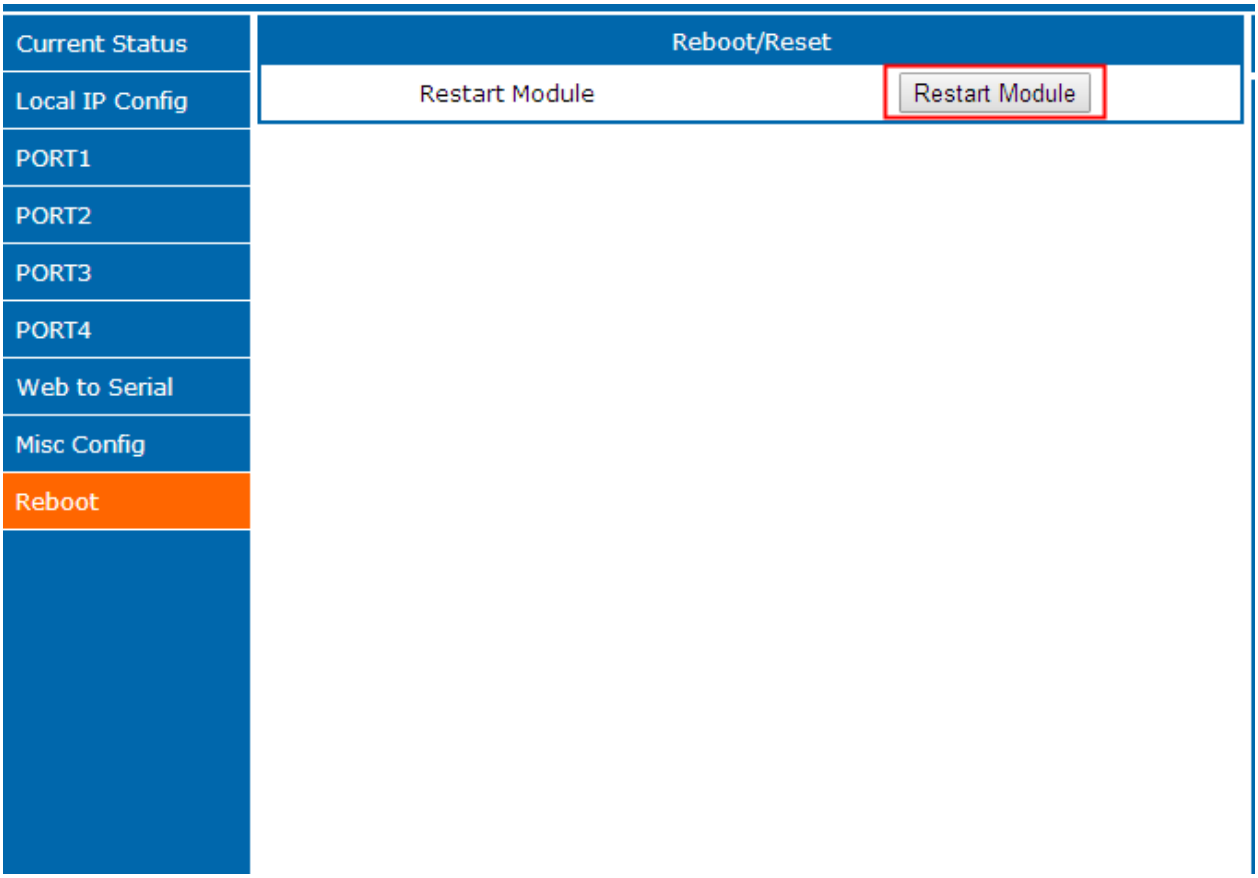
- MAC address(can be revised)
- User Name/ Password: Used for login web-page, user can modify it
- Buffer data before connected: whether serial and network data are cached if disconnection.
- Reset timeout: how long USR-N540 reset when no data from COM or Network. Set to “0” then no rest.



6. Reboot

   Save all data then click restart to take effect.

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Webpage configuration- Restart

5.3 Serial Configuration

Serial configuration use AT command, please refer to this documents:

6. Contact

Company: Jinan USR IOT Technology Limited
Address: Floor 11,Building1,No.1166 Xinluo Street,Gaoxin Distric,Jinan,Shandong,250101 China
Tel: 86-531-55507297, 86-531-88826739
Web: http://www.usriot.com
Support : http://h.usriot.com
Email: sales@usriot.com

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8. Update History

2015-10-22	V1.0.1	Established.
2015-11-24	V1.0.6	Add the connection diagram
2015-11-24	V1.0.7	Modify the instr of HTTPD
2019-5-9	V1.1.0	Using new hardware type, cover picture, correct the faults of the DB9
2019-5-22	V1.1.1	Modify the wrong picture of the client
2019-5-30	V1.1.2	Modify the dimension diagram

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