Multifunctional Serial to Ethernet converter

(USR-TCP232-E2)
(USR-TCP232-ED2)
(USR-TCP232-410)

File version: V1.0.10

Jinan USR IOT Technology Co., Ltd. works on LAN and WAN and wireless for MCU to Ethernet Solutions, Ethernet, WIFI, GPRS, and Wireless modules, we can supply custom design for those usage, looking forward to cooperate with you.

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1. Introduction

1.1. Overview

The USR-TCP232-M4 product series is an intelligent plug-and-play RS232/RS485/UART to Ethernet adapter that enables any device or machine with a serial port, to become Ethernet network and Internet enabled, and have network data transmit ability. It features a powerful built-in device server, so you can access your serial device from anywhere in the world over internet! The USR-TCP232-M4 is easily configured via local network, or through the serial port and web pages.

We Provide Network products and the best service to our customers.
• Chips • Modules • Software • Products

1.2 Features

1. New Cortex-M4 kernel, industrial working temperature range(-40~85℃), elaborate optimization TCPIP protocol stack, stable and reliable.
2. selectable RS232/RS485/UART port, Different port can be used together, work independently, distinguish the connected serial port via port number.
3. Auto-MIDX function, discretionarily connect cross-over or direct network cable, automatic switching.
4. Support TCP Server, TCP Client, UDP, UDP Server, HTTPD Client,websocket, various of ethernet protocols.
5. Support virtual serial port, provide corresponding software.
6. Serial port highest baud rate from 600bps to 1024000bps(COM0 only max 256000bps).
7. wide voltage input, more applications.
8. Support DHCP, automatically access IP, can inquire the facility within network through the UDP broadcast protocol(using software USR-TCP232-E45 Setup).
9. Supply the protocol for VIP customers
10. Provide PC TCP/IP SOCKET programming example, VB, C++, Delphi, Android, IOS.
11. A built-in web page, also parameter setting via web, can customize web pages for users.
12. Can also set via UDP broadcast, provide the set up protocol.
13. Reload button, a key restore default Settings.
14. RJ45 status indicator light, RJ45 interface built-in isolation transformer, 2 KV isolation.

15. The global unique MAC address bought from IEEE, the user can define MAC address (please state when you make order).
16. Support upgrade firmware via network.
17. Support visit IP and domain name at the same time
18. Support up to 8 link from client when act as TCP Server, same data will be send to all client.
19. Can modify http server port from default port 80 for module built-in http server.
20. Support Keepalive, detect a dead link quickly and make sure the connection more stable.

1.2. Applications

- Fire and Security Panels
- Vending Machines
- Point of Sale Terminals
- Remote equipment management
- IT management services
- Access Control
- Industrial Control
- Home Automation
- Instrumentation
- Building Control
- Power Management

1.3. Order information

Type	Part Numbers	Electric interface
Serial to Ethernet Converter	USR-TCP232-E2	2 * TTL232
Serial to Ethernet Converter	USR-TCP232-ED2	3 * TTL232
Serial to Ethernet Converter	USR-TCP232-410	1 * RS232, 1 * RS485

Diagram 1-1 Order information

Note:

For webpages: PORT0, PORT1 and PORT2, represent below:

TCP232-E2: PORT0 represent UART0, PORT1 represent UART1, PORT2 not available in hardware;

TCP232-ED2: PORT0 represent UART0, PORT1 represent UART1, PORT2 represent UART2;

TCP232-410: PORT0 represent RS232，PORT1 represent RS485，PORT2 not available;

1.4. Electrical characteristics

All the data is get at tempture 25℃, network cable plug in, max data transmittion(10ms, 20 byte, sending data constantly).

Working tempterature range: -40~85℃.

Unpowered storage temperature and humidity range: -65~150℃, 5~95%RH

	Input Voltage range	Current cosumption at 3.3V	Current cosumption at 5V	Current cosumption at 12V
TCP232-E2	DC3.3 or 5V	120mA(115-125)	120mA(115-125)	Not available
TCP232-ED2	DC3.3 or 5V	120mA(115-125)	120mA(115-125)	Not available
TCP232-410	DC5~18V	Not available	86.5mA(85-87.9)	44.3mA(43.7-45.1)

1.5. Difference between E45 series and M4 series

The new M4 series is a function full-compatible product to the old E45 series product, but there are still difference.

difference	TCP232-E45	TCP232-M4
frequency	50MHz	120MHz
Flash size	256Kbyte	512Kbyte
RAM size	64Kbyte	256Kbyte
current	180~190mA（-E）	120mA（-E2）
485 connector	3.81-2	5.08-2
size		ultra-tiny product USR-K3
LEDs	No	LED holder, more tight
webpage	No change	New web page style
Setup software	Use V1.x.x.x setup software	V2.x.x.x or higher
Comm number	3	3(have 1 and more Model)

2. Module Test

If you have any question, please contact us the in the client support center:

http://h.usriot.com/index.php?c=frontTicket&m=sign

2.1. Hardware connection

The picture below is a serial device server of TCP232-410. It have 1 RS232 and 1 RS485, they can work independently, now we are going to test it's RS232 function.

Diagram 2-1 TCP232-410 with case

Power 410 with DC5V adaptor(make sure you can supply at least 200mA current at DC5V)

Connect 410's RJ45 to PC directly with network cable(No need to distinguish cross or direct connect cable), or connect the module and PC via switch or router and set the PC's ip address to 192.168.0.201(must be a format of 192.168.0.xxx), netmask 255.255.255.0.

Connect 410 and PC's comm port together, with a standard female-female extend cable(default cross-over cable).

Here is TCP232-410's default net configuration,

IP address: 192.168.0.7

Subnet mask: 255.255.255.0

The default gateway: 192.168.0.1

2.2. Login

Open a browser, type and Login above IP address http://192.168.0.7, you will enter module's setup web pages.

User name and password are both “admin”, this can be modified after login into the system.

Default user name: admin

Default password: admin

After you have login, you can see webpage as follow, this is config page for TCP232-410

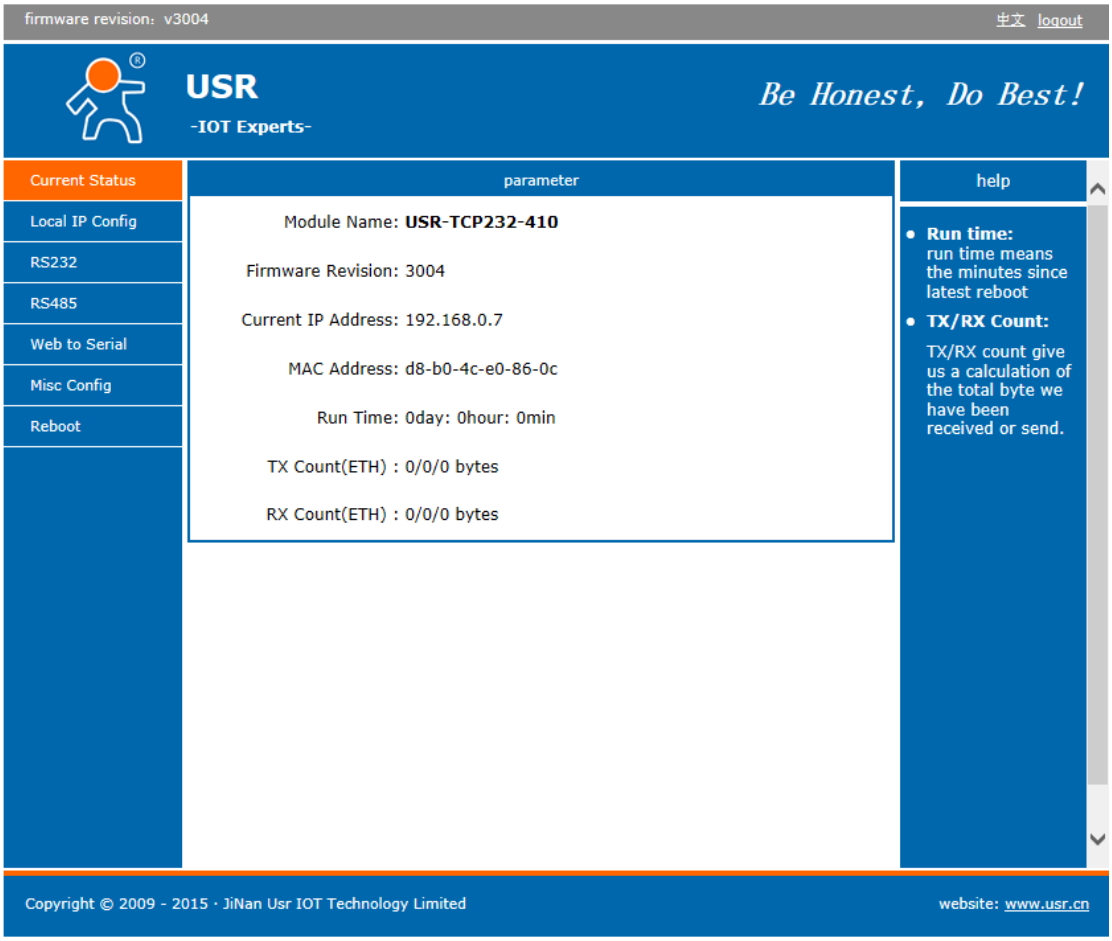


Diagram 2-2 page after login

Current config and status: include display of firmware revision, ip address and mac address.

RS232: represent RS232 port config.

Port1 settings: represent RS485 port config.

Port2 settings: not available.

Web to serial: wesocket function which enable you send and receive data between webpage and comm port 0(Port 0 only).

Miscellaneous settings: used to set key parameters such as module IP and module name, also include reset and reload button in webpage.

2.3. Default parameter test

To test briefly in default working mode, on the foundation of the hardware connection, use the matched software USR-TCP232-Test to make transmitting and receiving test. The left side is

serial port, use software default settings, the right side is the network part, set to TCP Client and server to be IP 192.168.0.7, port 23.

By default, the two COM port to be set as TCP Server mode, port is 23/26.

This illustration shows the 10 ms two-way simultaneous automatically transmit screenshots. As the allocated memory of the display control is limited, in order to test large amount of data transceiver, here will suspend the receive display, only statistical data. Below is the effect after testing for a few hours, and transmitting millions of bytes. Stable and reliable, without a byte loss.

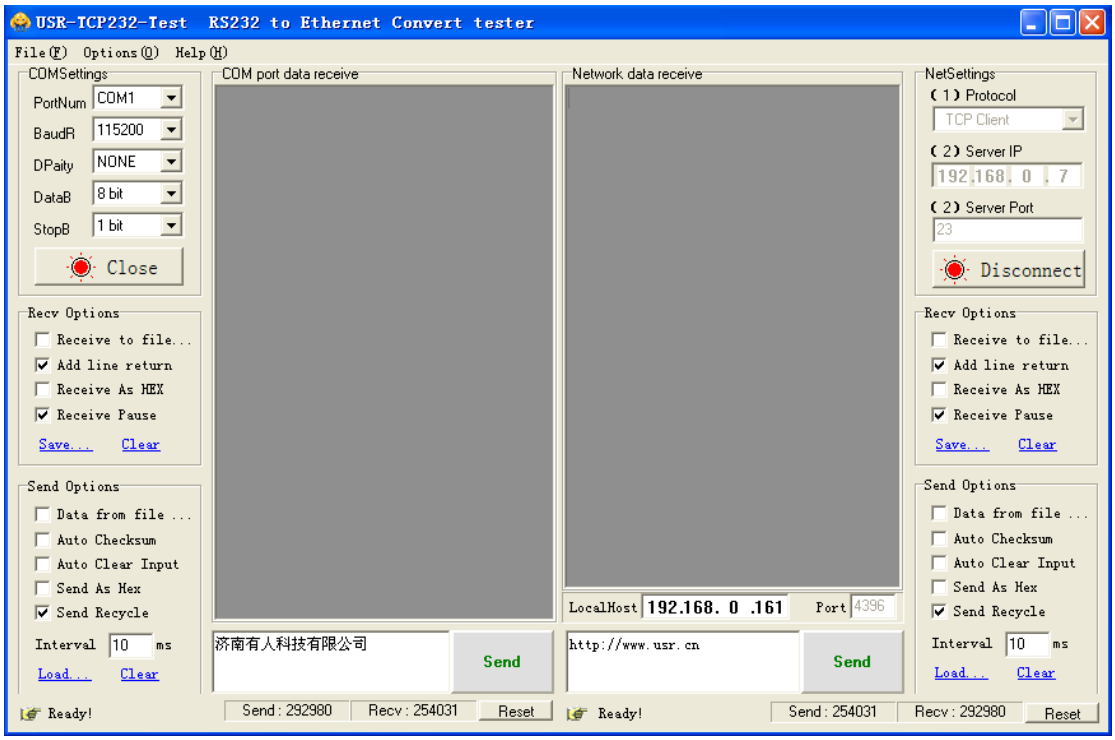


Diagram 2-3 default working mode communication

3. Work mode

3.1. UDP mode

When in UDP mode, after power on, module will connect to remote server's specific port.

When received data from the remote server, module will send it to serial port;otherwise, when data is received from serial port, send it to ethernet.

The assist software can be download from link below:

http://www.usriot.com/Download/199.html

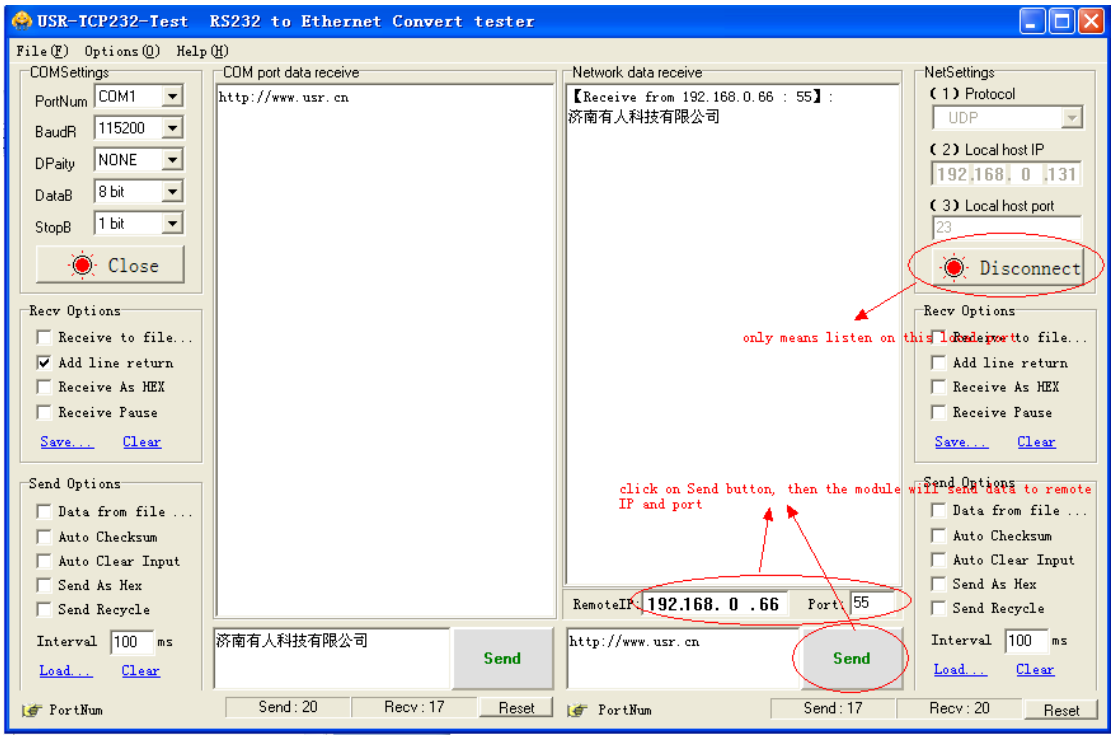


Diagram 3-1 UDP mode communication test

Note:

1) local port and remote port can be different.
2) Max UDP send length(ethernet to serial) is 1472 bytes. If you want to send more than 1472 Bytes, please div it into shorter packet.

3.2. TCP Client mode

Open web pages and config module to

Telent Mode: TCP Client

Remote port number: 23

Telnet Server Addr: 192.168.0.131

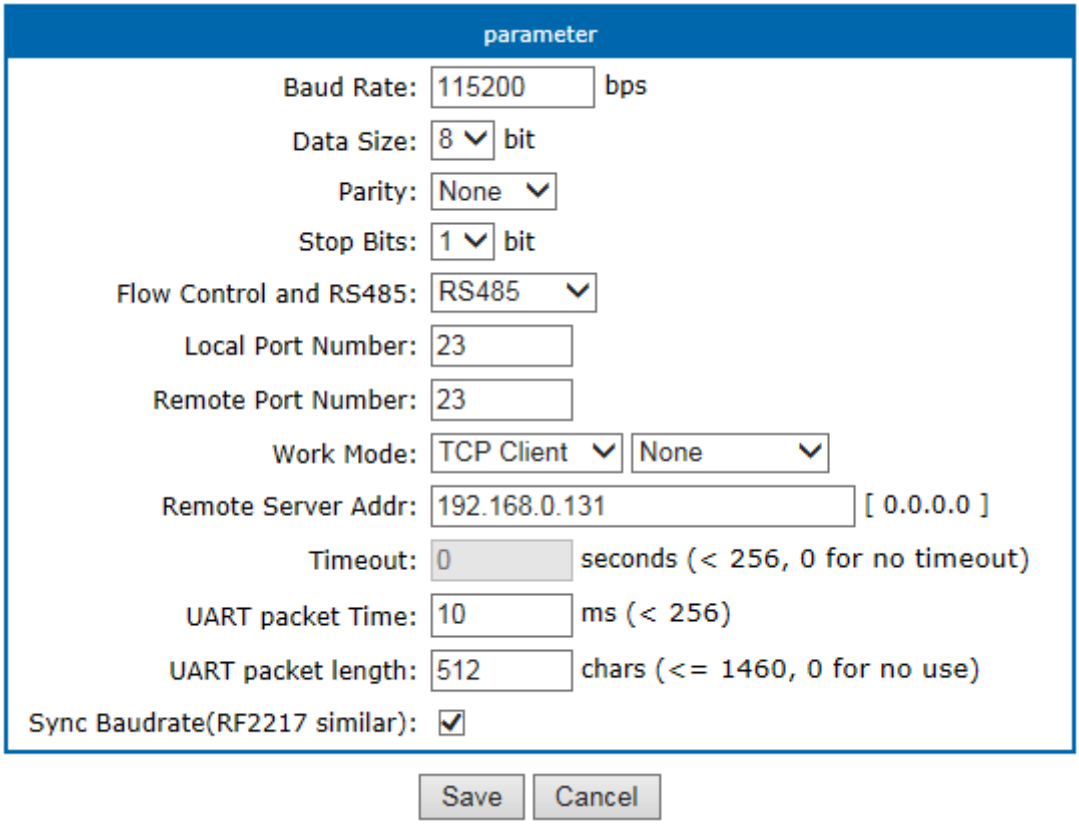


Diagram 3-2 TCP Client mode

Use USR-TCP232-Test,

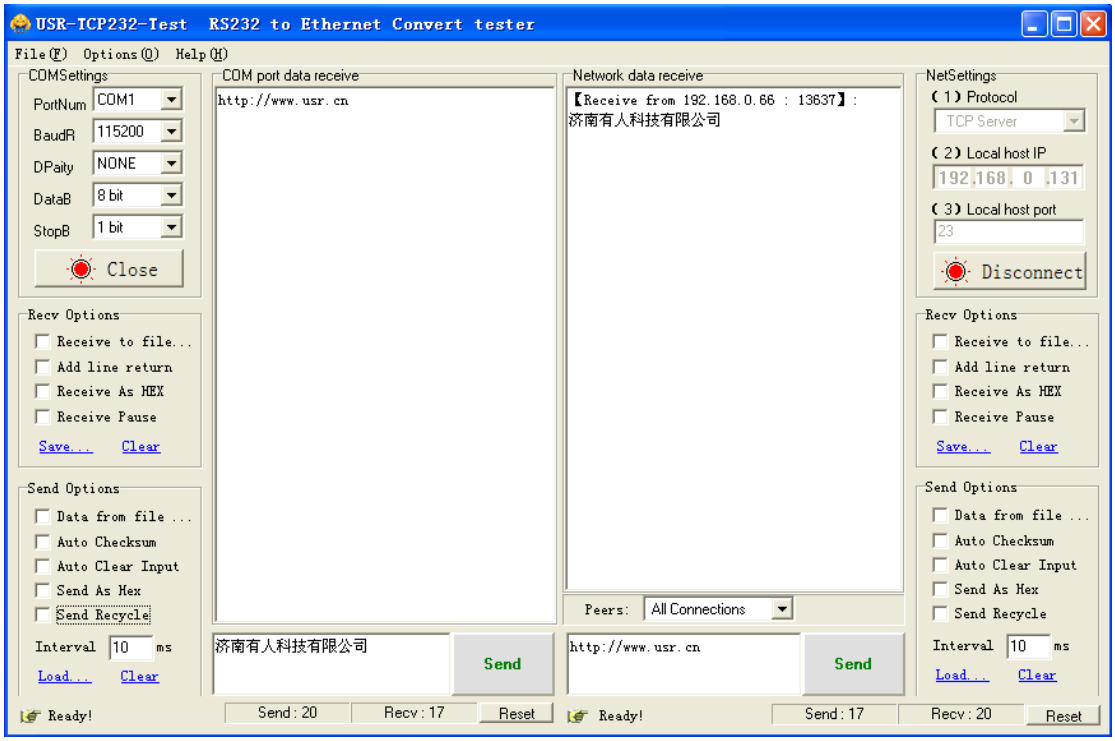
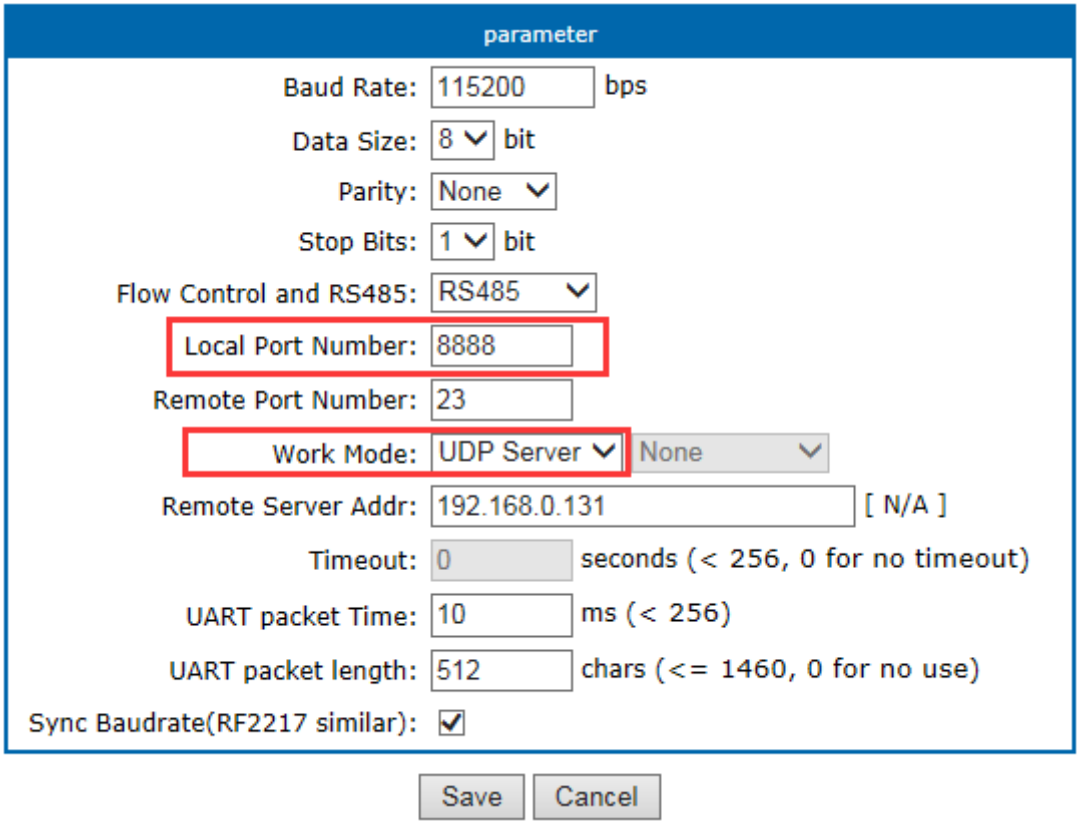


Diagram 3-3 TCP Client communication test

3.3. UDP Server mode

Like the socket UDP server in pc API. Many to one data transfer supported, the data from uart/232/485 part will be transformed to the last UDP packet's address.

Here show 2 UDP client communicate with server, server send data to the last client communicates with it.



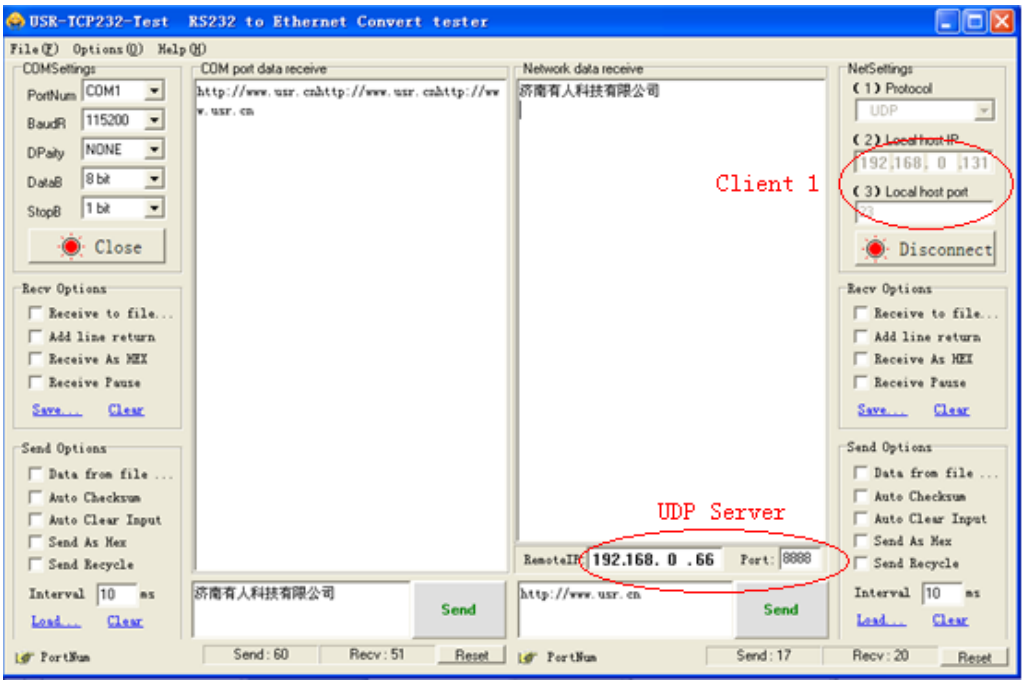


Diagram 3-4 Client 1 <-> server

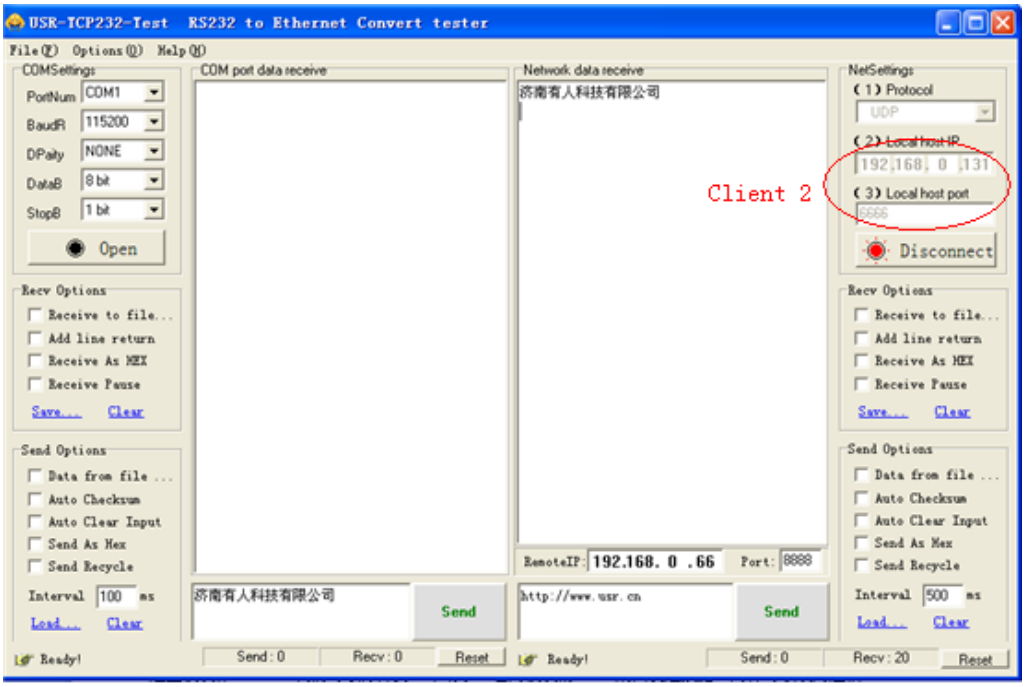


Diagram 3-5 Client 2 <-> server

3.4. TCP Server mode

TCP Server mode have max 8 client connected at max;

When act as TCP server, only local port matters,

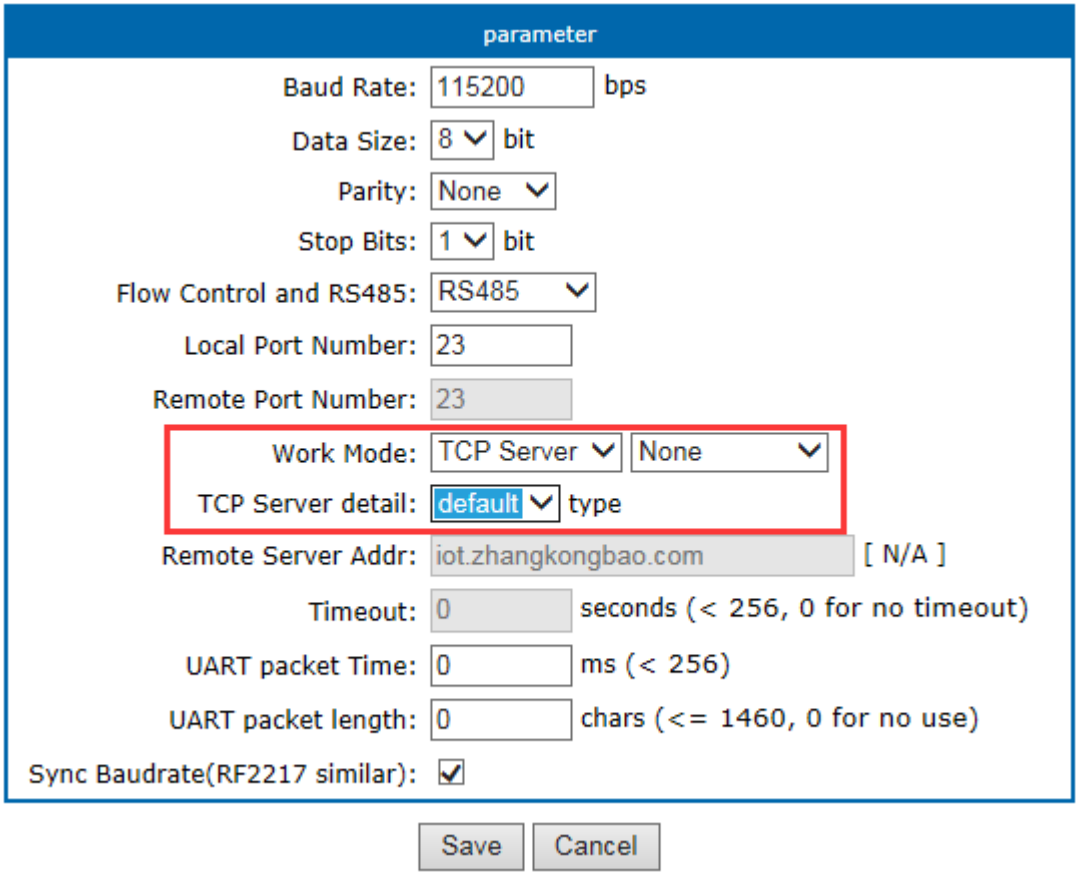


Diagram 3-6 select workmode TCP server

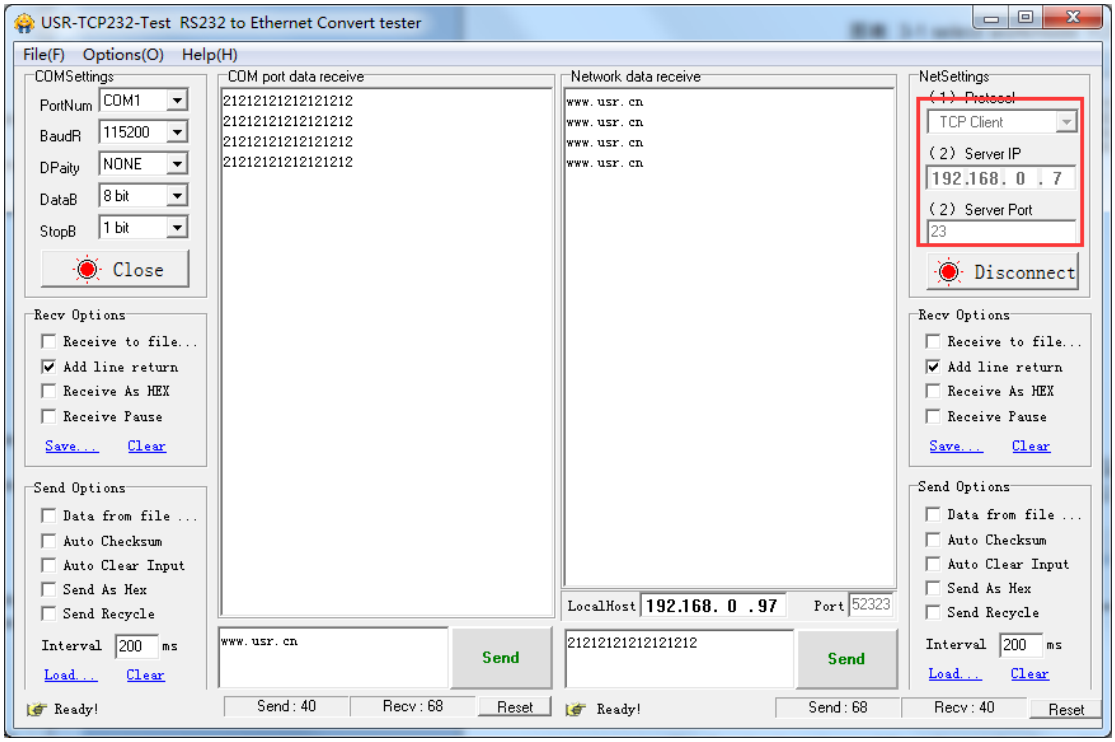


Diagram 3-7 test result, we can establish more than 1 client to test

3.5. Httpd Client mode

This function is easier used for webpage developer. We establish one web server page, add this:

[<?php echo $_GET['data']; ?>]

Means we can GET data from HTTP client's request. Open this URL: test.usr.cn/1.php?data=12345, the web page is downbelow, we can see that the web server have got the data(12345),

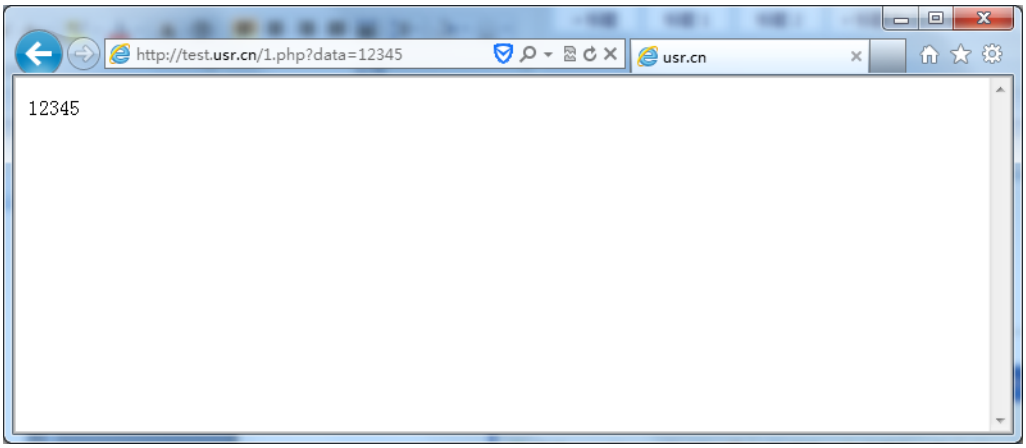


Diagram 3-8 Request **test.usr.cn/1.php?** and upload data

Then we take another way, set module Work mode HTTPD Client, Target address **test.usr.cn,** Target port 80.

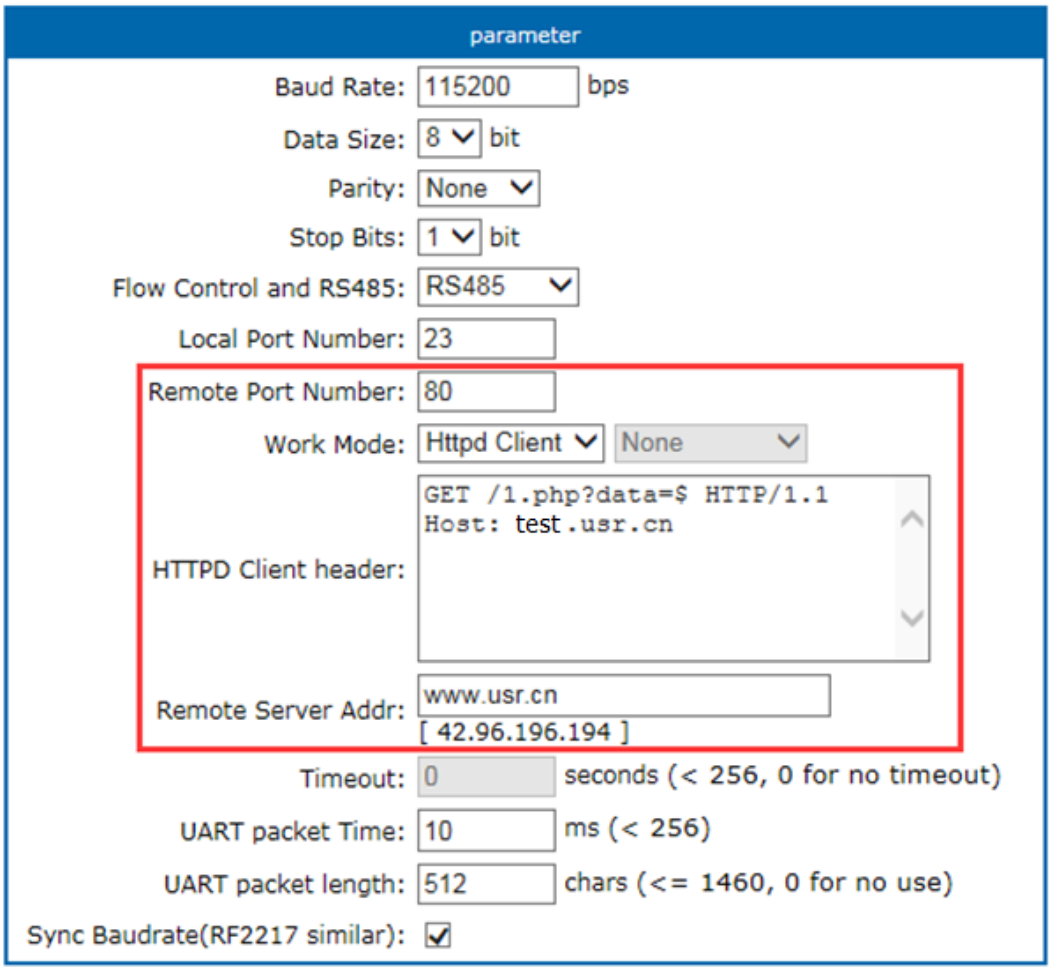


Diagram 3-9 config HTTPD Client

Open USR-TCP232-Test, and type in a string such as "12345", then send via comm port to TCP232-410, and see the response from **test.usr.cn** .

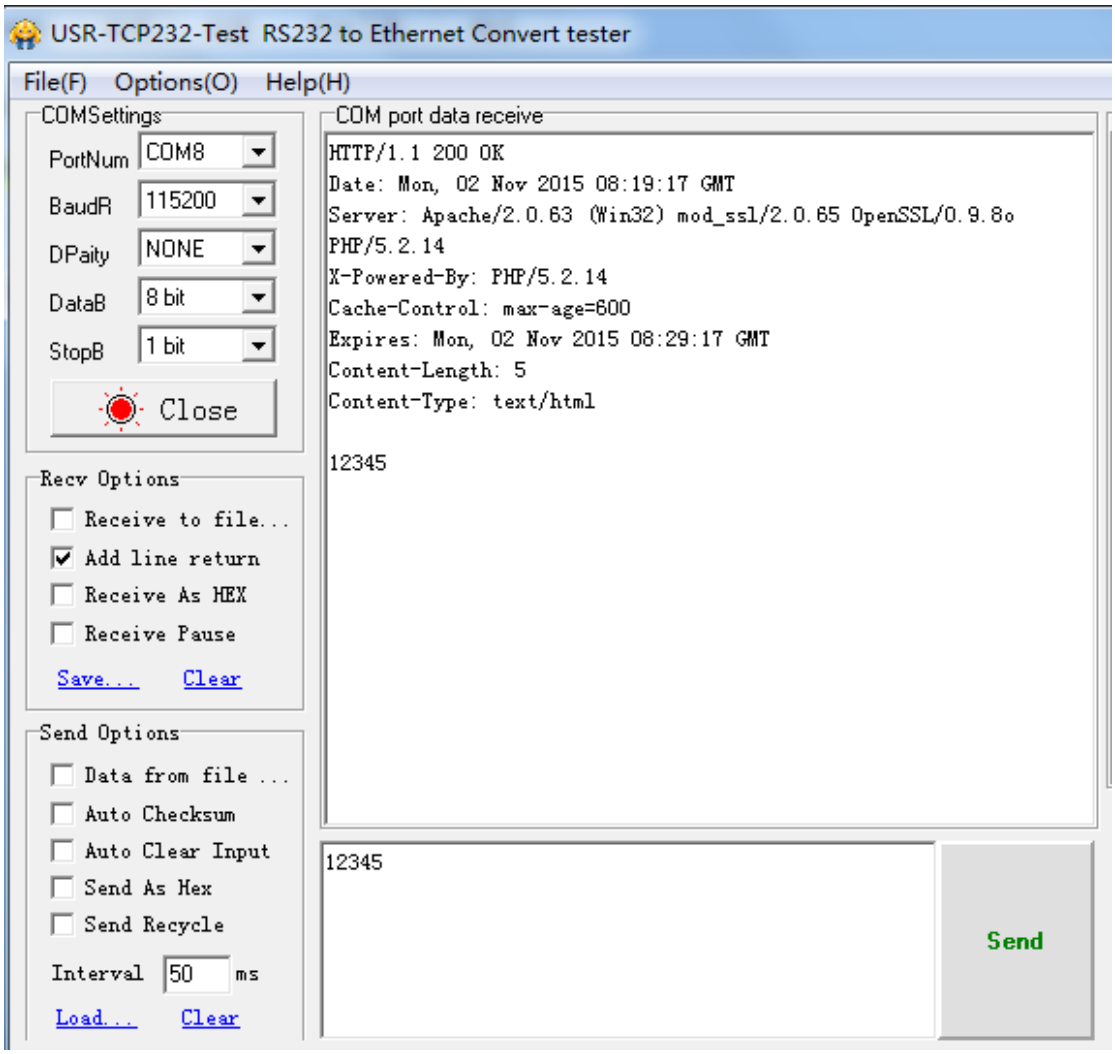


Diagram 3-10 module act as HTTPD Client

In the response, all the data returned, but the http header from server will be returned, too. the user may need to parse this to get your data.

4. Hardware

About the new PCB libraries file, we can download it from website **http://www.usriot.com/Download/221.html** .

4.1. USR-TCP232-E2

4.1.1. Hardware

Diagram 4-1 USR-TCP232-E2

1) Mechanical dimesion: (L×W×H): 55×30×23.2(mm) including RJ45 and connector；
2) PCB dimension(L×W): 50.4×30.0(mm)；
3) 5V 3.3V double power input， choose 1 input
1) 2 * serial port (2 * TTL, 3.3V)
2) TTL serial port 0 support hardware flow control(RTS/CTS)

4.1.2. Power and other pin

Power supply socket, The input voltage range 3.3V or 5V, average current both 120 MA. We default supply customer with high quality 5 V / 1 A power adapter.

if your MCU's signal is 5V, pls add a signal convert between 3.3V and 5V

id	name	description
1	VDD	DC5V(you must choose only one supply between 5V or 3.3V)
2	VCC	DC3.3V(you must choose only one supply between 5V or 3.3V)
3	GND	ground
4	RST	Reset pin(give a constant 200ms low level make module reset)

5	TXD0	Data transmit pin for comm port 0
6	RXD0	Data receive pin for comm port 0
7	Reload	Pin to make module back to factory default parameters(take this pin to low , then power off and on, keep this pin down for 2 seconds, then release it)
8	WORK	WORK LED indicate, it will toggle every 1 second
9	CTS0	Clear to send
10	RTS0	Request to send(also muxed as RS485 enable tx pin, enable it from software in)
11	RXD1	Data receive pin for comm port 1
12	TXD1	Data transmit pin for comm port 1

Diagram 4-2 pin description

Download is pin position for TCP232-E2, if you want accurate footprint, please see the pcb library file **http://www.usriot.com/Download/221.html**

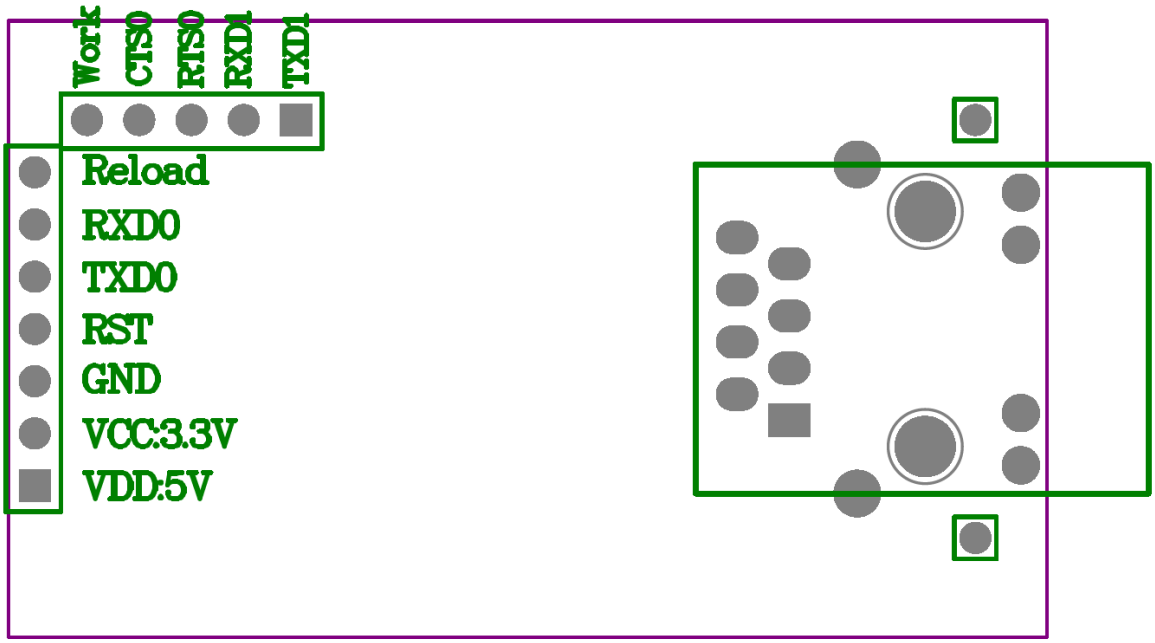


Diagram 4-3 pin position

4.1.3. LED status

besides Link and Data LED of RJ45, there is one work LED pin interface reserved on board.

ID	name	Description
1	Work	Just interface pin, have no LED on module,

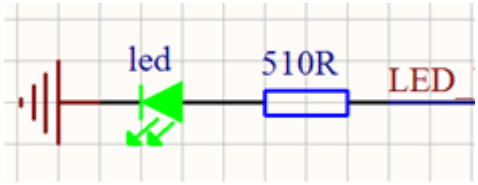
		If you need it, take this pin with LED and 510 ohm resistor to GND. 
2	Link(green)	On RJ45, when ethernet physical link established, on.
3	Data(yellow)	On RJ45, wnen ethernet data communicate, twinkle.

Diagram 4-4 LED definition

4.1.4. Serial(TTL) interface

There is 2 serial port on TCP232-E2, only UART0 have 485_en pin.

The serial port is 3.3V TTL level (2 * TTL serial port, can be directly connected to customer's MCU).

name	Description
TXD0	Uart0 transmit data pin
RXD0	Uart0 receive data pin
CTS0	Default unused. (can be configured as Uart0 clear to send)
RTS0	Default as 485_en for UART0, (can be configured as Uart0 require to send)
RXD1	Uart1 receive data pin
TXD1	Uart1 transmit data pin

Diagram 4-5 connector interface

4.2. USR-TCP232-ED2

4.2.1. Hardware

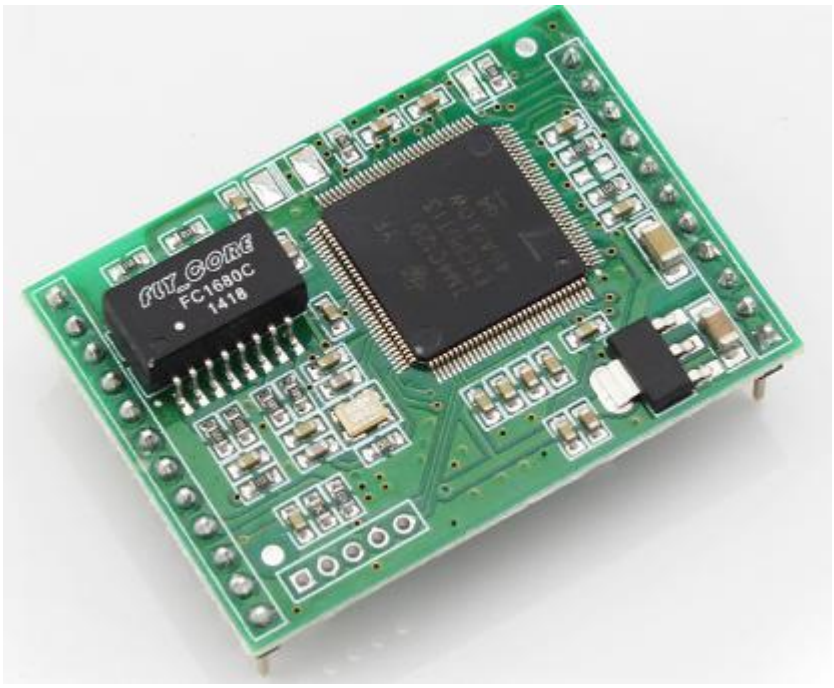


Diagram 4-6 USR-TCP232-ED2

1) Mechanical dimesion: (L×W×H)44.45×31.75×15.4(mm) including RJ45 and connector.
2) PCB dimension(L×W): 44.45×31.75(mm).
3) 5V 3.3V double power input, you can only choose 1 of them as input.
4) 3 * serial(3 * TTL, 3.3V).
5) TTL serial port support hardware flow control(RTS/CTS).

4.2.2. Power

Power supply socket, The input voltage range 3.3V or 5V, average current 120 MA. We default supply high quality 5 V / 1 A power adapter.

4.2.3. LED status

Except for Link and Data of RJ45, there is one work LED interface

ID	name	Description
1	Work(green)	Toggle every 1 seconds, this LED already on board
2	Link(green)	On RJ45, when ethernet physical link established, on.
3	Data(yellow)	On RJ45, wnen ethernet data communicate, toggle.

Diagram 4-7 LED definition

4.2.4. Serial(TTL) interface

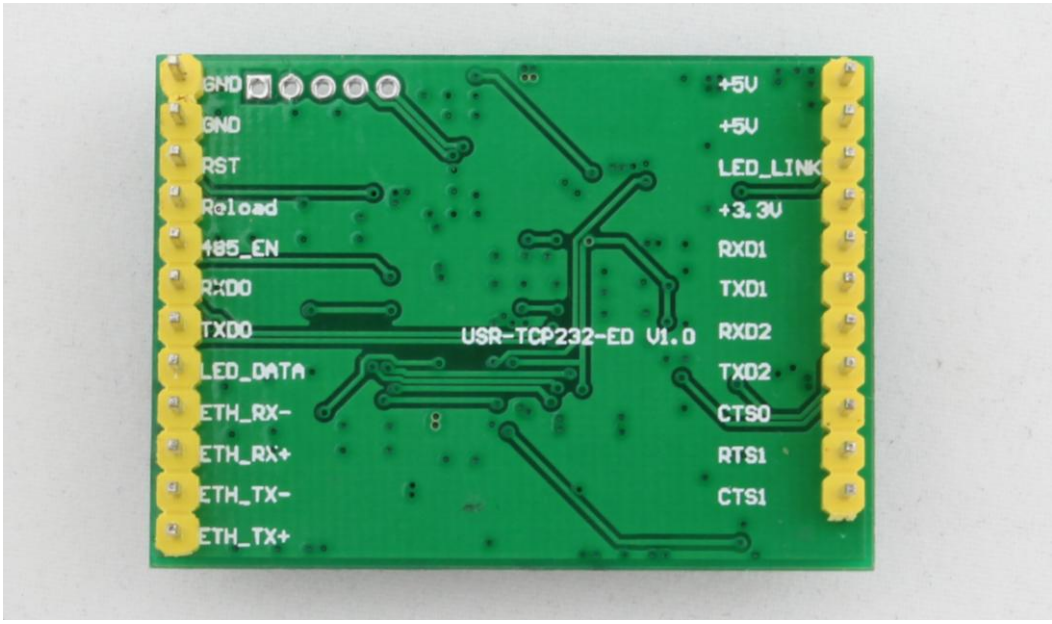


Diagram 4-8 view from bottom

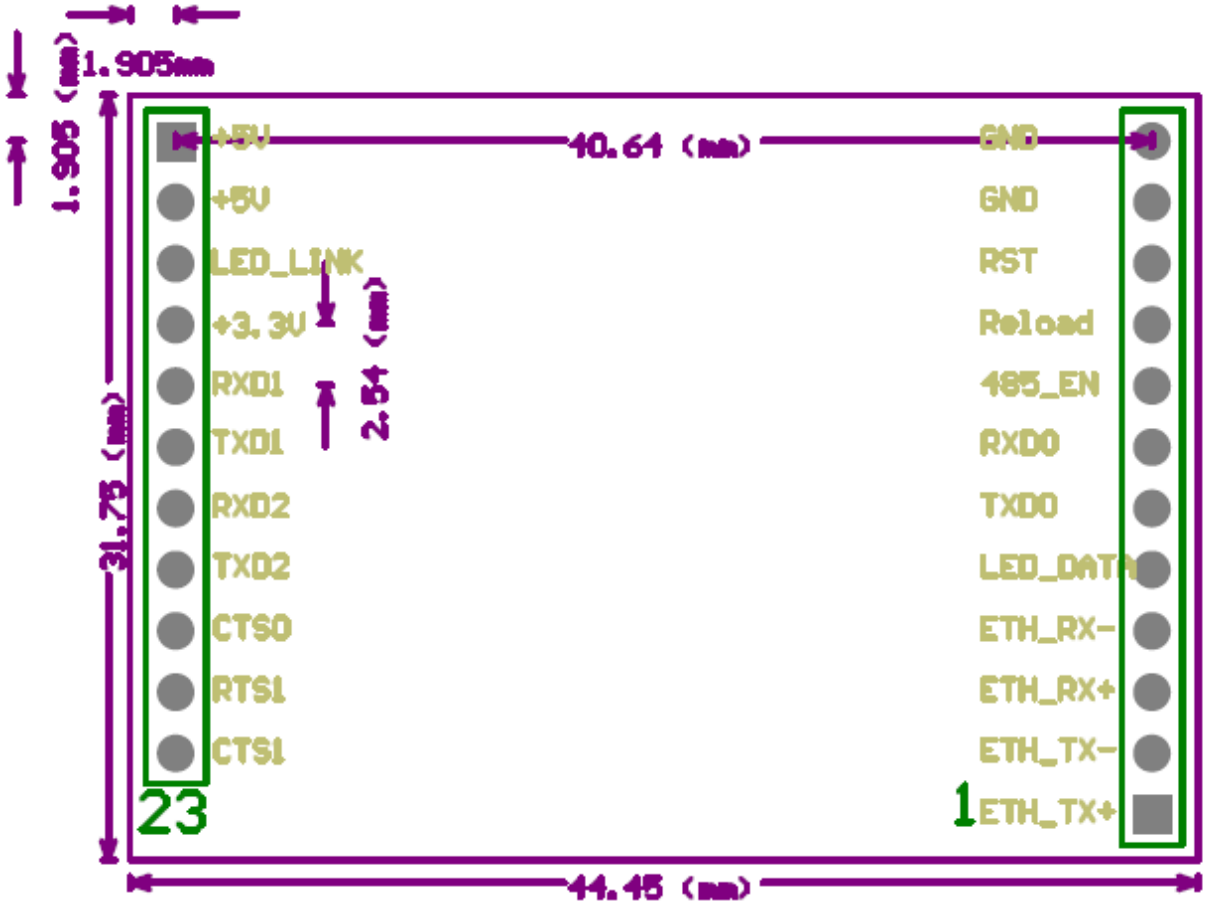


Diagram 4-9 pin diagram

The serial port is TTL level (3 * TTL serial port, can be directly connected to MCU).

number	name	Description
1	ETH_TX+	Ethernet TX+
2	ETH_TX-	Ethernet TX-
3	ETH_RX+	Ethernet RX+
4	ETH_RX-	Ethernet RX-
5	LED_DATA	Ethernet Data LED
6	TXD0	Uart0 transmit data pin
7	RXD0	Uart0 receive data pin
8	485_en(RTS0)	Default as 485_en for Uart1(RS485 enable)(can be configured as RTS0, Uart0 require to send)
9	Reload	Restore to factory
10	RST	Reset(give a 200ms low pulse will make module reset)
11	GND	ground
12	GND	ground
13	+5V	+5V power
14	+5V	+5V power
15	LED_LINK	Ethernet link LED
16	+3.3V	+3.3V power
17	RXD1	Uart1 receive data pin
18	TXD1	Uart1 transmit data pin
19	RXD2	Uart2 receive data pin
20	TXD2	Uart2 transmit data pin
21	CTS0	Default no use. Uart0 clear to send
22	RTS1	Default as 485_en for Uart1, Uart1 require to send
23	CTS1	Default no use. Uart1 clear to send

Diagram 4-10 connector interface(include uart0, uart1, uart3)

Note:

1) There is no RTS2 and CTS2 pin for UART2 on this module, so that means, you can not use Hardware flow control(RTSCTS), or RS485 tx and rx control pin for the last serial port.

4.2.5. hardware connection

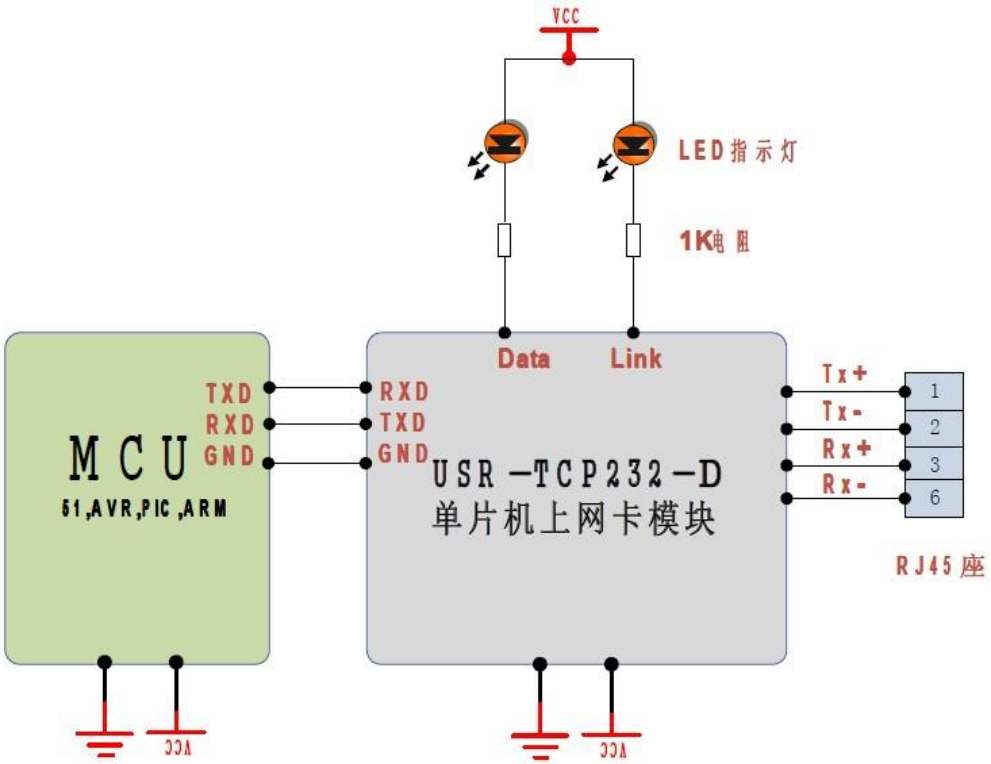


Diagram 4-11 a connection sample

Note

ED2 already have a network transformer on board.

4.3. USR-TCP232-410

4.3.1. Hardware

Diagram 4-12 USR-TCP232-410

1) Mechanical dimesion: (L×W×H)90×84×25(mm) including RJ45 and connector.
2) PCB dimension(L×W): 80.3×50.3(mm).
3) DC+5 ~ +18V power input.
4) DC power plug(can be customized to 5.08 connector power input).
5) 1 * RS232 support hardware flow control(RTS/CTS).
6) 1 * RS485.

4.3.2. Power

This system default use a Power supply socket, we can also customized for 5.08-2 terminal.

The Power supply socket, outer diameter 5.5 mm inner 2.1 mm standard size, inside plus, outside minus. The input voltage range DC5 ~ 18 V, average current 120 MA. We default supply high quality 5 V / 1 A power adapter.

4.3.3. LED status

Equipment have 4 indicator lights in total, sequence from left to right.

ID	name	Description
1	Work	Twinkle every 1 seconds
2	Power	On after power up
3	Link(green)	On RJ45, when ethernet physical link established, on.
4	Data(yellow)	On RJ45, wnen ethernet data communicate, twinkle.

Diagram 4-13 LED definition

4.3.4. RS232 interface

The serial port is male (needle), RS232 level (can be directly connected to computer serial via a RS232 extend wire), When connected with the computer, we need to use cross cable (2-3 cross, 7-8 cross, 5-5 direct Otherwise, it might lead to irregularly work).

Number	RS232	Description
1	-	-
2	RXD	RS232 device receive data pin
3	TXD	RS232 device transmit data pin
4	-	-
5	GND	Signal ground
6	-	-
7	RTS	RS232 require to send
8	CTS	RS232 clear to send
9	-	-

Diagram 4-14 DB9 interface

4.3.5. RS485 interface

RS485 two wirings terminal, A (DATA +), B (DATA), when connected with RS485, A (+) to A (+), B (-) to B (-).

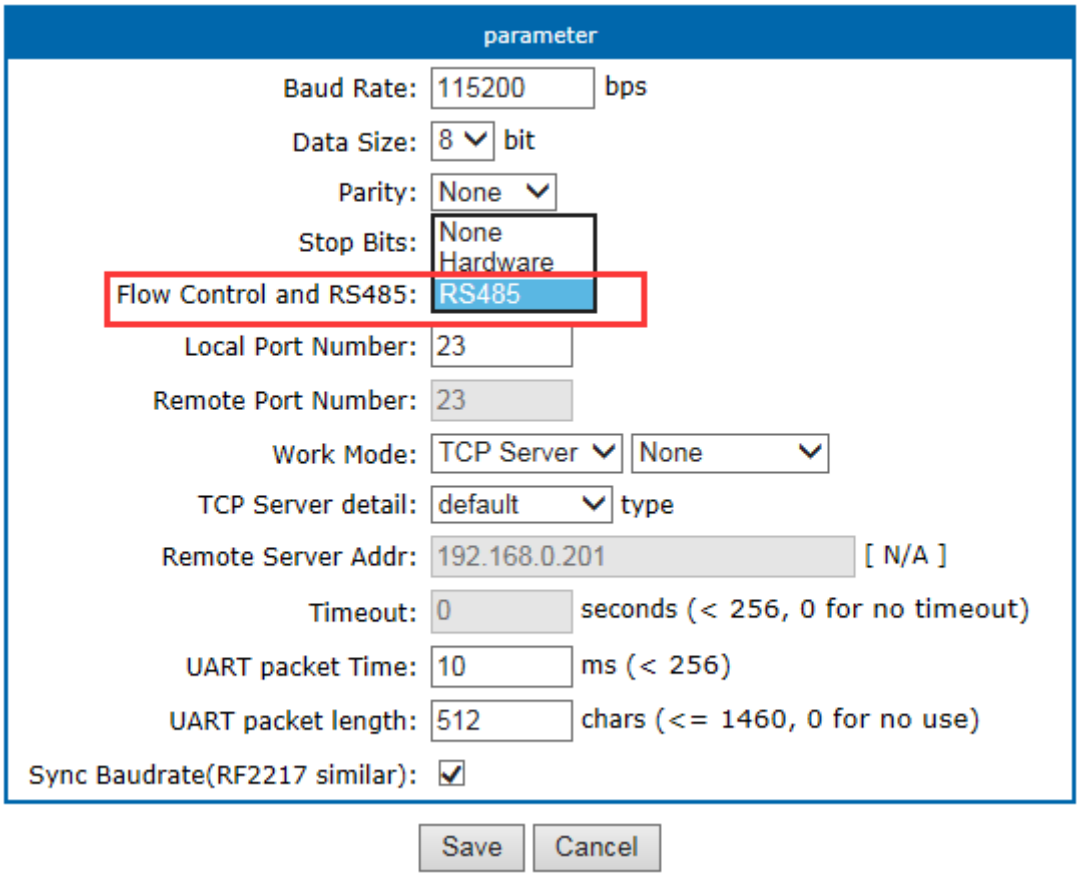


Diagram 4-15 check RS485 selection if you want RS485(default selected)

4.4. RJ45 interface

module network interface is 10 M / 100 M adaptive, support AUTO - MDIX, can discretionarily connect cross-over or direct network cable. That is to say, you can use either kind of cable to connect with computer or other network decice .

Pin	Name	Description
1	TX+	Transceiver Data+
2	TX-	Transceiver Data-
3	RX+	Receive Data+
4	n/c	Not connected
5	n/c	Not connected
6	RX-	Receive Data-
7	n/c	Not connected
8	n/c	Not connected

Diagram 4-16 RJ45 interface

4.5. Reload

This button is used to restore factory settings. Press the button, keep it pressed, then power on, after 2 second, free this Reload button, device will be back to factory settings.

Default settings main parameters as follows

Address type： static IP

Static IP Address： 192.168.0.7

User name： admin

password： admin

5. Paramters configuration

5.1. Web page

Usually, this series of TCP232 module is configured through web pages.

5.2. Serial port

1. This function. Which we mean Config module's param via serial port, need the coordination of reload pin as a config pin.

2. For further information, see protocol pdf: **http://www.usriot.com/Download/222.html**

5.3. network command(setup software)

1. through software ;

2. Network command(need to ask for protocol).

Down below is the Setup, **http://www.usriot.com/Download/90.html**

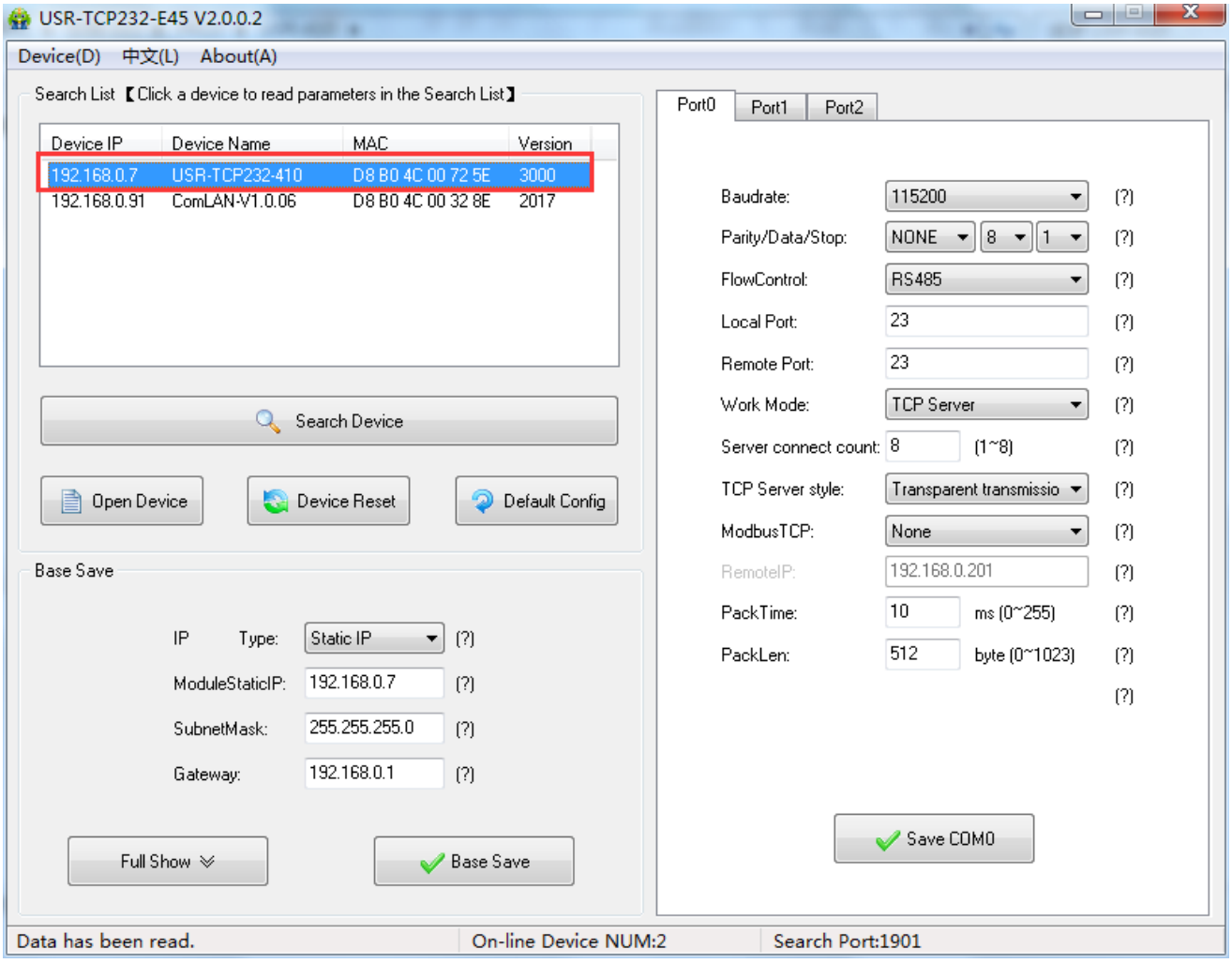


Diagram 5-1 Setup software

(1)click ‘Search Device’;

(2)Select device in search list;

(3)Modified paramters such as static ip;

(4)Click ‘Base Save’ or Save COMx, paramters will be saved;

(5)After 2 second, Search again, module will appear in new paramters.

6. Specific functions

6.1. ModbusRTU to ModbusTCP

The whole series product support ModbusRTU to ModbusTCP. When you use it, you have to select the protocols, just here:

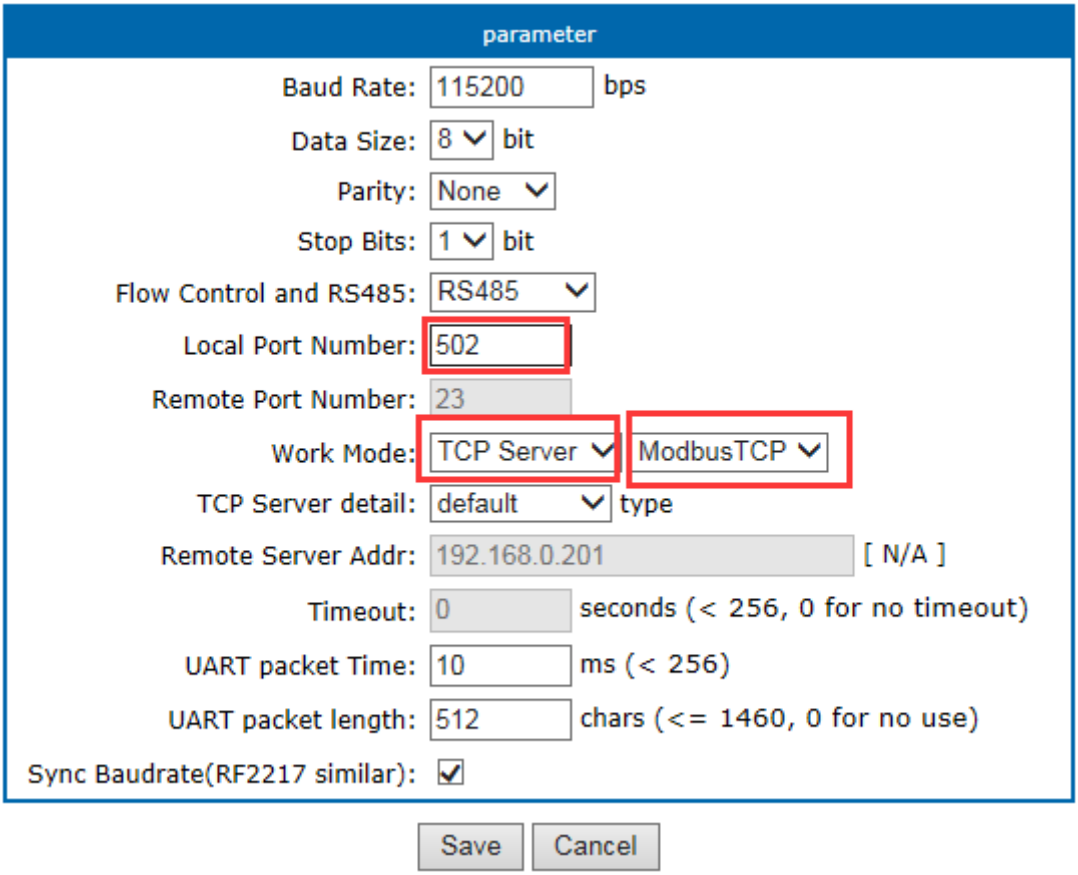


Diagram 6-1 setup of ModbusTCP

Here, the usement and function is presented below.

- Selection None, that indicate we are using Transparent mode, no protocol convertion.
- Selection ModbusTCP, means we use protocol convertion from Modbus RTU to ModbusTCP.
- In the comm side(RS232 or RS485), it's ModbusRTU protocol , the ethernet side is ModbusTCP.
- The ethernet side must be a Master, who send query frame first, and the Modbus RTU device respond with data to the command.

The function acts as below.

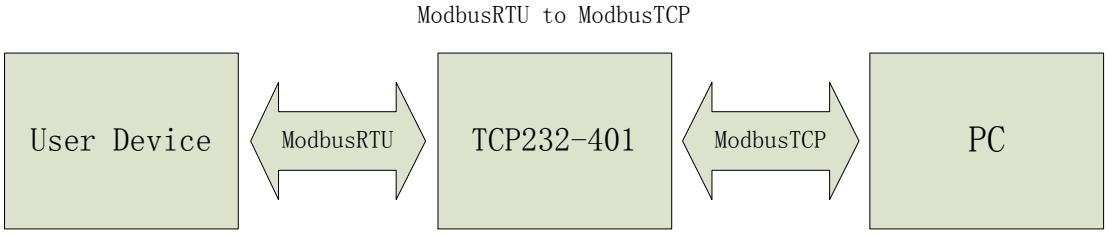


Diagram 6-2 function description for ModbusTCP to modbus RTU

6.2. Hardware flow control(RTS/CTS)

If you want to use Hardware flow control, select it before using.

RS232 interface support hardware flowcontrol（RTS/CTS）

Pin name	Description	IO type	Operater
RTS	Request to Send	O	module
CTS	Clear to Send	I	Outside device(PC)

Diagram 6-3 Pin description

When RTS = 0, enable the other side to send, at this time, TTL is 0 volt, RS232 is -3V ~ -15V.

When CTS = 0, represent module is enabled to send, at this time, TTL is 0 volt, and RS232 is -3V ~ -15V.

When the logic is reverse, represent that disable the other side to send or was disabled the module to send.

When connect with PC's RS232 interface, we can use the serial cable(cross).

6.3. MAC address

In Current config and status, can see the currently MAC address in use. Diagram below is using the factory MAC.

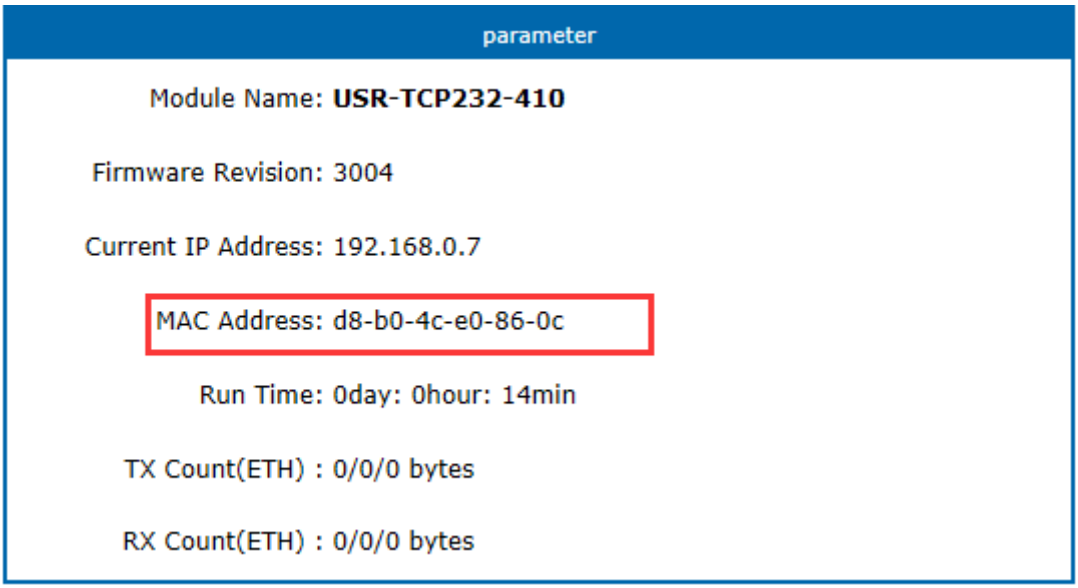


Diagram 6-4 currently MAC in use

6.4. Packet time and Packet length

If packet time is 10ms, packet length 512 byte. Then it represent this meaning:

If there is no data since the last char received during the past 10ms, the current data will be send to remote server.

If the currently received data length exceed 512 byte, then the module will pack all the 512 byte and send to remote server.

The pack mechanism would be triggered if there is either 1 condition meet them.

If we set packet time and packet length to 0, then the module would use a mechanism of auto-packet, which have 4-byte-time packet time, and 1460 byte packet length(available only when firmware revision >= 3006).

6.5. Sync baud via net(2217)

This is a function similiar to RFC2217(but different protocol), which can modify the device's comm parameters via ethernet(tcp or udp connection).

This option is checked by default.

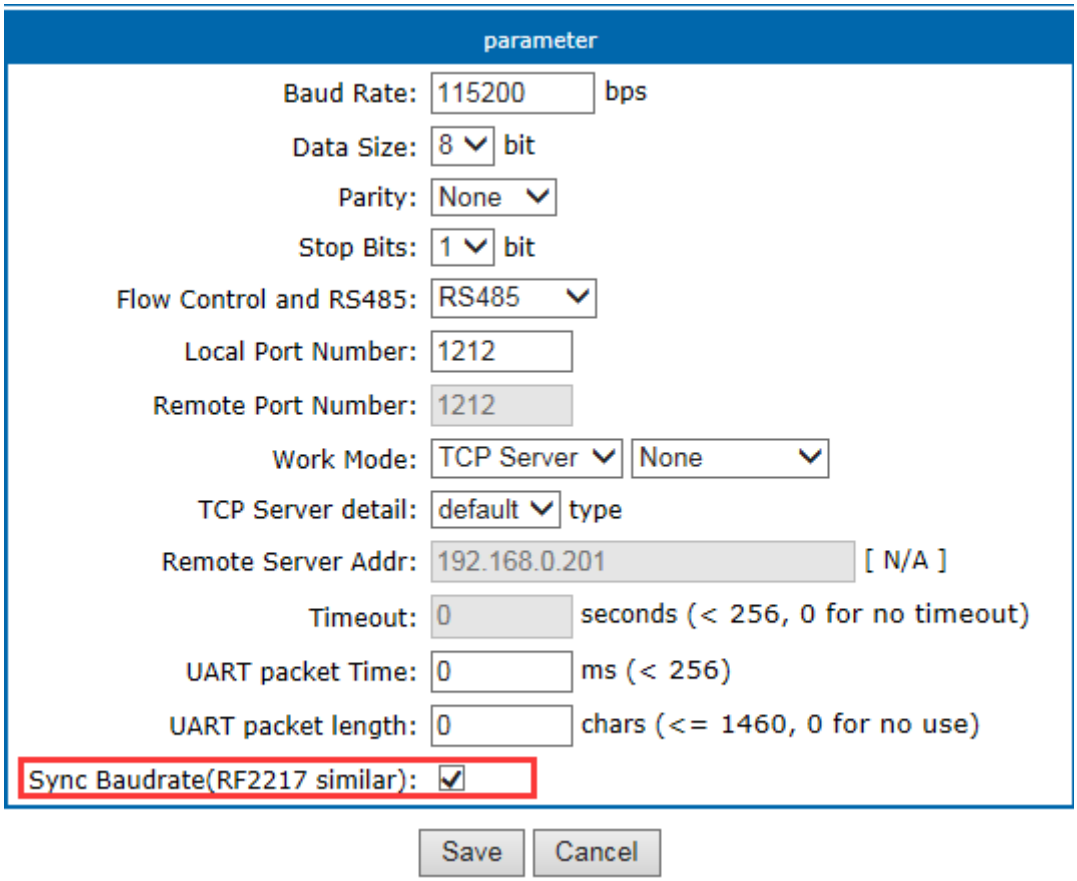


Diagram 6-5 sync baud

6.6. Webserver port

The module have built-in webserver which allow user to setup parameters via webpage. Default port 80, but we could modify this port according to some special uses.

6.7. Module id and id type

All module have a 2 byte id, default 1; id type default 0

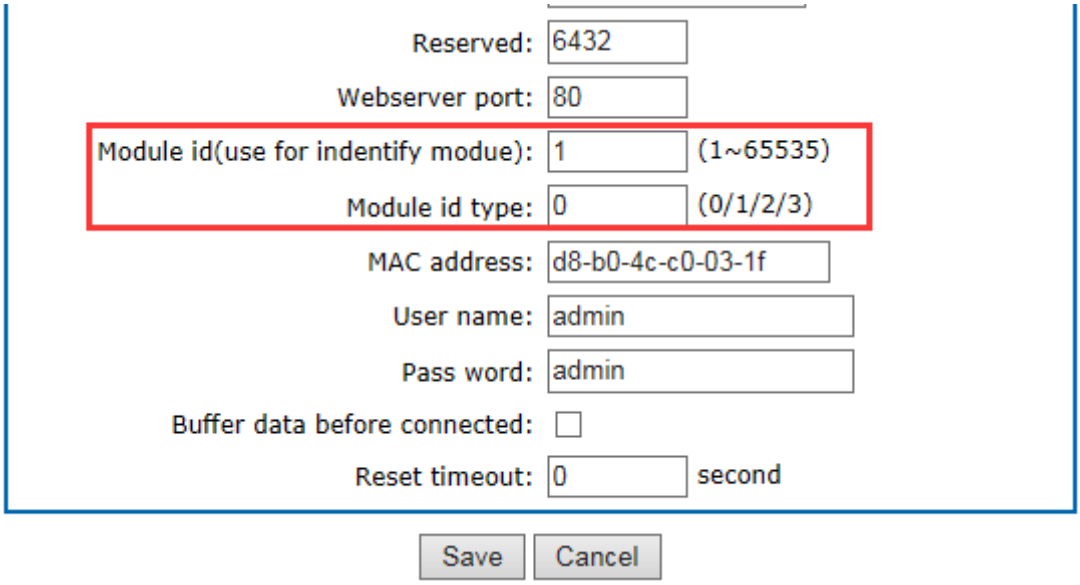


Diagram 6-6 module id and id type

The id type have a mean as below.

ID type	description
0(by default)	No use
1	When module act as client(tcp or udp), after it connect to server, send 4 byte immediately(2 byte Id + 2 byte Id-Complement, 00 01 FF FE by default); This can be used for USR-D2D service
2	add 4-byte before each frame send to server
3	Both 1 and 2

6.8. Device name

User can modify this name, 15 chars max.

6.9. Buffer data before connected

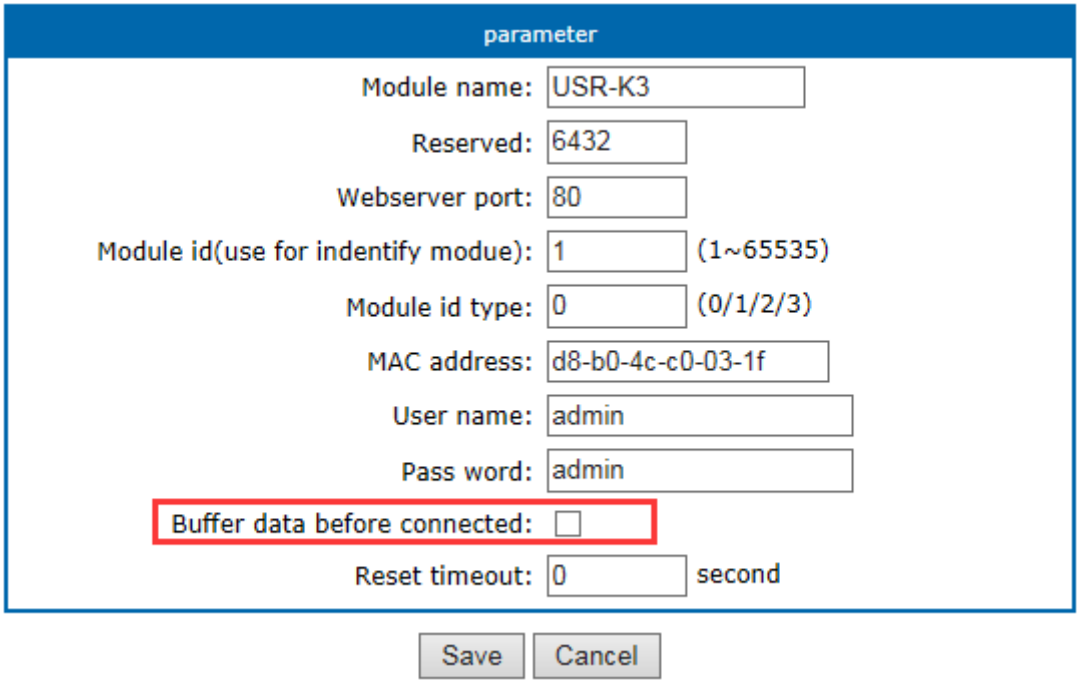


Diagram 6-7 buffer data or not

Default not checked. That is before TCP connected, all the data comm port previously received, will be flushed.

If checked, all the data comm port previously received would be saved and send to server after connected.

6.10. Reset timeout

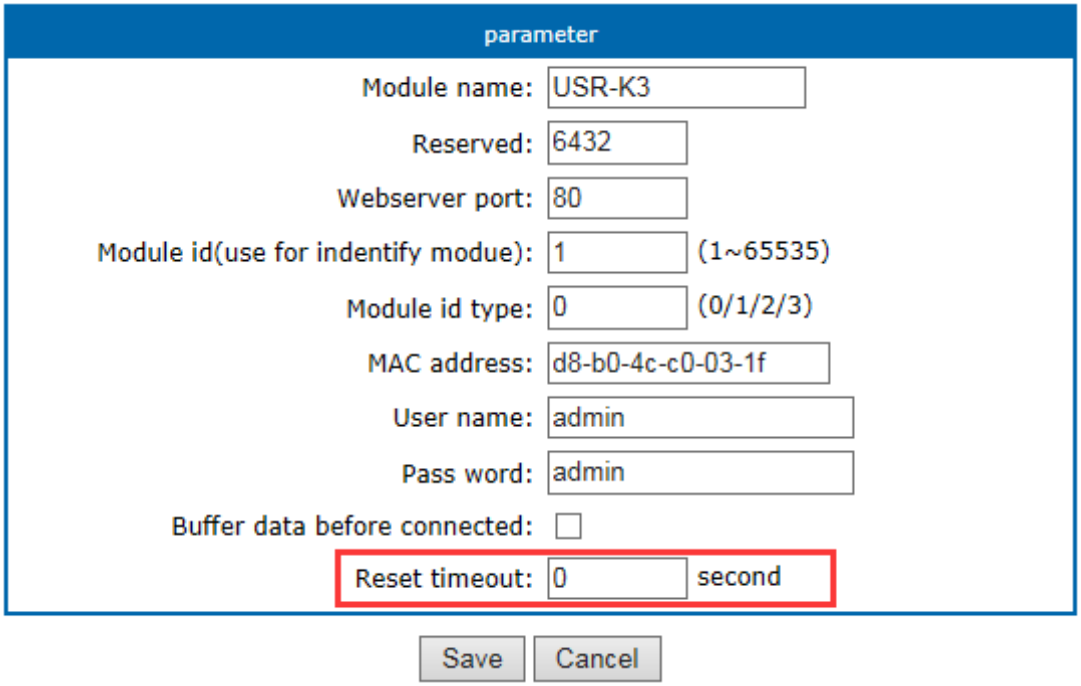


Diagram 6-8 Reset timeout

Default 0, unit is second. When this value between 0~60, the reset timeout function would be no use.

When this value is higher than 60, the module will restart if there is no data received during this time.

6.11. Local IP config

There is Static IP and DHCP, Static IP by default.

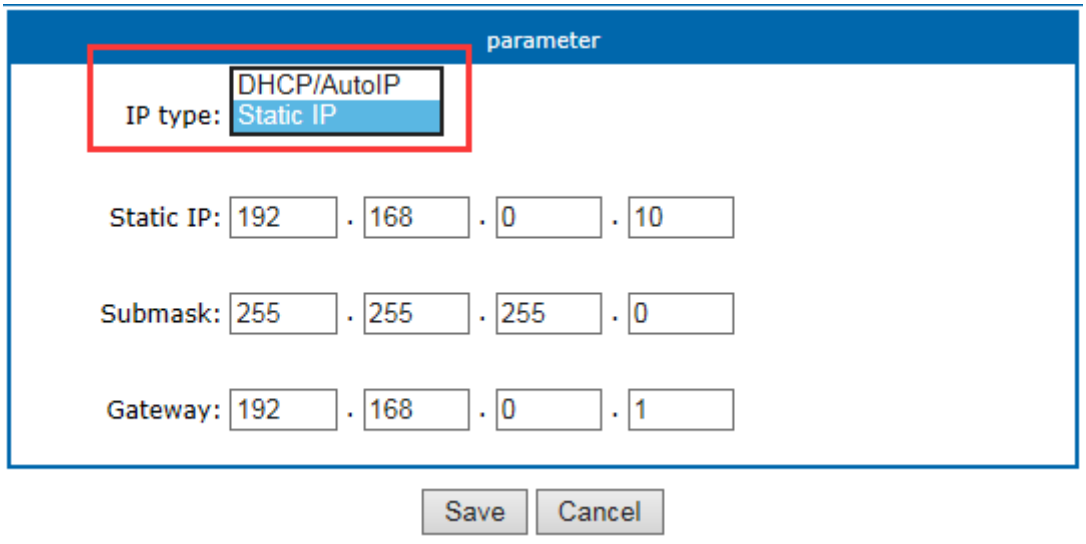


Diagram 6-9 Local IP config

6.11.1. Static IP

Type in the ip address you want to config, such as 192.168.0.10 (192.168.0.7 by default);

Submask usually 255.255.255.0

Gateway usually 192.168.0.1 (your router's ip address)

6.11.2. DHCP

Choose DHCP and save, then reset to take effect. The module will get it's ip address in 5-10seconds, after that you can search for it in the setup software.

6.12. DNS

The module can visit both ip or remote domain name, user can type in the domain name in the IP box. The domain name max length will be 30 chars.

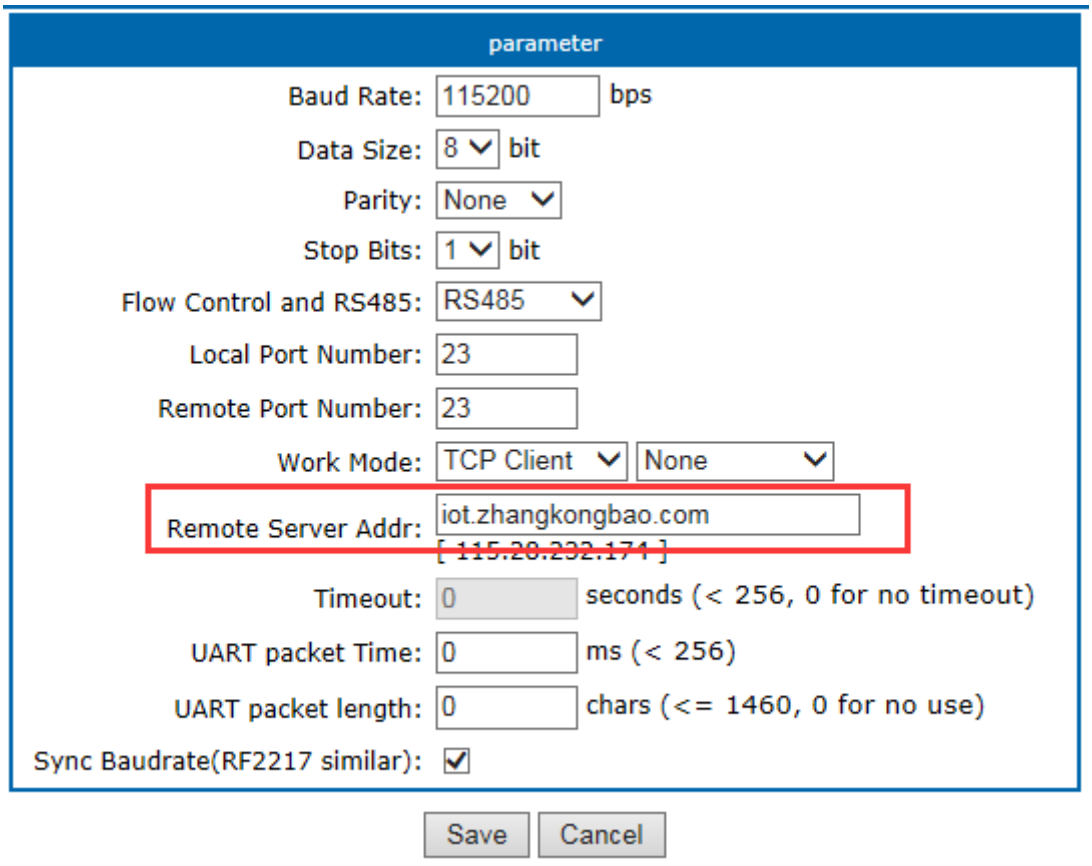


Diagram 6-10 domain name or IP

6.13. Comm param

The baud ranges from 600bps to 1024kbps, user can define this to any value.

For the serial device server of RS232 interface, such as TCP232-410, the RS232 interface can only up to 115200bps.

Databit range 5, 6, 7, 8;

Paritybit range None, Odd, Even, Mark, Space

Stopbit range 1, 2

6.14. Username and password

Default both "admin", max 5 chars.

6.15. Firmware revision

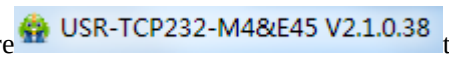
Diagram 6-11 Firmware revision

6.16. RS485

The module's RTS pin, is configured as 485_EN pin, by default.

If you want to extend a RS485 interaface for TCP232-E or TCP232-ED2, you can connect this RTS pin to the 485 IC's enable pin.

6.17. Firmupdate

Use search and config software 

to update firmware, only once for one time, can not cross network segment.

1. Search and select one module

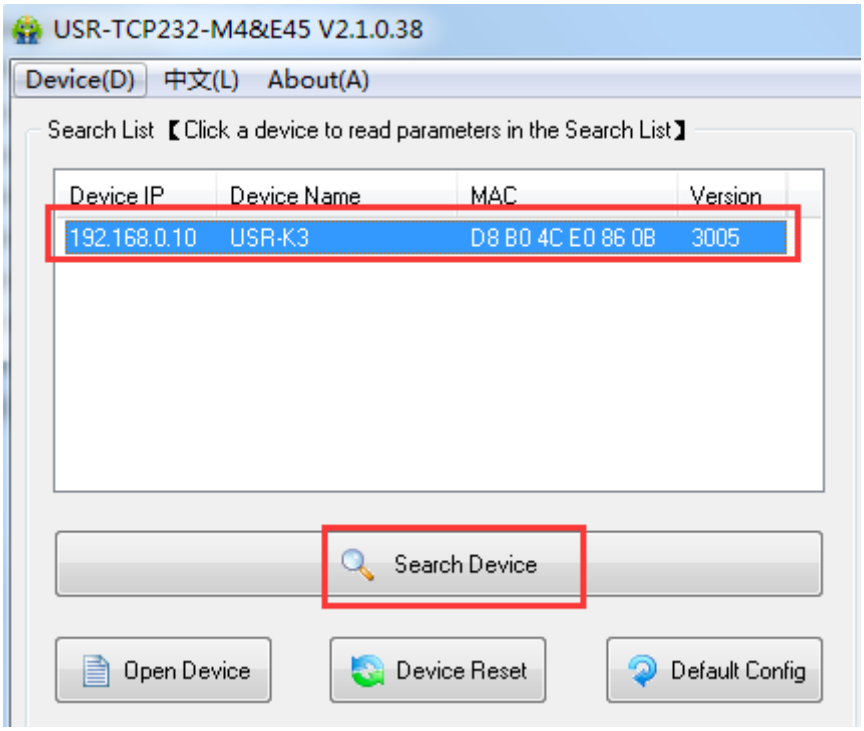


Diagram 6-12 search and select

2. 'Device' -> firmware update

Diagram 6-13 firmware update

Click

to start update progress.

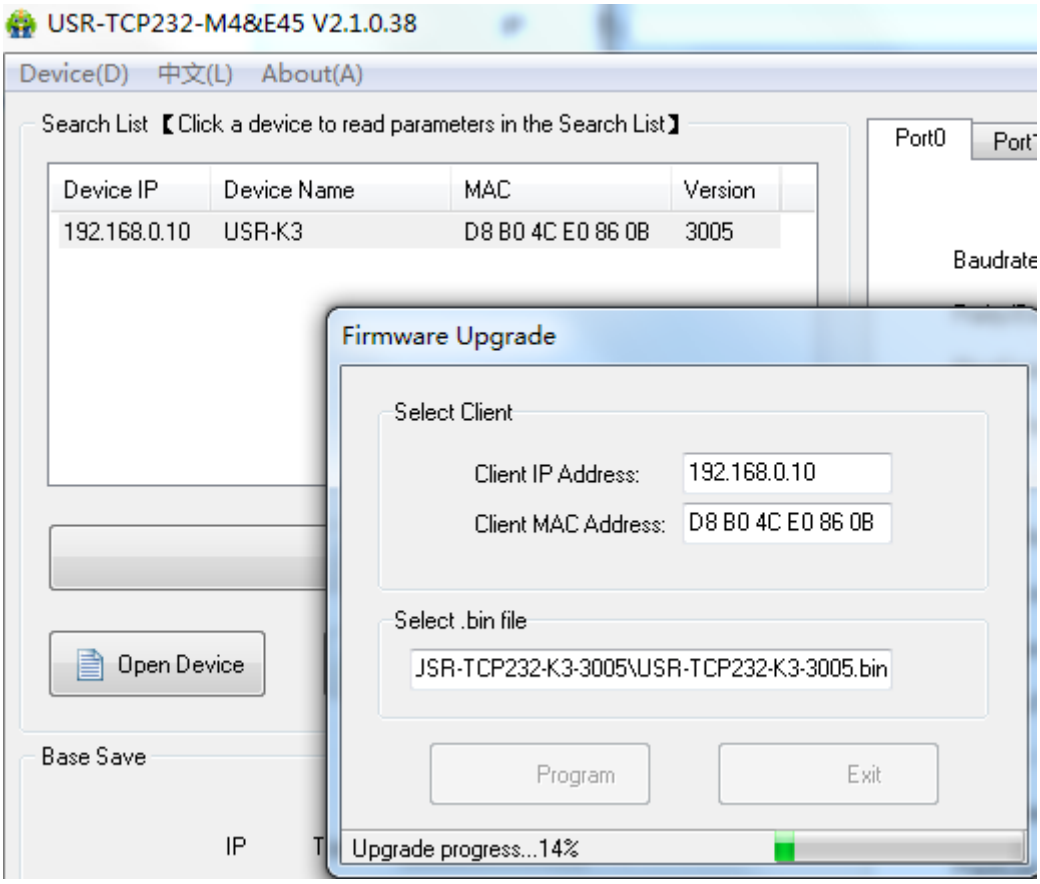


Diagram 6-14 in update progress

3. Update success, click exit.

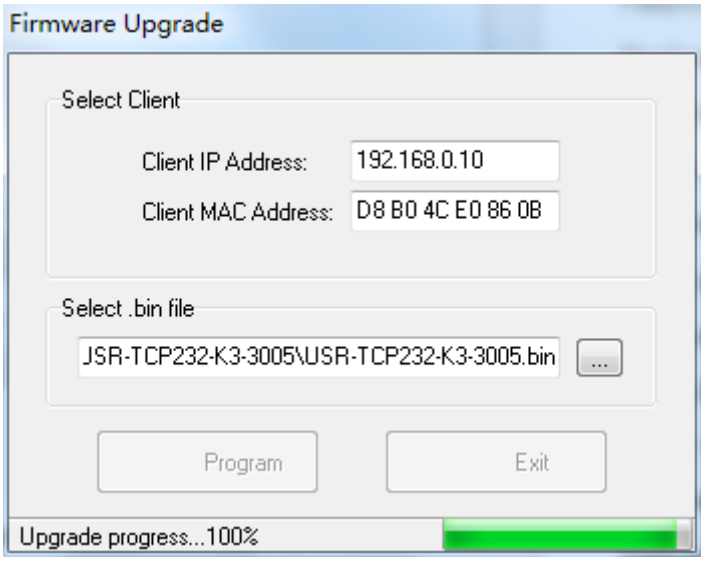


Diagram 6-15 success

Note. After update, if can not search module, restore to factory will fix this problem.

6.18. Common questions

6.18.1. Work across network segment

If your TCP232 device's IP is 192.168.0.7, and remote PC's IP is 192.168.1.7, we need to config.

Subnet mask of TCP232 device, PC, and router to 255.255.0.0, if not ,the TCP232 module will not communicate normally.

6.18.2. Ping is OK but can not open web pages

Some possible causes
1. Module is set a static ip and conflicts with another ethernet device.
2. Cross network and false subnet mask .
3. HTTP server port is modified(default 80).
Solutions:
1. Set another static or use DHCP.
2. Set correct subnet mask.
3. Set this port to 80 or open web page with correct port.

6.18.3. After firm update, can not open web page

Reload this module back to factory settings.

6.18.4. When connection established, server received serval chars

Possible causes.

1) Module id type is not 0.

Solutions.

1) Module id type set 0.

6.18.5. Every serval seconds, module reconnect

Maybe there is a network device which is same ip to module, pls check if ip conflict.

7. Contact us

Company: Jinan USR IOT Technology Co., Ltd

Address: Floor 11,Building1,No.1166 Xinluo Street,Gaoxin Distric,Jinan,Shandong,250101 China

Tel: 86-531-55507297 86-531-88826739-803

Web: **http://www.usriot.com/**

Skype: lisausr

Support: **http://h.usriot.com/index.php?c=frontTicket&m=sign**

Email: sales@usr.cn tec@usr.cn

8. Modified history

1) V1.0.1 doc established by Huibin Li
2) V1.0.3 correct website link and picture mistake
3) V1.0.5 add support center website
4) V1.0.6 remove some error
5) V1.0.7 add reset timeout and buffer data
6) V1.0.8 a new address