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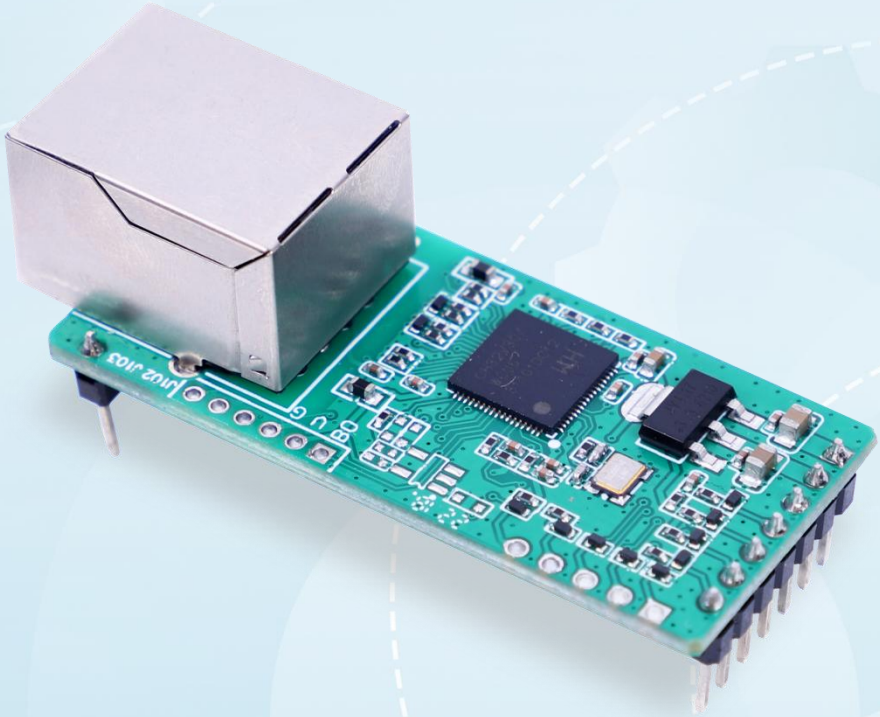

Ethernet module

USR-TCP232-T0

manual

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Reliable Smart Industrial IoT Partner

1.product introduction

USR-TCP232-T0 is a module that quickly realizes the transparent transmission of network port and serial port data. All data protocol conversions are processed internally. Users only need simple configuration to realize the transmission of data from the serial port to the network. The product comes with RJ45 network port, supports TCP/UDP protocol, supports DHCP and DNS functions, product parameters can be configured through serial port AT, network configuration protocol or built-in Web, which is simple and fast. Pin-type design, faster integration into field applications, products are widely used in industrial PLC supervision and control, medical device network monitoring, industrial automation network monitoring and other application scenarios.

1.1. Features

- 10Mbps Ethernet interface
- Working mode can choose TCP Server, TCP Client, UDP Client, UDP Server Serial port baud
- rate can be set from 300bps to 921600bps
- TCP Server supports a maximum of 16-way Client access and supports
- custom registration packets and custom heartbeat packets
- Various parameter configuration methods, built-in web, AT commands and network protocols can be
- configured Support timeout restart (restart without data) function, restart time customization Support
- DHCP and DNS protocols, DNS server address can be set
- Support virtual serial port, supporting USR-VCOM software independently developed by someone

1.2. Basic parameters

surface1 Basic parameters

Classification	parameter	value
hardware parameters	Operating Voltage	VCC: 3.15～3.45V
		VDD:5.0～7.0V
	Rated voltage	VCC: 3.3V
		VDD:5.0
	Working current	100mA@5V/3.3V
	Network port specification	10Mbps
	Serial baud rate	300-921600 (bps)
	Serial standard	TTL-3.3V level
software parameters	Network protocol	IP, TCP/UDP, ARP, ICMP, IPV4
	IP acquisition method	Static IP, DHCP
	DNS	support
	user configuration	Software configuration, web configuration, AT command configuration
	Simple transparent transmission method	TCP Server/TCP Client/
		UDP Server/UDP Client
	Class RFC2217	not support
	TCP Server connection	Support up to 16 TCP connections (customizable)
	web cache	Send: 6Kbyte; Receive: 4Kbyte;
	Serial cache	Receive: 1kbyte
	average transmission delay	<10ms
	supporting software	Virtual serial port, human cloud, parameter setting software
	packaging mechanism	4 bytes packed time, 400 bytes packed length
	size	50.5x22.6x15.0mm(L*W*H)
	Operating temperature	- 40～85℃

	storage temperature	- 40～105℃
	Working humidity	5%～95% RH (no condensation)
	storage humidity	5%～95% RH (no condensation)
	Package	Static Foam

1.3. Hardware parameters

1.3.1. Pin definition

The following table is a detailed description of the pin definition of USR-TCP232-T0

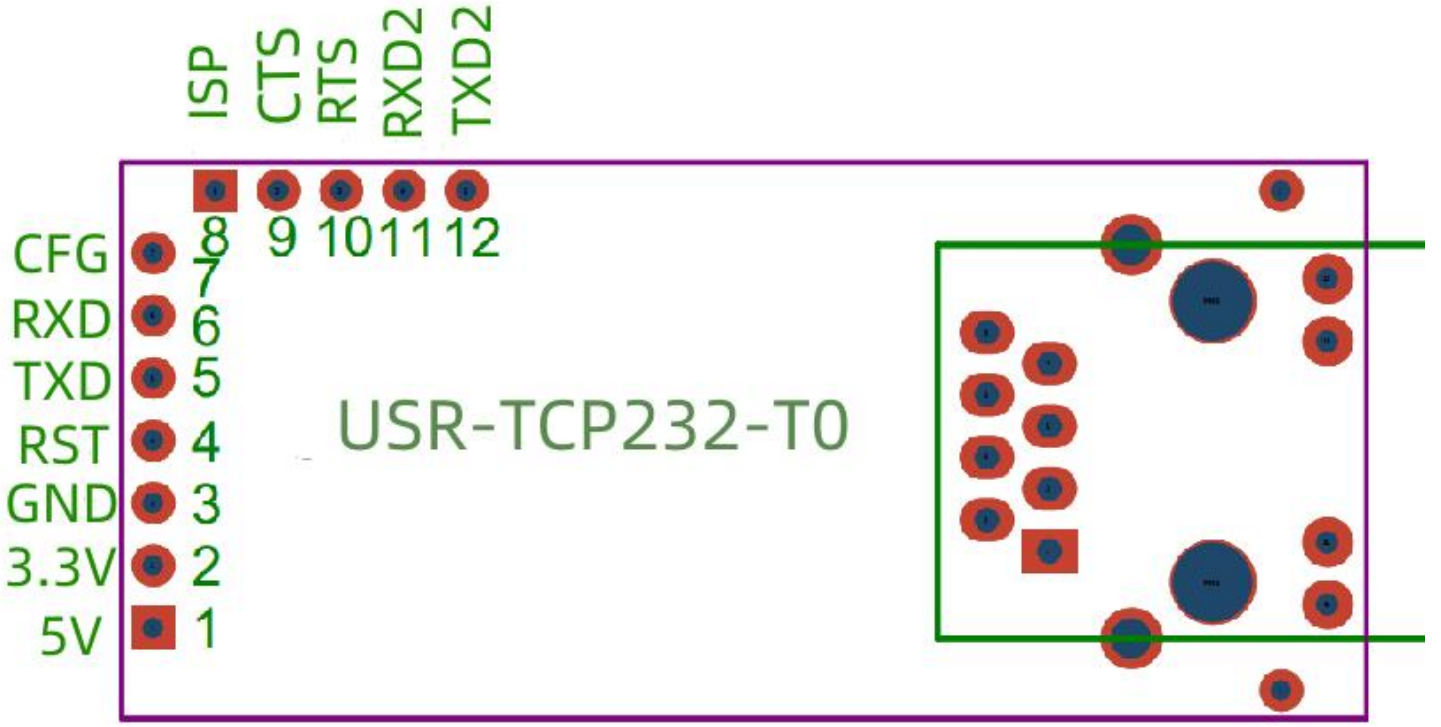

Figure 1. Pin Definitions

surface2 **USR-TCP232-T0Pin Description**

serial number	pin	Function	illustrate
1	VDD	power supply	Module Power Supply: Typical 5V @ 100mA
2	VCC	power supply	Module Power Supply: Typical 3.3V @ 100mA
3	GND	signal ground	grounding
4	RST	reset	The RST pin is the module reset pin, please connect it to the IO port of the user's MCU, reset the module when an exception occurs, and reset the module after the pin receives a low level for 200ms. Reset the module after power-on to ensure the normal operation of the module.
5	TXD	Module data sending	The data sending end of the module, the TTL level can be connected to a 3.3V microcontroller (when connected to 5v, refer to the conversion circuit: voltage matching circuit diagram)
6	RXD	module data reception	The data receiving end of the module, the TTL level can be connected to a 3.3V microcontroller (when connected to 5v, refer to the conversion circuit: voltage matching circuit diagram)
7	CFG (Reload)	Used as a serial port configuration guide foot	not open

surface3 **Definition of reserved pins**

serial number	pin	Function	illustrate
8	ISP	\	temporarily closed
9	LINK	o	It can be used as an indicator pin for network connection. When a communication connection is established, this pin outputs a low level, and when no connection is established, it outputs a high level. When the module is in TCP mode and a communication connection is established, the LINK pin will be pulled low automatically. When not connected, the LINK pin is pulled high.

			When the module is in UDP mode, the LINK pin is always pulled low.
10	RS485_EN	o	Can be used as the enable pin of RS485, high level enables sending
11	UART_RXD2	I	temporarily closed
12	UART_TXD2	o	temporarily closed

1.3.2. Dimensional drawing

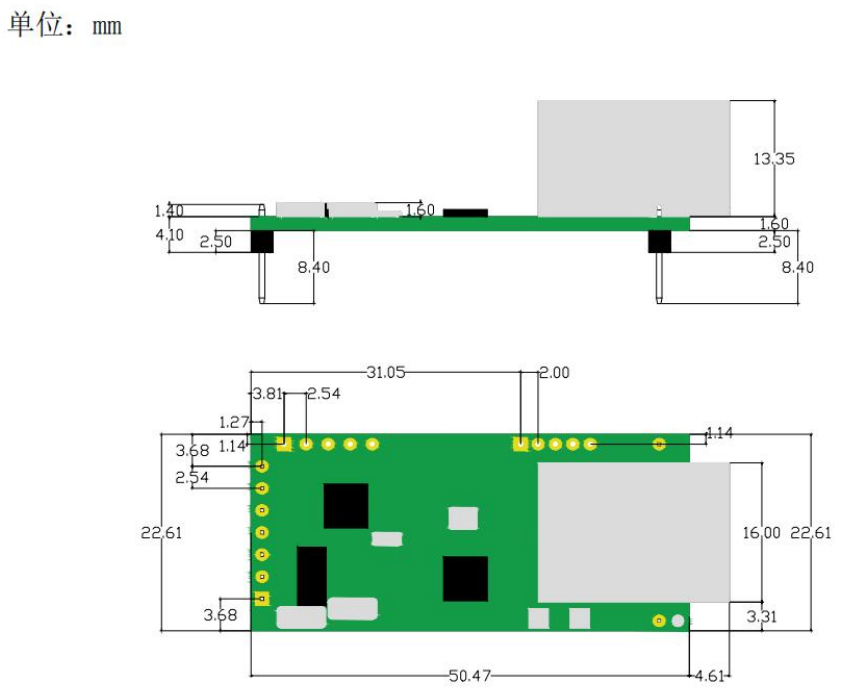

Figure 2. Dimensional drawing

2.quick start

This chapter is a quick-start introduction for the product USR-TCP232-T0. It is recommended that users read this chapter systematically and follow the instructions to have a systematic understanding of this product. Users can also choose interesting chapters to read as needed. For specific details and instructions, refer to subsequent chapters.

If there is a problem during use, you can submit the problem to our user support center:

http://im.usr.cn

Product information list:

profile name	illustrate	Link
manual	Product function and parameter introduction	https://www.usr.cn/Download/1191.html
AT command set	AT command description	see below
Specification selection	Product Series Selection Table	https://www.usr.cn/Product/351.html
hardware manual	Product hardware related parameters and recommended design	https://www.usr.cn/Download/1193.html

2.1. Hardware preparation

The quick test requires the following:

USR-TCP232-T0 one

USR-TCP232-EVB one piece

a network cable

One DC5V 1A power supply

One RS232 serial cable

a computer

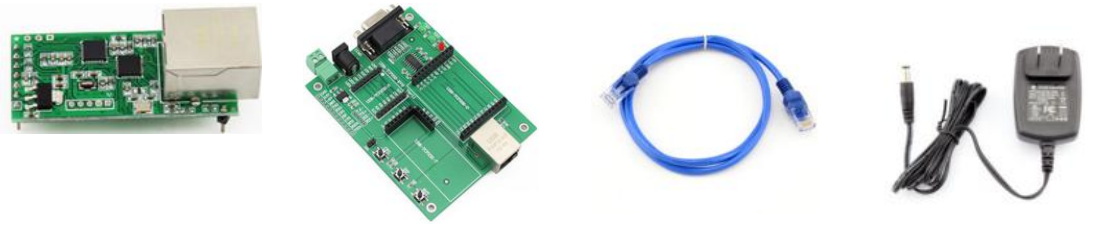

Figure 3. Hardware preparation materials

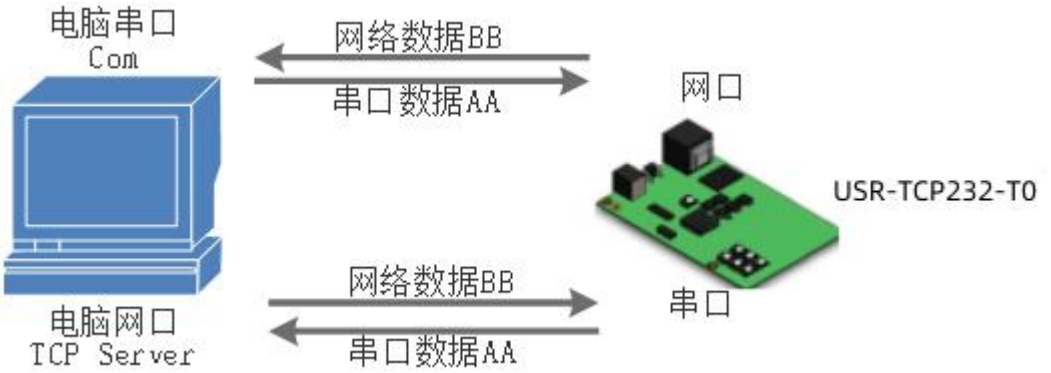

Figure 4. Data Flow

2.2. Network test environment

In order to ensure the normal progress of the test, the test computer needs to be checked and configured as follows before the test:

- Turn off the computer's firewall (usually found in the control panel) and anti-virus software;
- Close the network card that is not related to this test, and only keep a local connection;
- For the case where the server is directly connected to the PC, it is necessary to set a static IP address on the same network segment as the IP of T0 for the computer;

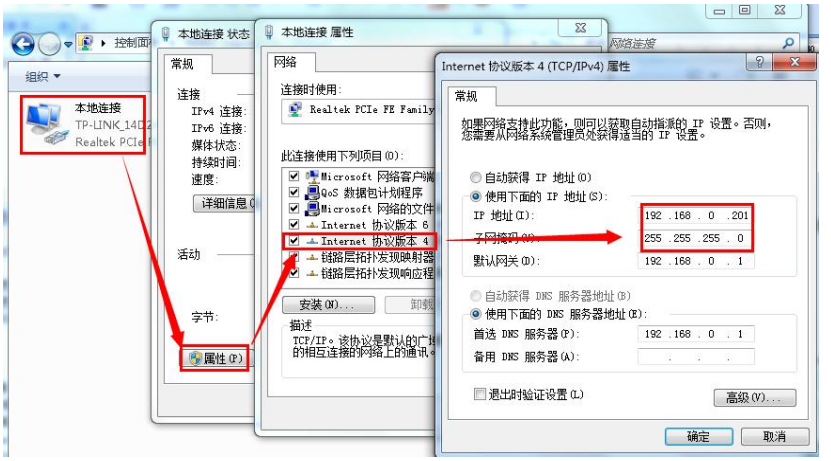

Figure 5. PC local connection settings

2.3. Default parameter test

surface4 Device default parameters

project	content
username	admin
password	admin
IP address	192.168.0.7
subnet mask	255.255.255.0
default gateway	192.168.0.1
default working mode	TCP Client
default target port	8234
default local port	20108
Default target IP	192.168.0.201
Serial baud rate	115200

Serial parameters	None/8/1

2.4. Hardware connection

In order to test the communication conversion from the serial port to the network, we connect the serial port of T0 (USR-TCP232-T0, referred to as T0, the same below) to the computer through a serial cable (or USB to serial cable), and use a network cable to connect the network port of T0 to the The network port of the PC is connected to each other. After checking that the hardware connection is correct, connect the power adapter provided by us to supply power to T0. The connection diagram is shown in the figure:

Figure 6. Schematic diagram of hardware connection

Note: The power supply level of the EVB test board is 5V, please use the power supply voltage of the main power adapter.

Data transfer test:

After the above steps are confirmed, the two-way communication between the serial port and the Ethernet port can be performed. The operation steps are as follows: Open the test software "USR-TCP232-Test.exe"①, connect the hardware according to the "Hardware Connection Diagram".

Select TCP Server mode in the network setting area, enter the computer IP for the server IP address, enter 8234 for the server port number, click Connect to establish a TCP connection, set the serial port baud rate to 115200, and set the serial port parameters to None/8/1, click Open to open the serial port .

At this point, we can perform data sending and receiving tests between the serial port and the network. The data flow direction from the serial port to the network is: computer serial port -> T0 serial port -> T0 Ethernet port -> computer network; the data flow direction from the network to the serial port is: Computer network -> T0 Ethernet port -> T0 serial port -> computer serial port. The specific demonstration is shown in the figure below:

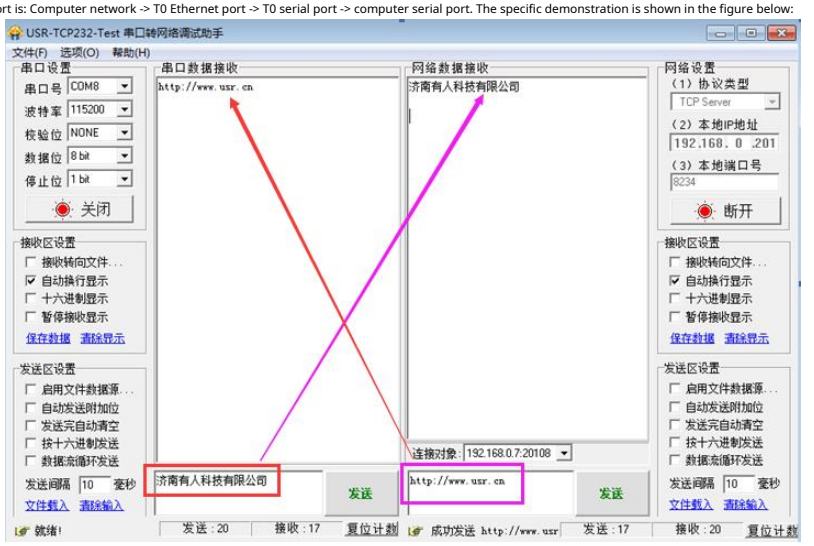

Figure 7. Default parameter test

① **Someone's network debugging assistant download link:**http://www.usr.cn/Download/27.html

3.Product Features

This chapter introduces the functions of T0. The figure below is the overall block diagram of T0 functions, which can help you have a general understanding of the product.

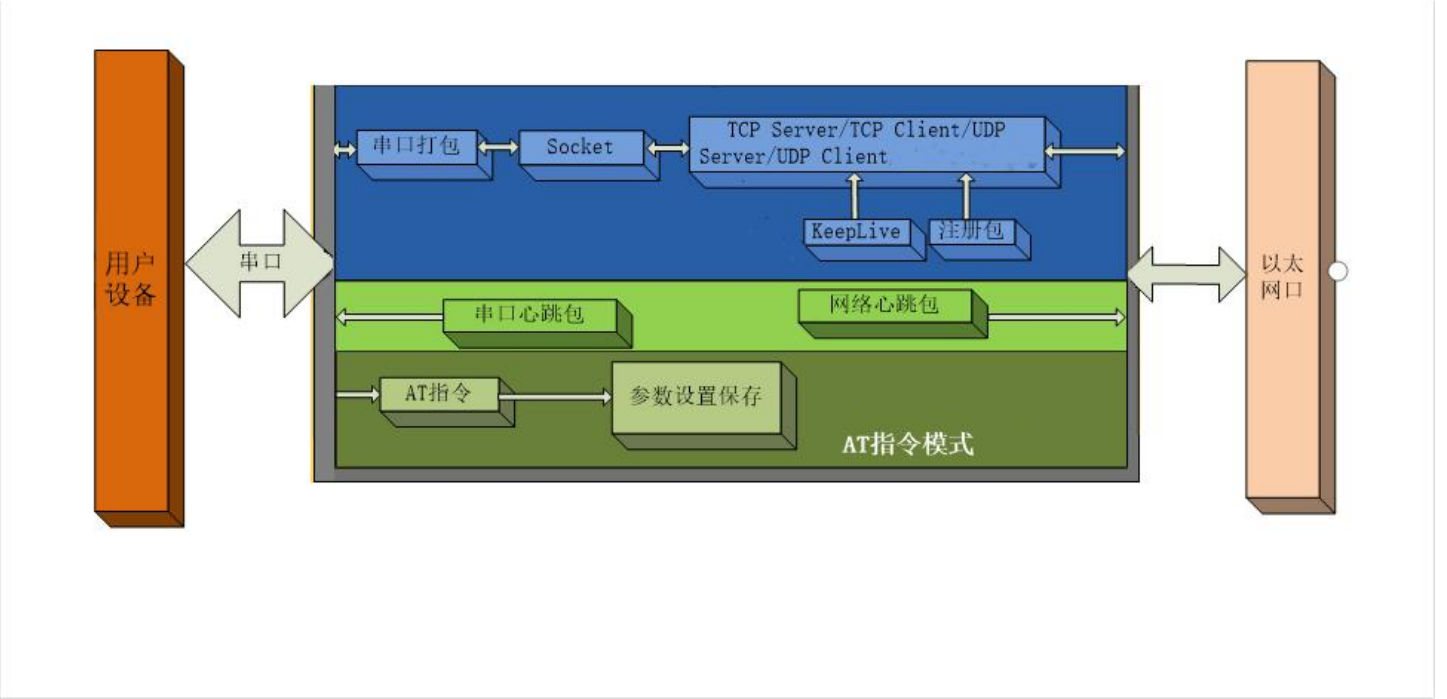

Figure 8. T0 functional block diagram

3.1. Introduction to basic network functions

This chapter mainly introduces the basic functions of the network. All the parameters involved are mainly used for the normal communication connection and data interaction between the network device and the connected network.

3.1.1. IP Address/Subnet Mask/Gateway

1) IP address

It is the identity of the module in the local area network. It is unique in the local area network, so it cannot be duplicated with other devices in the same local area network. There are two ways to obtain the IP address of T0: static IP and DHCP.

- **Static IP**

Static IP needs to be set manually by the user. During the setting process, please pay attention to write in IP, subnet mask and gateway at the same time. Static IP is suitable for scenarios where statistics need to be calculated on IP and devices and one-to-one correspondence is required.

Advantages: access devices that cannot be assigned IP addresses can be searched through the broadcast mode of the entire network segment.

Disadvantage: Different network segments in different LANs lead to inability to carry out normal TCP/UDP communication.

- **DHCP**

The main function of DHCP is to dynamically obtain information such as IP address, Gateway address, and DNS server address from the gateway host, thereby eliminating the cumbersome steps of setting the IP address. It is suitable for scenarios where there is no requirement for IP, and the one-to-one correspondence between IP and modules is not required.

Advantages: Access routers and other devices with DHCP Server can communicate directly, reducing the trouble of setting IP address gateway and subnet mask.

Disadvantages: T0 will not work properly if it is connected to a network without DHCP Serve, such as directly connected to a computer.

2) Subnet mask

It is mainly used to determine the network number and host number of the IP address, indicate the number of subnets, and determine whether the module is in the subnet. The subnet mask must be set. Our commonly used class C subnet mask: 255.255.255.0, the network number is the first 24 digits, the host number is the last 8 digits, the number of subnets is 255, and the module IP is in the range of 255 If it is within this subnet, the module IP is considered to be in this subnet.

3) Gateway

Refers to the network number of the network where the current IP address of the module is located. If you connect to a device such as a router when connecting to the external network, the gateway is the IP address of the router. If the setting is wrong, you will not be able to access the external network correctly.

Refer to the AT command set:

surface5 **staticIP/DHCP ATinstruction**

command name	describe
AT+WANN	Set and query the IP acquisition method of T0, IP/subnet mask/gateway parameters

Setup software:

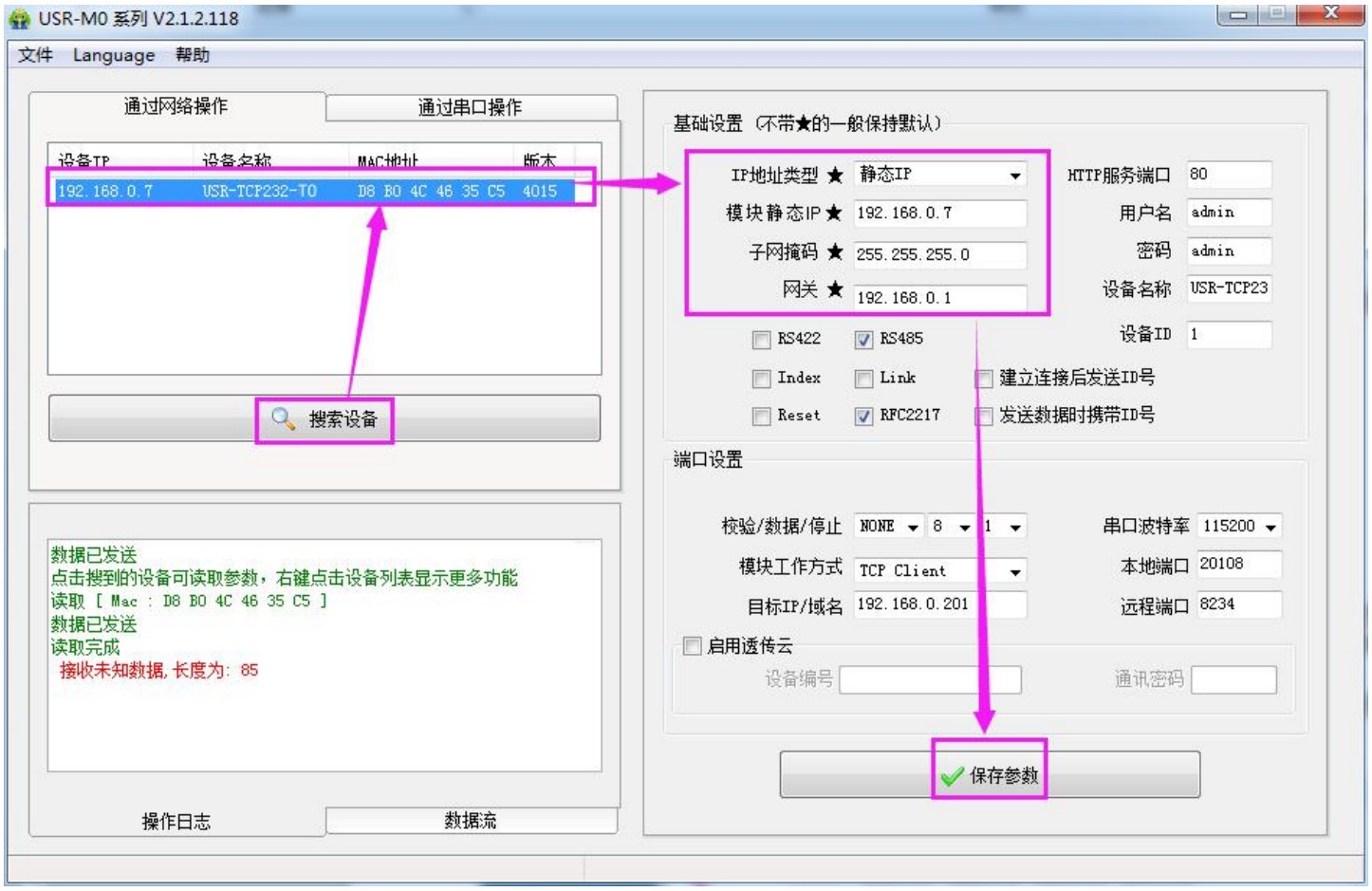

Figure 9. Schematic diagram of setting software

3.1.2. DNS server address

DNS servers are mainly used to convert domain names into IP addresses recognizable by the network. The DNS server address can be set, which can realize domain name resolution when the local domain name server is not perfect. Users can also set the address of a specific DNS server according to their needs. When T0 needs domain name resolution, it will submit a resolution request to the set DNS server. It is more flexible and reliable to use.

In static IP mode, the DNS server address is 208.67.222.222 by default, and in DHCP mode, the DNS server address is obtained automatically. Versions above 4015 support domain name server address can be set.

Figure 10. Example of web page settings

Refer to the AT command set:

surface6 **DNSserverATinstruction**

command name	describe
AT+DNS	Set and query the DNS server address of T0

3.1.3. Built-in Web

T0 comes with a built-in Web, which is mainly convenient for users to set parameters and query T0 status. The port number of the web server can be set, and the default is 80.

manual:

- Open the browser and enter the IP address of T0 in the address bar, such as 192.168.0.7 (the IP address is in the same network segment as the computer).
- Enter the user name and password in the pop-up login interface. The default user name and password are both admin. Click "OK" to enter the main interface of the built-in web page.
- The main interface is the status interface.

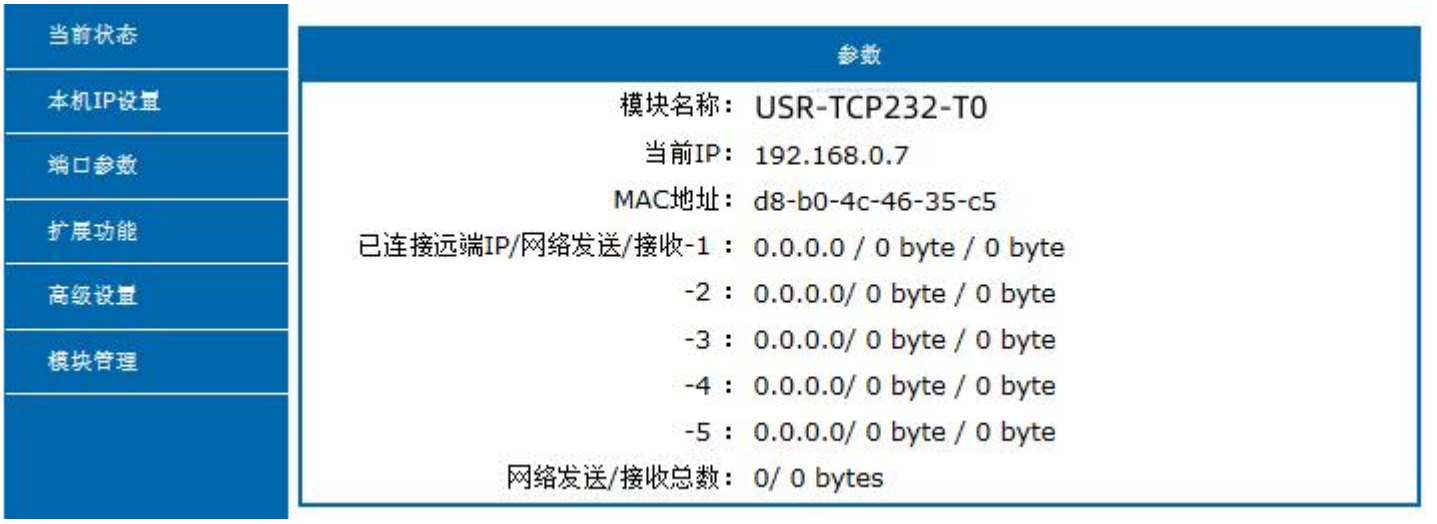

Figure 11. Current status display screenshot

3.1.4. Network upgrade firmware

Network upgrade firmware is reliable and simple. Experience new functions by upgrading the new firmware to meet the higher needs of customers. If the customer needs to upgrade the firmware of a higher version, he can ask for the firmware from the supplier or consult with the manned user support center to ask for the new firmware.

After getting the corresponding firmware, search for the device on the configuration tool interface, right-click the device to be upgraded, select "Firmware Upgrade" in the drop-down menu, select the corresponding firmware path and click the "Upgrade" button, and wait for the upgrade to complete.

When upgrading the firmware, it is best to connect the computer directly to the module, and prohibit the computer from upgrading the module firmware through wifi.

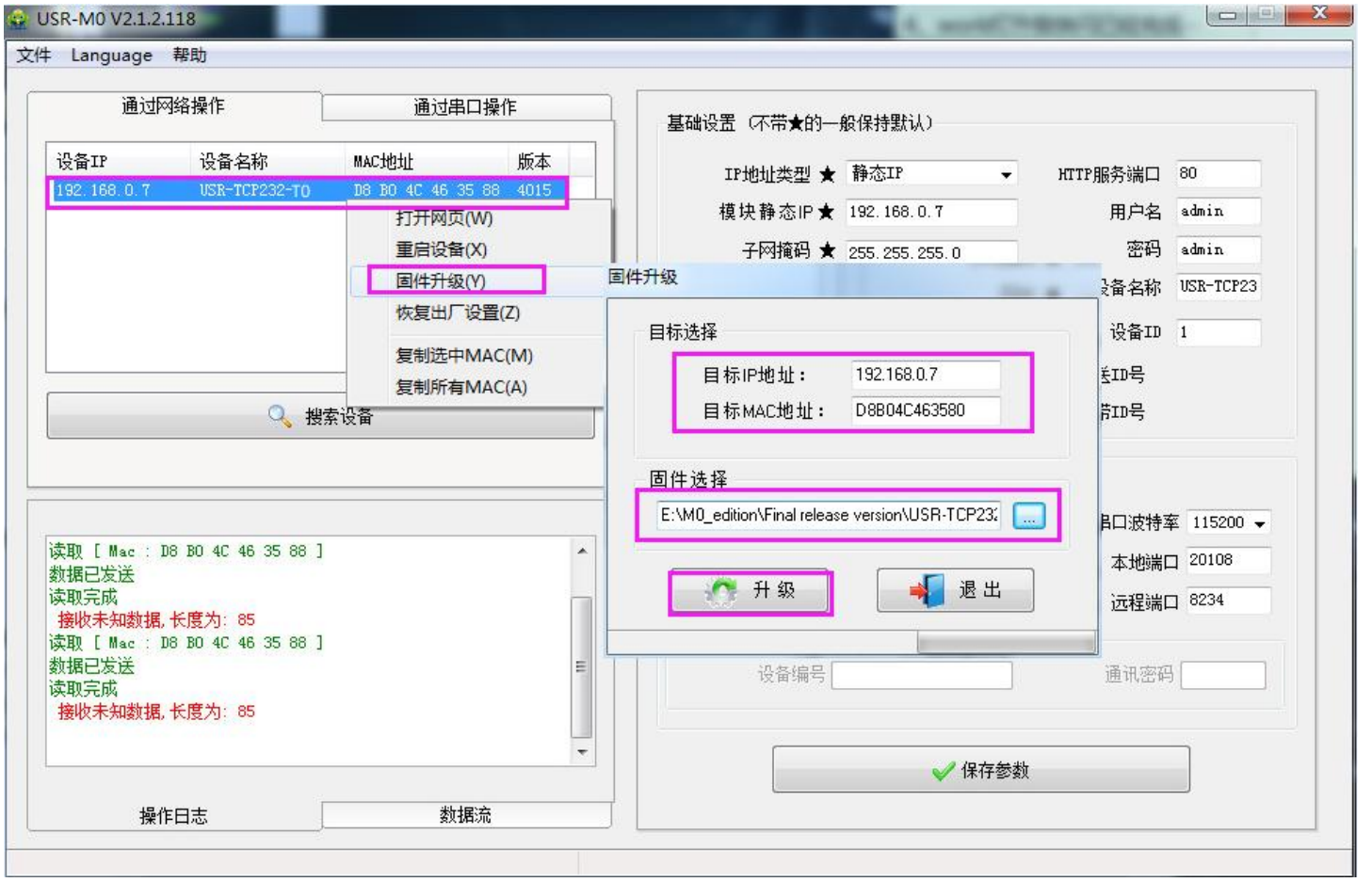

Figure 12. firmware upgrade

3.2. Socket function

T0 supports 4 working modes, TCP Client, TCP Server, UDP Client, UDP Server. Through the web page, AT commands and configuration tools can be set.

3.2.1. TCP Client mode

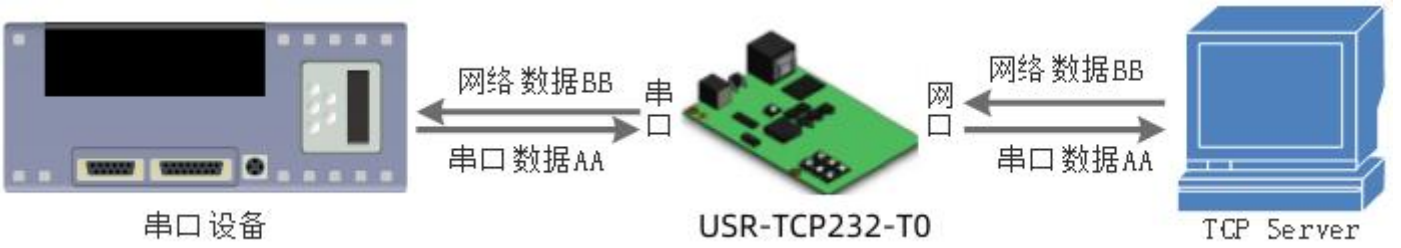

Figure 13. TCP Client mode description

TCP Client Provides client connections for TCP network services. Actively initiate a connection request to the server and establish a connection to realize the interaction between serial port data and server data. According to the relevant regulations of the TCP protocol, the TCP Client has the difference between connection and disconnection, so as to ensure reliable exchange of data. It is usually used for data interaction between devices and servers, and is the most commonly used networking communication method.

T0 supports 1-way TCP Client connection, has the function of disconnecting and reconnecting, and has the function of actively identifying connection abnormalities. After the connection is established, there will be a KeepAlive probe packet sent at an interval of about 15s. If the connection is abnormally interrupted, etc. , it will be detected immediately and prompt T0 to disconnect the original connection and reconnect.

When T0 tries to connect to the server in TCP Client mode and the local port is 0, it initiates a connection with a random port every time. Under the same LAN, if T0 is set as a static IP, please keep the IP of T0 and the gateway in the same network segment, and set the gateway IP correctly, otherwise it will not be able to communicate normally. Note: KeepAlive function, human cloud, detailed introduction later.

3.2.2. TCP Server mode

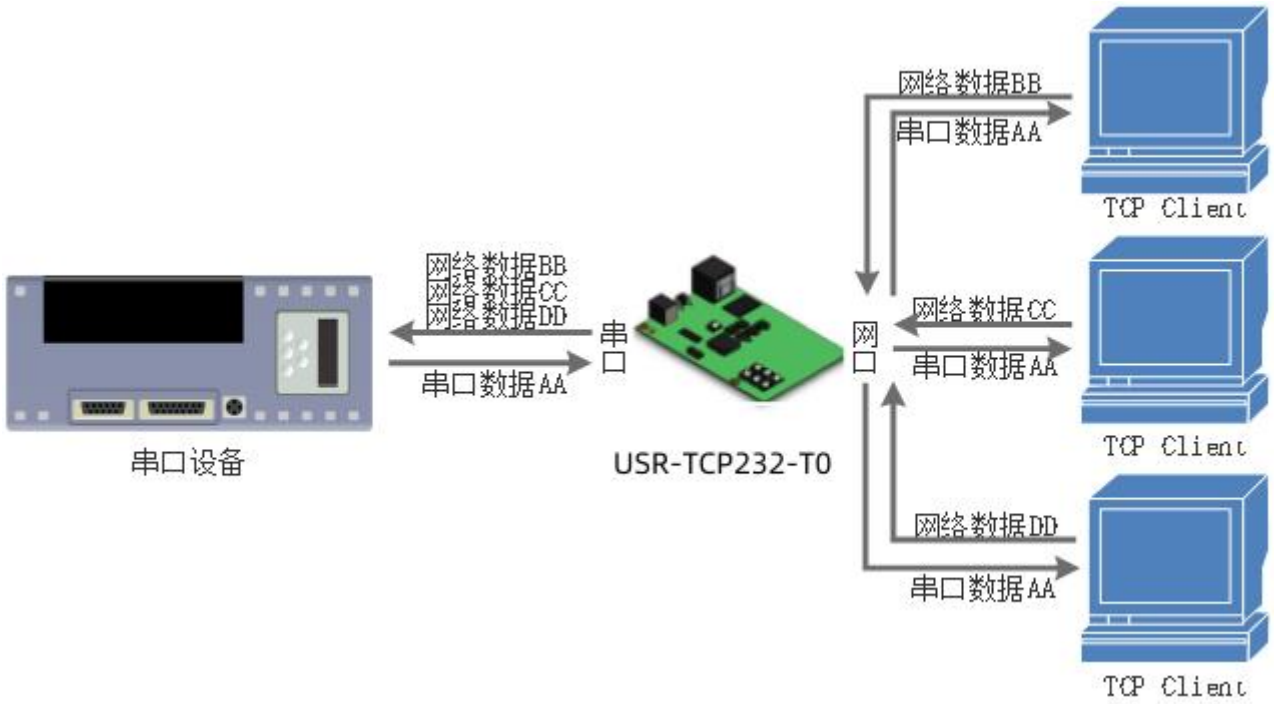

Figure 14. TCP Server mode description

TCP Server is the TCP server. In TCP Server mode, T0 listens to the local port, accepts and establishes a connection for data communication when a connection request is sent, and when the T0 serial port receives the data, it will send the data to all client devices connected to T0 at the same time. The TCP Server mode also has a KeepAlive function for real-time monitoring of connection integrity.

Usually used for communication with TCP clients in LAN. It is suitable for scenarios where there is no server in the LAN and there are multiple computers or mobile phones requesting data from the server. Same as TCP Client There is also the difference between connection and disconnection to ensure reliable exchange of data.

When T0 is used as TCP Server, it can accept up to 16 Client connections (the number of connections can be customized). The local port number is a fixed value and cannot be set to 0.

3.2.3. UDP Client mode

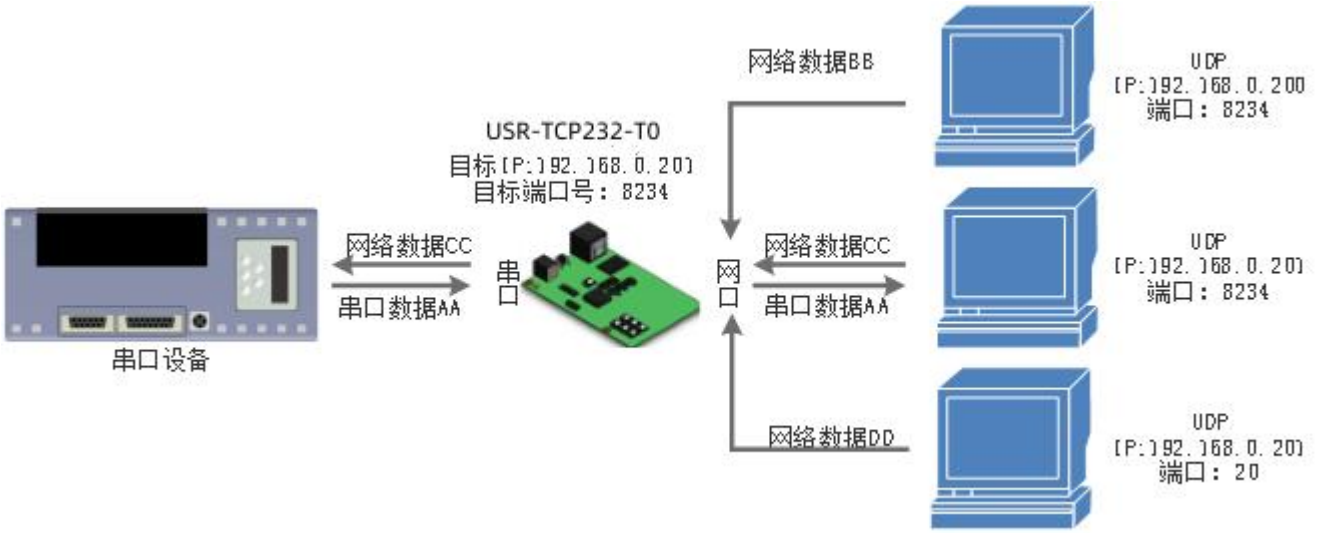

Figure 15. UDP Client mode description

This working mode is subordinate to UDP protocol.

UDP Client is a connectionless transmission protocol that provides transaction-oriented simple and unreliable information transmission services. There is no connection establishment and disconnection, and data can be sent to the other party only by specifying the IP and port. It is usually used in data transmission scenarios where there is no requirement on the packet loss rate, the data packets are small and the sending frequency is fast, and the data is to be transmitted to the specified IP.

In UDP Client mode, T0 will only communicate with the target port of the target IP, if the data is not from this channel, the data will not be received by T0. In this mode, if the target address is set to 255.255.255.255, it can achieve the effect of UDP broadcasting on the entire network segment; at the same time, it can also receive broadcast data; firmware 4015 and later supports broadcasting in the network segment, such as xxx.xxx.xxx. 255 broadcast mode.

3.2.4. UDP Server mode

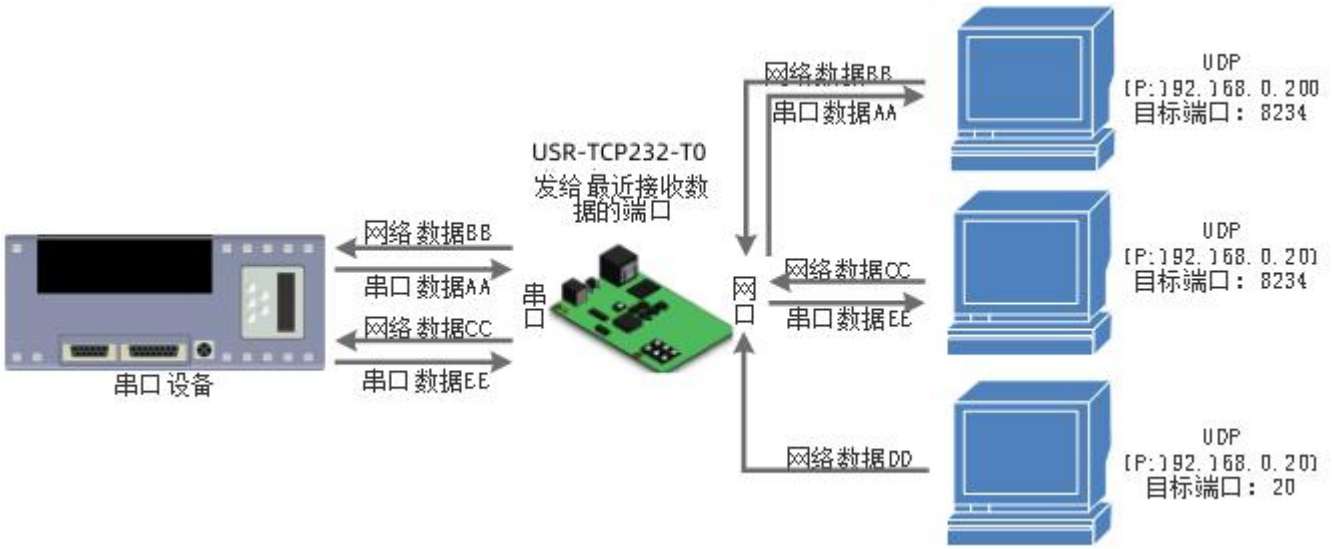

Figure 16. UDP server mode

UDP Server means that the source IP address is not verified on the basis of ordinary UDP. After receiving a UDP data packet, the target IP is changed to the data source IP and port number. When sending data, it is sent to the IP and port number of the latest communication. The port number.

This mode is usually used in data transmission scenarios where multiple network devices need to communicate with the module and do not want to use TCP due to the high speed and frequency.

3.2.5. Supporting software VCOM (virtual serial port)

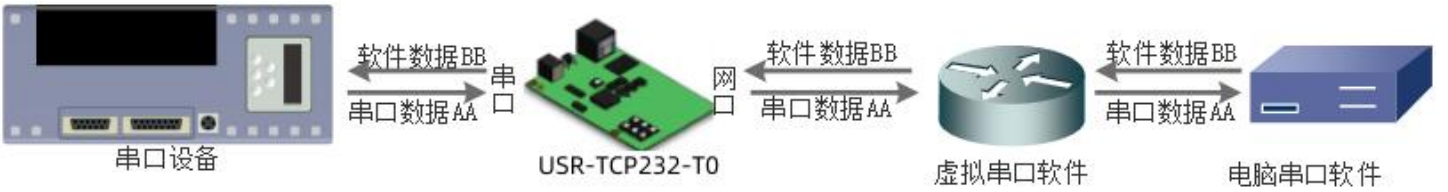

Figure 17. VCOM application introduction

By using the supporting software VCOM (virtual serial port), the data of the specified virtual serial port is received, and then the data is sent out in the form of network data, so as to solve the problem that the PC-side software cannot communicate with networked devices because of the serial port mode, and is convenient for users. Refer to the T0 software design manual for specific usage instructions.

USR-VCOM software download addresshttp://www.usr.cn/Download/31.html.

3.3. Serial port function

3.3.1. Basic parameters of serial port

surface7 **Basic parameters of serial port**

project	parameter
baud rate	300-921600bps
data bit	5, 6, 7, 8
stop bit	1, 2
Check Digit	None, Odd, Even, Mark, Space
Flow Control	none

3.3.2. Serial framing mechanism

Since the data on the network side is transmitted in units of data frames, it is necessary to form frame data through the serial port and send it to the network side, so that data can be transmitted more efficiently and quickly. During the data transparent transmission process, T0 packs the serial data according to the fixed packing length and packing time.

The serial port framing mechanism is based on the packing time and packing length, and when the two meet any one, it will be packed and

sent. **Serial packet length**: The default packing length is 400 bytes

Serial port packing time: The default is the sending time of 4 bytes, that is, when the interval time between receiving data by the serial port exceeds the time of sending 4 bytes, it will be packaged and sent out. For example, when the baud rate is 115200, the packing time of four bytes is: T=0.4ms. When the calculated value is less than 0.1ms, the packing time is calculated as 0.1ms. Calculated as follows:

$$T = \frac{1}{\text{波特率}} * 10 * 4$$

When T0 receives data from the network end and then sends it to the serial port, due to the limitation of the serial port speed, the user needs to control the sending flow, otherwise there will be data overflow at the serial port end, resulting in packet loss. So when the user sends data from the network to the serial port, it is necessary to calculate the traffic.

Calculation method: Assuming that a network data takes n seconds, m bytes of data are sent. The method to check whether there is a possibility of overflow is: (assuming that the network is in good condition and the network data transmission time is negligible) the transmission time required to complete the transmission of M bytes is:

$$T = \frac{1}{\text{波特率}} * 10 * \mathrm{m}$$

If there is no overflow, m bytes of data must be transmitted within n seconds, then n>2T is required, and T0 can work normally.

3.4. Featured functions

3.4.1. Heartbeat packet function

In network transparent transmission mode, users can choose to let T0 send heartbeat packets. The heartbeat packet can be sent to the network server or to the serial device, and cannot be run at the same time. The maximum content of the custom heartbeat packet is 40 bytes, the default heartbeat time is 30s, and the range is 1~65535.

The main purpose of sending to the network is to keep the connection with the server, and it only takes effect in the modes of TCP Client and UDP Client. When the network port has data to send, the network heartbeat packet stops end.

In the application where the server sends a fixed query command to the device, in order to reduce the communication traffic, the user can choose to send a heartbeat packet (query command) to the serial port device instead of

Send a query command from the server. When the serial port is in the AT command mode, the heartbeat of the serial port stops.

3.4.2. Registry package function

In the network transparent transmission mode, the user can choose to let the module send the registration package to the server. The registration package is for the server to identify the data source device, or as a password for obtaining server function authorization.

The registration packet can be sent when the module establishes a connection with the server, or the registration packet data can be inserted at the front end of each data packet as a data packet. The data of the registration package can be MAC address or self-defined registration data, and the maximum content of the self-defined registration package is 40 bytes, and supports hexadecimal input.

3.4.3. Human cloud function

Figure 18. **Transparent cloud function**

Human Cloud is mainly an open platform for communication between devices and devices, devices and host computers (Android, IOS, PC). Renyun is mainly used for transparent transmission of data, and the access device can be connected to realize remote transparent transmission of data with almost no modification. Human cloud is suitable for remote monitoring, Internet of Things, Internet of Vehicles, smart home and other fields, so USR-TCP232-T0 is connected to human cloud function. For more information about Renyun, please visit cloud.usr.cn for more information.

3.4.4. Link function

The Link pin is the status indication pin for T0 to establish a communication connection. When the communication connection is established, this pin will output a low level, and if no connection is established, it will output a high level. When T0 is in TCP mode, after the communication connection is established, the Link pin will be pulled low automatically, otherwise it will be pulled high. When T0 is in UDP mode, the Link pin is always pulled low. The "Link" spare pin in the USR-TCP232-T0 product can be used as Link indication.

3.4.5. Status display

In the web page of USR-TCP232-T0, there is a current status page, which can display the IP of the currently connected device, the number of bytes of data sent and received by each connection, and the total number of data sent and received by the T0 server on the page. Byte count.

At present, the T0 server can only count the IP and the amount of data sent and received by the first five devices currently connected in TCP mode, and the status interface is automatically refreshed every 10s. In UDP Server mode, only the data sent and received is counted, and the connection IP is not displayed.

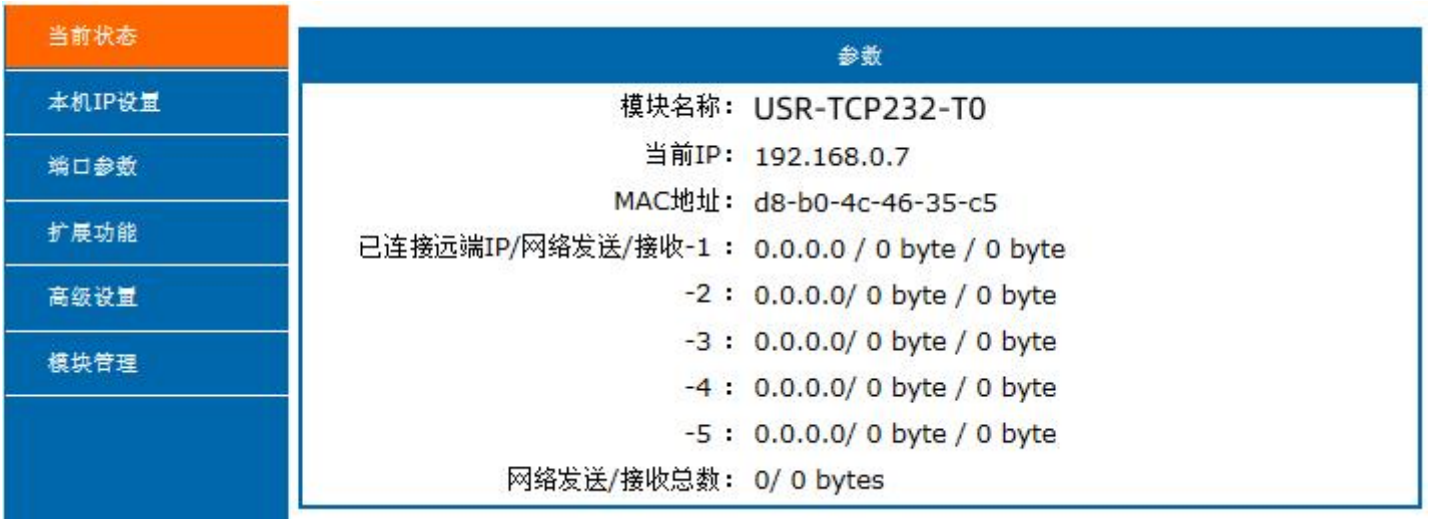

Figure 19. **Current status interface**

3.4.6. Clear cached data

When the TCP connection is not established, the data received by the serial port will be placed in the cache area. The T0 serial port receive buffer is 1024byte. After the TCP connection is established, the serial port cache data can be cleared according to customer needs.

This function defaults to no cleanup.

3.4.7. Timeout restart

The timeout restart (restart without data) function is mainly used to ensure the long-term stable operation of T0. When there is no data interaction on the network side for a long time, T0 will restart after exceeding the set time, so as to avoid the impact of abnormal conditions on communication. The time of overtime restart can be set through the webpage. The normal working time of this function is set to 60~65535s, and the default value is 3600s. When the setting time is less than 60s, it is set to zero by default, that is, the function is turned off.

4. Parameter setting

This chapter mainly introduces how to set the parameters of T0, and achieve your own personalized application through parameter setting. T0 parameter setting methods mainly include setting software setting parameters, web page setting parameters and serial port setting parameters. User configuration process:

Modify the user name and password → set the IP address acquisition method → serial port parameters → T0 working mode → parameters related to the working mode

In order to ensure the normal use of the setting software, the following steps are required

1. When using the setting software to set parameters, it must be ensured that T0 and the computer to which the setting software belongs are in the same local area network.
2. Turn off the anti-virus software and firewall on the computer.
3. Turn off the network card not related to this test.

4.1. Configure software setting parameters

1. Open the setup software and click Search (download address: http://www.usr.cn/Download/257.html), and search for all T0s in the local area network. The search information includes T0's current IP, device name, MAC address and T0 version number.

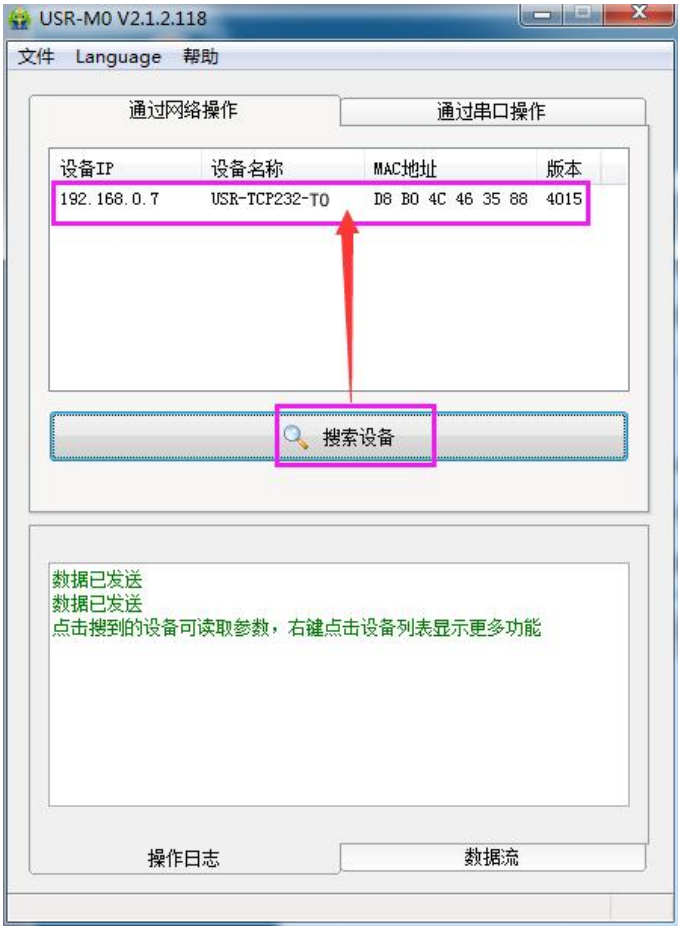

Figure 20. Software Setting Parameters—Search

2. Click on the searched content, T0 checks the password first, if the password is correct, T0 information will be displayed, if the password is wrong, the software will pop up a window to enter the user name and password, enter the correct user name and password and click "OK" , T0 default user name: admin password: admin (the default user name and password of the software are also admin), so by default, the setting software will not pop up the window for entering the user name and password.

Figure 21. Software setting parameters - password input

3. Basic parameter setting

Click the searched device to see the basic parameters that need to be set. Combined with the function introduction in Chapter 3, set the parameters you need, and then click Save Parameters to set the parameters required for success. If you don't need it, keep the default. Yes, no need to change.

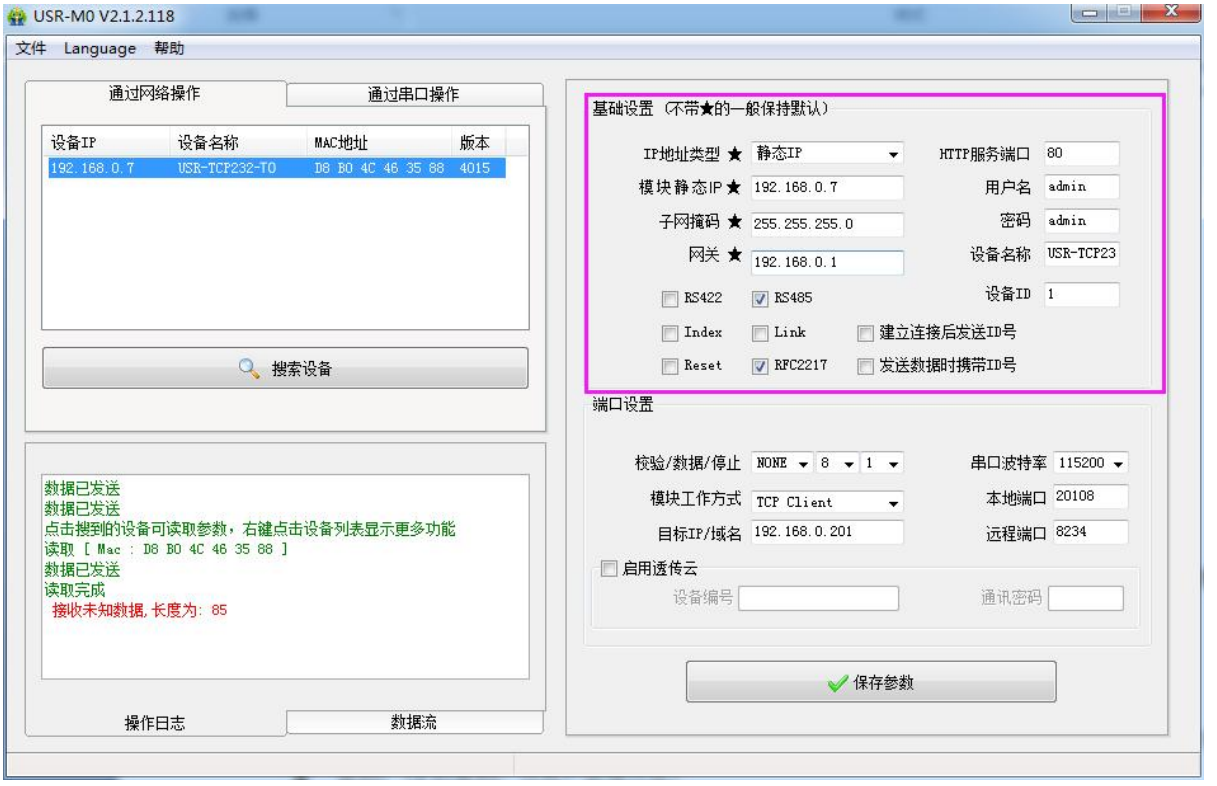

Figure 22. Software setting parameters

- Web page port: The default port number when accessing the web page is 80
- Username: Username for T0 login, authentication code when modifying parameters, which can prevent other users in the same LAN from modifying T0 parameters
- Password: Password for T0, corresponding to the user name.
- Device name: The name of T0 can be customized
- IP address type: Static and DHCP
- Static IP: The static IP address of T0, which should be in the same network segment as the router IP when setting.
- Subnet mask: generally default 255.255.255.0
- Gateway: Generally, it is the IP of the router. Only when the setting is correct can cross-segment communication and domain name resolution be carried out

4.2. Set protocol setting parameters

Through the setting agreement, the process of searching - setting - saving parameters - restarting can be completed, which is convenient for users to make their own setting software. For the setting agreement, see "M0 Series Parameter Configuration Agreement".

4.3. Web page setting parameters

Open the browser and input the IP address of T0, the default is (192.168.0.7) to open the login interface of T0. Enter the user name: admin password admin, click Login to enter the login interface.

Figure 23. Web login window

Click "Chinese" in the upper right corner of the web page to switch to the Chinese interface.

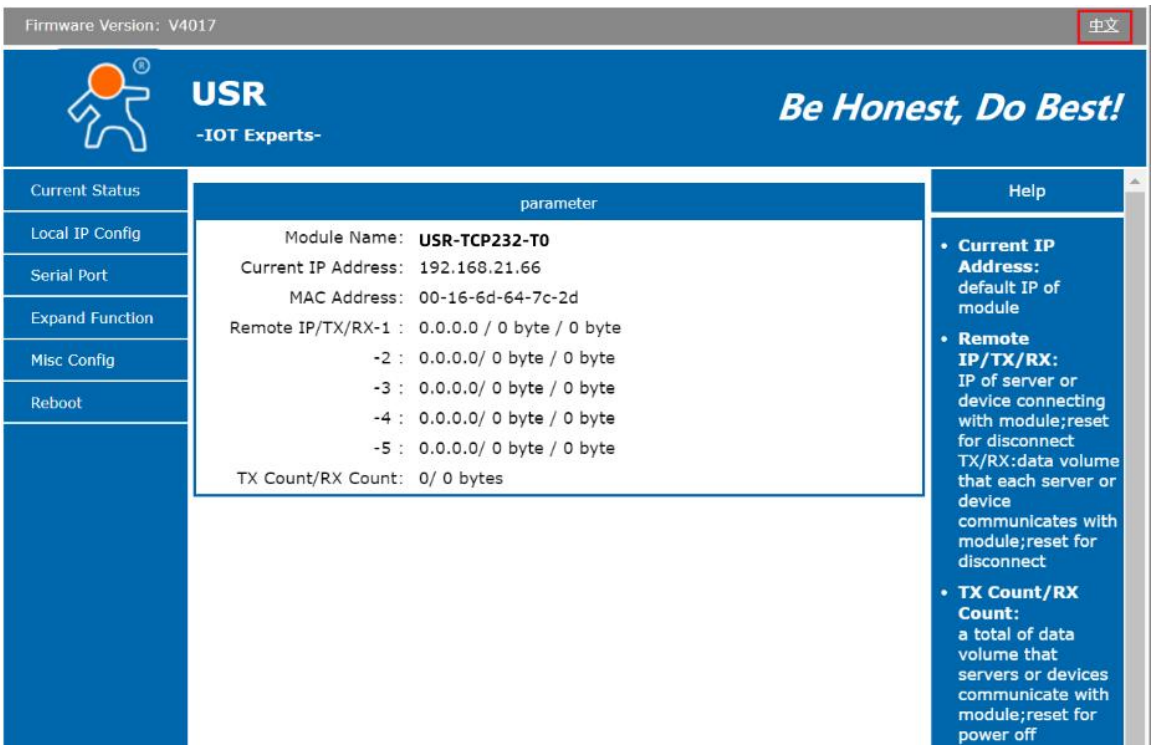

Figure 24. Web page - current status display

1. Current status page

The current status page shows some basic information of T0:

- T0 name
- current ip address
- MAC address
- The IP address of the connected device and the amount of data sent and received by the connection
- The total amount of data sent and received by all connections

2. Local IP setting

Modify the parameters that need to be set on this page, click Save Settings, and then modify the parameters on the next page. If other parameters do not need to be modified, click Restart to take effect.

- How to obtain IP address
- Local IP
- subnet mask
- gateway address
- DNS server

Figure 25. Web page local IP settings

3. Port parameters

- baud rate
- data bit
- Check Digit
- stop bit
- local port
- remote port
- Way of working
- remote server address
- some special features

Figure 26. **port parameters**

4. Extended functions

- Someone cloud number and password
- Custom heartbeat package function: can be opened through the web page, the content can be customized, up to 40 bytes Custom registration package function: can be opened through the web
- page, the content can be customized, the maximum length is 40 bytes, and the usage method of the registration package can be customized. In TCP Server mode, the new connection kicks off
- the old connection function
- Clear cache data: You can set whether to clear cache data before connection.

Figure 27. **Extended function interface**

5. Advanced Settings

- T0 name
- web port
- username
- password
- The number of TCP Server connection clients: 1~16, can customize the
- timeout restart time: the default value is 3600s

Figure 28. Advanced Settings Interface

6. Module management

- After the data is saved, click Restart, and the T0 restart will take effect.

Figure 29. Web page restart interface

4.4. AT command configuration

4.4.1. Overview of AT commands

The AT+ command refers to the command set that the user transmits commands to the module through the UART in the command mode. The usage format of the AT+ command will be explained in detail later. After power-on and start-up, the module can be set through UART.

The module's default UART port parameters are: baud rate 115200, no parity, 8 data bits, 1 stop bit. **<description>**

AT command debugging tool, UART interface is recommended to use SecureCRT software tool or professional APP application program. The following introductions all use UART communication and SecureCRT tool demonstration.

Switching from transparent transmission mode to command mode requires the following two steps:

- Input "+++" on UART, the module will return a confirmation code "a" after receiving "+++";
- Enter the confirmation code "a" on the UART, after the module receives the confirmation code, it will return "+OK" to confirm and enter the command mode;

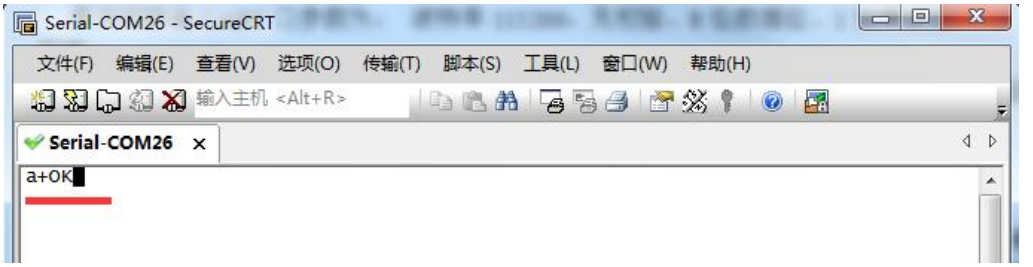

Figure 33 AT command

When entering "+++" and confirmation code "a", there is no echo, as shown in the figure above.

Inputting "+++" and "a" needs to be completed within a certain period of time to reduce the probability of entering the command mode by mistake during normal work. Specific requirements are as follows:

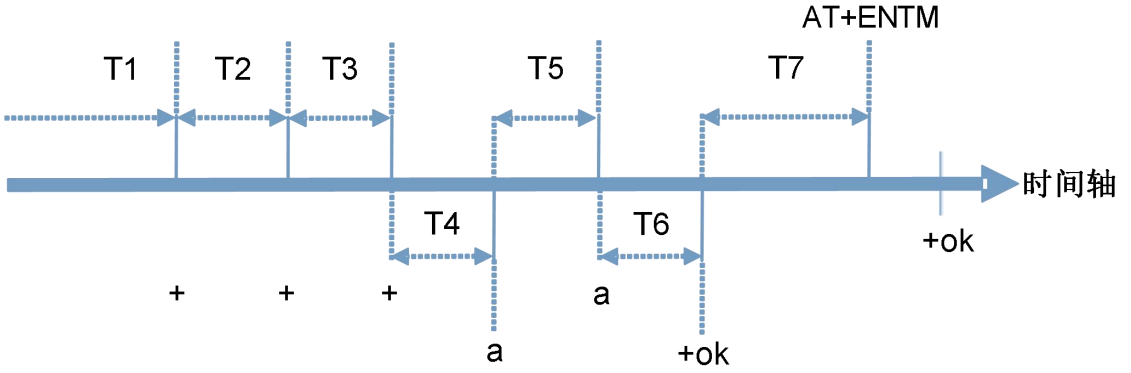

Figure 34 Schematic diagram of AT command

time requirement:

T1 > serial packet interval
T2 < 300ms
T3 < 300ms
T5 < 3s

The timing of switching from transparent transmission mode to temporary command mode:

1. The serial device sends "+++" to the module continuously, and the module sends an 'a' to the device after receiving "+++". No data can be sent during the packing time before sending "+++".
2. After the device receives 'a', it must send an 'a' to the module within 3 seconds.
3. After receiving 'a', the module sends "+OK" to the device and enters the "AT command mode".
4. After the device receives "+OK", it knows that the module has entered the "AT command mode", and can send AT commands to it.

The timing of switching from AT command mode to network transparent transmission:

1. The serial device sends the command "AT+ENTM" to the module.
2. After receiving the command, the module will echo "+OK" and return to the previous working mode.

4.4.2. AT command error code

surface8 List of error codes

error code	illustrate
+ CME ERROR: 1	Does not conform to the AT command format, does not start with AT
+ CME ERROR: 2	The AT command was not found and does not exist
+ CME ERROR: 3	The AT command does not conform to the format of the query or setting
+ CME ERROR: 4	Wrong range or number of parameters
+ CME ERROR:5	operation not allowed

4.4.3. AT command set

Note 1: For the specific format of AT commands, please refer to "AT command set"

Note 2: "AT+REGUSR" command and "AT+REGDT" do not support English comma (,)

surface9 ATcommand list

serial number	instruction	illustrate
1	E.	Set/query echo status
2	Z	Reboot the device
3	VER	Query version number
4	ENTM	Exit CMD mode
5	CPUID	Query CPUID
6	RELD	Restore user configuration parameters
7	MAC	Query module MAC address
8	WEBU	Set/query username and password
9	WANN	Set/query network parameters
10	DNS	Query/set DNS server address

12	SEARCH	Set/query network AT command search port number
13	WEBPORT	Set/query web page port number
14	DHCPEN	Set/query DHCP status
15	UART	Set/query UART interface parameters
16	UARTCLBUF	Set/query clear serial port cache enable status before module connection
17	UARTTL	Set/query serial port packaging parameters
18	SOCK	Query/set SOCKET parameters
20	TCPSE	Set/query whether the TCP Server kicks off old connections
twenty one	SOCKLK	Query socket connection status
twenty two	SOCKPORT	Set/query the local port number
twenty four	PDTIME	Query factory time
26	REGEN	Set/query registration package mechanism
27	REGTCP	Set/query the registration package execution mechanism
28	REGCLOUD	Set/query user name and password of transparent transmission cloud
29	REGUSR	Set/query user-defined registration package content
Extended function instructions		
30	SCSLINK	Set/query Socket connection status indication function
31	CLIENTRST	Set/query Reset function of TCP Client mode connection failures for many times
35	UARTCLBUF	Set/query clear serial port cache enable status before module connection
36	RSTIM	Set/query timeout restart time
37	TCPREIP	Query target IP address
38	MAXSK	Set/query the maximum number of TCP Server connection Clients
39	MID	Set/query module name
40	SN	Query device SN
41	WRSN	Write factory SN
42	MAC	Query device MAC address
43	WRMAC	Write factory MAC
44	BUILD	query compile time
45	PING	Detect the on-off status of the network
46	RSTIM	Set/query restart time without data
47	HEARTEN	Set/query heartbeat packet enable

48	HEARTSND	Set/query the sending direction of the heartbeat packet
49	HEARTTP	Set/query the sending direction of the heartbeat packet
50	HEARTDT	Set/query custom heartbeat packet data
51	HEART™	Set/query heartbeat time
52	CLOUD	Set/query user name and password of transparent transmission cloud
53	CFGTF	Set user default parameters
54	CLEAR	Restore factory parameters
55	REGEN	Set/query registration package enable
56	REGTCP	Set/query registration package sending method
57	REGSND	Set/query registration package sending method
58	REGDT	Set/query custom registration package
59	STRSON	Query the restart reason

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