RS485 TO LTE CAT4 (EU)

User Manual

Figure   RS485 TO LTE CAT4

1. OVERVIEW

- 5 modes and 13 frequencies: supports 4G high-speed access, and supports 2G/3G network at the same time;

- Wide voltage input, RS485 TO LTE CAT4 adopts DC 9~36V power supply.

- Based on embedded Linux system development, with high reliability;

- Support TCP and UDP at the same time;

- Support TCPServer, support 8-way Client access;

- Support 20 packets from serial port, when the connection is abnormal, it can be selected to cached data not to be lost;

- It supports edge computing and cloud service polling, and can realize data monitoring of terminal equipment with zero development;

- Support the transferring terminal data of cloud transparent transmission, provide supporting virtual serial port software and secondary development SDK;

- Support sending the data of registration packet/heartbeat packet;

- Support sending SMS to set up device parameters;

- Support multiple working modes: network transparent transmission mode, cloud configuration mode, protocol transparent transmission (UDC) mode, HTTPD mode;

- Support basic instruction set;

- Support socket distribution protocol, can send data to different sockets;

- Support FTP update protocol to facilitate remote update of client equipment;

- Support FOTA self-upgrade;

- Support simple instructions to send Chinese/English text messages, avoiding the complexity and difficulty of sending Chinese text messages from PDU;

- Support base station positioning function;

- Support protocol transparent transmission mode (UDC mode), and provide server-side secondary development materials;

CONTENTS

2. QUICK START

RS485 TO LTE CAT4 is a 4GDTU for serial device and network server to transmit data to each other via operator network. Users can easily use it to achieve two-way data transparent transmission from serial port to network by setting up AT commands. RS485 TO LTE CAT4 also supports cloud, providing users with software and hardware integrated system.

This chapter is a quick start guide for RS485 TO LTE CAT4. It is recommended that new users read this chapter carefully and follow the instructions to have a systematic understanding of the equipment. Users familiar with such products can skip this chapter. Refer to subsequent chapters for specific details and instructions.

The relevant software involved is as follows:

SSCOM.exe: Serial debugging assistant

RS485 TO LTE.exe :Configuration tool for RS485 TO LTE CAT4

2.1. PRODUCT TESTING HARDWARE ENVIRONMENT

2.1.1. HARDWARE PREPARATION

The test in this chapter is based on RS485 TO LTE CAT4 and its accessories. If you have purchased it, you will have the following accessories:

Table Accessories List

Working Mode	Network Transparent Data Transmission

Figure   Test Data Flow

Before testing, please connect the hardware as shown below. Connect the serial port of the computer to RS485 TO LTE CAT4, if there are no serial ports in your computer, you can connected with a USB to RS485 cable. For the specific connection method, please refer to the following hardware connection Figure.

2.2. DATA TRANSFER TEST

2.2.1.   INITIAL PARAMETERS OF THE DEVICE

Table   Initial Testing Parameters

Working Mode	Network Transparent Data Transmission
Server Address	test.waveshare.net
Server Port	2317
Serial Port Parameters	115200,8,1,None
Heartbeat Packet	Enable, heartbeat data: www.waveshare.com

1. Put the SIM card in the RS485 TO LTE CAT4 card slot, and connect it to the computer serial port using the above connection method. Open the setting software, first select the RS48 serial port number, baud rate and other parameters, and open the serial port, as shown below.

Note: Take WIN10 system as an example, the serial port number can be queried in "Control Panel→Device Manager→Port".
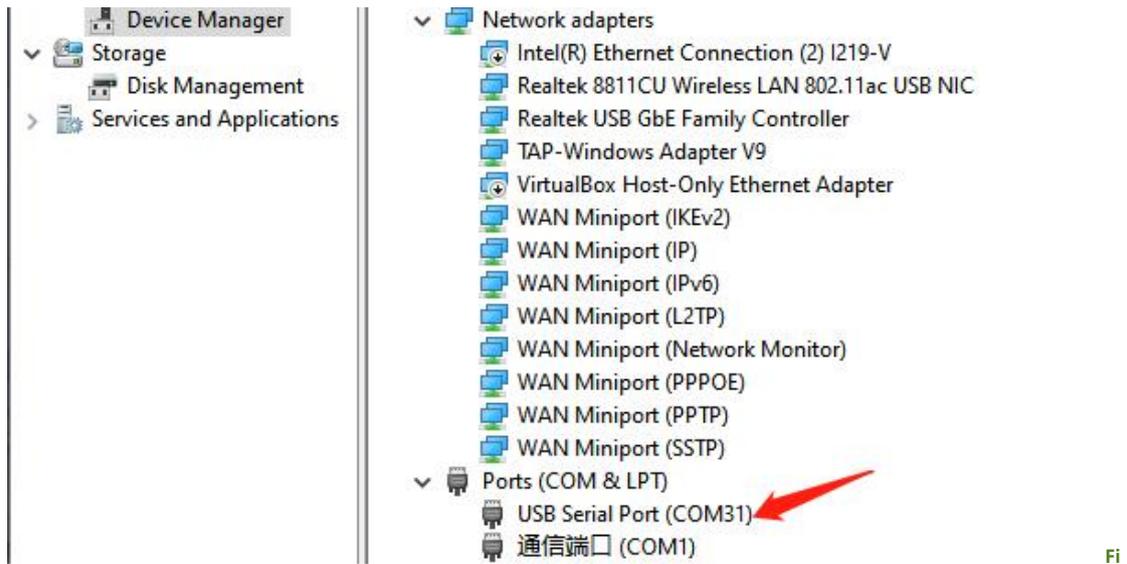
Figure   USB TO RS485 port
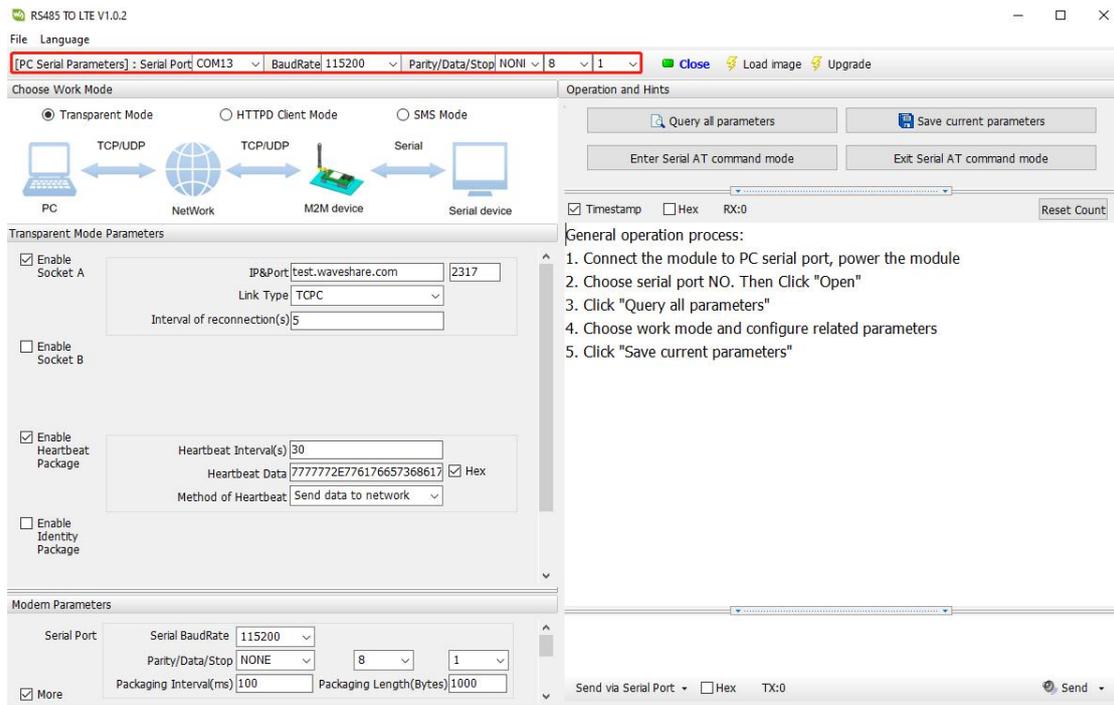
Figure   Software Setting

2.Power on RS485 TO LTE CAT4, the PWR light is on, wait for about 20 seconds, the WORK indicator is always on, the NET indicator is flashing and the LINKA indicator is on. Please refer to the following chapters for details about the indicator.

Note: During the test, a TCP server needs to be set up, or use it shared online: 118.190.93.84:2317

3.After the LINKA light is on, send data to the device through the RS485 serial port, for example, send "www.waveshare.com", later, go back to the receiving window of the software and receive "www.waveshare.com", which is the test server Returned, the product will have a default heartbeat

packet of 30s, so if the user does not send data, he can see the "www.waveshare.com" returned by the server every 30s in the receiving window.

4. The test is completed, and the product communication is normal.

3. PRODUCT OVERVIEW

3.1. PRODUCT INTRODUCTION

RS485 TO LTE CAT4 adopts DC 12V power supply, supports 4G, 3G and 2G network access at the same time. The software has complete functions and covers most of the common application scenarios. Users can realize the transparent data transmission from the serial port to the network through simple settings. And it supports protocol transparent transmission mode, custom registration package, heartbeat package function, supports 2-way Socket connection, supports TCPServer, and supports cloud access. It has the characteristics of high speed and low delay, and supports FTP upgrade protocol and   protocol.

3.2. EQUIPMENT BASIC PARAMETERS

Table   Basic Parameters

Parameter	Item	Index	
Wireless Parameter	wireless standard	TDD-LTE	
		FDD-LTE	
		WCDMA	
		TD-SCDMA	
		GSM/GPRS/EDGE	
	Standard frequency range	TDD-LTE	Band38/39/40/41
		FDD-LTE	Band1/3/8
		WCDMA	Band1/8
		TD-SCDMA	Band34/39
		GSM/GPRS/EDGE	Band3/8
	Transmitting power	TDD-LTE	+23dBm(Powerclass3)
		FDD-LTE	+23dBm(Powerclass3)
		WCDMA	+23dBm(Powerclass3)
		TD-SCDMA	+24dBm(Powerclass2)
		GSMBand8	+33dBm(Powerclass4)
		GSMBand3	+30dBm(Powerclass1)
	Technical regulations	TDD-LTE	3GPPR9CAT4 downlink 150Mbps, uplink 50Mbps

		FDD-LTE	3GPPR9CAT4 downlink 150Mbps，uplink 50Mbps
		WCDMA	HSPA+ Downlink rate 21Mbps,uplink rate 5.76Mbps
		TD-SCDMA	3GPPR9 Downlink rate 2.8Mbps,uplink rate 2.2Mbps
		GSM/GPRS/EDGE	MAX:uplink rate 384kbps uplink rate 128kbps
	Antenna Options	SMA interface	
Hardware Parameter	Data interface	RS485:1200,2400,4800,9600,19200,38400,57600,115200,230400,460800（unit：bps）	
	Working voltage	DC9V~36V(RS485 TO LTE CAT4)	
	Working current	72mA/12V maximum in average 110mA/12V10mA/220v	
	Stand-by current	67mA@12V in average	
	Operating temperature	-25℃-75℃	
	Storage temperature	-40℃-85℃	
	Size(mm)	28*64.7*109.7 （L*W*H）	
Software Parameter	Operating mode	Transparent transmission mode, cloud configuration mode, HTTPD mode, UDC mode	
	Command setup	AT+Command structure	
	Network protocol	TCP/UDP/DNS/HTTP/FTP/MQTT	
	Maximum TCP connection number	2	
	User configuration	Serial AT commands, network AT commands, SMS AT commands	
	Customer application	Support custom application software	
Software Function	DNS	Support	
	Simple transparent transmission	Support TCPClient/TCPServer/UDPClient	
	Socket Distribution Protocol	Support sending data to different sockets through protocols	
	HTTP protocol transmission	Support	
	MQTT protocol transmission	Support	
	Heartbeat packet	Support	
	Registration package mechanism	Support Custom registration package/ICCID registration package/IMEI registration package	
	Cloud service	Support	

Base station positioning	Support
FTP upgrade protocol	Support
Cloud Server	Support, for details, please refer to the cloud functions supported by the device.
ModbusTCP/RTU protocol mutual conversion	Support

3.3. CLOUD FUNCTIONS SUPPORTED BY THE DEVICE

Table   Cloud Monitoring & Cloud Configuration Function Column

Monitoring and Configuration	Function	Standard
cloud configuration	Edge computing	Support. Supports the data of the terminal devices to be monitored by "edge computing", only supports Modbus RTU protocol, supports up to 500 registers, and can achieve second-level acquisition
	Cloud polling	Support. Supports the data of the terminal devices to be monitored by "cloud polling", and supports data collection at the fastest 1 minute
	Transfer terminal data to cloud	Support 1. Support transparent transmission between "terminal equipment" and "VCOM virtual serial port software"; 2. Support transparent transmission between "terminal device" and "secondary development SDK" 3. Support transparent transmission between "terminal equipment" and "terminal equipment";
Cloud monitoring	Signal qualities measuring	Support
	Data flow monitoring	Support
	Signal strength alarm	Support
	Data traffic excess alarm	Support
	Frequent disconnection	Support

	alarm	
	Remotely configure DTU parameters	Support. Supports configuring batch parameters of a large number of devices through configuration tasks
	Remote upgrade of DTU firmware	Support.Supports upgrading a large number of devices through upgrade tasks
Others	Automatic positioning	Support.Real-time location tracking and historical track tracing
	Zero configuration to the cloud	Support.No need for complicated configuration with traditional host computer

3.4. DIMENSIONAL DESCRIPTION

The following picture is the size chart (mm) of RS485 TO LTE CAT4:

Figure   Outline Dimensions

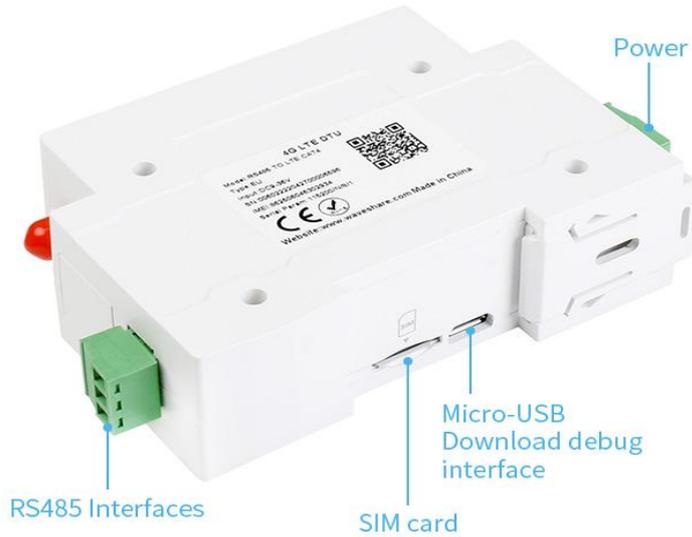## 3.5. INTERFACE DESCRIPTION

Figure   Interface Description

4.   PRODUCT FEATURES

This chapter introduces the functions of RS485 TO LTE CAT4. The following figure is the overall frame of the device function, which can help you have a general understanding of the product.
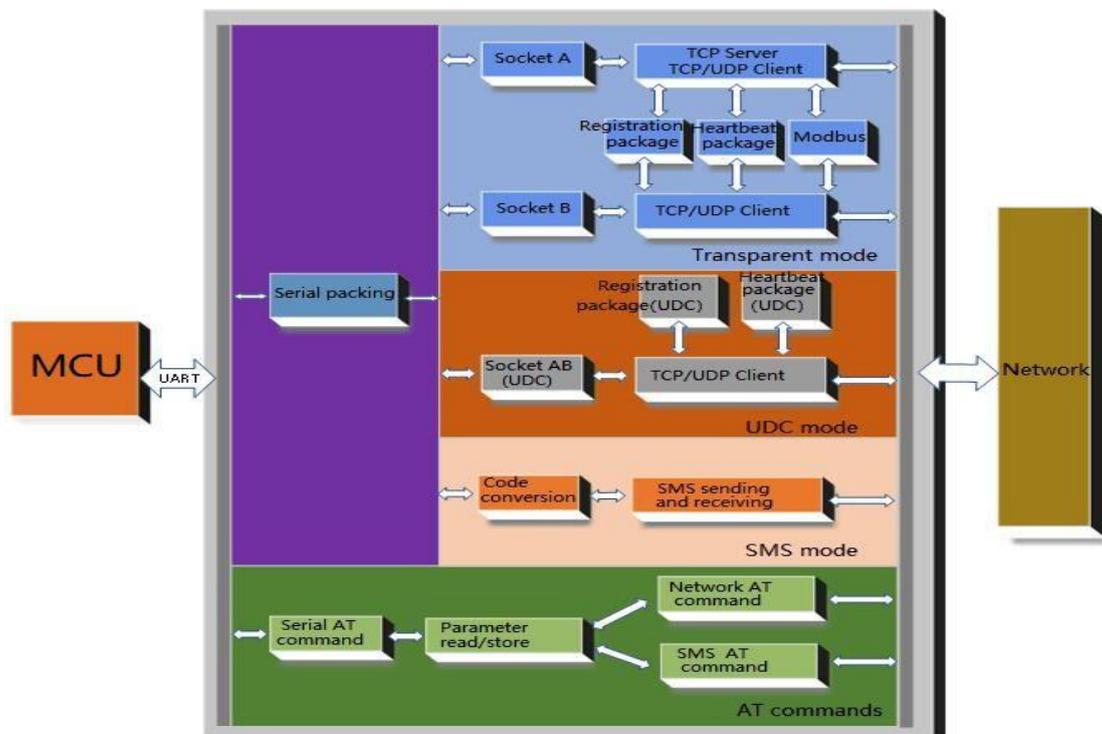

Figure   Function Frame

4.1. WORKING MODE

There are 4 working modes:

① Network transparent transmission mode (NET)

② Cloud configuration mode (CLOUD)

③ Protocol transparent transmission mode (UDC)

④ HTTPDClient mode (HTTPD)

■ Network transparent transmission mode

In this mode, the user's serial device can send data to the specified server on the network through this device. The device can also accept data from the server and transfer the data to the serial device.

■ Cloud configuration mode

In this mode, the serial port data from the terminal device will be transmitted to the cloud, which can realize "terminal device data monitoring" and "terminal device data cloud transfer".

■ Protocol transparent transmission mode

This mode adds specific registration packets and heartbeat packets to the network transparent transmission mode, and groups the data. This mode is more convenient for secondary development, and users can understand it as a network transparent transmission mode that joins the UDC protocol.

■ HTTPDClient mode

In this mode, the user's serial device can send request data to the specified HTTP server through the device, and then the device receives the data from the HTTP server, parses the data and sends the result to the serial device.

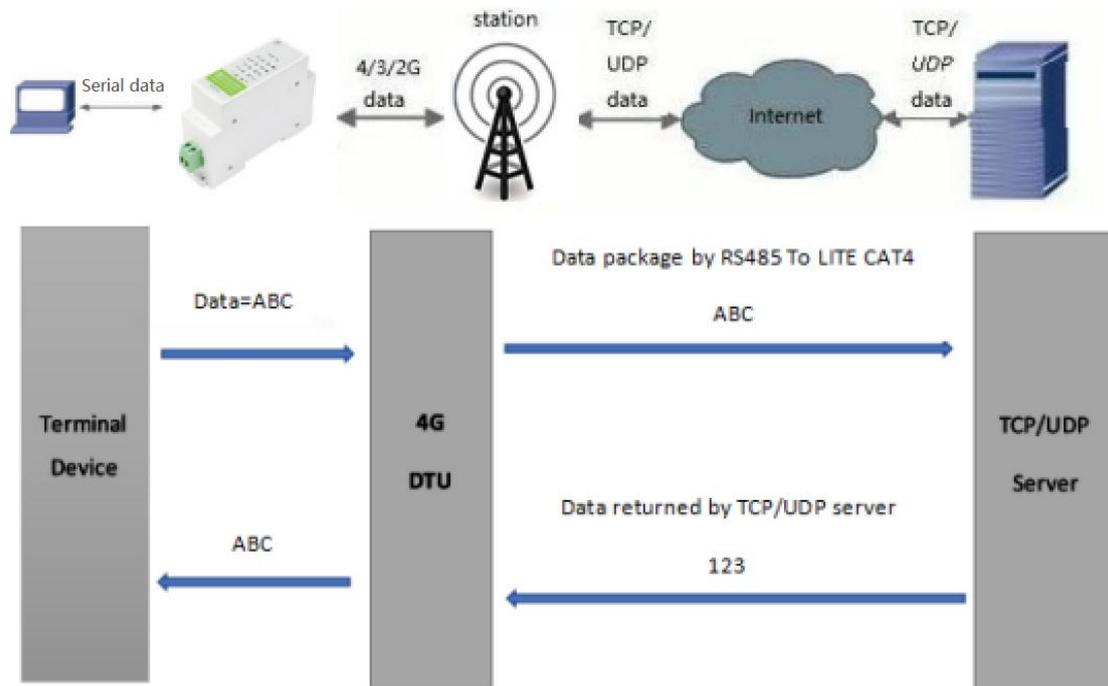## 4.1.1. NETWORK TRANSPARENT TRANSMISSION MODE

Figure   Network Transparent Transmission

In this mode, the user's serial device can send data to the specified server on the network through this device. The device can also accept data from the server and forward the data to the serial device. The maximum length of data sent at one time is determined by the packet length, refer to AT+UARTFL.

Users do not need to pay attention to the data conversion process between serial port data and network data packets, just through simple parameter settings, the data transparent communication between the serial port device and the network server can be realized.

This device supports two Socket connections, SocketA and SocketB, which are independent of each other. RS485 TO LTE CAT4 only supports SocketA as TCPClient, TCPServer and UDPClient. SocketB only supports TCPClient and UDPClient functions. The TCPServer function supports up to 8 channels of Client access, and more than 8 channels will no longer be connected. Because the regular carrier network cannot be accessed through the external network, a dedicated APN card is required for the Server function.

The device supports two sockets to be set as short links respectively. When set to short links, the connection with the server will be established only when data is sent. When there is no data transmission, the timer will start, and after the set timeout time is exceeded, it will be disconnected from the server connect.

Note: The short connection and long connection of this product cannot be mixed. If two connections are enabled, both of them need to be long connections, or both of them must be short connections.

Table   AT Command

Command	Function	Default Parameters
AT+WKMOD	Query/Set working mode	NET
AT+SOCKA	Query/set socketA parameters	TCP,test.waveshare.com,2317
AT+SOCKB	Query/set socketB parameters	TCP,test.waveshare.com,2317
AT+SOCKAEN	Query/set whether socketA is enabled	ON
AT+SOCKBEN	Query/set whether socketB is enabled	OFF
AT+SOCKASL	Query/set socketA connection mode	LONG
AT+SOCKBSL	Query/set socketB connection mode	LONG
AT+SOCKALK	Query socketA connection status	None
AT+SOCKBLK	Query socketB connection status	None
AT+SOCKATO	Query/set the reconnection time after A is disconnected	5
AT+SOCKBTO	Query/set the reconnection time after connection B is disconnected	5
AT+SHORATO	Query/set the timeout of short connection A	5
AT+SHORBTO	Query/set the timeout of short connection B	5
AT+KEEPALIVEA	Query/set the keepalive parameter of socketA	1,60,15,3
AT+KEEPALIVEB	Query/set the keepalive parameter of socketA	1,60,15,3
AT+SOCKIND	Query/set whether to display the socketID function	OFF
AT+SDPEN	Query/set whether to enable the socket distribution protocol	OFF
AT+SOCKRSTIM	Query/set the maximum times of reconnections of the socket	60

Set RS485 TO LTE CAT4 work at TCP client by AT commands:

1.Set the working mode to net transparent transmission:

AT+WKMOD=NET

2. Enable socket A:

AT+SOCKAEN=ON

3. Setup remote IP and port:

AT+SOCKA=TCP,test.waveshare.com,2317

4. Setup APN

E. g: APN is CMNET, username is empty, password is empty, authentication method is NONE:

AT+APN=CMNET,,,0

5.Reboot

AT+Z

Set RS485 TO LTE CAT4 work at TCP Sever by AT commands:

1. Set the work mode to net transparent mode:

AT+WKMOD=NET

2. Enable socket A:

AT+SOCKAEN=ON

3. Set socket A as TCP Server, local port 2317, IP has no reference meaning in Server:

AT+SOCKA=TCPS,test.waveshare.com,2317

4. E. g: APN is CMNET, username is empty, password is empty, authentication method is NONE:
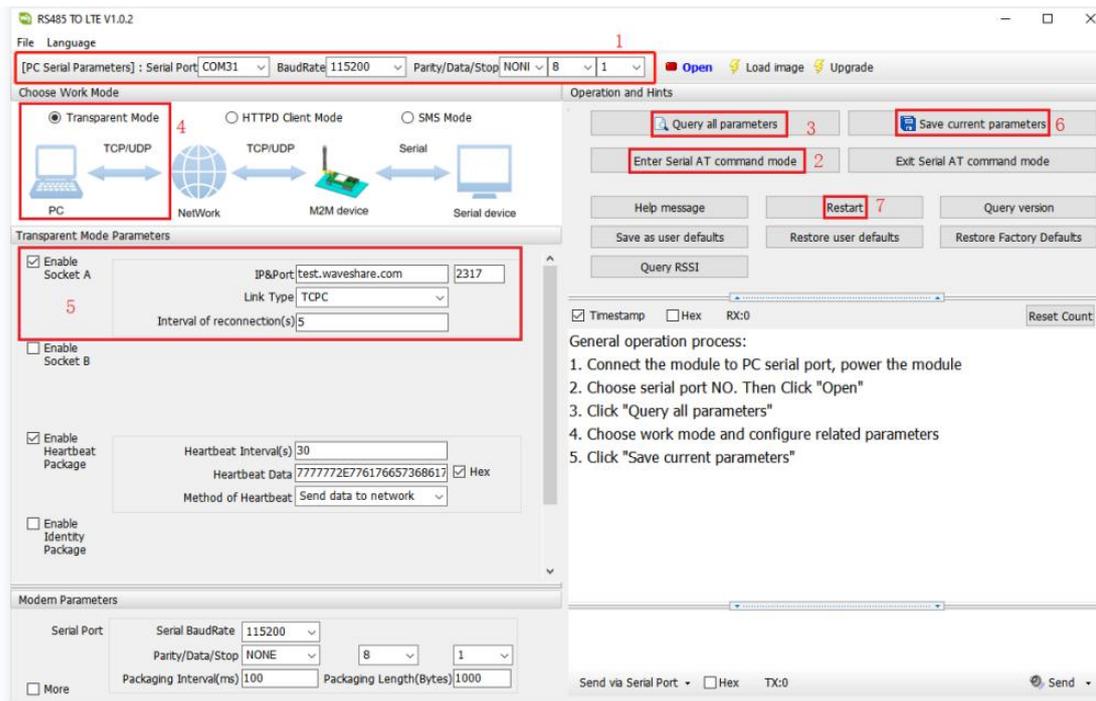
AT+APN=CMNET,,,0

5. Reboot:

AT+Z

Figure   Software Setup

1. Open the dedicated setting software "RS485 TO LTE CAT4_V1.0.0.exe". Set the serial port parameters according to the actual situation and click "Open Serial Port".

2. Click "Enter configuration state" and wait for the device to enter the AT command configuration mode.

3. Click "Get Current Parameters" and wait for the completion of obtaining all current parameters.

4. In the "Select Working Mode" column, select "HTTPD Mode".

5. Set "HTTP Request Method" to GET. Set "HTTP Request URL" to "/1.php[3F]". Set "Server Address" to "test.waveshare.com". Set the "Server Port" to 80, and set the "Timeout" to 10 seconds. Set "HTTP Request Header" to "Connection:close[0D][0A]", and select "Filter HTTP Header".

6. Click "Set and save all parameters".

7. After saving, click the "restart button" to restart the device, or power off the device and power it on again.
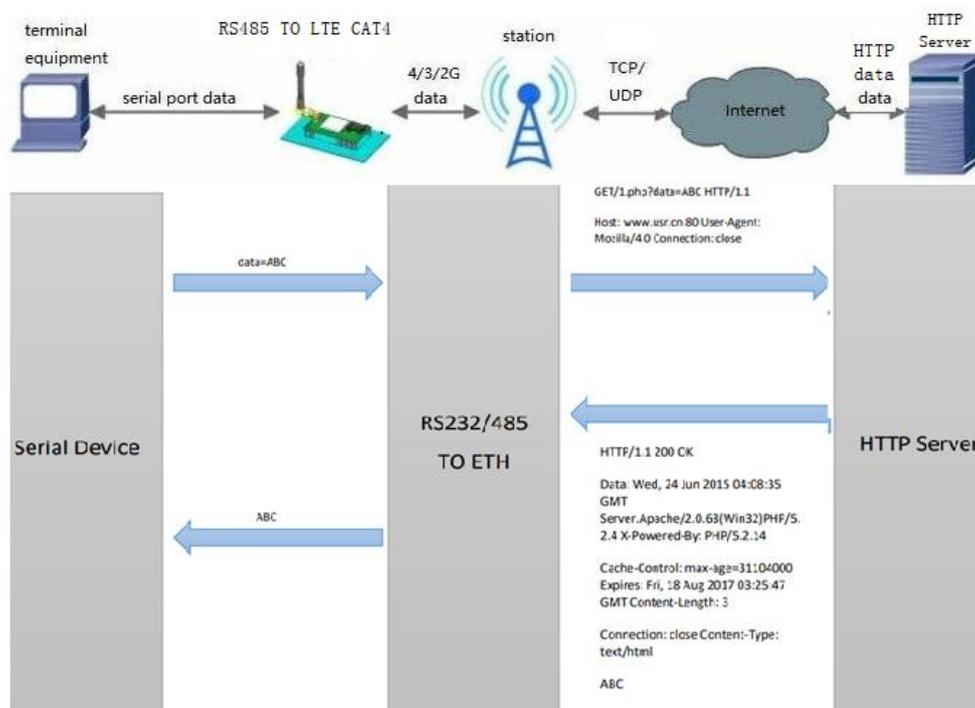
4.1.2. HTTPD MODE

Figure   HTTP Mode

In this mode, the user's terminal device can send request data to the specified HTTP server through this device, and then the device receives the data from the HTTP server, parses the data and sends the result to the serial device.

Users do not need to pay attention to the data conversion process between serial port data and network data packets, and only need to set simple parameters to realize the data request from the serial port device to the HTTP server.

The device will filter the received data by default, and only output the user data to the serial port. Customers can use AT commands to choose whether to filter HTTPD data.

Table   AT Command

Command	Function	Default Parameters
AT+WKMOD	Query/Set working mode	NET
AT+HTPTP	Set/query how HTTP works	GET
AT+HTPURL	Set/Query URL	/1.php[3F]
AT+HTPSV	Set/query target server address and port	test.waveshare.com
AT+HTPHD	Set/query HTTP protocol HEAD inTableation	Connection:close[0D][0A]
AT+HTPFLT	Set/query whether to enable HEAD filtering	ON

AT+HTPTO	Set/query HTTPD timeout	10

AT command setting method:

1. Set the working mode to HTTPD:

    AT+WKMOD=HTTPD

2. Set the HTTP request method:

    AT+HTPTP=GET

3. Set the HTTP request URL:

    AT+HTPURL=/1.php[3F]

4. Set up the HTTP request server:

    AT+HTPSV=test.waveshare.com,80

5. Set the HTTP request header inTableation:

    AT+HTPHD=Connection:close[0D][0A]

6. Set the HTTP request timeout time:

    AT+HTPTO=10

7. Set whether to filter the reply header:

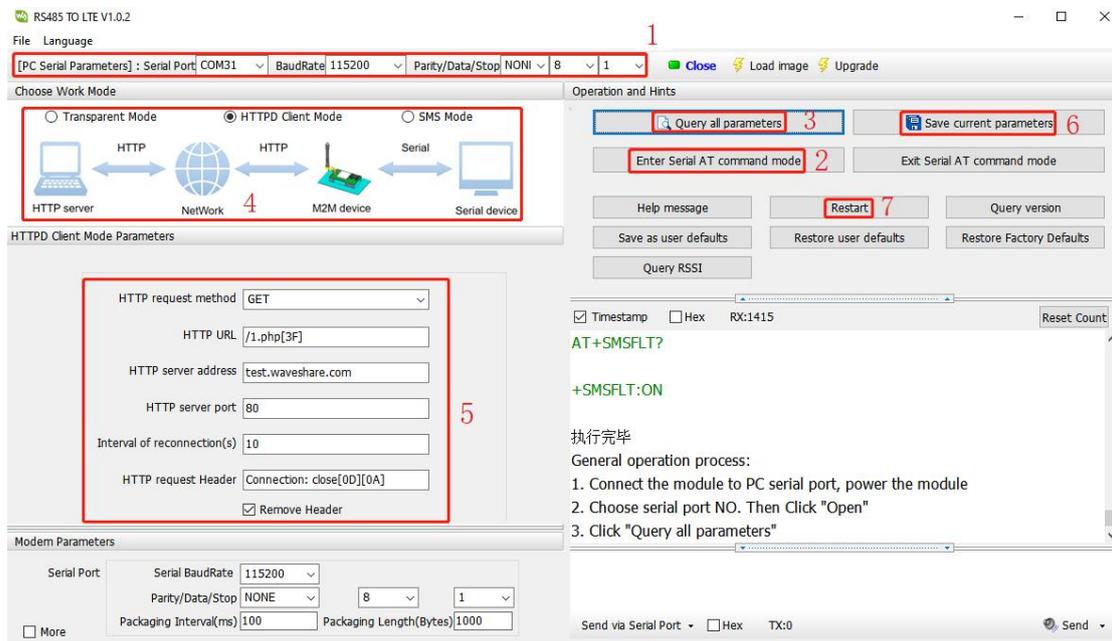   AT+HTPFLT=ON

8. Reboot:

    AT+Z

Figure　Software Setup

1. Open the dedicated setting software "RS485 TO LTE CAT4_V1.0.0.exe". Set the serial port parameters according to the actual situation and click "Open Serial Port".

2. Click "Enter configuration state" and wait for the device to enter the AT command configuration mode.

3. Click "Get Current Parameters" and wait for the completion of obtaining all current parameters.

4. In the "Select Working Mode" column, select "HTTPD Mode".

5. Set "HTTP Request Method" to GET. Set "HTTP Request URL" to "/1.php[3F]". Set "Server Address" to "test.waveshare.com". Set the "Server Port" to 80, and set the "Timeout" to 10 seconds. Set "HTTP Request Header" to "Connection:close[0D][0A]", and select "Filter HTTP Header".

6. Click "Set and save all parameters".

7. After saving, click the "restart button" to restart the device, or power off the device and power it on again.

4.2. SERIAL PORT

4.2.1. BASIC PARAMETERS

Table   Serial Port Parameter

Item	Parameter
Baud Rate	1200，2400，4800，9600，19200，38400，57600，115200，230400，460800
Data Bit	7,8
Parity Bit	NONE（without parity bit） EVEN（even parity bit） ODD（odd parity bit）
Flow Control	NFC：No hardware flow control

Note: Flow control is temporarily not supported, the default is NFC

4.2.2. FRAMING MECHANISMS

4.2.2.1. TIME TRIGGER MODE

When RS485 TO LTE CAT4 receives data from UART, it will constantly check the interval time between adjacent 2 bytes. If the interval time is greater than or equal to a certain "time threshold", it is considered that a frame ends, otherwise, data will be received until it is greater than or equal to the set packet length bytes.

Send this frame of data to the network as a TCP or UDP packet. The "time threshold" here is the packing interval time. The settable range is 50ms~60000ms. The factory default is 50ms.

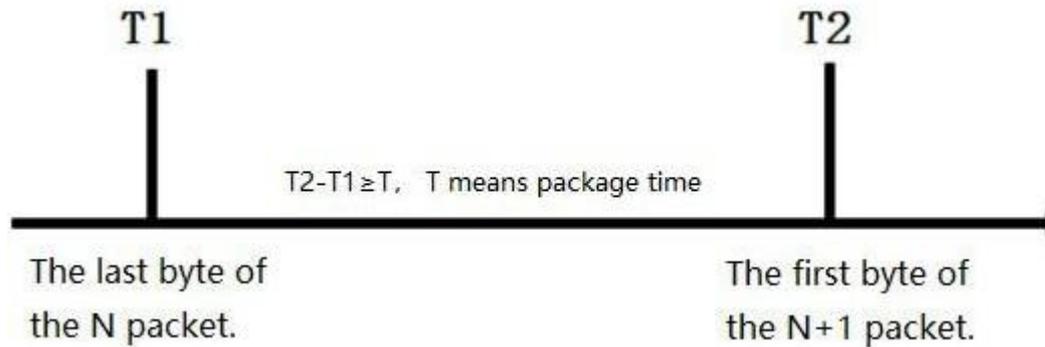This parameter can be set according to AT command, AT+UARTFT=<time>.

Figure   Time Trigger Mode

4.2.2.2. LENGTH TRIGGER

When RS485 TO LTE CAT4 receives data from the UART, it constantly checks the number of bytes received. If the number of bytes received is equal to a certain "length threshold", a frame is considered to have ended, otherwise the packaging time is waiting for the end. This frame is sent to the network as a TCP or UDP packet. The "length threshold" here is the package length. The settable range is 100~1000. Factory default 1000.

Note: when using "command password +AT command" function, the package length must be larger than the "command password +AT command", otherwise AT command is invalid.

This parameter can be set by AT command, AT+UARTFL=<length>.
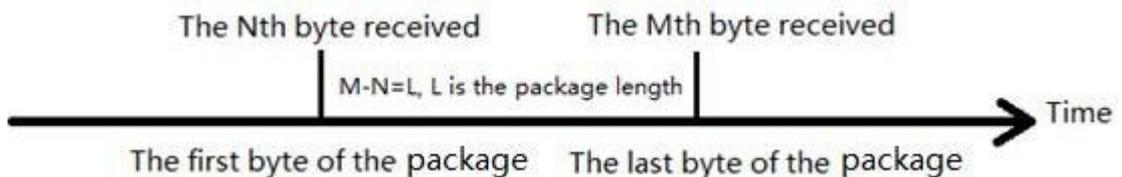
Figure   Length Trigger

4.3. FEATURES

4.3.1. AUTOMATIC POSITIONING

RS485 TO LTE CAT4 has LBS base station positioning function, which can obtain the general location of the device through the operator's network, and the positioning accuracy is generally about 100 meters.

(1) Using the cloud automatic positioning function

(2) If the user does not use the cloud, the base station positioning inTableation can be read through AT commands

RS485 TO LTE CAT4 has LBS base station positioning function, which can obtain the general location of the device through the operator's network, and the positioning accuracy is generally about 100 meters. Base station positioning inTableation is obtained through AT commands, which can be used flexibly with serial AT and SMS AT commands.

Table   AT Command

Command	Function	Default Parameters
AT+LBS	Query base station location inTableation	None

Note: This function does not obtain direct positioning inTableation (for example: latitude and longitude inTableation), but the number of the base station. The query result is divided into two parts: LAC (LocationAreaCode, location area code) and CID (CellIdentity, base station number). As long as we use these two data, we can go to the corresponding library to convert the corresponding coordinates. For example, the result of our query is LAC=8EDA (hexadecimal), CID=08EF6701 (hexadecimal). The user needs to give this inTableation to the third-party website or API interface, and the third-party can obtain the direct positioning inTableation through the library adjustment. The location inTableation services of third parties are generally paid services. During user testing, you can go to this website to convert the actual location http://www.minigps.net/cellsearch.html, this website is a non-profit third-party website, and some Internet of Things does not guarantee its services.

4.3.2. REGISTERING PACKAGE FUNCTIONS

Figure   Registering package functions
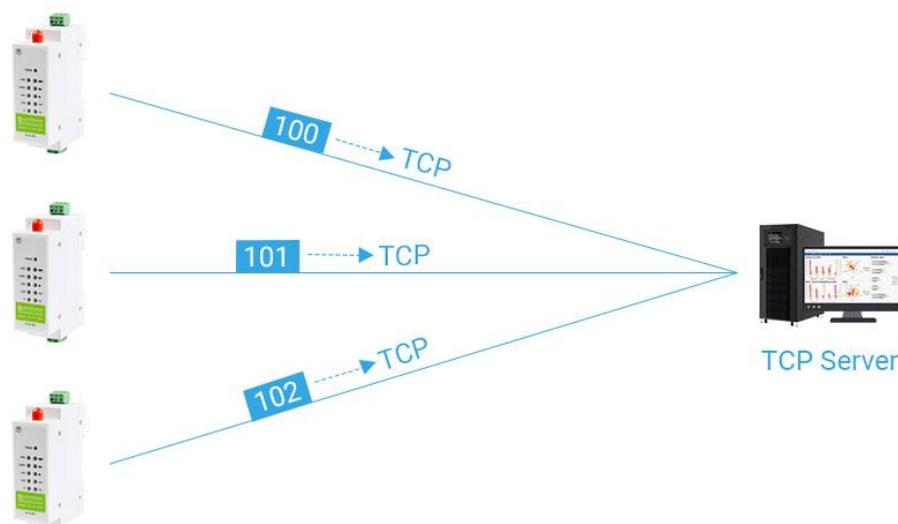
In the network transparent transmission mode, the user can choose to let the device send the registration package to the server. The registration package is used to allow the server to identify the data source device, or as a password to obtain authorization for server functions. The registration packet can be sent when the device establishes a connection with the server, or the registration

packet data can be spliced into the front end of each data packet as a data packet. The data of the registration package can be ICCID code, IMEI code, or custom registration data.

● ICCID, the unique identification code of the SIM, is suitable for applications based on SIM card identification.

● IMEI, the unique identification code of the Internet DTU in the DTU device, is suitable for applications based on device identification and has nothing to do with the SIM card installed in it.

● CLOUD, based on the identification code of the cloud application, you can easily use the manned service by setting the relevant parameters of the acquired permissions.

● USER, user-defined data, can be applied to user-defined registration data.

<p align="center">Table   AR Command</p>

Command	Function	Default Parameter
AT+REGEN	Query/set whether to enable the registration package	OFF
AT+REGTP	Query/set registration package content type	WAVESHARE
AT+REGDT	Query/set custom registration inTableation	7777772E7761766573686172652E636F6D
AT+REGSND	Query/set the registration package sending method	LINK

1. Enable the registration package function:

AT+REGEN=ON

2. Set the registration package content type to user-defined:

AT+REGTP=WAVESHARE

3. Set custom registration package data:

AT+REGDT=7777772E7761766573686172652E636F6D

4. Set the registration packet sending method to use the registration data as the header of each packet:

AT+REGSND=DATA

5. Reboot:

AT+Z

Figure   Software Setting

1. Open the dedicated setting software "RS485 TO LTE CAT4_V1.0.0.exe". Set the serial port parameters according to the actual situation and click "Open Serial Port".

2. Click "Enter configuration state" and wait for the device to enter the AT command configuration mode.

3. Click "Get Current Parameters" and wait for the completion of obtaining all current parameters.

4. In the "Select working mode" column, select "Network transparent transmission mode".

5. Set the parameters of socketA.

6. Enable the registration package function and set various parameters.

7. Click "Set and save all parameters".

8. After saving, click the "restart button" to restart the device, or power off the device and power it on again.

4.3.3. HEARTBEAT PACKET MECHANISM

In network transparent transmission mode, users can choose to let DTU send heartbeat packets. Heartbeat packets can be sent to the network server or to the serial device.

The main purpose of sending to the network is to maintain a connection with the server, and to keep a DTU that is idle for a long time (will not send data to the server for a long time) to maintain a connection with the server.

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 device side instead of sending the query command from the server.

Table   AT Command

Command	Function	Default Parameter
AT+HEARTEN	Query/set whether to enable heartbeat packets	ON
AT+HEARTDT	Query/set heartbeat packet data	7777772E7573722E636E
AT+HEARSND	Query/set the sending method of heartbeat packets	NET
AT+HEARTTM	Query/set the heartbeat packet sending interval	30

AT command setting method:

1. Turn on the heartbeat packet function:

AT+HEARTEN=ON

2. Set the heartbeat packet data: AT+HEARTDT=7777772E7573722E636E

3. Set the heartbeat packet sending method to send to the network:

AT+HEARTTP=NET

4. Set the sending interval of heartbeat packets:

AT+HEARTTM=30
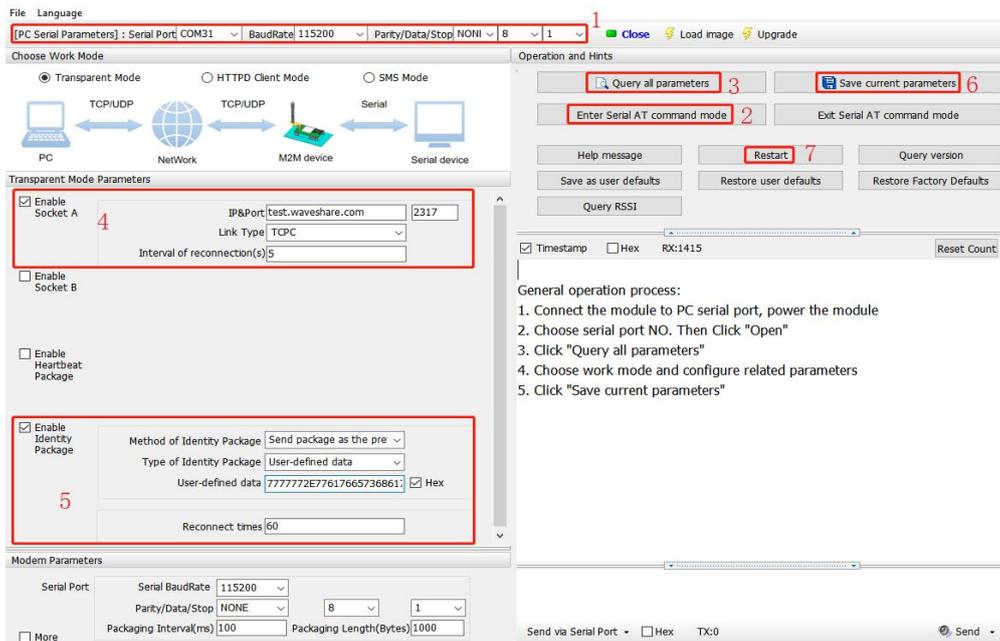
5. Reboot:

AT+Z
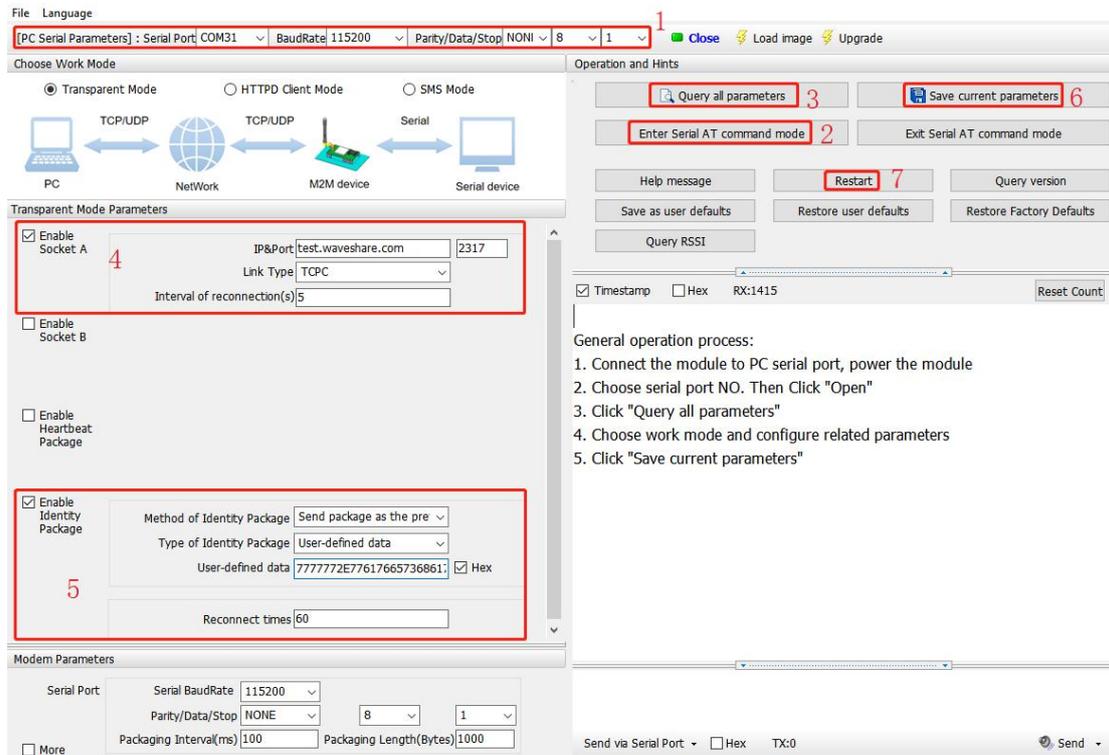
Figure   Software Setting

1. Open the dedicated setting software "RS485 TO LTE CAT4_V1.0.0.exe". Set the serial port parameters according to the actual situation and click "Open Serial Port".

2. Click "Enter configuration state" and wait for the device to enter the AT command configuration mode.

3. Click "Get Current Parameters" and wait for the completion of obtaining all current parameters.

4. In the "Select working mode" column, select "Network transparent transmission mode"

5. Set the parameters of socketA.

6. Turn on the heartbeat package function and set various parameters.

7. Click "Set and save all parameters".

8. After saving, click the "restart button" to restart the device, or power off the device and power it on again.

4.3.4. MODBUSTCP/RTU PROTOCOL CONVERSION

Figure   Schematic diagram of ModbusTCP/RTU protocol mutual conversion function

In the network transparent transmission mode, if the terminal device transmits data through the ModbusRTU protocol, and the server communicates through the ModbusTCP protocol, the user can enable 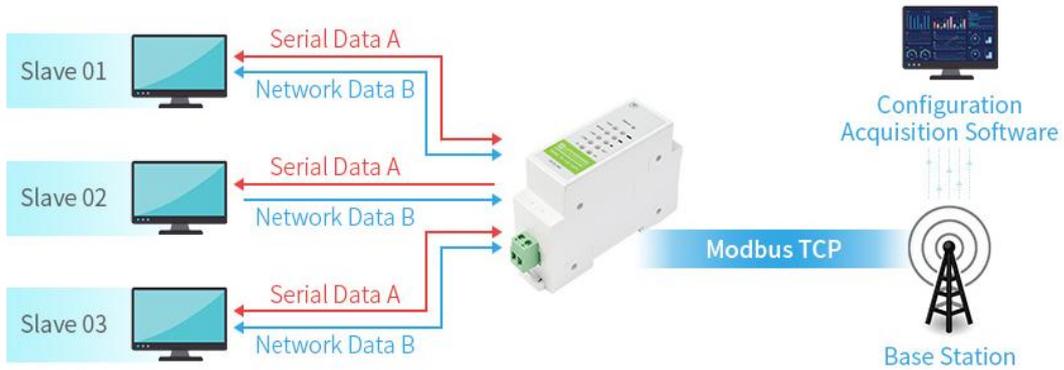the DTUModbusTCP/RTU protocol interconversion function. After this function is enabled, DTU converts the ModbusTCP protocol data sent by the server into ModbusRTU protocol and sends it to the terminal device, and converts the ModbusRTU protocol data responded by the terminal device into ModbusTCP protocol and sends it to the server.

The ModbusTCP/RTU protocol inter-conversion function is only valid in the network transparent transmission mode SocketA. Set TCP to Client or Server mode. After setting to Server mode, the TCPServer function only supports 1 channel of Client access, and more than 1 channel will no longer be connected. Because the regular carrier network cannot be accessed through the external network, a dedicated APN card is required for the Server function. After the ModbusTCP/RTU protocol interconversion function is enabled, SocketB will not be available.

Table   AT Command

Command	Function	Default Parameter
AT+MODBUSEN	Query/set whether to enable the Modbus protocol conversion function	OFF

The AT command is set as TCPClient, and the method of opening the modbus protocol conversion function:

1. Set the working mode to network transparent transmission:

   AT+WKMOD=NET

2. Set socketA to enabled state:

   AT+SOCKAEN=ON

3. Set socketA as TCPClient:

   AT+SOCKA=TCP,test.waveshare.com,2317

4. Set socketA to be a long connection:

   AT+SOCKASL=LONG

5. Turn on the Modbus protocol conversion function:

   AT+ENMODBUS=ON

6. Reboot:

   AT+Z

   The AT command is set as TCPServer, and the method of opening the modbus protocol conversion function:

1. Set the working mode to network transparent transmission:

   AT+WKMOD=NET

2. Set socketA to enabled state:

   AT+SOCKAEN=ON

3. Set socketA as TCPServer, local port 2317, IP has no reference meaning when server is:

   AT+SOCKA=TCPS,test.waveshare.com,2317

4. Turn on the Modbus protocol conversion function:

   AT+ENMODBUS=ON

5. Reboot:

   AT+Z

4.3.5. INDICATOR LIGHT STATUS INDICATION

There are ten indicators on the RS485 TO LTE CAT4, which are PWR, WORK, NET, LINKA, LINKB, TX, RX, primary signal strength, secondary signal strength and tertiary signal strength. The statuses represented by the indicator lights are as follows:

Table Indicator Status

Indicator	Function	Status
PWR	Power Indicator	Power supply works normally
WORK	System running work indicator	Always on after the system is running
NET	Network status indicator	2G network: flashes 2 times 3G network: flashes 3 times 4G network: flashes 4 times no network: off
LINKA	Indicates SocketA Connection	SocketA connection establishment is always on
LINKB	Indicates SocketB Connection	SocketB connection establishment is always on
TX	Serial data sending instruction	Lights on when the serial port has data to send
RX	Serial port data receiving indication	Lights on when the serial port is receiving data
Level 1 Signal Strength	Level 1 Signal Strength Indication	Long on when the signal strength is level 1 and above
Level 2 signal strength	Level 2 signal strength Indication	Lights on when the signal strength is level 2 or above
Level 3 Signal Strength	Level 3 signal strength Indication	Lights on when the signal strength is level 2 or above

Note: Signal strength classification range (dBm, in LTE mode)

Level 0 signal strength: RSSI<-115dBm

Level 1 signal strength: -115dBm<=RSSI<-108dBm

Level 2 signal strength: -108dBm<=RSSI<-96dBm

Level 3 signal strength: -96dBm<=RSSI

In order to facilitate customers and the operation of the firmware USB upgrade, RS485 TO LTE CAT4 has the function of FOTA upgrade. As FOTA is imperceptible to users, if the FOTA upgrade function is enabled, RS485 TO LTE CAT4 will query the server for version inTableation at regular intervals (time can be set). If there is a new version of the firmware, and the server allows the device to be upgraded , RS485 TO LTE CAT4 will download the differential package from the server to the local for upgrading. After finishing upgrade, RS485 TO LTE CAT4 will restart and run the new version of the firmware by itself.

4.3.6. HARDWARE RESET TO DEFAULT SETTINGS

How to restore factory default setting: power on; press the Reload button for 3~15S; and then release it, the device parameters can be restored.

4.4. AT COMMAND CONFIGURATION

4.4.1. SETUP SOFTWARE INSTRUCTIONS

Description:

1. In the software serial port parameter setting area, it is necessary to set the parameters consistent with the current serial port of the device, otherwise it cannot communicate with the device.

2. Working mode selection area, choose which mode the device works with.

3. Function parameter setting area, set the function-related parameters of the device.

4. In the global parameter area, set the basic global parameters of the device.

5. The command sending button, click to send the command from the input.

6. Input box, self-input instruction text box.

7. Receive box, receive the return inTableation from the device.

8. Common command button, click to input common AT commands.

9. Parameters are imported or exported from a file to a file.

4.4.2. AT COMMAND MODE

When the device works in any of the three working modes of network transparent transmission, protocol transparent transmission and HTTPD, the device can switch to "command mode" by sending data of a specific timing to the serial port of the device. When the operation in the "command mode" is completed, the device is returned to the previous working mode by sending a specific command.
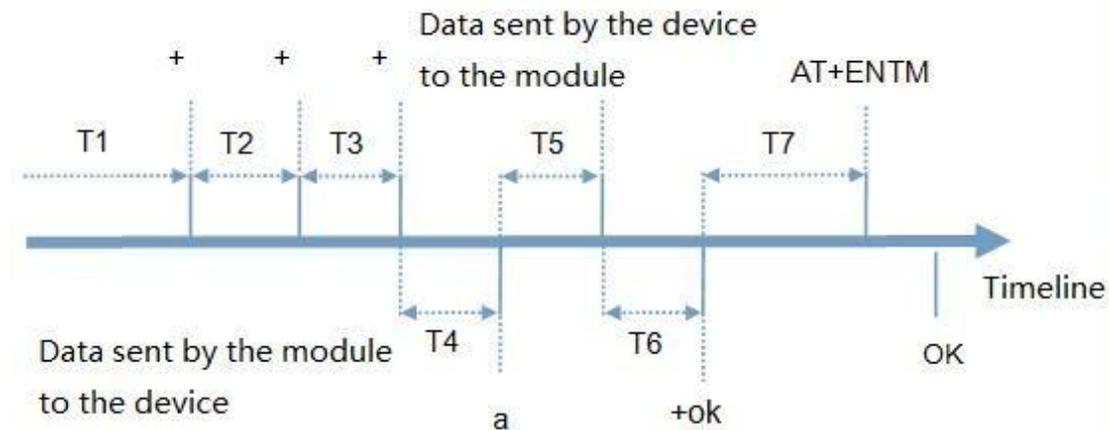
Figure   Switching Command Mode Timing

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

time requirement:

◆ T1> current serial port packing interval (refer to AT+UARTFT)

◆ T2< current serial port packing interval (refer to AT+UARTFT)

◆ T3< current serial port packing interval (refer to AT+UARTFT)

◆ T5<3s

The sequence of switching from network transparent transmission, HTTPD to temporary command mode:

1. The serial device continuously sends "+++" to the device. After the device receives "+++", it will send an 'a' to the device. While sending "+++"

No data can be sent within the previous 200ms.

2. When the device receives 'a', it must send an 'a' to the device within 3 seconds.

3. After the device receives 'a', it sends "+ok" to the device and enters the "temporary command mode".

4. After the device receives "+ok", it knows that the device has entered the "temporary command mode" and can send AT commands to it.

The sequence of switching from temporary command mode to SMS transparent transmission, network transparent transmission, and HTTPD:

1. The serial device sends the command "AT+ENTM" to the device.

2. After the device receives the command, it sends "+OK" to the device and returns to the previous working mode.

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

4.4.3. SMS AT COMMAND

Figure   SMS Transparent Transmission

SMS AT command means that we can use SMS to query and configure the parameters of DTU.

SMS AT command is generally used when customers need to query or modify parameters temporarily. As long as you know the phone number of the device, you can query and modify parameters, which is very convenient for equipment management in remote areas.

Take the query of firmware version number as an example, send AT command. Send "www. waveshare.com#AT+VER" from the mobile phone to the module. After receiving it, the module will return the response information as shown in the figure below:
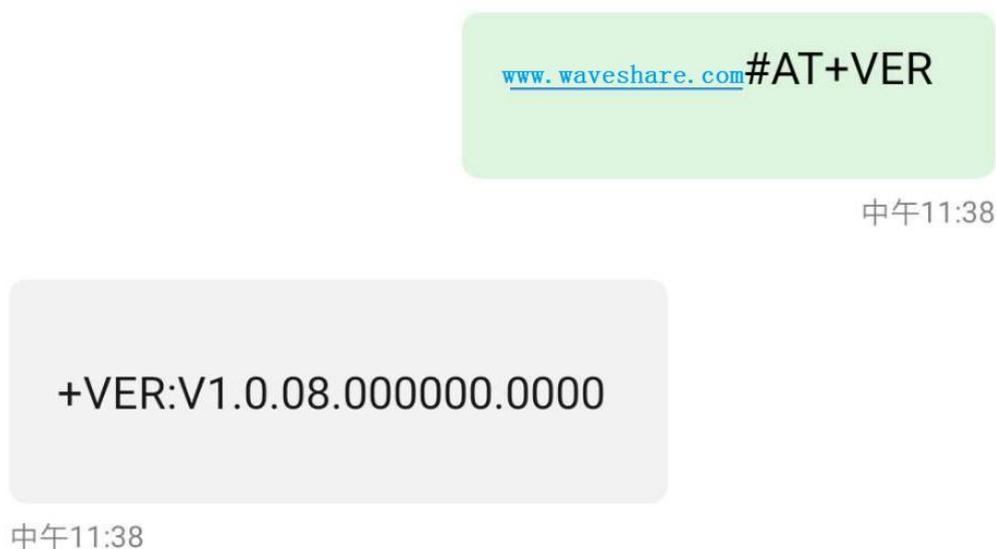

www. waveshare. com#AT+VER

中午11:38

+VER:V1.0.08.000000.0000

中午11:38

Figure   SMS Command

4.4.4. COMMAND FORMAT

AT command is "question and answer" command, divided into "question" and "answer" two parts. "Question" means that the device sends an AT command to RS485 TO LTE CAT4, and "answer" means that RS485 TO LTE CAT4 sends a reply to the device.

Note: characters in instructions are case-insensitive.

4.4.4.1. SYMBOL DESCRIPTION

Table   Symbol Description

Symbol name	Implication
<>	The content is necessary items
[]	The content is non-essential items
{}	The content is a string with special meaning
~	Parameter range , e. g. A~B. Parameter 's range is from A to B
CMD	Command code
OP	The operator
PARA	Parameters
CR	Enter key in ASCII, 0X0D in hex
LF	Line break in ASCII,0X0A in hex

4.4.4.2. THE QUEATION FORMAT IN COMMAND

Command string: <AT+>[CMD][OP][PARA]<CR>

Figure   symbol description

Symbol name	Implication
<>	The content is necessary items
[]	The content is non-essential items
{}	The content is a string with special meaning
~	Parameter range , e. g. A~B. Parameter 's range is from A to B
CMD	Command code
OP	The operator
PARA	Parameters
CR	Enter key in ASCII, 0X0D in hex
LF	Line break in ASCII,0X0A in hex

Table   Commonly used escape characters

Symbol	Implication	Escape characters
=	Equal sign	[3D]
,	Comma	[2C]
?	Question mark	[3F]
<CR>	Enter key	[0D]
<LF>	Line break	[0A]

4.4.4.3. THE ANSWER FORMAT IN COMMAND

Note: the response information of the command can be divided into two types: return and no return. Return means to return the input content when the instruction is input, and then make a response to the command.

No return means no input is returned and only the command is responded to. In the following instructions, no return mode is used as an example.

Command String: [CR][LF][+CMD][OP][PARA][CR][LF]<CR><LF>[OK]<CR><LF>

Table   Symbol Descriptions

Command	Implication	Necessary or not
CR	Enter key	No
LF	Line break	No
+CMD	Response header	No
OP	Operator , for example ":"	No
PARA	Returned parameter	No
CR	Enter key	No
LF	Line break	No
CR	Enter key	Yes
LF	Line break	Yes
OK	Operate successfully	No
CR	Enter key	Yes
LF	Line break	No

Response instruction type description:

Figure   The description of string format

Type	String Format	Description
0	<CR><LF><OK><CR><LF>	Means command send success
1	<CR><LF><+CMD:><PARA><CR><LF><CR><LF><OK><CR><LF>	Return current parameters

4.4.4.4. SPECIAL SYMBOLS

In AT commands, equals (=), comma (,), question mark (?), enter, line feed are special symbols, so the parameter can not directly contain the equals sign, comma, question mark. It needs to be escaped.

Escape rule: use [] to enclose the hexadecimal code of a special symbol, representing the ASCII code represented by an input hexadecimal code.

Example: question mark (?)The hexadecimal encoding of 0x3F is expressed as [3F] after escaping by this escape method.

Table   Commonly used escape characters

Symbol	Implication	Escape characters
=	Equal sign	[3D]
,	Comma	[2C]
?	Question mark	[3F]
<CR>	Enter key	[0D]
<LF>	Line break	[0A]

5. AT COMMAND SET

Table   AT command set

Command	Function
General Command	
AT	Test
AT+H	Help
AT+Z	Reboot the software
AT+REBOOT	Reboot the device
AT+CLEAR	Restore to factory setting and reboot
AT+E	Query/set whether to enable command echo
AT+ENTM	Exit command mode
AT+WKMOD	Query/Set working mode
AT+CMDPW	Query/Set Command Password
AT+STMSG	Query/set device startup inTableation
AT+CSQ	Query the current signal strength inTableation of the device
AT+RSTIM	Query/set the automatic restart time of the device
AT+SYSINFO	Query current network inTableation
AT+SHELL	Execute shell commands, mainly used to upload certificates
InTableation query command	
AT+VER	Query version inTableation
AT+BUILD	Querying Firmware Compilation Time
AT+SN	Query SN code

AT+ICCID	Query ICCID code
AT+IMEI	Query IMEI code
AT+IMSI	Look up IMSI code
AT+LOCIP	Query the local IP address
AT+LBS	Query the local IP address
AT+CCLK	query time
Serial parameter command	
AT+UART	Query/set serial port parameters
AT+UARTFT	Query/set serial port packing interval
AT+UARTFL	Query/set serial port data length
Network parameter command	
AT+APN	Query/Set APN InTableation
AT+SOCKA	Query/set socketA parameters
AT+SOCKB	Query/set socketB parameters
AT+SOCKAEN	Query/set whether socketA is enabled
AT+SOCKBEN	Query/set whether socketB is enabled
AT+SOCKASL	Query/set socketA connection mode
AT+SOCKBSL	Query/set socketB connection mode
AT+SOCKALK	Query socketA connection status
AT+SOCKBLK	Query socketB connection status
AT+SHORATO	Query/set socketA short connection timeout
AT+SHORBTO	Query/set socketB short connection timeout
AT+SOCKATO	Query/set the reconnection time after connection A is disconnected
AT+SOCKBTO	Query/set the reconnection time after connection B is disconnected
AT+KEEPALIVEA	Query/set the keepalive parameter of socketA
AT+KEEPALIVEB	Query/set the keepalive parameter of socketB
AT+SOCKIND	Query/set whether to enable the socket indicating the source of transparent data transmission
AT+SDPEN	Query/set whether to enable the socket distribution protocol
AT+SOCKRSTIM	Query/set the maximum times of reconnects after the socket connection fails
Register package directive	
AT+REGEN	Query/set whether to enable the registration package
AT+REGTP	Query/set registration package content type
AT+REGDT	Query/set custom registration inTableation
AT+REGSND	Query/set the registration package sending method
AT+CLOUD	Query/set cloud (transparent cloud) registration parameters
AT+ID	Query/set device ID in UDC mode
Heartbeat packet command	
AT+HEARTEN	Query/set whether to enable heartbeat packets
AT+HEARTDT	Query/set heartbeat packet data
AT+HEARTSND	Query/set the sending method of heartbeat packets

AT+HEARTTM	Query/set the heartbeat packet sending interval
HTTPD Command	
AT+HTPTP	Query/set how HTTP works
AT+HTPURL	Query/Set URL
AT+HTPSV	Query/set target server address and port
AT+HTPHD	Query/set HTTP protocol HEAD inTableation
AT+HTPTO	Query/set timeout
AT+HTPFLT	Query/set whether to enable filtering of packet headers
Text Command	
AT+SMSEND	send SMS
AT+CISMSSEND	send SMS
Modbus Protocol conversion instructions	
AT+MODBUSEN	Query/set whether to enable the Modbus protocol conversion function

Table AT command error code

Value	Definition
Err1	Does not conTable to the AT command Tableat, does not start with AT
Err2	The AT command was not found and does not exist
Err3	The AT command does not conTable to the query or set Tableat
Err4	Incorrect parameter range or number