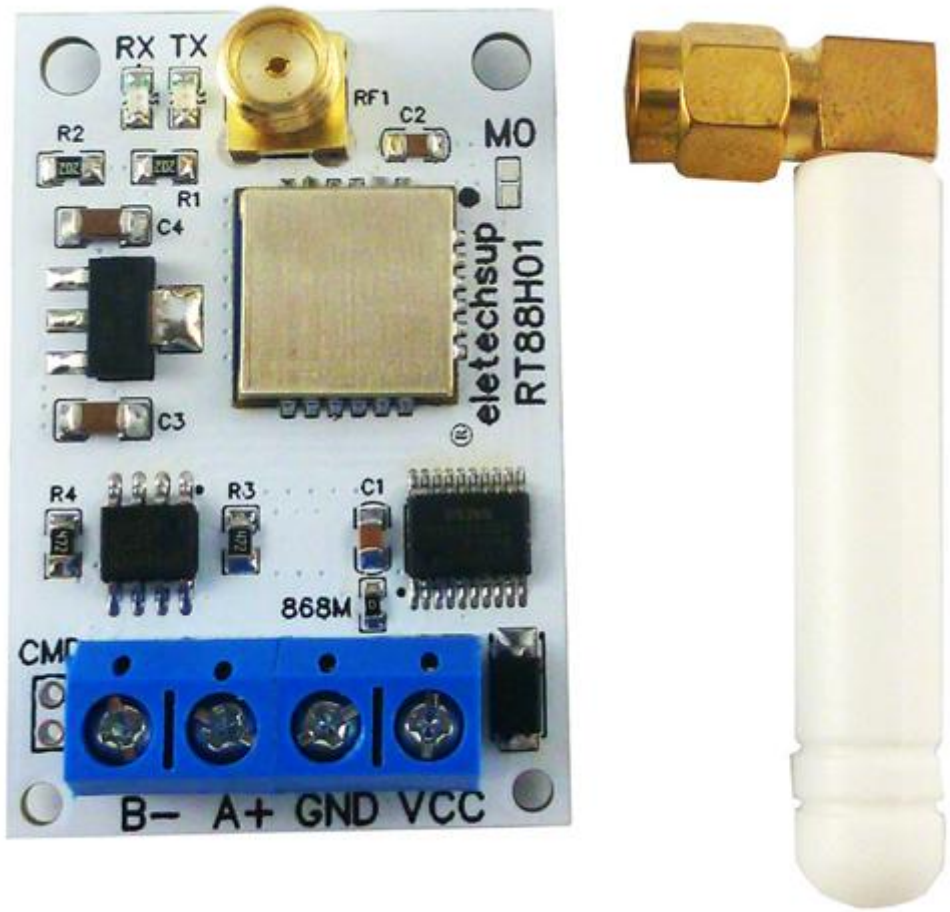
RT88H01 LORA Wireless Transparent Transmission Module Application Document



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Foreword:

The RT88H01 LORA wireless transparent transmission module is a low-power Sub-1GHz radio frequency transceiver device that uses a serial port to transmit and receive. The product is designed with simplicity and high efficiency as its design purpose. During the design process, a lot of optimization work has been done on its appearance and software. Its main features are: using RS485 as the communication port, providing wiring sockets, which is convenient for users to debug and produce; the appearance is small, Four assembly positioning holes are provided to facilitate customer assembly without affecting the structural design of the customer's finished product; the embedded transceiver processor deeply strips the complex underlying operations of the RF chip (data register/command register read and write, initialization parameter setting) , change and query of transmission power register, change and verification of communication frequency, etc.), extract a set of efficient wireless transparent transmission module instruction set, which is easy and worry-free to operate. Based on the above hardware and software characteristics, RT88H01 LORA wireless transparent transmission module can be widely used in wireless meter reading, wireless access control, smart home, industrial control, wireless sensor network, wireless remote control, telemetry equipment and other fields.

In this document, the RT88H01 LORA wireless transparent transmission module is referred to as the transparent transmission module for short.

1. Module introduction

(1) Module features

- Long-distance wireless transmission (up to 1000 meters in open space, Bit rate 1.76~62.5Kb/s);
- Working frequency range: 410~512MHz for 433 version, 854.5~931MHz for 868 version, up to 256 communication channels;
- Maximum 156mW (22dBm) transmit power (10 levels of power can be set);
- Built-in MCU, use serial port to communicate with external devices;
- Send a maximum of 250 bytes at a time, and a maximum of 240 bytes in encrypted mode;
- The module can support one-to-one, one-to-many transparent transmission communication through ID setting
- The receiving module can be set to Repeater mode to extend the communication distance (solder the M0 solder spot on the module);
- The module can set data AES encrypted transmission to enhance data confidentiality.

(2) Module overview

RT88H01 LORA wireless transparent transmission module is a new generation of multi-channel embedded wireless data transmission module. Working in the 410~512MHz frequency band (or 854.5~931MHz frequency band), you can set multiple channels, the 433 frequency band is 400kHZ stepping, the 868 frequency band is 300kHZ stepping, with a total of 256 channels (0~255), the largest module The transmitting power is 156mW (22dB), the receiving sensitivity reaches -129dBm, and the communication distance in open space can reach 1000 meters.

The module carries RS485 communication interface, which can be directly connected to industrial equipment. Carrying SMA antenna interface, it is convenient for users to install or replace a suitable antenna.

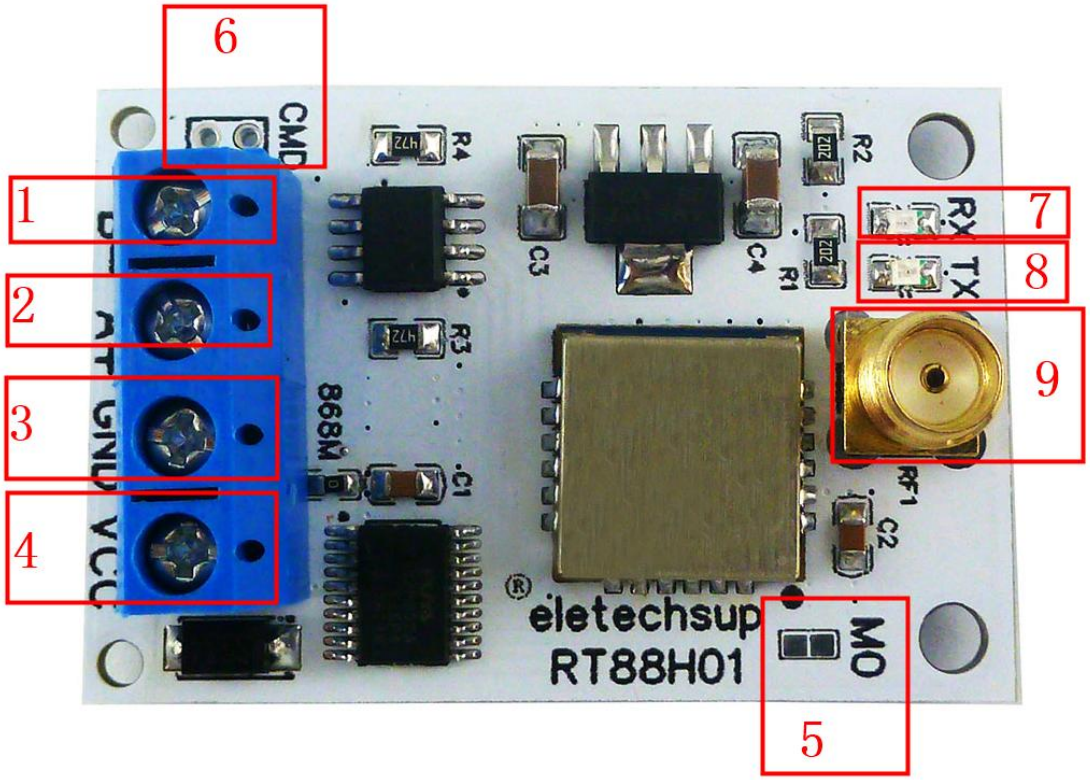
There is an MCU inside the module, and the user does not need to program the module separately, just send and receive serial data, which is easy to use. The module adopts a variety of serial port baud rates and check digits, which is convenient to meet the needs of different devices for different baud rates and check digits. In addition, there are up to ten gradients of transmit power options, the most suitable power can be selected according to actual needs, and power consumption can be reduced while meeting the needs.

(3) Basic parameters

parameter name	Parameter value	parameter name	Parameter value
Model	RT88H01	Module size (without antenna)	45x30x14mm
Wireless Chip Model	LLCC68	Working frequency	410~512MHz
Communication Interface	RS-485		854.5~931MHz
Working Voltage	5~12V	Antenna interface	SMA
Weight	11g	Working humidity	10％~90％
Transmit power	-9dBm~22dBm	Working temperature	-40℃~+85℃
Receiving sensitivity	-129dBm	Bit rate	1.76~62.5Kb/s
Reference distance	1000m	Storage temperature	-40℃~+125℃
Transmit current	22mA ~150mA	Receive current	70~80mA, typical 75mA
Stand-by current	Typical 8mA	Default working frequency	433M version is 434MHz, 868M version is 868MHz

***Note**: Manual measurement has a certain error with the actual situation.

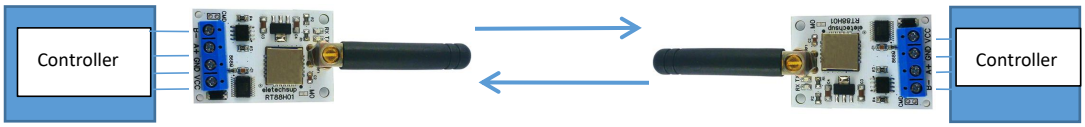
(4) Onboard device description



Serial number	definition	illustrate
1	B-	RS-485 bus B- interface
2	A+	RS-485 bus A+ interface
3	GND	GND
4	VCC	VCC power supply interface
5	M0	Repeater port, the module will enter Repeater mode after short connection
6	CMD	AT command port, the module enters AT command mode after short circuit
7	RX LED	Red LED light, flashes when receiving data or powering on
8	TX LED	Green LED light, flashes when sending data or powering on
9	SMA carrier	Used to connect SMA interface antenna

2. Connection instructions

(1) Brief introduction of working principle

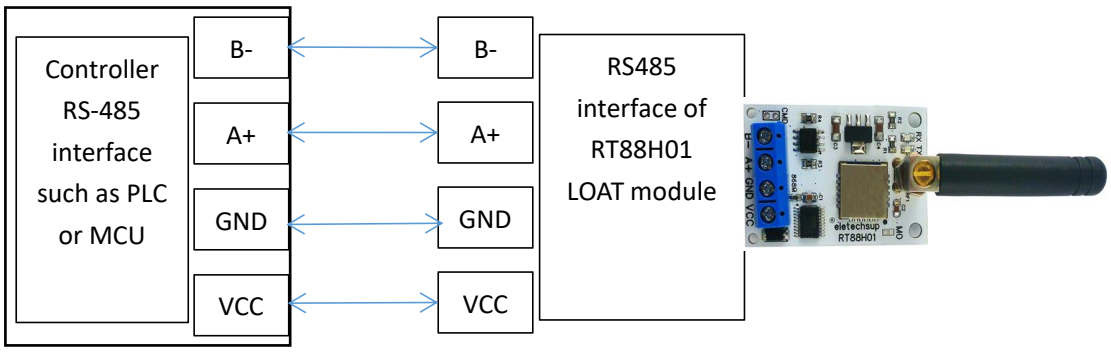


Data transparent transmission between modules

As shown in the figure above, the RT88H01 wireless transparent transmission module is used to replace the physical connection in half-duplex communication. The host device sends serial data to the transparent transmission module, and after receiving the serial data at the RXD port of the transparent transmission module, it automatically sends the data to the air by means of radio waves. The transparent transmission module of the slave device automatically receives it and sends the data to the slave device through the serial port. Modules can only work in half-duplex mode, and cannot send and receive data at the same time.

We call the device that needs to send data as the host device, and the device that needs to receive data as the slave device。

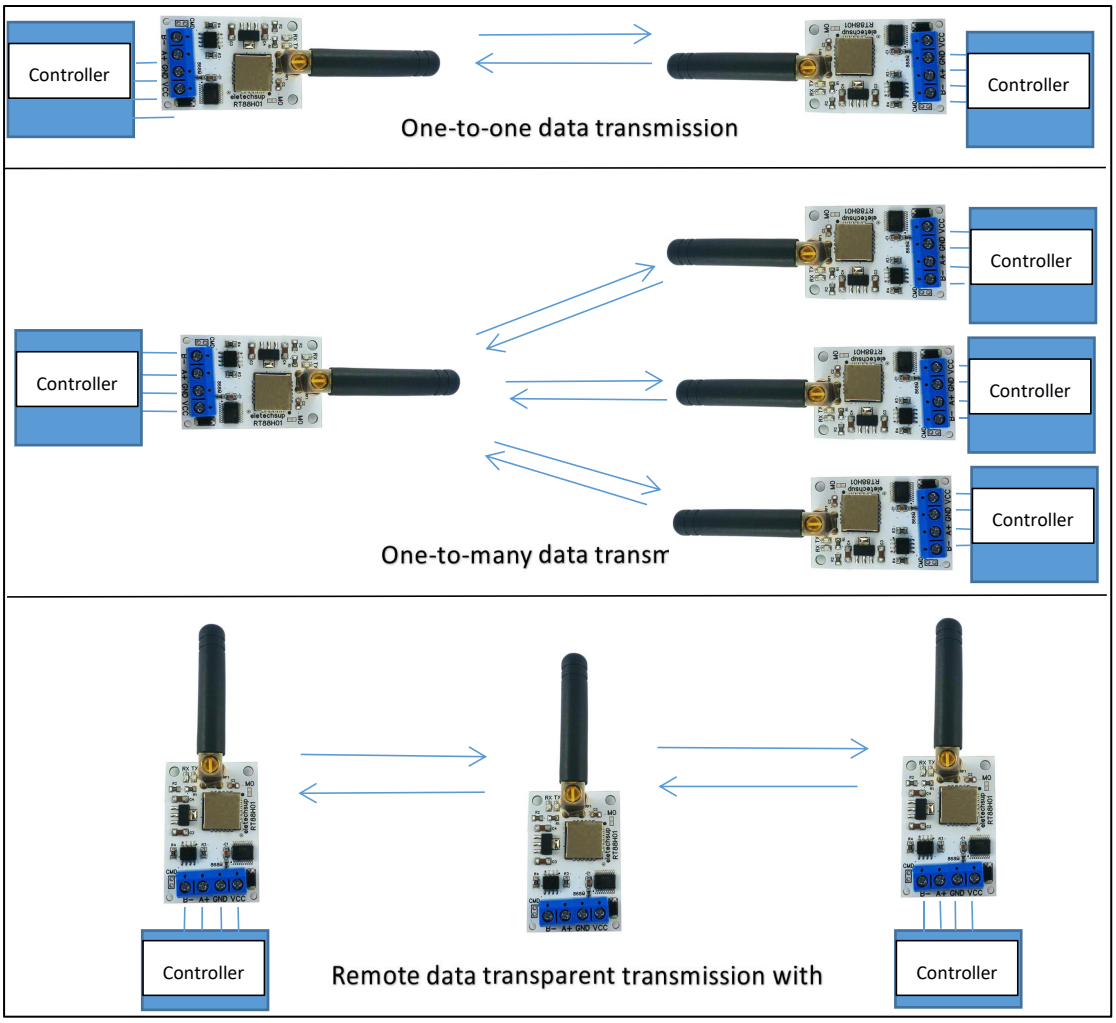
(2) Connection between module and MCU device



Wiring diagram of controller and RT88H01 module

The baud rate set by controllers such as PLC or MCU needs to be consistent with the baud rate set by the module (the default is 9600, which can be modified by AT commands).

(3) Connection between modules

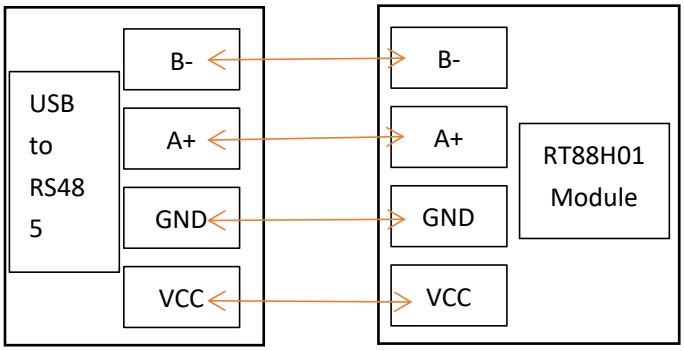


- In one-to-one data transparent transmission, the module that sends data is the master module, and the module that receives data is the slave module.
- In one-to-many data transparent transmission, the master module can send data to multiple slave modules, and the slave module can also be converted to a master module to send data to other modules, but there can only be one master module sending data at a time.
- When two modules are too far apart or there is an obstacle in the middle that prevents communication, a transparent transmission module can be converted into a Repeater module for use. Soldering or grounding the two solder joints at the M0 position on the module can be converted into a Repeater module. After the module receives data from the air, it sends the data to the serial port and at the same time resends the received data to the air in the form of electromagnetic waves. Thereby extending the communication distance.
- No matter which mode, the module and the module need to work under the same ID number and the same frequency.

3. Quick test

(1) USB TO RS485 is connected to the module

(1)The transparent transmission module supports the RS485 serial communication protocol (two wires A and B). One wire is defined as A and the other wire is defined as B. Normally, the positive level between the sending driver A and B is +2 ~+6V is a logic state, and the negative level is between -2 and 6V, which is another logic state. Therefore, the connection of the transparent transmission module only needs 4 wires to connect. At the same time, it should be noted that the transparent transmission module A is connected to the client host A, and the transparent transmission module B is connected to the client host B. Cross-connection is not required.



(2)The transparent transmission module defaults to 5V power supply.

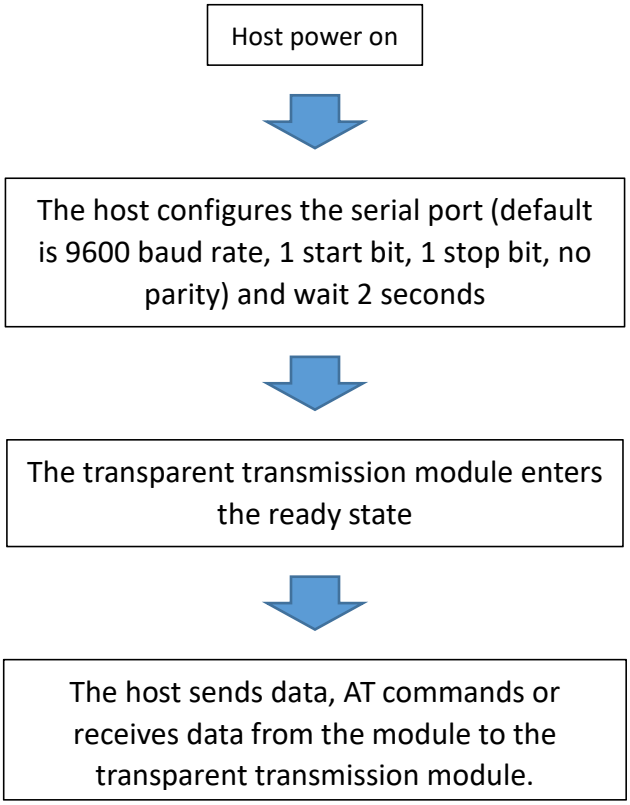
(3)Before use, you need to screw the glue stick antenna to the SMA port on the top of the module.

(4)When debugging with the computer's serial software tool, you need to find a tool that converts USB to RS485. You can refer to the following tool, connect to the computer to install or update the CH340 serial driver, and then connect the A of the board to the A of the tool, and the B is connected to B of the tool, and connected to VDD and GND.

USB to RS485

(2) Startup instructions

After the transparent transmission module is powered on, the initialization of each functional component needs to be completed, so it is necessary to wait for the red LED and green LED on the module to flash three times at the same time and finally be in the off state (about 1-2 seconds). Only after ensuring that the internal internal of the module is initially normal can information or instructions be sent to it. Therefore, the power-on process must meet the following conditions:



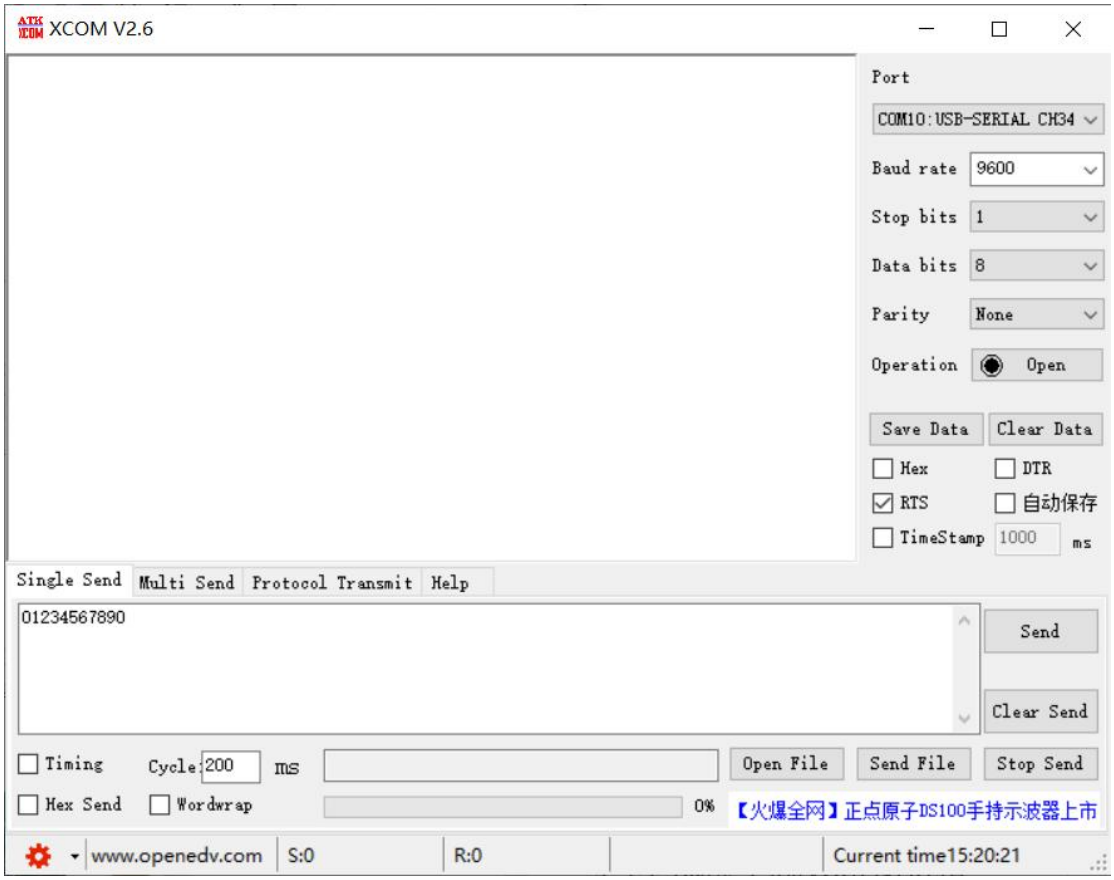
(3) One-to-one communication test

(1)Download a serial debugging assistant online, or use the XCOM serial debugging assistant in the attached information
(2)Connect the host module to the computer with USB TO RS485.
(3)Open the serial port assistant and configure the serial port assistant as shown in Figure 1 to monitor the host module.
(4)Select the serial port assigned by the computer to the host in the serial port selection column, and then open the serial port.
(5)Connect the slave module to the computer with USB TO RS485.
(6)Then open a serial port debugging assistant, and configure it according to Figure 1 to monitor the slave module.
(7)Select the serial port assigned by the computer to the slave in the serial port

selection bar, and then open the serial port.

(8)Send any string in the serial debugging assistant of the monitoring host, and observe whether the serial debugging assistant of the monitoring slave receives the data sent by the host module.

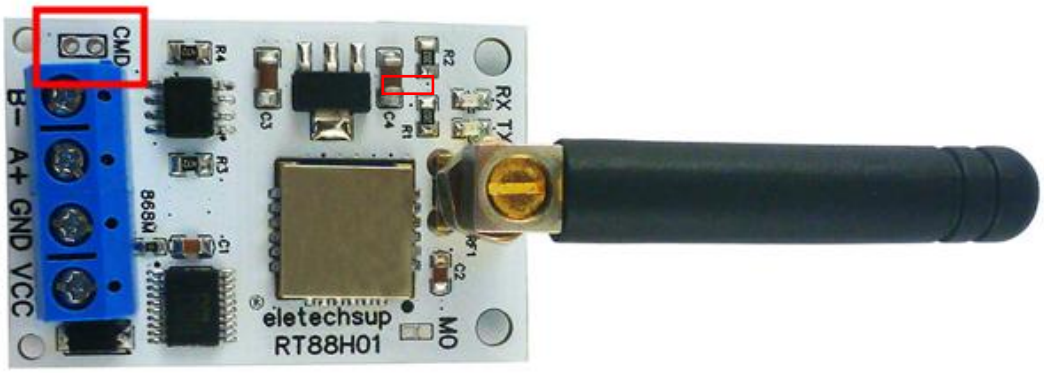
(9)While sending the string, you can also observe whether the red light of the master module and the green light of the slave module flicker. If there is a fast flicker, it means that the data is sent successfully. If there is no flicker, it means that the data has not been sent successfully.



(4) AT command mode test

(1)Complete the steps (1) to (9) of "3. One-to-one communication test".

(2)Connect the CMD solder joints of the modules that need to enter the AT command mode, or ground them. When the red LED (TX) and green LED (RX) light up at the same time, it enters the AT command mode.



(3)Send AT commands to the module through the serial port assistant to set the corresponding parameters or obtain the corresponding information.

(4)After sending the AT query command, if the command is correct, the query information will be returned. If the command is wrong, "N" is returned.

For example, to query the transmit power, send the command "AT+POWER?", and the default value "3" will be returned.

(5)After sending the AT setting command, if the command is correct, it will return "Y". If the command is wrong, "N" is returned. Note: After setting the parameters, you need to enter the command "AT+REPOWER" to restart the device for the setting to take effect.

For example, to set the ID number, send the command "AT+ID=090", and return "Y". Then enter the command "AT+REPOWER", after the red LED and green LED flash three times together, the restart is completed and the setting takes effect.

(6)For specific AT commands and their meanings, please see "4. AT Commands".

(5) Repeater mode test

(1)Connect the host module to the computer with USB TO RS485.

(2)Open the serial port assistant and configure the serial port assistant as shown in Figure 1 to monitor the host module.

(3)In the serial port selection bar, select the serial port assigned by the computer to the host, and then open the serial port.

(4)Connect the slave module to another computer with USB TO RS485.

(5)Open a serial port debugging assistant on that computer and configure it as shown in Figure 1 to monitor the slave module.

(6)In the serial port selection bar, select the serial port assigned by the computer to the slave, and then open the serial port.

(7)Send any string in the serial debugging assistant of the monitoring host, and observe whether the serial debugging assistant of the monitoring slave receives the data sent by the host module.

(8)While sending the string, you can observe whether the red light of the

master module and the green light of the slave module flicker. If the LED light flashes quickly, it proves that the data is sent and received successfully. If there is no flicker, it means that the data has not been sent successfully.

(9) Connect the CMD solder joints of the host module or ground them. When the red LED (TX) and green LED (RX) light up at the same time, it enters the AT command mode.

(10) Send the command "AT+POWER=0" and return "Y". Set the transmission power to the lowest level

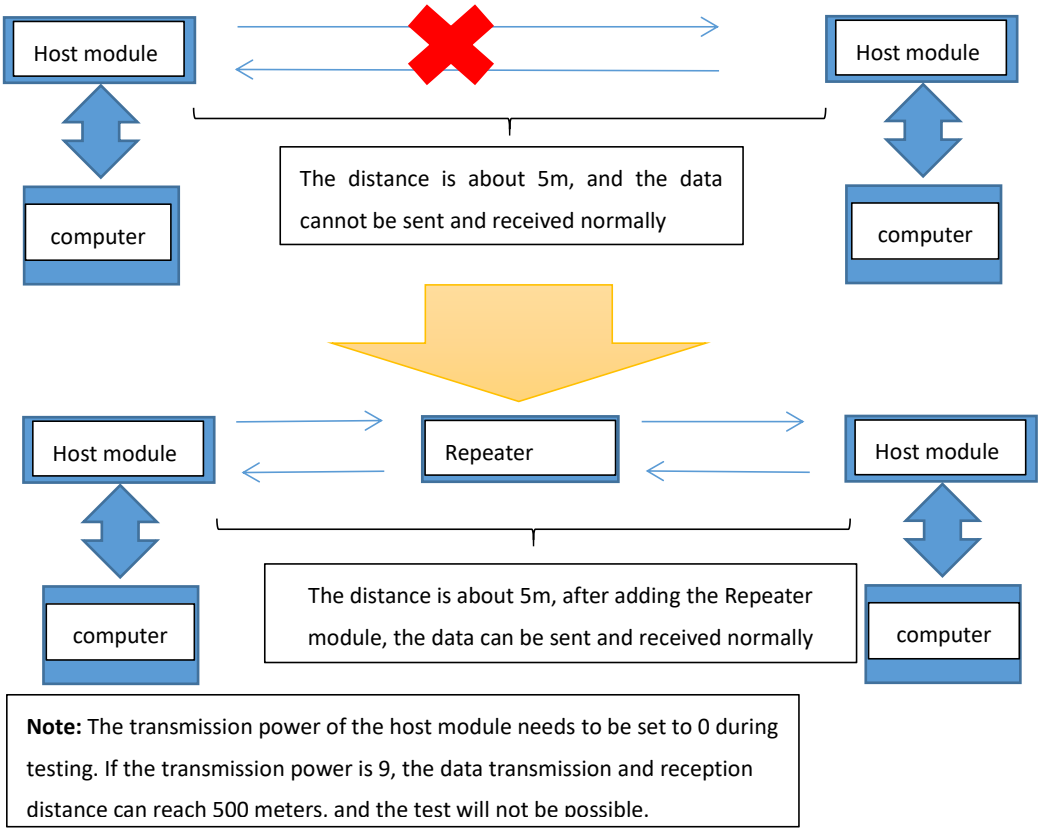
(11) Enter the command "AT+REPOWER" to restart the device to make the settings take effect. After the restart is complete, remove the CMD connection.

(12) Take the slave module to a place 5 meters away from the master module, so that the slave cannot receive data from the master (the green light of the slave module does not flash).

(13) Take out the third transparent transmission module, solder the M0 spot, and this module will be converted into a Repeater module.

(14) Connect the Repeater module to the power supply and place it next to the main module. When the master module sends data, observe whether the slave module receives data.

Note: In the Repeater mode, the master module and the slave module need to be separated far enough to ensure that they cannot send and receive normally without the Repeater module. Otherwise, the slave module may repeatedly receive the same data in a short time.



4. AT command

The AT command is used to set and query the parameters of the module. After setting the parameters, you need to enter the AT restart command or perform a power-off operation to restart the setting to take effect. The modified parameters will not be lost after restarting.

(1) How to enter and exit AT commands

- Connect the CMD solder joints on the transparent transmission module or ground at the same time to enter the AT command module.
- Disconnect the connected CMD solder joints or disconnect the grounding of the CMD solder joints to exit the AT command mode.
- If the parameters are set, you need to restart and then exit the AT command mode.
- In the AT command mode, the serial port baud rate for sending and receiving AT commands is fixed at 9600, which is not affected by the "AT+BAUD=x" command. That is, after entering the AT command mode, you

need to fix the baud rate of the serial debugging assistant to 9600 before sending AT commands to the module.

- The specific process can be seen in "(4). AT Command Mode Test" in "3.Quick test".

(2) Serial data format

Fixed 8 data bits, 1 stop bit

(3) Default factory parameters

Baud rate: 9600, communication channel: 45 or 60, ID number: 16, transmission frequency: 22dBm, software version number: 1.

(4) Introduction to AT command

(1)ID number: The master module automatically adds an ID number to the sent data, and the slave module detects whether the ID number on the data is the same as its own ID number after receiving the data. If they are the same, the data will be sent to the MCU through the serial port. If they are not the same, the data will be discarded. Therefore, it is necessary to keep the ID numbers of both sending and receiving data the same. When there are multiple sets of transmitting and receiving devices working at the same place, different devices can be distinguished by setting different ID numbers.

(2)Working channel: Set different working channels so that data is transmitted on different frequencies. The frequency of data transmission is 410MHz+xxx*0.4MHz or 854.5MHz+xxx*0.3MHz (xxx is the selected working channel). Only the transceiver devices in the same channel can receive data, so different devices can be distinguished by setting different channels.

(3)Baud rate: The baud rate in this document refers specifically to the serial port baud rate. Only devices with the same baud rate can transmit data through the serial port and the transparent transmission module.

(4)Transmitting power: Transmitting power refers to the power of the electromagnetic wave transmitted by the transparent transmission module through the antenna. The greater the transmission power, the greater the distance of data transmission.

(5) Introduction to the use of AT commands

(1) Query the currently used ID

Instruction	Response	Description
AT+ID?	ID number currently in use, the factory setting is 16	

example:

Send the module command "AT+ID?", the module returns "016". The ID number used by the current module is 016.

(2) Query current software version information

Instruction	Response	Description
AT+INF?	The current software version information, the factory setting is 1	

example:

Send the module command "AT+INF?", the module returns "001". The software version number used by the current module is 001.

(3) Query current working channel

Instruction	Response	Description
AT+FREQ?	The current working channel, the factory setting 433 frequency band is 60,868 frequency band is 45	

example:

Send the module command "AT+FREQ?", the module returns "100". The current module working channel is 100.

(4) Query the current serial port baud rate

Instruction	Response	Description
AT+BAUD?	The current serial port baud rate level, the factory setting is 3	

example:

Send the module command "AT+BAUD?", the module returns "003". Convert the level to baud rate to get the serial port baud rate used by the current module is 9600.

Query the baud rate level of the module, the return value range is 0-7, and the corresponding module serial port baud rate is as follows:

Grade	0	1	2	3	4	5	6	7
BaudRate	1200	2400	4800	9600	19200	38400	57600	115200

(5) Query the current serial port parity bit

Instruction	Response	Description
AT+PARITY?	The current serial port parity bit level, the factory setting is 0	

example:

Send the module command "AT+ PARITY?", the module returns "000". Convert the level into a check digit, and the serial port check digit used by the current module is None parity.

Query the parity level of the module, the return value ranges from 0 to 2, and the parity bit of the corresponding module serial port is as follows:

Grade	0	1	2
Parity bit	None	Even Parity	Odd Parity

(6) Query current transmit power

Instruction	Response	Description
AT+POWER?	The current transmit power level, the factory setting is 9	

example:

Send the module command "AT+POWER?", the module returns "009". Converting the level to power, the current transmit power used by the module is 22dBm.

Query the baud rate level of the module, the return value range is 0-9, and the corresponding module serial port baud rate is as follows:

Grade	0	1	2	3	4	5	6	7	8	9
Transmit power /dBm	-9	-5	0	+5	+8	+12	+15	+18	+20	+22

(7) Query the current Bit rate

Instruction	Response	Description
AT+RATE?	The current Bit rate, the factory setting is 7	

example:

Send the module command "AT+RATE?", and the module returns "007". Converting the level to the Bit rate can get the air rate used by the current module to be 62.5Kb/s.

Query the Bit rate level of the module, the return value range is 0~7, and the air speed of the corresponding module is as follows:

Grade	0	1	2	3	4	5	6	7
Bit rate /Kb/s	1.76	2.4	4.8	9.6	19.2	38.4	50	62.5

(8) Query the current encryption status

Instruction	Response	Description
AT+ ENCRYPT?	The current encryption state, the factory setting is 0	

example:

Send the module command "AT+ENCRYPT?", and the module returns "000". It can be seen that the current data transmission is not encrypted.

Query the encryption status of the module, the return value ranges from 0 to 1, and the corresponding module encryption status is as follows:

Grade	0	1
Encryption status	no encryption	encryption

(9) Set the current module ID number

Instruction	Response	Description
AT+ID=xxx	Success：”Y” Failure：”N”	The ID number ranges from 000-254, and the ID number must be 3 digits

example:

Send the module command "AT+ID=016", the module returns "Y". The ID number is set successfully.

(10) Set the current module serial port baud rate

Instruction	Response	Description
AT+BAUD=x	Success：”Y” Failure：”N”	The value of x is 0-4, which is the baud rate level and must be one bit

example:

Send the module command "AT+BAUD=x", the module returns "Y". The serial port baud rate is set successfully.

Set the baud rate level of the module, the sending value range is 0-4, and the corresponding module serial port baud rate is as follows:

Grade	0	1	2	3	4
Baud rate	1200	2400	4800	9600	19200

(11) Set the serial port parity bit of the current module

Instruction	Response	Description
AT+PARITY =x	Success：”Y” Failure：”N”	The value of x is 0-2, which is the parity bit level and must be 1 digit

example:

Send the module command "AT+ PARITY =x", and the module returns "Y". The serial parity bit is set successfully.

Corresponding module serial port parity level is as follows:

Grade	0	1	2
Parity bit	None	Even Parity	Odd Parity

(12) Set the current module channel

Instruction	Response	Description
AT+FREQ=xxx	Success：”Y” Failure：”N”	The channel value is 000-254, and the channel number must be 3 digits

example:

Send the module command "AT+FREQ=016", the module returns "Y". The channel is set up successfully.

(13) Set the current module transmit power

Instruction	Response	Description
AT+POWER=x	Success：”Y” Failure：”N”	The value of x is 0-9, which is the transmit power level and must be one bit

example:

Send the module command "AT+POWER=x", the module returns "Y". The transmit power is set successfully.

Query the baud rate level of the module, the return value range is 0-9, and the corresponding module serial port baud rate is as follows:

Grade	0	1	2	3	4	5	6	7	8	9
Transmit power/dBm	-40	-16	-10	-5	0	+5	+10	+15	+18	+20

(14) Set the current Bit rate

Instruction	Response	Description
AT+RATE=x	Success：”Y” Failure：”N”	x takes a value from 0 to 7, which is the Bit rate level and must be 1

		bit

example:

Send the module command "AT+RATE=x", and the module returns "Y". The transmit power is set successfully.

The Bit rate level of the module ranges from 0 to 7, and the air speed of the corresponding module is as follows:

Grade	0	1	2	3	4	5	6	7
Bit rate/Kb/s	1.76	2.4	4.8	9.6	19.2	38.4	50	62.5

(15) Set the current module encrypted transmission status

Instruction	Response	Description
AT+ ENCRYPT=x	Success：”Y” Failure：”N”	x takes a value from 0 to 1 and must be 1 bit

example:

Send the module command "AT+ ENCRYPT=x", and the module returns "Y". Encrypted transport status set successfully.

The encryption status of the module ranges from 0 to 1, and the corresponding module encryption status is as follows：

Grade	0	1
Encryption status	no encryption	encryption

(16) Restore parameters to factory settings

Instruction	Response	Description
AT+RESET	Success：”Y” Failure：”N”	

example:

Send the module command "AT+RESET", the module returns "Y". The factory settings were restored successfully.

(17) Restart the module

Instruction	Response	Description
AT+RESET	Success: The module restarts, and the red and green lights flash 3 times at the same time. Failure: No restart	

example:

Send the module command "AT+REPOWER", and the module restarts.

Note: After setting the parameters, you need to send the command "AT+REPOWER" or restart the module by powering off to make the parameters take effect. If you directly disconnect the CMD solder joint and

exit the AT command mode without restarting, the current running parameters will still be the values before setting.

5. Matters needing attention

(1) In non-encrypted mode, a maximum of 250 bytes of data can be sent each time, and in encrypted mode, a maximum of 240 bytes of data can be sent each time;
(2) If the Bit rate is too low, too much data cannot be transmitted. The actual measurement can stably transmit 50 bytes at 1.76Kb/s
(3) The ID number and channel of the master module and the slave module are the same to communicate with each other.
(4) After the module is powered on, you need to wait for the LED to flash three times (about 2 seconds) before you can input data or instructions through the serial port.
(5) If the transmission power is small and the distance is long, the data transmission interval should be increased.
(6) In the Repeater mode, the master module and the slave module need to be separated far enough to ensure that they cannot send and receive normally without the Repeater module. Otherwise, the slave module may repeatedly receive two identical data in a short time.
(7) When using the computer serial port to debug the transparent transmission module, if the slave module receives data (green LED flashes), the serial port debugging assistant does not display the data or displays garbled characters. It may be caused by the inconsistency between the baud rate of the serial debugging assistant and the baud rate of the slave module. You can try to change the serial port debugging assistant to one of 1200,2400,4800,9600,19200,38400,57600,115200 in order and observe whether the data is displayed.
(8) In the AT command mode, the serial port baud rate for sending and receiving AT commands is fixed at 9600, which is not affected by the "AT+BAUD=x" command. That is, after entering the AT command mode, you need to fix the baud rate of the serial debugging assistant to 9600 before sending AT commands to the module.