



SHENZHEN HI-LINK ELECTRONIC CO.,LTD

HLK-RM28E USER MANUAL

ETHERNET

WIFI

SERIAL PORT NETWORK/WIRELESS MODULE



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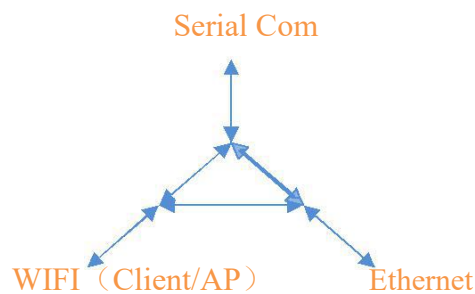
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1. Product Brief

HLK-RM28E is a new low-cost embedded UART-ETH-WIFI (serial port-Ethernet-wireless network) launched by Hi-link Electronics.

This product is based on the universal serial interface in accordance with the network standard embedded module, built-in TCP/IP protocol stack, can achieve the user serial port, Ethernet, wireless network (WIFI) three interfaces between the conversion.

Through HLK-RM28E module, the traditional serial port device can transmit its own data through Internet network without changing any configuration. Provide a complete and fast solution for users' serial port devices to transmit data over the network.



Pic 1.functional configuration

1.1. Essential Parameter

- Super-strong data processing capability, MCU main frequency up to 580 MHz
- 2.4G/300M 2T2R, 5.8G/900M 2T2R
- Support 802.11 a/b/g/n mode
- 20/40/80 channel bandwidth
- Support 802.11v
- Support AP,STA and AP,STA mixed model
- 5 10/100M Adaptive network port
- 1 USB2.0 host interface
- Multiple interfaces SPI/SD-XC/eMMC
- Rich peripheral interface, SPI,I2C,I2S,PCM,UART,JTAG,GPIO

- Widely used in the Internet of things
- Built-in powerful PMU
- Support for a variety of encryption methods WEP64/128, TKIP, AES, WPA, WPA2, WAPI

2. Product Summary

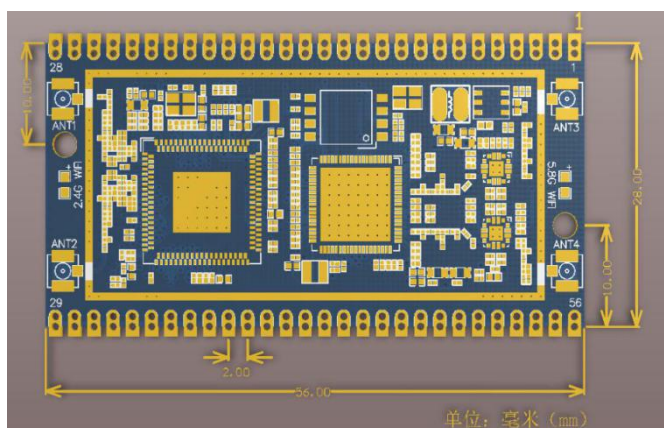
2.1. Technical Specifications

Pic 2-1 Product technical specification

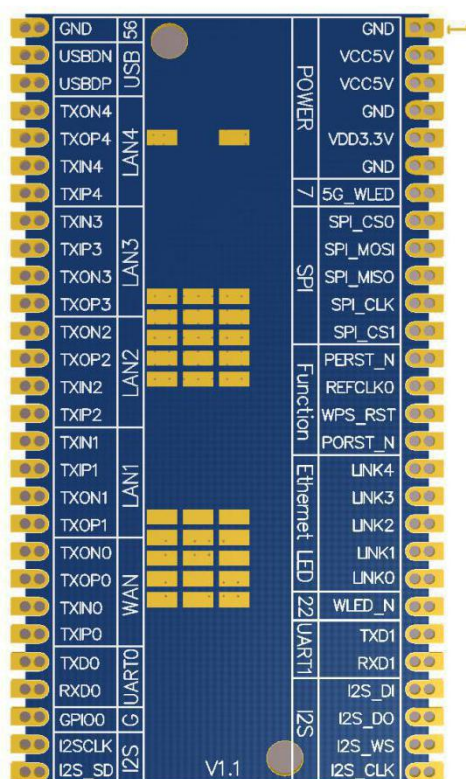
Network standard	Wireless standard: IEEE 802.11a/ac、IEEE 802.11n、IEEE 802.11g、IEEE 802.11b
	Wired standard: IEEE 802.3、IEEE 802.3u
Wireless transmission rate	11a:Maximum up to 450Mbps
	11n:Maximum up to 150Mbps
	11g:Maximum up to 54Mbps
	11b:Maximum up to 11Mbps
Number of channels	2.4g:1-14 5.8g: 36-173
Frequency range	2412-2488MHZ 5180-5865MHZ
Transmitting power	12-18DBM
Interface	5 Ethernet port、2 Serial port、1usb port (host/slave) 、GPIO
Antenna type	External antenna
WIFI working mode	wireless network adapter/Wireless access point/wireless router
WDS function	support WDS Wireless bridge
Wireless security	wireless MAC Address filtering
	Wireless security function switch
	64/128/152 bit WEP encryption
	WPA-PSK/WPA2-PSK、WPA/WPA2 Security mechanism
Administration of networks	Remote Web Management
	Configuration file import and export
	WEB Software upgrade
Serial port to network	
Maximum transmission rate	500000bps
TCP connection	Maximum number of connections>20
UDP connection	Maximum number of connections>20
Serial port baud rate	1200~500000bps (Support for non-standard baud rates)
Other parameters	
Status indicator	Status indication
Environmental criteria	working temperature : -20-80℃
	Working humidity : 10%-90%RH (non-condensing)
	Storage temperature: -40-90℃
	Storage humidity: 5%-90%RH (non-condensing)
Other performance	Band bandwidth optional: 20MHz、40MHz、80MHZ

2.2. Hardware Description

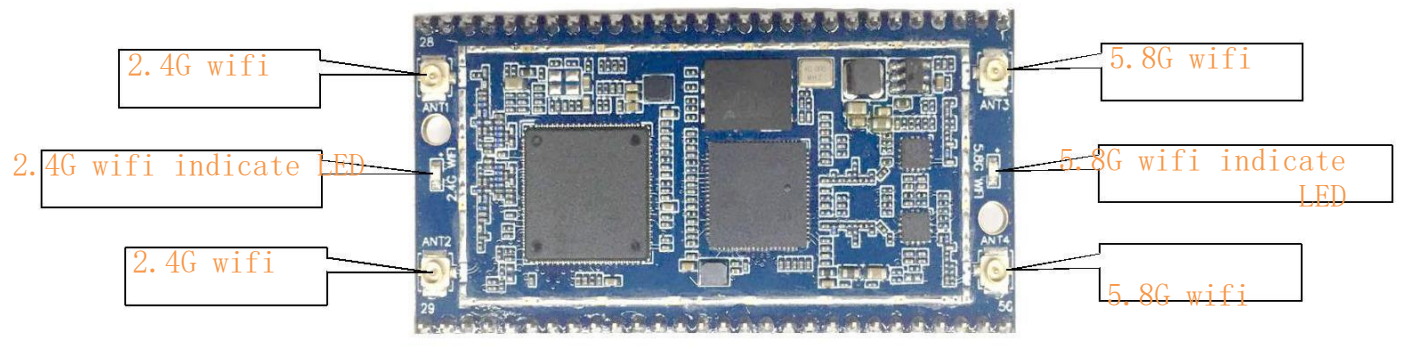
The dimension of HLK-RM28E are shown in the following: (L*W) =56mm*28mm



Pic 1 HLK-RM28E size



Pic 2 HLK-RM28E Default pin definition diagram

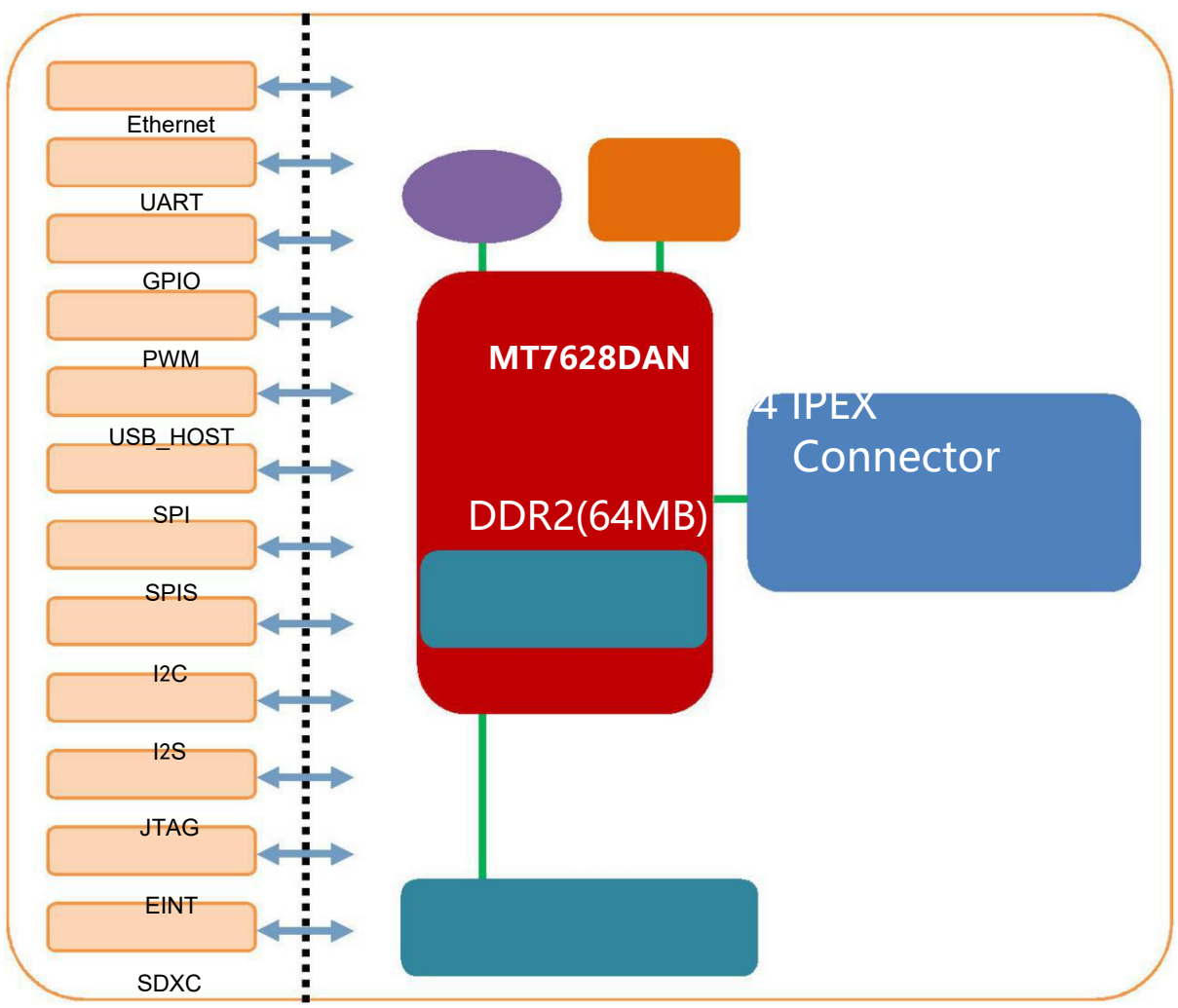


Pic 3 HLK-RM28E

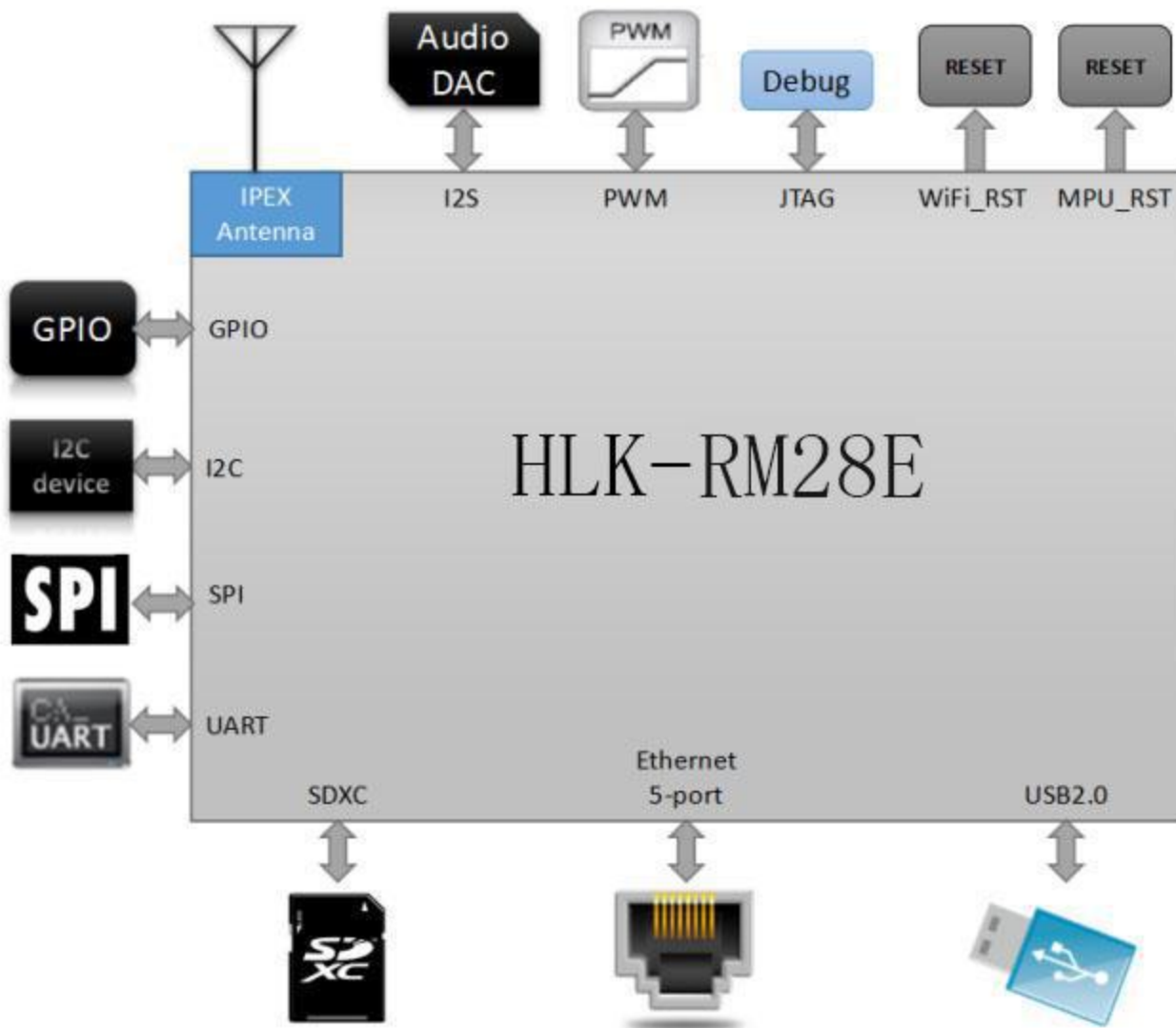
Note:

- 1. I/O port the level voltage is 3.3V.

2.3. Block Diagram



2.4. Peripheral Interface



Pic 5 HLK-RM28E Typical peripheral interface diagram

2.5. Power supply requirements

Power supply requirements	
Power input voltage	DC: $5 \pm 0.2V$
No-load operating current	$450 \pm 50mA$
Power supply current requirements	$\geq 1000mA$

2.6. Number of interfaces

interface	Interface of Module	Interfaces supported by factory default firmware
WiFi standard	IEEE 802.11a/ac/b/g/n	support
Ethernet port	5 10M/100Mself-adaption port	1 WAN、4 LAN
UART	2 way	The 2-way UART has the function of transmission.
SDIO	nonsupport	nonsupport
SPI	1 way	nonsupport
I2C	1way	nonsupport
I2S	1way	nonsupport
PWM	2way	nonsupport
GPIO	8 above the way	Defined Features

Instruction:

The firmware developed by our company based on Linux is burned by default in the module factory; the Ethernet, WiFi, UART0 and uart1 of the firmware have transparent transmission function.

2.7. Default pin function (Serial Port Transmission Firmware)

Number	Name	Type	Functional Description	Default Functionality
1	GND	P	Ground	system power supply
2	5V	P	5 input, supply current $\geq 1000\text{mA}$	
3	5V	P		
4	GND	P	Ground	
5	3.3V	O	3.3V output	
6	GND	P	Ground	
7	5G_WLED	I/O	WiFi LED, Low level efficiency	WiFi LED flickers with WiFi signal and can be suspended
8	SPI_CS0	I/O	SPI bus chip select signal 0	Undefined, please suspend.
9	SPI_MOSI	I/O	SPI Bus Data Host, Out and Down	Not defined, please hang up, do not pull up and down
10	SPI_MISO	I/O	SPI Bus Data in and out	Undefined, please suspend.
11	SPI_CLK	I/O	SPI bus clock signal	Not defined, please hang up, do not pull up and down
12	SPI_CS1	I/O	SPI bus chip selection signal 1	Not defined, please hang up, do not pull up and down
13	PERST_N	I/O	PCIe device reset output	Not defined, please hang up, do not pull up and down
14	REF_CLK0	I/O	Reference clock output	Undefined, please suspend.
15	WPS_RST	I	Enter at instruction mode pin	Low level entry into at instruction mode
16	PORST_N	I/O	CPU reset, low level effective	Reset input, do not need to hang empty
17	LINK4	I/O	PORT4 LED, Low level efficiency	LAN4 lamp
18	LINK3	I/O	PORT3 LED, Low level efficiency	LAN3 lamp
19	LINK2	I/O	PORT2 LED, Low level efficiency	LAN2 lamp
20	LINK1	I/O	PORT1 LED, Low level efficiency	LAN1 lamp

	LINK0	I/O	PORT0 LED, Low level efficiency	WAN lamp
	WLED_N	I/O	WiFi LED, Low level efficiency	WIFI LED flickers with WiFi signal and can be suspended
	UART_TXD1	0	Serial port 1 data transmission	Serial port 1 output, no need to be suspended.
	UART_RXD1	I	Serial port 1 data reception	Serial port 1 input, do not need to hang empty
	I2S_SDI	I/O	I2S data input	Undefined, please suspend.
	I2S_SDO	I/O	I2S data output	Not defined, please hang up, do not pull up and down
	I2S_WS	I/O	I2S channel selection, 0: left; 1: right	Undefined, please suspend.
	I2S_CLK	I/O	I 2 S data bit clock.	Undefined, please suspend.
	I2C_SD	I/O	I2C bus data	Undefined, please suspend.
	I2C_SCLK	I/O	I2C bus clock	Undefined, please suspend.
	GPIO0	I/O	Universal input and output interface.	Undefined, please suspend.
	UART_RXD0	I	Serial port 0 data input	Serial port 0 input, no need to suspend.
	UART_TXD0	0	Serial port 0 data output	Serial port 0 output, do not to suspend, do not pull up and down
	TXIP0	I/O	PORT0 network signal receiving positive	WAN, no need to suspend.
	TXIN0	I/O	PORT0 Network Signal Sending Negative	
	TXOP0	I/O	PORT0 network signal transmission positive.	
	TXON0	I/O	PORT0 Network Signal Sending Negative	
	TXOP1	I/O	PORT1 network signal receiving positive	LAN1, no need to suspend.
	TXON1	I/O	PORT1 Network Signal Sending Negative	
	RXIP1	I/O	PORT1 network signal receiving positive	
	RXIN1	I/O	PORT1 Network Signal Sending Negative	
	RXIP2	I/O	PORT2 network signal receiving positive	LAN2, no need to suspend.
	RXIN2	I/O	PORT2 Network Signal Sending Negative	
	TXOP2	I/O	PORT2 network signal receiving positive	
	TXON2	I/O	PORT2 Network Signal Sending Negative	
	TXOP3	I/O	PORT3 network signal receiving positive	LAN3, no need to suspend.
	TXON3	I/O	PORT3 Network Signal Sending Negative	
	RXIP3	I/O	PORT3 network signal receiving positive	
	RXIN3	I/O	PORT3 Network Signal Sending Negative	
	RXIP4	I/O	PORT4 network signal receiving positive	



	TXOP4	I/O	PORT4 Inetwork signal receiving positive	
	TXON4	I/O	PORT4 Network Signal Sending Negative	
	USB_DP	I/O	USB Data positive	Undefined, please suspend.
	USB_DM	I/O	USB Data negative	Undefined, please suspend.
	GND	P	Ground	landing

Notes:

- 1, I-input; O-output; I/O-digital I/O; P-power。 IO port drive current 8mA .
- 2, Red representation on the name bar: Related to the startup of the chip, the external can not pull up and down, can not connect the driver source.
- 3, Blue representation on the note bar: The default firmware of our factory has this function.
- 4, Except for power pin pin2,3, The average electricity of the other pins is 3.3 v

3. Quick Start Wizard

3.1. Restoration of factory setting

To ensure that all configuration processes are correct, let the module restore the factory settings first. Modules that are already in factory mode can skip this step. Lift 5V (1000mA) power to the module, waiting for about 30 seconds, let the module start complete, pull down the RESET (PIN15) pin more than 6S (Trst), release RESET foot after startup, the system will automatically restart. After restart, the system is already in factory mode.

3.2. Configure network parameters

PC is set to static IP mode to connect to modules via Ethernet or WIFI. The IP address is set to 192.168.16.100/255.255.255.0. the gateway is 192.168.16.254. (wifi default ssid and default password see this document.) Open the browser <http://192.168.16.254/>, enter to the web configuration page, and the default username and password is admin/admin. The corresponding network parameters are modified by web. At this point, the module IP address is 192.168.16.254.

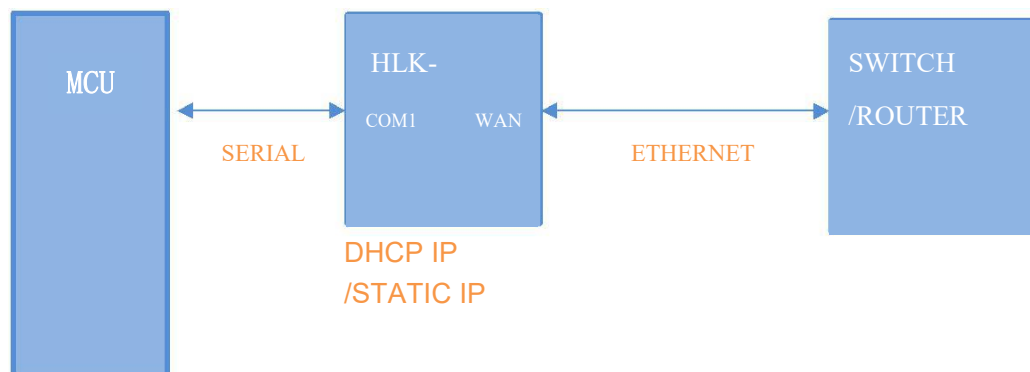
3.3. Configure serial port to network parameters

Open the browser <http://192.168.16.254/>, enter into Serial port to network web configuration page. Configure serial port to network parameters through web pages as needed.

4. Function Declaration

Module functions can be divided into four modes: default mode, serial to Ethernet mode, serial to WIFI CLIENT mode and serial to WIFI AP mode.

4.1. Serial port to Ethernet



pic 6. Serial port to Ethernet

In this mode, the WAN port is enabled and the WIFI, LAN port function is turned off. Through the appropriate settings, the data of COM1 and the network data of WAN port are converted to each other. Ethernet can be configured as a dynamic IP address (DHCP), Can also be configured as static IP (STATIC).

4.2. Serial port to WIFI CLIENT



Pic 7.Serial port to WIFI CLIENT

In this mode, WIFI enabled, working in CLIENT mode, WAN, LAN function closed. Through appropriate settings, COM1 data and WIFI network data are converted to each other. WIFI CLIENT can be configured as dynamic IP address (DHCP) or static IP address (STATIC). WIFI security supports all current encryption methods.

4.3. Serial port to WIFI AP



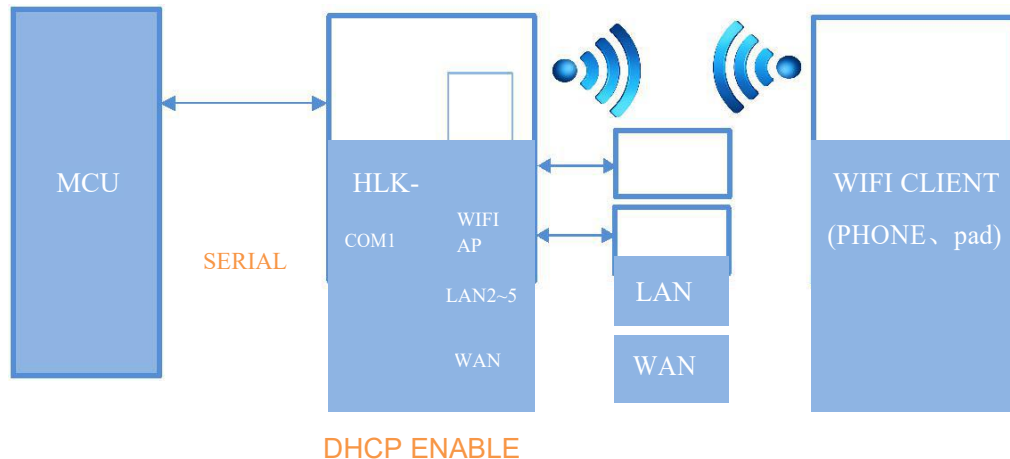
Pic 8. Serial port to WIFI AP

In this mode, WIFI enabled, working in AP mode, WAN, LAN2 ~ 5 function closed. Through appropriate settings, COM1 data and WIFI network data are converted to each other.

WIFI security supports all current encryption methods.

In this mode, WIFI devices can be connected to modules and become devices under the WIFI LAN.

4.4. Default mode



Pic 9.Default pattern model

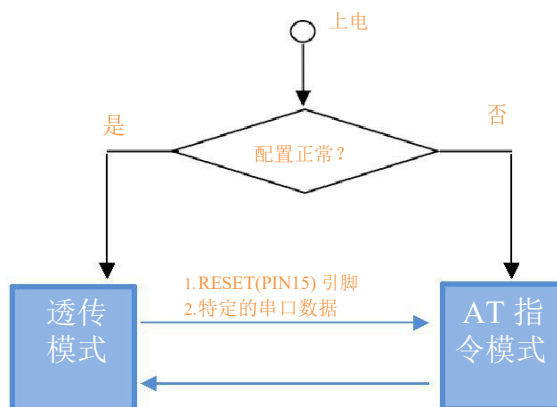
In this mode, WIFI enabler, works in AP mode, WAN, LAN 2 ~ 5 function enabler. With appropriate settings, COM1 data and network data are converted to each other.

WIFI security supports all current encryption methods.

In this mode, WIFI devices can be connected to modules and become devices under the WIFI LAN. WAN side defaults to dynamic IP address mode. LAN and WIFI are the same LAN. DHCP server is opened by default.

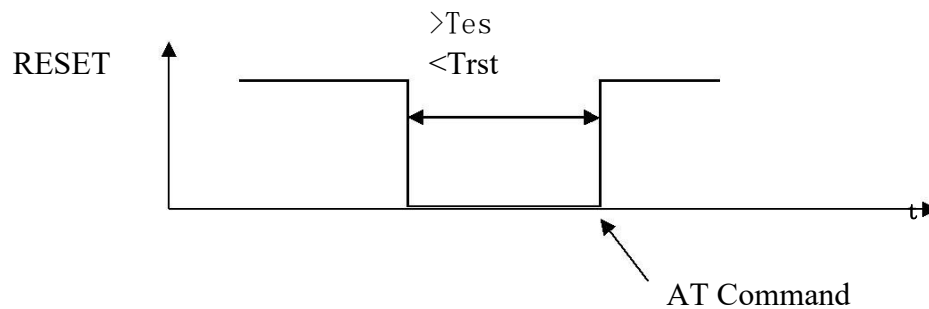
5. Working State Conversion of Serial Port

The module defines the working state of serial port as two modes: transmission mode and AT instruction mode.



Pic 10 .Serial port working state transition

After normal power-on, the module will check whether the current network serial port configuration is normal. If the network connection is normal, the module will automatically enter the transmission mode, otherwise the module will enter the AT instruction mode. In any state, the time to keep RESET foot low level is longer than T_{es} and less than T_{rst} , and it will enter AT instruction mode immediately.



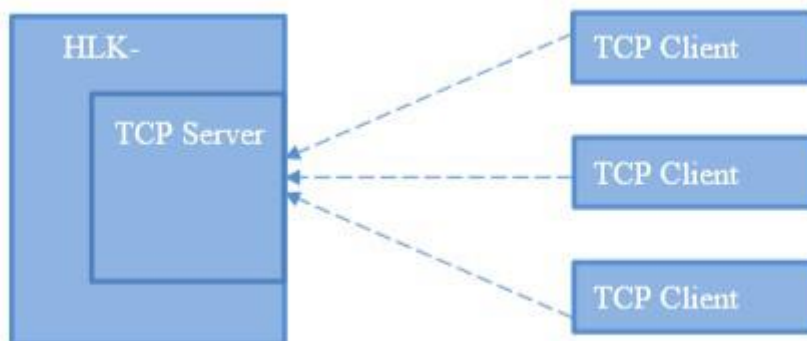
Pic 11. RESET Exit Translucent Mode

Remark: $T_{es}=100ms, T_{rst}=6s$

5.1. Serial port-network data conversion

Module serial port - network data conversion is divided into four modes : TCP Server、TCP Clinet、UDP Server、UDP Client.

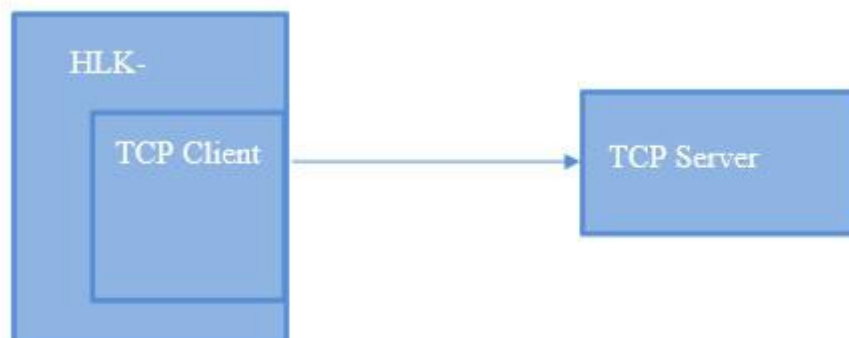
5.1.1. TCP Server



Pic 12. TCP Server

In this mode, the module listens to the specified port and waits for the TCP Client connection. After the connection, all the TCP data is sent directly to the serial port, and the data from the serial port is sent to all the TCP Client.

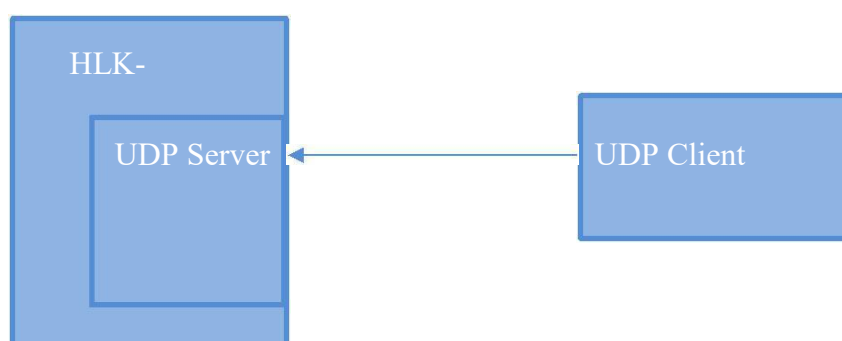
5.1.2. TCP Client



Pic 13. TCP Client

In this mode, the module connects the specified domain name/IP, port. All data sent from TCP Server is sent directly to serial port, and data from serial port is sent to TCP Server. Abnormal network disconnection can lead to active reconnection of modules. When the active reconnection function of TCP enables, TCP Server disconnects actively, and the module will reconnect actively immediately, otherwise the module will not reconnect.

5.1.3. UDP Serve

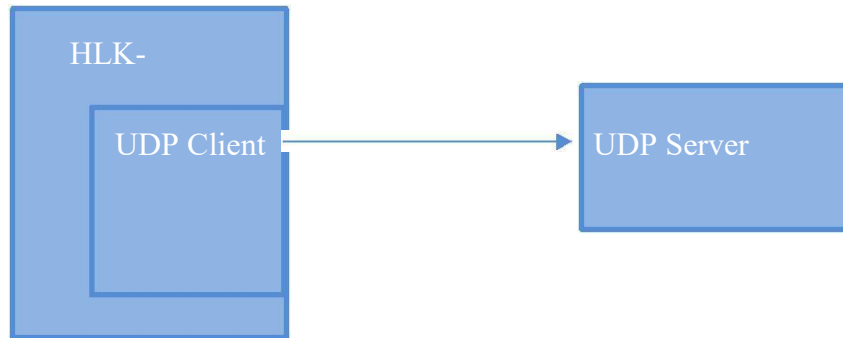


Pic 14. UDP Server

In this mode, the module opens the local designated port. Once the data sent to the port is received, the module will send the data to the serial port and record the remote IP and port. Modules only record remote information on the last connection.

The data received by serial port will be sent directly to the recorded remote IP and port.

5.1.4. UDP Client



Pic 15. UDP Client

In this mode, the module sends the serial port data directly to the specified ip,port. The data returned from the server will be sent to the serial port.

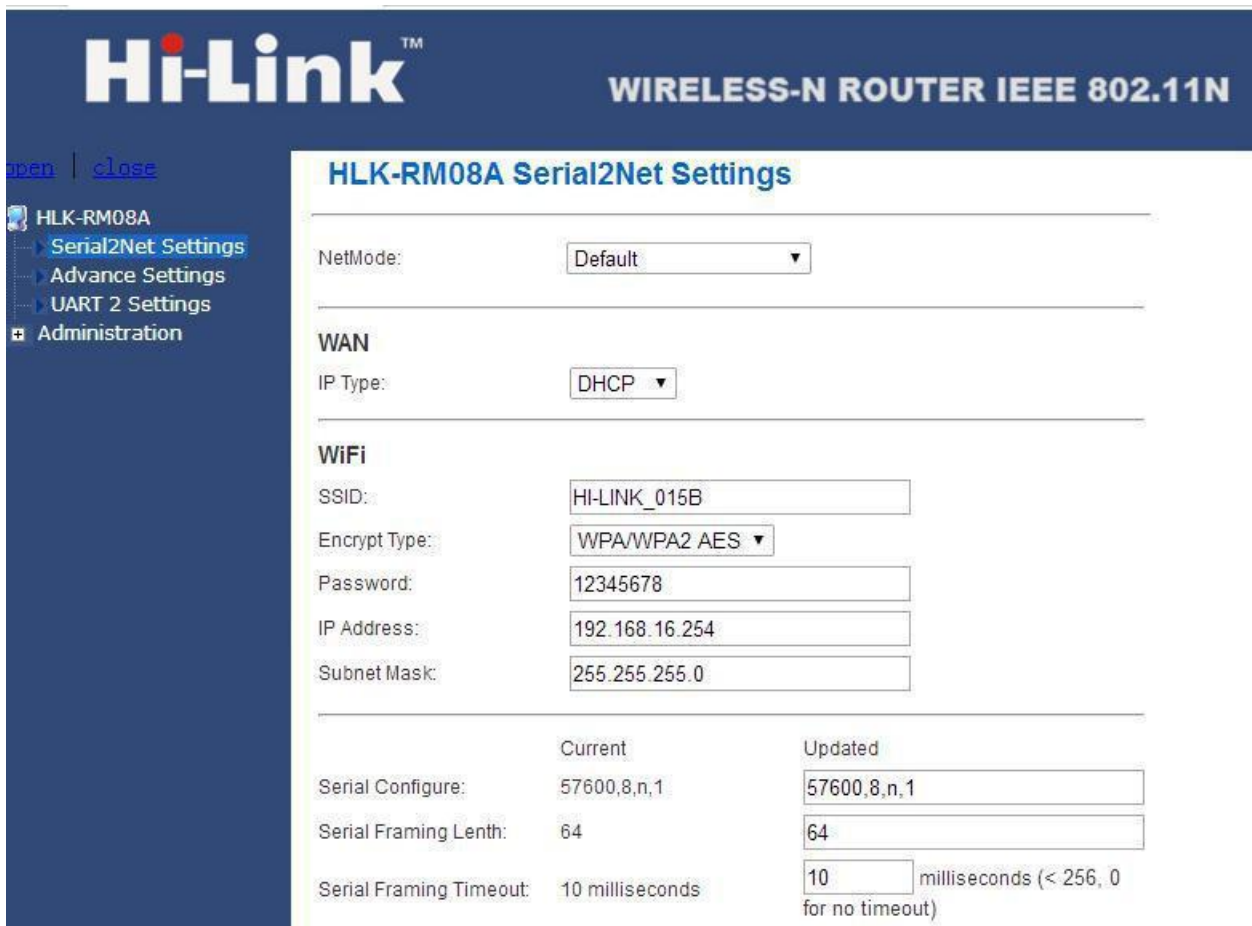
6. Parameter Configuration Mode

The module provides two ways to configure the parameters: 1, Web page; 2, serial port AT instruction. Access to the WEB configuration page requires confirmation of the IP address of the module, as well as the WEB certified username password.

The configuration parameters of AT instruction through serial port need to let the module enter AT instruction mode first.

HLK-RM04_CONFIG, a serial port configuration tool, configures modules by AT instruction mode, and provides a simple and convenient configuration process by configuring and combining various parameters.

6.1. WEB Page Configuration



The screenshot shows the Hi-Link WEB Configuration page for the HLK-RM08A Serial2Net Settings. The page is divided into three main sections: Network configuration, Serial port function configuration, and a configuration commit area.

Serial2Net Settings

NetMode:

WAN

IP Type:

WiFi

SSID:

Encrypt Type:

Password:

IP Address:

Subnet Mask:

	Current	Updated
Serial Configure:	57600,8,n,1	<input type="text" value="57600,8,n,1"/>
Serial Framing Lenth:	64	<input type="text" value="64"/>
Serial Framing Timeout:	10 milliseconds	<input type="text" value="10"/> milliseconds (< 256, 0 for no timeout)

Pic 16. WEB Configuration page

According to the correct module address(default <http://192.168.16.254/>)can access the WEB configuration page.The page is divided into three areas:

- 1 Network configuration area
- 2.Serial port function configuration area
- 3.Configure commit area

6.2. WEB Configure network

Network mode selection (NetMode) :

Default – Default mode of operation

ETH-SERIAL – Serial port to Ethernet

WIFI(CLIENT)-SERIAL – Serial port to WIFI CLIENT

WIFI(AP)-SERIAL) – Serial port to WIFI AP

Select different working modes and the pages displayed by web will be different. The sub-mode configuration interface is as follows:

6.2.1. Serial port to Ethernet-dynamic ip

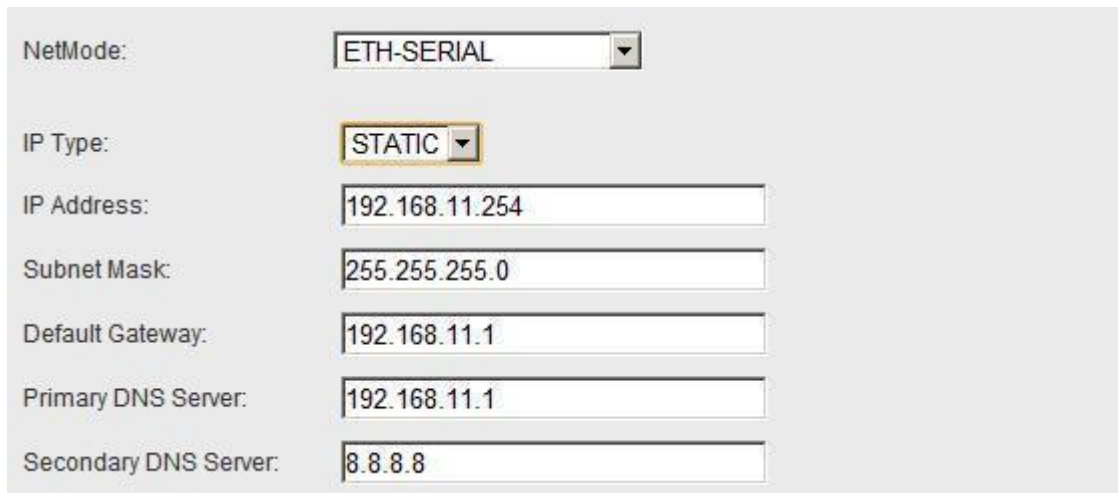


NetMode:

IP Type:

Pic 18. Serial port to Ethernet-dynamic

6.2.2. Serial port to Ethernet-static state ip



NetMode:

IP Type:

IP Address:

Subnet Mask:

Default Gateway:

Primary DNS Server:

Secondary DNS Server:

Pic 19. Serial port to Ethernet-static state

6.2.3. Serial port to WIFI CLIENT-dynamic ip



NetMode:

SSID:

Encrypt Type:

Password:

IP Type:

Pic 20. Serial port to WIFI CLIENT dynamic

6.2.4. Serial port to WIFI CLIENT-static state ip

NetMode:	<input type="text" value="WIFI(CLIENT)-SERIAL"/>
SSID:	<input type="text" value="Hi-Link_"/>
Encrypt Type:	<input type="text" value="WPA2 AES"/>
Password:	<input type="text" value="12345678"/>
IP Type:	<input type="text" value="STATIC"/>
IP Address:	<input type="text" value="192.168.11.254"/>
Subnet Mask:	<input type="text" value="255.255.255.0"/>
Default Gateway:	<input type="text" value="192.168.11.1"/>
Primary DNS Server:	<input type="text" value="192.168.11.1"/>
Secondary DNS Server:	<input type="text" value="8.8.8.8"/>

Pic 21. Serial port to WIFI CLIENT-static state

6.2.5. Serial port to WIFI AP

NetMode:	<input type="text" value="WIFI(AP)-SERIAL"/>
SSID:	<input type="text" value="Hi-Link_"/>
Encrypt Type:	<input type="text" value="WPA2 AES"/>
Password:	<input type="text" value="12345678"/>
IP Address:	<input type="text" value="192.168.11.254"/>
Subnet Mask:	<input type="text" value="255.255.255.0"/>

Pic 22. Serial port to WIFI AP

6.2.6. WEB Configure serial port

Serial port part the Web configuration is as follows:

	Current	Updated
Serial Configure:	115200,8,n,1	<input type="text" value="115200,8,n,1"/>
Serial Framing Lenth:	64	<input type="text" value="64"/>
Serial Framing Timeout:	10 milliseconds	<input type="text" value="10"/> milliseconds (< 256, 0 for no timeout)
Network Mode:	none	<input type="text" value="None"/>
Remote Server Domain/IP:	192.168.11.245	<input type="text" value="192.168.11.245"/>
Locale/Remote Port Number:	8080	<input type="text" value="8080"/>
Network Protocol:	tcp	<input type="text" value="TCP"/>
Network Timeout:	0 seconds	<input type="text" value="0"/> seconds (< 256, 0 for no timeout)

Pic 23. web Serial port configuration

Current column shows the current configuration,Update column shows the currently modified parameters.

Serial Configure: Serial port configuration. The format is as follows: Baud rate,data bit,check bit,stop bit.

Such: “115200,8,n,1”。

Serial Framing Lenth: Serial port frame length

Serial Framing Timeout: Serial port framing time

Network Mode: Network mode.choose Client、 Server or none

Remote Server Domain/IP: Remote server domain name or IP address

Such : 192.168.11.245 or www.hlktech.com

Locale/Remote Port Number: Local or remote port number.The parameters specified in different network modes are different.Specify the remote port number under Client, Specify the local port number under Server.

Network Protocol: Network protocol type.using tcp or udp protocol.

Network Timeout: Network timeout.In Server network mode, when there is no data transmission during the timeout, the connection will be disconnected.0 Designation is always open.

6.2.7. Commit changes

Click Apply to submit the configuration of the current page. If some of the network parameters have been changed, the commit process may take about 25 seconds. If you only modify the serial port function configuration, the submission process will be completed quickly. Clicking on Cancel will overload the page and the modified configuration will be lost

7. Serial AT Instruction Configuration

7. 1. AT instruction format

In AT mode, the system parameters can be configured through the AT instruction of serial port. Following is the instruction format: `at+[command]=[value]\r`

Depending on the command module, different return values are returned.

Example: `"at+remoteip=192.168.11.133\r"` setting remote ip address to 192.168.11.133.

Example: `"at+remoteip=? \r"` Query remote IP address.

Following is the list of instructions:

netmode	Network mode
wifi_conf	WiFi configure
Channel	WiFi channel
dhcpc	DHCP Client configuration
net_ip	Network IP
net_dns	Network DNS
dhcpd	DHCP Server configuration
dhcpd_ip	DHCP Server IP
dhcpd_dns	DHCP server DNS
dhcpd_time	DHCP Server allocation time
net_commit	Submit network configuration
out_trans	Exit transmission
remoteip	Remote Server Domain Name or IP Address
remoteport	Local or remote port number
remotepro	Network protocol type
timeout	Network timeout
mode	Serial port network mode
uart	Serial port configuration
uartpacklen	Serial port frame length
uartpacktimeout	Serial port framing time

escape	Serial port exit transmission
tcp_auto	TCP Automatic reconnection
save	Submit Serial Port Conversion Configuration and Restart Services
reconn	Restart service
default	Restore factory setting
reboot	Restart module
ver	Module version
CLport	TCP/UDP CLIENT Local port
RTS	Serial port output indication (485)
XON_XOFF	XON/XOFF Flow control enable
net_wanip	wan ip address
tcp_client_check	TCP CLIENT Remote State Detection
S2N_Stat	Serial function status
Get_MAC	Get the MAC address
wifi_ConState	WiFi CLIENT connection status
wifi_Scan	WiFi scan
suspend	System pending
C2_uart	Serial port 2 serial port configuration
C2_mode	Serial port 2 Serial port network mode
C2_remoteip	Serial port 2 Remote server domain name or IP address
C2_port	Serial port 2Local or remote port number
C2_CLport	Serial port 2TCP/UDP CLIENT Local port
C2_protocol	Serial port 2 Network protocol type
C2_timeout	Serial port 2 Network timeout
C2_uartpacklen	Serial port 2 Serial port frame length
C2_uartpacktimeout	Serial port 2 Serial port framing time
C2_tcp_auto	Serial port 2TCP Automatic reconnection
C2_tcp_client_check	Serial port 2TCP CLIENT remote state detection

7.1.1. Netmode

Function	Network mode setting
Form	at+netmode=<netmode>\r
Parameter	0: Default mode 1: Ethernet 2: WiFi client 3: WiFi AP

7.1.2. wifi_conf

Function	Wireless parameter setting
Form	at+wifi_conf=<ssid>, <encrypt type>, <password> \r
Parameter	ssid:networkssid encrypt type:encryption way Password:password

Encryption mode:

Value	Meaning
none	Open network
wep_open	wep encryption, Open authentication mode
wep	wep encryption, Encryption authentication
wpa_tkip	wpa tkip
wpa_aes	wpa aes
wpa2_tkip	wpa2 tkip
wpa2_aes	wpa2 aes
wpa/wpa2_tkip	wpa/wpa2tkip
wpa/wpa2_aes	wpa/wpa2aes
auto	automatic selection

7.1.3. Channel

Function	Wifi Wireless channel selection
Form	at+Channel=<Channel>\r
Parameter	Channel:0-14. (0-automatic selection)

7.1.4. dhcpc

Function	Dhcp Client enabling
Form	at+dhcpc=<dhcpc>\r
Parameter	0: Static ip address 1: dynamic ip address

7.1.5. net_ip

Function	Network IP Settings. DHCP the parameter is invalid when the client function is turned on
Form	at+Net_ip=<ip>, <mask>, <gateway>\r
Parameter	Ip: ip address Mask: subnet mask Gateway: gateway

7.1.6. net_dns

Function	Network DNS setting. DHCP the parameter is invalid when the client function is turned on
Form	at+Net_dns=<dns1>, <dns2>\r
Parameter	dns1: main DNS address dns2: secondary DNS address

7.1.7. dhcpd

Function DHCP Server enable. The parameter is invalid when the network mode is non-AP mode

Form At+dhcpd=<dhcpd>\r

Parameter 0: close 1: open

7.1.8. dhcpd_ip

Function Dhcp server ip setting

Form At+Dhcpd_ip=<ip start>, <ip end>, <mask>, <gateway>\r

Parameter Ip start: ip start address

User Manual

Ip end: ip ending address
 Mask: subnet mask
 Gateway: gateway

7.1.9. dhcpd_dns

Function	Dhcp server dns setting
Form	At+Dhcpd_dns=<dns1>, <dns2>\r
Parameter	dns1: first dns address dns2: secondary dns address

7.1.10. dhcpd_time

Function	Dhcp server time setting
Form	At+Dhcpd_time=<time >\r
Parameter	time: DHCP effective time allocated to equipment

7.1.11. net_commit

Function	Submit network settings.All parameters related to network configuration need to be submitted and saved after setting. Command execution time needs to be about 30s
Form	At+ Net commit=< Net commit >\r
Parameter	0: invalid 1: submit

7.1.12. out_trans

Function	Exit Translucent Mode.The function of exiting the transmission mode cannot be used at the serial port
Form	At+out_trans=<out_trans>\r
Parameter	0: Enter the transmission mode None: None Tcp:Tcp protocol Udp:Udp protocol

7.1.13. timeout

Function	Network timeout
Form	At+timeout=<timeout>\r
Parameter	Network timeout.server under network mode, When there is no data transmission during the timeout period, the connection will be disconnected. 0 Designation is always open

7.1.14. mode

Function	Conversion mode setting
Form	At+mode=<mode>\r
Parameter	None:None Client:client Server:server

7.1.15. uart

Function	Serial Port Configuration Settings
Form	At+uart=<baud>, <data>, <parity>, <stop>\r
Parameter	Baud: baud rate Data: data bit Parity: check bit Stop: Stop bit length

7.1.16. uartpacklen

Function	Serial port frame length setting
Form	At+uartpacklen =<uartpacklen>\r
Parameter	uartpacklen: Serial port frame length (unit: byte)

7.1.17. uartpacktimeout

Function	Serial port group frame time setting
Form	At+ uartpacktimeout=<uartpacktimeout>\r
Parameter	uartpacktimeout: Serial port framing time (unit: ms)

7.1.18. escape

Function	Serial port exit transmission enable
Form	At+ escape=<escape>\r
Parameter	escape: 0 - close, 1 - enable

7.1.19. tcp_auto

Function	TCP Automatic reconnect. When this function is turned on, the module will continue to try to re-establish the connection regardless of the reason for the disconnection.
Form	At+ tcp_auto=<tcp_auto>\r
Parameter	tcp_auto: 0 - close, 1 - enable

7.1.20. Save

Function	Submit serial port conversion configuration and restart service
Form	At+ save=<save>\r
Parameter	0: invalid 1: submit

7.1.21. Reconn

Function	Restart serial port conversion service
Form	At+ reconn =< reconn >\r
Parameter	0: invalid 1: Restart serial port conversion service

7.1.22. Ver

Function	Checking the firmware version
Form	At+ver=? \r
Parameter	none

7.1.23. Clport

Function	TCP/UDP CLIENT Local port
Form	At+ CLport=< CLport>\r
Parameter	Clport: Local port number

7.1.24. RTS (This function has not yet been implemented)

Function	Serial port output indication. Individual pin instructions are usually required in 485 schemes. Receiving or sending status of 485 transceiver After this function is enabled, the GPIO_1 pin acts as the output pin to indicate the output status of the serial port
Form	At+ RTS =< RTS >\r
Parameter	0: close 1: open

7.1.25. XON_XOFF

Function	XON/XOFF flow control
Form	At+ XON_XOFF=< XON_XOFF >\r
Parameter	0: close 1: open

7.1.26. net_wanip

Function	wan ip address
Form	At+ net_wanip =? \r
Parameter	None

7.1.27. tcp_client_check

Function	TCP CLIENT remote state detection
Form	At+ tcp_client_check =< tcp_client_check >\r
Parameter	0: close 1: open

7.1.28. S2N_Stat

Function	Serial function status
Form	At+ S2N_Stat =? \r
Parameter	None

7.1.29. Get_MAC

Function	Get the MAC address
Form	At+ Get_MAC =? \r
Parameter	None

7.1.30. wifi_ConState

Function	WiFi CLIENT connection status
Form	At+ wifi_ConState =? \r
Parameter	None

7.1.31. wifi_Scan

Function	WiFi scan
Form	At+ wifi_Scan =? \r
Parameter	None

7.1.32. suspend

Function	System pending
Form	At+ suspend =< suspend >\r
Parameter	0: wake up 1: hang-up

7.1.33. C2_remoteip

Function	Serial port 2 remote ip or domain name settings
Form	At+ C2_remoteip=< remoteip >\r
Parameter	Remote server domain name or ip address

7.1.34. C2_remoteport

Function	Serial port 2 Remote port setting
Form	At+ C2_remoteport=<remoteport>\r
Parameter	Remoteport: Remote Port

7.1.35. C2_remotepro

Function	Serial port 2 Protocol type setting
Form	At+ C2_remotepro=<remotepro>\r
Parameter	None:none Tep:Tcp protocol Udp:Udp protocol

7.1.36. C2_timeout

Function	Serial port 2 Network timeout
Form	At+ C2_timeout=<timeout>\r
Parameter	Network timeout. In server network mode, when there is no data transmission during the timeout period, the connection will be disconnected. 0 Designation is always open

7.1.37. C2_mode

Function	Serial port 2 Conversion mode setting
Form	At+ C2_mode=<mode>\r
Parameter	None:none Client:client Server:server

7.1.38. C2_uart

Function	Serial port 2 Serial Port Configuration Settings
Form	At+ C2_uart=<baud>, <data>, <parity>, <stop>\r
Parameter	Baud: Baud rate Data: data bit Parity: check bit Stop: Stop bit length

7.1.39. C2_uartpacklen

Function	Serial port 2 Serial port frame length setting
Form	At+ C2_uartpacklen =<uartpacklen>\r
Parameter	uartpacklen: Serial port frame length (unit: byte)

7.1.40. C2_uart pack timeout

Function	Serial port 2 serial port framing time setting
Form	At+ C2_uartpacktimeout=<uartpacktimeout>\r
Parameter	uartpacktimeout: Serial port framing time (unit: ms)

7.1.41. C2_tcp_auto

Function	Serial port 2TCP automatic reconnection. When this function is turned on, the module will continue to try to re-establish the connection regardless of the reason for the disconnection.
Form	At+ C2_tcp_auto=<tcp_auto>\r
Parameter	tcp_auto: 0 - close, 1 - enable

7.1.42. C2_tcp_client_check

Function	Serial port 2TCP CLIENT remote state detection
Form	At+ C2_tcp_client_check =< tcp_client_check >\r
Parameter	0:close 1: open

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8. AT Instruction Control Code Routine

8.1. Check configuration information

```

code:
char *query="\
at+netmode=?\r\n\
at+wifi_conf=?\r\n\
at+dhcpcd=?\r\n\
at+dhcpcd_ip=?\r\n\
at+dhcpcd_dns=?\r\n\
at+dhcpcd_time=?\r\n\
at+dhcpc=?\r\n\
at+net_ip=?\r\n\
at+net_dns=?\r\n\
at+net_wanip=?\r\n\
at+remoteip=?\r\n\
at+remoteport=?\r\n\
at+remotepro=?\r\n\
at+timeout=?\r\n\
at+mode=?\r\n\
at+uart=?\r\n\
at+uartpacklen=?\r\n\
at+uartpacktimeout=?\r\n\
at+ver=?\r\n\
";
Com_send(query);
Run return:
at+netmode=? 0
at+wifi_conf=? Hi-Link,wpa2_aes,12345678 at+dhcpcd=? 0
at+dhcpcd_ip=? 192.168.14.1,192.168.15.254,255.255.254.0,192.168.15.254
at+dhcpcd_dns=? 192.168.15.254,0.0.0.0 at+dhcpcd_time=? 86400
at+dhcpc=? 1
at+net_ip=? 192.168.15.254,255.255.254.0,192.168.11.1
at+net_dns=? 192.168.11.1,0.0.0.0
at+net_wanip=? ,, at+remoteip=? 192.168.11.245
at+remoteport=? 8080
at+remotepro=? tcp at+timeout=? 0
at+mode=? server at+uart=?
115200,8,n,1 at+uartpacklen=? 64
at+uartpacktimeout=? 10
at+ver=? V1.39(Dec 6 2012)

```

8.2. Serial port to Ethernet(dynamic ip address)

code:

```
char *commands_eth="\n
at+netmode=1\r\n\n
at+dhcpc=1\r\n\n
at+remoteip=192.168.11.245\r\n\n
at+remoteport=8080\r\n\n
at+remotepro=tcp\r\n\n
at+timeout=0\r\n\n
at+mode=server\r\n\n
at+uart=115200,8,n,1\r\n\n
at+uartpacklen=64\r\n\n
at+uartpacktimeout=10\r\n\n
at+net_commit=1\r\n\n
at+reconn=1\r\n\n
";
Com_send(commands_eth);
```

Run return:

```
at+netmode=1 ok at+dhcpc=1
at+remoteip=192.168.11.245 ok
at+remoteport=8080 ok
at+remotepro=tcp at+timeout=0 ok
at+mode=server at+uart=115200,8,n,1
ok at+uartpacklen=64 ok
at+uartpacktimeout=10 ok
at+net_commit=1
```

8.3. Serial port to Ethernet(static state ip)

code:

```
char *commands_eth_static="\n
at+netmode=1\r\n\n
at+dhcpc=0\r\n\n
at+net_ip=192.168.11.254,255.255.255.0,192.168.11.1\r\n\n
at+net_dns=192.168.11.1,8.8.8.8\r\n\n
at+remoteip=192.168.11.245\r\n\n
at+remoteport=8080\r\n\n
at+remotepro=tcp\r\n\n
at+timeout=0\r\n\n
at+mode=server\r\n\n
at+uart=115200,8,n,1\r\n\n
at+uartpacklen=64\r\n\n
```

```
at+uartpacktimeout=10\r\n\
at+net_commit=1\r\n\
at+reconn=1\r\n\"
```

```
Com_send(commands_eth_static);
```

```
Run return:
```

```
at+netmode=1 ok at+dhcpc=0
at+net_ip=192.168.11.254,255.255.255.0,192.168.11.1 ok
at+net_dns=192.168.11.1,8.8.8.8 ok
at+remoteip=192.168.11.245 ok

at+remoteport=8080 ok
at+remotepro=tcp at+timeout=0 ok
at+mode=server at+uart=115200,8,n,1
ok at+uartpacklen=64 ok
at+uartpacktimeout=10 ok
at+net_commit=1
```

8.4. serial port to wifi client(dynamic ip)

```
code:
```

```
char *commands_wifi_client_static="\
at+netmode=2\r\n\
at+wifi_conf=HI-LINK, wpa2_aes, 12345678\r\n\
at+dhcpc=0\r\n\
at+net_ip=192. 168. 11. 254, 255. 255. 255. 0, 192. 168. 11. 1\r\n\
at+net_dns=192. 168. 11. 1, 8. 8. 8. 8\r\n\
at+remoteip=192. 168. 11. 245\r\n\
at+remoteport=8080\r\n\
at+remotepro=tcp\r\n\
at+timeout=0\r\n\
at+mode=server\r\n\
at+uart=115200, 8, n, 1\r\n\
at+uartpacklen=64\r\n\
at+uartpacktimeout=10\r\n\
at+net_commit=1\r\n\
at+reconn=1\r\n\";
Com_send(commands_wifi_client_static);
```


Run return:

```
at+netmode=2 ok
at+wifi_conf=HI-LINK,wpa2_aes,12345678 ok
at+dhcpc=1
at+remoteip=192.168.11.245 ok
at+remoteport=8080 ok
at+remotepro=tcp
at+timeout=0 ok
at+mode=server
  at+uart=115200,8,n,1 ok
at+uartpacklen=64 ok
at+uartpacktimeout=10 ok
at+net_commit=1
```

8.5. Serial port to wifi client(static state ip)

code:

```
char *commands_wifi_ap="\
at+netmode=3\r\n\
at+wifi_conf=Hi-Link_, wpa2_aes, 0000000000\r\n\
at+dhcpcd=1\r\n\
at+dhcpcd_ip=192. 168. 16. 100, 192. 168. 16. 200, 255. 255. 255. 0, 192. 168. 16. 254\r\n\
at+dhcpcd_dns=192. 168. 16. 254, 8. 8. 8. 8\r\n\ at+dhcpcd_time=86400\r\n\

at+net_ip=192. 168. 16. 254, 255. 255. 255. 0, 192. 168. 16. 254\r\n\
at+net_dns=192. 168. 16. 254, 8. 8. 8. 8\r\n\
at+remoteip=192. 168. 11. 245\r\n\
at+remoteport=8080\r\n\
at+remotepro=tcp\r\n\
at+timeout=0\r\n\
at+mode=server\r\n\
at+uart=115200, 8, n, 1\r\n\
at+uartpacklen=64\r\n\
at+uartpacktimeout=10\r\n\
at+net_commit=1\r\n\
at+reconn=1\r\n\";
Com_send(commands_wifi_ap);
```

Run return:

```
at+netmode=2 ok
at+wifi_conf=HI-LINK,wpa2_aes,12345678 ok
at+dhcpc=0
at+net_ip=192.168.11.254,255.255.255.0,192.168.11.1 ok
at+net_dns=192.168.11.1,8.8.8.8 ok
at+remoteip=192.168.11.245 ok
at+remoteport=8080 ok
at+remotepro=tcp
at+timeout=0 ok at+mode=server
at+uart=115200,8,n,1 ok
at+uartpacklen=64 ok
at+uartpacktimeout=10 ok
at+net_commit=1
```

8.6. serial port to wifi AP

code:

```
char *commands_wifi_ap="\
at+netmode=3\r\n\
at+wifi_conf=Hi-Link_, wpa2_aes, 0000000000\r\n\
at+dhcpcd=1\r\n\
at+dhcpcd_ip=192. 168. 16. 100, 192. 168. 16. 200, 255. 255. 255. 0, 192. 168. 16. 254\r\n\
at+dhcpcd_dns=192. 168. 16. 254, 8. 8. 8. 8\r\n\ at+dhcpcd_time=86400\r\n\
at+net_ip=192. 168. 16. 254, 255. 255. 255. 0, 192. 168. 16. 254\r\n\
at+net_dns=192. 168. 16. 254, 8. 8. 8. 8\r\n\
at+remoteip=192. 168. 11. 245\r\n\
at+remoteport=8080\r\n\
at+remotepro=tcp\r\n\
at+timeout=0\r\n\
at+mode=server\r\n\
at+uart=115200, 8, n, 1\r\n\
at+uartpacklen=64\r\n\
at+uartpacktimeout=10\r\n\
at+net_commit=1\r\n\
at+reconn=1\r\n\";
Com_send(commands_wifi_ap);
Run return:
at+netmode=3 ok
at+wifi_conf=Hi-Link_,wpa2_aes,0000000000 ok at+dhcpcd=1ok
at+dhcpcd_ip=192.168.16.100,192.168.16.200,255.255.255.0,192.168.16.254 ok
at+dhcpcd_dns=192.168.16.254,8.8.8.8 ok
```

```
at+dhcpcd_time=86400 ok
at+net_ip=192.168.16.254,255.255.255.0,192.168.16.254 ok
at+net_dns=192.168.16.254,8.8.8.8 ok
at+remoteip=192.168.11.245 ok
at+remoteport=8080 ok
at+remotepro=tcp
at+timeout=0 ok
at+mode=server
at+uart=115200,8,n,1, ok
at+uartpacklen=64
ok at+uartpacktimeout=10 ok
at+net_commit=1
```

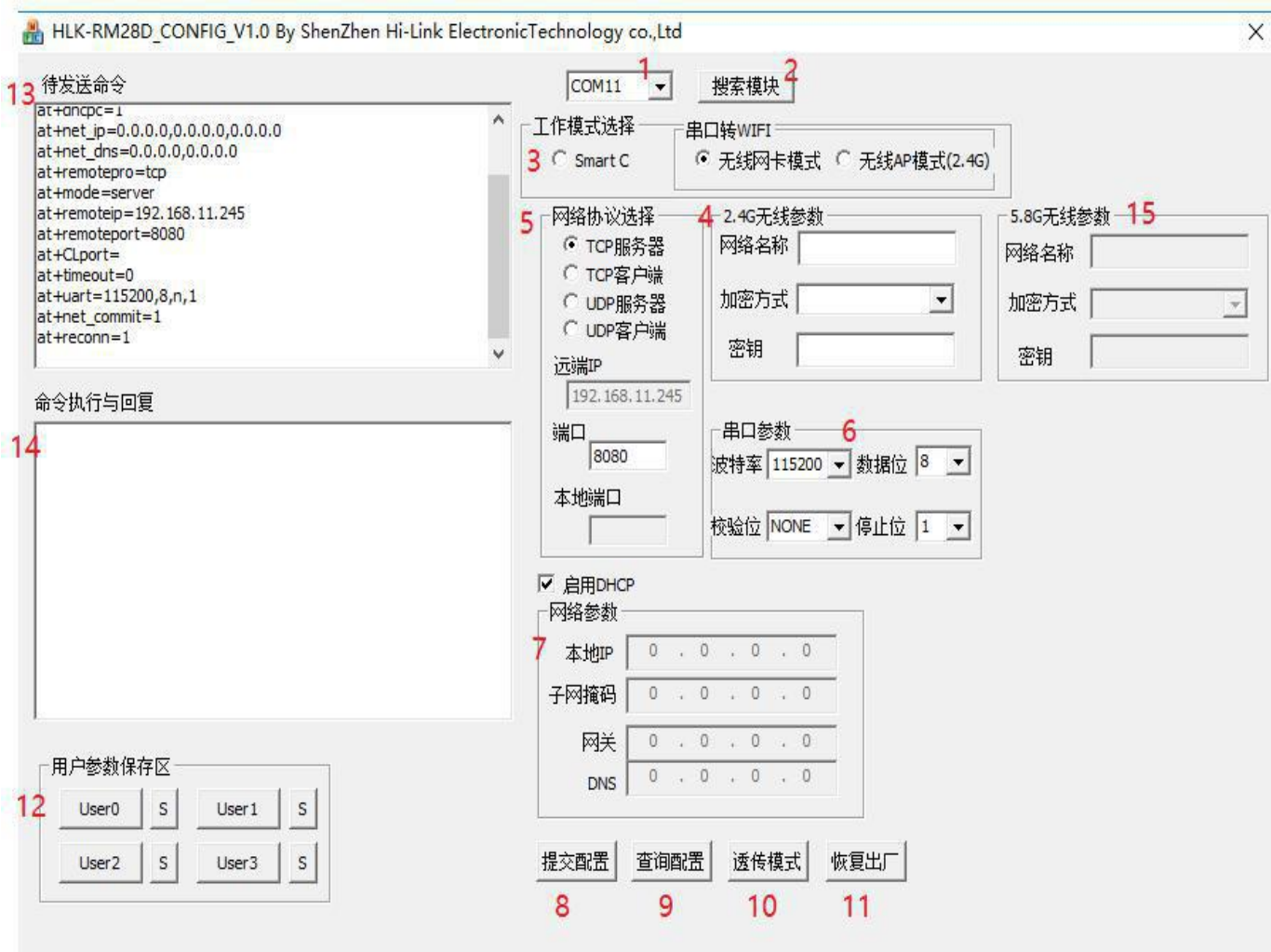
8.7. Restoration of factory setting

```
code:
char *commands_device_default="\
at+default=1\r\n\
at+reboot=1\r\n\";
Com_send(commands_device_default);
Run return:
at+default=1
```

After 30 seconds, the module starts normally and all configuration parameters are factory configuration.

9. Serial port configuration tool

HLK-RM28E_CONFIG is a tool for configuring modules through serial ports. The tool interface is as follows:



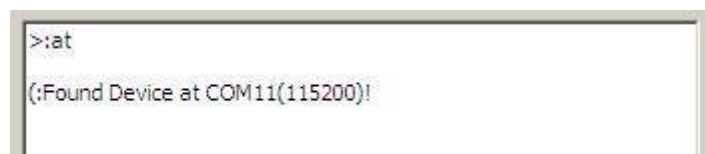
Pic 24. Serial port configuration tool interface

Interface description:

1. Configure serial port selection
2. Search module button
3. Working mode selection button
4. 2.4g wifi wireless configuration parameters
5. Network protocol selection
6. Serial port configuration parameters
7. Network IP address configuration
8. Submit configuration button
9. Check configuration button
10. Enter through mode button
11. Restore factory settings button
12. User parameter save area
13. AT instruction area to be sent
14. AT instruction execution return information area
15. 5.8g wifi wireless configuration parameters

9.1. Search module

Before searching module, we need to let the module enter at instruction mode, select the serial port of PC through "Configuration Serial Port Selection" and click the "Search Module" button. The tool will search HLK-RM28E module with the specified serial port, and the module already connected and in AT instruction mode will be searched. The module information searched will be displayed in the return information area of AT instruction execution. as follows:



```
>:at
(:Found Device at COM11(115200)!
```

Pic 25. Serial port configuration tool search module

At this time, the normal AT instruction communication between PC and module can be established. All AT command interaction processes need to be based on normal AT command communication.

9.2. Set the parameters of each option

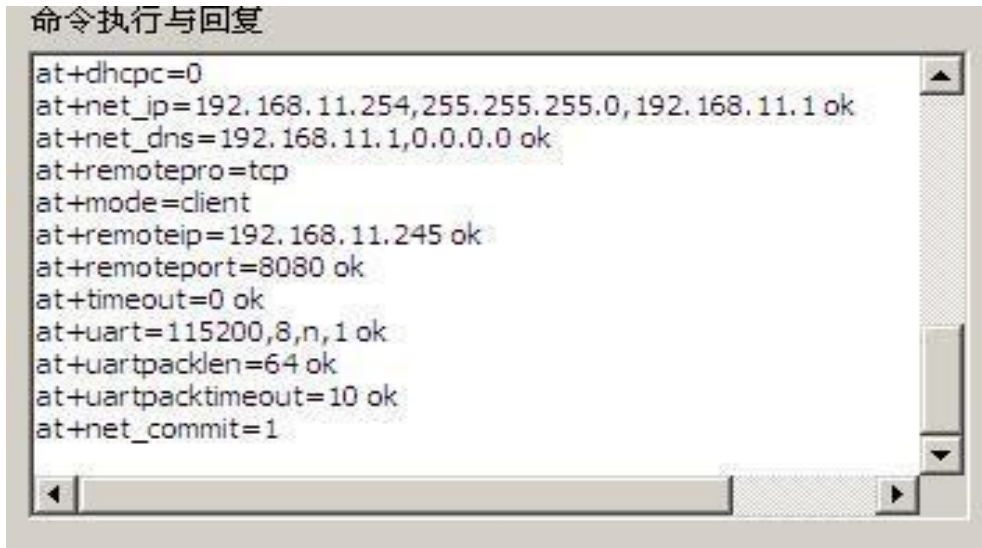
Configure the required functionality through configuration items 3、4、5、6、7. During configuration modification, the corresponding AT instruction is generated immediately in the AT instruction area to be sent. The generated AT instructions are not immediately passed to the module, as follows:



Pic 26. Serial port configuration tool generates instructions

9.3. Submit configuration

Click the submit configuration button, and the tool will immediately send the instruction to the module in the AT command area to be sent. The result of command execution will be displayed in the return information area of AT command execution.



9.4. User data preservation

The user parameter save area provides the function of saving the parameters. With this feature, you can save up to four sets of parameters, each of which is user0、user1、user2、user3. Click on the "S" button next to it, and the confirmation box will pop up, as follow:



Pic 28. Serial port configuration tool saves pop-up box

Click "yes", Instructions from the AT instruction area to be sent are saved as user0 parameter groups. And then click in any state "user0", Will immediately pull out the user0 parameter group and overwrite to the AT instruction area to be sent.

Saved user parameters are saved as text files in the tool directory, The file names are user0、user1、user2、user3.

Pic 27. Serial port configuration tool instruction execution

9.5. Checking configuration

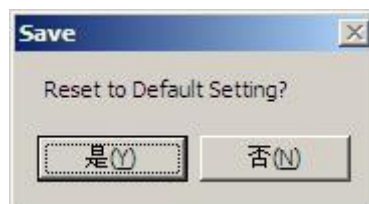
Click on the checking Configuration button, the tool will immediately send a series of AT instructions to the module to query the current configuration of the module. The results of AT instruction execution will be displayed in the return information area of AT instruction execution, and the configuration items will change with the return information.

9.6. Enter the transmission mode

Assuming that the module is already under the AT instruction, you can immediately enter the transmission mode by clicking the pass mode button.

9.7. Restoration of factory setting

Click the factory settings button, the tool will pop up the confirmation box, as following:

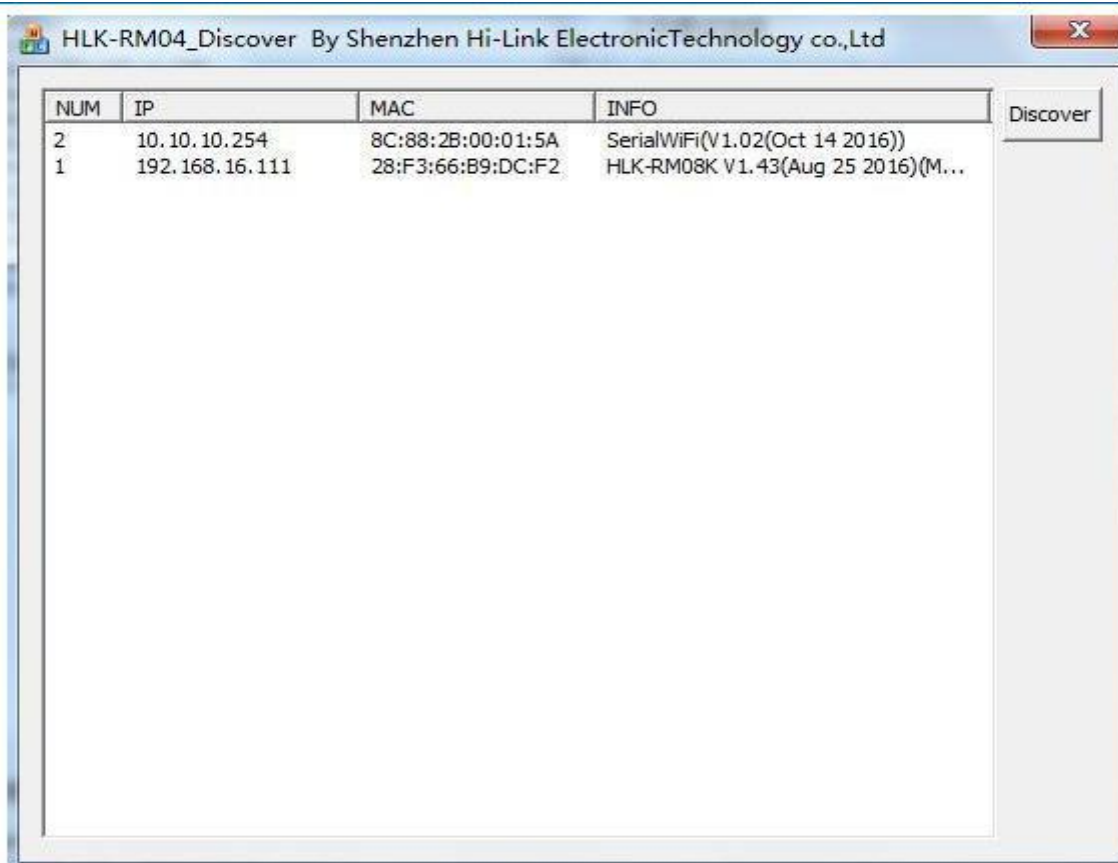


Pic 29. Serial port configuration tool to restore factory settings pop-up box

Click “yes”, The tool sends the AT instruction immediately, and the module enters the factory-set state after about 30s.

10. Device search tool

HLK-RM04_Discover is a tool for searching HLK-RM28E modules on the network side.。 Following is the interface 下:



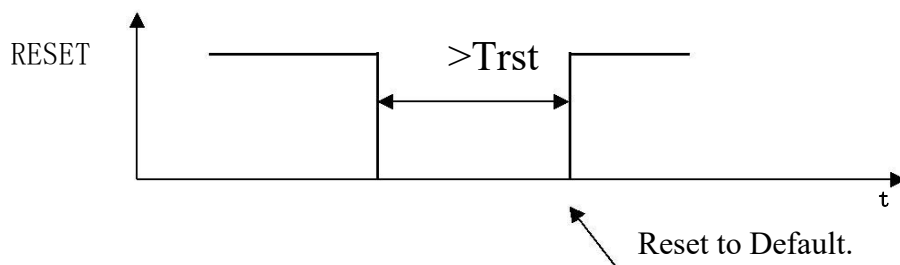
Pic 30. Device search tool interface

Click on the "Discover" button and the tool will immediately search all HLK-RM28E modules in the LAN connected by the PC. The module searched is immediately displayed in the information box. Module information includes IP address, MAC address and version information

11. Restoration of factory setting

Support the following ways to restore factory settings.

1. Through the web page.
2. Through serial port AT instruction.
3. By keeping WDT/RST foot low level, the time is longer than Trst.



Pic 31. RESET Restoration of factory setting

Notes: Trst=6s

The factory default settings parameter values are listed below:

netmode	0
wifi_conf	Hi-Link_, wpa2_aes, 12345678
Channel	1
dhcpc	1
net_ip	192.168.11.254, 255.255.255.0, 192.168.11.1
net_dns	192.168.11.1, 8.8.8.8
dhcpd	1
dhcpd_ip	192.168.16.100, 192.168.16.200, 255.255.255.0, 192.168.16.1
dhcpd_dns	192.168.16.1, 8.8.8.8
dhcpd_time	86400
remoteip	192.168.11.245
remoteport	8080
remotepro	tcp
timeout	0
mode	server
uart	115200, 8, n, 1
uartpacklen	64
uartpacktimeout	10
escape	0
escape2	1
tcp_auto	1
IP address	192.168.16.254
Wifi password	12345678
Web username/password	admin/admin
Tes	100ms
Trst	6s
Tescape2	2000ms
C2_uart	57600, 8, n, 1
C2_mode	0
C2_remoteip	192.168.1.245
C2_port	8081
C2_CLport	0
C2_protocol	1
C2_timeout	0
C2_uartpacklen	64

C2_uartpacktimeout	10
C2_tcp_auto	1
C2_tcp_client_check	1

12. Firmware upgrade

1. Restoration of factory setting.
2. Pc connects modules in Ethernet mode, IP is 192.168.16.123/255.255.255.0. Browser access to 192.168.16.254. account and password: admin/admin.
3. Open the following page. Select the appropriate firmware, Click on apply to start the upgrade. Wait about 1.5 minutes.

Notes:The power cannot be cut off during the upgrade process, otherwise the module may be damaged.



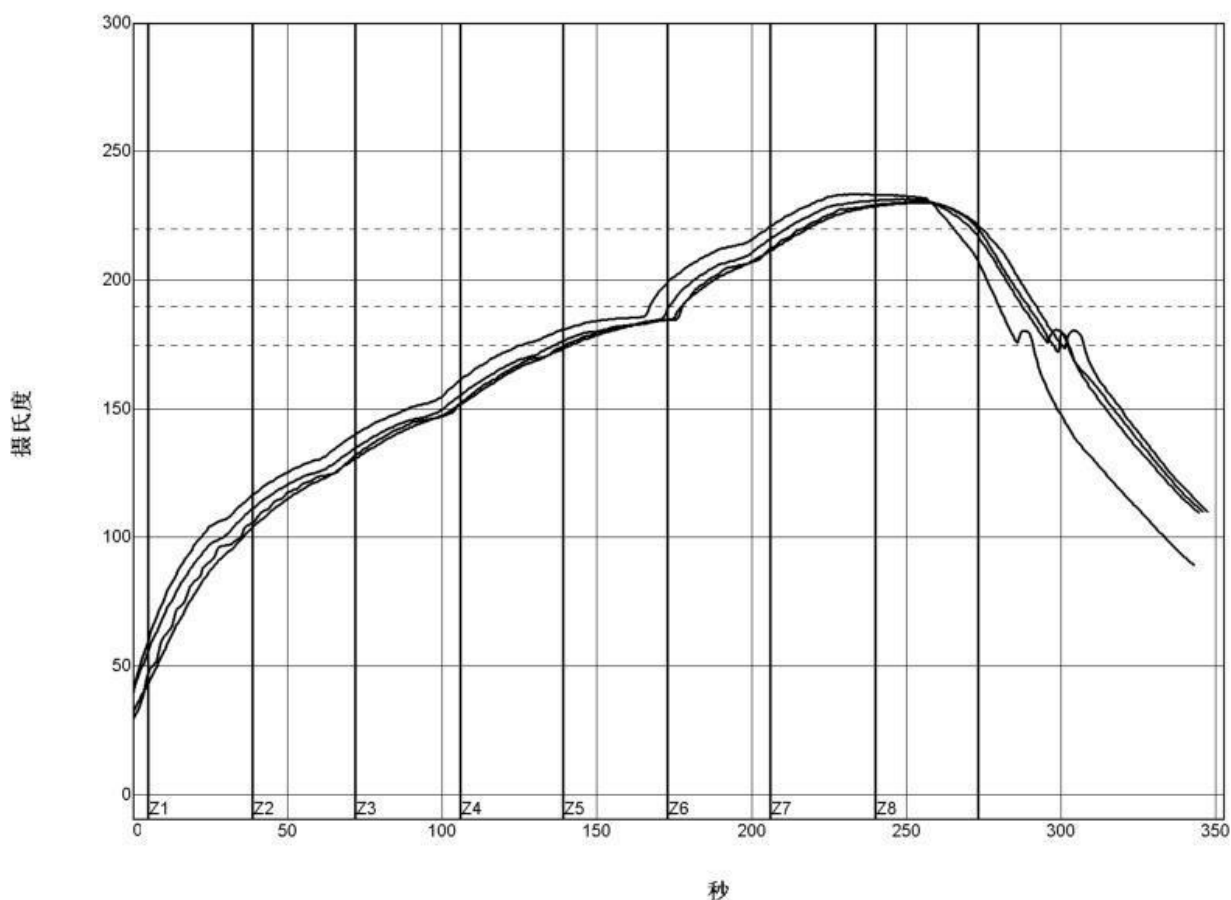
Pic 32. Firmware upgrade

13. Reflow welding temperature curve

Please strictly follow this temperature curve when the module passes through the furnace for the second time. the module will be damaged If the temperature deviation of reflow welding is too large.

Temperature setting (°C)									
Temp region	1	2	3	4	5	6	7	8	
Upper Temp region	125	135	155	185	195	225	240	230	
Lower 下温区	125	135	155	185	195	225	240	230	

line speed : 70.0 cm/min



PW= 94%	恒温时间175至190C		回流时间 /220C		最高温度	
<TC2>	35.53	-82%	55.58	-72%	230.28	-94%
<TC3>	37.66	-74%	58.66	-57%	230.56	-89%
<TC4>	41.52	-62%	60.63	-47%	233.62	-28%
<TC5>	37.07	-76%	60.44	-48%	231.67	-67%
温差	5.99		5.05		3.34	

制程界限:

锡膏: System Default for Reflow			
统计数名称	最低界限	最高界限	单位
恒温时间175-190摄氏度	30	90	秒
回流以上时间 - 220摄氏度	50	90	秒
最高温度	230	240	度 摄氏度

Appendix A Document revision record

Version number	Scope of revision	Date
1.00		2019-4-15